



Model 2 Central Controller and Related Components

User Guide

This User Guide is applicable for Model 2 serial numbers:
M2-01361 and later

Issue 10, November 2009

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Introduction

The IFB Plus Series Model 2 Central Controller from Studio Technologies is a highly integrated, 2-channel IFB (interruptible foldback) system contained in a single rack space unit. It is expressly designed to provide talent cueing for ENG, SNG, and mobile production facilities. The performance and features of the Model 2 reflect the needs of contemporary applications. Only after extensive polling of field production and engineering personnel was the Model 2's feature group established. We think you'll find the Model 2 a great addition to your facility.

What This User Guide Covers

This User Guide applies to Studio Technologies, Inc. IFB Plus Series Model 2 Central Controllers with a serial number of M2-01361 and later. If you are installing a Model 2 with a serial number of M2-01360 or earlier, please contact Studio Technologies to obtain the appropriate documentation.

This guide is designed to assist you when installing, configuring, and using the Model 2 Central Controller. The following items will be covered in this User Guide:

Model 2 Central Controller

An integrated 2-channel IFB unit intended for applications where space is at a premium, yet high performance is still required. The unit contains everything required to implement a full-featured system in a single rack space. Includes multiple program inputs, integral telephone interfaces, monitor amplifier, internal interrupt microphone, among many other features. The unit is powered by 120 or 220/240 V, 50/60 Hz.

Model 22 Access Station

Used by a producer or director to access the Model 2's IFB channels. Allows connection of a Studio Technologies Model 11A Gooseneck Microphone or a line-level audio source. Contains two lighted pushbutton switches which display IFB interrupt status. Up to four Model 22s can be connected to and powered by a Model 2 Central Controller. The Model 25A 19-Inch Rack Adapter allows a Model 22 Access Station and Model 11A Gooseneck Microphone to be mounted in a single 19-inch rack space. The Model 28A Panel Adapter allows a Model 22 and Model 11A Gooseneck Microphone to be installed in an opening made in a table, equipment console, etc.

Model 24 Access Station

The Model 24 allows broadcast personnel to access four IFB channels associated with two Model 2 units. The unit contains five lighted pushbutton switches, four of which are used to activate and display the status of the IFB channels and one that provides an "all call" function. The Studio Technologies Model 11A Gooseneck Microphone or a line-level audio source can be connected. Up to four Model 24 units can be connected and supported by two Model 2 units. The Model 27A 19-Inch Rack Adapter allows a Model 24 and a Model 11A Gooseneck Microphone to be mounted in a single space of a standard rack enclosure.

Model 32A and Model 33A Talent Amplifiers

The Model 32A and Model 33A Talent Amplifiers are self-contained "belt pack" units that drive talent earpieces or headsets. Up to four Model 32A and/or Model 33A Talent Amplifiers can be connected to, and powered by, a single Model 2 Central Controller.

The Model 32A is intended for use by on-air personnel, and contains a source switch, along with an output level control. Either IFB channel 1 or IFB channel 2 can be sent to the talent, along with the desired audio “volume.” For user convenience, both ¼-inch and 3.5 mm output jacks are provided.

The Model 33A is unique in that a “mix” of IFB channels 1 and 2 can be created. Two level controls, along with a source select switch, allows camera and production personnel to hear IFB cues from either or both channels. This allows IFB signals intended for both technician and talent to be simultaneously monitored. For user convenience, both ¼-inch and 3.5 mm output jacks are provided.

Model 2 Central Controller

Contained in a single rack space unit is everything required to implement a 2-channel IFB system. Features include multiple program inputs, telephone interfaces, voice-operated (VOX) interrupt, level meters, monitor amplifier, and internal interrupt microphone. Up to four Model 22 or Model 24 Access Stations can be connected to a Model 2, allowing producer or director positions to access the IFB channels. In addition, up to four Model 32A or Model 33A Talent Amplifiers can be connected to a Model 2. The Model 32A and Model 33A allow personnel access to the IFB channels using a single standard microphone cable.

The Model 2 packs numerous features into a single, 19-inch rack space. Standard connectors are used throughout, including 3-pin XLR-type, ¼-inch 2-conductor, 9-position D-subminiature, and modular telephone (RJ11-type) jacks. Power is supplied by standard 120 or 220/240 V (factory configured), 50/60 Hz via a detachable cord.

IFB Channels

The Model 2 contains two independent IFB channels. Each channel has individual controls and indicators, including program source select switches, program level control, 5-segment LED level meter, and LED status indicators. We’ll describe one channel in this paragraph. Six switches allow the four program inputs and incoming audio from the two telephone interfaces to be selected as program audio. A level control allows adjustment of the program audio level relative to the fixed interrupt audio level. A 5-segment LED level meter displays the composite IFB channel audio level, i.e., program and interrupt audio level. The meter facilitates the rapid setting of the program level control, as well as providing a general indication of the channel’s signal level.

Each channel’s composite IFB audio signal (program and interrupt audio) is sent to four places: line output, talent amplifier output, telephone interface 2, and monitor amplifier. The line outputs provide electronically balanced, line-level signals that interface with external equipment via two XLR-type connectors. The talent amplifier output provides channel 1 and 2 audio, along with +22 Vdc power on one 3-pin XLR-type connector. Any combination of up to four Model 32A or Model 33As can be connected to the talent amplifier output.

Program Inputs

The Model 2 contains four program inputs. Each can be individually assigned to the two IFB channels, with the ability to assign multiple program inputs to an IFB channel. Program signals enter the unit via four XLR-type connectors on the back panel. The program inputs are electronically balanced with a nominal input impedance of 24 k ohms.

They feature low noise, low distortion, and high common mode signal rejection. Each program input has a trim potentiometer associated with it. The trim pots, accessible from the back panel, allow the nominal +4 dBu input level to be adjusted over a ± 8 dB range.

Program audio is muted whenever an interrupt takes place. A sophisticated analog switch is used to give a noise-free mute with absolutely no clicks or pops! If desired, a program “dim,” rather than a full mute can be implemented by adding two resistors to the Model 2’s circuit board.

Compressor Circuits

Each IFB channel contains a studio-quality compressor circuit. This serves to even out variations in the interrupt audio signals and smoothly control peak signal levels. They make talent cues more intelligible and prevent abnormally high signal levels from reaching a user’s ears. The resulting audio quality is very, very good.

Telephone Interfaces

The Model 2 contains two telephone interfaces. Both interfaces can be used to bring audio into the Model 2 from the outside world. These two audio signals can be independently assigned as program sources for IFB channels 1 and 2, as well as being used as an input source for the voice operated (VOX) interrupt function. Each telephone interface has a receive level trim potentiometer that is accessible via access holes in the front panel. The large variations one finds in telephone line signal levels make “on the fly” level trimming a useful feature. In addition to receiving audio, telephone interface 2 can be used to originate an IFB feed. A switch selects if audio will be received from the outside world, or if audio from IFB channel 1 or 2 will be sent out the interface.

The two telephone interfaces contain a unique feature which allows two very different types of telephone “lines” to be correctly interfaced. Each interface can be independently set to operate in either the telephone-line mode or the standard-audio mode. A telephone line has the profile of being a 2-wire, DC-biased (normally -48 Vdc) circuit provided by a local telephone company. A standard audio signal could be provided by, for example, a fax adapter associated with a cellular telephone.

When an interface is set to the telephone-line mode and a DC-biased telephone line is connected, full monitoring and control is implemented. Each interface contains a switch that allows the telephone line to be seized (taken off hook) or hung up. Loop current is monitored when the interface is off hook. If a disconnect signal (a momentary break in loop current) is detected the interface will automatically return to the on-hook state. Each interface contains an LED indicator that lights whenever loop current is detected. Interface 2 also implements an auto answer function, automatically taking the telephone line to the off-hook state when ringing voltage is detected.

In many cases a “telephone line” is actually provided by a cellular telephone. This cellular telephone may provide an unbiased (no DC loop current) audio output. The standard audio mode was designed expressly to interface with this “cell phone” arrangement. In this mode, the interface’s loop current-specific features are disabled, and the interface appears electrically as a transformer coupled balanced audio input.

When in the standard audio mode, an interface’s front-panel switches are inactive. Also inactive is channel 2’s auto answer function. An LED associated with each interface

displays when the standard audio mode is selected. Even during operation in this mode, the loop current LEDs remain active, serving as a useful diagnostic tool. They will display if your “standard audio signal” is actually a telephone line!

Voice Operated (VOX) Interrupt

The Model 2 contains circuitry to allow an audio signal to serve as both an interrupt audio source and a control signal. This eliminates the need for a separate push-to-talk button or contact closure. The VOX feature allows an audio signal from a remote source, such as a two-way radio or telephone line, to serve as the interrupt source. The VOX function was optimized for detection of audio signals in the voice band. As voice detection is quite tricky to perform, great care was taken when designing this function.

Three audio sources can serve as the VOX input: receive audio from telephone interface 1, receive audio from telephone interface 2, or the auxiliary audio input. The auxiliary audio input is a separate line-level audio input that serves the VOX circuit only. A 3-position switch selects which source will be used. A second 3-position switch selects which IFB channel the VOX interrupt is assigned to, or if the function is not active. The VOX function can be assigned to only one IFB channel at a time. Each IFB channel contains an LED indicator light to display when a voice-activated interrupt is taking place.

Internal Interrupt Microphone

Contained behind the Model 2’s front panel is an internal interrupt microphone. Associated with the microphone are two switches, allowing the internal microphone to interrupt IFB channel 1, channel 2, or both.

Monitor Section

The Model 2 contains a simple but excellent monitor section. At the core is a 4 watt audio amplifier designed to drive an 8 ohm (or greater) loudspeaker. Associated with the monitor amplifier is a 3-position source select switch and a level control. The switch selects monitoring of IFB channel 1 or 2, as well as having an off position. A click-free analog switch mutes the monitor output whenever the internal microphone or a Model 22 or Model 24 Access Station, if installed and configured, is interrupting either IFB channel.

Model 22 Access Station

The Model 22 Access Station provides the capability to add up to four additional interrupt locations. Model 22s are intended to be installed at positions convenient to producers, directors, or other personnel who need to “cue” talent and related personnel. The unit consists of a metal chassis containing two lighted pushbutton switches, unbalanced microphone and balanced line inputs, and status and control circuitry.

The two high-quality, back-lit pushbutton switches provide access to the two IFB channels. The lights in the switches display when an interrupt is taking place on its respective channel. When a channel is idle, the light is lit dimly. An input select switch allows connection of a Model 11A Goose-neck Microphone or a line-level signal. The electronically balanced line-level input allows interfacing with other communications equipment, such as an intercom system.

The Model 22 can be configured to mute the Model 2’s monitor amplifier output. This function will prevent acoustic feedback from occurring when a Model 22 is located close to the Model 2’s monitor speaker.

Model 22 Access Stations are linked to the Model 2 Central Controller via 9-pin D-type female connectors. Each access station contains two connectors, allowing a simple daisy-chain installation. The nine leads carry all signals; audio, control, status lamp (tally), and power. The Model 2 provides all power required by the access stations. The Model 25A 19-Inch Rack Adapter is available to mount a Model 22 and a Model 11A Gooseneck Microphone in one space of a 19-inch rack. The Model 28A Panel Adapter allows a Model 22 and a Model 11A Gooseneck Microphone to be mounted in a panel opening.

Model 24 Access Station

The Model 24 is similar to the Model 22 with the exception that it works with two Model 2 units. In this way production personnel can access all four of the IFB channels associated with the two Model 2 units. Up to four Model 24s can be connected to each Model 2. A Model 24 unit consists of a metal chassis that holds the audio and control circuitry, microphone and line input connectors, and five lighted pushbutton switches.

Each of the four IFB channel pushbutton switches display when an interrupt is taking place on its respective channel. A fifth button is specified as “all call” and lights when pressed. The Model 2 supports connection of a Model 11A Gooseneck Microphone or a line-level signal. The latter is transformer-balanced, allowing compatibility with virtually any line-level source. A switch is used to selection the interrupt audio source. A second switch allows the Model 24 to mute the monitor output on each of the Model 2 units whenever an IFB channel is activated.

Model 24 Access Stations connect to the Model 2 units using two 9-pin D-subminiature connectors. The nine conductors

that link each Model 2 with the Model 24 support all the audio, signaling, and power requirements. No external power source is required. The Model 27A allows a Model 24, along with a Model 11A Gooseneck Microphone, to be mounted in one space of a standard 19-inch rack enclosure.

Model 32A and Model 33A Talent Amplifiers

The Model 32A and Model 33A Talent Amplifiers are self-contained “belt pack” units that drive talent earpieces or headsets. A single 3-conductor microphone-type cable links the Model 2 with the talent amplifiers. Each Model 32A and Model 33A contains both a male and female XLR-type connector, allowing simple “loop through” connection of multiple units. Up to four talent amplifiers can be connected to, and powered by, a single Model 2 Central Controller. On each talent amplifier the audio output signal is provided on both a standard ¼-inch 2-conductor phone jack and a 3.5 mm output jack. An LED on each unit lights whenever power is present, providing setup assistance and user confidence. Identical in size, each is housed in a lightweight, yet rugged, aluminum housing. A belt clip allows it to be attached to belts, clipboards, scabbards, pizza boxes, production assistants, etc. An optional mounting adapter is available, allowing a Model 32A or Model 33A to be installed in a permanent location.

The Model 32A is intended for use by on-air personnel, and contains a source switch, along with an output level control. Either IFB channel 1 or IFB channel 2 can be sent to the talent, along with the desired audio “volume.”

The Model 33A is unique in that a “mix” of IFB channels 1 and 2 can be created. Two

level controls, along with a source select switch, allows camera and production personnel to hear IFB cues from either or both channels. This allows IFB signals intended for both technician and talent to be simultaneously monitored.

Installation

In this section you will be installing a Model 2 Central Controller in an equipment rack. In conjunction with the Model 2, up to four Model 22 or Model 24 Access Stations can be installed. In addition, wiring can be installed for up to four Model 32A and Model 33A Talent Amplifiers.

Internally, the Model 2 has no configuration switches or trim pots to set. However, there are several reasons why you may need to access the “guts” of the unit:

- The factory-selected AC mains voltage will be either 120 or 220/240 V, depending on the shipping destination. It may need to be revised for your installation.
- From the factory, the Model 2 is set to mute program audio when an interrupt takes place. If desired, a program “dim” function, rather than mute function, can be implemented.

Refer to the Technical Notes section for details on revising these conditions.

In addition to the above situations, you may want to take a look inside and familiarize yourself with the unit on the rare occasion that it may need service. (The people here in the marketing department taught us never to say a unit may need to be fixed—service is much nicer!) We are proud of how the “guts” of the Model 2 look and how it is constructed so we encourage you to take a “peek”!

On a more serious side, removing the Model 2’s cover with the AC mains cord connected exposes you to hazardous voltages.

Warning: Never remove the cover without disconnecting mains power. We make the assumption that anyone gaining access to the inside of our products meets the requirements for “qualified service personnel”—including knowledge of safety precautions.

Locating the Unit

Physical access and mechanical noise are the primary factors when choosing a mounting location. You don’t want a cooling fan blowing directly onto the internal microphone, nor do you want the microphone at the level of your navel. It is also a good idea to keep the Model 2 physically separated from other electronic devices that produce strong electrical fields. 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 such as power amplifiers, power transformers, and lighting controls will help to avoid pickup of unwanted signals. Precautions were taken to limit the Model 2’s bandwidth, minimizing the chance for RF pickup problems.

Mounting

The Model 2 is intended for rack mounting, requiring one 1.75-inch rack space. It weighs a bit over 10 pounds (4.7 kg), and operates on either 120 or 220/240 V, 50/60 Hz. The unit is secured to the front mounting rails of an equipment rack using two mounting screws per side. In addition to the front mounting “ears,” we encourage you to secure the Model 2 from the back. Provision

has been made for this to be easily accomplished. On each side of the Model 2's chassis are two threaded fasteners intended to secure user-fabricated mounting bars or brackets. Use standard 8-32 screws to secure the mounting brackets to the Model 2's chassis. To prevent damage to the Model 2's "guts," limit the screw length so that the threads extend into the chassis a maximum of ¼-inch. Refer to Figure 1, located at the end of this guide, for a mechanical drawing detailing the fastener locations. This drawing will assist you in fabricating the mounting brackets.

Program Inputs

The Model 2 allows four line-level program audio sources to be connected. The input circuitry is designed for a nominal input level of +4 dBu. A trim potentiometer is associated with each input, giving a ± 8 dB adjustment range. The trim pots are not intended for precise calibration, but strictly to allow the program input signals to be adjusted to the same relative level. A little attention to setting the trim pots will give better operational performance. It will allow an operator, using the front-panel program switches, to rapidly change program inputs, while not giving large changes in level to users listening to the IFB channel. It is anticipated that the trim pots will be adjusted only upon initial installation or during maintenance, and are not considered an operator function. Refer to the Technical Notes section of this guide for details on setting the trim pots.

Program audio connections are made via four 3-pin female XLR-type connectors located on the back panel. The program input circuitry on the Model 2 is direct coupled, electronically balanced with an input impedance of 24 k ohms. Prepare the mating connectors (male XLRs) so that pin 2 is positive

(+ or hot), pin 3 is negative (– or cold), and pin 1 is shield. With unbalanced signals connect pin 2 to positive, and pins 1 and 3 to shield.

Auxiliary Audio Input

The Model 2 allows an auxiliary line-level audio source to be connected for use with the voice operated (VOX) interrupt function. Identical to the program inputs, the auxiliary input circuitry is designed for a nominal signal level of +4 dBu. A trim pot is associated with the auxiliary input, giving a ± 8 dB adjustment range. The pot is not intended for precise calibration, but strictly to allow the AUX input level to be adjusted for correct VOX operation. It is anticipated that this pot will be adjusted only upon initial installation or during maintenance, and is not considered an operator function. Refer to the Technical Notes section of this guide for details on setting the trim pot.

The auxiliary audio connection is made via a 3-pin female XLR-type connector on the back panel. The auxiliary audio input circuitry is direct coupled, electronically balanced with an input impedance of 24 k ohms. Prepare the mating connector (male XLR) so that pin 2 is positive (+ or hot), pin 3 is negative (– or cold), and pin 1 is shield. With unbalanced signals connect pin 2 to positive, and pins 1 and 3 to shield.

The VOX interrupt function is quite specialized and may not be used regularly in your facility. For maximum flexibility, it may be best to terminate the auxiliary audio input to a patch point in the audio patch bay. In this way, a variety of audio sources can quickly be selected as the VOX interrupt input source. The VOX feature may sit unused for months or years, but when you need it there's no substitute! The Model 2's VOX

interrupt works quite well, better than you may think. (Actually better than we thought, too, until we tested it!) Try it out and you may soon find more applications than you expected.

Talent Amplifier Output

The talent amplifier output is designed to supply power and audio signals for up to four Model 32A or Model 33A Talent Amplifiers. The talent amplifier output exits the Model 2 via one 3-pin male XLR-type connector. Pin 1 is common, pin 2 is +22 Vdc modulated with channel 1 audio, and pin 3 is channel 2 audio. For convenience, it is expected that the talent amplifier output will be wired to a main input/output (I/O) panel, along with microphone, camera, and other various connections. This will allow easy talent amplifier connection using standard flexible microphone cable. The distribution panel does not really need more than two talent amplifier output connectors that are “muled” from the Model 2’s talent amplifier output. Each Model 32A and Model 33A Talent Amplifier has both a female and a male 3-pin XLR-type connector. This allows the talent amplifier interconnecting cables to be “looped” through the talent amplifiers. This will simplify and, in most cases, reduce the amount of cabling required to connect multiple talent amplifiers.

Line Outputs

Associated with each of the two IFB channels is an electronically balanced line-level output with a nominal signal level of +4 dBu. The line outputs are capable of driving balanced or unbalanced, low or high impedance loads. The line outputs exit the Model 2 via two 3-pin male XLR-type connectors. Prepare the mating connectors

(female XLRs) so that pin 2 is positive (+ or hot), pin 3 is negative (– or cold), and pin 1 is shield. To connect to an unbalanced load connect pin 2 to positive (+ or hot) and pins 1 and 3 to shield.

Some installations may use the line outputs to drive wireless IFB transmitters. In other installations they may be used for special applications, such as feeding a satellite uplink. For maximum flexibility it is recommended that the line outputs be wired via audio patch points, even if you have a dedicated application.

The Model 2’s audio quality and flexibility make it a useful tool for non-IFB applications. Not to “toot our own horn,” but the Model 2’s sonic quality is as good as many audio consoles, storage devices, etc. As an example, the frequency response from program input to line output is better than ± 0.5 dB from 20 Hz to 20 kHz. This makes using one of the IFB channels as a four input, one output audio source selector for an uplink application completely valid. Let the Model 2 become a useful part of your facility’s “bag of tricks!”

Connecting Telephone Lines

Words of Caution: As with any product, installing the Model 2 requires a safety-first approach.

Never install telephone wiring during a lightning storm. Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations. Never touch non-insulated telephone wires or terminals unless the telephone line has been disconnected at the network interface. Use caution when installing or modifying telephone lines.

The Model 2 contains two telephone interfaces which can be individually configured to allow connection to a telephone line or to a standard audio signal. A telephone line is designated as such if it has a DC bias current associated with it. This type of signal is sometimes referred to as a “wet” signal. A standard audio signal is one that is isolated from any source of DC voltage. Some fax adapters associated with cellular telephones provide this type of “telephone” line. A standard audio signal is sometimes 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 often one provided by the local telephone company on an RJ11. To a mobile ENG vehicle, a telco signal might come from a cellular telephone which in most cases is a standard audio signal.

Here is a review of the important features of the Model 2’s telephone interfaces:

Interface 1

- Telephone line or standard audio mode select switch on back panel
- Used to receive audio only
- Receive audio used as program and/or VOX source
- Front panel ± 8 dB receive level trim pot
- Switch allows manual off-hook and hang-up (telephone line mode)
- Auto disconnect upon break in loop current (telephone line mode)
- Operating mode and loop current status LEDs

Interface 2

- Telephone line or standard audio mode select switch on back panel
- Used to receive or send audio
- Receive audio used as program and/or VOX source
- Sends audio from either IFB channel
- Automatic answer of “ringing” telephone line (telephone line mode)
- Auto disconnect upon break in loop current (telephone line mode)
- Front panel ± 8 dB receive level trim pot
- Switch allows manual off-hook and hang-up (telephone line mode)
- Operating mode and loop current status LEDs

Setting the mode switches and connecting signals is quite easy. Set the telephone interface mode switches, located on the back panel, to the desired mode—either telephone line or standard audio signal. Use modular telephone cables to mate the Model 2’s modular jacks (RJ11-type) with two more RJ11-type jacks. Technically, the Model 2’s telco interfaces use 6-position modular jacks with pins 3 and 4 utilized.

If the telephone line mode is selected, the telco interfaces should, in most cases, terminate on an access panel of some sort. This will make rapid termination with telephone company-provided lines. Because of the presence of high voltage ringing signals, it is best not to route telephone lines through an audio patch bay.

If the standard audio mode is selected, a direct connection to the source device is acceptable, but connecting it via audio patch points provides better flexibility. In the

standard audio mode the interfaces look like standard, transformer coupled audio inputs. Interface 1 has an input impedance of 2200 ohms. Interface 2 has an input impedance of 2200 ohms in the receive mode, and 700 ohms in the send mode. In standard audio mode, the interfaces are compatible with balanced or unbalanced signals. No shield connection is associated with the telephone interfaces. Audio signals should be connected to the telco interfaces, via a modular jack and cable, using shielded cable, with the shield wire connected to the appropriate point at the end opposite of the Model 2. The shield wire should remain unterminated at the Model 2's end.

The telco interfaces are designed to receive and, in the case of interface 2, send audio signals at nominal levels that are correct for telephone circuits, but which are far lower than the typical +4 dBu professional audio standard. The nominal receive signal level is expected to be -15 dBu, the transmit level is -6 dBu. Trim pots are associated with both interfaces, allowing the receive level to be adjusted over a ± 8 dB range. Special precautions may need to be taken when an interface is set for standard audio mode and +4 dBu signals are going to be connected. These would include the use of an audio attenuator or "pad" for connecting receive audio, and the use of a line amplifier to achieve send gain from interface 2.

Model 22 Access Stations

The Model 2 allows the connection of up to four Model 22 Access Stations. The Model 22 provides an unbalanced microphone input, a balanced line-level input, two lighted pushbutton switches, and related circuitry to access the two IFB channels. Power is provided by the Model 2, so an external power

source is not required. Nine-pin D-subminiature connectors link the Model 22 with the Model 2 Central Controller and, if desired, another Model 22. A 5-position screw terminal strip allows connection of a Studio Technologies Model 11A Gooseneck Microphone or a line-level signal.

There are three mounting methods appropriate for the Model 22: the Model 25A 19-Inch Rack Adapter, the Model 28A Panel Adapter, or custom. The Model 25A 19-Inch Rack Adapter allows the rapid installation of a Model 22 and a Model 11A Gooseneck Microphone in a single rack space. Refer to Figure 3 for details on how the Model 22 is physically positioned in the rack adapter. Plenty of room remains on the right side of the rack adapter, allowing you to add custom switches, lights, or jacks as your installation may require.

The Model 28A Panel Adapter allows the installation of a Model 22 and a Model 11A Gooseneck Microphone in a "cut out" made in a desk, console, or other enclosure. Refer to Figure 4 for a mechanical drawing of the panel adapter and the required mounting hole size.

A custom Model 22 installation is any installation where you devise the mounting method! Refer to Figure 2 for a mechanical drawing showing the dimensions of the Model 22. This will assist you in implementing your own mounting method.

Contained on both the Model 2 and the Model 22 are standard 9-pin D-type female connectors. A "straight through" cabling scheme links the units together, with pin 1 connected to pin 1, pin 2 to pin 2, etc. Shielded cable is required as the two audio buses linking the Model 22s to the Model 2 are unbalanced. The shield should be

connected to pin 1 on the 9-pin plugs. For reference, the following chart displays the signals associated with the access station connector:

<u>Pin #</u>	<u>Function</u>
1	Common/Shield
2	Interrupt Audio, CH1
3	Interrupt Audio, CH2
4	+18 Vdc
5	Interrupt Control, CH1
6	Interrupt Control, CH2
7	Lamp Voltage, CH1
8	Lamp Voltage, CH2
9	Monitor Speaker Mute Control

For ease of installation, each Model 22 contains two 9-pin D-type female connectors wired in parallel. This allows signals to be easily “looped through” on their way to the next Model 22. For short cable runs, standard 9-pin video monitor extension cables, commonly used with personal computers, are an inexpensive and readily available way to link a Model 2 with a Model 22. Ensure that any cable assemblies you purchase use shielded cable, with the shield connected at pin 1 of both plugs.

For best performance, a maximum total cable length of 500 feet should be used to link Model 22s to the Model 2. Minimizing the cable length reduces the total exposure the unbalanced audio buses have to noise pickup, etc. Cable runs longer than 500 feet are possible but should be carefully checked for correct operation.

The Model 22 Access Station contains several configuration switches that must be set. The input select switch allows the unit to be set for a mic or a line-level input. In most cases the Model 11A Gooseneck Microphone, available from Studio Technologies, will be used with a Model 22. Setting the switch to the mic position activates the mic

input terminals. The mic input is configured only for use with unbalanced electret-type microphones. The + terminal on the mic input provides current limited 5 Vdc to power the electret microphone. Don't use a dynamic microphone as damage may occur. The – terminal is connected to the microphone's low signal lead. The connection marked SHLD is intended for the shield wire of the microphone cable; it doesn't carry signal.

The Model 11A Gooseneck Microphone is an unbalanced electret type, requiring an external source of DC power. The microphone utilizes a ¼-inch 3-conductor plug for interconnection. The tip lead brings DC power to the microphone, as well as having microphone audio superimposed on it. The ring lead is microphone common. The sleeve lead is a shield connection.

Included with the Model 11A is a mounting hardware kit. Included with the kit is a ¼-inch 3-conductor jack used to mate with the microphone's plug. At the factory a 3-conductor wiring harness assembly is attached to the jack. The wiring harness has a red-colored wire, a black-colored wire, and a shield wire. One end of the red wire is attached to the tip connection on the jack. The other end should be connected to the + terminal on the Model 22's microphone input. One end of the black-colored wire is attached to the ring lead of the jack. The other end should be connected to the – terminal on the Model 22's microphone input. One end of the shield connection is attached to the sleeve of the jack. The other end should be connected to the SHLD terminal on the Model 22's microphone input.

Setting the input select switch to the line position activates the line input, and the associated input trim potentiometer. The line input circuit is electronically balanced,

capacitor coupled, with an input impedance of 24 k ohms. Balanced or unbalanced signals can be connected. The input trim pot allows signals with a nominal level of -15 to +10 dBu to be correctly interfaced. When connecting balanced signals the audio should connect to the + and - terminals. The shield wire can be connected to the SHLD terminal associated with the mic input. Unbalanced signals require a bit more attention for correct operation. The signal high lead should be connected to the + terminal. The signal low/shield wire should connect to both the - terminal and the SHLD terminal. Failure to make this connection can result in large amounts of hum being induced into the interrupt signal.

If you have connected a signal to the line input terminals, set the trim pot only after installing the entire IFB system. Refer to the Technical Notes section of this guide for details on setting the trim pot.

The Model 22 contains a monitor mute function, which is intended to prevent acoustical feedback if the access station is located close to the monitor loudspeaker associated with the Model 2 Central Controller. When the monitor mute switch is set to the ON position, the monitor output is muted whenever an interrupt occurs from that access station.

Model 24 Access Stations

Up to four Model 24 Access Stations can be connected to two Model 2 units. In this way the Model 24 units can provide remote access to the four IFB channels associated with the two Model 2s. One cable, terminated with a 9-pin D-subminiature connector on each end, links the Model 24 with the Model 2 designated to provide IFB channels 1 and 2. A second identical cable links the Model 24 with the Model 2 designated to

provide IFB channels 3 and 4. Each Model 24 has an unbalanced microphone input, a balanced line-level input, five lighted pushbutton switches, and related circuitry to access the four IFB channels. Power is provided by the Model 2 units; an external power source is not required. A 5-position screw terminal strip allows connection of a Studio Technologies Model 11A Gooseneck Microphone or a line-level signal.

The Model 24 can be mounted using either the Model 27A 19-Inch Rack Adapter or a custom panel cutout. The Model 27A 19-Inch Rack Adapter allows convenient installation of a Model 24 and a Model 11A Gooseneck Microphone into one space of a standard rack enclosure. Refer to Figure 6 for details. Plenty of room remains on the right side of the rack adapter panel, allowing you to add custom switches, lights, or jacks as your installation may require.

A custom Model 24 installation is defined as any installation where you devise the mounting method! Refer to Figure 5 for a mechanical drawing showing the dimensions of the Model 24. This will assist you in implementing your own mounting method.

The Model 24 contains two 9-pin D-subminiature connectors, one designated to connect to the Model 2 designated to provide IFB channels 1 and 2 (Unit #1) and the other to connect to the Model 2 designated for IFB channels 3 and 4 (Unit #2). Contained on the Model 2 is a 9-pin D-type female connector that is used to connect to the access stations. A "straight through" cabling scheme links the Model 24 units to the Model 2 units, with pin 1 connected to pin 1, pin 2 to pin 2, etc. Shielded cable is required as the audio buses linking a Model 24 to the Model 2s are unbalanced. The shield should be connected to pin 1 on the

9-pin plugs. For reference, the following chart displays the signals associated with the access station connector:

<u>Pin #</u>	<u>Function</u>
1	Common/Shield
2	Interrupt Audio, CH1 (Model 2 #1) or CH3 (Model 2 #2)
3	Interrupt Audio, CH2 (Model 2 #1) or CH4 (Model 2 #2)
4	+18 Vdc (Model 2 #1 and #2)
5	Interrupt Control, CH1 (Model 2 #1) or CH3 (Model 2 #2)
6	Interrupt Control, CH2 (Model 2 #1) or CH4 (Model 2 #2)
7	Lamp Voltage, CH1 (Model 2 #1) or CH3 (Model 2 #2)
8	Lamp Voltage, CH2 (Model 2 #1) or CH4 (Model 2 #2)
9	Monitor Speaker Mute Control (Model 2 #1 and #2)

For best performance, a maximum total cable length of 500 feet should be used to link Model 24s to the Model 2s. Minimizing the cable length reduces the total exposure the unbalanced audio buses have to noise pickup, etc. Cable runs longer than 500 feet are possible but should be carefully checked for correct operation.

If more than one Model 24 is going to be installed some method of “multing” or “splitting” the 9-pin D-subminiature connectors will have to be provided. The simplest method is to use a short section of ribbon cable and multiple 9-pin insulations-displacement (IDC) connectors. Depending on the specific installation, the “break out” assemblies can be connected directly to the access station connectors on the Model 2 units, or can be “downstream” at one of the Model 24s.

The Model 24 Access Station contains several configuration switches that must be set. The input select switch allows the unit to be set for a mic or a line-level input. In many cases the Model 11A Gooseneck Microphone, available from Studio Technologies, will be used with a Model 24. Setting the switch to the mic position activates the mic input terminals. The mic input is configured only for use with unbalanced electret-type microphones. The + terminal on the mic input provides current limited 5 Vdc to power the electret microphone. Don't use a dynamic microphone as damage may occur. The – terminal is connected to the microphone's low signal lead. The connection marked SHLD is intended for the shield wire of the microphone cable; it doesn't carry signal.

The Model 11A Gooseneck Microphone is an unbalanced electret type, requiring an external source of DC power. The microphone utilizes a ¼-inch 3-conductor plug for interconnection. The tip lead brings DC power to the microphone, as well as having microphone audio superimposed on it. The ring lead is microphone common. The sleeve lead is a shield connection. Included with the Model 11A is a mounting hardware kit. Included with the kit is a ¼-inch 3-conductor jack used to mate with the microphone's plug. At the factory a 3-conductor wiring harness assembly is attached to the jack. The wiring harness has a red-colored wire, a black-colored wire, and a shield wire. One end of the red wire is attached to the tip connection on the jack. The other end should be connected to the + terminal on the Model 24's microphone input. One end of the black-colored wire is attached to the ring lead of the jack. The other end should be connected to the – terminal on the Model 24's microphone input. One end of the shield connection is

attached to the sleeve of the jack. The other end should be connected to the SHLD terminal on the Model 24's microphone input.

Setting the input select switch to the line position activates the line input, and the associated input trim potentiometer. The line input circuit is balanced, transformer coupled, with an input impedance of 40 k ohms. Balanced or unbalanced signals can be connected. The input trim pot allows signals with a nominal level of -15 to +10 dBu to be correctly interfaced. When connecting balanced signals the audio should connect to the + and - terminals. The shield wire can be connected to the SHLD terminal associated with the mic input. Unbalanced signals can be connected so that the signal high lead is connected to the + terminal and the signal low/shield lead connects to the - terminal. If this results in hum or noise it's possible that improvements will be found by connecting the low/shield lead to both the - and the SHLD terminals. If you have connected a signal to the line input terminals, set the trim pot only after installing the entire IFB system. Refer to the Technical Notes section of this guide for details on setting the trim pot.

The Model 24 contains a monitor mute function, which is intended to prevent acoustical feedback if the access station is located close to monitor loudspeakers associated with the Model 2 Central Controllers. When the monitor mute switch is set to the ON position, the monitor outputs mute whenever an interrupt occurs from that access station.

Monitor Output

The Model 2 contains a 4 watt monitor amplifier which is intended to drive a small, efficient loudspeaker. A switch on the front panel selects whether IFB channel 1 or 2 will

be monitored. The monitor output is accessible from the back panel using a ¼-inch 2-connector jack. The output can drive 8 ohm or greater loads, and is quite "hi-fi." Ensure that both conductors of the speaker wiring are "floating" (isolated) from ground. This will prevent ground loops that could cause oscillation or other strange audio gyrations. We recommend using a good quality loudspeaker. If you do so we think you'll find the monitor output sounds quite nice. In our lab, we tested the monitor amp by connecting it to a JBL two-way speaker cabinet, with a compact disc acting as our program source. The amp, within reason, really "kicked some tail!"

Connecting AC Mains Power

The Model 2 is factory configured to operate from AC mains power of either 120 or 220/240 V, 50/60 Hz. In most cases, units shipped to North America are factory selected for 120 V operation and are supplied with an internal 0.500 A, 5 x 20 mm fast-acting fuse. Most units shipped outside North America are factory selected for 220/240 V operation and are supplied with a 0.250 A, 5 x 20 mm fast-acting fuse. Before connecting the Model 2 to mains power, determine the actual mains voltage and confirm that the Model 2 has been configured correctly, as an incorrect setting could seriously damage the unit. Should it be necessary to change the unit's operating voltage refer to the Technical Notes section of this guide. Because the Model 2 contains no power switch it will start operating as soon as mains power is connected.

The Model 2 uses an IEC standard connector to mate with the AC mains cord. Normally the cord supplied has a North American standard plug at one end and an IEC connector at the other. In non-North American

applications the appropriate plug must be attached. The wire colors in the mains cord, in most cases, will conform to the internationally recognized CEE color code and should be wired accordingly:

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

Operation

The Model 2's Front-Panel Controls and Indicators

If you value equipment by the number of switches and lights per rack space, the Model 2 is really a good deal—there is more stuff crammed onto the front panel than we thought possible! Seriously, the designers had the difficult problem of getting maximum functionality into a single rack space. We had heated arguments about the feature list, what to include, what to delete. In the end, we feel that all important features were included. Once you understand all the functions, we think you'll find the Model 2 quite powerful, yet easy and intuitive to use.

Looking at the Model 2's front panel from the left to the right, you should note the functional groups: internal interrupt microphone, channel 1-related items, channel 2-related items, voice activated (VOX) interrupt, telephone interface 1, telephone interface 2, monitor amplifier, and power LED. We'll discuss these groups in the following sections.

Internal Interrupt Microphone

The Model 2 contains an internal microphone which can be used to access either, or both, of the IFB channels. Two momentary action pushbutton switches are located on the left

end of the front panel and are labeled IFB 1 and 2. Pressing either switch mutes (or optionally dims) program audio, mutes the monitor speaker output, and connects the microphone to the selected IFB channel(s). The IFB status LED associated with each channel will light whenever its corresponding interrupt button is pressed. Notice that sound enters the microphone via the small openings in the front panel above and slightly to the right of the switches.

Program Select, Level Adjustment, and Indicators

Two identical sets of controls and indicators serve IFB channels 1 and 2. Each channel contains six program select switches, two status LEDs, a program level control, and a 5-segment LED level meter. The six switches are used to select which of the four program inputs, and the receive audio from the two telephone interfaces, will serve as the program audio source(s). The 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 defect, but is a feature which can be useful in special circumstances.

The red LED, labeled IFB, is lit any time program audio is being interrupted. There are three ways an interrupt can take place: by the internal microphone being activated, by a Model 22 or Model 24 Access Station being used, or via a control signal from the voice operated (VOX) interrupt function. The yellow LED, labeled VOX, is lit any time interrupt is caused by the VOX function.

The program level control allows the program audio signal to be adjusted relative to the interrupt audio level. The interrupt level is internally fixed and serves as the reference. The gain structure was configured so that the level control set for 50 percent

of rotation (12 o'clock) will give a program level approximately equal to the interrupt level. This statement is made under the assumption that a +4 dBu program signal is selected and its associated input trim pot is correctly set.

The 5-segment LED level meter displays the internal 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 average. 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 meter and a peak (PPM) meter. (We affectionately refer to it as a "PU" meter!) The meter should prove useful during installation and maintenance, as well as during normal operation.

A typical interrupt signal will light the green LEDs, with peaks lighting the yellow LED. The internal compressor circuits will keep most interrupt signals from lighting the red LED. When an interrupt is not taking place, the level meter will reflect the level of the program audio source. Setting the program level control to occasionally light the yellow LED will give a program level approximately equal to the interrupt level.

Voice Operated (VOX) Interrupt

The Model 2 contains a specialized function that allows an audio signal to automatically interrupt the program signal. By contrast, using the Model 2's internal microphone requires an explicit action by the operator, i.e., pressing a button to cause an interrupt. In some cases, this explicit action is simply not possible. An example would be a director giving cues via a two-way radio or a telephone line. The VOX circuitry creates an interrupt control signal by detecting energy in the voice band. This control signal acts

on the selected IFB channel, interrupting program audio and routing VOX audio in its place. The VOX interrupt can be assigned to either IFB channel 1 or 2, but not to both simultaneously.

The VOX interrupt function is only sophisticated from an internal-circuitry stand point. Operation is quite simple, with only two switches to set. The input switch allows one of three audio sources to be connected to the VOX input: audio from the auxiliary audio input, receive audio from telephone interface 1, or receive audio from telephone interface 2. The output switch is used to select whether the VOX interrupt function is off (not used), or is assigned to interrupt IFB channel 1 or 2. VOX operation can commence as soon as the output is assigned to one of the channels. VOX interrupt activity can be noted by observing the yellow VOX LED associated with the assigned IFB channel.

Telephone Interface 1

Two status LEDs, one switch, and one trim potentiometer are associated with telephone interface 1. The yellow LED, labeled STD, is lit whenever the interface is set for the standard audio mode by the switch on the back panel. The red LED, labeled LC for loop current, lights any time DC current is flowing through the interface. Normally in the standard audio mode, loop current would not be flowing through the interface and the LC LED will not be lit. In most cases the loop current LED lighting would indicate that the mode switch should be changed to the telephone line position.

The interface control switch, active in the telephone line mode, allows the interface to be taken off hook or hung up. Momentarily pressing the switch to the up position, labeled MAN OH for manual off hook, places

the interface in the off-hook state. If loop current is detected, the interface will stay in the off-hook state and the loop current LED will light. If loop current is not detected, the interface will return to the off-hook (idle) state after a few seconds. Momentarily pressing the switch to the down position, labeled HANG UP, immediately disconnects the interface from the telephone line. In the standard audio mode, the interface control switch is not active because the standard audio mode places the interface permanently in what is effectively the off-hook condition.

Telephone line audio signals can vary greatly in level on a call-by-call basis. To counter this problem, a level trim potentiometer is provided for the operator, allowing adjustment over a ± 8 dB range. A quiet signal can be boosted, and a “hot” signal can be attenuated. The trim pot is accessible via a small hole in the front panel, directly to the right of the interface control switch.

Telephone Interface 2

Two status LEDs, two switches, and one trim potentiometer are associated with telephone interface 2. The yellow LED, labeled STD, is lit whenever the interface is set for the standard audio mode by the switch on the back panel. The red LED, labeled LC for loop current, lights any time DC current is flowing through the interface. In the standard audio mode, loop current will not usually be flowing through the interface. If it is, the red LED will light. In most cases the loop current LED lighting would indicate that the mode switch should be changed to the telephone line position.

The interface control switch, active in the telephone line mode, allows the interface to be taken off hook or hung up. Momentarily pressing the switch to the up position,

labeled MAN OH for manual off hook, places the interface in the off-hook state. If loop current is detected, the interface will stay in the off-hook state and the loop current LED will light. If loop current is not detected, the interface will return to the on-hook (idle) state after a few seconds. Momentarily pressing the switch to down position, labeled HANG UP, disconnects the interface from the telephone line. An apparent problem occurs if the switch is used to place the interface in the off-hook state and then immediately used to hang up the interface. A pause of approximately three seconds is required before the manual hang-up function becomes active after the interface is manually taken off hook. This is due to the charge time of a debounce capacitor required in the auto answer circuit. This capacitor is not associated with interface 1 and the pause is not required. In the standard audio mode, the interface control 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 interface 2. In the center position, audio is received from the telephone line. In the up position, labeled SEND CH1, composite IFB channel 1 audio is sent out the interface. In the down position, labeled SEND CH2, composite IFB channel 2 audio is sent out the interface. The overall send level is not adjustable. Just like the talent amplifier and line outputs, the interrupt level is fixed, and the program level is adjusted in reference to it. The send level has been internally configured to give the highest signal level possible, without overloading the telephone company equipment.

On interface 2 a level trim pot is provided, allowing the receive audio to be adjusted over a ± 8 dB range. A quiet signal can be

boosted, and a “hot” signal can be attenuated. The trim pot is accessible via a small hole in the front panel, directly to the right of the routing control switch. The trim pot is active only in the receive mode.

Monitor Output

A level control and source select switch is associated with the monitor section. The level control adjusts the output level sent to the external monitor speaker. IFB channel 1 is monitored when the source select switch is in the up position. In the down position, channel 2 is monitored. The middle position is labeled OFF and the monitor amplifier is, as you might guess, off!

Power Indicator Light

A red LED indicator light located on the right side of the front panel is lit any time mains power is applied to the Model 2. Since the Model 2 does not contain a power switch, the power LED should be lit at all times that power is applied to your equipment racks.

It's Time to Use the System!

Operation can commence after the Model 2 and related equipment have been installed and connected. The power LEDs on the Model 2 and, if present, Model 32A and/or Model 33A Talent Amplifiers should be lit. If one or more Model 22 or Model 24 Access Stations are installed, their push-button switches should be dimly lit.

Earpieces should be connected to the talent amplifiers. Both the Model 32A and Model 33A Talent Amplifiers utilize a ¼-inch 2-conductor phone jack and a 3.5 mm output jack for their audio output. On the Model 32A, either IFB channel can be selected as the audio source. On the Model 33A, either or both IFB channels can be selected as the audio source(s). The level control(s) should

be adjusted for the desired level during an interrupt from the Model 2's internal microphone. Note that the even when the level control(s) are set to the fully counterclockwise position, the audio output will not be fully “off.” This ensures personnel will never (hopefully!) miss an important cue because a level control was accidentally turned “off.”

Once the talent amplifier's output level has been set, a Model 2 program source can be selected and the program level control on the Model 2 adjusted as required. Remember that the nominal interrupt level is internally set in the Model 2, and acts as the system reference.

In the following paragraphs we'll describe several simple procedures you can use to try out the Model 2's features.

Connect a high quality audio source, e.g., compact disc or MP3 player, to a program input. Select it as the program audio source for one of the IFB channels. Set the program level control to get the yellow meter LED lighting on signal peaks. Test the monitor amp—it should let you “rock out” pretty well. If not, put in a maintenance request for a better speaker!

Bring an audio source into the auxiliary audio input and test the VOX interrupt feature. Set the VOX input switch to the middle position, connecting the auxiliary audio input to the VOX circuitry. Use the VOX output switch to assign the VOX output to one of the IFB channels. On the channel you selected for VOX interrupt watch the VOX and IFB status LEDs light when signal is detected. Use the monitor amplifier to monitor VOX interrupt activity.

Try receiving audio via telephone interface 1. Use the receive audio as a program source. Use the receive level trim pot to vary the

receive audio level. Use the receive audio as a source for the VOX interrupt function.

Telephone interface 2 has more features; try them all. If set for the telephone line mode, let the interface automatically answer an incoming telephone call. Use the interface to receive, as well as send audio. Use the receive audio as a program source. Use the receive level trim pot to vary the receive audio level. As with interface 1, use the receive audio as a source for the VOX interrupt.

If applicable, test the Model 22 or Model 24 Access Stations. Is the interrupt audio loud and clear? Observe the status lamps inside the pushbutton switches. Do the appropriate lamps light fully bright when an interrupt takes place? If an access station is configured to mute the Model 2's monitor output, ensure that the monitor speaker does mute during an interrupt.

In all cases, you should hear clear, click-free audio. We intended the Model 2 to sound great—if not, call us for technical help. A completed installation should be reliable, easy to use, and perform to high sonic standards. Questions and comments from the field are welcomed and encouraged!

Technical Notes

Schematic Diagrams

Schematic diagrams are available to all purchasers of IFB Plus systems. Contact Studio Technologies' support, via phone or email, to obtain the electronic files. The schematics show the graphical representation of all the electronic components, along with their electrical value and connections. Traditionally, a problem with schematics has been the decimal point marking. It either disappears due to bad printing, or dust, dirt or other

imperfections end up looking like decimal points. For clarity, Studio Technologies has adopted a more "European" component marking scheme. Upon first review it may seem quite confusing, but it can eliminate problems. For resistors, the designation "K" for kilo (1000) has been moved to the decimal point position. A 4700 ohm resistor is shown as 4K7, rather than 4.7K. An example for a one percent value, a 49900 ohm resistor would be shown as 49K9. For capacitors, the letter "r" is simply substituted for the decimal point marking. A 0.47uF capacitor is shown as r47uF. Once you are accustomed to this system you may well prefer it.

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 line outputs were terminated with 600 ohm loads. In this way it was easy to say that 0 dBm is 1 milliwatt dissipated in the known load (i.e., 0 dBm across 600 ohms will measure 0.775 V). In current situations an output is rarely terminated in 600 ohms; generally 5 k ohms or higher. The dBu designation is better because it refers to dB referenced to 0.775 V, with no reference to load impedance. This takes into account the current audio scene where most equipment has a low output source impedance, and a high input impedance.

Revising Mains Voltage

The Model 2 can operate from mains power of either nominal 120 or 220/240 V. Internal "straps" select the operating voltage. Follow this section if a change of operating voltage is required.

The following procedures must be performed by a qualified technician. Operating the Model 2 with the cover removed exposes the technician to points in the

power input section with hazardous voltages.

1) Ensure that the mains power cord is removed from the Model 2's power connector on the back panel.

2) Remove the top cover via the four 6-32 button-head cap screws.

3) Locate the power supply jumper straps. They are directly adjacent to the power transformers on the right side of the circuit board. The circuit board legend shows the designated locations for the two operating voltages. From the factory, 0 ohm "resistors" are used for the straps. These resistors are really just encapsulated jumper wires. For 120 V operation, two "0 ohm" jumper straps are installed for each of the three power transformers (total of six straps). For 220/240 V operation one strap is associated with each transformer.

4) Review the present configuration. If a change is required, use a soldering iron and appropriate tools to revise the straps. With care, the changes can be made without removing the circuit board from the chassis. Removing the circuit board from the chassis is a painful and time-consuming experience. The voltage selection straps can be removed and installed from the component (top) side of the circuit board. Ensure that the ends of the straps do not extend below the circuit board so as to touch, or even come near the bottom of the chassis. Failure to heed this warning can result in safety, reliability, and operational problems. Confirm that the required straps have been installed for all three transformers.

5) If the mains voltage was changed, replace the fuse with the correct value: 0.500 A for 120 V, 0.250 A for 220/240 V. The fuse is a 5 x 20 mm fast-acting type.

6) Replace the top cover and secure it using the screws.

7) Before reconnecting mains power, use an ohm meter to ensure that none of the straps leads have shorted to metal chassis below the circuit board.

8) Reconnect the mains power and check the Model 2 for correct operation.

Dim/Mute Function

From the factory, program audio is set to mute upon interrupt. If level "dimming" rather than full muting is desired, a simple modification can be performed by a qualified technician. Schematic diagrams should be obtained prior to performing any revisions.

The following procedures must be performed by a qualified technician. Operating the Model 2 with the cover removed exposes the technician to points in the power input section with hazardous voltages.

1) Ensure that the mains power cord is removed from the Model 2's power connector on the back panel.

2) Remove the top cover via the four 6-32 button-head cap screws.

3) Referring to page 2 of the Model 2's schematic diagram, find the resistor identification numbers for the dim resistors. From the factory, resistors are not inserted into these locations. If resistors are installed, someone has beaten you to the punch and already performed this modification!

4) Refer to the chart located on page 2 of the schematic. The chart gives resistor values corresponding to several "dim" values. The level in dB refers to the program level drop that will occur during an interrupt. After selecting and acquiring the desired

resistors, prepare them for insertion into the circuit board. With care, the resistors can be added without removing the circuit board from the chassis. Bend the leads so that they are 1/2-inches apart, allowing them to easily drop into the resistor locations. Trim the leads so that once inserted and soldered into the board, the ends of the leads will not touch the chassis below the board. Again, ensure that the ends of the straps do not extend below the circuit board so as to touch, or even come near the bottom of the chassis. Failure to heed this warning can result in operational problems.

- 5) Replace the top cover and secure it using the screws.
- 6) Reconnect the mains power and check the Model 2 for correct operation.

Disabling the Auto Answer Feature

In the telephone line mode, telephone interface 2's circuitry will automatically go off-hook upon detecting ringing voltage on the telephone line. This feature can be very useful, allowing another site to access the Model 2 without operator intervention. There may be cases where this feature is not desired, and the auto answer function can be disabled. Referring to page 5 of the Model 2's schematic diagram, observe the ring detection circuit in the lower left section of the page. If needed contact the factory to obtain the schematic files. A 5K6 resistor (5600 ohm, 1 watt) is in series with the optocoupler. Remove this resistor to disable auto answer. Remember to be careful inside the cabinet. Disconnect mains power prior to taking off the cover!

Voice Operated (VOX) Interrupt Release Time

The VOX interrupt circuit was designed to have a fast detect time and a relatively long

release time. The fast detect time ensures that the beginning of a word will not be lost. The slower release time keeps the circuit from "modulating" during normal English language speech patterns. This release time was scientifically determined—we gathered a bunch of people in our lab, "listened" to a number of different release times, then chose the favorite. Actually, we think the selected time works quite well. However, you may have a different opinion. (Do beans belong in chili? Is Elvis really dead?) The release time is set using one capacitor. Referring to the right side of page 7 of the Model 2's schematic, locate the r33uF (0.33uF) capacitor connected to the output of the synchronous half-wave rectifier. Reducing the capacitance to r22uF (0.22uF) or r1uF (0.1uF) will shorten the release time. Increasing the capacitance to r47 (0.47uF) or 1uF, will increase the release time. Use safety precautions if you will be performing this, or any other, modification. If needed, contact the factory to obtain the schematic files.

Line Output Nominal Level

The nominal level of the line outputs is +4 dBu. This should be well-suited for most professional applications. However, the line output stage is such that if you require a different nominal output level, you can achieve it by simply changing one resistor per channel. Refer to page 9 of the Model 2's schematic to observe the two identical line output stages. If needed contact the factory to obtain the schematic files. Audio enters the line driver stage at the internal nominal operating level of -10 dBu. Each channel's composite IFB signal enters a section of operational amplifier which is configured to add 8 dB of gain, bringing the nominal level to -2 dBu. This signal connects to a differential line driver integrated circuit. By the very nature of a balanced line driver a 6 dB level boost is achieved. The nominal output level is now +4 dBu.

You might enjoy a quick explanation of why 6 dB is added by a differential output stage. We'll use the example of an input signal to the differential line driver chip which, upon taking a "snapshot" view, is swinging positive to a level of +2 V. Observing the balanced output at that very same instant, the "high" output is swinging +2 V, while the "low" output is swinging -2 V. The unbalanced input has an excursion of 2 V, but the balanced output had an excursion of 4 V (+2 V to -2 V). Since voltage gain in dB is equal to $20 \log V_{out}/V_{in}$, calculating our example you get $20 \log 4/2 = 6 \text{ dB}$! Another side note, this 6 dB of boost is exactly why the differential line receiver, used the Model 2's program input circuits, contains a fixed 6 dB attenuation. The receiver IC gets rid of the 6 dB gain created by a differential driver, saving headroom and correctly matching equipment levels.

Anyway, to modify the nominal output level requires you to change the gain of an operational amplifier by changing the value of its feedback resistor. Refer to the chart on page 9 of the schematic diagrams for several output levels and the corresponding resistor values. If you need an output level that requires less than unity gain from the op-amp you can do it, but be careful. If you choose a feedback resistor less than 10 k ohms a potential stability problem arises. To eliminate the chance of a problem, connect a 100pF capacitor in parallel with the feedback resistor to reduce the open loop gain.

As with all changes to internal Model 2 circuitry, taking a safety first approach is required. Disconnect mains power before removing the Model 2's cover.

Setting the Program Input Level Trim Pots

There is no hard and fast rule on how to best adjust the trim pots associated with the

program inputs. As mentioned in the installation section, the pots are provided simply to allow the relative levels of the program input signals to be equalized. This will allow minimal level changes when an operator is switching between the four program inputs. A simple method of using the trim pots to "calibrate" the program input levels is to start by connecting an audio level meter to the line output of IFB channel 1. Set the front-panel program level control associated with IFB channel 1 to the middle position (12 o'clock or 50 percent of rotation). Set the four program level trim pots to 50 percent of their rotation. Set the four program sources to deliver their normal operating signal level to the Model 2's program inputs. These signals could be in the form of alignment tones, or actual program material. Use the program select switches to select, one at a time, the four program inputs. The line output should give an output level of +4 dBu nominal, with +8 to +12 dBu probable on peaks. The actual output level is not important, and a lower level is much better than a "hotter" average level. After observing the relative strengths of the four sources, use one or more of the trim pots, if required, to get an equal average level from the four sources.

If you have a source that is especially low in level, e.g., -10 dBu, all is not lost. While getting a -10 to +4 level booster box is a good idea, the level trim pots can come to the rescue. On the inputs that have signal sources of nominally +4 dBu, set their trim pots fully counterclockwise, reducing their input sensitivity by approximately 8 dB. On the inputs that have the -10 sources connected, set their input trim pots to fully clockwise, adding 8 dB of input sensitivity. You have now equalized the 14 dB (+4 to -10) level difference using the trim pots! Using the program input switches, you now

should find relatively equal audio levels. Use the audio level meter, connected to IFB channel 1's line output, to "tweak" the trim pots.

If you don't have an audio level meter handy, or if you're not concerned about exact calibration, use one of the LED level meters on the front panel to set the trim pots. Actually, if your ears are pretty good use them, and no meters, to set the trim pots to get equal levels—that's what we would do if we were in the field! Confirm your subjective adjustment with the LED meter and you should be set.

Setting the Line-level Trim Pot on the Model 22 and Model 24 Access Stations

The Model 22 and Model 24's line input circuitry allows balanced and unbalanced signals with a nominal level of -15 to $+10$ dBu to be correctly interfaced. The system is designed to have an access station send interrupt signals at a signal level of -10 dBu to the Model 2 Central Controller. A level adjustment trim pot on the Model 22 and Model 24 allows the various signal levels to be adjusted to give the desired signal strength. Set the trim pot only after installing the entire IFB system. Start by connecting an audio level meter across the two test points, labeled COM and AUDIO, on the Model 22 or Model 24's circuit board. Then, while speaking into the microphone, headset, or other device that produces the line-level signal, adjust the trim pot to give an average level of approximately -10 dBu on the meter. Peak signals should fall in the -5 to 0 dBu range. This setting should result in a clean, clear interrupt signal, without excess compressing by the Model 2's circuitry.

Model 32A and Model 33A Output Level

By design, the output level on the Model 32A and Model 33A 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 33A Talent Amplifier, where a mix of the two IFB channels can be achieved. Referring to the Model 32A or Model 33A schematic diagram, observe that a resistor is connected between circuit common and the counterclockwise connection of each potentiometer. This resistor prevents full attenuation. By replacing this resistor with a "0 ohm" resistor or jumper strap, full attenuation can be achieved.

Troubleshooting

Troubleshooting the Model 2 and related components is to be performed only by a qualified technician. Operating the Model 2 with the cover removed exposes you to hazardous voltages.

Block diagrams are located at the end of this guide. Schematic diagrams are available upon request. These documents provide assistance during maintenance and repair. Understanding the schematics and block diagrams will lead to much better understanding of the individual circuits and how they work together (or, in case of trouble, how they don't work together!)

Model 2 Central Controller

The Model 2 consists of many relatively simple circuits. Detailed troubleshooting procedures are difficult to describe because there are few specific circuits that are prone to failure. The following paragraphs may give a few helpful hints if problems do arise. In all cases, you are welcome to contact Studio Technologies for technical support.

Wiring Errors

The Model 2 provides +18 Vdc for use by the Model 22 and Model 24 Access Stations. Up to four access stations can be connected, drawing a total maximum of 100 mA nominal from the +18 Vdc supply. The +18 Vdc is produced by a 3-terminal regulator. Should the +18 Vdc get shorted to common up to one amp of current may flow through the regulator. By design, the +18 Vdc regulator does not use a heat sink. This helps the device heat faster under excessive current flow, allowing the internal overpower protection to shut down the regulator. During the short circuit condition the power transformer may vibrate under the strain of excessive current. Be aware that the monitor output power amplifier shares this transformer. Should the +18 Vdc be “dead shorted” the monitor performance will also suffer.

The talent amplifier output uses current-limited temperature-sensing components to create the +22 Vdc modulated with channel 1 audio. Like the +18 Vdc supply for the access station, a shorted talent amplifier output will result in excessive currents, followed by thermal shutdown. Removing the short and allowing time for the device to cool will restore operation.

Power Supplies

Should problems occur with the Model 2, the power supplies are the first thing to examine. The unit contains three independent supplies, each with transformer, bridge rectifier, filtering, etc. Use the test points to ensure that the correct voltages are present. Be aware that the test points for the unregulated supply points can vary greatly from their nominal values.

There are two very common reasons why a power “rail” can go down: defective electrolytic capacitor and a shorted power bus.

With time, over-temperature, etc., an electrolytic capacitor can fail. The caps used in the Model 2 are heavily overrated for normal use, but still could fail. Use an oscilloscope to examine the unregulated voltage points. Check for excessive “ripple.” The 3-terminal regulators are quite reliable and are not a weak link. A shorted integrated circuit can draw enough current to cause a regulator to go into the thermal shutdown mode. Eliminate the short, wait a minute or two, and the supply should come up again.

Audio Circuitry

The Model 2 uses straightforward audio circuitry throughout. Normal “follow the audio flow” troubleshooting techniques should be used. A digital multimeter, oscilloscope, signal generator, and audio VTVM should be all that is required.

Model 22, Model 24, Model 32A, and Model 33A

The Model 22 and Model 24 Access Stations and the Model 32A and the Model 33A Talent Amplifiers all have fairly simple circuitry. A careful review of the block diagrams, located at the end of this guide, and schematic diagrams, available upon request, should allow rapid problem solving. All share the condition that all signals, including power, audio, and logic, begin and/or end with the Model 2 Central Controller.

The first thing to determine is that the wiring linking the units together is correct. Ensure that the Model 22 or Model 24 units are getting +18 Vdc for operation. The Model 32A and Model 33A use +18 Vdc modulated with channel 1 audio. Use an oscilloscope to check for both the DC voltage, and the superimposed audio signal.

Specifications

Model 2 Central Controller

IFB Channels: 2

Channel Features: 6-input program select switch, program level control, 2 status LEDs, 5-segment LED level meter

General Audio Parameters:

Audio Switching and Muting: “clickless” using special “ramping” analog switches

Distortion (THD+N): 0.3%

Overall Frequency Response: 20 Hz to 20 kHz, ±0.5 dB

S/N Ratio: 67 dB

Interrupt Audio Compressor/Limiters: one per IFB channel, studio quality, dual slope

Connectors:

Audio Inputs: 3-pin XLR-type, female

Audio Outputs: 3-pin XLR-type, male

Talent Amplifier Output: 3-pin XLR-type, male

Monitor Amplifier Output: ¼-inch, 2-conductor phone jack

Access Station: 9-pin, D-subminiature, female

Telephone Interfaces: 6-position modular (RJ11-type jack)

Mains Power: standard 3-blade IEC-type plug

Internal Interrupt Microphone: electret condenser

Program Inputs: 4

Type: electronically balanced, direct coupled

Impedance: 24 k ohms

Level: +4 dBu, nominal, trim adjustable ±8 dB

Auxiliary Audio Input:

Type: electronically balanced, direct coupled

Impedance: 24 k ohms

Level: +4 dBu, nominal, trim adjustable ±8 dB

Application: used with voice operated (VOX) interrupt

Talent Amplifier Output:

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

Line Outputs: 2, 1 per IFB channel

Type: electronically balanced, capacitor coupled, intended to drive 600 ohm or greater loads

Level: +4 dBu, nominal, +24 dBu maximum

Voice Operated (VOX) Interrupt Function:

Input Source: receive audio from telephone interface 1 or 2, or auxiliary audio input, selectable

Output: IFB channel 1 or 2, selectable

Detection Bandpass: 400 to 1400 Hz, nominal

Detect Time: less than 1 mSec

Telephone Interfaces 1 and 2:

Operating Modes: switch selectable for use with telephone lines or standard balanced or unbalanced audio signals

Receive Audio Level: –15 dBu, nominal, trim adjustable ±8 dB

Telephone Line Requirements: 2-wire, loop start, 10 mA loop current minimum

Telephone Line Disconnect: manual, using front-panel switch; automatic, after detection of 250 mSec, nominal, break in loop current

Telephone Line Interface Control: switch on front panel allows manual off-hook and manual hang-up functions

Telephone Interface 2—Additional Features:

Auto Answer: when set for telephone line operation, answers on one ring

Audio Routing Control: switch on front panel allows Interface 2 to receive audio, or send IFB channel 1 or 2 audio

Send Audio Level: –6 dBu, nominal

Monitor Output:

Power: 4 W RMS into 8 ohms @ 1% THD+Noise

Application: designed to drive loads of 8 ohms or greater

Access Station Interface: allows connection of up to four Model 22 or Model 24 Access Stations

AC Mains Requirement: 115 or 230 V, ±10%, internally configurable, 50/60 Hz, 20 watts maximum

Dimensions (Overall):

19.0 inches wide (48.3 cm)

1.72 inches high (4.4 cm)

11.4 inches deep (29.0 cm)

Mounting: one space (1U) in a standard 19-inch rack

Weight: 10.4 pounds (4.7 kg)

Model 22 Access Station

Application: provides remote 2-channel interrupt (talk) location based on a Model 2 Central Controller unit; up to four Model 22 units can be connected to a Model 2 Central Controller.

Power Requirements: +18 Vdc, 25 mA maximum, provided by connected Model 2 Central Controller

Interconnection:

Contains two 9-pin D-subminiature connectors (female). One connector intended to link Model 22 to Model 2 Central Controller. The second connector, wired in parallel with the first, is designed to allow “loop through” installation for connection to additional Model 22(s).

Pushbutton Switches: 2

Type: backlit, momentary, EAO 99-series

Lamp Type: incandescent, T-1, bi-pin, 18 V, 26 mA, 0.5 W Equivalent to EAO Switch Corp. 11-903-2, Wamco 0L1100BPE, Lamtronics AS25-8

Audio Inputs: electret microphone or line level, switch selectable

Microphone Input:

Compatibility: designed only for use with 2-wire gooseneck electret microphone (2 wires + shield). Intended input level –25 dBu nominal. Model 11A Gooseneck Microphone available from Studio Technologies.

Microphone Power: +5 Vdc, current limited. Applied to microphone “high” lead.

Connector: three terminals on a screw terminal strip

Line Input:

Type: electronically balanced, capacitor coupled, compatible with balanced or unbalanced audio signals

Input Impedance: 24 k ohms

Common Mode Rejection: 100 dB at DC and 60 Hz, 70 dB at 20 kHz, 62 dB at 40 kHz (typical)

Input Level: –15 to +10 dBu, input level adjustable via trim potentiometer

Connector: two terminals on a screw terminal strip

Dimensions (Overall):

6.4 inches wide (16.3 cm)
1.6 inches high (4.1 cm)
5.2 inches deep (13.2 cm)

Mounting:

Rack mounted using Model 25A 19-Inch Rack

Adapter. Panel mounted using Model 28A Panel Adapter. Custom mounting easily accomplished.

Weight: 0.8 pounds (0.4 kg)

Model 24 Access Station

Application: provides remote 4-channel interrupt (talk) location for IFB system based on two Model 2 Central Controller units, up to four Model 24 units can be connected to the two Model 2 Central Controllers.

Power Requirements: +18 volts DC, 50 mA, nominal, provided by connected Model 2 Central Controller

Interconnections: two 9-pin D-subminiature connectors (female), each linking the Model 24 with a Model 2 Central Controller

Interrupt Switches: 5

Functions: IFB 1-4, All Call

Type: momentary pushbutton, EAO 99-series, all backlit, tally indication for IFB 1-4 functions

Microphone Input:

Compatibility: 2-wire electret, designed for use with Studio Technologies’ Model 11A Gooseneck Microphone (purchased separately)

Connector: three terminals on a screw terminal strip

Line Input:

Type: transformer coupled, compatible with balanced or unbalanced audio signals

Input Impedance: 40 k ohms, nominal

Input Level: –15 to +10 dBu, adjustable using trim potentiometer

Connector: two terminals on a screw terminal strip

Monitor Muting: switch selectable, allows Model 24 interrupt activity to mute monitor amplifier outputs on Model 2 Central Controllers

Dimensions (Overall):

6.4 inches wide (16.3 cm)
1.6 inches high (4.1 cm)
5.2 inches deep (13.2 cm)

Mounting:

Rack mounted using Model 27A 19-Inch Rack Adapter (purchased separately). Can also be flush mounted in custom-fabricated rectangular opening in enclosure or work surface.

Weight: 0.8 pounds (0.35 kg)

Model 25A 19-Inch Rack Adapter

Application: intended for use with Model 22 Access Station and Model 11A Gooseneck Microphone

Dimensions (with Model 22 attached):

19.0 inches wide (48.3 cm)
1.72 inches high (4.4 cm)
5.2 inches deep (13.2 cm)

Mounting: one space (1U) in a standard 19-inch rack

Weight (with Model 22 attached): 1.6 pounds (0.7 kg)

Model 27A 19-Inch Rack Adapter

Application: intended for use with Model 24 Access Station and Model 11A Gooseneck Microphone

Dimensions (with Model 24 attached):

19.0 inches wide (48.3 cm)
1.72 inches high (4.4 cm)
5.2 inches deep (13.2 cm)

Mounting: one space (1U) in a standard 19-inch rack

Weight (with Model 24 attached): 1.6 pounds (0.7 kg)

Model 28A Panel Adapter

Application: intended for use with Model 22 Access Station and Model 11A Gooseneck Microphone

Dimensions (with Model 22 attached):

8.0 inches wide (20.3 cm)
2.75 inches high (7.0 cm)
5.2 inches deep (13.2 cm)

Mounting:

Designed to be mounted in a panel opening. Recommended opening size 6.5 inches wide (16.5 cm), 1.7 inches high (4.3 cm), 6.5 inches minimum depth (16.5 cm)

Weight (with Model 22 attached): 1.3 pounds (0.6 kg)

Model 32A Talent Amplifier

Primary Application: intended for use with Model 2 Central Controller

Indicator Light: red LED indicates operation of internal power supply

Power/Audio Input:

Connector: 3-terminal XLR-type female

Signals: pin 1 common, pin 2 +DC modulated with channel 1 audio, pin 3 channel 2 audio

Audio Levels: -10 dBu nominal

Power Requirements: 12 to 35 Vdc, 20 mA normal operation, 110 mA worst case (shorted headphone output)

Loop Through Connector:

Type: 3-terminal XLR-type male, connected in parallel with input connector

Purpose: Intended to be used to connect multiple talent amplifiers in a "loop through" arrangement

Audio Amplifier:

Output Connectors: ¼-inch and 3.5 mm 2-conductor (monaural) phone jacks

Load: intended for connection to headphones or earpieces with impedance of 8 ohms or greater

Source: IFB channel 1 or channel 2, switch selectable by user

Output Level: user adjustable via log taper potentiometer

Maximum Output Power: 170 mW into 8 ohms, at 1% THD+Noise, 400 Hz

Distortion (THD+N): less than 0.15%, measured at 400 Hz, 100 mW output power into 8 ohms

Frequency Response: optimized for voice response and high frequency rejection

Dimensions (Overall):

3.6 inches wide (9.1 cm)
4.8 inches high (12.2 cm)
1.9 inches deep (4.8 cm)

Mounting:

Intended for portable applications. Contains integral belt clip. Optional mounting adapter allows Model 32A to be permanently mounted.

Weight: 0.6 pounds (0.3 kg)

Model 33A Talent Amplifier

Primary Application: intended for use with Model 2 Central Controller

Indicator Light: red LED indicates operation of internal power supply

Power/Audio Input:

Connector: 3-terminal XLR-type female

Signals: pin 1 common, pin 2 +DC modulated with channel 1 audio, pin 3 channel 2 audio

Audio Levels: -10 dBu nominal

Power Requirements: 12 to 35 Vdc, 21 mA normal operation, 34 mA worst case (shorted headphone output)

Loop Through Connector:

Type: 3-terminal XLR-type male, connected in parallel with input connector

Purpose: Intended to be used to connect multiple talent amplifiers in a “loop through” arrangement

Audio Amplifier:

Output Connectors: ¼-inch and 3.5 mm 2-conductor (monaural) phone jacks

Load: intended for connection to headphones or earpieces with impedance of 150 ohms or greater

Source: IFB channel 1 and/or channel 2, switch selectable by user

Output Level: user adjustable via two log taper potentiometers

Maximum Output Power: 35 mW into 150 ohms, at 1% THD+Noise, 400 Hz

Distortion (THD+N): less than 0.15%, measured at 400 Hz, 32 mW output power into 150 ohms

Frequency Response: optimized for voice response and high frequency rejection

Dimensions (Overall):

3.6 inches wide (9.1 cm)

4.8 inches high (12.2 cm)

1.9 inches deep (4.8 cm)

Mounting:

Intended for portable applications. Contains integral belt clip. Optional mounting adapter allows Model 33A to be permanently mounted.

Weight: 0.6 pounds (0.3 kg)

Specifications and information contained in this User Guide subject to change without notice.

**Figure 1. Model 2 Central Controller Rear Bracket Mounting Hole Location
(for fabricating customer-provided brackets)**

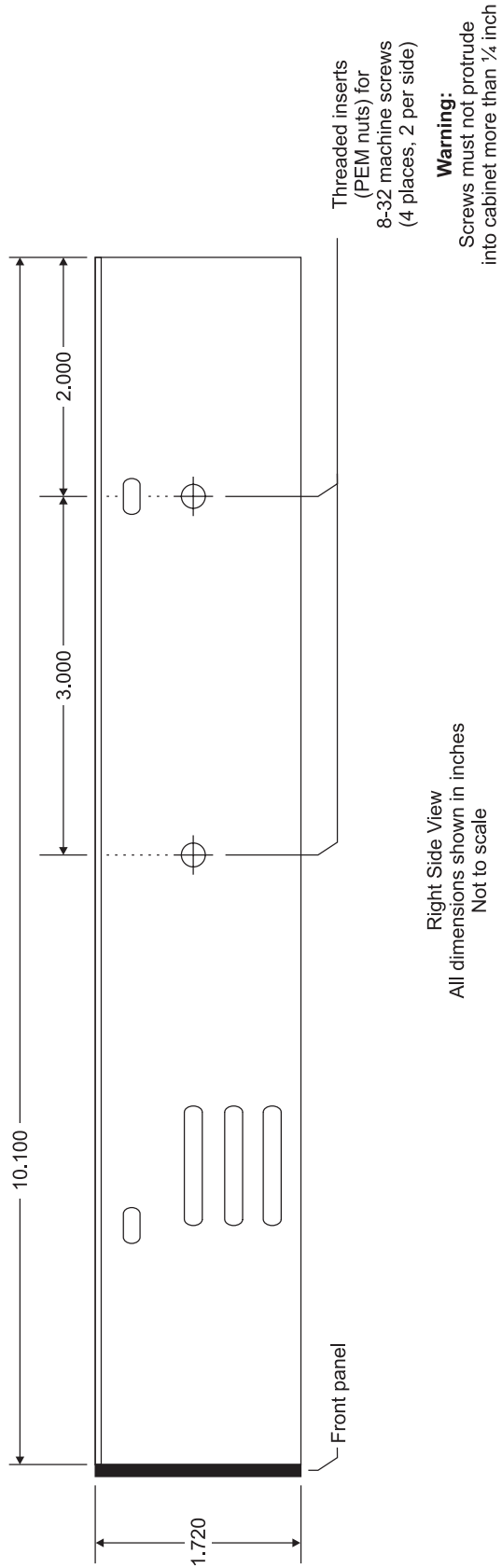
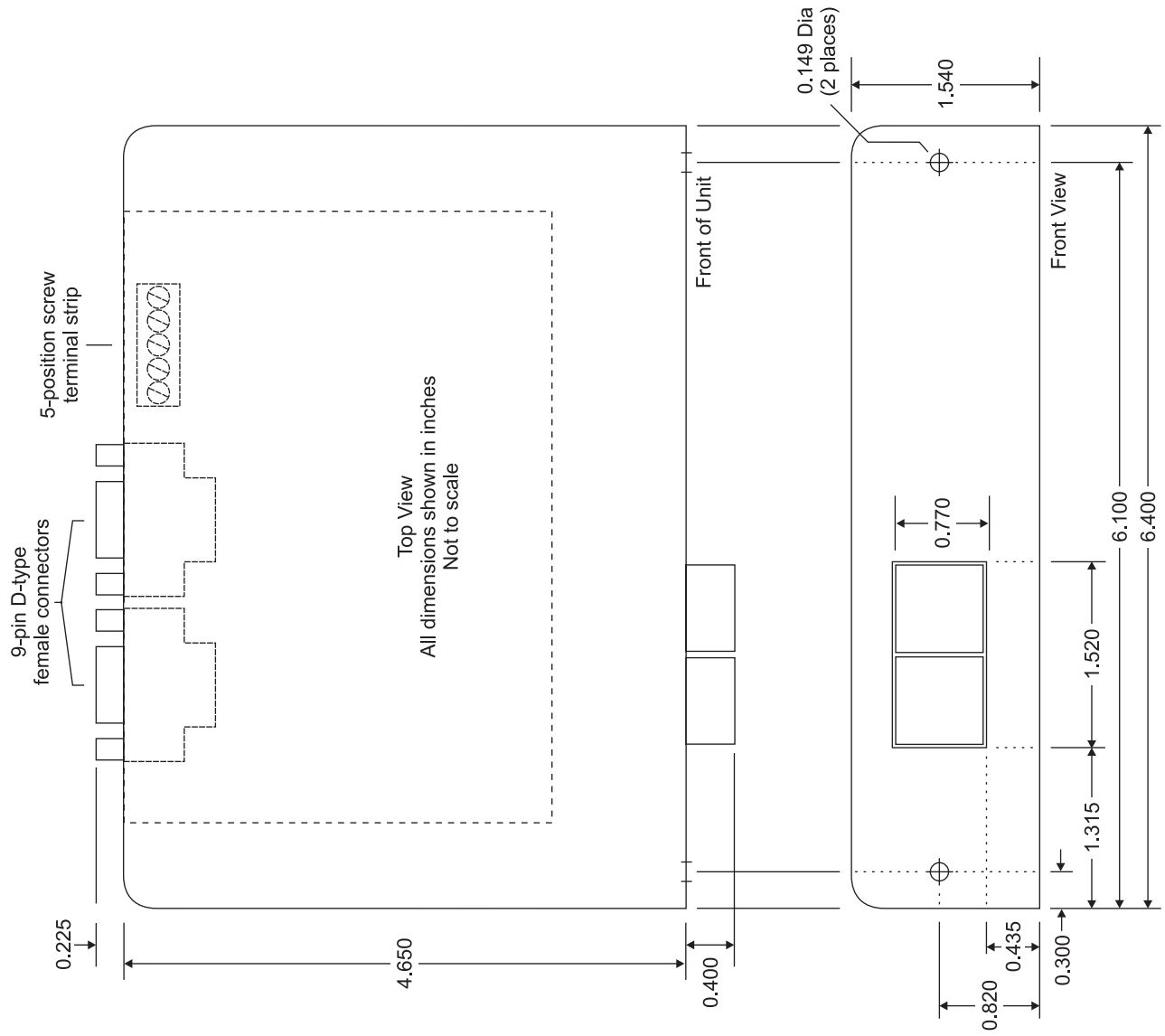
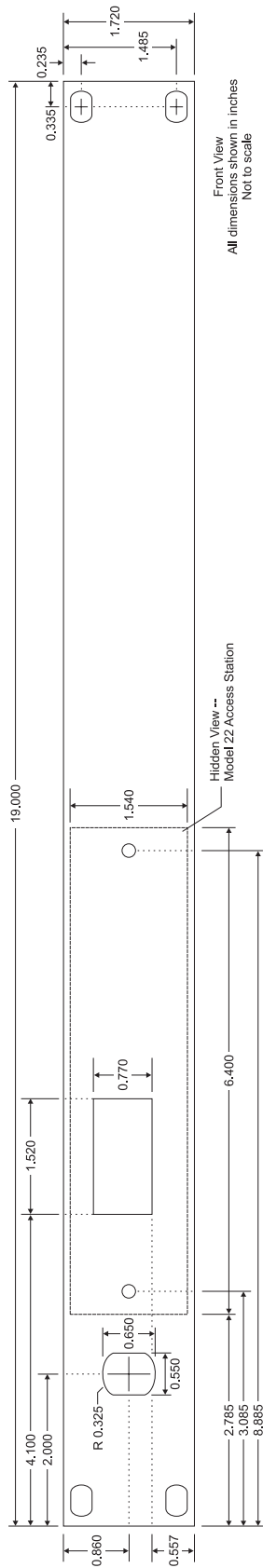


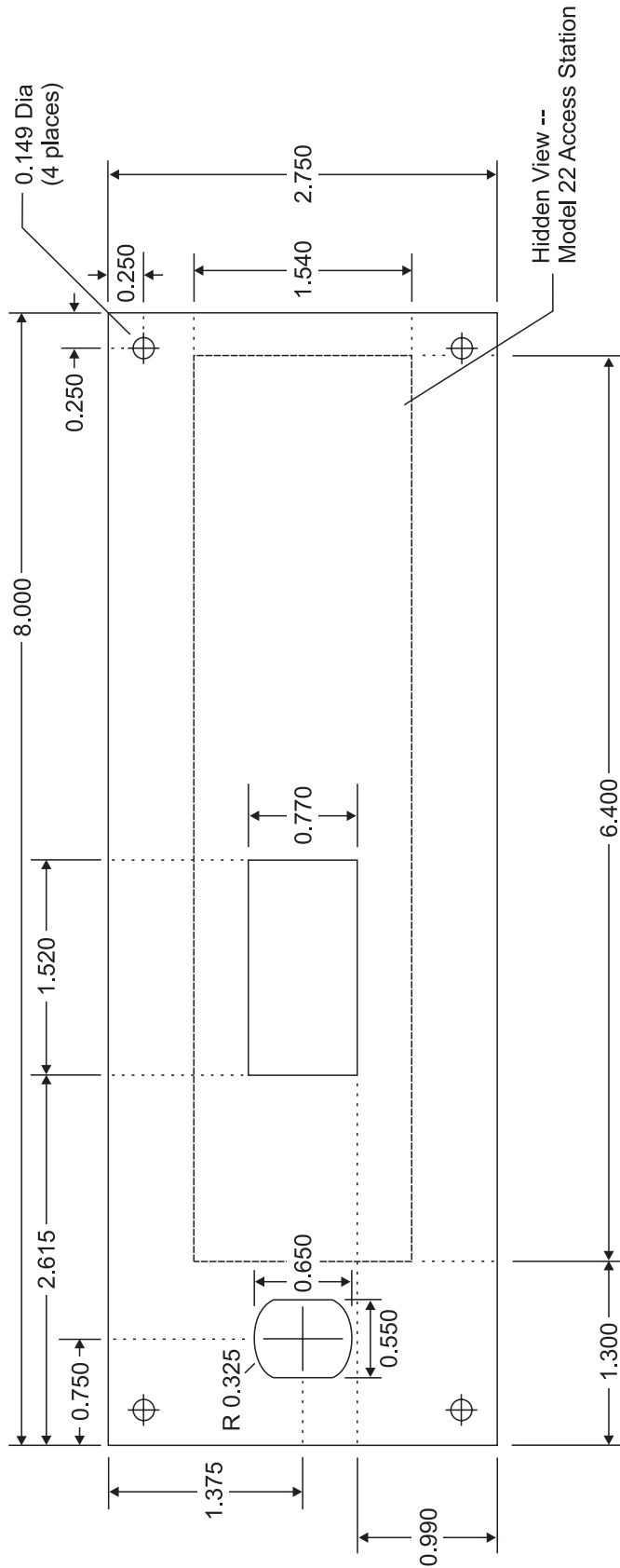
Figure 2. Model 22 Access Station Overall Dimensions



**Figure 3. Model 25A 19-Inch Rack Adapter
(used with Model 22 Access Station and Model 11A Gooseneck Microphone)**

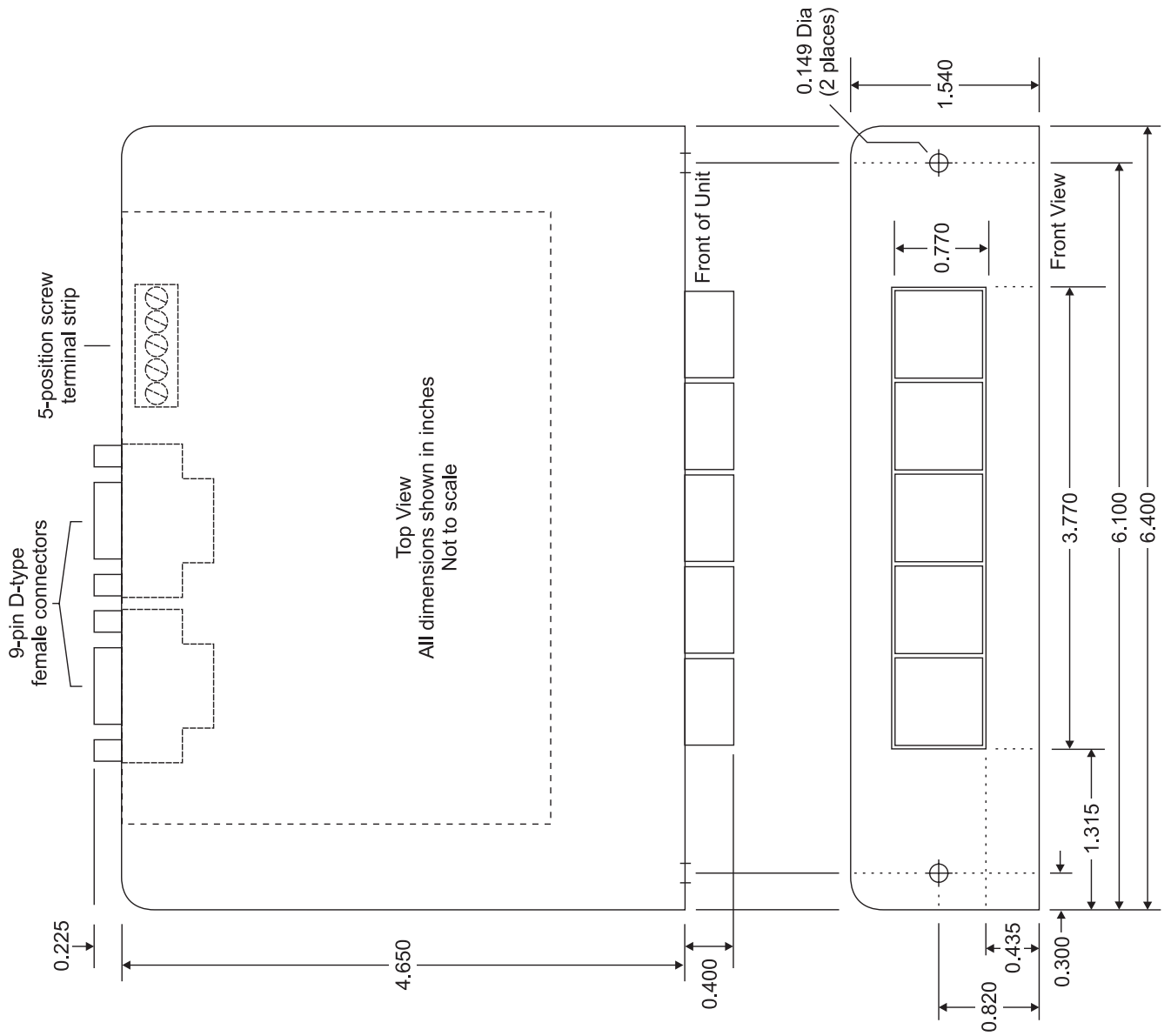


**Figure 4. Model 28A Panel Adapter
(used with Model 22 Access Station and Model 11A Gooseneck Microphone)**

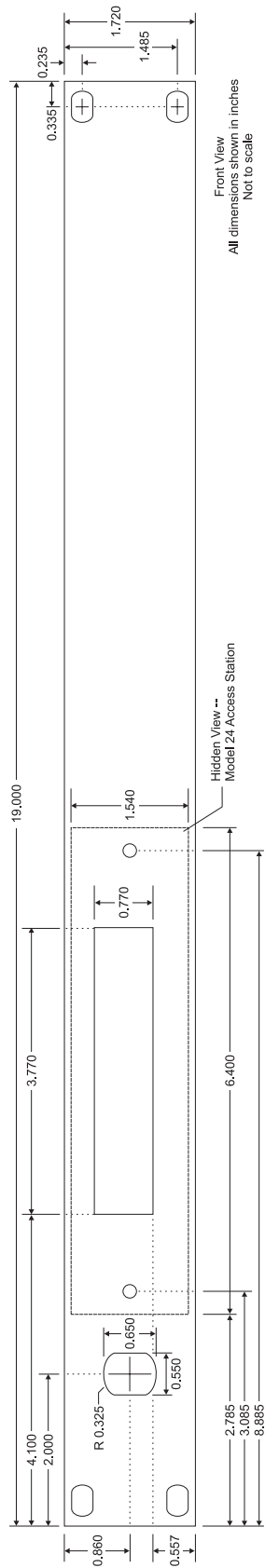


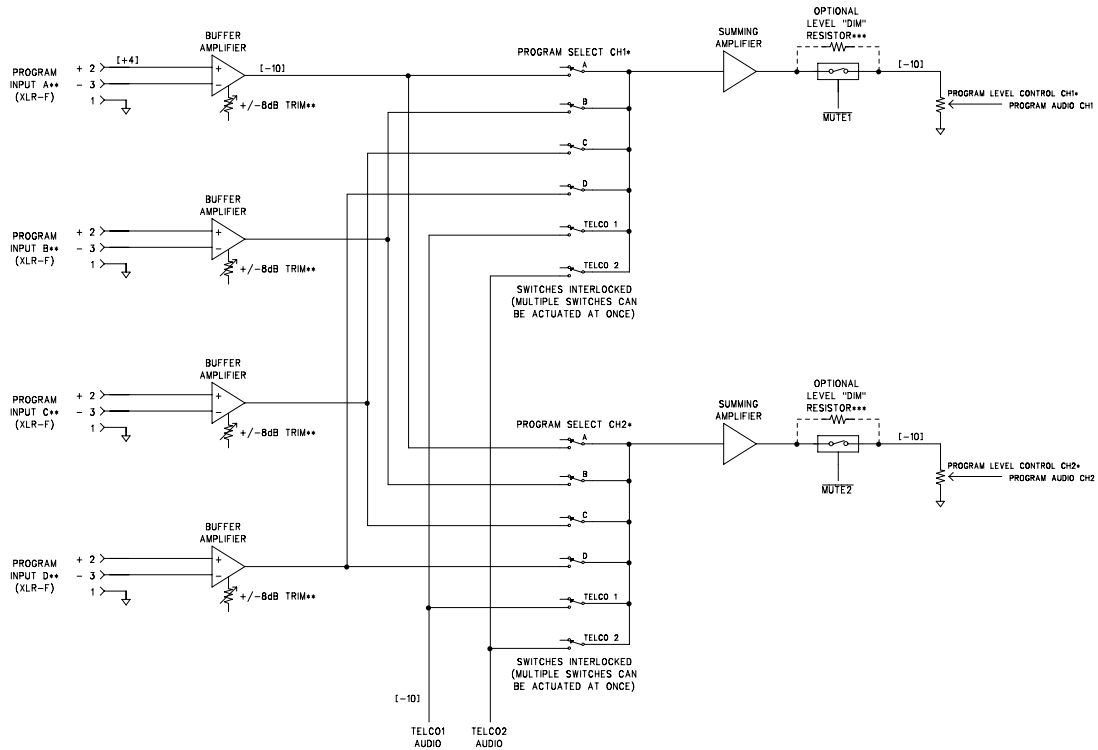
Front View
All dimensions shown in inches
Not to scale

Figure 5. Model 24 Access Station Overall Dimensions



**Figure 6. Model 27A 19-Inch Rack Adapter
(used with Model 24 Access Station and Model 11A Gooseneck Microphone)**

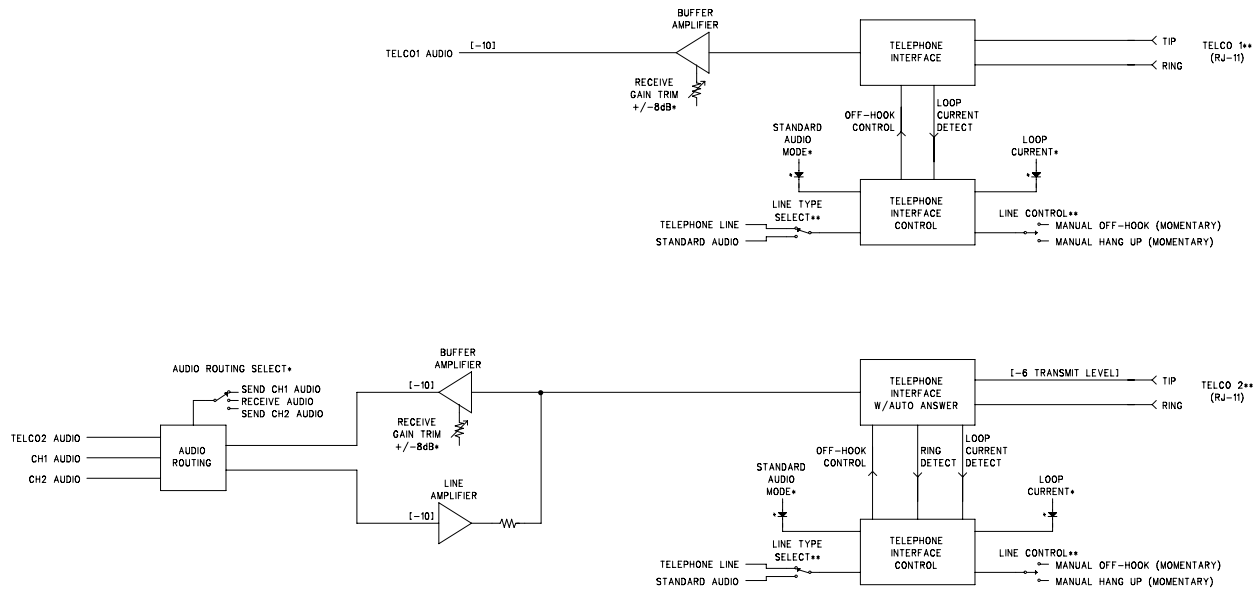




* LOCATED ON FRONT PANEL
 ** LOCATED ON BACK PANEL
 *** FACTORY CONFIGURATION MUTES AUDIO DURING INTERRUPT.
 ADD RESISTORS TO DROP, RATHER THAN FULLY MUTE, PROGRAM AUDIO.
 [NOMINAL LEVEL IN dBu]

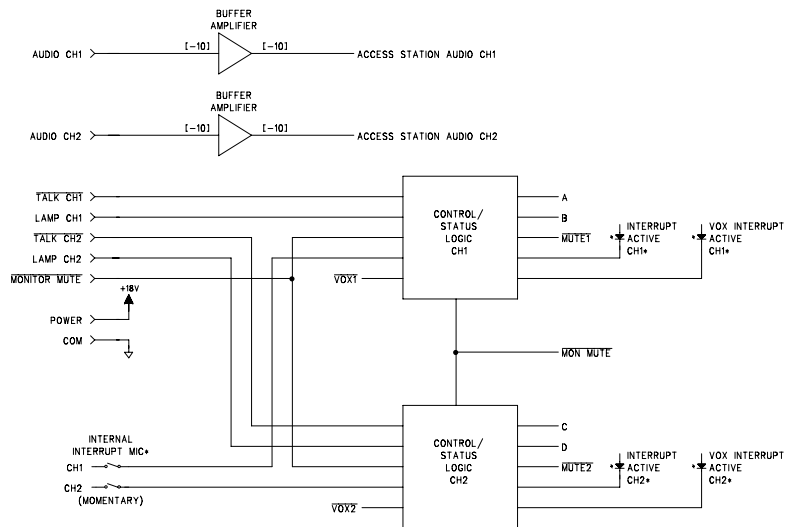
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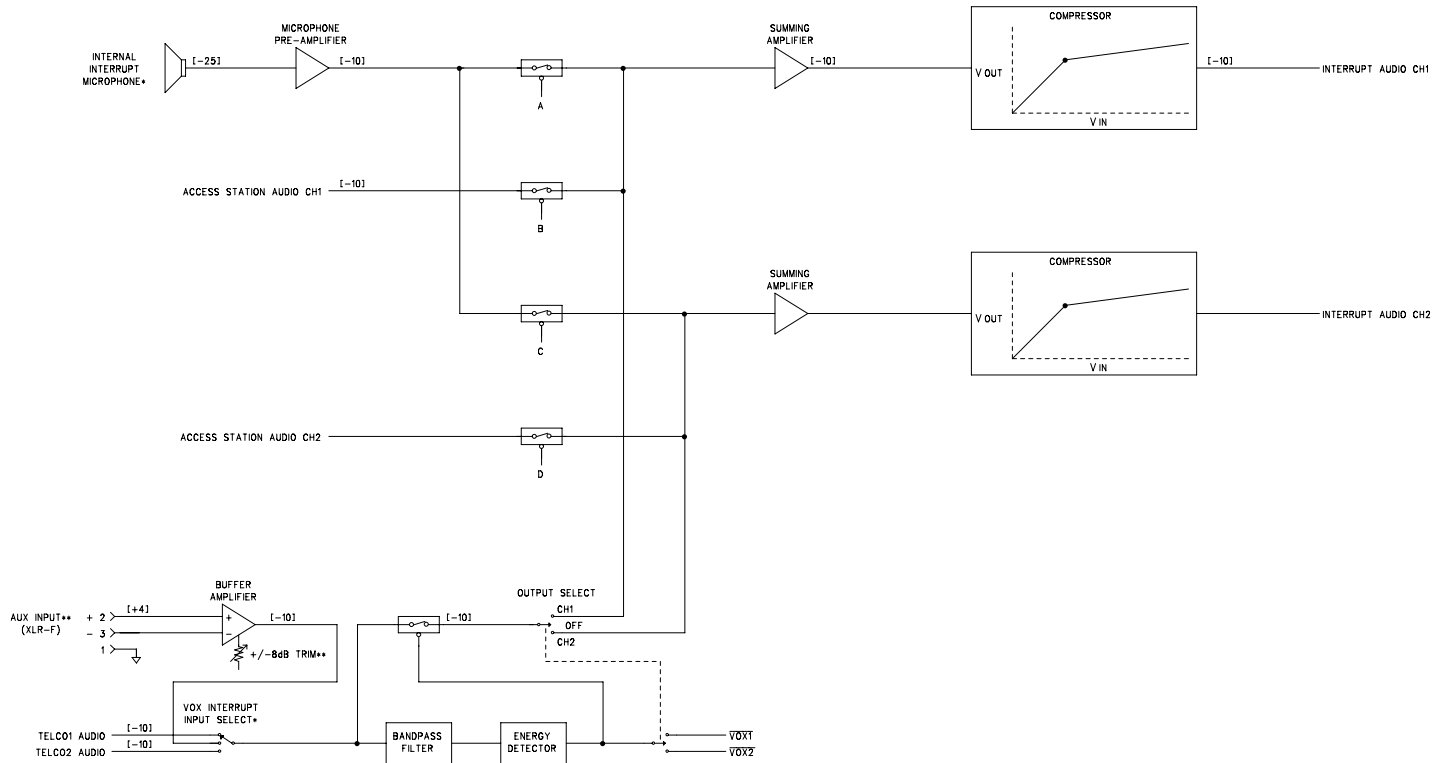
* LOCATED ON FRONT PANEL
 ** LOCATED ON BACK PANEL
 [NOMINAL LEVEL IN dBu]

AUDIO, STATUS, AND
CONTROL SIGNALS
TO/FROM
ACCESS STATION(S)**
(9-PIN D-TYPE F)

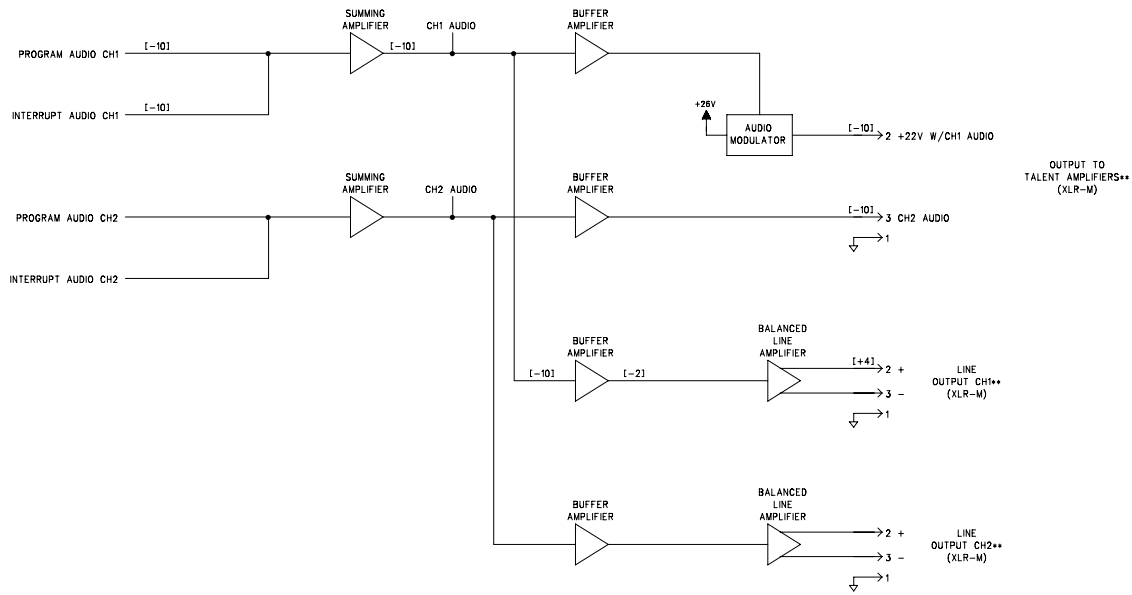


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* LOCATED ON FRONT PANEL
** LOCATED ON BACK PANEL
[NOMINAL LEVEL IN dBu]

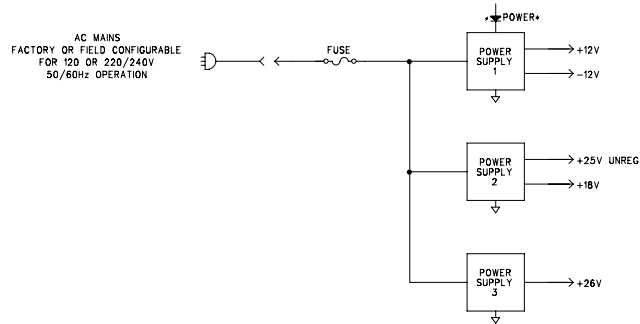
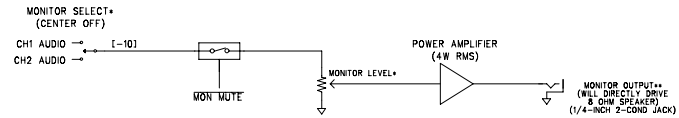
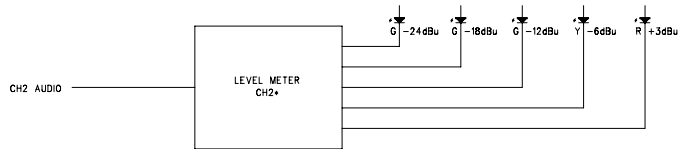
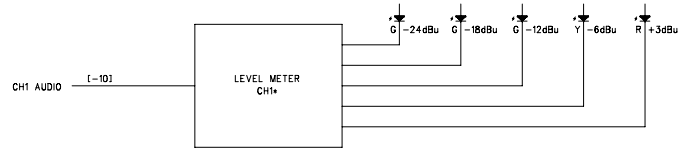


* LOCATED ON FRONT PANEL
 ** LOCATED ON BACK PANEL
 [NOMINAL LEVEL IN dBu]



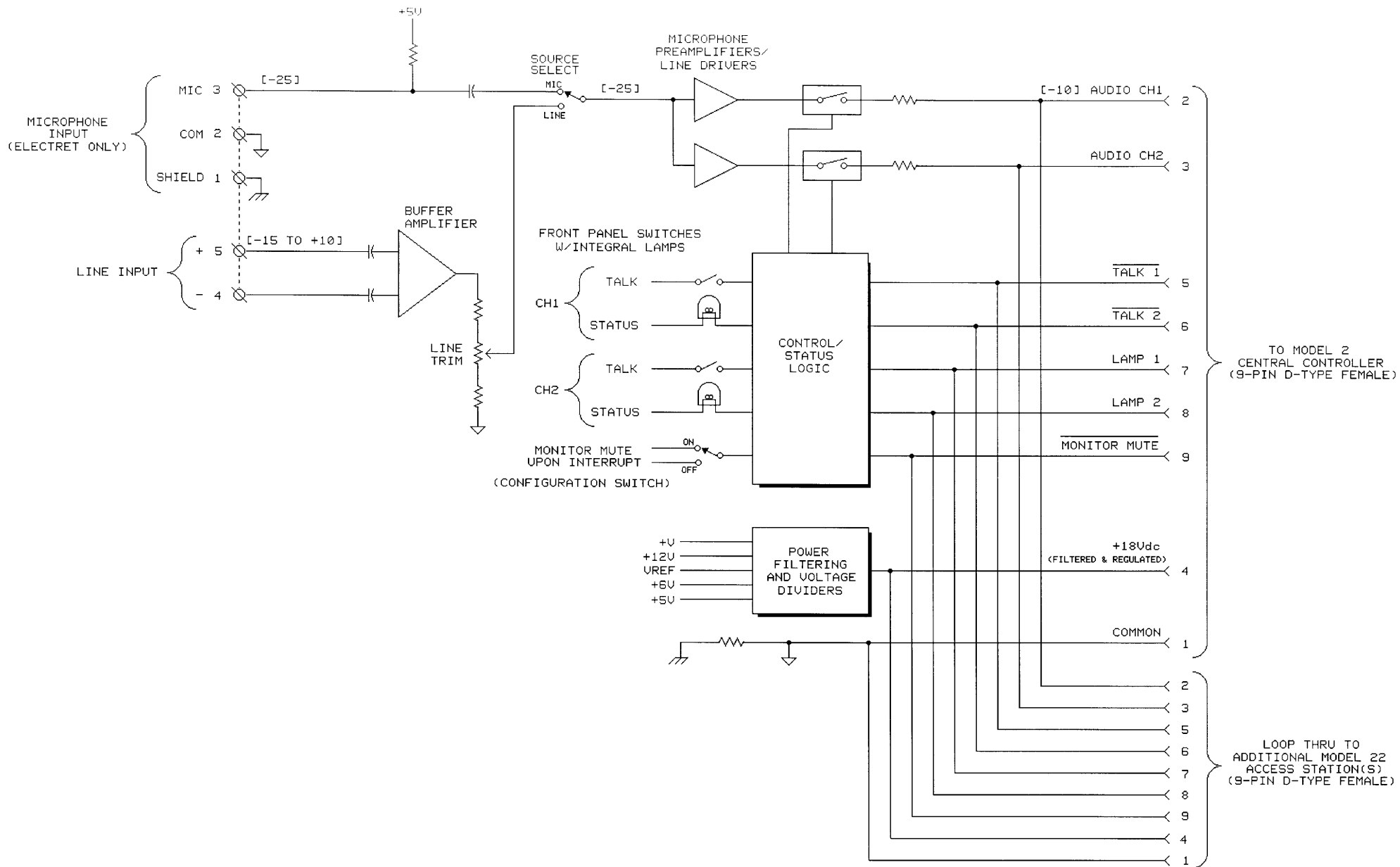
* LOCATED ON FRONT PANEL
 ** LOCATED ON BACK PANEL
 [NOMINAL LEVEL IN dBu]

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MODEL 2 CENTRAL CONTROLLER		
BLOCK DIAGRAM		
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* LOCATED ON FRONT PANEL
 ** LOCATED ON BACK PANEL
 [NOMINAL LEVEL IN dBu]



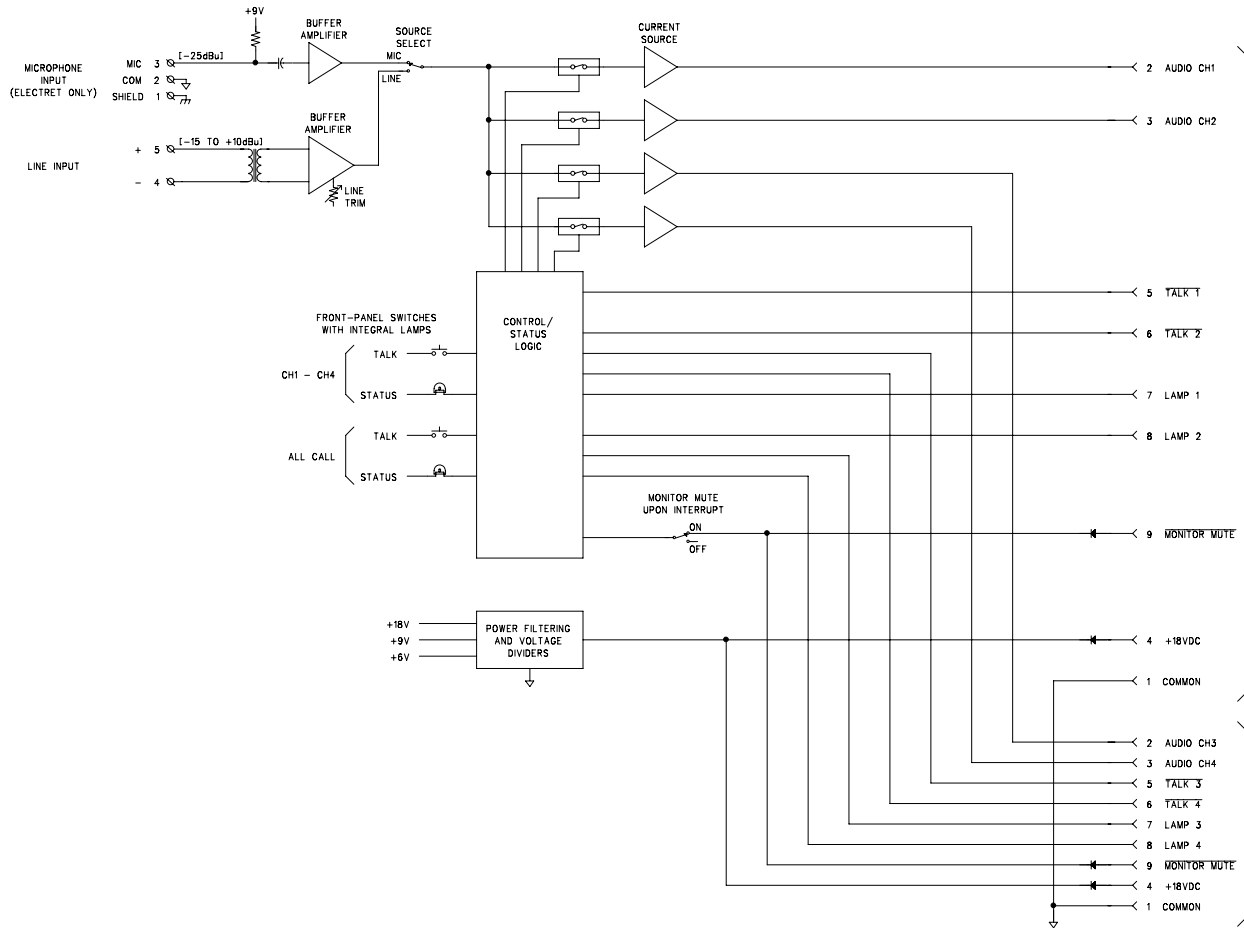
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IFB PLUS SERIES
 MODEL 22 ACCESS STATION
 BLOCK DIAGRAM

[NOMINAL LEVEL IN dBu]

PAGE 01 of 01

DATE 10/2/91

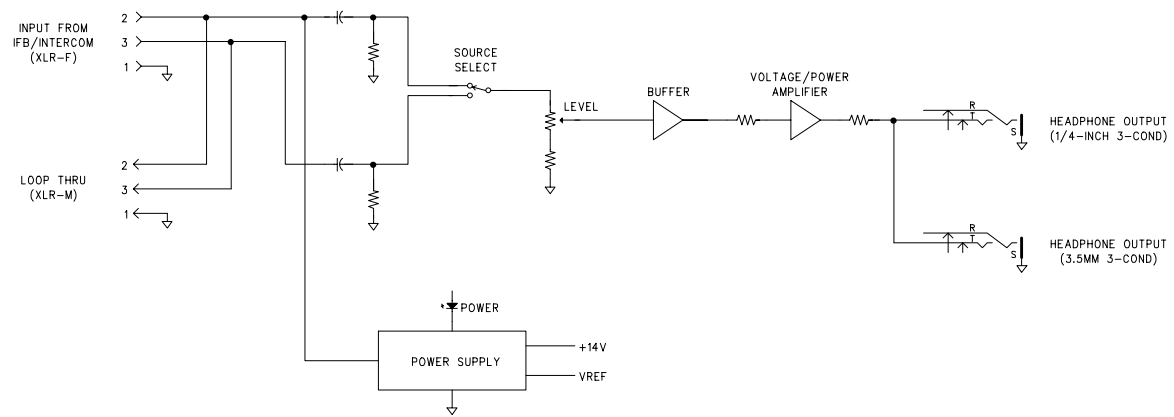


TO/FROM MODEL 2 #1
FOR IFB CHANNELS 1 & 2
(9-PIN D-TYPE FEMALE)

TO/FROM MODEL 2 #2
FOR IFB CHANNELS 3 & 4
(9-PIN D-TYPE FEMALE)

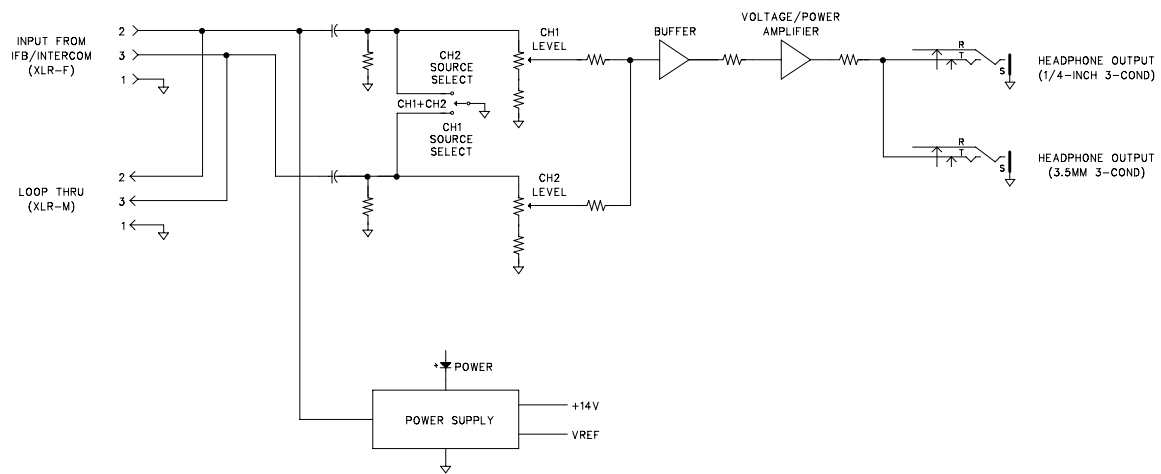
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MODEL 32A TALENT AMPLIFIER BLOCK DIAGRAM		
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M33ABD_A

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MODEL 33A TALENT AMPLIFIER BLOCK DIAGRAM		
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31531	11/19/09	01 OF 01

