Model 216

Announcer's Console

User Guide

Issue 5, November 2017

This User Guide is applicable for serial numbers
M216-00151 and later with application firmware 2.1 and later

www.studio-tech.com

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Revision History

Issue 5, November 2017:

1. Documents two new system modes: production with tone and production with dim and tone. (Added to support tone-operated (TOX) IFB functionality in Model 5422 Dante Intercom Audio Engine.)

Issue 4, July 2017:

1. Documents that the unit now supports the STcontroller software application.
2. Documents the new configurable headphone output level feature.

Issue 3, March 2017:

1. Documents revised headphone operating mode choices. This relates only to application firmware 1.3 and later as noted on the title page.

Issue 2, September 2015:

1. Documents enhanced unit identification feature.
2. Adds improvements to IP address configuration assignment explanation.

Issue 1, July 2014:

1. Initial release.

Introduction

What This User Guide Covers

This User Guide is designed to assist you when installing, configuring, and using Model 216 Announcer's Consoles. Additional background technical information is also provided.

System Overview

The Model 216 Announcer's Console is designed to serve as the audio control center for announcers, commentators, and production personnel. This tabletop unit supports applications utilizing the Dante® Audio-over-Ethernet media networking technology. The Model 216 is suitable for numerous applications including on-air television sports broadcasting, stadium announce, and corporate AV. It can also serve as a 4-channel IFB (talent cueing) master station for remote production (REMI) applications. The unit integrates all on-air, talkback, and cue audio signal routing in one compact system. Four pushbutton switches allow the user to control the main and talkback audio output channels. Ease of use, configuration flexibility, and sonic excellence are some of the unit's highlights.

The Model 216 is compatible with the latest broadcast and audio system environments that use the Dante technology. An Ethernet connection with Power-over-Ethernet (PoE) power is all that's required to make the unit part of a sophisticated, networked audio system. Connect a microphone and pair of headphones (or a broadcast headset) and the installation is complete. Whether it's the on-air audio, the talkback audio, or the headphone cue feed, superior audio quality is always maintained. A range of configuration choices allow the desired operating parameters to be easily selected.

Figure 1. Model 216 front and back views

These choices can be made locally using pushbutton switches or remotely using the STcontroller application. And while flexible to configure, the user is presented with an easy-to-understand set of controls and indicators.

System Features

User Controls and Status Indicators

Four pushbutton switches, five LED indicators, and three rotary controls provide the user with a clear, easy-to-use interface. One pushbutton switch controls the status of the main output. This is the audio channel

intended for on-air, announcement, or other primary uses. Two LEDs display the on/off status of the main output. Three additional pushbutton switches control the status of the talkback output channels. These are the audio signals used to communicate with producers, directors, spotters, or other behind-the-scenes production personnel. A status LED is associated with each of the talkback pushbuttons. The pushbutton switches use gold-plated contacts for reliable long-term operation and include backlighting using white LEDs. Three rotary controls allow the user to adjust the content and level of the headphone output.

Microphone Input

The Model 216 provides a high-performance microphone preamplifier which offers low-noise, low-distortion, and high headroom amplification over a 19 to 64 dB range. The gain is adjustable in 3-dB steps. A 2-digit display indicates the amplification in dB. The microphone input is compatible with balanced dynamic or condenser microphones. Phantom power is provided and meets the worldwide P48 standard. A dual-color LED indicator serves as an aid for optimizing the setting of the preamplifier's gain. Microphone signals are connected to the Model 216 by way of a standard 3-pin female XLR connector.

Microphone operating parameters can be set both locally and by way of the STcontroller remote control software application. Two pushbutton switches, accessible on the bottom of the unit, allow adjustment of the microphone preamplifier's gain and the on/off status of P48 phantom power. The STcontroller application allows personal computer users to both view and change the preamp gain and P48 on/off status.

Output Channels and their Operation

By way of the Dante interface, the Model 216 provides a main output channel and three talkback output channels. The main output channel is designed to serve as the on-air, stadium announcement, or other primary audio feed. The talkback output channels are intended to provide production trucks, control rooms, or support personnel with talent-originated cue signals.

A large part of the Model 216's unique power is the ability to configure the operation of the main and talkback functions. To meet the needs of the many specific broadcast and production applications, a variety of pushbutton operating modes are available. The main pushbutton can be selected to operate from among four modes. In the "push-to-mute" mode the pushbutton performs a momentary mute of the audio signal associated with the main output channel. In this way a "cough" pushbutton function is created, something typically required for television sports broadcasting. In the "push-to-talk" mode the pushbutton provides a momentary active function for the main output. This mode would be appropriate for an application such as stadium announcement. An alternate action "latching" configuration allows the pushbutton to enable or disable the audio signal associated with the main output channel as desired. This is useful in radio broadcasting, announce-booth, or voice-over applications. The fourth mode provides a hybrid function, supporting both push-to-talk and tap-to-enable/tap-to-disable operation. This operation is similar to that found in many broadcast intercom system user stations.

The three pushbutton switches associated with the talkback functions can be configured to operate from either of two modes. One of the modes supports a "push-to-talk" function. This is typically used for on-air broadcast applications. The other mode provides a hybrid function, the operation of which is discussed in the previous paragraph. The hybrid mode is especially useful when the Model 216 is used in a production-support application.

Overall Model 216 operation can be configured from among one on-air and four production modes. The Model 216's on-air mode is appropriate for on-air television, radio, and streaming broadcast applications. When on-air is selected the audio signal associated with the main output channel will always mute when either or both talkback functions are active. This prevents audio that's intended for production or support personnel from being sent out the on-air audio path.

For non-on-air applications, the Model 216 can be configured to operate in one of four production modes. These allow the main output to be used as a fourth talkback output channel, rather than always muting when a talkback function is active. Using these production modes the unit can be even more powerful when used in a live event application, such as serving as a small IFB (talent cueing) console for a sports-event spotter, musical director, or production assistant. In addition to changing how the main output functions, two of the production modes also support using the headphone output for connection with amplified speakers. In these modes the headphone output level will automatically be reduced (attenuate or dim) whenever the main or talkback output channels are active. This can enhance intelligibility and help prevent acoustical feedback from occurring between the speakers and the active microphone.

REMI IFB Creation

Two production modes, production with tone and production with dim and tone, are specifically included to support the tone operated IFB function that's part of the Studio Technologies' Model 5422 Dante Intercom Audio Engine. These modes add an 18 kHz sine-wave signal to the talk audio so that activation of the Model 5422's TOX (tone operated interrupt) IFB function will occur. The TOX function supports the REMI production model where production personnel are present at one physical location while a broadcast event takes place at another. Only audio paths linking the sites are required for professional-quality IFB signals to be created. The Model 216 can serve as a 4-channel IFB master station while the Model 5422, located at the event site, will perform the switching between interrupt audio (coming from the Model 216) and program audio (originating at the event site).

Headphone Output

The Model 216 provides a number of configuration choices that relate to the headphone output. These choices include the headphone output gain range, which audio sources are utilized, how the rotary level controls function, and what sidetone action will take place. Four headphone control source assignment modes are offered. These modes impact how the three rotary controls adjust the four Dante input channels and the sidetone audio signals.

The first two modes support standard on-air applications and use Dante audio input channels 1 and 2. In the broadcast world

these two signals are often referred to as talent cue or IFB audio. In live television applications they typically originate in production trailers or control rooms and provide one channel of program-with-interrupt audio and a second channel with program-only audio. The third and fourth configuration modes allow all four of the Dante-provided audio sources to be utilized. These can be useful for more complex or specialized situations.

The three headphone level controls ("rotary pots") are provided for setting the "mix" of the selected audio input sources as well as adjusting the overall headphone output level. How these controls function depend on the selected headphone output mode. The first mode can be used to support traditional on-air sports applications. In this mode it would be typical to feed (connect) program-with-interrupt audio to the channel 1 audio input and program-only audio to the channel 4 audio input. Rotary control C1, located on the left side, is used to adjust the level of the program-with-interrupt audio signal that's routed to the left headphone output channel. Rotary control C2, located in the center, is used to adjust the level of the program-only audio signal that's routed to the right headphone output channel. For use with dual-channel or stereo cue signals, another headphone output mode provides a stereo ("level/balance") mode. In this mode rotary control C1 adjusts the level of both input channels 1 and 2, while rotary control C2 allows adjustment of the left/right level balance. In both of these modes rotary control C3, located on the right, is used to adjust the level of the sidetone audio signal that is sent to both the left and right headphone output channels.

In the third headphone output mode rotary control C1 adjusts the level of the channel 1 input audio source before it is routed to both the left and right headphone output channels. Rotary control C2 adjusts the level of the channel 2 audio source before it is routed to both the left and right headphone output channels. Rotary control C3 adjusts the level of both the channel 3 and channel 4 audio inputs which are then routed to, respectively, the left and right headphone output channels.

The fourth headphone output mode is similar to the third with the exception that input 1 is routed only to the left headphone output channel while input 2 is routed only to the right headphone output channel. Inputs 3 and 4 will function in the same way in both modes 3 and 4.

The sidetone function allows audio from the Model 216's microphone preamplifier to be routed to the headphone output. This can be useful, providing the user with an aural confirmation of the signal connected to the mic input. It is especially important when a "mix-minus" talent cue signal is provided for the user. For application flexibility the sidetone function can be configured from among four choices, specifying when it will be active in relation to the status of the main and talkback functions.

To help minimize the chance of broadcast cues being missed, the action of the level controls can be configured so that there's always a minimum headphone output level. Alternately, the controls can be configured to fully mute when they are at their minimum (fully-counterclockwise) position. When the level control on the right side is used for sidetone it will always allow the sidetone signal to be fully muted.

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

A configuration feature allows the headphone output gain range to be selected. The low setting is appropriate for most applications where users need to listen at moderate levels. The high setting can be useful when monitoring at higher levels is warranted by an application.

Dante Audio-over-Ethernet

Audio data is sent to and from the Model 216 using the Dante Audio-over-Ethernet media networking technology. For flexibility in meeting a variety of sonic requirements bit depths of up to 24 and sample rates of 44.1 and 48 kHz are supported.

Audio transmitter (output) and receiver (input) channels on associated Dante-enabled devices can be assigned to the Model 216 using the Dante Controller software application. This makes selecting the way in which the Model 216 fits into an application a simple matter. For example, the main audio output channel can be assigned to the input of an audio console. The talkback audio output channels could be assigned to inputs of a matrix intercom system. No special routing or "multing" using cables or patch points is required to send the output channels to multiple destinations. And a single mouse-click is all that's required to reroute the audio signals.

On the input side, the Model 216 allows up to four headphone cue sources to be received from an audio console, matrix intercom system, or a variety of other Dante-enabled devices; the sources don't need to originate from the same device. "Program" audio could be supplied by an audio console while "IFB" (interrupted foldback or talent cue) audio could be supplied by a matrix intercom system.

Ethernet Data, PoE, and DC Power Source

The Model 216 connects to a data network using a standard 100 Mb/s twisted-pair Ethernet interface. The physical interconnection is made by way of a Neutrik® etherCON RJ45 connector. While compatible with standard RJ45 plugs, etherCON allows a ruggedized and locking interconnection for harsh or high-reliability environments. The Model 216's operating power can be provided by way of the Ethernet interface using the Power-over-Ethernet (PoE) standard. This allows fast and efficient interconnection with the associated data network. To support PoE power management, the Model 216's PoE interface reports to the power sourcing equipment (PSE) that it's a class 2 (low power) device. The unit can also be powered using an external source of 12 volts DC. For redundancy, both power sources can be connected simultaneously. If both sources are connected PoE will power the unit. Four LEDs display the status of the network connection, PoE power source, and Dante interface.

Configuration and Flexibility

Model 216 configuration settings can be made using twelve DIP switches and two pushbutton switches. The STcontroller software application can be used to view and change the gain of the microphone preamplifier and the on/off status of P48 phantom power. The 12-position switch array configures parameters such as the pushbutton operating modes, headphone operating mode, sidetone function, and the overall system mode. The pushbuttons are used to set the gain of the microphone preamplifier, control the on/off status of the microphone P48 phantom power function, and select the headphone output gain range. The switches and pushbuttons are accessible via the bottom of the Model 216's enclosure; the unit does not have to be disassembled. Changes made to any of the configuration parameters become active immediately. To prevent unwanted access to the configuration switches and pushbuttons a security panel, included with each unit, is attached to the bottom of the enclosure.

In the world of broadcast and production audio it's fair to say that applications vary widely. To this end, one or two additional XLR connectors can easily be mounted into the Model 216's back panel. Multiple 3-position "headers" located on the Model 216's circuit board provide technician access to many of the input and output connections. Using a variety of optional factory-supplied modules and interface cable kits allows a Model 216 to be optimized to meet the needs of specific applications. For example, some applications may prefer to use a multi-pin XLR connector to interface with a headset. This can easily be accomplished by installing the appropriate 6- or 7-pin XLR connector kit and making a few simple connections. Other applications may benefit from having "mult" or "loop-through" connections, something easily incorporated into a Model 216. And access to the relay contacts can be made adding a 4-pin XLR connector kit.

Two general-purpose relay contacts are provided on the Model 216's circuit board. Accessible using 3-pin "header" connectors they allow specialized configurations to be created. Under software control, the form-A (normally open) solid-state relay contacts follow the state of the main and talkback 1 pushbuttons. Taking advantage of the two locations provided for additional XLR connectors, a technician may easily implement a variety of functions such as a tally indication or audio muting during talkback.

Firmware Updating

A USB connector, located on the Model 216's back panel, allows the operating firmware (embedded software) to be updated using a standard USB flash drive. The Model 216 uses Audinate's Ultimo™ integrated circuit for implementing Dante. The integrated circuit's firmware can be updated via the Ethernet connection, helping ensure that its capabilities remain up to date.

Dante-Enabled Announcer Console Products

The Model 216 is just one in a series of Dante-enabled announcer console products available from Studio Technologies. For applications that require an alternate set of features the other products in the 200-Series should be reviewed. Complete information is available on the Studio Technologies website.

Installation

In this section signal interconnections will be made using the connectors located on the back panel of the Model 216. A microphone signal will be interfaced by way of a 3-pin XLR connector. A ¼-inch 3-conductor phone jack is provided for the headphone output. An Ethernet data connection will be made using either a standard RJ45 patch cable or an etherCON protected RJ45 plug. A 4-pin XLR connector allows the connection of an external source of 12 volts DC.

System Components

Included in the shipping carton are the following: Model 216 Announcer's Console, user guide, and pushbutton label sheet. If the installation or specific application requires an external source of 12 volts DC it needs to be provided separately. An applicable power supply, the Studio Technologies PS-DC-02, is available as an option.

Microphone Input

The Model 216 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 216's P48 power source will support essentially all phantom-powered microphones. The quality of the Model 216'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, DPA, Sennheiser, and Shure will perform very well in Model 216 applications.

Microphone interconnection is made by way of a 3-pin female XLR connector which is located on the Model 216'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.

As of the writing date of this guide, the Sennheiser HMD 26 and HMD 27 headsets are very popular for on-air sports broadcasting use. Fine products, they work very well with the Model 216. Adding the suffix "-XQ" to the headsets' full part number specifies a 3-pin male XLR connector for the dynamic microphone and a ¼-inch 3-conductor plug for the stereo headphones. This configuration is very useful, allowing the headsets to work directly "out of the box" with the Model 216. Another headset that users have reported being satisfied with is the audio-technica BPHS1. Offered at a lower price-point, it may be applicable for some applications.

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 the "lower-end" (much less expensive) models of name-brand headsets, which he did by the veritable "boatload." Why? Because these 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 216'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 since essentially all of the contemporary devices meet this recommendation.

Devices are connected to the headphone output by way of a ¼-inch 3-conductor phone jack located on the Model 216's back panel. As is standard for stereo headphones, the left channel is connected to the tip lead of the ¼-inch headphone jack. The right channel is connected to the ring lead of the jack. Common for both channels is connected to the sleeve lead.

Devices with ¼-inch 2-conductor "monaural" plugs can also be used with the Model 216'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 since 10 ohm protection resistors are electrically in series with the headphone output circuits.

Ethernet Connection

An Ethernet connection that supports 100BASE-TX is required for the Model 216's Dante Audio-over-Ethernet connectivity. A 10BASE-T connection is not sufficient for Model 216 operation. A 1000BASE-T ("GigE") connection is not supported unless it can automatically "fall back" to 100BASE-TX operation. An Ethernet connection that supports Power-over-Ethernet (PoE) is preferred as it will provide operating power for the Model 216. For Ethernet with PoE switch (PSE) power management the Model 216 will enumerate itself as a PoE class 2 device. If PoE is not available an external 12 volt DC power source can also be connected. This will be discussed in the next section of this guide.

The 100 Mb/s twisted-pair Ethernet connection is made by way of a Neutrik etherCON protected RJ45 connector that is located on the back panel of the Model 216. This allows connection by way of a cable-mounted etherCON plug or a standard RJ45 plug. The Model 216's Ethernet interface supports auto MDI/MDI-X so that most cabling implementations will be directly supported.

External 12 Volt DC Input

An external source of 12 volts DC can be connected to the Model 216 by way of the 4-pin male XLR connector which is located on the back panel. While the requirement for the external source is nominally 12 volts, correct operation will take place over a 10 to 18 volt range. The Model 216 requires 270 milliamperes at 12 volts DC for correct operation. The DC source should be terminated to a 4-pin female XLR connector with pin 1 negative (–) and pin 4 positive (+). Purchased as an option, the PS-DC-02 power supply is available from Studio Technologies. Its AC mains input allows connection to 100-240 volts, 50/60 Hz and its 12 volt DC, 1.5 amperes maximum output is terminated on a 4-pin female connector.

As previously discussed in this guide, an Ethernet connection that provides Power-over-Ethernet (PoE) can serve as the Model 216's power source. Alternately, an external 12 volt DC source can be

connected. For redundancy, both PoE and the external source can be connected at the same time. If both PoE and an external 12 volt DC source are connected, power will be drawn only from the PoE supply. If the PoE source becomes inoperative the 12 volt DC source will provide the Model 216's power with no interruption in operation.

Pushbutton Labeling

The four pushbutton switches used in the Model 216 were selected for several reasons. Foremost was the fact that they are highly reliable, using gold-plated contacts for long life in less-than-ideal environments. A second reason was that applying customized labels to the pushbutton caps would be very simple. The labels, text printed on clear material, are placed under the clear caps on the top of the pushbuttons.

From the factory the pushbuttons are labeled, from left to right, COUGH, TALKBACK 1, TALKBACK 2, and TALKBACK 3. These were 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, a clear sheet with a number of commonly used pushbutton designations printed on it is included in the shipping carton. These were created at the factory using a standard personal computer graphics program and laser printed onto sheets of transparency film. The desired pushbutton labels can be cut out with a pair of scissors or an X-ACTO® knife following the printed guide lines that indicate the required size.

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

Configuration

For the Model 216 to support the needs of specific applications a number of operating parameters must be configured. These include headphone output gain range, microphone preamplifier gain, P48 phantom power on/off status, pushbutton operation, sidetone, headphone operating mode, and system mode. Two pushbutton switches and a 12-position DIP switch assembly can be used to establish the desired configuration. A 2-digit LED display will indicate the selected headphone gain range, gain of the microphone preamplifier and the P48 phantom power on/off status. The pushbutton switches, LED display, and DIP switches are accessed through an opening in the bottom of the Model 216's enclosure. The enclosure does not have to be disassembled to gain access.

To prevent unauthorized personnel from changing the configuration settings, a security panel is attached to the bottom of the Model 216's enclosure. For convenience, the security panel provides a summary of the configurable parameters and related information. Refer to Appendix A for a representative view. The security panel 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 panel can be removed. Refer to Figure 2 for a detailed view of the configuration switch assemblies.

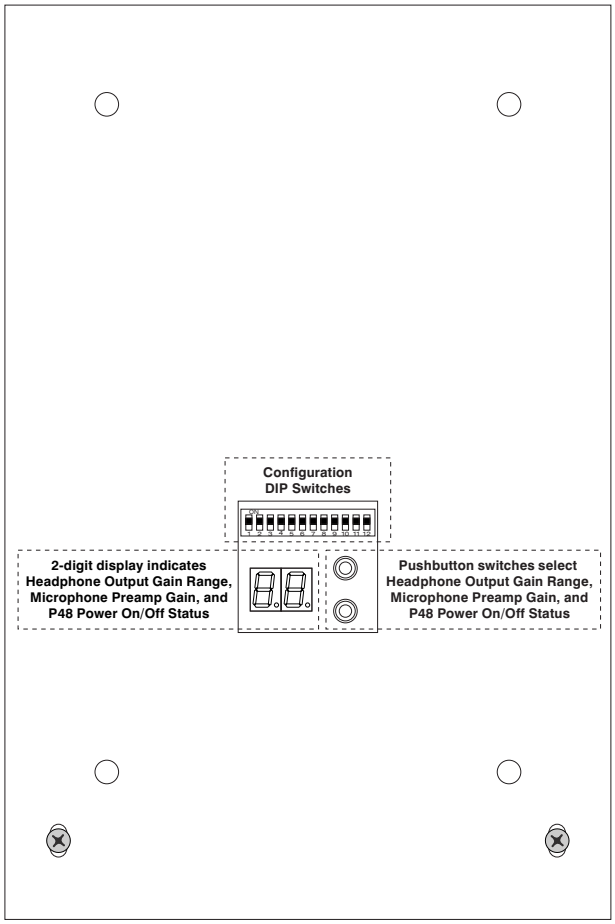


Figure 2. Bottom view of Model 216 showing configuration switches and 2-digit display

Headphone Output Gain Range, Mic Preamp Gain, and P48 Phantom Power

On the unit, two pushbutton switches, located on the bottom of the Model 216, are used to set the headphone gain range. They can also be used to select the gain of the microphone preamplifier and the on/off status of the P48 phantom power source. A 2-digit LED display provides a status indication of all these functions.

As previously mentioned, the STcontroller software application can be used to view and revise the gain of the microphone preamplifier and the on/off status of the P48 phantom power source.

Selecting the Headphone Output Gain Range

Upon application of Model 216 power the 2-digit display, as part of its power-up sequence, will first display the firmware version and then the current setting of the headphone output gain range. The setting will be either low or high. During the brief interval when the headphone gain range is displayed the two pushbuttons can be used to change the setting.

Local Selection of Mic Preamp Gain

The two pushbutton switches can be used to select the gain of the microphone preamplifier. The range is 19 to 64 dB in 3-dB steps. There's no problem changing the gain setting while the unit is operating. Small 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. As expected, the 2-digit LED display will directly indicate, in dB, the selected amount of gain.

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 the Dante reference level which is typically considered to be –20 dBFS. (This is 20 dB below digital maximum.) Operating at this signal level will help ensure the delivery of "clean" audio to the destination device or devices.

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 HMD 26 or HMD 27, selecting an initial setting of 43 or 46 dB would be appropriate. Users who speak loudly might need to have the gain reduced to 40 or even 37 dB. Quiet users might need 49 or 52 dB of gain.

Using the device that's digitally connected (via Dante) to the Model 216's main output channel is typically the best way to check the signal level and the setting of the mic preamplifier. Most devices have some method of providing an indication of the digital level, either in the form of a numerical value, virtual meter, or LED-based meter display. The Studio Technologies' Model 5202 Dante to Phones and Line Output Interface would also be an excellent means of monitoring the Model 216's output level. The Model 5202 provides a 2-channel LED level that is calibrated in dBFS.

Level Status LED Indicator

A dual-color LED, located on the back panel directly below the microphone input connector, is provided as an aid when using the Model 216. It can also be useful when setting the gain of the Model 216's microphone preamplifier. It provides a 3-step indication of the output level of the microphone preamplifier. It will light green when the signal level is –40 dBFS or greater, a mix of green and red when the signal level is –14 dBFS or greater, and red only when the signal level is –4 dBFS or greater. When the gain of the microphone preamplifier is set optimally a normal signal applied to the microphone input will cause the LED to light green with an occasional "peak" signal causing the LED to light both green and red at the same time. A more conservative gain setting would find that the LED would only light green. A gain setting that results in the LED ever lighting only red is incorrect. The gain must be reduced or the audio quality will be severely compromised.

Local Selection of P48 Phantom Power

The Model 216 can provide P48 phantom power to the connected microphone. The two pushbutton switches can be used to control whether or not P48 phantom power is active. Pressing both pushbuttons simultaneously will toggle (change) the on/off state. The decimal point indicator, located on the lower right corner of the 2-digit LED display, is used to show the P48 phantom power on/off status. When the decimal point is lit P48 phantom power is enabled. By the very nature of phantom power it should be able to be left enabled at all times. But generally people prefer to turn it off unless required for a specific microphone.

Remote Configuration of Gain and P48 Phantom Power

Using the STcontroller application allows personal computer users to view and adjust the Model 216's mic preamplifier gain and P48 phantom power on/off status.

The application is available for download on the Studio Technologies website (www.studio-tech.com). Its initial release is compatible with the Windows® operating system. Changes made using the application will be displayed in real-time on the Model 216's 2-digit display. Changes made to the mic pre gain and P48 on/off status using the Model 216's pushbutton switches will be displayed in STcontroller.

LED Display Time-Out

The 2-digit LED display provides an indication of the headphone output gain range, the gain of the microphone preamplifier as well as the on/off status of P48 phantom power. As a power-saving measure the display will automatically stop lighting approximately 100 seconds after the last time that either of the bottom pushbutton switches is pressed. A different time-out interval applies after the Model 216 has had power applied and neither pushbutton is pressed; the display will light for approximately 10 seconds and then turn off.

In most cases this display auto-off function will lead a technician or installer to initially observe that the 2-digit display is not lighting. For example, a Model 216 has been operating normally but the security panel has just been removed. To cause the 2-digit display to again light just requires pressing either of the bottom pushbutton switches. This "wakes up" the display and resets the timer. The initial press of either pushbutton will not cause the gain to change or impact the P48 phantom power on/off status. Only when the 2-digit display is active will the pushbuttons impact the settings.

Operating Modes

Twelve DIP switches are used to configure the Model 216's operating modes. Technically, these switches "talk" to a microcontroller integrated circuit and associated software that give the Model 216 its "smarts." The software has been carefully designed to provide a number of different ways in which the unit can function. It's important to carefully review the available options and choose the ones that best meet the needs of a specific application. Note that the switches can be changed even while the Model 216 is powered up and operating. The unit's operating characteristics will change in real-time in response to switch changes.

Main Button Mode

Switches 1 and 2 configure how the main pushbutton functions.

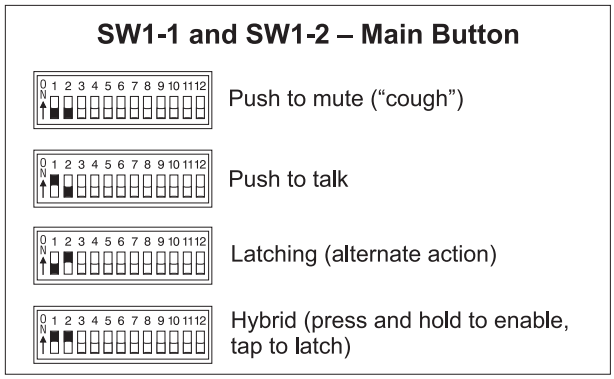


Figure 3. Main button mode switch settings

There are four available modes:

- Push to Mute: In this mode the audio signal on the main output channel is normally active. The audio signal will mute whenever the pushbutton is pressed and held. This is the "cough" mode typically used for on-air sports broadcasting applications.

- Push to Talk: In this mode the audio signal on the main output channel is normally muted. The main audio signal will become active whenever the push-button is pressed and held.
- Latching: In this mode the audio signal on the main output channel will change between its active and muted states whenever the pushbutton is pressed. Upon power up the audio signal on the main output will be in its muted state.
- Hybrid: This mode is a combination of push to talk and latching action. It's similar to the way talk pushbuttons function on user stations associated with broadcast and production intercom systems. If the pushbutton is pressed and held, the audio signal on the main output channel will become active until the pushbutton is released. If the push-button is momentarily "tapped" the audio signal on the main output channel will change state. Upon power up the audio signal on the main output channel will be in its muted state.

Talkback Button Mode

Switch 3 configures the way the talkback pushbuttons function.

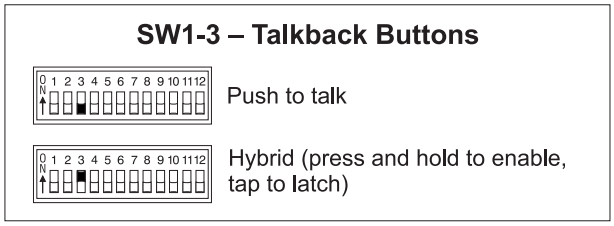


Figure 4. Talkback buttons switch settings

Two modes are available:

- Push to Talk: In this mode the audio signal on the talkback output channels is normally muted. The audio signal will become active whenever its associated pushbutton is pressed and held.
- Hybrid: This mode is a combination of push to talk and latching action. If a pushbutton is pressed and held the audio signal associated with that talkback output channel will become active until the pushbutton is released. If a push-button is momentarily "tapped" the audio signal on the associated talk-back output channel will change state. Upon power up the audio signals on the talkback output channels will be in their muted state.

Button Backlight Intensity

Switch 4 selects the intensity of the white LEDs that provide backlighting for the four pushbutton switches. Two choices are available: low and high. Low is appropriate when the Model 216 is to be used in an environment where the ambient light level is low. High would be appropriate where other light sources in the physical area may make the pushbuttons more difficult to identify. High may also be useful when identification markings have been inserted under the clear lens caps.

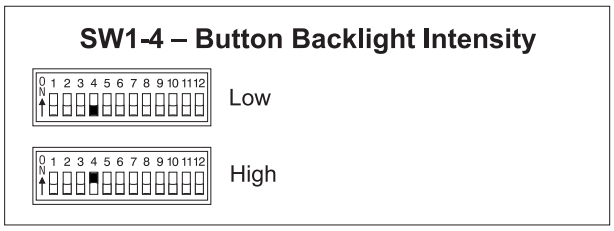


Figure 5. Button backlight intensity switch settings

Sidetone

Switches 5 and 6 configure the way the sidetone function operates.

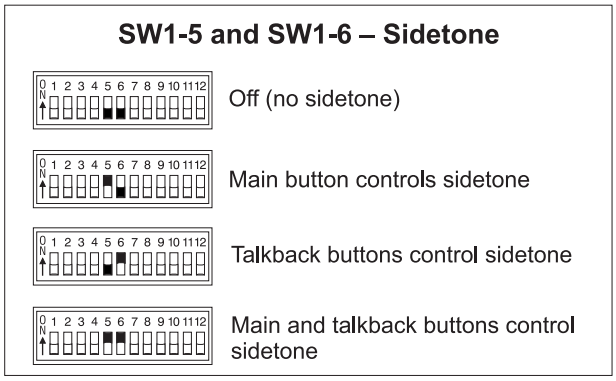


Figure 6. Sidetone switch settings

Four modes are available:

- Off: In this mode the sidetone function not active.
- Main Button: In this mode the sidetone function will be active whenever the audio signal is present on the main output channel.
- Talkback Button: In this mode the sidetone function will be active whenever the audio signal is present on any of the talkback output channels.
- Main and Talkback Buttons: In this mode the sidetone function will be active whenever the audio signal is present on the main and/or talkback output channels.

Headphone Operating Mode

Switches 7 and 8 are used to select how the four Dante receiver (audio input) channels, three rotary level controls, and 2-channel headphone output work together.

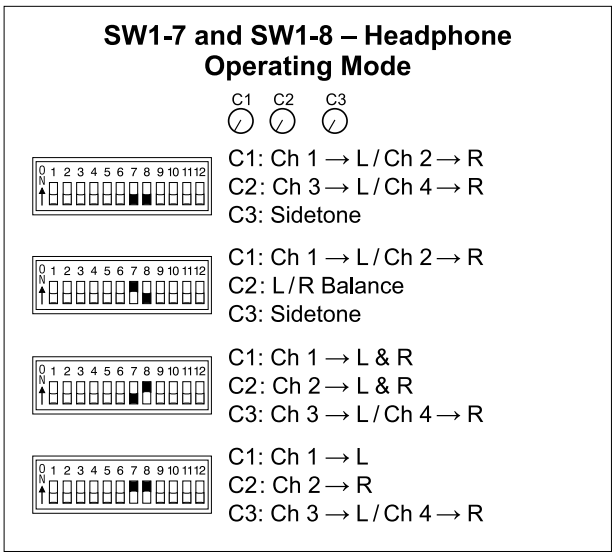


Figure 7. Headphone operating mode switch settings

There are four choices available:

- SW7 Off (Down)/SW8 Off (Down): Audio input channel 1 is assigned to the left headphone output channel and audio input channel 2 is assigned to the right headphone output channel. The level of audio inputs 1 and 2 are controlled by rotary level control C1, located on the left side of the front panel. Audio input channel 3 is assigned to the left headphone output channel and audio input channel 4 is assigned to the right headphone output channel. The level of audio inputs 3 and 4 are controlled by rotary level control C2, located in the center of the front panel. Sidetone audio is assigned to both the left and right headphone output channels and its level is controlled by rotary level control C3, located on the right side of the front panel.
- SW7 On (Up)/SW8 Off (Down): Audio input channel 1 is assigned to the left headphone output channel and audio input channel 2 is assigned to the right headphone output channel. The level of

audio inputs 1 and 2 are controlled by rotary level control C1, located on the left side of the front panel. The balance (relative level) of both these signals is controlled by rotary level control C2, located in the center of the front panel. Sidetone audio is assigned to both the left and right headphone output channels and its level is controlled by rotary level control C3, located on the right side of the front panel. Audio inputs 3 and 4 are not used.

- SW7 Off (Down)/SW8 On (Up): Audio input channel 1 is assigned to both the left and right headphone output channels. The level of the signal being sent to both channels is controlled by rotary level control C1, located on the left side of the front panel. Audio input channel 2 is assigned to both the left and right headphone output channels. The level of the signal being sent to both channels is controlled by rotary level control C2, located in the center of the front panel. Audio input channel 3 is assigned to the left headphone output channel and audio input channel 4 is assigned to the right headphone output channel. The level of audio inputs 3 and 4 is controlled by rotary level control C3, located on the right side of the front panel. The sidetone function will not be active.
- SW7 On (Up)/SW8 On (Up): Audio input channel 1 is assigned to the left headphone output channel and its level is controlled by rotary level control C1, located on the left side of the front panel. Audio input channel 2 is assigned to the right headphone output channel and its level is controlled by rotary level control C2, located in the center of the front panel. Audio input channel 3 is assigned to the left headphone output channel and audio input channel 4 is assigned to the right headphone output channel. The level of audio inputs 3 and 4 is controlled by rotary level control C3, located on the right side of the front panel. The sidetone function will not be active.

Headphone Minimum Level

Switch 9 is used to configure the headphone output's minimum level. In the –40 dB setting the minimum headphone output level is approximately 40 dB below maximum. The headphone output will never fully mute. This ensures that any audio signal present on the assigned audio input channels (1 and 2 or 1, 2, 3, and 4) will always be present on the headphone output. In most on-air broadcast applications this is the appropriate setting, ensuring the some level of signal is always present.

When full mute is selected moving any level control to its fully counterclockwise position will cause its associated channel to fully mute. If a rotary level control is set to serve as a balance control, moving it to either fully counterclockwise or fully clockwise position will cause the associated signal to fully mute. Selecting the full mute mode may be appropriate for applications where minimizing the chance of audio "leakage" is important. This could occur when the connected headset or headphones are at times placed on a desk or tabletop.

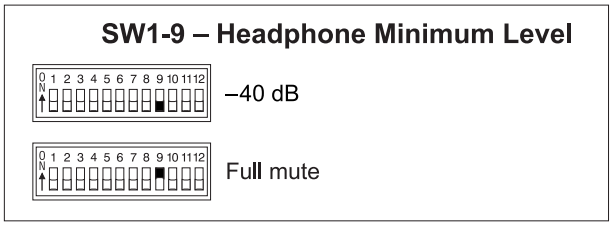


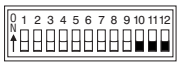
Figure 8. Headphone minimum level switch settings

When the rotary level control on the right side of the front panel has been assigned to control the sidetone level the setting of the headphone minimum level mode will not impact it. In this case when the control is in its fully counterclockwise position it will always cause the sidetone level to be fully muted.

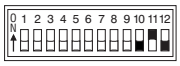
System Mode

Switches 10, 11, and 12 are used to configure the system mode of the Model 216. Specifically, they determine how the main output channel operates vis-à-vis the talkback output channels, whether the headphone output level is reduced during talk operation, and whether a high-frequency tone is added to the talk signal. Understanding how these five modes impact overall system operation will ensure that correct operation and maximum usability will occur.

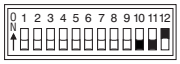
SW1-10, SW1-11, SW1-12 – System Mode



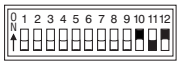
On-Air (talkback status impacts main out status)



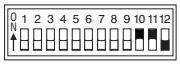
Production with Dim (talkback status does not impact main out status; headphone out dims during talk)



Production (talkback status does not impact main out status)



Production with Tone (talkback status does not impact main out status; 18 kHz tone added to talk audio)



Production with Dim & Tone (talkback status does not impact main out status; headphone out dims during talk; 18 kHz tone added to talk audio)

Figure 9. System mode settings

- When selected to the on-air mode the audio signal on the main output channel will mute whenever the audio signal on any of the talkback output channels is active. The on-air mode should be selected for all on-air broadcast applications when it's imperative that the audio signal on the main output channel be muted whenever on-air talent uses a talkback output channel to communicate with production personnel.
- When the system mode is set for production with dim the audio signal on the main output channel is never muted in response to the audio signal on any of the talkback output channels being active. In addition, the level of the headphone output is dimmed (reduced in level or attenuated) by 18 dB whenever the main or talkback output channels have audio present. In this way the four output channels can be used independently, with none impacting the other. And, the headphone output can be connected to amplified loudspeakers. The speakers will reduce in level whenever one of the output channels is active, preventing acoustical feedback.
- When the system mode is set for production the audio signal on the main output channel is never muted in response to the audio signal on any of the talkback output channels being active. This mode allows the main output channel to be used, for example, as an additional talkback output. In this way the main and talkback output channels can be used independently, with neither impacting the other. This also allows all four pushbuttons to be used simultaneously. When selected for the correct application, this production mode can prove to be very useful. But it's not appropriate for on-air use!

- When the system mode is set for production with tone it functions the same as when in the production mode except that an 18 kHz sine wave tone is added to the talk audio signal. This mode is specifically included to allow the Model 216 to function as an IFB master station when used in conjunction with the Studio Technologies Model 5422 Dante Intercom Audio Engine's tone operated (TOX) IFB function.
- When the system mode is set for production with dim and tone it functions the same as when in the production with dim mode except that an 18 kHz sine wave tone is added to the talk audio signal. Again, this mode is specifically included to allow the Model 216 to function as an IFB master station when used in conjunction with the Studio Technologies Model 5422 Dante Intercom Audio Engine's tone operated (TOX) IFB function. In this mode it's expected that the headphone output channels will be connected to inputs on amplified speakers. During talk activity the level of the headphone output channels will dim (reduce in level) by 18 dB.

Conclusion

Once the desired configuration has been established, the security panel can be reattached. The four rubber bumpers should be hand-tightened only. No tools should be used.

Dante Configuration

A number of the Model 216's Dante-related parameters can be configured. These configuration settings will be stored in nonvolatile memory within the Model 216's circuitry. The Model 216 uses the Ultimo 4-input/4-output integrated circuit to implement the Dante architecture. This dictates which parameters can be configured and what choices are available.

The audio receiver (input) and transmitter (output) channels associated with the Model 216's Dante interface must be assigned to desired sources and destinations. This will typically be done with the Dante Controller software application which is available for download free of charge at www.audinate.com. Versions are available to support Windows® and OS X® operating systems. Within Dante Controller a "subscription" is the term used for routing a transmitter flow (a group of output channels) to a receiver flow (a group of input channels). Note that as of the writing of this guide the Ultimo integrated circuit limits the number of Dante flows to two in each direction (two transmitter and two receiver).

The Model 216 has a default Dante device name of **ST-M216** and a unique suffix. The suffix identifies the specific Model 216 that is being configured. The Model 216 provides four Dante transmitter (output) channels with the default names of **Main**, **Talkback 1**, **Talkback 2**, and **Talkback 3**. The Model 216 has four Dante Receiver (input) channels with default names of **Headphone Ch1**, **Headphone Ch2**, **Headphone Ch3**, and **Headphone Ch4**.

Using Dante Controller these names can be revised as appropriate for the specific application.

The Model 216 will support audio sample rates of 44.1 kHz or 48 kHz with the ability to select pull-up/pull-down values. These parameters can be selected using the Dante Controller application but in most applications 48 kHz will be appropriate. The Model 216 can serve as the clock master for a Dante network but in most cases that would not be optimal.

Operation

At this point the audio, Ethernet, and power connections should have been made. The pushbutton labels may have been revised. The desired configuration should have be made using the pushbutton and DIP switches. The Dante receiver (input) and transmitter (output) channels should have been routed using the Dante Controller software application. Normal operation of the Model 216 can now begin.

Initial Operation

The Model 216 will begin functioning a few seconds after its power source is connected. As previously discussed, the power source can be provided by Power-over-Ethernet (PoE) or an external source of 12 volts DC. If both are connected the PoE source will power the unit. Should PoE subsequently no longer be available uninterrupted operation will continue using the external source.

Upon Model 216 power up most of the status and backlight LEDs along with the 2-digit display will activate in a test sequence. The PoE, USB, and SIG/PEAK LEDs, located on the back panel, will light one after another. On the top surface of the Model 216 the two status LEDs and the backlight LED associated with the main pushbutton switch and the status LED and the backlight LEDs associated with the talk-back pushbutton switches will momentarily light in sequence. Once that sequence has completed all the LEDs will begin to function normally.

The 2-digit LED display is visible on the bottom of the unit when the security panel is removed. Upon unit power up, all segments of each display digit will light briefly as a confirmation that they are functioning. The version number of the operating firmware (embedded software) will briefly display. For example, the first firmware version that shipped with the Model 216 displayed 1.0. Next, the setting of the headphone output level will be displayed for three seconds, displaying either Lo or Hi. During this interval the level setting can be changed by pressing one of the buttons that are located to the right of the display: press the up button for high and the down button for low. After a few seconds the digits will briefly turn off and the gain of the microphone preamplifier (in dB) and the P48 phantom power on/off status will display and remain active. Unless either or both of the pushbutton switches are pressed, approximately 10 seconds after the unit begins operation the display will stop lighting. This is a power-saving measure. The display will again light after either or both of the pushbuttons are pressed.

Note that the way in which the LINK/ACT, SYS, and SYNC LEDs (all located below the etherCON connector) will light depends on characteristics related to the connected Ethernet signal and the configuration of the

unit's Dante interface. This will be covered in detail in the next section of this guide.

After the power-up sequence has completed the Model 216 will begin normal operation. Depending on the selected configuration, one status LED associated with the main pushbutton switch may be lit. The user is now presented with four pushbutton switches, five LEDs, and three rotary controls. These are simple to operate and understand, as will be described in later paragraphs.

Ethernet, PoE, and Dante Status LEDs

Four status LEDs are located below the etherCON connector on the Model 216's back panel. The LINK/ACT LED will light green whenever an active connection to a 100 Mb/s Ethernet network has been established. It will flash on and off in response to data packet activity. The PoE LED will light green whenever Power-over-Ethernet (PoE) associated with the connected Ethernet signal is providing operating power for the Model 216. The SYS and SYNC LEDs display the operating status of the Dante interface and associated network. The SYS LED will light red upon Model 216 power up to indicate that the Dante interface is not ready. After a short interval it will light green to indicate that it is ready to pass data with another Dante device. The SYNC LED will light red when the Model 216 is not synchronized with a Dante network. It will light solid green when the Model 216 is synchronized with a Dante network and an external clock source (timing reference) is being received. It will slowly light on and off green when the Model 216 is part of a Dante network and is serving as a clock master.

How to Identify a Specific Model 216

The Dante Controller software application offers an identify command that can be used to help locate a specific Model 216. When identify is selected for a specific unit the button backlight LEDs will flash. In addition, the SYS and SYNC LEDs, located directly below the etherCON connector on the back panel, will slowly flash green. After a few seconds the LED identification patterns will cease and normal Model 216 operation will again take place.

Signal Present/Peak LED

A dual-color LED is located on the Model 216's back panel, directly below the microphone input connector. It monitors the output of the microphone preamplifier, providing a 3-step signal level indication. The LED will light green when the signal level is –40 dBFS or greater, both green and red at the same time when the signal level is –14 dBFS or greater, and red when the signal level is –4 dBFS or greater. During normal operation the LED should light green and, with peak signals, occasionally both green and red at the same time. If the LED is lit constantly green and red at the same time the gain of the microphone preamplifier most likely should be reduced. The LED should never light red only as this would indicate a signal that's in danger of reaching 0 dBFS (digital "clipping"). This would indicate that the gain of the microphone preamplifier should be significantly reduced.

Pushbutton Switches and Status LEDs

Four pushbutton switches are used to control the audio signals on the main and talkback output channels. The way each

operates depends on the selected configuration. Five LED indicators are located adjacent to the pushbuttons and reflect the status of the audio signals associated with the main and talkback output channels. The pushbuttons' clear lenses are backlit using white LEDs. The intensity (brightness) of the LEDs is configured from a choice of two values, low or high. The backlighting does not provide an indication of the associated pushbutton's status nor do they serve as a tally function, but rather allow the pushbutton's labeling and location to be visible in low-light conditions.

Main Button and LED Indicators

The pushbutton on the left, factory labeled as COUGH, functions according to the selected configuration. Two LED indicators, located directly above the pushbutton, are associated with the status of the audio signal on the main output channel. The green LED, located on the right, is lit whenever the microphone audio signal is connected to the main output channel. This could be considered as an "on-air" or "mic-active" indicator. If the Model 216's system mode is configured to on-air, the red LED, located on the left, will be lit when the audio signal associated with main output channel is muted.

If the Model 216 is configured to operate in any of the production modes, the red LED will never light. This is to reflect the fact that the main pushbutton has now taken on a function similar to that of the talkback pushbutton. To clarify, when the Model 216 is set to any of the production modes, the red LED will never light; the green LED will light whenever microphone audio is connected to the main output channel.

Main Button Modes

Depending on the selected configuration, there are four ways the main pushbutton can function:

- Push to Mute: If this mode is selected the audio signal associated with the main output channel is normally active. The audio signal will mute whenever the pushbutton is pressed and held.
- Push to Talk: If this mode is selected the audio signal associated with the main output channel is normally muted. The audio signal will become active whenever the pushbutton is pressed and held.
- Alternate Action: If this mode is selected the audio signal associated with the main output channel will alternate between its active and muted states whenever the pushbutton is pressed. Upon power up the audio signal will be in its muted state.
- Hybrid: This mode is a combination of push to talk and alternate action. It's similar to the way talk pushbuttons function on user stations associated with broadcast or production intercom systems. If the pushbutton is pressed and held the audio signal associated with the main output channel will become active until the pushbutton is released. If the pushbutton is momentarily "tapped" the audio signal will change state. Upon Model 216 power up the audio signal will be in its muted state.

Main Output vis-à-vis Talkback Activity

This short section applies only in the case where the Model 216's system mode is configured for on-air and the main pushbutton mode is set to alternate action or hybrid.

Talkback activity will always cause the audio signal associated with the main output channel to be placed in its muted state. If the audio signal was in the "latched-on" state when talkback activity began, once talkback activity ends that state will resume; the audio signal associated with the main output channel will again be in its on ("latched") state.

Talkback Buttons and LED Indicators

The second pushbutton from the left, factory labeled TALKBACK 1, controls the audio signal associated with the talkback output channel 1. The third pushbutton from the left, factory labeled TALKBACK 2, controls the audio signal associated with the talkback output channel 2. The pushbutton on the right, factory labeled TALKBACK 3, controls the audio signal associated with the talkback output channel 3. The manner in which the talkback pushbuttons function depends on the way they were configured. One LED indicator, green in color, is located directly above each talkback pushbutton. It lights whenever the microphone audio signal is connected to its associated talkback output channel. If the Model 216's system mode is selected for on-air, whenever any of the talkback functions are active the audio signal associated with the main output channel will be placed in its muted state. If the Model 216 is selected for any of the production modes, the status of the talkback pushbuttons will not impact the status of the audio signal associated with the main output channel.

Talkback Button Modes

Depending on the selected configuration, there are two ways the talkback pushbutton can function:

- Push to Talk: If this mode is selected the audio signal associated with the talkback output channels is normally muted. The audio signal will become active whenever its associated talkback pushbutton is pressed and held.
- Hybrid: This mode is a combination of push to talk and alternate action. If the pushbutton is pressed and held, the audio signal associated with that talkback output channel will become active until the talkback pushbutton is released. If the talkback pushbutton is momentarily "tapped" the audio signal will change state. Upon Model 216 power up the audio signal will always be in its muted state.

Headphone Output

Three rotary controls ("pots") are located on the Model 216's front panel and are associated with the headphone output. The way the controls function depends on the selected headphone output configuration. One configuration parameter sets what audio input signals are assigned to the controls. There are four modes available. Another parameter selects whether the headphone output channels will maintain a minimum output level or can be fully muted.

To understand exactly how the level controls on a specific Model 216 will function requires knowledge of how that unit has been configured. Please refer to the Configuration section of this guide for details. It may require a bit of study to fully understand how the controls will function. The author would like to be able to provide a simple explanation. But there are really four simple explanations, one for each configuration choice!

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 216 users. In an ideal installation, setting the controls to their detent position will result in a comfortable headphone output level. The user, in response to a changing operating environment, can then move the level controls to get more or less level as desired. The detent position will always remain as a useful reference point. To achieve this condition the audio level on the appropriate audio inputs will have to be calibrated as required. This is somewhat counter intuitive to the usual mentality of just providing the user with whatever level comes up by default. Spending a few extra minutes "trimming" the input audio channel levels can result in much happier, and more productive, users.

One of the headphone output modes uses the control in the center of the unit as a balance function. In this case the detent position will send approximately equal levels to both the left and right headphone output channels. This is as one would expect from a "stereo" balance control such as provided in consumer electronic equipment.

When the headphone minimum level configuration is set to –40 dB, turning a level control to its fully counterclockwise position will cause the level of its associated headphone output channel(s) to 40 dB below maximum. This ensures that users will never be fully "isolated" from potentially important cue signals. In addition, when a control is set to provide a balance function, turning it to either its fully clockwise or fully counterclockwise position will cause the level on the applicable headphone output channel to be 40 dB below its maximum.

If the headphone minimum level configuration is set for full mute, turning a level control to its fully counterclockwise position will cause the level of the associated channel(s) to fully mute. In addition, when a control is configured to provide a balance function, rotating it to either its fully clockwise or fully counterclockwise position will cause the level of the applicable channel to fully mute.

The overall level of the headphone output can be configured as desired for specific applications. The default setting, low, is designed so that users will typically set the rotary controls at approximately 50% of rotation. The high setting would be applicable in cases where an extreme headphone output level is required or the source material that is provided on the Dante receiver (input) channels is lower than typical.

USB Interface

A USB type A connector and associated status LED is located on the back panel of the Model 216. This data interface is used only for updating the unit's operating firmware (embedded software). No audio data of any kind will pass through it. For details please refer to the Technical Notes section of this guide.

Technical Notes

IP Address Assignment

By default the Model 216's Ethernet interface will attempt to obtain an IP address and associated settings using DHCP (Dynamic Host Configuration Protocol). If a DHCP server is not detected an IP address will be assigned using the link-local protocol. This protocol is known in the Microsoft® world as Automatic Private IP Addressing (APIPA). It is also sometimes

referred to as auto-IP (PIPPA). Link-local will assign an IP address in the IPv4 range of 169.254.0.1 to 169.254.255.254. In this way multiple Dante-enabled devices can be connected together and automatically function, whether or not a DHCP server is active on the LAN. Even two Dante-enabled devices that are directly interconnected using an RJ45 patch cord will correctly acquire IP addresses and be able to communicate and transport audio.

Using the Dante Controller software application the Model 216's IP address and related network parameters can be set for a fixed ("static") configuration. While this is more involved than letting DHCP or link-local "do their thing," if fixed addressing is necessary then that capability is available. But in this case it's highly recommended that each unit be physically marked, e.g., directly using a permanent marker or "console tape," with its specific IP address. If knowledge of a Model 216's IP address has been misplaced there is no reset button or other method to restore the unit to a default IP setting.

In the unfortunate event that a device's IP address is "lost," the Address Resolution Protocol (ARP) networking command can be used to "probe" devices on a network for this information. For example, in Windows OS the **arp –a** command can be used to display a list of LAN information that includes MAC addresses and corresponding IP addresses. The simplest means of identifying an unknown IP address is to create a "mini" LAN with a personal computer connected directly to the Model 216. Then by using the appropriate ARP command the required "clues" can be obtained.

For best Dante audio-over-Ethernet performance a network that supports VoIP QoS capability is recommended. This can typically be implemented on virtually all contemporary managed Ethernet switches. There are even specialized switches that are optimized for entertainment-associated applications. Refer to the Audinate website (www.audinate.com) for details on optimizing networks for Dante applications.

P48 Phantom Power

The Model 216 provides a 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, consisting of 6.85 k ohm resistors that provide a path from a 45 volt source to pins 2 and 3 of the microphone input connector. The resistors and the power source work together to provide the required 48 ±4 volts, up to a maximum current of 10 milliamperes.

Travel Case

For portable applications it may be desirable to store and transport each Model 216 in a protective case. After much travel with prototype announcer's 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 216, an external 12 volt DC power supply, and 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 216 units. Pelican sells their products through a dealer network, many of which can be located via a web search.

Additional Connectors Locations

Two spare connector locations are provided on the Model 216's back panel. They are labeled A and B. From the factory they contain blank plates that can be readily removed and replaced with a variety of "XLR style" connectors. The spare connector locations are specifically included so that a Model 216 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 6- or 7-pin XLR connector to allow direct connection of a broadcast headset. Other uses include creating a "loop through" or "mult" function for the microphone input or headphone output connections. A number of interface cable assemblies, along with some special function kits, are available from Studio Technologies. Please refer to the website for details on what is available.

The spare connector locations are compatible with the Neutrik DL-series of connectors. For flexibility, XLR 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. The NC6FDS-L-1 is often used to support headsets. This is a 6-pin female connector with the unique Switchcraft® 6-pin arrangement. Other connectors, such as the etherCON protected RJ45 and 3-conductor ¼-inch jack, can be also be installed. The 4-40 thread-pitch hardware that secures the blank plates to the Model 216's back panel are also intended to secure the replacement connectors.

If connectors are added to the Model 216's spare connector locations adding labels to them can be helpful. For a great look it is recommended that Brother® P-Touch ¼-inch (6 mm) labels be created. Tape material that prints white text on a black background works out well for the Model 216. The Brother label cassette number TX-3151, white on black, is appropriate for use with many of their printers.

The Model 216's enclosure must be disassembled prior to installing connectors in the spare locations. Four 6-32 button-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 assembly that contains the pushbutton switches and LED indicators. Ensure that the flex cable is not damaged while the Model 216 is being customized.

3-Position Headers

In addition to the spare connector locations on the back panel, provision has been made to allow easy interconnection with the Model 216's printed-circuit-board-mounted input and output connectors. This was accomplished by including several 3-position male "header" connectors on the Model 216's circuit board. These headers, on 0.1-inch centers, are wired in parallel with some of the Model 216's connectors. This "no solder" solution makes customizing a Model 216 a simple process. The headers, located on the Model 216'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 three loose wires and then "snapped" into the housing.

Molex part number 08-50-0114 specifies crimp terminals that are appropriate for 22 to 30 gauge wires. These terminals are available worldwide from sources such as Digi-Key (www.digikey.com).

To make the process of connecting to the Model 216'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, approximately 12 inches in length, allow convenient soldering to a connector selected to be installed in a spare location on the Model 216'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 terminals or "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 a connection! (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….)

Most of the 3-position headers on the Model 216's main circuit board assembly are located close to their related input or output connectors. Others headers provide access to functions such as the relays or the contact closure inputs. For details on the headers please refer to Appendix B at the end of this guide.

Contact Closure Input Connections

Provision has been made on the Model 216's printed circuit board assembly to allow external switches or contact closures to control the status of the audio signal sent to the main and talkback output channels. Two 3-position headers provide access to the circuitry associated with the functions. Refer to Appendix B for connection details. The input circuitry is "active low," with a 3.4 k ohm resistor connected to +3.3 volts DC to act as a pull up. A combination of resistors and capacitors provide ESD protection.

Relay Contacts

The Model 216 provides two normally open (not shorted) relay contacts for use in specialized applications. One is associated with the main pushbutton and the other with the talkback 1 pushbutton. Whenever audio is being sent to the main output channel relay contact 1 will close (short). And whenever audio is being sent to the talkback output channel 1 relay contact 2 will close (short). The two relays operate under software control and are always active, whether or not connections are made to them.

Some "head scratching" or "brainstorming" should lead to a number of interesting ways to take advantage of the relay contacts. Applications could include keying wireless transmitters, activating "on-air" lights, and muting loudspeaker systems. To utilize the relay contacts does require the talents of a qualified technician. This is because the Model 216's enclosure must be disassembled and the desired wiring scheme implemented. For detailed information on interfacing with the relay contacts refer to Appendix B at the end of this guide.

Pushbutton Backlighting

From the factory, white LEDs are installed in the pushbutton housings. These LEDs provide illumination ("backlighting") of the pushbutton switches. This may prove useful for applications where adequate room lighting is not available. It's important to note that the pushbutton lighting does not provide a tally function; it is intended to illuminate the pushbutton's clear lens and associated labeling.

The socket in each of the pushbutton housings was originally designed to allow insertion of a pluggable T-1 bi-pin incandescent bulb. But they are also compatible with the more modern leaded T-1 LEDs. As of the time of writing this guide the specific LED used at the factory is the Kingbright WP7104QWC/D. If backlighting is not desired it's easy to remove the LED lamps. The mating socket in each pushbutton assembly is accessed by carefully removing the pushbutton's lens cap, graphic label, and frosted lens. Once this is done carefully pull on the body of the LED and it will pull out of the socket. (A pair of needle-nose pliers may be required to perform this task.)

If an LED needs to be replaced note that it is a polarized device. If upon insertion it does not light, simply remove the LED, rotate it 180 degrees, then re-insert it into the socket.

Application Firmware Update Procedure

It's possible that updated versions of the application firmware (embedded software) that is utilized by the Model 216's microcontroller (MCU) integrated circuit will be released to add features or correct issues. Refer to the Studio Technologies website for the latest application firmware file. The unit has the ability to load a revised file into the MCU's nonvolatile memory by way of a USB interface. The Model 216 implements a USB host function that directly supports connection of a USB flash drive. The Model 216's MCU updates its firmware using a file named **m216.bin**.

The update process begins by preparing a USB flash drive. The flash drive doesn't have to be empty (blank) but must be in the personal-computer-standard FAT32 format. Save the new firmware file in the root directory with a name of **m216.bin**. Studio Technologies will supply the application firmware file inside a .zip archive file. While the firmware file inside of the zip file will adhere to the naming convention required by the Model 216, the name of the zip file itself will include the file's version number. For example, a file named **m216v1r3MCU.zip** would indicate that version 1.3 of the application firmware (**m216.bin**) is contained within this zip file. Once the USB flash drive is inserted into the USB interface, the unit powered off and again powered on, the file will automatically load. The precise steps required will be highlighted in the next paragraphs of this guide. Once the new file is loaded into the Model 216 the 2-digit LED display should be used to confirm that the correct firmware version has been successfully installed.

To install the firmware file follow these steps:

1. Remove power from the Model 216. This will entail removing the Ethernet connection if it is providing PoE power and/or removing the external source of 12 volts DC if that is being used.

2. Ensure that nothing is present in the USB port. Then again apply power to the unit and "read" the currently loaded firmware version using the 2-digit LED display. Note this for later reference.
3. Remove power from the Model 216.
4. Insert the prepared USB flash drive into the Model 216's USB port, located on the back panel of the unit.
5. Apply power to the Model 216. Power can be provided by Power-over-Ethernet (PoE) associated with a connected Ethernet signal or can be from an external 12 volt DC source.
6. The Model 216 will run a "boot loader" program that will immediately load the new MCU (**m216.bin**) file. This process takes only a few seconds. During this time period the LED located below the USB connector will flash slowly on and off green. Once the entire loading process is over, taking approximately 10 seconds, the Model 216 will restart using the newly-loaded firmware.
7. At this time the Model 216 is functioning with the newly-loaded firmware and the USB flash drive can be removed. But to be conservative, remove power first and then remove the USB flash drive.
8. Apply power to the Model 216 and "read" the MCU's firmware version number by observing the 2-digit display. Ensure that this is the desired version and that it's different from that noted in step 2.

Note that upon power being applied to the Model 216 if the USB flash drive doesn't have the correct file (**m216.bin**) in the root folder no harm will occur. Upon power up the USB LED will flash on and off rapidly for a few seconds to indicate this condition and then normal operation using the unit's existing firmware will begin.

Ultimo Firmware Update

As previously discussed in this guide, the Model 216 implements Dante connectivity using the 4-input/4-output Ultimo integrated circuit from Audinate. The Dante Controller software application can be used to determine the version of the firmware (embedded software) residing in the Ultimo "chip." This firmware can be updated by way of the Model 216's Ethernet connection. The latest Dante firmware file is available on the Studio Technologies website. The Dante Firmware Update Manager application is used to install the firmware. This program is also available for download on the Studio Technologies website.

Specifications

Power Sources:

Power-over-Ethernet (PoE): class 2 (low power) per IEEE 802.3af

External: 10 to 18 volts DC, 270 mA max @ 12 volts DC

Network Audio Technology:

Type: Dante Audio-over-Ethernet

Bit Depth: up to 24

Sample Rates: 44.1 and 48 kHz

Number of Transmitter (Output) Channels: 4 (main, talkback 1, talkback 2, talkback 3)

Number of Receiver (Input) Channels: 4

Dante Audio Flows: 4; 2 transmitter, 2 receiver

Analog to Digital Equivalence: a +4 dBu input with 0 dB gain selected results in a Dante digital output level of –20 dBFS

Network Interface:

Type: twisted-pair Ethernet, preferably with Power-over-Ethernet (PoE) support

Data Rate: 100 Mb/s (10 Mb/s Ethernet not supported)

General Audio Parameters:

Frequency Response: 20 Hz to 20 kHz, +0/–1 dB, mic input to Dante output

Distortion (THD+N): 0.004%, measured at 1 kHz, –36 dBu mic input, 40 dB gain (Dante output approximately –20 dBFS)

Dynamic Range: >109 dB, 40 dB gain, A-weighted

Microphone Input/Preamplifier:

Type: electronically balanced

Input Impedance: 3.7 k ohms

CMRR: >76 dB, 20 Hz to 20 kHz, 40 dB gain

Gain Range: 19 to 64 dB, adjustable in 3-dB steps

EIN: –123 dBu, 22 kHz bandwidth, 64 dB gain, 150 ohm source resistance

Compatibility: dynamic or phantom-powered mics

Phantom Power: 45 volts DC, nominal, meets IEC 61938 P48 standard

Remote Configuration Capability: microphone preamplifier gain and P48 power on/off status (uses STcontroller application)

Headphone Output:

Type: stereo, configured to drive headphones through 10 ohm series resistors

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

Level: adjustable using rotary level control

Maximum Voltage: 7.5 Vpp, 150 ohm load

Dim: 18 dB when active

Tone:

Use: provides support for tone operated (TOX) IFB function on Studio Technologies' Model 5422 Dante Intercom Audio Engine

Type: sine wave, <0.01% THD+N

Level: –20 dBFS

Frequency: 18 kHz ± 0.1 Hz

Relays Contacts: 2

Functions: one each follows main and talkback 1 pushbutton status

Contacts: form A (normally open, not shorted)

Rating: 100 mA, 60 volts AC/DC, maximum

Contact Resistance: 16 ohms, maximum

Access: requires user-implemented connector scheme

Connectors:

Microphone Input: 3-pin female XLR

Headphone Output: ¼-inch 3-conductor jack

Ethernet: Neutrik etherCON RJ45

External DC: 4-pin male XLR

USB: type A receptacle

Spare Connector Locations: 2

Allows Studio Technologies' cable assemblies or option modules to be installed. Also compatible with Neutrik NC*D-L-1 connectors (*=3F, 3M, 5M, 6F, 6FS, etc.).

Dimensions (Overall):

5.6 inches wide (14.2 cm)
3.3 inches high (8.4 cm)
8.5 inches deep (21.6 cm)

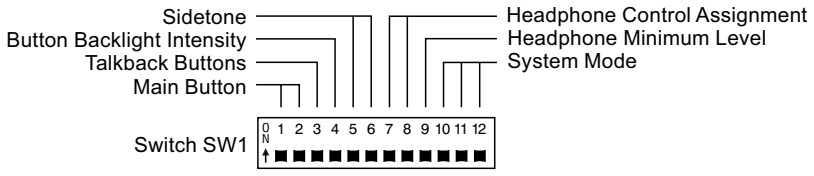
Weight: 2.7 pounds (1.2 kg)

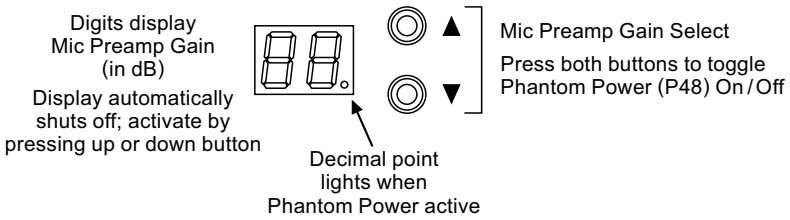
Specifications and information contained in this User Guide subject to change without notice.

Appendix A

Attached to the bottom of the unit is a security panel with text that provides a summary of the configurable parameters and related information.

Model 216 Announcer's Console
Configuration Settings
For full documentation go to www.studio-tech.com





Main Button (1, 2)
- ▼ ▼ Push to Mute
- ▲ ▼ Push to Talk
- ▼ ▲ Latching
- ▲ ▲ Hybrid

Talkback Buttons (3)
- ▼ Push to Talk
- ▲ Hybrid

Button Backlight Intensity (4)
- ▼ Low
- ▲ High

Sidetone (5, 6)
- ▼ ▼ Off
- ▲ ▼ Main Button
- ▼ ▲ Talkback Buttons
- ▲ ▲ Main & Talkback Buttons

Headphone Operating Mode (7, 8)

C1 C2 C3

- ▼ ▼ C1: Ch 1 → L / Ch 2 → R
C2: Ch 3 → L / Ch 4 → R
C3: Sidetone
- ▲ ▼ C1: Ch 1 → L / Ch 2 → R
C2: L / R Balance
C3: Sidetone
- ▼ ▲ C1: Ch 1 → L & R
C2: Ch 2 → L & R
C3: Ch 3 → L / Ch 4 → R
- ▲ ▲ C1: Ch 1 → L
C2: Ch 2 → R
C3: Ch 3 → L / Ch 4 → R

Headphone Minimum Level (9)
- ▼ –40 dB
- ▲ Full Mute

System Mode (10, 11, 12)
- ▼ ▼ ▼ On-Air
- ▼ ▲ ▼ Production with Dim
- ▼ ▼ ▲ Production
- ▲ ▼ ▲ Production with Tone
- ▲ ▲ ▼ Production with Dim & Tone

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Appendix B

The following list provides details on the 3-pin header connectors located on the Model 216's printed circuit board. Shown are both reference numbers and associated functions.

P2: Microphone Input
Pin 1 common
Pin 2 high (+)
Pin 3 low (–)

P3: External 12 Volt DC Input
Pin 1 – DC
Pin 2 + DC
Pin 3 not used

P5: Headphone Output
Pin 1 common
Pin 2 left channel (tip)
Pin 3 right channel (ring)

P6: DC Output
Pin 1 common
Pin 2 10-18 volts DC out
Pin 3 not used

P7: Relay Contact 1
Pin 1 common
Pin 2 normally open
Pin 3 normally open
Note: Pins 2 and 3 close (short) when main pushbutton is active.

P8: Relay Contact 2
Pin 1 common
Pin 2 normally open
Pin 3 normally open
Note: Pins 2 and 3 close (short) when talkback 1 pushbutton is active.

P10: Contact Closure Input – Main and Talkback 1
Pin 1 common
Pin 2 main pushbutton
Pin 3 talkback 1 pushbutton

P11: Contact Closure Input – Talkback 2 & Talkback 3
Pin 1 common
Pin 2 talkback 2 pushbutton
Pin 3 talkback 3 pushbutton