Section 1
Introduction & Specifications

1-1. INTRODUCTION

1-2. The Model 335D Voltage Standard combines a dc voltage and a dc voltage measurement capability in one instrument. Precision dc voltages up to 1100 volts, variable by way of the front panel readout dials, are provided at the OUTPUT terminals of the instrument. Measurement capabilities from 10 microvolts to 1000 volts are provided by a precision dc differential voltmeter. This combination allows flexible use of the instrument as a voltage standard, a differential voltmeter, or as a null detector.

1-3. Protection against possible equipment failures or operator errors, which might otherwise damage expensive instruments, is incorporated. The VOLTAGE TRIP and VERNIER controls provide a means of limiting the output voltage within the range. Should the output voltage exceed a preset limit, the OUTPUT terminals are de-energized. A current limiting circuit limits the available current to a level determined by the setting of the CURRENT LIMIT control. Therefore, the 335D is able to provide currents up to, but not exceeding the level determined by the setting of the CURRENT LIMIT control.

1-4. The inner chassis and circuitry are surrounded by a guard which is isolated from the front panel and the outside cover. When properly connected, the guard bypasses any circulating ground currents which otherwise may cause error. Remote sensing of the output voltage is also used to reduce errors caused by voltage drop in external cables.

1-5. Most of the instrument circuitry is mounted on modular plug-in cards. An extender card is provided as an accessory to aid in the maintenance and adjustment of the instrument.

1-6. SPECIFICATIONS

1-7. Specifications for the Model 335D are listed in Table 1-1 and Figure 1-1.

Table 1-1. Specifications

VOLTAGE STANDARD	
PARAMETER	**SPECIFICATIONS**
OUTPUT VOLTAGE	0 to 1111.1110 VDC
OUTPUT CURRENT	0. to 50 milliamperes
VOLTAGE RANGES	10, 100, and 1000V with output as follows: 10V – 0 to 11. 111110 (1 μV steps) 100V – 0. to 111. 11110 (10 μV steps) 1000V – 0 to 1111. 1110 (100 μV steps)

Table 1-1. Specifications (cont)

VOLTAGE STANDARD (cont)	
PARAMETER	**SPECIFICATIONS**
METER AND DIAL RESOLUTION	0.1 ppm of range (1 μV maximum)
ACCURACY OF OUTPUT (for 60 days)	10V range ± (0.001 + 10 μV) 100V range ± (0.001 + 20 μV) 1000V range ± (0.0015 + 200 μV)
NOTE *The previous accuracies are absolute, relative to NBS standards, and include effects of stability, line regulation, load regulation, and calibration uncertainties under standard reference conditions of 23°C ± 1°C and up to 70% relative humidity.*	
TEMPERATURE COEFFICIENT OF OUTPUT	Less the ±(0.0002% of setting + 1 μV)/°C from 0°C to 50°C
STABILITY OF OUTPUT: (At standard reference conditions described under ACCURACY OF OUTPUT)	10V range ±(0.0005 + 7 μV) per month 100V and 1000V ranges ±(0.0005 + 30 μV) per month
OVERVOLTAGE PROTECTION	Automatically disconnects load if output voltage exceeds 1 to 1200V setting of front panel controls. Manual reset.
OVERCURRENT PROTECTION	Automatic current limiting continuously adjustable from 1 to 60 mA with front panel control and indicator. Normal operation restored upon removal of overload.
RIPPLE AND NOISE (DC to 100 kHz)	10V range — less than 20 μV rms 100V range — less than 30 μV rms 1000V range — less than 40 μV rms
SETTLING TIME	Typically, within 10 ppm of final output, less than 20 seconds after a range change
OUTPUT RESISTANCE	Less the 0.0005 ohms or (0.0001E_O) ohms at dc
REGULATION	0.0002% of setting or 10 μV for either a 10% line voltage change or a full load change.
COMMON MODE REJECTION	Better than 125 dB from dc to 400 Hz, up to 700V rms or 1000 VDC
ISOLATION	Either output terminal may be floated up to 1000 VDC from chassis ground
REMOTE SENSING	Separate terminals are provided to sense the output voltage directly at the load, reducing errors caused by voltage drop in connecting wires between the output and the load.

Table 1-1. Specifications (cont)

DIFFERENTIAL VOLTMETER	
PARAMETER	**SPECIFICATIONS**
ABSOLUTE ACCURACY, TEMP. COEFF. OF ACCURACY, INPUT RANGES, and STABILITY	Same as output characteristics under Voltage Standard
NULL SENSITIVITIES	1000V to 10 μV (full-scale) in 9 decade ranges. Any null sensitivity may be used on any voltage range.
INPUT RESISTANCE	Infinite at null from 0 to 1111.1110 VDC
METER AND DIAL RESOLUTION	0.1 ppm of range

CONVENTIONAL VOLTMETER		
ACCURACY	±3% of range.	
RANGES	Voltage Range	Input Resistance
	1000-0-1000	100 MΩ
	100-0-100	100 MΩ
	10-0-10	100 MΩ
	1-0-1	100 MΩ
	0.1-0-0.1	10 MΩ
	0.001-0-0.001	1 MΩ
	0.0001-0-0.0001	1 MΩ
	0.00001-0-0.00001	1 MΩ

GENERAL	
DESIGN	Solid-state
STABILITY OF METER ZERO	On most sensitive range (10 μV full-scale): 0.5 μV peak-to-peak noise 0.5 μV peak-to-peak stability for 10% line voltage variation
RECORDER/ISOLATION AMPLIFIER OUTPUT	Adjustable from 0 to over 1.0V for end-scale meter deflection; source resistance 5 to 8 kΩ; linearity better than ±0.5% of end-scale. Gain as an isolation amplifier is 1.0V/null range sensitivity. Recorder output may be grounded or floated up to 100 VDC.
TEMPERATURE	0°C to +50°C, operating; −40°C to +65°C, non-operating.
HUMIDITY	0 to 70% relative humidity.
SHOCK AND VIBRATION	Meets all requirements of MIL-T-945A, rigidly mounted or rack mounted with slides.
ALTITUDE	Operating, 10,000 ft. - 3.0 km Non-operating, 50, 000 ft - 15.2 km

Table 1-1. Specifications (cont)

GENERAL (cont)	
PARAMETER	SPECIFICATIONS
FUNGUS NUTRIENTS MERCURIC COMPONENTS	None
FUSES	One power-line fuse; one high-voltage fuse.
INPUT POWER	115/230 VAC ±10%, 50—60 Hz, single phase, approximately 130 VA fully loaded.
SIZE	Height: 17.8 cm (7 in) Width: 4.83 cm (19 in) Depth: 45.7 cm (18 in)
WEIGHT	Approximately 23 kg (50 lbs)

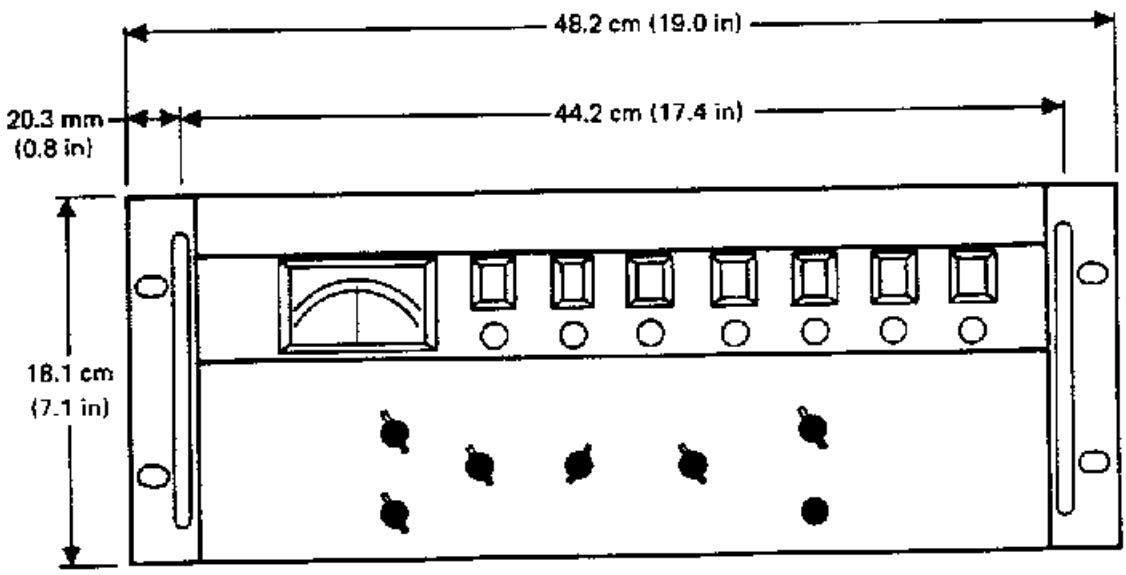

Figure 1-1. Outline Drawing

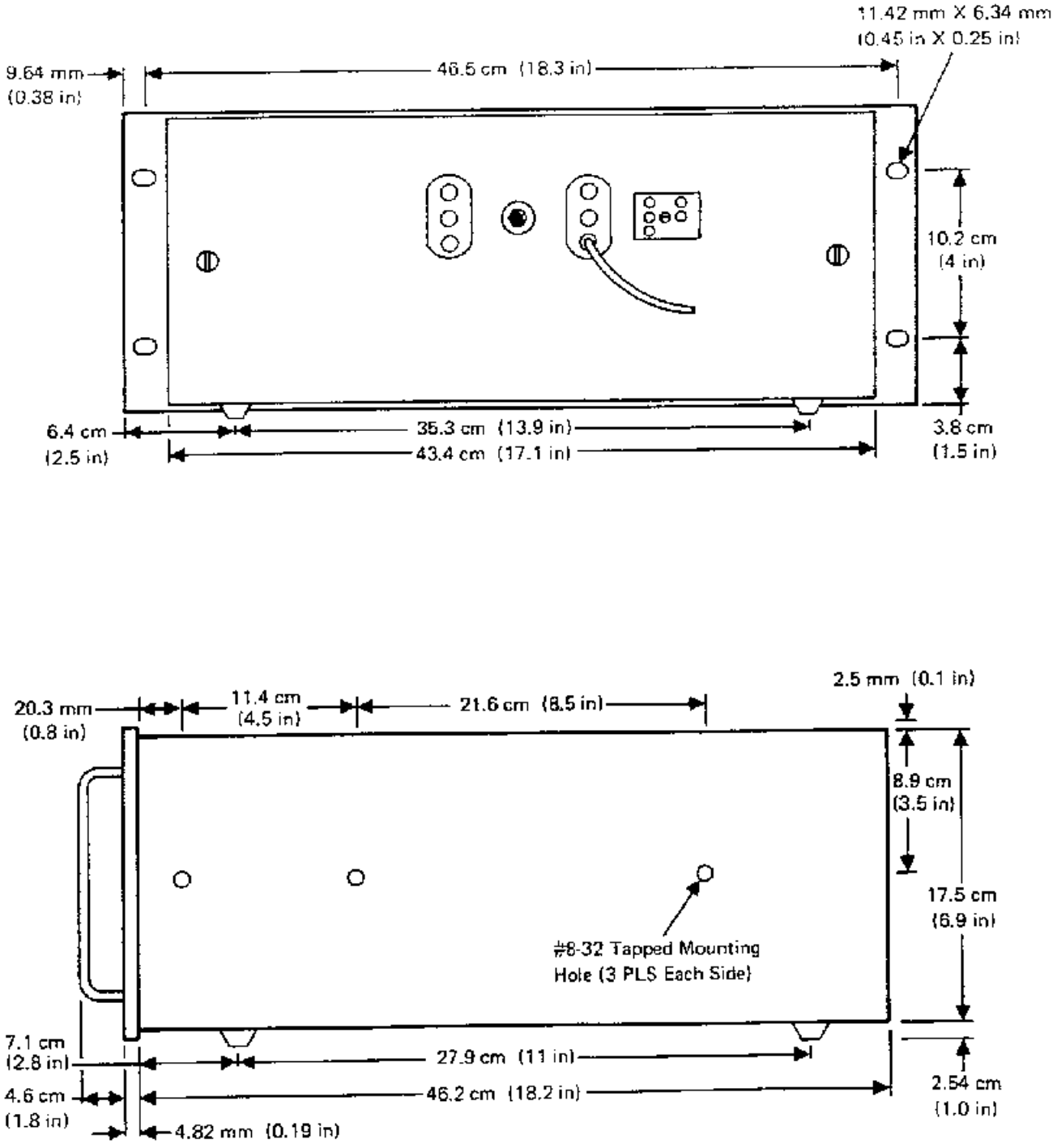

Figure 1-1. Outline Drawing (cont)