

x.sum

16 Channel Line Mixer

Reference Manual



speck electronics

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Speck Electronics
341 East Alvarado Street
Fallbrook, California 92028
USA
760-723-4281
www.speck.com

Introduction



General Thank you for purchasing our X.Sum Mixer. The X.Sum has operational features that are easy to understand and you should be up and running in no time. If you are unfamiliar with audio equipment or audio signal flow, it is recommended that you read this manual. If you have any questions regarding the X.Sum or any Speck product, do not hesitate to contact Speck Electronics.

Speck Electronics
341 E. Alvarado Street
Fallbrook, CA 92028
Phone +760-723-4281
email sales@speck.com
www.speck.com

Unpacking & Inspection The X.Sum is delivered in a special protective container and was carefully inspected both mechanically and electrically before shipment. All items should be physically free of marks and scratches and in perfect electrical order upon receipt. To confirm this, the mixer and power supply should be inspected for physical damage that may have occurred in transit. Any damage should be reported to your dealer and delivery company as soon as possible.

Repacking If the product is to be shipped to Speck Electronics for service or repair, attach a tag to the product, identifying the owner and indicating the service or repair to be accomplished. Include the model number and serial number of the product. Place the product in the original container if available. If the original container is not available, a suitable one can be purchased from Speck Electronics.

If the original container is not used, wrap the product in heavy plastic before placing in an inner container. Use plenty of packing material around all sides of the product and protect panel faces with cardboard strips. Mark shipping container with "Delicate Instrument" or "Fragile", and insure the shipment for the proper amount.

Standard Accessories The X.Sum is shipped with the following list of accessories:

- **PS-6 Power Supply**
- **Operations Manual**
- **BB-03 Breakout box**
- **Power cord (NA version only)**

Optional Accessories The following Mix link interface cables to interface additional X.Sum's are available from the factory or your Speck dealer:

- **2 unit cable - P/N MP50-Link2**
- **3 unit cable - P/N MP50-Link4**

**Operator Safety
Summary**

Use only the PS-6 external power supply that is supplied with your X.Sum mixer. Using any other power supply or power source will most definitely damage the X.Sum.

To avoid personal injury, do not remove the top cover from the power supply and never operate the external power supply without the cover properly installed. If it becomes necessary to service any part of the mixer, always unplug the AC power and disconnect the DC interface cable before proceeding.



Upon loss of the protective ground connection, all accessible conductive parts, including knobs and controls that may appear to be insulating, can render an electric shock.

X.Sum General Description

The X.Sum is a 32 x 4 line mixer that can be used for external DAW summing or as a line mixer for synths, samplers, and effect returns. Any of the 16 stereo channels can be assigned to either the main stereo Mix output or the stereo Mix-B output.

Connect the X.Sum to virtually any line level source: balanced, unbalanced, transformer, or transformer-less. The X.Sum has high headroom that will handle balanced signals up to +28dBu. All audio inputs and outputs are fully balanced and available on TRS connectors.

The X.Sum includes the Model BB-03 external breakout box that adds connections for the Mix-B outputs and Mix-A "pre-fader" outputs. The left and right Mix-A pre-fader outputs bypass the X.Sum's master section and master level control so you can use your own external preamps to add character and color to your mix.

X.Sum Features**16 Stereo Line Inputs-**

- Stereo level control.
- Pan/balance control.
- Mix assign switch that routes input channel to the main stereo mix or Mix-B stereo mix.
- Mono Switch.
- Left and right balanced TRS inputs.

Master Section-

- Master level control.
- Stereo/mono switch
- Monitor/Phone level provides adjustment to headphone jack and Mix-B output.
- Balanced TRS stereo mix output.

Multi-purpose I/O connector.**Expandable to 128 inputs.****Breakout Box & Expander cables.**

Specifications

| | |
|--|--|
| Line input impedance | |
| Balanced | 30K ohms |
| Unbalanced | 15K ohms |
| Maximum input level | +28dBu |
| Output Impedance | 60 ohms |
| All Active-balanced outputs | |
| Maximum output level (2k load) | +28dBu (Balanced) |
| All Active-balanced outputs | |
| Frequency Response (12 dB gain) (Any line input to mix output) | 3Hz-54kHz (+0/- .5dB) |
| THD+n (+12dBu any line input, Gain 12, +24dBu mix out) | .0024% |
| Crosstalk (1kHz) | |
| Channel to channel | -100dBu |
| Input to Mix out, channel mix deselected | -95dBu |
| Input to Mix out, channel level off | -89dBu |
| Noise (22Hz-22kHz) | |
| Residual Mix-A and Mix-B output noise | -102dBu |
| Mix-A output - 16 channels routed, faders off | -87dBu |
| DC Power Requirements (Mixer) | +/- 16.5 VDC @ .8A |
| AC Power Requirements (External supply) | 100-120 VAC 50/60Hz 1 amp 220-240 VAC 50/60Hz .50 Amp |
| Dimensions (Mixer) | WxDxH=1.75" x 19" x 10.75" (44mm x 483mm x 2734mm) |
| Dimensions (External supply) | WxDxH=4.6" x 2.75" x 7.3" (117mm x 70mm x 185mm) |
| Weight (Mixer) | 11 Lbs (5kg) |
| Weight (External supply) | 3 Lbs (1.4kg) |
| Total shipping weight | 15 Lbs (6.8kg) |

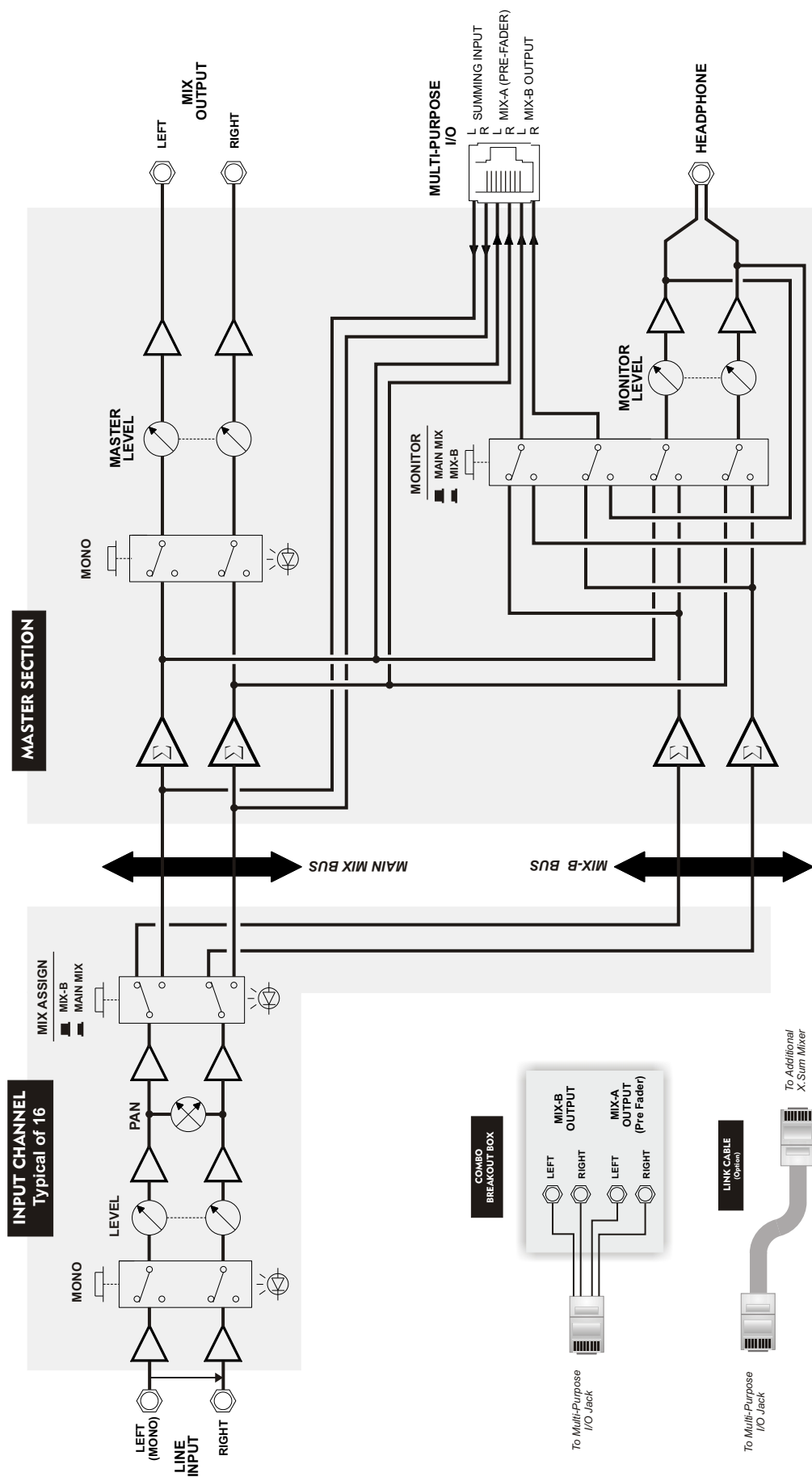


Figure 1. X.Sum signal Flow

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Installation & Setup

General The following information should give you the basics on how to install the X.Sum mixer and power supply. The proper installation of the X.Sum requires a clear understanding of audio wiring, AC distribution, grounding, and shielding techniques.

If the X.Sum is being installed into a larger studio or as an expander to a host console, it may be necessary to retain the services of someone experienced in these matters.

Power Supply Installation One of the primary reasons that the power supply of the X.Sum is external is to insure that the power transformer enclosed within the power supply chassis maintains a safe distance from the active electronics of the X.Sum. For that matter, any device that has a strong magnetic power field should be kept at a reasonable distance from the X.Sum and its audio cables.

Because the power supply does not use a cooling fan, it is silent and can be located in the same room as the mixer. It is important that the ventilation holes are not obstructed and that the unit is operated in free air to prevent overheating. Allow a minimum of 4”(100mm) of clearance from all ventilation holes.

The X.Sum's power supply can operate with two mains settings of 115 VAC or 230 VAC 50/60hz. Before switching “on” the power, you should verify that the voltage setting on your power supply is configured to match the AC mains requirements of your country. If the AC mains voltage needs to be changed, this procedure should be performed and checked by a qualified technician.

Before connecting the DC power supply cable to the X.Sum, make certain the power switch is set to the “off” position.

To connect the power supply to the mixer, fit the circular connector from the power supply to the chassis mount receptacle on the rear of the X.Sum. The respective connectors are keyed so the plug and the receptacle can fit in only one direction.



Always turn the power supply “off” and disconnect the DC power cable before servicing the X.Sum mixer.

In the unlikely event that a fuse blows, it is **EXTREMELY** important that a fuse of the same type and current rating be replaced. The chart below in Figure 2 lists the fuse current ratings to be used for your country's mains voltage. All fuses are 20mm x 5mm slow blow type.

| Fuse Chart for PS-6 Power Supply | | | | |
|----------------------------------|---------|---------|---------|---------|
| 100 VAC | 120 VAC | 220 VAC | 230 VAC | 240 VAC |
| 1.0 Amp | 1.0 Amp | .5 Amp | .5 Amp | .5 Amp |

Figure 2.

Environmental Considerations

The X.Sum will operate satisfactorily over a wide range of ambient temperatures, and the external power supply will operate from -10° C to +30 ° C. If the power supply is installed in an equipment rack that also contains heat producing equipment, adequate ventilation should be provided. This will prolong component life and maximize operational stability.

While the internal circuitry of the X.Sum is fully shielded by the chassis, installation should nevertheless be planned to avoid locating the X.Sum immediately adjacent to power amplifiers, power supplies, or any source of Electromagnetic emissions.

Physical Placement of Adjacent Equipment

Any device that emits a high EMI (Electro Magnetic Interference) or RFI (Radio Frequency Interference) energy field should be treated with suspicion. EMI is considered any unwanted signal which adversely affects the operation of the mixer or the mixing system. This subject is discussed in Chapter 4.

Electronic equipment such as power amplifiers, power supplies (especially wall mount type), video monitors, computers, certain synths and samplers must be located away from the X.Sum and its associated cables. It may be necessary to alter the positions of certain equipment that you feel would cause buzzes or hums in the mixer system.

Hooking up the Mixer

A quality installation is essential when wiring any audio system. When the time comes to actually interconnect your equipment, proceed slowly. Interfacing the many pieces of electronic equipment to your mixer and audio system should be a logical, methodical process.

Start by connecting only the monitor power amp (or active monitors) to the mixer, and then add one line signal to the mixer at a time; carefully listening and monitoring your progress. If a problem arises, such as a buzz, hum, intermittent signal, or nonexistent signal, stop at that point and solve the problem before proceeding.

Due to the high performance of the X.Sum, it is recommended that you use only the highest quality audio cable. A high quality cable by definition is a cable that provides good mechanical strength, high microphonic noise immunity, high frequency response, low crosstalk, and 100% shielding ability. All audio cable used with the X.Sum should be a 3 conductor foil shield type (2 inner conductors and a shield drain conductor). It is not recommended that the 2 conductor "off the shelf cables" be used.

All wire and cable interfaced to the X.Sum should be terminated with high quality connectors. A 1/4" plug or XL connector should make a positive connection to its respective mating jack and provide adequate strain relief to its cable. All connectors should also have a metal shell to provide 100% shield for exposed conductors.

Cleaning To clean the front panel, wipe the surface gently using a soft lint-free cloth to avoid scratching the panel or markings. Paper towels are not recommended. Commercially available window cleaner solutions may be used; however, the solution should be applied to the cloth and not the panel to avoid the seepage of liquid to the inside of the enclosure.

Do not use brushes or feather dusters to remove dust. This may cause dust to fall into the openings around the pushbutton switches.

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Mixer Operation



Overview In this section we hope to give you basic information on the operation of the X.Sum and adequately describe its controls, switches, and connectors.

The information in this section of the manual is intended to help with the technical process when using your X.Sum. Words alone could not adequately describe how to adjust the controls for every situation you might encounter with the X.Sum. You should experiment with settings and routing techniques to achieve the best results for any particular situation. Your ears should be your best gauge of how to adjust the settings on the X.Sum to make the sound fit your requirements.

Default Control Settings Before any attempt is made to operate the mixer, it would be a good idea to set all the mixers controls to their neutral positions. This gives you a reference point to work from when adjusting controls and switches.

All volume controls should be set to their full counter-clockwise setting. All pan controls should be set centered. All pushbutton switches on the input channels and master module should be set to the out position.

Signal Flow Diagram

When any future reference is made to the controls or switches of the X.Sum, it will be assumed that they have been set to their neutral positions. Use this channel signal flow diagram shown below in Figure 3 as a reference when reading the descriptions of the controls, switches, and connectors [1] through [16] in this chapter.

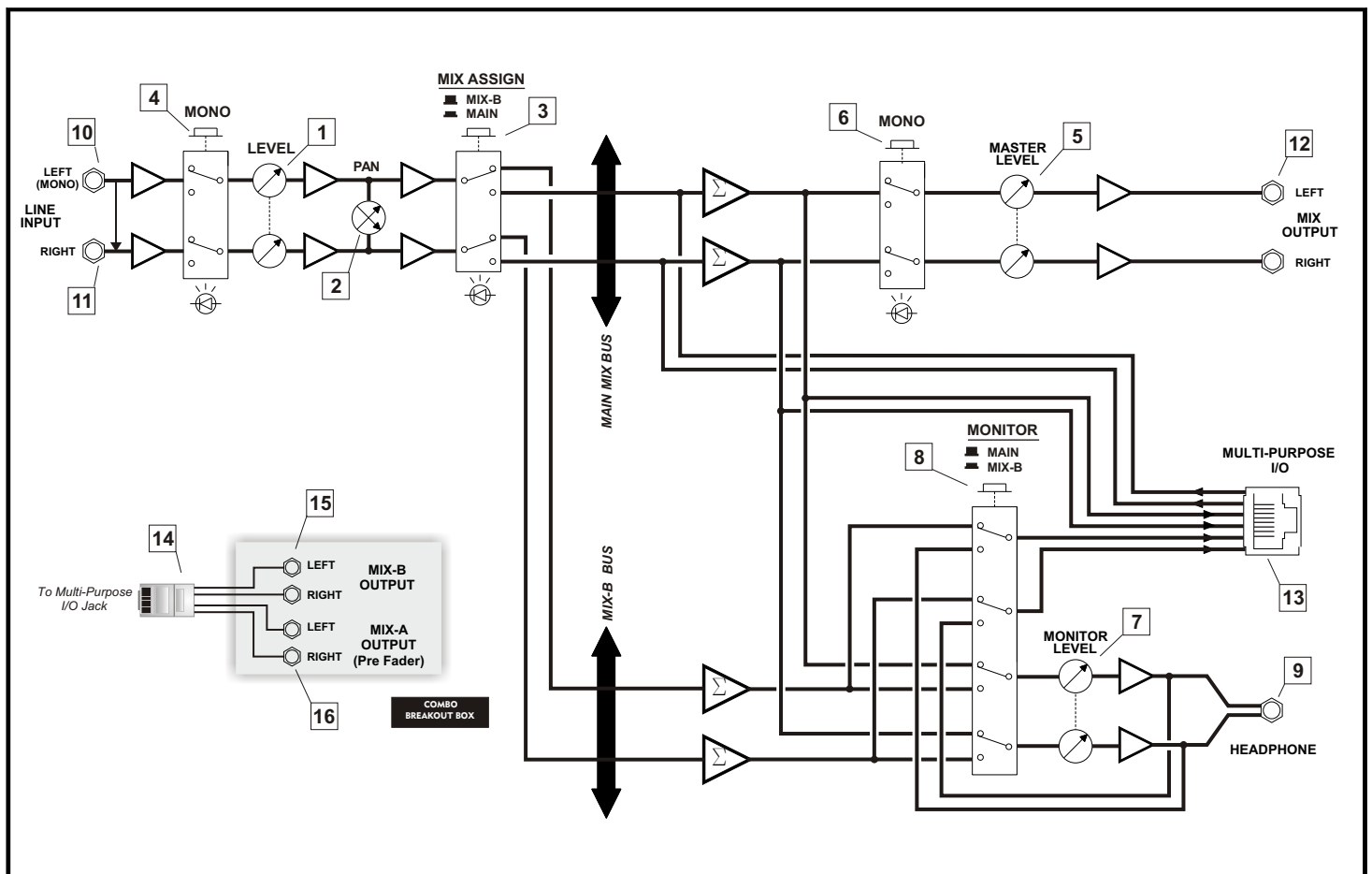
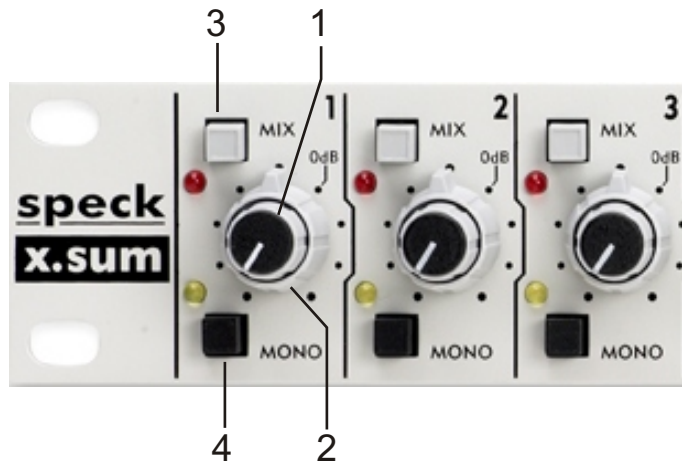


Figure 3. X.Sum signal flow and reference designations.

Input Channel



1. Input Level Control

The smaller (inner) knob of the black capped concentric is a dual rotary potentiometer that simultaneously and equally adjusts both the left and right channel levels.

The 0dB mark is the "unity gain" setting for the input channel. There is 12 dB more gain available past the "0db" mark.

It is recommended that the input channel be set to this "0dB" mark when the X.Sum is being used exclusively as a summing box.

2. Input Pan/Balance Control

The larger (outer) knob of the black capped concentric pot used in conjunction with the input level control [1] and Mix Assign Switch [3] allows an input channel to be panned to either the Mix-A or Mix-B outputs.

When an input channel is operated in the stereo mode, this control acts as an odd/even (left/right) balance for the selected subgroup pair. If the channel is operated in the mono mode or has a mono source connected to the Left/Mono input jack, then this control acts as a traditional pan.

3. Mix Assign Switch

The Mix Assign Switch allows an input channel to be assign to the Mix-A or Mix-B left/right outputs. A red L.E.D. indicates that the channel has been assigned to the Mix-A outputs.

When the mix switch on any channel is in the "out" position, the channel's stereo signal is routed to the Mix-B stereo outs. When the mix switch is depressed on any channel, its stereo signal is routed to the main Mix-A outputs. This function is on a per-channel basis so you can have some of the input channel's assigned to the main stereo Mix-A and others to Mix-B.

4. Mono Select Switch

When depressed, this switch sums the left and right signal together. The summed left/right signal can be panned using the pan pot. A yellow L.E.D. indicates the operation of the Mono switch.

Master Section



5. Master Level Control This pot acts as the master volume to the Mix-A output. The operation of this control does not affect the operation of the Monitor level [7].

6. Master Mono Switch When depressed, this switch sums the left and right signal together, creating a mono composite for the Mix-A. The operation of the Mono switch does not affect the Mix-B stereo mix. A yellow L.E.D. indicates the operation of the Mono switch.

The Mono switch allows the user to check for any out-of-phase signals or simply monitoring your mix in monaural.

7. Monitor Level Control This adjusts the overall level to the headphone jack on the front panel and the Mix-B outputs on the external breakout box (Model BB-03). This control operates independent of the Master Level Control [5]. The source select for this control is the Mix-B Select Switch [8].

8. Mix-B Select Switch This switch simultaneously changes two monitoring functions of the Monitor Level Control [7].

The first is that it selects the source for the headphone jack. In the "Out" position the source for the headphone jack is the Mix-A stereo bus and when depressed the source is the Mix-B stereo bus.

The second function of this switch is that it changes the Mix-B output signal to the breakout box. In the "Out" position the source for the Mix-B jacks is the Mix-B stereo bus set at a fixed level (pre the monitor level). When this switch is depressed, the source for the Mix-B jacks is the Mix-B stereo bus under the control of the Monitor Level Control [7].

9. Headphone Jack This standard 1/4" stereo phone jack will accommodate most popular stereo headphones. The tip of the stereo jack is the left headphone signal and the ring of the jack is the right headphone signal.

Input Channel Connectors



10. Left/Mono Input Jacks

Typically, this input is used to connect one side of a stereo or dual channel source. The "mono" designation on the left jack indicates that this jack should be used when you have only a monaural source.

11. Right Input Jack

Typically, this input is utilized to connect the alternate side of a stereo or dual voice source. An input channel cannot function in stereo unless the right input is connected.

The 16 stereo input channels of the X.Sum will work with either balanced tip-ring-sleeve (TRS) 1/4" plugs as or unbalanced tip-sleeve (TS) 1/4" plugs.

The configuration for the 1/4" TRS Input Jacks are as follows:

Tip = High (+)
Ring = Low (-)
Sleeve = Ground

Output Connectors

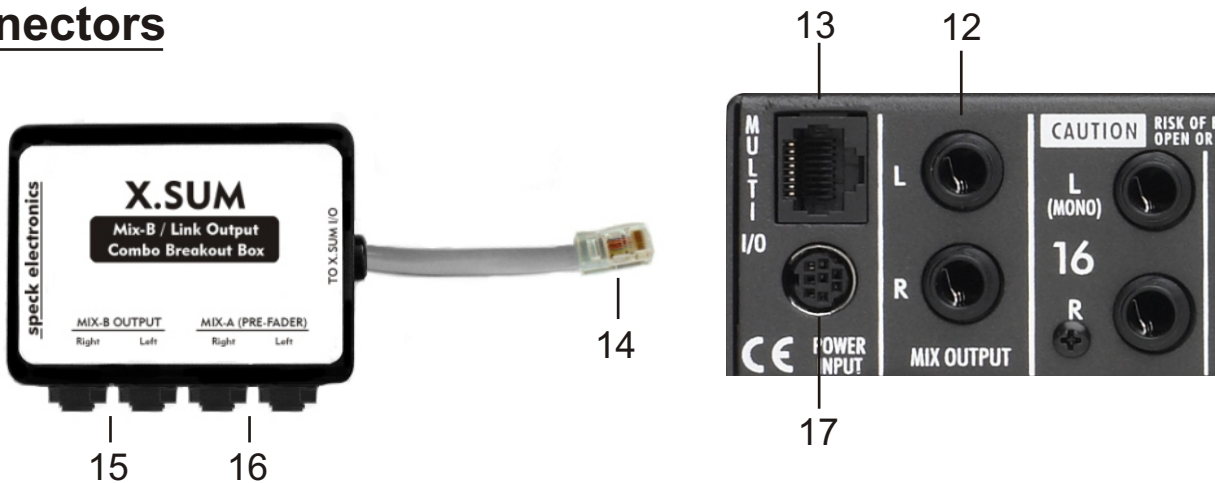


Figure 4. BB-03 combo breakout box

12. Mix Output Jacks These balanced 1/4" TRS phone type connectors are the left and right outputs for the stereo mix bus. The signal present at these jacks is adjusted by the Mix Master Control [5] on the front panel.

The configuration for the 1/4" TRS Mix Output Jacks are as follows:

- Tip = High (+)
- Ring = Low (-)
- Sleeve = Ground

Note - All active-balanced output circuits of the X.Sum were designed for balanced lines and should only be connected to balanced inputs. If that is not possible and it is necessary to connect to an unbalanced input, care must be taken not to connect the low (-) terminal to ground. If the low (-) terminal of these outputs is connected to ground, the result will be a high level of audio distortion.

13. Multi-purpose I/O Connector The multi-function I/O connector is used to connect the BB-03 Breakout Box or link up to two additional X.Sum's.

The pin-outs for the multi-pupose I/O connector are shown below in Figure 5.

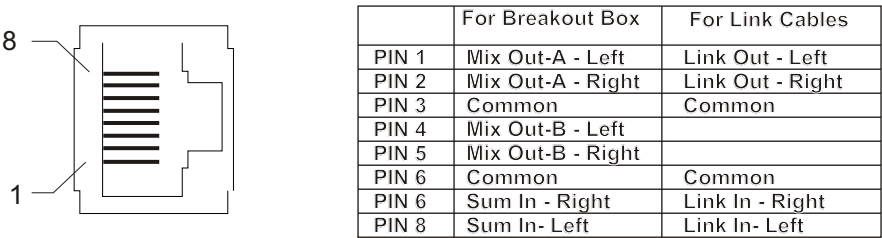


Figure 5. Pin-outs for Multi-purpose I/O connector

14. Breakout Box Connector

This modular plug connects the BB-03 Breakout Box to the multifunction I/O connector [13] on the rear panel of the X.Sum.

15. Mix-B Output Jacks

These balanced ¼" TRS jacks are the left and right outputs of the Mix-B bus. The signal present at these jacks is adjusted by the Monitor [7] control on the front panel.

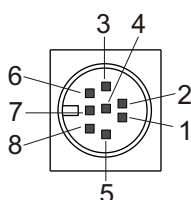
16. Mix-A (pre fader) Output Jacks

Another function of the breakout box connector will also let you connect your own external preamps to the X.Sum should you want to experiment with a more "colored" sound. The Mix-A (pre-fader) output jacks on the breakout box bypass the output circuits and the master level control of the Xsum so you can connect a pair of external preamps should you want to experiment with "character" sounds.

17. D.C. Power Inlet

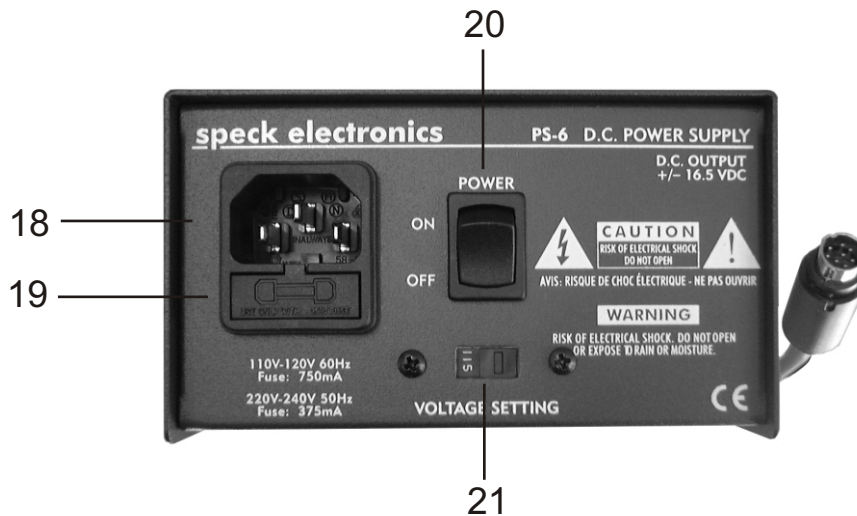
The DC power cable that comes from the power supply connects to this 8 pin circular connector. This connector and its respective plug is keyed so they will only fit in one direction. For power supply installation instructions, refer to the Interface & Setup Section in this manual.

The following connector illustration and chart as shown in figure 6 represents the DC voltages to the 8 pin circular connector required to power the X.Sum.



| | |
|-------|-----------|
| PIN 1 | 0 VDC |
| PIN 2 | 0 VDC |
| PIN 3 | -16.5 VDC |
| PIN 4 | 0 VDC |
| PIN 5 | +16.5 VDC |
| PIN 6 | -16.5 VDC |
| PIN 7 | 0 VDC |
| PIN 8 | +16.5 VDC |

Figure 6

**18. A.C. Power Inlet**

This AC (mains) power inlet accepts a standard IEC power cord. Before connecting the power cord, make certain that power cord matches the operating voltage shown on the voltage setting switch [21].

The ground pin of the power cord is internally connected to the chassis. **For safety reasons, do not lift the ground on the power plug by using a ground lift adapter.**

19 . Fuse

The AC power inlet has integral fuse holder that uses a 5mm x 20mm slow blow type fuse. To avoid the risk of fire, always replace the fuse with the correct value fuse as marked on the rear panel; .2 amp for the 120V model, or .1 amp for the 230V model.

20. Power Switch

This ON/OFF power switch applies AC (mains) power to the PS-6 power supply and the X.Sum mixer.

21. Voltage Selector Switch

The PS-6 power supply will operate at mains voltages between 100-120 and 220-240. This two position switch must be set to the correct voltage.

Set the voltage selector switch to the "115" position if your mains voltage is 100VAC or 120VAC. Set the voltage selector switch to the "230" position if your mains voltage is 220VAC, 230VAC or 240VAC.

Always turn "Off" the power before changing the 115/230 voltage selector.

Wiring & Other

General The following information is not specific to the operation of the X.Sum, but rather general information regarding the “care and feeding” of an audio system.

A general discussion about AC, AC grounding, audio grounding, EMI, and quality wiring is discussed in this section. These subjects are very often overlooked or misunderstood, and should be given consideration when interfacing your equipment to any audio product.

AC Distribution and Safety

Proper AC grounding When you are evaluating voltage and current requirements for your audio system, it is important that your X.Sum and/or audio system does not exceed the capacity of your AC service. You should make certain that the earth (green) wire for the AC system makes a reliable earth connection, and determine as best as possible that the AC system is free of noise that could generate unwanted audible sounds or cause problems in microprocessor based equipment.

Quality AC system When using a larger studio system it is recommended that a dedicated and isolated AC service be provided. This service should have its own AC wires, isolated receptacle, and breaker and not be shared with other unrelated equipment.

Even with an isolated AC system, it may still be necessary to make use of surge protectors, line filters, isolation transformers, or all of the above. Power conditioners should be selected with care, since they sometimes generate undesirable switching noises in audio systems.

AC distribution When connecting many pieces of electronic equipment to an AC system it is important that the AC is properly distributed. It is better to connect all plugs to a common AC source than to have AC receptacles in different locations.

When installing a large audio system, it may be necessary to consult a qualified electrician that is familiar with the specialized style of electrical wiring required for recording studios.

Clock noise and AC

Clock noise is one of the greatest enemies of the audio racks AC system. If a computer or any microprocessor based device (most samplers and effects are) emits or somehow couples its clock signal with the neutral or earth of its own power cable, it will contaminate your AC system and carry the clock noise into other equipment; almost always with undesirable results.

Safety earth connection

The AC earth connection exists to protect you, your equipment and possibly your building from an electrical disaster. In a properly wired system, if a 120 volt AC wire were to break within your equipment's chassis, it should make contact with the Safety Earth Wire that is connected to the chassis, and blow the fuse or trip the circuit breaker until the problem has been corrected. Given the same circumstances, if the AC safety ground has been defeated with a ground lift or the AC service is incorrectly wired, the equipment's chassis and quite possibly everything attached in that rack would be "live" with 120 volts.

Audio earth

In an electronics context, an earth provides a path for unwanted EMI noise to be carried away from your audio equipment. If you disable your earth with a ground lift or do not have a reliable earth connection, the unwanted noise (EMI or RFI), will find an electrical path of least resistance. That will most likely be your audio equipment and would result in unwanted buzzes or hums.

Proper Grounding and Shielding

In order for any audio signal to get from "Point A" to "Point B" requires a cable with a minimum of 2 conductors. One conductor is the hot, or high, or whatever you are familiar with; the other conductor is the ground or common. Additionally, all audio wires must be protected from environmental occurrences such as EMI (Electro Magnetic Interference) and RFI (Radio Frequency Interference) with an outer shield. An outer shield protects the 2 inner conductors from outside interference, and prevents that cable from inducing its signal onto adjacent audio cables.

One common misconception is that the shield of a cable should act as the common. This may be acceptable for guitar cords or semi-professional applications, but not for professional applications. The audio signals must be carried only by the 2 inner conductors and the shield must act only to cover these 2 conductors without transmitting the signal from one location to another. It is recommended that the shield be attached to the common (ground) at one connector's end, and the shield not be connected at the other connector's end. It is recommended that all shields be connected at the mixer end, and the shields not be connected at the other ends (synths, effects, power amps, etc.).

If a patchbay is utilized in your mixing system, the rules for shielding change. With a patchbay, normally all shields are connected at the patchbay jacks, and not connected at the mixer or external audio equipment.

EMI and RFI

The occurrence of EMI (Electro Magnetic Interference) and RFI (Radio Frequency Interference) in a contemporary studio system should be of great concern and not overlooked when installing the X.Sum. EMI is defined as any unwanted signal which adversely affects the operation of the X.Sum or your audio system.

Stated simply, the undesirable effects of EMI may be perceived as a low frequency smooth sounding 60Hz hum; a low frequency "edgy" sounding 120Hz buzz; or a higher frequency "whine" caused by the timing circuits in microprocessor based devices.

Almost every electronic device generates some amount of EMI emissions. These emissions can be transmitted as electromagnetic radiation or simply conducted through audio cables and power cords. In the same respect, most electronic devices are also very susceptible to the EMI emissions generated by other electronic devices.

Sources of EMI

There are natural and man made sources of EMI that you can't do anything about. These sources include radio, TV, and radar transmitters, as well as motors, lights, and computers. Even the Sun and atmospheric conditions can be contributors to noise that you experience in your audio system.

Reducing EMI

There are generally 3 elements that must be present for EMI to exist. These include the source of the EMI (conducted or radiated), the propagation medium by which EMI is transmitted (directly on the cables or through the air), and the receptor that suffers the adverse affects of EMI. If any of these 3 elements are eliminated or reduced, the EMI interference will be eliminated or reduced.

The more electronic equipment operating within a studio or equipment rack, the higher the EMI emissions. The more audio cable and low level audio equipment that exists within the same proximity, the greater possibility of unwanted noise. The result of EMI in an audio system manifests itself as a buzz, hum, whine, or all three.

The most common EMI occurrence in an audio system is radiated emissions from microprocessors in computers, samplers, and magnetic field sources from transformers and power supplies.

