

2-2. Current Specifications

The accuracy figures given below are valid for ambient temperatures between 20°C and 30°C for a period of one year from the date of calibration following a 1 hour warm-up period.

2-2-1. Current Ranges, Resolution and Bandwidth

	<u>Low Shunt</u>	<u>Medium Shunt</u>	<u>High Shunt</u>
Ranges:	0.2A, 0.5A, 1A	2A, 5A, 10A	20A, 50A, 100A
Resolution:	100 μ A	1mA	10mA
Impedance:	100m Ω	10m Ω	1m Ω
Bandwidth:	DC & 20Hz-10kHz	DC & 20Hz-5kHz	DC & 20Hz-1kHz
Max Input:	2A continuous	20A continuous	150A continuous
Peak Input: (no damage)	100msec @5A (fused)	100msec @50A	100msec @500A

2-2-2. Current Accuracy

For all models @ 20°C to 30°C for 1 year. True RMS, DC coupled (AC+DC)

$\pm 0.5\%$ of reading $\pm 0.5\%$ of range at DC

$\pm 0.25\%$ of reading $\pm 0.25\%$ of range from 20Hz to bandwidth

2-2-3. Miscellaneous Current Specifications

Temperature Coefficient: $\pm 1/10$ of accuracy specification per °C (0-19°C and 31-50°C)

Crest Factor: 50:1 at minimum input linearly decreasing to 2.5:1 at full scale

Minimum Input: 5% of range

Peak Indicator: Illuminates at 2 times range

Shunt Compliance Voltage: 100mV at full scale on highest range for shunt (1A, 10A, 100A)



2-3. Power Specifications

The accuracy figures given below are valid for ambient temperatures between 20°C and 30°C for a period of one year from the date of calibration following a 1 hour warm-up period.

2-3-1. 2300L/2301L Single-Phase Resolution (Watts)

<u>Range</u>	<u>0.2A</u>	<u>0.5A</u>	<u>1A</u>	<u>2A</u>	<u>5A</u>	<u>10A</u>	<u>20A</u>	<u>50A</u>	<u>100A</u>
5V	1.0000	2.500	5.000	10.000	25.00	50.00	100.00	250.0	500.0
15V	3.000	7.500	15.00	30.00	75.00	150.00	300.0	750.0	1500.0
30V	6.000	15.000	30.00	60.00	150.00	300.0	600.0	1500.0	3000
60V	12.000	30.00	60.00	120.00	300.0	600.0	1200.0	3000	6000

2-3-2. 2300/2301 Single-Phase Resolution (Watts)

<u>Range</u>	<u>0.2A</u>	<u>0.5A</u>	<u>1A</u>	<u>2A</u>	<u>5A</u>	<u>10A</u>	<u>20A</u>	<u>50A</u>	<u>100A</u>
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

2-3-3. 2300L Three-phase Three-wire Resolution (Watts)

<u>Range</u>	<u>0.2A</u>	<u>0.5A</u>	<u>1A</u>	<u>2A</u>	<u>5A</u>	<u>10A</u>	<u>20A</u>	<u>50A</u>	<u>100A</u>
5V	2.000	5.000	10.000	20.00	50.00	100.00	200.0	500.0	1000.0
15V	6.000	15.000	30.00	60.00	150.00	300.0	600.0	1500.0	3000
30V	12.000	30.00	60.00	120.00	300.0	600.0	1200.0	3000	6000
60V	24.00	60.00	120.00	240.0	600.0	1200.0	2400	6000	12000

2-3-4. 2300 Three-phase Three-wire Resolution (Watts)

<u>Range</u>	<u>0.2A</u>	<u>0.5A</u>	<u>1A</u>	<u>2A</u>	<u>5A</u>	<u>10A</u>	<u>20A</u>	<u>50A</u>	<u>100A</u>
50V	20.00	50.00	100.0	200.0	500.0	1000.0	2000	5000	10000
150V	60.00	150.00	300.0	600.0	1500.0	3000	6000	1500	30.00KW
300V	120.00	300.0	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

2-3-5. 2300L Three-phase Four-wire Resolution (Watts)

<u>Range</u>	<u>0.2A</u>	<u>0.5A</u>	<u>1A</u>	<u>2A</u>	<u>5A</u>	<u>10A</u>	<u>20A</u>	<u>50A</u>	<u>100A</u>
5V	3.000	7.500	15.000	30.00	75.00	150.00	300.0	750.0	1500.0
15V	9.000	22.50	45.00	90.00	225.0	450.0	900.0	2250	4500
30V	18.000	45.00	90.00	180.00	450.0	900.0	1800.0	4500	9000
60V	36.00	90.00	180.00	360.0	900.0	1800.0	3600	9000	18000



2-3-6. 2300 Three-phase Four-wire Resolution (Watts)

<u>Range</u>	<u>0.2A</u>	<u>0.5A</u>	<u>1A</u>	<u>2A</u>	<u>5A</u>	<u>10A</u>	<u>20A</u>	<u>50A</u>	<u>100A</u>
50V	30.00	75.00	150.00	300.0	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

2-3-7. Power Accuracy and Bandwidth

For all models @ 20°C to 30°C for 1 year. True RMS, DC coupled (AC+DC)

±0.5% of watts reading ±0.5% of (volts range x amps range) at DC

±0.25% of watts reading ±0.25% of (volts rng x amps rng) throughout "Shunt Bandwidth"

Shunt Bandwidths

Low Shunt: 20Hz to 10KHz

Medium Shunt: 20Hz to 5KHz

High Shunt: 20Hz to 1KHz

Temperature Coefficient: ±1/10 of range specification per °C (0-19°C and 31-50°C)

2-4. Physical Specifications

Height 7" (178mm) not including feet
Width 17" (432mm)
Depth 19.75" (490mm)
Weight 33lbs (15kg) net; 38lbs (17.5kg) shipping

2-5. Environmental Specifications

Temperature Range: Operating: 0°C to 50°C
Storage: -20°C to +75°C

Humidity: 70% RH max @ 40°C (non-condensing)

Altitude: -10,000 to +10,000 feet

Vibration: Per MIL-T-28800C, Type III, Class 5, Style E

2-6. Miscellaneous Specifications

Settling Time: (to within 0.1% of change)

No range change: 1.5 sec
Following range change: 5 sec



Maximum Common Mode Voltage: 1500V peak from any terminal to chassis

Power Factor Response: Zero to unity power factor, leading or lagging

Warm-up Time: 1 hour to specifications

Power: 50 to 400Hz @ 105-125VAC or 210-250VAC, 40VA max

Safety: Complies with UL1244 and IEC-348

Connections: Three sets of fully floating terminals, one for each channel

Input Configuration: Three-wire type wattmeter with three current inputs for each phase

Displays: Three simultaneous displays. One each for volts, amps, and watts.

Display Type: Red LED 4½ digits per display

Peak Overload Indication: Six LED's; one for voltage, one for current for each channel

Range Selection: Manual push-button or via Option TL-4 IEEE-488 interface

IEEE Interface (Option "TL-4"): Compliance with IEEE-488 (1978) with subsets SH1, AH1, T6, TE0, L4, LE0, SR1, RL1, PP0, DC1, DT1, C0

2-7. Performance Verification

Verification of the performance of the Model 2300 may be performed at any time, and is especially recommended following receipt of the unit or following transportation. Verification may be achieved with two levels: verified as operational; verified as operational and within specifications. The procedures for both are given below.

2-7-1. Verification of Operation

If the 2300 fails any of the tests below, employ normal troubleshooting procedures or consult the factory for advice.

- 1) Ensure that the POWER switch (lower left hand corner of the front panel) of the 2300 is in the OFF position, i.e. no yellow dot showing.
- 2) Ensure that the rear panel switch is set to the correct local line voltage and apply AC power to the 2300. Make no connections to the shunt input terminals under the flip lid.
- 3) Press the 2300 POWER switch to the ON position (yellow dot showing). The LED's on the front panel should illuminate in the 600V, 100A and ϕ A positions, and the displays should indicate near zero. Wandering displays or continuous illumination of any overload indicator signifies that a problem may exist.



- 4) Allow the 2300 to warm up for 5 minutes.
- 5) Connect the 2300 as described in Section 6-4-1 to a known resistive load, e.g. a 100-watt incandescent light bulb. Verify that the voltage display reads the present line voltage, the current display reads approximately 1 amp, and the power display reads approximately 100 watts. This should be repeated for each of the 3 channels: ϕA , ϕB and ϕC . Note that Model 2301 has only one channel.

After successful completion of all of the steps above, the 2300 is fully operational with no faulty parts apparent.

2-7-2. Verification of Specification

Attempting to prove that the 2300 is performing to specification requires that the user be aware of the following points:

- 1) The specifications in Section 2 are valid for reasonable use of the 2300 during the specified period of time. If the 2300 has been transported it may have been subjected to extremes of temperature. As with any precision equipment some change in calibration may occur due to this. This effect has been carefully monitored by Valhalla Scientific and has been found to be small, even in extreme cases.
- 2) A wattmeter calibration system is required to verify the specifications of the 2300. A source of voltage and current in phase with each other is required to check the power accuracy. Phase shifts between voltage and current will cause measurement errors. The calibration procedure of Section 8 may be used as a guide for verifying specifications.
- 3) Prior to specification verification it is recommended that the user be familiar with the manual operation of the 2300 and allow at least one hour for the unit to warm up.

If the 2300 is found to be fully operational but not performing to specifications it is recommended that a full calibration be performed. If this does not bring all points within specifications, contact your nearest Valhalla Scientific Service Center before returning the unit for repair or attempting to repair the unit yourself.

