

Model 543D IFB Interface

User Guide

Issue 1, August 2023

This User Guide is applicable for serial numbers M543D-00151 and later with Application Firmware 1.00 and later and STcontroller application version 3.11.19 and later.

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Revision History

Issue 1, August 2023:

- Initial release.

Introduction

The Model 543D IFB Interface provides broadcast-standard powered and line-level (non-powered) analog IFB outputs from audio signals that are supplied by way of Dante® audio-over-Ethernet media networking technology. IFB, also known as “interruptible foldback” or talent cueing, is a method commonly used by broadcast on-air talent and related personnel to receive one-way (listen-only) audio signals associated with live-event broadcasts. Especially important in sports and entertainment events, IFB plays a crucial role in virtually all broadcast applications that require people to stay “in the know.” Dante has found wide acceptance as an audio “backbone” due to its ease of use, high performance, strong interoperability, and wide adoption by a large number of equipment manufacturers. The Model 543D is a unique product that helps to extend Dante’s capabilities into the important but specialized world of broadcast and production IFB.

Dante audio-over-Ethernet technology is used to transport four audio channels from their source to the Model 543D and then on to the two, 2-channel IFB outputs. Each of the Model 543D’s powered IFB outputs supplies DC voltage and two audio channels to groups of listen-only user devices. Two analog line-level IFB outputs are also provided for general-purpose use. The Model 543D is compatible with the latest broadcast and audio equipment that uses Dante technology. An Ethernet connection is all that’s required to make the Model 543D part of a sophisticated, networked audio system.

A Model 543D can utilize up to four digital audio input channels provided by Dante-enabled devices such as matrix intercom systems, DSP processors, broadcast routers, and audio consoles. The unit’s powered IFB outputs allow direct connection with listen-only user beltpacks such as the Studio Technologies’ Model 32A, Model 33A, or Model 34. The powered IFB outputs also support connection of listen-only devices from manufacturers such as RTS® and Clear-Com®. Two LED indicators serve as status displays for the 28 volts DC that is an integral part of each powered IFB output. The two line-level IFB outputs are provided for connection with a variety of devices that have balanced or unbalanced analog inputs.

Four audio level meters, located on the unit’s front panel, provide confirmation of system performance during setup and operation. Careful attention to circuit design and component selection ensures that excellent audio quality is maintained. The Model 543D’s operating power can be provided either by a power-over-Ethernet (PoE) connection or an external source of 12 volts DC. Two front-panel LEDs display the status of the PoE and/or DC sources. Standard connectors are used for the powered and line-level IFB outputs, Ethernet, and DC power interconnections. The Model 543D’s enclosure has a “1/2-rack” 1U form factor and weighs less than two pounds, making it well suited for use in portable applications. Alternately, using one of the optional installation kits, one or two Model 543D units can be mounted in a single space (1U) of a standard 19-inch rack enclosure.



Figure 1. Model 543D IFB Interface front and back views

In addition to the front-panel LEDs, the STcontroller software application allows DC status monitoring for the two powered IFB outputs. Versions of STcontroller are available that are compatible with the Windows® and macOS® operating systems. They are available, free of charge, from the Studio Technologies' website.

Dante Audio-over-Ethernet

Digital audio data is sent to the Model 543D using the Dante audio-over-Ethernet media networking technology. Audio signals with a sample rate of 48 kHz and a bit depth of 16, 24, or 32 are supported. Using the Dante Controller application, up to four Dante transmitter (output) channels on associated equipment can be assigned to the unit's Dante receiver (input) channels. This makes it simple to select the way in which a Model 543D fits into a specific application.

Applications

The Model 543D was designed to add broadcast-standard 2-channel IFB functionality to Dante-enabled broadcast and related applications. Combining the networked audio capability of Dante with traditional analog powered ("wet") and non-powered ("dry" or line-level) IFB outputs allows traditional, proven cueing methods to be maintained.

The Model 543D can be used in applications where IFB (talent cueing) channels are created in matrix intercom systems and become part of a Dante audio-over-Ethernet network deployment. Output ports on matrix intercom systems that directly support Dante, such as the RTS ODIN® or ADAM® with OMNEO™, can be routed to the Model 543D's Dante receiver (input) channels. The Model 543D's circuitry will then convert these signals into analog powered and line-level (non-powered) IFB audio outputs. In this way, adding IFB support for RTS + OMNEO infrastructures is a simple task. Other matrix intercom and broadcast router systems also directly support Dante.

The Model 543D can also be used with matrix intercom systems that don't directly support Dante. An external analog-to-Dante interface can be used to convert analog intercom output ports to Dante channels. For example, the Studio Technologies' Model 544D or Model 5412 audio interfaces do an excellent job of converting line-level analog signals to Dante digital audio channels. Once in the Dante digital

domain, these audio channels can be transported over standard Ethernet networks and then interconnected with the Model 543D's audio input channels.

In applications where on-air talent uses headsets with two earphones (stereo or "dual muff"), two unique audio channels are typically part of the provided IFB signal source. Generally, one channel is configured in a matrix intercom system as "interrupt" while the other channel is configured as "program" or "program only." (In U.S. applications the former signal is typically assigned to the left ear and the latter signal to the right ear.) An alternate term often used for the "interrupt" channel is "program-with-interrupt." This is probably a more descriptive as the function is actually a program source that gets interrupted with talk audio. The source of interrupt audio is typically a producer or director who provides real-time information to the on-air talent. The "program" channel is typically a continuous source of program audio.

In other applications, talent will use a single-ear headset, earbud, or in-ear monitor, keeping the other ear accessible to ambient audio. This is frequently done in electronic news gathering (ENG) or sports-broadcast applications where live interviews take place. A program-with-interrupt audio signal is normally provided; no program-only audio source is utilized.

Powered IFB Outputs

The Model 543D provides two, 2-channel powered IFB outputs that are designed to directly support connection of listen-only user devices. Each powered IFB output provides both DC voltage and two channels of unbalanced analog audio. Two, 3-pin male XLR connectors, located on the Model 543D's back panel, are used to interface the powered IFB outputs with the listen-only user devices. Following broadcast-industry conventions, pin 1 is the common connection, pin 2 has DC power with channel 1 audio superimposed on it, and pin 3 has channel 2 audio. The nominal audio levels are -10 dBu. Each power source supplies 28 volts DC with a maximum current of 120 milliamperes. The DC power sources are monitored for over-current and short-circuit conditions. Under firmware (embedded software) control the DC power sources will automatically cycle off and on to help prevent damage to the circuitry and connected equipment.

Line-Level IFB Outputs

The Model 543D provides two analog line-level IFB output channels. The audio sources for these two outputs are the same as used for channels 1 and 2 of powered IFB output 2. The line-level IFB outputs are intended to allow interconnection with externally powered listen-only user devices, inputs on wireless IFB systems, or analog inputs on consoles or related audio devices. The nominal level of the line-level IFB outputs is +4 dBu. The outputs are electronically balanced, capacitor-coupled and ESD (static) protected. They should be compatible with virtually all balanced and unbalanced line-level analog inputs that have an impedance of 2 k ohms or greater.

Reliability and Pro Audio Quality

The Model 543D is a fully professional product that offers the audio quality, features, and reliability required by 24-hour, on-air, and commercial applications. The unit's audio circuitry was designed in the spirit of professional audio equipment rather than that found in typical IFB or talent cueing gear. High performance components are used throughout, providing low-distortion, low-noise, and high headroom. The powered IFB outputs offer a unique level of performance, able to deliver reliable power and excellent audio quality in a variety of challenging applications.

Audio Meters

The Model 543D provides four 5-segment LED meters. The meters, located on the unit's front panel, display the level of the audio signals associated with the two, 2-channel IFB outputs. At the time of installation and setup the meters can be invaluable in helping to confirm correct operation. During normal operation the meters offer a real-time confirmation of the unit's incoming audio signal levels, helping to ensure that optimal audio quality is maintained.

Status Display

Two LED indicators, located on the Model 543D's front panel, offer a status indication of the DC power sources that are part of the powered IFB outputs. Two other LEDs offer a direct indication of what source or sources of power are connected to the Model 543D. In addition, the STcontroller software application provides a real-time "virtual" status display of the DC power sources that are associated with the powered IFB outputs.

Ethernet Data, PoE, and DC Power Source

The Model 543D connects to a local area data network (LAN) using a standard 100 Mb/s twisted-pair Ethernet interface. The physical interconnection is made by way of a Neutrik etherCON RJ45 jack. While compatible with standard RJ45 plugs, an etherCON CAT5-compatible plug allows a ruggedized and locking interconnection method for harsh or high-reliability environments. Three LEDs on the unit's back panel display the status of the network connection and Dante interface.

The Model 543D'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 543D's PoE interface reports to the power sourcing equipment (PSE) that it is a class 3 (mid power) device. Alternately, the unit can be powered using an external source of 12 volts DC. For redundancy, both power sources can be connected simultaneously. Two LEDs on the unit's front panel provide a real-time indication of the connected power sources.

Simple Installation

The Model 543D uses standard connectors to allow fast and convenient interconnections. A twisted-pair Ethernet signal is connected using a Neutrik etherCON RJ45 jack. If Power-over-Ethernet (PoE) is available operation will commence immediately. An external source of 12 volts DC can also be connected by way of a 4-pin female XLR connector. Powered IFB and line-level IFB output connections are made using 3-pin male XLR connectors. The Model 543D is housed in a rugged yet lightweight aluminum enclosure that is designed to be "field tough." It can be used as a standalone portable unit, supporting what's known in the broadcast world as "throw-down" applications. Installation kits are available, as an option, allowing one or two Model 543D units to be mounted in one space (1U) of a standard 19-inch rack enclosure. Mounting in a panel cutout or to a flat surface is also possible.

Future Capabilities and Firmware Updating

The Model 543D was designed so that its capabilities and performance can easily be enhanced in the future. A USB receptacle, located on the unit's back panel, allows the application firmware (embedded software) to be updated using a USB flash drive. The Model 543D's Dante interface uses the UltimoX4™ integrated circuit from Audinate. The firmware in this integrated circuit can be updated via the Ethernet connection helping to ensure that its capabilities remain up to date.

Getting Started

In this section, a location will be selected for the Model 543D. If desired, an optional installation kit will be used to mount one or two units into a panel cutout, a flat surface, or an equipment rack. Signal interconnections will be made using the unit's back-panel connectors. An Ethernet data connection, which typically includes Power-over-Ethernet (PoE) capability, will be made using a standard RJ45 patch cord or a cable-mounted etherCON CAT5-compatible plug. A 4-pin XLR connector allows connection of an optional 12 volts DC power source. Connections to the two powered IFB and two line-level IFB outputs will be made using the unit's 3-pin male XLR connectors.

What's Included

Included in the shipping carton is a Model 543D IFB Interface and instructions on how to obtain an electronic copy of this guide. An optional installation kit allows a Model 543D to be mounted in a rectangular opening in a tabletop or attached to a flat surface. If one or two Model 543D units are going to be mounted in a 19-inch equipment rack then having another of the optional installation kits is required. If an installation kit was purchased it would typically have been shipped in a separate carton. As a device that can be powered by Power-over-Ethernet (PoE) or an external source of 12 volts DC, no power source is included. (A compatible 12 volts DC power supply, the Studio Technologies' PS-DC-02, is available as an option.)

Locating the Model 543D

Where to locate a Model 543D will typically depend on being able to minimize the interconnection length to the devices that will utilize the powered IFB outputs.

This type of circuit carries unbalanced audio which can be susceptible to interference and crosstalk issues. And since powered IFB circuits also carry DC power a voltage drop due to the resistance in an interconnecting cable can become an issue. In general, minimizing the length of the cables used with the powered IFB outputs will help ensure more reliable and consistent powered IFB device performance. Of equal importance is the 100-meter (325-foot) twisted pair Ethernet cable limitation. But that can be overcome by using a fiber-optic interconnect between the related Ethernet switch and the other switches in the Ethernet network. With a fiber interconnection there's no reason why a Dante-supporting LAN can't be distributed over many miles (or kilometers).

The Model 543D is shipped as a self-contained "throwdown" unit suitable for portable use or placement in a semi-permanent location. Installed on the bottom of the chassis are four screw-on rubber feet. These are useful if the unit is going to be placed on surfaces where scratching of either the Model 543D's enclosure or the surface material could take place. However, the feet can be removed without the use of a tool when rack- or custom-mounting the unit.

Mounting Options

Panel Cutout or Surface Mounting One Model 543D Unit

Installation kit RMBK-10 allows one Model 543D to be mounted in a panel cutout or onto a flat surface. The kit contains two standard-length brackets and four 6-32 thread-pitch Phillips-head machine screws. Refer to Appendix A for a visual explanation.

Begin installing the kit by removing the four screw-on rubber feet from the bottom of the Model 543D's chassis. They can be removed using one's fingers to rotate them counterclockwise; no tool is required. Store the feet for possible later use.

Panel Cutout or other Opening Mounting

To prepare the unit to mount in a cutout or other opening in a panel, use a #2 Phillips screwdriver and two 6-32 machine screws to attach one of the standard-length brackets onto the left side (when viewed from the front) of the Model 543D's enclosure. Orient the standard-length bracket such that its front is parallel to the Model 543D's front panel. Using two additional 6-32 machine screws, attach the other

standard-length bracket onto the right side of the Model 543D's enclosure. The screws will mate with the threaded fasteners that can be seen on the sides of the Model 543D's enclosure, near the front of the unit.

Once the two standard-length brackets have been installed, the Model 543D will be ready to be mounted into an opening. Secure the unit's left and right sides into the opening using two mounting screws per side.

Flat Surface Mounting

To prepare the unit to be mounted onto a flat surface simply requires the standard-length brackets be attached to the Model 543D at 90 degrees from how they are mounted for use in a panel cutout. Use a #2 Phillips screwdriver and two 6-32 machine screws to attach one of the standard-length brackets onto the left side (when viewed from the front) of the enclosure. Orient the bracket such that its front is parallel with the top surface of the Model 543D's enclosure. Following the same orientation, use two additional 6-32 machine screws to attach the other standard-length bracket onto the right side of the Model 543D's enclosure. The screws will mate with the threaded fasteners that can be seen on the sides of the Model 543D's enclosure, near the front of the unit.

Once the two standard-length brackets have been installed the Model 543D will be ready to be mounted onto a flat surface. Secure the unit to the surface using two mounting screws per side.

Left- or Right-Side Rack Mounting One Model 543D Unit

Installation kit RMBK-11 allows one Model 543D to be mounted in the left or right side of one space (1U) of a standard 19-inch rack enclosure. The kit contains one standard-length bracket, one long-length bracket, and four 6-32 thread-pitch Phillips-head machine screws. Refer to Appendix B for a visual explanation.

Begin the installation by removing the four screw-on rubber feet from the bottom of the Model 543D's chassis. They can be removed using one's fingers to rotate them counterclockwise; no tool is required. Store the feet for possible later use.

To prepare the unit to mount in the left side of a rack enclosure, use a #2 Phillips screwdriver and two 6-32 machine screws to attach the standard-length bracket onto the left side (when viewed from the front) of the

enclosure. Using two additional 6-32 machine screws, attach the long-length bracket onto the right side of the Model 543D's enclosure. The screws will mate with the threaded fasteners that can be seen on the sides of the Model 543D's enclosure, near the front of the unit.

To prepare the unit to mount in the right side of a rack enclosure, use a #2 Phillips screwdriver and two 6-32 machine screws to attach the long-length bracket onto the left side of the enclosure. Using two additional 6-32 machine screws, attach the standard-length bracket onto the right side of the Model 543D's enclosure.

Once the standard-length and long-length brackets have been installed the Model 543D will be ready to be mounted into the designated equipment rack. One space (1U or 1.75 vertical inches) in a standard 19-inch equipment rack is required. Secure the unit into the equipment rack using two mounting screws per side.

Rack-Mounting Two Model 543D Units

Installation kit RMBK-12 is used to allow two Model 543D units to be mounted in one space (1U) of a standard 19-inch equipment rack. The kit can also be used to mount one Model 543D and one other Studio Technologies' product that is compatible with the RMBK-12. Compatible products include the Model 544D Audio Interface, Model 545DC Intercom Interface, Model 545DR Intercom Interface, and Model 5421 Dante Intercom Audio Engine. The RMBK-12 installation kit contains two standard-length brackets, two joiner plates, eight 6-32 thread-pitch Phillips-head machine screws, and two 2-56 thread-pitch Torx™ T7 thread-forming machine screws. Refer to Appendix C for a visual explanation.

Begin installing the kit by removing the four screw-on rubber feet from the bottom of each chassis. They can be removed using one's fingers to rotate them counterclockwise; no tool is required. Store the feet for possible later use.

With assistance from a #2 Phillips screwdriver, use two of the 6-32 machine screws to attach one of the standard-length brackets onto the left side (when viewed from the front) of one of the Model 543D units. Using two more of the 6-32 machine screws, attach one of the joiner plates onto the right side of the

same Model 543D unit. The screws will mate with the threaded fasteners that can be seen on the sides of the Model 543D's enclosure, near the front of the unit.

Again using two of the 6-32 machine screws, attach the second standard-length bracket onto the right side of the second Model 543D or another compatible unit. Using the final two 6-32 machine screws, attach the second joiner plate onto the left side of the second Model 543D or other compatible unit with an orientation of 180 degrees from the way in which the first plate was installed.

To complete the assembly, "join" the units together by sliding each joiner plate through the other. The grooves in each joiner plate will carefully align with each other and form a relatively tight bond. Line up the two units so that the front panels form a common plane. With the aid of a Torx T7 screwdriver, use the two 2-56 Torx machine screws (included as part of the installation kit) to secure the two joiner plates together. The screws should fit snugly into the small openings formed by the mating of the two joiner plates.

The 2-unit assembly is now ready to be mounted into the designated equipment rack. One space (1U or 1.75 vertical inches) in a standard 19-inch equipment rack is required. Secure the assembly into the equipment rack using two mounting screws per side.

Center Rack Mounting One Model 543D Unit

Installation kit RMBK-13 allows one Model 543D to be mounted in the center of one space (1U) of a standard 19-inch rack enclosure. The kit contains two medium-length brackets and four 6-32 thread-pitch Phillips-head machine screws. Refer to Appendix D for a visual explanation.

Begin the installation by removing the four screw-on rubber feet from the bottom of the Model 543D's chassis. They can be removed using one's fingers to rotate them counterclockwise; no tool is required. Store the feet for possible later use.

To prepare the unit to mount in the center of a rack enclosure, use a #2 Phillips screwdriver and two 6-32 machine screws to attach one of the medium-length brackets onto the left side (when viewed from the front) of the enclosure. Using two additional 6-32 machine screws, attach the other medium-length

bracket onto the right side of the Model 543D's enclosure. The screws will mate with the threaded fasteners that can be seen on the sides of the Model 543D's enclosure, near the front of the unit.

Once the two medium-length brackets have been installed the Model 543D will be ready to be mounted into the designated equipment rack. One space (1U or 1.75 vertical inches) in a standard 19-inch equipment rack is required. Secure the unit into the equipment rack using two mounting screws per side.

Ethernet Connection with PoE

An Ethernet connection that supports 100BASE-TX (100 Mb/s over twisted-pair) is required for Model 543D operation. A 10BASE-T connection is not sufficient; 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 also provide operating power for the Model 543D. To support Ethernet switches that include PoE power management capability the Model 543D will enumerate itself as a PoE class 3 (mid power) device.

A 100BASE-TX Ethernet connection is made by way of a Neutrik etherCON RJ45 jack that is located on the back panel of the Model 543D. This allows connection by way of a standard RJ45 patch cord or a cable-mounted etherCON CAT5-compatible plug. A crossover cable will never be required as the Model 543D's Ethernet interface supports auto MDI/MDI-X. As specified in the Ethernet standard, the Ethernet Switch-to-Ethernet Device length limitation for twisted-pair cabling is 100-meters (325-feet).

External 12 Volt DC Input

An external source of 12 volts DC can be connected to the Model 543D by way of a 4-pin male XLR connector which is located on the unit's back panel. While the requirement for the external source is nominally 12 volts, correct operation will take place with any source that has a range of 10 to 16 volts DC. The Model 543D requires 1.0 amperes maximum 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 compatible PS-DC-02 power supply is available from Studio Technologies. Its AC mains input allows connection of a 100-240 volts, 50/60 Hz

source and its 12 volt DC, 1.5 amperes maximum output is terminated on a 4-pin female connector.

As previously discussed, an Ethernet connection that provides Power-over-Ethernet (PoE) can serve as the Model 543D's power source. Alternately, a source of nominal 12 volts DC can be connected. For redundancy, both PoE and the external 12 volts DC source can be connected at the same time. If both PoE and an external 12 volts DC source are connected, power will be drawn only from the PoE supply. If the PoE source becomes inoperative the 12 volts DC source will provide the Model 543D's power with no interruption in operation. (Of course, if both PoE and Ethernet data support are lost that is a very different situation!)

Powered IFB Outputs

The Model 543D provides two, 2-channel powered IFB outputs. The powered IFB outputs are intended to directly support listen-only beltacks such as talent amplifier units available from Studio Technologies. The four channels of audio associated with the two powered IFB outputs are provided by the four Dante receiver (input) channels. These audio sources will be routed, typically using the Dante Controller application, from the desired Dante transmitter (output) sources to the Model 543D's four receiver (input) channels.

The signals that are present on the powered IFB outputs' 3-pin male XLR connectors are typical for broadcast powered (also known as "wet") IFB circuits. Pin 1 is common for power and audio, pin 2 is nominal 28 volts DC with channel 1 audio modulated on it, and pin 3 is channel 2 audio. The nominal audio levels on the IFB channels are -10 dBu. The maximum allowable current draw from pin 2 to pin 1 is 120 milliamperes nominal. The circuitry associated with pin 3 is protected from damage should pin 2 (with 28 volts DC on it) be accidentally connected to it. Both pins 2 and 3 are protected should an external powered IFB or party-line (PL) intercom circuit be connected to them.

One or more listen-only broadcast-standard IFB user devices can be connected to each of the powered IFB outputs. The only restriction on the number of devices that can be connected is that the total current drawn from each powered output must be equal to or less than 120 milliamperes. Devices such as the Studio Technologies' Models 32A, 33A, or 34 are directly compatible and will provide excellent performance.

While possibly not cost-effective, it's also possible to use intercom beltacks, such as the RTS BP-325, as listen-only devices.

The Models 32A and 33A each have a quiescent current of approximately 15 milliamperes and a maximum current draw of 40 milliamperes. As such, a combination of up to three of these user devices can be supported by each of the Model 543D's powered IFB outputs. With typical, rather than maximum, audio signal levels being sent to a powered IFB output support for four user devices is also possible. The Model 34 uses a maximum of 45 milliamperes so a conservative application would have no more than two Model 34 units connected to each of the Model 543D's two powered IFB outputs.

Line-Level IFB Outputs

The Model 543D provides two analog line-level IFB outputs. In the broadcast world these might be referred to as "dry" IFB outputs. The audio sources for these outputs are the same as used by the two channels associated with powered IFB output 2. (These are the third and fourth Dante receive (input) audio channels that are routed, using Dante Controller, to the Model 543D's receiver inputs.) The line-level IFB outputs are designed for general-purpose use which could include connecting to externally-powered (typically battery-powered) listen-only user beltacks, transmitters associated with wireless in-ear monitors, audio consoles, or amplified speakers.

The circuitry associated with the two line-level IFB outputs has a nominal level of $+4$ dBu, is electronically balanced, capacitor-coupled, and has a nominal source impedance of 200 ohms. These outputs will perform optimally when driving loads of 2 k (2000) ohms or greater.

Note that a signal entering one of the Model 543D's Dante receiver (input) channels with a digital level of -20 dBFS will produce an analog signal with a level of $+4$ dBu on its associated line-level IFB output.

Two 3-pin male XLR connectors, located on the Model 543D's back panel, are provided for interfacing the line-level IFB outputs with associated equipment. Prepare 3-pin female XLR mating connectors such that pin 1 is common/shield, pin 2 is signal high (+), and pin 3 is signal low (–). To connect to an unbalanced load use pin 1 as low/shield and pin 2 as

signal high (+); do not connect anything to pin 3. Do not connect (short) pin 3 to pin 1 as it will stress the output circuitry.

Dante Configuration

To integrate the Model 543D into an application requires that a number of Dante-related parameters be configured. These configuration settings will be stored in non-volatile memory within the Model 543D's Dante interface circuitry. Configuration will typically be done using the Dante Controller software application which is available for download free of charge at audinate.com. Versions of Dante Controller are available to support the Windows and macOS personal computer operating systems. The Model 543D uses the UltimoX4 4-input/4-output integrated circuit to implement its Dante interface. The Model 543D's Dante interface is compatible with AES67 as well as the Dante Domain Manager™ (DDM) software application.

Audio Routing

Up to four Dante transmitter (output) channels on associated equipment can be routed (subscribed) to the Model 543D's four Dante receiver (input) channels. This will achieve audio interconnection between the desired Dante device (or devices) and the Model 543D's four IFB input channels.

Within Dante Controller, a "subscription" is the term used for routing a Dante transmitter (output) channel or a flow (a group of up to four output channels) to a Dante receiver (input) channel or a flow (a group of up to four input channels). The number of receiver flows associated with an UltimoX4 integrated circuit is limited to two. These can either be unicast, multicast, or a combination of the two. If more than two flows are needed for routing the desired audio signals to the Model 543D's four Dante receiver (input) channels it's possible that an intermediary device, such as the Studio Technologies' Model 5421 or Model 5422A Dante Intercom Audio Engine, can be used to "repeat" the signals.

Device and Channel Names

The Model 543D has a default Dante device name of **ST-M543D-** followed by a unique suffix. The suffix identifies the specific Model 543D that is being configured. The suffix's actual alpha and numeric

characters relate to the MAC (media access control) address of the UltimoX4 integrated circuit that's present in the specific Model 543D. The four Dante receiver (input) channels have the default names of **To Out1 Ch1**, **To Out1 Ch2**, **To Out2 Ch1**, and **To Out2 Ch2**. Using Dante Controller these names can be revised as appropriate for the specific application.

Device Configuration

The Model 543D supports an audio sample rate of 48 kHz with no pull-up/pull-down values available. The audio encoding is fixed for PCM 24. Device Latency and Clocking can be adjusted if required but the default value is typically correct.

Network Configuration – IP Address

By default, the Model 543D's Dante IP address and related network parameters will be determined automatically using DHCP or, if not available, the link-local network protocol. If desired, Dante Controller allows the IP address and related network parameters to be manually set to a fixed (static) configuration.

AES67 Configuration – AES67 Mode

The Model 543D can be configured for AES67 operation. This requires that Dante Controller's AES67 Mode be set for Enabled. By default, AES67 mode is set for Disabled.

Model 543D Clocking Source

While technically the Model 543D can serve as a Leader clock for a Dante network (as can all Dante-enabled devices) in virtually all cases the unit will be configured to receive "sync" from another device. As such, the check box in Dante Controller for Preferred Leader associated with the Model 543D would typically not be enabled.

Operation

At this point, the Model 543D should have connections to its Ethernet, powered IFB outputs, and line-level IFB outputs implemented as desired for the application. If the signal connected to the Ethernet jack doesn't support Power-over-Ethernet (PoE), an external source of 12 volts DC power should also have been connected. Normal operation of the unit should now be occurring.

The Model 543D is designed for continuous operation with no adjustments required. Maintaining the correct signal levels coming into the Dante receiver (input) channels is important. This will ensure that proper signal levels are presented to the Model 543D's circuitry, leading to optimal audio performance. The input power, DC status, and audio level meters LEDs on the front panel will provide assistance in confirming that correct operation is taking place. The STcontroller software application can also be used to observe the DC status of the powered IFB outputs.

Initial Operation

The Model 543D will begin its initial functioning a few seconds after its power source is connected. As previously discussed, the unit's 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 power subsequently no longer be available, uninterrupted operation will continue using the external 12 volts DC source. (This will probably prove to be a "hollow" victory since a loss of PoE will probably also mean a loss of the required Ethernet data connection!)

Upon Model 543D power up, the Ethernet, Dante and USB status LEDs, located on the back panel, will light in various ways. On the front panel the input power, DC status, and audio level meter LEDs will light in a test sequence. After this sequence completes, the Model 543D will begin normal operation.

The way in which the back-panel LINK/ACT, SYS, and SYNC LEDs light will depend on the characteristics of the connected Ethernet signal and the configuration of the unit's Dante interface. The user is presented on the front panel with two input power status LEDs, two DC status LEDs, and four 5-segment LED audio level meters. These back- and front-panel resources are simple to understand and should prove to be useful as will be highlighted in the following paragraphs.

Ethernet and Dante Status LEDs

Three status LEDs are located below the etherCON RJ45 jack on the Model 543D's back panel. The LINK/ACT LED will light green whenever an active data connection to a 100 Mb/s Ethernet network has been established. It will flash on and off in response to data packet activity. The SYS and SYNC LEDs display the operating status of the Dante interface

and associated audio-over-Ethernet network. The SYS LED will light red upon Model 543D 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 audio data with other Dante devices. The SYNC LED will light red when the Model 543D is not synchronized with a Dante network. It will light solid green when the Model 543D is fully synchronized with a Dante network and an external clock source (timing reference) is being received. It will slowly flash green if this specific Model 543D is serving as the Leader clock for the Dante network. While technically possible, typically a Model 543D should not serve as the Leader clock for any Dante application.

Power Status LEDs

Two power status LEDs are located on the left side of the Model 543D's front panel. When an Ethernet connection with power-over-Ethernet (PoE) capability has been connected the PoE LED will light. When an external source of nominal 12 volts DC is connected the DC LED will light. If both LEDs are lit then the Model 543D is being powered by the PoE connection.

How to Identify a Specific Model 543D

Functions within the Dante Controller and STcontroller software applications allow specific Model 543D units to be identified. Each application provides an "eye-ball" icon that when clicked will activate the Identify function. When the Identify function is activated the associated software application will send a command to a specific Model 543D unit. This will cause that unit's four audio level meters to light in a unique pattern. In addition, the SYS and SYNC LEDs, located below the etherCON RJ45 jack on the back panel, will slowly flash. After a few seconds the LED identification patterns will cease and normal Model 543D level meter and Dante status LED operation will resume. Audio performance will not be impacted by the use of the Identify command. As such, it's perfectly acceptable to use this command any time it would be useful.

Level Meters

The Model 543D contains four 5-segment LED level meters, two associated with each IFB output. The meters are provided as a support aid during installation, configuration, operation, and troubleshooting. The meters represent the strength of the audio signals

going to the four channels associated with the two, 2-channel IFB outputs. The meters are organized into two groups with each group representing the two audio channels being sent to the powered IFB outputs and, in the case of output 2, both the powered and line-level IFB outputs.

The meters are calibrated to reflect the levels relative to the -10 dBu nominal of the powered IFB outputs. As an example of how the meters function let's review the situation where the output 1 channel 1 meter has its bottom three LEDs (-18 , -12 , and -6) lit solid and its 0 LED just barely lighting. This would indicate that a signal with an approximate level of -10 dBu is present on channel 1 of powered IFB output 1.

Note that a -10 dBu signal on a powered IFB output (and represented by "0" on the Model 543D's LED meter) equates to a -20 dBFS digital audio signal being present on its associated Dante receiver (input) channel. This was selected to match Studio Technologies' decision to define -20 dBFS as the nominal level for its Dante digital audio signals.

Each level meter contains four green LEDs and one yellow LED. The four green LEDs indicate a signal level that's at or below -10 dBu on a Model 543D powered IFB output. The top LED is yellow and will light when a signal that is 6 dB or greater than the -10 dBu nominal is present on the associated powered IFB output channel. An input audio signal that causes the yellow LED to light doesn't necessarily indicate an excessive level condition, but it does provide a warning that reducing the source's signal level may be prudent. Typical operation with normal signal levels should find the meters lighting near their 0 point. Signal peaks may cause the yellow LEDs to flash and that would be acceptable. But a yellow LED that fully lights during normal operation will typically indicate an excessive signal level and/or a configuration problem with the Dante transmitter (output) channel(s) on associated equipment.

Non-Optimal Signal Levels

If any or all of the front-panel meters consistently display levels that are lower or higher than the meters' 0 (reference) point it's possible that a configuration issue exists. This would typically be related to an incorrect setting on the equipment providing the audio on the associated Dante transmitter (output) channels. With a digital matrix intercom system providing

the Model 543D's Dante receiver (input) signals this problem could be due to an incorrect configuration having been made to a specific channel or port. For example, the RTS ADAM system has a published nominal level of $+8$ dBu, but it's not clear how this translates into a digital audio level on an associated OMNEO (Dante-compatible) port. Using RTS's configuration software it's possible to set the nominal level of intercom key panels or ports to something different than $+8$ dBu. The best solution in this case would be to adjust the relevant OMNEO ports such that a nominal level of -20 dBFS is provided on the associated Dante transmitter (output) channels. This should lead to the optimal performance of the Model 543D and associated IFB user devices.

Powered IFB Outputs

The Model 543D's microcontroller integrated circuit, under firmware (embedded software) control, monitors the DC voltage present on pin 2 of the powered IFB outputs to ensure that they are at an acceptable level. (As previously discussed, the nominal DC level on pin 2 is 28 volts.) If this condition is met the two DC status LEDs on the front panel will steadily light. So, under normal conditions where the performance is as expected both LEDs will be lit. If 24 volts DC or less is present on either of the powered IFB outputs a low-voltage condition is detected. This would typically be caused by the connected devices drawing too much current (more than 120 milliamperes) or a full short circuit being present. If an under-voltage condition is detected for a continuous 1-second period the microcontroller integrated circuit determines that a fault condition is present. The associated DC status LED will indicate this condition by flashing on and off. In addition, the output voltage on the powered IFB output will automatically shut down to an essentially off condition. This protects the IFB power source and causes all connected devices to power down. A 5-second "cool-down" period will then take place, after which the IFB voltage on pin 2 will again become active. As soon as the DC voltage on the IFB output is enabled for three second, output voltage monitoring will again take place. In summary, a continuous over-current or short circuit condition on pin 2 of a powered IFB output will result in a continuous 4-seconds-on/ 5-seconds-off cycle. It's important to note that during the 5-seconds-off period no voltage monitoring takes places. Removing the fault condition

on pin 2 will not result in the powered IFB output voltage immediately turning on again; the 5-second shut-down period must first elapse.

Line-Level IFB Outputs

No special precautions are necessary when using the line-level IFB outputs. They have a nominal level of +4 dBu and are compatible with balanced and unbalanced analog inputs that have an impedance of 2 k (2000) ohms or greater. The line-level IFB output circuitry is protected from damage should a moderate DC voltage be accidentally connected. For example, no damage will occur if one of the Model 543D's powered IFB outputs (which supply 28 volts DC on pin 2) is accidentally connected to one of the line-level IFB outputs. This protection would also be effective should an analog party-line (PL) intercom circuit or a P48 phantom power source that's associated with a microphone input circuit be accidentally connected to one of the Model 543D's line-level IFB outputs.

USB Interface

A USB type A receptacle and an associated status LED is located on the back panel of the Model 543D. This USB host interface is used only for updating the unit's application firmware. No audio data of any kind will pass through it. Refer to the Technical Notes section for details.

Model 543D and STcontroller

The STcontroller software application can be used to monitor (view) the DC voltage status of the Model 543D's two powered IFB outputs. For this resource to be available requires that STcontroller be ready for convenient use on a personal computer that's connected to the related LAN.

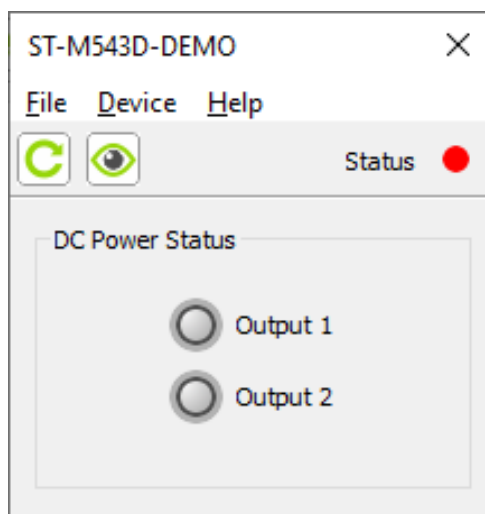
STcontroller doesn't provide any Model 543D configuration choices. All operating characteristics are "fixed" and cannot be changed.

Installing STcontroller

STcontroller is available free of charge on the Studio Technologies' website (studio-tech.com). Versions are available that are compatible with personal computers running selected versions of the Windows and macOS operating systems. If required, download and install STcontroller onto a designated personal computer. This personal computer must be on the same local area network (LAN) and subnet as the one or more Model 543D units that are to be monitored. Immediately after starting STcontroller, the application will locate all the Studio Technologies' devices that it can support. The Model 543D unit(s) should appear in the device list. Use the *Identify* command to allow easy recognition of a specific Model 543D unit. Double-clicking on a device name will cause the associated STcontroller menu to appear.

STcontroller Model 543D Menu Page

The STcontroller application will support monitoring of the following Model 543D's parameters.



DC Power Status

A DC voltage detection function is associated with each of the Model 543D's powered IFB outputs. These detection functions are used to control the front-panel status LEDs and STcontroller's "virtual" DC Power Status LED icons (graphics). For the function to be active (voltage normal), a nominal minimum DC voltage of 24 must be present on pin 2 of a powered IFB output. When this minimum voltage condition is met, the DC Power Status icon on the STcontroller's menu will show solid green. When the voltage drops below 24 volts DC, the STcontroller icon will flash green.

Technical Notes

IP Address Assignment

By default, the Model 543D's Dante-associated Ethernet interface will attempt to automatically obtain an IP address and associated settings using DHCP (Dynamic Host Configuration Protocol). If a DHCP server is not detected an IP address will automatically 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 randomly assign a unique 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, in most cases, establish IP addresses and be able to communicate with each other.

An exception does arise when trying to directly interconnect two Dante-enabled devices that use Ultimo integrated circuits to implement Dante. The Model 543D uses an UltimoX4 "chip" and, as such, a direct one-to-one interconnection between it and another Ultimo-based product would typically not be supported. An Ethernet switch linking these units would be required to successfully interconnect the two Ultimo-based devices. It's probable that the technical reason that a switch is required relates to the need for a slight latency (delay) in the data flow; an Ethernet switch will provide this. This wouldn't typically prove to be an issue as the Model 543D uses Power-over-Ethernet (PoE) to provide its operating power. As such, in most cases a PoE-enabled Ethernet switch would be utilized to support Model 543D units.

Using the Dante Controller software application, the Model 543D's Ethernet interface's IP address and related network parameters can be set for a manual (fixed or static) configuration. While this is a more-involved process than simply letting DHCP or link-local "do their thing," if fixed addressing is necessary then this capability is available. In this case, it's highly recommended that every unit be physically marked, e.g., directly using a permanent marker or "console tape," with its specific static IP address. If knowledge of a Model 543D's IP address has been misplaced

there is no reset button or other method to easily restore the unit to a default IP setting.

In the unfortunate event that a Model 543'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 small PoE-enabled Ethernet switch connecting a personal computer to the Model 543D. Then by using the appropriate ARP command the required "clues" can be obtained.

Optimizing Network Performance

For best Dante audio-over-Ethernet performance, a network that supports VoIP QoS capability is recommended. In applications that utilize multicast Ethernet traffic, enabling IGMP snooping can be valuable. (In this case, ensure that support for PTP timing messages over the associated LAN is still available.) These protocols can be implemented on virtually all contemporary managed Ethernet switches. There are even specialized switches that are optimized for entertainment-associated applications. Many will offer "Dante" mode operation which can make high-performance network implementations simple to deploy. Refer to the Audinate website (audinate.com) for details on optimizing networks for Dante applications.

Application Firmware Version Display

A selection in the STcontroller software application allows the Model 543D's application firmware version to be identified. This can be useful when working with factory personnel on application support and troubleshooting. To identify the firmware version, begin by connecting the Model 543D unit to the network (via Ethernet with PoE) and then wait until the unit starts to function. Once the unit is operating, utilize STcontroller to review the list of identified devices, selecting the specific Model 543D for which you want to determine its application firmware version. Then select **Version and Information** under the **Device** tab. A page will show that will provide a set of useful information. This includes the application firmware version as well as details on the Dante interface firmware.

Application Firmware Update Procedure

It's possible that updated versions of the application firmware (embedded software) that is utilized by the Model 543D'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 its MCU's non-volatile memory by way of a USB interface. The Model 543D implements a USB host function that directly supports connection of a USB flash drive. The Model 543D's MCU updates its application firmware using a file named **M543DvXrXX.stm** where the *Xs* are decimal digits that represent the actual firmware version number.

Begin the firmware update process 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. The USB interface in the Model 543D is compatible with USB 2.0-, USB 3.0-, and USB 3.1-compliant flash drives. Save the new application firmware file in the root directory of the flash drive with a name of **M543DvXrXX.stm** where the *XrXX* is the actual version number. Studio Technologies will supply the application firmware file inside of a .zip archive file. The name of the zip file will reflect the application file's version number and will contain two files. One file will be the actual application file and the other a readme (.txt) text file. It's recommended that the readme (.txt) file be reviewed as it will contain details about the associated application firmware file. The application firmware file inside of the zip file will adhere to the required naming convention.

Once the USB flash drive is inserted into the USB host interface, by way of a USB type A receptacle that is located on the Model 543D's back panel, the unit must be powered off and again powered on. At this point, the file from the USB flash drive will automatically load. The precise steps required will be highlighted in the next paragraphs.

To install an application firmware file, follow these steps:

1. Disconnect power from the Model 543D. This may entail either removing the PoE connection that is made to the RJ45 jack on the back panel. Alternately, it may involve removing a source of 12 volts DC that is connected to the 4-pin XLR connector which is also located on the back panel.
2. Insert the prepared USB flash drive into the USB receptacle on the back panel of the unit.
3. Apply power to the Model 543D either by connecting a PoE Ethernet signal or a source of 12 volts DC.
4. After a few seconds the Model 543D will run a "boot loader" program that will automatically load the new application firmware file (**M543DvXrXX.stm**). This loading process will take only a few seconds. During this time period the green LED that's located directly below the USB receptacle will flash slowly. Once the entire loading process is over, taking approximately 10 to 15 seconds, the Model 543D will restart using the newly loaded application firmware.
5. At this time, the Model 543D is functioning with the newly loaded application firmware and the USB flash drive can be removed. But to be conservative, remove the PoE Ethernet connection or the 12 volts DC power source first and then remove the USB flash drive. Re-connect the PoE Ethernet connection or the 12 volts DC power source to restart the unit.
6. Using STcontroller, confirm that the desired application firmware version has been correctly loaded.

Note that upon power being applied to the Model 543D, if a connected USB flash drive doesn't have the correct file (**M543DvXrXX.stm**) in its root folder no harm will occur. Upon power up the green LED, located directly below the USB receptacle on the back panel, will flash on and off rapidly for a few seconds to indicate this error condition after which normal operation, using the unit's existing application firmware, will begin.

Ultimo Firmware Update

As previously discussed, the Model 543D implements its Dante connectivity using the UltimoX4 integrated circuit from Audinate. The STcontroller or Dante Controller software applications can be used to determine the version of the firmware (embedded software) that resides in this integrated circuit. The firmware (embedded software) residing in the UltimoX4 can be updated by way of the Model 543D's Ethernet port. Performing the update process is easily accomplished using an automated method called Dante Updater that's included as part of the Dante Controller application. This application is available, free of charge, from the Audinate website (audinate.com). The latest Model 543D firmware file, with a name in the form of **M543DvXrXrX.dnt**, is available on the Studio Technologies' website as well as being part of Audinate's product library database. The latter allows the Dante Updater software application that is included with Dante Controller to automatically query and, if required, update the Model 543D's Dante interface.

Specifications

Power Sources:

Power-over-Ethernet (PoE): class 3 (mid power, ≤12.95 watts) per IEEE® 802.3af

DC In: 10 to 16 volts DC, 1.0 A max at 12 volts DC

Network Interface:

Type: 100BASE-TX, Fast Ethernet per IEEE 802.3u (10BASE-T and 1000BASE-T (GigE) not supported)

Power-over-Ethernet (PoE): Per IEEE 802.3af

Data Rate: 100 Mb/s (10 Mb/s and 1000 Mb/s not supported)

General Network Audio:

Type: Dante audio-over-Ethernet

AES67-2018 Support: yes, selectable on/off

Dante Domain Manager (DDM) Support: yes

Bit Depth: up to 24

Sample Rate: 48 kHz

Dante Receiver (Input) Channels: 4

Nominal Level: –20 dBFS

Dante Receiver Audio Flows: 2

Powered IFB Outputs: 2

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

Compatibility: 2-channel listen-only powered IFB user devices such as those offered by Studio Technologies

Power Source: 28 volts DC, 120 mA maximum, nominal

Nominal Audio Level: –10 dBu, +4 dBu maximum, pins 2 and 3

Frequency Response: ±1 dB, 20 Hz to 20 kHz

Distortion (THD+N): <0.02%, measured at 1 kHz, pins 2 and 3

Signal-to-Noise Ratio: >85 dB, A-weighted, measured at 1 kHz, pins 2 and 3

Line-Level IFB Outputs: 2

Type: analog, electronically balanced, capacitor coupled, intended to drive balanced or unbalanced loads of 2 k ohms or greater.

Source Impedance: 200 ohms

Nominal Level: +4 dBu

Maximum Level: +24 dBu

Frequency Response: ±0.1 dB, 20 Hz to 20 kHz

Distortion (THDS+N): 0.003% (–90 dB), measured at –1 dBFS input, 22 kHz bandwidth

Signal-to-Noise Ratio: >87 dB, A-weighted, measured at 1 kHz

Meters: 4

Function: displays level of IFB output audio

Type: 5-segment LED, modified VU ballistics

Status LEDs: 2

Connectors:

Powered and Line-Level IFB Outputs: 3-pin male XLR

Ethernet: Neutrik etherCON RJ45 jack (Compatible with standard RJ45 plug or etherCON CAT5-compatible plug)

External DC: 4-pin male XLR

USB: type A receptacle (used only for updating application firmware)

Remote Status Monitoring: requires Studio Technologies' STcontroller software application

Software Updating: USB flash drive used for updating application firmware; Dante Updater application used for updating Dante interface firmware

Environmental:

Operating Temperature: 0 to 50 degrees C (32 to 122 degrees F)

Storage Temperature: –40 to 70 degrees C (–40 to 158 degrees F)

Humidity: 0 to 95%, non-condensing

Altitude: not characterized

Dimensions – Overall:

8.70 inches wide (22.1 cm)

1.72 inches high (4.4 cm)

8.30 inches deep (21.1 cm)

Weight: 1.7 pounds (0.77 kg); rack-mounting installation kits add approximately 0.2 pounds (0.09 kg)

Deployment: intended for tabletop applications.

Four optional mounting kits are also available:

RMBK-10 allows one unit to be mounted in a panel cutout or on a flat surface

RMBK-11 allows one unit to be mounted in the left- or right-side of one space (1U) of a standard 19-inch rack

RMBK-12 allows two units to be mounted in one space (1U) of a standard 19-inch rack

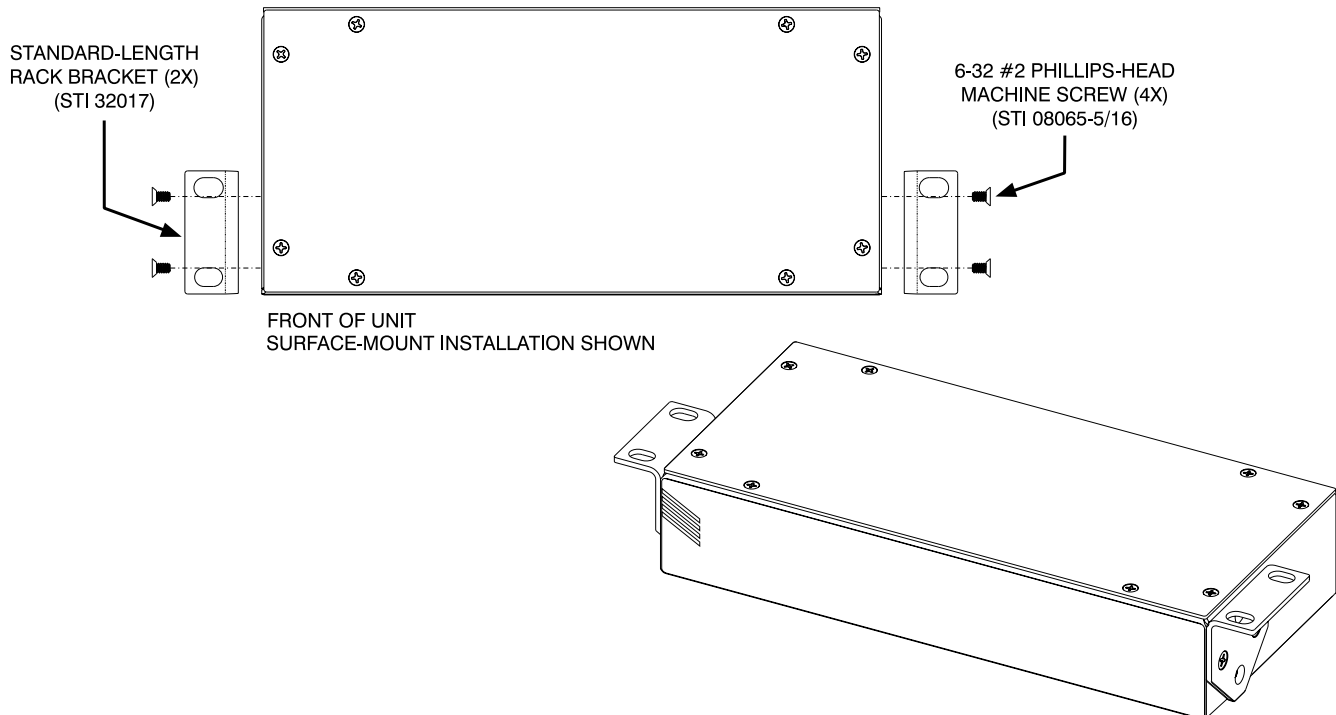
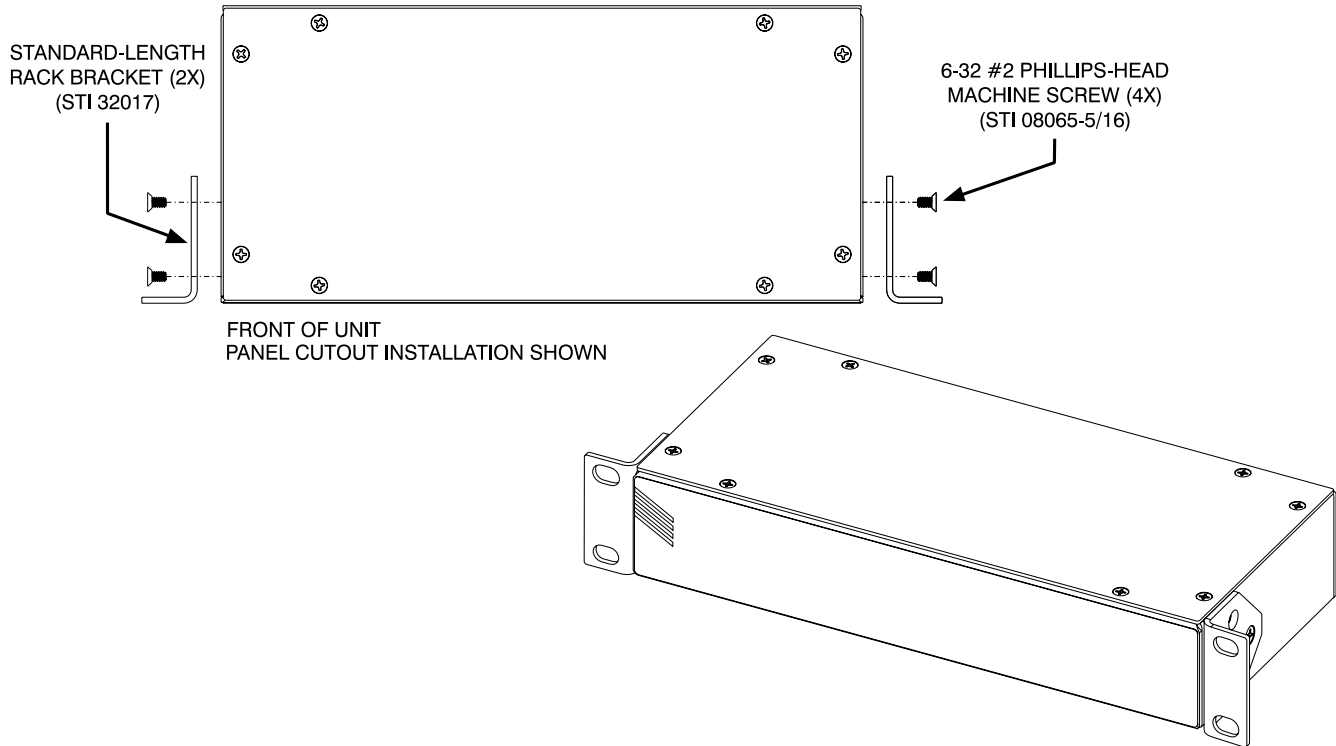
RMBK-13 allows one unit to be mounted in the center of one space (1U) of a standard 19-inch rack

DC Power Supply Option: Studio Technologies' PS-DC-02 (100-240 volts, 50/60 Hz, input; 12 volts DC, 1.5 A, output), purchased separately

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

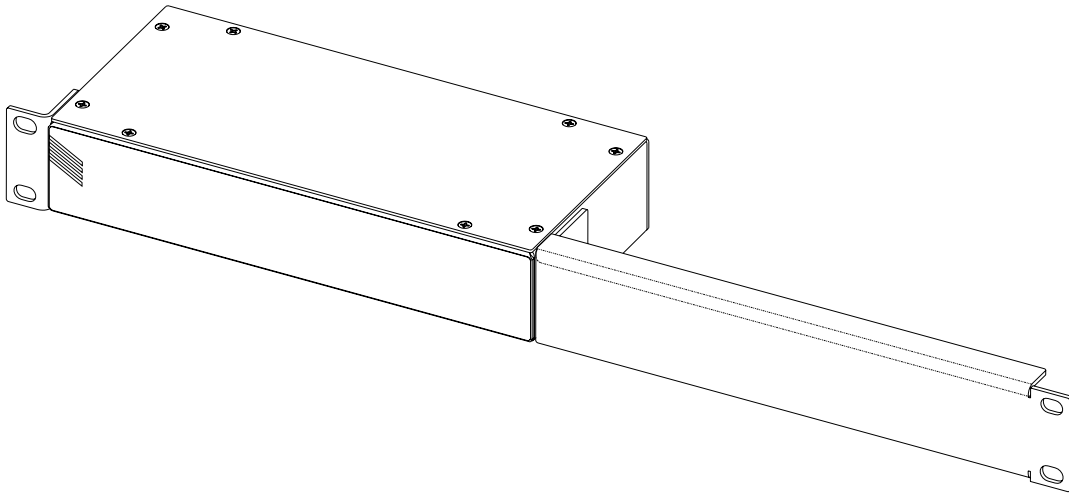
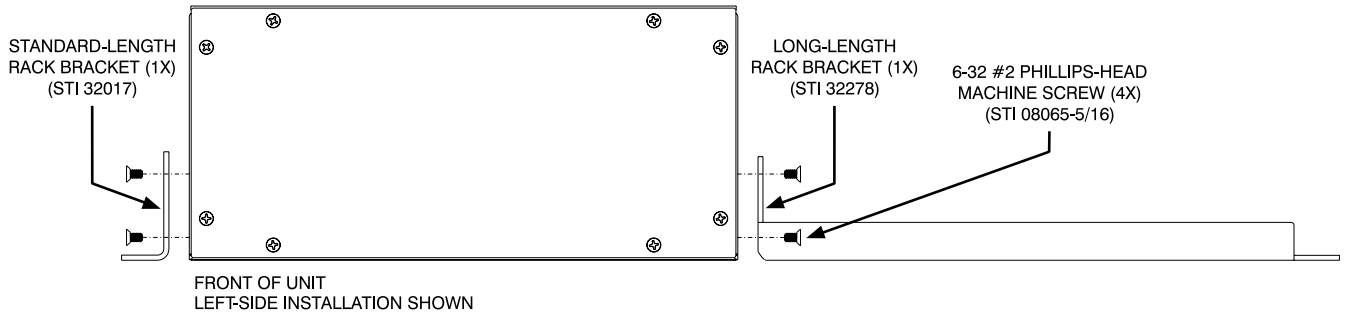
Appendix A—Graphical Description of the Installation Kit for Panel Cutout or Surface-Mounting Use (Order Code: *RMBK-10*)

This installation kit is used for mounting one Model 543D unit into a panel cutout or flat surface.



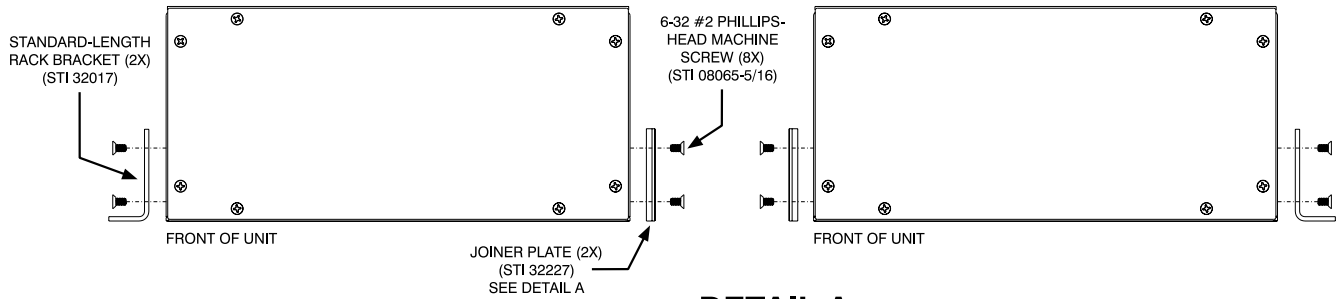
Appendix B—Graphical Description of Left- or Right-Side Rack-Mount Installation Kit for One “1/2-Rack” Unit (*Order Code: RMBK-11*)

This installation kit is used for mounting one Model 543D unit into one space (1U) of a 19-inch equipment rack. Unit will be located on the left- or right-side of the 1U opening.

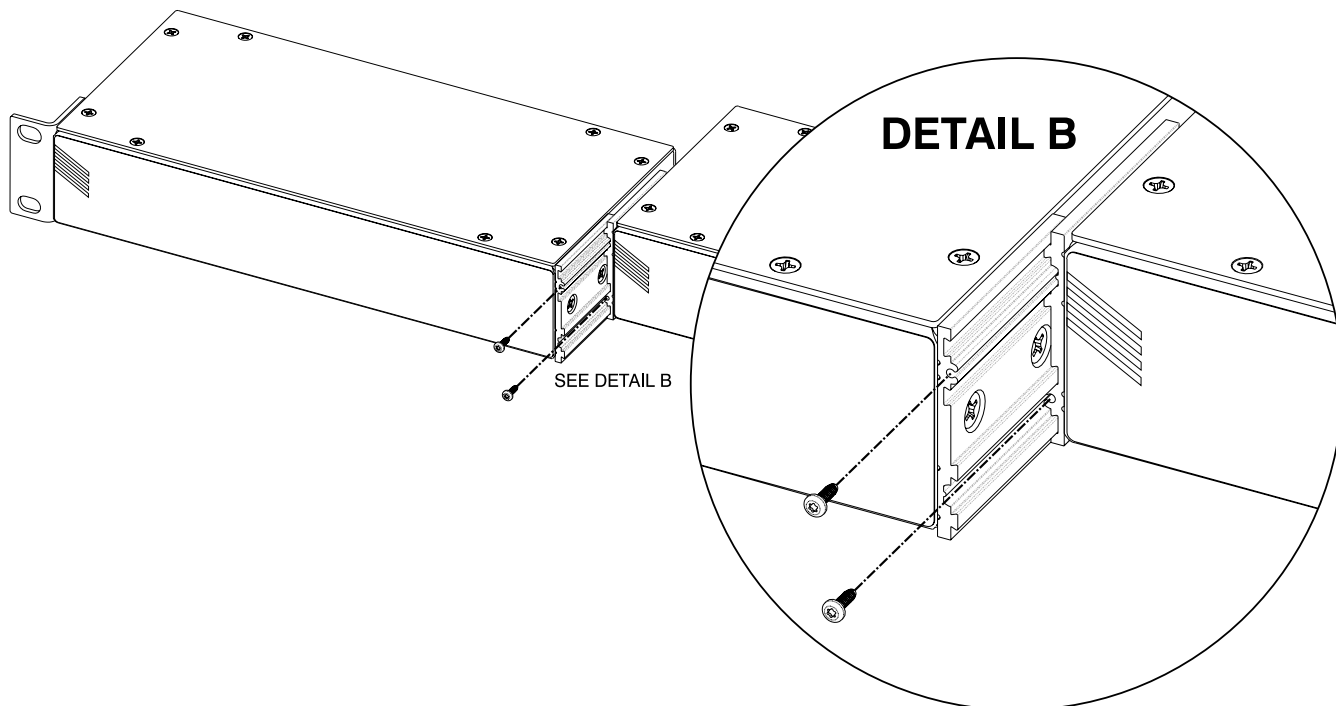
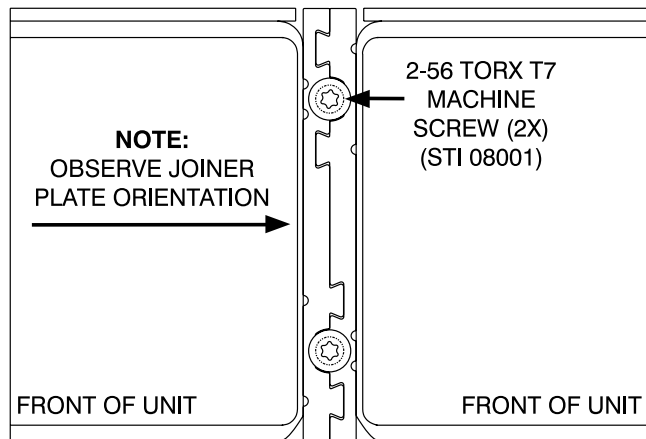


Appendix C—Graphical Description of Rack-Mount Installation Kit for Two “1/2-Rack” Units (*Order Code: RMBK-12*)

This installation kit can be used to mount two Model 543D units or one Model 543D unit and another product that is compatible with the RMBK-12 (such as the Studio Technologies’ Model 5421 Dante Intercom Audio Engine) into one space (1U) of a 19-inch equipment rack.



DETAIL A



Appendix D—Graphical Description of Center Rack-Mount Installation Kit for One “1/2-Rack” Unit (*Order Code: RMBK-13*)

This installation kit is used for mounting one Model 543D unit into one space (1U) of a 19-inch equipment rack. Unit will be located in the center of the 1U opening.

