

# **Model 48D Dante® Bridge**

## **User Guide**

Issue 2, July 2018

This User Guide is applicable for serial numbers M48D-00151 and later with application firmware 1.1 and later and Dante firmware 1.0.0 (UltimoX4 4.1.2.1)

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# Revision History

**Issue 2, July 2018:**

1. Added additional content.

**Issue 1, July 2018:**

1. Initial release.

# Introduction

The Model 48D Dante® Bridge provides a simple yet high-performance means of interconnecting, or “bridging,” Dante audio signals associated with two independent local-area-networks. The unit allows up to four audio channels to pass in each direction. Internal circuitry provides timing and bit-depth correction to ensure that audio signal integrity is maintained.

Dante audio-over-Ethernet has found wide acceptance as a network “backbone” due to its ease of use, excellent audio performance, strong interoperability, and wide adoption by a large number of equipment manufacturers. However, interconnecting audio signals on independent local-area-networks that support Dante can present a challenge. The Model 48D makes that a simple task to implement. Interconnecting a Model 48D with two Ethernet connections, along with a minimal amount of configuration, is all that’s required to make the unit part of a sophisticated, networked audio system.

The Model 48D can be powered by Power-over-Ethernet (PoE) or an external source of 12 volts DC. Standard connectors are used for the Ethernet and DC power interconnections. The Model 48D’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 rack-mounting kits one or two Model 48D units can be mounted in a single space (1U) of a standard 19-inch rack enclosure. The unit is built to professional standards and is intended for demanding 24-hour operation.

The Dante Controller software application can be used to configure all Dante network and audio parameters. Front-panel LED indicators, an LCD display, and five push-button switches are provided to view and revise selected operating parameters. The Model 48D is compatible with the Dante Domain Manager™ (DDM) software application and is compliant with AES67 digital audio signals.



Figure 1. Model 48D “throw-down” front view



Figure 2. Model 48D back view

## Dante Audio-over-Ethernet

Audio data is sent to and received from the Model 48D using the Dante audio-over-Ethernet media networking technology. Two separate network interfaces allow completely independent configurations. Audio signals with a sample rate of 44.1, 48, 88.2, and 96 kHz and a bit depth of up to 24 are supported. Up to four audio channels in each direction can pass (be “bridged”) between the Model 48D’s two network interfaces. (Four channels at 48 kHz sample rate and two channels at a sample rate of 96 kHz.)

Sample rate converter (SRC) integrated circuits ensure that audio that enters on one network interface exits the corresponding network interface with correctly-aligned digital audio information. Each interface has four Dante input (receiver) and output (transmitter) channels. They are associated on a one-to-one basis with the channels both interfaces. For example, input 1 on Network A is associated with output 1 on Network B. Routing (subscribing) of the Dante input and output channels to other devices can be performed using the Dante Controller software applications.

## Applications

The Model 48D’s primary application is to interconnect audio channels associated with two independent networks that are supporting Dante-compliant equipment. Up to four channels of audio in each direction can be “bridged” between each network. Each Dante network can have its own master clock, bit depth, and sample rate. Circuitry within the Model 48D ensures that the audio signals can pass between the networks with minimal degradation to performance. The Model 48D’s two network

ports are fully metallically isolated and share very little network data. This helps to ensure that the risk of security issues is minimized. Only uncompressed PCM digital audio signals pass, by way of sample-rate-converter (SRC) integrated circuits, between the two network interfaces.

The most basic application for the Model 48D is to allow up to four audio channels on two independent Dante networks to be interconnected — there’s really no simpler means of interconnecting Dante audio channels from between two separate networks. With standard connectors and PoE power, setup can be completed in just a few minutes. This makes Model 48D units effective in both fixed and portable applications. Ideal uses would include stadiums, concert venues, media production studios, and education facilities where “guests” frequently need to interconnect their Dante equipment with “house” resources. One of the Model 48D’s network connections can be secured while the other remains “open” for guest use.

As the number of mobile broadcast facilities that utilize Dante-compliant equipment increases so does the need to interconnect them with a venue’s resources. But maintaining isolation between the two networks can be important for reasons of both signal-integrity and security. In just minutes the Model 48D can allow audio signals in both directions to be traversing the two networks.

The Model 48D can also find use within a single Dante network. The unit’s ability to link Dante audio channels that have different clocking, bit depth, and sample rate characteristics can be valuable. For example, one piece of equipment may only

support a sample rate of 96 kHz, while the other devices connected to the network only support 48 kHz. In this situation the Model 48D would allow two channels in each direction to interconnect, while still maintaining the required 96 kHz and 48 kHz sample rates. In this application it's interesting to note that both of the Model 48D's Ethernet ports would be connected to the same local-area-network (LAN).

The Model 48D supports a maximum of four audio channels in each direction which can seem to be a significant limitation. But this small channel count should prove very adequate for many applications. For example, live-event venues may only need to interchange a few audio channels with OTA (over-the-air) or web streaming mobile broadcast facilities. The venue might send one or two channels of scoreboard, replay, or stadium announcer audio. While the mobile facility may only need to return program or "on-air" feeds to the "house" audio console.

## **DDM and AES67**

The Model 48D is compliant with the Dante Domain Manager software application. However, there is no requirement that each of the two network interfaces be part of a DDM domain. One of the Model 48D's network interface's can utilize the security resources of DDM while the other remains "open." Each of the Model 48D's network interface's can be configured to support, or not support, AES67 digital audio signals. This allows a Model 48D to serve in a unique Dante-to-AES67 bridge function. However, note that when AES67 support is enabled for an interface the sample rate will be fixed at 48 KHz.

## **Pro Audio Quality**

The Model 48D's audio circuitry was designed to meet the demands of professional audio applications. Audio data passing between the two network interfaces remains within the digital domain. To achieve audio data synchronization between the two networks high-performance sample-rate-converter (SRC) integrated circuits are utilized. This allows compatibility between widely-divergent sample rates while maintaining low-distortion, low-noise, and high headroom.

## **Status LEDs and LCD Display**

On the front panel the Model 48D provides four LED indicators, a 2-line back-lit LCD display, and five pushbutton switches. Two of the LEDs indicate the status of the input power sources. The other two LEDs are associated with the two network interfaces. The LCD display allows a number of operating conditions to be monitored, including firmware version numbers, network parameters, and Dante operating characteristics. The pushbutton switches can be used to select which menu page is displayed as well as allowing key network parameters to be revised. These include the IP configuration methods, IP addresses, and subnet mask values. Six LEDs on the back panel indicate the status of the two network connections and associated Dante interfaces.

## **Ethernet Data and Power Source**

The Model 48D interconnects with two independent local-area-networks (LANs) using standard 100 Mb/s twisted-pair Ethernet signals. The physical connections are made by way of two Neutrik® etherCON RJ45 receptacles. While compatible with standard

RJ45 plugs, etherCON allows a ruggedized and locking interconnection for harsh or high-reliability environments. The Model 48D's operating power can be provided by a Power-over-Ethernet (PoE)-compliant Ethernet signal that's connected to the Model 48D's Network A interface. For network management purposes the interface will report to the power sourcing equipment (PSE) that it is a class 1 (very low power) device. If PoE is not available the unit can also be powered using an external source of 12 volts DC.

## Simple Installation

The Model 48D 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. Optional rack-mounting installation kits are available to allow one or two units to be mounted in one space (1U) of a standard 19-inch rack enclosure. As previously mentioned the Model 48D uses standard connectors to allow fast and convenient interconnections. Two Ethernet signals are connected using Neutrik etherCON RJ45 receptacles. Operation will commence immediately if Power-over-Ethernet (PoE) is available on the Ethernet connection associated with the Network A interface. A 12 volt DC power source can also be connected by way of a 4-pin XLR connector.

## Future Capabilities and Firmware Updating

The Model 48D was designed so that its performance and capabilities can be enhanced in the future. A USB connector, accessible on the unit's back panel, allows

the main firmware (embedded software) to be updated using a USB flash drive. To implement its Dante interfaces the Model 48D uses two of Audinate's Ultimo™ integrated circuits. The firmware in these integrated circuits can be updated via the unit's two Ethernet connections, helping to ensure that the Dante capabilities remain up to date.

## Getting Started

In this section signal interconnections will be made using the connectors located on the Model 48D's back panel. Two Ethernet data connections will be made using either standard RJ45 patch cables or etherCON protected RJ45 plugs. The unit can be powered using an Ethernet connection that provides Power-over-Ethernet (PoE). If that is not available 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 Model 48D Dante Bridge and a printed copy of this guide. If the specific application requires a source of 12 volts DC it must be provided separately. A compatible power supply, the Studio Technologies' PS-DC-02, is available as an option.

If one or two Model 48D units are going to be mounted in a 19-inch equipment rack then an optional rack-mount installation kit is required. Specific kits are available for rack-mounting one or two Model 48D units. If one or more rack-mount kits were purchased they would typically have shipped in separate cartons.

## Locating the Model 48D

The location of the Model 48D will primarily depend on being within the 100-meter (325-foot) twisted pair Ethernet cable limitation. Each of the two Ethernet ports on the Model 48D would have to be within that length limit. But that requirement can be overcome by using fiber-optic interconnects between the Model 48D-related Ethernet switches and the other Ethernet switches in the local-area-networks (LANs).

## Protecting the Enclosure

The Model 48D is shipped as a self-contained unit suitable for portable use or placement in a semi-permanent location. Installed on the bottom of the chassis are screw-on “bump on” protectors (also known as “rubber feet”). These are useful if the unit is going to be placed on surfaces where scratching of either the Model 48D or the surface material could take place. The “feet” can be removed, without the use of a tool, when rack- or custom-mounting the unit.

## Rack Mounting

For some applications it might be desirable to mount one or two Model 48D units into one space (1U) of a 19-inch rack enclosure. Rack-mount installation kits, purchased separately, are available from Studio Technologies. The following sections provide details on how to use the rack-mount kits. Refer to Appendices B and C of this guide for graphical descriptions of how to attach the rack-mount kits.

### Rack-Mounting One Model 48D

Rack-mount installation kit RMBK-11 is used to allow rack mounting of one Model 48D unit. The kit contains one standard

rack bracket, one long rack 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 “bump on” protectors from the bottom of the Model 48D’s chassis. They can be removed using one’s fingers to rotate them counterclockwise; no tool is required. It’s probably a good idea to store the four “bump on” protectors for possible later use.

With assistance from a #2 Phillips-tip screw driver, use the machine screws to attach the standard and long rack brackets to the sides of the Model 48D’s enclosure. The screws will mate with the threaded fasteners that can be seen on the sides of the Model 48D’s enclosure, near the front of the unit.

Mount the standard rack bracket to the left side of the Model 48D (when viewed from the front) if the unit needs to be located on the left side of the rack enclosure. Then mount the long rack bracket to the right side of the Model 48D. Mount the brackets in the opposite orientation should the Model 48D need to be located on the right side of the rack enclosure.

Once the “bump on” protectors have been removed and the standard and long rack brackets have been installed the Model 48D 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 48D Units

Rack-mount installation kit RMBK-12 is used to allow one-space (1U) rack

mounting of two Model 48D units. The kit contains two standard rack 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 “bump on” protectors from the bottom of each chassis. They can be removed using one’s fingers to rotate them counterclockwise; no tool is required. Store the eight “bump on” protectors for possible later use.

With assistance from a #2 Phillips-tip screw driver, use two of the 6-32 machine screws to attach one of the standard rack brackets to the left side (when viewed from the front) of one of the Model 48D units. The screws will mate with the threaded fasteners that can be seen on the sides of the Model 48D’s enclosure, near the front of the unit. Using two more of the 6-32 machine screws, attach one of the joiner plates to the right side of that same Model 48D unit.

Again using two of the 6-32 machine screws, attach the second standard rack bracket to the right side of the second Model 48D unit. Using the final two 6-32 machine screws, attach the second joiner plate to the left side of the second Model 48D 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 driver, use the two 2-56 machine screws 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.

Once the “bump on” protectors are removed and the assembly created, the two Model 48D units are 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 Connections

The Model 48D has two network connections called Network A and Network B. These are associated with the two networks that are going to “bridged” by the Model 48D. Each network connection needs to support 100BASE-TX (100 Mb/s over twisted-pair) for the Model 48D’s Dante audio-over-Ethernet connectivity. 10BASE-T connections are not sufficient for Model 48D operation. 1000BASE-T (“GigE”) connections are not supported unless they can automatically “fall back” to 100BASE-TX operation.

An Ethernet connection that supports Power-over-Ethernet (PoE) is preferred for connecting to Network A as it will provide both data and operating power for the Model 48D. To support power management functionality on an associated PoE switch (PSE) the Model 48D’s Network A connection will enumerate itself as a PoE class 1 (very low power) device. If PoE is not available on Network A an external 12 volt DC power source can be connected. This will be discussed in a later subsection of the guide.

No problems will occur if an Ethernet signal that supports Power-over-Ethernet (PoE) is connected to the RJ45 receptacle associated with the Model 48D's Network B. It will not enumerate (announce) itself to the PoE-enabled switch as a PoE device nor will it supply power to the Model 48D. Only if a PoE-supporting Ethernet signal is connected to Network A will operating power be supplied.

The Model 48D's Ethernet connections are made by way of two Neutrik etherCON protected RJ45 receptacles that are located on the back panel of the Model 48D. This allows connections by way of cable-mounted etherCON plugs or standard RJ45 plugs. The Model 48D's Ethernet interfaces support auto MDI/MDI-X and, as such, using crossover or "reversing" cables is not required.

## 12 Volt DC Input

As previously discussed in this guide, an Ethernet connection to Network A that supports Power-over-Ethernet (PoE) can serve as the Model 48D's power source. Alternately, a source of 12 volt DC power can be connected to the Model 48D. For redundancy, both the PoE and 12 volt DC sources can be connected at the same time. If this is the case then power will be drawn only from the PoE source. If the PoE source that's connected to Network A becomes inoperable the 12 volt DC source will provide the Model 48D's power with no interruption in operation. (Of course, normal operation would cease if PoE power and data transport were both to fail on the Ethernet connection made to Network A.)

A source of 12 volts DC can be connected to the Model 48D by way of a 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 with any source over the range of 10 to 18 volts DC. The Model 48D requires 150 milliamperes 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 PS-DC-02 power supply is available from Studio Technologies. Its AC mains input allows connection to a 100-240 volt, 50/60 Hz source and its 12 volt DC, 1.5 amperes maximum output is terminated on a 4-pin female connector.

## Configuration

The Dante Controller software application will typically be used to review and make changes to the configuration parameters associated with the Model 48D's two Dante network interfaces. The Model 48D does not provide a separate menu system, e.g., one that is accessible using a web browser. Alternatively, the Model 48D's front-panel LCD display and pushbutton switches allow some configuration parameters to be viewed and, if desired, revised. These directly relate to the most important network connectivity parameters. This ability to locally make changes can be very useful when initially making connections to the two network interfaces.

Model 48D configuration settings are made and stored within each of the two Dante interface circuits. They are fully independent and need to reflect the operating parameters required for each network. The set of configuration parameters is relatively limited and incorporates the entire range of Model 48D functions.

As previously discussed, the Model 48D's LCD display and pushbutton switches allow changes to both of the unit's Dante network interfaces. But it's important to note that when using Dante Controller to make changes to the operation of a specific network interface one must run a designated instance of the application. A personal computer that's running Dante Controller would have to have its associated local-area-network interface connected, by way of a port on an Ethernet switch, to the applicable RJ45 receptacle. This is because the Model 48D provides two fully-isolated Dante interfaces.

## Configuration using Dante Controller

The Dante Controller software application is available for download free of charge at [www.audinate.com](http://www.audinate.com). Versions are available to support Windows® and OS X® operating systems. Using Dante Controller the Model 48D's two network interfaces can be configured for their desired network parameters, performance choices, and channel subscriptions (routing). The configuration settings will be stored in non-volatile memory within the Model 48D's circuitry. As such, power-down and power-up activities will not impact the unit's settings. The Model 48D uses two Ultimo 4-input/4-output integrated circuits to implement Dante networking.

### Network Parameters

The method used to determine the network IP addresses can be selected with the choices of *Automatic* or *Manual*. Details about the automatic process can be found in the Technical Notes section of this guide. If *Manual* is selected a specific IP address can be entered along with the

subnet mask value. Typically a reboot of an interface is required for new network interface values to be utilized.

### Sample Rate

The sample rate of the Dante interface can be selected with choices of *44.1 kHz*, *48 kHz*, *88.2 kHz*, and *96 kHz*. Several pull-up/pull-down value configuration choices are also available. The selected sample rate for the two Dante interfaces does not have to be the same. Circuitry within the Model 48D will correctly interconnect different sample rates. If both interfaces are selected for 44.1 or 48 kHz four audio channels can be bridged between the Model 48D's network interfaces. If either or both network interfaces are selected for a sample rate of 88.2 or 96 kHz then only two audio channels can be bridged between the two network interfaces.

### AES67 Support

The ability to support AES67 can also be selected with choices of *Disabled* or *Enabled*. If selected for *Enabled* the sample rate is automatically configured for 48 kHz, overriding any other value. This is because 48 kHz is the only sample rate that can be supported when a Dante interface is compliant with AES67.

### Audio Channel Subscriptions

To integrate the Model 48D into an actual application requires that the transmitter and receiver audio channels associated with Network A and Network B be routed (inter-connected) with other Dante-compatible devices. This is typically performed with the Dante Controller application. 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 the Ultimo integrated circuit limits the number of Dante flows to four, two in each direction. These can either be unicast, multicast, or a combination of the two. The Model 48D uses two Ultimo integrated circuits and, as expected, each is limited to two flows for transmitter channels and two flows for receiver channels.

Each Model 48D has four Dante output (transmitter) channels and four Dante input (receiver) channels. The four Dante output channels on each interface must be routed to the desired Dante input channels on related devices. The four receiver channels associated with each of the Model 48D's Dante interfaces must be assigned to inputs on the desired destinations.

As previously discussed in this guide, if the sample rate for either or both network interfaces has been selected for 88.2 or 96 kHz then only two Dante audio channels can be bridged between the two network interfaces. This limitation is due to the Ultimo integrated circuit's ability to only support two audio channels when its sample rate has been selected for 88.2 or 96 kHz. If selected to this configuration only two transmitter and two receiver channels will display in Dante Controller's routing screen for that network interface. That makes sense and clearly indicates that only two channels are available for bridging to and from the Model 48D's other network interface. However, if the other network interface has been selected for a sample rate of 44.1 or 48 kHz then Dante Controller's routing screen will, for that interface, still display four transmitter and four receiver channels. However, channels 3 and 4 won't be utilized by the Model 48D. This can seem to be somewhat confusing but an

explanation should provide clarity. In this situation while output (transmitter) channels 3 and 4 will have their names displayed and are able to be routed (subscribed) to other Dante input (receiver) channels, they will never supply audio data. And while output (transmitter) channels on other Dante devices can be routed (subscribed) to input (receiver) channels 3 and 4 on the Model 48D's network interface, any audio data that is supplied on those channels will be ignored. In conclusion, when either or both network interfaces on a Model 48D are selected for a sample rate of 88.2 or 96 kHz then any references to channels 3 and 4 can be ignored. Routes (subscriptions) should not be made to those channels as no audio data can be sent to or received from them.

### **Names for Network A**

The connection for Network A has a default Dante device name of **ST-M48D-A-** followed by a unique suffix. The suffix identifies the specific Model 48D that is being configured. The suffix's actual alpha and numeric characters relate to the MAC address of the Ultimo integrated circuit that's present. The four Dante input (receiver) channels have the default names of **Ch1 In**, **Ch2 In**, **Ch3 In**, and **Ch4 In**. The four Dante output (transmitter) channels have the default names of **Ch1 Out**, **Ch2 Out**, **Ch3 Out**, and **Ch4 Out**. Using Dante Controller these names can be revised as appropriate for the specific application.

### **Names for Network B**

The names for Network B are essentially the same as what was described for Network A. The exception being that Network B has a default Dante device

name of **ST-M48D-B-**, again followed by a unique suffix that's based on the MAC address of the Ultimo integrated circuit. The four Dante input (receiver) channels have the default names of **Ch1 In**, **Ch2 In**, **Ch3 In**, and **Ch4 In**. The four Dante output (transmitter) channels have the default names of **Ch1 Out**, **Ch2 Out**, **Ch3 Out**, and **Ch4 Out**. Use Dante Controller to revise the names as would be appropriate for the specific application.

## Configuration using the Front-Panel Buttons and Display

Some applications may benefit from being able to configure key network parameters using the pushbutton switches in conjunction with the LCD display. This allows each network interface to be independently configured without requiring the use of Dante Controller. This ensures that both Model 48D network ports can be accessed under a variety of network conditions. In most cases it will be simpler to use Dante Controller but this alternate method isn't much more time consuming.

The structure of the front-panel menu system is shown in Appendix A located at the back of this guide. Review the appendix first before attempting to make configuration changes. Navigating to either the **Net A IP Config** or the **Net B IP Config** screens will cause the currently-enabled method for obtaining the IP address and subnet mask to be shown. If a change is desired press the **Enter** button and both choices, *Automatic* and *Manual*, will be displayed. Use the left and right buttons to select the desired method. Then press the **Enter** button for the choice to be stored. If *Automatic* is selected then a prompt will display asking if a restart is desired.

A restart is required for a change to become active. If a restart is requested then only that specific network interface will be impacted. That one Dante network connection will be terminated followed by a restart which will include either DHCP or link-local being used to obtain the IP address and subnet mask.

If *Manual* was selected for the configuration method and the **Enter** button was pressed the menu will change to the **IP Address** screen which will display the currently-stored fixed or "static" IP address. This value can be revised using the left, right, up, and down pushbutton switches. When the desired IP address is displayed press the **Enter** button to store the value. The menu system will automatically move on to the **Subnet Mask** screen, displaying the currently-stored value. Use the left, right, up, and down pushbuttons to make any desired changes and then press the **Enter** button. A prompt will then display asking if a reboot is desired. If **Yes** is selected followed by pressing **Enter** button that specific interface will reboot and the stored IP address and subnet mask values will be used.

If the **NET A IP Config** or the **Net B IP Config** screen is already enabled for *Manual* then the IP address and subnet mask values for that interface can be directly edited. Moving to the **IP Address** screen will show the currently-active IP address. And since the configuration method is *Manual* then this value is the same as the one that is stored in memory. Press the **Enter** button and the edit mode will be enabled. Use the left, right, up, and down pushbuttons to make any desired changes and then press the **Enter** button. The menu system will automatically move

on to the **Subnet Mask** screen which will display the currently-stored value. Again use the pushbuttons to make any desired changes followed by pressing the **Enter** button. A prompt will then display asking if a reboot is desired. Select **Yes** to reboot the interface using the revised IP address and subnet mask values.

Whenever an interface determines that a configuration change has been made an indication is shown in the LCD display's lower-right corner. Consisting of **[!]**, it will only stop being displayed after that specific interface has been reboot or after the entire Model 48D has been rebooted. Operation will continue when **[!]** displays but it's likely that the operating IP address and subnet mask values will not be the same as those stored in the Model 48D.

Note that the Model 48D will display **[!]** even if a change was made and then "unmade." The firmware is not sophisticated enough to determine that a parameter that was changed has been returned to its original value. Only a reboot will cause the **[!]** to no longer be displayed.

## Operation

At this point the Model 48D should have Ethernet connections made to the two network interfaces. Depending on the capabilities of the Ethernet connection made to Network A, a source of 12 volt DC power may also have been connected. Using the Dante Controller software and/or the front-panel LCD display and pushbutton switches the network-related configuration settings should have been made. The audio sample rate and AES67 support status for each network interface

should have been selected using Dante Controller. For each network interface the four Dante output (transmitter) channels and four Dante input (receiver) channels should have been routed (subscribed) using Dante Controller.

## Initial Operation

The Model 48D will begin functioning within a minute of its power source being connected. As previously discussed, the unit's power source can be provided by Power-over-Ethernet (PoE) on Network A 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 to Network A, uninterrupted operation will continue using the external 12 volt 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 the Model 48D receiving power the status LEDs will light in various manners. The Ethernet and Dante interface status LEDs, located below the RJ45 receptacles on the back panel, will light in various ways. On the front panel the four status LEDs and the LCD display will light in a defined sequence. Once this startup sequence has completed the unit will begin operation.

Upon power up the front-panel LCD display will first show the Studio Technologies logo, followed by the product name and then the main firmware version number. After that the Model 48D's menu system will be active with the network-related fields displaying **Net Starting...** as the Dante connections are being established.

The manner in which the back-panel LINK/ACT, SYS, and SYNC LEDs light will depend on the characteristics of the connected Ethernet signals and the configuration of the unit's Dante interfaces. On the front panel the user is presented with four status LEDs, a two-line (18 characters-per-line) back-lit LCD display, and five pushbutton switches. These resources are simple to understand and should prove to be useful during operation and troubleshooting. Their operation will be highlighted in the following sections of this guide.

To protect the long-term integrity of the LCD display a "screen saver" mode will always begin 30 seconds after the last press of any of the pushbutton switches. This mode consists of an alternating display of the Studio Technologies logo, the Dante device name for Network A, and the Dante device name for Network B. So that an operator will always be able to return a Model 48D to a known display location, simultaneously pressing the left and right pushbutton switches will always return the unit to its screen saver mode.

## Ethernet and Dante Status LEDs

There are three status LEDs located below each etherCON RJ45 receptacle on the Model 48D's back panel. They perform identical functions for the two Dante interfaces. A LINK/ACT LED will light green whenever an active connection to a 100 Mb/s Ethernet network port 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 interfaces and their associated audio-over-Ethernet networks. The SYS LEDs will light red upon Model

48D power up to indicate that the Dante interfaces are not ready. After a short interval they will light green to indicate that their respective Ultimo integrated circuit is ready to pass audio data with another Dante device. The SYNC LEDs will light red when their associated Ethernet interface is not synchronized with a Dante network. They will light solid green when their associated interface is fully synchronized with the connected Dante network and an external clock source (timing reference) is being received. A SYNC LED will slowly flash green if its associated Dante interface is serving as the clock master for the connected Dante network.

## Front-Panel Status Indicators

There are four LED indicators visible on the Model 48D's front panel. Two of the LEDs are associated with the status of the operating power of the unit. The other two provide an indication of the network status and Dante clock operation of the two Ethernet interfaces.

The LED labeled PoE will light green whenever the unit is operating using power provided by a PoE Ethernet connection made to the Network A connection. The LED labeled DC will light green when DC is present and meets or exceeds 10 volts DC. If the DC input voltage is between 9 and 10 volts the DC LED will flash to indicate a low-voltage condition. If both LEDs are lit this will indicate that redundant power sources are present, however in this situation PoE power will always supply the Model 48D with its operating power.

The two network LEDs provide information relating to operation of the two network interfaces. They are, as expected, labeled A and B. A network LED that is lit red

indicates that no valid network connection is present on its respective network interface. An LED that is lit green indicates that the associated network has a successful Dante connection and another device is serving as the master clock source. If the network LED is flashing green then it will indicate that both a valid Dante connection is established and that this specific interface is serving as the Dante network's master clock source.

## How to Identify a Specific Model 48D

The Dante Controller software application offers an identify command that can be used to help locate a specific Model 48D network interface. When the identify command is selected the applicable network LED on the Model 48D's front panel will flash. The backlight on the front-panel LCD display will also flash. On the back panel the SYS and SYNC LEDs, located directly below the relevant etherCON receptacle, will slowly flash green. After a few seconds the identification patterns will cease and normal Model 48D LED and LCD display back-lighting operation will resume. Audio performance will not be impacted by the use of the identify command. As such it's perfectly acceptable to use the identify command at any time.

## Front-Panel LCD Display

The front-panel LCD display can provide a number of useful pieces of information as well as being used to configure selected Model 48D parameters. Refer to Appendix A at the end of this guide for a detailed graphical explanation of the menus. The functioning of much of the front-panel LCD display and pushbutton switches has been

previously discussed in the guide. The Configuration section provided details on how the pushbuttons, in conjunction with the LCD display, can be used to configure the IP address and subnet mask values. Earlier paragraphs in this section (Operation) have discussed what happens when the unit begins operation due to power being applied or a reboot command being initiated. The following short paragraphs provide additional information about specific menu pages. Descriptions will only be provided for Network A but will also apply, as applicable, to the menu pages provided for Network B.

### Net A Dante Name

This is a display-only field that indicates the Dante name of the associated Dante interface. It typically is thought of as the Dante device name. Revising the name can be performed using the Dante Controller application. Note that in the case of the Model 48D there are two Dante interfaces so, in a sense, one unit has two independent Dante device names.

### Net A IP Config

This field displays the method to be used for establishing the IP address and subnet mask values for the Ethernet interface associated with Network A. The available methods are *Automatic* and *Manual*. A button-press sequence can be used to change this configuration. Refer to the Configuration section of this guide for details. Revising the configuration method can also be performed using Dante Controller.

### Net A IP Address

This field displays the IP address actively being used by the Ethernet interface associated with Network A. This value will be provided by the DHCP or link-local process

if the *Automatic* IP configuration method has been selected. Dante Controller can be used to change a fixed (“static”) IP address. A button-press sequence can also be used to change this value if the *Manual* IP configuration method has been selected. Refer to the Configuration section of this guide for details.

### **Net A Subnet Mask**

This field displays the subnet mask value actively being used by the Ethernet interface associated with Network A. This value will be provided by the DHCP or link-local process if the *Automatic* IP configuration method has been selected. Dante Controller can be used to change a fixed (“static”) subnet mask value. A button-press sequence can also be used to change this value if the *Manual* IP configuration method has been selected. Refer to the Configuration section of this guide for details.

### **Net A Sample Rate**

This is a display-only field that will show the sample rate active for the Network A Dante interface. The possible rates will be *44.1kHz*, *48kHz*, *88.2kHz*, and *96kHz*. If *AES67* mode is enabled the only valid sample rate will be 48 kHz. Selecting the active sample rate is performed using the Dante Controller application.

### **Net A AES67**

This is a display-only field that shows the status of the AES67 Mode for Network A. The possible values are *Disabled* and *Enabled*. Selecting the AES67 Mode is performed using the Dante Controller application.

### **Main Firmware Ver**

This is a display-only field that shows the version of the main firmware (embedded software) that is currently being used in the Model 48D’s microcontroller integrated circuit. This is not related to the version of firmware associated with the two Dante Interfaces. Additional details regarding the main firmware can be found in the Technical Notes section of this guide.

### **Net A Product Ver**

This is a display-only field that shows the version of the Dante firmware (embedded software) that is currently being used in the Ultimo integrated circuit associated with Network A. This is not related to the version of the main firmware associated with the Model 48D’s microcontroller integrated circuit. Additional details regarding the Dante firmware can be found in the Technical Notes section of this guide.

### **Reboot**

This menu choice allows the Model 48D’s microcontroller and Dante network interfaces to be rebooted (restarted). This is essentially the same as if the unit had its power temporarily removed and then re-applied. This capability was provided primarily to support troubleshooting activities. Performing a reboot will not typically create any issues but will interrupt normal Model 48D operation for approximately one minute.

# Technical Notes

## IP Address Assignment

By default each of the Model 48D's Ethernet interfaces will attempt to automatically obtain an IP address and associated settings using DHCP (Dynamic Host Configuration Protocol). If a DHCP server is not detected on an interface then 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. 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 present on the associated LAN.

Using the Dante Controller software application allows the Model 48D's two Ethernet interfaces to have their IP address and related network parameters independently set to either automatically obtain an IP address and related parameters or to utilize a manual (fixed or "static") configuration. While selecting manual is a more-involved process than simply letting DHCP "do its thing," if fixed addressing is necessary or desired this capability is available. There is no problem allowing one interface to obtain its network parameters automatically while the other interface has been configured with fixed network parameters.

The Operation section of this guide also provides details on how to use the front-panel pushbutton switches and LCD display to view and configure the network parameters.

## Direct Device Interconnection

A technical limitation can arise when trying to directly interconnect two Dante-enabled devices whose Dante network capability is provided by the Ultimo integrated circuit. The Model 48D's two Dante interfaces each use an Ultimo "chip" and, as such, a direct interconnection between either of them and another device that also utilizes Ultimo won't result in a valid connection. An Ethernet switch is required to successfully interconnect two Ultimo-based devices directly with each other. (The technical reason relates to the need for the slight latency provided by an Ethernet switch.)

## Optimizing Network Performance

For best Dante audio-over-Ethernet performance connecting the Model 48D's two Ethernet interfaces to networks that support VoIP Quality-of-service (QoS) capability is recommended. This can 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](http://www.audinate.com)) for details on optimizing networks for Dante applications. Also, be certain to disable Energy-Efficient Ethernet (EEE) support on all Ethernet switch ports that are associated with Dante devices. Some implementations of EEE can incorrectly interpret that a connected device is not present and prevent proper Dante operation.

## Main Firmware Version

As part of the Model 48D's power-up sequence the unit's main firmware version number is indicated by way of the front-panel LCD display. In addition, using the

front-panel pushbutton switches and LCD display allows this information to be determined. The Operation section of this guide provides details on how to use the pushbutton switches. Knowing the Model 48D's firmware version can be useful when working with factory personnel on application support or troubleshooting situations.

## Main Firmware Update Procedure

It's possible that updated versions of the main firmware (embedded software) that runs the Model 48D's microcontroller (MCU or processor) integrated circuit will be released to add features or correct issues. Refer to the Studio Technologies' website for the latest main firmware file. The unit has the ability to automatically load and save revised files into the MCU's non-volatile flash memory by way of its USB interface. The Model 48D implements USB host functionality and provides access by way of a type A receptacle on the back panel. A standard USB flash drive is used to provide an updated MCU file that is named **M48D.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. The new firmware file will be saved in the root directory with a name of **M48D.bin**. Studio Technologies will supply the main 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 48D, the name of the zip file itself will include the file's version number. For example, a file named **M48Dv1r3MCU.zip** would indicate that version 1.3 of the main firmware

(**M48D.bin**) is contained within this zip file. Once the desired **M48D.bin** file has been stored in the root directory the flash drive will be ready for use.

To install a new main firmware file follow these steps:

1. Remove power from the Model 48D. This will entail removing the Ethernet connection from Network A if it is providing PoE power or removing the external source of 12 volts DC if that is being used. (Both must be disconnected if for some reason dual-power has been implemented.)
2. Identify the USB connector which is located on the right side of the back panel. It is labeled FIRMWARE UPDATE. Directly below the USB connector is a small hole that provides visual access to an LED indicator.
3. Insert the prepared USB flash drive into the USB connector.
4. Apply power to the Model 48D. Power can be provided by Power-over-Ethernet (PoE) associated with an Ethernet signal connected to Network A or from an external 12 volt DC source.
5. After a few seconds the Model 48D will run a "boot loader" program that will automatically load and save the new main firmware file (**M48D.bin**). This process will take 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 48D will restart using the newly-saved main firmware.

6. At this time the Model 48D is functioning with the newly-saved main firmware and the USB flash drive can be removed. But to be conservative, remove the power source first and then remove the USB flash drive.
7. Apply power to the Model 48D and observe the main firmware version number by viewing the front-panel LCD display upon power up. Ensure that this is the desired version is present.

Note that upon power being applied to the Model 48D if the USB flash drive doesn't have the correct file (**M48D.bin**) in the root folder no harm will occur. Upon power up the green LED located below the USB connector will flash on and off rapidly for a few seconds to indicate that a valid file was not found and then normal operation using the unit's existing main firmware will begin.

## Ultimo Firmware Update

As previously discussed in this guide, the Model 48D implements Dante connectivity using two 4-input/4-output Ultimo integrated circuits from Audinate. Firmware (embedded software) resides in each Ultimo device and implements the Dante functionality. It's technically possible for different versions of the Dante firmware to reside in the two interfaces. But that would not be desirable. The two devices should be loaded with the identical software versions, preferably the most recent.

The Dante Controller software application can be used to determine the version of the firmware (embedded software) residing in the two Ultimo devices. This information is also available using the front-panel menu system. The Dante firmware must be updated by way of the Model 48D's

two Ethernet connections; each interface must be independently updated. That's because, as previously stated a number of times, the two Model 48D's Dante interfaces are separate with limited connectivity between them. (Only digital audio signals pass between the Ultimo chips.)

The latest Dante firmware file is available on the Studio Technologies website. The Dante Firmware Update Manager (FUM) software application can be used to install the firmware. This program is available for download directly from Audinate ([www.audinate.com](http://www.audinate.com)). It's anticipated that an updated version of the Dante Controller software application will include an automated method of updating Ultimo firmware. It should offer a much simpler method of keeping the Ultimo firmware on the two Model 48D units current.

Typically, during the actual update process separate Ethernet connections from an Ethernet switch associated with the same local area network (LAN) would be made to the Model 48D's two RJ45 receptacles. Dante Firmware Update manager would then correctly identify these as two separate Dante devices and the firmware update process performed on each one.

Alternately, a single Ethernet connection could be made to one of the Model 48D's RJ45 receptacles and its firmware updated. After that update process has completed the Ethernet connection would then be physically moved to the second RJ45 receptacle and its firmware updated.

# Specifications

## Power Sources:

**Power-over-Ethernet (PoE):** class 1 (low power, ≤3.84 watts) per IEEE® 802.3af

**External:** 10 to 18 volts DC, 0.15 A maximum (can be powered by optional PS-DC-02)

## Network Interfaces: 2

**Type:** 100BASE-TX, twisted-pair Ethernet, Power-over-Ethernet (PoE) supported

**Data Rate:** 100 Mb/s (10 Mb/s and 1000 Mb/s “GigE” not supported)

## Network Audio Technology (each Network Interface):

**Type:** Dante audio-over-Ethernet

**AES67-2013 Support:** yes

**Dante Domain Manager (DDM) Support:** yes

**Bit Depth:** up to 24

**Sample Rate:** 44.1, 48, 88.2, 96 kHz

**Number of Transmitter (Output) Channels:**

4 (44.1 and 48 kHz sample rate), 2 (88.2 or 96 kHz sample rate)

**Number of Receiver (Input) Channels:** 4 (44.1

and 48 kHz sample rate), 2 (88.2 or 96 kHz sample rate)

**Dante Audio Flows:** 4; 2 receiver, 2 transmitter

## Audio Performance:

**Type:** fully-digital paths between network interfaces (by way of sample-rate-converter integrated circuits)

**Dynamic Range:** 147 dB at 48 kHz sample rate, 148 at 96 kHz sample rate, A-weighted

**Distortion (THD+N):** –140 dB at 48 kHz sample rate, –143 dB at 96 kHz sample rate, measured at –1 dBFS, 1 kHz

## Connectors:

**Ethernet:** Neutrik NE8FBH etherCON RJ45 receptacles

**External DC:** 4-pin male XLR

**USB:** type A receptacle (used only for main firmware updates)

## 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:

8.7 inches wide (22.1 cm)

1.72 inches high (4.4 cm)

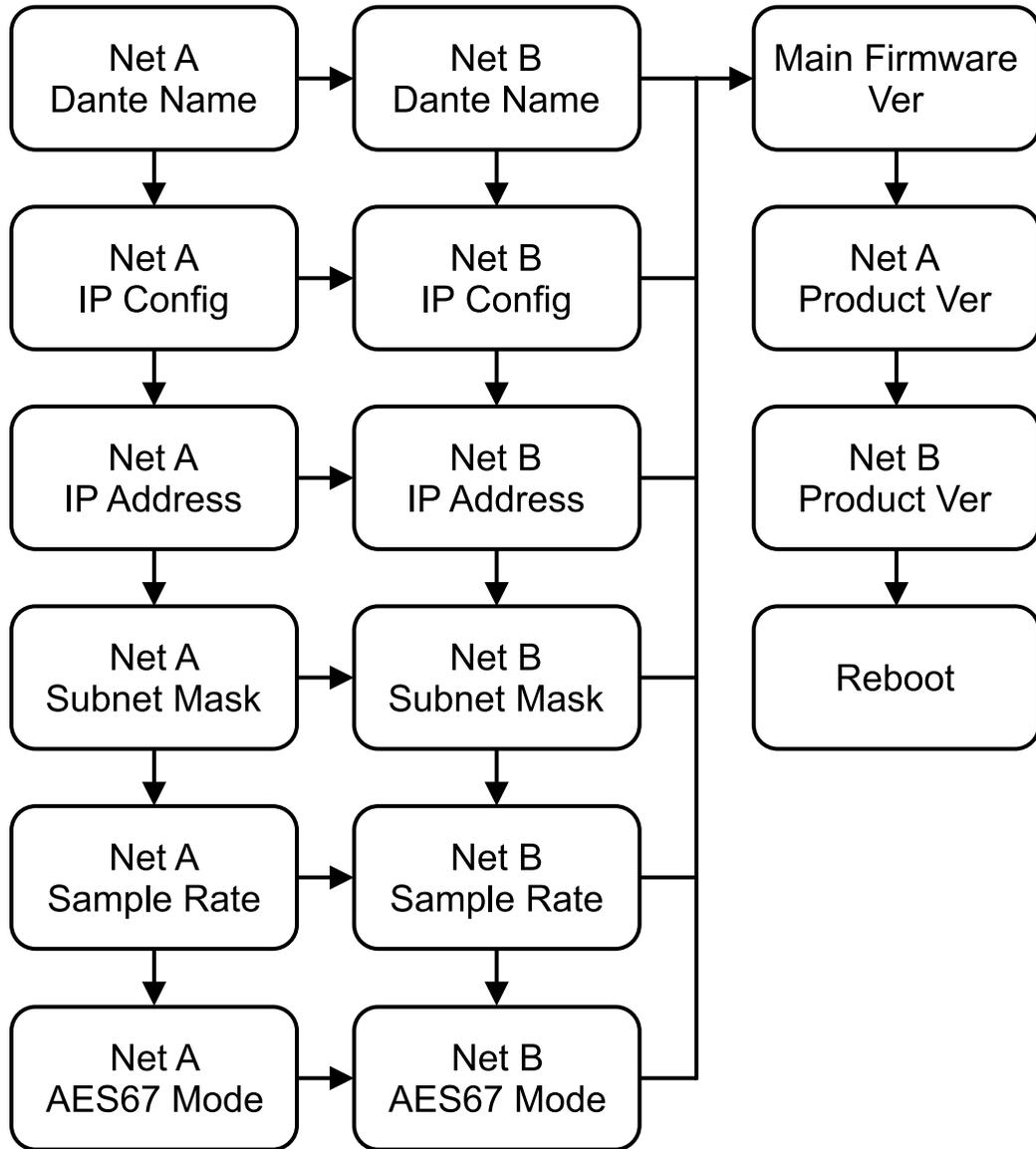
8.3 inches deep (21.1 cm)

**Mounting Options:** single-unit (RMBK-11) and dual-unit (RMBK-12) rack-mounting installation kits (purchased separately) use one space (1U) in a standard 19-inch rack

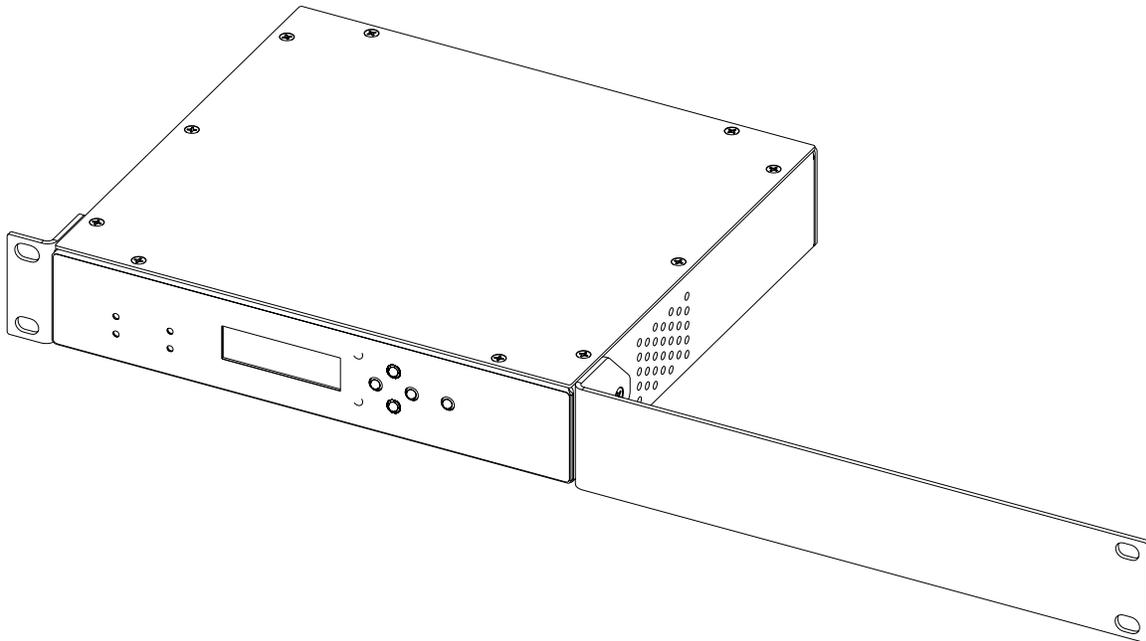
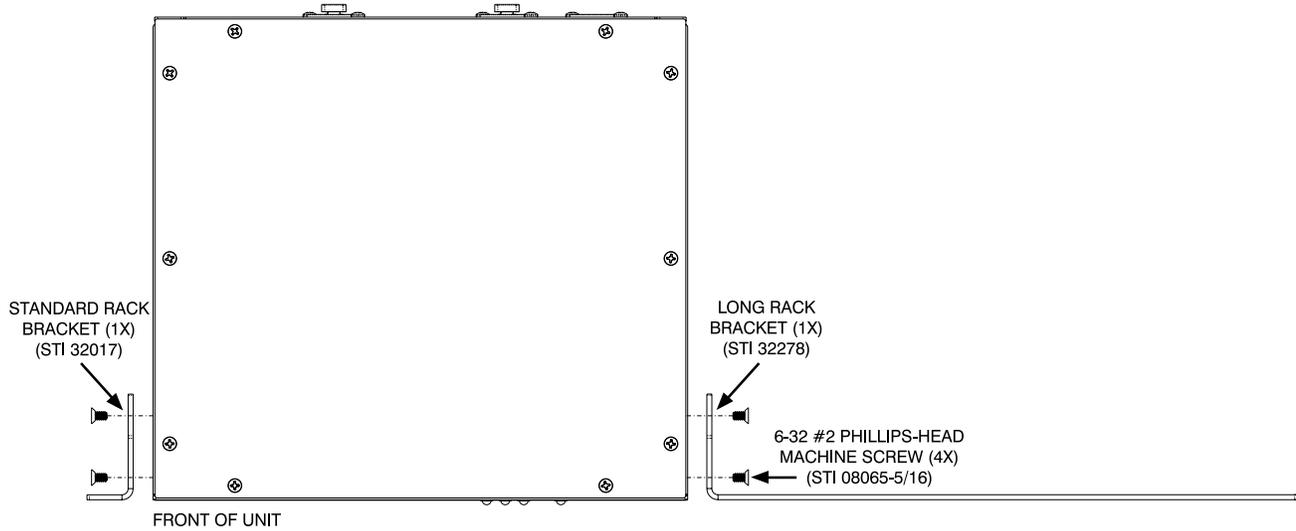
**Weight:** 1.8 pounds (0.80 kg); rack-mounting installation kits add 0.2 pounds (0.09 kg)

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

## Appendix A—Model 48D Front-Panel LCD Display Menu Structure



## Appendix B—Graphical Description of Model 48D Rack-Mount Installation Kit for One Model 48D Unit (*Order Code: RMBK-11*)



## Appendix C—Graphical Description of Model 48D Rack-Mount Installation Kit for Two Model 48D Units (*Order Code: RMBK-12*)

