GFT1008

4 Channel Digital Delay Generator

Features

- Eight Independent Delay Channels (up to 16 in option)
  - 1 ps Time Resolution
  - < 15 ps rms Jitter for Internal Triggered Delays
  - < 25 ps rms Jitter for External Triggered Delays
- Adjustable Output Pulse up to 10 V, 1 ns Rise Time
- External or Internal Trigger Sources for Every Channel
- Internal or External Clocking up to 100 MHz
- Independent Control of Delay, Width, and Amplitude
- Controlled via Ethernet, Web Page and Front Panel
- Compact Packaging 1U, 19”
- Options:
  - Extension to 12 or 16 Channels
  - Output pulse: 3.3 V (low jitter), TTL, 50 V, or Optical

Applications

- Components Test
- Automated Test Equipment (ATE)
- System Laser Timing Control
- Control Flash Lamps and Q-switches
- Synchronization with selectable clock frequency - Mode Locked Laser
- Precision Pulse Application
- Gate High-Speed Cameras
- Instrument Triggering

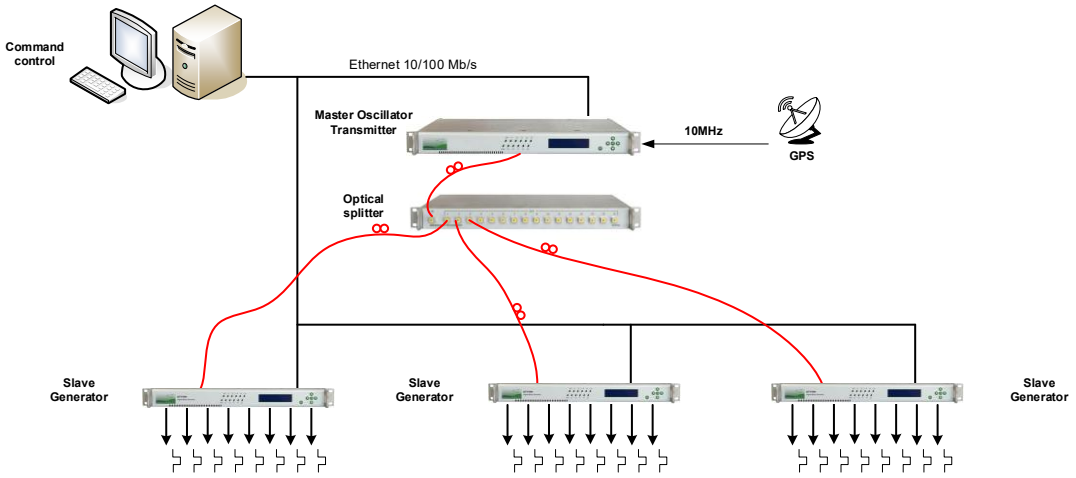
Description

The GTF1008 Digital Delay Generator provides eight independently delayed pulses on the rear panel with options for four, twelve or sixteen channels. Delays up to 10 seconds can be programmed with 1 ps resolution, and channel-to-channel jitter is less than 15 ps RMS. BNC outputs deliver up to 10 V, 1.5 ns under 50 Ω. Pulse amplitude and width are adjustable on each output channel.

One input channel, or two internal synchronized timers are used to trigger all output channels. One T0 channel is used as a time reference for all the delayed output pulses.

The GFT1008 is a Digital Delay Generator that operates either as a standalone device, or as a component in a timing system (Option 2). In a timing system (see below), the GFT1008 is operated in conjunction with a Master Oscillator Transmitter that controls and synchronizes a number of GFT1008 DDGs via optical fibers.

GFT1008 parameters can be locally controlled over the front panel keys and LCD display, and remotely controlled via Ethernet (1 Gb/s) or Internet (web page from internal web server).



Timing System Application with 3 Slave Generators (24 delay Channels)

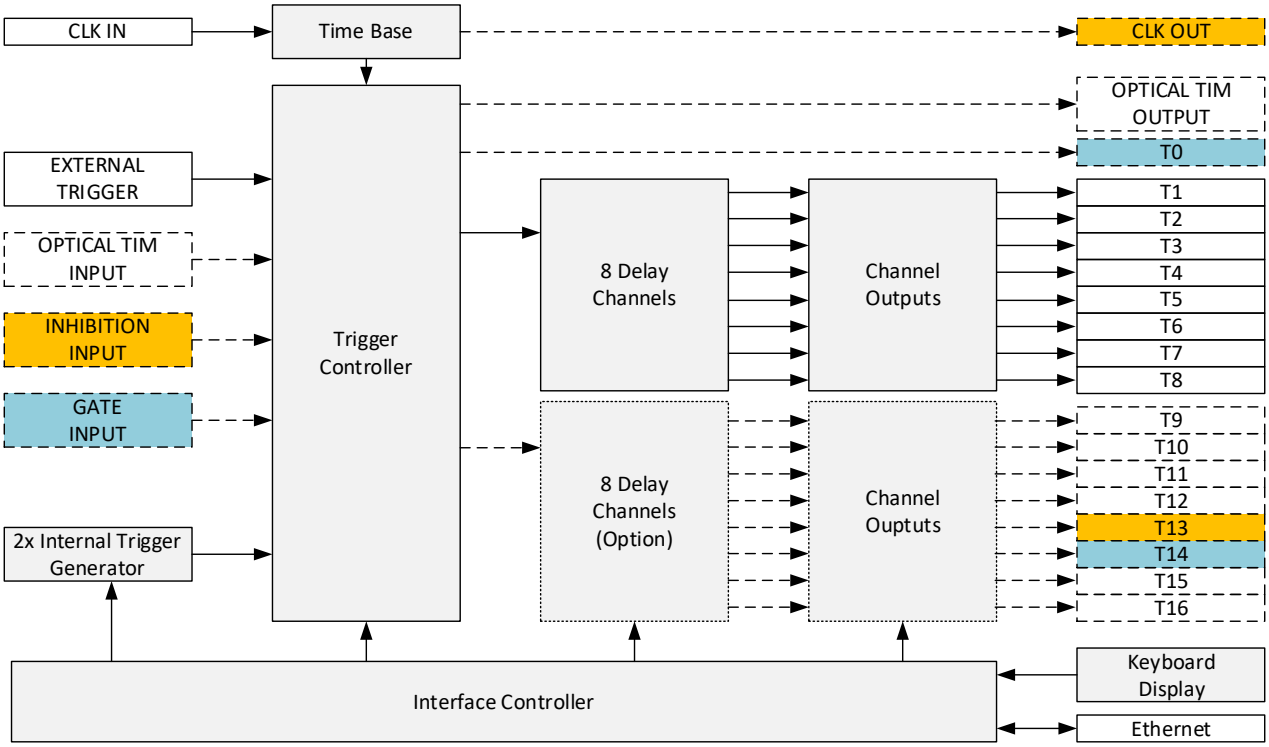
Specifications

Delay Channel	
Number	8 independents
Range	0 to 10 seconds
Resolution	1 ps
RMS Jitter	< 15 ps + delay (s) x 10^{-8} (channel-to-channel in internal trigger)
	< 15 ps (short delay) < 50 ps + delay (s) x 10^{-8} (external trigger to any channel)
	< 15 ps + delay (s) x 10^{-8} (external time reference to any channel - TBC)
Accuracy	< 100 ps + delay (s) x 10^{-7}
Time Base	160.00 MHz frequency, ±25 ppm stability
External Trigger Input	
Repetition Rate	Up to 1 MHz or single-shot
Trigger Level	± 3.3 V / 50 Ω, step of 1 mV / Maximum ± 5 V during 1 µs
Slope	Positive
Minimum Trigger Delay	< 100 ns (insertion delay)
Internal Trigger	
Two Synchronized Timers	Frequency = 1 Hz to 1 MHz, resolution = 6.25 ns
Output Pulse T1 to T8	
Amplitude	3 V to 10 V in steps of 10 mV
Load	50 Ω
Rise/Fall Time	< 1.5 ns / 1.5 ns @ 10 V
Width	50 ns to 10 ms in steps of 6.25 ns ± 3.125 ns
External Time Reference	
Threshold	0 V, internal 50 Ω
Level	Min -3 dBm, typical 0 dBm
Frequency	10 MHz (other frequencies are available up to 100 MHz)
General	
User Interface	Front panel, Ethernet 1 Gb/s, Internet (web page) – RJ45
Power Consumption	90 to 240 V / 50 – 60 Hz/ 30 W
Weight / Size	< 6 kg / 19” W X 410 mm D X 1U H

Options	
1	**-04C/08C/12C/16C**: 4/8/12/16 channels
2	**-OTS/OTB**: Optical input for timing System mode (SC/APC) / Bidirectional link (LC/PC). 1550 nm, jitter < 15 ps rms + delay x 10^{-8} (channel-to-channel in internal trigger), single or repetitive trigger
3	Configurable by group of 4 channels **-STD**: base version **-3.3V**: (Bank of 4 channels) 3.3 V channel output, rise/fall time = 1/1 ns (700 ps typ.) into 50 Ω. Width = 50 ns to 10 s, in step of 6.25 ns; polarity: positive or negative, RMS jitter< 6 ps + delay x 10^{-8} **-05V**: (Bank of 4 channels) 1.5 V to 5 V channel output, step of 1 mV, rise/fall time = 1/1 ns into 50 Ω @ 5 V, 3/3 ns into 50 Ω @ 1.5 V; 3 V to 10 V channel output, step of 2 mV, rise/fall time = 2/2 ns into >1 kΩ. Width = 50 ns to 10 s, in step of 6.25 ns; polarity: positive or negative **-50V**: (Bank of 4 channels) 15 V to 50 V channel output, width = 50 ns to 5 µs, rise/fall time = 3/15 ns into 50 Ω **-W850ST/W1310SC/W1310FC/W1550SC/W1550FC**: (Bank of 4 channels) optical channel output >250 µW, width = 0.1 to 10 µs, rise/fall time = 1/2 ns; RMS jitter< 10 ps + delay x 10^{-8}, wavelength 850 nm (ST), 1310 nm (SC or FC), 1550 nm (SC or FC)
4	**-AUX**: AUXILIARY INPUTS/OUTPUTS details (*not compatible with extension to 16 channels)
	-INH/GAT*: INHibition/GATe input, adjustable threshold
	-INH/GAT2*: INHibition/GATe input 2, adjustable threshold
	-CLK*: Clock output (sinus, AC, 2V pp, Time base / 2)
	-T0*: T0 output
5	**-TB**: Time base between 10 to 100 MHz (CLK IN) and 150 to 200 MHz (Timing system)
6	Limited performances
	-100: 100 ps delay channel resolution
	-2n: RMS jitter < 2 ns + delay x 10^{-8} (external trigger to any channel)
7	**-SFPLX**: Ethernet with SFP module – 770 nm to 860 nm, LC/PC **-SFPSX**: Ethernet with SFP module – 1270 to 1355 nm, LC/PC

Functional Overview

Block Diagram: The GFT1008 includes the five following functions: Time Base, Trigger Controller, Digital Delay Channel, Channel Output and Interface Controller.



Block diagram of the delay generator (□ □ ■ □ only one input/output available)

Time Base: This function provides a 160.00 MHz time base from an internal reference or an external 10 MHz reference. As an option, the external reference can be up to 100 MHz (Ask to factory).

Trigger Controller:

This function provides 4 trigger sources to each delay channel:

- External trigger source: When the external trigger source is selected, a rising edge on "TRIG IN" starts a delay sequence. After each channel's delay period, a pulse appears on each channel's output,
- There are two internal trigger sources from two synchronous Timers. The frequency of each Timer is programmable from 1 Hz to 1 MHz,
- Optical trigger source (as an option) is operated in conjunction with a Master Transmitter that controls a number of GFT1008. Via optical fiber, the Master Transmitter provides a serial data stream for time base synchronization, single-shot, repetitive triggers, and inhibition information to the multiple GFT1008 units at distance greater than 1 km from the Master Transmitter.

"Inhibition input" allows the system to quickly inhibit selected outputs.

Delay Channel: They are 8 independent delay channels (with options for eight, twelve or sixteen channels). The delay from the selected trigger source is programmable up to 10 seconds in 1 ps increments.

Channel Output: Each delayed output pulse (T1 to T12, AUX1 to AUX3) can be independently adjusted in level and width. The outputs are designed to drive a 50 Ω load. As an option, channel output level can be 1.5 to 5 V, or 15 to 50 V, or optical pulse.

Driver	10V	3.3V	05V	50V	WxxxYY
Amplitude	3 to 10 V @ 50 Ω	3.3 V @ 50 Ω	1.5 to 5 V @ 50 Ω 3 to 10 V @ 1 MΩ	15 to 50 V @ 50 Ω	> 250 µW
Width	50 ns to 10 ms	50 ns to 10 s	50 ns to 10 s	50 ns to 5 µs	0.1 to 10 µs
Rise & Fall time	1.5 ns @ 10 V	0.7 ns	1 ns @ 5V	3/15 ns	1/2 ns
Polarity	+	+/-	+/-	+	+
RMS Jitter	< 15 ps	< 6 ps	< 15 ps	< 15 ps	< 15 ps
Duty cycle	0 to 25 %	0 to ∞	0 to ∞	0 to 25 %	0 to 25 %

AUX1 to AUX4 can be an input or an output:

	AUX1	AUX2	AUX3	AUX4
OUTPUT	T13	T14	T15 or CLK OUT	T16 or T0
INPUT	INH/GAT	INH/GAT		

Interface Controller: It manages internal functions and user interfaces. The parameters can be locally controlled over the front panel keys, and remotely controlled via Ethernet (1 Gb/s) or Internet (web page from internal web server) All parameter values are automatically saved.

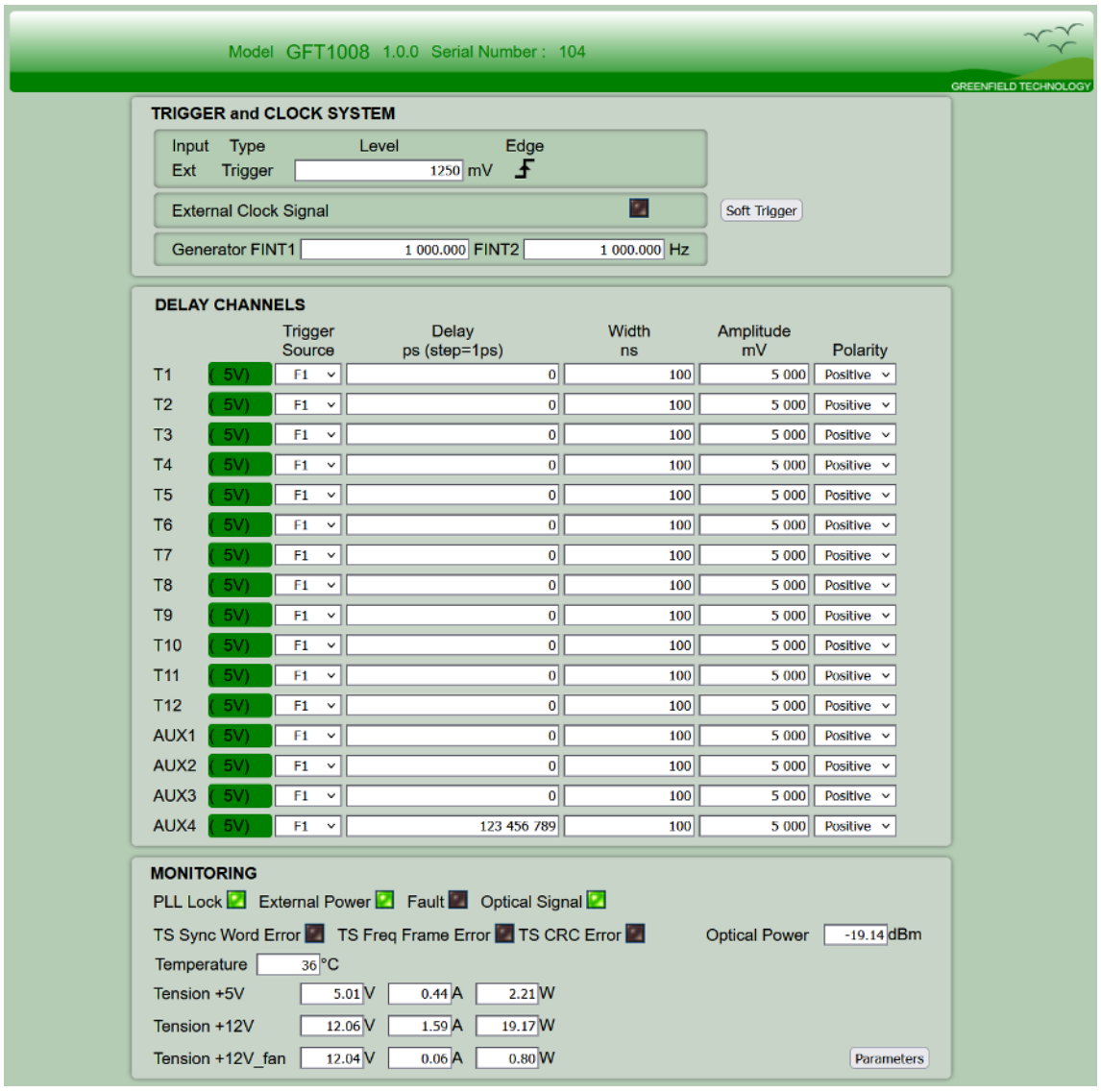
Control and Software Tools

They are three ways to control the generator:

- **"Local way"** via the front Panel Display an Keyboard

- **"Quick remote way"** via Internet and control panel web pages.
  Web page, from embedded Web server, provides a simple method to configure settings for each channel (delay, output amplitude, polarity, output width, trigger mode, trigger source), to control operation and to display the status of the instrument.
  The configuration information of the instrument is stored and saved in the GFT1008.

  The web page can be opened via Chrome, Mozilla Firefox or Chrome.
  After connecting a cable from the GFT1008's Ethernet port to your computer network, enter the GFT1008'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.

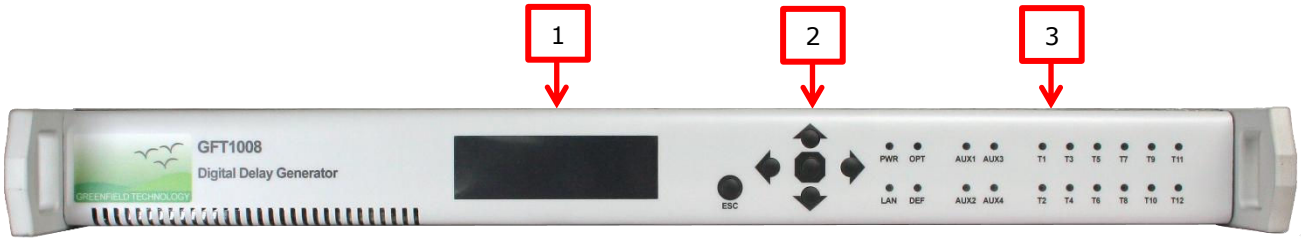


Setup Web page

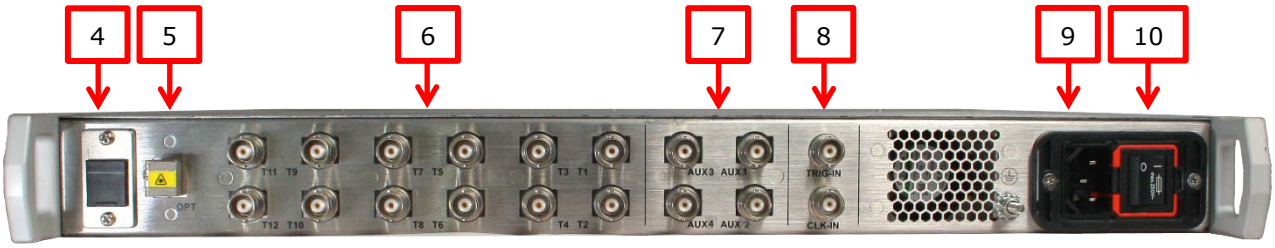
- **"General remote way"** via PC software application.

Product interface

Front panel



Rear panel



Interface

Front Panel		Rear Panel	
Indicators		**Connectors**	
1	Display for local control	4	LAN: LAN connection: RJ45 connector
3	PWR: Power supply ON	5	OPT: Optical TIM input: SC/APC connector
	OPT: Synchronized by optical timing network	6	T1 to T12: T1 to T12 output pulses: BNC connectors
	LAN: Synchronized by network	7	AUX1 to AUX4 input or output: BNC connectors
	DEF: Default	8	TRIG IN: External Trigger Input: BNC connector
	T1 to T12: Blinks at the trigger frequency of channel 1 to 12		CLK IN: Clock input: BNC connector
	AUX1 to AUX 4: Input/Output status	9	Power: AC power plug (90-240 V)
Switches		**Switches**	
2	Small keyboard for local control	10	ON/OFF: Power ON/OFF switch

Ordering information

GFT1008 Delay Generator part numbering

GFT1008-X-X-X-X (Where "X" is option number)

Ordering examples

GFT1008 – C - TS – 10V – 10V – 3.3V – AUX – INH – GAT – CLK - T0 – Ø – 100 – 2ns- SFPSX

Part Family
"GFT1008"

Channel number
" 04C" : 4 channels
" 08C" : 8 channels
" 12C" : 12 channels
" 16C" : 16 channels

Timing System
"Ø" : Local mode (base version)
"OTS" : Optical input for Timing System
"OTB" : Optical bidirectionnal link for Timing System

Output configuration by group of 4 channels
"10V" : 3V to 10V base output version
"3.3V" : Fix 3.3V channel outputs – Best RMS jitter
"05V" : 1.5V to 5V outputs
"50V" : 15V to 50V outputs
"W850ST" : Optical output 850nm ST connector
"W1310SC" : Optical output 1310nm SC connector
"W1310FC" : Optical output 1310nm FC connector
"W1550SC" : Optical output 1550nm SC connector
"W1550FC" : Optical output 1550nm FC connector

Auxiliary inputs/outputs (if AUX selected) – all optional
"INH/GAT" : Inhibit/Gate signal 1 – Aux 1
"INH/GAT" : Inhibit/Gate signal 2 – Aux 2
"CLK" : Clock output (AC signal – 80MHz – Aux 3)
"T0" : Ref Output – (Fix delay – 5 to 10V – Aux 4)

Ethernet option
"Ø" : SFP RJ45 (base version)
"SFPLX" : SFP optical module – 770 to 860 nm
"SFPSX" : SFP optical module – 1270 to 1355nm

Limited performances
"Ø" : Base version – 1 ps delay resolution – Lowest RMS jitter from external trigger (< 50 ps RMS)
"100" : 100 ps delay resolution
"2ns" : Limited external resync – 2 ns ps RMS jitter

Clock In value
"Ø" : 80 MHz (base version) or TS Time Base
"77.76" : CLK In value in MHz