

# **Model 5401**

## **Dante<sup>®</sup> Master Clock**

### **User Guide**

Issue 1, March 2023

This User Guide is applicable for serial numbers  
M5401-00151 and later with application firmware 1.09 and later  
and Dante firmware 4.4.1 (Brooklyn II v4.2.7.4) and later

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## Revision History

### Issue 1, March 2023:

- Initial release.

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# Model 5401

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## Introduction

The Model 5401 Dante Master Clock provides precise timing signals for applications that utilize the Dante® audio-over-Ethernet media networking technology. The unit implements a high-performance IEEE 1588 precision time protocol (PTP) server, compatible with the requirements of Dante and capable of simultaneously supporting the timing needs of up to hundreds of Dante-compatible devices. As expected, the Model 5401 provides the PTPv1 (IEEE® 1588-2002) compatibility that's required by Dante. In addition, the unit supports PTPv2 (IEEE 1588-2008) for AES67 applications. A word clock output provides a timing reference for use by external devices. The Model 5401 also generates up to eight sine-wave audio tones on Dante transmit (output) channels, useful during audio network installation, maintenance, and operation. A sync input connection allows the Model 5401's internal oscillator to synchronize with a variety of timing reference signals.

The Model 5401 is suitable for use in fixed and mobile broadcast facilities, post-production studios, commercial and educational theater environments, and entertainment applications. Only power and one or two Ethernet network connections are required for full operation. Using Dante's inherent capabilities two Model 5401 units can serve in primary and secondary master clock roles for redundant operation.

An integral web server allows fast and flexible monitoring and configuration of the Model 5401's master clock, tone generation, and networking performance. Front-panel indicators, an LCD display, and pushbutton switches provide personnel with direct access to key operating parameters. Updating of the Model 5401's operating software can be easily performed using the integrated FTP (file-transfer protocol) client. The unit's dual Gigabit Ethernet (GigE) network interfaces allow support for redundant Dante operation. All software files and configuration parameters are stored in non-volatile memory. The Model 5401 can be powered by 100-240 V, 50/60 Hz mains or a source of 12 volts DC. The lightweight enclosure mounts in one space (1U) of a standard 19-inch rack.

## Applications

Applications for the Model 5401 include broadcast facilities, college and university audio networks, arenas, stadiums, and corporate installations — virtually any application where substantial numbers of Dante-compatible devices are utilized. The Model 5401 will serve as a stable and consistent master clock for the entire Dante “network.” And, as expected, the Model 5401 is compatible with all Dante devices, no matter what their primary function or manufacturer. Applications that utilize devices compatible with AES67 will also benefit from the Model 5401's resources.



**Figure 1. Model 5401 Dante Master Clock front and back views**

### Why a Dedicated Dante Master Clock?

With Dante ubiquitous in fixed and mobile facilities of all sizes and types, the need arose for a cost-effective, purpose-designed, dedicated master clock. While an inherent strength of Dante networking is its carefully implemented use of IEEE 1588 to ensure that all connected devices maintain a common timing reference, the actual performance can vary widely depending on the specific Dante devices in use and the overall number of devices on a network. There are many Dante-compatible devices that can provide adequate basic performance as a master clock, but with the Model 5401 networked audio systems get the benefits of a high-performance “grandmaster” PTP server, along with additional unique capabilities. The unit’s feature set, along with the associated internal hardware and software, was designed to provide optimum performance, flexibility, and system integrity.

### Timing Sources

The Model 5401 can provide excellent master clock performance using its accurate and stable internal oscillator, which is temperature-controlled and exceeds the performance of standard Dante devices by at least an order of magnitude. While its standalone performance is excellent, the Model 5401 can also be “locked” to a variety of external signals for integration into facilities that include a master timing reference. Compatible signals include word clock, video reference, and 10 MHz.

A word clock signal is often used as a timing reference in audio-only facilities. Several word clock rates, including 48 and 96 kHz, are compatible with the Model 5401’s sync input. Video reference (“sync”) signals are found in most broadcast and post-production facilities. The Model 5401 supports

the most-common video format/rate combinations including “black burst,” bi- and tri-level HD, and several that are specifically intended for 4K applications. Industrial and commercial facilities often utilize a GPS-disciplined source of 10 MHz as a timing reference. This sine-wave signal is directly compatible with the unit’s sync input.

### Word Clock Output

The Model 5401 generates a precise word clock output signal that can be used as a timing reference for related equipment. It’s specifically intended for “locking” audio equipment in applications that have Dante equipment whose timing reference signals are provided by a Model 5401. In this way, all devices will share a common timing reference.

The word clock output rate can be selected to be 44.1, 48, 88.2, or 96 kHz. The underlying timing source for the word clock output is derived from the Model 5401’s main timing source. As previously reviewed, the internal oscillator, if desired, can be “locked” to an external source. The main timing source is divided and processed by the Model 5401’s logic circuitry to create the highly stable word clock output. This ensures that the word clock output is synchronized with the unit’s PTP server functionality.

### Audio Reference Signals

The Model 5401 generates eight sine-wave audio reference signals for general-purpose use. They are individually configurable in level and frequency. These audio “tones” are available on the Model 5401’s Dante transmitter (output) channels and can be connected, using the Dante Controller application, to Dante receivers (inputs) on related equipment. The flexibility of the available routes (Dante “subscriptions”) between all Dante devices on a network allows the reference

signals to be used for a variety of purposes. Configuration choices allow the frequency and level of the sine-wave signals to be optimized for specific applications.

### Master Clock Support for Dante Networks

A core part of the technology underlying Dante audio-over-Ethernet networking ensures that all connected devices follow a common timing reference. This is accomplished using the industry-standard IEEE 1588-2002 precision time protocol (PTPv1). Any connected Dante device can be used as a master clock; there is no requirement that a dedicated master clock device be utilized to realize adequate performance. However, the actual performance can range widely depending on the specific Dante devices available and the overall number of Dante devices on the network.

Many Dante devices utilize the 2- or 4-channel Ultimo™ integrated circuit to implement Dante connectivity. While Ultimo devices will fully support Dante audio transport they are not well suited to serve as a master clock. Ultimo's PTP performance is limited and does not have the ability to synchronize with an external timing reference. Other Dante devices use the Brooklyn II module to support Dante connectivity. In many cases these devices can provide good basic performance as a master clock including some that allow connection of an external source of word clock.

However, problems and limitations may arise when these devices are called upon to perform "double duty," serving both a primary function (such as analog-to-Dante interfacing or audio signal processing) as well as acting as a master clock. This is understandable as the main purpose of these devices is to serve a function other than as a master clock. Timing related features,

such as allowing connection of a video bi- or tri-level sync signal is rarely, if ever, supported. And PTP performance can degrade when the computing power of a device is intended primarily for handling and manipulating digital audio signals. This can lead to the required PTP resources being in short supply when the number of Dante devices that need timing messages moves into the hundreds. Also, firmware updates, cabling changes, and other maintenance tasks typically associated with a general-purpose Dante audio device would impact the master clock functionality for an entire installation.

The Model 5401 was specifically designed to support a Dante-based audio system's master clock requirements. The unit's generation of audio tones and implementation of the word clock output utilize hardware that is separate from that associated with PTP functionality. As such, this secondary functionality will not interfere with PTP operation. Unlike a general-purpose audio device, once mounted in an equipment rack and the required interconnections are made, the Model 5401 will perform its tasks without risk of interruption due to conflicting resource demands.

### Overall Networking Capability

Using the Dante Controller application program the Model 5401's two Gigabit Ethernet ports can be selected to operate in one of three modes: Switched, Redundant, and Pri Dante/Sec Mgmt. In the Switched mode, a single Ethernet connection to either of the Model 5401's Ethernet ports will provide Dante master clock functionality as well as access to the Model 5401's management webpages. The remaining Model 5401 Ethernet port will provide network "loop-through" capability and can be used to interface with another piece of Ethernet-connected equipment. In the Redundant mode, two independent Ethernet connections are made to



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the Model 5401's Ethernet ports, enabling Dante's redundant network capability. In this mode, the Model 5401's primary Ethernet port will provide access to the management webpages. In the Pri Dante/Sec Mgmt mode, the Model 5401's primary Ethernet port will be used by the network associated with Dante while the secondary Ethernet port will be used to access the unit's management webpages. This allows separate networks to be maintained for Dante and maintenance and configuration purposes.

### Operating Power

The Model 5401 allows an AC mains source of 100-240 V, 50/60 Hz to be directly connected. It can also be DC powered using a 10-18 volt source that is connected via a broadcast-standard 4-pin XLR connector. If both AC and DC power sources are connected the unit will be powered by the AC mains supply. Only if the AC mains source fails will a load be placed on the DC source. This allows a source of DC, typically an external power supply or broadcast-style battery, to serve in a backup capacity. With this arrangement normal operation can continue even if AC mains power is lost.

### Future Capabilities

The Model 5401's main and logic (FPGA) embedded software (firmware) can be updated by way of its Ethernet network connection and the Internet. Multiple versions of firmware are used to support the Dante interface hardware, user management menus, and audio generation capabilities. Each can be independently updated as required.

## Installation

In this section, the Model 5401 will be mounted in one space (1U) of an equipment rack. In many cases, an external synchronization

source will be connected to the sync input BNC jack. If needed, a connection may be made to the word clock output BNC jack on the back panel. One or two Ethernet data connections will be made. AC mains and/or DC power will be connected.

Using a coaxial cable terminated with a BNC plug, an external source of synchronization may be connected to the sync input. A word clock output is provided by way of a BNC jack and may be utilized by one or more pieces of equipment. One or two Ethernet data connections will be made to the Model 5401 using standard RJ45 patch cables.

AC mains power can be connected to the Model 5401 by means of a detachable cord that is compatible with the unit's 3-pin IEC 320 C14 inlet connector. Some applications may warrant connection to a source of nominal 12 volts DC which can be made by way of a 4-pin XLR connector. A DC source can be used to power the unit as well as serving as a backup power source should AC mains not be present.

### What's Included

The shipping carton contains a Model 5401 Dante Master Clock and instructions on how to obtain an electronic copy of this guide. Also included in the shipping carton is a North-American-standard AC mains cord. For destinations outside of North America the local reseller or distributor should provide an appropriate AC mains cord.

### Mounting the Model 5401

The Model 5401 Dante Master Clock requires one space (1U) in a standard 19-inch (48.3 cm) equipment rack. Secure the unit into the designated equipment rack using two mounting screws per side. As the Model 5401 does not contain a fan or other noise-producing source it can be located



within a room or other structure where audio monitoring is going to take place.

Some or all of the connections involving the sync input BNC jack, the word clock output BNC jack, the Ethernet interface RJ45 jacks, and the AC mains and/or DC power connectors may be utilized. Twisted-pair (UTC) Ethernet has a 100-meter (325-foot) interconnection cable limitation. But that can be overcome by using fiber-optic interconnections between the Model 5401 and the Ethernet switch or switches in the one or more associated local-area-networks (LANs).

### Sync Input

An external synchronization source can be connected to the Model 5401's sync input BNC jack. Located on the back panel, this input allows the Model 5401's internal timing to be "locked" to an external reference.

Signals that are compatible with the Model 5401's sync input include word clock, bi-level video, tri-level video, and 10 MHz sine wave. A configuration setting in the Sync Settings webpage defines what type of signal is going to be connected. Another setting defines if a termination impedance is applied to the sync input. Refer to the Specifications section for the general characteristics required of acceptable external sync signals.

A connected word clock signal must be a square wave with a rate that matches the Dante sample rate as defined in the Dante Controller application. The rate can be 44.1, 48, 88.2, or 96 kHz. If termination has been enabled for the sync input when it has been configured for word clock an impedance of 75 ohms will be applied.

A source of bi-level or tri-level video can also be connected to the sync input. Circuitry within the Model 5401 will decode many of the common video rates and formats, allowing them to serve as a timing reference.

Refer to Appendix A for a list of compatible rates and formats. If the sync input is configured for video and termination has been enabled an impedance of 75 ohms will be applied.

A source of 10 MHz sine wave can be connected to the Model 5401's sync input. This type of signal is commonly used as a timing reference in industrial and instrumentation applications. It maybe also be derived from a GNSS (satellite) receiver. An impedance of 50 ohms will be applied to the sync input if termination has been enabled and the source is selected for 10 MHz.

### Word Clock Output

A word clock output signal is provided for use by other devices that want to be "timed" from the Model 5401. Available by way of a BNC jack located on the back panel, the square wave output has a frequency that matches the unit's configured Dante sample rate. Choices are 44.1, 48, 88.2, and 96 kHz. The exact frequency of the word clock output is based on the timing reference that has been selected for the Model 5401. If, for example, the Sync Input was selected as the unit's timing reference, then the word clock output would be "locked" to it.

The source impedance of the word clock signal is 75 ohms and its unterminated output level is 5 volts peak-to-peak (Vpp). When externally terminated with a 75 ohm load the word clock output level will drop to 2.5 Vpp.

### Ethernet Connections

The Model 5401 provides two Gigabit Ethernet (GigE) ports which allow interconnection with one or two local area networks (LANs) associated with Dante audio-over-IP networking schemes. They can also be used to access the management webpages. They are labeled as PRI (primary) and SEC (secondary).

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An internal web server function supports the Model 5401's management port's webpages. These webpages are used for configuration, monitoring, and maintenance of Model 5401 operation. Refer to Figure 2 for an overview of the Model 5401's Ethernet ports and how they can operate.

Using the Dante Controller application, the two Ethernet ports can be configured to operate in one of three modes: *Switched*, *Redundant*, or *Pri Dante/Sec Mgmt*. If configured for the *Switched* mode, the management webpages can be accessed by way of either Ethernet port. When configured for the *Redundant* mode, the management webpages are accessed by way of the primary Ethernet port. When configured for the *Pri Dante/Sec Mgmt* mode, the management webpages are accessed using a connection made to the secondary Ethernet port.

By providing two Ethernet ports and three configuration modes, the Model 5401 allows support for many facilities, including those that utilize a separate network for Dante audio transport and equipment management. In this way, "production" networks that support transport of audio signals by way of a single LAN (Switched mode) can be separate from an engineering network that is used by technical personnel for configuring and maintaining a facility or "plant."

Connections to the two Ethernet interfaces are made by way of standard RJ45 jacks that are located on the back of the Model 5401's enclosure. The Ethernet interfaces

support auto MDI/MDI-X so that crossover cables are never required. Refer to Appendix B for examples of how the Model 5401's two Ethernet interfaces might be utilized.

## Dante Ports

At least one 1000BASE-T (GigE) Ethernet connection is required for Model 5401 Dante operation. It should be connected to the primary RJ45 jack. A second 1000BASE-T (GigE) connection can be made to the secondary RJ45 jack if Redundant Dante is desired. For this functionality to be active, the Model 5401's network configuration must be set for the *Redundant* mode within the Dante Controller software application. While technically 100BASE-TX (100 Mb/s) Ethernet can also be used for these Dante connections, it is not optimal. Additionally, it's important to note that 10BASE-T (10 Mb/s) Ethernet connections are not sufficient.

When configured in Dante Controller for the *Switched* mode, the Model 5401's secondary Ethernet connection can also be used as a "loop through" port such as would be provided by an Ethernet switch. Using the secondary port in this manner for applications other than troubleshooting or "looping" to access the Model 5401's management port is not recommended. It will function reliably but "daisy chaining" Ethernet signals can limit flexibility and present a failure point; it's optimal if each Dante Ethernet interface connects directly to a separate port on an Ethernet switch.

| Dante Controller Network Switch Configuration | Model 5401 Ethernet Port     |                 |
|---|------------------------------|-----------------|
|   | Pri                          | Sec             |
| Switched                                      | Dante and Management         |                 |
| Redundant                                     | Dante Primary and Management | Dante Secondary |
| Pri Dante/Sec Mgmt                            | Dante                        | Management      |

**Figure 2. Model 5401 Ethernet Port Configuration and Operation**

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### Management Port

The management webpages can be accessed using an Ethernet signal connected to the Model 5401's primary or secondary Ethernet ports. The exact functionality will depend on the configuration of the network mode within the Dante Controller application. To utilize the primary or secondary Ethernet port requires that the network mode be configured for *Switched*. If the network mode has been selected for *Redundant* then the management webpages will be accessible only by way of the primary Ethernet port. To utilize the secondary Ethernet port, independent of a network handling Dante data, requires that the network mode be configured for *Pri Dante/Sec Mgmt*. Appendix B provides example of how these network scenarios can easily be implemented.

### Connecting Power

The Model 5401 requires a source of AC mains or nominal 12 volts DC for operation. Either source can be connected with the same result. Both can also be simultaneously connected if a redundant (backup) power scheme is desired.

#### Connecting AC Mains Power

The Model 5401 can operate directly from AC mains power of 100 to 240 volts, 50/60 Hz, 5 watts maximum. As a "universal mains input" device there are no switches to set or jumpers to install. A 3-pin IEC 320 C14 inlet connector on the back panel mates with a detachable mains cord set.

All units are supplied from the factory with an AC mains cord that has a North-American (NEMA 5-15L) standard plug on one end and an IEC 320 C13 connector on the other end. Units intended for use in other destinations require that an appropriate mains cord be obtained. The wire colors in the mains cord should conform to the internationally

recognized color code and be terminated accordingly:

| <u>Connection</u> | <u>Wire Color</u> |
|-------------------|-------------------|
| Neutral (N)       | Light Blue        |
| Line (L)          | Brown             |
| Earth/Ground (E)  | Green/Yellow      |

Because the Model 5401 does not contain a power on/off switch it will begin operation as soon as AC mains power is connected.

**Safety Warning:** The Model 5401 does not contain an AC mains disconnect switch. As such, the AC mains cord plug serves as the disconnection device. Safety considerations require that the plug and associated inlet be easily accessible to allow rapid disconnection of AC mains power should it prove necessary.

### Connecting DC Power

The Model 5401 can also operate from a source of 10 to 18 volts DC. The current required from a 12 volts DC source is 0.5 ampere (500 milliamperes) maximum. A 4-pin male XLR connector, located on the unit's back panel, is used to connect the source of DC. Prepare a mating connector (female) so that pin 1 is DC- and pin 4 is DC+. Pins 2 and 3 are not used and should remain unconnected. This connector type and pinout have become a broadcast DC power standard and should be familiar to many technical personnel. Because the Model 5401 contains no power on/off switch it will begin operation as soon as a DC power source is connected.

As previously mentioned, both an AC mains source and a DC source can be connected at the same time. If this is the implementation then the AC mains source will always power the Model 5401 with the DC source serving as a "hot standby." Only if the AC source fails will the unit draw power from the DC source. This will occur automatically

with no interruption of Model 5401 operation. In this “standby” mode (when an AC mains source is connected), the Model 5401 draws less than 110 microamperes (uA) from a 12 volts DC input.

## Dante Configuration

For audio and timing to correctly pass from the Model 5401 requires that several Dante-related parameters be configured. These configuration settings are stored in non-volatile memory within the Model 5401’s Dante network interface circuitry. Configuration will typically be done with the Dante Controller software application, available for download free of charge at [audinate.com](http://audinate.com). Versions of Dante Controller are available to support several operating systems. Refer to Appendix C for a list of the Model 5401’s Dante Controller default configuration settings.

The Model 5401’s Dante interface is compatible with the Dante Domain Manager (DDM) software application. Refer to DDM documentation, also available from Audinate, for details on which Model 5401 and related parameters may have to be configured.

## Audio Routing

The Model 5401’s eight Dante transmitter (output) channels can be assigned to the desired Dante receiver (input) channels on associated equipment. This will route the eight channels associated with the tone generator function. Within Dante Controller a “subscription” is the term used for routing a transmitter flow (a group of up to four output channels) to a receiver flow (a group of up to four input channels).

The Model 5401 uses a Brooklyn II module to implement its Dante functionality. The number of transmitter flows associated with this module is 32 and, as such, typically

no flow limitation should occur. These flows can either be unicast, multicast, or a combination of the two. Note, however, that when AES67 mode is enabled in Dante Controller the Dante transmitter (output) channels will only function in multicast; unicast is not supported.

## Unit and Channel Names

The Model 5401 has a default Dante device name of **ST-M5401-** along with a unique suffix. The suffix identifies the specific Model 5401 that is being configured. The suffix’s actual alpha and/or numeric characters relate to the MAC address of the unit’s Brooklyn II module. The eight Dante transmitter (output) channels associated with the tone outputs have default names of **Tone01** through **Tone08**. Using Dante Controller, the device and channel names can be revised as appropriate for a specific application.

## Device Configuration

The Model 5401 supports audio sample rates of 44.1, 48, 88.2, and 96 kHz with no pull-up/down options available. The digital audio data is in the form of 24-bit pulse-code modulation (PCM 24) samples. Clocking- and latency-related parameters can be adjusted if required in Dante Controller but the default values are typically correct.

## Network Configuration – Dante

As has been covered previously, the Model 5401 allows connection of one or two Ethernet signals using standard RJ45 jacks which are located on the back panel. In some applications, one of the jacks will be used for Dante audio while the second is used for connection to a network designated for device management purposes. It’s also possible to access the Model 5401’s management webpages using the primary Ethernet port. The Model 5401’s Ethernet ports are labeled



PRI and SEC indicating that they are typically used for the Dante primary and Dante secondary connections. The ports can also be used to access the management webpages. How these Ethernet ports function can be selected in the Network Config – Switch Configuration section of Dante Controller. The choices are *Switched*, *Redundant*, and *Pri Dante/Sec Mgmt*.

If *Switched* is selected then the Model 5401 can establish one Dante audio connection with an Ethernet network. It doesn't matter which RJ45 jack is utilized, although for simplicity this would typically be the primary jack. This Ethernet connection would also be used to access the management webpages. The secondary RJ45 jack can be used to interconnect with another piece of networked equipment. But it's recommended that this jack not be utilized.

If the Model 5401's Dante network is configured for *Switched* ensure that only one of the two Dante RJ45 jacks on the back panel is connected to the LAN associated with the Dante network. If both of the Model 5401's Dante RJ45 jacks are routed to ports on the same LAN this will typically "crash" the network! (Although some of the latest/most-advanced Ethernet switches will automatically detect and prevent such a "network bridging" issue from occurring.)

If *Redundant* is selected then Dante's Redundant networking capability will be enabled. In this case, separate Ethernet LAN connections should be made to the Dante primary and Dante secondary RJ45 jacks. The primary Ethernet port will also be used to access the management webpages.

If *Pri Dante/Sec Mgmt* is selected a single Dante network will be connected to the primary RJ45 jack. The management webpages would be accessed using the secondary Ethernet port.

## IP Addresses

When a Model 5401 has been configured for either the *Switched* or *Pri Dante/Sec Mgmt* network modes a single Dante IP address will be associated with the network connection that is made to either the Dante primary or the Dante secondary RJ45 jack. If the network configuration has been selected for *Redundant* then separate IP addresses and related network parameters will be assigned to the Dante primary and Dante secondary Ethernet ports. No matter what network mode is selected the Model 5401 will always have a separate management IP address.

Typically, the Model 5401's Dante IP address or addresses and related network parameters will be determined automatically using DHCP or, if that's not available, the link-local network protocol. If desired, the Dante Controller application does allow Dante IP addresses and related network parameters to be manually set to a fixed (static) configuration. While this is a more-involved process than simply letting DHCP or link-local "do their thing," if fixed addressing is necessary then this capability is available.

Note that if the Model 5401's network configuration has been set for *Redundant* then the Dante primary and Dante secondary IP addresses and related parameters can be independently configured. This allows both Ethernet interfaces to be configured automatically, both interfaces to be configured manually, or one interface to be configured automatically and the other to be configured manually.

By default, the Model 5401's management IP address and related network parameters will be determined automatically using DHCP or link-local. A configuration option, accessible using the front-panel display and associated buttons or the management webpages, allows manual control of the management IP address, subnet mask, and gateway address values.

## **AES67 Configuration – AES67 Mode**

Dante Controller allows a Model 5401 to be configured for AES67 operation. This requires the AES67 mode to be set for *Enabled*. As previously noted, if AES67 mode is enabled then PTPv2 will be utilized and the Dante transmitter (output) channels will use multicast. The sample rate will be fixed at 48 kHz.

## **Preferred Clock Source**

By the very nature of its intended application, the Model 5401 will normally serve as the Master Clock for all Dante-enabled devices. The unit has the ability to communicate with the Dante network, selecting itself as the Preferred Leader and causing the Enabled Sync to External function to be enabled. The status of these two parameters can be observed using the Clock Status function in Dante Controller.

Settings accessible using the Model 5401's management webpages allow extensive changes to the clock configuration. These are provided for use when troubleshooting or addressing special applications. In most cases, the Model 5401's default settings would be appropriate and should be utilized.

## Model 5401 Configuration

Many Model 5401 operating parameters can be viewed and configured using the management system's webpages that are accessed by way of one of the unit's Ethernet ports. The specific port utilized for management will depend on the network configuration that is selected using the Dante Controller application. A standard web browser is all that is required to utilize the menu webpages.

Several key network configuration parameters can also be viewed and revised using the Model 5401's front-panel graphics display and associated pushbutton switches. Refer to the Operation section for details on which parameters can be revised in this manner.

### Management IP Address

It's easy to identify the Model 5401's management IP address by way of the front-panel display. If the screen saver function is active, as it will be in most situations, one of the four pages that will automatically show the current management IP address. As such, a user can simply observe the sequencing menu pages and watch for the one that shows the current management IP address.

If it's desired that the current management IP address be continuously shown, begin by pressing the Enter pushbutton switch on the front panel, followed by pressing the down arrow pushbutton switch. This will stop the screen saver function and cause the current management IP address to show. It will also allow the various menu pages to be accessed using the up, down, left, and right pushbutton switches. Simultaneously pressing the left and right arrow buttons will cause the screen saver mode to begin again. The

screen saver mode will also automatically start two minutes after the last press of any of the front-panel pushbutton switches.

How the management Ethernet port obtains its IP address will depend on the management interface configuration setting. The default method is automatic so the Model 5401's management port will first try to obtain an IP address using DHCP. If that is not successful an IP address will be assigned using the link-local protocol. An address of 169.254.x.x will indicate that an IPv4 address was established using link-local. The Model 5401 may also have been configured to use a manual (fixed or static) IP address. The front-panel display and associated pushbuttons, or the Model 5401's management webpages, can be used to review and/or make changes to the management IP address and related parameters.

### Accessing the Management Webpages

To access the Model 5401's home webpage, type the unit's management IP address into a browser's search bar. (It's possible that some browsers may require including the text **http://** followed by the IP address.) Of course, the computer associated with the browser must be on the same LAN and subnet as the Model 5401.



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### Overview Menu

Once the Model 5401 menu system has been accessed the Overview menu webpage will appear. It provides five display-only fields along with a link to the Configuration menu webpage. The fields are similar to those provided in the Sync Settings menu configuration webpage.

|   |   |
|---|---|
| ST-M5401-232724                               | <b>Model 5401</b><br>Dante Master Clock |
| <b>Overview</b>                               | <a href="#">Configuration Menu</a>      |
| Welcome to the Model 5401 Dante Master Clock. |   |
| Current Dante Sample Rate                     | 48 kHz                                  |
| Clock Source                                  | Internal                                |
| Sync Input Type                               | Disabled                                |
| Sync Input Status                             | ---                                     |
| Detected Sync Input Format                    | ---                                     |
| <a href="#">Studio Technologies, Inc.</a>     |   |

**Current Dante Sample Rate:** This field shows the sample rate being utilized by the eight Dante transmitter (output) channels.

**Clock Source:** This field will show the clock source (timing reference) being utilized by the Model 5401.

**Sync Input Type:** This field shows the type of source that has been selected for the sync input connection on the Model 5401's back panel.

**Sync Input Status:** This field shows the current operating condition of the sync input circuitry.

**Detected Sync Input Format:** This field shows the type of sync signal that has been detected on the sync input connection on the back panel.

## Login Menu

From the Overview Menu webpage click on the Configuration Menu tab, located in the upper-right corner. This will provide access to the Login menu webpage. Entry of a valid user name and password is required to access the Configuration Menu. The Model 5401 doesn't incorporate a sophisticated security implementation. The user name and password, as well as the underlying software, is intended to keep "honest" people from making unauthorized changes to the configuration of the Model 5401. It is not intended as a sophisticated, rigorous security system.

Should the applicable user name and/or password be misplaced, refer to the Technical Notes section and/or Appendix G for a recovery method.

|  |   |
|--|---|
| ST-M5401-232724                              | <b>Model 5401</b><br>Dante Master Clock |
| <hr/>  |   |
| <b>Login</b><br>A user is already logged in. | <a href="#">Help</a>                    |
| User Name                                    | <input type="text" value="guest"/>      |
| Password                                     | <input type="password" value="guest"/>  |
|  | <input type="button" value="Login"/>    |
| <hr/>  |   |
| <a href="#">Studio Technologies, Inc.</a>    |   |

**User Name:** Enter the Model 5401's user name into this field. It is case sensitive. The default user name is **guest**. If both the default user name and the default password are active then the user name will be shown in this field.

**Password:** Enter the Model 5401's password into this field. It is case sensitive. The default password is **guest**. If both the default user name and the default password are active then the password will be shown in this field.

**Login Button:** Click on the Login button to submit the entered user name and password. If the correct entries have been made the Configuration Menu webpage will be shown. If an incorrect user name and/or password is entered then a login failed message will be shown.

## Configuration Menu

Once the correct user name and password pair have been submitted the Configuration menu webpage will be shown. This menu provides the ability to select from among five sub-menus. These menus allow the display and configuration of many of the Model 5401's operating parameters.

Note that a choice in the Configuration Menu is called Network Information. However, the actual menu page is called Network Configuration. This reflects a programming issue but does not impact operation of the Model 5401.

ST-M5401-232724

Identify Device

**Model 5401**  
Dante Master Clock

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**Configuration Menu**

[Help](#)

- [Sync Settings](#)
- [Audio Generator](#)
- [Network Information](#)
- [Menu Access](#)
- [System Information](#)

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## Sync Settings Menu

ST-M5401-232724 Model 5401  
Identify Device Dante Master Clock

**Sync Settings**

[Configuration Menu](#) [Help](#)

Force Preferred Master Enabled ▾

Clock Source Internal ▾

Sync Input Type Word Clock ▾

Sync Input Termination On ▾

Termination impedance is 75Ω when configured for Word Clock or Video and 50Ω for 10 MHz.

Sync Input Failover Source Dante ▾

Sync Input Status ---

Detected Sync Input Format ---

Current Dante Sample Rate 48 kHz

Submit

[Studio Technologies, Inc.](#)

**Force Preferred Master:** This is a configurable field with two choices: *Disabled* or *Enabled*. The default factory selection is *Enabled*; restoring the Model 5401's factory defaults will return the selection to *Enabled*.

This function impacts how the Model 5401 will control a Dante network's selection of which device is going to serve as the master clock. As the main reason for the Model 5401's existence is to serve as a master clock, in most cases the unit should serve in that role. By forcing the Model 5401 to be a preferred master it helps to ensure optimal Dante network operation. Users of the Dante Controller application will not be able to accidentally disable the Model 5401 as a Preferred Master. One can see exactly what is meant by the term "force preferred master" by unchecking the Model 5401's Preferred Master check box in Dante Controller. After a short interval the box will automatically return to the enabled (checked) state.

How the Model 5401 handles forcing the Dante network to be a Preferred Master clock and, if applicable, automatically supporting an

external clock input is not trivial. This ability to control Dante network operation is part of the unit's "secret sauce." If the Model 5401's clock source is configured for Dante then the Model 5401 will force off (uncheck) the *Enable Sync to External* selection in Dante Controller. If the Model 5401's main clock source is configured for *Internal* or *Sync Input* then the Model 5401 will force on (check) the *Enable Sync to External* configuration in Dante Controller. This will apply as long as this specific Model 5401 is acting as Primary Master, Master, or AES67 Master.

**Clock Source:** This is a configurable field with three choices: *Internal*, *Sync Input*, or *Dante*. The default factory selection is *Internal*; restoring the Model 5401's factory defaults will return the selection to *Internal*.

This setting determines which timing source is used by the Model 5401's circuitry as its own "master" timing reference. This is the clock source that will be used by the Model 5401's PTP server circuitry, the "heart" of the Model 5401's support of related Dante devices. When *Internal* is selected the

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## Model 5401

### DANTE MASTER CLOCK

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Model 5401's temperature-stabilized, high-performance crystal oscillator is utilized. This will provide excellent timing accuracy and long-term consistent performance. This source is far superior to that provided by other standard Dante devices. This is the correct choice if a high-quality external reference signal is not going to be connected.

When *Sync Input* is selected the Model 5401's external sync input connection will be active. Using a BNC connector, located on the Model 5401's back panel, an external source of word clock, video reference, or 10 MHz sine wave can be connected. Circuitry within the Model 5401 will "lock" (synchronize) the internal timing signals to the externally provided reference signal. This is the recommended operating mode if a precision external reference is available. For example, in facilities that have equipment that supports video it's typical to have a high-end master timing generator. And in audio facilities a "master" source of word clock may be available. In industrial or commercial settings a GPS receiver may be provided as a source of high-precision 10 MHz. But be aware that it is possible that an externally available reference signal may not be as "good" as the Model 5401's internal oscillator. If that is the case then the internal source should be utilized. Other devices in a facility can then "lock" to the Model 5401's word clock output. (This is available by way of a BNC connector located on the Model 5401's back panel.)

Selecting *Dante* will instruct the Model 5401 to use the clock signal from its Dante interface circuitry as the timing source for the PTP server. The Dante interface circuitry will either use its internal crystal oscillator or synchronize to another Dante device on the network. The clock source the Model 5401's Dante interface uses will depend on a setting in the Dante Controller application. The Model 5401 includes the choice of *Dante*

as a clock source only for trouble-shooting or other factory-directed activities. It's not expected that this selection will ever be used during normal Model 5401 operation. By selecting *Dante* the excellent timing performance that the internal oscillator can provide or the benefits gained from synchronization with a "house" timing reference would not be utilized.

**Sync Input Type:** This is a configurable field with three choices: *Word Clock*, *Video*, or *10 MHz*. The default factory selection is *Word Clock*; restoring the Model 5401's factory defaults will return the selection to *Word Clock*.

If the Model 5401's clock source has been selected to *Sync Input* the type of connected source must be defined. If *Word Clock* is selected then a square wave source with a rate of 44.1 kHz, 48 kHz, 88.2 kHz, or 96 kHz can be connected. For proper operation the nominal level of the word clock source must be 5 volts DC. Also, the connected word clock source must match the current Dante sample rate shown. This is a bit of a "chicken or the egg" situation since it can be confusing as to who is supposed to control the sample rate and who is supposed to follow the sample rate! The Dante Controller software application should be used to select the desired Model 5401 sample rate. This is the sample rate desired for the eight channels of audio tone generator (Model 5401 Dante transmitter channels). In most applications this will be 48 kHz. It's possible that in some audio-only applications 96 kHz will be selected. Once the desired sample rate has been selected and/or confirmed, an external word clock source of the same rate should be connected. If the available external word clock source has a rate different than the current Dante sample rate then a review of the entire application must be performed and a common rate selected.

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## Model 5401

### DANTE MASTER CLOCK

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If *Video* is selected for the sync input type then a wide range of bi- and tri-level video reference signals can be connected to the sync input BNC connector. The Model 5401's circuitry will automatically decode the most common format/rate combinations. These include ubiquitous "black burst" signals as well as signals intended to support 4K video applications. Refer to Appendix A for a detailed list of compatible video sources.

If a choice of sync sources is available the factory recommends that a source of word clock be utilized. This is because the Model 5401's clock circuitry has to perform the least amount of processing with a word clock input signal as compared to that required for a video or 10 MHz signal.

**Sync Input Termination:** This is a configurable field with two choices: *Off* and *On*. The default factory selection is *On*; restoring the Model 5401's factory defaults will return the selection to *On*.

If desired, the Model 5401 can apply a terminating impedance to the sync input connection. The need for an input source to be terminated, or not, will depend on the source of the external sync signal. Typically a source of sync should have one (and only one) termination applied. The source can generally be shared ("bused") to multiple devices with the last connection on the connection string applying an appropriate termination.

If sync input termination is configured for *Off* then the sync input's impedance will be greater than 100 k ohms. If the sync input termination is selected to *On* and the sync input type is selected for *Word Clock* or *Video* the termination impedance will be 75 ohms. If *10 MHz* has been selected as the sync input type then a termination impedance of 50 ohms will be applied.

**Sync Input Failover Source:** This is a configurable field with two choices: *Internal* or *Dante*. The default factory selection is *Dante*; restoring the Model 5401's factory defaults will return the selection to *Internal*.

This configuration choice applies only if the Model 5401 has been configured to use the sync input. It specifies which clock source should be used by the Model 5401 if a valid sync source is not connected to the sync input. If *Internal* is selected then the precision crystal oscillator will be utilized as the master clock source should a valid signal not be connected to the sync input. From a performance standpoint it's preferable to select *Internal*. This ensures that the best clock performance can be obtained should a valid external sync source not be present (sync input status unlocked).

If *Dante* is selected then the clock source derived from the Dante interface will be used. This would allow an interesting alerting feature to become active. In the Dante Controller application a device, such as the Model 5401, that has been selected as the preferred master with an external source allowed will have an error condition occur if the Dante interface doesn't detect an external reference being applied. And losing the external reference is what the Model 5401's circuitry will do should Dante be selected as the failure source. In this way, a Dante network user could be alerted to an issue with the Model 5401 should it lose its very important external sync source.

Getting an error condition reported in Dante Controller is probably not terribly important. The sync LED on the Model 5401's front panel will also offer a clear indication of a loss of an external sync signal. The LED will typically slowly flash green when the Model 5401 is functioning correctly as the clock master for the Dante network. However, should the unit



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## Model 5401

### DANTE MASTER CLOCK

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be configured to use an external sync signal and a valid one is not present, the sync LED will flash orange to indicate the loss of lock to the sync input.

In addition, the display will provide a text indication of this condition.

**Sync Input Status:** This is a display-only field that can show ---, *Unlocked*, or *Locked*.

This field reflects the status of the Model 5401's sync input circuitry. If the Model 5401's clock source has not been selected for *Sync Input* then the sync input status field will show ---. This simply indicates that the Model 5401 has not been configured to utilize an external sync source so there is no status associated with it.

*Unlocked* will be shown if the sync input has been selected as the clock source but either no signal is connected or a non-compatible signal is connected. A non-compatible signal would include a sync input type being selected for *Word Clock* and then a word clock signal at a different rate than the current Dante sample rate being connected. For example, the situation where the current Dante sample rate is 48 kHz but the connected word clock signal is 96 kHz. Probably the most common non-compatible signal would be a situation where a video reference signal is connected to the sync input but the sync input type was left at the default (*Word Clock*) rather than being selected for *Video*.

*Locked* will be shown when a signal connected to the Model 5401's sync input is serving as the master timing reference. If the clock source configuration has been selected for *External* this is the desired condition. If *Locked* does not show then standard troubleshooting should be performed to remedy the issue. In most cases the problem will be resolved by ensuring that the sync input type configuration and the actual connected sync source are the same.

**Detected Sync Input Format:** This is a display-only field that can show ---, *Error*, 44.1 kHz, 48 kHz, 88.2 kHz, 96 kHz, one of the video format/rate combinations, or 10 MHz.

This field reflects the operation of the Model 5401's sync input circuitry. If the clock source is not set for *External* then the circuitry is not operational and --- will be shown. If *External* is selected then the field will show either *Error* or a detected rate. *Error* will show if the connected source doesn't match the selected sync input type. For example, if *Word Clock* has been selected as the sync input type but a video sync signal has been connected. The detected rate will be shown whenever the sync input status is locked. If this is a word clock signal then one of the four compatible rates will be shown. If this is due to a video source being connected then the actual rate/format characteristics will be shown. The compatible rate/format combinations are listed in Appendix A. If locked is due to a 10 MHz signal being recognized then 10 MHz will be shown.

**Current Dante Sample Rate:** This is a display-only field that can show 44.1 kHz, 48 kHz, 88.2 kHz, or 96 kHz.

This field shows the Model 5401's currently selected sample rate as used by the Model 5401's Dante transmitter (output) channels. The transmitter channels, as of the initial firmware release, provide eight unique tone outputs labeled Tone01 through Tone08. From the factory the Model 5401's sample rate is selected to be 48 kHz. Changes to the sample rate are made using the Dante Controller software application. Restoring the Model 5401's factory defaults will not change the sample rate setting.



**Submit:** The *Submit* button is located on the bottom of the Sync Settings menu page. For any changes made to fields on the Sync Settings page to be saved and acted upon the *Submit* button must be pressed.

**Identify Device:** The *Identify Device* button is located in the upper-left corner of the Sync Settings page, directly below the Dante device name display. Pressing the *Identify Device* button will cause the associated Model 5401 to flash its green backlight associated with the display five times.

### Audio Generator Menu

The Model 5401's audio generator function is capable of creating eight precision sine-wave signals ("tones") with independent frequency and level configuration. The frequency range is 1 to 22000 hertz (Hz) and the level range is -99 to 0 dBFS. The output signals have default names of *Tone01* through *Tone08*. It's expected that most applications will only use a few of the tones. But having eight output channels provides flexibility in creating a range of signals with various frequency and level combinations. These can be used for a range of applications including identifying individual channels in a multi-channel arrangement, e.g., stereo, 5.1, or 7.1.

ST-M5401-232724

Identify Device

Model 5401  
Dante Master Clock

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Audio Generator

[Configuration Menu](#) [Help](#)

| Channel | Frequency (Hz)                   | Level (dBFS)                     |
|---------|----------------------------------|----------------------------------|
| Tone01  | <input type="text" value="100"/> | <input type="text" value="-21"/> |
| Tone02  | <input type="text" value="200"/> | <input type="text" value="-22"/> |
| Tone03  | <input type="text" value="300"/> | <input type="text" value="-23"/> |
| Tone04  | <input type="text" value="400"/> | <input type="text" value="-24"/> |
| Tone05  | <input type="text" value="500"/> | <input type="text" value="-25"/> |
| Tone06  | <input type="text" value="600"/> | <input type="text" value="-26"/> |
| Tone07  | <input type="text" value="700"/> | <input type="text" value="-27"/> |
| Tone08  | <input type="text" value="800"/> | <input type="text" value="-28"/> |

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**Frequency (Hz):** These eight fields reflect the Model 5401's currently selected sine-wave generator frequencies. For each channel enter the desired frequency in full hertz. Don't use a suffix such as k or kHz, nor enter a comma or period to delineate thousands. Entering 1001 would be correct while 1,001 or 1.001 k would not be acceptable.

The default tone frequencies were selected in hundreds of hertz with the first digit matching the channel number: 100, 200, 300, etc. This can be useful when checking a series of channels as this pattern can be easily recognized either by ear or using equipment that can display the frequency in text. Some applications may need the common 1000 or 10000 Hz reference sine wave tones

and there's no problem configuring these if desired.

**Level (dBFS):** These eight fields display the level of the Model 5401's eight sine-wave outputs. The output level for each of the eight audio generator output channels is independently adjustable over a range of -99 to 0 dBFS.

Enter the desired level in full dBFS with a hyphen as the prefix to indicate less than full scale. In applications that comply with the SMPTE® audio standards the typical nominal level will be -20 dBFS which can be thought of as 20 dB less than full scale or digital 0. In EBU applications the typical nominal level will be -18 dBFS. Some applications may

benefit from a sine wave test tone that's 12 dB less than the reference level. This would equate to configuring an output to -34 dBFS (SMPTE) or -32 dBFS (EBU). These would typically be associated with a 1000 Hz.

The default tone levels were selected in a pattern that could help identify a specific channel. Channel Tone01 has a default level of -21 dBFS with the value of 1 being selected to reflect the channel number. Each subsequent channel then reduces its level by 1 dB. So, for example, the second channel, Tone02, has a level of -22 dBFS. While these level steps may not be readily discernible to human ears most test equipment or metering could easily be used to identify specific channels.

**Submit:** The *Submit* button is located on the bottom of the Audio Generator menu page. For any changes made to fields on the Audio Generator page to be saved and acted upon the *Submit* button must be pressed.

**Identify Device:** The *Identify Device* button is located in the upper-left corner of the Audio Generator page, directly below the Dante device name display. Pressing the *Identify Device* button will cause the associated Model 5401 to flash its green backlight on the display five times.

## Network Configuration Menu

ST-M5401-232724

Identify Device

Model 5401

Dante Master Clock

Network Configuration

[Configuration Menu](#) [Help](#)

Dante IP Addresses

Primary

192.168.1.147

Secondary

Disabled

Management Addresses

MAC Address

00-04-22-F2-02-03

Current IP Address

192.168.1.145

IP Address Configuration

Automatic ▾

Manual IP Address

Subnet Mask

255.255.255.0

Gateway IP Address

192.168.1.1

DNS IP Address

75.75.76.76

Submit

System must be rebooted for new network settings to take effect. Reboot causes cessation of audio for several seconds.

System Reboot

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### Dante IP Addresses

**Primary:** This is a display-only field that shows the IP address associated with the Model 5401's primary Dante data path. It will show either *No Ethernet Link* or an IP address. The IP address displayed in this field is not the IP address associated with the Model 5401's internal management web server. The 32-bit IP v4 address is displayed in what's known as dot-decimal notation.

How the IP address is determined depends on the Model 5401's network configuration setting as performed using the Dante Controller application. The IP address can be established automatically using a DHCP server or the IPv4 link-local protocol. An IP address assigned to the primary Dante port by link-local will have a format of 169.254.x.x. The primary IP address can also be set to a

manual (static or fixed) IP address using Dante Controller.

If the network configuration is selected in Dante Controller for *Switched* (the factory default) then the primary Dante IP address will be associated with a network connection made to either the primary or the secondary RJ45 connections on the Model 5401's back panel. If the network configuration is selected for *Redundant* or *Pri Dante/Sec Mgmt* then the primary Dante IP address will be associated with the RJ45 connection labeled Primary on the Model 5401's back panel. *No Ethernet Link* will display if a valid Ethernet connection has not been made with the primary RJ45 jack.

If the Model 5401's network configuration in Dante Controller is selected for *Switched* ensure that only one of the RJ45 connections

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## Model 5401

### DANTE MASTER CLOCK

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on the back panel is connected to the LAN associated with the Dante devices. The other RJ45 connection can be used to interconnect with another piece of networked equipment. But having both of the Model 5401's RJ45 connections routed to ports on the same LAN will typically "crash" the network!

**Secondary:** This is a display-only field that shows the IP address associated with the Model 5401's secondary Dante data path. It will show *Disabled*, *No Ethernet Link*, or an IP address. The IP address displayed in this field is not the IP address associated with the Model 5401's internal management web server.

What is displayed and how a displayed IP address is determined depends on the setting of the Model 5401's network configuration using the Dante Controller application. If the network configuration is selected for *Switched* or *Pri Dante/Sec Mgmt* then a secondary Dante IP address will never be active and *Disabled* will be displayed.

If the network configuration is selected for *Redundant* then the secondary Dante IP address will be displayed. This is the Ethernet connection that is associated with RJ45 connection labeled Secondary on the Model 5401's back panel. The IP address can be established automatically using a DHCP server or the IPv4 link-local protocol. An IP address assigned to the secondary Dante port by link-local will have a format of 172.31.x.x. The secondary IP address can also be set to a manual (static or fixed) number using the Dante Controller application. *No Ethernet Link* will display if a valid Ethernet connection has not been made with the secondary RJ45 jack.

### Management Addresses

**MAC Address:** This is a display-only field that shows the Model 5401's MAC (media

access control) address. This is a unique hardware identification number that is assigned to each specific Model 5401. No two Ethernet-connected devices should ever share a MAC address.

**Current IP Address:** This is a display-only field that shows the IP address associated with the Model 5401's internal management web server. This address can be assigned automatically via DHCP or IPv4 link-local. It can also be manually assigned with a fixed or static IP address. The Current IP Address is not associated with the Model 5401's primary or secondary Dante data connections.

If the Model 5401's network configuration is selected in Dante Controller for *Switched* (the factory default) then the management IP address will be associated with a network connection made to either the primary or secondary RJ45 connections on the Model 5401's back panel. If the network configuration is selected for *Redundant* then the IP address will be associated with the network connection made to the RJ45 connection labeled Primary on the Model 5401's back panel. If the network configuration is selected for *Pri Dante/Sec Mgmt* then the IP address will be associated with the network connection made to the RJ45 connection labeled Secondary on the Model 5401's back panel.

As previously mentioned, if the Model 5401's network configuration in Dante Controller is selected for *Switched* ensure that only one of the RJ45 connections on the back panel is connected to the LAN associated with the Dante devices. The other RJ45 connection can be used to interconnect the same LAN with another piece of networked equipment. But having both of the Model 5401's RJ45 connections routed to ports on the same LAN will typically "crash" the network!

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# Model 5401

## DANTE MASTER CLOCK

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**IP Address Configuration:** This is a configurable field with two choices: *Automatic* and *Manual*. The default factory selection is *Automatic*. To minimize the chance of losing access to the internal management web server restoring the Model 5401's factory defaults will not change the currently selected choice.

This configuration impacts how the Model 5401 obtains the IP address that is used for accessing the Model 5401's management web server and associated menu pages. This setting has no impact on how the Model 5401 obtains the primary and secondary IP addresses associated with the Dante Ethernet connections.

Selecting the *Automatic* setting will cause the Model 5401 to use DHCP or IPv4 link-local to establish the IP address of the Model 5401's management port. With this setting upon establishing a link to the appropriate Model 5401 RJ45 jack the DHCP protocol will request an IP address and related parameters. If obtaining an IP address by way of the DHCP protocol is not successful then the IPv4 link-local protocol will be used. If an IP address that has the format of 169.254.x.x displays as the current IP address then it was assigned using IPv4 link-local. Even if the IP address was established using link-local the DHCP protocol will stay active. Approximately every 60 seconds the Model 5401's firmware will check for the presence of a DHCP server. If one becomes available then an IP address will be requested and, when obtained, will automatically be used, replacing the IP address that was previously established by link-local.

The *Manual* setting allows the desired IP address and related parameters to be manually entered. This can be useful when a fixed addressing scheme has been established. In this way, a static IP address can be entered along with the other important network parameters.

When selected for *Automatic* the fields for manual IP address, subnet mask, gateway IP address, and DNS IP address will be "grayed out" (will have a gray background) to indicate that their values cannot be manually changed. In this condition, they are display-only. Changing between *Automatic* and *Manual* and vice-versa will not impact the values stored in the manual IP address, subnet mask, gateway IP address, and DNS IP address fields.

**Manual IP Address:** This field is grayed out and will not display any text when the IP address configuration mode is selected for *Automatic*. (Although, the default IP address is 192.168.1.54.) When the IP address configuration is selected for *Manual* this field will display the IP address that is stored in the Model 5401. This is the IP address that is currently being used, or will be used at the time of the next Ethernet connection reboot. It is the IP address that allows access to the Model 5401's management web server and associated menu pages. It has nothing to do with the IP address(es) associated with the Dante port(s).

The manual IP address can be modified as desired to meet the requirements of the application. After entering an IP address using the standard dot-decimal notation format (4 octets separated by dots) the *Submit* button must be pressed for the changes to be stored. Restoring the Model 5401 default values will not change the stored IP address. A system reboot is required for the revised manual IP address to be utilized.

**Subnet Mask:** This field is grayed out when the IP address configuration mode is selected for *Automatic*. This field will be display-only in this instance and will display an IPv4 subnet mask in dot-decimal notation (4 octets separated by dots) if the current IP address and related network parameters



were obtained by way of DHCP. This is the subnet mask that is being used by the internal management web server. If IP configuration mode is selected for *Automatic* and the current IP address was obtained by way of link-local then the associated subnet mask of 255.255.0.0 will be shown in this field.

When the IP address configuration is selected for *Manual* the field will not be grayed out. In this situation, the stored subnet mask will be displayed and can be modified as desired to meet the requirements of the application. The displayed value is the subnet mask that is currently in use or will be used at the time of the next Ethernet connection reboot. After entering an IP address using the standard dot-decimal notation format (4 octets separated by dots) the *Submit* button must be pressed for a change to be stored. A system reboot is required for the revised subnet mask value to be utilized. Restoring the Model 5401 default values will not change the stored subnet mask value.

**Gateway IP Address:** This field is grayed out when the IP address configuration mode is selected for *Automatic*. This field will be display-only in this instance and will display an IPv4 gateway IP address in dot-decimal notation (4 octets separated by dots) if the current IP address and related network parameters were obtained by way of DHCP. This is the gateway IP address that is being used by the Model 5401's management web server. If the IP configuration mode is selected for *Automatic* and the current IP address was obtained by way of link-local no gateway IP address will be shown in this field. This is because no gateway IP address is associated with link-local.

When the IP address configuration is selected for *Manual* the field will not be grayed out. In this situation, the stored gateway IP address will be displayed and can be modified as desired to meet the requirements

of the application. The displayed value is the gateway IP address that is currently in use, or will be used at the time of the next Ethernet connection reboot. After entering a gateway IP address using the standard dot-decimal notation format (4 octets separated by dots) the *Submit* button must be pressed for a change to be stored. A system reboot is required for the revised gateway IP address to be utilized. Restoring the Model 5401 default values will not change the stored gateway IP address value.

**DNS IP Address:** This field is grayed out when the IP address configuration mode is selected for *Automatic*. This field is display-only in this instance and will display an IPv4 DNS IP address in dot-decimal notation (4 octets separated by dots) if the current IP address and related network parameters were obtained by way of DHCP. This is the DNS IP address that is being used by the Model 5401's management web server. If IP configuration mode is selected for *Automatic* and the current IP address was obtained by way of link-local no subnet mask will be shown in this field. This is because no DNS IP address is associated with link-local.

When the IP address configuration is selected for *Manual* the field will not be grayed out. In this situation, the stored DNS IP address will be displayed and can be modified as desired to meet the requirements of the application. The displayed value is the DNS IP address that is currently being used, or will be used at the time of the next Ethernet connection reboot.

In most cases the Model 5401's default DNS IP address will be appropriate. It is 8.8.8.8 which is one of the two IPv4 recursive public name servers provided by Google®. But there's no issue entering a revised DNS IP address. Once it is entered, using the standard dot-decimal notation format (4 octets separated by dots), the *Submit* button must



be pressed for a change to be stored. A system reboot is required for the revised gateway IP address to be utilized. Restoring the Model 5401 default values will not change the stored gateway IP address.

**Submit:** The *Submit* button is located near the bottom of the Network Configuration menu page. For any changes made to fields on the Network Configuration page to be saved and acted upon the *Submit* button must be pressed.

**System Reboot:** The Reboot function is located on the bottom of the Network Configuration webpage. It allows the Model 5401 to be rebooted (restarted) without having to perform a power cycle. (The function can be considered to invoke a “warm boot.”) During normal operation a system reboot should never be required. After changes are made to any of the unit’s management interface network configuration a reboot is required. A system reboot will cause the Model 5401’s two Ethernet interfaces to go through a reconnection process, necessary should any of the management interface network parameters be revised. (These changes can be made by way of the Network Configuration menu choices or, for some parameters, using the front-panel display and associated buttons.)

## Menu Access Menu

As a security method a user name and password must be entered before the configuration webpages can be accessed. (This is what you did to get this far!) These values can be changed as desired.

The Model 5401's access security method is in no way rigorous. The user name and password are sent to and received from the Model 5401 as plain text. They are also stored within the Model 5401 as plain text. There is no security method or encryption associated with these fields. Anyone "snooping" on the LAN that is transporting Model 5401 management data will see all values in plain text. The ability to select user name and password values is intended simply to provide a means of keeping "honest" users from easily changing the configuration of a Model 5401.

The default user name is **guest** and the default password is **guest**. These are case sensitive. If neither of the default entries are changed then they will be shown in the user name and password entry fields on the Login menu webpage. If the default user name and/or default password is changed then neither the user name nor the password will be shown upon accessing the Login menu webpage.

The screenshot shows the 'Menu Access' page of the Model 5401 Dante Master Clock. At the top left, it displays 'ST-M5401-232724' and an 'Identify Device' button. The title 'Model 5401 Dante Master Clock' is centered at the top. Below the title, there is a horizontal line. On the left, the 'Menu Access' section is titled. On the right, there are links for 'Configuration Menu' and 'Help'. The main form area contains three input fields: 'User Name' (with 'guest' entered), 'New Password', and 'Confirm New Password'. Below these fields is a 'Submit' button. At the bottom of the page, there is a link to 'Studio Technologies, Inc.'.

**User Name:** In this field a revised user name can be entered. The user name must be a minimum of five characters, a maximum of 15 characters, and is case sensitive. All 95 of the printable ASCII characters can be used. These include upper and lower alphabetic characters, numbers, and standard punctuation marks.

**New Password:** In this field, a revised password can be entered. The password must be a minimum of five characters, have a maximum of 15 characters, and is case sensitive. All 95 of the printable ASCII characters can be used. These include upper and lower

alphabetic characters, numbers, and standard punctuation marks.

**Confirm New Password:** For a new password to be considered valid, enter it identically into this field.

**Submit:** The Submit button is located below the field for Confirm New Password. To save changes made to the User Name and/or New Password fields requires that the Submit button be pressed. Changes made will be effective upon the next attempt at logging into the Model 5401. Restoring the Model 5401 to its default values does not change the stored user name and password.

# Model 5401

## DANTE MASTER CLOCK

### System Information Menu

This menu webpage has many display-only fields that can provide the user with information about key Model 5401 operating parameters. In addition, functions on this page allow the Model 5401's firmware (operating software) to be updated. Additional configuration changes can also be made.

ST-M5401-232724

Identify Device

**Model 5401**  
Dante Master Clock

---

**System Information**

[Configuration Menu](#) [Help](#)

Serial Number

00515

Sync Board Revision

B

Default Settings

Restore

---

| Main Firmware           | Version | Build Date  | Next Boot                        |   |
|-------------------------|---------|-------------|----------------------------------|---|
| Currently Running       | 1.09    | 15 Apr 2020 |                                  | System Reboot                           |
| Memory 1                | 1.09    | 15 Apr 2020 | <input checked="" type="radio"/> | (Protected)                             |
| Memory 2                | 1.09    | 15 Apr 2020 | <input type="radio"/>            | Delete                                  |
| Memory 3                | ---     | ---         | <input type="radio"/>            | Download                                |
| Available on FTP Server | ---     | ---         |                                  | Check Now                               |
|                         |         |             | Save Next Boot                   | Enable Delete: <input type="checkbox"/> |

---

| Main FPGA Firmware      | Version | Build Date  |           |
|-------------------------|---------|-------------|-----------|
| Currently Running       | 1.01    | 16 Aug 2017 |           |
| Memory 1                | 1.01    | 16 Aug 2017 | Download  |
| Available on FTP Server | ---     | ---         | Check Now |

---

| Sync FPGA Firmware      | Version | Build Date  |           |
|-------------------------|---------|-------------|-----------|
| Currently Running       | 2.00    | 21 Dec 2020 |           |
| Memory 1                | 1.01    | 02 Oct 2018 | Download  |
| Available on FTP Server | ---     | ---         | Check Now |

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Dante Information

Product Version

4.4.1

Software Version

4.2.7.4

---

FTP Server

Active Server

Studio-Tech ▼

Server Address

ftp.studio-tech.com

User Name

M5401

Password

---

Submit

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[Studio Technologies, Inc.](#)

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# Model 5401

## DANTE MASTER CLOCK

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**Serial Number:** This is a display-only field that shows the Model 5401's hardware serial number. This number has been assigned at the factory and cannot be changed.

**Sync Board Revision:** This is a display-only field that shows the revision letter of the Model 5401's sync printed circuit board. This number has been entered at the factory and cannot be changed.

**Default Setting:** This button allows restoring of the Model 5401's default settings. Pressing the Restore button box allows all the Model 5401's configuration, management interface, and user access settings to be restored to their factory default values. This includes returning the IP Configuration method, Manual IP Address, Manual Subnet Mask, Manual Gateway, User Name, and Password to their factory default values. Refer to Appendix E for a list of all default values.

**Main Firmware:** Ten display-only fields show information about the currently running, stored in memory, and FTP-available Main firmware. This includes the version number and associated release date. This firmware can be field-updated using a file transfer method called FTP. Update details are provided in the Technical Notes section.

**Main FPGA Firmware:** Four display-only fields show the version number and associated date of the Model 5401's Main FPGA (field-programmable-gate-array) firmware. This firmware can be field-updated using FTP. Update details are provided in the Technical Notes section.

**Sync FPGA Firmware:** Four display-only fields show the version number and associated date of the Model 5401's synchronization board FPGA (field-programmable-gate-array) firmware. This firmware can be field-updated using FTP. Update details are provided in the Technical Notes section.

### Dante Information

**Product Version:** This display-only field shows the product version number that's stored in and being utilized by the Dante interface. (The Dante interface is implemented using a Brooklyn II module from Audinate.) This version number is assigned by Studio Technologies as an identifier when a file is released that combines specific Model 5401 configuration information along with Dante operating firmware. The firmware for the Model 5401's Dante interface can be updated by way of an Ethernet connection using the Dante Updater software application that's provided as part of the Dante Controller software application.

**Software Version:** This is a display-only field that shows the version number of the firmware (embed software) associated with the Dante interface (Brooklyn II module) that the Model 5401 utilizes for Dante interconnectivity. The version number shown is assigned by Audinate and can't be changed by Studio Technologies. It is incorporated into the Dante Product (.dnt) file that is released by Studio Technologies specifically for the Model 5401. As noted previously, this firmware, part of the Dante product firmware, can be updated by way of an Ethernet connection using the Dante Updater software application.

### FTP Server

For additional details, refer to the Technical Notes section.

**Active Server:** This configurable parameter allows selection of the FTP server to be utilized by the firmware update process. There are two choices available.

**Server Address:** This configurable parameter allows the address of the FTP server to be changed if required.

**User Name:** This configurable parameter allows the user name associated with accessing the FTP server to be changed if required.

**Password:** This configurable parameter allows the password associated with accessing the FTP server to be changed if required.

### Webpage Inactivity Timer/ Automatic Log Out

Once a web browser has successfully logged into the Model 5401's menu system an inactivity timer will become active. If no configuration setting has been changed, a webpage refreshed, or a webpage newly accessed for 15 minutes, the user will automatically be logged out. Returning to the menu pages will require the login procedure to be successfully completed.

### Menu Text and Links

The following provides details on some of the text and links that are presented on the Model 5401's webpages.

**Dante Device Name:** In the upper-left corner of each Model 5401 webpage is the Dante device name. This name is unique to each device in a Dante deployment and is used as part of the Dante subscription (channel routing) process. The name can be changed from within the Dante Controller application.

**Identify Device Link:** In the upper-left corner of most webpages, directly below the Dante device name, is a link called Identify Device. Clicking on it will cause the Dante identify action to commence on the specific Model 5401. The action will consist of the front-panel display's green backlight flashing five times. This command will help confirm that the web server on the desired Model 5401 is being accessed.

**Company Name Link:** On the bottom of each webpage is a link with the title Studio

Technologies, Inc. Clicking on this link will cause the browser to open the Home webpage of the Studio Technologies' website.

**Configuration Menu Link:** In the upper-right part of the most of the Configuration menu webpages is a link called Configuration Menu. It will cause the web browser to return to the Configuration webpage. From that page the user can access the log out link, causing them to log out and end the session.

**Help Menu Link:** In the upper-right part of the Configuration menu webpages is a link called Help. This will cause the web browser to open another webpage, going to the Studio Technologies' website and specifically to the webpage associated with the Model 5401.

## Operation

Now that the Model 5401 is installed and configured, it's ready for use. The unit is designed for continuous, unattended operation. However, there are a number of nuances in the unit's operation. This may make it worthwhile for personnel to spend some time reviewing this section.

Upon application of AC mains or DC power, the Model 5401 will go through a power-up sequence. The six dual-color LEDs on the Model 5401's front panel will light green, then light red in a confirmation sequence. The unit's graphics display will show the Studio Technologies logo graphics image, followed by a menu page that shows the product name (Model 5401) and the Dante name. Then the version number of the Main firmware will show. After a few seconds the screen saver mode, detailed later in this section, will begin operation.

Upon power being applied to the unit, the LEDs on the back panel associated with the unit's two Ethernet RJ45 jacks may briefly flash twice.

After the Model 5401 has completed its power-up sequences the unit will begin operation. The six front-panel LEDs will reflect the real-time status of the unit's major functions. The front-panel display will allow access to 19 menu pages that show some unit's operating parameters and facilitate revising some of the configuration choices. In addition to the LEDs and display, there are five pushbutton switches which are also located on the front panel. They are used in conjunction with the display to allow some of the unit's configuration settings to be revised as required.

The following paragraphs will detail the operation of the front-panel LEDs.

### Power LEDs

Two LEDs indicate the presence of incoming AC mains and 12 volts DC power. They are labeled AC and DC and can light green or red. When a source of AC mains power is connected the AC LED will light green. (This is actually in response to 12 volts DC that is being generated by the internally located AC mains input/12 volts DC output power supply.) The LED labeled DC will light green whenever a connected DC source exceeds approximately 10 volts. The DC LED will light red when the DC input is between approximately 9 and 10 volts, indicating a low-voltage condition. Once the DC input is less than approximately 9 volts the DC LED will not light and the Model 5401 will no longer operate from the DC source.

### Network LEDs

Two LEDs provide status indications related to the Model 5401's Ethernet network interfaces. They are labeled PRI and SEC. The way in which the Ethernet interfaces and their associated front-panel status LEDs function will depend on the network configuration as selected using the Dante Controller application. The configurable choices are *Switched*, *Redundant*, and *Pri Dante/Sec Mgmt*.

### Switched Network Operation

**PRI LED:** The PRI LED will light red when no Ethernet connection is present on the primary or secondary Ethernet ports. It will light green whenever a Gigabit Ethernet connection is present on either the primary or the secondary Ethernet port and a link has been established. It will light orange whenever a 100 Mb/s Ethernet connection is present on either the primary or the secondary Ethernet port and a link has been established.

**SEC LED:** The SEC LED will not light.

### Redundant Network Operation

**PRI LED:** The PRI LED will light red when no Ethernet connection is present on the primary Ethernet port. It will light green whenever a Gigabit Ethernet connection is present on the primary Ethernet port and a link has been established. It will light orange whenever a 100 Mb/s Ethernet connection is present on the primary Ethernet port and a link has been established.

**SEC LED:** The SEC LED will light red when no Ethernet connection is present on the secondary Ethernet port. It will light green whenever a Gigabit Ethernet connection is present on the secondary Ethernet port and a link has been established. It will light orange whenever a 100 Mb/s Ethernet connection is present and a link has been established.

### Pri Dante/Sec Mgmt Network Operation

**PRI LED:** The PRI LED will light red when no Ethernet connection is present on the primary Ethernet port. It will light green whenever a Gigabit Ethernet connection is present on the primary Ethernet port and a link has been established. It will light orange whenever a 100 Mb/s Ethernet connection is present on the primary Ethernet port and a link has been established.



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## Model 5401

### DANTE MASTER CLOCK

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**SEC LED:** The SEC LED will not light if the Model 5401 has been configured for Pri Dante/Sec Mgmt. This is due to hardware/firmware limitations in the Brooklyn II firmware that prevents monitoring of the secondary Ethernet port.

## Dante LEDs

Two LEDs are associated with the Model 5401's Dante interface. The system LED, labeled SYS, and the synchronization LED, labeled SYNC, will both light red as the Model 5401's Dante interface starts to function, but prior to connection and full operation with one or two local area networks (LANs). (Two networks are utilized only when Dante redundancy is enabled.) The SYS LED will light red to indicate that the unit's Dante interface is not ready to pass data to other devices. It will blink red if there is an issue communicating with the internal Dante Brooklyn II module. It will light green when the Dante interface is operating normally and is ready to pass Dante data.

The SYNC LED will light red to indicate that the Model 5401's Dante interface has not established timing synchronization. The complete action of the SYNC LED will depend on the network configuration as set using the Dante Controller application. Details are provided in the following paragraphs.

### Switched Operation or Pri Dante/Sec Mgmt Operation

If *Switched* or *Pri Dante/Sec Mgmt* has been selected then the SYNC LED will slowly flash green if this specific Model 5401 is serving as the PTP version 1 (PTPv1) Master clock for the associated Dante network. (In the latest Dante applications the term Leader clock is used in place of Master clock.) This is a typical situation where the Model 5401 will be providing the timing reference for all of the other Dante devices. The SYNC LED

slowly flashing green can be misconstrued as an error condition. The SYNC LED slowly flashing green will mimic the action that other Dante devices will perform if they are acting as the Master clock.

The SYNC LED will light solid green when the Model 5401 is acting as a follower clock. In this case, the unit is using another Dante device on the network to provide its timing reference. This would not be a typical-use case and might only occur while performing system testing or serving in a backup role.

The SYNC LED will slowly flash orange if the Model 5401 is serving as the PTPv1 Master clock for the Dante network and its failover mode is active. This would indicate that the unit was specified to utilize the sync input but is not able to do so. If the SYNC LED is lit solid orange, then the Model 5401 is not acting as the PTPv1 Master clock for the Dante network and the failover mode is active.

The SYNC LED lighting orange, whether solid or flashing, would typically indicate an error condition that should be resolved.

### Redundant Operation

If the *Redundant* network configuration has been selected then the SYNC LED will slowly flash green if this specific Model 5401 is serving as the PTPv1 Master clock for either the Dante primary or Dante secondary network. The SYNC LED will light solid green when the Model 5401 is not acting as the PTPv1 Master clock for the Dante primary and Dante secondary networks and the unit is locked to another Master clock. In this case, the unit is acting as a follower, using another Dante device to provide the timing reference for the Dante primary network. This would not be a typical-use case and might only occur while performing system testing or serving in a backup role.



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### DANTE MASTER CLOCK

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The SYNC LED will slowly flash orange if this Model 5401 is serving as the PTPv1 Master clock for the Dante primary network and its failover mode is active. This would indicate that the unit was specified to utilize the sync input but is not able to do so. If the SYNC LED is lit solid orange, then the Model 5401 is not acting as the PTPv1 Master clock for the Dante primary network and its failover mode is active.

The SYNC LED lighting orange, whether solid or flashing, would typically indicate an error condition that should be resolved.

Note that it's possible that up to 30 or 40 seconds may be required for the SYNC LED to reach its final state after the Model 5401 powers up or performs a reboot (restart). Also, both the SYS and SYNC LEDs will flash red whenever the Model 5401's network configuration mode is changing. (This would be performed using the Dante Controller application.) After the revised network configuration has been established the SYS and SYNC LEDs will perform normally.

The Management Webpages can be utilized to observe the Model 5401's complete sync status. The Overview webpage will provide a view of the current operating state. Using the Network Configuration webpage, the status of the Dante primary, Dante secondary, and management interfaces will be shown.

## Ethernet RJ45 LED Indicators

Located on the Model 5401's back panel are two RJ45 jacks that are provided for interfacing with the unit's Ethernet ports. The ports are used to access both the Dante and management functions. The Ethernet ports are labeled PRIMARY and SECONDARY. Associated with each RJ45 jack are two LEDs. One LED is labeled LINK and lights orange when a GigE Ethernet connection has been established with that specific port. The other LED

is labeled ACT and flashes green to indicate activity, responding to Ethernet data traveling through that specific port.

As previously discussed, the Model 5401's two Ethernet ports can be configured, using the Dante Controller application, to operate in one of three network configuration modes: *Switched*, *Redundant*, and *Pri Dante/Sec Mgmt*. The manner in which the LEDs associated with each RJ45 jack light will depend on the network configuration. The following sections detail the operation of the LEDs based on the specific network configuration.

## Switched Network Operation

### PRIMARY RJ45 LEDs:

**LINK (Orange):** Off if no Ethernet signal is connected or if a 100 Mb/s Ethernet signal is connected; lit if a GigE Ethernet signal is connected.

**ACT (Green):** Off if no data traffic; flashes to show data traffic.

### SECONDARY RJ45 LEDs:

**LINK (Orange):** Off if no Ethernet signal is connected or if a 100 Mb/s Ethernet signal is connected; lit if a GigE Ethernet signal is connected.

**ACT (Green):** Off if no data traffic; flashes to show data traffic.

## Redundant Network Operation

Same as Switched.

## Pri Dante/Sec Mgmt Network Operation

### PRIMARY RJ45 LEDs:

**LINK (Orange):** Off if no Ethernet signal is connected or if a 100 Mb/s Ethernet signal is connected; lit if a GigE Ethernet signal is connected.

**ACT (Green):** Off if no data traffic; flashes to show data traffic.

### SECONDARY RJ45 LEDs:

**LINK (Orange):** Off if no Ethernet signal is connected or if a 100 Mb/s Ethernet signal is connected; lit if a GigE Ethernet signal is connected.

**ACT (Green):** Off if no data traffic; flashes to show data traffic.

## Front-Panel Display Menu Page Descriptions

The following sections provide information about the Model 5401's front-panel menu pages. Additional details can be found in the Model 5401 Configuration section. Refer to Appendix D for a menu structure diagram.

### Row One

There are four display pages associated with the top row which we'll refer to as row one. They relate to the Model 5401's selected internal timing source, the parameters related to the sync input, and a special display of timing parameters that can be useful for factory troubleshooting.

**Clock Status & Source:** This menu page will show the status of the Model 5401's selected clock on line 1. Line 2 shows which timing source is actively being used by the unit's circuitry. The clock status will typically show Master when the unit is functioning correctly. Only if the unit is experiencing a problem will no text be shown. The second line shows the name of the clock source with the possibilities being *Dante*, *Internal*, *Sync Input*, *Failover Dante*, *Failover Internal*, or ---.

**Sync Input & Status:** This display-only page shows two parameters. The first line will show the type of input that has been configured for the sync input. The possibilities are *Disabled*, *Word Clock*, *Video*, or *10 MHz*. The second line will show the status of the sync input circuitry. The possibilities are *Locked*, *Unlocked*, *Standby*, *Idle*, or ---.

**Sync Input Termination:** This menu page will show the status of a terminating impedance being applied to the sync input BNC jack. The two possibilities are *Off* and *On*.

### Phase Detector Deviation (Factory Use):

This menu page will show two numbers related to how well the Model 5401's internal logic circuitry is "locking" to an external timing reference. The information on this menu page will only be relevant to factory personnel if they have been contacted in regards to a technical issue.

### Row Two

Row two has two front-panel menu pages that involve the management IP address and associated subnet mask.

**Current Management IP Address:** This menu page will show the IP address associated with the Model 5401's internal management web server. This address can be assigned automatically using the DHCP protocol or, if a DHCP server is not available, using the IPv4 link-local protocol. (An IP address that has the format of 169.254.x.x was assigned using IPv4 link-local.) The management IP address can also be manually assigned with a fixed or static IP address.

If the Model 5401's network configuration in the Dante Controller application is selected for *Switched* then this menu page will show the IP address that's associated with the connection made to the Model 5401's primary or secondary Ethernet interface. If the Model 5401's network configuration in the Dante Controller application is selected for *Redundant* then the IP address that is shown will be associated with a connection that is made to the primary Ethernet interface.

If no Ethernet connection has been made to support the management webpages the text **Link Down** will be shown.

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# Model 5401

## DANTE MASTER CLOCK

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If the network configuration in Dante Controller has been selected for *Pri Dante/Sec Mgmt* then a limitation in the Dante Brooklyn II module's firmware restricts the Model 5401's ability to show the management IP address and subnet mask. If a Dante network has been connected to the primary Ethernet port then the IP address associated with the secondary Ethernet port will be shown. But if a network connection has not been made to the primary Ethernet port, then the message **No Ethernet Link** will be shown. This can be somewhat confusing. But rest assured, a network connection made to the secondary Ethernet port will be available for use for accessing the management menu system; its IP address and subnet mask value won't show unless a network connection is active on the primary Ethernet port.

**Current Management Subnet Mask:** This menu page will show, in dot-decimal notation, the subnet mask value that is active for the Model 5401's management interface and associated web server. If the IP address and related network parameters were obtained by way of DHCP then this field will show an IPv4 subnet mask value. If the IP configuration mode is selected for Automatic and the current IP address was obtained by way of link-local, then 255.255.0.0 will show. It's also possible that the subnet mask value was manually entered as part of a fixed or static IP address. If this is the case, then its value would show here.

### Row Three

Row three has a total of three menu pages. They relate to the management IP configuration method, the management IP address, and the associated subnet mask.

**Management IP Configuration:** This menu page allows the display of, and if desired, revision of the method that the Model 5401 will use to obtain a management IP address

and related parameters. The choices are *Automatic* and *Manual*. The selected configuration impacts how the Model 5401 obtains the IP address and subnet mask that is used for accessing the management web server and associated menu webpages. This setting has no impact on how the Model 5401 obtains IP addresses for the Dante primary and Dante secondary Ethernet ports.

If the active configuration method is not the desired one, press the Enter pushbutton switch located on the front panel. Use the up and down arrow buttons to select the desired method. Then again press the Enter button. The entry will be stored. To cause the Model 5401 to use a new setting requires that the unit be rebooted (restarted). This can be performed using one of three ways: via another front-panel menu page, using a selection in one of the management webpages, or by power cycling the unit.

Selecting the *Automatic* setting causes the Model 5401 to use DHCP or, if DHCP is not available, the IPv4 link-local protocol to establish the IP address for the management port. Even if the IP address was established using link-local the DHCP protocol will remain active. In this case, approximately every 30 seconds the Model 5401's firmware will check for the presence of a DHCP server. If one becomes available then an IP address and subnet mask value will be requested and, when obtained, will automatically replace the IP address and subnet mask value that was previously established by link-local.

The *Manual* setting allows the desired management IP address and subnet mask to be manually entered. This can be useful when a fixed or static addressing scheme has been established. In this way, a designated IP address can be entered along with the other necessary network parameters.

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**Manual Management IP Address:** This menu page shows the stored IP address associated with the management web server. (This address has nothing to do with the IP address utilized by the Dante primary and Dante secondary ports.) It will be utilized only when the manual mode has been selected for the management IP address configuration. When the IP address configuration has been selected for *Automatic* this field cannot be changed.

Whenever the IP address configuration is selected for *Manual* the manual IP address can be modified as desired. To start the process of changing the manual management IP address press the Enter pushbutton switch on the front panel. Press the left and right arrow pushbutton switches to select which specific digit of the IP address is to be modified. Press the up and down arrow pushbuttons to select the desired number. The standard dot-decimal notation is used to display and revise the IP address. Once all the desired changes have been made press the Enter button to store the values.

To cause the Model 5401 to use a new manual management IP address requires that the unit be rebooted (restarted). This can be performed using one of three ways: via another front-panel menu page, using a selection in one of the management webpages, or by power cycling the unit.

**Manual Management Subnet Mask:** This menu page shows the stored subnet mask value associated with the management web server. (This value has nothing to do with the subnet mask values utilized by the Dante primary and Dante secondary ports.) It will be utilized only when the manual mode has been selected for the management IP address configuration. When the IP address configuration has been selected for *Automatic* this field cannot be changed.

Whenever the IP address configuration is selected for *Manual* the manual management subnet mask value can be modified as desired. To start the process of changing the subnet mask value press the Enter pushbutton switch on the front panel. Use the up and down arrow pushbutton switches to select the desired subnet mask value. Use the left and right arrow buttons to select the octet to be modified. Once the desired value has been selected press the Enter button to store it.

To cause the Model 5401 to use a new manual management subnet mask value requires that the unit be rebooted (restarted). This can be performed using one of three ways: via another front-panel menu page, using a selection in one of the management webpages, or by power cycling the unit.

#### Row Four

Row four contains four menu pages. They provide information about the specific Model 5401, including its serial number and version numbers for the firmware (embedded software) that are in use.

**Product Name & Serial Number:** This menu page shows the name of the product (Model 5401) and the hardware serial number. The name and serial number are assigned at the factory and cannot be changed.

**Main Firmware Version:** This menu page shows the version number of the Model 5401's Main firmware. Details regarding updating this firmware are provided in the Technical Notes section.

**Main FPGA Firmware Version:** This menu page shows the version number of the Model 5401's Main FPGA (field-programmable-gate-array) firmware. Details regarding updating this firmware are provided in the Technical Notes section.



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**Sync FPGA Firmware Version:** This menu page shows the version number of the Model 5401's synchronization FPGA (field-programmable-gate-array) firmware. Details regarding updating this firmware are provided in the Technical Notes section.

### Row Five

Row five has a total of five menu pages which related to the Dante interface. The first page shows the Dante device name that has been assigned to the Model 5401 unit. The next two pages show the IP addresses of the primary and, if utilized, secondary Dante Ethernet ports. The fourth and fifth pages relate to the firmware version that is being utilized by the Dante interface implemented by a Brooklyn II module.

**Dante Device Name:** The Dante device name is shown on this menu page. This name is unique to each device in a Dante deployment and is used as part of the channel routing (Dante subscribing) process. The name can be changed only from within the Dante Controller application. The text shown on this menu page is the same as is shown in the upper-left corner of each Model 5401 management webpage.

**Dante Primary IP Address:** This menu page shows the IP address associated with the Dante primary port. (This address has nothing to do with the IP addresses utilized by the Dante secondary and management interface ports.) If the network configuration is selected in the Dante Controller application for *Switched* then the Dante primary IP address will be associated with a network connection made to either the primary or secondary Ethernet RJ45 jacks on the Model 5401's back panel. If the network configuration is selected for *Redundant* then the Dante primary IP address will be associated with the primary Ethernet RJ45 jack. If the network configuration is selected for

*Pri Dante/Sec Mgmt* then the Dante primary IP address will be associated with the primary Ethernet RJ45 jack.

**Dante Secondary IP Address:** This menu page shows the IP address associated with the Dante secondary port. (This address has nothing to do with the IP address utilized by the management interface port.) If the network configuration is selected for *Redundant* then the Dante secondary IP address will be associated with the RJ45 jack labeled secondary on the Model 5401's back panel. If the network configuration is selected in the Dante Controller application for *Switched* or *Pri Dante/Sec Mgmt* then the Dante secondary IP address will be shown as *Disabled*.

**Dante Product Version:** This menu page shows the product version number that's being utilized by the Dante interface. The Model 5401's Dante interface is implemented using a Brooklyn II module from Audinate. This version number is assigned by Studio Technologies as an identifier when a file is released that combines specific Model 5401 configuration information along with Audinate-developed Dante operating firmware.

The firmware for the Model 5401's Dante interface can be updated by way of an Ethernet connection using the Dante Updater software application that's provided as part of the Dante Controller software application.

**Dante Software Version:** This menu page shows the version number of the Audinate-developed Dante operating firmware being utilized by the Model 5401's Dante interface. The Model 5401's Dante interface is implemented using a Brooklyn II module from Audinate. The firmware for the Model 5401's Dante interface can be updated by way of an Ethernet connection using the Dante Updater software application that's provided as part of the Dante Controller software application.

### Row Six

Row six contains one menu page. It allows the Model 5401 to be rebooted (restarted).

**Reboot:** This menu page allows the Model 5401 to be rebooted (restarted). This can be useful to force the unit to utilize a revised management or Dante interface configuration change. Once on this menu page, to start the process of rebooting the Model 5401 simultaneously press the left arrow push button and the enter pushbutton on the unit's front panel. Continue to hold both buttons while the timer indication in the upper-right corner of the display counts down from five to zero. Upon reaching zero the unit will reboot. Releasing the buttons before zero is reached will abort the reboot process and the Model 5401 will continue in its current operation.

After performing a system reboot (restart), 20 to 60 seconds may be required for the Model 5401 operation to fully restore. During this time period, the two Ethernet ports will briefly disconnect and then reconnect.

### Screen Saver

A "screen saver" mode will automatically activate two minutes after the last press of a front-panel pushbutton switch. When active, the screen saver mode will cause a continuous sequence of four menu pages to activate. Each menu page will be present for approximately four seconds before the next menu page will be shown.

When the screen saver mode is active pressing any of the five pushbutton switches on the front panel will cause it to stop and the Clock Status & Source menu page will immediately be shown. To cause the screen saver mode to immediately start, simultaneously press the left and right arrow pushbutton switches.

There are four menu pages that will be shown when the screen saver mode is active. Details regarding the information provided in these menu pages were documented in previous sections. The menu pages consist of:

1. The product name (Model 5401) and Dante device name.
2. The unit's management IP address.
3. The unit's clock status and current source.
4. The unit's selected sync input and current status.

## Technical Notes

### Precision Time Protocol

For clock synchronization "native" Dante utilizes version 1 of the Precision Time Protocol (PTPv1). Technically, the applicable standard is IEEE 1588-2002, which is what the Model 5401 supports for applications that utilize both single and redundant Dante. When operating in the *Redundant* network mode, independent PTPv1 server functionality is supported, one instance provided for the Dante primary port and a second instance provided for the Dante secondary port.

Applications that utilize AES67 require PTP version 2 (PTPv2) as covered under the standard IEEE 1588-2008. (And following details as specified in the SMPTE ST2059-2 profile.) The Model 5401 will provide support for PTPv2 if the AES67 mode has been enabled in the Dante Controller application. This is in addition to PTPv1 support; both can function simultaneously. When AES67 mode has been enabled and *Redundant* mode is selected, then both the Model 5401's Dante primary and Dante secondary Ethernet interfaces will provide independent PTPv2 server functionality. (And, to highlight to users, this is in addition to PTPv1 functionality.)



For Dante-related AES67 applications the Model 5401 can provide effective PTPv2 functionality. But the Model 5401 can't serve as a general-purpose PTPv2 grandmaster clock. Limitations in Dante's AES67 implementation restricts Studio Technologies' ability to adjust PTPv2 operating parameters, something that some applications may require. Refer to Appendix F for details on the PTPv2 implementation that the Model 5401 provides.

### Dante IP Addresses

If the Model 5401's Dante interface has been configured in the Dante Controller application for *Switched* operation, by default the Model 5401's primary Ethernet interface will attempt to automatically obtain an IP address and associated settings using DHCP (Dynamic Host Configuration Protocol). If a DHCP server is not detected then an IP address will be automatically 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 randomly assign a unique IP address in the IPv4 range of 169.254.0.1 to 169.254.255.254. In this way, multiple Dante-enabled devices will connect 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 should correctly acquire IP addresses and be able to communicate with each other. As previously discussed, using Dante Controller the Model 5401's Dante Ethernet IP address and related network parameters can also be set for manual (fixed or static) operation.

If the Model 5401's Dante interface has been configured in Dante Controller for *Redundant* operation then both the Model 5401's primary and secondary Ethernet interfaces

will attempt to automatically obtain IP addresses and associated network settings using DHCP. If DHCP is not available on an interface then a link-local IP address will be assigned. If automatic assignment of IP addresses is not desired each interface can be individually configured using Dante Controller to use a manual (fixed or static) IP address and related network parameters.

The specific IP address assigned to each of the Model 5401's Ethernet interfaces can be identified using several methods. The Dante Controller application will directly show the network parameters of the primary and, if utilized, secondary Ethernet interfaces. Another means of identifying the Dante IP address or addresses is to utilize the Model 5401's network configuration webpage. This will show the IP address assigned to the primary Ethernet port and, if utilized, the IP address of the secondary Ethernet port. The Model 5401's front-panel menu system can also be selected to show the Dante primary and secondary IP addresses.

### Optimizing Dante Network Performance

For best Dante audio-over-IP performance a network that supports VoIP QoS (Voice-over-Internet-protocol quality of service) 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. Also, it's recommended that IGMP snooping functionality on Ethernet switch ports associated with Dante devices be disabled. This can be important, allowing Dante-related multicast data traffic, including PTPv1, to be correctly supported. Refer to the Audinate website ([audinate.com](http://audinate.com)) for details on how to optimize a network for Dante applications.

## Management IP Address and Configuration

It's easy to determine the active IP address being used by the Model 5401's management Ethernet connection. The most direct method is to simply watch the front-panel screens that are active in the "screen saver" mode. This mode will enable automatically two minutes after the last press of any of the front-panel buttons. The front-panel menu system also allows the management IP address to be shown and, if required, revised. A menu structure diagram is available in Appendix D. It's also available as a separate document on the Studio Technologies' website.

By default, the Model 5401's management Ethernet interface address configuration is set for automatic. In this way, it will attempt to automatically obtain an IP address and associated settings using DHCP. If a DHCP server is not detected an IP address will be automatically assigned using the link-local protocol in the IPv4 range of 169.254.0.1 to 169.254.255.254. There are two ways that the management Ethernet IP address and related network parameters can be set to a manual (fixed or static) configuration. The first method uses the front-panel display and buttons to allow the management Ethernet network parameters to be viewed and revised as desired. An alternative and possibly easier method would be to use the network configuration webpage that is provided as part of the Model 5401's Network Configuration webpage.

## Model 5401 Firmware Update Procedure

It's possible that updated versions of the three firmware (embedded software) files that are utilized by the Model 5401's MCU (microcontroller) and two FPGA

(field-programmable-gate-array) integrated circuits will be released to add features or correct issues. The Model 5401 has the ability to obtain these firmware files via the primary Ethernet connection using FTP (file transfer protocol). Technically, the Model 5401 implements FTP client capability such that it can download files from a Studio Technologies' controller FTP server. These files will arrive via a network connection and then be automatically stored in non-volatile memory within the Model 5401.

The latest firmware files are stored on the FTP server which can be automatically accessed by way of commands contained in the System Information webpage. The Model 5401 updates its firmware using three files. The Main firmware file is named **M5401vXrXX.bin**. The Main FPGA firmware file is named **DSMCvXrXX.bin**. And the name of the Sync FPGA firmware file is **CLOKvXrXX.bin**. For all three files **XrXX** represents the revision level of the file.

The Model 5401 provides three memory locations for the Main firmware. They are labeled Memory 1, Memory 2, and Memory 3. These are provided so that the active Main firmware version can be selected. This will help to ensure that reversion to a previous version of the Main firmware can always be accomplished. For operation reliability, Memory 1 is loaded at the factory and cannot be field-updated. This ensures that it can always be selected. Memory 2 and Memory 3 are available for user updating. A command called Next Boot allows selection of which memory location will be used by the Model 5401 upon its next restart.

To determine which Main firmware version is available on the associated FTP server use the Check Now command. If what is available on the FTP server is newer than the file in one of the memory locations then the newer file should be downloaded. The

Download command allow control of the FTP process for placing the Main firmware file in the Memory 2 and Memory 3 storage locations. If a file is already stored in one of those locations it must be erased prior to the download process being utilized. The Delete command is used for erasing the memory location.

Updating the Main FPGA and Sync FPGA firmware is performed in a similar fashion as the Main firmware. However, only one memory location is provided for each of those files. Using the download command will erase the presently-stored file and start the FTP download process. As with the Main firmware, only download a file if it is newer than what is presently stored.

The Model 5401 must have access to the Internet for FTP operation with the Studio Technologies' FTP server to be successful. The parameters to access that server are shown in fields located on the bottom of the System Information webpage. If a different FTP server, typically one located within a LAN, is going to be utilized then the parameters can be revised as necessary. The latest Model 5401 firmware files are available on the Studio Technologies' website. This allows them to be copied and stored on a user-implemented FTP server.

Once one, two, or all three of the firmware files have been downloaded using FTP then the System Reboot Command should be used to restart the Model 5401. It will halt operation and the begin again using the stored files.

## Dante Firmware Update

As previously discussed, the Model 5401 implements Dante connectivity using a Brooklyn II module from Audinate. The Dante Controller software application can be used

to determine the version of the firmware (embedded software) that resides in the Brooklyn II module. The unit's System Information webpage and the front-panel display menus can also be used to identify the firmware version.

The firmware (embedded software) residing in the Brooklyn II module can be updated using the Model 5401's Dante primary Ethernet port. Performing the update process is easily accomplished using an automated method called Dante Updater that's included as part of the Dante Controller software application. The Dante Controller application is available, free of charge, from the Audinate website ([audinate.com](http://audinate.com)).

The latest Model 5401 Dante firmware file, with a .dnt extension, is available on the Studio Technologies' website as well being part of Audinate's product library database. The latter allows the Dante Updater software application that is included with Dante Controller to automatically query the Model 5401's Dante interface and, if required, update its Dante firmware.

## Restoring Model 5401's Default Settings

A command provided in the System Information webpage allows most of the configuration settings to be restored to their default values. This command can be useful but must be used with caution. Any customization made to the Model 5401's configuration will be lost. This can be offset in a positive way by returning the Model 5401 to a known configuration, a point that might aid in troubleshooting an issue. Refer to Appendix E for a list of the default values.

## **Lost User Name and/or Password**

As is covered in detail in other sections, gaining access to the Model 5401's webpages require entering the correct user name and password. If the default entries, both of which are guest, are stored for use then they will be shown on the Login menu webpage. Pressing the Login button on the bottom of that webpage will then access the Configuration Menu webpage. If either or both the user name and the password have been configured to be something other than guest (the default) then nothing will show in the fields associated with the Login menu webpage.

If knowledge of the stored user name and/or password is "lost" then the Model 5401 includes a "back door" to allow access. But as a security measure physical access to the unit is required to utilize that access method; there is no means to access the unit via an Ethernet port without knowledge of the user name and password. The exact process of accessing the Model 5401's configuration webpages without knowledge of the user name and/or password is detailed in Appendix G.

# Specifications

### Applications:

High-performance master clock for Dante audio-over-Ethernet applications. Also supports AES67-2013 applications. In addition provides audio reference signals (tones) for general-purpose use and a precision word clock sync output.

### Precision Time Protocol (PTP) Support:

IEEE® 1588-2002 Version 1 (v1) for Dante; IEEE 1588-2008 Version 2 (v2) for AES67-2013

### Timing Reference:

**Source:** internal time-base, external sync input, or via an existing Dante network, selectable

### Internal Time Base:

**Type:** 24.576 MHz temperature-stabilized crystal oscillator

**Initial Accuracy:** 2 ppm (parts-per-million)

**Long-Term Accuracy:** 1 ppm (parts-per-million) per year

**Temperature Stability:** ±280 ppb (parts-per-billion), 0-50 degrees C

### Sync Input:

**Compatible Sources:** word clock, bi-level video, tri-level video, 10 MHz

**Termination:** 50 ohms (10 MHz), 75 ohms (word clock or video), or high Z (unterminated), selectable

**Word Clock Characteristics:** square wave, 5 Vpp nominal unloaded, 44.1, 48, 88.2, or 96 kHz

**Video Characteristics:** bi- or tri-level, 1 Vpp into 75 ohm load

**10 MHz Characteristics:** sine wave, 3 Vpp into 50 ohm load

### Word Clock Output:

**Type:** square wave

**Rate:** 44.1, 48, 88.2, or 96 kHz, selectable using Dante Controller application

**Source Impedance:** 75 ohms

**Amplitude:** 5 Vpp unterminated; 2.5 Vpp terminated with 75 ohms

**Jitter:** 0.01 UI (using internal oscillation)

### Network Audio Technology:

**Type:** Dante audio-over-Ethernet

**AES67-2013 Support:** yes; selectable on/off

**Dante Domain Manager (DDM) Support:** yes

**Ethernet Interface Configuration:** Switched, Redundant, or Pri Dante/Sec Mgmt

**Clock Source:** follows overall Model 5401 configuration

**Bit Depth:** 24

**Sample Rate:** 44.1, 48, 88.2, or 96 kHz, selectable using Dante Controller application

**Number of Dante Transmitter (Output) Channels:** 8

**Number of Dante Flows:** 32

### Audio Reference Signals:

**Type:** continuous sine-wave signals on Dante transmitter (output) channels

**Number of Channels:** 8

**Frequency:** 1 Hz to 22 kHz, individually configurable in 1-Hz steps

**Amplitude:** 0 to -99 dBFS, individually configurable in 1-dB steps

**Distortion (THD+N):** <0.0001% (<-121 dB), measured at 1 kHz, -1 dBFS

### Network Interfaces: 2, primary and secondary

**Type:** 1000BASE-T (Gigabit Ethernet ("GigE")) per IEEE 802.3ab (100 Mb/s also supported but not recommended for optimal performance)

**NIC Status LEDs:** one link and one activity for each Ethernet interface

**Software Updating:** internal FTP client supports updating of application, main FPGA, and sync FPGA software; process requires unrestricted access to the Internet or a local FTP server

**Front-Panel Display:** LCD with LED backlighting

**Front-Panel LEDs:** 6, dual-color

**Functions:** provides indication of condition of incoming AC and DC power, status of Dante connections on Ethernet interfaces, and status of Dante connectivity

### Power Sources:

**AC Mains:** 100 to 240 V, 50/60 Hz, 5 W maximum

**DC:** 10 to 18 V, 0.5 A max

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# Model 5401

## DANTE MASTER CLOCK

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### **Connectors:**

**Sync Input, Word Clock Output:** BNC, per IEC 61169-8 Annex A

**Ethernet:** 2, RJ45

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

**DC Input:** 4-pin male XLR (pin 1 negative, pin 4 positive)

### **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):**

19.00 inches wide (48.3 cm)

1.72 inches high (4.4 cm)

7.9 inches deep (20.1 cm)

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

**Weight:** 3.0 pounds (1.4 kg)

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



## Appendix A—Compatible Sync Input Sources

The Model 5401's sync input has been tested and confirmed for correct operation with the following sync signals:

**Word Clock:** Square wave signal with rate of 44.1, 48, 88.2, or 96 kHz

**10 MHz:** Sine wave signal with an amplitude of 1 Vrms, nominal, terminated with 50 ohms

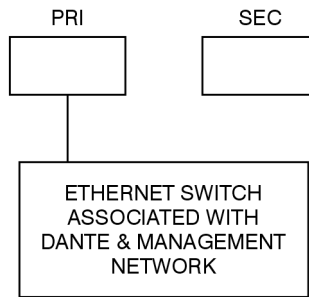
**Bi-Level and Tri-Level Video:** See table below

| Video Format         |
|----------------------|
| NTSC ("Black Burst") |
| PAL ("Black Burst")  |
| 720p/50 Hz           |
| 720p/59.94 Hz        |
| 720p/60 Hz           |
| 1080psf/23.98 Hz     |
| 1080psf/24 Hz        |
| 1080i/50 Hz          |
| 1080i/59.94 Hz       |
| 1080i/60 Hz          |
| 1080p/23.98 Hz       |
| 1080p/24 Hz          |
| 1080p/25 Hz          |
| 1080p/29.97 Hz       |
| 1080p/30 Hz          |
| 1080p/50 Hz          |
| 1080p/59.94 Hz       |
| 1080p/60 Hz          |

## Appendix B–Network Configuration Examples

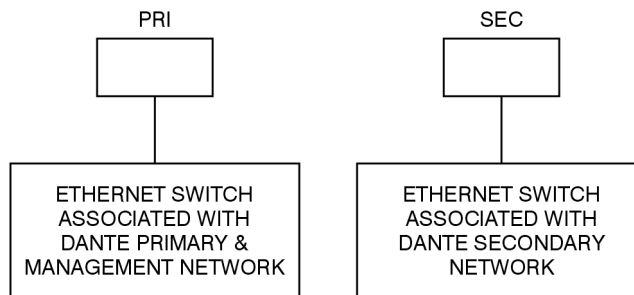
### ONE LAN – SWITCHED DANTE

MODEL 5401 NETWORK INTERFACE  
CONFIGURED FOR SWITCHED OPERATION



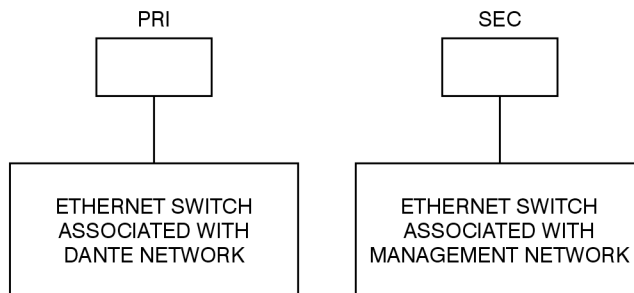
### TWO LANs – REDUNDANT DANTE

MODEL 5401 NETWORK INTERFACE  
CONFIGURED FOR REDUNDANT OPERATION



### TWO LANs – PRI DANTE/SEC MGMT

MODEL 5401 NETWORK INTERFACE  
CONFIGURED FOR PRI DANTE/SEC MGMT OPERATION



## Appendix C–Dante Controller Network Default Settings

### Dante Interface Default Values:

Device Config, Sample Rate: 48k

Device Config, Clocking, Unicast Delay Requests: Disabled

Device Config, Device Latency: Latency: 1.0 msec

Network Config, Switch Configuration, Current: Switched

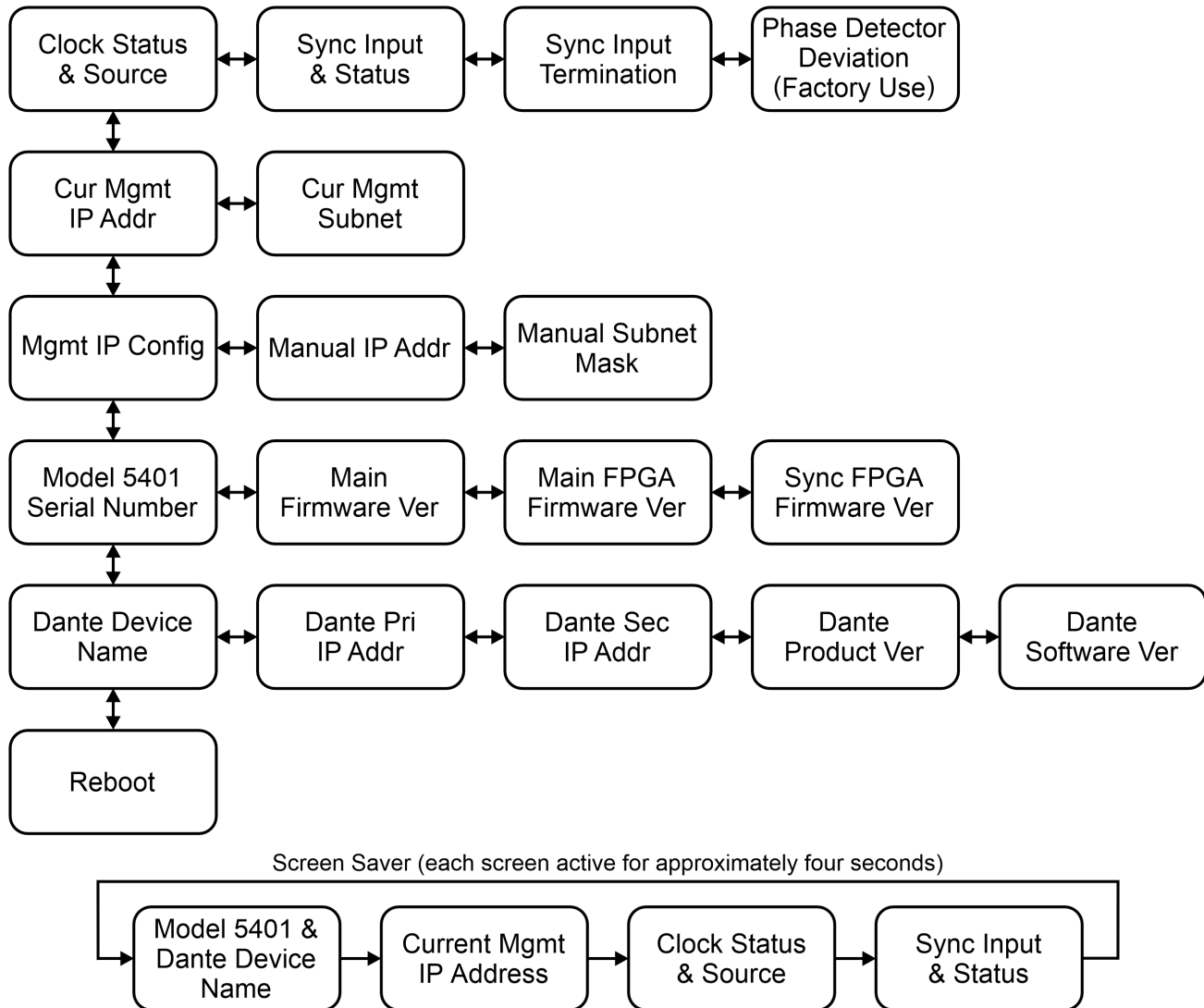
Network Config, Addresses: Obtain an IP Address Automatically (default)

AES67 Config, AES67 Mode, Current: Disabled

Leader Clock, Preferred Leader: Enabled

Leader Clock, Enable Sync to External: Enabled

## Appendix D—Front-Panel Menu Structure



## Appendix E–Model 5401 Default Operational Settings

### **Sync Settings Menu:**

Force Preferred Master: Enabled  
Clock Source: Internal  
Sync Input Type: Word Clock  
Sync Input Termination: On  
Sync Input Failover Source: Dante

### **Audio Generator Menu:**

Tone01: Frequency 100 Hz, Level –21 dBFS  
Tone02: Frequency 200 Hz, Level –22 dBFS  
Tone03: Frequency 300 Hz, Level –23 dBFS  
Tone04: Frequency 400 Hz, Level –24 dBFS  
Tone05: Frequency 500 Hz, Level –25 dBFS  
Tone06: Frequency 600 Hz, Level –26 dBFS  
Tone07: Frequency 700 Hz, Level –27 dBFS  
Tone08: Frequency 800 Hz, Level –28 dBFS

### **Network Configuration Menu, Management Address:**

IP Address Configuration: Automatic  
Manual IP Address: 192.168.1.54 (Not shown in field)  
Subnet Mask: 255.255.255.0  
Gateway IP Address: 192.168.1.1  
DNS IP Address: 75.75.76.76

### **Menu Access Menu:**

User Name: guest  
Password: guest

## Appendix F–PTPv2 (IEEE®-1588-2008) Characteristics

### Notes:

1. For Model 5401 PTPv2 support to be active AES67 compatibility check box must be enabled in Dante Controller application.
2. These default configuration characteristics apply to both the Dante primary and Dante secondary Ethernet interfaces.

**Domain:** 0

**Priority 1:** 114

**Clock Class:** 248

**Accuracy:** Unknown (0xFE)

**Variance:** 61536

**Priority 2:** 112

**Unique ID:** 00:1D:C1:XX:XX:XX

**DSCP:** EF (46)

| Preferred Leader |          |             |          |     |
|------------------|----------|-------------|----------|-----|
| Enabled          |          | Disabled    |          |     |
| SYNC to Ext      |          | SYNC to Ext |          |     |
| Enabled          | Disabled | Enabled     | Disabled |     |
| Priority 1       | 114      | 119         | 242      | 247 |
| Priority 2       | 112      | 112         | 116      | 116 |



## Appendix G—Accessing the Unit when the Password is Not Known

Follow this procedure if the password to access the Configuration Menu is not known.



1. Remove power from unit.
2. Press and hold the left and Enter buttons.
3. While holding the two buttons apply AC Mains or 12 volt DC power.
4. While continuing to hold the two buttons allow the Model 5401 to start. The six Status LEDs on the front panel will first light green then light red in a start-up pattern.
5. Once the Status LEDs complete their start-up pattern release the two buttons.
6. Use a web browser to access the Model 5401's menu system. The IP address to use is shown in the current management IP address page on the front-panel display.
7. Go to the Configuration Menu Login page. Leave the Password field empty then use the mouse to click the Login button. This should allow access to the Configuration Menu.
8. Note that you will not be able to view the previously saved password. Use the Menu Access page should a new password need to be entered and saved.