

# SWR-2755

## Programmable Audio Switcher



USER'S MANUAL



# SWR-2755 Programmable Switcher User's Manual



## Setup and Installation Guide

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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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## Safety Information

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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.

One of two external power supplies is provided with this product:

The power supply PN 4540.0020 is designed to operate only from an AC power source (100 V–240 V rms, 47 Hz–63 Hz) with an approved three-conductor power cord and safety grounding. Do NOT defeat the safety ground connection.

The power supply PN 4540.0051 is designed to operate only from an AC power source (100 V–240 V rms, 50 Hz–60 Hz). This power supply has an integral 2-conductor mains plug.

Either power supply automatically adjusts to the line voltage and frequency within the specified range. No user adjustments are necessary. Neither of the power supplies nor the SWR-2755 contain user-replaceable fuses.

Use only the AP power supply PN 4540.0020 or PN 4540.0051 with the SWR-2755. The use of other power supplies may result in damage to the SWR-2755, electrical shock hazard from the power supply or the SWR-2755, and loss of fire hazard protection.

This product and power supply are for indoor use ONLY.

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

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

## Safety Symbols

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The following symbols may be marked on the panels or covers of equipment or modules, and may be 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 Safety Information on page 8 of this manual for specific information.



**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, consult 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.



# Chapter 1

## Introduction



Figure 1. SWR-2755 switchers.

The SWR-2755 family of programmable switchers are accessory units for most of Audio Precision’s audio analyzers, including the 2700 series, ATS-2, System One, System Two, System Two Cascade and Cascade *Plus* instruments. Since the switcher operations for all these systems are the same, in this manual the designation “instrument” indicates any of the above models.

When used without a switcher, these instruments can provide two analog outputs and two analog inputs. A programmable switcher such as the SWR-2755 can be used to expand the two-channel input and output to interface to multi-channel devices or production “bed-of-nails” test fixtures.

SWR-2755 switchers use highly reliable electromechanical relays to best preserve the signal integrity of the generator and signals from the device under test (DUT) for transparent operation. Unlike conventional industrial audio sig-

nal routing switchers, the SWR-2755 achieves exceptional crosstalk performance, less than  $-150$  dB at 20 kHz in balanced operation.

The switchers are controlled by our proprietary APIB interface, and the switcher operation is integrated into Audio Precision's AP2700, ATS, APWIN and S1.exe control software. Channel-in-use LEDs next to each connector indicate crosspoint activity.

There are three versions of SWR-2755 switchers that differ from one another in connector configuration. These are:



- SWR-2755M, front panel fitted with 12 XLR male connectors and 2 XLR female connectors, typically used as an output switcher;



- SWR-2755F, front panel fitted with 12 XLR female connectors and 2 XLR male connectors, typically used as an input switcher; and



- SWR-2755U, front panel fitted with 14 BNC connectors. The “U” or “unbalanced” switchers can appear to the control software as either an input or an output switcher, according to the position of a rear-panel switch. See page 14.

An output switcher (either an SWR-2755M or an output-configured SWR-2755U) is used to connect the instrument generator outputs to multiple DUT inputs. An input switcher (either an SWR-2755F or an input-configured SWR-2755U) is used to connect multiple DUT outputs to the instrument analyzer inputs.

The core of each switcher 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 internal circuits are of balanced design but may be used with unbalanced circuits in the BNC connector version, which is implemented with floating (ungrounded) connector shells. Up to 16 switchers of any configuration can be used in a system, enabling testing of DUTs with a total of up to 192 inputs and/or outputs (up to 96 stereo pairs). Additional switchers are “daisy-chained” on the APIB bus. Configuration switches on the SWR-2755 rear panel enable setting the APIB address of each switcher to the desired channel number selections: 1–12, 13–24, etc. Simplified diagrams of the switcher configurations are shown in the following subsections. The contacts shown in the diagrams 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-quality consumer applications.

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*The SWR-2755 is identical in features to the discontinued SWR-2122 family of switchers, with improved performance.*

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## 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 (+).

Pin 3: Signal low (–).

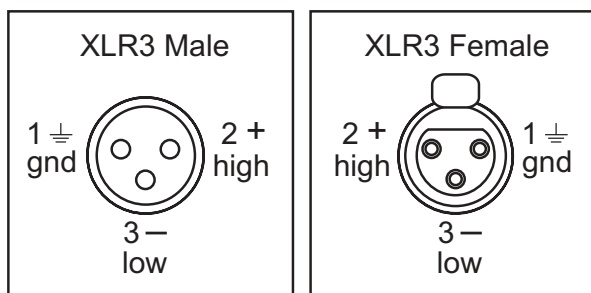


Figure 2. SWR-2755M switcher simplified schematic.

## SWR-2755M output switcher

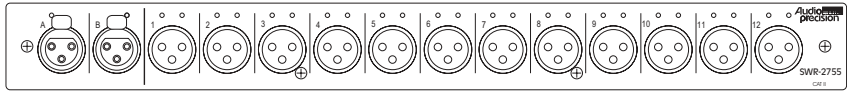


Figure 3. SWR-2755M switcher front panel.

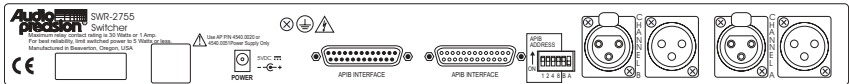


Figure 4. SWR-2755M and SWR-2755F switcher rear panel.

The SWR-2755M front panel is fitted with 12 XLR male connectors and 2 XLR female connectors. SWR-2755M switchers are configured as output switchers.

Each output switcher module connects two generator output channels (A & B) to any of 12 device input channels. The SWR-2755M input switcher simplified schematic is shown in Figure 5.

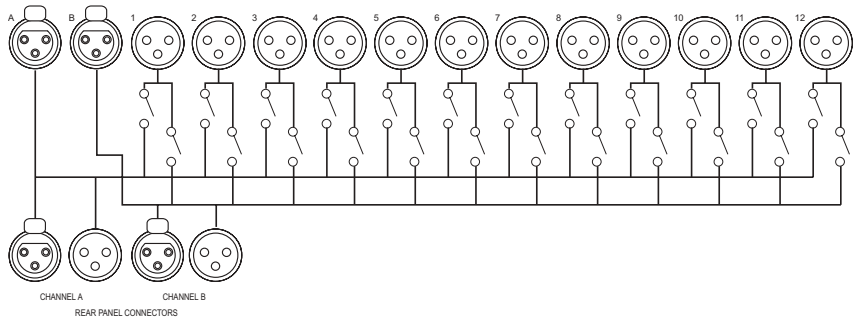


Figure 5. SWR-2755M switcher simplified schematic.

## SWR-2755F input switcher

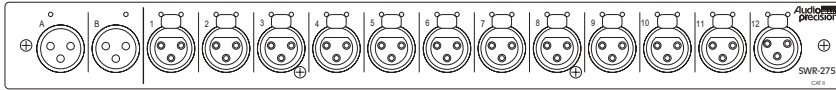


Figure 6. SWR-2755F switcher front panel.

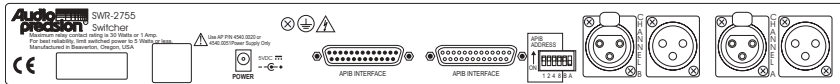


Figure 7. SWR-2755M and SWR-2755F switcher rear panel.

The SWR-2755F front panel is fitted with 12 XLR female connectors and 2 XLR male connectors. SWR-2755F switchers are configured as input switchers.

Each input switcher module connects any of 12 channels to the two analyzer input channels (A & B). The SWR-2755F input switcher simplified schematic is shown in Figure 8.

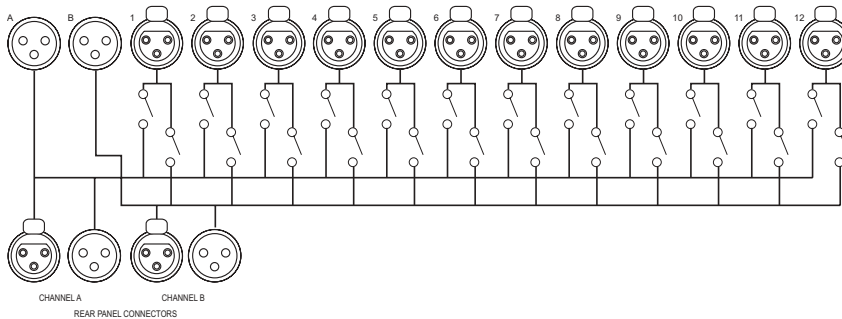


Figure 8. SWR-2755F switcher simplified schematic.

## SWR-2755U unbalanced switcher

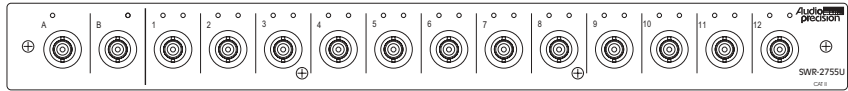


Figure 9. SWR-2755U switcher front panel.

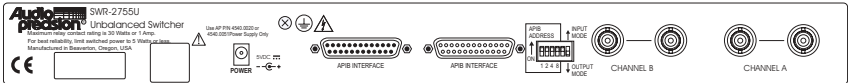


Figure 10. SWR-2755U switcher rear panel.

The SWR-2755U unbalanced switcher 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-2755M. See Figure 11 for a simplified schematic.

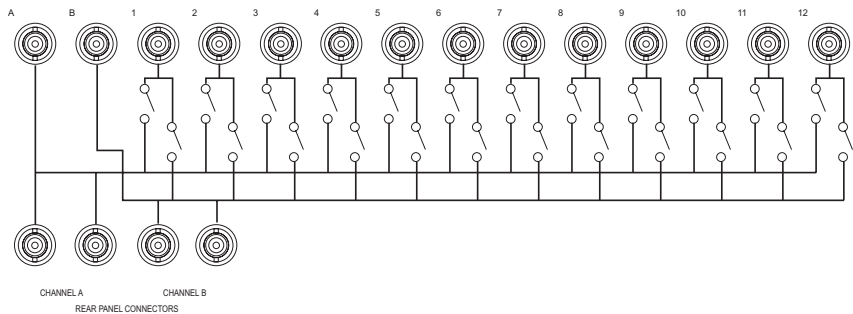


Figure 11. SWR-2755U switcher simplified schematic.

## Specifications (all models)

### Electrical Characteristics

Max Voltage Rating	200 Vpk, 160 Vrms.
Max Signal Power <sup>1</sup>	5 W or 200 mA.
Crosstalk <sup>2</sup>	
Balanced 600 $\Omega$ load (F and M versions only)	-150 dB @ 20 kHz. -136 dB @ 100 kHz.
Unbalanced 600 $\Omega$ load (all versions)	-138 dB @ 20 kHz. -124 dB @ 100 kHz.
Series Resistance	Typically <0.3 $\Omega$ per side.
Shunt Capacitance	Typically <90 pF from signal path to chassis (100 nF from BNC shell to chassis on U versions).
Reverse Termination (M version only)	604 $\Omega$ , 250 mW maximum.
Power Requirements	90–250 Vac, 50–60 Hz (via external dc supply module).
Temperature Range	
Operating	0° C to +50° C.
Storage	-40° C to +75° C.
Humidity	80% RH to +40° C (non-condensing).
Altitude	0–2000 m.
Dimensions	16.5" $\times$ 1.75" $\times$ 10.5" [41.9 cm $\times$ 4.4 cm $\times$ 26.7 cm].
Weight	Approximately 9.9 lbs [4.5 kg].

### 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 (1903)— IEC 1010-1 (1990) + Amendment 1 (1992) + Amendment 2 (1995).
- Installation category II—Pollution Degree 2.

<sup>1</sup> Relay contact life decreases very rapidly with increasing switched power. Under no circumstances should the switched power exceed 30 W or 1 A.

<sup>2</sup> Measured between any two selectable channels into the specified load impedance.

<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.

- External Power Supply AP part number 4540.0020 complies with IEC 60950:1991+A1+A2+A3+A4, UL 950 Third Edition E183744, CSA C22.2 No. 950.
- External Power Supply AP part number 4540.0051 complies with IEC 60950:1991, UL60950 Third Edition E199447, CSA C22.2 No. 60950, PSE J60950:1998, NOM-001-SCFI-1993.

## Safety information

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### Safety Ground connection


This equipment must be connected to a low impedance Safety Ground using the Safety Ground terminal on the rear panel. The user is responsible for:

- confirming the suitability of the Safety Ground.
- confirming a suitable low impedance connection (less than  $0.1 \Omega$ ) between the exposed conductive surfaces of the equipment and Safety Ground.

### Maximum voltage rating

The maximum voltage rating applies to intentional signals applied from external equipment, and also unintentional signals from external equipment due to fault or failure conditions.

The user is responsible for controlling and limiting the maximum voltage applied to this equipment. An appropriate limiting device in the external equipment may be required.

Failure to limit the maximum input voltage combined with a failure to connect the Safety Ground terminal (marked with ) on the rear panel of this equipment to a low impedance Safety Ground could expose the equipment operator to potentially hazardous voltages.



# Chapter 2

## Hardware Installation

### Mounting

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Switchers 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"). They are provided with 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.

### Primary power considerations

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#### AC mains switch required

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SWR-2755 series switchers do not have individual power switches and are intended for continuous operation. However, the power supply provided with the switcher should be plugged into a switched power source or mounted in a manner that gives the user access to the mains cable for disconnect.

#### AC mains voltage, frequency and fusing

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The power supply provided with SWR-2755 switchers (either pn 4540.0020 or 4540.0051) is designed to operate from mains voltages in the range of

- 100 Vac to 240 Vac.

Power supply 4540.0020 operates across a mains frequency range of

- 47 Hz to 63 Hz.

Power supply 4540.0051 operates across the mains frequency range of

- 50 Hz to 60 Hz.

Either power supply automatically adjusts to the line voltage and frequency within the specified range. No user adjustment is necessary.

Neither of the power supplies nor the SWR-2755 switcher contain user-replaceable fuses.

## Operating environment

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Audio Precision SWR-2755 switchers are intended for use indoors, in a normal environment. Refer to Specifications on page 7 for temperature range and humidity specifications.

## Connecting the APIB interface

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SWR-2755 is controlled via the Audio Precision Interface Bus (APIB) by an Audio Precision measurement system such as a 2700 series instrument, an ATS-2, a System Two, etc., with its attendant PC running Audio Precision control software such as AP2700, ATS, or APWIN.

Each SWR-2755 switcher has two APIB connectors on its rear panel. This enables connecting the switcher sequentially in a “daisy-chain” fashion between the APIB card in the PC and the instrument APIB connector. The switcher’s connectors pass the APIB lines through, and the switchers respond only when specifically addressed, as described in following topics. Normally, the PC will be connected to the first switcher using an APIB cable, the first switcher is connected to the second, and so on; the last switcher connects to the instrument APIB connector.

## APIB connections block diagram (typical)

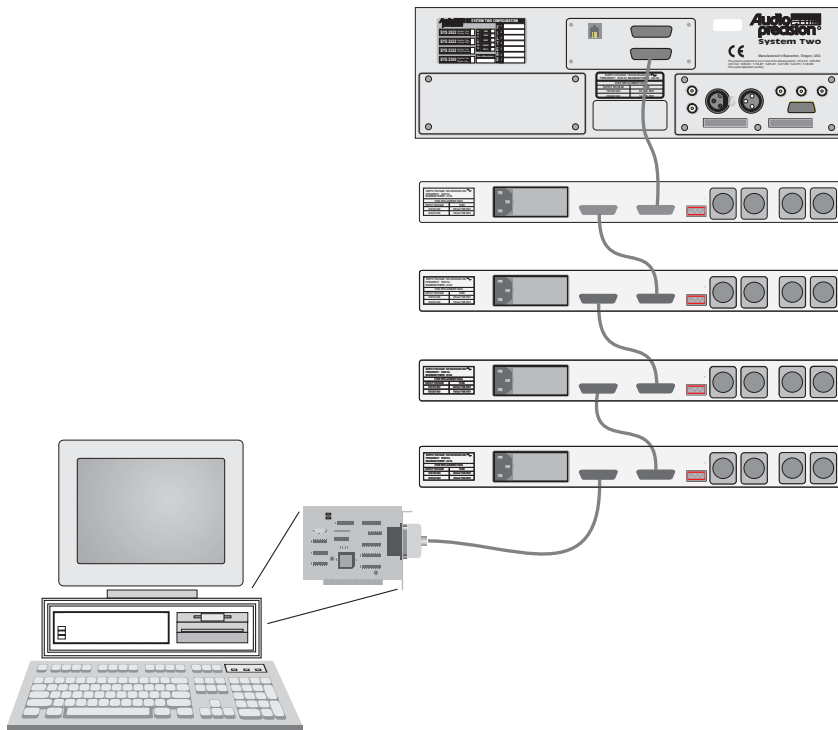


Figure 12. Typical APIB interconnections.

## Switcher APIB 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 enable each switcher to respond to the appropriate channel commands from the instrument control software. For example, the first switcher might be set to channels 1–12, the second module to channels 13–24, etc.

Figure 13 shows a typical rear-panel APIB address switch. The table below shows relationships among APIB address switch positions, binary codes, and channel numbers assigned in the control software.

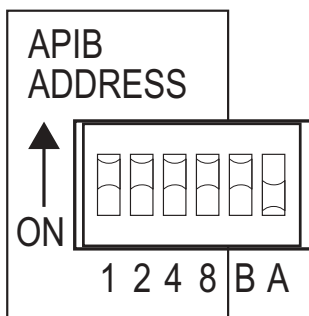


Figure 13. Typical APIB address DIP switch.

### 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	0001
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

## I / O switcher mode switches

Switches 5 and 6 of the DIP switch bank (labeled B and A) set the switcher mode as described below.

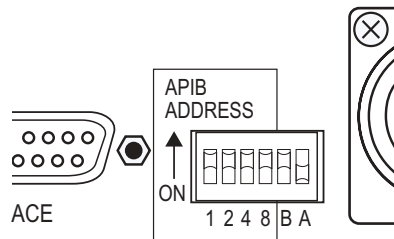
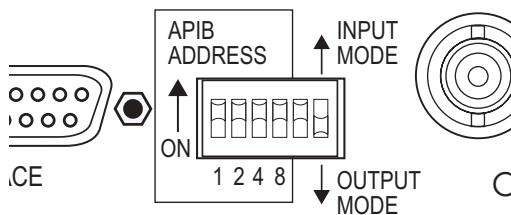


Figure 14. Input / Output switcher APIB address and mode switches.

Input, Output Mode	Rear Panel DIP 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.

## Unbalanced switcher mode switches



*Figure 15. Unbalanced switcher APIB address and mode switches.*

The SWR-2755U 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.

# Chapter 3

## *Maintenance and Troubleshooting*

### 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.

### 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)







