#### greenMachine<sup>®</sup> Testor **GMPT TESTOR AV GMC-TESTOR AV-titan Datasheet** Video and Audio Testing

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



packad

licenses:

#### 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 4k/UHD: Single link or guad-link (2SI) 12G-SDI
- Quad Channel 3G: 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: Analyzer: Overlay:	Multi-channel GLITS AV Test signal Measure delays of audio channels 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 use patterns log	r-defined and customizeabe signal gos and text
HDR Test signals:	Test patteri	ns 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)	

#### Front-/Backpannel greenMachine titan



#### **Technical Specifications**

#### **Operation Modes**

- 4k UHD single channel configuration
- 3G HD guad 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.



GMPT-TestorAV\_DS\_Rev1.1 Specifications subject to change

LYNXTechnik AG<sup>®</sup> | Broadcast Television Equipment





### 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.





#### **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:



GMPT-TestorAV\_DS\_Rev1.1 Specificati

LYNXTechnik AG | Broadcast Television Equipment



## 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.







### 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

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

#### **Standard Test Patterns**

#### **Color Bars**

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

Field Pattern Red/ Colorbar







#### **HDR Test Patterns**



### **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: 4k UHD Single Channel Operation



## **Functional Diagram: 3G Quad Channel Operation**









## **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 (SMPTE 259M, 292M, 424M, 2082) with automatic video format and standard detection			
	Return Loss:	>7dB to 6GHz; >4dB to 12GHz		
SDI Output	4x 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 (SMPTE 259M, 292M, 424M, 2082)			
	Return Loss:	>7dB to 6GHz; >4dB to 12GHz		
Reference Input	<ul> <li>1x analog video reference on 75 Ohm BNC connector</li> <li>Analog bi-level (SDTV) or tri-level (HDTV) auto detect</li> </ul>			
Reference Output	<ul> <li>1x analog video refe</li> <li>Analog bi-level (SD capability</li> </ul>	erence on 75 Ohm BNC connector TV) or tri-level (HDTV), cross lock		

#### **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

#### **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") - including 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

#### **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
3Gbit/s Level A	1080p / 50Hz 1080p / 59.94Hz 1080p / 60Hz		
12Gbit/s* Single Link	3840 x 2160p / 50ł 3840 x 2160p / 59. 3840 x 2160p / 60ł	Hz 94Hz Hz	
12Gbit/s <sup>*</sup> Quad Link 2SI Level A (4 x 3G)	3840 x 2160p / 50ł 3840 x 2160p / 59. 3840 x 2160p / 60ł	Hz 94Hz Hz	

\*NOTE: 12G SDI operations not supported on 3G contellations and constellation modes ( i.e. 3G quad channel confoguration)

#### **Optical Connection** (optional SFP required)

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

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

#### **AV Connection**

HDMI	<ul> <li>1x Input 10 bit HDMI 1.4b</li> </ul>
	<ul> <li>1x Output 10 bit HDMI 1.4b</li> </ul>

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)

#### **Network Connection**

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





# green Machine<sup>®</sup>

## **Options:** Rack Frames, Carry Case, and SFP Options

### RFR 6000 - 1RU 19" Rack Mount Chassis

Rack mounting hardware which can accommodate one or two greenMachines in 1RU of rack space which also securely mounts the power supplies. Note: Two power supplies can be mounted onto one RFR 6000. Please see more information in the RFR 6000 guick reference guide.



One greenMachine in Rack Mount

### 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<sup>®</sup>, 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<sup>®</sup> whenever it is not wired in a rack, standalone or any other system you can think of.



#### SFP Fiber Options (12G variants also support 3G/1.5G SDI)

12G SDI Video Fib	Power			
OH-TX-12G-LC	12G SDI Fiber TX SFP - LC - 10km* - 1310nm	-5dBm		
12G SDI Video Fik	Sensitivity			
OH-RX-12G-LC	12G SDI Fiber RX SFP - LC - 10km* - 1270- 1610nm	-10dBm (12G) -14dBm (6G/3G) -16dBm (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	-10dBm (12G/6G) -14dBm (3G/1.5G)	
CWDM SDI Video	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	-20dBm (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	-10dBm (12G/6G) -14dBm (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.

## **Ordering Information**

greenMachine Package						
les	GM 6840:	greenMachine titan Processor Hardware				
cluc	2x RPS A100:	Primary and Redundant Power Supplies with Region Specific Power Cord				
Ē	GMC-TESTOR:	Testor Constellation Software License				
	RFR 6000	1RU 19" Rack Mount Chassis				
GM (N	MPT TESTOR AV /EU/US/UK)	1 x 12G/4 x 3G SDI AV Test Signal Generator (Hardware & License)Power plug Variants (please specify when ordering)GMPT TESTOR AV NPower supply without PlugGMPT TESTOR AV EUPower Supply with EU PlugGMPT TESTOR AV USPower Supply with US PlugGMPT TESTOR AV UKPower Supply with UK Plug	EAN: 4250479929357			
License Only (no hardware included)						
GN tita	AC-TESTORAV- an	greenMachine titan Testor constellation	4250479929364			
Accessories and Power Supply						
RF	R 6000	1 RU 19" Rack Mount Chassis	4250479324466			
RX	T 6001	19" Rack Frame Extension for RFR 6000	4250479326507			
RP (N,	S A100 /EU/US/UK)	AC to DC Desktop Power Supply Module 12V/8A (with None / EU / US / UK plug)	4250479327955			

#### More broadcast applications:

- GMC-3GUPXD: Dual 3G Up/down/cross converter and Dual scaler
- GMC-4KUPXD: 4K Up/Down/Cross Converter
- GMC-HDREvie+: Segmented, Dynamic HDR>SDR converter
- GMC-4FS: 4x3Gbit/s Frame Synchronizer
- GMC-BiDi-Transport: Bi-directional Transport

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

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



GMPT-TestorAV\_DS\_Rev1.1 Specification



www.lynx-technik.com