

GFT1602

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

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).

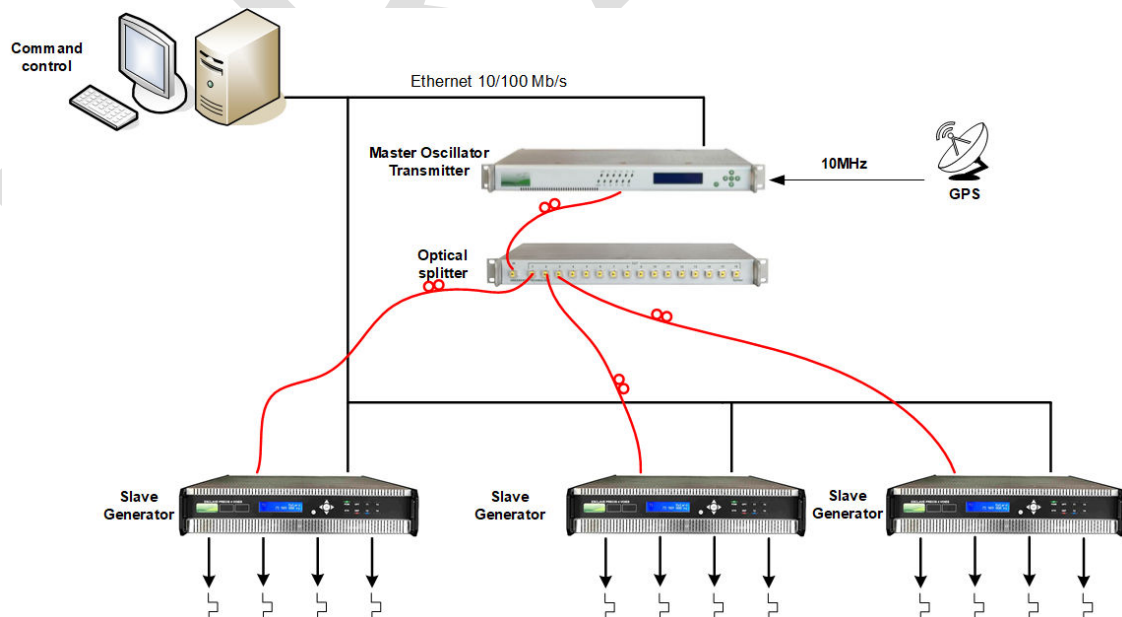
The GFT1602 provides four independently delayed pulses on the front panel. Delays up to 1 second can be programmed with 1 ps resolution, and channel-to-channel jitter is less than 25 ps RMS. SMA outputs deliver pulses up to 3.3 V with 1 ns rise time under 50 Ω .

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

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



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
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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	Channel to channel	< 10 ps rms + delay * 10 ⁻⁷

Interface

Ethernet	Telnet commands, Web page 1 Gb/s - RJ45
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Power supply input

Power	20 W / 5V $\pm$ 5% DC
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General

Weight	< 5 kg (< 11.023 lbs)
Dimension	155 x 110 x 50 mm

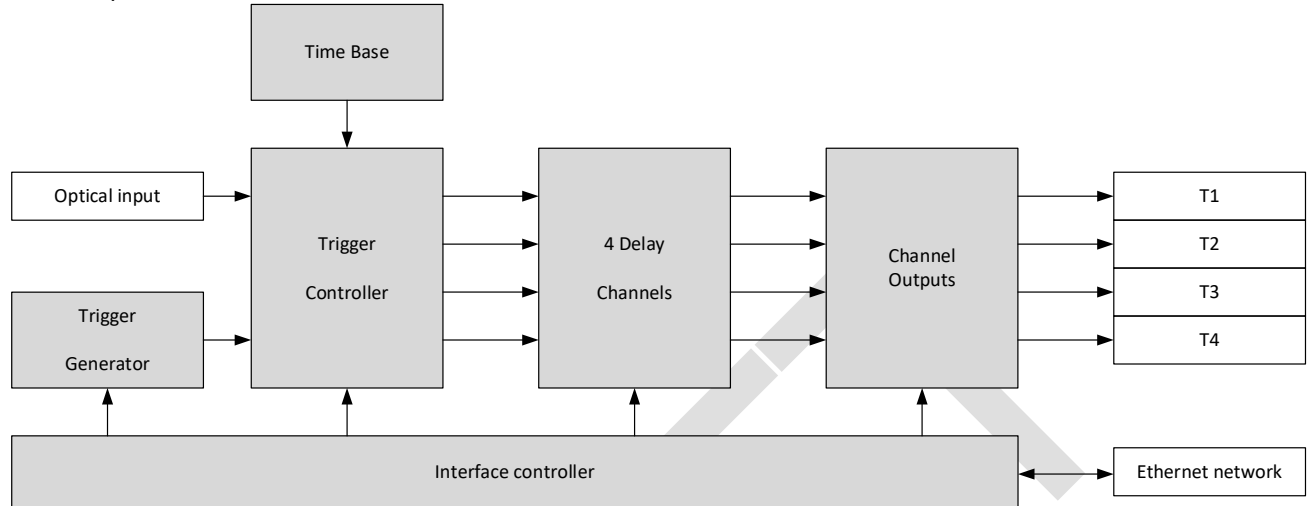
Options

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

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).

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Software tools

They are two ways to control the generator:

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

The screenshot displays the GFT1602 Main Web Page interface. At the top, a green header bar contains the text 'GFT1602 4 channels', 'Firmware version : 0.19', 'Software version : 0.17', and 'Serial Number : 4'. Below this, the 'CLOCK SYSTEM' section features a 'Generator FINT' dropdown menu set to '1000 Hz'. The 'DELAY CHANNEL' section contains a table with four rows (T1, T2, T3, T4) and three columns: 'Trigger Source' (all set to 'OFF'), 'Delay ps (step=1 ps)' (all set to '0'), and 'Width ns' (all set to '100'). The 'MONITORING' section displays various status indicators: 'PLL Lock' and 'Optical Signal' are checked (green squares); 'TS Sync Word Error', 'TS Freq Frame Error', and 'TS CRC Error' are unchecked (red squares). It also shows 'Temperature' at 39.681 °C, 'Current' at 1.500 A, 'Optical Power' at -17.166 dBm, and 'Voltage' at 5.018 V. Power supply status is shown as checked for '+1.8V', '+3.3V', '+5V Driver', and 'MGT Vcc Aux'. A 'Parameters' button is located at the bottom right of the monitoring section.

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.

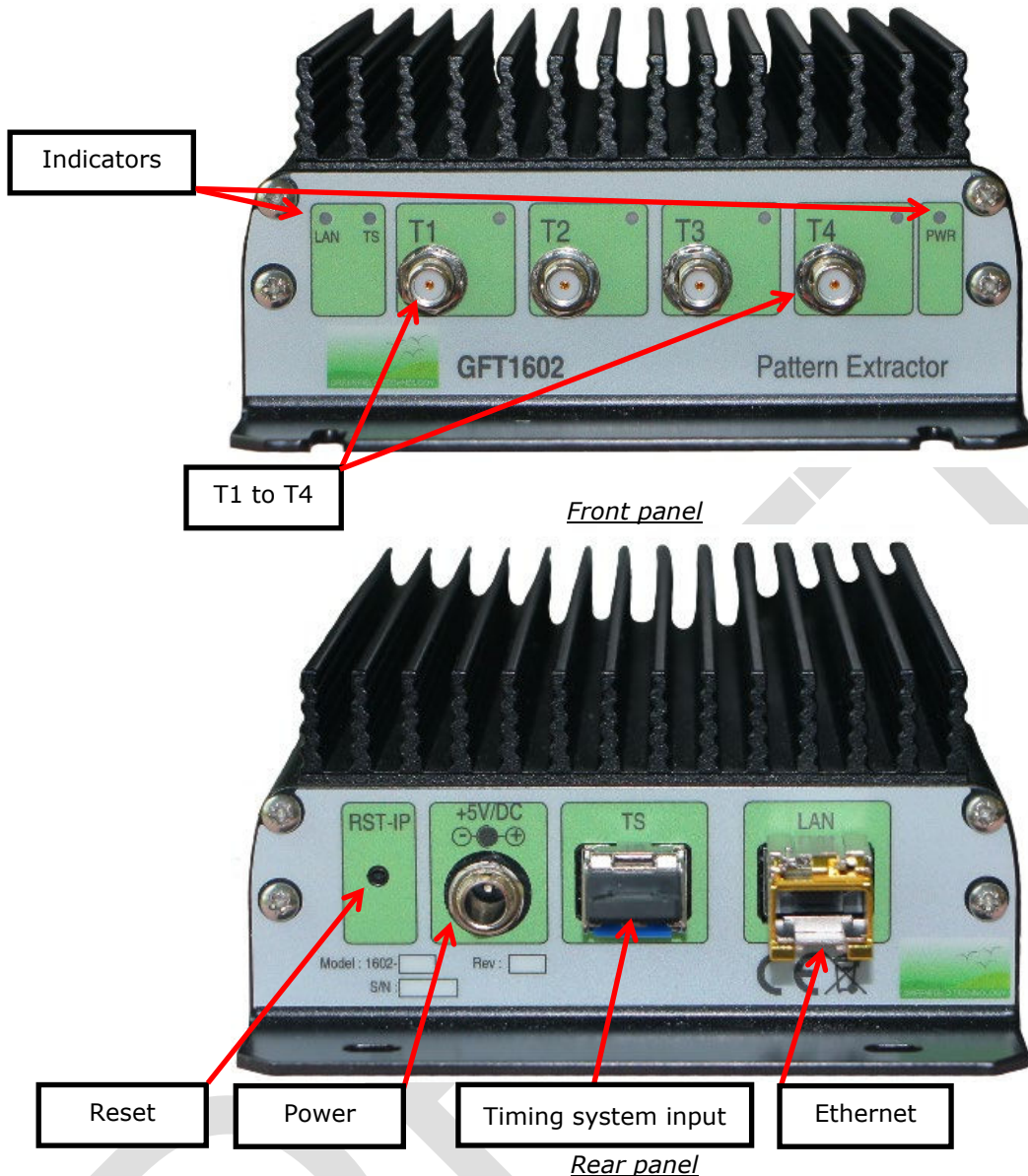
The web page can be opened via Edge, Mozilla Firefox or Chrome. After connecting a cable from the GFT1602's Ethernet port to your computer network, enter the GFT1602's IP address into your PC's browser (the IP address can be identified or assigned via the front panel). The browser will automatically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



Connector, Switch, Indicators

Front Panel		Rear Panel	
Connectors		Connectors	
T1 to T4	T1 to T4 outputs: SMA connector	LAN	LAN connection: RJ45 or LC/PC connector
Indicators		TS	Timing System Input: LC/PC connector
PWR	Power supply ON: blinking during power on and switched ON in operational state	+5V/DC	Jack diameter 1.3 mm
LAN	RJ45 connected: blinking during power on and switched ON in operational state.	Switch	
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	RST IP	Reset IP Default
T1 to T4	T1 to T4 trigger monitoring: ON when triggered at least one time (can be reset)		