

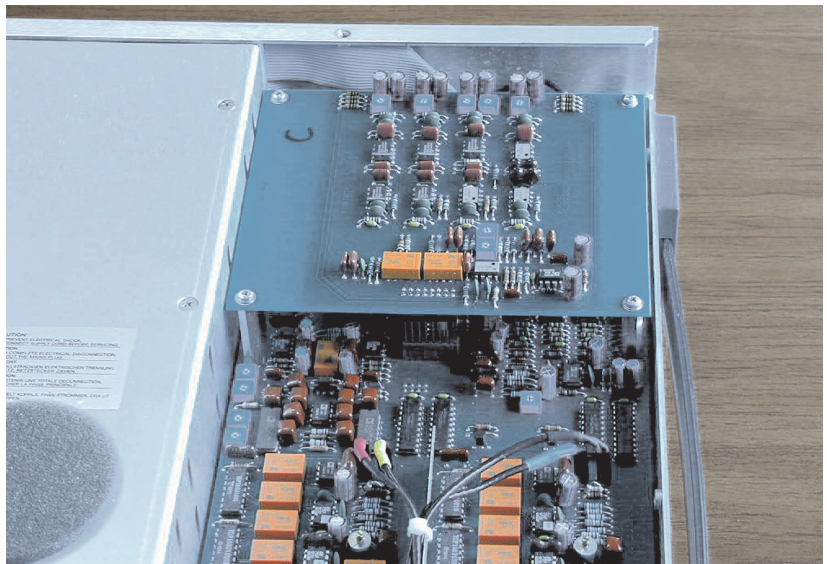
OPT-2020

Pre-Analyzer Filter



USER'S MANUAL

OPT-2020 Pre-Analyzer Filter User's Manual



Installation and Operation of the

OPT-2020
Pre-Analyzer Filter

Audio 
precision®

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Audio Precision part number 8211.0191 Rev 0

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Safety Information

Do NOT service or repair this product unless properly qualified. Only a qualified technician or an authorized Audio Precision distributor should perform servicing.

Do NOT defeat the safety ground connection. This product is designed to operate only from a 50/60 Hz AC power source (250 Vrms maximum) 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 product.

For continued fire hazard protection, fuses should be replaced ONLY with the exact value and type as indicated on the rear panel of the instrument. The AC voltage selector also must be set to the same voltage as the nominal power source voltage (100, 120, 230, or 240V rms) with the appropriate fuses installed.

The International Electrotechnical Commission (IEC 1010-1) requires that measuring circuit terminals used for voltage or current measurement be marked to indicate their *Installation Category*. The Installation Category is defined by IEC 664 and 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 INSTALLATION CATEGORY II, abbreviated “**CAT II**” on instrument front panels. Do NOT substitute parts or make any modifications without the written approval of Audio Precision. Doing so may create safety hazards.

This product contains a lithium battery. Dispose only in accordance with all applicable regulations.

This product is for indoor use – pollution degree 2.

Safety Symbols



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. Refer to the User's Manual or Operator's Manual for precautionary instructions.



FUNCTIONAL EARTH TERMINAL—This symbol marks a terminal that 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—This symbol marks a terminal that is bonded to conductive parts of the instrument. Confirm that this terminal is 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.

Chapter 1

Description

Scope of This Manual

This guide serves several purposes:

- It describes the installation the OPT-2020 Pre-Analyzer Filter into your Audio Precision instrument, and instructs you in changing the instrument firmware setting.
- It presents characteristics and specifications of the OPT-2020 Pre-Analyzer Filter.
- It describes the use of the OPT-2020 Pre-Analyzer Filter with your Audio Precision instrument and control software.

Overview

Introduction

This guide covers the installation and use of the OPT-2020 Pre-Analyzer Filter in the Audio Precision instruments System Two, System Two Cascade and Cascade *Plus* and 2700 series instruments.

For the filter to be functional, these conditions must be met:

- **You must be running control software appropriate for your instrument and of the correct version: APWIN version 2.10 or later, or AP2700 (any version).**
Earlier versions of APWIN control software will not recognize the OPT-2020 Pre-Analyzer Filter.
- **You must have run the utility `sys_opt_programmer.apb`.**
This utility sets a bit in firmware to tell the instrument that the OPT-2020

Pre-Analyzer Filter is present. Otherwise, the filter selection will not show up in the Analog Analyzer filter selection list.

- **The filter must be installed and working properly.**

With the OPT-2020 filter selected in the control software but not physically installed, the only noise improvement will be due to the instrument 80 kHz low-pass filter, which is also enabled when the OPT-2020 filter is selected.

Nomenclature

The OPT-2020 Pre-Analyzer Filter was previously sold by Audio Precision under the model number S2-AES17-LP. Although the OPT-2020 does satisfy the AES17 requirements for a low-pass filter for converter measurements, for that application we recommend a filter set with significantly improved performance, the Audio Precision model S-AES17 Low-Pass Filter. Contact your Audio Precision representative or visit audioprecision.com on the Web for more information.

Background

Measuring the audio performance of converters and other devices that by design present high-level out-of-band noise can be a challenge for most contemporary audio analyzers.

Analog audio devices typically exhibit a noise floor evenly spread over the full spectrum, frequently diminishing with increased frequency. Since all analog-based analyzers are wide-band measuring devices, the character of the

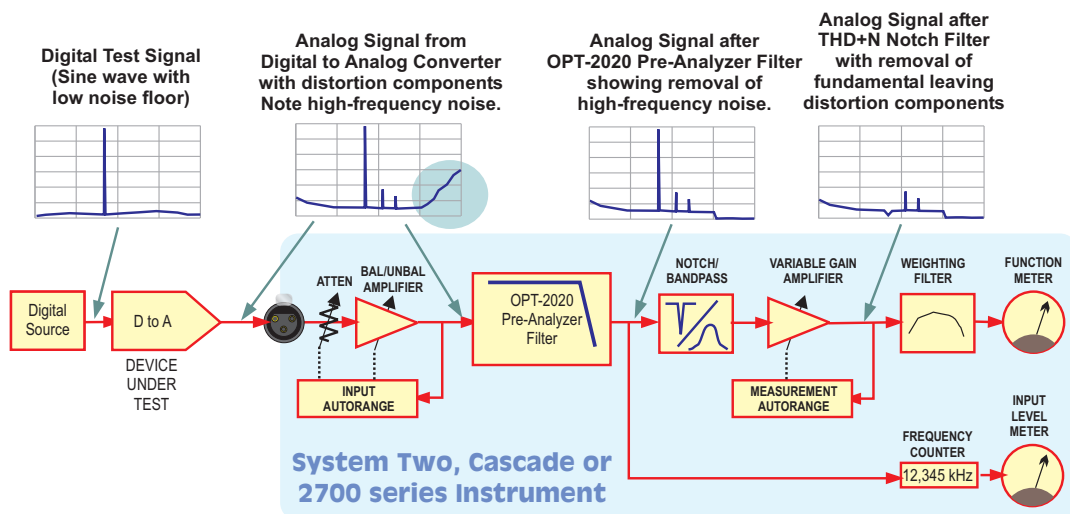


Figure 1. Conceptual signal path diagram showing how the OPT-2020 Pre-Analyzer Filter attenuates out-of-band noise and allows accurate measurement of audio-band distortion.

noise floor can contribute significantly to signal-to-noise and total harmonic distortion plus noise (THD+N) measurements. The performance of a device where the spectrum of the noise floor is somewhat constant or diminishes at higher frequencies can be easily characterized with this conventional wide-band measurement technique. Band-limiting or noise-weighting filters, inserted at the end of the measurement path and following several gain stages, yield repeatable and accurate results.

The spectrum of the noise floor of a noise-shaped delta-sigma converter, for example, shows a steeply rising energy characteristic beyond the 20 kHz upper limit of the audio band (see Figure 1). When measuring low-level signals, the energy contribution of this out-of-band noise can be significant. In many situa-

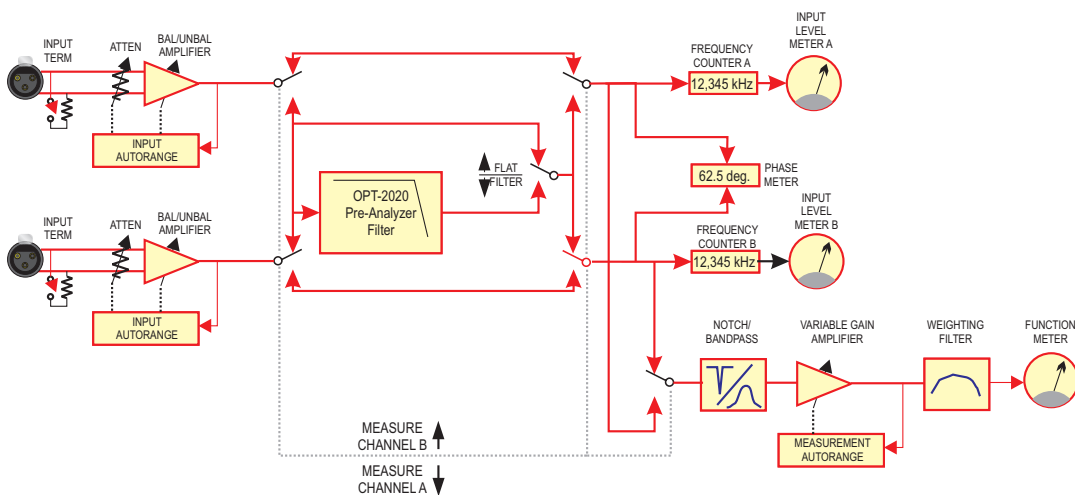


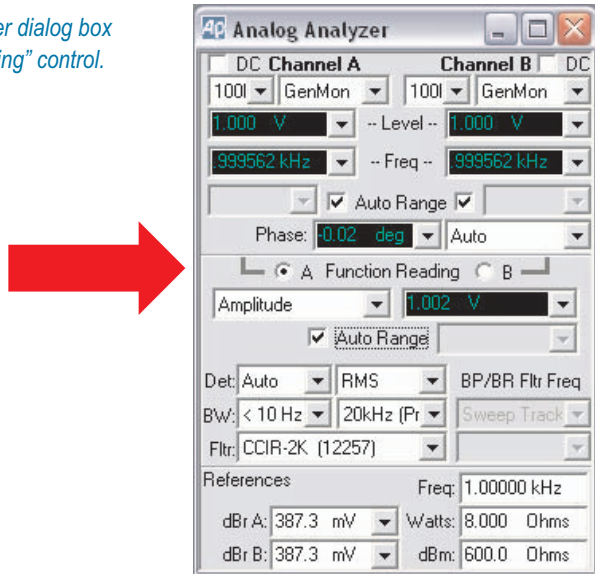
Figure 2. Block diagram showing the OPT-2020 Pre-Analyzer Filter enabled. Note that the single OPT-2020 Pre-Analyzer Filter is switched between input channels A and B depending on the setting of the “Function Reading” control (shown in Figure 3).

tions, it can cause grossly inaccurate reading results. Conventional band-limiting and noise-weighting filters cannot solve the problem because they are located too late in the measurement chain—the damage is already done.

Audio Precision OPT-2020 Pre-Analyzer Filter

The Audio Precision OPT-2020 Pre-Analyzer Filter provides a sharp roll-off beyond 20 kHz. This filter can be added to an Audio Precision System Two, System Two Cascade or 2700 series instrument. The filter has a stop-band attenuation of 60 dB or better above 24 kHz, an aggressive slope. See Figures 4 and 5.

Figure 3. Analog Analyzer dialog box showing “Function Reading” control.



Unlike the small option filters designed to fit in the seven analyzer filter slots, the OPT-2020 Pre-Analyzer Filter is a larger module mounted above the INP module. It also is inserted at a different point in the instrument signal path: just after the input conditioning amplifier and prior to any measurement circuits. Installation early in the signal path is necessary to remove the out-of-band noise before the measurement notch filter and its subsequent gain. This insures that the “+N” part of THD+N contains only the in-band noise and distortion. Without the filter, the automatic gain ranging that normally follows the THD+N notch filter would behave incorrectly, resulting in measurement errors.

The OPT-2020 Pre-Analyzer Filter is a single-channel device that accommodates two input channels by tracking the Function Reading channel selection buttons.

Chapter 2

Specifications

The OPT-2020 Pre-Analyzer Filter enables accurate measurements of in-band THD+N of audio devices exhibiting high levels out-of-band noise. OPT-2020 is a very sharp roll-off filter whose primary function is to remove out-of-band noise that might influence a THD+N measurement. It is compatible with the Audio Precision System Two, System Two Cascade (and Cascade *Plus*) and 2700 series instrument families.

Passband Response: ± 0.10 dB, 10 Hz to 20.0 kHz

Stopband Attenuation: ≥ 60 dB, 24.0 kHz to 200 kHz

Residual THD+N (1 kHz): $\leq (0.0008\% [-102 \text{ dB}] + 1.0 \mu\text{V})$

Figures 4 and 5 show the curve of the Audio Precision OPT-2020 Pre-Analyzer Filter. The dashed lines indicate the AES17-1998 specification.

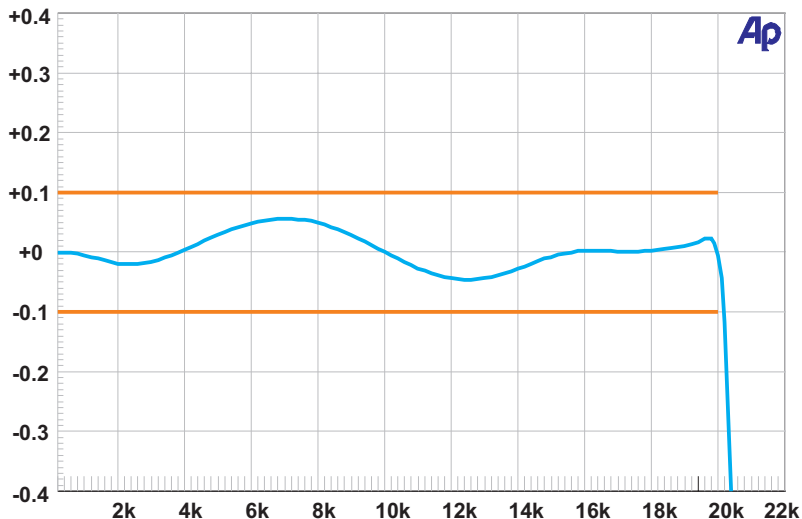


Figure 4. OPT-2020 Pre-Analyzer Filter in-band response

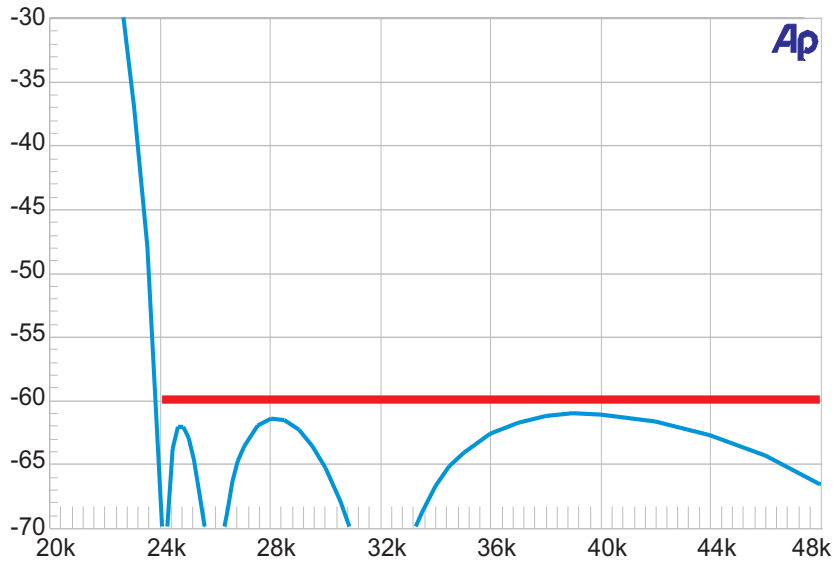


Figure 5. OPT-2020 Pre-Analyzer Filter out-of-band response.

Caveats

- Do not perform interchannel phase measurements with this filter enabled. Since one analyzer channel is filtered while the other is not, interchannel phase measurements made using the OPT-2020 will provide meaningful results.
- Analyzer Level and Frequency meters become unusable above the filter knee, about 22 kHz.
- Analyzer Ratio units are not valid with the filter active, since the filter is positioned before the Analyzer Level meters.
- Residual distortion of the filter will degrade the internal instrument residual distortion performance, starting at levels above approximately -20 dBV.

Chapter 3

Filter Installation

Summary

These instructions cover the field installation of the Audio Precision OPT-2020 Pre-Analyzer Filter in System Two, System Two Cascade and 2700 series instruments. If the OPT-2020 Pre-Analyzer Filter was factory-installed, the steps in this section have been performed for you.

NOTE: NOTE: Filter operation requires the use of correct control software: APWIN version 2.10 or later, or AP2700 version 3.00 or later. Earlier software can be used to operate your instrument normally with the filter installed, but the function of the filter will not be enabled. A software utility is included that sets the instrument firmware to enable the filter.

These instruction assume that correct control software has been previously installed, and that the technician installing the filter hardware is a qualified electronics technician, working on an approved static-protected workstation, and observing proper handling and safety precautions. (You should wear a grounded wrist strap; the workstation should be grounded, and should be free of all static-generating materials, including this manual.)

Parts List

Qty	AP Part No.	Description
1	SAES-xxxx-xxx-xxxx	Circuit board assy, OPT-2020 Pre-Analyzer Filter
1	4221.0024.2	Interconnect, 16-pin (24-pin interconnect modified)
4	5532.1240	Standoff, hex 1-1/4 in. M-F

You will also need the AP Basic macro (procedure) **sys_opt_programmer.apb**. With recent versions of control software, this file will be installed on your computer in the control software root folder. If you do not have the macro file on your computer, you can download it from audioprecision.com/techsupport/downloads/index.htm

Procedure

1. Disconnect the instrument from the ac mains supply and place it on your workstation surface.
2. Using a Philips head screwdriver, remove the top cover from the instrument (12 screws).
3. Locate the top right-hand compartment, shown in Figure 6.

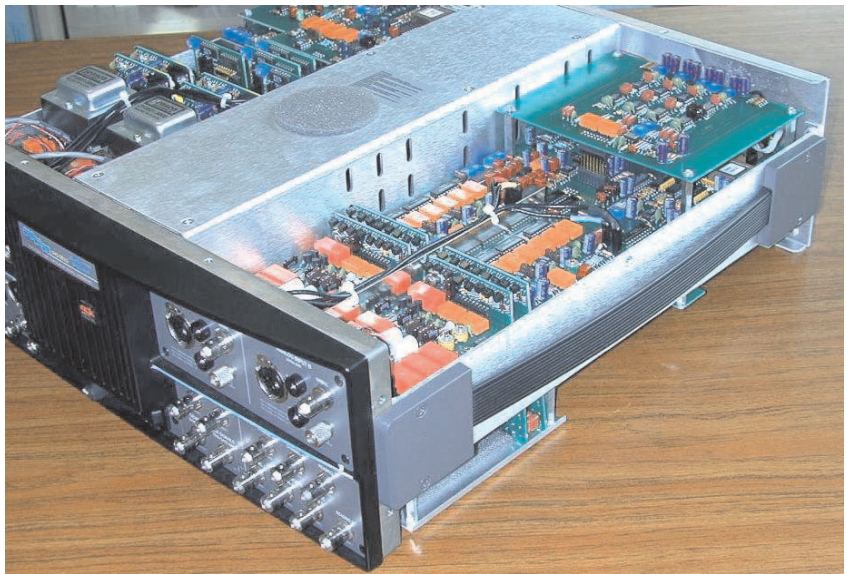


Figure 6. System Two Cascade with covers removed (shown with filter installed). System Two and 2700 series instruments are mechanically similar.

4. Locate the four rear mounting screws for the INP Module (marked “A” in Figure 7).
5. Remove these four screws (save for re-use), and replace them with the four standoff posts from the kit. USE CAUTION not to overtighten the standoffs, since they break easily.
6. Install the 16-pin interconnect assembly by inserting the longer pins into J570 on the INP Module (marked “B” in Figure 7).

- Install the OPT-2020 Pre-Analyzer Filter circuit board assembly by carefully aligning its header with the shorter pins of the 16-pin interconnect installed in the previous step, and pressing it into place.

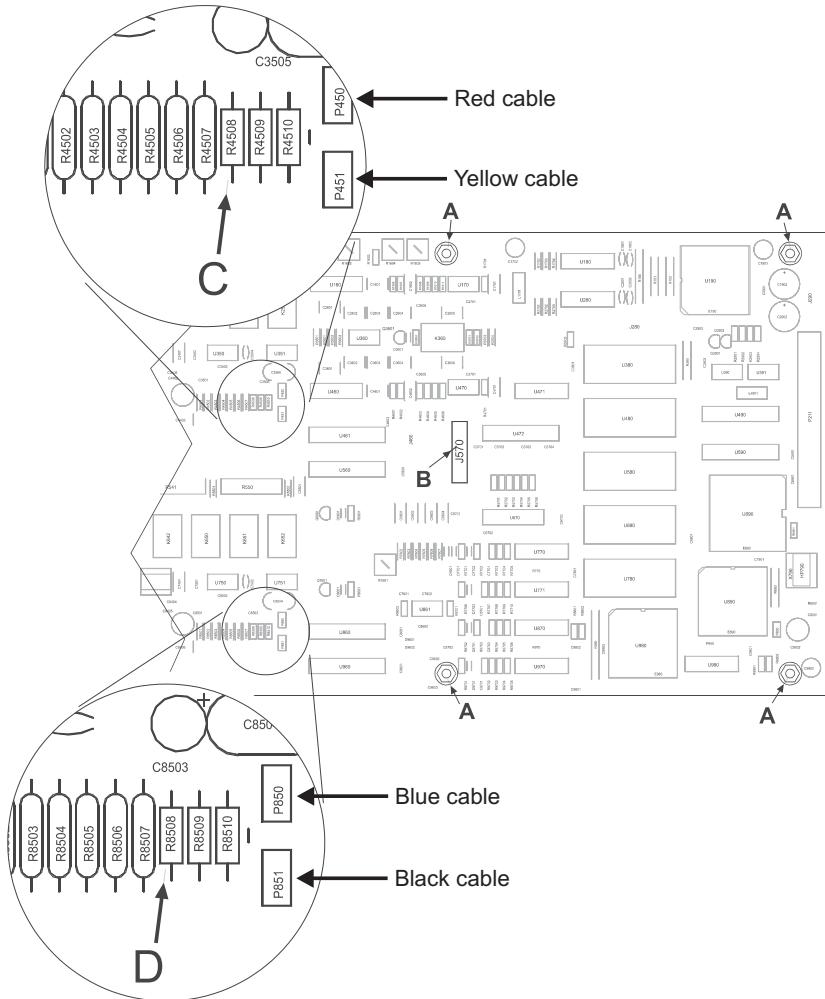
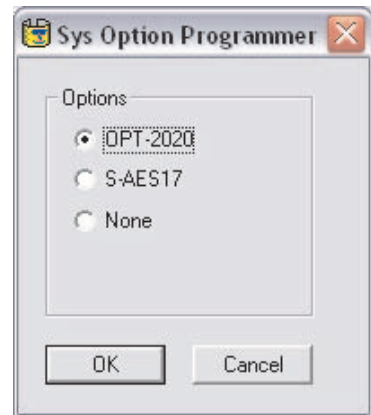


Figure 7. INP Module (partial).

- Install the four screws (removed in step 5) into the four mounting holes of the filter board. Again, do not overtighten the screws.

9. Locate the zero-ohm resistors R4508 and R8508 (marked “C” and “D” in Figure 7).
10. Remove these resistors from the circuit. We suggest cutting the resistor leads at each end of the resistors, removing and discarding the resistors. Unsoldering both resistor leads and removing the resistors is also acceptable, but increases risk of damage to the circuit board or components.
11. Replace the covers on your instrument.
12. Connect the instrument to the APIB cable and the power mains, and turn on the system.
13. From your instrument control software, run the macro (procedure) `sys_opt_programmer.apb`. This macro sets a firmware bit to indicate to the control software various installed options. A dialog box similar to Figure 8 will open.

Figure 8. System Option Programmer dialog box.



14. Select **OPT-2020**, then click **OK**.
15. Close the control software and then re-open it to enable the change to take effect.

THIS COMPLETES THE INSTALLATION.

No adjustments are necessary.

To remove the filter

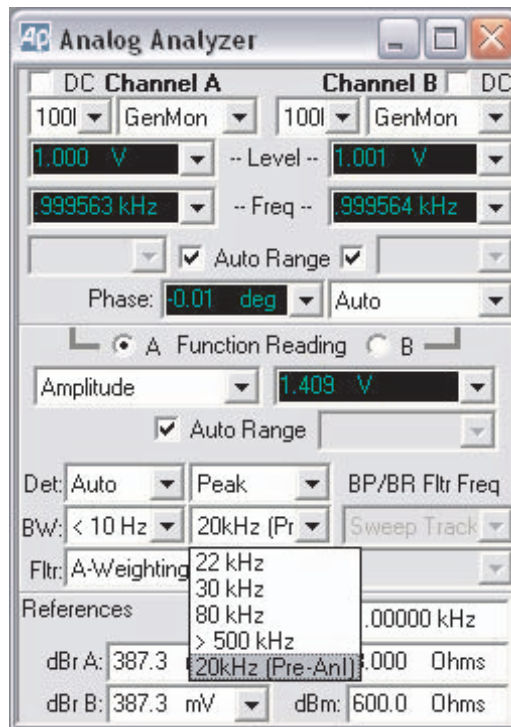
1. Generally reverse the steps of the previous section and restore the jumper (zero ohm) connections.
2. From your instrument control software, run the macro `sys_opt_programmer.apb`, and select **None** in the dialog box, then click **OK**.

Chapter 4

Using the Filter

To activate the filter, select the **20 kHz (Pre-Anl)** choice from the Analog Analyzer dialog box (see Figure 9).

Figure 9. Analog Analyzer dialog box showing 20 kHz (Pre-Anl) filter selection



*NOTE: Early compatible versions of APWIN control software will list this selection as **20 kHz (AES17)**.*

If neither

- **20 kHz (Pre-Anl)** nor
- **20 kHz (AES17)**

appear as filter choices for the Analog Analyzer, the instrument firmware has not been set for OPT-2020 filter use. See page 10.

If the four selections

- **20 kHz AES17**
- **20 kHz SPCL**
- **40 kHz AES17** and
- **40 kHz SPCL**

appear as filter choices, the instrument firmware has been set for S-AES17 filter use. Stop and correctly reset the instrument firmware for OPT-2020 filter use. See page 10.

Chapter 5

Technical Support

If all else fails and you still have problems installing or using your OPT-2020 Pre-Analyzer Filter, call our technical support team for assistance. We can be reached during the following hours Monday through Friday except holidays: 8:00 am to 5:00 p.m. Pacific Time. You can reach us in any of the following ways:

- U.S. Toll Free Phone: 1-800-231-7350
- Phone: (503) 627-0832
- Fax: (503) 641-8906
- Email: techsupport@audioprecision.com.
- Web: audioprecision.com

When you call or fax please have the following information available:

- Your computer: CPU type and speed.
- Amount of RAM installed.
- Instrument configuration SYS-2322, SYS-2522, SYS-2722, etc. and options such as DSP, Dual Domain, BUR-GEN, IMD.
- Control software versions.

If you call, we strongly recommend that you have the computer keyboard and monitor at the same location as the telephone as we will likely ask you to try several things to assess the situation. If you need to determine which version of your control software is loaded, click on the Help menu item and then **About AP2700** or **About APWIN** in the pull-down menu. A dialog box similar to the following will appear:

Figure 10. About AP2700 dialog box (typical—your version and build numbers will be different)

