

Polyphase Programmable Power Analyzers



Shipped in 5 Days

2300 Series Systems Power Analyzers

The 2300 Series Digital Power Analyzers are the automatic choice for a broad range of power measurement applications. Each unit features a 4 $\frac{1}{2}$ digit tri-mode information readout system which simultaneously displays true RMS voltage, true RMS current and true power. The 2300 series DPA's are loaded with high performance features, which make 1 \emptyset and 3 \emptyset power measurement as easy as 1-2-3. An optional IEEE-488 interface provides full talk/listen capability for automated systems applications. Single and 11 channel analog output options provide proportional DC voltages for strip-chart recording and data logging applications.

1 \emptyset or 3 \emptyset Power Measurement — The Choice is Yours

The 2300 and the 2300L Three Phase Digital Power Analyzers are capable of making single phase, two phase (split phase), three phase 3-wire delta and three phase 4-wire wye power measurements. These units may monitor up to three separate single phase loads with V-A-W information for the desired channel available at the touch of a fingertip. Additionally, efficiency of AC power supplies can easily be tested by connecting input and output power to two respective channels of the three phase models.

For dedicated single phase applications, the 2301 and 2301L offer the full range measurement capability of the 2300/2300L, but provide additional cost savings through the elimination of the two extra measurement channels.

True RMS Current 100 μ A to 100A

The super wide range of input current that the 2300 series is capable of handling directly, spans from 100 micro-amp resolution on the 200 milli-amp range, all the way up to 100 amperes RMS. The nine current ranges covered by the 2300 Series Digital Power Analyzers are made possible through a network of three wideband shunts per phase. The three shunts utilized in each phase represent the results of an extensive engineering study to optimize thermal stability and minimize series inductance, insuring stable wideband performance.

Valhalla employs the use of high bandwidth true RMS AC converter technology to capture and display the true root-mean value of the current waveform, regardless of waveshape. You can count on accurate results long after conventional watt-ammeter readings have dropped off.

DC or True RMS AC Voltage 1mV to 600V

The voltage ranges of the 2300 and 2301 are set up for conventional AC power measurement applications. The four pushbutton selectable voltage ranges cover 50.00V RMS full scale with 10 millivolt resolution up to 600 volts RMS. For special dedicated low voltage applications, such as three phase gyro motor testing, or transformer core loss testing, the 2300L and 2301L provide full-scale voltage ranges of 5.000 volts to 60.00 volts RMS.

The displayed voltage measurement utilizes the same wideband true RMS AC converter technology as that of the current measurement channels. Crest factor response capability is 50:1 for minimum RMS inputs, linearly decreasing to 2.5:1 for full scale RMS inputs.

Digital Power Analyzers

True Power Measurement — Zero to Unity Power Factor

Whether you're working at zero or unity power factor and anywhere in between, the proprietary wideband multiplier design of the 2300 Series Digital Power Analyzers guarantees an accurate watts product. In fact, the power measurement integrity of the 2300 remains intact even on tough high frequency switching applications which analog wattmeters and lesser bandwidth digitals just can't handle.

Over one hundred single and three phase power measurement ranges on the 2300 combine to provide readings from one milliwatt resolution, on the ten watt range all the way up to 180 kilowatts direct. This expansive measurement range can be extended even further with the implementation of external current and potential transformers. Power factor calculations can easily be made using the W/VA formula. All necessary data to perform this computation is available from one glance at the instrument's tri-mode display front panel or via the optional IEEE-488 interface, or via Valhalla's "PC-WATTS" software package.

Power Factor Available with "PC-Watts" Software

Valhalla's 2300 Series Wattmeters with IEEE-488 interface (Option "TL-4") now offer **VARs, Power Factor, Volt-Amps (VA's), Kilowatt Hours** and **3-Phase P.F.** computation with the "P.C.-Watts" software utility package. Our menu-driven "P.C. Watts" software package is ideal for use with IBM-PC, XTs, ATs and other compatible instrument controllers. In addition, current transformer ratios and potential transformer ratios are easily accommodated with "PC-Watts".

Valhalla's "P.C. Watts" software operates under Microsoft BASIC, and with pop-up help windows explaining the test generator, the user does not have to write a single line of BASIC code. In addition, actual sample 2300 Series Power Analyzer test programs are included for complete wattmeter data acquisition purposes.

Option "PC-1" software package includes the comprehensive documentation manual and is command compatible with the HP P/N 82990A IEEE-488 PC interface card.

Option "PC-2" software package includes documentation and is command compatible with National Instruments P/N 776-113-01 IEEE-488 PC interface card.

Option PC-3" is the Valhalla "PC-Watts" software package with manual and includes IEEE-488 compatible PC interface card (see GP1 for cable).

Measure Transformer Loss with 2300

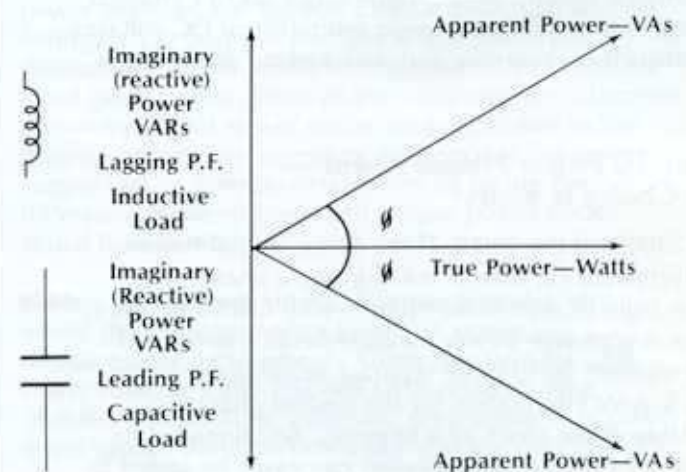
When the 2300 is connected for source power measurement, the power display has a negative polarity. The three phase, three wire display sums the power measurements of channel A and C. The result is the 2300 displays the difference between the power drawn by the transformer and the power sourced by the transformer. This difference is less, or the amount of power dissipated by the transformer.

Measure Phase Currents in 3-Wire Systems

The standard three phase, three wire connections allow for display of the Phase A and phase C currents directly. The phase B current is usually measured with an external ammeter. The 2300 can easily be reconnected to measure the phase B current as well.

VAs, WATTS, VARs and PF

The relationship between VAs, WATTS, VARs and PF can best be described in a graphical manner. Figure 1 illustrates these relationships. VAs are determined by multiplying the true RMS voltage and true RMS current measurements of the digital power analyzer. Power factor is the cosine of the angle between VAs and WATTS and can be easily calculated. VARs are easily calculated from VAs and WATTS using the Pythagorean theorem.



$$PF = \cos \phi = \frac{W}{VA}$$

$$VAs = TRMS \text{ Volts} \times TRMS \text{ Amps}$$

$$VARs = \sqrt{VAs^2 - Ws^2}$$

$$VAs = \sqrt{VARs^2 + Ws^2}$$

$$Ws = \sqrt{VAs^2 - VARs^2}$$

Figure 1: Watts, VAs, VARs and PF

Digital Wattmeters

Built-In Overload Protection

The 2300's are tough and built to last. All measurement connections are made through the instrument's recessed and hinged-cover protected input terminal compartment. Built-in overload protection prevents damage to the instrument for a minimum of 500% overload on current and up to 3000V peak-to-peak on voltage.

2300 Series Specifications

TRUE RMS CURRENT

Ranges	0.2A, 0.5A, 1.0A	2.0A, 5.0A, 10.0A	20.0A, 50.0A, 100.0A
Resolution	100uA	1mA	10mA
Shunt	0.10	0.010	0.0010
Bandwidth	Low Shunt 20Hz-50KHz	Medium Shunt 10Hz-20KHz	High Shunt 20Hz-20KHz
Overload	2A continuous 5A 1000 mSec	20A continuous 50A 100 mSec	150A continuous 500A 100 mSec

TRUE RMS VOLTAGE

Model 2300 & 2301 Range/Resolution Table

Ranges(VAC RMS)	50.00	150.00	300.0	600.0
Resolution	10mV	10mV	100mV	100mV
Impedance	1 megaohm all ranges			

Model 2300L & 2301L Range/Resolution Table

Ranges(VAC RMS)	5.000	15.000	30.00	60.00
Resolution	1mV	1mV	10mV	10mV
Impedance	100 kilo-ohm all ranges			

POWER (WATTS)

Single Phase Power Range/Resolution Table*

Ranges	Low Shunt			Medium Shunt			High Shunt		
	0.2A	0.5A	1.0A	2.0A	5.0A	10.0A	20.0A	50.0A	100.0A
50V	10.000	25.00	50.00	100.00	250.0	500.0	1000.0	2500	5000
150V	30.00	75.00	150.00	300.0	750.0	1500.0	3000	7500	15000
300V	60.00	150.00	300.0	600.0	1500.0	3000	6000	15000	30.00KW
600V	120.00	300.0	600.0	1200.0	3000	6000	12000	30.00KW	60.00KW

The 2300 and 2300L have 3 independent, single phase input channels, while the 2301 and 2301L have only 1 single phase channel.

Three Phase 3-Wire Total Power Range/Resolution Table*

Ranges	Low Shunt			Medium Shunt			High Shunt		
	0.2A	0.5A	1.0A	2.0A	5.0A	10.0A	20.0A	50.0A	100.0A
50V	20.00	50.00	100.00	200.00	500.0	1000.0	2000	5000	1000
150V	60.00	150.00	300.00	600.0	1500.0	3000	6000	15000	30.00KW
300V	120.00	300.00	600.0	1200.0	3000	6000	12000	30.00KW	60.00KW
600V	240.0	600.0	1200.0	2400	6000	12000	24.00KW	60.00KW	120.00KW

Three Phase 4-Wire Total Power Range/Resolution Table*

Ranges	Low Shunt			Medium Shunt			High Shunt		
	0.2A	0.5A	1.0A	2.0A	5.0A	10.0A	20.0A	50.0A	100.0A
50V	30.00	75.00	150.00	300.00	750.0	1500.0	3000	7500	15000
150V	90.00	225.0	450.0	900.0	2250	4500	9000	22.50KW	45.00KW
300V	180.00	450.0	900.0	1800.0	4500	9000	18000	45.00KW	90.00KW
600V	360.0	900.0	1800.0	3600	9000	18000	36.00KW	90.00KW	180.00KW

*The voltage and power range of the 2300L and 2301L are reduced by a factor of 10:1 over those given for the 2300 and 2301 in the above tables.

AC/DC VOLTAGE and AC/DC CURRENT (True RMS)

Accuracy: (Voltage and Current)

DC & 40Hz to 5KHz: ±0.1% of reading ±6 digits

5KHz to 15KHz: ±0.5% of reading ±6 digits

15KHz to 20KHz: ±0.75% of reading ±6 digits

useable to 50KHz with typically 1% error per 10KHz.

Crest Factor Response: 50:1 for minimum RMS input, linearly decreasing to 2.5:1 for full scale RMS input.

Minimum Input: 5% of range.

Maximum Input: 600V DC or RMS AC, 1500V peak

Maximum Common Mode: 1500V peak, neutral to earth

Peak Indicator: Illuminates at 2.5 x full scale

Overrange: 150% of full scale for DC, up to maximum input

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WATTS (True Power-EI cos Φ)

Accuracy: 25°C±5°C, 1 year

DC & 40Hz to 5KHz: ±0.25% of reading±6 digits

5KHz to 10KHz: ±0.5% of reading±0.5% of range

10KHz to 20KHz: ±1% of reading±1% of range (2A range only)

20KHz to 50KHz: additional±1% per 10KHz above 20KHz

Power Factor Response: Unity to zero leading or lagging

Accuracy: (V-A-W 25°C±5°C, 1 Year)

DC & 40Hz to 5KHz: ±0.25% of reading±6 digits

5KHz to 10KHz: ±0.5% of reading±0.5% of range

10KHz to 20KHz: ±1% of reading±1% of range

(2A range only)

General Specifications

Displays: 3 simultaneous displays V-A-W featuring 5 L.E.D.s each

Operating Temperature Range: 0°C to 50°C

Size: 178mm/432mm/483mm (7" H x 17" W x 19" D)

Weight: 15KG/33 lbs Net, 19KG/41 lbs Shipping

Power: 115/230 ± 10% 50 to 60Hz 40VA

Load Connections: Floating Insulated to 1500V Peak to Chassis

Range Selection: Manual Push Button -IEEE-488 Optional

Warm-Up Time: 30 minutes to specifications

Display A/D Conversion Rate: 3 readings/second

Option Specifications

IEEE-488 Interface Option "TL-4": Microprocessor based talk/listen GPIB interface. Allows full remote ranging capability, plus data output for V-A-W on all channels, plus an on-board integrator to provide continuous wathour computation and output.

Single Channel Analog Output Option "I01": Proportionally scaled 0-5 VDC output corresponding to watts input. Available via a rear panel mounted BNC connector.

V-A-W Analog Output Option "I03": Proportionally scaled 0-5 VDC output corresponding to the voltage, current and watts input.

11 Channel Simultaneous Analog Output Option "I0X": Permits simultaneous monitoring of V-A-W for each phase plus three phase 3-wire and 4-wire total power. These proportionally scaled 0-5 VDC signals are available at a 24 pin connector located on the rear panel. IOX is not compatible with Option "TL-4".

Ordering Information

Model 2300	30 Digital Power Analyzer.....
Model 2301	10 Digital Power Analyzer.....
Model 2300L	30 Digital Power Analyzer.....
Model 2301L	10 Digital Power Analyzer.....
Option "TL-4"	GPIB KWHR Interface.....
Option "PC-Watts"	Software Package.....
Option "PC-1"	HPIB Card Compatible.....
Option "PC-2"	National Instruments Compatible.....
Option "PC-3"	Includes GPIB Card.....
Option "I01"	Single Channel Watts Output.....
Option "I03"	V-A-W Analog Output.....
Option "I0X"	11 Channel Analog Output.....
Option "I-150"	150A Clamp-on C.T.....
Option "I-1000"	1000A Clamp-on C.T.....
Option "RX7"	Rack Mount Adapter.....
Option "SP-2"	2-Year Spares Kit (3Φ).....
Option "SP-2"	2-Year Spares Kit (1Φ).....
Additional	Operating/Maintenance Manual.....