

## GENERAL

The 92E R.F. Millivoltmeter provides voltage measurements from the low radio frequencies to the gigahertz region, over a range of 200  $\mu$ V to 3 volts (to 300 V, up to 700 MHz, with accessory 100:1 divider). It is a range programmable instrument of high sensitivity and accuracy, characterized by high input impedance, excellent stability, and low noise. The 92E includes an r.f. probe, 50  $\Omega$  BNC adapter, and probe tip. Optional probe accessories with either 50  $\Omega$  or 75  $\Omega$  characteristic impedance are available for unterminated, terminated, and through-line measurements.

## TRUE R.M.S. RESPONSE

Boonton r.f. probes use a full-wave rectifying circuit with diodes that have special characteristics, including low capacitance and controlled thermal offsets. Response is true r.m.s. for inputs below 30 mV, allowing accurate voltage measurements with all types of waveforms. As the input voltage increases above 30 mV, the response gradually changes, approaching peak-to-peak at the higher levels. Readings, however, are shaped to indicate r.m.s. voltage, provided that the input is reasonably sinusoidal, as would be the case with c.w. or f.m. signals. By using the 952005 100:1 voltage divider, the true r.m.s. range can be extended to 3 V.

## WIDE VOLTAGE RANGE

Eight ranges from 1 mV full scale to 3 V full scale are arranged in 1-3-10 sequence. No attenuator attachments are required for measurements up to 3 V. While this range is ample for the majority of r.f. voltage measurements, voltage capability can be increased to 300 V (up to 700 MHz) by using the accessory 952005 100:1 Voltage Divider. Use of the 100:1 voltage divider also increases the input resistance of the probe by a factor of more than 1000.

## FREQUENCY RANGE

The calibrated frequency range extends from 10 kHz to 1.2 GHz, with uncalibrated response to beyond 8 GHz. Relative accuracy above 1.2 GHz is typically  $\pm 0.5$  dB.

A 952002 50  $\Omega$  Terminated BNC Adapter is supplied as standard for voltage measurements in a 50  $\Omega$  system up to 1.2 GHz. For through-line voltage measurements, the optional accessory 952003 Tee Adapter is required. It is designed to compensate for the r.f. probe capacitance and to present a low insertion loss up to 1.2 GHz. It may be used in conjunction with the 952014 50  $\Omega$  Load for terminated voltage measurements. Both adapters exhibit a low s.w.r. up to 1.2 GHz.

## LOW NOISE

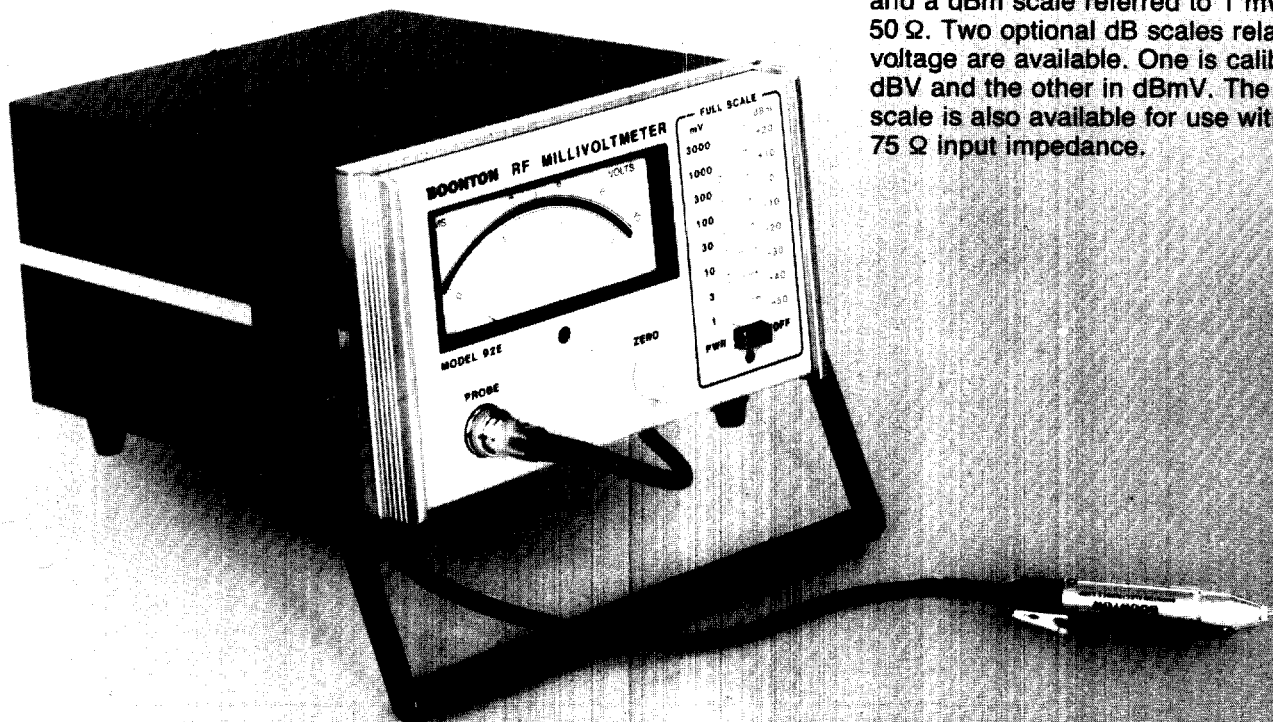
Extensive care has been taken throughout the design and construction to hold noise from all sources to a minimum. The probe cable is of special low-noise design and the r.f. probe is not sensitive to shock or vibration. Amplification takes place at 94 Hz, reducing susceptibility to any 50 Hz or 60 Hz line-frequency-related fields.

## LOW ZERO-DRIFT

Zero adjustment is not required on the upper five voltage ranges. For measurements on the lower three ranges, the ZERO control is set on the most sensitive range prior to operation. This control balances out small thermal voltages in the probe elements and, once adjusted, requires only infrequent checking during the course of subsequent measurements.

## VOLTAGE & dB SCALES

The 92E has a large mirrored meter with two linear 0-3 and 0-10 voltage scales and a dBm scale referred to 1 mW in 50  $\Omega$ . Two optional dB scales relative to voltage are available. One is calibrated in dBV and the other in dBmV. The dBm scale is also available for use with 75  $\Omega$  input impedance.



# SPECIFICATIONS

**VOLTAGE RANGE:** 200  $\mu$ V to 3 V (300 V up to 700 MHz with accessory 100:1 voltage divider). Lowest detectable voltage is approximately 100  $\mu$ V. Full scale ranges are 1, 3, 10, 30, 100, 300, 1000, and 3000 mV.

**dBm RANGE:** -61 to +23 dBm in eight ranges (+63 dBm up to 700 MHz with optional accessory 100:1 Voltage Divider).

**FREQUENCY RANGE:** 10 kHz to 1.2 GHz (uncalibrated response to approximately 8 GHz).

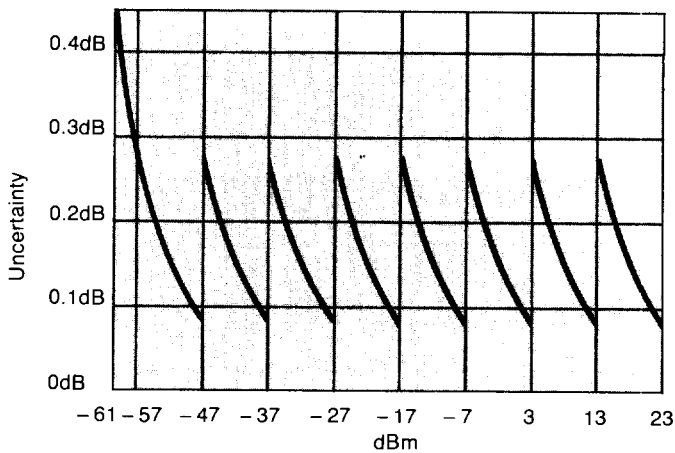
**ACCURACY:** The maximum uncertainty is the sum of the uncertainties listed in sections A, B, and C.

## A. Basic Uncertainty:

Voltage Ranges:

Level	Uncertainty
200 $\mu$ V - 3000 mV	1% f.s.

dBm Ranges:



## B. Frequency Effect:

(50-ohm measurements, using the 952001 Probe with the 952002 BNC Adapter or terminated 952003 Type-N Tee Adapter at 100 mV level.)

Frequency	mV	dBm
1 MHz (Cal. frequency)	0	0
10 kHz - 100 MHz	1% rdg.	0.09 dB
100 MHz - 1 GHz	3% rdg.	0.27 dB
1 GHz - 1.2 GHz	7% rdg.	0.63 dB

S.W.R.: 1.05 to 300 MHz; 1.10 to 1 GHz; 1.15 to 1.2 GHz.

## C. Temperature Effect: (at 1 MHz)

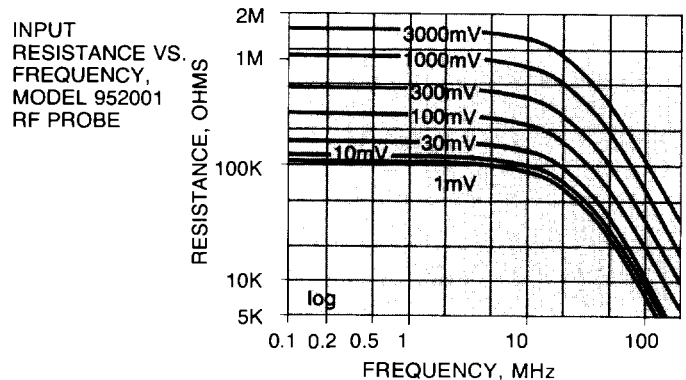
Temperature Range	mV Ranges		dBm Ranges	
	Instrument	R.F. Probe	Instrument	R.F. Probe
21°C to 25°C	0	0	0	0
18°C to 30°C	0.2% rdg.	1% rdg.	0.02 dB	0.09 dB
10°C to 40°C	0.5% rdg.	5% rdg.	0.04 dB	0.45 dB
0°C to 55°C	1% rdg.	12.5% rdg.	0.09 dB	1.16 dB

**WAVEFORM RESPONSE:** R.M.S. to 30 mV, calibrated in r.m.s. of a sinewave above 30 mV (r.m.s. to 3 V and 700 MHz with divider).

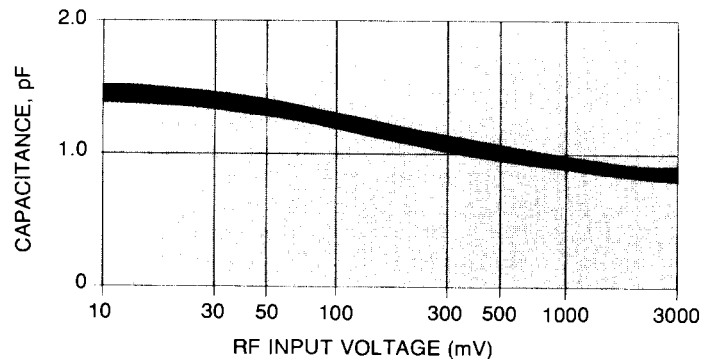
## CREST FACTOR:

Direct Input:	Level	300 $\mu$ V	1 mV	3 mV	10 mV	30 mV
	C.F.	140	42	14	4.2	1.4
With Divider:	Level	30 mV	100 mV	300 mV	1 V	3 V
	C.F.	140	42	14	4.2	1.4

## INPUT IMPEDANCE:



## INPUT CAPACITANCE VS. INPUT VOLTAGE, MODEL 952001 RF PROBE



**MAXIMUM AC INPUT:** 10 V, all frequencies and ranges  
**MAXIMUM DC INPUT:** 400 V, all ranges

**METER:** 4 1/2-inch taut-band.

Two linear voltage scales:

0 to 3 ; resolution 0.05 per division

0 to 10; resolution 0.1 per division

One logarithmic dBm scale:

- 10 to +3; resolution 0.2 per division, max.

**METER UNREST:** (1 mV f.s. range, only)

Indicated Voltage	Unrest
600 $\mu$ V to 1 mV	< 1% f.s.
300 $\mu$ V to 600 $\mu$ V	< 2% f.s.
200 $\mu$ V to 300 $\mu$ V	< 5% f.s.

**R.F.I.:** There is no detectable radiated or conducted leakage from the instrument or the probe.

**POWER SENSITIVITY:** 800 pW, minimum measurable power in 50 ohms. Minimum detectable power in 50 ohms is 200 pW.

**D.C. OUTPUT:** 0 to 10 V, d.c., proportional to r.f. input voltage. Source resistance of 9 k $\Omega$ ; will deliver 1 mA into 1 k $\Omega$  load. Full-scale input step-function response time less than 100 ms on 30 mV f.s. to 3 V f.s. ranges, increasing to 1 s on the 1 mV f.s. range.

**REMOTE OPERATION:** Ranges are selected via rear card-edge connector using logic low (or shorting to common). One line for manual disable; one line for each of the eight ranges.

**WARM-UP:** Warm-up period typically 1 min. Adjust zero on 1-mV range when measuring below 10 mV.

**POWER:** 100, 120, 220, 240 V  $\pm$  10%, 50 to 400 Hz.

**ENVIRONMENTAL PERFORMANCE:**

Operating temperature: 0°C to +55°C

Storage temperature: -55°C to +75°C

Classification: Conforms to the requirements of Mil-T-28000C for Type III, Class 5 Style E equipment.

**DIMENSIONS:** 132 mm high (without rubber feet) x 211 wide x 292 deep (5.2 in. x 8.3 x 11.5).

**WEIGHT:** Net 3.2 kg (7 lbs).

**OPTIONS:**

- |       |   |
|-------|---|
| - 04  | dBV as the uppermost scale on the meter face. The two voltage scales are above and below the mirror. Standard accessories.                            |
| - 06  | 75 $\Omega$ dBm as the uppermost scale on the meter face. 75 $\Omega$ BNC Adapter 952006 supplied instead of standard 50 $\Omega$ BNC Adapter 952002. |
| - 08  | R.F. probe input connector duplicated on rear of unit.  |
| - 12  | dBmV as the uppermost scale on the meter face. 75 $\Omega$ BNC Adapter 952006 supplied instead of standard 50 $\Omega$ BNC Adapter 952002.            |
| - S/5 | Internal 5000 hour elapsed time meter. Also includes 952011 Accessory Kit.  |

**FURNISHED ACCESSORIES**

**952001** R.F. Probe. 10 kHz to 1.2 GHz. Overload protection to 10 V a.c. and 400 V d.c.

**952002** 50  $\Omega$  BNC Female Adapter. For measurements to 1.2 GHz in a 50-ohm system.

**952004** Probe Tip. With ground clip lead for use to approximately 100 MHz.

BOONTON ELECTRONICS CORPORATION  
791 ROUTE 10  
RANDOLPH, NJ 07869  
(201) 584-1077  
TELEX: 710-986-8215

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

**OPTIONAL ACCESSORIES**

**952003** 50  $\Omega$  Tee Adapter. Permits connection into a 50  $\Omega$  line to 1.2 GHz. Type N female/female.

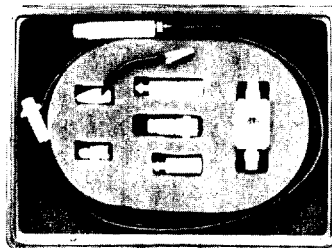
**952005** 100:1 Voltage Divider. Attenuates input signal by a factor of 100. Adds  $\pm (1 + f_{\text{MHz}}/200)$  % to instrument uncertainty. For measurements to 300 V (r.m.s. measuring range to 3 V). Frequency range 50 kHz to 700 MHz. Maximum input 1000 V (d.c. plus peak a.c.).

**952006** 75  $\Omega$  BNC Female Adapter. For measurements to 500 MHz in a 75  $\Omega$  system.

**952007** 75  $\Omega$  Tee Adapter. Permits connection into a 75  $\Omega$  line to 1 GHz. Type N female/female.

**952008** Unterminated BNC Female Adapter. For coaxial connection to approximately 100 MHz, or to 400 MHz if fed from a low-impedance source in an electrically short system.

**952011** 50  $\Omega$  Accessory Kit. Consists of 952003, 952005, 952008, 952013, and 952014 50  $\Omega$  type N Male Termination.



**952012** 75  $\Omega$  Accessory Kit. Consists of 952005, 952007, 952008, 952013, and 952015 75  $\Omega$  Type N Male Termination.

**952013** Accessory Case. For 952001 Probe and accessories.

**952014** 50  $\Omega$  N Termination. For 952003 Tee Adapter.

**952015** 75  $\Omega$  N Termination. For 952007 Tee Adapter.

**950030** Rack Mounting Kit (Dual). Mounts two units side by side. 5.25 inches high.

**950031** Transit Case

**950032** Rack Mounting Kit (Single). Mounts one unit to left or right of blank panel. 5.25 inches high.

**91-4C** Low Frequency R.F. Probe. 1 kHz to 250 MHz.

**91-6F** Unterminated Type F Female Adapter. For coaxial connection up to 100 MHz or 400 MHz when fed from a low impedance in an electrically short system.

**91-6G** Unterminated BNC Male Adapter. For coaxial connection to approximately 100 MHz, or to 400 MHz if fed from a low-impedance source in an electrically short system.

**91-8B-1A** 75  $\Omega$  Type F Female Adapter. For measurements to 500 MHz in a 75  $\Omega$  system.

**91-16A** Unterminated Type N Female. For coaxial connection up to 100 MHz or 400 MHz when fed from a low impedance in an electrically short system.

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