VICON ENTERTAINMENT

BEYOND MOTION

SETTING UP VIDEO CAMERAS FOR VICON SHOGUN

WHAT'S INSIDE

Revision 1. For use with Vicon Shogun 1.11.

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This guide explains how to set up compatible video cameras for use with Vicon Shogun.

> **Note**
> For information on setting up Vicon video cameras (Vicon Vue), see Prepare video cameras (optional step) in the *Vicon Shogun User Guide* and watch the Vicon video: 3 - Shogun Live - Setting up Vue video camera[1].

For instructions on how to set up your video camera, see the relevant section:

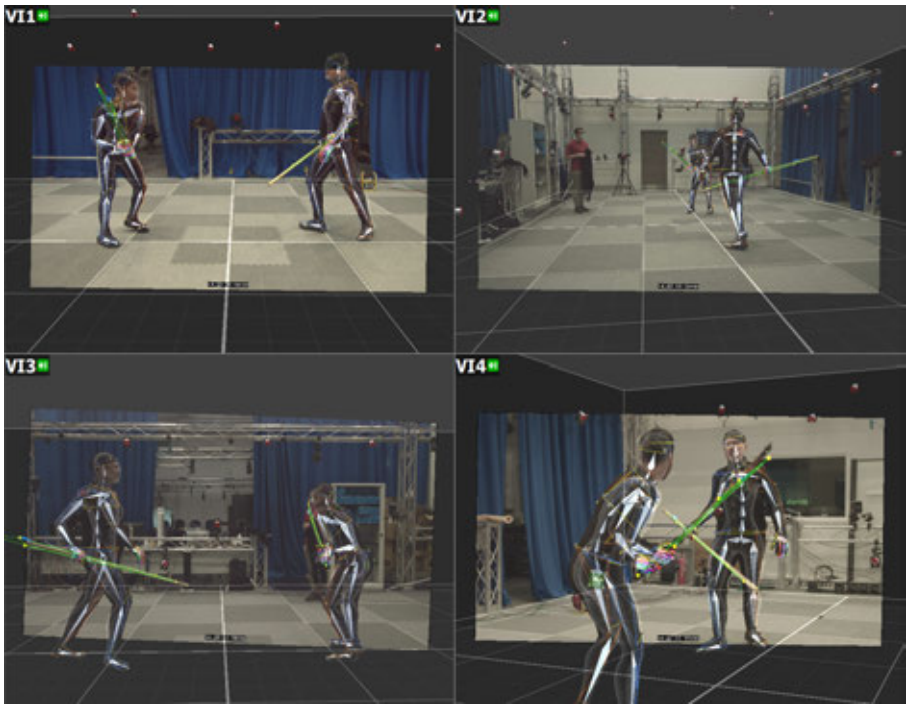
- Set up an SDI video camera in Shogun Live, page 3

1 https://youtu.be/tpqNoIPLb7g

Set up an SDI video camera in Shogun Live

In Shogun Live 1.5 and later, you can include up to four SDI video cameras (including sound) in your Vicon Shogun system.

This section describes how to set up SDI video cameras and related hardware, and how to connect them into your Vicon Shogun system.



When you have calibrated the SDI video cameras, you can overlay the motion capture data and check the solve against the video. You can also export the calibrated cameras with the image sequence directly into Autodesk® Maya® software as an FBX file.

Set up an SDI video camera in Shogun Live

The following topics describe how to set up SDI video with a single Blackmagic URSA Mini 4K camera and an Evertz 5601MSC timecode generator, but the same principles apply to other supported hardware.

- Recommended SDI video hardware, page 5
- Set up a capture card for SDI video in Shogun Live, page 15
- Set up a timecode generator for SDI video in Shogun Live, page 23
- Set up cameras for SDI video in Shogun Live, page 37
- Check and connect the SDI video system components, page 62
- Choose shutter duration, video standard and system frame rate, page 65
- Calibrate the SDI video system, page 71

For details about this procedure, watch the Vicon video, Shogun Live SDI Video[2], available on YouTube.

> **Note**
> As the videos were recorded using an earlier version of Shogun, you may notice minor differences in the user interface.

Shogun Live lets you link a calibrated SDI or Vicon Vue video reference camera to a rigid tracking object. This enables the video camera to be tracked, providing real-time 3D overlay in Shogun Live while the camera is moving and enabling the animation to be captured to the MCP. For more information, see Link a prop and a video camera in *Getting more from Vicon Shogun*.

2 https://youtu.be/X-GiJ9bHAvY

Recommended SDI video hardware

In Vicon Shogun Live 1.2 and later, you can display and capture video from SDI video cameras. This enables you to use a huge range of third-party, professional-quality video cameras to overlay and capture calibrated reference video.

The following recommendations are based on what the software supports for calibration and what has been tested with this version of the software. They are provided to help you to choose the most suitable SDI hardware.

Recommended cameras for calibrated video

For a camera to work well with Vicon Shogun it must:

- Have a global shutter sensor.
- Be able to outputprogressive video(eg, 720p, 1080p). Interlaced video (eg, 625i/PAL, 525i/NTSC, 1080i) is not supported.
- Support a genlock/reference/sync input.
- Have a timecode inputand supportembedding timecode in the video, or else you will need a separate timecode embedder.
- Produce output that is compatible with a Blackmagic DeckLink capture card.

Set up an SDI video camera in Shogun Live

Following testing, Vicon recommends these cameras for calibrated reference video:

Camera	SDI outputs	Global shutter	Genlock/ Reference sync	Timecode input	Timecode embedded in output	Highest supported video standard
RED Komodo 6K[1]	1 x 12G	✓	✓	✓	✓	2160p/60
Blackmagic URSA Mini 4K (discontinued)[2]	1 x 12G 1 x 3G	✓	✓	✓	✓	2160p/60
ARRI Alexa Mini LF	1 x 6G	✗ [3]	✓	✓	✓	2160p/30

1. For timecode and genlock, the Komodo Expander Module[3] is required.

2. Only LTC timecode is supported. When LTC timecode is used, only the SDI reference signal can be used (ie, not tri-sync).
Set **Reference Input** on camera to **Program** and check for REF and EXT on screen overlay.

3. Rolling shutter, but tested and found to be fast enough in most cases.

> ⚠ **Blackmagic URSA Mini 4.6K**
> The Blackmagic URSA Mini 4.6K uses a different sensor that is not global shutter, so is not recommended.

3 https://www.red.com/komodo-expander-module

Suitable cameras for uncalibrated reference video

The following camera has been used for capturing reference video in Shogun Live, but because it has a rolling shutter sensor, it can't be used for calibration:

Camera	SDI outputs	Global shutter	Genlock/ Ref. sync	Timecode input	Timecode embedded in output
Blackmagic Micro Studio 4K (discontinued) [1]	1 x 6G	✗	✓	✗	✗

1. SDI reference is supported. A timecode embedder is required.

Recommended capture cards

Shogun Live supports capturing from Blackmagic DeckLink cards using the DeckLink API, thus any DeckLink card should work with it. In addition, Shogun Live 1.6 and later includes support for the two Bluefish444 SDI video capture cards listed at the bottom of the following table.

Vicon has tested Shogun Live with the following cards:

Manufacturer	Model		No. of inputs	Notes
Blackmagic Design	Decklink 8K Pro		4 x 12G	Recommended for 12G and multi-camera captures. The host PC must be powerful enough to support multi-camera capture. In particular, it must have enough fast drives.
	Decklink Mini Recorder 4K		1 x 6G	Recommended as a cost effective option for setups where 12G is not required.
	Decklink 4K Pro		1 x 12G	
	Decklink 4K Extreme 12G		1 x 12G	
	DeckLink SDI 4K		1 x 6G	
	DeckLink 4K Extreme		1 x 6G	

Set up an SDI video camera in Shogun Live

Manufacturer	Model		No. of inputs	Notes
Bluefish444	Kronos K8		8 x 3G	Supported as either 8 independent 3G inputs or 4 x 3G inputs for quad-link video. 8 x small-size BNC ports.
	Epoch | 4K Neutron		3 x 3G	Supported as 3 x 3G inputs. An optional LTC expansion module is available.

Recommended timecode embedder

We have tested the following timecode embedder:

Timecode embedder	Number of channels	Notes
Blackmagic Teranex Mini Audio to SDI	1 x 12G	Use right XLR audio input to insert LTC timecode, and select **Timecode** mode in control software.

Recommended master clock/SPG/timecode generators

We have tested the following timecode generators:

Timecode generator	Notes
Evertz 5601	If the camera requires SDI sync (eg. Blackmagic URSA) then the Evertz 5601 must have a suitable HD or 3G SDI TG (Test Generator) option. The options are known as +HDTG and 3GTG. The presence of the options is not apparent from the number of connectors (ie, the connectors can be present even if the option is not included). To determine which options are enabled, go to the **Status** tab in VistaLink. In the **Options** group, ensure that the **TG** option is present, ie, it displays **HD Present** or **3G Present** rather than **Not Valid**. Typically the following connections are required: • **LTC 1, 2 (XLR)**: Provide LTC for SDI camera or timecode inserter. • **TG 1, 2 (BNC)**: Provide SDI sync if SDI camera accepts this, or • **Sync 1, 2, 3, 4, 5, 6 (BNC)**: Provide Tri-Sync or Blackburst if camera accepts this. • **Sync 1, 2, 3, 4, 5, 6 (BNC)**: Can be configured to supply PAL/NTSC sync with VITC to Lock/Lock+, or • **TG 1, 2 (BNC)**: Provide SDI sync to Lock Studio.
Courtyard CY440	• **LTC/Wordclock**: May be configured to provide LTC output. • **SDI 1, 2 (BNC)**: Provide SDI sync to camera, or • **Tri/Black 2, 3, 4**: Provide tri-sync to camera • **Composite (BNC)**: Provides PAL/NTSC sync with VITC to Lock/Lock+, or • **SDI 1, 2 (BNC)**: Provide SDI sync to Lock Studio

Set up an SDI video camera in Shogun Live

Timecode generator	Notes
Courtyard CY460	Typically the following connections are required: • **Balanced Audio/AES/LTC (Molex)**: May be configured to provide LTC output. Custom cable required. • **SDI 1, 2 (BNC)**: Provide SDI sync to camera, or • **Tri/Black 2, 3, 4**: Provide Tri-sync to camera • **Composite (BNC)**: Provides PAL/NTSC sync with VITC to Lock/Lock+, or • **SDI 1, 2 (BNC)**: Provide SDI sync to Lock Studio

Recommended cabling

SDI video uses co-ax cable with 75Ω characteristic impedance. Cables labeled RG-59U will be 75Ω, but may not be of sufficient quality for 3G video. Good quality cables with low return-loss are very important, and become even more crucial over longer distances and at higher standards, such as 6G and 12G. SDI sync also requires good quality video cable because it is also an SDI video signal. Analog blackburst, tri-sync and LTC signals are likely to be more forgiving.

We have tested the following cable types:

Cable	Notes
Belden 1694A	This is sometimes said to be industry-standard video cable. This was used for testing up to a range of 30 m for 3G and 20 m for 6G.
Van Damme 278-175-000 LSZH	20 m lengths of this were used for 3G and 6G.

Set up a capture card for SDI video in Shogun Live

These cards are supported for SDI video in Shogun Live 1.6 and later:

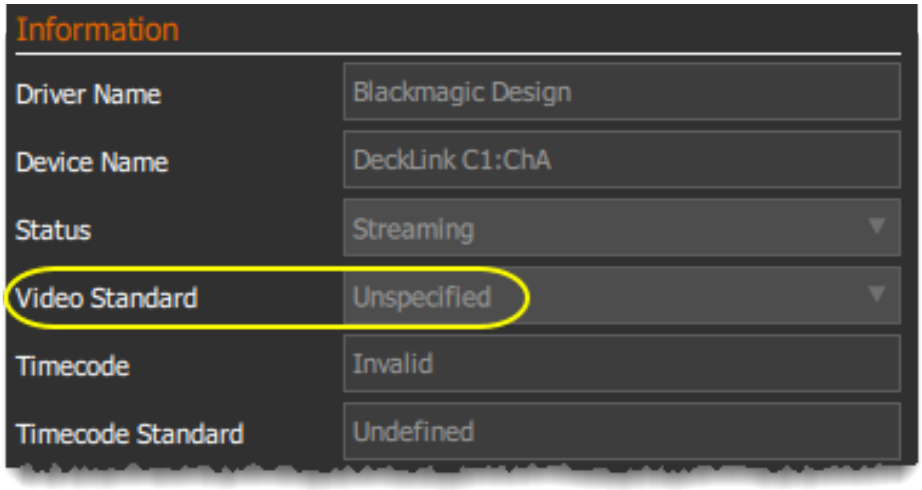
- Set up a Blackmagic DeckLink card, page 16
- Set up a Bluefish444 card, page 18

Set up a Blackmagic DeckLink card

1. Install the capture card in your computer. Remember to connect its extra power connector if it has one.
2. Download and run the Blackmagic Desktop Video Installer, which includes the drivers.

   ⚠ **Note**: We recommend that you use version 12.1 or later of the Blackmagic Desktop Video Installer. Earlier versions may not work with Shogun Live.
3. Open Shogun Live and ensure that in the **System** panel, the card is listed under **Video Inputs**.

   If the device isn't listed, the capture card could be incorrectly installed, the correct driver could be missing, or another instance of Shogun Live could be running and using it.
4. Ensure that the card is selected and in the **Information** section of the Properties, note that **Video Standard** is set to Unspecified. This indicates that the cable is not connected or there's no signal on it.

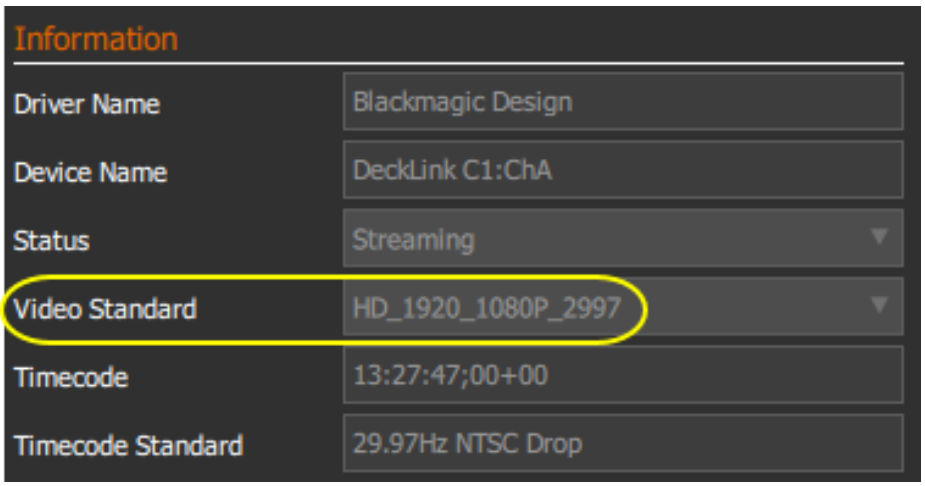


5. Identify which BNC connector is the video input. Some cards have multiple inputs that are not labeled, so you may need to refer to the Blackmagic documentation.

6. Connect this input to the SDI output from the camera.

   In the Properties, the icon changes in the **Video Inputs** section.

   In the Information section, the **Video Standard**is now displayed.



   If the video standard is not shown, the standard may not supported by the capture card, or there may be a problem with the camera or the cabling.

Set up a Bluefish444 card

For supported cards, see Recommended capture cards, page 9.

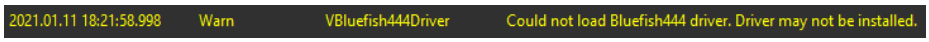
1. Install the card following the instructions in the manual.
2. Note that Shogun Live requires version 6.3.3.1 or later of the drivers.

   Download the Bluefish444 driver installer from the Bluefish444 website[4].
3. Run the installer in administrator mode, ensuring that utilities and drivers are selected.
4. To configure card for inputs, press the Windows key and enter `BlueFirmwareUpdater`. Follow the instructions to configure the card for inputs (eg, 3 inputs for the Epoch 4K Neutron or 8 inputs for the Kronos K8).

   ⚠ **Important**: Ensure that you completely power down the computer after a firmware update. It is not sufficient to just reboot.
5. Power down the computer.
6. Start Shogun Live.
7. Check that the card has been detected on start-up. If it is detected, a message similar to this is displayed in the log:

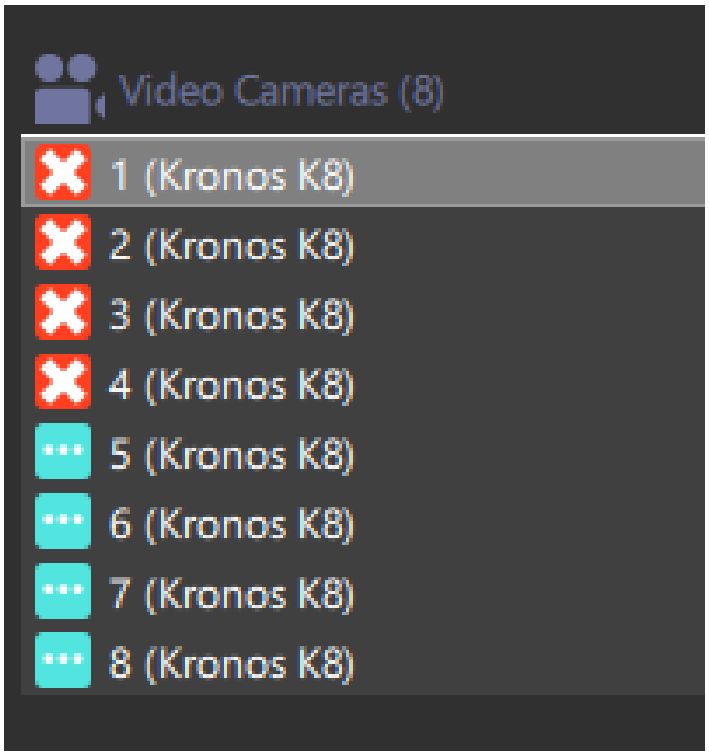
   

   If a warning like the following appears in the log instead, it probably means that the driver is not properly installed:

4 https://bluefish444.com/support/downloads/details/1/bluefish444-windows-installer.html

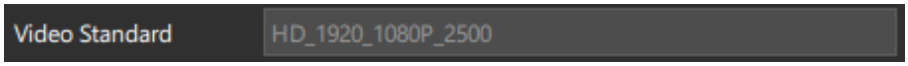
In the the **System** panel, go to the **Video Cameras** section of and check that a separate entry is displayed for each camera:



Configure for quad-link

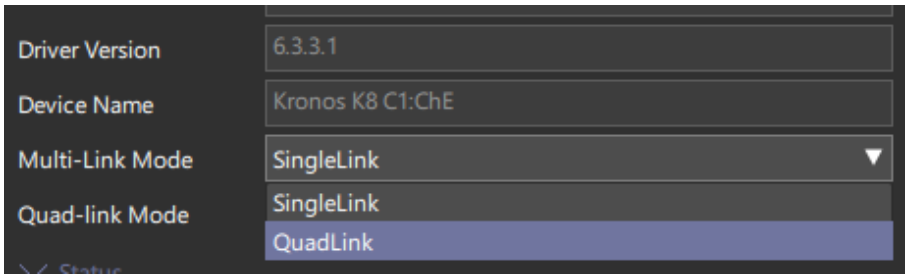
If you want to use quad-link mode on the Kronos K8:

1. Connect four 1.5G or four 3G signals to inputs A, B, C and D, or inputs E, F, G, and H.
2. Confirm that you can see four separate video streams in the Shogun Live workspace. Note that each one is receiving a 1.5 G or 3 G standard.

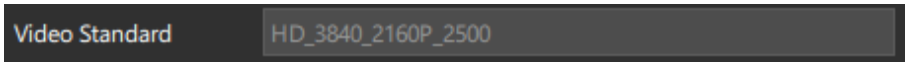


3. In Shogun Live, go to the **System** panel and in the Properties pane, select Advanced parameters to display all the available parameters.

4. Change input A or E from **SingleLink** to **QuadLink** mode. (Inputs B,C, D, and F, G, H will not have this option.)



After you have changed the relevant input to QuadLink, inputs B, C and D; or F, G, and H disappear, and input A or E now reports receiving a 2160p stream.



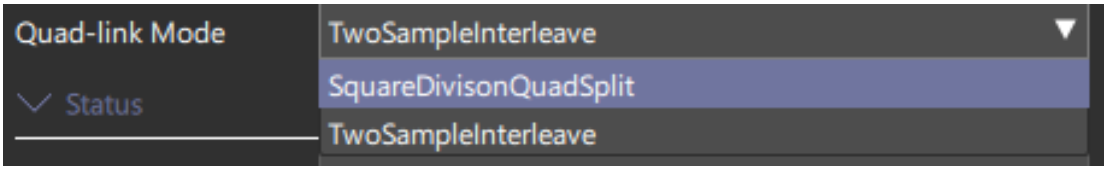
About quad-link mode

Quad link Mode provides these options:

- In **Square Division Quad Split** mode, the image is divided into quarters and each is transmitted on a single 3G link.
- In **Two Sample Interleave** mode, alternate pixels are divided between image, so each stream has a full image effectively subsampled.

Both modes enable the full original image to be reconstructed without loss of data.

Shogun Live cannot determine which type of quad-link mode is in use, so you must select the correct mode.



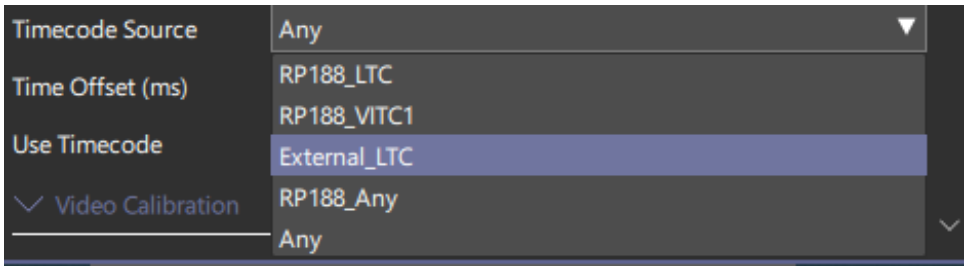
The selected option takes effect immediately. If you choose the wrong option, the video will appear obviously wrong:

Original image	
When **Two Sample Interleave** is incorrectly treated as **Square Division Quad Split**, it will appear as four copies of the video tiled together.	
When **Square Division Quad Split** is incorrectly treated as **Two Sample Interleave**, all four quarters of the video appear to have been superimposed on top of each other.	

> **Note**
> In **Two Sample Interleave** mode, Luminance8, BGRA, RGBA, and U10Y10V10Y10 pixel formats are not supported. We recommend using U8Y8V8Y8 mode instead.

Use External LTC extension

If you have an LTC extension board, you can make available the timecode that this provides by setting the **Timecode Source** to **External LTC**.



Known Limitations

- 3G Level-B Dual link mode is not supported on either card.
- 4:4:4 RGB mode is not supported on either card.
- Both **Quad Division** and **Two Sample Interleave** mode are supported, but in **Two Sample Interleave** mode, not all pixel formats are supported.

Set up a timecode generator for SDI video in Shogun Live

These timecode generators (SPGs) are supported for SDI video in Shogun Live 1.6 and later.

- Set up a Courtyard CY440 timecode generator, page 24
- Set up an Evertz 5601MSC timecode generator, page 32

Set up a Courtyard CY440 timecode generator

You can set up the Courtyard CY440 to provide reference and timecode to both the SDI camera and the Vicon system. Most SDI cameras require two cables to provide both timecode and sync. In the case of SDI and Composite, Vicon Lock units can accept one cable that carries both reference sync and timecode. However, when tri-level sync is used, LTC timecode is also required.

Consequently, either three or four ports on the timecode generator are used: two to the camera, and either one or two to the Lock unit. If multiple cameras are used, then you may need to add distribution amplifiers for LTC, and for either tri-sync or SDI.

The software used to set up the Courtyard timecode generator is ROSS DashBoard[5]. It can be freely downloaded and installed on Windows.

To set up the timecode generator:

1. If the SDI feature is required to sync the camera or the Lock unit, check that it is enabled.
2. On the front panel, select **System Setup** > **Option Enable**.

   If SDI is present, **HD** and **3G** are listed, together with an option code for each.

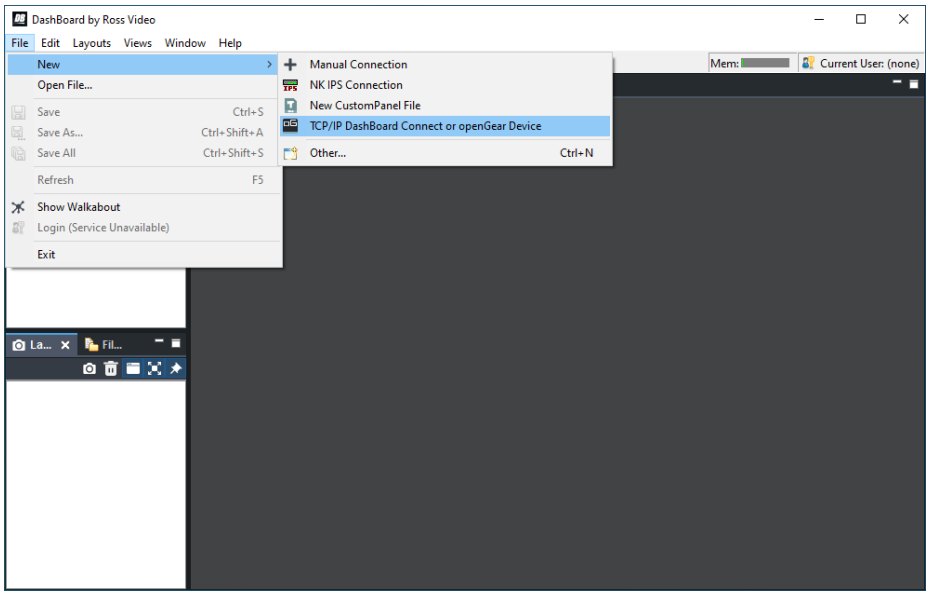
   The SDI feature is required for cameras that require SDI sync, such as the Blackmagic URSA Mini 4K, and if you want to use the SDI input on a Vicon Lock Studio.
3. Find the IP address of the device using the front panel, or set an IP address.

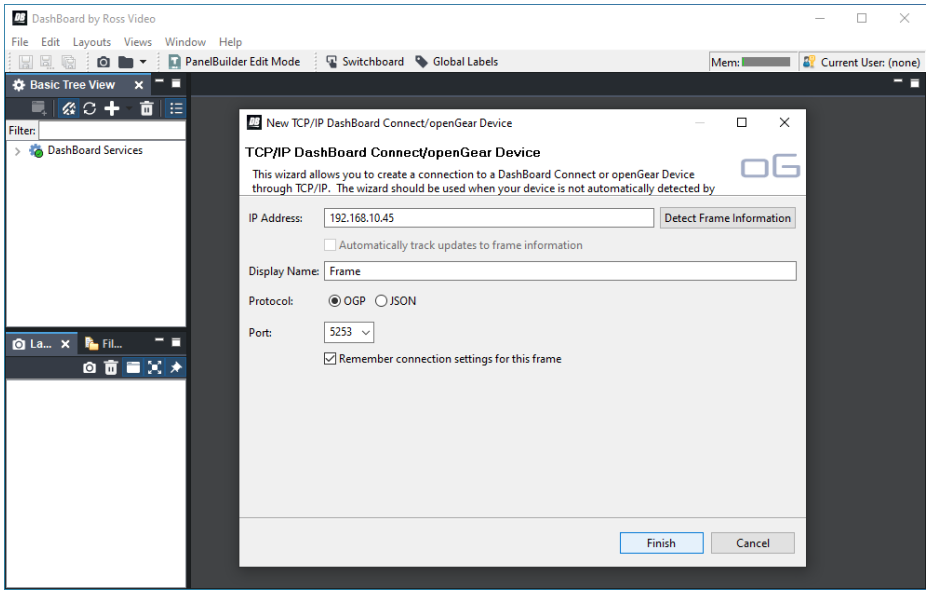
   The IP address is shown on the front panel of the device when the menu is not in use.

   If you need to change any network settings, go to **System Setup** > **Network**.

5 https://www.rossvideo.com/support/software-downloads/dashboard/

4. Use the Ross Dashboard software to add a connection to the device.



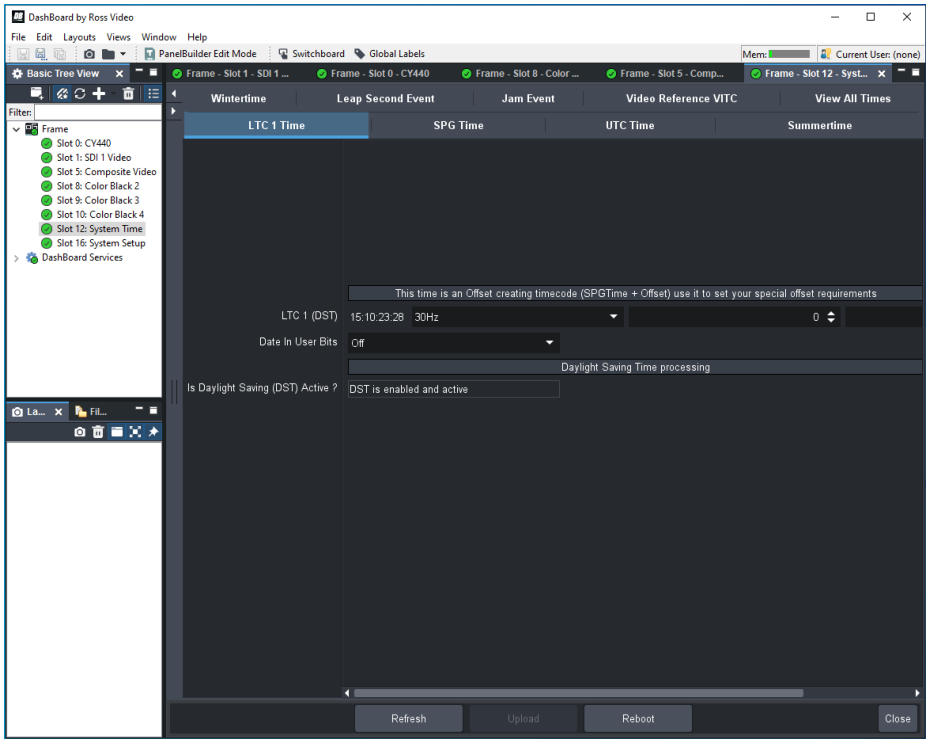


If the connection succeeds, the new display is added to the tree view in green, with sub-menus below it.

If it is not found, it is added to tree in gray, with no sub-menus under it.

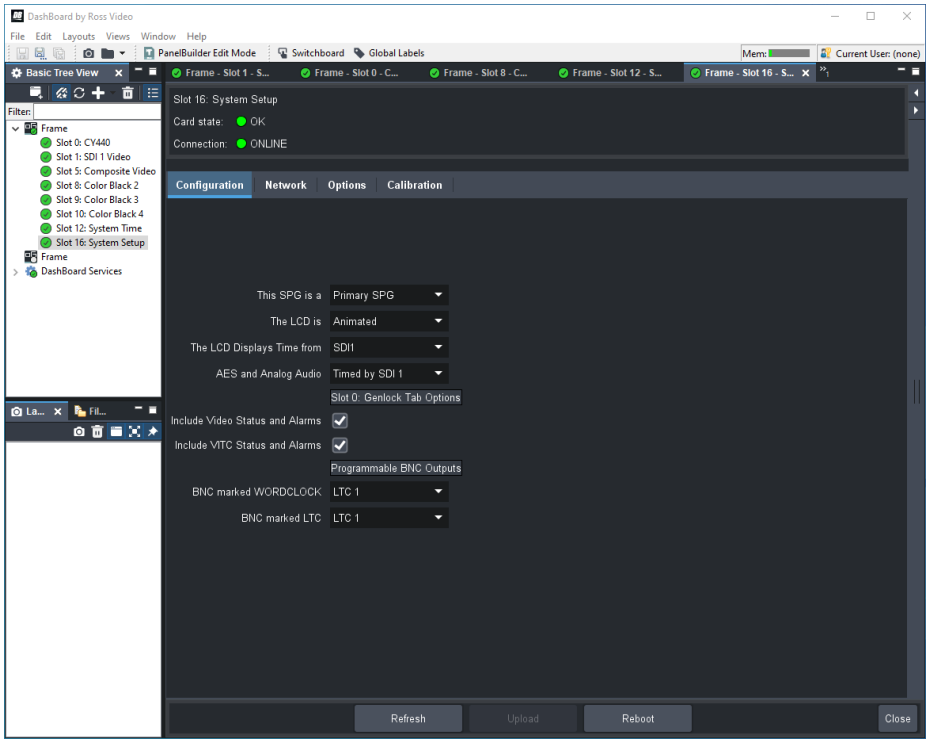
5. On the **System Time** menu, set the frame rate for the LTC signal to the video camera, and a Lock is required.

You must set the frame rate to the base rate associated with the desired video standard on the camera. For example, for 60 Hz video standards, the timecode frame rate is 30 Hz.



The CY440 has only one LTC generator, to provide timecode to the SDI camera and the Vicon system. Two outputs on the CY440 can be used for LTC. We recommend that you set them both to LTC1.

This gives two timecode outputs: one for the camera and one for the Vicon Lock unit (if required, as the Lock can also get timecode from Composite, or SDI in the case of a Lock Studio.)

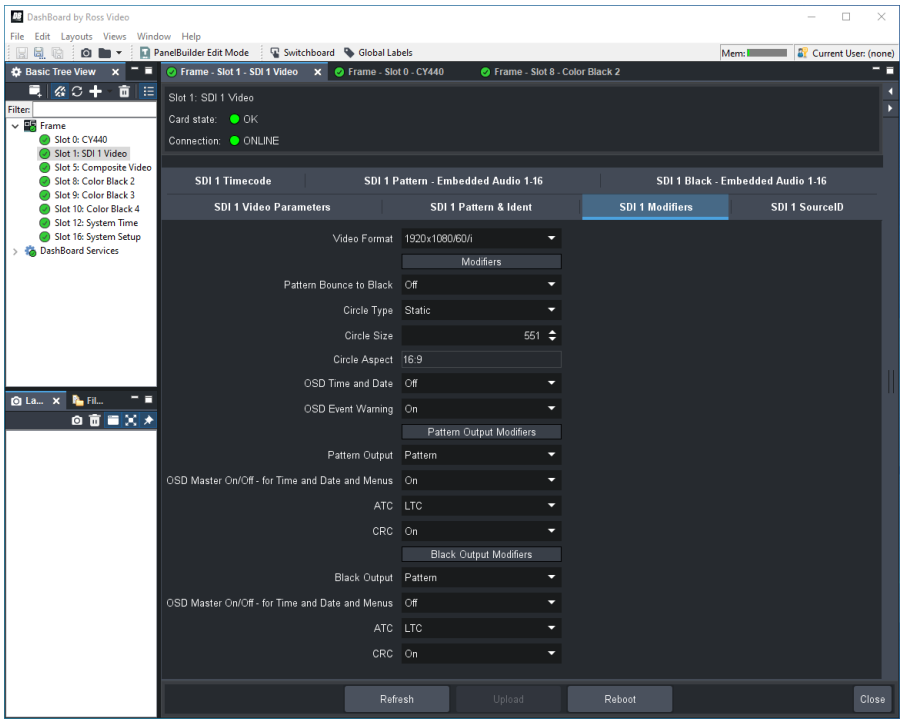


The outputs on the CY440 that can be configured for LTC are labeled **LTC**and **Wordclock**.

Connect one of the LTC outputs to the video camera and one to the Lock unit, if the Lock is using tri-sync and LTC. (If a Lock Studio is getting an SDI signal, or any type of Lock is getting a composite signal for sync, then the embedded timecode in the signal can be used and a separate LTC connection is not required.)

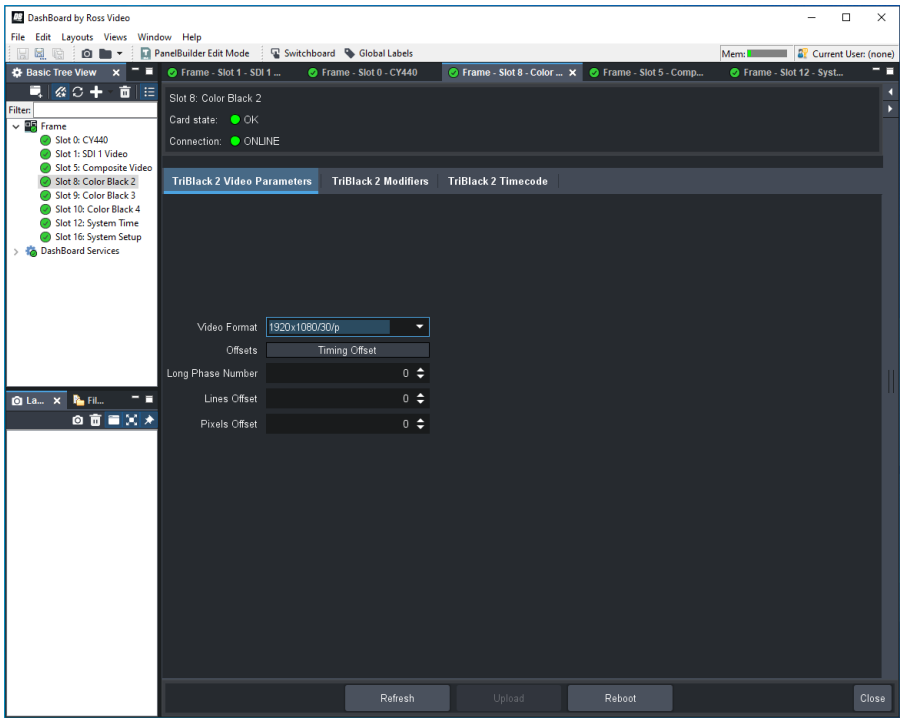
6. Set up the reference signal for the camera. This must be the same as the video standard that is selected on the camera.

   - For cameras that take SDI reference, such as the Blackmagic URSA Mini 4K, page 58, use Slot 1: SDI 1 Video.



   Then connect the output labeled SDI1to the camera's SDI IN port.

- For cameras that take tri-sync reference, such as the ARRI Alexa Mini LF, page 46, use Slot 8: Color Black 2.

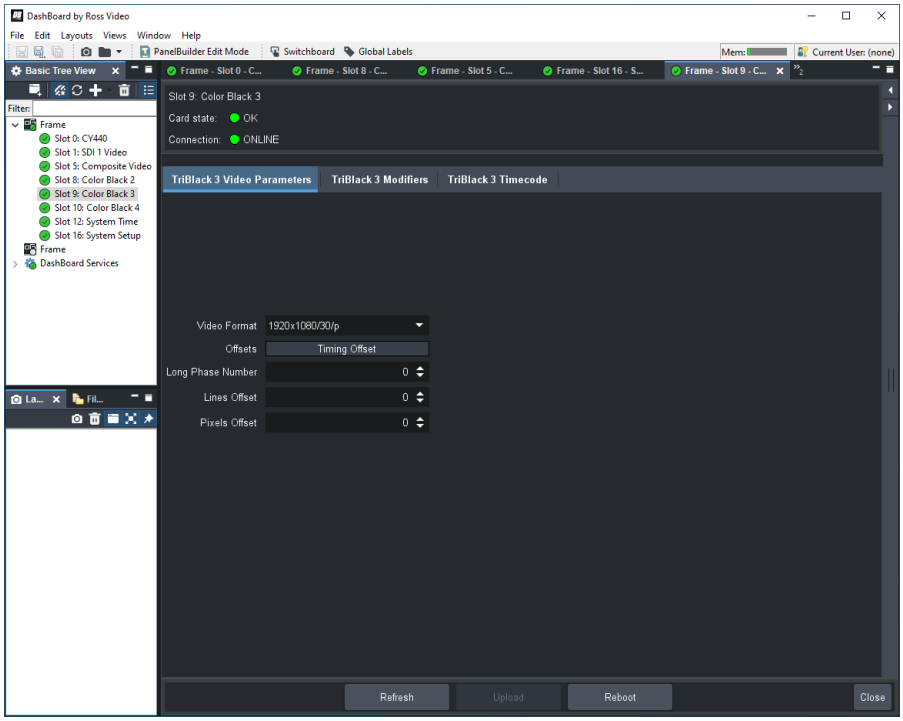


Connect the output labeled Tri Black 2 to the cameras SYNC IN port.

7. Set up the timecode and sync for the Vicon Lock unit.

   - Vicon Lock or Lock+:

     Use **Slot 9: Color Black 3** and set the video format as required.



     Connect the output labeled **Tri Black 3**to the Lock's **REF LOOP** port.

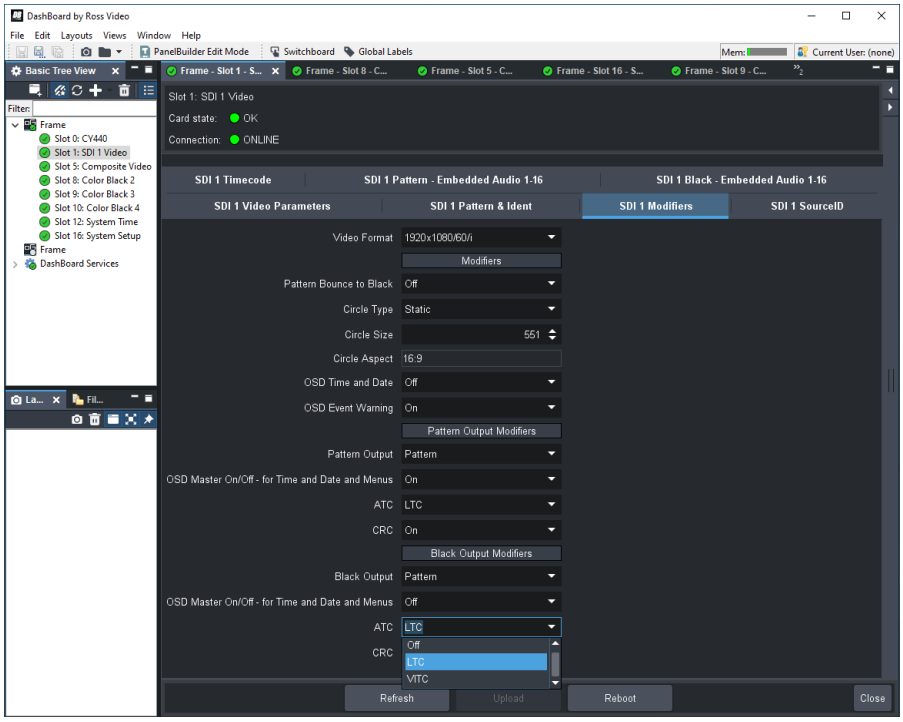
- Vicon Studio:

  Set the SDI output as shown in step 6. The CY440 can generate only one type of SDI signal at a time, although it has two physical BNC connectors, labeled **SDI 1** and **SDI 2**.

  This means the standard chosen must be suitable for syncing both the Lock and the SDI. If there is no suitable SDI standard, the Lock must be synced from the CY440, using either tri-level or composite. If tri-level is used, LTC is required for timecode because tri-level sync does not include timecode.

  You can configure independently whether the two outputs are black or show a test pattern, but this is usually irrelevant for sync and timecode.

  Make sure that embedded timecode is enabled. This is described as **ATC**in the software and must be set to **LTC**.



  Connect **SDI 2** to the Lock's SDI port.

> **29.97 Hz non-drop frame**
> Some older versions of the Courtyard firmware do not support 29.97 Hz timecode in non-drop-frame mode. For more information, contact Courtyard.

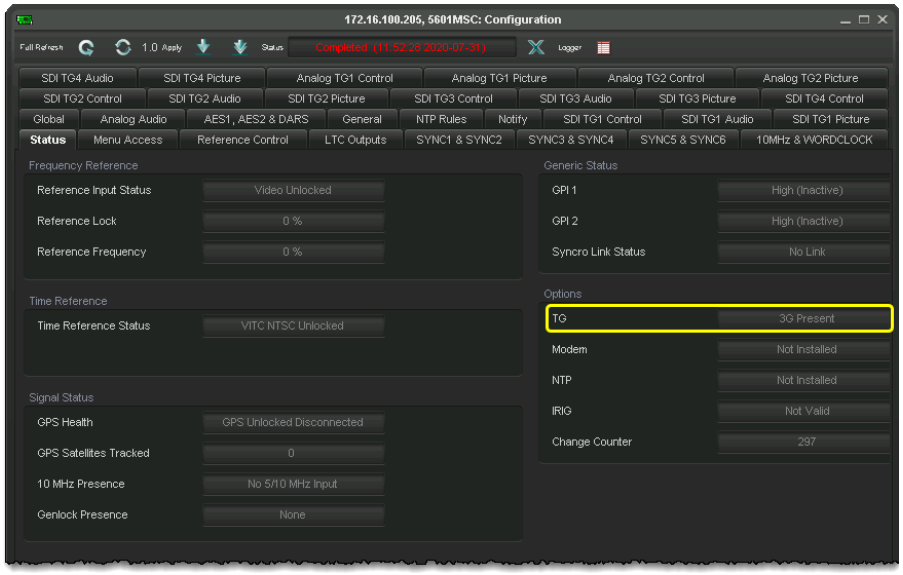
Set up an Evertz 5601MSC timecode generator

You can set up the Evertz 5601MSC to provide reference and timecode to both the SDI camera and the Vicon system. The URSA Mini 4K always requires two cables to provide both timecode and sync. The Vicon system requires one cable that can carry both reference sync and timecode. Consequently, at least three connections on the timecode generator are used.

VistaLINK PRO[6] software is used to control the timecode generator.

To set up the timecode generator:

1. Check that the Evertz 5601MSC has a suitable HD or 3G SDI module. These modules are known as +HDTG and +3GTG by Evertz. To check that the correct module is selected:
   - In VistaLink, go to the **Status** panel and in the **Options** group ensure that the **TG** option is **HD Present** or **3G Present**.

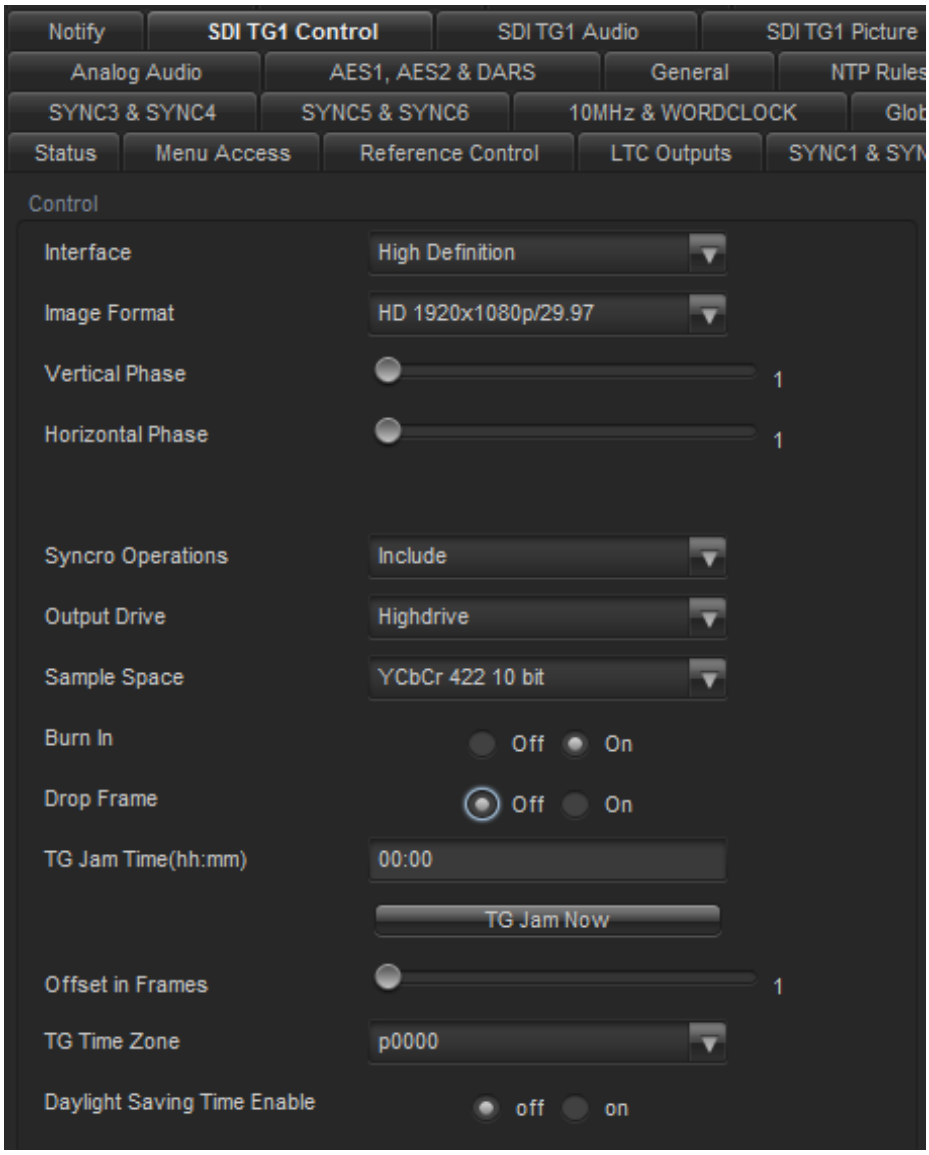


   If the **TG** option is **Not Valid**, upgrade yourEvertz 5601MSC to include the HD or 3G SDI modules.

6 https://evertz.com/solutions/vistalink

2. Set the frame rate for the timecode signal (LTC) for the URSA camera. This must be set to the base rate associated with the desired video standard on the camera. For example, for 59.94 Hz video standards, the timecode frame rate is 29.97 Hz.

3. Set up the SDI reference signal for the camera. This must be the same as the video standard that is selected on the camera.



4. Set up the timecode reference to the Vicon Lock unit. The connection to use depends on your Vicon Lock model:

   - Vicon Lock or Lock+ : Use one of the SYNC outputs from the timecode generator. Lock or Lock+ supports only analog black-burst sync with VITC. This means that only base rates of 25 Hz (PAL) or 29.97 Hz (NTSC) are available (for true 30 Hz, use a Lock Studio). Choose either PAL or NTSC-M, to match the base rate of the SDI video standard.

- Vicon Lock Studio: Use one of the SDI TG-x outputs on the timecode generator. Lock Studio supports HD-SDI with embedded timecode. Ensure that the settings match those you specified in step 2 for the camera.

> **Drop frame setting**
> Shogun Live supports 29.97 Hz timecode in drop-frame or non drop-frame mode. However, the drop-frame setting must be consistent between all three outputs on the timecode generator.

Set up cameras for SDI video in Shogun Live

These cameras are supported for SDI video in Shogun Live 1.6 and later:

- Set up a RED Komodo camera in Shogun Live, page 38
- Set up an ARRI Alexa Mini LF camera, page 46
- Set up a Blackmagic URSA Mini 4K camera, page 58

Set up a RED Komodo camera in Shogun Live

The RED Komodo camera is supported for SDI video in Shogun Live. Full details of how to set up and use the camera can be found in the Komodo Operation Guide[7]. This document includes the extra information required to set up and use the camera with Vicon Shogun Live.

Global shutter sensor

This camera has a global shutter sensor which makes it particularly suitable for use with the calibrated video feature of Vicon Shogun Live.

7 https://www.red.com/download/komodo-operation-guide

Sync and timecode

To calibrate the camera in Shogun Live, both genlock and timecode are required. The camera requires the RED Komodo Expander Module to give easy access to genlock and timecode. Ensure this is fitted according to the manufacturer's instructions.

Set up an SDI video camera in Shogun Live

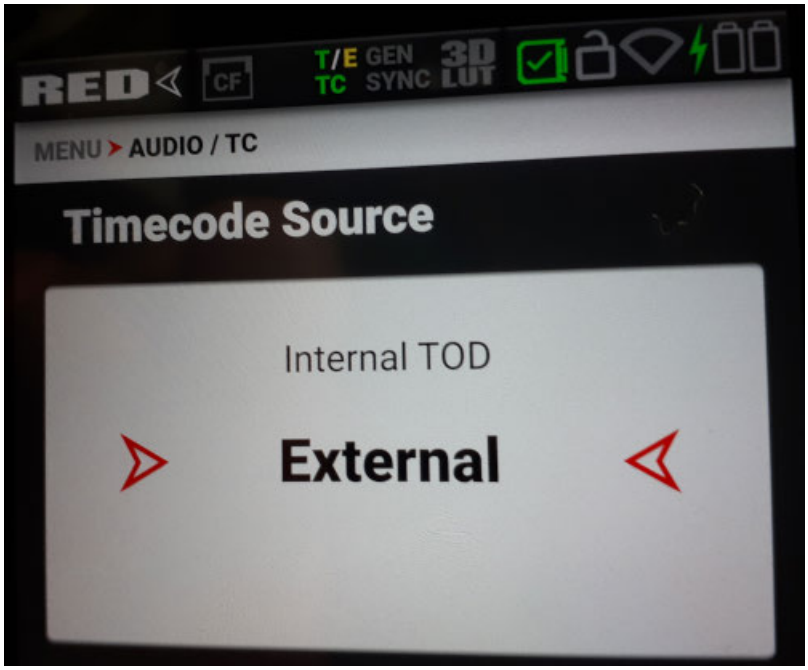
Two cables are required to connect the timecode generator to the Komodo Expander module: one for genlock and one for timecode.

Set up the required timecode

1. Connect the timecode to the BNC connector labeled **Timecode**.

   This must be the LTC timecode from the port on the timecode generator labeled **TC**, **Timecode**or **LTC**.

2. On the camera's onscreen display, select **Menu** > **Audio / TC** > **Timecode Source** and then select **External**.



Set up the required genlock

Tri-sync genlock is supplied to the BNC connector labeled **Genlock**. This must be tri-sync genlock from the port on the timecode generator, usually labeled **Sync N** or **Tri-Black N**.

Check timecode and genlock

Check these settings on the camera display:

- GEN Must be green, indicating external sync is being received.
- TC Must be green, indicating timecode is being received.
- SYNC Must be green, indicating sensor is synced with timecode and the camera's output is synced with genlock.

Any other colors (gray, red, yellow, etc) indicate a setup problem, which may not be immediately apparent in Shogun Live but which will cause problems for capturing calibrated video later. For more detailed information including the meaning of each status color, see the *Komodo Operation Guide*.

Status	On-screen display	Explanation
Genlock and timecode being received		Ready to capture in Shogun Live.
Genlock being received but not timecode		Fix problems with camera setup before capturing or calibrating in Shogun Live.
Timecode being received but not genlock		
Neither timecode or genlock being received		

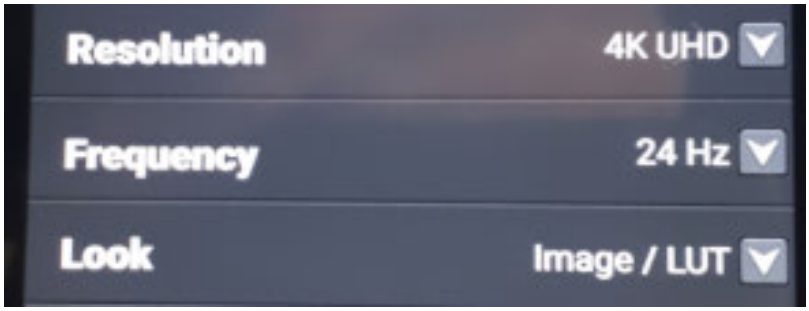
Important
Shogun Live does not visually indicate whether the camera is getting a genlock signal and cannot tell whether the camera is getting external timecode or generating it internally, so you must check this on the camera itself.

Set up the SDI output

Connect the SDI output to the capture PC's capture card. If multiple outputs are required (eg, for a monitor), we recommend using an SDI distribution amplifier.

Set resolution and frame rate

- To set the resolution for the SDI output, on the camera's onscreen display select Menu > Monitoring > SDI > Resolution .
- To set the frame rate, select Menu > Monitoring > SDI > Frequency.



> **UHD and DCI**
> Shogun Live supports progressive video standards up to 4K, as long as a compatible capture card is used.
> However, it has been more rigorously tested with the UHD standards (1920 × 1080, 3840 × 2160) than the DCI standards (2048 × 1080, 4096 × 2160).

Disable onscreen displays

We strongly recommend that you disable all the monitoring features on the SDI output. The onscreen display can interfere with calibrating in Shogun Live, unless the text is masked, and if the display features are changed after calibrating, the calibration may be invalidated.

On the camera's onscreen display, select **Menu** > **Monitoring** > **SDI**. Change all of **Guides**, **Tools**, and **Overlay** to **0** (red color, meaning off).

Set up an ARRI Alexa Mini LF camera

The ARRI ALEXA Mini LF camera is supported for SDI video in Shogun Live.

The following topics provide information about setup and calibration. Read them in conjunction with the ARRI ALEXA Mini LF Manual[8] (PDF download from arri.com).

8 https://www.arri.com/resource/blob/176542/b9f286327d89a155c06e3cca81bf6fc6/alexa-mini-lf-sup-6-0-user-manual-data.pdf

Use of the rolling shutter

The ARRI ALEXA Mini LF camera has a roller shutter sensor. In general, we don't recommend the use of cameras with rolling shutter sensors. However, the acceptability depends on the speed of the readout from the sensor. A good test is whether the calibrator detects wands during a normal fast wand wave. If it does, this indicates that the rolling shutter time is fast and the amount of distortion is unlikely to be problematic except for very fast movement.

If you are forced to use a deliberately slow wand wave to enable the calibrator to detect wands, it is likely the rolling shutter effect will be problematic in normal use.

Satisfactory results were obtained with a normal, fast wand wave with this camera.

Sync and timecode

The ARRI ALEXA Mini LF camera takes a separate timecode and sync/genlock connection. It can also extract reference sync from the timecode signal, but we do not recommend this mode of operation. As with all SDI video cameras, both sync/genlock (SYNC IN) and timecode (TC) are required for the camera to be calibrated in Shogun Live. The sync/genlock and timecode signal can come from a sync and timecode generator (SPG), such as the Evertz 5601MSC, or Courtyard CY440 or CY460.

Set up the required timecode

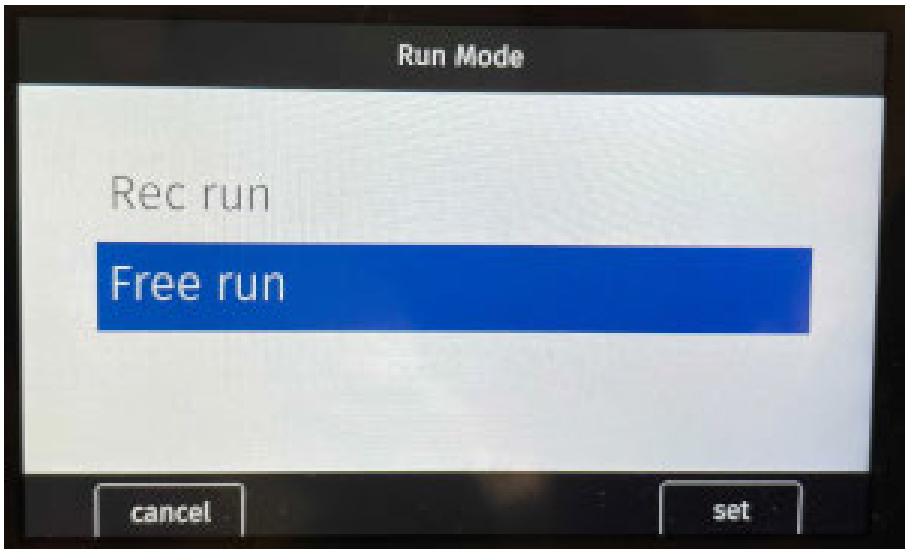
The timecode cable is used to carry an LTC signal from the sync and timecode generator. At the camera end, a 5-pin lemo connector plugs into the port on the camera labeled TC, and at the other end is either BNC or XLR, depending on the type of device being used. Plug it into an LTC output on the timecode generator, which is usually labeled LTCor Timecode.

As usual when using timecode, set the timecode generator to provide LTC at a rate equal to, or exactly half the video frame rate desired, as LTC rates only go up to 30 Hz.

To set up the camera for timecode:

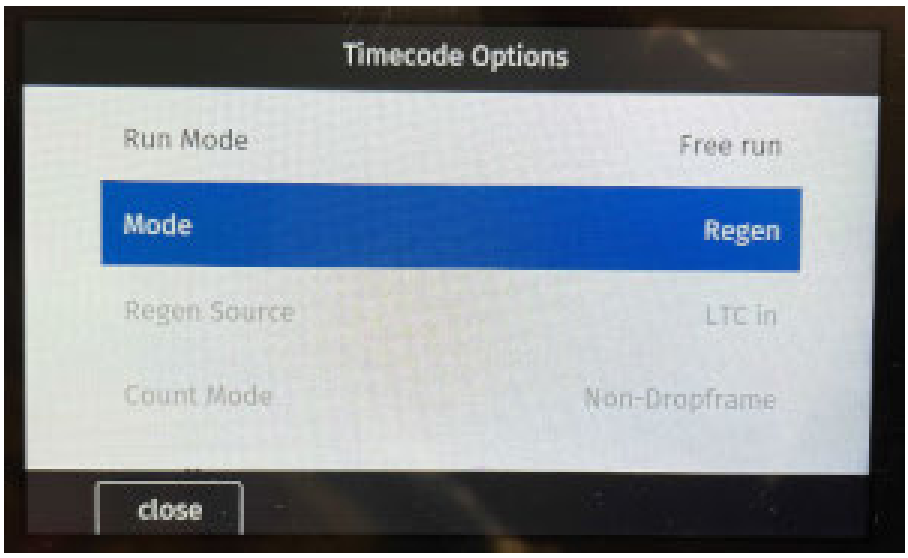
1. Navigate to HOME > TC > Options > Run Mode and ensure that the value is set to Free Run.

   In this mode, the timecode continues to count up, even when not recording on the camera, which is the behavior required by Shogun Live.



2. Navigate to HOME > TC > Options > Mode and ensure that the value is set to Regen

   In this mode, the timecode does not sync to the input once, but keeps in track with it, except when the camera is recording. If the timecode generator is also providing sync/genlock and the standards are set correctly on both outputs, there should be no discontinuities in the timecode received.

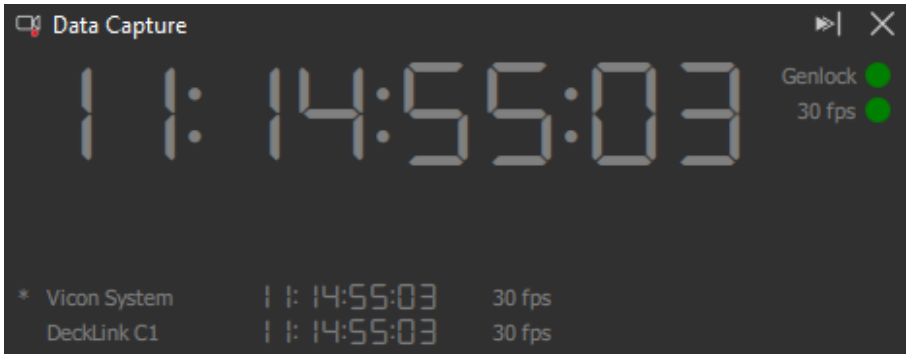


3. As an additional check that the settings are correct, navigate to HOME > TC > Options > Regen Source and ensure that LTC in is displayed.

   The camera displays TC in white when it has a timecode. The timecode itself is also shown on the camera's display.

Set up an SDI video camera in Shogun Live

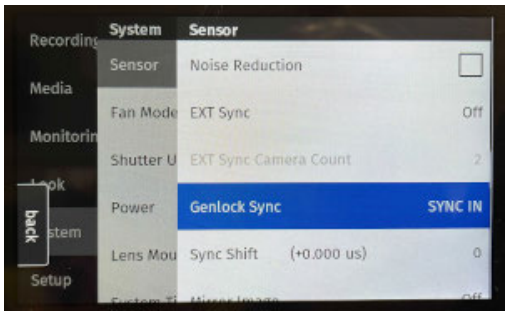
When the timecode is set up correctly, it is displayed in Shogun Live below the Vicon system timecode. In this example, it is listed as **DeckLink C1**, referencing the SDI capture card in use.



Set up the required genlock

The genlock cable is a BNC-to-BNC cable that is used to carry genlock from the timecode generator.

1. On the camera, plug the cable into the connector labeled SYNC IN.
2. Ensure the cable is connected to a tri-sync output on the timecode generator, and set the video standard to that required for the camera.
3. Navigate to MENU > System > Sensor > Genlock Sync and set the value to SYNC IN.

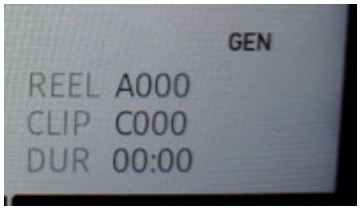
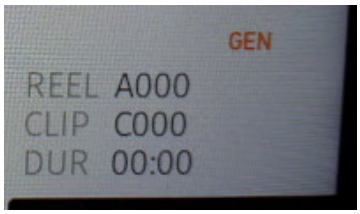
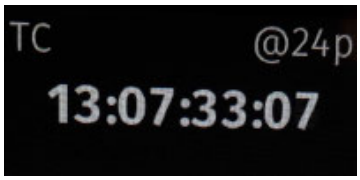


> **Important**
> Check that the GEN message changes to orange when the cable is removed. It is important to do this to verify that the genlock input is being used, rather than the camera obtaining sync from timecode, which we don't recommend.

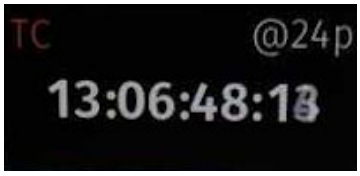
Check timecode and genlock

When timecode and genlock are being received, on the display TC in white and GEN in black are displayed, as shown here:

When there is a problem with timecode or genlock, the ARRI ALEXA Mini LF camera shows TC or GEN in amber respectively.

Status	On-screen display
Genlock / Sync In working	
Genlock / Sync In disconnected or not working	
Timecode working	

Set up an SDI video camera in Shogun Live

Status	On-screen display
Timecode disconnected or not working	

Important
Shogun Live does not visually indicate whether the camera is getting a genlock signal, so it is particularly important to check this on the camera itself.

Set the required video standard

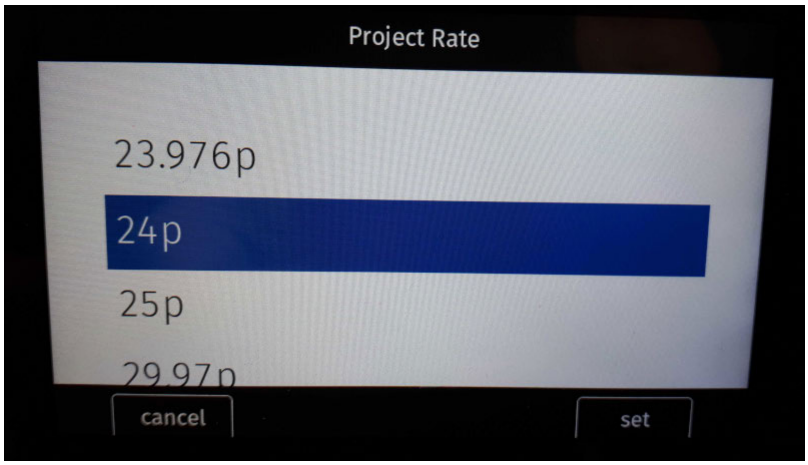
The ARRI ALEXA Mini LF camera supports 1.5 G and 3 G video standards on the outputs labeled SDI 1 and SDI 2. It supports only 6 G video standards on its SDI 2 output.

Connect the SDI 2 output to the Shogun Live PC. If SDI connections to other devices are required, use a distribution amplifier. Distribution amplifiers should not introduce a significant delay to the signal, but we recommend that you set up all of the cabling before calibrating, rather than plugging and unplugging cables after calibration.

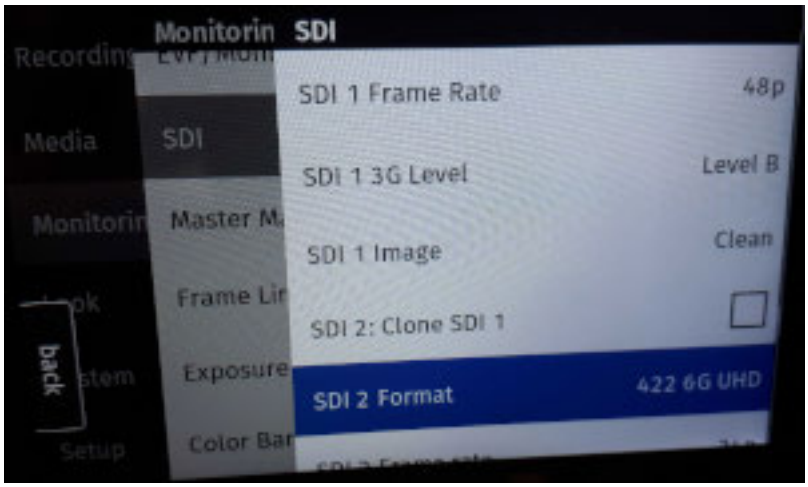
The camera doesn't have a direct video standard setting. The video frame rate is determined in the Project settings. The transport format on the SDI output is set in the Monitoring settings.

To change the video standard:

1. Navigate to HOME > FPSand use the jog wheel to choose the desired frame rate.



2. Navigate to MENU > Monitoring > SDI > SDI 2: Clone SDI and ensure that the checkbox is cleared.



3. Navigate to MENU > Monitoring > SDI > SDI 2 Format and set it to the desired video transport format. For example, to enable 2160 p (4K) output, change SDI 2 Format to 422 6G UHD.

Set up a Blackmagic URSA Mini 4K camera

The Blackmagic URSA Mini 4K camera is supported for SDI video in Shogun Live.

Documentation for using all cameras in the URSA Mini range can be found in the Blackmagic URSA Mini Manual[9].

Global shutter sensor

This camera has a global shutter sensor which makes it suitable for producing calibrated reference video in Shogun Live.

Newer cameras in the range, the URSA Mini 4.6K, URSA Mini 4.6K G2, URSA Mini Pro and URSA Mini Pro 12K all have rolling shutter sensors that make them much less suitable for use with Shogun Live, so we do not recommend using these cameras.

9 https://documents.blackmagicdesign.com/UserManuals/BlackmagicURSAMiniManual.pdf

Sync and timecode setup

The URSA Mini 4K has an unusual set of inputs for sync and timecode. A single connector is used for tri-sync reference and timecode (LTC) meaning that it is not possible to use tri-sync reference still get external timecode. There is also an SDI input that accepts reference SDI but ignores any embedded timecode in the SDI stream.

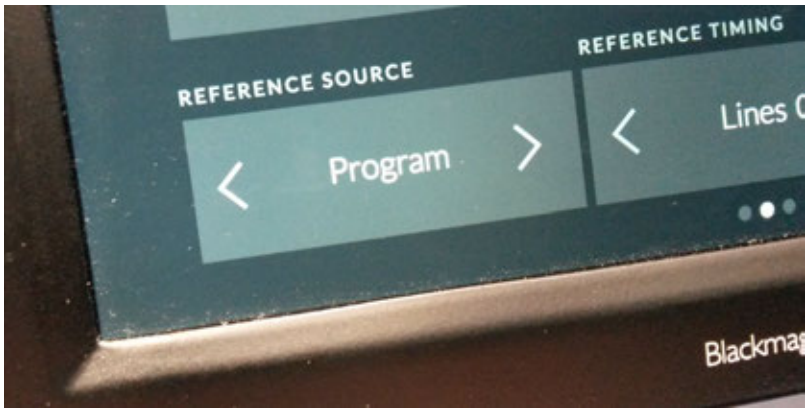
Since Shogun Live requires both genlock and timecode, the only combination of inputs that will allow this is:

- SDI In Used for reference input
- REF-IN/TC-IN Used for LTC timecode input

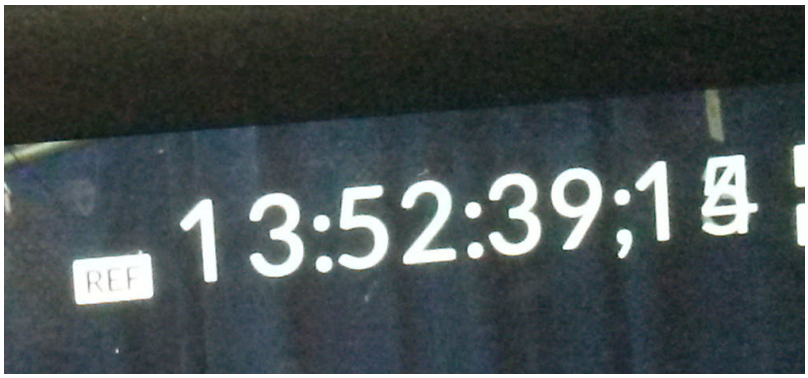
This means that the timecode generator must also be capable of providing SDI reference video. This is usually an optional extra in timecode generators, and older models may not have it.

To set up the camera:

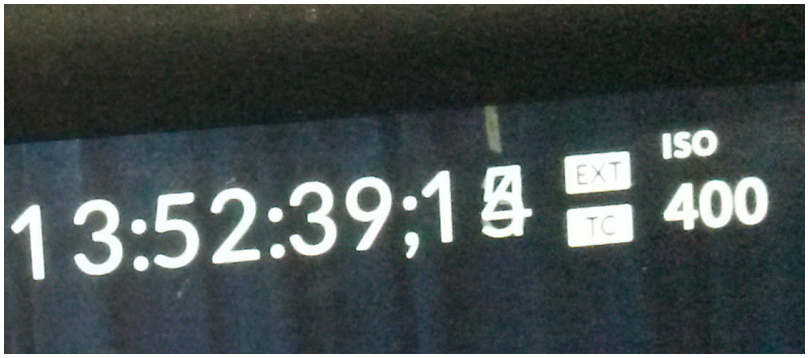
1. Ensure that the software on the camera is version 4.9 or later. This reduces video latency.
2. From the onscreen display, choose the correct video standard.
3. Set **Reference Source** to **Program**.



REF is now displayed on the camera monitor.



4. Check that timecode is working correctly. The timecode should be in sync with the timecode generator and EXT should be displayed above TC on the camera monitor.



Check and connect the SDI video system components

Before you begin to connect your system components, check that your hardware is included in Recommended SDI video hardware, page 5. For setup instructions for the components, see:

- Set up a capture card for SDI video in Shogun Live, page 15
- Set up timecode generators (SPG) for SDI video in Shogun Live, page 23
- Set up cameras for SDI video in Shogun Live, page 37

Connect the SDI video system components

To ensure that the camera shutters are aligned, the SDI camera must be genlocked to the Vicon system. This ensures that the SDI camera reliably see strobes from the Active Wand.

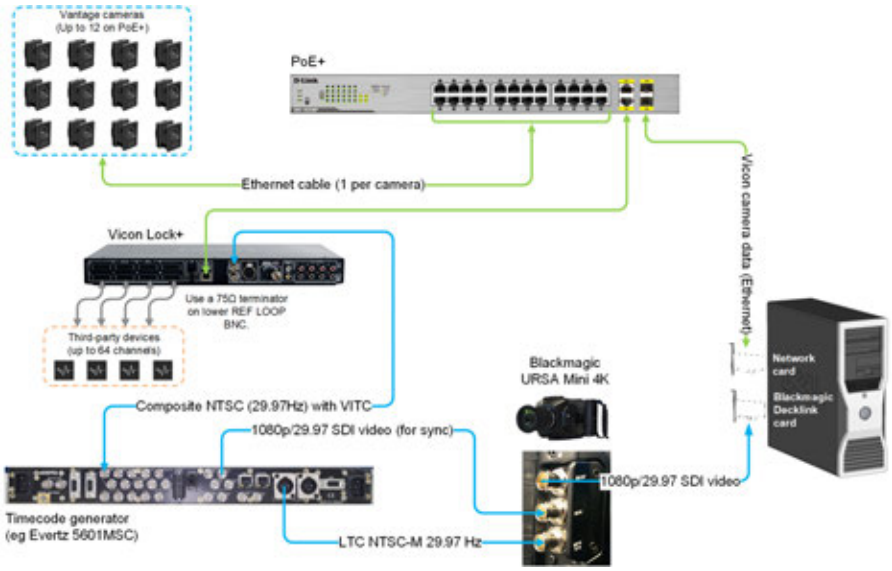
Timecode is used to identify the time at which data from the SDI camera and the Vicon system was captured. This ensures that the data from the two sources can be aligned. The calibrator can then determine any small remaining discrepancy and apply an offset to the video input to correct for it.

Consequently, both the SDI camera and the Vicon system must have a valid genlock signal and a valid timecode. Two cables are required to transmit reference sync and timecode to the camera, whereas the a single cable can carry both reference sync and timecode to the Vicon Lock unit.

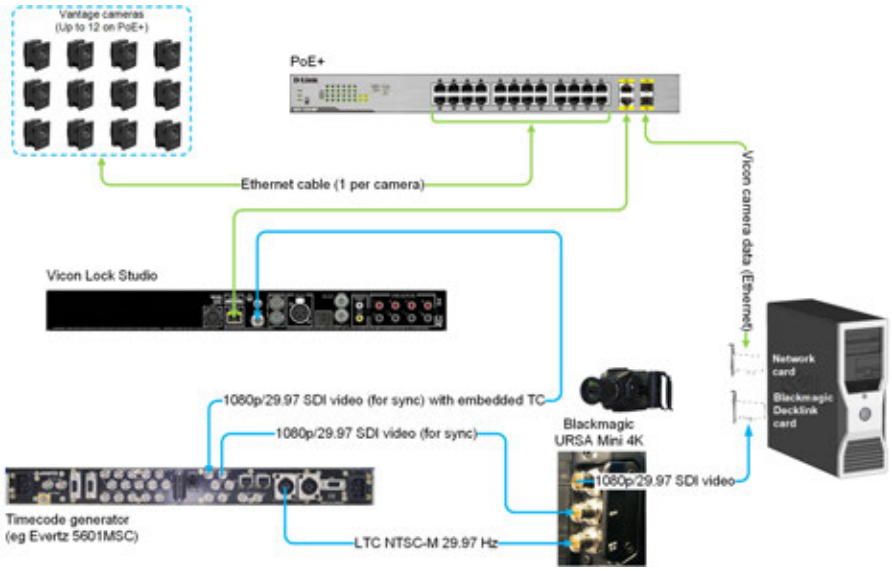
> **Note**
> In the following instructions and except where differences are noted, references to Vicon Lock units apply to Vicon Lock, Vicon Lock+ and Vicon Lock Studio.

To connect the system components:

1. On the Blackmagic URSA Mini 4K:
   a. Connect **SDI Out** to the input on the DeckLink card on the PC that will run Shogun Live.
   b. Connect **SDI In** to **TG1-2** on the Evertz 5601MSC.
   c. Connect **REF IN / TC IN** to **LTC OUT 1**on the Evertz 5601MSC.
2. Connect from the Evertz 5601MSC to the Vicon Lock unit, depending on your Lock model:
   - **Vicon Lock or Vicon Lock+**: Connect **SYNC 1** on the Evertz 5601MSC to **REF LOOP** on the Lock or Lock+. Put a 75Ω terminator on the other **REF LOOP** connector. (Note that Lock or Lock+ can capture only PAL (25 Hz) or NTSC (29.97 Hz): for true 30 Hz, you must use a Lock Studio.)



- Vicon Lock Studio: Connect TG1-1 on the Evertz 5601MSC to SDI In on the Lock Studio.



Choose shutter duration, video standard and system frame rate

The SDI video standard frame rate and Vicon system frame rate must both be multiples of the same SMPTE base rate. The SMTPE base rates are 23.98 Hz, 24 Hz, 25 Hz, 29.97 Hz, and 30 Hz.

As shown in the following table, it is usually best to have the Vicon system rate higher than the video standard frame rate, so that the Vicon cameras can accurately track fast movement, but so the video cameras do not produce data at a rate that is higher than the PC can capture.

Base rate (Hz)	SDI video standard	Vicon system frame rate (Hz)
24	1080p/24 (1x)	96 (4x)
25	1080p/25 (1x)	50 (2x)
25	1080p/50 (2x)	100 (4x)
29.97	1080p/29.97 (1x)	59.94 (2x)
29.97	1080p/59.94 (2x)	119.88 (4x)

Note
Vicon Active Wands do not work at system frame rates below 50Hz.

When the system is set up in this way, the Vicon system strobes several times during each video frame. The active wand calibration device also strobes in sync with the optical system, so when the wand is moving, the video camera may see it in more than one place during each video frame. For this reason the shutter duration must be set within a particular range:

- If the shutter duration is set too low, the camera may not see the wand at all because the shutter is not open while it is strobing.
- If the shutter duration is set too high, the camera will see the wand in several places because the wand strobed more than once during the period the shutter was open.

The first situation is easy to spot by looking at the video screen on the camera. As long as the video is synced to the same source as the Vicon system, the strobes are clearly visible. If they are not, increase the shutter duration to cause them to appear.

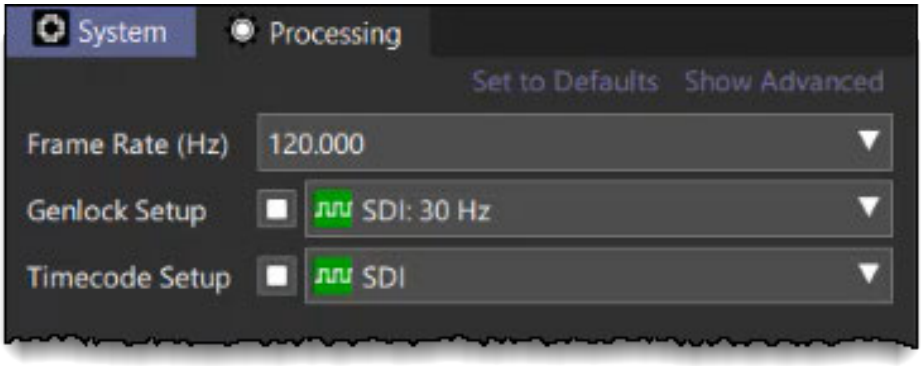
The second situation is harder to spot. You can detect it by pausing live video of a wand wave in Shogun Live and carefully stepping through the video frames to look for multiple wands. Alternatively, set the shutter duration to a safe maximum value, as shown here:

Base rate (Hz)	SDI video std	Video frame period (ms)	Vicon system rate (Hz)	Vicon frame period (ms)	Vicon frames per video frame	Safe max. shutter duration
25	1080p/25 (1x)	40	50 (2x)	20	2	1 / 60 = 16.7 ms
25	1080p/25 (1x)	40	100 (4x)	10	4	1 / 120 = 8.3 ms
25	1080p/50 (2x)	20	100 (4x)	10	2	1 / 120 = 8.3 ms
29.97	1080p/ 29.97 (1x)	33.4	59.94 (2x)	16.7	2	1 / 60 = 16.7 ms
29.97	1080p/ 29.97 (1x)	33.4	119.88 (4x)	8.3	4	1 / 120 = 8.3 ms
29.97	1080p/ 59.94 (2x)	16.7	119.88 (4x)	8.3	2	1 / 120 = 8.3 ms

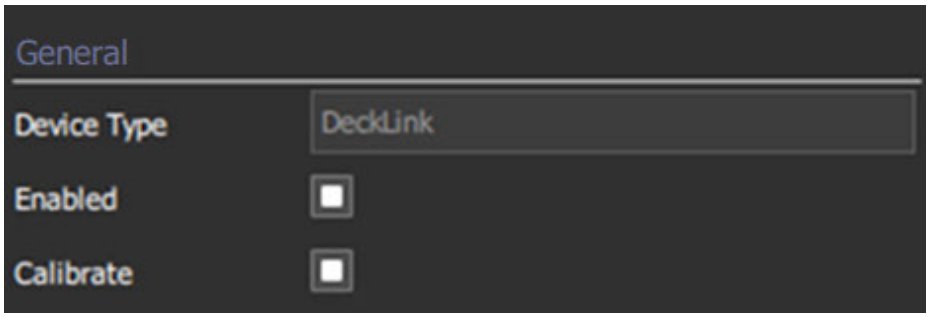
> **Caution**
> It might seem a good idea to reduce the shutter duration during calibration and then increase it afterwards for capture. However, this is not good practice because the shutter timing on the Blackmagic URSA 4K Mini is not center-aligned. In other words, the middle of the shutter-open time shifts as the duration is changed. If your video is always too dark, it may be better to reduce the Vicon system frame rate for calibration and increase it afterwards for capture, or choose a higher frame rate video standard.

Set up the video input device

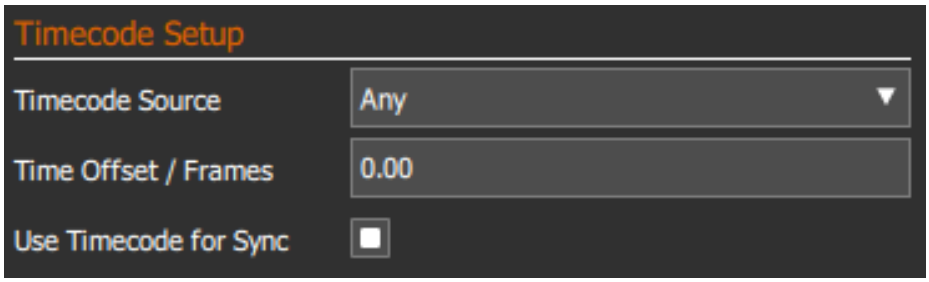
1. On the **System** tab, ensure the required frame rate is selected (Choose shutter duration, video standard and system frame rate).



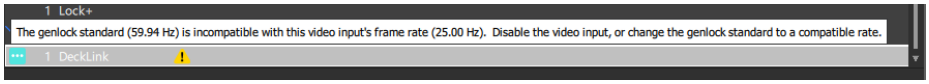
2. In theSystem Properties for the video input device, in the **General** section, ensure the **Enabled** and **Calibrate** options are selected.



3. Under **Timecode Setup**, ensure that **Use Timecode for Sync** is selected.



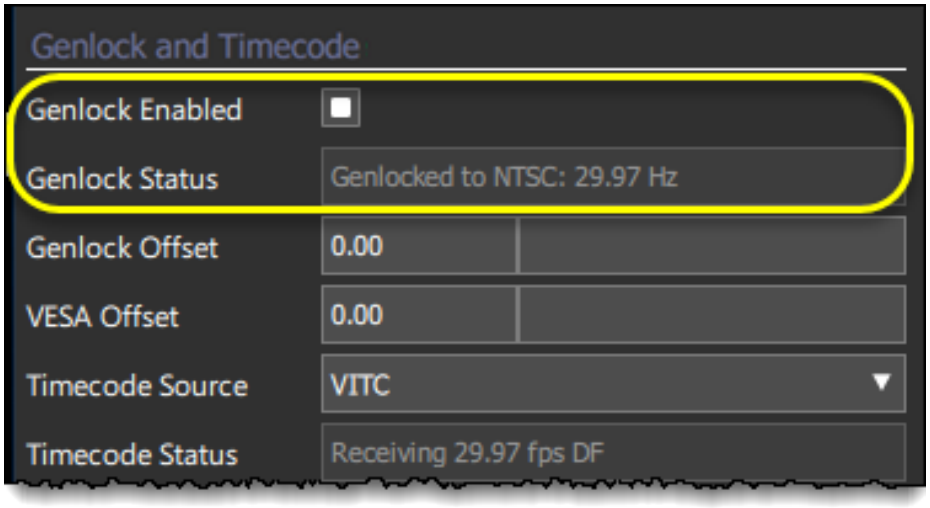
4. Ensure that the video standard is compatible with the Vicon system standard, and that there are no warnings such as this one:



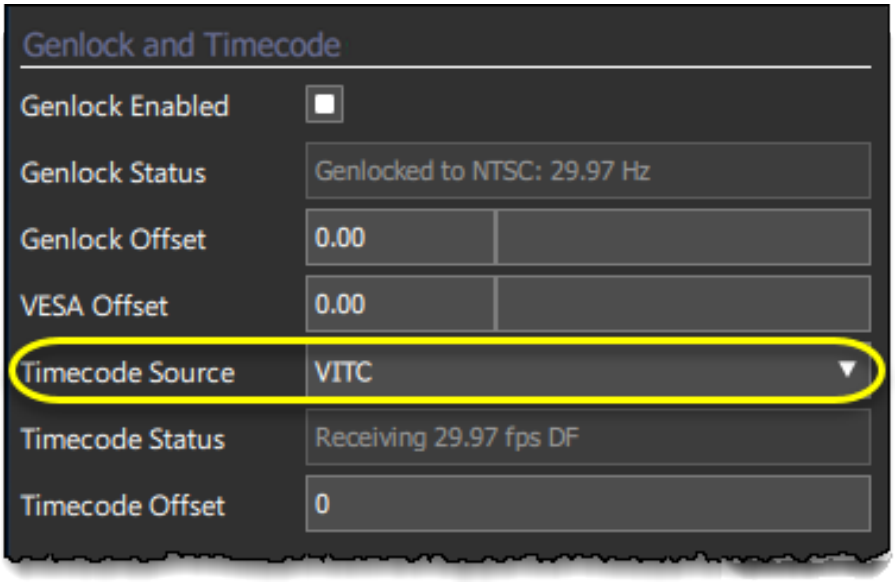
5. Ensure that the correct timecode is present on the video. You should be able to see it counting up.

Set up the connectivity device

1. Go to theSystem Properties for the Vicon Lock unit, and in the **Genlock and Timecode** section, ensure that **Genlock Enabled** is selected.
2. Ensure that **Genlock Status** shows that the Vicon Lock unit is genlocked.



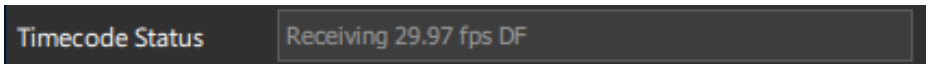
3. Ensure that a valid timecode source is set for the Lock unit.
   - **Lock or Lock+** Set the timecode source to VITC.



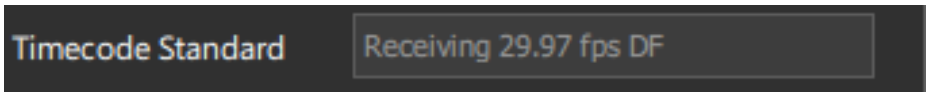
   - **Lock Studio** Set the timecode source to SDI.

4. On the **Capture** tab on the right, in the **Data Capture** panel, ensure that the system is genlocked and has timecode. This is indicated by two green circles.

5. If you are running at 29.97Hz timecode, ensure that drop-frame modes are compatible between the Vicon Lock and the video input device. For example, if the Lock shows this:



The video input should show this:



Calibrate the SDI video system

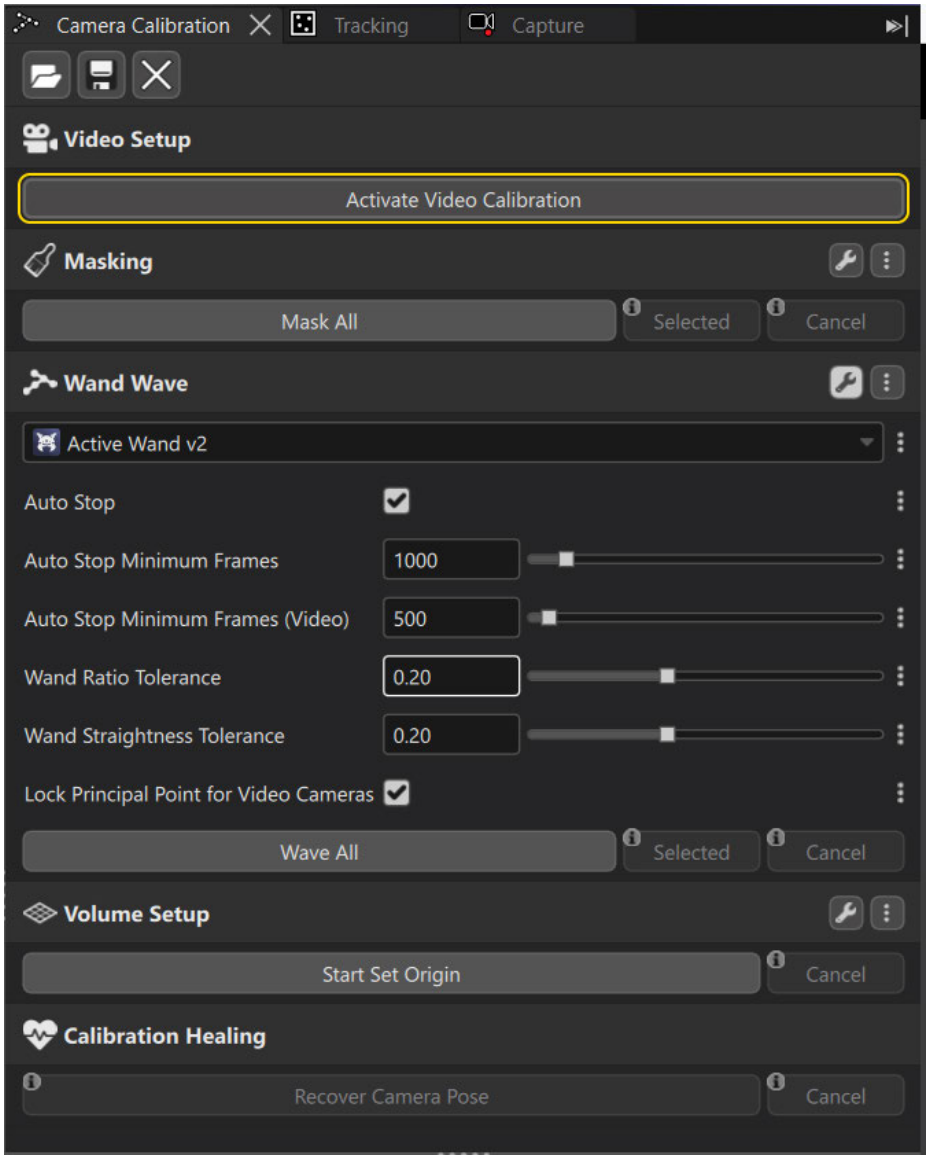
Before attempting to calibrate, ensure you have completed all the steps in the previous sections (for a list of the relevant sections, see Setting up video cameras for Vicon Shogun, page 2).

Note that tracked circles are not visible until you select Activate Video Calibration, as described below.

If you want to add an SDI camera to a Vicon system that is already calibrated, see also SDI lens calibration example *in Getting started with Vicon Shogun*.

1. In the **Camera Calibration** panel, display the advanced options and click **Activate Video Calibration**.

Set up an SDI video camera in Shogun Live



Tip: If you can't see any tracked circles on the wand, this may be due to the system and camera not being frame-aligned. To correct this, in the **Genlock & Timecode Settings** section, drag the slider for the Advanced setting, **Genlock Offset,** until the circles appear.

2. Ensure that video camera is positioned so that items in its field of view, including the wand, can also be seen by the Vicon cameras.

3. As normal, mask out any artifacts that could be mistaken for circles by selecting **Start Masking**. To ensure that the image is not so bright that the whole view is masked, but not so dark that the camera is prevented from seeing the wand, do one of the following:
   - On the camera, reduce the aperture, ensuring that the wand is still visible; or
   - In Shogun Live, go to the System Properties for the Decklink card and in the **Optical Setup** section, adjust the **Threshold** setting.

     Tip: A setting of 0.6 is a good starting point for most studios, but for a very bright space, you may need a slightly higher value.
4. Click **Start Wave** and ensure that the wand is waved so that it is seen by the SDI video camera as well as the Vicon cameras.

   Note that video cameras normally see less wand information than optical cameras: half the amount seen by the optical cameras is usually enough for a good calibration.
5. During calibration, any time offset between the video camera and the system is calculated and automatically applied. If necessary, you can change the offset in the **Timecode Setup** section of the DeckLink properties.

6. With video calibration turned off, you can now set the origin as normal.