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Chapter 1 ABOUT THIS GUIDE

NewTek live production systems deliver awesome production power ‘right out of the box’. Their ability to simplify and automate custom operations and workflows, and to leverage the features and content of other platforms in the ecosystem, is the icing on the cake. This guide introduces all of these capabilities.

Even if you are the hands-on, never-ask-directions type, please peruse this page. If any questions arise later, you may find the information here allows you to jump directly to the details you need with a minimum of reading.

For the purpose of clarity within this document the term “NewTek live production system” refers to any of our systems, including not only TriCaster® and VMC1™ but also many other products.

- **PART I – OVERVIEW**: The introduction to the NewTek ecosystem also explains the organization of this guide.

  Third-party developers who are interested in participating in the NewTek Developer Program will also find this discussion helpful as an introduction to the way their products can interact with NewTek products.

- **PART II – AUTOMATION**: Introduction to the NewTek product macro system, including the NewTek live video mixer and 3Play™ macro implementations, all about macro editing and management, and discussion of the numerous ways you can trigger macros.

- **PART III – INTEGRATION**: This section covers cross-product and cross-platform integration and communication.

This section provides a high level overview of the different components of the NewTek live production ecosystem, and serves a guide to your locating and utilizing those tools that will help you accomplish your production needs and creative goals.
Chapter 2 THE ECOSYSTEM

NewTek live video production systems are everywhere. ‘If only they could talk, the stories they would tell’; but wait, they do communicate! And not only with their siblings. More and more, third-party developers have prepared software and systems that can also talk to them, with manifold benefits.

Section 2.1 NO MAN IS AN ISLAND

Appealing as insularity may seem at times, John Donne had it right – “No man is an island”. We are inextricably connected.

This is truer now than ever. In the twenty-first century, technology multiplies, extends, and amplifies our connections enormously.

Perhaps that’s why, four centuries later, we have the temerity to extend Donne’s aphorism as follows: “No system is an island”. To elaborate just a bit, the more efficient, flexible, and deep the connections between systems are, the greater the rewards in creativity and productivity.

Fluid data transfer between systems is obviously fundamental to modern video production and broadcast. Beyond that, systems with deeply integrated and open communication and control capabilities offer collaborative, efficient workflows and outcomes simply impossible by other means.

Section 2.2 FAMILY AND FRIENDS

At NewTek, we deeply respect these principles. Our systems are engineered with extensive, open and innovative integration in mind. They ‘talk’ to each other, to make your work more efficient and rewarding. In particular, the NewTek live video mixer, 3Play™ and TalkShow™ product families, along with supporting NewTek software and hardware products, enjoy a high level integration.

We also appreciate the importance of ‘family friends’. Our customers have diverse needs, and equally unique pipelines. Simple connectivity is important, but much larger workflow benefits can accrue from more advanced interaction. The better we ‘play well with others’, the more we all gain.

No doubt our obsession with integration accounts for the rapidly expanding collection of collaborative systems and software we refer to as ‘the NewTek ecosystem’.
Just as many different members contribute to a literal ecosystem, so too the NewTek ecosystem includes a large and diverse population.

Section 2.3 Symbiosis and Communication

Communication in one or another form lies at the core of symbiotic relationships. Obviously, NewTek systems can 'listen' for input from external hardware control devices and systems. You'll find options discussed in Section 5.1.

NewTek live production systems can also exchange a/v streams and metadata, system status details (including 'tally', audio VU levels, etc.), and control instructions with suitably prepared external systems and software.

For example, audio, video, media files, and system control commands can easily be transmitted bi-directionally between systems across a shared network. Third-party solutions can even 'cross-pollinate' with NewTek systems, endowing the latter with dedicated custom macro commands specially designed to work with their product.

2.3.1 NEWTEK DEVELOPER NETWORK

The NewTek Developer Network counts among its members many of the most respected veteran contributors to the industry. Alongside these, you will find many smaller firms offering novel solutions that leverage and enhance the prodigious strengths inherent to NewTek platforms. And the ecosystem is flourishing, with new members and more innovative solutions appearing at a phenomenal pace.

The NewTek Developer Program provides members with access to SDKs detailing how to prepare or adapt their products to take advantage of these capabilities for many creative and productive purposes.

For further information, please visit http://www.newtek.com/solutions/newtek-developer-network.html.

Software Development Kit

Some existing level of programming expertise is required to use the components included in the NewTek Software Development Kit. Each is fully documented in this distribution, and may be accompanied by examples and guidelines useful in creating applications or plug-ins to integrate with NewTek products.
Let's briefly consider distinctions between automation and integration as the terms are used in this guide. This is a bit trickier than it might seem, but we want to make the effort as it will enable you to quickly locate the type of information you want without too much tedious searching.

Section 3.1 Introduction to Automation

To begin, let’s pay automation its due by giving a nod to its virtually endless benefits. Even in its simplest forms, it can render repetitive operations virtually effortless and error-free at the same time.

The principle native engine of automation for NewTek live video production systems is the Macro system. The very same commands exposed for your convenience in this system account for virtually every operation executed by the system.

And, of course, macros can be combined endlessly, with full control over timing. Without much effort at all, you will be able to customize your NewTek system to streamline your workflow and accommodate your personal preferences.

Hint: Chapter 4 provides a thorough introduction to the Macro system.

Without belaboring the point, obviously automation can be extremely simple, or more complex. For example, a simple macro might select a transition and perform an Auto to display a specific video source. For convenience, you might assign this macro to a keyboard shortcut.

A slightly more complex macro might load a designated M/E preset, select it on the main Switcher’s Preview row, load a custom transition, perform an Auto, and reconfigure the Audio Mixer to match the changes. Again, a single keystroke, click, or button press can trigger all of this.

Hint: NewTek live production products support numerous and diverse input methods for triggering macros – see Section 4.4.1 for details.

Let's raise the automation bar even more. Rather than relying on manual input to trigger a sequence of automated tasks, the whole process can be driven by external systems.

For example, an external software application serving as a master control process can execute all manner of complex production operations according to predefined scheduling or other stimuli.
A typical example of this type of automation would include newsroom MOS protocol implementations, which are used to create, edit, manage, schedule and execute virtually every audio, video and graphic element of on air segments in many news centers worldwide.

By mentioning this level of automation, we have wandered into the rather fuzzy boundary between ‘automation’ and ‘integration’. Before moving on to discuss the latter, let’s touch briefly on one rather special automation task.

In high end, mission critical production settings, failsafe systems are de rigueur. One of the more important redundant systems in such settings is the primary video mixer. NewTek live video mixers have unique features that permit them to serve in these environments.

Section 3.2 Introduction to Integration

In this guide, we use the term “integration” when referring to broader topics, including cross-platform communication, data transfer and also multi-system control. This may all sound somewhat daunting, but some rather wonderful things are actually readily accessible thanks to ‘smart’ connectivity inherent in NewTek live production systems.

Let’s consider an example. You may already know that most NewTek video systems provide native support for network sources. A/V signals supplied across standard TCP/IP network connections can be ingested live, just like any other source.

When one NewTek system is linked to another, both are ‘aware’ of the live connection, and the two systems are able to ‘converse’ without any further configuration. This allows simple signal traffic, such as tally notification, to pass between systems automatically. More than this, however, the native Macro systems of both units allow operators to send instructions from one system to another.

Thus a NewTek live video mixer operator could easily create a macro that would i) jump the live video stream from a 3Play networked source back 5 seconds, ii) select a custom “Instant Replay!” transition, iii) commence slow motion playback of the 3Play recording, iv) Auto the network source onto Program output, v) select a “Back to Live!” transition, and vi) Auto back to the original source 15 seconds later – then execute the whole thing with a single click at any time.

A new and growing resource is NewTek NDI which (among other things) allows you to access video streams among NDI enabled devices. Imagine your production switcher, capture system, media server—any NDI-enabled device on the network—can now see and access content from all other devices, allowing more sources than ever before to be used for live production.
Of course, integration with kindred NewTek systems is just the beginning. The chapters in the Integration section of this guide (Part III) also discuss integration with third party systems and products too. This includes, as well, coverage of related topics such as file import and export, and drive formats.
Full details of the macro system native to the NewTek live production family, along with an explanation of redundant control over NewTek live video mixer systems.
Chapter 4 **THE MACRO SYSTEM**

Macros can smooth your workflow, reducing complex operations to a single button press, and making it easier to produce sophisticated programs. Macros can also eliminate embarrassing operator errors. Too, the fact that there are nearly endless ways to trigger macros provides many opportunities for both workflow streamlining and creative applications.

Keeping up with the action is one of the hardest things about live production. Fingers can only move so fast, and it can be hard to recall and perform important sequential steps without any slipups.

Macros are the answer to that dilemma. Record a sequence of events and play it back with one click. Or trigger it with a keystroke, control surface, MIDI panel or sequencer, your smart phone, automatically on a HotSpot action, on achieving a designated audio threshold, or many other alternatives.

**FIGURE 4-1**

Macros can do almost anything. Preload and play content, modify audio settings, automate multi-step sequences or perform synchronous operations. The amazing versatility of macros more than justifies the prominence the *Macros* button gets in the *Dashboard* area of most NewTek live video mixer and 3Play models.

**Section 4.1 MACRO CONFIGURATION**

**FIGURE 4-2**
Click *Macros* to show a menu which lists a *Configure Macros* item at the bottom. Select this menu item to open the *Macro Configuration panel* (Figure 4-2), which in turn enables you to create, edit, and manage your macros.

**Note:** You may notice some differences in layout of this panel from one product and model to another, but basic functionality is generally as described in this guide.

---

### 4.1.1 SYSTEM MACROS

The largest part of the (resizable) *Macro Configuration* panel consists of the *Macro List*. By default, for any product, this list includes an uppermost entry labeled *System Commands*. Expand this entry by clicking the triangle at left to see a long list of these important macros. The macro entries in this group actually invoke the same shortcuts called by the user interface and *Control Surface* to operate your system (Figure 4-2 shows typical 3Play *System Command* list content).

**Hint:** Notice that keystroke shortcuts assigned to macro entries are visible at right.

It’s worth noting a few unique aspects of *System Commands*. First, *System Commands* are specially safeguarded within the system. *Rename* and *Delete*, functions normally available from a right-click folder or entry context menu, are disabled.

**Hint:** If you copy a *System Macro* outside that group, the copy becomes editable.

Individual entries in the list can be disabled by un-checking the switch at left; not surprisingly, removing the checkmark beside the *System Macros* folder itself will result in the failure of all ‘system default’ keystroke shortcuts. By design, this does not affect *Control Surface* operations, however.

---

### 4.1.2 SESSION MACROS

*Session Macros* is another macro folder that always appears in the list. Macros you create in or move into this special folder are available in the current session (only). This collection gives you a place to collect custom macros that are designed for use within a specific production without cluttering up the list.

**Note:** The *Session Macros* group itself cannot be deleted or renamed.

One advantage of the *Session Macros* implementation is that it lets you invoke session specific variants of a macro using the same keystroke shortcut (or MIDI surface button, etc.) without conflicts. For example, you might set up macros that behave similarly in every session, but which point to different content.

**Hint:** One easy way to copy content from one *Session Macros* folder to a different session is to Clone the folder and rename it. Then launch the target session, and move the macros you want to transfer from the renamed clone into the current *Session Folder*.

---

### Section 4.2 RECORDING MACROS

Creating a new macro is simple. Buttons at upper right let you add new folders or macros. Click the Folder button to add a folder, and name it.
Selecting a folder in the list (other than the System Macros folder) enables the Add Macro button (Figure 4-3). Click this button to add a new macro entry.

**Hint:** Double-click directly on the name field for a folder or macro to edit it, or select Rename from the context menu.

Continue to define the macro by clicking the Record button at the bottom of the panel, and then just go ahead and perform the sequence of operations you wish to include in the macro. You can use mouse, keyboard, and Control Surface operations when doing so. When finished, click the Stop button to complete recording.

Test the new macro by clicking the Play button (or by double-clicking the macro entry in the list). You'll notice that an animated bar in the background of the macro's entry in the list tracks playback progress. You can set macros to loop using the button at right, or modify the playback rate using the nearby menu.

**Hint:** You can record a macro that includes other macros. Depending on your order of operations, you may need to re-highlight the newly recorded macro in the list to show its Stop control (to end macro recording).

---

### 4.2.1 Snapshot Mode

One option in the playback rate menu bears explanation: Snapshot is rather special. When you choose Snapshot as the macro's 'speed', you essentially tell it to jump to its end result. Any operation or delay that is ultimately irrelevant in achieving that end is simply omitted.

Snapshot mode is very useful for macros that configure NewTek live video mixer to a particular state. For example, you might want to instantly reconfigure multiple M/Es with different angles of a single virtual set for an impending scene change; or perhaps you want to quickly disable LiveMatte for all Media Players at once. The possibilities are endless.
4.2.2 FAVORITES MENU

You'll see a 'star' gadget (Figure 4-6) at right for each macro entry in the Macro Configuration panel. Click the star to include the macro in the quick access Favorites list, shown in the Dashboard Macro menu (Figure 4-7).

Section 4.3 MANAGING MACROS

The Macro Configuration panel has numerous features to help you organize and manage your macros, including not only folders, but also rename, clone, copy and paste, and hotkey assignment, as well as Import and Export.

4.3.1 THE CONTEXT MENU

Entries in the macro lister have a context menu, shown when you right-click an item (Figure 4-8). Menu items allow you to play or record a macro, delete or rename it. You can, of course, cut, copy, and paste macros, or clone them, combining the latter two operations in one step.

You can also export selections, including multi-selected macros, or even entire folders.

The corresponding import item is shown in the menu if you right-clicked either a folder or a blank area in the macro list pane. Import and export can be used to share macros with multiple users and systems, but provide another important service, too.

A good deal of time can be spent preparing complex macros designed to support your production. It would be a shame for these to be lost unintentionally through some mishap, as by some overly-tidy assistant.
deleting a folder on your day off (or perhaps by performing a *System Restore*). For this reason, we encourage you to use the *Export* feature to prepare a backup archive of your painstakingly designed macros.

**Section 4.4 Editing Macros**

Often you will wish to modify values assigned to the various steps in an existing macro, rather than re-recording it; or perhaps you want to experiment with other possibilities. Click the *Edit* button (Figure 4-9) to open the *Macro Editor* for the currently selected macro.

![Figure 4-9](Image)

This deceptively simple editor presents the shortcut sequence your macro contains, along with all of its values, including timing information for each line, in a simple to comprehend ‘spreadsheet-style’ interface. Simply click a cell to edit the current entry, or use the arrow keys to navigate.

- Click any cell in the table to select it for editing or other operations. Or click the left-most cell to select a row. Select multiple rows using Shift or Ctrl modifier keys in the usual manner.
- Right-clicking opens the editor's context menu, which allows you to *Undo, Redo, Insert* a row (the keyboard shortcut Ctrl + i also inserts a row), *Delete*, or *Cut, Copy* and *Paste* selections.
- Standard copy and paste keyboard shortcuts are supported as well. When done editing a macro, click **Apply** (or **Cancel**, to close the editor without saving your changes).

**Hint:** Use the Record button in the footer of the Editor to directly record new entries to be inserted into the current macro at the selected line.

### 4.4.1 MULTI-STEP MACROS

The NewTek live video mixer's Macro Editor permits you to create and execute multi-step macros. Adding the line “#waitforcontinue” (or simply, “#pause”) to a macro using the Macro Editor causes the macro to wait for user input at that step in its execution.

The new *Continue Paused Macro* shortcut, assigned by default to the `backtick` key (`) serves to resume playback. This feature can be used in endless ways, as for example to allow a user to step dynamically through a series of animated CG overlays on demand.

### Section 4.5 MORE ABOUT MACROS

Macros consist of a **shortcut**, or command, and (at times) one or more **values**. Let’s consider an example. The shortcut `grab_still` is easy to use. You can simply enter it as shown in Figure 4-11, and run the macro.

![Macro Editor - Untitled Macro](image)

**FIGURE 4-11**

In this case, the result will be identical to what would happen if you clicked the GRAB button in the interface of a TriCaster or VMC1. The grab operation will use the current settings from the *Grab Still Configuration* dialog.
Macros can do much more, however. Let’s see what the *grab_still* shortcut is really capable of.

### 4.5.1 UNDERSTANDING SHORTCUTS

To do so, you must exit to Windows, and locate the file named shortcuts.cfg.xml on your system. Depending on your NewTek product, you will find this file in the (hidden) directory `C:\ProgramData\NewTek\productName (e.g., TriCaster)\Configuration`. You can view the content of this file in most web browsers, or you might prefer to view it in a text editor.

**Hint:** You may wish to save this file to another system for reference purposes, but note that the content of the file changes from time to time as new features are added.

Either way, if you search the file for “grab”, you will be able to locate the lines below, which include a dictionary that defines the properties of the *grab_still* shortcut.

```xml
<shortcut name="grab_still">
  <shortcut_dictionary>
    <entry key="sources" type="string" />
    <!-- ',' separated sources to capture, the pattern is [output/input]+[index], like "output1,input1", if this is not set selected sources in the combobox will be used-->
    <entry key="path" type="string" />
    <!-- the root path to store the files, if this is not set then the default session's still path would be used-->
    <entry key="addto" type="bool" />
    <!-- whether or not add images to the selected destinations-->
  </shortcut_dictionary>
</shortcut>
```

**Hint:** See also Exporting Macros in Section 7.2.1.

### KEYS AND VALUES

Notice that the dictionary (in our example above) defines three entry keys, and explains their use:

- A key labeled *sources* allows us to specify which sources to grab. If we supply values for the *sources* key, we can tell *grab_still* which specific sources to grab from.
- Another key, labeled *path*, allows us to tell the system where to store the grabbed files.
- Finally, the key *addto* tells the system whether or not to automatically add the grabbed files to the current playlist of one or more Media Player modules.

As you can see, values can take different forms. The sources and path keys take text values (*string*), while the dictionary tells us that *addto* takes a *boolean* (0 or 1, true or false) value. Let’s try these out.
In Figure 4-12, we added *sources* and *path* keys to our example, and gave them values. Executing our macro grabs an image from the source of switcher Input 1, storing it on the D:\ drive with the base name “mypic”.

*Hint: Note that the sources key supports values that are not available in the Grab Configuration panel. It is not unusual for a shortcut to provide extended capabilities in this manner, which is another advantage of macros.*

### Prefixes, Suffixes, and Targets

*Grab_still* is a very simple *shortcut*, really just a single command. Many other *shortcuts* consist of two parts, a *prefix*, which is prepended to the shortcut string to identify its target, and the *suffix*, (typically the *shortcut* or command itself). Syntax for a slightly more complex shortcut is thus as follows: Prefix_shortcut (value).

For example, the “_auto” shortcut requires a *prefix*, but does not require a *value*. A prefix tells the shortcut what the target of the instruction is. Recording a macro will often capture the prefix you need, but in any case you can search for “prefix” in shortcutsCfg.xml to find a lengthy list of applicable prefixes. This list includes the examples below (among many others):

- “main”
- “main_background”
- “main_dsk1”
- “v1_dsk1”

If we add the prefix *main* to the shortcut _auto, we get *main_auto*, which will perform an auto (transition) on NewTek video mixer’s main *Switcher*. In this case, the auto will be applied to all delegated video layers, just as if you clicked the *Auto* button below the *T-Bar* in the interface. However, other prefixes let you apply the shortcut to individual layers.

For example, a macro containing the compound shortcut *main_background_auto* exclusively applies the auto to the Program/Preview layers, ignoring other delegated video layers. Similarly, *main_dsk1_auto* affects only the first DSK video layer, while *v1_dsk1_auto* is limited to the first key layer for M/E 1 (a.k.a., v1).
In some cases, a *value* is further refines a shortcut. For example, “v1” is the prefix that targets M/E 1. The index value “0” identifies the first video input. Thus supplying the shortcut *v1_a_row* with a value of 3 selects Input 4 on the A row of M/E 1.

As we have seen in this section, it is simple matter to record a macro (Section 4.2), and tweak it using the Macro Editor (Section 4.4). This is usually the quickest approach to finding a macro shortcuts (command), any prefixes it requires, and the sort of values that it requires. The shortcuts_cfg.xml file provides deeper detail that can be helpful at times.
Macros can reduce or eliminate embarrassing errors. Too, the fact that there are nearly endless ways to trigger macros provides many opportunities for workflow streamlining and creative applications.

As discussed in the previous chapter, one way to execute a macro is directly from the Macro Configuration panel, by double-clicking a macro entry, or by clicking the Play button (Figure 5-1).

This is just the beginning, however. Macros can be triggered in so many ways that we've devoted a whole chapter to the topic.

For example, macros can be triggered by the following means:

- Keystroke shortcuts
- Control surface buttons
- MIDI pads and sequencers
- GPI signals
- Software events such as:
  - A NewTek live video mixer HotSpot 'hit'
  - An audio event
  - Or input state change.
- Third-party software applications communicating with your NewTek live production system over a network
- HTTP commands sent by a webpage designed for the purpose

Section 5.1 Hardware

As mentioned earlier, macros can be triggered by any of a wide array of supported external hardware devices. Obviously this includes your keyboard; and the majority of NewTek control surfaces compatible with your live production system have a Macro button for this purpose.
As the simplest example, let’s briefly consider keyboard shortcuts before looking into some of the other options.

Of course, many of the System Commands entries have default keystroke shortcuts pre-assigned. The first shortcut assigned to a macro (some systems support multiple shortcuts) is displayed at right on the row, near the Favorites star mentioned earlier.

---

**5.1.1 KEYBOARD SHORTCUTS**

To set a new shortcut or replace an existing one, click a ‘gesture field’ in the Shortcuts group at the bottom of the Macro Configuration panel. It will display a “Listening ...” tag (Figure 5-3). Then press the desired keystroke.

*Hint: For clarity, lower-case characters are uniformly shown as upper-case. True upper-case letters are displayed in the form [Shift + (character)].*

---

**FEELING CONFLICTED?**

By the way, assigning identical shortcut combinations to multiple macros is supported, and deliberately so. Still, as you may wish to avoid conflicts, a yellow triangular gadget referred to as a ‘bang’ (or, if you are a ‘foodie’, a ‘nacho’) is shown in this case.
Bangs appear at right for all macro entries in the *Macro Configuration* panel lister with shortcut conflicts (Figure 5-4).

**FIGURE 5-5**

Of course, when multiple shortcuts are assigned, the first shortcut for a macro – i.e., the one displayed at right in the *Macro Configuration* panel lister – may not actually be the one that is conflicted; or there can be several conflicts for a single macro.

In such a case, select the macro in the list to show the corresponding *Shortcuts group* entries at the bottom of the panel (Figure 5-5). Conflicted ‘Listen’ controls will *all* show bangs. Clicking a bang automatically jumps to the next conflicted entry, so you can advance quickly through the list resolving conflicts as you go.

Obviously, you can resolve a conflict by assigning different keystrokes to conflicted macros. Or you can disable conflicted macros if you prefer, using the checkmark switch.

*Hint: Folder level checkmark switches offer a method for managing ‘deliberate’ shortcut conflicts. For example, the shortcuts assigned to entire folders of macros designed for various purposes can conflict with shortcuts in another folder, but keystrokes for any inactive folders will be ignored.*

---

### Deliberate ‘Conflicts’

On the other hand, your ‘conflicts’ may be deliberate; running multiple macros with just one button press or gesture may be just what you had in mind. Pressing the conflicted shortcut key will perform *all* macros sharing that keystroke assignment.

---

### 5.1.2 NEWTEK CONTROL SURFACES

**FIGURE 5-6**

Several NewTek manufactured control surfaces feature a dedicated *Macro* button (Figure 5-6). When this is true, a macro can be assigned to buttons on the control surface in much the same manner as it would be assigned to a keyboard button. You would simply do as follows:

2. In the macro list, select the macro you wish to assign to a button.
3. Click the mouse in a *Listen* control at the bottom of the panel.
4. Hold down the MACRO button (on the control surface) and press the button you want to assign the macro to.

That’s it – close the Macro Configuration panel, and test the result.

Hint: When you press the MACRO button, all buttons that currently have assignments light up. This makes it easy to see which buttons are available for your use.

5.1.3 MIDI CONTROLLERS

The MIDI (Musical Instrument Digital Interface) protocol and devices and systems supporting it offers another very useful (and often very affordable) macro trigger option. MIDI devices are often used in the audio and events industries, but can be found in other realms as well. Literally thousands of devices and systems of this sort are available.

The Macro Configuration panel system can ‘listen’ for button presses from most MIDI devices, just as it recognizes input from the keyboard or native control surface.

Note: Many MIDI devices provide ‘plug-and-play’ convenience. Some, though, require non-standard device drivers. Generally, adding device drivers to NewTek products is discouraged, since these may not have been prepared with the rigorous demands of live production in mind.

If you install a driver and encounter unintended consequences, you can resolve the problem by restoring to factory defaults and, if necessary, updating to the current software version appropriate for your NewTek system.

Too, a wide variety of MIDI software and extensions are available for various platforms, including mobile devices such as tablets and smart phones. These can be used to create unique custom NewTek live video mixer control alternatives. See the control surface documentation and addenda for your live production system for more on this topic.

5.1.4 GPI CONTROLLERS

GPI, or General Purpose Interface, is a long-serving analog control signal system based on simple contact closure. GPI inputs and outputs are very common on professional production equipment. The macro system in NewTek live production devices can take advantage of intermediary devices, such as the eBOX™ network/GPI hardware interface from JLCooper Electronics, to support both GPI signal input and output.

Configuration

For an external GPI device to communicate with a NewTek live production system, it must be manually defined by text entries in the file named gpi_setup.xml. This file can be located in the directory shown below as appropriate for your platform:

- C:\ProgramData\NewTek\ProductName(e.g., TriCaster)\Configuration\

The entry for a given GPI control device must contain an IP address and port, password, and custom name, entered as follows:
At the time of writing, the XML 'element name' signified above by the placeholder device should be "jlcooper", without the quotation marks. The value for the "name" attribute that follows is a custom name of your choosing.

Hint: Normally, connected GPI devices are identified by unique names in this file; otherwise (if GPI devices share a single name) GPI commands are issued to them simultaneously.

The remaining configuration attributes ("ip", "port" and "password") are set at the external hardware device (refer to the vendor’s documentation for details); the corresponding values need only be transferred into the XML configuration file. A typical entry might look like this:

```xml
<jlcooper name="JLCooper1" ip="192.168.128.102" port="23" password=""/>
```

**LISTENING FOR GPI TRIGGERS**

Just like keyboard shortcuts, control surface and MIDI button operations described earlier, properly configured and connected GPI devices can trigger macros. To assign a GPI trigger to a macro, simply click a 'gesture field' in the Shortcuts group at the bottom of the Macro Configuration panel (Figure 5-3); then send the desired external GPI trigger to the system. The 'listening' control will recorded the GPI signal, and a suitable shortcut entry will be displayed.

**SENDING GPI COMMANDS**

A special macro command allows you to send GPI signals to external devices and systems via network-connected GPI interface devices (such as the eBOX™ from JLCooper Electronics). GPI macro entries are formatted as shown below:

<table>
<thead>
<tr>
<th>Delay [ms]</th>
<th>Shortcut</th>
<th>Value</th>
<th>Key 1</th>
<th>Value 1</th>
<th>etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>####</td>
<td>gpi</td>
<td>name</td>
<td>GPI_pin#</td>
<td>boolean</td>
<td></td>
</tr>
</tbody>
</table>

- **Delay** – the interval, in milliseconds, between the time when the command on the prior line (if any) was issued to the system, and execution of this line.
- **Shortcut** – Use the entry “gpi” in this field to send a GPI signal.
- **Value** – The shortcut value is the name of the GPI device (defined earlier in gpi_setup.xml) that you want the signal defined on this line to address.
- **Key # (0–n)** – The value you enter in this field identifies a target pin on the external DVI device to receive a signal defined in the following field. The entry should be formatted as "pin#" (e.g., “pin12”, without quotation marks).
- **Value # (0–n)** – This value controls the contact closure state (on or off) for the GPI device pin identified by the preceding key. The value can be entered variously as “1” or “0”, “on” or “off”, “true” or “false” (without quotations).

A typical entry might look like the following:

```xml
<delay ms="1000" action="send" pin="pin12" state="true"/>
```
Hint: Multiple GPI pins can be targeted simultaneously by key/value pairs entered on a single line.

Alternatively, some GPI devices require a GPI ‘pulse’ of a specified duration. In such a case, you might send an “on” command on one line, followed – after a suitable delay – by an “off” command sent to the same pin.

Section 5.2 SOFTWARE

As mentioned earlier, macros can also be triggered by software events of various types, including internal or interactive events such as a NewTek live video mixer HotSpot ‘hit’, audio event or input state change, or externally, in response to commands from software applications or even a webpage designed for the purpose.

5.2.1 SWITCHER STATE

The State Change controls located in the Automation tab of NewTek live video mixer’s Input Configuration panel allow you to flexibly trigger macros based on the utilization of video sources used in your production.

FIGURE 5-7

Macros can now be assigned to run on specific Switcher operations, such as:

- Program or Preview row selection
- Displaying/ hiding the source in a DSK or KEY channel
- Selecting/de-selecting it on an M/E’s A row
- Or any M/E row, or ...
Showing or hiding a source on the Program or Preview output.

This feature is immensely powerful, and lends itself to all manner of applications, such as the following, to name just a few:

- Automatically fly in a title whenever you switch to a specified remote source
- Then remove it again automatically after it is displayed for a specified time.
- Or automatically select a different Audio Mixer preset when you switch from viewing a source in the B monitor of a virtual set on Program to displaying it full-screen
- And then change back to the original audio setup when you switch back to the anchor desk.

The possibilities are truly endless.

Simply click the E (Event) button next to a ‘state’ option for the input and select macros that will run when the source assumes or exits the specified state.

5.2.2 HOTSPOTS

On-screen HotSpots, also configured in NewTek live video mixer’s Automation tabs, provide yet another way to trigger macros – based this time on activity detected in specially defined regions of the video frame.

Hotspots can serve many purposes. For example, onscreen talent can trigger one macro by moving their hand (for example) into a Hotspot, another by moving it out.

- Use live action to play sounds, make Overlays and DSKs appear auto-magically, or switch the video in a virtual monitor by tapping it with a fingertip.
- Switch from a seated desk shot to a standup virtual set simply set by walking into it; then auto-switch to the next shot when you walk back out of the frame.
- Load up a different DDR MEM slot, audio configuration and camera assignments when talent moves from the desk shot to standup in a virtual set.
- Reveal an over-the-shoulder Skype® feed from TalkShow™ and configure audio for the remote interview, then close the picture-in-picture and restore the original sound setup with a wave of the hand.
Hotspots are configured in the configuration panels for individual inputs. Double-click the viewport for a camera input to open this dialog, and click the LiveMatte tab. The lower portion of this tab contains the Hotspots control group.

**Note:** All Hotspots for an individual source can be enabled or disabled using the switch in the group header, or globally for all sources in a given session using the Options menu.

Hotspots are color-coded, and their respective colors are used to draw the Hotspot overlay boxes on your viewports when the Hotspot Markers overlay is enabled for a corresponding monitor viewport.

Scale and Position buttons allow you to re-size and place the ‘trigger zone’ for each Hotspot accurately.

The Event button for each Hotspot, marked by a capital “E”, opens the Event Triggers dialog. This is where you will assign macros that are triggered when something moves into (On Screen) or out of (Off Screen) the otherwise transparent area defined by that Hotspot.

**Hint:** Use the Overlay option Flip View Horizontal to let talent see exactly where their marks are on a Multiview screen.

### 5.2.3 MEDIA PLAYER MACROS

Naturally, Media Players get automation support like other Switcher inputs, as described above. We didn’t stop there, though. Every item in a playlist – each clip, still image, audio file or title page – has its very own automation features.

- Any macro you can record or create can be executed automatically on either playback or end of play for any and every individual playlist item.
- Improved multi-selection support in the playlist makes it a breeze to assign macros to multiple items.
- Automatically show titles for certain types of clips and not others.
  - Give them different title page types
  - Use macros to selectively adjust Proc Amps on a per-clip basis.
  - Or enable LiveMatte keying automatically when needed for certain items.

### 5.2.4 AUDIO AUTOMATION

Similar automation functionality is provided by NewTek live video mixer’s Audio Mixer. The related controls are located in the Automation group in the Input Settings tab of the advanced Audio Configuration panel.
Hint: To open this panel, roll the mouse over the control group for any input in NewTek live video mixer’s Audio Mixer, and click the gear gadget that appears at the top in the label for that input.

The **Automation** control group contains **Follow Program Video** (also known as ‘AFV’, for Audio Follows Video) and **Macro** options.

**Follow Program Video**

Enabling **Follow Program Video** options for an audio source directs the NewTek live video mixer to track switcher operations affecting the related video source.

Audio for sources with **Follow Program Video** enabled in the **Audio Configuration** panel is automatically removed from mixed outputs until one or more specified video sources are actually displayed on **Program** output.

**Run Macro**

Audio threshold triggers allows you to specify a value in decibels to serve as a macro trigger. Whenever the sound level on that input rises above the threshold (or falls below it), designated macros will run.

**Hint:** Transient sounds such as a brief cough are automatically filtered out.

In this manner you could, for example, automatically perform a ‘hands-free’ camera switch to show someone who begins speaking, and then switch back again when he stops.
NewTek’s LivePanel application (available for selected systems as a standalone purchase or included with Premium Access membership) provides a wide variety of prepared web applets.

You can use these to switch a show, adjust audio levels, update DataLink values in your title pages, trigger macros, and much more. Configuration is as simple as entering the appropriate URL into your web browser, and you can even create custom webpage applets of your own using the included LivePanel Builder.
5.3.2 NDI CONTROL AND MORE

Additional means for communicating and controlling NewTek live production systems over a network, including macros that use HTTP, NDI communication, and other methods relevant to developing custom applications that use TCP/IP or HTTP protocols, are discussed in Section 7.2 of PART III (Integration).
PART III (INTEGRATION)

in-te-gra-te [in-ti-greyt] – verb:

1. to bring together or incorporate (parts) into a whole.
2. to make up, combine, or complete to produce a whole or a larger unit.
3. to unite or combine.
NewTek live video mixer’s integrated title page system provides many opportunities for internal automation and broader pipeline integration.

Its unique DataLink™ implementation combines with native as well as third-party automation systems to supply text and image updates for CG purposes from a wide array of live and prepared data sources.

Section 6.1 INTRODUCTION

NewTek live video mixers include internal Media Players and native title systems. These are coupled to a world-class effects engine so you can display colorful and informative titles and graphics into your productions with ease and flair. And, as discussed in earlier chapters, the macro and automation features add greatly to the value of this implementation:

- The display of title pages can be automatically controlled and timed based on diverse trigger events and Switcher states.
- Using the integrated title editor, text and image content of title pages can also be manually updated while live.
- Third-party software solutions can also control and update title page text and image content.

In addition, NewTek’s innovative DataLink™ technology extends these capabilities greatly, by providing realtime updates from a wealth of data sources.

6.1.1 LIVETEXT™

Let’s consider its best known prior role as background. The optional standalone version of LiveText™, NewTek’s titling and graphics software, has long benefitted from its native DataLink support.

Title pages prepared and displayed in LiveText can be updated in realtime based on data from a variety of different source types, including files in ‘watch folders’, data feeds from scoreboards, and more.

In turn, LiveText (running on an outboard system) can transmit the updated title page display across the local network to a NewTek live video mixer for use in live programming. (See your LiveText standalone documentation for more detail.)
Section 6.2 **NewTek™ Video Mixers and DataLink™**

6.2.1 **TITLE TEMPLATES**

NewTek live video mixers include a *native* DataLink implementation to dynamically update the values of *key name* entries in titles. When the page is displayed on output, information drawn from external data sources is substituted for the key name. (The external data is formatted with the attributes you assigned to the key name entry when creating the title page).

**Hint:** You can force a minimum number of whole digits before and places after the decimal as in the following example. If the current value for “some numeric key” is 12.23456789, we can force the title page to display four places before the decimal and just two after by using the following DataLink entry:

\[
\%\text{some numeric key}[4.2]\%
\]

The displayed result will be “0012.23” (without quotation marks). Positive and negative values can also be displayed.

Expressing a number as a percentage (of 1) can be done using as follows:

\[
\%\text{numeric key}[\text{percent}]\%
\]

You can enter DataLink keys as the source for text or image fields using the integrated version of LiveText (provided with NewTek video mixers for page authoring purposes), or later in NewTek live video mixer’s *live* text editor. Text fields on title pages can contain either literal text or a DataLink key. Let’s spend on a few moments considering how you do the latter.

**FIGURE 6-2**

In Figure 6-2, note that the default entries for the name and description lines of the lower-third title page are bracketed by % (percentage) signs.

**Hint:** See the next section for a discussion of the special %Session xxxx% keys.
Any text entry surrounded by % signs in this manner is automatically evaluated on display as a DataLink key, and the current value for that key is shown. You can manually enter keys by simply typing them into the field, but there’s a method you might like better.

![DataLink Key Drop Down Menu](image)

**FIGURE 6-3**

If you simply click a text field and type a % sign, DataLink keys are shown in a drop down menu. As you continue entering characters, the list updates to show relevant entries. You can use the arrow keys to highlight the key you want in the menu, and press Enter to select it. To enter a DataLink key for an image, right click the placeholder image in the live text editor, and select Properties.

*Hint: Notice that many internal keys are provided, including keys based on time and day, Media Player metadata (such as %DDR1 Clip Alias% and %DDR1 Clip Comment%), and more. These allow you to easily, for example, use a single title page to automatically show the name and comment for the current DDR clip. If you then record a macro that displays that page in DSK1 (for example) briefly and then removes it, you can assign that macro to automatically display and hide the correct title for every clip you play from the DDR.*

---

**6.2.2 LIVEGRAPHICS**


You don’t need to be an After Effects® expert to create beautiful, multi-layered, editable LiveGraphic™ titles for your TriCaster® or VMC1™, and NewTek live production systems make displaying and controlling these graphic pages a breeze.

![LiveGraphics Creator Example](image)

**FIGURE 6-4**
Naturally, editable text can be modified in realtime using TriCaster or VMC1’s native Title Editor (Figure 2), which also lets you display or hide the individual graphic elements of your LiveGraphic title pages at will. In addition, the Title Editor lets you store different layouts as LiveGraphic presets. Recalling these presets triggers any number of dynamic layer animations to update the page.

*DataLink keys* can be inserted into LiveGraphics at the time of their creation, but of course the integrated Title Editor for NewTek live production systems supporting LiveGraphics also lets you enter for keys for text lines and replaceable imagery later if you need to.

**FIGURE 6-5**

A line of text or image set to a *DataLink* key is automatically replaced by the value currently assigned to that key when the LiveGraphic layer containing it is displayed.

---

### Section 6.3 *DataLink™ Sources*

NewTek live video mixers include *internal* DataLink™ sources to complement the integrated title and CG toolset, extending the original data sources available in several ways. In some cases, support for a given source type has been enhanced; for example, the former ASCII text file support now includes XML and CSV file support. Beyond this, a number of important internal keys and external sources have been added.

Here’s a list of some important data sources:

- **LivePanel™**
  - Scoreboard applets
  - DataLink applet
- **File Watcher**
  - ASCII text files
  - XML files
  - CSV (Comma Separated Value) files
- **Database**
  - MySQL database queries
- **RSS** (Really Simple Syndication) feeds
- **External hardware controllers**
- *Daktronics™*
  - Allsport
    - Baseball
    - Basketball
    - Football
    - Hockey
    - Soccer
    - Volleyball
  - Allsport CG
    - Baseball
    - Basketball
    - Football
    - Hockey
    - Soccer
    - Volleyball
- DSI (Basketball)
- OES
  - Basketball
  - Hockey
- Translux Fairplay
  - Basketball
  - Football
- WhiteWay (Basketball)
- Whiteway Rainbow (Basketball)

- **Internal**
  - Time
    - Time
    - Time (filename)
    - Hours (short)
    - Hours (long)
    - Hours (short, 24h)
    - Hours (long, 24h)
    - Minutes (short)
    - Minutes (long)
    - Seconds (short)
    - Seconds (long)
    - AM/PM (short)
    - AM/PM (long)
    - Next Event
    - Time Until Next Event (or end)
  - Date
    - Date (MM/DD/YY)
    - Date (DD/MM/YY)
• Date (DD/MM/YYYY)
• Date (filename)
• SystemDate
• Day (short, numeric)
• Day (long, numeric)
• Day (short)
• Day (long)
• Month (short, numeric)
• Month (long, numeric)
• Month (short)
• Month (long)
• Year (short)
• Year (full)
  o PGM Source Name
  o PGM Source Comment
  o Session
    ▪ Title Name
    ▪ Title Description
    ▪ Title Image
    ▪ Session Name
    ▪ Session Type
    ▪ Session Encoding
    ▪ Session Aspect Ratio
  o Media Player
    ▪ DDR1 Clip Alias
    ▪ DDR1 Clip Comment
    ▪ Etc.
• Web Browser
  o DataLink Web plugin
    ▪ text, including paragraphs
    ▪ images (files or URLs)
• ** Network
  o TCP/IP
  o HTTP
  o NDI

* Certain Daktronics controllers (including Allsport 3000 and 5000 models) require an AllSport CG unit to convert the proprietary Daktronics feed to serial data to DataLink. Please contact your Daktronics representative for more information.

** These methods are discussed in Chapter 7, Network A/V & Control.
6.3.1 DATALINK BROWSER EXTENSION AND MORE

As long as the above list might be, it is not complete. In addition, third-party applications can create DataLink keys and supply their values, and you can create and populate DataLink keys using the "datalink_set" shortcut.

One of the most interesting sources of DataLink keys is DataLink™ for the NewTek live video mixer, NewTek's new custom extension for the Chrome® web browser. Available without charge from the Chrome Web Store, DataLink™ Web allows you to easily populate both text and image DataLink keys from webpages.

![DataLink Web extension](image)

**FIGURE 6-6**

The DataLink keys and values are immediately available for use in NewTek live video mixer title pages, and elsewhere in the NewTek live video mixer. Simply select some text, or an image, and use the right-click context menu (or a hotkey) to update a DataLink key you have defined. Any title page using that key will immediately update.

6.3.2 SESSION KEYS

Note that %Session Title Name% and %Session Title Description% are special DataLink keys. Along with %Session Title Image%, the values for these keys are defined in the Startup>Session screen (Figure 6-7).
These special ‘session keys’ are pre-assigned by default to appropriate title entries in specific title pages supplied with your NewTek live video mixer. When displayed live, these keys are replaced by the values you entered in the Startup screen. In certain cases, then, this means that simply taking a few moments to choose appropriate values for your company or client will automatically pre-populate stock titles in the session with those values. (Of course, you can modify the individual title page entries as you see fit, too).

6.3.3 TIME AND DATE

A diverse set of useful time and date keys are always available in the key insertion drop-down menu. These keys allow you to prepare clock and calendar objects that update in realtime on your title pages.

When these keys are displayed, the corresponding values are derived from the NewTek live video mixer’s production clock. This provides many useful and creative possibilities, including counting down to an upcoming events.

6.3.4 FILE WATCHER

Among other sources as described earlier, NewTek live video mixer monitors files in designated DataLink Watch folders for changes to keys and their values.

The DataLink Watch folder system is implemented per-session, allowing you to automatically provide different video programs you produce with unique DataLink key setups. You will find the folder on your local NewTek live video mixer host at *(Your session volume)\Sessions\session-name\DataLink Watch Folder.*
Hint: If you enable the Share Media Folders and Buffers option in NewTek live video mixer’s File menu (Live Desktop), this folder will be accessible to other systems on the network.

Note that it is best to write data into a different folder on the same volume (such as a sub-folder in the Watch folder), then move the file to the Watch folder. This reduces resource demands, and can prevent display glitches that may sometimes occur when modifying and saving files in the Watch folder itself.

ASCII Text

DataLink pulls data from ASCII text files (.txt) residing in the (constantly monitored) DataLink Watch folder. As this is arguably the simplest source available to DataLink, let’s use it to demonstrate a few basics before continuing.

1. Create a new text file in the folder (the filename doesn't matter), and open it in a text editor (Notepad will do).

To supply usable values for DataLink, the text files should contain only key-value pairs, arranged in the following format: [key] = [value]

Key names from the file(s) will be available as DataLink entries in your title pages. The value you enter beside the key name in the text file will be shown when the page is displayed on output.

Two Key-Value pairs entry examples are shown below:

    city = San Antonio
    temperature = 98°

Note: Keys and values may contain punctuation and spaces.

XML

Similarly, XML (eXtensible Markup Language) files can supply DataLink keys and values. Consider the example xml file content provided below:

```
<Key>
    <word1>Hello</word1>
    <Child>
        <word2>World</word2>
    </Child>
</Key>
```

From the entries listed above, the DataLink drop-down will show the following keys with the values listed:

    %Key word1% = Hello
    %Key Child word2% = World
CSV Files

Imagine using common spreadsheet functions to manage complex sport statistics, then pushing the results to a title page with a single keystroke. That’s all possible, thanks to DataLink’s CSV (Comma Separated Value) file support.

For example, simply save changes in the CSV file to NewTek live video mixer’s network-shared DataLink Watch Folder, and DataLink parses the keys and values it contains, then immediately updates the title page, even if it is on display at the moment.

DataLink parses key-value pairs from neighboring cells on each row as shown in the table below.

<table>
<thead>
<tr>
<th>Team01</th>
<th>Germany</th>
<th>Team01Wins</th>
<th>6</th>
<th>Team02Losses</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Team02</td>
<td>Belgium</td>
<td>Team02Wins</td>
<td>4</td>
<td>Team02Losses</td>
<td>1</td>
</tr>
<tr>
<td>etc.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In this case, the key %Team01% would have the value “Germany”; %Team01Wins% would hold “6”, etc.

Let’s go on to consider the external hardware sources (such as scoreboards) supported by DataLink. The NewTek live video mixer depends on an external hardware connection to supply values for these keys. In the next section, we’ll explain how to connect these external devices.

Section 6.4 Source Configuration

Internal DataLink sources, such as clip comments or time and date keys, do not require any configuration beyond populating them. Some other source types require a little more setup, however. Data from RSS feeds, database queries, and external hardware sources (such as scoreboards) fall into this category.

The necessary settings for these latter sources are conveniently located in the DataLink Source Configuration application, launched from the menu shown when you select the Add-Ons icon on the ring in the Startup screen. The DataLink Source Configuration panel has three tabs, RSS, Database, and Scoreboard. The purpose and contents of each is discussed next.
6.4.1 RSS

In the RSS tab, click the Add button at right to open a dialog that lets you define a new RSS source. Provide a Name to identify the new RSS source, and enter the URL to the feed below. The Refresh Rate entry below determines how often DataLink will poll the source for updates. Click Save to store the source (afterward, you can click the gear gadget that appears on rolling the mouse over the source entry to make changes, or the (x) to delete it).

Hint: Key names for RSS feed elements are automatically generated.

6.4.2 DATABASE

For database sources, DataLink monitors the value for keys you designate are produced by queries you define. The Add a Database Key dialog is shown when you click Add in the Database tab. Here you can enter a descriptive key Name, and the SQL query that will produce the desired value (or values).

Note: You (or someone helping you) will need a measure of familiarity with database addressing and queries.
Enter a representative name in the Database box (this is simply to help you identify the data source; it need not be an actual file name). Then enter a User Name and Password for the database in the boxes provided, and specify the driver used for SQL queries in the ODBC Driver box. Finally, enter the Server name into the corresponding entry box.

Click Add to create a new DataLink key. Give it a suitable Key Name in the popup panel, and enter the query string that will produce the value(s) you wish to associate with this key into the large box below.

When the SQL query provides more than one match, DataLink creates a key/value pair for each qualified result.

For example, a keyword “author” could produce an array of matches, which DataLink would arrange as follows:

%author% -> "Voltaire"
%author.1% -> "James Joyce"

%author.2% -> "Herman Melville"

Click Save to finish the addition of the new key.

6.4.3 SERIAL (SCOREBOARD) SETUP

This DataLink component receives data from compatible external scoreboard hardware controllers. For information on connecting these devices to a NewTek live video mixer, see Section 6.4.4.

![DataLink Source Configuration](image)

**FIGURE 6-12**

Once connected, use the *DataLink Source Configuration* utility to notify the NewTek live video mixer that it is available as a source. Use the *Board* menu to choose the device brand/model you have connected from the list of supported devices. Choose a supported *Sport* in the same manner. The rest of the settings for serial devices auto-fill based on your Board and Sport selections, with one exception - select the Port using the information from the heading.

Find the COM *Port* in Section 6.4.4.

Once you have a supported device successfully connected and configured, the drop-down key insertion menu in LiveText's canvas will list valid key names for that device.
Appendix A, DataLink Hardware Keys lists the keys available for use with DataLink and the different brands of external equipment it supports.

---

**6.4.4 HARDWARE CONNECTIONS**

**Note: The steps in this section are mandatory if you require data from an external hardware scoreboard controller.**

Naturally, for DataLink to communicate with an external data source, such as a scoreboard, that equipment must be connected to a NewTek live video mixer and powered up. As well, DataLink must be configured to find and use the connection. We’ll discuss how to make and configure connections under this heading.

**USB-SERIAL ADAPTERS**

The diversity of supported external systems, cable connectors, and available ports on the host system means this connection may require an adapter.

Newer external devices may use USB connections, but many use older RS-232 (25-pin) connectors (or occasionally, slightly more recent 9-pin) connectors.

**Note: Unless the external system is supplied with a USB connection, a USB-Serial adapter is likely required to connect it to a NewTek live video mixer.**

To connect using a USB-Serial adapter, follow these steps:

- Connect the scoreboard controller’s output cable connector to the USB-Serial adapter.
  - Connect the adapter to NewTek live video mixer.
  - Install drivers for your USB-Serial adapter on the NewTek live video mixer. Drivers are generally supplied on a Compact Disk (CD) packaged with the adapter by the manufacturer.

  Note that the NewTek live video mixer may warn you about the dangers of foreign software if it does not recognize the driver for your adapter. (You may wish to ask NewTek Customer Service about supported adapters or request that your favorite be qualified for exemption from these warnings.)

  **Note: Certain Daktronics controllers (including Allsport 3000 and 5000 models) require an AllSport CG unit to convert the propriety Daktronics feed to serial data for use in LiveText. Please contact your Daktronics representative for more information.**

---

**FIND THE COM PORT**

The next step involves determining which COM port has been assigned to the new connection by the operating system. This information is required to configure DataLink.
• Right-click the *My Computer* icon on the *Windows® Desktop*, and select *Manage* from the menu (to open the Computer Management panel).

• Open the *Device Manager*, and click the + sign next to *Ports (COM and LPT)* in the right-hand pane to disclose available communication ports.

• Locate the entry for your scoreboard controller – take note which COM port number is assigned to it (such as COM 1 or COM2).

  *Note: You should see your new connection listed. If it doesn’t appear at first, try removing and re-inserting the USB cable connector – or you can use the “Scan for hardware changes” item in the Device Manager’s Action menu. (If it appears, but shows a ! icon next to its entry, this may indicate a problem with either the USB connection or your driver installation – try re-installing the driver, following the directions supplied with it.)*

• Close the *Device Manager*.

Again, the port number you noted above is required to enable DataLink to recognize the external device.

  *Important Note: In some environments, Windows may arbitrarily reassign the external device to a different COM port following a reboot. If this happens, you could simply update the COM port entry in the affected configuration profile. However, you may prefer instead to lock the connected device to a specific COM port, using the Windows Device Manager. To do this, please locate the current port entry for your scoreboard controller. Right-click the entry name, and select *Properties* in the drop-down menu. Next, click the Port Settings tab at the top of the Properties panel, and click the button labeled “Advanced”. Use the Com Port Number drop-down menu to choose an unused port number, and click the OK button. OK the Properties panel too, then close the Device Manager. The Port Number you assigned should now be retained on subsequent reboots.*
Most NewTek live production systems support both ingest and output of a/v feeds over standard network infrastructure via NDI. This provides a plethora of valuable creative and efficient alternatives. In addition, many NewTek systems can send or receive control instructions from networked devices and systems, offering many powerful possibilities.

Given NewTek’s preeminent position of innovation in IP solutions for video production, it will surprise no one that it is entirely possible to operate and/or control various NewTek products from other NewTek or third-party systems or software using network control methods. We will discuss the various approaches available in this chapter.

Section 7.1 NDI

NewTek’s Network Device Interface (NDI) technology is a very popular standard for live production video over IP workflows using standard Ethernet networks. NDI allows systems and devices to identify and communicate with each other, to encode, transmit, and receive high quality, low latency, frame-accurate video and audio over IP in real time. NDI enabled-devices and software can greatly enhance video production pipelines, making video input and output available anywhere your network runs.

Most NewTek live video products and an immense number of third party systems provide direct support for NDI, both for ingest and output. “But, as they say, wait – there’s more!”

7.1.1 CONTROL CONNECTIONS

NDI supports more than just a/v data transfer. As just one example, it makes tally (on-air) notification available to all connected NDI sources and systems. Arguably even better, NDI provides the ability to transmit instructions between NewTek live production systems and other connected devices.

For example, IP-based Viz Engine™ and Viz Trio™ graphics systems from Vizrt® are able to select and display CG pages, perform animations and more based on instructions from the macro system native to NewTek live video mixers and 3Play systems. This permits you to synchronize operations between NewTek and Vizrt products for sophisticated live production workflows with centralized control.

For TriCaster TC1 and IP Series VMC1 systems running V2 software or better, applications can be developed to send commands to systems connected to it by NDI. Here is a code example to perform a take:

```c
NDIlib_metadata_frame_t meta_data;
meta_data.p_data = "<ntk_shortcut><shortcut name="main_dsk1_take"
value="\""/</ntk_shortcut>";
NDIlib_send_send_metadata(pNDI_send, &meta_data);
```

*Hint: Multiple shortcuts can be sent this way.*
In similar fashion, Datalink updates can be sent along NDI connections (requires V2 software). Here is example code to send a DataLink message:

```c
NDIlib_metadata_frame_t meta_data;
    meta_data.p_data = "<ntk_shortcut><shortcut name="set_datalink"
    datalink_key="second_line" datalink_value="NewTek Inc"/>
</ntk_shortcut>";
    NDIlib_send_send_metadata(pNDI_send, &meta_data);
```

Third-party developers can also implement custom commands to support their requirements. These can even be used in macros just like ‘NewTek native’ commands. Documentation supplied with third-party products will provide information on custom commands that have been prepared for your use by their developers.

**MACROS AND NDI**

As well, NewTek live production systems with macro support can use this mechanism to transmit and receive supported instructions across an NDI connection (see Chapter 4, The Macro System).

Among other things, this makes it a trivial matter to send control messages between a TriCaster and a 3Play. Such a macro might perform synchronized operations on both systems and, conveniently, can be executed by a keystroke shortcut or other macro trigger (see Chapter 5, Triggering Macros).

When both parties to the network ‘conversation’ support NDI, as in this case, there is no need for complicated configuration. The NewTek live video mixer 'knows' which NDI source is connected to its network inputs, and automatically opens a bi-directional communication channel to its host. Let’s consider an example scenario.

**Example (Controlling 3Play)**

By default, 3Play's two primary NDI outputs will appear grouped as “OUT A” and “OUT B” under the 3Play system name in the Input Configuration source selector of a TriCaster on the same network. If you select either output as the active source for NewTek live video mixer’s Input 1, a communication channel is automatically opened between the 3Play and the mixer.

By using special “netn” shortcut entries in the Macro Editor, you can identify the upstream NDI source connected to a specific input as the target for instructions you add to the macro (rather than the local host).

*Hint: Commands to both the remote target and local host can be entered on different lines in a single macro.*

When examined in NewTek live video mixer’s Macro Editor, a typical macro entry of this type might look as follows:

<table>
<thead>
<tr>
<th>Delay (ms)</th>
<th>Shortcut</th>
<th>Value</th>
<th>Key 1</th>
<th>Value 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>net1</td>
<td>clip_play</td>
<td>speed</td>
<td>.5</td>
</tr>
</tbody>
</table>

In this case, the shortcut “net1” defines the Switcher input (i.e., input 1) whose NDI source system will be the target for the instruction on the same line in the macro.
The actual command to be processed on the remote host is supplied in the first Value field. Additional key/value entries may be supplied as arguments of the instruction performed when the macro is executed.

- The Value “clip_play” commands the target source to play the currently selected clip (in our example, the current clip selected on 3Play’s channel A)

Note: Clip_play is one of a small number of special 3Play ‘channel shortcuts’ that address the specific connected 3Play channel directly (channel A, in this case) rather than directing the instruction to the target system. These special commands, listed in the next section, remove the need to identify the channel to operate on. Otherwise, the same result would be achieved using two lines in the macro - one to select the output and then another to initiate playback.

- The Key 1 entry “speed” sets the playback speed to the value which follows next on the line, “.5” in our example. This will cause playback to occur at 50% speed.

It is entirely possible to create more complex macros that combine commands of the sort just mentioned.

### 3Play Channel Shortcuts

3Play supports a small handful of unique ‘channel’ commands, listed below. Unlike standard shortcuts, these target the relevant module supplying either output A or B, whichever is connected to the Switcher input identified by the “net” shortcut. (The target for most other shortcuts is defined by individual prefixes, as discussed in Section 4.5.1.)

#### CLIP_STORE

This command stores a local reference ID for the current clip (the one visible on the network input). The value ID can be a string. ID is global and shared across your system (i.e., not per system output).

For example:

<table>
<thead>
<tr>
<th>Delay (ms)</th>
<th>Shortcut</th>
<th>Value</th>
<th>Key 1</th>
<th>Value 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>.0001</td>
<td>net1</td>
<td>clip_store</td>
<td>index</td>
<td>AAA1</td>
</tr>
</tbody>
</table>

The entry above will ‘remember’ the current clip with the name “AAA1”. (The default for ID is an empty string, which is a valid storage target.)

#### CLIP_RESTORE

This command cues up content previously stored with a specified ID value on the upstream source channel assigned to the network input designated.

<table>
<thead>
<tr>
<th>Delay (ms)</th>
<th>Shortcut</th>
<th>Value</th>
<th>Key 1</th>
<th>Value 1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>net1 or net2</td>
<td>clip_restore</td>
<td>index</td>
<td>ID</td>
</tr>
</tbody>
</table>
For example:

<table>
<thead>
<tr>
<th>Delay (ms)</th>
<th>Shortcut</th>
<th>Value</th>
<th>Key 1</th>
<th>Value 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>.0001</td>
<td>net1</td>
<td>clip_restore</td>
<td>index</td>
<td>AAA1</td>
</tr>
</tbody>
</table>

The clip previously indexed as “AAA1” (using clip_store) is restored on the source system output channel connected to Net 1. The playhead is set to the beginning of the clip. (If the indexed clip is not located, nothing occurs.)

**CLIP_SELECT**

<table>
<thead>
<tr>
<th>Delay (ms)</th>
<th>Shortcut</th>
<th>Value</th>
<th>Key 1</th>
<th>Value 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>(ms)</td>
<td>net1 or net2</td>
<td>clip_select</td>
<td>index</td>
<td>#</td>
</tr>
</tbody>
</table>

Select a page (or clip) defined by the value assigned to index. This may be a number specifying a particular page or at times, another property.

For example, sending a “clip_select” command to 3Play with a suitable numeric value assigned as the “index” key selects a specific Play List tab by index (assuming Play List mode is active. On the other hand, in Clip List mode, if the value for “index” was “0-023” the clip referred to would be selected.

For example:

<table>
<thead>
<tr>
<th>Delay (ms)</th>
<th>Shortcut</th>
<th>Value</th>
<th>Key 1</th>
<th>Value 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>.0001</td>
<td>net1</td>
<td>clip_select</td>
<td>index</td>
<td>4</td>
</tr>
</tbody>
</table>

This would select the fourth Play List tab on the 3Play output (A or B) connected to Net 1.

**CLIP_MOVE**

<table>
<thead>
<tr>
<th>Delay (ms)</th>
<th>Shortcut</th>
<th>Value</th>
<th>Key 1</th>
<th>Value 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>(ms)</td>
<td>net1 or net2</td>
<td>clip_move</td>
<td>distance</td>
<td>#</td>
</tr>
</tbody>
</table>

Move the specified number of pages forwards or backwards from the current page.

For example:

<table>
<thead>
<tr>
<th>Delay (ms)</th>
<th>Shortcut</th>
<th>Value</th>
<th>Key 1</th>
<th>Value 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>.0001</td>
<td>net1</td>
<td>clip_move</td>
<td>distance</td>
<td>-1</td>
</tr>
</tbody>
</table>

The entry above would select the previous clip on the source connected to Net 1.

**CLIP_PLAY**
You can specify "speed", "position" or both keys (the order of keys is not important).

When "position" is not specified, play begins at the current frame. The value for position is specified in seconds, while speed is expressed as a playback rate value (1.0 = 100%).

For example:

<table>
<thead>
<tr>
<th>Delay (ms)</th>
<th>Shortcut</th>
<th>Value</th>
<th>Key 1</th>
<th>Value 1</th>
<th>Key 2</th>
<th>Value 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>.0001</td>
<td><em>net1</em></td>
<td>clip_play</td>
<td>speed</td>
<td>-.5</td>
<td>position</td>
<td>10</td>
</tr>
</tbody>
</table>

This entry would play a clip backwards at 50% speed from a position 10 seconds into the clip.

**CLIP_ SCRUB**

This command will move the playhead backward or forward by a distance of # seconds.

For example:

<table>
<thead>
<tr>
<th>Delay (ms)</th>
<th>Shortcut</th>
<th>Value</th>
<th>Key 1</th>
<th>Value 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>.0001</td>
<td><em>net1</em></td>
<td>clip_scrub</td>
<td>distance</td>
<td>#</td>
</tr>
</tbody>
</table>

The entry above would advance the playhead five seconds further into a clip displayed on the source connected to Net 1.

**NOTES:** The software associates values with their key name, so keys can be entered in any order. The following are valid formats for numeric entries: "+0.1", "0.1", ".1", "-0.1".

**Section 7.2 TCP/IP**

It is also possible to communicate with NewTek live video mixer and 3Play over a standard network TCP/IP connection. Custom applications running on a networked host system can directly control the functionality of most NewTek live production systems by this means.

Here is some sample code that will open and send a message over TCP:

```c
int _tmain( int argc, _TCHAR* argv[] )
{
    // Initialize Winsock (only needed once for the entire program)
    WSAData wsaData_;
    ::WSAStartup( MAKEWORD(2, 2), &wsaData_ );

    // The machine name we are going to connect too.
    const wchar_t* p_machine_name = (argc>1) ? argv[1] : L"127.0.0.1";
```
// We create a socket to use
SOCKET hSock = ::socket( AF_INET, SOCK_STREAM, 0 );
if ( hSock == INVALID_SOCKET ) { /* Handle error */ return 1; }

// We are now going to get the address information
struct addrinfoW *p_result = NULL, hints = { 0 };
hints.ai_family   = AF_INET;
hints.ai_socktype = SOCK_STREAM;
hints.ai_protocol = IPPROTO_TCP;

// Resolve the server address and port
if ( ::GetAddrInfoW( p_machine_name, /* Port No.*/ L"5951", &hints, &p_result ) != 0 ) { /* Handle error */ return 1; }

// We now try to connect to the actual destination
if ( ::connect( hSock, p_result->ai_addr, p_result->ai_addrlen ) == SOCKET_ERROR ) { /* Handle error */ return 1; }

// We are going to register to receive state information
const char cmd_2[] = "<shortcut name="main_dsk1_take" value="/">";
const int cmd_2_sz = ::strlen( cmd_2 )+1;
if ( ::send( hSock, cmd_2, cmd_2_sz, 0 ) != cmd_2_sz ) { /* Handle error */ return 1; }

// Close the socket
::closesocket( hSock );

// Finished !
return 0;
}

7.2.1 FINDING COMMANDS
The easiest way to find a command (shortcut) you can use in this manner is to record a macro on the NewTek system you are working with. Then you can use the integrated Macro Editor to view the shortcuts you recorded, and see what arguments they support.

For example, Figure 7-1 shows the result of recording a main switcher Background Auto transition to a macro. The “shortcut” column lists the basic command that was applied to produce the auto, and the subsequent columns list any values or additional data associated with its execution.
The next section explains how to use this data to produce the XML string needed to issue commands across the network, as illustrated in the code example above.

**Hint:** Section 4.5.1, *Understanding Shortcuts*, can help you to locate and use the shortcuts you need.

**EXPORTING MACROS**
Another way to obtain very useful information about macros and the shortcuts used in them is to use the Export feature provided in the Macro Editor provided on supporting NewTek products.

Right-click a macro (or even a folder full of macros) to show a menu including the Export item. Use the Save as Type menu at the bottom of the file-save window that opens to choose which format the export operation will produce from the following options:

- XD Macros – NewTek’s internal macro format
- Spreadsheet – Microsoft Excel’s common XLSX format
- JSON – JavaScript Object Notation format, a popular data-interchange language supported by modern programming languages.
- Javascript – This is a particularly interesting and useful alternative, as the exported code includes a functional websocket implementation.

**MACRO UTILITY SHORTCUTS**

We’ll highlight one particular group of shortcuts here. These commands operate on macros, and thus can serve to reduce or eliminate the need to send a batch of shortcuts sequentially; this is equally true whether you are using TCP/IP or HTTP methods of communication.

These are:

- play_macro_byname – the value supplies the name of a macro that will be run.
- play_macro_byid – internally, macros are identified by an ID string (see hint below). Launching a macro by its ID can be useful when it is possible that the operator may rename a macro.
- record_macro_byname
- stop_record_macro

Other macro-related shortcuts worth mentioning follow below:

- stop_macro_byname
- stop_macro_byid
- macro_is_enabled_byname
- macro_is_enabled_byid

**Javascript Export**

A WebSocket connection can execute sequential commands faster a series of HTTP GET requests. The example code exported illustrates handling multiple commands, keys and values.

The Javascript code loops through consecutive shortcuts, including delays found in the original macro, and also demonstrates how to establish and maintain a WebSocket connection.

**Hint:** Macros are defined in two files. The first is named system_macros.xdm, and is located in the directory at C:\ProgramData\NewTek\product-name\Configuration\Macros. The file lists (write-protected) system macros as well as any global (non-'session') macros you create. The second is located in the session folder, typically D:\Sessions\session_name and is named session.xdm. This file is holds macros affecting just that one session.
7.2.2 COMMAND FORMAT

Commands (shortcuts) you will send across the network are formatted as XML strings as follows:

```xml
<shortcut name="" value=""/>
```

Commands with multiple parameters are formatted as follows:

```xml
<shortcut name="" value="" key1="value1"/>
```

For instance, the following table illustrates several possible commands in XML format:

<table>
<thead>
<tr>
<th>Command formatted as XML</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>&lt;shortcut name=&quot;main_background_take&quot;/&gt;</code></td>
<td>Perform a Take</td>
</tr>
<tr>
<td><code>&lt;shortcut name=&quot;main_a_row_named_input&quot; value=&quot;ddr1&quot; /&gt;</code></td>
<td>Select DDR 1 on the program row</td>
</tr>
</tbody>
</table>

All XML strings are sent in UTF8 encoding, and should be terminated either with a carriage return, line feed, or NULL terminator. Many commands can be sent back to back without requiring the socket to be closed.

To send multiple commands at once, you may use the following method:

```xml
<shortcuts><shortcut name="" value=""/></shortcuts>
```

7.2.3 TALLY EXAMPLE

Here is an example in which we connect to a NewTek system via TCP and get tally (On Air) notifications.

The sample code supplied below will connect to a TriCaster TC1 (or any NewTek switcher) and start listening for the current states of the system.

```cpp
#include "stdafx.h"

int _tmain( int argc, _TCHAR* argv[] )
{
    // Initialize Winsock (only needed once for the entire program)
    WSADATA wsaData_;
    ::WSAStartup( MAKEWORD(2, 2), &wsaData_);

    // The machine name we are going to connect too.
    const wchar_t* p_machine_name = (argc>1) ? argv[1] : L"127.0.0.1";
```
/* We create a socket to use */
SOCKET hSock = ::socket( AF_INET, SOCK_STREAM, 0 );
if ( hSock == INVALID_SOCKET ) { /* Handle error */ return 1; }

/* We are now going to get the address information */
struct addrinfoW *p_result = NULL, hints = { 0 };
hints.ai_family   = AF_INET;
hints.ai_socktype = SOCK_STREAM;
hints.ai_protocol = IPPROTO_TCP;

/* Resolve the server address and port */
if ( ::GetAddrInfoW( p_machine_name, /* Port No.*/ L"5951", &hints, &p_result ) != 0 ) { /* Handle error */ return 1; }

/* We now try to connect to the actual destination */
if ( ::connect( hSock, p_result->ai_addr, p_result->ai_addrlen ) == SOCKET_ERROR ) { /* Handle error */ return 1; }

/* We are going to register to receive state information */
const char cmd_2[] = "<register name="NTK_states"/" >";
const int cmd_2_sz = ::strlen( cmd_2 )+1;
if ( ::send( hSock, cmd_2, cmd_2_sz, 0 ) != cmd_2_sz ) { /* Handle error */ return 1; }

/* For the next minute or so, we display whatever is happening on in terms of states */
for( DWORD start_time = ::GetTickCount(); ::GetTickCount() - start_time < 60000; )
{
    /* We probably want to do something better than this in production code, but this is meant to keep things short. */
    char some_data[ 4096 ];
    if ( ::recv( hSock, some_data, sizeof(some_data), 0 ) < 0 ) { /* Handle error */ return 1; }

    /* Display the data */
    ::puts( some_data );
}

/* Lets stop receiving state changes from now */
const char cmd_3[] = "<unregister name="NTK_states"/" >";
const int cmd_3_sz = ::strlen( cmd_3 )+1;
if ( ::send( hSock, cmd_3, cmd_3_sz, 0 ) != cmd_3_sz ) { /* Handle error */ return 1; }

/* Close the socket */
::closesocket( hSock );
You will receive messages like this one when the tally changes:

```
<shortcut_states>
  <shortcut_state name="program_tally" value="INPUT1|BFR2|DDR3" type="" sender="" />
  <shortcut_state name="preview_tally" value="INPUT7" type="" sender="" />
</shortcut_states>
```

In this example, INPUT1, BFR1, DDR3 are identified as being on Program output, while INPUT7 is on Preview.

## Section 7.3 HTTP

Most current NewTek products also act as HTTP servers, and are able to receive either GET or POST messages. HTTP methods that are easily accessed by advanced end users.

Using a simple text editor, anyone conversant with HTML can create useful web browser ‘applets’ that can interoperate with NewTek systems. Add programming knowledge (say, javascript or Python for example) and a whole world of possibilities open up. The internal web server can be addressed as in this example:

```
http://NewTek live video mixer SystemName
```

**Hint:** In order to determine if the session is running, you can query “http:// NewTek live video mixer SystemName /v1/live”. Alternatively, us the IP address for the system, for example “http:// 192.168.1.24/v1/live”.

This will return a text string of TRUE when in a session, and FALSE when in the control panel.

### 7.3.1 PASSWORD PROTECTION

Password protection for web access conforms to standard practices for a web server, using a standard Apache server password file. Users or developers can using standard command line tools to configure the password as follows:

```
https://httpd.apache.org/docs/current/programs/htpasswd.html
```

The password file is typically located in the folder below:

```
%PROGRAMDATA%\NewTek\product_name\Configuration\web_passwords
```

Deleting this file removes web password protection for the system. The TriCaster/VMC1 Administrator panel also provides a convenient “Change password” link. Upgrade installers may show option to “Disable web access password”. By default this option is disabled (i.e., the password is enabled by default). The default username and passwords are both “admin”.

// Finished!
return 0;
}
The web server employs standard HTTP authentication methods. While RFC3986 is supported, we would recommend digest access authentication which follows RFC2069.


7.3.2 GET COMMANDS

You can send shortcut commands and (macro) trigger messages by using http GET commands.

For example, to send a shortcut that executes an “Auto” (transition) on the main Switcher’s background video layer, you would simply get the address below:

```
http://Insert_IP_Address/v1/shortcut?name=main_background_auto
```

*Hint: Generally, the URL you wish to ‘get’ should be formatted as follows:*

```
/v1/shortcut?name=NAME&value=VALUE&value1=ANOTHER_VALUE
```

To issue a trigger you would GET the address “/v1/trigger?name=NAME”

To issue a DataLink update, you would GET the address “/v1/datalink?key=KEY&value=VALUE”. You can easily obtain a full list of the current set of DataLink key/value pairs by querying the URL below:

```
http://NewTek live video mixer SystemName /v1/datalink
```

This returns the current DataLink keys and values in the format listed next:

```
<datalink_values>
<data>
  <key>Time</key>
  <value>5:08:50 PM</value>
</data>
<data>
  <key>Hours (short)</key>
  <value>5</value>
</data>
<data>
  <key>Hours (long)</key>
  <value>05</value>
</data>
<data>
  <key>Hours (short, 24hr)</key>
  <value>05</value>
</data>
```

Note: The name and value pairs must be correctly escaped.
7.3.3 POST COMMANDS

You can POST a `<shortcut ...>` or `<trigger ...>` message directly. You should send these to any URL that is in the path `/v1/shortcut`, `/v1/trigger` or `/v1/datalink`. Since these are XML messages, the content-type should be `text/xml`. For instance, if you wished to send a shortcut contained in the file “MyShortcut.xml”, you would use the following CURL command line:

```
curl -X POST -d @MyShortcut.xml http://NewTek live video mixer SystemName/v1/shortcut --
  header "Content-Type:text/xml"
```

If you are using PHP, it is common to wish to post commands in a form “shortcut=<shortcut name=value...”.

This is automatically detected for “shortcut=“, “trigger=“, “datalink=“ where the value is the regular XML form of the shortcut (the value is fully escaped).

7.3.4 MACROS AND HTTP

It’s also possible to use the native Macro engine on NewTek systems to send (HTTP) GET commands to external NewTek systems or other supporting devices (such as a PTZ camera). To do this, use the shortcut “http_request” in your macro.

Doing so sends the GET request to the target identified in the value string you supply. For example, a macro prepared as shown below will trigger an Auto (transition) on the main Switcher of a TriCaster with the IP address 192.168.1.120. (Any response the request generates is ignored.)

![Macro Editor - UX-TC1 AUTO](image)

**FIGURE 7-3**
7.3.5 FILE TRANSFER

It is possible to send media files directly to a NewTek live video mixer via HTTP post commands. Post commands are sent to http://NewTek live video mixer SystemName/v1/file. As an example, the following curl command would post a PNG file to the NewTek live video mixer system.

```
```

The header "Filename:somefilename" is optional, but allows you to give the NewTek live video mixer a hint as to what file-name to choose for this file. If one is not specified then a filename will be chosen for you automatically.

Specify "Overwrite:true" if you wish the filename to be used no matter whether it exists or not (by default, overwrite is false).

The response from the file transfer will either be a 400 error, with a text description of the error, or a 200 success with the filename of the file returned; allowing you to then use this in titles, DDRs, etc.

Supported content types are:

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>audio/mpeg</td>
<td>MP3 Audio file</td>
</tr>
<tr>
<td>audio/basic</td>
<td>AU Audio file</td>
</tr>
<tr>
<td>audio/x-wav</td>
<td>WAV file</td>
</tr>
<tr>
<td>audio/x-aiff</td>
<td>AIFF file</td>
</tr>
<tr>
<td>image/gif</td>
<td>GIF image file</td>
</tr>
<tr>
<td>image/jpeg</td>
<td>JPEG image file</td>
</tr>
<tr>
<td>image/png</td>
<td>PNG image file</td>
</tr>
<tr>
<td>image/tiff</td>
<td>TIFF image file</td>
</tr>
<tr>
<td>image/bmp</td>
<td>BMP image file</td>
</tr>
<tr>
<td>video/x-msvideo</td>
<td>AVI file</td>
</tr>
<tr>
<td>video/quicktime</td>
<td>QuickTime file (MOV)</td>
</tr>
<tr>
<td>video/mp4</td>
<td>MPEG-4 wrapper (H.264 normally)</td>
</tr>
<tr>
<td>video/mpeg</td>
<td>MPEG-2 video file.</td>
</tr>
</tbody>
</table>

7.3.6 VIDEO PREVIEWS

It is possible to receive JPG images back for any source within the NewTek live video mixer or 3Play system. These may be queried as described next.

Possible names of sources for use with this method are listed in the table below:

<table>
<thead>
<tr>
<th>Source Name</th>
<th>Description</th>
<th>Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>output1</td>
<td>The primary video output</td>
<td>All NewTek live video mixer units</td>
</tr>
<tr>
<td>output2</td>
<td>The secondary video output</td>
<td>All NewTek live video mixer units</td>
</tr>
</tbody>
</table>
Additional parameters are available that perform the following:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>xres</td>
<td>Force the resolution of the image to be this width. If this is omitted, this is computed from the source aspect ratio.</td>
</tr>
<tr>
<td>yres</td>
<td>Force the resolution of the image to be this width. If this is omitted, this is computed from the source aspect ratio.</td>
</tr>
<tr>
<td>q</td>
<td>JPEG image quality (range 50-100).</td>
</tr>
</tbody>
</table>

**TABLE 1**

In general, it is wise not to query frames at high image rates. Request them at a resolution that is close to what you need. For instance, to receive a 640x480 preview of the current output, you would get:


**Note:** See also Section 7.3.9 for information on NewTek live video mixer’s WebSocket implementation.

---

### 7.3.7 GENERATING ICONS

It is possible to obtain an icon representation for any file that is on the system. This can be used, for instance, to generate icons for LiveSet or Transition files that may be loaded into the switcher (with the names given to you by getting the NewTek live video mixer state data). Similar to how inputs are read, you get an icon by specifying the path (required), the resolution of the longest side (optional), and the JPEG quality (optional).

For instance to get the icon for the LiveSet effect file at the location below:

C:\"NewTek live video mixer \"\ProgramData\Newtek\Effects\LiveSets\Alignment\Center.LiveSet

You could get the URL:

http://"NewTekVideoMixer"/v1/icon?filename=C:%5CProgramData%5CNewTek%5CEffects%5CLiveSets%5CAlignment%5CCenter.LiveSet&res=320&Q=90

---

### 7.3.8 GETTING TALLY AND OTHER SETTINGS

NewTek live video mixers can provide XML-formatted lists of parameters and values representing various states of the switcher, buffers and effects. Combining this information with scripted shortcut commands,
sophisticated interactions can be made between the NewTek live video mixer and a web application, controlled from either side of the client/server relationship.

Requesting the URL below (where “NewTek live video mixer System” is the system name), returns a full description of all of the video inputs on the system, with information regarding whether they are currently being displayed on program or preview output (tally information):

http://NewTek live video mixer SystemName/v1/dictionary?key=tally

An example returned XML result would be as follows:

```xml
<tally>
  <column name="input1" index="0" on_pgm="false" on_prev="false" ndi_id="0"/>
  <column name="input2" index="1" on_pgm="false" on_prev="false" ndi_id="1"/>
  <column name="input3" index="2" on_pgm="false" on_prev="false" ndi_id="2"/>
  <column name="input4" index="3" on_pgm="false" on_prev="false" ndi_id="3"/>
  <column name="input5" index="4" on_pgm="false" on_prev="false" ndi_id="4"/>
  <column name="input6" index="5" on_pgm="false" on_prev="false" ndi_id="5"/>
  <column name="input7" index="6" on_pgm="false" on_prev="false" ndi_id="6"/>
  <column name="input8" index="7" on_pgm="false" on_prev="false" ndi_id="7"/>
  <column name="input9" index="8" on_pgm="false" on_prev="false" ndi_id="8"/>
  <column name="input10" index="9" on_pgm="false" on_prev="false" ndi_id="9"/>
  <column name="input11" index="10" on_pgm="false" on_prev="false" ndi_id="10"/>
  <column name="input12" index="11" on_pgm="false" on_prev="false" ndi_id="11"/>
  <column name="input13" index="12" on_pgm="false" on_prev="false" ndi_id="12"/>
  <column name="input14" index="13" on_pgm="false" on_prev="false" ndi_id="13"/>
  <column name="input15" index="14" on_pgm="false" on_prev="false" ndi_id="14"/>
  <column name="input16" index="15" on_pgm="false" on_prev="false" ndi_id="15"/>
  <column name="bfr1" index="16" on_pgm="false" on_prev="false"/>
  <column name="bfr2" index="17" on_pgm="false" on_prev="false"/>
  <column name="bfr3" index="18" on_pgm="false" on_prev="false"/>
  <column name="bfr4" index="19" on_pgm="false" on_prev="false"/>
  <column name="bfr5" index="20" on_pgm="false" on_prev="false"/>
  <column name="bfr6" index="21" on_pgm="false" on_prev="false"/>
  <column name="bfr7" index="22" on_pgm="false" on_prev="false"/>
  <column name="bfr8" index="23" on_pgm="false" on_prev="false"/>
  <column name="bfr9" index="24" on_pgm="false" on_prev="false"/>
  <column name="bfr10" index="25" on_pgm="false" on_prev="false"/>
  <column name="bfr11" index="26" on_pgm="false" on_prev="false"/>
  <column name="bfr12" index="27" on_pgm="false" on_prev="false"/>
  <column name="bfr13" index="28" on_pgm="false" on_prev="false"/>
  <column name="bfr14" index="29" on_pgm="false" on_prev="false"/>
  <column name="bfr15" index="30" on_pgm="false" on_prev="false"/>
  <column name="ddr1_a" index="31" on_pgm="false" on_prev="false"/>
  <column name="ddr1_b" index="32" on_pgm="false" on_prev="false"/>
  <column name="ddr2_a" index="33" on_pgm="false" on_prev="false"/>
  <column name="ddr2_b" index="34" on_pgm="false" on_prev="false"/>
  <column name="gfx1_a" index="35" on_pgm="false" on_prev="false"/>
  <column name="gfx1_b" index="36" on_pgm="false" on_prev="false"/>
  <column name="gfx2_a" index="37" on_pgm="false" on_prev="false"/>
</tally>
```
Other system information can also be obtained in this manner. For example, getting the URL below returns information about the system, software, and session:

http:// NewTek live video mixer SystemName /version

An example response would look like the following:

<product_information>
  <product_model>TC1</product_model>
  <product_name>TriCaster TC1</product_name>
  <product_version>7-0</product_version>
  <product_id>NCWL-WFKJ8YAA-200918</product_id>
  <product_serial_no/>
  <product_build_no>7-0-180920</product_build_no>
  <machine_name>TC1</machine_name>
  <session_x_resolution>1920</session_x_resolution>
  <session_y_resolution>1080</session_y_resolution>
  <session_fielded>true</session_fielded>
  <session_frame_rate>29.970030</session_frame_rate>
  <session_aspect_ratio>1.777778</session_aspect_ratio>
  <session_color_format>CCIR709</session_color_format>
  <session_color_coding>NTSC</session_color_coding>
  <session_name>TC1 Session</session_name>
</product_information>

To offer another example, requesting the (example) URL below returns a wealth of switcher parameters.


The result would include:
- All inputs, physical and virtual
- Switcher row sources for M/Es, including up to 4 rows if using a LiveSet
- Overlay information for main and M/E switchers
  - Overlay source
  - T-Bar position
- Currently loaded Effect (Transition or LiveSet)

An example response would look like the following:

```
<switcher_update main_source="BFR4" preview_source="gfx1" effect="Q:\Products\ NewTek live video mixer _Content\Animation Stores\Output\Broadcast\Door Slam.effect">
    <tbar position="0.000000" speed="0.000000"/>
    <switcher_overlays>
        <overlay z_order_position="0" source="V2">
            <tbar position="0.000000" speed="0.000000"/>
        </overlay>
        <overlay z_order_position="1" source="BFR1">
            <tbar position="0.000000" speed="0.000000"/>
        </overlay>
    </switcher_overlays>
</switcher_update>
```

Or, requesting the URL below will return a list of the currently-assigned buffers for the main switcher row and the M/E rows, similar to the following example:

```
http://NewTek live video mixer SystemName/v1/dictionary?key=buffer:
    <buffers>
        <main>
            <buffer selection="BFR4"/>
        </main>
        <me index="0">
            <row>
                <buffer selection="BFR1"/>
            </row>
        </me>
        ...
```

The URL below returns a list of all the effects loaded into all the bins for each transition and overlay in the main Switcher and all M/Es.

```
```

An example result follows:

```
<switcher_ui_effects>
    <switcher name="main">
        <effect_bin>
            <effect0 effect="Fade"/>
            <effect1 effect="Q:\Products\ NewTek live video mixer _Content\Animation Stores\Output\Broadcast\Door Slam.effect"/>
            <effect2 effect="c:\Program Files\NewTek\...\Effects\Transitions\Fades\Non Additive Fade.trans"/>
            <effect3 effect="c:\Program Files\NewTek\...\Effects\Transitions\Fades\Flash.trans"/>
            <effect4 effect="c:\Program Files\NewTek\...\Effects\Transitions\Fades\Clouds.trans"/>
            ...
            <effect7 effect="c:\Program Files\NewTek\...\Effects\Overlays\Iris\Hard\Rectangle (H).ofx"/>
        </effect_bin>
    </switcher>
```

The complete list of key values supported for dictionary use in the manner disclosed in the preceding examples follows below:

- shortcut_states
- tally
- ddr_playlist
- ddr_timecode
- buffer
- switcher
- buffer
- switcher_ui_effects
- audiomixer
- audio_bins
- audiomixer
- filebrowser
- macros_list
- ndi_sources

7.3.9 WEBSOCKETS

The WebSockets protocol is supported by most major web browsers and allows NewTek systems to push data (including a great deal of system status information along with image previews and audio data) to the client. This allows improved responsiveness by notifying clients of state changes, removing the need for clients to periodically poll for changes.
NewTek systems support a number of different web socket connections. These can variously receive notifications of state changes or quickly execute shortcut commands. The process for establishing a web socket connection is the same regardless of the connection type. For example, to receive state change notifications, first open a connection to the NewTek system with a web socket on port 5951 using the path “/v1/change_notifications” and the WebSocket protocol. Then listen for data coming in on that connection.

To keep the connection active for lengthy periods, you may send the web server ping frames periodically (every 15 seconds would be fine). Another common approach is to wrap the connection in a function that is called upon its closing.

The following is a list of available web socket addresses, which will vary depending on the system.

- v1/audio_notifications
- v1/change_notifications
- v1/shortcut_notifications
- v1/shortcut_state_notifications
- v1/timecode_notifications
- v1/vu_notifications

**Opening a Connection in Javascript**

```javascript
var url = 'ws://' + ipAddress + 'v1/change_notifications';
var ws = WebSocket( url );
```

*Hint: See also Exporting Macros in Section 7.2.1.*

**State Change Notifications**

The “v1/change_notifications” web socket connection notifies the client of state changes (for example a clip being added to or removed from a DDR, or a change to tally). The only data sent over this connection is the name of the served state page whose content has changed. A subsequent HTTP request is required in order to obtain the actual updated state data.

For example, if the text received is “tally”, the web page located at “/v1/dictionary?key=tally” has changed. Notification messages will pertain to one of the following key values, depending on the action on the device.

- shortcut_states
- tally
- ddr_playlist
- buffer
- switcher
- switcher_ui_effects
- audiomixer
- audio_bins
- macros_list
- ndi_sources
STATE CHANGE MESSAGE PROCESSING

The example code below creates a WebSocket that renews itself upon closing, has handler functions for onopen, onclose, and onmessage, and gives three stubs for processing received messages.

```javascript
function createWebsocket() {
    var url = 'ws://' + ipAddress + 'v1/change_notifications';
    var ws = new WebSocket( url );
}

// create the socket the first time
createWebsocket();

// Attach event handlers. Standard WebSocket handlers are supported.
ws.onopen = function() {
    console.log("TriCaster WebSocket Opened");
}

// The incoming message data will be one of the states listed above.
ws.onmessage = function( msg ) {
    if (msg.data == "tally") {
        // do tally things
    } else if (msg.data == "switcher") {
        // do switcher things
    }
    // ...
}

ws.onclose = function() {
    createWebsocket(); // Upon closing, reopen the socket
}
```

VIDEO PREVIEWS

Some NewTek products (such as TriCaster) also support the serving of video preview streams over websockets. The web socket location takes the form shown below:

```
http://SystemNameOrIPAddress/v1/video_notifications?name=NAME&xres=RESX&yres=RESY&q=QUALITY
```

(Parameters in the above example are described in Section 3.4, and work the same way.)

A web socket will be opened and JPG images will be streamed to it as fast as the network can send them. Each frame is sent in a single send operation, so you know the size of the JPG data from the size of the received packet.
Receiving/Sending Audio

NewTek systems may also allow you to observe audio over a web socket. To do so, use the following format to create a connection:

http://SystemNameOrIPAddress/v1/audio_notifications?name=NAME

Supported audio names are listed below:

- output
- aux
- phones

There following caveats are important:

- Audio is uncompressed stereo 44.1 kHz, in signed 16 bit format. This requires approximately 180 Kb/s over the network so make sure you have a good enough connection.

- The implementation does not do dynamic audio resampling. Thus occasional audio glitches may be expected, since the client computer is not locked to TriCaster's audio clock.

TriCaster and VMC1 also support serving VU data over web sockets. The web socket address takes the form shown below:

http://SystemNameOrIPAddress/v1/vu_notifications?name=NAME

Receiving/Sending Shortcuts

For some shortcuts, state change notifications that require a subsequent HTTP request could make an app feel slow or unresponsive. The “v1/shortcut_state_notifications” web socket connection not only notifies the client that a shortcut has changed, but includes its updated value as well, omitting the need for any HTTP request.

The “v1/shortcut_state” web socket can be used to quickly issue a shortcut command when performance is important (like updating a volume slider). No data is ever received by the client on this connection, it is only meant for sending data from the client to the system.

Issuing a Shortcut via WebSocket in Javascript

```javascript
var url = 'ws://' + ipAddress + 'v1/shortcut_state';
var ws = WebSocket( url );
ws.send( 'name=<shortcut_name>&value=<shortcut_value>' );
```

Section 7.4 AMP

To assist with backwards compatibility, 3Play™ systems also support an older control protocol called AMP. AMP stands for “Advanced Media Protocol”, and its command set is quite similar the 3Play NDI instructions just discussed. AMP provides another means by which compatible systems can issue commands to 3Play.
For example, Carbonite™ video switchers from Ross Video® support AMP over an Ethernet connection. The switcher panel can control NewTek 3Play instant replay systems, treating them as video servers and accessing and clips, playlists, or delayed video streams.

The AMP integration provides play-list and queuing support, clip query and more.

Some corollary of ‘Murphy’s Law’ must state that “The more critical it is to a production, the greater the likelihood that important media will be delivered at the last possible moment and the wrong format, if it can be found at all.” This section is devoted to reducing your stress level when this inevitably occurs.

Section 8.1 Media File Formats

8.1.1 Video Capture

Current NewTek live video mixer products support a several file formats for capture, including Quicktime and M4V formats. In general, where other considerations permit, we recommend the use of the native Quicktime formats for high quality video capture, while M4V encoding may be better suited to applications where small file size is important.

The Quicktime format supports all NewTek live video mixer features, including embedded timecode, and provide high quality capture suitable for almost any purpose. Generally, most modern software applications can work with the Quicktime format (some applications may require installation of NewTek Quicktime codecs).

*Note: NewTek live video mixer and 3Play are able to play back Quicktime files that are still ‘growing’ (being actively captured). Some external software applications can enjoy the same benefits for files being recorded on NewTek systems in Quicktime® format by supporting NewTek’s File Reader SDK, available to members of the NewTek Development Network.*

8.1.2 NewTek Codecs

Codecs for both Windows® and OS X® systems are available for NewTek’s high quality AVI and Quicktime® capture formats. The codecs are included in the “Extras” folder of all NewTek live production systems, and can alternatively be downloaded from the Support pages of the NewTek website.

Windows® Platform

Users of Microsoft Windows® systems (other than a NewTek live video mixer or 3Play) will need to install NewTek’s Quicktime™ codecs to be able to read and write files in these formats. The NewTek codec pack for Windows also provides read and write support for NewTek’s SpeedHQ™ AVI format to suitable video applications.

OS X® Platform

The NewTek Quicktime codecs are not required to be able to read NewTek live video mixer or 3Play Quicktime® files on OS X systems. However, depending on what other software you already have installed,
you may need to download and install a 'professional' codec pack available from Apple® at the ULR shown below (at the time of writing):

http://support.apple.com/kb/DL1396

Apple® platform users may find it useful to install the NewTek Codec Pack for OS X® anyway, since it does offer certain added benefits. Specifically, suitable applications (such as Compressor™) will be able to access them to read and write NewTek’s SpeedHQ Quicktime® files, and even read the SpeedHQ AVI file format.

Section 8.2 Import

NewTek live video mixer and 3Play are able to play back media files in many different popular file formats, but some of these require more system resources to play than others. With a view to making best use of precious resources, then, media files should ideally be prepared beforehand.

With the assistance of the NewTek codec packs just mentioned, it is often true that media can be created in or converted to NewTek-friendly formats that are easy to play back right in your favorite non-linear editor or compositing package. We can recommend NewTek’s own SpeedHQ Quicktime® or AVI encoding as a good high quality format for use in any of our live production systems. (SpeedHQ options include support for files with embedded alpha channel, especially valuable for animations intended for use as overlays.)

Alternatively, NewTek live production systems generally include dedicated Import modules. This module, typically provided in the File menu at upper left in the Live Desktop (see the manual for your product for details) provides a way to add multiple items to a queue for batch processing, including optional transcoding as necessary.

Otherwise, most high quality Quicktime formats (other than ProRes) will work reasonably well. For HD files, you might consider trying the Quicktime PNG encoder (especially when an alpha channel is required).

Section 8.3 Export

At times you may wish to export files recorded with a NewTek live production in some other popular format. Of course, whether working with files captured to shared storage systems or copied to external media across a network, for example, you could perform transcoding entirely externally using your favorite conversion software. You may instead, though, wish to use your NewTek system to do transcoding.

All current NewTek live production platforms include an Export feature in the system’s Startup pages. Most also provide a Publish Queue in the Live or Replay Desktop. Files can be added to the lists in these modules using a variety of method, even – in this latter case – during live production. The modules provide access to a deep set of transcoding tools and control over destinations for file output (including local and networked volumes, and ftp).

Section 8.4 Asset Management

The integrated Media Browser native to NewTek live production systems is a competent asset management system, enabling to quickly locate and work with files related to your sessions, or external files. Of course,
more extensive media asset management systems provided by leading industry providers are also available within the NewTek ecosystem, and may be directly supported by NewTek products.

To utilize your favorite (supported) third-party asset management systems, you need simply hold down the keyboard Ctrl key when invoking a file browser. For example, double-clicking a blank spot in a DDR playlist on a NewTek live video mixer with Ctrl depressed will show your compatible custom asset management interface, rather than NewTek live video mixer’s native Media Browser.

Hint: Alternatively, you can open a standard system file explorer, by holding down the Shift key rather than Ctrl when adding files.

Asset management solutions can include outboard storage systems, so let’s talk about this related matter.

Section 8.5 **EXTERNAL STORAGE**

Generally, NewTek live productions systems provide substantial integrated storage for media used in your productions, by means of internal and removable drives. Of course, many broadcast settings have still larger requirements, making external storage solutions attractive. In addition, by virtue of their potential for great capacity, fails-safe mechanisms, transfer speed, and shared access, external storage solutions can facilitate file ingest, shared access, media updates, and more.

Large storage solutions come in many varieties, including SAN (Storage Area Network), NAS (Networked Attached Storage) and others. Individual solutions may include dedicated MAM (Media Access Management) implementations, or not.

In general, we recommend the use of the NTFS file system, not least because (unlike, for example, FAT32) it properly handles files larger than four gigabytes, but also because it fully supports the NewTek live video features.

At times, though, you may prefer to employ another file system for media used for video capture or file sharing. If so, note that it’s best if the actual “Session Volume” for a NewTek live video mixer or 3Play is still NTFS-formatted. Otherwise, links to media captured during the session that are automatically generated by the system may fail, forcing you to expend extra effort to locate them.
APPENDIX A. DATALINK HARDWARE KEYS

This section lists the actual key names that are available for use with DataLink for the different brands of external equipment it supports. Mostly, the key names are self-explanatory, but we’ve added slightly more descriptive notes where appropriate. The list is grouped by manufacturer.

Note: the key names listed are shown inserted between percent (%) signs as a reminder, since this is how you will enter them onto your pages.

A.1 Daktronics

A.1.1 Baseball

%DakClock% - Game Clock Time – “MM:SS.T”

%DakClockStatus% - Game Clock Status

%DakHomeHits% - Home Team Hits

%DakGuestScore% - Guest Team Score

%DakInning% - Current inning

%DakHhr% - Hour (from Clock Time)

%DakMin% - Minutes (from Clock Time)

%DakSec% - Seconds (from Clock Time)

%DakTen% - Tenths (secs/10 from Clock Time)

A.1.2 Basketball

%DakClock% - Game Clock Time – “MM:SS.T”

%DakClockStatus% - Game Clock Status

%DakShotClock% - Shot Clock Time – “SS”

%DakHomeScore% - Home Team Score

%DakGuestScore% - Guest Team Score

%DakHomeFouls% - Home Team Fouls

%DakGuestFouls% - Guest Team Fouls

%DakHomeTOFull% - Home Time Outs Left – Full
%DakHomeTOpPart% - Home Time Outs Left – Partial
%DakHomeTOTotal% - Home Time Outs Left – Total
%DakGuestTOFull% - Guest Time Outs Left – Full
%DakGuestTOpPart% - Guest Time Outs Left – Partial
%DakGuestTOTotal% - Guest Time Outs Left – Total
%DakPeriod% - Current period
%DakHhr% - Hour (from Clock Time)
%DakMin% - Minutes (from Clock Time)
%DakSec%- Seconds (from Clock Time)
%DakTen% - Tenths (secs/10 from Clock Time)

------------------------------------------------------------------------------------------------------------------------

A.1.3 FOOTBALL

%DakClock% - Game Clock Time – “MM:SS.T”
%DakClockStatus% - Game Clock Status
%DakPlayClock% - Play Clock Time – “SS”
%DakHomeScore% - Home Team Score
%DakGuestScore% - Guest Team Score
%DakHomeTOFull% - Home Time Outs Left – Full
%DakHomeTOpPart% - Home Time Outs Left – Partial
%DakHomeTOTotal% - Home Time Outs Left – Total
%DakGuestTOFull% - Guest Time Outs Left – Full
%DakGuestTOpPart% - Guest Time Outs Left – Partial
%DakGuestTOTotal% - Guest Time Outs Left – Total
%DakQuarter% - Current quarter
%DakMin% - Minutes (from Clock Time)
%DakSec% - Seconds (from Clock Time)
%DakTen% - Tenths (secs/10 from Clock Time)
A.1.4 HOCKEY

%-DakClock% - Game Clock Time – “MM:SS.T”
%-DakClockStatus% - Game Clock Status
%-DakShotClock%% - Shot Clock Time – “SS”
%-DakHomeScore% - Home Team Score
%-DakGuestScore% - Guest Team Score
%-DakHomeTOFull% - Home Time Outs Left – Full
%-DakGuestTOFull% - Guest Time Outs Left – Full
%-DakGuestTOTotal% - Guest Time Outs Left – Total
%-DakPeriod% - Current period
%-DakMin% - Minutes (from Clock Time)
%-DakSec% - Seconds (from Clock Time)
%-DakTen% - Tenths (secs/10 from Clock Time)

A.1.5 SOCCER

%-DakClock% - Game Clock Time – “MM:SS.T”
%-DakClockStatus% - Game Clock Status
%-DakShotClock%% - Shot Clock Time – “SS”
%-DakHomeScore% - Home Team Score
%-DakGuestScore% - Guest Team Score
%-DakHomeTOFull% - Home Time Outs Left – Full
%-DakGuestTOFull% - Guest Time Outs Left – Full
%-DakGuestTOTotal% - Guest Time Outs Left – Total
%-DakHalf% - Current half
%-DakMin% - Minutes (from Clock Time)
%-DakSec% - Seconds (from Clock Time)
%DakTen%  -  Tenths (secs/10 from Clock Time)

---

A.1.6 VOLLEYBALL

%DakClock%  -  Game Clock Time – “MM:SS.T”

%DakClockStatus%  -  Game Clock Status

%DakHomeServiceIndicator%

%DakHomeScore%  -  Home Team Score

%DakGuestScore%  -  Guest Team Score

%DakHomeTOFull%  -  Home Time Outs Left – Full

%DakHomeTOTotal%  -  Home Time Outs Left – Total

%DakGuestTOFull%  -  Guest Time Outs Left – Full

%DakGuestTOTotal%  -  Guest Time Outs Left – Total

%DakGameNumber%  -  Current game number

%DakMin%  -  Minutes (from Clock Time)

%DakSec%  -  Seconds (from Clock Time)

%DakTen%  -  Tenths (secs/10 from Clock Time)

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A.2 Daktronics CG

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A.2.1 BASEBALL

%CGDakHomeScore%  -  Home Team Score

%CGDakGuestScore%  -  Guest Team Score

%CGDakInning%  -  Current inning

%CGDakInningText%  -  Current inning (text)

%CGDakInningDescription%  -  Inning Description (text)

%CGDakHomeAtBat%  -  Home At-bat indicator (0 or 1).

%CGDakGuestAtBat%  -  Guest At-bat indicator (0 or 1).

%CGDakHomeHits%  -  Home Team Hits

---
%CGDakHomeInningScore1% - Home Score, First Inning
%CGDakHomeInningScore2% - etc.
%CGDakHomeInningScore3%
%CGDakHomeInningScore4%
%CGDakHomeInningScore5%
%CGDakHomeInningScore6%
%CGDakHomeInningScore7%
%CGDakHomeInningScore8%
%CGDakHomeInningScore9%
%CGDakHomeInningScore10%
%CGDakHomeInningScore11%
%CGDakHomeInningScore12%
%CGDakGuestInningScore1% - Guest Score, First Inning
%CGDakGuestInningScore2% - etc.
%CGDakGuestInningScore3%
%CGDakGuestInningScore4%
%CGDakGuestInningScore5%
%CGDakGuestInningScore6%
%CGDakGuestInningScore7%
%CGDakGuestInningScore8%
%CGDakGuestInningScore9%
%CGDakGuestInningScore10%
%CGDakGuestInningScore11%
%CGDakGuestInningScore12%
%CGDakHomePitcherNum% - Home Pitcher Player Number
%CGDakHomePitchesBalls% - Home Pitches, Balls
%CGDakHomePitchesStrikes%  -  Home Pitches, Strikes
%CGDakHomePitchesFoulBall%  -  Home Pitches, Foul Balls
%CGDakHomePitchesInPlay%  -  Home Pitches In Play
%CGDakHomePitchesTotal%  -  Total Home Pitches
%CGDakGuestPitcherNum%  -  Guest Pitcher Player Number
%CGDakGuestPitchesBalls%  -  Guest Pitches, Balls
%CGDakGuestPitchesStrikes%  -  Guest Pitches, Strikes
%CGDakGuestPitchesFoulBall%  -  Guest Pitches, Foul Balls
%CGDakGuestPitchesInPlay%  -  Guest Pitches In Play
%CGDakGuestPitchesTotal%  -  Total Guest Pitches

---------------------------------------------------------------------------------------------------------------------

A.2.2  BASKETBALL

%CGDakClock%  -  Game Clock Time – “MM:SS.T”
%CGDakClockStatus% -  Game Clock Status
%CGDakShotClock%  -  Shot Clock Time – “SS”
%CGDakHomeScore% -  Home Team Score
%CGDakGuestScore% -  Guest Team Score
%CGDakHomeFouls% -  Home Team Fouls
%CGDakGuestFouls% -  Guest Team Fouls
%CGDakHomeTOFull%  -  Home Time Outs Left – Full
%CGDakHomeTOPart%  -  Home Time Outs Left – Partial
%CGDakHomeTOTotal%  -  Home Time Outs Total
%CGDakGuestTOFull%  -  Guest Time Outs Left – Full
%CGDakGuestTOPart%  -  Guest Time Outs Left – Partial
%CGDakGuestTOTotal%  -  Guest Time Outs Left – Total
%CGDakPeriod%  -  Current period
%CGDakMin% -  Minutes (from Clock Time)
%CGDakSec% - Seconds (from Clock Time)
%CGDakTen% - Tenths (secs/10 from Clock Time)

A.2.3 FOOTBALL

%CGDakClock% - Game Clock Time – “MM:SS.T”
%CGDakHomeTeamName% - Home Team Name
%CGDakGuestTeamName% - Guest Team Name
%CGDakHomeScore% - Home Team Score
%CGDakGuestScore% - Guest Team Name
%CGDakQuarter% - Current quarter
%CGDakBallOn% - Current ball position
%CGDakDown% - Current down
%CGDakToGo% - Yards to go
%CGDakHomePossess% - Possession indicator (0 or 1).
%CGDakGuestPossess% - Possession indicator (0 or 1).
%CGDakPlayClock% - Play Clock Time – “SS”
%CGDakHomeTO% - Home Time Outs
%CGDakGuestTO% - Guest Time Outs
%CGDakMin% - Minutes (from Clock Time)
%CGDakSec% - Seconds (from Clock Time)
%CGDakTen% - Tenths (secs/10 from Clock Time)

A.2.4 HOCKEY

%CGDakClock% - Game Clock Time – “MM:SS.T”
%CGDakClockStatus% - Game Clock running status indicator
%CGDakHomeScore% - Home Team Score
%CGDakGuestScore% - Guest Team Score
%CGDakHomeTO% - Home Time Outs
%CGDakGuestSaves% - Guest Saves
%CGDakGuestCornerKicks% - Guest Corner Kicks
%CGDakHomeFouls% - Home Fouls
%CGDakGuestFouls% - Guest Fouls
%CGDakHhr% - Hours (from Clock Time)
%CGDakMin% - Minutes (from Clock Time)
%CGDakSec% - Seconds (from Clock Time)
%CGDakTen% - Tenths (secs/10 from Clock Time)

A.2.6 VOLLEYBALL

%CGDakClock% - Game Clock Time – “MM:SS.T”
%CGDakClockStatus% - Game clock running status indicator
%CGDakHomeGameScore% - Home Team Score
%CGDakGuestGameScore% - Guest Team Score
%CGDakHomeTO% - Home Time Out
%CGDakGuestTO% - Guest Time Out
%CGDakHomeServiceIndicator% - Home Service indicator (0 or 1)
%CGDakGuestServiceIndicator% - Guest Service indicator (0 or 1)
%CGDakHomeGamesWon% - Home Games Won
%CGDakGuestGamesWon% - Guest Games Won
%CGDakGameNumber% - Current Game Number
%CGDakHomeGameScore1% - Home Score, First Game
%CGDakHomeGameScore2% - Home Score, Second Game
%CGDakHomeGameScore3% - Home Score, Third Game
%CGDakHomeGameScore4% - Home Score, Fourth Game
%CGDakGuestGameScore1% - Guest Score, First Game
%CGDakGuestGameScore2% - Guest Score, Second Game
%CGDakGuestGameScore3% - Guest Score, Third Game
%CGDakGuestGameScore4% - Guest Score, Fourth Game
%CGDakMin% - Minutes (from Clock Time)
%CGDakSec% - Seconds (from Clock Time)
%CGDakTen% - Tenths (from Clock Time)

A.3 DSI KEYS:

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A.3.1 BASKETBALL
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%DSIClock% - Game Clock Time – “MM:SS.T”
%DSIShotClock% - Shot Clock Time – “SS”
%DSIMin% - Minutes (from Clock Time)
%DSISec% - Seconds (from Clock Time)
%DSITen% - Tenths (secs/10 from Clock Time)

A.4 OES

---------------------------------------------------------------------------------------------------------------
A.4.1 BASKETBALL
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%OESClock% - Game Clock Time – “MM:SS.T”
%OESShotClock% - Shot Clock Time
%OESAwayScore% - Guest Team Score
%OESHHomeScore% - Home Team Score
%OESHHomeFouls% - Home Team Fouls
%OESAwayFouls% - Guest Team Fouls
%OESHHomeTOFull% - Home Team Time Out - Full
%OESHHomeTOPart% - Home Team Time Out - Partial
%OESAwayTOFull% - Guest Team Time Out - Full
%OESAwayTOPart% - Guest Team Time Out - Partial
%OESPeriod% - Current period
%OESMin% - Minutes (from Clock Time)
%OESSec% - Seconds (from Clock Time)
%OESTen% - Tenths (secs/10 from Clock Time)

A.5 **Translux Fairplay**

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A.5.1 **Football**

%TLFPClock% - Game Clock Time – “MM:SS.T”
%TLFPQuarter% - Current quarter
%TLFPHomeScore% - Home Team Score
%TLFPEnterScore% - Visiting Team Score
%TLFPDown% - Current down
%TLFPTogo% - To go (yards)
%TLFPBallOn% - Ball on (yard line)
%TLFPTFieldTimer% - Current field timer (SS)
%TLFPMin% - Minutes (from Clock Time)
%TLFPEnter% - Seconds (from Clock Time)
%TLFPTen% - Tenths (secs/10 from Clock Time)

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A.6 **Whiteway**

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A.6.1 **Basketball**

%WWPeriod% - Current period
%WWClock% - Game Clock Time – “MM:SS.T”
%WWAwayScore% - Guest Team Score
%WWHomeScore% - Home Team Score
%WWShotClock% - Shot Clock Time
%WWMin% - Minutes (from Clock Time)
%WWSec% - Seconds (from Clock Time)
%WWTen% - Tenths (secs/10 from Clock Time)

A.7 Whiteway Rainbow

A.7.1 Basketball

%WWRSportNum% - Sport Number

%WWRPeriod% - Current period

%WWRShotClock% - Shot Clock Time

%WWRAwayScore% - Guest Team Score

%WWRHomeScore% - Home Team Score

%WWRMinutes% - Minutes (from Clock Time)

%WWRSeconds% - Seconds (from Clock Time)

%WWRTenths% - Tenths (from Clock Time)
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