

# RD-21

## Dytronic Single-Phase Reference Standard



## Overview

**PRODUCT HIGHLIGHTS:** The Radian RD-21 Single-phase Electricity Reference Standard is one of the most versatile reference instruments ever. The RD-21 has a guaranteed accuracy of 0.02%. This guaranteed accuracy specification includes the variables of stability, power factor, traceability uncertainty and test system errors.

The RD-21 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-21 absolutely unsurpassed in its ability to accurately measure "real world" waveforms. The RD-21'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 single-phase standard.

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

**MEASUREMENTS:** The RD-21 is a four quadrant single-phase, simultaneous measuring instrument that registers both forward and reverse energy flow and provides voltage, current, power and energy (Active, Reactive, Apparent) information. The Harmonic Analysis option makes available the analysis of customer load through the 50th harmonic order while the Built-in Comparator option provides for the automatic calculation of test results for the meters and standards being tested.

**METER AND STANDARD TESTING:** The compact design of the RD-21 makes it an ideal reference standard for field testing applications where optimal accuracy is required. The RD-21 can be used with a controlled current source to test revenue meters and reference standards. In field applications the RD-21 can perform a single-phase meter accuracy test using existing service load. Pickups to sense meter disk rotation or calibration pulses of infrared, visible light, or KYZ signal plug directly into the standard. The RD-21 is ideal for testing high end energy meters found in power plants, substations, inter-tie points and at large utility customer accounts. The RD-21 may serve as a secondary standard to test portable field standards or standards within meter test benches. The RD-21 is also ideal to be integrated as the reference standard within a meter test bench.

## Intuitive User Interface

The RD-21's LCD and five-button keypad provides a direct interface to the end user while the RD-21's RS-232 port, utilized with the applicable software, allows for remote PC control and configuration of the RD-21. Utilizing the five-button keypad and observing the LCD, the user is able to scroll through the various measurement functions of the RD-21 and toggle between the different menu screens. The amount of measurement information and the number of menu screens viewable is determined by the model number of the RD-21.

### MENU SCREENS

The key menu screens are the Measurement Screens, Run Test Screen, Harmonics Screen, and Setup Screen.

The Measurement Screens will display the measurement functions the RD-21 supports. There are different screens for Instantaneous Measurements, Accumulating Measurements, and Minimum & Maximum Measurements. Using the keypad, it is very simple to toggle between the various measurement screens and to scroll through the various measurement functions.

INS	0.00000	V
RMS	0.00000	A
	0.00000	W
	0.00000	VA

ACC	0.00000	Wh
RMS	0.00000	VARh
	0.00000	Qh
	0.00000	VAh

INS	0.00000	VAR
RMS	0.00000	Hz
	0.00000	PA
	0.00000	PF

ACC	0.00000	Vh
RMS	0.00000	Ah
	0.00000	V2h
	0.00000	A2h

The Main Menu Screen allows users to gain access to the specific functionality of their RD-21. From the Main Menu, the user may select to run a meter or standard test, perform harmonics analysis, set-up/configure their RD-21, perform a self test, and review information pertinent to their RD-21.

Run Test
Harmonics: Volt
Harmonics: Amp
Setup

Select Test Type
▼ Meter
Standard

The Run Test Screen allows the user to select the type of test they would like to run and then to enter the different variables for that specific test.

Test Running	
Revs Test	0000
Wh	0.00000

Test Results	
Whr	0.00000
%Err	0.000
%Reg	0.000

In the Harmonics Screen the user may select to view voltage or amperage harmonics, scroll through the harmonic order to observe the phase and magnitude of a specific harmonic, and view the total harmonic distortion.

Port 1
Port 2
Port 3
Port Polarity

Measure Type
Beep
Backlight
Factory Default

The Setup Screen allows the user to custom configure their RD-21. The options available are changing the operation of the BNC ports, enabling or disabling the backlit display, selecting RMS or AVG measurement response, disabling or enabling the RD-21's audible beeps, auto-scrolling the screens, and returning the RD-21 to its original factory default settings.

The above features and functions may also be utilized via a PC running Radian Software packages. RR-Analyze allows for the custom configuration of the RD-21 along with data analysis and RR-Kit software is a set of commands, routines, and instructions for custom application development.

## Residential Meter Testing

Guaranteed Accuracy = +/- 0.02%

# Technical Specifications

## Operating Range

- Current (Autoranging)
  - ♦ .02 to 67 amps per input (three input option)
  - ♦ .02 to 75 amps per input (three input extended range option)
  - ♦ .02 to 120 amps per input (one input option)
- Input voltage: 30 to 600 volts (Autoranging)
- Auxiliary power input: 60 to 600 volts (Autoranging)
- Frequency: 45 to 65 Hz
- Phase Angle: 0 to 360° or -180 to 180°
- Power Factor: -1 to 1
- Temperature: -20° to +70°C (-4° to +158°F)
- Humidity: 0% to 95% non-condensing
- Shock and vibration: Any that is not destructive

## Physical Description

- Weight: 2.5 kg (5.5 lbs); 3.6 kg (8lbs) shipping weight
- Size 190.5 mm (7.5") H x 139.7 mm (5.5") D excluding strap
- Backlit LCD, 4 line by 16 character
- Current inputs: 6mm jacks
- Potential and Aux power inputs: 4mm Banana type jacks
- BNC connector (port 1) used for input/gating
- BNC connector (port 2) used for pulse outputs
- BNC connector (port 3) used for three phase SYNC or analog sense
- 5 membrane button keypad: UP/DOWN/ESC-RESET/ENTER/MODE
- 8 pin RJ-45 jack for RS-232 communication
- Pickup input for direct interface to RR-DS, RR-1H, or RR-KYZ
- Clamp-on CT input for optional clamp-on current transformer

## Test And Calibration

- No physical adjustments, all calibration performed with software
- 50 or 60 Hz calibration can be provided
- Orientation: Any within 90° of vertical
- Re-calibration interval: 365 days
- Warm up time: 30 seconds

## Accuracy

Guaranteed accuracy specification includes stability, traceability uncertainty, power factor, and test system errors. - **Guaranteed Accuracy: ±0.02%**

Temperature influence outside normal operating temperature range per °C: ±0.0005%  
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 ± 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: #34.3117 for potential and auxiliary power

## Inputs (Port 1)

- Display Gate ..... BNC with 150 ohms pull up to 5 volts, clamped at 5.7 volts

## Outputs (Port 2)

- Type: BNC, Open collector, clamped at 27 volts (50mA max)
- Frequency: Max 2.1 MHz (200 nS pulse width minimum)
- Metrics: Selectable, i.e. Watt hours, VAR hours, VA Hours, etc.
- Pulse value: Programmable (0.00001 Wh/pulse Default)

## Quality

- Meets all applicable ANSI and IEC specifications
- Radian Research's calibration procedures are in compliance with MIL-STD-45662A and ANSI/NCSL Z540-1-1994
- Radian Research's primary transfer standards are traceable to NIST
- Radian Research's quality system is ISO-9001-2000 certified
- Warranty: Two years parts and labor

## MODEL

## MEASUREMENT FUNCTIONS

<b>RD-21-112</b>	Dytronic Portable Standard, 0.02% Accuracy, Built-In Comparator, Three 67Amp Current Inputs (200Amp Single Phase), Whrs, Volts, Amps, VARhrs
<b>RD-21-232</b>	Dytronic Portable Standard, 0.02% Accuracy, Built-In Comparator, Harmonic Analysis, Three 67Amp Current Inputs (200Amp Single Phase), Whrs, Volts, Amps, VARhrs, VAhrs, Qhrs, Watts, VARs, VA, Phase Angle, Power Factor, Frequency
<b>RD-21-332</b>	Dytronic Portable Standard, 0.02% Accuracy, Built-In Comparator, Current Clamp Input, Harmonic Analysis, Three 67Amp Current Inputs (200Amp Single Phase), Whrs, Volts, Amps, VARhrs, VAhrs, Qhrs, Watts, VARs, VA, Phase Angle, Power Factor, Frequency, Vhr, Ahr, V2hr, A2hr, Min & Max Measurements: All Indicating Functions
<b>RD-21-372</b>	Dytronic Portable Standard, 0.02% Accuracy, Built-In Comparator, Current Clamp Input, Harmonic Analysis, Analog Sense, Three 67Amp Current Inputs (200Amp Single Phase), Whrs, Volts, Amps, VARhrs, VAhrs, Qhrs, Watts, VARs, VA, Phase Angle, Power Factor, Frequency, Vhr, Ahr, V2hr, A2hr, Min & Max Measurements: All Indicating Functions
<b>RD-21-433</b>	Dytronic Portable Standard, 0.02% Accuracy, Built-In Comparator, Current Clamp Input, Harmonic Analysis, Three 75Amp Current Inputs (225Amp Single Phase), Whrs, Volts, Amps, VARhrs, VAhrs, Qhrs, Watts, VARs, VA, Phase Angle, Power Factor, Frequency, Vhr, Ahr, V2hr, A2hr, Min & Max Measurements: All Indicating Functions, AVG Response: VAhrs, VA, Volt, Vhrs, Amps, Ahrs

## ACCESSORIES

<b>RR-Analyze</b>	Software for Harmonics Analysis (included with harmonics option)
<b>RR-Kit</b>	Software for Custom Application Development
<b>RR-1H</b>	Optical Pickup for Infrared LED, 4-Pin plug
<b>RR-DS/sm</b>	Meter Disk Sensor with 4-Pin plug, suction mount
<b>RR-DS/f</b>	Meter Disk Sensor with 4-Pin plug, field mount
<b>RR-DS/s</b>	Meter Disk Sensor with 4-Pin plug, shop mount
<b>RR-KYZ</b>	Pulse Input Adapter with 4-Pin plug
<b>RR# 352000</b>	Soft Carrying Case for RD Standard and Test Accessories

## WARRANTY

The RD-21 is warranted to be substantially stable in calibration over time. If within one year after factory calibration the RD-21 does not meet its specifications, Radian will repair and recalibrate the unit. Radian Research warrants the RD-21 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-21's autoranging feature from catastrophic failure resulting from failure to autorange.