Audio Precision APx515 B Series Audio Analyzer Installation Guide

Contents

Audio Precision APx515 B Series Audio Analyzer

Product Information

Specifications:

- **Product:** APx515 B Series Audio Analyzer
- **Manufacturer:** Audio Precision
- **Model:** APx515
- **Technology:** MPEG-4 AAC-LC audio licensed by Fraunhofer IIS
- **Trademarks:** HDMI, Qualcomm, aptX
- **Contact:** Audio Precision, 9290SW Nimbus Ave Beaverton, Oregon 97008, Phone: 503-627-0832, 800-231-7350,
- **Website:** ap.com

Installation Instructions:
Ensure the safety ground connection is not defeated. Use only an approved three-conductor power cord with safety grounding. Replace fuses with the exact value and type indicated on the rear panel.

Operation Information:
For detailed operation instructions, refer to the APx500 User's Manual available in the embedded Help installed with the APx500 measurement software. Additional support is available on the APx500 Application USB and on the Audio Precision website.

Contact Information:
For technical support, visit ap.com, contact techsupport@ap.com, or call 503-627-0832 ext. 4 or 800-231-7350 ext. 4 (toll-free in the U.S.A.).

Safety Information:

- Do NOT service or repair unless properly qualified.
- Do NOT defeat the safety ground connection.
- Replace fuses only with the exact value and type indicated.
- Do NOT substitute parts or make modifications without written approval.

FAQ:

- **Q: Where can I find detailed operation instructions for the APx515 B Series Audio Analyzer?**
  A: Detailed operation instructions can be found in the APx500 User's Manual available in the embedded Help installed with the APx500 measurement software, on the APx500 Application USB, and on the Audio Precision website.

Copyright © 2011–2023 Audio Precision, Inc.
All rights reserved.
Printed in the United States of America.
No part of this manual may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording, or by any information storage and retrieval system, without permission in writing from the publisher.
Audio Precision, AP, and APx are trademarks of Audio Precision, Inc. Windows™ is a trademark of Microsoft Corporation. Dolby © Digital is a trademark of Dolby Laboratories. DTS © Digital Surround is trademark of DTS, Inc.
The Bluetooth® word mark and logos are registered trademarks owned by the Bluetooth SIG, Inc. and any use of such marks by Audio Precision is under license. Other trademarks and trade names are those of their respective owners.
MPEG-4 AAC-LC audio technology is licensed by Fraunhofer IIS (https://www.iis.fraunhofer.de/de/ff/amm.html). HDMI, High-Definition Multimedia Interface, and the HDMI Port

Design Logo are registered trademarks of HDMI Licensing Adminis-trator, Inc.
Qualcomm® aptX™, aptX™ HD, and aptX™ Low Latency audio codecs are products of Qualcomm Technologies International, Ltd. Qualcomm is a trademark of Qualcomm Incorporated, registered in the United States and other countries, used with permission. aptX is a trademark of Qualcomm Technologies International, Ltd., registered in the United States and other countries, used with permission.
Audio Precision
9290SW Nimbus Ave
Beaverton, Oregon 97008
503-627-0832
800-231-7350
ap.com

Documentation and Support
This booklet contains safety information, installation instructions and full specifications for the Audio Precision APx515 B Series Audio Analyzer.

The APx500 User's Manual
Detailed information on the operation of the APx515 B Series Audio Analyzer is available from the embedded Help installed with the APx500 measurement software, in the APx500 User's Manual PDF on the APx500 Application USB, and on the Web at **ap.com**; printed copies can be ordered from Audio Precision or your local distributor.
ap.com
Visit the Audio Precision Web site at **ap.com** for APx support information. APx resources are available at **ap.com**. You can also contact our Technical Support staff at **techsupport@ap.com**, or by telephoning **503-627-0832** ext. 4, or **800-231-7350** ext. 4 (toll-free in the U.S.A.).

Safety

Safety Information

- Do NOT service or repair this equipment unless properly qualified. Servicing should be performed only by a qualified technician or an authorized Audio Precision distributor.
- Do NOT defeat the safety ground connection.
- This equip-ment is designed to operate only with an approved three-conductor power cord and safety grounding.
- Loss of the protective grounding connection can result in electrical shock hazard from the accessible conductive surfaces of this equipment.
- Do NOT exceed mains voltage ratings. This equipment is designed to operate only from a 50–60 Hz ac mains power source at 100–240 Vac nominal voltage.
- The mains supply voltage is not to exceed ±10 % of nominal (90–264 Vac).
- For continued fire hazard protection, fuses should be replaced ONLY with the exact value and type indicated on the rear panel of the instrument and discussed on page 24 of this booklet.

The International Electrotechnical Commission (IEC 1010-1) requires that measuring circuit terminals used for voltage or current measurement be marked to indicate their Measurement Category. The Measurement Category is based on the amplitude of transient or impulse voltage that can be expected from the AC power distribution network. This product is classified as Measurement Category I, abbreviated "CAT I" on the instrument front panel. This product should not be used within Categories II, III, or IV. The APx515 measurement terminals are rated for a maximum input of 125 Vpk, 88 Vrms and are intended to be used for the measurement of audio signals only.

Do NOT substitute parts or make any modifications without the written approval of Audio Precision. Doing so may create safety hazards. Using this product in a manner not specified by Audio Precision can result in a safety hazard.

This product is for indoor use—Installation Category II, Measurement Category I, pollution degree 2. To clean the enclosure of this product, use a soft cloth or brush to remove accumulated dust. A mild detergent may be used to remove remaining dirt or stains. Do not use strong or abrasive cleaners. Wipe all surfaces with a damp cloth.
This unit is supplied with four feet on the bottom surface and four feet on the right side surface. The unit should only be operated while resting on the bottom surface feet. The feet on the right side are provided for convenience and stability when transporting the unit. DO NOT operate the unit while it is sitting on the side feet.

Safety Symbols
The following symbols may be marked on the panels or covers of equipment or modules, and are used in this manual:

-  **WARNING!—**This symbol alerts you to a potentially hazardous condition, such as the presence of dangerous voltage that could pose a risk of electrical shock. Refer to the accompanying Warning Label or Tag, and exercise extreme caution.
-  **ATTENTION!—**This symbol alerts you to important operating considerations or a potential operating condition that could damage equipment. If you see this marked on equipment, refer to the Operator's Manual or User's Manual for precautionary instructions.
-  **FUNCTIONAL EARTH TERMINAL**—A terminal marked with this symbol is electrically connected to a reference point of a measuring circuit or output and is intended to be earthed for any functional purpose other than safety.
-  **PROTECTIVE EARTH TERMINAL**—A terminal marked with this symbol is bonded to conductive parts of the instrument and is intended to be connected to an external protective earthing system.

Disclaimer
Audio Precision cautions against using their products in a manner not specified by the manufacturer. To do otherwise may void any warranties, damage equipment, or pose a safety risk to personnel.

Installation

Software
The APx515 audio analyzer system uses the award-winning APx500 measurement software. This is the same software used in the APx52x, 555 and APx58x analyzer families.

APx "B Series" analyzers
All analyzers shipped in late December 2018 (or afterward) have a new embedded processor and enhanced security provisions. These analyzers are designated "B Series" and carry "B Series" nomenclature. "B Series" APx analyzers do not require an APx KeyBox (see below), but may require authorization codes to enable APx500 software or software options.

The APx KeyBox
If you are using APx500 software version 4.6 or later with an earlier APx analyzer (non "B Series"), you must attach an authenticated APx KeyBox to the Software Options connector on the analyzer rear panel.
The APx KeyBox must be programmed with your analyzer's serial number at the Audio Precision factory, and

cannot be used with any other APx analyzer. You may require authorization codes to enable APx500 software or software options.
Note that without a properly authenticated APx KeyBox attached, APx500 version 4.6 or later will only run in demo mode. If you need a KeyBox, locate your analyzer serial number and go to **https://ap.com/get-keybox/** to complete the order form. Analyzer serial numbers are located on the configuration label on the analyzer rear panel, and on the calibration label on the forward edge of the top panel.

PC system requirements
The APx500 measurement software version 4.1 and later can be very demanding of the personal computer (PC) running the APx software.

- **Moderate measurement demands**

  Moderate measurement demands (measurement band-widths under 90 kHz, channel counts of 2 or 1) will perform adequately using a PC with these minimum specifications. Measurement demands of the APx515 typically fall within this moderate range:

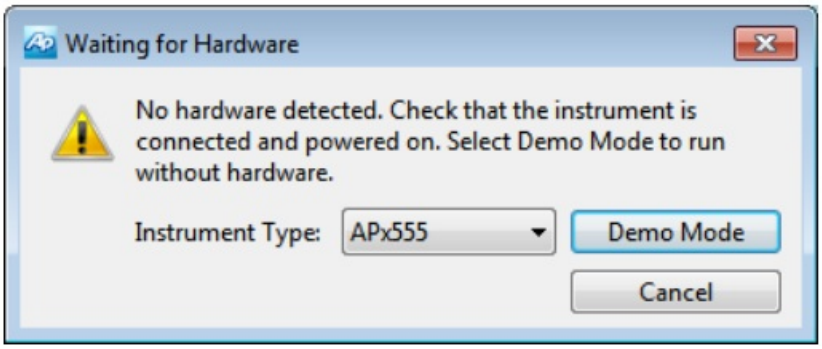
  - Operating system: Microsoft Windows 10 (64-bit).
  - Intel i5 or better processor running at a clock speed of at least 2.5 GHz. AMD Processors with similar specifications are also supported.
  - • At least 8 GB of RAM. 16 GB is recommended.
    • At least 1.5 GB of free hard disk space. An SSD for the operating system drive is highly recommended.
    • A CD-ROM optical disc drive or Internet connection to download and install software.
    • A USB 2.0 port or USB 3.0 port; two are required for optional switcher use.
  - A color monitor with SXGA (1280 x 1024) video graphics support. A video resolution of 1900 x 1080 or greater is recommended.

Installation
To install the measurement software, insert the APx500 CD-ROM into the optical drive on the PC and follow the instructions in the installation dialog.

NOTE: You must have local administrator rights to install APx500 software. Go to User Accounts in the Windows Control Panel, or check with your network administrator.

Running the software without instrument hardware attached
NOTE: You must have standard user rights or administrator rights to operate APx500 software. Guest users are not supported.

You can launch the APx500 software without the instrument hardware attached. When no hardware is detected, APx500 will present you with the following dialog box:



Select “Demo Mode.” APx500 will run in demo mode, which allows you to explore the user interface but does not enable any measurement functions. Input data shown in Demo Mode is false data, generated for display only. From the Instrument Type menu, select an instrument to be emulated in Demo Mode.

Running the software with instrument hardware attached
NOTE: You must have standard user rights or administrator rights to operate APx500 software. Guest users are not supported.

- **Connecting the instrument to your PC**

  Before connecting your APx515 instrument to your PC, install the APx500 measurement software as described above. Connecting the instrument prior to software installation may cause Windows to select an incorrect USB driver for the instrument.
- **USB driver selection**

  The measurement software communicates with the APx515 using a USB 2.0 interconnection. Once the software is successfully installed, connect one end of the USB cable to a USB 2.0 port on the PC, and the other end to the PC INTERFACE port on the rear of the APx515. We strongly recommend that you use the USB cable included with your instrument (AP part number CAB-APSI). We have tested other USB cables that perform poorly.

  Note: Some PCs have optional USB ports on the front of the PC, or on extension brackets on the rear. In many cases these convenience ports have compromised performance due to the extra cable length within the PC. We recommend using USB ports directly connected to the PC motherboard, typically at the rear of the PC.

Connect the APx515 mains power cord to the instrument and to a source of ac mains power. See Connecting your instrument to the electrical mains supply below for more information about mains connections.
Turn the instrument on by rocking the mains power switch up to ON (|). The mains power switch is located in the power entry module on the rear of the APx515. Windows will detect the presence of the APx515 on the USB port and will open the Hardware Update Wizard to search for the correct software driver. Select “Install the software automatically.” Windows will find the Audio Precision driver software installed with APx500 and connect to the APx515.
Launch APx500 by double-clicking on the installed shortcut. With the APx515 connected, you may be asked to update the instrument firmware during the first launch of the measurement software. APx500 will start, and in a short time you will be presented with the opening screen. Refer to the APx500 User’s Manual for more information about making measurements.

The APx500 User’s Manual is available as a PDF on the APx500 Application Disc and online at **ap.com**; a hard-copy version can be ordered from Audio Precision or your local distributor.

Connecting your instrument to the electrical mains supply
The APx515 instrument must be connected to a 50–60 Hz alternating current (ac) electrical mains supply, maximum voltage 250 Vrms.
The instrument has been configured at the factory for the expected voltage at its intended destination, as ordered. The voltage setting and fusing arrangement will normally be correct unless the instrument has been transported into another area. The power entry module has a strip of indicator tape showing its mains voltage setting. This tape must be removed before use.

You MUST be sure that the APx515 installment mains power configuration is correct for the electrical mains power supplied in your area. If you are not sure, do not plug the instrument into the mains power. Follow the instructions below to check or change the instrument mains supply voltage selection.

The mains power supply is applied to your APx515 instrument through the power entry module located on the rear panel. Before connecting the power cord, confirm that the input voltage selection and fusing arrangement in the power entry module are correct for your mains power supply.

Figure 2. Detail, power entry module on APx515 instrument rear panel. The mains power switch is to the left.

Checking the mains supply voltage configuration

The white plastic voltage indicator pin protrudes through one of the four labeled holes in the module cover to indicate the selected input voltage. Figure 2 shows the pin in the second position, indicating 120 V. Check to see that the indicated voltage matches your mains supply voltage. If it does not, change the mains supply voltage configuration as described below.

Opening the power entry module

Unplug the power cord from the instrument before changing fuses or performing any other operations described in this section.

To open the power entry module, refer to Figure 3 and proceed as follows:

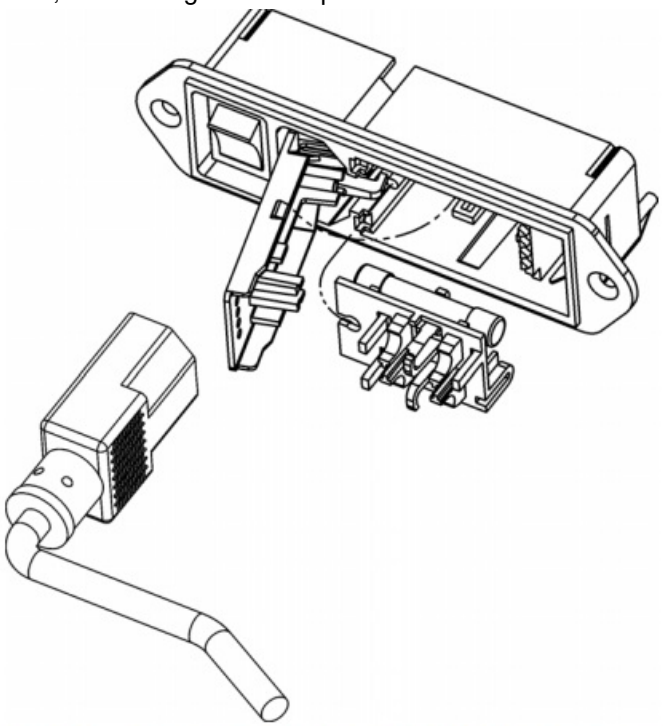


Figure 3. Power entry module door and fuse block.

- Remove the mains power supply cord from the power cord connector.
- Locate the slot in the module cover door hinge. The hinge is a the left side of the cover door, and the slot in the hinge is visible in the power cord connector cavity. Insert a small screwdriver or similar tool in the slot and pry

the cover door hinge outward. The cover door will snap out, and then can be pivoted on its hinge for access to the fuse block assembly and voltage selector card.

Changing the Mains Supply Voltage Configuration

- Open the Power Entry Module as described above.
- The voltage selector card is a small circuit board fitted with a white plastic indicator pin, installed in a housing on the right side of the Power Entry Module as shown in Figure 4. Pull the voltage selector card straight out of the housing, using narrow pliers to grab the card. Do not use the indicator pin as a handle.

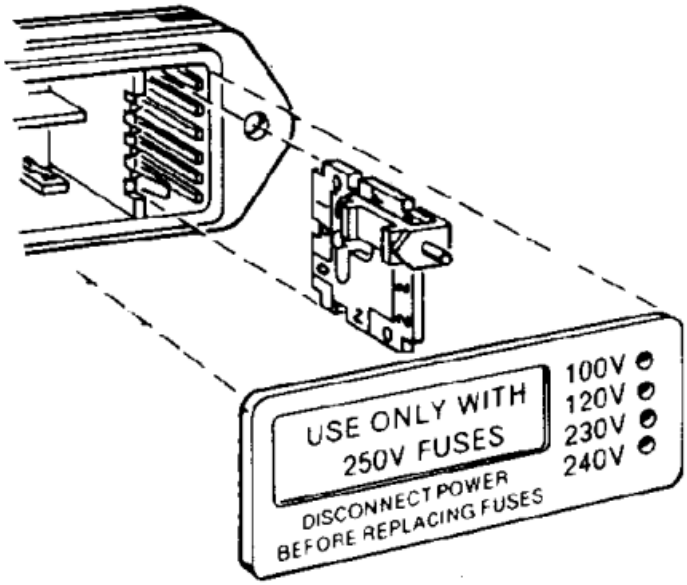


Figure 4. Changing the mains power supply voltage.

- Orient the selector card so that the desired input voltage is readable at the bottom, shown in Figure 5. Then move the indicator pin to point UP, opposite the indicated voltage. Seat the pin assembly in the notch on the board edge.
- Insert the voltage selector card into the housing with the printed side of the card facing toward the mains power connector. The card edge indicating the desired voltage should enter the housing first.
- Confirm that the correct fuse or fuse combination is installed for the intended input voltage (refer to the fuse ratings marked on the instrument rear panel). If necessary, change the fuse type as described in the following section.

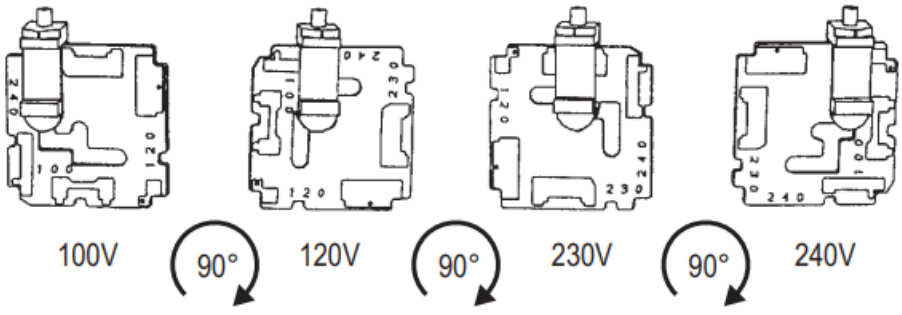


Figure 5. Voltage card selector orientation.

- Close the module the cover door and verify that the indicator pin shows the desired voltage.
- Once you have verified that the line voltage selection is correct, connect the power cord from a mains power outlet to the power cord connector on the instrument rear panel.

Fuse information
The power entry module accommodates two fusing arrangements, as illustrated in Figure 6.

- **100/120 VAC operation**
  The 100/120 VAC fusing arrangement uses a single type 3AG (0.25″ x 1.25″) slo-blo fuse. Audio Precision recommends only the following replacement fuse:
  - 1 each Littelfuse 313 Series, 800 mA 3AG 250 V slo-blo glass fuse.
- **230/240 VAC operation**
  The 230/240 VAC fusing arrangement uses two 5 x 20 mm IEC-approved type T fuses. Audio Precision recommends only the following replacement fuses:
  - 2 each Littelfuse 213 Series, 400 mA 250 V 5 x 20 mm Time Lag (slo-blo) glass fuses or
  - 2 each Littelfuse 218 Series, 400 mA 250 V 5 x 20 mm Time Lag (slo-blo) glass fuses.
    Refer to the label on the instrument rear panel for fuse current ratings.

Changing the fusing arrangement

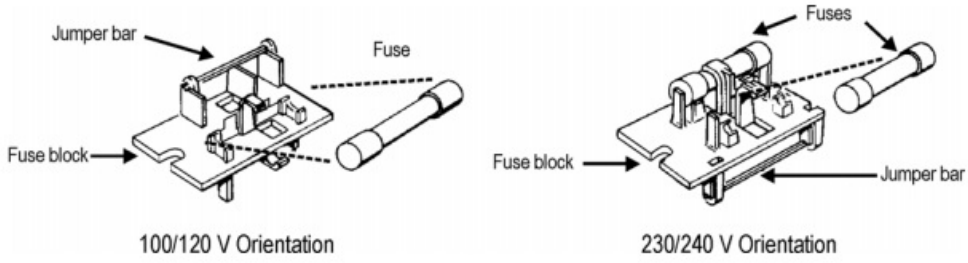


Figure 6. Fuse block orientation for 100/120 VAC and 230/240 VAC operation.

To replace a fuse or change the fusing arrangement, proceed as follows:

- Remove the mains power cord from the power cord connector and open the Power Entry Module as described above.
- Using narrow pliers, pull the fuse assembly out of the housing.
- Change or add the correct fuses as necessary, referring to Figure 6. Refer to the instrument rear panel for the correct fuse electrical current rating.
- Insert the fuse assembly in the housing, with the side of the assembly that carries the fuse(s) for your desired fusing arrangement facing into the housing. Press the fuse assembly firmly into the housing.
- Confirm that the line voltage selection is correct for your mains voltage and your fusing arrangement.

Once you have verified that the line voltage selection is correct, connect the power cord from a mains power outlet to the power cord connector on the instrument rear panel.

Abbreviations, Terms and Symbols

- **ADC or A/D** . . . . . .Analog to Digital converter or conversion.
- **BW** . . . . . .Bandwidth or Measurement Bandwidth, nominally at –3 dB; a single number indicates only the upper limit.
- **DAC or D/A** . . . . . .Digital to Analog converter or conversion.
- **DSP** . . . . . .Digital Signal Processing or Digital Signal Processor.
- **DUT** . . . . . .Device Under Test, the device to which the generator or analyzer is connected.

- **EMC** . . . . . .Electro-Magnetic Compatibility, usually refers to both emissions (radiated and conducted via AC mains) and susceptibility.
- **ENBW** . . . . . .Equivalent Noise Bandwidth, the frequency of an ideal filter having the same rms response to white noise.
- **FFT** . . . . . .Fast Fourier Transform, a mathematical process converting a signal in the time domain to the frequency domain.
- **IMD** . . . . . .Inter-Modulation Distortion, a measure of non-linearity using a test signal with two or more components.
- **RMS or rms** . . . . . .Root Mean Square, an equivalent-power expression of signal amplitude.
- **SR** . . . . . .Sample Rate, usually as it applies to the conversion rate of A/D and D/A converters or digital audio formats.
- **THD** . . . . . .Total Harmonic Distortion, rms summation of d2 to d9 (may be bandwidth limited), usually derived from an FFT.
- **THD+N** . . . . . .Rms measurement of ALL harmonics, spurious signals, and noise within a specified bandwidth.
- **Typical or Typ** . . . . . .A characteristic that is not guaranteed, usually due to a practical limitation in testing or metrology.
- **UI** . . . . . .Unit Interval, a measure of time is it applies to digital audio formats. 1 UI= 1/(128 • SR)
- **[ ]** . . . . . Indicates a specification in an equivalent unit, for example: 0.030 dB [0.35%] or 10.61 Vrms [30.00 Vpp].
- **≈** . . . . . Indicates an approximate or nominal value, or range of values; not guaranteed.

Specifications

Characteristic	Specifications	Supplemental Information
ANALOG GENERATOR		
Number of Channels	2, independent amplitude control	
Waveforms	Sine, sine split frequency, sine split phase, sine+DC offset, continuously swept-sine, noise, IMD test signals, multi-tone, wave file playback	
Sine Characteristics		
Frequency Range (Fs)	2 Hz to 80.1 kHz	*Setting resolution is typically 45 µHz*
Frequency Accuracy	±(0.0003% + 100 µHz)	
Amplitude Range	0 to 16.00 Vrms [45.2 Vpp], balanced; 0 to 8.00 Vrms [22.6 Vpp], unbalanced	
Amplitude Accuracy, 1 kHz	±0.05 dB [±0.58%]	
Flatness (1 kHz ref)		
Fs = 10 Hz to 20 kHz	±0.010 dB	*Typically <0.005 dB.*
Fs = 20 kHz to 50 kHz	±0.030 dB	
Fs = 50 kHz to 80 kHz	±0.10 dB	
Residual THD+N[1,2]		
Fs = 20 Hz–20 kHz	≤ (–102 dB + 2.0 µV), 20 kHz BW	

Non-Harmonic Content		*Typically <-110 dB when Fs ≤75 kHz, increasing to ≈-55 dB at Fs =80 kHz*
Phase Offset Range (Split Phase)	–179.999 to +180.000 deg	
DC Offset Range	±12.00 Vdc balanced; ±6.00 Vdc unbalanced	*DC offset limits maximum ac signal*
Residual DC Offset	≤0.25% of Vrms setting [≤0.09% of Vpp setting] + 100 µV	

Noise Characteristics

Shape	White (<5 Hz to 86.4 kHz), Pink (<10 Hz to 86.4 kHz), IEC 60268-1 or BS EN 50332-1	
Amplitude Range	0 to 45.2 Vpp, balanced; 0 to 22.6 Vpp, unbalanced	*Amplitude calibration is approximate*

IMD Test Signals (requires option AML)

SMPTE & MOD

Lower Frequency (LF)	40 Hz to 1.00 kHz	*LF tone must be ≤1/6 • HF tone.*
SMPTE Upper Frequency (HF)	2.00 kHz to 60.00 kHz	
MOD Upper Frequency (HF)	240 Hz to 60.00 kHz	
Mix Ratio (LF:HF)	10:1, 4:1 or 1:1	
Amplitude Range	0 to 45.2 Vpp, balanced; 0 to 22.6 Vpp, unbalanced.	
Amplitude Accuracy	±0.06 dB [±0.70%]	
Residual IMD[1,2,3]	≤0.0025% [-92 dB], 4:1 mix ratio	

DFD & CCIF

Difference Frequency (Fdiff)	80 Hz to 2.00 kHz	$F_{mean} = (F1 + F2)/2.$
Mean Frequency (Fmean)	250 Hz to 60.00 kHz	$F_{diff} = \|F2 - F1\|$ F_{mean} *must be* $\geq 6 \cdot F_{diff}$
Amplitude Range	0 to 45.2 Vpp, balanced; 0 to 22.6 Vpp, unbalanced.	
Amplitude Accuracy	±0.06 dB [±0.70%]	
Residual IMD[1,2,3]	≤ 0.0010% [–100 dB]	

Multitone, Wave File Playback (requires option HST)

Sample Rate Range (SR)	8 kS/s to 108 kS/s, and 175 kS/s to 192 kS/s	*Operation from 109 kS/s to 175 kS/s is possible, but with degraded flatness*
Maximum File Size	32 MSample.	
Amplitude Range	0 to 45.2 Vpp, balanced; 0 to 22.6 Vpp, unbalanced.	*.Wav file must peak at digital full scale to obtain selected amplitude*
Flatness (1 kHz ref)		
SR = 175 kS/s to 192 kS/sec		*Typically <0.012 dB to 20 kHz*
SR = 8 kS/s to 108 kS/s		*Typically <0.04 dB to 20 kHz;* *max frequency limited to ≈0.45 • SR*
Spurious Content		*Typically <–100 dB*

Output Equalization

Arbitrary 30-pole output filter

Source Resistance (Rs)

Balanced	Selectable 100 Ω ±1% or 600 Ω ±1%.	*Grounded, symmetrical*
Unbalanced	Selectable 50 Ω ±1.5% or 600 Ω ±1%.	*Electronically floating, 0.3 Vpk max;* *bnc shield to ground ≈10-17 Ω || 22nF*
Common Mode Test	Same as Balanced selections	

Max Output Current

Typically >50 mA peak, 50 mA dc

Reverse Overload Protection

Up to 30 W

Output Related Crosstalk[1]

≤ (–120 dB + 1 µV) to 20 kHz

ANALOG ANALYZER

Number of Channels

2, independently auto-ranging. *Max ADC sample rate = 192 kS/s*

Maximum Rated Input	125 Vpk, 120 Vdc any input to ground; 0.5 Vpk for unbalanced bnc shields	
Input Impedance		
Balanced	100 kΩ || ≈230 pF, each side to gnd	
Unbalanced	100 kΩ || ≈230 pF to bnc shield	*Electronically floating, 0.5 Vpk max; bnc shield to ground ≈500Ω || 22nF*
Input Termination	Selectable 600 Ω ±1%, 1.5 W max.	*Termination automatically opens in the 80 V range.*
Input Coupling	Selectable DC or AC	*Typically <0.5 µA bias current with DC coupling, typically <0.03 dB roll-off at 20 Hz with AC coupling*
Input Ranges	250 mVrms to 80 Vrms, 10 dB steps	*Maximum ac signal is ≈88 Vac unbal, 115 Vac bal, in the 80V range*
Common Mode Rejection[4]		*Max common mode signal range:*
250 mV, 800 mV, 2.5 V ranges	≥ 80 dB, 5 Hz to 5 kHz; ≥ 70 dB, 5 kHz to 20 kHz.	*±6 Vpk*
8 V range	≥ 50 dB, 5 Hz to 20 kHz	*±12 Vpk*
25 V range	≥ 50 dB, 5 Hz to 20 kHz	*±60 Vpk*
80 V range	≥ 45 dB, 5 Hz to 20 kHz	*±120 Vpk*
Input Related Crosstalk	≤ (–120 dB + 0.3 µV) to 20 kHz	$R_s \leq 600\ \Omega$
Level (Amplitude) Measurement		
Range		
Balanced or bridging input	< 1 µV to 115 Vrms	
Unbalanced input	< 1 µV to 85 Vrms	
Accuracy (1 kHz)	±0.05 dB [±0.60%]	
Flatness (1 kHz ref, DC coupling)		
10 Hz to 20 kHz	±0.010 dB	*Typically < 0.005 dB.*
20 kHz to 50 kHz	±0.030 dB	
50 kHz to 80 kHz	±0.10 dB	
Residual Noise (inputs shorted)	≤ 1.4 µVrms, 20 kHz BW	*Typically < 8.0 nV/√Hz at 1 kHz*
THD+N Measurement		
Fundamental Range	5 Hz to > 90 kHz	
Measurement Range	0 to 100%	
Accuracy	±0.5 dB	
Residual THD+N[1,2]		
20 Hz–20 kHz fundamentals	≤ (–102 dB + 2.0 µV), 20 kHz BW	
Bandwidth Limiting Filters		
High-Pass[8]		
DC	DC coupling	
AC (< 10 Hz)	AC coupling	*Response is 2-pole via a combination of analog and digital filters, and is typically –3 dB at 4.1 Hz*
Butterworth	F_{HP} (–3 dB) = 10 Hz to 90 kHz, 4-pole	
Elliptic	F_{HP} (–0.01 dB) = 10 Hz to 90 kHz; 5-pole; 0.01 dB pass-band ripple; ≤–60 dB stop-band	
Low-Pass[5, 8]		
ADC Passband	No filter is implemented, bandwidth and response are limited by the A/D and sample rate (SR)	*–3 dB at ≈ 0.490 • SR, SR ≤ 216 kS/s*
20k (AES17), 40k (AES17)	Special filters conforming with AES17	
Butterworth	F_{LP} (–3 dB) = 10 Hz to 90 kHz, 8-pole	*ENBW ≈ 1.006 • F_{LP}*
Elliptic	F_{LP} (–0.01 dB) = 10 Hz to 90 kHz, 8-pole; 0.01 dB pass-band ripple; ≤–60 dB stop-band	*ENBW ≈ (1.012–1.062) • F_{LP} (varies due to warping)*

Weighting	A-wt, B-wt, C-wt, CCIR-1k, CCIR-2k, CCITT, C-message, 50 µs or 75 µs de-emph (with and without A-wt), or None	*Weighting filter is cascaded with both high-pass and low-pass filters*
Input Equalization	Arbitrary 30-pole input filter	*The EQ operates on any selected analyzer input channels.*
IMD Measurement		
Test Signal Compatibility		
SMPTE & MOD	Any combination of 40 Hz–1 kHz (LF) and 240 Hz–60 kHz (HF), mixed in any ratio from 1:1 to 10:1 (LF:HF)	*LF tone must be ≤1/6 • HF tone.*
DFD & CCIF	Any two-tone combination with mean frequency of 250 kHz–60 kHz and a difference frequency of 80 Hz–2.0 kHz	$F_{mean} = (F1 + F2)/2.$ $F_{diff} = \|F2 - F1\|$ F_{mean} *must be* $\geq 6 \bullet F_{diff}$
IMD Measured		
SMPTE	Amplitude modulation of HF tone.	*Measurement BW is typ. 40–750 Hz.*
MOD	d2, d3, d2+d3, or d2+d3+d4+d5	*Use "d2+d3" for measurements per IEC 60268*
DFD	d2, d3, d2+d3, or d2+d3+d4+d5	*Use "d2+d3" for measurements per IEC 60268*
CCIF	d2 only	*"CCIF" is an archaic form of DFD that measures only the d2 product. CCIF uses a different 0 dB reference giving readings 2x higher than DFD.*
Measurement Range	0 to 20%	
Accuracy	±0.5 dB	
Residual IMD[1,2,3]		
SMPTE & MOD	≤-92 dB [0.0025%], 4:1 mix ratio	
DFD	≤-100 dB [0.0010%]	
Frequency Measurement		
Range	5 Hz to 90 kHz	
Accuracy	±0.0003% [3 ppm]	V_{in} *must be ≥ 5 mV.*
Resolution	6 digits	
Phase Measurement		
Ranges	–90 to +270, ±180, or 0 to 360 deg	
Accuracy	±0.2 deg, 5 Hz to 5 kHz; ±0.8 deg, 5 kHz to 20 kHz; ±2.0 deg, 20 kHz to 50 kHz	V_{in} *must be ≥ 5 mV with dc coupling, both channels. Accuracy degrades below 50 Hz with ac coupling.*
Resolution	0.001 deg	
DC Voltage Measurement		
Input Ranges	0.25 V to 80 V, 10 dB steps	*±120 Vdc maximum in 80 V range*
Accuracy		
250 mV and 800 mV ranges	±(0.7% reading + 1 mV)	
2.5 V-80 V ranges	±(0.7% reading + 0.1% range)	
Normal Mode Rejection		*Typically > 90 dB, 20 Hz to 20 kHz.*

DIGITAL I/O

DIGITAL OUTPUT RELATED:

Formats		
Electrical, unbalanced	SPDIF-EIAJ per IEC60958, 0.50 Vpp or 1.00 Vpp ±10% into 75 Ω	*Output R is nominally 75 Ω.*
Electrical, balanced	AES-EBU per AES3-1992, 5.00 Vpp ±10% into 110 Ω	*Output R is nominally 110 Ω.*
Optical	Toslink®	
Sample Rate (SR) Range		
Electrical	27 kS/s to 200 kS/s	*Usable over the extended range of 16 kS/s to 216 kS/s with degraded waveform*
Optical	27 kS/s to 108 kS/s	
Sample Rate (SR) Accuracy	±0.0003% [3 ppm]	

Channel Status Bits	Full implementation per IEC-60958	*Automatically set or manual override, hex or plain English*
User Bits and Validity Flag	Fully settable	*Hex*
Residual Jitter[1,6]		
Electrical		*Typically < 1.5 ns*
Optical		*Typically < 2.5 ns, SR ≤ 96 kS/s*

EMBEDDED OUTPUT SIGNAL RELATED:

Waveforms	Sine, sine split frequency, sine split phase, sine+DC offset, continuously swept-sine, square-wave, noise, IMD signals, multi-tone, constant value, walking ones/zeros, bittest random, wave file playback	*8–24 bit word width, triangular PDF dither.*
Sine Characteristics		
Frequency Range	5 Hz to 0.499 • SR	
Flatness[1]		*Typically <0.001 dB*
Offset Range	To maximum digital code [±1D]	*Offset limits maximum ac signal*
Harmonics & Spurious[1,6]		*Typically <–140 dBFS*
Square Characteristics		
Frequency Range (Fq)	10 Hz to SR / 6	*Only specific values are allowed: Fq = SR / N where N is an even integer ≥6*
Even Harmonic, Spurious Content		*Typically <-140 dBFS*
Noise Characteristics		
Shape	White (<5 Hz to 0.499 • SR), Pink (<10 Hz to 0.45 • SR), IEC 60268-1 or BS EN 50332-1	
IMD Test Signals		
SMPTE & MOD		
Lower Frequency (LF)	40 Hz to 1.00 kHz	*LF tone must be ≤1/6 • HF tone.*
SMPTE Upper Frequency (HF)	2 kHz to (0.499 • SR) or 60 kHz, whichever is lower	
MOD Upper Frequency (HF)	240 Hz to (0.499 • SR) or 60 kHz, whichever is lower	
Mix Ratio (LF:HF)	10:1, 4:1 or 1:1	
Residual IMD[1,6]		*Typically <–140 dBFS*
DFD & CCIF		
Tone Pair Mean Range	2.5 kHz to (0.499 • SR – F_{mean} / 2) or 20 kHz, whichever is lower	*F_{mean} = (F1 + F2)/2.*
Tone Pair Difference Range	80 Hz to 2.0 kHz	*F_{mean} = (F1+F2)/2, F_{diff} = |F2–F1|. F_{mean} must be ≥ 6 • F_{diff}*
Residual IMD[1,6]		*Typically <–150 dBFS*
Multitone, Wave File Playback		
Sample Rate (SR)	8 kS/s to 216 kS/s	
Maximum File Size	32 MSample.	
Flatness (1 kHz ref)		*Typically <0.001 dB to 0.499 • SR*
Spurious Content		*Typically <–140 dB*

DIGITAL INPUT RELATED:

Formats		
Electrical, unbalanced	SPDIF-EIAJ per IEC60958, ≤10 Vpp.	*Input R is nominally 75 Ω.*
Electrical, balanced	AES-EBU per AES3-1992, ≤10 Vpp.	*Input R is nominally 110 Ω.*
Optical	Toslink®	
Sample Rate Range (SR)		
Electrical	27 kS/s to 216 kS/s	*Typically locks down to 16 kS/s*
Optical	27 kS/s to 108 kS/s	

EMBEDDED INPUT SIGNAL RELATED:

Level (Amplitude) Measurement

Measurement Range	< –120 dBFS to +3 dBFS	
Accuracy (1 kHz)		*Typically < 0.001 dB*
Flatness[1]		*Typically <0.001 dB*

Residual Noise[1]

Typically <–140 dBFS

THD+N Measurement

Fundamental Range	5 Hz to 0.49 • SR or 50 kHz, whichever is lower	*Tuning can be set to track measured frequency, generator setting or fixed*
Measurement Range	0 to 100%	
Accuracy	±0.5 dB	*Q=2.6 typically*
Residual THD+N[1, 7]		*Typically <–140 dBFS*

Bandwidth Limiting Filters

High-Pass[8]		
DC	DC coupling	
AC (< 10 Hz)	AC coupling	*–3 dB at 4.1 Hz*
Butterworth	F_{HP} (–3 dB) = 10 Hz to 100 kHz, 4-pole	
Elliptic	F_{HP} (–0.01 dB) = 10 Hz to 100 kHz; 5-pole; 0.01 dB pass-band ripple; ≤–60 dB stop-band	
Low-Pass [8]		
FS/2	No filter is implemented, bandwidth and response are limited by the SR	
Butterworth	F_{LP} (–3 dB) = 10 Hz to 100 kHz, 8-pole	*ENBW ≈ 1.006 • F_{LP}*
Elliptic	F_{LP} (–0.01 dB) = 10 Hz to 100 kHz, 8-pole; 0.01 dB pass-band ripple; ≤–60 dB stop-band	*ENBW ≈ (1.012–1.062) • F_{LP} (varies due to warping)*
Weighting	A-wt, B-wt, C-wt, CCIR-1k, CCIR-2k, CCITT, C-message, 50 µs or 75 µs de-emph (with and without A-wt), or None	*Weighting filter is cascaded with both high-pass and low-pass bandwidth limiting filters*

Input Equalization

Arbitrary 30-pole input filter — *The EQ operates on any selected analyzer input channels.*

IMD Measurement

Test Signal Compatibility		
SMPTE & MOD	Any combination of 40 Hz–1 kHz (LF) and 240 Hz–60 kHz (HF), mixed in any ratio from 1:1 to 10:1 (LF:HF)	*LF tone must be ≤1/6 • HF tone.*
DFD & CCIF	Any two-tone combination with mean frequency of 250 kHz–60 kHz and a difference frequency of 80 Hz–2.0 kHz	*F_{mean} = (F1 + F2)/2* *F_{diff} = |F2 - F1|* *F_{mean} must be ≥ 6 • F_{diff}*
IMD Measured		
SMPTE	Amplitude modulation of HF tone.	*Measurement BW is ≈40–750 Hz.*
MOD	d2, d3, d2+d3, or d2+d3+d4+d5	*Use "d2+d3" for measurements per IEC-60268.*
DFD	d2, d3, d2+d3, or d2+d3+d4+d5	*Use "d2+d3" for measurements per IEC-60268*
CCIF	d2 only	*"CCIF" is an archaic form of DFD that measures only the d2 product. CCIF uses a different 0 dB reference giving readings 2x higher than DFD.*
Measurement Range	0 to 20%	
Accuracy	±0.5 dB	
Residual IMD[1, 7]		
SMPTE & MOD		*Typically <–140 dBFS*

DFD		*Typically <–150 dBFS*
Frequency Measurement		
Range	<5 Hz to 0.499 • SR	
Accuracy	±(0.0003% + 100 µHz)	
Resolution	6 digits	
Phase Measurement		
Ranges	–90 to +270, ±180, or 0 to 360 deg	
Accuracy[1]		*Typically 0.001 deg*
Resolution	0.001 deg	

GENERAL/ENVIRONMENTAL

Power Requirements	100, 120, 230 or 240 Vac, 50–60 Hz, with safety ground via approved power cord, 75 VA max.	*Typical operating range is 90–110 Vac (100V), 108–132 Vac (120V), 198–242 Vac (230V), or 216–264 Vac (240V).*
Temperature Range		
Operating	0° C to +45° C	
Storage	–40° C to +75° C	
Humidity	10 % to 80 %, non-condensing	
Max Operating Altitude	3,000 m [9,840 feet]	
Stabilization Time	20 minutes	*Allow up to 1 hour per 10°C if unit has been exposed to a significant change in temperature. Allow 24–48 hours to recover if condensation has occurred.*
EMC	Complies with Directive 2004/108/EC, IEC 61326-1:2005, EN 61326-1:2006. Radiated and conducted emissions are within Class B limits of CISPR 11.	*Emission and immunity levels are influenced by the shielding performance of interface and signal cables attached to the instrument. EMC compliance was demonstrated using Audio Precision cables*
Safety	Complies with Directive 2006/95/EC, IEC 61010-1:2001, EN 61010-1:2001, CAN/CSA-C22.2 No. 61010-1-04, and UL Std No. 61010-1 (2nd Edition).	*Equipment Class I, Installation Category II, Pollution Degree 2, Measurement Category I*
Dimensions (W x H x D)	370 x 86 x 343 mm [14.55 x 3.40 x 13.53 in]	*2U rack mount tray available. D is 351 mm [13.56 in] if rear panel option keys are installed*
Weight	4.45 kg [9.8 lbs]	

Notes to Specifications

1. System specification including contributions from both generator and analyzer. Generator-only and/or analyzer-only contributions are typically less.
2. Generator load must be ≥600 Ω balanced or ≥ 300 Ω unbalanced for specified performance. Generator dc offset must be off or set to ≤10 mV.
3. Analyzer input must be ≥150 mV for specified performance. Analyzer set to measure “d2+d3” IMD products for MOD and DFD modes.
4. Valid for the balanced input configuration with dc coupling only. With ac coupling, specified performance is invalid below 50 Hz.
5. Maximum low-pass filter frequency is limited by analyzer input bandwidth setting.
6. Sample rate (SR) must be ≥ 27 kS/s for specified performance. Jitter analyzer set for 700 Hz high-pass response per AES3-1992.
7. Digital generator word width must be set to 24 bits for specified performance; shorter word widths may degrade performance.
8. Filter response is relative to “no filter” selection; overall system performance will also include analog flatness imperfections. DSP warping may significantly increase roll-off rate and lower ENBW.

Documents / Resources

	**Audio Precision APx515 B Series Audio Analyzer** [pdf] Installation Guide APx515 B Series Audio Analyzer, APx515 B Series, Audio Analyzer, Analyzer

References

- **Audio Analyzers & Testing: Audio Precision | The Global Leader**
- **Audio Analyzers & Testing: Audio Precision | The Global Leader**
- **Get Keybox: Audio Precision | The Global Leader**
- **Audio und Medientechnologien**
- **User Manual**

Manuals+, **Privacy Policy**

This website is an independent publication and is neither affiliated with nor endorsed by any of the trademark owners. The "Bluetooth®" word mark and logos are registered trademarks owned by Bluetooth SIG, Inc. The "Wi-Fi®" word mark and logos are registered trademarks owned by the Wi-Fi Alliance. Any use of these marks on this website does not imply any affiliation with or endorsement.