BRIDGE NDI 3G

Conversion Gateway Appliance

Installation and Operation Guide

AJA
VIDEO SYSTEMS

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Contacting AJA Support

When calling for support, have all information at hand prior to calling. To contact AJA for sales or support, use any of the following methods:

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Support Email	support@aja.com
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Chapter 1 – Introduction

Overview

BRIDGE NDI 3G is a 1RU gateway offering high density conversion to and from SDI to NDI and NDI to SDI for UltraHD/4K, HD, and SD signals. Designed to drop into any existing NDI or SDI workflow as a plug and play appliance, BRIDGE NDI 3G is easy to deploy and administer.

BRIDGE NDI 3G brings immense conversion power and flexibility, fully controllable remotely for AV use, security and surveillance, broadcast, eSports, entertainment venues, and a wide range of other facilities needing high quality, efficient NDI encode and decode. Set and forget, or use more dynamically as project needs dictate.

BRIDGE NDI 3G can support workflows across:

- 16 channels of HD and SD
- 4 channels of 4K/UltraHD
- 8 V+K channel pairs
- combinations of the above

NOTE: Total channel count and/or supportable rates may be reduced in some situations, due to network conditions, video processing load, and other parameters.

NOTE: In this manual and the BRIDGE NDI 3G UI the term 'HD' can refer to all SDI formats from SD to 3Gb.

Features

- 3G-SDI I/O supports 16-channels of SD through 3Gb or 4-channels of 4K/ UltraHD up to 60p as standard
- Bidirectional encode/decode SDI to NDI, NDI to SDI, with a combination of SD through 3Gb or 4K/UltraHD video
- Confidence monitoring
- Supports both NDI 5 and NDI 4
- Discovery Server Compatible
- Selectable NDI encode profiles for 8-bit and 16-bit, 4:2:2
- Buffer controls for low latency tuning
- Video and Key support
- Progressive and Interlaced video support
- 16-channel audio support
- Timecode support across VITC1, VITC2, LTC, and Time-of-Day
- Remote WebUI or local GUI for easy administration, control, and operation
- Turnkey 1RU rackmountable, enterprise-class form factor
- Dual 10GigE interface for control and transport
- Dual power supplies for critical application redundancy
- Three year warranty

Real World Applications

The BRIDGE NDI 3G's 1-RU high SDI channel density chassis, simultaneous SDI to NDI and NDI to SDI conversion, wide variety of supported SDI formats, and intuitive UI capabilities makes it ideally suited for the many real world applications.

AV

- eSports
- Conference Video
- Display walls (events, buildings)

Broadcast

- Production Control Rooms
- In-studio
- Temporary Production/Post expansions (rapid deployment of extra capability with little outlay or complexity)

Corporate

- MS Teams
- Video Communications

Production

- On-set monitoring distribution

Post

- Share SDI channels between numerous NDI enabled NLEs
- Cost effective video monitoring

Technical Description

Engines and Banks

Engines control whether BRIDGE NDI 3G is converting SDI to NDI, or NDI to SDI, whereas Banks control the configuration of the Inputs or Outputs (Channels or Groups).

BRIDGE NDI 3G's internal signal processing is structured as two Engines and four Banks. Engine A is associated with Banks 1 and 2, while Engine B is associated with Banks 3 and 4. Each Bank has four bi-directional SDI channels with corresponding small Din 1.0/2.3 slip-on connections on the rear of the chassis.

- Bank 1 consists of Channels 1, 2, 3, 4 (Engine A)
- Bank 2 consists of Channels 5, 6, 7, 8 (Engine A)
- Bank 3 consists of Channels 9, 10, 11, 12 (Engine B)
- Bank 4 consists of Channels 13, 14, 15, 16 (Engine B).

Each Engine also has an external reference connector.

Each Engine can be configured to either convert SDI to NDI, or NDI to SDI. Each Bank determines the configuration of the Inputs or Outputs (Channels or Groups) of that Bank's rear SDI connectors.

Grouping Channels within a Bank

Each Bank can be independently configured for one of the following:

- Four separate HD Inputs or Outputs
- Two Video and Key Input or Output pairs (two groups)
- One 4K/UltraHD Input or Output (one group)

NOTE: Groups cannot span multiple Banks.

Input and Output Configurations

If both Engines are set to convert in the same direction (SDI to NDI, or NDI to SDI), then all four Banks will be available for a total of up to 16x individual HD channels, 4x 4K/UltraHD Groups, or 8x V+K Groups, or some combination thereof.

If one Engine is set to convert SDI to NDI, and the other Engine is set to convert NDI to SDI, then there will be two Banks available in each direction, for a total of up to 8x individual HD channels In and Out, 2x 4K/UltraHD Groups In and Out, or 4x V+K Groups In and Out, or some combination thereof.

Network Capabilities

BRIDGE NDI 3G ships configured for DHCP operation.

Media vs Control Networks

BRIDGE NDI 3G is equipped with two internal Network Interface Cards (NICs), each 10GigE capable, supporting simultaneous operation over two separate networks (Media and Control).

The Media Network can be a dedicated NDI network that carries just the NDI traffic. If you are working in a single network environment, you can use the Media Network for both NDI traffic and system control.

Using a separate Control Network allows you to connect your BRIDGE NDI 3G to a general facility network without the concern of swamping that network with high bandwidth NDI signals. This method allows you to safely access BRIDGE NDI 3G from anywhere in your facility or Virtual Private Network (VPN).

Unicast Supported

BRIDGE NDI 3G supports Unicast. Multicast is not supported.

NDI Support

BRIDGE NDI 3G is compatible for NDI input (receive) and output (transmit) with both NDI 4.x and NDI 5.x software/hardware. For NDI input, NDI HX is also supported.

Chassis Description

The BRIDGE NDI 3G has a 1RU height rack mountable chassis with hot swappable redundant power supplies.

Chassis Front

Figure 1. BRIDGE NDI 3G Chassis Front View

Cooling Airflow Entrance   Power Switch
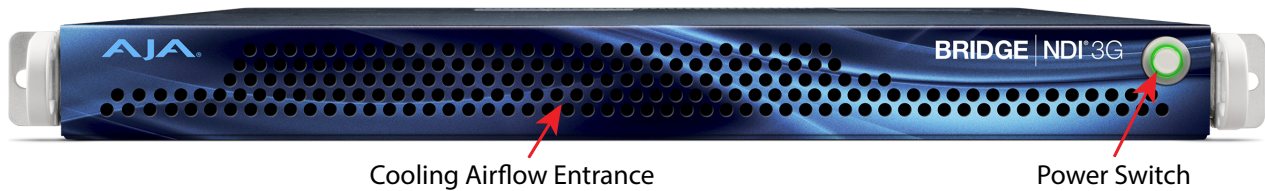
Chassis Power Button

The main power switch is used to apply or remove power from the power supply to the system. Turning off system power with this button removes the main power but keeps standby power supplied to the system.

Chassis Rear

Figure 2. BRIDGE NDI 3G Chassis Rear View

Redundant AC Power Supplies — Reserved for IPMI — SDI Connectors (5, 6, 7, 8) — SDI Reference BNC Inputs (R) — SDI Connectors (12, 11, 10, 9) — Unused

Cooling Airflow Exit Rear and Top Panels — USB Ports (4) — SDI Connectors (1, 2, 3, 4) — SDI Connectors (16, 15, 14, 13)

Unused — Media Active RJ-45 Ethernet (2) — Control — VGA Monitor Port
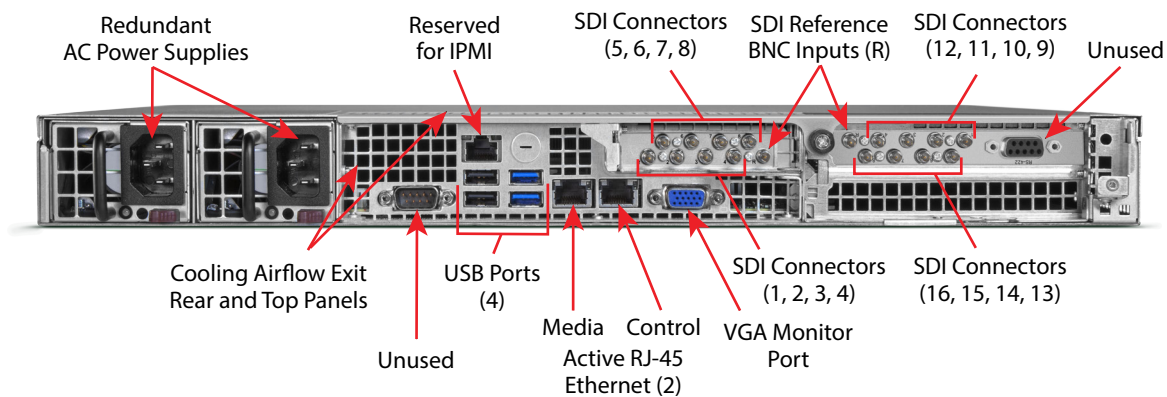
Connectors

BRIDGE NDI 3G is equipped with:

- Two USB 3.0 (blue) connectors
- Two USB 2.0 (black) connectors
- Two 10Gb RJ-45 Ethernet connectors
- One IPMI (Intelligent Platform Management Interface) RJ-45 connector
- One VGA monitor port
- Two external Reference ports (labeled R)
- 16 bi-directional 3G-SDI Din 1.0/2.3 connectors

Cabling

NOTE: *SDI connections, including input or output signal direction, are affected by the current BRIDGE NDI 3G's system configuration settings.*

The SDI connectors on the cards in the chassis are associated with the following Engines, Banks, and Channels (see *Table 1*). Each Engine can be configured for either SDI input or SDI output.

Table 1. SDI Connector and Channel Numbers

Engine A (left)			Engine B (right)		
Connector	**Channel**	**Bank**	**Connector**	**Channel**	**Bank**
1	01	1	1	09	3
2	02		2	10	
3	03		3	11	
4	04		4	12	
5	05	2	5	13	4
6	06		6	14	
7	07		7	15	
8	08		8	16	
R (left)	Engine A (R1) Reference In		R (right)	Engine B (R2) Reference In	

Figure 3. BRIDGE NDI 3G SDI Cabling Guide, Channel Numbers Shown
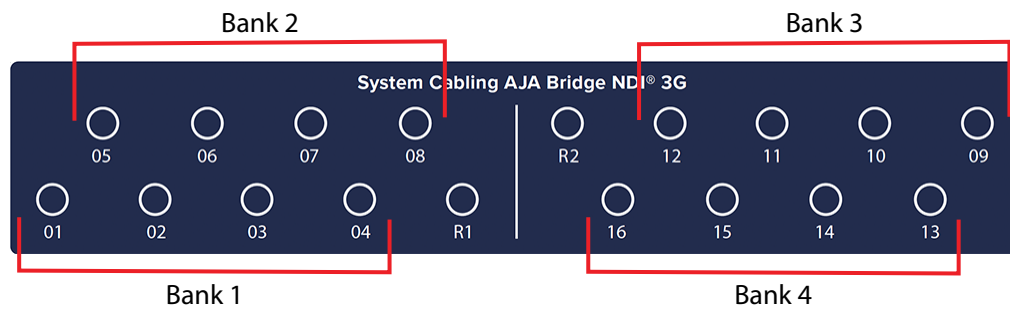
NOTE: The SDI rear connectors are actually silk screened 1-8-R, and R-8-1 (identical cards installed in reversed orientation).

Rear Panel Power Supply LEDs

On the rear of each power supply module, an LED indicates its status as follows.

- Solid Green: When illuminated, indicates that the power supply is on.
- Solid Amber: When illuminated, indicates the power supply is plugged in and turned off, or the system is off but in an abnormal state.
- Blinking Amber: When blinking, this system power supply temperature has reached 63°C. The system will automatically power-down when the power supply temperature reaches 70°C and restarts when the power supply temperature goes below 60°C.

BRIDGE NDI 3G User Interface Displays

The BRIDGE NDI 3G can be controlled remotely (Web interface), or locally (Kiosk interface). These interfaces are essentially the same, with the following differences.

Remote Web Interface

The Web Browser interface provides picture confidence-monitoring via the I/O screen. Audio confidence monitoring (other than visual level meters) requires the use of a separate utility such as NewTek NDI Studio Monitor.

Figure 4. Example I/O Screen with SDI Encode and NDI Decode

Local Kiosk Interface

The local Kiosk interface is dedicated to BRIDGE NDI 3G and is not a web browser. This interface requires connecting a customer supplied VGA Monitor, USB Keyboard, and USB mouse directly to the rear of the chassis.

The local Kiosk interface also provides picture confidence-monitoring and visual level meters via the I/O screen. Actual audio monitoring can be accomplished using the supplied USB sound card, with any additional tools.

Keyboard shortcuts available only with the Kiosk interface include:
- Space Bar: Exit from Splash Screen to BRIDGE NDI 3G User Interface
- CTRL+R: refresh screen
- ALT+F4: logout and return to the splash screen (saves system resources)
- ALT+Left: Go back to previous page (useful after selecting Product and Support buttons)

Chapter 2 – Installation

Overview

Quick Start Guide Login Credentials

BRIDGE NDI 3G ships with a Quick Start Guide when it comes from the factory. This physical document contains the login information for accessing BRIDGE NDI 3G for the first time. Do not discard the unique Quick Start Guide, as these credentials will be required following any future Factory Reset. If you do not have this Quick Start Guide, you will need to contact AJA tech support.

If you are receiving a system that has been used elsewhere and you do not have the password that may have been applied, you can perform a Factory Reset and then use the factory supplied password from the Quick Start Guide to regain access to the system for set up.

Hardware Installation Overview

An initial BRIDGE NDI 3G installation includes the following steps:

- Unpack the shipping box.
- Mount the physical chassis as desired, using the provided sliding rails. Cooling airflow enters the chassis from the front, and exits from the rear and top panels. Do not obstruct these air vents.
- Connect the two BRIDGE NDI 3G power cords to mains AC. For redundancy, use both power supplies and connect them to separate branch circuits so that the BRIDGE NDI 3G will continue to operate even if a circuit breaker opens on one branch.
- Power up the BRIDGE NDI 3G chassis.
- Connect the BRIDGE NDI 3G to your local network(s) using one or two RJ-45 Ethernet cables, depending on your facility network architecture.
- Establish BRIDGE NDI 3G network communications, using either a separate network connected computer (DHCP), or with a customer supplied VGA monitor, keyboard and mouse (and, if desired, the provided USB sound card).
- Login to your BRIDGE NDI 3G for the first time, using the credentials in the BRIDGE NDI 3G Quick Start Guide document included in your shipping box.
- Connect the 1.0/2.3 DIN to full-size BNC adapter cables to the BRIDGE NDI 3G input/output connectors.
- Connect the BRIDGE NDI 3G inputs/outputs to your video sources and destinations as required. Subsequent system configuration may require changing these physical connections.

The BRIDGE NDI 3G system will then be ready to be configured to transcode SDI to and/or from NDI for transport over the network (see *"Initial Workflow Configuration" on page 15*).

Hardware Installation Details

Unpacking

As you unpack the shipping box, carefully examine the contents. Ensure you received everything and that nothing was damaged during shipment. If you find any damage, immediately notify the shipping service and supply them with a description of the damage. AJA will repair or replace damaged items.

If you find shipping damage, contact your AJA dealer or distributor for details on how to have your BRIDGE NDI 3G repaired or replaced.

NOTE: *Save packing materials and the shipping box. If your BRIDGE NDI 3G ever requires service or you move your system, use the packaging materials and box for safe shipment.*

Rack Mounting the Chassis

Install the BRIDGE NDI 3G chassis into a standard 19-inch wide equipment rack, allowing space for cooling airflow. The chassis occupies only one vertical rack unit.

Two rack rail assemblies are included in the rack mounting kit. Each assembly consists of two sections: an inner fixed chassis rail that secures directly to the server chassis and an outer fixed rack rail that secures directly to the rack itself.

The rail assemblies are shipped with rack adapters installed for use with IT (square hole) style rack frames. For IT racks, simply slide the unit into place, as the rails will lock automatically. For use with a standard round hole rack frame, you will need to remove the adapters using a small Phillips head screwdriver.

Connecting SDI Sources and/or Destinations

BRIDGE NDI 3G is equipped with 18 Din 1.0/2.3 SDI connectors. Din to BNC adapter cables with push on/off mini-connectors are provided with product shipment. Connect the adapters to the eight SDI ports, and then connect your SDI input or output signals as required for your intended workflow (see *Table 1 on page 11*).

External Reference

External Reference In Din 1.0/2.3 connectors (R1, R2) are also available for each Engine.

Networking

The BRIDGE NDI 3G ships with both active LAN ports configured for DHCP operation.

Initial Network Connection to BRIDGE NDI 3G

Connecting to your BRIDGE NDI 3G for network and other configuration can be accomplished remotely with a network connected computer, or using a directly connected VGA monitor, keyboard, and mouse.

Network Environment

BRIDGE NDI 3G must be configured to match your network environment. Procedures to do so vary, depending on whether you will be using two networks or one, and whether you will be using DHCP and/or Static IP addressing.

NOTE: *If you are unsure of the correct IP Address settings, consult with your network administrator.*

BRIDGE NDI 3G can support two simultaneous network connections, one designed for Media transfer (Network 1) and the other for BRIDGE NDI 3G Control (Network 2). Both network connections are 10 Gig capable.

While it is possible to use just the Network 1 connection for both purposes, best practice is to use separate networks. This lets you remove high bandwidth NDI traffic from the network used for system control, and allows you to access BRIDGE NDI 3G from anywhere in your facility or VPN without worrying about exceeding that network's capacity.

Media (Network 1)

The Media network is used for incoming and outgoing media (NDI) signal traffic. Regardless of your workflow, whether receiving NDI for decode to SDI, or ingesting SDI for encode to NDI, a connection to the Media network is required. BRIDGE NDI 3G supports NDI versions 4 and 5, and can also use an NDI Discovery Server.

AJA recommends using a 10Gb Media network, as a 1Gb network can quickly become oversubscribed and result in significant impact to signal health.

You can also use the Network 1 Ethernet port for network control of the BRIDGE NDI 3G device. In this case the Network 2 port is unused.

Control (Network 2)

The Control network can be used to control the BRIDGE NDI 3G device from a remote location. Using a separate Control network lets you connect to an existing facility network without sending NDI signals over it.

NOTE: *The Control Network 2 cannot be used for media traffic.*

Wireless Workflows

You can set up a wireless router to your media network in order to use an iPhone NDI camera app wirelessly. You can also wire a control switch to a wireless router so you can monitor the BRIDGE NDI 3G from a wireless laptop.

Initial Workflow Configuration

Overview

After initial installation and network configuration, the steps involved in making the BRIDGE NDI 3G fully operational include the following:

- Determine workflow
- Choose conversion directions (SDI to NDI, NDI to SDI)
- Determine any Bank groupings

- Connect the BRIDGE NDI 3G inputs/outputs to your video sources and destinations as required
- Choose any NDI sources
- Edit labels as appropriate
- Configure video and audio monitoring
- Logout, Set and Forget

Initial Configuration Testing

To monitor NDI outputs from BRIDGE NDI 3G, use an NDI MultiViewer or other similar application on a separate host system on the same network.

To monitor SDI outputs from BRIDGE NDI 3G, connect the rear BNC connectors to an SDI Monitor or MultiViewer or SDI Router.

To monitor Audio directly from BRIDGE NDI 3G locally, connect the USB sound card (supplied). Unlike the SDI and NDI I/O, the included USB sound card supports only stereo/two-channel audio monitoring, but you can select which channel pair to monitor.

BRIDGE NDI 3G System Administration

Accept EULA

On initial system startup, you will need to accept the AJA EULA (End User License Agreement). The EULA is presented only on the first time booting up the system following delivery, or following a factory reset. Once accepted, the EULA will no longer be presented upon boot up.

Admin Password

From the User Management/Administration Login Screen, you can change the admin password.

Figure 5. User Management Screen, Changing Admin Password
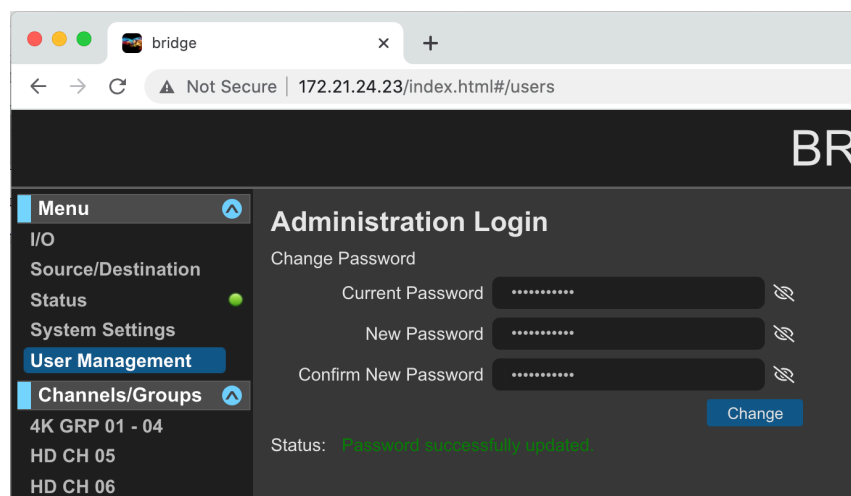
To Change the Admin Password

1. Enter the current password in the Current Password field.
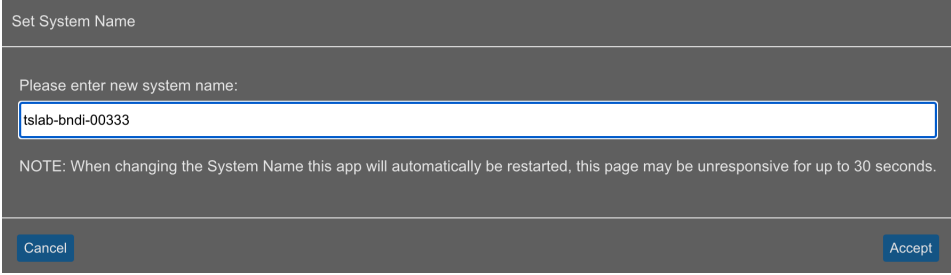
2. Enter your desired new password (up to a maximum of 22 characters) in the New Password field.

3. Enter your desired new password again in the Confirm New Password field.

4. Select Change. A Sign in prompt displays.

5. Enter your current user name and the new password that you just created.

6. Select Sign In. The User Management screen refreshes with the Status "Password successfully updated."

System Name

System Name provides up to 44 characters for giving the BRIDGE NDI 3G system a unique name. A reboot will be required for this to take effect.

The System Name can be changed from the System Settings Screen. Your BRIDGE NDI 3G will come from the factory with a unique System Name, but your organization may wish to assign it another name according to your internal naming schema.

Figure 6. Set System Name Pop-up Window

Set System Name

Please enter new system name:

tslab-bndi-00333

NOTE: When changing the System Name this app will automatically be restarted, this page may be unresponsive for up to 30 seconds.

Cancel   Accept

To Change the System Name

1. Navigate to the System Settings Screen by clicking System Settings in the left navigation menu. The System Settings Screen displays.

2. Next to the System Name field, click Change. The Set System Name pop-up window displays.

3. Enter the name you want to use for your system. You must use at least one character (a-z, 0-9, dashes accepted but no spaces). The System Name must be limited to 22 characters total.

After changing the System Name, the unit will disconnect and may be unresponsive for a few moments. It is recommended to reboot after changing the System Name.

System Date/Time

System Date and Time can be set to Automatic or Manual.

Automatic - BRIDGE NDI 3G will seek date and time via the NTP server(s) specified. BRIDGE NDI 3G will use UTC time, unless a different Time Zone is specified. If the connection to the NTP server is lost, BRIDGE NDI 3G will continue keeping time by itself until the connection is restored and a new sync can take place.

Figure 7. System Date/Time Pop-up window, Automatic Configuration

Date and Time Settings

Time Zone: (UTC) Coordinated Universal Time

Configuration: Automatic

Primary NTP Server: time.aja.com

Secondary NTP Server:

Cancel   Apply

Manual - BRIDGE NDI 3G date and time are specified by the user. If BRIDGE NDI 3G was previously connected under the Automatic setting to an NTP server and current date and time were obtained, then upon switching to Manual, BRIDGE NDI 3G will continue keeping time by itself. Click Apply to enter Manual mode while leaving the time as set by NTP. This could be a quick way to set up units that will be deployed in a secure/offline environment.

Figure 8. System Date/Time Pop-up window, Manual Configuration

Date and Time Settings

Time Zone: (UTC) Coordinated Universal Time

Configuration: Manual

Set Date and Time:

Cancel   Apply

Alternatively, after selecting Manual, activate the "Select Time and Date" button, and proceed to set date and time manually.

Figure 9. System Date/Time Pop-up window, Manual Configuration selected with Set Date and Time option enabled

Date and Time Settings

Time Zone: (UTC) Coordinated Universal Time

Configuration: Manual

Set Date and Time:

Date: Apr   7   2022

Time: 12 : 33 : 00

Cancel   Apply

When running under Manual date and time settings, BRIDGE NDI 3G will not seek out an NTP server, and will be unaffected by the presence or absence of Internet connectivity.

Factory Reset

Performing a Factory Reset has the following results:

- All Users are logged out (except admin)
- Admin Login and Password is reset (to details on physical Quick Start Guide that shipped in the box with your BRIDGE NDI 3G system)
- System Name is reset

- EULA/Licenses must be re-agreed to upon reboot
- Network settings are purged and reset to default (i.e. DHCP)
- Operator Video Refresh Rate Reset
- Custom SDI Ch/Grp Labels Reset
- NDI Favorites Erased
- Channels/Groups revert to HD
- Channels revert to encode (SDI->NDI)

Performing a Factory Reset

NOTE: *A factory reset can be performed only from the Kiosk system, not from a remote browser system.*

1. Shut down your BRIDGE NDI 3G unit.

2. Start up your unit again.

3. Immediately start tapping the space bar (once or twice per second) until you see the boot selection screen that has "Release," "Safe boot" and "Factory Reset."

4. Select "Factory Reset" and hit Return.

5. Enter "Yes" and Return when prompted.

Updating Software/Firmware

From the Software/Firmware section of the System Settings Screen, you can update your software. Two methods for updating software/firmware are available:

- Updating from a Remote System
- Updating Locally from a USB Connected Storage Device

Download the Latest BRIDGE NDI 3G Update

The update can be obtained with a separate Mac, Windows or Linux-based host-system with a network interface and access to the Internet. If you wish to apply the update from the same system you are using to download the update package, it will need to be connected to the same network as BRIDGE NDI 3G.

1. From a web browser, navigate to:

   https://www.aja.com/products/bridge-ndi-3g#support

2. Under the Software heading, select the BRIDGE NDI 3G package for download. The current and previous releases of BRIDGE NDI 3G will be available on AJA's website.

3. Download the package you require to the separate host-system, connected to the same network as BRIDGE NDI 3G.

Unpack BRIDGE NDI 3G Update

The update downloaded from AJA.com is a "ZIP" file which can be opened with OS tools or third party applications.

4. Extract/unzip the contents of the ZIP file. This will present a folder containing the BRIDGE NDI 3G Product Manual, Release Notes, and the appropriate Software update package.

Updating BRIDGE NDI 3G from a Remote System

1. From the BRIDGE NDI 3G web browser interface, navigate to the System Settings Screen.

2. Under the Software/Firmware heading, select Browse. A navigation window opens.

3. Navigate to the unzipped Software update (*.ajas file) and select it.

4. Click Open. The name of the Software update file displays in the field just below the Browse and Submit buttons.

5. Select Submit. The file uploads to BRIDGE NDI 3G, then the system automatically reboots.

6. Following the reboot, if prompted, login to the system. The update has now been applied.

Updating BRIDGE NDI 3G with a USB Connected Storage Device

1. Copy the downloaded and unzipped update file to a USB drive.

2. Plug the USB drive into a BRIDGE NDI 3G USB port.

3. From the BRIDGE NDI 3G Kiosk Interface, go to the System Settings Screen.

4. Under the Software/Firmware heading, select Browse. A navigation window opens.

5. From the left hand OS navigation menu, go to Run > Media > sda1.

6. Navigate to the unzipped Software update (*.ajas file) and select it.

7. Click Open. The name of the Software update file displays in the field just below the Browse and Submit buttons.

8. Select Submit. The file uploads to BRIDGE NDI 3G, then the system automatically reboots.

9. Following the reboot, login to the system. The update has now been applied.

WARNING: **While updating software, do not remove power.**

Safeboot

BRIDGE NDI 3G has a safety feature where an internal "safeboot" copy of earlier software is retained in the event the update process fails or its software becomes corrupted.

Using Safe Boot mode provides an environment where it is easier to troubleshoot and detect issues.

Entering Safe Boot Mode

1. Shutdown BRIDGE NDI 3G.

2. Start it back up while pressing the space bar repeatedly once or twice per second during the startup process, using a keyboard that is connected via USB to the BRIDGE NDI 3G device.

3. When menu options display, choose Safe boot. The system will proceed to boot up in safe mode.
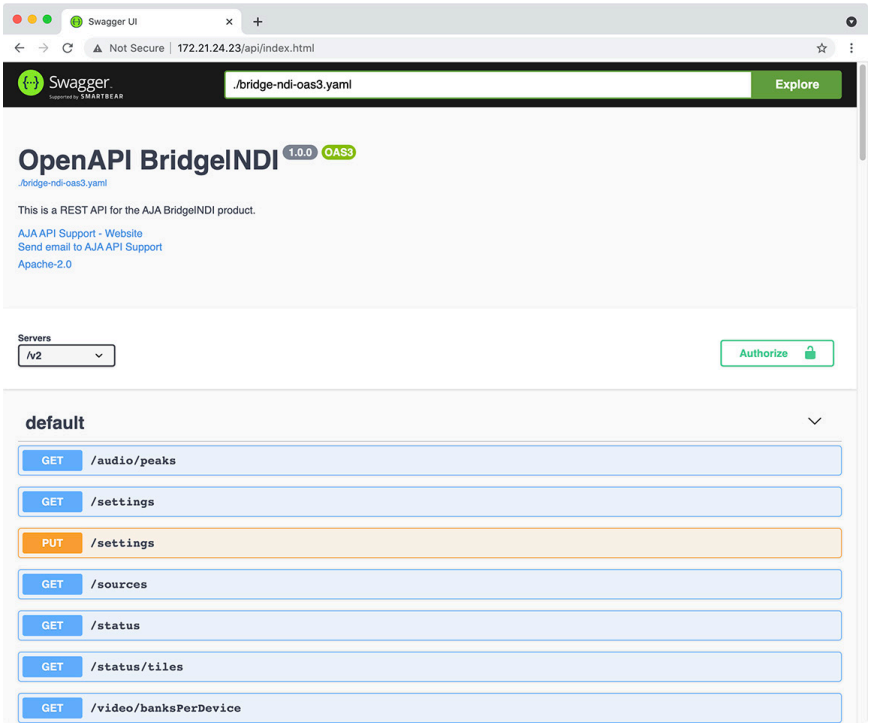
Using REST API

BRIDGE NDI 3G is supported via REST API.

To access the REST API from a remote system, type the IP address of your BRIDGE NDI 3G followed by "/api" into your browser navigation bar:

"<ipaddress>/api"

The swagger UI launches and displays interactive documentation.

Figure 10. REST API Landing Page

Chapter 3 – Operation

Overview

The BRIDGE NDI 3G is designed to operate as an appliance, such that once it is configured it can run continuously without operator intervention. Even if the unit is power cycled, it will reboot, recall its previous settings, and resume its last configured SDI>NDI and NDI SDI conversions and signal routing.

Accessing the BRIDGE NDI 3G UI may only be necessary if your workflow's signal requirements change, or the unit needs to operate on a different network.

Reconfiguring a BRIDGE NDI 3G involves the following steps:
- Access the BRIDGE NDI 3G UI
- Choose conversion directions (SDI to NDI, NDI to SDI)
- Determine any Bank groupings
- Connect the BRIDGE NDI 3G inputs/outputs to your video sources and destinations as required
- Choose any NDI sources
- Edit labels as appropriate
- Configure video and audio monitoring

Accessing the BRIDGE NDI 3GI User Interface

After initial system configuration, access to the BRIDGE NDI 3G user interface can be accomplished using either a directly connected VGA monitor, keyboard, and mouse, or with a network connected computer by entering the unit's IP address into a web browser.

Following boot up, the c system will present a login screen. Enter the username and password configured for that system.

NOTE: Contact your network system administrator for your unit's unique user name and password.

To Access the BRIDGE NDI 3G Interface Remotely

For Windows

1. Open Windows Explorer.
2. Navigate to Network.
3. Click Network to enumerate network devices.
4. Search for either "BRIDGE" or the device's Serial Number (see sticker on rear panel, to the left of the 4 USB ports).
5. Double-click on the intended device. Your remote system web browser will launch and display the web GUI for the device.

For macOS

1. Download and install an MDNS browser, such as Discovery, from which you can browse local Bonjour services to discover network devices on a Mac host.

2. Use this method to identify the BRIDGE NDI 3G's IP address. In the example shown below in *Figure 11*, the IP address is 172.21.24.26.

3. Enter the IP address into a browser.

Figure 11. Example of using Discovery to find the IP address
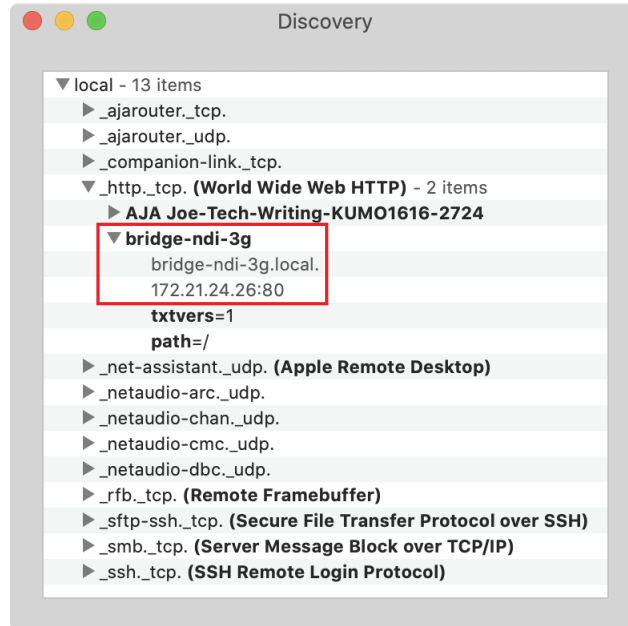
Following local login, BRIDGE NDI 3G will present the Splash Screen.

Figure 12. Initial View of BRIDGE NDI 3G Remote Interface after Login

NOTE: *If using the Kiosk interface, the initial splash screen will lack a screen selection menu. In that case, press the Space Bar to proceed to the BRIDGE NDI 3G UI.*

Once BRIDGE NDI 3G has been accessed and set up locally, the keyboard command ALT+F4 will log you out and return the system to displaying the Splash Screen, meaning that it will be able to devote all of its resources to Video I/O.

It is recommended to leave the system displaying the Splash Screen when not actively accessing the interface locally.

BRIDGE NDI 3G User Interface Description

The BRIDGE NDI 3G interface is the same whether accessed via browser on a remote system, or locally through a monitor connected to the unit's VGA port (Kiosk Interface).

Dynamic User Interface Displays

The BRIDGE NDI 3G user interface is dynamic, allowing you to select which channels to view, and what information is displayed. This is designed to give you the most efficient and effective control of your system.

Methods to control the UI display include:

- Selecting a Menu (I/O, Source/Destination, Status, etc.)
- Selecting a Channel or Group from a Menu
- Using the Control Bar to modify the Monitoring of the I/O menu.
- Modifying a Channel's parameters (direction, grouping)
- Selecting a Channel directly in the Canvas area

These selections affect the information and controls displayed in the Canvas area of the BRIDGE NDI 3G UI.

User Interface Screen Layout

Figure 13. BRIDGE NDI 3G User Interface Example, I/O Screen
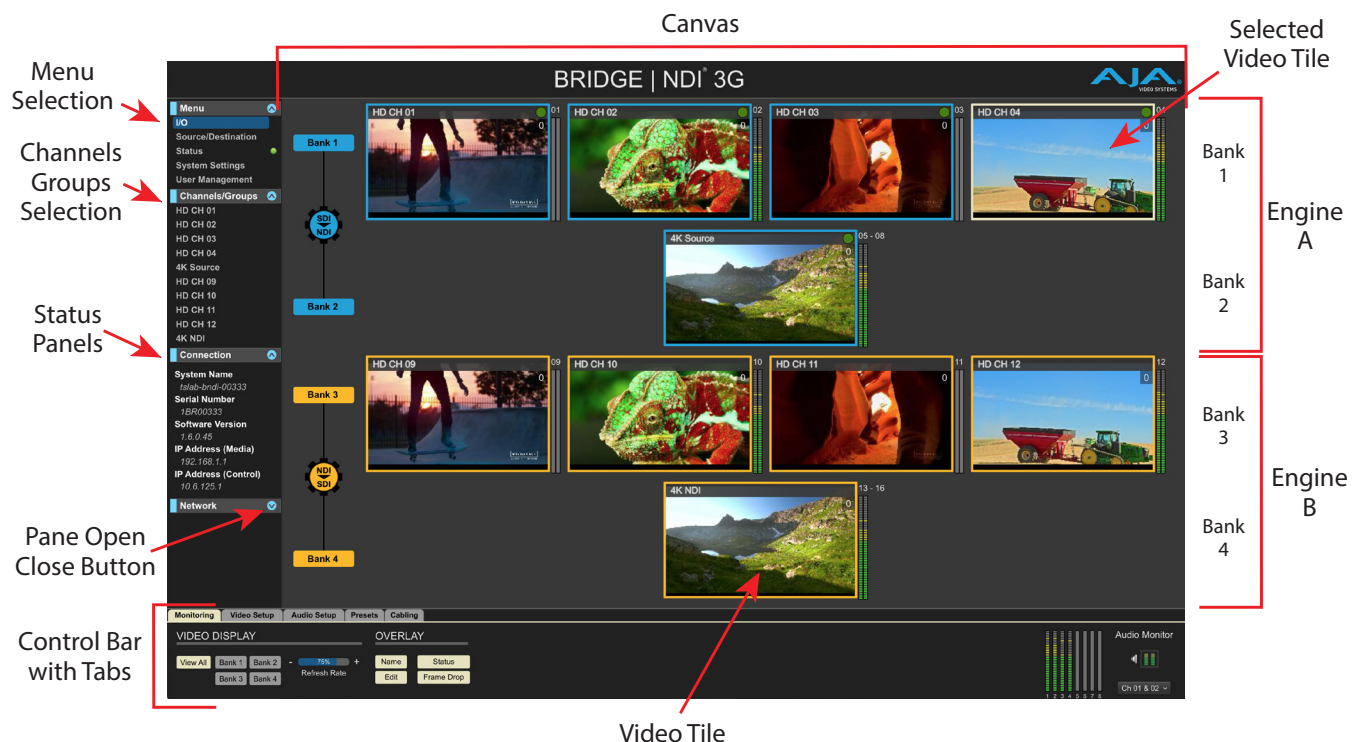
A column on the left provides access to various BRIDGE NDI 3G Menu screens, along with status information panels.

Collapse/expand buttons on the upper right of each menu pane lets you open and close that pane.

The Canvas fills the majority of the screen, displaying confidence monitoring images of signals (Video Tiles), parameter controls or other information, depending on the menu selected on the left.

The Control Bar at the bottom of the screen, with selection tabs, allows different displays in the Canvas area, particularly for the I/O menu, along with other information display controls.

Video Tiles

Each Video Tile on the Canvas displays one video Channel or Group with a dynamic image of the signal being carried (intended for confidence monitoring only). Status and other information can also be displayed on each Video Tile, using the Monitoring Tab on the Control Bar.

All Video Tiles can be shown on the I/O Screen Canvas, offering an easy method for monitoring all of the video channel activity that is flowing through BRIDGE NDI 3G. For everyday operations, you may be able to get most your work done from the I/O Screen.

Confidence Monitoring

The confidence monitoring of each Video Tile can vary in image quality. BRIDGE NDI 3G prioritizes system resources for actual SDI/NDI video signal transport. Confidence monitoring is given lower priority.

BRIDGE NDI 3G supports a graceful link degradation for remote monitoring and control, whereby a progressive reduction in image quality and rate for previews enables continued connectivity and responsiveness. Low bandwidth or highly variable network Internet/network conditions, however, may still result in a "Disconnected" notification until the worst of the network interruption has passed, at which point the connection will be restored.

The quality of the confidence monitor display can also be controlled with the Refresh Rate control on the Control Bar's Monitoring Tab.

Audio Metering

Each Video Tile can show two channels of Audio Metering along its right side. This can be toggled on and off at the far right of the Control Bar, under Audio Monitor, by clicking on the dual channel Audio Meter.

The Control Bar is located along the lower area of the BRIDGE NDI 3G interface. It is split into five tabs: Monitoring, Video Setup, Audio Setup, Presets, and Cabling.

Color Coding

Colors are used to identify the direction of signal conversion. Blue signifies SDI to NDI encoding, while Orange signifies NDI to SDI decoding. When a tile is selected it is outlined in yellow.

Menu Screens

I/O Menu

Figure 14. I/O Menu Screen Example, 16 HD Channels

The I/O Screen displays previews of up to 16 channels of video along with two channels of corresponding audio levels for each channel (see above). Different numbers of channels will be displayed, depending on the current configuration. See *Figure 4 on page 12* for an example of 4 HD and 1 UHD channels configured for SDI encoding and 4 HD and one UltraHD channel for NDI decoding. From this screen, you can easily see the direction and groupings of conversions underway between SDI and NDI. See *"I/O Screen Detailed Description" on page 29*.

The information displayed in this screen can be changed using the Control Bar's Monitoring tab.

Source/Destination Menu

Figure 15. Source/Destination Menu Screen Example
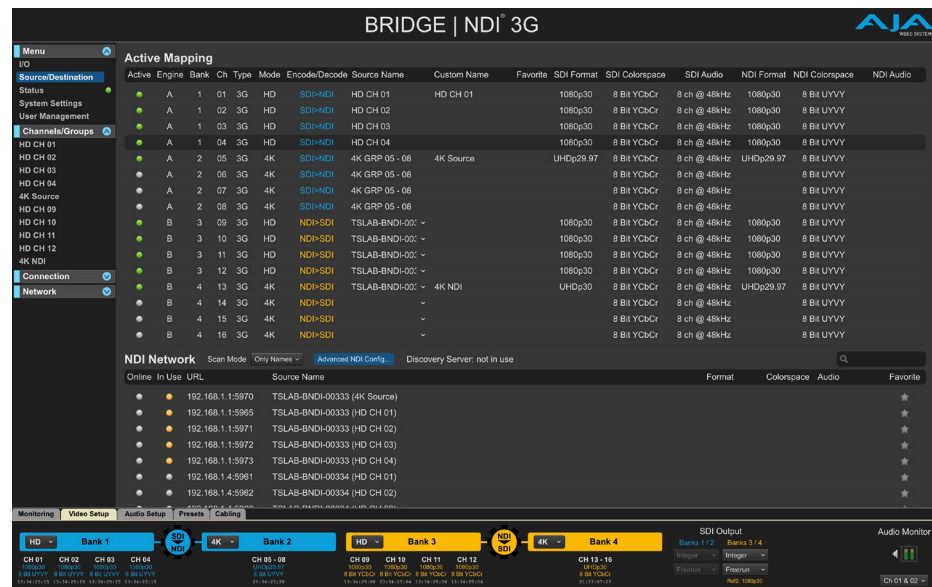
Use the Source/Destination Screen to see what is on your network and what is actively mapped to/from SDI Channels and/or Groups. You can also see what NDI sources are available on your NDI network See *"Source/Destination Screen Detailed Description" on page 32*.

Status Menu

Figure 16. Status Menu Screen Example
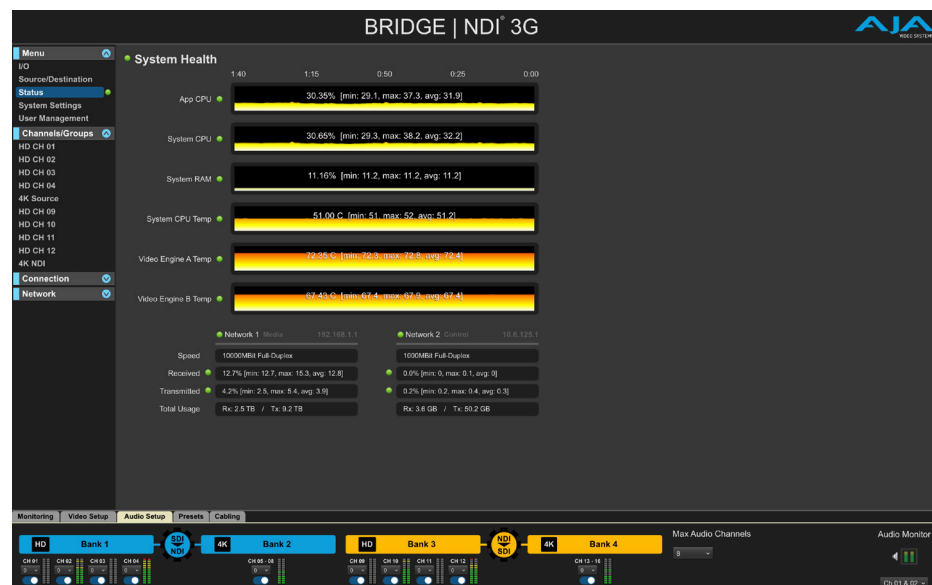
The Status Screen shows you indicators of key aspects of the system's health and network activity. This includes application and system CPU usage and temperature. See *"Status Screen Detailed Description" on page 40*.

System Settings Menu

Figure 17. System Settings Screen Example

The System Settings Screen displays system details such as system name, serial number, system time, system date, system up-time, video engine firmware versions, network settings, and other system details and resources. See *"System Settings Screen Detailed Description" on page 41*.

User Management Menu

Figure 18. User Management Screen Example

Here you can change the Administration Login password.

Channels/Groups Menu

Figure 19. Channels/Groups Screen Example
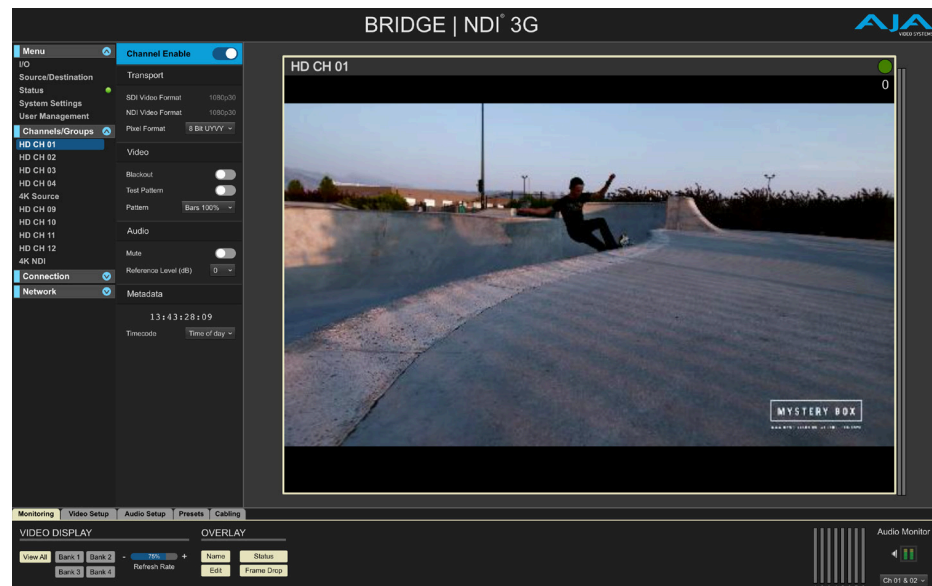
Provides access to deeper controls for individual channels or groups. See *"Channels/Groups Screen Detailed Description" on page 46*.

Status Displays

Status information is available for display the left Menu.

Connection Panel

This panel displays the unit's serial number, software version, and IP addresses for the Media and Control Ethernet ports. This information is contained elsewhere in the BRIDGE NDI 3G interface, with this subset of details gathered here for at-a-glance reference. See *Figure 13 on page 24*.

Network (AJA Devices)

This panel displays any detected AJA devices that are on the same network as BRIDGE NDI 3G. See *Figure 13 on page 24*.

I/O Screen Detailed Description

The I/O Screen displays previews of up to 16 channels of video along with two channels of corresponding audio levels for each source and/or destination.

Variety of Bank Views Available

The I/O Screen by default shows all four Banks.

Figure 20. I/O Screen Example, All Banks, 16 HD Channels

A modified view of the I/O Screen can be presented by using the Bank View buttons which restricts the confidence monitor to one Bank, which may therefore show 4x channels, 1x 4K Group or 2x Video Plus Key Groups.

Figure 21. I/O Screen Example, Bank 2, Four HD Channels
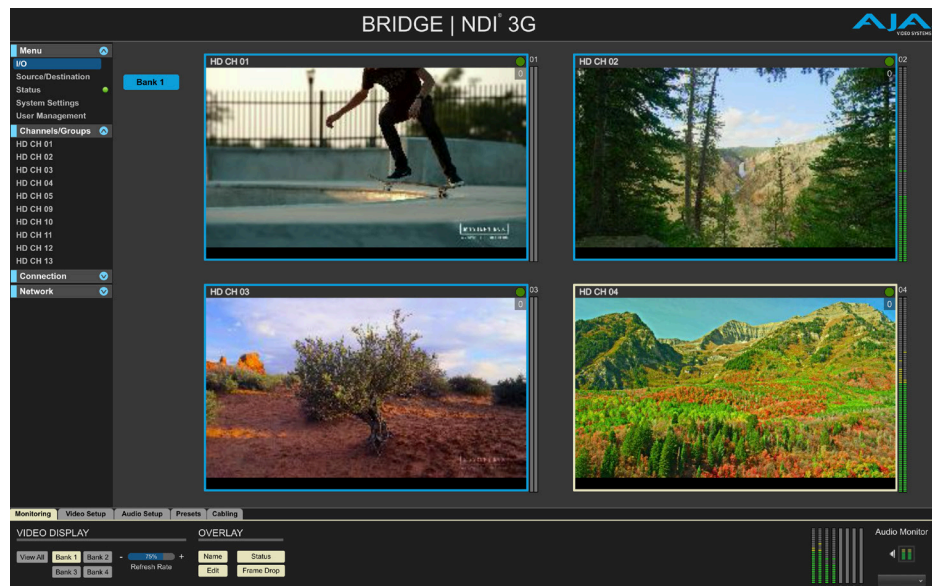
Figure 22. I/O Screen Example, Bank 1, 1 4K Channel

Changing Conversion Direction

When viewing the I/O screen with Control Bar's View All setting, there are also controls presented on the left side of the canvas. Using the Encode/Decode button, you can change the direction of the conversion for an entire Engine; i.e., encoding SDI to NDI (blue), or else decoding NDI to SDI (orange).

Figure 23. Encode/Decode and Decode/Encode Button

These same controls are available in the Video Setup tab within the Control Bar.

Individual Channel or Group Screen

For more intricate tasks, such as choosing 2SI or Square, or muting video but leaving audio live, you can do that from the individual channel or group screen. Double clicking on a Video Tile will take you to that specific individual Channel or Group Screen.

Source/Destination Screen Detailed Description

Figure 24. Viewing the Source/Destination Screen

Use the Source/Destination screen to get organized, to look at what is on your network and to see what is actively mapped from/to SDI C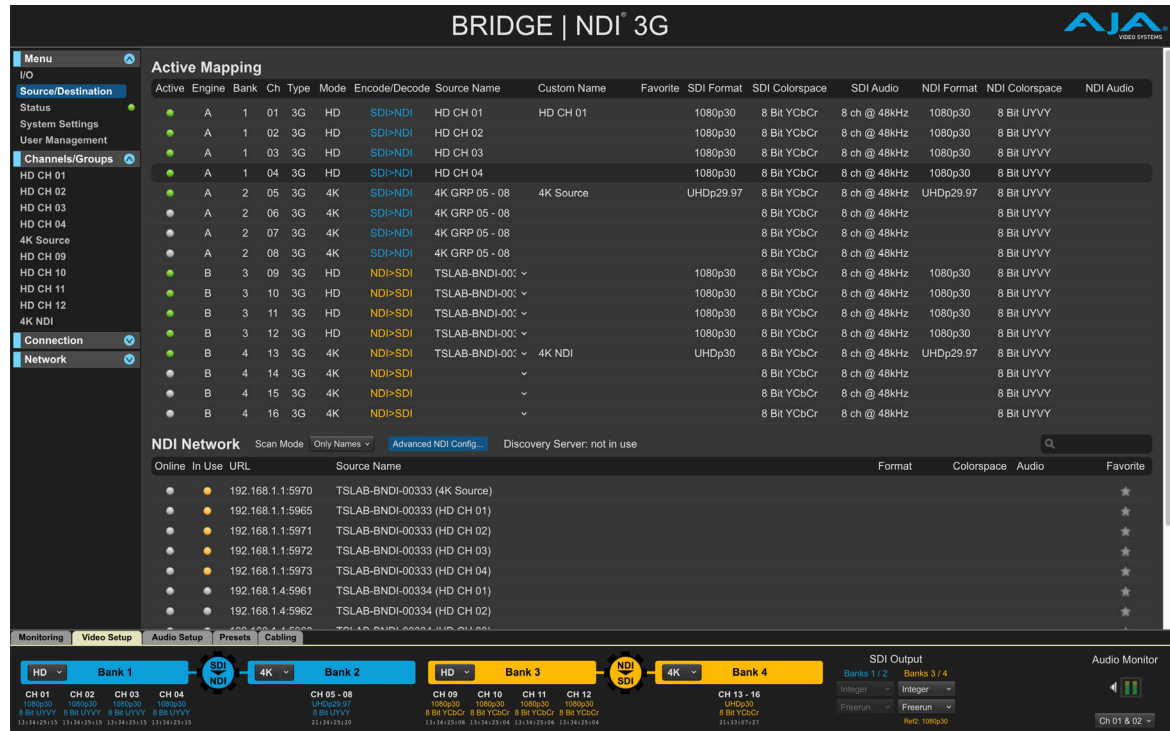hannels and/or Groups. This can be a useful place to determine which NDI sources you want to subscribe to, and it provides intuitive channel configuration.

The Source/Destination Screen is split into two different sections. The upper section, "Active Mapping," and the lower section, "NDI Network."

Active Mapping

The Active Mapping section of the Source/Destination Screen provides a mapping of the signals that are coming in and going out of BRIDGE NDI 3G. It indicates the direction and signal type for each of the 16 channels.

The attributes for sources/destinations are shown across the following columns:

Column Name	Definition
Active	Indicates whether the channel/group has an active signal or not
Engine	Indicates Engine (A or B)
Bank	Indicates Bank number
Ch	Displays the physical channel number for the SDI connectors
Type	Shows the SDI Channel type
Mode	Shows whether the SDI Channel is being used as an HD Channel, or in a 4K Group, or for a V+K Group
Encode/Decode	Encoding SDI to NDI (Blue)
	Decoding NDI to SDI (Orange)

Column Name	Definition
Source Name	For SDI this would be, for example, HD Channel 01
	For NDI, this might be a string of numbers and/or letters
	NOTE: When a Bank is grouped, then its constituent channels lose their source names HD Channel 01, 02, 03, 04 and instead the entire group is now entitled 4K Group 01. This will be shown on the Video Tile, unless a Custom Name has been entered/applied.
Custom Name	Instead of relying on the Source name, the Custom name can be used to help operational efficiency. Under the Custom Name column, you can edit channel names to match your naming conventions or to best support your unique installation. Will be displayed instead of the Source Name when "labels" are activated using the Control Bar Monitor Tab. If populated, then this is the name shown in the Video Tile.
Favorite	For NDI Sources only. In the NDI Network section, selecting a Favorite star for a specific NDI Source causes a star to populate the corresponding Favorite column in the Active Mapping section.
SDI Format	For SDI inputs, BRIDGE NDI 3G will always output NDI with the same video format.
SDI ColorSpace	For SDI inputs, BRIDGE NDI 3G supports YCbCr, 4:2:2, 10-bit uncompressed video.
SDI Audio	PCM
NDI Format	For NDI inputs that are non standard rasters or rates as compared with SDI, BRIDGE NDI 3G provides the choice of preserving smaller rasters within a black frame or else scaling them thus leaving black only at the top and bottom (letterbox) or side to side (pillarbox). The Scale Control is found on the Individual Channel/Group Screen.
NDI ColorSpace	BRIDGE NDI 3G supports UYVY, 8-bit for standard video, UYVA, 8-bit for video plus alpha channel.
	NDI Hx is supported for input and P216, 16 bit output is supported when running the NDI 5.x library. It is not supported when running the NDI V4.x library.
NDI Audio	NDI uncompressed (float)

Subscribe to NDI Sources for Specific Channels

Where an Engine is set to decode NDI to SDI, it is possible to select the NDI source directly from the Source/Destination Screen.

For NDI sources, under the Source Name column, you can select from the drop-down selection of available NDI sources to subscribe to for that particular channel. The drop-down list will show all detected sources available on your network. Further down the page, you can see everything that is on your NDI Network.

Selecting NDI Source from Source/Destination Screen

With the NDI sources shown, you can select them, give them custom names (45-character limit), and tag them as favorites for easy reference.

Figure 25. Selecting an NDI Source from the Source/Destination Screen

Encode/Decode Indicated by Blue/Orange

The color blue indicates that the signal is entering BRIDGE NDI 3G through a cable (SDI). The color orange indicates that the signal is coming from the network (NDI).

The SDI Source is determined by what signal is cabled to the BNC connector for each channel.

Figure 26. Source/Destination Screen Encode/Decode Color Indicators

NDI Network

Each NDI Source can have multiple signals to choose from, depending on the NDI sources that are available on your network. This can be because the NDI source device is multi-channel, or it may be that the device is a camera producing more than stream quality.

Working with NDI Sources

BRIDGE NDI 3G provides discovery and enumeration of NDI Sources. Each discovered source is profiled and its attributes displayed across the following columns.

Column Name	Definition
Online	Shows whether the NDI source is currently online. A previously discovered NDI source, that is not online, will show amber instead of green.
In Use	Indicates whether this particular NDI source is being used by BRIDGE NDI 3G
URL	The specific address for the NDI source stream
Source Name	The default name generated by the transmitting NDI software or device
Custom Name	A meaningful name that can be manually entered
Format	NDI Video raster and rate
Colorspace	NDI Colorspace
Audio	NDI Audio
Favorite	Active or not

Discovering NDI Sources

There are two methods for discovering NDI Sources. The default method is for BRIDGE NDI 3G to automatically discover NDI Sources on your local network using mDNS. No special configuration is needed.

Another method is to use a separate host system on the network that runs a Discovery Service. The Discovery Service creates and updates a central store of discovery information and status. This approach can be useful when dealing with an especially large-scale NDI infrastructure that supports dozens or even hundreds of NDI sources.

NOTE: *Since BRIDGE NDI 3G is able to run under either NDI 5 or NDI 4, it is helpful to be aware of some subtle differences in what is possible when running under each "mode".*

NDI Discovery Service

The NDI Discovery Service runs on a separate host system and helps make the retrieval and updating of NDI source information more efficient for large networks supporting large numbers of NDI devices and software sources.

NDI 5 Library - When running BRIDGE NDI 3G under the NDI 5 library, an external discovery service can be run under Windows (NewTek NDI Discovery Service), Linux (ndi-directory-service) or macOS (Mac.NDI.DirectoryService).

NDI 4 Library - When running BRIDGE NDI 3G under the NDI 4 library, an external discovery service can be run under Windows (NewTek NDI Discovery Service), or via Linux (ndi-directory-service).

NOTE: *While there is currently no NDI 4.x Discovery Service for macOS, users with macOS systems as part of their environment can still connect to a Discovery Server running on Windows or Linux.*

To configure BRIDGE NDI 3G to access NDI sources on a Discovery Service:

1. From the Source/Destination Screen, in the NDI Network section, click the **Advanced NDI Config** button, shown in Figure 46. The Advanced NDI Configuration window displays, shown in Figure 47.
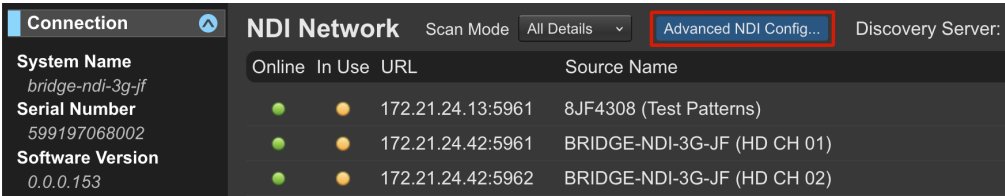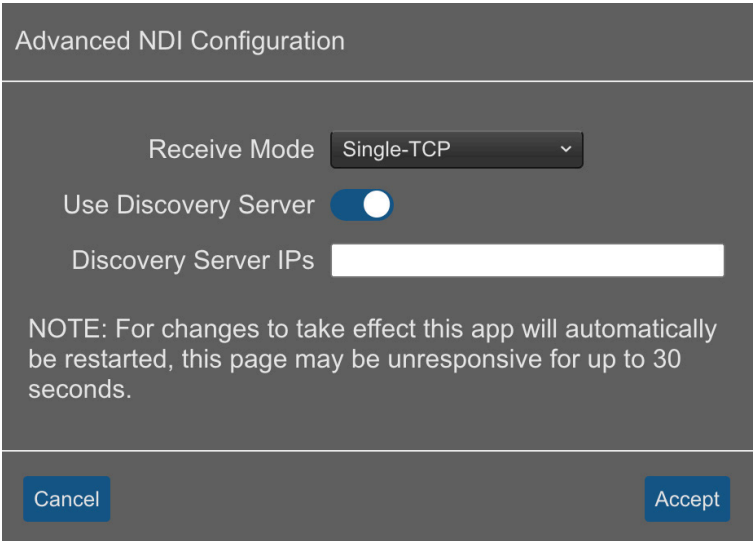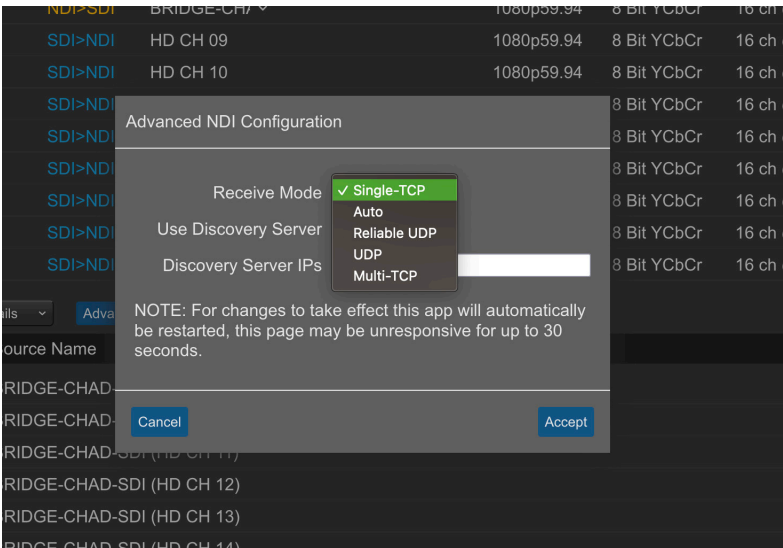
Figure 27. Advanced NDI Config Button

Figure 28. The Advanced NDI Configuration window

2. Make a selection from the Receive Mode drop-down control.

Figure 29. The Advanced NDI Configuration window

Receive Mode for NDI Protocol

NOTE: *Starting with BRIDGE NDI 3G v1.6, additional Receive Mode options were added, and the default setting was changed to Single-TCP, which we have found to be the most reliable signal quality setting.*

Single–TCP - (new default setting) Tested to be the most consistent protocol. This setting is recommended, unless your workflow requires different protocols

Auto - When set to Auto, the MultiTCP and UDP protocols will both be turned on so that BRIDGE NDI 3G is prepared to receive NDI sources using either method.

Reliable UDP - This is a non-standard protocol, designed to solve for when UDP is unsuitable since guaranteed packet-order delivery is required, but TCP would increase complexity/overhead past necessary constraints. To enable a higher quality of service, RUDP implements features that are similar to TCP, but with less overhead. This protocol is only available when running NDI 5.

UDP - (Legacy) UDP is typically used for applications where timeliness is more important than strict accuracy, such as streaming media, teleconferencing, and voice-over-IP (VoIP). Using this setting may be recommended when working in a mixed NDI environment where there may be older NDI devices or software from NDI v3.x or earlier.

Multi–TCP - (Legacy) The Multipath TCP protocol permits transport across multiple NICs and all network paths, helping to maximize throughput, resource usage, and increase redundancy across the network. It is not disrupted by adding or dropping pathways and works across multiple network types such as wireless and mobile.

3. Click the Use Discovery Server toggle switch to the On position (*Figure 30*). This will turn off mDNS.

Send Mode for NDI Protocol

NOTE: *Starting in BRIDGE NDI 3GI v1.6, the Send mode has been locked to Single-TCP and is not selectable. AJA has found it to be the most reliable signal quality setting.*

Use Discovery Server

Figure 30. Use Discovery Server toggle switch turned on

4. In the **Discovery Server IP** field, enter the IP address of the discovery server you will be accessing.

   For example, if you use IP address 192.168.1.100 as the address of the discovery server, NDI Senders connecting to that discovery will advertise their sources on the 192.168.1.xxx range. When in single TCP mode, this means all receivers will connect to the source in this range and will not use any other network ranges. This principle does NOT apply if you are enabling multiple different NDI protocols such as UDP Unicast, MultiTCP or rUDP.

   When running NDI 5 - You can enter multiple IP addresses for multiple Discovery Servers in the Discovery Server IP field by separating the IP addresses with a comma.

5. Click **Accept**.

NOTE: You may need to restart your BRIDGE NDI 3G unit after setting up your discovery server before it will register on the discovery server.

Scan Modes

Make selections from the Scan Mode drop-down control to modify how discovery behaves. These choices will work the same way regardless of whether you are using BRIDGE NDI 3G's built-in discovery or an external Discovery Server.

Figure 31. Scan Mode drop-down control
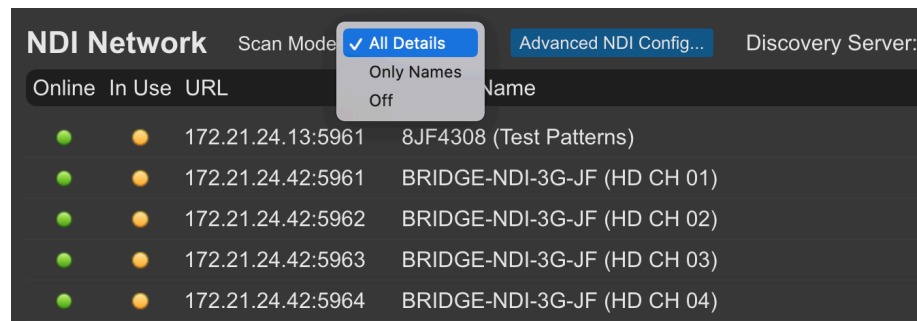
All Details - Provides the NDI format and online information. Using this setting can cause more network traffic and may impact the performance of other applications. When names and format details change, BRIDGE NDI 3G updates that information in the list within 10 seconds.

Only Names - Provides the names only of NDI sources. Using this setting reduces impact on the network. When names change, BRIDGE NDI 3G updates the names on the list, but details will remain unchanged. This could result in stale data displaying if details have changed since using the All Details setting.

Off - Stops discovery of new sources. Using this setting will not create any additional network traffic. BRIDGE NDI 3G will stop updating the list.

Once BRIDGE NDI 3G is either restarted or the app is refreshed, the Scan Mode list will only reflect what is set in the Scan Mode, and will not display any stale data that may have been present.

Search for NDI Sources

If there are numerous sources on the network, it may be easier to search for NDI sources using the search box.

Filter NDI Sources

NDI Source Filter/Search Controls

NDI Source filtering can be done using information from across any of the columns described above.

Activity Indicator - Shows whether the NDI video is stale/gone.

In Use Indicator - Shows whether the NDI source is currently being Decoded by BRIDGE NDI 3G.

NDI Source - Non-editable field. This is determined by the device or software that is transmitting the NDI. However, you can describe via a custom name instead. This does not affect the original source name; instead, it just shows the custom name in the interface for ease of use.

NDI Favorite - Toggle on/off. When selected as a favorite, the NDI Source will display.

NDI Source Label - Edit this field to reflect how you want the NDI Source name to appear.

You can change "NDI Label" and "SDI Label," favorite/unfavorite, choose NDI source, search and filter NDI source list found via scanning network.

You cannot change encode/decode, or group/ungroup, however.

Make an NDI Source a Favorite

Under the NDI Network section, click the favorite icon next to the NDI source in the far right column.

Label an NDI Source

Under the Active Mapping section, enter a new name in the custom name field.

Status Screen Detailed Description

Figure 32. Status Menu Screen
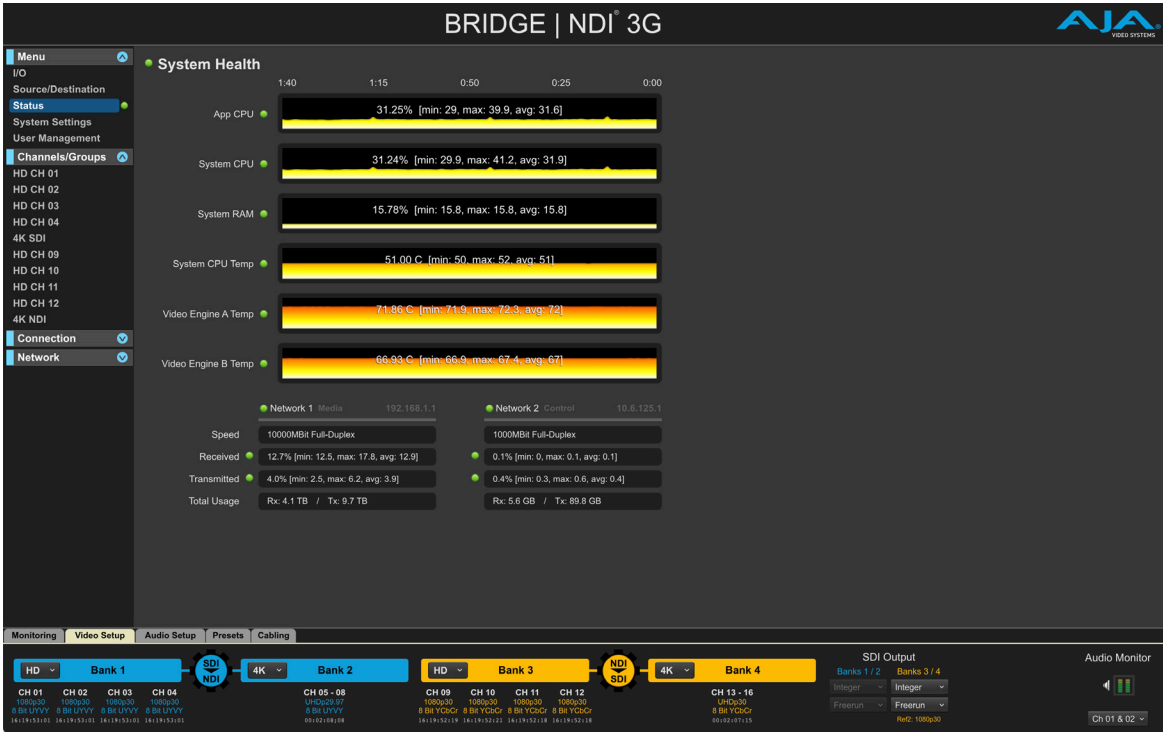
The System Screen shows you current status and recent history of key aspects of the system's health and network activity. It provides "at-a-glance" system performance and health together with a readout of maximum values, minimum values and average.

System Health and Network Activity

Column Name	Definition
App CPU	How much of the CPU is being consumed by BRIDGE NDI 3G software tasks
System CPU	How much of the CPU is being consumed overall
System RAM	How much of the RAM is being consumed overall
System CPU Temp	Temperature of the system CPU
Video Engine A Temp	Temperature of Video Engine A
Video Engine B Temp	Temperature of Video Engine B

If all of the status lights for the above system attributes are green, then the overall status light shown in the Menu Screen Column will also be green. If any of these status lights for the above system attributes are amber or red, then that is the status color shown in the Menu Screen Column.

Network Activity Health

Network status is also reported for Network 1 Media and Network 2 Control.

Alarm indicators at the top of the statistics information for Network 1 and Network 2 represents connection status.

- Green - Network device is connected
- Red - Network device is not connected
- Grey – Unknown

Received and Transmitted Alarms present network usage in each direction and are defined by the network bandwidth set.

- Green – Bandwidth usage is under 80%
- Amber – Bandwidth usage is between 80% and 89%
- Red – Bandwidth usage is 90% and above

System Settings Screen Detailed Description

Figure 33. System Settings Screen

System Details

Some fields will be pre-populated, such as Serial Number, System Time, System Date, System Up-Time, Video Engine A Firmware, Video Engine B Firmware, System OS Version, and AJA Technical Support.

System Name

System Name provides up to 44 characters for giving the BRIDGE NDI 3G system a unique name. A reboot will be required for this to take effect.

System Date/Time

System Date and Time can be set to Automatic or Manual.

Automatic - BRIDGE NDI 3G will seek date and time via the NTP server(s) specified. BRIDGE NDI 3G will use UTC time, unless a different Time Zone is specified. If the connection to the NTP server is lost, BRIDGE NDI 3G will continue keeping time by itself until the connection is restored and a new sync can take place.

Figure 34. System Date/Time Pop-up window, Automatic Configuration selected

Date and Time Settings

Time Zone: (UTC) Coordinated Universal Time

Configuration: Automatic

Primary NTP Server: time.aja.com

Secondary NTP Server:

Cancel   Apply

Manual - BRIDGE NDI 3G date and time are specified by the user. If BRIDGE NDI 3G was previously connected under the Automatic setting to an NTP server and current date and time were obtained, then upon switching to Manual, BRIDGE NDI 3G will continue keeping time by itself. Click Apply to enter Manual mode while leaving the time as set by NTP. This could be a quick way to set up units that will be deployed in a secure/offline environment.

Figure 35. System Date/Time Pop-up window, Manual Configuration selected

Date and Time Settings

Time Zone: (UTC) Coordinated Universal Time

Configuration: Manual

Set Date and Time:

Cancel   Apply

Alternatively, after selecting Manual, activate the "Select Time and Date" button, and proceed to set date and time manually.

Figure 36. System Date/Time Pop-up window, Manual Configuration selected with Set Date and Time option enabled

Date and Time Settings

Time Zone: (UTC) Coordinated Universal Time

Configuration: Manual

Set Date and Time:

Date: Apr   7   2022

Time: 12 : 33 : 00

Cancel   Apply

When running under Manual date and time settings, BRIDGE NDI 3G will not seek out an NTP server, and will be unaffected by the presence or absence of Internet connectivity.

Selecting NDI 4 or 5

Next to the NDI Version field, selecting the Change button opens the window for selecting NDI version 4 or 5.

Figure 37. Selecting NDI version 4 or 5

Select NDI Version

NOTE: When changing the NDI version, this app will automatically be restarted and this page may be unresponsive for up to 30 seconds.

NDI Version: ○ 4
              ◉ 5

Cancel   Apply
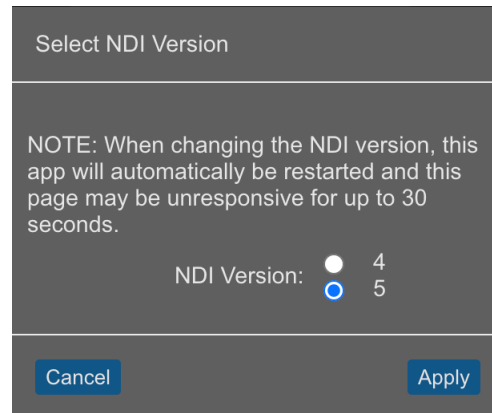
Network Settings

If you are using DHCP (default) to assign your IP addresses, you can be up and running quickly. If you are using Static IP addresses, you will need to manually enter IP addresses and Subnet Masks for your network settings.

NOTE: If you are unsure of the correct IP Address settings, consult with your network administrator.

To manually modify Network 1 or Network 2 settings, click the **Edit** button located under the column you want to configure. The corresponding Network Settings pop-up window displays.

NOTE: Network 2 cannot be used for media traffic.

Figure 38. Network Settings

When using DHCP, the Network Settings fields are automatically dynamically populated, and will display "TBD."

When using Static settings, enter values for the following Network Settings:

- IP Address
- Subnet Mask
- Gateway
- Primary DNS Server
- Secondary DNS Server
- DNS Search Path

When finished, click **Apply**.

Resources Buttons

Figure 39. The Resource Buttons on System Settings Screen

Product

Navigates to the product overview page at AJA.com where you can access product information including tech specs, workflow and use-case examples.

Support

Navigates to the AJA product support page at AJA.com where you can access software updates, release notes, manuals and other documentation.

About

This opens a local pop-up window containing "About" information for BRIDGE NDI 3G. In the Kiosk view only, there are also a few useful keyboard shortcuts described for accessing Factory Reset and Safe boot options.

Additionally, from the Kiosk view only, the following keyboard shortcuts are described:

CTRL+R: refresh screen

ALT+F4: logout and return to the splash screen (saves system resources)

ALT+Left: Go back to previous page (useful after selecting Product and Support buttons)

System Control Buttons

Refresh App

Use the Refresh App button to refresh the application.

Restart

Use the Restart button to restart BRIDGE NDI 3G.

Shutdown

Use the Shutdown button to shutdown BRIDGE NDI 3G.

User Management Screen Detailed Description

From the User Management/Administration Login Screen, you can change the admin password.

Figure 40. User Management Screen, Changing Admin Password
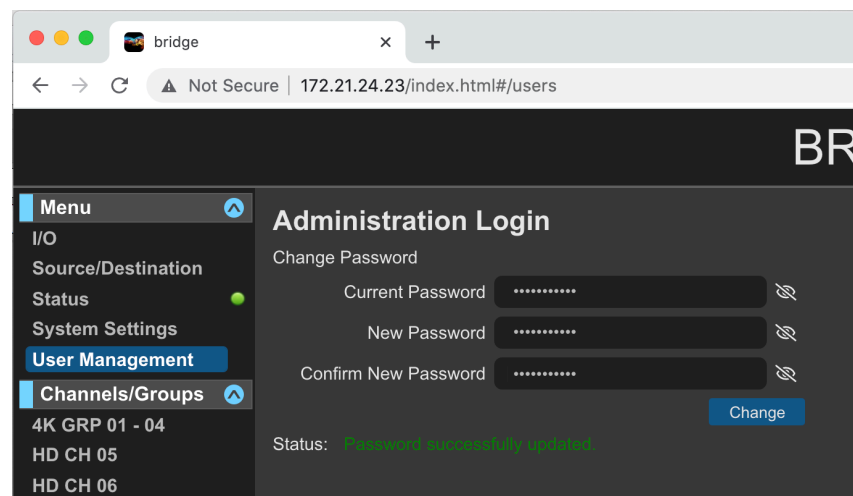
To Change the Admin Password

1. Enter the current password in the Current Password field.

2. Enter your desired new password (up to a maximum of 22 characters) in the New Password field.

3. Enter your desired new password again in the Confirm New Password field.

4. Select Change. A Sign in prompt displays.

5. Enter your current user name and the new password that you just created.

6. Select Sign In. The User Management screen refreshes with the Status "Password successfully updated."

Channels/Groups Screen Detailed Description

There is another set of menu Screens which correlate with the current setup of Channels/Groups.

Individual Channel/Group Screens can be reached by either double-clicking on a Video Tile when on the I/O Screen, or navigating using the Screen Menu on the interface left side. On these Screens, the Video is displayed across the entire Canvas and there are extra video and audio controls.

These Screens will dynamically update based on grouping or ungrouping.

For example, if Channels 01 through 04 are grouped, there will no longer be 4 individual Screens in the left menu bar (HD Channel 01, 02, 03, 04); instead, there will be a single Screen entitled "4K GRP 01 - 04".

To the left of the Canvas is an Individual Channel/Group Column containing the controls pertinent to that specific Encode/Decode.

Control Bar Detailed Description

The Control Bar provides easy access to the most frequently used video and audio controls and settings.

The Control Bar is located along the lower area of the BRIDGE NDI 3G interface, and has five tabs. The Control Bar tabs are always visible, so you always have access to all of this functionality regardless of which Menu Screen you have selected.

Figure 41. The Control Bar
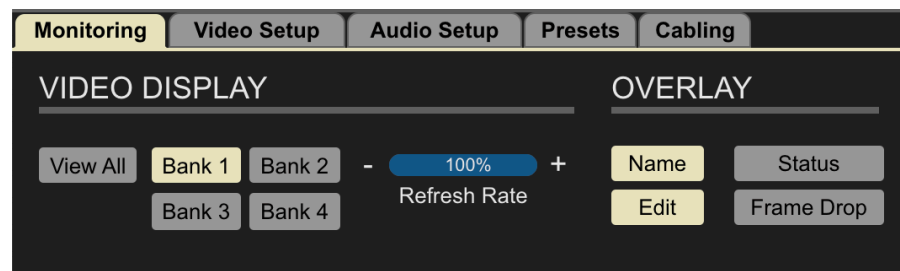
Control Bar Quick Overview

Tab Name	Function
Monitoring Tab	Selects which Banks of video channels you want to display in the Canvas and Overlay features

Tab Name	Function
Video Setup Tab	Selects video grouping of channels (HD, V+K, 4K). Selects the direction of conversion (SDI to NDI, NDI to SDI) for each Engine (Two Banks)
Audio Setup Tab	Manages all aspects of your Audio Monitoring for each channel in terms of channel selection, enabling or disabling audio, and setting audio reference levels
Presets Tab	Accesses system preset configurations for quick setup for common use cases
Cabling Tab	Highlights the BNC connector(s) in the Rear View Connections diagram with the corresponding selected Video Tiles

Control Bar – Monitoring Tab

Use the Monitoring Tab to select which video channels you want to display in the Canvas:

From the Monitoring Tab, you can also modify the elements that are overlayed on the Video Tiles, such as Channel Name, Status, and Frame Drop.

Video Display

- Video Monitoring Controls
  - View All
  - Bank 1
  - Bank 2
  - Bank 3
  - Bank 4
  - Name toggle on/off

Variety of Bank Views Available

The Canvas can display a more focused view of specific Banks rather than all 16 video channels. Choose which Bank you want to show on the Canvas by selecting one of the Bank buttons on the Monitoring Tab located on the Control Bar along the lower area of the BRIDGE NDI 3G interface.

Viewing only one Bank offers you a different view if you need to focus only on the Video Tiles for one Bank.

NOTE: This view will change depending on how you have grouped the Bank (HD Channels, 4K/UltraHD or Video + Key).

Figure 42. Viewing only Bank 1, 4 HD Channels
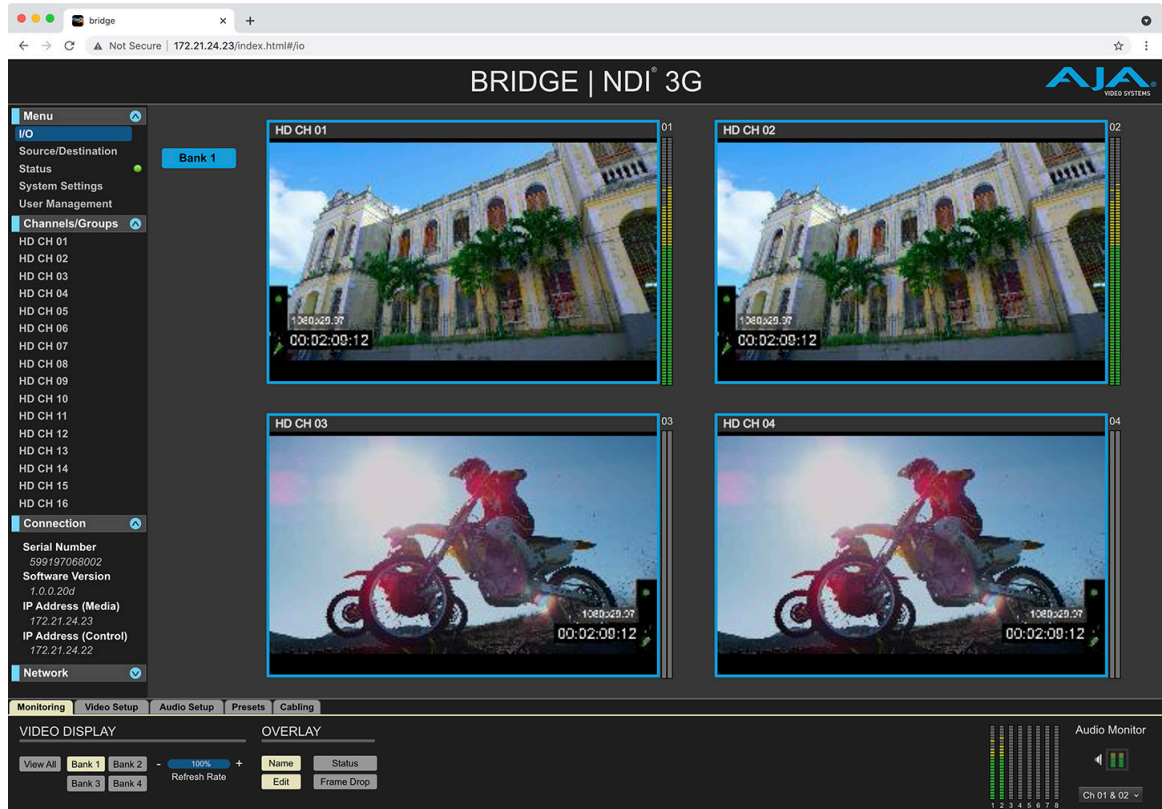
Refresh Rate

This control is designed to allow you to find the "sweet spot" for the smoothest representation of moving video in the confidence view, given network conditions and other variables. The default setting is 75%.

The best Refresh Rate setting will vary depending on your network conditions. A value of 100% will most likely not be the optimal setting unless the unit is working in a very well-behaved network environment. Changing the Refresh Rate while watching the screen will help you find the best balance.

NOTE: If using the local Kiosk Interface, this will affect the behavior of that interface for all users. If using the remote Web Browser Interface, this setting will be local to that specific remote Web Browser Interface.

Overlays

Overlays on the Video Tiles provide extra information for you about what's going on with each channel or group. Some overlays can be edited and customized.

Name

Toggle on or off. It will default to showing the Channel/Group name, unless the Custom Name has been populated on the Source/Destination Screen, in which case the Custom Name will be displayed instead.

Edit

When clicked, can edit the channel/group names from this screen.

Status

When Status is selected, it will overlay a status symbol (small circle in upper right corner of the video tile). The status symbol will display in one of four ways.

Blackout - The blackout icon warns you if Video Blackout (Mute) is active (vs there simply being a black source image). The blackout icon is a green circle with a black "X" through it.

Test Pattern - The test pattern icon warns you if the Video Test Pattern is active. It appears as a green circle with a large black "T" through it.

Tally - The tally icon is a function of NDI that shows whether the source is being subscribed to (preview) or whether the source is being taken live (program). This is only functional in the SDI to NDI direction.

- The preview tally icon is a green circle.
- The live (program) icon is a red circle.

Frame Drop

A counter when you are dropping frames. A number shows up on preview video tiles counting how many frames are being dropped from the session. This may be an indication that it's time to Refresh the application from the System Settings Screen.

Audio Monitoring

For Audio Monitoring, select the Video Tile for the channel/group you want to monitor.

Audio Monitoring Controls pertain to:
- the dual-channel visual audio meters that can be enabled adjacent to each Video Tile on the I/O Screen > Canvas and the Individual Channel/Group Screens.
- the audible analog audio out by the dual channel USB sound card (supplied with the system) for audio monitoring when using the system via the local Kiosk interface.

The Control Bar > Monitoring Tab > Audio Monitor controls persist across all Control Bar Tabs. This is to ensure that the audio controls are within easy reach whatever you may be working on. As such most of the aspects covered here apply across all Control Bar Tabs.

Figure 43. Audio Monitor (lower right corner) indicating that audio channels 1 and 2 are being monitored.
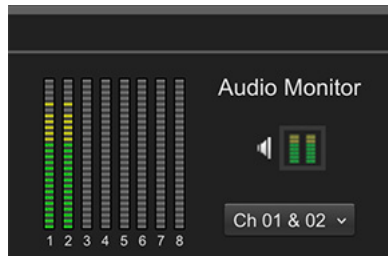
IMPORTANT: *Audio Monitoring controls only affect visual and audible audio monitoring. Changes to the Audio Monitoring Controls will never affect the SDI or NDI Audio I/O.*

MultiChannel Audio Meter

On the Monitoring Tab only, immediately to the left of the Audio Monitor controls is a MultiChannel Audio Meter. This display is not affected by Audio Monitoring controls, as it is showing the actual NDI/SDI audio I/O on the system, which is never affected by the Audio Monitoring Controls.

Figure 44. Audio Monitor toggled off
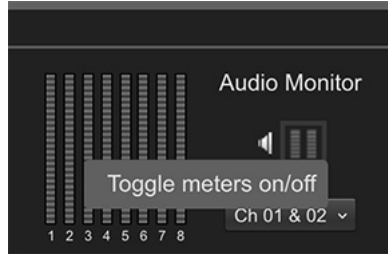
Audio Monitor

There are 3 distinct controls provided in the Audio Monitor section of the Control Bar:

Metering Toggle - Toggles between **display** or **hide** for the Video Tile Meters on the I/O Screen.

> The dual channel Audio Meters on the Canvas can be toggled on or off. Turn off the dual channel Audio Meters is useful for minimizing activity in the interface, as well as reducing the load on system resources.

> These dual channel meters reflect the two channels being monitored. For all video channels/groups this will by default be audio channels 1 and 2.

Speaker Toggle - Toggles between **muted** or **audible** for Audible Audio Monitoring.

> This setting impacts Kiosk users since the Kiosk system has the Dual-Channel USB Sound card.

> For remote users through a web browser, this setting has no impact. It is not applicable.

> The Speaker Toggle (Mute Audio Monitoring) button in the Control Bar is a monitoring control toggle only and has no effect on the SDI or NDI audio I/O. This function is provided so that an operator could quickly stop audio being monitored via the analog Audio Output from the supplied USB sound Card (Kiosk interface only).

When audio meters are on, audio meters display next to each video tile.

When audio meters are off, no audio meters will be displayed next to each video tile.

Channel Pair Selector

For the video channel/group that is currently selected, you can use this selection to monitor the audio levels on channels other than 1 and 2 with the "Select" drop-down control.

This will affect both the visual audio metering on the Canvas, as well as the audible analog Audio Output from the supplied USB sound Card (Kiosk interface only).

Figure 45. Selecting Pair of Audio Channels for Monitoring
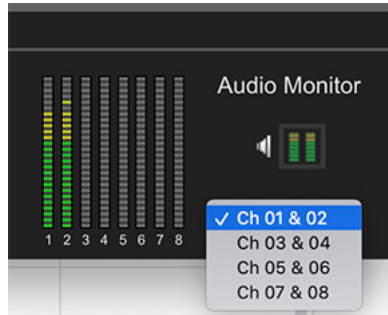
Audio Monitoring Continuity

Continuity of Audio Monitoring is preserved when moving between Menu Screens. For example, if you are monitoring HD Ch 2 on the I/O Screen, and then you select the SRC/Dest screen or System Settings, the audio monitoring for HD Ch 2 would not be interrupted. Even though the Video Tile for HD Ch 2 would no longer be displaying, the audio would continue until it is either muted or until a new video tile, channel, or group is selected.

Clicking on an individual Channel/Group Screen will also change the Channel/ Group being monitored (if it differs from the current selection).

Audio Monitoring vs. Audio I/O

The Metering Toggle and the Speaker Toggle buttons only impact monitoring on the I/O Screen > Canvas.

It will have no affect on the Audio metering which takes place on the Control Bar, since meters on the Control Bar are showing actual Audio I/O - which is never affected by monitoring controls.

This is true for both of the following:
- Control bar > Monitoring Tab > MultiChannel Audio metering
- Control bar > Audio Setup Tab > Channel/Group metering

Control Bar – Video Setup Tab

Figure 46. Video Setup Tab
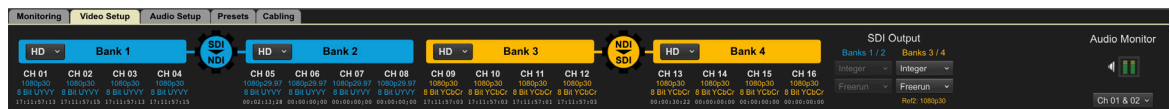
Engine Controls

Use the Encode/Decode Cog buttons to change the direction of an Engine.

When an Engine is encoding from SDI to NDI, it is blue and indicates the SDI to NDI direction, as shown here in *Figure 47*.

Figure 47. SDI to NDI direction
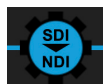
When an Engine is decoding from NDI to SDI, it is orange and indicates the NDI to SDI direction, as shown here in *Figure 48*.

Figure 48. NDI to SDI direction

Clicking on the Cog button causes the Engine to switch directions.

Bank Controls

Bank 1 and Bank 2 are supported by Engine A. Changing the Encode/Decode direction for Engine A will affect both Banks 1 and 2.

Bank 3 and Bank 4 are supported by Engine B. Changing the Encode/Decode direction for Engine B will affect both Banks 3 and 4.

IMPORTANT: *Control Bar > Video Setup Tab must be selected in order to be able to change encode/decode direction above on the I/O Screen. When Viewing the I/O Screen, if the Control Bar > Video Setup Tab is NOT selected, the Encode/Decode Cog is disabled.*

Each Bank can be independently configured from the other Banks in one of three ways:

4 x HD Channels

- 4 x SDI used to support 4 separate sources/destinations

1x 4K Group

- 4x SDI used to support a single 4K/UltraHD source/destination
- For 2SI LFR, the first two channels of the bank can be used
- For 2SI HFR or Square Division all four channels of the bank must be used.

2x HD Video plus Key Group

- 2x dual SDI used to support two separate pairs of Video and Key sources/destinations
- Video and Key pair one uses the first two channels of the bank
- Video and Key pair two uses the second two channels of the bank
- SDI Video and Key input is through two separate SDI connections
- NDI Video and Key is through a single NDI stream with Alpha Channel

Video Format Displayed

Beneath each Bank under Control Bar > Video Setup tab, each channel/group has video format information shown beneath (output video format).

Timecode Displayed

The timecode read-out per channel or group displays at the very bottom of the Video Setup tab area.

Please see also:
- *"Metadata — Configuring Timecode NDI to SDI" on page 61* and
- *"Metadata — Configuring Timecode SDI to NDI" on page 62*.

Channel/Group Information

Beneath each Bank, information about the channels or groups is displayed. For example, when Bank 1 is configured for HD, each of the four channels is indicated with signal information shown as well.

Figure 49. Video Setup Tab showing Bank 1 as HD
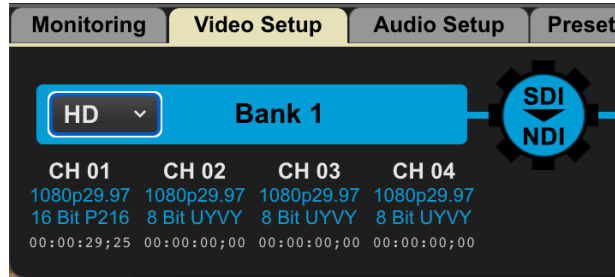
When Bank 1 is configured for 4K, the four channels of Bank 1 are combined into an UltraHD group, with signal information shown as well.

Figure 50. Video Setup Tab showing Bank 1 as 4K
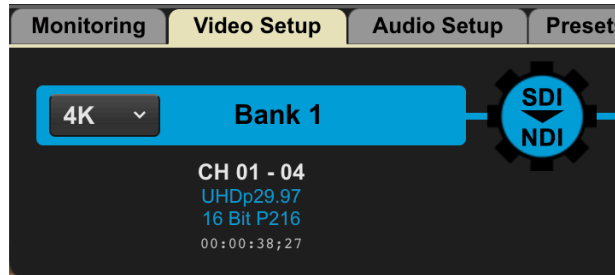
SDI Output Controls

Figure 51. Video Setup Tab, SDI Output Controls
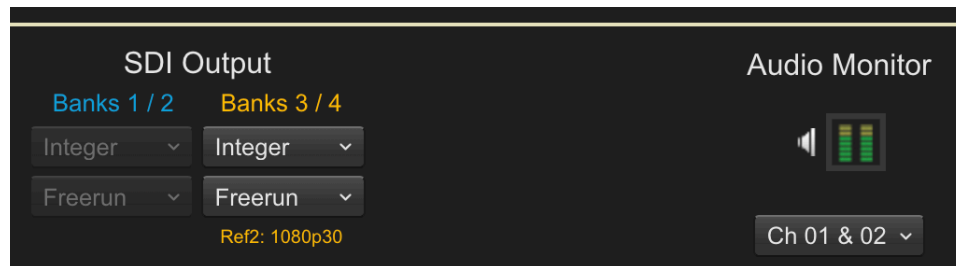
Banks 1/2, if NDI source of 30p from a computer or a phone, and professional source of 29.97, in order to not create any glitches, you need to decide which output you want to use — fractional or integer.

Integer vs. Fractional

With this control, you can select integer or fractional. This is relevant when you have mixed types of inputs, such as 23.98, 29.97, 30, etc.

If there is a mismatch, such as having a frame rate of 25 but the SDI Output control is set to Fractional, the Status overlay will show a warning and the channel will stop. Once the mismatch is fixed by aligning the setting and the signal type to match, you may need to resubscribe to the channel, restart the channel or re-enable the channel.

• Fractional frame rates are 23.98, 29.97, 59.94
• Integer frame rates are 24, 25, 30, 50, 60

If SD NDI sources are in use, the SDI output must be set correctly before the SD output will function.:

- 525i requires the Bank to be set to Fractional.
- 625i requires the Bank to be set to Integer.
- 525i and 625i signals cannot be used simultaneously in the same bank.

Free Run vs. Ref In

Each of the cards have a reference. Can choose Free run or Ref 1. Relevant for SDI Output. Not relevant to NDI Output.

Bank 1 and Bank 2 share a Ref In.

Bank 3 and Bank 4 share a second Ref In. Diagram of connectors is shown in the Cabling Tab.

Control Bar – Audio Setup Tab

The Audio Setup Tab contains controls for Mute, Audio Reference Level, and Audio Levels for each channel. This topic was addressed in detail earlier. Please see *"Audio Monitoring" on page 49* for more information.

Figure 52. Audio Setup Tab

Audio Reference Levels

NDI Sources can sometimes be too loud for an SDI environment. As such, The audio reference level can be used to attenuate (reduce) the audio level for a particular Channel/Group. For example, choosing the value "20" will attenuate the audio for that channel/group by 20dBu.

Setting Audio Reference Levels

To set the audio reference level, click the audio reference Level drop-down control and select 0, 6, 10 or 20.

Figure 53. Selecting an audio reference level
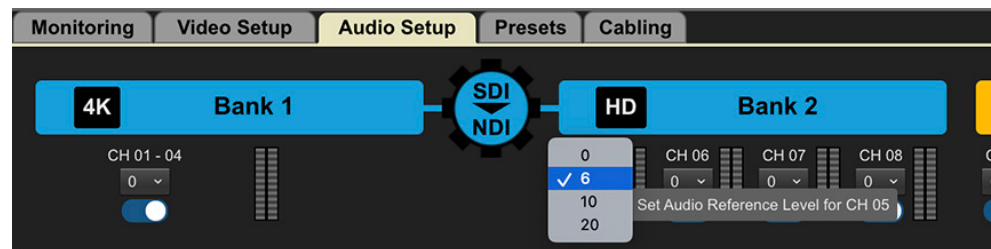
Audio Channel Number Default

8 audio channels is the BRIDGE NDI 3G system default. This can be changed to either 16 channels or two channels depending on your workflow.

NOTE: *Some NDI receivers (hardware or software) have problems when receiving 16 audio channels. To avoid this, use 8 channels or 2 channels as your system preset.*

Control Bar – Presets Tab

Figure 54. Presets Tab
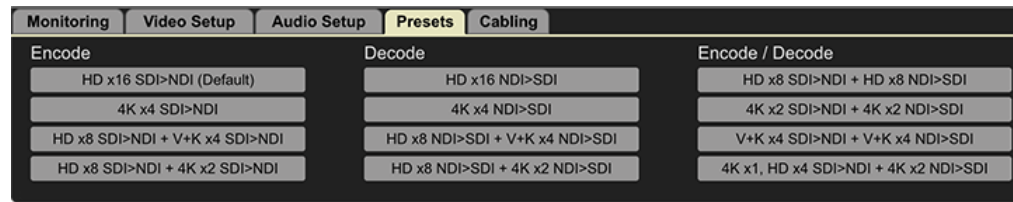
As you configure your BRIDGE NDI 3G device, consider how each Bank will be used, i.e., as individual HD Channels, 4K/UltraHD Groups, Video + Key Groups, or some combination thereof.

If BRIDGE NDI 3G is already up and running and you are ready to re-cable as necessary, then the Presets Tab is a fast way to choose between numerous system-wide configurations. Used in conjunction with the Cabling Tab, this can make for an efficient method to rapidly re-setup a system for a new task.

Control Bar – Cabling Tab

Figure 55. Cabling Tab
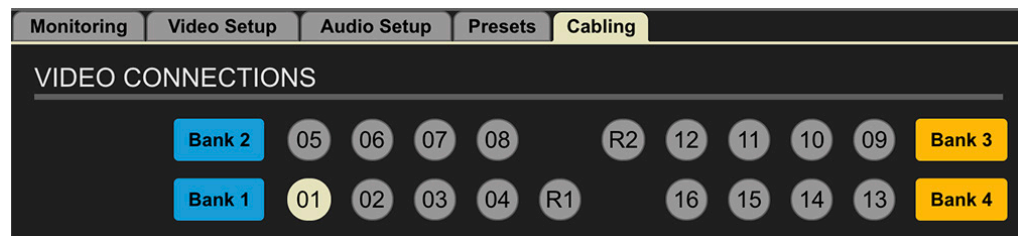
Within the Cabling Tab Screen, the BNC connector for the currently selected Video Tile will be highlighted. This is for ease of cabling setup, troubleshooting, reconfiguring, and to make it easy to know which cabling connection is relevant to your currently selected Video Tile. This is especially helpful when you need to make directional changes that may impact your cabling.

Cabling Considerations and Changing Directions

Because BRIDGE NDI 3G is a gateway device, it is not expected that you will need to change your cabling connections very frequently. However, when cabling changes are required the diagram in the Cabling Tab will help you quickly identify the inputs and outputs of your current configuration.

NOTE: *While it is really easy to change directions (NDI to SDI or SDI to NDI) on the interface, please keep in mind that it may impact cabling connections and other configurations.*

A map is shown that corresponds to the connectors are arranged on the back of the box. Very helpful visual reference guide. Any channels that are currently selected are indicated by dark blue, making it clear which connectors correspond to actions you are taking at the time.

If you have grouped channels into a 4K group, and you select that 4K group on the I/O Screen, it will light up that whole bank on the Cabling Tab. For example, if you select V+K pair (using Ch 1 and Ch 2), connectors 01 and 02 are highlighted in Cabling Tab. If you select a 4K Group in Bank 2, the Cabling Tab shows that Ch 05, 06, 07, 08 are highlighted.

Chapter 4 – Workflow Configuration Details

This chapter provides example procedures for creating various workflows. The actual steps will vary, however, depending on your network configuration and signal requirements.

Get Up and Running with BRIDGE NDI 3G

BRIDGE NDI 3G is designed to be intuitive to configure so that you can get the system operating quickly according to your use case requirements.

It is recommended that you plan your use case in advance. If you will be inputting SDI and outputting NDI exclusively, then all 16 SDI connectors will be dedicated to upstream SDI sources.

If you will be inputting NDI and outputting SDI exclusively, then all 16 SDI connectors will be dedicated to downstream SDI destinations.

If supporting a dynamic environment where you need the capability to convert in both directions at any given time, then it is recommended that you set the system up with one engine dedicated to 8 upstream SDI sources, and the other engine dedicated to 8 downstream SDI destinations.

When cabling, remember that Banks cannot be split, and Groups cannot span Banks.

In summary, follow this approach:

- Determine Use Case
- Connect Cables According to Use Case
- Configure System to Match Use Case

Determining Encoding vs. Decoding

Figure 56. Showing SDI to NDI Encoding

In the example above, all channels of SDI input are being encoded from SDI to NDI. The Bank buttons are blue, as is the outline of each Video Tile, which is the system color for SDI to NDI encoding (SDI In, NDI Out).

When Bank buttons and the outline of each Video Tiles are colored orange, this is indicating that those channels/groups/banks are set for decoding NDI to SDI (NDI In, SDI Out).

Changing SDI>NDI Encoding and NDI>SDI Decoding

To change between SDI to NDI Encoding and NDI to SDI Decoding, use a single click on the Cog Icon found on the I/O Screen (and on the Control Bar > Video Setup Tab). This will toggle between the two modes, and the color of the Bank Indicators, Video Tile borders, etc., will change accordingly.

Figure 57. SDI to NDI direction

Figure 58. NDI to SDI direction

NOTE: *When changing an engine between encode and decode, all system channels/ groups will re-lock to incoming video and a momentary interruption to video and audio will likely occur.*

NOTE: *Interface highlights or selections are shown in light yellow.*

Each channel or group is represented by a Video Tile, showing the video signal for confidence monitoring, along with the name of its source.

Minimizing Resources As Needed

If you want to minimize resources, you can disable or mute specific channels that you don't need for any given configuration.

Disabling SDI Output (NDI to SDI)

At the very top of the Individual Channel/Group Column is an orange-colored strip (indicating a Decode from NDI to SDI). Embedded within this strip is a Channel/Group Enable/Disable toggle.

Disabling the Channel or Group using the button means that no video is being sent out of the SDI connectors associated with that Channel or Group.

From the left menu, select the specific channel you want to turn off; for example, HD CH 09. The Canvas displays only HD CH 09 along with a control panel for the selected channel.

Figure 59. Canvas Displaying One Selected Channel

Figure 60. Canvas Displaying One Selected Channel with SDI Output Disabled
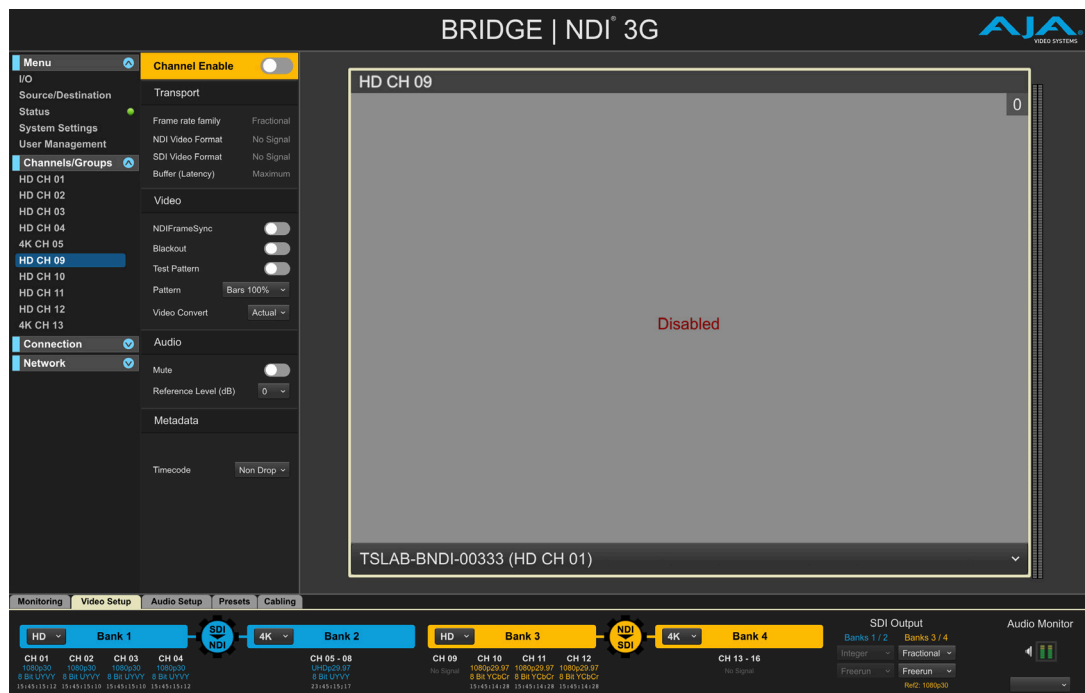
At the very top of the Individual Channel/Group Column is an blue strip (indicating Encode from SDI to NDI). Embedded within this strip is a Channel/Group Enable/Disable toggle.

Disabling the Channel or Group using the button means that no video is being sent out to the NDI Network associated with that Channel or Group.

Disabling NDI Output (SDI to NDI)

Similar to disabling the SDI Output (), select the specific channel you want to turn off and click on the Blue Channel Enable toggle off.

Figure 61. Canvas Displaying One Selected Channel with NDI Output Disabled

Individual Channel/Group Decoding NDI to SDI

Individual Video Tile Control Panel (NDI to SDI)

The individual video tile control panel offers detailed controls that impact only the currently selected channel.

Figure 62. Control Panel for Individual Video Channel/Group
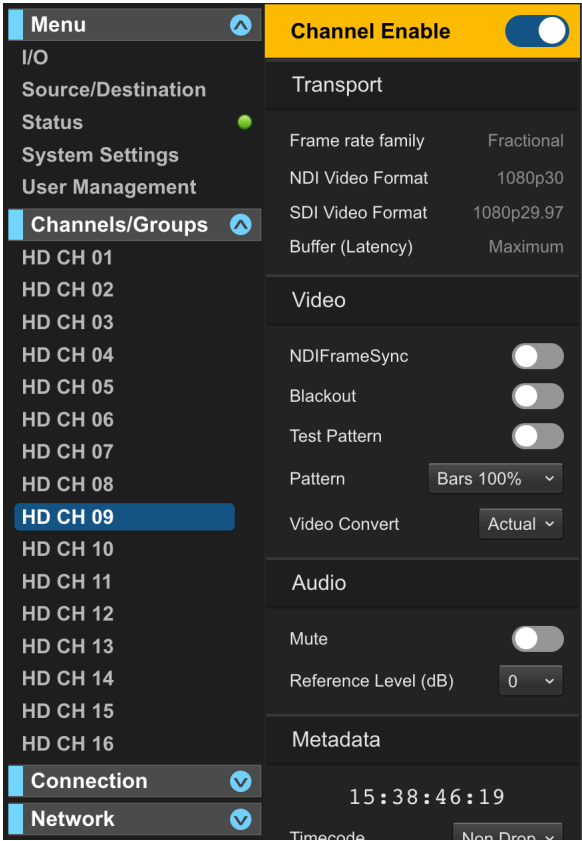
Transport

Transport Reporting fields – frame rate family, Inter or Fractional.

Video Format – reports the format of the video signal (for example, 1080p30).

When working with 4K signals, can select 2SI or squares.

4K Transport – Squares or 2SI.

Video

NDIFrameSync - Toggles on and off to enable the NDI Frame Sync feature, used to enhance the capability to receive NDI signals that have high jitter or potential A/V drift issues. This is most commonly activated for HX sources, Teams sources, and some high bandwidth needs.

Blackout - Toggles on and off to mute the video signal.

Test Pattern - Toggles test pattern output on and off.

Pattern - Select the desired test pattern from the list.

Bars 100%	Multi Pattern
Bars 75%	Black
Ramp	White
Multi Burst	Border
Line Sweep	Linear Ramp
Check Field	Slant Ramp
Flat Field	Zone Plate

Video Convert - Actual, Scale. When the video signal is a small raster size, you can click Scale to fill the full frame.

Audio

Mute - toggles on and off.

Audio Reference Level - (dB) 0, 6, 10, 20. You can raise or lower the reference level. For example, "20" means a 20 dB attenuation.

These controls are also available in the Audio Setup tab from the lower Control Bar.

Metadata — Configuring Timecode NDI to SDI

Timecode is displayed here.

When processing NDI to SDI, BRIDGE NDI 3G reads the timecode value, if present, and puts that value out via SDI on VITC1, VITC 2 and LTC.

Select Non Drop or Drop from the dropdown menu.

Individual Channel/Group Encoding SDI to NDI

Individual Video Tile Control Panel (SDI to NDI)

The individual video tile control panel offers detailed controls that impact only the currently selected channel.

Figure 63. Control Panel for Individual Video Channel/Group – NDI Output
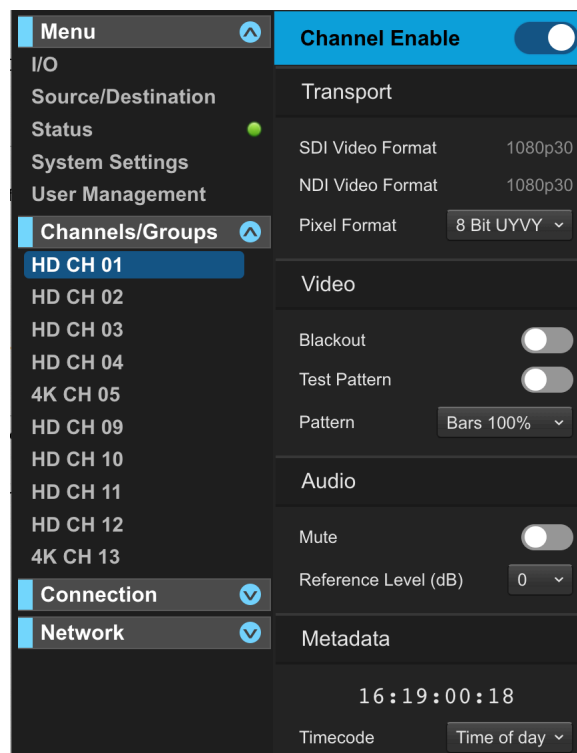
Transport

Transport section — Shows SDI Video Format (input) and NDI Video Format (output).

Pixel Format: For NDI Output, BRIDGE NDI 3G supports both 8-bit UYVY or 16-bit P216.

Video

Blackout – toggles on and off to mute the video signal. Can mute the video and cue it.

Test Pattern – toggles on and off. Can send out test pattern. Can select a test pattern from list.

Pattern – select from a list of patterns.

Bars 100%	Multi Pattern
Bars 75%	Black
Ramp	White
Multi Burst	Border
Line Sweep	Linear Ramp
Check Field	Slant Ramp
Flat Field	Zone Plate

Audio

Mute – toggles on and off.

Audio Reference Level (dB) 0, 6, 10, 20. You can raise or lower the reference level. For example, "20" means a 20 dB attenuation.

These controls are also available in the Audio Setup tab from the lower Control Bar.

Metadata — Configuring Timecode SDI to NDI

Timecode is displayed here.

When processing SDI to NDI, you can make a selection from one of the following choices from the dropdown menu:

1. None: Ignore Timecode from the SDI signal

2. Auto: BRIDGE NDI 3G will look for the presence of timecode in the following places in this specific sequence until timecode is found:

    A. VITC1

    B. VITC2

    C. LTC (longitudinal timecode)

    D. Time of Day (based on selected Timezone)

    E. UTC

3. When not using Auto, make your own selection from the Timecode dropdown menu.

SDI to NDI Encoding

If the system will be devoted to receiving incoming SDI and encoding to NDI for output to the NDI Network, then all SDI connections to BRIDGE NDI 3G will be SDI sources coming from devices such as Cameras, Routers, Recorders/Players, and NLE/VFX/GFX system playback.

SDI to NDI Encoding for HD Channels

To configure a Bank for HD, select the Video Setup tab on the Control Bar along the lower area of the interface. The Bank Configuration buttons display.

Figure 64. Selecting the Video Setup Tab
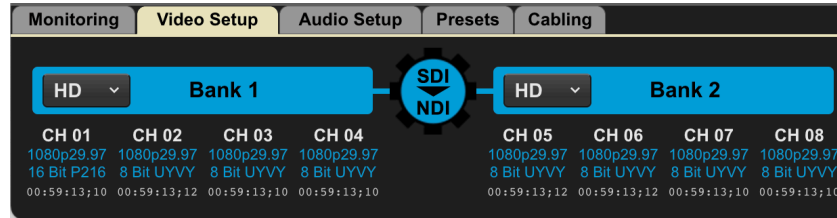
Select HD from the Bank Configuration drop-down menu.

With the Video Setup tab selected, the Bank Configuration buttons also display on the I/O Screen. You can make Bank Configuration selections from either the Video Setup tab in the Control Bar or from the I/O Screen.

If the Video Setup tab is not selected, the Bank Configuration buttons will not display on the I/O Screen.

Figure 65. I/O Screen Bank Configuration Buttons
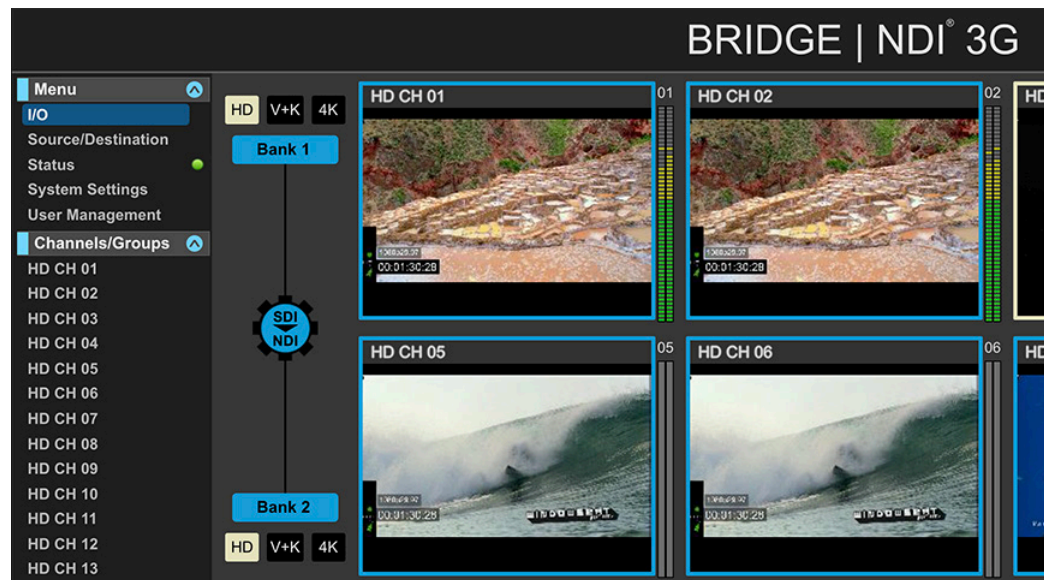
This will allow selection of HD, V+K, or 4K mode. Each Video Tile represents an HD signal from each SDI connection that is being used to feed or receive the HD signal using that specific Bank.

SDI to NDI Encoding for 4K/UltraHD Groups

To configure a Bank for 4K/UltraHD, select the Video Setup tab on the Control Bar. The Bank Configuration buttons display.

Figure 66. Selecting 4K from Bank Configuration drop-down menu
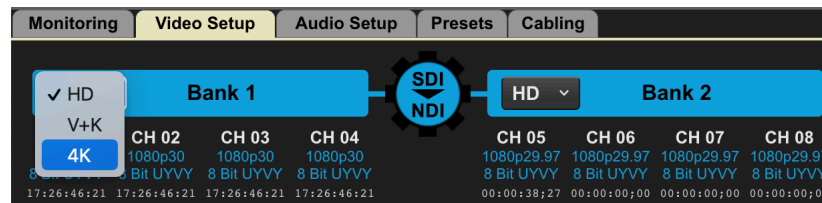
With the Video Setup tab selected, select 4K from the Bank Configuration drop-down menu.

Figure 67. 4K Selected for Bank 1
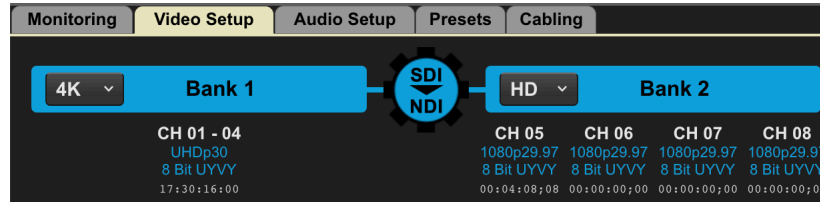
In this example, Channels 01 through 04 are now grouped together as a 4K/Ultra HD Group.

When viewed from the I/O Screen, this shows as a "collapsed" Video Tile representing the signal across the four SDI connections that are being used to feed the 4K/UltraHD signal using that specific Bank.

Figure 68. The I/O Screen Showing Bank 1 as a 4K Video Tile
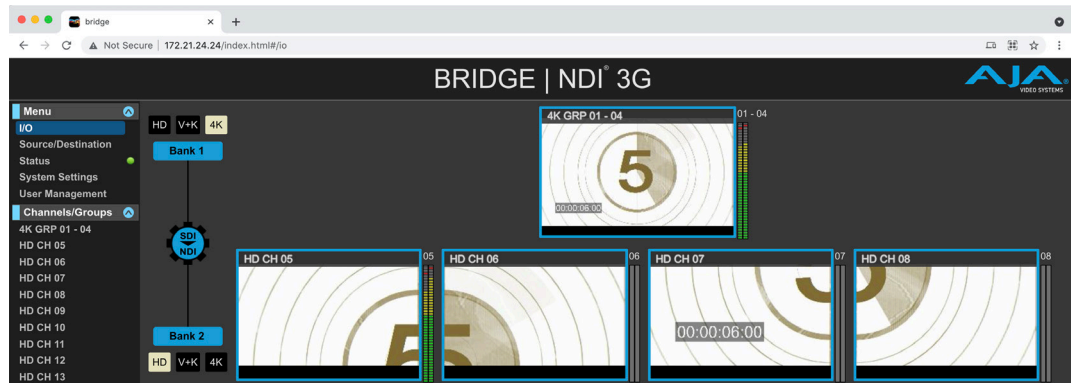
2SI LFR and HFR Input

For LFR (Low Frame Rate) 2SI video, BRIDGE NDI 3G uses only the first two connections of the Bank:

- Bank 1 – Ch 1, 2
- Bank 2 – Ch 5, 6
- Bank 3 – Ch 9, 10
- Bank 4 – Ch 13, 14

For HFR (High Frame Rate) 2SI video, BRIDGE NDI 3G uses all 4 SDI connections of the Bank:

- Bank 1 – Ch 1, 2, 3, 4
- Bank 2 – Ch 5, 6, 7, 8
- Bank 3 – Ch 9, 10, 11, 12
- Bank 4 – Ch 13, 14, 15, 16

Square Division Input

For Square Division, BRIDGE NDI 3G uses all 4 SDI connections of the Bank:

- Bank 1 – Ch 1, 2, 3, 4
- Bank 2 – Ch 5, 6, 7, 8
- Bank 3 – Ch 9, 10, 11, 12
- Bank 4 – Ch 13, 14, 15, 16

Double-clicking the Video Tile that represents the 4K/UltraHD Group opens the Individual Channel/Group Screen for that 4K/UltraHD Group, shown in the next figure below.

Figure 69. The Individual Channel Screen for 4K/UltraHD Group 01-04

An alternative method for navigating to the Individual Channel/Group Screen is to select "4K GRP 01 - 04" in the left menu under the Channels/Groups heading.

This is where a deeper set of controls and tools can be found, such as:

- Disabling or enabling NDI Output
- Pixel Format
- Video Blackout
- Test Pattern on/off and Test Pattern selection
- Audio Mute
- Audio Reference Level (dB)

The system will auto-detect Square or 2SI on input. In NDI output channels, you can select which way to output it – Square or 2SI.

SDI to NDI Encoding for Video + Key Groups

You can use the same Bank Configuration button to break a Group back apart into individual Channels, or change the Group type from 4K/UltraHD to Video + Key.

To configure a Bank for Video + Key, select the Video Setup tab on the Control Bar. The Bank Configuration buttons display.

Figure 70. Selecting V+K from Bank Configuration drop-down menu
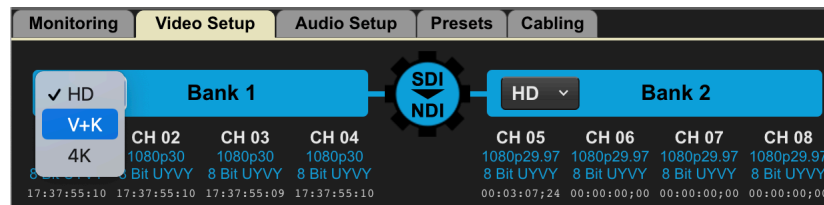
With the Video Setup tab selected, select V+K from the Bank Configuration drop-down menu.

Figure 71. V+K Selected for Bank 1
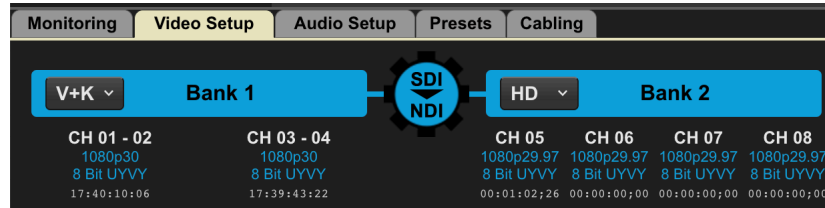
In this example, Channels 01 through 04 are now grouped together as two separate V+K Groups.

When viewed from the I/O Screen, since each Bank has four connectors available, BRIDGE NDI 3G will automatically create a pair of Dual-Channel Video + Key Groups that will show as two "collapsed" Video Tiles, each representing the signal across two of the four SDI connections that are being used to receive the dual Video + Key (HD) signals via SDI, using that specific Bank.

When two separate SDI feeds for Video and Key are encoded to NDI, the resultant NDI is a single stream comprised of Video and Alpha Channel (UYVA).

NOTE: When a Bank is set up for Video and Key, each SDI video pair should be connected with the first connector being Video Channel 1, the second connector being Key Channel 1, the third connector being Video Channel 2, and the fourth connector being Key Channel 2.

Figure 72. The I/O Screen Showing part of Bank 1 (Channels 01 and 02) and part of Bank 3 (Channels 09 and 10) as a Video + Key Configuration
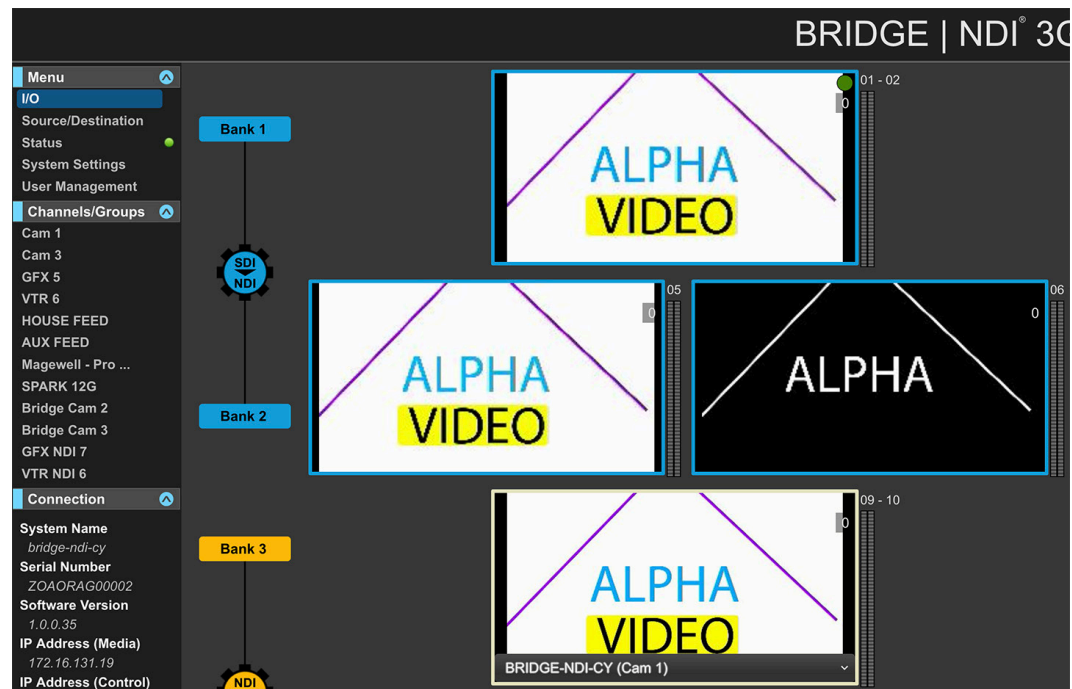
NDI to SDI Decoding

If the system will be devoted to receiving incoming NDI from the NDI Network and decoding to SDI for output from the rear of BRIDGE NDI 3G, then all SDI connections to BRIDGE NDI 3G will be SDI Destinations such as switchers, routers, ingest servers, and edit bays.

Consider how each Bank will be used, i.e., as individual HD Channels, 4K/UltraHD Groups, Video + Key Groups, or some combination thereof.

Most of the controls described above for SDI to NDI encoding are essentially the same when using them for NDI to SDI decoding.

Figure 73. The first time the system is set up for all NDI to SDI, the Video Tiles won't show any video
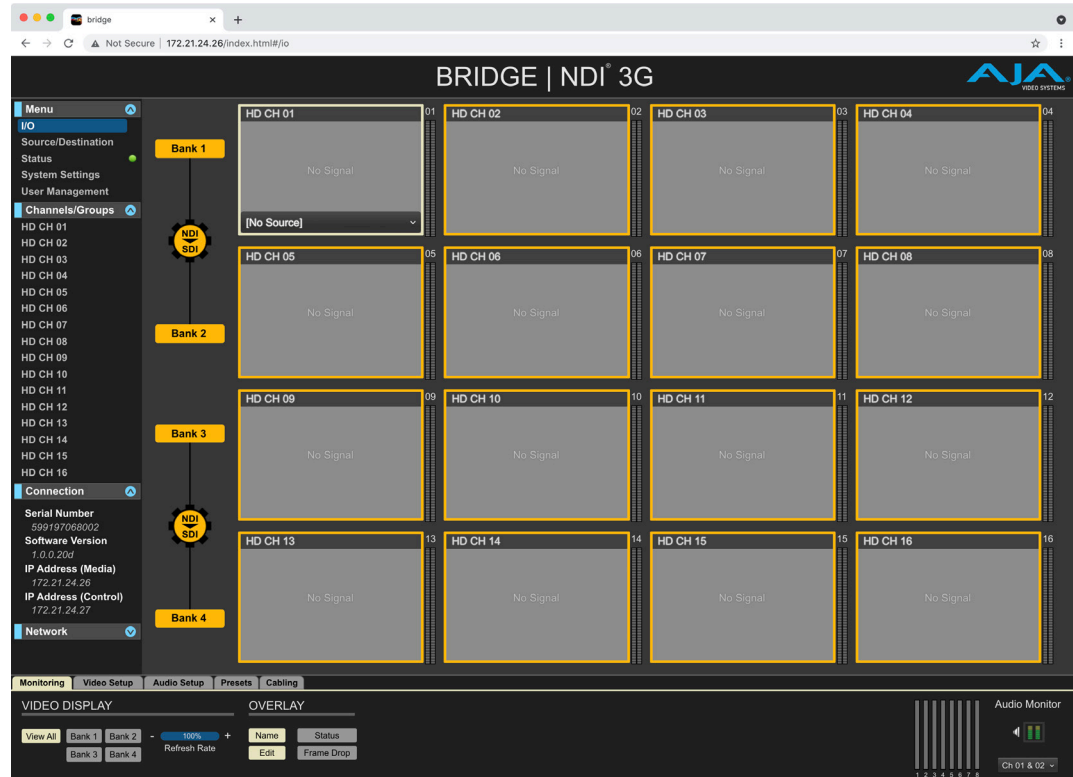
About NDI Sources

BRIDGE NDI 3G is able to receive NDI sources that are HD, 4K or HD Video plus Alpha (V+K). Note, though, that to get the correct result, the Bank(s) will need to be configured correctly by the operator of BRIDGE NDI 3G. Banks do not reconfigure between HD, 4K and Video plus Key automatically based on NDI Source changes.

BRIDGE NDI 3G is compatible for NDI input (receive) and output (transmit) with both NDI 4.x and NDI 5.x software/hardware. For NDI input, NDI HX is also supported.

NOTE: NDI HX (v1, 2, 3) is a highly-compressed version of NDI, created by a hardware chip that resides in devices such as a PTZ camera.

BRIDGE NDI 3G will auto-discover NDI Sources from your network. You can then subscribe to them if you want to convert that NDI Source into SDI.

NDI Source names are non-editable, but Operators can enter descriptive labels for them. There are no default custom names for NDI Sources; the field is blank by default. Custom names have a 45-character limit.

Methods of Discovering NDI Sources

There are a couple of methods for discovering NDI Sources. The default method is for BRIDGE NDI 3G to automatically discover NDI Sources on your local network using mDNS. No special configuration is needed.

Another method is to use a separate host system on the network that runs a Discovery Service. The Discovery Service creates and updates a central store of discovery information and status. This approach can be useful when dealing with an especially large-scale NDI infrastructure that supports dozens or even hundreds of NDI sources.

For more information, please see *"Discovering NDI Sources" on page 35*.

NDI to SDI Decoding for HD Channels

In this example, we are using Bank 3 and Bank 4 to decode NDI to SDI.

Selecting an NDI Source from the NDI Network

Unlike the SDI channels in which the signal source is determined by cabling, NDI sources need to be selected from a drop-down menu for each Video Tile. Until that is done, these channels/groups will display "No Signal."

To Select an NDI Source

1. From the I/O Screen, select the Video Tile you want to use for NDI to SDI. Its frame is outlined in yellow, and "No Source" displays along the lower area.

Figure 74. Selecting NDI to SDI Video Tile for HD CH 09
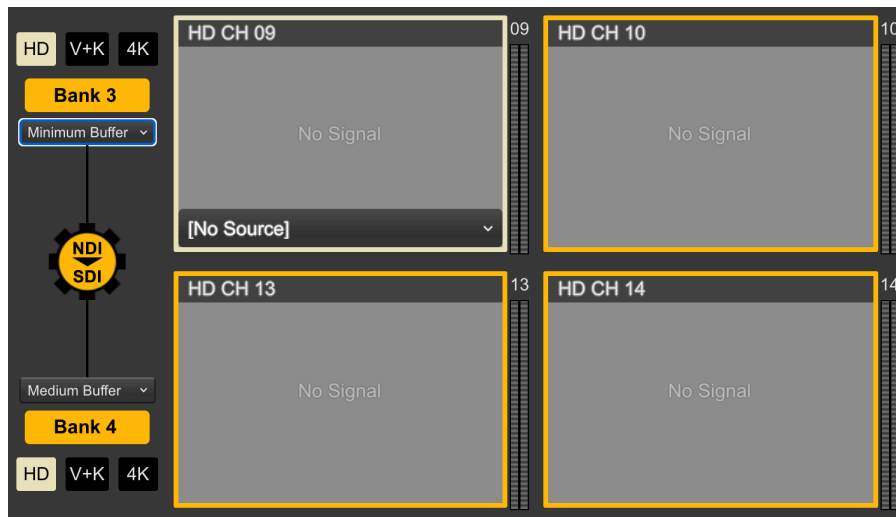
2. Select the drop-down menu. A list of detected NDI sources displays. In this example, eight NDI sources have been detected.

Figure 75. Drop-down menu displaying detected NDI sources
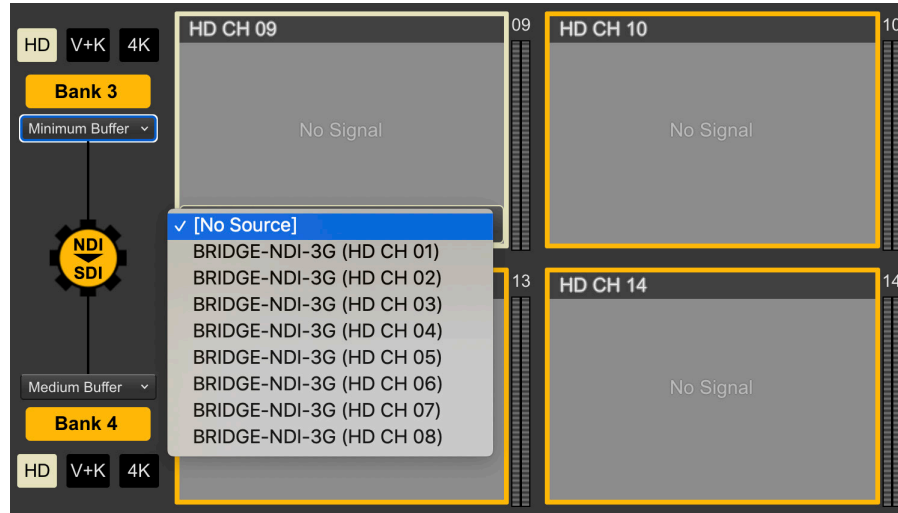
3. Select one of the NDI sources. Its video signal displays in the Video Tile for HD CH 09.

Figure 76. Selected NDI source displaying in Video Tile

4. Repeat this process for each channel that you want to use to decode NDI to SDI.

In the above example, since HD CH 09 was selected, the decoded NDI to SDI video signal will be sent out through the rear BNC connector for Channel 9.

Configuring Banks for HD, V+K, 4K

For NDI to SDI, the steps for configuring Banks for selecting HD, V+K or 4K/Ultra HD are the same as described earlier for the SDI to NDI process. See the steps described in the following sections:

- *"SDI to NDI Encoding for HD Channels" on page 62*
- *"SDI to NDI Encoding for 4K/UltraHD Groups" on page 63*
- *"SDI to NDI Encoding for Video + Key Groups" on page 65*

Figure 77. I/O Screen with all channels decoding NDI to SDI
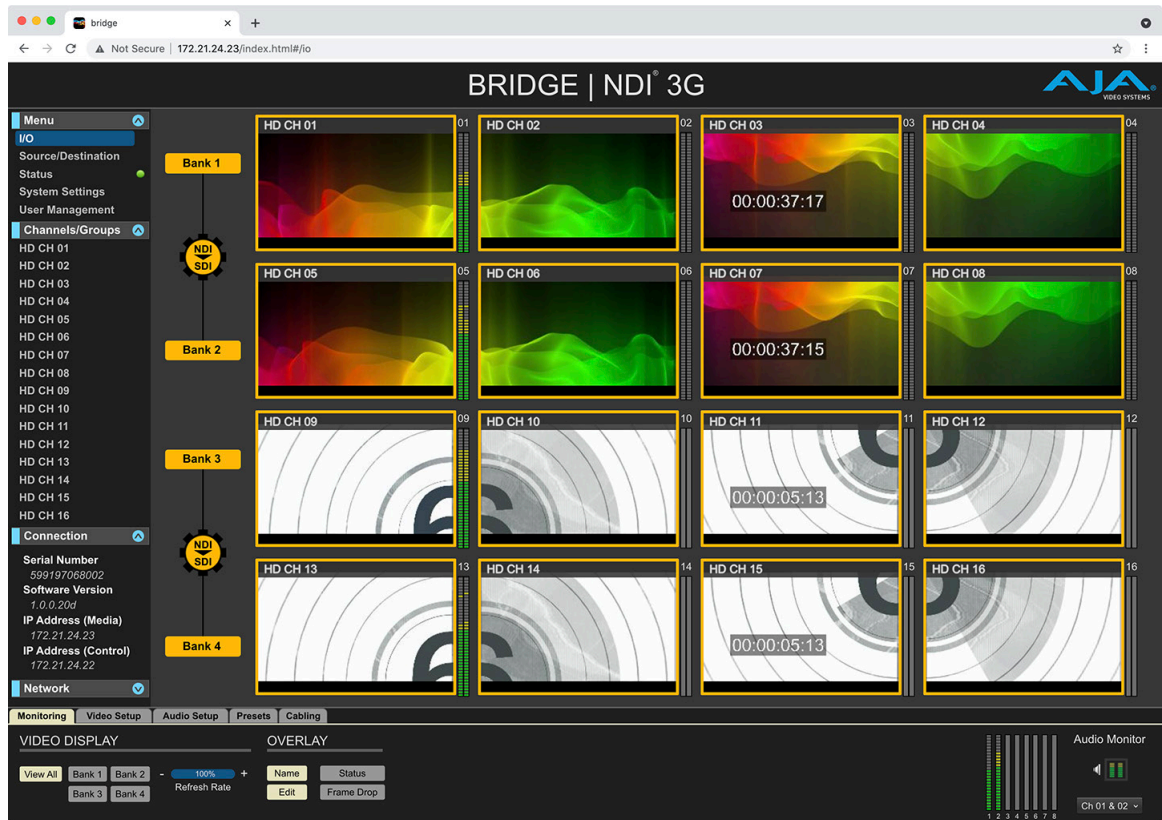
Note that the Bank buttons and the outline of each Video Tiles are colored orange, indicating that those channels/groups/banks are set for decoding NDI to SDI (NDI In, SDI Out).

Buffer and Latency Options

The NDI to SDI video buffer is used to ensure accurate and smooth playback when decoding NDI to SDI.

If you have extremely tight control of your NDI networks and the devices attached to those networks, it may be possible to reduce the size of the video buffer, lowering the latency with no adverse impact on frame drops on the SDI output.

For circumstances in which timeliness is of higher priority than accuracy, such as a two-way interview, or integration of content into a time-critical situation, you could consider reducing the size of the video buffer, lowering the latency until you find a subjective balance between acceptable latency vs. acceptable frame drops on the SDI output.

The Buffer drop-down menu is present only on the I/O Screen when decoding NDI to SDI, and when the Control Bar > Video Setup Tab is selected.

When NDIFrameSync is enabled, it is common to select 'minimum buffer' to automatically adjust the buffer as needed.

Figure 78. NDI Buffer drop-down selections
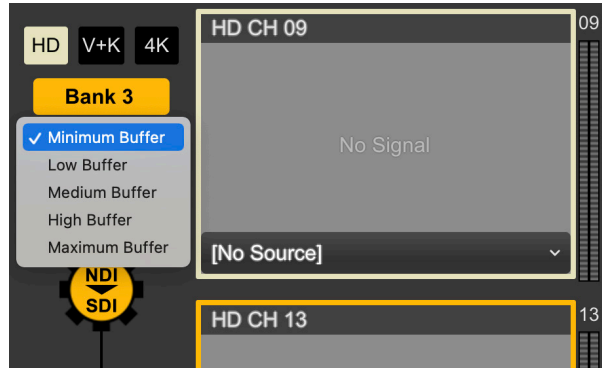
Buffer Settings

Minimum - minimum latency, minimum accuracy/stability

Low - low latency, low accuracy/stability

Medium - medium latency, medium accuracy/stability

High - high latency, high accuracy/stability

Maximum - maximum latency, maximum accuracy/stability

NDI Frame Sync

Starting in V1.6, BRIDGE NDI 3G supports an NDI Frame Sync feature. This is a Viz-NDI technology which can be enabled or disabled on a channel by channel basis.

NOTE: *NDI Frame Sync is a Viz-NDI software feature and does not use AJA FrameSync technology.*

NDI Frame Sync feature is only available in the NDI to SDI direction. This feature assists in keeping A/V sync in high frame rate and is very helpful for signals like HX and Teams meetings that may be inconsistent due to packet loss.

The NDI Frame Sync is activated on a per channel basis in the 'Channels/Groups' section.

Simultaneous SDI Encoding and NDI Decoding

Setting up the system for simultaneous encoding and decoding is straightforward, but it is recommended that you think through your cabling needs ahead of time for the smoothest configuration process.

Plan in Advance for SDI Cabling

If you will be using your BRIDGE NDI 3G system for simultaneously receiving incoming SDI and Encoding to NDI and receiving incoming NDI from the NDI Network and Decoding to SDI, then it is recommended that you decide in advance which connectors will be SDI Inputs, and which connectors will be SDI Outputs.

Example of Simultaneous Encoding and Decoding

For example, if Engine A (Banks 1 and 2) will be used for Receiving incoming SDI and Encoding to NDI for Output to the NDI Network, then SDI connections 1-8 on BRIDGE NDI 3G will be taking in SDI Sources.

If Engine B (Banks 3 and 4) will be used for Decoding NDI from the NDI Network and outputting SDI, then SDI connections 9-16 will output SDI.

Figure 79. I/O Screen with SDI and NDI Sources Displaying
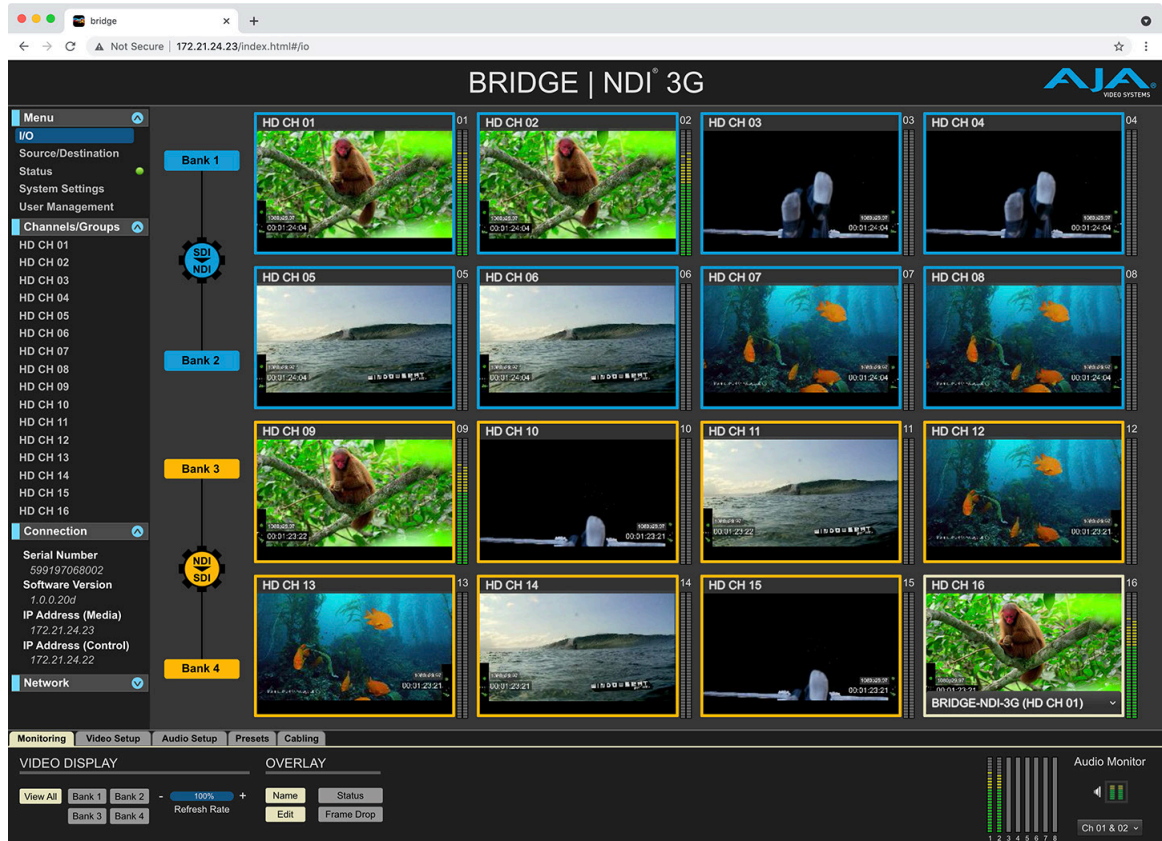
Leverage the Presets Tab

Based on the above planning, the information is now available to correctly cable BRIDGE NDI 3G Video I/O. You can use the Presets Tab from the Control Bar to experiment with different configurations.

Chapter 5 – Interoperability

This chapter presents a summary of some software and hardware tested with BRIDGE NDI 3G, and is not a comprehensive listing. Many other products are also supported by BRIDGE NDI 3G. The 3rd parties product support described here is based upon the versions available at time of testing.

NDI Sources Compatible with BRIDGE NDI 3G

NDI

Newtek's NDI Tools can be downloaded for Windows or macOS at NDI.tv/tools/. This will provide you with many useful apps as well as the plug-ins that will be required for use with Adobe After Effects, Premiere, Apple Final Cut Pro, and VLC.

For macOS users only, similar tools can downloaded from www.sienna-tv.com/ndi.

NDI – Test Patterns

Allow you to output a standard reference or custom image with tone as NDI. You can send a reference signal to other NDI devices on your network to confirm connectivity and enable audio and video calibration.

STEPS:

1. Download and install the NDI Tools software package.

2. Open the NDI Test Patterns Application.

3. Select any of the available test patterns.

4. If desired, select the Audio Tone Level from the drop-down options at the bottom of the screen.

5. Select the "+" icon if you wish to upload and use a custom image. *(Once selected, you will see the system/source information become available for subscription on the BRIDGE NDI 3G Source/Destination page. It can now be selected on the I/O page as an NDI-to-SDI source.)

NDI – Screen Capture

Allows the user to present a computer display, webcam, or region of interest as NDI output with audio.

STEPS:

1. Download and install the NDI Tools software package.

2. Open the NDI Screen Capture Application.

3. Your Desktop will now be mirrored as an NDI source

4. Right-clicking on the Icon in the desktop tray or dock will open a menu that will allow you to change the capture settings. *(Once opened, you will see the system/source information become available for subscription on the BRIDGE NDI 3G Source/Destination page. It can now be selected on the I/O page as an NDI-to-SDI source.)

Live Stream Software (OBS, vMix, Wirecast)

Live stream software applications are capable of outputting an NDI signal as well as receiving them.

Here are the steps to output NDI from the following applications:

OBS

You will first need to download the OBS Studio NDI Plugin by Palakis on GitHub (https://github.com/Palakis/obs-ndi/releases)

STEPS:

1. Open OBS and select Tools in the header

2. From the drop-down menu, select NDIPlugin.Menu. OutputSettings.

3. Here you have the option to select the program and or preview content as individual NDI outputs.

4. After making your selection hit OK. *(Once selected, you will see the system/source information become available for subscription on the BRIDGE NDI 3G Source/Destination page and now can be selected on the I/O page as an NDI-to-SDI source.)

vMix

No extra downloads are required to use NDI with vMix.

STEPS:

1. Open vMIx and select the Gear Icon next to the "External" Tab at the bottom of the window.

2. From the drop-down menu, select "Output/NDI/SRT Settings"

3. You can customize up to four separate NDI outputs to display the Output, Preview, MultiView, Replay, or individual Inputs, by selecting the "NDI ON" buttons next to the Output selection options.

4. You can also activate the "Cameras/Calls/ Audio Inputs" and /or "Audio Outputs as separate NDI Outputs.

5. Select OK.

6. Select the "External" Tab to activate your NDI Output selections. *(Once selected, you will see the system/source information become available for subscription on the BRIDGE NDI 3G Source/Destination page and now can be selected on the I/O page as an NDI-to-SDI source.)

Wirecast

No extra downloads are required to use NDI with Wirecast.

STEPS:

1. Open Wirecast and select Output from the header.

2. From the drop-down menu, select NDI Output and then Start.

3. The default will be set to Match Canvas or you can customize the NDI output from the raster and frame rates that are listed. *(Once selected, you will see the system/source information become available for subscription on the BRIDGE NDI 3G Source/Destination page and now can be selected on the I/O page as an NDI-to-SDI source.)

NLE Software (Adobe, Final Cut Pro, Avid)

NOTE: *A/V Sync may be off when using Non-linear editors such as Premiere. This is a known issue.*

The project preview monitors can be sent out as an NDI outputs once the NDI Tools Plugin has been downloaded and installed from NDI.tv/tools from the following NLE Applications:

Adobe After Effects

STEPS:

1. Open After Effects and select Edit and then Preferences from the drop-down menu.

2. Select Video Preview...

3. Select NDI Output from the Video Device options and hit OK. (Once selected, you will see the system/source information become available for subscription on the BRIDGE NDI 3G Source/Destination page and now can be selected on the I/O page as an NDI-to-SDI source.)

Adobe Premiere

STEPS:

1. Open Premiere Pro and select Edit and then Preferences from the drop-down menu.

2. Select Playback...

3. Select NDI Output from the Video Device options and hit OK.

Apple Final Cut Pro

STEPS:

1. Open the System Preferences from the dock.

2. Select the NDI output Icon.

3. Select the desired Video Format and Frame Rate from the drop-down menus.

4. Click Restart NDI.

5. Open Final Cut Pro. Select Final Cut Pro, then Preferences from the drop-down menu.

6. Select Playback.

7. Select NDI from the A/V Output options and close.

Once selected, you will see the system/source information become available for subscription on the BRIDGE NDI 3G Source/Destination page. You can now select it on the I/O page as an NDI-to-SDI source.

Avid Media Composer

STEPS:

1. Open a new project.

2. Right-click on the "Toggle Hardware Button.

3. Select "OpenIO_NDI" .*(Once selected, you will see the system/source information become available for subscription on the BRIDGE NDI 3G

Source/Destination page and now can be selected on the I/O page as an NDI-to-SDI source.)

Cameras

NDI PTZ camera connectivity may differ based on brand and model. Individual user manuals should be consulted when connecting to the Bridge via your NDI network.

If your Media network switch is set to DHCP, then you should see the camera's system/source information become available for subscription on the BRIDGE NDI 3G Source/Destination page and now can be selected on the I/O page as an NDI-to-SDI source.

If your Media switch is set to Static, you may need to connect the camera to your Control Network first in order to change the camera's default IP address to a new one that is compatible with your Media network.

iPhone

The iPhone camera can be connected to the BRIDGE NDI 3G via a Lightening-to-RJ45 adapter or over WiFi. You will first need to download some type of NDI camera app from the App store. For example, NDI or NDI HX apps will work. The NDI HX app will require less bandwidth but may not have as good a picture as the standard NDI app.

If using WiFi or LAN, the iPhone will send NDI simply by using the NDI app on the phone. Bridge can then subscribe to it provided that your media network is on the same network.

If using a static IP configuration, you will need to set up the static network in the iPhone settings after the LAN connection to lightening cable is connected.

Wi-Fi

STEPS:

1. Configure a wireless router to have a Static IP address that is in the parameters of the IP Domain being used by your Media switch.

2. Open Settings on the iPhone and select this Wi-Fi.

3. Open the NDI camera app on the phone. *(Once selected, you will see the system/source information become available for subscription on the BRIDGE NDI 3G Source/Destination page and now can be selected on the I/O page as an NDI-to-SDI source.).

Single Channel SDI to NDI Converters

Single SDI-NDI Converters connections may differ based on the brand and model. Individual user manuals should be consulted when connecting to the Bridge via your NDI network.

Examples include Magewell Pro Convert, BirdDog, NDI Spark 12G.

If your Media network switch is set to DHCP, then you should see the converters system/source information become available for subscription on the BRIDGE NDI 3G Source/Destination page and now can be selected on the I/O page as an NDI-to-SDI source.

If your Media switch is set to Static, you may need to connect the converter to your Control Network first in order to change the converter's default IP address to a new one that is compatible with your Media network.

Presentation Software (ProPresenter, Resolume Arena, VLC)

ProPresenter

STEPS:

1. Select Screens in the Header and then select "Configure Screens..." from the drop-down menu.

2. Enable the Audience and/or Stage toggle and select the "+" icon to add a screen.

3. Select the Hardware Tab and from the Output drop-down window select "New NDI"

4. Select the desired raster and frame rate. *(Once selected, you will see the system/source information become available for subscription on the BRIDGE NDI 3G Source/Destination page and now can be selected on the I/O page as an NDI-to-SDI source.)

Arena

STEPS:

1. Open Arena and select Output from the Header.

2. Select Network streaming (NDI) from the drop-down menu. *(Once selected, you will see the system/source information become available for subscription on the BRIDGE NDI 3G Source/Destination page and now can be selected on the I/O page as an NDI-to-SDI source.)

VLC

STEPS:

1. Open VLC and select Tools from the Header.

2. Select Preferences from the drop-down menu

3. Select the Video Icon and then select "NDI video output" from the Output drop-down menu. *(Once selected, you will see the system/source information become available for subscription on the BRIDGE NDI 3G Source/Destination page and now can be selected on the I/O page as an NDI-to-SDI source.)

NDI Receivers Compatible with BRIDGE NDI 3G

Single-View Monitor Applications

Newtek NDI Monitor

STEPS:

1. Open NDI Studio Monitor.

2. Select the settings icon in the top left header.

3. From the drop-down menu, select the BRIDGE NDI 3G, and then select the HD Channel of your choice.

4. The NDI video and audio will now be active in the monitor.

Sienna NDI Monitor

STEPS:

1. Open NDI Monitor.

2. From the drop-down menu below the monitor window, select the BRIDGE NDI 3G HD Channel of your choice.

3. The NDI video and audio will now be active in the monitor.

KILOVIEW – MultiView

This multi-view application can be downloaded from Kiloview.com.

NOTE: A 1Gb network will only be able to support 8 channels of HD NDI Video before seeing poor performance. This will also be subject to the capabilities of the host system. A 10Gb network will be able to support a much higher channel count for viewing.

STEPS:

1. Open the app and select the settings icon in the top right of the header.

2. In the toolbar, select the desired screen number and configuration options

3. Click the Discovery button to populate the list of all the available NDI sources on the network.

4. Any available BRIDGE NDI 3G outputs will be identified by device name/channel and IP address/channel.

5. These now can be dragged and dropped into the screen of your choice *(Selecting the NDI Output Toggle will then send back the Multi-view video as a unique NDI source that can be subscribed to.

Live Stream Software (OBS, Wirecast, vMix)

Live stream software applications are capable of capturing an NDI signal as well as outputting them.

Here are the steps to capture a NDI signal from the following applications:

OBS

STEPS:

1. Open OBS and select the "+" Icon in the Source window.

2. Select "NDIPlugin.NDISourceName from the drop-down menu.

3. Select "Create new" or "Add Existing" and hit OK.

4. Select the BRIDGE NDI 3G (HD CH) of your choice and hit OK. The SDI-NDI video from the Bridge will now be visible in the viewer screen.

Wirecast

STEPS:

1. Open Wirecast and select the "+" Icon in the Layer Bar.

2. Select the Network Tab.

3. Select the BRIDGE NDI 3G (HD CH) of your choice and hit Add. The SDI-NDI video from the Bridge will now be visible in the Preview Window.

vMix

STEPS:

1. Open vMix and select the Add Input Tab.

2. Select "NDI/Desktop Capture" and you will see thumbnails of the NDI sources available on your Media network.

3. Select the BRIDGE NDI 3G (HD CH) of your choice and hit OK. The SDI-NDI video from the Bridge will now be visible in the Input Preview Window.

Single Channel NDI-SDI Converters

Single NDI-SDI Converter connections may differ based on the brand and model. Individual user manuals should be consulted when connecting to the Bridge via your NDI network.

If your Media network switch is set to DHCP, then you should see the Bridge system/source information become available for subscription on the Source List page and now can be selected as an NDI-to-SDI source.

If your Media switch is set to Static, you may need to connect the converter to your Control Network first in order to change the converter's default IP address to a new one that is compatible with your Media network.

NewTek Connect Spark Plus I/O

STEPS:

1. Input IP address for converter and login to device.

2. Select the Decoder Tab.

3. Select the BRIDGE NDI 3G from the Source List under the Device Name options.

4. Select the desired Channel from the Channel Name list.

5. Connect the SDI output of the converter to an SDI monitor or capture device.

6. Observe BRIDGE NDI 3G Ch is now active on SDI monitor or capture device.

Chapter 6 – Troubleshooting

Using Refresh Application

Refresh App is a simple way to clear out any issues and to reset all the channels. It also resets all the frame drop counters and creates a fresh start. Output will be interrupted for a few seconds when performing this operation.
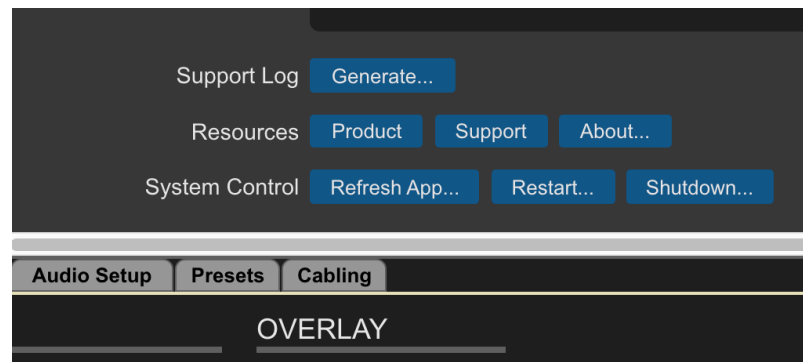
Refresh App

- clears out issues
- resets all the channels
- resets frame drop counters

Refresh Browser

- command + R

NOTE: Command + R refreshes the browser, whereas refresh app resets all the channels.

Figure 80. System Settings Screen > System Control Buttons

Checking Network Connectivity

From the Status Screen, use the Network 1 and Network 2 fields to check the network connectivity and network link state. Here, you can see when your network is up and connected. You can also monitor network traffic.

Figure 81. Status Screen, Network Connectivity State

Appendix A – Specifications

BRIDGE NDI 3G Tech Specs

Video Formats

- (4K) 4096 x 2160p 23.98, 24, 25, 29.97, 30, 50, 59.94, 60
- (UltraHD) 3840 x 2160p 23.98, 24, 25, 29.97, 30, 50, 59.94, 60
- (HD) 1080p 23.98, 24, 25, 29.97, 30, 50, 59.94, 60
- (HD) 1080i 50, 59.94, 60
- (HD) 720p 50, 59.94, 60
- (SD) 525i 59.94, 625i 50

Video Codecs

- NDI
- NDI HX (input only)

Audio Streams/Codecs

- NDI (uncompressed float)
- SDI (PCM)

Color Component Sampling, Color Space and Bit-Depth

- SDI
  - YCbCr, 4:2:2, 10-bit
- NDI
  - UYVY, 4:2:2, 8-bit
  - UYVA, 4:2:2, 8-bit
  - P216, 4:2:2, 16-bit (output only)

Video Processing

- Scaling
- Letterbox/Pillarbox
- Video/Key Pair (2x SDI to 1x NDI + Alpha, or, 1x NDI + Alpha to 2x SDI)
- Reclocking for integer/fractional rate conversion

Audio Processing

- Audio reference level per video channel / group (up to 16 audio channels)
- Sample Rate conversion

Performance

- Up to 16x HD (NDI/SDI)
- Up to 4x 4K (NDI/SDI)
- Ultimate performance based on network conditions, concurrent video processing, and other parameters

NDI Video Input

- NDI (approx. 150–250Mbit/s)
- NDI HX (approx. 8-20Mbit/s)

NDI Video Output

- NDI (approx. 150–250Mbit/s)

SDI Video Input Digital

- 3G-SDI, SMPTE-424, 10-bit
- 1.5G-SDI, SMPTE 292M, 10-bit
- 270Mb-SDI, SMPTE 259M-C, 10-bit

SDI Video Output Digital

- 3G-SDI, SMPTE-424, 10-bit
- 1.5G-SDI, SMPTE 292M, 10-bit
- 270Mb-SDI, SMPTE 259M-C, 10-bit

NDI Audio Input

- Up to 16-channel, uncompressed float, 48 kHz sample rate, per NDI connection

NDI Audio Output

- Up to 16-channel, uncompressed float, 48 kHz sample rate, per NDI connection

SDI Audio Input Digital

- Up to 16-channel, 16 and 24-bit SDI embedded audio, 48 kHz sample rate, synchronous per SDI connection

SDI Audio Output Digital

- Up to 16-channel, 16 and 24-bit SDI embedded audio, 48 kHz sample rate, synchronous per SDI connection

Reference

- Dual Analog Color Black or HD Tri-level sync

Timecode

- VITC1, VITC2, LTC (embedded), Time-of-Day

Network modes

- Unicast-for each RX requesting a stream, TX to replicate the same stream. Can impact TX performance if too many RXs request source

Configuration and Monitoring

- NDI 5.5 or NDI 4 library can be used via interface toggle
- Browser via network attached client system
- Local "Kiosk" interface via monitor (VGA), keyboard, and mouse (not included)
- Local Dual Channel Audio via USB sound card (included)
- REST API

Form Factor

- 1RU turnkey system
- 18x Din 1.0/2.3 BNC: 16SDI I/O, 2Ref (3G/1.5G-SDI compatible)
- 2x 10GigE
- Local interface via VGA and USB
- OS custom image
- Updates via download

Size (w x d x h)

- 17.2" x 16.9" x 1.7" (436.88 x 429.26 x 43.18 mm)

Weight

- 28 lb. (12.7kg) in box
- 18 lb. (8.2kg) server only

Power

- 100-240 VAC 50/60 Hz (Dual, redundant power supplies)
- 190W typical, 245W Maximum

Environment

- Safe Operating Temperature: 5 to 35 C (41 to 95 F)
- Safe Storage Temperature (Power OFF): -40 to 60 C (-40 to 140 F)
- Operating Relative Humidity: 8-90% noncondensing
- Nonoperating Relative Humidity: 5-95% noncondensing

Appendix B – Safety and Compliance

Federal Communications Commission (FCC) Compliance Notices

Class A Interference Statement

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15, Subpart B of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC Caution

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Canadian ICES Statement

Canadian Department of Communications Radio Interference Regulations

This digital apparatus does not exceed the Class A limits for radio-noise emissions from a digital apparatus as set out in the Radio Interference Regulations of the Canadian Department of Communications. This Class A digital apparatus complies with Canadian ICES-003.

Règlement sur le brouillage radioélectrique du ministère des Communications

Cet appareil numérique respecte les limites de bruits radioélectriques visant les appareils numériques de classe A prescrites dans le Règlement sur le brouillage radioélectrique du ministère des Communications du Canada. Cet appareil numérique de la Classe A est conforme à la norme NMB-003 du Canada.

European Union and European Free Trade Association (EFTA) Regulatory Compliance

This equipment may be operated in the countries that comprise the member countries of the European Union and the European Free Trade Association. These countries, listed in the following paragraph, are referred to as The European Community throughout this document:

AUSTRIA, BELGIUM, BULGARIA, CYPRUS, CZECH REPUBLIC, DENMARK, ESTONIA, FINLAND, FRANCE, GERMANY, GREECE, HUNGARY, IRELAND, ITALY, LATVIA, LITHUANIA, LUXEMBOURG, MALTA, NETHERLANDS, POLAND, PORTUGAL, ROMANIA, SLOVAKIA, SLOVENIA, SPAIN, SWEDEN, UNITED KINGDOM, ICELAND, LICHTENSTEIN, NORWAY, SWITZERLAND

Declaration of Conformity

Marking by this symbol indicates compliance with the Essential Requirements of the EMC Directive of the European Union 2014/30/EU.

CE   This equipment meets the following conformance standards:

EN 62368-1: 2014 + A11 (T-Mark License),

IEC 62368-1: 2014 (CB Scheme Report/Certificates

Additional licenses issued for specific countries available on request.

Emissions

EN 55032: 2015 + A11: 2020, CISPR 32: 2015,

EN 61000-3-2: 2014, EN 61000-3-3: 2013

Immunity

EN 55035: 2017 + A11: 2020, EN 61000-4-2:2009,

EN 61000-4-3: 2006 + A1:2008 + A2:2010,

EN 61000-4-4: 2012, EN 61000-4-5: 2014 + A1: 2017, EN 61000-4-6: 2014,

EN 61000-4-11: 2020

Environments: E2, E3 and E4

The product is also licensed for additional country specific standards as required for the International Marketplace.

Warning! This is a Class A product. In a domestic environment, this product may cause radio interference, in which case, the user may be required to take appropriate measures.

Achtung! Dieses ist ein Gerät der Funkstörgrenzwertklasse A. In Wohnbereichen können bei Betrieb dieses Gerätes Rundfunkstörungen auftreten, in welchen Fällen der Benutzer für entsprechende Gegenmaßnahmen verantwortlich ist.

Attention! Ceci est un produit de Classe A. Dans un environnement domestique, ce produit risque de créer des interférences radioélectriques, il appartiendra alors à l?utilisateur de prendre les mesures spécifiques appropriées..

Recycling Notice

This symbol on the product or its packaging indicates that this product must not be disposed of with your other household waste. Instead, it is your responsibility to dispose of your waste equipment by handing it over to a designated collection point for the recycling of waste electrical and electronic equipment. The separate collection and recycling of your waste equipment at the time of disposal will help conserve natural resources and ensure that it is recycled in a manner that protects human health and the environment. For more information about where you can drop off your waste for recycling, please contact your local authority, or where you purchased your product.

Korea KCC Compliance Statement

사 용 자 안 내 문
이 기기는 업무용 환경에서 사용할 목적으로 적합성평가를 받은 기기로서 가정용 환경에서 사용하는 경우 전파간섭의 우려가 있습니다.

Taiwan Compliance Statement

警告使用者：
這是甲類的資訊產品，在居住的環境中使用時，可能會造成射頻
干擾，在這種情況下，使用者會被要求採取某些適當的對策。

This is a Class A product based on the standard of the Bureau of Standards, Metrology and Inspection (BSMI) CNS 13438, Class A. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

Japan Compliance Statement

この装置は、クラスＡ情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。　　　　ＶＣＣＩ－Ａ

This is a Class A product based on the standard of the VCCI Council (VCCI 32: 2016). If this equipment is used in a domestic environment, radio interference may occur, in which case, the user may be required to take corrective actions.

Chinese Compliance Statement

This product has been tested to the following Chinese standards:

GB/T 13837-2012; GB 17625.1-2012; GB 8898-2011; GB/T 9254-2008 (Class A)

This is to certify that the above mentioned product(s) complies with the requirements of certification rules of CQC12-045800-2022 under certificate number CQC2021010805367344.

Translated Warning and Caution Messages

The following caution statements, warning conventions, and warning messages apply to this product and manual.

 Warning Symbol   Hazard Symbol   Caution Symbol

Before Operation Please Read These Instructions

Warning! Read and follow all warning notices and instructions marked on the product or included in the documentation.

Avertissement! Lisez et conformez-vous à tous les avis et instructions d'avertissement indiqués sur le produit ou dans la documentation.

Warnung! Lesen und befolgen Sie die Warnhinweise und Anweisungen, die auf dem Produkt angebracht oder in der Dokumentation enthalten sind.

¡Advertencia! Lea y siga todas las instrucciones y advertencias marcadas en el producto o incluidas en la documentación.

Aviso! Leia e siga todos os avisos e instruções assinalados no produto ou incluídos na documentação.

Avviso! Leggere e seguire tutti gli avvisi e le istruzioni presenti sul prodotto o inclusi nella documentazione.

Warning! Do not use this device near water and clean only with a dry cloth.

Avertissement! N'utilisez pas cet appareil près de l'eau et nettoyez-le seulement avec un tissu sec.

Warnung! Das Gerät nicht in der Nähe von Wasser verwenden und nur mit einem trockenen Tuch säubern.

¡Advertencia! No utilice este dispositivo cerca del agua y límpielo solamente con un paño seco.

Aviso! Não utilize este dispositivo perto da água e limpe-o somente com um pano seco.

Avviso! Non utilizzare questo dispositivo vicino all'acqua e pulirlo soltanto con un panno asciutto.

Warning! Do not block any ventilation openings. Install in accordance with the manufacturer's instructions.

Avertissement! Ne bloquez aucune ouverture de ventilation. Suivez les instructions du fabricant lors de l'installation.

Warnung! Die Lüftungsöffnungen dürfen nicht blockiert werden. Nur gemäß den Anweisungen des Herstellers installieren.

¡Advertencia! No bloquee ninguna de las aberturas de la ventilación. Instale de acuerdo con las instrucciones del fabricante.

Aviso! Não obstrua nenhuma das aberturas de ventilação. Instale de acordo com as instruções do fabricante.

Avviso! Non ostruire le aperture di ventilazione. Installare in conformità con le istruzioni del fornitore.

Warning! Do not install near any heat sources such as radiators, heat registers, stoves, or other apparatus (including amplifiers) that produce heat.

Avertissement! N'installez pas l'appareil près d'une source de chaleur telle que des radiateurs, des bouches d'air de chauffage, des fourneaux ou d'autres appareils (amplificateurs compris) qui produisent de la chaleur.

Warnung! Nicht in der Nähe von Wärmequellen wie Heizkörpern, Heizregistern, Öfen oder anderen Wärme erzeugenden Geräten (einschließlich Verstärkern) aufstellen.

¡Advertencia! No instale cerca de fuentes de calor tales como radiadores, registros de calor, estufas u otros aparatos (incluidos amplificadores) que generan calor.

Aviso! Não instale perto de nenhuma fonte de calor tal como radiadores, saídas de calor, fogões ou outros aparelhos (incluindo amplificadores) que produzam calor.

Avviso! Non installare vicino a fonti di calore come termosifoni, diffusori di aria calda, stufe o altri apparecchi (amplificatori compresi) che emettono calore

Warning! Do not defeat the safety purpose of the polarized or grounding-type plug. A polarized plug has two blades with one wider than the other. A grounding type plug has two blades and a third grounding prong. The wide blade or the third prong are provided for your safety. If the provided plug does not fit into your outlet, consult an electrician for replacement of the obsolete outlet.

Avertissement! La sécurité de la prise polarisée ou de la prise de type mise à la terre ne doit en aucun cas être empêchée de fonctionner. Une prise polarisée a deux broches, l'une étant plus large que l'autre. Une prise de type mise à la terre a deux broches et une troisième broche pour la mise à la terre. La broche large ou la troisième broche sont fournies pour votre sécurité. Si la prise fournie ne s'insère pas dans votre prise femelle, consultez un électricien pour le remplacement de la prise femelle obsolète.

Warnung! Der Sicherheitszweck des gepolten bzw. Schukosteckers ist zu berücksichtigen. Ein gepolter Stecker verfügt über zwei Pole, von denen einer breiter als der andere ist. Ein Schukostecker verfügt neben den zwei Polen noch über einen dritten Pol zur Erdung. Der breite Pol bzw. der Erdungspol dienen der Sicherheit. Wenn der zur Verfügung gestellte Stecker nicht in Ihren Anschluss passt, konsultieren Sie einen Elektriker, um den veralteten Anschluss zu ersetzen.

¡Advertencia! No eche por tierra la finalidad del tipo de enchufe polarizado con conexión a tierra. Un enchufe polarizado tiene dos espigas, una más ancha que la otra. Un enchufe con conexión a tierra tiene dos espigas iguales y una tercera espiga que sirve para la conexión a tierra. La expiga ancha, o la tercera espiga, sirven para su seguridad. Si el enchufe suministrado no encaja en el tomacorriente, consulte con un electricista para reemplazar el tomacorriente obsoleto.

Aviso! Não anule a finalidade da segurança da ficha polarizada ou do tipo ligação terra. Uma ficha polarizada tem duas lâminas sendo uma mais larga do que a outra. Uma ficha do tipo de ligação à terra tem duas lâminas e um terceiro terminal de ligação à terra. A lâmina larga ou o terceiro terminal são fornecidos para sua segurança. Se a ficha fornecida não couber na sua tomada, consulte um electricista para a substituição da tomada obsoleta.

Avviso! Non compromettere la sicurezza della spina polarizzata o con messa a terra. Una spina polarizzata ha due spinotti, di cui uno più largo. Una spina con messa a terra ha due spinotti e un terzo polo per la messa a terra. Lo spinotto largo o il terzo polo sono forniti per motivi di sicurezza. Se la spina fornita non si inserisce nella presa di corrente, contattare un elettricista per la sostituzione della presa obsoleta.

Warning! Since the Mains plug is used as the disconnection for the device, it must remain readily accessible and operable.

Avertissement! Puisque la prise principale est utilisée pour débrancher l'appareil, elle doit rester aisément accessible et fonctionnelle.

Warnung! Da der Netzstecker als Trennvorrichtung dient, muss er stets zugänglich und funktionsfähig sein.

¡Advertencia! Puesto que el enchufe de la red eléctrica se utiliza como dispositivo de desconexión, debe seguir siendo fácilmente accesible y operable.

Aviso! Dado que a ficha principal é utilizada como a desconexão para o dispositivo, esta deve manter-se prontamente acessível e funcional.

Avviso! Poiché il cavo di alimentazione viene usato come dispositivo di sconnessione, deve rimane prontamente accessibile e operabile.

Warning! Protect the power cord from being walked on or pinched particularly at plugs, convenience receptacles, and the point where they exit from the device.

Avertissement! Protégez le cordon d'alimentation pour que l'on ne marche pas dessus ou qu'on le pince, en particulier au niveau des prises mâles, des réceptacles de convenance, et à l'endroit où il sort de l'appareil.

Warnung! Vermeiden Sie, dass auf das Netzkabel getreten oder das Kabel geknickt wird, insbesondere an den Steckern, den Steckdosen und am Kabelausgang am Gerät.

¡Advertencia! Proteja el cable de energía para que no se le pise ni apriete, en especial cerca del enchufe, los receptáculos de conveniencia y el punto del que salen del equipo.

Aviso! Proteja o cabo de alimentação de ser pisado ou de ser comprimido particularmente nas fichas, em tomadas de parede de conveniência e no ponto de onde sai do dispositivo.

Avviso! Proteggere il cavo di alimentazione in modo che nessuno ci cammini sopra e che non venga schiacciato soprattutto in corrispondenza delle spine e del punto in cui esce dal dispositivo.

Warning! Unplug this device during lightning storms or when unused for long periods of time.

Avertissement! Débranchez cet appareil pendant les orages avec éclairsou s'il est inutilisé pendant de longues périodes.

Warnung! Das Gerät ist bei Gewitterstürmen oder wenn es über lange Zeiträume ungenutzt bleibt vom Netz zu trennen.

¡Advertencia! Desenchufe este dispositivo durante tormentas eléctricas o cuando no se lo utilice por largos periodos del tiempo.

Aviso! Desconecte este dispositivo da tomada durante trovoadas ou quando não é utilizado durante longos períodos de tempo.

Avviso! Utilizzare soltanto i collegamenti e gli accessori specificati e/o venduti dal produttore, quali il treppiedi e l'esoscheletro.

Warning! Refer all servicing to qualified service personnel. Servicing is required when the device has been damaged in any way, such as power-supply cord or plug is damaged, liquid has been spilled or objects have fallen into the device, the device has been exposed to rain or moisture, does not operate normally, or has been dropped.

Avertissement! Référez-vous au personnel de service qualifié pour tout entretien. L'entretien est exigé quand l'appareil a été endommagé de quelque manière que ce soit, par exemple lorsque le cordon d'alimentation ou la prise sont endommagés, que du liquide a été versé ou des objets sont tombés dans l'appareil, que l'appareil a été exposé à la pluie ou à l'humidité, ne fonctionne pas normalement ou est tombé.

Warnung! Das Gerät sollte nur von qualifizierten Fachkräften gewartet werden. Eine Wartung ist fällig, wenn das Gerät in irgendeiner Weise beschädigt wurde, wie bei beschädigtem Netzkabel oder Netzstecker, falls Flüssigkeiten oder Objekte in das Gerät gelangen, das Gerät Regen oder Feuchtigkeit ausgesetzt wurde, nicht ordnungsgemäß funktioniert oder fallen gelassen wurde.

¡Advertencia! Consulte al personal calificado por cuestiones de reparación. El servicio de reparación se requiere cuando el dispositivo ha recibido cualquier tipo de daño, por ejemplo cable o espigas dañadas, se ha derramado líquido o se han caído objetos dentro del dispositivo, el dispositivo ha sido expuesto a la lluvia o humedad, o no funciona de modo normal, o se ha caído.

Aviso! Remeta todos os serviços de manutenção para o pessoal de assistência qualificado. A prestação de serviços de manutenção é exigida quando o dispositivo foi danificado mediante qualquer forma, como um cabo de alimentação ou ficha que se encontra danificado/a, quando foi derramado líquido ou caíram objectos sobre o dispositivo, quando o dispositivo foi exposto à chuva ou à humidade, quando não funciona normalmente ou quando foi deixado cair.

Avviso! Fare riferimento al personale qualificato per tutti gli interventi di assistenza. L'assistenza è necessaria quando il dispositivo è stato danneggiato in qualche modo, ad esempio se il cavo di alimentazione o la spina sono danneggiati, è stato rovesciato del liquido è stato rovesciato o qualche oggetto è caduto nel dispositivo, il dispositivo è stato esposto a pioggia o umidità, non funziona correttamente o è caduto

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Warning! Do not open the chassis. There are no user-serviceable parts inside. Opening the chassis will void the warranty unless performed by an AJA service center or licensed facility.

Avertissement! Ne pas ouvrir le châssis. Aucun élément à l'intérieur du châssis ne peut être réparé par l'utilisateur. La garantie sera annulée si le châssis est ouvert par toute autre personne qu'un technicien d'un centre de service ou d'un établissement agréé AJA.

Warnung! Öffnen Sie das Gehäuse nicht. Keine der Geräteteile können vom Benutzer gewartet werden. Durch das Öffnen des Gehäuses wird die Garantie hinfällig, es sei denn, solche Wartungsarbeiten werden in einem AJA-Service-Center oder einem lizenzierten Betrieb vorgenommen.

¡Advertencia! No abra el chasis. El interior no contiene piezas reparables por el usuario. El abrir el chasis anulará la garantía a menos que se lo haga en un centro de servicio AJA o en un local autorizado.

Advertência! Não abra o chassi. Não há internamente nenhuma peça que permita manutenção pelo usuário. Abrir o chassi anula a garantia, a menos que a abertura seja realizada por uma central de serviços da AJA ou por um local autorizado.

Avvertenza! Non aprire lo chassis. All'interno non ci sono parti riparabili dall'utente. L'apertura dello chassis invaliderà la garanzia se non viene effettuata da un centro ufficiale o autorizzato AJA.

Warning! Disconnect the external AC power supply line cord(s) from the mains power before moving the unit.

Avertissement! Retirez le ou les cordons d'alimentation en CA de la source d'alimentation principale lorsque vous déplacez l'appareil.

Warnung! Trennen Sie die Wechselstrom-Versorgungskabel vom Netzstrom, bevor Sie das Gerät verschieben.

¡Advertencia! Cuando mueva la unidad desenchufe de la red eléctrica el/los cable(s) de la fuente de alimentación CA tipo brick.

Advertência! Remova os cabos CA de alimentação brick da rede elétrica ao mover a unidade.

Avvertenza! Scollegare il cavo dell'alimentatore quando si sposta l'unità.

Warning! Only use attachments and accessories specified and/or sold by the manufacturer.

Avertissement! Utilisez seulement les attaches et accessoires spécifiés et/ou vendus par le fabricant.

Warnung! Verwenden Sie nur Zusatzgeräte und Zubehör angegeben und / oder verkauft wurde durch den Hersteller.

¡Advertencia! Utilice solamente los accesorios y conexiones especificados y/o vendidos por el fabricante.

Aviso! Utilize apenas equipamentos/acessórios especificados e/ou vendidos pelo fabricante.

Avviso! Utilizzare soltanto i collegamenti e gli accessori specificati e/o venduti dal produttore.

Hazard! High Voltage. This situation or condition can cause injury due to electric shock.

Avertissement! Tension élevée. Cette situation ou condition peut causer des blessures dues à un choc électrique.

Warnung! Hochspannung. Diese Situation oder Bedingung kann zu Verletzungen durch Stromschlag führen.

¡Advertencia! Alto voltaje . Esta situación o condición puede causar lesiones debidas a una descarga eléctrica.

Aviso! Alta Tensão . Esta situação ou condição pode causar danos devido a choques elétricos.

Avviso! Alta tensione. Questa situazione o condizione può causare lesioni a causa di scosse elettriche.

Warning! Dual Power Cord Notice—please read this. To reduce the risk of electrical shock,disconnect both power cords before servicing equipment.

Avertissement! Avis concernant la double alimentation électrique — à lire soigneusement. Pour éviter tout risque d'électrocution, débranchez les deux câbles électriques avant d'intervenir sur l'équipement.

Achtung! Hinweis auf Doppel-Netzkabel—bitte lesen. Um das Risiko eines Elektroschocks zu verringern, müssen beide Netzkabel ausgestöpselt werden, bevor die Vorrichtung gewartet wird.

Avvertenza. Avviso concernente il cavo di alimentazione doppio – leggere attentamente. Per ridurre il rischio di elettrocuzione, scollegare entrambi i cavi di alimentazione prima di eseguire la manutenzione o riparazioni di questo apparecchio.

Aviso! Aviso de Cabo Elétrico Duplo - por favor, leia isto. Para reduzir o risco de choque elétrico, desconecte ambos os cabos elétricos antes de fazer manutenção ao equipamento.

¡Advertencia! Aviso del doble cable de alimentación - leer esto por favor. Para reducir el riesgo de descarga eléctrica, desconecte ambos cables de alimentación antes de dar servicio al equipo.

Caution! To meet safety regulations for leakage current, connect the dual power supplies to separate branch circuits.

¡Advertencia! Para cumplir con las normas de seguridad para la corriente de fuga, conecte las dos fuentes de alimentación para circuitos derivados diferentes.

Attention! Pour répondre aux mesures de sécurité concernant le courant de fuite, raccorder les sources d'alimentation doubles à des circuits de dérivation distincts.

Warnung! Zur Erfüllung der Sicherheitsbestimmungen bezüglich Reststrom schließen Sie bitte die zwei Netzteile an unterschiedlichen Abzweigleitungen an.

Cuidado! Para atender aos regulamentos de segurança para correntes de fuga, conecte as fontes duplas a circuitos elétricos separados.

Attenzione! Per soddisfare le norme di sicurezza sulla corrente di perdita, collegare i doppi alimentatori a circuiti derivati separati.

Warning! Hazardous Voltages! The safe operation of this product requires that a protective earth connection be provided. This protective earth is provided by the grounding conductor in the equipment's supply cord. To reduce the risk of electrical shock to operator and service personnel, this ground conductor must be connected to an earthed ground.

Avertissement : tensions dangereuses — Pour utiliser ce produit en toute sécurité, il faut un raccordement à la terre. Ce raccordement s'effectue par l'intermédiaire du connecteur de terre dans le cordon d'alimentation de l'équipement. Pour réduire le risque d'électrocution de l'opérateur ou du personnel de maintenance, ce cordon avec conducteur de terre doit être branché sur une prise reliée à la terre.

Achtung! Gefährliche Spannungen — Sichere Bedienung dieses Geräts erfordert, dass ein Schutzleiteranschluss vorgesehen wird. Dieser Schutzleiteranschluss wird mittels der Erdungsleitung im Netzkabel der Vorrichtung vorgesehen. Um die Gefahr eines Elektroschocks für Bedien- und Wartungspersonal zu verringern, muss diese Erdungsleitung mit einer geerdeten Masse verbunden werden.

Avvertenza – Alte tensioni – Il funzionamento in sicurezza di questo prodotto richiede una presa di terra, che viene fornita dal conduttore di messa a terra presente nel cavo di alimentazione dell'apparecchio. Per ridurre il rischio di elettrocuzione per l'operatore e il personale di manutenzione, tale conduttore deve essere collegato a un punto al potenziale di terra.

Advertencia de voltajes peligrosos — El funcionamiento seguro de este producto require que se proporcione una conexión terrestre protegida. Esta protección terrestre es proporcionada por el conductor de conexión en la tierra del cable de alimentación del equipo. Para reducir el riesgo de descarga eléctrica al operador y el personal de servicio, este conductor de conexión de la tierra debe ser conectado a la misma tierra.

Warranty and Liability Information

Limited Warranty on Hardware

AJA Video Systems, Inc. (AJA Video) warrants that the hardware product, not including storage modules or software components, will be free from defects in materials and workmanship for a period of three years from the date of purchase. AJA Video warrants that the storage modules provided as part of the hardware product will be free from defects in materials and workmanship for a period of one year from the date of purchase. AJA Video provides a separate software warranty as part of the license agreement applicable to software components.

If the Customer brings a valid claim under this limited warranty for a hardware product or storage module (hereafter, a "product") during the applicable warranty period, AJA Video will, at its sole option and as the Customer's sole remedy for breach of the above warranty, provide one of the following remedies:

- Repair or facilitate the repair the product within a reasonable period of time, free of charge for parts and labor.
- Replace the product with a direct replacement or with a product that performs substantially the same function as the original product.
- Issue a refund of the original purchase price less depreciation to be determined based on the age of the product at the time remedy is sought under this limited warranty.

To obtain service under this warranty, the Customer must notify AJA Video of the defect before expiration of the warranty period and make suitable arrangements for the performance of service by contacting AJA Video support through the channels set forth on the support contacts web page at https://www.aja.com/support. Except as stated, the Customer shall bear all shipping, packing, insurance and other costs, excluding parts and labor, to effectuate repair. Customer shall pack and ship the defective product to a service center designated by AJA Video, with shipping charges prepaid. AJA Video shall pay to return the product to Customer, but only if to a location within the country in which the AJA Video service center is located. SOME JURISDICTIONS DO NOT ALLOW THE EXCLUSION OF IMPLIED WARRANTIES OR LIMITATIONS ON APPLICABLE STATUTORY RIGHTS OF A CONSUMER, SO SOME OR ALL OF THE TERMS OF THIS PARAGRAPH MAY NOT APPLY TO YOU.

Limitation of Liability

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