



Model 545DC Intercom Interface

Key Features

- Dante audio-over-Ethernet technology
- Excellent audio quality
- Integrated party-line (PL) intercom power sources
- Uses STcontroller for monitoring and configuration
- Analog hybrids with auto null capability
- PoE and 12 volts DC powering
- Input and output level metering
- Table-top, portable, or optional rack-mount use

Overview

The Model 545DC Intercom Interface allows two single-channel analog party-line (PL) intercom circuits and associated user devices to be incorporated into Dante® audio-over-Ethernet applications. Single-channel analog party-line (PL) intercom systems are commonly used in theater, entertainment, and education applications where a simple, reliable, low-cost, and easy-to-use solution is desired. Dante has become a major method of interconnecting audio signals and various devices using standard Ethernet networks. The Model 545DC directly supports both analog party-line (PL) and Dante, providing excellent performance in both domains. Single-channel analog party-line (PL) products from Clear-Com® are directly compatible with the Model 545DC. The Dante audio-over-Ethernet media networking technology is used to transport the send and receive audio channels associated with the two single-channel party-line (PL) circuits. The Model 545DC's two hybrid circuits with automatic nulling action provide

good separation of send and receive audio with high return loss and excellent audio quality. (These hybrid circuits are sometimes referred to as 2-wire to 4-wire converters.) The Model 545DC's digital audio signals are compatible with all equipment that utilizes Dante technology. An Ethernet connection is all that's required to make the Model 545DC part of a sophisticated, networked audio system.

The Model 545DC can interconnect with Dante-supported devices such as matrix intercom systems, digital audio processors, and audio consoles. The unit is directly compatible with RTS ADAM® and ODIN® intercom systems that support OMNEO® network technology. Alternately, two Model 545DC units can be interconnected by way of an associated Ethernet network. The Model 545DC can also become part of a party-line (PL) intercom system when used in conjunction with devices such as the Models 5421 and 5422A Dante Intercom Audio Engine units from Studio Technologies. In this way, analog party-line (PL)



Model 545DC Intercom Interface front and back views

intercom circuits can become part of a high-performance digital party-line (PL) intercom deployment.

The Model 545DC can be powered by Power-over-Ethernet (PoE) or an external source of 12 volts DC. The unit can provide two party-line (PL) power sources and analog impedance termination networks, allowing direct connection of user beltpacks such as the Clear-Com RS-501 and RS-701 devices. A Model 545DC can also connect to one or two existing powered and terminated single-channel analog party-line (PL) intercom circuits. The unit provides four audio level meters that help to confirm system performance during setup and operation. Support for transporting industry-standard call light signals between two Model 545DC units, as well as between a Model 545DC and other compatible units, is also provided.

The STcontroller software application can be used to real-time monitor and control several Model 545DC operating parameters. In addition, two configuration settings are performed using the application. Versions of STcontroller are available that are compatible with the Windows® and macOS® operating systems. They are available, free of charge, from the Studio Technologies' website.

Standard connectors are used for Model 545DC party-line (PL) intercom, Ethernet, and DC power interconnections. Set up and configuration of the Model 545DC is simple. A Neutrik® etherCON RJ45 jack is used to interconnect with a standard twisted-pair Ethernet port associated with a local-area network (LAN). This connection can provide both PoE power and bidirectional digital audio. LEDs provide status indications of the Ethernet and Dante connections.

The unit's lightweight aluminum enclosure is intended for desk or tabletop use. Optional mounting kits allow one or two Model 545DC units to be mounted in one space (1U) of a standard 19-inch rack enclosure.

Applications

There are three main ways the Model 545DC can be used in applications: connecting analog party-line (PL) intercom circuits into Dante-based intercom applications, adding party-line (PL) intercom support for matrix intercom systems, and linking two stand-alone analog party-line intercom circuits. The Model 545DC's Dante transmitter (output) and

receiver (input) channels can be connected to Dante-based digital PL intercom circuits. These circuits would typically be created using devices such as the Studio Technologies' Models 5421 or 5422A Dante Intercom Audio Engines. This would allow legacy analog party-line intercom equipment to become part of contemporary digital intercom applications. The resultant audio quality for both the analog and Dante-base PL should be excellent.

Ports on matrix intercom systems that support Dante, such as the RTS ADAM and ODIN with OMNEO, can be routed to the Model 545DC's Dante transmitter (output) and receiver (input) channels. The Model 545DC's circuitry will then convert these signals into two single-channel analog party-line intercom circuits. In this way, adding analog party-line support will be a simple task. The Model 545DC can also be used with matrix intercom systems that don't support Dante. An external analog-to-Dante interface can be used to convert "4-wire" analog intercom resources to Dante channels. For example, the Model 544D Audio Interface from Studio Technologies is well suited to function with matrix intercom systems. Once in the Dante digital domain, these audio channels can be interconnected with the Model 545DC's Dante receiver (input) and transmitter (output) channels.

Separate single-channel analog party-line (PL) intercom circuits can easily be interconnected using two Model 545DC Interfaces. On each end, a Model 545DC is connected to one or two PL circuits as well as to the Dante network. The Dante Controller software application is used to route (subscribe) the audio channels between the two Model 545DC units. (The physical distance between units will only be limited by the deployment of the LAN's subnet.) That's it — nothing else is required to achieve excellent performance.

The Model 545DC can also be used to "bridge" (interconnect) one or two single-channel party-line intercom circuits with a 2-channel party-line intercom circuit. This involves using a Model 545DC to support the single-channel circuits and a Studio Technologies' Model 545DR Intercom Interface to support the 2-channel party-line intercom circuit. The Model 545DR is a "cousin" of the Model 545DC and supports one 2-channel party-line intercom circuit rather

than two single-channel circuits. This 2-channel circuits, typically supported by equipment from RTS, are commonly used in broadcast applications.

Party-Line Interface

As previously discussed, the Model 545DC's two party-line intercom interfaces are optimized for connection with two single-channel party-line intercom circuits or groups of single-channel user devices. (While the Model 545DC will also function in a limited manner with 2-channel RTS TW circuits, the Model 545DR Intercom Interface is the much-preferred choice.) A party-line active detection function ensures that should a user beltpack or active party-line intercom circuit not be connected the Model 545DC's interface circuitry will remain stable. This unique feature makes certain that objectionable audio signals, including oscillations and "squeals," won't be sent to other Dante-enabled devices.

A significant capability of the Model 545DC's two party-line interfaces is their ability to supply power and a 200 ohms AC termination to "create" two independent intercom circuits. Each 28 volts DC output can power a moderate number of devices such as user beltpacks. With up to 150 milliamperes (mA) of current available, a typical entertainment application could connect up to three RS-501 or five RS-701 beltpacks to each of the Model 545DC's two interfaces. In many applications, this can eliminate the need for an external intercom power supply, reducing total system cost, weight, and required mounting space. The power supply outputs are monitored for over-current and short-circuit conditions. Under firmware (embedded software) control the outputs will automatically cycle off and on to help prevent damage to the circuitry and connected equipment.

Dante Audio-over-Ethernet

Audio data is sent to and from the Model 545DC using the Dante audio-over-Ethernet media networking technology. Audio signals with a sample rate of 48 kHz and a bit depth of up to 24 are supported. Audio transmitter (output) and receiver (input) channels on associated Dante-enabled devices can be routed (subscribed) to the Model 545DC using the Dante Controller application. This makes it

simple to select the way in which a Model 545DC fits into a specific application.

Analog Hybrids with Auto Nulling

Two circuits, referred to as "hybrids," interface the Dante transmitter (output) and receiver (input) channels with the two party-line channels. The hybrids provide low noise and distortion, good frequency response, and high return-loss ("nulling"), even when presented with a wide range of party-line conditions. Unlike telephone-line ("POTS") oriented DSP-based hybrid circuits, the Model 545DC's analog circuitry maintains extended frequency response. With a passband of 100 Hz on the low end and 8 kHz on the high end, natural-sounding voice signals can be sent to and received from a party-line circuit.

The Model 545DC's sophisticated hybrid auto nulling function uses a combination of digital and analog circuitry under microprocessor control to achieve significant trans-hybrid loss. This return-loss "null" is achieved by making a series of firmware-directed adjustments to account for the resistive, inductive, and capacitive conditions that are present on the connected party-line cabling and user devices. Whenever one of the Model 545DC's auto null buttons is pressed, or the STcontroller application is used, digital circuitry adjusts the associated hybrid to achieve its maximum return-loss in under 15 seconds. While the nulling process is automatic, it only takes place upon user request. The resulting null parameters are stored in non-volatile memory.

Pro Audio Quality

The Model 545DC's audio circuitry was designed in the spirit of professional audio equipment rather than that found in typical party-line intercom gear. High-performance components are used throughout, providing low-distortion, low-noise, and high headroom. Using active filters, the frequency response of the audio channels is limited to nominally 100 Hz to 8 kHz. This range was selected to provide excellent performance for human speech while maximizing the ability of the hybrid circuits to create substantial "nulls."

Audio Meters

The Model 545DC contains two sets of 5-segment LED level meters. Each set of two meters displays the level of the signals being sent to and received from a party-line

interface. At the time of installation and setup the meters are invaluable in helping to confirm correct operation. During normal operation the meters offer rapid confirmation of audio signals flowing in to and out of the Model 545DC unit.

Status Display

LED indicators are provided on the Model 545DC's front panel, offering a status indication of the party-line power sources, party-line activity, and auto null functions. Two other LEDs offer a direct indication of what source or sources of power are connected to the Model 545DC. The STcontroller application also provides a real-time "virtual" status display of the unit's PL power sources, PL activity, and auto null functions.

Call Light Support

Typical single-channel party-line intercom circuits provide a call light function by way of a DC voltage applied to the audio path. The Model 545DC can detect such call light activity, converting it to a 20 kHz audio tone which is then transported over the Dante audio path. A Model 545DC unit at the "far end" will detect the "call" audio tone and regenerate it as a DC voltage on the party-line intercom audio path. This allows full "end-to-end" call light support between two Model 545DC units. It also allows a Model 545DC to send and receive call light status with an interconnected Model 545DR Intercom Interface. The Model 545DR is typically used with the RTS TW-series of two-channel party-line user beltpacks, including the popular BP-325.

Ethernet Data, PoE, and DC Power Source

The Model 545DC connects to a local area data network (LAN) using a standard 100 Mb/s twisted-pair Ethernet interface. The physical interconnection is made by way of a Neutrik etherCON RJ45 jack. While compatible with standard RJ45 plugs, an etherCON jack allows a ruggedized and locking interconnection for harsh or high-reliability environments. The Model 545DC's operating power can be provided by way of the Ethernet interface using the

Power-over-Ethernet (PoE) standard. This allows fast and efficient interconnection with the associated data network. To support PoE power management, the Model 545DC's PoE interface reports to the power sourcing equipment (PSE) that it is a class 3 (mid power) device. The unit can also be powered using an external source of 12 volts DC.

For redundancy, both power sources can be connected simultaneously. An internal switch-mode power supply ensures that all Model 545DC features, including party-line intercom circuit power, are available when the unit is powered by either source. Four LEDs on the back panel display the status of the network connection, Dante interface, and PoE power source.

Simple Installation

The Model 545DC uses standard connectors to allow fast and convenient interconnections. An Ethernet signal is connected using a Neutrik etherCON RJ45 jack. If Power-over-Ethernet (PoE) is available operation will commence immediately. An external 12 volts DC power source can also be connected by way of a 4-pin female XLR connector. Party-line intercom connections are made using two 3-pin male XLR connectors. The Model 545DC 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. Rack-mounting option kits are available that allow one or two Model 545DC units to be mounted in one space (1U) of a standard 19-inch rack enclosure.

Future Capabilities and Firmware Updating

The Model 545DC was designed so that its capabilities and performance can easily be enhanced in the future. A USB receptacle, located on the Model 545DC's back panel, allows the application firmware (embedded software) to be updated using a USB flash drive. To implement its Dante interface the Model 545DC uses the UltimoX2™ integrated circuit from Audinate. The firmware in this integrated circuit can be updated via the Ethernet connection helping to ensure that its capabilities remain up to date.

Model 545DC Specifications

Power Sources:

Power-over-Ethernet (PoE): class 3 (mid power) per IEEE® 802.3af
External: 10 to 18 volts DC, 1.0 A max at 12 volts DC

Network Audio Technology:

Type: Dante audio-over-Ethernet
AES67-2018 Support: yes, selectable on/off
Dante Domain Manager (DDM) Support: yes
Bit Depth: up to 24
Sample Rate: 48 kHz
Dante Transmitter (Output) Channels: 2
Dante Receiver (Input) Channels: 2
Dante Audio Flows: 4; 2 transmitter, 2 receiver
Analog to Digital Equivalence: a -10 dBu analog signal on a party-line interface channel results in a Dante digital output level of -20 dBFS and vice-versa

Network Interface:

Type: 100BASE-TX, Fast Ethernet per IEEE 802.3u (10BASE-T and 1000BASE-T (GigE) not supported)
Power-over-Ethernet (PoE): Per IEEE 802.3af
Data Rate: 100 Mb/s (10 Mb/s and 1000 Mb/s not supported)

General Audio:

Frequency Response (PL to Dante): -0.3 dB @ 100 Hz (-4.8 dB @ 20 Hz), -2 dB @ 8 kHz (-2.6 dB @ 10 kHz)
Frequency Response (Dante to PL): -3.3 dB @ 100 Hz (-19 dB @ 20 Hz), -3.9 dB @ 8 kHz (-5.8 dB @ 10 kHz)
Distortion (THD+N): <0.15%, measured at 1 kHz, Dante input to PL interface pin 2 (0.01% pin 3)
Signal-to-Noise Ratio: >65 dB, A-weighted, measured at 1 kHz, Dante input to PL interface pin 2 (73 dB, PL interface pin 3)

Party-Line (PL) Intercom Interfaces: 2

Type: single-channel analog PL (XLR pin 1 common; XLR pin 2 DC; XLR pin 3 unbalanced audio)
Compatibility: single-channel PL intercom systems such as those offered by Clear-Com®
Power Source, XLR Pin 2: 28 volts DC, 150 mA maximum
Impedance, XLR Pin 3 – Local PL Power Not Enabled: >10 k ohms
Impedance, XLR Pin 3 – Local PL Power Enabled: 200 ohms
Analog Audio Level, XLR Pin 3: -14 dBu, nominal, +7 dBu maximum
Call Light Signal Support, XLR Pin 3: DC voltage on pin 3; detects at >= 5.5 volts DC nominal; generates at 16 volts DC nominal
Mic Kill Signal Support, XLR Pin 2 – Local Power Enabled: momentary break in DC voltage

Party-Line (PL) Hybrids: 2

Topology: 3-section analog circuitry compensates for resistive, inductive, and capacitive loads
Nulling Method: automatic upon user initiation, processor implements digital control of analog circuitry; settings stored in non-volatile memory
Nulling Line Impedance Range: 120 to 350 ohms
Nulling Cable Length Range: 0 to 3500 feet
Trans-Hybrid Loss: >55 dB, typical at 800 Hz

Meters: 4

Function: displays level of audio input and output channels
Type: 5-segment LED, modified VU ballistics

Connectors:

Party-Line (PL) Intercom: two, 3-pin male XLR
Ethernet: Neutrik etherCON RJ45 jack
External DC: 4-pin male XLR
USB: type A receptacle (used only for updating application firmware)

Configuration: requires Studio Technologies' STcontroller software application

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

Environmental:

Operating Temperature: 0 to 50 degrees C (32 to 122 degrees F)
Storage Temperature: -40 to 70 degrees C (-40 to 158 degrees F)
Humidity: 0 to 95%, non-condensing
Altitude: not characterized

Dimensions – Overall:

8.70 inches wide (22.1 cm)
1.72 inches high (4.4 cm)
8.30 inches deep (21.1 cm)

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

Deployment: intended for tabletop applications. Four optional mounting kits are also available:

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

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

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

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

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

Specifications subject to change without notice.

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