greenMachine® Testor
Datasheet — Video and Audio Testing

Test Signal Generator Plus AV Sync Measurement Tool

✗ **callisto+**
✓ **titan**

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 quad-link (2SI) 12G-SDI
- **Quad Channel 3G:** Four independent 3G-SDI channels

The green Machine Testor includes a library of industry standard test patterns which includes 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.
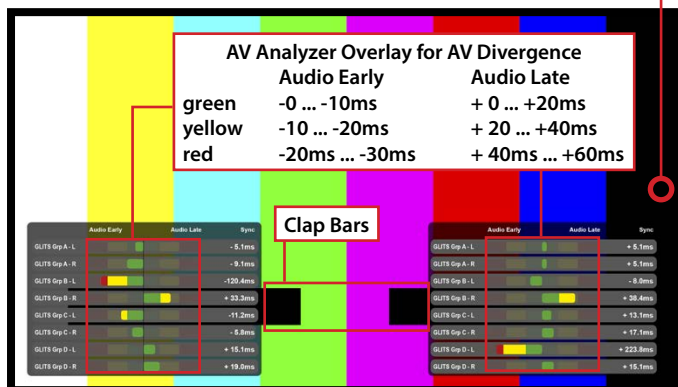
The powerful AV delay analyzer and measurement tool allows for the precise measurement of the audio/video delay in 64 simultaneous channels of embedded audio in a 12G signal (or 16 channels in 3G). Simply feed the Testor pattern output into the signal path to be analyzed and then back into the Testor 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.

Compatible with most test patterns, backgrounds, and video feeds that don't conflict with "Black Flash" or audio

AV Analyzer Overlay for AV Divergence

	Audio Early	Audio Late
green	-0 … -10ms	+ 0 … +20ms
yellow	-10 … -20ms	+ 20 … +40ms
red	-20ms … -30ms	+ 40ms … +60ms

Clap Bars

AV Sync analyzer overlay on standard colorbars*

*****NOTE:** *If the AV Sync overlay output is enabled, the reference source automatically jumps to the selected Overlay Video Source. If you want to use the Overlay feature with only one greenMachine, there must be a clock/sync uncupled device (e.g. a Frame Sync) between gM Output and gM Input.*
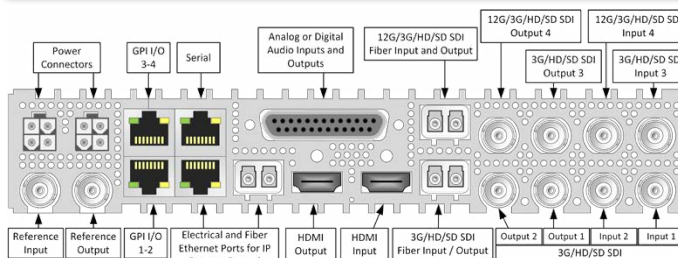
Functions

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:		36 SDR + 6 HDR test signals and patterns 2 Large Scale LED panel 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)

Technical Specifications

Operation Modes

- 4k 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

GMPT-TestorAV_Rev1.0 Specifications subject to change

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Testor GMPT-Testor AV
Video and Audio Testing GMC-Testor AV

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Standard Test Patterns

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**	

Color Bars

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

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HDR Test Patterns

HDR Colorbar BT.2111 HLG Narrow

HDR Colorbar BT.2111 PQ Full

HDR Colorbar BT.2111 PQ Narrow

HDR Colorbar BT.2111 Slog3 Full

HDR PLUGE BT.814 HLG

HDR PLUGE BT.814 PQ

EBU AV Sync HLG Narrow

EBU AV Sync PQ Narrow

Full Field Color Tests

Full field Black

Full field Blue

Full field Cyan

Full field Green

Full field Magenta

Full field Red

Full field White

Full field Yellow

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.
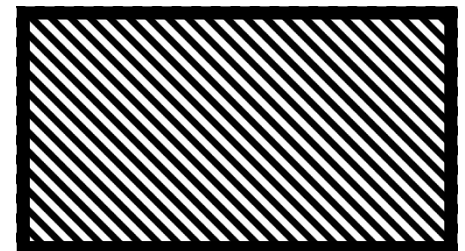
Strobe Pattern

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.
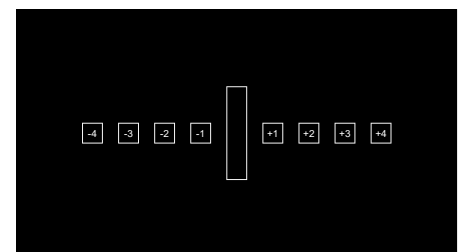
Feature: AV Sync Generator / Analyzer

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 both 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 towards each other and 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 used audio signals work with 4 different frequencies, to be able 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 and in quad channel mode, up to four of these test signals can be generated at the same time. (one in 12G mode)

Using a greenMachine with Testor Constellation in quad channel mode, up to four signal chains can be measured at the same time 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.)
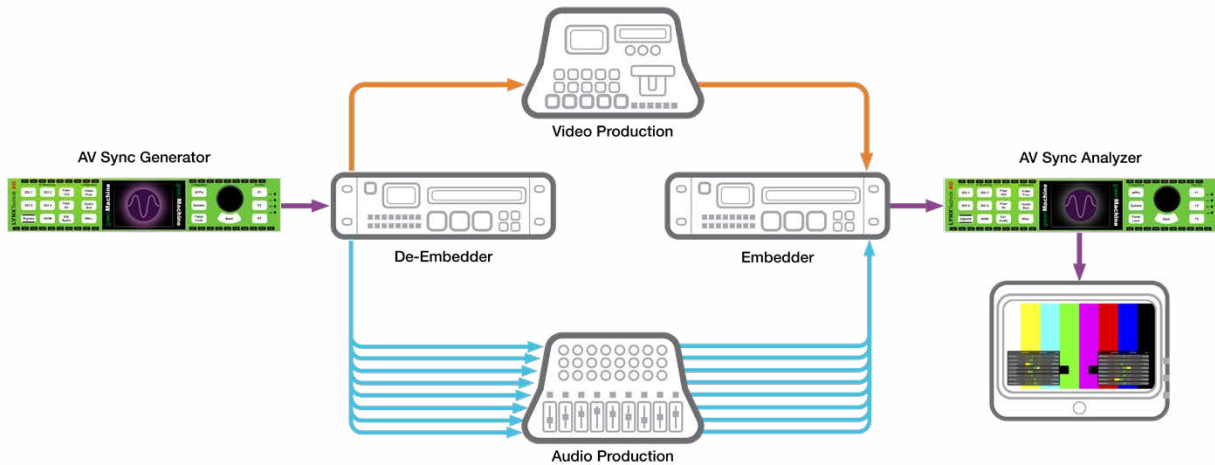
It is possible to use one greenMachine as an AV Sync generator and analyzer at the same time. But _if the AV Sync overlay output is enabled, the reference source automatically jumps to the selected Overlay Video Source. If you want to use the Overlay feature with only one greenMachine, there must be a clock/sync uncupled device (e.g. a Frame Sync) between gM Output and gM Input._
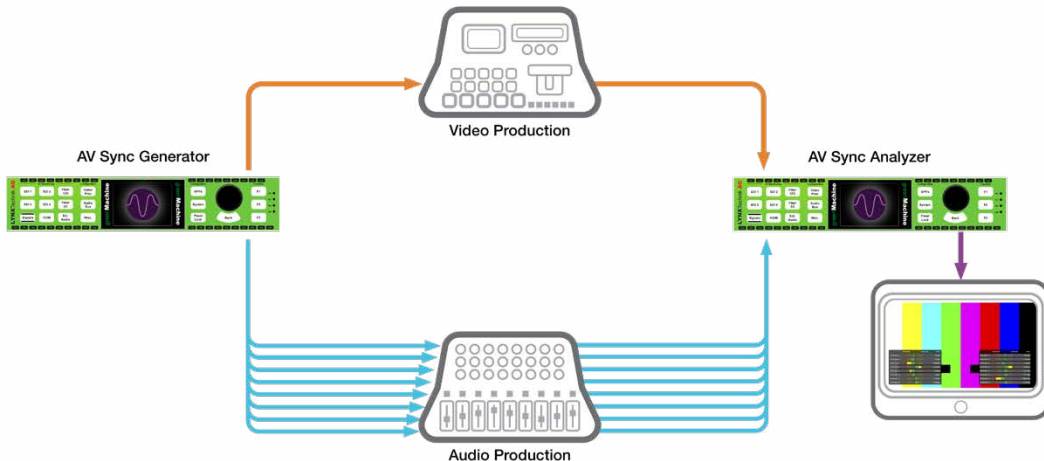
Incompatible Test Patterns

Some test patterns would cause interference with the AV Sync Generator and thus also the analyzer. The AV Sync Generator is not offered for these patterns:

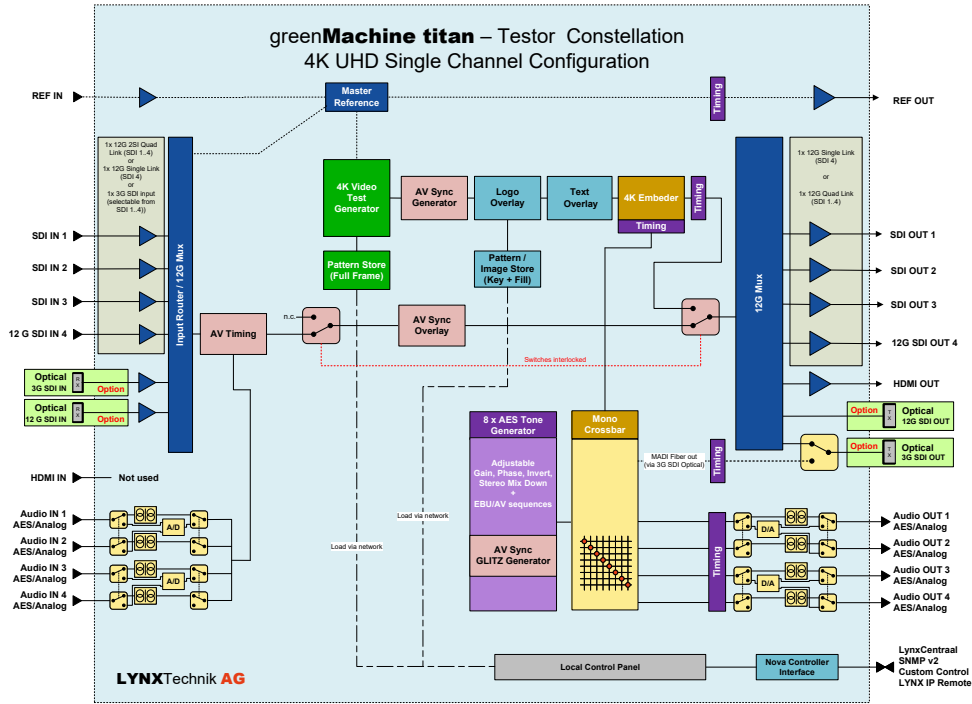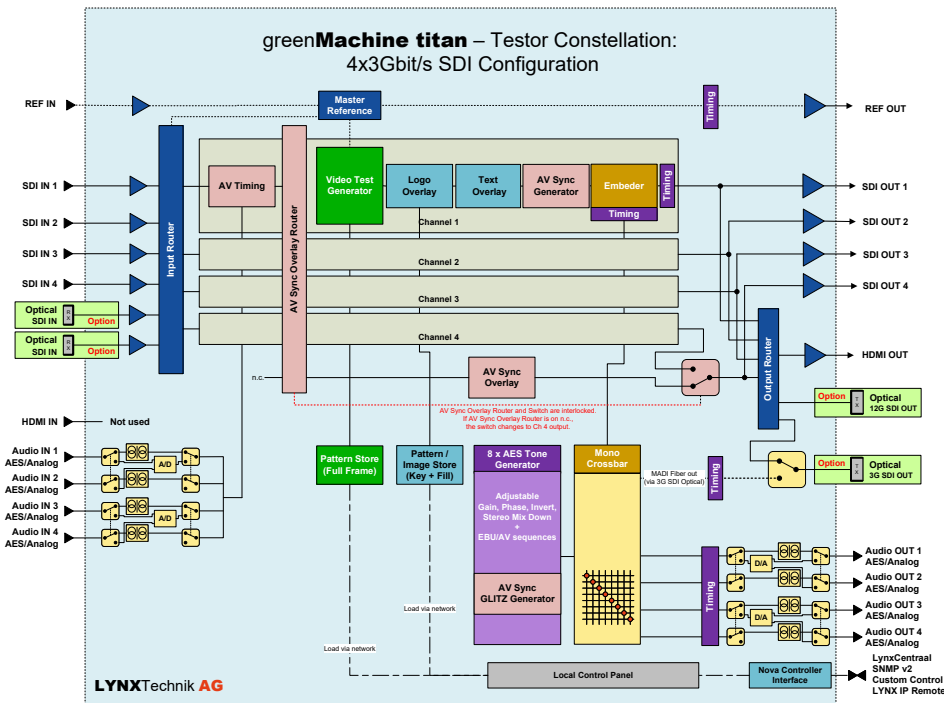|	
EBU AV Sync (SDR and HDR)	Colorbar SMPTE
HDR PLUGE BT.814 (HLG and PQ)	Strobe Pattern
Flash Black	Flash White
Convergence Grill	Persistence Test
Four-Level PLUGE	Full Field Black

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

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

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Functional Diagram: 4k UHD Single Channel Mode

greenMachine titan – Testor Constellation
4K UHD Single Channel Configuration

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Functional Diagram: 3G Quad Channel Mode

greenMachine titan – Testor Constellation:
4x3Gbit/s SDI Configuration

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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	• 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
3Gbit/s Level A	1080p / 50Hz 1080p / 59.94Hz 1080p / 60Hz		
12Gbit/s* Single Link	3840 x 2160p / 50Hz 3840 x 2160p / 59.94Hz 3840 x 2160p / 60Hz		
12Gbit/s* 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 contellations and constellation modes (i.e. 3G quad channel confoguration)

Optical Connection (optional SFP required)

Optical SDI I/O	• 1x 3G SDI SFP Transceiver (SMPTE 297M - 2006) • 1x 12G SDI SFP Transceiver (SMPTE 292M, 424M , 2081 2082) - no SD SDI (270MBit)**
Optical Ethernet	IEEE 802.3z 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	• 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") - 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

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 Lynx-Centraal) - RJ45 connector ESD protection for up to 16kV

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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 quick 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®, 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.

SFP Fiber Options (12G variants also support 6G/3G/1.5G SDI)

12G SDI Video Fiber Transmitter		Power	
OH-TX-12G-LC	12G SDI Fiber TX SFP - LC - 10km* - 1310nm	-5dBm	
12G SDI Video Fiber Receiver		**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 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	-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		
GM 6840:	greenMachine titan Processor Hardware	
RPS A100:	Primary Power Supplies with Region Specific Power Cord	
GMC-TESTOR:	Testor Constellation Software License	

		EAN:
GMPT TESTOR AV (N/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 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	4250479929357

License Only (no hardware included)		
GMC-TESTORAV-titan	greenMachine titan Testor constellation	4250479929364

Accessories and Power Supply		
RFR 6000	1 RU 19" Rack Mount Chassis	4250479324466
RXT 6001	19" Rack Frame Extension for RFR 6000	4250479326507
RPS A100 (N/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 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

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