

80

PLUS®

**Testing Frequently
Asked Questions**

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Where do you measure the output voltage?

For 115V input units, the output voltage is measured at the back pin of the mating connector on the load side of the connector. Voltage is measured with the DVM test probe and recorded manually into the unit under test data sheet. Figure 1-1 below is an example of manual probes being used to measure voltage on the back of the unit output connector pin. The output connector is shown plugged into the load fixture interface board.

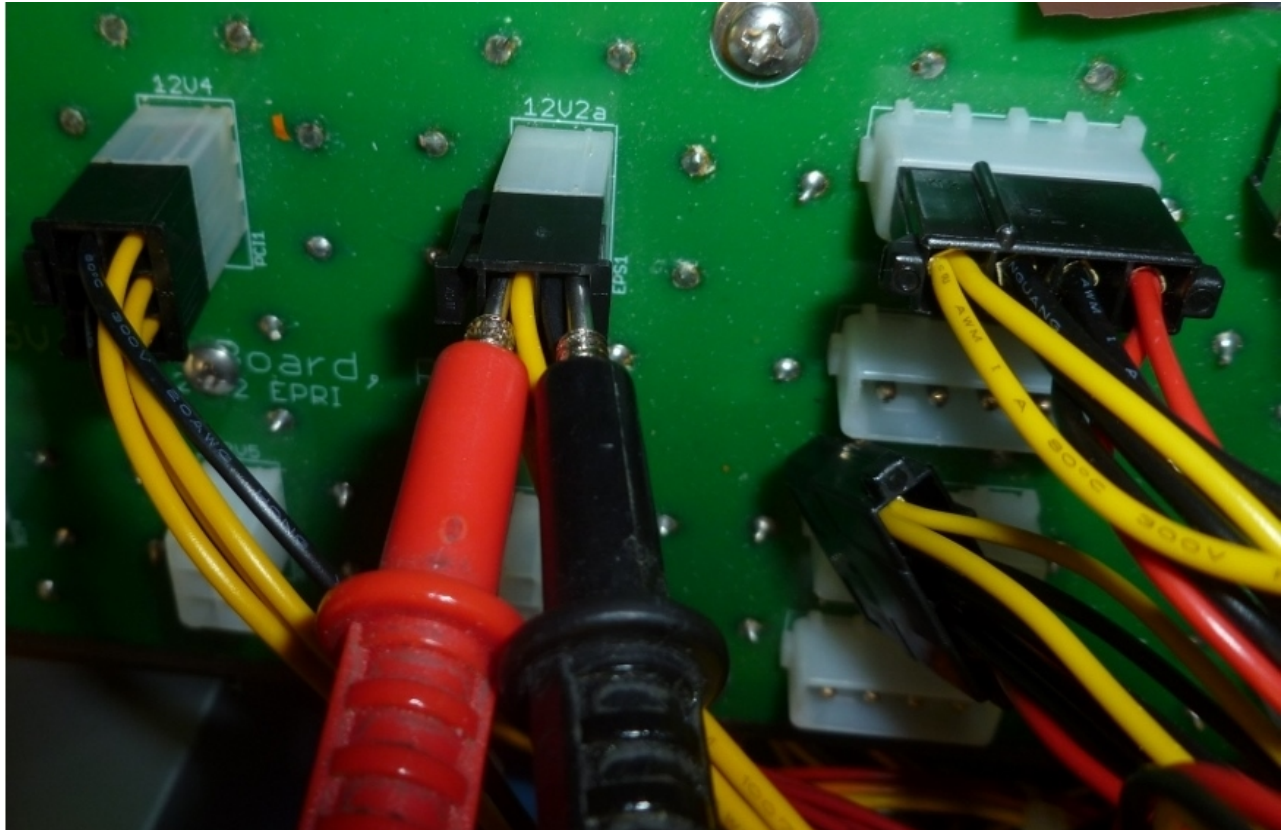


Figure 1-1: Back-pinning 12V2 to measure the output voltage of 12V2 rail.

For 230V input units, the same procedure is followed, unless a custom interface board is supplied with the unit. If a custom interface board is supplied, test points must be incorporated to measure the output voltage and return ground directly at the point they exit the mating connector on the load side of the unit. Test points should be clearly marked on the test board, or in photos that accompany the submitted units.

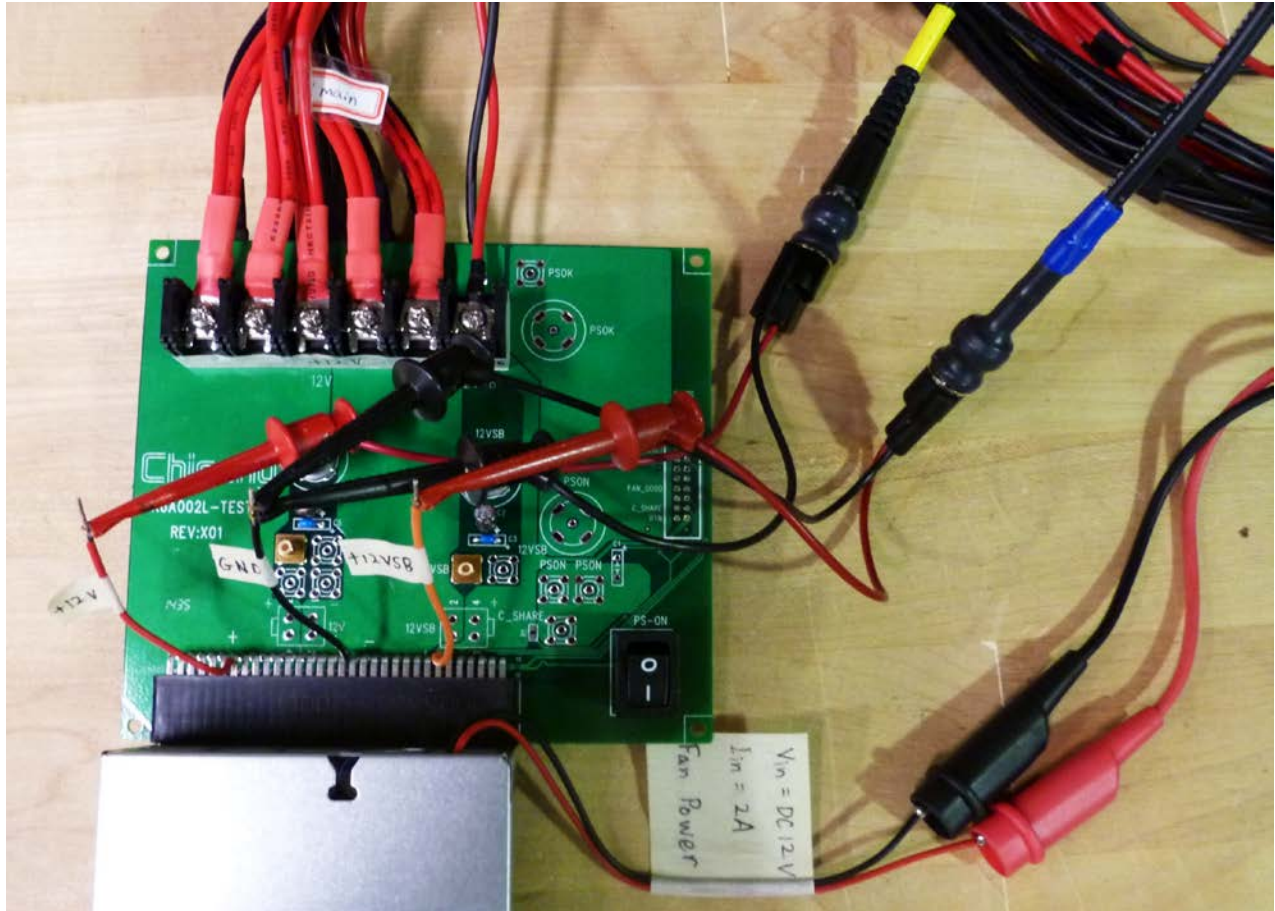


Figure 1-2: Sense lines, when provided, are used to measure the output voltages for 230V.

Where do you measure the input voltage?

For both 115V input and 230V input test benches, the input voltage is measured as close to the input connector of the unit as possible. A standard cable has been prepared for common input connectors. The input power cable provides voltage measurement leads that are attached to the input voltage wires of the cable within one and a half inches of the unit input power mating connector.

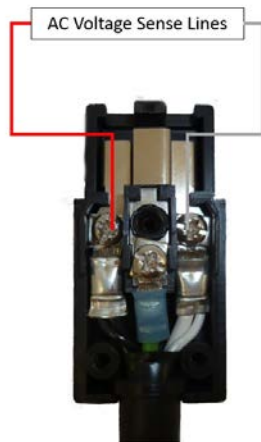


Figure 2-1: C19 Open Connector

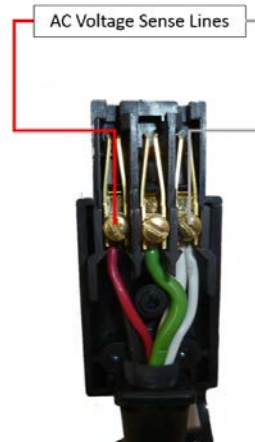


Figure 2-2: C14 Open Connector

What instrument do you use to measure the input voltage, input current and input frequency?

For both 115V and 230V input test benches, the input voltage, input current, input frequency, input power, power factor, and THD (%) are measured using a Yokogawa WT-2030 (Figure 3-1). There are three channels available for measuring parameters. These are first assigned to voltage, current, and power until data is recorded. Then two of the channels are re-assigned to measure input power factor and THD for the current load setting.



Figure 3-1: Yokogawa WT2030

What instrument do you use to measure the output voltages?

All output voltages are measured using test probes and a Fluke 8846A 6 ½ Digit Multimeter (Figure 4-1). Data is captured manually, one reading at a time, and entered into the unit under test cal sheet.

Take a sample of 10 data points per output voltage using the statistical analysis function of the Fluke 8846A. This displays the minimum and maximum measurements along with the average and standard deviation value at the resolution of 6 digit 10 power line cycle (PLC) setting.

For example, selecting “6 DIGIT 10 PLC” will display 6½ digit resolution and take a measurement using ten power line cycle A/D integrate period. For 60 Hz power, a measurement is almost once every 60th of a second, or 166.666 milliseconds.



Figure 4-1: Fluke 8846A

Why must we use an LISN in the input circuit for testing efficiency?

An LISN (Line Impedance Stabilization Network) was added to the Generalized Test Protocol Version 6.2. The addition of the LISN provides a stable input impedance when measuring input power factor of very lightly loaded power supplies (below 20% loading). Testing at several labs, including OEM labs, showed the power factor readings were much more repeatable when using the LISN.

What power source do you use?

For 115V input units we use an 8KV UPS followed by a step up/step down isolation transformer. The output voltage is measured prior to each load level data recording step and adjusted to 115 V as accurately as possible.

For 230V units, including the EU listed units, the source is an AMTEK MX45-3PI-480-HV solid state voltage source.

Do you start at 100% load and then reduce load? Or do you start at 10% load and increase to 100%?

For each UUT, the protocol is to start at 10% load, run the unit for 15 minutes and then take data. The unit loading is then increased to the next loading level and the 15-minute run time initiated before data is recorded. The process repeats until data at 100% load is taken.

How, and when, is the load adjusted for each level?

The load is manually adjusted while the unit is in operation in a continuous linear manner.

What happens if my unit fails?

If a unit fails to meet the any 80 PLUS criteria for certification, the test for that unit is terminated. The second unit is then tested at the specific condition of failure. If the second unit passes, the second unit is tested fully and data used for the report. If the second unit fails then the test is terminated and a report is issued with the failure data recorded.

Our results are significantly different from yours. Why?

The test equipment used can have a significant impact on measurements. In most cases the difference will be due to measurement of the input power. The accuracy of the input power measurement is dependent on power factor of the unit under test, as well as the base accuracy of the measuring equipment. If all equipment and setups were identical, it is still possible to have a difference in readings of twice the stated accuracy. For example, if a power analyzer has an accuracy of $\pm 0.1\%$, the worst-case difference could be as much as 0.2%. The power analyzer used by 80 PLUS has a base accuracy of $\pm 0.04\%$ of the reading plus 0.04% of the range.

What happens if my unit performance misses a badge performance level?

When a unit comes within 0.5% of the next higher badge level, on any loading parameter, the test of that unit is completed and a second unit is tested at the failed point. Should the second unit pass the next level then the second unit is completely tested and that data is used for the 80 PLUS report. If the second unit fails to meet the higher level then the data from the first unit is used to create the 80 PLUS report.

How do you measure output current?

Output current on the 115V test bench is measured using the Yokogawa WT-2030. The electronic load box (ELB) is set to a current that is varied from 1% to 100% of the ELB rating. The current value in amps is read from 0% to 10% loading in 1% increments. Each value is recorded. The current is then varied in 10% increments up to 100% of the ELB rating, with data recorded at each increment. The values are then used to create a piecewise linear calibration curve for that load bank. The curve is recorded and used to calculate the calibrated current from the recorded current in the efficiency tab of the cal sheet for each unit under test. This calibration process is repeated for each load bank used in efficiency testing each year.

Output current for the 230V test bench uses calibrated current shunts. The main output is a custom designed shunt that is capable of operation to 1000 amperes. The shunt is calibrated to within ± 165 ppm. Figure 12-1 shows an example of the shunt calibration certificate.



CALIBRATION REPORT 14547-1
 ORDER No. 69915
 FEBRUARY 5, 2015
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EPRI
 942 CORRIDOR PARK BLVD.
 KNOXVILLE, TN 37932-3294

MANUFACTURER:	EMPRO	PROCEDURE:	CS CAL
DESCRIPTION:	CURRENT SHUNT	LAB ENVIRONMENT:	22.6 °C / 17 %RH
MODEL:	1000-100	CALIBRATION DATE:	05/FEB/2015
SERIAL:	N/A	CALIBRATION DUE	

MEASUREMENT DATA -- AS FOUND / AS LEFT		
APPLIED CURRENT	MEASURED VALUE	UNCERTAINTY
100 A	0.997 598 mΩ	124 μΩ/Ω
200	0.997 817	154
300	0.998 065	143
400	0.998 298	145
500	0.998 444	163

NOTES:
 SHUNT WAS ALLOWED TO FULLY STABILIZE AT EACH APPLIED CURRENT.
 CALIBRATION LIMITED TO 50 % CURRENT TO PREVENT DAMAGE FROM OVERHEATING.
 AN ADDITIONAL 100 μΩ/Ω UNCERTAINTY IS ALSO ADDED FOR ESTIMATED CONNECTION VARIATION UNCERTAINTY ON METERING TYPE SHUNTS.
 THE REPORTED UNCERTAINTY INCLUDES AN ESTIMATED TEMPERATURE COEFFICIENT OF RESISTANCE (TCR) VARIABILITY OF 20 μΩ/Ω FOR MANGANIN TYPE SHUNTS, CORRESPONDING TO A +/- 1 °C AMBIENT TEMPERATURE UNCERTAINTY.

STANDARDS USED			
ID	DESCRIPTION	MAKE & MODEL	CAL DUE
AS3001	RESISTANCE STANDARD	OHM-LABS 200	02/MAR/2015
AS3401	RESISTANCE BRIDGE	GUILDLINE 9920A	11/MAR/2015

COMMENTS:
 OHM-LABS, INC. CERTIFIES THAT THIS CALIBRATION IS TRACEABLE TO THE NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST), OR ANOTHER RECOGNIZED NATIONAL MEASUREMENT INSTITUTE, OR DERIVED BY A RATIO TYPE SELF-CALIBRATION TECHNIQUE, AND IS ACCREDITED TO ISO/IEC 17025. OHM-LABS' QUALITY CONTROL SYSTEM MEETS THE REQUIREMENTS OF ANS/INGSL Z540-1-1994. THE REPORTED UNCERTAINTIES REPRESENT EXPANDED UNCERTAINTIES EXPRESSED AT A CONFIDENCE LEVEL OF APPROXIMATELY 95 %, USING A COVERAGE FACTOR OF K=2. THIS UNCERTAINTY IS AT THE TIME OF TEST ONLY AND DOES NOT TAKE INTO ACCOUNT TRANSIT, USAGE, DRIFT OVER TIME, OR OTHER FACTORS AFFECTING STABILITY. THIS DOCUMENT CERTIFIES THAT THE ITEMS IDENTIFIED HEREIN COMPLY WITH ALL REQUIREMENTS OF THE ABOVE PURCHASE ORDER, AND THAT THE CALIBRATION PERFORMED WAS IN ACCORDANCE WITH THE CURRENT REVISION LEVEL OF OHM-LABS' QUALITY CONTROL SYSTEM. TRAINED AND QUALIFIED PERSONNEL PERFORMED THE CALIBRATIONS IN ACCORDANCE WITH THE REQUIREMENTS OF ISO/IEC 17025. THIS CERTIFICATE SHALL NOT BE REPRODUCED, EXCEPT IN FULL, WITHOUT WRITTEN PERMISSION BY OHM-LABS, INC.

PERFORMED BY:
 GAGE TROY, CALIBRATION TECHNICIAN

REVIEWED BY:
 JAY KLEVENS, QUALITY MANAGER



Figure 12-1: Shunt Calibration Certificate

How do you calculate the loading for a specific unit?

The ratings shown on the label of the test unit are entered into an Excel worksheet that performs a calculation based on the algorithm explained in the [Generalized Test Protocol](#) for testing the energy efficiency of AC-DC and DC-DC internal power supplies (Version 6.2), Paragraph 6.1.1 *Proportional allocation method for loading multiple and single-output AC-DC and DC-DC power supplies.*

Can you test and certify an open frame unit?

Open frame units can be tested. The unit must be connectorized and if it requires specific cooling air, instructions to provide that air must be included with the unit. If an air plenum is required then it must be provided with the unit on submittal.

Do you ensure all connectors are loaded?

All power supply output connectors are mated to the load test fixture. Some power supply configurations have a large number of connectors. The 80 PLUS test board has the following connectors available for connecting loads:

Number of Connectors	Type of Connector
1	24-pin Main PSU
2	AUX 8-pin 12V
4	6-pin PCI Express
4	Molex 4-pin Peripherals
2	SATA

How do you ensure all connector pins or wires for a given output are equally loaded?

All pins of the loading fixture utilize balancing resistors to ensure the drop associated with both connector resistance, and wire resistance in series with the load, is insignificant.