SECTION I
GENERAL INFORMATION

1-1. DESCRIPTION.

1-2. The Hewlett-Packard Models 333A and 334A Distortion Analyzers are solid state instruments for measuring distortion on ac voltages. The Models 333A and 334A include two control loops that automatically tune both legs of a bridge circuit which rejects the fundamental when the rejection circuit is initially set within the range of the loops. The 334A has a high impedance detector which operates from 550 kHz to greater than 65 MHz and provides the capability of monitoring the distortion of the amplitude modulation on an rf carrier.

1-3. Distortion levels of 0.1% to 100% full scale are measured in seven ranges for any fundamental frequency of 5 Hz to 600 kHz. Harmonics are indicated up to 3 MHz. The high sensitivity of these instruments requires only 0.3V rms for the 100% set level reference. The distortion characteristics can be monitored at the OUTPUT connectors with an oscilloscope, a true rms voltmeter, or a wave analyzer. The instruments are capable of an isolation voltage of 400 volts above chassis ground.

1-4. The voltmeter can be used separately for general purpose voltage and gain measurements. It has a frequency range of 5 Hz to 3 MHz (20 Hz to 500 kHz for 300 μV range) and a voltage range of 300μV to 300 V rms full scale.

1-5. The AM detector included in the Model 334A is a broadband dc restoring peak detector consisting of a semiconductor diode and filter circuit. AM distortion levels as low as 0.3% can be measured on a 3 V to 8 V rms carrier modulated 30% in the standard broadcast band. Distortion less than 1% can be measured at the same level of the carrier up to 65 Mc.

1-6. ACCESSORY FEATURES.

1-7. The accessory available with the 333A and 334A Distortion Analyzers is a voltage divider probe, -hp- Model No. 10001A. The features of the probe are:

a. 10 megohms shunted by 10 pF, giving 10:1 attenuation.

b. DC to 30 MHz bandwidth.

c. 2% division accuracy.

d. 600 V peak input.

e. 5 ns rise-time.

1-8. OPTION.

1-9. Option 01 is a standard -hp- Model 333A or 334A with a special meter and meter amplifier, compensated to permit response to VU (volume units) characteristics.

1-10 INSTRUMENT IDENTICATION.

1-11. Hewlett-Packard uses a two-section serial number. The first section (prefix) identifies a series of instruments. The last section (suffix) identifies a particular instrument within the series. If a letter is included with the serial number, it identifies the country in which the instrument was manufactured. If the serial prefix of your instrument differs from the one on the title page of this manual, a change sheet will be supplied to make this manual compatable with newer instruments or the backdating information in Appendix C will adapt this manual to earlier instruments. All correspondence with Hewlett-Packard should include the complete serial number.

Table 1-1. Specifications

MODEL 333A

DISTORTION MEASUREMENT RANGE
Any fundamental frequency, 5 Hz to 600 kHz. Distortion levels of 0.1%-100% are measured full scale in 7 ranges.

DISTORTION MEASUREMENT ACCURACY
Harmonic measurement accuracy (full scale)

Fundamental Input Less Than 30 V

RANGE	±3%	±6%	±12%
100%-0.3%	10 Hz 1 MHz	10 Hz 3 MHz	
0.1%	30 Hz 300 kHz	20 Hz 500 kHz	10 Hz 1.2 MHz

Fundamental Input Greater Than 30 V

RANGE	±3%	±6%	±12%
100%-0.3%	10 Hz 300 kHz	10 Hz 500 kHz	10 Hz 3 MHz
0.1%	30 Hz 300 kHz	20 Hz 500 kHz	10 Hz 1.2 MHz

Elimination Characteristics:
Fundamental Rejection > 80 dB
Second Harmonic Accuracy for a fundamental of:
5 Hz to 20 Hz: better than +1 dB
20 Hz to 20 kHz: better than ±0.6 dB
20 kHz to 100 kHz: better than -1 dB
100 kHz to 300 kHz: better than -2 dB
300 kHz to 600 kHz: better than -3 dB

Table 1-1. Specifications (Cont'd)

Distortion Introduced by Instrument:
> -70 dB from 5 Hz to 200 kHz
> -64 dB from 200 kHz to 600 kHz

Meter indication is proportional to the average value of a waveform.

FREQUENCY CALIBRATION ACCURACY
Better than ±5% from 5 Hz to 300 kHz
Better than ±10% from 300 kHz to 600 kHz

INPUT IMPEDANCE
Distortion Mode: 1 MΩ ±5% shunted by <70 pF.
Voltmeter Mode:
1 MΩ ±5% shunted by <30 pF (333A only),
1 MΩ ±5% shunted by <35 pF (334A only),
1 to 300 V ranges; 1 MΩ ±5% shunted by <70 pF,
300 μV to 0.3 V ranges.

INPUT LEVEL FOR DISTORTION MEASUREMENTS
0.3 V rms for 100% set level (up to 300 V may be attenuated to set level reference). The minimum measurable distortion for floating operation on the X1 frequency range is 50dB below the fundamental.

DC ISOLATION
Signal ground may be ±400 Vdc from external chassis.

VOLTMETER RANGE
300 μV to 300 V rms full scale (13 ranges), 10 dB per range.

VOLTMETER FREQUENCY RANGE
5 Hz to 3 MHz (300 μV range: 20 Hz-500 kHz).

VOLTMETER ACCURACY:

RANGE	±2%	±5%
300 μV	30 Hz-300 kHz	20 Hz-500 kHz
1 mV-30 V	10 Hz-1 MHz	5 Hz-3 MHz
100 V-300 V	10 Hz-300 kHz	5 Hz-500 kHz

NOISE MEASUREMENTS
Voltmeter residual noise on the 300 μV range: < 25 μV rms terminated in shielded 600Ω; < 30 μV rms terminated in shielded 100 kΩ.

OUTPUT
For input frequencies from 20 Hz to 600 kHz, 0.1 V rms ± 0.01 V open circuit for full scale meter deflection; 0.05 V rms ± 0.005 V into 2 kΩ for full scale meter deflection.

AUTOMATIC NULLING MODE
Set Level: At least 0.2 V rms.
Frequency Ranges:
X1, manual null tuned to less than 3% of set level; total frequency hold-in ±0.5% about true manual null.

X10 through X10K, manual null tuned to less than 10% of set level; total frequency hold-in ±1% about true manual null.

AUTOMATIC NULL ACCURACY
5 Hz to 100 Hz: Meter reading within 0 to +3 dB of manual null.

100 Hz to 600 kHz: Meter reading within 0 to +1.5 dB of manual null.

HIGH-PASS FILTER
3 dB point at 400 Hz with 18 dB per octave roll off. 60 Hz rejection > 40 dB. Normally used only with fundamental frequencies greater than 1 kHz.

POWER SUPPLY
100 V/120 V/220 V/240 V + 5% - 10%, 48 - 66 Hz, approximately 4 watts.

MODEL 334A

Same as Model 333A except as indicated below:

AM DETECTOR
High impedance dc restoring peak detector with semi-conductor diode operates from 550kHz to greater than 65 MHz. Broadband input. Maximum input; 40 V p-p ac or 40 V peak transient.

CARRIER FREQUENCY
550kHz to 1.6 MHz: Distortion introduced by detector is < 0.3% for 3 to 8 volt carriers modulated 30%.

1.6 MHz to 65 MHz: Distortion introduced by detector is < 1% for 3 to 8 volts rms carriers modulated 30%.

NOTE

Distortion measurement at carrier levels as low as 1 volt may be made with reduced accuracy.

OPTION: 01

Indicating meter has VU characteristics conforming to FCC Requirements for AM, FM, and TV broadcasting.