



Typical Accuracy = +/- 0.005%
Guaranteed Accuracy = +/- 0.02%

OVERVIEW

PRODUCT HIGHLIGHTS: The Radian RD-31 Three-phase Electricity Reference Standard achieves a level of accuracy and performance never before available in a portable standard. The RD-31 has a guaranteed accuracy of 0.02% for all measurement functions across its entire operating range, with typical accuracy of 0.005%. This guaranteed accuracy specification includes the variables of stability, power factor, and traceability uncertainty.

The RD-31 utilizes Radian's new Dytronic measurement technology consisting of a *Radian designed Integrating Analog to Digital Signal Converter*. Unlike off-the-shelf A/D Converters used in other instruments, *Radian's A/D Converter is specifically designed and optimized for power and energy measurement*. This unique design makes the RD-31 absolutely unsurpassed in its ability to accurately measure "real world" waveforms. The RD-31's A/D Converter is combined with Radian's renowned electronically compensated voltage and current input transformers and a hermetically sealed reference set to provide the highest degree of accuracy, stability and versatility offered in a portable three-phase standard.

MEASUREMENTS: The RD-31 is a four quadrant three-phase-measuring instrument that registers both forward and reverse energy flow and provides per phase voltage, current, power and energy (Active, Reactive, Apparent) information.

ANALOG SENSE: The optional analog sense feature enables testing of transducers and electronic energy meters that provide an analog current output from zero to 2 mA.

METER AND STANDARD TESTING: The RD-31 can be used with a controlled current source to test revenue meters and reference standards. In field applications the RD-31 can perform a true three phase meter accuracy test using existing service load. Pickups to sense meter disk rotation or calibration pulses of infrared, visible light or KYZ variety plug directly into the unit. The RD-31 is ideal for testing high end energy meters found in power plants, substations, inter-tie points and at large utility customer accounts. The RD-31 is also the perfect complement to relay test sets where it can serve as an active reference standard when testing meters or can be used to periodically certify the accuracy of the test set itself.

The RD-31 is available in a portable or rack mount package. Technical details for the RD-31 are listed on the back side of this bulletin.

POWERFUL SOFTWARE

The RD-31 has an optional built in computer with color touchscreen display. Windows CE based *RR-MobileSuite* software powers the testing and analysis functions of the RD-31. *RR-MobileSuite* is a set of simple, yet extremely powerful, software tools. *Metrics* enables the user to view and manipulate views of all measurements including: Instantaneous, MIN/MAX, and Accumulating. *Configure* enables setting

and control of various device parameters. *Meter Test* allows you to perform a test on a revenue meter. *Standard Test* allows you to test up to three secondary standards. Results for meter and standards testing are calculated, displayed, and can be saved. The use of standard memory cards makes data expansion unlimited. Data management features allow users to easily query, view and transfer saved test results to a PC. Customizable export files can be created using a flexible Comma Separated Variable (CSV) format that is easily imported into other PC applications. The RD-31 can also be controlled with an external computer using an RS-232 serial connection. *RR-PCSuite* is a PC based version of



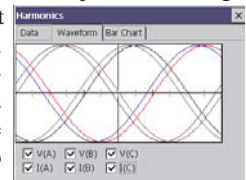
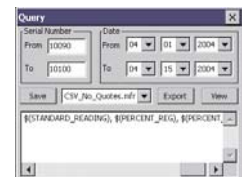
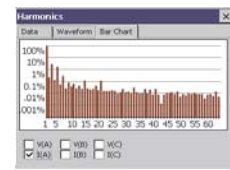
RR-MobileSuite software that adds the ability to directly save test results to a computer's hard disk. *RR-Kit* software is a set of commands, routines and instructions for developing custom software applications.

Inst	Min	Max	Accum	Options
Wh	3.917	4.015	4.114	12.835
VARh	0.145	0.148	0.152	0.466
Ch	2.084	2.136	2.188	6.721
VWh	3.920	4.018	4.116	12.844
Vh	0.392	0.402	0.412	N/A
Ah	0.017	0.017	0.017	N/A
VZh	92.552	94.057	97.194	N/A

POWER ANALYSIS: This option to the RD-31 adds valuable tools to *RR-MobileSuite*. *Vectors* graphically displays three phase vector diagrams with flexible display settings. *Harmonics* provides Total Harmonic Distortion (THD) for all three phases of voltage

and current waveforms, displays amplitude and relative phase angle data up to the 64th

harmonic, and provides graphical representations of all harmonics information. *Trend* enables you to generate a trend chart for any of the instantaneous metrics. The unprecedented accuracy of measuring distorted waveforms combines with this power analysis capability to clearly distinguish the RD-31 as the definitive portable energy reference instrument for both testing and power quality applications.



Trend Chart window showing a line graph of test results over time from 12:25:22 to 27:9.

	A	B	C
V	✓	✓	✓
A	✗	✗	✗
W	✗	✗	✗

Technical Specifications

OPERATING RANGE

- Current input range is 0.02 to 120 (200 optional) amps per input autoranging - direct connection.
- Voltage input range is 30 to 630 volts autoranging.
- Auxiliary power input range is 60 to 630 volts autoranging.
- The BNC pulse output has a default value of 0.00001 Wh/pulse but may be reprogrammed with RR-MobileSuite or RR-PCSuite.
- Frequency range is 45 to 65 Hz. (Fundamental)
- Harmonic Analysis through the 64th harmonic order.
- Power Factor range is any.
- Operating temperature range is -20°C to $+70^{\circ}\text{C}$.
- Shock and vibration withstand are any that is not destructive.

PHYSICAL DESCRIPTION

- Adjustable to Rack mount, Desktop or Field Applications.
- Weight is 16 pounds (7.2 kg). Shipping weight 28 pounds (12.6 kg)
- Dimensions are 5 inches H, 17.5 inches W, 6.25 inches D (127mm H, 444.5mm W, 158.75mm D.)
- Case Construction is a powder coated aluminum
- The LCD is backlit
- Current inputs are 6mm Multi-Contact brand sockets for 120 Amp version or 8mm bolt on for 200 Amp version.
- The potential input and auxiliary power inputs are insulated 4mm Multi-Contact brand sockets.
- 9 pin DB9 jack
- Lemo connector for interface to sensors.
- 3 Clamp-on CT inputs. These connectors are for direct interface to an optional clamp-on current transformer, available from Radian.

TEST AND CALIBRATION

- The unit is calibrated by software.
- 50 and 60 Hz calibration sheets can be provided.
- Orientation is any.
- Re-calibration interval is 365 days.
- Warm up time is 15 seconds or less.

ACCURACY

Accuracy specifications apply to all supported measurement functions using sinusoidal waveforms and across the entire operating range of the product between the temperatures of -20°C to $+70^{\circ}\text{C}$. Maximum guaranteed accuracy specification includes stability, traceability uncertainty, power factor, and test system errors.

Typical Accuracy: $\pm 0.005\%$
Guaranteed Accuracy: $\pm 0.02\%$

Temperature Influence outside normal operating temperature range per $^{\circ}\text{C}$: $\pm 0.0005\%$ typical $\pm 0.001\%$ maximum.

For Power Factors of 100% and 50% output for Whrs, VARhrs, VAhrs there is no impact on accuracy. For Power Factor of <0.5 (PF between -60° and -90°) then Guaranteed Accuracy is $\pm 0.02\%/PF$.

PROTECTION

- Isolation: Complete Input/output/power/case/control.
- Dielectric withstand: 2.3 kVrms, 60Hz 60 seconds.
- Surge withstand: IEEE 472 and ANSI 37.90.
- Fuses: Schurter #0342516 for potential and auxiliary power.

ENVIRONMENTAL

- Temperature: -20°C to 70°C (-4°F to 158°F) operation
 -20°C to 70°C (-4°F to 158°F) storage
- Humidity: 0% to 95% non-condensing

INPUTS 1, 2, 3

- Display Gate: BNC with 150 ohms pull up to 5 volts, clamped at 5.7 volts
- Gate Rate: 200 nS pulse width minimum, maximum 20 Hz repetition rate

OUTPUTS 1, 2, 3

- Type: Open collector, clamped at 27 volts
- Frequency: Max 2.1 MHz (200 nS pulse width minimum)
- Metrics: Selectable, i.e. Watt Hours, VAR Hours, VA Hours, etc.

RD-31 Menu for Measurements & Functionality: The last three digits determine the model. The first of the last three digits determines the measurement functions. The second digit determines if the unit has a built-in computer, power analysis option and/or analog sense input. The third of the last three digits determines the current input configuration and enclosure type.

Specifying the first of the last three digits: RD-31-Xxx

MODEL	MEASUREMENT FUNCTIONS
RD-31-2xx	Whrs, VARhrs, Volts, Amps, VAhrs, Qhrs, Watts, VARs, VA, Phase Angle, PF, Frequency
RD-31-3xx	Whrs, VARhrs, VAhrs, Qhrs, Volts, Amps, Watts, VARs, VA, Vhr, Ahr, V2hr, A2hr, Phase Angle, PF, Frequency Min & Max measurements: All indicating functions
RD-31-4xx	Whrs, Volts, Amps, VARhrs, Qhrs, VAhrs, Watts, VARs, VA, Vhr, Ahr, V2hr, A2hr, Phase Angle, PF, Frequency Min & Max: All indicating functions AVG response: VAhrs, VA, Volts, Whrs, Amps, Ahrs

Specifying the second of the last three digits: RD-31-xXx

-x0x	No computer, No power analysis, No analog sense input
-x1x	Built-in computer (with color display and WIN CE MobileSuite software)
-x2x	Power analysis (Harmonics, Trending and Vector Analysis)
-x3x	Built-in computer and Power analysis
-x4x	Analog Sense Input (for Volts, Amps, Watts, VARs, VA) (2mA DC max)
-x5x	Built-in computer and analog sense input
-x6x	Power analysis and analog sense input
-x7x	Built-in computer, power analysis and analog sense input

Specifying the third of the last three digits: RD-31-xxX

-xx1	120 Amp (6mm insert) current inputs, Rack Mount
-xx2	200 Amp (bolt on) current inputs, Rack Mount
-xx3	120 Amp (6mm insert) current inputs, Portable
-xx4	200 Amp (bolt on) current inputs, Portable

ACCESSORIES

RR-PCSuite	Testing and Analysis PC software for RD Standards
RR-Kit	Software for Custom Application Development
RR-1H	Optical Pickup for Infrared LED, 4-Pin plug
RR-DS/sm	Meter Disk Sensor with 4-Pin plug, suction mount
RR-DS/f	Meter Disk Sensor with 4-Pin plug, field mount
RR-DS/s	Meter Disk Sensor with 4-Pin plug, shop mount
RR-KYZ	Pulse Input Adapter with 4-Pin plug

WARRANTY

The RD-31 is warranted to be substantially stable in calibration over time. If within one year after factory calibration the RD-31 does not meet its specifications, Radian will repair and recalibrate the unit. Radian Research warrants the RD-31 to be free from defects in material and workmanship. Radian will repair or replace any instrument or component therein which, within two years after shipment, proves to be defective upon examination. For a period of ten years, Radian warrants the RD-31's autoranging feature from catastrophic failure resulting from failure to autorange.