

Model 200

Announcer's Console

User Guide

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This User Guide is applicable for serial numbers:
M200-00161 and later

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Introduction

What This User Guide Covers

This User Guide is designed to assist you when installing, configuring, and using the Model 200 Announcer's Console. Additional background technical information is also provided. A product block diagram is included at the end of this guide.

System Overview

The Model 200 Announcer's Console is specifically designed for television sports broadcasting applications, serving as the audio control center for on-air talent. The unit integrates on-air, talkback, and cue audio signal routing and control into one compact package. Highlights of the Model 200 include ease of installation and use, reliability, and sonic excellence. Whether used for professional, amateur, or entertainment-only broadcast events, "pro" quality performance is always maintained.

The Model 200 is optimized to directly interface into the broadcast environments typically used for events such as football, baseball, basketball, and motor sports. Standard connectors are used for the microphone, headphone, talkback, and IFB signals. This allows setup to be fast and consistent. A limited number of configuration options are provided. Once selected, no event-to-event configuration changes should be required. For ease of use, the on-air talent is presented with a simple set of controls and indicators. Whether it's mic preamplifier, audio switching, talkback output, or headphone cue feed, excellent audio performance is maintained throughout.



Figure 1. Model 200 front panel



Figure 2. Model 200 back panel

System Features

Microphone Input and Configuration

A high-performance microphone preamplifier circuit provides low-noise/low-distortion amplification over a 20 to 60 dB gain range. The gain is adjustable in 10 dB steps. The input is compatible with balanced dynamic or condenser microphones. The microphone power source is 48 volts nominal and meets the worldwide P48 phantom standard.

The output of the microphone preamplifier is used by the main and talkback output circuits.

One 8-position DIP-type switch array is used to set the gain of the microphone preamplifier and the on/off status of the phantom power. These switches are accessible via the bottom of the Model 200's enclosure; the unit does not have to be disassembled. To prevent access to the configuration switches a security panel, included with each unit, is attached to the bottom of the enclosure.

Main and Talkback Outputs

The Model 200 provides one main and one talkback output. The main output is intended to serve as the on-air audio feed. It is designed as a fully professional interface with high output capability, low distortion, and low noise. It features an output transformer that is well suited for driving long broadcast cable runs. The talkback output is intended to provide production trucks, control rooms, or support personnel with a talent-originated cue signal. The talkback output is transformer-coupled with a +4 dBu nominal signal level. It contains resistors in series with its output connections, allowing the talkback output from multiple Model 200 units to be directly "summed."

User Controls and Status Indicators

Two pushbutton switches, three LED indicators, and two rotary controls provide the user with a clear, easy-to-use interface. One of the pushbutton switches controls the status of the main output. This is the audio output intended for on-air use. The main output button performs a

"push-to-mute" function that momentarily mutes the main output. This "cough" function is typically required for on-air applications. Two LEDs display the on/off status of the main output.

A second pushbutton switch controls the talkback output. This is the audio output used to communicate with producers, directors, or other behind-the-scenes production personnel. The talkback button provides a "push-to-talk" function. When active, the talkback function routes the microphone signal to the talkback output while muting the main output. A status LED is associated with the talkback button. Two rotary controls allow the user to adjust the level of the headphone output.

IFB Input

A broadcast-standard "wet" (DC with audio) IFB circuit can be directly connected to the Model 200's IFB input. Originated by sources such as the RTS™ 4000-series IFB system or IFB interface devices from Studio Technologies, the connected IFB circuit can provide DC power to operate the Model 200 as well as two channels of cue audio.

Cue Sources and Headphone Output

The two audio sources associated with the IFB input are routed, by way of interface, level controls, and output circuitry, to the headphone output. Originating in production trailers, control rooms, or remote locations, these cue sources typically provide program-with-interrupt audio on one channel and program-only audio on the other. The Model 200 doesn't perform any cue source channel rerouting, summing, or muting. Channel 1 (pin 2 of the IFB connector) serves as the headphone output's left

channel source. Channel 2 (pin 3 of the IFB connector) serves as the source for the headphone's right channel output.

Some applications may benefit by being able to connect standard line-level audio signals to the Model 200. To meet this need one or two optional line input cards can be installed in the unit's back panel. Each card provides a 3-pin female XLR-type connector and transformer-isolated +4 dBu nominal input circuit. One card is assigned to the left headphone output, the other to the right.

Two rotary controls are provided for user adjustment of the headphone output levels. They provide independent volume-control adjustment of the left and right channels. To help minimize the chance of broadcast cues being missed, both level controls are configured so that a minimum headphone output level is maintained.

The headphone output was designed to meet the needs of contemporary headphones and headsets. Specifically, the output circuits act as voltage, rather than power, drivers. This implementation provides high output levels with very low distortion and noise, along with minimal current consumption. The output circuits can safely drive stereo or mono loads, ensuring that all types of headphones, headsets, and earpieces can be directly connected.

Audio Quality and Protection

The Model 200's circuitry has been carefully designed to provide excellent audio performance. Pro-audio-quality components are featured throughout. For reliability all audio switching is performed using solid-state devices. In the critical main output and talkback output audio

paths, "clickless" electronic switches provide noise-free control. All audio inputs and outputs make extensive use of protection components. This limits the chance of damage from ESD and other undesirable, yet real-world, hazards.

Power Sources

The Model 200 can derive its operating power from either the IFB input or an external 24 volt DC source. For redundancy, both power sources can be connected simultaneously. An internal switch-mode power supply ensures that all Model 200 features are available, including phantom power, when powered by either source.

The Model 200 is compatible with IFB circuits provided by most standard broadcast systems. However, maximum performance can often be obtained by using the IFB interface devices available from Studio Technologies. Single-channel and four-channel units are available, each providing high-quality audio along with an excellent source of DC power. They're directly compatible with most matrix intercom systems, as well as standard line-level audio signals. Refer to the Studio Technologies website for details.

Connectors

The Model 200 uses standard connectors throughout. The microphone and IFB inputs use 3-pin female XLR-type connectors. The main and talkback outputs use 3-pin male XLRs. The headphone output utilizes a 1/4-inch 3-conductor jack. The external source of 24 volt DC power is connected by way of a 2.1 x 5.5 mm "locking" coaxial power jack.

In the world of broadcast audio it's fair to say that applications vary widely. To this end, one or two additional XLR-type connectors can be easily mounted into the Model 200's back panel. Seven 3-position "headers" are located on the Model 200's circuit board and provide technician-access to all input and output connections. Using a factory-available interface cable kit, these allow a Model 200 to be optimized to meet the exact needs of specific applications. For example, some applications may prefer to use a multi-pin XLR-type connector to interface with a headset. This could be easily accomplished by adding the appropriate 5-, 6-, or 7-pin XLR-type connector and making a few simple connections. Other applications may benefit from having "mult" or "loop-through" connections, something easily incorporated into a Model 200. One or two optional line-input cards, as previously discussed, can also be mounted in the spare XLR positions.

200-Series Announcer Console Products

The Model 200 is just one in a series of announcer console products available from Studio Technologies. The Model 200 was designed specifically for on-air television sports applications where the performance requirements were well defined. The unit's features and operating modes were selected to provide excellent performance and rapid setup, along with limited configuration flexibility. For applications that require additional performance enhancements the other products in the 200-series should be reviewed. Complete information is available on the Studio Technologies website.

Installation and Setup

In this section interconnections will be made using the input and output connectors located on the Model 200's back panel. Microphone input, IFB input, main output, and talkback output signals are interfaced by way of 3-pin XLR-type connectors. A ¼-inch 3-conductor phone jack is provided for the headphone output. A 2.1 x 5.5 mm coaxial jack allows connection of an external 24 volt DC power source.

System Components

Included in the shipping carton are the following: Model 200 Announcer's Console, user guide, button label sheet, and 24 volt DC power supply. For units shipped to destinations in Japan and North America the power supply will have a nominal AC mains input of 120 volts. For all other destinations a power supply compatible with 220/240 volt AC mains will be included.

Microphone Input

The Model 200 is compatible with balanced dynamic and condenser microphones. Depending on the application, the microphone may be part of a headset, or be an independent handheld or stand-mounted model. The Model 200's 48 volt nominal power source will support essentially all phantom-powered microphones. The quality of the Model 200's microphone preamplifier and associated circuitry is such that special applications may benefit from using "high-end" microphones. If selected appropriately, models from manufacturers such as AKG, Beyer, Neumann, Sennheiser, and Shure will perform very well in Model 200 applications.

Microphone interconnection is made by way of a 3-pin female XLR-type connector which is located on the Model 200's back panel. The mating connector (male) should be wired so that pin 2 is signal high (+ or hot), pin 3 is signal low (– or cold), and pin 1 is shield. It's possible that an unbalanced microphone will also work correctly. In this case, the mating connector (male) should be wired so that pin 2 is signal high (+ or hot), and signal common/shield is connected to both pins 1 and 3.

The Model 200 is not compatible with unbalanced “electret”-type microphones that require a source of low-voltage DC for operation. These microphones, sometimes found in low-cost headsets, are not generally suitable for on-air or other demanding applications.

As of the writing date of this user guide, the Sennheiser HMD25 headset is very popular for on-air sports broadcast use. A fine product, it works very well with the Model 200. Note that adding the suffix “-XQ” to the headset's part number (HMD25-XQ) specifies a 3-pin male XLR-type connector for the dynamic microphone and a ¼-inch 3-conductor plug for the stereo headphones. This configuration is very useful, allowing the headset to work directly “out of the box” with the Model 200.

If the writer may digress for a moment to recount a story... an audio dealer once shared a secret with me concerning headsets. He loved selling name-brand but “lower-end” (less expensive) headsets, which he did by the veritable “boatload.” Why? Because they usually broke soon after going into service! He knew that on a regular basis he'd receive orders for more of them. Had these users, from the beginning, purchased only premium-quality headsets,

their total cost of ownership would have been much less. Enough said...

Headphone Output

The Model 200's headphone output is compatible with stereo or mono headphones, headsets, or earpieces. Connecting devices with a nominal impedance of 100 ohms or greater is preferred. This shouldn't prove to be an issue as essentially all contemporary devices will meet this condition.

Devices are connected to the headphone output by way of a ¼-inch 3-conductor phone jack which is located on the Model 200's back panel. As is standard for stereo headphones, the left output is connected to the “tip” lead of the ¼-inch headphone jack. The right output is connected to the “ring” lead of the jack. Common for both outputs is connected to the “sleeve” lead.

Devices with ¼-inch 2-conductor “mono” plugs can also be used with the Model 200's headphone output. In this arrangement only the tip lead (left channel) will be active. The 2-conductor plug will physically connect (“short”) the ring lead (right channel) to the sleeve lead (common). Technically this won't damage the circuitry associated with the right-channel headphone output. (51 ohm protection resistors are electrically in series with the headphone output circuits.) However energy will be wasted if an audio signal coming out of the right channel goes into a “dead short.” There are several ways of limiting the chance that this condition will occur. The first way is to disconnect or “un-route” any audio source going to channel 2 of the connected IFB circuit. Channel 2 audio is found on pin 3 of the IFB input XLR-type connector. The second way is pretty obvious—keep the right channel level control

in its fully counterclockwise position. A third way is preferred, but unfortunately might prove to be impractical out in the field. It would mandate the use of 1/4-inch 3-conductor plugs on all devices, stereo or monaural, that are to be connected. Stereo headphones or headsets would connect in the usual way: left channel on tip, right channel on ring, and common on sleeve. But monaural devices would connect only to the tip and sleeve leads; the ring lead would remain unconnected. This would ensure that the Model 200's right-channel headphone output would never be shorted.

Main Output

The main output is intended to be the "on-air" signal that connects to the input of an audio console. The output is transformer balanced with a nominal signal level of -2 dBu. The actual level will depend on the gain setting of the microphone preamplifier, sensitivity of the microphone, and how loudly the talent speaks into the microphone. The transformer used in the main output is intended for professional broadcast applications. It has a low source impedance and can drive lengthy cable runs with no difficulty. It is capable of driving 600 ohm loads but performs best with loads of 2 k ohms or greater. (This should not prove to be an issue as virtually all contemporary audio equipment has a relatively high input impedance.) As the secondary winding of the output transformer connects directly to the main output connector, care should be taken so that DC voltage is never present on the interconnecting cable.

The main output is interfaced by means of a 3-pin male XLR-type connector located on the Model 200's back panel. The interconnecting cable's mating connector (female) should be wired so that signal high

(+ or hot) is on pin 2 and signal low (- or cold) is on pin 3. The cable's shield can be connected to pin 1, but it will have no function. To limit the chance of grounding interaction between the Model 200 and connected equipment, pin 1 on the main output's connector is isolated from any point in the Model 200. The fact that pin 1 "floats" will minimize the chance of hums, noises, or buzzes being present on the equipment connected to the main output.

Talkback Output

The talkback output is intended for connection to control rooms, production trailers, or other locations where talent-originated voice cues are required. The talkback output is transformer-balanced with a nominal level of +4 dBu. The actual level will depend upon the output level of the connected microphone and the amount of gain selected for the microphone preamplifier.

For protection against accidental connection to cables that have DC power present, the talkback output is capacitor coupled. In series with the talkback output leads are 300 ohm resistors, making the effective output impedance approximately 600 ohms. These resistors allow talkback outputs on multiple Model 200 units to be connected together, creating a passive summing network.

The talkback output is connected by way of a 3-pin male XLR-type connector which is located on the Model 200's back panel. A mating connector (female) should be prepared so that signal high (+ or hot) is expected on pin 2. Signal low (- or cold) should be expected on pin 3. The cable's shield can be connected to pin 1. But, like the main output, to minimize the chance

that ground problems will arise, pin 1 of the talkback output connector is isolated from any point in the Model 200. By making pin 1 “float,” an often-feared “ground loop” problem shouldn’t arise.

The talkback output is intended to drive lengthy cable runs that are frequently part of a remote broadcast application. While the output circuitry is not intended to be “on-air” quality, overall audio performance should be very good. Devices connected to the talkback output can range from amplified loudspeakers, analog inputs on intercom systems, and input channels associated with audio consoles. Connecting the talkback output to devices that allows easy control of the signal level can be helpful. For example, connecting to a spare input module on an audio console provides the flexibility to add “gain or attenuate as required. A talkback-associated output connection on the audio console can then connect to the final destination(s).

As previously mentioned, the talkback outputs on multiple Model 200 units can be directly connected together. Using a simple “Y” or “W” cable, this passive summing (adding together) of talkback signals allows one audio cable to serve as a master talkback path. A side effect from using this passive summing technique is that signal attenuation will occur. The audio quality won’t suffer, but this passive mixing method does create an audio “pad.” If two talkback outputs are connected together, a signal attenuation of 6 dB can be expected. Connecting three talkback outputs together will result in 9.5 dB of attenuation. And four talkback outputs “malted” together will lead to 12 dB of attenuation. In most cases this attenuation won’t pose a problem.

Typically a device that receives the talkback signal, such as an amplified loudspeaker, will have adjustable input sensitivity.

IFB Input

The Model 200’s IFB input is designed to directly connect with “wet” (DC-biased) IFB circuits. These circuits provide DC power and one or two channels of audio over a standard 3-conductor microphone-style cable. Typically, the IFB circuit’s interface connector is a 3-pin male XLR-type wired so that common is on pin 1, DC with channel 1 audio is on pin 2, and channel 2 audio is on pin 3. Some IFB circuits may only have one audio channel. In this case, audio will generally be on pin 3 with pin 2 providing only DC power.

The power supplied by an IFB circuit, normally in the range of 28 to 32 volts DC, is usually sufficient to operate the Model 200’s circuitry. The acceptable input range is 24 to 32 volts, with a required current of 95 milliamperes. Note that the specified input voltage is given when measured directly at the Model 200’s IFB input connector, not at the source of the IFB circuit. The one or two audio signals provided by the IFB circuit will serve as the audio source(s) for the headphone outputs. Audio that arrives on pin 2 of the IFB input connector is used for the left-channel headphone output. Audio on pin 3 is used for the right-channel output. The Model 200’s IFB input has a nominal audio level of –10 dBu, matching that of typical IFB circuits.

In North American field and in-studio broadcast applications it is common to find RTS 4000-series IFB equipment being used to provide the IFB circuits.

The Model 200 can be directly connected to, and function correctly with, one of these circuits. For reliable operation, especially when using lengthy cable runs, it's strongly recommended that no other device be connected to a 4000-series IFB circuit that is specified for connection to a Model 200. This requirement is due to the current-limited DC source that is supplied by the 4010 IFB Controller.

With 4000-series IFB circuits channel 1 (XLR pin 2) provides program audio that is "interrupted" with cue signals. This channel is sometimes referred to as "program-with-interrupt." It's important to note that the program audio source fully mutes whenever directors or producers are communicating with on-air talent. Channel 2 (XLR pin 3) of the IFB circuit provides a "program-only" audio feed. It is never interrupted with cue signals.

While the Model 200's IFB input was designed for connection to a "wet" IFB circuit, it's also possible to connect line-level audio sources. Please refer to the Technical Notes section of this user guide for details.

External Power Input

An external source of 24 volt DC power can be connected to the Model 200 by way of a 2.1 x 5.5 mm coaxial power jack which is located on the unit's back panel. The center pin of the jack is the positive (+) connection. While the requirement for the external source is nominally 24 volts, correct operation will take place over a 20 to 30 volt range. The Model 200 requires 50 milliamperes maximum for correct operation. Included with each Model 200 is a 24 volt DC external power supply. The power supply's DC output cable has

been terminated with a Switchcraft® S760K coaxial power plug. This "locking" type of plug correctly mates with the Model 200's DC input jack. The locking feature is important, allowing the external power supply to be securely attached to the Model 200.

As previously discussed in this user guide, an IFB circuit connected to the IFB input can serve as the Model 200's power source. Alternately, an external 24 volt source can be connected. For redundancy, both the IFB circuit and the external source can be connected at the same time. If one or the other becomes inoperative, the remaining source will provide all Model 200 power.

Note that if both an IFB circuit and an external 24 volt DC source are connected, power will be drawn only from the external source. This minimizes the chance that lengthy cable runs or other IFB circuit issues will impact Model 200 operation. Whatever device is providing power, audio signals from the IFB circuit will continue to serve as the audio source(s) for the headphone output.

Pushbutton Labeling

The two pushbutton switches used in the Model 200 were selected for several reasons. Foremost was the fact that they were highly reliable, using gold-plated contacts for long life in less-than-ideal environments. A second reason was that applying customized labels to the button caps would be very simple. The labels, text printed on clear material, are placed under the clear caps that are on the top of the buttons. From the factory the left button is labeled COUGH and the right button is labeled TALKBACK. This was

selected to be appropriate for many on-air applications in English-speaking locations. But it's expected that these may need to be changed to meet the needs of specific applications.

As a "head start" for some applications, included in the shipping carton is a clear sheet with a number of commonly used button designations printed on it. These were created at the factory using a standard personal computer graphics program and laser printed onto 3M CG3300 transparency film. The desired button labels can be cut out with a pair of scissors, following the printed guide lines that indicate the required size.

The clear lens on top of each button cap can be removed with a fingernail or small screwdriver. Be certain not to scratch the button if a screwdriver or other small tool is used. The clear label can then be removed and replaced. The button cap is then snapped back into the top of the button housing using finger-pressure only. No tool is required to replace the button cap.

If you need to make your own labels the process is quite simple. Use a personal computer to create the desired text. The finished label size should be 0.625-inches (15.8 mm) square. The completed artwork can then be printed on transparency film sheets using a laser or inkjet printer. These sheets are readily available from most office supply stores. A pair of scissors or an X-ACTO® knife will complete the task.

Configuration

For correct Model 200 operation, two operating parameters must be configured: microphone preamplifier gain and phantom power on/off. An 8-position DIP-type switch assembly is used to set the desired configuration. Refer to Figure 3 for a detailed view of the configuration switches. These switches are accessible through an opening in the bottom of the Model 200's enclosure. The enclosure does not have to be disassembled to gain access to the switches.

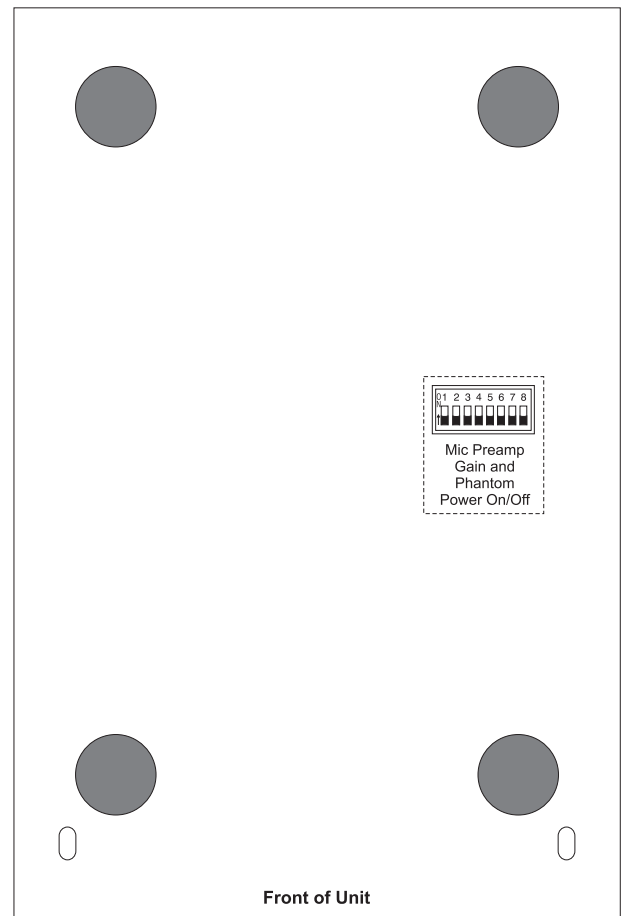


Figure 3. Bottom view of Model 200 showing configuration switches

To prevent unauthorized personnel from changing configuration settings, a security plate is attached to the bottom of the Model 200's enclosure. For convenience, attached to the security plate is a configuration settings label. It provides a summary of the configurable parameters and related information. Refer to Appendix A for a representative view of the label. The security plate is held in place by means of four rubber bumpers ("feet") that have built-in screws. Using your fingers, remove the four bumpers so that the plate becomes loose.

Microphone Preamp Gain

Switch positions 1-5 are used to select the gain of the microphone preamplifier. The choices are 20, 30, 40, 50, and 60 dB. Only one switch should be enabled at a time. There's no problem changing the gain setting while the unit is operating. Audio clicks or pops might occur during gain transitions, but this shouldn't be a major issue as long as associated monitor loudspeakers are temporarily attenuated or muted.

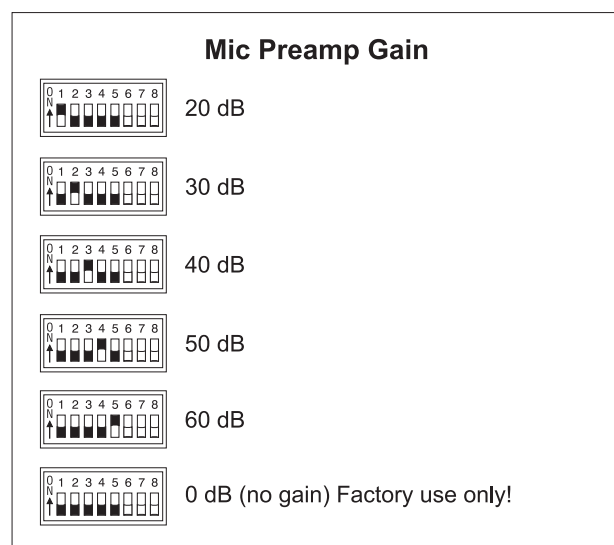


Figure 4. Microphone preamplifier gain switch settings

Selecting the correct amount of gain for an application might take a little experimentation. The goal is to bring the mic's signal up to line level, nominally -2 dBu for the Model 200's main output. Operating at this signal level will help to ensure the delivery of "clean" audio to the connected device. The output of the Model 200's microphone preamplifier is used by both the main and talkback outputs. So creating a nice "hot" signal will help maintain audio quality, specifically the signal-to-noise ratio, when driving the often-lengthy cable runs.

Unfortunately, there's no "perfect" gain setting that this guide can recommend. The two issues that impact the setting are output sensitivity of the connected microphone and the acoustical output level of the microphone's user. With some headset microphones, such as the Sennheiser HMD25, selecting an initial setting of 40 dB is appropriate. Users who speak loudly might need to have the gain reduced to 30 dB. Quiet users might need 50 dB of gain.

It's expected that the 20 and 60 dB gain settings will not often be used. But there are always exceptions and that's why they were included. It's possible that with a very "hot" microphone, such as a phantom-powered condenser-type, 20 dB of gain could be correct. It's also possible that a microphone with a very low-level output, such as a ribbon-type, would need 60 dB of gain. But in general, the 30, 40, and 50 dB gain settings will serve most applications.

Note that if no gain switch is set to its active (on) position the preamplifier will operate at unity (0 dB) gain. In this mode the preamplifier remains stable, but is intended for use only during factory testing. The only exception would be a special application where a line-level signal was connected to the

microphone input. But with a microphone connected as the input source one should never use the 0 dB setting. The issue is that with no gain added to the microphone input signal, the relative noise floor on the main and talkback outputs will be much too high. These outputs are designed for handling line-level signals, expecting to receive the output of the microphone preamplifier. In conclusion, the 0 dB gain setting doesn't highlight a problem, but simply reflects the unit's gain structure.

Phantom Power On/Off

Position 8 of the switch assembly controls the on/off status of the 48 volt phantom power supply. As expected, placing the switch to the on position applies phantom power to the microphone input. By phantom power's very nature it could be left applied to the microphone input at all times. But generally people prefer to turn it off unless required for a specific microphone.

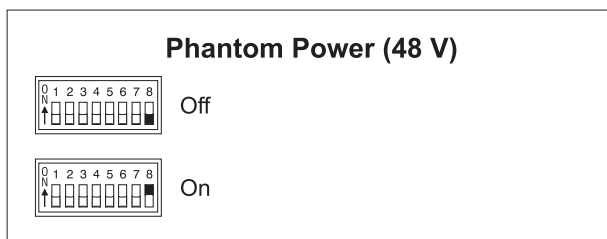


Figure 5. Phantom power switch settings

Conclusion

Once the switches have been set to the desired configuration, the security plate should be reattached. The four rubber bumpers should be hand-tightened only. No tools should be used.

Operation

At this point the desired input, output, and power connections should have been made. The button labels may have been revised. Finally, the configuration switches should have been set. Normal operation of the Model 200 can now begin. The unit will begin functioning as soon as a power source (either the IFB circuit, external 24 volt DC power source, or both) is connected. It's important to highlight the fact that the Model 200 is an active device. Audio signals will not be present on the main output if correct power has not been supplied! The microphone does not passively "cut through" to the main output connector.

Upon power up, only the green LED associated with the main output button, factory labeled as COUGH, will be lit. The user is now presented with two buttons, three LEDs, and two rotary controls. These are simple to operate and understand, as will be described in the following paragraphs.

Pushbutton Switches and Status LEDs

Two pushbutton switches are used to control the main and talkback outputs. The button on the left, factory labeled as COUGH, provides a push-to-mute function for the main output. The function is momentary, the output mutes only when the button is pressed and held. Two LED indicators are located directly above this button. The green LED is lit whenever the main output is active. This could be considered to be an "on-air" or mic active indicator, or at least serve as a "careful what you say" warning! The red LED, located to the left of the green LED, is lit whenever the main output is not active.

The button on the right, factory labeled as TALKBACK, provides a push-to-talk-back function. The function is momentary, activating the talkback output only when the button is pressed and held. One LED indicator is located directly above this button. Green in color, it lights whenever the talkback output is active. Also, whenever the talkback output is active the main output is muted. The LEDs associated with the main output will light accordingly.

If both buttons are pressed at the same time, the main output is muted and the talkback output is active.

Headphone Output Level Controls

Two rotary level controls are located on the Model 200's front panel and are associated with the headphone outputs. The control on the left side is used to set the level of the left headphone output. The control on the right side is used to set the level of the right headphone output. In typical sports broadcasting applications, the left headphone output will supply program audio that is interrupted with cue signals. The right headphone output will supply an uninterrupted source of program audio.

By design, the headphone level controls will not turn their respective outputs to a fully muted condition. When a control is set to its fully counterclockwise position, the output will be 40 dB below its maximum level. This setting ensures that talent will never be fully "isolated" from potentially important cue signals. Some signal will always be presented to the headphone outputs.

Each level control has a mechanical step (detent) that is located at the halfway

(50%) position of its rotation range. This is intended to serve as an aid to Model 200 users. In an ideal installation, setting the controls to their detent position will result in a comfortable headphone output level. The user can then move the level control as desired to get more or less level as conditions change. But the detent position will always remain as a useful reference point. To achieve this condition the audio level on the connected IFB circuit would have to be adjusted as required. This is somewhat counter to the usual mentality of just providing the user with whatever level comes up by default. Spending a few extra minutes "trimming" the audio levels can result in much happier, and more productive, talent.

Technical Notes

Grounding and Shielding

As previously discussed in this user guide, the pin 1 connections on both the main and talkback outputs' 3-pin male XLR-type connectors are "floating," i.e., not connected to anything within the Model 200's enclosure. Some audio experts might take offense to this, grousing that this should have been left to the user or installer to be connected or disconnect as desired. However, repeated field testing found that floating pin 1 on the outputs was the key to maintaining quiet audio. From Fenway Park, to the Orange Bowl, and then northwest to Husker Stadium, lifting pin 1 did the trick.

A simple solution is available if an application does require that a ground be available on the main and talkback outputs' interconnecting cable. All Model 200 XLR-type connectors have a ground connection that is made to the interfacing connector's metal "shell." And most XLR-type connectors

have a pin or connection point available to access its metal shell. By adding a jumper wire from the mating connector's shell terminal to its pin 1 and cable shield, the common connection typically found on audio interconnections is created.

IFB Channel Crosstalk

By the very nature of its design, standard "wet" IFB circuits are prone to exhibit crosstalk between the two audio channels. This occurs because the audio path is unbalanced ("single-ended") and typically transported on a single shielded twisted-pair audio cable. The primary cause of the crosstalk is the capacitance between the wires in the cable pair. The greater the capacitance, due to cable type and length, the more crosstalk there will be. It's not surprising to find in sports broadcasting venues that audio from one channel in an IFB circuit can be heard "bleeding" into the other channel. Is this generally an issue? No, as each channel in an IFB circuit generally carries related audio content. For example, on-air talent hearing in their left ear a small amount of program audio from channel 2 while an interrupt from channel 1 is active, typically wouldn't be a problem.

There are several ways of reducing IFB channel crosstalk. Probably the easiest way is to use cable pairs that are not twisted. Twisted pairs are great for differential (balanced) signals, but not so great for unbalanced transmission. This is generally because the more twists in a pair the greater the cable capacitance. In a stadium or arena setting, choosing standard "telco" pairs may actually work better than "high-performance" audio or data cable!

Another option is to use two cable pairs for each IFB circuit. If the pairs are not shielded the wiring is simple. Common would be connected to one side of each pair, and then signal from each channel would connect to the other side of the pairs. If the pairs also contain shields the wiring could be done somewhat differently. One option is to connect common to both cable shields, IFB channel 1 (DC with audio) to one full pair, and IFB channel 2 to the second full pair. A better option might be to have common connect to both shields and one side of the pair that serves IFB channel 2.

Other options are available if an application demands low crosstalk. If resources in the broadcast or production facility allow one method would be to run the IFB circuits "dry" (no DC) and differential (balanced). This would gain the benefits of differential transmission, including minimizing the crosstalk. If optional line input cards have been installed in the Model 200, the balanced line-level signals can be directly connected. However, if it's desired to connect cue sources to the Model 200 using an IFB-type circuit, the line-level audio signals will need to be "wetted up" into standard IFB circuits. This is easily accomplished using one of several high-performance IFB interface units from Studio Technologies. For further information please refer to the Studio Technologies website.

IFB Audio Levels

The Model 200 is designed to operate best with IFB audio levels that are nominally -10 dBu. This is the nominal level of most IFB systems, such as the RTS 4000-series. But actually having the correct level present on an IFB circuit is often

a “hit-or-miss” proposition. During field testing of prototype announcer’s consoles, Studio Technologies’ personnel found that a wide range of nominal audio levels were present on “real-world” IFB circuits. Many were fine, being reasonably close to –10 dBu. But some were much too low, while others much too “hot.” We observed one unfortunate baseball “color” commentator being sent interrupt audio signals so “hot” relative to program audio as to almost make his ears bleed! This situation should not have been allowed to happen.

In defense of field technical personnel, measuring the audio level of an IFB circuit hasn’t traditionally been an easy proposition. But that situation has now changed. After experiencing this condition in the “field,” Studio Technologies’ engineers were motivated to design the Model 72 Level Meter/Interface. This compact device plugs directly into IFB and intercom circuits and provides two useful functions: level meters and “dry” audio outputs. Two 5-segment LED meters allow direct observation of the audio signal levels present on IFB or intercom circuits. The display range is optimized for the signal levels found on these circuits, rather than traditional “VU” scaling. The Model 72 also provides two transformer-coupled “dry” audio outputs, one for each IFB or intercom channel. These outputs are useful for a variety of production and testing applications. For example, the outputs can serve as the interface between a traditional “wet” IFB system and a wireless in-ear monitor system. The outputs can also be connected to a monitor panel, allowing visual and aural monitoring of the IFB audio signals.

In conclusion, we’re sorry for this shameless promotion of the Model 72 Level Meter/Interface! But necessity was

definitely the “mother” when it came to the unit’s invention. Working “in the field” without such a device, we felt “blind” when connecting to IFB circuits. That no longer has to be the case and we think that you’ll find owning one a very worthwhile investment. For further information please refer to the Studio Technologies website.

Phantom Power

The Model 200 provides a 48 volt nominal source of “phantom power” to support condenser-type microphones. It’s designed to meet the P48 requirements as specified in the IEC 61938 standard. The circuitry is very simple: two 6.81 k ohm resistors provide a path from a 48 volt source to pins 2 and 3 of the microphone input connector. The resistors and the power source work together to provide 48 ±4 volts, up to a maximum current of 10 milliamperes.

External Power Sources

As has been previously discussed, an external source of 24 volt DC can be used to power the Model 200. While developing the 200-series of announcer console products, an interesting phenomenon was discovered regarding acceptable sources. To meet worldwide requirements, using a compact switch-mode “universal input” power supply seemed to be an excellent solution. Supplying one of these with each Model 200 would have allowed operation anywhere in the world. Whether connecting to 100 volts, 60 Hz in Japan or 240 volts, 50 Hz in Australia all would be well. Unfortunately, things did not work out as planned! It turned out that all of the compact switch-mode power supplies that were tested induced a great deal of noise into their DC output. This noise, especially

noticeable in the negative lead of their DC output, fed right into the common lead of the IFB circuit. From what could be determined, noise current would travel from the power supply, through IFB input pin 1, and on to the IFB circuit source's ground connection. Making the problem more insidious was the fact that only when the IFB circuit's interconnecting cable was sufficiently long did the problem become noticeable. In the "lab" where 10-foot long test cables were used, the audio from the IFB circuit was extremely quiet. But testing with 500 or 1000 feet of interconnecting cable resulted in an annoying "buzz" on the IFB audio channels.

Many hours were spent trying to eliminate this problem. But, unfortunately, no solution was found. It was a humbling experience that only a few visits to the local tavern made us feel better about.

The solution turned out to be very simple, but not without other ramifications. By changing to a low-cost transformer-based ("linear") 24 volt DC power supply the problem disappeared. With no high-frequency switching noise to get into the IFB circuit, everything worked fine. But a new problem arose when it came to finding an external linear power supply for Model 200 users worldwide. For locations that are served by 100 or 120 volts, 60 Hz a 24 volt DC linear "wall-wart" power supply was readily available. This is the power supply that is provided with the Model 200 when it is shipped to North America or Japan. But as of this writing, no "perfect" 24 volt DC linear power source has been located that would serve 220/240 volts, 50 Hz applications. So a compromise had to be made. For these applications a small universal input switch-mode power supply is included with each

Model 200. It's far from an ideal solution, leading to noise on the IFB audio channels when long cable runs are present. But at least users will have an "emergency" power source if nothing else is available.

In conclusion, users where the AC mains power is 220/240 volts should consider locating an alternate 24 volt DC power source. Several options are available that could make the task simple. It's expected that a more sophisticated "medical-grade" switch-mode power supply will have much better control of induced noise. It's highly likely that using one of these supplies will provide good results. As the Model 200's current requirement is only 50 milliamperes, a typical medical-grade power supply should be able to power multiple units. Another solution would be to obtain two of the more commonly available 12 volt DC linear power supplies, connecting their outputs in "series" to create a 24 volt DC source. While not a glamorous solution, it is technically correct and should prove cost effective. If this arrangement is implemented remember that the center pin of the 2.1 x 5.5 mm coaxial jack is used for the positive (+) connection.

Symptoms of Insufficient Power

A core part of the Model 200's internal circuitry is a switch-mode power supply that produces +48 volts, +12 volts, and -12 volts. This power supply circuit works very well as long as it is "fed" with sufficient input voltage and current. "Sufficient" is defined as a minimum of 24 volts on the IFB input and 20 volts on the external 24 volt DC input. The IFB input must be capable of supplying 95 milliamperes of current over its entire voltage range. The external

source must provide 50 milliamperes at 24 volts DC.

It's worth discussing what will happen if either power source falls below its specified minimum. Typically, if the Model 200 is being powered by an external power source, apparently normal operation will continue until the input falls to the 18-20 volt range. The Model 200's internal power supply will have reduced stability until its low-voltage shutdown circuit halts its operation. Note that as the input voltage moves down from 24 volts the input current will rise proportionately to make up for the loss of power.

If an IFB circuit is powering the Model 200, maintaining the required voltage and current is more critical. Should the voltage or current fall below the specified minimum, the Model 200's power supply circuit will again become unstable. This will become an issue as noise will be induced into the IFB circuit's audio signals. The reason is simple: an IFB circuit "multiplexes" 3-conductors so that they carry both power and audio signals. If sufficient amounts of voltage and current are presented to the IFB input, the Model 200's power supply draws a nice and steady amount of energy. This will not disturb the analog signals on pin 1 (common for DC and audio) and pin 2 (DC and channel 1 audio). But if the Model 200's power supply is not presented with sufficient energy it will try to draw what it needs from the IFB circuit, becoming unstable in the process. The IFB circuit's audio signals will be corrupted by the power supply's attempt to draw enough power. Instead of nice clean audio there will be squeaks, squeals, and some awfully funky noises added. Again, in a low-voltage or low-current situation, no damage will be done to the Model 200's circuitry but correct operation will not be possible.

In most cases maintaining the IFB circuit's required voltage and current shouldn't be a problem. But issues may arise due to malfunctioning IFB sources or poor interconnect cabling. Typically, excessive cable length won't be the cause of a problem. Generally, problems will be caused by broken or damaged connector pins, dirty patch points, or damaged (partially open) cable conductors. Measuring the IFB circuit's voltage and current draw directly at the Model 200's IFB input connector will quickly identify if there's a power issue.

And now for another shameless "plug" for other Studio Technologies products: Frankly, most devices that supply IFB circuits for broadcast applications use outdated technology that provides mediocre performance. That's why Studio Technologies' developed high-performance IFB interface units. These products do an excellent job of providing power and audio to connected devices such as the Model 200. However, unlike other products, the power supplied by these units' IFB circuits maintain their output voltage all the way to their full rated current. The result is being able to power more devices over longer cable runs. In addition, the audio quality of these units is superior. For further information please refer to the Studio Technologies website.

LED Colors

As previously described, two LED indicators are associated with the main output and are located directly above the main output pushbutton switch. The red LED, located on the left, is lit whenever the main output is muted. The green LED, located on the right, is lit whenever the main output is active. The thought process behind the color choices was that red would relate to the main output being muted ("stop") while

green would relate to the main output being active (“go”). It’s possible that these color choices may not meet the needs of all users and applications. For example, it’s reported that one European broadcaster typically uses the colors in the opposite fashion. Their choice is to have the red LED lit whenever the main output is active, warning the talent that they are “on-air.” The green LED is lit whenever the main output is muted, indicating to the talent that it’s “safe” to say whatever they wish, about whomever they wish to say it about!

For consistency, the LED associated with the talkback button was selected to be green. This lights whenever talkback is active. It’s possible that some applications may benefit from revising this LED color, too. While red is certainly one possible choice, other colors are also a possibility including amber, orange, or blue—these days there are lots of choices available. The only limitation is the amount of current available to light each LED. Using series resistors of no less than 560 ohms will ensure correct Model 200 operation.

A qualified technician can easily revise the LED colors to meet an application’s exact needs. The process would begin by disassembling the Model 200’s enclosure and detaching the pushbutton/LED printed circuit board assembly. The LEDs would then be unsoldered, removed, and reinstalled (or replaced) in the desired locations. To control the LED current and set the brightness, a resistor is electrically in series with each LED. An 820 ohm, ¼-watt resistor is associated with the red LED while a 560 ohm, ¼-watt resistor is associated with each green LED. These resistors would also have to be unsoldered, removed, and reinstalled. Then the unit would be reassembled and tested

to confirm that the changes function as desired. For additional information about changing the LED colors, please contact Studio Technologies’ technical support.

Travel Case

For portable applications it may be desirable to store and transport each Model 200 in a protective case. After much travel with prototype announcer console units, Studio Technologies’ personnel learned to appreciate the Pelican Model 1450 case. Purchased with the foam interior option, it does an excellent job of holding one Model 200, associated 24 volt DC power supply, and related documentation. Some applications may benefit from selecting a larger case that would also hold a related headset, cables, etc. A larger case could also be selected that would hold multiple Model 200 units. Pelican sells their products through a dealer network, many of which can be located via a web search.

Connecting Line-Level Inputs

The Model 200’s IFB input was designed to work with “wet” broadcast IFB circuits. However, there may be applications where it would be helpful to be able to connect standard line-level audio sources. If it’s anticipated that line-level audio sources will frequently need to be connected to the Model 200, one or two line input cards can be installed. These cards, available from Studio Technologies and purchased separately (part number 31084), are mounted into spare connector locations that are provided on the Model 200’s back panel. The line input card contains passive circuitry, including a 3-pin female XLR-type connector and a 10 k ohm to 10 k ohm isolation transformer. Once installed,

balanced or unbalanced line-level audio sources can be directly connected. Note that in cases where only line-level signals, rather than an IFB circuit, is connected to the Model 200 an external source of 24 volt DC power is required. This shouldn't pose a problem as a 24 volt DC power supply is included with each Model 200.

Each line input card kit contains a printed circuit board assembly, an interconnecting cable, and hardware. To install the kit is very simple. The XLR-type connector is mounted into one of the spare connector locations on the Model 200's back panel. This secures the connector and associated printed circuit board to the enclosure. The interconnecting cable is then used to link the card and the Model 200's main printed circuit board assembly. One end of the cable is plugged into the line input card's 3-position "header" that is labeled OUT. The other end of the cable is plugged into the desired 3-position header located on the main printed circuit board. The header associated with the left channel of the headphone output is labeled P11. (This is the same channel that IFB channel 1 is routed to.) The header associated with the right channel of the headphones is labeled P10. (This is same channel as IFB channel 2.) Note that the unused header remaining on the line input card has its pins "muted" with the leads on the 3-pin female XLR-type connector. It is provided for other applications that may need it. Additional installation details are provided in the next section of the user guide. Included is a recommended connector labeling method that is appropriate when line input cards are installed.

For balanced audio sources the mating connector (3-pin male XLR-type) should be wired so that signal high (+ or hot)

is connected to pin 2, signal low (– or cold) is connected to pin 3, and shield is connected to pin 1. Unbalanced sources should be wired so that signal high is on pin 2, and signal low/shield is connected to both pins 1 and 3. If this results in hum on the input, trying connecting signal high to pin 2, signal low/shield to pin 3, and pin 1 left unterminated ("floating").

Several things are worth mentioning when it comes time to actually use a line input card. The input is transformer coupled with a nominal input impedance of 10 k ohms. Capacitors in series with the transformer's primary provide protection against accidental connection of a cable that has DC voltage present on it. The nominal input level is +4 dBu but should work correctly with signal levels down to nominal –10 dBu. So that the rotary level controls provide a more comfortable range of operation during actual use, reducing the level of a "hot" input signal by 3 to 6 dB is preferred, versus having a full +4 dBu nominal level.

Note that if one or two line input cards are installed in a Model 200, both "dry" line-level audio signals and a "wet" IFB circuit can be connected at the same time. Nothing untoward will happen to the Model 200 or related connections. The left channel of the headphone output will have a mix of left-channel line-level audio and IFB channel 1 audio. The right channel will have a mix of right-channel line-level audio and IFB channel 2 audio. There is no reason why this situation can't be used to meet the needs of special applications.

In "emergency" situations it's possible to connect line-level audio signals directly to the Model 200's IFB input connector. This can be successfully done as long as

several limitations are taken into account. The first limitation is that the 10 k ohm input circuit presents an unbalanced load to the source. In most cases this shouldn't pose a problem. If a balanced interconnection scheme must be maintained in-line isolation transformers can be used. A second limitation is that the audio level presented must not exceed 0 dBu or signal "clipping" may occur. Prepare a 3-pin male XLR-type connector so that the line-level audio source designated as channel 1 (left headphone output) is connected with signal high on pin 2 and low/shield on pin 1. The audio source designated as channel 2 (right headphone output) should be connected with signal high on pin 3 and low/shield on pin 1. With this connection scheme the nominal input level is -10 dBu, the same as with an IFB circuit. As expected, powering the Model 200 requires an external source of 24 volt DC to be connected.

Additional Connectors

Two spare connector locations are provided on the Model 200's back panel. From the factory they contain blank plates that can be readily removed and replaced with a variety of XLR-type connectors. These spare connector locations are specifically included so that a Model 200 can be customized to meet the many specific needs that arise in broadcast and related audio applications. Expected uses for these locations include adding a 5-, 6-, or 7-pin XLR-type connector to allow direct connection of a broadcast headset. Other uses include creating "loop through" or "mult" functions for the talkback output or IFB input connections. In addition, Studio Technologies offers an optional line input card that mounts directly in a spare

connector location. This was previously described in this user guide.

The spare connector locations are compatible with the Neutrik DL-series of connectors. For flexibility, versions are available that provide from three to seven contacts. For example, a compatible 3-pin female connector would be Neutrik part number NC3FD-L-1. To support headsets the NC6FDS-L-1 is often used. This is a 6-pin female connector with the unique Switchcraft 6-pin arrangement. The hardware that secures the blank plates to the Model 200's back panel is also intended to secure the replacement connectors.

If connectors are added to the Model 200's spare connector locations adding labels to those connectors can be helpful. For a great look it is recommended that Brother® P-Touch 1/4-inch (6 mm) labels be created. Tape material that prints white text on a black background works out well for the Model 200. The Brother label cassette number TX-3151, white on black, is appropriate for use with many of their printers.

In addition to the spare connector locations on the back panel, provision has been made to allow easy interconnection with the Model 200's printed-circuit-board-mounted input and output connectors. This was accomplished by including numerous 3-position male "header" connectors on the Model 200's circuit board. These headers, on 0.1-inch centers, are wired in parallel with the Model 200's connectors. This "no solder" solution makes customizing a Model 200 a simple process. The headers, located on the Model 200's printed circuit board, are Molex® part number 22-23-2031. They mate with Molex housing number 22-01-3037. To

make the interconnection, separate crimp terminals are attached to loose wires and then “snapped” into the housing. Molex part number 08-50-0114 specifies crimp terminals that are appropriate for wires of 22 to 30 gauge. These parts are available worldwide from sources such as Digi-Key (www.digikey.com).

To make the process of connecting to the Model 200's headers a simple task an interface cable kit, part number 31087, is available from Studio Technologies. Each kit includes five cable assemblies and a length of heat-shrinkable tubing. Each cable assembly consists of a mating connector with three color-coded wires attached. These wires, nominally 12 inches in length, allow convenient soldering to a connector installed in a spare location on the Model 200's back panel. For reference, the wire color for pin 1 is gray, pin 2 is yellow, and pin 3 is blue.

The heat-shrinkable tubing is provided so that the connector solder cups can be insulated from each other. It will also provide some strain relief to the solder joints. Be certain to slip the desired length of tubing over the wire prior to soldering. (If the writer had a dollar for every time he forgot to put tubing on a wire (or slip on a connector shell) before making a solder connection...)

The Model 200's enclosure must be disassembled prior to installing connectors in the spare locations. Four hex-head machine screws, two on the bottom front of the enclosure and two on the back panel, must be removed. A 5/64-inch hex driver is required. The cover can then be carefully separated from the chassis, remaining attached by means of a flexible cable

assembly. This “flex-cable” assembly links the main printed circuit board assembly with the board that contains the push-buttons and LED indicators. Ensure that the flex cable is not damaged while the Model 200 is being customized. For easier access, the pushbutton/LED board assembly can also be easily removed.

The 3-position headers on the Model 200's main circuit board assembly are located close to their related input or output connectors. The following list provides the printed circuit board reference numbers and associated functions:

P3: Headphone output, pin 1 common, pin 2 tip (left), pin 3 ring (right).

P4: Microphone input, pin 1 shield, pin 2 high, pin 3 low. Follows back-panel 3-pin female XLR pin assignment.

P5: Main output, pin 1 shield, pin 2 high, pin 3 low. Careful! Back-panel 3-pin male XLR has pin 1 floating, pin 2 high, pin 3 low.

P6: Talkback output, pin 1 shield, pin 2 high, pin 3 low. Careful! Back-panel 3-pin male XLR has pin 1 floating, pin 2 high, pin 3 low.

P7: IFB input, pin 1 common, pin 2 DC with channel 1 audio, pin 3 channel 2 audio. Follows back-panel 3-pin female XLR pin assignment.

P9: External 24 volt DC input, pin 1 common, pin 2 +24 volts, pin 3 not used. Back-panel 2.1 x 5.5 mm jack has +24 volts on center pin. Header P8 is used by the back-panel 24 Vdc jack assembly and is electrically in parallel with P9.

P10: Aux input 2, pin 1 common, pin 2 audio input. Audio connected to this input routed to right headphone output. Nominal level –10 dBu.

P11: Aux input 1, pin 1 common, pin 2 audio input. Audio connected to this input routed to left headphone output. Nominal level –10 dBu.

Specifications

General Audio:

Frequency Response: 20 Hz-20 kHz, ± 0.3 dB, mic in/main out, 40 dB gain

Distortion (THD+N): 0.008%, measured at 1 kHz, mic in/main out, 40 dB gain

S/N Ratio: 80 dB, referenced to -40 dBu mic in/
0 dBu main out

Connectors:

Mic In, IFB In: 3-pin female XLR-type

Main Out, Talkback Out: 3-pin male XLR-type

Headphone Out: ¼-inch 3-conductor phone jack

24 Vdc Power In: coaxial power jack, 2.1 x 5.5 mm, locking bushing, compatible with Switchcraft S760K plug

Spare Connector Locations: 2

Allows one or two Neutrik NC*D-L-1 connectors to be installed (*=3F, 3M, 5F, 5M, 6F, 6FS, etc.)

Microphone Input/Preamplifier:

Type: electronically balanced

Input Impedance: 2 k ohms, nominal

Gain Range: 20 to 60 dB, nominal, adjustable in 10 dB steps

Compatibility: dynamic or phantom-powered microphones

Phantom Power: 48 Vdc, nominal, meets IEC 61938

IFB Input:

Type: 2-channel, unbalanced (pin 1 common; pin 2 DC with channel 1 audio; pin 3 channel 2 audio)

Impedance: 10 k ohms, nominal

Nominal Level: -10 dBu

Main Output:

Type: balanced, transformer-coupled

Impedance: 100 ohms, nominal

Nominal Level: -2 dBu

Maximum Level: $+19$ dBu into 2 k ohms

Talkback Output:

Type: transformer-coupled with series capacitors and isolation resistors

Impedance: 600 ohms, nominal

Nominal Level: $+4$ dBu

Maximum Level: $+20$ dBu into 2 k ohms

Headphone Output:

Compatibility: intended for connection to mono or stereo headphones or headsets with nominal impedance of 100 ohms or greater

Type: voltage driver

Maximum Output Voltage: 8 Vpp, 150 ohm load

Power Sources:

IFB: 24-32 Vdc, 95 mA

External: 24 Vdc nominal, 50 mA @ 24 Vdc; acceptable range 20-30 Vdc. Units shipped to North America and Japan include a 120 V input/24 Vdc output power supply. Units shipped to all other locations include a universal input/24 Vdc output power supply.

Options:

One or two line input cards can be installed to provide support for connection of line-level balanced or unbalanced audio sources

Dimensions (Overall):

5.6 inches wide (14.2 cm)

3.3 inches high (8.4 cm)

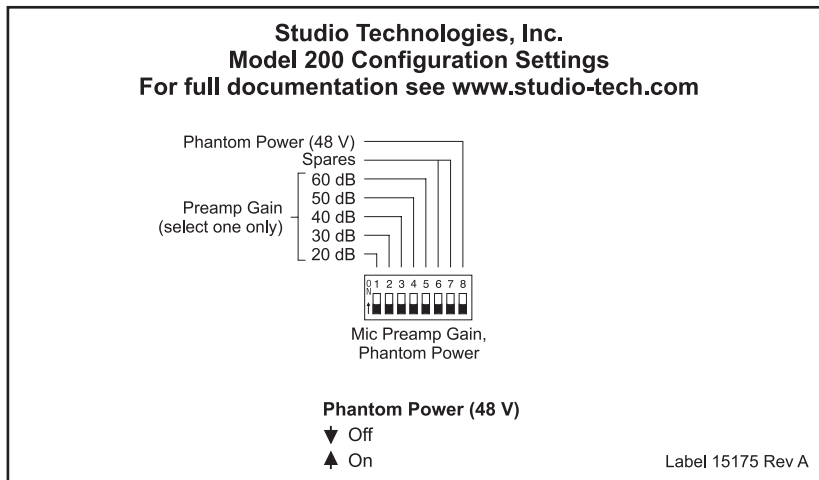
8.5 inches deep (22.4 cm)

Weight: 3.4 pounds (1.6 kg)

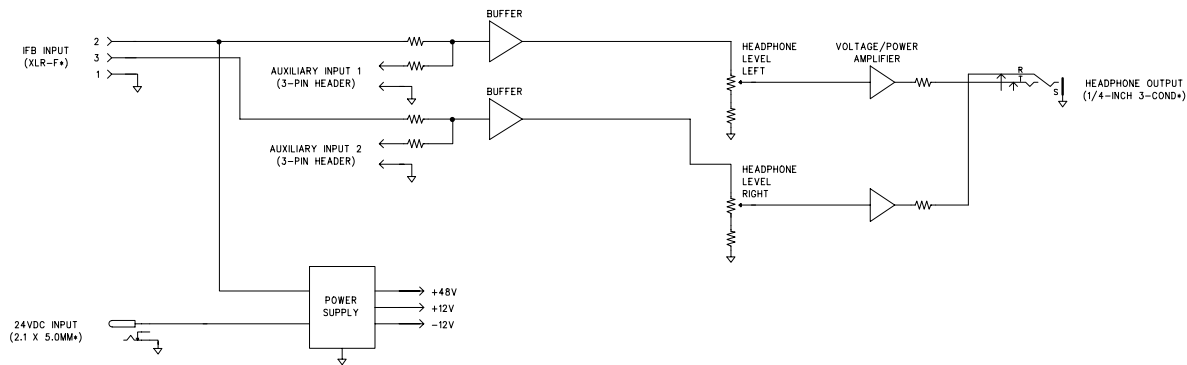
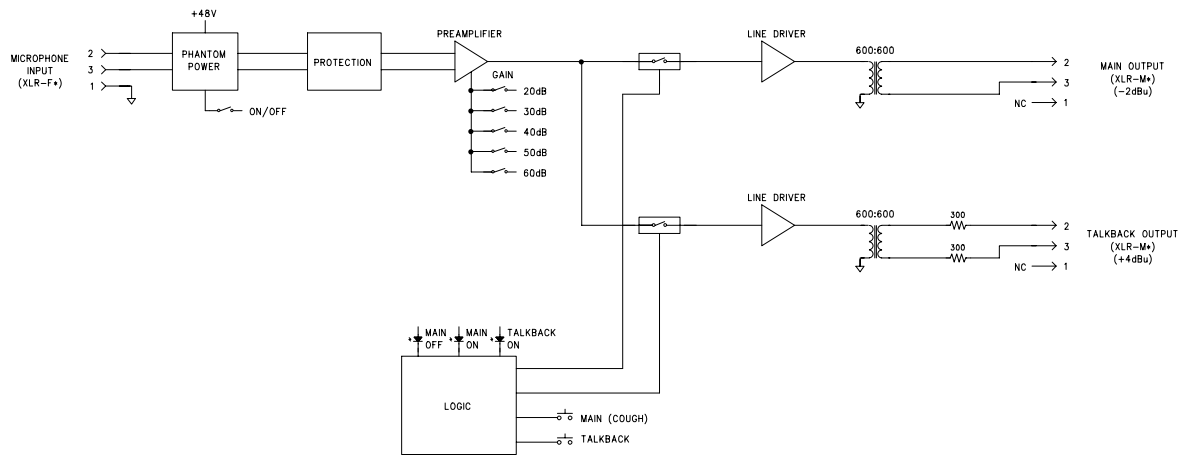
Specifications and information contained in this User Guide subject to change without notice.

Appendix A

A label is attached to the security plate on the bottom of the unit. It provides a summary of the configurable parameters and related information. The actual label size 4.25 inches by 2.50 inches.



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* ALSO HAS 3-PIN HEADER IN PARALLEL ON PRINTED CIRCUIT BOARD

M200BD_B

STUDIO TECHNOLOGIES, INC.		
MODEL 200 ANNOUNCER'S CONSOLE BLOCK DIAGRAM		
DRAWING NO.	DATE	PAGE
31062	05/10/04	01 OF 01