Multiformat Video Test Signal Generator

TG8000 Datasheet

The TG8000 is a precision multiformat analog and digital signal generation platform, designed for sync pulse and timecode generation in broadcasting applications and reference test signal generation in video equipment testing applications.

Key features

- Multiformat analog and digital test signal generation

- Ideal channel configuration and performance to support reference generator needs

- Modular configurable platform

- Stay GenLock™ – Unique, robust Genlock mode provides stable synchronization signals for digital and traditional broadcast facilities

Applications

- Sync pulse generator and test signal generator for post production and broadcast facilities

- Test signal generator for research and development

- Equipment design and maintenance

TG8000 mainframe

The TG8000 mainframe is a modular system, accommodating up to four user-changeable generator modules and one power supply module in a full-width 1RU form factor. A total of 12 different modules are available for the TG8000, covering a wide range of interfaces and functions such as GPS synchronization and genlock, SD/HD/3G-SDI test signal generation, composite and component analog test signal generation, and audio test signal generation.

The TG8000 mainframe has a high-precision oscillator for master operation, or for stable holdover operation when the genlock or GPS reference is interrupted. A 10/100/1000BASE-T Ethernet interface provides connectivity to the local network for remote operation, test pattern download, and an NTP server (when the GPS7 module is present). A General Purpose Input/Output (GPIO) interface is available to recall one of seven user-configured presets and to report system alarms. The front-panel USB port can be used to easily download user-created test patterns and system preset information, and can be used for system upgrades.

AGL7 Analog Genlock Module

The AGL7 Analog Genlock Module adds the capacity to lock to a variety of signals, which makes the TG8000 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 TG8000 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 TG8000 reference.
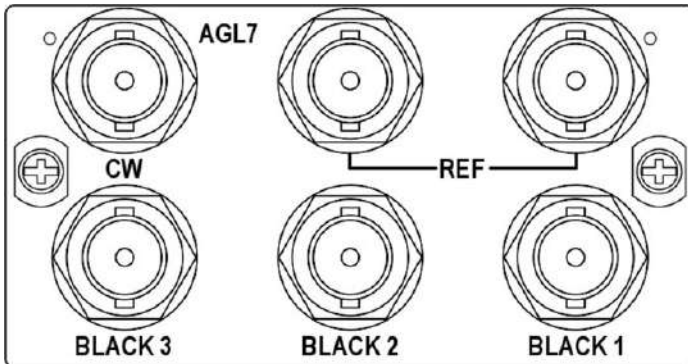

AGL7 Analog Genlock Module

GPS7 GPS Synchronization and Time Code Module

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.

The GPS RF coaxial signal input is available with 3.3 V or 5 V DC power output for the GPS antenna enabling the user to select from a variety of GPS antennas available on the market. The GPS7 also includes a genlock input with VITC reader, enabling user-selectable configuration of the TG8000 as the master reference or as a slave to another master, depending on the dynamic requirements of each production.

The GPS7 module will maintain system timing by Stay GenLock™ technology even during periods of GPS signal loss or genlock signal loss. Three black outputs are available and are selectable for HDTV tri-level, NTSC, or PAL. Time code source can be selectable to the time-of-day (with user-selectable offsets) from GPS receiver, internal source, VITC on the reference input, LTC input, or to a "program time" counter for elapsed-time time code.

The Daylight Savings Time (DST) adjustment could be scheduled as a recurring event based on calendar rules. Time code is available as VITC on black outputs (GPS7, BG7 – hardware V1.2 or above), as Ancillary Time Code (ATC) (HDVG7 – hardware V2.0 or above, HD3G7, SDI7), from four independent LTC outputs (GPS7), and as a response to time requests on a Network Time Protocol (NTP version 3.0) Server.
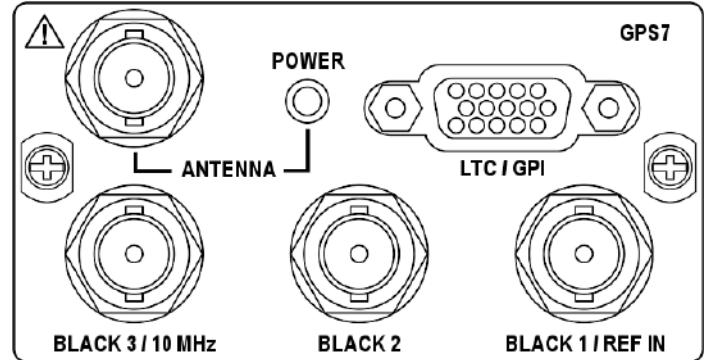
GPS7 GPS Synchronization and Time Code Module

## ATG7 Composite Analog Test Generator Module

The ATG7 Composite Analog Test Generator Module 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.
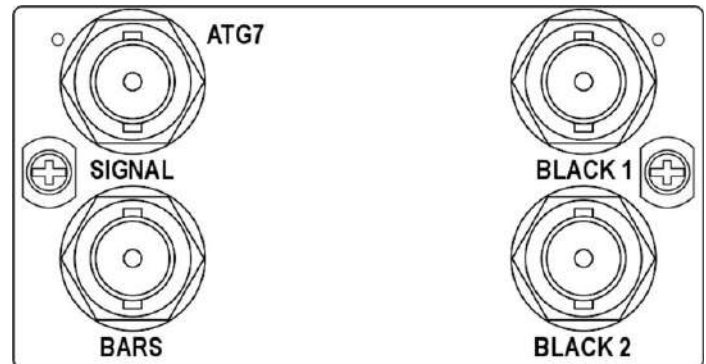
ATG7 Composite Analog Test Generator Module
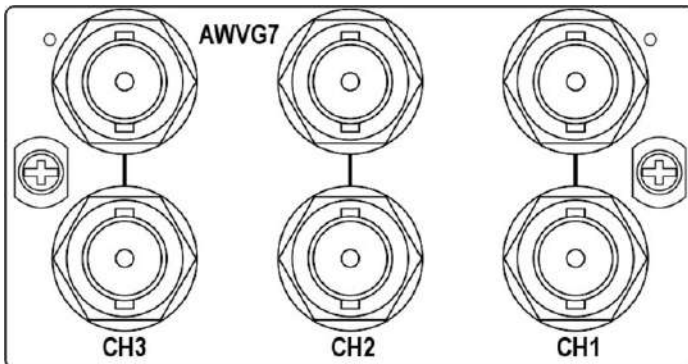
AVG7 Analog Video Generator Module

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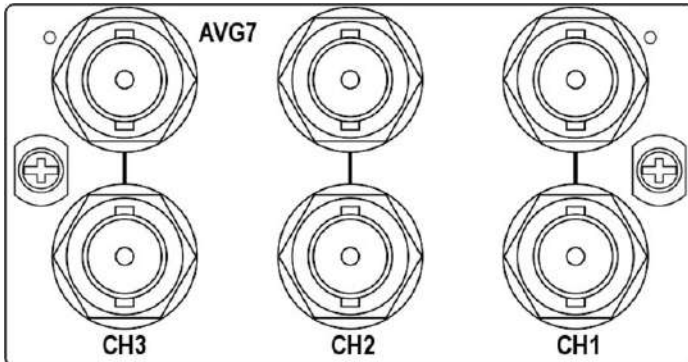
AVG7 Analog Video Generator Module

## AWVG7 Analog Wideband Video Generator Module

The AWVG7 Analog Wideband Video Generator Module 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 modules can be placed in a single TG8000 mainframe.

AWVG7 Analog Wideband Video Generator Module

AG7 Audio Generator Module

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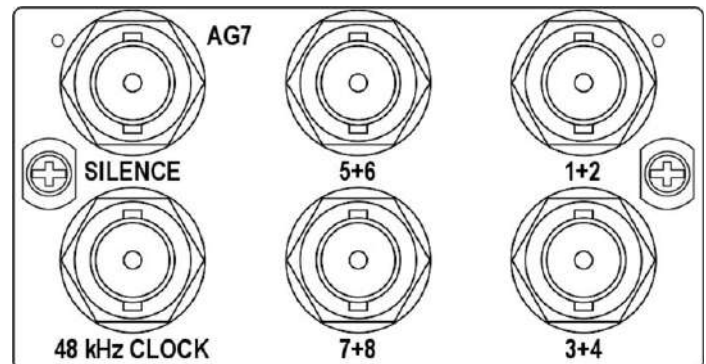
AG7 Audio Generator Module

BG7 Analog Black Generator Module

The BG7 Analog Black Generator Module provides four independently selectable outputs. The module 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.
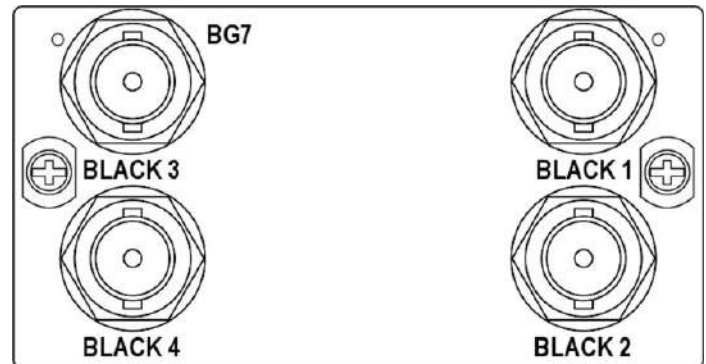
BG7 Analog Black Generator Module

DVG7 SD-SDI Digital Video Generator Module

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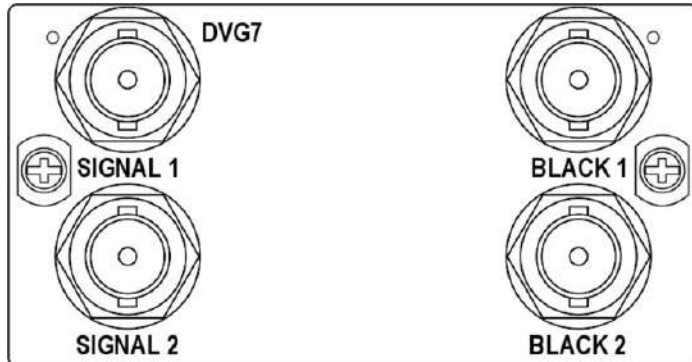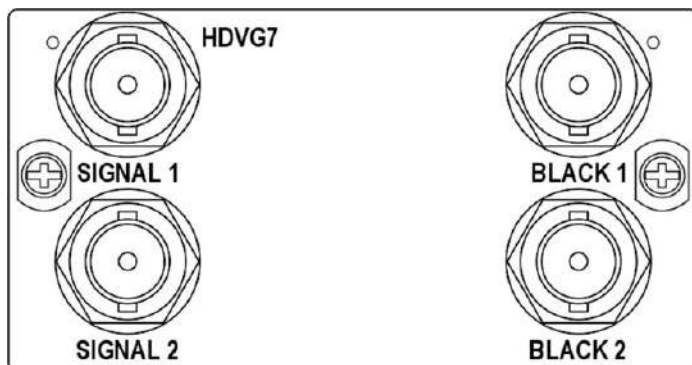

DVG7 SD-SDI Digital Video Generator Module (shown with Option BK)

HDVG7 HD-SDI Digital Video Generator Module

The HDVG7 HD-SDI Digital Video Generator Module 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. Ancillary Time Code (ATC) generation is available when the GPS7 is installed in the TG8000 mainframe. Up to two HDVG7 modules can be placed in a single TG8000 mainframe.

The digital modules DVG7, HDVG7, and SDI7 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, HDVG7, and SDI7 modules. Simple full frame patterns are available on the TG8000 CD-ROM.

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

HDLG7 Dual Link HD-SDI Generator Module

The HDLG7 Dual Link HD-SDI Generator Module 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 an 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.
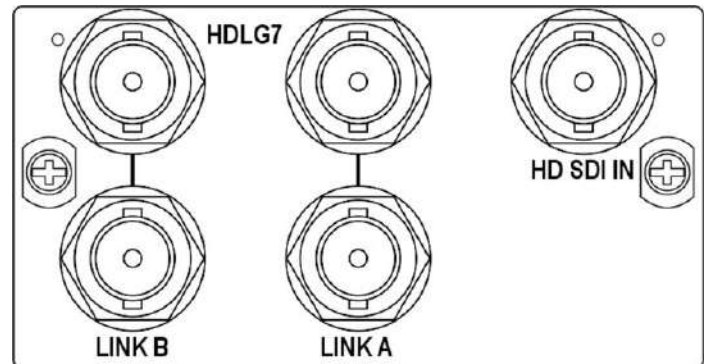
HDLG7 Dual Link HD-SDI Generator Module

HD3G7 HD/3G-SDI Test Signal Generator Module

The HD3G7 HD/3G-SDI Test Signal Generator Module 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 2×SMPTE 292M HD-SDI format used by some 3D TV applications is also supported.

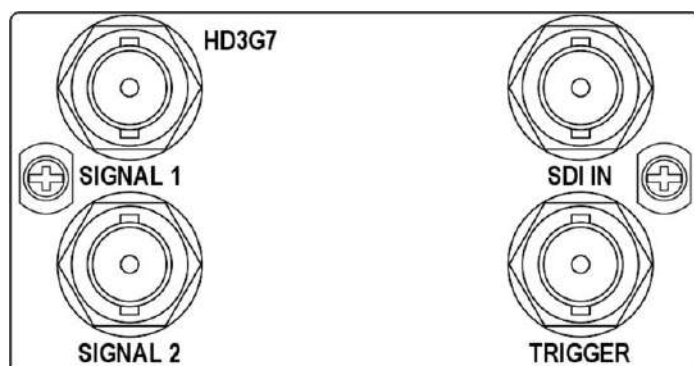The HD3G7 can generate up to 32 channels of 24-bit 48 kHz embedded audio, with independently set frequency and amplitude for each channel. The HD3G7 also has the ability to generate other types of ancillary data, such as video payload identifier, ancillary time code, and user-defined packets.

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 module has a clock/frame trigger output that can be used to synchronize the output with an oscilloscope.
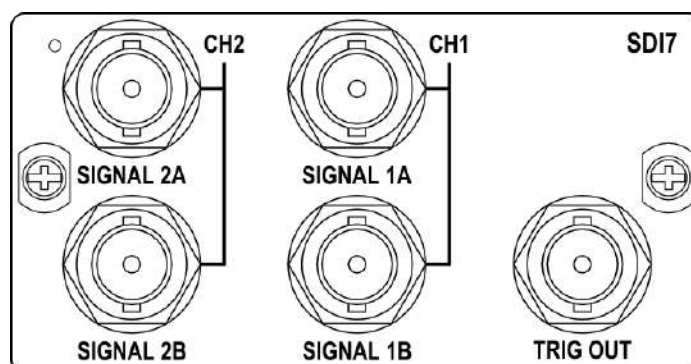

HD3G7 HD/3G-SDI Test Signal Generator Module

SDI7 SD/HD/3G-SDI Test Signal Generator Module

The SDI7 SD/HD/3G-SDI Test Signal Generator Module provides two independent channels of SD/HD/3G-SDI video test signal generation in a variety of formats with separate test and test/black signal generation per channel (3G-SDI signal generation is optionally available).

The SDI7 can generate up to 32 channels of 24-bit 48 kHz embedded audio, with independently set frequency and amplitude for each channel. Option DBT extends the audio functionality by generating these test tones in Dolby E format. Various Dolby E audio frame start locations can be set to test the error handling ability of the signal processing equipment in the signal path. Embedded Dolby E metadata are also included in the Dolby E test stream. Supported Dolby E program configurations include mono, stereo, 5.1 and 7.1 surround sound audio. The SDI7 also has the ability to generate other types of ancillary data, such as video payload identifier, ancillary time code, and user-defined packets.

The SDI7 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 generate full frame test signals created by the user. AV timing signal generation, when used in conjunction with a waveform monitor, can be used to ensure that audio and video are synchronized through a video path.

Circle, multi-language text, and color logo overlays may be applied to the generated test signals to check aspect ratio, identify streams, or apply station logos. The SDI7 has a clock/frame trigger output that can be used to trigger an oscilloscope to be synchronous with the video output.

SDI7 SD/HD/3G-SDI Test Signal Generator Module

AGL7 Analog Genlock Module specifications

Reference input

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

Input connector	BNC ×1, internally terminated
Input impedance	75 Ω
Input signal	CW (continuous wave)
Amplitude	2 V (1 to 2.25) V_{p-p}
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 (typical 1°) with CW input S/N >50 dB

Genlock

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

Outputsignal	
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

Output standards	EBU N14, SMPTE RP154
	PAL-M and PAL-N are not supported

Amplitude accuracy	Standard 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

Standards	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	Standard HDTV tri-level ±2%

Timing adjustment	
Range	Anywhere in the frame
Resolution	<1 ns

AG7 Audio Generator Module specifications

Audio test signal output

Standards	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

Standards	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

Output connector	BNC ×1
Output level	CMOS compatible
Frequency	48 kHz

ATG7 Composite Analog Test Generator Module specifications

Signal output

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
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

NTSC/NTSC no setup signals	100%/75% Color Bars, SMPTE Color Bars, 40% Flat Field, Black Burst, Black Burst with Field REF, Monitor Setup, SNG Color Bars
PAL signals	100%/75% Color Bars, 100%/75% Color Bars over RED, 40% Flat Field, Black Burst, Black Burst with No Field REF, Monitor Setup, SNG Color Bars
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	±2%

BLACK 1/2 outputs

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_{p-p})

TG8000 Datasheet

Signal, BARS, and BLACK 1/2 (common)

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 Module specifications

Analog signal output

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 Module specifications

Analog signal output

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 Analog Black Generator Module specifications

Analog signal outputs

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

Output standards	EBU N14, SMPTE RP 154, RP318M-B
Time code	Optional VITC insertion (if GPS7 module is present)
Required hardware	V1.2 or above
Line	One or two lines, user selectable
Source	Time-of-day with adjustable offset, or program (elapsed) time counter
Amplitude accuracy	Standard 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

Standards	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	Standard HDTV tri-level ±2%
Timing adjustment	
Range	Anywhere in the frame
Resolution	Clock resolution 13.5 ns (1/74.25 µs)

Analog test signal (Option CB)

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 SD-SDI Digital Video Generator Module specifications

Serial digital signal output

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 (143 Mb/s is only available when the module is installed in a TG700)
Resolution	8 or 10 bits
Output connector	BNC ×2 or ×4 with Option BK
Output impedance	75 Ω
Output amplitude	800 mV$_{p-p}$ ±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

Active channels	1-16 channels
Sample frequency	48 kHz
Digital coding	20 or 24 bits
Signal alignment	Asynchronous and Synchronous (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 specifications

GPS receiver

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

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

Input connector	BNC, terminated, shared with BLACK 1 output
Input impedance	75 Ω
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 ±40°
Return loss	≥30 dB at 300 kHz to 10 MHz
Burst lock / sync lock stability	±3 dB amplitude change: <1 ns
Jitter with burst lock	<0.5°
Jitter with sync lock	<1 ns

Genlock

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
Time reference	VITC reader for NTSC/PAL black burst input signal

Analog signal outputs

Output connector	BNC ×3
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
	Black output 3 can be configured as a 10 MHz continuous wave output
Return loss	≥30 dB to 30 MHz

Black burst output

Output standards	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	Standard black burst ±2%
SCH phase	< ±5°
Timing adjustment	Each output is independent
Range	Anywhere in the color frame
Resolution	Clock resolution 18.5 ns (1/54 µs)

HDTV tri-level sync output

Standards	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	Standard HDTV tri-level ±2%
Timing adjustment	Each output is independent
Range	Anywhere in the color frame
Resolution	Clock resolution 13.5 ns (1/74.25 µs)

TG8000 Datasheet

LTC input

LTC input	LTC1 can be configured as an input, a time-of-day source, or an output
Formats	23.98, 24, 25, 30 fps drop-frame as per SMPTE 12M
Timing to video	Compliant with SMPTE 12M and continues to operate over at least 90% of possible timing range
Signal voltage range	0.5 to 10 V_{p-p} differential, 1 to 5 V_{p-p} single ended
Noise tolerance	–30 dB SNR RMS white noise with 10 kHz BW to the p-p signal level, or –10 dB SNR for 5 MHz white noise
Hum tolerance	0 dB hum-to-signal ratio
Error immunity	100 consecutive frames with consistent time code must be detected for time to be considered valid
Input impedance	Nominal 600 Ω differential, 300 Ω single ended

LTC output

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 ±10%; adjustable from 0.5 V to 5 V in 0.5 V steps

Network time protocol

Mode	Server only, using Ethernet interface on the TG8000 mainframe
Standard	NTPv3 for IPv4, per RFC 2030

General Purpose Interface (GPI)

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 HD-SDI Digital Video Generator Module specifications

Serial digital signal output

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 formats	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)
Required hardware	V2.0 or above
Source	Time-of-day with adjustable offset, or program (elapsed) time counter
Output connector	BNC ×2 or ×4 with Option BK
Output impedance	75 Ω
Output amplitude	800 mV$_{p-p}$ ±10% (typical)
Overshoot	≤10% (typical)
Rise/fall time	≤270 ps (20-80%) (typical)
DC offset (AC coupling)	0 V ±0.5 V (typical)
Jitter	≤135 ps (typical) alignment
Timing adjustment	
Range	Anywhere in the frame
Resolution	Clock resolution 13.5 ns (1/74.25 MHz)
Return loss	≥15 dB from 5 MHz to 750 MHz
	≥10 dB from 750 MHz to 1.485 GHz (typical)

Embedded audio signal

Active channels	1-16 channels
Sample frequency	48 kHz
Digital coding	20 or 24 bits
Signal alignment	Asynchronous and Synchronous (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 Dual Link HD-SDI Generator Module specifications

Serial digital signal output

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 formats	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
	2048×1080p/23.98 Hz, 24 Hz, 25 Hz, 29.97 Hz, 30 Hz
	2048×1080psF/23.98 Hz, 24 Hz
	2048×1556psF/14.99 Hz, 15 Hz, 17.98 Hz, 18 Hz
Sampling formats	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 convertor 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, ±200 ns in single clock increments
Output impedance	75 Ω
Output amplitude	800 mV$_{p\text{-}p}$ ±10%
Overshoot	≤10% (typical)
Rise/fall time	≤270 ps (20-80%)
DC offset (AC coupling)	0 V ±0.5 V (typical)
Jitter	≤135 ps (typical) alignment

Serial digital signal output

Timing adjustment

Range	Anywhere in the frame
Resolution	Clock resolution 13.5 ns (1/74.25 MHz)

Return loss

≥15 dB from 5 MHz to 750 MHz

≥10 dB from 750 MHz to 1.485 GHz

HD3G7 HD/3G-SDI Test Signal Generator Module specifications

Serial digital signal output

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, Pluge and Luma Reference, Production Aperture, Window, SMPTE 303M Color Reference, ChromaDuMonde, 2T Pulse and Bar, Color Pulses, Equalizer Test, PLL Test, SDI Matrix, Co-siting Pulse, Parametric Moving Zone Plate (More test signals are available on the TG8000 SW Library and Documentation DVD.)
HD-SDI converter	Input 1080 line HD-SDI signal up-converted to output 3G-SDI signal
Standards	SMPTE 12M-2, 272M, 274M, 291M, 292M, 296M, 299M, 352M, 424M, 425M-AB
Bit rate	2.97 Gb/s, 2.97/1.001 Gb/s, 1.485 Gb/s, 1.485/1.001 Gb/s
Output formats	720p/23.98 Hz, 24 Hz, 25 Hz, 29.97 Hz, 30 Hz, 50 Hz, 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, 50 Hz, 59.94 Hz, 60 Hz 1080psF/23.98 Hz, 24 Hz, 25 Hz, 29.97 Hz, 30 Hz 2048×1080p/23.98 Hz, 24 Hz, 25 Hz, 29.97 Hz, 30 Hz 2048×1080psF/23.98 Hz, 24 Hz, 25 Hz, 29.97 Hz, 30 Hz
Sampling formats	4:2:2 Y'C'bC'r, 4:2:2 Y'Cb'Cr'+A, 4:4:4 Y'Cb'Cr', 4:4:4 Y'C'bC'r+A, 4:4:4 G'B'R', 4:4:4 G'B'R'+A, 4:4:4 X'Y'Z'
Word size	10 or 12 bits
3G-SDI mapping formats	Level A, Level B, 2x HD in Level B
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 Ω
Output amplitude	800 mV$_{p-p}$ ±3%
Overshoot	≤5% (typical)
Rise/fall time	≤135 ps (20-80%)
DC offset (AC coupling)	0 V ±0.5 V (typical)

TG8000 Datasheet

Serial digital signal output

Jitter	≤67 ps (typical) (3 Gb, alignment)
	≤80 ps (typical) (3 Gb, timing)
Timing adjustment	
Range	Anywhere in the frame
Resolution	One clock cycle at the Y, G, or X pixel rate
Return loss	≥15 dB from 5 MHz to 2.5 GHz
	≥10 dB from 2.5 GHz to 3 GHz

Embedded audio signal

Active channels	1-32 channels
Sample frequency	48 kHz
Digital coding	24 bits
Signal alignment	Asynchronous and Synchronous (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

Output format	148.5 MHz clock, frame pulse, or line pulse
Output impedance	50 Ω
Output amplitude	720 mV$_{p\text{-}p}$ ±10%
Return loss	≥15 dB from 10 MHz to 300 MHz

SDI7 SD/HD/3G-SDI Test Signal Generator Module specifications

Serial digital signal output

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, Multiburst, Checkerboard, Clean Aperture, Convergence, Black-White Step Scale, Black-Dark Gray Step Scale, Pluge and Luma Reference, Production Aperture, Window, SMPTE 303M Color Reference, ChromaDuMonde, 2T Pulse and Bar, Color Pulses, Equalizer Test, PLL Test, SDI Matrix, Co-siting Pulse, Parametric Moving Zone Plate
	(More test signals are available on the TG8000 SW Library and Documentation DVD.)
Standards	SMPTE 12M-2, 259M, 272M, 274M, 291M, 292M, 296M, 299M, 352M, 424M, 425M-AB
Bit rate	2.97 Gb/s, 2.97/1.001 Gb/s, 1.485 Gb/s, 1.485/1.001 Gb/s, 270 Mb/s
Output formats	525i/59.94 Hz
	625i/50 Hz
	720p/23.98 Hz, 24 Hz, 25 Hz, 29.97 Hz, 30 Hz, 50 Hz, 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, 50 Hz, 59.94 Hz, 60 Hz
	1080psF/23.98 Hz, 24 Hz, 25 Hz, 29.97 Hz, 30 Hz
	2048×1080p/23.98 Hz, 24 Hz, 25 Hz, 29.97 Hz, 30 Hz
	2048×1080psF/23.98 Hz, 24 Hz, 25 Hz, 29.97 Hz, 30 Hz
Sampling formats	4:2:2 Y'C'bC'r, 4:2:2 Y'Cb'Cr'+A, 4:4:4 Y'Cb'Cr', 4:4:4 Y'C'bC'r+A, 4:4:4 G'B'R', 4:4:4 G'B'R'+A, 4:4:4 X'Y'Z'
Word size	10 or 12 bits
3G-SDI mapping formats	Level A, Level B, 2x HD in Level B
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
Full frame picture	Up to 1920×1080 (.bmp file)
Logo	Up to 1920×1080 (.bmp file)
Text	A preinstalled TrueType font is provided for Latin, Greek, and Cyrillic characters; users may provide their own TrueType font to support other characters
Output impedance	75 Ω

TG8000 Datasheet

Serial digital signal output

Output amplitude	800 mV$_{p-p}$ ±3%
Overshoot	≤1% (typical)
Rise/fall time	
HD, 3G	≤70 ps (typical) (20-80%)
SD	≤700 ps (typical) (20-80%)
DC offset (AC coupling)	0 V ±0.5 V (typical)
Jitter	
HD, 3G	≤50 ps (typical) (alignment)
	≤80 ps (typical) (timing)
SD	≤200 ps (typical) (alignment)
	≤200 ps (typical) (timing)
Timing adjustment	
Range	Anywhere in the frame
Resolution	One clock cycle at the Y, G, or X pixel rate
Return loss	≥15 dB from 5 MHz to 2.5 GHz (typical)
	≥10 dB from 2.5 GHz to 3 GHz (typical)

Embedded audio signal

Active channels	32 channels (3G-B)
	16 channels (SD, HD, 3G-A)
Sample frequency	48 kHz
Digital coding	24 bits (HD, 3G)
	20 bits (SD)
Signal alignment	Asynchronous and Synchronous (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

Output formats	System Clock, Pixel Clock, Line Rate Pulse, Field/Frame Rate Pulse
Output impedance	50 Ω
Output amplitude	520 mV$_{p-p}$ ±10%
Return loss	≥15 dB from 10 MHz to 300 MHz (typical)

TG8000 mainframe specifications

Mainframe

Frequency accuracy

Internal mode	$\pm110 \times 10^{-9}$ over 1-year calibration interval
	Typically $\pm10 \times 10^{-9}$ just after adjustment
Over temperature	$\pm2 \times 10^{-9}$ for ±5 °C variation
	$\pm10 \times 10^{-9}$ for 0 to 50 °C

Frequency drift	$< \pm100 \times 10^{-9}$ per year for internal and stay current frequency / stay genlock modes at constant temperature
Genlock range	$\pm50 \times 10^{-6}$
Number of slots for modules	4
Power supply slot	1
Communication	USB 2.0 on front panel
	1000/100/10BASE-T on power supply module
	GPIO interface for preset recall input, alarm output on power supply module

Physical characteristics

Dimensions

Height	44 mm (1.7 in.)
Width	483 mm (19 in.)
Length	559 mm (21.5 in.)

Weight (net)	6 kg (13 lb.)

Environmental

Power consumption	135 W (max)
Temperature	0 to +50 °C
Altitude	4500 m (15,000 ft.)
Source voltage	100 to 240 V, 50/60 Hz

Ordering information

Models

TG8000	**Multiformat Video Generator**

(mainframe; up to four modules can be installed in the mainframe at a time)

Standard accessories:

– TG8000 User Manual (part number 071-3036-XX)

– TG8000 SW Library and Documentation CD (part number 063-4440-XX)

– Rackmount Rails Kit (part number 351-1137-XX)

– Rackmount Slides and Rails Kit Instructions (part number 071-2746-XX)

NOTE: Please specify a power cord option when ordering.

Module installation limitations:

– Only one AGL7 or GPS7 module may be installed in one TG8000 mainframe.

– No more than two HDVG7, HD3G7, or AWVG7 modules, in any combination, may be installed in one TG8000 mainframe.

AGL7	Analog Genlock Module
AG7	Audio Generator Module
ATG7	Composite Analog Test Generator Module
AVG7	Analog Video Generator Module
AWVG7	Analog Wideband Video Generator Module
BG7	Analog Black Generator Module

Option CB: Add NTSC/PAL color bar. Option must be added at time of order; option cannot be added later.

DVG7	SD-SDI Digital Video Generator Module

Option 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	HD-SDI Digital Video Generator Module

Option BK: Add black outputs. Option must be added at time of order; option cannot be added later.

HDLG7	Dual Link HD-SDI Generator Module
HD3G7	HD/3G-SDI Test Signal Generator Module
SDI7	SD/HD/3G-SDI Test Signal Generator Module

Option 3G: Add 3G-SDI support.

Option DBT: Add embedded Dolby E audio test signal generation capability.

Instrument options

Common options for all models

Opt. 88	Module installation [1]
Opt. D1	Calibration data report in English/Japanese

Power plug options

All power cords include a lock mechanism except as otherwise noted.

Opt. A0	North America power plug (115 V, 60 Hz)
Opt. A1	Universal Euro power plug (220 V, 50 Hz)
Opt. A2	United Kingdom power plug (240 V, 50 Hz)
Opt. A3	Australia power plug (240 V, 50 Hz)
Opt. A5	Switzerland power plug (220 V, 50 Hz)
Opt. A6	Japan power plug (100 V, 110/120 V, 60 Hz)
Opt. A10	China power plug (50 Hz)
Opt. 11	India power plug (50 Hz) – No lock mechanism
Opt. 12	Brazil power plug (60 Hz) – No lock mechanism
Opt. A99	No power cord

Service options

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)
Opt. G5	Complete Care 5 Years (includes loaner, scheduled calibration, and more)
Opt. R3	Repair Service 3 Years (including warranty)
Opt. R5	Repair Service 5 Years (including warranty)

TG8UP field upgrades

Field upgrades for the TG8000 generator.

Opt. PW	Replacement power supply module for the TG8000 mainframe

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[1] Applies to mainframe and all modules.

SDI7UP field upgrades

Field upgrades for the SDI7 module.

Opt. 3G   Add 3G-SDI support.

Opt. DBT   Add embedded Dolby E audio test signal generation capability.

Optional accessories

Blank panel for empty module slot Order part number 614-1051-XX

DSUB-to-XLR adapter cable for the Order part number 012-1717-XX
GPS7 module

Warranty

1 year parts and labor.

CE

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