SIGNAL ANALYZERS

Audio Analyzer, 20 Hz to 100 kHz

Model 8903A

- Measures distortion, SINAD, signal-to-noise
- Measures true rms volts, dc volts, frequency
- Programmable low distortion source

NEW

HP-IB SYSTEMS

8903A

8903A Audio Analyzer

The 8903A Audio Analyzer combines the capabilities of several instruments under microprocessor control to yield accurate and rapid characterizations of audio signals in the range of 20 Hz to 100 kHz. It contains an audio source, measures distortion, SINAD, and signal-to-noise ratio, ac and dc level, and counts frequency completely automatically with either a single front panel keystroke or under HP-IB remote control. This combination reduces the number of instruments and complexity of setup needed in many applications.

The analyzer is ideally suited for performing audio measurements on transceivers. Along with a suitable generator and modulation analyzer, receiver sensitivity and transmitter distortion measurements can be made accurately and rapidly.

With the internal source and measurement functions enhanced by microprocessor control, the 8903A has more measurement capability and less display ambiguity than separate instruments. The Audio Analyzer makes true rms measurements for ac level and distortion, thus assuring more accurate measurements of complex waveforms and noise. The ability to perform swept measurements makes it an extremely versatile stand-alone bench instrument for general audio stimulus/response work. Its programmability over HP-IB is well suited to system applications.

Transceiver Testing

The Audio Analyzer performs several measurements and contains various features specifically designed for receiver testing. The most common audio measurements are SINAD for FM receivers and signal-to-noise for AM receivers. In the 8903A, these measurements are optimized for measuring the noisy signals encountered in receiver testing. Measurements of SINAD are indicated both by the analog meter and the digital display. The specially marked meter for EIA and CEPT sensitivity and selectivity results in fast, accurate, repeatable measurements. Also, a psophometric filter allows testing to CEPT standards.

By combining the 8903A with the 8901A Modulation Analyzer, you can make all common transmitter tests. The 8903A provides the tone for microphone inputs, measures transmitter audio distortion, and counts squelch tones. Distortion measurements can be made using the 400 Hz high pass filter to reject squelch tones. In rapid frequency count mode, counter measurements can be made at a rate of 8 ms/reading, allowing burst counting of squelch tone frequencies. In rapid programming mode, the source can switch frequencies rapidly enough to generate sub-audio squelch tone sequences. All functions are remotely programmable.

Audio Testing

The 8903A simplifies general audio testing by combining several traditional audio instruments into one. It is fully automatic and autoranging, so most measurements take only a single keystroke. Microprocessor control of all functions greatly enhances measurement efficiency. For example, distortion can be displayed in either percent or dB. In ac level you can choose between volts, dBV, or watts by entering the load resistance from the keyboard. You can establish a reference and make measurements in percent or dB relative to a measured or entered value. Using the source increment/decrement keys and relative display mode it is easy to determine parameters such as the 3 dB points of filters and amplifiers. With both low-distortion source and analyzer built in, the 8903A makes stimulus-response measurements. Internal processor control over all functions expands this capability to powerful swept characterization. With only a few keystrokes you can measure frequency response and swept distortion characteristics of filters, high quality amplifiers, audio IC's, and other devices. Hard copy results are easily generated with an X-Y recorder connected to the analyzer's rear panel outputs.

Systems Applications

The Audio Analyzer is a powerful HP-IB system component. Many audio functions frequently required in automatic systems are combined in the 8903A. In many cases it does the work of an audio synthesizer, digital voltmeter, frequency counter, and custom interface with notch filters. All these measurements are available at a single input connector. As a result, interfacing requirements, hardware cost, and software development time are reduced. The 8903A makes a major contribution by automatically measuring distortion under HP-IB control. It also provides a low distortion programmable source. Typical combined distortion of both source and analyzer at 1V is $<0.003\%$ between 20 Hz and 20 kHz.

Often systems applications involve measuring low level ac signals. The 8903's most sensitive range features a full scale ac level display of .300 mV with an accuracy of 4% of reading (2% of reading >50 mV, 20 Hz to 20 kHz). The ac converter is true rms for correct noise measurements and the 3 dB bandwidth is greater than 500 kHz.

Large measurement systems often have troublesome noise problems. The 8903A has 30 kHz and 80 kHz low-pass filters to reject high frequency noise. Also, the 400 Hz high-pass filter rejects line related hum and noise greater than 68 dB.

Two special binary programming modes are available in remote operation. Rapid frequency count mode provides a packed four byte output for fast counting. Also, a rapid source mode is available which allows the internal oscillator hardware to be programmed directly with five bytes.

8903A Specifications

Source

Frequency range: 20 Hz to 100 kHz.
Frequency resolution: 0.3%
Frequency accuracy: 0.3% of setting.
Output level range: 0.6 mV to 6V open circuit.
Output level resolution: 0.3% or better.
Output level accuracy (open circuit): 2% of setting, 60 mV to 6V, 20 Hz to 50 kHz; 3% of setting, 6 mV to 6V, 20 Hz to 100 kHz; 5% of setting, 0.6 mV to 6 mV, 20 Hz to 100 kHz.
Flatness (1 kHz reference): ±0.7%, 20 Hz to 20 kHz; ±2.5%, 20 Hz to 100 kHz.
Distortion & noise: the higher of: −80 dB or 30 μV, 20 Hz to 20 kHz, 80 kHz BW; −70 dB or 95 μV, 20 kHz to 50 kHz, 500 kHz BW; −65 dB or 169 μV, 50 kHz to 100 kHz, 500 kHz BW.
Impedance: 600Ω ±1%.
Sweep mode: logarithmic sweep with up to 500 points/decade or 255 points between entered start and stop frequencies, whichever is smaller.

AC Level

Full range display: 300.0V, 30.00V, 3.000V, 0.3000V, 30.00mV, 3.000 mV, 0.3000mV.
Overrange: 33% except on 300V range.
Accuracy: ±2% of reading, 30V to 300V, 20 Hz to 1 kHz; ±2% of reading, 50 mV to 30V, 20 Hz to 20 kHz; ±4% of reading, 0.3 mV to 30V, 20 Hz to 100 kHz.
AC Converter: true-rms responding for signals with crest factor ≤3 and harmonics up to 80 kHz typical. 3 dB measurement BW: >500 kHz typical.

DC Level

Full range display: 300.0V, 48.00 V, 16.00V, 4.00V.
Overrange: 33% except on 300V range.
Accuracy: ±0.75% of reading, 400 mV to 300V; ±3 mV, <400 mV.

Distortion

Fundamental frequency range: 20 Hz to 100 kHz.
Display range: 0.001% to 100%,−99.99 dB to 0 dB.
Accuracy: ±1 dB, 20 Hz to 20 kHz; ±2 dB, 20 kHz to 100 kHz.
Input voltage range: 50 mV to 300V.
Residual noise and distortion: the higher of: 0.01%, −80 dB, or 30 μV, 20 Hz to 20 kHz, 80 kHz BW; 0.032%, −70 dB, or 95 μV, 20 kHz to 50 kHz, 500 kHz BW; 0.056%, −65 dB, or 169 μV, 50 kHz to 100 kHz, 500 kHz BW.
Displayed resolution: 0.0001%, <0.1% distortion; 0.001%, 0.1% to 3% distortion; .01%, 3% to 30% distortion; 0.1%, >30% distortion.
Detection: true rms.

SINAD[1,2]

Fundamental frequency range: 20 Hz to 100 kHz.
Display range: 0 dB to 99.99 dB.
Accuracy: ±1 dB, 20 Hz to 20 kHz; ±2 dB, 20 kHz to 100 kHz.
Input voltage range: 50 mV to 300V.
Detection: true rms (average detection selectable by internal jumpers).
Resolution: 0.01 dB for SINAD ratios >25. For ratios <25 the display is rounded to the nearest half dB to reduce digit flickering of noise signals. (Full resolution is available by defeating this feature using special function 16.1).
Analog meter: active in SINAD only and for SINAD ratios <18 dB (or 24 dB using special function 7.1).
Tuning: notch filter is tuned to analyzer source frequency.

Signal to noise

Frequency range: 20 Hz to 100 kHz.
Display range: 0 dB to 99.99 dB.
Accuracy: ±1 dB.
Input voltage range: 50 mV to 300V.
Residual noise: the higher of −80 dB or 30 μV, 80 kHz BW; −70 dB or 95 μV, 500 kHz BW.
Resolution: same as SINAD.
Operation: The analyzer displays the ratio of the input voltages as the internal source is automatically switched on and off.

Frequency counter

Range: 20 Hz to 150 kHz[3].
Resolution: 5 digits[4].
Accuracy: 0.004% ±1 digit.
Input sensitivity: 50 mV in distortion and SINAD modes, 5.0 mV in ac level and sig/noise modes.
Counting technique: reciprocal with 2 MHz timebase.

Audio Filters

400 Hz high pass filter: 3 dB cutoff frequency, 400 Hz ±40 Hz; 140 dB/decade rolloff.
Psophometric filter (CCITT recommendation P53): deviation from ideal response: ±0.2 dB at 800 Hz; ±1 dB, 300 kHz to 3 kHz; ±2 dB, 50 Hz to 3.5 kHz; ±3 dB, 3.5 kHz to 5 kHz.
30 kHz low pass filter: 3 dB cutoff frequency, 30 kHz ±2 kHz; 60 dB/decade rolloff.
80 kHz low pass filter: 3 dB cutoff frequency, 80 kHz ±4 kHz; 60 dB/decade rolloff.

Rear Panel Inputs/Outputs

Recorder output: X: 0-10 Vdc (typical) corresponding to log of oscillator frequency.
Y: 0-10 Vdc (typical) corresponding to displayed value and entered plot limits.
Recorder output resistance: 1 kΩ nominal.
Monitor output: In ac level mode provides scaled output of measured input signal. In SINAD, distortion, and distortion level modes provides scaled output of input signal with the fundamental removed.

General

Input impedance: 100kΩ ±1% shunted by <300 pF with low terminal grounded[5,6].
CMRR (@ 60 Hz): 60 dB for differential input <2V; 36 dB for differential input <48V; 30 dB for differential input >48V.
Remote operation: HP-IB, all functions except the line switch, low terminal ground switches, and the x10 ÷ 10 increment keys.
Temperature: operating, 0° to 55°C; storage, −55°C to 75°C.
Power requirements: 100, 120, 220, or 240 volts (+5, -10%); 48-440 Hz; 100 VA maximum.
Weight: net, 12.3 kg (27 lb); shipping, 16.4 kg (36 lb).
Size: 146 H x 425 W x 440 mm D (5.75 x 16.8 x 17.3 in.).
EMI: Conducted and radiated interference is within the requirements of methods CE03 and RE02 of MIL STD 461A, VDE 0871, and CISPR publication 11. Conducted and radiated susceptibility meet the requirements of methods CS01, CS02, and RS03 (1 volt/meter) of MIL STD 461A dated 1968.

Ordering Information

	Price
8903A Audio Analyzer	$5800
(**Note:** HP-IB cable not supplied. See page 30.)	
Option 001: Rear panel connections instead of front panel for source output and analyzer input.	add $50
Option 907: Front panel handle kit	add $32
Option 908: Rack mount flange kit	add $25
Option 909: Front panel handle plus rack mount flange kit	add $55
Option 910: Extra Operating & Service Manual	add $30

[1] SINAD is a sensitivity measurement computed from the ratio of signal plus noise and distortion to noise and distortion.
[2] Residual noise and distortion same as for distortion mode.
[3] 20 Hz to 100 kHz in SINAD and distortion.
[4] Resolution is limited to 0.01 Hz for input frequencies <100 Hz.
[5] In dc level mode input resistance is 101kΩ ± 1%.
[6] Input capacitance is <330 pF for Option 001.