NewTek Connect Pro

Studio Input/Output Module

User Guide

TABLE OF CONTENTS

This chapter explains how to connect power, monitors and audio visual devices to your NC1 Input/Output Module. It also reviews the registration process. After completing this short section, you'll be all set to begin using NewTek Studio 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 NC1 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 NC1 IO's turnkey installation and operation, you can easily assemble a network of modules to configure your own multi-system and multi-site workflows.
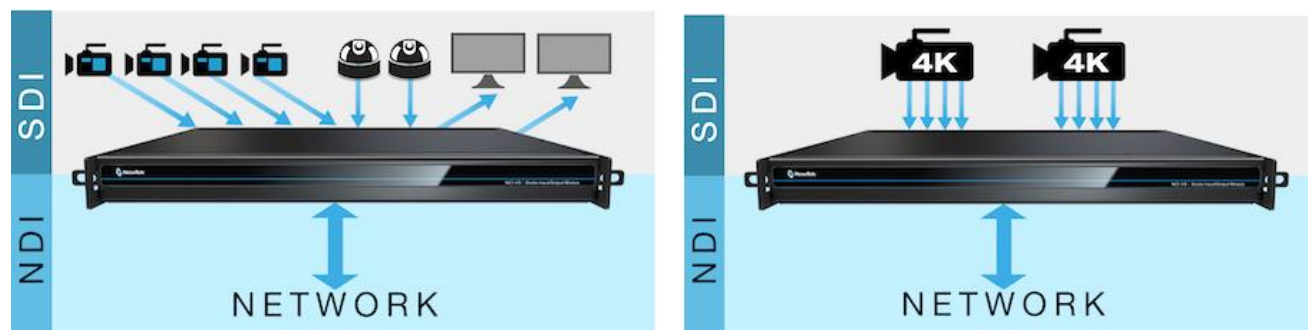
From increasing your available inputs and outputs, to merging established and emerging technologies, to linking locations across your network, the NewTek Studio I/O Module is a universal solution that adapts to your production needs.

- 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: NC1 IO's interface requires a monitor resolution setting of at least 1280x1024.

1. Connect an external computer monitor to the HDMI port on the backplate (see Input/Output connections).
2. Connect the *mouse* and *keyboard* to USB ports also on the backplate.
3. Connect the *power cord* to NC1 IO's backplate.
4. Turn on the computer monitor.
5. Press the *Power* switch on NC1 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 NC1 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 NC1 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. HDMI – monitor port
2. Ethernet – network connections
3. USB – connect keyboard, mouse and other peripheral devices
4. Motherboard audio connectors
5. Genlock and SDI In/Out – current generation units (designated 'Mark M') provide HD-BNC connectors (High Density BNC); earlier (Mark D) units employ DIN 1.0/2.3 (Mini BNC) connectors
6. Power

SECTION 1.4 NETWORKING

Generally, simply connecting a suitable cable from one of the two Gigabit Ethernet ports on NC1 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.

This chapter explains the layout and options of the user interface, and how to configure NC1 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 NC1 IO default Desktop interface is shown below, and provides very useful remote monitoring options in addition to configuration and control features.
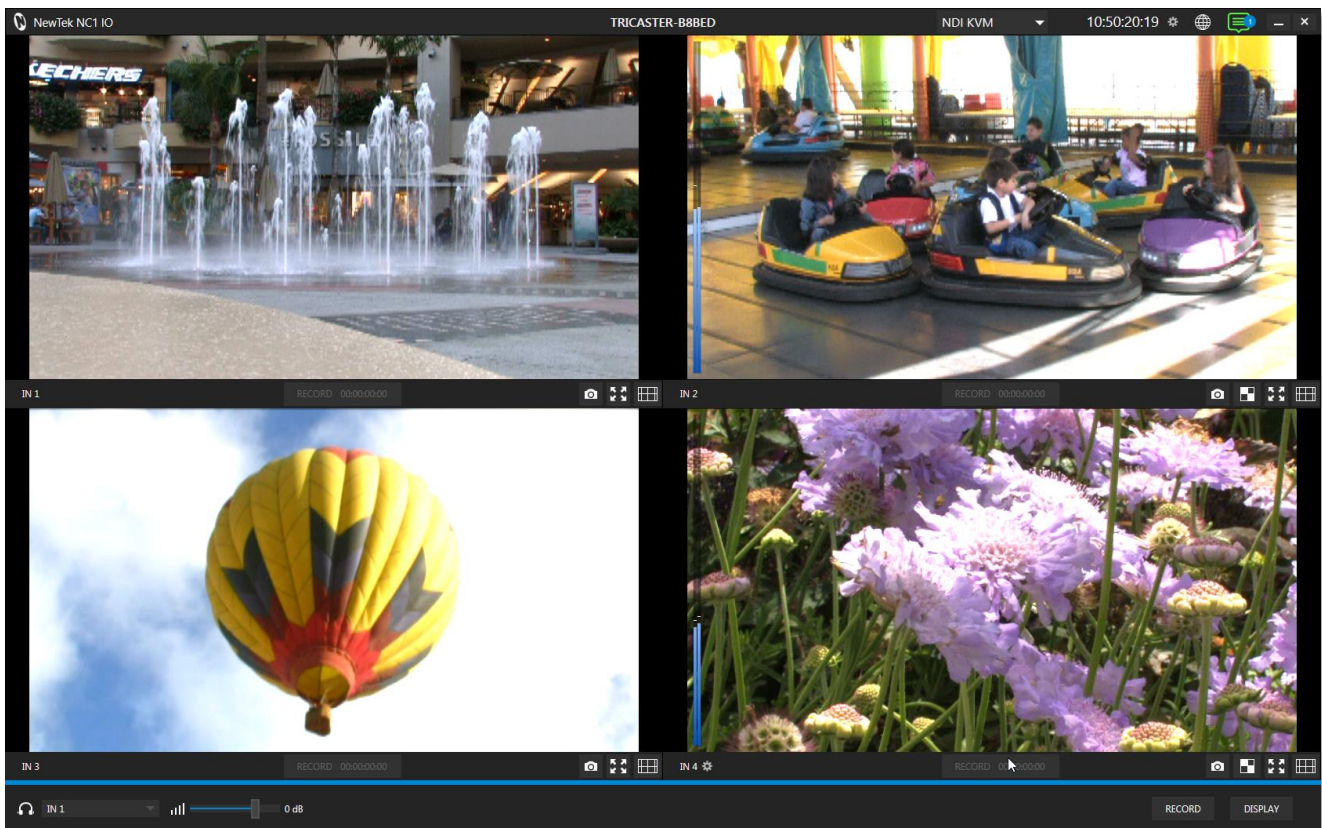

FIGURE 2

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 NC1 IO *Desktop* features.

FIGURE 3

NC1 IO allows you to select different audio and video sources for each channel via the *Configure* panel (Figure 4). Click the gear next to the channel label below a viewport to open its *Configure* panel (Figure 3).

INPUT TAB
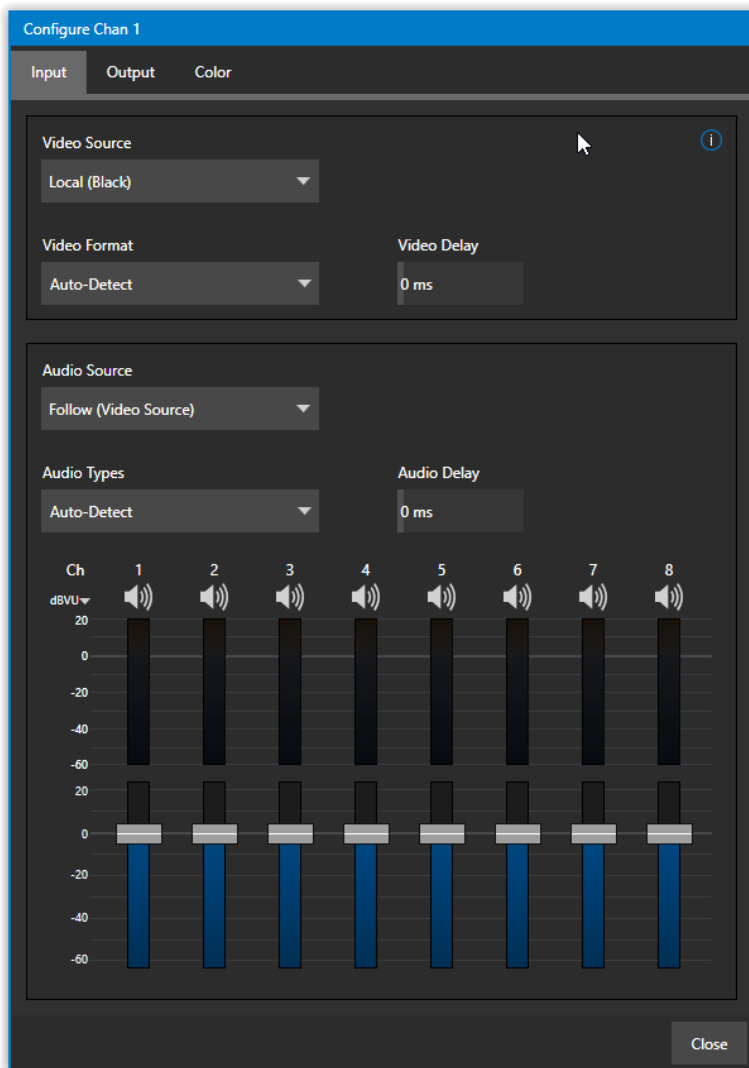
FIGURE 4

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.)

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

Clips and IP Sources

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, and *Add IP Source* menu item (Figure 5).
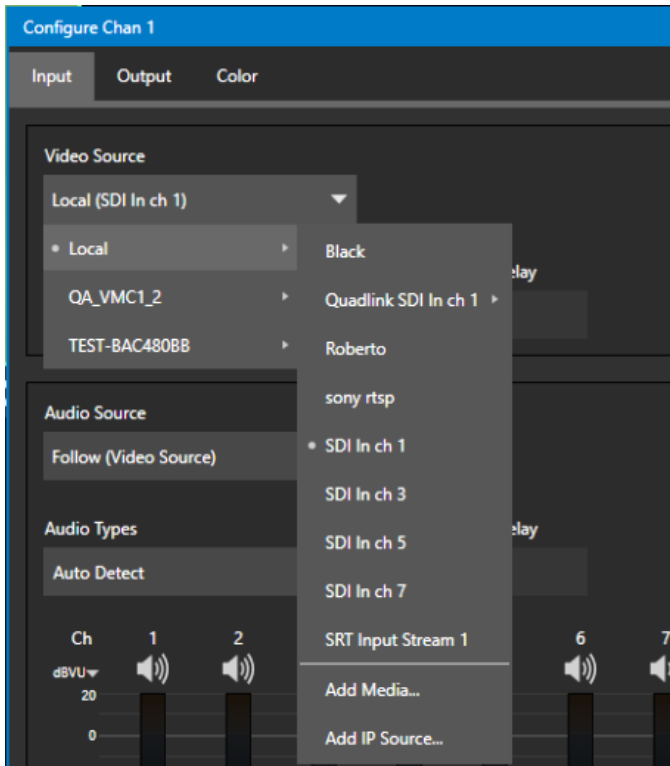
FIGURE 5

Clicking the *Add IP Source* entry opens the *IP Source Manager*. 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 (Figure 6).
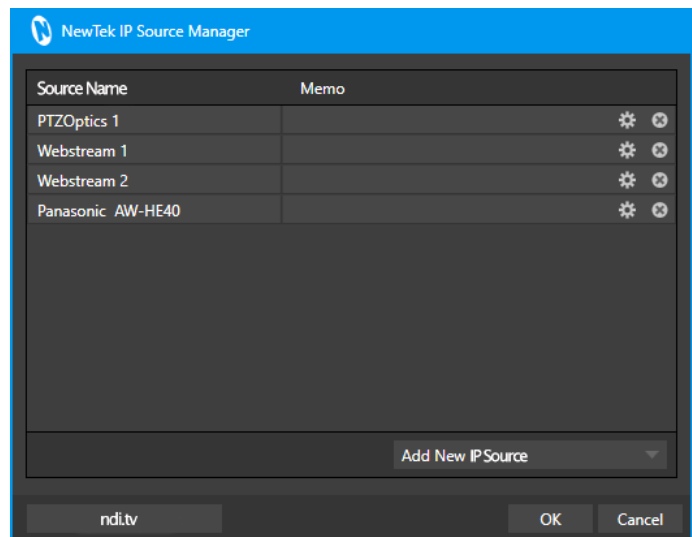

FIGURE 6

FIGURE 7

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, as shown in Figure 8.
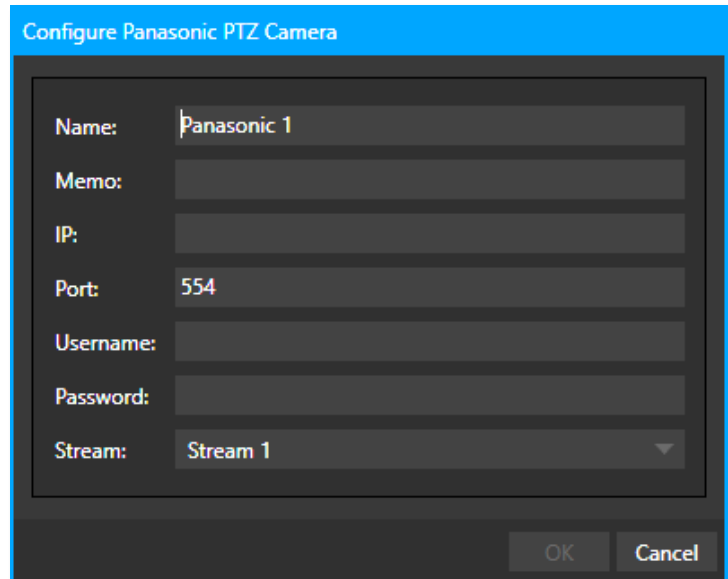

FIGURE 8

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

The second tab in the *Configure Channel* pane hosts settings related to output from the current channel.
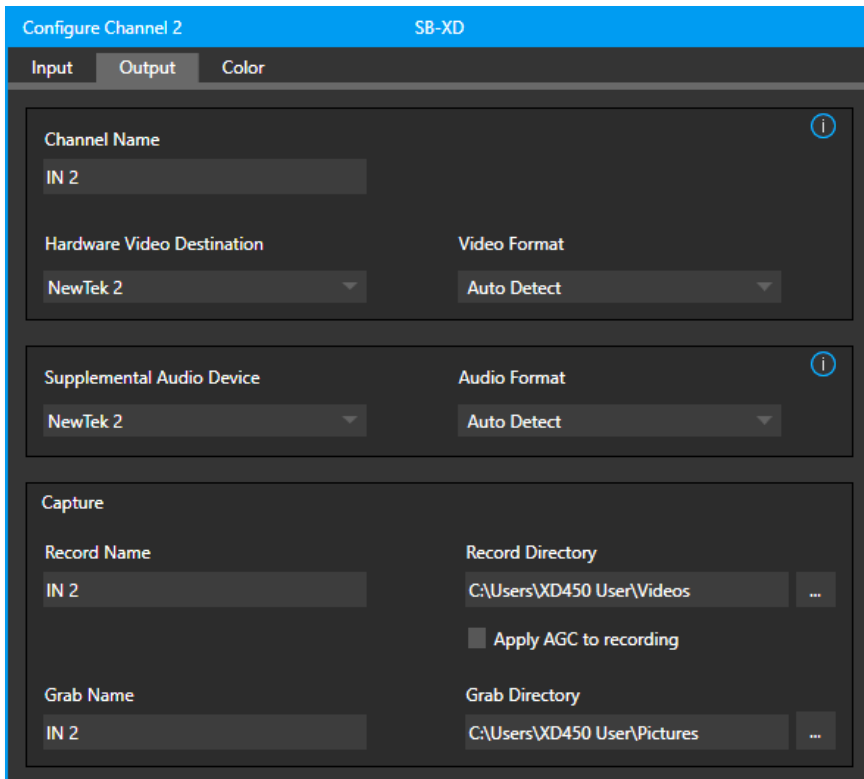
FIGURE 9

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 9) identifies output from this channel to other NDI-enabled systems on the network.

> *Note: NDI Access Manager, included with your NC1 IO, can be used to control access to NDI source and output streams. For additional NDI Tools, visit ndi.tv/tools.*
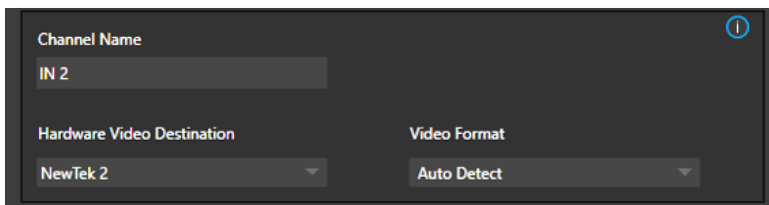
HARDWARE VIDEO DESTINATION

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.)

> *See Appendix A: Key/Fill Connections for key/fill connection details.*

SUPPLEMENTAL AUDIO DEVICE
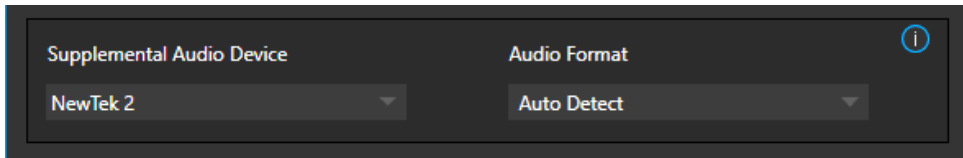
FIGURE 11

The *Supplemental Audio Device* allows you to direct audio output to system sound devices as well 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.

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 or an external drive connected to one of the (blue) USB3 ports on NC1 IO's rear panel for video capture especially.

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.
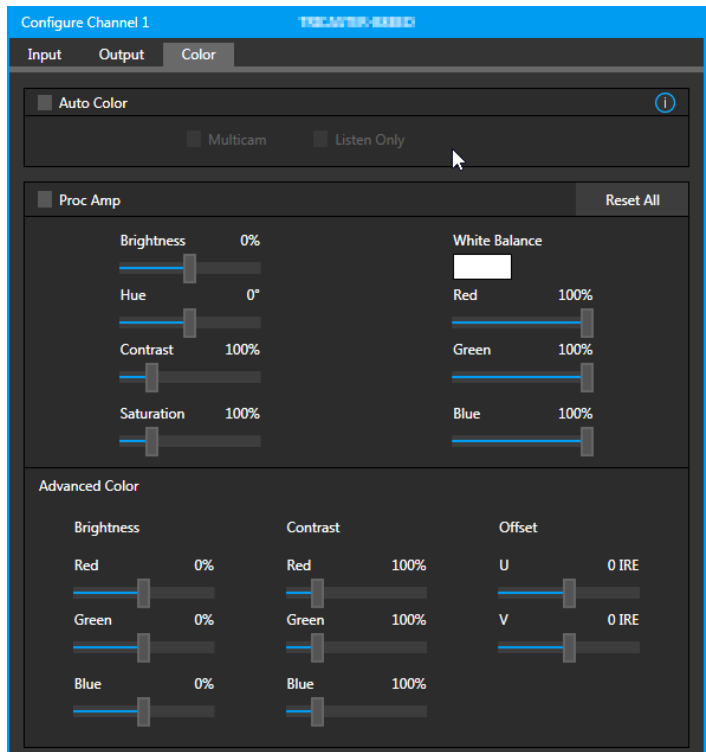
FIGURE 12

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

FIGURE 13

SECTION 2.2 TITLEBAR & DASHBOARD

NC1 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)
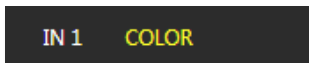2. *NDI KVM menu* – Options to control NC1 IO remotely via NDI connection
3. *Time Display*
4. *Configuration* (see Section 2.2.1)
5. *Notifications Panel*
6. *Headphones Source and Volume* (see Section 2.2.7)
7. *Record* (see Section 2.2.7)
8. *Display* (see section 2.2.7)

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).

2.2.1 TITLEBAR TOOLS

NDI KVM

Thanks to NDI®, it is no longer necessary to configure complicated hardware KVM installations to enjoy remote control over your NC1 IO system. The free NDI Studio Monitor application brings network KVM connectivity to any Windows® system on the same network.
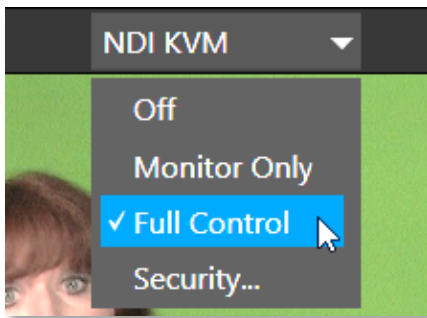

FIGURE 14

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 NC1 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.)

MARK M The *System Configuration* dialog is opened by clicking the 'gear' gadget next to the *Titlebar* time display, and appears as shown in Figure 15.

LTC 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.

ABOUT

The *About* box displays the current software version and hardware revision of the unit.

> *Hint: There are several ways to determine which hardware revision your NC1 IO system ('Mark M', or 'Mark D'). If the unit is operating, open the System Configuration panel by clicking the 'gear' in the Titlebar. The hardware revision is listed in this panel's footer. Otherwise, note that the top row on the backplane of Mark M systems hosts even-numbered connectors, while Mark D systems show odd-numbered connectors above.*

I/O CONFIGURATION

Further configuration options, including controls to determine how the SDI connectors on the backplane are allocated (as either inputs or outputs) are hosted in *Admin>Configure NC1 I/O Connectors* (Figure 16).
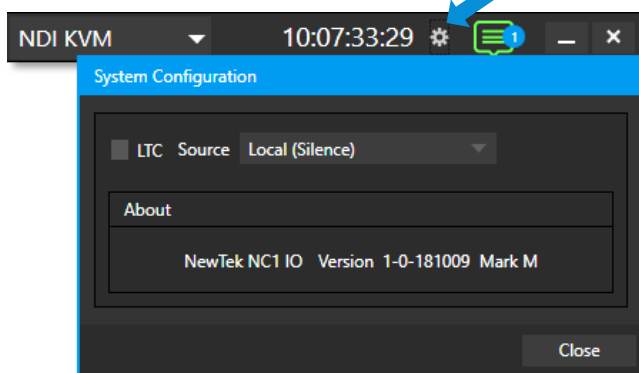

FIGURE 15

This dialog is shown on first launch, but can be accessed later from the *Live Desktop* to make modifications to the configuration as follows:

- Since it is necessary to restart the application after changes to these configuration options, you must click the Exit gadget (x) at extreme right in the *Titlebar* of the *Live Desktop*.

- Select either the *IO Configuration* or *Genlock* tabs, according to your need.

> *Note: Certain selections may require rebooting the system to re-initialize the SDI hardware.*
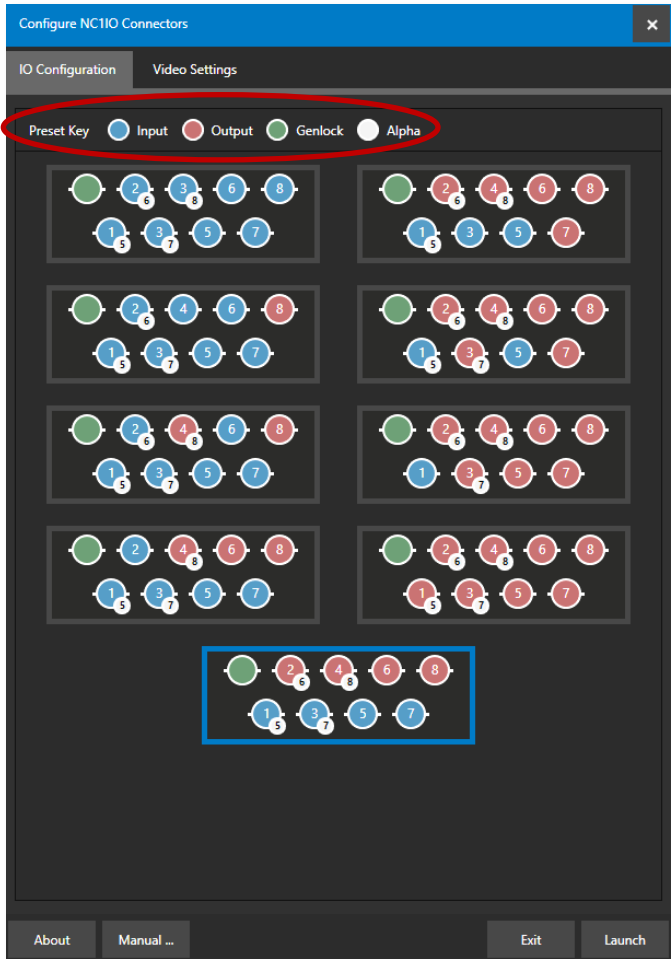
FIGURE 16

The *IO Configuration* tab makes it a simple matter to select presets using graphic representations that reference which ports will be input vs output, as well as show the port numbering and Alpha supporting connections, as shown in the red circle in Figure 16.

Hint: To use Alpha Quadlink, you need to be either all "In" mode (8in-0out) or all "OUT" mode (0in-8out).

Video Format

If you configure at the start of the session, you can easily be reminded of which Inputs/Outputs have a paired alpha by listing the SDI connection numbers in the drop down list under *Video Format (*Figure 18*).*

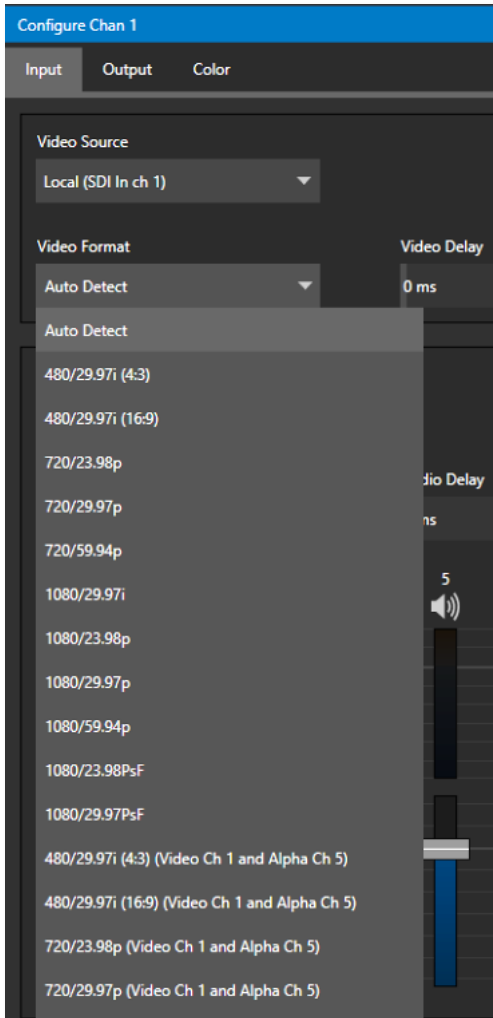*See Appendix A: Key/Fill Connections for key/fill connection details.*

FIGURE 17

VIDEO SETTINGS

The second tab in this configuration panel is labeled *Video Settings*, and its controls are discussed next.
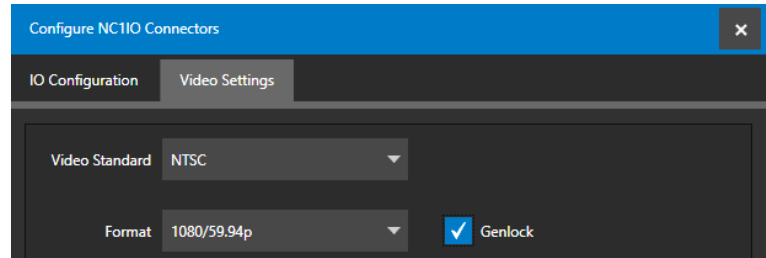

FIGURE 18

VIDEO STANDARD

The *Video Standard* option is an important one, since it determines the framerate 'family' that the hardware is able to access, and thus what formats will be available for input and output. Options are NTSC and PAL.

GENLOCK

The *Genlock* input on NC1 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 NC1 IO, *and* the NC1 IO unit. To connect the genlock source, supply the reference signal from the 'house sync generator' to the *Genlock* connector on the backplane.

> Note: The unit can use SD (Bi-level) or HD (Tri-level) reference. (If the Genlock switch is disabled, the unit operates in an internally managed 'free running' mode, instead.)

In the *Genlock* control group, select the format of the reference signal you are supplying.

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2.2.3 System Configuration (Mark D)

The *System Configuration* panel for Mark D systems is opened by clicking the configuration (gear) gadget found in the upper-right corner of the screen (Figure 19).

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.
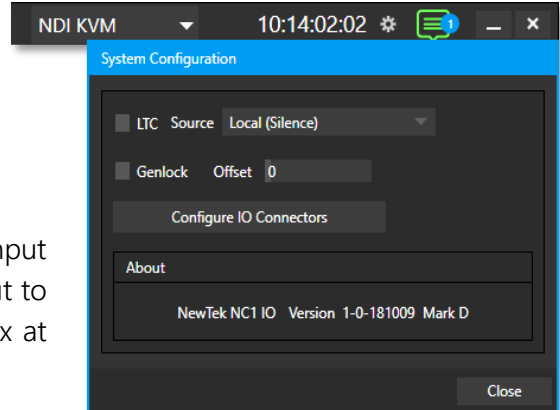
GENLOCK

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If your equipment allows you to do so, you *should* genlock all hardware sources supplying NC1 IO, *and* the NC1 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: If the Genlock switch is disabled, the unit operates in internal or 'free running') mode .*

CONFIGURE IO CONNECTORS

The SDI connectors on NC1 I/O's backplane can variously be assigned as either inputs or outputs. This determination is made in the *Configure NC1 I/O Connectors* dialog, which you can open by clicking the *Configure IO Connectors* button.

> *Note: There are two versions of this panel, based on whether the unit is a "Mark D" or "Mark M" system.*

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

FIGURE 20

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.*

2.2.4 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.

> *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.
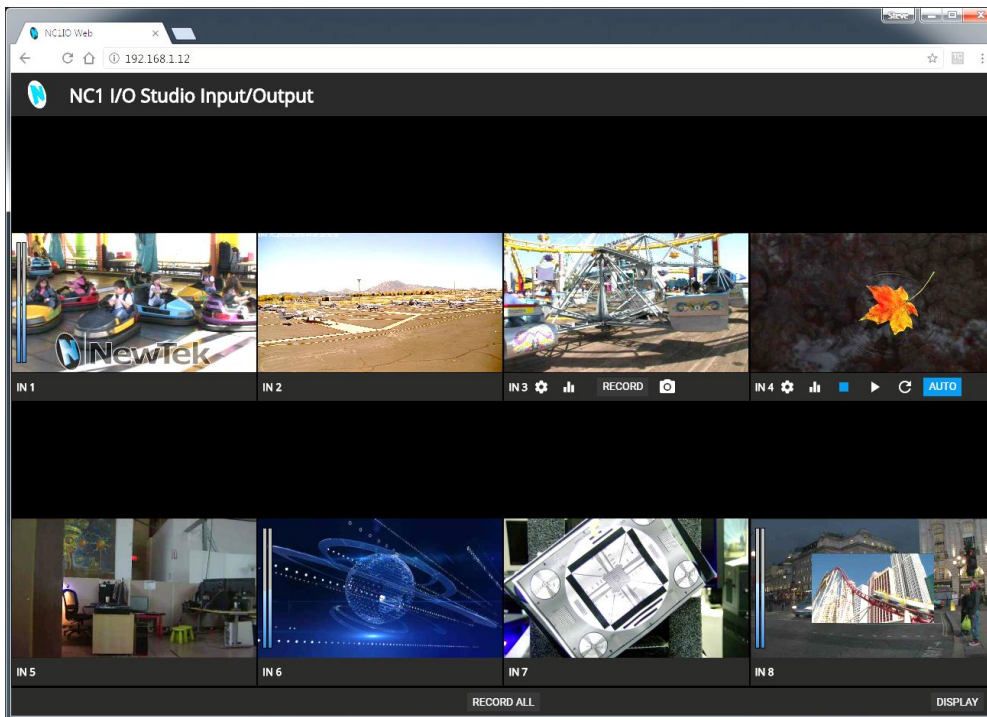
WEB BROWSER

FIGURE 21

In addition to the remote control features provided for your NC1 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.

2.2.5 VIEWPORT TOOLS
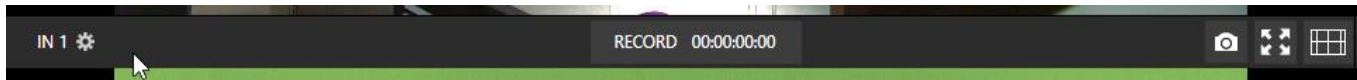

1   2   3   4   5

NC1 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 23

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 24

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 25

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 (Figure 26); more than one overlay can be active at the same time.
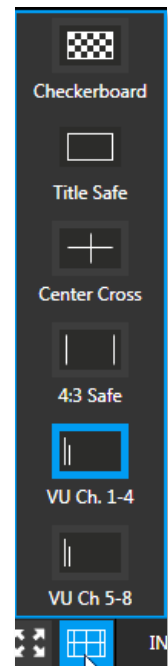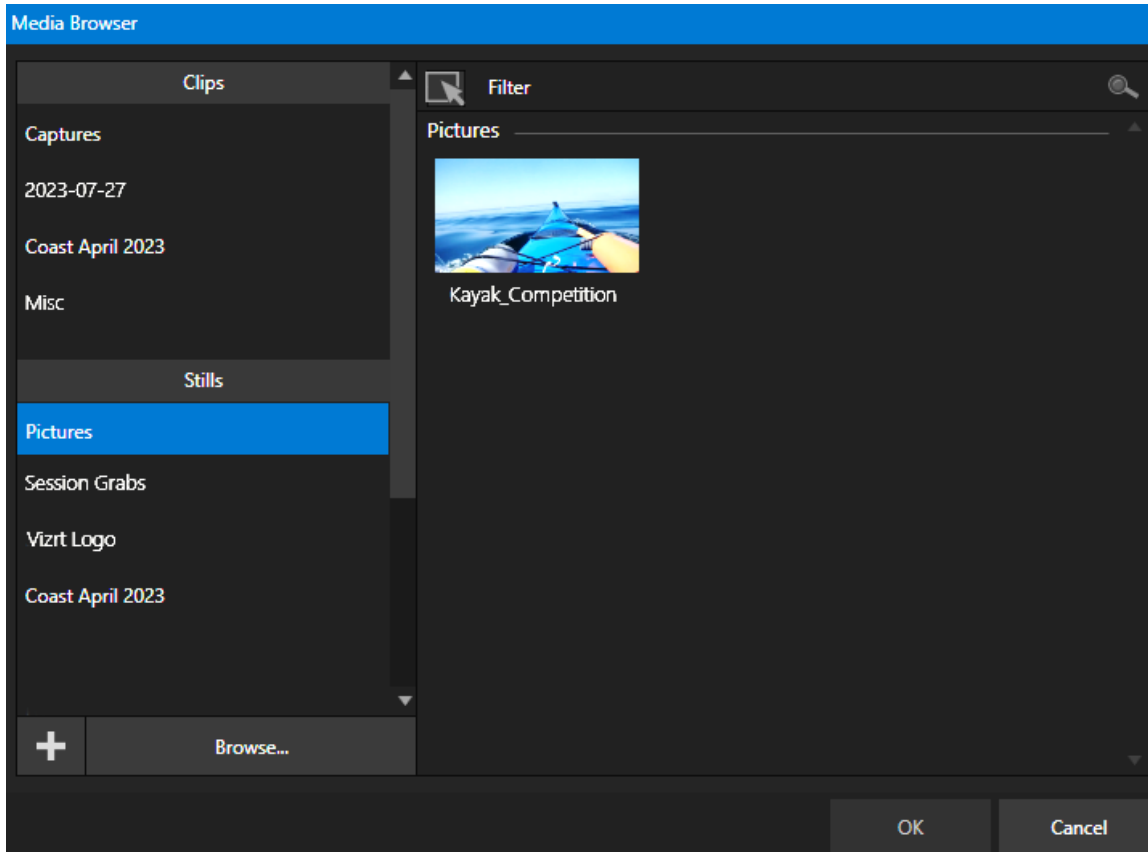

FIGURE 26

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FIGURE 27

The custom *Media Browser* provides easy navigation and selection of content on the local network. Its layout is principally comprised of two panes on the left and right that we'll refer to as the *Location List* and *File Pane*.

LOCATION LIST

The *Location List* is a column of favorite "locations", grouped under headings such as LiveSets, Clips, Titles, Stills, and so on. Clicking the + (plus) button will add selected directory to the Location List.

SESSION AND RECENT LOCATIONS

The *Media Browser* is context sensitive, so the headings shown are generally appropriate for the purpose for which they were opened.

In addition to locations named for your stored sessions, the *Location List* includes two notable special entries.

The *Recent* location provides quick access to newly captured or imported files, saving you time hunting through a hierarchy to find them. The *Session* location (named for the current session) shows you all files captured in the current session.

Clicking *Browse* opens a standard system file explorer, rather than the custom *Media Browser*.

FILE PANE

Icons appearing in the *File Pane* represent content located inside the sub-heading selected at left in the *Locations List*. These are grouped under horizontal dividers named for sub-folders, which allows related content to be organized conveniently.

FILE FILTERS

The *File Pane* view is filtered to show only relevant content. For example, when selecting *LiveSets*, the browser only shows *LiveSet* files (.vsfx).
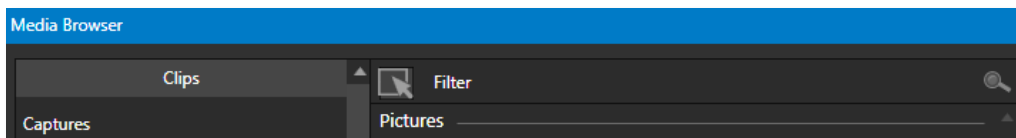

FIGURE 28

An additional filter appears above the *File Pane* (Figure 28). This filter quickly locates files matching criteria you enter, doing so even as you type. For example, if you enter "wav" into the filter field, the *File Pane* displays all content at the current location with that string as part of its filename. This would include any file with the extension ".wav" (WAVE audio file format), but also "wavingman.jpg" or "lightwave_render.avi".

FILE CONTEXT MENU

Right-click on a file icon in the *right-hand* pane to show a menu providing *Rename* and *Delete* options. Be aware that *Delete* really does remove content from your hard drive. This menu is not shown if the item clicked is write-protected.
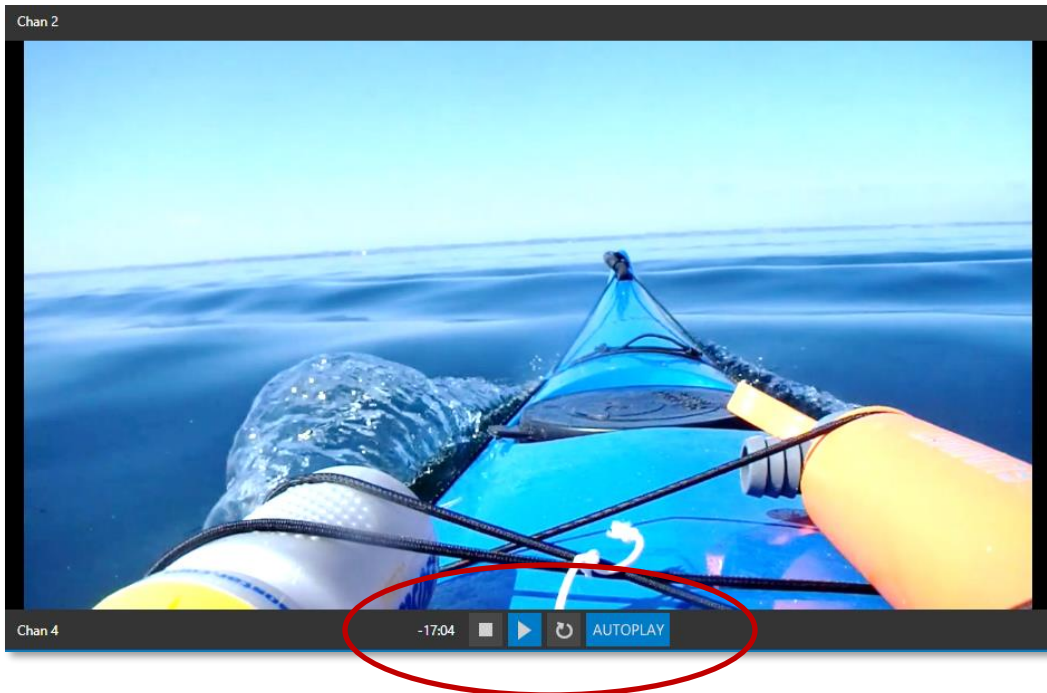
FIGURE 29

The *Player Controls* (located directly below the viewport) appear only when *Add Media* has been chosen as your video input source.

TIME DISPLAY

To the far left of the controls is the *Time Display*, during playback it displays the current countdown time for the embedded clip timecode. The time display provides visual indication that the playback is nearing its end. Five seconds before the end of play for the current item, the digits in the time display turn red.

STOP, PLAY AND LOOP

- *Stop* - clicking Stop when the clip has already stopped goes to the first frame.
- *Play*
- *Loop* - when enabled, playback of the current item repeats until manually interrupted.

AUTOPLAY

Autoplay, located to the right of the *Loop* button, is linked to the player's current tally status, where it remains in the play state if at least one of the connected live production systems has it on Program (PGM), unless manually overridden through the user interface. However, once all the connected live production systems have removed this NDI output from PGM, it will automatically stop and return to its cue state.

> *Note: The Autoplay button becomes somewhat hidden when the 8 Channel layout is selected for display, see 2.2.7 Dashboard Tools.*

2.2.7 DASHBOARD TOOLS

AUDIO (HEADPHONES)

You can connect a headset to the (green) audio output jack on the rear of NC1 IO's motherboard.

1   2

Controls for *Headphone audio* are found in the lower-left corner of the dashboard at the bottom of the screen Figure 30).

1. The audio source supplied to the *Headphone* jack can be selected using the menu next to the *headphone icon* (Figure 31).

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).
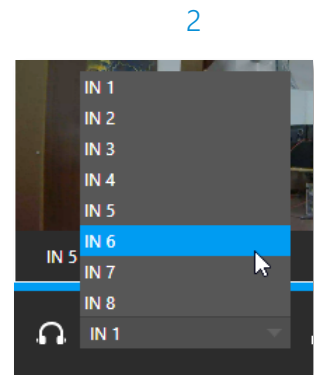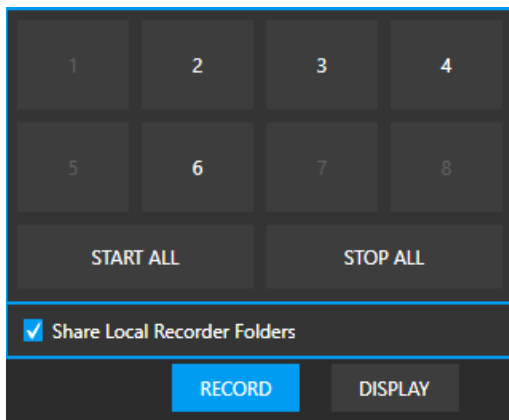

FIGURE 31

RECORD

FIGURE 32

The *Record* button is also located in the lower-right corner of the dashboard (Figure 32). 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.*

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 33).
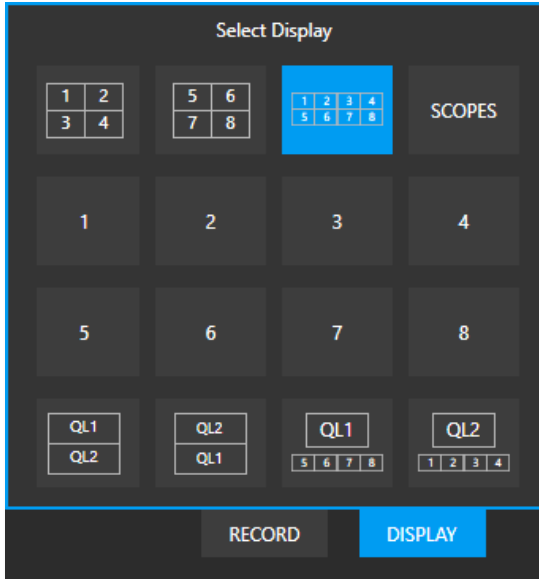

FIGURE 33

Please note that if you have selected the Add Media option as a video source when the 8-channel layout is chosen for display, the Autoplay button resizes down to 'A' due to size restraints as shown in Figure 34.

FIGURE 34

Waveform and *Vectorscope* features are shown when you select the *SCOPES* option in the *Display* widget (Figure 35).
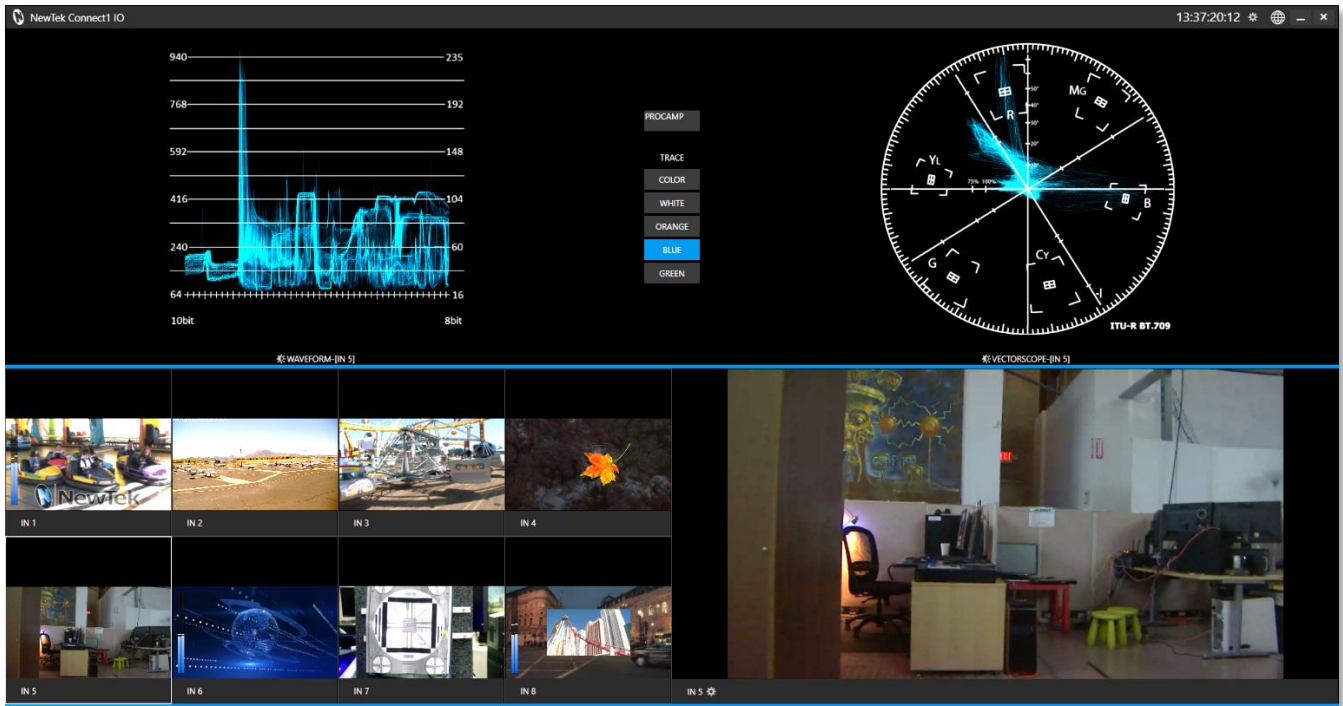

FIGURE 35

APPENDIX A: KEY/FILL CONNECTIONS

A.1 MARK M SYSTEMS

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

- SDI connectors numbered 1-4 show "video and alpha" options in their Configure Channel *Format* menu. Selecting this option sends 'video fill' from the source to the designated SDI connector (let's refer to it as SDIn), and places the 'matte' output on the SDI output connector SDI(n+4).

  For example, suppose the unit is configured with 4 inputs and 4 outputs:
  - In this configuration, SDI connectors 5-8 serve as outputs.
  - If the *Format* for SDI 5 is set to a "video and alpha" option in its *Output* tab, SDI 9 will supply the corresponding matte output.

Key/Fill with 4K format is supported as follows:

- Using NDI source with an alpha layer and output a key + fill over quad-link SDI.

  In this configuration use output 1-4 for the Fill and 5-8 for the Key.

  - Bring the NDI video to Channel 1 (ensure the video being received has an alpha layer).
  - Make sure all Channels are set to a Hardware Video Destination of "None".
  - Set Channel 1's Hardware Video Destination to "Quadlink SDI Out ch 1 (1, 2, 3, 4)".
  - Set the Video Format to the desired resolution and framerate making sure it includes "and Alpha" in the option.

A.2 MARK D SYSTEMS

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).

APPENDIX B: 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 NC1 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 C: DIMENSIONS AND MOUNTING

NC1 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.
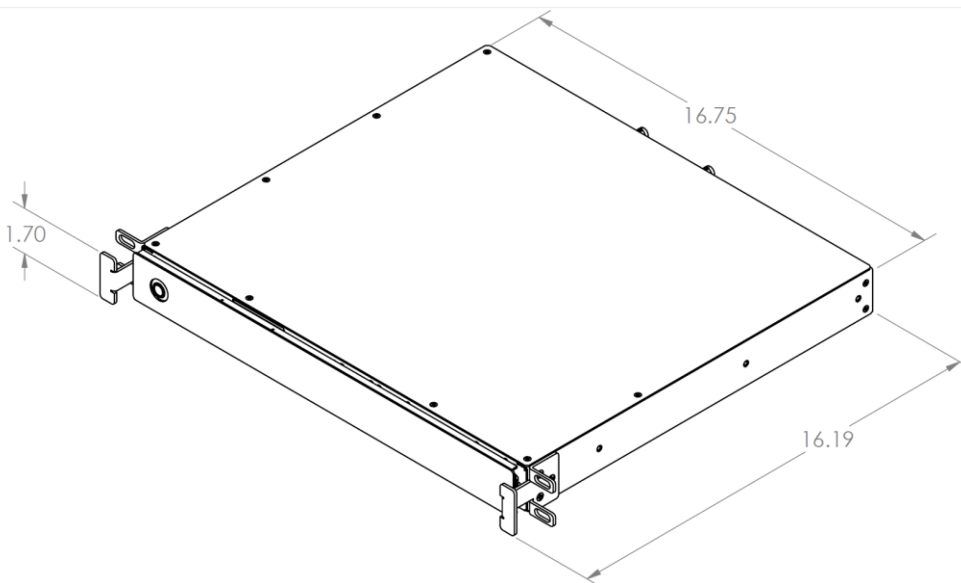

FIGURE 36

The units weigh nearly 14 pounds (6.35 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 and 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 NC1 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 NC1 IO will be installed inside furniture-style enclosures.

APPENDIX D: ENHANCED SUPPORT (PROTEK)

NewTek's optional ProTek^{SM} 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 E: 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 NC1 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

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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
- – FFMPEG library   ffmpeg.org

For a copy of the LGPL license, please look in the folder c:\TriCaster\LGPL\

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