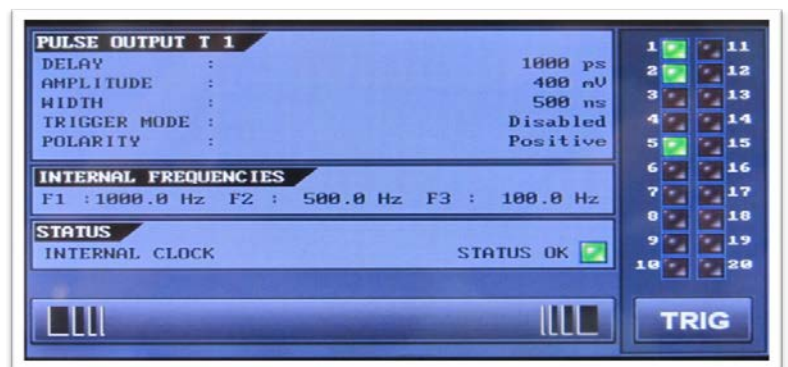# GFT1020
20 Channel Digital Delay Generator

Features

- 20 independent delay channels
    - 100 ps resolution (1 ps in option)
    - 25 ps RMS jitter
    - 10 second range
- Output pulse up to 6 V into 50 Ω
- Independent trigger for every channel
- Four trigger sources
  Three are repetitive from three internal generators
  One is single-shot from external input, or software command
- External Clocking up to 100 MHz
- Controlled via Front panel, Ethernet, Internet (web page)
- Options
    - Channel output amplitude 10 V or 20 V or 32 V into 50 Ω
    - Optical channel output
    - Extension to 40 channels

Applications

- Picosecond Laser Timing System
- ATE Application
- Components Test
- Precision Pulse Application
- Laser Pulse Picking
- Instrument Triggering

GFT1020: Front Panel view
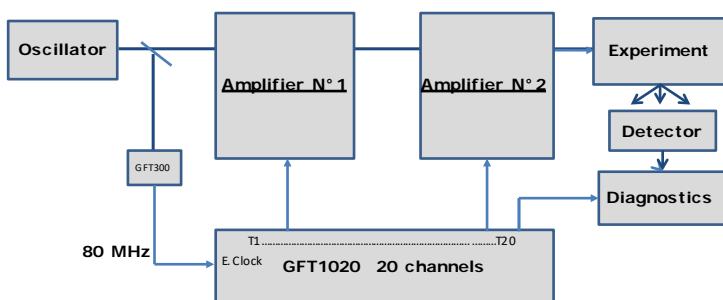

Touch screen: Main menu

Description

The GFT1020 Digital Delay Generator provides twenty independently delayed outputs on the rear panel. Delays up to 10 seconds can be programmed with 100 ps resolution (or 1 ps as an option) and channel-to-channel jitter is less than 25 ps RMS. BNC outputs deliver 6 V level under 50 Ω. Pulse amplitude, polarity and width are independently adjustable for each output pulse. Options include:

- Output amplitude can be 2.5 to 10 V, or 5 to 20 V, or fixed 32 V, or 250 mW optical pulse.
- The number of delay channels can be extended to 40 channels.

One input trigger (TRIG IN), or one of the three synchronized internal generators or a remote command can trigger all output channels. A T0 output pulse marks zero delay for each trigger.

All parameters (delay/amplitude/width/trigger source for each channel) may be locally controlled over touch panel and remotely controlled over Ethernet and Internet (internal web server) interface (10 / 100 Mb/s).

Laser pulse picking application: The GFT1020 is well suited to synchronize all the devices of a Picosecond Laser System with only one compact unit and one GUI.

In this application the external clock input (CLK IN) of GFT1020 Delay Generator receives an 80 MHz frequency from a laser oscillator.

Each amplifier (Pump-laser, Q switch, Pockel cell, etc.), or diagnostic instrument (Photodiode, Digitizer, Oscilloscope, Calorimeter, CCD camera, Streak camera, etc.) can receive repetitive or single pulses (adjusted in rate, delay, amplitude, polarity and width) and synchronized on the 80 MHz external clock with a very low jitter.

Picosecond laser system synchronization example

GFT1020
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Specifications

Delay Channels

Number	20 independents
Range	0 to 10 s
Resolution	100 ps
RMS jitter	25 ps (external trigger or T0 to any output)
Accuracy	< 250 ps + delay x 10^{-7}
Time base	160 MHz Frequency, 0.05 ppm Stability

External Trigger Mode

Input "TRIG"	Rate up to 50 kHz, 1 V/50Ω Threshold, slope positive, 5ns minimum pulse width

Internal Trigger Mode : sources

Internal	3 generators 0.1 Hz to 10 kHz in 1-2-5 sequence
Input "TRIG IN"	2 Single-shots, 1 V/50 Ω Threshold, slope positive
Soft Command	2 Single shots

Output T0

3 V to 6 V / 50 Ω, Width = 100 ns to 300 ms

Outputs T1 to T20

Amplitude	3 V to 6 V / 50 Ω
Rise / fall time	5 ns / 5 ns
Width	100 ns to 300 ms
Polarity	+/-
Form	Square
Connector	BNC

Clock Input (1)

Shape	Sinewave or Square
Threshold	0 V, internal 50Ω load, AC
Min level	-3dBm
Frequency	10 MHz (up to 100 MHz in option)

Clock Output

|	
Shape	Sinewave
Level	3 dBm under 50 Ω
Frequency	80 MHz (1/2 Time base frequency)
Spectral purity	>-40 dBm

Gate Input

Level	Active high, 1 V/50 Ω Threshold
Rate	< 1 kHz

General

Interface control	Front panel, Ethernet 10/100 Mb/s, Internet (web page)
Software tools	Free Drivers for Win7 and LabVIEW application.
Size / Weight	19'' W, 2U H , 300 mm D / 10 kg
Rack mount kit	included
Power	90 to 220 V / < 0.5 A

Options

1- Output 10V (2) amplitude = 2.5 to 10 V, rise/fall time = 1/3 ns under 50 Ω, width =100 ns to 10 ms

2- Output 20 V (2) amplitude = 5 to 20 V, rise/fall time= 3/15 ns under 50 Ω, width =0.1 to 10 µs

3- Output 32 V (2) amplitude = 32 V fixed, rise/fall time < 3/15 ns, width =1 µs fixed

4- 1 ps delay resolution	RMS jitter: <10 ps (T0 to T1..T10 Outputs)
	<20 ps (T0 to T11..T20 Outputs)
	Other specifications are same as basic version
5- Optical Output	
Power / Wavelength	250 µW / 850 nm
Width	100 ns to 300 ms
Max link distance	1.5 km
Connector type	ST

6- Clock Input / Output frequency Input /output clock frequency can be up to 100 MHz (specify when ordering)

7- 40 Digital Delay Channels The system is comprised of two synchronized GFT1020 units (to learn more refer to GFT1040 datasheet)

(1) User Specified, settable at factory

(2) This option can be independently applied to each output. Ask to factory for mixed output amplitude solutions.

Functional overview

Block diagram: The GFT1020 includes the five following functions: Time base, Trigger controller, Delay Channels, Channel Output and Interface controller.
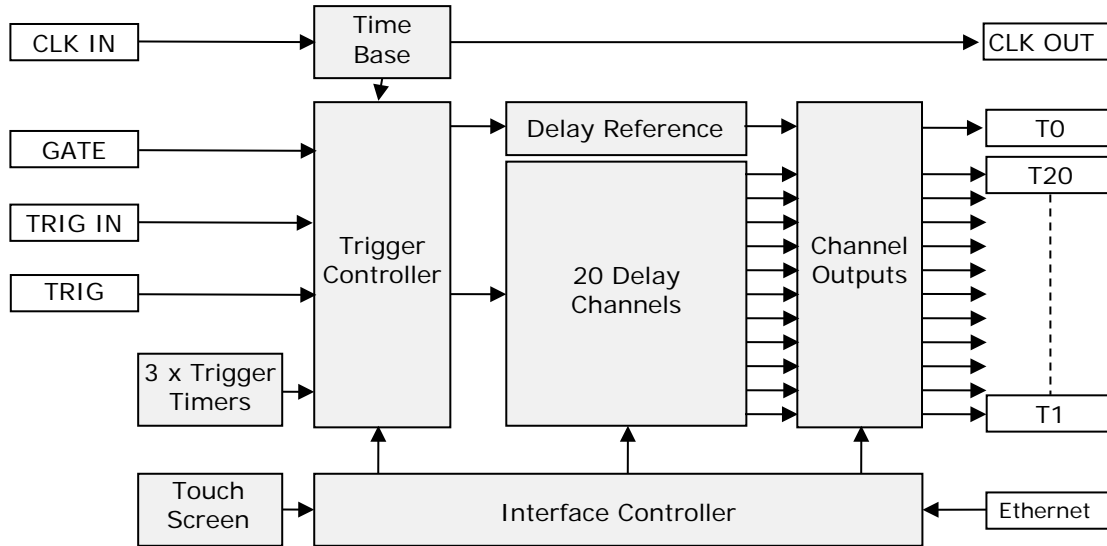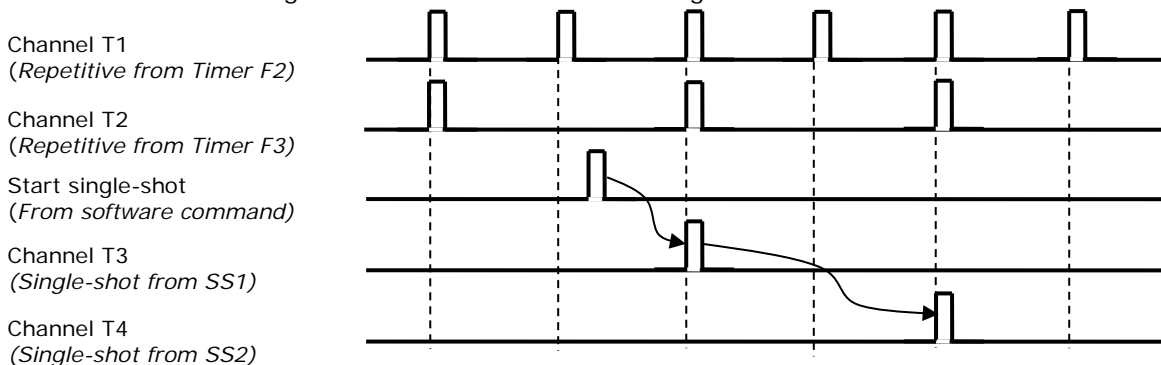

Block diagram

Time base: This function provides a 160 MHz time base from an internal clock or an external 10 MHz clock (CLK IN). In option the external clock can be up to 100MHz. The internal time base is available on the rear-panel (CLK OUT)

Trigger controller: This function provides two trigger modes: External or Internal

-External Trigger Mode: In this mode a rising edge on input "TRIG", triggers all delay channels. On every channel, the trigger rate can be single or repetitive.

-Internal Trigger Mode: This mode allows four trigger sources to each delay channel.

- Three are "Repetitive Triggers" from synchronous programmable "Trigger Generators" according to the following values: 10 kHz, 5 kHz, 2 kHz,1 kHz, 500 Hz, 200 Hz, 100 Hz, 50 Hz, 20 Hz, 10 Hz, 5 Hz, 2 Hz, 1 Hz, 0.5 Hz, 0.2 Hz or 0.1 Hz.
- One is a double "single-shot trigger". "Start" of single shot triggers (SS1 and SS2) is from a pulse on the external input (TRIG IN) or software command (Front panel or Ethernet or web page) Each single-shot is synchronous with the lowest Frequency Generator (F3). "SS1" activates low frequency equipment very early in the event and "SS2" activates fast equipment near or during the event like a Digitizer or a Streak Camera for diagnostics.

Channel T1
(Repetitive from Timer F2)

Channel T2
(Repetitive from Timer F3)

Start single-shot
(From software command)

Channel T3
(Single-shot from SS1)

Channel T4
(Single-shot from SS2)

Example of channel outputs modes

Delay channel: They are twenty delay channels (T1 to T20). The delay of each channel is adjustable up to 10 seconds in 100 ps increments (or 1ps in option)
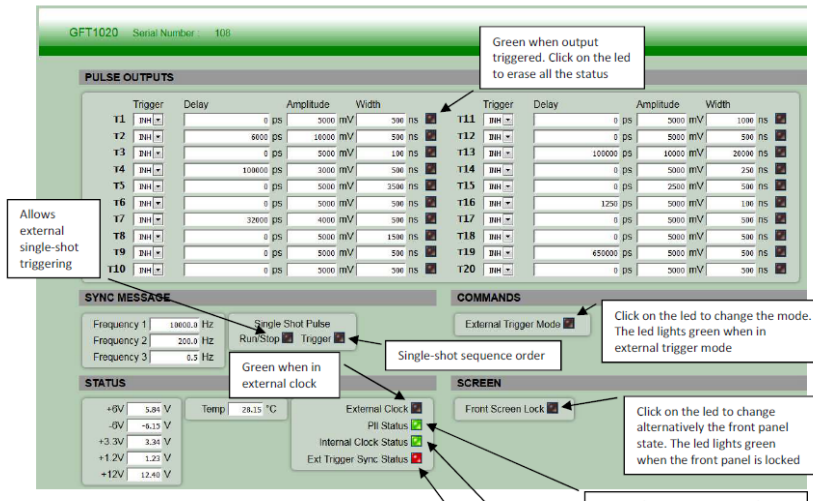The "T0" output pulse, generated by one of trigger event, marks zero delay.

Channel Output: Each channel output provides a delayed pulse independently adjustable in amplitude, polarity and width. The outputs are designed to drive 50Ω loads.

Interface controller: It manages internal functions (Time base, Delay, Channel Output, etc.) Front panel operation, Ethernet network and web pages (via embedded web server)

Control & Software Tools

They are three ways to control the generator:
- "local mode" via the front panel touch-screen
- "Easy remote mode" via Control panel web pages. This "web page", from an embedded web server is a simple method to configure settings for each channel (delay, output amplitude, output width, trigger mode, trigger source), and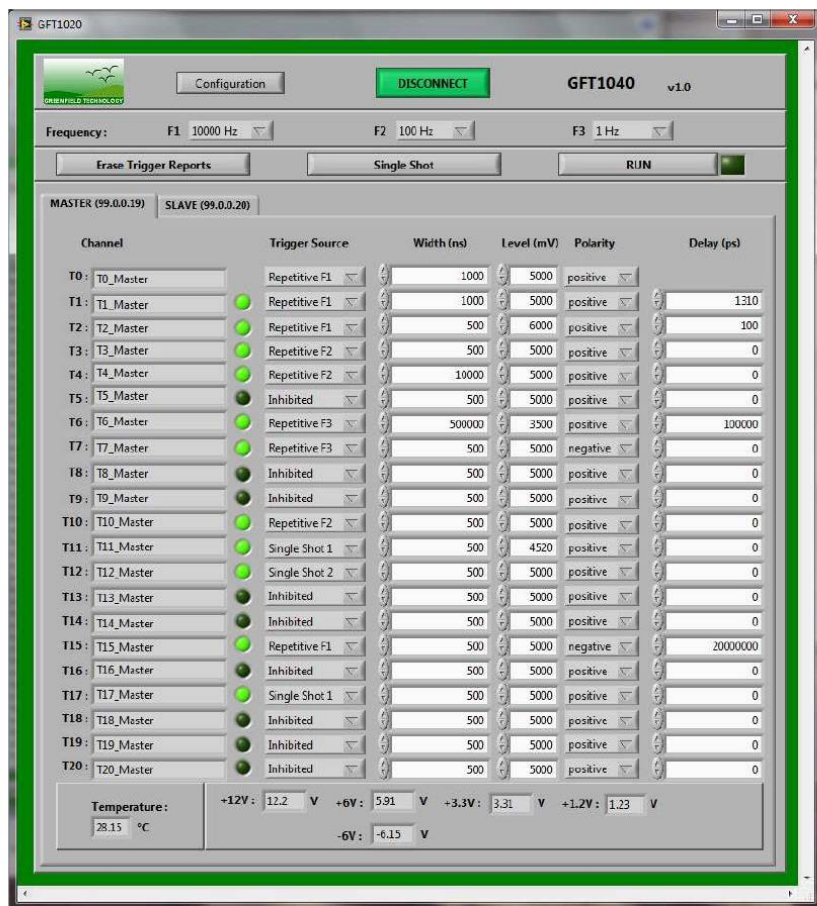 to control operation and status of the instrument. The configuration information of the instrument is stored and saved in the GFT1020.

Main Web page

The user can open a "web page" to control the GFT1020 via Internet Explorer, Mozilla Firefox or Google Chrome. After connecting a cable from the GFT1004's Ethernet port to your computer network, enter the GFT1004's IP address into your PC's browser. The browser will automatically open the control panel web page on your PC.

- "general remote mode" via LabVIEW software application supplied with GFT1020 Generator or other PC software application

Example of LabVIEW VI

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GFT1020
20 Channel Digital Delay Generator

Front and Rear panel interfaces

Front panel

Rear panel

Connector, Switch, Indicators

Front panel		Rear panel	
Touch screen	For local control	LAN	LAN connection: RJ45 connector
Push button	Activates single-shot triggers	T1 to T20	T1 to T20 outputs: BNC connector
AUX1	Not connected	T0	T0 output: BNC connector
GATE	Gate input: BNC connector	CLK IN	Clock input: BNC connector
TRIG	Trigger input (external mode): BNC connector	TRIG IN	Trigger input (internal mode): BNC connector
		CLK OUT	Clock output: BNC connector
		PLUG	AC power plug (90-240 V)
		I/O	Power ON/OFF switch

Ordering information

GFT1020 Delay Generator part numbering

GFT1020-X-X-X-X (Where X is option number)

Ordering examples: GFT1020-1-4 (GFT1020 with 5 V to 10 V channel output and 1 ps delay resolution)

Accessories (Modules to provide specific output pulse shape)

Model	Description
GFT101	Electrical-to-optical pulse converter
GFT300	100 mV/500 ps input sensitivity, Sub-nanosecond Pulse Stretcher
GFT400	500 ps width, 2 V into 50 Ω Pulse Generator
GFT500	200 ps rise time, 4- 9 V into 50 Ω Step Generator
GFT632	3 ns rise time, 1 µs width, 15- 70 V into 50 Ω Pulse Generator