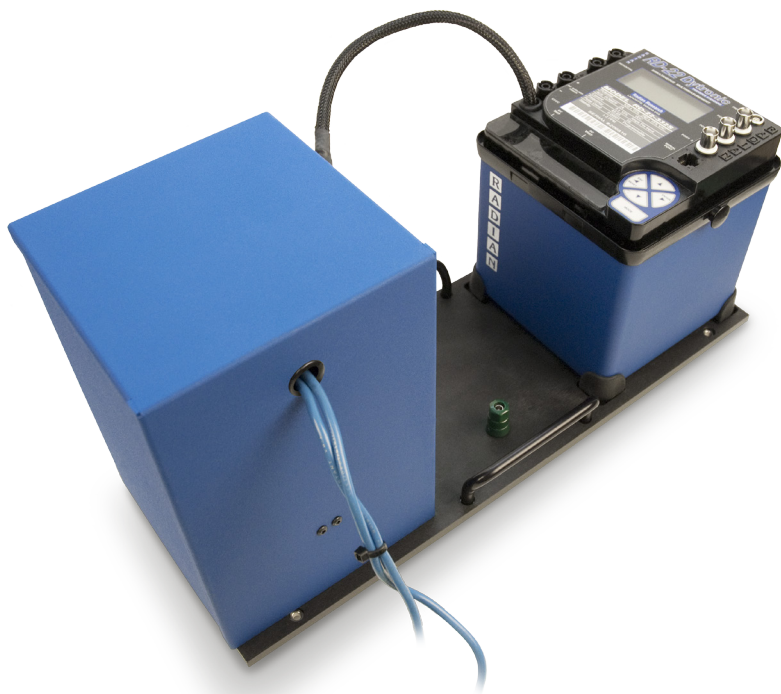


RD-22

Dytronic Primary Transfer Ultra Stable Standard



Non - Galvanic Current Connection

Concentric Core Current Comparator

Harmonic Waveform Analysis

Built-in Comparator

PC Interface

Overview

The RD-22 Ultra Stable Primary Transfer Standard represents the state-of-the-art technology in a commercially available AC transfer reference. The Ultra Stable RD-22 is a variant of the RD-22 Primary Transfer Standard that has been optimized for 120/240 V @ 5A operation to provide optimum stability. In a stable test environment, repeatability for a 10-second test of $\pm 0.6 \mu\text{Wh}/\text{VAh}$ is attained at 120 V and 240 V at 5A inputs with a 95% confidence interval. A typical experimental 2 repeatability of less than $\pm 0.25 \mu\text{Wh}/\text{VAh}$ is achieved. In a stable test environment, a reproducibility of $\pm 2 \mu\text{Wh}/\text{VAh}$ over a five-day interval is attained at 120 V and 240 V at 5A inputs with 95% confidence interval.

The technology utilized in the Ultra Stable RD-22 is based on Radian's Dytronic measurement system featuring a Radian designed Integrating Analog to Digital Converter based on a charge-balance conversion principle. The potential input contains a newly designed potential transformer and range switching design optimized for 120/240 V operation. The Ultra Stable RD-22 also employs the Radian electronically compensated concentric core current comparator with a fixed winding around the core to optimize repeatability and reproducibility on the current input. These new technologies combine with existing Radian features to provide the highest degree of accuracy, stability and versatility offered in a primary transfer standard.

The Ultra Stable RD-22 can be used to transfer accurate and traceable measurements from Radian Research's calibration laboratory. Alternatively, it can be calibrated directly by a National Metrology Institute such as the National Institute of Standards and Technology (NIST).

The same low temperature coefficients of the traditional RD-22 are achieved by Ultra Stable RD-22. Each Ultra Stable RD-22 Calibration Report comes with the temperature coefficients for the twelve cardinal test points, 120/240V at 5A at 50/60 Hz at unity and 0.5 lead and lag power factors. The temperature coefficients are typically below 2ppm/K.

Four quadrant, single-phase simultaneous energy and power measurements are provided by Ultra Stable RD-22. The potential input is autoranging between 120 and 240V. This autoranging feature was pioneered by Radian Research. The potential input ranges are 120 V $\pm 15\%$ (102 V to 138 V) and 240 V $\pm 15\%$ (204 V to 276 V) with a maximum input voltage of 276 V. The current input range is 5 A $\pm 15\%$ (4.25 A to 5.75 A). The external auxiliary power input converter provides 24 V DC to the auxiliary power input of the RD-22. The external auxiliary power converter minimizes 60/50 Hz line frequency interference from coupling to the measurement circuitry.

Optionally the Ultra Stable RD-22 can analyze harmonic waveforms through the 50th harmonic order. A second option enables the Ultra Stable RD-22 to automatically calculate and display the error of standards being tested. A serial communication port for direct connection to the RS-232 serial port of a personal computer is also provided.

Additional details provided on the back page of this bulletin.

Transfer Uncertainty + 2 ppm

Technical Specifications

RD-22 Optional Accessories:

- RM-1S Reset Switch
- RR-DS Meter Disk Sensor
- RR-PCSuite
- RR-1H Infrared LED Sensor
- RD-Kit Software
- RR-1H/v Visible LED Sensor
- RD-Calibrate Software
- RM-OA Optical Adapter
- RR-KYZ Pulse Input Adapter
- RM-111 Automated Comparator

OPERATING RANGE

- Current Comparator (Autoranging)
 - 1.25 A to 10 A operational range
 - 5A $\pm$ 15% (4.25 to 5.75 A) Ultra Stable range
- Input voltage: 60 to 276V (Autoranging) operational range
 - 120 V $\pm$ 15% (102 V to 138 V) Ultra Stable range
 - 240 V $\pm$ 15% (204 V to 276 V) Ultra Stable range
- Auxiliary power converter input: 120 V or 240 V @ 50/60 Hz
- Auxiliary Power DC input: 24 volts nominal
- Frequency: 45 to 65 Hz
- Phase Angle: 0 to 360° or -180 to 180°
- Temperature:
 - 18 to 30°C operational range
 - 23°C $\pm$ 2°C Ultra Stable range
- Humidity:
 - 0% to 95% non-condensing operational range
 - 30% to 65% Ultra Stable Range
- Shock and vibration: 50G

PHYSICAL DESCRIPTION

- **Weight**
 - RD-22 + Current Comparator + Platform: 12 lbs (5.45kg)
 - Auxiliary Power Input Converter: 3 lbs (1.36kg)
- **Size**
 - RD-22: 190.5 mm (7.5") H x 139.7mm (5.5") W x 139.7mm (5.5") D
 - Platform: 19mm (0.75") H x 152.4mm (6"0 W x 508mm (20")D
- Backlit LCD, 4 line by 16 character
- Potential and Aux power inputs: 4mm Banana type jacks
- BNC (port 1) input/gating, time reference input
- BNC (port 2) pulse outputs
- BNC (port 3) three phase SYNC
- 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
- CCT input to external current comparator

TEST AND CALIBRATION

- No physical adjustments, all calibration performed with software
- 50 or 60 Hz calibration can be provided
- Orientation: Upright only
- Re-calibration interval: 365 days
- Warm up time: 60 minutes

UNCERTAINTY FROM RADIAN

+ 50 ppm¹

(1) includes stability, traceability, uncertainty, power factor and test system errors

RD-22 TRANSFER UNCERTAINTY

+ 2 ppm²

(2) Within 5 days and < 0.5° C

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
- Gate Rate: 200 nS pulse width minimum, maximum 20 Hz repetition rate

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 ANSI/NCSL Z540-1-1994
- Radian Research's primary transfer standards are traceable to NIST
- Radian Research's quality system is ISO-9001 certified
- Warranty: Two years parts and labor

MODEL

RD-22-332

MEASUREMENT FUNCTIONS

Dytronic Portable Standard, 0.005% Accuracy, Built- in comparator, Harmonic Analysis, One 200 Amp Current Comparator Transformer, Whrs, VARhrs, VAhrs, Qhrs, Volts, Amps, Watts, VARs, VA, Vhr, Ahr, V2hr, A2hr, Phase Angle, PF, Frequency. Min & Max Measurements: All Indicating Functions