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*Proposed*

*Recommended Guide for Specification of*

**ELECTRONIC VOLTMETERS**

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# ***Proposed Recommended Guide*** **of the** **American Institute of Electrical Engineers**

## **SPECIFICATION of ELECTRONIC VOLTMETERS**

**Purpose** The purpose of these specifications is to give a common basis of comparison among electronic voltmeters offered for general-purpose applications. It is recommended that all manufacturers offering instruments for general applications supply the information outlined. For the purpose of these specifications, general-purpose voltmeters do not include instruments which are primarily intended for measurement of pulses or similar discontinuous waveforms, or instruments of the electrometer type which are designed to provide an extremely high input resistance ( $10^{10}$  ohms or more). It is recognized that additional information should be supplied with instruments in these and other special groups which manufacturers should not be asked to supply when they are offering instruments for more general applications.

**Definition** An electronic voltmeter is a device utilizing the characteristics of an electron tube for measuring voltages.

### **1 Classification**

- 1.1** State name, type number and manufacturer of instrument.
- 1.2** State purpose of instrument (general, specific, laboratory, service, field, shipborne, aircraft, portable, rack-mounted, etc.).
- 1.3** State frequency range.
- 1.4** State the general type of circuit employed.
- 1.5** It shall be indicated whether the instrument is intended for direct or alternating voltage measurements, or both.

### **2 Voltage Range**

- 2.1** Maximum and minimum voltage shall be given.
  - 2.1.1** Where multipliers are used each scale range shall be specified, or a single range and the maximum voltage for each other range shall be specified.
- 2.2** The range shall be that for which the full accuracy as specified applies.

- 2.2.1** If additional ranges are possible at reduced accuracy under certain operating conditions, the supplementary ranges shall be stated as well as the conditions under which they are available.

### **3 Frequency Range**

#### **3.1 Instruments Designed to Measure Alternating Voltage**

- 3.1.1** The normal operating range of frequency over which the specified accuracy applies shall be stated.

#### **3.2 Instruments Designed to Operate at High Frequencies**

- 3.2.1** The resonant frequency of the input circuit shall be stated.

### **4 Input Impedance and Terminal Arrangement**

#### **4.1 D-C Voltmeters**

- 4.1.1.** The input resistance (for all ranges, if different) shall be stated.

#### **4.2 A-C Voltmeters**

- 4.2.1** The resistive and capacitive components of the input impedance shall both be stated, with further elaboration if frequency appreciably affects either component.
  - 4.2.2** It shall also be stated whether this impedance is the terminal impedance at the panel or if it includes the input cable characteristics.
  - 4.2.3** It shall be indicated whether a probe incorporating the detecting element is provided.
  - 4.2.4** It shall be stated whether the measuring input terminals are isolated from the instrument housing, and the maximum voltage rating of such isolation.
  - 4.2.5** State whether an independent ground terminal is provided for the instrument case.
- 4.3** State any special input circuit considerations which may affect the use of the instrument.

## 5 Accuracy

5.1 The accuracy shall be stated: in percent of full scale; in percent of instrument indication; or by other appropriate method if necessary.

5.2 Accuracy as stated shall hold for the voltage ranges listed under 2.0 above, and under standard operating conditions.

5.3 The accuracy specification shall be further qualified by complete statements covering the following items.

### 5.3.1 Ambient Temperature and Humidity

5.3.1.1 The range of ambient temperature and humidity over which the specified accuracy holds and the effects of variations outside of this range shall be stated.

5.3.1.2 Required warm-up time shall be stated and a statement of drift included.

### 5.3.2 Frequency Range

5.3.2.1 Range for standard specified accuracy.

5.3.2.2 Extension of range, if any, at reduced accuracy.

5.3.2.3 Curves may be included.

### 5.3.3 Source Impedance (Circuit to which the voltmeter is connected)

5.3.3.1 Limits for specified accuracy.

5.3.3.2 Additional ranges at reduced accuracy, if any.

### 5.3.4 Waveform

5.3.4.1 The waveform under which the specified accuracy obtains shall be stated.

5.3.4.2 Some quantitative indication of the effect of distortion on the accuracy shall be stated.

### 5.3.5 Effect of Power Supply

5.3.5.1 Effect of variations in voltage and frequency of the supply line shall be stated. This should be given as a percentage of variation in voltage reading corresponding to a percentage variation in line voltage from a specified value. Unless otherwise stated, it will be assumed that the accuracy statement holds

good for power line variations of 105 to 125 volts.

5.3.5.2 If battery-operated, state battery voltages at which accuracy becomes impaired.

### 5.3.6 Effect of Tube Replacements

5.3.6.1 State the extent to which the calibration may be affected by tube replacements.

5.3.6.2 State whether internal adjustments are provided for matching the calibration.

### 5.3.7 Instrument Zero

5.3.7.1 If it is necessary that the instrument zero be carefully adjusted to obtain the stated accuracy, information shall be included to indicate the normal instrument-zero drift per hour or per day and the degree of dependency of the instrument zero on power-supply voltage, temperature, etc.

### 5.3.8 Hum

5.3.8.1 The effect of internal pickup of power voltage upon the accuracy of measurement at power frequencies or harmonics shall be stated.

## 6 Scale and Indication Instrument

6.1 The useful scale length in inches (or centimeters) shall be given.

6.2 It shall be stated whether the indicating instrument has a linear, logarithmic or other scale and whether the calibration starts at zero or not.

6.3 The current for full-scale deflection of the indicating instrument shall be given.

6.4 State type of pointer and whether parallax mirror is provided.

## 7 Type of Response

### 7.1 A-C Voltmeters

7.1.1 The type of response shall be stated, e.g., peak, half- or full-wave, square-law, average, etc.

7.1.2 If the type of response is a function of the voltage level, it shall be so stated.

## 8 Overload Capacity

8.1 The maximum allowable voltages which may

- be applied to the input of the electronic voltmeter without causing damage or affecting the calibration of the instrument shall be stated.
- 8.2 These overload voltages shall also consider superimposed values likely to be encountered; for example, the maximum direct-voltage rating on alternating-voltage electronic voltmeters.
- 9 Power Supply**
- 9.1 State whether the power supply equipment is self-contained or external.
- 9.2 State the nominal voltage and frequency, and the maximum current and power required from the electric supply. State also the range of frequency and voltage.
- 9.3 If batteries are required, list the battery complement and state the current.
- 9.4 If fuses are employed, the number, type and rating shall be stated.
- 10 Electron Tubes**
- 10.1 List electron-tube complement.
- 10.2 Where matched or selected tubes are required, this fact shall be stated. -
- 11 Special Equipment Features**
- 11.1 Special features, such as fungiciding and ruggedized construction, shall be listed.
- 11.2 State type of case.
- 12 Accessories**
- 12.1 List accessory equipment required (specifying whether supplied with instrument), such as coaxial cable, connectors, external meters, voltage dividers, multipliers, shunts, light shields, power cords, etc., and state any limitations their use imposes on the normal operating specifications.
- 13 Spares**
- 13.1 List spares regularly supplied with instrument, such as fuses, pilot lights, etc.
- 14 Dimensions**
- 15 Weight**
- 15.1 Special points, such as including batteries in the case of d-c operated instruments.
- 16 External Influences (If Not Covered Elsewhere)**
- 16.1 Describe any sensitivity of instrument to external electric and magnetic fields, also to atmospheric variations.
- 16.2 Describe any performance aberrations, such as frequency locking at power-line frequency or harmonics.
- 17 Reliability**
- 17.1 If known, state how long the instrument will maintain stated performance. State what, if any, phenomena can be used as alarm warnings of deterioration of performance below specification limits.