

Model 5330 Flex-Use Dante® Audio Interface

User Guide

Issue 1, July 2018

This User Guide is applicable for serial numbers
M5330-02001 and later with application firmware 1.0 and later
and Dante firmware 4.2.0 (UltimoX4 4.1.2.1)

Also applicable for serial numbers
M5330-00151 to 02000 with application firmware 1.0 and later
and Dante firmware 2.5.0 (Ultimo 4.0.9.1)

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Revision History

Issue 1, July 2018:

1. Initial release.

Introduction

The Model 5330 Flex-Use Dante Audio Interface provides a simple yet high-performance means of interfacing analog signals with applications that utilize Dante® audio-over-Ethernet media networking technology. Four line-level analog sources can be connected to the unit and then, after conversion to digital, output by way of four output (transmitter) channels associated with the Dante interface. Four signals that arrive by way of Dante can be converted to analog and then output as balanced line-level signals. A monitor section allows the input and output signals to be selectively observed using meters, a headphone output, and a line-level output.

The Model 5330 is a fully professional product that offers the audio quality, features, and reliability required by 24-hour commercial applications. Four inputs, two on the front panel and two on the back, allow simple interfacing with a variety of unbalanced and balanced line-level analog sources. The 2-channel (stereo) input on the front panel is optimized for use with portable electronics that provide “–10” unbalanced audio sources. Using a rotary control, users can adjust the sensitivity of the input circuitry to match the level of the source. Two additional inputs are

provided on the back panel and meet the requirements of professional audio equipment. They are differential (balanced) with a nominal level of +4 dBu and plenty of signal-handling “headroom.” The four input signals are converted to 24-bit digital audio and then transported out of the unit via the Dante interface.

Four digital audio channels enter the Model 5330 via its Dante interface. These general-purpose audio channels are then converted from the digital domain to the analog domain. Four 3-pin male XLR connectors, located on the unit’s back panel, provide balanced +4 dBu-nominal line-level analog outputs. An auxiliary output, also located on the back panel, provides a fifth “professional-quality” output. Pushbutton switches, located on the front panel, allow the user to select the source for the auxiliary output from among the four Dante input (receiver) channels.

The monitor section allows the user to select any audio input or output signal for visual and aural observation. Two 8-segment LEDs meters, calibrated in dBFS, allow precise monitoring of signal levels as they exist in the digital domain. A 2-channel (stereo) headphone output allows connection of headphones or ear



Figure 1. Model 5330 front view



Figure 2. Model 5330 back view

buds that use either 3.5 mm or ¼-inch jacks. A separate line-level analog monitor output allows connection to inputs on amplified speakers or power amplifiers. Two rotary controls allow individual adjustment of the headphone and monitor outputs.

An Ethernet connection is all that's required to make the Model 5330 part of a sophisticated networked audio system. Dante audio-over-Ethernet has found wide acceptance as an audio "backbone" due to its ease of use, interoperability, excellent audio quality, and wide adoption by a large number of equipment manufacturers.

The Model 5330 can serve as an "edge" device for a Dante network implementation, providing high-performance input, output, and monitor resources for various applications. The unit is an excellent general-purpose "tool" to help expand Dante capabilities for facilities and applications that were initially implemented to support signals in the analog domain.

The Model 5330 is "universal" mains powered, requiring 100 to 240 volts, 50/60 Hz for operation. Standard connectors are used for interfacing with the audio input and output channels, Ethernet interface, and AC mains input. The unit's enclosure mounts in one space (1U) of a standard 19-inch rack enclosure and weighs less than four pounds (2 Kg).

Dante Audio-over-Ethernet

Digital audio data associated with the Model 5330 is interfaced with a local area network (LAN) using Dante audio-over-Ethernet media networking technology. The unit is compatible with the Dante Domain Manager™ (DDM) software application. For serial numbers 02001 and later, the unit is also compliant with AES67 digital audio signals.

A major benefit of using Dante is its ability to use any standard Ethernet network implementation, including cabling and switches, to directly transport professional audio signals. The Model 5330 supports digital audio signals with sample rates of 44.1 and 48 kHz and a bit depth of up to 24. These sample rates were selected for optimal support of broadcast, production, industrial, commercial, and consumer applications. Status LEDs provide a real-time indication of LAN and Dante performance.

The signals associated with the Model 5330's four analog input channels are converted to digital and then routed to transmitter (output) channels on the unit's Dante interface. Four Dante transmitter (output) channels from an associated Dante-enabled device can be assigned to the Model 5330's input (receiver) channels using the Dante Controller application. These input signals are converted into analog and then sent to the output circuitry.

Applications

The Model 5330 is a general-purpose analog input, analog output and monitoring device intended for use in a variety of audio and audio-with-picture applications where Dante technology is utilized. It's applicable anywhere that line-level analog inputs and outputs need to be converted to and from Dante while audio quality is maintained. The term "Flex-Use" comes from the flexibility that the unit's range of simple but carefully-implemented resources can provide. It's suitable for demanding on-air broadcast and live-event applications that require both excellent audio performance and reliable operation. It can also be a perfect complement for academic, industrial, or corporate audio-visual facilities where a

variety of analog input and output devices must be supported.

The rack-mounted unit is appropriate for installation in fixed locations, serving the needs of systems associated with stadium, worship, education, commercial, and government facilities. Its lightweight enclosure also makes it suitable for mobile and field uses. The Model 5330 features an optimized set of controls and indicators that makes it simple and intuitive to use. With the unit's metering and monitoring resources it's easy for users to obtain optimal performance. And by providing standard connectors for all inputs and outputs, along with universal AC mains powering, installation and setup can be completed in only a short period of time.

Four Analog Inputs

The Model 5330's four inputs allow connection to a range of unbalanced and balanced analog audio sources. Inputs 1 and 2 have a nominal level of -10 dBu and are intended for use with unbalanced sources associated with personal electronic devices such as phones, tablet and notebook computers. For easy access a 3.5 mm 3-conductor (stereo) jack is provided on the front panel. A rotary level control, located adjacent to the input jack, allows adjustment of the input sensitivity to match a wide range of audio sources. This allows the audio quality to easily be optimized. Inputs 3 and 4 are electronically balanced with a nominal level of $+4$ dBu. They use two 3-pin female XLR connectors which are located on the unit's back panel. They are intended for connection to professional audio sources such as audio consoles, wireless microphone receivers, and video playback equipment.

The four inputs are capacitor-coupled and ESD (static) protected to provide reliable operation in a variety of demanding applications. Extensive filtering minimizes the chance that radio frequency (RF) energy will cause interference. Low-noise, low-distortion, and wide dynamic-range circuitry ensures that audio quality is preserved. Four bi-color signal present/peak LEDs provide a simple means of observing input activity. The analog input audio is routed to high-performance analog-to-digital conversion (ADC) integrated circuits that support sampling rates of 44.1 and 48 kHz with a bit depth of up to 24. The audio signals, now in the digital domain, are connected to the Dante interface where the data is packetized and prepared for transport over Ethernet. The Dante Controller software application will typically be used to assign the Model 5330's four output (transmitter) channels to inputs (receiver) channels on designated Dante equipment.

Five Analog Outputs

The Model 5330 provides five analog line-level outputs, four main and one auxiliary. The unit's four Dante input (receiver) channels serve as the audio sources for the five outputs. The Dante Controller software application can be used to route (subscribe) Dante sources (transmitters) to the Model 5330's four Dante inputs (receivers). The unit's four Dante input (receiver) channels are "mapped" one-to-one with the four main output channels. Four bi-color LEDs provide a signal present/peak indication of level of the four Dante input (receiver) channels. The audio source for the auxiliary output is selected by the user from among the four Dante input (receiver) channels. Two push-button switches and four LEDs, located on the front panel, allow for simple source selection.

The Model 5330's five outputs have a nominal signal level of +4 dBu and a maximum output level of +24 dBu. The outputs are electronically balanced, capacitor-coupled, and ESD (static) protected. They are compatible with virtually all balanced and unbalanced loads with an impedance of 2 k ohms or greater. High-quality components, including the important digital-to-analog converter (DAC) integrated circuits, are used to provide low-distortion, low-noise, and sonically-excellent performance. Robust circuitry provides protection from damage should a moderate DC voltage be accidentally connected, something especially useful in applications where powered party-line (PL) or talent-cueing (IFB) circuits may be present.

Monitoring

A flexible yet easy-to-use monitor section offers the ability to listen to and visually observe the level of the four input and four output audio signals. Two pushbutton switches allow a user to select which audio source or sources are to be monitored over headphones and/or loudspeakers. A configuration choice allows monitoring of either a single audio channel or a pair of audio channels. This mode choice can be valuable when monitoring monaural (single-channel) and stereo (dual-channel) signals. Two 8-segment LED meters display the level of the source or sources that are selected for monitoring. The meters are calibrated in dBFS, directly reflecting the digital signal levels of the Dante output (transmitter) and input (receiver) channels.

A 2-channel (stereo) headphone output allows support for stereo headphone or ear buds. For convenience both 3.5 mm and 1/4-inch 3-conductor (stereo) phone

jacks are provided. In addition, a separate 2-channel (stereo) monitor output allows interfacing with inputs on amplified loudspeakers or a power amplifier associated with monitor loudspeakers. Two rotary controls allow the levels of the headphone and monitor outputs to be independently adjusted.

Simple Installation

The Model 5330 is housed in a lightweight aluminum enclosure and mounts in one space (1U) of a standard 19-inch rack enclosure. The unit uses standard connectors to allow fast and convenient interconnections. This includes 3-conductor male and female XLR connectors, 3.5 mm and 1/4-inch jacks, and an IEC C14 receptacle for mains power. The unit connects to a local area network (LAN) using a standard RJ45 receptacle and supports 100 Mb/s twisted-pair Ethernet. Four LEDs on the back panel display the status of the Ethernet connection and Dante interface. The Model 5330 requires 100-240 volts, 50/60 Hz mains power for operation.

Future Capabilities and Firmware Updating

The Model 5330 was designed so that its performance and capabilities can be enhanced in the future. A USB receptacle, accessible on the unit's back panel, allows the application firmware (embedded software) to be updated using a USB flash drive. To implement its Dante interface the Model 5330 uses one of Audinate's 4-in/4-out Ultimo™ integrated circuit. The firmware in this integrated circuit can be updated via the unit's Ethernet connection, helping to ensure that its Dante capabilities remain up to date.

Installation

In this section the Model 5330 will be installed and signals interconnected. The one-rack-space (1U) unit will be mounted in an equipment rack. On the back panel analog audio input and output connections will be made using 3-pin male and female XLR connectors. An Ethernet data connection will be made using a standard RJ45 patch cable. Also on the back panel, AC mains power will be connected by means of a detachable cord set that is compatible with the unit's 3-pin IEC 320 C14 inlet connector. On the front panel a 3-conductor (stereo) 3.5 mm jack allows access to audio inputs 1 and 2. Also on the front panel are 3-conductor 3.5 mm and ¼-inch jacks that provide access to the 2-channel (stereo) headphone output.

System Components

The shipping carton contains a Model 5330 Flex-Use Dante Audio Interface, a copy of the user guide, and an AC mains cord suitable for use in North America and Japan. When installation will take place in a different geographic location your dealer or distributor should provide a suitable AC mains cord.

Locating the Unit

Providing convenient access to the front-panel controls and connectors is the primary focus when selecting a Model 5330 mounting location. It's expected that users will need to frequently access the unit so selecting a convenient location will greatly aid the operating experience. The selected mounting location must be within the 100-meter (325-foot) twisted pair Ethernet cable limitation. But that can be overcome by using a fiber-optic interconnection between the Model 5330-related Ethernet switch and the other Ethernet switches in the related local-

area-network (LAN). Access to a source of AC mains power is also required. But that isn't expected to be a problem as it is typically available as part of a rack enclosure's resources.

Mounting

Once a mounting location has been selected installation can begin. The Model 5330 requires one space (1.75 vertical inches or 1U) in a standard 19-inch (48.3 cm) equipment rack. Secure the unit into the equipment rack using four mounting screws, two per side.

Ethernet Connection

An Ethernet connection that supports 100BASE-TX (100 Mb/s over twisted-pair) is required for the Model 5330's Dante audio-over-Ethernet connectivity. A 10BASE-T connection is not sufficient for Model 5330 operation. A 1000BASE-T ("GigE") connection is not supported unless it can automatically "fall back" to 100BASE-TX operation.

The 100BASE-TX Ethernet connection is made by way of an RJ45 receptacle that is located on the Model 5330's back panel. This allows connection by way of a standard Ethernet twisted-pair cable and associated RJ45 plug. The Model 5330's Ethernet interface supports auto MDI/MDI-X, eliminating the need to use a crossover or "reversing" cable.

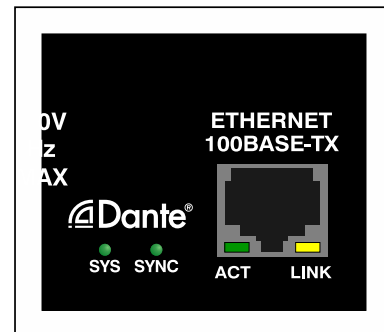


Figure 3. Ethernet connection (back panel)

Analog Inputs

The Model 5330 provides four inputs that are intended for connection to line-level analog audio signal sources. Inputs 1 and 2 are accessible on the front panel and are intended for connection to a 3-conductor 3.5 mm plug that is associated with an unbalanced 2-channel (stereo) source. Inputs 3 and 4 utilize 3-pin female XLR connectors that are located on the back panel.

Inputs 1 and 2

On the front panel one 3-conductor (stereo) 3.5 mm jack provides access to inputs 1 and 2. These inputs are analog, unbalanced, and have a nominal level of -10 dBu. They are primarily intended for interconnection with a stereo audio signal provided by a personal audio device. A 3-conductor audio patch cord with a 3.5 mm plug on its end will typically be used to mate with the Model 5330's jack. It's expected that in many applications the connection made to the front-panel inputs will be temporary, varying "day-to-day" as applications change. As such, although acceptable, permanent wiring to the 3.5 mm jack associated with inputs 1 and 2 is not expected to be made.

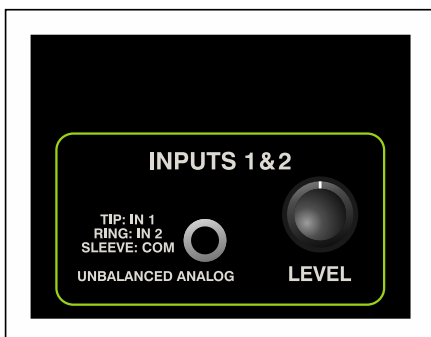


Figure 4. Inputs 1 and 2 (front panel)

Inputs 3 and 4

Inputs 3 and 4 are located on the back panel and utilize two 3-pin female XLR connectors. They are electronically-balanced (differential), capacitor-coupled, and have a nominal level of $+4$ dBu. Prepare 3-pin male XLR mating connectors such that pin 2 carries signal high (+), pin 3 carries signal low (–), and pin 1 is common/shield. Unbalanced sources can also be successfully interfaced with these inputs. With an unbalanced source begin by connecting signal high (+) to pin 2 and signal low/shield (–) to both pins 1 and 3. If this provides a "clean" signal interconnection then all is well. However, if this results in hum or noise on the associated line input, try connecting signal high (+) to pin 2 and signal low/shield (–) only to pin 3; leave pin 1 unconnected ("floating").

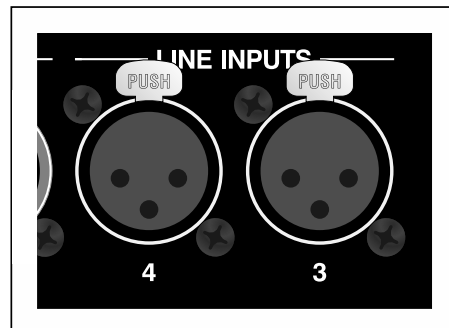


Figure 5. Inputs 3 and 4 (back panel)

Analog Outputs

The Model 5330 provides seven analog, electronically-balanced line-level outputs. They all utilize 3-pin male XLR connectors which are located on the unit's back panel. The seven outputs consist of main outputs 1-4, the auxiliary output, and monitor outputs 1 and 2.

Main Outputs 1-4 and the Auxiliary Output

Main outputs 1-4 and the auxiliary output are designed for general-purpose use which could include connecting to analog inputs on devices such as audio consoles, transmitters associated with wireless in-ear monitors, matrix intercom systems, or amplified speakers. The circuitry associated with these outputs is capacitor-coupled, electronically-balanced (differential) and has a nominal level of +4 dBu. The outputs have a source impedance of 200 ohms and will perform optimally when driving loads of 2 k (2000) ohms or greater. The circuitry is capable of providing a maximum output level of +24 dBu. This 20 dB of audio “headroom” means that +24 dBu will be present on a line output when its corresponding Dante input (receiver) channel’s digital audio level is 0 dBFS.

No special precautions are necessary when using these outputs in applications where a variety of other specialized signals may be present. The circuitry is protected from damage in situations such as the accidental interconnection with broadcast-type analog party-line (PL) intercom or powered IFB (talent cuing) circuits or to microphone inputs that have P48 phantom power present.

Five 3-pin male XLR connectors, located on the Model 5330’s back panel, are provided for interfacing main outputs 1-4 and

the auxiliary output with associated equipment. Prepare 3-pin female XLR mating connectors such that pin 3 is signal high (+), pin 2 is signal low (–), and pin 1 is common/shield. To connect to an unbalanced load use pin 2 as signal high (+) and pin 1 as low/shield; do not connect anything to pin 3. Do not connect (short) pins 3 to pins 1 on the mating connectors as this will stress the output circuitry.

Monitor Outputs 1 and 2

Monitor outputs 1 and 2 are designed for connection to inputs on audio power amplifiers or amplified speakers. The circuitry is identical in design and performance to that used for main outputs 1-4 and the auxiliary output. The one exception is the nominal operating level is 0 dBu. Two 3-pin male XLR connectors, located on the Model 5330’s back panel, are provided for interfacing with monitor outputs 1 and 2. Prepare 3-pin female XLR mating connectors such that pin 3 is signal high (+), pin 2 is signal low (–), and pin 1 is common/shield. To connect to an unbalanced load use pin 2 as signal high (+) and pin 1 as low/shield; do not connect anything to pin 3. Do not connect (short) pins 3 to pins 1 on the mating connectors as this will stress the output circuitry.

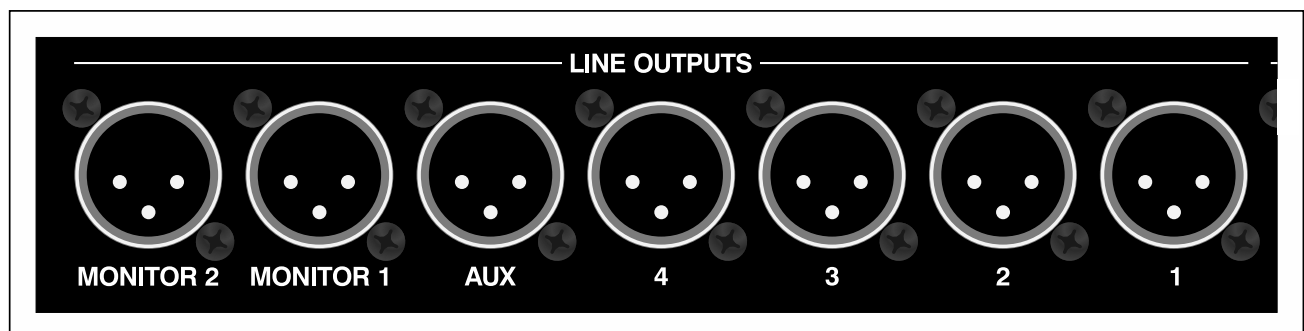


Figure 6. Main outputs 1-4, auxiliary output, and monitor outputs (back panel)

Headphone Output

The Model 5330 provides a 2-channel (stereo) headphone output that for convenience can be accessed on two jacks—one 3.5 mm and the other 1/4-inch. Both jacks are 3-conductor (stereo) and are located on the unit's front panel. Using one or the other of the jacks allows compatibility with a wide range of ear buds and headphones. As would be expected, the headphone output jacks have the left channel audio on their tip leads, the right channel audio on their ring leads, and common for both audio channels on their sleeve leads.

Connecting AC Mains Power

The Model 5330 operates directly from an AC mains power source of 100 to 240 volts, 50/60 Hz, 15 watts maximum. As a “universal mains input” device, there are no switches to set or jumpers to install. A 3-pin IEC 320 C14 inlet connector on the back panel mates with a detachable mains cord set. All units are supplied with an AC mains cord that has a North-American (NEMA 5-15L) standard plug on one end and an IEC 320 C13 connector on the other end. Units bound for other destinations require that an appropriate cord set be obtained. Because the Model 5330 does not contain a power on/off switch it will begin operation as soon as AC mains power is connected.

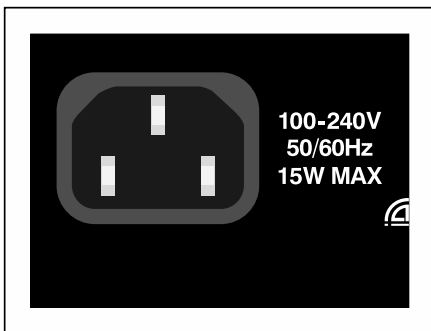


Figure 7. AC mains input (back panel)

Safety Warning: The Model 5330 does not contain an AC mains disconnect switch. As such, the AC mains cord plug serves as the disconnection device. Safety considerations require that the plug and associated inlet be easily accessible to allow rapid disconnection of AC mains power should it prove necessary.

Configuration

The Dante Controller software application will typically be used to review and make changes to the configuration parameters associated with the Model 5330's Dante network interface. The Model 5330 does not provide a separate menu system, e.g., one that is accessible using a web browser.

Configuration using Dante Controller

The Dante Controller software application is available for download free of charge at www.audinate.com. Versions are available to support Windows® and OS X® operating systems. Using Dante Controller the Model 5330's network interface can be configured for its desired device and channel names, network parameters, performance choices, and channel subscriptions (routing). The configuration settings will be stored in non-volatile memory within the Model 5330's circuitry. As such, power-down and power-up activities will not impact the unit's settings. The Model 5330 uses an Ultimo 4-input/4-output integrated circuit to implement Dante networking.

Device and Channel Names

The Model 5330 has a default Dante device name of **ST-M5330-** followed by a unique suffix. The suffix identifies the specific Model 5330 that is being configured. The suffix's actual alpha and numeric characters relates to the MAC address of the Ultimo integrated circuit that's present in the specific Model 5330. The four Dante output (transmitter) channels have the default names of **Ch1**, **Ch2**, **Ch3**, and **Ch4**. The four Dante input (receiver) channels have default names of **Ch1**, **Ch2**, **Ch3**, and **Ch4**. Using Dante Controller these names can be revised as appropriate for the specific application.

Network Parameters

Using Dante Controller the method used to determine the network IP address 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 device reboot is required for new network interface values to be utilized.

Sample Rate and AES67 Parameters

The sample rate of the Dante interface can be selected with choices of **44.1 kHz** and **48 kHz**. Several pull-up/pull-down value configuration choices are also available. 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. 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

The Model 5330's four Dante output (transmitter) channels must be routed (subscribed) to the desired Dante input (receiver) channels on associated devices. The Model 5330's four Dante input (receiver) channels must be routed (subscribed) with the desired output (transmitter) channels on associated Dante devices. This will typically be done with the Dante Controller software application. Within Dante Controller a "subscription" is the term used for routing or connecting a transmitter flow (a group of output channels) to a receiver flow (a group of input channels). The Ultimo integrated circuit used in the Model 5330 limits the number of Dante flows to four, two in each direction. These can be unicast, multicast, or a combination of the two.

Operation

At this point the Model 5330 should have its Ethernet, audio input, audio output, and AC mains connections implemented as desired for the application. The four Dante output (transmitter) channels and four Dante input (receiver) channels should have been routed (subscribed) using the Dante Controller software application. In addition, network and operating parameters should have been configured, also using Dante Controller. Normal operation of the Model 5330 can now begin. The unit is designed for continuous operation with no regular maintenance required.

Initial Operation

The Model 5330 will begin its power-up process as soon as AC mains power is connected. As an integrity check all the LEDs located on the unit's front panel will light

in a test sequence. This will take approximately six seconds and then immediately be followed by the application firmware's (embedded software) version number being displayed for one second on the monitor section's 2-channel LED meter. At this point preliminary operation will begin. Full Model 5330 operation will occur after Dante connectivity has been established by way of the Ethernet interface. This can take 30 to 45 seconds, depending on the configuration of the Dante network.

Also upon Model 5330 power up the Ethernet and Dante status LEDs on the back panel will light in various manners. A status LED, located below the USB receptacle, will flash once to indicate that it is functioning. The two Ethernet status LEDs, located below the RJ45 receptacle, and the two Dante LEDs, located adjacent to the RJ45 receptacle, will light in seemingly random ways as Ethernet and Dante network performance begins. Please refer to a later section of this guide for details on what these LEDs indicate.

User Displays and Controls

On the front panel the user is presented with a variety of status LEDs, level meters, pushbutton switches, level controls, and headphone output connectors. On the back panel are five status LEDs. These resources are simple to understand and use and should prove to be useful in obtaining the desired performance.

Ethernet and Dante Status LEDs

As previously mentioned, two status LEDs are located below the RJ45 receptacle on the Model 5330's back panel. The LINK LED will light amber whenever an active

data connection to a 100 Mb/s Ethernet network has been established. The green ACK LED will flash on and off green in response to data packet activity. The SYS and SYNC LEDs are located adjacent to the RJ45 receptacle and display the operating status of the Dante interface and associated audio-over-Ethernet network. The SYS LED will light red upon Model 5330 power up, indicating 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 another Dante device. (It doesn't indicate that data is passing but simply that data could be passing!) The SYNC LED will light red when the Model 5330 is not synchronized with a Dante network. It will light solid green when the Model 5330 is synchronized with a Dante network and an external clock source (timing reference) is being received. It will slowly flash green if this specific Model 5330 is serving as the clock master for the Dante network. (It's not expected that a Model 5330 will serve as a clock master but technically it is capable of doing that.)

How to Identify a Specific Model 5330

The Dante Controller software application offers an identify command (initiated using the "eyeball" icon) that can be used to help locate a specific Model 5330. When identify is selected for a specific unit its eight signal present/peak LEDs and two level meters on the front panel will light in a unique pattern. This festive display on the front panel will make the unit readily identifiable. In addition, the SYS and SYNC LEDs, located adjacent to the RJ45 receptacle on the back panel, will slowly flash green. After a few seconds the identification patterns will cease and normal Model 5330 operation

will again take place. Audio performance will not be impacted by the use of the identify command. As such it's perfectly acceptable to use the identify command any time it would be useful.

Inputs 1 and 2

Inputs 1 and 2 are intended for interconnection with personal electronic devices or “consumer” audio/video products that have analog, unbalanced signal sources with a nominal level in the range of -10 dBu. Both input sources connect to the Model 5330 using a single 3-conductor (stereo) 3.5 mm jack that's located on the front panel. A single rotary level control allows the sensitivity of both input channels to be adjusted.

Two dual-color LEDs, located on the front panel, provide signal present/peak indications to assist users when adjusting the level control. A signal present/peak LED will light green when its associated signal level, along with the position of the level control, results in a Dante output (transmitter) level of -40 dBFS. (This is 20 dB less than the nominal level of -20 dBFS.) A signal present/peak LED will light red when its associated signal level, along with the position of the level control, results in a Dante output (transmitter) level of -5 dBFS. (This is 5 dB less than the digital maximum of 0 dBFS.)

The signal present/peak LEDs can prove useful in providing an overall guide as to where to set the level control. The green signal present indication should light essentially at all times when a signal is connected and active. The red peak indication should never light or light very infrequently. This indication will only activate when the signal level on the Dante output (transmitter) is getting quite close to digital maximum.

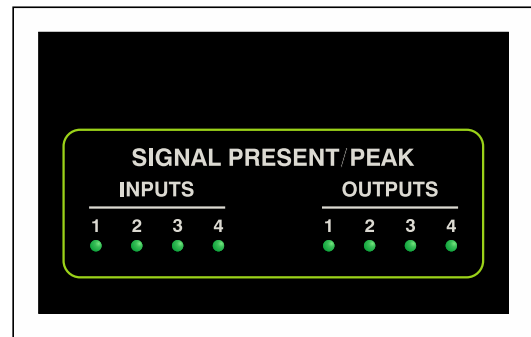


Figure 8. Signal present/peak LEDs (front panel)

Observing the meters associated with the monitor section is a far superior guide when making a precise level control adjustment. Select the monitor sources to be inputs 1 and 2 and then adjust the level control such that signal peaks will cause the two yellow LEDs (labeled -15 and -10 dBFS) in each meter to light. The monitor and headphone outputs associated with the monitor section can also be used to ensure that the audio fidelity of signals connected to inputs 1 and 2 are as desired.

Inputs 3 and 4

Inputs 3 and 4 are intended for interconnection with professional-type analog, balanced signal sources with a nominal level $+4$ dBu. The input sources connect to the Model 5330 using two 3-pin female XLR connectors that are located on the back panel. No controls or configuration methods are provided to adjust the input sensitivity.

Two dual-color LEDs, located on the front panel, provide signal present/peak indication of inputs 3 and 4. A signal present/peak LED will light green when its associated signal level is -16 dBu. This correlates to a Dante output (transmitter) level of -40 dBFS; 20 dB less than the -20 dBFS nominal. A signal present/peak LED will light red when its associated signal level is

19 dBu. This correlates to a Dante output (transmitter) level of -5 dBFS; 5 dB less than the digital maximum of 0 dBFS.

The signal present/peak LEDs can prove useful in providing an overall indication of the level of the signals associated with inputs 3 and 4. A green signal present indication should light essentially at all times when a signal is connected and active. The red peak indication should never light or light very infrequently. This indication will only activate when the signal level on the Dante output (transmitter) is getting quite close to digital maximum. Observing the meters associated with the monitor section is a better means of determining the level of signals connected to inputs 3 and 4. Use the pushbutton switches to select the monitor sources to be inputs 3 and 4. The monitor and headphone outputs associated with the monitor section can also be used to ensure that the audio quality of signals connected to inputs 3 and 4 are as expected.

Main Outputs 1-4

On the Model 5330's back panel are four 3-pin male XLR connectors that provide access to main outputs 1-4. For these analog line-level outputs to be active only requires using the Dante Controller software application to establish the subscriptions (routes) that link the desired Dante audio sources (transmitters) with the Model 5330's Dante input (receiver) channels. Typically the nominal level of the outputs will be +4 dBu, assuming that the associated Dante source channels observe a -20 dBFS nominal level. Within the Model 5330 there are no controls or other configuration functions that will impact the level of the main outputs. A Dante source signal with a level of -20 dBFS will always result in a +4 dBu analog signal level on its associated output.

The general level of the four signals associated with main outputs 1-4 can be visually observed using the four signal present/peak LEDs that are located on the front panel. Each signal present/peak LED will light green when the level of the Dante input (receiver) channel is -40 dBFS. This correlates to a level of -16 dBu on its associated analog output. The signal present/peak LED will light red when the level of the Dante input (receiver) channel is -5 dBFS. This correlates to a level of +19 dBu on its associated main output. The Model 5330's monitor section is a more thorough means of visually and aurally observing the four outputs. Details regarding understanding and using the monitor section are provided in a later section of this guide.

Auxiliary Output

A 3-pin male XLR connector on the back panel of the Model 5330 provides access to the auxiliary output. The audio source for the auxiliary output can be selected from among the four Dante input (receiver) signals that are associated with outputs 1-4. Two pushbutton switches on the front panel allow a user to select the desired source. Four LEDs indicators, located adjacent to the source pushbutton switches, display which source is actively utilized as the auxiliary output's source. Typically the nominal

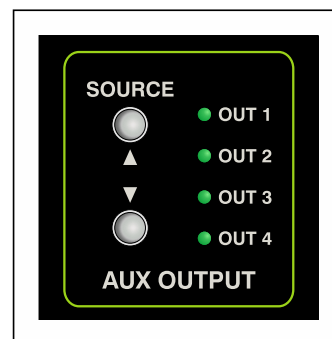


Figure 9. Auxiliary output (front panel)

level of the auxiliary output will be +4 dBu, assuming that the selected Dante input (receiver) source observes a –20 dBFS nominal level. A Dante source signal with a level of –20 dBFS will always result in a +4 dBu signal level on the auxiliary output. There is no specific level indicator or monitor function associated with the auxiliary output. This is not a limitation as each of the possible audio sources (outputs 1-4) can be independently monitored for level and audio quality.

Monitor Section

The monitor section provides users with the ability to listen to and visually observe the level of the audio signals that are associated with the four input channels and the four output channels. Eight green LEDs indicate which source or sources are actively being monitored. Two pushbutton switches allow users to select the input source(s) to be monitored. A mode selection allows either a single audio channel or a pair of audio channels to be monitored. A 2-channel (stereo) analog output, located on the back panel, can be connected to inputs on amplified speakers or an audio power amplifier. In addition, a 2-channel (stereo) headphone output is accessible on the front panel by way of 3-conductor

(stereo) 3.5 mm and 3-conductor (stereo) ¼-inch output jacks. Separate rotary level controls allow independent adjustment of the monitor and headphone output levels.

Two 8-segment LED meters display the level of the signal or signals selected for monitoring. The meters, calibrated in dBFS, display the level of the selected signal(s) as they exist in the digital domain. The meter's two yellow LEDs will only light when signal levels are in the range that's typically considered to be headroom. This could be thought of as the area above the typical Dante nominal level of –20 dBFS. Caution must be observed whenever a meter's red LED lights. This would indicate that there is little or no headroom left and that signal "clipping" may be taking place.

As previously mentioned, two rotary controls allow independent adjustment of the monitor and headphone output levels. These controls are "push-in/push-out" type which allows its associated knob to be in its "out" position when adjusting a level and placed in its "in" position when protection from an unwanted change is desired. Note that audio signals do not pass directly through the level controls. Their position is recognized by the Model 5330's processor which in turn adjusts the signal levels within

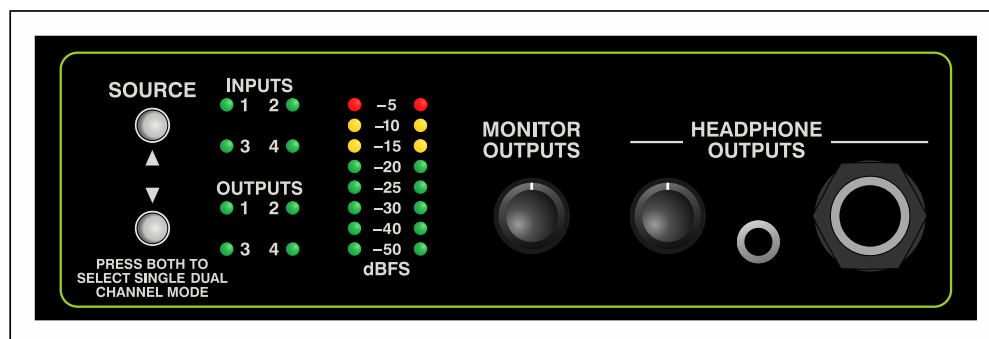


Figure 10. Monitor section (front panel)

the digital domain. Users should find the audio quality of the monitor and headphone outputs to be excellent, with high maximum output level and low distortion. While this is a positive situation, it does allow high signal levels to be present on connected headphones or related devices. Care must be taken to limit exposure to excessive signal levels so as not to cause hearing damage.

The monitor section can be selected to function in either a single-channel or a dual-channel mode. In the single-channel mode each input and each output can be individually monitored. In this way any one of the eight total sources can be monitored. Pressing the up or down source pushbutton switches will move between individual channels. In the dual-channel mode four pairs of channels can be selected for monitoring. These pairs consist of inputs 1 and 2, inputs 3 and 4, outputs 1 and 2, and outputs 3 and 4. Simultaneously pressing the monitor section's up and down pushbutton switches will alternate ("toggle") between the single-channel mode and the dual-channel mode.

When using the up and down pushbuttons to change the source(s) to be monitored a slight delay will be present before the new audio source(s) become active. This is a software function that allows a user to "hop over" sources that are not actually intended to be selected. An example might offer clarification. Begin from the condition where the single-channel mode was selected and output 1 was being monitored. A user then wants to monitor output 4 so they rapidly press the down button three times. The Model 5330's software would ignore the fact that output 2 and output 3 were each momentarily selected while directly changing the source from output 1 to output 4.

This prevents momentary "bursts" of audio from monitor sources that were not actually desired.

When in the single-channel mode the level of the selected source will be displayed on the left level meter. The source will be routed to both the left and right channels of the monitor and headphone outputs, providing a dual-channel listening experience. When in the dual-channel monitor mode the level of the source selected for the left channel will display on the left meter and be routed to the left channel of the monitor and headphone outputs. The level of the source selected for the right channel will be displayed on the right meter as well as being routed to the right channel of the monitor and headphone outputs.

Power Down

Whenever power is disconnected from a functioning Model 5330 the unit's current operating parameters are saved in non-volatile memory. In this way all settings, including auxiliary output source, monitor mode, and monitor source, will be restored upon the next power-up cycle.

Technical Notes

IP Address Assignment

By default the Model 5330's 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. Link-local

will assign an IP address in the IPv4 range of 169.254.0.1 to 169.254.255.254. In this way multiple Dante-enabled devices can be connected together and automatically function, whether or not a DHCP server is active on the LAN.

Using the Dante Controller software application the Model 5330'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 "do its thing," if fixed addressing is necessary then this capability is available. But in this case it's highly recommended that each unit be physically marked, e.g., directly labeled using a permanent marker or "console tape," with its specific IP address. If knowledge of a Model 5330'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 device's IP address is "lost," the Address Resolution Protocol (ARP) networking command can be used to "probe" devices on a network for this information. For example, in Windows OS the **arp -a** command can be used to display a list of LAN information that includes MAC addresses and corresponding IP addresses. The simplest means of identifying an unknown IP address is to create a "mini" LAN with a personal computer connected directly to the Model 5330. Then by using the appropriate ARP command the required "clues" can be obtained.

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 5330's Dante interface uses an Ultimo "chip" and, as such, a direct interconnection between it 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 5330's Ethernet interface to a network that supports 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) 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 Dante device is not present and prevent proper Dante operation.

Application Firmware Version Display

As part of the Model 5330's power-up sequence the two LED level meters associated with the monitor section, located on the right side of the front panel, will indicate the unit's application firmware version number. Knowing the version number can be useful when working with factory personnel on application support and troubleshooting situations. The eight LEDs associated with the left meter are used to display the major release number with a range of 1 through 8. The eight LEDs associated with the right meter are used to display the release sub-number which ranges from 0 (no LED lit) through 8.

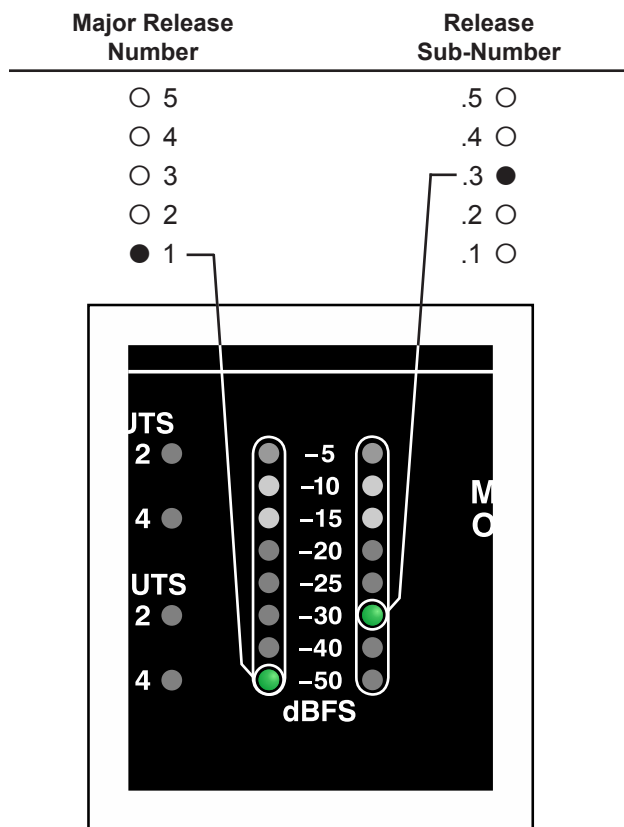


Figure 11. Level meter LEDs displaying application firmware version 1.3 (front panel)

Application Firmware Update Procedure

It's possible that updated versions of the application firmware (embedded software) that runs the Model 5330'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 application firmware file. The unit has the ability to automatically load revised files into the MCU's non-volatile memory by way of its USB interface. The Model 5330 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 file that is named **M5330.bin**.

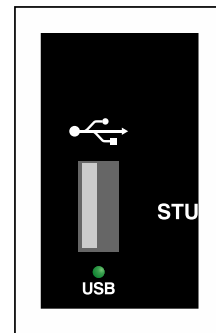


Figure 12. USB receptacle (back panel)

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 **M5330.bin**. Studio Technologies will supply the application firmware file inside a .zip archive file. While the firmware file inside of the zip file will adhere to the naming convention required by the Model 5330, the name of the zip file itself will include the file's version number. For example, a file named **M5330v1r3MCU.zip** would indicate that

version 1.3 of the application firmware (**M5330.bin**) is contained within this zip file. Once the desired **M5330.bin** file has been stored in the root directory the flash drive will be ready for use.

To install a new application firmware file follow these steps:

1. Remove power from the Model 5330. This will require removing the IEC C13 connector associated with the AC mains cord.
2. Identify the USB receptacle which is located on the right side of the back panel. It is labeled FIRMWARE UPDATE. Directly below the USB receptacle is a small hole that provides visual access to an LED indicator.
3. Insert the prepared USB flash drive into the USB receptacle.
4. Apply AC mains power to the Model 5330.
5. After a few seconds the Model 5330 will run a “boot loader” program that will automatically load and save the new application firmware file (**M5330.bin**). This process will take only a few seconds. During this time period the LED located below the USB receptacle will slowly flash on and off green. Once the entire loading process is over, taking approximately 10 seconds, the Model 5330 will restart using the newly-saved application firmware.
6. At this time the Model 5330 is functioning with the newly-saved application firmware and the USB flash drive can be removed. But to be conservative, remove AC mains power first and then remove the USB flash drive.

7. Apply AC mains power to the Model 5330 and “read” the application firmware version number by observing the LED level meters associated with the monitor section on the right side of the front panel. Ensure that this is the desired version.

Note that upon power being applied to the Model 5330 if the USB flash drive doesn't have the correct file (**M5330.bin**) in the root folder no harm will occur. Upon power up the green LED located below the USB receptacle 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 application firmware will begin.

Ultimo Firmware Update

As previously discussed in this guide, the Model 5330 implements Dante connectivity using the 4-input/4-output Ultimo integrated circuit from Audinate. Firmware (embedded software) resides in the Ultimo device and implements the Dante functionality. The Dante Controller software application can be used to determine the version of the firmware (embedded software) that resides in the Ultimo “chip.” This firmware can be updated by way of the Model 5330's Ethernet connection. The latest Dante firmware file is available for download from the Studio Technologies website (www.studio-tech.com). The Dante Firmware Update Manager (FUM) application is used to install the firmware. This program is available for download directly from the Audinate website (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 current.

Specifications

Network Audio Technology:

Type: Dante audio-over-Ethernet

AES67-2013 Support: yes (for serial numbers M5330-02001-later)

Dante Domain Manager (DDM) Support: yes

Bit Depth: up to 24

Sample Rates: 44.1 and 48 kHz

Number of Transmitter (Output) Channels: 4

Number of Receiver (Input) Channels: 4

Dante Audio Flows: 4; 2 transmitter, 2 receiver

Network Interface:

Type: twisted-pair Ethernet

Data Rate: 100 Mb/s (10 Mb/s not supported; 1000 Mb/s “GigE” Ethernet not supported unless falls back to 100 Mb/s)

Inputs 1 and 2:

Compatibility: unbalanced line-level sources

Type: analog, unbalanced, capacitor coupled

Impedance: 10 k ohms, nominal

Nominal Level: –10 dBu, adjustable with input level control

Maximum Level: depends on setting of the input level control

Dynamic Range: >116 dB, 0 dB gain, A-weighted

Distortion (THD+N): <0.001% (–101 dB) at –1 dBFS, 40 dB gain, 22 kHz bandwidth

Frequency Response: +0.0/–0.5 dB, 22 Hz to 22 kHz

Status LEDs: 2, displays signal present/peak

Inputs 3 and 4:

Compatibility: balanced or unbalanced line-level sources

Type: analog, electronically balanced, capacitor coupled

Impedance: 20 k ohms, nominal

Nominal Level: +4 dBu (results in Dante output level of –20 dBFS)

Maximum Level: +24 dBu (results in Dante output level of 0 dBFS)

Dynamic Range: >116 dB, 0 dB gain, A-weighted

Distortion (THD+N): <0.001% (–101 dB) at –1 dBFS, 40 dB gain, 22 kHz bandwidth

Frequency Response: +0.0/–0.5 dB, 22 Hz to 22 kHz

Status LEDs: 2, displays signal present/peak

Main, Auxiliary, and Monitor Outputs:

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 – Main and Auxiliary: +4 dBu, reference –20 dBFS on Dante input

Nominal Level – Monitor: 0 dBu, reference –20 dBFS on Dante input

Maximum Level: +24 dBu with 0 dBFS on Dante input

Dynamic Range: >119 dB, A-weighted

Distortion (THD+N): 0.0012% (–99 dB), measured at –1 dBFS, 22 kHz bandwidth

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

Status LEDs: 4, displays signal present/peak

Audio Monitor:

Source: inputs 1-4 or main outputs 1-4, selectable as monaural or stereo

Level Meters: 2, 8-segment LED

Headphone Output:

Type: stereo (dual-channel)

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

Maximum Output Voltage: 4.9 volts RMS, 1 kHz, 150 ohm load

Frequency Response: +0/–1.4 dB, 20 Hz to 20 kHz

Distortion (THD+N): 0.005%

Dynamic Range: >100 dB

Connectors:

Inputs 1 and 2: 3-conductor 3.5 mm jack

Inputs 3 and 4: 3-pin female XLR

Main, Auxiliary, and Monitor Outputs: 3-pin male XLR

Headphone Output: 3-conductor 3.5 mm jack and 3-conductor ¼-inch jack

Ethernet: RJ45 receptacle

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

AC Mains: 3-blade, IEC 320 C14-compatible (mates with IEC 320 C13)

Power Source:

AC Mains: 100 to 240 volts, +10/–15%, 50/60 Hz, 15 watt maximum

Dimensions – Overall:

19.0 inches wide (48.3 cm)

1.72 inches high (4.4 cm)

7.8 inches deep (19.8 cm); 8.2 inches (20.8 cm) overall

Mounting: one space (1U) in a standard 19-inch rack

Weight: 3.3 pounds (1.5kg)

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