

Certificate of Calibration

Manufacturer **Radian Research, Inc.**
Instrument Model: **RD-23-472 Dytronic Portable Standard**
Serial Number 123456
Firmware Revision: 07.10.14
Error Specification .01% worst case



**Quality Management System
ISO 9001 Certified**

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

P.O. Number:
CE Number:
RMA / Certificate Number: RO12345
Calibration Date: 27-May-11

Environmental Conditions
Temperature: 23°C +/- 1°C
Humidity: between 35% and 60%

Based on the recommended calibration interval, the next calibration is due on: 26-May-12

Radian Research's As-Found Test Results showed this Instrument to be:

New In Tolerance Out of Tolerance 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/NCCL 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: 703143, 703144, 703146

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 $\pm .1$ ppm.
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 $\pm .390$ ppm. 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

Scott E. Blackwell LAB
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Calibration Report

RD-23-472 Dytronic Portable Standard

Function..... Watt-hour 60 Hz

Date..... 27-May-11

Serial Number..... 201809

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 5 seconds and the stabilization time in between points is 5 seconds. For lagging power factors the current lags the voltage. Results are listed in Parts Per Million. The RS-703A has at least a 4 times greater accuracy than the Instrument under test.

Voltage & Phase Angle

Amps	120	120	240	240	480	480	600	600
	Unity	60°Lag	Unity	60°Lag	Unity	60°Lag	Unity	60°Lag
0.2	8.01	8.57	6.67	12.93	-0.03	0.75	-3.01	4.95
0.25	5.76	4.95	2.63	10.32	-3.54	-2.56	-1.72	1.93
0.3	3.66	4.03	0.45	8.28	-6.33	-2.68	-4.20	2.60
0.5	5.49	6.20	2.27	10.41	-3.99	0.66	-2.72	5.36
1.0	4.33	8.71	1.11	11.84	-5.42	1.55	-3.22	5.58
2.0	5.13	7.37	1.73	9.33	-4.44	-0.77	-2.36	3.72
2.5	4.08	6.29	1.57	7.94	-4.94	-1.72	-2.79	2.93
3.0	4.68	4.62	1.88	5.46	-4.44	-4.55	-3.93	-1.36
4.0	4.15	7.01	0.84	6.92	-5.33	-2.92	-3.22	1.72
5.0	4.29	7.01	1.50	6.36	-5.37	-3.29	-2.79	1.67
7.0	10.13	10.94	8.08	10.94	1.24	1.13	3.42	5.14
10.0	3.65	6.72	1.79	3.79	-4.79	-6.51	-2.45	-1.42
15.0	8.27	8.84	5.13	5.79	-0.98	-4.32	0.60	-0.23
20.0	5.79	7.29	2.93	1.93	-3.72	-7.58	-1.53	-2.68
25.0	6.36	6.48	4.42	1.67	-2.10	-7.94	-2.86	-5.15
30.0	3.41	4.55	1.88	1.02	-4.70	-8.99	-2.75	-5.04
35.0	4.40	6.53	3.42	2.11	-3.61	-7.94	-1.43	-3.66
40.0	5.08	5.51	4.22	2.50	-3.15	-7.58	-0.84	-3.02
45.0	5.03	4.65	3.76	1.47	-3.74	-9.08	-3.59	-5.93
50.0	12.20	7.28	12.09	4.88	4.30	-5.65	3.82	-3.41
60.0	9.70	4.93	9.80	3.60	1.41	-7.27	2.89	-4.05
80.0	7.81	12.32	3.02	0.09	-4.13	-9.57	-2.02	-5.33
100.0	7.32	9.61	3.20	0.92	-4.35	-8.47	-5.04	-6.23
120.0	8.28	12.49	4.70	4.43	-3.08	-5.46	-1.41	-1.85
150.0	10.60	13.57	6.63	6.48	-0.92	-4.28	0.25	0.01
180.0	12.28	17.55	8.15	9.16	0.13	-1.77	-0.95	1.29
200.0	13.04	20.02	8.92	9.60	1.14	-1.27	-0.26	0.84
Average	6.78	8.30	4.18	5.93	-2.77	-4.37	-1.63	-0.43
Minimum	3.41	4.03	0.45	0.09	-6.33	-9.57	-5.04	-6.23
Maximum	13.04	20.02	12.09	12.93	4.30	1.55	3.82	5.58

<u>Overall</u>	Unity	60°Lag
Average	1.64	2.36
Minimum	-6.33	-9.57
Maximum	13.04	20.02

Calibration Report

RD-23-472 Dytronic Portable Standard

Function..... Watts 60 Hz

Date..... 27-May-11

Serial Number..... 201809

The following data was collected by a Radian Research RS-703A Automated Calibration System. The RS-703A Watt 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 5 seconds and the stabilization time in between points is 5 seconds. For lagging power factors the current lags the voltage. Results are listed in Parts Per Million. The RS-703A has at least a 4 times greater accuracy than the Instrument under test.

Voltage & Phase Angle

Amps	120	120	240	240	480	480	600	600
	Unity	60°Lag	Unity	60°Lag	Unity	60°Lag	Unity	60°Lag
0.2	8.71	9.15	7.06	13.25	0.61	1.07	-2.57	5.52
0.25	6.51	5.57	3.06	10.53	-3.00	-1.34	-0.89	2.38
0.3	4.04	4.77	0.95	8.29	-6.00	-1.70	-3.37	2.97
0.5	6.03	7.18	3.33	11.21	-3.05	1.57	-2.06	5.81
1.0	4.93	8.99	1.54	12.51	-4.88	2.16	-2.42	5.99
2.0	5.96	8.22	2.59	9.96	-3.69	-0.06	-1.50	4.27
2.5	5.02	7.29	2.06	8.58	-4.06	-1.12	-2.08	3.89
3.0	5.03	5.02	2.57	5.86	-3.92	-4.29	-3.52	-0.78
4.0	4.71	7.57	1.73	7.60	-4.60	-2.17	-2.52	2.49
5.0	4.90	7.72	2.29	7.02	-4.59	-2.72	-2.34	2.08
7.0	10.83	11.47	8.35	11.40	1.81	1.50	3.95	5.87
10.0	4.21	7.30	2.48	4.62	-4.20	-5.75	-1.76	-0.68
15.0	8.25	9.32	5.39	6.18	-0.90	-4.10	1.15	-0.04
20.0	6.57	7.96	3.52	2.96	-2.63	-6.87	-0.76	-2.03
25.0	7.30	7.07	5.27	2.66	-1.38	-7.26	-2.21	-4.09
30.0	3.61	4.98	2.34	1.14	-4.37	-8.75	-2.55	-4.65
35.0	5.41	6.99	4.40	2.60	-3.18	-7.19	-0.63	-2.85
40.0	5.48	5.87	4.53	3.20	-2.58	-6.75	-0.34	-2.56
45.0	5.33	5.19	4.43	1.85	-3.35	-8.60	-3.32	-5.43
50.0	12.98	8.01	13.05	5.37	4.79	-5.07	4.65	-2.47
60.0	10.16	5.59	10.16	4.08	1.68	-6.73	3.62	-3.63
80.0	9.51	14.01	4.06	0.79	-3.03	-8.85	-1.14	-4.19
100.0	8.04	10.54	3.84	1.53	-3.76	-8.07	-4.49	-5.76
120.0	8.88	13.22	5.25	5.16	-2.40	-4.99	-0.72	-1.15
150.0	11.35	13.96	7.20	6.70	-0.43	-3.89	0.92	0.69
180.0	12.52	17.61	8.59	9.68	0.75	-1.53	-0.52	1.65
200.0	12.95	20.73	9.52	10.31	1.42	-0.67	0.39	1.42
Average	7.38	8.94	4.80	6.48	-2.18	-3.78	-1.00	0.17
Minimum	3.61	4.77	0.95	0.79	-6.00	-8.85	-4.49	-5.76
Maximum	12.98	20.73	13.05	13.25	4.79	2.16	4.65	5.99

<u>Overall</u>	Unity	60°Lag
Average	2.25	2.95
Minimum	-6.00	-8.85
Maximum	13.05	20.73

Calibration Report

RD-23-472 Dytronic Portable Standard

Function..... VAR-hour 60 Hz

Date..... 27-May-11

Serial Number..... 201809

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 5 seconds and the stabilization time in between points is 5 seconds. For lagging power factors the current lags the voltage. Results are listed in Parts Per Million. The RS-703A has at least a 4 times greater accuracy than the Instrument under test.

Voltage & Phase Angle

Amps	120	120	240	240	480	480	600	600
	90°Lag	30°Lag	90°Lag	30°Lag	90°Lag	30°Lag	90°Lag	30°Lag
0.2	-0.48	-8.64	-5.40	-19.14	-20.48	-34.12	-21.60	-43.51
0.25	-3.81	-11.68	-7.56	-14.27	-19.01	-34.12	-21.82	-37.41
0.3	-8.64	-14.00	-10.13	-15.49	-20.04	-30.32	-20.17	-33.52
0.5	-5.42	-5.87	-7.92	-11.50	-16.06	-26.79	-15.95	-30.11
1.0	-5.06	-11.95	-8.01	-12.84	-15.97	-25.63	-15.74	-26.89
2.0	-2.92	-4.52	-6.31	-9.17	-14.63	-19.63	-14.38	-21.74
2.5	-5.08	-6.15	-7.51	-8.01	-15.09	-16.09	-12.63	-19.50
3.0	-5.75	-2.29	-8.49	-8.31	-17.25	-18.56	-16.05	-24.25
4.0	-3.18	-4.44	-6.40	-9.08	-14.45	-16.95	-13.88	-19.46
5.0	-4.08	-1.43	-6.58	-7.30	-13.95	-14.52	-11.95	-16.29
7.0	2.67	6.34	0.72	0.11	-8.06	-9.08	-8.10	-12.19
10.0	-2.65	4.65	-5.65	-3.72	-13.45	-11.09	-10.80	-13.20
15.0	4.17	9.89	-2.22	0.26	-8.89	-6.03	-8.47	-8.25
20.0	0.50	12.16	-5.29	-0.79	-10.66	-4.86	-8.51	-7.83
25.0	1.90	13.92	-5.31	-1.19	-11.60	-6.91	-11.10	-12.66
30.0	2.93	16.47	-5.17	-1.36	-11.18	-5.46	-10.53	-9.85
35.0	4.73	18.46	-4.75	0.81	-9.98	-2.46	-7.84	-6.01
40.0	6.44	23.10	-3.86	1.64	-8.51	0.14	-6.11	-3.82
45.0	6.94	24.23	-4.00	1.47	-8.07	1.66	-6.54	-2.47
50.0	14.83	36.46	1.90	8.65	-2.33	7.97	-2.68	2.73
60.0	15.62	40.13	1.69	7.41	-1.17	9.32	-2.68	5.95
80.0	10.39	35.06	-1.99	7.38	-6.85	6.02	-4.53	1.53
100.0	14.08	40.28	-0.23	7.32	-3.89	7.67	-3.48	3.85
120.0	21.09	51.95	3.97	11.21	1.04	14.41	0.35	10.31
150.0	26.70	60.88	5.72	14.87	3.66	19.68	4.40	15.82
180.0	33.39	71.47	8.34	16.47	6.94	23.47	7.29	18.58
200.0	37.99	79.99	10.29	19.45	9.72	28.95	9.44	23.64
Average	5.83	17.57	-2.97	-0.93	-9.27	-6.05	-8.67	-9.87
Minimum	-8.64	-14.00	-10.13	-19.14	-20.48	-34.12	-21.82	-43.51
Maximum	37.99	79.99	10.29	19.45	9.72	28.95	9.44	23.64

<u>Overall</u>	90°Lag	30°Lag
Average	-3.77	0.18
Minimum	-21.82	-43.51
Maximum	37.99	79.99

Calibration Report

RD-23-472 Dytronic Portable Standard

Function..... VAR 60 Hz

Date..... 27-May-11

Serial Number..... 201809

The following data was collected by a Radian Research RS-703A Automated Calibration System. The RS-703A VAR 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 5 seconds and the stabilization time in between points is 5 seconds. For lagging power factors the current lags the voltage. Results are listed in Parts Per Million. The RS-703A has at least a 4 times greater accuracy than the Instrument under test.

Voltage & Phase Angle

Amps	120	120	240	240	480	480	600	600
	90°Lag	30°Lag	90°Lag	30°Lag	90°Lag	30°Lag	90°Lag	30°Lag
0.2	0.42	-7.86	-4.70	-18.72	-19.92	-32.83	-21.20	-43.29
0.25	-3.23	-11.09	-6.79	-12.41	-18.92	-33.43	-20.93	-36.67
0.3	-7.89	-13.55	-9.68	-13.67	-19.34	-30.40	-19.52	-32.70
0.5	-4.65	-3.76	-7.07	-10.41	-15.55	-25.80	-15.26	-29.54
1.0	-5.02	-12.20	-7.54	-12.95	-15.54	-24.43	-15.47	-26.46
2.0	-2.42	-3.64	-5.83	-9.06	-13.89	-19.15	-13.89	-21.21
2.5	-4.21	-5.84	-6.96	-6.46	-14.41	-15.32	-11.96	-19.27
3.0	-5.09	-2.44	-7.84	-7.69	-16.65	-17.02	-15.38	-24.48
4.0	-2.62	-2.81	-5.88	-8.79	-13.90	-16.86	-13.10	-19.42
5.0	-3.38	-1.02	-6.14	-6.82	-13.34	-14.13	-11.26	-15.99
7.0	3.32	6.53	1.42	0.18	-7.38	-8.64	-7.54	-11.51
10.0	-2.23	6.28	-5.02	-2.39	-12.78	-9.97	-10.24	-12.33
15.0	4.57	9.72	-2.05	0.45	-8.80	-6.42	-8.44	-7.51
20.0	1.27	13.29	-4.44	0.97	-9.92	-4.18	-7.76	-7.47
25.0	2.44	14.46	-4.51	0.03	-10.43	-6.18	-10.37	-11.74
30.0	3.12	16.51	-4.72	-0.75	-10.68	-5.69	-10.31	-9.22
35.0	5.28	19.20	-3.92	0.58	-9.23	-1.96	-7.09	-5.22
40.0	7.02	23.00	-3.33	1.65	-7.69	0.66	-5.26	-3.23
45.0	7.43	25.31	-3.41	1.66	-7.45	2.16	-6.15	-1.96
50.0	15.56	37.15	2.74	9.70	-1.68	8.06	-1.94	3.65
60.0	16.13	39.74	2.19	7.94	-0.62	9.39	-2.17	6.23
80.0	11.29	35.90	-1.11	9.40	-6.01	6.80	-3.54	3.17
100.0	14.76	40.45	0.39	8.01	-3.56	7.30	-2.62	4.14
120.0	21.52	52.07	4.55	11.48	1.79	14.52	0.89	10.59
150.0	27.43	61.55	6.51	15.83	4.33	20.06	4.84	16.92
180.0	33.82	72.67	8.88	17.25	7.35	23.50	7.80	18.49
200.0	38.46	80.36	10.59	19.39	10.34	30.05	10.14	24.96
Average	6.41	18.15	-2.36	-0.21	-8.66	-5.55	-8.06	-9.30
Minimum	-7.89	-13.55	-9.68	-18.72	-19.92	-33.43	-21.20	-43.29
Maximum	38.46	80.36	10.59	19.39	10.34	30.05	10.14	24.96

<u>Overall</u>	90°Lag	30°Lag
Average	-3.17	0.77
Minimum	-21.20	-43.29
Maximum	38.46	80.36

Calibration Report

RD-23-472 Dytronic Portable Standard

Function.....VA-hour RMS 60 Hz

Date..... 27-May-11

Serial Number..... 201809

The following data was collected by a Radian Research RS-703A Automated Calibration System. The RS-703A VA-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 5 seconds and the stabilization time in between points is 5 seconds. For lagging power factors the current lags the voltage. Results are listed in Parts Per Million. The RS-703A has at least a 4 times greater accuracy than the Instrument under test.

Voltage & Phase Angle

Amps	120	120	240	240	480	480	600	600
	Unity	60°Lag	Unity	60°Lag	Unity	60°Lag	Unity	60°Lag
0.2	6.90	8.35	5.44	-2.60	-1.26	-15.79	-1.93	-14.36
0.25	5.58	4.42	2.54	-4.17	-3.72	-17.58	-1.93	-16.17
0.3	3.43	2.54	0.38	-5.21	-6.40	-17.21	-4.44	-16.48
0.5	5.31	4.77	2.09	-2.38	-4.17	-12.66	-3.01	-11.30
1.0	4.06	4.51	0.93	-2.47	-5.60	-11.77	-3.51	-10.59
2.0	4.86	5.40	1.55	-1.13	-4.61	-10.34	-2.65	-8.94
2.5	2.93	4.86	0.43	-1.36	-6.08	-10.44	-3.93	-8.74
3.0	3.25	4.62	0.45	-2.41	-5.93	-13.20	-3.08	-11.85
4.0	3.88	5.67	0.57	-1.66	-5.60	-10.60	-3.51	-9.23
5.0	3.22	4.65	0.36	-1.86	-6.44	-9.80	-3.82	-8.17
7.0	10.23	11.35	8.18	5.22	1.34	-4.18	3.83	-2.55
10.0	2.50	6.44	0.64	-0.07	-5.94	-9.44	-3.59	-7.14
15.0	7.99	10.08	4.93	2.74	-1.17	-5.08	0.38	-3.90
20.0	4.65	8.87	1.86	-0.14	-4.86	-7.23	-2.56	-5.65
25.0	4.99	8.77	2.93	-0.16	-3.59	-8.63	-1.85	-7.62
30.0	3.12	9.70	1.60	-0.31	-4.98	-7.46	-2.90	-6.64
35.0	4.16	11.51	3.26	1.05	-3.77	-5.32	-1.70	-4.31
40.0	4.00	12.09	3.07	1.22	-4.29	-4.36	-1.87	-3.25
45.0	3.50	12.60	2.23	0.52	-5.33	-4.63	-2.98	-3.59
50.0	10.83	19.07	10.60	6.71	2.93	0.76	4.74	0.80
60.0	9.42	20.10	9.51	5.98	1.12	1.22	2.66	1.44
80.0	6.74	22.69	1.95	2.73	-5.28	-3.42	-3.05	-2.59
100.0	5.84	22.77	1.83	2.75	-5.72	-2.52	-4.03	-1.83
120.0	8.00	28.60	4.52	7.36	-3.35	2.42	-1.63	2.91
150.0	10.37	34.10	6.40	9.91	-1.15	5.56	0.01	6.11
180.0	10.82	39.81	6.62	11.90	-1.39	8.27	-0.23	8.82
200.0	11.55	43.71	7.54	13.50	-0.35	10.98	0.66	10.91
Average	6.00	13.78	3.42	1.69	-3.54	-6.02	-1.70	-4.96
Minimum	2.50	2.54	0.36	-5.21	-6.44	-17.58	-4.44	-16.48
Maximum	11.55	43.71	10.60	13.50	2.93	10.98	4.74	10.91

<u>Overall</u>	Unity	60°Lag
Average	1.05	1.12
Minimum	-6.44	-17.58
Maximum	11.55	43.71

Calibration Report

RD-23-472 Dytronic Portable Standard

Function..... VA RMS 60 Hz

Date..... 27-May-11

Serial Number..... 201809

The following data was collected by a Radian Research RS-703A Automated Calibration System. The RS-703A VA 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 5 seconds and the stabilization time in between points is 5 seconds. For lagging power factors the current lags the voltage. Results are listed in Parts Per Million. The RS-703A has at least a 4 times greater accuracy than the Instrument under test.

Voltage & Phase Angle

Amps	120	120	240	240	480	480	600	600
	Unity	60°Lag	Unity	60°Lag	Unity	60°Lag	Unity	60°Lag
0.2	7.51	9.07	5.83	-2.26	-0.58	-15.24	-1.44	-13.76
0.25	6.40	5.01	2.92	-4.00	-3.21	-16.53	-1.11	-15.64
0.3	3.88	3.15	0.82	-4.98	-6.13	-16.33	-3.58	-16.05
0.5	5.81	5.65	3.16	-1.60	-3.30	-11.94	-2.29	-10.85
1.0	4.67	4.92	1.30	-1.96	-5.13	-11.33	-2.73	-10.24
2.0	5.77	6.13	2.34	-0.53	-3.93	-9.53	-1.78	-8.35
2.5	3.92	5.75	0.86	-0.65	-5.19	-9.75	-3.19	-7.87
3.0	3.55	5.17	1.12	-1.84	-5.41	-12.75	-2.61	-11.29
4.0	4.46	6.33	1.45	-1.04	-4.84	-10.08	-2.82	-8.58
5.0	3.78	5.34	1.17	-1.26	-5.70	-9.27	-3.44	-7.59
7.0	10.97	11.91	8.49	5.70	1.97	-3.68	4.39	-1.90
10.0	3.10	7.32	1.40	0.62	-5.35	-8.75	-2.85	-6.44
15.0	7.91	10.49	5.12	3.14	-1.14	-4.93	0.96	-3.65
20.0	5.48	9.64	2.42	0.80	-3.73	-6.43	-1.80	-4.98
25.0	5.85	9.62	3.89	0.67	-2.78	-7.93	-1.18	-6.80
30.0	3.41	9.98	2.05	0.01	-4.64	-7.17	-2.74	-6.32
35.0	5.19	12.24	4.17	1.57	-3.42	-4.55	-0.87	-3.50
40.0	4.39	12.66	3.42	1.87	-3.75	-3.59	-1.36	-2.71
45.0	3.80	13.12	2.90	0.98	-4.92	-4.11	-2.64	-3.16
50.0	11.60	19.69	11.63	7.27	3.40	1.42	5.62	1.60
60.0	9.92	20.68	9.88	6.57	1.42	1.69	3.42	1.99
80.0	8.42	24.35	2.92	3.53	-4.13	-2.68	-2.19	-1.60
100.0	6.63	23.42	2.38	3.24	-5.20	-1.95	-3.50	-1.42
120.0	8.61	29.26	5.08	7.97	-2.69	2.99	-1.01	3.54
150.0	11.14	34.61	7.00	10.34	-0.61	6.16	0.66	6.84
180.0	11.01	40.14	7.09	12.25	-0.77	8.66	0.22	9.22
200.0	11.54	44.54	8.09	14.11	-0.02	11.53	1.35	11.50
Average	6.62	14.45	4.03	2.24	-2.95	-5.41	-1.06	-4.37
Minimum	3.10	3.15	0.82	-4.98	-6.13	-16.53	-3.58	-16.05
Maximum	11.60	44.54	11.63	14.11	3.40	11.53	5.62	11.50

<u>Overall</u>	Unity	60°Lag
Average	1.66	1.73
Minimum	-6.13	-16.53
Maximum	11.63	44.54

Calibration Report

RD-23-472 Dytronic Portable Standard

Function..... Q-hour 60 Hz

Date..... 27-May-11

Serial Number..... 201809

The following data was collected by a Radian Research RS-703A Automated Calibration System. The RS-703A Q-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 Q-hour. Calibration temperature is 23 degrees Centigrade. Test time is 5 seconds and the stabilization time in between points is 5 seconds. For lagging power factors the current lags the voltage. Results are listed in Parts Per Million. The RS-703A has at least a 4 times greater accuracy than the Instrument under test.

Voltage & Phase Angle

Amps	120	120	240	240	480	480	600	600
	60°Lag	Unity	60°Lag	Unity	60°Lag	Unity	60°Lag	Unity
0.2	9.02	-8.19	-1.82	-11.99	-15.01	-29.42	-14.18	-42.70
0.25	5.22	-8.01	-3.36	-13.29	-16.68	-27.32	-15.74	-36.19
0.3	3.80	-7.82	-4.02	-14.30	-15.94	-26.89	-16.71	-31.68
0.5	5.67	-5.60	-1.40	-11.50	-11.86	-22.14	-10.80	-28.68
1.0	5.49	-9.08	-1.57	-13.82	-10.96	-22.85	-10.01	-26.75
2.0	6.20	-4.35	-0.14	-9.44	-9.35	-18.20	-8.37	-20.82
2.5	6.22	-5.08	0.00	-7.80	-9.23	-16.24	-8.86	-19.38
3.0	4.98	-2.47	-2.11	-7.54	-12.78	-17.85	-11.76	-22.05
4.0	6.65	-2.11	-0.86	-9.17	-9.71	-17.22	-8.73	-19.31
5.0	6.01	-0.93	-0.57	-6.44	-8.51	-14.95	-8.28	-16.64
7.0	12.17	6.34	5.94	0.72	-3.46	-8.47	-2.30	-10.47
10.0	7.80	2.57	1.36	-4.22	-8.15	-10.37	-7.25	-12.75
15.0	11.04	11.71	3.69	0.36	-4.03	-6.13	-3.52	-9.39
20.0	10.30	11.87	1.22	0.07	-5.87	-4.65	-5.77	-7.83
25.0	9.34	13.69	0.41	-0.04	-8.17	-5.31	-7.53	-12.29
30.0	10.66	13.52	0.55	-2.70	-6.51	-5.94	-6.26	-9.16
35.0	12.33	17.48	1.79	-0.17	-4.51	-3.20	-3.79	-5.68
40.0	13.45	21.24	2.50	1.79	-2.93	-0.50	-3.36	-3.25
45.0	14.06	24.29	1.98	2.04	-3.30	0.52	-3.59	-3.08
50.0	19.53	35.43	7.17	12.43	1.22	8.54	0.99	2.91
60.0	21.05	36.31	6.94	9.23	2.17	8.56	1.83	4.80
80.0	23.98	33.63	4.02	7.53	-2.06	4.38	-2.59	0.85
100.0	23.12	39.94	3.20	7.55	-1.95	5.38	-1.74	-0.55
120.0	29.52	49.20	8.46	10.11	3.33	11.02	3.42	7.52
150.0	35.32	59.20	11.21	13.42	6.86	16.93	6.05	11.85
180.0	40.95	67.91	13.23	15.65	9.67	20.67	8.92	13.29
200.0	44.28	74.38	13.95	17.73	11.44	24.71	10.91	16.95
Average	14.75	17.22	2.66	-0.51	-5.05	-5.81	-4.78	-10.39
Minimum	3.80	-9.08	-4.02	-14.30	-16.68	-29.42	-16.71	-42.70
Maximum	44.28	74.38	13.95	17.73	11.44	24.71	10.91	16.95

	60°Lag	Unity
Average	1.89	0.13
Minimum	-16.71	-42.70
Maximum	44.28	74.38

Calibration Report

RD-23-472 Dytronic Portable Standard

Function..... Volts RMS 60 Hz

Date..... 27-May-11

Serial Number..... 201809

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 5 seconds per point with a 5 second stabilization time in between points. Results are in Parts Per Million. The RS-703A has at least a 4 times greater accuracy than the Instrument under test.

Voltage	V RMS	Vh RMS	V2h RMS
60	-3.01	-3.72	-7.27
80	2.26	1.76	3.75
100	2.58	2.14	4.42
120	1.00	0.39	0.93
140	-3.81	-4.38	-8.50
160	1.87	1.22	2.68
180	1.06	0.45	1.09
200	0.54	-0.11	0.16
220	0.83	0.31	0.83
240	0.57	0.03	0.36
260	1.44	0.79	1.83
280	0.99	0.29	0.82
300	-3.38	-4.08	-7.93
320	-6.15	-6.56	-12.98
340	-5.98	-6.41	-12.54
360	-3.59	-4.02	-7.81
380	-3.57	-4.19	-8.27
400	-3.42	-3.97	-7.73
420	-2.87	-3.46	-6.72
440	-2.51	-3.01	-5.87
460	-5.61	-6.32	-12.42
480	-4.68	-5.33	-10.42
500	-2.25	-2.96	-5.76
520	-4.96	-5.48	-10.68
540	-3.48	-4.00	-7.62
560	0.34	-0.25	-0.23
580	-2.30	-2.89	-5.57
600	-1.03	-1.65	-3.10
Average	-1.75	-2.34	-4.45
Minimum	-6.15	-6.56	-12.98
Maximum	2.58	2.14	4.42

Calibration Report

RD-23-472 Dytronic Portable Standard

Function..... Amps RMS 60 Hz

Date..... 27-May-11

Serial Number..... 201809

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 5 seconds per point with a 5 second stabilization time inbetween points. Results are in Parts Per Million.

The RS703A has at least a 4 times greater accuracy than the Instrument under test.

Amps	A RMS	Ah RMS	A2h RMS
0.2	3.39	2.74	5.66
0.25	2.16	1.09	2.43
0.3	-0.23	-0.79	-1.35
0.5	1.39	0.67	1.59
1.0	-0.04	-0.59	-0.93
2.0	0.58	-0.17	-0.09
2.5	-0.66	-1.46	-2.68
3.0	-0.28	-0.81	-1.34
4.0	0.07	-0.59	-0.93
5.0	-0.88	-1.46	-2.79
7.0	6.21	5.54	11.31
10.0	-0.99	-1.60	-2.90
15.0	3.11	2.90	5.98
20.0	0.08	-0.73	-1.18
25.0	0.61	-0.22	-0.11
30.0	-1.22	-1.57	-2.98
35.0	0.41	-0.40	-0.65
40.0	-0.24	-0.79	-1.29
45.0	-1.31	-1.69	-3.15
50.0	6.35	5.58	11.42
60.0	4.22	3.70	7.70
80.0	2.52	0.79	1.82
100.0	-0.93	-1.59	-2.98
120.0	0.94	0.28	0.83
150.0	2.54	1.86	3.92
180.0	1.43	1.11	2.36
200.0	2.08	1.76	3.69
Average	1.16	0.50	1.24
Minimum	-1.31	-1.69	-3.15
Maximum	6.35	5.58	11.42

Calibration Report

RD-23-472 Dytronic Portable Standard

Mode..... Frequency

Date..... 27-May-11

Serial Number..... 201809

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 million, 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. Results are listed in Parts Per Million. The RS703A has at least a 4 times greater accuracy than the Instrument under test.

Frequency

45	3.75
46	3.87
47	3.63
48	3.58
49	3.93
50	4.17
51	3.68
52	3.87
53	3.79
54	3.70
55	4.01
56	3.75
57	4.07
58	4.05
59	4.07
60	3.84
61	3.70
62	3.94
63	4.19
64	3.95
65	3.98
Average	3.88
Minimum	3.58
Maximum	4.19

Calibration Report

RD-23-472 Dytronic Portable Standard

Function..... Phase 60 Hz

Date..... 27-May-11

Serial Number..... 201809

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 0.003%. Calibration temperature is 23 degrees Centigrade. The test time is 2 seconds and the stabilization time in between points is 2 seconds. For lagging power factors current lags the voltage. Results are listed in Parts Per Million of 360°. The RS703A has at least a 4 times greater accuracy than the Instrument under test..

Voltage & Current

	120 1	120 5	120 15	120 30	120 50	240 1	240 5	240 15	240 30	240 50	480 1	480 5	480 15	480 30	480 50
Phase															
-180	0.10	-0.08	-0.44	-0.06	0.08	-0.24	-0.44	-1.10	-1.28	-1.93	-0.93	-0.90	-1.49	-1.43	-1.74
-150	-1.31	-1.34	-1.76	-1.48	-1.17	-1.57	-1.67	-2.42	-2.57	-2.91	-2.27	-2.14	-2.80	-2.64	-2.81
-120	-0.97	-1.35	-1.62	-1.61	-1.74	-1.17	-1.49	-2.02	-2.17	-2.76	-1.63	-1.80	-2.29	-2.36	-2.78
-90	0.22	-0.28	-0.64	-0.89	-1.30	0.20	-0.20	-0.67	-0.83	-1.32	-0.05	-0.39	-0.86	-1.00	-1.43
-60	0.66	0.09	-0.45	-0.95	-1.61	0.86	0.33	-0.04	-0.15	-0.44	0.89	0.34	-0.09	-0.37	-0.76
-30	0.70	0.13	-0.42	-1.15	-2.15	1.08	0.39	0.36	0.21	-0.21	1.20	0.40	0.27	-0.01	-0.55
0	0.96	0.27	-0.43	-1.32	-2.33	1.25	0.61	0.30	0.30	-0.01	1.58	0.68	0.30	-0.06	-0.51
30	2.04	1.24	0.50	-0.31	-1.48	2.16	1.44	1.22	1.11	0.55	2.51	1.54	1.19	0.89	0.05
60	1.66	1.25	0.67	0.00	-0.66	1.73	1.32	1.07	0.90	0.53	1.81	1.37	0.91	0.62	0.27
90	0.64	0.44	-0.20	-0.56	-0.93	0.76	0.41	-0.18	-0.39	-0.82	0.63	0.21	-0.35	-0.47	-0.93
120	0.43	0.32	-0.18	-0.19	-0.47	0.54	0.11	-0.49	-0.73	-1.29	-0.13	-0.24	-0.82	-0.88	-1.38
150	0.72	0.45	-0.06	0.26	0.30	0.35	0.13	-0.60	-0.83	-1.30	-0.39	-0.21	-0.99	-0.86	-1.21
180	0.12	-0.12	-0.44	-0.11	0.10	-0.27	-0.35	-1.03	-1.28	-1.87	-0.97	-0.86	-1.51	-1.38	-1.86
Average	0.46	0.08	-0.42	-0.64	-1.03	0.44	0.05	-0.43	-0.59	-1.06	0.17	-0.15	-0.66	-0.77	-1.20
Minimum	-1.31	-1.35	-1.76	-1.61	-2.33	-1.57	-1.67	-2.42	-2.57	-2.91	-2.27	-2.14	-2.80	-2.64	-2.81
Maximum	2.04	1.25	0.67	0.26	0.30	2.16	1.44	1.22	1.11	0.55	2.51	1.54	1.19	0.89	0.27