Radian Research, Inc.

RD-22 Dytronic Primary Transfer Standard

Non - Galvanic Current Connection

Concentric Core Current Comparator

Input for External DC Reference

Harmonic Waveform Analysis

Built-in Comparator

Analog Sense

PC Interface

Maximum AC Measurement Error:
50 ppm ± Tracebility Uncertainty

OVERVIEW

The RD-22 Primary Transfer Standard represents the state-of-the-art technology in a commercially available true DC to AC accuracy transfer reference. The RD-22 has typical AC measurement accuracies within the limits of traceability. Repeatability of 1 ppm can be attained at 120 V and 5 A inputs of specific models.

The RD-22 utilizes Radian's Dytronic measurement technology featuring a Radian designed Integrating Analog to Digital Signal Converter based upon a charge-balance conversion principle. The RD-22 also employs a new Radian electronically compensated concentric core current comparator transformer. This current comparator is autoranging and external to the standard, allowing for non-galvanic current connection to the unit. These two new technologies combine with existing Radian features to provide the highest degree of accuracy, stability and versatility ever offered in a primary transfer standard.

The 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 Laboratory, such as the National Institute of Standards and Technology (NIST).

The RD-22 can also be tested by using external DC primary reference sets of voltage, current, and time. These external DC references can be compared directly to the RD-22's internal reference sets. Additionally, the RD-22 can be used as the active reference to the Radian RS-703A Laboratory Reference System to provide a complete AC electric metrology lab.

The RD-22 provides four quadrant, single-phase simultaneous energy and power measurements. The potential input and current input are totally autoranging. This autoranging feature was pioneered by Radian Research and makes it impossible to damage the unit by applying a signal to the wrong tap. The potential input range is 60 to 600 V, the current input range is 0.2 to 125 A or 0.2 to 200 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.

The RD-22 can optionally analyze harmonic waveforms through the 150th harmonic order. A second option enables the RD-22 to automatically calculate and display the error of standards being tested. The analog sense option allows for testing of transducers and other devices that provide an analog current output instead of a digital pulse output. The RD-22 also provides a serial communications port for direct connection to the RS-232 serial port of a personal computer.

Additional details of the RD-22 are provided on the back page of this bulletin.

RADIAN

Technical Specifications

RD-22 Optional Accessories:

- RS-703A V/I Signal Source
- RR-DS Meter Disk Sensor
- RR-1H Infrared LED Sensor
- RR-1H/v Visible LED Sensor
- RM-OA Optical Adapter
- RR-KYZ Pulse Input Adapter
- RM-110 Automated Comparator
- RM-1S Reset Switch
- RR-*PCSuite*
- RD-*Kit* Software
- RD-*Calibrate* Software

OPERATING RANGE

- Current Comparator (Autoranging)
  - 0.2 to 125 amps per input (125 amp option)
  - 0.2 to 200 amps per input (200 amp option)
- Input voltage: 60 to 600 volts (Autoranging)
- Auxiliary power converter input: 120 V or 240 V
- Auxiliary Power DC input: 24 volts nominal
- Frequency: 45 to 65 Hz
- Phase Angle: 0 to 360° or -180 to 180°
- Power Factor: -1 to 1 with no impact on accuracy
- Temperature: 18° to 30°C
- Humidity: 0% to 95% non-condensing
- Shock and vibration: Any that is not destructive

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 x139.7mm (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 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
- 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

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 18 to 30 C. Maximum worst case accuracy specification includes stability, traceability uncertainty, power factor, and test system errors.

Typical Accuracy:	within traceability uncertainties
Worst Case Accuracy:	±0.01%
DC to AC Transfer Accuracy:	±0.005%

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 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 certified
- Warranty: Two years parts and labor

RD-22 Menu for Measurements & Functionality: The last three digits determine the model. The first of the last three digits determines the measurement functions. The second of the last three digits determines if the unit has a built-in comparator, harmonics analysis, and/or analog sense capability. The third of the last three digits determines the current comparator capacity.

Specifying the first of the last three digits: RD-22-Xxx

MODEL	MEASUREMENT FUNCTIONS
RD-22-0xx	Whrs, Volts, Amps
RD-22-1xx	Whrs, Volts, Amps, VARhrs
RD-22-2xx	Whrs, Volts, Amps, VARhrs, VAhrs, Qhrs Phase Angle, Power Factor, Frequency
RD-22-3xx	Whrs, VARhrs, VAhrs, Qhrs, Volts, Amps, Watts, VARs, VA,Vhr, Ahr, V2hr, A2hr, Phase Angle, Power Factor, Frequency Min & Max measurements: All indicating functions
RD-22-4xx	Whrs, VARhrs, VAhrs, Qhrs, Volts, Amps, Watts, VARs, VA,Vhr, Ahr, V2hr, A2hr, Phase Angle, Power Factor, Frequency Min & Max measurements: All indicating functions AVG response: VAhrs, VA, Volts, Vhour, Amps, Ahour

Specifying the second of the last three digits: RD-22-xXx

-x0x	No comparator, No harmonic analysis, No analog sense input
-x1x	Built-in comparator
-x2x	Harmonic analysis
-x3x	Built-in comparator and harmonic analysis
-x4x	Analog sense input (2 mA DC current maximum)
-x5x	Built-in comparator and analog sense input
-x6x	Harmonic analysis and analog sense input
-x7x	Built-in comparator, harmonic analysis, and analog sense input

Specifying the third of the last three digits: RD-22-xxX

-xx1	125 Amp Maximum Current Comparator Transformer
-xx2	200 Amp Maximum Current Comparator Transformer

Options:
RR-TAD Transconductance Amplifier and Precision Divider. For use with Primary DC V & R. Used to convert Primary 10VDC cell into 3VDC for input to the RD-22. Used to divide (2) 10K ohm Primary resisters for current input to the RD-22.

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