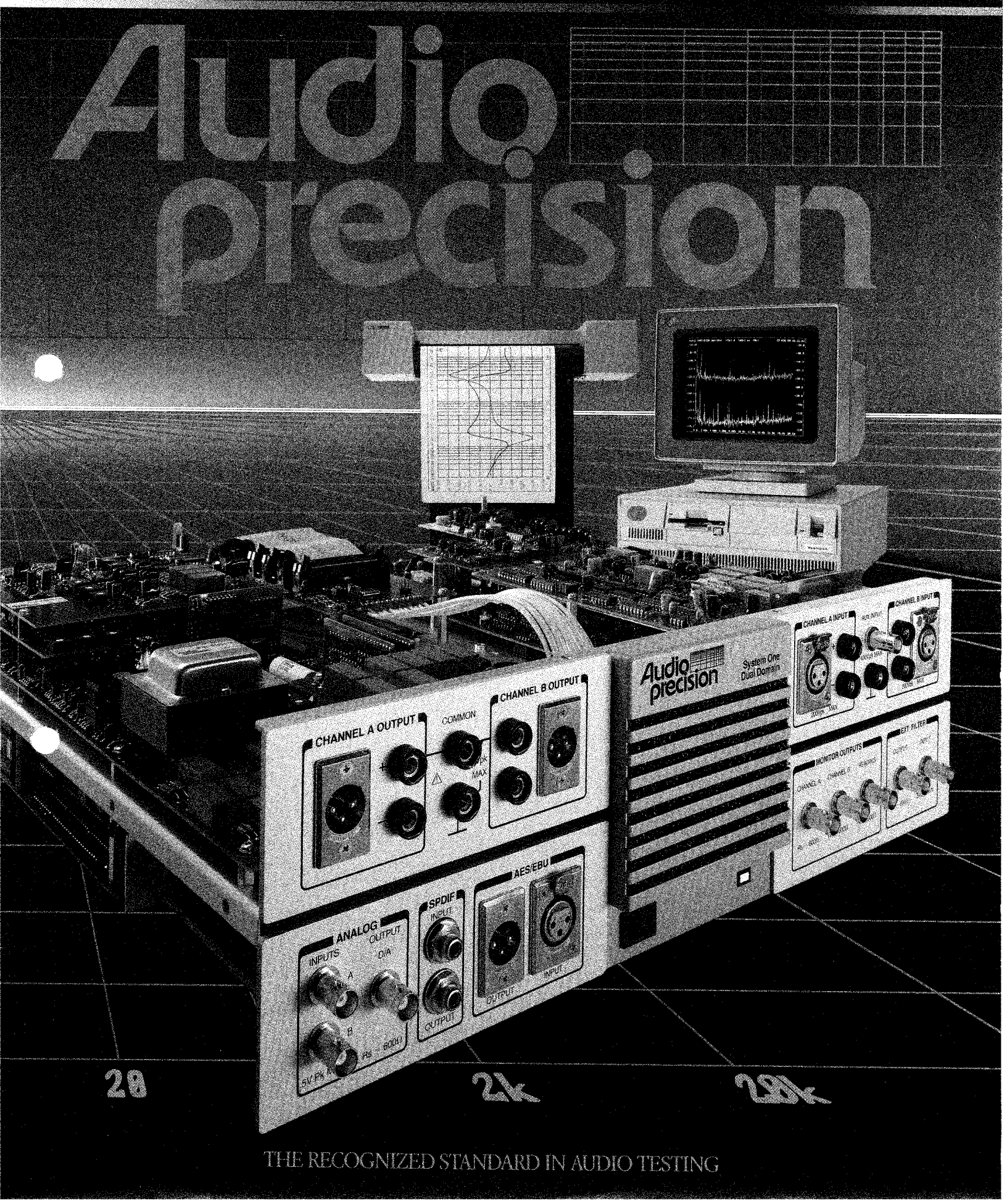
SYSTEM ONE

Audio precision



THE RECOGNIZED STANDARD IN AUDIO TESTING

- **FASTER**
- **EASIER TO USE**
- **GRAPHIC TEST RESULTS**
- **HIGHER PERFORMANCE**
- **FLEXIBLE—INDUSTRY STANDARDS OR YOUR OWN**
- **COST EFFECTIVE**
- **COMPACT**

WHO USES IT?

Audio Precision's System One is used daily, worldwide, by thousands of design and test engineers and technicians at manufacturing firms, unskilled operators at test stations, maintenance engineers at broadcast stations and recording studios, installation engineers, equipment reviewers, consultants It rapidly and easily does performance testing of prototypes, component evaluation, measures performance during environmental testing, assists in alignment, does manufacturing testing from board to system level, and verifies performance or helps with trouble shooting in complex broadcasting, recording, and sound reinforcement systems System One is regularly used in design, test, and maintenance of power amplifiers, analog and digital audio signal processors, distribution amplifiers, routing switchers, mixing consoles, equalizers, compressors, limiters, broadcast transmitters, loudspeakers, microphones, telephone handsets and headsets, hearing aids, crossover networks, tuners and receivers, CD players, RDAT recorders, professional digital audio recorders, analog tape recorders, digital editors and disk recorders, automotive stereo components, satellite communications circuits, consumer stereo high-fidelity equipment, DSP equipment

HOW DOES IT HELP YOU?

System One is ***FAST***—performs standard audio tests faster than other automated systems, twenty to one hundred times faster than manually operated instruments Stable, settled data is guaranteed even at maximum speed by System One's unique SETTLING features

System One is ***EASY*** to use Select standard audio tests and complete procedures from directories via arrow keys or by pointing at menu choices with a "mouse" The panel and menu concept eliminates any need for the user to write or understand software

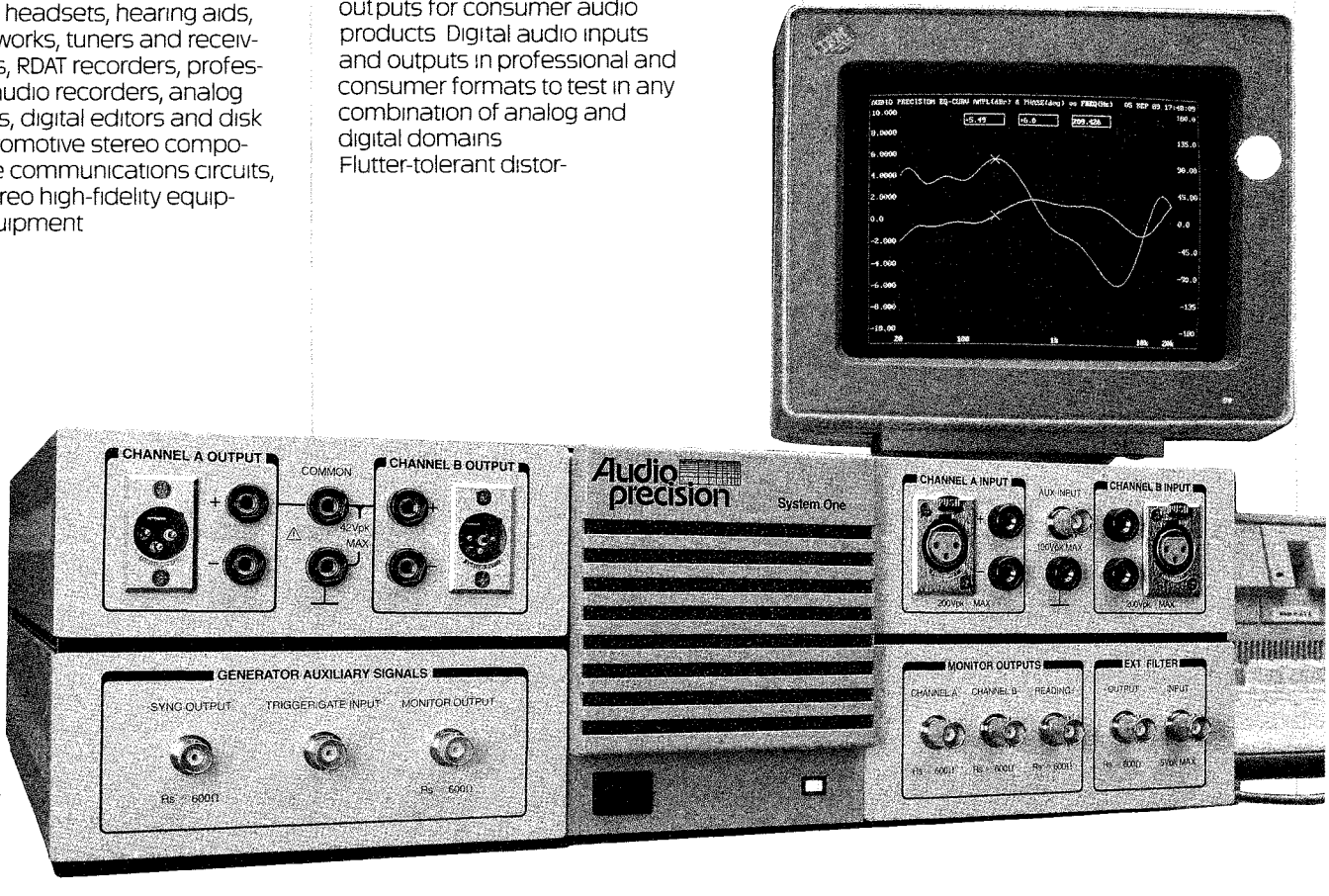
System One completes the measurement task with high resolution color or monochrome ***GRAPHIC RESULTS*** viewable for interpretation while the test is being made Print graphs to laser or dot-matrix printers in 20 seconds! High resolution multi-color plots can be made to HPGL-compatible plotters

System One is ***HIGH PERFORMANCE***, lower guaranteed residual noise and distortion than any other automated or semi-automated audio test equipment Specifications are guaranteed across the full range of real-world needs Balanced inputs plus balanced, transformer-isolated high level outputs and multiple impedances for critical pro audio applications Single-ended outputs for consumer audio products Digital audio inputs and outputs in professional and consumer formats to test in any combination of analog and digital domains Flutter-tolerant distortion measurement circuitry, plus phase and wow and flutter measurement capability, for analog tape machine measurements Thoroughly shielded and filtered for operation in high rf fields around broadcast transmitters

System One is ***FLEXIBLE***, test in accordance with industry standards or create your own Define test conditions such as levels, frequency limits for sweeps, source and load impedances System One compares results to standards which you define and provides "go/no-go" response Link together a series of sweeps and tests into a complete test procedure which runs automatically, even by unskilled operators

System One is ***COST-EFFECTIVE***, priced low enough to replace manual test equipment, productive enough to quickly pay for itself in labor saved The huge quantities in which PCs are manufactured make them far better buys than dedicated computer/controllers built for control of test instrument systems

System One is ***COMPACT*** No stack of multiple boxes with complex interconnecting cables and differing display and control schemes One instrument rapidly makes virtually all standard audio tests

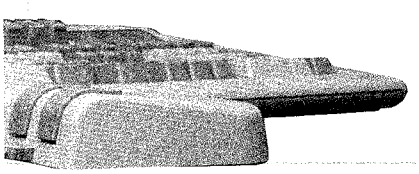


WHAT MEASUREMENTS DOES IT MAKE?

System One measures frequency response, weighted and unweighted noise and signal-to-noise ratio, wideband or selective amplitude and noise, real-time crosstalk, gain, loss, absolute level, level with respect to any reference, real-time level ratio, total harmonic distortion plus noise, individual harmonic distortion from 2nd through 9th harmonic, spectra via FFT to 3 Hz resolution across the 20 kHz audio band, three forms of intermodulation distortion, interchannel phase, input-output phase, linearity, quantization noise and distortion, wow and flutter by both rotational and scrape techniques, FFT spectrum analysis of wow and flut- to 0 06 Hz resolution—plus generation of tone bursts, squarewaves, white noise, pink noise, and 1/3 octave bandpassed noise Most of these measurements can also be made in the digital domain on digital audio signals in the AES-EBU or SPDIF-EIAJ formats, or any other digital format which can be interfaced to a 24-bit serial or parallel connector A fully-software-integrated companion instrument adds measurement of dc voltage, resistance, and the value of a 21-bit digital word plus generation of two dc voltages and a 21-bit parallel word Accessory switchers permit up to 192 channels of audio to be tested Tests can be performed in accordance with virtually all published standards, including those of SMPTE, DIN, IEC, CCIR, EIA, EIAJ, IHF, NAB, JIS, and others

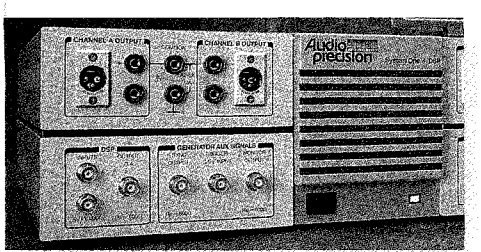
NFIGURATIONS AND NOMENCLATURE

System One is a modular test system with both analog and digital stimulus and measurement modules which can be fitted inside the basic enclosure. Switcher modules in their own enclosures may be added for testing devices with more than two channels. A multifunction unit in its own enclosure is available for dc voltage and resistance measurements, variable dc outputs, and low-speed digital input and output.



SYSTEM ONE—BASIC AUDIO MEASUREMENTS IN THE ANALOG DOMAIN:

The basic stimulus-response unit for audio measurements in the analog domain is the SYS-22, where the digits indicate a two-channel (stereo) generator and two-channel analyzer. Generator-only (SYS-20) and analyzer-only (SYS-02) units are available, as is a single channel unit (SYS-11). A basic System One without options measures THD + N (total harmonic distortion plus noise), phase, frequency, wideband or selective (1/3 octave) amplitude and noise, real-time crosstalk (selective), and real-time amplitude ratio.



SYSTEM ONE + DSP—ENHANCED AUDIO MEASUREMENTS IN THE ANALOG DOMAIN:

DSP (Digital Signal Processor) technology adds enhanced measurements of analog domain signals. Standard DSP programs are furnished which support individual harmonic measurements (2nd through 9th harmonics) and other selective amplitude measurements, waveform display (digital storage oscilloscope mode) of signals to 80 kHz, and spectrum analysis via FFT (Fast Fourier Transform) of signals to 80 kHz. DSP programs are downloaded from the PC for flexibility and future expansion. This unit, generically called System One + DSP, carries the nomenclature SYS-222 for a generator-analyzer package and SYS-202 for an analyzer-only unit.

SYSTEM ONE DUAL DOMAIN:

System One Dual Domain adds digital interfaces plus still more DSP capability to generate and measure audio signals in the digital domain in several formats, including the professional AES-EBU format, the consumer SPDIF-EIAJ format, and general purpose 24-bit serial and parallel formats Combined with the analog domain capability of all System Ones, the Dual Domain series can thus measure in any of the four possible combinations of analog or digital stimulus with analog or digital acquisition and measurement This series is called the SYS-322 for full stimulus-response capability and SYS-302 for a unit lacking an analog generator

MAJOR OPTIONS:

Major additional capabilities for any of these series include the IMD (intermodulation distortion) option, the W&F (wow and flutter) option, and the BUR (sinewave burst, squarewave, pseudorandom and random white and pink noise generator) option. All mount internally within the System enclosure.

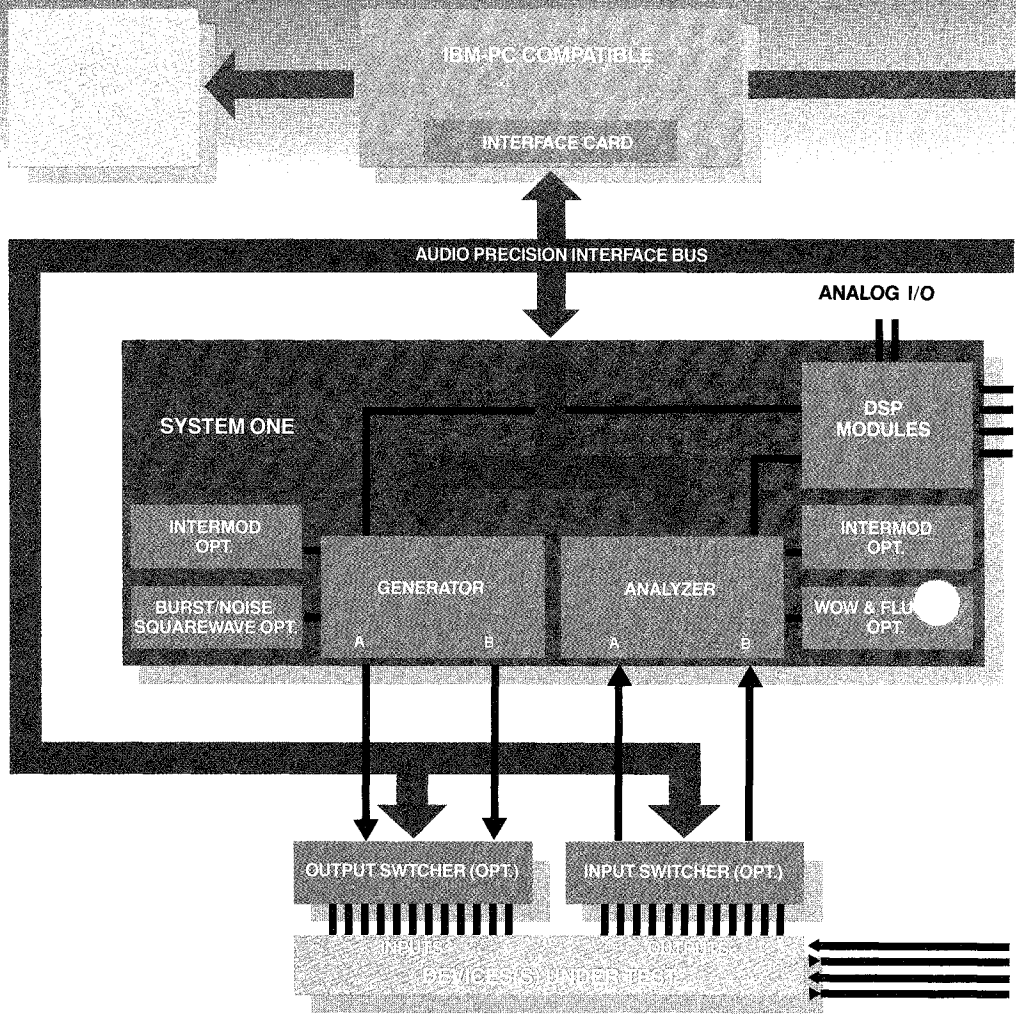
SYSTEM ONE COMPUTER INTERFACES:

System One is available in three different computer interface versions. A suffix character added to the model number indicates the system computer interface. The character "A" indicates the Audio Precision Interface Bus, operating via a digital interface cable from an Audio Precision-furnished PCI interface card plugged into an expansion slot of an IBM-PC compatible. "S" indicates a serial interface (RS-232) connection from the serial port of an IBM-PC compatible running Audio Precision S1.EXE software. "G" indicates a GPIB (IEEE-488) interface, operating from any IEEE-488 controller-computer and requiring user development of software. Both "S" and "G" versions also include the Audio Precision Interface Bus, though only one interface is usable at a time.

SYSTEM ARCHITECTURE:

System One is unique in many respects. No other audio test set incorporates so many types of audio measurements and signals. No other audio test set was designed exclusively for operation from a computer. No other audio test set had an extensive software package developed, in parallel with the hardware effort, so that most audio tests are performed automatically by users with no experience in programming or knowledge of computer languages.

Interconnection between computer and instruments is normally via the Audio Precision Interface Bus, using an interface card plugged into a computer expansion slot. All control and display functions are accomplished by the computer.



PC ADVANTAGES

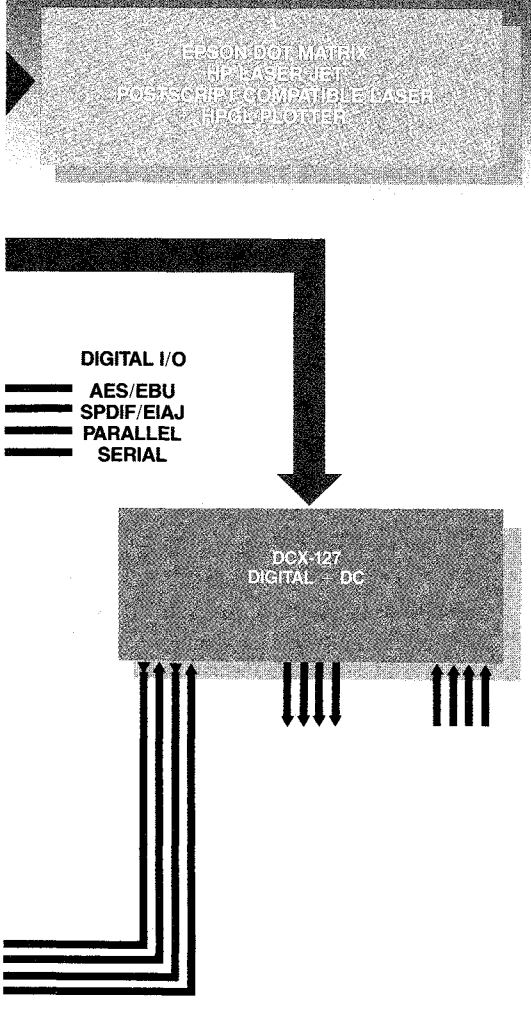
Personal Computers deliver more function for their cost than almost any product available. System One exploits PC capabilities for instrument setup, data storage, program storage, graphic and alphanumeric display, post-measurement processing, communications with remotely located test systems, graphic or tabular hard copy via an attached dot matrix printer or laser printer, and high-resolution graphic output to HPGL pen plotters and laser printers. The basic strategy of Audio Precision's design engineers was non duplication in their instrument of all functions which the PC could logically perform. With PC-compatibles manufactured in millions of units annually while audio test equipment manufacturers build hundreds of units, the economies of scale make the PC-based System One the most cost-effective in the world. And, the manufacturing cost savings from not including dedicated displays and controls in the instrument, more than pay for a personal computer!

SOFTWARE ARCHITECTURE

Audio Precision's comprehensive S1.EXE software package is used by nearly all "A" version users and must be used to operate any "S" version system. All of the operating examples, menus, graphs, and panels illustrated in this brochure are part of the S1.EXE software package furnished with every "A" and "S" version. For users with unusual applications not supported by the features of S1.EXE, the LIB-MIX function library is available for "A" version systems to provide instrument control from user-written programs in Microsoft C, Microsoft QuickC, Microsoft QuickBasic, or Lattice C and running on an IBM-PC-compatible computer. "G" version systems require user-created software, written in the language and for the operating system of the IEEE-488 controller which will be used, with Audio Precision-documented commands imbedded to control System One.

SOFT VS HARD PANELS

In earlier generations of test equipment with hardware front panels, the measurement functions initially designed are the only functions available for the life of the instrument. Conventional instruments are limited to the units of measurement for which the designer has panel room and meter scale space, typically only Volts or dBm for level and percent or dB for distortion. Modes are limited by the number of knobs and switches which can be usably located on a panel. System One, with its "soft panel" on the computer display, can measure or be controlled in any units. Most options can be added in the field, with new panels selected by a keystroke. Alphanumeric, analog bargraph, or color or monochrome X-Y graph display modes are instantly selectable.



KEY SPECIFICATIONS

Analog domain:
Total system THD + N, 20-20 kHz, 80 kHz measurement bandwidth <0.0015%; 22 kHz bandwidth <0.001%

Total system flatness ±0.05 dB, 20-20 kHz

Total system IMD <0.0018% SMPTE, <0.002% DIM, <0.0005% CCIF

Analyzer residual noise <1.5 microvolts (−114 dBu) in 22 kHz bandwidth

Digital domain:
THD + N -120 dB (20 bits)

Flatness ±0.02 dB

Analog and digital domains:
FFT spectrum analysis to 80 kHz with 8,192 line resolution. Waveform display to 80 kHz with pre-trigger, record length to 30.7k samples

OPERATING ADVANTAGE EXAMPLES

System One automatically graphs stereo response, distortion, and phase sweeps from test CDs and standard reference tapes, even with voice announcements between tones. Equalization mode controls generator amplitude during a frequency sweep to follow standard curves such as RIAA phono equalization or broadcasting de-emphasis curves, user entered functions, or a measured and inverted curve. Nested sweep mode automatically steps the generator amplitude between frequency sweeps to produce multi-trace graphs displaying response across the full dynamic range of a device.

Mixing consoles, multi-track tape machines, and racks of amplifiers are automatically tested without cable juggling when the SWR-122 family of switchers is added. Variable dc outputs of the DCX-127 permit graphing VCA (voltage-controlled amplifier) performance while gain and/or THD null voltage are automatically varied. Graphed spectrum analysis of noise (by high-resolution FFT or 1/3 octave spectrum analysis) quickly locates hum, spurious signals, and other noise sources. Definitive measurements of bit-weighting errors and quantization noise and distortion in digital systems are made via amplitude-swept THD measurements down to 25 microvolts.

A-D and D-A converters can be dynamically tested without additional, unnecessary conversions between analog and digital domains. Sweep tests can be made where the generator amplitude automatically adjusts at each frequency in order to hold an arbitrary distortion percentage or power level constant at the device output. Generator frequency can automatically search for a measured output amplitude value such as -3.00 dB or the maximum response of a bandpass filter. Audio transmission links from studio to transmitter or continent-to-continent are tested in ***REMOTE*** mode. An operator at either end of the link controls instruments at both ends, with data graphing in real time at the control point. ***REMOTE*** mode even permits testing at a remote, unstaffed transmitter or repeater location. Computing utilities show deviation from linearity, equalize results after measurement, center test data between limits, smooth data curves, subtract one test from another at the touch of a few keys.

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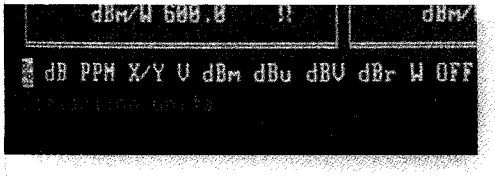
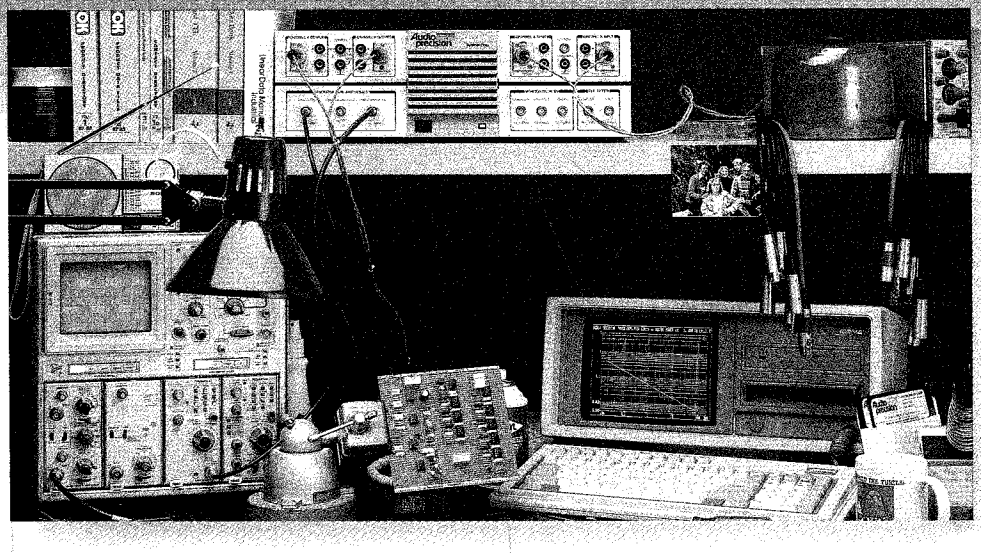
Enhance your engineering development, design, and research testing with the power of System One.

Prove your finest designs with System One's ultra-high performance; typical 0.0007% distortion, 0.03 dB flatness, 1.2 microvolt noise levels in the audio bandwidth. Use FFT analysis following the analog notch filter to resolve distortion components 145 to 150 dB below the fundamental.

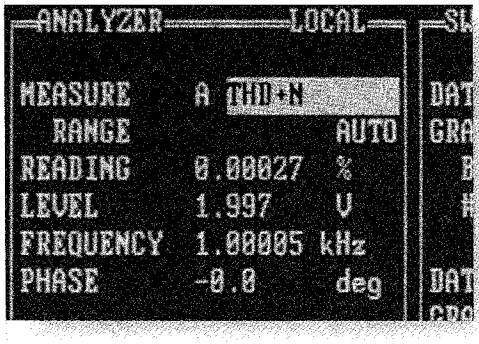
Test virtually all audio parameters with a single instrument. Measure THD + N, individual harmonics through the 9th, three forms of intermodulation distortion including transient/dynamic, phase, frequency, broadband and weighted noise and signal-to-noise ratio to all major international specifications, spectral distribution with 3 Hz resolution across the audio band via FFT, selective amplitude via swept 1/3 octave filter, common mode rejection ratio, crosstalk, wow and flutter (rotational and scrape) with spectral analysis of wow and flutter to 0.06 Hz resolution, dc and resistance, and display waveforms to 80 kHz bandwidth. Acquire digital audio signals and analyze them in the digital domain. Generate ultra-low distortion sine waves (+30 to -90 dBm, 10 Hz to 204 kHz), three intermodulation test waveforms, two variable dc outputs with 20 microvolt resolution, square waves, pink noise, white noise, 1/3 octave filtered noise, and continuous, triggered, or gated sine bursts with complete control over burst duration, burst interval, upper and lower amplitudes. Generate 24-bit accurate signals in the digital domain.

Graph results in real time for easy interpretation of measurements. Or, display data in tabular format for highest precision. Select display units including Volts, dBm, dBu, dBV, dB relative to any reference, %, amplitude ratio, frequency ratio. Re-scale and zoom graphs and change units after data is taken. Save any test data to disk. Print lab notebook graphs to inexpensive dot matrix printers or laser printers. Print publication quality graphics to plotters (in multiple colors) and laser printers. Overlay multiple graphs for comparison.



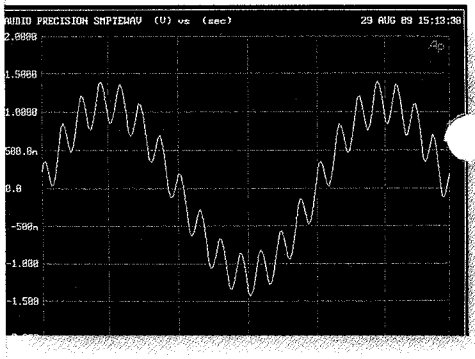


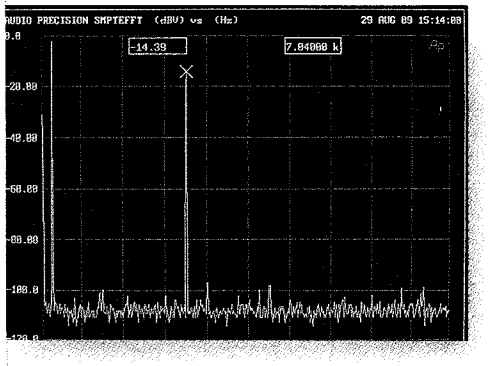
Choose frequency or amplitude of analog or digital sinewaves, time, switcher channel, or variable dc output voltage as the swept independent variable of a test and horizontal axis of a graph. Select one or two parameters to be measured and ***plotted in real time*** versus the independent variable. Save any test setup to disk under a name you create. View four measured parameters simultaneously in numeric display format, or three as analog bar graphs. Plot one measured variable against another. "Nest" amplitude and frequency sweeps to provide full spectral and dynamic range information in one test, on one graph. Simplify adjustments with bar graphs; use mouse or arrow keys for smooth, continuous control of generator. Increment amplitude or frequency in ***any*** arbitrary step size. Sweep frequency while generator amplitude follows ***any*** desired function via EQUALIZATION mode. Select equalization curves from standard furnished functions (RIAA, pre and de-emphasis curves), or ***create your own***. Calibrate out cable and system non-flatness by inverting a measured response and using it as an equalization curve.



Sweep frequency while the generator amplitude automatically adjusts to maintain constant some measured parameter such as distortion or power, via REGULATION mode.

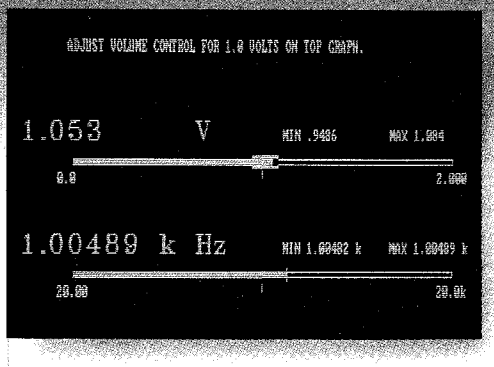
Save test data in a format compatible with statistical analysis packages, all popular computer languages, and personal computer programs such as spreadsheets and data base management. Display group delay following a phase vs frequency sweep. ***Smooth, normalize, invert, display deviation from perfect linearity, subtract curves with standard internal computational capabilities.***



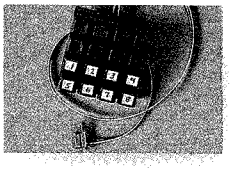


Verify production quality rapidly, thoroughly, repeatably at the module, board, complete equipment, or system level with System One. Speed performance tests up to 100 times over manual methods; use the time saved to ***reduce test costs or increase testing confidence***. Perform tests at exact frequencies and amplitudes specified in earlier, manual test specifications. Make virtually all audio tests including harmonic and intermodulation distortion, wideband and selective amplitude and noise measurements, crosstalk, phase, frequency, wow and flutter, dc voltage and resistance, digital input/output with one compact high performance unit. Test multi-channel devices or multiple units via SWR-122 audio signal switchers.

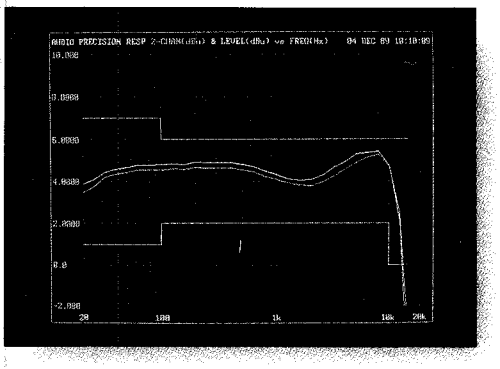
Conserve scarce technician skills by using less-experienced operators for production testing since test setups, measurements, and decisions are computer-controlled. Create procedures which specify test sequence and instrument setup, control other



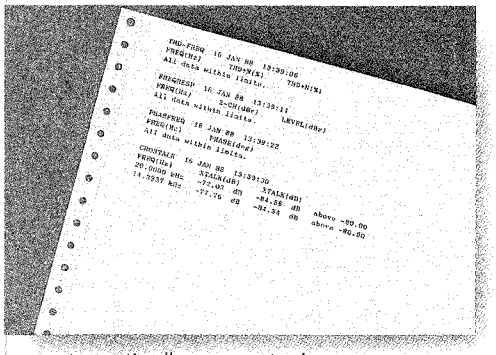
devices, display bargraphs for required adjustments and prompt the operator. ***Replace the computer keyboard with a simple***, limited-function keypad or buttons. Use no-display mode to avoid confusing non-technical operators with information they need not interpret, while the system makes go/no-go decisions. Drive pass/fail indicators or device handlers to separate good and bad units.



Prepare procedures in minutes-to-hours without knowledge of programming languages, rather than the weeks-to-months of experienced programmer time required to write software for other test systems. ***Specify limits for each test***. Limits can be



entered from engineering data or generated by averaging test data from acceptable units. Create on-screen menus for operator selection of test type. Halt or branch to other procedures upon out-of-limits measurements. Print



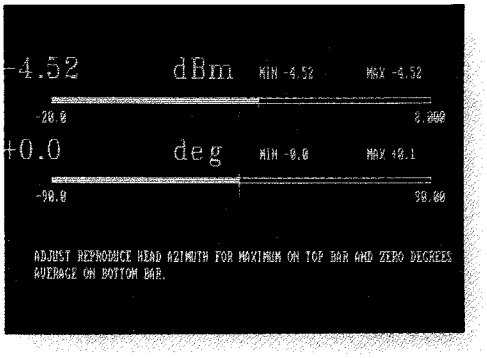
automatically-generated error summary files as failure tags and quality records. Test every unit at rated output, even if gain varies from unit to unit, with REGULATION mode. Slide data vertically for best fit between limits via COMPUTE CENTER when response curve shape is important but sensitivity is not.

Print graphic or tabular data for shipment to customer or company files. Duplicate earlier tabular reports by exporting data to spreadsheet software. Dump data to disk for later statistical analysis. Network to a central computer for data storage.

Control the "G" version System One from any IEEE-488 controller, or combine an "A" version system and IEEE-488 instruments by using IEEE-488 and Audio Precision interface cards in the same PC. Write custom software in QuickBASIC, C, or QuickC using the LIB-MIX function library.

FENDER INC., LAKE OSWEGO, OREGON

Rapidly align and verify performance of stereo and multi-track reel to reel and broadcast cartridge decks and audio channels of VTR and VCR machines.



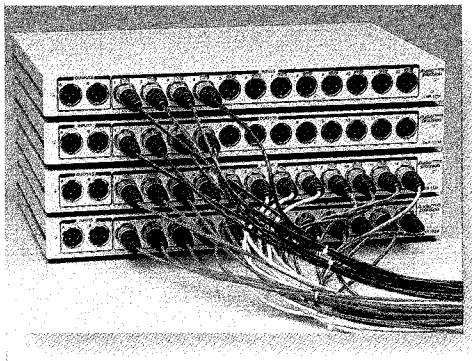
Align reproduce and record sections. Adjust azimuth with bargraph displays of 2-channel amplitude plus phase or repeating phase-vs-frequency sweeps for completely non-ambiguous adjustments. ***Automatically graph stereo reproduce frequency response from existing reference tapes, even those with voice announcements between tones***, using EXTERNAL FREQUENCY sweep mode. Measure frequency response of three-head machines with any amount of delay between heads via System One's asynchronous architecture and SETTLING DELAY parameter. Optimize bias using overbias or minimum distortion techniques. Simplify overbias adjustments with the bargraph MAXIMUM HOLD feature which displays both peak and present values. Repeat a fast frequency response graph automatically while adjusting record equalization on three-head machines.

Find crosstalk below noise level via BANDPASS or CROSSTALK modes. Quickly optimize crosstalk adjustments on stereo machines with simultaneous screen display of L-R and R-L crosstalk.

Measure wow and flutter by IEC/DIN, NAB, JIS methods in the ***rotational*** spectrum (***<200 Hz) and via wideband/scrape*** methods (5 kHz bandwidth). Use COMPUTE 2-SIGMA to produce a single number wow and flutter result. Display drift (speed error). Perform FFT spectrum analysis of wow and flutter to 0.06 Hz resolution to quickly identify diameter of the defective rotating part.

Plot MOL (maximum output level) via 3rd harmonic distortion. Discover bias waveform and magnetization problems via 2nd harmonic distortion.

Test for distortion (THD + N with all systems, or 2nd or 3rd harmonic with DSP units) at ***any*** audio frequency, in record-playback mode on three-head machines or in reproduce mode from



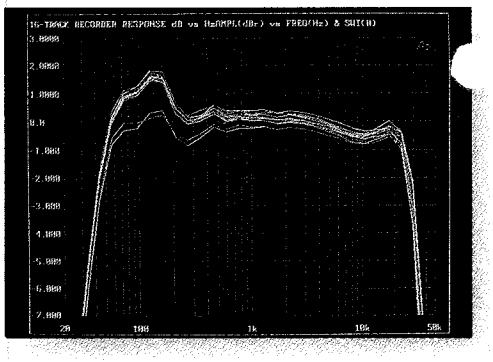
existing reference tapes or those you record. Distortion measurements are ***flutter-tolerant*** due to System One's patented two-stage notch filter.

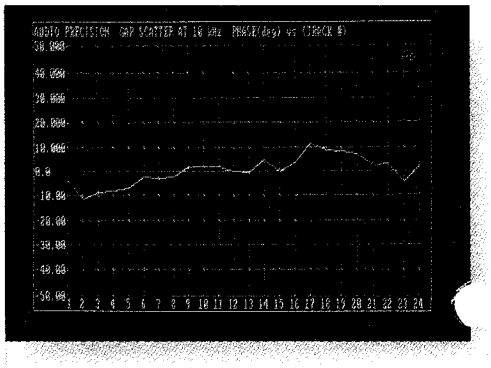
Connect the SWR-122 switchers to 24- or-32-track machines. Touch one key or use a mouse to move from track-to-track while aligning via bargraph display. ***Make response tests of all tracks in 5 minutes***. Create a procedure which runs complete 24/32 track performance verifications in 20-30 minutes, without operator assistance. Measure ***worst-case crosstalk*** by driving all but one channel while measuring that channel. Graph ***gap scatter*** across 24-and 32-track heads in 10 seconds.

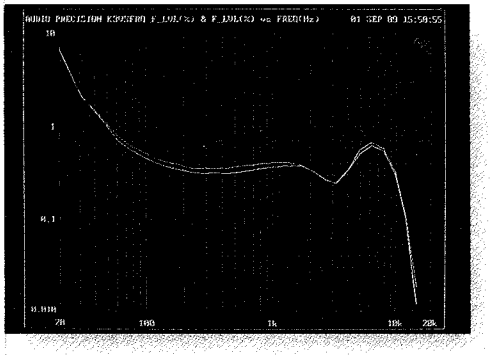
Control the tape transport via parallel or serial interfaces for unattended testing. Perform completely automated alignment of the Studer A820-A812-A810-A807 series, both reproduce and record sections.

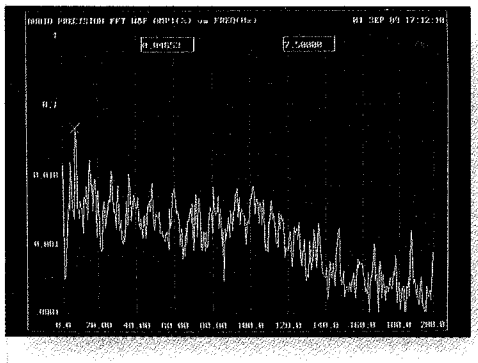
Measure print-through and depth of erasure. Test tape media by controlling bias current of a modified tape machine. Graph tape sensitivity versus bias. Use REGULATION mode to measure MOL and SOL (saturated output level) vs bias.

Perform wide-range input vs output amplitude sweeps and display deviation from perfect linearity.









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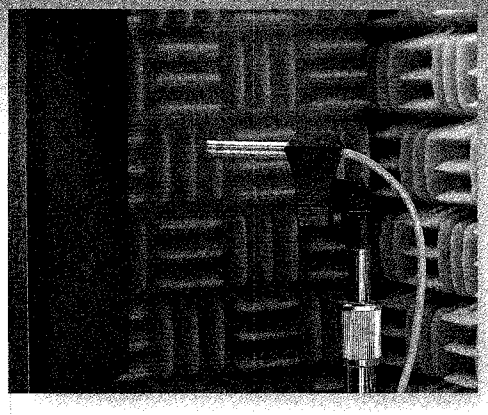


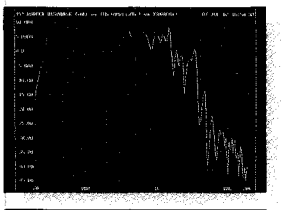
Test frequency response of ***loudspeakers, headphones, hearing aids, headset earpieces*** using a standard reference microphone and swept sine waves, pink noise, white noise, or 1/3 octave bandpassed noise. Select wideband analysis, swept ANSI 1/3 octave Class II selectivity, or FFT spectrum analysis. Process data with the COMPUTE SMOOTH feature to correlate better with human hearing. Measure polarity and rub and buzz. Measure and compute ***Thiele-Small parameters*** at the voice coil ***in five seconds.***

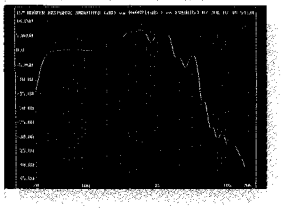
Measure microphone and telephone handset response by comparison to a reference microphone or using a standard artificial voice. Test microphones by four methods:

- at constant sound pressure level via REGULATION mode which adjusts generator amplitude at each frequency to hold reference microphone output (spl) constant
- by graphing the difference between microphone under test and reference mic, in real time
- using an equalized generator sweep which adjusts speaker input power to compensate for measured response of speaker and room
- using COMPUTE DELTA to subtract previously measured speaker/room response from the measurement

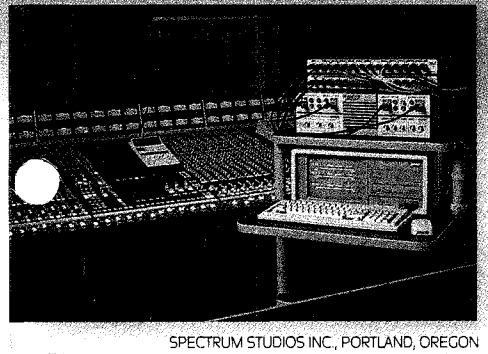
Slide microphone measurement curves vertically for best fit between response limits, using COMPUTE CENTER.

Graph acoustical test results at any desired vertical and horizontal resolution. Calibrate dBr (dB relative) as dB spl. Create test limits from measurements of a "golden unit", or from the average of measurements of many units.





STUDIO MAINTENANCE:



SPECTRUM STUDIOS INC., PORTLAND, OREGON

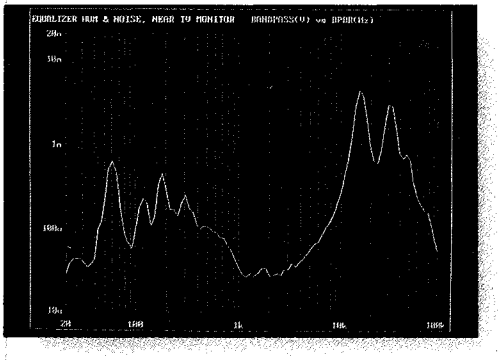
Adjust and verify performance of analog and digital tape machines, consoles, distribution amplifiers, processors, microphones, power amplifiers, and other studio equipment with System One. Standardize test methods via stored setups. Document automatically with disk-stored or paper-printed graphic or tabular results. Compare results graphically with past measurements to ***predict replacement needs***. Run a procedure which makes multiple tests quickly and consistently, independent of the operator's skills. Automatically test complete mixing consoles, routing switchers, and multi-track tape machines with the SWR-122 audio signal switchers. Make worst-case crosstalk measurements by driving all but one channel.

Measure power-based (impedance matched) and voltage-based systems, using transducer gain or voltage gain methods. Make dBm (power) measurements with reference to ***any*** impedance. Terminate fully balanced analyzer inputs in 150 or 600 Ohms (300/600 Ohm option available) or select bridging mode. Drive at +30 dBm levels for headroom tests. Drive at microphone equivalent levels without external attenuators. Select 50/150/600 Ohm output impedance ***fully transformer balanced***. Measure common mode rejection ratio without disconnecting cables or searching for matched equivalent source resistors. Measure noise without disconnecting cables or connecting terminations, since the generator back terminates when off.

Overlay graphs of multiple settings of EQ circuits. ***Track down noise sources*** via swept or FFT spectrum analysis.

Drive dynamic processors with a tone burst signal giving full control of frequency, duration, interval, and amplitude between bursts. Evaluate transient response with a square wave and waveform display mode of DSP-based System Ones.

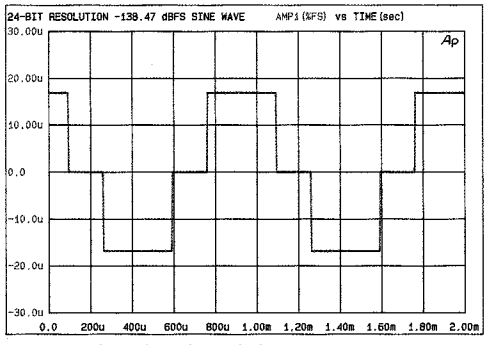
Use pink noise or 1/3 octave bandpass noise for acoustical measurements. Graph microphone response relative to a reference mic, independent of loudspeaker and room response.



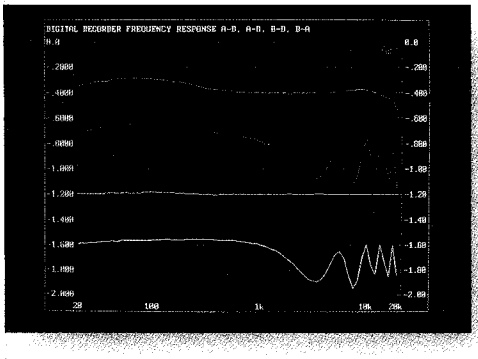
Quickly test A-D and D-A converters, professional digital tape recorders, digital mixing consoles, digital processors, digital audio tracks of VTRs, CD players, RDAT machines, digital workstations and direct-to-disk systems, digital transmission links, DSP prototypes.

Directly connect to digital audio device inputs and outputs via the two-channel ***professional (AES/EBU)*** interface, ***consumer (SPDIF-EIAJ)*** interface, general-purpose 24-bit ***parallel*** interface, or general-purpose 24-bit ***serial*** interface.

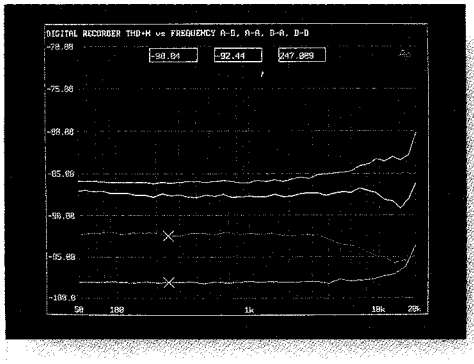
Generate sinewaves of any amplitude and frequency with the analog generator, or up to 1/2 the sample rate with 24-bit frequency and amplitude resolution in the digital domain. Set digital generator levels in dBFS (dB below digital full scale) and %FS. Lock the sample rate of generated signals to "house sync" by use of the external sync input. Acquire signals in analog or digital domains. Display waveforms of signals acquired in the digital domain, from full scale to the minimum theoretical amplitude digital



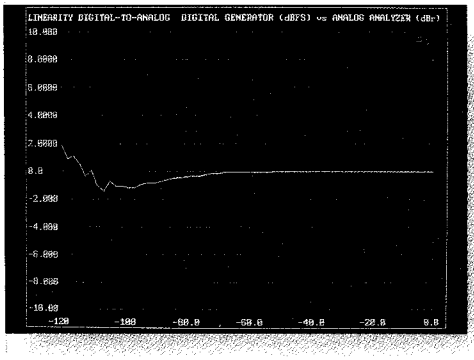
signal. In the digital domain, measure THD + N (20-bit residual distortion), response, weighted or unweighted noise, linearity. Use the same measurement concepts in analog and digital domains to make the results directly comparable. Make digital domain amplitude measurements in dBFS and %FS, plus THD + N measurements in dB and BITS. Graph frequency response or THD + N of digital recorders and similar



devices in all four possible combinations: A-D, D-A, D-D, and A-A.



Measure linearity across a 110 dB range in dithered systems via wide-range amplitude sweep and frequency-selective amplitude measurement in digital or analog domains. Use COMPUTE LINEARITY to display deviation from perfect linearity. Measure THD + N at 25 microvolt levels as part of quantization distortion sweeps across a 110 dB dynamic range. Graph THD + N in abso-



lute units to show bit-weighting errors in converters.

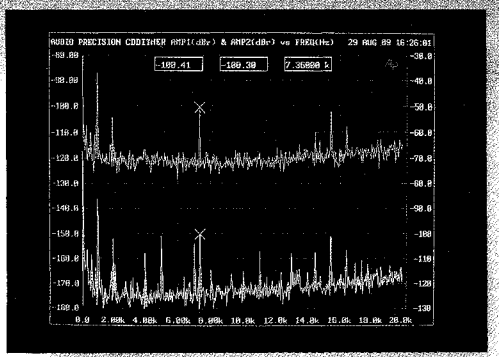
Make definitive measurements on the best D-A systems via ***digital generator distortion of -130 dB,*** analog domain residual THD + N below −100 dB (typically −106 dB at the standard output level of CD players), amplitude resolution of 0.01 dB, typical flatness of 0.02 dB. Or, ***resolve distortion products more than 145 dB down*** by analog notching out the sinewave fundamental followed by FFT analysis. Select triangular or rectangular probability distribution dither at any LSB level, or undithered.

Measure the best A-D systems via analog generator THD + N below −106 dB (harmonics typically below −120 dB at fundamentals from 20 Hz-5 kHz), ***digital domain residual THD + N below −120 dB,*** amplitude resolution of 0.01 dB, flatness of 0.02 dB.

Identify clock leakage and aliased or other out-of-band analog signals through swept 1/3 octave spectrum analysis up to 200 kHz or high-resolution FFT spectrum analysis to 80 kHz.

Measure input/output phase shift and ***display group delay of anti-aliasing and reconstruction filters.***

Compare spectra of two digital or analog channels via twochannel FFT spectrum analysis; use two-channel graphic



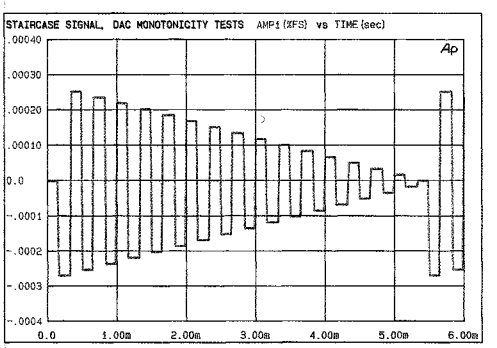
cursors for precise readout of amplitude at any frequency. Make "before and after" comparisons by acquiring the two channels at different times. Dithered vs non-dithered signals from the same CD player are shown in the example.

Capture signals in the analog or digital domains, save to computer disk for later analysis, display as waveforms or FFT spectra.

Test CD players and playback-only systems in EXTERNAL sweep modes, using existing test discs or tapes. Make comprehensive CD player measurements. Ask for the Applications Note and diskette of tests and procedures for CD player testing.

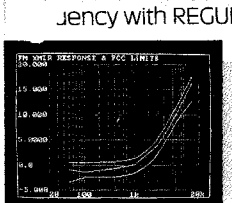
Adjust MSB trim of D-A and A-D converters for best linearity using a repeating low-level amplitude sweep from digital or analog generator, narrowband analog or digital amplitude measurement, and the "sweep-erase-repeat" X-Y graphic display mode.

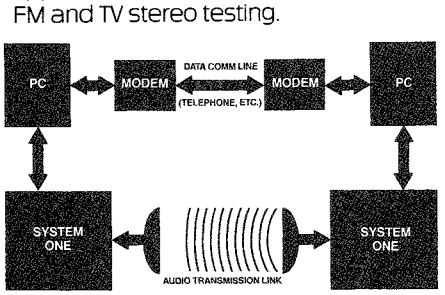
Measure bit errors of digital interfaces, digital transmission paths, and digital storage media with any amount of delay between input and output. ***Generate pseudorandom, walking 1 and walking 0, staircase, ramp, impulse, constant and sinewave signals.*** Locate "stuck bits" with the walking bit signals. Measure bit errors through digital devices with gain or loss by use of the sinewave signal. Measure transfer function of D-A converters with the constant ("digital dc") signal and dc voltage measurement via the DCX-127. ***Measure monotonicity*** and low-amplitude linearity of D-A converters with the staircase signal and waveform display. Measure time delay through a digital device with the impulse signal.



BROADCAST TRANSMISSION:

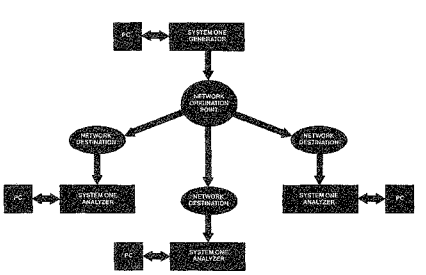
Make audio ***proof-of-performance tests in minutes*** on FM, AM, and TV stereo and monaural stations. ***Generator output will automatically adjust for constant modulation*** at each frequency with REGULATION mode. Use limits files to compare measurements to regulatory requirements, and instantly center measurements between the limits. Control generator amplitude with 75 usec or 50 usec de-emphasis curves. Applications packages available for U.S. FM and TV stereo testing.



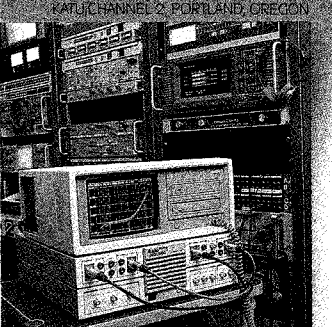


Perform fast system tests when transmitter-demodulator are remote from studio via ***"split site"*** architecture. Control generator at studio and analyzer at transmitter from either location, graph ***real-time test results at either location. Test remotely located equipment*** at distant, unmanned transmitter or repeater locations. Perform automatic, unattended performance tests of broadcast stations and networks.

Test broadcast networks or simple links without modems via EXTERNAL



KATU CHANNEL 2, PORTLAND, OREGON



FREQUENCY mode at the destinations and a sweep from the origination. Graph response, distortion vs frequency from present repeating step-tone signals.

Measure transmission circuit phase vs frequency and display group delay. ***Sweep stereo systems and graph both channels, or level difference and phase between them, in one rapid sweep.***

Operate in high rf environments due to System One's shielding and filtering —tested at Mt. Wilson, South Mountain Phoenix, and adjacent to half-megawatt transmitters.

EQUALIZED SWEEPS

Analog generator sweeps are completely software controlled, so amplitude can follow any arbitrary function as frequency sweeps. Applications include broadcasting de-emphasis and pre-emphasis curves, RIAA curves, equalization according to an equation, or data you enter. You can even make a response measurement of long cables, invert the curve and use it as an EQ curve, and ***produce flat response at the cable ends*** as the generator makes equal but opposite amplitude changes to compensate.

FREQUENCY CONTROL MODES

System One software and hardware provide two means of frequency control. *FAST mode settles in a few cycles* and provides frequency accuracy of 0.5%, adequate for most audio measurements. HIGH ACCURACY mode provides 0.005% resolution and 0.03% accuracy, but takes approximately 150 milliseconds every time frequency is changed.

UNITS FLEXIBILITY

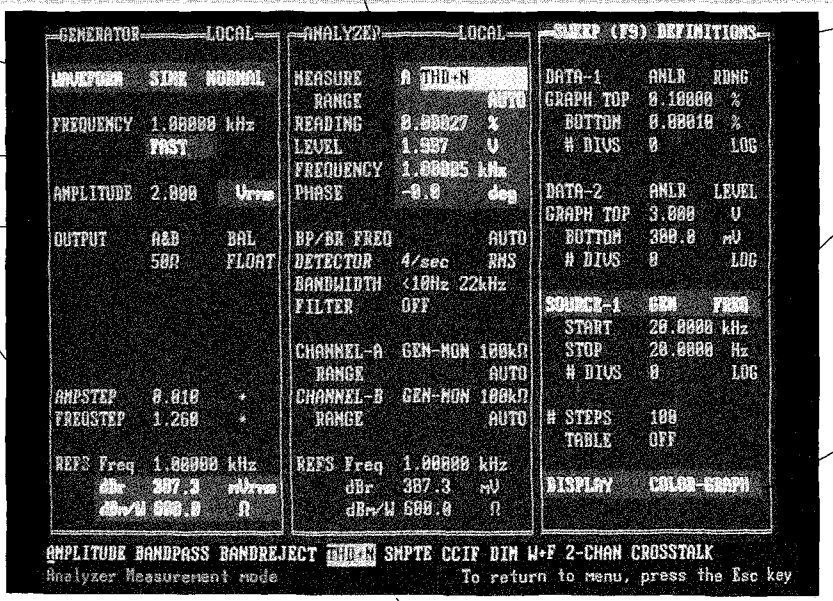
System One software features the industry's widest selection of units. Volts RMS and dBm units are common on other equipment; System One also provides choices including Volts P-P, dBu (relative to 0.7746 Volts), dBV (relative to 1.000 Volt), dBr (relative dB), dBFS (relative to digital full scale), BITS (for distortion levels in digital systems) and Watts. System One's dBm units are true dBm, taking into account circuit impedances for actual power indications; nearly all other instruments actually measure dBu when their "dBm" mode is selected. Furthermore, dBm and Watts *units may be used with any value of* external resistance by entering the resistance value, letting the computer do the calculations. A most useful unit is dBr—dB relative to a reference amplitude which you enter from the keyboard *or store from the present measurement* by pressing a key. dBr instantly sets the reference for signal-to-noise, gain-loss, and frequency response measurements.

PANEL SET-UP

System One's PANEL mode is the real "front panel" of the instrument. Use it to set up new tests and modify old ones. Use it for impromptu, "spot" measurements with up to nine values displayed simultaneously—LEVEL, FREQUENCY, PHASE, your choice of principal READING meter functions (AMPLITUDE, BANDPASS, BANDREJECT, THD + N, SMPTE, CCIF, DIM, WOW&FLUTTER, 2-CHANNEL, CROSSTALK), dc voltage or resistance, digital word value, and up to 3 DSP-measured parameters. Readings update in real time as you modify settings.

Move the cursor to a field with arrow keys or mouse . Fields are numeric entry or multiple choice. Numeric entry fields, such as generator AMPLITUDE or FREQUENCY, let you type any number with common engineering prefixes such as k for kilo-, m for milli-, u for micro—or use integer or scientific notation. Multiple choice fields, such as selection of measurement units or choice of principal voltmeter function, show the available choices at the bottom of the panel. Make your choice with the mouse or <Enter> key.

Any three functional panels (generator, analyzer, sweep panels shown below) visible at the same time—reduces "screen hopping". Generator amplitude or frequency may be incremented in any desired step size via AMPSTEP and FREQSTEP fields.



CHANGING SETTINGS

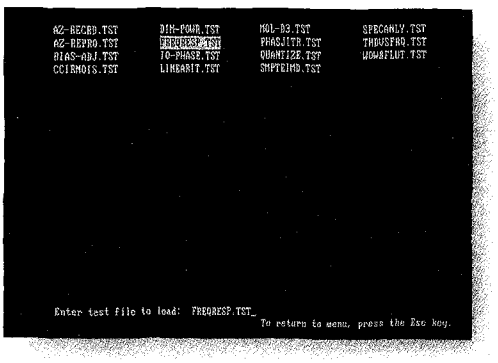
The two bottom lines describe how to make changes—when to enter digits, when to select with the space bar, and how to enter the change.

GO/NO-GO TESTS

Acceptance LIMITS are easily generated and attached so that pass/fail results can be obtained. The limits can be easily created from a specification or can result from a test or the average of many tests . An error-reporting file can be specified, into which System One writes a summary with test name, date, time, and out-of-spec readings or the statement "All data within limits". The same file may be named for every test in a procedure, resulting in a master test summary file for the entire procedure.

TEST SELECTION

Most audio testing consists of a few or few dozen tests such as response, distortion versus frequency, crosstalk, or noise level. Examples of those and other common tests are furnished on diskette with System One. To run a test, press L T (LOAD TEST) and a directory of stored test files will be displayed. Select a test with the cursor, press F9 to run, and (if you wish) save the results. Modify furnished tests to your exact requirements and save them under another name.



SWEEPS AND GRAPHS

Most audio tests are sets of measurements, best analyzed from a graphic presentation. System One provides the SWEEP DEFINITIONS panel for easy setup of sweep tests. Choose frequency or amplitude sweeps, scans across switcher channels, dc or digital output, or measurements versus time (oscilloscope/chart recorder mode) for the horizontal graph axis. Specify ***any*** START and STOP values for the sweep, # STEPS, and LOG or LIN. Intermediate points will be automatically computed, or the sweep may be from a TABLE with ***any*** arbitrary values you choose. Select one or two measured parameters, such as LEVEL and PHASE, THD + N and LEVEL, or LEVEL on both stereo channels to be lines on the graph. Specify LOG or LIN vertical scales with ***any*** value for GRAPH TOP and BOTTOM calibrations. Press the F9 function key for a fast on-screen test with ***real-time graphing*** of results. If there's anything you don't like about the presentation, zoom or change coordinates or units and re-graph without retesting, via the F7 function key.

EXTERNAL SOURCE SWEEPS

Some audio devices have no real-time input; examples include compact disc players, playback-only tape machines, satellite downlinks carrying a distant origination signal. System One automatically graphs data from such devices when the signal is a swept or stepped tone, using EXTERNAL FREQUENCY mode. System One measures the incoming frequency plus two other selectable parameters such as distortion, phase, or stereo amplitude. Each time the frequency changes, System One makes and graphs another measurement. Voice announcements recorded on reference tapes are ignored; only the tones are plotted.

DISPLAY FLEXIBILITY

Measurements are graphed as they are made, in either MONO GRAPH or COLOR-GRAPH mode. System One software supports the full resolution of VGA, EGA, CGA, and Hercules high resolution monochrome graphics systems. When two parameters are measured, both graph as y-axis values versus the swept parameter on the x-axis. Solid and dashed lines (green and yellow on a color monitor) plot the two parameters. In VGA and EGA systems, up to four sweep repetitions are displayed in different colors. Two measured values may be graphed versus one another, such as distortion (on the y-axis) versus output power of an amplifier (on the x-axis). Data can also display in tabular form, with out-of-limits readings flagged as the test progresses.

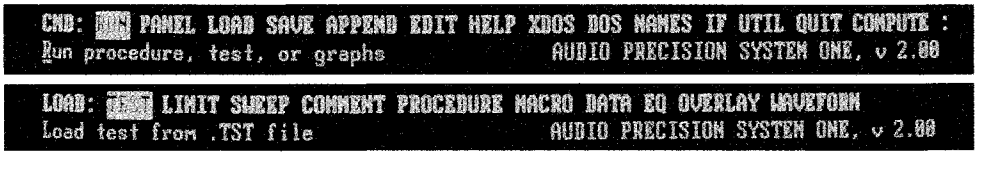
COMPLETE TEST PROCEDURES

When several tests have been created and saved, they may be easily linked into a test PROCEDURE which loads and runs as a single unit. Procedures may consist of tests, control signals to external devices, prompting messages to the operator, pauses until a condition is sensed at an external device, pauses for operator input, sub-procedures, and temporary exits to the computer operating system (DOS) to run programs outside System One. IEEE-488 instruments may be controlled in a procedure via an IEEE-488 interface card and temporary exits to IEEE-488 control software.

Procedures are easily created in "learn" mode which memorizes keystrokes as you go through the sequence. You can edit procedures in a full-screen editor.

MENUS

System One uses a simple menu system. Select menu actions by using the space bar to move a cursor to your choice, then press <Enter>. Even faster, type the first letter of the desired menu commands. Examples include S T (SAVE TEST) to save a setup and data to disk, L T (LOAD TEST) to bring a stored setup and data from disk, R P (RUN PROCEDURE) to start execution of an entire series of tests, U L (UTIL LEARN) to start the keystroke-learning process which generates a procedure. With only two levels of menu, you won't bog down in "menu drudgery". The complete menu "tree" is reproduced at the right.



MENU TREE

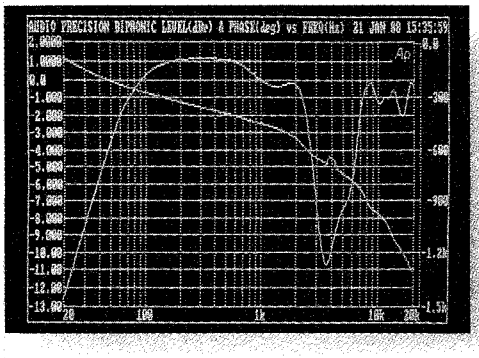
RUN	**Run procedure, test, graphs.**
PROCEDURE	Run a procedure.
TEST	Measure and graph new data.
GRAPH	Graph stored data.
BAR-GRAPH	Display readings on Bar-graph.
LOCAL	Cause instruments to be LOCAL.
REMOTE	Enable REMOTE instruments.
SLAVE	Split-site Slave mode.
CALL	Call a sub-procedure.
EXIT	Exit from a sub-procedure.
PANEL	**Display instrument panels.**
LOAD	**Load test, data from disk.**
TEST	Load test from .TST file.
LIMIT	Load test from .LIM file.
SWEEP	Load test from .SWP file.
COMMENT	Load comments from disk.
PROCEDURE	Load procedure from disk.
MACRO	Load macro from disk.
DATA	Load ASCII data from .DAT file.
EQ	Load test from .EQ file.
OVERLAY	Load test except punch-outs.
WAVEFORM	Load waveform from disk.
SAVE	**Save test, data to disk.**
TEST	Save test to .TST file.
LIMIT	Save test to .LIM file.
SWEEP	Save test to .SWP file.
COMMENT	Save comments to .TXT file.
PROCEDURE	Save procedure to .PRO file.
MACRO	Save macro to .MAC file.
DATA	Save ASCII data to .DAT file.
EQ	Save test to .EQ file.
OVERLAY	Save test except punch-outs.
GRAPHIC	Save graphics display list.
WAVEFORM	Save waveform to .WAV file.
APPEND	**Append from disk.**
TEST	Append data from .TST file.
DATA	Append data from .DAT file.
EDIT	**Edit text or data.**
COMMENT	Edit comment buffer.
PROCEDURE	Edit procedure buffer.
DATA	Edit data buffer.
MACRO	Edit macro buffer.
HELP	**Show help menu choices.**
SPECIAL	Show function keys screen.
OVERLAY	Show Overlay screen.
EDITOR	Show Text Editor screen.
DSP	Show DSP screen.
PANEL	Show mnemonics screen.
XDOS	**Call DOS.**
DOS	**Execute ONE DOS command.**
NAMES	**Select compare limits, etc.**
UPPER	Select upper compare limit.
LOWER	Select lower compare limit.
SWEEP	Select sweep source table.
GEN-EQ	Select file for generator eq.
ERR-FILE	Select file for error reporting.
OFF	Disable error reporting.
TITLE	Select title for graphs.
RENAME	Select new test name.
CLEAR	Clear Named files.
DELTA	Select file for COMPUTE DELTA.
PROGRAM	Select Program file for DSP.
IF	**Conditional execution.**
ERROR(	Do only if test error.
NOTERROR(	Do only if not test error.
ABOVE(	Do if above limit.
BELOW(	Do if below limit.
0(thru 9(	Do if CTRL—F10 response.
UTIL	**General utilities.**
RESTORE	Reset hardware.
OUT	Write to output port.
WAIT	Wait for value at input port.
DELAY	Delay for specified time.
BREAK	Put a break in procedure.
LEARN	Begin learning procedure.
END	End learning procedure.
PROMPT	Make prompt in procedure.
MESSAGE	Make message in to error file.
GOTO	Go to label in procedure.
SERIAL-DSP	Digital I/O configuration.
TRANSMIT	Enter Channel Status Data.
RECEIVE	Refresh received status data.
MODE	Serial digital intfc modes.
AES-EBU	AES-EBU DSP digital mode.
SPDIF	SPDIF DSP digital mode.
SERIAL	SERIAL DSP digital mode.
DITHER	
TRIA	Triangular DSP dither.
RECT	RECTANGULAR DSP dither.
FEED	Send form feed to printer.
QUIT	**Quit program to DOS.**
COMPUTE	**Select data computation.**
NORMALIZE	Normalize data values specified.
INVERT	Invert (reciprocate) DATA-1.
SMOOTH	Smooth data.
LINEARITY	Deviation from Best Fit Line.
CENTER	Center data between limits.
DELTA	Subtract DELTA file from data.
2-SIGMA	Max excluding peak 5%
EXCHANGE	Exchange DATA-1 and 2.
:	**Enter label for UTIL GOTO.**

COMPATIBILITY WITH OTHER SOFTWARE

System One can save data as an ASCII file with values separated by commas, this format is compatible with most software languages and other programs such as Lotus 1-2-3, dBASE III, and statistical programs which do computations such as averaging and standard deviation. Graphs can be captured on-screen, then edited with "Paint" software and sized or cropped with desktop publishing software for inclusion in data sheets or manuals.

GRAPHIC SOPHISTICATION

When graphing phase, System One software doesn't display discontinuities when the phase change exceeds 360 degrees. System One automatically adds integral multiples of 360 degrees as necessary to display a continuous plot of phase—even through thousands of degrees of rotation.

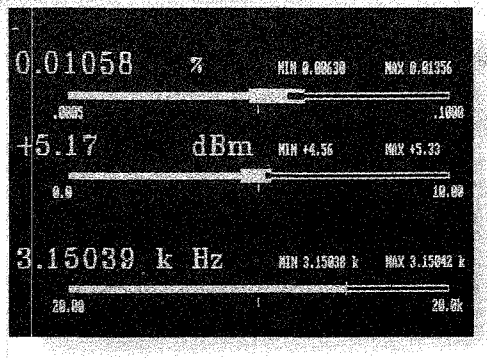


TRUE MEASUREMENT SPEED

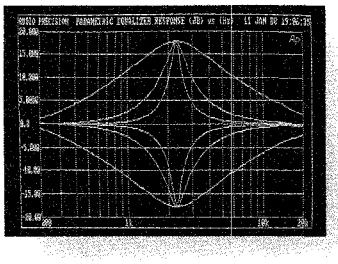
With fast reading rates (32/second under most conditions), automatically switched detector time constants, careful selection of low-frequency rolloffs, and automatically switched high-pass filter, System One was designed for ***SPEED***. 30-point frequency response tests of both stereo channels made and graphed in 10 seconds. 16-point distortion sweeps made and graphed in 10 seconds. Response tests of 24 tracks of a tape recorder made and graphed in 4 minutes. Thiele-Small parameters of a loudspeaker in 10 seconds. Most important—***these speeds are achieved with fully-settled data***, not merely listings of how many "garbage points" can be taken "on the fly".

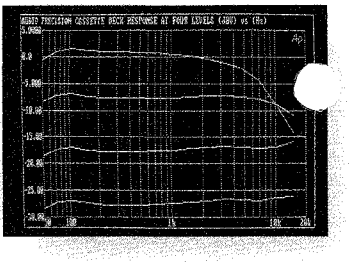
ANALOG DISPLAYS

Adjustments such as nulling or peaking are easiest with an analog display. System One furnishes several such displays via BARGRAPH (F2 function key) mode. You have total control over bargraph units and calibration. One, two, or three measured values may be simultaneously displayed on bargraphs. Generator frequency or amplitude or switcher channel may be controlled on stimulus bargraphs by mouse or arrow keys while up to two measured values are displayed.



MULTIPLE SWEEPS





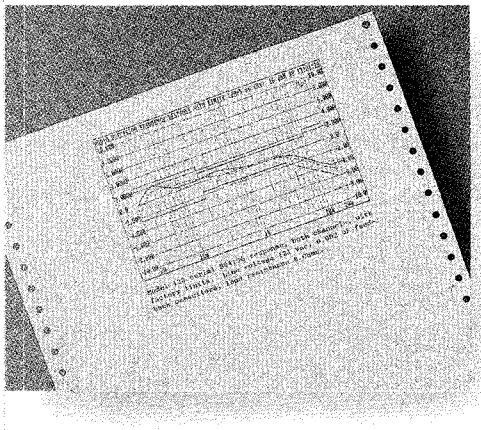
Any number of sweeps may be overlaid, such as when changing settings of equalization controls on a device under test. A sweep or a disk-stored test can be re-graphed, followed by a new test on the same graph. A composite image can be built up from any number of graphs. A sweep-erase-repeat mode simplifies adjustment of device controls. Nested sweep capability generates a family of sweeps, such as frequency sweeps with each at a higher amplitude or on a different channel. Multiple sweeps are displayed in different colors on VGA and EGA displays.

DATA SETTLING

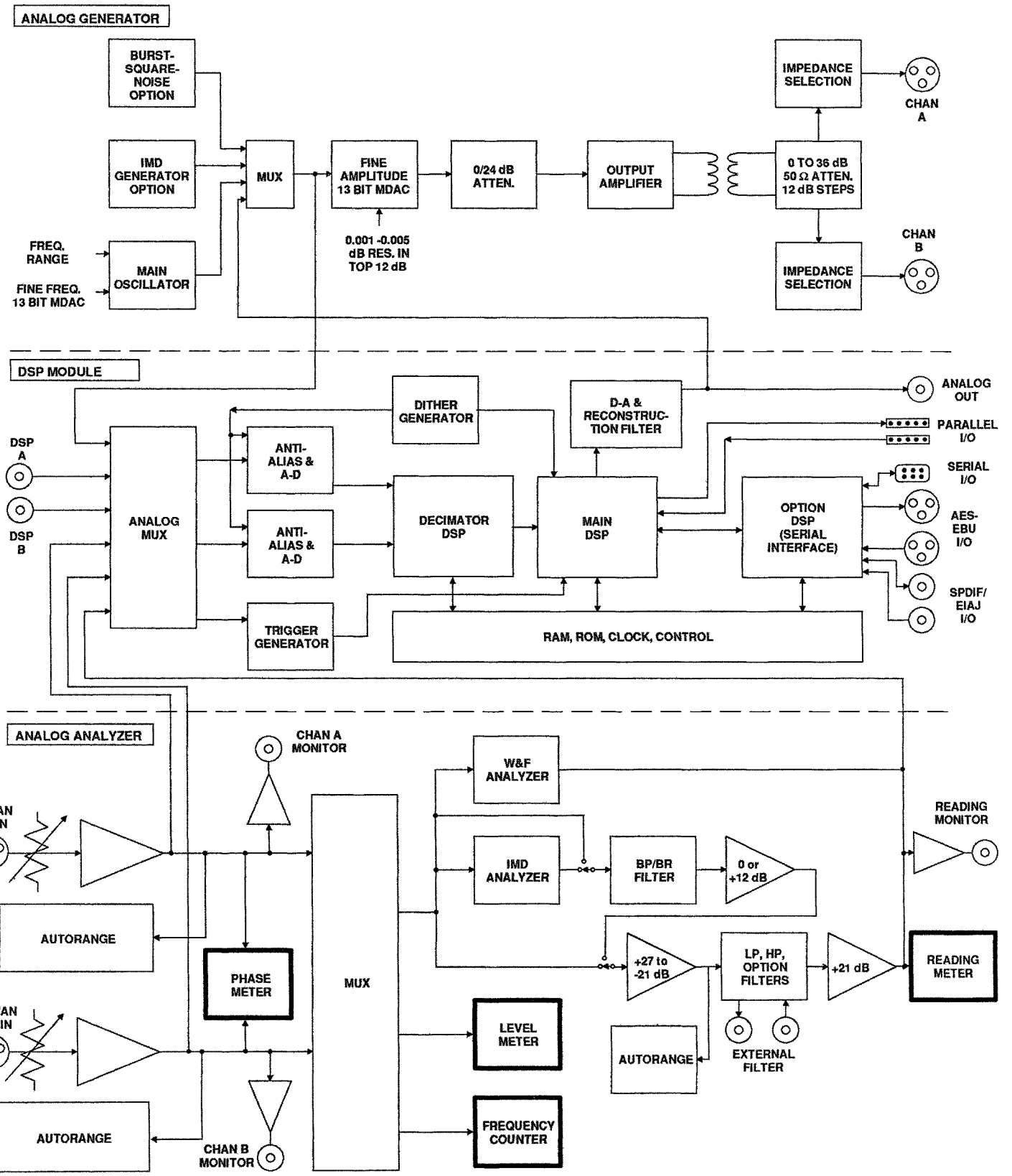
Many automated systems have reading rates faster than the settling time of either the device under test or the analog portions of the instruments. Many other systems cope with this problem by inserting a fixed time delay after each generator amplitude or frequency change. If the delay is long enough to handle worst-case settling times, operation is greatly slowed under normal conditions. System One software solves the settling problem by continually comparing a series of measurements, using an "acceptance window" or "envelope" whose shape and tolerance you vary to fit each application's need for settled data. The result is settling speed adaptively optimized under a wide variety of signal conditions, meeting your requirement for accuracy which ***only you can specify***.

HARD COPY

System One provides easy plain paper copies of graphs. The graph on screen is reproduced in 20 to 40 seconds on an inexpensive Epson-compatible dot matrix printer or HP LaserJet printer. If you use EDIT COMMENTS capability to type additional information, it saves to disk with the test and prints below the graph. High-resolution graphs can be printed by an HPGL plotter or laser printer.



BLOCK DIAGRAMS OF GENERATOR AND ANALYZER:

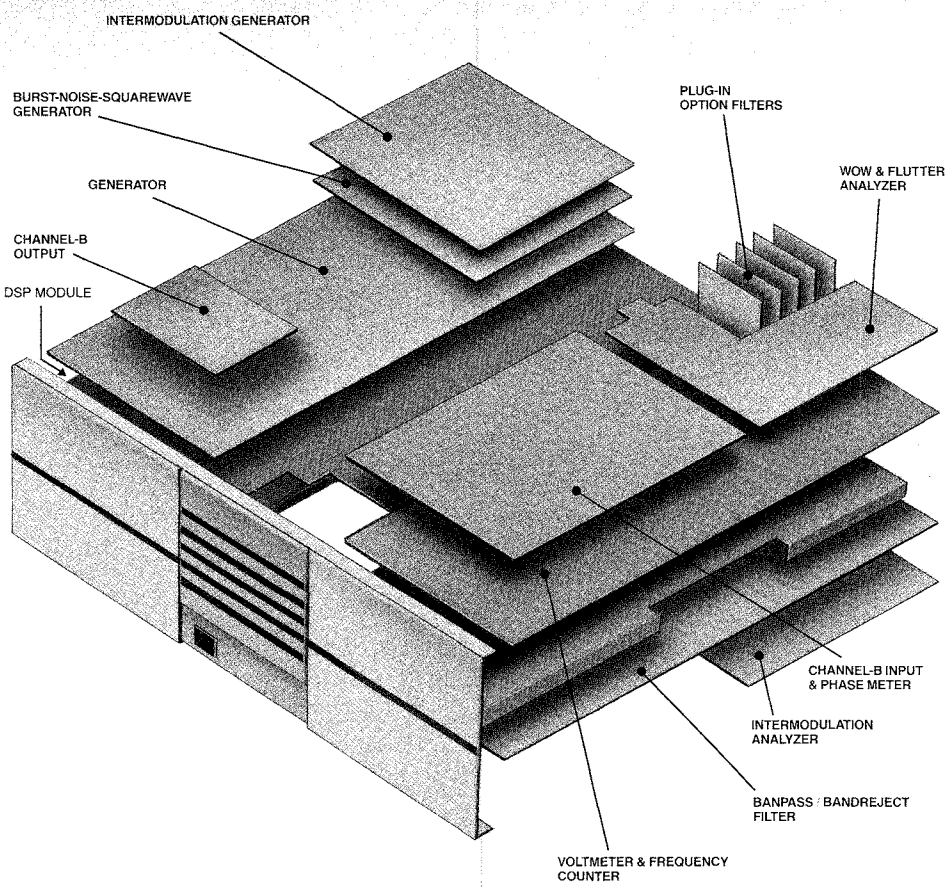


SPECIFICATIONS:

System One specifications are ***guaranteed*** specifications across a full-range of real-world conditions When "typical" performance is also shown, it is clearly identified as typical and represents performance of the large majority of units shipped, operating under normal environmental conditions Audio Precision does not subscribe to a philosophy of quoting performance with qualifiers like "as low as", or over a narrow amplitude range centered at the "sweet voltage" where the instrument functions best Graphs of performance over wide frequency and amplitude ranges are furnished in many cases

System One combinations are made up of selections of the modules and options described in the following pages DSP modules mount in the lower left compartment The IMD (intermodulation distortion) option adds plug-on IMD modules to the generator and filter module of the analyzer The BUR (tone burst noise-squarewave) option adds a plug-on generator module The W&F (wow and flutter) option adds a plug-on module to the principal voltmeter portion of the analyzer

The SWR-122 family of switchers and the DCX-127 multifunction unit are separately packaged modules which may stack or rack mount Their control cables are "daisy chained" on the digital interface cable to System One



All specifications subject to change without notice.

GENERAL:

System One and the DCX-127 operate from line voltages of 100, 120, 220, or 240 Volts rms +5/–10%, 48-63 Hz System One draws 200 VA maximum, the DCX-127 draws 20 VA maximum The SWR-122 switchers operate from 90-126 or 180-250 Volts rms, 48-63 Hz, and draw 20 VA maximum All meet performance specifications at temperatures from 5 to 40 degrees Celsius

Product and Shipping Weights:

Product	Net Weight	Shipping Weight
SYS-nn (full options)	33 lbs (15 kg)	44 lbs (20 kg)
SWR-122	10 lbs (4.5 kg)	12.5 lbs (5.7 kg)
DCX-127	10 lbs (4.5 kg)	12.5 lbs (5.7 kg)

Dimensions	(h x w x d)
SYS-nn	5.75x17.25x17" (13.3x43.8x43.2 cm)
SWR-122	1.75x17.1x11" (4.4x43.5x27.9 cm)
DCX-127	1.75x17.1x10.75" (4.4x43.5x27.3 cm)

The Audio Precision System One generator features a true transformer-coupled balanced output, ultra-low distortion, and wide dynamic range. Patented circuit techniques combined with a custom transformer design virtually eliminate the problems associated with electronically-floating output designs, with no compromises in performance. Standard connectors include both male XLR (pin 2 high) and dual banana jacks, wired in parallel. (Specify option "GXPH" to substitute a 1/4-inch stereo phone jack for the XLR.) Separate ground and output common banana jacks are also provided.

The generator has two frequency setting modes. HIGH ACCURACY mode initiates an auto-calibration cycle following each frequency change. This cycle takes approximately 150 msec above 50 Hz, increasing to about 0.75 sec at 10 Hz. Until the cycle is completed, accuracy and resolution are the same as the FAST mode. FAST mode is recommended for most applications where speed is important and 0.5% worst case accuracy is sufficient. Stability is typically <0.01%/°C in either mode.

Generator amplitude can be set and displayed in a wide variety of units including dBu/Volts-mV-uV open circuit, dBm/Watts-mW-uW into any specified load resistance, or dB with respect to any reference. The output amplitude at the front panel terminals can also be monitored by the System One analyzer via its GENERATOR MONITOR input selection. Residual generator leakage in output OFF state is virtually non-existent, typically <80 nV (-140 dBu).

Engineering benchtop applications often require an interactive control of the generator parameters. System One allows both generator frequency and amplitude to be incremented or decremented using keyboard keys or an optional mouse. Virtually any frequency and amplitude step sizes may be selected. Steps can be additive or multiplicative (for example, +0.25 dB steps or x1.256 frequency steps).

FREQUENCY RELATED

Range: 10 Hz-204.775 kHz

	High-Acc Mode	Fast Mode
Accuracy	0.03%	0.5%
Resolution	0.005%	0.025 Hz, 10 Hz to 204 Hz 0.25 Hz, 205 Hz to 2.04 kHz 2.5 Hz, 2.05 kHz to 20.4 kHz 25 Hz, 20.5 kHz to 204 kHz

AMPLITUDE RELATED

Range[1]	
20 Hz-50 kHz	<25 μVrms-26.66 Vrms (<-90 dBu to +30.7 dBu)
10 Hz-204 kHz	<25 μVrms-13.33 Vrms (<-90 dBu to +24.7 dBu)
Maximum Output Power[2]	
into 600 ohms	+30.0 dBm, R_s = 50; +24.7 dBm, R_s = 600
into 150 ohms	+30.0 dBm, R_s = 50
Resolution	<0.01 dB or 1.27 μV, whichever is greater
Accuracy	±0.1 dB (1%) at 1 kHz
Flatness (1 kHz ref)	±0.03 dB, 20 Hz-20 kHz; ±0.15 dB, 10 Hz-120 kHz

DISTORTION

Measured with a passive notch filter and spectrum analyzer. Valid for any $R_{load} \geq 300\Omega$

20 Hz[3]-20 kHz	0.0005% (-106 dB)
10 Hz-100 kHz	0.0050% (-86 dB)

OUTPUT RELATED

Configurations	Balanced, Unbalanced, or Common Mode Test (same as balanced except generator is connected between the output common and source impedance center tap)
Source Impedance	50-150-600[4] Ω balanced, or 25-600[4] Ω unbalanced, ±1 Ω. Source impedance does not change with output OFF
Maximum Rated Floating Voltage	42 V peak ac, 60 V dc. True transformer isolation

AUXILIARY SIGNALS

Sync Output	LSTTL-compatible squarewave signal for triggering stable oscilloscope displays with all signals.
Monitor Output	Ground-referenced replica of the generator signal. Nominally 2.8 V_{pp} amplitude, R_{out} = 560 Ω.
Trigger/Gate Input	LSTTL-compatible input for use with the tone burst option.

DUAL OUTPUT RELATED (SYS-22 & SYS-20 ONLY)

SYS-22 and SYS-20 configurations provide a second switchable generator output. Frequency, amplitude, impedance, and mode selection apply to both outputs simultaneously. Both outputs must be properly terminated in the A & B and A & −B modes for correct amplitude calibration using dBm or Watts units.

Output Modes	A only, B only, A & B, A & −B, or OFF
Output Separation	110 dB to 20 kHz
Maximum Output Power[2] (both channels loaded)	
into 600 ohms	+29.4 dBm each load, R_s = 50; +24.3 dBm each load, R_s = 600
into 150 ohms	+24.0 dBm each load, R_s = 50

[1]Unloaded (open circuit). Divide maximum amplitude by 2 (-6 dB) for unbalanced or common-mode configurations.

[2]Total peak output current rating is 120 mA balanced/ 240 mA unbalanced, 20 Hz-20 kHz.

[3]25 Hz if output open circuit voltage exceeds 20 Vrms balanced, or 10 Vrms unbalanced.

[4]Specify option "EURZ" to substitute <40-200-600 Ω balanced, <20-600 ohm unbalanced impedance selections.

The System One analyzer contains two independent voltmeters. The "READING" meter displays the selected measurement mode and has the greatest sensitivity and dynamic range. The "LEVEL" meter monitors the wideband input signal following input attenuation and pre-amplification, before subsequent signal processing, filtering, and additional gain stages. Its most sensitive range is 80 mV, limiting full performance to inputs ≥10 mV (-38 dBu). In the 2-CHANNEL and CROSSTALK modes the LEVEL meter displays the amplitude of the alternate input (SYS-22 and SYS-02 only), thus enabling simultaneous amplitude measurements on both input channels.

Inputs are fully differential (balanced) with female XLR (pin 2 high) and dual banana jack connectors. (Specify option "LXPH" to substitute a 1/4-inch stereo phone jack for the XLR.) An additional unbalanced and switchable Auxiliary Input (Channel-A only) is provided for special applications.

Amplitude can be displayed in Vrms, dBV (1.000 Vrms ref), dBu (0.7746 Vrms ref), dBr with respect to any predefined or measured reference, or dBm/Watts computed into any arbitrary resistance. The READING meter has selectable rms, average, peak, Q-peak (per CCIR Rec. 468-3), and S-peak detectors; the LEVEL meter detector is rms only. Measurement resolution is approximately 0.004% (1/25200) of range at "4/sec", varying to 0.032% (1/3150) at "32/sec". All displays are rounded to 4 digits or 0.01 dB.

INPUT RELATED

Impedance	100 kΩ ±1%; shunted by 270 pF each side to ground. Selectable 600-150[1] Ω (±1%) terminations.
Maximum Rated Input	200 Vpeak, 140 Vrms on main inputs; 100 Vpeak on auxiliary input. 1 Watt (+30 dBm) with terminations.
Common-Mode Rejection Ratio	70 dB, 50 Hz-20 kHz, $V_{in} \leq 2V$; 50 dB, 50 Hz-1 kHz, $V_{in} > 2$ V

AMPLITUDE MEASUREMENT RELATED

Ranges	300 μV[2]-160 Vrms (6 dB steps above 80 mV, 12 dB steps below 80 mV). Autoranging is peak sensitive to prevent clipping with high crest factor signals.
Accuracy[3]	±0.1 dB (1%), 20 Hz-20 kHz
Response Flatness[3]	±0.03 dB, 20 Hz-20 kHz; ±0.1 dB, 10 Hz-120 kHz; +0.2/-3 dB to 500 kHz
Residual Noise (input shorted)	1.5 μV (-114 dBu), 22 Hz-22 kHz; 3.0 μV (-108 dBu), 22 Hz-80 kHz; 10.0 μV (-98 dBu), full BW; 1.0 μV (-118 dBu), A-wtg; 5.0 μV (-104 dBqps), Qpeak CCIR-wtg

[1]Specify option "EURZ" to substitute 300 Ω for the 150Ω termination selection.

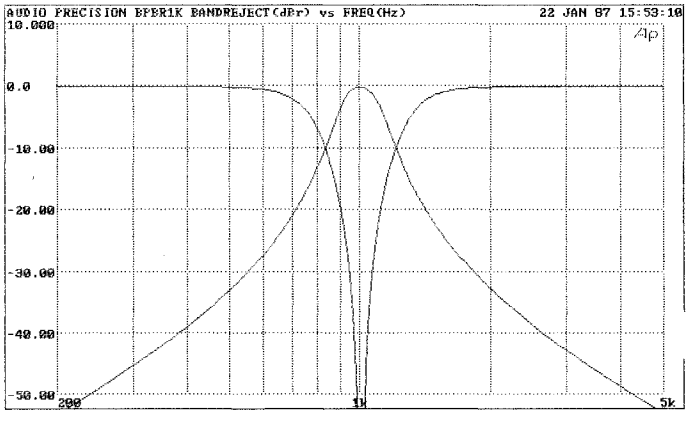
[2]80 mV-160 Vrms for LEVEL meter.

[3]V_{in} ≥5% of range, rms and average detectors only. Peak detectors are +0.2/-0.3 dB, 30 Hz-100 kHz.

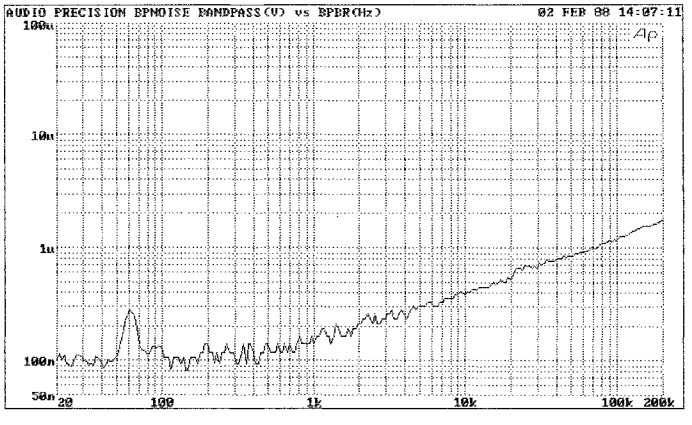
BANDPASS/BANDREJECT RELATED

The Bandpass/Bandreject modes provide selective amplitude measurements processed through a 4-pole constant-Q filter. Filter tuning may be directly programmed ("FIXED"), tracking ("AUTO"), or swept for spectral displays. Units selection and resolution are the same as the Amplitude measurement mode, but with one additional range of sensitivity.

Amplitude Ranges	75 μV-160 Vrms (6 dB steps above 80 mV, 12 dB steps below 80 mV)
Tuning Range (f_o)	10 Hz-200 kHz, ±3% accuracy
Bandpass Response	±0.5 dB (at f_o), 20 Hz-120 kHz, 1/3-octave Class II response per ANSI S1.11-1975. Typically <-32 dB at $0.5f_o$ & $2.0f_o$
Bandreject Response	±0.3 dB, 20 Hz-120 kHz, excluding the band from $0.5f_o$ to $2.0f_o$. Typically -3 dB at $0.73f_o$ & $1.37f_o$, -20 dB within ±10% of f_o, and -40 dB within ±3% of f_o
Bandpass Noise (input shorted)	0.5 μV (-124 dBu), 20 Hz-5 kHz, 1.0 μV (-118 dBu) to 20 kHz, 2.5 μV (-110 dBu) to 120 kHz



Typical bandpass and bandreject responses at 1 kHz.



Typical residual bandpass noise vs frequency, input shorted.

FREQUENCY MEASUREMENT RELATED

Range	10 Hz to at least 500 kHz
Timebase Accuracy	0 003%
Resolution	6 digits+0 0002 Hz
Reading Time	Determined by the nearest integral number of signal periods greater than the reading rate sample time (See Detector Characteristics)
Minimum Input	10 mV (38 dBu) useable to <1 mV

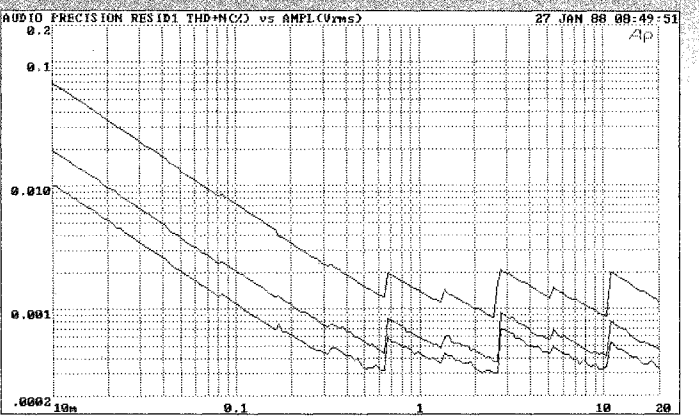
THD + N MEASUREMENT RELATED

THD + N mode is similar to the Bandreject mode but with auto nulling and fine tuning loops activated to maintain optimum f undamental rejection With FIXED tuning the notch frequency ay be directly programmed (± 3% tracking range) for quan tization distortion or SINAD tests With AUTO tuning the notch frequency is ganged to the GEN 1 module frequency during a generator sweep otherwise it will track the measured input frequency (provided $V_n \geq 10$ mV and signal THD + N ≤20%) THD + N may be displayed as a ratio (% dB PPM X/Y) of the total input signal measured by the LEVEL meter or as an abso lute amplitude (Volts dBu dBm etc)

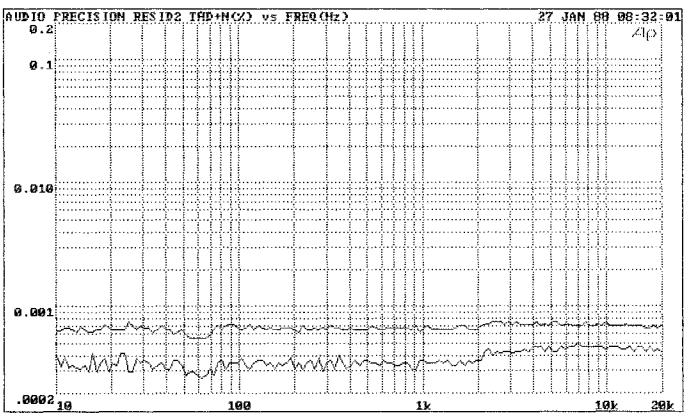
Fundamental Range	10 Hz 200 kHz
Minimum Input	<25 μV (90 dBu) with FIXED tuning 10 mV (38 dBu) with AUTO tuning
THD + N Range	0 to 100%
Accuracy[4]	± 0 5 dB for harmonics to 120 kHz + 0 5/ 3 dB to 500 kHz
Residual THD + N[5]	
20 Hz 20 kHz fundamentals	0 0010%+1 5 μV 22 Hz 22 kHz BW 0 0015%+3 0 μV 22 Hz 80 kHz BW 0 0040%+10 μV full BW <0 0010% at V_n = 2 Vrms 22 Hz 80 kHz BW
10 Hz 100 kHz fundamentals	0 010% + 10 μV full BW
Auto Nulling Time	Typically 0 3 0 4 sec above 100 Hz 1 5 sec at 20 Hz 3 5 sec at 10 Hz A 20 Hz 20 kHz 16 point sweep will typically run in 9 11 sec (8087 co processor installed in computer)

[4]Input must be ≥10 mV with a ratio unit selection.

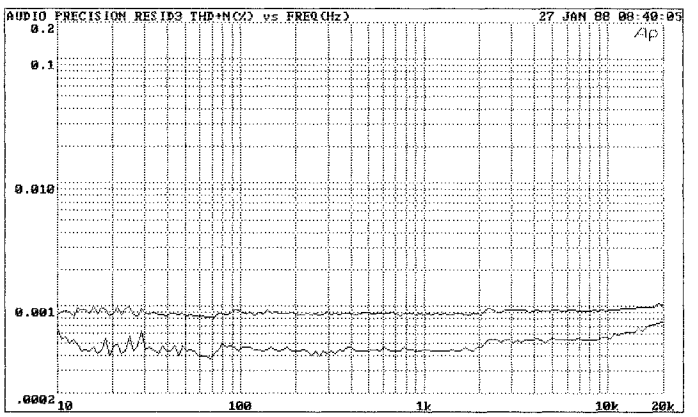
[5]System specification including THD + N contributions from the generator (20-25 Hz derated near maximum output). The analyzer contribution is mainly noise with THD typically <0.0004%, 10 Hz-20 kHz.



Typical residual THD + N vs amplitude, at 1 kHz. Upper trace is with full measurement bandwidth (>500 kHz); center trace is with 22 Hz-80 kHz bandwidth limiting; bottom trace is with 22 Hz-22 kHz bandwidth limiting.



Typical residual THD + N vs frequency, 22 Hz-22 kHz limiting. Upper trace is with 3.0 V input; bottom trace is with 2.0 V input. (Performance with other input amplitudes 300 mV will typically fall between these values.)



Typical residual THD + N vs frequency, 22 Hz-80 kHz limiting. Upper trace is with 3.0 V input; bottom trace is with 2.0 V input. (Performance with other input amplitudes < 300 mV will typically fall between these values.)

DETECTOR CHARACTERISTICS

Five detector selections are available with the principal READING meter rms, average, true peak, Q-peak (per CCIR Rec 468-3), and S-peak (scaled peak to read rms with sinewaves) The LEVEL meter detector is rms only All detectors are linear with signal crest factors up to 7

Reading rate selection determines the sample time of the measurement, and minimum recommended frequency for specified accuracy/stability

Reading Rate	Sample time	Minimum frequency
"32/sec"	32 8 msec	50 Hz
"16/sec"	65 5 msec	30 Hz
"8/sec"	131 msec	20 Hz
"4/sec"	262 msec	10 Hz

Total measurement time is the sum of the sample time plus an additional 10 30 msec for data transfer and processing

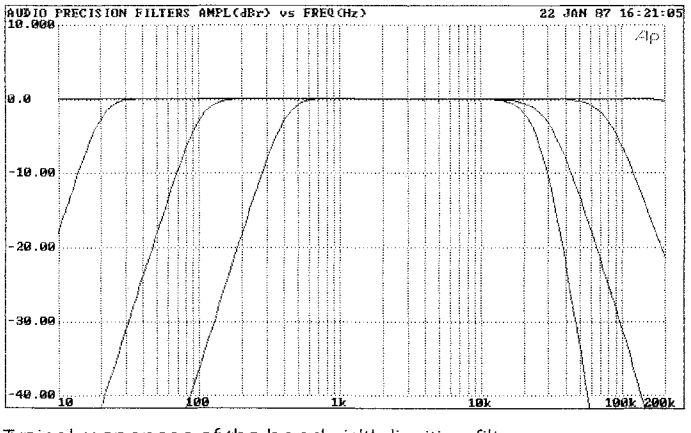
BANDWIDTH LIMITING FILTERS

Full measurement bandwidth is typically 4 Hz 600 kHz in the AMPLITUDE mode, 6 Hz 600 kHz in the THD+N and BANDREJECT modes Measurement bandwidth can be limited by independent high pass and low pass filters, or an external filter Up to five option filters may also be installed for weighted noise or other special measurements (see OPTION FILTERS)

High pass Filters	400 Hz ±5%, 3 pole Butterworth, 100 Hz ±5%, 3 pole Butterworth, 22 Hz, 3-pole within CCIR 468-3 limits for unweighted response
Low-pass Filters	80 kHz ±5%, 3-pole Butterworth; 30 kHz ±5%, 3-pole Butterworth; 22 kHz, 6-pole within CCIR 468-3 limits for unweighted response

External Filter Connections

Output	560 Ω ±5%, unbalanced. Maximum signal level is 700 mVpp (-10 dBu)
Input	1 Meg Ω ±5%, unbalanced. Protected up to 15 Vpeak overloads. Bandwidth is >200 kHz.



Typical responses of the bandwidth limiting filters.

MONITOR OUTPUTS

Channel A	Buffered version of channel A input signal following attenuation and/or pre amplification 3 Vpp maximum R_{out} = 560Ω ±5%
Channel B	Buffered version of channel B input signal following attenuation and/or pre amplification 3 Vpp maximum R_{out} = 560Ω ±5%
Reading Signal (Processed Signal)	Buffered version of the final (Processed Signal) signal presented to the detector stages following all filtering and additional gain stages 3 Vpp maximum R_{out} = 560 ohm ±5%

DUAL INPUT/PHASEMETER RELATED (SYS-22 AND SYS-02 CONFIGURATIONS ONLY)

SYS 22 and SYS 02 configurations add a second autoranging Channel B input and phasemeter enabling simultaneous measurement of both input amplitudes ratio or crosstalk All analyzer specifications valid for either input The 2 CHANNEL and 'CROSSTALK' measurement modes route the selected input channel through the main measurement path and the alternate (reference) channel to the LEVEL meter and frequency counter CROSSTALK mode additionally processes the selected input channel through the 1/3 octave bandpass filter automatically tuned to the reference channel frequency (or generator frequency)

PHASE MEASUREMENT

Ranges	±180° or 0-360° Phase rotations beyond -180/+360° can be accumulated during sweeps
Resolution	0.1° displayed. (Measurement quantization is 0.013° at "4/sec"; varying to 0.10° at "32/sec")
Accuracy[6]	±1°, 20 Hz-20 kHz; ±2°, 10 Hz-50 kHz

CROSSTALK/RATIO MEASUREMENT

Ratio Accuracy[7]	±0.1 dB, 20 Hz-20 kHz; ±0.2 dB, 10 Hz-120 kHz. (Typically 0.03 dB on same ranges)
Crosstalk Accuracy[7]	±0.7 dB, 20 Hz-120 kHz
Input Crosstalk (R_S <600 Ω)	The greater of:
10 Hz-20 kHz	-140 dB or 1 μV (-118 dBu)
20 kHz-100 kHz	-126 dB or 2.5 μV (-110 dBu)

[6]Both input signals between 10 mV-8 Vrms. Above 8 Vrms accuracy is ±1°, 20 Hz-5 kHz; ±2°, 10 Hz-20 kHz; ±3° to 50 kHz.

[7]Alternate channel signal must be ≥10 mV.

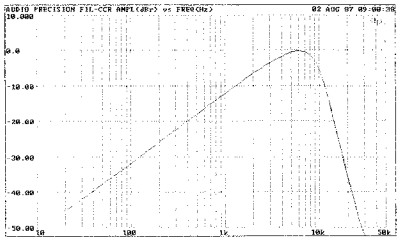
OPTION FILTERS FOR ANALYZER:

Up to five option filters can be installed in the System One analyzer for weighted noise or other special measurements. Option filters function with the principal READING meter, and can be enabled (one at a time) in series with the standard bandwidth limiting filters.

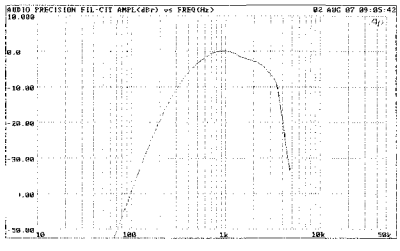
Contact Audio Precision for quotations concerning other possible filter designs. Custom designs may be constructed on the FIL-USR blank card. However please note that the system autoranging is based upon the peak value of the unfiltered signal and will limit the maximum useable dynamic range to approximately 50dB.

Contact Audio Precision or your Audio Precision distributor for complete specifications on option filters.

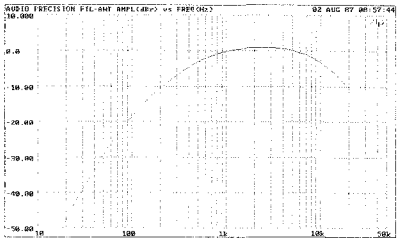
"CCIR" Weighting Filter (FIL-CCR)



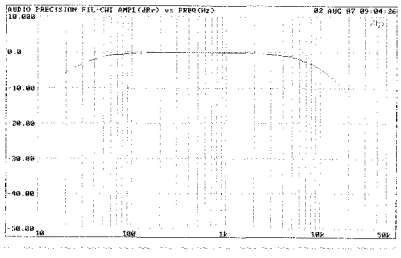
"CCITT" Weighting Filter (FIL-CIT)



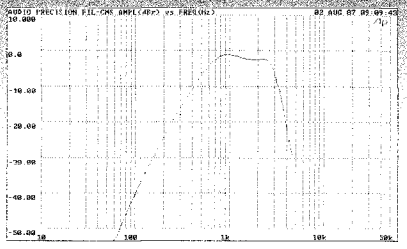
"A" Weighting Filter (FIL-AWT)



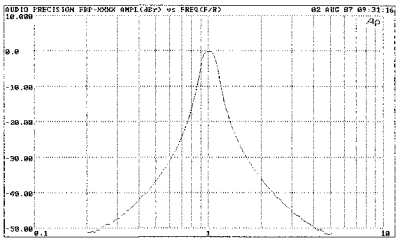
"C" Weighting Filter (FIL-CWT)



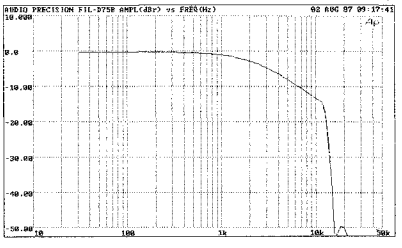
"C-Message" Weighting Filter (FIL-CMS)



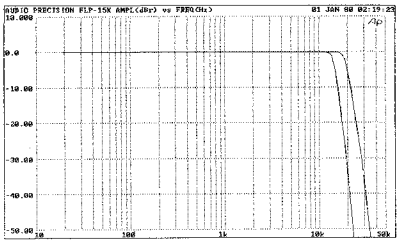
1/3-Octave Bandpass Filter (FBP-xxxxx)



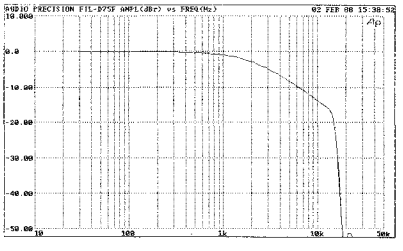
75 μsec De-Emphasis + 15.734 kHz Notch Filter (FIL-D75B)



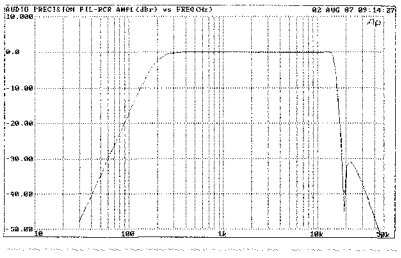
15 kHz and 20 kHz Precision Bandwidth Limiting Filters (FLP-20K or FLP-15K)



75 μsec De-Emphasis + 19.0 kHz Notch Filter (FIL-D75F)



200 Hz-15 kHz Receiver/Tuner Bandpass Filter (FIL-RCR)



INTERMODULATION DISTORTION OPTION, (IMD):

The IMD Option enables intermodulation distortion measurements to all three of the most popular methods SMPTE (or DIN), DIM (or TIM), and CCIF difference frequency IMD testing can reveal important forms of non-linearity that are not easy to detect with conventional THD/THD + N tests

The SMPTE test measures the amount of amplitude modulation of a high frequency tone caused by the presence of a relatively low frequency tone The SMPTE IMD test is extremely sensitive to frequency independent non-linearities such as non-ohmic connectors, A/D-D/A problems, and other simple transfer function deviations

The DIM (or "dynamic intermodulation") test measures non-linearities that can be provoked by the rapidly slewing portions of a combined sine-squarewave test signal This form of IMD is quite common in certain operational amplifiers and systems employing large amounts of negative feedback SMPTE and DIM are good complementary tests of feedback amplifiers because many designs will often trade off one form of distortion for the other Only the very best equipment exhibits simultaneously low SMPTE, DIM, and THD + N distortion factors

The CCIF difference frequency test measures the amount of 2nd-order (or difference frequency) distortion that is caused by two closely spaced high frequency test tones It is sensitive only to asymmetric forms of non-linearity and is an excellent test of transfer function symmetry

OPTION CONFIGURATION

The System One IMD option consists of two circuit boards. The analyzer option board (IMD-DIS) mounts to the DIS-1 distortion measurement module.The generator option board (IMD-GEN) mounts to the main generator module. It contains the SMPTE and CCIF IM-frequency generator and the DIM test signal squarewave generator. The main oscillator of the generator module provides the HF tone for SMPTE, probe tone for DIM, and the carrier (or center frequency) for CCIF signals.

GENERATOR RELATED SPECIFICATIONS

Test Signal Modes	SMPTE1:1, SMPTE4:1, CCIF, DIM-30, DIM-100, and DIM-B
Amplitude Range[1]	<70 μVpp to 75.40 Vpp
SMPTE LF Tone	Selectable 40, 50, 60, 100, 125, 250, or 500Hz, all ±2%
CCIF Difference Frequency	Selectable 80, 100, 120, 200, 250, 500, or 1kHz, all ±2%
DIM Squarewave	3.15kHz (DIM-30 and DIM-100) or 2.96kHz (DIM-B), ±1%. Squarewave is bandwidth limited with a 1-pole filter at 100kHz in DIM-100 mode and 30kHz in DIM-30/DIM-B modes.

[1]Balanced output mode only. Divide maximum amplitude by 2 (-6 dB) for unbalanced output mode. Amplitude is calibrated in Vpp. Other units are referenced to an equivalent sinewave with the same peak-peak amplitude.

ANALYZER RELATED SPECIFICATIONS

Minimum Input	10 mV
IMD Range	0-20%
Accuracy	±1 dB, for indicated IMD products
Residual IMD[2]	0 0018% SMPTE, 0 0020% DIM, 0 0005% CCIF
SMPTE Mode	
Test Signal Compatibility	40-500 Hz (LF) mixed with 3-200 kHz (HF), any ratio from 0 1 to 8 1 (LF HF)
IMD Measured[3]	40-500 Hz amplitude modulation products of the HF tone Measurement bandwidth is typically 30 Hz-700 Hz, however the tunable 1/3-octave bandpass filter may be used for improved sensitivity or analysis of individual products
DIM Mode	
Test Signal Compatibility	2 96-3 18 kHz squarewave mixed with 4-100 kHz sinewave, 4 1 peak-peak
IMD Measured[4]	All products in the 750 Hz-2 40 kHz band, expressed relative to the amplitude of the sinewave tone Measurement bandwidth is 400 Hz 2 45 kHz, however the tunable 1/3-octave bandpass filter may be used for improved senstitivity or analysis of individual products.
CCIF Mode	
Test Signal Compatibility	Two equal amplitude 4-200 kHz tones with 80 Hz-1 kHz separation.
IMD Measured[5]	Difference frequency product only, expressed relative to the amplitude of either test tone. Measurement bandwidth is always 1/3-octave.

[2]System specification including contributions from both generator and analyzer. Valid for inputs ≥200 mV and test signal frequencies to at least 20 kHz.

[3]Complies with SMPTE TH22.51 and DIN 45403.

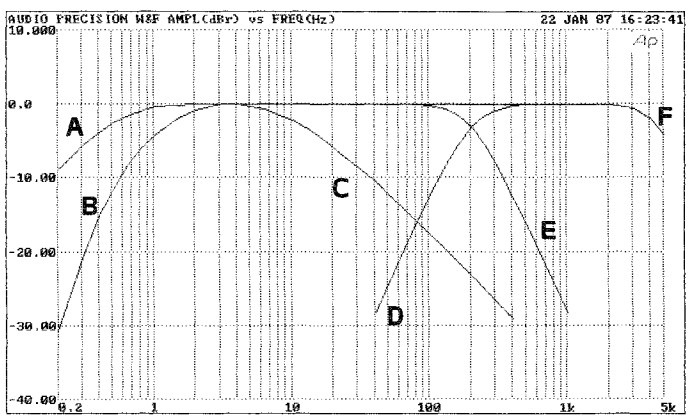
[4]Technique suggested by Paul Skritek of the Technical University —Vienna, Austria. For more information see "Simplified Measurement of Squarewave/Sine and Related Distortion Test Methods" by P.Skritek, a paper presented at the 1985 Audio Engineering Society convention in Hamburg, Germany (preprint 2195); and "Practical Extended Range DIM Measurements" by Bruce E. Hofer, a paper presented at the 1986 AES convention in Montreux, Switzerland (preprint 2334).

[5]Complies with IEC 268.3 and IHF A202 recommendations for the difference frequency product. Odd order IMD products are not measured.

WOW & FLUTTER ANALYZER OPTION, (W&F):

The Audio Precision Wow & Flutter Analyzer Option adds the capability to measure rotational wow & flutter in accordance with IEC 386, DIN 45507, CCIR 409-3, NAB, ANSI C16.5 (1971), JIS 5551 standards, and scrape flutter using the technique developed by Dale Manquen of Altair Electronics, Inc. (Thousand Oaks, California USA). Rotational wow & flutter is typically characterized by FM products in the 0.5-200 Hz range. Scrape flutter is caused by frictional effects of the tape sliding over guides or the tape heads and is characterized by FM products extending to 5 kHz, often peaking near 3 kHz.

To measure wow & flutter a pre-recorded test tone of 3.0 kHz or 3.15 kHz is played-back into System One, where it is routed to an FM discriminator located on the option board. The discriminator generates a signal proportional to instantaneous frequency deviation. It is passed through a weighting or bandwidth limiting filter before detection. All of the standards recommend the weighting curve "B-C" shown below. This provides measurements that correlate with the human ear's sensitivity to the various FM products. Unweighted measurements employ the response shown by curve "A-E" exhibiting a controlled bandwidth from approximately 0.5 Hz to 200 Hz.



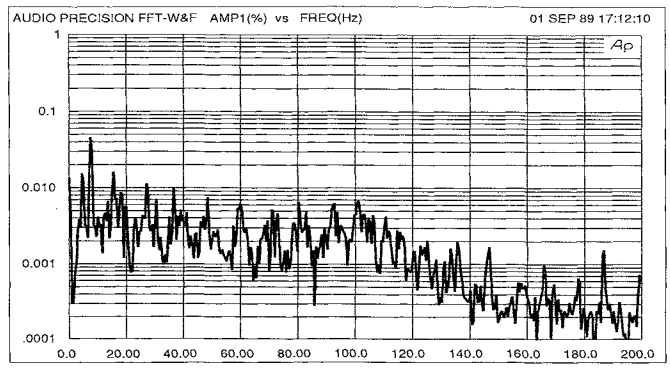
Wow & Flutter analyzer selectable responses. "B-C" is weighted, "A-E" is unweighted, "D-F" is scrape, and "A-F" is wideband. (Ideal response data graphed using standard System One software.)

Scrape flutter must be measured using a higher test tone frequency such as 12.5 kHz to permit the discrimination of FM products up to 5 kHz without aliasing. A slightly lower test frequency such as 10.0 kHz may be desirable when testing sharply bandwidth-limited systems such as video tape recorders (VTR's). The Audio Precision wow & flutter analyzer will accept any test signal frequency in the 10.0-13.0 kHz "high-band". Usable scrape flutter measurements can be made with test signals as low as 8.0 kHz, however aliasing of any FM products above 4 kHz will occur.

Scrape flutter is measured using the response selection "D-F" and is sensitive only to FM products above 200 Hz. Comparing the below-200 Hz and above-200 Hz FM contributions is a useful troubleshooting aide in servicing professional grade tape recorders. A good machine will exhibit similar readings for two different ranges. The wideband response selection "A-F" covering the entire 0.5 Hz to 5 kHz range permits a single rapid check of total flutter performance.

The standard Audio Precision System One software allows wow & flutter measurements to be displayed in three different formats: direct digital readout, "analog" bargraphs, or time sweeps for chart-recorder-like plots. Two parameters can be graphed simultaneously permitting both speed error (drift) and wow and flutter measurements on the same graph. Up to three different parameters can be displayed as bargraphs, for example, wow and flutter, speed error, and input level. The MAX and MIN hold features are useful in determining worst case readings over a time interval.

System One DSP configurations can perform FFT spectrum analysis of wow and flutter to 0.06 Hz resolution. The graphic cursor in the example below shows the frequency of the dominant component, from which the diameter of the defective part can be calculated.



SPECIFICATIONS

Configuration	Option circuit board mounting to the LVF-1 module.
Test Signal Compatibility	2.80 kHz-3.30 kHz, or 10.0 kHz-13.0 kHz ("high-band") for scrape flutter measurements)
Minimum Input	10 mV (-38 dBu)
Detection Modes	IEC/DIN, NAB, and JIS
Response Selections	
Weighted	4 Hz bandpass per IEC/DIN/NAB
Unweighted	0.5 Hz-200 Hz
Scrape[1]	200 Hz-5 kHz
Wideband[1]	0.5 Hz-5 kHz
Range	0 to 1%
Accuracy	±(5% of reading + 0.0005%)
Residual W&F	0.001% weighted; 0.002% unweighted; 0.005% scrape or wideband

Wow and flutter units selection includes %, dB, and PPM (parts-per-million) units with displayed resolutions of 0.0001%, 0.01 dB, or 0.1 PPM respectively. The design architecture features a single internal measurement range for optimum speed and rapid recovery from the transients associated with tape dropouts.

[1]Operational with "high-band" test signals of 10.0-13.0 kHz only. Upper -3 dB rolloff is typically 4.5 kHz using a 12.5 kHz test signal.

BURST NOISE-SQUAREWAVE OPTION, (BUR):

Option "BUR" adds burst, noise, and squarewave signal selections to the System One generator Typical applications include dynamic signal processor testing, absolute polarity testing, acoustic response measurements using noise, loudspeaker efficiency measurements, and investigating amplifier or transducer transient response

The tone bursts are generated by synchronously gating the generator main oscillator at zero crossings The number of ON cycles, repetition interval, and OFF level relative amplitude are all programmable The repetition interval can be expressed in total number of cycles, time, or bursts-per second A front panel input is additionally provided for triggering individual bursts or gating the sinewave from an external signal

Noise signals include white, pink, bandpass, and equalized bandpass All of the noise signals are based upon a digital white noise generator with a choice of pseudo-random (0 262 sec sequence length) or true random modes Both modes feature excellent conformity to the ideal Guassian distribution The white noise signal is lowpass filtered at 22 kHz to maximize its energy within the audio bandwidth The pink noise signal contains energy over an extended bandwidth of 10 Hz-200 kHz with -3 dB/octave response characteristic The bandpass noise signal is obtained by passing pink noise through a tunable 2-pole constant Q filter with approximately 1/3-octave bandwidth All noise signals may be gated via the front panel trigger/gate input

The squarewave signal is optimized for general purpose time domain testing of audio equipment It features a controlled 2 μsec risetime, very low energy content above 500 kHz, and excellent symmetry Even harmonic components are typically below 70 dB

TONE BURST SIGNAL

Frequency Range	20 Hz-100 kHz
Amplitude Range[1]	<70 μVpp-37 70 Vpp
ON Cycle Range	1-65534 cycles Programmable in cycles, sec, or %-ON
Interval Range	2-65535 cycles Programmable in cycles, sec, or Bursts/sec
"OFF" Amplitude Range and Accuracy	0 dB to <-60 dB, ±0 5 dB, 20 Hz-20 kHz

NOISE SIGNALS

Spectral Modes	
Pink	Bandwidth limited 10 Hz-200 kHz
White	Bandwidth limited 10 Hz 22 kHz
Bandpass	1/3 octave (2-pole) filtered pink noise, continuously tunable or sweepable, 20 Hz-100 kHz
Amplitude Range[1 2]	<70 μVpp-37 70 Vpp
Typical Crest Factor	4 1
Pseudo-random Cycle Time	0 262 sec, synchronized to the "4/sec" analyzer reading rate

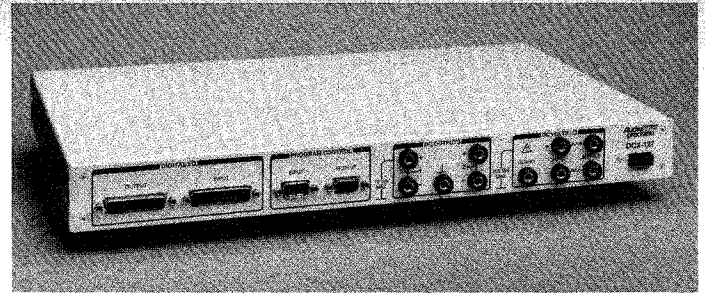
SQUAREWAVE SIGNAL

Frequency Range	20 Hz 20 kHz
Amplitude Range[1]	<70 μVpp 37 70 Vpp
Risetime	Typically 2 μsec

[1]Unloaded (open circuit). Divide maximum amplitude by 2 (-6 dB) for unbalanced or common-mode configurations. Amplitude is calibrated in Vpp. Other amplitude units are referenced to a sinewave with equivalent Vpp.

[2]Noise amplitude calibration is approximate only, and may be exceeded 0.01% of the time.

DCX-127 MULTI-FUNCTION MODULE:



The DCX-127 multi-function module contains an autoranging 4-1/2 digit voltmeter ohmmeter, two 20-bit programmable dc voltage sources, 21 bits of digital I/O, and three 8 bit program mable auxiliary output ports for device control or status indica tors Typical applications include A/D and D/A converter testing, VCA gain control linearity, VCA distortion, amplifier dc offset and power supply checks, power amplifier load switching control, loudspeaker voice coil resistance measurements, tem perature measurements and test fixture control

The meter features 200 mV 500 V and 200 Ω 2 MΩ ranges, fully floating and guarded for accurate measurements in the presence of large common mode voltages Resistance mea

surements can be made using either the 4-wire or 2-wire technique. Readings can be offset and scaled by the System One software.

The two independently programmable dc sources have a ±10.5 V bipolar range with 20 μV resolution and monotonicity to 40 μV (19 bits). Either dc source can be swept by the System One software.

The DCX-127 also contains a simplified 8-bit program control interface that can be defined to execute any pre-defined keystroke sequence. This can be used to run different software procedures based upon switch closures.

DC VOLTS MEASUREMENT RELATED

Accuracy[1]	6 rdg/sec	25 rdg/sec
200 mV range	0.05% + 0.03 mV	0.05% + 0.1 mV
2 V range	0.05% + 0.1 mV	0.05% + 1 mV
?0 V range	0.05% + 1 mV	0.05% + 10 mV
∠00 V range	0.05% + 10 mV	0.05% + 100 mV
500 V range	0.05% + 100 mV	0.05% + 1 V
Resolution		
200 mV-200 V ranges	0.005% of range	0.025% of range
500 V range	100 mV	500 mV
Input Resistance	10 MΩ, ±1% (all ranges)	
Common Mode Rejection	>120 dB, at dc and 50 Hz-20 kHz	
Common Mode Range	500 Vpeak	
Normal Mode Rejection	>60 dB, 50 Hz-60 Hz	

OHMS MEASUREMENT RELATED

Accuracy[1,2]	6 rdg/sec	25 rdg/sec
200 Ω range	0.05% + 0.04 Ω	0.05% + 0.1 Ω
2 kΩ range	0.05% + 0.2 Ω	0.05% + 1 Ω
20 kΩ range	0.05% + 1 Ω	0.05% + 10 Ω
200 kΩ range	0.05% + 10 Ω	0.05% + 100 Ω
? MΩ range[3]	0.15% + 100 Ω	0.15% + 1 kΩ
Resolution		
	0.005% of range	0.025% of range
Open Circuit Voltage	<6 Vdc	
Overload Protection	100 Vrms continuous, + to − Input; 40 Vrms, either Source to Input	

DC OUTPUT RELATED

Range	±10.500 Volts (bipolar output)
Resolution	20 μV (20 bits equivalent)
Accuracy[1,4]	±(0.05% + 0.2 mV), absolute; ±40 μV, relative to best fit line
Maximum Output Current	20 mA source; 10 mA sink
Residual Noise	<10 μV RMS, 10 Hz-80 kHz BW
Output Floating Characteristics	Electronically balanced to allow low output (-) terminal to float up to 2 Vpk. Common mode rejection is typically >54 dB (500:1)

PROGRAM CONTROL INPUT/OUTPUT

Input Configuration	8-bit parallel input. Input bits are software definable to execute any valid keystroke sequence. An 8-byte FIFO buffer allows asynchronous inputs
Output Configuration	
Pin 1	Delayed Gate. High-low transition occurs 50 msec to 12.75 sec (in 50 msec steps) after sweep start
Pin 2	Reset pulse, high during UTILITY RESTORE command or following power cycling to the DCX-127
Pin 3	2 msec pulse when data is settled
Pin 4	2 msec pulse at end of settling delay
Pin 6	Sweep Gate, low during sweeps
Pin 7	A/B Gate; high when LVF is measuring channel A
Connectors	9-pin D-subminiature

DIGITAL INPUT/OUTPUT RELATED

Configuration	22-bit (21 bits data + sign) words, plus data valid/new data strobes. 25-pin D-subminiature connectors.
Maximum data rate	Approximately 8 msec/transfer, limited by computer speed

AUXILIARY OUTPUT PORTS

Configuration	Three independent 8-bit parallel output ports. 9-pin female D-subminiature connectors

MISCELLANEOUS

All digital input/output is LSTTL/CMOS compatible. Outputs in series with 390Ω resistors. Input resistance typically 100 kΩ. Maximum rated input 0-5V. Output drive +5mA/bit maximum.

Dimensions	17" W, 1.75" H, 10.5" D
Operating temperature	+5°C to +40°C, <80% RH
Power requirements	100/120/220/240 Vac (+5/-10%); 48-63 Hz; 20 VA maximum

[1]Valid from +15°C to +30°C, <80% RH, for 1 year. Derate linearly to 2 times indicated values at +5°C and +40°C.

[2]With both 2-wire or 4-wire configurations. When using 4-wire configuration, lead resistance must be ≤1.5 Ohms.

[3]Full scale on the 2 MΩ range is 2.50 MΩ.

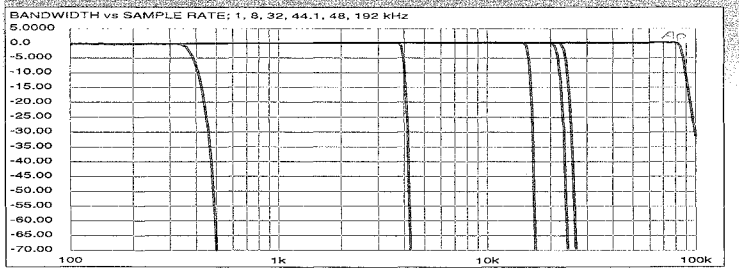
[4]Load current must be ≤1 mA for specified accuracy. Output resistance is typically <0.1 Ω.

DSP (Digital Signal Processing) capability within System One is available in two configurations—System One + DSP™ and System One Dual Domain.™

System One + DSP adds the functions of waveform display, FFT spectrum analysis, individual harmonic distortion analysis, and general purpose selective amplitude measurements for analog domain signals

System One Dual Domain offers these same features plus digital audio inputs and outputs in the professional AES EBU format, consumer SPDIFEIAJ format, and 24 bit parallel format Analysis capability in the digital domain includes wideband and selective amplitude, 2 channel amplitude, weighted or unweighted noise, THD + N, ratio, crosstalk, and frequency by techniques directly comparable to traditional analog analysis methods System One Dual Domain may thus stimulate and measure in any of the four possible combinations of analog and digital input and output

The specific function of the DSP module depends on DSP pro grams which are furnished on diskette and downloaded from the computer to the DSP module when desired Most DSP specifications are thus program dependent DSP program specifications follow the basic specifications



BASIC SPECIFICATIONS

PROCESSING Two or three 24 bit 25 MHz third generation digital signal processors

DATA MEMORY 32k x 24 bit (128k x 24 bit in System One Dual Domain or the MEM option). Actual data record length depends upon DSP program in use.

PROGRAM MEMORY 8k x 24 bit

ANALOG INPUT RELATED

Converters: Dual channel independent 16 bit

Sample rates: 192k (80 kHz analog bandwidth), 176.4k (80 kHz bandwidth), 48k (22 kHz bandwidth), 44.1k (20 kHz bandwidth), 32k (15 kHz bandwidth), or 1k sample/second (350 Hz bandwidth). See the figure for typical frequency response at each sample rate. Not all sample rates are available with all DSP programs.

Analog source: Selectable A-monitor output, B-monitor output, Reading monitor output (analyzer output), generator monitor output, or front panel dc-coupled fixed-sensitivity inputs.

	Direct Inputs	Input via Analog Analyzer
Amplitude range	2.00 Vrms full scale (2.828 Vpk)	300 μV to 160 V rms, autoranging
Accuracy, flatness	±0.25 dB dc-(0.45 x sample rate) at sample rates ≥8 kHz; for example, dc-20 kHz @ 44.1 kHz sample rate	±0.25 dB 20 Hz-(0.45 x sample rate) at sample rates ≥8 kHz; for example, 20 Hz-20 kHz @ 44.1 kHz sample rate

Worst-case harmonic or spurious product: −90 dB for in-band signals (<0.5 x sample rate); −60 dB for out-of-band signals

ANALOG OUTPUT RELATED

Converter: 16-bit, slaved to A/D sample rate.

Signal Routing: From front panel dc-coupled output, or through analog generator transformer-coupled output stage

Parallel I/O (System One Dual Domain only): 24 bit dual channel available on two 34 conductor connectors on rear panel (one for input, one for output). Channels are multiplexed on each connector. Data rates are selectable 32k, 44.1k, or 48k. Data strobe is included or may be externally supplied.

Serial I/O (System One Dual Domain only): Supports the full implementation of the AES/EBU digital interface. 20/24-bit data, parity, validity, and channel status bits are provided. The user bits are not supported. Electrically compatible with the Sony Philips Digital Interface (SPDIF) and EIAJ interface. The transmitter and receiver may operate at 32k, 44.1k, or 48k. The transmitter may be slaved to the received signal, internal clocks, or house synch.

PROGRAM DESCRIPTION AND SPECIFICATIONS

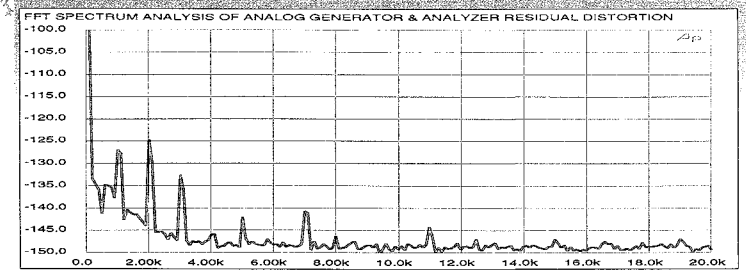
The function of the DSP module depends upon which DSP program is downloaded from computer disk to DSP unit Initially, four DSP programs are available HARMONIC DSP to perform individual harmonic analysis and other selective wave analyzer functions, FFTGEN DSP and FFTSLIDE DSP for waveform display (time domain) and spectrum analysis (frequency domain) via fast Fourier transform, and GENANLR DSP for generation and analysis of signals directly in the digital domain Only FFTGEN DSP and GENANLR DSP include sinewave generation capability

DIGITAL SINEWAVE GENERATOR SPECIFICATIONS (FFTGEN.DSP & GENANLR.DSP)

	Direct D-A Output	Through Analog Generator Output Stage	Digital Output
ÆQUENCY RELATED			
Range vs Sample Rate	10 Hz-15 kHz @ 32 kHz; 10 Hz-20.67 kHz @ 44.1 kHz; 10 Hz-22.5 kHz @ 48 kHz		
Resolution	(Sample Rate) /2^{24} (approx. 0.003 Hz @ 48 kHz rate)		
AMPLITUDE RELATED			
Range	Fixed, 2.00 Vrms maximum	26.66 Vrms to <25 μV rms (same as analog generator)	Full 24 bit amplitude range
Resolution	1/2^{16} (approx 30 μV)	<0.01 dB or 1.27 μV, whichever is greater	1 LSB (1/2^{24})
Flatness and Accuracy	±0.25 dB 20 Hz-20 kHz @ sample rate ≥44.1 kHz		unmeasurable
Units	%FS, dBFS (FS = digital full scale)	same as analog generator	%FS, dBFS (FS = digital full scale)
DISTORTION			
THD + N	≤0.01%		≤0.00003%FS
Worst harmonic/spurious signal	−90 dB for in-band signals (<0.5 x sample rate); −60 dB for out-of-band signals		≤0.00003%FS
TPUT RELATED			
Configuration	Unbalanced, single channel	BAL-UNBAL-CMTST; FLOAT-GROUND; A, B, A&B, A& − B (same as analog generator)	AES-EBU, SPDIF, or parallel; A, B, A&B
Source Impedance	560 Ω	50/150/600 Ω (same as analog generator)	110 Ω AES/EBU, 75 Ω SPDIF, 22 Ω parallel
DITHER			
Distribution	Triangular or rectangular probability distribution		
Amplitude		±16th bit	Selectable from ±1 LSB of 8 bit word through 24 bit word or OFF

FFTGEN.DSP AND FFTSLIDE.DSP SPECIFICATIONS

FFTGEN DSP and FFTSLIDE DSP are programs for acquisition of waveforms and either waveform display or fast Fourier transform and spectral display FFTGEN includes a digital sinewave generator function (specifications above), can average FFTs for noise reduction purposes, and has modest triggering capability when acquiring signals FFTSLIDE features more powerful and flexible triggering including pre-trigger, plus the ability to perform an FFT starting at any selected point in the stored signal Both permit high-resolution FFTs with up to 8,192 spectral lines (bins), providing resolution of about 3 Hz at the 48 kHz rate and 0 06 Hz at the 1 kHz rate for wow and flutter analysis



SPECTRUM AND WAVEFORM DISPLAY

RECORD LENGTH	FFTSLIDE.DSP	FFTGEN.DSP
Standard memory	8,192 samples/channel	4,096 samples/channel maximum
Duration @ 192 kHz	0.043 sec	0.021 sec
Duration @ 48 kHz	0.171 sec	0.085 sec
Duration @ 32 kHz	0.256 sec	0.128 sec
Duration @ 8 kHz	1.024 sec	0.512 sec
Duration @ 1 kHz	6.144 sec	4.096 sec
Maximum memory (MEM option or System One Dual Domain)	30,720 samples/channel	16,384 samples/channel maximum
Duration @ 192 kHz	0.160 sec	0.085 sec
Duration @ 48 kHz	0.640 sec	0.341 sec
Duration @ 32 kHz	0.960 sec	0.512 sec
Duration @ 8 kHz	3.840 sec	2.048 sec
Duration @ 1 kHz	24.576 sec	16.384 sec
TRIGGER RELATED		
Source	All analog or digital input sources, analog generator sync, power line	Channel 1 or 2 signal, which may be any analog or digital input source
Slope	+ or—	+
Pre-Trigger	Yes	No
FREQUENCY RESOLUTION	(Sample rate)/(FFT input data length); for example, 48 kHz sample rate and 16,384 samples gives 2.93 Hz resolution (bin width)	
SPECTRUM AVERAGING	No	1, 4, or 16x
AMPLITUDE RELATED	**Direct Inputs**	**Input via Analog Analyzer**
Accuracy, Flatness	Depends upon frequency separation of signal component from center of bin. Worst-case errors are 0.8 dB for BH4 window, 1.5 dB for Hann, and 4.5 dB for "flat" (no window)	
Units (%FS & dBFS also available for analysis of digital signals in Dual Domain units)	V, dBV, dBr, dBm, dBu, W	V, dBV, dBr, dBm, dBu, W, %, dB, PPM, X/Y
CHANNEL PHASE MATCH	±1 degree to 50 kHz	±2 degrees to 50 kHz
SPEED		
Signal Acquisition Time	see RECORD LENGTH/Duration above	
Transform, Windowing, and Magnitude Calculation	typically 600 msec for 16,384 samples; 165 msec for 4,096 samples; 50 msec for 1,024 samples	
Transfer to computer and display	depends on number of points plotted, computer processor type, clock rate, co-processor, type of display system. For 20 MHz 80386 with 80387 co-processor, color VGA, 512 points plotted, typical time is 2.2 seconds	

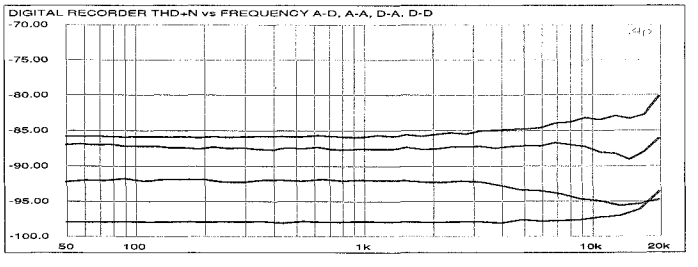
HARMONIC.DSP SPECIFICATIONS

HARMONIC DSP is a real-time program providing frequency-selective amplitude measurements of analog signals A tunable bandpass filter may be steered by a panel entry, by the analog generator frequency, or by the analog analyzer band pass-bandreject filter frequency Tuning can be directly at the steering source frequency, at the 2nd through 9th harmonic of that frequency, or offset by a user-entered value above or below that frequency A DSP implemented RMS detector follows the filter

Harmonic Analysis	**Direct Input**	**Input via Analog Analyzer**
AMPLITUDE RELATED		
Units	V, dBV, dBr, dBm, dBu, W	V, dBV, dBr, dBm, dBu, W, %, dB, PPM, X/Y
FREQUENCY RELATED	**Sample Rate ≤48 kHz**	**Sample Rate ≥176.4 kHz**
Range	10 Hz 21 77 kHz @ 48 kHz, 10 Hz 20 0 kHz @ 44 1 kHz, 10 Hz 14 5 kHz @ 32 kHz	10 Hz 80 kHz
Filter Shapes	1/8 octave (Q = 12, −3 dB BW 8% of center frequency) or 1/10 octave (Q = 15, −3 dB BW 6 7% of center frequency)	1/8 octave (Q = 12, −3 dB BW 8% of center frequency)
Filter Steering	Steering source software panel entry or analog generator frequency or analog analyzer BP/BR filter frequency Filter can track directly at source frequency, or at selectable harmonic 2 9 of source frequency, or at panel entered frequency offset above or below source frequency	

GENANLR.DSP SPECIFICATIONS

GENANLR.DSP is a real-time digital input/output program designed for use only with System One Dual Domain. It acquires digital-format audio data on two channels simultaneously, has two DSP-implemented RMS detectors, and offers a selection of filters including tunable bandpass, tunable bandreject, and A-weighting and CCIR weighting filters plus a quasi-peak detector for noise measurements. It thus emulates in the digital domain most of the common analog domain audio measurements.

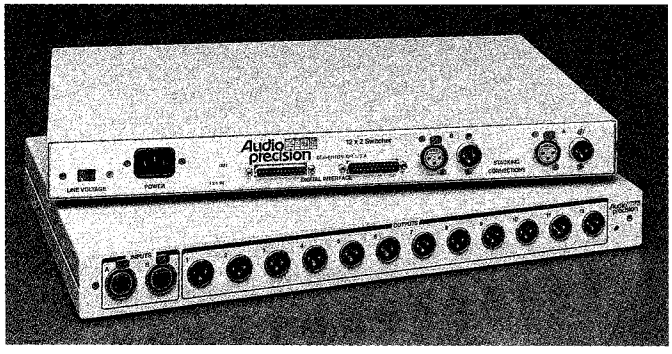


DIGITAL ANALYZER SPECIFICATIONS

INPUT FORMATS	**AES-EBU, SPDIF-EIAJ, Parallel. 2 channels, 24 bits**
LEVEL MEASUREMENT RELATED	
ıge	0 dBFS to −125 dBFS
Resolution	±0.01 dB
Accuracy & Flatness	±0.02 dB
Units	%FS, dBFS
FILTERED LEVEL MEASUREMENT RELATED	
Filter Shapes	Bandpass (Q = 15), bandreject, BR + 400 Hz HP, 400 Hz HP, A-weighting, CCIR weighting
Bandpass Frequency Range	0.04% to 40% of sample rate; for example, 20 Hz-19.2 kHz @ 48 kHz sample rate
Bandreject Frequency Range	0.1% to 40% of sample rate; for example, 50 Hz-19.2 kHz @ 48 kHz sample rate
Residual THD + N	−120 dB
Units	%FS, dBFS, BITS, dB (ref LEVEL measurement)
FREQUENCY MEASUREMENT RELATED	
Range	5 Hz to 40% of sample rate for rated accuracy
Resolution	Maximum of 0.003% of reading or 0.0001% of sample rate
Accuracy	0.01% of reading or 0.0001% at 4 readings/second

The SWR-122 line of audio switchers can connect System One to a wide variety of devices under test All connections to multi track recorders, routing switchers, distribution amplifiers, mix ing consoles, or multiple units may be made at one time and the complete device characterized without operator interven tion In production board test applications the switchers may be used to access multiple points in the circuit under test The Series 122 switcher family is available in four versions

- Input switcher with XLR connectors (SWR 122F)
- Output switcher with XLR connectors (SWR 122M)
- Patch point switcher with XLR connectors(SWR 122P)
- Connectorless, terminal strip version (SWR 122T) which can be configured in any of the above three functional types



All four of the Series 122 switchers use the same circuit board. They differ from one another in connector configuration and in attributes set by internal jumpers, which define them as an input switcher, output switcher, or a patch point switcher.

Each of the switchers is a 12 by 2 relay matrix. Either common point can be connected to any of the twelve selectable points. All the switchers are of balanced design but may be used with unbalanced circuits. Input switchers expand input channels above the two available in the dual channel System One. Output switchers expand output channels. Output switchers also permit measurement of worst-case crosstalk by driving all but one channel. System One may control up to 16 Input switchers (192 channels) and 16 Output switchers (192 channels).

The Patch-Point switcher is both an input and output switcher. The front panel has twelve 5-pin XLR connectors plus one connector each for the System One generator output and analyzer input. The Patch-Point switcher is designed for insertion between the output of one stage or device and the input of the following stage or device. When a channel is not selected, the device connections are looped through the switcher and no connections are made to System One. When an input channel is selected, the analyzer is bridged across the signal at that point. If a channel is selected as an output, the "normalled through" connection will be broken. The System One generator can then drive the input of the following stage or device, and the analyzer can measure the unloaded output of the preceding stage.Multiple points in a signal chain can be wired through the Patch-Point switcher and measurements can be made of any portion of the chain, under program control. A simplified diagram of the Patch-Point switcher is shown in the figure 2. Although a Patch-Point occupies both input and output spaces in the System One program, it may be configured for either Channel A or Channel B operation. This allows two Patch-Point switchers to replace an input and an Output switcher.

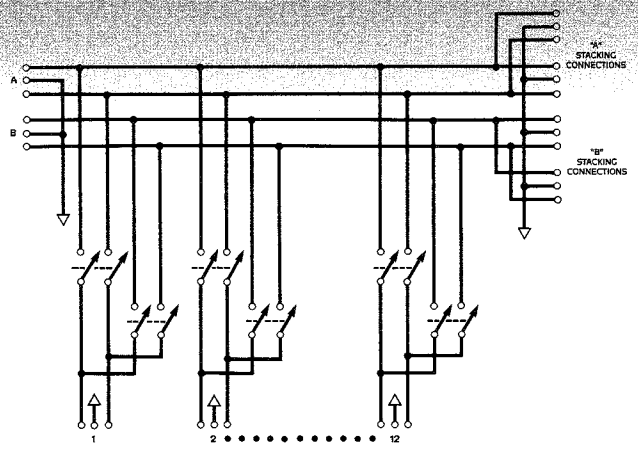


Figure 1. Simplified diagram of input or output versions.

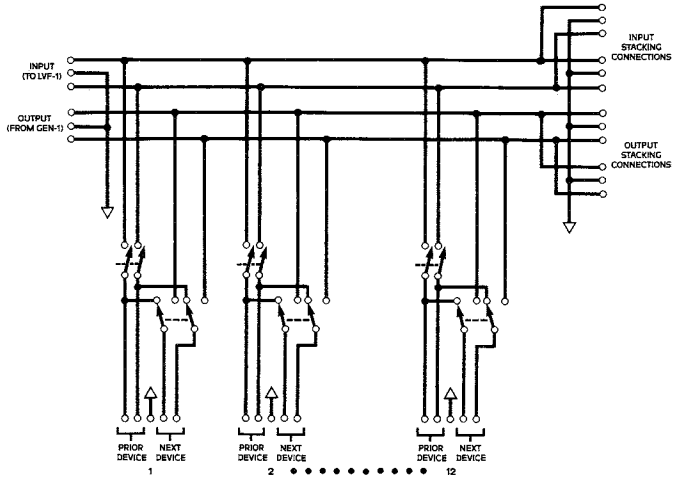


Figure 2. Simplified diagram of Patch Point version.

SPECIFICATIONS

Max Signal Rating	200 V peak; relay contacts rated to switch up to 60 Watts or 2 Amperes
Crosstalk[1]	-134 dB to 20 kHz; -120 dB to 100 kHz
Series Resistance	0.5 Ω per side
Shunting Capacitance	Typically 90 pF each side to ground; 80 pF balanced
Dimensions	17" W x 1.75" H x 10.5" D; mounts within standard rack unit with supplied brackets
Temperature Range	+5°C to +40°C, operating
Power Requirements	90-126 or 180-250 Vac, 48-63 Hz; 12 VA max

[1]Measured between any two channels with 600 Ω or lower source/load resistance on the measured channel. The crosstalk from the interrupted input to output on the the patch-point switcher is typically 70 dB to 20 kHz.

SYSTEM ORDERING INFORMATION:

System One nomenclature consists of the letters SYS, two or three digits, and the letter A, S, or G The last two digits describe the number of audio outputs and inputs For example, an SYS-22 has two generator outputs and two analyzer inputs The 200 series (SYS-222, etc) features DSP capability for waveform display, FFT spectrum analysis, and individual harmonic analysis The 300 series (SYS-322, etc) adds digital audio input-output capability to the 200 series features "A" describes the IBM-PC-compatible version which communicates with the PC over the Audio Precision Interface Bus (APIB) via a furnished interface card plugged into an expansion slot "S", also PC compatible, is the serial version requiring only an RS-232 port describes the GPIB (IEEE-488) version "S" and "G" versions also have APIB ports, but are not supplied with interface cards

IMD option adds an IMD generator and IMD analyzer
W&F option adds the Wow & Flutter analyzer
BUR option adds the tone burst, square wave, noise generator

To operate the "A" version from the IBM PS/2 microchannel bus, specify the ***MICRO-CH*** option which replaces the PCI-2 with the PCI-3 card SWR-122 switcher modules and the DCX-127 multifunction module, when used with an A version, connect in "daisy chain" fashion with System One from the interface card in the PC When SWR-122 and DCX-127 modules are used with an S or G version, they connect to the SYS unit via the Audio Precision Interface Bus The SYS unit is then controlled via either RS-232 (S version) or IEEE-488 (G version)

SOFTWARE COMPATIBILITY

The A version is normally controlled from the panel-menu graphic display software (S1 EXE) described throughout this brochure; the S version must be controlled from S1.EXE. The G version is normally controlled from an IEEE-488 controller via user-written software, using the extensive command set furnished

For specialized applications over ***the Audio Precision Interface Bus***, the user may write custom software in the C or BASIC languages The LIB-MIX function library augments those languages with over 160 functions providing complete control of System One hardware LIB-MIX is compatible with Microsoft C 5, Microsoft QuickC 1 0, Microsoft QuickBASIC 4 0, and Lattice C 3

SYS

11 Single output, single input
22 Dual output, dual input
20 Dual output, no analyzer
02 No generator, dual input
202 System One + DSP analyzer only
222 System One + DSP dual channel
302 System One Dual Domain, analyzer only
322 System One Dual Domain, dual channel

A PC version with interface card
S PC RS-232 version
G IEEE-488 version

	PCI CARD	INTFC CABLE	S1.EXE S/W	APIB PORT	RS-232 PORT	IEEE-488 PORT
A version	YES	YES	YES	YES	NO	NO
S version	NO	NO	YES	YES	YES	NO
G version	NO	NO	NO	YES	NO	YES

COMPUTER REQUIREMENTS:

System One operates with IBM-PC, XT, AT, and PS/2 computers and compatibles, running under DOS 3.1 or later These computers are generally based on 8088, 8086, 80286, or 80386 microprocessors System One is in daily use with dozens of different brands of compatibles including Compaq, Olivetti, AT&T, Dell, Zenith, Tandy, and many "clones"

640 kbytes memory size is required System One is compatible with any clock rate in the host PC Faster testing results from computers with more powerful processors and faster clock rates An AT-compatible or faster is recommended for FFT and waveform display with System One DSP units A math co-processor (8087, 80287, etc) is strongly recommended, especially with the less powerful computers

DISPLAY SYSTEMS

System One software supports the full resolution of VGA, CGA, and Hercules high resolution monochrome display systems Portable computers are rec ommended for field and portable use Desktop units typically provide larger screens, color screens, and more expansion slots when portability is not a factor

DISK STORAGE

System One will operate with disk drive configurations as minimal as one diskette, but is more convenient with two diskette drives or a fixed (hard) disk A typical test setup with data stores in less than 2 kbytes of disk space. A hard disk is recommended for saving waveforms from System One DSP units

PRINTERS

System One's graphic hard copy capability, at screen resolution, is com patible with Epson FX compatible dot matrix printers and HP LaserJet printers High resolution graphic hard copy is available to HPGL plotters, suitably interfaced HP LaserJet printers, and PostScript laser printers such as the Apple LaserWriter

THE PEOPLE

Audio Precision team members are active contributors to the technical advancement of the audio industry Contributions include technical papers presented at Conventions of the Audio Engineering Society, Society of Broad cast Engineers, National Association of Broadcasters, SMPTE, Central Canadian Broadcast Engineers, and International Congress on Acoustics, plus seminars and presentations at numerous chap ter meetings of the AES, SMPTE, and SBE Articles by Audio Precision staff appear frequently in publications including The Journal of the Audio Engineering Society, Broadcast Engineering, Studio Sound, Sound & Video Contractor, Recording Engineer/ Producer, TV Technology, and Radio World

Audio Precision was formed in 1984 by four former Tektronix engineers and managers who had developed two generations of high technology audio test equipment for Tek.

THE MISSION

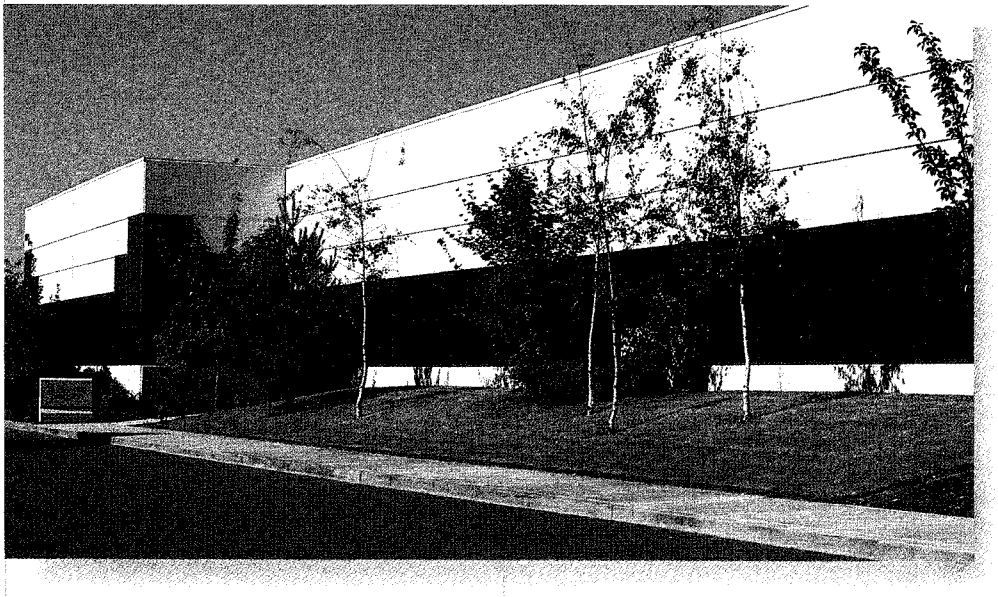
Audio Precision's mission is "to be the International technology and quality leader in the audio test equipment field". System One has brought automated testing to hundreds of companies where it was previously excluded due to the large investment required in programming or the inadequate performance levels previously available. Audio Precision is uniquely positioned by technical talents, experience, and size to serve the world's audio testing needs.

TODAY'S PROBLEMS

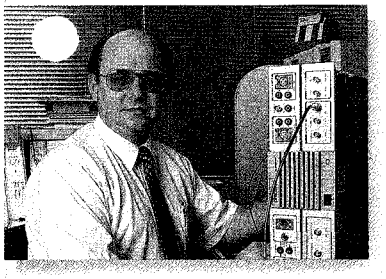
Many audio workers still make measurements with equipment so laborious in setup and operation that they can't do as much testing as they would like. Many use test instruments whose specifications are exceeded by much of the equipment they measure. Many need to test both digital and analog audio equipment, but lack digital audio test instruments. Many still prepare test results with laborious hand techniques of point by point plotting on graph paper.

AUDIO PRECISION'S APPROACH

The Audio Precision team focuses purely on audio testing applications. Extensive use of computer modeling and analysis expands productivity and ensures stable, reliable products. All the design team are broadly experienced in both analog and digital design, and both hardware and software solutions. The results are optimum, balanced designs with intelligent tradeoffs. Audio Precision is committed to product quality, reliability, and usability under real-world conditions.

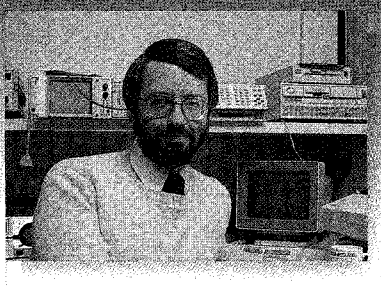


Bob Metzler, President. B.S. Physics, U. of Louisville; M.B.A., U. of Portland. 11 years at Tektronix, principally as Marketing Manager of TM 500 and TM 5000 instrumentation lines which included Tek's audio test equipment products. Author of numerous articles and applications notes. Member, AES.

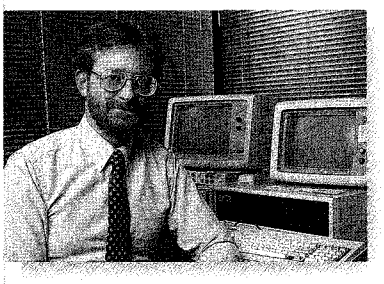


Bruce Hofer, Vice-President/Principal Engineer. B.S.E.E., Oregon State University. 15 years at Tektronix; program manager and contributing design engineer for all audio test instruments and programmable power supplies. Design engineer on timebases for 7000 series oscilloscopes. Eleven patents. Numerous publications and presentations. Member, AES and American Scientific Affiliation.

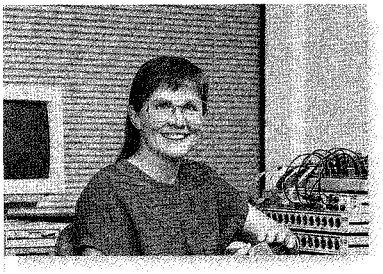
Tom Mintner, Director of Sales & Marketing, U.S.A. B.Mus., Northwestern University; followed by fellowship and professional staff position at University of Iowa for diverse recording and Art & Technology projects including laser image projection systems. Active for 20 years as professional recording engineer; as well as in applications engineering, sales and management positions with Neve and Studer. Member, AES and the National Academy of Recording Arts & Sciences.



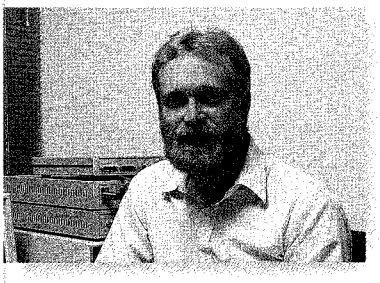
Dr. Richard Cabot, Vice-President/ Principal Engineer. B.S.E.E., M.Eng., M.S. Mech, Ph.D.E.E., all from Rensselaer Polytechnic Institute. Registered Professional Engineer. Six years at Tektronix as project/design engineer on audio test instruments. Author of over 35 papers/ presentations. Six patents. Fellow of AES, senior member IEEE, member Acoustical Society of America. International Regional VP of AES, member AES Journal Review Board, Chairman of AES Subcommittee on Digital Audio Measurement.



Robert Wright, Vice-President/ Software Engineering. A.S. Computer Technology, American River College. Additional studies at Case Western Reserve Universities and University of Portland. 6 years at Tektronix; project leader for AA5001 Programmable Distortion Analyzer. Programming experience under UNIX and MSDOS, and in many high level and microprocessor assembly languages. One patent pending. Member, AES, ACM.

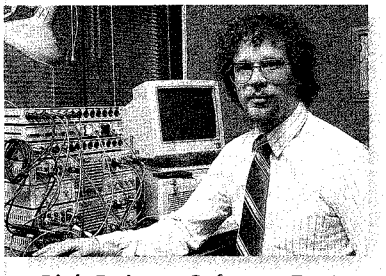


Debra Brimacombe, Applications Engineer. 2 years of university work towards a B.S.E.E. degree. 10 years experience in AM & FM commercial broadcasting including Assistant and Chief Engineer positions. Experienced in all phases of broadcast maintenance including proof-of-performance measurements and tape recorder alignment. Licensed amateur radio operator.



Carl Hovey, Software Engineer. B.S.E.E. and M.S.E.E., Washington State University. 9 years experience at Tektronix, including firmware design for Programmable Distortion Analyzer. Designed architecture and hardware for 32 bit microprocessor emulator. Designed polyphonic keyboard synthesizer as thesis project. Member, AES.

Tony Dal Molin, Operations Manager (Manufacturing, Materials, Quality Control). B.S.E.E., Massachusetts Institute of Technology. 11 years experience in circuit design, manufacturing, quality assurance, installations for Biamp Systems, Neptune Electronics, Sundholm Electronics. Developed pro audio signal processing, sound reinforcement, recording equipment. Member, AES and IEEE.

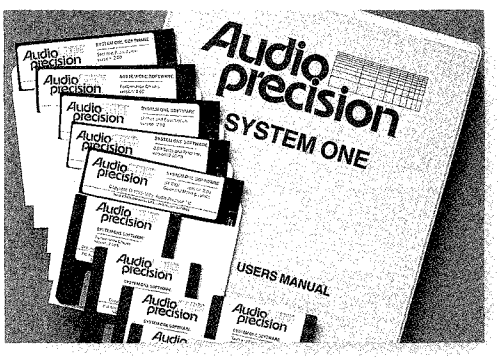


Rick Swimm, Software Engineer, B.S.C.S.E.T. Oregon Institute of Technology. Six years experience at Tektronix designing firmware of programmable signal generator, firmware and hardware on test interface product. Member, AES and ACM.

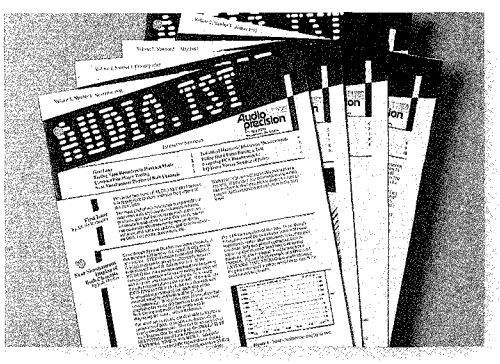
Test equipment is normally purchased for an expected lifetime of 7-10 years or more. After-sale support is an important part of the product.

OPERATING AND APPLICATIONS SUPPORT

The System One User's Manual is a 300-page-plus document describing operation from initial installation through sophisticated applications. The User's Manual is thoroughly indexed and illustrated.

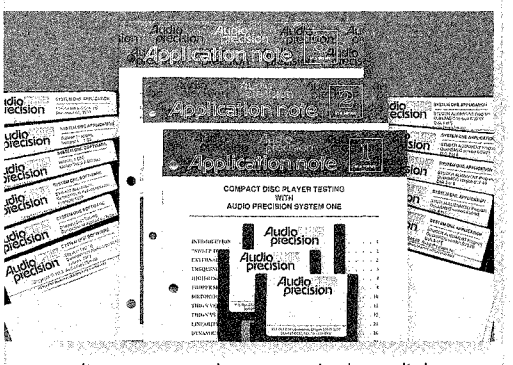


Each System One is shipped with diskettes of sample tests, procedures, and other useful software. These tests can be used to begin automated testing instantly. They can be modified as desired to fit your specific needs.



Audio Precision regularly publishes the AUDIO.TST newsletter. This newsletter contains articles on new testing techniques, describes new hardware and software products and features, and lists new literature. It offers a forum to share testing ideas as users and Audio Precision discover new ways to exploit the capabilities of System One.

Applications notes are in-depth discussions of how to use System One for particular types of measurement. They frequently have companion diskettes of prepared tests and procedures. Notes on compact disk player testing and loudspeaker testing are available. Other applications notes are planned on topics including analog tape machine testing, digital recorder testing, tape media testing, and acoustical tests.



Applications packages include a diskette of specialized software and may include specialized hardware. Examples include packages for BTSC (U.S. stereo tv standard) system testing and FM stereo broadcast equipment testing.

Audio Precision and its International distributors have experienced applications engineers standing by for consultation. Audio Precision can be quickly reached by telephone (toll-free number available within the U.S.), FAX, or telex. A growing library of software utilities supplements built-in computational features of System One software. These utilities can be run manually or automatically, as part of a procedure. Utilities perform tasks such as calculating group delay, calculating linearity of a Compact Disc player, combining selected data from different tests in order to graph desired functions versus one another, finding maximum or minimum values of a test run, averaging data and generating limit files offset from the average, etc.

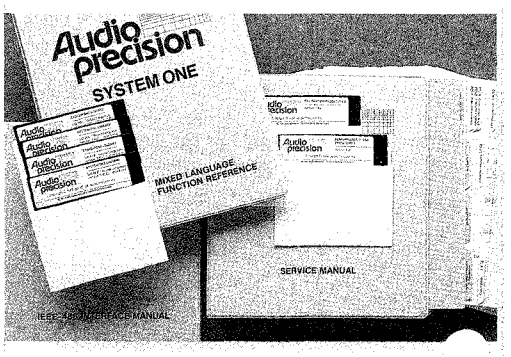
SOFTWARE UPGRADES

Free software upgrades, consisting of new diskettes and a new User's Manual, are furnished to all customers each time the software is revised.

Most of today's key features have thus become available even to customers who purchased the very first units in 1985. Examples of powerful capabilities added by software upgrades include VGA and EGA display support, high-resolution printout via plotters and laser printers, sub-procedures, user-created test menus, generator equalization, regulation mode, stereo sweep modes, nested sweeps, X-Y display of two measured parameters, bandpass sweeps (spectrum analysis), overlay capability (parameter passing from test to test), remote control capability, polarity test mode, improved control of data settling, data subtraction capability (analyzer equalization), computation of deviation from perfect linearity, data smoothing, 2sigma computation for wow and flutter, and appending data from multiple tests.

PRODUCT REPAIR AND CALIBRATION

Audio Precision warrants its hardware, software, and firmware products for three years against defects in materials and workmanship. Audio Precision will, at its option, repair or replace products which prove to be defective during the period. The foregoing warranty is exclusive and no other warranty shall be made by Audio Precision whether express or implied. This warranty is subject to certain limitations and restrictions set forth in Audio Precision's terms and conditions of sale which will be furnished to customers at time of quotation or sale.



An Extended Warranty Policy is available within the U.S. to continue warranty coverage for an additional three-year period; similar plans may be available from Audio Precision International Distributors. An extensive service manual can be purchased. This manual includes schematic diagrams, parts lists, exploded mechanical views, parts location diagrams, discussions of theory of operation, and calibration procedures. It also includes a calibration procedure diskette, which prompts a technician through complete adjustments of System One with on-screen drawings of test point and adjustment locations and bargraph displays for adjustments.

Standard tests and procedures furnished with all systems include a quick performance check which can be run as desired for an indication that System One is performing properly.

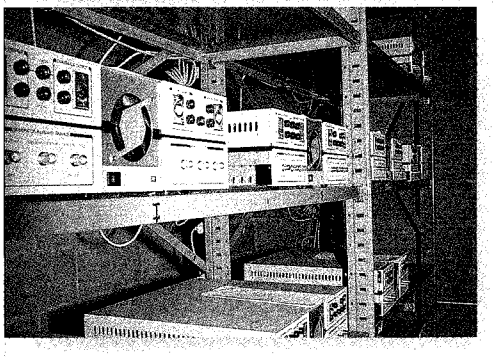
QUALITY:

COMPONENT QUALITY

Audio Precision products are designed around high quality components including low-noise integrated circuits, high stability mica and polypropylene dielectric capacitors, precision film resistors, and ultra-high-reliability relays with bifurcated, gold-plated contacts of good wiping action sealed in a dry nitrogen atmosphere A custom Jensen transformer is used in the generator MDACs (multiplying digital-to-analog converters) linearized by a patented technique are used as variable control elements, rather than drift-prone temperature-sensitive light dependent resistors or distortion-introducing analog multipliers used in other designs

QUALITY ASSURANCE

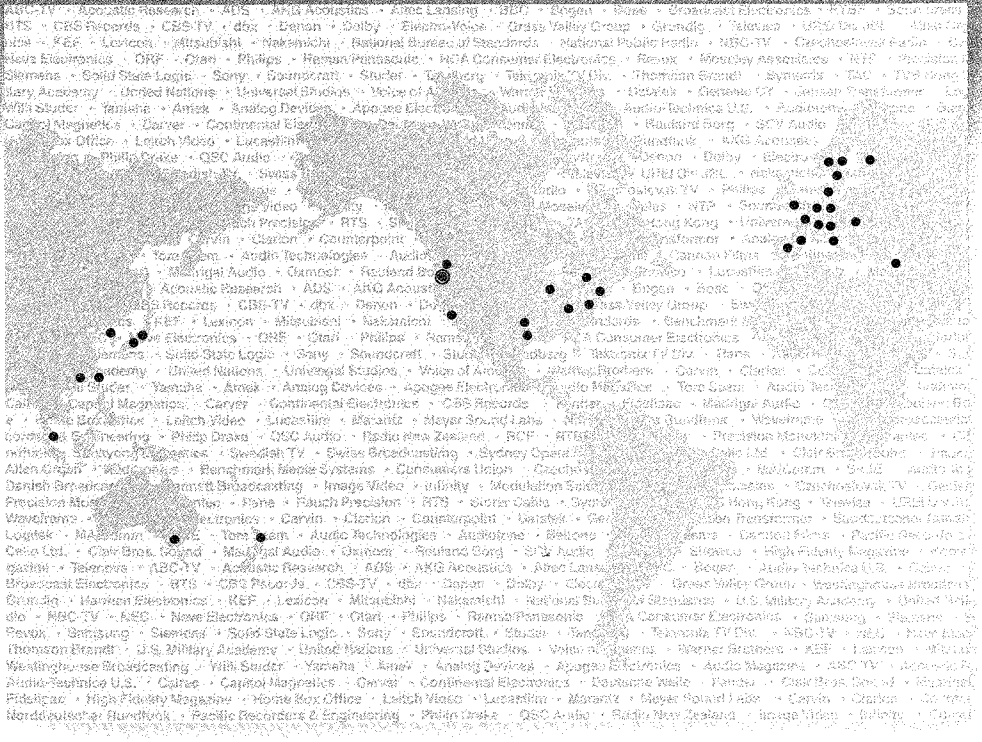
Raw circuit boards are continuity-tested Completed circuit boards are functionally tested before assembly into units. Newly-assembled units are again tested and pre-calibrated. A 7-day burn-in follows at a temperature of 50 degrees Celsius Power is cycled at one hour intervals during this period This burn-in locates "infant mortality" problems while the unit is still at Audio Precision, rather than in the customer's hands Units are then fully calibrated using computer-assisted programs similar to the calibration process furnished with the Service Manual Accuracy of the test instruments used is traceable to the U S National Bureau of Standards Each unit then goes through a completely automated test procedure which, on a fully-optioned system, consists of over 1,500 measurements Every measurement is compared to Audio Precision's internal specifications, which in most cases are tighter than the specifications published in this brochure The results of every measurement are stored on disk for each unit

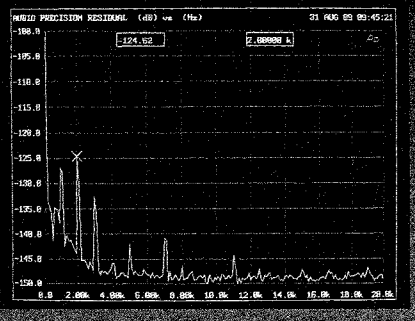


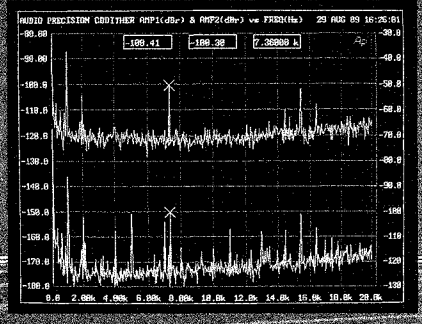
WORLD-WIDE SERVICE NETWORK:

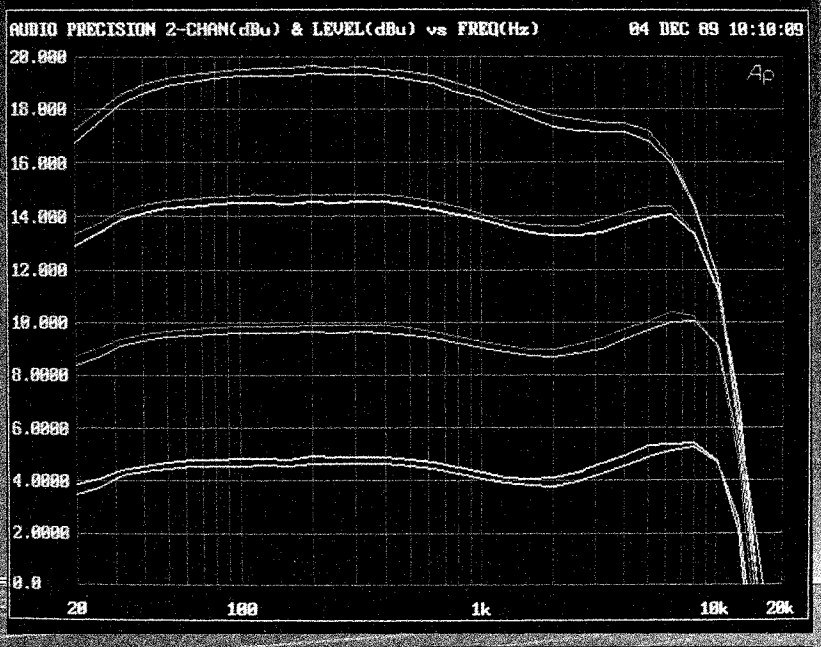
From its original conception, System One was designed for world markets Filters, impedances, detector responses, units of measure, and other requirements of European and Japanese standards were given equal weight to U S methods One half of System One sales have consistently been outside the U S

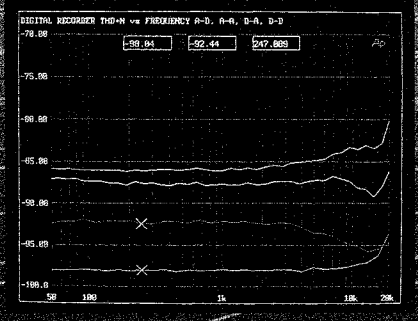
Audio Precision distributors with trained Sales Engineers, demonstrator instruments, and service facilities are located in 23 countries System One is currently in use in over 30 countries

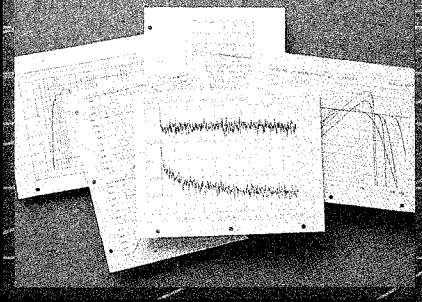


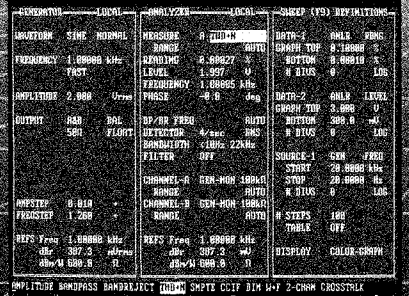


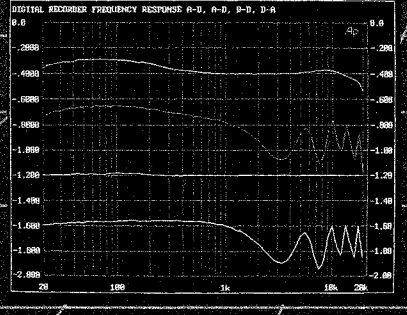












Audio precision

CMD: RUN PANEL LOAD SAVE APPEND EDIT HELP XDOS DOS NAMES IF UTIL QUIT COMPUTE :

Run procedure, test, or graphs

AUDIO PRECISION SYSTEM ONE, v 2.00

Audio Precision, Inc.
P.O. Box 2209
Beaverton, Oregon 97075-3070
503-627-0832 1-800-231-7350
TELEX: 283957 AUDIO UR FAX: 503-641-8906