The Models 2015-P and 2016-P Audio Analyzing Digital Multimeters and the Models 2015 and 2016 Total Harmonic Distortion Multimeters combine audio band quality measurements and analysis with a full-function 6½-digit DMM. Test engineers can make a broad range of voltage, resistance, current, frequency, and distortion measurements, all with the same compact, half-rack measurement instrument. The Model 2016 and 2016-P have twice the sine wave generator output of the Model 2015 for applications that require test signals greater than 8Vrms. The Model 2015-P and 2016-P offer additional processing capacity for frequency spectrum analysis.

**Frequency Domain Distortion Analysis**

For applications such as assessing non-linear distortion in components, devices, and systems, DSP-based processing allows the Models 2015-P, 2015, 2016, and 2016-P to provide frequency domain analysis in conventional time domain instruments. They can measure Total Harmonic Distortion (THD) over the complete 20Hz to 20kHz audio band. They also measure over a wide input range (up to 750Vrms) and have low residual distortion (~87dB). The THD reading can be expressed either in decibels or as a percentage.

In addition to THD, the Models 2015, 2015-P, 2016, and 2016-P can compute THD+Noise and Signal-to-Noise plus Distortion (SINAD). For analyses in which the individual harmonics are the criteria of greatest interest, the instruments can report any of the (up to 64) harmonic magnitudes that can be included in the distortion measurements. The user can program the actual number of harmonics to be included in a computation, so accuracy, speed, and complexity can be optimized for a specific application. (See Figure 1)

![Figure 1. Frequency Spectrum of 1kHz Square Wave](image.png)

*Figure 1 shows a plot of a square wave’s harmonics (frequency components) computed and transmitted to a personal computer by the Model 2015 or 2016. A square wave’s spectral content consists of only odd harmonics whose magnitudes are (1/harmonic number × the magnitude of the fundamental). For example, the magnitude of the third harmonic is 1/3 the magnitude of the fundamental.*
The Models 2015, 2015-P, 2016, and 2016-P can perform fast frequency sweeps for characterizing audio-band circuitry in production test systems. For example, the instruments can execute a single sweep of 30 frequencies and transmit both rms voltage readings and THD readings to a computer in only 1.1 seconds. With that data, a complete frequency response analysis and a harmonic distortion vs. frequency analysis can be performed in a very short time. Thus high speed testing of the audio performance of a high volume device such as a cellular telephone can be performed without reducing the number of tests or reducing the measurements in each test.

Optimized for Production Testing

The Models 2015, 2015-P, 2016, and 2016-P can perform fast frequency sweeps for characterizing audio-band circuitry in production test systems. For example, the instruments can execute a single sweep of 30 frequencies and transmit both rms voltage readings and THD readings to a computer in only 1.1 seconds. With that data, a complete frequency response analysis and a harmonic distortion vs. frequency analysis can be performed in a very short time. Thus high speed testing of the audio performance of a high volume device such as a cellular telephone can be performed without reducing the number of tests or reducing the measurements in each test. With these instruments, which are optimized for production testing, test engineers can lower test times, in comparison to test speeds achievable with general purpose audio analyzers, without sacrificing production test quality.

Dual Output Source

The Models 2015, 2015-P, 2016, and 2016-P include an internal audio band sine wave source for generating stimulus signals. A second output, the inverse of the first output, is also available, simplifying the testing of differential input circuits for common mode or noise cancellation performance.
The Models 2015 and 2015-P have a 4Vrms single-ended output and 8Vrms differential source output. For tests that require a higher stimulus signal, the Model 2016 and 2016-P provide a 9.5Vrms single-ended output and a 19Vrms differential output.

**Wide Selection of Audio Filters**

Five industry-standard bandpass filters are provided for shaping the input signal for audio and telecommunication applications. Available filters include the CCITT weighting filter, CCIR filter, C-message filter, CCIR/ARM filter, and “A” weighting filter (see Figures 5a–5e). The Models 2015, 2015-P, 2016, and 2016-P provide programmable, high cutoff (low pass) and low cutoff (high pass) filters. Furthermore, the two filters can be implemented together to form a bandpass filter. The programmable filters can be used to filter out noise generated by electromechanical machinery on the production floor or to simulate other types of system transmission characteristics.

**Broad Measurement Flexibility**

In addition to their THD, THD+Noise, SINAD, and individual harmonic measurement capabilities, the instruments provide a comprehensive set of DMM functions, including DCV, ACV, DCI, ACI, 2W, 4W, temperature, frequency, period, dB, dBm, and continuity measurements, as well as diode testing. This multi-functional design minimizes added equipment costs when configuring test setups.
**Wide Band or Narrow Band Noise Measurements**

The Models 2015, 2015-P, 2016, and 2016-P are capable of measuring both wide band noise and narrow band noise. Alternatively, these instruments’ DSP (digital signal processing) capabilities allow users to make frequency domain measurements of RMS voltage noise over the 20Hz–20kHz frequency audio band or a narrow portion of the band. Furthermore, noise measurements can be extracted in the presence of a stimulus signal for fast signal-to-noise computations.

**Spectrum Analysis**

The Model 2015-P and 2016-P have internal computational capabilities that allow them to characterize an acquired signal spectrum. These instruments can identify and report the frequency and amplitude of the highest value in a complete spectrum or within a specified frequency band. It can also identify additional peaks in descending order of magnitude (see Figure 6). The Model 2015-P’s and 2016-P’s on-board capabilities make it simple to obtain a thorough analysis of a frequency spectrum more quickly and with little or no need for external analysis software.

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**SERVICES AVAILABLE**

- **2015-3Y/EW** 1-year factory warranty extended to 3 years from date of shipment
- **2015-P-3Y/EW** 1-year factory warranty extended to 3 years from date of shipment
- **2016-3Y/EW** 1-year factory warranty extended to 3 years from date of shipment
- **2016-P-3Y/EW** 1-year factory warranty extended to 3 years from date of shipment
- **C/2015-3Y/ISO** 3 (ISO-17025 accredited) calibrations within 3 years of purchase for Models 2015, 2015-P*
- **C/2016-3Y/ISO** 3 (ISO-17025 accredited) calibrations within 3 years of purchase for Models 2016, 2016-P*

*Not available in all countries

**CABLES/ADAPTERS**

- 7007-1: Shielded IEEE-488 Cable, 1m (3.3 ft)
- 7007-2: Shielded IEEE-488 Cable, 2m (6.6 ft)
- 85011, 85012: Trigger-Link Cables, 1m (3.3 ft), 2m (6.6 ft)
- 8502: Trigger Link Adapter Box
- 8503: Trigger Link Cable to 2 male BNCs, 1m (3.3 ft)
- 7009-5: RS-232 Cable

**ACCESSORIES AVAILABLE**

- **RACK MOUNT KITS**
  - 4288-1: Single Fixed Rack Mount Kit
  - 4288-2: Dual Fixed Rack Mount Kit

- **GPIB INTERFACES**
  - KPCI-488LPA: IEEE-488 Interface/Controller for the PCI Bus
  - KUSB-488B: IEEE-488 USB-to-GPIB Interface Adapter

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[www.keithley.com](http://www.keithley.com)

A Greater Measure of Confidence

[Keithley](https://www.keithley.com)
6½-Digit THD Multimeters
6½-Digit Audio Analyzing Multimeters

DISTORTION CHARACTERISTICS

VOLTAGE RANGE: 100mV 1V 10V 100V 750V (user selectable).
INPUT IMPEDANCE: 1Mohm paralleled by <100pF.
DISPLAY RANGE: 0–100% or 0–100.00%.
RESOLUTION: 0.001% or 0.0001%.
FUNDAMENTAL FREQUENCY RANGE: 1kHz–20kHz.
HARMONIC FREQUENCY RANGE: 4kHz–5kHz.
FREQUENCY RESOLUTION: 0.008kHz.
FREQUENCY ACCURACY: ±0.01% of reading.
FREQUENCY TEMPERATURE COEFFICIENT: ≤100ppm over operating temperature range.

<table>
<thead>
<tr>
<th>Measurement Mode</th>
<th>Accuracy (1 Year, 23°C ±5°C)</th>
<th>Residual Distortion</th>
</tr>
</thead>
<tbody>
<tr>
<td>THD and individual harmonic magnitudes</td>
<td>±0.8 dB</td>
<td>0.004% or –87 dB</td>
</tr>
<tr>
<td>THD + n</td>
<td>±1.5 dB</td>
<td>0.05% or –65 dB</td>
</tr>
<tr>
<td>SINAD</td>
<td>±1.5 dB</td>
<td>±65 dB</td>
</tr>
<tr>
<td>AC Level</td>
<td>±(±13% of reading + 0.009% of range)</td>
<td>20 Hz to 20 kHz</td>
</tr>
</tbody>
</table>

DISTORTION MEASUREMENT AUDIO FILTERS

None, C-Message, CCITT Weighting, CCIR/ARM, C/W, ‘A’ Weighting

NUMBER OF HARMONICS INCLUDED IN THD CALCULATION: 2 to 64 (user selectable).

DISTORTION MEASUREMENT READING RATE

<table>
<thead>
<tr>
<th>Fundamental Frequency Acquisition Mode</th>
<th>Fundamental Frequency Range</th>
<th>Minimum Readings Per Second</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single acquisition or stored value</td>
<td>20 Hz to 100 Hz</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>1 kHz</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>2 kHz</td>
<td>28</td>
</tr>
<tr>
<td>Automatic</td>
<td>20 Hz to 30 Hz</td>
<td>5.5</td>
</tr>
<tr>
<td></td>
<td>30 Hz to 400 Hz</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>400 Hz to 2kHz</td>
<td>6.6</td>
</tr>
</tbody>
</table>

FREQUENCY SWEEP READING RATE

<table>
<thead>
<tr>
<th>Number of Frequencies</th>
<th>Time (seconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>0.2</td>
</tr>
<tr>
<td>30</td>
<td>1.1</td>
</tr>
<tr>
<td>100</td>
<td>3.5</td>
</tr>
<tr>
<td>200</td>
<td>6.9</td>
</tr>
</tbody>
</table>

NOTES

1. Input signal at full scale.
2. Y = >20% of range and harmonics > –56dB.
3. Speeds are for default operating conditions (*RST), and display off, auto range off, binary data transfer, trig delay = 0.
4. Typical times; frequencies in 4kHz–4kHz range, binary data transfer, trig delay = 0, display off, auto range off. Data returned is THD measurement plus AC voltage.

FREQUENCY RANGE: 10–20kHz.
FREQUENCY RESOLUTION: 0.007Hz.
FREQUENCY ACCURACY: ±0.015% of reading + 0.007Hz.
FREQUENCY TEMPERATURE COEFFICIENT: <100ppm over operating temperature range.

SOURCE OUTPUT:

WAVEFORM: Sinewave.
AMPLITUDE RANGE: 2015, 2015-P: 2V rms (50Ω and 600Ω) or 4V rms (HI Z).
2015, 2016-P: 4.75V rms (50Ω and 600Ω) or 9.5V rms (HI Z).
AMPLITUDE RESOLUTION: 2015, 2015-P: 0.5mV rms (50Ω and 600Ω) or 1mV rms (HI Z).
2015, 2016-P: 1.25mV rms (50Ω and 600Ω) or 2.5mV rms (HI Z).
AMPLITUDE ACCURACY: 2015, 2015-P: ±0.3% of setting + 1mV ± 200ppm over operating temperature range.
2015, 2016-P: ±0.3% of setting + 2mV ± 200ppm over operating temperature range.
AMPLITUDE TEMPERATURE COEFFICIENT: Typically 0.05%/°C.
AMPLITUDE FLATNESS: ±1dB ± 5%.
OUTPUT IMPEDANCE: 50Ω ± 1Ω or 600Ω ± 1Ω, user selectable.
THD: –64dB.
NOISE: 2015, 2015-P: 10µV rms.
2015, 2015-P: 25µV rms.
DC OFFSET VOLTAGE: 2015, 2015-P: ±1mV. 2016, 2016-P: ±3mV.

INV/PULSE OUTPUT (SINEWAVE MODE):

FREQUENCY: Same as source output.
AMPLITUDE RANGE: 2015, 2015-P: 2V rms (50Ω and 600Ω) or 4V rms (HI Z).
2015, 2016-P: 4.75V rms (50Ω and 600Ω) or 9.5V rms (HI Z).
AMPLITUDE RESOLUTION: 2015, 2015-P: 0.5mV rms (50Ω and 600Ω) or 1mV rms (HI Z).
2015, 2016-P: 1.25mV rms (50Ω and 600Ω) or 2.5mV rms (HI Z).
AMPLITUDE ACCURACY: 2015, 2015-P: ±2.0% of setting + 2mV ± 200ppm over operating temperature range.
2015, 2016-P: ±2.0% of setting + 5mV ± 200ppm over operating temperature range.
AMPLITUDE FLATNESS: ±1dB ± 5%.
OUTPUT IMPEDANCE: Same as Source Output setting.
THD: –64dB.
NOISE: 2015, 2015-P: 10µV rms.
2016, 2016-P: 25µV rms.
DC OFFSET VOLTAGE: 2015, 2015-P: ±1mV typ. ±15mV max.
2015, 2016-P: ±3mV typ. ±15mV max.

INV/PULSE OUTPUT (PULSE MODE):

FREQUENCY: Same as source output.
DUTY CYCLE: 45% ±3.
OUTPUT IMPEDANCE: Same output impedance as the source output.
AMPLITUDE: 0.0V ±0.07V to 4.9V ±0.12V pulse open circuit.
0.0V ±0.05V to 3.5V ±0.08V pulse 100Ω load.
OVERSHOOT: 10V maximum pulse open circuit.
0.2V maximum with 100Ω load pulse open circuit.
UNDERSHOOT: 1.1V maximum pulse open circuit.
0.45V maximum with 100Ω load pulse open circuit.

NOTES

1. 1 year, 23°C ±5°C
2. Measured at ±Uot = 0 with gain 100 amplifier and 2-pole 50kHz low pass filter. In/Out in sinewave mode; HI Z output impedance, and no load.
3. With HI Z output impedance and 1m 50Ω coaxial cable.
4. HI Z output impedance, no load.
5. 4V output.
6. THD measurement includes harmonics 2 through 5, 4V rms output, HI Z, no load.
**DC Characteristics**

**CONDITIONS:** MED (1 PLC) or SLOW (10 PLC) or MED (1 PLC) with filter of 10.

<table>
<thead>
<tr>
<th>Function</th>
<th>Range</th>
<th>Resolution</th>
<th>Test Current or Burden Voltage (±5%)</th>
<th>Input Resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>100.0000 mV</td>
<td>0.1 µV</td>
<td>&gt; 10 GΩ</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.000000 V</td>
<td>1.0 µV</td>
<td>&gt; 10 GΩ</td>
<td></td>
</tr>
<tr>
<td></td>
<td>10.00000 V</td>
<td>10 µV</td>
<td>&gt; 10 GΩ</td>
<td></td>
</tr>
<tr>
<td></td>
<td>100.0000 V</td>
<td>100 µV</td>
<td>10 MΩ ±1%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1000.000 V</td>
<td>1 mV</td>
<td>10 MΩ ±1%</td>
<td></td>
</tr>
<tr>
<td>Resistance</td>
<td>100.000 Ω</td>
<td>100 µΩ</td>
<td>1 mA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.00000 kΩ</td>
<td>1 mΩ</td>
<td>1 mA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>10.0000 kΩ</td>
<td>10 Ω</td>
<td>100 µA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>100.0000 kΩ</td>
<td>100 Ω</td>
<td>30 µA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.000000MΩ</td>
<td>1 Ω</td>
<td>10 µA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>10.00000MΩ</td>
<td>10 Ω</td>
<td>700 mA/10MΩ</td>
<td></td>
</tr>
<tr>
<td></td>
<td>100.0000MΩ</td>
<td>100 Ω</td>
<td>700 mA/10MΩ</td>
<td></td>
</tr>
<tr>
<td>Current</td>
<td>100.0000 mA</td>
<td>10 nA</td>
<td>&lt; 0.15 V</td>
<td></td>
</tr>
<tr>
<td></td>
<td>100.000 mA</td>
<td>100 nA</td>
<td>&lt; 0.03 V</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.00000 A</td>
<td>1 µA</td>
<td>&lt; 0.3 V</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.00000 A</td>
<td>10 µA</td>
<td>&lt; 1 V</td>
<td></td>
</tr>
<tr>
<td>Continuity</td>
<td>2W 1 kΩ</td>
<td>100 mA</td>
<td>1 mA</td>
<td></td>
</tr>
<tr>
<td>Diode Test</td>
<td>3.00000 V</td>
<td>10 µV</td>
<td>1 mA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>10.00000 V</td>
<td>100 µA</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>100.0000 V</td>
<td>10 µA</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Accuracy:** ±(ppm of reading + ppm of range) (ppm = parts per million) (e.g., 10ppm = 0.001%)

<table>
<thead>
<tr>
<th>Temperature</th>
<th>24 Hour</th>
<th>90 Day</th>
<th>1 Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>23°C ± 1°C</td>
<td>30 + 1</td>
<td>15 + 6</td>
<td>15 + 6</td>
</tr>
<tr>
<td>20°C ± 1°C</td>
<td>40 + 0</td>
<td>25 + 7</td>
<td>20 + 5</td>
</tr>
<tr>
<td>23°C ± 5°C</td>
<td>50 + 5</td>
<td>100 + 10</td>
<td>30 + 5</td>
</tr>
<tr>
<td>23°C ± 5°C</td>
<td>50 + 5</td>
<td>30 + 5</td>
<td>10 + 5</td>
</tr>
</tbody>
</table>

**Temperature Coefficient:** 0°C–18°C & 28°C–50°C

<table>
<thead>
<tr>
<th>Speed and Noise Rejection</th>
<th>Rate</th>
<th>Readings/s</th>
<th>Digits</th>
<th>RMS Noise 10V Range</th>
<th>NMRR 12</th>
<th>CMRR 13</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 PLC</td>
<td>6%</td>
<td>6%</td>
<td>&lt; 1.5 µV</td>
<td>60 dB</td>
<td>140 dB</td>
<td></td>
</tr>
<tr>
<td>1 PLC</td>
<td>5%</td>
<td>6%</td>
<td>&lt; 4 µV</td>
<td>60 dB</td>
<td>140 dB</td>
<td></td>
</tr>
<tr>
<td>0.1 PLC</td>
<td>5%</td>
<td>5%</td>
<td>&lt; 22 µV</td>
<td>—</td>
<td>80 dB</td>
<td></td>
</tr>
<tr>
<td>0.01 PLC</td>
<td>4%</td>
<td>4%</td>
<td>&lt; 150 µV</td>
<td>—</td>
<td>80 dB</td>
<td></td>
</tr>
</tbody>
</table>

**DC NOTES**

1. Add the following to ppm of range accuracy specification based on range: 1V and 100V: 2ppm; 1mA and 10mA: 10ppm.
2. Speeds are for 60Hz operation using factory default operating conditions (*RST). Autoretain off, Display off, Trigger delay = 0.
3. Speeds include measurement and binary data transfer out the GPIB.
4. Auto zero on/off.
5. Sample count = 1024, auto zero off.
6. Auto zero off, NPRC = 0.01.
7. 0ms = 24 readings/second.
8. 1 PLC = 16.67ms (40kHz, 20ms) 50Hz 4kHz. The frequency is automatically determined at power up.
9. For signal levels >900mV, add 0.1ppm/V uncertainty for the portion exceeding 500mV.
10. Add 120µs for Ohms.
11. Must have 10% matching of lead resistance in Input HI and LO.
12. For line frequency 20Hz to 1kHz.
13. For 1kHz inductance in LO lead.
14. Relative to calibration accuracy.
15. Specifications are for 4-wire ohms. Add ±1Ω additional uncertainty.
16. For two inputs. Add the following to Temperature Coefficient: “ppm of reading” uncertainty: 10mΩ±70ppm, 10mΩ±80ppm. Operating environment specified for 0°C to 50°C, 50% RH at 35°C.
### True RMS AC Voltage and Current Characteristics

<table>
<thead>
<tr>
<th>Voltage Range</th>
<th>Resolution</th>
<th>Calibration Cycle</th>
<th>Accuracy (^1) ±(% of reading + % of range), 23°C ±5°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>100.00000 mV</td>
<td>0.1 μV</td>
<td>90 Days</td>
<td>3 Hz–10 Hz: 0.35 ± 0.03</td>
</tr>
<tr>
<td>1.000000 V</td>
<td>1.0 μV</td>
<td>1 Year</td>
<td>3 Hz–10 Hz: 0.35 ± 0.03</td>
</tr>
<tr>
<td>10.00000 V</td>
<td>10 μV</td>
<td></td>
<td>3 Hz–10 Hz: 0.35 ± 0.03</td>
</tr>
<tr>
<td>100.0000 V</td>
<td>100 μV</td>
<td></td>
<td>3 Hz–10 Hz: 0.35 ± 0.03</td>
</tr>
<tr>
<td>750.000 V</td>
<td>1 mV</td>
<td></td>
<td>3 Hz–10 Hz: 0.35 ± 0.03</td>
</tr>
</tbody>
</table>

### HIGH CREST FACTOR ADDITIONAL ERROR ±(% of reading) \(^7\)

<table>
<thead>
<tr>
<th>CREST FACTOR:</th>
<th>ADDITIONAL ERROR:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1–2</td>
<td>0.05</td>
</tr>
<tr>
<td>2–3</td>
<td>0.15</td>
</tr>
<tr>
<td>3–4</td>
<td>0.30</td>
</tr>
<tr>
<td>4–5</td>
<td>0.40</td>
</tr>
</tbody>
</table>

### AC OPERATING CHARACTERISTICS \(^2\)

#### Function

<table>
<thead>
<tr>
<th>Digits</th>
<th>Rate</th>
<th>Bandwidth</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACV (all ranges), and ACI (all ranges)</td>
<td>SLOW</td>
<td>3 Hz–500 kHz</td>
</tr>
<tr>
<td>6½ 4</td>
<td>2/sreading</td>
<td></td>
</tr>
<tr>
<td>6½ 3</td>
<td>1.4</td>
<td>MED</td>
</tr>
<tr>
<td>6½ 2</td>
<td>4.8</td>
<td>MED</td>
</tr>
<tr>
<td>6½ 1</td>
<td>2.2</td>
<td>FAST</td>
</tr>
<tr>
<td>6½ 0</td>
<td>55</td>
<td>FAST</td>
</tr>
</tbody>
</table>

#### ADDITIONAL LOW FREQUENCY ERRORS ±(% of reading)

<table>
<thead>
<tr>
<th>Slow</th>
<th>Med</th>
<th>Fast</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 Hz–50 Hz</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>50 Hz–100 Hz</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>100 Hz–200 Hz</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>200 Hz–300 Hz</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>&gt;300 Hz</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

### AC SYSTEM SPEEDS \(^2\), \(^5\)

- FUNCTION/RANGE CHANGE: 4/s
- AUTORANGE TIME: <5s
- ASCII READINGS TO RS-232 (19.2k baud): 50/s
- MAX. INTERNAL TRIGGER RATE: 500/s
- MAX. EXTERNAL TRIGGER RATE: 260/s

### AC GENERAL

- INPUT IMPEDANCE: 1MΩ ±2% paralleled by <100pF
- ACV INPUT PROTECTION: 400V on any ACV range
- ACI INPUT PROTECTION: 3A, 250V fuse
- MAXIMUM DCV: 400V on any ACV range
- SHUNT RESISTOR: 0.1Ω on all ACI ranges
- AC CMRR: >70dB with 1kΩ in LO lead
- MAXIMUM CREST FACTOR: 5 at full scale
- VOLT HERTZ PRODUCT: <8 × 10^6 V Hz
- OVERRANGE: 120% of range except on 750V and 3A ranges

### AC NOTES

1. Specifications are for SLOW rate and sinewave inputs >5% of range.
2. Speeds are for 60Hz operation using factory default operating conditions (*RST). Auto zero off, Auto range off, Auto trigger off. Includes measurement and binary data transfer out the GPIB.
3. 0.01% of full scale settling error. Trigger delay = 400ms.
4. Trigger delay = 0
5. DETECTOR BANDWIDTH 300, NPLC = 0.01
6. Maximum useful limit with trigger delay = 175ms.
7. Applies to non-sinewaves >5Hz and <50kHz. Guaranteed by design for crest factors >1.3.
8. Applies to 0°–18°C and 28°–50°C
9. For signal levels >2A, add additional 0.4% to "of reading" uncertainty.
10. Typical uncertainties. Typical represents two sigma or 95% of measured units measure <0.35% of reading and three sigma or 99.7% <1.0% of reading.
2015, 2015-P, 2016, 2016-P

6½-Digit THD Multimeters
6½-Digit Audio Analyzing Multimeters

Triggering and Memory

READING HOLD SENSITIVITY: 0.01%, 0.1%, 1%, or 10% of reading.
TRIGGER DELAY: 0 to 99 hrs (1ms step size).
EXTERNAL TRIGGER LATENCY: 200µs + <300µs jitter with autozero off, trigger delay = 0.
MEMORY: 1024 readings.

Math Functions

Ref, Min/Max/Average/StdDev (of stored reading), dB, dBm, Limit Test, %, and mX+b with user defined units displayed.
dBm REFERENCE RESISTANCES: 1 to 9999Ω in 1Ω increments.

Standard Programming Languages

SCPI (Standard Commands for Programmable Instruments).

Frequency and Period Characteristics

<table>
<thead>
<tr>
<th>ACV Range</th>
<th>Frequency Range</th>
<th>Period Range</th>
<th>Gate Time</th>
<th>Resolution ± (ppm of reading)</th>
<th>Accuracy ± (% of reading)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 mV to 750 V</td>
<td>5 Hz to 500 kHz</td>
<td>335 ms to 2 µs</td>
<td>1 µs (SLOW)</td>
<td>0.355</td>
<td>0.01</td>
</tr>
<tr>
<td>10 mV to 100 µV</td>
<td>0.1 Hz to 0.5 Hz</td>
<td>10 µs (FAST)</td>
<td>0.1 µs</td>
<td>0.33</td>
<td>0.01</td>
</tr>
</tbody>
</table>

FREQUENCY NOTES

1. Specifications are for square wave inputs only. Input signal must be >10% of ACV range. If input is <20µV on the 100mV range, then the frequency must be >10Hz.
2. 20% overrange on all ranges except 750V range.

Temperature Characteristics

<table>
<thead>
<tr>
<th>Thermocouple Type</th>
<th>Resolution</th>
<th>Accuracy 90 Day/1 Year (23°C ±5°C) Relative to Reference Junction</th>
</tr>
</thead>
<tbody>
<tr>
<td>J</td>
<td>0.001°C</td>
<td>±0.5°C.</td>
</tr>
<tr>
<td>K</td>
<td>0.01°C</td>
<td>±0.5°C.</td>
</tr>
<tr>
<td>T</td>
<td>0.001°C</td>
<td>±0.5°C.</td>
</tr>
</tbody>
</table>

TEMPERATURE NOTES

1. For temperatures <~100°C, add ±0.1°C and >900°C add ±3°C.
2. Temperature can be displayed in °C, K, or °F.
3. Accuracy based on ITS-90.
4. Exclusive of thermocouple error.

GENERAL

POWER SUPPLY: 100V/120V/220V/240V.
LINE FREQUENCY: 50Hz to 60Hz and 400Hz, automatically sensed at power-up.
POWER CONSUMPTION: 40VA.
VOLT HERTZ PRODUCT: ≤8 × 10⁷V·Hz.
SAFETY: Conforms to European Union Low Voltage Directive.
EMC: Conforms to European Union EMC Directive.
VIBRATION: MIL-PRF-28800F Class 3 Random.
OPERATING ENVIRONMENT: Specified for 0°C to 50°C. Specified to 80% R.H. at 35°C and at an altitude of up to 2,000 meters.
STORAGE ENVIRONMENT: −40°C to 70°C.
WARMUP: 1 hour to rated accuracy.
DIMENSIONS:
- Rack Mounting: 89mm high × 215mm wide × 370mm deep (3.5 in × 8.5 in × 14.56 in).
- Bench Configuration (with handle and feet): 104mm high × 238mm wide × 370mm deep (4.1 in × 9.38 in × 14.56 in).
NET WEIGHT: 4.2kg (8.8 lbs).
SHIPPING WEIGHT: 5kg (11 lbs).