Model 770

Model 770 Audio Mixer/IFB Controller

User Guide

Issue 1, October 1997

This User Guide is applicable for serial numbers SN-00151 and later.

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Foreword

It was a great pleasure to have had the chance to design the Model 770, a unique product for a specialized application. Our goal was to take a set of requirements that were essentially at odds with each other and combine them into a rational product. We had to make the Model 770 meet a highly specific application, be flexible to configure and use, be feature-rich yet easy to operate, have good sonic performance, with everything combined in a compact and reliable package.

Many broadcast professionals contributed their time, expertise, and good ideas to help shape the Model 770. Without their help the unit would definitely not be as "tweaked out" as it is. A hearty thanks to all of you!

Many people at Studio Technologies contributed toward making the Model 770 a reality. Fred Roeck did the mechanical design and prepared the production documentation. Carrie Loving designed the graphics and provided engineering CAD support. Al Lux designed the printed circuit boards. Mitch Budniak, Ace Consulting Engineer, designed the power supply and did several overall "reality" reviews. Joe Urbanczyk designed the computerized test routines for the Audio Precision System One and worked on agency approvals. Larry Leviton wrote the software that drives the itty-bitty micro-controller in the telco interface section—all in a few hundred bytes of C! Minas Serbekian and his crew built the prototype units, ensuring that the final design was "manufacturable."

Please contact me with your questions, comments, and suggestions. I can be reached by voice at (847) 676-9177, fax at (847) 982-0747, or via E-mail at gkapes@studio-tech.com.

Sincerely,

Gordon Kapes
President

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Model 770

Introduction

Now for the first time mobile broadcast applications can have both an audio mixer and an IFB controller in one compact, highly integrated package. Designed expressly for electronic-news-gathering (ENG) vehicles, the Model 770 doesn't sacrifice features and performance to achieve its two rack-space size. Using its experience in "on-air" and IFB audio, Studio Technologies was able to design a product that has an extensive set of features to meet the special needs of fast-paced news-gathering operations, while maintaining excellent overall audio performance.

The Model 770 consists of three main sections: mixer, IFB, and monitor. Each section performs in a manner which meets or exceeds those provided by "stand alone" products. In addition, by integrating audio mixer and IFB functions into one unit, capabilities are provided that have previously been unavailable.

What This User Guide Covers

This User Guide is designed to assist you when installing, configuring, and using the Model 770 Audio Mixer/IFB Controller. A limited amount of background technical information is also provided. A packet containing Model 770 schematic diagrams is not shipped with each Model 770, but is available from the factory upon request.
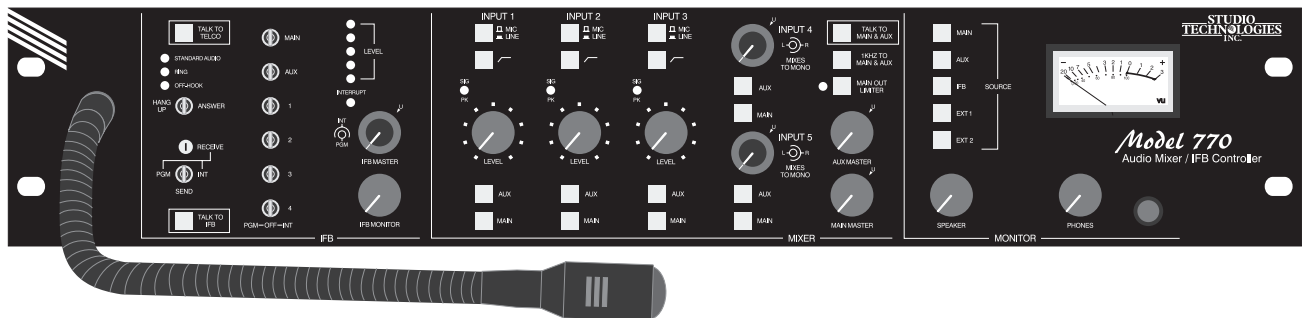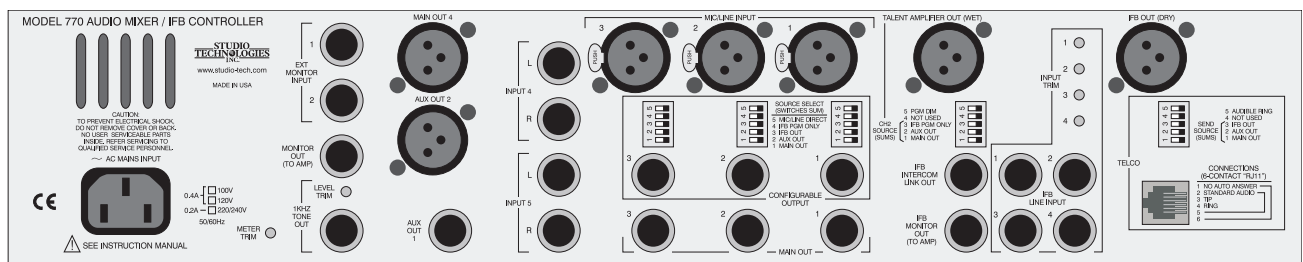

Figure 1. View of Model 770 Front Panel

Figure 2. View of Model 770 Back Panel

System Features

Mixer Section

Mic/Line Inputs

Three transformer-coupled input channels are provided for connection to microphone or line-level signals. The circuitry is "ruggedized" for reliability under tough operating conditions. Features provided for each input channel include selectable input sensitivity, low-cut filter, and level control. For operator assistance, a bi-color LED provides signal present and peak level indication. Two push-button switches control the routing of the input signal to the main and auxiliary (AUX) audio buses. For convenience the three mic/line input sensitivity buttons, like all the Model 770's operator controls, are located on the front panel.

Stereo Line Inputs

Two stereo line-level input channels are provided and are intended for connection with audio signals associated with video playback. To support "real world" broadcast applications the stereo inputs automatically mix, using individual level controls, to monaural. Two buttons are part of each input channel, controlling the routing of the signals to the main and AUX audio buses.

Main Output

Signals from the mic/line and stereo line input channels combine to create a monaural signal, called the main output bus. A studio-quality, limiter/compressor circuit is provided to control the dynamic range of the main audio bus. Far from a simple "clipper," the limiter/compressor circuit utilizes a sophisticated laser-trimmed

voltage-controlled amplifier (VCA) integrated circuit for quiet, low-distortion operation. For installation flexibility, four output circuits provide access to the main bus: three are electronically balanced; the fourth is transformer-balanced.

AUX Output

The Model 770 provides a second monaural audio bus. The AUX bus allows special applications to be easily supported, such as creating a "mix-minus" feed or serving as a second output for on-air use. Signals from the mic/line and stereo line input channels section can be assigned to the AUX bus. Access to the AUX bus is provided by means of one electronically balanced and one transformer-balanced output.

Configurable Outputs

Three monaural, electronically balanced, line-level outputs are provided and can serve in a wide range of installation-specific applications. DIP switches, located on the back panel, are used to select from the five available signal sources: main output, AUX output, IFB output, IFB program only output, and mic/line input channel direct. The DIP switches can be set to provide additional outputs, create a summed output from the sources, or to provide direct outputs from the mic/line input channels.

IFB Section

The IFB section provides an extensive set of resources to create and maintain one channel of excellent-quality IFB audio. A full set of controls and indicators make operation fast and simple. A front-panel-mounted gooseneck microphone allows an operator to make "local" interrupts. IFB

audio level is displayed by a 5-segment LED meter, while interrupt activity is displayed by an LED indicator.

Unique to the Model 770 is the ability to use each of the IFB section's seven possible audio sources as a program or an interrupt source. A voice-operated (VOX) circuit monitors the interrupt bus for signal activity. Whenever a signal meets the requisite parameters, it is connected to the IFB output. Using a carefully designed fast-attack/slow-release circuit results in very good interrupt audio performance. Whenever interrupt is active, the program source can be configured to either fully mute, or be reduced in level ("dimmed") by 10dB. While a full mute is normally desired, the "dim" mode can serve special applications, such as sports events.

The IFB section doesn't take a "back seat" when it comes to audio quality. Sophisticated "ramping" analog switches are used to ensure "click-free" audio. Studio-quality limiter/compressor circuits serve the interrupt audio signal and the gooseneck microphone. These circuits help to minimize level variations, making talent cues more intelligible and reducing the risk of abnormally high signal levels from reaching the talent's ears.

Audio Sources

Seven audio signals can be selected to serve as IFB program or interrupt sources: the mixer section's main and AUX bus, four external line-level inputs, and an internal telephone interface. More than one input can be simultaneously selected to create a mix of signals for program or interrupt audio. Without external patching or connections, the Model 770's main and AUX audio buses can be directly assigned as program or interrupt sources. Four

external line-level inputs allow a variety of audio sources to be connected. For assistance during installation, input level trim pots, located on the back panel, allow the nominal "+4" input level to be adjusted over a ±8dB range.

Telephone Interface

The Model 770 contains a telephone interface that, using an 8-bit micro-controller integrated circuit, is powerful yet simple to use. Overall, the telephone interface is designed to receive audio signals for use by the IFB section, or to send out audio from the IFB or mixer sections. A front-panel switch selects if receive audio will serve as a program or interrupt source, or if the telco interface will send audio. The receive level of the telephone interface is adjustable using a trim pot located on the front panel. DIP switches, located on the back panel, allow the selection of main bus, AUX bus, or IFB audio as the send source. For operator assistance, a push-button switch allows voice signals from the gooseneck microphone to be sent out the telephone interface. This "talk-to-telco" function is extremely useful, especially when an IFB connection is initially being established with a remote facility.

The telephone interface is unique in that it allows two very different telephone "lines" to be correctly interfaced, meeting the needs of contemporary installations. The two operating modes make the interface compatible with telephone lines or standard audio signals. When set to the telco mode, the interface is compatible with 2-wire loop-start DC-biased ("wet") tip-and-ring circuits. When set to the standard audio mode, the interface is directly compatible with audio signals provided by many cellular or satellite telephones.

Becoming increasingly common for use in IFB applications, these telephones often don't provide a "wet" interface, but do exhibit the audio levels of a conventional telephone line.

When the interface is set to the telco mode, full loop current monitoring and control is implemented. A front-panel switch allows the telephone line to be seized (answered) or disconnected (hung up). The interface will automatically hang up if a telephone-company-provided disconnect signal is received. An audible signal and LED indicator are active whenever "ringing" voltage is present. An auto-answer function is also provided.

When the interface is set to the standard audio mode, the loop-current-specific features are disabled, and the interface operates as a transformer-coupled balanced audio input. The input level sensitivity is optimized for use with telephone-type audio signals.

IFB Outputs

The IFB section contains four outputs: talent amplifier, line, intercom link, and monitor. The talent amplifier output is a "wet" output that supports the connection of belt pack modules from Studio Technologies. A single XLR-type cable links the talent amplifier output with up to four Model 32 or Model 33 Talent Amplifiers. The talent amplifier output provides DC power, along with two audio channels. The first audio channel provides IFB audio, while the second is configurable. Using DIP switches, located on the back panel, three audio sources are available: the mixer section's main and AUX bus, and IFB program only. This allows a broad range of applications to be supported.

The line output is transformer coupled, with a nominal level of +4dBu. Well protected from damage due to externally generated signals, it is suitable for connection to devices remote from the Model 770. The intercom link output allows the direct connection of IFB audio into broadcast intercom systems. The output impedance and signal level was carefully designed to eliminate the need for external "pads," isolation resistors, or blocking capacitors.

While the Model 770's monitor section allows switch-selectable monitoring of the IFB signal, for efficient broadcast operation it is often imperative that the IFB signal be monitored continuously. This is why the IFB section provides a separate line-level monitor output and associated level control. With this output, the operator can have a monitor loudspeaker dedicated exclusively to IFB.

Monitor Section

The Model 770's monitor section provides separate outputs, along with an associated level control, to allow connection of a monitor amplifier and headphones. In addition to monitoring the main, AUX, and IFB audio buses, provision has been made for monitoring two external audio sources. These monaural inputs are intended to be connected to off-air, microwave, or satellite receivers.

Multiple sources can be simultaneously selected for monitoring. This can prove useful by allowing, for example, an operator to simultaneously monitor a local mix and an externally provided mix-minus signal.

A mechanical VU-type meter provides a "user-friendly" indication of audio-signal

levels. Fanatics for addressing the details, Studio Technologies has even eliminated the issue of burned-out meter-scale illumination by implementing a solid-state, LED-based lighting scheme.

A 1kHz sine-wave signal is provided for alignment and reference use. While the 1kHz tone can be assigned to the main and AUX output buses, a direct line-level output is also provided. This allows the 1kHz tone to be used as a setup or test signal without interfering with normal operation of the main and AUX audio buses.

Talk Back

The Model 770 includes a "talk back" function. A push-button switch allows audio from the gooseneck microphone to be routed to the main and AUX outputs.

Mounting, Connectors, and Mains Power

While the Model 770 is loaded with features, it only requires two spaces in a standard 19-inch rack. XLR-type and ¼-inch 3-conductor audio connectors are used for audio interconnection. A standard modular (RJ11) telephone jack is used by the telco interface. Mains power is factory configured for 100, 120, or 220/240V, 50/60Hz.

Installation

In this section you will be installing the Model 770 Audio Mixer/IFB Controller in an equipment rack. Input and output connections for the mixer, IFB, and monitor sections will be made using the Model 770's multitude of jacks. AC mains power will then be connected.

During normal operation, no access to the back panel of the Model 770 is required. However, there are six trim potentiometers that may need to be adjusted prior to the Model 770 going into service. Refer to the Configuration section of this guide for details.

Locating the Unit

Physical access and mechanical noise are the primary factors when choosing a mounting location. By its very nature as an audio mixer and IFB controller, an operator will need easy access to all the controls and the gooseneck microphone. The gooseneck microphone is located on the left side of the front panel so be careful that there isn't a cooling fan blowing directly onto it. Also, a good sight line to the VU meter, located on the right side of the front panel, is important.

As a device that contains high gain audio stages, hum and noise pickup is possible through the chassis and associated cabling. Locating the unit away from devices that radiate strong AC fields is an excellent idea.

While not likely, it is possible that the Model 770's toroidal power transformer may radiate energy into adjacent equipment. It is located at the right, bottom rear corner of the unit, and may need to be physically isolated from sensitive equipment, especially videotape recorders.

Mounting

The Model 770 is intended for mounting in a standard 19-inch equipment rack, requiring 3.5 inches vertically (two standard rack spaces). It weights approximately 13.5 pounds (6.1kg), and operates on mains power of 100, 120, or 200/240V, 50/60Hz.

The unit is secured to the front mounting rails of an equipment rack using two mounting screws per side.

Connections

The Model 770's input, output, and telco connections are made using 3-pin XLR-type male and female connectors, ¼-inch 3-conductor phone jacks, and one 6-position modular telephone-type jack.

> **Caution:** For reliable audio interconnection, the phone plugs you use must comply with industry-standard RS-453. Switchcraft No. 297 or Neutrik NP3C are highly recommended.

Mixer Section

Mic/Line Inputs

The Model 770 contains three input channels that are compatible with microphone or line-level sources. Each of the three Mic/Line inputs use a single 3-pin female XLR-type connector. Prepare the mating connectors (males) so that pin 2 is signal high (+ or hot), pin 3 is low (– or cold), and pin 1 is shield.

It is expected that the mic/line inputs will be wired to an input/output connector panel located on the side or rear of the vehicle. It's also nice to have one or two of the inputs "multed" to connectors inside the vehicle, allowing the rapid connection of microphone or line-level signals. To minimize noise and other problems, it is recommended that the mic/line signals are not wired by way of points on an audio patch bay.

Stereo Line Inputs

The Model 770 contains two stereo line-level input channels. They are intended for connection to sources located within the vehicle, specifically the audio output channels of videotape machines. Note that the left and right inputs associated with the stereo line inputs are always mixed, by way of level controls, to monaural. The electronically balanced input circuitry has extremely low noise and high common-mode rejection, but no extra protection from overvoltage or static. (Don't get us wrong—the stereo line input circuitry is better than what's found on most audio mixers available today—they're just not as "tough" as the mic/line inputs!) The stereo line input circuitry is intended for connection to balanced or unbalanced, line-level signals with a nominal operating level of +4dBu.

Each stereo line input channel uses two ¼-inch 3-conductor phone jacks. Prepare the mating connectors (plugs) so that tip is signal high (+ or hot), ring is low (– or cold), and sleeve is shield. With an unbalanced source connect the tip to high (+ or hot), and both the ring and sleeve to shield. If connecting to an unbalanced source in this manner results in hum or noise, connect tip to high (+ or hot) and ring to shield; leave the sleeve unterminated. For flexibility of use it is recommended that the stereo line input connections be routed through points on a patch bay.

Main Outputs—General Information

The Model 770 contains four outputs associated with the main audio bus. Main Outputs 1, 2, and 3 are electronically balanced, have a nominal level of +4dBu, and are capable of driving balanced or unbalanced loads of 600 ohms or greater.

Note: While the electronically balanced output circuits are capable of driving loads of 600 ohms or greater, the output level will drop slightly as the load impedance approaches 600 ohms. A 0.5dB difference in output level can be expected as the load impedance changes from 10k ohms to 600 ohms. This applies to all of the electronically balanced output circuits provided on the Model 770.

Main Output 4 is transformer balanced, with a nominal level of +4dBu. It is capable of driving full level into a balanced or unbalanced load of 2k ohms or greater.

Main Outputs 1, 2, and 3

Main Outputs 1, 2, and 3 are intended for connection only to devices located within the vehicle. It is recommended that either Main Output 1, 2, or 3 be used as the "on-air" source. Each output utilizes a ¼-inch 3-conductor phone jack for interconnection. Prepare the mating connectors (plugs) so that tip is signal high (+ or hot), ring is low (− or cold), and sleeve is shield. Whether these outputs are wired via a patch bay will depend on the specific installation.

While balanced operation is preferred, unbalanced operation is not a problem for the output circuitry. To connect to an unbalanced load connect the tip to high (+ or hot), and both the ring and sleeve to shield. For optimal unbalanced operation, it is important to connect both ring and sleeve together directly on the plug that mates with the Model 770, and not at the other end of the cable.

Main Output 4

Main Output 4 has been optimized for connection to devices located external to the vehicle. This "ruggedized," transformer-coupled output has a nominal level of +4dBu. A 3-pin male XLR-type connector is used for interconnection. Prepare the mating connector (female) so that pin 2 is high (+ or hot), pin 3 is low (− or cold), and pin 1 is shield. It is recommended that Main Output 4 be wired, via a patch bay, to the vehicle's input/output connector panel.

Main Output 4 was specifically designed to provide a fully isolated output with good sonic performance. It was NOT designed to drive full level into 600 ohm loads! While a 600 ohm load can be connected without damage, a 2dB level drop should be expected. Used with 2k ohm or greater loads, Main Output 4 will provide its full specified performance.

AUX Outputs—General Information

The Model 770 contains two outputs associated with the AUX audio bus. AUX Output 1 is electronically balanced, has a nominal level of +4dBu, and is capable of driving balanced or unbalanced loads of 600 ohms or greater. AUX Output 2 is transformer balanced, with a nominal level of +4dBu. It is capable of driving full level into a balanced or unbalanced load of 2k ohms or greater.

AUX Output 1

AUX Output 1 is intended for connection to devices located only within the vehicle. The output utilizes a ¼-inch 3-conductor phone jack for interconnection. Prepare the mating connector (plug) so that tip is signal high (+ or hot), ring is low (− or cold), and sleeve is shield. This output

should be wired via a patch bay to allow ready access.

While balanced operation is preferred, unbalanced operation is not a problem for the output circuit. To connect to an unbalanced load connect the tip to high (+ or hot), and both the ring and sleeve to shield. For optimal unbalanced operation, it is important to connect both the ring and sleeve together directly on the plug that mates with the Model 770, and not at the other end of the cable.

AUX Output 2

AUX Output 2 has been optimized for connection to devices located external to the vehicle. This "ruggedized," trans-former-coupled output has a nominal level of +4dBu. A 3-pin male XLR-type connector is used for interconnection. Prepare the mating connector (female) so that pin 2 is high (+ or hot), pin 3 is low (− or cold), and pin 1 is shield. It is recommended that AUX Output 2 be wired, via a patch bay, to the vehicle's input/output connector panel.

AUX Output 2 was specifically designed to provide a fully isolated output with good sonic performance. It was NOT designed to drive full level into 600 ohm loads! While a 600 ohm load can be connected without damage, a 2dB level drop should be expected. Used with 2k ohm or greater loads, AUX Output 2 will provide its full specified performance.

Configurable Outputs

Each of the three configurable outputs is electronically balanced, has a nominal level of +4dBu, and is capable of driving balanced or unbalanced loads of 600 ohms or greater. The outputs are intended for connection to devices located only

within the vehicle. DIP switches are associated with each configurable output. Details on using these switches can be found in the Configuration section of this guide.

Each of the configurable outputs is accessible via a ¼-inch 3-conductor phone jack. Prepare the mating connectors (plugs) so that tip is signal high (+ or hot), ring is low (− or cold), and sleeve is shield. To connect to an unbalanced load connect the tip to high (+ or hot), and both the ring and sleeve to shield.

It is highly recommended that the configurable outputs be routed via a patch bay. Or, if there are no immediate needs for these outputs, be certain to terminate them on a patch bay for future use.

IFB Section

IFB Line Inputs

The Model 770's IFB section allows four line-level audio sources to be connected. These sources can serve as program or interrupt audio signals, their function being selectable by the operator using front-panel controls. The direct-coupled, electronically balanced input circuitry is intended for connection to sources located within the vehicle. The nominal input level is +4dBu, but a trim potentiometer associated with each input gives a ±8dB input sensitivity range. The Configuration section of this guide has details on using the trim pots.

Each of the four IFB line inputs use a ¼-inch 3-conductor phone jack for interconnection. Prepare the mating connectors (plugs) so that tip is signal high (+ or hot), ring is low (− or cold), and sleeve is shield. With an unbalanced source connect the plug's tip to high (+ or hot), and

both the ring and sleeve to shield. If connecting to an unbalanced source in this manner results in hum or noise, connect tip to high (+ or hot), and ring to shield; leave the sleeve unterminated. For flexibility it is recommended that at least one of the IFB line input connections be routed through a patch bay.

Telephone Interface

The Model 770's IFB section contains a sophisticated telephone interface which allows connection to a telephone line or standard audio signal. Using the telco interface, an audio signal can be brought in for use as a program or interrupt source. The telco interface can also be used to send out audio signals. We define a telephone line as a signal having a DC bias current associated with it. This type of signal is sometimes referred to as "wet." We define a standard audio signal as one that is isolated from any source of DC voltage; sometimes being referred to as a "dry" signal. While this sounds confusing, contemporary applications sometimes refer to both types of signals as "telco." To a large production vehicle that pulls up to do a two-week golf tournament, a telco line is "wet," being provided by the local telephone company on an RJ11 jack. To a mobile ENG vehicle, a telco signal might come from a cellular or satellite telephone which often provides a "dry" audio signal.

A unique means of interfacing signals to the telco interface is utilized. While most people would consider that the Model 770 has an RJ11 jack on its back panel, it's actually a 6-position modular jack with all 6 positions used for electrical connections; two are used to connect to the telephone line or standard audio signal, two to select telco or standard audio mode, and two to

defeat the auto-answer function. This connection method wasn't selected to make life difficult, but to allow a range of signal types to be connected to the telco interface, while simultaneously having the interface's operating mode automatically selected. This eliminates the need for operating mode selection switches from being located on the front or back panel. The next paragraphs detail how this works.

To show you "where we're coming from," it may be helpful to provide some background information on what most people refer to as an "RJ11" jack. The term RJ comes from the connection section of Part 68 of the United States' FCC rules, created in the late 1970's. A number of RJ-types are specified, including RJ11, as well as others such as RJ12, RJ21, and RJ48. The different RJ-types specify in great detail the authorized mechanical and electrical means for telephone companies to provide service to customers. The well-known RJ11 actually refers to an analog telephone line's tip and ring connections being terminated on pins 3 and 4 of a 6-position modular jack; pins 1, 2, 5, and 6 are not utilized and do not have to be physically present. So the physical telephone-type jack that most people refer to as an RJ11 is really just a 6-position device with an unspecified number of contacts inserted. Our discussion ends with this fact: The jack used by the Model 770's telco interface is similar to an RJ11, but uses all 6-positions for connections.

To access all the functions of the Model 770 telco interface requires a 6-conductor modular jack and cord. But most "real world" telephone jacks and interconnecting cords have only two or four of the six positions implemented. For this reason a

6-conductor jack, along with a 6-conductor cord, is included with each Model 770. (However, the reality is that in most Model 770 applications, access to four of the six contacts in the interface's jack is sufficient. Using a 4-conductor jack and cable will provide access to the telco/standard input and the wet/standard audio mode select function. The last two contacts in the telco interface's 6-conductor jack allows the auto-answer function to be disabled, a condition that is less frequently required.)

Now down to the "nitty gritty" of making connections! A 6-position modular jack is most often organized as three pairs. We'll use this terminology in our explanation. Pair 1, pins 3 and 4, of the 6-position modular jack are used to connect to the telco or standard audio signal. Pair 2, pins 2 and 5, of the jack are used to control the input mode; shorting pins 2 and 5 together places the telco interface in the standard audio mode. Pair 3, pins 1 and 6, of the jack are used to control the auto-answer mode; shorting pins 1 and 6 together causes the interface not to automatically "answer" when a ringing telephone-line signal is present. A typical 6-position modular jack will have the following terminal colors:

Pin No.	Wire Color	Alternate Color
1	White	W-GN
2	Black	W-OR
3	Red	BL-W
4	Green	W-BL
5	Yellow	OR-W
6	Blue	GN-W

The question that you may be rightfully thinking is: Why doesn't the Model 770 simply have switches to select between telco and standard audio mode, and to defeat the auto answer function? This

would be adequate if only one source was going to be connected to the telco interface, but that's not the reality for most broadcast settings. A number of "telco" signals may be available in a single vehicle, each requiring the ability to be connected to the Model 770's telco interface at a moments notice. By terminating these various signals onto 6-position modular jacks, or a modular-jack patch panel, they can be quickly "patched" into the Model 770's telco interface. By connecting jumper wires across pins 2 & 5 and 1 & 6 of the source jacks as required, the telco interface will automatically configure to the correct operating mode as that source is connected.

> If you are going to use a modular-jack patch panel, be careful to select one that has all six contacts available in each jack—many will only provide access to two or four.

When selecting your "telco" sources it may be useful to review the characteristics of the Model 770's telco interface. When set to the telephone-line mode, a DC-biased signal (often –48V), with high-voltage ringing, is expected to be connected. The telco interface is transformer-isolated, and very well protected from damage due to static and transients. It has a nominal audio impedance of 600 ohms to match the requirements of a normal telephone line. When set to the standard audio mode, no DC ringing voltage is expected. Transformer-coupling is still present, as is the 600 ohm impedance. The receive and transmit audio levels are still matched to the requirements of telephone devices, not the much "hotter" +4dBu professional audio level!

An input audio signal is expected to be in the range of –15dBu nominal.

In this paragraph we'll provide examples of two hypothetical sources, and how they might be connected to the Model 770's telco interface. The first source is a signal from a satellite telephone system. It's a "wet" telco signal because it has a DC voltage present, with standard high-voltage ringing to indicate that a call is coming in. From an operational standpoint auto-answer is not desired. In this case connect tip and ring from the satellite telephone system to pins 3 and 4 (red and green) of the source modular jack, and connect a jumper wire across pins 1 and 6 (white and blue). Now when this jack is connected to the Model 770's telco interface, of course using a 6-conductor cord, the telco interface's operating mode will remain in telco, but auto-answer will be defeated. Our second example is a signal is a cell-phone fax adapter. It's a "dry" audio signal, not having a DC voltage associated with it. In this case the signal is terminated on pins 3 and 4 (red and green) of the source modular jack, and a jumper wire is connected across pins 2 and 5 (black and yellow). When this jack is connected to the Model 770's telco interface the operating mode will automatically switch to standard audio.

Talent Amplifier Output

The talent amplifier output is designed to supply power and audio signals for up to four Studio Technologies' Model 32 or Model 33 Talent Amplifiers. The term "wet" is associated with the talent amplifier output because, along with analog audio signals, DC power is present . The talent amplifier output uses a single male XLR-type connector for interconnection; pin 1

is common, pin 2 is +22Vdc modulated with IFB audio, and pin 3 is "dry" audio. The audio signal associated with pin 3 is configured using DIP switches located on the back panel. Refer to the Configuration section of this guide for details.

It is expected that the talent amplifier output will be wired to the vehicle's input/output connector panel. As the Model 32 and 33 Talent Amplifier units have "loop thru" connectors, an input/output panel does not need numerous "mults" of the signal—two should be sufficient. As DC power is present, it is recommended that the talent amplifier output signal not be wired by way of a patch bay.

IFB Line Output

The IFB line output has been optimized for connection to devices located external to the vehicle. This "ruggedized," transformer-coupled output has a nominal level of +4dBu. It is considered a "dry" output as DC power is not present. It is expected that the IFB line output be wired, via the patch bay, to the vehicle's input/output connector panel. A 3-pin male XLR-type connector is used for interconnection. Prepare the mating connector (female) so that pin 2 is high (+ or hot), pin 3 is low (– or cold), and pin 1 is shield.

Should a line-level IFB signal need to be connected to a device located within the vehicle, such as a wireless IFB transmitter, it is better to use one of the configurable outputs, rather than the IFB line output. Sonically there is little difference, except that the IFB line output is a well-protected, transformer-isolated output that is best kept available exclusively for connecting to devices external to the vehicle. In this way externally generated noise, static, or

"ground loops" will be isolated, protecting the Model 770 and related equipment that is located inside the vehicle.

The IFB line output was designed to provide a fully isolated output with decent sonic performance. It was NOT designed to drive full level into 600 ohm loads! While a 600 ohm load can be connected without damage, a 3-4dB level drop should be expected. Used with 2k ohm or greater loads, the IFB line output will provide its full specified performance.

IFB Monitor Output

The IFB monitor output is designed for connection to an audio power amplifier associated with a monitor loudspeaker. In mobile applications it may prove common for an amplified speaker, such as from Fostex, to be connected. The IFB monitor output is similar to the monitor output associated with the Model 770's monitor section. The difference lies with the signal source. While the monitor section's monitor output allows the audio source to be selected from among five choices, the audio source for the IFB monitor output is always the IFB signal. By having two monitor outputs, an operator can monitor his or her desired source, while ensuring that important talent cues will not be missed.

The IFB monitor output is electronically balanced, line-level, and can drive a balanced or unbalanced load of 600 ohms or greater. A ¼-inch 3-conductor phone jack is utilized for interconnection. Prepare the mating connector (plug) so that tip is signal high (+ or high), ring is low (– or cold), and sleeve is shield. To connect to an unbalanced load connect the plug's tip to high (+ or hot), and both the ring and

sleeve to shield. Whether this output is wired via a patch bay will depend on the specific installation.

Intercom Link Output

The ability to have IFB audio available on an intercom system can be very useful for smaller broadcast applications. But often an intercom power supply or user station with a line-level program input isn't available for "injecting" the signal into the system. The intercom link output is designed expressly to allow the Model 770's IFB audio signal to be directly connected to the bus of an intercom system. The output is a current source with an impedance of 10k ohms, is DC isolated, and has a level optimized for RTS/Telex intercom systems. (Note that RTS/Telex specifies a nominal audio operating level of 0dBu, but their equipment performs more like −10dBu nominal systems.)

It is important to understand that the intercom link output is a current source, rather than a voltage source. Most intercom systems, such as those from RTS/Telex, utilize a 200 ohm intercom bus impedance and expect devices that connect to the bus to maintain a source impedance of 10k ohms or higher. Connecting a standard, low-impedance output circuit directly to an intercom bus will not provide an acceptable audio "feed." An additional problem is that the output circuit may be damaged by the DC that is present on the intercom bus. The Model 770's intercom link output has the correct characteristics to meet the challenge—maintaining the correct impedance and being isolated from DC voltage.

The intercom link output is accessible via a ¼-inch 3-conductor jack. Prepare the

mating connector (plug) so that tip is connected to the desired channel of the intercom system, and sleeve is connected to intercom system common; leave the ring unterminated.

It is common in smaller broadcast application to use the RTS/Telex PS15 Power Supply. The PS15 provides capacitor-coupled access, by means of a ¼-inch 3-conductor jack, to the two intercom buses. To connect the Model 770's intercom link output to the PS15 is incredibly simple. Prepare an interconnecting cable using two ¼-inch 3-conductor plugs that are wired in this fashion: Sleeve connected to sleeve, tip on the Model 770 end to tip on the PS15 end; leave the ring leads unconnected. This cable will connect IFB audio into channel 1 of the intercom system. To connect IFB audio into channel 2 of the intercom system: Tip on the Model 770 end to ring on the PS15 end.

In applications where a PS15 isn't used, the intercom link output can be directly connected to the bus of an intercom system. For example, the XLR connectors associated with RTS/Telex systems use pin 1 for common, pin 2 for DC with channel 1 audio, and pin 3 for channel 2 audio. In this scenario, an interconnecting cable would have the tip lead of the ¼-inch plug connected to XLR pin 2 or 3 (depending on the channel desired), and sleeve to XLR pin 1.

While the intercom link output was designed to allow a direct connection to an intercom bus or power supply, there are other applications where it can be useful. The secret is to change the intercom link output's current signal into a voltage. But be warned, a very sophisticated method of conversion is required...Not! All you need

is a single 200 ohm resistor connected across the tip and sleeve of the mating plug! This resistor terminates the current output into its expected load. Using Ohm's Law you know that E(voltage) = I(current) R(resistance), so a voltage is produced across the resistor. You end up with a nice unbalanced audio source with a nominal level of −18dBu.

This unbalanced output can be directly connected to the program input on an intercom power supply, such as the RTS/Telex PS31. It's actually better to connect to an intercom system in this manner, rather than directly to the intercom bus, as the PS31 has a program input level control which would allow the level of the IFB signal to be adjusted for user preference.

Don't minimize the usefulness of converting the intercom link output to an unbalanced IFB audio source. You can use it to connect to an intercom system, or to other gear that needs an IFB "feed." The important parameter is that it has a nominal level of −18dBu, rather than +4dBu as found with the Model 770's other audio outputs. While some equipment is specified to have an input compatible with "0," "+4," or "line-level" audio signals, they are really not designed to be connected to signals this "hot." As an example, take the MS-222 Master Intercom Station from Clear-Com. It has a program input that is specified for microphone or line-level, with a rated input level of 0dB in the line position. But try to connect a signal with a nominal level of 0dBu and see what happens. It's so loud you'd think you were blowing up the input stage! But connect our nominal −18dBu signal and all is well. (By the way, we have no "beef" with Clear-Com in general. They make many fine products.)

Monitor Section

External Monitor Inputs

Two external audio signals can be connected, allowing them to be monitored independently of the internal audio signals. It is intended that the external monitor inputs will be connected to outputs associated with off-air, microwave, or satellite receivers. The inputs are monaural, electronically balanced, have a nominal level of +4dBu, and interface using ¼-inch 3-conductor phone jacks.

Prepare the mating connectors (plugs) so that tip is signal high (+ or hot), ring is low (− or cold), and sleeve is shield. With an unbalanced source connect the plug's tip to high (+ or hot), and both the ring and sleeve to shield. If connecting to an unbalanced source in this manner results in hum or noise, connect tip to high (+ or hot) and ring to shield; leave the sleeve unterminated.

Monitor Output

The monitor output is designed for connection to an audio power amplifier associated with a monitor loudspeaker. In mobile applications it may prove common for a loudspeaker with an internal amplifier, such as from Fostex, to be connected to the Model 770's monitor output. The output is electronically balanced, line-level, and can drive a balanced or unbalanced load of 600 ohms or greater.

The monitor output utilizes a ¼-inch 3-conductor phone jack for interconnection. Prepare the mating connector (plug) so that tip is signal high (+ or hot), ring is low (− or cold), and sleeve is shield. To connect to an unbalanced load connect the plug's tip to high (+ or hot), and both

the ring and sleeve to shield. Whether this output is wired via a patch bay will depend on the specific installation.

1kHz Direct Output

Direct access to a continuous 1kHz tone signal is provided by means of a line-level output. As one of the unique features of the Model 770, it should definitely be utilized! This output is intended to be connected to the audio input associated with a video/audio switcher's "bars and tone" position. For maximum flexibility, it is recommended that this signal be routed via a patch bay. In this way it can be accessed for test and calibration purposes.

The electronically balanced, nominal +4dBu output is accessible via a ¼-inch 3-conductor phone jack. The circuitry is capable of driving a balanced or unbalanced load of 600 ohms or greater. Prepare the mating connector (plug) so that tip is signal high (+ or hot), ring is low (− or cold), and sleeve is shield. To connect to an unbalanced load connect the tip to high (+ or hot), and both the ring and sleeve to shield.

A trim potentiometer is used to set the precise output level of the 1kHz direct output. Refer to the Configuration section of this guide for details.

Connecting AC Mains Power

The Model 770 is factory configured to operate from AC mains power of either 100, 120, or 220/240V, 50/60Hz. In most cases, units shipped to North America are factory configured for 120V operation and are supplied with an internal 0.2A, 5 x 20mm fast-acting fuse. Units configured for 100V also utilize a 0.2A fuse.

Units configured for 220/240V operation are supplied with a 0.1A, 5 x 20mm fast-acting fuse.

Before connecting the Model 770 to mains power, determine the actual mains voltage and confirm that the Model 770 has been configured correctly. As could be expected, an incorrect mains configuration could seriously damage the unit. Should it be necessary to change the unit's operating voltage contact Studio Technologies technical support for details.

The Model 770 uses an IEC standard connector to mate with the AC mains cord. Normally the cord supplied has a North-American standard plug on one end and an IEC connector on the other. In non-North American applications the appropriate plug must be attached. The wire colors

Figure 3. Detail of back panel showing mains power and voltage configuration chart

in the mains cord conform to the internationally recognized CEE color code and should be wired accordingly:

Connection	Wire Color
Neutral (N)	Light Blue
Live (L)	Brown
Earth/Ground (E)	Green/Yellow

Because the Model 770 contains no power switch it will begin operating as soon as AC mains power is connected.

Configuration

As in life, power leads to responsibility. The Model 770 is no exception as its features, flexibility, and operational power leads to a number of configuration issues that must be reviewed once installation has been completed. All are quite simple and will only need to be addressed once.

Configurable Outputs

The Model 770 contains three configurable outputs. Their uniqueness may make them seem a bit confusing at first glance. However, they aren't too "far out," simply being electronically balanced output circuits whose input source is selectable, rather than being fixed. The hardest part of using the configurable outputs is deciding which audio source, or sources, should be assigned to which output! By carefully reviewing the choices, and how their selection may benefit an installation, the power of these humble outputs should become apparent. These three outputs may well eliminate the need for external distribution amplifiers, combining amplifiers, or microphone preamplifiers.
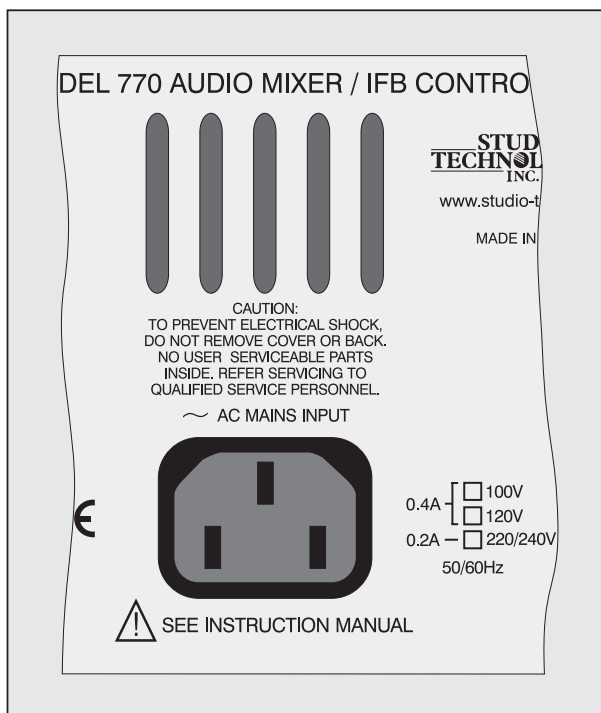
The five choices are main output, AUX output, IFB output, IFB program only output, and mic/line direct:

• Main output is the same signal that connects to the mixer section's main outputs.

• AUX output is the same signal that connects to the mixer section's AUX outputs.

• IFB output is the final output from the IFB section. It consists of both program and interrupt audio. The program audio will, depending on the configuration, mute or "dim" when interrupt is active.

• IFB program only is provided by the IFB section, and consists only of the program audio signal; no interrupt audio signals are present. No muting or "dimming" of the program audio signal takes place, even when interrupt is active.

• Mic/line direct is a signal that is derived from its associated mic/line input channel. The signal is the same as that connected to the front panel bus assignment switches; post input preamplifier and low-cut filter. Configurable output 1 has access to the signal from mic/line input 1; configurable output 2 has access to the signal from mic/line input 2; etc.

Using the five DIP switches associated with each configurable output, simply select the source or sources desired. Note the word "sources"—more than one source can be selected! As an example, selecting switch 1, main out, and switch 2, AUX out, will produce a combined version of the main and AUX outputs. Selecting, as another example, switch 1, main out,

Figure 4. Detail of back panel configurable output section (typical of 3)

for configurable output 1, will result in another main output, viola, main output 5!

It would be the author's choice to use the configurable outputs in this way: Configurable output 1 set for a summed version of the main and AUX outputs, configurable output 2 set for IFB program only, and configurable output 3 set for mic/line direct. Terminated on a patch bay, these three outputs could prove quite handy for those "once-in-a-blue-moon" situations that seem to occur about once a month!

The mic/line direct output may prove especially helpful, providing a "mic/line amplifier" for general purpose or emergency use. In special situations, a signal of virtually any audio level could be "bumped" to nominal +4dBu.

VU Meter Calibration

A trim potentiometer allows calibration of the monitor section's VU meter. The range of this trim pot allows "0" on the meter to represent an output signal level of +1 to +7dBu. From the factory, the VU meter is calibrated so that 0 VU represents an output level of +4dBu on main output 1,

when loaded with 100k ohms. In certain cases it may be a good idea to check the meter calibration, such as when main output 1 is loaded with 600 ohms, or when either main output 2, 3, or 4 is going to serve as the "primary" output.

While not difficult, meter calibration is a bit tedious:

1. Ensure that mains power is connected to the Model 770.

2. Place the main output limiter/compressor to the off state by placing the button labeled LIMITER to the out position.

3. Connect the 1kHz tone to the output buses by placing the button labeled 1KHZ TO MAIN & AUX to the on (in) position.

4. Select MAIN as the monitor source.

5. Designate main output 1, 2, 3, or, in rare circumstances, 4 as the desired "primary" output. This is the output that the meter will be calibrated against.

6. Confirm that the designated main output is terminated with its normal load impedance.

7. Using an appropriate adapter cable, connect an audio level meter directly across the designated main output. Ensure that the meter connection does not remove the normal load. The level meter must be a precision device that's intended for audio use—a general-purpose voltmeter is not adequate!

8. Carefully observing the audio level meter, set the main bus master output control so that the output level is precisely +4dBu.

Figure 5. Detail of back panel showing meter calibration trim pot

9. Observing the Model 770's VU meter, adjust the meter trim pot to give 0 VU. The pot is accessible on the back panel, to the right of the mains power connector.

IFB Line Input Configuration

A trim potentiometer is associated with each of the four IFB line inputs. The trim pots are accessible on the back panel, directly above the IFB line input jacks. The pots are provided simply to allow the relative levels of the input signals to be equalized. This will allow minimal level changes when an operator is switching among the various IFB audio sources. Calibration is quite simple and doesn't require a "down to the tenth of a dB" adjustment regimen.

1. Ensure that mains power is connected to the Model 770.

2. Have audio present, at its normal level, on the IFB line inputs. An audio tone is acceptable, but typical audio material is preferred.

3. On the front panel, set the IFB program master output level potentiometer to the unity gain position. This position is physically marked with a graphic letter U.

4. On the monitor section, located on the far right side of the front panel, set the monitor source for IFB.

5. Select IFB line input 1 as the IFB program audio source. Ensure that line inputs 2, 3, and 4, the telco interface, and main and AUX source switches are set to their off (center) off position.

6. Adjust the trim pot associated with IFB line input 1 so that the meter displays 0 VU (or a little "hotter") when signal peaks occur.

7. Repeat this procedure, starting at step 5, for IFB line inputs 2, 3, and 4.

If this procedure has been successful, selecting any of the audio sources as program material will provide the same perceived output level. Remember, the goal is not to have things "look right" on
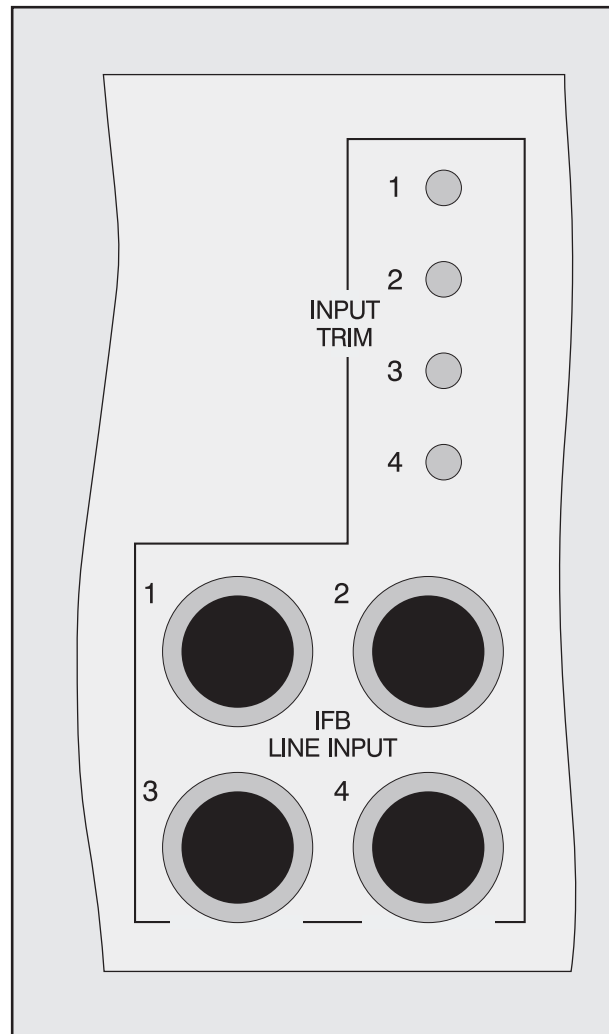

Figure 6. Detail of back panel showing IFB line input configuration section

the meter, but to supply talent and support personnel with excellent cue audio. That's what it's all about!

IFB Telco Interface Configuration

Telephone Interface Send Audio Source

One of the nice features of the Model 770's telco interface is the ability to send an audio signal out the interface. Switches on the back panel allow the audio source to be selected, with the choices being the mixer section's main and AUX outputs, and the IFB output. Sections 1 , 2, and 3 of the DIP switch located directly above the telco interface's modular jack are used to select the source. (Should the need arise, more that one source can be selected simultaneously.) Unless there is a specific need to select main or AUX, enabling IFB audio as the source should

Figure 7. Detail of back panel showing IFB telco interface configuration section

prove to be the most useful. There may also be cases where no send audio source is desired. In this case simply turn all three switches to their off positions.

Telephone Interface Audible Ringing

A piezoelectric sounder, located inside the Model 770's enclosure, can be enabled to provide an audible indication when ringing voltage is present on the telco interface. When enabled, a square-wave signal is sent to the sounder in cadence with the ringing voltage. Not terribly loud, it is intended to give the operator a little auditory "nudge" that the telephone line is "ringing." Position 5 of the DIP switch located directly above the telco interface's modular jack is used to enable the audible ringer. As may be expected, in the on position the audible ringer in enabled. In most applications having the audible ringer enabled is preferable, but exceptions do exist. The author was told of news events involving the President of the United States where disabling the audible ringer would be a wise move. Having an audible ringing signal occur during the middle of a news conference would be seriously frowned upon!

IFB Program Mute/Dim Configuration

In traditional news-oriented IFB systems program audio is fully muted whenever interrupt is active. In other applications, such as live sports, it may be desirable to "dim" (attenuate) the program audio whenever interrupt is active. One switch on the Model 770's back panel allows the program audio configuration to be selected for either full muting or 10dB dim. Position 5 of the DIP switch that is located directly below the talent amplifier output

connector is used to select this mode. When the switch is in the off position program audio is fully muted. In the on position program audio dims by 10dB.

Note that any function that uses the IFB program only signal, such as the talent amplifier output, are not affected by either the mute or dim action; interrupt activity does not impact the level of the IFB program only signal.

IFB Talent Amplifier Output Configuration

The talent amplifier output associated with the IFB section supports two discrete audio output channels. Channel 1 audio, along with DC power, is carried on pin 2 of the output XLR connector; channel 2 audio is carried on pin 3. The source of channel 1 audio is internally configured to be IFB audio and cannot be changed. The source of channel 2 audio is selectable, with the choices being main output, AUX output, and IFB program only; of course selecting no audio source is valid also:

• Main output is the same signal that connects to the output circuitry associated with the mixer section's main outputs.

• AUX output is the same signal that connects to the output circuitry associated with the mixer section's AUX outputs.

• IFB program only is provided by the IFB section, and consists of the program audio signal only; no interrupt audio signals are present. No muting or "dimming" of the program audio signal takes place, even when interrupt is active.

Figure 8. Detail of back panel showing PGM dim/mute and talent amplifier output

Positions 1, 2, and 3 of the DIP switch that is located directly below the talent amplifier output connector are used to select the source for channel 2. Simply select the source desired, or leave all three switches in their off position to have channel 2 be a "quiet" output. Note that more than one source can be selected at the same time—let your imagination run wild with the possibilities!

The ability to select the talent amplifier output channel 2 audio source is very useful, greatly expanding the capability

of the Model 770's single IFB channel. An example would be where on-air talent and a field producer were equipped with Model 32 Talent Amplifiers. The talent would listen to IFB audio on channel 1. By assigning main audio to channel 2, the field producer could normally monitor the main bus of the mixer section, while having the ability to quickly switch to the IFB signal on channel 1. Note that the same 3-conductor cable would be supporting both the talent the field producer's Model 32 Talent Amplifiers!

Another example would be to assign IFB program only audio to channel 2. Separate Model 32 Talent Amplifiers could be provided to a field reporter and the guests to be interviewed. By setting the source switch on the Model 32 to channel 2, interviewees would hear program audio, without unfamiliar and unwanted IFB audio.

A third example could be for a sports event where a separate non-interrupt signal needs to be monitored at all times. Assigning the mixer section's AUX audio bus to channel 2, and providing a Model 33 Talent Amplifier to the on-air talent would achieve this. A mix of the IFB signal and AUX audio could easily be created by using the Model 33's level controls.

1kHz Direct Output

The 1kHz direct output is a line-level output that provides direct access to the 1kHz tone signal. A trim potentiometer allows adjustment of the output level from approximately +3 to +7dBu. The trim pot is located on the back panel, directly above the 1kHz direct output's ¼-inch phone jack. At the factory this output is loaded with 100k ohms, and then the trim

pot is adjusted to give an output level of +4dBu.

If the 1kHz direct output is to be used in an installation, it's important that its output level be adjusted to precisely match the requirements of the system. Also note that while the output circuitry is capable of driving loads of 600 ohms or greater, the output level will drop slightly as the load impedance approaches 600 ohms.

Figure 9. Detail of back panel showing 1kHz tone direct output configuration

In practice, calibrating the output level is quite simple:

1. Confirm that the 1kHz direct output is terminated with its normal load impedance.

2. Ensure that the Model 770 is connected to mains power.

3. Using an appropriate adapter cable, connect an audio level meter directly across the 1kHz direct output. Ensure that your connection does not remove the normal load! The level meter must be a precision device that's intended for audio use—a general-purpose voltmeter is not adequate!

4. Carefully observing the level meter, adjust the trim pot to give the desired output level.

Operation

While the Model 770 Audio Mixer/IFB Controller is quite simple to operate, there are nuances to its design that make a detailed discussion worthwhile. We'll start with the individual sections that make up the Model 770. Then we'll review how the sections work together to become your audio "master control."

Mixer Section

Mic/Line Inputs

Three identical input channels are provided, each being compatible with a microphone or line-level signal. A detailed description of one mic/line channel follows:

Input Sensitivity

The mic/line button is used to select the sensitivity of the input circuitry. In the mic

Figure 10. Detail of front panel showing mic/line input channel (typical of 3)

(out) position, the expected nominal input level is −55 to −35dBu. In the line (in) position, a 40dB pad is inserted into the circuit, making the expected nominal input level −15 to +5dBu. The input circuitry is compatible with a wide range of signal levels and is protected from overload.

Low-Cut Filter

The button associated with the "bent line" graphic symbol is used to select the low-cut filter function. (If you are a stickler for semantics, it's actually a high-pass filter

function!) In the off (out) position the filter is not placed in the audio path, leaving the signal essentially "flat." In the on (in) position the signal is routed through the filter circuit, removing low-frequency energy.

The filter is useful for eliminating wind noise, traffic rumble, and AC mains hum. It was carefully designed to give a steep slope (18dB/octave), with the −3dB point at 85Hz. For most voice applications the filter can be left activated. For wide-bandwidth signals, such as music, the filter should be used only as necessary.

Changing the on/off status of the low-cut filter will result in little or no noise being added to the audio signal. While it is better to set the filter's button to the desired position prior to being "live," it can certainly be used at any time.

Status LED

A bi-color LED acts as a user-confidence indication of the overall signal level in the mic/line input channel's circuitry. The LED will light with the color green as a signal present indicator, showing that the input signal, along with the gain of the input preamplifier, is at least 18dB below the nominal internal operating level. The LED will light with the color red as a peak signal indicator, showing that the input signal, along with the gain of the preamplifier, is within 6dB of the circuitry's maximum level.

Level Control

The rotary control is used to adjust the gain of the input preamplifier circuit. In the fully counterclockwise position the preamplifier gain is set to its minimum, and full attenuation is achieved. This means that no signal continues on to the next stage

of the mic/line input circuitry and, if configured, to the configurable output on the back panel. As the level control is rotated in the clockwise direction the gain of the preamplifier increases.

Bus Assignment

Located below the level control are two buttons, labeled MAIN and AUX. These buttons control the connection of the audio signal to the main and AUX audio buses.

Main Bus Assignment

The button labeled MAIN controls the assignment of the audio signal to the main audio bus. In the off (out) position, signal is not connected to the main bus; in the on (in) position, the signal is connected to the main audio bus.

AUX Bus Assignment

The button labeled AUX controls the assignment of the audio signal to the AUX audio bus. In the off (out) position, signal is not connected to the AUX bus. In the on (in) position, the signal is connected to the AUX audio bus.

Stereo Line Inputs

The Model 770 contains two identical stereo line input channels. They are unique in that the left and right signals associated with each stereo input are automatically mixed to monaural, by way of level controls, in preparation for assignment to the mono mixing buses. The input circuitry was designed for compatibility with signals that have a nominal level of +4dBu. However, nominal signal levels of −10 to +10dBu are perfectly acceptable. A description of one of the stereo line input channels is provided.

Figure 11. Detail of front panel showing stereo line inputs

Level Controls

Two level controls are used to set the amount of input signal that is sent to the monaural summing (mixing) circuitry. The inner knob controls the level of the left channel input signal; the outer knob controls the right channel input signal. On the front panel, note the small arrow graphic symbol and the letter "U," located at approximately the "1-o'clock" rotation position. This indicates the approximate setting for the level controls to give unity gain.

Bus Assignment

The signal from the mono summing amplifier is sent to the main and AUX bus assignment buttons. These two buttons operate in the same fashion as described for the mic/line input channels.

Master Output

The Model 770's master output section contains a number of buttons and controls associated with the main and AUX audio buses.

Main and AUX Master Level Controls

Two controls are used to set the overall level of the main and AUX audio buses. On the front panel, note the small arrow graphic symbol and the letter "U," located at the "1-o'clock" rotation position. This indicates the approximate setting for the level controls to give unity gain, and is the position where the controls should normally be set. Refer to the 1kHz to main and AUX paragraph in this section for how best to set the controls.

Limiter/Compressor

A studio-quality limiter/compressor circuit is associated with the main audio bus. A push-button switch selects the its status; when the button is in the out position the limiter/compressor is disabled. When the button is in the on (in) position, high signal levels on the main audio bus will be automatically attenuated.

A green LED, located to the left of the status button, displays the operating condition of the limiter/compressor. It lights whenever signal attenuation is taking place.

Figure 12. Detail of front panel showing master output section

1kHz to Main and AUX

A 1kHz tone signal can be connected to the main and AUX buses, serving as a reference signal for local and remote use. A push-button switch selects its status; when the switch is in the in position tone is connected. The tone level is factory set to precisely match the Model 770's internal operating level. When the tone is connected to the main and AUX buses, the main and AUX master level controls can be adjusted to give "0" level on the meter.

Talk to Main and AUX

A button allows audio from the gooseneck microphone to be connected to the main and AUX buses, creating a "talk back" function for cueing, slating, and setup use. The monitor output and IFB monitor output both are automatically muted whenever the talk to main and AUX function is active. Note that the voice audio signal will be added (summed) with whatever signals are also present on the buses.

IFB Section

The IFB section is located on the left side of the Model 770's front panel.

Program and Interrupt Bus Operation

Probably the most complicated part of the Model 770 is how the IFB section creates the IFB signal. Actually, it really quite simple, but may take users a few moments of quiet meditation before the mental "light bulb" goes on! Once someone gets the chance to use the controls and experiment routing signals, all should become clear.

The first topic that must be covered is how the Model 770 defines program audio and interrupt audio. Program audio is a signal that connects to the IFB output during normal operation. Interrupt audio is a signal whose mere presence causes it to be connected to the IFB output, as well as causing muting or dimming (attenuating) of the program audio. Internal to the Model 770's IFB section are two audio buses ("highways"); program and interrupt. The program audio bus has a mute/dim circuit associated with it. The interrupt bus has a special voice detection circuit associated with it. Commonly known as a VOX circuit, it generates a logic signal

whenever energy in the voice band is present with sufficient level. "Clickless" electronic switches control the routing of program and audio signals to the IFB output.

With the Model 770 any of seven audio sources can be assigned as a program or interrupt audio source; mixer main bus audio, mixer AUX bus audio, IFB line inputs 1-4, and telco interface receive audio. Any signal assigned as program audio will be connected to the IFB output whenever there is no signal present on the

Figure 13. Detail of front panel showing IFB line inputs

interrupt bus. If voice energy is detected on the interrupt bus, it is connected to the IFB output, and the program audio signal is muted or dimmed. Once voice audio is no longer present on the interrupt bus, the interrupt bus is disconnected from the IFB output and the program bus is again connected.

Semantics are what leads to the confusion when learning to use the Model 770. When users start describing the actual signals that will be presented to the IFB section, all clarity seems to disappear! On the Model 770, how does a user assign a signal to give the desire cueing performance? First lets start with some examples of audio signals that may be encountered. It is common for an "interrupt" signal to originate from a control room located in a major city, such as New York. This may be a program or mix-minus signal that gets interrupted in the aforementioned control room. It's really a combination of program and interrupt. In a second example a program signal may come from an off-air receiver, with no cues present. A third example could be the output of a 2-way radio that a director is using to "cue" the talent.

The best way to determine whether these signals should be assigned as program or interrupt is to decide what you want to do with them, as related to the IFB output. Decide if each signal must always to be heard by the talent, or if another signal needs to have priority over it. Signals that must have priority over others need to be assigned as interrupt audio. Signals that need to be muted (or dimmed) when other signals are active, should be assigned as program audio. Signals that neither have priority or are subservient to others should be assigned as program.
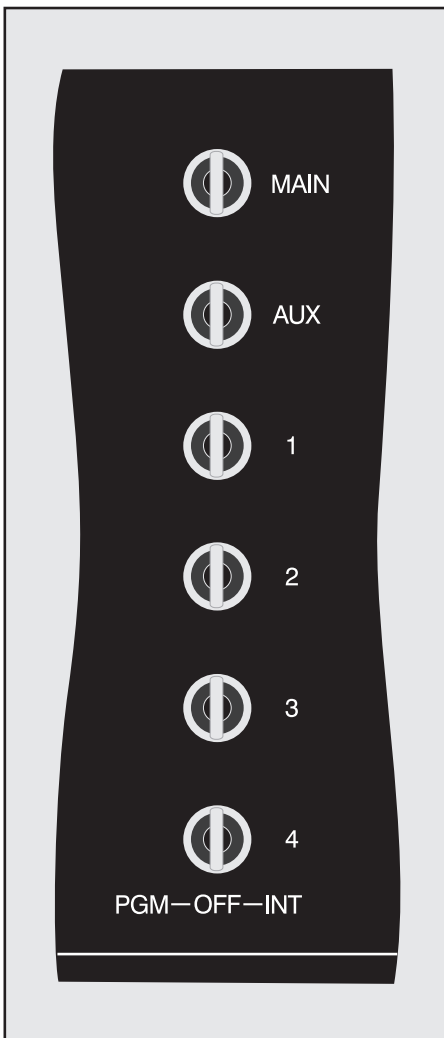
All these "wordy" sentences are trying to describe a simple procedure. Let's take our first example, where an "interrupt" signal is coming from a control room in New York. In most cases this signal would need to be routed to the Model 770's IFB output; nothing should cause its level to be muted or dimmed. If this is correct, then this signal should be assigned as interrupt. Assignment of another signal to the interrupt bus, or activation of the front-panel gooseneck microphone, will simply cause these signals to be added (summed) with the signal from New York.

The second example, audio from an off-air receiver, is pretty straight forward; it should be assigned as program. The third example, the director cueing via a 2-way radio, is simple too. It should be assigned as an interrupt source.

Source Assignment Switches

Seven switches are provided to route the source signals to the program and interrupt audio buses. The sources are: mixer section main and AUX audio, four IFB line inputs, and telephone interface. The switches have three mechanical positions; left, center, and right which are labeled respectively PGM (for program), OFF, and INT (for interrupt). In the off position signal is not connected to either of the buses. In the program position signal is connected to the program bus. In the interrupt position signal is connected to interrupt audio bus, as well as the interrupt signal detection circuit. There is absolutely no problem assigning multiple sources to program or interrupt.

Local IFB

The button labeled TALK TO IFB, located on the lower-left-corner of the front panel, is used to connect audio from the gooseneck microphone to the interrupt bus, and on to the IFB output. This allows cue or setup information to be sent to the talent, or other users of the IFB output. The interrupt LED will light whenever the button is pressed, and the program audio will be muted or attenuated (dimmed). If the interrupt function is already active, the gooseneck microphone audio will be added (summed) with the other interrupt signal. To prevent acoustic feedback, pressing the talk to IFB button also causes the IFB monitor output and the monitor section's monitor output to mute.

Interrupt LED

The yellow LED, labeled INTERRUPT, is lit any time program audio is being interrupted. There are two way an interrupt can take place: by the presence of signal on the interrupt bus, or by pressing the local talk-to-IFB button.

Level Meter

A 5-segment LED level meter displays the level of the composite (program and interrupt) IFB signal. The three green LEDs are lit with signals in the normal operating range. The yellow LED lights with a signal slightly higher than normal. The red LED lights when signal levels are in the "headroom" area. The ballistics of the meter are a cross between that of a VU and a peak (PPM) meter. (We affectionately refer to it as a "PU" meter!)

The Model 770's monitor section allows the selection of IFB as it's source. With this selection the mechanical VU meter will also display the IFB signal. With normal IFB audio signal levels the mechanical VU meter may seem to display a few dB lower than that displayed on the IFB section's

Figure 14. Detail of front panel showing IFB master section

marked on the front panel, will provide the best performance. During actual operation there is absolutely no problem adjusting the controls to give the desired program-to-interrupt level balance, along with keeping the LED meter lighting in the normal range; the green LEDs lighting regularly, with an occasional lighting of the yellow LED.

Telephone Interface

Three status LEDs, three switches, and one trim potentiometer are associated with the telephone interface. The yellow LED, labeled STANDARD AUDIO, is lit whenever the interface is set for the standard audio mode. This occurs when the second pair (pins 2 and 5) of the telco interface's modular jack are shorted (connected together). The red LED, labeled RING, lights whenever a high-voltage ringing signal is detected on the input to the telco interface. The green LED, labeled OFF-HOOK, lights whenever DC "loop" current is flowing through the interface. If the interface is set for the standard audio mode and DC current is detected, the off-hook LED will light in a flashing on-and-off cadence. This is to indicate an abnormal condition, one that requires the mode of the interface to be changed to the tele-phone line mode.

The interface control switch, active in the telephone line mode, allows the interface to be manually answered or hung up. Momentarily pressing the switch to the position labeled ANSWER places the interface in the off-hook state, and causes a one-second acknowledgment tone to be sent out the interface. If DC current is detected, the interface will stay in the off-hook state and the off-hook LED will light. If loop current is not detected, the

LED meter. This is because the mechanical meter is "slower" in responding to signal peaks. With a more constant signal, such as a tone, the meters will display essentially identical levels.

IFB Master Level Controls

Two controls are used to set the master levels of the IFB audio buses. The inner knob controls the level of the program audio bus; the outer controls the interrupt audio bus. In most cases simply setting the controls to the unity gain position, as

Model 770

interface will return to its on-hook state after a few seconds. Momentarily pressing the switch to the position labeled HANG UP disconnects the interface from the telephone line. Note that in the standard audio mode this switch is not active because the standard audio mode places the interface permanently in what is effectively the off-hook condition.

A second switch controls the audio routing through the interface. In the switch's center position, labeled SEND, the send audio source (selected using the DIP switches on the back panel) is sent out the interface. The send level has been internally set to give the highest signal level possible, without overloading connected equipment. In the switch's left position, labeled PGM, audio received by the interface is connected to the program audio bus. In the switch's right position, labeled INT, audio received by the interface is connected to the interrupt audio bus. A receive level trim potentiometer is provide, allowing the receive audio level to be adjusted over a ±8dB range. A quiet signal can be boosted, or a "hot" signal can be attenuated.

IFB Monitor Output

A separate monitor output is provided by the IFB section, independent of the monitor section's monitor output. This allows the IFB signal to be monitored at, essentially, all times, minimizing the chance of important cues being missed. Only when the gooseneck microphone is active will the IFB monitor output be muted to prevent acoustic feedback. To use the IFB monitor output is simple, just set the rotary level control to the give the desired output level.

Auto Answer Function

When the mode of the telco interface is set for telephone line, and auto answer has not been disabled, the interface will "answer" a call after the detection of two ringing voltage cycles. Waiting for two complete ring cycles was specifically selected so that a calling party will have a chance to hear audible call progress tones provide by their communications provider. The telco interface's circuitry is capable of answering in a fraction of a ring cycle, but this can be confusing to callers, especially

Figure 15. Detail of front panel showing telco interface

ones who are located internationally, where call setup time can vary greatly. Upon answer a one second acknowledgment tone is sent out the interface. This is to assist the caller in knowing that the connection has been made.

Talk To Telco Function

The button labeled TALK TO TELCO is used to connect audio from the gooseneck microphone to the telco interface. This allows a cue or setup information to be sent to the connected device. If the telephone interface is set to the telephone line mode, only when the interface is in the off-hook state will the talk to telco function be available. When the telephone interface is set to the standard audio mode the talk to telco function is always available. Activating the talk to telco function temporarily disables the receiving or sending of audio through the telco interface. Pressing the talk to telco button also causes the IFB monitor output and the monitor section's monitor output to mute.

Monitor Section

The monitor section assists the operator in obtaining the best performance from the Model 770. It controls the signal that is presented to the VU meter, monitor output, and headphone output. Acting as a trusty assistant, the monitor section allows visual and aural monitoring of a variety of signals, without affecting the main, AUX, and IFB audio buses. Understanding and becoming comfortable with using the monitor section is crucial to obtaining optimal Model 770 performance.

Source Selection Buttons

The core of the monitor section are five monitor source buttons. These buttons

Figure 16. Detail of front panel showing monitor section

allow one or more of the audio sources to be selected for monitoring. A review of the sources may prove helpful:

• **Main** This button selects the mixer section's main audio bus as the monitor source.

• **AUX** This button selects the mixer section's AUX audio bus as the monitor source.

• **IFB** This button selects IFB audio as the monitor source.

• **EXT 1** This button selects external monitor input 1 as the monitor source.

• **EXT 2** This button selects external monitor input 2 as the monitor source.

The monitor source push-button switches were chosen to allow more than one source to be selected at a time. The ability to simultaneously depress and lock multiple buttons is not a "glitch," but is a feature which can prove useful in some specialized situations. An example is where a "mix-minus" cue signal from a remotely located facility is being returned

to the Model 770 by means of external monitor input 1. By selecting both EXT 1 and main, a composite signal is created for monitoring.

Metering

A VU-type meter is provided for visual level monitoring. The meter provides the operator with an excellent sense of the average signal level. Its source is the monitor's section selected audio source.

Monitor Output

The monitor section provides a monitor output, along with an associated level control. The source for the monitor output is the selected monitor source. The monitor output is line-level and is designed to be connected to an audio power amplifier and associated loudspeaker. Alternatively, it can be connected to an "amplified" speaker that contains an internal power amplifier.

The monitor output is muted whenever the functions talk to telco, talk to IFB, or talk to main and AUX are active. The mute function limits the amount of sound that gets into the gooseneck microphone, helping cue intelligibility and preventing acoustic feedback.

Headphone Output

A separate stereo headphone output is provided, along with an associated level control. The 'phones output is designed to work well with virtually any of the contemporary medium- and high-impedance headphones. Sony headphones were used during the design of the Model 770; their high sensitivity made them go "way loud!" While a bit "bright" in the high-end for our taste, their comfort and fine design make them a good choice for use with the Model 770.

Warning: Protect your ears! The Model 770 is capable of driving headphones to extremely high sound pressure levels. Hearing experts advise against continuous extended play, especially at high levels. Polka music has been found to be especially dangerous, so please be careful.

Practical Operating Tips

Now that we've reviewed all the sections that comprise the Model 770, it's time to actually use the unit. In the following paragraphs some suggestions about how to best use the Model 770 are provided.

Setting the Mixer Section's Bus Operating Levels

The mixer section's main and AUX master level controls allow the overall gain structure of the audio mixing buses to be set. Correctly setting these controls ensures that maximum audio quality will be achieved. In most cases simply setting the controls to the unity gain position is appropriate; the unity gain position is clearly marked on the front panel. If you are a fanatic for accuracy, you may want set the level controls "precisely" using the following procedure:

1. Set the 1kHz to main and AUX button to the on (in) position. This will cause a precision-level 1kHz tone to be connected to the main and AUX buses.

2. Select main as the monitor source.

3. Adjust the main master level control so that the meter displays 0 VU. The main bus is now set for unity gain.

4. Select AUX as the monitor source.

5. Adjust the AUX master level control so that the meter displays 0 VU. The AUX bus is now set for unity gain.

6. The procedure has now been completed. Return the 1kHz to main and AUX button to the off (out) position.

Signal Present/Peak LEDs

Bi-color status LEDs are provided on the mixer section's mic/line input sections. Under normal operating conditions the LEDs should light only with the color green. Signal peaks may cause an occasional red flash, but sustained lighting of the peak indicator means that audio performance is being compromised. Adjust the level controls so that you aren't "in the red" except on rare occasions.

Limiter/Compressor

While the Model 770 was designed to provide lots of signal "headroom," most applications, especially broadcast, won't benefit from it. In fact, wide dynamic range, in many cases, will simply tax the transmission chain and lead to signal degradation. Our feeling is that leaving the limiter/compressor in the on state is your best bet. If you can't think of a good reason why extended dynamic range on the mixer section's main audio bus is desired, leave the limiter/compressor active!

Don't misunderstand our position: Extended dynamic range is great for music recordings. We love listening to terrific classical, jazz, and, when available, pop recordings. But for most applications served by the Model 770 dynamic range is not really a factor.

Talent Amplifiers

Both the Model 32 and Model 33 Talent Amplifiers utilize a ¼-inch 2-conductor

phone jack for their audio output. On the Model 32, either IFB audio or the channel 2 audio source, if configured, can be selected as the audio source. On the Model 33, either or both audio signals can be selected. The level control(s) should be adjusted for the desired level. Note that even when the level control(s) are set to the fully counterclockwise position, the audio output will not be fully "off." This ensures that personnel will never (hopefully!) miss an important cue because a level control was accidentally turned "off."

Technical Notes

¼-Inch Plugs and EIA RS-453

An incompatibility problem lurks between some ¼-inch 2-conductor and 3-conductor phone plugs and the jacks found on professional audio equipment. While all the plugs seem to "look" the same, some do not comply with the industry standard, called EIA RS-453. This standard defines the physical dimensions, including the shape of the plug's tip. It seems that some plug manufacturers don't bother to make the tip comply with the standard.

Why is this relevant to you? Because the phone jacks used on the Model 770 do comply with the standard, and they expect to be mated with plugs that do, too. Should a connection seem "flaky," sound noisy, or make intermittent contact, the most likely problem is a nonstandard phone plug. Replace the plug if this is the case.

You should find that all plugs from Switchcraft or Neutrik will work correctly, specifically Switchcraft No. 297 or Neutrik NP3C. In our experience, headphones are

the most likely place to find nonstandard plugs—we even found them on some "world-class" headphones that we use in our lab!

Definition of Level

Studio Technologies has opted to use the dBu designation as it seems to be quite rational. Using dBm was fine when all audio outputs were terminated with 600 ohm loads. In this way it was easy to say that "0dB" was 1 milliwatt dissipated in the known load (i.e., 0dBm across 600 ohms will measure 0.775V). Today, an output is rarely terminated with 600 ohms; generally 10k ohms or higher. The dBu designation is better because it refers to dB referenced to 0.775V, with load impedance not a factor. This takes into account the contemporary audio scene where most equipment has a low output source impedance, and a high input impedance.

Faux VU Meter

In the spirit of George Washington (and to make our mothers proud of us) we have to "tell the truth" and admit that while the meter selected for the Model 770 is of very good quality, it doesn't meet the specifications of a "true" VU meter. So why was a less-than-perfect meter selected for the Model 770? The answer is easy and not surprising—bucks! While the Model 770's existing meter is already quite expensive, being built in England by a top-notch meter manufacturer, the cost for a "true" VU meter is about five times as much!

The technical difference between the meter used on the Model 770 and a "true" VU meter lies in the ballistic characteristics, i.e. how the pointer accelerates and decelerates in response to audio signals. The Model 770's meter pointer moves very

close to, but not exactly, in the manner required to be "perfect."

For the Model 770 operator, the selected meter provides a completely acceptable indication of level. But as a technically oriented company, we wanted to "come clean" about our actions. Too bad so many other audio companies don't tell you that their "VU meters" are fakes—many don't even come close to meeting the specs!

VU Meter Calibration

From the factory the VU meters are calibrated so that a +4dBu signal level, as measured on main output 1, results in a reading of 0 VU on the meter. However, it may be observed that the meter may no longer be precisely calibrated when the monitor source button is set to something other than main. A difference of up to 0.5dB from the calibrated value could be expected. This is due to tolerance variations in the components of the monitor circuitry. In reality, only when steady tones are present on the monitor sources will this variation become apparent. During actual operation it's unlikely to become a factor.

Model 32 and 33 Output Level

By design, the output level on the Model 32 and Model 33 Talent Amplifiers cannot be set to fully "off." While the output level can be substantially attenuated, it never can be set for full attenuation. This was to ensure that talent personnel could never accidentally be fully "isolated" from their program or IFB source. There may be special cases where full attenuation is desired. This might be especially true with the Model 33 Talent Amplifier, where a mix of the two IFB channels can be achieved.

Referring to the Model 32 or Model 33 schematic diagram, observe the 200 ohm resistor that is connected between circuit common and the counterclockwise connection of each potentiometer. This resistor prevents full attenuation. By replacing this 200 ohm resistor with a "0 ohm" resistor or jumper strap, full attenuation can be achieved.

Specifications

General

Connectors:

Mic/Line: 3-pin XLR-type, female (pin 2 high)

Outputs — Main 4, AUX 2, IFB Line, and IFB Talent Amplifier: 3-pin XLR-type, male (pin 2 high for main 4, AUX 2, and IFB line)

All Other Audio: ¼-inch 3-conductor phone jacks

Telco Interface: 6-position modular jack ("RJ11-type")

AC Mains: 3-blade IEC-type

AC Mains Requirement:

100, 120, or 220/240V, ±10%, factory configured; 50/60Hz; 40 watts maximum

Mains Fusing: 1

Type: 5x20mm, fast acting

Rating: 0.4A for 100 or 120V mains, 0.2A for 220/240V mains

Dimensions (Overall):

19.00 inches wide (48.3cm)
3.49 inches high (8.9cm)
9.50 inches deep (21.4cm)

Mounting:

2 standard rack spaces

Weight:

13.5.0 pounds (6.1kg)

Mixer Section

General Audio Parameters:

Frequency Response: 20Hz-20kHz, ±0.2dB, mic in/main out 1

Distortion (THD+N): 0.04%, measured at 1kHz, +4dBu input to mic in/main out 1

S/N Ratio: 85dB, referenced to +4dBu to mic in/main out 1

Mic/Line Inputs: 3

Type: balanced, transformer-coupled

Impedance: mic 1.6k ohms, line 15k ohms

Common Mode Rejection Ratio: 62dB @ 60Hz (typical)

Level Range:
Mic: −70 to −10dBu; Line: −30 to +30dBu
Range specified to give +4dBu output level, master level controls set to unity gain position

Low-Cut Filter: −3dB at 85Hz, 18dB/octave slope

Status LED: bi-color, signal present/peak

Stereo Line Inputs: 2

Type: electronically balanced, direct-coupled, compatible with balanced or unbalanced signals

Impedance: 24k ohms

Common Mode Rejection Ratio: 80dB @ 60Hz, 70dB @ 40kHz, typical

Nominal Level: +4dBu (−8 to +10dBu acceptable)

Main Audio Bus Limiter/Compressor:

Type: single-knee, VCA-controlled

Slope: 5:1, nominal

Threshold: +10dBu, nominal (6dB above nominal output level)

Attack Time: 2mSec, nominal

Release Time: 100mSec, nominal

Status LED: limiter/compressor active

Outputs — Main 1, 2, 3, AUX 1:

Type: electronically balanced, capacitor-coupled, intended to drive balanced or unbalanced loads of 600 ohms or greater

Source Impedance: 50 ohms, nominal

Nominal Level: +4dBu

Maximum Level: +27dBu into 10k ohms, +26dBu into 600 ohms

Main Output 4, AUX Output 2:

Type: balanced, transformer-coupled, intended to drive balanced or unbalanced loads of 2k ohms or greater

Source Impedance: 170 ohms, nominal

Nominal Level: +4dBu

Maximum Level: +21dBu into 10k ohms

IFB Section

General Audio Parameters:

Audio Switching and Muting: "clickless" using special "ramping" analog switches

Frequency Response: 20Hz-20kHz, ±0.5dB, IFB line in/IFB line out

Distortion (THD+N): 0.04%, measured at 1kHz, +4dBu input to IFB line in/IFB line out

S/N Ratio: 71dB, referenced to +4dBu to IFB line in/IFB line out

Interrupt Audio Limiter/Compressor: studio quality, dual slope

Gooseneck Microphone Limiter/Compressor: studio quality, dual slope

Line Inputs: 4

Type: electronically balanced, direct-coupled, compatible with balanced or unbalanced signals

Impedance: 24k ohms

Common Mode Rejection Ratio: 80dB @ 60Hz, 70dB @ 40kHz, typical

Nominal Level: +4dBu, adjustable over ±8dB

Voice Operated (VOX) Interrupt Function:

Detection Bandpass: 400 to 1400Hz, nominal

Detect Time: less than 1mSec

Detect Level: 18dB below nominal

IFB Line Output:

Type: balanced, transformer-coupled, intended to drive balanced or unbalanced loads of 2k ohms or greater

Source Impedance: 170 ohms, nominal

Nominal Level: +4dBu

Maximum Level: +21dBu into 10k ohms

IFB Intercom Link Out: allows direct connection to RTS/Telex intercom buses

Output Type: current source

Output Impedance: 10k ohms, nominal

Output Level: −18dBu when connected to 200 ohm load

Talent Amplifier Output:

Application: provides power and audio signals for up to four Model 32 or Model 33 Talent Amplifiers. The output connector (3-pin XLR-type, male) has common on pin 1, +22Vdc modulated with IFB audio (−10dBu nominal) on pin 2, and selectable audio source (−10dBu nominal) on pin 3.

Telco Interface:

Application: selectable for compatibility with telephone line ("wet") or standard audio ("dry") signals

Impedance: 600 ohms

Receive Audio Level: −15dBu, nominal, adjustable over ±8dB range

Send Audio Level: −6dBu, nominal

Telephone Line:

Compatibility: 2-wire, loop start, 10mA loop current minimum

Ring Detection: 40-150Vrms, 18-68Hz, ringer equivalence 1.0B

Auto Answer: after detection of two complete ring cycles (can be disabled)

Disconnect: manual using front-panel switch; automatic after detection of break in loop current

Overcurrent Protect: solid-state, automatic reset

IFB Monitor Output:

Type: electronically balanced, capacitor-coupled, intended to drive balanced or unbalanced loads of 600 ohms or greater

Source Impedance: 50 ohms, nominal

Nominal Level: −4dBu, with monitor level control @ 100%

Maximum Level: +19dBu into 10k ohms, +18dBu into 600 ohms

Monitor Section

External Monitor Inputs: 2, monaural

Type: electronically balanced, direct-coupled, compatible with balanced or unbalanced signals

Impedance: 24k ohms

Common Mode Rejection Ratio: 80dB @ 60Hz, 70dB @ 40kHz, typical

Nominal Level: +4dBu

Monitor Output:

Type: electronically balanced, capacitor-coupled, intended to drive balanced or unbalanced loads of 600 ohms or greater

Source Impedance: 50 ohms, nominal

Nominal Level: −2dBu, with monitor level control @ 100%

Maximum Level: +21dBu into 10k ohms, +20dBu into 600 ohms

Headphone Output:

Compatibility: intended for connection to head-phones with impedance of 100 ohms or greater

Maximum Voltage: 8Vpp, 100 ohm load

1kHz Tone Output:

Type: electronically balanced, capacitor-coupled, intended to drive balanced or unbalanced loads of 600 ohms or greater

Source Impedance: 100 ohms, nominal

Wave Form: sine

Output Level: +4dBu, nominal, adjustable over −1/+3dB

Metering:

Type: analog, VU scale

Calibration: 0 VU = +4dBu, adjustable ±3dB

Illumination: 7 LEDs

Polarity:
Input-to-output polarity maintained with the exception of monitor output, IFB monitor output, and IFB intercom link output

Specifications subject to change without notice.

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Studio Technologies, Inc.

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MIC/LINE INPUT*
(XLR-F)

2 (+)
3
1

40dB PAD

150:10K

AMPLIFIER (GAIN 0 TO 28dB)

AMPLIFIER (GAIN 0 TO 28dB)

(+) [-2]

LEVEL**

MIC**
LINE
-15V

BI-COLOR LED**
-20 +16

SIGNAL PRESENT/ PEAK DETECT

LOW-CUT FILTER

(+) [-2]

OUT**

IN

+15V
AUX**

AUX SUMMING BUS

AUX ACTIVE

+15V
MAIN**

MAIN SUMMING BUS

MAIN OUTPUT 1/2/3
(1/4" 3-COND)
(+4dBu)

R
S

BALANCED LINE DRIVER

CONFIGURABLE OUTPUT 1/2/3*
(1/4" 3-COND)
(+4dBu)

R
S

BALANCED LINE DRIVER

(-) [-2]

SUMMING BUFFER

DIP 1*   (+) [-2] MAIN
DIP 2*   (+) [-2] AUX
DIP 3*   (+) [-2] IFB
DIP 4*   (+) [-2] IFB PGM ONLY
DIP 5*   (+) [-2] MIC/LINE DIRECT

+15V
-15V

M770BD_A

* LOCATED ON BACK PANEL
** LOCATED ON FRONT PANEL

(POLARITY VS INPUT)
[NOMINAL LEVEL IN dBu]

STUDIO TECHNOLOGIES, INC.

MODEL 770
AUDIO MIXER/IFB CONTROLLER
MIC/LINE INPUT CARD
BLOCK DIAGRAM

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STEREO LINE INPUT 1∗
(+4dBu)

LEFT
(1/4" 3-COND)

RIGHT
(1/4" 3-COND)

DIFFERENTIAL
INPUT
BUFFER

(+) [-2]

BUFFER

(-) [-2]

LEVEL∗∗

CONCENTRIC

SUMMING
BUFFER

(+) [-2]

+15V

AUX∗∗

AUX SUMMING BUS

AUX ACTIVE

+15V

MAIN∗∗

MAIN SUMMING BUS

STEREO LINE INPUT 2∗
(+4dBu)

LEFT
(1/4" 3-COND)

RIGHT
(1/4" 3-COND)

DIFFERENTIAL
INPUT
BUFFER

(+) [-2]

BUFFER

(-) [-2]

LEVEL∗∗

CONCENTRIC

SUMMING
BUFFER

(+) [-2]

+15V

AUX∗∗

+15V

MAIN∗∗

+15V

-15V

∗ LOCATED ON BACK PANEL
∗∗ LOCATED ON FRONT PANEL

(POLARITY VS INPUT)
[NOMINAL LEVEL IN dBu]

STUDIO TECHNOLOGIES, INC.		
MODEL 770 AUDIO MIXER/IFB CONTROLLER DUAL STEREO LINE INPUT CARD BLOCK DIAGRAM		
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MAIN SUMMING BUS (+) [-2]

SUMMING BUFFER [-2]

BUFFER (+) [-2]

MAIN MASTER LEVEL**

* ACTIVE**

LIMITER/ COMPRESSOR (+) [-2]

OFF ON

LINE DRIVER [+5]

600:600

2
3
1

MAIN OUTPUT 4 (XLR-M) (+4dBu)

(+) [-2] MAIN OUT

AUX SUMMING BUS (+) [-2]

SUMMING BUFFER [-2]

(+) [-2]

AUX MASTER LEVEL**

LINE DRIVER [+5]

600:600

2
3
1

AUX OUTPUT 2 (XLR-M) (+4dBu)

BALANCED LINE DRIVER

+
-

R T S

AUX OUTPUT 1 (1/4" 3-COND) (+4dBu)

(+) [-2] AUX OUT

(NA) [-10] MIC AUDIO

TALK TO MAIN & AUX**

MIC ACTIVE

1kHz TONE**

1KHZ

+15V

-15V

* LOCATED ON BACK PANEL
** LOCATED ON FRONT PANEL

(POLARITY VS INPUT)
[NOMINAL LEVEL IN dBu]

STUDIO TECHNOLOGIES, INC.

MODEL 770
AUDIO MIXER/IFB CONTROLLER
MASTER OUTPUT CARD
BLOCK DIAGRAM

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BUFFER

MAIN OUT (+) [-2]   (+) [-2]   IFB PGM SUMMING BUS

ASSIGN**
PGM
OFF
INT   IFB INT SUMMING BUS

BUFFER

AUX OUT (+) [-2]   (+) [-2]

ASSIGN**
PGM
OFF
INT

DIFFERENTIAL
INPUT BUFFER   BUFFER

IFB LINE INPUT 1   R
(1/4" 3-COND)   S   T   (-) [-2]   (+) [-10]
(+4dBu)
                                               +/-8dB
                                               TRIM**
ASSIGN**
PGM
OFF
INT

DIFFERENTIAL
INPUT BUFFER

IFB LINE INPUT 2   R
(1/4" 3-COND)   S   T   (-) [-2]   (+) [-10]
(+4dBu)
                                               +/-8dB
                                               TRIM**
ASSIGN**
PGM
OFF
INT

DIFFERENTIAL
INPUT BUFFER

IFB LINE INPUT 3   R
(1/4" 3-COND)   S   T   (-) [-2]   (+) [-10]
(+4dBu)
                                               +/-8dB
                                               TRIM**
ASSIGN**
PGM
OFF
INT

DIFFERENTIAL
INPUT BUFFER

IFB LINE INPUT 4   R
(1/4" 3-COND)   S   T   (-) [-2]   (+) [-10]
(+4dBu)
                                               +/-8dB
                                               TRIM**
ASSIGN**
PGM
OFF
INT

+15V

-15V

* LOCATED ON BACK PANEL
** LOCATED ON FRONT PANEL

(POLARITY VS INPUT)
[NOMINAL LEVEL IN dBu]

STUDIO TECHNOLOGIES, INC.

MODEL 770
AUDIO MIXER/IFB CONTROLLER
IFB LINE INPUT CARD
BLOCK DIAGRAM

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TELCO INPUT
(6-POSITION MODULAR)

+26V

6
5
T 4
R 3
STD AUDIO 2
AA DISABLE 1

[-15 RECEIVE/-6 TRANSMIT]

TELEPHONE
INTERFACE

BUFFER
[-2]
+/-8dB
TRIM**

IFB PGM SUMMING BUS

IFB INT SUMMING BUS

BUFFER
[-2]

(-10) [NA] MIC AUDIO

RING DETECT

LOOP CURRENT DETECT

OFF-HOOK CONTROL

BUFFER

SEND SOURCE SELECT*

DIP 1   (+) [-2] MAIN OUT
DIP 2   (+) [-2] AUX OUT
DIP 3   (+) [-2] IFB OUT

LINE DRIVER
[+5]   600:600

2
3   IFB OUT
       (DRY)
1   [+4dBu]

INTERFACE CONTROL
(MICROCONTROLLER & LOGIC)

STD AUDIO
AA DISABLE

STANDARD AUDIO**   OFF-HOOK**   RING**

TALENT AMPLIFIER
OUT (WET)
(XLR-M)
[-10dBu]

MIC ACTIVE

"RINGER"

LOCAL IFB**

LOCAL IFB

+26V

+15V

-15V

ANSWER
HANG UP
LOOP CONTROL**

RECEIVE TO PGM
SEND
RECEIVE TO INT
AUDIO ROUTING**

TALK TO TELCO**

DIP 4   SPARE*
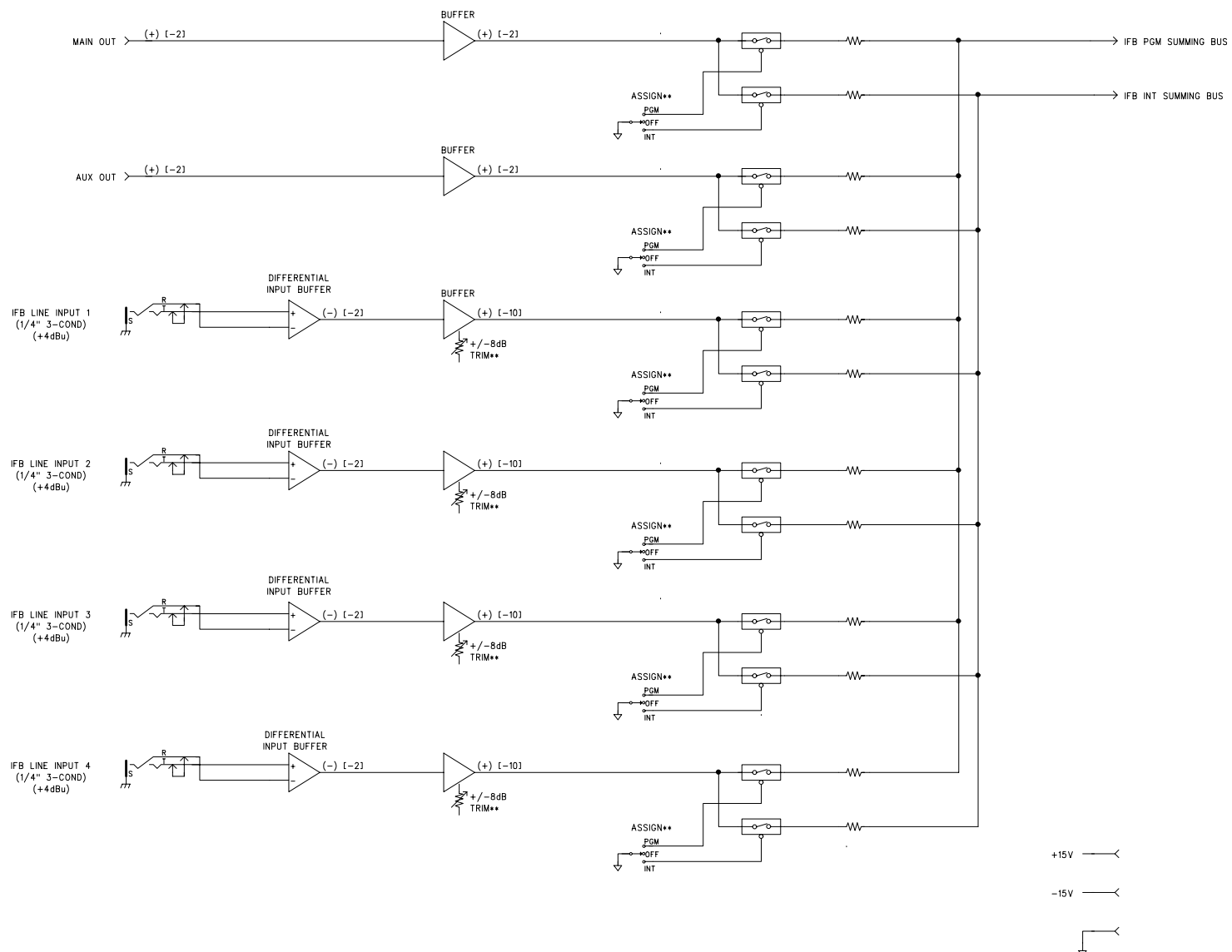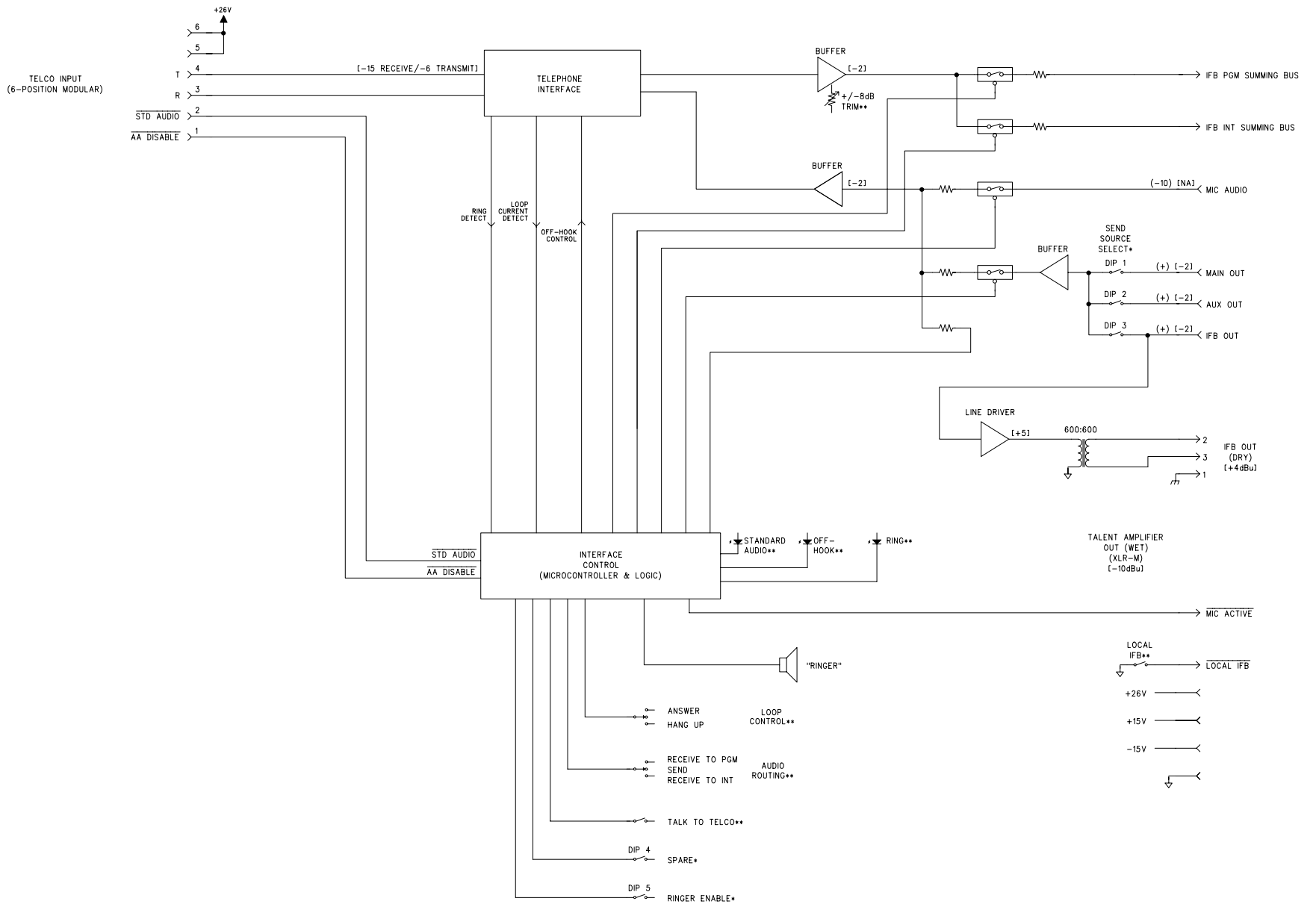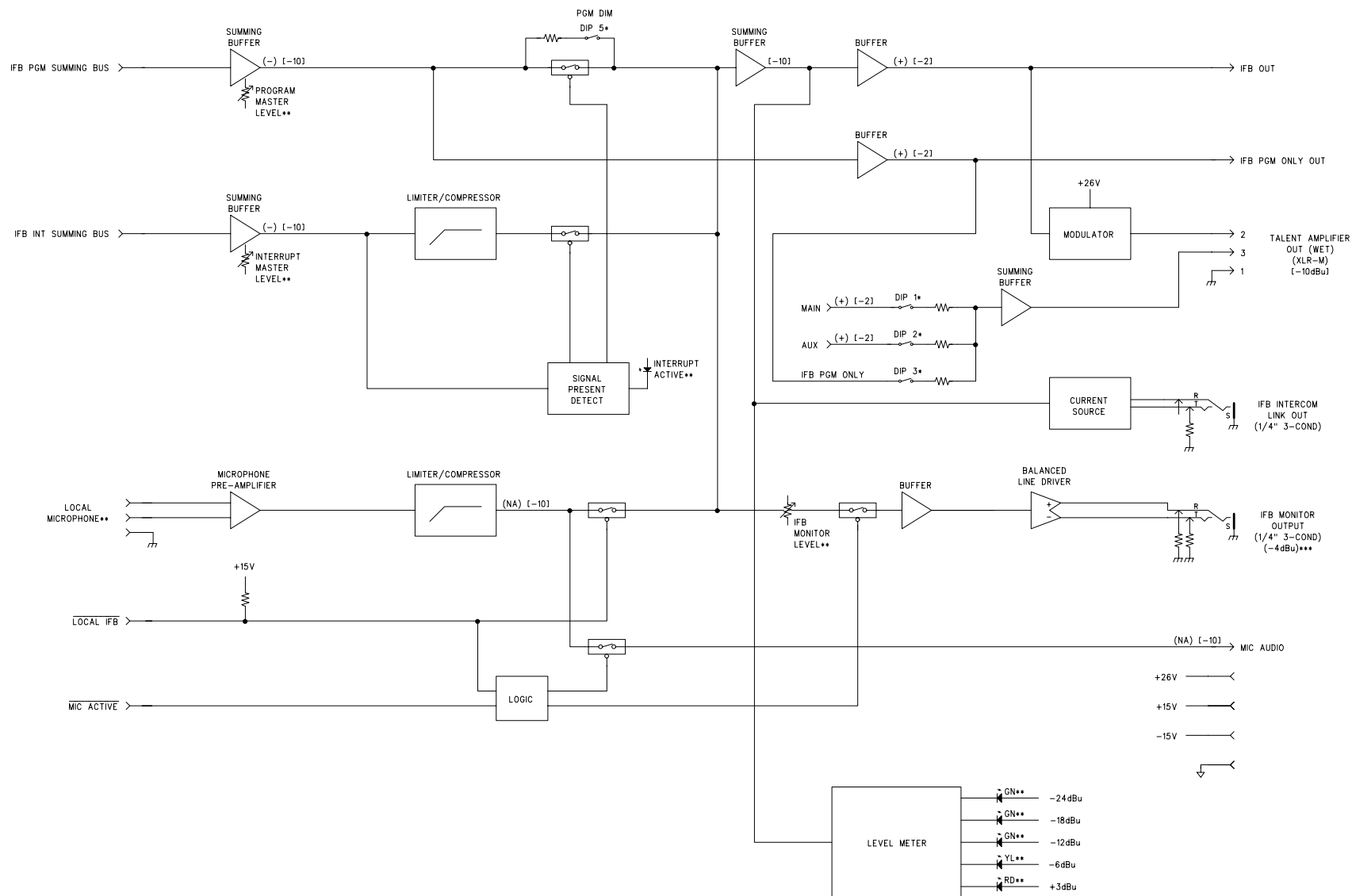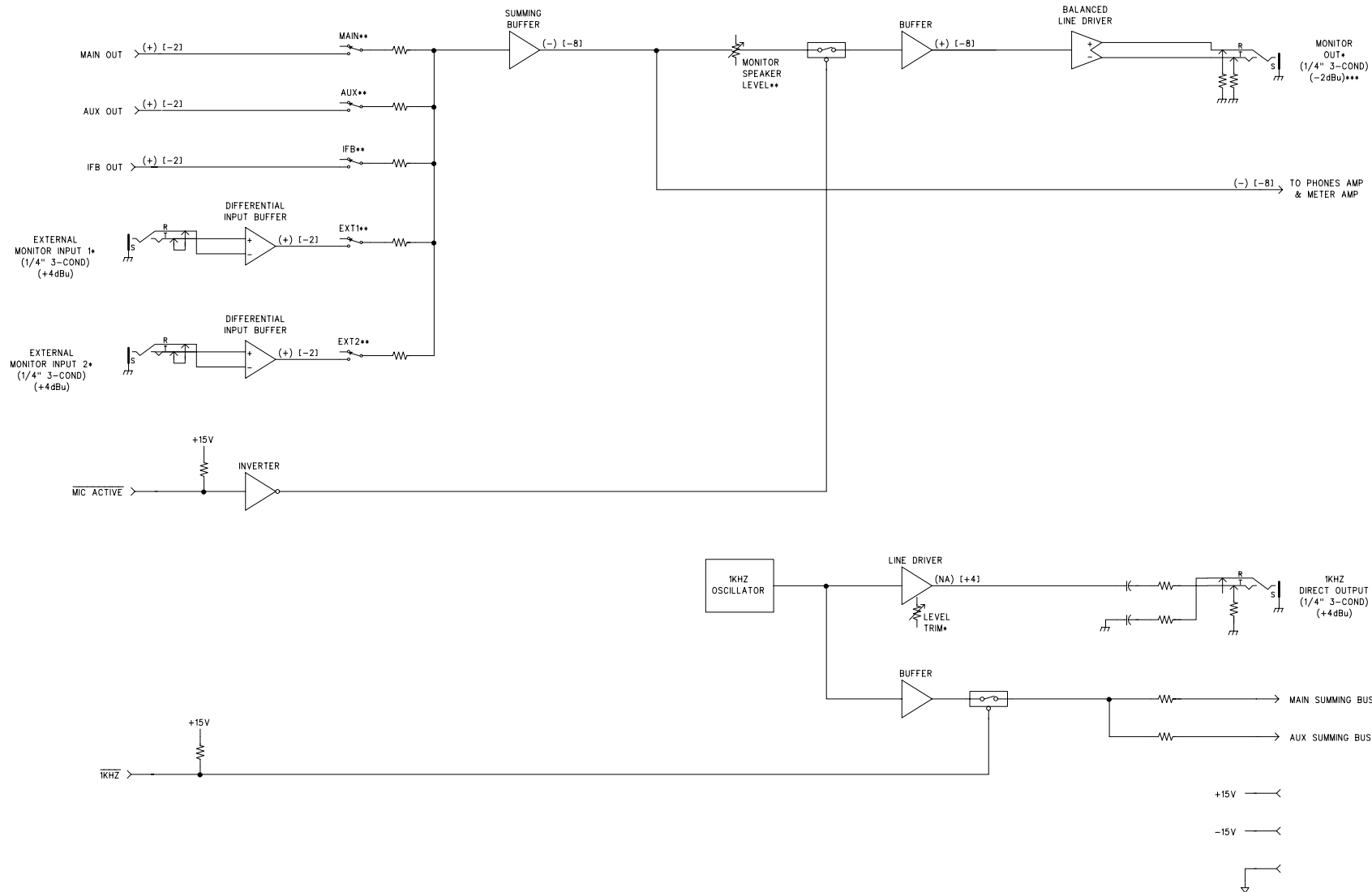
DIP 5   RINGER ENABLE*

* LOCATED ON BACK PANEL
** LOCATED ON FRONT PANEL

(POLARITY VS INPUT)
[NOMINAL LEVEL IN dBu]

STUDIO TECHNOLOGIES, INC.

MODEL 770
AUDIO MIXER/IFB CONTROLLER
IFB TELCO INTERFACE CARD
BLOCK DIAGRAM

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SUMMING BUFFER

IFB PGM SUMMING BUS

SUMMING BUFFER (−) [−10]

PROGRAM MASTER LEVEL**

PGM DIM
DIP 5*

SUMMING BUFFER [−10]

BUFFER (+) [−2]

IFB OUT

BUFFER (+) [−2]

IFB PGM ONLY OUT

IFB INT SUMMING BUS

SUMMING BUFFER (−) [−10]

INTERRUPT MASTER LEVEL**

LIMITER/COMPRESSOR

+26V

MODULATOR

2
3
1

TALENT AMPLIFIER OUT (WET) (XLR−M) [−10dBu]

MAIN (+) [−2] DIP 1*

AUX (+) [−2] DIP 2*

IFB PGM ONLY DIP 3*

SUMMING BUFFER

SIGNAL PRESENT DETECT

INTERRUPT ACTIVE**

CURRENT SOURCE

R
T
S

IFB INTERCOM LINK OUT (1/4" 3−COND)

LOCAL MICROPHONE**

MICROPHONE PRE−AMPLIFIER

LIMITER/COMPRESSOR

(NA) [−10]

IFB MONITOR LEVEL**

BUFFER

BALANCED LINE DRIVER

R
T
S

IFB MONITOR OUTPUT (1/4" 3−COND) (−4dBu)***

+15V

LOCAL IFB

(NA) [−10] MIC AUDIO

MIC ACTIVE

LOGIC

+26V
+15V
−15V

LEVEL METER

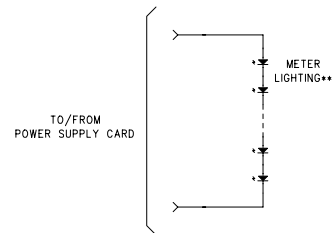GN** −24dBu
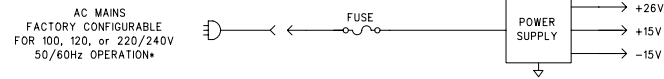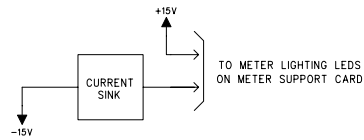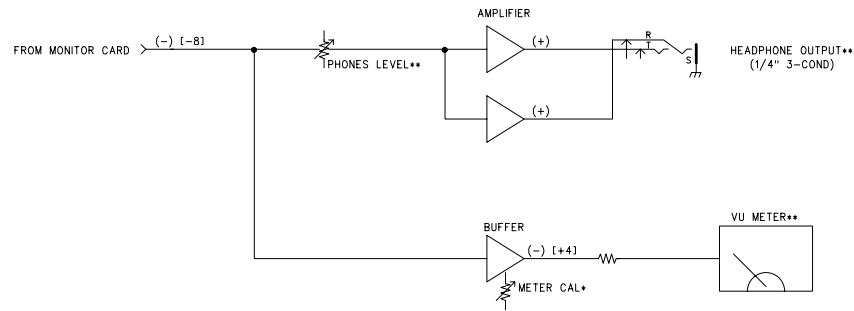GN** −18dBu
GN** −12dBu
YL** −6dBu
RD** +3dBu

* LOCATED ON BACK PANEL
** LOCATED ON FRONT PANEL
*** W/LEVEL CONTROL @ 100%

(POLARITY VS INPUT)
[NOMINAL LEVEL IN dBu]

STUDIO TECHNOLOGIES, INC.

MODEL 770
AUDIO MIXER/IFB CONTROLLER
IFB MASTER CARD
BLOCK DIAGRAM

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MAIN OUT (+) [-2]   MAIN**

AUX OUT (+) [-2]   AUX**

IFB OUT (+) [-2]   IFB**

EXTERNAL
MONITOR INPUT 1*
(1/4" 3-COND)
(+4dBu)
DIFFERENTIAL
INPUT BUFFER   (+) [-2]   EXT1**

EXTERNAL
MONITOR INPUT 2*
(1/4" 3-COND)
(+4dBu)
DIFFERENTIAL
INPUT BUFFER   (+) [-2]   EXT2**

SUMMING
BUFFER   (-) [-8]

MONITOR
SPEAKER
LEVEL**

BUFFER
(+) [-8]

BALANCED
LINE DRIVER

MONITOR
OUT*
(1/4" 3-COND)
(-2dBu)***

(-) [-8] TO PHONES AMP
& METER AMP

+15V
INVERTER
MIC ACTIVE

1KHZ
OSCILLATOR

LINE DRIVER
(NA) [+4]

LEVEL
TRIM*

1KHZ
DIRECT OUTPUT
(1/4" 3-COND)
(+4dBu)

BUFFER

MAIN SUMMING BUS

AUX SUMMING BUS

+15V
1KHZ

+15V

-15V

* LOCATED ON BACK PANEL
** LOCATED ON FRONT PANEL
*** W/MONITOR POT @ 100%

(POLARITY VS INPUT)
[NOMINAL LEVEL IN dBu]

STUDIO TECHNOLOGIES, INC.

MODEL 770
AUDIO MIXER/IFB CONTROLLER
MONITOR CARD
BLOCK DIAGRAM

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AMPLIFIER

FROM MONITOR CARD (−) [−8]

PHONES LEVEL**

(+)

(+)

R
S

HEADPHONE OUTPUT**
(1/4" 3-COND)

BUFFER

(−) [+4]

METER CAL*

VU METER**

+15V

CURRENT
SINK

TO METER LIGHTING LEDS
ON METER SUPPORT CARD

−15V

AC MAINS
FACTORY CONFIGURABLE
FOR 100, 120, or 220/240V
50/60Hz OPERATION*

FUSE

POWER
SUPPLY

+26V
+15V
−15V

TO/FROM
POWER SUPPLY CARD

METER
LIGHTING**

* LOCATED ON BACK PANEL
** LOCATED ON FRONT PANEL

(POLARITY VS INPUT)
[NOMINAL LEVEL IN dBu]