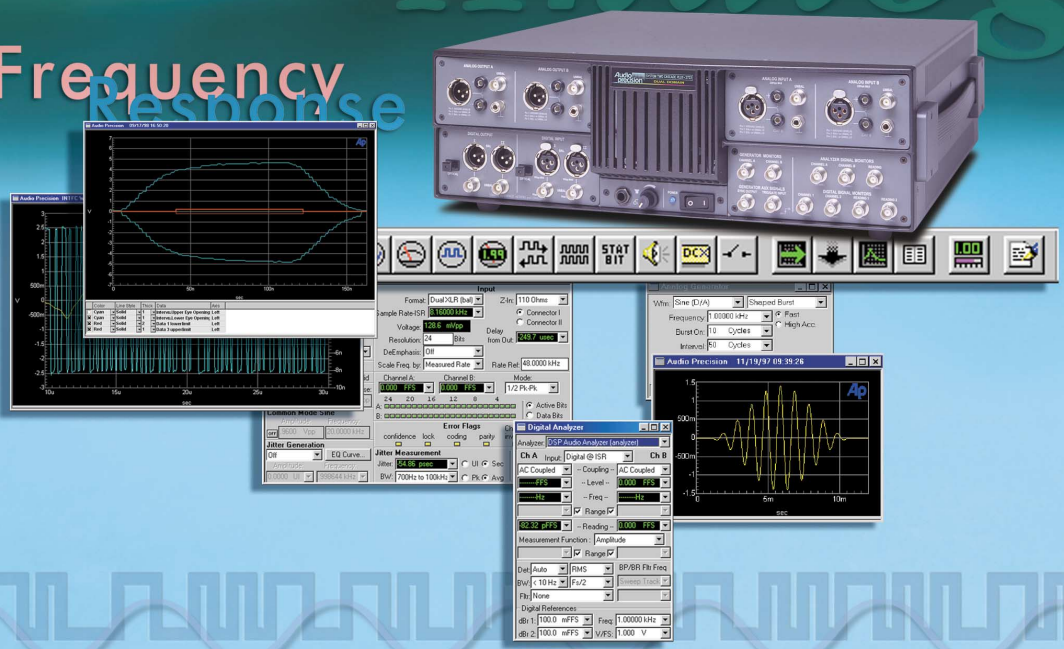
Audio precision®

Digital Domain

Analog

Frequency Response



Getting Started with System Two Cascade PLUS

Audio precision®

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An Introductory Guide to System Two Cascade *Plus*

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CE This mark signifies that the product conforms to all applicable requirements of the European Community. A Declaration of Conformance is included with the user information that describes the specifications used to demonstrate conformity.

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Contents

Do NOT service or repair this product 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 product is designed to operate only from a 50/60 Hz AC power source (250 V rms 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 indicated on the rear panel of the instrument and discussed on page 54 of this manual. The AC voltage selector also must be set to the same voltage as the nominal power source voltage (100, 120, 230, or 240 V rms) with the appropriate fuses. Different fuses are required depending on the line voltage.

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 the instrument front panel.

Do NOT substitute parts or make any modifications without the written approval of Audio Precision. Doing so may create safety hazards.

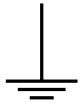
This product is for indoor use—pollution degree 2.

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.

Chapter 1
Introduction

Scope of This Manual

This guide serves several purposes:

- It describes several basic hardware considerations for installing the components, such as power line voltage settings, fuse information, APIB interface cable connections and jumper and DIP switch settings.
- It contains full specifications for the System Two Cascade *Plus*, and its options.

A list and a brief description of other Cascade *Plus* documents follows.

Related Documentation

- The *APWIN User's Manual for System Two Cascade* in conjunction with the *APWIN 2.22 Addendum* contain a comprehensive description of the full capabilities of APWIN software for System Two Cascade *Plus*.
- *AP Basic Language Reference,* the *AP Basic Language Extensions for System Two Cascade* and the *APWIN 2.22 Addendum* together provide detailed descriptions and syntax for all OLE commands used in APWIN automation.
- The *System Two Cascade* Plus *Service Manual* contains detailed Cascade *Plus* information, including adjustment procedures, diagnostic procedures, and drawings of electrical and mechanical parts. This manual is not required for routine understanding or operation and must be purchased separately.

Overview

General System

System Two Cascade *Plus* is an audio test set with broad, high-performance capabilities for analog, digital, and mixed-domain devices. Cascade *Plus* includes both signal generation and analysis capability for audio stimulus-response testing. Virtually all common and many specialized tests are performed on analog domain and digital domain signals and on the digital interface signal (pulse train) itself. Control of the Cascade *Plus* is via software running on a Windows-based personal computer.

The versatility of Cascade *Plus* can be extended through major options and accessories. The SWR-2122-series of Audio Switchers are available in input, output, and insertion (patch point) versions. The DCX-127 adds dc measurement and digital generation capabilities. The PSIA-2722 Programmable Serial Interface Adapter converts the Cascade *Plus* parallel ports to a wide variety of serial digital interface formats. These accessories are described in greater detail in the following subsections.

Cascade *Plus* and its accessories are controlled by APWIN, Audio Precision's user interface and software package, which must be installed in the user's personal computer (the computer is not included). Alternatively, Cascade *Plus* may be ordered with GPIB capability and may be controlled by GPIB software. See **GPIB ("G") Option** on the next page.

Specifications for the System Two Cascade *Plus* and its accessories are found in Chapter 2.

System Two Cascade Plus

System Two Cascade *Plus* audio test equipment provides stimulus and measurement capability. The Cascade *Plus* family includes the following product configurations:

- **The SYS-2622**
  The 2622-Series is based on the advanced Cascade *Plus* platform. It provides analog stimulus and measurement capability, using newly-improved analog circuits for signal generation, filtering, and measurement. It also has a dual-channel DSP analyzer and dual-channel DAC signal source. Its enhanced capability includes digital signal generation, high-resolution spectrum analysis via FFT, waveform capture and display, and fast multitone testing.

- **The SYS-2722**
  The 2722-Series is the Dual Domain product in the Cascade *Plus* family. It includes the capabilities of the 2622 series plus digital audio

inputs and outputs in AES/EBU, SPDIF/EIAJ, optical, parallel, general-purpose serial formats and complete serial interface analysis per AES3. These features give the 2722-Series the capability of providing stimulus and measurement in any combination of digital and analog domains.

- **The SYS-2700**
  The 2700-Series has the same digital capabilities of 2722-Series above, but no analog capabilities.

- **The SYS-2122**
  The 2122-Series has the same analog capabilities of 2622- Series and 2722-Series above, but no DSP or digital capabilities.

The models described above have a model number suffix of "A" or "G." The "A" denotes that the instrument is APIB-controlled with APWIN software; the "G" denotes that the instrument has a GPIB (IEEE-488) interface in addition to the APIB interface. See **GPIB ("G") Option** below.

System Two Cascade *Plus* "A" (APIB) versions are available with an ISA-bus interface card, a PCI-bus interface card, or, for use with a notebook computer, a type II PCMCIA interface adapter.

Each of these cards comes with the appropriate APIB (Audio Precision Interface Bus) cable to interconnect the computer to Cascade *Plus*.

GPIB ("G") Option

System Two Cascade *Plus* "G" with GPIB option supports all of the System Two Cascade *Plus* configurations as well as the SWR switchers and the DCX-127 Multi-function Interface. No accessories or measurement software are provided with the "G" instrument.

An optional GPIB software development kit is available for the "G" versions that includes sample files, utilities, the *System Two Cascade* Plus *GPIB Programmer's Reference Manual* and APWIN software for test development. Contact your distributor or go to the Audio Precision Web site at audioprecision.com for more information about System Two Cascade *Plus* with GPIB.

Additional Options for System Two Cascade Plus

These analog options may be installed in your System Two Cascade *Plus*:

- **S2-IMD**
  Adds the IMD (InterModulation Distortion) generator and IMD analyzer.

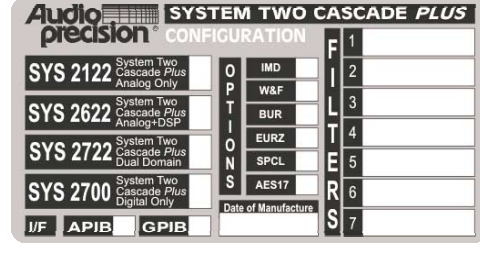
- **S2-W&F**
  Adds the wow and flutter analyzer.
- **S2-BUR**
  Adds the tone burst, square wave, and noise generator.
- **S2-EURZ**
  Changes the generator output selections to 40/200/600 Ω, prevalent in Europe.
- **S-AES17**
  Adds a special filter option for THD+N and small signal measurement of DAC output in conformance with the AES17 standard.

Additionally, your Cascade *Plus* may include up to seven optional hardware filters, or may include custom filters. Commonly installed filters include:

- **FIL-AWT**
  A-weighting filter
- **FIL-CWT**
  C-weighting filter
- **FIL-CCR**
  IEC468-3 (CCIR) weighting filter

Approximately 50 other Audio Precision option filters are available. Visit the Audio Precision Web site at audioprecision.com to view the current filter offerings.

A rear-panel configuration label on the Cascade *Plus* identifies the model number, the options and filters installed, and the date of manufacture.



Switchers

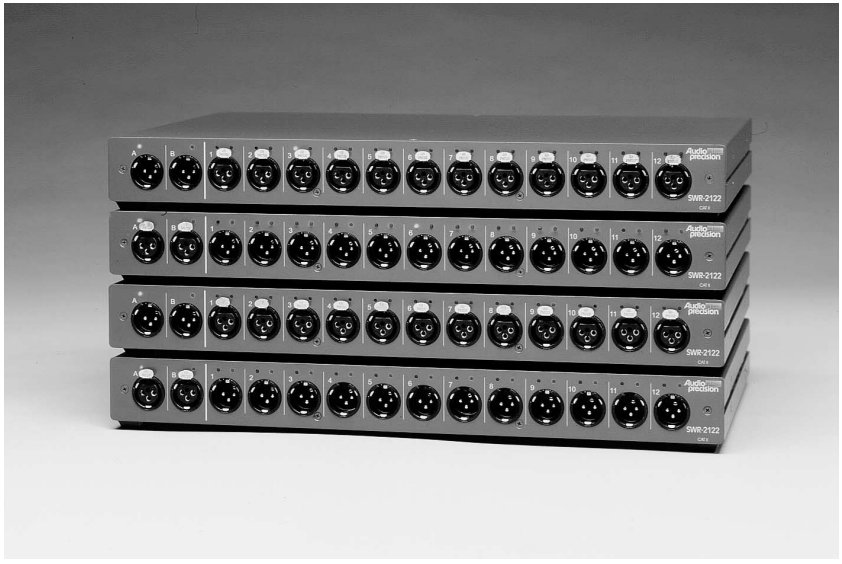


Figure 1. SWR-2122 Switchers

The four versions of switchers are described below. Each features 12 x 2 architecture with provisions for cascading up to 16 units, allowing up to 192 channels to be accessed. Switching is computer-controlled via the same APIB as the Cascade *Plus*. See Chapter 3 for further information.

- **SWR-2122M** Output Switcher
  Routes either of the two generator output channels (A & B) to any of 12 channels. Uses male XLR connectors for balanced signals. Complement mode allows all but one channel to be driven while measuring the undriven channel for worst-case crosstalk on multichannel devices.
- **SWR-2122F** Input Switcher
  Routes either of the two analyzer input channels (A & B) from any of 12 channels. Uses female XLR connectors for balanced signals.
- **SWR-2122U** Unbalanced Switcher
  Can be used as either an input or output switcher. Uses floating BNC connectors for unbalanced signals to prevent ground loops.
- **SWR-2122P** Patch-Point Switcher
  12-point configuration allows a signal path to be interrupted and a test generator inserted while a measuring analyzer can access the output of a previous device. Path continuity is maintained in the default (non-accessed) mode. Each of the 12 insertion points has a

5-pin XLR connector to allow balanced interface to the previous and next device.

DCX-127 Multi-Function Module

Figure 2. DCX-127 Multi-Function Module

The DCX-127 Multi-Function Module contains an autoranging 4-1/2 digit dc voltmeter-ohmmeter, two 20-bit programmable dc voltage sources, 21 bits of digital I/O, and three 8-bit programmable auxiliary output ports for device control or status indicators. Typical applications include A/D and D/A converter testing, VCA gain control linearity, VCA distortion, amplifier dc offset and power supply checks, power amplifier load switching control, loudspeaker voice coil resistance measurements, temperature measurements, and test fixture control.

The meter features 200 mV–500 V and 200 Ω–2 MΩ ranges, fully floating and guarded for accurate measurements in the presence of large common mode voltages. Resistance measurements can be made using either 4-wire or 2-wire techniques. Readings can be offset and scaled by the software.

The two independently programmable dc sources have a ±10.5 V bipolar range with 20 mV resolution and monotonicity to 40 mV (19 bits). The software can sweep either dc source.

The DCX-127 also contains a simplified 8-bit program control interface that can be defined to execute any pre-defined keystroke sequence. This can be used to run different software procedures based upon switch closures.

PSIA-2722 Programmable Serial Interface Adapter

Figure 3. PSIA-2722 Programmable Serial Interface Adapter

The PSIA-2722 Programmable Serial Interface Adapter provides a means of interfacing System Two Cascade or Cascade *Plus* to a variety of data acquisition, reconstruction and communication hardware that use a serial bus for data exchange. This greatly increases the system's flexibility in interfacing to serial systems for a wide range of tests and measurements. The PSIA consists of a parallel-to-serial transmitter and an independent serial-to-parallel receiver under APWIN software control.

A serial interface adapter such as PSIA-2722 is required to transmit or receive digital signals and associated clock inputs and outputs for the non-AES3/IEC60958 serial digital audio formats often encountered in telecommunications and in converter design and testing. The settings necessary to configure the PSIA are easily accomplished in software, and converter-specific setups can be saved, reloaded or downloaded from the Web.

PSIA-2722 requires APWIN version 2.22 or later software.

Chapter 2
Specifications

Analog Signal Outputs

All System Two Cascade *Plus* configurations except SYS-2700 contain an ultra-low distortion analog sine wave generator and two independent transformer-coupled output stages.

The SYS-2622 and SYS-2722 configurations also contain a dual-channel D/A signal generator for enhanced capabilities. Option "BUR" adds analog-generated sine burst, square wave, and noise signals. Option "IMD" adds analog-generated IMD test signals.

Unless otherwise noted, all specifications are valid only for outputs ≥150 μVrms [420 μVpp].

Analog Output Characteristics

Source Configuration	Selectable balanced, unbalanced, or CMTST (common mode test)
Source Impedances	
Balanced or CMTST	40 Ω (±1 Ω), 150 Ω[1] (±1.5 Ω), or 600 Ω (±3 Ω)
Unbalanced	20 Ω (±1 Ω) or 600 Ω (±3 Ω)
Max Floating Voltage	42 Vpk (outputs are isolated from each other)
Output Current Limit	Typically >80 mA
Max Output Power into 600 Ω	
Balanced	+30.1 dBm (Rs = 40 Ω)
Unbalanced	+24.4 dBm (Rs = 20 Ω)
Output Related Crosstalk	
10 Hz–20 kHz	≤ –120 dB or 5 µV, whichever is greater
20 kHz–100 kHz	≤ –106 dB or 10 µV, whichever is greater

Low Distortion Sine Wave Generator

Frequency Range	10 Hz–204 kHz
Frequency Accuracy	
High-accuracy mode	±0.03%
Fast mode	±0.5%

[1] *200 Ω ±2 Ω with option "EURZ"*

NP0020.0001.000 R3

Cables and Adapters

Analog Audio Cables

These cables provide a convenient method to connect Audio Precision measurement equipment with a device under test. These cable kits consist of four cables, each with a unique color band at the connector ends to facilitate identification. The cables are high quality Mogami NEGLEX super flexible shielded cable, and are 8 ft (2.4 m) long. The cables and connector shells are satin black, and all connectors have gold plated contacts.

- CAB-XMF consists of a set of four XLR male to XLR female cables.

CAB-XBR consists of a set of four cables: two with RCA/PHONO male to XLR male connectors, and two with RCA/PHONO male to XLR female connectors. Also provided are four adapters, from RCA female to BNC male. The cables are wired with pin 2 of the XLR connector as "hot" (center pin of the RCA connector) and pins 1 and 3 connected to ground and shield, to agree with the unbalanced wiring convention of Audio Precision instruments. See Figures 38 and 39.

Figure 38. CAB-XBR cable kit

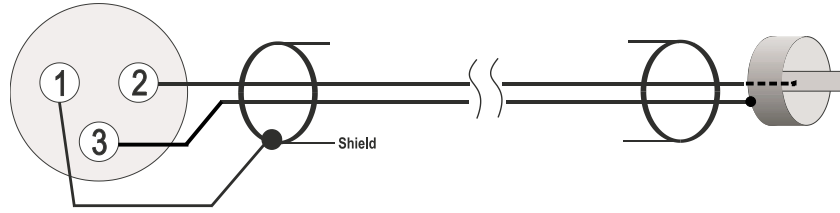


Figure 39. XLR to BNC wiring

Digital Audio Cables

Figure 40. CAB-AES cable set

These cables are designed for digital audio connections using the AES/EBU format, XLR connectors, 110 Ω cable, double-shielded for improved EMI performance.

- CAB-AES: Set of two AES/EBU cables, 39 in (1 m) long. See Figure 40.
- CAB-AES2: Set of two AES/EBU cables, 6.5 ft (2 m) long.
- CAB-AES4: Set of two AES/EBU cables, 13 ft (4 m) long.
- CAB-DIO: Set of two interface cables, 4.25 ft (1.3 m) long, to connect between the SYS-2722 rear panel 50-pin ribbon input/output connectors to a DUT fixture with 0.1 in spaced 2 x 25-pin headers. See Figure 41.

Figure 41. CAB-DIO cables

Cable Adapters

- CAD-RCA: set of 14 RCA/Phono female to BNC male adapters, intended primarily for use with the SWR-2122U Unbalanced Switcher.

Digital Control (APIB) Cables

These cables can be used as extensions or replacements for the APIB cables that come with each switcher or DCX-127.

- CAB-D0: Extension APIB Interface cable, 20 in (0.5 m).
- CAB-D2: Extension APIB Interface cable, 6.5 ft (2 m).
- CAB-D6: Extension APIB Interface cable, 12.7 ft (6 m).

Chapter 3
Hardware Installation

For table top use, the System Two Cascade *Plus* can be stacked with switchers or other instruments.

Rack Mounting

There are two styles of rack mount kits available to rack mount Cascade *Plus*: fixed, and slide-out.

Fixed Rack-Mounting Brackets

Install the fixed installation rack mounting kit as shown in Figure 42. The parts required are identified in the table in Figure 43.

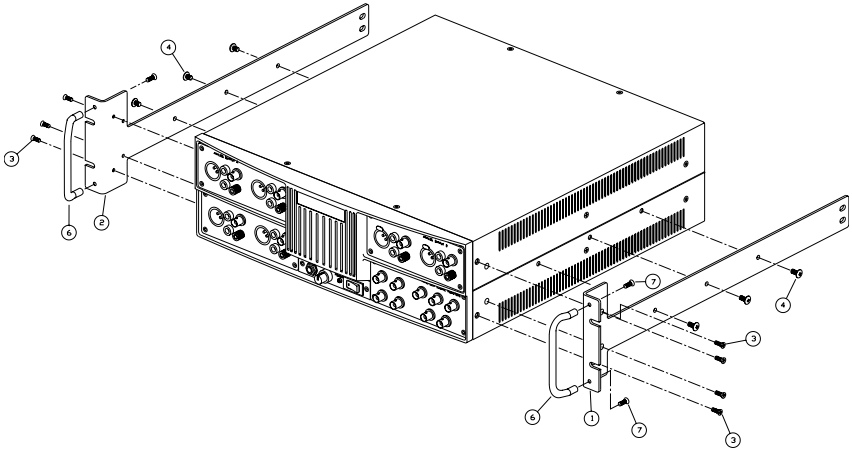


Figure 42. Fixed installation rack mounting kit

Figure 43. Parts list for fixed installation rack mounting

ITEM	A-P NUMBER	DESCRIPTION
-1	7170.XXXX	RACK EAR BRACKET, RH
-2	7170.XXXX	RACK EAR BRACKET, LH
-3	5113.1110.6	SCREW #6-32X5/16 MC FLT PH DGY
-4		SCREW #10-32X3/8 MC TRUSS PH DGY
-6	7320.0006	HANDLE
-7	5114.1108	SCREW MC FLT PH ZN #8-32X1/4

Sliding Rack-Mounting Brackets

The slide rack mounting kit is intended to be used with Chassis Track C-300-S Series non-pivoting solid bearing chassis sections from General Devices Inc, Indianapolis, IN. These chassis sections are available in several lengths to fit a wide variety of racks.

Install the sliding installation rack mounting kit as shown in Figure 44. The parts required are identified in the table in Figure 45.

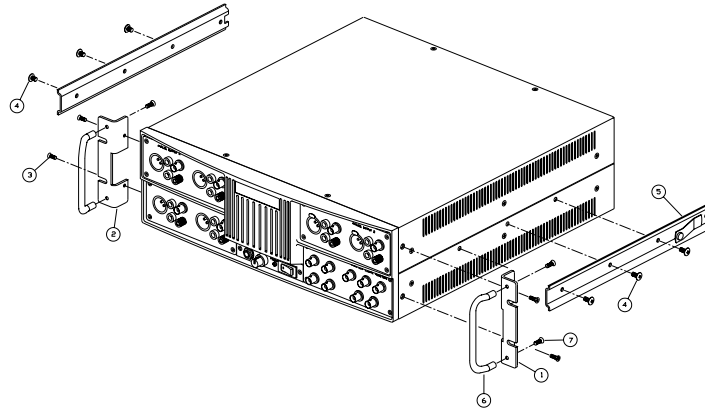


Figure 44. Sliding rack mount installation kit

Figure 45. Parts list for sliding rack mounting installation

ITEM	A-P NUMBER	DESCRIPTION
-1	7170.0202	RACK EAR BRACKET, RH
-2	7170.0201	RACK EAR BRACKET, LH
-3	5113.1110.6	SCREW #6-32X5/16 MC FLT PH DGY
-4		SCREW #10-32X5/16 MC TRUSS PH DGY
-5		SLIDE - STATIONARY SECTION
-6	7320.0006	HANDLE
-7	5114.1108	SCREW MC FLT PH ZN #8-32X1/4

Checking or Changing Power Line Voltage

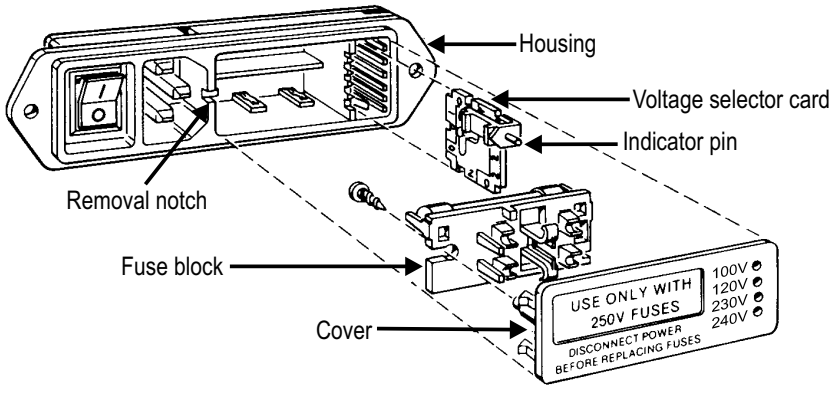


Figure 46. Changing power line voltage

The AC Mains input to each instrument is made through a connector/fuse block/voltage selector assembly. Before connecting the power cord, confirm that the input voltage selection is correct for your power source. An indicator pin shows the selected input voltage in one of the four holes in the cover (see Figure 46).

To change the input voltage, refer to Figure 46 and proceed as follows:

1. Remove the AC power cord from the AC Mains Connector.
2. Open the cover, using a small blade screwdriver or similar tool. Set aside the cover/fuse block assembly.
3. Pull the voltage selector card straight out of the housing, using the indicator pin.

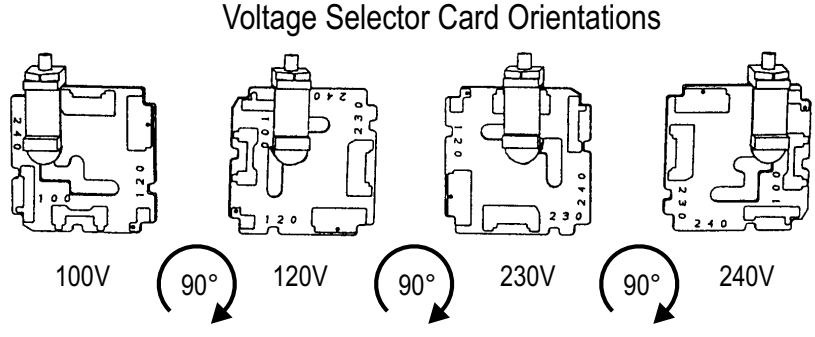


Figure 47. Voltage selector card positions

4. Orient the selector card so that the desired input voltage is readable at the bottom (see Figure 47). Then orient the indicator pin to point

up when the desired voltage is readable at the bottom, with the indicator pin assembly seated in the notch on the board edge.

5. Insert the voltage selector card into the housing with the printed side of the card facing toward the connector, and the edge indicating the desired voltage first.
6. Confirm that the correct fuse is installed for the intended input voltage (refer to fuse ratings marked on the rear panel). If necessary, change the fuse type as described in the following section.
7. Replace the cover and verify that the indicator pin shows the desired voltage.

Fuse Information

The connector/fuse block/voltage selector assembly allows two fusing arrangements: North American (see Figure 48), and European (see Figure 49). The North American fusing arrangement uses a single type 3AG (0.25 x 1.25 in) SB ("slow blow") fuse; the European fusing arrangement uses two 5 x 20 mm IEC-approved type T fuses. Refer to the label on the rear panel for fuse current ratings.

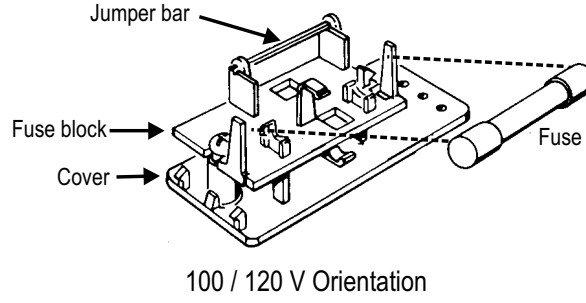


Figure 48. North American fusing arrangement

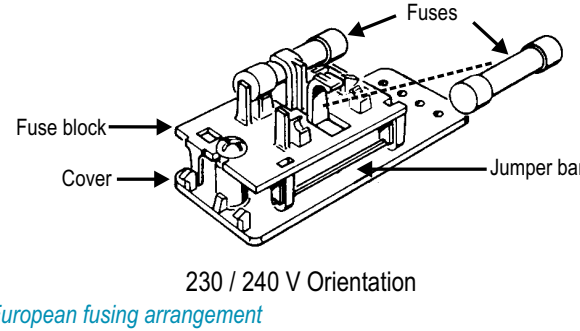


Figure 49. European fusing arrangement

Changing Fusing Arrangement

To change from one fusing arrangement to the other:

1. Remove the AC power cord from the AC Mains Connector.
2. Open the cover of the connector/fuse block/voltage selector assembly with a small blade screwdriver or similar tool.
3. On the back of the cover, loosen the Phillips screw two turns, then remove the fuse block by sliding up, then away from the screw and lifting from pedestal at the other end (refer to Figure 50).

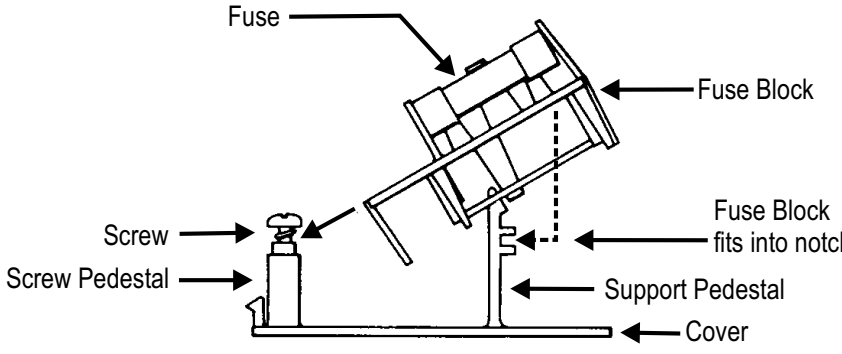


Figure 50. Changing fuse types

4. Invert the fuse holder and reassemble it on the Phillips screw and pedestal, and tighten the screw.
5. Change or add the correct fuses as necessary (again, refer to rear panel for the correct fuse current rating).
6. Confirm the line voltage setting as described in the previous section, then replace the cover.

Proper Environment

All Audio Precision System One, System Two, System Two Cascade and System Two Cascade *Plus* products are intended for use indoors, in a normal environment. Refer to Chapter 2 for temperature range and humidity specifications.

Chapter 5
Getting Started with APWIN

This section will get your system up and running and will put results on the screen for you in mere moments. For more detailed information about APWIN, System Two Cascade *Plus*, and all the options available, see the *APWIN User's Manual* or APWIN Help.

If you haven't done so yet, unpack and install the System Two Cascade *Plus* and APWIN software and hardware components. To mount the APIB interface card, see Chapter 3. To install APWIN software on your computer, see Chapter 4.

Turn on System Two Cascade *Plus* with the rocker switch on the front panel. The blue POWER indicator will light, and you will hear a brief clatter of relay switches from within the unit.

Now launch APWIN on your computer. You should find a shortcut icon on your desktop, or choose **Start > Programs > Audio Precision APWIN 2.2 > APWIN 2.2x**

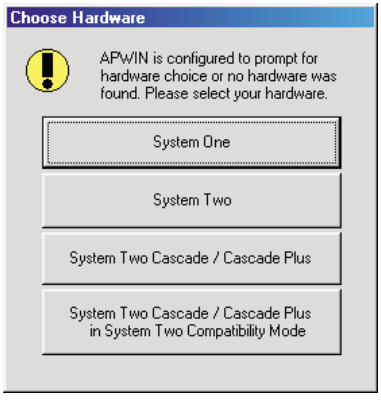


Figure 66. Choose hardware dialog box.

If the dialog box in Figure 66 appears on your screen, APWIN is not exchanging information with System Two Cascade *Plus*. Check your APIB connections and be sure power is applied to System Two Cascade *Plus*. If System Two Cascade *Plus* is not available, you won't be able to perform the tests described here, but you can run APWIN in Demo Mode to become familiar with its interface and capabilities.

If Figure 66 did not appear on your screen, you are properly connected to System Two Cascade *Plus*. As APWIN initializes, you will see the APWIN startup screen and hear the relays click once again. The main APWIN Screen will appear, as shown in Figure 67. Like most Windows programs, the APWIN Screen has a title bar, a menu bar and a collection of toolbars.

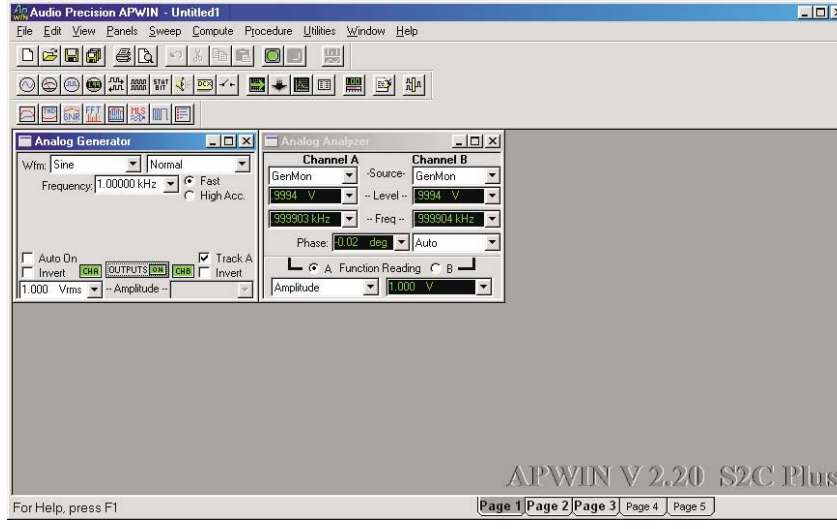


Figure 67. APWIN screen

The APWIN Screen has five tabbed pages for display of its various test panels. By default, APWIN launches with the Analog Generator and Analog Analyzer panels on Page 1, the Sweep panel and an empty Graph on Page 2, and the Digital I/O panel on Page 3. APWIN panels can be opened, closed, expanded or contracted (double-click the panel's title bar) and placed on any page (or even repeated on several pages).

Running Your First Tests

This section discusses three different ways to use APWIN and System Two Cascade *Plus* to test your DUT. (DUT means Device Under Test, the unit you are subjecting to measurement. Sometimes it's called the EUT, for

Equipment Under Test.) First we will run a test manually, then load a saved test, and finally use the Quick Launch toolbar.

Use balanced or unbalanced connections between your equipment and System Two Cascade *Plus* as appropriate. Most professional and broadcast audio equipment uses balanced connections ("high" and "low" audio signal lines plus ground for each channel) with "XLR" connectors; most consumer audio equipment uses unbalanced connections (a "high" audio signal line plus ground, which also carries the audio "low" signal) with ¼" phone, RCA or 3.5 mm mini jacks.

System Two Cascade *Plus* uses both XLR and "banana" connectors (connected in parallel, with both active in the balanced configuration) to carry its balanced inputs and outputs. Unbalanced inputs and outputs are carried on BNC connectors. The balanced and unbalanced designations on System Two Cascade *Plus* are mutually exclusive. You must select one or the other for each input and output.

Figure 68 shows some common cable hookups.

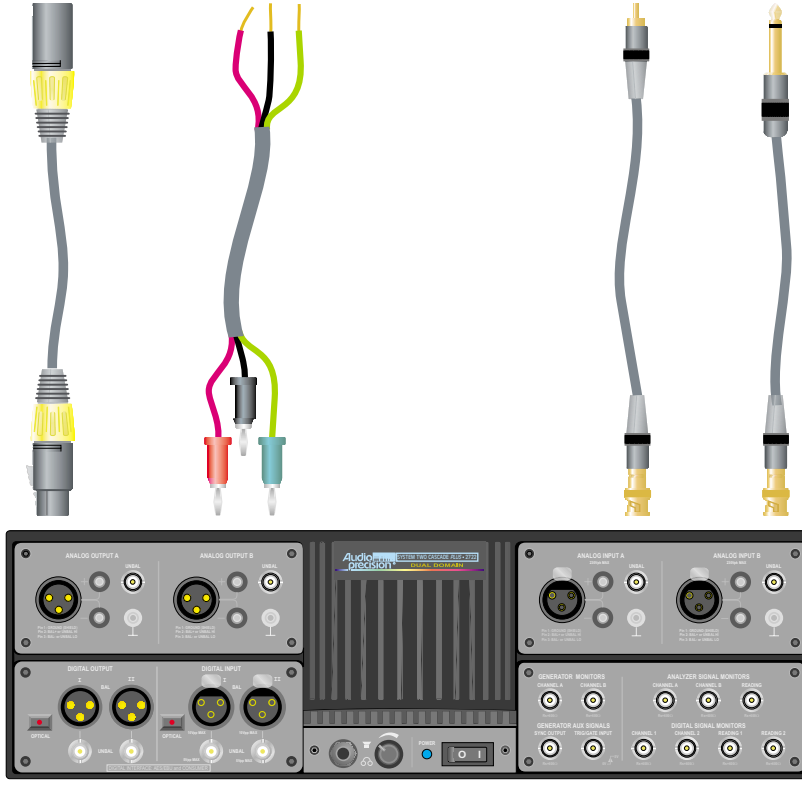


Figure 68. Typical balanced and unbalanced connections