Model 392
Visual Indicator Unit

User Guide
Issue 2, December 2022

This User Guide is applicable for serial numbers
M392-00151 and later with Application Firmware 1.00 and later

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Revision History

Issue 2, December 2022:

- Added STcontroller screenshot.

- Miscellaneous edits.

Issue 1, February 2022:

- Initial release.

Introduction

The Model 392 is designed for a variety of applications that require a visual status indicator. An array of red/green/blue (RGB) LEDs provide backlighting for a distinctively shaped polycarbonate (plastic) lens assembly. The Model 392 can serve as a broadcast "on-air" light, a room occupied display, or an intercom call signal indicator. In addition, the unit can serve as an audio level display, with a green, yellow, and red indication of audio level. Full operation requires only a Power-over-Ethernet (PoE) 100 Mb/s data connection. It's compatible with the popular Dante® audio-over-Ethernet protocol but offers support for a range of additional applications. Configuration is performed using the Studio Technologies' STcontroller software application. Selected configuration values are stored within the Model 392's non-volatile memory. A variety of methods are provided to allow control of the Model 392's LED array. These include using STcontroller's "virtual" button, receiving network-transported UDP commands, and responding to an audio signal level associated with a Dante digital audio connection.

The Model 392 is a compact, lightweight unit that is primarily intended for fixed applications with mounting in a US-standard 2-gang electrical box or by way of a 2-gang low-voltage mounting bracket. The unit's optical lens conforms to the requirements of a 1-Decora® opening, allowing a 2-gang wall plate with centered 1-Decora opening to be used to complete the "look" of an installation. Standard wall plates are available in a variety of materials and finishes. For convenience, each unit includes a stainless steel wall plate. It's expected that 3rd-party custom wall plates will be created to support the Model 392. These would include the selection of material and text that would support specific applications. The Model 392 can also be used in portable applications by mounting the unit in a 2-gang electrical box intended for surface-mount or outdoor applications. These boxes typically have rugged finishes that would be appropriate for deployment by personnel for temporary use.

Configuration of the Model 392 is performed using the STcontroller software application. Choices include the display activation method, the LED colors, the LED intensity, and the LED action.

Applications

The on and off status of the Model 392's display can be controlled using a "virtual" selection within STcontroller. This is a simple means of controlling the unit, but would require user intervention. While available, in most cases this method will be used only during deployment and testing.

Custom applications can generate UDP commands that can control operation of the Model 392's display. It's expected that a simple software program or routine would be created for use within personal computers, media routers or switchers, or digital matrix devices. Refer to Appendix C for details on the UDP packet structure.

The Model 392 is also directly compatible with the call signals generated by the popular Studio Technologies' Dante-enabled beltpacks and intercom stations. These Dante-connected user devices generate a 20 kHz tone whenever their call button is activated. Model 392 applications can also employ the Studio Technologies' intercom interface units to provide compatibility with legacy analog PL intercom systems. Interface units are available that at compatible with Clear-Com® PL as well as the TW-series from RTS®/Bosch®.

In addition to responding to intercom beltpack call requests, the Model 392 can also be used in other

Figure 1. Model 392 Visual Indicator Unit front view

Dante-related applications. These include allowing one of the contact-closure inputs on a Studio Technologies' Model 44D Interface to trigger the display on a Model 392. Being Dante networked audio devices, the Model 392 and Model 44D units will function together as long as they are located on the same network, whether the devices are in the same room or on the opposite sides of a university campus. Another application would be to use signals generated by other products, such as the Studio Technologies' Models 214A and 215A Announcer's Consoles, to allow the Model 392 to directly serve as a broadcast "on-air" indicator.

An audio level meter function allows a Model 392 to directly display a visual color and intensity representation of the signal level of a connected Dante audio signal. By simply routing a Dante transmitter (output) audio channel to the Model 392's Dante (receiver) input channel, the unit's display can provide a 3-color indication of the level of the incoming PCM digital audio data. Green is utilized for signals within the normal level range. Yellow is displayed when a signal is within an acceptable level, but greater than what is normal. Red is displayed when a signal is near to, or has reached, the maximum level. Within each level range the intensity of the green, yellow, and red LED display will increase as the input level increases.

Features

The Model 392 incorporates a trapezoidal-prism-shaped polycarbonate lens lit with multiple red/green/blue (RGB) LEDs. The unit is designed for mounting in a 2-gang electrical box with a lens that is compatible with a 1-Decora opening. The unit can also be mounted utilizing a 2-gang low-voltage mounting bracket. Only a single 100BASE-TX with PoE network connection is required. These characteristics makes the unit ideal for deployment in "new build" applications as well as for retrofitting into existing structures. The Model 392's display lens provides a highly visible, wide viewing field. Configuration choices allow selection of the exact color, intensity, and lighting cadence. If desired, the Model 392 can be configured to display a selected color and intensity when the unit has been selected for "off" or inactive. This ensures that the unit's display can always be active, confirming that the unit is operating normally.

Dante Audio-over-Ethernet

Audio and related data is sent to the Model 392 using the Dante audio-over-Ethernet media networking technology. As a Dante-compliant device, the Model 392's Dante receiver (input) audio channel can be assigned (routed) from a source device using the Dante Controller software application. The Model 392 is compatible with Dante digital audio sources that have a sample rate of 48 kHz and a bit depth of up to 24.

Ethernet Data and PoE

The Model 392 connects to an Ethernet data network using a standard 100 Mb/s twisted-pair Ethernet interface. The physical interconnection is made by way of an RJ45 jack. Two LEDs display the status of the Ethernet connection. The Model 392's operating power is provided by way of the Ethernet interface using the 802.3af Power-over-Ethernet (PoE) standard. This allows fast and efficient interconnection with an associated data network. To support PoE power management, the Model 392's PoE interface reports to the power sourcing equipment (PSE) that it's a class 1 (very low power) device.

Setup, Configuration, and Operation

Setup, configuration, and operation of the Model 392 is simple. An RJ45 jack is used to interconnect the unit's network interface with a standard twisted-pair Ethernet cable associated with a port on a PoE-enabled network switch. This connection provides both network data and power. The Model 392's compact enclosure can be mounted into a standard 2-gang electric box. A stainless steel wall plate with a 1-Decora opening is provided with each unit. Custom wall plates can be created if warranted for an installation. This would allow specific finishes and/or labeling to be implemented.

All Model 392 features are configured using the STcontroller personal computer software application. An extensive set of parameters allows the unit's operation to be tailored to meet the needs of many applications. STcontroller, available in versions that will support the Windows® and macOS® operating systems, is a fast and simple means of confirming and revising the unit's operating parameters. The Dante Controller personal computer application will typically be used to route ("subscribe") a Dante audio source to

the Model 392's Dante receiver (input) audio channel. However, this is not required as the Model 392 can respond to UDP commands provided by way of the connected Ethernet network.

Future Capabilities and Firmware Updating

The Model 392 was designed so that its capabilities and performance can be enhanced in the future. A USB receptacle, located on the front of the unit (under the wall plate), allows the application firmware (embedded software) to be updated using a USB flash drive.

To implement the Dante interface the Model 392 uses Audinate's UltimoX2™ integrated circuit. The firmware in this integrated circuit can be updated via the Ethernet connection, helping to ensure that its capabilities remain up to date.

Getting Started

What's Included

Included in the shipping carton is a Model 392 Visual Indicator Module and a 2-gang stainless steel wall plate. One of the labels on the Model 392's enclosure will provide a QR code which will lead to product documentation. (A smart-phone based camera application will allow direct access to the Studio Technologies' website.) As the Model 392 is Power-over-Ethernet (PoE) powered, no external power source is provided. If the application requires a different wall plate from that provided, it will have to be supplied separately.

Ethernet Connection, Mounting, and Wall Plate

In this section, an Ethernet interconnection will be made using the RJ45 connector located on the side of the Model 392's enclosure. The unit's Ethernet interface requires connection of a 100BASE-TX signal that supports Power-over-Ethernet (PoE). The Model 392 will then be mounted in a US-standard 2-gang electrical box or affixed to a 2-gang low-voltage mounting bracket. As a final step, a wall plate will be attached to the front of the Model 392.

Ethernet Connection

A 100BASE-TX Ethernet (100 Mb/s) connection that also supports Power-over-Ethernet (PoE) is required for Model 392 operation. This single connection will provide both the Ethernet data interface and power for the Model 392's circuitry. The Ethernet connection is made by way an RJ45 jack that is located on the side of the unit's enclosure. This jack allows connection of an Ethernet signal by way of a standard, cable-mounted RJ45 plug. The Model 392's Ethernet interface supports auto MDI/MDI-X so that a crossover cable will never be required. The Model 392's Ethernet interface enumerates itself as a class 1 Power-over-Ethernet (PoE) device. (Technically, the Model 392 could also be known as a PoE class 1 PD.) To comply with the class 1 PoE standard, a power-sourcing-equipment (PSE) port is only required to supply a modest 3.84 watts maximum of power.

Mounting

After the Model 392's Ethernet connection has been established, the unit should be securely mounted in a 2-gang US-standard electrical box. Alternately, a 2-gang low-voltage mounting bracket can be utilized. The rear portion of the unit's enclosure is specified to be 1.172 inches deep and, as such, should not require a "deep" electrical box or special mounting method. To secure the Model 392 into either mounting arrangement would typically be performed using four 6-32 thread machine screws. These screws are commonly associated with installation of electrical products and are included with the Model 392. Refer to Appendix B for a detailed description of the unit's dimensions.

Wall Plate

The final Model 392 installation step is to attach a wall plate to the front surface of the unit. This provides a decorative finish to the installation, allows it to be physically "leveled", and limits access to the unit's USB receptacle and reset pushbutton switch. The unit's visual display (polycarbonate lens) conforms to the dimensions (length and width) of a 1-Decora opening. This allows standard wall plates to be utilized. Included with each Model 392 is a 2-gang, 1-Decora opening stainless steel wall plate This is affixed to the Model 392 using two 6-32 machine screws. Two oval-head 6-32 thread stainless steel machine screws are included with the wall plate. Refer to Appendix B for a detailed description of the wall plate's dimensions.

It's expected that some installations may utilize custom wall plates that are designed and fabricated to

meet an application's specific needs. These bespoke plates would allow the exact materials, colors, and finishes to be specified. In addition, site-specific graphics could be screened onto a plate, or added using a laser marking method. In cases where a custom wall plate is to be utilized as part of the final installation, the included stainless steel wall plate can serve in a temporary role while the final one is being obtained.

Dante Configuration

Correct Model 392 operation requires that one or more Dante-related parameters be correctly configured. The configuration settings will be stored in non-volatile memory within the Model 392's circuitry. Configuration will typically be done with the Dante Controller software application which is available for download free of charge at audinate.com. Versions of Dante Controller are available to support the Windows and macOS operating systems. The Model 392 uses the UltimoX2 integrated circuit to implement its Dante architecture. The Model 392'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 392 and related parameters may have to be configured.

Audio Routing

The Model 392 has one Dante receiver (input) channel that is associated with the unit's Dante interface. In most cases, a transmitter (output) channel on a designated device will be routed to the Dante receiver (input) channel. This transmitter channel would be used to supply the Model 392 with a call signaling tone. (If UDP commands are utilized to control the Model 392's display then a Dante audio connection will not have to be made.) 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). Due to the nature of its function, the Model 392 does not have any Dante transmitter (output) channels.

Unit and Channel Names

The Model 392 has a default Dante device name of **ST-M392-** and a unique suffix. The suffix identifies the specific Model 392 that is being configured. The suffix's actual alpha and/or numeric characters relate to the MAC address of the unit's UltimoX2 integrated circuit. The unit's Dante receiver (input) channel has a default name of **Ch1**. Using Dante Controller, the default device name and channel name can be revised as appropriate for the specific application.

Device Configuration

The Model 392 supports an audio sample rate of 48 kHz with no pull-up/pull-down options available. The unit's digital audio input data is in the form of pulse-code modulation (PCM) samples. The encoding choice is fixed to be PCM 24. Clocking and device latency parameters can be adjusted within Dante Controller if required but the default values are typically correct.

Network Configuration – IP Address

By default, the Model 392's Dante IP address and related network parameters will be determined automatically using DHCP or, if not available, the link-local network protocol. If desired, Dante Controller allows the IP address 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. But in this case, it's highly recommended that a unit be physically marked, e.g., directly using a permanent marker or "console tape," with its specific static IP address. If knowledge of a Model 392's IP address has been misplaced there is no configuration reset button or other method to easily restore the unit to a default IP setting.

AES67 Configuration – AES67 Mode

The Model 392 can be configured for AES67 operation. This requires that the AES67 Mode in Dante Controller be set for Enabled. By default, AES67 mode is set for Disabled.

Model 392 Clocking Source

While technically the Model 392 can serve as a Leader clock for a Dante network (as can every Dante-enabled device), in virtually all cases the unit will be configured to receive its timing reference ("sync") from another Dante device. As such, the Dante Controller check box for the Preferred Leader that is associated with the Model 392 would typically not be enabled.
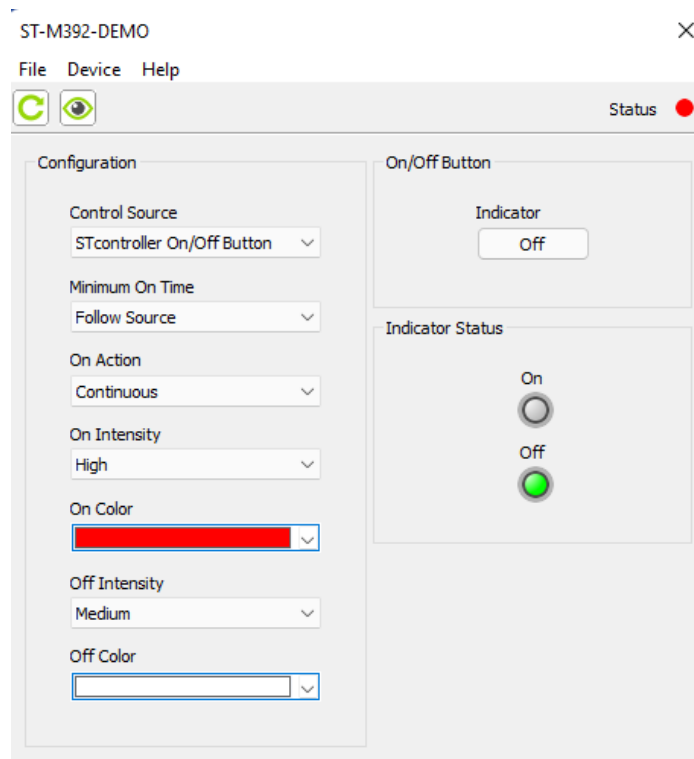
Model 392 Configuration

The STcontroller software application is used to configure the way in which the Model 392 functions. No DIP switch settings or other local actions are used to configure the unit. This makes it imperative that STcontroller be available for convenient use on a personal computer that's connected to the related LAN.

Installing STcontroller

STcontroller is available free of charge on the Studio Technologies' website (studio-tech.com). Versions are available that are compatible with personal computers running selected versions of the Windows and macOS operating systems. If required, download and install STcontroller onto the designated personal computer. The network connection of this personal computer must be on the same local area network (LAN) and subnet as the Model 392 unit that is going to be configured. Immediately after starting STcontroller the application will locate all the Studio Technologies' devices that it can control. The one or more Model 392 units to be configured will appear in the device list. Use the Identify command to allow easy recognition of a specific Model 392 unit. Double-clicking on a device name will cause the associated configuration menu to appear. Review the current configuration and make any changes that are desired.

Changes made using STcontroller will be immediately reflected in the unit's operation; no Model 392 reboot is required. Each time a Model 392 configuration change is made the unit's display will flash orange twice in a distinctive pattern. This provides a clear indication that a command from STcontroller has been received and acted upon.

Configuration
Control Source

Choices are: *STcontroller On/Off Button*, *UDP Commands*, *Tone Detect (TOX)*, and *Input Audio (Level Meter)*.

The Control Source configuration allows selection of which source will control the on and off state of the unit's visual display.

STcontroller On/Off Button: If this choice is selected the software-implemented (virtual) pushbutton switch in STcontroller can be used to select the on or off

state of the visual display. A Model 392 power-down/power-up cycle will cause the unit to return to its last selected state.

UDP Commands: Selecting this choice allows commands received by way of the Ethernet data connection to control the on and off state of the Model 392's visual display.

Tone Detect (TOX): When this choice is selected a high-frequency tone signal (18-23 kHz nominal) that is detected as being within the Dante receiver (input) channel will cause the unit's visual display to turn on.

Input Audio (Level Meter): Selecting this choice will configure the Model 392 to provide a visual representation of the level of the incoming audio signal that's present on the Dante receiver (input) channel. The level will cause the visual indicator to light green, yellow, or red. This serves as a form of level metering, changing from lighting green, then lighting yellow, then lighting red in response to an increasing signal level. The intensity (brightness) of each color will also increase as the input level increases. While a bit difficult to explain in words, observing this function in action will readily make it apparent.

Minimum On Time

Choices are: *Follow Source*, *2 Seconds*, *4 Seconds*, and *6 Seconds*.

In the *Follow Source* configuration, the on or off state of the visual indicator will directly follow the trigger source. This can be in response to a request made by way of STcontroller's virtual On/Off Button, a UDP command, or a call (high-frequency tone) signal. As an example, a very short (e.g., less than one second) high-frequency call signal would result in a very short activation of light from the visual indicator. Selecting *Follow Source* as the configuration might be correct for some applications, but could allow for situations where users may be left unaware that an on request had taken place.

Three of the Minimum On Time configuration choices can be useful in situations where it's important for users to be aware that the visual indicator has gone into its on state. The configuration choices for 2, 4, or 6 seconds ensures that the visual indicator will light for a "reasonable" amount of time. Selecting one of

these values will ensure that the visual indicator will activate for a minimum period of time. As an example, if selected for *4 Seconds* and an on request is active for 1 second, the visual indicator will stay active for an extra 3 seconds. (It would stay enabled for 4 seconds.) In this same example, should the on request remain active for 5 seconds then the visual indicator will immediately turn off at the end of the 5 seconds. (The 5-second signal would exceed the four-second minimum on time.)

Technically, the three minimum time choices could be considered to provide non-retriggerable one-shot actions. Each of these is effectively a logical "OR" function with two sources, one being the trigger signal that enables the visual indicator and starts a timer and the other being a 2-, 4-, or 6-second timer. (Please ignore this paragraph if you're not an engineer and/or don't appreciate this kind of obscure technical stuff!)

Note that when the Control Source configuration has been selected for the Input Audio (Level Meter) choice the Minimum On Time configuration is not applicable and the section will be "grayed" out.

On Action

Choices are: *Continuous*, *Slow Flash*, *Fast Flash*, and *Pulse*.

The four On Action choices allow the character of the visual indicator to be selected. These choices allow the manner in which the display will light to be selected to best fit the application. When selected for *Continuous* the visual indicator will light at a uniform intensity whenever it is enabled. When selected to *Slow Flash* the visual indicator will alternate between on and off two times per second. In *Fast Flash* the visual indicator will alternate between on and off a little more than four times per second. In the *Pulse* configuration the visual indicator will light twice followed by a short pause, repeating a little more than once per second. The *Pulse* setting can be effective in applications where gaining a viewer's attention is desired.

Note that when the Control Source configuration has been selected for the Input Audio (Level Meter) choice the On Action configuration is not applicable and the section will be "grayed" out.

On Intensity

Choices are: *High*, *Medium*, and *Low*.

The intensity (brightness or number of lumens) emitted by the visual indicator when it is in its on state can be selected. Select the value that's appropriate for the application.

Note that when Input Audio (Level Meter) has been selected for the Control Source the On Intensity configuration is not applicable and the section will be "grayed" out. In this situation, the intensity (brightness) of the visual indicator will be automatically controlled by the Input Level (Level Meter) function.

On Color

Choices are a set of standard colors and the operating system's color picker.

The On Color configuration allows the color created by the visual indicator's red/green/blue (RGB) LEDs to be selected when the function is on (active). STcontroller will provide a set of standard colors to choose from. Should none of the standard colors meet the application's needs, the palette provided by the operating system's color picker function can provide many more choices. Note that selecting black will result in the visual indicator producing a dark gray color. Producing this color seemed to be more reasonable than trying to generate black which is the absence of light!

Note that if the Control Source configuration has been selected for Input Audio (Level Meter) the On Color configuration is not applicable and the section will become unavailable. The color of the visual indicator will be controlled by the Input Audio (Level Meter) function.

Off Intensity

Choices are: *High*, *Medium*, *Low*, and *Off*.

The Model 392 can be configured such that the visual display will always be lit, even when in its off (inactive) state. The ability to have the Model 392's visual display light when in the off state can serve as a confidence signal, ensuring that it's readily apparent that the unit is functioning. The visual display can also be configured to be fully off (no light output) when it is in the off state.

The intensity (brightness) emitted by the visual indicator when it is in its off state can be selected from among four choices. Select the value that's appropriate for the application.

Note that if Input Audio (Level Meter) has been selected for the Control Source configuration the Off Intensity configuration selection is not applicable and the section will be "grayed" out. The intensity (brightness) of the visual indicator will be controlled by the Input Audio (Level Meter) function.

Off Color

Choices are a set of standard colors and the operating system's color picker.

The Off Color configuration allows the color created by the visual indicator's red/green/blue (RGB) LEDs to be selected when the Model 392's visual indicator is in its off (inactive) state. STcontroller provides a set of standard colors to choose from. Should none of the standard colors meet the application's needs, the palette provided by the operating system's color picker function can provide many more choices. Selecting black will result in the visual indicator producing a dark gray color.

Note that if the Control Source has been selected for Input Audio (Level Meter) the Off Color configuration is not applicable and the section will become unavailable.

On/Off Button

STcontroller's graphics button, labeled Indicator within the On/Off Button section, provides a "virtual" (software-implemented) pushbutton switch. This allows manual on and off control of the Model 392's visual display when the Control Source configuration has been selected for STcontroller On/Off Button. If this Control Source configuration choice has not been selected then the button will be "grayed" out and not available for use.

The On/Off Button, Indicator virtual button can be "pressed," using a mouse or keyboard key, to change the state of the visual display from off-to-on or on-to-off. This can prove useful during installation and testing of the Model 392. It can also be used effectively during normal operation to manually control the state of the visual display.

Indicator State

STcontroller includes two virtual "LEDs" that can be viewed to determine the on or off status of the visual display. They are updated every two seconds in real time. (This limits the amount of data traffic required to support this function.)

Operation

At this point, all Model 392 connection, mounting, and configuration steps should have been completed and everything should be ready for operation to commence. An Ethernet connection with Power-over-Ethernet (PoE) capability should have been made to the unit's RJ45 jack. The unit should have been mounted into a 2-gang electrical box or in conjunction with a low-voltage mounting bracket. The wall plate should have been attached.

The Model 392's Dante configuration settings should have been made using the Dante Controller software application. In most cases, the transmitter (output) channel on a piece of Dante-enabled equipment will have been routed, by way of a Dante "subscription," to the unit's Dante receiver (input) channel. Using the Studio Technologies' STcontroller software application the unit's configuration should have been selected to meet the needs of the specific application.

Initial Operation

The Model 392 will begin to function as soon as a Power-over-Ethernet (PoE) source is connected. A bi-color (red and green) LED is located adjacent to the USB receptacle on the Model 392's front panel and is visible through a small hole. The LED will light in a specific pattern as part of the unit's power-up sequence. This LED will first light green for a few seconds when the boot loader firmware is executing. It will then momentarily light red and then not light at all for a few seconds. The LED will then light orange (simultaneously lighting red and green) for approximately 6-8 seconds. While the LED is lighting orange, the application firmware will check the Ultimo integrated circuit (which provides the Dante interface) for correct operation. It will also check the unit's DC power supply voltages to ensure that they are correct. If these firmware-initiated checks are successful the LED will stop lighting and normal operation will take place. If a problem is detected the LED will flash red in a pattern

that will indicate a diagnostic code. A single flash in each 2-second period will indicate an error with the Ultimo integrated circuit. (This could be caused by a inter-integrated-circuit communications error or a PTP problem.) Two flashes in each 2-second period will indicate a power supply error. (This could be caused by an error with one or more of the unit's 3.3, 5, and 12 volt DC power supply "rails.") Three LED flashes in each 2-second period would indicate that the firmware detected both an Ultimo and a power supply error. If any error condition is present the factory should be contacted for technical support.

The unit's two Ethernet status LEDs, LINK and ACT, located adjacent to the RJ45 jack on the back of the unit, will begin to light as the network connection is established. The LINK LED, located nearest to the unit's corner, will light yellow whenever an active connection to a 100 Mb/s Ethernet network has been established. The ACT LED will flash green in response to all Ethernet data packet activity. Note that in most cases these three LEDs (USB status, LINK, and ACT) won't be visible as they would be obscured by the mounting arrangement and the wall plate.

At the same time that the Ethernet status LEDs begin to light, the LEDs associated with the Model 392's display will light sequentially in a color pattern (essentially red, then green, then blue) to indicate their functionality.

Full operation of the Model 392 will commence after the Dante interface has completed its connection tasks. It's typical for that to take 20 to 30 seconds. After the power-up sequence has completed, operation of the display will depend on the Model 392's configuration. The display's LEDs may, or may not, light when the display is in its off state. When the display function is in its on state its LEDs will light in a color and cadence that follows the configuration setting.

How to Identify a Specific Model 392

User-activated functions within the Dante Controller and STcontroller software applications allow a specific Model 392 unit to be identified. Each application provides an "eyeball" icon that when clicked will activate the *Identify* function. When this function is selected a command will be sent to a specific Model 392 unit. On that unit's display the LEDs will flash red

in a distinctive pattern three times. Once the Identify function has ended then normal Model 392 operation will again take place.

Technical Notes

IP Address Assignment

By default, the Model 392's Dante-associated 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 an IP address will automatically be assigned using the link-local protocol. This protocol is known in the Microsoft® world as Automatic Private IP Addressing (APIPA). It is also sometimes referred to as auto-IP (PIPPA). Link-local will 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 can be connected together and automatically function, whether or not a DHCP server is active on the LAN. Even two Dante-enabled devices that are directly interconnected using an RJ45 patch cord will, in most cases, correctly acquire IP addresses and be able to communicate with each other.

An exception does arise when trying to directly interconnect two Dante-enabled devices that use Ultimo integrated circuits to implement Dante. The Model 392 uses an UltimoX2 "chip" and, as such, a direct one-to-one interconnection between it and another Ultimo-based product would typically not be supported. An Ethernet switch would be required to successfully interconnect the two Ultimo-based devices. The technical reason that a switch is required relates to the need for a slight latency (delay) in the data flow; an Ethernet switch will provide this. This wouldn't typically prove to be an issue as the Model 392 uses power-over-Ethernet (PoE) to provide its operating power. As such, in most cases a PoE-enabled Ethernet switch would be utilized to support Model 392 units.

Using the Dante Controller software application, the Model 392's IP address and related network parameters can be set for a manual (fixed or 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. But in this case, it's highly recommended that every unit be physically marked, e.g., directly using a permanent marker or "console tape," with its specific static IP address. If knowledge of a Model 392's IP address has been misplaced there is no reset button or other method to easily restore the unit to a default IP setting.

In the unfortunate event that a device's IP address is "lost," the Address Resolution Protocol (ARP) networking command can be used to "probe" devices on a network for this information. For example, in Windows OS the **arp –a** command can be used to display a list of LAN information that includes MAC addresses and corresponding IP addresses. The simplest means of identifying an unknown IP address is to create a "mini" LAN with a small PoE-enabled Ethernet switch connecting a personal computer to the Model 392. Then by using the appropriate ARP command the required "clues" can be obtained.

Optimizing Network Performance

For best Dante audio-over-Ethernet performance a network that supports VoIP QoS capability is recommended. In applications that utilize multicast Ethernet traffic enabling IGMP snooping can be valuable. (In this case, ensure that support for PTP timing messages is maintained.) These protocols 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 (audinate.com) for details on optimizing networks for Dante applications.

Application Firmware Version Display

A selection in the STcontroller software application allows the Model 392's application firmware version to be identified. This can be useful when working with factory personnel on application support and troubleshooting. To identify the firmware version, begin by connecting the Model 392 unit to the network (via Ethernet with PoE) and wait until the unit starts to function. Then, after starting STcontroller, review the list of identified devices and select the specific Model 392 for which you want to determine its application firmware version. Then select **Version and Information** under the **Device** tab. A page will then display that will provide lots of useful information. This includes the application firmware version and well as details on the Dante interface firmware.

Application Firmware Update Procedure

It's possible that updated versions of the application firmware (embedded software) that is utilized by the Model 392's microcontroller (MCU) integrated circuit will be released to add features or correct issues. Refer to the Studio Technologies' website for the latest application firmware file. The unit has the ability to load a revised file into its MCU's non-volatile memory by way of a USB interface. The Model 392 implements a USB host function that directly supports connection of a USB flash drive. The Model 392's MCU updates its application firmware using a file named **M392v*XrXX*.stm** where the *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. The processor in the Model 392 is compatible with USB 2.0, USB 3.0, and USB 3.1-compliant flash drives. Save the new firmware file in the root folder with a name of **M392v*XrXX*.stm** where *XrXX* is the actual version number. Studio Technologies will supply the application firmware file inside a .zip archive file. The name of the zip file will include the file's version number and the firmware file inside of the zip file will adhere to the naming convention required by the Model 392. For example, a file named **M392v1r00MCU.zip** would indicate that version 1.00 of the application firmware (**M392v1r00.stm**) is contained within this zip file along with a readme (.txt) text file.

To update the firmware requires access to the front surface of the Model 392. The unit does not have to be removed from the electrical box or mounting bracket in which it may have been mounted. If a wall plate is attached over the front of the Model 392 unit, then that will have to be removed. (A stainless-steel 2-gang, 1-Decora opening wall plate is supplied with each Model 392 unit.) Once the front surface of the Model 392 is accessible observe the USB Type A receptacle that's adjacent to the polycarbonate lens. Refer to Figure 1 for a view of the front of the Model 392. It shows the USB Type A receptacle, the small hole that allows access to the unit's reset pushbutton switch, and the small hole that an LED shines through. The LED provides a USB status indication. Insert the prepared USB flash drive into the USB receptacle.

For the firmware loading process to start the unit must be rebooted (restarted). This can be accomplished in either of two ways. The unit can be powered off and on again (power cycled) by removing and re-attaching the PoE Ethernet connection. This requires access to the RJ45 jack on the side of the Model 392 unit. If the unit is already mounted in an electrical box or mounting bracket, it does not have to be removed. A reset button, accessible from inside a small round hole that's adjacent to the USB receptacle, can be momentary pressed and released. Gently pressing this button using, if possible, a non-metallic tool will cause the Model 392 to reboot (restart). At this point, the file saved on the USB flash drive will automatically load. Then the unit will restart using the updated firmware. The precise steps required will be highlighted in the next paragraphs of this guide.

To install an application firmware file, follow these steps:

1. If present, remove the wall plate that may be covering the front of the Model 392 unit.

2. Only if convenient, disconnect power from the Model 392. This will entail removing the PoE Ethernet connection that is made to the RJ45 jack on the side of the unit. But don't worry about removing the PoE Ethernet connection if the unit is mounted into an electrical box or mounting bracket and access to the RJ45 jack is not available.

3. Locate the USB receptacle on the front of the unit. Insert the prepared USB flash drive into it.

4. If the Ethernet connection was removed, re-attach it. If the Ethernet connection was maintained press the reboot button located adjacent to the USB receptacle. The button is very small and only a small "tool" is needed to access it. A plastic writing stylus or the end of a pen would be sufficient. Gently press and release the button. Be careful not to twist the selected tool or otherwise muck around inside the button's hole. Be careful not to damage any of the internal circuitry with a "ham-handed" attempt at accessing the button!

5. After a few seconds the Model 392 will reboot (restart) and execute a "boot loader" program. This will automatically load an application firmware file (**M392v*XrXX*.stm**) contained on the USB flash drive. This loading process will take only a few

seconds. During this time period the LED that's located adjacent to the USB receptacle will slowly flash green. Once the entire loading process is over, taking approximately 10 seconds, the LED will stop flashing and the Model 392 will restart using the newly loaded application firmware.

6. At this time, the Model 392 will be functioning with the newly loaded application firmware and the USB flash drive can be removed. To be conservative, after the flash drive has been removed the unit can be restarted, either by removing and re-attaching the PoE Ethernet connection or pressing and releasing the reset button.

7. Using the STcontroller software application, confirm that the desired application firmware version has been correctly loaded.

8. If necessary, re-attach the wall plate that was previously secured to the front of the Model 392 unit.

Note that upon either PoE power being applied or the reset button being pressed, having a connected USB flash drive that doesn't have the correct file (**M392v*XrXX*.stm**) in its root folder will not cause harm. Upon the Model 392 starting operation, due to a power cycle or the reset button being pressed and released, the LED located adjacent to the USB receptacle will flash green rapidly for a few seconds to indicate an error condition and then normal operation using the unit's existing application firmware will begin.

Ultimo Firmware Update

As previously discussed, the Model 392 implements its Dante connectivity using the UltimoX2 integrated circuit from Audinate. The Dante Controller software application can be used to determine the version of the firmware (embedded software) that resides in this integrated circuit. The firmware (embedded software) residing in the UltimoX2 can be updated using the Model 392's 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 application. This application is available, free of charge, from the Audinate website (audinate.com). The latest Model 392 firmware file, with a name in the form of **M392v*XrXrX*.dnt**, is always 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 query and, if required, update the Model 392's Dante interface.

Restoring Factory Defaults

A command in the STcontroller software application allows the Model 392's defaults to be reset to the factory values. From within STcontroller select the Model 392 for which you want to restore its defaults. Select the **Device** tab and then the **Factory Defaults** selection. Then click on the OK box. Refer to Appendix A for a list of the Model 392's factory defaults.

Specifications

Power Source:

Power-over-Ethernet (PoE): class 1 (very low power, ≤3.84 watts) per IEEE® 802.3af

Network Audio Technology:

Type: Dante audio-over-Ethernet

AES67-2013 Support: yes, selectable on/off

Dante Domain Manager (DDM) Support: yes

Bit Depth: up to 24

Sample Rate: 48 kHz

Pull Up/Down Support: no

Dante Receiver (Input) Channels: 1

Dante Receiver (Input) Nominal Level: –20 dBFS

Network Interface:

Type: 100BASE-TX, Fast Ethernet per IEEE 802.3u (10BASE-T and 1000BASE-T (GigE) not supported)

Power-over-Ethernet (PoE): Per IEEE 802.3af (class 1 (very low power, ≤3.84 watts))

Data Rate: 100 Mb/s (10 Mb/s and 1000 Mb/s not supported)

Visual Display:

Technology: red/green/blue (RGB) LEDs (qty 11), within polycarbonite lens assembly

Off Color: single, adjustable (choices include standard colors and operating system color picker)

Off Intensity: adjustable from among three values and off

On Color: single, adjustable (choices include standard colors and operating system color picker)

On Intensity: adjustable from among three values

On Action: adjustable from among four choices

Visual Display Off/On Control: manual control via STcontroller, UDP command, tone detect (TOX), and input audio level meter

UDP Command Function: UDP command provided by way of Ethernet interface

Tone Detect (TOX) Function:

Detection Method: in-band tone

Tone Characteristics: 18-23 kHz, nominal

Minimum Level: –27 dBFS, nominal

Detect Time: 10 milliseconds, minimum

Input Audio (Level Meter) Function:

Function: responds to level of PCM audio data within Dante receiver (input) channel

Colors and Level Thresholds: green lights at –40 dBFS (range of –40 dBFS to –16 dBFS); yellow lights at –15 dBFS (range of –15 dBFS to –6 dBFS); red lights at –5 dBFS (range of –5 dBFS to 0 dBFS)

Intensity: increases within each level range

Connectors:

Ethernet: RJ45 jack

USB: type A receptacle (used only for updating application firmware)

Configuration: requires Studio Technologies' STcontroller software application

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

Environmental:

Operating Temperature: 0 to 50 degrees C (32 to 122 degrees F)

Storage Temperature: –40 to 70 degrees C (–40 to 158 degrees F)

Humidity: 0 to 95%, non-condensing

Altitude: not characterized

Dimensions (Overall):

3.25 inches wide (8.26 cm)
4.14 inches high (10.52 cm)
3.08 inches deep (7.82 cm)

Dimensions (Rear Depth):

1.17 inches (2.97 cm)

Weight: 0.40 pounds (0.18 kg)

Mounting: intended for installation in a US-standard 2-gang electrical box (four 6-32 thread machine screws included). Polycarbonite lens compatible with 1-Decora® opening.

Included Accessory: Leviton® S746-N wall plate, 2-gang, 1-Decora opening, centered, 302 stainless steel material with protective film, 4 ⁵⁄₁₆-inches wide by 4 ½-inches tall (two 6-32 thread mounting screws included)

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

Appendix A–STcontroller Default Configuration Values

Configuration – Control Source: STcontroller On/Off Button

Configuration – Minimum On Time: Follow Source

Configuration – On Action: Continuous

Configuration – On Intensity: High
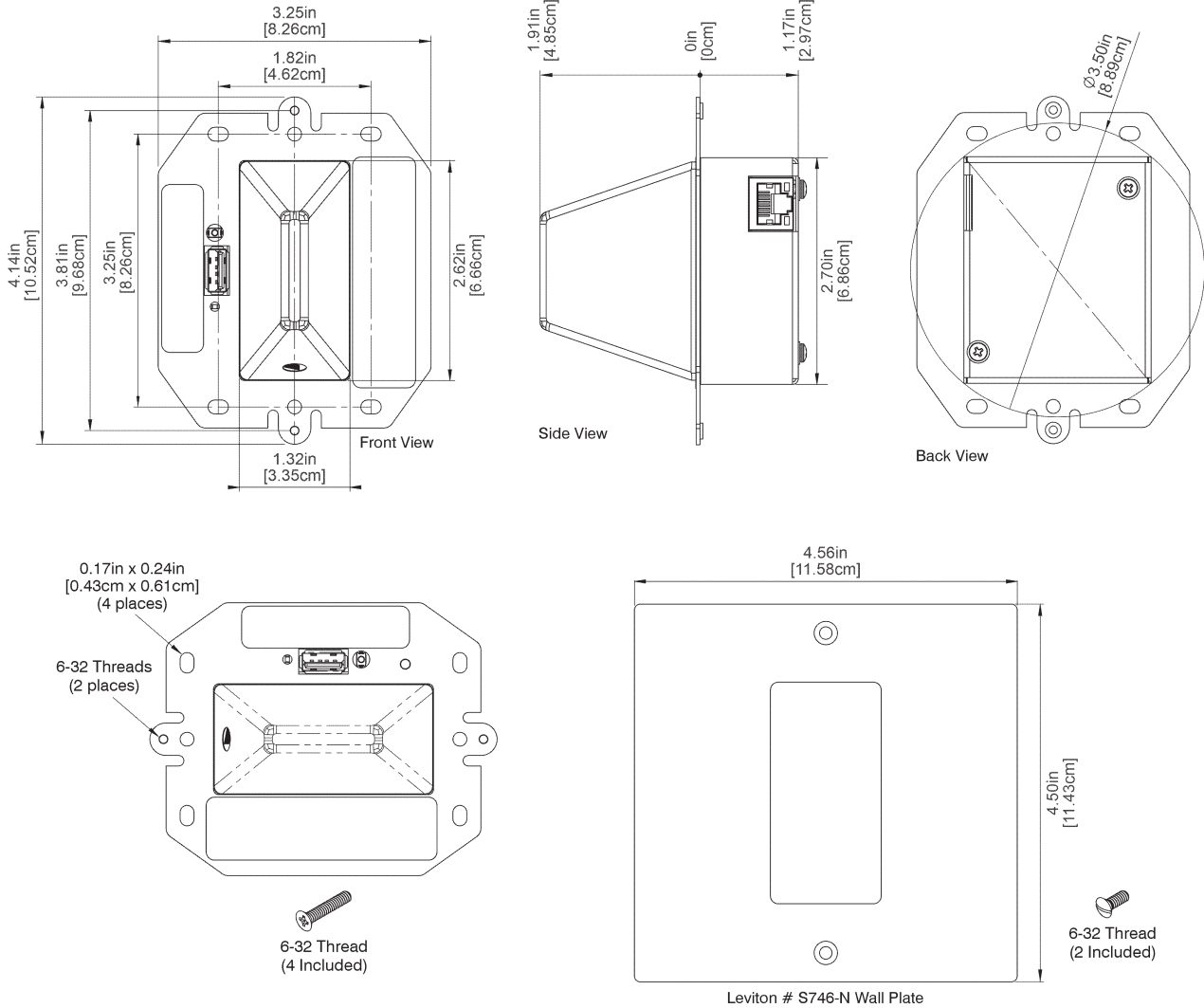
Configuration – On Color: Red

Configuration – Off Intensity: Medium

Configuration – Off Color: White

On/Off Button – Indicator: Off

Appendix B–Dimensions

Front View

Side View

Back View

0.17in x 0.24in
[0.43cm x 0.61cm]
(4 places)

6-32 Threads
(2 places)

6-32 Thread
(4 Included)

6-32 Thread
(2 Included)

Leviton # S746-N Wall Plate

Recommended for use with any commercial electrical box, low-voltage device box, or suitable panel/drywall mounting bracket in a 2-gang configuration.

Recommended for horizontal or vertical wall mounting as shown. May also be mounted to ceilings.

Not recommended for use with gangable switch boxes or mounting methods with less than 1.5" usable depth.

Not recommended for outdoor use.

Appendix C–UDP Packet Structure

Model 392 Remote Settings

Setting ID	Setting Name	Setting Values
0x19	Active State On/Off	0x00 - Off 0x01 - On

Command Structure (without UDP header):
```
<start> <cmd_system> <settings_len> <setting_id> <setting_val>
[<setting_id>, <setting_val>...] <crc8>
```

In this case, the command structure for setting On State enabled is:
```
0x5A 0x09 0x02 0x19 0x01 0x10
```

Usage

STcontroller communicates with the Model 392 Visual Indicator Unit using Audinate's Packet Bridge protocol which allows an OEM's CPU to receive UDP datagrams via the corresponding Dante interface. A reliable implementation of Packet Bridge requires the use and licensure of Dante API, however UDP datagrams sent to the appropriate address will suffice in this case. In order to construct a UDP message a 24-byte header must be concatenated with data specific to the device being transmitted to. If a packet sniffing tool is used to analyze messages sent to a device from STcontroller the header will be similar to the example below, but the example header can also be used in your own application. The example header is as follows:
```
0xFF 0xFF 0x00 <msg_len> 0x07 0xE1 0x00 0x00 0x90 0xB1 0x1C 0x5B 0xD2
0x85 0x00 0x00 0x53 0x74 0x75 0x64 0x69 0x6F 0x2D 0x54 [data]
```

`msg_len` is the combined length of the header and data and is the only modifiable value in the example header.

Following the header is the unique device data. It is indicated with the Studio Technologies' start byte `0x5A`. It is typically followed by the specific command ID (`cmd_id`), its data length (`cmd_data_len`), setting ID (`setting_id`) and value (`setting_val`), and finally a crc (`crc8`). Here is the typical structure:
```
0x5A <cmd_id> <cmd_data_len> [<setting_id>, <setting_val>, ...] <crc8>
```

Note that multiple settings can be set at the same time if desired. `crc8` is calculated as CRC-8/DVB-S2 and uses the Studio Technologies' start byte through the command data in its calculation.

The example command below is for turning on the visual indicator on the Model 392 Visual Indicator Unit. The setting ID and value can be found in the table above.
```
0x5A 0x09 0x02 0x19 0x01 0x10
```

If combined with the necessary header the complete message to be sent to the Model 392 is:
```
0xFF 0xFF 0x00 0x1E 0x07 0xE1 0x00 0x00 0x90 0xB1 0x1C 0x5B 0xD2 0x85
0x00 0x00 0x53 0x74 0x75 0x64 0x69 0x6F 0x2D 0x54 0x5A 0x09 0x02 0x19
0x01 0x10
```

The message must be sent to the device's Dante IP address on port 8700. This can be found using Dante Controller. It is suggested that only one device should be transmitted to at one time and that there should be at least 200 milliseconds between each transmitted message to allow for ample processing time.

This approach is slightly different from STcontroller which creates a subscription to the device in order to transmit the message more reliably. The device will always acknowledge a received message, however this is to a multicast address.