

StudioComm

Model 40 Central Controller and Related Components

User Guide

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StudioComm

Introduction

The Model 40 Central Controller, along with related components, are part of the StudioComm series. StudioComm products provide monitoring and communications functions for professional audio applications. The Model 40 Central Controller, along with up to eight Model 35 or Model 38 Talent Amplifiers, allow the creation of sophisticated headphone (cue) systems for use in recording, broadcast, film, and specialized applications. With a totally unique, proprietary design, a specialized, high-quality headphone system is easily configured and installed.

What This User Guide Covers

This User Guide is designed to assist you when installing, configuring, and using the Model 40 Central Controller, Model 35 Talent Amplifier, and Model 38 Talent Amplifier. It also contains detailed service information, including block and schematic diagrams.

System Overview

The underlying concept of a StudioComm headphone system is distributed amplification. The Model 40 Central Controller provides two stereo line inputs, each which can be assigned to two output groups. Each output group distributes line-level stereo audio and DC power over standard 3-conductor microphone-type

cables to up to four Model 35 or Model 38 Talent Amplifiers. Two pairs of headphones can be connected to each talent amp. By placing the final output stage in the talent amplifiers, superior audio quality can be delivered directly to the user.

The highlight of a StudioComm headphone system is the sonic quality; low distortion, low noise “high fi” audio with an output level loud enough for “rock ‘n roll.” The entire audio path is optimized for one thing: making headphones sound great.

The design and implementation of a StudioComm headphone system is simple. Cables terminated with standard 3-pin XLR-type connectors link the Model 40 Central Controller with the talent amplifiers. For assistance, both input and loop-through connectors are provided on each talent amp. For the first time, cable length simply stops being an issue. Locating talent amplifiers over 500 feet (164m) away from a Model 40 is perfectly acceptable.

Model 40 Central Controller

The Model 40 is the connection point for the audio inputs, and provides the talent amplifier outputs which connect to the talent amplifiers. The unit mounts in one standard rack space.

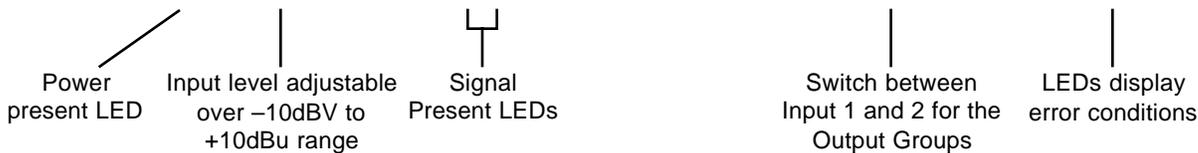
Two Stereo Line Inputs

The analog outputs of consoles, workstations, off-air receivers, or virtually any analog source can be connected to the Model 40's line inputs. The inputs accept balanced or unbalanced signals, with an acceptable input level range of -10dBV to $+10\text{dBu}$. Signal Present LEDs provide assistance when adjusting the input level controls.

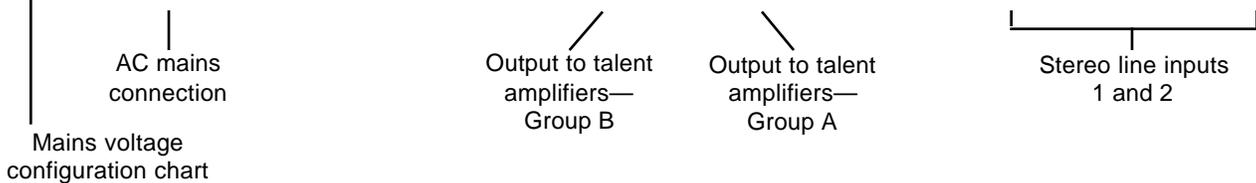
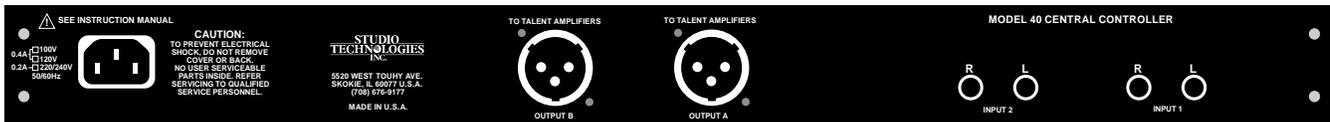
Talent Amplifier Output Groups

Each of the two output groups is designed to feed up to four StudioComm talent amplifier modules. The physical output of each group is a 3-pin male XLR-type connector that provides power and left and right audio to the talent amplifiers. The talent amplifier output groups are short circuit protected. Error conditions are displayed by the Over Current LEDs on the Model 40's front panel.

Model 40 Front Panel



Model 40 Back Panel



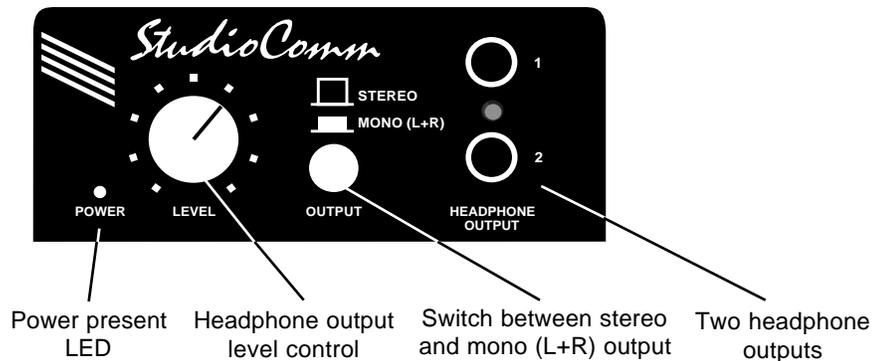
Model 35 Talent Amplifier

The Model 35 Talent Amplifier is a portable amplifier unit capable of driving two sets of high-impedance headphones (>150Ω). The audio output is loud, and very “clean.” The units feature a built-in level control, a stereo/mono switch, and a power present LED. A single microphone-type cable links the Model 35 with the Model 40 Central Controller.

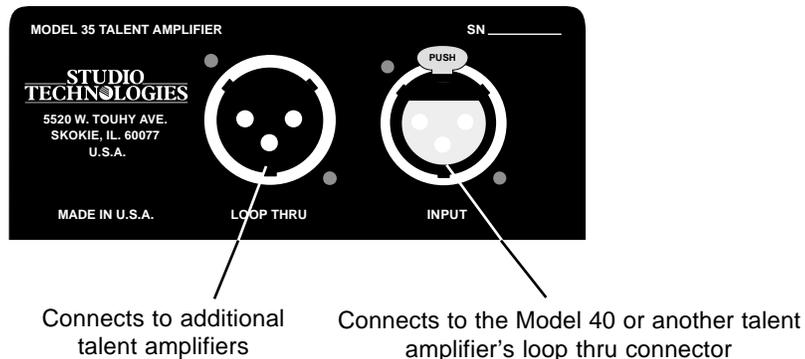
Model 38 Talent Amplifier

The Model 38 Talent Amplifier takes the basics from the Model 35 and adds a unique stereo preamplifier section. This allows a musician’s microphone or line-level signal to be “looped” through the Model 38, boosted by its preamp, and then combined with the stereo cue mix supplied by the Model 40. This allows the Model 38 user to create an individual headphone

Model 35 Front Panel

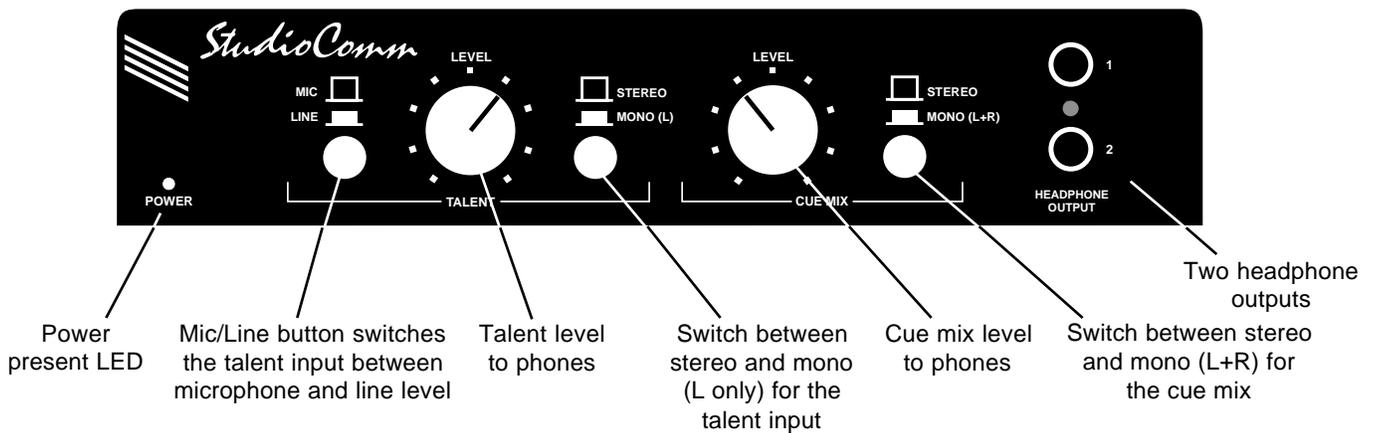


Model 35 Back Panel

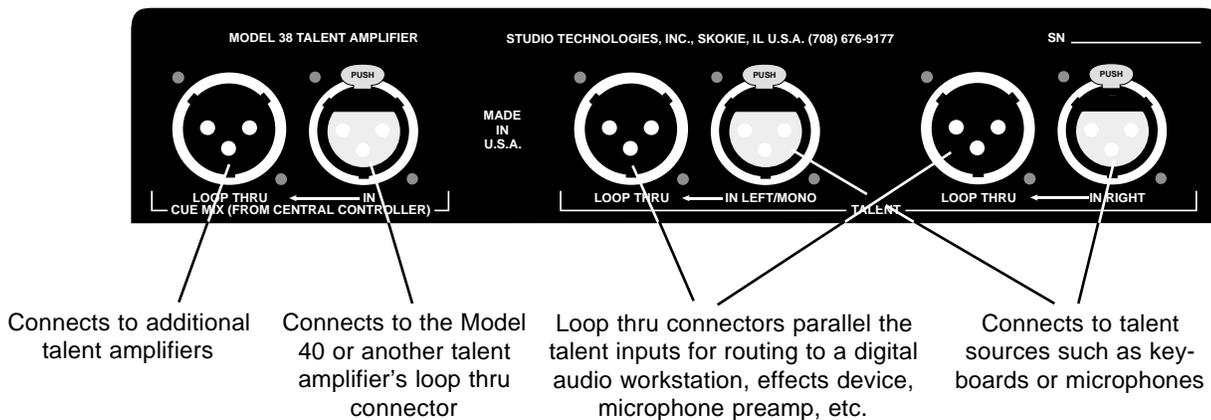


mix, solving the classic problem of wanting “more me” in the phones! Like the Model 35, the Model 38 is linked with a Model 40 Central Controller by a single cable.

Model 38 Front Panel



Model 38 Back Panel



Installation

In this section you will be installing the Model 40 Central Controller in an equipment rack. Audio input connections will be made. Wiring will be installed to allow Model 35 or Model 38 Talent Amplifiers to be connected. AC mains power will be connected to the Model 40.

System Components

The main StudioComm shipping carton contains a Model 40 Central Controller, User Guide, and warranty card. Units destined for North America are shipped with an AC mains cord. Your dealer or distributor will provide an AC mains cord for non-North American destinations. Model 35 and Model 38 Talent Amplifiers will be contained in separate cartons. Please check to ensure you have everything you need.

Sample Installation

Please refer to the following page for a diagram detailing a possible Model 40 and talent amplifier installation.

Mounting the Model 40

The Model 40 requires one space in a standard 19-inch (48.3cm) equipment rack. It is desirable to locate the Model 40 to allow easy access to both the front and the back panels. The back panel contains the input and output connectors, while the front panel contains several controls, switches, and LED indicators. The Model 40 is secured to the equipment rack using two mounting screws per side.

Audio Inputs

The Model 40's line-level audio input connections are made using ¼-inch 3-conductor phone jacks. Don't be con-

cerned about damage to your audio quality, the jacks we use are manufactured by Neutrik of Switzerland and feature gold-plated contacts for excellent performance.

Caution: For reliable audio interconnection, the plugs you use must comply with industry standard RS-453. Switchcraft No. 297, Neutrik NP3C, or equivalent will work correctly. Refer to the Technical Notes section for details.

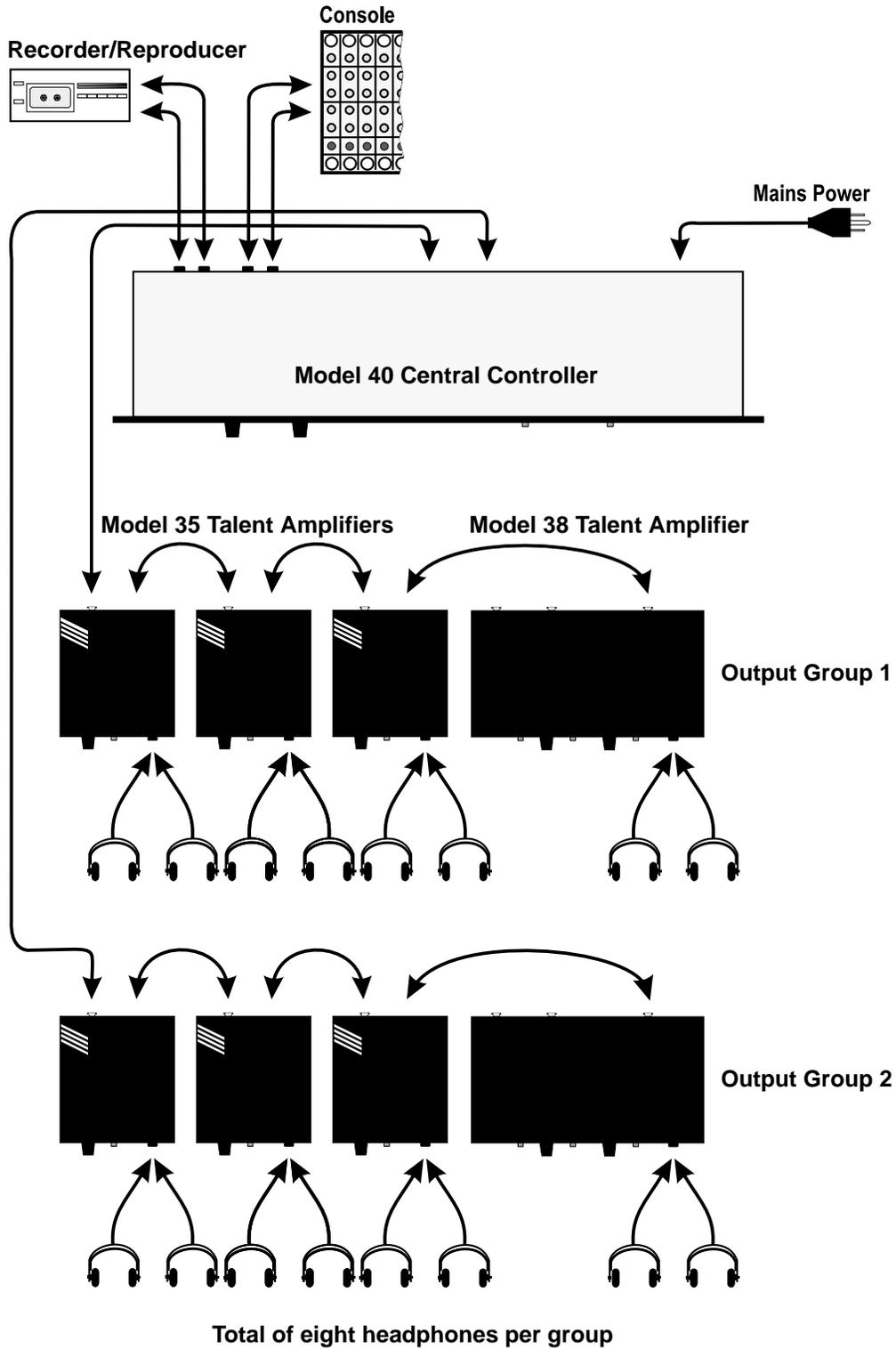
Stereo Line Inputs

The Model 40 allows two stereo line input sources to be connected. During operation either talent amplifier output group can select either of the stereo inputs as its source. This allows flexibility in routing the desired source to the desired group of talent amplifiers. In some installations only one stereo source may be available. In this case the one stereo source should be connected to input 1. For future use it may be wise to connect input 2 to points on a patch bay. This will allow rapid connection of another audio source should the need arise.

The input circuitry is electronically balanced, and is compatible with balanced or unbalanced signals that have a nominal level range of -10dBV to +10dBu. The input impedance is 50K ohms so that compatibility with virtually every source is assured.

Prepare the input plugs so that tip is positive (+ or hot), ring is negative (- or cold), and sleeve is shield. The input jacks will also accept unbalanced ¼-inch 2-conductor phone plugs. With unbalanced phone plugs, tip is positive (+ or hot) and sleeve is shield. If 3-conductor phone plugs are used to connect unbalanced input signals, connect positive (+ or hot) to tip and shield to ring and sleeve.

Example Installation



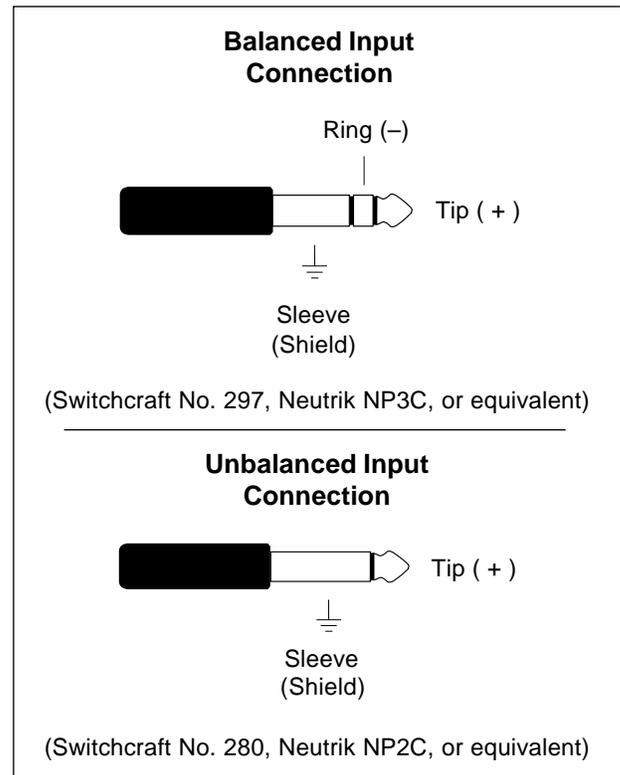
If one or both audio sources is monaural several installation options are available:

- The mono signal is wired to both the left and right inputs, thus sending two channels of audio to the talent amplifiers. This installation is simple, but prevents the rapid connect of a stereo source should the need arise.
- The mono source is connected to the left input only. As both the Model 35 and Model 38 Talent Amplifiers contain a monaural switch, talent amplifier users can select to hear the signal in both channels. This has the downside of possibly confusing users who don't know to press the mono button.
- Our preferred installation has the left and right inputs connected to points on a patch bay. The mono source would be connected to the "normal" connections on both the left and right patch points. This would feed the mono signal to both the left and right inputs, while giving the ability to quickly "patch in" a stereo source.

Talent Amplifier Outputs

The Model 40 contains two talent amplifier output groups which are designated Group A and Group B. Each group will support up to four Model 35 or Model 38 Talent Amplifiers in any combination. Two male XLR-type connectors are provided on the Model 40's back panel for connecting to the output groups.

For best performance, use low-capacitance shielded microphone-type cable to distribute the output groups. If you have a choice, select cable with the heaviest wire gauge commonly available. This will reduce voltage drop when using long cable



runs. Refer to the Technical Notes section for additional information.

The simplest installation would use microphone cables to connect the Model 40 to the first talent amplifier in each group; the loop through connector on the first talent amps sending the signal on to the next.

For convenience, you may want to wire your facility to allow easy access to the output groups at all locations where talent amplifiers might be used. Talent amplifiers connect to an output group in parallel, so the connectors on the distribution panels or mult boxes must be wired in parallel.

Warning: Do not connect talent amplifier output signals to anything but Studio Technologies' talent amplifiers. Some audio equipment may be damaged by the +23Vdc contained on pin 2 of the talent amplifier output group connectors.

AC Mains Power

The Model 40 is internally configured to operate from either 100, 120, or 220/240V, 50/60Hz. In most cases, units shipped to North America are factory selected for 120V operation. Units bound for Japan are selected for 100V, while our friends “down under” and in Europe receive units set for 220/240V. Before connecting the Model 40 to mains power, check that it is configured to match the local mains voltage. Look on the back panel, adjacent to the power entry connector, for the configured voltage(s). Note that an incorrect configuration could seriously damage the unit. Should it be necessary to change the unit’s operating voltage it must be performed only at the factory or by an authorized service technician.

The Model 40 uses an IEC standard connector to mate with the AC mains cord. The wire colors in the AC mains cord should conform to the internationally recognized CEE color code and must be wired accordingly:

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

Safety Warning: The Model 40 does not contain an AC mains disconnect switch. As such the mains cord plug serves as the disconnection device. Safety consideration requires that the plug and associated outlet be easily accessible to allow rapid disconnection of mains power should it prove necessary.

As soon as mains power is applied, the Model 40’s power present LED will light. The power present LEDs on the talent amplifiers will also light.

The Over Current LEDs associated with the output groups should not light. If either or both are flashing, immediately refer to the Troubleshooting section of this guide. If everything appears to be functioning properly you are now ready to configure the system.

Model 35 Stand Mounting

Included with each Model 35 Talent Amplifier is a nifty mounting adapter that allows the unit to be conveniently attached to a microphone stand. Please refer to the Installation Guide provided in the Model 35’s shipping carton for details.

Model 38 Mounting Options

The Model 38 Talent Amplifier includes provisions for mounting to microphone stands, equipment consoles, etc. To avoid “reinventing the wheel,” it was designed for compatibility with the 25 Series of components from OmniMount Systems, Tempe, Arizona U.S.A. (602) 829-8000, a supplier of finely engineered mounting systems. This firm makes many versions of the 25 Series; one of which should fit your needs. If you desire microphone stand mounting the following components would be appropriate for English-thread applications: 25RST-25H Straight Tube Reverse Mount with Quick Release, along with a 25MA Microphone Stand Adapter. (If quick adjustment is not required the 25RST Straight Tube Reverse Mount can be used in place of the first item.) When connecting to metric-thread stands please contact OmniMount for the correct part numbers.

The bottom surface of the Model 38 Talent Amplifier contains two threaded inserts that will accept English-standard ¼-20 screws. Using two, 5/8-inch long, round-head machine screws, the 25 Series clamp assembly can be directly attached. The cover of the Model 38 does not have to be removed.

Configuration

Input Level Calibration

Optimal performance of the Model 40 and associated talent amplifiers depend on the correct setting of the input level controls. Each of the two stereo input sections contain an input level potentiometer and two Signal Present LEDs. The level control is a stereo device, adjusting the input sensitivity for both the left and right inputs. The Signal Present LEDs are provided for assistance during adjustment of the pot, as well as for general signal present indication.

The following is a step-by-step procedure for using an input control to match an input signal to the Model 40:

- Set the input control fully counterclockwise (all the way to the left end of the travel).
- Supply a 1kHz sine wave to both the left and right line inputs. Set the level of the source to be precisely the nominal operating level. If, for example, the output of a console is connected to the input of the Model 40, the console output should be adjusted so that the meters read 0dB or 100%. If the output of the console is a "+4-type," then setting the console's left and right output levels to nominal should find the console output levels to be exactly +4dBu.

- Slowly turn the level control clockwise. As you increase the level, watch the Signal Present LEDs. The correct setting is just at the point where both LEDs light.
- For future reference it may be helpful to mark the correct input level and right trim adjustment points. Use a grease pencil or a piece of adhesive tape so as not to damage the front panel.
- Disconnect the 1kHz signal and connect the normal audio source.

Operation

Now that you've installed and set the input level controls, you're ready to go. You should find system operation very easy, as there is almost nothing to do on a day-to-day basis except adjust the output levels on the talent amplifiers. For peace of mind, the Signal Present LEDs will give you a visual indication whenever audio signals are present on the Model 40's inputs.

In most cases the input level controls shouldn't be changed, as they will effect the input calibration. If you change the input source you can use the input level control and the Signal Present LEDs to recalibrate the input.

Model 40 Central Controller

The Model 40's front panel contains seven LEDs, two controls, and two switches.

The power present LED should be lit whenever AC mains power is connected to the Model 40. During normal operation the two Over Current LEDs will not be lit. They will flash only if there is a problem with a talent amplifier or associated wiring.

Refer to Troubleshooting section if either Over Current LED lights.

The Signal Present LEDs will light whenever a signal of “reasonable” level is connected to its respective input.

Talent Amplifiers

Warning: Protect your ears! The StudioComm talent amplifiers are capable of driving headphones to extremely high sound pressure levels. Hearing experts advise against continuous extended play, especially at high levels.

Model 35 Talent Amplifier

The power present LED should be lit whenever the Model 35 is connected to an operating Model 40. The Model 35 has a level control and a stereo/mono switch. You can plug in one or two pairs of headphones with a total impedance of 75 ohms or greater. Turn the knob to the output level you want and select stereo or mono by pressing the button. Both headphone outputs are controlled by the one level control. The Mono button sends L+R to both the left and right output.

Model 38 Talent Amplifier

The Model 38 has the unique ability to provide a personalized headphone mix for the in-studio talent. The performer’s audio can be connected to the talent inputs and passively looped through to the control room. This lets performers increase their level in the headphone mix without an engineer getting involved. The Model 38’s circuitry was carefully designed to not interfere with the talent audio as it passes through.

The Model 38 has all the functions of the Model 35, plus it provides personal mix controls. The power present LED should be lit whenever the Model 38 is connected to an operating Model 40. You can plug in one or two pairs of headphones with a total impedance of 75 ohms or greater. The Cue Mix Level control sets the headphone output level for the signal coming from the Model 40. The Cue Mix Stereo/Mono button switches both headphone outputs between a stereo and mono (L+R) feed of the cue mix.

The Model 38 allows connection of a stereo or mono talent signal at microphone or line level. If your talent source is stereo, connect it to the In Left/Mono and In Right connectors and set the Talent Stereo/Mono switch for stereo operation. With a mono source, use only the In Left/Mono connector and set the Stereo/Mono switch for mono operation. This will feed the mono talent source to both left and right headphone channels. Connect loop through cables as needed for feeds to the control room.

The Talent Mic/Line switch is used to select the input sensitivity, matching the talent source with the Model 38’s input circuitry. When you connect a microphone or direct box, select Mic. When keyboards or other preamplified sources are connected, select Line. The expected signal level in the Mic position is -40 to -60 dBu. In the Line position it’s -10 to $+10$ dBu. If you are unsure of your signal level, start with input sensitivity set for Line. If the output level is not sufficient, turn down the talent level control, switch to Mic, then listen as again you raise the level control.

The talent level control works just like you would guess: turn it up for more talent signal in the headphone mix, and turn it down for less. The talent and cue mix level controls work like a mixer for the headphone outputs, so you can have any level you want of either source in the headphone mix.

Troubleshooting

If you're having problems getting the StudioComm system up and running, this section can help. If you haven't read the other sections of this guide, you should do so before proceeding.

Talent Amplifier Over Current LED

During normal operation the talent amplifier Over Current LEDs should not light. They will flash on and off if a talent amplifier output group is loaded to exceed its maximum output current. The most common reason for an over current condition would be a shorted interconnecting cable. Also, connecting more than the specified maximum of four Model 35 or Model 38 Talent Amplifiers to each group can also cause the LED to light. A possible, but not likely, cause would be a fault condition within a Model 35 or Model 38.

If an LED does flash, troubleshooting should prove quite simple. Begin by disconnecting the cable that is plugged into the applicable talent amplifier output group connector. Perform the disconnection directly on the Model 40's back panel. The LED should stop flashing. Now check through all the wiring to determine where the short circuit condition is located. The Model 40 will not be damaged if the Over Current LED is flashing so you should use

it to help you locate the fault in your system. In just a few minutes you should be able to isolate exactly what cable or talent amplifier is causing the problem.

Intermittent Audio Connections

Should you experience audio connections that seem to be "flaky" or intermittent, refer to the Technical Notes section of this guide. The ¼-inch 3-conductor phone jacks used on the StudioComm products are of very high quality, conforming to the industry standard EIA RS-453. Some plugs do not meet this standard, specifically in the shape of the tip conductor. In rare cases you may have to replace plugs on interconnecting cables or headphones to remedy an interconnection problem. Switchcraft No. 297 or Neutrik NP3C phone plugs will function correctly.

Technical Notes

Talent Amplifier Cable Length

There are no hard and fast rules defining the maximum cable length when connecting Model 35 or Model 38 Talent Amplifiers to the Model 40 Central Controller. The maximum cable length is directly related to the amount of resistance in the connecting cable; the lower the resistance per foot (or meter), the longer the cable can be. (Although cable capacitance affects high frequency performance, resistance is the limiting factor in this case.)

To lay out the facts in grammar-school story problem format: for correct operation, a Model 35 or Model 38 needs to see at least +20Vdc between pins 1 and 2 of their input connector. The Model 40's talent amplifier output voltage across pins

1 and 2 is +23Vdc, with a maximum current draw of 0.2A (200mA). This difference between the voltage supplied and the voltage required results in a maximum voltage drop of 3V over the interconnecting cables. Since cable is rated in ohms per 1000 feet (or ohms per 1000 meters), you need to know what the maximum cable resistance is. This can be easily calculated by dividing the maximum voltage drop by the maximum current flow: $3V$ divided by $0.2A = 15$ ohms. For example, a standard 20 AWG microphone cable is Belden 8412, which has 10.9 ohms resistance per conductor per 1000 feet. Since we're using two conductors to carry the signal (pins 1 and 2) you'd get 21.8 ohms per 1000 feet of microphone cable. With our 15 ohm maximum resistance you'd be able to use 688 feet (210m) of this cable.

By using the numbers provided, along with the resistance of your specific cable, you can select a cable, and its maximum length, for your application.

¼-Inch Plugs versus EIA RS-453

An incompatibility problem lurks between some ¼-inch 2-conductor and 3-conductor phone plugs and the jacks found on professional audio equipment. While all the plugs seem to “look” the same, some do not comply with the industry standard, called EIA RS-453. This standard defines the physical dimensions, including the shape of the plug's tip. It seems that some plug manufacturers don't bother to make the tip comply with the standard. Why is this relevant to you? Because the phone jacks used on the Model 40 Central Controller, Model 35 Talent Amplifier, and Model 38 Talent Amplifier do comply with the standard. They expect to be mated with plugs that also meet the specification.

When interfacing your line inputs or headphones be careful with the plugs you utilize. Should a connection appear “flaky,” sound noisy, or make intermittent contact, the most likely problem is a non-standard phone plug. Replace the plug if this is the case. You should find that all plugs from Switchcraft or Neutrik will work correctly, specifically Switchcraft No. 297 or Neutrik NP3C. In our experience, headphones are the most likely place to find non-standard plugs—we even found them on some “world-class” headphones that we use in our lab!

Definition of Level—dBu and dBV

Whenever possible, 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 0dBm is 1 milliwatt dissipated in the known load (i.e., 0dBm across 600 ohms will measure 0.7747V). In contemporary situations an output is rarely terminated with 600 ohms; generally 10k ohms or higher. The dBu designation is better because it refers to dB referenced to 0.7747V, with no reference to load impedance. This takes into account today's audio scene where signals have a low source impedance and a high input impedance. The dBu designation is becoming the standard for the professional audio industry.

The Model 40 is designed to interface with audio signals that have nominal signal levels of -10 dBV to $+10$ dBu. You might wonder why dBV came into the picture. Most people don't realize that equipment that utilizes “ -10 ” levels usually mean -10 dBV—substantially different from -10 dBu (-10 dBV = -7.78 dBu). The dBV

designation is simply a different way of measuring signal level and is often used when dealing with portable or consumer audio equipment. The dBV designation refers to dB referenced to 1.0V, rather than dBu which refers to 0.7747V.

Talent Amplifier Mono Function

Many arguments were had while designing the talent amplifier monaural function. Was mono to be the sum of left and right sent to both left and right channels? What about level build up with phase coherent signals that are in both the left and right channels? After much head scratching it was realized that the mono function that most people are accustomed to is not really a “true” mono function, but is the sum of the left and right signals, dropped in level by 3dB, and connected to the left and right outputs. This is what is implemented in the Model 35 and Model 38 Talent Amplifiers.

Input Level and the Talent Amplifiers.

Optimal performance of Model 35 and Model 38 Talent Amplifiers depends on the proper setting of the Model 40's input level controls. The headphone volume is intended to be adjusted only by the level controls on the talent amplifiers. If the setting of the input level control vis-a-vis the actual level of the source is not correct, the talent amplifier will simply not be able to create the maximum volume in the headphones or will exhibit excessive distortion.

The Model 38 Talent Amplifier can also exhibit reduced performance if the level of the input source is significantly “hotter” than nominal. The entire system has plenty of headroom, but maintaining proper signal levels, as usual, is important.

If the input level is excessive, a small amount of bleed-through can be heard with the Model 38's cue mix level control set fully counterclockwise. Instead of having no sound in the phones, a bit of sound can be heard. This is not a design problem; the Model 38 has a sensitive preamplifier section which doesn't like “seeing” excessive excursions in the left channel modulation of the +23Vdc signal. The Model 38's power supply can reject the left channel modulation within the design parameters, creating a clean reference voltage for the stereo preamplifier. Modulation levels outside the design parameters show up in the reference voltage!

Circuit Description



The information contained in this section is not provided as an endorsement for you to perform repairs or modifications to StudioComm components. Removing the cover or the back panel from the Model 40 Central Controller exposes personnel to hazardous voltages. Repairs or modifications should be performed only at the factory or authorized service center.

Model 40 Central Controller

This information will help you understand how the Model 40 functions and, if required, help you identify where a failure may be located. Please refer to the attached block and schematic diagrams while reading this material.

Power Supplies

The Model 40 contains two independent linear power supply circuits. We felt that reliability would be enhanced by splitting the circuitry into two main groups, and then optimizing a power supply for each. Using this scheme, the Model 40 will operate reliably, even with wide swings in ambient temperature, varied operating duty cycles, and mains voltage fluctuations. The result is a unit that should prove quite hard to kill! The power supplies use separate step down transformers, the primary side of each containing two 115V windings. This allows them to be configured for nominal mains voltages of 100V, 120V, or 220/240V. For 100V and 120V operation the primaries are connected in parallel; for 220/240V operation they are connected in series. The configuration is performed using jumper straps on the printed circuit board. For safety, a fuse is in series with the incoming mains power.

Because the Model 40 is intended for continuous operation, a power switch is not included. This serves several purposes: eliminating the chance of a power switch being accidentally turned off, increasing the physical isolation between the nasty 50/60Hz fields and the sensitive analog circuitry, and eliminating the physical space required by a switch.

The first power supply generates filtered and regulated $\pm 15\text{Vdc}$. The two 18V secondaries are connected in series, with the series connection point providing circuit common, as well as being strapped to the metal chassis and the ground pin of the power entry connector. The transformer's secondary is fed to a full wave diode bridge. The output of the bridge is filtered with electrolytic capacitors, producing

nominal $\pm 22\text{Vdc}$. Two integrated circuit regulators produce the $\pm 15\text{Vdc}$ from the unregulated voltages. Capacitors on the outputs of the regulators provide stability. The $\pm 15\text{Vdc}$ is utilized by most of the analog circuitry.

Interesting technical note department: notice that a diode is connected from the output pin of each regulator to circuit common. These serve to keep the $\pm 15\text{Vdc}$ rails at, worst case, one diode drop (0.7V) away from ground. The +15V regulator will, worst case only, go to -0.7Vdc ; the -15V regulator to $+0.7\text{V}$. This is important when supplying bipolar loads, such as operational amplifiers, etc. Without these diodes the regulators can "latch-up" when mains power is applied or removed. When mains power is initially applied one of the supplies can "come up" (get to its operating voltage) sooner than the other. This voltage is fed back through the loads (the op-amps) to the output pin of the other regulator that is still coming up to full voltage. Upon seeing this unexpected opposite polarity voltage on its output pin, the regulator may get very unhappy, possibly latching into a nonoperating state, drawing lots of current, burning up, etc.! The protection diodes keep this condition from happening.

The second power supply generates two unregulated DC voltages: +V UNREG, which ranges from approximately +30 to +55Vdc, and +V LED which ranges from +15 to +28Vdc. Its transformer has dual 15V secondaries for 120V and 220/240V operation, and dual 17V secondaries for 100V operation. The secondary windings are connected in series, and then go to a full wave diode bridge and an electrolytic filter capacitor. The negative pin of the

bridge is connected as the circuit common, as well as being strapped to the metal chassis and the ground pin of the power entry connector. +V UNREG is used by the talent amplifier output group's power modulator circuitry. The center tap of the transformer creates +V LED—can you figure out how this works? For filtering, an electrolytic capacitor is connected from +V LED to circuit common.

For service assistance, several test points are included on the printed circuit board: $\pm 15\text{Vdc}$, +V UNREG, and circuit common.

Analog Circuitry

The Model 40 takes advantage of an excellent series of audio-specific integrated circuits from Analog Devices. Using these parts saved us from using literally hundreds of additional components. More importantly, performance levels were achieved that would have been difficult, if not impossible, to obtain with more conventional circuitry. These Analog Devices parts have the common prefix of SSM, indicating their roots in a company called Solid State Microelectronics for Music, purchased, by way of Precision Monolithics, a few years ago. Hats off to the guys and gals at Analog Devices!

Line Inputs

The Model 40 contains two identical stereo line input circuits. The line inputs are compatible with balanced or unbalanced signals with nominal levels of -10dBV to $+10\text{dBu}$. The exact purpose of the line input circuits is to receive the audio signal, separate out common-mode hum and/or noise, unbalance the signal, and attenuate it to the -10dBu internal operating level. Each line input circuit contains a differential input integrated

circuit, followed by a variable gain reduction stage. The line input signals are direct coupled to SSM-2141 differential (balanced) line receiver integrated circuits. The '2141 has excellent common mode rejection, low noise, and high slew rate. It contains two internal 25k ohm series input resistors, individually laser trimmed for accuracy. By design, the '2141 acts as a unity-gain device.

The output of the SSM-2141 is capacitive coupled to one section of dual potentiometer. The coupling capacitor is a non-polar type, allowing for small DC voltages of unknown polarity to be received on a line input. The wiper of the pot is connected to one section of op amp configured as an inverting, unity-gain buffer. The output of the op amp serves as the internal signal "bus."

Signal Present LEDs

Four identical signal present circuits monitor the audio level on the internal audio buses; left and right for input 1, and left and right for input 2. Audio signals enter each meter circuit via an operational amplifier configured as a half-wave synchronous rectifier. The resulting DC output is smoothed via a resistor/capacitor low pass filter. The output of the low pass filter is connected to the input of one section of integrated circuit comparator. Two precision resistors are connected in series with the $+15\text{Vdc}$ power supply rail to create a DC reference voltage. This reference voltage is used as the switching point for the comparator. The output of the comparator is used to control the base lead of a transistor, a transistor which directly controls the Signal Present LED.

Talent Amplifier Output Groups

Two identical circuits are used to create talent amplifier output groups A and B. Each circuit provides power and stereo audio for connecting up to four Model 35 or Model 38 Talent Amplifiers. One circuit will be described. A double-pole/double-throw switch selects which audio bus is connected to the output group. From the switch, signal connects to sections of operational amplifier which are configured as inverting, unity-gain amplifiers. The selected op-amps are capable of driving low impedance loads.

The output of the op-amp that serves the left channel is capacitive coupled to a power modulator circuit. The power modulator circuit provides the talent amplifiers with nominal +23Vdc, amplitude modulated with left channel audio at a nominal level of -10dBu. The modulator consists of a 3-terminal regulator integrated circuit, two transistors, and several discrete components. The voltage regulator creates nominal +26Vdc from +V UNREG. The regulator has inherent thermal protection so that an over-current condition will not damage the circuitry. One of the transistors is used as the actual modulator. It is connected in a series-pass arrangement, with the left channel audio connected to its base. The other transistor, along with a resistor, serves to limit the maximum current.

The second section of op-amp provides right channel audio to the output group. A capacitor, along with a series resistor protects the op amp from capacitive loads, as well as from an accidental short circuit to the power/left channel signal.

Over Current Detection

Two identical circuits monitor the operating status of the talent amplifier output groups; we will describe one. The +23Vdc with left channel audio output signal is connected to a network consisting of two precision resistors and a filter capacitor which serves as a voltage divider/filter. The scaled voltage is connected to one section of integrated circuit comparator. The switching point of the comparator is set by a reference voltage that is created from the +15Vdc power supply rail. The output of the comparator is used to control the base lead of a transistor, which in turns controls the Over Current LED. The LED lights whenever the output voltage falls below the threshold.

Model 35 Talent Amplifier

General Description

The Model 35 Talent Amplifier is a self-contained module which allows headphones to be driven with stereo audio provided by a talent amplifier output group from the Model 40 Central Controller. The major components of the Model 35 are the power supply and headphone amplifier. The Model 35's circuitry is contained on two printed circuit boards which are interconnected via a 5-conductor flexible jumper cable. All active circuitry lies on the electronics board; the connectors lie on the connector board. No surprises here!

Power Supply

A 3-terminal adjustable integrated circuit voltage regulator is configured to provide +19V from the incoming +23V that is modulated with left channel audio. The important characteristic of this circuit is its constant input impedance. The input impedance is fixed at a moderately high

value, approximately 2K ohms, and does not vary appreciably with load. This is important so that the left channel audio signal is not significantly attenuated, nor distorted by normal fluctuations in the power draw. A moderately large capacitor is connected across the output of the regulator. This capacitor provides a reserve of energy to allow the left and right channel audio amplifiers to respond with gusto when encountering audio transients. An LED indicator shows that +19V power is present. Two resistors and a capacitor create a +9.5V reference. This reference is used to set the operating point of the circuitry.

Audio Amplifier

Two identical amplifier circuits provide the left and right headphone outputs. The circuits are designed to produce a maximum voltage swing, rather than to source a large amount of power. This is the correct means of driving contemporary headphones, most of which have a load impedance of 250 ohms or higher. The reality is that with most phones a high output level is obtained via a large voltage swing, not through power.

For simplicity, only the left channel circuit will be described. Audio enters the amplifier via an electrolytic capacitor and is connected to a log taper potentiometer. The "pot" is used to set the output level. From the pot the signal is connected to one section of integrated circuit operational amplifier via resistors and a switch which performs the mono function. In the mono position the switch connects the left channel signal to the right channel amplifier, while dropping the level by 6dB. The op amp, along with two transistors and supporting components form the left

channel output stage. A low pass filter in the feedback loop helps to provide stability. The amplifier's output is capacitor coupled, via a series resistor, to the output connectors. The capacitor changes the audio output signal from being biased at approximately +9.5V, to being biased at signal common. The series resistor limits the output current in the event of a shorted output load. The output capacitor was selected for sonic performance, rather than what the math told us to select. We used our ears, not the numbers!

Model 38 Talent Amplifier

General Description

The Model 38 Talent Amplifier is a self-contained module which allows headphones to be driven with a mix of audio from the Model 40 Central Controller, along with another signal that we refer to as the talent signal. The talent signal can be stereo or mono, microphone or line level, allowing an individual headphone mix to be created.

The major components of the Model 38 are the power supply, talent preamplifier, and headphone amplifier. The Model 38's circuitry is contained on two printed circuit boards, which are interconnected via two 5-conductor flexible jumper cable. All active circuitry lies on the electronics board; the connectors lie on the connector board.

Power Supply

A 3-terminal adjustable integrated circuit voltage regulator is configured to provide +19V from the incoming +23V that is modulated with left channel audio. The important characteristic of this circuit is its constant input impedance. The input

impedance is fixed at a moderately high value, approximately 2K ohms, and does not vary appreciably with load. This is important so that the left channel audio signal is not significantly attenuated, nor distorted by normal fluctuations in the power draw. A moderately large capacitor is connected across the output of the regulator. This capacitor provides a reserve of energy to allow the left and right channel audio amplifiers to respond with vigor when encountering audio transients. An LED indicator shows that +19V power is present. Two resistors and a capacitor are used to create a low-impedance reference voltage of approximately +9.5V. This reference voltage is used to set the operating point for all the analog circuitry.

Talent Preamp

Two identical sections of preamplifier serve the talent input. For clarity we will describe only the section that serves the left/mono input. Signal enters the preamplifier via blocking capacitors. These are specifically provided to block +48V phantom voltage that may be present on microphone signals. From the blocking capacitors the signal enters one section of operational amplifier that is configured to act as a differential amplifier. This allows balanced or unbalanced signals to be connected.

A switch controls the gain of the op amp, providing a voltage gain of 20dB when set to the microphone position, or an attenuation of 30dB when set to the line position. Signal diodes protect the inputs of the op amp from destruction due to an over-voltage condition. Compensation capacitors are provided to ensure stability at the two gain settings. (Note that the gain set switch is a four-pole/double-throw

type, allowing one switch to control both preamplifier sections.)

The output of the op amp is connected to one section of a dual audio-taper potentiometer. This pot is the user control that sets the level of the talent signal fed to the headphone outputs. Signal from the wiper of the pot is capacitively coupled to the input of another section of operation amplifier. This op amp has a fixed voltage gain of 25dB. The output of this op amp is connected to the left headphone amplifier and the talent input stereo/mono switch. In the stereo position the output of the left preamp is connected only to the input of the left headphone amp; the output of the right preamp is connected to the input of the right headphone amp. In the mono position the output of the left preamp is connected to the inputs of both the left and right headphone amps; the right preamplifier is not connected to anything.

Headphone Amplifier

Two identical amplifier circuits provide the left and right headphone outputs. The circuits are designed to produce a maximum voltage swing, rather than to source a large amount of power. This is the correct means of driving contemporary headphones, most of which have a load impedance of 250 ohms or higher. The reality is that with most phones a high output level is obtained via a large voltage swing, not through power. For simplicity, only the left channel circuit will be described.

Cue mix audio (audio from the Model 40) enters the amplifier via an electrolytic capacitor and is connected to a log taper potentiometer. The "pot" is used to set the output level of the cue signal. From the pot the signal is connected to one section of

integrated circuit operational amplifier via resistors and a switch which performs the mono function. In the mono position the switch connects the left channel signal to the right channel amplifier, and drops the level by 6dB. The op amp is configured as a summing amp, allowing the signal from the cue mix pot to be summed (mixed) with the signal from the talent preamplifier.

The op amp, along with two transistors and supporting components form the left channel output stage. A low pass filter in the feedback loop is included for stability. The amplifier's output is capacitor coupled via a series resistor to the output connector. The capacitor changes the audio output signal from being biased by the +9.5V reference voltage to being biased at signal common. The series resistor limits the output current in the event of a shorted output load.

Specifications

Model 40 Central Controller

Mounting

One space in a standard 19-inch (48.3cm) rack

AC Mains Requirement

100, 120, or 220/240V, $\pm 10\%$, factory configured, 50/60Hz, 100-120V 0.4A maximum, 220/240V 0.2A maximum

Fusing

Qty: 1

Type: 5 x 20mm time lag (Littelfuse 218-series or equivalent)

Rating: 0.400A for 100 and 120V mains power, 0.200A for 220/240V mains power

Connectors

Audio Inputs: dual, ¼-inch, 3-conductor phone jacks, gold-plated contacts. (Manufactured by Neutrik.) Mates with all plugs specified by EIA RS-453.

Talent Amplifier Output Groups: 3-pin XLR-type, male (Neutrik)

AC Mains: standard 3-blade plug, meets IEC 320 specifications

Audio Inputs

Qty: 2, stereo (separate left and right input connectors)

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

Impedance: 50k ohms

Nominal Input Level: -10dBV to $+10\text{dBu}$

Input Level Control: allows calibration over -10dBV to $+10\text{dBu}$ input range

Maximum Input Level: $+27\text{dBu}$ balanced, $+21\text{dBu}$ unbalanced

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

Talent Amplifier Outputs

Application: provides power and audio signals for two groups of up to 4 Model 35 or Model 38 Talent Amplifiers (total 8 talent amplifiers). The output connectors (3-pin XLR-type, male) have common on pin 1, +23Vdc modulated with left channel audio at -10dBu on pin 2, and right channel audio at -10dBu on pin 3. Maximum output current 200mA (nominal)

Frequency Response, Distortion (THD+N), S/N Ratio: refer to Model 35 and Model 38 specifications

LED Indicators

Qty: 7, power present, signal present (4), over current (2)

Dimensions (Overall)

19.00 inches wide (48.3cm)

1.72 inches high (4.4cm)

8.75 inches deep (22.2cm)

(1 standard rack space)

Weight

8.8 pounds (4.0kg)

Model 35 Talent Amplifier

Mounting

Desktop. Provision for stand mounting available as option.

Power Requirements

+20-32Vdc (modulated with left channel audio), provided by Model 40 Central Controller

Power Present LED

Red LED indicates presence of operating power

Connectors

Input (from Model 40): 3-pin XLR-type, female (Neutrik)

Loop Thru: 3-pin XLR-type, male, connected in parallel with input connector (Neutrik)

Headphone Outputs: 2, ¼-inch, 3-conductor (stereo) phone jacks, gold-plated contacts (Neutrik)

Headphone Output

Qty: 1, feeds two headphone jacks

Load: intended for connection to one or two pairs of headphones with total impedance of 75 ohms or greater

Output Level: user adjustable

Maximum Output Voltage: 16V peak-to-peak into 150 ohms @ 1% THD+Noise, 400Hz

Distortion (THD+N): 0.03%

Frequency Response: 20Hz-20kHz ±0.5dB

Dimensions (Overall)

4.2 inches wide (10.7cm)

2.0 inches high (5.1cm)

5.3 inches deep (13.5cm)

Weight

0.8 pounds (0.4kg)

Model 38 Talent Amplifier

Mounting

Desktop. Provision for stand mounting provided.

Power Requirements

+20-32Vdc (modulated with left channel audio), provided by Model 40 Central Controller

Power Present LED

Red LED indicates presence of operating power

Connectors

Cue Mix Input (from Model 40): 3-pin XLR-type, female (Neutrik)

Cue Mix Input Loop Thru: 3-pin XLR-type male, connected in parallel with input connector (Neutrik)

Talent Input (Left In/Mono and Right In): 3-pin XLR-type, female (Neutrik)

Talent Input Loop Thru: 3-pin XLR-type male, connected in parallel with input connectors (Neutrik)

Headphone Outputs: 2, ¼-inch, 3-conductor (stereo) phone jacks, gold-plated contacts (Neutrik)

Cue Mix Input

Intended for connection only with Model 40 Central Controller

Talent Input

Qty: 1, stereo or mono, switch selectable

Type: electronically balanced, capacitor coupled, input impedance 20k ohms

Input level: switch selectable for microphone or line-level signals. Expected signal level: Mic position -40 to -60dBu, Line position -10 to +10dBu.

Headphone Output

Qty: 1, feeds two headphone jacks

Load: intended for connection to one or two pairs of headphones with total impedance of 75 ohms or greater

Output Level: user adjustable

Maximum Output Voltage: 16V peak-to-peak into 150 ohms @ 1% THD+Noise, 400Hz

Distortion (THD+N): 0.1%

Frequency Response: 20Hz-20kHz ±0.5dB

Dimensions (Overall)

8.0 inches wide (20.3cm)

2.0 inches high (5.1cm)

5.4 inches deep (13.7cm)

Weight

1.5 pounds (0.7kg)

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

Appendix

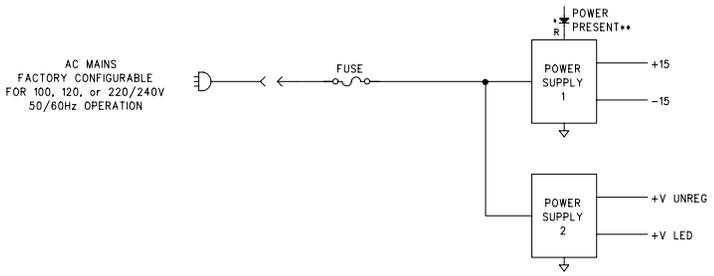
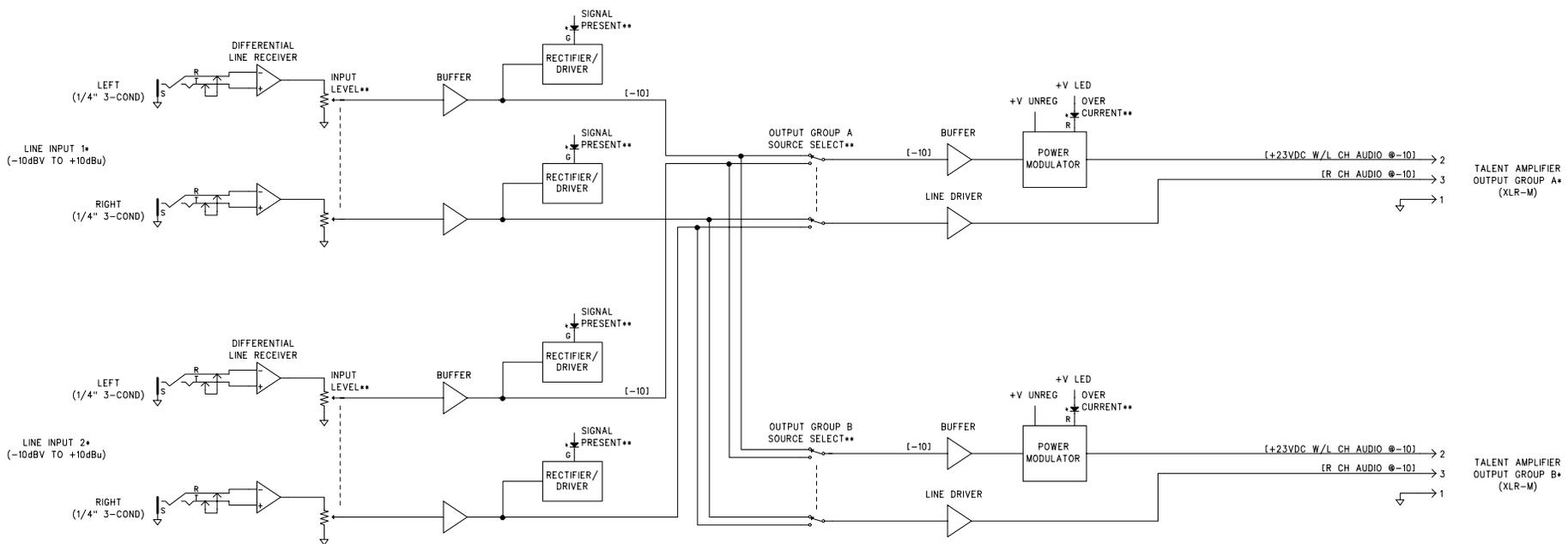
Block Diagrams

The following block diagrams are contained in this guide:

Model 40 Central Controller

Model 35/Model 38 Talent Amplifiers

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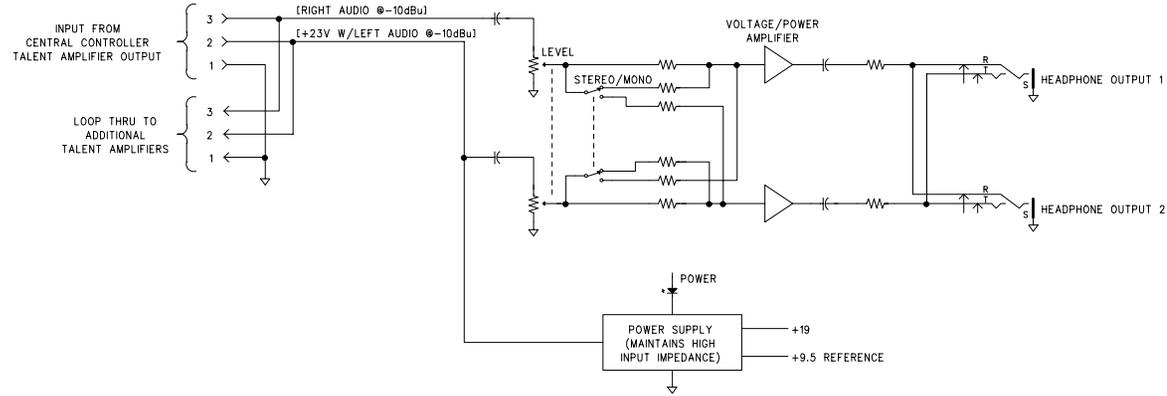


* LOCATED ON BACK PANEL
 ** LOCATED ON FRONT PANEL
 (NOMINAL LEVEL IN dBu)

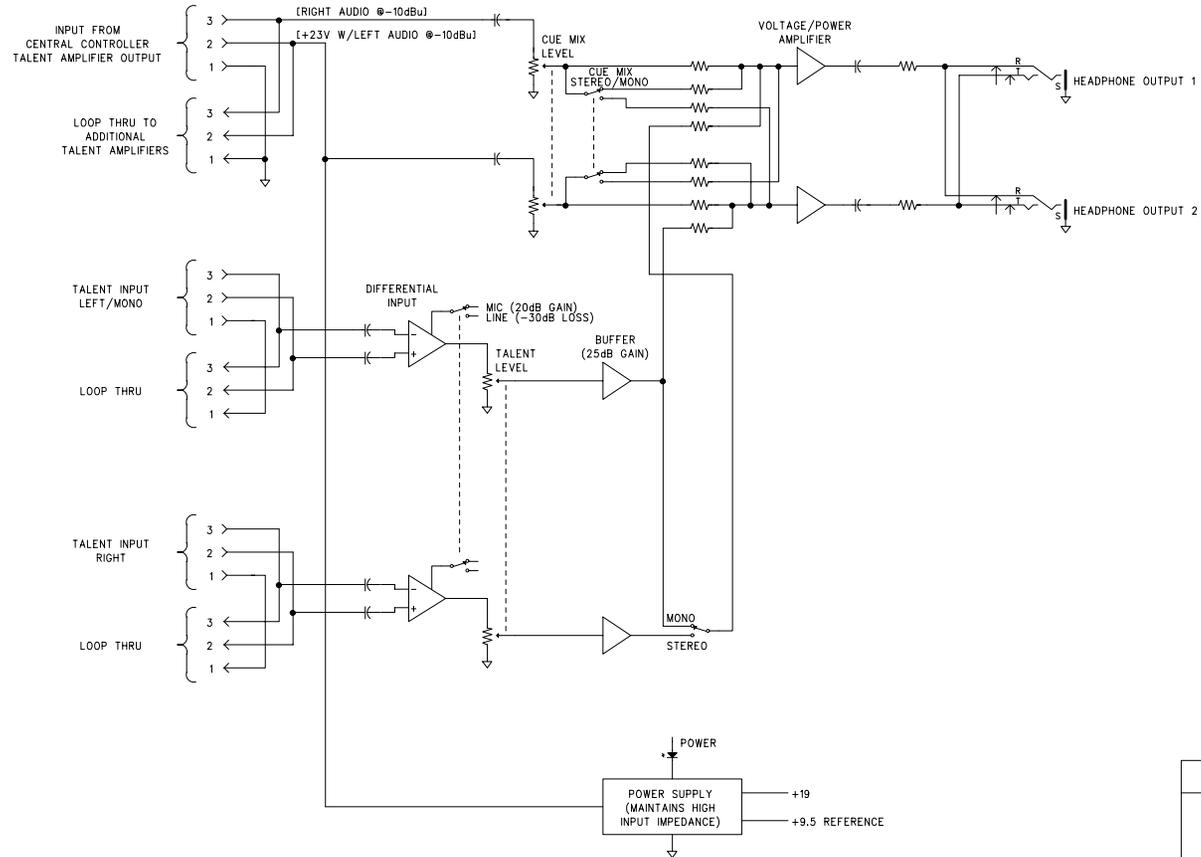
STUDIO TECHNOLOGIES, INC.		
MODEL 40 CENTRAL CONTROLLER BLOCK DIAGRAM		
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MODEL 35 TALENT AMPLIFIER



MODEL 38 TALENT AMPLIFIER



M3538BDB

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MODEL 35 AND MODEL 38 TALENT AMPLIFIERS BLOCK DIAGRAM		
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