Features

- 4 independent Delay Channels (10 in option)
  - 100 ps resolution (1ps in option)
  - 25 ps RMS jitter (channel to channel)
  - 10 second range
- Channel Output pulse
  - 6 V/50 Ω, 3 ns rise time
  - Independent control of width, polarity and amplitude
- Independent trigger rate (repetitive or single) for every channel
- External trigger mode from external input or Internal trigger mode from two synchronous programmable timers
- External Clocking up to 90 MHz (in option)
- Controlled via Front panel, Ethernet, Internet (Control panel Web page)
- Compact packaging
- Options
  - Extension to 8 or 10 delay channels
  - Channel Output amplitude 10V or 20V or 32V under 50Ω, or Optical pulse

Applications

- ATE application
- System Laser timing control
- Laser pulse piking
- Precision pulse Application
- Instrument triggering
- Components test

Description

The GFT1504 Digital Delay Generator provides up to ten independent delayed pulses. Delays up to 10 seconds can be programmed with 100 ps resolution and channel to channel jitter is less than 25 ps rms. BNC outputs deliver up to 6 V, 3 ns rise time under 50 Ω. Pulse amplitude, width and polarity are adjustable on each output channel. In option pulse amplitude can be 2.5 to 10 V or 5 to 20 V or fixed 32 V or optical pulse.

The generator provides two trigger mode to trigger delay channel: External mode from one input trigger or Internal from two synchronous programmable timers. Each channel can be single or repetitive trigger rate.

GFT 1504 parameters can be local controlled over the front panel keys and LCD display and remote controlled via Ethernet (10/100Mb/s) or Internet (Web page from Internal Web server). This "web page" provides a simple method to configure the settings on each channel and to control operation.

Application laser pulse picking

The GFT1504 is well suited in laser pulse picking application to synchronize all the equipments of a Laser System with only one compact unit and one Control command.

In this application external clock (CLK IN) of GFT1504 Delay Generator receive an 80 MHz frequency from laser oscillator. Each Amplifier (Pump-laser, Q switch, Pockel cell...), or instrument for several kinds of diagnostics (Photodiode, Digitizer, Oscilloscope, Calorimeter, CCD camera and Steak camera...) can received repetitive or single pulses (adjusted in rate, delay, amplitude, width) and synchronized on 80MHz external clock with a very low jitter.
**Specifications**

**Delay channels**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>4 independents (up to 10 in option)</td>
</tr>
<tr>
<td>Range</td>
<td>10 seconds</td>
</tr>
<tr>
<td>Resolution</td>
<td>100 ps (1 ps see option 8)</td>
</tr>
<tr>
<td>RMS jitter</td>
<td>35 ps + delay x 10^-7 (channel to channel)</td>
</tr>
<tr>
<td></td>
<td>25 ps for delay &lt;1 µs (channel to channel)</td>
</tr>
<tr>
<td></td>
<td>35 ps + delay x 10^-7 (External trigger to any channel)</td>
</tr>
<tr>
<td></td>
<td>25 ps for delay &lt;1 µs (External trigger to any channel)</td>
</tr>
<tr>
<td>Accuracy</td>
<td>&lt; 150 ps + delay x 10^-7</td>
</tr>
<tr>
<td>Trigger delay</td>
<td>&lt; 100 ns (insertion delay)</td>
</tr>
<tr>
<td>Time base</td>
<td>160 MHz frequency, ±50 ppb stability</td>
</tr>
</tbody>
</table>

**External Trigger Mode: Source**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input “TRIG”</td>
<td>Rate single or repetitive up to 100 KHz, +1.35 V/50 Ω Threshold, slope positive, 5 ns minimum pulse width</td>
</tr>
</tbody>
</table>

**Internal Trigger Mode: sources**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two synchronous timers</td>
<td>Frequency= 1 Hz to 100 KHz (Period= 1 s to 10 µs)</td>
</tr>
<tr>
<td></td>
<td>Resolution= 6.25 ns</td>
</tr>
<tr>
<td>Input “TRIG IN”</td>
<td>Pair of single trigger, 1.35 V/ 50 Ω Threshold, Slope positive</td>
</tr>
<tr>
<td>Soft command</td>
<td>Pair of single trigger</td>
</tr>
</tbody>
</table>

**Channel Output pulse T1 to T4**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amplitude</td>
<td>2.5 V to 6 V in step of 10 mV</td>
</tr>
<tr>
<td>Load</td>
<td>50 Ω</td>
</tr>
<tr>
<td>Rise/Fall time</td>
<td>3 ns (at 5 V) / 5 ns</td>
</tr>
<tr>
<td>Width</td>
<td>100 ns to 1 s in step of 6.25 ns</td>
</tr>
<tr>
<td>Pulse polarity</td>
<td>Positive or negative</td>
</tr>
</tbody>
</table>

**Clock Reference Input**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Threshold</td>
<td>0 V, internal 50 Ω</td>
</tr>
<tr>
<td>Level</td>
<td>Min +3 dBm, typical +10 dBm</td>
</tr>
<tr>
<td>Frequency</td>
<td>10 MHz (other frequency are available see option 7)</td>
</tr>
</tbody>
</table>

**Clock Output**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shape, level</td>
<td>Sinewave, &gt;10dBm under 50 Ω</td>
</tr>
<tr>
<td>Frequency</td>
<td>80 MHz (½ time base frequency)</td>
</tr>
<tr>
<td>Spectral purity</td>
<td>-40 dBm</td>
</tr>
</tbody>
</table>

**Gate**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input</td>
<td>Active high, Threshold 1.35 V, Rate &lt; 1kHz</td>
</tr>
</tbody>
</table>

**General**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Control</td>
<td>Front panel, Ethernet 10/100Mb/s, Internet (Web page)</td>
</tr>
<tr>
<td>Software tools</td>
<td>Free Drivers for Windows 7/10</td>
</tr>
<tr>
<td>Power consumption</td>
<td>90 to 220 V / 50 – 60 Hz/ 50 W</td>
</tr>
<tr>
<td>Weight</td>
<td>&lt; 6 kg</td>
</tr>
<tr>
<td>Size</td>
<td>237 x 363 x 125 mm</td>
</tr>
</tbody>
</table>

**Option**

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Extension to 8 channels</td>
</tr>
<tr>
<td>2</td>
<td>Extension to 10 channels</td>
</tr>
<tr>
<td>3</td>
<td>2.5 V to 10V channel output (Width 100 ns to 10 ms, rise/fall time = 0.8/2.4 ns typ. under 50 Ω)</td>
</tr>
<tr>
<td>4</td>
<td>5 V to 20 V channel output (Width=100 ns to 10 µs, rise/fall time = 3/15 ns under 50 Ω)</td>
</tr>
<tr>
<td>5</td>
<td>32 V channel output, With=1 µs, Rise/fall= 3/15 ns under 50 Ω</td>
</tr>
<tr>
<td>6</td>
<td>Optical channel output (250 µW, 850 nm, ST connector)</td>
</tr>
<tr>
<td>7</td>
<td>Other frequency for Clock In and clock Out up to 90MHz (ask to the factory)</td>
</tr>
<tr>
<td>8</td>
<td>1 ps delay channel resolution</td>
</tr>
</tbody>
</table>
Operating Information

**Block diagram of the generator**

![Block diagram of the generator]

**Time base:** This functions provides a 160 MHz time base from an internal reference or an external 10MHz reference. In option the external reference can be up to 90 MHz (ask to the factory)

**Trigger controller:**
This function provides 2 Trigger Modes
- **External Trigger Mode:** In this mode a rising edge on input "TRIG" trigs all delay channel. On every channel trigger rate can be single or repetitive or inhibited.
- **Internal Trigger Mode:** This mode provides 4 programmable trigger sources for each channel
  - Two are "Repetitive Triggers" from two synchronous timers. Frequency of each timer (IN1 and IN2) is programmable from 1 Hz to 100 KHz. In the normal way the IN1’s frequency > IN2’s frequency and IN1 must be a multiple of IN2 frequency.
  - Two are a pair of “Single trigger” from a rising edge on “TRIG IN” input or from software command (Front panel or Ethernet or Web page). Each single trigger (SS1 and SS2) are synchronous of the lowest Frequency Trigger Generator (IN2). In single-shot experiment application:
    - “SS1” is used to active low frequency equipment very early to the experiment
    - “SS2” is used to active fast equipment near or during the experiment like Digitizer or Steak Camera for diagnostics.

“Gate Input” allows to inhibit quickly all channel Output.

**Delay Channel:** They are 4 independent delay channels (8 or 10 in option). The delay from selected trigger source is programmable up to 10 seconds in 100 ps increments (1 ps in option)

**Channel Output**
Each delayed output pulse (T1 to T10) can be independently adjustable in level, width and polarity. The outputs are designed to drive 50 Ω load.
In option every Channel Output level can be 2.5 to 10 V or 5 to 20 V or fixed 32 V or optical pulse (ask to the factory for mixed Channel output level configuration)

**Interface Controller** manages internal functions and user interfaces. All the parameters can be local controlled over the front panel keys and Display and remote controlled via Ethernet (10/100 Mb/s) or Internet (Web page from internal Web server)
All parameters values are automatically saved.
Control and Software Tools

They are three ways to control the generator:

- "**Local way**" via the front Panel Display an Key board

  ![Display example: Settings of Channel T1](image)

- "**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 GFT1504.

  The web page can be opened via Internet Explorer, Mozilla Firefox or 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 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 LabVIEW software application or other PC software application.
GFT1504
4/10 channel Digital Delay Generator

Front and rear panel interfaces

Front Panel

Rear panel

Connector, switch, Indicators

<table>
<thead>
<tr>
<th>Front panel</th>
<th>Rear panel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display</td>
<td>TRIG IN</td>
</tr>
<tr>
<td>Key board</td>
<td>Internal mode trigger input: BNC connector</td>
</tr>
<tr>
<td>T1 to T4</td>
<td>GATE</td>
</tr>
<tr>
<td>TRIG</td>
<td>Gate Input : BNC connector</td>
</tr>
<tr>
<td>• Indicators</td>
<td>CLK IN</td>
</tr>
<tr>
<td>T1 to T4</td>
<td>Clock input : BNC connector</td>
</tr>
<tr>
<td></td>
<td>CLK OUT</td>
</tr>
<tr>
<td></td>
<td>Clock output : BNC connector</td>
</tr>
<tr>
<td></td>
<td>LAN</td>
</tr>
<tr>
<td></td>
<td>Ethernet connection : RJ45 connector</td>
</tr>
<tr>
<td></td>
<td>Power</td>
</tr>
<tr>
<td></td>
<td>Red Switch On/off and plug connector</td>
</tr>
</tbody>
</table>

Ordering Information

GFT1504 Delay generator part numbering

GFT1504-X-X-X-X (Where X is option number)

Ordering examples

GFT1504-1 (GFT1004 with extension to 8 channels)
GFT1504-5-7 (GFT1004 with extension to 10 channels, TTL level channel output)

Accessories (modules to provide specific Output pulse shape)

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>GFT101</td>
<td>Electrical to optical pulse converter</td>
</tr>
<tr>
<td>GFT300</td>
<td>Sub-nanosecond pulse stretcher</td>
</tr>
<tr>
<td>GFT400</td>
<td>500ps width, 2V under 50Ω Pulse Generator</td>
</tr>
<tr>
<td>GFT500</td>
<td>200ps rise time, 4- 9V under 50Ω Step Generator</td>
</tr>
<tr>
<td>GFT632</td>
<td>2ns rise time, 32- 70V under 50Ω Pulse Generator</td>
</tr>
</tbody>
</table>