

Features of the 745T-20C:

- 20 Independent delay channels
 - 100 ps resolution
 - 25 ps rms jitter
 - 10 second range
- Output pulse up to 6 V/50 Ω
- Independent trigger for every channel
- External Clock up to 100 MHz
- Controlled via Front Panel, Ethernet, Internet (webpage)

Applications of the 745T-20C:

- Picosecond Laser Timing Systems
- ATE Applications
- Components Testing
- Laser Pulse Picking
- Instrument Triggering



Model 745T-20C
20 Channel Digital Delay Generator

Model 745T-20C 20 Channel Digital Delay Generator

Description

The 745T-20C Digital Delay Generator provides twenty independently delayed pulse outputs on the rear panel. Delays up to 10 seconds can be programmed with 100 ps resolution (or 1 ps option) and channel-to-channel jitter less than 25 ps RMS. BNC output connectors deliver 6 V level under 50 Ω . Pulse amplitude and width are independently adjustable for each output pulse.

One input trigger (TRIG IN), or one of the three synchronized internal generators, or remote command can be used to 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 using the touch-panel and remotely controlled using ethernet and internet (internal web server) interface (10 / 100 Mb/s).

745T-20C Front and Back Panels



Front Panel



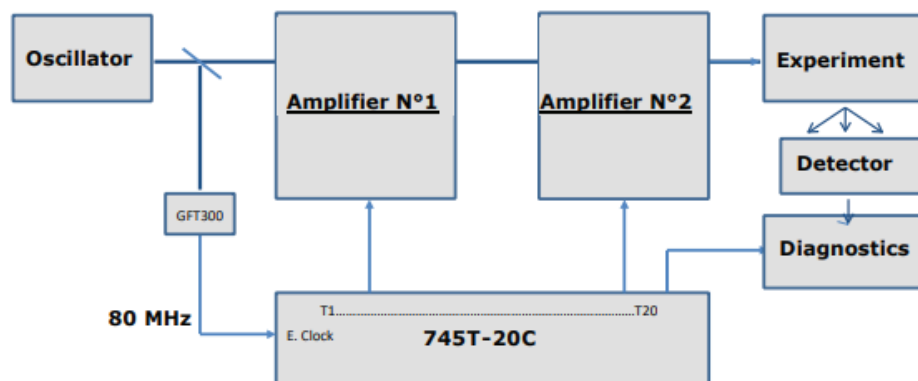
Back Panel

Front Panel		Back Panel	
Touch screen	For local control	LAN	LAN / ethernet: 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)
		Power	Power ON/OFF switch

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Laser Pulse Picking Application:

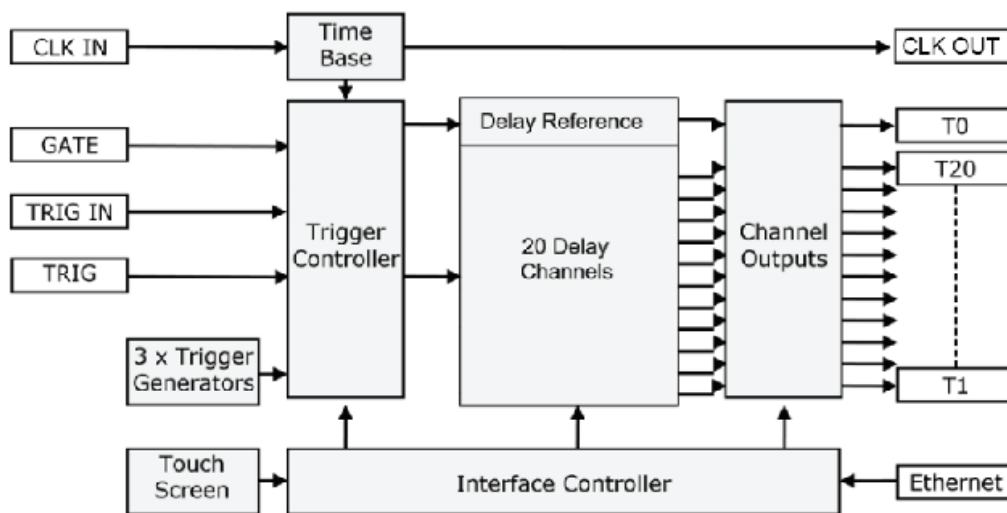
The 745T-20C is well suited to synchronize all the instruments involved in a Picosecond Laser System using only one compact unit and one GUI. In this application the external clock input (CLK IN) of the 745T-20C Delay Generator receives a 80 MHz signal from a laser oscillator. Each amplifier (pump-laser, Q-switch, Pockels cell, etc.), or various diagnostic instruments (photodiode, digitizer, oscilloscope, calorimeter, CCD camera, streak camera, etc...) can receive repetitive or single pulse (adjusted in rate, delay, amplitude, polarity and width) that are synchronized to the 80 MHz external clock with a very low jitter.



Picosecond laser timing system synchronization example

Functional Overview

Block diagram: The 745T-20C includes the five following functions: Time base, Trigger controller, Delay Channels, Channel Output and Interface controller.



Block diagram

Model 745T-20C 20 Channel Digital Delay Generator

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

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

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

-Internal Trigger Mode: This mode allows four trigger sources to trigger 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”. Single-shot triggers (SS1 and SS2) are initiated from a pulse on the TRIG IN input, from the Front Panel, or from software command (ethernet or web page) Each single-shot is synchronous with the lowest Frequency Generator (F3). “SS1” is used to activate low frequency equipment very early in the event, and “SS2” is used to activate fast equipment during the event like a digitizer or streak camera for diagnostics.

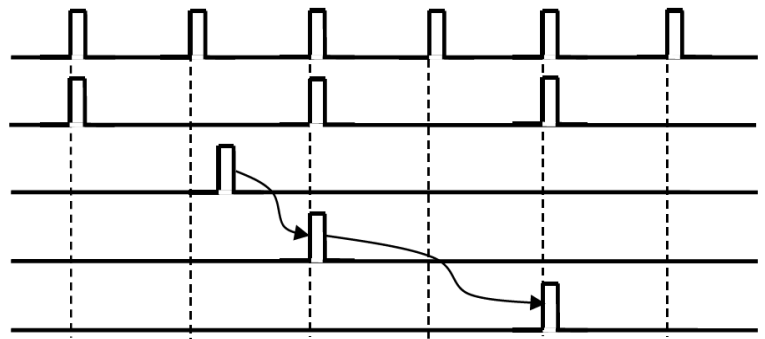
Channel T1
(Repetitive from Timer F2)

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

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Delay channel: There are twenty delay channels (T1 to T20). The delay of each channel is adjustable up to 10 seconds in 100 ps increments (or 1 ps in option). The "T0" output pulse, generated by one of trigger, 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 50 Ω loads.

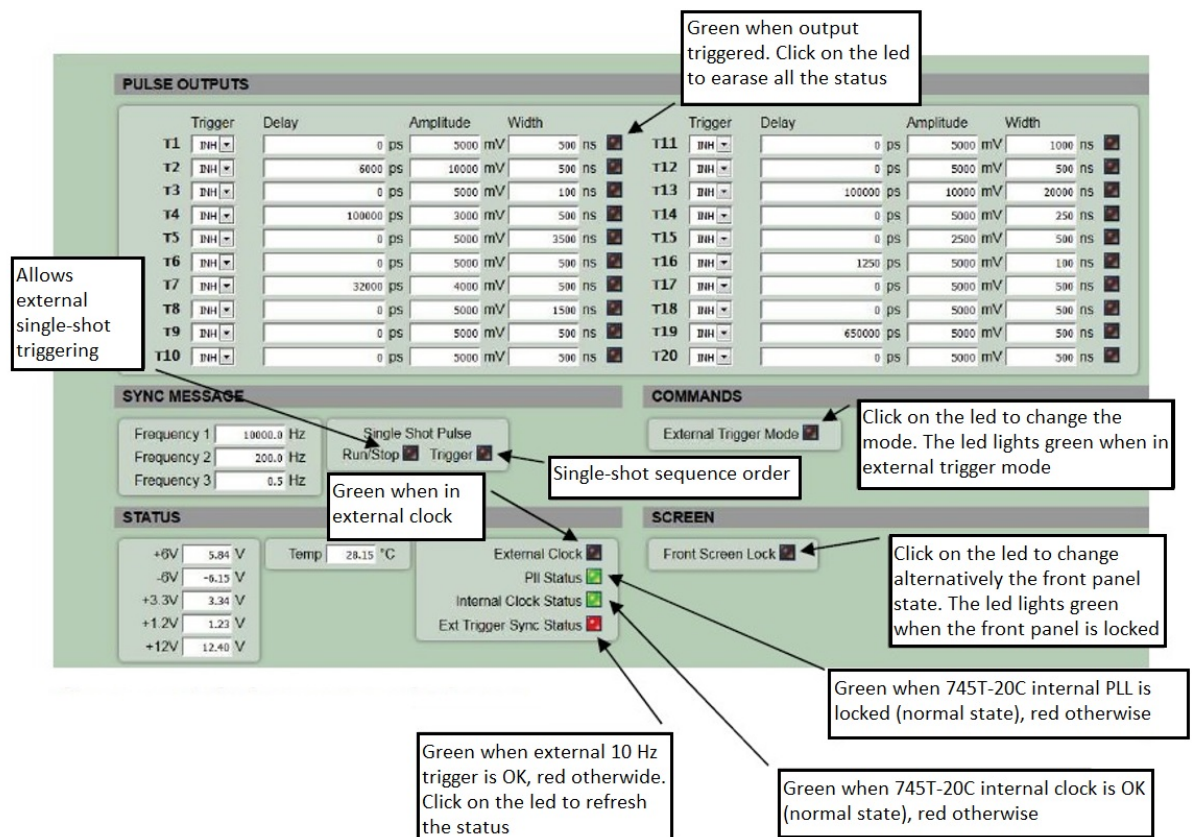
Interface controller: The interface controller manages internal functions (Time base, delay, Channel Output, etc..) front panel operation, ethernet network and web pages (via embedded web server)

Control & Software Tools

There 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 745T-20C. The user can open a web page to control the 745T-20C via Internet Explorer, Mozilla Firefox or Google Chrome.



PULSE OUTPUTS

Trigger	Delay	Amplitude	Width	Trigger	Delay	Amplitude	Width
T1	0 ps	5000 mV	500 ns	T11	0 ps	5000 mV	1000 ns
T2	6000 ps	10000 mV	500 ns	T12	0 ps	5000 mV	500 ns
T3	0 ps	5000 mV	100 ns	T13	100000 ps	10000 mV	20000 ns
T4	100000 ps	3000 mV	500 ns	T14	0 ps	5000 mV	250 ns
T5	0 ps	5000 mV	3500 ns	T15	0 ps	2500 mV	500 ns
T6	0 ps	5000 mV	500 ns	T16	1250 ps	5000 mV	100 ns
T7	32000 ps	4000 mV	500 ns	T17	0 ps	5000 mV	500 ns
T8	0 ps	5000 mV	1500 ns	T18	0 ps	5000 mV	500 ns
T9	0 ps	5000 mV	500 ns	T19	650000 ps	5000 mV	500 ns
T10	0 ps	5000 mV	500 ns	T20	0 ps	5000 mV	500 ns

SYNC MESSAGE

Frequency 1: 10000.0 Hz
 Frequency 2: 200.0 Hz
 Frequency 3: 0.5 Hz

COMMANDS

External Trigger Mode: ☒ **Single Shot Pulse**
 Run/Stop: ☒ **Trigger**

STATUS

+6V: 5.84 V
 -6V: -6.15 V
 +3.3V: 3.34 V
 +1.2V: 1.23 V
 +12V: 12.40 V
 Temp: 28.15 °C

SCREEN

External Clock: ☒ **PLL Status**: ☒
 Internal Clock Status: ☒
 Ext Trigger Sync Status: ☒ **Front Screen Lock**: ☒

Annotations:

- Green when output triggered. Click on the led to erase all the status
- Allows external single-shot triggering
- Green when in external clock
- Single-shot sequence order
- Click on the led to change the mode. The led lights green when in external trigger mode
- Click on the led to change alternatively the front panel state. The led lights green when the front panel is locked
- Green when 745T-20C internal PLL is locked (normal state), red otherwise
- Green when external 10 Hz trigger is OK, red otherwise. Click on the led to refresh the status
- Green when 745T-20C internal clock is OK (normal state), red otherwise

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After connecting a cable from the 745T-20C's Ethernet port to your computer network, enter the 745T-20C'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 745T-20C) or other PC software application

The screenshot displays the web control panel for the Model 745T-20C. At the top, there are frequency selectors for F1 (10000 Hz), F2 (100 Hz), and F3 (1 Hz). Below these are buttons for 'Erase Trigger Reports', 'Single Shot', and a 'RUN' button with a green indicator light. The main section is divided into 'MASTER (99.0.0.19)' and 'SLAVE (99.0.0.20)' tabs. A table lists 20 channels (T0 to T20) with columns for Channel, Trigger Source, Width (ns), Level (mV), Polarity, and Delay (ps). Channel T0 is the master, and T1-T20 are slaves. Various trigger sources like Repetitive F1, Repetitive F2, Repetitive F3, Single Shot 1, Single Shot 2, and Inhibited are used. At the bottom, there are voltage level indicators for +12V, +6V, +3.3V, +1.2V, -6V, and a temperature readout of 28.15 °C.

Channel	Trigger Source	Width (ns)	Level (mV)	Polarity	Delay (ps)
T0: T0_Master	Repetitive F1	1000	5000	positive	
T1: T1_Master	Repetitive F1	1000	5000	positive	1310
T2: T2_Master	Repetitive F1	500	6000	positive	100
T3: T3_Master	Repetitive F2	500	5000	positive	0
T4: T4_Master	Repetitive F2	10000	5000	positive	0
T5: T5_Master	Inhibited	500	5000	positive	0
T6: T6_Master	Repetitive F3	500000	3500	positive	100000
T7: T7_Master	Repetitive F3	500	5000	negative	0
T8: T8_Master	Inhibited	500	5000	positive	0
T9: T9_Master	Inhibited	500	5000	positive	0
T10: T10_Master	Repetitive F2	500	5000	positive	0
T11: T11_Master	Single Shot 1	500	4520	positive	0
T12: T12_Master	Single Shot 2	500	5000	positive	0
T13: T13_Master	Inhibited	500	5000	positive	0
T14: T14_Master	Inhibited	500	5000	positive	0
T15: T15_Master	Repetitive F1	500	5000	negative	20000000
T16: T16_Master	Inhibited	500	5000	positive	0
T17: T17_Master	Single Shot 1	500	5000	positive	0
T18: T18_Master	Inhibited	500	5000	positive	0
T19: T19_Master	Inhibited	500	5000	positive	0
T20: T20_Master	Inhibited	500	5000	positive	0

Temperature: 28.15 °C

+12V: 12.2 V +6V: 5.91 V +3.3V: 3.31 V +1.2V: 1.23 V

-6V: -6.15 V

Model 745T-20C Specifications

Delay Channel		Clock Input (1)	
Number	20 Independent	Shape	Sinewave or Square
Range	0 to 10 s	Threshold	0 V, internal 50 Ω load, AC
Resolution	100 ps	Min Level	-3 dBm
RMS Jitter	25 ps (external trigger or T0 to any output)	Frequency	10 MHz (up to 100 MHz in option)
Accuracy	< 250 ps + delay x 10 ⁻⁷	Clock Output	
Time base	160 MHz Frequency, 0.05 ppm stability	Shape	Sinewave
External Trigger Mode		Level	3 dBm under 50 Ω
Input "TRIG"	Rate up to 50 kHz, 1 V / 50 Ω Threshold, slope positive, 5 ns minimum pulse width	Frequency	80 MHz (1/2 Time base frequency)
Internal Trigger Mode		Spectral Purity	>-40 dBm
Internal	3 generators 0.1 Hz to 10 kHz in 1-2-5 sequence	Gate Input	
Input "TRIG IN"	2 Single Shots, 1V/50 Ω Threshold, Slope positive	Level	Active high, 1 V / 50 Ω Threshold
Soft Command	2 Single Shots	Rate	< 1kHz
Output T0		General	
Outputs T1 to T20	3 V to 6 V / 50 Ω width =100 ns to 300 ms	Interface Control	Front panel, Ethernet 10 / 100 MB/s, Internet (web page)
Amplitude	3 V to 6 V / 50 Ω	Software Tools	Free Drivers for Win7 and LabView application
Rise / fall time	5 ns / 5 ns	Size / Weight	19" W, 2U H, 300 MM D / 10 kg
Width	100 ns to 300 ms	Rack Mount Kit	Included
Polarity	+/-	Power	90 to 220 V / 0.5 A
Connector	BNC		

Options

- 1- Output 10 V (2) amplitude = 2.5 to 10 V, rise time = 1 ns / fall time= 3 ns under 50 Ω , Width = 100 ns to 10 ms
- 2- Output 20 V (2) amplitude = 5 to 20 V, rise time = 3 ns / fall time= 15 ns under 50 Ω , Width = 0.1 μ s to 10 μ s
- 3- Output 32 V (2) amplitude = 32 V fixed, rise time < 3 ns / fall time < 15 ns, Width =1 μ s 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 identical as basic version

5- Optical Output

Power / wavelength 250 μ W / 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 745T-20C units

(1) User Specified, settable at factory

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