Audio precision®

Testing for Optimal Results

System Two Cascade Plus

Audio Test and Measurement System

Unmatched Performance

Turn on High Performance Testing with System Two Cascade Plus

Audio Precision's System Two Cascade *Plus*, a PC-controlled audio test and measurement system, is the newest generation of the company's award-winning System Two. Already the recognized worldwide standard for design and test of audio equipment, Cascade *Plus* brings the improved distortion and noise specifications required to test the latest advances in converter technology.

True Dual Domain architecture provides uncompromised performance for both analog and digital signals, and the DSP-based analysis techniques offer a wide array of high speed, precise measurements.

- **Unparalleled Precision**
- **PC-Control and Programmability**
- **Unparalleled Speed**
- **Comprehensive Digital Interface Testing**
- **Flexible Configuration Options**

System Two Cascade *Plus*. Proven, reliable, high performance from the industry's preeminent audio test and measurement company.

Unparalleled Precision

Low Distortion

Analog System THD+N 20kHz BW **-112dB**
Typical worst case harmonic **< -130dB**
Digital Distortion/Spurious Products **-160dB**

High Analog Bandwidth

Signal generation to **200kHz**
Measurements to **500kHz**
FFTs and Multitone analysis to **120kHz**

Low Noise

22–22kHz **< -118dBu**
A-weighted **< -124dBu**

Flat Response

20–20kHz typically **±0.003dB**

Low Crosstalk

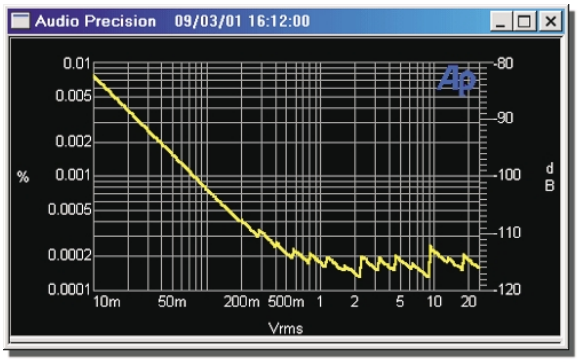
Input **< -140dB**
Output **< -120dB**

Low Jitter

Generator **< 0.8ns**
Analyzer **< 1.6ns**

FFT Acquisitions

up to **4MSamples** (> 1 minute @48kHz)



Analog System THD+N 20kHz BW -112dB

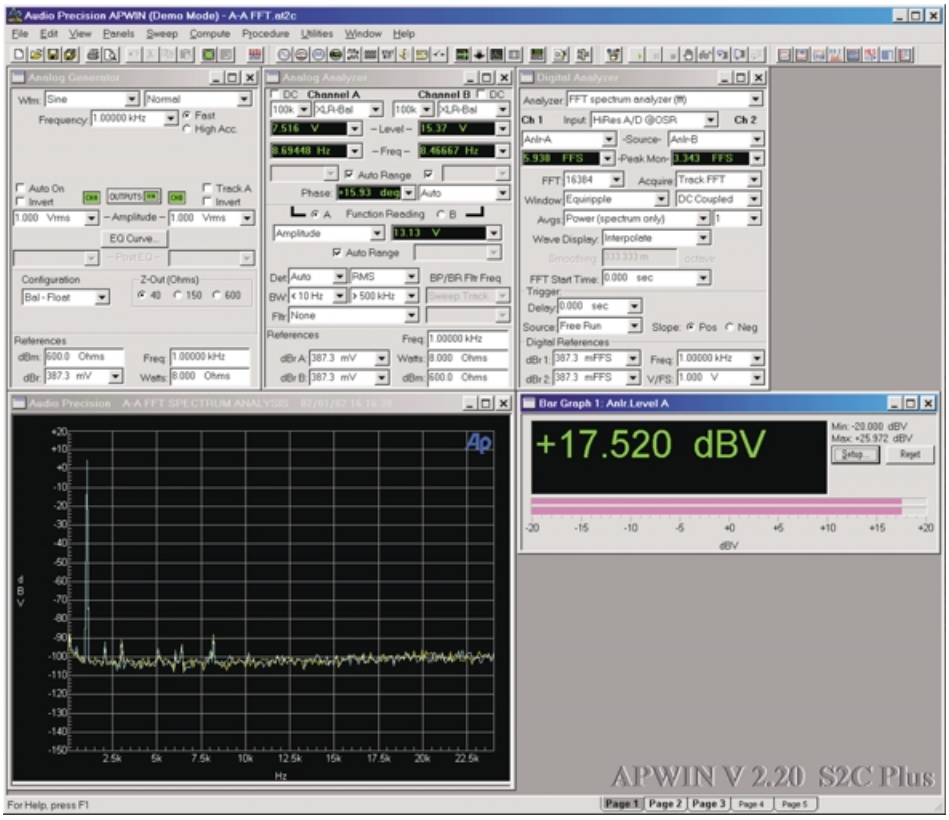
Optional Carrying Handle Shown

PC Control and Programmability: APWIN

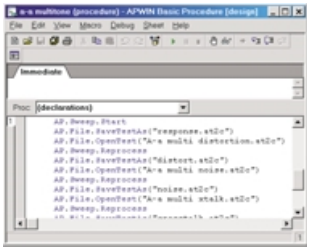
APWIN is a comprehensive PC-based real-time interface for control and display of System Two Cascade *Plus*, and a development system for automated audio testing.

Operating on all Windows® Operating Systems, it provides a graphical user interface capable of generating a wide variety of test signals, displaying readings, graphs, and data tables, storing setups and test data, and comparing data to test limits.

The flexible panel-based architecture offers the configurability to address a wide range of uses from benchtop engineering to automated production test.



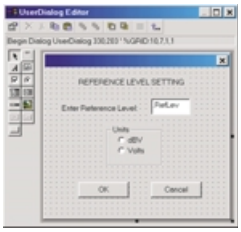
- **APWIN includes advanced programming capabilities for complete control of the instrument and the user interface via OLE. The fully functioned BASIC programming language supports complex, branched test procedures as well as simpler step-by-step routines.**



Procedure Editor facilitates procedure creation and verification including step and trace mode.

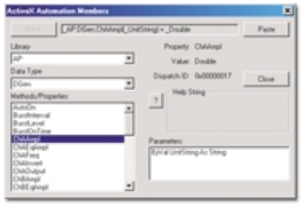
- **Learn Mode provides a fast and convenient way to generate automated test procedures without any programming experience.**

- **The graphical dialog editor enables drag and drop design of custom user interfaces with seamless integration into the BASIC procedure editor.**



AP Basic Dialog Editor allows creation of professional user interface panels within procedures.

- **The complete OLE command structure is accessible to Visual Basic®, enabling the programmer to integrate System Two Cascade *Plus* with a wide variety of other equipment and applications.**



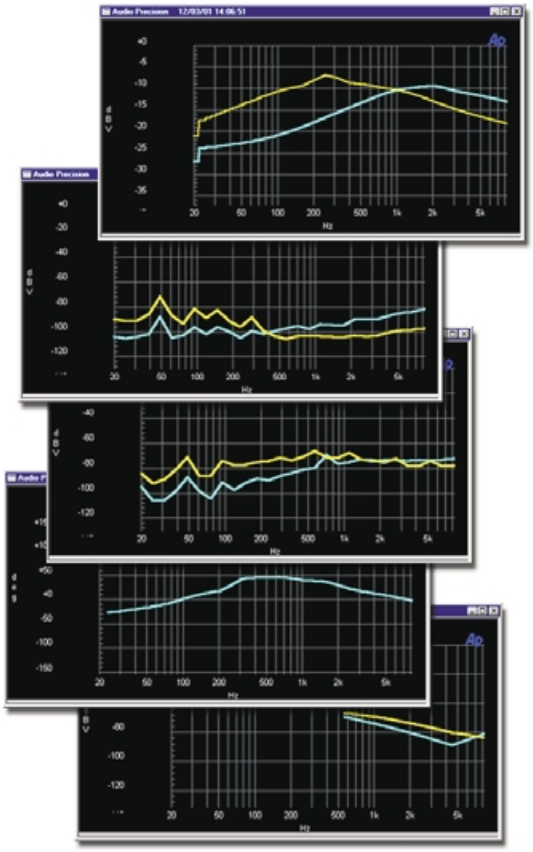
Convenient Object Browser assists integration of commands and correct syntax within macros

- **APWIN conforms to the standards of Microsoft Windows®, allowing graphs and data to be directly pasted in applications like Word and Excel.**
- **Test setups, test data, and graphs can be exchanged with co-workers by email to quickly duplicate test results, study test data, or publish reports regardless of location.**
- **The GPIB option offers an IEEE-488 interface for compatibility with other automated test instruments.**

Unparalleled Speed

System Two Cascade *Plus* offers an array of powerful, time-saving tools to speed your testing requirements.

Synchronous Multitone Testing provides response, distortion, noise, crosstalk, and phase measurements from a single sub-second acquisition. The program material-like multi-sinewave stimulus can be tailored to a wide variety of high speed testing applications, and the synchronous analysis provides the necessary selectivity to measure low frequencies and noise in the presence of signal.



Example of five dual-channel parameters versus frequency produced from a single under-one-second multitone test signal.

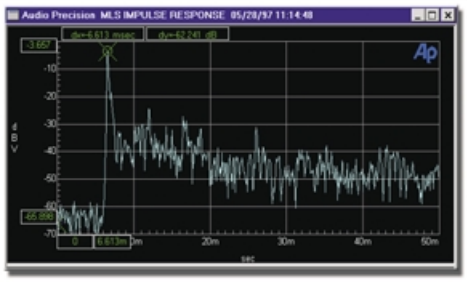
The Fast RMS Detector speeds sine wave sweeps by making measurements in as little as one cycle of a sine wave. This can provide an order of magnitude improvement in speed over normal RMS measurements.

Harmonic selection controls and graph of individual harmonic amplitude versus frequency.

The dual-Channel Harmonic Distortion Analyzer can simultaneously measure the fundamental and up to four individual harmonics. Sweeps using this analyzer can rapidly characterize frequency or amplitude dependent distortion mechanisms.

A sophisticated data settling algorithm allows the engineer to optimize the tradeoff between testing speed and measurement accuracy.

Individual settling parameters are stored for every available measurement.



Loudspeaker Impulse Response, showing 6.6 millisecond delay to impulse peak.

Quasi-anechoic Measurements of transducers and acoustics using Maximum Length Sequence (MLS) noise signals produce impulse, frequency, and phase response graphs in less than a second.

Extensive Library of noise weighting and band-limiting filters allow noise measurements to virtually any international standard. Software-implemented filters can be created and downloaded by a supplied utility.

Comprehensive Digital Interface Testing

Cascade *Plus'* Digital I/O capabilities combined with its Digital Signal Analyzer allow complete measurement and characterization of digital interface pulse streams.

All digital I/O capabilities are functional over the full range of sample rates from 8 kHz to over 200 kHz.

Jitter— Measure the peak or average jitter amplitude, view the jitter waveform, or display the jitter spectrum or a histogram of the jitter amplitude. Add jitter of various types and amplitudes to the generated pulse stream and measure the effect on the receiver and the resulting audio signal.

Eye Patterns are a triggered oscilloscope view of the minimum pulse stream amplitude vs. time, computed over thousands of data cells. The eye opening provides a quick check of signal amplitude, signal-to-noise ratio, rise and fall times, and jitter.

Fully characterize a serial digital bit stream including waveforms, eye patterns, spectrums and histograms as shown by these nine graphs.

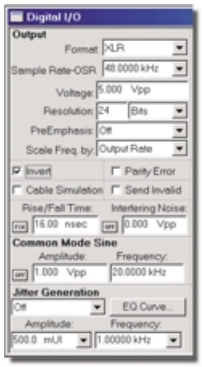
Digital Input/Output panel.

The Digital Input/Output panel includes input and output provision for single XLR connector 48 & 96 kHz sample rate professional formats, dual connector 96 & 192 kHz rates, as well as input switching for 4 channels of AES/EBU audio at 48kHz. It also provides BNC and optical connections for 48 and 96 kHz unbalanced and consumer formats.

Rear panel connections.

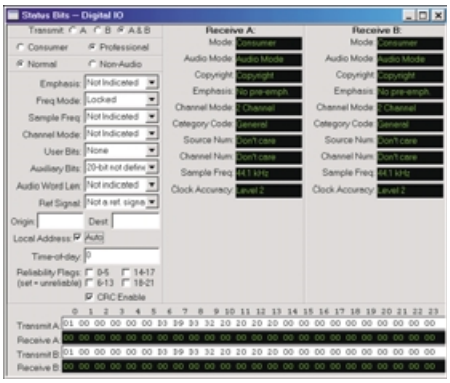
Histograms display the probability distribution of pulse stream parameters like timing (jitter), amplitude, sample rate, and bit width.

The interface signal and the jitter waveform can be viewed either in the time domain (oscilloscope view) or the frequency domain (FFT spectrum).



Selectively inject various impairments in the digital signal to test device susceptibility.

The introduction of impairments to the digital interface pulse stream allows evaluation of the susceptibility of receivers to sub-standard signals. Variable impairment capabilities include sample rate, pulse amplitude, pulse rise and fall times, long cable simulation, addition of normal mode noise or common mode signals, and controlled amounts of jitter.



Compelete Status Bit information in either Consumer or Professional format.

Complete control and display of interface information including sample rate, amplitude, active data bits, error flags, and status bytes displayed in both hex and high-level English terminology.

System Two Cascade Plus Specification Summary

Valid for 20 Hz - 20 kHz unless otherwise noted. For full specifications with qualifying footnote data, please request the System Two Cascade Plus Specification document.

ANALOG SIGNAL OUTPUTS (except SYS-2700)

ANALOG SIGNAL GENERATOR

Low Distortion Sine Wave

Frequency Range	10 Hz to 204 kHz
Frequency Accuracy	
High-accuracy mode	±0.03%
Fast mode	±0.5%
Amplitude Range	
Balanced	<10 mV to 26.66 Vrms [+30.7 dBu]
Unbalanced	<10 mV to 13.33 Vrms [+24.7 dBu]
Amplitude Accuracy	±0.7% [±0.06 dB] at 1 kHz
Amplitude Resolution	
Vout ³150 mVrms	0.003 dB
Vout û mVrms	0.05 mVrms
Flatness (1 kHz ref)	
10 Hz-200 kHz	+0.21 / -0.3 dB
Residual Distortion	
at 1 kHz	typically .00003% [-130 dBc]
20 Hz - 20 kHz	typically .0001% [-120 dBc];
Residual THD+N	
at 1 kHz	(0.00025% + 1.0 µV) [-112 dB], 22 kHz BW(valid only for analyzer inputs 8.5 Vrms)
20 Hz-20 kHz	(0.00032% + 1 mV), 22 kHz BW [-110 dB] (0.0005% + 2 mV), 80 kHz BW [-106 dB]

SMPTE (or DIN) Test Signals

LF Tone	40, 50, 60, 70, 100, 125, 250, or 500 Hz; all ±1.5%
HF Tone Range	2 kHz-200 kHz
Mix Ratio	4:1 or 1:1 (LF:HF)

CCIF and DFD Test Signals

Difference Frequency	80, 100, 120, 140, 200, 250, 500 or 1 kHz; all ±1.5%
Center Frequency	4.5 kHz-200 kHz

DIM (or TIM) Test Signals

Squarewave Frequency	3.15 kHz (DIM-30 and DIM-100);2.96 kHz (DIM-B); both ±1%
Sinewave Frequency	15 kHz (DIM-30 and DIM-100); 14 kHz (DIM-B)

Sine Burst

Frequency Range	20 Hz-100 kHz

Square Wave

Frequency Range	20 Hz-20 kHz

Noise Signals

White Noise	Bandwidth limited 10 Hz-23 kHz
Pink Noise	Bandwidth limited 10 Hz-200 kHz
Bandpass Noise	Approximately 1/3-octave (2-pole) filtered pink noise, continuously tunable from 20 Hz-100 kHz
Generator	True random or Pseudo-random
Pseudo-Random Repeat Time	Typically 262 ms (synchronized to the analyzer 4/s reading rate)

D/A GENERATED ANALOG SIGNALS

Common Specifications

D/A Resolution	24-bit sigma-delta, stereo
Sample Rate (SR)	
Sine, IMD signals	fixed 65.536ks/s or 131.072ks/s
Other signals	7.2ks/s to 108.0ks/s variable; or fixed 65.536ks/s or 131.072ks/s
Frequency Accuracy	±0.0002% [2 PPM] internal reference, lockable to external reference

"SINE (D/A)" Signal Family

Frequency Ranges	10 Hz to 30 kHz (65.536 ks/s), or 10 Hz to 60 kHz (131.072 ks/s)
Flatness (1 kHz ref)	
20 Hz-20 kHz	±0.01 dB
THD+N (20Hz-20kHz)	
30 kHz range	0.0007% [-103 dB];
Variable Phase Range	-180.0 to +179.9 deg
Dual-Sine Ratio Range	0 dB to -100 dB, usable to -138 dB
Shaped Burst Interval	2-65536 cycles

"IMD (D/A)" Signal Family

SMPTE/DIN Test Signal	
LF Tone	40 Hz to 500 Hz (continuously settable)
HF Tone	2.00 kHz to 30kHz
CCIF/DFD Test Signal	
Difference Frequency	80 Hz to 2 kHz
Center Frequency	4.50 kHz to 25 kHz
DIM Test Signal	
Squarewave Frequency	3.15 kHz for DIM30 and DIM100; 2.96 kHz for DIMB
Sinewave Frequency	15.00 kHz for DIM30 and DIM100, 14.00 kHz for DIMB

OTHER SIGNALS

Arbitrary Waveform (and Multitone)

Signal	determined by the associated file specified in the panel drop-down box.

Maximum Length Sequence (MLS)

Sequences	4 pink, 4 white

Special Signals

Polarity	Asymmetric waveform for polarity testing.15 kHz at 30 kHz bandwidth20 Hz to 30 kHz at 60 kHz bandwidth
Pass Thru	Accepts signal at rear panel Reference Input with sample rate from 27 kHz to 54 kHz.

Squarewave

Frequency Range	20 Hz to 15.1 kHz

Noise Signal

True random white	

Output Characteristics

Source Configuration	Selectable balanced, unbalanced, or CMTST (common mode test)
Source Impedances	
Balanced or CMTST	40 Ω (±1 Ω), 150 Ω (200 Ω with option "EURZ") (±1 Ω), or 600 Ω (±3 Ω)
Unbalanced	20 Ω (±1 Ω) or 600 Ω (±3 Ω)
Max Output Power	
Balanced	+30.1 dBm into 600 Ω (Rs = 40 Ω)
Unbalanced	+24.4 dBm into 600 Ω (Rs = 20 Ω)
Output Related Crosstalk	
10 Hz-20 kHz	-120 dB or 5 mV, whichever is greater
20 kHz-100 kHz	-106 dB or 10mV, whichever is greater

ANALOG ANALYZER (except SYS-2700)

Analog Input Characteristics

Input Ranges	40 mV to 160 V in 6.02 dB steps
Maximum Rated Input	230 Vpk, 160 Vrms (dc to 20 kHz); overload protected in all ranges
Input Impedance	
Balanced (each side)	Nominally 100 k ohms
Unbalanced	Nominally 100 k ohms
Terminations	Selectable 600 Ω or 300 Ω, ±1%; 1 Watt [+30 dBm] maximum power

Level Meter Related (both channels)

Measurement Range	5 mV–160 V for specified accuracy and flatness, usable to <100 µV
Accuracy (1 kHz)	±0.5% [±0.05 dB]
Flatness (1 kHz ref)	
20 Hz - 20 kHz	±0.008 dB (typically .003 dB)
20 Hz-200 kHz	+0.2/-0.3 dB (typically .5 dB at 500 kHz)

Frequency Meter Related (both channels)

Measurement Range	10 Hz–500 kHz
Accuracy	±0.0006% [±6 PPM]
Resolution	6 digits + 0.000244 Hz
Minimum Input	5 mV

Phase Measurement Related

Measurement Ranges	±180, -90/+270, or 0/+360 deg
Accuracy	
10 Hz–5 kHz	±0.5 deg
5 kHz–20 kHz	±1 deg

Wideband Amplitude/Noise Function

Measurement Range	mV to 160 Vrms
Accuracy (1 kHz)	±1.0% [±0.09 dB]
Flatness (1 kHz ref)	
20 Hz–20 kHz	±0.02 dB
20 Hz–200 kHz	+0.2 dB/-0.3 dB (typically -3 dB at 500 kHz)
Bandwidth Limiting Filters	
LF -3 dB	<10 Hz, 22 Hz per CCIR Rec 468, 100 Hz ±5% (3-pole), or 400 Hz ±5% (3-pole)
HF -3 dB	22 kHz per CCIR Rec 468, 30 kHz ±5% (3-pole), 80 kHz ±5% (3-pole), or >500 kHz
Optional Filters	up to 7
Detection	RMS (τ = 25 ms or 50 ms),AVG,QPk per CCIR Rec 468,Pk (pseudo-peak), or S-Pk (0.7071 x Pk reading)
Residual Noise	
22 Hz-22 kHz BW	1.0 mV [-118 dBu]
80 kHz BW	2.0 mV [-112 dBu]
500 kHz BW	6.0 mV [-102 dBu]
A-weighted	0.5 mV [-124 dBu]
CCIR-QPk	2.5 mV [-110 dBu]

Bandpass Amplitude Function

Tuning Range (f_o)	10 Hz to 200 kHz
Bandpass Response	1/3-octave class II (4-pole); 2 dB at 0.5 f_o and 2.0 f_o

Bandreject Amplitude Function

Tuning Range (f_o)	10 Hz to 200 kHz
Tuning Accuracy	±2%
Bandreject Response	typically: -3 dB at 0.73 f_o & 1.37 f_o -20 dB at f_o ±10% -40 dB at fo ±2.5%
Accuracy	±0.3 dB, 20 Hz–120 kHz (excluding 0.5 f_o to 2.0 f_o)
Residual Noise	same as Amplitude Function

THD+N Function

Fundamental Range	10 Hz to 200 kHz
Accuracy	±0.3 dB, 20 Hz-120 kHz harmonics
Measurement Bandwidth	
LF -3 dB	<10, 22, 100, or 400 Hz
HF -3 dB	22k, 30k, 80k, or 500 kHz; option filters are also functional
Residual THD+N	
at 1 kHz	(0.00025% + 1.0 µV) [-112 dB], 22 kHz BW (valid only for analyzer inputs 8.5 Vrms)
20 Hz–20 kHz	(0.00032% + 1.0 mV), 22 kHz BW [-110 dB] (0.0005% + 2.0 mV), 80 kHz BW [-106 dB] (0.0010% + 6.0 mV), 500 kHz BW [-100 dB]
10 Hz–100 kHz	(0.0040% + 6.0 mV), 500 kHz BW [-88 dB]
Minimum Input	5 mV for specified accuracy, usable to <100 µV with fixed notch tuning

IMD MEASUREMENTS with option "IMD"

SMPTE (DIN) IMD Function

Test Signal Compatibility	Any combination of 40-250 Hz (LF) and 2 kHz–100 kHz (HF) tones, mixed in any ratio from 0:1 to 8:1 (LF:HF)

CCIF and DFD IMD Functions

Test Signal Compatibility	Any combination of equal amplitude tones from 4 kHz–100 kHz spaced 80 Hz–1 kHz (difference frequency)

DIM (TIM) IMD Function

Test Signal Compatibility	2.96–3.15 kHz squarewave mixed with 14–15 kHz sine probe tone

WOW & FLUTTER MEASUREMENTS with option "W&F"

Test Signal Compatibility	
Normal	2.80 kHz–3.35 kHz
"High-band"	11.5 kHz–13.5 kHz

DSP ANALYSIS of ANALOG SIGNALS (except SYS-2700)

High Resolution Converter

A/D Resolution	24-bit sigma-delta
Sample Rate (SR)	7.2ks/s to 108ks/s variable; or 65.536ks/s fixed
Flatness	±0.01 dB to 0.450 SR or 20 kHz, whichever is lower
Distortion	-105 dB for sample rates A.536 ks/s; -102 dB for sample rates up to 100 ks/s
Maximum usable BW	30 kHz with SR = 65.536 ks/s, 45 kHz with SR = 100 ks/s

High Bandwidth Converter

A/D Resolution	16-bit sigma-delta
Sample Rate (SR)	56 ks/s to 216 ks/s variable; or 131.072 ks/s or 262.144 ks/s fixed
Flatness (1 kHz ref)	±0.01 dB to 20 kHz, ±0.10 dB to 120 kHz (262.144 ks/s)
Distortion	-92 dB for SR 216 ks/s

FFT Analyzer

Acquisition Length	800–256 k samples in 11 steps
Transform Length	256–32768 samples in binary steps
Processing	48 bit
Windows	Ten choices
Averaging	1–4096 in binary steps, averaging algorithm is power (spectrum only) or synchronous

DSP Audio Analyzer

Wideband Level/Amplitude

Frequency Range	<5 Hz to 45.8% of frequency range
High pass Filters	<10 Hz, 22 Hz, 100 Hz, 400 Hz, 400 Hz 10-pole elliptical when not using notch filter or bandpass mode
Low pass Filters	20 kHz 6-pole elliptic low-pass; 15 kHz 6-pole elliptic low-pass
Weighting Filters	ANSI-IEC "A" weighting, CCIR QPk, CCIR RMS, C-message, CCITT, "F" weighting

specifications

Narrow Band Amplitude

Frequency Range	<5 Hz to 40% of sample rate
Filter Shape	10-pole, Q=19

THD+N Measurements

Fundamental Range	<5 Hz to 45% of sample rate
High pass Filters	<10 Hz, 22 Hz, 100 Hz, 400 Hz
Low pass Filters	20 kHz, 15 kHz
Weighting Filters	ANSI-IEC "A" weighting, CCIR QPk, CCIR RMS, C-message, CCITT, "F" weighting

Frequency Measurements

Range	5 Hz to 47% of sample rate
Accuracy	Greater of ±0.01% of reading or 0.0001% of sample rate
Resolution	Greater of 0.003% of reading or 0.0001% of sample rate

Quasi-anechoic acoustic tester (MLS)

Signals	Four pink sequences, four white sequences
Frequency Range	Sample rate/2000 to sample rate/2
Frequency Resolution	1.465 Hz at 48.0 ks/s
Acquisition Length	32767 samples or 131071 samples

Multitone Analyzer ("FASTTEST.AZ2")

Measurements	Level vs frequency, Total distortion vs frequency, Noise vs frequency, Phase vs frequency, Crosstalk vs frequency, Masking curve
Frequency Resolution	2.93 Hz with 96.0 ks/s 1.345 Hz with 44.1 ks/s 1.465 Hz with 48.0 ks/s
Distortion	-115 dB

DIGITAL SIGNAL GENERATOR (SYS-2700 and SYS-2722 only)

DIGITAL OUTPUT CHARACTERISTICS

Output Formats	AES/EBU (per AES3-1992)SPDIF-EIAJ; Optical (Toslink®); General purpose parallel; Serial interface to chip level via optional PSIA accessory
Sample Rates	28.8 kHz–100 kHz AES/EBU, 64 kHz–200 kHz dual connector AES/EBU, general purpose serial; 8 kHz–200 kHz parallel; independent from input sample rate
Word Width	8 to 24 bits
Output impedance	Balanced (XLR), 110Ω; Unbalanced (BNC), 75Ω approx.

DIGITAL SIGNAL GENERATION

Sine Wave (all sine wave variants)

Frequency Range	10 Hz to 47% of sample rate (22.56 kHz at 48 ks/s)
Frequency Resolution	Sample Rate ÷ 2^{23} (typically 0.006 Hz at 48 ks/s)
Flatness	±0.001 dB
Harmonics and Spurious Products	0.00001% [-160 dB]

Sine Burst *Sine burst with rectangular envelope*

Interval	2–65536 cycles
Burst On	1 to number of Interval cycles minus 1

Variable Phase Sine Wave *Two sine waves, same frequency, independently settable phase*

Phase Range	±180 deg.

Stereo Sine Wave *Sine wave of independent frequency and amplitude on each channel*

Dual Sine Wave *Twin sine waves of independent frequency and settable amplitude ratio; applied to both output channels*

Sine + Offset *Sine wave plus a constant value*

Offset Amplitude	Sinewave amplitude + |offset amplitude| 100% FS

Shaped Sine Burst *Sine burst with raised cosine envelope*

Interval	2–65536 cycles
Burst On	1 to number of Interval cycles minus 1

Square Wave

Frequency Range	≤1 Hz to 1/6 sample rate (7350 Hz at 44.1 ks/s, 8000 Hz at 48 ks/s, 16000 Hz at 96 ks/s

SMPTE/DIN Waveform

Upper Tone Frequency Range	2 kHz to 47% of sample rate (22.56 kHz at 96 ks/s)
Lower Tone Frequency Range	40 Hz - 500 Hz

CCIF and DFD IMD Waveforms

Center Frequency Range	3000 Hz to (47% of sample rate - ½ IM frequency)
IM Frequency Range	80 Hz–2000 Hz

DIM IMD Waveform

Sine wave Frequency	100/21 * squarewave frequency
Square wave Frequency	≤1/10 to 1/16 sample rate, depending on SR
Amplitude Ratio	4:1 (squarewave:sinewave)

Noise

Types	Pink, White, USASI

Special Signals

Monotonicity	Low level staircase waveform for D/A linearity testing.
J-Test	Produces a maximum amount of data-induced jitter on low-bandwidth transmission links.
Polarity	Two sinewaves phased for reinforcement with normal polarity.
Walking Ones	A single binary one value "walked" from LSB to MSB.
Walking Zeros	A single binary zero value "walked" from LSB to MSB.
Constant Value	(Digital DC)

Maximum Length Sequence Signals *Pseudo random noise signal for speaker testing with MLS analyzer*

Signals	Four pink sequences, four white sequences

Multitone Signals

Number of Tones	1 to 128 typical, 8191 maximum
Frequency Resolution	Sample Rate ÷ 2^{14} (typically 2.93 Hz at 48 ks/s)
Flatness	±0.001 dB
Residual Distortion	0.00001% [-140 dB]

Arbitrary Waveforms

Length	256–16384 points per channel, user specified waveform. Utility is provided to prepare a time record file from user specified frequency, amplitude, and phase data.

Dither (all waveforms)

Probability Distribution	Triangular or rectangular; true random; independent for each channel
Spectral Distribution	Flat (white) or Shaped (+6 dB/oct)
Amplitude	8-24 bit or off

Pre-Emphasis Filters (all waveforms)

Filter Shape	50/15 μs or J17
Response Accuracy	±0.02 dB 10 Hz to 45% sample rate
Residual Distortion	0.00003% [-130 dB]

AES/EBU INTERFACE GENERATION (SYS-2700 and SYS-2722 only)

Interface Signal

Amplitude Range	(Fixed RISE/FALL time)
Balanced (XLR)	0-10.24 Vpp, ±(10% + 80 mV) into 110Win 40 mV steps
Unbalanced (BNC)	0 to 2.048 Vpp, ±(8% + 16 mV) into 75Win 8 mV steps
Optical (Toslink®)	0 to 256% of nominal intensity in 1% steps
Channel Status Bits	Full implementation, English language decoded, Professional or consumer or hex formats; independent in each channel
User Bits	set to 0
Validity Flag	selectable, set or cleared

AES/EBU Impairments

Variable rise/fall time; Induced Jitter	
Jitter Flatness	±1 dB, 100 Hz to 20 kHz
Residual Jitter	
48 ks/s	0.010 UI [1.6 ns]
96 ks/s	0.020 UI [1.6 ns]
Cable Simulation	Multi-pole fit to AES 3-1992 filter to simulate the response degradation of a worst case long cable
Offset from reference	-64 to +63.5 UI, in 0.5 UI steps

REFERENCE INPUT CHARACTERISTICS

Input Formats	AES/EBU (per AES 3-1992), NTSC/PAL/SECAM video, or squarewave

REFERENCE OUTPUT CHARACTERISTICS

Output Format	AES/EBU (per AES 11-1994)

DIGITAL ANALYZER (Sys-2700 and Sys-2722 only)

DIGITAL INPUT CHARACTERISTICS

Input Formats	AES/EBU (per AES 3-1992)Dual Connector AES/EBUSPDIF-EIAJDual Connector SPDIF-EIAJOptical (Toslink®)General purpose parallel, Serial interface to chip level via PSIA accessory
Sample Rates	28.8 kHz-100 kHz AES/EBU, 64 kHz-200 kHz Dual Connector AES/EBU, 8 kHz to 200 kHz parallel, PSIA; independent from output sample rate
Word Width	8 to 24 bits

EMBEDDED AUDIO MEASUREMENTS

Wideband Level/Amplitude

Range	0 dBFS to 40 dBFS
Frequency Range	<5 Hz to 45.8% of sample rate
Accuracy	±0.01 dB, ≥-120 dBFS
Flatness	±0.01 dB, 15 Hz-22 kHz, with <10 Hz high-pass filter selection
High pass Filters	<10 Hz, 22 Hz, 100 Hz, 400 Hz, 400 Hz, 10-pole elliptical when not using notch filter or bandpass mode
Low pass Filters	20 kHz, 15 kHz
Weighting Filters	ANSI-IEC "A," CCIR QPk, CCIR RMS, C-message, CCITT, "F" weighting
Residual Noise	-140 dBFS unweighted, -142 dBFS A-weighted

Narrow Band Amplitude

Frequency Range	<5 Hz to 40% of sample rate

THD+N Measurements

Frequency Range	<5 Hz to 45% of sample rate
Residual THD+N	-140 dBFS
High pass Filters	<10 Hz, 22 Hz, 100 Hz, 400 Hz
Low pass Filters	20 kHz, 15 kHz
Weighting Filters	ANSI-IEC "A," CCIR QPk, CCIR RMS, C-message, CCITT, "F" weighting

Frequency Measurements

Range	5 Hz to 47% of sample rate

FFT Spectrum Analyzer (fft)

Acquisition Length	800 to 256 k samples in 11 steps
Transform Length	256-32768 samples in binary steps
Processing	48 bit
Windows	Ten choices
Averaging	1-4096 in binary steps, averaging algorithm is power based or synchronous
Distortion Products	-160 dB

Multitone Analyzer

Acquisition Length	512-32768 samples in binary steps
Transform Length	512-32768 samples in binary steps
Processing	48 bit
Measurements	Level vs frequency, Total distortion vs frequency, Noise vs frequency, Phase vs frequency, Crosstalk vs frequency, Masking curve

Quasi-Anechoic Acoustic Tester

Signals	Four pink sequences, four white sequences

DIGITAL INTERFACE MEASUREMENTS

AES/EBU Impairments, real time displays

Input Sample Rate; Output to Input Delay	Measures status propagation from the AES/EBU output to the input. Range is 0-1 frame, resolution ±60 ns.
AES/EBU Input Voltage	
XLR	100 mV to 10.24 Vpp, ±(5% + 50 mV)
BNC	25 mV to 2.048 Vpp, ±(5% + 12 mV)

AES/EBU Interface Analyzer

AES/EBU Input Voltage	
Balanced	0–20.48 Vpp, ±(10% + 50 mV)
Unbalanced	0–4.096 Vpp, ±(8% + 12 mV)
Acquisition time/memory	50 ms / 1,572,864 samples

AUXILIARY SIGNALS

all units except SYS-2700:

Generator Signal Monitors	Channel A; Channel B
Generator Aux Signals	Sync Output; Trig/Gate Input
Analyzer Signal Monitors	Channel A; Channel B; Reading

SYS-2622 & SYS-2722 only

Digital Signal Monitors	Channel 1; Channel 2; Channel 3; Channel 4

SYS-2700 & SYS-2722 only

Digital Interface Monitors	Transmit Frame Sync; Receive Frame Sync; Master Clock Out
Miscellaneous Digital I/O	Auxiliary Input; Auxiliary Output; Trigger Output

GENERAL / ENVIRONMENTAL

Power Requirements	100/120/230/240 Vac (-10%/+6%), 50-60 Hz, 240 VA max
EMC	Complies with 89/336/EEC, CISPR 22 (class B), and FCC 15 subpart J (class B)
Dimensions	16.5 x 6.0 x 13.6 inches [41.9 x 15.2 x 34.5 cm]
Weight	Approximately 34 lbs [15.9 kg]

SYS-2122 & SYS-2622

SYS-2722

SYS-2700

System Two Cascade *Plus* is available in four models to accommodate analog signals, digital signals, or both (Dual Domain). The **SYS-2122** offers low-distortion analog I/O only. The **SYS-2622** adds converters and digital signal processing (DSP) for advanced analysis capabilities. To this, the **SYS-2722** adds digital I/O for a true Dual Domain instrument. The **SYS-2700** is a digital I/O only instrument that lacks the low-distortion analog I/O sections.

The GPIB option adds an IEEE-488 interface to the instrument. *(APIB interface is still present but APIB PC interface card and APWIN software not included.)*

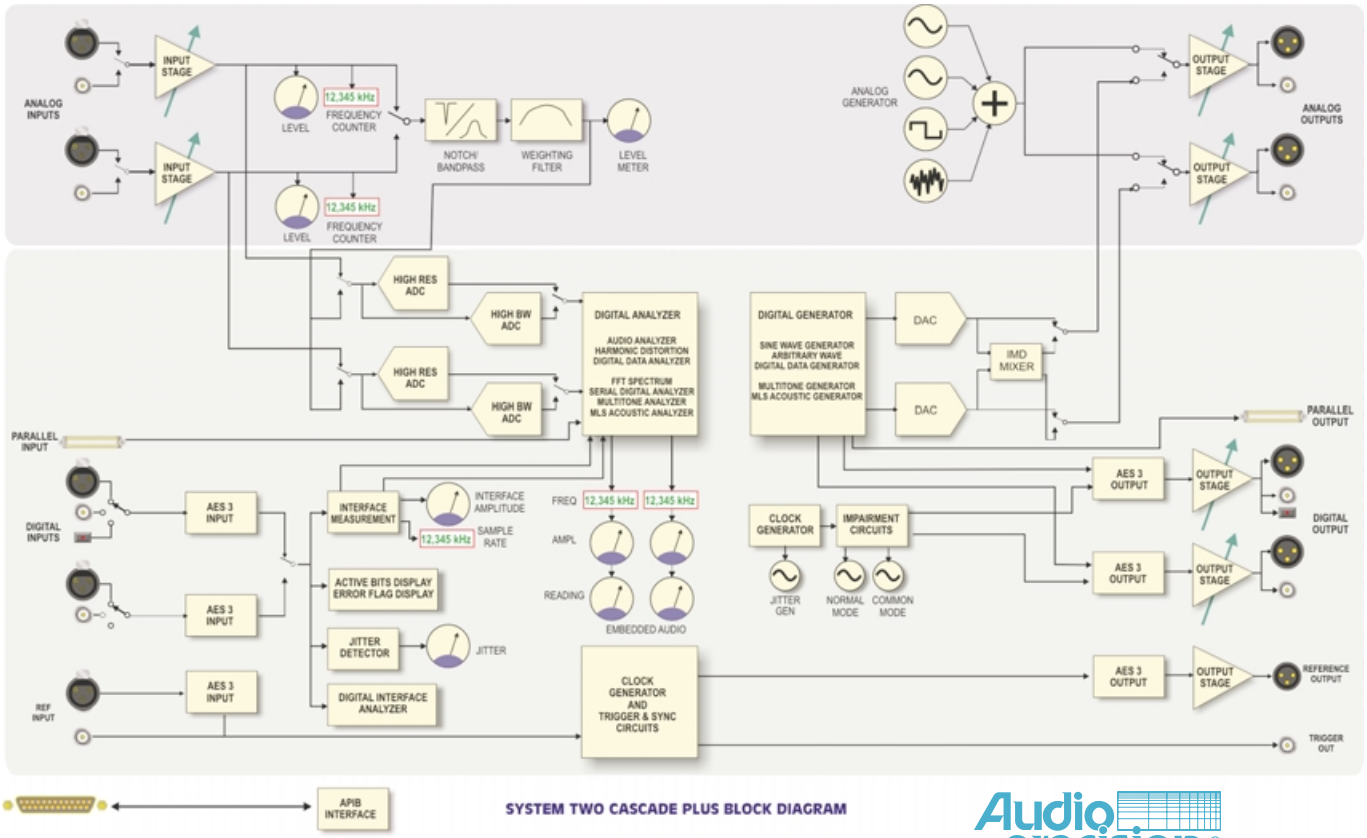
Three major internal analog options may be fitted to all instruments except the SYS-2700. The **BUR** option adds analog domain generation of burst sine waves with controllable burst duration, interval and amplitude between bursts. It also includes analog square waves to 20 kHz, and analog random and pseudorandom white and pink noise, and bandpass filtered pink noise.

The analog **IMD** option analyzes analog domain devices for intermodulation distortion to the SMPTE/DIN, CCIF (twin tone or difference tone) and DIM/TIM (dynamic/transient intermodulation distortion) standards. The **W&F** option measures analog wow & flutter to the IEC/DIN, NAB, JIS, and scrape flutter standards, weighted or unweighted.

System Two Cascade Plus Ordering Information	
Models	
SYS-2122	Analog Output/Input
SYS-2622	Analog Output/Input plus DSP
SYS-2722	Dual Domain
SYS-2700	Digital Output/Input (no analog)
Options	
BUR	Analog burst sine waves, square waves to 20kHz, random and pseudorandom white and pink noise signals
IMD	Analog Intermodulation distortion to SMPTE/DIN, CCIF, and DIM/TIM standards
W&F	Wow & Flutter to IEC/DIN, NAB, JIS and scrape flutter standards, weighted or unweighted
EWP-S2CP	Three-Year Extended Warranty *(Adds three more years to standard three-year warranty included with instrument)*
Interface Options (selected at time of order)	
S2-ISA	ISA Interface card w/APWIN software
S2-PCI	PCI Interface card w/APWIN software
S2-PCMCIA	PCMCIA Interface card w/APWIN software
-G	IEEE-488 (GPIB) Interface
Filters	
S-AES17	Lowpass filter for AES-17 D/A measurements
FIL-xxx	Family of analog psophometric noise weighting filters
FLP-xxx	Family of analog sharp low-pass filters
FBP-xxx	Family of analog 1/3 octave bandpass filters
External Accessories	
PSIA	Programmable Serial Interface Adapter
SWR-2122	12 X 2 Switcher family expandable to 192 channels
DCX-127	Multifunction module including 4½ digit DC voltmeter/ohmmeter and various digital control I/O
RAK-S2	Rackmount kit
HAN-S2	Carrying handle

The APWIN/APIB interface is available in three different formats for use in **ISA**, **PCI**, or **PCMCIA** slots on the PC.

Each instrument (except the 2700) can accept up to 7 analog filter cards, selectable from a large assortment of lowpass, bandpass, and psophometric weighting filters. Other external accessories include the Programmable Serial Interface Adapter (**PSIA**) for connecting to devices that use non-standard serial interfaces, the **SWR-2122** family of high performance signal switchers/multiplexers, and the **DCX-127** DC/Ohms/low speed digital logic multifunction module.



SYSTEM TWO CASCADE PLUS BLOCK DIAGRAM

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