

SPECIFICATION

Instrument Description

The AA 501 is a fully automatic distortion analyzer, packaged as a two-wide TM 500 plug-in. Total harmonic distortion is measured with the standard instrument. Option 01 instruments also measure SMPTE/DIN intermodulation distortion and CCIF two-tone difference frequency distortion.

Distortion set level, frequency tuning and nulling are fully automatic, requiring no operator adjustment. Input level range and distortion measurement range selections are fully automatic or may be manually selected. Distortion readout is provided in percent or dB.

The AA 501 is also a high sensitivity, autoranging, audio frequency voltmeter. Readings may be in volts, dBm, or dB relative to any arbitrary reference.

Filters are included which allow measurement of noise to IHF and FCC specifications. A hum rejection filter is provided as are provisions for external filters.

All readings are displayed on a 3 1/2 digit readout. An uncalibrated analog readout is also provided to aid in nulling and peaking applications.

Ac to dc conversion is either average or true rms responding, allowing conformance with most standards. This feature permits comparison with readings obtained on other instruments.

Ac input and output connections are available on both the front panel and the rear interface. Dc signals, corresponding to the displayed reading, are available through the rear interface. This allows flexibility in interconnection with other instruments such as filters, chart recorders, spectrum analyzers, oscilloscopes, etc.

Performance Conditions

The electrical characteristics in this specification are valid only if the AA 501 has been adjusted at an ambient temperature between +20°C and +30°C. The instrument must be in a noncondensing environment whose limits are described under the environmental part. Allow twenty minutes warm-up time for operation to specified accuracy; sixty minutes after exposure to or storage in a high humidity (condensing) environment. Any conditions that are unique to a particular characteristic are expressly stated as part of that characteristic.

The electrical and environmental performance limits, together with their related validation procedures, comprise a complete statement of the electrical and environmental performance of a calibrated instrument.

Items listed in the Performance Requirements column of the Electrical Characteristics are verified by completing the Performance Check in the Calibration section of this manual. Items listed in the Supplemental Information column are not verified in this manual.

Table 1-1
ELECTRICAL CHARACTERISTICS

Characteristics	Performance Requirements	Supplemental Information
INPUT (all functions)		
Impedance	100 k Ω \pm 2%, each side to ground	Full differential. Each side ac coupled through 1 μ F and shunted to ground by \approx 100 pF. Dual banana jack connectors at 0.750 inch spacing with ground connector additionally provided.
Level ranges		200 mV to 200 V in seven 10 dB steps (2-6 sequence) with additional 200 μ V, 2 mV, and 20 mV ranges for level function only. All ranges are manual or auto-ranging. Autoranging time is typically <1 second. Separate increase range and decrease range indication. Indicators illuminate whenever input level does not fall within optimum window for selected range. For specified instrument performance both indicators must be extinguished.
Maximum input voltage		300 V peak, 200 V rms either input to ground or differentially. No damage to instrument with continuous overloads of 120 V rms or 200 V rms for 30 minutes in all level ranges.
Common mode rejection	\geq 50 dB at 50 or 60 Hz	Typically \geq 40 dB to 300 kHz. Common mode signals not to exceed one half of selected level range or 1 V, whichever is greater.
LEVEL FUNCTION		
Modes		Volts, dBm (600 Ω), or dB ratio with push to set 0 dB reference. Input level range determines display range. Single effective range in dB modes with 0.1 dB resolution. Stored 0 dB reference is unaffected by subsequent changes in mode or function.
Detection (response)		Selectable average or true rms for waveforms with crest factors \leq 3.

Table 1-1 (cont)

Characteristics	Performance Requirements		Supplemental Information
Accuracy ($V_{in} \geq 100 \mu V$ with level ranging indicators extinguished)			Accuracy below $100 \mu V$ is limited by residual noise.
	Volts	dBm or dB ratio	*On the $200 \mu V$ range, accuracy above 50 KHz is +4%, -6% (+0.5 dB, -0.7 dB).
20 Hz to 20 kHz	Within $\pm 2\%$	± 0.3 dB	
10 Hz to 100 KHz*	Within $\pm 4\%$	± 0.5 dB	
Bandwidth	At least 300 kHz with no filters selected.		
Residual noise (source resistance $\leq 1 k\Omega$)	$\leq 3.0 \mu V$ (-108 dBm) with 80 kHz and 400 Hz filters.		
	$\leq 1.5 \mu V$ with 'A' weighting filter.		
TOTAL HARMONIC DISTORTION PLUS NOISE FUNCTION Operation			Fully automatic THD+N measurements to specified accuracy in ≤ 6 seconds (7 seconds if input level autoranging) with no operator level setting, tuning, or nulling adjustments. For proper tuning THD+N $\leq 10\%$. After initial tuning THD+N can degrade to 30% without loss of lock for SINAD testing.
Fundamental frequency range	10 Hz to 100 kHz		
Minimum input level	60 mV (-22 dBm)		
Distortion ranges			Auto range, 20%, 2%, 0.2%, and dB. dB is internally autoranging with single effective display range. Auto range allows measurements to 100%.
Detection (response)			Selectable average or true rms for waveforms with crest factors ≤ 3 . Average detection will typically read 1 to 2 dB lower for noise dominated signals.
Accuracy (THD $\leq 30\%$ with readings $\geq 4\%$ of selected distortion range).			Accuracy is limited by residual THD+N and filter selection.
20 Hz to 20 kHz	Within $\pm 10\%$ (± 1 dB) for harmonics ≤ 100 kHz.		
10 Hz to 100 kHz	Within $+10\%$ -30% ($+1$ dB, -3 dB) for harmonics ≤ 300 kHz.		

Table 1-1 (cont)

Characteristics	Performance Requirements	Supplemental Information
Residual THD+N ($V_{in} \geq 250$ mV, source resistance ≤ 1 k Ω),		Measured with SG 505 oscillator. All distortion, noise, and nulling error sources combined.
20 Hz to 20 kHz with 80 kHz noise limiting filter	$\leq 0.0025\%$ (–92 dB) average response $\leq 0.0032\%$ (–90 dB) rms response	
10 Hz to 50 kHz	$\leq 0.0071\%$ (–83 dB)	
50 kHz to 100 kHz	$\leq 0.010\%$ (–80 dB)	
Typical THD contribution ($T \leq +30^\circ$ C)		
10 Hz to 20 kHz		$\leq 0.0018\%$ (–95 dB)
20 kHz to 50 kHz		$\leq 0.0032\%$ (–90 dB)
50 kHz to 100 kHz		$\leq 0.0071\%$ (–83 dB)
Typical fundamental rejection Intermodulation Distortion Function.		At least 10 dB below specified residual THD+N or the actual signal THD, whichever is greater.
Operation		Fully automatic SMPTE, DIN, or CCIF difference tone tests depending upon actual input signal whenever respective IMD $\leq 20\%$. Distortion ranges are same as THD+N function. Internal jumper selects Automatic, CCIF or SMPTE-DIN.
SMPTE and DIN tests		
Lower frequency range		50 Hz to 250 Hz
Upper frequency range		3 kHz to 100 kHz
Level ratio range		1:1 to 5:1 (lower : upper)
Residual IMD ($V_{in} \geq 250$ mV, source resistance ≤ 1 k Ω)	$\leq 0.0025\%$ (–92 dB) for 60 Hz–7 kHz or 250 Hz–8 kHz, 4:1 signals.	
CCIF difference tone test (IM components ≤ 1 kHz)		
Frequency range		4 kHz to 100 kHz
Difference frequency range		50 Hz to 1 kHz
Residual IMD ($V_{in} \geq 250$ mV, source resistance ≤ 1 k Ω)	$\leq 0.0018\%$ (–95 dB) with 14 kHz and 15 kHz.	
Minimum input level	60 mV (–22 dBm)	
Accuracy (IMD $\leq 30\%$ and readings $\geq 4\%$ of selected distortion range)	Within $\pm 10\%$ (± 1 dB)	Accuracy is limited by residual IMD and filter selection.

Table 1-1 (cont)

Characteristics	Performance Requirements	Supplemental Information
FILTERS		
400 Hz high pass	-3 dB at 400 Hz $\pm 5\%$; at least -40 dB rejection at 60 Hz.	3 pole Butterworth response
80 kHz low pass	-3 dB at 80 kHz $\pm 5\%$	3 pole Butterworth response
30 kHz low pass	-3 dB at 30 kHz $\pm 5\%$	3 pole Butterworth response
'A' weighting		Within specifications for type 1 sound level meters listed in ANSI S 1.4 1971 (revised 1976) and IEC Recommendation 179.
Auxiliary		Selects front panel AUXILIARY INPUT allowing connection of external filter between it and FUNCTION OUTPUT.
FRONT PANEL SIGNALS		
MONITOR OUTPUT		
$V_{in} \geq 50$ mV	1 V rms $\pm 10\%$	Constant amplitude (average response) version of differential input signal. THD is typically $\leq 0.0010\%$ (-100 dB) from 20 Hz to 20 kHz.
$V_{in} < 50$ mV		Approximately 20 times input signal.
Impedance	1 k Ω $\pm 5\%$	
FUNCTION OUTPUT		
Signal	1 V $\pm 3\%$ for 1000 count volts or % display.	Selected and filtered ac signal actually being measured.
Impedance	1 k Ω $\pm 5\%$.	
AUXILIARY INPUT		
Sensitivity	1 V $\pm 3\%$ for 1000 count volts or % display.	Loop through accuracy from FUNCTION OUTPUT is $\pm 3\%$.
Maximum Input Voltage		15 V peak, 6 V peak for linear response.
Impedance	100 k Ω $\pm 5\%$	Ac coupled.
DISPLAYS		
Digital		3 1/2 digit, 2000 count LED. Overrange indication is 1, blank, blank, blank.
Analog bar graph		10 segment LED intensity modulated bar graph display of digital readout. Segments are logarithmically activated with approximately 2.5 dB/segment.

Table 1-1 (cont)

Characteristics	Performance Requirements	Supplemental Information
MISCELLANEOUS		
Power Consumption		≈24 watts.
Recommended adjustment interval		1000 hours or 6 months whichever occurs first.
Warm-up time		20 minutes (60 minutes after storage in high humidity environment).

Table 1-2

ENVIRONMENTAL CHARACTERISTICS^a

Characteristics	Description
Temperature	Meets MIL-T-28800B, class 5.
Operating	0° C to +50° C
Non-operating	-55° C to +75° C
Humidity	Exceeds MIL-T-28800B, class 5.
	95% RH, 0° C to 40° C
	45% RH, to 50° C
Altitude	Exceeds MIL-T-28800B, class 5.
Operating	4.6 km (15,000 feet)
Non-operating	15 km (50,000 feet)
Vibration	Exceeds MIL-T-28800B, class 5, when installed in qualified power modules ^b .
	0.38 mm (0.015") peak-to-peak, 5 Hz to 55 Hz, 75 minutes.
Shock	Meets MIL-T-28800B, class 5, when installed in qualified power modules ^b .
	30 g's (1/2 sine) 11 ms duration, 3 shocks in each direction along 3 major axes, 18 total shocks.
Bench handling ^c	Meets MIL-T-28800B, class 5.
	12 drops from 45@, 4" or equilibrium, whichever occurs first.

Table 1-2 (cont)

ENVIRONMENTAL CHARACTERISTICS^a

Characteristics	Description
Transportation ^c	Qualified under National Safe Transit Association Preshipment Test Procedure 1A-B-1 and 1A-B-2.
EMC	Within limits of MIL-461A.
Electrical discharge	20 kV maximum charge applied to instrument case.

^a With power module.^b Refer to TM 500 power module specifications.^c Without power module.

Table 1-3

PHYSICAL CHARACTERISTICS

Characteristics	Description
Maximum Overall Dimensions	
Height	126.0 mm (4.96 inches)
Width	131.2 mm (5.16 inches)
Length	285.5 mm (11.24 inches)
Net Weight	≈1.7 kg (3.75 lbs.)
Finish	
Front Panel	Plastic-aluminum laminate
Chassis	Anodized aluminum