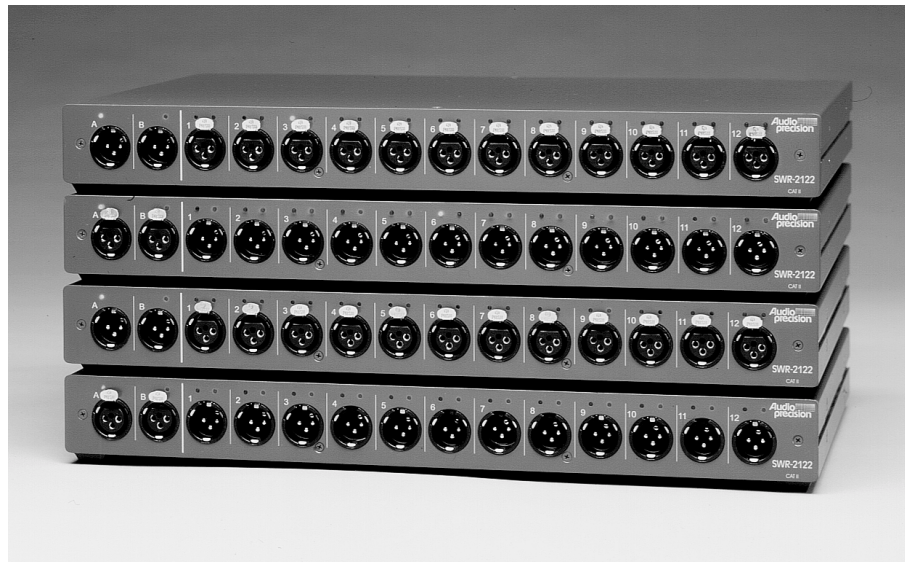


## Setup and Installation Guide



**Audio precision®**

Version 3  
April 2000  
Audio Precision PN 8211.0023

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## Safety Information

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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 and in Section 2.2.3 of this document. 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 is for indoor use - pollution degree 2.

Use this equipment only for switching applications as described in this manual.

## Safety Symbols

---

The following symbols may be marked on the panels or covers of equipment or modules:



**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

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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.

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# 1. General Information

---

## 1.1. Introduction

---

### 1.1.1. Scope of This Manual

This manual describes the SWR-2122 Series of Audio Switchers, including the differences among the four models, and their applications.

### 1.1.2. Related Documentation

<i>System One and System Two APWIN User's Manual</i>	Contains a comprehensive discussion of switcher operation, as well as a description of the full capabilities of APWIN.	Included with APWIN
<i>APWIN Tutorial (System One or System Two)</i>	Designed to lead you through your first operating session with APWIN and System One or System Two.	Included with APWIN
<i>APWIN BASIC (procedure language) User's Manual and Programmer's Reference</i>	Detailed descriptions and syntax for every command.	Included with APWIN
<i>System One or System Two Service Manual</i>	Contains detailed information, including adjustment procedures, diagnostic procedures, and drawings of electrical and mechanical parts.	Sold separately
<i>Audio Measurement Handbook</i>	Intended as a practical, hands-on assistance for workers in all phases of the audio field. Describes general measurement techniques and includes a glossary of specific audio terminology and test definitions.	Included with new orders of System One or System Two or available for purchase.

## **1.2. Switcher Descriptions**

---

The Audio Precision series SWR-2122 audio switchers can be used to expand the two-channel input and output of System One® and System Two™. Switchers are particularly useful to interface to multi-channel devices or production “bed-of-nails” test fixtures.

Being high-reliability relay-based, they preserve the signal integrity of the generator and signals from the device under test for transparent operation. Unlike conventional industrial signal routing switchers, the SWR-2122 series switchers achieve exceptional crosstalk performance, exceeding 140dB at 20kHz in balanced operation.

The switchers are controlled by an APIB interface and integrate into either APWIN™ Windows™ or S1.EXE DOS control software. Convenient channel-in-use LEDs indicate crosspoint activity.

There are four versions of switchers, as described below. The switchers differ from one another primarily in connector configuration and in attributes set by internal jumpers or rear-panel switches. These differences define them as an input switcher (connecting multiple device-under-test outputs to the analyzer inputs), an output switcher (connecting generator outputs to multiple inputs of devices under test), or a patch-point switcher.

Each of the switchers is a balanced 12 x 2 crosspoint matrix. Either of the two common points can be connected, under software control, to any of the twelve selectable points. The circuit boards are of balanced design but may be used with unbalanced circuits with the BNC connector version (floating shells). Up to 16 modules of the input and/or output switcher may be stacked and connected in daisy-chain fashion to permit testing devices with up to 192 inputs and/or outputs (up to 96 stereo pairs). Rear panel switches permit setting the address of each module for the desired channel number selections 1 through 12, 13 through 24, etc. Simplified diagrams of the switchers are shown in the following subsections. The contacts shown as single switches are actually multiple relay contacts connected in a more complex arrangement. This is necessary to obtain the isolation and crosstalk required for practical professional and high-grade consumer applications.

### **1.2.1. XLR Connector Pin Assignments**

The following XLR connector pin assignments are common throughout the Audio Precision product line:



Pin 1 – Chassis ground (not signal ground)

Pin 2 – Signal high, or +

Pin 3 – Signal low, or -

The pin assignments of the five-pin XLR connectors, used on the SWR-2122P Patch-Point Switcher, are given in Section 1.2.5.

### 1.2.2. SWR-2122F Input Switcher

Each input switcher module connects any of 12 channels to the two analyzer input channels (A & B). Input switcher modules have two male XLR connectors and 12 female XLR connectors on the front panel. The input switcher simplified schematic is shown in Figure 1-3.

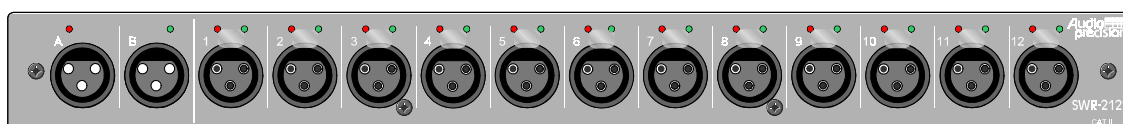


Figure 1-1. Input switcher front panel

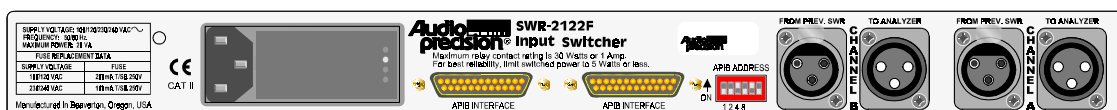


Figure 1-2. Input switcher rear panel

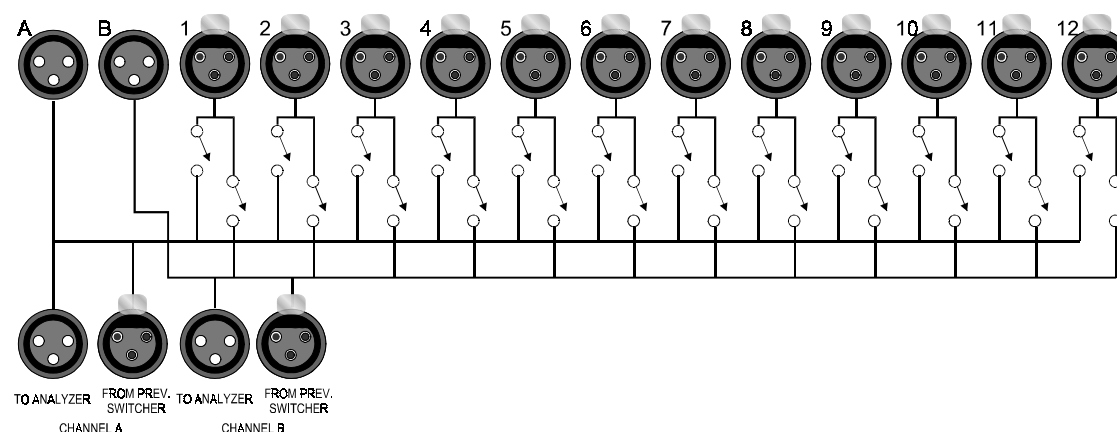


Figure 1-3. Input Switcher simplified schematic

### 1.2.3. SWR-2122M Output Switcher

Each SWR-2122M module routes two generator output channels (A & B) to any of 12 channels. They have two female XLR connectors for and 12 male XLR connectors on the front panel. Complement mode allows all but one channel to be driven while measuring the undriven channel for worst-case crosstalk on multichannel devices. The output switcher simplified schematic is shown in Figure 1-2.

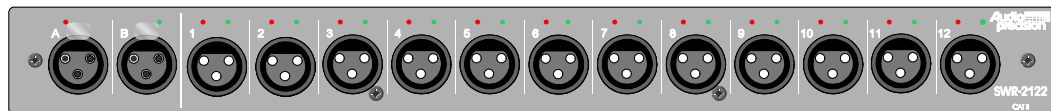


Figure 1-4. Output switcher front panel

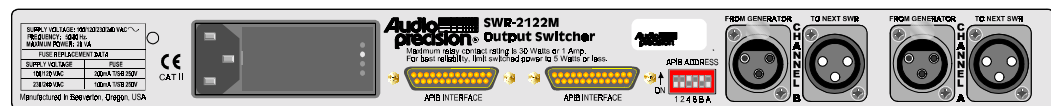


Figure 1-5. Output switcher rear panel

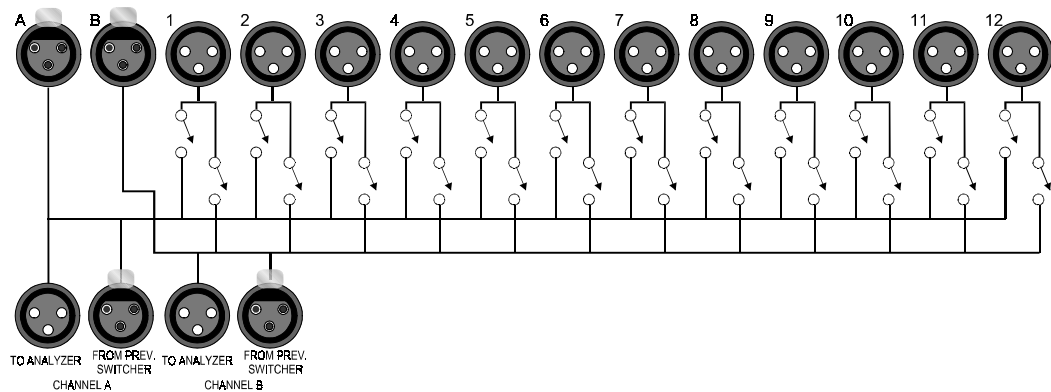


Figure 1-6. SWR-2122M Output Switcher simplified schematic

### 1.2.4. SWR-2122U Unbalanced Switcher

The SWR-2122U Unbalanced switcher Module can be used as either an input or output switcher. Floating BNC connectors help prevent ground loops. When used in the output mode, this module is also capable of the complement mode described above for the SWR-2122M. See Figure 1-9 for a simplified schematic.

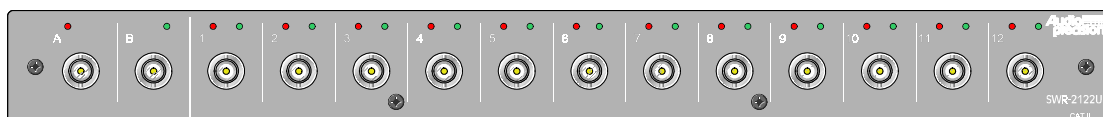


Figure 1-7. Unbalanced switcher front panel



Figure 1-8. Unbalanced switcher rear panel

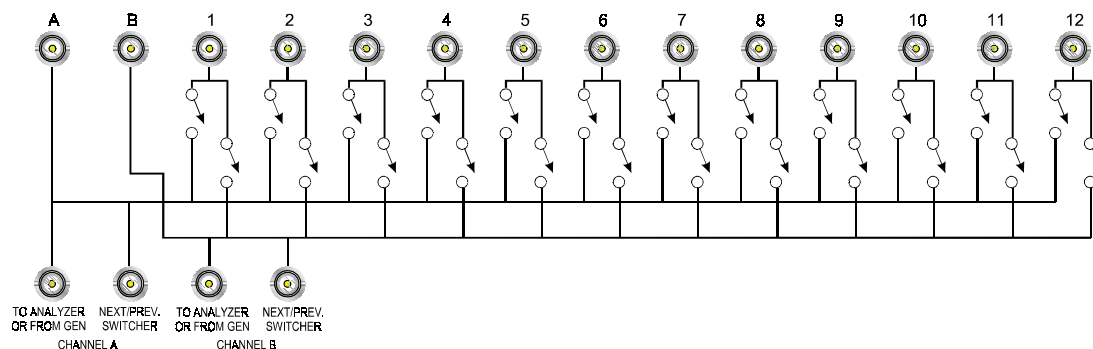


Figure 1-9. SWR-2122U Unbalanced Switcher simplified schematic

### 1.2.5. SWR-2122P Patch-Point Switcher

The SWR-2122P Patch Point Switcher module allows a signal path to be interrupted and a test generator inserted, while a measuring analyzer accesses the output of a previous device. The patch point switcher differs considerably from the input and output switchers in that the twelve connectors of the patch point version are 5-pin XLR connectors. They are designed for connection at major circuit nodes of a console, or between series-connected devices in an audio chain in a studio, transmitter, or sound reinforcement system. Pins 1 (high) and 2 (low) connect from a balanced output of the preceding device. Pin 3 is ground. Pins 4 (high) and 5 (low) are the signal to a balanced input of the following stage or device. The two “common” connectors of the patch point switcher are a female 3-pin XLR (INPUT) connector for connection to an output of the generator, and a male 3-pin XLR connector (OUTPUT) for connection to an input of the analyzer.

The patch point switcher is “fail safe” in that in its normal mode (power off, or no channel selected), the previous stage or device is directly connected to the input of the following stage or device.

Figure 1-12 shows a simplified diagram of the patch-point switcher.

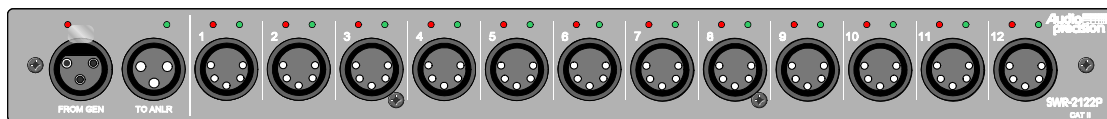


Figure 1-10. Patch point switcher front panel



Figure 1-11. Patch point switcher rear panel

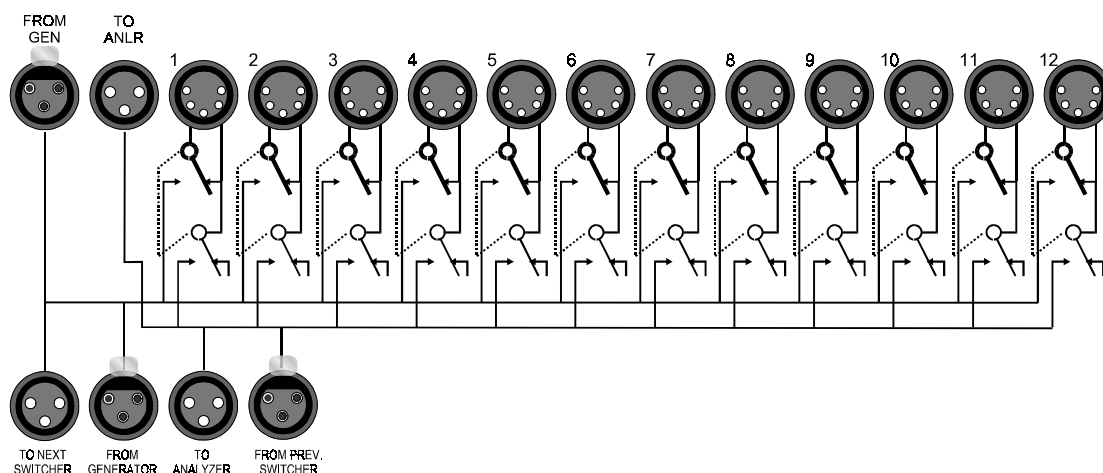


Figure 1-12. SWR-2122P Patch-Point Switcher simplified schematic

## 1.3. Specifications (all models)

### 1.3.1. Electrical Characteristics

Max Voltage Rating	200 V pk, 160 V rms
Max Signal Power <sup>1</sup>	30 watts or 1 ampere, whichever is greater
Crosstalk <sup>2</sup>	
Balanced 600 Load	
20 kHz	-140 dB
100 kHz	-126 dB
Unbalanced 600 Load	
20 kHz	-120 dB
100 kHz	-106 dB
Series Resistance	Typically <0.3 ohms per side
Shunt Capacitance	Typically <90 pF, each side to ground

<sup>1</sup> Relay contact resistance degrades rapidly with increasing switched power. For maximum relay life (typically 20 x 10<sup>6</sup> operations) Audio Precision recommends limiting the maximum switched signal power to 5 Watts or 200 mA

<sup>2</sup> Measured between any two selectable channels into the specified load impedance. SWR-2122P (patch point switcher) crosstalk from the interrupted input to output is typically 70 dB to 20 kHz.

### 1.3.2. General Characteristics

Power Requirements	100/120/230/240 V ac (-10%/+6%) 50-60 Hz, 20 VA max
Temperature Range	
Operating	+5°C to +40°C
Storage	-40°C to +75°C
Humidity	80% RH to at least +40°C (non-condensing)
Altitude	2000 m Maximum
Dimensions	16.5 x 1.75 x 10.5 inches [41.9 x 4.4 x 26.7 cm]
Weight	Approximately 9.9 lbs [4.5 kg]

### 1.3.3. Regulatory Compliances

EMC <sup>3</sup>	Complies with FCC Part 15 Subpart J (class B), 89/336/EEC, 92/31/EEC, and 93/68/EEC, EN 50081-1 (1992) Emissions Class B, EN-50082-1 (1992) Immunity
Safety	Complies with 73/23/EEC, 93/68/EEC, EN6010-1 (1993) – IEC 1010-1 (1990) + Amendment 1 (1992) + Amendment 2 (1995) Installation category II – Pollution Degree 2

---

<sup>3</sup> Emission and Immunity levels are influenced by the shielding performance of the connecting cables. The shielding performance of the cable will depend on the internal design of the cable, connector quality, and the assembly methods used. EMC compliance was evaluated using Audio Precision XLR type cables, part number 4155.0117.

## 2. Hardware Installation

### 2.1. Mounting

Switcher modules may be either rack-mounted or simply stacked on top of one another. They do not consume appreciable power, and therefore require no extraordinary ventilation considerations. All switchers occupy one rack unit of height (1.75 inches). They are provided with bottom feet for tabletop use. The optional rack mount adapters available from Audio Precision (order number RAK-212) allow either conventional flush front mounting or setback mounting to prevent the front connectors from protruding from the rack.

### 2.2. Primary Power Considerations

#### 2.2.1. AC Mains Switch Required

The SWR-2122-Series switchers do not have individual power switches and are intended for continuous operation. However, they should be plugged into a switched power source or mounted to give the user access to the mains cable for disconnect.

#### 2.2.2. Checking or Changing Power Line Voltage

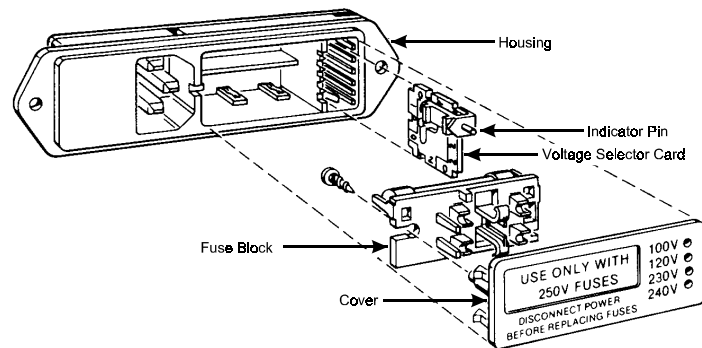


Figure 2-1. Changing power line voltage

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

## Hardware Installation

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power source. An indicator pin shows the selected input voltage in one of the four holes in the cover (see Figure 2-1)

To change the input voltage, refer to Figure 2-1 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.

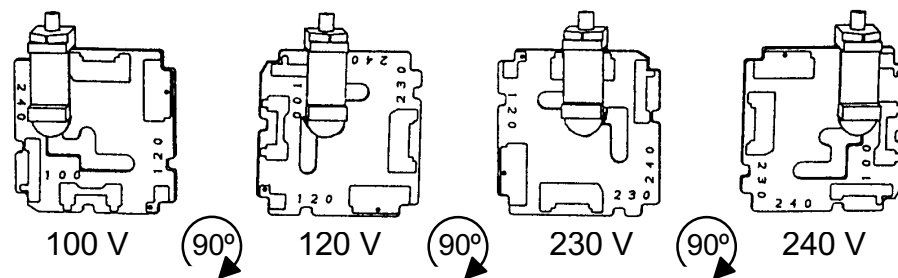


Figure 2-2. Voltage selector card positions

4. Orient the selector card so that the desired input voltage is readable at the bottom (see Figure 2-2). 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 or in the manual). 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.



### 2.2.3. Fuse Information

The connector/fuse block/voltage selector assembly allows two fusing arrangements: North American (see Figure 2-3), and European (see Figure 2-4). 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. Both types should be rated 250 V. Fuse current ratings are 200 mA for 100 – 120 V inputs, or 100 mA for 230 – 240 V inputs. Confirm this information on the label on rear panel.

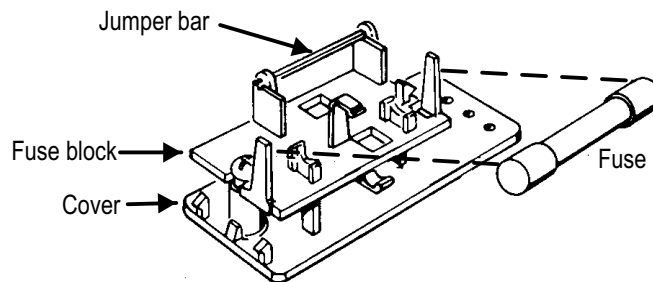


Figure 2-3. North American fusing arrangement

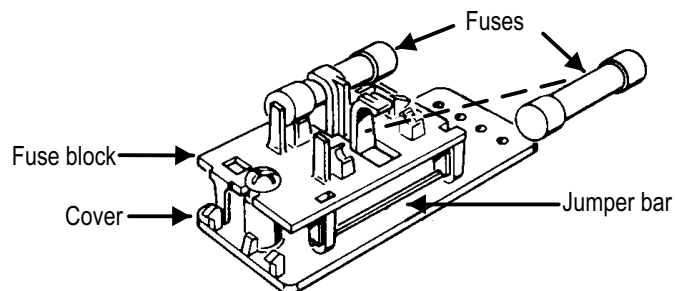


Figure 2-4. European fusing arrangement

### 2.2.4. 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 2-5).

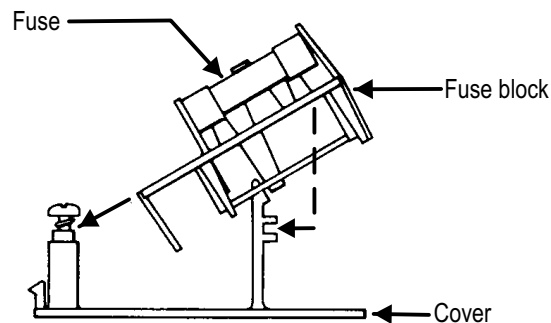


Figure 2-5. Changing fuse types

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.

### 2.2.5. Proper Environment

All Audio Precision System One and System Two products are intended for use indoors, in a normal environment. Refer to Section 1.3 for temperature range and humidity specifications.

## 2.3. Computer Requirements

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The System One or System Two and the SWR-2122 Switchers are controlled by APWIN, Audio Precision's user interface and control software package. APWIN must be installed on the user's computer under Microsoft Windows and provides a graphical user interface and sophisticated instrument control facilities.

Windows in turn has its own hardware and software requirements. Although there is a minimum configuration that will run Windows, practical considerations suggest a configuration exceeding this to achieve acceptable speed with most applications, including APWIN. If the computer used to run APWIN would also be required to run other Windows applications such as word processors, spread sheets, or data bases, we suggest a computer configuration better than the minimum requirement. The following table lists the minimum and recommended requirements.

*Table 2-1. Minimum and recommended computer configurations*

	<b>Minimum Requirement</b>	<b>Recommended Configuration</b>
Computer CPU:	386SX, 20 MHz	486DX2, 66 MHz or better
Memory:	8 Mb	16 Mb or more
Hard drive:	100 Mb	>500 Mb
Hard drive space:	20 Mb	100 Mb
Video:	VGA (640 x 480)	SVGA (1024 x 768)
Operating System:	Windows 3.1	Windows 95, Windows 3.11
Pointing device:	Mouse	Mouse

## 2.4. ISA-WIN APIB Card

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APWIN controls the switchers through the APIB (Audio Precision Interface Bus), connected to an ISA-WIN card installed in the user's pc (optionally, the APIB may be connected to a PCM-WIN card in a laptop computer). Refer to the APWIN documentation for installation of this card if necessary.

### 2.5. Connecting the APIB Interface

---

Each SWR-2122 switcher has two APIB connectors on its rear panel. This is to permit connecting them in a “daisy-chain” fashion between the computer’s APIB card connector and the System One or System Two APIB connector. The switcher’s connectors pass the APIB lines through, and the switchers respond only when specifically addressed, as described below. Normally, the computer will be connected to the first switcher with a digital interface cable, the first switcher connects to the second, etc, and the last switcher connects to the system digital interface (APIB) connector.

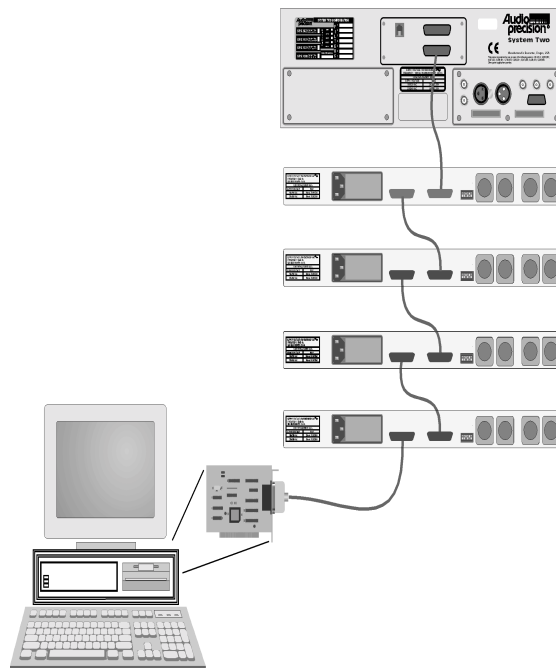


Figure 2-6. APIB connections block diagram (typical)

## 2.6. Input/Output/Patch Point Jumpers

Remove the AC power cord from the AC Mains Connector before removing the cover to inspect or change the jumper settings.

A common circuit board design is used in all models of the switchers; two jumpers on the circuit board select whether the switcher functions as an input switcher, output switcher, unbalanced switcher, or patch point switcher. These jumpers, marked P62 and P63, are shown in Figure 2-7. The jumper positions are shown for reference only and will normally not need to be changed.

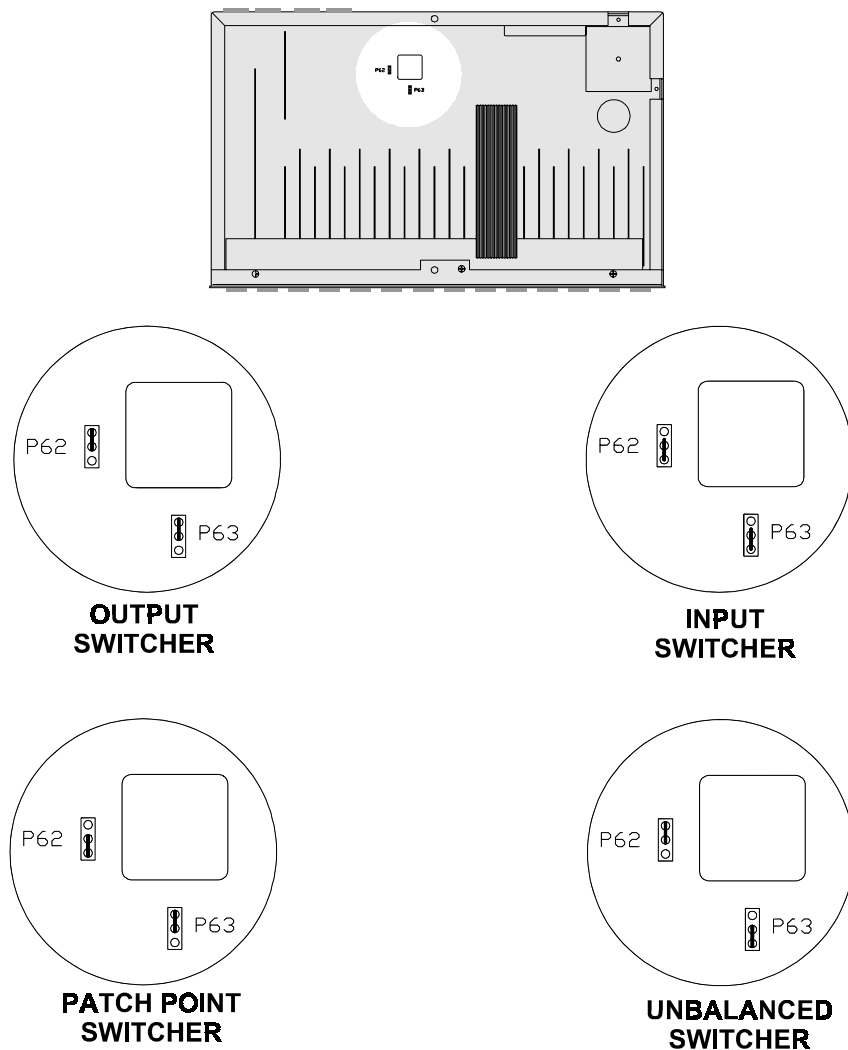


Figure 2-7. Mode jumper arrangements

## 2.7. Setting Switcher Addresses and Modes

A six-switch binary switch bank is located on the rear panel. The first four switches on this bank select which group of channel numbers the module responds to as described in Table 2-2. The last two switches function as described in the appropriate subsection below.

These switches are marked 1 through 6 on the switch itself; on the panel, the first four are labeled 1, 2, 4, and 8, which corresponds to their bit value in the address word. The up, or ON, position corresponds to a logic 0 (low).

Input, Output, and patch point switchers may all be combined in the same system. Input and output switchers may share the same addresses. A patch point switcher must not have the same addresses as either an input or output switcher. Two patch point switchers may be set to the same address if one is set as Channel A and the other as Channel B (see Section 2.7.2).

### 2.7.1. Switcher Address Settings

Each switcher module consists of 12 channels. Up to 16 modules may be stacked to provide up to 192 channels. Rear panel address switches must be set to select to which channel commands from the software each switcher module should respond. For example, the first switcher is normally set to channels 1-12, the second module to channels 13-24, etc.

Figure 2-8 shows a typical rear-panel APIB Address switch. Table 2-2 shows relationships among APIB Address switch positions, binary codes, and channel numbers on the APWIN software “panels.”

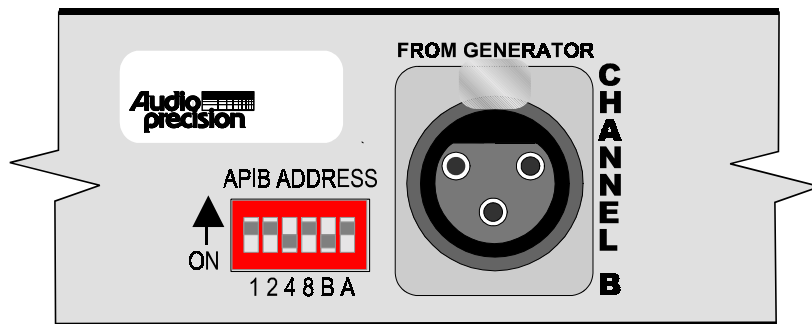


Figure 2-8. Rear panel DIP switch (typical)

*Table 2-2. APIB Address switch settings*

Channel Numbers	Rear Switch Settings				Binary Code
	1 (Switch 1)	2 (Switch 2)	4 (Switch 3)	8 (Switch 4)	
1 – 12	Up	Up	Up	Up	0000
13 – 24	Down	Up	Up	Up	0001
25 – 36	Up	Down	Up	Up	0010
37 - 48	Down	Down	Up	Up	0011
49 - 60	Up	Up	Down	Up	0100
61 - 72	Down	Up	Down	Up	0101
73 - 84	Up	Down	Down	Up	0110
85 - 96	Down	Down	Down	Up	0111
97 - 108	Up	Up	Up	Down	1000
109 - 120	Down	Up	Up	Down	1001
121 - 132	Up	Down	Up	Down	1010
133 - 144	Down	Down	Up	Down	1011
145 - 156	Up	Up	Down	Down	1100
157 - 168	Down	Up	Down	Down	1101
169 - 180	Up	Down	Down	Down	1110
181 - 192	Down	Down	Down	Down	1111

### 2.7.2. Input, Output, and Patch Point Switcher Mode Switches

Switches 5 and 6 of the switch bank set the switcher mode as described in Table 2-3. The modes are defined below.

Table 2-3. Switcher mode settings

Input, Output Mode	Rear Switch	
	B (Switch 5)	A (Switch 6)
Either A or B*	Up	Up
Channel A	Down	Up
Channel B	Up	Down
Off	Down	Down

**\*Either A or B:** This mode is valid only for Input and Output switchers. The switcher's channel A responds to the A channel addresses, and channel B responds to B channel addresses. This is the normal mode.

**Channel A:** The switcher's channel A and channel B both respond to A channel addresses.

**Channel B:** The switcher's channel A and channel B both respond to B channel addresses.

**Off:** Neither channel responds to any address.



### 2.7.3. Unbalanced Switcher Mode Switches

The SWR-2122U unbalanced switcher may be used for generator output or analyzer input switching. Switch 6 of the six-switch binary switch bank selects between these modes:

Set Switch 6 to the UP position to operate as an input switcher (switcher will use Input switch channel numbers for Channel A and Channel B on A Channel and B Channel addresses).

Set Switch 6 to the DOWN position to operate as an output switcher (switcher will use Output switch channel numbers for Channel A and Channel B on A Channel and B Channel addresses).

Switch 5 disables the switcher; in the DOWN position, the switcher will not respond to any addresses.

Also note the labeling on the rear panel describing the difference in cable connections to the four rear-panel BNCs when used as an input versus output switcher. See Figure 2-9.

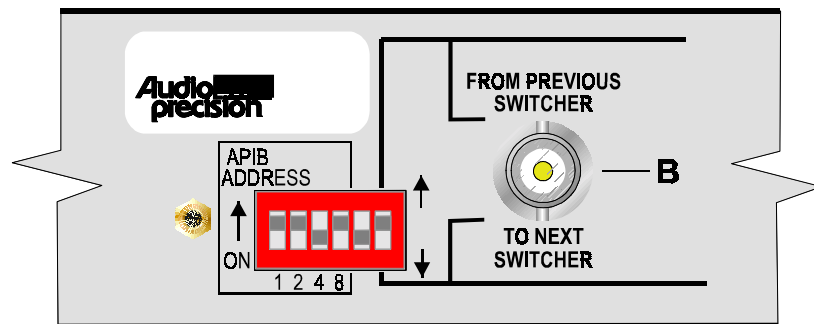


Figure 2-9. Unbalanced switcher address/mode switch

## Hardware Installation

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## **3. Maintenance and Troubleshooting**

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### **3.1. Cleaning**

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Remove power cord before cleaning. Remove accumulated dust on instrument enclosures and other mechanical parts with a soft cloth or small brush. A mild detergent may be used to remove stubborn dirt or stains. Wipe all surfaces clean with a damp cloth.

Clean front and rear panels with a cotton swab or a soft cloth dampened with isopropyl alcohol or water only. Do not use cleaning agents that contain petroleum-based solvents or abrasive compounds; these can damage paint or remove lettering. Do not allow liquids to flow into openings around connectors or switches. The use of contact cleaners is not recommended.

### **3.2. Technical Support**

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If all else fails and you still have problems, call our technical support team for assistance. We can be reached during the following hours Monday through Friday except holidays: 8:30 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](mailto:techsupport@audioprecision.com)
- Web: [www.audioprecision.com](http://www.audioprecision.com)

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

Your computer: CPU type and speed (e.g.: 386, 486, Pentium; 33MHz, 66MHz, 90MHz etc.)

Amount of RAM installed (typically 8, 12, 16 or 32Meg)

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.



US Toll Free: 1-800-231-7350    Tel: 503-627-0832    Fax: 503-641-8906  
email: [techsupport@audioprecision.com](mailto:techsupport@audioprecision.com)    Web: [audioprecision.com](http://audioprecision.com)