



- High Accuracy
- 30 Hz to 54 kHz Frequency Range
- 20 mV to 300 V RMS Voltage Range
- Autoranging
- IEEE-488 Interface
- Self Calibrating

### GENERAL

The Model 2251 is Similar to the Popular Model 2250. The 2251 is a Multifunction Voltmeter that Combines a Total Voltmeter, a Phase Angle Voltmeter, and a Waveform Signal Analyzer in a Single Microprocessor-Based Instrument. As a Total Voltmeter the 2251 Can be Used for the RMS Measurement of a Total AC Signal Including Harmonics. In Addition, the 2251 Can Make Various Voltage Gain and Attenuation Measurements Directly in Decibels. As a Phase Angle Voltmeter the 2251 is Capable of Making the Following Multi-Frequency, Phase-Sensitive Measurements on an AC Signal:

**Phase Angle:** Is the amount of phase shift in degrees between the signal and reference voltage

**Fundamental:** Is the RMS measurement of a fundamental signal voltage without noise and harmonics

**In-Phase:** Is the RMS measurement of the vector component of a signal voltage that is in phase with a reference voltage

**Quadrature:** Is the RMS measurement of the quadrature vector component of a signal voltage that is 90° out of phase with a reference voltage

**Signal to Reference Ratio:** Is used with total, fundamental, in phase and quadrature modes to display a signal to reference ratio

As an Analyzer the 2251 Uses a Combination of Waveform Sampling and Signal Processing Techniques to Determine the Magnitudes and Phases of a Signal Waveform Under Investigation. These Adjustments Facilitate Signal Analysis. The 2251 Has a Dual-Channel Measurement System which Uses Identical, (though isolation) Signal And Reference Circuits. The Isolation Feature Enables Input Voltages to Float with Respect to Circuit Ground.

### TYPICAL APPLICATIONS

- ATE
- Transformer Ratio & Phase Tests
- Amplifier Gain & Phase
- Phase Sensitive Null Detection
- Network Transfer Function Analysis
- Input – Output Impedance Testing
- Wide Band, High Sensitivity Voltage Measurements
- Attenuator Linearity Testing
- Harmonic Analysis
- Accelerometer Testing
- Phase Angle Measurements
- Synchro/Resolver Transducer Testing
- LVDT/RVDT Testing
- Filter Testing – Insertion Loss, Phase Shift measurement of Power Factor & Complex Impedance Phasing of Servo Motors & Servo's

## SPECIFICATIONS

<b>Resolution</b>	Voltage Modes 4-1/2 digits Phase Angle 0.01° Frequency Display 3 digits
<b>Signal Scale Range: Voltage Modes</b>	20mV - 300V* in 6 ranges or autoranging <i>* 300V range is actually a 2000V range with maximum signal limitations of 300V. Voltages in excess of 300V should not be applied</i> 0.00° - 360.00° or ±180.00°
<b>Phase Angle Mode</b>	
<b>Reference Voltage Range</b>	2mV - 300Vrms*, autoranging (no adjustment necessary); 400Vdc, total of 700 V peak maximum <i>* 300V range is actually a 2000V range with maximum signal limitations of 300V. Voltages in excess of 300V should not be applied</i>
<b>Frequency Range</b>	30 Hz - 54 kHz in Phase Sensitive and Total modes
<b>Signal Autoranging</b>	Up-ranges at approximately 108% FS; down ranges at approximately 9.9% FS. Note: the above assumes sine wave input. Levels will vary with crest factor on non-sine waves.
<b>Ratio Autoranging</b>	Up-ranges at 160% of range; down ranges at 10% of range.
<b>Displays</b>	<i>Primary:</i> 4 1/2 digits, 0.005% full range resolution.
Voltage	
Phase	0.0° to 359.99° phase lead 0.01° resolution or 0.0° ±180° 0.01° resolution
<b>Displays cont'd</b>	<i>Secondary:</i> Lock Frequency - (in kHz) 3-digit, 0.28" high, 7-segment red LED  Null Meter - Zero center scale, moving LED, log scaled, 5/8" high 6" long. Covers dynamic range of scale selected with center having 1-LSB sensitivity.
<b>Input Impedance</b>	<i>Signal &amp; Reference</i> 2 MΩ shunted by 180pF (typical)
<b>Nulling Sensitivity</b>	1μV
<b>Total Mode Noise</b> (20 mv Range)	35μV maximum
<b>0 Volt Input Accuracy</b>	Equal to full scale accuracy spec
<b>Common Mode</b>	30 Hz - 999.9 Hz                      116 db min.
<b>Rejection</b>	1 kHz - 5 kHz                            100 db min.
(Zero source impedance)	>5 kHz - 32 kHz                        90 db min.
	>32 kHz - 54 kHz                       81 db min.
<b>Signal &amp; Reference Channel Isolation</b>	1000 MΩ shunted by 2pF Hi with respect to case (guard driven) 1000 MΩ shunted by 10 pF Lo with respect to case (guard driven) 1000 MΩ shunted by 2000 pF between guard and case.

Specifications Continued...

**Harmonic Rejection** 60 db all even and odd order Harmonics  
**Data Refresh** 25 Hz and above 40 ms nominal 1/f ms max below 25 Hz  
**Remote Control** IEEE-488 1978 standard GPIB  
**Recorder Output** Separate In-Phase and Quad Outputs Provided

Range Full Scale Equals  $\pm 2.0$  VDC ( $\pm 8.75$  Vdc Selectable)  
 Accuracy  $\pm 0.15\%$   
 Resolution 1 mV nominal

**Power Requirements** 115/230 Vrms  $\pm 15\%$ , 47 to 67 Hz, 70 VA  
**Operating Temperature** 10°C to 40°C ambient temperature  
**Operating Position** Horizontal  
**Maximum Tilt Angle**  $\pm 30^\circ$   
**Warm-up Time** 30 minutes to achieve rated accuracy

**Dimensions** 5¼" H x 16¾" W x 19"D  
 (133.35mm x 425.45mm x 482.6mm)

**Weight** 35 lb (15.75 kg)

**Fuse** 2A for 115V Operation  
 1A for 230V Operation (included in accessory kit)

**Connectors** **Type**

Front SIG input 5 way binding post  
 Front REF input 5 way binding post  
 Rear SIG input MS3102A14S-2P  
 Rear REF input MS3102A14S-2P  
 Trigger input BNC female  
 Recorder output MS3102A14S-2S  
 Remote Interface IEEE-488 standard connector  
 Power input IEC standard 115/230 V connector

**Mating Connectors** Signal Input - MS3106A-14S-2S  
 (Connector kit: Reference Output- MS3106A-14S-2S  
 NAI part # 789005) Recorder Output - MS3106A-14S-2P  
 Trigger- BNC (Male)

**Accuracy**

TOTAL (sum)\*, FUND, PHASE SENSITIVE MODES\*\*

FREQUENCY	---VOLTAGE		-----		PHASE
	200V/2000V* Range (*300V RMS MAX)	20mV Range	ALL OTHER RANGES		
>30 Hz to 1.5kHz	0.07% Full Scale +0.20% Reading	0.15% Full Scale +0.07% Reading	0.07% Full Scale Reading	+0.07%	±0.1°
>1.5 kHz to 5 kHz	0.08% Full Scale +0.15% Reading	0.20% Full Scale +0.08% Reading	0.08% Full Scale Reading	+0.08%	±0.1°
>5 kHz to 20 kHz	0.08% Full Scale +0.30% Reading	0.25% Full Scale +0.20% Reading	0.08% Full Scale Reading	+0.20%	±f (in kHz)° /50
>20 kHz to 32 kHz	0.24% Full Scale +0.50% Reading	0.30% Full Scale +0.30% Reading	0.24% Full Scale Reading	+0.30%	±f (in kHz)° /50
>32 kHz to 54 kHz	0.24% Full Scale +1.0% Reading	0.30% Full Scale +1.0% Reading	0.50% Full Scale Reading	+1.0%	±f (in kHz)° /50

TOTAL (Avg) #	0 to 1/2 SCALE	1/2 SCALE to F.S.
>30 Hz to 10kHz Hz	0.25% Full Scale	0.5% reading.
>10 kHz to 30 kHz	0.5% Full Scale	2.0% reading.

\* TOTAL (sum) = fundamental + harmonics

# TOTAL (Avg) = Average RMS of fundamental + harmonics + noise

\*\* Not including phase errors