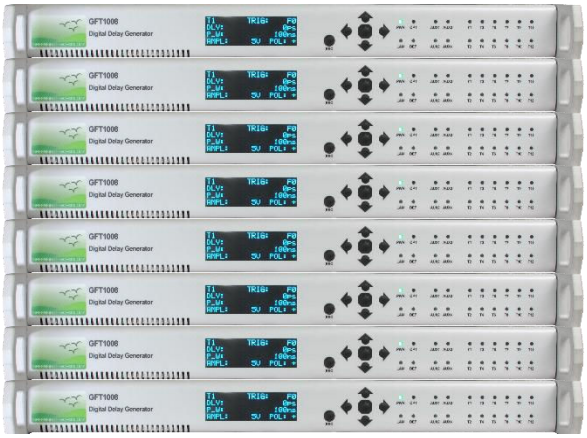
GFT1000: Picosecond Timing System

128 to 4000 Synchronized Pulses

Features

- 128 independent delay channels (4000 in option)
  - 1 ps resolution (100 ps in option)
  - < 10 ps RMS jitter
  - Up to 10 second range
- Adjustable Output pulse up to 10 V into 50 Ω
- Up to 1 Km between two Output pulses
- Independent trigger rates on each channel
- 10 MHz external reference (up to 100 MHz in option)
- Controlled via Front panel, Ethernet, and Internet
- Options:
  - Output electrical pulse 3.3 V (fixed), 1.5 to 5 V, 15 to 50 V into 50 Ω or
  - Output optical pulse



16 delay channel Slave generators

Applications

- Picoseconds system laser
- Synchrotron
- High energy laser
- Accelerator
- Large physics system
- Detonic

Description

The GFT1000 can provide one hundred of delayed pulses to equipment's distributed over an area of thousands of square meters, within a time resolution of 1 ps (100 ps in option).

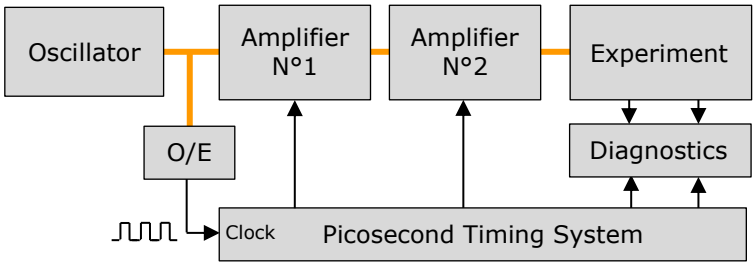
The basic version of the GFT1000 is a system made with eleven synchronized units. One unit is the Master Oscillator (GFT3022) and provides the triggers and time base to eight Slave units (GFT1008) via an optical network (splitter and optical fibers). Each Slave is a digital delay generator and provides sixteen channels. The delay of each channel is programmable up to 10 second with a resolution of 1 ps. Channel to channel jitter is less than 10 ps RMS. In standard BNC output delivers 1.5 ns / 10V level into 50 Ω.

Amplitude and width are independently adjustable on each output giving you complete time and amplitude domain control. Each channel can be independently set to trigger in single shot mode, or repetitive mode with a set of frequencies between 0.1 Hz and 10 kHz.

External clock input allows to synchronize the GFT1000 to an 10 MHz frequency standard or to selectable clock frequency (Mode Lock laser).

The high accuracy, wide range, low jitter, and up to 1 km separation between the channels, designate the GFT1000 as the ideal solution to many critical timing problems encountered in large physics system like Synchrotron, Accelerator and High energy laser. The basic version provides 128 channels distributed over 10 areas. In option the number of channels can be extended up to 4000 and the number of areas up to 256.

Application example: The system is well suited in Picoseconds Laser System applications to synchronize all the equipment's and functions with only few compact units. In this application the "Clock reference input" of the System receives a signal from laser oscillator via an O/E (Optical to Electrical converter) From the Timing System each Amplifier (Pum-laser Q-switch, Pockel cell ...) or diagnostic instruments (Digitizer, Calorimeter, CCD camera, …) can receive repetitive or single pulses (adjusted in rate, delay, amplitude, polarity and width) synchronized on "Clock reference input" with a very low jitter. All the parameters may be remote controlled via Ethernet



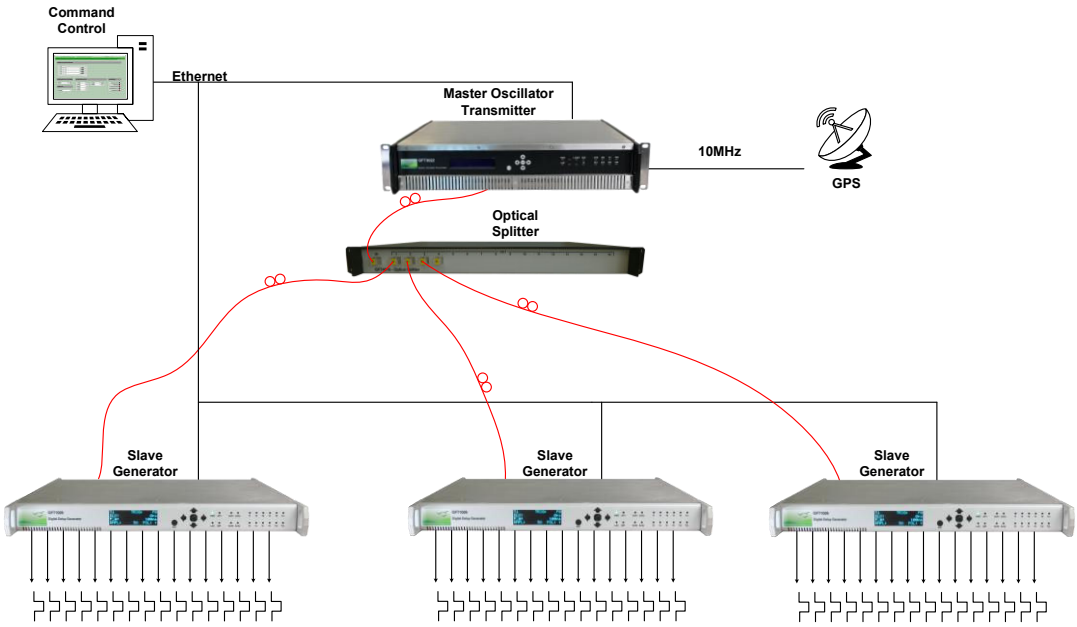
Picosecond laser System

Specifications

MASTER OSCILLATOR TRANSMITTER	
Trigger Source	
Internal	3 repetitive triggers programmable from 0.1 Hz to 10 kHz
External and command	Pair of single shot
Optical Output	
Function	Output to transmit time base and triggers
Time base	
Frequency	160 MHz, 0.05 ppm stability
Inhibition Input	
Level	Active high, Threshold = +1.5 V
T0 Master Output	
Level	10 V into 50 Ω, 100 ns width
Clock Reference input	
Frequency	10 MHz (up to 100 MHz in option)
ALL SLAVES GENERATOR	
Delay Channel	
Number	16 independents
Range	0 to 10 seconds
Resolution	1 ps (100 ps in option)
Jitter	10 ps (channel to channel)
Accuracy	<150 ps + delay x 10^{-7}
Time base	25 ppm stability
Channel Output Pulse T1 to T16	
Amplitude	3 to 10 V into 50 Ω
Rise / Fall time	1.5 ns / 1.5 ns @ 10 V
Width	50 ns to 10 ms in step of 6.25 ns
Polarity	Positive
Connector	BNC
Optical Input	
Function	Input of time base and triggers from MASTER
General	
Interface control	Front panel, Ethernet (TCP IP commands), Internet (web page)
Software	Python example
Power	90 to 240 V / <100 W per equipment
Size	Racks 19''
OPTIONS	
1	100 ps delay channel resolution
2	3.3 V or 1.5 to 5 V or 15 to 50 V driver output (ask to the factory)
3	Optical output (ask to the factory)
4	Specific clock input frequency (10 to 100 MHz) ask when ordering
5	Channel number extension: Up to 4000 channels (ask to the factory)
6	GFT1018 Low cost 8 channels slave
7	Other application (ask to the factory)

Operating information

Functional block diagram



Master Oscillator Transmitter provides triggers and time base and allows the transmission of them via an optical serial data stream to synchronize Slave generator.

Triggers: The Master provides

- 3 repetitive triggers. The frequency of each repetitive trigger is made with 3 synchronous timers programmable by the user
- Pair of single shot trigger synchronized with repetitive trigger and started by the user command or external signal on external trigger input.

Clock reference input: time base of the master may be synchronized on external clock.

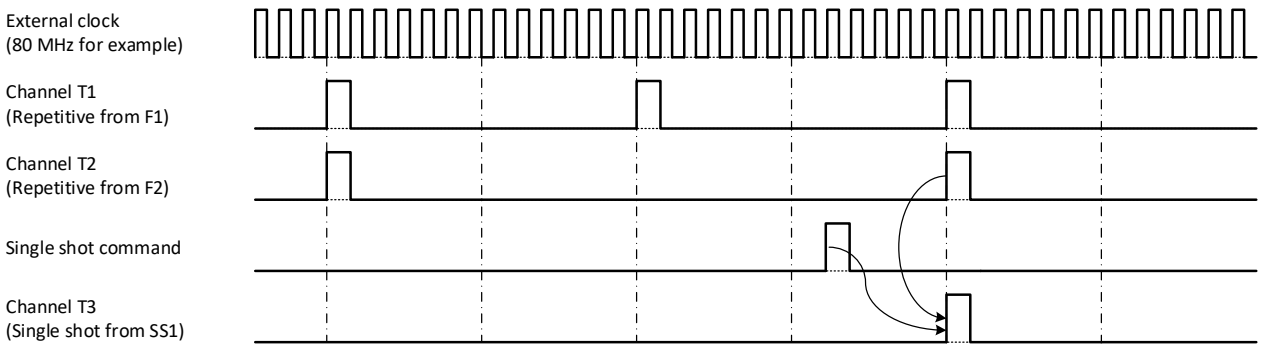
Inhibition input stops the single-shot trigger with hardware preset level for safety management

Optical Splitter via optical cables allows the distribution of the data stream over the different area with very low jitter.

Slave generator receives the optical data stream decodes time base and triggers and then generate ten local delayed pulses to toggle different devices. Each output pulse can be adjusted in delay, amplitude, Width, and polarity and synchronized on one of three repetitive trigger or single shot trigger.

Command control: All parameters in the timing system may be controlled with front panel interface or over a remote network.

Example of channel output mode



Mode sequence

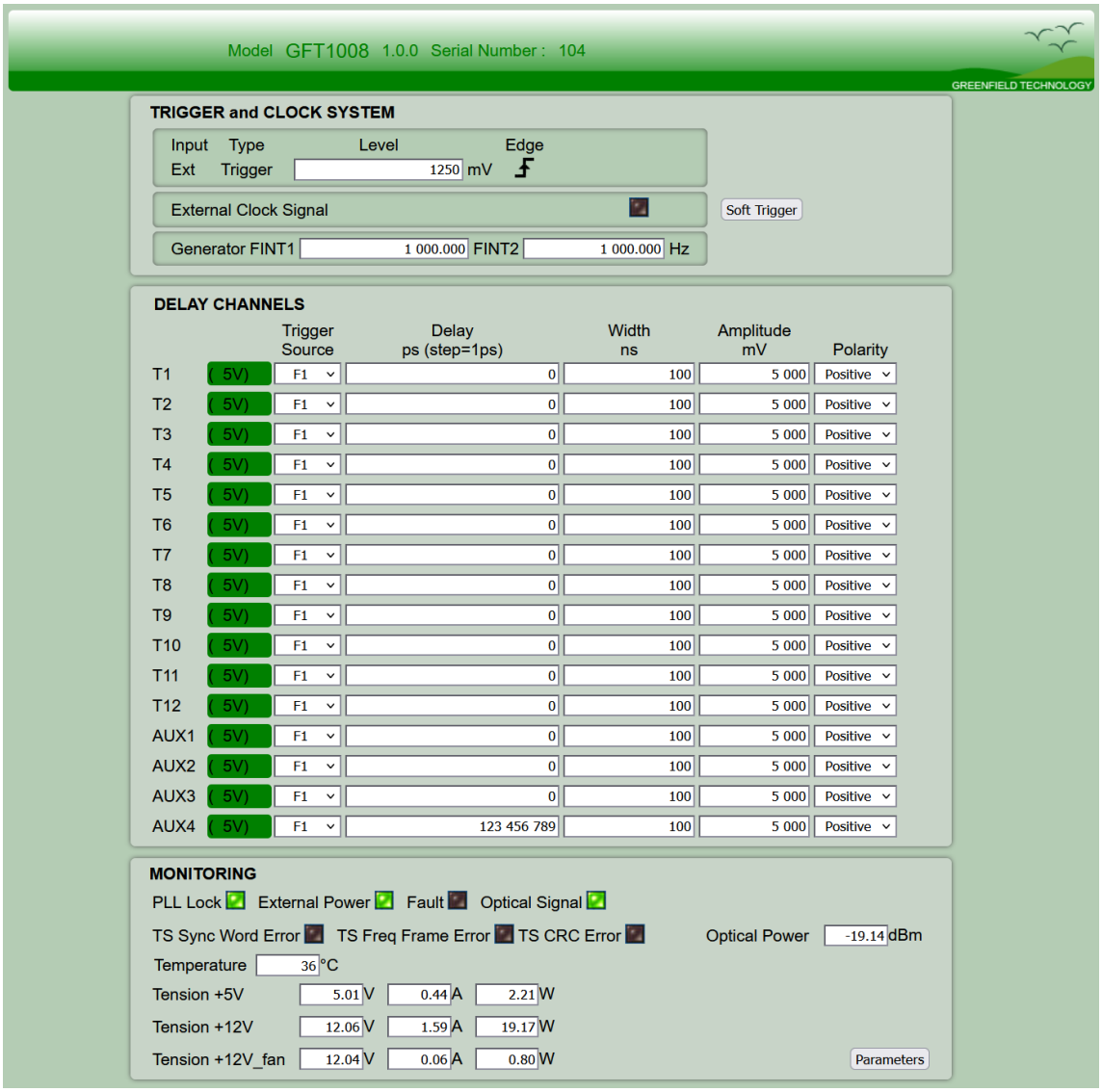
The user may program a sequence of single shot as shown in figure below: Repetitive single shot, single burst, repetitive single burst.

Sequence example: Repetitive single burst (count = 3)

Control and software tools

There are three ways to control the system
"local way" via the front Panel Display an Key board

Easy remote way via Internet and control panel web pages.



"General remote way" via Python application or other PC software application (EPIC; TANGO, LabView, …).

Physical organization

The system

Base version (128 channels) of the system is built with the following devices

- 1x GFT3022 is the Master Oscillator Transmitter
- 1x GFT4016 is the Optical Splitter (8 outputs)
- 9x optical fiber cables
- 8x GFT1008 are the Slave generator

For more information you can see specific datasheet of each device.

Ordering Information

Model	Description
GFT1000	Base version: Electrical to Optical Module
-1	100 ps delay channel resolution
-2	3.3 V or 1.5 to 5 V or 15 to 50 V driver output (ask to the factory)
-3	Optical output (ask to the factory)
-4	Specific clock input frequency (10 to 100 MHz) ask when ordering
-5	Channel number extension: Up to 4000 channels (ask to the factory)
-6	GFT1018 Low cost 8 channels slave
-7	Other application (ask to the factory)

Ordering example: GFT1000-XX-XX where “xx” is option number