Model 43D
Dante™ to IFB Interface

User Guide

Issue 1, September 2015

This User Guide is applicable for serial numbers
M43D-00151 and later with application firmware 1.1 and later
and Dante firmware 1.2 (Ultimo 2.2.2.5) and later

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1. Initial release.

Introduction

The Model 43D IFB Interface provides broadcast-standard powered and non-powered analog audio IFB outputs from audio signals that are being transported using the Dante™ Audio-over-Ethernet media networking technology. IFB, also known as “interruptible foldback” or talent cueing, is a method commonly used for on-air talent and related personnel to receive one-way (listen-only) audio signals associated with live-event broadcasts. Especially important in sports and entertainment events, IFB plays a crucial role in virtually all broadcast applications that require people to stay “in the know.” Dante has found wide acceptance as an audio “backbone” due to its ease of use, high performance, strong interoperability, and wide adoption by a large number of equipment manufacturers. The Model 43D is a specialized “tool” that helps to extend Dante’s capabilities into the important but specialized world of broadcast and production IFB.

Dante Audio-over-Ethernet technology is used to transport the four audio channels that are associated with two, 2-channel IFB outputs from their source to the Model 43D. Each of the Model 43D’s two powered IFB outputs supply operating power and two audio channels to groups of listen-only user devices. Two line-level analog outputs are also provided for general-purpose use. The Model 43D is compatible with the latest broadcast and audio equipment that uses Dante technology. An Ethernet connection is all that’s required to make the Model 43D part of a sophisticated, networked audio system.

A Model 43D utilizes four digital audio input channels typically provided by Dante-enabled devices such as matrix intercom systems, DSP processors, broadcast routers, and audio consoles. The powered IFB outputs allow direct connection with listen-only user beltpacks such as the popular Model 32A from Studio Technologies. The line-level IFB outputs are provided for connection with a variety of devices that

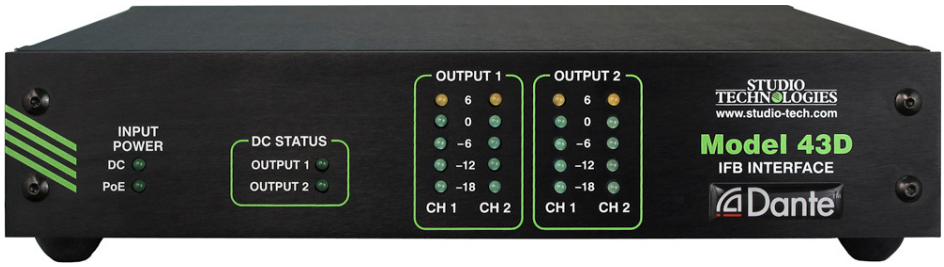

Figure 1. Model 43D standard “throw-down” front view

Figure 2. Model 43D back view

use analog interfacing. Careful attention to circuit design and component selection ensures that excellent audio quality is maintained. Audio level meters provide confirmation of system performance during setup and operation. The Model 43D can be powered by Power-over-Ethernet (PoE) or an external source of 12 volts DC.

Standard connectors are used for the powered IFB outputs, line-level IFB outputs, Ethernet, and DC power interconnections. The Model 43D's enclosure has a "1/2-rack" 1U form factor and weighs less than two pounds, making it well suited for use in portable applications. Alternately, using one of the optional rack-mount front panels, one or two Model 43D units can be mounted in a single space (1U) of a standard 19-inch rack enclosure.

Dante Audio-over-Ethernet

Audio data is sent to the Model 43D using the Dante Audio-over-Ethernet media networking technology. Audio signals with a sample rate of 44.1 or 48 kHz and a bit depth of up to 24 are supported. Four transmitter (output) channels on associated Dante-enabled source devices can be assigned to the Model 43D's receiver (input) channels using the Dante Controller application. This makes it simple to select the way in which a Model 43D fits into a specific application.

Applications

The Model 43D was designed to add broadcast-standard 2-channel IFB functionality to Dante-enabled broadcast and related applications. Combining the networked audio capability of Dante with traditional analog powered ("wet") and non-powered ("dry" or line-level) IFB outputs allows traditional and effective cueing methods to be maintained.

The Model 43D can be used in applications where IFB (talent cueing) channels are created in matrix intercom systems and become part of a Dante Audio-over-Ethernet network deployment. Output ports on matrix intercom systems that directly support Dante, such as the RTS ADAM® with OMNEO®, can be routed to the Model 43D's Dante receiver (input) channels. The Model 43D's circuitry will then convert these signals into standard analog IFB audio outputs. In this way adding IFB support for RTS + OMNEO infrastructures is a simple task. Other matrix intercom and broadcast router systems also directly support Dante. The Model 43D 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 output ports to Dante channels. For example, the Studio Technologies Model 44D Audio Interface does an excellent job of converting line-level analog signals to Dante digital audio channels. Once in the digital domain, these Dante channels can be interconnected with the Model 43D's audio input channels.

In applications where on-air talent uses headsets with two earphones (stereo or "dual muff") two unique audio channels are typically part of the provided IFB signal source. Generally one channel is configured in a matrix intercom system as "interrupt" while the other channel is configured as "program." (In U.S. applications the former signal is assigned to the left ear and the latter signal to the right ear.) An alternate term often used for the "interrupt" channel is "program-with-interrupt."

This may be more descriptive as the function is actually a program source that gets interrupted with talkback audio. The "program" channel is typically a continuous source of program audio. An alternate term is "program-only." The source of interrupt audio is typically a producer or director who provides real-time information to the on-air talent.

In other applications, talent will use a single-ear headset, "ear bud," or in-ear monitor, keeping the other ear accessible to ambient audio. This is frequently done in electronic news gathering (ENG) or sports-broadcast applications where live interviews take place. An audio source with program-with-interrupt is provided; no program audio source is utilized.

Powered IFB Outputs

The Model 43D provides two, 2-channel powered analog IFB outputs that are designed to directly support connection of listen-only user devices such as the Models 32A, 33A, or 34 from Studio Technologies. Each powered IFB output provides both DC and two channels of unbalanced audio. Two 3-pin male XLR connectors, located on the Model 43D's back panel, are used to interface with the listen-only user devices. Following broadcast-industry conventions, pin 1 is the common connection, pin 2 has 28 volts DC with channel 1 audio superimposed on it, and pin 3 has channel 2 audio. Each power source supplies a maximum current of 120 milliamperes. 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.

Line-Level IFB Outputs

In addition to the two, 2-channel powered IFB outputs, the Model 43D also provides two channels of analog line-level IFB. The audio sources for the line-level outputs is the same as used for channels 1 and 2 of powered IFB output 2. The line-level outputs are intended to allow interconnection with externally-powered listen-only user devices, inputs on wireless IFB systems, or analog inputs on consoles or related audio devices. The line-level IFB outputs have a nominal level of –10 dBu and are transformer- and capacitor-coupled, helping to ensure successful interconnection with virtually any line-level analog input.

Pro Audio Quality

The Model 43D's audio circuitry was designed in the spirit of professional audio equipment rather than that found in typical IFB or talent cueing gear. High-performance components are used throughout, providing low-distortion, low-noise, and high headroom. The Model 43D's powered IFB output sources offer a unique level of performance; their ability to deliver power while maintaining audio quality is simply excellent.

Audio Meters and Status LEDs

The Model 43D provides four 5-segment LED meters. The meters, located on the front panel, display the level of the audio signals associated with the two, 2-channel IFB outputs. At the time of installation and setup the meters are invaluable in helping to confirm correct operation. During normal operation the meters offer direct confirmation of the unit's audio signal levels, helping to ensure that optimal

audio quality is maintained. Additional LED indicators are provided on the front panel, offering status indications of the incoming power and two IFB power sources.

Ethernet Data, PoE, and DC Power Source

The Model 43D 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. The Model 43D'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 43D'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. Four LEDs on the back panel display the status of the network connection, Dante interface, and PoE power source.

Simple Installation

The Model 43D uses standard connectors to allow fast and convenient interconnections. An Ethernet signal is connected using a Neutrik etherCON RJ45. If Power-over-Ethernet (PoE) is available operation will commence immediately. An external 12 volt DC power source can also be connected by way of a 4-pin XLR. Powered IFB and line-line IFB outputs are made using 3-pin male XLR connectors. The Model 43D is housed in a rugged yet lightweight aluminum enclosure that is designed to be "field tough." It can be used as a stand-alone portable unit, supporting what's known in the broadcast world as "throw-down" applications. Rack-mount options are also available allowing one or two units to be mounted in one space (1U) of a standard 19-inch rack enclosure.

Future Capabilities and Firmware Updating

The Model 43D was designed so that its capabilities can be enhanced in the future. A USB connector, located on the Model 43D's back panel, allows the application firmware (embedded software) to be updated using a USB flash drive. To implement the Dante interface the Model 43D uses Audinate's Ultimo™ integrated circuit. The firmware in this integrated circuit can be updated via the unit's Ethernet connection, helping to ensure that its capabilities remain up to date.

Getting Started

In this section signal interconnections will be made using the connectors located on the back panel of the Model 43D. Connections to the two powered IFB and two line-level IFB outputs can be made using four 3-pin XLR connectors. An Ethernet data connection will be made using either a standard RJ45 patch cable or an etherCON protected RJ45 plug. A 4-pin XLR connector allows the connection of an external source of 12 volts DC.

System Components

Included in the shipping carton are the Model 43D IFB Interface and a printed copy of this guide. If a rack-mount front

panel is going to be used as part of the installation it will typically be shipped in a separate carton. If the installation or specific application requires an external source of 12 volts DC it needs to be provided separately. An applicable power supply, the Studio Technologies PS-DC-02, is available as an option.

Locating the Model 43D

The location of the Model 43D may primarily depend on the length of cable needed to link the unit with the associated powered IFB devices. This type of circuit carries unbalanced audio which can be susceptible to interference and crosstalk issues. And since powered IFB circuits also carry DC power a voltage drop due to the resistance in the interconnecting cable can become an issue. In general, minimizing the length of the cables used with the powered IFB outputs will help ensure more reliable and consistent powered IFB device performance. Of equal importance is the 100-meter (325-foot) twisted pair Ethernet cable limitation. But that can be overcome by using a fiber-optic interconnect between the related Ethernet switch and the other switches in the Ethernet network.

Protecting the Enclosure

The Model 43D is shipped as a self-contained unit suitable for portable use or placement in a semi-permanent location. Installed on the bottom of the chassis are screw-on “bump on” protectors (also known as “rubber feet”). These are useful if the unit is going to be placed on surfaces where scratching of either the Model 43D or the surface material could take place. The “feet” can be removed, without the use of a tool, when rack- or custom-mounting the unit.

Rack Mounting the Model 43D

For permanent or mobile applications it might be desirable to mount one or two Model 43D units into one space (1U) of a 19-inch rack enclosure. A number of rack-mount front panels, purchased separately, are available from Studio Technologies. The following provides details on how to install Model 43D units to these panels.

To attach a Model 43D unit to the single-unit rack-mount panel, begin the process by using a 5/64-inch hex wrench to remove the four 6-32 thread button-head cap screws that hold the standard front panel to the chassis. Note that the screws might be quite tightly affixed. Ensure that a good-quality hex wrench is used and press and hold it firmly into the screw heads while turning counterclockwise. Unless this recommendation is followed the wrench could “cam out” and the head could be “stripped.”

Using the screws that were just removed, attach the rack-adapter front panel to the Model 43D’s chassis. To prevent damage care is required when aligning the front panel with the 24 LEDs and auto null pushbutton switch that protrude through both the Model 43D’s chassis and front panel. Tighten the four screws only after a careful inspection ensures that the switch and all 24 of the LEDs protrude through the front panel without interference. To allow vertical clearance in the associated rack, remove the four “bump on” protectors from the bottom of the chassis. They are removed by using the fingers to rotate them counterclockwise; no tool is required. Carefully protect and store the standard front panel, along with the “bump on” protectors, for possible later use.

Mounting a Model 43D to a dual-unit rack-mount panel follows the same procedure but will apply to two units. Store both of the removed standard front panels and the eight “bump on” protectors for possible later use. Note that on the rack-panel’s graphics the unit on the left is designated as A while the unit on the right is designated as B. This is provided so that each can be easily identified during installation, troubleshooting, and operation.

Once the desired one or two Model 43D units have been installed in a rack-mount front panel, the assembly can be mounted into the designated equipment rack. One space (“1U” or 1.75 vertical inches) in a standard 19-inch equipment rack is required. Secure the front panel into the equipment rack using two mounting screws per side.

Ethernet Connection

An Ethernet connection that supports 100BASE-TX (100 Mb/s over twisted-pair) is required for the Model 43D’s Dante Audio-over-Ethernet connectivity. A 10BASE-T connection is not sufficient for Model 43D operation. A 1000BASE-T (“GigE”) connection is not supported unless it can automatically “fall back” to 100BASE-TX operation. An Ethernet connection that supports Power-over-Ethernet (PoE) is preferred as it will provide operating power for the Model 43D. To support power management functionality on an associated PoE switch (PSE) the Model 43D will enumerate itself as a PoE class 3 (mid power) device. If PoE is not available an external 12 volt DC power source can be connected. This will be discussed later in this section of the guide.

The 100BASE-TX Ethernet connection is made by way of a Neutrik etherCON protected RJ45 connector that is located on the back panel of the Model 43D. This allows connection by way of a cable-mounted etherCON plug or a standard RJ45 plug. The Model 43D’s Ethernet interface supports auto MDI/MDI-X so that using a crossover or “reversing” cable will not be required.

External 12 Volt DC Input

An external source of 12 volts DC can be connected to the Model 43D by way of a 4-pin male XLR connector which is located on the back panel. While the requirement for the external source is to be nominally 12 volts, correct operation will take place over a 10 to 18 volt range. The Model 43D requires 1.0 amperes maximum at 12 volts DC for correct operation. The DC source should be terminated to a 4-pin female XLR connector with pin 1 negative (–) and pin 4 positive (+). Purchased as an option, the PS-DC-02 power supply is available from Studio Technologies. Its AC mains input allows connection to 100-240 volts, 50/60 Hz and its 12 volt DC, 1.5 amperes maximum output is terminated on a 4-pin female connector.

As previously discussed in this guide, an Ethernet connection that provides Power-over-Ethernet (PoE) can serve as the Model 43D’s power source. Alternately, an external 12 volt DC source can be connected. For redundancy, both PoE and an external 12 volt DC source can be connected at the same time. If both PoE and an external 12 volt DC source are connected, power will be drawn only from the PoE supply. If the PoE source becomes inoperative the 12 volt DC source will provide the

Model 43D's power with no interruption in operation. (Of course, normal operation will cease if both PoE and Ethernet data support are lost.)

Powered IFB Outputs

The Model 43D provides two, 2-channel powered IFB outputs. The powered IFB outputs are intended to directly support listen-only beltpacks such as the talent amplifier units available from Studio Technologies. The four channels of audio associated with the IFB outputs are provided by the receiver (input) channels of the Dante Audio-over-Ethernet data connection. These audio sources will usually be routed, using the Dante Controller application, from the desired Dante transmitter (output) sources to the Model 43D's receiver (input) channels.

The signals that are present on the powered IFB outputs' 3-pin male XLR connectors are typical for broadcast powered "wet" IFB circuits. Pin 1 is common for power and audio, pin 2 is nominal 28 volts DC with channel 1 audio modulated on it, and pin 3 is channel 2 audio. The nominal audio levels on the IFB channels are –10 dBu. The maximum current draw from pin 2 to pin 1 is nominal 120 milliamperes. The circuitry associated with pin 3 is protected from damage should pin 2 (28 volts DC) be accidentally connected to it. Both pins 2 and 3 are protected should an external powered IFB or party-line (PL) intercom circuit be connected to pin 2 and/or pin 3.

One or more listen-only broadcast-standard IFB devices can be connected to each of the powered IFB outputs. The only restriction on the number of units that can be connected to each output is that the total current drawn from each output must be equal to or less than 120 milliamperes. Devices such as the Studio Technologies' Models 32A, 33A, or 34 are directly compatible and will provide excellent performance. While not cost-effective, it's also possible to use intercom beltpacks such as the RTS® BP-325 as listen-only devices.

The Models 32A and 33A each have a quiescent current of approximately 15 milliamperes and a maximum current draw of 40 milliamperes. As such, a combination of up to three of these units can be supported by each of the Model 43D's powered IFB outputs. With typical, rather than maximum, audio signal levels being sent to a powered IFB output supporting four units is also possible. The Model 34 uses a maximum of 45 milliamperes so a conservative application would have no more than two Model 34 units connected to each Model 43D powered IFB output.

Line-Level IFB Outputs

The Model 43D provides two line-level IFB audio outputs. In the broadcast world these might be referred to as "dry" IFB outputs. The audio sources for these outputs are the same as used by the two channels associated with powered IFB output 2. (These are the third and fourth Dante audio channels that are routed, using Dante Controller, to the Model 43D's receiver inputs.) The IFB line outputs are designed for general-purpose use which could include connecting to externally-powered (typically battery-powered) listen-only user beltpacks, transmitters associated with wireless in-ear monitors, audio consoles, or amplified speakers. The outputs are analog, transformer-coupled, capacitor-coupled, and will

perform optimally when driving loads of 2000 (2 k) ohms or greater. The nominal level of the IFB line outputs is –10 dBu. As expected, a signal supplied by the Dante source that has a nominal level of –20 dBFS will result in a level of –10 dBu being present on its associated IFB line output. While this –10 dBu nominal level is lower than the 0 or +4 dBu that is typically provided by broadcast equipment, it should prove to be extremely compatible with inputs on a wide range of equipment that has various input level sensitivities. Any required "make up" gain can typically be easily accomplished in the connected equipment. And equipment that has lower "pro-sumer" nominal audio levels can be interfaced without issue.

The Model 43D provides two 3-pin male XLR connectors for interfacing the IFB line outputs with associated equipment. A user will provide two 3-pin female cable-mounted connectors to interface with the IFB line outputs: pin 2 should be connected as signal + (high) and pin 3 as signal – (low). The cable's shield can be connected to pin 1, but it will have no function. To limit the chance of grounding interaction between the Model 43D and connected equipment, pin 1 on the line-level IFB output connectors is isolated from any point in the Model 43D. The fact that pin 1 "floats" will minimize the chance of hums, noises, or buzzes being present on the connected equipment.

Configuration

Back-Panel DIP Switches

A 4-position DIP switch assembly, labeled Config, is located on the Model 43D's back panel. As of the time of writing this guide none of the switches are utilized and they have no impact on Model 43D operation.

Dante Configuration

To integrate the Model 43D into an application several Dante-related parameters can be configured. At a minimum, signals must be routed to the four Dante receiver (input) channels. The configuration settings will be stored in nonvolatile memory within the Model 43D's circuitry. As such, power-down and power-up activities will not impact the unit's settings. The Model 43D uses the Ultimo 4-input/4-output integrated circuit to implement the Dante architecture. However, only the four receiver (input) channels are utilized. This dictates which parameters can be configured and what choices are available.

The four receiver (input) channels associated with the Model 43D's Dante interface must be assigned to the desired sources (Dante transmitter channels). This will typically be done with the Dante Controller software application which is available for download free of charge at www.audinate.com. Versions are available to support Windows® and OS X® operating systems. 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 Ultimo integrated circuit limits the number of Dante flows to two. These can either be unicast, multicast, or a combination of the two.

The Model 43D has a default Dante device name of **ST-M43D** followed by a unique suffix. The suffix identifies the specific Model 43D that is being configured. The suffix's actual alpha and numeric characters relate

to the MAC address of the Ultimo integrated circuit that's present in the specific Model 43D. The four Dante receiver (input) channels have the default names of **To Out1 Ch1**, **To Out1 Ch2**, **To Out2 Ch1**, and **To Out2 Ch2**. Using Dante Controller these names can be revised as appropriate for the specific application.

The Model 43D supports audio sample rates of 44.1 and 48 kHz along with several pull-up/pull-down values. The desired configuration can be made using the Dante Controller software application. The Model 43D can serve as the clock master for a Dante network but in most cases that would not be optimal.

The actual source of the audio signals can vary widely depending on the specific application. Some matrix intercom systems can create IFB (talent cueing) channels as well as having a Dante Audio-over-Ethernet interface. In this case it would be a simple matter to route the intercom system's appropriate Dante transmitter channels to the Model 43D's Dante receiver channels. For example, the RTS ADAM matrix intercom system provides Dante interconnection capability using its OMNEO interface card. The transmitter channels on the OMNEO card would be routed to the receiver channels on the Model 43D. Other equipment that supports Dante, such as audio consoles or audio interfaces (Dante-to-MADI, Dante-to-SDI, etc.), can have their audio channels routed to a Model 43D. Equipment that provides only analog audio sources can still be used with the Model 43D. External conversion devices, such as the Studio Technologies Model 44D or Model 5204 interfaces, can covert line-level analog signals to Dante digital audio channels.

Operation

At this point the Model 43D should have its Ethernet, powered IFB output, and line-level IFB output connections implemented as desired for the application. Depending on the capabilities of the Ethernet connection an external 12 volt DC power connection may have also been made. The four Dante receiver (input) channels should have been routed using the Dante Controller software application. Normal operation of the Model 43D can now begin.

The Model 43D is designed for continuous operation with no adjustments required. Maintaining the correct levels coming into the Dante receiver channels is important. This will ensure that the proper signal levels are presented to IFB users, leading to optimal audio fidelity. The audio level meters and DC status LEDs will provide assistance in confirming that correct operation is taking place. In addition, the under-voltage shutdown function associated with the powered IFB outputs will help to protect the IFB power output circuitry should a fault condition be detected.

Initial Operation

The Model 43D will begin its initial functioning a few seconds after its power source is connected. As previously discussed, the unit's power source can be provided by Power-over-Ethernet (PoE) or an external source of 12 volts DC. If both are connected the PoE source will power the unit. Should PoE power subsequently no longer be available, uninterrupted operation will continue using the external 12 volt DC source. (This will probably prove to be a "hollow" victory since a loss of PoE will probably also mean a loss of the required Ethernet data connection!)

Upon Model 43D power up the status and meter LEDs will activate in test sequences. The PoE and USB LEDs, located on the back panel, will light one after another. On the front panel the input power, DC status, and audio level meter LEDs will light in a sequence. Once the test sequence has completed the two columns of level meter LEDs associated with output 2 will momentarily display the version number of the unit's application firmware (embedded software). Details on how to "read" the version number is provided in the Technical Notes section of this guide.

The Model 43D will now begin normal operation. The way in which the back panel LINK/ACT, SYS, SYNC, and PoE LEDs light will depend on the characteristics of the connected Ethernet signal and the configuration of the unit's Dante interface. Details will be covered in the next paragraph. The user is presented on the front panel with two input power status LEDs, two DC output status LEDs, and four 5-segment LED audio level meters. These resources are simple to understand and should prove to be useful as will be highlighted in the following paragraphs.

Ethernet, PoE, and Dante Status LEDs

Four status LEDs are located below the etherCON connector on the Model 43D's back panel. The LINK/ACT LED will light green whenever an active data connection to a 100 Mb/s Ethernet network has been established. It will flash on and off in response to data packet activity. The PoE LED will light green whenever Power-over-Ethernet (PoE) associated with the connected Ethernet signal is providing operating power for the Model 43D. The SYS and SYNC LEDs display the operating status of the Dante interface and associated Audio-over-Ethernet network. The SYS LED will light red upon Model 43D 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 audio data with another Dante device. The SYNC LED will light red when the Model 43D is not synchronized with a Dante network. It will light solid green when the Model 43D is fully synchronized with a Dante network and an external clock source (timing reference) is being received. It will slowly light on and off green if this specific Model 43D is serving as the clock master for the Dante network.

How to Identify a Specific Model 43D

The Dante Controller software application offers an identify command that can be used to help locate a specific Model 43D. 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 43D level meter and Dante status LED 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.

Level Meters

The Model 43D contains four 5-segment LED level meters, two associated with each IFB output. The meters are provided as a support aid during installation, configuration, operation, and troubleshooting. The

meters represent the strength of the audio signals going to the four channels associated with the two, 2-channel IFB outputs.

The meters are organized into two groups with each group representing the two audio channels being sent to the powered and, in the case of output 2, the line-level IFB outputs. The meters are calibrated to reflect the level relative to the –10 dBu reference (nominal) level of the powered and line-level IFB outputs. As an example of how the meters function let's review the situation where the output 1 channel 1 meter has its bottom three LEDs (–18, –12, and –6) lit solid and its 0 LED just barely lighting. This would indicate that a signal with an approximate level of –10 dBu is being sent to channel 1 of output 1's powered IFB output.

Of interest one may want to note that a –10 dBu signal on the powered and, if applicable, line-level IFB output (and represented by "0" on the meter) equates to a –20 dBFS digital audio signal being present on its associated Dante receiver (input) channel. This is due to Studio Technologies' selecting –20 dBFS as the reference (nominal) level for Dante digital audio signals.

Each level meter contains four green LEDs and one yellow LED. The four green LEDs indicate IFB audio signal levels at or below –10 dBu. The top LED is yellow and indicates a signal that is 6 dB or greater than the –10 dBu nominal level. An audio signal that causes the yellow LED to light doesn't necessarily indicate an excessive level condition, but it does provide a warning that at some stage reducing the signal level of the source may be prudent. Typical operation with normal signal levels should find the meters lighting near their 0 point. Signal peaks may cause the yellow LEDs to flash. But a yellow LED that lights fully during normal operation will typically indicate excessive signal level and/or a configuration problem with associated Dante-enabled equipment.

Non-Optimal Signal Levels

If the meters consistently display levels that are lower or higher than the meter's 0 (reference) point it's possible that a configuration issue exists. This would typically be related to incorrect settings on the equipment providing the associated Dante transmitter channels. With a digital matrix intercom system providing the Dante signal this problem could be due to an incorrect configuration having been made to a specific channel or port. For example, the RTS ADAM system has a published nominal level of +8 dBu, but it's not clear how this translates into a digital audio level on an associated OMNEO (Dante-compatible) port. Using its configuration software it's most likely possible to set the nominal level of intercom key panels or ports to something different than +8 dBu. The best solution in this case would be to adjust the associated OMNEO (Dante-compatible) port such that it results in a nominal level of –20 dBFS on the associated Dante transmitter channel. This should lead to the optimal performance of the Model 43D and associated IFB user devices.

Powered IFB Outputs

The Model 43D's microcontroller integrated circuit, under firmware control, monitors to ensure that the DC voltage present on pin 2 of each of the powered IFB outputs is at an acceptable level. (As previously discussed the nominal level is 28 volts DC.) If this condition is met

the two DC status LEDs on the front panel will steadily light. So under normal conditions where the performance is as expected both LEDs will be lit. If 24 volts DC or less is present on either powered IFB output a low-voltage condition is detected. This would typically be caused by connected devices drawing too much current (more than 120 milliamperes) or a full short circuit being present. If an under-voltage condition is present for a continuous 1-second period a fault condition is recognized. The associated DC status LED will indicate this condition by flashing on and off. In addition, the output voltage on the powered IFB output will automatically shut down to an essentially off condition. This protects the IFB power source and allows any connected devices to power down. A 5-second "cool-down" period will then take place, after which the IFB output voltage will again become active. As soon as the IFB output is enabled for three seconds normal output voltage monitoring will again take place. In summary, a continuous short circuit or over-current condition presented to a powered IFB output will result in a continuous 4-seconds-on/ 5-seconds-off cycle. It's important to note that during the 5-seconds-off period no voltage monitoring takes places. Removing the fault condition will not result in the IFB output voltage immediately turning on again; the 5-second shut-down period must first elapse.

Line-Level IFB Outputs

No special precautions are necessary when using the line-level IFB outputs. The IFB line output circuitry is protected from damage should a moderate DC voltage be accidentally connected. For example, no damage will occur if a Model 43D's powered IFB output (28 volts DC) be accidentally connected to one of the IFB line outputs. This protection would also be effective should a party-line intercom circuit or microphone P48 phantom power signal be accidentally connected to an IFB line output.

Users unfamiliar with the Model 43D may not understand that the nominal level of the line outputs is –10 dBu. This may lead them to assume that there is an issue. But operationally there should rarely be a problem. Should a higher nominal level be required it can typically be "made up" in the connected device(s).

USB Interface

A USB type A connector and associated status LED is located on the back panel of the Model 43D. This data interface is used only for updating the unit's application firmware. No audio data of any kind will pass through it. For details please refer to the Technical Notes section of this guide.

Technical Notes

IP Address Assignment

By default the Model 43D's Ethernet interface will attempt to obtain an IP address and associated network settings using the 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 (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 43D'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 43D'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 43D. 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.

Application Firmware Version Display

As part of the Model 43D's power-up sequence the unit's application firmware version number is displayed. This is useful when working with factory personnel on application support and troubleshooting situations. The five output 2 channel 1 LEDs are used to display the major release number with a range of 1 through 5. The five LEDs associated with output 2 channel 2 are used to display the release sub-number which ranges from 1 through 5. Refer to Figure 3 for a detailed view of the LEDs and the corresponding application firmware version numbering scheme.

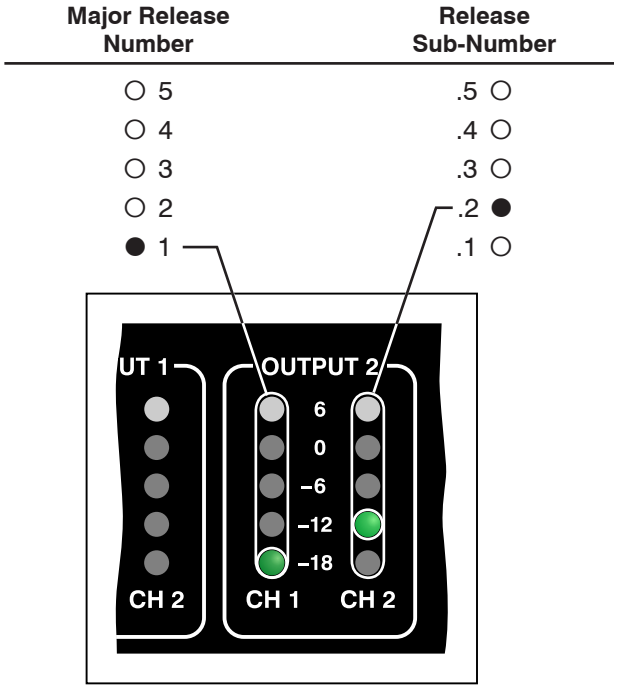

Figure 3. Detail of front panel showing the status LEDs that display the application firmware version. In this example, the application firmware version is 1.2.

Application Firmware Update Procedure

It's possible that updated versions of the application firmware (embedded software) that runs the Model 43D's microcontroller (MCU) 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 nonvolatile memory by way of its USB interface. The Model 43D implements a USB host function that directly supports connection of a USB flash drive. The Model 43D's MCU updates using a file named **M43D.bin**.

The update process begins by preparing a USB flash drive. The flash drive doesn't have to be empty (blank) but must be in the personal-computer-standard FAT32 format. The new firmware file will be saved in the root directory with a name of **M43D.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 43D, the name of the zip file itself will include the file's version number. For example, a file named **M43Dv1r2MCU.zip** would indicate that version 1.2 of the application firmware (**M43D.bin**) is contained within this zip file. Once the desired **M43D.bin** file has been stored in the root directory the flash drive will be ready for use.

To install the application firmware file follow these steps:

1. Remove power from the Model 43D. This will entail removing the Ethernet connection if it is providing PoE power or removing the external source of 12 volts DC if that is being used. (Both must be disconnected if for some reason dual-power has been implemented.)
2. Ensure that nothing is connected to the USB port. Then again apply power to the unit and "read" the currently-loaded application firmware version during the power-up sequence using the output 2 level meters. (Refer to the Application Firmware Version Display paragraph earlier in this section.) Note the displayed version number for later reference.
3. Remove power from the Model 43D.
4. Insert the prepared USB flash drive into the Model 43D's USB port, located on the back panel of the unit.
5. Apply power to the Model 43D. Power can be provided by Power-over-Ethernet (PoE) associated with a connected Ethernet signal or from an external 12 volt DC source.
6. The Model 43D will run a "boot loader" program that will immediately load the new application firmware file (**M43D.bin**). This process will take only a few seconds. During this time period the LED located below the USB connector will flash slowly on and off green. Once the entire loading process is over, taking approximately 10 seconds, the Model 43D will restart using the newly-loaded application firmware.

7. At this time the Model 43D is functioning with the newly-loaded application firmware and the USB flash drive can be removed. But to be conservative, remove power first and then remove the USB flash drive.
8. Apply power to the Model 43D and "read" the application firmware version number by observing the output 2 level meters. Ensure that this is the desired version and that it's different from that noted in step 2.

Note that upon power being applied to the Model 43D if the USB flash drive doesn't have the correct file (**M43D.bin**) in the root folder no harm will occur. Upon power up the USB LED 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 43D implements Dante connectivity using the 4-input/4-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 43D'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.

Specifications

Power Sources:

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

External: 10 to 18 volts DC, 1.0 amp maximum at 12 volts DC

Network Audio Technology:

Type: Dante Audio-over-Ethernet

Bit Depth: up to 24

Sample Rates: 44.1, 48 kHz

Number of Receiver (Input) Channels: 4

Dante Audio Flows: 2 receiver

Network Interface:

Type: twisted-pair Ethernet, Power-over-Ethernet (PoE) supported

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

Powered IFB Outputs: 2

Type: 2-channel analog powered IFB, unbalanced (pin 1 common; pin 2 DC with channel 1 audio; pin 3 channel 2 audio)

Compatibility: 2-channel listen-only IFB user devices such as those offered by Studio Technologies

Power Source: 28 volts DC, 120 mA maximum, nominal

Analog Audio Level: –10 dBu, nominal, +4 dBu maximum, pins 2 and 3

Frequency Response: ±1 dB, 20 Hz-20 kHz

Distortion (THD+N): <0.02%, measured at 1 kHz, pins 2 and 3

Signal-to-Noise Ratio: >85 dB, A-weighted, measured at 1 kHz, pins 2 and 3

Line-Level IFB Outputs: 2

Type: transformer-coupled, capacitor isolated

Nominal Level: –10 dBu

Maximum Level: +10 dBu into 2 k ohms

Frequency Response: –1 dB @ 20 Hz, –1.3 dB @ 20 kHz

Distortion: <0.04%, measured at 1 kHz

Signal-to-Noise Ratio: >87 dB, A-weighted, measured at 1 kHz

Meters: 4

Function: displays level of IFB output audio channels

Type: 5-segment LED, modified VU ballistics

Connectors:

Powered and Line-Level IFB Outputs: 3-pin male XLR

Ethernet: Neutrik etherCON RJ45

External DC: 4-pin male XLR

USB: type A receptacle

Dimensions – Overall:

8.7 inches wide (22.1 cm)
1.72 inches high (4.4 cm)
8.3 inches deep (21.1 cm)

Mounting Options: single-unit, dual-unit, and combination-unit rack-mount front panels; uses one space (1U) in a standard 19-inch rack

Weight: 1.8 pounds (0.80 kg); rack-mount front panels add 0.2 pounds (0.09 kg)

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