# S2 Family
# Performance Checks


Audio precision®

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# General Information

## 1.1 Introduction

### 1.1.1 The SVC-S2Family performance checks

The S2 Family Performance Checks procedure supports the Audio Precision S2 family of test and measurement instruments. The Perfomance Checks use the instrument's own measurement functions to indicate passing or failing performance in a module.

See Table 1.1 for a listing of the models and configurations included in the S2 family. Many of these models and instruments were previously supported by dedicated "perf check" or "self test" procedures for System Two, System Two Cascade and System Two Cascade *Plus* instruments. The earlier performance check procedures have been deprecated.

Extract the files to a convenient location on your PC hard drive; normally to the C:\ root location.

*NOTE: The Performance Check procedures are driven by AP Basic macros. File-opening commands in AP Basic do not support path+file names longer than 128 characters, so if you copy the service files to a location deep in your folder heirarchy, you may experience file-opening errors.*

### 1.1.2 Models Within The S2 Family

There are four model lines within the S2 family, as shown in the four columns of Table 1.1. Each of the model lines have four system configurations. Internal options are available, and upgrade paths may convert one model or configuration to another. An upgrade is also available to convert a System Two Cascade to one of two unique instruments: the SYS-2500 (192k) or the SYS-2522 (192k).

| | System Two | System Two Cascade | System Two Cascade *Plus* | 2700 Series |
|---|---|---|---|---|
| analog only | SYS-2022 | ---- | SYS-2122 | SYS-2702 |
| analog +DSP | SYS-2222 | SYS-2422 | SYS-2622 | SYS-2712 |
| digital only (w / DSP) | SYS-2300 | SYS-2500 | SYS-2700 | SYS-2720 |
| dual domain (analog, digital w / DSP) | SYS-2322 | SYS-2522 | SYS-2722 (96k) | SYS-2722 (192k) |
| digital only, mod to 192k | | SYS-2500 (192k) | | |
| dual domain, mod to 192k | | SYS-2522 (192k) | | |

***Table 1.1. S2 Family models and configurations.***

### 1.1.3 Control software: APWIN and AP2700

The Performance Check files are tests and macros that require Audio Precision control software to operate.

For System Two instruments, the control software must be APWIN version 2.24

For all other S2 family instruments, the control software must be AP2700 version 3.30.

# S2 Family Performance Checks

## for all S2 Family instruments

## 2.1 Usage & Precautions

The S2 Family Performance Checks exploit the fact that a S2 Family instrument can be used to check major aspects of its own operation using with no external equipment other than commonly available cables.

To execute a diagnostic performance check, simply open the top level macro called "S2FamilyCheck.apb" from the S2 Family Perf Checks folder and select the modules and/or options to be tested. Allow at least 20 minutes for warm-up and circuit stabilization for valid results.

*NOTE: DO NOT open S2 Family Performance Check files by "double-clicking" the file from Windows Explorer or from a folder window. Instead, run the control software and open the service file from the File menu. This assures that the control software working directory is properly set.*

### 2.1.1 Not a Substitute for Calibration

The diagnostic performance checks are not a substitute for calibration because the instrument is used to test itself. The performance checks should only be used for assurance testing or as an aid during troubleshooting.

### 2.1.2 Test Failure Interpretation

The first test in most performance checks is generally a basic check of functionality. If a performance check aborts, inspect the cable hookup and repeat the check, if required. If the performance check aborts again, troubleshooting or module replacement is indicated.

*NOTE: Certain types of failures may cause a performance check to abort.*

## 2.2 Performance Check Summaries

This chapter contains brief summaries of the tests performed during each of the various performance checks. Each check requires approximately one to three minutes to execute, depending upon the number of tests to be performed.

### 2.2.1 GEN Module Tests

The GEN module performance check requires two XLR-to-XLR and two BNC cables, length not critical. The four cables are used to connect the generator Analog Outputs to their respective Analog Inputs. The banana jack connectors are not tested because they electrically parallel the XLR connectors.

[Test 1] Checks the generator output XLR signal paths.

[Test 2] Checks the generator output BNC signal paths.

*NOTE: A failure in either Test 1 or Test 2 can be caused by an improper cable hookup. If the cable connections appear to be correct, check the generator signal amplitude using an independent DVM to determine whether the generator or analyzer is at fault.*

[Test 3] Checks the internal generator monitor signal paths. Also checks the basic amplitude of the oscillator signal, the output amplitude control, and output attenuator operation by measuring amplitude over the range of 26 V to 10 mV.

[Test 4] Checks the low distortion oscillator frequency accuracy in each of its four frequency bands.

[Test 5] Checks the "High-Accuracy" tuning mode of the oscillator.

[Test 6] Checks the relative phase difference between the two analog outputs.

[Test 7] Checks operation of the Channel A Invert feature.

[Test 8] Checks operation of the Channel B Invert feature.

[Test 9] Checks the balanced 40 Ω output configuration by measuring the amplitude terminated into 300 Ω .

[Test 10] Checks the balanced 150 Ω (200 Ω in units with option EGZ installed) output configuration by measuring the amplitude terminated into 300 Ω.

[Test 11] Checks the balanced 600 Ω output configuration by measuring the amplitude terminated into 300 Ω.

[Test 12] Checks the unbalanced 20 Ω output configuration by measuring the amplitude terminated into 300 Ω.

[Test 13] Checks the unbalanced 600 Ω output configuration by measuring the amplitude as terminated in to 300 Ω.

*NOTE: A failure in Tests 9–13 could be caused by excessive resistance in the external test cables. Cable resistance must be <1 Ω.*

[Test 14] Checks the generator sinewave flatness at 4 Vrms using the 40 Ω balanced output configuration.

[Test 15] Checks the residual channel B-into-A crosstalk.

[Test 16] Checks the residual channel A-into-B crosstalk.

[Test 17] Checks the output coupling transformer distortion null at 20 Hz, 26.6 V.

[Test 18] Checks residual THD+N at 1 kHz as the output amplitude is swept from 26 V to 10 mV.

*NOTE: Test 18 takes about 35–45 seconds to complete due to the number of data points.*

[Test 19] Checks residual THD+N at high frequencies.

### 2.2.2 INP Module Tests

The INP module performance check procedure requires two XLR-XLR and two BNC cables, length not critical. The four cables are used to connect the generator Analog Inputs to their respective Analog Outputs. The banana jack connectors are not tested because they electrically parallel the XLR connectors.

[Test 1] Checks the analyzer input XLR signal paths.

[Test 2] Checks the analyzer input BNC signal paths

*NOTE: A failure in either Test 1 or Test 2 can be caused by an improper cable hookup. If the cable connections appear to be correct, check the generator signal amplitude using an independent DVM to determine whether the generator or analyzer is at fault.*

[[Test 3] Checks the level meter accuracy in the 2.5 V input range (via the internal generator monitor signal path).

[Test 4] Checks the level meter linearity in the 2.5 V input range (2.5 V to 25 mV).

[Test 5] Checks the 10 V input range by comparing the ratio of level meter readings to that of the 2.5 V range.

[Test 6] Checks the 5 V input range by comparing the ratio of level meter readings to that of the 2.5 V range.

[Test 7] Checks the 1.25 V input range by comparing the ratio of level meter readings to that of the 2.5 V range.

[Test 8] Checks the 600 mV input range by comparing the ratio of level meter readings to that of the 2.5 V range.

[Test 9] Checks the 300 mV input range by comparing the ratio of level meter readings to that of the 2.5 V range.

[Test 10] Checks the 160 mV input range by comparing the ratio of level meter readings to that of the 2.5 V range.

[Test 11] Checks the 80 mV input range by comparing the ratio of level meter readings to that of the 300 mV range.

[Test 12] Checks the 40 mV input range by comparing the ratio of level meter readings to that of the 300 mV range.

[Test 13] Checks the –12 dB input attenuator accuracy (used for the 20 V and 40 V input ranges).

[Test 14] Checks the –12 dB input attenuator compensation (used for the 20 V and 40 V input ranges).

[Test 15] Checks the –24 dB input attenuator accuracy (used for the 80 V and 160 V input ranges).

[Test 16] Checks the –24 dB input attenuator compensation (used for the 80 V and 160 V input ranges).

[Test 17] Checks CMRR in the 2.5 V input range (with dc coupling).

[Test 18] Checks CMRR in the 5 V input range (with ac coupling).

[Test 19] Checks CMRR in the 10 V input range (with ac coupling).

[Test 20] Checks CMRR with the –12 dB input attenuator enabled (20 V input range).

[Test 21] Checks CMRR with the –24 dB input attenuator enabled (80 V input range).

[Test 22] Checks the 600 Ω input termination by measuring the signal loss using the generator's 600 Ω output impedance.

[Test 23] Checks the 300 Ω input termination by measuring the signal loss using the generator's 600 Ω output impedance.

*NOTE: A failure in Test 22 or 23 could be caused by excessive resistance in the external test cables. Resistance must be <1 Ω.*

[Test 24] Checks residual input noise with a 22–22 kHz analyzer bandwidth.

[Test 25] Checks residual input noise with a 10–500 kHz analyzer bandwidth.

[Test 26] Checks frequency meter operation.

[Test 27] Checks phase meter operation.

[Test 28] Checks residual THD+N in each of the 40 mV to 40 V input ranges.

*NOTE: This test is similar to Test 18 of the GEN module check procedure, except fewer data points are taken.*

### 2.2.3 ANL Module Tests

The ANL module performance check procedure does not require any external cables. All tests are conducted using the internal generator monitor signal paths. For this procedure in particular, test results may be invalid if failures are detected during either the GEN or INP module performance check procedures.

[Test 1] Checks the channel A/B input selector.

[Test 2] Checks the five 12 dB range steps (0 to +60 dB).

[Test 3] Checks the RMS detector accuracy.

[Test 4] Checks the RMS detector linearity.

[Test 5] Checks the average detector accuracy.

[Test 6] Checks the average detector linearity.

[Test 7] Checks the quasi-peak detector accuracy.

[Test 8] Checks the quasi-peak detector linearity.

[Test 9] Checks operation of the "peak" detector (quasi-peak detector with a very short attack time constant).

[Test 10] Checks analyzer flatness (frequency response) with all filters disabled.

[Test 11] Checks response of both the 22 Hz highpass and 22 kHz lowpass filters.

[Test 12] Checks response of both the 100 Hz highpass and 30 kHz lowpass filters.

[Test 13] Checks response of both the 400 Hz highpass and 80 kHz lowpass filters.

[Test 14] Checks response of the 1/3-octave bandpass filter tuned to 1 kHz.

[Test 15] Checks the response of the 1/3-octave bandpass filter at center frequency from 20 Hz to 100 kHz.

[Test 16] Checks the residual noise in the bandpass mode.

[Test 17] Checks the response of the bandreject filter tuned to 1 kHz.

[Test 18] Checks the basic tuning accuracy of the bandreject filter by measuring notch rejection with the auto-tuning and auto-nulling servos disabled.

*NOTE: The auto-tuning and auto-nulling servos are disabled in the "Bandreject" function of the analog analyzer.*

[Test 19] Checks the tracking range of the THD+N bandreject filter auto-tuning servo.

*NOTE: The auto-tuning and auto-nulling servos are active in the "THD+N" function.*

[Test 20] Checks residual THD+N (system) from 20 Hz to 20 kHz using the 22–22 kHz analyzer bandwidth.

[Test 21] Checks bandreject filter auto-nulling operation at high frequencies by testing residual THD+N from 20 kHz to 100 kHz.

### 2.2.4 DSP Module Tests

The DSP module performance check procedure requires two BNC cables, length not critical. The two cables are used to connect the Digital Signal Monitors to the Analog Analyzer Inputs.

[Test 1] Checks the internal sample rate clock generator by measuring the frequency of a DAC based sinewave as the sample rate is varied.

[Test 2] Checks the amplitude accuracy of the DACs.

[Test 3] Checks the inter-channel phase difference between the two DACs.

[Test 4] Checks the response flatness of the DACs.

[Test 5] Checks the residual THD+N of the DACs.

[Tests 6–11] Checks the multiplexer and the internal signal paths that can be routed to the ADCs.

*NOTE: Failures following DSP module servicing or installation are most commonly caused by a plug-in error of one or more of the internal signal cables.*

[Test 12] Checks the high-resolution (low-bandwidth) ADC signal path gain.

[Test 13] Checks the frequency response of the high resolution ADCs.

[Test 14] Checks the residual distortion performance of the high resolution ADCs at 1 kHz as the signal amplitude is varied.

[Test 15] Checks the residual distortion performance of the high resolution ADCs at 20 kHz as the signal amplitude is varied.

[Test 16] Checks the high bandwidth ADC signal path gain.

[Test 17] Checks the frequency response of the high bandwidth ADCs.

[Test 18] Checks the residual distortion performance of the high bandwidth converters at 1 kHz as the signal amplitude is varied.

[Test 19] Checks the residual distortion performance of the high bandwidth converters at 20 kHz as the signal amplitude is varied.

[Tests 20 and 21] Checks the Digital Signal Monitors.

### 2.2.5 DIO Module Tests

The DIO module performance check procedure requires two 75 Ω BNC cables (50 Ω permitted if ≤1 meter in length) and two balanced XLR audio cables to connect the Digital Outputs to the Digital Inputs.

[Test 1] Checks the amplitude accuracy of the unbalanced digital output voltages.

[Test 2] Checks the amplitude accuracy of the balanced digital output voltages.

[Test 3] Checks the amplitude accuracy of the common mode signal sources.

[Test 4] Checks the amplitude accuracy of the interfering noise signal sources.

[Test 5] Checks the jitter meter AVG detector linearity.

[Test 6] Checks the jitter meter peak detector linearity.

[Test 7] Checks the overall jitter response through both digital interface I/O paths.

[Test 8] Checks jitter analyzer 120 Hz high-pass filter

[Test 9] Checks jitter analyzer 700 Hz high-pass filter.

[Test 10] Checks jitter analyzer 1.2 kHz high-pass filter.

[Test 11] Checks residual jitter at 48 k.

[Test 12] Checks residual jitter at 96 k.

[Test 13] Checks the spectrum of the residual jitter.

### 2.2.6 IMD Option Tests

The IMD option performance check procedure does not require any external cables. All tests are performed using the internal generator monitor signal paths and no external cables are required. Both the IMG (signal generator) and IMA (analyzer) option boards are checked.

[Test 1] Checks the frequency accuracy of the IM generator used as the LF tone with SMPTE (DIN) test signals.

*NOTE: The IM generator is also used as the modulating frequency in the twin tone CCIF/DFD test signal generator.*

[Test 2] Checks the amplitude accuracy of the SMPTE 4:1 test signal.

[Test 3] Checks the mix ratio accuracy of the SMPTE 4:1 test signal.

[Test 4] Checks the amplitude accuracy of the SMPTE 1:1 test signal.

[Test 5] Checks the mix ratio accuracy of the SMPTE 1:1 test signal.

[Test 6] Checks the amplitude accuracy of the CCIF/DFD test signal.

*NOTE: The CCIF and DFD test signals are identical.*

[Test 7] Checks the amplitude accuracy (flatness) of the CCIF/DFD test signal as the center frequency is varied between 20 kHz and 4 kHz.

[Test 8] Checks the amplitude accuracy of the DIM-100 test signal.

*NOTE: The DIM-30 and DIM-B signals differ only in squarewave risetime and frequency.*

[Test 9] Checks the 3.15 kHz squarewave frequency accuracy of the DIM-100 test signal.

[Test 10] Checks the 3.15 kHz squarewave frequency accuracy of the DIM-30 test signal.

[Test 11] Checks the 2.96 kHz squarewave frequency accuracy of the DIM-B test signal.

[Test 12] Checks SMPTE residual IMD as the LF tone is varied from 40 Hz to 500 Hz.

[Test 13] Checks CCIF residual IMD at a center frequency of 15 kHz as the difference frequency is varied from 80 Hz to 1 kHz.

[Test 14] Checks DFD residual IMD at a center frequency of 15 kHz as the difference frequency is varied from 80 Hz to 1 kHz.

[Test 15] Checks DIM-100 residual IMD.

[Test 16] Checks DIM-30 residual IMD.

[Test 17] Checks DIM-B residual IMD.

[Test 18] Checks the SMPTE analyzer accuracy and frequency response using a DAC generated two tone calibration signal.

[Test 19] Checks the DIM analyzer accuracy and frequency response using a DAC generated two tone calibration signal.

### 2.2.7 BUR Option Tests

The BUR option performance check requires two BNC cables, length not critical. One cable is used to connect the Sync Output signal to the channel A analog input. The other cable is used to connect the Trig/Gate Input to the channel B analog input.

[Test 1] Checks operation of the burst gate input.

*NOTE: The switchable 300 Ω termination of the channel B analyzer input is used to test the Trig/Gate Input (active pull-up).*

[Test 2] Checks operation of the On-cycles burst counter by measuring the frequency of the Sync Output signal.

[Test 3] Checks operation of the Interval burst counter by measuring the frequency of the Sync Output signal.

[Test 4] Checks burst on-off ratio accuracy.

[Test 5] Checks basic operation (frequency accuracy) of the squarewave signal generator.

[Test 6] Checks amplitude accuracy of the squarewave signal generator.

[Test 7] Checks amplitude accuracy of the pink noise generator.

[Test 8] Checks spectral flatness of the pink noise generator.

[Test 9] Checks amplitude accuracy of the white noise generator.

[Test 10] Checks spectral flatness of the white noise generator.

[Test 11] Checks amplitude accuracy of the bandpass noise generator.

[Test 12] Checks flatness of the bandpass noise generator versus frequency.

### 2.2.8 WFA Option Tests

The WFA option performance check procedure does not require any external cables. All tests are performed using the internal generator monitor signal paths.

[Tests 1 and 2] Checks unweighted and weighted residual W&F using the IEC detector and a 3.15 kHz test tone.

[Tests 3 and 4] Checks unweighted and weighted residual W&F using the NAB detector and a 3.00 kHz test tone.

[Test 5] Checks residual scrape flutter using a 12.5 kHz test tone.

[Test 6] Checks analyzer calibration with the IEC detector.

[Test 7] Checks analyzer calibration with the NAB detector.

[Test 8] Checks analyzer calibration with the JIS detector.

### 2.2.9 S-AES17 Option Tests

The S-AES17 Option performance check procedure does not require any external cables. All tests are performed using the internal generator monitor signal paths.

[Test 1] Checks response of the 20 kHz pre-analyzer filter.

[Test 2] Checks response of the 40 kHz pre-analyzer filter.

[Test 3] Checks response of the FLP-B20K option filter.

[Test 4] Checks response of the FLP-B40K option filter.

[Test 5] Checks residual THD+N at 1 kHz in the “20k AES17” mode.

[Test 6] Checks residual THD+N at 1 kHz in the “40k AES17” mode.

### 2.2.10 OPT-2020 Option Tests

The OPT-2020 Option performance check procedure does not require any external cables. All tests are performed using the internal generator monitor signal paths.

[Test 1] Checks response of the pre-analyzer filter.

[Test 2] Checks pre-analyzer filter residual THD+N at 1 kHz.

**END OF
PERFORMANCE CHECK PROCEDURES**