



# GFT1000: Picosecond Timing System

## 100 to 2500 synchronized pulses

### Features

- 100 independent delay channels (2500 in option)
  - 100 ps resolution (1 ps in option)
  - 25 ps RMS jitter
  - 10 second range
- Adjustable Output pulse up to 6 V into 50  $\Omega$
- 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 (Web page)
- Options:
  - Output pulse 10 V or 20 V or 32 V into 50  $\Omega$
  - Synchrotron application
  - Other form factor cPCI, PXI, 19" low cost



10 delay channel Slave generators

### Applications

- Picoseconds system laser
- Synchrotron
- High energy laser
- Accelerator
- Large physics system
- Automatic Test Equipment

### 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 100 ps (1 ps in option).

The basic version of the GFT1000 is a system made with eleven synchronized units. One unit is the Master Oscillator (GFT3001) and provides the triggers and time base to ten Slave units (GFT1004) via an optical network (splitter and optical fibers). Each Slave is a digital delay generator and provides ten channels. The delay of each channel is programmable up to 1 second with a resolution of 100ps. Channel to channel jitter is less than 25ps . In standard BNC output delivers 3ns /6V level into 50 $\Omega$ .

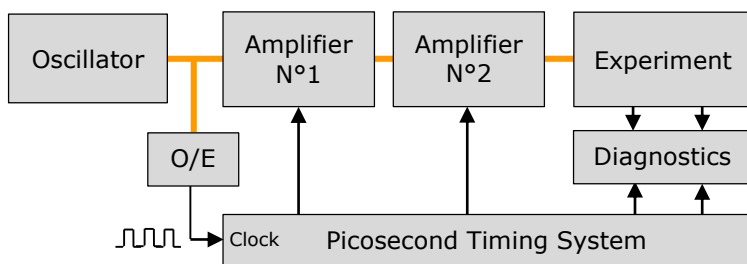
Amplitude, polarity and width are independently adjustable on each output giving you complete time and amplitude domain control.

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 100 channels distributed over 10 areas. In option the number of channels can be extended up to 2500 and the number of areas up to 128.

**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"



Picosecond laser System

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



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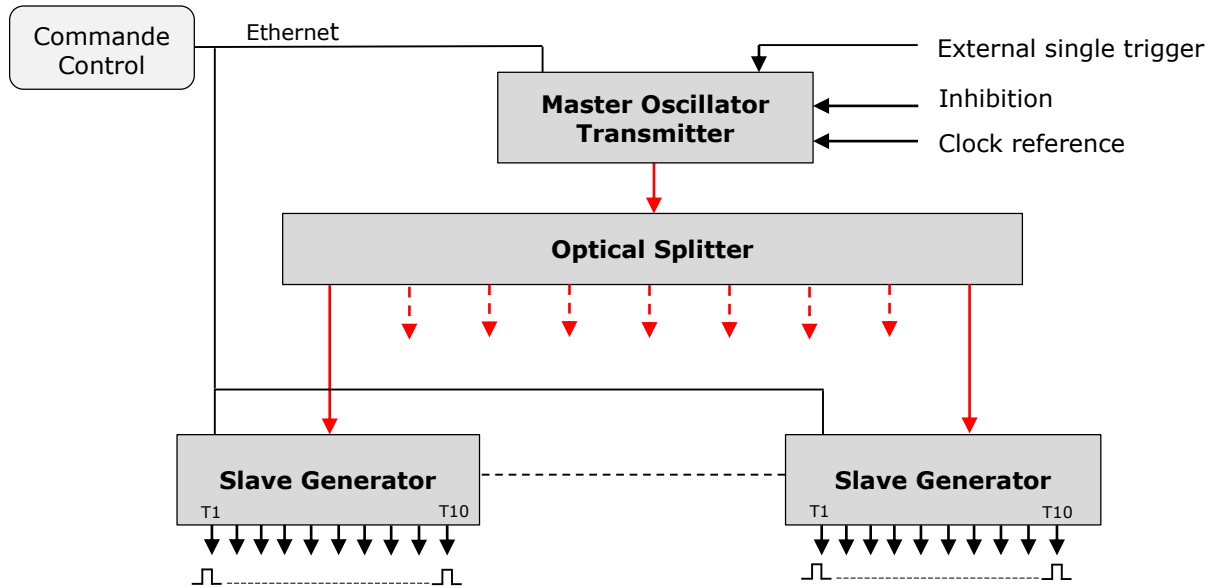
## 100 to 2500 synchronized pulses

### Specifications

<b>MASTER</b>	
<b>Trigger Source</b>	
Internal	3 repetitive triggers programmable from 0.1 Hz to 10 kHz
External and command	Pair of single shot
<b>Optical Output</b>	
Function	Output to transmit time base and triggers
<b>Time base</b>	
Frequency	160 MHz, 0.05 ppm stability
<b>Inhibition Input</b>	
level	Active high, Threshold = +1.5 V
<b>T0 Master Output</b>	
level	10 V into 50 $\Omega$ , 100 ns width
<b>Clock Reference input<sup>(1)</sup></b>	
Frequency	10 MHz (up to 100 MHz in option)
<b>ALL SLAVES</b>	
<b>Delay Channel</b>	
Number	10 independents
Range	0 to 10 seconds
Resolution	100 ps (1 ps in option)
Jitter	25 ps (channel to channel)
Accuracy	<250 ps + delay x 10 <sup>-7</sup>
Time base	0.05 ppm stability
<b>Channel Output Pulse T1 to T10</b>	
Amplitude	3 to 6 V into 50 $\Omega$
Rise / Fall time	3 ns / 5 ns
Width	100 ns to 1 second
Polarity	Positive or negative
Connector	BNC
<b>Optical Input</b>	
Function	Input of time base and triggers from MASTER
<b>To Output ( slave delay reference)</b>	
Level	10 V into 50 $\Omega$ , 100 ns width
<b>General</b>	
Interface control	Front panel, Ethernet / Internet(web page)
Software	Labview application and EPICS, Tango driver
Power	90 to 240 V / <50 W
Size	Racks 19", 1 U, 300 mm (include rack mount kit)
<b>OPTIONS</b>	
Option 1:	1ps delay channel resolution
Option 2:	Specific clock input frequency (10 to 100 MHz) ask when ordering
Option 3:	Channel number extension : Up to 2500 channels (ask to the factory )
Option 4:	Other Slave Form factors: CPCI (GFT1208) , PXI (GFT1404) (ask to factory)
Option 5:	GFT1018 Low cost 8 channels slave
Option 6:	Synchrotron application

### Operating information

#### Functionnal block diagram



**Central Master Oscillator** provides triggers and time base and allows the transmission of them via an optical serial data stream to synchronize local 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.

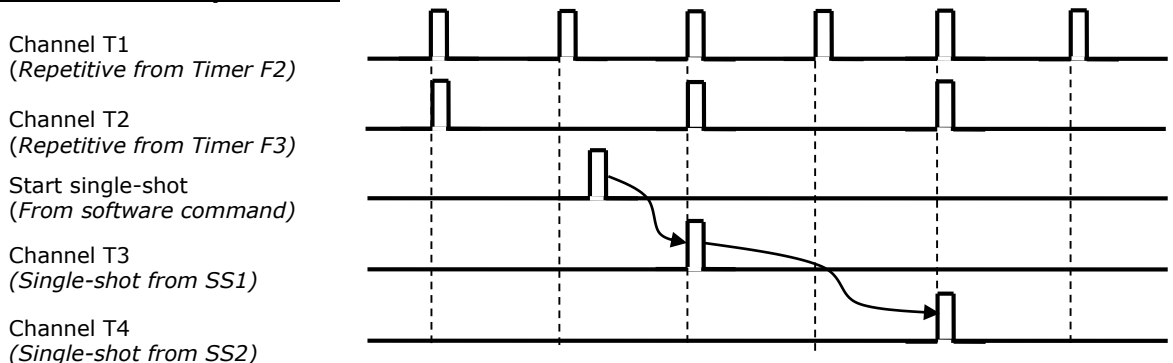
*Inhibition input* stops the single-shot trigger with hardware preset level for safety management

**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)

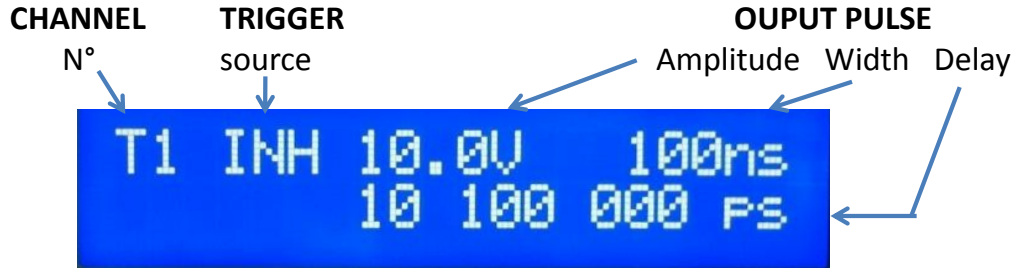


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## Control and software tools

There are three ways to control the system

**"local way"** via the front Panel Display an Key board



*Display example: Settings of Channel T1*

**"Easy remote way"** via Internet and control panel web pages.



**"General remote way"** via LabVIEW software application or other PC software application.



*Example of LabVIEW VI*

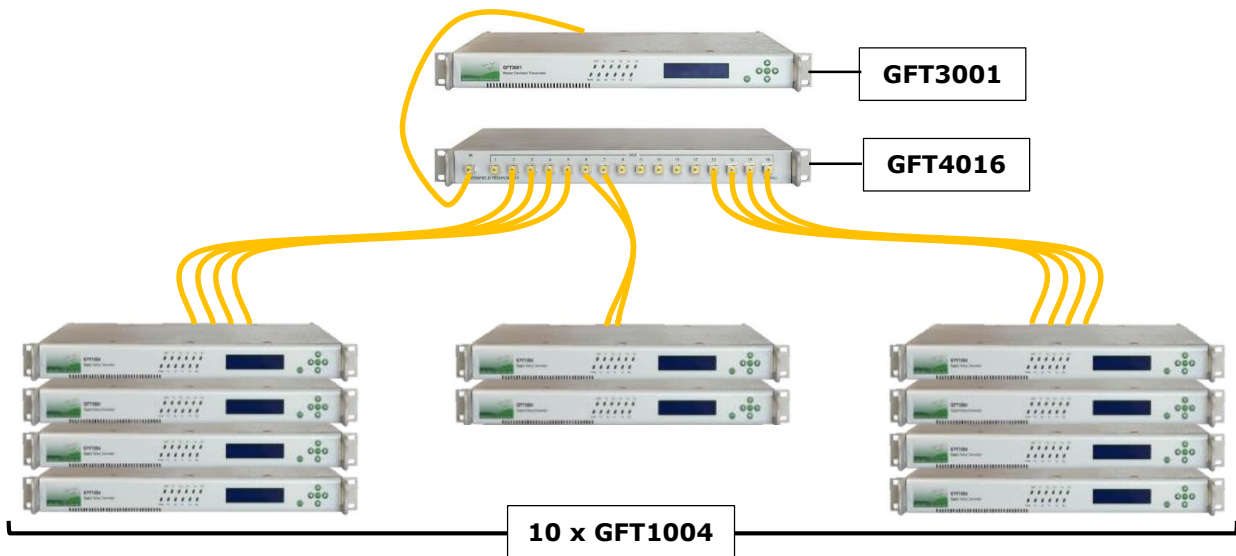
## Physical organization

### The system

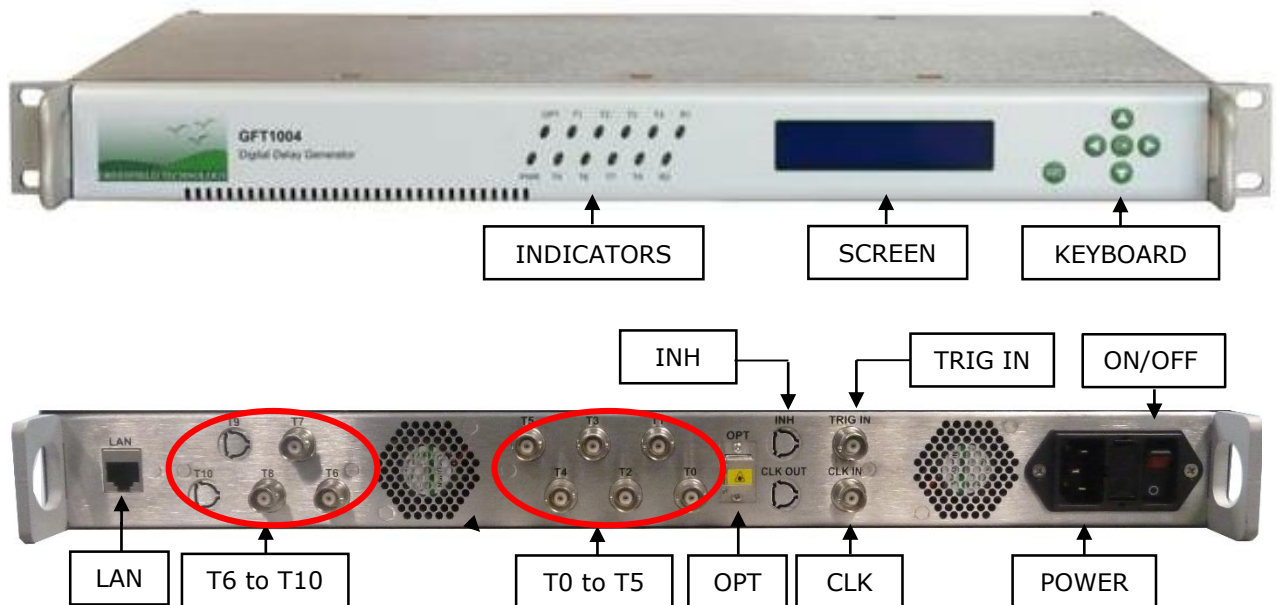
Base version (100 channels) of the system is built with the following devices

- One GFT3001 is the Master Oscillator Transmitter
- One GFT4016 is the Optical Splitter
- Eleven optical fiber cables
- Ten GFT1004 are the Slave generator

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



### Slave front and rear panel



## Ordering information

Generator part number: GFT1000-XX-XX where "xx" is option number