greenMachine® Datasheet

Testor AV
Video and Audio Testing

packages:
GMPT TESTOR AV
licenses:
GMC-TESTOR AV-titan

~~callisto+~~
✓ titan

4x3G/1x12G Test Signal Generator & AV Sync Measurement Tool

Description

The greenMachine Testor is a multi-format video and audio test signal generator plus audio/video delay analyzer and measurement tool. This is the ideal solution for the verification, troubleshooting and alignment of AV systems either in the field as a portable device, or rack mounted with network control in a studio installation.

The greenMachine Testor has two primary modes of operation:
- **Single Channel UHD:** Single link or quad-link (2SI) 12G-SDI
- **Quad Channel HD:** Four independent 3G-SDI channels

The greenMachine Testor offers a library of industry standard test patterns which include SDR static patterns, HDR static patterns, and dynamic (moving) patterns. All patterns can be customized with logos and text overlays if needed. You also have the ability to upload your own custom design test patterns.

The powerful AV delay analyzer and measurement tool allows for the precise measurement of the audio/video delay in 64 simultaneous channels of embedded audio in a 12G signal (or 16 channels in 3G). Simply feed the Testor pattern output into the signal path to be analyzed and then back into the Testor input. The results are shown graphically in LynxCentraal to visually identify early or late timing with a precise AV delay measurement of each audio channel.





Functions

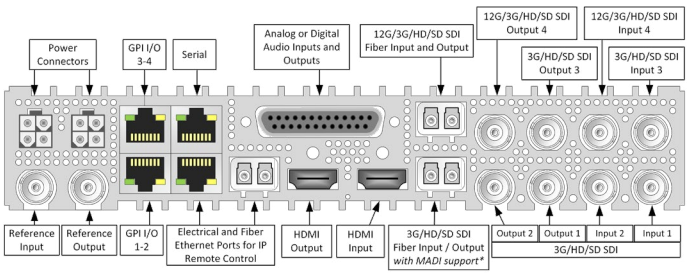
AV Sync:	**Generator:** Multi-channel GLITS AV Test signal **Analyzer:** Measure delays of audio channels **Overlay:** Visualize measurements and overlay them on output signal. Two greenMachines running Testor needed
Test Signals:	38 SDR + 8 HDR test signals and patterns
User-defined Signal Patterns:	Upload user-defined and customizeabe signal patterns logos and text
HDR Test signals:	Test patterns for PQ, HLG and SLOG3
Integrated Overlay Editor:	Tool to place images and logos, add text, and user-defined signals, patterns, and graphics
Audio Test Generator:	16-channel audio test generator with adjustable level, phase, frequency, mix-down, and an EBU/AV sequence. Audio signals can be embedded into the SDI video output(s) and/or routed to the external audio outputs
AV Delay Test:	Test signal generator which is compatible with most standard AV delay meters. Not for use with AV Sync Analyzer.
H/V Rolling:	Horizontal and vertical rolling and speed adjustments.
Link Indicator:	For UHD signals, allows indication of 2SI link on quad link channels.
MADI Signal:	Generate a 64/56 channel MADI Signal and use audio crossbar to assign 16-channel audio test generator. (MADI transmission requires optional SFP)

Want to see more?
Visit the Testor AV Real World Application page for tutorials, demos and further information.

https://lynx-technik.com/portfolio/testor-av/

Front- & Backpannel





Technical Specifications

Operation Modes
- 12G UHD single channel configuration
- 3G HD quad channel configuration

Input / Output Data Range
- Full range : Video signal representation (10bits) in full range of values from 0 to 1023 decimal (according to ITU BT 2100)
- Narrow range : Traditional video signal (10 bits) in range of values from 64 to 940 decimal

Feature: AV Delay Compensation

The "AV Delay Compensation Feature" is an automated delay compensation of any audio and video processing installation available for Testor AV and LynxCentraal. It offers the convenient choice of a single click action or an extensive dialogue for correction settings, including backups of results. Both include the option to correct switched audio channels, if necessary.

With the AV Delay Correction feature any processing path up to 12G-SDI (excl. 6G-SDI) can be automatically tested, measured, and corrected. Besides a greenMachine with a TestorAV constellation, and a PC or MAC with LynxCentraal version 1.6.0 installed, a second greenMachine titan with a compatible constellation is recommended (for example HDR Evie+, HDR Static, UPXD).

Recorded delay settings can also be applied to a greenMachine callisto+ with 2C UPXD deployed. Please note that no default constellation of any greenMachine is able to correct audio delays, a compatible constellation is always necessary. If necessary, the same greenMachine titan that was used to measure the delay with Testor AV can be used to apply the corrections. For this, a compatible constellation has to be deployed on the machine and the recorded delay settings need to be applied.

Connect an output of the greenMachine Testor AV to the input of your system under test. Return the signal from the output of the system under test back into the greenMachine Testor AV. If your second greenMachine is part of the processing path (for example as an Up / Down / Cross Converter) route the output signal of that greenMachine to the first greenMachine with Testor AV.

To test the signal chain, connect your greenMachines and PC or MAC via ethernet. Start LynxCentraal and enter the "green" section. Select your greenMachine with Testor AV and double click the generator on the desired processing path (Purple Column) and enable the "AV Sync Generator Enable" parameter on the right.

Return to the overview of the grenMachine with Testor AV (Click the "FIT" button next to the plus and minus button on top of the viewport) and double click the corresponding input in the MIX IN (Orange Column) section that displays the measured delays as bar graphs. Here you can instantly apply the correction to a target greenMachine.

For a more extensive test with the options to save and restore results, the bottom part of the MIX IN column offers the "AV Delay Recording and Compensation" function. The popup dialogue will extensively explain each option and step. Should more details be necessary, please refer to the Quick Reference Guide for Testor AV.

Additional Notes

The following points are some technical limitations and quality-of-life improvements, should you encounter issues during the test:

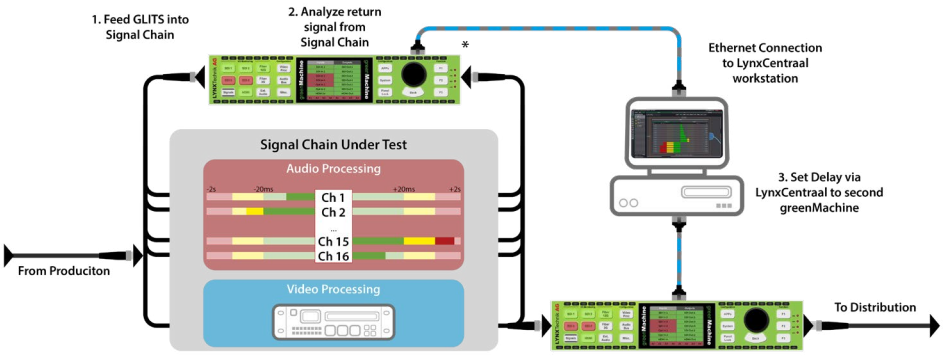
1. The AV Delay Compensation can test and monitor up to four paths with 16 audio channels each in 3G, or 64 audio channels in 12G.
2. The system under test can be connected via BNC or Fiber, but not via HDMI.
3. It is generally recommended to connect your greenmachines to the same reference signal as your usual SDI Reference and enable the "Source in Sync" checkbox in the target greenmachine to avoid complications during measuring and correction.
4. The greenMachine Testor AV does not need to be present in the signal chain after the measurement is taken.
5. We generally recommend measuring multiple points over time to reduce measurement errors because of exceptional measurement results
6. Measurements that have been exported are XML files that can be imported and applied at any time. Results of a measurement that aren't exported will be lost when exiting LynxCentraal.

Workflow Example: AV Delay Compensation Setup and Workflow

Setup to Measure and Correct with dedicated greenMachines

To conveniently correct the measured delay in three easy steps, without re-deploying a different license on the same machine follow the diagram to the right.

The greenMachine used for testing does not need to remain in the signal chain, and can be re-used in other setups.



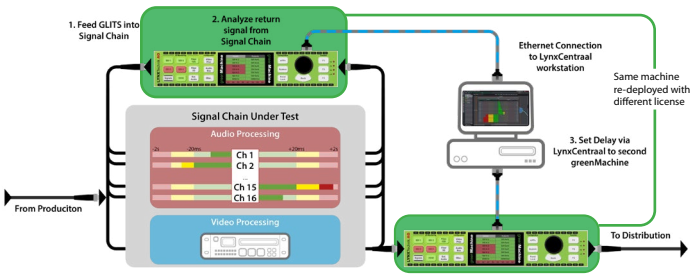
* This greenMachine can be removed one the measurement has been taken.

Setup to Measure and Correct with same greenMachine

If the same greenMachine is used to measure and correct the delay an instant correction is not possible, since the target machine with Testor AV deployed on it does not support setting a delay for a throughput signal.

The results of a measurement will have to be (temporarily) saved in LynxCentraal and applied to the machine, once it's reconnected at the output of the Signal chain under test.

Please note that any delay caused by processing in the greenMachine can not be measured if it wasn't present for the measurement in it's processing configuration.



Feature: AV Sync Generator / Analyzer

The AV Sync Generator and Analyzer feature allows synchronization measurements between multi-channel audio and video within a signal path. To use this measurement methodology, an AV Sync Generator is activated through the selected test pattern and passed through the signal path to be measured.

The generated test signal includes video and audio markers, which use the "GLITS" (BBC) audio test signal standard for that purpose. The video marker consists of a horizontal black line in the center of the video image, flashing into one frame every four seconds (the "Black Flash"). In addition, two black bars moving toward each other and colliding in the middle (commonly referred to as "Clap Bars") indicate the upcoming Black Flash to the watcher. The audio markers are small gaps in the tone that begin with a precise timing relationship to the Black Flash. The test signal uses 4 different frequencies to detect audio channel swaps.

The generated video and audio markers can be activated on most existing test signals in the greenMachine's Testor constellation. Up to four so-called GLITS test signals can be generated (one in 12G mode).

Up to four signal chains can be measured simultaneously and the measurement results are shown within LynxCentraal. In addition, the measurement results of one input channel can be overlayed on the incoming measured signal and routed out of greenMachine's SDI output 4, the optical, or HDMI output for external monitoring. (If SDI output 4 is used for the measurement overlay, it can't be used for the generator side anymore.)

It is possible to use one greenMachine as an AV Sync generator and analyzer at the same time.



AV Delay Measurements in LynxCentraal

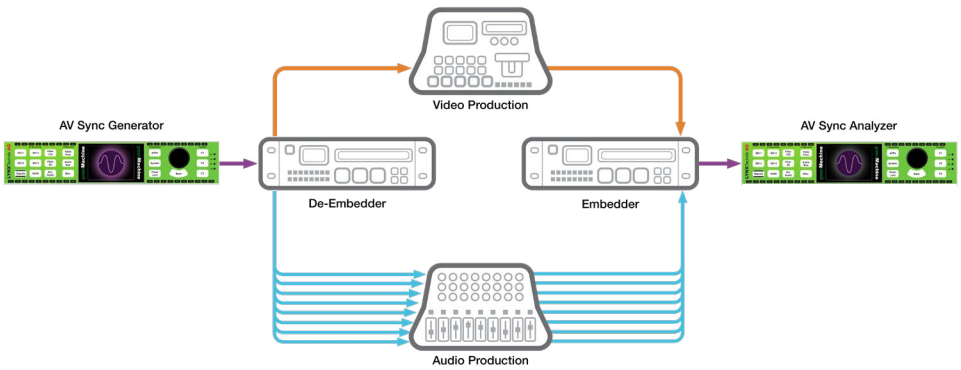
Incompatible Test Patterns

Some test patterns cause interference with the AV Sync Generator. The AV Sync Generator is not available with these patterns:

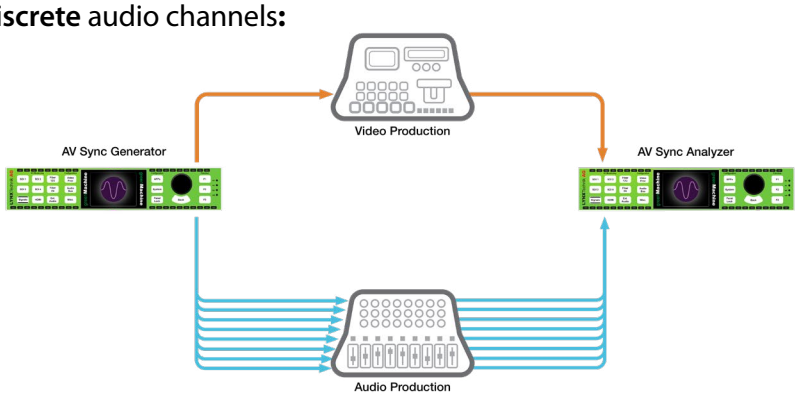
EBU AV Sync (SDR and HDR)	Colorbar SMPTE
HDR PLUGE BT.814 (HLG and PQ)	Strobe Pattern
Flash Black	Flash White
Convergence Grille	Persistence Test
Four-Level PLUGE	Full Field Black

Workflow Example: Working with Embedded and Discrete Audio Channels

AV Sync Workflow with **embedded** audio channels**:**



AV Sync Workflow with **discrete** audio channels**:**

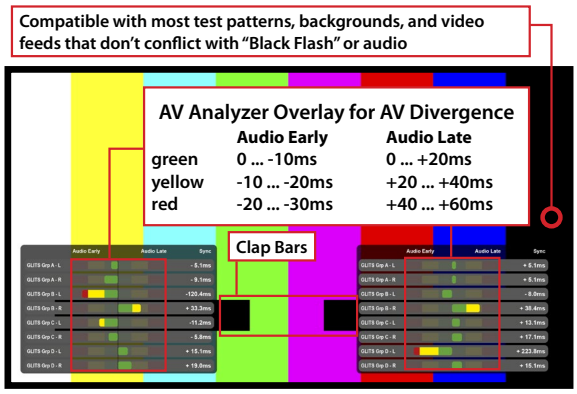


Feature: AV Sync Analyzer Overlay

The AV Sync Analyzer Overlay feature makes it possible to show the measured delay as a burn-in on SDI output 4 of the greenMachine. This feature is useful for monitoring unexpected changes in the AV delay over time and applying delay compensation if necessary.

To enable the overlay, double-click the bottom section of the generator column in Lynx Centraal (labeled "AV Sync Overlay"). Select which MIX In Analyzer source you want to overlay and which Audio Source (Embedded SDI or External AES) you wish to present. Please note that 12G-SDI requires a second machine to analyze the pattern.

The divergence bars of the overlay are color-coded to present audio early/late in different criticality segments. Please note that Audio Early and Late bars are not split equally, since a delta in audio early is considered a more critical issue than audio late.

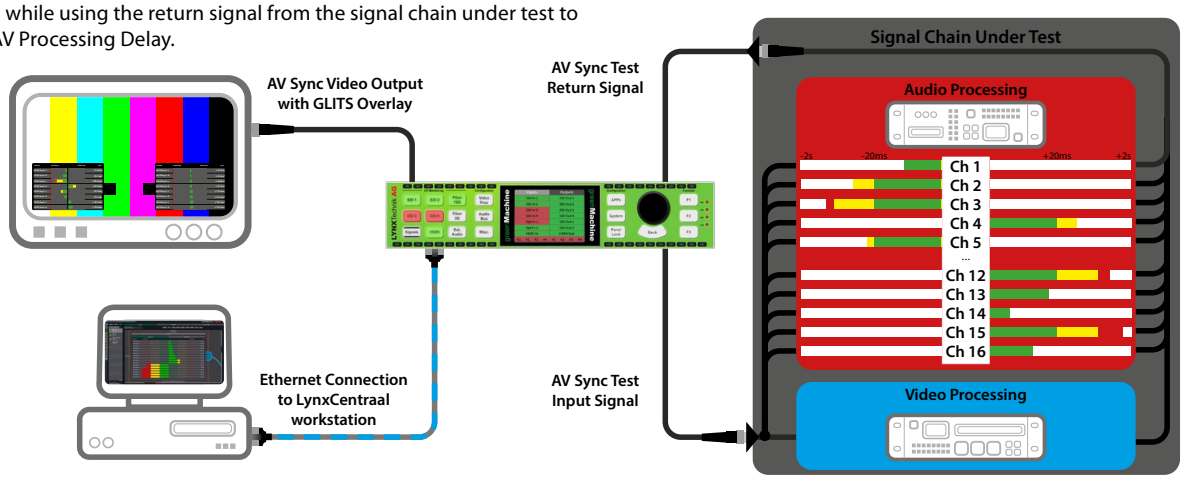


AV Sync Analyzer Overlay
on Standard Colorbars

Workflow Example: Setup for AV Sync Analyzer Overlay

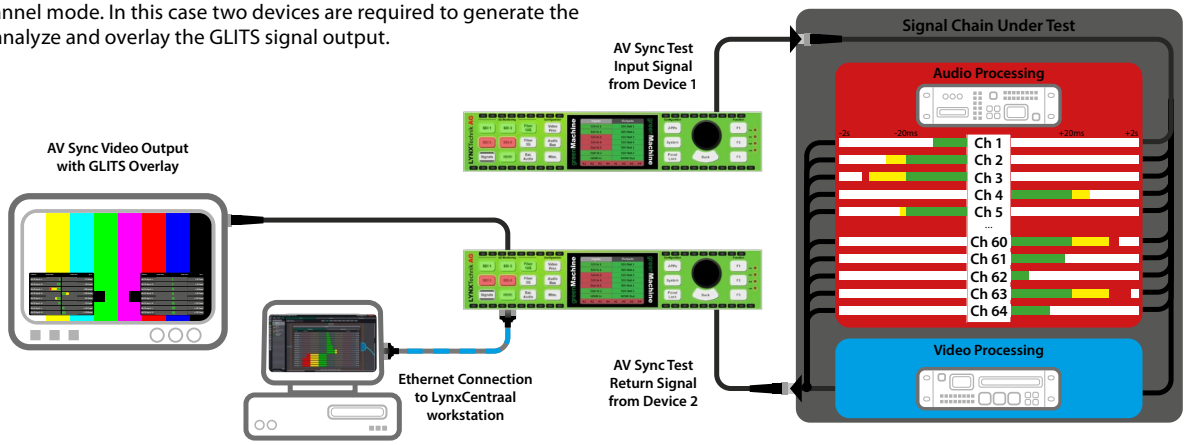
Single Device 3G-SDI Setup:

If the greenMachine is used for 3G, HD or SD applications Testor AV can operate in a quad channel mode. While usually this enables the user to process four fully independent signals, one channel can also be used to output the GLITS signal overlay, while using the return signal from the signal chain under test to measure the AV Processing Delay.



Dual Device 12G-SDI Setup:

If the greenMachine is used for 12G UHD applications Testor AV can only operate in a single channel mode. In this case two devices are required to generate the GLITS and to analyze and overlay the GLITS signal output.



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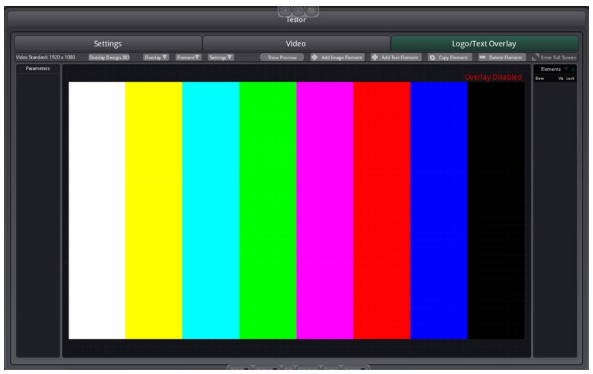
Testor AV GMPT-Testor AV GMC-Testor AV
Video and Audio Testing with AV Sync Generator and Analyzer

callisto+ titan

Feature: Test Pattern Generator

Testor AV inherits all Test Patterns from Testor, including a wide range of Standard Patterns (to correct Color Corrections, Screen Distortions, and more), HDR Patterns, and Dynamic Patterns.

In addition, custom test patterns can be loaded via LynxCentraal to be displayed. Test Patterns can be modified by placing text or images. The layout can be saved and copied to other generators. This can be useful to identify monitors, including branding or notes.



Customization Settings for Logo/Text Overlay

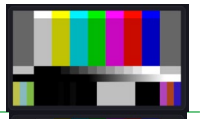
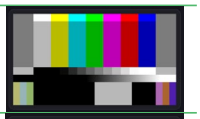
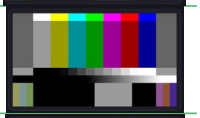
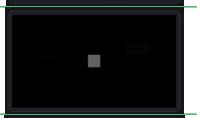
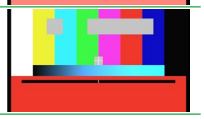
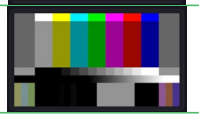
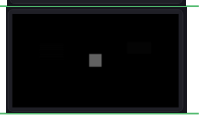
Standard Test Patterns

- Center Sweep
- Convergence Grille
- Color Temperature
- Flash Black
- Flash White
- Four-Level PLUGE
- Frequency Sweep
- Multiburst
- Pathological EQ
- Pathological EQ/PLL
- Pathological PLL
- Persistence Test
- Ramp Down Y
- Ramp Up CB
- Ramp Up CR
- Ramp Up Y
- Ramp Up YCbCr
- Staircase
- Zoneplate
- Zoneplate Moving

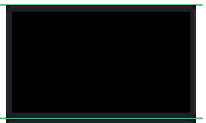
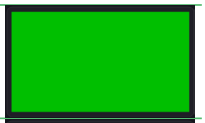
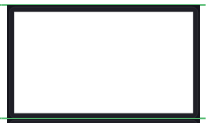
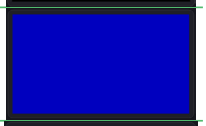
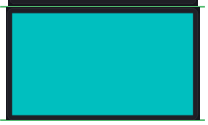
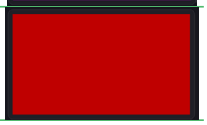
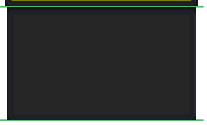
Color Bars

- Color Bar 100%
- Color Bar 75%
- Color Bar 75% over Red
- Colorbar SMPTE
- EBU AV Sync
- Field Pattern Colorbar/Red
- Field Pattern Red/ Colorbar

HDR Test Patterns

HDR Colorbar BT.2111 HLG Narrow 	HDR Colorbar BT.2111 Slog3 Full 	EBU AV Sync HLG Narrow 
HDR Colorbar BT.2111 PQ Full 	HDR PLUGE BT.814 HLG 	EBU AV Sync PQ Narrow 
HDR Colorbar BT.2111 PQ Narrow 	HDR PLUGE BT.814 PQ 	

Full Field Color Tests

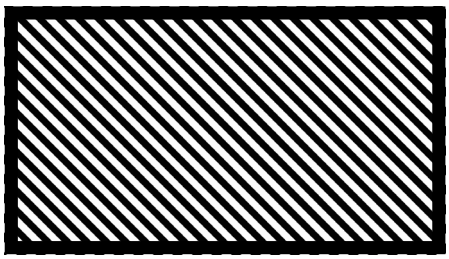
Full field Black 	Full field Green 	Full field White 
Full field Blue 	Full field Magenta 	Full field Yellow 
Full field Cyan 	Full field Red 	Grey 15% 

Dynamic Test Patterns for Large Scale LED Panel Display

Zebra Pattern

The Zebra Pattern is a display tearing and aspect ratio validator. The 45° angled, 20px wide, black and white bars move across an entire array of panels at the speed of 1px per frame. Individual delays of panels can easily be noticed this way.

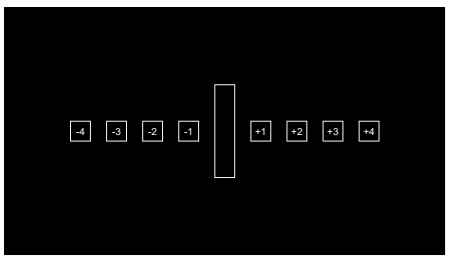
A precise delay in frames or ms can be calculated in regards of the frame rate of the display. Please note that greenMachine Testor can not change the individual delay of led panels.



Strobe Pattern

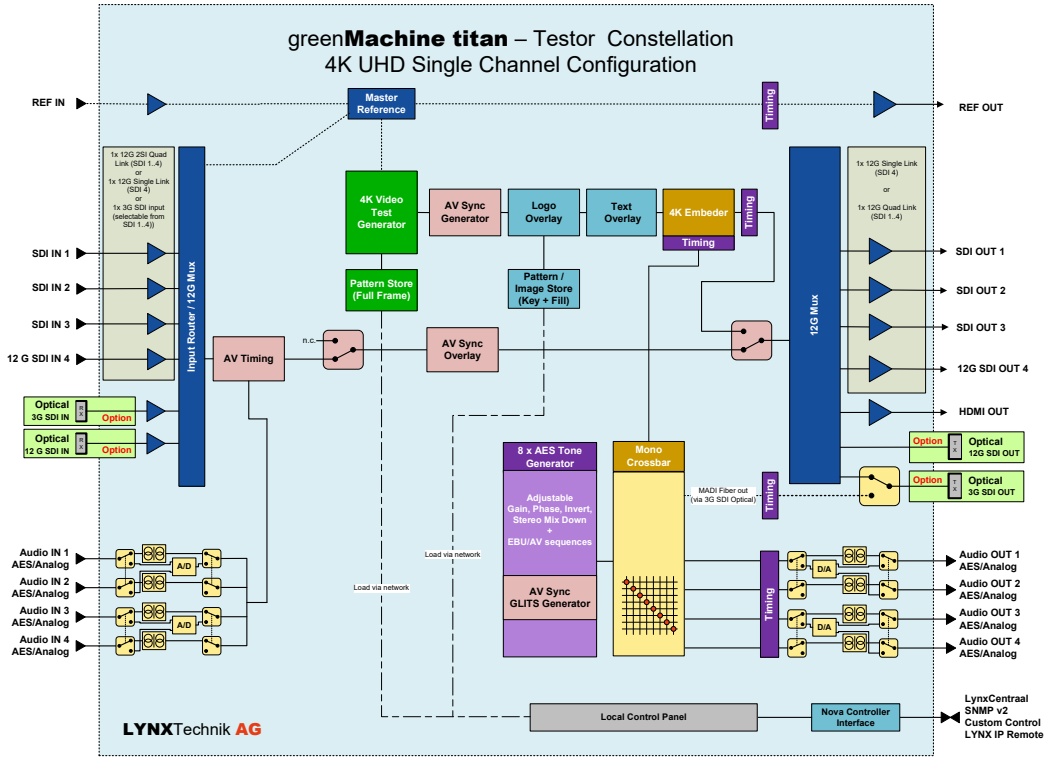
The background strobes one white frame periodically every 100 frames. If synchronization of all displays is accurate, a simultanious strobe will be visible.
To veryfy sincronicity a synchronized (genlocked) or high-speed camera has to film the screens.

The counters to the left and right of the sync bar will indicate how many frames ahead or behind any individual display is.

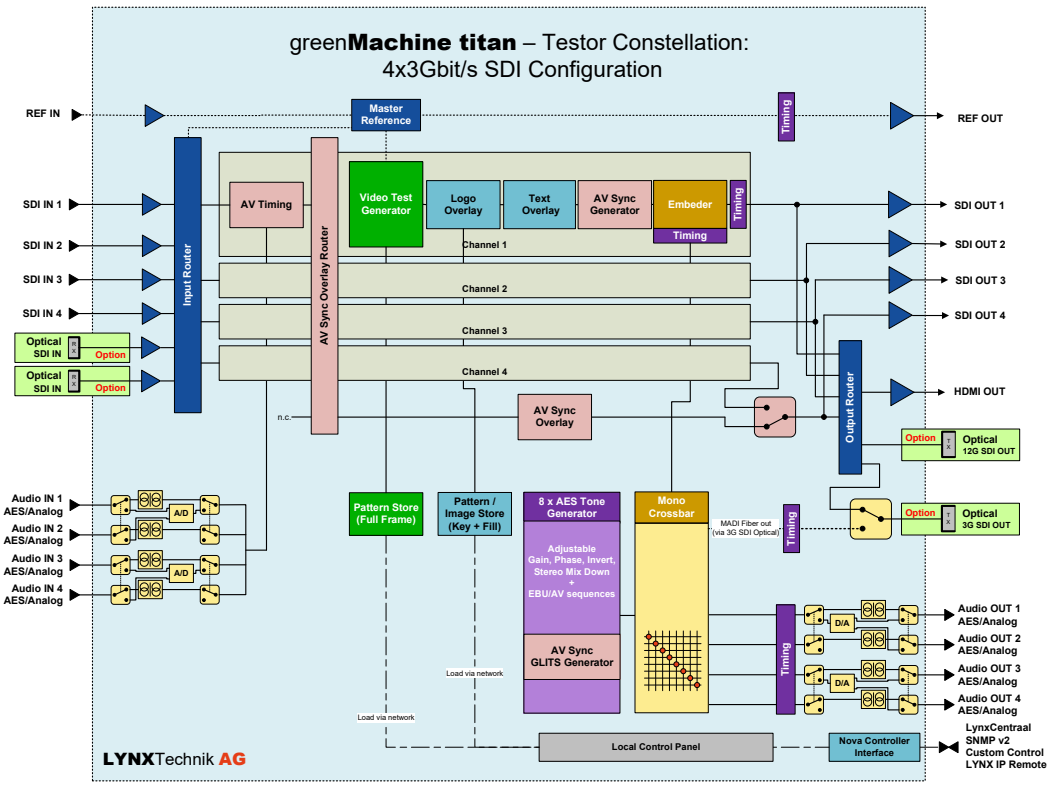


Functional Diagram

12G-SDI Single Channel Mode



3G-SDI Quad Channel Mode



greenMachine®

Testor AV GMPT-Testor AV GMC-Testor AV
Video and Audio Testing with AV Sync Generator and Analyzer

callisto+ titan

Hardware Specifications

BNC Connection

SDI Inputs	4x 3G-SDI video on 75 Ohm BNC connector (SMPTE 259M, 292M, 424M) with automatic video format and standard detection	
	Return Loss:	>15dB from 5MHz to 1.5GHz, >10dB from 1.5GHz to 3GHz
	Automatic cable EQ (Belden 1694A):	340m @ 270Mbit/s, 150m @ 1.5Gbit/s, 110m @ 3Gbit/s
12G-SDI Input*	1x 12G-SDI video on 75 Ohm BNC connector [Input 4] (SMPTE 259M, 292M, 424M, 2082) with automatic video format and standard detection	
	Return Loss:	>4dB to 12GHz
SDI Output	4x 3G-SDI video on 75 Ohm BNC connector (SMPTE 259m, 292M, 424M)	
	Timing jitter:	< 0.2 UI @ 270Mbit/s, < 1.0 UI @ 1.5Gbit/s, < 2.0 UI @ 3Gbit/s
	Alignment jitter:	< 0.2 UI @ 270Mbit/s, < 0.2 UI @ 1.5Gbit/s, < 0.3 UI @ 3Gbit/s
	Return Loss:	>15dB from 5MHz to 1.5GHz, >10dB from 1.5GHz to 3GHz
12G-SDI Output*	1x 12G-SDI video on 75 Ohm BNC connector [Output 4] (SMPTE 259M, 292M, 424M, 2082)	
	Return Loss:	>4dB to 12GHz
Reference Input	• 1x analog video reference on 75 Ohm BNC connector • Analog bi-level (SDTV) or tri-level (HDTV) auto detect	
Reference Output	• 1x analog video reference on 75 Ohm BNC connector • Analog bi-level (SDTV) or tri-level (HDTV), cross lock capability	

Supported SDI Formats

SDTV	525 / 59.94Hz 625 / 50Hz		
HDTV	1080i / 50Hz 1080i / 59.94Hz 1080i / 60Hz 1080p / 23.98Hz 1080p / 24Hz 1080p / 25Hz 1080p / 29.97Hz	1080p / 30Hz 1080psf /23.98Hz 1080psf / 24Hz 1080psf / 25Hz 720p /23.98 Hz 720p / 24Hz 720p / 25Hz	720p / 29.97Hz 720p / 30Hz 720p / 50Hz 720p / 59.94Hz 720p / 60Hz
3G-SDI Level A/B	1080p / 50Hz 1080p / 59.94Hz 1080p / 60Hz		
12G-SDI* Single Link	3840 x 2160p / 50Hz 3840 x 2160p / 59.94Hz 3840 x 2160p / 60Hz		
12G-SDI* Quad Link 2SI Level A (4 x 3G)	3840 x 2160p / 50Hz 3840 x 2160p / 59.94Hz 3840 x 2160p / 60Hz		

***NOTE:** 12G-SDI operations not supported on 3G-SDI constellations and constellation modes (i.e. 3G-SDI quad channel configuration)

Optical Connection (optional SFP required)

Fiber I/O	• 1x 3G-SDI SFP Transceiver (SMPTE 297M - 2006) • 1x 12G-SDI SFP Transceiver (SMPTE 292M, 424M , 2082) • no SD SDI (270MBit) and no 6G-SDI**
Optical Ethernet	IEEE 802.3z 1000Base-X Gbit/s Ethernet over Fiber at 1Gbit/s (125 MB/s)

****NOTE:** 12G-SDI SFPs can be used with 3G constellation and constellation modes, but only support 3G-SDI signals

AV Connection

HDMI	• 1x Input 10 bit HDMI 1.4b • 1x Output 10 bit HDMI 1.4b

Audio Connection

Audio I/O	4x input and 4x output on Sub-D 25 female connector
Analog I/O	input impedance >10k Ohm Output Impedance 150 Ohm
	Analog I/O full scale level: selectable 12, 15, 18, 20, 22, 24 dBu
Digital	AES3 balanced transformer isolated; Digital output level: 4V peak to peak nom
MADI	64 channel MADI supported on selected constellations (optional MADI SFP reqired for this)

Technical Information

Power	12V DC @ 45W nominal (supports 7 - 24VDC input range)
	2x power connections for redundant power supply
Mechanical	W: 218mm (1/2 19"), H: 44mm (1.75"), D: 225mm (8.86") - incl. connectors
	Weight: 1.4kg (3.09lb)
Ambient	Temperature: 5°C to 40°C (41°F to 104°F) maintaining specification
	Humidity: 90% maximum, non-condensing

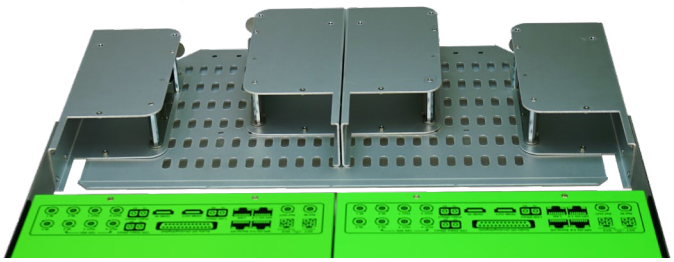
Network Connection

Ethernet (LAN)	1x 10/100/1000 BaseT RJ45 Connector
GPI I/O	• 4x general purpose inputs (RJ45 Connector) • 4x general purpose outputs (RJ45 Connector)
Serial Data	EIA/ETA RS232C / RS422 /RS 485 (selectable through LynxCentraal) - RJ45 connector ESD protection for up to 16kV

Options

RXT 6001 19" Rack Extension for RFR 6000

The RXT 6001 is a compact and flexible rack extension for RFR 6000. It can be setup to hold up to four RPS A100 power supplies with optimized airflow surfaces.

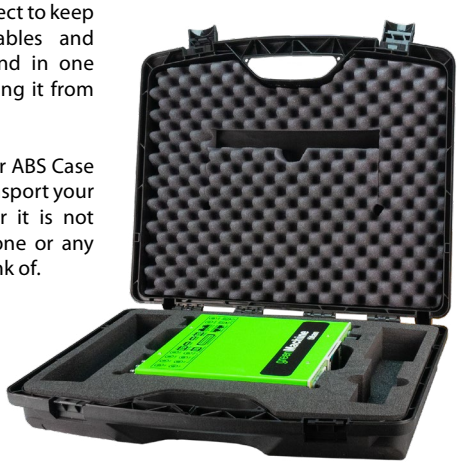


RXT 6001 installed in RFR 6000

ABS Case for greenMachine

The transport case is perfect to keep your greenMachine®, cables and documents organized and in one place, while also protecting it from enviromental influences.

With it's study design, our ABS Case is the ideal partner to transport your greenMachine® whenever it is not wired in a rack, standalone or any other system you can think of.



Ordering Information

greenMachine Package			
Includes	**GM 6840:**	greenMachine titan Processors	
	GMC-TESTOR AV-titan:	greenMachine titan - UHD 12G-SDI or 4x 3G-SDI Audio & Video Test Signal Generator. With AV SYNCH Analyzer functionality (Constellation Licence)	
	RFR 6000	Rack Frame for 1 or 2 greenMachines (without power supplies)	
	2x RPS A100:	Primary and Redundant Power Supplies with Region Specific Power Cord	
GMPT TESTOR AV (N/EU/US/UK)	UHD 12G-SDI or 4x 3G-SDI Audio & Video Test Signal Generator. With AV Sync Analyzer functionality(Hardware & License) Power plug Variants (please specify when ordering) GMPT TESTOR AV N Power supply without Plug GMPT TESTOR AV EU Power Supply with EU Plug GMPT TESTOR AV US Power Supply with US Plug GMPT TESTOR AV UK Power Supply with UK Plug		**EAN:** 4250479929357
License Only (no hardware included)			
GMC-TESTOR AV-titan	greenMachine titan - UHD 12G-SDI or 4x 3G-SDI Audio & Video Test Signal Generator. With AV SYNC Analyzer functionality. Constellation Licence. (No Hardware)		4250479929364

More broadcast applications:

- *GMC-TESTOR*: Audio & Video Test signal generator in UHD or Quad 3G mode including HDR test patterns
- *GMC-4KUPXD*: UHD Up/Down/Cross converter
- *GMC-HDREvie+*: Segmented, Dynamic HDR>SDR converter
- *GMC-4FS*: 4x3Gbit/s Frame Synchronizer
- *GMC-3GUPXD*: Dual 3G Up/Down/Cross converter and Dual scaler

The greenMachine hardware can be configured for a different broadcast application by re-deploying a different application called "constellation". These perpetual licenses are and application deployment on the greenMachine.

For greenMachine the following regulatory and safety standards apply:

CE: EN 55103-1/1996, EN 55103-2 /1996, EN 60950-1/2006
Following the provisions of 2004/108/EC and 2006/95/EC directives.

FCC: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15, Subpart B of the FCC Rules.

The RPS A100 power supply (EA11011D-1200) complies with the following safety standards:
UL/cUL 62368-1, TUV EN 62368-1, CB IEC 62368-1, FCC, CE, BSMI, PSE, RCM, IRAM

SFP Fiber Options

12G SDI Video Fiber Transmitter		Power		
OH-TX-12G-LC	12G-SDI Fiber TX SFP - LC - 10km* - 1310nm	-5 dBm		
12G SDI Video Fiber Receiver		**Sensitivity**		
OH-RX-12G-LC	12G-SDI Fiber RX SFP - LC - 10km* - 1270-1610nm	-10 dBm (12G)	-14 dBm (3G)	-16 dBm (1.5G)
12G SDI Video Fiber Transceiver		**Power**	**Sensitivity**	
OH-TR-12G-LC	12G-SDI Fiber Transceiver, Singlemode - 10km* - LC - 1310nm	-5/+0.5 dBm	-10 dBm (12G)	-14 dBm (3G/1.5G)
CWDM SDI Video Transceiver (TR)		**Power**	**Sensitivity**	
OH-TR-4-XXXX-LC **XXXX** = Wavelength	3G-SDI Fiber Transceiver, Singlemode CWDM capable - 40km* - LC 18 wavelengths acc. to ITU T G692.2: 1270 - 1610nm.	-4 ... +2 dBm	-20 dBm (3G/1.5G/SD)	
OH-TR-12G-XXXX-LC **XXXX** = Wavelength	12G-SDI Fiber Transceiver, Singlemode CWDM capable - 10km* - LC 18 wavelengths acc. to ITU T G692.2: 1270 - 1610nm.	-2/+3 dBm	-10 dBm (12G)	-14 dBm (3G/1.5G)

* **Distance is an approximation.** Actual distances achieved can be longer or shorter depending on the type of fiber cable and accumulated optical losses in the fiber link. Determine link losses and perform optical budget calculations to ensure correct operation.
More SFP options are available.