Model 545DR Intercom Interface

Key Features

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

Overview

The Model 545DR Intercom Interface allows 2-channel analog party-line (PL) intercom circuits and user devices to be incorporated into Dante® audio-over-Ethernet applications. Analog party-line intercom is commonly used in broadcast, corporate, and commercial applications where a simple, reliable, 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 545DR directly supports both analog PL and Dante, providing excellent performance in both domains. The popular RTS® TW 2-channel analog intercom circuit technology is directly compatible with the Model 545DR. The Dante audio-over-Ethernet media networking technology is used to transport the two send and two receive audio channels associated with this type of party-line circuit. The Model 545DR'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 545DR's digital audio signals are compatible with all broadcast and audio equipment that utilizes Dante technology. An Ethernet connection is all that's required to make the Model 545DR part of a sophisticated, networked audio system.

The Model 545DR can interconnect with Dante-supported devices such as matrix intercom systems, digital audio processors, and audio consoles. The unit is directly compatible with the RTS ADAM® OMNEO® matrix intercom network. Alternately, two Model 545DR units can be interconnected by way of an associated Ethernet network. The Model 545DR can also become part of a 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, an analog party-line intercom circuit can become part of a high-performance digital party-line intercom deployment.

Model 545DR Intercom Interface front and back views

The Model 545DR can be powered by Power-over-Ethernet (PoE) or an external source of 12 volts DC. The unit can provide a party-line power source and impedance termination networks to allow direct connection of 2-channel user beltpacks. This ability allows support for connection of up to three of the popular RTS BP-325 beltpacks. A Model 545DR can also connect with an existing powered and terminated PL intercom circuit. The unit provides four audio level meters that help to confirm system performance during setup and operation. Support for transporting call light signals between two Model 545DR units, as well as between a Model 545DR and other compatible units, is also provided.

The STcontroller software application can be used to real-time monitor and control several Model 545DR 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 545DR party-line (PL) intercom, Ethernet, and DC power interconnections. Set up and configuration of the Model 545DR 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 545DR units to be mounted in one space (1U) of a standard 19-inch rack enclosure.

Applications

There are three main ways the Model 545DR can be used in applications: connecting analog party-line (PL) intercom circuits to 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 545DR'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 equipment to become part of contemporary all-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 with OMNEO, can be routed to the Model 545DR's Dante transmitter (output) and receiver (input) channels. The Model 545DR's circuitry will then convert these signals into a 2-channel analog party-line intercom circuit. In this way, adding analog party-line support to RTS + OMNEO is a simple task. The Model 545DR can also be used with matrix intercom systems that don't support Dante. An external analog-to-Dante interface can be used to convert analog intercom ports to Dante channels. For example, the Model 544D Audio Interface from Studio Technologies is specifically designed to work with matrix intercom systems. Once in the Dante digital domain, these channels can be interconnected with the Model 545DR's Dante input and output channels.

Two separate analog party-line (PL) intercom circuits can easily be interconnected using two Model 545DR Interfaces. A Model 545DR is connected to each PL circuit as well as to the Dante network. The Dante Controller software application will then be used to route (subscribe) the audio channels between the two 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 545DR can also be used to "bridge" a 2-channel party-line intercom circuit with one or two single-channel party-line intercom circuits. This involves using a Model 545DR with the 2-channel circuit and one or two of the Studio Technologies' Model 545DC Intercom Interface units that support single-channel party-line intercom circuits. The Model 545DC is a "cousin" of the Model 545DR and supports two single-channel party-line intercom circuits rather than one 2-channel circuit. These single-channel circuits, typically supported by equipment from Clear-Com®, are commonly used in theatrical and entertainment applications.

Party-Line Interface

As previously discussed, the Model 545DR's party-line intercom interface is optimized for connection with 2-channel party-line intercom circuits and user devices such as the TW-series from RTS. In addition, other industry-standard single- and 2-channel party-line intercom circuits and user devices, including those from Clear-Com, are compatible. (While the Model 545DR will function in a limited manner with single-channel Clear-Com circuits, the Model 545DC Intercom Interface unit is a much-preferred choice for that.) A party-line active detection function ensures that should a user beltpack or active party-line intercom circuit not be connected the Model 545DR'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 545DR's party-line interface is its ability to supply DC power and 200 ohms AC terminations to "create" an intercom circuit. The 29 volt output can power a moderate number of devices such as beltpacks. With up to 240 milliamperes (mA) of current available, a typical broadcast application which uses up to three BP-325 beltpacks can be supported. 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 output is monitored for over-current and short-circuit conditions. Under firmware (embedded software) control the output 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 545DR 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 assigned to the Model 545DR using the Dante Controller application. This makes it simple to select the way in which a Model 545DR fits into a specific application.

Analog Hybrids with Auto Nulling

Circuits referred to as "hybrids" interface the Dante transmitter (output) and receiver (input) channels with the two channels of the party-line circuit. 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 545DR'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 545DR'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 the Model 545DR's auto null button is pressed, or the STcontroller application is used, digital circuitry adjusts the hybrids to achieve their maximum return-loss in less than 15 seconds. While the nulling process is automatic, it only takes place upon user request. The resulting null parameters are stored in nonvolatile memory.

Pro Audio Quality

The Model 545DR'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." Moreover, the Model 545DR's party-line intercom power source offers a unique level of performance; its ability to deliver power while maintaining audio quality is simply unmatched.

Audio Meters

The Model 545DR 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 channel. 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 545DR unit.

Status Display

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

Call Light Support

RTS TW-compatible party-line intercom user devices, such as the BP-325 beltpack, provide a call light function using a 20 kHz square-wave signal that is added to the designated audio path. To achieve optimal audio performance this signal, along with essentially all content above 10 kHz, is normally removed from the audio signal that is sent out the Model 545DR's Dante transmitter (output) channels. It's also removed from the audio signal that arrives by way of the Model 545DR's Dante receiver (input) channels. While the result is excellent party-line talk audio, 20 kHz call light signals are prevented from being directly sent to and received from multiple Model 545DR units. A Model 545DR feature overcomes this limitation, detecting the call light activity and regenerating it (again as a 20 kHz tone) in the applicable audio path. This allows reliable "end-to-end" call light support between two Model 545DR units. It also allows a Model 545DR to send and receive call light status signals with an interconnected Model 45DC or Model 545DC Intercom Interface. These units are typically used with Clear-Com party-line user beltpacks including the popular RS-501 and RS-701.

Ethernet Data, PoE, and DC Power Source

The Model 545DR 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 545DR'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 545DR'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 545DR 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 545DR 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 can be made using 3-pin male and female XLR connectors. The Model 545DR 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 545DR units to be mounted in one space (1U) of a standard 19-inch rack enclosure.

Future Capabilities and Firmware Updating

The Model 545DR was designed so that its capabilities and performance can easily be enhanced in the future. A USB receptacle, located on the Model 545DR's back panel, allows the application firmware (embedded software) to be updated using a USB flash drive. To implement its Dante interface the Model 545DR 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 545DR 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 Interface:
Type: 2-channel analog PL, unbalanced (XLR pin 1 common; XLR pin 2 DC with channel 1 audio; XLR pin 3 channel 2 audio)
Compatibility: 2-channel PL intercom systems such as those offered by RTS®
Power Source: 29 volts DC, 240 mA maximum, on XLR pin 2
Impedance – Local PL Power Not Enabled: >10 k ohms
Impedance – Local PL Power Enabled: 200 ohms
Analog Audio Level: –10 dBu, nominal, +3 dBu maximum, PL interface XLR pin 2 (+7 dBu maximum, PL interface XLR pin 3)
Call Light Signal Support: 20 kHz, ±800 Hz
Mic Kill Signal Support: 24 kHz, ±1%

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 nonvolatile memory
Nulling Line Impedance Range: 120 to 350 ohms
Nulling Cable Length Range: 0 to 3500 feet
Trans-Hybrid Loss: >50 dB, typical at 800 Hz, PL interface XLR pin 2 (>55 dB, PL interface XLR pin 3)

Meters: 4
Function: displays level of audio input and output channels
Type: 5-segment LED, modified VU ballistics

Connectors:
Party-Line (PL) Intercom: 3-pin male and female XLR
Ethernet: Neutrik etherCON RJ45 jack
External DC: 4-pin male XLR (pin 1 negative, pin 4 positive)
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: 5 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.

Studio Technologies, Inc.
Skokie, Illinois USA

studio-tech.com