APx52x/58x
FAMILIES OF AUDIO ANALYZERS

Installation Instructions
and Specifications

B Series

APx52x and 58x
B Series families of audio analyzers
Installation Instructions and Specifications

B Series APx525 with DIO, PDM, DSIO and Bluetooth options

November, 2023

An Axiometrix Solutions Brand

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Documentation and Support

This booklet contains safety information, installation instructions and full specifications for the Audio Precision APx52x and 58x families of audio analyzers.

The APx500 User's Manual

Detailed information on the operation of the APx52x and 58x families of analyzers is available from the embedded Help installed with the APx500 measurement software, and in the APx500 User's Manual, included with the analyzer. The user's manual is also available as a PDF on the APx500 Application Disc and on the Web at ap.com; additional 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.).

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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 equipment 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 95–264 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 19 of this manual.

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 2-channel input module measurement terminals are rated for a maximum voltage of 230 Vpk to ground, and a signal input of 160 Vrms unbalanced, 300 Vrms balanced; the 8-channel input module measurement terminals are rated for a maximum input of 160 Vpk to ground, and a signal input of 115 Vrms, balanced or unbalanced. These terminals 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.

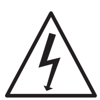
This product is for indoor use—Installation Category II, Measurement Category I, pollution degree 2.

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

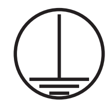
The following symbols may be marked on the panels or covers of equipment or modules, and are used in this manual:



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.

Sécurité

Consignes de sécurité

Ne procédez PAS à l'entretien ou à la réparation de cet équipement à moins d'être dûment qualifié(e) pour le faire. L'entretien devrait être effectué uniquement par un technicien qualifié ou un distributeur Audio Precision agréé.

Ne PAS dérouter le branchement de la mise à la terre de sécurité. Cet équipement est conçu pour être utilisé uniquement avec un cordon d'alimentation approuvé avec connecteur à trois conducteurs et mise à la terre de sécurité. La perte de connexion à la mise à la terre protectrice peut entraîner un risque de choc électrique à partir des surfaces conductrices accessibles de cet équipement.

Ne PAS dépasser la tension de réseau nominale. Cet équipement est conçu pour fonctionner uniquement à partir d'une source d'alimentation réseau de 50–60 Hz CA, à une tension nominale de 100–240 V CA. La tension d'alimentation du réseau ne doit pas dépasser ±10 % de la tension nominale (90–264 V CA).

Pour obtenir en permanence la protection contre les risques d'incendie, les fusibles doivent être remplacés UNIQUEMENT par des fusibles de même valeur et type, comme indiqué sur le panneau arrière de l'instrument et précisé à la page 24 de ce livret.

La International Electrotechnical Commission (la Commission électrotechnique internationale) (CEI 1010-1) exige que les bornes des circuits de mesure utilisées pour la mesure de la tension ou du courant identifient leur catégorie de mesure. La catégorie de mesure se base sur l'amplitude de la tension transitoire ou de la tension d'impulsion à laquelle on peut s'attendre d'un réseau de distribution d'alimentation électrique CA. Ce produit est classé dans la catégorie de mesure I, selon l'abréviation « CAT I » inscrite sur le panneau avant de l'instrument. Ce produit ne devrait pas être utilisé dans les catégories II, III ou IV. Les bornes de mesure du module d'entrée à deux canaux sont classées selon une tension maximale de crête de 230 V à la terre et une entrée de signal de 160 V RMS non équilibrés, et de 300 V RMS équilibrés; les bornes de mesure du module d'entrée à huit canaux sont classées selon une tension maximale de crête de 160 V à la terre et une entrée de signal de 115 V RMS, équilibrés ou non équilibrés. Ces bornes sont destinées à la mesure des signaux audio seulement.

Ne PAS remplacer de pièces ou effectuer de modifications sans l'approbation écrite d'Audio Precision. Si c'est le cas, il pourrait y avoir des risques pour la sécurité. Utiliser ce produit d'une manière non précisée par Audio Precision peut entraîner un risque pour la sécurité.

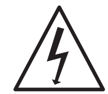
Ce produit est destiné à une utilisation à l'intérieur-Catégorie d'installation II, Catégorie de mesure I, degré de pollution 2.

Pour nettoyer le boîtier de ce produit, utiliser un chiffon doux ou une brosse douce permettant d'éliminer la saleté accumulée. Un détergent doux peut être utilisé pour éliminer la saleté ou les taches. Ne pas utiliser de produits nettoyants forts ou abrasifs. Essuyer toutes les surfaces à l'aide d'un chiffon humide.

Cette unité est fournie avec quatre pattes sur le dessous et quatre pattes sur le côté droit. L'unité doit être utilisée uniquement lorsqu'elle repose sur les pattes du dessous. Les pattes sur le côté droit sont installées pour plus de commodité et de stabilité lors du transport. NE PAS utiliser l'unité lorsqu'elle repose sur les pattes du côté

Symboles de sécurité

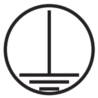
Les symboles suivants peuvent être présents sur les panneaux ou les couvercles de l'équipement ou des modules, et sont utilisés dans le présent manuel:



AVERTISSEMENT!—Ce symbole vous informe d'une situation potentiellement dangereuse, par exemple, la présence d'une tension dangereuse qui pourrait présenter un risque de choc électrique. Consultez l'autocollant ou l'étiquette d'avertissement qui l'accompagne, et faites preuve d'une grande prudence.

ATTENTION!—Ce symbole vous informe d'importantes considérations liées au fonctionnement ou d'une condition d'utilisation potentielle qui pourrait endommager l'équipement. Si vous voyez ce symbole sur l'équipement, consultez le manuel de l'opérateur ou le manuel de l'utilisateur pour connaître les instructions préventives.

BORNE DE TERRE FONCTIONNELLE— Les bornes identifiées à l'aide de ce symbole sont reliées électriquement à un point de référence d'un circuit ou d'une sortie de mesure et doivent être raccordées à la terre (mise à la terre) pour toute fonction utilitaire autre que la sécurité.



BORNE DE TERRE DE PROTECTION—Les bornes identifiées à l'aide de ce symbole sont liées à des pièces conductrices de l'instrument et elles doivent être raccordées à un système protecteur de mise à la terre externe.

Avis de non-responsabilité

Audio Precision déconseille fortement l'utilisation de ses produits d'une manière non spécifiée par le fabricant. Une telle utilisation pourrait annuler toute garantie, endommager l'équipement ou présenter un risque de sécurité pour le personnel.

Seguridad

Información de seguridad

NO proporcione servicio o reparación a este equipo a menos que esté debidamente calificado. El trabajo de servicio deberá ser efectuado solamente por un técnico calificado o un distribuidor autorizado de Audio Precision.

NO modifique la conexión de seguridad a tierra. Este equipo está diseñado para operar solamente con una extensión aprobada de tres conductores puestos a tierra de seguridad. La pérdida de conexión de protección a tierra puede dar como resultado un peligro de descarga eléctrica al tocar las superficies conductoras accesibles de este equipo.

NO exceder las clasificaciones de la tensión de red eléctrica. Este equipo está diseñado para operar solamente de una fuente de suministro eléctrico de 50–60 Hz de corriente alterna a una tensión nominal de 100–240 VCA. La fuente de suministro de voltaje no debe exceder del ±10 % del nominal (90–264 VCA).

Para protección continua contra riesgo de incendio, los fusibles deberán reemplazarse SOLAMENTE con fusibles de valor y tipo exactos indicados en el panel posterior del instrumento y que se explica en la página 28 de este folleto.

International Electrotechnical Commission [La Comisión Electrotécnica Internacional] (IEC 1010-1) requiere que los terminales del circuito de medición que se utilizan solamente para medición de voltaje o corriente se marquen para indicar la categoría de medición. La categoría de medición se basa en la amplitud del voltaje transitorio o de impulso que se puede esperar de la red de distribución de voltaje de CA. Este producto se clasifica como Medición de Categoría I, abreviado como “CAT I” en el panel frontal del instrumento.

Este producto no deberá usarse dentro de las categorías II, III, o IV. Los terminales de medición del módulo de entrada de 2 canales tienen una capacidad para un voltaje máximo de 230 Vpk a tierra, y una entrada de señal de 160 Vrms no balanceada, 300 Vrms balanceada; los terminales de medición del módulo de entrada de 8 canales tienen una capacidad para un voltaje máximo de 160 Vpk a tierra, y una entrada de señal de 115 Vrms, balanceada o no balanceada. Estos terminales están concebidos para usarse solamente para la medición de señales de audio.

NO reemplace partes ni haga modificaciones sin la aprobación por escrito de Audio Precision. Hacerlo podría causar riesgos de seguridad. El uso de este producto en una manera no especificada por Audio Precision puede resultar en un riesgo de seguridad.

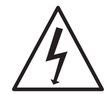
Este producto es para uso en interiores-Categoría de instalación II, Categoría de medición I, grado de contaminación 2.

Para limpiar la caja de este producto, utilice un trapo o cepillo suave para remover el polvo acumulado. Se puede utilizar un detergente neutro para remover la suciedad o manchas remanentes. No utilice limpiadores fuertes o abrasivos. Limpie todas las superficies con un trapo húmedo.

Esta unidad se suministra con cuatro patas en la superficie inferior y cuatro patas en la superficie del costado derecho. La unidad solamente debe operarse al estar apoyada en las patas de la superficie inferior. Las patas en el costado derecho se proporcionan para conveniencia y estabilidad al transportar la unidad. NO opere la unidad al estar apoyada sobre las patas laterales.

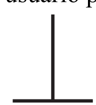
Símbolos de seguridad

Los siguientes símbolos podrían estar marcados en los paneles o cubiertas del equipo o los módulos, y se utilizan en este manual:

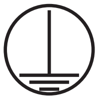


¡ADVERTENCIA!—Este símbolo le alerta sobre una condición potencialmente peligrosa, tal como la presencia de voltaje peligroso que pudiera representar un riesgo de descarga eléctrica. Consulte la etiqueta de advertencia adjunta y tenga mucha precaución.

¡ATENCIÓN!—Este símbolo le alerta de consideraciones operativas importantes o de una condición operativa potencial que pudiera dañar al equipo. Si usted ve este símbolo en el equipo, consulte el Manual del operador o el Manual del usuario para instrucciones de precaución.



TERMINAL DE TIERRA FUNCIONAL—Un terminal marcado con este símbolo está conectado eléctricamente a un punto de referencia de un circuito de medición o salida y se supone está conectado a tierra (aterrizado) para algún fin funcional diferente a la seguridad.



TERMINAL DE TIERRA DE PROTECCIÓN—Un terminal marcado con este símbolo está enlazado a partes conductores del instrumento y se supone que está conectado a un sistema externo de protección a tierra (aterrizada).

Exención de responsabilidad

Audio Precision advierte contra el uso de este producto de una manera no especificada por el fabricante. El hecho de no hacerlo de la manera indicada invalidaría las garantías, causaría daño al equipo, o representaría un riesgo de seguridad para el personal.

Installation

Software

All APx systems use the same award-winning measurement software, APx500.

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 can be very demanding of the personal computer (PC) running the APx software.

Moderate measurement demands
Moderate measurement demands (measurement bandwidths under 90 kHz, channel counts of 2 or 1) will perform adequately using a PC with these minimum specifications:

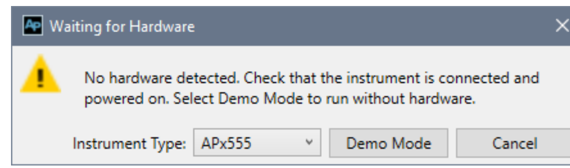
- Operating system: Microsoft Windows 10 (64-bit) or Windows 11.
- Intel i5 or better processor running at a clock speed of at least 2.5 GHz. AMD processors with similar specifications are also supported.
- At least 8 GB of RAM. 16 GB is highly recommended.
- At least 1.5GB of free hard disk space. An 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 or USB 3.0 port; two are required for optional switcher or DCX-127 use.
- A color monitor with at least SXGA (1280 x 1024) video graphics support. Video resolution of 1900 x 1080 or greater is recommended.

High measurement demands
High measurement demands (measurement bandwidths above 90 kHz, channel counts over 2) will perform much better with a superior PC; in some cases, very high measurement demands can slow or stop measurements.

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
You can launch the APx500 software without 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 APx 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 instrument 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 instrument. We strongly recommend that you use the USB cable included with your instrument (AP order 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 instrument 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 pressing the pushbutton on the front of the instrument. Microsoft Windows will detect the presence of the instrument on the USB 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 instrument.

Launch APx500 by double-clicking on the installed shortcut. With the instrument 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.

> *A copy of the APx500 User’s Manual is included with your instrument. The manual is also available as a PDF on the APx500 Application Disc and online at ap.com.*

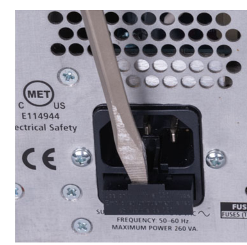
Connecting your instrument to the electrical mains supply

APx52x/58x instruments must be connected to a 50–60 Hz alternating current (ac) electrical mains supply. The minimum voltage is 95 Vac; maximum voltage is 264 Vac. These instruments are fitted with a universal power supply that does not require voltage configuration or change of fuse type to accept mains voltages within the specified range. For all rated voltages, use two mains fuses of type 3.15A T/SB (5 x20 mm) 250 V.

Removing and installing mains fuses

To remove the mains fuse carrier module, refer to the figures below and proceed as follows:

Power entry module



Fuse carrier removal

Remove the mains power supply cord from the connector on the power entry module, located on the instrument rear panel. The mains fuse carrier module is part of the power entry module, below the power cord connector.

Insert a small screwdriver into the power cord connector area, reaching into the slot on the mains fuse carrier module. Pry the module out slightly, until you can grasp the module firmly with your fingers. Pull the fuse carrier module out of the power entry module. The two mains fuses are loosely mounted within the fuse carrier module; take care not to let them fall.

Replace the fuses if necessary, using fuses as described above. Carefully reinsert the fuse carrier module into the power entry module, and press it firmly into place.

Connect the power cord from a mains power outlet to the power cord connector on the instrument rear panel.

Installation (Fr)

Logiciel

Tous les systèmes APx utilisent le même logiciel de mesure lauréat, soit APx500.

Analyseurs APx « B Series »

Tous les analyseurs livrés à compter de la fin de décembre 2018 seront dotés d'un processeur intégré et de dispositions de sécurité améliorées. Ces analyseurs portent la désignation « B Series » et suivent la nomenclature « B Series ». Les analyseurs APx « B Series » n'exigent pas de dispositif APx KeyBox (voir ci-dessous), mais peuvent nécessiter des codes d'autorisation afin d'activer le logiciel ou les options de logiciel APx500.

Dispositif APx KeyBox

Si vous utilisez la version 4.6 ou une version plus récente du logiciel APx500 avec un analyseur APx antérieur (pas « B Series »), vous devez installer un dispositif APx KeyBox authentifié au connecteur Software Options sur le panneau arrière de l'analyseur.

Le dispositif APx KeyBox doit être programmé avec le numéro de série de votre analyseur à l'usine d'Audio Precision et ne peut être utilisé avec aucun autre analyseur APx. Des codes d'autorisation afin d'activer le logiciel ou les options de logiciel APx500 peuvent être requis.

Veuillez noter que sans l'installation d'un dispositif APx KeyBox correctement authentifié, le logiciel APx500 version 4.6 ou plus récente ne fonctionnera qu'en mode de démonstration. Si vous avez besoin d'un dispositif KeyBox, trouvez le numéro de série de votre analyseur et allez à https://ap.com/get-keybox/ afin de remplir le formulaire de commande.

Le numéro de série de l'analyseur se trouve sur l'étiquette de configuration à l'arrière de l'analyseur et sur l'étiquette d'étalonnage sur le bord avant du panneau supérieur.

Exigences de système pour l'ordinateur personnel (PC)

Le logiciel de mesure APx500 peut être très exigeant pour l'ordinateur personnel (PC) qui l'exécute.

Demandes de mesure modérées

Les demandes de mesures modérées (bandes passantes de mesure de moins de 90 kHz, nombre de canaux de 2 ou 1) fonctionneront adéquatement avec un PC détenant ces caractéristiques minimales :

- Système d'exploitation : Microsoft Windows 10 (64 bit) ou Windows 11.
- Processeur Intel i5 ou meilleur avec une vitesse d'horloge d'au moins 2,5 GHz. Processeurs AMD avec spécifications semblables également pris en charge.
- Au moins 8 Go de mémoire vive. Recommandation : 16 Go.
- Au moins 1.5 Go d'espace libre sur le disque dur. Un disque SSD à titre de lecteur du système d'exploitation est hautement recommandé.
- Un lecteur optique de CD-ROM ou une connexion Internet pour télécharger et installer le logiciel.
- Un port USB 2.0 ou USB 3.0; deux ports requis dans le cas de l'utilisation du DCX-127 ou du commutateur optionnel.
- Un moniteur couleur avec carte vidéo SXGA (1280 x 1024). Une résolution vidéo de 1900 x 1080 ou supérieure est recommandée.

Demandes de mesures élevées

Les demandes de mesures élevées (bandes passantes de mesure de plus de 90 kHz, nombre de canaux de plus de 2) fonctionneront beaucoup mieux avec un PC de puissance supérieure; dans certains cas, les demandes de mesures très élevées peuvent ralentir ou même interrompre les mesures.

Installation

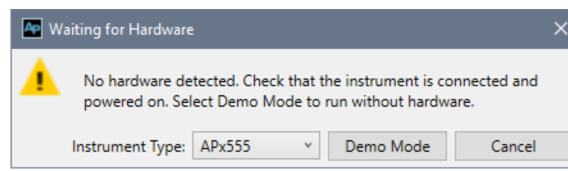
Pour installer le logiciel de mesure, insérez le CD-ROM APx500 dans le lecteur optique de l'ordinateur et suivez les instructions dans la fenêtre de dialogue du logiciel d'installation. Si vous n'avez pas de disque d'application APx500, vous pouvez le télécharger à partir du site web d'Audio Precision, à l'adresse ap.com.

REMARQUE : Vous devez détenir les droits d'administrateur local pour installer le logiciel APx500. Dans le panneau de configuration (Control Panel) de Windows, consultez les comptes d'utilisateur (User Accounts) ou consultez votre administrateur de réseau.

Exécuter le logiciel sans brancher l'instrument

REMARQUE : Vous devez détenir des droits d'utilisateur standard ou des droits d'administrateur pour utiliser le logiciel APx500. Les utilisateurs invités ne sont pas pris en charge.

Vous pouvez exécuter le logiciel APx500 sans brancher l'instrument. Lorsqu'aucun appareil n'est détecté, APx500 vous présente la fenêtre de dialogue suivante :



Sélectionner le « Demo Mode » (mode démo). APx500 sera exécuté en mode démo, ce qui vous permet d'explorer la surface d'utilisateur, mais pas de prendre des mesures. Les données d'entrée présentées en mode démo sont de fausses données, destinées uniquement à des fins de présentation.

À partir du menu Instrument Type (type d'instrument), sélectionnez un instrument à simuler en mode démo.

Exécuter le logiciel avec l'instrument branché

REMARQUE : Vous devez détenir des droits d'utilisateur standard ou des droits d'administrateur pour utiliser le logiciel APx500. Les utilisateurs invités ne sont pas pris en charge.

Brancher l'instrument à votre ordinateur personnel

Avant de brancher votre instrument APx à votre ordinateur, installez le logiciel de mesure APx500 comme décrit plus haut. Brancher l'instrument avant d'installer le logiciel peut entraîner la sélection du mauvais pilote USB pour l'instrument.

Sélection de pilote USB

Le logiciel de mesure communique avec l'instrument à l'aide d'une interconnexion USB 2.0. Une fois l'installation du logiciel réussie, branchez une extrémité du câble USB à un port USB 2.0 de l'ordinateur, et l'autre extrémité au port PC INTERFACE situé à l'arrière de l'instrument. Nous vous recommandons fortement d'utiliser le câble USB fourni avec votre instrument (numéro de commande AP CAB-APSI). Nous avons testé d'autres câbles USB dont le fonctionnement est médiocre.

Remarque : Certains ordinateurs sont équipés de ports USB optionnels à l'avant, ou sur des supports de prolongation à l'arrière. Dans bien des cas, ces ports pratiques compromettent la performance étant donné la longueur de câble supplémentaire installée dans l'ordinateur. Nous vous recommandons d'utiliser les ports USB directement branchés à la carte mère de l'ordinateur, soit habituellement ceux qui sont placés à l'arrière de l'ordinateur.

Branchez le cordon d'alimentation électrique de l'instrument à celui-ci et à une source d'alimentation électrique c.a. Voir « Setting up the hardware » (configurer l'appareil) ci-dessous pour obtenir de plus amples renseignements sur les raccordements au secteur.

Mettez l'instrument sous tension en appuyant sur le bouton d'alimentation à l'avant de l'instrument.

Microsoft Windows détectera la présence de l'instrument branché au port USB et lancera le logiciel Hardware Update Wizard qui recherchera le bon pilote logiciel à installer. Sélectionner « Install the software automatically » (installation automatique du logiciel). Windows trouvera le logiciel pilote Audio Precision installé avec APx500 et branché à l'instrument.

Lancez APx500 en cliquant deux fois sur le raccourci. Une fois l'instrument branché, on pourrait vous demander de mettre à jour le micrologiciel de l'instrument lors de la première exécution du logiciel de mesure. APx500 démarrera et, peu de temps après, affichera l'écran d'accueil. Consultez le manuel de l'utilisateur du logiciel APx500 pour de plus amples renseignements à propos des prises de mesures.

Un exemplaire du manuel de l'utilisateur du logiciel APx500 est inclus avec votre instrument. Le manuel de l'utilisateur est aussi disponible en format PDF, sur le disque de l'application APx500 et en ligne à l'adresse ap.com.

Configurer l'appareil

Branchement de votre instrument à l'alimentation secteur

L'instrument APx doit être branché à une alimentation de courant alternatif (c.a.) de 50–60 Hz. La tension minimale est de 90 V c.a.; la tension maximale est de 264 V c.a.

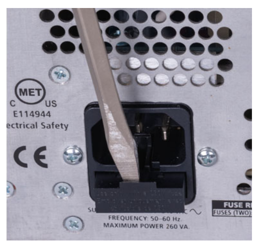
L'instrument est équipé d'une alimentation universelle qui n'exige pas de configuration de tension ni de changement de type de fusible pour accepter les tensions de secteur à l'intérieur de la plage spécifiée.

Retirer et installer des fusibles secteur

Pour toutes les tensions nominales, utilisez deux fusibles secteurs de type 3.15A T/SB (5 x 20 mm) 250 V.

Pour retirer le module porte-fusibles secteurs, consultez les figures ci-dessous et procédez comme suit :

Module d'entrée d'alimentation



Retrait du porte-fusibles

Retirez le cordon d'alimentation secteur du connecteur au niveau du module d'entrée d'alimentation qui est situé sur le panneau arrière de l'instrument. Le module porte-fusibles secteurs fait partie du module d'entrée d'alimentation, situé sous le connecteur de cordon d'alimentation.

Insérez un petit tournevis dans la zone du connecteur de cordon d'alimentation, dans la fente située sur le module porte-fusibles secteurs. Écartez légèrement le module jusqu'à ce que vous puissiez le saisir fermement entre vos doigts. Tirez le module porte-fusibles du module d'entrée d'alimentation. Les deux fusibles secteurs sont montés de manière libre dans le module porte-fusibles; prenez soin de ne pas les laisser tomber.

Remplacez les fusibles, au besoin, à l'aide de fusibles identiques à ceux décrits précédemment. Réinsérez délicatement le module porte-fusibles dans le module d'entrée d'alimentation, et insérez-le fermement en position.

Branchez le cordon d'alimentation d'une prise secteur au connecteur de cordon d'alimentation, sur le panneau arrière de l'instrument.

Instalación

Software

Todos los sistemas APx utilizan el mismo software laureado, APx500.

Analizadores APx "B Series"

Todos los analizadores enviados a fines de diciembre de 2018 (o posteriormente) tienen un nuevo procesador integrado y provisiones de seguridad mejoradas. Estos analizadores se designaron como "B Series" y llevan la nomenclatura "B Series". Los analizadores APx "B Series" no requieren el APx KeyBox (ver más abajo), pero pueden requerir códigos de autorización para habilitar el software APx500 o las opciones de software.

El APx KeyBox

Si está usando el software APx500 versión 4.6 o posterior con un analizador APx anterior (que no sea "B Series"), debe acoplar un APx KeyBox autenticado al conector "Software Options" en el panel trasero del analizador.

El APx KeyBox debe ser programado con el número de serie de su analizador en la fábrica de Audio Precision, y no puede ser usado con ningún otro Analizador APx. Puede requerir códigos de autorización para habilitar el software APx500 o las opciones de software.

Tenga en cuenta que sin la APx KeyBox debidamente autenticada acoplada, el APx500 versión 4.6 o posterior solo correrá en modo de demostración. Si necesita una KeyBox, localice el número de serie del analizador y vaya a https://ap.com/get-keybox/ para completar el formulario de orden.

Los números de serie del analizador se localizan en la etiqueta de configuración en el panel trasero del analizador, y en la etiqueta de calibración en el borde delantero del panel superior.

Requisitos de sistema de la PC

El software APx500 para medición puede ser muy exigente de las capacidades de la computadora personal (PC) que opera el software APx.

Demandas de medición moderadas

Las demandas de medición moderadas (anchos de banda de medición de menos de 90 kHz, conteos de canales de 2 o de 1) se ejecutarán adecuadamente usando una PC con las siguientes especificaciones mínimas:

- Sistema operativo: Microsoft Windows 10 (64 bit).
- Procesador Intel i5 o mejor operando a una velocidad de reloj de por lo menos 2.5 GHz. También soporta procesadores AMD con especificaciones similares.
- Por lo menos 8 GB de RAM. Se recomienda 16 GB RAM.
- Por lo menos 1.5 GB de espacio libre en disco duro. Se recomienda ampliamente usar un SSD para el disco duro del sistema operativo.
- Un disco óptico CD-ROM o una conexión a Internet para descargar e instalar software.
- Un puerto USB 2.0 o USB 3.0; se requieren dos para usar un interruptor opcional o un DCX-127.
- Un monitor de color con soporte de gráficas de video SXGA (1280 x 1024). Se recomienda una resolución de vídeo de 1900 x 1080 o superior.

Demandas de medición alta

Las demandas de medición alta (anchos de banda de medición de más de 90 kHz, conteos de canal de más de 2) tendrán mejor rendimiento con una mejor PC; en algunos casos, las demandas de medición muy altas pueden ralentizar o detener las mediciones.

Instalación

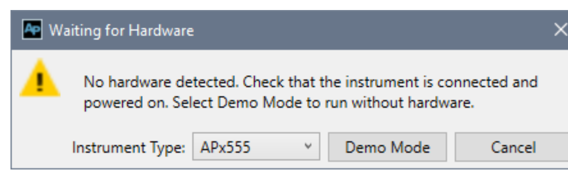
Para instalar el software de medición, inserte el CD-ROM del APx500 dentro de la unidad óptica de la PC y siga las instrucciones en el diálogo de instalación. Si usted no tiene el disco de la aplicación disco de aplicación del APx500 [APx500 application disc], puede descargar APx500 del sitio web de Audio Precision en www.ap.com.

NOTA: Usted debe tener derechos de administrador local para instalar el software APx500. Ingrese a Cuentas de usuarios en el Panel de Control de Windows, o revise con su administrador de red.

Operación del software sin el hardware del instrumento conectado

NOTA: Usted debe tener derechos estándar de usuario o de administrador para operar el software APx500. No se permiten usuarios invitados.

Usted puede iniciar el software APx500 sin tener conectado el hardware del instrumento. Cuando no se detecta el hardware, el APx500 le mostrará el siguiente cuadro de diálogo:



Seleccione "Demo Mode" [Modo de demostración]. El APx500 funcionará en modo de demostración, lo que le permite explorar la interfaz de usuario pero no habilita ninguna función de medición. Los datos de entrada que se muestran en el Demo Mode [Modo de demostración] son falsos, se generan solamente para fines de visualización.

Desde el menú de Instrument Type [Tipo de instrumento], seleccione un instrumento a ser emulado en el Demo Mode [Modo de demostración].

Operación del software con el hardware del instrumento conectado

NOTA: Usted debe tener derechos estándar de usuario o de administrador para operar el software APx500. No se permiten usuarios invitados.

Conexión del instrumento a su PC

Antes de conectar su instrumento APx a su PC, instale el software de medición APx500 tal como se describió anteriormente. El conectar el instrumento antes de instalar el software puede resultar en que Windows seleccione un controlador de USB incorrecto para el instrumento.

Selección del controlador del USB

El software de medición se comunica con el instrumento utilizando una interconexión USB 2.0. Una vez que el software se haya instalado correctamente, conecte un extremo del cable USB a un puerto USB 2.0 en la PC, y el otro extremo al puerto de PC INTERFACE [INTERFAZ de la PC] en la parte posterior del instrumento. Recomendamos enfáticamente que use el cable USB incluido con su instrumento (AP número de orden CAB-APSI). Hemos probado otros cables USB con mal funcionamiento.

Nota: Algunas PC tienen puertos USB opcionales al frente de la PC, o en soportes de extensión en la parte posterior. En varios casos, estos puertos de conveniencia han afectado el rendimiento debido a la longitud adicional del cable dentro de la PC. Recomendamos usar estos puertos USB directamente conectados a la tarjeta madre de la PC, típicamente en la parte posterior de la PC.

Conecte al instrumento el cable de suministro de voltaje y a una red eléctrica de CA. Consulte “Setting up hardware” [Configuración del hardware] para obtener más información acerca de las conexiones a la red eléctrica.

Encienda el instrumento presionando el botón de pulsar al frente del instrumento.

Microsoft Windows detectará la presencia del instrumento en el puerto USB y abrirá el Hardware Update Wizard [Asistente de actualización de hardware] para buscar el controlador de software correcto. Seleccione “Install the software automatically” [Instalar el software automáticamente]. Windows encontrará el software del controlador de Audio Precision instalado con APx500 y se conectará al instrumento.

Ejecute APx500 haciendo doble clic en el acceso directo instalado. Con el instrumento ya conectado, se le podría pedir actualizar el firmware del instrumento durante la primera ejecución del software de medición. APx500 iniciará, y en un tiempo breve se mostrará la pantalla de inicio. Consulte el Manual del usuario del APx500 para obtener más información acerca de hacer las mediciones.

Su instrumento incluye una copia del Manual del usuario del APx500. El manual también está disponible como PDF en el Disco de Aplicación del APx500 y en línea en ap.com.

Configuración del hardware

Conexión de su instrumento a la red de energía eléctrica

El instrumento APx debe conectarse a una red de corriente alterna (AC) a 50–60 Hz. El voltaje mínimo es de 90 VCA, el voltaje máximo es de 264 VCA.

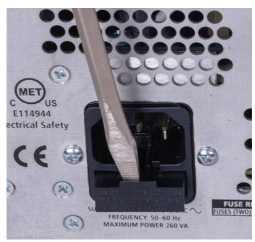
El instrumento está equipado con una fuente de alimentación universal que no requiere configurar el voltaje ni cambiar el tipo de fusible para aceptar voltajes de alimentación dentro del rango especificado.

Extracción e instalación de fusibles de fuente de alimentación

Para todos los voltajes nominales, use dos fusibles de fuente de alimentación tipo 2A T/SB (5x20 mm) 250 V.

Para extraer los fusibles del módulo portador de fusibles de fuente de alimentación, consulte las figuras a continuación y proceda de la siguiente manera:

Módulo de entrada de energía



Extracción de portador de fusibles

Extraiga el cable de la fuente de alimentación del conector en el módulo de entrada de energía, que se localiza en el panel posterior del instrumento. El módulo del portador de fusible de fuente de alimentación es parte del módulo de entrada de energía, debajo del conector del dable de alimentación.

Inserte un desarmador pequeño dentro del área del conector de cable de alimentación, alcanzando dentro de la ranura del módulo de portador de fusible de la fuente de alimentación. Separe el módulo levemente, hasta que pueda sujetarlo firmemente con sus dedos. Tire del módulo de portador de fusibles hacia fuera del módulo de entrada de energía. Los dos fusibles de fuente de alimentación están montados holgadamente dentro del módulo de portador de fusible, tenga cuidado de que no se caigan.

Reemplace los fusibles si es necesario, usando los fusibles como se describió previamente. Reinserte cuidadosamente el módulo portador de fusibles dentro del módulo de entrada de energía, y presione firmemente en su lugar.

Conecte el cable de alimentación desde una salida de fuente de alimentación hacia el conector de cable de alimentación en el panel posterior del instrumento.

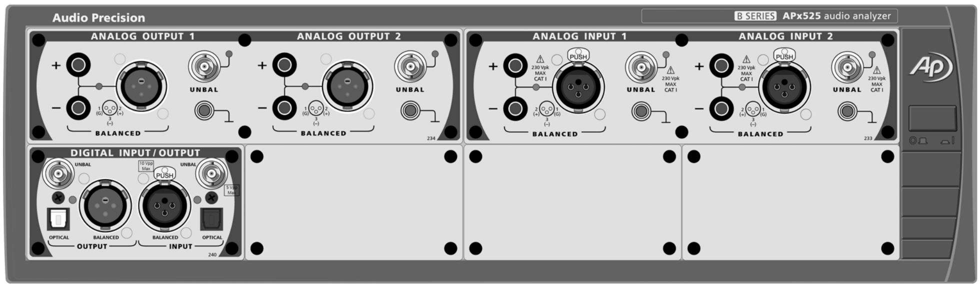
Abbreviations, Terms and Symbols

used in the following specifications

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.

APx525/526 B Series family of audio analyzers analog I/O specifications

with APx500 v5.0 or higher measurement software
March 2023 NP0020.00032 r002



This illustration shows an APx525 B Series in its standard configuration, with a DIO module installed.

These specifications cover the analog input and output functions of the Audio Precision APx525 and APx526 B Series analyzers.

The APx525 has 2 analog output channels and 2 analog input channels.
The APx526 has 2 analog output channels and 4 analog input channels.

The performance of AG52 analog generator option and the BW52 analog analyzer option are also specified in this section.

Specifications for the DIO interface and other available interface modules including ADIO, DSIO, HDMI, PDM, AMC and Bluetooth, are found in other sections of this document, as are General and Environmental specifications for the entire APx 52x/58x B Series family.

Analog specifications begin on the next page.

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, square-wave, noise, IMD signals, multi-tone, wave file playback	*Option AG52 required for square waves and DIM test signals*
Sine Characteristics		
Frequency Range (Fs)	0.1 Hz to 80.1 kHz	*Setting resolution is typically 45 μHz*
Frequency Accuracy	±(0.0003% + 100 μHz)	
Amplitude Range	0 to 21.21 Vrms [60.0 Vpp], bal; 0 to 10.61 Vrms [30.0 Vpp], unbal	*Option AG52 increases max output to 26.66 Vrms bal, 13.33 Vrms unbal*
Amplitude Accuracy, 1 kHz		
+15C to +30C	±0.03 dB [±0.35%]	
0C to +45C	±0.05 dB [±0.58%]	
Flatness (1 kHz ref)		
Fs = 5 Hz to 20 kHz	±0.008 dB	*Typically <0.003 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	≤ (–105 dB + 1.3 μV), 20 kHz BW; ≤ (–98 dB + 1.8 μV), 40 kHz BW; ≤ (–90 dB + 2.6 μV), 80 kHz BW; ≤ (–85 dB + 8.9 μV), 250 kHz BW; ≤ (–82 dB + 11.4 μV), 500 kHz BW	*Typically <–110 dB at 1 kHz, 2.5 V with option AG52; typically <–108 dB in standard units*
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	

Characteristic	Specifications	Supplemental Information
Square Characteristics (requires option AG52)		
Frequency Range (Fq)	0.1 Hz to 30 kHz	*Same accuracy as sine wave*
Amplitude Range	0 to 60.0 Vpp, balanced; 0 to 30.0 Vpp, unbalanced	
Amplitude Accuracy	±0.10 dB [±1.2%]	
Risetime	≤2.0 µsec	*Typically <1.7 µsec when Rs ≤200 Ω*
Even Harmonic Content		
Fq = 10 Hz to 5 kHz	≤–100 dB to at least 80 kHz	
Fq = 5 kHz to 20 kHz	≤–90 dB to at least 80 kHz	
Non-Harmonic Content		*Typically <–110 dB*
Noise Characteristics		
Shape	White or Pink (5 Hz to >86.4 kHz), IEC 60268-1 or BS EN 50332-1	
Amplitude Range	0 to 60.0 Vpp, balanced; 0 to 30.0 Vpp, unbalanced	*Amplitude calibration is approximate*
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)	2.00 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 60.0 Vpp, balanced; 0 to 30.0 Vpp, unbalanced.	*Option AG52 increases maximum to 75.4 Vpp bal, 37.7 Vpp unbal.*
Amplitude Accuracy	±0.06 dB [±0.70%]	
Residual IMD[1,2,3]	≤ –95 dB [0.0018%], 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 60.0 Vpp, balanced; 0 to 30.0 Vpp, unbalanced.	*Option AG52 increases maximum to 75.4 Vpp bal, 37.7 Vpp unbal.*
Amplitude Accuracy	±0.06 dB [±0.70%]	

Characteristic	Specifications	Supplemental Information
Residual IMD[1,2,3]	≤ –106 dB [0.0005%]	
DIM (requires option AG52)		
Square / Sine Frequencies	3.15 kHz / 15.0 kHz, 2.96 kHz / 14.0 kHz, or 2.96 kHz / 8.0 kHz.	*“DIM100” or “DIM30”* *“DIM-B”* *“DIM-B8”*
Mix Ratio	4:1, square to sine, peak-peak	
Amplitude Range	<60 μV to 75.4 Vpp, balanced; <30 μV to 37.7 Vpp, unbalanced.	
Amplitude Accuracy	±0.10 dB [±1.2%]	
Residual IMD[1,2,3]	≤ –95 dB [0.0018%]	
Multitone, Wave File Playback		
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	32M Sample	
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/sec		*Typically <0.04 dB to 20 kHz;* *max frequency limited to ≈0.45*SR*
Spurious Content		*Typically <–110 dB*
Output Equalization	Arbitrary 30-pole output filter	*Filter cannot be applied to AG52 special waveforms square and DIM.*
Source Resistance (Rs)		
Balanced	Selectable 40 Ω ±1.5%, 100 Ω ±1%, 150 Ω ±1%, 200 Ω ±1%, or 600 Ω ±1%.	*Grounded, symmetrical*
Unbalanced	Selectable 20 Ω ±2%, 50 Ω ±1.5%, 75 Ω ±1.2%, 100 Ω ±1%, or 600 Ω ±1%.	*Electronically floating, 0.3 Vpk max;* *bnc shield to ground ≈10-17Ω || 22nF*
Common Mode Test	Same as Balanced selections, or 10 Ω Unbalanced per IEC-60268.	
Max Output Current		*Typically >80 mA peak, 50 mA dc*

Characteristic	Specifications	Supplemental Information
Reverse Overload Protection		*Up to 1A or 30 W, whichever is less*
Output Related Crosstalk[1]	≤ (–130 dB + 0.3 μV) to 20 kHz	

ANALOG ANALYZER

Characteristic	Specifications	Supplemental Information
Number of Channels		
APx525 (and APx520)	2, independently auto-ranging.	
APx526 (and APx521)	4, independently auto-ranging.	*With option BW52: only Channels 1 and 2 are active if BW setting = 250 kHz, 500 kHz or 1 MHz*
Maximum Rated Input	230 Vpk, 160 Vdc, any input to ground; 0.5 Vpk for unbalanced bnc shields	
Input Impedance		
Balanced	100 kΩ || ≈220 pF, each side to ground	
Unbalanced	100 kΩ || ≈220 pF to bnc shield	*Electronically floating, 0.5 Vpk max; bnc shield to ground ≈500Ω || 22nF*
Input Terminations	Selectable 600 Ω ±1% (1.5 W max), or 300 Ω ±1% (3 W max).	*Terminations automatically open in the 100 V and 300 V ranges.*
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	320 mV to 300 V, 10 dB steps	*Maximum ac signal is ≈160 Vac unbal, 300 Vac bal, in the 300V range*
Common Mode Rejection[4]		*Max common mode signal range:*
320 mV, 1 V, 3.2 V ranges	≥ 80 dB, 5 Hz to 5 kHz; ≥ 72 dB, 5 kHz to 20 kHz	*±6 Vpk*
10 V range	≥ 50 dB, 5 Hz to 20 kHz	*±16 Vpk*
32 V range	≥ 50 dB, 5 Hz to 20 kHz	*±60 Vpk*
100 V and 300 V ranges	≥ 45 dB, 5 Hz to 20 kHz	*±230 Vpk*
Input Related Crosstalk	≤ (–140 dB + 0.1 μV) to 20 kHz	$R_S \leq 600\ \Omega$

Characteristic	Specifications	Supplemental Information
Level (Amplitude) Measurement		
Range		
Balanced or bridging input	< 1 μV to 300 Vrms	
Unbalanced input	< 1 μV to 160 Vrms	
Accuracy (1 kHz)		
+15C to +30C	±0.03 dB [±0.35%]	
0C to +45C	±0.05 dB [±0.58%]	
Flatness (1 kHz ref, DC coupling)		
10 Hz to 20 kHz	±0.008 dB	*Typically < 0.003 dB*
20 kHz to 50 kHz	±0.030 dB	
50 kHz to 80 kHz	±0.10 dB	
80 kHz to 250 kHz (requires option BW52)	±0.20 dB	*Roll-off is typically <–3 dB at the selected input BW setting, 1 MHz max*
Residual Noise (inputs shorted)		
20–20 kHz BW[5]	≤ 1.3 μVrms [-115.5 dBu]	*Typically <8.0 nV / √Hz at 1 kHz.*
20–500 kHz, with option BW52	≤ 11.4 μVrms [-96.6 dBu]	
THD+N Measurement		
Fundamental Range	5 Hz to 90 kHz	
Measurement Range	0 to 100%	
Accuracy	±0.5 dB	*Q=2.6 typically*
Residual THD+N[1,2]		
20 Hz–20 kHz fundamentals	≤ (–105 dB + 1.3 μV, 20 kHz BW); ≤ (–98 dB + 1.8 μV, 40 kHz BW); ≤ (–90 dB + 2.6 μV, 80 kHz BW); ≤(–85 dB + 8.9 μV), 250 kHz BW; ≤(–82 dB + 11.4 μV), 500 kHz BW	*Typically <–110 dB at 1 kHz, 2.5 V with option AG52; typically <–108 dB in standard units.*
Input Equalization	Arbitrary 30-pole input filter	*The EQ operates on any selected analyzer input channels.*

Characteristic	Specifications	Supplemental Information
Bandwidth Limiting Filters		
High-Pass[6]		
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; 10 Hz to 1 MHz (BW52)	
Elliptic	F_{HP} (–0.01 dB) = 10 Hz to 90 kHz, 5-pole; 10 Hz to 1 MHz (BW52); 0.01 dB pass-band ripple; ≤–60 dB stop-band	
Low-Pass [5, 6]		
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; for BW52, add: –3 dB at ≈ 260 kHz for 624 kS/s –3 dB at ≈ 520 kHz for 1.248 MS/s –3 dB at ≈ 1 MHz for 2.496 MS/s*
20k (AES17), 40k (AES17)	Special filters conforming with AES17	
Butterworth	F_{LP} (–3 dB) = 10 Hz to 90 kHz, 8-pole; 10 Hz to 1 MHz (BW52)	*ENBW ≈ 1.006 •* F_{LP}
Elliptic	F_{LP} (–0.01 dB) = 10 Hz to 90 kHz, 8-pole; 10 Hz to 1 MHz (BW52); 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*

Characteristic	Specifications	Supplemental Information
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}
DIM	DIM100, DIM30, DIM-B, or DIM-B8	
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 IEC60268*
DFD	d2, d3, d2+d3, or d2+d3+d4+d5	*Use "d2+d3" for measurements per IEC60268*
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.*
DIM	u1 to u9 per IEC-60286	
Measurement Range	0 to 20%	
Accuracy	±0.5 dB	
Residual IMD[1,2,3]		
SMPTE & MOD	≤ –95 dB [0.0018%], 4:1 mix ratio	
DFD	≤ –106 dB [0.0005%]	
DIM	≤ –95 dB [0.0018%]	
Frequency Measurement		
Range	<5 Hz to 90 kHz, standard; <5 Hz to 1 MHz with option BW52.	
Accuracy	±(0.0002% + 100 µHz)	V_{in} *must be* ≥ *5 mV.*
Resolution	6 digits	

Characteristic	Specifications	Supplemental Information
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		*Valid only for input bandwidths ≤90k*
Input Ranges	0.32V to 300V, 10 dB steps	*±160 Vdc maximum in 300V range*
Accuracy		
0.32 V range	±(0.7% reading + 800 μV)	
1 V–300 V ranges	±(0.7% reading + 0.1% range)	
Normal Mode Rejection		*Typically > 90 dB, 20 Hz to 20 kHz.*

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 ≥600Ω balanced or ≥300Ω unbalanced for specified performance. Generator dc offset must be off or set to ≤10 mV.
3 Input must be ≥150 mV for specified performance. Analyzer must be set to measure “d2+d3” for MOD and DFD, and “U1…U9” for DIM per IEC-60268.
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 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.

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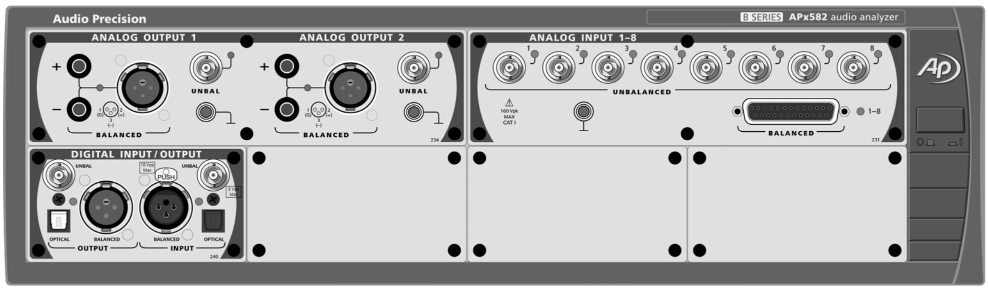
APx582 B Series audio analyzer analog I/O specifications

with APx500 v5.0 or higher measurement software
December 2018   NP0020.00039 r000



This illustration shows an APx582 B Series in its standard configuration, with a DIO module installed.

These specifications cover the analog input and output functions of the Audio Precision B Series APx582 audio analyzer. The APx582 has 2 analog output channels and 8 analog input channels. The APx582 is fitted with the AG52 analog generator option as a standard feature. The performance of the AG52 when fitted in an APx582 is also specified in this section.

Specifications for the DIO interface and other available interface modules including DSIO, HDMI, PDM and Bluetooth, are found in other sections of this document, as are General and Environmental specifications for the entire APx B Series family.

Analog specifications begin on the next page.

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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, square-wave, noise, IMD signals, multi-tone, wave file playback	
Sine Characteristics		
Frequency Range (Fs)	0.1 Hz to 80.1 kHz	*Setting resolution is typically 45 µHz*
Frequency Accuracy	±(0.0003% + 100 µHz)	
Amplitude Range	0 to 26.66 Vrms [75.4 Vpp], bal; 0 to 13.33 Vrms [37.7 Vpp], unbal	
Amplitude Accuracy, 1 kHz		
+15C to +30C	±0.03 dB [±0.35%]	
0C to +45C	±0.05 dB [±0.58%]	
Flatness (1 kHz ref)		
Fs = 5 Hz to 20 kHz	±0.008 dB	*Typically <0.003 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	≤ (–105 dB + 1.3 µV), 20 kHz BW; ≤ (–98 dB + 1.8 µV), 40 kHz BW; ≤ (–90 dB + 2.6 µV), 80 kHz BW; ≤ (–85 dB + 6 µV), 250 kHz BW; ≤ (–82 dB + 9 µV), 500 kHz BW	*Typically <–110 dB at 1 kHz, 2.5 V*
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	

Characteristic	Specifications	Supplemental Information
Square Characteristics		
Frequency Range (Fq)	0.1 Hz to 30 kHz	*Same accuracy as sine wave*
Amplitude Range	0 to 60.0 Vpp, balanced; 0 to 30.0 Vpp, unbalanced	
Amplitude Accuracy	±0.10 dB [±1.2%]	
Risetime	≤2.0 µsec	*Typically <1.7 µsec when Rs ≤200 Ω*
Even Harmonic Content		
Fq = 10 Hz to 5 kHz	≤–100 dB to at least 80 kHz	
Fq = 5 kHz to 20 kHz	≤–90 dB to at least 80 kHz	
Non-Harmonic Content		*Typically <–110 dB*
Noise Characteristics		
Shape	White (<5 Hz to >80 kHz), Pink (<10 Hz to >80 kHz), IEC 60268-1 or BS EN 50332-1	
Amplitude Range	0 to 60.0 Vpp, balanced; 0 to 30.0 Vpp, unbalanced	*Amplitude calibration is approximate*
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)	2.00 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 75.4 Vpp, balanced; 0 to 37.7 Vpp, unbalanced.	
Amplitude Accuracy	±0.06 dB [±0.70%]	
Residual IMD[1,2,3]	≤–95 dB [0.0018%], 4:1 mix ratio	
DFD		
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 75.4 Vpp, balanced; 0 to 37.7 Vpp, unbalanced.	

Characteristic	Specifications	Supplemental Information
Amplitude Accuracy	±0.06 dB [±0.70%]	
Residual IMD[1,2,3]	≤–106 dB [0.0005%]	
DIM		
Square / Sine Frequencies	3.15 kHz / 15.0 kHz, 2.96 kHz / 14.0 kHz, or 2.96 kHz / 8.0 kHz.	*“DIM100” or “DIM30”* *“DIM-B”* *“DIM-B8”*
Mix Ratio	4:1, square to sine, peak-peak	
Amplitude Range	<60 µV to 75.4 Vpp, balanced; <30 µV to 37.7 Vpp, unbalanced.	
Amplitude Accuracy	±0.10 dB [±1.2%]	
Residual IMD[1,2,3]	≤–95 dB [0.0018%]	
Multitone, Wave File Playback		
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	32M Sample	
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/sec		*Typically <0.04 dB to 20 kHz;* *max frequency limited to ≈0.45*SR*
Spurious Content		*Typically <–110 dB*
Output Equalization	Arbitrary 30-pole output filter	*Filter cannot be applied to special waveforms square and DIM.*
Source Resistance (Rs)		
Balanced	Selectable 40 Ω ±1.5%, 100 Ω ±1%, 150 Ω ±1%, 200 Ω ±1%, or 600 Ω ±1%.	*Grounded, symmetrical*
Unbalanced	Selectable 20 Ω ±2%, 50 Ω ±1.5%, 75 Ω ±1.2%, 100 Ω ±1%, or 600 Ω ±1%.	*Electronically floating, 0.3 Vpk max;* *bnc shield to ground ≈10-17Ω || 22nF*
Common Mode Test	Same as Balanced selections, or 10 Ω Unbalanced per IEC-60268.	

Characteristic	Specifications	Supplemental Information
Max Output Current		*Typically >80 mA peak, 50 mA dc*
Reverse Overload Protection		*Up to 1A or 30 W, whichever is less*
Output Related Crosstalk[1]	≤(–130 dB+0.3 μV) to 20 kHz	
<u>ANALOG ANALYZER</u>		
Number of Channels	8, independently auto-ranging	
Maximum Rated Input	160 Vpk, 120 Vdc any input to ground; 0.5 Vpk bnc shields to ground	
Input Impedance		
Balanced	100 kΩ || ≈230 pF, each side to ground	
Unbalanced	100 kΩ || ≈230 pF to bnc shield	*Electronically floating, 0.5 Vpk max; bnc shield to ground ≈500Ω || 22nF*
Input Coupling	DC	*Typically <0.5 μA bias current*
Input Ranges	320 mV to 100 V, 10 dB steps	*Maximum ac signal ≈115 Vac, unbal or bal, in the 100 V range*
Common Mode Rejection[4]		*Max common mode signal range:*
320 mV, 1 V, 3.2 V ranges	≥ 70 dB, 5 kHz to 20 kHz	*±6 Vpk*
10 V range	≥ 50 dB, 5 Hz to 20 kHz	*±16 Vpk*
32 V range	≥ 50 dB, 5 Hz to 20 kHz	*±60 Vpk*
100 V range	≥ 45 dB, 5 Hz to 20 kHz	*±160 Vpk*
Input Related Crosstalk		*Typically <100 dB to 20 kHz between any two channels*
Level (Amplitude) Measurement		
Range	< 1 μV to 115 Vrms	
Accuracy (1 kHz)		
+15C to +30C	±0.03 dB [±0.35%]	
0C to +45C	±0.05 dB [±0.58%]	

Characteristic	Specifications	Supplemental Information
Flatness (1 kHz ref, DC coupling)		
10 Hz to 20 kHz	±0.008 dB	*Typically < 0.003 dB*
20 kHz to 50 kHz	±0.030 dB	
50 kHz to 80 kHz	±0.10 dB	
Residual Noise (inputs shorted)	≤ 1.3 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	≤ (–103 dB + 1.3 μV, 20 kHz BW); ≤ (–95 dB + 2.5 μV, 80 kHz BW)	*Typically <-108 dB at 1 kHz, 2.5V*
Bandwidth Limiting Filters		
High-Pass[6]		
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, 6]		
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)*

Characteristic	Specifications	Supplemental Information
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* ≥6 • F_{diff}
DIM	DIM100, DIM30, DIM-B, or DIM-B8	
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 IEC60268*
DFD	d2, d3, d2+d3, or d2+d3+d4+d5	*Use “d2+d3” for measurements per IEC60268*
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.*
DIM	u1 to u9 per IEC-60286	
Measurement Range	0 to 20%	
Accuracy	±0.5 dB	
Residual IMD[1,2,3]		
SMPTE & MOD	≤ –95 dB [0.0018%], 4:1 mix ratio	
DFD	≤ –106 dB [0.0005%]	
DIM	≤ –95 dB [0.0018%]	
Frequency Measurement		

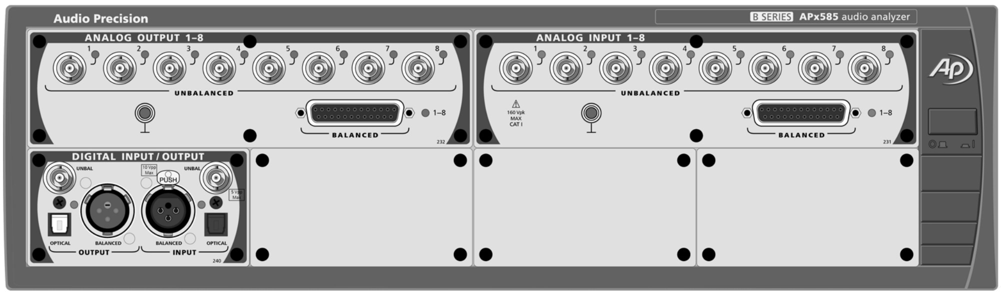
Characteristic	Specifications	Supplemental Information
Range	<5 Hz to 90 kHz	
Accuracy	±(0.0003% + 100 µHz)	*V_{in} must be ≥ 5 mV*
Resolution	6 digits	
Phase Measurement		
Ranges	–90 to +270, ±180, or 0 to 360 deg	
Accuracy	±0.25 deg, 5 Hz to 5 kHz; ±1.0 deg, 5 kHz to 20 kHz; ±2.5 deg, 20 kHz to 50 kHz	*Vin must be ≥5 mV, all channels*
Resolution	0.001 deg	
DC Voltage Measurement		*Valid only for input bandwidths ≤90k*
Input Ranges	0.32 V to 100 V, 10 dB steps	*±120 Vdc maximum in 100 V range*
Accuracy		
0.32 V range	±(0.7% reading + 800 µV)	
1 V–100 V ranges	±(0.7% reading + 0.1% range)	
Normal Mode Rejection		*Typically > 90 dB, 20 Hz to 20 kHz.*

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 ≥600Ω balanced or ≥300Ω unbalanced for specified performance. Generator dc offset must be off or set to ≤10 mV.
3 Input must be ≥150 mV for specified performance. Analyzer must be set to measure “d2+d3” for MOD and DFD, and “U1…U9” for DIM per IEC-60268.
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 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.

APx585/586 B Series audio analyzers analog I/O specifications

with APx500 v5.0 or higher measurement software
December 2018 NP0020.00031 r000



This illustration shows an APx585 B Series in its standard configuration, with a DIO module installed.

These specifications cover the analog input and output functions of the Audio Precision B Series APx585 and APx586 audio analyzers. The APx585 has 8 analog output channels and 8 analog input channels; the APx586 has 8 analog output channels and 16 analog input channels.

Specifications for the DIO interface and other available interface modules including DSIO, HDMI, PDM and Bluetooth, are found in other sections of this document, as are General and Environmental specifications for the entire APx B Series family.

Analog specifications begin on the next page.

Characteristic	Specifications	Supplemental Information
ANALOG GENERATOR		
Number of Channels	8, independent amplitude control	
Waveforms	Sine, sine split frequency, sine split phase, sine+DC offset, continuously swept-sine, square-wave, noise, IMD signals, multi-tone, wave file playback	
Sine Characteristics		
Frequency Range (Fs)	5 Hz to 80.1 kHz	*Setting resolution is typically 45 µHz*
Frequency Accuracy	±(0.0003 % + 100 µHz)	
Amplitude Range	0 to 14.40 Vrms [40.72 Vpp], bal; 0 to 7.20 Vrms [20.36 Vpp], unbal	
Amplitude Accuracy, 1 kHz		
+15C to +30C	±0.03 dB [±0.35%]	
0C to +45C	±0.05 dB [±0.58%]	*+40C max with APx586*
Flatness (1 kHz ref)		
10 Hz to 20 kHz	±0.008 dB	*Typically <0.003 dB.*
20 kHz to 50 kHz	±0.030 dB	
50 kHz to 80 kHz	±0.10 dB	
Residual THD+N[1,2]		
20 Hz–20 kHz fundamentals	≤ (–103 dB + 1.4 µV)	
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	

Characteristic	Specifications	Supplemental Information
Noise Characteristics		
Shape	White (<5 Hz to >80 kHz), Pink (<10 Hz to >80 kHz), IEC 60268-1 or BS EN 50332-1	
Amplitude Range	0 to 40.72 Vpp, balanced; 0 to 20.36 Vpp, unbalanced	*Amplitude calibration is approximate*
IMD Test Signals		
SMPTE & MOD		
Lower Frequency (LF)	40 Hz to 1.00 kHz	*LF tone must be* $\leq$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 40.72 Vpp, balanced; 0 to 20.36 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 40.72 Vpp, balanced; 0 to 20.36 Vpp, unbalanced.	
Amplitude Accuracy	±0.06 dB [±0.70%]	
Residual IMD[1,2,3]	≤ 0.0010% [–100 dB]	
Multitone, Wave File Playback		
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	32M Sample	
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*

Characteristic	Specifications	Supplemental Information
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	*The EQ operates on the first two internal generator channels, and is disabled for >2 output channels.*
Source Resistance (Rs)		
Balanced	100 Ω, ±1 %	*Grounded, symmetrical*
Unbalanced	50 Ω, ±2 %	*Electronically floating, 0.3 Vpk max; bnc shield to ground ≈10-17Ω || 22nF*
Maximum Output Current		*Typically >30 mA peak, 10 mA dc; sum of all outputs ≤180 mA peak*
Reverse Overload Protection		*Up to 30 W*
Output Related Crosstalk[1]		
Balanced	≤ (–100 dB + 1 μV) to 20 kHz	*With AP cable PN 4150.0001.*
Unbalanced	≤ (–115 dB + 1 μV) to 20 kHz	
<u>ANALOG ANALYZER</u>		
Number of Channels		
APx585	8, independently auto-ranging	
APx586	16, independently auto-ranging	
Maximum Rated Input	160 Vpk, 120 Vdc any input to ground; 0.5 Vpk bnc shields to ground	
Input Impedance		
Balanced	100 kΩ || ≈230 pF, each side to ground	
Unbalanced	100 kΩ || ≈230 pF to bnc shield	*Electronically floating, 0.5 Vpk max; bnc shield to ground ≈500Ω || 22nF*
Input Coupling	DC	*Typically <0.5 μA bias current*
Input Ranges	320 mV to 100 V, 10 dB steps	*Maximum ac signal ≈115 Vac, unbal or bal, in the 100 V range*

Characteristic	Specifications	Supplemental Information
Common Mode Rejection[4]		*Max common mode signal range:*
320 mV, 1 V, 3.2 V ranges	≥ 70 dB, 5 kHz to 20 kHz	*±6 Vpk*
10 V range	≥ 50 dB, 5 Hz to 20 kHz	*±16 Vpk*
32 V range	≥ 50 dB, 5 Hz to 20 kHz	*±60 Vpk*
100 V range	≥ 45 dB, 5 Hz to 20 kHz	*±160 Vpk*
Input Related Crosstalk		*Typically <100 dB to 20 kHz between any two channels*
Level (Amplitude) Measurement		
Range	< 1 µV to 115 Vrms	
Accuracy (1 kHz)		
+15C to +30C	±0.03 dB [±0.35%]	
0C to +45C	±0.05 dB [±0.58%]	
Flatness (1 kHz ref, DC coupling)		
10 Hz to 20 kHz	±0.008 dB	*Typically < 0.003 dB*
20 kHz to 50 kHz	±0.030 dB	
50 kHz to 80 kHz	±0.10 dB	
Residual Noise (inputs shorted)	≤ 1.3 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	≤ (–103 dB + 1.3 µV, 20 kHz BW); ≤ (–95 dB + 2.5 µV, 80 kHz BW)	*Typically <-108 dB at 1 kHz, 2.5V*

Characteristic	Specifications	Supplemental Information
Bandwidth Limiting Filters		
High-Pass[6]		
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, 6]		
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* $\geq 6 \cdot F_{diff}$
IMD Measured		

Characteristic	Specifications	Supplemental Information
SMPTE	Amplitude modulation of HF tone	*Measurement BW is typ. 40–500 Hz*
MOD	d2, d3, d2+d3, or d2+d3+d4+d5	*Use “d2+d3” for measurements per IEC60268*
DFD	d2, d3, d2+d3, or d2+d3+d4+d5	*Use “d2+d3” for measurements per IEC60268*
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	≤ –95 dB [0.0018%], 4:1 mix ratio	
DFD	≤ –106 dB [0.0005%]	
Frequency Measurement		
Range	<5 Hz to 90 kHz	
Accuracy	±(0.0003% + 100 μHz)	*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	*Vin must be ≥5 mV, all channels*
Resolution	0.001 deg	

Characteristic	Specifications	Supplemental Information
DC Voltage Measurement		*Valid only for input bandwidths ≤90k*
Input Ranges	0.32 V to 100 V, 10 dB steps	*±120 Vdc maximum in 100 V range*
Accuracy		
0.32 V range	±(0.7% reading + 800 µV)	
1 V–100 V ranges	±(0.7% reading + 0.1% range)	
Normal Mode Rejection		*Typically > 90 dB, 20 Hz to 20 kHz.*

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 ≥600Ω balanced or ≥300Ω unbalanced for specified performance. Generator dc offset must be off or set to ≤10 mV.

3 Input must be ≥150 mV for specified performance. Analyzer must be set to measure “d2+d3” for MOD and DFD.

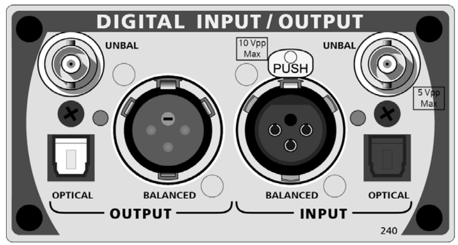
4 Valid for the balanced input configuration only.

5 Maximum low-pass filter frequency is limited by analyzer input bandwidth setting.

6 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.

DIO digital input/output module specifications

with APx500 v5.0 or higher measurement software
as fitted in APx517, 52x and 58x B Series audio analyzers
NP0020.00037 rev 000
December, 2018



This illustration shows an APx DIO module, model 240.

These specifications cover the digital input and output functions of the Audio Precision DIO. The DIO is available as a stand-alone module (models 240).

The APx DIO provides balanced digital input and output compatible with AES3, AES/EBU and IEC60958-4, on XLR connectors; unbalanced digital input and output compatible with S/PDIF and IEC60958-3 and also AES3id and SMPTE 276 M, on BNC connectors; and optical digital input and output compatible with Toslink interfaces.

DIO specifications begin on the next page.

Characteristic	Specifications	Supplemental Information
DIGITAL I/O		
DIGITAL OUTPUT RELATED:		
Formats		
Electrical, unbalanced	SPDIF-EIAJ per IEC60958	
Electrical, balanced	AES-EBU per AES3-1992	
Optical	Toslink® or equivalent	
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 fidelity, accuracy, and jitter*
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, all channels same	
User Bits and Validity Flag	Fully settable	
Residual Jitter[1]		
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*

DIO

Characteristic	Specifications	Supplemental Information
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]		*Typically < –140 dBFS*
Square Characteristics		
Frequency Range (Fq)	10 Hz to SR / 6	*Fq must equal 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	IEC 60268-1 is shaped pink noise. BS EN 50332-1 is similar, but with soft clipping to limit crest factor to ≈2.
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]		*Typically < –140 dBFS*
DFD & CCIF		
Difference Frequency (Fdiff)	80 Hz to 2.0 kHz	$F_{mean} = (F1 + F2)/2$
Mean Frequency (Fmean)	2.5 kHz to (0.499 • SR – F_{diff} / 2) or 60 kHz, whichever is lower	$F_{diff} = \|F2-F1\|$; F_{mean} *must be* ≥ 6 • *Fdiff*
Residual IMD[1]		*Typically < –150 dBFS*

Characteristic	Specifications	Supplemental Information
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 dBFS*
DIGITAL INPUT RELATED:		
Formats		
Unbalanced	SPDIF-EIAJ per IEC 60958, ≤5 Vpp	*Input typically 75 Ω or ≈8.3 kΩ*
Balanced	AES-EBU per AES3-2003, ≤10 Vpp	*Input typically 110 Ω or ≈2.5 kΩ*
Optical	Toslink® or equivalent	
Sample Rate (SR) Range		
Electrical	27 kS/s to 216 kS/s	*Usable over the extended range of 16 kS/s to 216 kS/s with degraded waveform fidelity, accuracy, and jitter*
Optical	27 kS/s to 108 kS/s	
SR Measurement Accuracy	±0.0003% [±3 ppm]	
EMBEDDED INPUT SIGNAL RELATED:		
Level (Amplitude) Measurement		
Measurement Range	< –120 dBFS to +3 dBFS	
Accuracy (1 kHz)		*Typically < 0.001 dB*
Flatness		*Typically < 0.001 dB*
Residual Noise		*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	
Residual THD+N[2]		*Typically < –140 dBFS*

Characteristic	Specifications	Supplemental Information
Bandwidth Limiting Filters (audio signals)		
High-Pass[4]		
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[4]		
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 the 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}

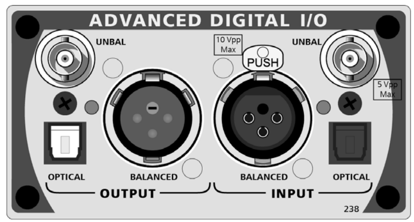
Characteristic	Specifications	Supplemental Information
IMD Measured		
SMPTE	Amplitude modulation of HF tone	*Measurement BW is ≈40–750 Hz*
MOD	d2, d3, d2+d3, or d2+d3+d4+d5	*Use “d2+d3” for measurements per IEC-60268*
DFD	d2, d3, d2+d3, or d2+d3+d4+d5	*Use “d2+d3” for measurements per IEC-60268*
CCIF	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[2]		
SMPTE & MOD		*Typically < –140 dBFS*
DFD		*Typically < –150 dBFS*
Frequency Measurement		
Range	< 5 Hz to 0.499 • SR	
Accuracy	±(0.0003% + 100 μHz)	
Phase Measurement		
Ranges	–90 to +270, ±180, or 0 to 360 deg	
Accuracy		*Typically < 0.001 deg*

NOTES to SPECIFICATIONS:

1. Sample rate (SR) must be ≥27 kS/s for specified performance. Jitter analyzer set for 700 Hz high-pass response per AES3-1992.
2. Digital generator word width must be set to 24 bits for specified performance; shorter word widths may degrade performance.
3. Maximum low-pass filter frequency is limited by input sample rate (SR).
4. DSP warping may significantly increase roll-off rate and lower ENBW.

ADIO Advanced Digital Input/Output module specifications

with APx500 v5.0 or higher measurement software
as fitted in APx52x, 555, and 58x B Series audio analyzers
NP0020.00041 rev 001
March, 2020



This illustration shows an APx ADIO module, model 238.

These specifications cover the digital input and output functions of the Audio Precision Advanced Digital Input/Output (ADIO). The ADIO is available as a stand-alone module (model 238).

The APx ADIO provides balanced digital input and output compatible with AES3, AES/EBU and IEC60958-4, on XLR connectors; unbalanced digital input and output compatible with S/PDIF and IEC60958-3 and also AES3id and SMPTE 276 M, on BNC connectors; and optical digital input and output compatible with Toslink interfaces.

ADIO also enables certain carrier and metadata impairments, and it supports the imposition of jitter on the transmitted carrier, and jitter measurement, when used with the Advanced Master Clock (AMC).

ADIO specifications begin on the next page.

Characteristic	Specifications	Supplemental Information
ADVANCED DIGITAL I/O		
DIGITAL OUTPUT RELATED:		
Formats		
Electrical, unbalanced	SPDIF-EIAJ per IEC60958	
Electrical, balanced	AES-EBU per AES3-1992	
Optical	Toslink® or equivalent	
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 fidelity, accuracy, and jitter*
Optical	27 kS/s to 108 kS/s	
Sample Rate (SR) Accuracy	±0.0003% [3 PPM]	
Output Amplitude		
Unbalanced		
Range	0.0 Vpp to 2.50 Vpp into 75 Ω	*1 mV resolution*
Accuracy	±(8 % + 20 mV)	
Source Impedance		*Typically 75 Ω*
Balanced		
Range	0.0 Vpp to 8.00 Vpp into 110 Ω	*1 mV resolution*
Accuracy	±(10 % + 80 mV)	
Source Impedance		*Typically 110 Ω*
Optical	Fixed, determined by transducer.	
Channel Status Bits	Full implementation per IEC-60958 (consumer) and AES3 (professional)	*Automatically set or manual override, hex or plain English, CRC override and auto-increment local address and time of day*
User Bits and Validity Flag	Fully settable	*Hex*

Characteristic	Specifications	Supplemental Information
Residual Jitter[1]		
Unbalanced, Balanced		
700 Hz-100 kHz BW	≤600 ps	*Peak detection*
Optical		*Typically <2.5 ns, SR ≤96 kS/s*
INTERFACE SIGNAL IMPAIRMENTS		
Variable Rise/Fall Time		
Range	12 ns to 100 ns	*1 ns typical resolution*
Accuracy	±(10% + 2 ns)	
Cable Simulation		*Approximates the signal degradation of 100 meters of Belden 1696A.*
Induced Jitter		
Waveforms	Sine, Square, Noise	
Sine Wave Jitter		*Above 200 Hz, maximum allowable jitter decreases in a "1/f" fashion to 0.20 UI at F_J =10 kHz and higher.*
Frequency Range (F_J)	2 Hz to 200 kHz	
Amplitude Range	0-1.591 µs for F_J ≤20 Hz and derating linearly to 0.1591 µs at 200 kHz	*Equivalent to 0-9.775 UI at 48 kHz sample rate, derating to 0.9775 UI*
Amplitude Resolution	100 ps	
Accuracy (500 Hz)	±(0.5% + 0.1 ns)	
Flatness[1]	±0.5 dB, 100 Hz to 50 kHz	
Jitter Spectrum[1]		*Spurious products are typically –40 dBc (below jitter signal) or –60 dBUI, whichever is larger.*
Square Wave and Noise Waveform Jitter		*Jitter amplitude limited to 40 ns maximum.*
Normal Mode Noise		
Waveform	Pseudo-random pulse train	
Unbalanced	0 to 635 mVpp, 2.5 mV steps ±(10% + 25 mV)	
Balanced	0 to 2.55 Vpp, 10 mV steps ±(10% + 100mV)	

Characteristic	Specifications	Supplemental Information
Common Mode Signal (Bal only)		
Waveform	Sine	
Frequency Range	20 Hz to 100 kHz	
Amplitude Range	0 to 20.0 Vpp, 20 mV steps: ±(10% + 50 mV)	
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	0.001 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]		*Typically < –190 dBFS*
Square Characteristics		
Frequency Range (Fq)	10 Hz to SR / 6	*Fq must equal SR / N where N is an even integer ≥6.*
Even Harmonic, Spurious Content		*Typically < –190 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	IEC 60268-1 is shaped pink noise. BS EN 50332-1 is similar, but with soft clipping to limit crest factor to ≈2.

Characteristic	Specifications	Supplemental Information
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[1,2]		*Typically < –140 dBFS*
DFD		
Difference Frequency (Fdiff)	80 Hz to 2.0 kHz	F_{diff} = |F2-F1|; F_{mean} must be ≥ 6 • Fdiff
Mean Frequency (Fmean)	2.5 kHz to (0.499 • SR – F_{diff} / 2) or 60 kHz, whichever is lower	F_{mean} = (F1 + F2)/2
Residual IMD[1,2]		*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 dBFS*
DIGITAL INPUT RELATED:		
Formats		
Unbalanced	SPDIF-EIAJ per IEC 60958, ≤5 Vpp	*Input typically 75 Ω or ≈8.3 kΩ*
Balanced	AES-EBU per AES3-2003, ≤10 Vpp	*Input typically 110 Ω or ≈2.5 kΩ*
Optical	Toslink® or equivalent	
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 fidelity, accuracy, and jitter*
Optical	27 kS/s to 108 kS/s	
SR Measurement Accuracy	±0.0003% [±3 ppm]	

Characteristic	Specifications	Supplemental Information
Input Amplitude Measurement		
Unbalanced	0 to 2.50 Vpp, ±(5% + 6 mV)	
Balanced	0 to 8.0 Vpp, ±(5% + 25 mV)	
Jitter Measurement		
Range	0-4.0 UI at F_J ≤500 Hz	
Detection	Peak, RMS, or Average	*"Peak" detection must be used for residual measurements per AES3. "Average" detection is recommended for jitter response measurements.*
Bandwidth Limiting Filters (jitter signals)		
High-pass[4]		
700 Hz (AES3)	Special filter conforming with AES3	
Butterworth	F_{HP} (–3 dB) = 50 Hz to 150 kHz, 4-pole	
Elliptic	F_{HP} (–0.01 dB) = 50 Hz to 150 kHz, 5-pole; 0.01 dB pass-band ripple; ≤–60 dB stop-band	
Low-pass[4]		
Butterworth	F_{LP} (–3 dB) = 50 Hz to 150 kHz, 8-pole	ENBW ≈ 1.006 • F_{LP}
Elliptic	F_{LP} (–0.01 dB) = 50 Hz to 150 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
Accuracy (500 Hz)	±(10% + 1.0 ns)	
Flatness[1]	±0.5 dB, 100 Hz to 50 kHz	

Characteristic	Specifications	Supplemental Information
Residual Jitter[1]		
700 Hz - 100 kHz BW	≤600 ps	
Jitter Spectrum[1]		*Spurious products are typically –40 dBc (below jitter signal) or –60 dBUI, whichever is larger.*
Input Equalization	Arbitrary 30-pole input filter	*The EQ operates on any selected analyzer input channels.*
Channel Status Bits	Full implementation per IEC-60958 (consumer) and AES3 (professional)	
User Bits	Displayed in hex	
Validity Flag	Displayed for each channel	
Receiver Lock	Displayed, both channels combined	
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		*Typically < –140 dBFS*
THD+N Measurement		
Fundamental Range	5 Hz to 0.49 • SR	*Tuning can be set to track measured frequency, generator setting or fixed*
Measurement Range	0 to 100%	
Accuracy	±0.5 dB	
Residual THD+N[1,2]		*Typically < –140 dBFS*

Characteristic	Specifications	Supplemental Information
Bandwidth Limiting Filters (audio signals)		
High-Pass[4]		
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[4]		
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 the high-pass and low-pass bandwidth limiting filters.*
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* $\geq 6 \cdot F_{diff}$

Characteristic	Specifications	Supplemental Information
IMD Measured		
SMPTE	Amplitude modulation of HF tone	*Measurement BW is typ. 40–500 Hz xxx*
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[2]		
SMPTE & MOD		*Typically < –140 dBFS*
DFD		*Typically < –150 dBFS*
Frequency Measurement		
Range	< 5 Hz to 0.499 • SR	
Accuracy	±(0.0003% + 100 µHz)	
Phase Measurement		
Ranges	–90 to +270, ±180, or 0 to 360 deg	
Accuracy		*Typically < 0.001 deg*

NOTES to SPECIFICATIONS:

1 System specification including contributions from both generator and analyzer subject to the following conditions: (A) SR = 27 kS/s to 200 kS/s, (B) interface signal ≥1.5 Vpp Bal or ≥300 mVpp Unbal, (C) rise-time ≤20 ns, and (D) no impairments.
Optical interface is unspecified for residual jitter.

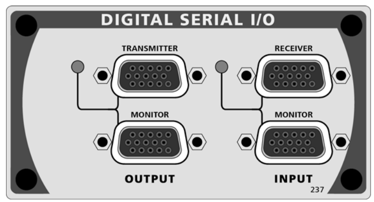
2 Digital generator word width must be set to 24 bits for specified performance; shorter word widths may degrade performance.

3 Maximum low-pass filter frequency is limited by input sample rate (SR).

4 DSP warping may significantly increase roll-off rate and lower ENBW.

DSIO digital serial input/output module specifications

with APx500 v5.0 or higher measurement software
as fitted in APx517, 52x, 555, and 58x B Series audio analyzers
NP0020.00034 rev 001
March, 2020



This illustration shows an APx DSIO module, model 237.

These specifications cover the digital serial input and output functions of the Audio Precision DSIO. The DSIO is available as a stand-alone module (model 237).

The Digital Serial Input/Output (or DSIO) option provides a flexible chip- or board-level serial input and output interface. With separate Master Clock, Bit Clock, Frame Clock, Channel

Clock and four Data lines, variable signal formats, variable word width, bit depth and synchronization options, the DSIO can address almost any serial interface need.

Formats include TDM, I^2S, DSP (bit-wide pulse) and custom formats. Up to 16 channels can be transmitted and received using the TDM format.

DSIO specifications begin on the next page.

Characteristic	Specifications	Supplemental Information
Functional characteristics		
Channels		
1 data line, TDM	1, 2, 4, 6, 8 or 16	*Time division multiplexing (TDM)*
Multiple data lines	1, 2, 4, 6 or 8	*up to 4 data lines; 2 channels on each line by TDM*
Data formats	I^2S, DSP, custom (left/right justified, one bit/ one subframe/50% duty cycle frame, inverted or normal frame, optionally 1-bit left-shifted frame). All modes LSB or MSB first	
Word width	8–128 bits	*cannot be less than bit depth*
Bit depth (data length)	8–32 bits	
Sample rate (frame rate)	4 kS/s–432 kS/s	*1, 2, 4, 6 or 8 channels[2]*
	4 kS/s–216 kS/s	*16 channels[2]*
Master Clock range	4 kHz–56 MHz	*Actual clock rate is dependent upon bit clock, word width, and sample rate settings.*
Logic voltage levels	1.8 V, 2.5 V, 3.3 V	

Characteristic	Specifications	Supplemental Information
DC characteristics, no load		
1.8 volt setting		
High level input		
Minimum	1.0 V	
Low level input		
Maximum	0.8 V	
High level output		
Minimum	1.6 V	
Low level output		
Maximum	0.1 V	
Absolute range		
Minimum	–0.5 V	
Maximum	5.5 V	
2.5 volt setting		
High level input		
Minimum	1.4 V	
Low level input		
Maximum	1.1 V	
High level output		
Minimum	2.2 V	
Low level output		
Maximum	0.1 V	
Absolute range		
Minimum	–0.5 V	
Maximum	5.5 V	

Characteristic	Specifications	Supplemental Information
3.3 volt setting		
High level input		
Minimum	1.8 V	
Low level input		
Maximum	1.5 V	
High level output		
Minimum	3.0 V	
Low level output		
Maximum	0.1 V	
Absolute range		
Minimum	–0.5 V	
Maximum	5.5 V	
Input/Output impedance		
All Outputs	50 Ω, nominal	
All Inputs	10 kΩ, nominal	
AC characteristics		
Clock frequencies, input or output		
Master clock	4 kHz–56 MHz	*Actual clock rate is dependent upon bit clock, word width, and sample rate settings.*
Bit clock	4 kHz–56 MHz maximum	*Actual clock rate is dependent upon word width and sample rate settings.*
Frame	432 kHz maximum	
Output latency		
Frame		*typ 3 ns referenced to Bit clock*
Data 1–4		*typ 3 ns referenced to Bit clock*
Monitor ports		*typ 10 ns referenced to Signal pin*
Input setup and hold requirements		
Frame, setup		*6 ns referenced to Bit clock*
Frame, hold		*2 ns referenced to Bit clock*
Data 1–4, setup		*6 ns referenced to Bit clock*
Data 1–4, hold		*2 ns referenced to Bit clock*

Characteristic	Specifications	Supplemental Information
Clock Jitter (Advanced Master Clock required)		
Jitter Measurement		
Range	0 to 650 ns	
Detection	Peak, RMS, or Average	*"Average" detection is recommended for jitter response measurements.*
Bandwidth		
Low Limit	50 Hz or 700 Hz	
High Limit	Variable from 1 kHz to 150 kHz in 0.1 kHz steps, Butterworth or Elliptic response	
Accuracy (1 kHz)	±(1% + 300 ps)	*"Average" detection*
Flatness[1]	±0.2 dB, 100 Hz to 100 kHz	
Residual Jitter[1]		
700 Hz to 100 kHz BW	≤600 ps	
Jitter Spectrum[1]		*Spurious products are typically –40 dBc (below jitter signal) or –60 dBUI, whichever is larger.[3]*
Induced Jitter		
Waveforms	Sine, Square, Noise	
Signals Affected	Master Clk, Bit Clk, Frame Clock and Data	
Sine Wave Jitter		
Frequency Range (F_J)	2 Hz to 200 kHz	
Amplitude Range	0 to 1591 ns for $F_J \leq 20$ kHz, derating linearly with frequency to 159.1 ns at 200 kHz	*Equivalent to 0 to 9.775 UI at 48 kHz sample rate, derating to 0.9775 UI.[3]*
Amplitude Resolution	100 ps	
Accuracy (1 kHz)	±0.01%	
Flatness	±0.01%	
Jitter Spectrum[1]		*Spurious products are typically –40 dBc (below jitter signal) or –60 dBUI, whichever is larger.[3]*
Square Wave and Noise Waveform Jitter		*Jitter amplitude limited to 40 ns maximum.*

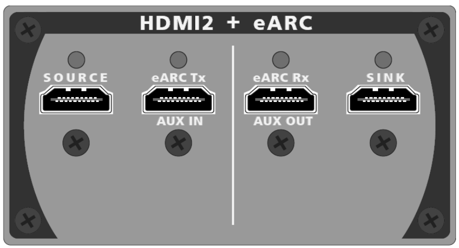
Characteristic	Specifications	Supplemental Information

NOTES to SPECIFICATIONS

1 System specification including contributions from both generator and analyzer subject to the following condition: Bit Clock ≥ 192 kHz.
2 In TDM, channel count can limit the bit clock rate.
3 For Digital Serial (DSIO), the Unit Interval (UI) is defined as 1/fb, where fb is the bitclock rate in hertz.

HDMI2+eARC input/output module specifications

with APx500 v8.1 or higher measurement software
as fitted in APx516, 517, 52x, 555 and 58x B Series audio analyzers
NP0020.00050 rev A
December, 2020



This illustration shows the HDMI2+eARC module.

These specifications cover the input and output functions of the Audio Precision HDMI2+eARC (High Definition Multimedia Interface plus Enhanced Audio Return Channel) I/O module. HDMI2+eARC is available as a stand-alone module and supports both ARC and eARC features.

The model HDMI2+eARC module is supports HDMI 2.1 for eARC features, and is fully compatible with HDMI 1.3a and supports a subset of HDMI 1.4b, the ARC (Audio Return Channel) feature. HDMI EDID 1.4, CDS (Capabilities Data Structure) for eARC, and CEC communications for ARC are supported on the Source and Sink connectors. Go to Help > About in APx500 to check feature availability.

HDMI is designed to carry high-bandwidth digital streams providing an audio/video interface that includes content protection and a bi-directional channel for interaction with connected electronic devices. eARC (Enhanced Audio Return Channel) and ARC (Audio Return Channel) provide an additional digital audio channel, which can simplify interface cabling in certain applications, for user convenience.

HDMI+eARC specifications begin on the next page.

Characteristic	Specifications	Supplemental Information
HDMI Revision	2.1 w/ eARC + ARC	*ARC (Audio Return Channel) implemented per HDMI 1.4a. eARC implemented per HDMI 2.1*
Device Connections		
SOURCE	Typically connects to the sink input of a DUT.	*The video is internally generated or supplied on the Aux Input. The generated video signal is a black and white checkerboard. The audio is internally generated: see “Embedded Output Signal Related” under “DIGITAL I/O” for typical waveforms and parameters.*
ARC Tx / AUX IN	HDMI ARC/eARC Tx configuration: Typically connects to an HDMI source that accepts ARC or eARC audio.	*Generates and transmits audio across ARC, per HDMI 1.4a and eARC per HDMI 2.1. HDMI source should not transmit video.*
	HDMI Sink configuration: typically connects to an external source of video to be included in the Source output signal.	*Incoming audio is ignored. Incoming video is passed to HDMI Source in “pass through” mode.*
ARC Rx / AUX OUT	HDMI ARC/eARC Rx configuration: Typically connects to an HDMI sink that produces ARC or eARC audio.	*HDMI ARC/eARC Rx configuration: Receives and analyzes audio across ARC, per HDMI 1.4a and eARC per HDMI 2.1. No video is transmitted.*
	HDMI Source configuration: Typically connects to an independent monitoring device.	*HDMI Source configuration: Contains video and audio received on the Sink input.*
SINK	Typically connects to the source output of a DUT.	*The embedded and encoded audio signal components are recovered for analysis.*
Hardware Interface	HDMI Type A	
EDID	256-byte on both SINK and AUX IN connectors.	
CEC (ARC connectors)	HDMI ARC Tx configuration: ARC CEC implementation per HDMI 1.4b. HDMI ARC Rx configuration: ARC CEC implementation per HDMI 1.4b.	*ARC link can be negotiated or forced on.* *User can manually send a CEC ping or arbitrary CEC message to any of the standard logical addresses.*

Characteristic	Specifications	Supplemental Information
CEC (HDMI Sink, Source Connectors)	HDMI Source configuration: CEC implementation per HDMI 1.4b. HDMI Sink configuration: CEC implementation per HDMI 1.4b. Also, user-selectable CEC pass through from Sink to AUX OUT	*User can manually send a CEC ping or arbitrary CEC message to any of the standard logical addresses.*
Video Modes	640x480 8-bit RGB	*TMDS*
	720x480 8-bit RGB	*TMDS*
	1280x720 8-bit RGB	*TMDS*
	1920x1080 8-bit RGB	*TMDS*
	3840x2160 8-bit RGB	*TMDS*
	3840x2160 8-bit / 10-bit 420	*FRL*
	4096x2160 8-bit RGB	*TMDS*
	4096x2160 8-bit / 10-bit 420	*FRL*
	7680x4320 8-bit / 10-bit 420	*FRL*

ARC / eARC DIGITAL I/O

ARC DIGITAL OUTPUT RELATED:

Characteristic	Specifications	Supplemental Information
Formats		
Electrical, Single Mode		
Electrical, Common Mode	Not Supported	
Sample Rate (SR) Range	27 kS/s–200 kS/s	*Usable over the extended range of 8 kS/s to 216 kS/s with degraded waveform fidelity and jitter*

HDMI2

Characteristic	Specifications	Supplemental Information
Sample Rate (SR) Accuracy	±0.0003% [3 PPM]	
Channel Status Bits	Full implementation per IEC-60958.	*Automatically set*
Audio Formats	2-CH PCM, IEC-61937	
Residual Jitter {notes 1,2}		*<1.0 ns typical*
eARC DIGITAL OUTPUT RELATED:		
Formats		
eARC		
Sample Rate (SR) Range	30.7 kS/s–192 kS/s	
Sample Rate (SR) Accuracy	±0.0003% [3 PPM]	
Channel Status Bits	Automatically set	
Audio Formats	2-CH PCM, 8-CH PCM, IEC-61937 Encoded	
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 {note 1}		*Typically <0.001 dB*
Harmonics & Spurious {notes 1,3}		*Typically <–140 dBFS*

Characteristic	Specifications	Supplemental Information
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		
<u>SMPTE & MOD</u>		
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 {notes 1,3}		*Typically <–140 dBFS*
<u>DFD & CCIF</u>		
Difference Frequency (Fdiff)	80 Hz to 2.00 kHz	*Fdiff = |F2 -F1|* *Fmean must be ≥6*Fdiff*
Mean Frequency (Fmean)	2 kHz to (0.499 • SR-Fdiff/2) or 60 kHz, whichever is lower	*Fmean = (F1 + F2)/2*
Residual IMD {notes 1,3}		*Typically <–150 dBFS*

DIGITAL INPUT RELATED:

Characteristic	Specifications	Supplemental Information
ARC Formats		
Single mode		
Dual mode		
Sample Rate Range (SR)	22 kS/s–216 kS/s	*Typically locks down to 16 kS/s*
eARC Format		
Sample Rate Range (SR)	30.7 kS/s–192 kS/s	
EMBEDDED INPUT SIGNAL RELATED:		
Level (Amplitude) Measurement		
Measurement Range	<–120 dBFS to +3 dBFS	
Accuracy (1 kHz)		*Typically <0.001 dB*
Flatness {note 1}		*Typically <0.001 dB*
Residual Noise		*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	
Residual THD+N {notes 1,3}		*Typically <–140 dBFS*
Bandwidth Limiting Filters		

Characteristic	Specifications	Supplemental Information
High-pass {note 4}		
DC	DC coupling	
AC (< 10 Hz)	AC coupling	*–3 dB at 4.1 Hz*
Butterworth	FHP (–3 dB) = 10 Hz to 100 kHz, 4-pole	
Elliptic	FHP (–0.01 dB) = 10 Hz to 100 kHz, 5-pole; 0.01 dB pass-band ripple; ≤–60 dB stop-band	*The settling time of elliptic high-pass filters is considerably longer (worse) than Butterworth having the same FHP.*
Low-pass {note 4}		
FS/2	No filter is implemented, bandwidth and response are limited by the SR	
Butterworth	FLP (–3 dB) = 10 Hz to 100 kHz, 8-pole	*ENBW ≈ (1.012–1.062) • FLP*
Elliptic	FLP (–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) • FLP (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) tones, 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 Hz-60 kHz and a difference frequency of 80 Hz-2.0 kHz	*Fmean = (F1 + F2)/2* *Fdiff = |F2 - F1|* *Fmean must be ≥6*Fdiff*

Characteristic	Specifications	Supplemental Information
IMD Measured		
SMPTE	Amplitude modulation of HF tone	*Measurement BW is typ 40-500 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 {notes 1,3}		
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 {note 1}		*Typically 0.001 deg*

Characteristic	Specifications	Supplemental Information
Resolution	0.001 deg	

NOTES to SPECIFICATIONS:

1 System specification including contributions from both generator and analyzer. Generator-only and analyzer-only contributions are typically less.

2 Sample rate (SR) must be ≥27 kHz for specified performance. Jitter analyzer set for 700 Hz highpass response per AES3-1992.

3 Digital generator word width must be set to 24 bits for specified performance; shorter word widths may degrade performance.

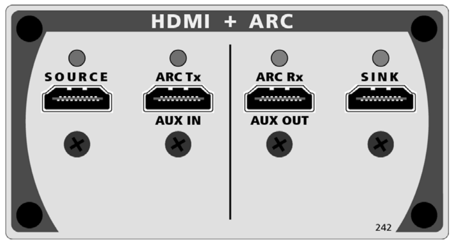
4 DSP warping may significantly increase roll-off rate and lower ENBW.

Characteristic	Specifications	Supplemental Information

HDMI2

HDMI+ARC input/output module specifications

with APx500 v5.0 or higher measurement software
as fitted in APx517, 52x, 555 and 58x B Series audio analyzers
NP0020.00033 rev 000
December, 2018



This illustration shows the HDMI+ARC module, model 242.

The HDMI+ARC module is superseded by the HDMI2+eARC module.

These specifications cover the input and output functions of the Audio Precision HDMI+ARC (High Definition Multimedia Interface plus Audio Return Channel) I/O module.

The model HDMI+ARC module is fully compatible with HDMI 1.3a; additionally, it supports a subset of HDMI 1.4a, the ARC (Audio Return Channel) feature. HDMI EDID 1.4 is supported, and CEC communications on the Source and Sink connectors is supported. Go to Help > About in APx500 to check feature availability.

HDMI is designed to carry high-bandwidth digital streams providing an audio/video interface that includes content protection and a bi-directional channel for interaction with connected electronic devices. ARC (Audio Return Channel) provides an additional digital audio channel, which can simplify interface cabling in certain applications, for user convenience. HDMI+ARC specifications begin on the next page.

Characteristic	Specifications	Supplemental Information
Revision	1.3a + ARC.	*ARC (Audio Return Channel) implemented per HDMI 1.4a*
Device Connections		
SOURCE	Typically connects to the sink input of a DUT.	*The video is an internally generated single color screen or the signal applied to the AUX IN connector. The audio is internally generated: see "Embedded Output Signal Related" under "DIGITAL I/O" for typical waveforms and parameters.*
ARC Tx / AUX IN	HDMI ARC Tx configuration: Typically connects to an HDMI source that accepts ARC audio.	*Generates and transmits audio across ARC, per HDMI 1.4a. HDMI source should not transmit video.*
	HDMI Source configuration: typically connects to an external source of video to be included in the Source output signal.	*Incoming audio is ignored. Incoming video is passed to HDMI Source in "pass through" mode.*
ARC Rx / AUX OUT	HDMI ARC Rx configuration: Typically connects to an HDMI sink that produces ARC audio.	*HDMI ARC Rx configuration: Receives and analyzes audio across ARC, per HDMI 1.4a. No video is transmitted.*
	HDMI Sink configuration: Typically connects to an independent monitoring device.	*HDMI Sink configuration: Contains video and audio sent to Sink input.*
SINK	Typically connects to the source output of a DUT.	*The embedded and encoded audio signal components are recovered for analysis.*
Hardware Interface	HDMI Type A	
EDID	256-byte EEPROM on both Sink and ARC TX / AUX IN connectors.	

Characteristic	Specifications	Supplemental Information
CEC (ARC connectors)	HDMI ARC Tx configuration: ARC CEC implementation per HDMI 1.4a. HDMI ARC Rx configuration: ARC CEC implementation per HDMI 1.4a.	*ARC link can be negotiated or forced on.* *User can manually send a CEC ping or arbitrary CEC message to any of the standard logical addresses. An indicator confirms the receipt of an ACK (acknowledged) message from the messaged device.*
CEC (HDMI Sink, Source Connectors)	HDMI Source configuration: CEC implementation per HDMI 1.4a. Also, user-selectable CEC pass-through from AUX IN to Source. HDMI Sink configuration: CEC implementation per HDMI 1.4a. Also, user-selectable CEC pass through from Sink to AUX OUT.	*User can manually send a CEC ping or arbitrary CEC message to any of the standard logical addresses. An indicator confirms the receipt of an ACK (acknowledged) message from the messaged device.*
Color Support	24-bit, 30-bit, 36-bit (Deep Color)	
Max Video Rate	1080p	

ARC DIGITAL I/O

ARC DIGITAL OUTPUT RELATED:

Characteristic	Specifications	Supplemental Information
Formats		
Signal level, single mode	0.5 Vpp typical	*Output R is 55 Ω typical.*
Signal level, common mode	0.4 Vpp typical	*Output R is 30 Ω typical.*
Sample Rate (SR) Range	27 kS/s–200 kS/s	*Usable over the extended range of 16 kS/s to 216 kS/s with degraded waveform fidelity, accuracy, and jitter*
Sample Rate (SR) Accuracy	±0.0003% [3 PPM]	
Channel Status Bits	Full implementation per IEC60958	*Automatically set or manual override, hex or plain English.*
User Bits	Fully settable	*Hex.*
Validity Flag	Set to 0, all channels	

Characteristic	Specifications	Supplemental Information
Residual Jitter[1,2]		*<1.0 ns typical*
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*
Harmonics & Spurious Products[1, 3]		*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		
<u>SMPTE & MOD</u>		
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]		*Typically < –140 dBFS*

Characteristic	Specifications	Supplemental Information
DFD & CCIF		
Difference Frequency (Fdiff)	80 Hz to 2.0 kHz	*F_{mean} = (F1 + F2)/2*
Mean Frequency (Fmean)	2.5 kHz to (0.499 • SR – F_{diff} / 2) or 60 kHz, whichever is lower	*F_{diff} = |F2-F1|; F_{mean} must be ≥ 6 • Fdiff*
Residual IMD[1, 3]		*Typically < –150 dBFS*
DIGITAL INPUT RELATED:		
Formats		
Single mode	≤1.5 Vpp	*Input R is nominally 55 Ω*
Dual mode	≤1.5 Vpp	*Input R is nominally 30 Ω*
Sample Rate Range	22 kS/s–216 kS/s	*Typically locks down to 16 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		*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	
Residual THD+N[1, 3]		*Typically < –140 dBFS*
Bandwidth Limiting Filters		
High-Pass[4]		
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	

Characteristic	Specifications	Supplemental Information
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[4]		
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 the 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 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.*

Characteristic	Specifications	Supplemental Information
Measurement Range	0 to 20%	
Accuracy	±0.5 dB	
Residual IMD[1, 3]		
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	

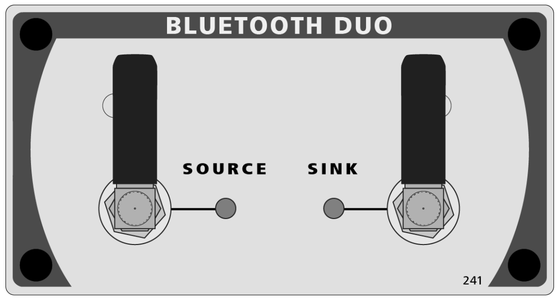
HDMI

Notes to Specifications

1. System specification including contributions from both generator and analyzer. Generator-only and analyzer-only contributions are typically less.
2. Sample rate (SR) must be ≥ 27 kHz for specified performance. Jitter analyzer set for 700 Hz highpass response per AES3-1992.
3. Digital generator word width must be set to 24 bits for specified performance; shorter word widths may degrade performance.
4. DSP warping may significantly increase roll-off rate and lower ENBW.

Bluetooth input/output module specifications

with APx500 v5.0 or higher measurement software
as fitted in APx517, 52x, 555 and 58x B Series audio analyzers
NP0020.00044 rev 000
December, 2018



This illustration shows the Bluetooth Duo module, model 241.

These specifications cover the digital input and output functions of the Audio Precision Bluetooth Duo interface.

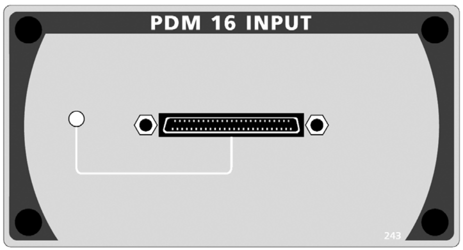
Bluetooth™ is a short-distance (a few meters) control, data, and audio communications wireless technology. Bluetooth uses low power, frequency-hopping radio in the 2.4 GHz band. Communication is two-way (for handshaking, metadata, etc); some profiles (HFP, for example) support duplex audio (both directions simultaneously); some profiles (A2DP) support only simplex audio (one direction per connection). Audio Precision supports several audio-specific Bluetooth profiles for audio test.

See acknowledgments on the copyright page at the front of the booklet.
Bluetooth specifications begin on the next page.

Characteristic	Specifications	Supplemental Information
Bluetooth Core Version		
	4.2	
Profiles/Roles, versions		
	A2DP Source/Sink 1.3	
	AVRCP Controller/Target 1.4	
	HFP Hands-Free 1.7	
	HFP Audio Gateway 1.7	
	HSP Headset/Audio Gateway 1.2	
A2DP Codecs		
	SBC	
	aptX	
	aptX Low Latency	
	aptX HD	
	AAC	
HFP Codecs		
	CVSD	
	mSBC	
RF Connections, Source and Sink		
	SMA x2	
RF Input Impedance		*Typically 50 Ω*
RF Output Impedance		*Typically 50 Ω*
RF Power		*Typically 0 dBm*
		Typical maximum +8 dBm
RF Sensitivity (0.1% BER)		*Typically ≤ –81 dBm*

PDM 16 input module specifications

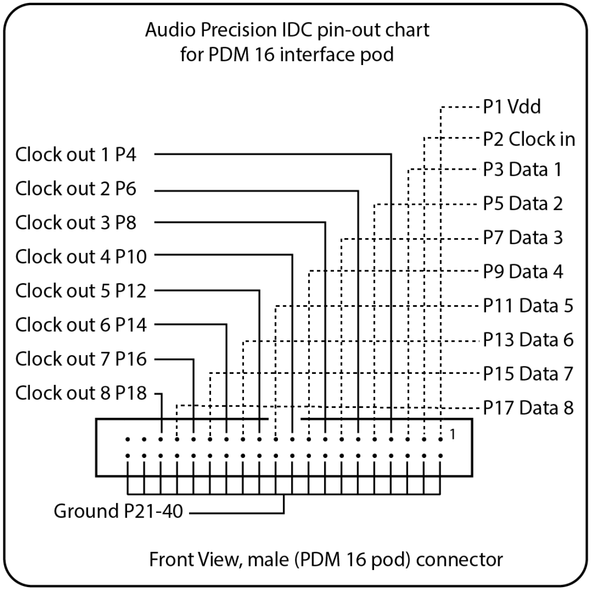
with APx500 v5.0.3 or higher measurement software
as fitted in APx517, 52x, 555 and 58x B Series audio analyzers
NP0020.00046 rev 000
November 2019



This illustration shows the PDM 16 module, model 243, and PDM 16 remote interface pod.

The PDM 16 option provides a solution for addressing circuits or devices with multiple PDM outputs. The PDM 16 option provides up to 16 acquisition channels that connect through the module's PDM 16 remote interface pod. All 16 channels can be measured simultaneously to provide sample-accurate interchannel information. The input accepts 1-bit PDM bitstreams, which are then decimated by one of several available decimation ratios and filtered into baseband audio at the Decimated Rate. The PDM 16 also provides a variable Vdd supply (0.0 V-3.6 V, 50 mA max.) and a bit clock that can be configured as an input or an output.

The PDM 16 remote interface pod provides a 40-pin, 0.1" (2.54mm) pitch IDC connector as an interface to PDM MEMS microphones. All signal pins are provided with individual, shared grounds. All clock outputs are redundant but individually buffered to drive multiple clock inputs if required. The Vdd output provides DC power, if required, for the device under test. The 8 data input pins can be used to interface up to 16 microphones simultaneously. The input is compatible with commonly available IDE / parallel ATA I/O cables.



These specifications cover the digital input functions of the Audio Precision PDM 16 interface for the current version, model 243.

PDM 16 specifications begin on the next page.

Technical Specifications

PDM 16

Parameter	Symbol	Test Conditions	Min	Type	Max	Unit
RECEIVER						
Remote Input Pod		Instrument to pod cable lengths of 2 m, 5 m and 10 m available				
Data Lines			1		8	
Channels			1		16	
Decimated Rate	F_S		4		192	kHz
Bit Clock Rate	F_B	Master or slave mode	0.128		24.576	MHz
Clock Outputs		1 master clock source replicated on 8 outputs			8	
Clock Inputs		1 slave clock input shared across all 8 data lines			1	
Phase/Synchronization		All channels sampled synchronously from common clock, phase relationships between channels fully maintained				
DECIMATION FILTER						
Decimation Ratio (FB/FS)	DECR	32, 64, 128, 256, 512	32		512	
Passband Frequency Range			0		0.45	F_S
Passband Gain		DECR = 64, 128, 256, 512	-0.001		+0.001	dB
Passband Gain		DECR = 32	-0.01		+0.01	dB
Stopband Frequency Range			0.55		DECR/2	F_S
Stopband Attenuation			120			dB

DISTORTION, NOISE and DYNAMIC RANGE (when tested with APx PDM Module output)[1]

MODULATOR: ORDER 4, 64X OSR

Parameter	Symbol	Test Conditions	Min	Type	Max	Unit
Overload Point	OLP	1 kHz			–7.8	dBFS
Total Harm. Dist. + Noise		@OLP; BW = 0.45 FS			-105	dB
Signal-to-Noise Ratio	SNR	@OLP; BW = 0.45 FS	106			dB
Dynamic Range	DNR	@MIL; FS = 48 kHz, per AES17	115			dB
MODULATOR: ORDER 5, 64X OSR						
Overload Point	OLP	1 kHz			-9.4	dBFS
Total Harm. Dist. + Noise		@OLP; BW = 0.45 FS			-116	dB
Signal-to-Noise Ratio	SNR	@OLP; BW = 0.45 FS	116			dB
Dynamic Range	DNR	@MIL; FS = 48 kHz, per AES17	125			dB
MODULATOR: ORDER 4, 128X OSR						
Overload Point	OLP	1 kHz			-7.9	dBFS
Total Harm. Dist. + Noise		@OLP; BW = 0.45 FS			-127	dB
Signal-to-Noise Ratio	SNR	@OLP; BW = 0.45 FS	127			dB
Dynamic Range	DNR	@MIL; FS = 48 kHz, per AES17	135			dB
MODULATOR: ORDER 5, 128X OSR						
Overload Point	OLP	1 kHz			-9.6	dBFS
Total Harm. Dist. + Noise		@OLP; BW = 0.45 FS			-127	dB
Signal-to-Noise Ratio	SNR	@OLP; BW = 0.45 FS	127			dB
Dynamic Range	DNR	@MIL; FS = 48 kHz, per AES17	135			dB
MODULATOR: ORDER 4, 256X OSR						
Overload Point	OLP	1 kHz			-8.0	dBFS
Total Harm. Dist. + Noise		@OLP; BW = 0.45 FS			-130	dB

Parameter	Symbol	Test Conditions	Min	Type	Max	Unit
Signal-to-Noise Ratio	SNR	@OLP; BW = 0.45 FS	129			dB
Dynamic Range	DNR	@MIL; FS = 48 kHz, per AES17	137			dB
MODULATOR: ORDER 5, 256X OSR						
Overload Point	OLP	1 kHz			-9.8	dBFS
Total Harm. Dist. + Noise		@OLP; BW = 0.45 FS			-128	dB
Signal-to-Noise Ratio	SNR	@OLP; BW = 0.45 FS	127			dB
Dynamic Range	DNR	@MIL; FS = 48 kHz, per AES17	137			dB
MODULATOR: ORDER 4, 512X OSR						
Overload Point	OLP	1 kHz			-8.2	dBFS
Total Harm. Dist. + Noise		@OLP; BW = 0.45 FS			-130	dB
Signal-to-Noise Ratio	SNR	@OLP; BW = 0.45 FS	129			dB
Dynamic Range	DNR	@MIL; FS = 48 kHz, per AES17	137			dB
MODULATOR: ORDER 5, 512X OSR						
Overload Point	OLP	1 kHz			-10	dBFS
Total Harm. Dist. + Noise		@OLP; BW = 0.45 FS			-128	dB
Signal-to-Noise Ratio	SNR	@OLP; BW = 0.45 FS	127			dB
Dynamic Range	DNR	@MIL; FS = 48 kHz, per AES17	137			dB
INPUT CHARACTERISTICS						
Impedance				>100 < 10		kOhms pf
Input Voltage Range			0		5	V
Interface Voltage (Logic Level)	VINT		0.8		3.30	V

Parameter	Symbol	Test Conditions	Min	Type	Max	Unit
Resolution					0.01	V
Accuracy				±0.05		V
OUTPUT CHARACTERISTICS						
Output Voltage High	VOH	ILOAD = 0.5 mA	0.7 × VINT			V
Output Voltage Low	VOL	ILOAD = 0.5 mA			0.3 × VINT	V
Output Impedance	Zo	At connector pin		50		Ohms
VDD OUTPUT						
DC Voltage	VDD		0.0		3.60	V
Resolution					0.01	V
Accuracy				±0.05		V
Maximum Current	IMAX				50	mA
TIMING CHARACTERISTICS						
PDM RECEIVER						
t_{CLKRX}		Clock period (master or slave mode)	41		7813	ns
t_{HP}		Data hold time, rising edge		0		ns
t_{HN}		Data hold time, falling edge		0		ns
t_{SU}		Data setup time			9	ns
PDM Input Jitter Tolerance		Sine wave jitter, bit clock rates from 128kHz to 24.576 MHz		<= 3.5 UI (subject to 1591ns max jitter limit)		UI[2]

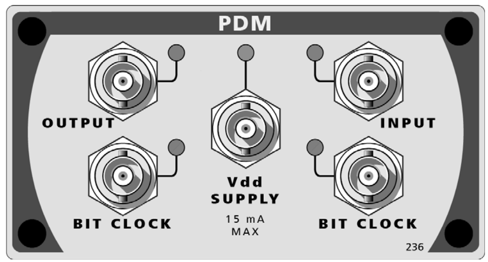
Notes to Specifications

1. System specification including contributions from both generator and analyzer subject to the following condition: Bit Clock ≥ 192 kHz.

2. For PDM, the Unit Interval (UI) is defined as 1/fb, where fb is the bitclock rate in hertz.

PDM input/output module specifications

with APx500 v5.0 or higher measurement software
as fitted in APx517, 52x, 555 and 58x B Series audio analyzers
NP0020.00036 rev 002
March 2020



This illustration shows the PDM module, model 236.

The PDM option provides a complete solution for addressing circuits or devices with a PDM input or output. The PDM signal output consists of an APx generator audio signal, interpolated by a broad choice of oversampling ratios, and modulated into a 1-bit PDM bitstream. A 4th-order modulator is the default; a 5th-order modulator can be selected. The PDM Option also provides a signal input with its associated clock connection. The input accepts a 1-bit PDM bitstream, which is then decimated by one of a wide range of decimation ratios and filtered into baseband audio at the Decimated Rate. The input bitstream can also be analyzed directly (before decimation) in the Signal Analyzer to view out-of-band components.

These specifications cover the digital input and output functions of the Audio Precision PDM interface for the current version, model 236.

PDM specifications begin on the next page.

PDM

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
TRANSMITTER						
Decimated Rate	F_S		4		216	kHz
Bit Clock Rate	F_B	Master or slave mode	0.128		24.576	MHz
INTERPOLATION FILTER						
Interpolation Ratio (F_B/F_S)	INTR	16, 16.67, 21.33, 24, 25, 32, 33.33, 37.5, 42.67, 48, 50, 62.5, 64, 66.67, 75, 85.33, 96, 100, 125, 128, 150, 192, 200, 250, 256, 300, 384, 400, 500, 512, 600, 768, 800	16		800	
Passband Frequency Range			0		0.45	F_S
Passband Gain		INTR = 64, 128, 256, 512	–0.0001		+0.0001	dB
		INTR = 32	-0.01		+0.01	dB
		All other INTR	–0.0063		+0.0001	dB
Stopband Frequency Range			0.55		INTR / 2	F_S
Stopband Attenuation		INTR = 32, 64, 128, 256, 512	115			dB
		All other INTR	100			dB
MODULATOR: GENERAL						
Passband Frequency Range			0		0.45	F_S
Passband Gain			–0.0001		+0.0001	dB
Maximum Input Level	MIL				0	dBFS
Linearity		–100 dBFS to MIL (order 4, 5)	–0.010		+0.001	dB
		MIL to 0 dBFS (order 4)	–0.010		+0.002	dB
		MIL to 0 dBFS (order 5)	–0.010		+0.001	dB
Ones Density at Full Scale			99.94	100		%
MODULATOR: ORDER 4, 64x OSR						
Overload Point	OLP	1 kHz			–7.8	dBFS
Total Harm. Dist. + Noise		@OLP; BW = 0.45 F_S			–105	dB
Signal-to-Noise Ratio	SNR	@OLP; BW = 0.45 F_S	106			dB

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Dynamic Range	DNR	@MIL; F_S = 48 kHz; per AES17	115			dB
MODULATOR: ORDER 5, 64x OSR						
Overload Point	OLP	1 kHz			–9.4	dBFS
Total Harm. Dist. + Noise		@OLP; BW = 0.45 F_S			–116	dB
Signal-to-Noise Ratio	SNR	@OLP; BW = 0.45 F_S	116			dB
Dynamic Range	DNR	@MIL; F_S = 48 kHz; per AES17	125			dB
MODULATOR: ORDER 4, 128x OSR						
Overload Point	OLP	1 kHz			–7.9	dBFS
Total Harm. Dist. + Noise		@OLP; BW = 0.45 F_S			–127	dB
Signal-to-Noise Ratio	SNR	@OLP; BW = 0.45 F_S	127			dB
Dynamic Range	DNR	@MIL; F_S = 48 kHz; per AES17	135			dB
MODULATOR: ORDER 5, 128x OSR						
Overload Point	OLP	1 kHz			–9.6	dBFS
Total Harm. Dist. + Noise		@OLP; BW = 0.45 F_S			–127	dB
Signal-to-Noise Ratio	SNR	@OLP; BW = 0.45 F_S	127			dB
Dynamic Range	DNR	@MIL; F_S = 48 kHz; per AES17	135			dB
MODULATOR: ORDER 4, 256x OSR						
Overload Point	OLP	1 kHz			–8.0	dBFS
Total Harm. Dist. + Noise		@OLP; BW = 0.45 F_S			–130	dB
Signal-to-Noise Ratio	SNR	@OLP; BW = 0.45 F_S	129			dB
Dynamic Range	DNR	@MIL; F_S = 48 kHz; per AES17	137			dB
MODULATOR: ORDER 5, 256x OSR						
Overload Point	OLP	1 kHz			–9.8	dBFS
Total Harm. Dist. + Noise		@OLP; BW = 0.45 F_S			–128	dB
Signal-to-Noise Ratio	SNR	@OLP; BW = 0.45 F_S	127			dB
Dynamic Range	DNR	@MIL; F_S = 48 kHz; per AES17	137			dB

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
MODULATOR: ORDER 4, 512x OSR						
Overload Point	OLP	1 kHz			–8.2	dBFS
Total Harm. Dist. + Noise		@OLP; BW = 0.45 F_S			–130	dB
Signal-to-Noise Ratio	SNR	@OLP; BW = 0.45 F_S	129			dB
Dynamic Range	DNR	@MIL; F_S = 48 kHz; per AES17	137			dB
MODULATOR: ORDER 5, 512x OSR						
Overload Point	OLP	1 kHz			–10	dBFS
Total Harm. Dist. + Noise		@OLP; BW = 0.45 F_S			–128	dB
Signal-to-Noise Ratio	SNR	@OLP; BW = 0.45 F_S	127			dB
Dynamic Range	DNR	@MIL; F_S = 48 kHz; per AES17	137			dB
RECEIVER						
Decimated Rate	F_S		0.160		768	kHz
Bit Clock Rate	F_B	Master or slave mode	0.128		24.576	MHz
DECIMATION FILTER						
Decimation Ratio (FB/FS)	DECR	1, 3.125, 4, 6.25, 8.00, 8.33, 10.67, 12.5, 16, 16.67, 18.75, 21.33, 24, 25, 32, 33.33, 37.5, 42.67, 48, 50, 64, 66.67, 75, 85.33, 96, 100, 128, 150, 192, 200, 256, 300, 384, 400, 512, 500, 768, 800	1		800	
Passband Frequency Range		All DECR except DECR = 1	0		0.45	F_S
		DECR = 1	0		0.5	F_B
Passband Gain		DECR = 1, 4, 8, 16, 32, 64, 128, 256, 512	–0.001		+0.001	dB
		All other DECR	–0.005		+0.005	dB
Stopband Frequency Range		All DECR except DECR = 1	0.55		DECR/2	F_S
Stopband Attenuation		All DECR except DECR = 1	120			dB

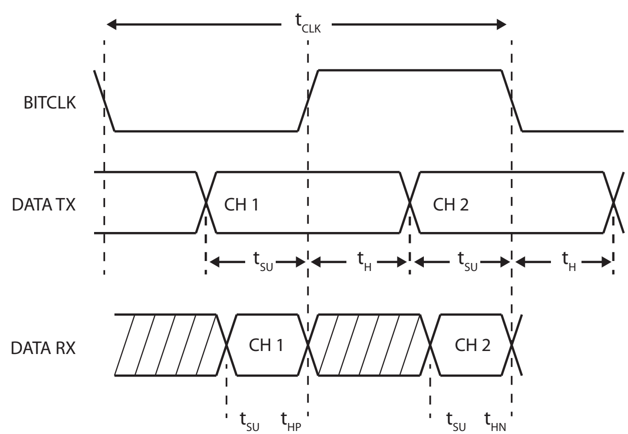
Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
LOGIC LEVEL						
Interface Voltage	V_{INT}		0.80		3.30	V
Resolution					0.01	V
Accuracy				±0.05		V
OUTPUT CHARACTERISTICS						
Output Voltage High	V_{OH}	I_{LOAD} = 0.5 mA	0.7 • V_{INT}			V
Output Voltage Low	V_{OL}	I_{LOAD} = 0.5 mA			0.3 • V_{INT}	V
VDD OUTPUT						
DC Voltage	V_{DD}		0.80		3.60	V
Resolution					0.01	V
Accuracy				±0.05		V
Maximum Current	I_{MAX}				15	mA
VDD MODULATION						
AC output level		All waveforms	0.01		V_{DD} / 5	V_{pp}
Square/Pulse Frequency		Per GSM standard		216.667		Hz
Sine Frequency			10		22000	Hz
Frequency Accuracy				3		ppm

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Timing Characteristics						
PDM TRANSMITTER						
t_{CLKTX}		Clock period (master or slave mode)	41		7813	ns
t_H		Data hold time	20			ns
t_{SU}		Data setup time		t_{CLKTX} / 2-30		ns
Logic Level = 0.8 V						
t_{CO}		Clock to out		58		ns
t_R		Rise Time		18		ns
t_F		Fall Time		16		ns
r_{OUT}		Output Impedance		450		ohms
f_{CLK} max		Maximum Clock Frequency		3.072		MHz
Logic Level = 1.0 V						
t_{CO}		Clock to out		32		ns
t_R		Rise Time		10		ns
t_F		Fall Time		7.7		ns
r_{OUT}		Output Impedance		225		ohms
f_{CLK} max		Maximum Clock Frequency		6.144		MHz
Logic Level = 1.5 V						
t_{CO}		Clock to out		18		ns
t_R		Rise Time		5.2		ns
t_F		Fall Time		3.8		ns
r_{OUT}		Output Impedance		85		ohms
f_{CLK} max		Maximum Clock Frequency		12.28		MHz

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Logic Level ≥ 2.0 V						
t_{CO}		Clock to out		15		ns
t_R		Rise Time		3.9		ns
t_F		Fall Time		2.9		ns
r_{OUT}		Output Impedance		40		ohms
f_{CLK} max		Maximum Clock Frequency		24.576		MHz

PDM RECEIVER

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
t_{CLKRX}		Clock period (master or slave mode)	41		7813	ns
t_{HP}		Data hold time, rising edge		5		ns
t_{HN}		Data hold time, falling edge		5		ns
t_{SU}		Data setup time			5	ns



Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Clock Jitter (Advanced Master Clock required)						
Jitter Measurement						
Range				0 to 650 ns		
Detection		Peak, RMS or Average				
Bandwidth						
Low Limit				50 Hz or 700 Hz		
High Limit		Variable in 0.1 kHz steps, Butterworth or Elliptic response	1 kHz		150 kHz	
Accuracy (1 kHz)		“Average” detection		±(1% + 300 ps)		
Flatness[1]		100 Hz to 100 kHz			±0.2 dB	
Residual Jitter[1]		700 Hz to 100 kHz BW			≤600 ps	
Jitter Spectrum[1]				Spurious products are typically –40 dBc (below jitter signal) or –60 dBUI, whichever is larger.[2]		
PDM Input Jitter Tolerance		Sine wave jitter, bit clock rates from 128kHz to 24.576 MHz.	3.5 UI, (subject to 1591 ns max jitter limit)			
Induced Jitter						
Waveforms		Sine, Square, Noise				
Signals Affected		Bit Clk and Data				

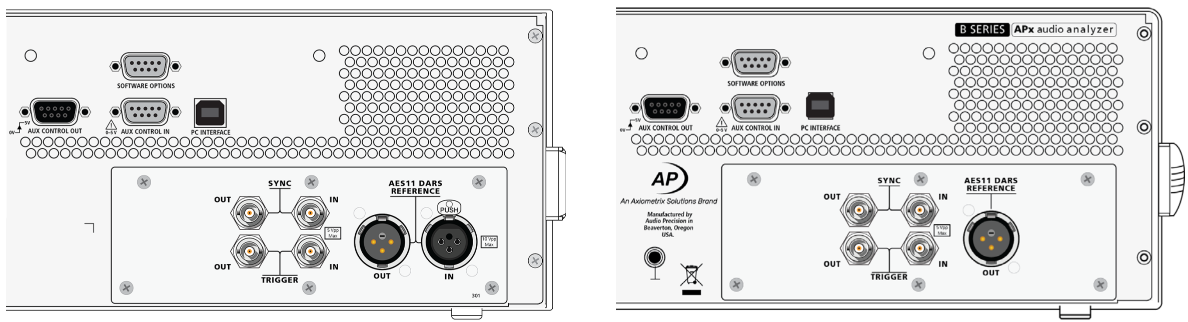
Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Sine Wave Jitter						
Frequency Range (f_J)			2 Hz		200 kHz	
Amplitude Range		Referenced to bit clock rate, subject to linear derating at jitter frequencies >20kHz		3.5 UI or 1591 ns which ever is less		
Amplitude Resolution			100 ps			
Accuracy (1 kHz)			±0.01%			
Flatness			±0.01%			
Jitter Spectrum[1]				Spurious products are typically –40 dBc (below jitter signal) or –60 dBUI, whichever is larger.[2]		
Square Wave and Noise Waveform Jitter				Jitter amplitude limited to 40 ns maximum.		
PDM Output Jitter Tolerance		Sine wave jitter, bit clock rates from 128kHz to 24.576 MHz		3.5 UI (subject to 1591ns max jitter limit)		

Notes to Specifications

1. System specification including contributions from both generator and analyzer subject to the following condition: Bit Clock ≥ 192 kHz.
2. For PDM, the Unit Interval (UI) is defined as 1/fb, where fb is the bitclock rate in hertz.

AMC Advanced Master Clock, Rear Panel Sync, Trigger and Ref I/O specifications

with APx500 v5.0 or higher measurement software
as fitted in APx52x, 555, and 58x B Series audio analyzers
NP0020.00042 rev 001
May 2023



This illustration shows a section of the APx rear panel, focusing on the Auxiliary I/O and the Sync, Trigger and DARS reference connections for the AMC.

These specifications cover rear panel Sync, Trigger and DARS Reference I/O functions for APx analyzers fitted with the Advanced Master Clock (AMC).

The Auxiliary I/O (GPIO) function connectors shown in the illustration are not part of the AMC option, but are fitted on all APx analyzers.

> *Earlier AMC modules were equipped with a DARS Reference Input. Both versions are shown in the above illustration for reference.*

Characteristic	Specifications	Supplemental Information
REAR PANEL I/O		
Auxiliary Digital Control		
Output	8 bits	*Typically 0-5V, 9-pin male D-sub*
Input	8 bits	*Internal pull-up, 9-pin female D-sub*
Sync Input		
Signal Compatibility	Square or Sine	
Voltage Range	0.8 Vpp to 5.0 Vpp	R_{IN} *>10 kΩ, AC coupled*
Frequency Range	4 kHz to 50 MHz, square; 1 MHz to 50 MHz, sine	
Lock Range		*Typically 100 ppm*
Sync Output		
Signal	Square	
Amplitude (V_H)	+0.8 V to +3.6 V, 0.1 V steps	$R_S \approx 50\ \Omega$; $V_L \approx 0$ *to 0.1 V*
Frequency Range	8 kHz to 50 MHz	*Maximum recommended frequency when interfacing to low voltage logic:* *50 MHz for 3.6 V ≥ VH ≥ 1.5 V* *40 MHz for 1.5 V > VH ≥ 1.0 V* *20 MHz for 1.0 V > VH ≥ 0.8 V* ** See complete table in Notes, below.*
Reference Input (AES11 / DARS)		
Voltage Range	2.0 Vpp to 6.0 Vpp	R_{IN} *selectable: >5 kΩ or ≈110 Ω*
Sample Rate Range	27 kS/s to 216 kS/s	
Lock Range		*Typically 100 ppm*

NOTE: The Reference Input feature is removed for instruments with serial numbers greater than or equal to the following:

APx525	102000525
APx526	101000526
APx555	101000555
APx582	100100582
APx585	101000585
APx586	101000586

Characteristic	Specifications	Supplemental Information
Reference Output (AES11 / DARS)		
Amplitude	5.0 Vpp into 110 Ω, balanced	
Sample Rate Range	8 kS/s to 216 kS/s	*Usable below 27 kS/s with some loss in waveform fidelity*
Trigger Input		
Voltage Range	–0.5 V to +5.5 V	
Threshold Level	+0.8 to +3.6 V, 0.1 V steps	*R_{IN} ≈10 kΩ, DC coupled, + or – edge selectable*
Minimum Pulse Width		*Typically 20 ns*
Trigger Output		
Trigger Sources	Analog Sine Generator, Audio Generator, and Jitter Generator	
Amplitude (V_H)	+0.8 V to +3.6 V, 0.1 V steps	*R_S ≈ 50 Ω; V_L ≈ 0 to 0.1 V*

Notes:

Sync Output: Typical Output Characteristics Over Interface Voltage

		No Load		50 pF Load		
Interface Voltage, V	**R. Out, ohms**	**Rise Time, ns**	**Fall Time, ns**	**Rise Time, ns**	**Fall Time, ns**	**Frequency Max, MHz**
0.8	650	13	9	50	32	20
1.0	300	7	5	25	17	40
1.5	120	4.3	2.7	14	10	50
2.0	84	3.3	2	10	8	50
2.5	68	2.8	1.7	9	7.3	50
3.0	65	2.5	1.5	8.4	6.8	50
3.6	62	2.3	1.5	8	6.5	50

General and Environmental Specifications

for APx52x, and 58x B Series audio analyzers
NP0020.00038 rev 001
August 2022

ENVR

Characteristic	Specifications	Supplemental Information
GENERAL/ENVIRONMENTAL		
Power Requirements	95 to 264 Vac, 50–60 Hz, with safety ground via approved power cord, 260 VA max	*No range switching or fuse changes required over the full operating range.*
Temperature Range		
Operating	0° C to +45° C 0° C to +40° C for APx586 only	
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. IEC 61326-2-1:2005 Section 5.2.401 is applied (controlled EM environment) for options “DSIO” and “PDM”. Complies with Directive 1995/5/EC if option “BT” (Bluetooth) is installed.	*Emissions and immunity levels are influenced by the quality of interface and signal cables attached to the unit. Compliance was demonstrated using Audio Precision cables*

Characteristic	Specifications	Supplemental Information
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)	432 x 129 x 467 mm [17.0 x 5.1 x 18.4 in]	*3U rack mount kit available. D is 475 mm [18.7 in] if rear panel option keys or Option AMC is installed.*
Weight	Ranges from 10.7 kg [23.5 lbs] to 11.8 kg [26 lbs]	*Weight depends upon model and installed options*

An Axiometrix Solutions Brand

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