ATS-1

Audio Precision Quality in a Low-Cost, Stand-Alone Test Set

Unmatched Value
ATS-1: Audio Precision Quality in a Stand-Alone Package

The ATS-1 family of audio test instruments—at home on the bench, or in a test rack under GPIB control.

With thousands of units sold, you’ll find the ATS-1 family of audio analyzers in operation around the world in maintenance, engineering and production facilities. Whether in broadcast, communications, bench or production use, ATS-1 offers a complete easy-to-use audio test set ready for almost any environment. With twelve different measurement functions selectable at the push of a button, ATS-1 is comprehensive while remaining user-friendly. Its popularity is no less due to its outstanding performance specifications; yet ATS-1 is as affordable as lower-performing test sets.

Analog Only or full Dual Domain—Analog and Digital

System replacement for obsolete equipment:
HP8903B emulation mode over HPIB (GPIB)

Unparalleled Precision

Low Distortion
Analog System THD+N 80 kHz BW –92 dB
Digital Distortion THD+N ≤–140 dB

High Analog Bandwidth
Signal Generation to 120 kHz

Low Noise
22 Hz–22 kHz < –114 dBu
A-weighted < –118 dBu

Wide Input Voltage Range
Input Range 80 mV–250 V in 10 dB steps

Flat Response
20 Hz–20 kHz ±0.05 dB

Low Crosstalk
Input < –120 dB
Output < –110 dB

Low Jitter
Generator < 0.8 ns
Analyzer < 1.6 ns

The ATS-1 Access
ATS-1 Access includes comprehensive analog generation and measurement, with two outputs and two inputs. Easy-to-set-up sweep capability produces graphs of frequency response, distortion vs. frequency and even amplitude sweeps. Non-volatile storage of up to 30 tests allows easy one-button recall of your favorite test setup. Connect ATS-1 to a compatible printer and produce reports incorporating high-resolution graphs. If you work with digital audio, the ATS-1 Dual Domain® model adds AES3/SPDIF audio and interface measurement capabilities to the comprehensive analog capabilities of the ATS-1 family.

Analog+Digital+AES3/SPDIF: the ATS-1 Dual Domain
ATS-1 Dual Domain® is a comprehensive audio test set for both analog and digital audio, as well as for generation and measurement of AES3/SPDIF digital interface characteristics such as jitter. Like our 2700 Series family of instruments, ATS-1 Dual Domain features true dual domain architecture. Digital signals are generated and measured purely in the digital domain, resulting in the extremely low distortion and noise residuals necessary for making useful digital audio measurements.
Performance, Measurement Power, and Ease-of-Use

Easy to Use

Measurement functions are simply selected from the front panel. Just press a button and make the measurement. Selection of analog and digital inputs is clearly indicated on the front panel with LED legends. ATS-1 makes graphs of swept measurements in real time on the high contrast back-lit LCD display, including both frequency and amplitude sweeps. Hard copy high-resolution graphs, compact screen-sized graphs or tabular data listings can be made from your ATS-1 to laser or ink jet printers at the touch of a button. Bargraphs can display measurements ranging from AC mains power line distortion to digital interface error rate …and nearly everything in between. Separate buttons and knobs provide independent control of frequency and amplitude. The buttons provide large and medium steps (decade and 1/3 octave steps for frequency, 10 dB and 1 dB for amplitude), with knobs for finer resolution. When not otherwise used, the setting knobs and buttons also provide a convenient human interface for scrolling display cursors and for entry of other settings and data.

Full Range of Analog & Digital Testing Facilities:

ATS-1 Dual Domain provides complete and parallel measurement capabilities for both analog and digital audio signals. Measurements common to both domains include: Amplitude, Noise, Level (2 channels simultaneously), Frequency, Phase, THD+N, SMPTE/DIN, IMD, Crosstalk and Level Ratio. Standard A-weighting, CCIR 468, and LP/HP filters are included in both domains. RMS and quasi-peak (CCIR 468) detectors are available in both domains.

Analog Performance:

The low distortion transformer-coupled analog generator supplies a full +30.17 dBu (+29.5 dBm into 600 Ω) at selectable (50 Ω, 150 Ω or 600 Ω) source impedances. Extremely low analyzer noise and residual distortion support measurement of high performance digital devices.

Analog Convenience Functions:

In addition to the above measurements, the analog GEN LOAD function measures the input resistance of your device at any frequency you choose and makes swept impedance measurements (including loudspeakers). AC MAINS CHECK measures the voltage, frequency and distortion of the power line without hazardous direct connections. BARGRAPH display in AC MAINS CHECK function provides a visible history of maximum and minimum mains voltage excursions.

The dBg unit (dB referred to the present analog generator amplitude) is useful for compression threshold measurements or rapid response sweeps at several different absolute levels, as well as for input to output gain/loss measurements.

600 Ω Analog Input Terminations are individually switchable for each channel of the analog analyzer.
**Comprehensive Analog and Digital Functions**

**Digital Performance:**
ATS-1 Dual Domain uses a true DSP-implemented analyzer for digital measurements, which results in –130 dB residual THD+N, 0.01 dB flatness, and –140 dBFS residual noise. Other mixed-signal test sets in the same price range have no digital analyzer, but use a D/A converter and an analog analyzer. These architectures “bottom out” at –70 dB to –84 dB residual THD+N (12–14 bit effective performance), and 0.1 dB flatness. With today’s best A/D converters measuring –108 to –112 dB THD+N, their real performance is invisible to these mixed signal analyzers …buried under the analyzer’s noise and distortion floor.

**Separate & Independent Analog & Digital Generators:**
Often necessary for dual domain testing. You may, for example, drive the inputs of an A/D converter with the low-distortion analog sine while simultaneously driving the converter’s digital reference (house sync) input with the digital generator. Then, add jitter or vary the sample rate to see the effect on THD+N, IMD, or noise. Competitive units can drive only one domain at a time or use their analog generator to create the digital jitter, and thus can’t make this measurement at all.

**Digital & Analog Monitors:**
Listen to all measurements in the digital and analog domains over the internal loudspeaker or a pair of headphones. In the analog domain, monitor signals or distortion. In the digital domain, the incoming signal, distortion, or jitter can all be monitored.

**Jitter Meter:**
ATS-1 Dual Domain includes jitter measurement in nanoseconds or in Unit Intervals. Two filter selections are provided for the jitter meter: a 700 Hz high-pass filter used for residual jitter measurements according to AES standards, and a 50 Hz high-pass filter for jitter response measurements.

**Other Interface Signal Measurements:**
ATS-1 Dual Domain measures key digital I/O interface parameters in addition to jitter, including sample rate, AES signal voltage, frame delay through the device under test, and delay of the input signal relative to a house sync reference (frame or block).

**Flexible Interface Impairment Simulation:**
Flexible digital interface testing is vital for troubleshooting and verifying performance of digital audio at the systems level. ATS-1 Dual Domain allows simulation of real world transmission and interface problems.

---

**Jitter Generator**

Vary the digital output signal to test the acceptance range of your digital devices. Set sample rate anywhere from 28.8 kHz to 52.8 kHz, not just at the three standard frequencies. Inject jitter amplitude from 0 UI to 2.5 UI (415 ns at 48 kHz) in 0.01 UI (1.6 ns) steps, or 0 UI to 25.5 UI (4150 ns) in 0.1 UI (16 ns) steps.
Injected jitter frequency can be set from 10 Hz to 38.8 kHz, not just to a fixed frequency. Adjust output signal amplitude continuously from zero to 5.12 Volts in 5 mV increments, not just at a few steps.

**Independent Interface I/O Word Lengths:**
Word length (resolution) of digital input and output are independently set from 16 to 24 bits. Output resolution is set to match the device under test to assure proper dither. Input resolution must be set to exclude signal in the AUX bits or other low-level bit activity meaningless to the desired measurement.

**Independent Input & Output Sample Rates:**
Lets you test sample rate converters. Measurement of the incoming embedded audio signal can be referred to the incoming sample rate, status byte indication of rate, or the outgoing generator rate.

**Data Error Testing Capability for Digital Audio Signals:**
Stimulate the test device with random data and display current or totaled error measurements on both channels. The signal and analysis techniques are compatible with the BITTEST feature of our System products, so you can test a transmission link end-to-end with an ATS-1 Dual Domain at one end and a System Two, Cascade or 2700 Series dual domain instrument at the other.

**Other Digital Convenience Functions:**
Digital Status bytes are displayed and set in high-level English.

**Dither amplitude is automatically set to the proper value for the output word length and the selected probability function.**

**Sample & Frame Sync:**
Synchronize ATS-1 Dual Domain sample and frame sync to the digital reference (house sync) input.

**Digital Pass Mode:**
Sends the input digital audio content to the output while modifying status bytes, validity bit, etc. ATS-1 Dual Domain can thus be used as a problem-solver between incompatible equipment.

**Signal Monitoring Outputs:**
A digital signal appropriate for syncing an external oscilloscope may be derived from the input sample rate, output sample rate, input block rate, output block rate, digital audio waveform, jitter signal, or the detected interface errors. A buffered version of the balanced AES3 signal from the XLR input is also available, which coupled with the high input impedance of the XLR in bridging mode allows non-intrusive digital line measurements with conventional ground-referenced oscilloscopes.
Versatile Connectivity

Choose among three different analog connector panels for your ATS-1. The connector panel can be mounted on the front of your instrument for convenience, or on the rear of the instrument if you’d prefer your ATS-1 hard-wired in a rack. All the panels come with extra dual banana and ground lugs. The XLR panel allows for either balanced or unbalanced measurements by using a simple dual banana-to-BNC (or to RCA phono) adapter.

Save & Recall Tests:

Save 30 instrument setups, including sweep results data, time-stamped from the internal clock calendar. Use for repeatable, easy bench and production testing or when in the field, for storing test data to be printed or analyzed later. Each saved test includes all settings for the entire instrument, a default description or your own title for the test, the date and time, and the last test sweep result data.

Print Graphs And Test Results:

ATS-1 prints graphs, panel setups and measured data either to laser (PCL compatible) or inkjet printers. Front panel keys select two sizes of graph output (including cursor data), tabular sweep data, bargraphs and front panels for printing.

Settled GPIB Readings:

Reliable measurements are assured by algorithms inside the instrument which automatically compensate for varying device settling speeds. Settling can be disabled for measurements of jitter or other instantaneous values.

GPIB Software Drivers

Audio Precision supports the ATS-1 with a National Instruments LabView and LabWindows CVI driver for C and Basic programmers. The LabWindows driver runs with National Instruments GPIB interface cards for personal computers. The driver speeds development of test routines by eliminating the need to learn the ATS-1 programming mnemonics.

IEEE-488.2 GPIB Port:

An IEEE-488.2 GPIB interface port is included on the ATS-1. The commands closely model the front panel interface to make software development more productive. ATS-1 provides full query back of all manual settings and on-line help to speed up code development. Measurement sweep data is stored in the instrument for quick batch transfers without holding up GPIB bus traffic.

HP8903B GPIB Emulation Mode

ATS-1 also emulates the HP8903B audio analyzer HP command set for a simple replacement of slow and outdated equipment in existing systems. A front panel button selects between the Audio Precision 488.2 (GPIB) command mode and the HPIB command mode.
**Low Distortion Sine Wave**

- **Frequency Range**: 10 Hz to 120 kHz
- **Frequency Accuracy**: ±0.3 %
- **Amplitude**: Balanced
  - ±0.25 mV to ±0.25 mV ±700 dB to ±0 dB
  - Unbalanced
  - ±0.25 mV to ±1.25 mV ±700 dB to ±250 dB
- **Amplitude Resolution**: 0.01 dB
- **Flatness**: (1 kHz ref) 10 Hz to 20 kHz ±0.05 dB

**Square Wave**

- **Frequency Range**: 20 Hz to 30 kHz
- **Amplitude Range**: Balanced
  - ±0.1 mV to ±0.1 mV
  - Unbalanced
  - ±0.1 mV to ±1 mV
- **Amplitude Accuracy**: ±0.3 dB ±30 kHz

**OUTPUT CHARACTERISTICS**

- **Source Impedance**: Balanced or unbalanced
- **Load Impedance**: Balanced
  - 50 Ω (±2 Ω), 150 Ω (±2 Ω), or 600 Ω (±3 Ω)
- **Gain**: Unbalanced
  - ±29.8 dBm into 600 Ω (±50 Ω)
  - ±23.4 dBm into 600 Ω (±50 Ω)
- **Output Current Limit**: ±0.01 A
- **Output Related Crosstalk**: ±100 dB or 10 μV, whichever is greater

**ANALOG SIGNAL OUTPUTS**

- **Mix Ratio**: 4:1 (LF:HF)
- **LF Tone**: 50, 60, 70, or 250 Hz
- **Rise/fall time**: Typically 2.5–3.0 µs

**DIGITAL INTERFACE CHARACTERISTICS**

- **Input Sample Rate**: ±0.0001% [±1 PPM]
- **Input to Output Delay**: ±0.0001 µs
- **Input Sample Rate**: ±0.0001% [±1 PPM]

**DIGITAL ANALYZER**

- **Input Formats**: AES/EBU (per AES3-1992); SPDIF-I/2L; AES/EBU
- **Input Sample Rates**: 28.8 kHz–52.8 kHz
- **Input Sample Rate**: ±0.0001% [±1 PPM]

**APPLICATION**

- **Power Output**: Typically 1 watt
- **Power Requirements**: 100/120/230/240 Vac (−10% to +15%)
- **Humidity**: 90% relative humidity at 40°C (−70°F to +104°F)
- **Operating Temperature**: 0–45°C (32–113°F)
- **Storage Temperature**: −40–85°C (−40–185°F)
- **Weight**: Approximately 20 lbs (9.1 kg)
- **Safety**: Complies with CE, UL, cUL: 61010-1, 61010-2-032, and IEC 61010-1, 2nd Edition
Buying an ATS-1 analyzer for analog and digital audio:

What to look for when evaluating competitive instruments

Digital Architecture and Features:
Not all analyzers that accept a digital input signal are actually digital analyzers. Does the instrument have a real (DSP-implemented) digital domain analyzer, or just a D/A converter from the digital input connector to an analog hardware analyzer? This latter approach in a competitive unit yields THD+N as high as –79 dB, flatness as poor as –0.2 dB — inadequate for most modern audio devices.

Interface Testing: Does the instrument have independent analog, digital, and jitter generators? If it can only provide analog or digital output at any one time, you can’t test a house-synchronized A/D converter for jitter rejection. Without independent, flexible digital audio and jitter generators, you can’t measure jitter sensitivity of a D/A converter at various audio and jitter frequency combinations.

True Dual Domain: True Dual Domain hardware by definition guarantees a full range of analysis capabilities in both analog and digital domains. Everyone measures level and some measure THD+N (although implemented with extremely limited performance, as noted above). Be sure that other useful measurements such as IMD (Intermodulation Distortion), Phase, and Crosstalk are available for both analog and digital signals, not just analog.