Model 5682
ST 2110 to Dante Bridge

User Guide

Issue Preliminary 3, January 2025

This User Guide is applicable for serial numbers
M5682-01-00151 and later with Main Firmware 1.03 and later
M5682-02-00151 and later with Main Firmware 1.03 and later

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Revision History

Issue Preliminary 3, January 2025:

- Miscellaneous improvements, clarifications, and corrections.

Issue Preliminary 2, January 2025:

- Miscellaneous improvements, clarifications, and corrections.

Issue Preliminary 1, November 2024:

- Initial Preliminary release.

Introduction

The Model 5682 ST 2110 to Dante Bridge provides a high-performance means of interconnecting ("bridging") SMPTE® ST 2110 audio channels with Dante® audio-over-Ethernet channels. Both the ST 2110 and the Dante interfaces are typically associated with independent local area networks (LANs). The Model 5682 supports this scenario, as well as a single network that carries both ST 2110 and Dante audio signals. The unit is compatible with the SMPTE ST 2110-30 standard for PCM audio signals and the ST 2110-10 standard for signal timing. On the Dante side, the Model 5682 is compatible with the Dante Domain Manager™ (DDM) software application and is complaint with the AES67 interoperability standard. The Model 5682 is available in two versions: the Model 5682-01 allows up to 32 audio channels to pass in each direction, while the Model 5682-02 allows up to 64 audio channels. Internal sample rate conversion (SRC) capability provides sample rate, bit depth, and timing conversion to ensure that audio signal integrity is maintained.

The suite of ST 2110 standards is finding wide-ranging use in broadcast applications. While also handling video and control signals, the Model 5682 is focused on ST 2110-compliant audio channels and their associated timing parameters. Dante audio-over-Ethernet has found acceptance in broadcast, audio/visual, and general audio applications due to its ease of use, excellent performance, strong interoperability, and wide adoption by many equipment manufacturers. However, interconnecting or bridging ST 2110 audio channels with Dante audio channels can present a challenge. Using the Model 5682 makes this a simple task, only requiring interconnecting standard Ethernet signals and performing a moderate amount of configuration.

The Model 5682 incorporates six Gigabit Ethernet (GigE) connections. Three GigE ports are utilized by the ST 2110 interface, two for timing and audio channel activity and one for configuration. Two GigE ports are designated for Dante timing, audio transport, and configuration. One GigE port is used by the factory for general Model 5682 configuration. The ST 2110 will support redundant streams, following the SMPTE 2022-7 standard. On the unit's Dante interface, a setting performed within the Dante Controller application selects whether the Dante interface will operate in a Switched or Redundant mode. Each Model 5682 audio channel is associated on a one-to-one basis with a channel on each interface. For example, input 1 on the ST 2110 interface is associated with transmitter (output) 1 on the Dante interface. The Model 5682 does not perform any routing or crosspoint functions.

Front-panel LED indicators, an LCD display, and five pushbutton switches are provided to view and revise selected operating parameters. NMOS, ANEMAN, and JSON configuration support for the unit's ST 2110 interface is provided. The Dante Controller software application, available free of charge from Audinate, is used to configure the unit's Dante network and audio parameters.

The Model 5682 can be powered by 100-240 V, 50/60 Hz or a source of 12 volts DC. Both can be simultaneously connected to provide redundant power operation. The unit's lightweight enclosure mounts in one space (1U) of a standard 19-inch equipment rack. Industry-standard connectors are used for the Ethernet, AC mains, and DC power interconnections. The unit is built to professional standards and is intended for continuous, 24-hour operation.

Applications

The Model 5682's primary application is to interconnect audio channels associated with two independent networks, one that supports ST 2110 and the other

Figure 1. Model 5682 ST 2110 to Dante Bridge front view

Dante. The source and destination of these audio channels would typically be other equipment such as mixing consoles, broadcast or production crosspoint switchers, matrix intercom systems, or digital audio processing units. The Model 5682 can also perform effectively on the same local area network (LAN), interconnecting independent ST 2110 and Dante audio channels. Each implementation, ST 2110 or Dante, can have its own Leader Clock (sync reference) and bit depth. Sample-rate conversion (SRC) logic within the Model 5682 ensures that the audio signals can pass between the two implementations with minimal degradation in performance. The Model 5682's ST 2110 and Dante network interfaces are electrically isolated and share no non-audio data, minimizing the risk of security issues. Only uncompressed PCM digital audio signals pass, by way of the SRC logic, between the two network interfaces.

The Model 5682 can be effective when used in both fixed and mobile applications. Ideal uses would include stadiums, live-event venues, media production studios, mobile production trucks or trailers, and education facilities. As the number of facilities that utilize both ST 2110 and Dante-compliant equipment increases so does the need to interconnect them. Maintaining isolation between these two network implementations can be important for reasons of both signal integrity and security.

ST 2110 Networking

The Model 5682's ST 2110 interface supports conformance levels A, B, C, AX, BX, and CX in single and redundant streams. The latter follows the SMPTE ST 2022-7 standard and allows connection of one or two networks as desired. The Model 5682 provides a separate Ethernet interface that serves as a control port, allowing configuration of the ST 2110 interface by way of web pages. NMOS support that follows the IS-04 and IS-05 standards is provided. The Merging Technologies ANEMAN Audio Network Manager application can also be utilized as can JSON. The ST 2110 audio sample rate is selected for 48 kHz with a bit depth of 24.

Studio Technologies has not fully explored the Model 5682's ability to support Ravenna and AES67. The ST 2110 capabilities in the Model 5682 are provided by the ZMAN module from Merging Technologies. The ZMAN specifications indicate full compatibility with Ravenna and AES67. As such, Model 5682 ST 2110 audio channels should be directly compatible with AES67 audio channels. (Actually, our impression is that ST 2110 audio was based on ensuring compatibility with AES67.) Ravenna is also, depending on its configuration, directly compatible with AES67. So, in theory, the Model 5682 can serve both as a Ravenna to Dante and a AES67 to Dante bridge. Settings in the ZMAN-provided configuration web pages may have to be selected specifically for compatibility with Ravenna or AES67, but the required parameters should be able to be selected. Over time Studio Technologies will explore this subject further and a conversation with factory personnel may provide additional clarity.

Dante Networking

The Model 5682's Dante interface can be configured for either Switched or Redundant network operation. In the Switched mode, only a single Gigabit Ethernet (GigE) connection is required. The unit's second Gigabit Ethernet port can function either as an active "loop-thru" resource or left unused. When the Model 5682 is placed in the Redundant mode,

Figure 2. Model 5682-01 ST 2110 to Dante Bridge back view

Figure 3. Model 5682-02 ST 2110 to Dante Bridge back view

two Gigabit Ethernet connections are made to two independent LANs, allowing support for Redundant Dante operation. This ensures that the loss of one network resource will not result in the interruption of Dante networked audio signals. Sample rates of 44.1, 48, 88.2, and 96 kHz are supported, although selecting the latter two will reduce the number of interface channels. The bit depth can be selected for 16, 24, or 32.

Dante AES67 and Domain Manager Support

The Model 5682's Dante interface can be configured to support AES67 digital audio signals. This feature, provided by Dante, would be a subset of the full AES67 range of operations. When this AES67 support is enabled, the Dante interface's sample rate will be fixed at 48 kHz and only multicast operation will be active. The Model 5682's Dante interface is also compliant with the Dante Domain Manager (DDM) software application.

Pro Audio Quality

The Model 5682's audio circuitry was designed to meet the stringent demands of professional audio applications. To ensure that superior performance is maintained, audio data passing between the ST 2110 and Dante network interfaces always remains within the digital domain. To achieve audio data synchronization between the two network interfaces, bi-directional sample-rate-converter (SRC) logic functions are implemented in high-speed programmable (FPGA) logic. This allows compatibility between the ST 2110 and Dante audio channels, even if they have widely divergent sample rates and independent reference clock sources.

Status LEDs and LCD Display

On the Model 5682's front panel are 12 LED indicator lights, a back-lit graphics display, and five pushbutton switches. Two of the LEDs indicate the status of the AC and DC input power sources. Two sets of five LEDs each are associated with the ST 2110 and Dante network interfaces. The graphics display allows the monitoring of a number of operating conditions, including interface names, network configurations, and product firmware versions. The five pushbutton switches can be used to select which information is displayed as well as allowing key network parameters to be revised. These include the ST 2110 and Dante interface IP configuration methods, IP addresses, and subnet mask values.

LEDs on the Model 5682's back panel indicate the status of the ST 2110 network interfaces, the Dante network interfaces, the ST 2110 control interface, and the management interface. There are two LED indicators for each of the six Gigabit Ethernet connections that reflect the link and network activity status. Two additional LEDs reflect the status of the USB host interfaces which are used to update the Model 5682's firmware.

Installation and Operating Power

The Model 5682 is housed in a rugged yet lightweight aluminum enclosure that is designed for use in fixed or mobile facilities. It mounts in one space (1U) of a standard 19-inch rack enclosure. The unit allows an AC mains source of 100-240 V, 50/60 Hz to be directly connected. It can also be powered using a 10–16 volts DC source that is connected via a broadcast-standard 4-pin XLR connector. If both AC and DC power sources are connected, the Model 5682 will be powered by the AC mains supply. Should the AC mains source fail, the DC source will provide operating power with no interruption in the performance of the unit. All six of the Model 5682's Gigabit Ethernet ports support twisted-pair signals, each with Auto MDI/MDI-X capability so reversing cables are never required.

Firmware Updating

The Model 5682 was designed so that its performance and capabilities can be enhanced in the future. Two USB receptacles, accessible on the unit's back panel, allow the Main and FPGA (programmable logic) firmware (embedded software) to be easily updated using a USB flash drive. A Merging Technologies ZMAN module is used to implement the Model 5682's ST 2110 functionality. The module's firmware can be updated using a web browser connected to the Ethernet interface dedicated to ST 2110 control use. To implement its Dante interface the Model 5682 uses an Audinate Brooklyn module. To help ensure that the unit's Dante capabilities remain up to date, the firmware in this module can be updated via one of the unit's Dante Ethernet connections.

Installation

In this section, the Model 5682 ST 2110 to Dante Bridge will be mounted in one space (1U) of an equipment rack. Two or three Gigabit Ethernet data connections will be made to the unit's ST 2110 interface using standard RJ45 patch cables. One or two Gigabit Ethernet data connections will be made to the unit's Dante interface using standard RJ45 patch cables. AC mains power can be connected to the Model 5682 by means of a detachable mains cord set 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. The DC source can be used to power the Model 5682 or it can serve as a backup power source should AC mains power be connected.

What's Included

The shipping carton contains one each of either a Model 5682-01 or Model 5682-02 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 5682

The Model 5682 Dante Bridge requires one space (1U) in a standard 19-inch (48.3 cm) equipment rack. Secure the unit into the equipment rack using two mounting screws per side. As the Model 5682 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. Select a location that is convenient for making connections to the Ethernet interfaces. 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 5682 and the Ethernet switches in the associated local area networks (LANs)

ST 2110 Interface Ethernet Connections

The Model 5682's ST 2110 interface provides three Gigabit Ethernet (GigE) ports for flexibility and compatibility with several ST 2110 implementations. Two

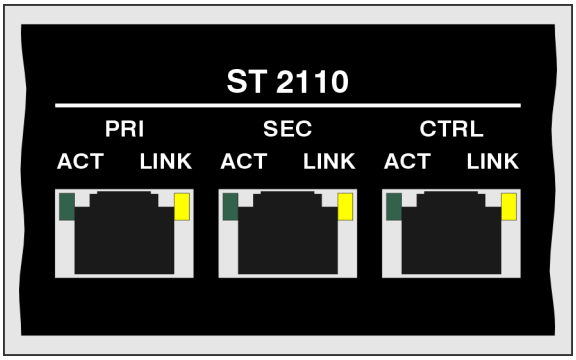


Figure 4. Detail of Model 5682 back panel showing the Ethernet port's RJ45 jacks for ST 2110 interface

of the ports are provided for interconnection with one or two local area networks (LANs) associated with a ST 2110 networking scheme. These Ethernet ports are accessible using RJ45 jacks and are labeled PRI for primary and SEC for secondary. Using the ST 2110 control (user) interface, these ports can be configured for single or redundant stream operation. The third Ethernet port, labeled CTRL (control), is associated with the ST 2110's control and configuration interface. This web-page-based interface is utilized for configuring ST 2110 operation. Connections to the Ethernet ports are made by way of standard RJ45 jacks that are located on the back of the Model 5682. The three Ethernet ports support auto MDI/MDI-X, ensuring that crossover cables are never required.

For ST 2110 operation, specifically transporting audio and timing signals, at least one 1000BASE-T Gigabit Ethernet (GigE) connection is required. It should be connected to the RJ45 jack labeled PRI (primary). If redundant stream operation is going to be utilized, a second 1000BASE-T GigE connection should be made to the RJ45 jack labeled SEC (secondary). These two Ethernet connections could be provided by independent local-area-networks (LANs) or by way of separate VLANs created on one physical network. A connection is not required to be made to the SEC (secondary) jack if redundant stream operation is not required.

Configuring the Model 5682's ST 2110 interface requires access to the control port. To achieve this, an Ethernet signal must be connected to the RJ45 jack labeled CTRL (control). This Ethernet signal can connect to the same local-area-network (LAN) as is being used for the ST 2110 audio and timing signals.

Or it can be connected to a separate local-area-network (LAN) that is designated for configuration use. It could also be connected directly to a personal computer that is intended for configuration use. Note that while technically 10BASE-T (10 Mb/s) or 100BASE-TX (100 Mb/s) Ethernet signals can be used with the ST 2110's control port, neither would be optimal. Once the ST 2110 interface has been configured, an Ethernet signal does not have to be made to the RJ45 jack labeled CTRL. Settings are stored in non-volatile memory within the Model 5682's ST 2110 interface hardware.

It's important to note that there is no problem with the Model 5682's ST 2110 interface being configured for redundant stream operation while the Dante interface is not configured for redundant operation. Correct ST 2110 to Dante bridge functionality will still occur no matter what configuration is selected for the ST 2110 and the Dante interfaces.

Dante Interface Ethernet Connections

The Model 5682's Dante interface provides two Gigabit Ethernet (GigE) ports for flexibility and compatibility with several Dante implementations. These ports are provided for interconnection with one or two local area networks (LANs) associated with a Dante audio-over-Ethernet networking scheme. The Ethernet ports are labeled PRI for primary and SEC for secondary. Using the Dante Controller application, these ports can be configured for Switched or Redundant Dante operation.

Connections to the PRI and SEC Dante Ethernet ports are made by way of standard RJ45 jacks that are located on the back of the Model 5682's enclosure. The Ethernet ports support auto MDI/MDI-X ensuring that crossover cables are never required. Note that while technically 100BASE-TX (100 Mb/s) Ethernet signals can be used with the Dante interface's Ethernet connections, it is not optimal. Additionally, it's important to note that 10BASE-T (10 Mb/s) Ethernet connections are not sufficient.

For Model 5682 operation, at least one 1000BASE-T Gigabit Ethernet (GigE) connection is required for the Dante interface. A network cable should be connected to the Dante interface's RJ45 jack that is labeled PRI. A second 1000BASE-T GigE connection can be made to the Dante interface's secondary (SEC) RJ45 jack if Redundant Dante operation is desired. (For this functionality to be active, the Model 5682's network configuration for the Dante interface must be set for Redundant within the Dante Controller software application.)

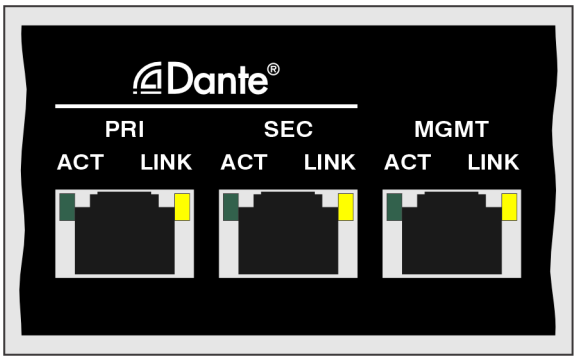


Figure 5. Detail of Model 5482 back panel showing the Ethernet port's RJ45 jacks for Network A

It's important to note that there is no problem with the Model 5682's Dante interface being configured for redundant operation while the ST 2110 interface is not configured for redundant streams. Correct bridge functionality will still occur no matter which way the Dante and ST 2110 interfaces are configured.

When the Model 5682 Dante interface is configured in Dante Controller for the Switched network mode, the associated secondary (SEC) Dante Ethernet port can also be used as a "loop through" port such as would be provided by an Ethernet switch. Switched mode is the default setting but using the secondary Dante port in this manner for applications other than troubleshooting is not recommended. It will function reliably but "daisy chaining" Ethernet signals can limit flexibility and present a failure point; it's optimal if a Dante Ethernet port connects directly to a separate port on an Ethernet switch.

Management Port Connection

The Model 5682 includes a management Ethernet port that can be accessed by way of an RJ45 jack. But please don't connect to it! It's labeled MGMT and is provided only for factory use. A plastic filler plug may be present in this RJ45 jack to indicate that it is not normally utilized. If a filler plug is present, do not remove the plug as hopefully it will indicate to other technical personnel that an Ethernet connection is not necessary.

The Model 5682's management Ethernet port is utilized by the factory at the time of Model 5682 manufacture, providing access to an internal web server and associated set of configuration web pages. There are no user-designated configuration parameters available using this port.

Should a factory support session be initiated, a 1000BASE-T Gigabit Ethernet (GigE) connection is preferred but a 100BASE-TX (100 Mb/s) or even a 10BASE-T (10 Mb/s) connection is sufficient. By default, the management port obtains its IP address and related network parameters by way of the DHCP protocol. If DHCP is not available, the link-local protocol will be utilized. The IP address can also be manually configured.

Connecting Power

The Model 5682 requires a source of AC mains or nominal 12 volts DC power 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 5682 can operate directly from AC mains power of 100 to 240 volts, 50/60 Hz, 8 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 standard (NEMA 5-15L) 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:

Connection	Wire Color
Neutral (N)	Light Blue
Line (L)	Brown
Earth/Ground (E)	Green/Yellow

Because the Model 5682 does not contain a power on/off switch it will begin operation as soon as AC mains power is connected.

Safety Warning: The Model 5682 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 5682 can also operate from a source of 10 to 16 volts DC. The current required from a 12 volts DC source is 0.6 ampere maximum. A 4-pin male XLR connector is located on the unit's back panel and 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 5682 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 5682 while the DC source will serve as a "hot standby." Only if the AC mains source fails will the unit draw significant power from the DC source. This will occur automatically with no interruption in Model 5682 operation. In the "standby" mode (when an AC mains source is connected), the Model 5682 will draw less than 120 microamperes (uA) from a connected 12 volts DC source.

ST 2110 Configuration

The Model 5682's ST 2110 interface is implemented by way of a ZMAN module from Merging Technologies of Switzerland. The ZMAN module is installed in the Model 5682's DFB II Card A and is accessed using the control Ethernet port which is located on the unit's back panel. A standard web browser running on a personal computer communicates with the ZMAN module utilizing web pages that are provided by ZMAN's web server capability.

To access the web pages is simple. Begin by identifying the control port's IP address using the front-panel

menu system. The second page of the screen saver, or a web page accessed using the pushbutton switches, will display the control port's IP address. On the web browser's command line enter the IP address followed by **/advanced**. As an example, if the IP address of the control port is 192.168.1.169 then one would enter **192.168.1.169/advanced** to access the web pages.

Once the correct address and suffix have been submitted by way of the web browser, the ZMAN module will provide a web page. This page will have approximately ten tabs that allow many ZMAN features to be displayed and often configured. Refer to Appendix C for a representative view of the Advanced ZMAN General Settings Screen.

Clocking selections can be found by accessing the PTP tab. The Session sources tab will allow the Model 5682's ST 2110 transmitter (output) channels to be displayed and configured. The Session sinks tab will allow the Model 5682's receiver (input) channels to be displayed and configured. Also provided is a tab for NMOS configuration.

For an overview of how to configure the Model 5682's ST 2110 capabilities, refer to the short video that was created by Studio Technologies' personnel. A link to the Quick Start Guide video can be found in the Model 5682 product page on the Studio Technologies' website (studio-tech.com) under the Documentation, Videos section.

Dante Configuration

For audio to correctly pass to and from the Model 5682 requires, at a minimum, that several Dante-related parameters be configured. These configuration settings are stored in non-volatile memory within the Model 5682's Dante interface. Configuration will typically be done with the Dante Controller software application, available for download free of charge from Audinate (getdante.com). Versions of Dante Controller are available to support several operating systems.

The Model 5682's Dante interface is compatible with the Dante Domain Manager (DDM) software application. Refer to the DDM documentation, also available from Audinate, for details on which Model 5682 and related parameters may have to be configured.

Unit and Channel Names

The Model 5682's Dante interface has a default device name of **ST-M5682-** along with a unique suffix. The suffix identifies the specific Model 5682 Dante interface that is being configured. The suffix's actual alpha and/or numeric characters relate to the MAC address of the associated Brooklyn module.

The Model 5682-01's Dante interface will have 32 Dante transmitter (output) channels with default names of **Ch01** through **Ch32**. It will have 32 Dante receiver (input) channels with default names of **Ch01** through **Ch32**. When the Model 5682-01's sample rate has been selected for 44.1 or 48 kHz, the 32 transmitter (output) and 32 receiver (input) channels will appear in Dante Controller. When the sample rate has been selected for 88.2 or 96 kHz, then 16 transmitter (output) and 16 receiver (input) channels will appear.

As expected, the Model 5682-02's Dante interface will have 64 Dante transmitter (output) channels with default names of **Ch01** through **Ch64**. The Model 5682-02's Dante interface will have 64 Dante receiver (input) channels with default names of **Ch01** through **Ch64**. When the Model 5682-02's sample rate has been selected for 44.1 or 48 kHz, the 64 transmitter (output) channels and 64 receiver (input) channels will appear in Dante Controller. When the sample rate has been selected for 88.2 or 96 kHz, then 32 transmitter (output) and 32 receiver (input) channels will appear. Using Dante Controller, the default device and channel names can be revised as appropriate for a specific application.

Sample Rate, Encoding, and Device Latency

The sample rate, encoding, and device latency of the Model 5682's Dante interface can be configured. The interface supports audio sample rates of 44.1, 48, 88.2, and 96 kHz with pull-up/down options available. The digital audio data is in the form of pulse-code modulation (PCM) samples. Encoding choices available within Dante Controller include PCM 16, PCM 24, and PCM 32, but in most cases the selection of PCM 24 would be appropriate. Device latency parameters can be adjusted if required but the default values in Dante Controller will typically be correct.

Clocking

Technically, the Model 5682's Dante interface can serve as Leader clock for the associated Dante network. However, in most cases the unit will be configured such that it will receive its Dante timing reference ("sync") from another Dante device on its associated local-area-network (LAN). This device could be an audio console, an input/output interface, or a dedicated device such as the Studio Technologies' Model 5401A Dante Leader Clock. As such, the Dante Controller check box for the Preferred Leader configuration that is associated with the Model 5682's Dante interface would typically not be enabled.

Network Configuration

A Model 5682's Dante interface allows connection of one or two Ethernet signals. Physical connections utilize standard RJ45 jacks which are located on the unit's back panel. The Dante ports are labeled PRI and SEC indicating that they are the primary and secondary connections. How these two ports function can be selected in the Dante Redundancy section of Dante Controller's Network Configuration tab. The choices are *Switched* or *Redundant.*

If *Switched* is selected for the Dante interface then it can establish one connection with an Ethernet network. Technically it doesn't matter which RJ45 jack, PRI (primary) or SEC (secondary), is utilized, although for clarity it's recommended that the PRI be used. If necessary, the SEC RJ45 jack can be used to interconnect with another piece of networked equipment.

If the Dante interface is configured for *Switched,* ensure that only one of the two Dante RJ45 jacks, PRI or SEC, is connected to the LAN associated with the Dante network. If both of the interface's 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 for the Dante interface, redundant networking capability will be enabled. In this case, separate network connections should be made to the Dante interface's PRI (primary) and SEC (secondary) RJ45 jacks.

IP Addresses

When the Model 5682's Dante interface has been configured for the *Switched* network mode, a single Dante IP address will be associated with the network connection that is made to one of the network's RJ45 jack. If the network configuration has been selected for *Redundant*, separate IP addresses and related network parameters will be assigned to the PRI (primary) and SEC (secondary) Dante Ethernet ports.

In many cases, the Model 5682's Dante interface will have its IP address (or addresses) and related network parameters determined automatically using DHCP. If DHCP capability is not available, then the link-local network protocol will be utilized. Other applications may want the IP address (or addresses) and related network parameters to be manually set to a fixed (static) configuration. This capability is available in the Dante Controller application. 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 5682's Dante interface configuration has been set for *Redundant*, the primary and secondary Dante IP addresses and related parameters can be independently configured. This allows both network connections associated with the Dante interface to be configured automatically, both network connections to be configured manually, or one connection configured automatically and the other configured manually.

AES67 Configuration – AES67 Mode

The Dante Controller application allows the Model 5682's Dante interface to be configured to allow AES67 operation. This requires the AES67 mode to be set for *Enabled*. As previously noted, if the AES67 mode is Enabled, the Dante transmitter (output) channels will use multicast. The sample rate will be fixed at 48 kHz.

Audio Routing

When a Model 5682-01 's Dante interface is selected for a sample rate of 44.1 or 48 kHz, it will have 32 Dante transmitter (output) and 32 Dante receiver (input) channels. These are associated with the unit's

32 interface channels. When selected to have a sample rate of 88.2 or 96 kHz, there will be 16 transmitter (output) and 16 receiver (input) channels. When a Model 5682-02 is selected for a Dante sample rate of 44.1 or 48 kHz, it will have 64 Dante transmitter (output) and 64 Dante receiver (input) channels. These are associated with the unit's 64 interface channels. When selected to have a sample rate of 88.2 or 96 kHz, a Model 5682-02 will provide 32 transmitter (output) and 32 receiver (input) channels. Neither the Model 5682-01 or the Model 5682-02 will support a sample rate of greater than 96 kHz. (As such, sample rates of 176.4, 192, and 384 kHz are not supported.)

Audio data received on a Dante receiver (input) channel will be output on the corresponding output channel of the ST 2110 interface. The input-channel-to-output-channel relationship in both Model 5682 versions will be mapped 01-to-01, 02-to-02, 03-to-03, etc. This will be true all the way up to channel 32 for the Model 5682-01 and up to channel 64 for the Model 5682-02. (16 and 32 channels, respectively, when the Dante sample rate is selected for 88.2 or 96 kHz). The digital audio data (1s and 0s) from the receiver channels to the transmitter channels will essentially be the same but the timing and related parameters will be adjusted by internal sample-rate-conversion (SRC) circuitry. So, as an example, Dante receiver (input) channel 01 associated with the Dante network will be associated with output channel 01 on the ST 2110 interface. As another example, Dante receiver (input) channel 15 will be associated with ST 2110 output channel 15.

The Model 5682's Dante transmitter (output) channels should be assigned to the desired Dante receiver (input) channels on associated equipment. The Model 5682's Dante receiver (input) channels should be assigned to the desired Dante transmitter (output) channels coming from the source equipment. Note that 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).

As previously discussed, at a sample rate of 44.1 or 48 kHz, the Model 5682-01 is a 32-channel resource. It can provide a 32 channel "bridge" between a Dante LAN and an ST 2110 LAN. But not all 32 channels have to be utilized. The Model 5682-02 provides a 64-channel resource (at 44.1 or 48 kHz) so creating a bridge with anywhere from 1 to 64 channels is perfectly acceptable.

The Model 5682's Dante interface uses a Brooklyn module to implement its Dante functionality. The number of flows associated with this module is 64; 32 transmitter (output) and 32 receiver (input). With this capability, typically no flow limitation will occur. Flows, each of which can support up to four audio channels, can operate either as unicast, multicast, or a combination of the two.

Note that when the AES67 mode has been enabled for the Model 5682 Dante interface, the associated Dante transmitter (output) channels will only function in multicast; unicast is not supported.

Front-Panel Display Page Descriptions

The following sections provide information about the Model 5682's front-panel menu pages. Refer to Appendix A for a diagram of the menu structure.

Row One

Row one has a total of eight menu pages. Six relate to the Model 5682's ST 2110 interface, one relates to the general operating firmware (embedded software), and one allows the module that implements ST 2110 (ZMAN) to be rebooted (restarted).

Menu Page 1 – **ST 2110 Name:** The name for the ST 2110 interface is shown on this menu page. This name should be unique to each interface in an ST 2110 deployment and is used as part of the channel routing process. The ST 2110 name can be changed using a feature provided in ZMAN's menu web pages.

Menu Page 2 – **ST 2110 Control Interface IP Configuration:** This menu page allows the display and revision of the method that the Model 5682's ST 2110 control Ethernet interface uses to obtain its IP address and related parameters. The choices are *Automatic* and *Manual*. This setting has no impact on how the Model 5682 obtains IP addresses for the primary and secondary ST 2110 interfaces.

If the active configuration method is not the desired one, press the Enter pushbutton switch located on the front panel. Use the left and right arrow buttons to select the desired method. Then again press the Enter button. The entry will be stored. To cause the control interface to use the new setting requires the interface card (DFB II Card A) associated with the ST 2110 interface to be rebooted (restarted). This can be performed by using another front-panel menu page or by power cycling the unit. (Power cycling means to restart the unit by first removing and then re-applying AC mains or DC power.)

Selecting *Automatic* will cause the ST 2110 control Ethernet interface to use DHCP or, if DHCP is not available, the IPv4 link-local protocol to establish the IP address. (An IP address that has the format of 169.254.x.x is one that was assigned using the IPv4 link-local protocol.) Even if the IP address was established using link-local, the DHCP protocol will remain active. In this case, the ST 2110 primary interface will continue to check for the presence of a DHCP server. If one becomes available, an IP address will be requested and, when obtained, will automatically replace the ST 2110 primary IP address that was previously established by way of link-local.

The *Manual* setting allows the ST 2110 control Ethernet interface's IP address and related parameters 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.

To cause the ST 2110's control Ethernet interface to use a revised manually entered IP address configuration method requires that the unit's ST 2110 interface module (ZMAN) be rebooted (restarted). This can be performed using either the ZMAN reboot front-panel menu page or by power cycling (restarting) the Model 5682.

Menu Page 3 – ST 2110 Control Interface IP Address: This menu page shows the IP address associated with the ST 2110 control Ethernet interface. (This address has nothing to do with the IP addresses utilized by the ST 2110's primary and secondary Ethernet interface ports.) When the IP address configuration for the ST 2110 control Ethernet interface has been selected for *Automatic,* this field cannot be changed and a lock icon will show in the lower-right corner of the display. It can be revised only when the *Manual* mode has been selected. If no Ethernet connection has been made to the ST 2110 control Ethernet interface the text **No Ethernet Link** will be shown.

Whenever the ST 2110 control Ethernet interface's address configuration method is selected for *Manual,* its IP address can be modified as desired. To start the process of changing the control Ethernet interface's IP address press the Enter pushbutton switch on the front panel. (An icon with a wrench and screwdriver will be shown to indicate that an edit is in process.) Use the left and right arrow pushbutton switches to select which specific digit of the IP address number 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 this IP address. Once the desired changes have been made, press the Enter button to save the changes.

To cause the ST 2110 control Ethernet interface to use the new IP address setting requires that the unit's ST 2110 interface module (ZMAN) be rebooted (restarted). This can be performed using either the ZMAN reboot front-panel menu page or by power cycling (restarting) the Model 5682.

Menu Page 4 – ST 2110 Control Interface Subnet: This menu page shows the active subnet mask value associated with the ST 2110 control Ethernet interface. This value has nothing to do with the subnet mask values utilized by the ST 2110's primary and secondary ports. When the control Ethernet interface's IP configuration has been selected for *Automatic,* this field cannot be changed and a lock icon will show in the lower-right corner of the display. This value will be utilized and can only be changed when the *Manual* mode has been selected.

When the ST 2110 control Ethernet interface's IP address configuration has been selected to the *Manual* mode, the 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. An icon with a wrench and screwdriver will be shown to indicate that an edit is in process. Use the up and down arrow pushbutton switches to select the desired subnet mask value.

Once the desired value has been selected, press the Enter button to store it.

To instruct the ST 2110 control Ethernet interface to use a new subnet mask value requires that the ST 2110 interface module (ZMAN) be rebooted (restarted). This can be performed using the ZMAN reboot front-panel menu page. Alternately, rebooting the Model 5682 by means of power cycle can also be utilized to cause a new subnet mask value to be used.

Menu Page 5 – DFB II Card A Main Firmware Version: This menu page shows the version number of the firmware (embedded software) being used by the general logic circuitry associated with operation of both the Model 5682 unit and the ST 2110 interface. This firmware is specifically used by the microcontroller (MCU) integrated circuit used by DFB II Card A and can be updated using a USB flash drive. Details regarding the firmware update process are provided in the Technical Notes section.

Menu Page 6 – DFB II Card A FPGA Firmware Version: This menu page shows the version number of the firmware (embedded software) used in the programmable logic (field-programmable-gate-array or FPGA) integrated circuit that is used in the circuitry associated with the ST 2110 interface. This firmware is stored on DFB II Card A and can be updated using a USB flash drive. Details regarding updating this firmware are provided in the Technical Notes section.

Menu Page 7 – ST 2110 Firmware Version: This menu page shows the product version number associated with the firmware (embedded software) that is used by the ST 2110 interface's ZMAN module which is located on DFB II Card A. The firmware version number is assigned by Studio Technologies as an identifier when a new ZMAN firmware file is released. This firmware combines specific Model 5682 configuration information with the Merging Technologies-developed ST 2110 firmware for the ZMAN module. This firmware can be updated using a USB flash drive. See the Technical Notes section for details regarding updating the ZMAN firmware.

Menu Page 8 – Reboot ZMAN Module: This menu page allows the unit's ST 2110 interface's ZMAN module to be rebooted (restarted). This can be useful to force the ZMAN module to utilize configuration changes made using the control Ethernet interface. Rebooting (restarting) using a power cycle will also cause the ZMAN module to reboot. An arrow icon is shown in the lower-right corner of this menu. To start the process of rebooting the ZMAN module, press the Enter pushbutton on the unit's front panel. This will lead to a confirmation page being shown. Use the left and right arrow pushbutton switches to select (highlight) the desired action. The choices are to cancel or to confirm. Press the Enter pushbutton switch to act upon the highlighted action. Rebooting of the ZMAN module will then immediately commence. After performing the reboot (restart) function, 20 to 60 seconds may be required for Model 5682's operation to fully restore. During this time period, the ST 2110 interface's Ethernet connections may briefly disconnect and then reconnect.

Row Two

Row one has a total of eight menu pages, all of which relate to the Model 5682's Dante resources.

Menu Page 1 – Dante Name: The Dante device name for the Dante interface 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 subscription) process. The Dante name can be changed using a feature provided in the Dante Controller application.

Menu Page 2 – Dante Primary Interface IP Configuration: This menu page allows the display and revision of the method that the Model 5682's Dante interface uses to obtain its Dante primary IP address and related parameters. The choices are *Automatic* and *Manual*. This setting has no impact on how the Model 5682 obtains IP addresses for the Dante secondary interface and management interface web pages.

An arrow icon will be shown in the lower-right corner of this menu page. This indicates that the setting can be changed. If the active configuration method is not the desired one, press the Enter pushbutton switch located on the front panel. Use the left and right arrow buttons to select the desired method. Then again press the Enter button. The entry will be stored. To cause the Dante interface to use the new setting requires that the Dante interface module (Brooklyn) be rebooted (restarted). This can be performed by using the reboot Brooklyn front-panel menu page or

by power cycling the unit. (Power cycling means to restart the unit by first removing and then re-applying mains or DC power.)

Selecting *Automatic* will cause the Dante primary interface to use DHCP or, if DHCP is not available, the IPv4 link-local protocol to establish the Dante primary IP address. (An IP address that has the format of 169.254.x.x was assigned using the IPv4 link-local protocol.) Even if the IP address was established using link-local, the DHCP protocol will remain active. In this case, the Dante primary interface will continue to check for the presence of a DHCP server. If one becomes available, an IP address will be requested and, when obtained, will automatically replace the primary IP address that was previously established by way of link-local.

The *Manual* setting allows the Dante primary IP address and related parameters 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.

To cause the Brooklyn module to use a revised Dante primary IP address configuration method requires that the module be rebooted (restarted). This can be performed using either the reboot Dante front-panel menu page or by power cycling (restarting) the Model 5682.

Menu Page 3 – Dante Primary Interface IP Address: This menu page shows the IP address associated with Model 5682's Dante primary interface. (This address has nothing to do with the IP addresses utilized by the Dante secondary and management interface ports.) When the IP address configuration has been selected for *Automatic,* this field cannot be changed and a lock icon will show in the lower-right corner of the display. It can be revised only when the *Manual* mode has been selected. If no Ethernet connection has been made to Network A's primary Ethernet port, the text **No Ethernet Link** will be shown.

If the network configuration is selected in the Dante Controller application for *Switched,* the Dante primary IP address will be associated with a network connection that has been made to either the Dante primary or Dante secondary RJ45 jack on the unit's back panel. If the network configuration is selected for *Redundant,* the Dante primary IP address will be associated with the RJ45 jack labeled Dante PRI on the Model 5682's back panel.

Whenever the Dante IP address configuration method is selected for the *Manual* mode, the Dante primary IP address can be modified as desired. This will be indicated by an arrow icon that will be shown in the lower-right corner of the display. To start the process of changing the Dante primary IP address, press the Enter pushbutton switch on the front panel. (An icon with a wrench and screwdriver will be shown to indicate that an edit is in process.) Use the left and right arrow pushbutton switches to select which specific digit of the IP address number 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 this IP address. Once the desired changes have been made, press the Enter button to save the changes.

To cause the Dante interface to use the new Dante primary IP address setting requires that the unit's Brooklyn module be rebooted (restarted). This can be performed using the reboot Brooklyn front-panel menu page. A power cycle will also cause a new Dante primary IP address to be utilized.

Menu Page 4 – Dante Primary Interface Subnet: This menu page shows the stored subnet mask value associated with unit's Dante primary interface. This value has nothing to do with the subnet mask values utilized by the Dante secondary or management ports. When the primary IP address configuration has been selected for *Automatic* this field cannot be changed and a lock icon will be shown in the lower-right corner of the display. This value will be utilized only when the *Manual* mode has been selected for the Dante primary IP address configuration.

Whenever the Dante interface's IP address configuration is selected for the *Manual* mode, the subnet mask value can be modified as desired. (This ability will be indicated by an arrow icon that will be shown in the lower-right corner of the display.) To start the process of changing the subnet mask value, press the Enter pushbutton switch on the front panel. An icon with a wrench and screwdriver will be shown to indicate that an edit is in process. Use the up and

down arrow pushbutton switches to select the desired subnet mask value. Once the desired value has been selected, press the Enter button to store it.

To instruct the unit use the new Dante primary subnet mask value requires that the Brooklyn module be re-booted (restarted). This can be performed using the reboot Brooklyn front-panel menu page. Alternately, rebooting the Model 5682 by means of a power cycle can also be utilized to cause a new Dante primary subnet mask value to be used.

Menu Page 5 – DFB II Card B Main Firmware Version: This menu page shows the version number of the firmware (embedded software) being used by the general logic circuitry associated with the Dante interface. This firmware, specifically used by the microcontroller (MCU) integrated circuit in DFB II Card B, can be updated using a USB flash drive. Details regarding this firmware update process are provided in the Technical Notes section.

Menu Page 6 – DFB II Card B FPGA Firmware Version: This menu page shows the version number of the firmware (embedded software) that is used by the programmable logic (field-programmable-gate-array or FPGA) integrated circuit in DFB II Card B. This card is used by the Dante interface and its FPGA firmware can be updated using a USB flash drive. Details regarding updating this firmware are provided in the Technical Notes section.

Menu Page 7 – Dante Product Version: This menu page shows the product version number associated with the Dante interface. (As previously described, the actual Dante interface is implemented using a Brooklyn module supplied by Audinate along with related components.) The Dante product version number is assigned by Studio Technologies as an identifier when a Dante firmware file is released. (This firmware combines specific Model 5682 Dante configuration information with the Audinate-developed Dante operating firmware for the Brooklyn module.) The Dante firmware 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.

Menu Page 8 – Reboot Dante: This menu page allows the Dante interface module (Brooklyn) associated with the Dante network to be rebooted (restarted). This can be useful, causing the Dante network to utilize configuration changes made to the primary Dante interface. Rebooting (restarting) using a power cycle will also cause the unit's Dante interface to reboot.

An arrow icon is shown in the lower-right corner of this menu. To start the process of rebooting the Brooklyn module, press the Enter pushbutton on the unit's front panel. This will lead to a confirmation page being shown. Use the left and right arrow pushbutton switches to select (highlight) the desired action. The choices are to cancel or to confirm. Press the Enter pushbutton switch to act upon the highlighted action. The Dante circuitry (contained in DFB II Card B) will then immediately commence the selected action. After performing the reboot (restart) function, 20 to 60 seconds may be required for Dante operation in the Model 5682 to fully restore. During this time period, the Dante Ethernet connections may briefly disconnect and then reconnect.

Row Three

Row three contains three menu pages.

Menu Page 1 – Management IP Address: This menu page is provided for factory use, allowing display of the IP address and MAC (media access controller) number associated with the Model 5682's management port. The MAC address is assigned by the factory to the management interface.

Menu Page 2 – Product Name & Serial Number: This menu page shows the name of the product (Model 5682) and the unit's hardware serial number. The name and serial number are assigned at the factory and cannot be changed by the user.

Menu Page 3 – Reboot Device: This menu page allows the entire Model 5682 to be rebooted (restarted). An arrow icon will be shown in the lower-right corner of the reboot device menu. To start the process of rebooting (restarting) the Model 5682, press the Enter pushbutton on the unit's front panel. This will lead to a confirmation page being shown. Use the left and right arrow pushbutton switches to select (highlight) the desired action. The choices are to cancel or to confirm. Press the Enter pushbutton switch to select the highlighted action. Note that it may take 60 to 90 seconds for the Model 5682's operation to reboot and operation to fully restore.

Screen Saver

A “screen saver” mode will automatically activate two minutes after the last press of any of the five front-panel pushbutton switches. When active, the screen saver mode will cause a continuous sequence of three menu pages to show. The display sequence is continuous with each menu page being present for three 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 immediately show menu one of row one, the ST 2110 interface name. To cause the screen saver mode to immediately start, simultaneously press the left and right arrow pushbutton switches on the front panel.

The three menu pages in the Model 5682’s screen saver mode are:

1. The Studio Technologies’ company logo graphic.
2. The IP address of the ST 2110 control interface
3. The IP address of the Dante primary interface

Details regarding the information provided in the screen saver menu pages has been discussed in previous sections.

Operation

Now that the Model 5682 is installed and configured, it’s ready for use. Normally no operator intervention should be required. However, there are a number of nuances in the unit’s operation. This may make it useful for technical personnel to spend some time reviewing this section.

Upon application of AC mains or DC power, the Model 5682 will go through several power-up sequences. The LEDs associated with the Model 5682’s six Ethernet jacks will flash briefly several times in response to their associated circuitry’s power-up action. Soon after, the LEDs associated with the USB receptacles on the unit’s back panel will briefly light green to indicate that the two circuit cards (one used primarily for ST 2110 operation and the other for Dante operation) are functioning under software control. After a few more seconds, the 12 LEDs on the unit’s front panel will first light green, then light red in a confirmation sequence. While the LEDs are going through their power-up sequence, the front-panel display will first show the Studio Technologies’ logo, followed by the unit’s model number (Model 5682). After a few seconds, the screen saver mode will become active. The screen saver consists of displaying the Studio Technologies’ logo, then the IP address of the ST 2110 control interface, and then the IP address of the primary Dante interface. When the screen saver mode is active each page will display for three seconds and then automatically transition to the next. After the Model 5682 has completed its power-up sequences, full operation will begin.

Front-Panel LED Indicators

The Model 5682’s front panel contains 12 bi-color LEDs which reflect the real-time status of unit’s major functions. The two power LEDs indicate the presence of incoming AC mains and nominal 12 volts DC power. They are labeled AC and DC. When a source of AC mains power is connected, the AC LED will light green. The DC LED 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.

Five of the LEDs are associated with the Model 5682’s ST 2110 interface. The system LED, labeled SYS, and the synchronization LED, labeled SYNC, will both light red as the associated ST 2110 interface starts to function and awaits connection and link to the associated LAN or LANs. The system LED will light red to indicate that the interface is not ready to pass data to other devices. It will blink red if there is an issue communicating with the internal ZMAN ST 2110 module. (This should never occur unless there is a Model 5682 hardware problem.) It will light green when the ST 2110 interface is operating normally and is ready to pass data.

The ST 2110’ s SYNC LED will light red when there is no link established on either ST 2110 interface. It will light green when there is a link established with either or both interfaces. It will flash green when the Model 5682’s ST 2110 interface is acting as a PTP v2 clock master for either or both ST 2110 Ethernet interfaces.

An LED is associated with the ST 2110's control Ethernet interface. This LED, labeled CTRL, will not light if an Ethernet connection has not been made to the jack labeled CTRL. It will light green if a GigE or a 100 Mb/s Ethernet connection has been made to the CTRL RJ45 jack.

Four LEDs are associated with the Model 5682's Dante interface. The system LED, labeled SYS, and the synchronization LED, labeled SYNC, will both light red as the Dante interface starts to function and awaits connection to the associated LAN or LANs. The SYS (system) LED will light red to indicate that the interface is not ready to pass data with other Dante devices. It will blink red if there is an issue communicating with the internal Dante Brooklyn module. (This should never occur unless there is a Model 5682 hardware problem.) It will light green when the Dante interface is operating normally and is ready to pass data.

The SYNC (synchronization) LED will light red to indicate that the Model 5682's Dante interface has not established timing synchronization. It will light solid green when it has synchronized with a Dante network and an external clock source (timing reference) is being utilized. The SYNC LED will slowly flash green if the Model 5682's Dante interface is part of a Dante network and is serving as the Leader Clock for all Dante devices. In this case, the other Dante devices are following the Model 5682 which is acting as their timing reference. It's possible that up to 30 or 40 seconds may be required for the SYNC (synchronization) LED to reach its final state.

Two LEDs are associated with the Dante interface's PRI (primary) and SEC (secondary) Ethernet connections. How they respond will depend on the unit's network configuration as made in the Dante Controller application.

When the Model 5682's Dante interface has been configured for *Switched* operation, the Dante PRI (primary) LED will light red when no Ethernet connection is present on the PRI RJ45 jack. It will light green when a Gigabit Ethernet (GigE) connection is present on the PRI jack. It will light orange when a 100 Mb/s Ethernet connection is present on the PRI jack. The SEC (secondary) Dante LED will not light when an Ethernet connection is not present on the SEC RJ45 jack. It will light green when a GigE or a 100 Mb/s Ethernet connection is present.

When the Model 5682's Dante interface has been configured for *Redundant* operation, the associated PRI (primary) and SEC (secondary) LEDs will light red when Ethernet connections are not present on their respective RJ45 jacks. Each will light green when a Gigabit Ethernet (GigE) connection has been made and orange when a 100 Mb/s Ethernet connection has been made.

An LED is associated with the Model 5682's system management Ethernet interface. This LED, labeled SYSTEM MGMT, will not light if an Ethernet connection has not been made to the MGMT (management) RJ45 jack. It will light green if a GigE or a 100 Mb/s Ethernet connection has been made to the MGMT RJ45 jack. As previously stated, the system management interface is provided for factory use and will typically not be utilized in the field. As such, the system MGMT LED will normally not be lit.

RJ45 LED Indicators

On the Model 5682's back panel are six RJ45 jacks that are provided for interfacing with the unit's three ST 2110-related interfaces, two Dante-related interfaces, and one system management interface. All six ports support Gigabit Ethernet (GigE) connections. Three of the RJ45 jacks are labeled ST 2110 PRI, SEC, and CTRL. Two of the jacks are labeled Dante PRI and SEC. And one jack is labeled MGMT. Associated with each jack are two LEDs. One LED is labeled LINK and lights orange when a GigE connection has been established with that specific jack. The LINK LED will not light if a 100 Mb/s Ethernet connection has been made. It will also not light if no Ethernet connection has been made. The second LED, labeled ACT, will flash green to indicate data activity, responding to Ethernet traffic traveling to and from that specific jack.

Technical Notes

Dante IP Addresses

Before reviewing this topic, it's important to highlight the fact that the Dante Controller application and its associated personal computer will only communicate with Dante devices that are on the same subnet of the same local area network (LAN). Dante Controller must be able to directly communicate with the Model 5682 for configuration changes to be made.

If the Model 5682's Dante interface has been configured in Dante Controller for *Switched* operation, it will have its associated primary (PRI) Ethernet interface attempt to automatically obtain its IP address and associated settings using DHCP (Dynamic Host Configuration Protocol). If a DHCP server is not detected then an IP address will automatically be assigned using the link-local protocol. (This protocol is known in the Microsoft® world as Automatic Private IP Addressing (APIPA).) Link-local will randomly assign a unique IP address in the IPv4 format of 169.254.x.x. In this way, multiple Dante-enabled devices on the same LAN will connect together and automatically function, whether or not a DHCP server is active on this LAN. Even two Dante-enabled devices that are directly interconnected using an RJ45 patch cord should, by way of the link-local protocol, correctly acquire IP addresses and be able to communicate with each other. Of course, automatically acquiring Dante Ethernet interface parameters is not required. Using Dante Controller, the Model 5682's Dante interface can have its Ethernet IP address and related network parameters set for manual (fixed or static) operation.

If the Model 5682's Dante interface has been configured in Dante Controller for *Redundant* operation, it will have its primary (PRI) and secondary (SEC) Ethernet interfaces attempt to automatically obtain IP addresses and associated network settings using DHCP. If DHCP is not available then link-local IP addresses will be assigned. Link-local will assign an IP address in the format of 169.254.x.x for Dante primary (PRI) and 172.31.x.x for Dante secondary (SEC). If automatic assignment of Ethernet interface parameters is not desired, each Ethernet interface can be individually configured using Dante Controller to have a manual (fixed or static) IP address and related network parameters.

The specific IP address (or addresses) assigned to the Model 5682's Dante interface can be identified using several methods. The Dante Controller application will directly display the network parameters of the primary (PRI) and, if utilized, secondary (SEC) Ethernet interfaces. Another means is to utilize the Model 5682's front-panel menu page that directly displays the IP address assigned to the Dante primary (PRI) port.

Optimizing Dante Network Performance

For best Dante audio-over-Ethernet performance, connecting the Model 5682's Dante interface to an Ethernet switch (or switches) and associated LANs that support QoS (Quality-of-Service) capability is recommended. This capability can be implemented on virtually all contemporary managed Ethernet switches. There are even specialized switches that are optimized for entertainment-associated applications. Refer to the Audinate website (getdante.com) for details on how to optimize networks for Dante applications.

Management IP Address

A management Ethernet interface is associated with the Model 5682's overall configuration. Using an RJ45 jack, this interface, labeled MGMT, is provided only for factory use. By default, the network parameters for this interface are set to be obtained automatically. 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 automatically be assigned using the link-local protocol in the IPv4 range of 169.254.x.x. The IP address can also be manually configured.

Model 5682 Firmware Update

The major functions implemented in the Model 5682 utilize two similar interface circuit boards which are named DFB II Card A and DFB II Card B. They are linked together inside the unit with a circuit card referred to as the motherboard. DFB II Card A supports the ST 2110 interface as well as the front-panel menu system. DFB II Card B is utilized for the Dante interface as well as the web-based management menu system. The management web pages are used by factory personnel to configure and monitor the Model 5682.

Three firmware files are utilized in each of the two interface circuit boards. Two files are the same on each board and the third is different. They can all be individually field-updated. One firmware file, called the main firmware, is used by each interface board's microcontroller integrated circuit. A second firmware file, called the FPGA firmware, is used by each board's field-programmable-gate-array (FPGA) integrated circuit. The third file used by DFB II Card A supports the ZMAN module which implements the Model 5682's ST 2110 interface. The third file on DFB II Card B is used by the Brooklyn module which implements the Model 5682's Dante interface.

The main and FPGA firmware files are updated using a USB flash drive that is first plugged into the USB type A receptacle labeled Firmware Update A and then into the USB type A receptacle labeled Firmware Update B. The firmware used by DFB II Card A for the ZMAN module is updated using a personal computer that is connected, via Ethernet, using the ST 2110's control (CTRL) RJ45 jack. It's not possible to directly use a USB flash drive for this update process. The firmware used by the Brooklyn module to implement the Dante interface can be updated using the Dante Updater program that is part of the Dante Controller application. The Dante Updater program connects to the Model 5682 by way of an Ethernet port associated with the Dante interface, rather than using a USB flash drive.

It's possible that updated versions of the firmware (embedded software) files that are utilized by the Model 5682 will be released to add features or correct issues. Refer to the Studio Technologies' website for the latest firmware files. Details on the actual update process will be covered in the following paragraphs.

DFB II Card A Main and FPGA Firmware Update

DFB II Card A is primarily used for supporting the Model 5682's ST 2110 functionality and has the ability to load two of its three firmware files into non-volatile memory by way of a standard USB flash drive. A USB host function provides access to update its firmware by way of a USB type A receptacle. This receptacle, labeled Firmware Update A, is located on the unit's back panel. The names of the two files are **M5682v*X*r*XX*.stm** for the main firmware and **M5682v*X*r*XX*.stf** for the FPGA firmware, where *X*s are decimal digits that represent the version number.

The update process begins by preparing a USB flash drive. The flash drive doesn't have to be empty (blank) but must be in the personal-computer-standard FAT32 format. Either or both of the firmware files can be automatically loaded at essentially the same time. On the flash drive's root folder, save the desired new firmware file(s), ensuring that the required name or names are specified. For the main firmware the file name must be **M5682v*X*r*XX*.stm**. For the FPGA firmware the file name must be **M5682v*X*r*XX*.stf**.

Studio Technologies will supply each firmware file inside a .zip archive file. While the firmware file inside of the .zip file will adhere to the required naming convention, the name of the .zip file itself will be slightly different. For example, a file named **M5682v1r03MCU.zip** would indicate that version 1.03 of the main firmware (**M5682v1*r*03.stm**) is contained within this .zip file.

Once the USB flash drive has been prepared it can be used to update both DFB II Card A and DFB II Card B. To begin the update process, insert the prepared flash drive into the USB receptacle that is labeled Firmware Update A, then the Model 5682 must be powered off and again powered on. At this point, the file(s) will be automatically loaded. Once completed, the USB flash drive can then be removed. The precise steps required will be highlighted in the next paragraphs.

To install either or both of the firmware files in DFB II Card A follow these steps:

1. Remove power from the Model 5682. This will entail either removing the AC mains power connector or removing the external source of 12 volts DC. (Both must be disconnected if dual powering has been implemented.)
2. Locate the USB type A receptacle on the Model 5682's back panel that is labeled Firmware Update A. Directly adjacent to this USB receptacle is a small hole that provides visual access to a green LED indicator.

3. Insert the prepared USB flash drive into the USB type A receptacle that is labeled Firmware Update A.
4. Apply power to the Model 5682. Power can be provided by connecting AC mains or a source of 12 volts DC.
5. After a few seconds, DFB II Card A will run a "boot loader" program that will automatically load and save the one or two new firmware files that are present on the USB flash drive. The time required for the update process can range from approximately 15 seconds to approximately 45 seconds, depending on which of the two files are going to be updated. While the files are being loaded, the green LED, located adjacent to the USB receptacle, will flash slowly. Once the entire loading process has completed, DFB II Card A will restart using the newly saved main and/or FPGA firmware.
6. At this time, DFB II Card A should be functioning with the newly loaded firmware and the USB flash drive can be removed. To be conservative, remove the power source first, then remove the USB flash drive.
7. Apply power to the Model 5682. Power can be provided by connecting AC mains or a source of 12 volts DC. At this point, it's a good idea to confirm that the desired main and/or FPGA firmware versions have been loaded into DFB II Card A. This will help to ensure that the Model 5682 is operating as expected. To observe the version numbers of the loaded main firmware, simply view the unit's front-panel display pages.

Note that upon power being applied to the Model 5682, if a connected USB flash drive doesn't have one or two files with the required names in its root folder no harm will occur. Upon power up the green LED, located adjacent to the USB receptacle, will flash on and off rapidly for a few seconds to indicate that a valid file has not been found. After this warning, operation using the unit's existing firmware will begin.

DFB II Card A ST 2110 Firmware Update

As previously discussed, the Model 5682 implements ST 2110 connectivity using Merging Technologies' ZMAN module which is installed in DFB II Card A. The Model 5682's front-panel display can be used to view the version number of the firmware that resides in the ZMAN module. A web page provided by the ZMAN module can also be used to determine the version of the firmware. The latest Model 5682 ST 2110 firmware file, with an extension of .zoem, is always available on the Studio Technologies' website.

The firmware (embedded software) residing in the ZMAN module is updated by way of an Ethernet connection that links DFB II Card A to a personal computer. Web pages that are "served" by the ZMAN module are accessed by the personal computer's browser and are used to execute the update process. The following sections detail the process involved in updating the ZMAN firmware.

1. Begin the update process by downloading the latest Model 5682 ZMAN firmware from the Studio Technologies' website (studio-tech.com). The file on the website will be in the form of a .zip file that contains both the actual ZMAN firmware file (.zoem extension) and a release notes file (.txt extension). The downloaded .zip file should be stored on the personal computer's disk and the actual firmware file should be extracted and stored in a location (disk folder) that allows easy access. The downloaded .zip and extracted firmware files can also be stored on a USB flash drive if the files need to be moved from a computer outside of a firewall to one that has access to the Model 5682. The firmware will be in the format of **M5682-*NN*v*XrX*.zoem** where the *NN*s are either 01 for a Model 5682-01 or 02 for a Model 5682-02. *Xs* represent the actual version number. As an example, a file with a name of **M5682-02v1r9.zoem** would support a Model 5682-02 with a version number of 1.9.
2. Use the personal computer to access the Model 5682's control port. The control port's IP address can be viewed from the front-panel menu. It's part of the screen saver routine as well as being accessible using the pushbutton switches. Refer to Appendix A for a detailed view of the menu system.

3. Using a standard web browser running on the personal computer, enter the control port's IP address into the command line. This will cause a web page to be "served" by the ZMAN module. We refer to this as the "landing page," an example of which is shown in Appendix B, Figure 1.
4. Using the personal computer's mouse, select the **Info** choice on the bottom of the landing page. This will take the browser to the info page, an example of which is shown in Appendix B, Figure 2. The info page will display several general ZMAN parameters, including the temperature, serial number, and firmware version. It will also provide two choices, including one that says **Firmware Update**.
5. Use the personal computer's mouse to select the firmware update command. The file selection web page will appear. Refer to Appendix B, Figure 3 for an example of this web page.
6. Using the personal computer's mouse, select the **Select File** button and choose the desired ZMAN file (.zoem) that was previously downloaded and stored on the personal computer. Once a file has been selected, a slightly changed download page will again display. Refer to Appendix B, Figure 4 for an example of what you might observe.
7. Using the personal computer's mouse, select the **Update** button and the updating process will begin. The process will begin by uploading the selected file from the person computer to the ZMAN module. The actual upload process will take approximately 30 seconds after which the menu will display the text **Uploading: 100%**. Refer to Appendix B, Figure 5 for an example of the web page. This is part of the process so just observe the web page at this stage.
8. The process will automatically continue, preparing the now-uploaded file and loading it into the required location on ZMAN's memory. This will take approximately five additional minutes. During this time, please do not disturb the personal computer browser or Model 5682. Once the update process has completed, a new web page will display, offering an opportunity to reboot the module. Refer to Appendix B, Figure 6 for an example.
9. On the reboot page, use the personal computer's mouse to click on **Reboot Device** to begin the ZMAN module's reboot process. This will take about one and a half minutes. When completed, the Model 5682 and associated ZMAN module will be operating under the new firmware. The info web page will again appear. Refer to Appendix B, Figure 7 for an example of this web page.
10. Observe the info web page and confirm that the ZMAN module is running the desired firmware version. If it is not, review the update steps and execute the update process again.

DFB II Card B Main and FPGA Firmware Update

DFB II Card B is primarily used for supporting the Dante interface and has the ability to load two of its three firmware files into non-volatile memory by way of a standard USB flash drive. A USB host function provides access to update its firmware via a USB type A receptacle. This receptacle, labeled Firmware Update B, is located on the unit's back panel. The names of the two files are **M5682v*XrXX*.stm** for the main firmware and **M5682v*XrXX*.stf** for the FPGA firmware, where *X*s are decimal digits that represent the version number.

The update process begins by preparing a USB flash drive. The flash drive doesn't have to be empty (blank) but must be in the personal-computer-standard FAT32 format. Either or both of the firmware files can be automatically loaded at essentially the same time. On the flash drive's root folder, save the desired new firmware file(s), ensuring that the required name or names are specified. For the main firmware the file name must be **M5682v*XrXX*.stm**. For the FPGA firmware the file name must be **M5682v*XrXX*.stf**.

As one might notice, these two files are the same as are used for DFB II Card A. If you have prepared a USB flash drive for updating DFB II Card A it will also function correctly for updating DFB II Card B. This guide will provide all the required steps for updating both DFB II Card A and DFB Card B. Astute readers will notice that the content is identical.

Studio Technologies will supply each firmware file inside a .zip archive file. While the firmware file inside of the .zip file will adhere to the required

naming convention, the name of the .zip file itself will be slightly different. For example, a file named **M5682v1r03MCU.zip** would indicate that version 1.03 of the main firmware (**M5682v*1r03*.stm**) is contained within this .zip file.

Once the USB flash drive has been prepared it can be used to update both DFB Card B and DFB Card A. To begin the update process, insert the USB flash drive into the USB receptacle that is labeled Firmware Update B. then the Model 5682 must be powered off and again powered on. At this point, the file(s) will be automatically loaded. Once completed, the USB flash drive can then be removed. The precise steps required will be highlighted in the next paragraphs.

To install either or both of the firmware files in DFB II Card B follow these steps:

1. Remove power from the Model 5682. This will entail either removing the AC mains power connector or removing the external source of 12 volts DC. (Both must be disconnected if dual powering has been implemented.)
2. Locate the USB type A receptacle on the Model 5682's back panel labeled Firmware Update B. Directly adjacent to this USB receptacle is a small hole that provides visual access to a green LED indicator.
3. Insert the prepared USB flash drive into the USB type A receptacle that is labeled Firmware Update B.
4. Apply power to the Model 5682. Power can be provided by connecting AC mains or a source of 12 volts DC.
5. After a few seconds, DFB II Card B will run a "boot loader" program that will automatically load and save the one or two new firmware files that are present on the USB flash drive. The time required for the update process can range from approximately 15 seconds to approximately 45 seconds, depending on which of the two files are going to be updated. While the files are being loaded, the green LED, located adjacent to the USB receptacle, will flash slowly. Once the entire loading process has completed DFB II Card B will restart using the newly saved main and/or FPGA firmware.
6. At this time, DFB II Card B should be functioning with the newly loaded firmware and the USB flash drive can be removed. To be conservative, remove the power source first, then remove the USB flash drive.
7. Apply power to the Model 5682. Power can be provided by connecting AC mains or a source of 12 volts DC. At this point, it's a good idea to confirm that the desired main and/or FPGA firmware versions have been loaded into DFB II Card B. This will help to ensure that the Model 5682 is operating as expected. To observe the version numbers of the loaded main firmware, simply view the unit's front-panel display pages.

Note that upon power being applied to the Model 5682, if a connected USB flash drive doesn't have a one or two files with the required names in its root folder no harm will occur. Upon power up the green LED, located adjacent to the USB receptacle, will flash on and off rapidly for a few seconds to indicate that a valid file has not been found. After this warning, operation using the unit's existing firmware will begin.

DFB II Card B Dante Firmware Update

As previously discussed, the Model 5682 implements Dante connectivity using a Brooklyn module which is installed in DFB II Card B. The firmware (embedded software) residing in the Brooklyn module can be updated by way of an Ethernet connection that links DFB II Card B with a personal computer and the internet. The Model 5682's front-panel display can be used to view the version number of the firmware that resides in the Brooklyn module. The Dante Controller software application can also be used to determine the version of the firmware. The Dante Updater software application, supplied with Dante Controller, includes an automated method of updating the Brooklyn module's firmware. The Dante Controller application is available, free of charge, on the Audinate website (getdante.com).

The latest Model 5682 Dante firmware file, with an extension of .dnt, is available on the Studio Technologies' website as well as being part of Audinate's product library database. The latter allows the Dante Updater software application that is included with

Dante Controller to automatically update the Model 5682's Brooklyn module.

Note that the Dante Updater software application requires internet connectivity for operation. Even if the desired .dnt file is stored locally, internet access is still required.

Specifications

Applications:

Interconnects audio paths in each direction between independent ST 2110 and Dante audio-over-Ethernet networks. Integrated sample-rate-conversion (SRC) functions ensure that timing of independent networks is supported.

Versions Available:

Model 5682-01: supports up to 32 channels (44.1 or 48 kHz Dante sample rates) and 16 channels (88.2 or 96 kHz Dante sample rates)

Model 5682-02: supports up to 64 channels (44.1 or 48 kHz Dante sample rates) and 32 channels (88.2 or 96 kHz Dante sample rates)

Network Audio Technology – ST 2110:

Type: SMPTE ST 2110-10:2017 and ST 2110-30:2017

Supports Conformance Levels:

A: 48 kHz streams with 1-8 audio channels at packet times of 1 ms
B: 48 kHz streams with 1-8 audio channels at packet times of 125 us
C: 48 kHz streams with 1-64 audio channels at packet times of 1 ms
AX: 96 kHz streams with 1-4 audio channels at packet times of 1 ms
BX: 96 kHz streams with 1-8 audio channels at packet times of 125 us
CX: 96 kHz streams with 1-32 audio channels at packet times of 125 us

AMWA NMOS Support: IS-04 Discover & Registration ("Discovery") and IS-05 Device Connection Management ("Routing")

Redundant Streams: compliant with Level B, SMPTE ST 2022-7:2013 Seamless Protection Switching (8-channel stream at 48 kHz sample rate, packet time 125 us)

Synchronization: per SMPTE ST 2110-10, Precision Time Protocol (PTP) IEEE® 1588-2008 Version 2; supported profile IEEE 1588:2008

Compatibility: JT-NM TR-1001 (System Environment and Device Behavior)

Discovery, Control, and Connection Management: includes web user interface, JSON API, NMOS, and Merging Technologies' ANEMAN Audio Network Manager

Audio Performance and Transport: digital

Audio Type: pulse-code modulation (PCM)

Sampling Rate: 48 kHz

Bit Depth: 24

Number of Sender (Output) Channels – Model 5682-01: 32

Number of Receiver (Input) Channels – Model 5682-01: 32

Number of Sender (Output) Channels – Model 5682-02: 64

Number of Receiver (Input) Channels – Model 5682-02: 64

Network Audio Technology – Dante:

Type: Dante audio-over-Ethernet

AES67-2018 Support: yes

Dante Domain Manager (DDM) Support: yes

Ethernet Interface Configuration: Switched or Redundant

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

Pull-Up/Down Support: yes

Bit Depth: 16, 24, or 32, selectable

Number of Transmitter (Output) Channels – M5682-01: 32 (44.1 or 48 kHz sample rates) or 16 (88.2 or 96 kHz sample rates)

Number of Receiver (Input) Channels – M5682-01: 32 (44.1 or 48 kHz sample rates) or 16 (88.2 or 96 kHz sample rates)

Number of Transmitter (Output) Channels – M5682-02: 64 (44.1 or 48 kHz sample rates) or 32 (88.2 or 96 kHz sample rates)

Number of Receiver (Input) Channels – M6482-02: 64 (44.1 or 48 kHz sample rates) or 32 (88.2 or 96 kHz sample rates)

Dante Audio Flows: 32 receiver and 32 transmitter

Network Interfaces: 3; ST 2110, Dante, and System Management

Physical Ethernet Connections – ST 2110: 3; Primary, Secondary, and Control

Physical Ethernet Connections – Dante: 2; Primary and Secondary

Physical Ethernet Connection – System Management: 1

Ethernet Connection Type: 1000BASE-T Gigabit Ethernet (GigE) per IEEE 802.3ab (10 and 100 Mb/s not supported)

Ethernet Connection NIC Status LEDs: one link and one activity for each Ethernet connection

Audio Performance:

Type: fully digital paths between ST 2110 and Dante network interfaces (by way of sample-rate-converter (SRC) functions)

Dynamic Range: 147 dB at 48 kHz sample rate, 148 at 96 kHz sample rate, A-weighted

Distortion (THD+N): –140 dB at 48 kHz sample rate, –143 dB at 96 kHz sample rate, measured at –1 dBFS, 1 kHz

Internal Digital Audio Processing: 32 bits

Input-to-Output Audio Processing Latency: <500 uSec

Front-Panel LEDs: 12, dual-color

Functions: provides indication of condition of incoming AC and DC power, ST 2110 status, Dante status, and system management interface status

Back-Panel LEDs: 14

Functions: provides status indication of both firmware update functions and six Ethernet interfaces

Power Sources:

AC Mains: 100 to 240 V, 50/60 Hz, 8 W maximum

DC: 10 to 16 V, 0.6 A max at 10 V; 0.5 A max at 12 V

Connectors:

Ethernet: 6, RJ45 jacks

USB: 2, Type A receptacles (used only for firmware updating)

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

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

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:

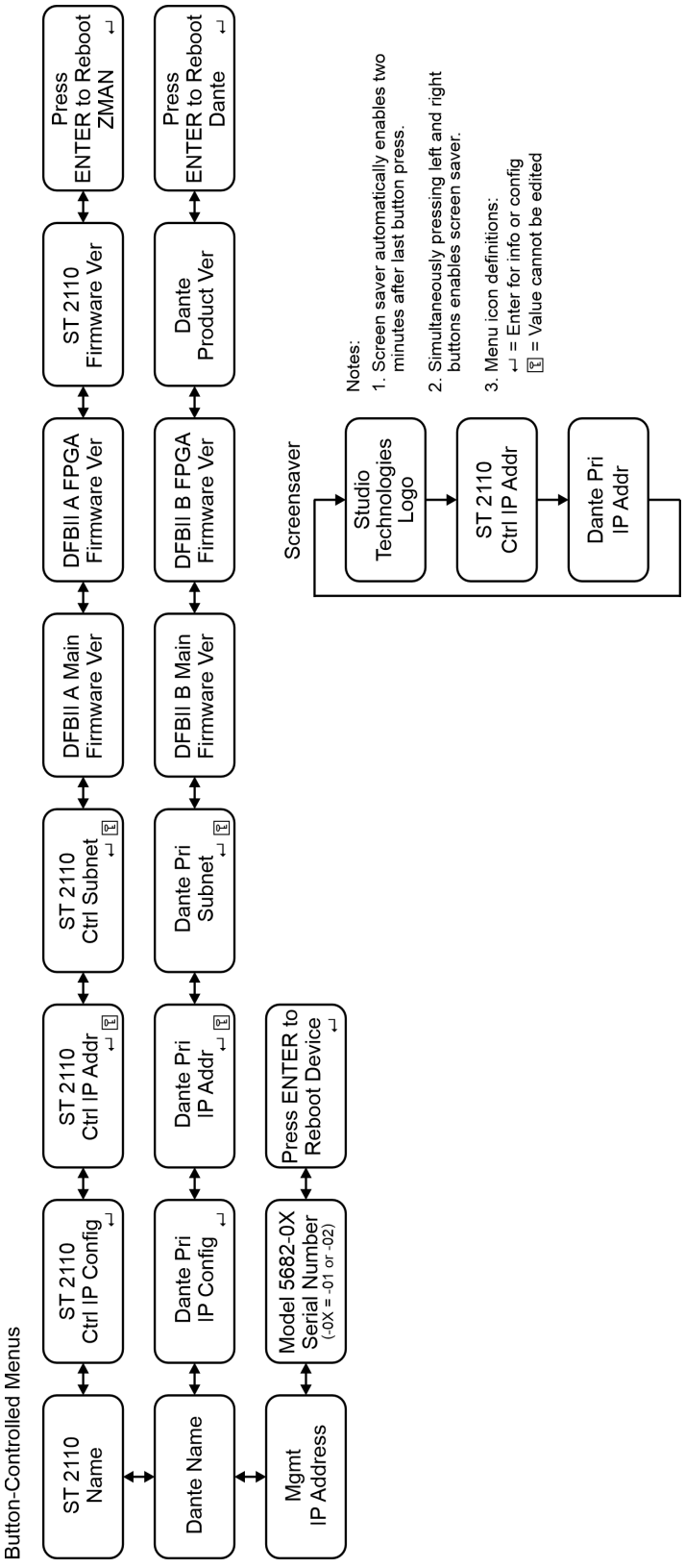
19.0 inches wide (48.3 cm)
1.72 inches high (4.4 cm)
8.0 inches deep (20.3 cm)

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

Weight: 3.3 pounds (1.5 kg)

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

Appendix A–Front-Panel Menu Structure



Appendix B–ZMAN Firmware Update Screens

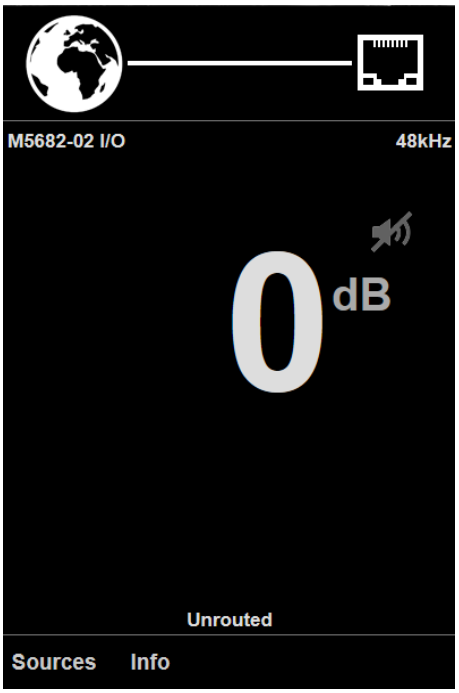


Figure 1.

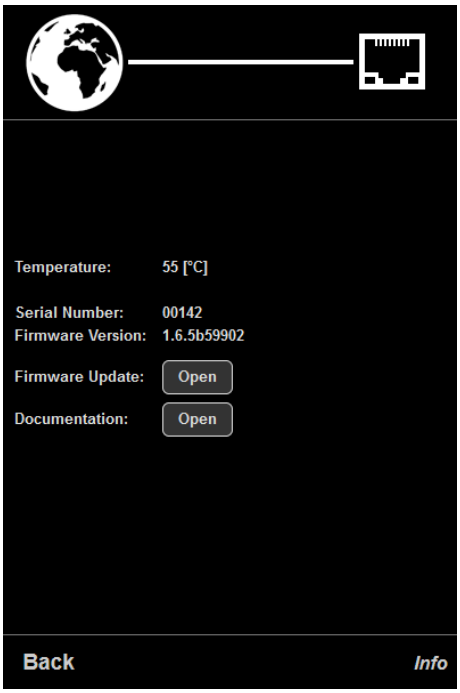


Figure 2.

Appendix B–ZMAN Firmware Update Screens, continued

Figure 3.

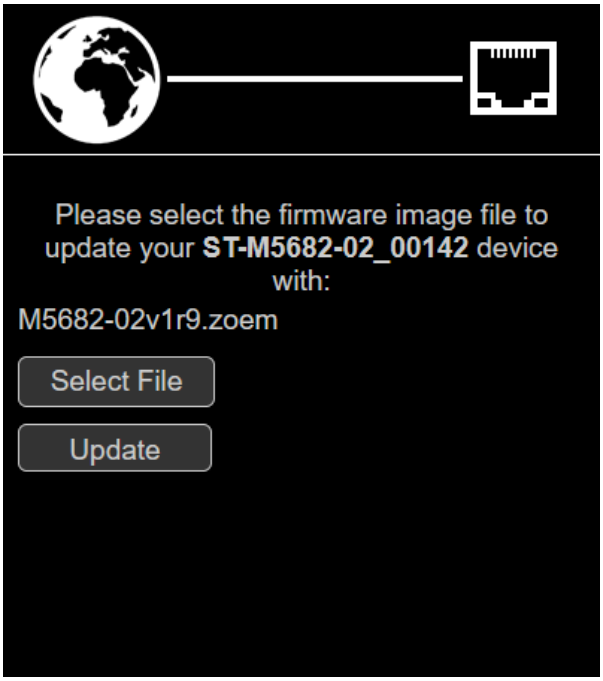


Figure 4.

Appendix B–ZMAN Firmware Update Screens, continued

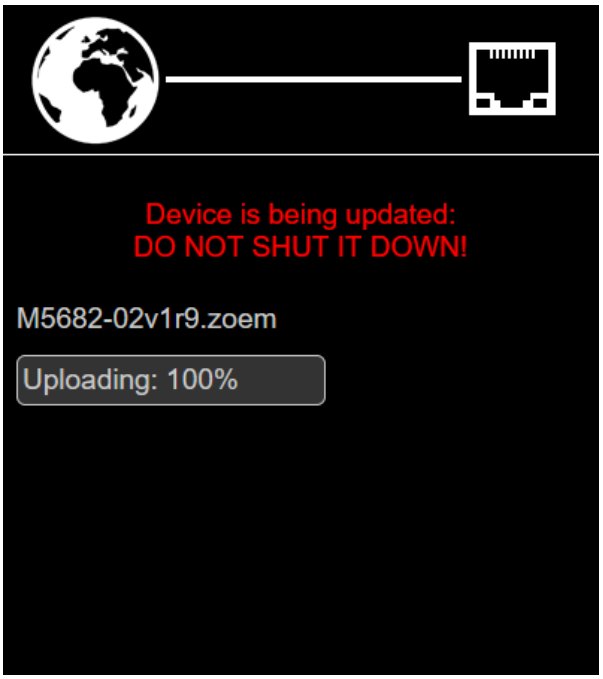


Figure 5.

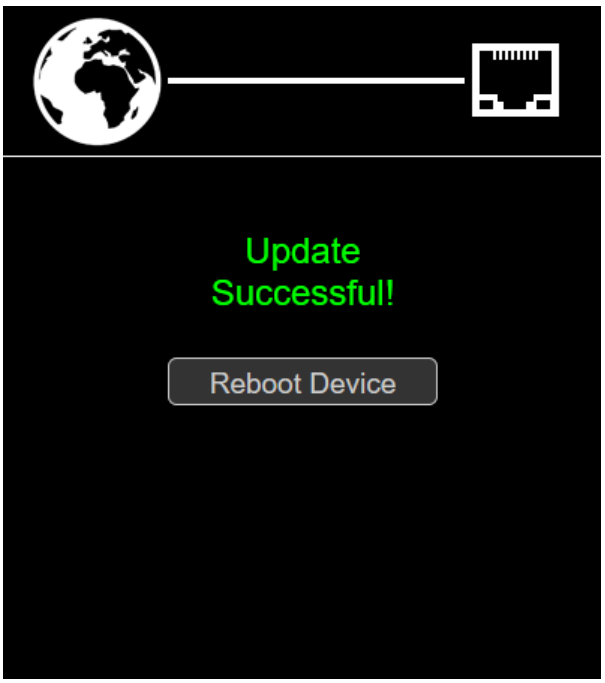


Figure 6.

Appendix B–ZMAN Firmware Update Screens, continued

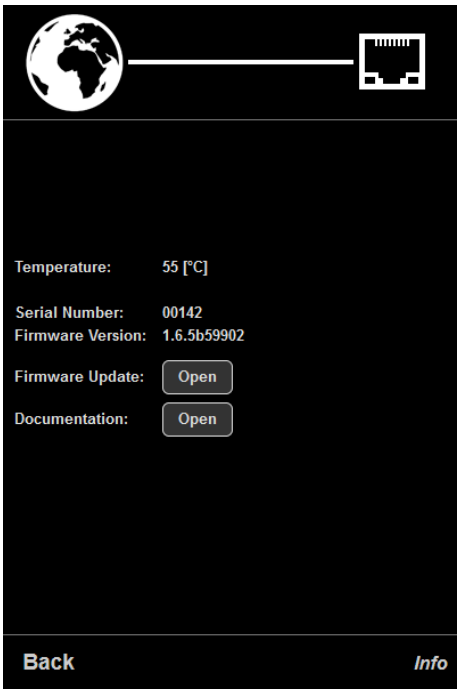


Figure 7.

Appendix C–Advanced ZMAN General Settings Screen