

# Multiformat Video Generator

## TG700 Data Sheet

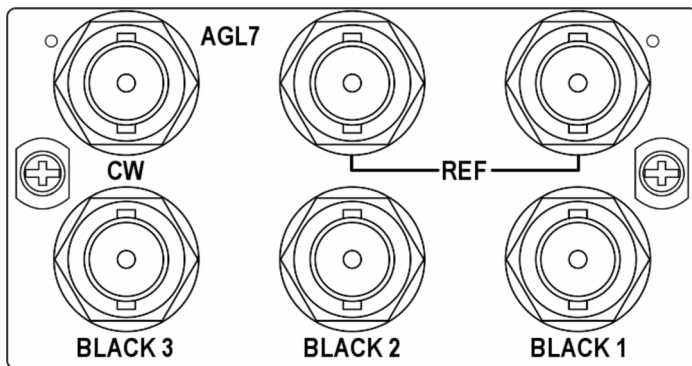


### Features & Benefits

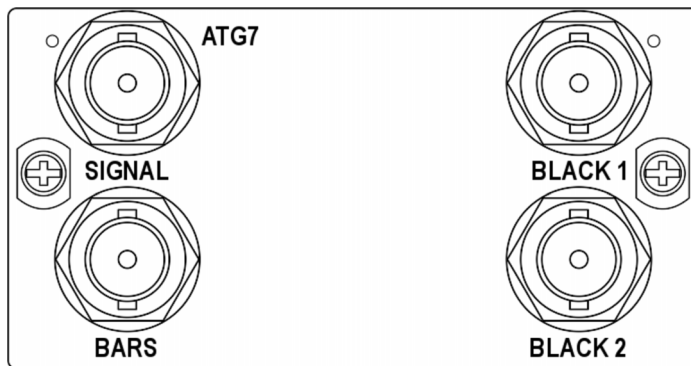
- Multiformat Analog and Digital Test Signal Generation
- Ideal Channel Configuration and Performance to Support Reference Generator Needs
- Modular Expandable Platform
- Stay GenLock™ – Unique, Robust Genlock Mode provides Stable Synchronization Signals for Digital and Traditional Broadcast Facilities

### Applications

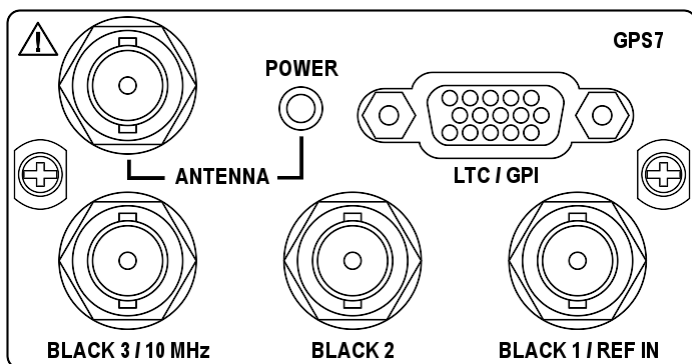
- Reference Generator and Test Signal Generator for Post Production and Broadcast Facilities
- Test Signal Generator for Research and Development
- Equipment Design and Maintenance



AGL7 Analog Genlock Module.



ATG7 Composite Analog Test Generator.



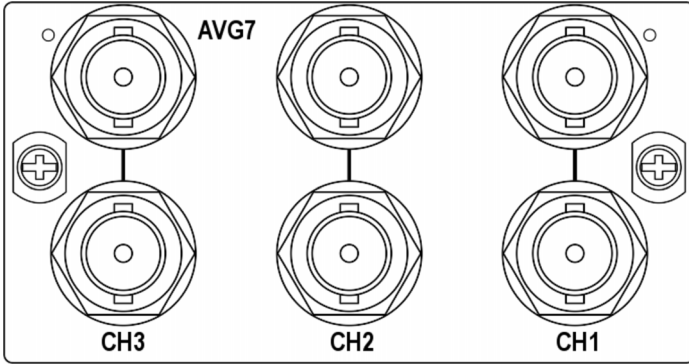
GPS7 GPS Synchronization and Time Code Module.

The TG700 is a multiformat, analog and digital, precision signal generation platform. Designed with the changing needs of the video industry in mind, the TG700 offers sync pulse generation and test signal generation for a wide array of analog, serial digital, and digital high-definition formats. The TG700 Multiformat Video Generator has a modular architecture that offers the flexibility to meet the single-format and growing multiformat needs of the video professional. The TG700 mainframe allows up to four of the following modules to be fitted in the mainframe.

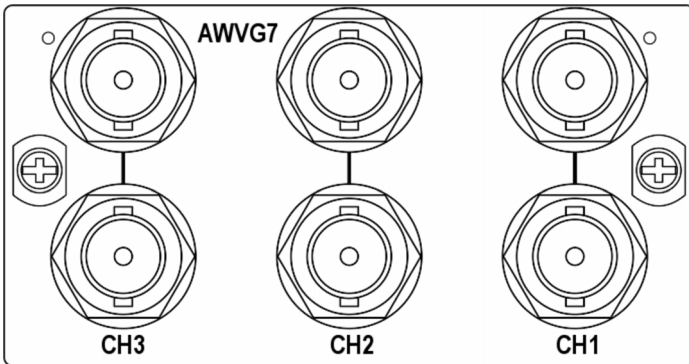
The TG700 has a high stability reference. The AGL7 Analog Genlock Module adds the capacity to lock to a variety of signals, which makes the TG700 an ideal solution as the master house reference or slave reference for broadcast and production/post-production applications. Three black outputs are available and are selectable for HDTV tri-level or NTSC or PAL. Additionally, the AGL7 can lock to a variety of formats to include NTSC/PAL black and HDTV tri-level as well as 1, 3.58, 4.43, 5, and 10 MHz CW. When the AGL7 is configured for Stay GenLock™ mode, a momentary loss of synchronization at the genlock reference input will not cause a disturbance in the TG700's test signal and black outputs. When the genlock signal is reapplied, the AGL7 will gradually reacquire lock, causing little disruption to devices synchronized to the TG700 reference.

The GPS7 GPS Synchronization and Time Code Module includes an integrated GPS receiver which can serve as the system timing reference. Synchronization to the GPS timing signals ensures long-term stability, and video frame alignment between independent systems. Three black outputs are available and are selectable for HDTV tri-level or NTSC or PAL. The GPS7 module will maintain system timing during periods of GPS signal loss, similar to the behavior of the Stay GenLock™ algorithm of the AGL7 module. Time code is available as VITC on black outputs, and from four independent LTC outputs. Time code can be selectable to the time-of-day (with user-selectable offsets), or to a "program time" counter for elapsed-time time code. For applications such as outside broadcast trucks, the GPS7 also includes a genlock input with VITC reader. This enables user-selectable configuration of the TG700 as the master reference, or as a slave to another master, depending on the dynamic requirements of each production.

The ATG7 Composite Analog Test Generator supports PAL, NTSC, and NTSC No Setup. It provides one test signal output, one color bar test signal output, and two black outputs. The black outputs can independently generate H, V, black burst, and subcarrier.



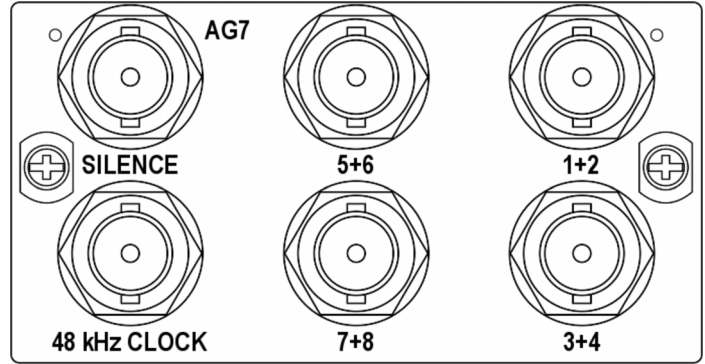
AVG7 Analog Video Generator.



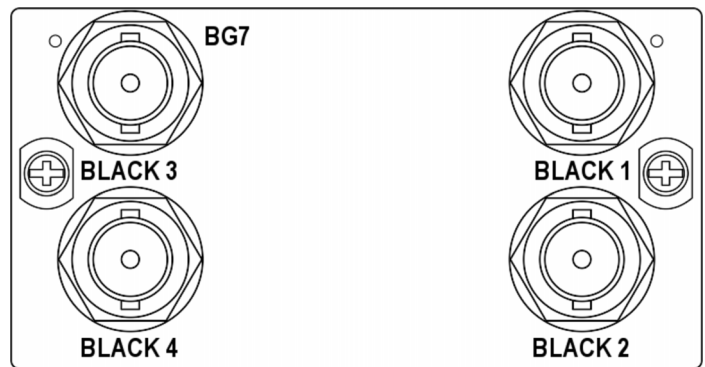
AWVG7 Analog Wideband Video Generator.

The AVG7 is an Analog Video Generator for 525/625 interlace formats supporting component (Y'P'bP'r, G,B,R, Y/C), 525 Beta, and composite (PAL, NTSC, NTSC No Setup). It provides two identical component outputs, two identical Y/C and composite, or six identical composite outputs.

The AWVG7 is an Analog Wideband Video Generator that supports a variety of HD analog component formats (Y'P'bP'r or GBR). The module provides two identical component outputs with a bandwidth of 30 MHz. Up to two AWVG7 Analog Wideband Video Generators can be placed in a single TG700 mainframe.



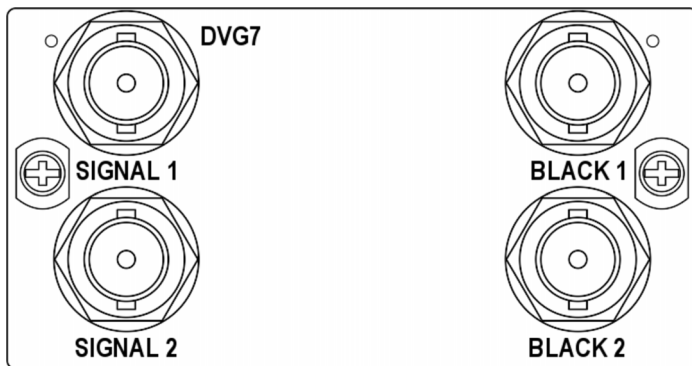
AG7 Audio Generator.



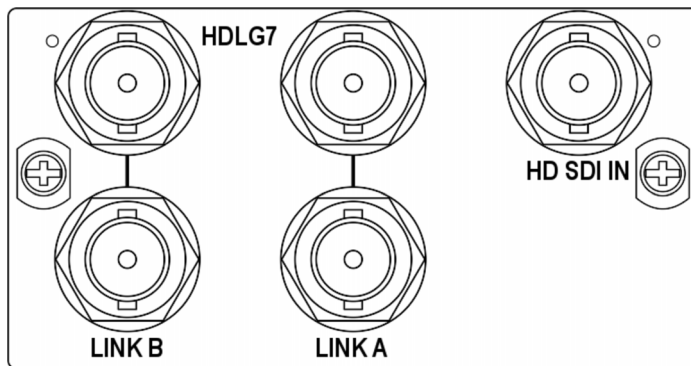
BG7 Analog Black Generator.

The AG7 provides eight channels (4 AES/EBU pairs) of audio signal generation. It also provides two channels (1 AES/EBU pair) of silence as well as a 48 kHz word clock output.

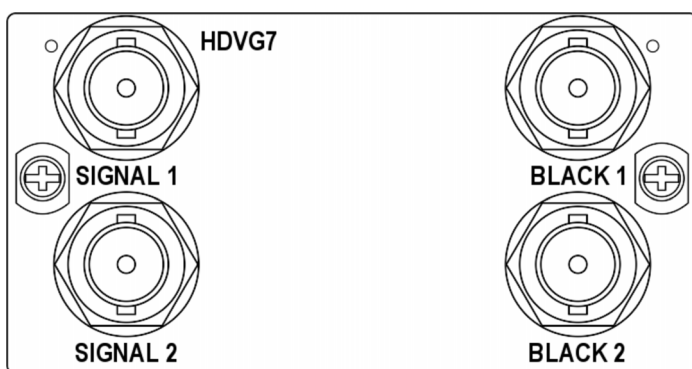
The BG7 is an analog black generator with four independently selectable outputs. The BG7 Black Generator supports NTSC and PAL black burst as well as HDTV tri-level sync. With Option CB, two of the outputs can also generate various analog NTSC and PAL color bar test signals.



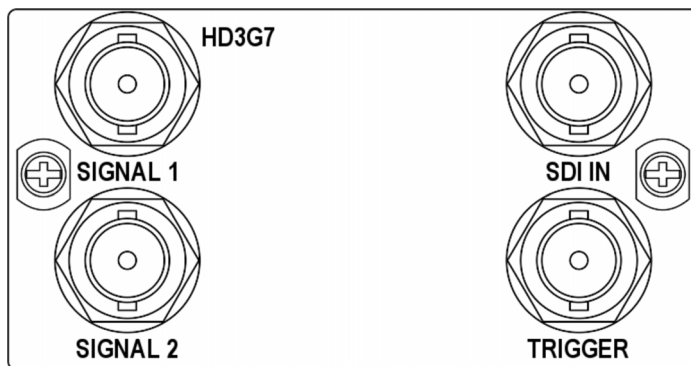
DVG7 SD-SDI Digital Generator (shown with Option BK).



HDLG7 Dual Link HD-SDI Generator.



HDVG7 HD-SDI Digital Generator (shown with Option BK).



HD3G7 HD/3G-SDI Test Signal Generator

The DVG7 is a multiformat SD-SDI test signal generator. The DVG7 Digital Video Generator supports 525 line and 625 line serial digital video at 270 Mb/s and NTSC composite digital at 143.181818 Mb/s. The DVG7 Digital Video Generator has two identical test signal outputs. With Option BK, two additional identical serial digital black signal outputs are available.

The HDVG7 is a high-accuracy, multiformat, high-definition test signal module that provides up to two identical 1.485 Gb/s serial digital video test signal outputs in a broad variety of formats. With Option BK, two additional identical serial black signal outputs are available. Up to two HDVG7 HDTV Digital Video Generators can be placed in a single TG700 mainframe.

The digital modules DVG7 and HDVG7 support AV timing mode and up to 16 channels of 20- or 24-bit audio sampled at 48 kHz embedded on the test signal outputs. The user can independently set frequency and level for each channel.

Full frame test and custom patterns can be generated for the AVG7, AWVG7, DVG7, and HDVG7 modules. Simple full frame patterns are available on V3.1 (or higher than V3.1) CD-ROM.

The HDLG7 is a test signal generator that provides two identical dual-link high-definition serial digital interface (HD SDI) outputs. The module supports video formats that require the use of a dual-link interface, such as 4:4:4 R'G'B' at rates up to 1080i/60 Hz or 1080p/30 Hz, or 4:2:2: Y'C'bC'r at rates up to 1080p/60 Hz. The HDLG7 supports several standard test signals, and also has the unique ability to up-convert an arbitrary single-link HD-SDI input signal to a dual-link format for the outputs. The HDLG7 also supports digital cinema 2K formats and test patterns.

The HD3G7 is a test signal generator that provides two outputs of a HD/3G-SDI video test signal. 720-line formats and 1080-line formats described in SMPTE standards are supported for both Level A and Level B mapping structures, including 4:4:4 and/or 12-bit sampling, Y'C'bC'r, R'G'B', or XYZ color space, and 2K digital cinema formats. The 2xSMPTE 292M HD-SDI format used by some 3D TV applications is also supported.

The HD3G7 can generate up to 32 channels of 24-bit 48 kHz embedded audio, with independently set frequency and amplitude for each channel. The HD3G7 also has the ability to generate other types of ancillary data, such as video payload identifier, ancillary time code, and user-defined packets.

The HD3G7 includes a wide variety of standard test signals, including SMPTE color bars, pathological test patterns, and a programmable moving zone plate pattern, and it also has the ability to up-convert an input 1.485 Gb/s HD-SDI signal to a 3G output. The HD3G7 has a clock/frame trigger output that can be used to synchronize the output with an oscilloscope, for example.

## Characteristics

### AGL7, Analog Genlock Module

#### Reference Input

Characteristic	Description
Input Connector	BNC ×2, passive loopthrough
Input Impedance	75 Ω
Input Signal	NTSC/PAL black burst or HDTV tri-level sync (720p, 1080i)
Amplitude Range	Standard ±6 dB
S/N Ratio	>40 dB
SCH Phase	0 ±40°
Return Loss	≥30 dB at 5 MHz to 30 MHz
Burst Lock / Sync Lock Stability	±3 dB amplitude change: <1 ns
Jitter with burst lock	<0.5°
Jitter with sync lock	<1 ns

#### CW Input

Characteristic	Description
Input Connector	BNC ×1, internally terminated
Input Impedance	75 Ω
Input Signal	CW (continuous wave)
Amplitude	2 V (1 to 2.25) V <sub>p-p</sub>
Frequency	NTSC/PAL FSC, 1/5/10 MHz
Return Loss	>30 dB to 30 MHz
CW Lock Stability	
Over the amplitude range	<1 ns
Jitter	<1 ns (typ. 1°) with CW input S/N >50 dB

#### Genlock

Characteristic	Description
Genlock Time Adjustment	
Range	Anywhere in the color frame
Resolution	<0.5° of NTSC/PAL subcarrier 1 ns with tri-level sync input
Color Framing	Keeps accuracy even with ±45° SCH error of input reference input

#### Reference Outputs

Characteristic	Description
Output Signal	
Black 1	NTSC/PAL black burst output
Black 2, 3	NTSC/PAL black burst output or tri-level HDTV sync
Output Format	Combination of the following:
1.	NTSC/PAL black burst ×3 (one black burst is independent, two black burst are distributed outputs)
2.	NTSC/PAL black burst ×2, HDTV tri-level sync ×1 (all three outputs are independent)
3.	NTSC/PAL black burst ×1, HDTV tri-level sync ×2 (HDTV tri-level are distributed from the same source)
Output Impedance	75 Ω
Return Loss	>30 dB to 30 MHz

#### NTSC/PAL Black Burst Output

Characteristic	Description
Output Standard	EBU N14, SMPTE RP154 PAL-M and PAL-N are not supported
Amplitude Accuracy	Std. black burst ±2%
Burst Frequency	NTSC/PAL FSC ±1 Hz
SCH Phase	< ±5°
Timing Adjustment	
Range	Anywhere in the color frame
Resolution	<0.5° of NTSC/PAL subcarrier

#### HDTV Tri-level Sync Output

Characteristic	Description
Standard	SMPTE 240M, 274M, 296M, RP211
Formats	1080i/50 Hz, 59.94 Hz, 60 Hz 1080p/23.98 Hz, 24 Hz, 25 Hz, 29.97 Hz, 30 Hz 1080psF/23.98 Hz, 24 Hz 720p/59.94 Hz, 60 Hz
Amplitude Accuracy	Std. HDTV tri-level ±2%
Timing Adjustment	
Range	Anywhere in the frame
Resolution	<1 ns

#### AG7, Audio Generator

##### Audio Test Signal Output

Characteristic	Description
Standard	ANSI S4.40 (AES3), AES3-ID
Output Channels	8 channels (4 AES/EBU pairs)
Output Impedance	75 Ω, unbalanced
Output Connector	BNC ×4
Output Amplitude	1 V ±0.2 V
Frequency (Hz)	50, 100, 150, 200, 250, 300, 400, 500, 600, 750, 800, 1000, 1200, 1500, 1600, 2000, 2400, 3000, 3200, 4000, 4800, 5000, 6000, 8000, 9600, 10000, 12000, 15000, 16000, 20000
Level	-60 to 0 dBFS, 1 dB step
Sampling Frequency	48 kHz (lock on video signal)
Quantization	Linear PCM, 20 or 24 bits (2's complement)
Transfer Coding	Bi-phase mark

##### Silence Output

Characteristic	Description
Standard	ANSI S4.40 (AES3), AES3-ID
Channel	2 channels (1 AES/EBU pair)
Output Impedance	75 Ω, unbalanced
Output Connector	BNC ×1
Output Amplitude	1 ±0.2 V
Frequency, Level	No signal
Sampling Frequency	48 kHz (lock on video signal)
Quantization	Linear PCM, 20 or 24 s (2's complement)
Transfer Coding	Bi-phase mark

##### Word Clock Output

Characteristic	Description
Output Connector	BNC ×1
Output Level	CMOS compatible
Frequency	48 kHz

**ATG7, Analog Test Signal Generator**

**Signal Output**

Characteristic	Description
NTSC/NTSC No Setup Test Signals	100%/75% Color Bars
	SMPTE Color Bars
	0% (NTSC only)/10%/40%/50%/100% Flat Field
	Black Burst
	Black Burst with Field Reference
	Field Square Wave
	10/5 Step, Ramp
	Modulated 5 Step
	Modulated Ramp
	Modulated Pedestal
	Shallow Ramp
	Convergence
	2/4 Level Pedestal and Pluge
	100%/75% Red Field
	Gray/White Window
	Safe Area
	Monitor Setup
	100%/60% Multiburst
	Multipulse
	100%/60% Sweep
	Chroma Frequency Response
	Window 2T Pulse and Bar
	Sin (x)/x
	FCC Composite/Multiburst
	NTC7 Composite/Combination
	Test Matrix SNG Color Bars and 0-100% Bounce
APL High/Low, APL Bounce	

Characteristic	Description
PAL Test Signals	100%/75% Color Bars
	100%/75% Color Bars over Red
	40%/50%/100% Flat Field
	Black Burst
	Black Burst with No Field Reference
	Field Square Wave
	5/10 Step
	Ramp
	Modulated 5/10 Step
	Modulated Ramp
	Modulated Pedestal
	Shallow Ramp
	Convergence
	2/4 Level Pedestal and Pluge
	100%/75% Red Field
	Gray/White Window
	Safe Area
	Monitor Setup Matrix
	100% Multiburst
	Multipulse
	100%/75% Sweep
	Window 2T Pulse and Bar
	Sin (x)/x
	CCIR 17/18/330/331
	UK ITS 1/2
	UK 1 Line ITS
ITS Matrix and 0-100% Bounce	
APL High/Low, APL Bounce	
ID Text	Max 18 characters. One row (character 14×11 pixels) Text and Position is embedded to each signal
Luminance Amplitude	±1% (measured at 700 mV)
Chrominance-to-Luminance Gain	±1%
Frequency Response	±1% to 5.5 MHz
Chrominance-to-Luminance Delay	≤10 ns
Linearity	≤1% (measured at 5 step signal)
Differential Gain Error	≤0.5%
Differential Phase Error	≤0.5°

**BARS Output**

Characteristic	Description
NTSC/NTSC No Setup Signals	100%/75% Color Bars
	SMPTE Color Bars
	40% Flat Field
	Black Burst
	Black Burst with Field REF
PAL Signals	Monitor Setup, SNG Color Bars
	100%/75% Color Bars
	100%/75% Color Bars over RED
	40% Flat Field
	Black Burst
ID Text	Black Burst with No Field REF
	Monitor Setup, SNG Color Bars
	Max 18 characters. One row (character 14×11 pixels)
	Text and Position is embedded to each signal
	Luminance Amplitude
Chrominance-to-Luminance Gain	±2%

**BLACK 1/2 Outputs**

Characteristic	Description
NTSC/NTSC No Setup Signals	Black Burst, Black Burst with Field Reference, Subcarrier, Composite Sync, H Drive, V Drive, Composite Blanking, and Color Frame ID
PAL Signals	Black Burst, Black Burst with Field Reference, Subcarrier, Composite Sync, H Drive, V Drive, Composite Blanking, Color Frame ID, and PAL Pulse
Timing Pulse Amplitude	-0.5 to 0.5 V (1 V <sub>P-P</sub> )

**SIGNAL, BARS, and BLACK 1/2 (Common)**

Characteristic	Description
Standards	ITU-R BT.470-6
	PAL-M and PAL-N are not supported
	SMPTE 170M
Output Impedance	75 Ω
Return Loss	≥36 dB to 6 MHz
Burst Amplitude	±2%
Sync Amplitude	±2%
Blanking Level	0 mV ±50 mV
SCH Phase Accuracy	0° ±5°
Timing Offset Range	Full color frame
Timing Offset Resolution	54 MHz clock resolution

**AVG7, Analog Video Generator****Analog Signal Output**

Characteristic	Description
Test Signals	Output signal (preinstalled for all formats): 100%, 75%, and SMPTE Color Bars, Linearity, Flat Field, Multiburst, Sweep, Monitor, Pulse & Bar and other major test signals
Formats Supported	NTSC, NTSC No Setup, PAL, 525 R'G'B', 525 Y'P'bP'r, 525 Beta, 625 R'G'B', 625 Y'P'bP'r
Output Connector	BNC ×6
Outputs	6 identical analog composite outputs, 2 identical component video outs, or 2 identical Y/C and composite out
Output Impedance	75 Ω
Luminance Linearity Error	≤0.5%
Luminance Amplitude	±1% (measured at 700 mV)
Chrominance-to-Luminance Gain Error	≤1% (relative to 100 kHz)
Chrominance-to-Luminance Delay	≤2.5 ns on a composite output (typical)
Channel-to-Channel Delay	≤2 ns (relative to CH1)
Frequency Response	≤0.5% to 8 MHz at 700 mV (typical)
Differential Gain Error	≤0.5%
Differential Phase Error	≤0.5°
Timing Adjustment	
Range	Anywhere in the frame
Resolution	0.1 ns
Return Loss	≥40 dB to 6 MHz

**AWVG7, Analog Wideband Video Generator****Analog Signal Output**

Characteristic	Description
Test Signals	(Preinstalled for all formats) 100%, 75%, and SMPTE Color Bars, Linearity, Multiburst, Sweep, Monitor, and other major test signals
Formats Supported	(All formats are factory preinstalled) Y'P'bP'r or R'G'B' 1080i/50 Hz, 59.94 Hz, 60 Hz 1080p/23.98 Hz, 24 Hz, 25 Hz, 29.97 Hz, 30 Hz 1080psF/23.98 Hz, 24 Hz 720p/23.98 Hz, 24 Hz, 25 Hz, 29.97 Hz, 30 Hz, 50 Hz, 59.94 Hz, 60 Hz
Output Connector	BNC ×6
Outputs	2 identical analog component video outputs
Output Impedance	75 Ω
Output Amplitude	≤1% at 700 mV
Channel-to-Channel Delay	≤2 ns (relative to CH1)
Frequency Response	±1% to 20 MHz ±2% to 28 MHz ±3% to 30 MHz
Timing Adjustment	
Range	Anywhere in the frame
Resolution	0.1 ns
Return Loss	≥35 dB to 30 MHz

**BG7, Black Generator****Analog Signal Outputs**

Characteristic	Description
Output Connector	BNC ×4
Output Impedance	75 Ω
Output Formats	NTSC/PAL black burst or HDTV tri-level sync, each output independently selectable. PAL-M and PAL-N are not supported. With Option CB, NTSC/PAL test signals are available on outputs 3 and 4
Return Loss	≥30 dB to 30 MHz
Jitter	≤1 ns

**NTSC/PAL Black Burst Output**

Characteristic	Description
Output Standard	EBU N14, SMPTE RP 154, RP318M-B
Time Code	Optional VITC insertion (if GPS7 module is present)
Line	One or two lines, user selectable
Source	Time-of-day with adjustable offset, or program (elapsed) time counter
Amplitude Accuracy	Std. black burst ±2%
SCH Phase	< ±5°
Timing Adjustment	
Range	Anywhere in the color frame
Resolution	Clock resolution 18.5 ns (1/54 μs)

**HDTV Tri-level Sync Output**

Characteristic	Description
Standard	SMPTE 240M, 274M, 296M, RP211
Formats	1080i/50 Hz, 59.94 Hz, 60 Hz 1080p/23.98 Hz, 24 Hz, 25 Hz, 29.97 Hz, 30 Hz 1080psF/23.98 Hz, 24 Hz 720p/50 Hz, 59.94 Hz, 60 Hz
Amplitude Accuracy	Std. HDTV tri-level ±2%
Timing Adjustment	
Range	Anywhere in the frame
Resolution	Clock resolution 13.5 ns (1/74.25 μs)

**Analog Test Signal (Opt. CB)**

Characteristic	Description
NTSC and NTSC No Setup Format	100% Color Bars, 75% Color Bars, SMPTE Color Bars, 40% Flat Field, SNG Color Bars, Monitor Setup Matrix, 10 Field ID
PAL Format	100% Color Bars, 75% Color Bars, 100% Color Bars over Red, 75% Color Bars over Red, 40% Flat Field, SNG Color Bars, 4-level Pluge, Monitor Setup Matrix
Luminance Amplitude Accuracy	±1% (video at 100%)
Chroma Amplitude Accuracy	±2%

**DVG7, Digital Video Generator****Serial Digital Signal Output**

Characteristic	Description
Test Signals	(Preinstalled for all formats) 100%, 75%, and SMPTE Color Bars, Linearity, Multiburst, Sweep, Monitor, SDI Pathological, Timing, and other major test signals
Standards	ITU-R BT 601, 656, EBU Tech 3267, SMPTE 125M, 244M, 259M, 272M, RP165, RP178
Bit Rate	143 Mb/s, 270 Mb/s
Resolution	8 or 10 bits
Output Connector	BNC ×2 or ×4 with Option BK
Output Impedance	75 Ω
Output Amplitude	800 mV <sub>pp</sub> ±10%
Overshoot	≤10%
Rise/Fall Time	0.4 to 1.5 ns (20-80%)
DC Offset (AC couple)	0 ±0.5 V
Jitter	≤0.2 UI, above 10 Hz jitter frequency
Timing Adjustment	
Range	Anywhere in the frame
Resolution	Clock resolution (37 or 70 ns)
Return Loss	>15 dB at 5-270 MHz

**Embedded Audio Signal**

Characteristic	Description
Active Channels	1-16 channels
Sample Frequency	48 kHz
Digital Coding	20 or 24 bits
Signal Alignment	Async. and Sync. (no frame #), Synchronous (frame #)
Audio Tone	Frequency (Hz) 50, 100, 150, 200, 250, 300, 400, 500, 600, 750, 800, 1000, 1200, 1500, 1600, 2000, 2400, 3000, 3200, 4000, 4800, 5000, 6000, 8000, 9600, 10000, 12000, 15000, 16000, 20000
Level	-60 to 0 dBFS, 1 dB steps

**GPS7, GPS Synchronization and Time Code Module****GPS Receiver**

Characteristic	Description
Type	L1 frequency (1575.42 MHz), C/A Code, 12 channels
Time-of-Day	User-selectable time zone and DST offset adjustment

**GPS Antenna Input**

Characteristic	Description
Connector	BNC
Input Impedance	50 Ω, internally terminated
DC Antenna Power Output Voltage	3.3 V or 5 V at nominal load
Fault Protection	Short-circuit/open detection and protection
Return Loss	8 dB at 1575 MHz



**Reference Input**

Characteristic	Description
Input Connector	BNC, terminated, shared with BLACK 1 output
Input Impedance	75 $\Omega$
Input Signal	NTSC/PAL black burst or HDTV tri-level sync
Amplitude Range	Standard -6 dB to +8 dB
S/N Ratio	>40 dB
SCH Phase	0 $\pm$ 40°
Return Loss	$\geq$ 30 dB at 300 kHz to 10 MHz
Burst Lock / Sync Lock Stability	$\pm$ 3 dB amplitude change: <1 ns
Jitter with burst lock	<0.5°
Jitter with sync lock	<1 ns

**Genlock**

Characteristic	Description
Genlock Time Adjustment	
Range	Anywhere in the color frame
Resolution	<0.5° of NTSC/PAL subcarrier 1 ns with tri-level sync input
Color Framing	Keeps accuracy even with $\pm$ 45° SCH error of input reference input
Time Reference	VITC reader for NTSC/PAL black burst input signal

**Analog Signal Outputs**

Characteristic	Description
Output Connector	BNC x3
Output Impedance	75 $\Omega$
Output Formats	NTSC/PAL black burst or HDTV tri-level sync, each output independently selectable. PAL-M and PAL-N are not supported. Black output 3 can be configured as a 10 MHz continuous wave output
Return Loss	$\geq$ 30 dB to 30 MHz

**Black Burst Output**

Characteristic	Description
Output Standard	EBU N14, SMPTE RP 154, RP318M-B
Time Code	Optional VITC insertion
Line	One or two lines, user selectable
Source	Time-of-day with adjustable offset, or program (elapsed) time counter
Amplitude Accuracy	Std. black burst $\pm$ 2%
SCH Phase	< $\pm$ 5°
Timing Adjustment	Each output is independent
Range	Anywhere in the color frame
Resolution	Clock resolution 18.5 ns (1/54 $\mu$ s)

**HDTV Tri-level Sync Output**

Characteristic	Description
Standard	SMPTE 240M, 274M, 296M, RP211
Formats	1080i/50 Hz, 59.94 Hz, 60 Hz 1080p/23.98 Hz, 24 Hz, 25 Hz, 29.97 Hz, 30 Hz 1080psF/23.98 Hz, 24 Hz 720p/59.94 Hz, 60 Hz
Amplitude Accuracy	Std. HDTV tri-level $\pm$ 2%
Timing Adjustment	Each output is independent
Range	Anywhere in the color frame
Resolution	Clock resolution 13.5 ns (1/74.25 $\mu$ s)

**LTC Outputs**

Characteristic	Description
Outputs	4 independent
Connector	Available through D-sub 15-pin connector. Optional break-out cable to XLR connectors available
Formats	24 fps (24 Hz or 23.98 Hz), 25 fps, 30 fps, 30 fps drop-frame as per SMPTE 12M
Source	Time-of-day with adjustable offset, or program (elapsed) time counter
Output Amplitude	5 V $\pm$ 10% Adjustable from 0.5 V to 5 V in 0.5 V steps

**Network Time Protocol**

Characteristic	Description
Mode	Server only, using Ethernet interface on the TG700 mainframe
Standard	SNTPv4 for IPv4, per RFC 2030

**General Purpose Interface**

Characteristic	Description
Connector	Available through D-sub 15-pin connector. Optional break-out cable to BNC connectors available
Outputs	Two, user-selectable to assert when GPS synchronization is lost, GPS signal falls below threshold, or elapsed time value reaches set value. In genlock mode, user-selectable to assert on loss-of-lock or near loss-of-lock
Output Level	0.5-5 V
Input	One, user-selectable to signal GPS reacquisition or restart timer
Input Level	0.8-2.4 V

## HDVG7, HDTV Digital Video Generator

### Serial Digital Signal Output

Characteristic	Description
Test Signals	(Preinstalled for all formats) 100%, 75%, and SMPTE Color Bars, Linearity, Multiburst, Sweep, Monitor, SDI Pathological, Timing, and other major test signals
Standards	SMPTE 240M, 272M, 274M, 292, 296M
Bit Rate	1.485 Gb/s, 1.485/1.001 Gb/s
Output Format	1035i/59.94 Hz, 60 Hz 1080i/50 Hz, 59.94 Hz, 60 Hz 1080p/23.98 Hz, 24 Hz, 25 Hz, 29.97 Hz, 30 Hz 1080psF/23.98 Hz, 24 Hz 720p/23.98 Hz, 24 Hz, 50 Hz, 59.94 Hz, 60 Hz
Time Code	Optional ATC-LTC insertion (if GPS7 module is present)
Source	Time-of-day with adjustable offset, or program (elapsed) time counter
Output Connector	BNC x2 or x4 with Option BK
Output Impedance	75 $\Omega$
Output Amplitude	800 mV <sub>p-p</sub> $\pm$ 10% (typ.)
Overshoot	$\leq$ 10% (typ.)
Rise/Fall Time	$\leq$ 270 ps (20-80%) (typ.)
DC Offset (AC coupling)	0 V $\pm$ 0.5 V (typ.)
Jitter	$\leq$ 135 ps (typ.) alignment
Timing Adjustment	
Range	Anywhere in the frame
Resolution	Clock resolution 13.5 ns (1/74.25 MHz)
Return Loss	$\geq$ 15 dB from 5 MHz to 750 MHz $\geq$ 10 dB from 750 MHz to 1.485 GHz (typ.)

### Embedded Audio Signal

Characteristic	Description
Active Channels	1-16 channels
Sample Frequency	48 kHz
Digital Coding	20 or 24 bits
Signal Alignment	Async. and Sync. (no frame #), Synchronous (frame #)
Audio Tone	Frequency (Hz) 50, 100, 150, 200, 250, 300, 400, 500, 600, 750, 800, 1000, 1200, 1500, 1600, 2000, 2400, 3000, 3200, 4000, 4800, 5000, 6000, 8000, 9600, 10000, 12000, 15000, 16000, 20000
Level	-60 to 0 dBFS, 1 dB steps

## HDLG7 HD Dual Link Video Generator

### Serial Digital Signal Output

Characteristic	Description
Test Signals	100%, 75%, and SMPTE Color Bars, Flat Field (0% to 100% in 10% steps), 100% and 75% Red/Green/Blue, Convergence, Ramp, Valid Ramp, 5-step Staircase, 2T30 Pulse and Bar, SDI Pathological
Projector Test Patterns (2K only)	Color Patch 1, Color Patch 2, Black-to-White Step Scale, Black-to-Gray Step Scale, Horizontal Gradient, Vertical Gradient, Flat Fields (each step-scale color), Red/Green/Blue/Cyan/Magenta/Yellow Color Fields, Grid, Aspect Ratio Frame, Checkerboard, Window
HD-SDI Converter	Input signal up-converted to dual link format for output signal
Standards	SMPTE 372M, 292, 274M, 352M
Bit Rate	1.485 Gb/s, 1.485/1.001 Gb/s for each link
Output Format	1080i/50 Hz, 59.94 Hz, 60 Hz 1080p/23.98 Hz, 24 Hz, 25 Hz, 29.97 Hz, 30 Hz, 50 Hz, 59.94 Hz, 60 Hz 1080psF/23.98 Hz, 24 Hz 2048x1080p/23.98 Hz, 24 Hz, 25 Hz, 29.97 Hz, 30 Hz 2048x1080psF/23.98 Hz, 24 Hz 2048x1556psF/14.99 Hz, 15 Hz, 17.98 Hz, 18 Hz
Sampling Format	4:2:2 Y'C'bC'r, 4:4:4 Y'C'bC'r, 4:4:4 G'B'R', 4:4:4 X'Y'Z'
Word Size	10 or 12 bits
Alpha Channel	Same as Y/G channel or Flat Field (0% to 100% in 10% steps)
Embedded Audio	16 channels copied from input signal to Link A and/or Link B in converter mode. No embedded audio in generator mode
Payload Identifier	Link A and Link B identified as per SMPTE 352M
Link Timing Offset	Adjustable timing offset between Link A and Link B, $\pm$ 200 ns in single clock increments
Output Impedance	75 $\Omega$
Output Amplitude	800 mV <sub>p-p</sub> $\pm$ 10%
Overshoot	$\leq$ 10% (typ.)
Rise/Fall Time	$\leq$ 270 ps (20-80%)
DC Offset (AC coupling)	0 V $\pm$ 0.5 V (typ.)
Jitter	$\leq$ 135 ps (typ.) alignment
Timing Adjustment	
Range	Anywhere in the frame
Resolution	Clock resolution 13.5 ns (1/74.25 MHz)
Return Loss	$\geq$ 15 dB from 5 MHz to 750 MHz $\geq$ 10 dB from 750 MHz to 1.485 GHz

**HD3G7, HD/3G-SDI Video Generator****Serial Digital Signal Output**

Characteristic	Description
Test Signals	100%/75%/SMPTE (EG1, EG432-1, RP219) Color Bars, 0%/50%/100% Flat field, Red/Green/Blue/Cyan/Magenta/Yellow 100% Field, Ramp, Limit Ramp, Valid Ramp, Shallow Ramp Matrix, 5/10 Step Staircase, Checkerboard, Clean Aperture, Convergence, Black-White Step Scale, Black-Dark Gray Step Scale, Plug and Luma Reference, Production Aperture, SMPTE 303M Color Reference, 2T Pulse and Bar, Color Pulses, Equalizer Test, PLL Test, SDI Matrix, Co-siting Pulse, Parametric Moving Zone Plate  (More signals in the DVD disk)
HD-SDI Converter	Input 1080 line HD-SDI signal up-converted to output 3G SDI signal
Standards	SMPTE 424M, 425, 274M, 291M, 292M, 296M, 299M, 352M
Bit Rate	2.97 Gb/s, 2.97/1.001 Gb/s, 1.485 Gb/s, 1.485/1.001 Gb/s
Alpha Channel	Same as Y/G channel or Flat Field (0% to 100% in 10% steps)
Payload Identifier	Per SMPTE 352M
Time Code	Optional ATC-LTC and/or ATC-VITC insertion
Source	Time-of-day with adjustable offset (if GPS7 module is present), or program (elapsed) time counter
Ancillary Data	User programmable
Content	DID, SDID, DC, UDW (255), CS. Automatically calculate checksum and/or parity, or manual override
Location	Line number, sample offset, luma/chroma channel, virtual link
Mode	Continuous insertion or single packet
Output Impedance	75 $\Omega$
Output Amplitude	800 mV <sub>p-p</sub> $\pm$ 3%
Overshoot	$\leq$ 5% (typ.)
Rise/Fall Time	$\leq$ 135 ps (20-80%)
DC Offset (AC coupling)	0 V $\pm$ 0.5 V (typ.)
Jitter	$\leq$ 67 ps (typ.) (3 Gb, alignment) $\leq$ 80 ps (typ.) (3 Gb, timing)
Timing Adjustment	
Range	Anywhere in the frame
Resolution	One clock cycle at the Y, G, or X pixel rate
Return Loss	$\geq$ 20 dB from 5 MHz to 2.5 GHz $\geq$ 10 dB from 2.5 GHz to 3 GHz

**Embedded Audio Signal**

Characteristic	Description
Active Channels	1-32 channels
Sample Frequency	48 kHz
Digital Coding	24 bits
Signal Alignment	Async. and Sync. (no frame #), Synchronous (frame #)
Audio Tone	10.0 Hz to 20000.0 Hz, 0.5 Hz resolution
Level	-60 to 0 dBFS, 1 dB steps

**Trigger Output**

Characteristic	Description
Output Format	148.5 MHz clock, frame pulse, or line pulse
Output Impedance	50 $\Omega$
Output Amplitude	720 mV <sub>p-p</sub> $\pm$ 10%
Return Loss	$\geq$ 15 dB from 10 MHz to 300 MHz

**Supported HD3G7 Generator Mode Standards**

**Generator Mode – HD-SDI (1920×1080)**

Structure	50i	59.94i	60i	23.98p	24p	25p	29.97p	30p	50p	59.94p	60p	23.98psf	24psf	25psf	29.97psf	30psf
YCbCr 4:2:2 10b	X	X	X	X	X	X	X	X				X	X	X	X	X

**Generator Mode – HD-SDI (1280×720)**

Structure	50i	59.94i	60i	23.98p	24p	25p	29.97p	30p	50p	59.94p	60p	23.98psf	24psf	25psf	29.97psf	30psf
YCbCr 4:2:2 10b				X	X	X	X	X	X	X	X					

**Generator Mode – 3G Level A (1920×1080)**

Structure	50i	59.94i	60i	23.98p	24p	25p	29.97p	30p	50p	59.94p	60p	23.98psf	24psf	25psf	29.97psf	30psf
YCbCr 4:4:4 12b	X	X	X	X	X	X	X	X				X	X	X	X	X
	X	X	X	X	X	X	X	X				X	X	X	X	X
YCbCr+A 10b	X	X	X	X	X	X	X	X				X	X	X	X	X
YCbCr 4:2:2 12b	X	X	X	X	X	X	X	X				X	X	X	X	X
									X	X	X					
GBR 4:4:4 12b	X	X	X	X	X	X	X	X								
	X	X	X	X	X	X	X	X				X	X	X	X	X
GBR+A 10b	X	X	X	X	X	X	X	X				X	X	X	X	X

**Generator Mode – 3G Level A (1280×720)**

Structure	50i	59.94i	60i	23.98p	24p	25p	29.97p	30p	50p	59.94p	60p	23.98psf	24psf	25psf	29.97psf	30psf
YCbCr 4:4:4 10b				X	X	X	X	X	X	X	X					
YCbCr+A				X	X	X	X	X	X	X	X					
GBR				X	X	X	X	X	X	X	X					
GBR+A				X	X	X	X	X	X	X	X					

**Generator Mode – 3G Level A (2K×1080)**

Structure	50i	59.94i	60i	23.98p	24p	25p	29.97p	30p	50p	59.94p	60p	23.98psf	24psf	25psf	29.97psf	30psf
XYZ 4:4:4 12b				X	X	X	X	X				X	X	X	X	X
GBR				X	X	X	X	X				X	X	X	X	X

**Generator Mode – 3G Level B (1920×1080)**

Structure	50i	59.94i	60i	23.98p	24p	25p	29.97p	30p	50p	59.94p	60p	23.98psf	24psf	25psf	29.97psf	30psf
YCbCr 4:4:4	12b	X	X	X	X	X	X	X				X	X	X	X	X
	10b	X	X	X	X	X	X	X				X	X	X	X	X
YCbCr+A	10b	X	X	X	X	X	X	X				X	X	X	X	X
YCbCr 4:2:2	12b	X	X	X	X	X	X	X				X	X	X	X	X
	10b								X	X	X					
YCbCr+A	12b	X	X	X	X	X	X	X				X	X	X	X	X
GBR 4:4:4	12b	X	X	X	X	X	X	X				X	X	X	X	X
	10b	X	X	X	X	X	X	X				X	X	X	X	X
GBR+A	10b	X	X	X	X	X	X	X				X	X	X	X	X

**Generator Mode – 3G Level B (2K×1080)**

Structure	50i	59.94i	60i	23.98p	24p	25p	29.97p	30p	50p	59.94p	60p	23.98psf	24psf	25psf	29.97psf	30psf
XYZ 4:4:4	12b			X	X	X	X	X				X	X	X	X	X
GBR				X	X	X	X	X				X	X	X	X	X

**Generator Mode – 3G Level B (2×HD 1920×1080)**

Structure	50i	59.94i	60i	23.98p	24p	25p	29.97p	30p	50p	59.94p	60p	23.98psf	24psf	25psf	29.97psf	30psf
YCbCr 4:2:2	10b	X	X	X	X	X	X	X				X	X	X	X	X

**Generator Mode – 3G Level B (2×HD 1280×720)**

Structure	50i	59.94i	60i	23.98p	24p	25p	29.97p	30p	50p	59.94p	60p	23.98psf	24psf	25psf	29.97psf	30psf
YCbCr 4:2:2	10b			X	X	X	X	X	X	X	X					

**Supported HD3G7 Converter Mode Standards**

**Converter Mode – 3G Level A (1920×1080)**

HD Input Signal	1080i				1080p				1080i				1080psf			
	50	59.94	60	23.98	24	25	29.97	30	50	59.94	60	23.98	24	25	29.97	30
<b>3 Gb Output Format</b>	<b>50i</b>	<b>59.94i</b>	<b>60i</b>	<b>23.98p</b>	<b>24p</b>	<b>25p</b>	<b>29.97p</b>	<b>30p</b>	<b>50p</b>	<b>59.94p</b>	<b>60p</b>	<b>23.98psf</b>	<b>24psf</b>	<b>25psf</b>	<b>29.97psf</b>	<b>30psf</b>
Output Sample Structure																
YCbCr	4:4:4	12b		Not Available												
		10b														
YCbCr	4:2:2	12b														
		10b							X	X	X					
GBR	4:4:4	12b		Not Available												
		10b														
GBR+A		10b														

**Converter Mode – 3G Level B (1920×1080)**

HD Input Signal	1080i				1080p				1080i				1080psf				
	50	59.94	60	23.98	24	25	29.97	30	50	59.94	60	23.98	24	25	29.97	30	
<b>3 Gb Output Format</b>	<b>50i</b>	<b>59.94i</b>	<b>60i</b>	<b>23.98p</b>	<b>24p</b>	<b>25p</b>	<b>29.97p</b>	<b>30p</b>	<b>50p</b>	<b>59.94p</b>	<b>60p</b>	<b>23.98psf</b>	<b>24psf</b>	<b>25psf</b>	<b>29.97psf</b>	<b>30psf</b>	
Output Sample Structure																	
YCbCr	4:4:4	12b	X	X	X	X	X	X	X				X	X	X	X	X
		10b	X	X	X	X	X	X	X				X	X	X	X	X
YCbCr+A		10b	X	X	X	X	X	X	X				X	X	X	X	X
YCbCr	4:2:2	12b	X	X	X	X	X	X	X				X	X	X	X	X
		10b								X	X	X					
YCbCr+A		12b	X	X	X	X	X	X	X				X	X	X	X	X
GBR	4:4:4	12b	X	X	X	X	X	X	X				X	X	X	X	X
		10b	X	X	X	X	X	X	X				X	X	X	X	X
GBR+A		10b	X	X	X	X	X	X	X				X	X	X	X	X

**Converter Mode – 3G Level B (2×HD 1920×1080)**

HD Input Signal	1080i				1080p				1080i				1080psf				
	50	59.94	60	23.98	24	25	29.97	30	50	59.94	60	23.98	24	25	29.97	30	
<b>3 Gb Output Format</b>	<b>50i</b>	<b>59.94i</b>	<b>60i</b>	<b>23.98p</b>	<b>24p</b>	<b>25p</b>	<b>29.97p</b>	<b>30p</b>	<b>50p</b>	<b>59.94p</b>	<b>60p</b>	<b>23.98psf</b>	<b>24psf</b>	<b>25psf</b>	<b>29.97psf</b>	<b>30psf</b>	
Output Sample Structure																	
YCbCr	4:2:2	10b	X	X	X	X	X	X	X				X	X	X	X	X

**TG700**

**Mainframe**

Characteristic	Description
Internal Reference Frequency	13.5 MHz
Long-term Stability	Less than 1 ppm/year
Number of Slots for Modules	4
Power Supply Slot	1
Network Interface	10BASE-T Ethernet

**Physical Characteristics**

Dimensions	mm	in.
Height	44	1.73
Width	483	19
Length	559	22
Weight	kg	lb.
Net	8.2	18

**Environmental**

Characteristic	Description
Power Consumption	100 W (max)
Temperature	0 °C to +50 °C
Altitude	4500 m (15,000 ft.)
Source Voltage	100 to 240 V, 48 to 63 Hz

## Ordering Information

### TG700

#### Multiformat Video Generator

Mainframe\*<sup>1</sup>. Up to four modules can be fitted in the frame.

**Included:** User Manual, CD-ROM (Containing ARIB STD-B28 standard Multiformat Color Bar library, SMPTE RP219 HD/SD Compatible Color Bar library, TG7 Communication SW, TG7 Setup SW, Logo Gen, Frame Picture Gen, Signal Viewer, Signal DNL, Sample Frame Pictures and Logos), Rackmount Kit, and Power Cord.

**Note:** Please specify power cord when ordering.

\*<sup>1</sup> Order requires one of the modules.

#### Modules

Module	Option	Description
AGL7		Analog Genlock
AG7		Audio Generator
ATG7		Analog Test Generator Module
AVG7		Component and Composite Analog Video Generator Module
AWVG7		Analog Wideband Video Generator Module
BG7		Black Generator
	Opt. CB	Add NTSC/PAL color bar. Option must be added at time of order. Option cannot be added later
DVG7		Digital Video Generator
	Opt. BK	Add SDI black outputs. Option must be added at time of order. Option cannot be added later
GPS7		GPS Synchronization and Time Code Module
HDVG7		HDTV Digital Video Generator
	Opt. BK	Add black outputs. Option must be added at time of order. Option cannot be added later
HDLG7		HD Dual Link Video Generator
HD3G7		HD/3G-SDI Video Generator

#### Module Limitations

Only one AGL7 or GPS7 module may be installed in one TG700 mainframe.

No more than two HDVG7, HD3G7, or AWVG7 modules, in any combination, may be installed in one TG700 mainframe.

#### Common Options for All Models

Option	Description
Opt. 88	Module installation* <sup>2</sup>
Opt. D1	Calibration data report in English/Japanese

\*<sup>2</sup> Applies to mainframe and all modules.

### Power Cord Options

#### International Power Plugs

Option	Description
Opt. A0	North America power
Opt. A1	Universal EURO power
Opt. A2	United Kingdom power
Opt. A3	Australia power
Opt. A4	240 V, North America power
Opt. A5	Switzerland power
Opt. A11	India power

#### Service

Option	Description
Opt. C3	Calibration Service 3 Years
Opt. C5	Calibration Service 5 Years
Opt. D1	Calibration Data Report
Opt. D3	Calibration Data Report 3 Years (with Opt. C3)
Opt. D5	Calibration Data Report 5 Years (with Opt. C5)
Opt. G3	Complete Care 3 Years (includes loaner, scheduled calibration and more). TG700, AGL7, AG7, AVG7, BG7, DVG7, GPS7, HDVG7, HD3G7 only
Opt. G5	Complete Care 5 Years (includes loaner, scheduled calibration and more). TG700, AGL7, AG7, AVG7, BG7, DVG7, GPS7, HDVG7, HD3G7 only
Opt. R3	Repair Service 3 Years (including warranty)
Opt. R5	Repair Service 5 Years (including warranty)

#### Optional Accessories

Accessory	Description	Order
TG700 Opt. FP Upgrade Kit	This kit upgrades any TG700 to 64 MB Flash Memory	040-1698-xx
Service Manual		070-A800-xx
Power Supply Module		650-A810-xx
Blank Panel for TG700		614-1051-xx
D-sub to XLR/BNC Cable for GPS7 Module		012-1717-xx

#### Warranty

1 year parts and labor.



Product Area Assessed: The planning, design/development and manufacture of electronic Test and Measurement instruments.



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\* European toll-free number. If not accessible, call: +41 52 675 3777

Updated 25 May 2010

**For Further Information.** Tektronix maintains a comprehensive, constantly expanding collection of application notes, technical briefs and other resources to help engineers working on the cutting edge of technology. Please visit [www.tektronix.com](http://www.tektronix.com)



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27 Sep 2010

20W-14227-11

