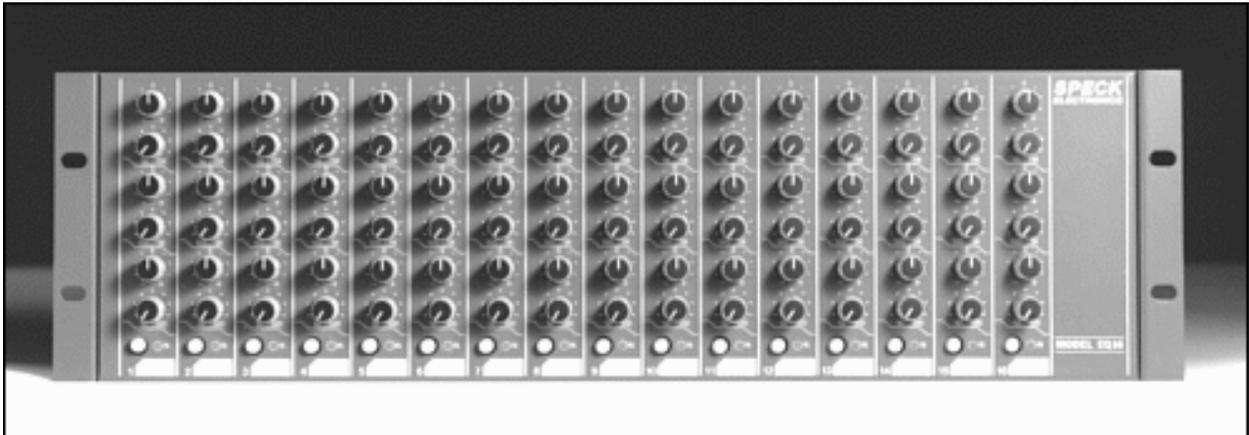


MODEL EQ16

16 CHANNEL - 3 BAND PARAMETRIC EQUALIZER

- Model EQ16-16
- Model EQ16-32

Reference Manual



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Introduction

General

Thank you for purchasing our Model EQ16 Sixteen Channel Equalizer. This manual covers the operation of the Model EQ16-16 and Model EQ16-32.

The Model EQ16 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 Model EQ16 or any Speck product, do not hesitate to contact Speck Electronics. Our phone number is (760) 723-4281.

Operator Safety Summary

Power source

This product and its power supply are intended to operate from an AC power source that does not apply more than 240 Volts RMS between the supply conductors or between either supply conductor and ground.

Grounding the product

The external power supply for the EQ16 is grounded through the grounding conductor of the power cord. To avoid electrical shock, plug the power cord into a properly wired receptacle before making any audio connection to the equalizer. A protective ground connection, by the way of the grounding conductor in the power cord, is essential for safe operation.

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.

Use the proper power cord

Use only the power cord and connector that is supplied with your power supply. The power cord must be in good condition.

Use the proper fuse

To avoid a fire hazard, use only a fuse of the correct type, voltage rating and current rating as specified on the chassis of the power supply and this manual.

Refer to the section in this manual regarding specific details on fuses.

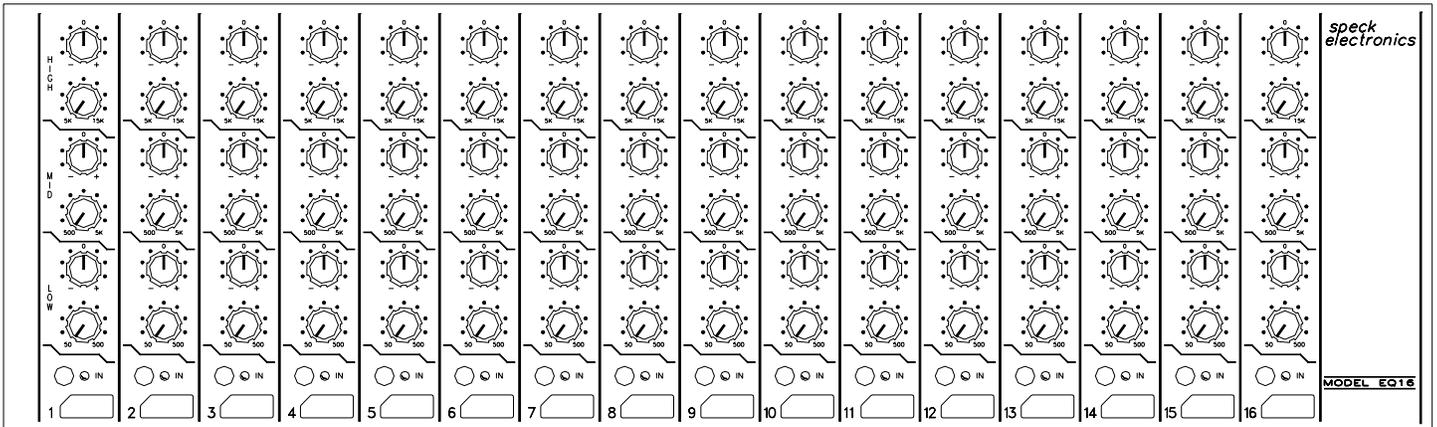


Figure 1a. Front Panel Layout

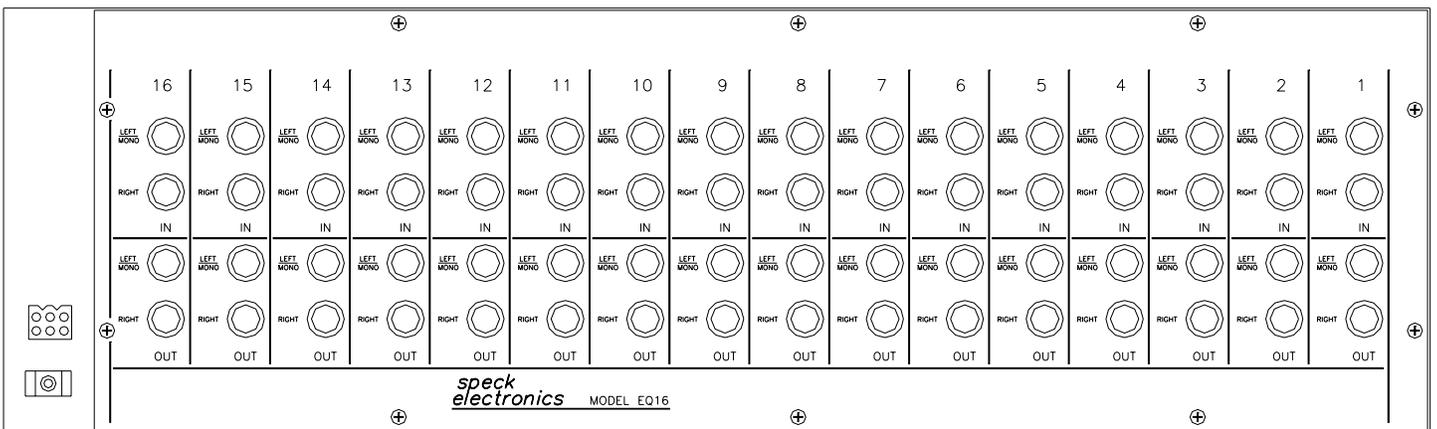


Figure 1b. Rear Panel Layout

Do not remove covers or panels

To avoid personal injury, do not remove the top cover from the power supply, or the rear panel of the Model EQ16 and never operate the external power supply without the cover properly installed. If it becomes necessary to remove the rear panel of the EQ16 for service, always unplug the AC power and disconnect the DC interface cable before proceeding.

General Description

The EQ16 is available in two versions: The EQ16-16; 16 mono three band equalizers, and the EQ16-32; 16 stereo three band equalizers. The EQ16 may be connected virtually anywhere in the line level audio path of professional equipment where equalization is required.

The Model EQ16 is a 3 rack space chassis that incorporates 16 independent channels of three band semi-parametric equalizers. Its versatility and applications are limited only by your imagination. The Model EQ16 is well suited in audio applications from professional recording, sound contracting, public address, stage, or any application where equalization is required.

Some of the many applications of the Model EQ16 is when interfaced to the Speck Electronics Xtramix or any one of the many commercially available recording mixers that lack the complete 3 sweepable bands of the Model EQ16, or lack equalization altogether.

The Model EQ16 will accept a wide variety of signal levels. From the wide range of levels developed from synths or samplers (typically -20 dBu to +10 dBu) to the highest levels developed by professional recorders (typically +4 dBu to +22 dBu).

Each channel of the Model EQ16 is divided into 3 bands; the low frequency band, mid frequency band, and high frequency band. Each band has 2 controls; the frequency sweep control and boost/cut control.

Standard Accessories**Model PS3 power supply**

The Model EQ16 is supplied with an external rack mount regulated power supply. The Model EQ16-16 (16 mono channel version) is supplied with the Model PS3-0.8 power supply. The Model EQ16-32 (16 stereo channel version) is supplied with the higher powered Model PS3-1.5 power supply.

Both versions of the PS3 power supply include a IEC power entry connector, a 3 conductor AC power cord, and a 6 foot DC cable. The DC cable has a 6 pin connector at one end that plugs into the power supply, and a 6 pin connector at the other end that plugs into the EQ16. This cable may be secured to the rear chassis of the EQ16 for a positive connection.

CAUTION!

ALWAYS CHECK THE PROPER OPERATING
VOLTAGE BEFORE OPERATING THE MODEL

IMPORTANT!

USE ONLY THE POWER SUPPLY THAT IS
SPECIFIED FOR YOUR PRODUCT.

Rack mount adapters

The Model EQ16 is supplied with a set of rack mount adapters. If the intention is to mount the EQ16 in a standard 19" equipment rack, these adapters must be mounted to the left and right sides of the mixer.

Initial Preparation

Unpacking and Inspection

The Model EQ16 is delivered in a special, protective container and was carefully inspected both mechanically and electrically before shipment. It should be physically free of marks and scratches and in perfect electrical order upon receipt. To confirm this, the product should be inspected for physical damage that may have occurred in transit. Any damage should be reported to your dealer or delivery company as soon as possible.

Environmental Considerations

The Model EQ16 will operate satisfactorily over a wide range of ambient temperatures. The EQ16 will operate from 10 to 50 degrees C and the external power supply will operate from 0 to 40 degrees C. If the EQ16 is installed in an equipment rack that also contains heat producing equipment such as power amplifiers or other power supplies, adequate ventilation should be provided. This will prolong component life and maximize operational stability.

While the internal circuitry of the EQ16 is fully shielded by the steel chassis, installation should nevertheless be planned to avoid locating it or any low level audio equipment immediately adjacent to power amplifiers, power supplies, or any source of electromagnetic emissions.

Grounding

To protect operating personnel, the National Electrical Manufacturers Association (NEMA) recommends that the instrument panel and rack cabinet be grounded. All Speck power supplies are equipped with a three conductor power cord which, when plugged into an appropriate receptacle, grounds the power supply.

The three conductor line cord and plug assembly is wired in accordance with NEMA convention (line - black, Neutral - white, and safety earth - green). Audio signal grounds and DC grounds from the EQ16 are isolated from the AC safety earth.

When using the EQ16 and its power supply outside North America, it may be necessary to adapt a different power cord for that specific country.

CAUTION!

DO NOT REMOVE, DEFEAT, OR DISABLE THE SAFETY EARTH TERMINAL ON ANY POWER CORD. DO NOT USE A GROUND LIFT ON THE POWER SUPPLY.

Rack grounding

Merely affixing the Model EQ16 into an equipment rack is no guarantee that the product is making a reliable ground connection. The mounting rails in the equipment rack should never be depended upon for a ground connection.

Repacking For Shipment

The following information is provided as a general guide for repackaging your Model EQ16 for shipment. If you have any questions, contact your local Speck Dealer or Speck Electronics direct.

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.

Installation

General

The following information should give you the basics on how to install the Model EQ16 and Power Supply. The proper installation of the Model EQ16 as a part of a larger system requires a clear understanding of audio wiring, AC distribution, grounding, and shielding techniques.

When the EQ16 is being installed into a larger system it may be necessary to retain the services of someone experienced in these matters.

Mechanical Installation

Before the EQ16 may be placed into its normal operating position, it will be necessary to install the rack mount adapters.

The Model EQ16 may be installed into any 19" wide equipment rack that uses standard E.I.A. universal spacing. The EQ16 may be affixed to standard E.I.A. rack rails using (4) 10-32 machine screws.

The location of the EQ16 should be such that the operator has a clear, unobstructed view of the front panel from his normal operating position. The unit should also be within easy reach of the operators normal position in order to facilitate the use of the front panel controls.

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 equalizer or the mixing system. This subject is discussed in Chapter 5.

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 EQ16 and its associated cables. It may be necessary to alter the positions of certain equipment that you feel would cause buzzes or hums in your audio system.

Power Supply

The PS3-0.8 power supply is supplied with the EQ16-16 (16 mono channel version), and the higher powered PS3-1.5 is supplied with the EQ16-32 (16 stereo channel version).

If you happen to be installing both versions of the Model EQ16 into your system, it is extremely important that the PS3-0.8 supply only be connected to the EQ16-16 and the PS3-1.5 only be connected to the EQ16-32.

The PS3 offers a variety of mounting options. The power supply may be placed on any flat surface, permanently affixed to a flat surface, or mounted on a single rack rail with the optional rack mount adapter.

One of the primary reasons that the power supply of the EQ16 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 EQ16. For that matter, any power supply (especially the small wall mount supplies), power amplifiers, or any strong power field device should be kept at a reasonable distance from the EQ16. It is also important to keep the above mentioned devices clear of all interface cables, audio cables and harnesses.

The external power supply for the EQ16 does not provide an AC power switch. It is recommended the power supply be plugged into an AC outlet that uses a power switch.

Mounting location

The power supply should not be installed directly above or below the equalizer. It is recommended that it be installed in the rear of the equipment rack, providing that it remains at a reasonable distance from the audio equipment and cables, and has adequate ventilation.

The power supply normally generates a small amount of heat during operation. It is important that adequate ventilation is provided when planning the mounting location.

Configuring the AC

The power supply may be wired to operate with 100 VAC, 120 VAC, 220 VAC, 230 VAC, or 240 VAC 50/60hz. Before applying AC power, you should verify that the voltage setting on your power supply is configured to match the AC requirements of your country. This procedure should be performed and checked by a qualified technician.

Unless otherwise specified on the panel of the supply, the power supply is wired for 120 VAC 50/60Hz operation and uses a North American style AC plug.

To gain access to the inside of the power supply, it will be necessary to remove the top cover. This is accomplished by removing the 4 screws on the bottom of the power supply chassis. Make certain that the power supply is unplugged before proceeding.

There are 5 terminals available on the power transformer of the power supply. The configuration of the five terminals determine the operating voltage of the power supply. It is only necessary to change the black (line) and white (neutral) AC wires. **Do not attempt to remove or change the Green AC safety wire or the multicolored wires used at the DC terminals.** It is recommended that you measure the DC voltages at the DC connector before reconnection to the mixer.

AC wiring chart

The following chart represents the proper AC terminal configuration for the Model PS3-0.8 and PS3-1.5 power supply.

FOR USE AT:	100 VAC	120 VAC	220 VAC	230 VAC	240 VAC
JUMPER AT:	1 & 3 2 & 4	1 & 3 2 & 4	2 & 3	2 & 3	2 & 3
APPLY A.C. AT:	5 & 1	4 & 1	1 & 5	4 & 1	4 & 1

Fuse chart

The following chart represents the proper fuse rating for the Model PS3 power supplies. All fuses are 5 x 20mm Slow-Blow type.

MODEL PS3- 0.8	
100 VOLTS AC	.75 AMP
120 VOLTS AC	.75 AMP
220 VOLTS AC	.375 AMP
230 VOLTS AC	.375 AMP
240 VOLTS AC	.375 AMP

MODEL PS3- 1.5	
100 VOLTS AC	1 AMP
120 VOLTS AC	1 AMP
220 VOLTS AC	.5 AMP
230 VOLTS AC	.5 AMP
240 VOLTS AC	.5 AMP

CAUTION!

ALWAYS VERIFY THE PROPER OPERATING VOLTAGE

Connecting the Power Supply

Before connecting the DC power supply connector to the Model EQ16, make certain the power supply is not plugged in.

The power supply interface cable is a 3 conductor wire with a square plug on each end. Do not attempt to extend or modify this cable. Any attempt to modify this cable could result in severe damage to the EQ16 or power supply.

To connect the power supply to the mixer, first fit the square plug into the receptacle on the power supply. The connectors are keyed so they will only fit in one direction.

Next, fit the square plug into the connector at the rear of the Model EQ16. These connectors are also keyed to fit in only one direction. Once the plug has been connected to the EQ16, it may be secured with a cable tie to the adjacent cable tie holder.

Power supply DC pin

The following chart represents the DC voltages available at the 6 pin connector (Figure 2) on the Model PS3 Power Supply.

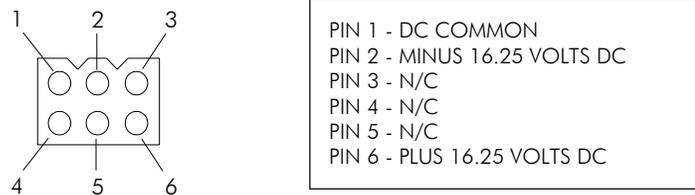


Figure 2.

Rack Mount Adapters

In order to install the Model EQ16 in a 19" equipment rack, it will be necessary to attach the two rack mount adapters to the main chassis of the Model EQ16. Each rack mount adapter is attached to the main chassis with (3) 6-32 x 3/16" Phillips machine screws.

Installation

Position the adapters so the side with the small round holes match the threaded holes on the sides of the EQ16, and the side with the oval shaped holes are towards the front panel. Using a #1 Phillips screwdriver, attach the rack mount adapters to the left and right sides of the chassis with the 6 screws and tighten.

IMPORTANT!

ONLY USE THE SHORT SCREWS THAT ARE SUPPLIED WITH THE MIXER. USING LONGER SCREWS WILL DAMAGE THE INTERNAL CIRCUITRY OF THE EQ16.

Default Control Settings

Before any attempt is made to operate the EQ16, it would be a good idea to set all the controls to their neutral positions. This gives you a reference point to work from when adjusting controls and switches.

All frequency sweep controls should be set to their full counter-clockwise setting. All boost/cut controls should be set centered. All pushbutton switches on the front panel should be set to the out position.

When any future reference is made to the controls or switches of the Model EQ16, it will be assumed that they have been set to their neutral positions.

The front and rear panels are a high quality painted surface and the panel lettering is applied using a silkscreen printing technique.

Cleaning

To clean the front or rear 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.

IMPORTANT!

DO NOT USE BRUSHES OR FEATHER DUSTERS TO REMOVE DUST. THIS MAY CAUSE DUST TO FALL INTO THE OPENINGS AROUND THE PUSHBUTTON SWITCHES.

Interfacing the Model EQ16 Equalizer

The Model EQ16 is available in two versions: The EQ16-16; 16 mono channels, and the EQ16-32; 16 stereo channels. Each channel of the EQ16-16 has two jacks; one input and one output. Each channel of the EQ16-32 has four jacks; left and right inputs jacks and left and right outputs jacks.

Any channel of the EQ16-32 stereo version may be utilized as mono channel by simply connecting to the left/mono input and left/mono output jacks.

Connections to each equalizer channel should be made with standard balanced tip, ring, and sleeve (TRS) 1/4" plugs as shown in Figure 3. Switchcraft brand #297 or #597 plugs are recommended.

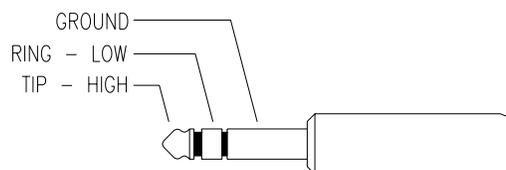


Fig 3. Tip, Ring, sleeve (TRS) plug

Things that can be interfaced to the Model EQ16

Virtually any line level signal may be connected to the inputs of the Model EQ16; Synths and samplers, mixing consoles (patch points, line inputs, effects returns, effects sends), multitrack DAT recorders, hard disk recorders, analog tape recorders, cassette recorders, CD players, external mike preamps, and effects.

Connecting the Model EQ16 to a Mixer

General

Due to the flexibility of the Model EQ16, there are many places it may be interfaced - too many to enumerate in the manual. A basic rule to follow when interfacing the EQ16 is that inputs connect to outputs, and outputs connect to inputs. This rule applies regardless of the type or brand of product that is interfaced to the EQ16. Each manufacturer has their own recommendation for interfacing external equipment. Refer to the operating manual that accompanies the equipment.

The channels of the Model EQ16 are line level, meaning that they may be connected to any other device that operates at line level. The EQ16 is also considered a unity gain device, which means that it has no gain. The EQ16 will operate with line input levels from -30 dBu to a maximum of +28 dBu. See Chapter 4 for a more complete explanation of operating levels.

When connecting the EQ16 to an audio mixer, it is recommended that it be connected to the patch points of the input channels. Patch points may also be referred to as insert points or channel access points. Regardless of their name, patch points exist exclusively for the access of devices such as the EQ16, limiters, compressors, gates, etc. These aforementioned devices are regarded as processing equipment and are normally connected (inserted) into a single channel. Processing equipment differs from effects devices in that effects devices are connected into the send/return jacks and may be accessed from all channels via the effects send controls.

A few of the larger recording consoles that lack a patchbay may use two jacks for the channel's insert points; one jack for insert output, and another for the insert input. Most of the smaller rack mount mixers mentioned in this manual utilize a stereo (TRS) jack for the insert points. For these mixers it will be necessary to utilize a special "Y" cable with a stereo plug at one end and two mono plugs at the other ends. (See figure 5)

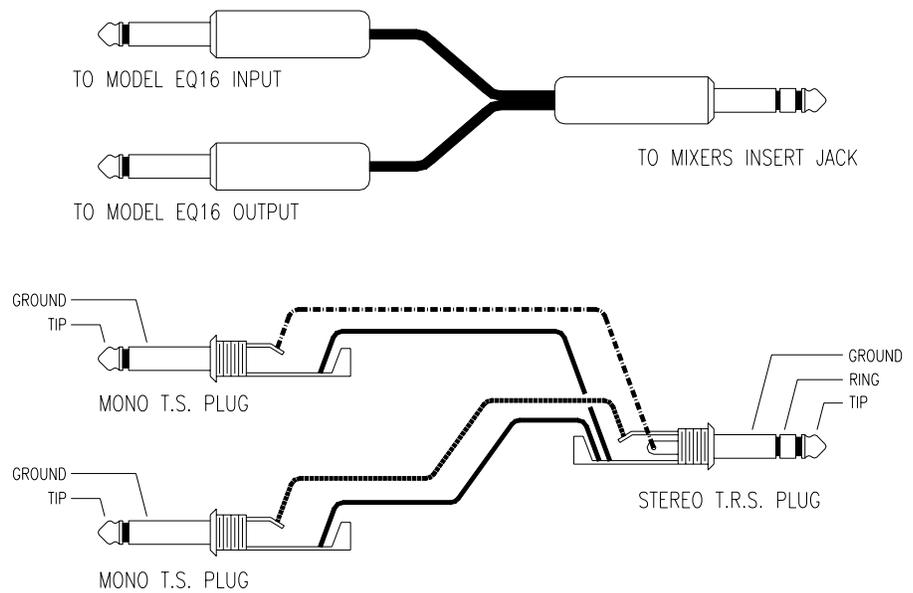


Figure 5. "Y" Cable schematic

When patch points are not available, such is the case with many smaller mixers, the source signal (synth/sampler or recorder) may be connected directly to the inputs of the EQ16. The outputs of the EQ16 would then be connected to the line inputs of the mixer.

It is recommended that interface cables be kept as short as possible and only high quality cable and connectors be considered.

Things that *cannot* be connected to the Model EQ16

Power amp speaker outputs, microphones, guitar pickups, phantom power supplies.

Interface to the Xtramix Mixer

There are no special requirements for installation and interface of the EQ16 to the Xtramix except to use reasonable care in the layout of the audio wires.

It is recommended that the EQ16 be installed directly above or below the Xtramix. This will allow you to keep the cable lengths short, thereby reducing the susceptibility to hums and buzzes caused by EMI emissions.

The EQ16 may be connected to virtually any signal path of the Xtramix. One choice is to connect any number of stereo synths into the stereo inputs of the Model EQ16-32 and the respective outputs of the EQ16-32 to the first 16 stereo inputs of the Xtramix. The following illustrations (Figure 6 and Figure 7) show two recommended methods of connecting the EQ16 to the Xtramix.

A balanced 1/4" TRS to 1/4" TRS audio cable is required for each "EQ Out" to "Xtramix In" connection to be made. If the EQ16-32 is used, it would require 32 cables for connection to the Xtramix.

The EQ16 may also be interfaced to the 8 subgroup patch points for overall equalization of the assign subgroups, or the effects returns for equalization of up to 8 stereo effects devices.

A special cable will be required if the EQ16 is interfaced to the subgroup insert jack. This cable should be wired with a stereo 1/4" TRS plug on one end, and (2) mono 1/4" TS plugs on the other ends (See figure 5a and 5b in chapter 3). The ring of the stereo plug is the subgroup insert output, this connects to the EQ input. The tip of the stereo plug is the subgroup return, this connects to the output of the EQ16.

A complete set of interface cables necessary to connect the Model EQ16 to the Xtramix are available from Speck Electronics.

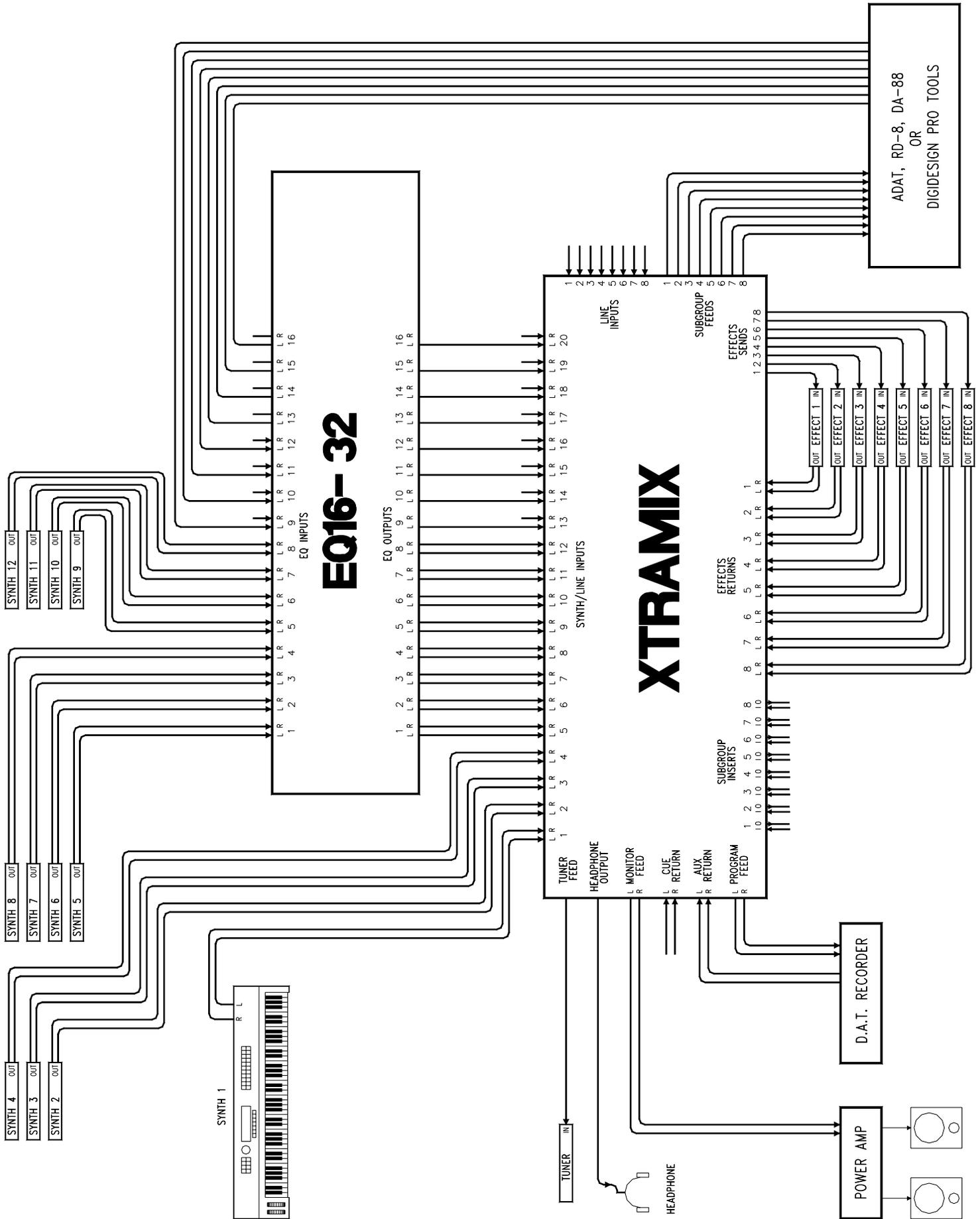


Figure 7. Speck Xtramix - Application #2

Operation

General

We hope to give you basic information on the operation of the Model EQ16 and adequately describe its controls, switches, and connectors.

The information in this manual is intended to help with the technical process when using your Model EQ16. Words alone could not adequately describe how to adjust the controls on the EQ16. Your ears should be your best gauge of how to adjust the frequencies to make the sound fit your requirements.

Basic Theory of Equalizers

A parametric equalizer falls into the generic category called filters. A filter is an electronic circuit that allows signals of certain frequencies to be transmitted through a system, while preventing the transmission of other frequency ranges.

There are 3 basic types of passive or active filters; low-pass, high-pass and bandpass.

Low-pass filter

A low-pass filter is a circuit that passes all low frequency signals and rejects high frequency signals. The crossover point that low frequencies pass through can be either fixed at a specific point or variable.

High-pass filter

A high-pass filter is a circuit that passes all high frequency signals and rejects low frequency signals. The crossover point that high frequencies pass through can be either fixed at a specific point or variable.

Bandpass filter

A bandpass filter is a circuit that will pass only a fixed frequency band and reject signals *above* and *below* the selected band. A parametric equalizer is a very elaborate bandpass filter that offers the ability to control the filter's basic parameters - hence the term "Parametric Equalizer". These controllable parameters are the bandpass center frequency, the amplitude of the bandpass frequency, and the width of the bandpass frequency. These previously mentioned parameters as found on audio parametric equalizers are commonly known as the sweep control, boost/cut control, and bandwidth (Q) adjust respectively.

The Model EQ16 utilizes 2 of the previously mentioned parametric controls; the frequency select control and boost/cut control. These controls are equally divided into 3 audio bands; low band: 50Hz to 500Hz, mid band: 500Hz to 5kHz, and the high band: 5kHz to 15kHz. The bandwidth on the EQ16 is adjusted automatically when the sweep control is adjusted.

FRONT PANEL CONTROLS

General

The Model EQ16 is available in two versions: The EQ16-16; 16 mono channels, and the EQ16-32; 16 stereo channels.

Each of the 16 channels of the Model EQ16-16 has a single signal path. Each of the 16 channels of the Model EQ16-32 has two independent signal paths for each channel and utilizes dual controls that simultaneously adjust the left and right parameters of that channel.

Any channel of the EQ16-32 stereo version may be utilized as mono channel by simply connecting to the left/mono input and left/mono output jacks.

Each channel of the EQ16 has 3 bands of semi-parametric equalization; Low, Mid and High bands. Each band has a frequency sweep control that is calibrated in frequency, and a boost/cut control that is calibrated in decibels. Each channel also has an EQ bypass switch and associated LED. When this switch is in the "out" position, the equalizer channel and all of its associated circuitry is totally bypassed. This should allow you to accurately compare your equalized signal to the original signal.

Frequency sweep controls

Each band is continuously sweepable from its lowest to its highest frequency; 50Hz to 500Hz for the low band, 500Hz to 5kHz for the mid band, and 5kHz to 15kHz for the high band. Once the desired frequency has been selected for any particular band (the center frequency), that frequency may be continuously accentuated or attenuated (boost or cut) from 0 to +15dB or -15dB.

Boost/cut controls

The boost/cut control provides a reciprocal adjustment of the selected frequency control. This means that whatever frequency is "boosted" with the boost/cut adjusted from its center position clockwise, an identical but opposite result is achieved when that same frequency selection is "cut" from its center position counterclockwise.

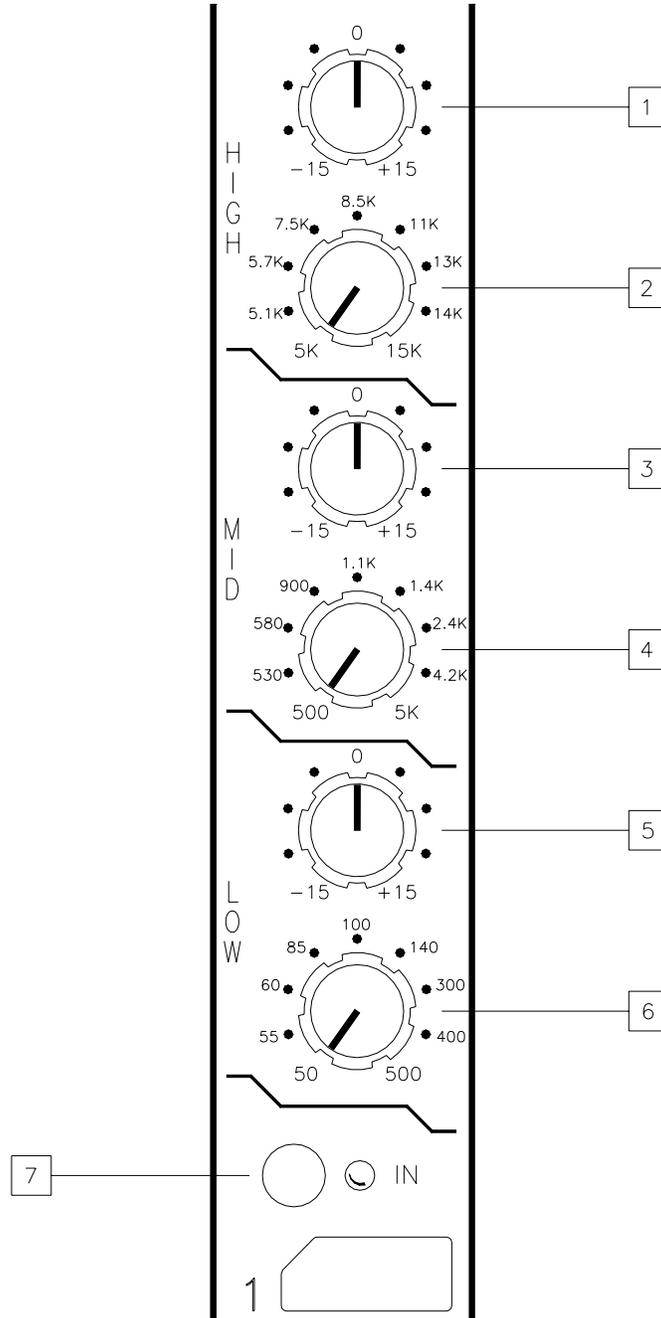


Figure 10. Equalizer Channel

Bandwidth (Q)

The bandwidth of the selected frequency is automatically adjusted with the selection of the frequency sweep control. The lowest setting on any band will result in a narrow bandwidth of approximately 11 dB/octave (Q = 3.3). As the frequency sweep control is adjusted to its highest setting (fully clockwise), the bandwidth widens to approximately 4 dB/octave (Q = .8).

Example: When the "mid band frequency sweep" control is set to its fully CCW position of 500Hz, the bandwidth is approximately 11dB/octave. Therefore, an octave above the 500Hz setting (1000Hz) and an octave below the 500Hz setting (250Hz) is affected 11dB less than its 500Hz center frequency when the "boost/cut" control is adjusted. This is considered a relatively narrow bandwidth.

When the "mid band frequency sweep" control is set to its fully CW position of 5kHz, the bandwidth is approximately 4dB/octave. Therefore, an octave above the 5kHz setting (10kHz) and an octave below the 5kHz setting (2.5kHz) is affected 4dB less than its 5KHz center frequency. This is considered a relatively wide bandwidth.

"Q" (Q factor) is another method of defining bandwidth and requires a small mathematical calculation. "Q" is the ratio between the selected center frequency and the -3dB down point bandwidth of that frequency.

formula:

$$Q = \text{Center Frequency} / \text{Bandwidth}$$

Refer to Figure 10 for location of items 1 thru 7.

1. High boost/cut

This control provides 15dB of bell shaped boost or cut for the high frequency range (5kHz to 15kHz), and is used in conjunction with the high frequency sweep adjust (see item 2). 0dB boost/cut (flat) is obtained when this control is set to its center position.

2. High frequency sweep

The high frequency sweep control is used in conjunction with the high boost/cut control and provides continuous adjustment from 5kHz (fully counterclockwise) to 15kHz (fully clockwise).

In addition to the ability to contour high band audio, the high band controls can reduce hiss that is present on low frequency information. If there is high frequency hiss or digital noise on a kick drum or bass track, the high sweep control may be set to its highest clockwise setting (15kHz) and its associated boost/cut control "cut" a few dB's.

As long as you don't dramatically change the sound of the low frequency audio, this could remove a little noise. Every little bit improves the overall quality of your sound.

3. Mid boost/cut This control provides 15dB of bell shaped boost or cut for the mid band (500Hz to 5kHz) frequency range, and is used in conjunction with the high frequency sweep adjust (see item 4). 0dB boost/cut (flat) is obtained when this control is set to its center position.

4. Mid frequency sweep The mid frequency sweep control is used in conjunction with the high boost/cut control and provides continuous adjustment from 500Hz (fully counterclockwise) to 5kHz (fully clockwise).

5. Low boost/cut This control provides 15dB of bell shaped boost or cut for the low band (50Hz to 500Hz) frequency range, and is used in conjunction with the low frequency sweep adjust (see item 6). 0dB boost/cut (flat) is obtained when this control is set to its center position.

6. Low frequency sweep The low frequency sweep control is used in conjunction with the low boost/cut control and provides continuous adjustment from 50Hz (fully counterclockwise) to 500Hz (fully clockwise).

In addition to the ability to contour low band audio, the low frequency controls may be used to reduce or eliminate low frequency hum or buzz. Low hum is typically 60Hz, whereas buzz is typically 120Hz. If there is a hum or buzz on an audio track, the low sweep control and associated boost/cut control can be used to remove this.

To reduce 60Hz hum, start by setting the low frequency sweep control to its fully counterclockwise (CCW) position; this is about 50Hz. Turn the Boost/Cut control fully CCW. Return to the frequency sweep control, and turn clockwise a little until the 60Hz hum has been reduced. This setting is the 60Hz point. Now go back to the Boost/Cut control and adjust as necessary.

In some extreme cases, it may be necessary to use 2 channels of equalization in order to remove the undesirable affects of 60Hz or 120Hz hum.

7. Equalizer bypass switch This switch is used to enable or disable the equalization channel. In the out position the equalizer channel is totally bypassed. When this switch is depressed, the equalizer is inserted in the channel's audio path.

The green LED to the right of this switch illuminates indicating that the equalizer has been inserted into the channels audio path.

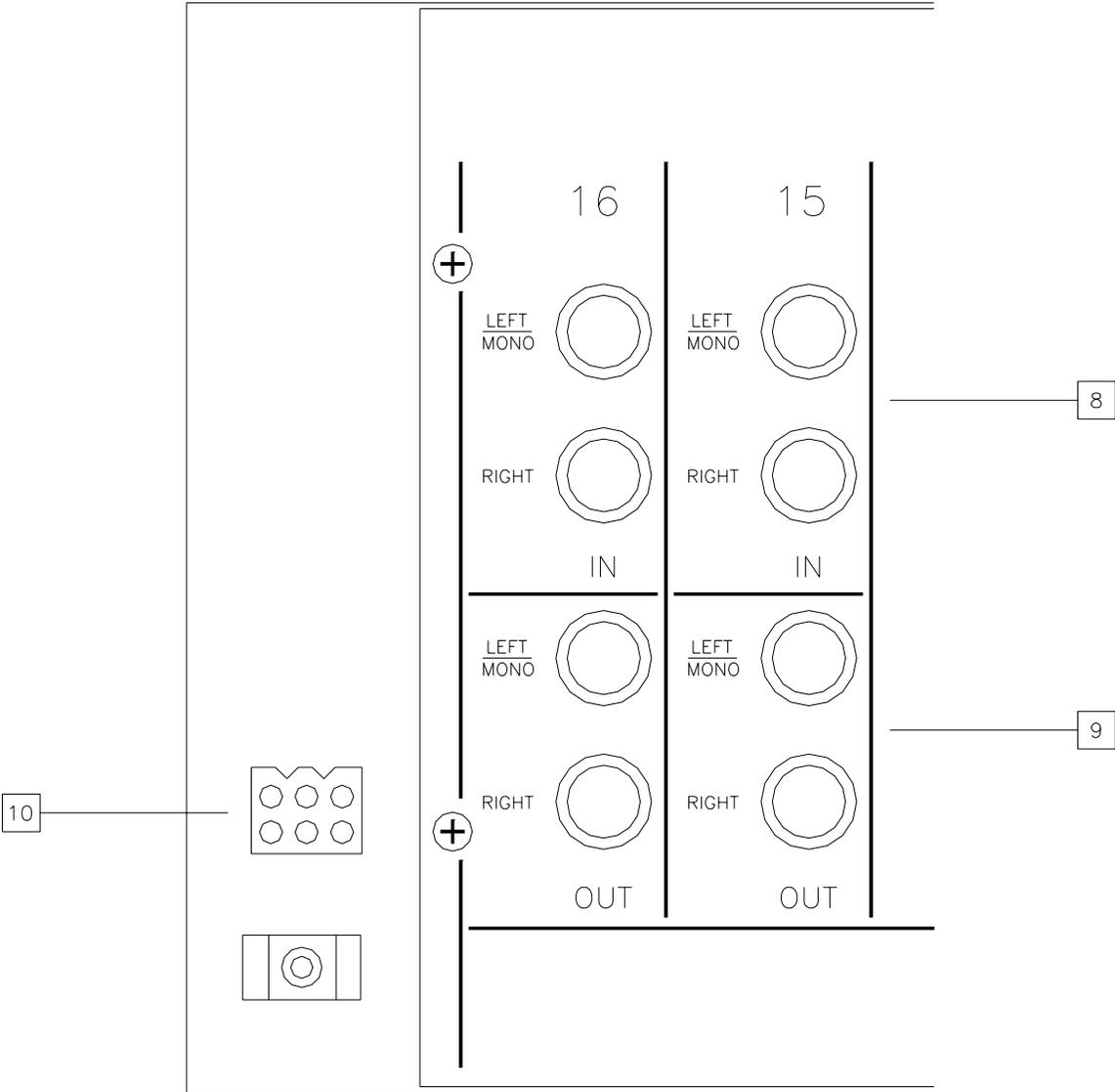


Figure 11. Equalizer Rear Panel

REAR PANEL

Refer to Figure 11 for location of items 8 thru 10.

General The Model EQ16 is available in two versions: The EQ16-16; 16 mono channels, and the EQ16-32; 16 stereo channels. Each channel of the EQ16-16 has two jacks; one input and one output. Each channel of the EQ16-32 has four jacks; left and right inputs jacks and left and right outputs jacks.

Any channel of the EQ16-32 stereo version may be utilized as mono channel by simply connecting to the left/mono input and left/mono output jacks.

8. Input jack(s) This input utilizes standard 1/4" Tip, Ring, Sleeve (TRS) balanced jacks. If you have the EQ16-16, there is a single input jack. If you have the EQ16-32, there are left and right input jacks.

Typically, this input is used to connect the output of a source signal. This output source could be synths, samplers, tape outputs, or any line level output signal. This jack could also be used in conjunction with the output jack (see item 9) and a "Y" type cable to connect to a mixer's channel insert jack (See "Y" Cable in Figure 5).

9. Output jack(s) This output utilizes a standard 1/4" Tip, Ring, Sleeve (TRS) balanced jack. If you have the EQ16-16, there is a single output jack. If you have the EQ16-32, there are left and right output jacks.

Typically, this output will be used to connect to the input of another line level audio device. This device could be the line inputs or effect returns of a mixer, the inputs of a tape recorder, the inputs of a sampler or any line level input. This jack could also be used in conjunction with the input jack (see item 8) and a "Y" type cable to connect to a mixer's insert jack (See "Y" Cable in Figure 5).

10. Power supply connector This connector will accommodate the 6 pin square plug of the power supply cable. This connector and respective plug are keyed so they will fit in only one direction. For installation instructions refer to "Connecting the Power Supply" as described in Chapter 3.

Headroom and Boost/Cut

When using the EQ16 it is important to understand the relationship between the maximum input level, the maximum output level, and the boost/cut controls. The maximum input level for the EQ16 is +28 dBu, and the maximum output is +28 dBu. The EQ16 can not exceed these maximum input or output levels without incurring distortion. The equalizer channels do not have any gain, so any signal that goes in will come out at the same level.

When interfaced to professional audio equipment that produces a nominal level of +4 dBm for a 0 VU indication, the Model EQ16 has a headroom margin of 24 dB.

formula:

$$+28 \text{ dB max output } \textit{minus} \text{ } +4 \text{ dB} = 24 \text{ dB of headroom}$$

The margin of headroom for the above examples apply only when the boost/cut controls on all three bands are set flat (0 center position).

When any boost/cut or any combination of boost/cut are "boosted", the margin of headroom is decreased. When any boost/cut or any combination of boost/cut are cut, the margin of headroom is increased. The preceding statements only apply to the frequency(s) that have been selected with the respective frequency sweep controls. When the EQ bypass switch is disabled, the maximum output of the EQ16 is only limited by the maximum output of your device.

For the sake of the following discussion, only "boosting" the boost/cut controls will be discussed since "cutting" on any band or combination of bands can only increase the headroom margin for its respective channels.

Boost/Cut

The boost/cut controls can be thought of as a gain increase or decrease control for the specific frequency(s) that have been selected. For example, if your signal had a low frequency signal content and this signal was boosted 12 dB, this would leave you 12 dB of headroom for that low frequency signal before the output would clip or cause distortion.

formula:

$$+4\text{dBu reference level } \textit{plus} \text{ } 12 \text{ dB boost } \textit{minus} \text{ } 28 \text{ dBu maximum output} = 12 \text{ dB headroom.}$$

Although 12 dB of headroom is not much, it still will result in a clean undistorted signal.

If the headroom is exceeded, it will be necessary to either reduce the amount of "boost" and/or reduce the input level. Reducing the level to the equalizer channel is usually the preferable option.

When the channels of the Model EQ16 are connected to a mixer's insert points, the level to the input of the EQ16 is adjusted by the controls of the mixer's input channel. When equalization is accentuated as part of an integrated mixing system, it is reflected as an increase of level on the mixer's input channels, buss outputs, and stereo outputs and ultimately on the VU meters. Be aware of these level increases when using the EQ16 with your mixer.

Wiring and Other

General

It is assumed that in addition to the Model EQ16, a considerable investment has been made in electronic equipment such as a mixer, synthesizers, samplers, effects, and computers. We believe that the overall performance of the EQ16 and your mixing system is dependent on the condition and quality of this equipment.

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 Speck product.

Start simple

A quality installation is essential when wiring any Speck product. When the time comes to actually interconnect your equipment, proceed slowly. Interfacing the many pieces of electronic equipment to your Model EQ16 and mixer should be a logical, methodical process.

Start by connecting your headphones or monitor power amp, and then add one 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.

Audio Cable

Due to the high performance of the Model EQ16, 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 EQ16 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.

Multipair wire harnesses

When multiple cables are necessary (which is generally the case with our products), multipair cable should be considered as an alternative to individual cables. Multipair cable and harnesses are generally available in 4, 8, 12, 16, 24, and 32 pair.

Connectors

All wire and cable interfaced to the EQ16 and Speck products 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.

Speck Electronics offers a complete line of interface cables for the project studio. Contact Speck or your dealer for information on these cables.

Proper AC Grounding

When you are evaluating voltage and current requirements for your audio system, it is important that your EQ16 equalizer and/or rack 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 rack 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.

CAUTION!

DO NOT REMOVE, DEFEAT, OR DISABLE THE SAFETY EARTH TERMINAL ON THE POWER CORD. DO NOT USE A GROUND LIFT ON THE POWER SUPPLY.

Clock noise and AC

Clock noise is one of the greatest enemies of the audio racks AC system. If a synth or any microprocessor based device 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 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 (or whatever voltage is common to your country) 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.

Electronics 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 Audio Grounding and Shielding

In order for any audio signal, such as a synth signal to get from the synth to the mixer, it 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 modern digital based recording system should be of great concern and not overlooked when installing the Model EQ16. EMI is defined as any unwanted signal which adversely affects the operation of the EQ16 or mixing 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 an equipment rack, the higher the EMI emissions. The more audio cable and low level audio equipment that exists within the same rack, 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 synths and samplers, and magnetic field sources from transformers and power supplies.