Certificate of Calibration

Manufacturer   **Radian Research, Inc.**
Instrument Model: **RD-20-103 Dytronic Portable Standard**
Serial Number   123456
Firmware Revision: 07.10.20
Error Specification .04% worst case

Quality Management System
ISO 9001Certified

Customer Name: RADIAN RESEARCH, INC.
Address: 3852 FORTUNE DRIVE
                    LAFAYETTE, INDIANA 47905

P.O.Number: **Environmental Conditions**
CE Number: Temperature: 23ºC +/- 1ºC
RMA / Certificate Number: ro12345   Humidity: between 35% and 60%
Calibration Date: 9-Jun-11
Based on the recommended calibration interval, the next calibration is due on: 8-Jun-12

Radian Research's As-Found Test Results showed this Instrument to be:
[ ] New   [ ] In Tolerance   [ ] Out of Tolerance   [**X**] Inoperative   [ ] Limited Calibration
For Out of Tolerance conditions, As-Found Data Reports are furnished.

Radian Research Inc. certifies the instrument listed above meets or exceeds all published
specifications and was calibrated in compliance with ANSI/NCSL Z540-1 using applicable
Radian Research procedures which meet the requirements of ISO 9001:2000.
This instrument was calibrated by a Radian Research RS-703A Syntron Automated
Calibration System which is traceable to the National Institute of Standards and
Technology (NIST). The RS-703A Calibration System is traceable within the limitations of
NIST's services, by accuracies derived from accepted values of natural physical
constants, or by accuracies derived from accepted ratio type calibration techniques. The
RS-703A Calibration System is cross checked and calibrated on a schedule which is
adjusted to maintain required accuracies and traceability.

Software used for Calibration: RS-703A Control Program Rel.04.20.02 May 30, 2006
RS-703A serial numbers: 703142, 703185, 703187
Applicable Traceability & Report Numbers for References used by Radian's Metrology Lab:

Watt-hour, VA-hour, VAR-hour, Q-hour, Amp-hour,
 Volt-hour, Volt-Squared hour, AC Volt
  Radian Dytronic Transfer Standards consisting of (3) RD-22-RTS,
  Serial Numbers: 200717, 200718, 200719
  NIST Test Report Number: 697/280054-10; Calibration Due Date 6-Jan-2012.

Time Base (Frequency)
  Arbiter Systems Model 1083B Satellite-Controlled Frequency Standard s/n B1057. GPS
  controlled system with an uncertainty of 0.000002ppm. No calibration required.

DC Volts
  Fluke Model 732B DC Volt Standard s/n 7703004 with an uncertainty of ± .1ppm.
  Fluke Certificate Number 9D5460; Calibration Due Date: 14-July-2012.

Resistance
  Guildline Standard Resistor Model 9330/10K s/n 62623, 62624. Guildline Test Certificate Numbers
  C13274 and C13275; with an Expanded Uncertainty of ± .390ppm. Calibration Due Date: 25-May-2012.

Other
  Hewlett Packard 8 Digit Multi-Meter Model 3458A s/n 2823A02816. Agilent Technologies
  Test Certificate Number 53298: Calibration Due Date 2-Mar-2012.

Metrology Laboratory Technician Signature   *This report shall not be reproduced, except*
ScottEBlackwell **LAB**   *in full, without prior written approval of the*
                   47   *Calibration Facility*

Calibration Report

RD-20-103 Dytronic Portable Standard

Function..................…   Watt-hour 60 Hz

Date.........…….......   9-Jun-11

Serial Number…….......   205760

The following data was collected by a Radian Research RS-703A Automated Calibration System. The RS-703A watt-hour calibration is derived directly from (3) Radian RD-22-RTS Dytronic Transfer Standards certified by the National Institute of Standards and Technology (NIST) to an uncertainty of 0.002% @ unity and 0.003% @ 60 degrees lagging Power Factor. Calibration temperature is 23 degrees Centigrade. The test time is 2 seconds and the stabilization time in between points is 5 seconds. For lagging power factors the current lags the voltage. All results are listed as Percent Error. The RS-703A has at least a 4 times greater accuracy than the Instrument under test.

Voltage & Phase Angle

Amps	120 Unity	120 60°Lag	240 Unity	240 60°Lag	480 Unity	480 60°Lag	600 Unity	600 60°Lag
0.2	0.002	0.002	0.001	0.002	0.000	0.002	0.000	0.002
0.25	0.001	0.002	0.000	0.002	0.000	0.002	0.000	0.002
0.3	0.001	0.001	0.000	0.002	0.000	0.002	0.000	0.002
0.5	0.001	0.002	0.001	0.002	0.000	0.003	0.000	0.003
1.0	0.001	0.002	0.001	0.002	0.000	0.002	0.000	0.003
2.0	0.002	0.002	0.001	0.002	0.000	0.002	0.000	0.002
2.5	0.001	0.002	0.001	0.002	0.000	0.002	0.001	0.002
3.0	0.001	0.002	0.000	0.002	0.000	0.002	0.000	0.002
4.0	0.002	0.002	0.001	0.002	0.001	0.002	0.001	0.003
5.0	0.002	0.002	0.001	0.002	0.001	0.002	0.001	0.003
7.0	0.002	0.002	0.002	0.002	0.001	0.003	0.001	0.003
10.0	0.002	0.001	0.001	0.002	0.001	0.002	0.001	0.002
15.0	0.002	0.001	0.001	0.002	0.001	0.002	0.001	0.002
20.0	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.002
25.0	0.001	0.000	0.001	0.001	0.000	0.001	0.000	0.001
30.0	0.001	0.001	0.001	0.001	0.000	0.001	0.000	0.002
35.0	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002
40.0	0.001	0.000	0.001	0.001	0.000	0.001	0.001	0.002
45.0	0.001	0.000	0.001	0.001	0.000	0.001	0.000	0.002
50.0	0.001	0.000	0.001	0.001	0.000	0.001	0.000	0.002
60.0	0.001	0.001	0.001	0.002	0.001	0.002	0.001	0.003
80.0	0.001	0.000	0.001	0.001	0.001	0.001	0.001	0.002
100.0	0.001	0.000	0.000	0.001	0.000	0.001	0.000	0.002
120.0	0.000	0.000	0.000	0.002	0.000	0.002	0.000	0.003
150.0	0.000	0.000	0.000	0.002	0.000	0.003	0.000	0.003
180.0	0.000	-0.001	0.000	0.001	0.000	0.002	0.000	0.003
200.0	-0.001	-0.001	0.000	0.001	0.000	0.002	0.000	0.003
Average	**0.001**	**0.001**	**0.001**	**0.002**	**0.000**	**0.002**	**0.000**	**0.002**
Minimum	-0.001	-0.001	0.000	0.001	0.000	0.001	0.000	0.001
Maximum	0.002	0.002	0.002	0.002	0.001	0.003	0.001	0.003

Overall	Unity	60°Lag
Average	0.001	0.002
Minimum	-0.001	-0.001
Maximum	0.002	0.003

Calibration Report

RD-20-103 Dytronic Portable Standard

Function.................…… VAR-hour 60 Hz

Date.........…........   9-Jun-11

Serial Number….......... 205760

The following data was collected by a Radian Research RS-703A Automated Calibration System. The RS-703A VAR-hour calibration is derived directly from (3) Radian RD-22-RTS Dytronic Transfer Standards certified by the National Institute of Standards and Technology (NIST) with the use of an ultra low distortion synthesis and digital delay. Uncertainty is 0.005% for VAR-hour. Calibration temperature is 23 degrees Centigrade. Test time is 2 seconds and the stabilization time in between points is 5 seconds. For lagging power factors the current lags the voltage. All results are listed as Percent Error. The RS-703A has at least a 4 times greater accuracy than the Instrument under test.

Voltage & Phase Angle

Amps	120 90°Lag	120 30°Lag	240 90°Lag	240 30°Lag	480 90°Lag	480 30°Lag	600 90°Lag	600 30°Lag
0.2	0.000	-0.001	-0.001	-0.003	-0.003	-0.006	-0.003	-0.007
0.25	0.000	-0.001	-0.002	-0.004	-0.003	-0.006	-0.003	-0.007
0.3	-0.001	-0.001	-0.002	-0.003	-0.003	-0.006	-0.003	-0.006
0.5	0.000	-0.001	-0.001	-0.003	-0.002	-0.005	-0.002	-0.006
1.0	0.000	-0.001	-0.001	-0.003	-0.002	-0.005	-0.002	-0.005
2.0	0.000	0.000	-0.001	-0.002	-0.002	-0.004	-0.002	-0.005
2.5	0.000	0.000	-0.001	-0.002	-0.002	-0.004	-0.001	-0.004
3.0	0.000	0.000	-0.001	-0.002	-0.002	-0.004	-0.001	-0.004
4.0	0.001	0.000	0.000	-0.002	-0.001	-0.004	-0.001	-0.004
5.0	0.001	0.000	0.000	-0.001	-0.001	-0.003	-0.001	-0.004
7.0	0.001	0.001	0.000	-0.001	-0.001	-0.003	-0.001	-0.004
10.0	0.001	0.001	0.000	-0.001	-0.001	-0.003	-0.001	-0.003
15.0	0.001	0.001	0.000	-0.001	-0.001	-0.003	-0.001	-0.004
20.0	0.001	0.001	0.000	-0.001	-0.001	-0.002	-0.001	-0.003
25.0	0.001	0.001	0.000	-0.001	-0.001	-0.002	-0.001	-0.002
30.0	0.001	0.001	0.000	-0.001	-0.001	-0.003	-0.001	-0.004
35.0	0.001	0.002	0.000	-0.001	-0.001	-0.002	-0.001	-0.003
40.0	0.001	0.002	0.000	-0.001	0.000	-0.002	-0.001	-0.002
45.0	0.001	0.002	0.000	0.000	0.000	-0.002	0.000	-0.002
50.0	0.002	0.002	0.001	0.000	0.000	-0.001	0.000	-0.002
60.0	0.002	0.002	0.001	0.000	0.000	-0.002	0.000	-0.003
80.0	0.000	-0.001	0.000	-0.001	0.000	-0.002	0.000	-0.002
100.0	0.000	-0.002	0.000	-0.002	0.000	-0.002	0.000	-0.002
120.0	0.000	-0.003	0.000	-0.003	0.000	-0.003	0.000	-0.003
150.0	-0.001	-0.004	0.000	-0.003	0.000	-0.002	0.001	-0.003
180.0	-0.001	-0.004	0.000	-0.003	0.001	-0.002	0.001	-0.002
200.0	0.000	-0.004	0.000	-0.003	0.001	-0.001	0.001	-0.001
Average	**0.000**	**0.000**	**0.000**	**-0.002**	**-0.001**	**-0.003**	**-0.001**	**-0.004**
Minimum	-0.001	-0.004	-0.002	-0.004	-0.003	-0.006	-0.003	-0.007
Maximum	0.002	0.002	0.001	0.000	0.001	-0.001	0.001	-0.001

**Overall**	90°Lag	30°Lag
Average	0.000	-0.002
Minimum	-0.003	-0.007
Maximum	0.002	0.002

Calibration Report

RD-20-103 Dytronic Portable Standard

Function..............……   **Volts RMS   60 Hz**

Date..................…........   **9-Jun-11**

Serial Number….........   **205760**

The following data was collected by a Radian Research RS-703A Automated Calibration System. The RS-703A Voltage Axis is calibrated to a bank of three RD-22-RTS Dytronic Transfer Standards certified by the National Institute of Standards and Technology (NIST) to an uncertainty of 0.0008%. Calibration temperature is 23 degrees Centigrade. Test time is 2 seconds per point with a 2 second stabilization time in between points.
All readings are in Percent Error. The RS-703A has at least a 4 times greater accuracy than the Instrument under test.

Voltage	V RMS
60	0.002
80	0.002
100	0.002
120	0.002
140	0.001
160	0.001
180	0.001
200	0.001
220	0.001
240	0.001
260	0.001
280	0.001
300	0.001
320	0.001
340	0.001
360	0.001
380	0.001
400	0.001
420	0.001
440	0.001
460	0.001
480	0.001
500	0.001
520	0.001
540	0.001
560	0.001
580	0.001
600	0.001
Average	**0.001**
Minimum	0.001
Maximum	0.002

Calibration Report

RD-20-103 Dytronic Portable Standard

Function…….....…… Amps RMS 60 Hz

Date.................…........ 9-Jun-11

Serial Number……....... 205760

The following data was collected by a Radian Research RS-703A Automated Calibration System. The RS-703A Current Axis calibration is derived directly from the ratio of the (3) Radian RD-22-RTS Dytronic Transfer Standards which are certified by the National Institute of Standards and Technology (NIST) for an uncertainty of .0028%. Calibration Temperature is 23° Centigrade. Test time is 2 seconds per point with a 5 second stabilization time inbetween points. All readings are in Percent Error.
The RS703A has at least a 4 times greater accuracy than the Instrument under test.

Amps	A RMS
0.2	-0.001
0.25	-0.001
0.3	-0.001
0.5	-0.001
1.0	-0.001
2.0	-0.001
2.5	-0.001
3.0	-0.001
4.0	0.000
5.0	0.000
7.0	0.000
10.0	0.000
15.0	0.000
20.0	0.000
25.0	-0.001
30.0	-0.001
35.0	0.000
40.0	0.000
45.0	-0.001
50.0	0.000
60.0	0.000
80.0	0.000
100.0	0.000
120.0	0.000
150.0	0.000
180.0	0.000
200.0	0.000
Average	**0.000**
Minimum	-0.001
Maximum	0.000

Calibration Report

RD-20-103 Dytronic Portable Standard

Mode.....................…… Frequency

Date.....................…....... 9-Jun-11

Serial Number…......... 205760

The following data was collected by a Radian Research RS-703A Automated Calibration System. The RS-703A time base calibration (1/frequency) is derived directly from an Arbiter Systems Model 1083B GPS Satellite-Controlled Frequency Standard. Uncertainty of the GPS System is .00005 parts per milion, traceable to United States Naval Observatory (USNO). Calibration temperature is 23 degrees Centigrade. Test time is 2 seconds with a stabilization of 2 seconds in between points. All Results are listed as Percent Error. The RS703A has at least a 4 times greater accuracy than the Instrument under test.

Frequency

45	-0.0001
46	-0.0001
47	-0.0001
48	-0.0001
49	-0.0001
50	-0.0001
51	-0.0001
52	-0.0001
53	0.0000
54	-0.0001
55	-0.0001
56	-0.0001
57	-0.0001
58	-0.0001
59	-0.0001
60	-0.0001
61	-0.0001
62	-0.0001
63	-0.0001
64	0.0000
65	-0.0001
Average	**-0.0001**
Minimum	-0.0001
Maximum	0.0000