

4 Channel Slave Generator Module

Features

- 4 Independent Delay Channels
 - 1 ps Time Resolution
 - 10 ps RMS Jitter typ. (Slave-to-Slave)
 - < 20 ps /°C Drift (Slave-to-slave)
 - 1 Second Range
- Output Pulse
 - Up to 3.3 V under 50 Ω
 - < 1 ns Rise Time under 50 Ω
- Two Trigger Modes
 - Internal or Timing System
- Controlled via Ethernet and Web
- Compact Packaging module



Applications

- Picosecond Timing System
- Components Test
- ATE Application
- System Laser Timing Control
- Control Flash Lamps and Q-Switches
- Instrument Triggering
- Precision Pulse Application
- Timing Control of Diagnostics

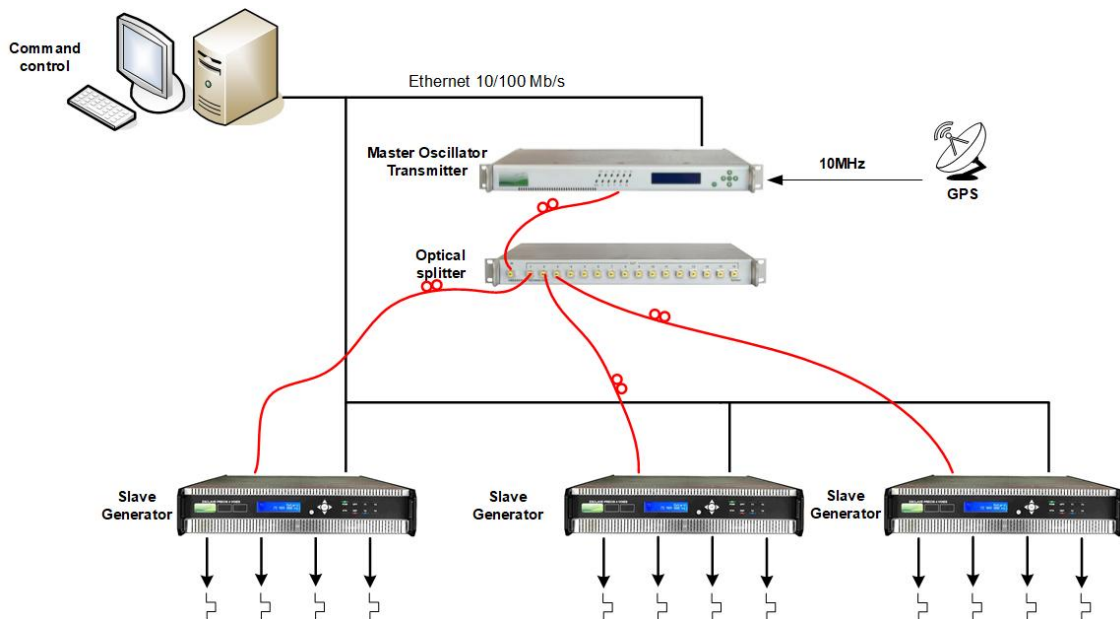
Description

The GFT1602 Slave Delay Generator module is specially designed to provide precise pulses in Timing System applications where a Master delivers an optical data stream to synchronize Slave Delay Generators (see application below).

The GFT1602 provides four independently delayed pulses on the front panel. Delays up to 1 second can be programmed with 1 ps resolution, and channel-to-channel jitter is less than 25 ps RMS. SMA outputs deliver pulses up to 3.3 V with 1 ns rise time under 50 Ω.

The GFT1602 provides two trigger modes: Internal trigger mode from one synchronized timer or software command, Timing System mode from optical input linked to a Master.

GFT1602 parameters can be remotely controlled via Ethernet (1 Gb/s) or Internet (Web page from Internal Web server).



Picosecond Timing System Application with 3 Slave Generators (12 delay channels)

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Specifications

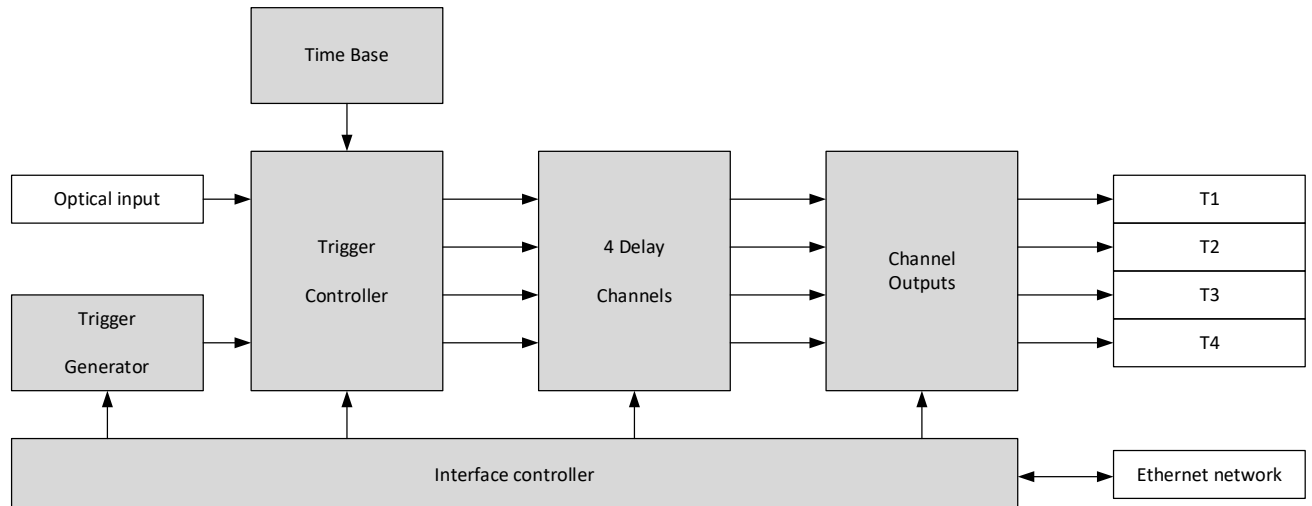
Timing system			
Distance between Master and Slave		Up to 1 km	
Internal timebase			
Frequency		160 MHz	
Stability		± 50 ppm	
Serial optical data stream input (OPT)			
Optical power		-15 dBm to -25 dBm (max: -10 dBm / min: -30 dBm)	
Wavelength		1550 nm ±10 nm	
Connector		LC/PC	
Master T0 OUT to GFT1602 Ti latency		< 800 ns + optical network propagation delay	
Delayed output (T1 to T4)			
Level		+3.3 V +/- 0.2V	
Impedance		50 Ω	
Rise time		< 1 ns, 600 ps typ.	
Width		Programmable, 100 ns to 1 ms +/- 30 ns, 6.25 ns steps	
Shape		Square	
Trigger sources		FINT, Optical trigger: single shot and repetitive trigger	
Connector		SMA	
Trigger sources			
Internal frequency		INTernal (FINT)	1 Hz to 100 kHz (1 Hz step)
Optical trigger		Single Shot or repetitive	
Delay generation (T1 to T4)			
Range		0 to 1 seconds	
Resolution		1 ps	
Accuracy		< 250 ps + delay * 10 ⁻⁷	
Drift (for short delay)		< 20 ps pp /°C @ 24 hours (GFT1602 to GFT1602)	
RMS jitter	Optical trigger	Channel to channel	< 10 ps rms + delay * 10 ⁻⁷ 4 ps rms typ + delay * 10 ⁻⁷
		GFT1602 to GFT1602	< 25 ps rms + delay * 10 ⁻⁷ 10 ps rms typ + delay * 10 ⁻⁷
	Internal trigger	GFT1602 to GFT1602	< 25 ps rms + delay * 10 ⁻⁷ 10 ps rms typ + delay * 10 ⁻⁷
		Channel to channel	< 10 ps rms + delay * 10 ⁻⁷
Interface			
Ethernet		Telnet commands, Web page 1 Gb/s - RJ45	
Power supply input			
Power		20 W / 5V±5% DC	
General			
Weight		< 5 kg (< 11.023 lbs)	
Dimension		155 x 110 x 50 mm	
Options			
Option 1		M: Master Oscillator transmitter	
Option 2		OTS/OTB: Optical input for timing System mode / Bidirectional link. 1550 nm, jitter < 10 ps rms + delay x 10 ⁻⁷ (channel-to-channel in internal trigger), single or repetitive trigger	
Option 3		-SFPLX: Ethernet with SFP module – 770 nm to 860 nm -SFPSX: Ethernet with SFP module – 1270 to 1355 nm	
Option 4		-TB: Time base between 100 to 200 MHz	

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Functional overview

Block diagram

The GFT1602 includes the five following functions: Time Base, Trigger Controller, Delay Channel, Channel Output and Interface Controller.



Block Diagram

Time Base: This function provides a 160 MHz time base from an internal clock (10 MHz) or from an optical timing system.

Trigger Controller: This function provides 2 Trigger modes to delay channels.

- Internal trigger mode

In this mode delay channels can be started from an internal Trigger Generator, programmable between 1 Hz to 1 000 000 Hz.

- Timing System mode

In this mode the GFT1602 receives on "Optical Input" an optical data stream from a Master Unit. Master unit provides triggers and time base over an optical network to synchronize multiple Slave Delay Generators. Triggers can be repetitive or single-shot.

Delay Channel: There are four delay channels (T1 to T4). The delay of each channel is programmable up to 1 second in 1 ps increments.

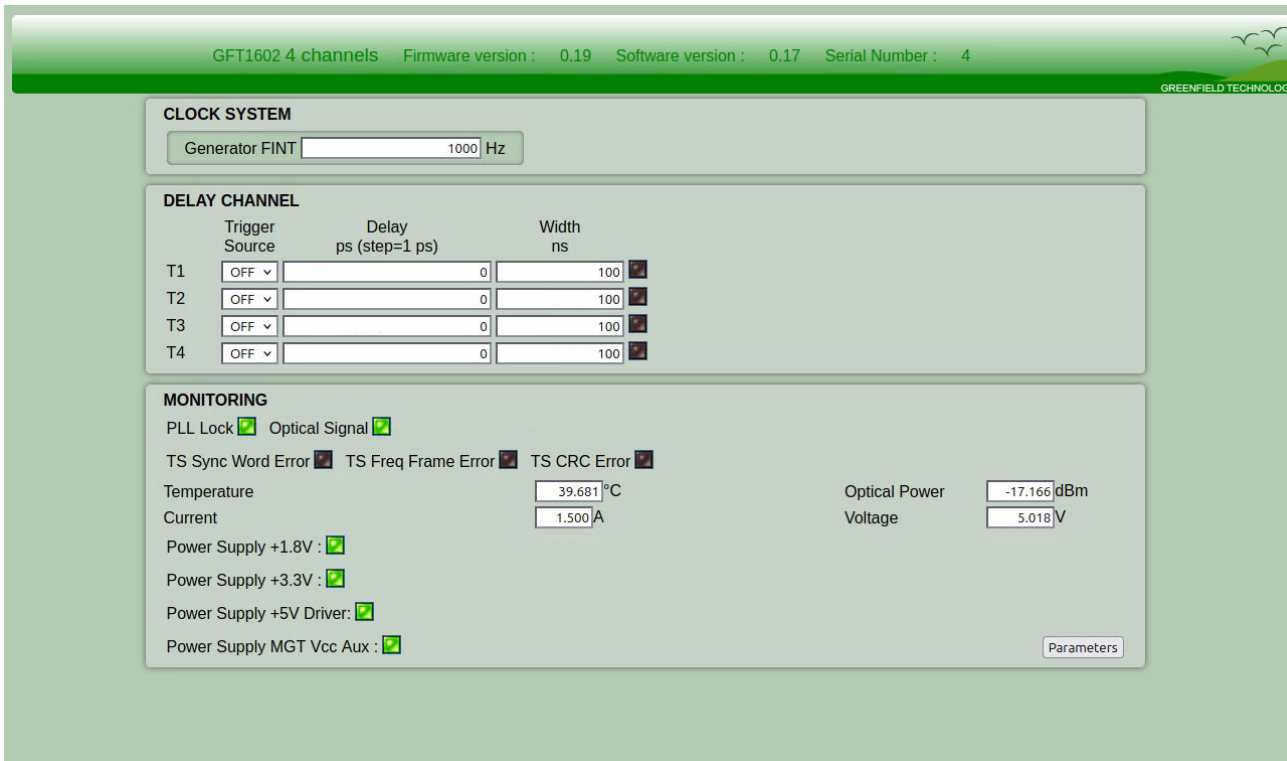
Channel Output: Each delay channel provides an output pulse. The outputs are designed to drive 3 V, 1 ns under 50 Ω loads.

Interface Controller: It manages internal functions (Time Base, Delay Channels) and user's interface (Ethernet network and Web pages via embedded web server).

Software tools

They are two ways to control the generator:

- **Quick remote way** via Internet (Web page from Internal Web server)



The screenshot shows the GFT1602 Main Web Page with the following sections:

- CLOCK SYSTEM**: Generator FINT set to 1000 Hz.
- DELAY CHANNEL**: A table with columns for Trigger Source, Delay ps (step=1 ps), and Width ns. All four channels (T1, T2, T3, T4) are currently set to OFF, 0 ps, and 100 ns.
- MONITORING**:
 - PLL Lock Optical Signal
 - TS Sync Word Error TS Freq Frame Error TS CRC Error
 - Temperature: 39.681 °C
 - Current: 1.500 A
 - Optical Power: -17.166 dBm
 - Voltage: 5.018 V
 - Power Supply +1.8V:
 - Power Supply +3.3V:
 - Power Supply +5V Driver:
 - Power Supply MGT Vcc Aux:

GFT1602 Main Web Page

This web page, from an embedded Web server, provides a simple method to configure settings for each channel (delay, trigger mode, trigger source), to control operation, and to display status of the instrument. The configuration information of the instrument is stored and saved in the GFT1602.

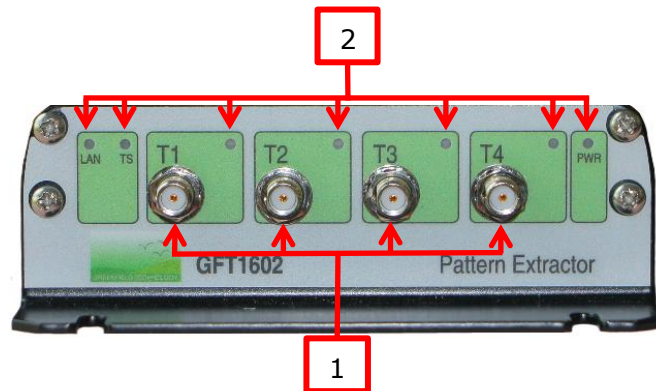
The web page can be opened via Edge, Mozilla Firefox or Chrome. After connecting a cable from the GFT1602's Ethernet port to your computer network, enter the GFT1602's IP address into your PC's browser (the IP address can be identified or assigned via the front panel). The browser will automatically open the control panel web page on your PC.

- **General remote way** via Python or LabVIEW software application in or PC software application.

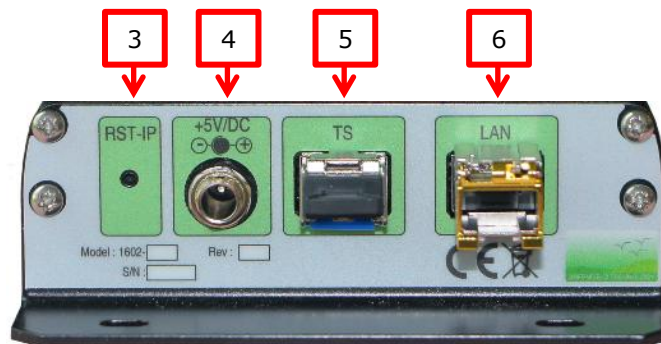
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Product Interface

Front panel



Rear panel



Interface

Front Panel			Rear Panel		
Connectors			Switch		
1	T1 to T4	T1 to T4 outputs: SMA connector	3	RST IP	Reset IP Default
Indicators			Connectors		
2	PWR	Power supply ON: blinking during power on and switched ON in operational state	4	+5V/DC	Jack diameter 1.3 mm
	LAN	RJ45 connected: blinking during power on and switched ON in operational state.	5	TS	Timing System Input: LC/PC connector
	TS	Synchronized by optical network: switched OFF when no optical signal detected, blinking in green when PLL is not locked and switched ON in green when PLL is locked	6	LAN	LAN connection: RJ45 or LC/PC connector
	T1 to T4	T1 to T4 trigger monitoring: ON when triggered at least one time (can be reset)			

Ordering Information

Model	Description
GFT1602	4 Channel Slave Generator Module
-1	M: Master Oscillator Transmitter
-2	OTS/OTB: Optical input for timing System mode / Bidirectional link. 1550 nm, jitter < 10 ps rms + delay x 10 ⁻⁷ (channel-to-channel in internal trigger), single or repetitive trigger
-3	SFPLX: Ethernet with SFP module – 770 nm to 860 nm SFPSX: Ethernet with SFP module – 1270 to 1355 nm
-4	TB: Time base between 100 to 200 MHz

Ordering example: GFT1602-M: Master Oscillator Transmitter