Variable Photonic Time Delay System

up to ms long delay, ns fast delay change, 25-bit highest resolution

The Variable Photonic Time Delay system (SLTD or LLTD) is a turn-key unit that provides true-time delay with a fiber input and output. Perfected over 15 years, it uniquely features a long delay of up to ms, ultra-fast (ns) delay variation speed, and up to 25 bits high resolution. Internally, the input optical signal propagates through various fiber optic loops before exits. Delay time can be digitally varied by switching to pass through N fiber segments, therefore providing N-bit resolution. Delay length and system performance can be tailored to meet customer-specific requirements with great flexibility. The optical loss difference can be compensated by incorporating amplifications in long fiber segments. We offer three types of fiber optical switches: MEMS (ms), CL (ms), and NS (ns) to meet application requirements. USB/GUI or RS232 interface is a standard while high-speed switching is controlled by TTL through a D connector. Front Touch-screen computer is also a choice for system control.

The system delivers unmatched performance for radar testing, signal processing, phased array antennas, and phase noise testing with greater flexibility than traditional coax or waveguide solutions.

Features

- Switching Option Available
- Smaller Size and Less Weight
- 0.1 - 40 GHz Bandwidth
- Flat Phase Response
- Minimal Triple-Transit Echoes
- Low Link Loss Options
- Low-Temperature Sensitivity

Applications

- Radar System Testing
- Phased Array Antennas
- Signal Processing
- Electronic Warfare (EW) Systems

Specifications

Parameter		Min	Typical	Max	Unit
Center Wavelength		1310		1550	nm
Wavelength Range			±50		nm
Delay Range		0.01		1000	μs
Delay Accuracy [1]		0.1	1		ns
Delay Increment		0.1			ns
Delay Resolution			20	25	Bit
System Intrinsic Delay [2]			100	200	ns
Delay Changing Speed	MEMS		10	20	ms
	CL		50	100	μs
	NS		0.1	0.3	μs
Cross Talk	MEMS	50	60	70	dB
	CL	40	45	50	
	NS	30	35	40	
Repetition Rate	MEMS			10	Hz
	CL			2	KHz
	NS			1	MHz
Insertion Loss [3]		0		TBD	dB
Insertion Loss Uniformity [4]			0.5	1	dB
Return Loss[4]		50			dB
Optical Power Handling			100	500	mW
Operating Temperature		0		60	°C
Storage Temperature		-40		85	°C
Power Supply		110		240	AVC
Power Consumption				250	W
Size		19" mount rack			

[1] It is defined @ maximum delay <=10us.
[2] Depending on the bit number N, such as 100ns up to 19-bit.
[3] The loss can be compensated by optical amplifiers
[4] Between delaying or bypassing at same bit delay loop

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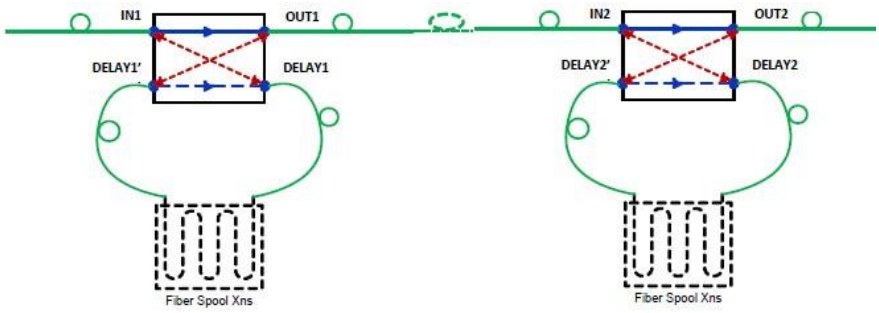
Optical Path Diagram

Switchable fiber loops in series



The variable time delay module selectively routes optical signals through N fiber segments having different lengths. Each fiber segment is defined to have the delay as

$$\Delta T_i = 2^{(i-1)}\delta T,\ i = 1, 2, ..., N$$

Where δT is the increment of time delay. Therefore, the module provides N-bit of digitally variable time delay, having the total time delay as

$$\Delta T_{Total} = (2^N - 1)\delta T$$

N and δT are defined by the customer.

Fiber Length = delay time * index of fiber (index of fiber ~1.456)

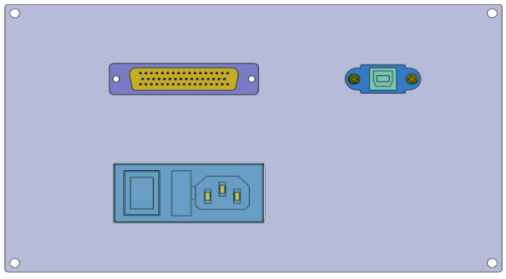
Enclosure Dimension (mm)

Typical 6U 19" rack for 16-19 bit system with the maximum delay of 0.1ms.

Front Panel (TBD)

a. Width of panel: 482mm
b. Width of rack: 420mm
c. Max. deep of rack: 550mm

Rear Panel (TBD)



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Ordering Information

	☐☐	☐	☐	☐	☐	☐	0	☐
Prefix	**Resolution**	**Wavelength**	**Switch Type**	**Package**	**Fiber Type [3]**	**Control [4]**	**Max Delay**	**Connector**
SLTD- [1] **LLTD- [2]**	19bit = 19 17bit = 17 16bit = 16 ... 9bit = A9 8bit = A8 ... 1bit = A1	1550nm = 5 1310nm = 3 Special = 0	CL/Latch = 2 NS/non-latch = 3 MEMS/non-latch = 4 MEMS/latch = 5 CL+MEMS = 6 Special = 0	3RU = 3 4RU = 4 5RU = 5 6RU = 6 7RU = 7 8RU = 8 Special = 0	SMF-28 = 1 DSP CMP fiber[5] = 2 Special = 0	TTL = 1 USB = 2 RS232 = 3 TounchScreen = 5 Special = 0	30 ms = 3 60 ms = 6 80 ms = 8 100ms = s 200ms = a 300ms = b 400ms = c 500ms = d 600ms = e 700ms = f 800ms = g 900ms = h 1ms = U	FC/PC = 2 FC/APC =3 SC/PC = 4 SC/APC = 5 ST/PC = 6 LC/APC = 7 LC/UPC = U Special = 0

[1]. Standard
[2]. Lossless
[3]. The dispersion compensated fiber must be used in the applications of long delay and high RF frequency. Please consult us on it.
[4]. Repeat rate of switching > 2kHz must use TTL control.
[5]. Dispersion compensation fiber

Fiber Core Alignment
Note that the minimum attenuation for these devices depends on excellent core-to-core alignment when the connectors are mated. This is crucial for shorter wavelengths with smaller fiber core diameters that can increase the loss of many decibels above the specification if they are not perfectly aligned. Different vendors' connectors may not mate well with each other, especially for angled APC.

Fiber Cleanliness
Fibers with smaller core diameters (<5 μm) must be kept extremely clean, contamination at fiber-fiber interfaces, combined with the high optical power density, can lead to significant optical damage. This type of damage usually requires re-polishing or replacement of the connector.

Maximum Optical Input Power
Due to their small fiber core diameters for short wavelength and high photon energies, the damage thresholds for device is substantially reduced than the common 1550nm fiber. To avoid damage to the exposed fiber end faces and internal components, the optical input power should never exceed 20 mW for wavelengths shorter 650nm. We produce a special version to increase the how handling by expanding the core side at the fiber ends.

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