Model 5204
Dual Line Input to Dante™ Interface

User Guide

Issue 2, August 2015

This User Guide is applicable for serial numbers
M5204-00151 and later with application firmware 1.3 and later
and Dante firmware 1.3 (Ultimo 2.2.2.5) and later

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Revision History

Issue 2, August 2015:

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

Issue 1, August 2014:

1. Initial release.

Introduction

The Model 5204 Interface is a general-purpose audio device that supports applications utilizing the Dante™ Audio-over-Ethernet media networking technology. Two 2-channel ("stereo") analog line-level audio signals can be connected to the Model 5204 and then converted to two channels on an associated Dante connection.

Analog audio signals connect to line input A by way of a 3-conductor ("stereo") 3.5 mm jack. This allows the direct interfacing of signals from a variety of sources such as personal audio and multimedia players, smartphones, and personal computers. These signals typically have an average (nominal) signal level in the range of –20 to –10 dBu. Line input B supports connection of balanced analog audio signals using two XLR connectors. Average signal levels for these types of signals are typically in the range of 0 to +4 dBu. Each input has an associated dual-channel rotary level control to optimize its audio performance. Following the level "pots" the signals from inputs A and B are summed (combined or mixed together) to create one 2-channel signal. (The channel 1 signals of line inputs A and B are summed to create output channel 1; channel 2 signals of line inputs A and B are summed to create output channel 2.)

The two channels are then output by way of the Dante interface. Multi-step LED meters provide confirmation of the level of the two output audio channels.

The audio quality of the Model 5204 is excellent, with low distortion and noise and high headroom. Careful circuit design and excellent components ensure long, reliable operation. A wide range of applications can be supported, including TV, radio, and streaming broadcast events, corporate and government AV installations, and Dante system testing.

For user convenience a dedicated charging port (DCP) is provided on a standard USB type A connector. This allows powering and charging of associated devices, such as personal audio players and tablets. The compact, lightweight design allows the Model 5204 to be used in portable or desktop situations or deployed as a permanent solution in fixed applications. Standard connectors ensure fast, reliable deployment. The unit requires only an Ethernet connection to supply both the data interface as well as Power-over-Ethernet (PoE) power. The Model 5204's audio, data, and dedicated charging port use power provided by the PoE connection.



Figure 1. Model 5204 Dual Line Input to Dante Interface front and rear views

Applications

The Model 5204 is perfect for use in conjunction with a variety of fixed and portable audio equipment that offer analog output signals. An obvious application is with legacy equipment that only offers analog outputs. A few simple connections are all that's required to covert those signals into the world of Audio-over-Ethernet. When deploying, maintaining, or modifying Dante networks the unit can be a useful test tool, offering a simple, high-quality means of creating a 2-channel signal source. For permanent applications there's no reason why a Model 5204 can't reside within an equipment rack or be mounted, using optional brackets, underneath a table or on-air studio set. In a conference room setting the unit can be permanently connected to a PoE-enabled Ethernet port, ready to accept a signal source from various user-provided devices.

Line Input A

Using a 3-conductor ("stereo") 3.5 mm jack, it's a simple matter to connect unbalanced sources to the Model 5204's line input A. These signals would typically be provided by personal computers, smartphones, or personal audio devices which have average (nominal) levels in the range of –20 to –10 dBu. One rotary control is used to adjust the input level, making it a simple task to optimize the conversion of the input analog audio source to the Dante output. The level knob is a push-in/push-out type which helps prevent inadvertent adjustment.

Line Input B

The Model 5204's line input B is designed for use with professional line-level analog audio signals. The 2-channel input is electronically balanced, capacitor-coupled, and uses two standard 3-pin female XLR connectors. A single rotary level control allows the input sensitivity of both channels to be adjusted. Using the push-in/push-out knob it's a simple matter to adjust the input circuitry to match average (nominal) signal levels which would typically be in the range of 0 to +4 dBu. And with a maximum input level of +24 dBu there will always be sufficient headroom for "pro" audio performance. Protection components in the input circuitry help ensure reliability in tough field applications.

Summing (Mixing) of the Input Signals

The two channels associated with line input A and the two channels associated with line input B are mixed (summed), sent to analog-to-digital conversion circuitry, and then transmitted over the Dante network. The two signals associated with the channel 1 (or "left") inputs are combined and sent out Dante channel 1. The two signals associated with the channel 2 (or "right") inputs are combined and sent out Dante channel 2. (There is no provision for creating a monaural signal which is typically not an issue as other connected Dante-enabled equipment can usually perform such tasks.)

Metering

Two 7-step LED meters provide a real-time level indication of the two audio output channels. Scaled in dBFS (decibels referenced to full scale digital) the meters offer a direct view of the signal levels as they are transported in the digital domain via Dante. Optimal audio performance requires transporting signals at their proper levels — without an accurate indication this can be difficult to achieve.

Ethernet Data and PoE

The Model 5204 connects to a data network using a standard 100 Mb/s twisted-pair Ethernet interface. The physical interconnection is made by way of a Neutrik® etherCON RJ45 connector. While compatible with standard RJ45 plugs, etherCON allows a ruggedized and locking interconnection for harsh or high-reliability environments. An LED displays the status of the network connection.

The Model 5204's operating power is provided by way of the Ethernet interface using the Power-over-Ethernet (PoE) standard. This allows fast and efficient interconnection with the associated data network. To support PoE power management, the Model 5204's PoE interface reports to the power sourcing equipment (PSE) that it's a class 3 (mid power) device. An LED is provided to indicate when power is being supplied to the Model 5204. Note that no provision has been made to allow an external power source to be connected. However, if the associated Ethernet switch does not provide PoE capability a commonly-available mid-span PoE power injector can be utilized.

Dedicated Charging Port (DCP)

A unique resource is the Model 5204's dedicated charging port. Using a standard USB type A receptacle, the port has a 5 volt output with a maximum current of approximately 1 amp. This nominally 5 watt output should be sufficient to rapidly charge a personal audio player, smartphone, or tablet device. An auto-detect feature supports divider mode, short mode, and 1.2 V/1.2 V charging modes. Besides charging, the port can allow a connected device to continuously send audio to the associated Dante network without requiring an external power source. Note that in this situation interfacing a device with the Model 5204 requires separate cables, one for the analog audio source and one for powering/charging.

One note of interest: the dedicated charging port derives its power from the Ethernet with Power-over-Ethernet (PoE) connection. While the Model 5204's audio and data circuitry takes very little energy, the dedicated charging port can source up to approximately 5 watts. As such, the Model 5204's Ethernet interface will identify itself to upstream power-sourcing-equipment (PSE), typically an Ethernet switch with integrated PoE, as a PoE class 3 powered device (PD).

Dante Audio-over-Ethernet

Audio data is sent from the Model 5204 using the Dante Audio-over-Ethernet media networking technology. As a Dante-compliant device, the Model 5204's two audio channels can be assigned to other devices using the Dante Controller software application. Bit depths of up to 24 and sample rates of 44.1, 48, 88.2, and 96 kHz are supported. Two bi-color LEDs provide an indication of the Dante connection status. The Model 5204 uses Audinate's Ultimo™ integrated circuit for implementing Dante. The integrated circuit's firmware can be updated via the Ethernet connection, helping to ensure that its capabilities remain up to date.

Getting Started

Included in the shipping carton are a Model 5204 Interface and a printed copy of this guide. As a device that is Power-over-Ethernet (PoE) powered, no external power source is provided. Should a PoE midspan power injector be required it must be purchased separately.

Mounting Options

There is no provision for directly mounting one or more Model 5204 units in an equipment rack. However, the overall height of the unit was carefully selected so that it could be placed without interference on a single space (1U) rack shelf. The Model 5204's enclosure width allows up to four units to be placed side-by-side on a 1U shelf that's mounted in a standard 19-inch equipment rack. Hook-and-loop ("Velcro") tape can be used to secure the Model 5204 units to the shelf. A set of mounting brackets is available to allow a Model 5204 to be attached to the underside of a desk, table, broadcast set, or other flat surface. Contact Studio Technologies for details.

Connections

In this section signal interconnections will be made using the connectors located on the front and back panel of the Model 5204. An Ethernet data connection with Power-over-Ethernet (PoE) capability will be made using either a standard RJ45 patch cable or an etherCON protected RJ45 plug. Line-level signal sources will be connected using the 3.5 mm jack associated with line input A and the 3-pin XLR connectors associated with line input B. The USB dedicated charging port can be connected to power or charge an external device.

Ethernet Connection

A 100BASE-TX Ethernet connection that supports Power-over-Ethernet (PoE) is required for Model 5204 operation. This one connection will provide both the Ethernet data interface and power for the Model 5204's circuitry. A 10BASE-T connection is not sufficient and a 1000BASE-T ("GigE") connection is not supported unless it can automatically "fall back" to 100BASE-TX operation. For PoE switch (PSE) power management the Model 5204 will enumerate itself as a PoE class 3 device.

The Ethernet connection is made by way of a Neutrik etherCON protected RJ45 connector that is located on the back panel of the Model 5204. This allows connection by way of a cable-mounted etherCON plug or a standard RJ45 plug. The Model 5204's Ethernet interface supports auto MDI/MDI-X so that most cabling implementations will be correctly supported.

Line Input A

Line input A is intended for connection with a 2-channel (stereo) unbalanced line-level analog audio signal source. This will typically be associated with consumer and semi-professional devices such as personal audio players, AV equipment, and tablet and personal computers. These signals will typically have a nominal level in the range of –15 to –10 dBu. Devices are connected to line input A by way of a 3.5 mm 3-conductor jack located on the Model 5204's front panel. As is standard for 2-channel (stereo) audio signals present on this type of connector channel 1 (left) is connected to the jack's tip lead, channel 2 (right) to the jack's ring lead, and the common connection to the jack's sleeve.

Line Input B

Line input B is intended for connection with two balanced line-level analog audio signal sources associated with professional audio and video equipment. These will include devices such as audio consoles, video storage and playback systems, wireless microphone receivers, and audio testing equipment. The audio quality is such that using line input B for on-air broadcast or streaming applications would be appropriate. The two channels associated with line input B are analog, electronically balanced, and capacitor coupled.

The Model 5204 provides two 3-pin female XLR connectors for interfacing signals with line input B. Pin 2 on a mating connector (3-pin male XLR) should be connected as signal + (high), pin 3 as signal – (low), and pin 1 as common/shield. With an unbalanced source connect signal + (high) to the pin 2 and signal – (low/shield) to both pins 1 and 3.

USB Dedicated Charging Port

A USB type A receptacle is located on the back panel of the Model 5204. It allows connection to a wide variety of devices that obtain power for operation and/or charging via USB. No data is transferred to or from the Model 5204 with this connector, only power is provided. The dedicated charging port (DCP) is capable of automatically enumerating ("handshaking") with a number of the popular device protocols. This allows operation with most mobile phones, tablet computers, and personal audio devices. Using the appropriate cable, simply connect the dedicated charging port to the selected device. Up to 5 watts of energy can be delivered on a continuous basis. It's possible that the device being powered and/or charged is also serving as the source of analog audio for line input A. In this case two interface cables will be used to link the device with the Model 5204.

Dante Configuration

Several Model 5204's Dante-related parameters can be configured. These configuration settings will be stored in nonvolatile memory within the Model 5204's circuitry. Configuration will typically be done with the Dante Controller software application which is available for download free of charge at www.audinate.com. Versions of Dante Controller are available to support Windows® and OS X® operating systems. The Model 5204 uses the Ultimo 2-input/2-output integrated circuit to implement the Dante architecture. However, only the two transmitter (output) channels are utilized. This dictates which parameters can be configured and what choices are available.

The two transmitter channels associated with the Model 5204's Dante interface must be assigned to the desired receiver channels. Within Dante Controller a "subscription" is the term used for routing a transmitter flow (a group of output channels) to a receiver flow (a group of input channels). Note that as of the writing of this guide the number of transmitter flows associated with an Ultimo integrated circuit is limited to two.

The Model 5204 will support audio sample rates of 44.1, 48, 88.2, and 96 kHz with a limited selection of pull-up/pull-down values. The Model 5204 can serve as the clock master for a Dante network but in most cases it will "sync" to another device.

The Model 5204 has a default Dante device name of **ST-M5204** and a unique suffix. The suffix identifies the specific Model 5204 that is being configured (it relates to the MAC address of the Ultimo integrated circuit). The two Dante transmitter channels have default names of **Ch1** and **Ch2**. Using Dante Controller the default device and channel names can be revised as appropriate for the specific application.

Operation

At this point an Ethernet connection with Power-over-Ethernet (PoE) capability should have been made. The unit's Dante configuration settings should have been selected using Dante Controller software application. At a minimum the Model 5204's two Dante transmitter channels should have been routed to receiver channels on an associated device. Analog signal source connections to line input A and line input B should have been made as desired. A device may have been connected to the USB dedicated charging port. Normal operation of the Model 5204 can now begin.

Initial Operation

The Model 5204 will immediately begin to function as soon as a Power-over-Ethernet (PoE) power source is connected. At this time the USB dedicated charging port will become functional. However, full operation may take up to 20 seconds to begin. Upon initial power up the four status LEDs located on the back panel will begin to light. The meter LEDs on the front panel will light in a test sequence. After the meter LEDs complete their test sequence one meter LED associated with channel 1 and one meter LED associated with channel 2 will briefly light to indicate the version number of the unit's firmware (embedded software). (Understanding how to "read" the application firmware number will be discussed in detail later in this guide.) Once that sequence has completed and the Dante connection has been established full operation will begin.

Ethernet, PoE, and Dante Status LEDs

Four status LEDs are located below the Ethernet connector on the Model 5204's back panel. The PoE LED will light green to indicate that Power-over-Ethernet (PoE) associated with the connected Ethernet signal is providing operating power for the Model 5204. The LINK/ACT LED will light green whenever an active connection to a 100 Mb/s Ethernet network has been established. It will flash in response to data packet activity. The SYS and SYNC LEDs display the operating status of the Dante interface and associated network. The SYS LED will light red upon Model 5204 power up to indicate that the Dante interface is not ready. After a short interval it will light green to indicate that it is ready to pass data with another Dante device. The SYNC LED will light red when the Model 5204 is not synchronized with a Dante network. It will light solid green when the Model 5204 is synchronized with a Dante network and an external clock source (timing reference) is being received. It will slowly flash green when the Model 5204 is part of a Dante network and is serving as a clock master.

How to Identify a Specific Model 5204

The Dante Controller software application offers an identify command that can be used to help locate a specific Model 5204. When identify is selected for a specific unit its meter LEDs will light in a unique pattern. In addition, the SYS and SYNC LEDs, located directly below the etherCON connector on the back panel, will slowly flash green. After a few seconds the LED identification patterns will cease and normal Model 5204 level meter and Dante status LED operation will again take place.

Level Meters

Two 7-step LED meters will display the level of the two Dante transmitter (output) channels. The meter steps are calibrated in dBFS which indicates the number of dB below the maximum possible digital signal level. The maximum level, 0 dBFS, is the digital audio reference level equal to "full scale." Full scale refers to the maximum level possible for a sine wave before "digital clipping." In typical applications a signal level of –20 dBFS would be the desired nominal (normal average) value. The five meter steps that have a threshold of –20 dBFS and less light with the color green. The step that lights at –15 dBFS and greater is yellow in color and indicates a "hot" or above average signal level. The top step lights red in color when a signal levels is –5 dBFS or greater, indicating that a potentially "clipped" (distorted due to excessive level) signal is present.

Input A

The signal connected to the tip (left channel) connection of line input A's 3.5 mm jack is associated with Dante transmitter (output) channel 1. The ring (right channel) connection of the 3.5 mm jack is associated with Dante transmitter channel 2. The push-in/push-out rotary control adjusts the input level of both channels of line input A. In its fully counterclockwise position the input signal are essentially off (muted). Adjust the control such that normal input signals will cause the five green LEDs to light. Peak signals can cause the yellow LED to light on occasion. But the yellow LED should never be continuously lit. The red LED should never light, except possibly in the case of an extreme peak. The red LED lighting on a regular basis indicates that the signal level is at risk of reaching digital 0 (0 dBFS) which is destructive to audio quality.

Input B

The signal connected to line input B's channel 1 3-pin female XLR connector is associated with Dante transmitter (output) channel 1. The signal connected to line input B's channel 2 XLR connector is associated with Dante transmitter (output) channel 2. The push-in/push-out rotary control adjusts the input level of both channels of line input B. In its fully counterclockwise position the input signals are essentially off (muted). Adjust the control such that normal input signals will cause the five green LEDs to light. Peak signals can cause the yellow LED to light on occasion. But the yellow LED should never be continuously lit. The red LED should never light, except possibly in the case of an extreme peak. The red LED lighting on a regular basis indicates that the signal level is at risk of reaching digital 0 (0 dBFS) which is destructive to audio quality.

Line Inputs A & B Combine

It's important to highlight that the Model 5204's two 2-channel line inputs (A and B) combine in the analog domain. In effect the Model 5204 is a dual-input 2-channel (stereo) mixer and Dante converter. A signal present on channel 1 (left) of line input A and a signal present on channel 1 of line input B will combine (mix together or sum) after ("post") the two level controls. This combined signal is routed to the analog-to-digital converter circuitry and on to the Dante transmitter (output) for channel 1. A signal present on channel 2 (right) of line input A and a signal present on channel 2 of line input B will combine (mix together or sum) after ("post") the two level controls. This combined signal is routed to the analog-to-digital converter circuitry and on to the Dante transmitter (output) for channel 2. But note that no monaural version of the input signals is created.

USB Dedicated Charging Port

There are no special instructions when using the dedicated charging port. Simply connect the desired device and the function will typically automatically start. The only limitations will be with the port's 5 volt, 1 ampere (5 watt) maximum power supply capability. A connected device that requires more energy for operation may not enumerate (handshake or negotiate) successfully. No damage will occur in this case.

There are no LEDs or performance indicators or configuration settings associated with the dedicated charging port. It's really just a "plug-in and go" feature.

Technical Notes

IP Address Assignment

By default the Model 5204's Ethernet interface will attempt to obtain an IP address and associated settings using DHCP (Dynamic Host Configuration Protocol). If a DHCP server is not detected an IP address will be assigned using the link-local protocol. This protocol is known in the Microsoft® world as Automatic Private IP Addressing (APIPA). It is also sometimes referred to as auto-IP (PIPPA). Link-local will assign an IP address in the IPv4 range of 169.254.0.1 to 169.254.255.254. In this way multiple Dante-enabled devices can be connected together and automatically function, whether or not a DHCP server is active on the LAN. Even two Dante-enabled devices that are directly interconnected using an RJ45 patch cord will correctly acquire IP addresses and be able to communicate and transport audio.

Using the Dante Controller software application the Model 5204's IP address and related network parameters can be set for a fixed ("static") configuration. While this is more involved than letting DHCP or link-local "do their thing," if fixed addressing is necessary then that capability is available. But in this case it's highly recommended that each unit be physically marked, e.g., directly using a permanent marker or "console tape," with its specific IP address. If knowledge of a Model 5204's IP address has been misplaced there is no reset button or other method to restore the unit to a default IP setting.

In the unfortunate event that a device's IP address is "lost," the Address Resolution Protocol (ARP) networking command can

be used to "probe" devices on a network for this information. For example, in Windows OS the **arp –a** command can be used to display a list of LAN information that includes MAC addresses and corresponding IP addresses. The simplest means of identifying an unknown IP address is to create a "mini" LAN with a personal computer connected directly to the Model 5204. Then by using the appropriate ARP command the required "clues" can be obtained.

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

Updating Main Application Firmware

The Model 5204 uses a Freescale HCS-08-series microcontroller (MCU) integrated circuit to run its main application firmware (embedded software). The firmware is loaded into and stored in the MCU's non-volatile memory by way of a stand-alone hardware programmer unit that interfaces with a header connector located on the unit's motherboard. This firmware programming is done at the factory at the time of manufacture using a Cyclone Pro or Cyclone Universal stand-alone programmer unit from P&E Micro (www.pemicro.com). There is no provision for updates of the application firmware to easily be performed in the field. Unlike some of the other Studio Technologies' Dante-enabled products, the Model 5204 does not have a USB interface for firmware updating. This is because of the Model 5204's simple, well-defined functionality and commensurate limited-resource MCU.

It's possible that updated versions of the Model 5204's application firmware will be released. This could be due to software bug fixes or feature improvements. It's expected that in most cases Model 5204 units will be returned to the factory should this firmware need to be loaded. This would be true unless a user, reseller, or distributor has access to an appropriate stand-alone programmer unit. For reference the Studio Technologies' website will make available the latest version of the Model 5204's application firmware file along with a text description file. Contact the factory for additional details.

Ultimo Firmware Update

As previously discussed in this guide, the Model 5204 implements Dante connectivity using the 2-input/2-output Ultimo integrated circuit from Audinate. The Dante Controller software application can be used to determine the version of the firmware (embedded software) residing in the Ultimo "chip." This firmware can be updated by way of the Model 5204's Ethernet connection. The latest Dante firmware file is available on the Studio Technologies website. The Dante Firmware Update Manager application is used to install the firmware. This program is also available for download on the Studio Technologies website.

Identifying the Firmware Version Number

As previously discussed in this guide, upon power up the meter LEDs are used to briefly display the version number of the Model 5204's firmware (embedded software). This information is typically only necessary when working with the factory on support issues. The meter LEDs will first go through a display sequence followed by an approximately 1-second period where the version number will be indicated. The top row of seven LEDs will display the major version number with a range of 1 to 7. The bottom row of seven LEDs will display the minor version number with a range of 1 to 7. Refer to Figure 2 for details.

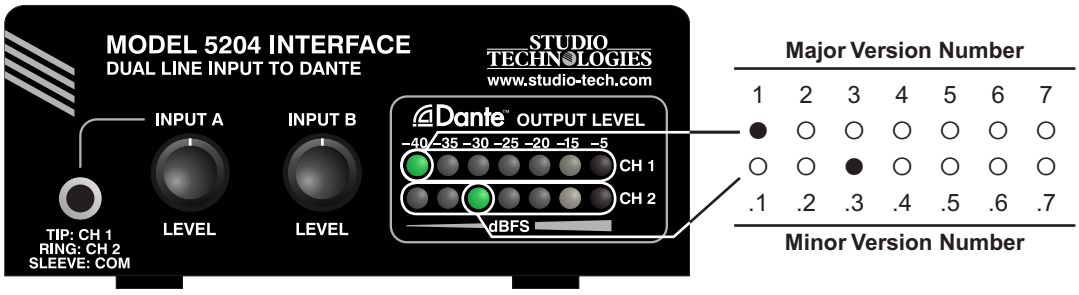


Figure 2. Detail of front panel showing the LEDs that display the firmware version. In this example, the version shown is 1.3.

Specifications

Network Audio Technology:

Type: Dante Audio-over-Ethernet

Bit Depth: up to 24

Sample Rates: 44.1, 48, 88.2, and 96 kHz

Number of Transmitter (Output) Channels: 2

Dante Audio Flows: 2 transmitter

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

Network Interface:

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

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

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

General Audio Parameters:

Frequency Response: 20 Hz to 20 kHz, ±0.5 dB, line input B to Dante

Distortion (THD+N): 0.01%, measured at 1 kHz, +4 dBu, line input B to Dante

Dynamic Range: >100 dB, A-weighted, line input B to Dante

Line Input A:

Type: 2-channel (“stereo”) unbalanced, capacitor-coupled

Input Impedance: 10 k ohms

Nominal Level: adjustable using rotary level control, –3 dBu @ 100% rotation

Maximum Level: +10 dBu

Line Input B:

Type: 2-channel (“stereo”) electronically balanced, capacitor-coupled

Input Impedance: 20 k ohms

Nominal Level: adjustable using rotary level control, +11 dBu @ 100% rotation

Maximum Level: +24 dBu

Meters: 2

Function: displays level of Dante output signals

Type: 7-segment LED, modified VU ballistics

Dedicated Charging Port:

Function: powering and charging of connected devices; no data interface

Output (Nominal): 5 volts DC, 1 amp (5 watts)

Compatibility: auto-detect supports divider mode, short mode, and 1.2 V/1.2 V charging modes

Connectors:

Ethernet: Neutrik etherCON RJ45

Line Input A: 3-conductor (“stereo”) 3.5 mm jack

Line Input B: 2, 3-pin female XLR

Dedicated Charging Port: USB type A receptacle

Dimensions (Overall):

4.2 inches wide (10.7 cm)
1.7 inches high (4.3 cm)
5.1 inches deep (13.0 cm)

Mounting Option: bracket kit

Weight: 0.8 pounds (0.35 kg)

Specifications subject to change without notice.