



NC2 IO

Studio Input/Output Module

User Guide

NDI™

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TABLE OF CONTENTS

CHAPTER 1 INTRODUCTION AND SETUP	5
Section 1.1 Welcome	5
Section 1.2 Overview	5
Section 1.3 Setting Up.....	6
1.3.1 Command and Control	6
1.3.2 Input/Output Connections	7
CHAPTER 2 USER INTERFACE	8
Section 2.1 The Desktop	8
2.1.1 Configure Channels	9
Section 2.2 Key/Fill Connections.....	15
Section 2.3 Titlebar & Dashboard	15
2.3.1 Titlebar Tools	16
2.3.2 System Configuration	17
2.3.3 Notifications	19
2.3.4 Viewport Tools	21
2.3.5 Dashboard Tools.....	22
APPENDIX A: NDI® (NETWORK DEVICE INTERFACE).....	25
APPENDIX B: DIMENSIONS AND MOUNTING	26
APPENDIX C: ENHANCED SUPPORT (PROTEK)	27
APPENDIX D: RELIABILITY TESTING	28
CREDITS.....	29

Chapter 1 INTRODUCTION AND SETUP



This chapter explains how to connect power, monitors and audio visual devices to your NewTek NC2 Input/Output Module. It also reviews the registration process. After completing this short section, you'll be all set to begin using NC2 I/O Module.

SECTION 1.1 WELCOME

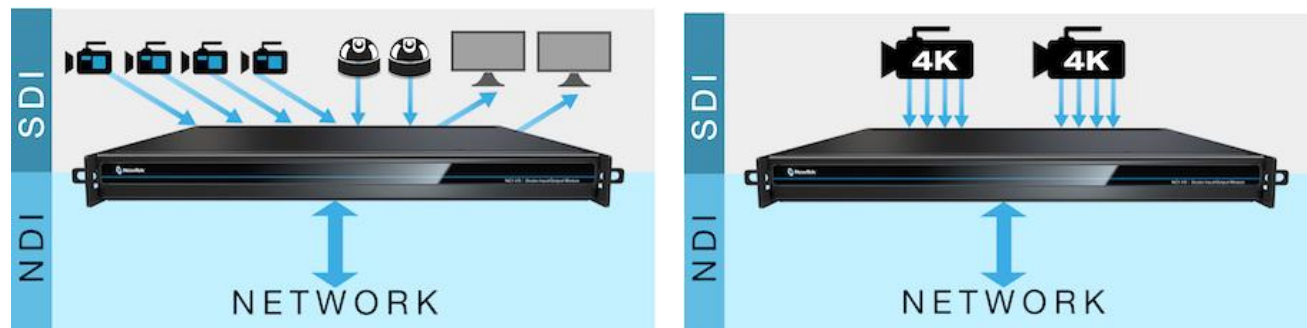
Thank you for purchasing this NewTek product. As a company, we are extremely proud of our record of innovation and commitments to excellence in design, manufacture, and superb product support.

NewTek's innovative live production systems have repeatedly redefined broadcast workflows, providing new possibilities and economy. In particular, NewTek has been a leader in introducing integrated devices providing a complete set of tools related to program creation and broadcast, along with web streaming and social media publishing. This tradition continues with the NC2 Studio IO Module. Its implementation of NDI® (Network Device Interface) protocol places your new system squarely in the forefront of IP technology solutions for the video broadcast and production industries.

SECTION 1.2 OVERVIEW

Commitments and requirements can change from production to production. A powerful, versatile platform for multi-source production and multi-screen delivery workflows, the Studio I/O Module quickly pivots to accommodate additional cameras, devices, displays or destinations.

With NC2 IO's turnkey installation and operation, you can easily assemble a network of modules to configure your own multi-system and multi-site workflows.



From increasing your available inputs and outputs, to merging established and emerging technologies, to linking locations across your network, the NewTek Studio I/O Module is a universal solution that adapts to your production needs.

- Translate up to 8 compatible video sources to SDI or NDI for input, output, or a combination of both
- Configure for dual-channel 4K Ultra HD at 60 frames per second with support for 3G-SDI quad-link grouping
- Integrate with compatible systems and devices across your network for switching, streaming, display, and delivery
- Stack modules in a single location or station in multiple locations to meet the demands of your productions

SECTION 1.3 SETTING UP

1.3.1 COMMAND AND CONTROL

Hint: NC2 IO's interface requires a monitor resolution setting of at least 1280x1024.

1. Connect an external computer monitor to the SDI port on the backplate (see Figure 1).
2. Connect the *mouse* and *keyboard* to USB ports also on the backplate.
3. Connect the *power cord* to NC2 IO's backplate.
4. Turn on the computer monitor.
5. Press the *Power* switch on NC2 IO's faceplate (located behind the drop-down door).

At this point, the blue *Power LED* will illuminate, as the device boots up. (If this does not happen, check your connections and retry). Though not a requirement, we do strongly recommend that you connect NC2 IO using an uninterruptable power supply (UPS), as for any 'mission critical' system.

Likewise, consider A/C "power conditioning", especially in situations where local power is unreliable or 'noisy'. Surge protection is especially important in some locales. Power conditioners can reduce wear on NC2 IO's power supplies and other electronics, and provide a further measure of protection from surges, spikes, lightning and high voltage.

A word about UPS devices:

'Modified sine wave' UPS devices are popular due to low manufacturing costs. However, such units should generally be viewed as being of low quality and possibly inadequate to fully protect the system from abnormal power events.

For a modest added cost, consider a "pure sine wave" UPS. These units can be relied on to supply very clean power, eliminating potential problems, and are recommended for applications demanding high reliability.

1.3.2 INPUT/OUTPUT CONNECTIONS

External audio and video sources are connected to the appropriate inputs.



FIGURE 1

1. Genlock and SDI – employs HD-BNC connectors
2. USB – connect keyboard, mouse, video monitor and other peripheral devices
3. Remote Power Switch
4. Serial Connector
5. Ethernet – network connections
6. Mains | Power

The 'Configure IO Connectors' dialog can be opened directly from the System Configuration panel. See Section 2.3.2.

Generally, simply connecting a suitable cable from one of the two Gigabit Ethernet ports on NC2 IO's backplane is all that is required to add it to a *local area network* (LAN). In some settings, additional steps may be required. You can access the system *Network and Sharing* control panel to accomplish more extensive configuration tasks. If further help connecting is required, please consult your system administrator.

Chapter 2 USER INTERFACE



This chapter explains the layout and options of the user interface, and how to configure NC2 IO audio and video input and output. It also introduces the various supplemental video production features NewTek IO provides, including Proc Amps, Scopes and capture.

SECTION 2.1 THE DESKTOP

The NC2 IO default Desktop interface is shown below, and provides very useful remote monitoring options in addition to configuration and control features.

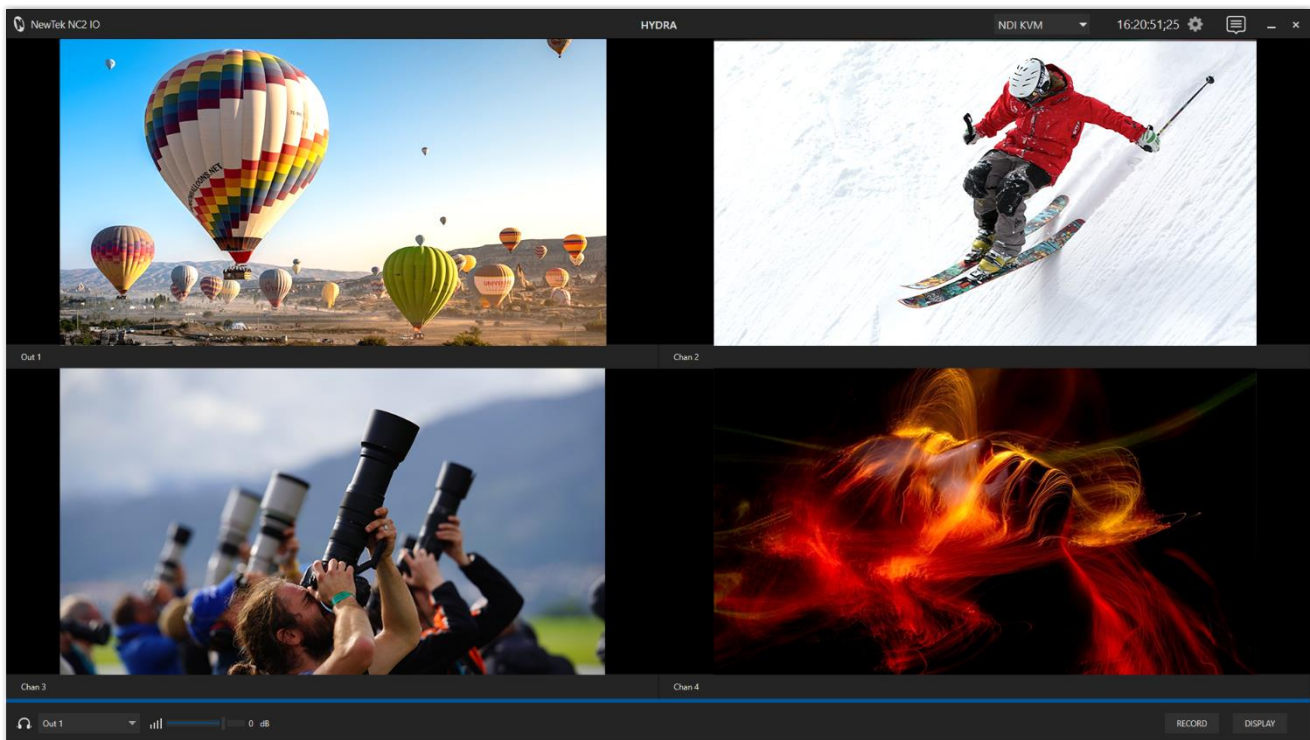


FIGURE 2

The *Desktop* interface includes *dashboards* running across the top and the bottom of the screen. By default, the large middle section of the *Desktop* is divided into quadrants, each displaying one video 'channel'. Beneath each channel's viewport is a toolbar. (Note that additional viewport toolbar controls are hidden when not in use, or until you move the mouse pointer over a viewport.)

Continue reading for an overview of the NC2 IO *Desktop* features.

2.1.1 CONFIGURE CHANNELS

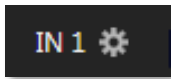


FIGURE 3

NC2 IO allows you to select different audio and video sources for each channel via the *Configure* panel (Figure 3). Click the gear next to the channel label below a viewport to open its *Configure* panel (Figure 4).

INPUT TAB

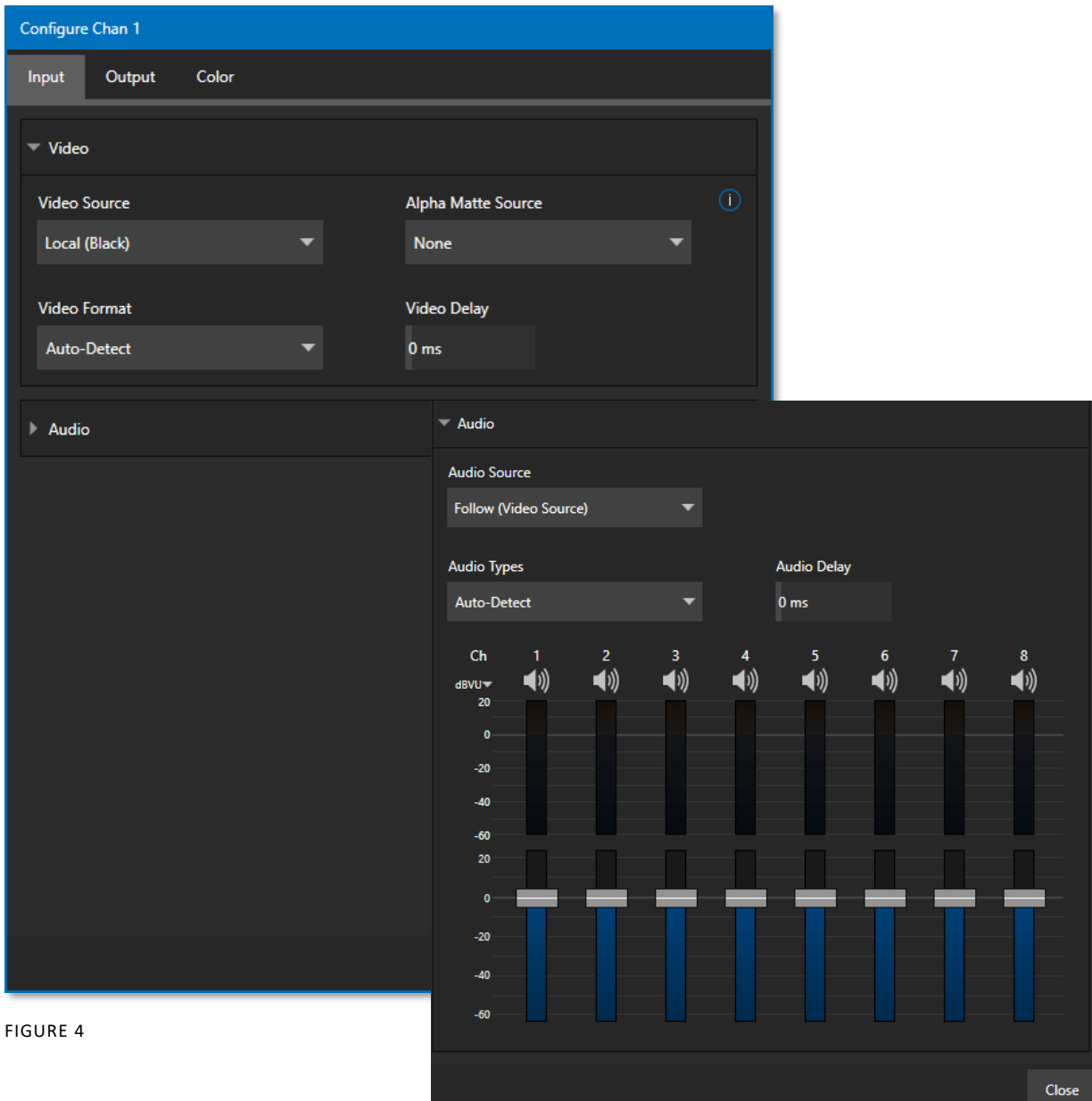


FIGURE 4

The tabbed *Input* pane allows you to select audio and video sources for this channel, and set their format. You can immediately choose any NDI or SDI connector configured as an input (the latter are shown in the *Local* group), a webcam or PTZ camera with compatible network output, or even an input from a suitable

external A/V capture device. (Quad-link selections list the four associated SDI input numbers that will be used, for reference.)

In the *Video Format* drop down menu (Figure 4), select the *Video and Alpha* option that corresponds to the designated SDI connectors you have set up. For example, if your *Video Input* is SDI In Ch(n), the corresponding Alpha for that connector will be SDI In Ch(n+4).

It is unnecessary to configure the key input for 32bit NDI sources.

Video and Alpha sources must be synchronized and have the same format.

A *Delay* setting is provided for both audio and video sources, allowing precise A/V synchronization where a/v source timing differs.

NDI Access Manager, included in [NDI Tools](#), can control which NDI sources are visible on this system.

CLIPS AND IP SOURCES

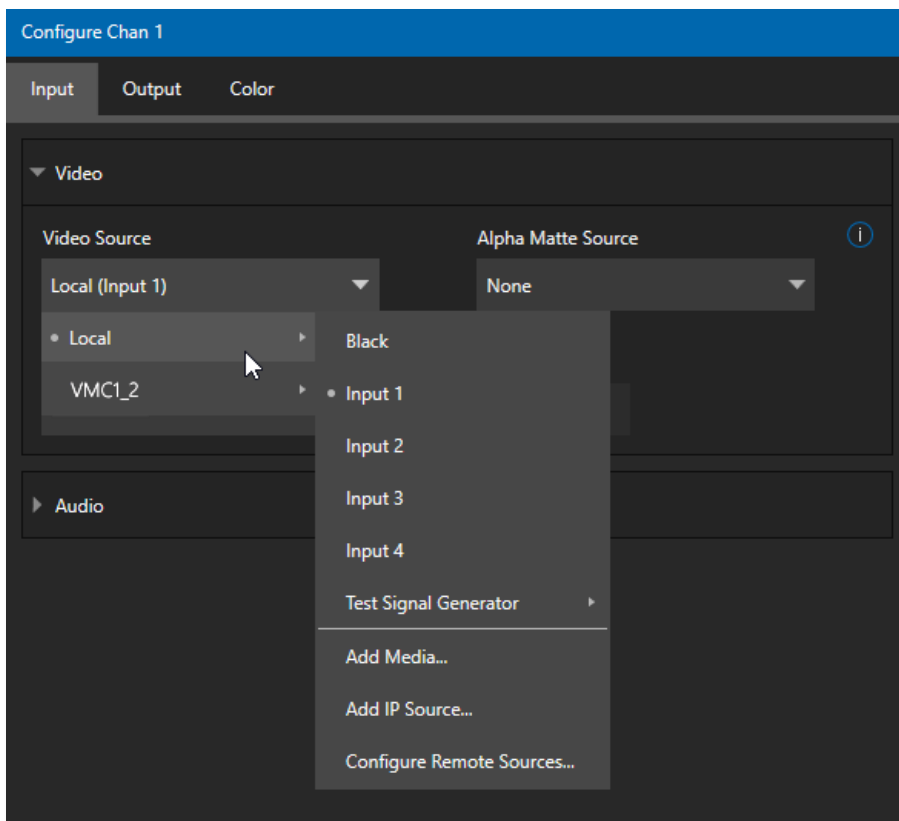


FIGURE 5

As mentioned in the previous section, an IP (network) source – such as a PTZ camera with NDI network video output – can be directly selected. The *Video Source* drop down menu contains an *Add Media* item to let you select a video file, *Add IP Source* menu item, and *Configure Remote Sources* option (Figure 5).



FIGURE 7

Clicking the *Add IP Source* entry opens the *IP Source Manager* (Figure 7). Adding entries to the list of sources shown in this panel causes corresponding entries for new sources to appear in the *Local* group shown in the *Video Source* menu of the *Configure Channel* panel.

To use, click the *Add New IP Source* menu, select a source type from the dropdown list provided. This opens a dialog suited to the particular source device you wish to add, such as one of the numerous supported PTZ camera brands and models.

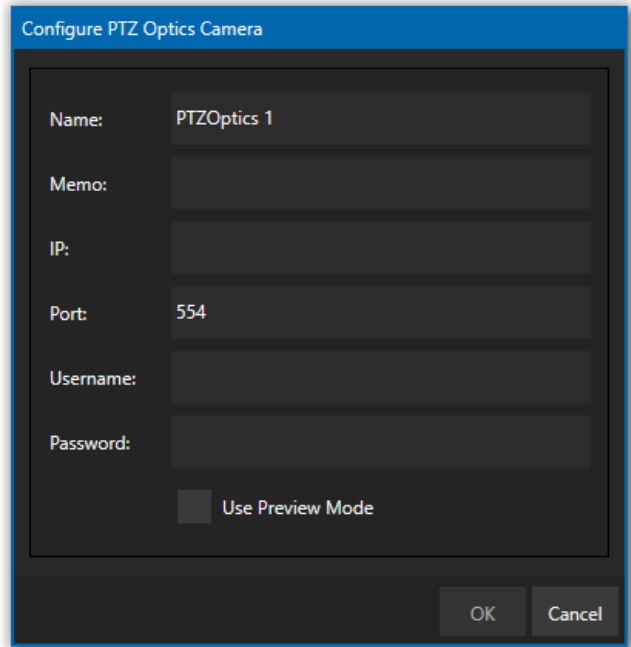


FIGURE 6

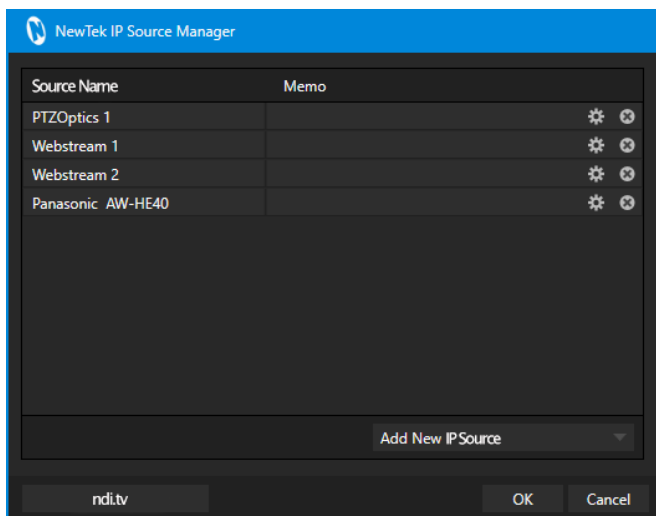


FIGURE 8

The *NewTek IP Source Manager* panel displays the selected sources, here you can edit by clicking the gear to the right of the source name, or click the X to remove the source.

Note: After adding an IP source, you must exit and restart the software for the new settings to be applied.

Additional protocols have been added to provide more options for video sources. RTMP (Real Time Message Protocol), a standard for delivering your streams to your online video platform. RTSP (Real Time Streaming Protocol), used for establishing and controlling media sessions between end points. Also included is SRT Source (Secure Reliable Transport) which is an open source protocol that is managed by the SRT Alliance. It can be used to send media over unpredictable networks, like the Internet. More information about SRT can be found at srtalliance.org.

OUTPUT TAB

The second tab in the *Configure Channel* pane hosts settings related to output from the current channel.

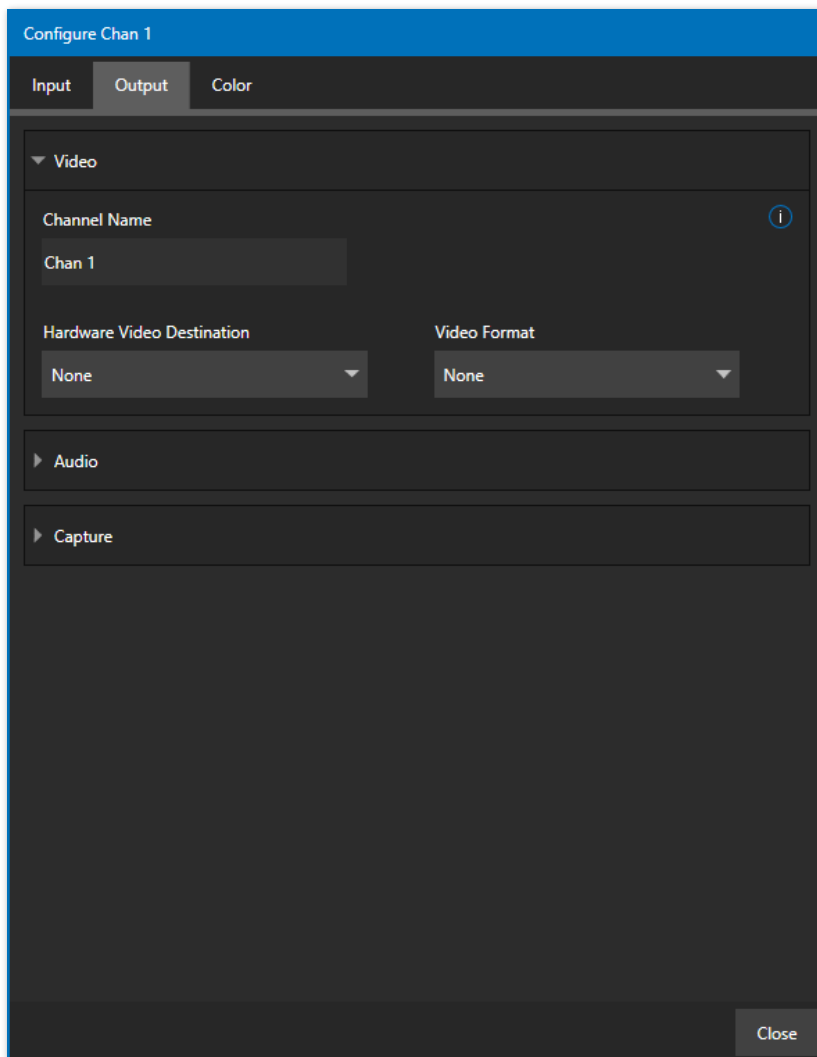


FIGURE 9

NDI OUTPUT

Output from channels assigned to local SDI input sources is automatically sent to your network as NDI signals. The editable *Channel Name* (Figure 10) identifies output from this channel to other NDI-enabled systems on the network.

Note: NDI Access Manager, included with your NC2 IO, can be used to control access to NDI source and output streams. For additional NDI Tools, visit ndi.tv/tools.

HARDWARE VIDEO DESTINATION

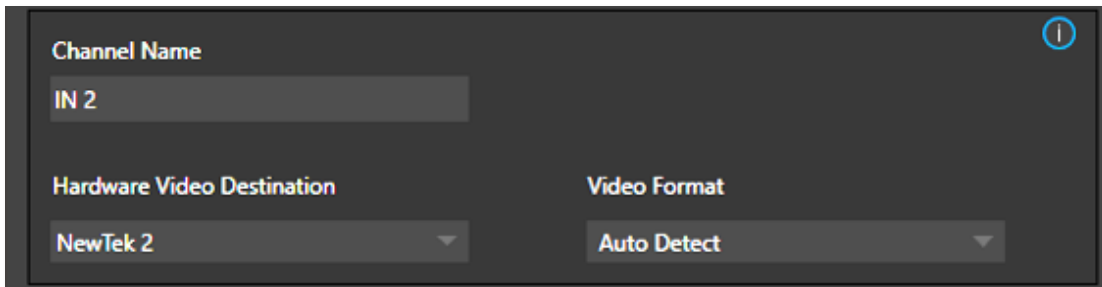


FIGURE 10

The *Hardware Video Destination* menu (as seen in Figure 10) allows you to direct video output from the channel to an SDI connector on the system's backplane that is configured as an output (or another video output device connected to and recognized by the system). *Video Format* options supported by the device are provided in a menu at right. (Quad-link selections list the four associated SDI output numbers that will be used, for reference.)

SUPPLEMENTAL AUDIO DEVICE

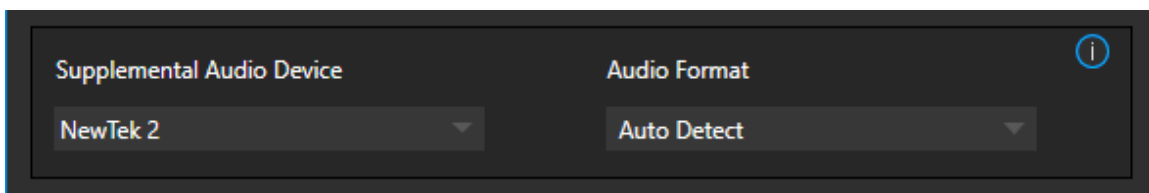


FIGURE 11

The *Supplemental Audio Device* allows you to direct audio output to system sound devices as well as any supported third part audio devices you may connect (typically by USB). As required, *Audio Format* options are provided in a menu at right.

Additional audio output devices (including Dante) recognized by the system can be configured in this section.

CAPTURE

This tab is also where you assign the path and filename for captured video clips and stills.

The initial *Record* and *Grab Directories* are the default *Videos* and *Pictures* folders on the system, but we strongly encourage you to use fast network storage volumes for video capture especially.

COLOR TAB

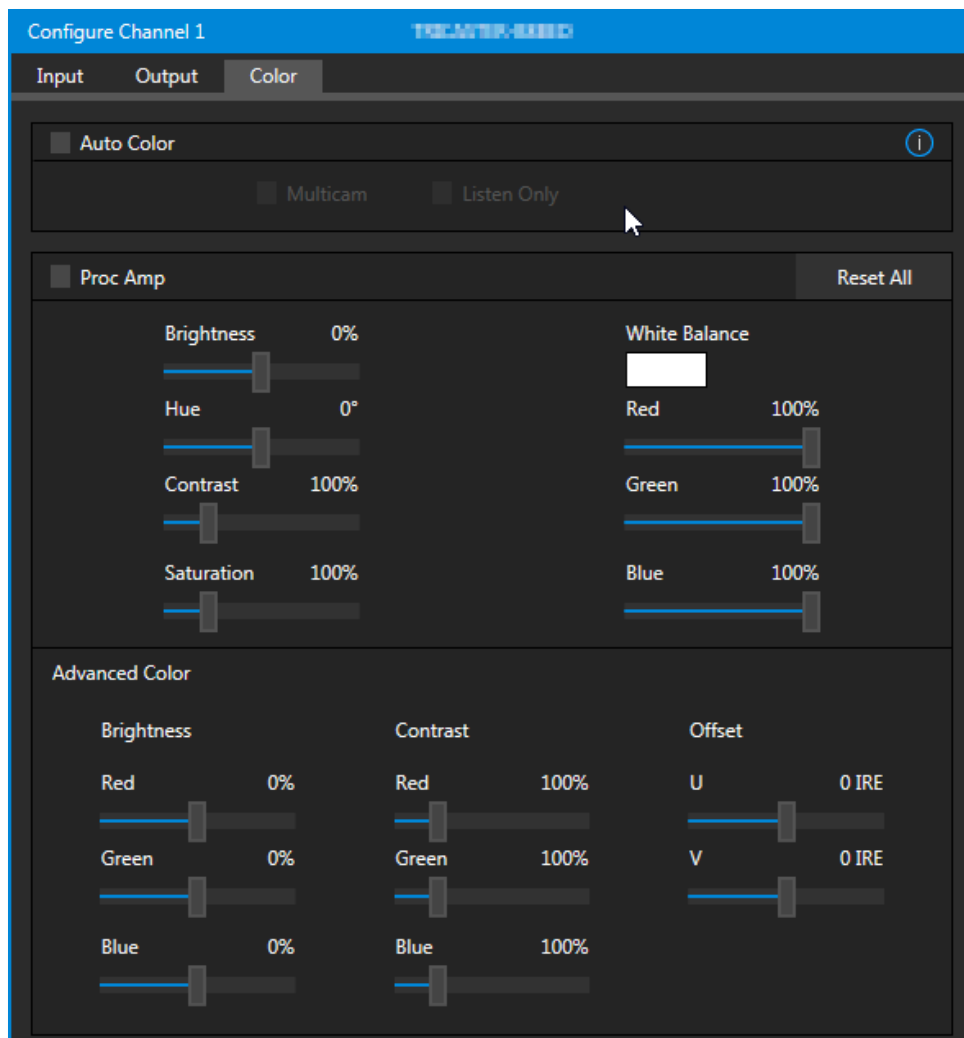


FIGURE 12

The *Color* tab provides an extensive set of tools for adjusting the color characteristics of each video channel.

Choosing *Auto Color* automatically adapts color balance as lighting conditions change over time.

Note: Proc Amp adjustments follow Auto Color processing.

By default, each camera with *Auto Color* enabled is processed by itself. Enable *Multicam* to process multiple cameras as a group.

To apply *Multicam* processing to a source without its own colors being evaluated, checkmark *Listen Only*. Or enable *Listen Only* for all *Multicam* group members except one to make that source the 'master' color reference.

Note: Custom settings in the Color tab trigger figure a COLOR notification message that appears in the footer below the viewport of the channel (Figure 13).

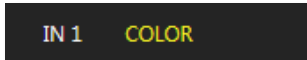


FIGURE 13

SECTION 2.2 KEY/FILL CONNECTIONS

Key/Fill output using two SDI output connectors is supported as follows:

- Even-numbered output channels show "video and alpha" options in their *Configure Channel Format* menu. Selecting this option sends 'video fill' from the selected source to the designated (even-numbered) SDI connector.
- The 'key matte' output is placed on the next lower-numbered connector. (So, for example, if the fill is output on SDI output 4, the SDI output connector labeled 3 will supply the corresponding matte).

SECTION 2.3 TITLEBAR & DASHBOARD

NC2 IO's *Titlebar* and *Dashboard* are home to a number of important displays, tools and controls. Prominently located at the top and bottom of the *Desktop*, the *Dashboard* occupies the full width of the screen.



The various elements presented in these two bars are listed below (starting from the left):

1. *Machine name* (the system network name supplies the prefix identifying NDI output channels)
2. *NDI KVM menu* – Options to control NC2 IO remotely via NDI connection
3. *Time Display*
4. *Configuration* (see Section 2.3.1)

5. *Notifications Panel*
6. *Headphones Source and Volume* (see Section 2.3.5)
7. *Record* (see Section 2.3.5)
8. *Display* (see section 2.3.5)

Of these items, some are so important that they rate their own chapters. Others are detailed in various sections of this guide (cross references to the relevant sections of the manual are provided above).

2.3.1 TITLEBAR TOOLS

NDI KVM

Thanks to NDI[®], it is no longer necessary to configure complicated hardware KVM installations to enjoy remote control over your NC2 IO system. The free NDI Studio Monitor application brings network KVM connectivity to any Windows[®] system on the same network.

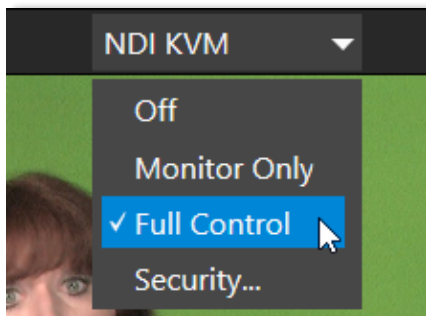


FIGURE 14

To enable NDI KVM, use the titlebar *NDI KVM* menu to select an operating mode, choosing between *Monitor Only* or *Full Control* (which passes mouse and keyboard operations to the remote system). The *Security* option lets you apply *NDI Group* control to limit who can view the *NDI KVM* output from the host system.

To view the output from the remote system and control it, select [Your NC2 IO Device Name]>*User Interface* in the *Studio Monitor* application supplied with the NDI Tool pack, and enable the KVM button overlaid at upper-left when you move the mouse pointer over the screen.

Hint: Note that Studio Monitor's KVM toggle button can be relocated to a more convenient spot by dragging.

This feature gives you a great way to control the system around your studio or campus. With the User Interface running full-screen in *Studio Monitor* on a receiving system, it's really hard to remember that you're actually controlling a remote system. Even touch is supported, meaning you can run the User Interface output on a Microsoft[®] Surface system for portable touch control over your entire live production system.

(Actually, many of the interface screengrabs shown in this manual – including those in this section – were grabbed from *NDI Studio Monitor* while controlling the remote system in the manner described above.)

2.3.2 System Configuration

The *System Configuration* panel is opened by clicking the configuration (gear) gadget found in the upper-right corner of the screen (Figure 15).

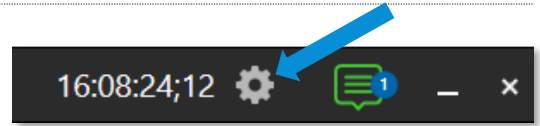


FIGURE 15

TIMECODE

LTC timecode support can be activated by choosing an input using the *LTC Source* menu to choose almost any audio input to receive the timecode signal over, and enabling the checkbox at left (Figure 16).

SYNCHRONIZATION

Under the *Synchronization* field, there are several options to Synchronize the Reference Clock. If your NC2 IO is running hardware, it will default to *Internal System Clock*, which means it is clocking to the SDI output.

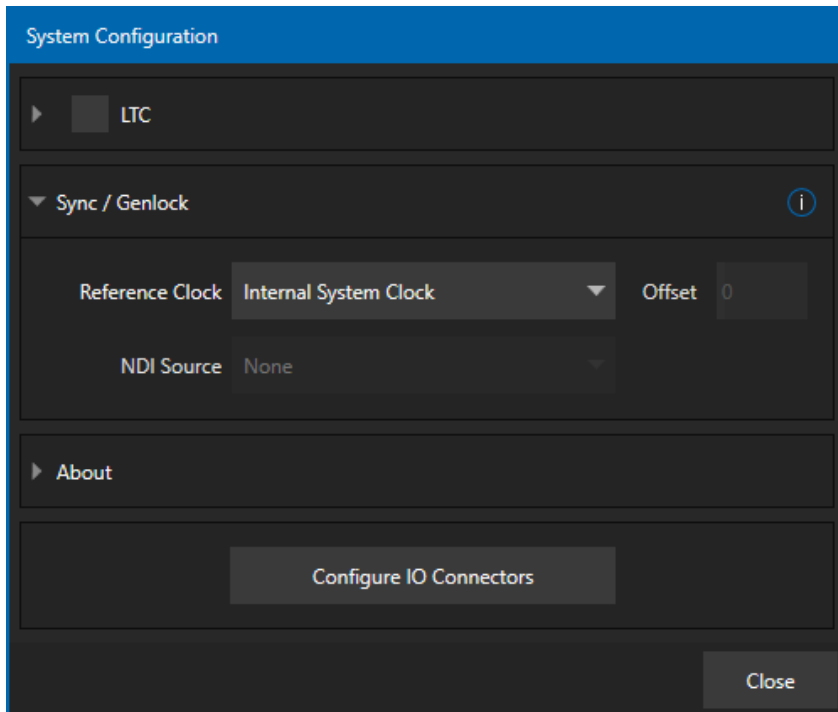


FIGURE 16

GENLOCK

The *Genlock* input on NC2 IO's backplane is for connection of a 'house sync' or *reference signal* (typically a 'black burst' signal intended specifically for this purpose). Many studios use this method to synchronize equipment in the video chain. Genlocking is commonplace in higher-end production environments, and genlock connections are typically provided on professional gear.

If your equipment allows you to do so, you *should* genlock all hardware sources supplying NC2 IO, *and* the NC2 IO unit. To connect the genlock source, supply the reference signal from the 'house sync generator' to the Genlock connector on the backplane. The unit can auto-detect an SD (Bi-level) or HD (Tri-level) reference. After connection, adjust the Offset as necessary to achieve stable output

Hint: The unit can be SD (Bi-level) or HD (Tri-level) reference. (If the Genlock switch is disabled, the unit operates in internal or 'free running' mode, instead.

CONFIGURE NDI GENLOCK

NDI Genlock synchronization allows video sync to reference a network-supplied external clock signal over NDI. This type of synchronization will be key to future 'cloud-based' (and hybrid) production environments.

The Genlock feature allows NC2 IO to 'lock' its video output or NDI signal, to timing derived from an external reference signal (house sync, such as 'black burst') supplied to its genlock input connector.

This allows NC2 output to be synchronized to other external equipment that is locked to the same reference. NC2 comes with additional options for Synchronization, (Figure 17) the pull down menu conveniently centralizes all sync options and allows them to be changed on the fly.

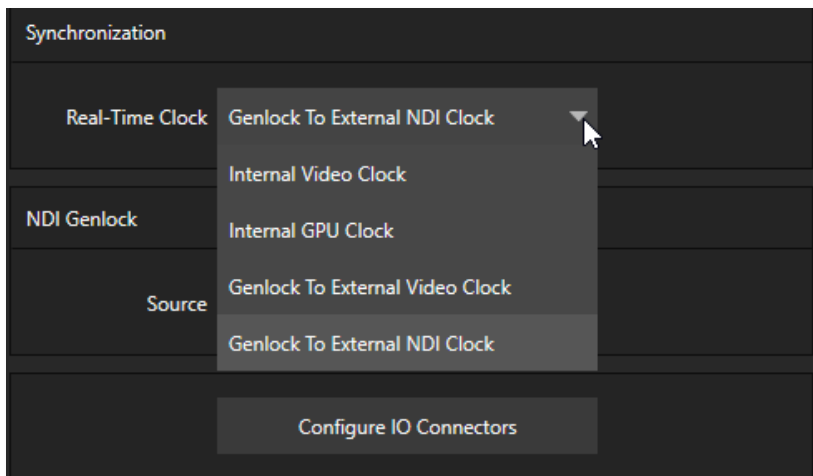


FIGURE 17

Genlocking is not an absolute *requirement* in most cases, but is recommended whenever you have the capability.

Tip: "Internal Video Clock" means clocking to the SDI output (best quality when connecting a projector to an SDI output).

"Internal GPU Clock" means following the graphics card output (best quality when connecting a projector to a Multiview output).

CONFIGURE IO CONNECTORS

The SDI connectors on NC2 I/O's backplane can variously be assigned as either inputs or outputs. This determination is made in the *Configure NC2 I/O Connectors* dialog, which you can open by clicking the *Configure IO Connectors* button.

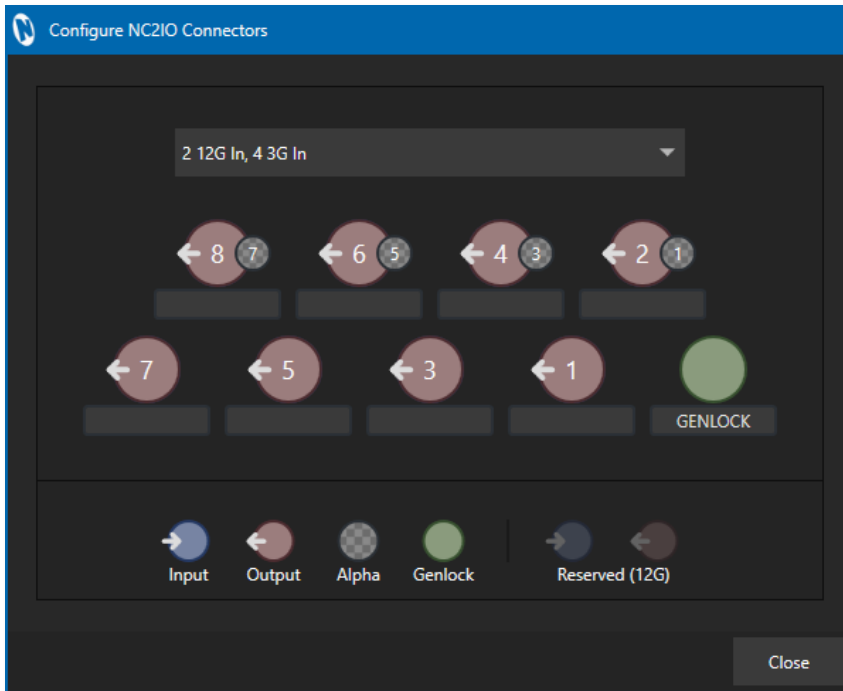


FIGURE 18

This panel presents various input/output preset options, providing access to all possible connector configuration alternatives.

The presets graphically display various i/o configurations as viewed from the rear of the system. Simply click a configuration preset to select it.

Note: Configuration changes require you to either reboot the system, or simply to restart the application.

2.3.3 NOTIFICATIONS

The Notifications panel opens when you click the 'text balloon' gadget at right in the *Titlebar*. This panel lists any information messages the system provides, including any cautionary alerts.

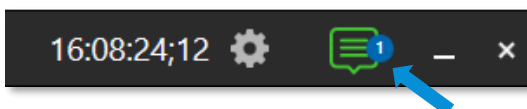


FIGURE 19

Hint: You can clear individual entries by right-clicking to show the item's context menu, or the Clear All button in the panel's footer.

The footer of the *Notifications* panel also features a Web Browser button, discussed next.

WEB BROWSER

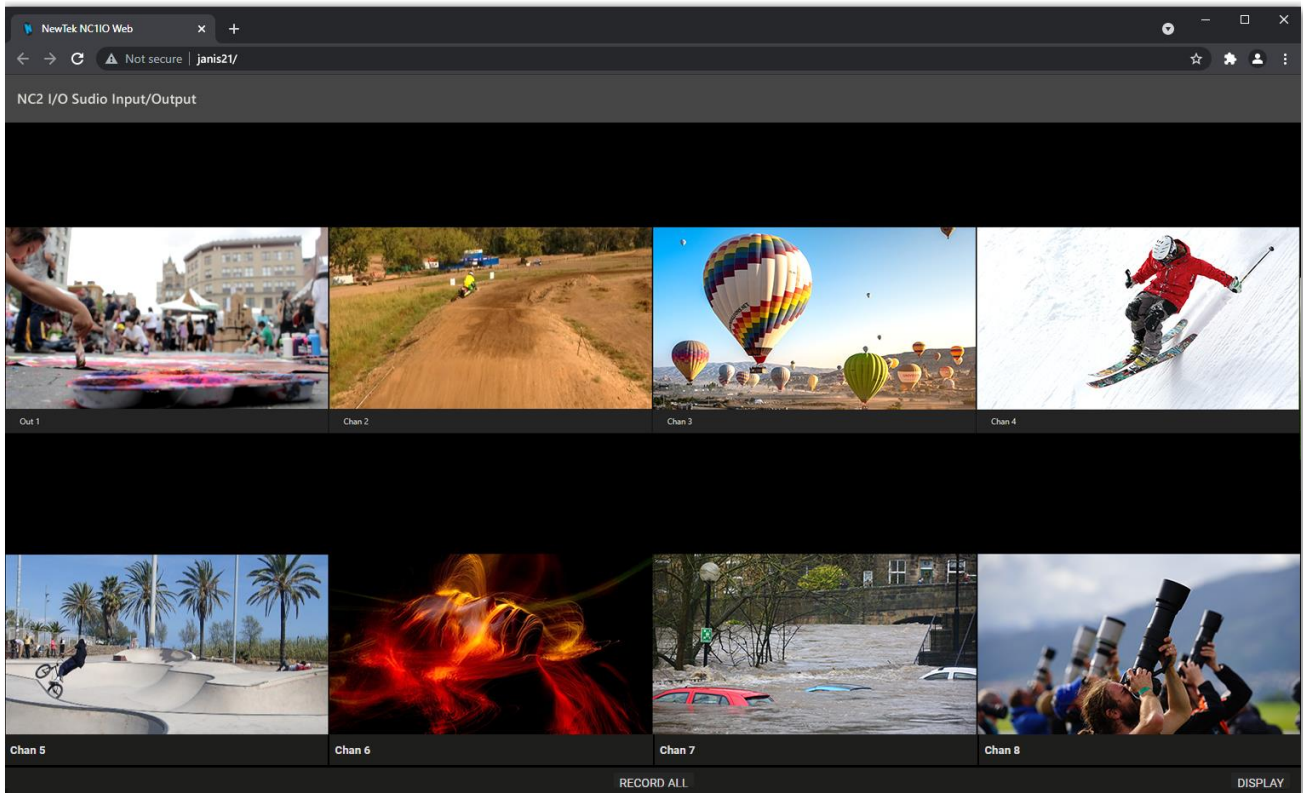


FIGURE 20

In addition to the remote control features provided for your NC2 IO system by the integrated NDI KVM feature, the unit also hosts a dedicated webpage.

The *Web Browser* button at the bottom of the *Notifications* panel provides a local preview of this webpage, which is served to your local network to let you control the system from another system on your network.

To visit the page externally, copy the IP address shown beside the *Web Browser* button in the *Notification* panel into the address field of a browser on any computer on your local network.

2.3.4 VIEWPORT TOOLS

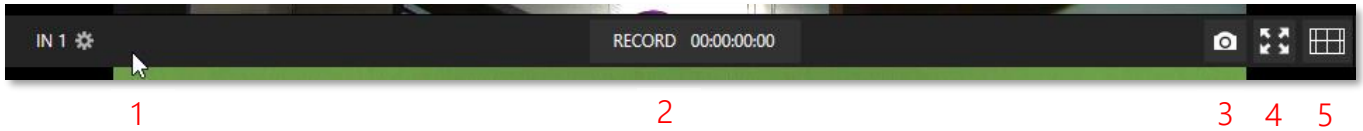


FIGURE 21

NC2 IO's channels each have a toolbar beneath their respective viewports. The various elements comprising the toolbar are listed below from left to right:

1. *Channel name* – Can be changed by clicking on the label, and also in the *Configure Channel* panel.
 - a. A *Configuration* gadget (gear) pops up next to the channel name when the mouse is over a viewport.
2. *Record and Record Time* – The record button below each viewport toggled recording that channel; the *RECORD* button in the bottom dashboard opens a widget enabling capture *from any SDI input*.
3. *Grab* – the base filename and path for still image grabs are set in the *Configure Channel* panel.
4. *Full screen*
5. *Overlays*

GRAB



FIGURE 22

A Grab Input tool is located in the lower right corner below the monitor for each channel. By default, still images files are stored in the system Pictures folder. The path can be modified in the Output window for the channel (see the Output heading above).

FULLSCREEN



FIGURE 23

Clicking this button expands the video display for the selected channel to fill your monitor. Press ESC on your keyboard or click the mouse to return to the standard display

OVERLAY



FIGURE 24

Found in the lower right corner of each channel, *Overlays* can be useful for visualizing safe zones, centering and more. To use an overlay, just click on an icon in the list (see Figure 25); more than one overlay can be active at the same time.

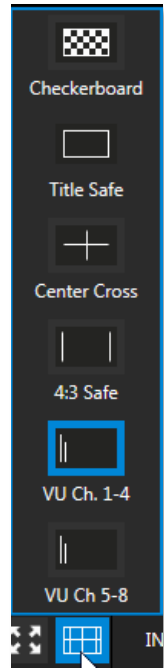


FIGURE 25

2.3.5 DASHBOARD TOOLS

AUDIO (HEADPHONES)

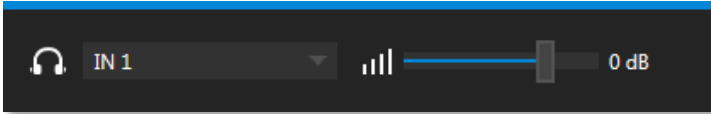


FIGURE 26

Controls for *Headphone audio* are found in the lower-left corner of the dashboard at the bottom of the screen (Figure 26).

1. The audio source supplied to the *Headphone* jack can be selected using the menu next to the *headphone icon* (Figure 27).
2. The *Volume* for the selected source can be adjusted moving the slider provided at right (double-click this control to reset it to the default 0dB value).

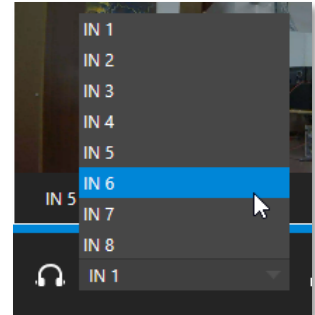


FIGURE 27

RECORD

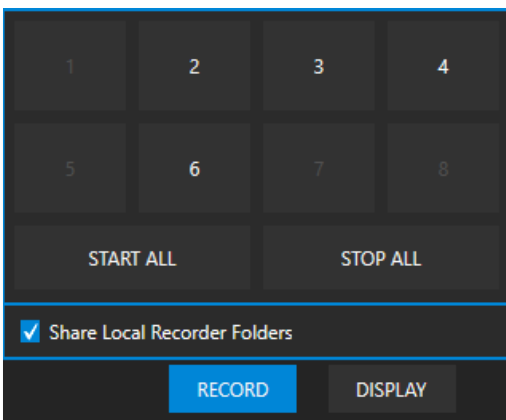


FIGURE 28

The *Record* button is also located in the lower-right corner of the dashboard (Figure 28). Click it to open a widget allowing you to begin or stop recording of individual channels (or start/stop all recordings.)

Notes: The destinations for recorded clips, their base file names and other settings are controlled in the Configuration panel (Figure 9). Recording NDI sources is not supported. The Share Local Recorder Folders can be used to expose local folders assigned to capture duties on your network, making it easy to access captured files externally.

DISPLAY

In the bottom-right corner of the *Dashboard* at the bottom of the (primary) screen, the *Display* widget offers a variety of layout options to let you view channels individually (Figure 29).

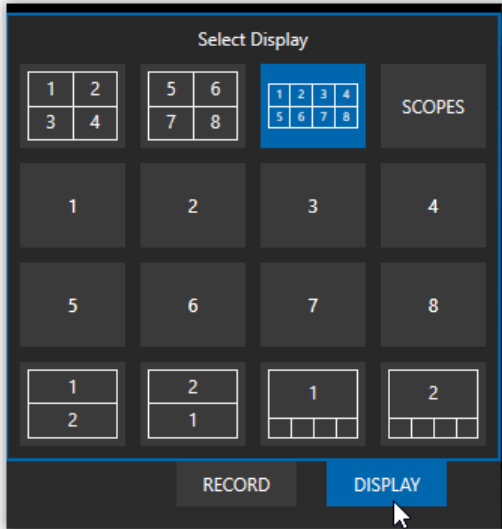


FIGURE 29

Waveform and *Vectorscope* features are shown when you select the *SCOPES* option in the *Display* widget (Figure 30).

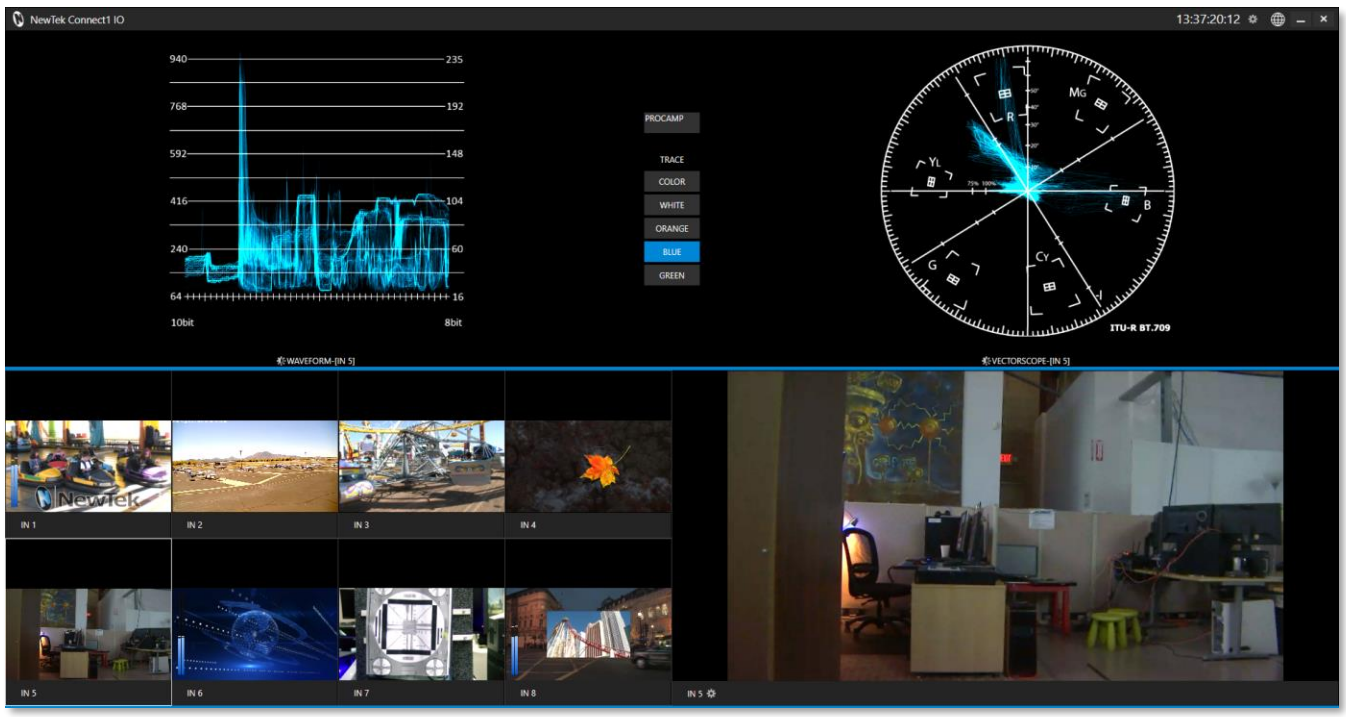


FIGURE 30

APPENDIX A: NDI® (NETWORK DEVICE INTERFACE)

For some, the first question may be “What is NDI?” In a nutshell, Network Device Interface (NDI) technology is a new open standard for live production IP workflows over Ethernet networks. NDI allows systems and devices to identify and communicate with each other, and to encode, transmit, and receive high quality, low latency, frame-accurate video and audio over IP in real time.

NDI enabled-devices and software have the potential to greatly enhance your video production pipeline, by making video input and output available anywhere your network runs. NewTek’s live video production systems and a growing number of third party systems provide direct support for NDI, both for ingest and output. Although NC2 IO provides many other useful features, it is purpose designed primarily to turn SDI sources into NDI signals.

For more extensive details on NDI, please visit <https://ndi.tv/>.

APPENDIX B: DIMENSIONS AND MOUNTING

NC2 IO is designed for convenient mounting in a standard 19" rack (mounting rails are available separately from NewTek Sales). The unit comprises a 1 Rack Unit (RU) chassis supplied with 'ears' designed to permit mounting in standard 19" rack architecture.

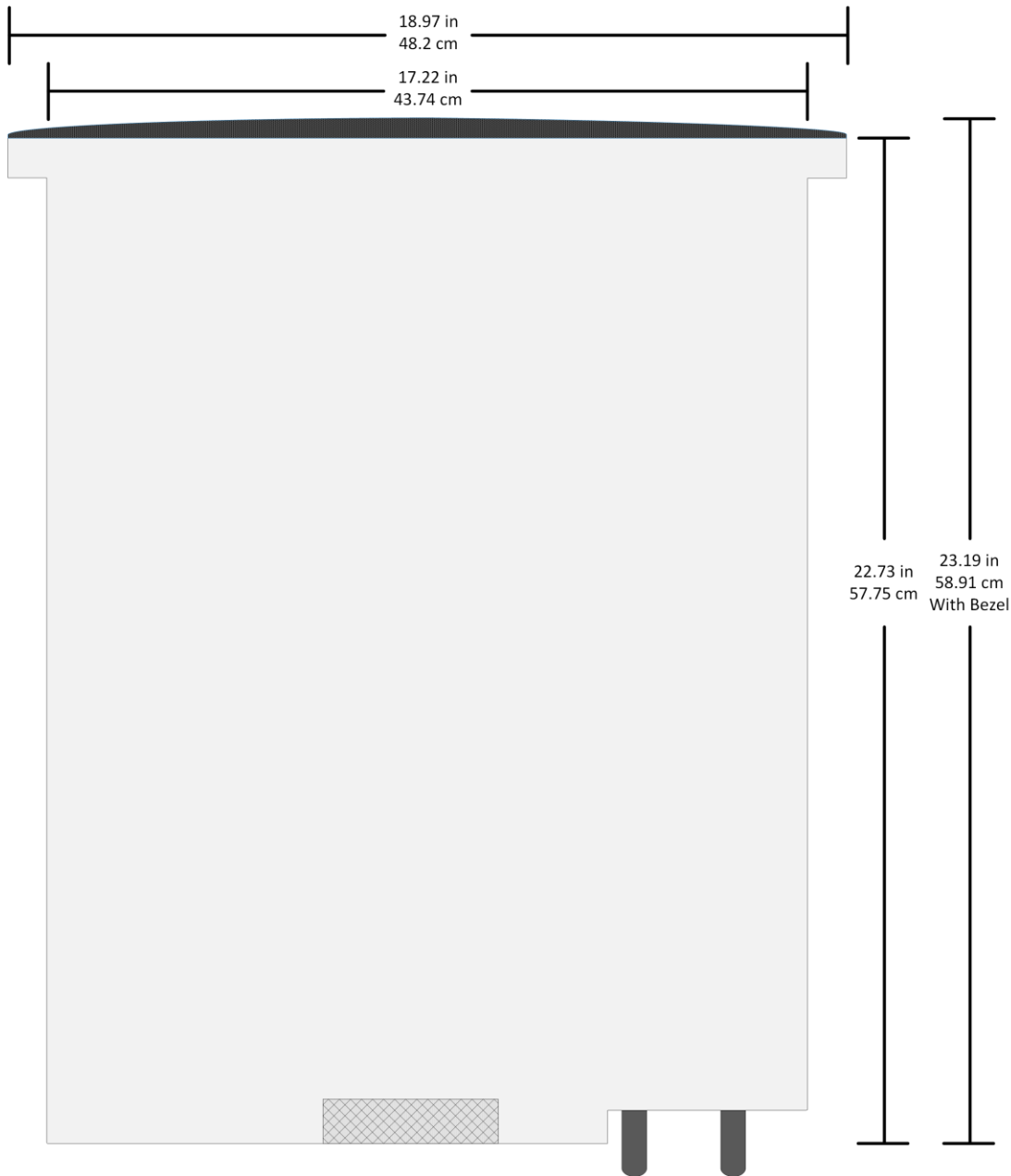
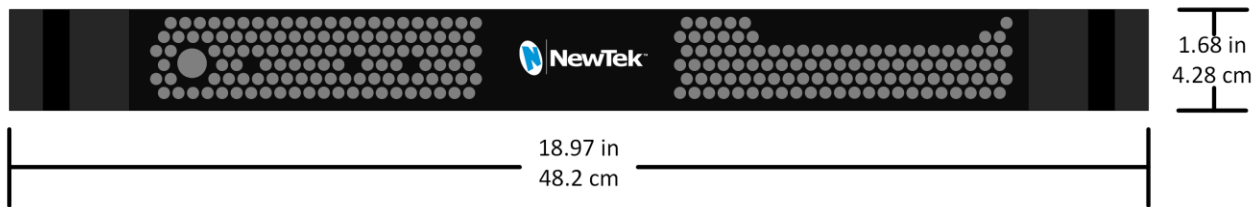


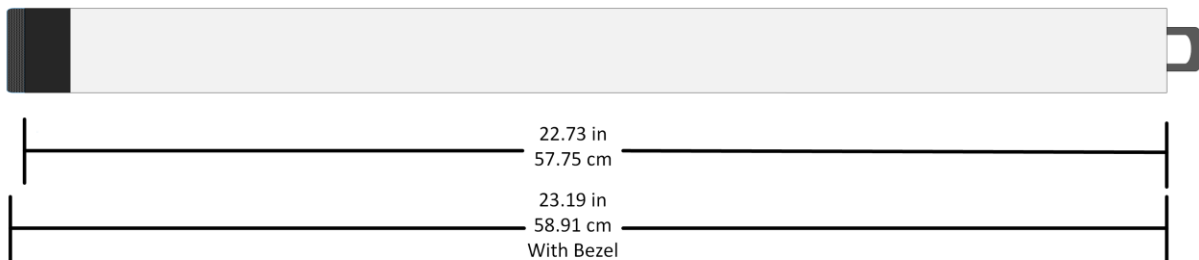
FIGURE 31

The units weigh 27.38 pounds (12.42 KG). A shelf or rear support will distribute the load more evenly if rack-mounted. Good front and rear access is important for convenience in cabling should be considered.

In view of the top panel vents on the chassis, at least one RU should be allowed above these systems for ventilation and cooling. Please keep in mind that adequate cooling is a very important requirement for virtually all electronic and digital equipment, and this is true of NC2 IO as well. We recommend allowing 1.5 to 2 inches of space on all sides for cool (i.e., comfortable 'room temperature') air to circulate around the chassis. Good ventilation at the front and rear panel is important, and ventilated space above the unit (1RU minimum is recommended).



When designing enclosures or mounting the unit, supplying good free air movement around the chassis as discussed above should be viewed as a critical design consideration. This is especially true in fixed installations where NC2 IO will be installed inside furniture-style enclosures.



APPENDIX C: ENHANCED SUPPORT (PROTEK)

NewTek's optional ProTekSM service programs offer renewable (and transferable) coverage and enhanced support service features extending well beyond the standard warranty period.

Please see our [Protek webpage](#) or your local authorized [NewTek reseller](#) for more details regarding ProTek plan options.

APPENDIX D: RELIABILITY TESTING

We know our products play vital roles in the productions of our customers. Durability and consistent, robust performance are much more than just adjectives for your business and ours.

For this reason, all NewTek products undergo rigorous reliability testing to ensure they meet our exacting test standards. For NC2 IO, the following standards are applicable:

Test Parameter	Evaluation Standard
Temperature	Mil-Std-810F Part 2, Sections 501 & 502
Ambient Operating	0°C and +40°C
Ambient Non-Operating	-10°C and +55°C
Humidity	Mil-STD 810, IEC 60068-2-38
Ambient Operating	20% to 90%
Ambient Non-Operating	20% to 95%
Vibration	ASTM D3580-95; Mil-STD 810
Sinusoidal	Exceeds ASTM D3580-95 Paragraph 10.4: 3 Hz to 500 Hz
Random	Mil-Std 810F Part 2.2.2, 60 minutes each axis, Section 514.5 C-VII
Electrostatic Discharge	IEC 61000-4-2
Air Discharge	12K Volts
Contact	8K Volts

CREDITS

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Libraries: This product uses the following libraries, licensed under the LGPL license (see link below). For the source, and the ability to change and recompile these components, please visit the links provided:

- FreeImage library freeimage.sourceforge.io
- LAME library lame.sourceforge.io
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For a copy of the LGPL license, please look in the folder c:\TriCaster\LGPL\

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