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General Photonics

C o r p o r a t i o n

VDL – 002

VariDelay™ I

Miniature Manual Variable Fiber Optic Delay Line

Operation Manual



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Section 1. Specifications:

Operating Wavelength	SM: 1260-1650 nm PM: 1310 or 1550 nm Other wavelengths may be available upon request
Optical delay range	0 ~ 100 ps (3 cm) continuous for 100 ps model 0 ~ 250 ps (7.5 cm) continuous for 250 ps model Internal mirror option for doubling the range ¹
Delay stability	0.15 ps
Zero point delay offset ²	180 ps
Insertion loss	1.0 dB nominal
Insertion loss variation	± 0.3 dB over entire range
PDL	0.1 dB
Return loss	55 dB
Extinction ratio	> 18 dB for PM model
Optical Damage Power Threshold	300 mW
Operating Temperature	-40 °C to 70 °C
Storage Temperature	-40 °C to 85 °C
Fiber type	SMF-28 or PM Panda fiber
Position locking	Included
Dimensions	100 ps model: 2.20" (L) × 1.46" (W) × 0.72" (H) 250 ps model: 3.15" (L) × 1.46" (W) × 0.72" (H)

Note: Loss values are given without connectors.

1. Wavelength range for double pass 1310 or 1550nm devices is center wavelength ±50nm.
2. Absolute delay at 0 ps setting measured to the edge of the enclosure (excluding caps, boots, and pigtails).

Section 2. Overview:

General Photonics' VDL-002 is a miniaturized variable optical delay line designed specifically for OEM applications. It provides precision optical path variation of up to 7.5 cm (15 cm with double pass option), which corresponds to 250 picoseconds (500 ps with double pass) maximum delay in the time domain. The delay can be continuously adjusted throughout the VDL's range. As shown in Figure 1, VariDelay™ employs a compact, rugged package design with a water-tight seal (hermetic sealing is also possible) that makes the device ideal for network equipment and test instrument integration. A built-in position locking mechanism allows the user to fix the delay at the desired position. The VDL can also be used in laboratories for precision optical path length control or timing alignment. Major applications include time division multiplexing (TDM), pulse alignment, optical spectrum analysis, and interferometry.

The VDL-002 line includes 100 ps (3cm) and 250 ps (7.5 cm) models. Each model can have single mode (SM) fiber or polarization maintaining (PM) fiber interfaces. The output pigtail can also be replaced with a Faraday mirror to double the delay range.

General Photonics provides a wide variety of delay control products, including longer range manual delay lines, as well as motorized variable optical delay lines which can be controlled with high precision via the front panel or remote control.

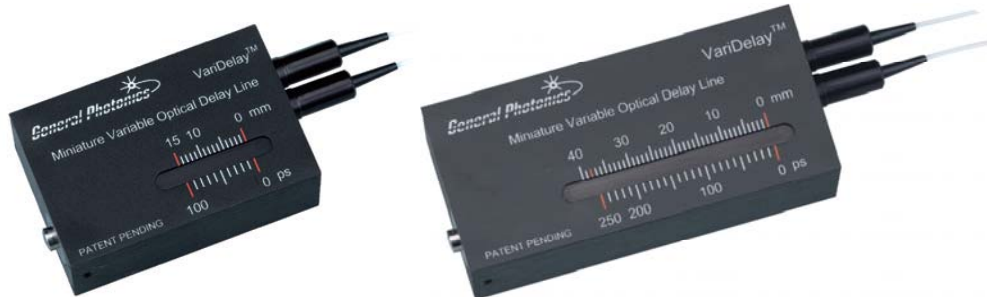


Figure 1 a) 100 ps VDL-002.

b) 250 ps VDL-002.

Section 3. Unpacking:

Inspect VDL-002 for any physical damage due to shipping/transportation. Contact carrier if any damage is found. Check the packing list to see if any parts or accessories are missing.

Be careful to handle the VDL by the enclosure rather than the pigtails. Direct force applied to the optical fibers may damage the optical fiber connection and degrade device performance.

Section 4. Device Description:

The VDL-002 consists of a delay block and two input/output fiber ports. Unless specified, the two fiber ports are symmetrical and therefore interchangeable. If the double-pass option is chosen, the lower fiber port is replaced with a Faraday mirror, and both the input and output signals travel on the remaining pigtail. A manual adjustment dial and a linear delay indicator are mounted on the delay block. There are four 0-80 tapped mounting holes (0.15 inch or 3.8 mm in depth) on the bottom side of the delay block to facilitate PC board mounting or other package configuration. The dimensions and mechanical layout of the VDL-002 are shown in Figure 2.

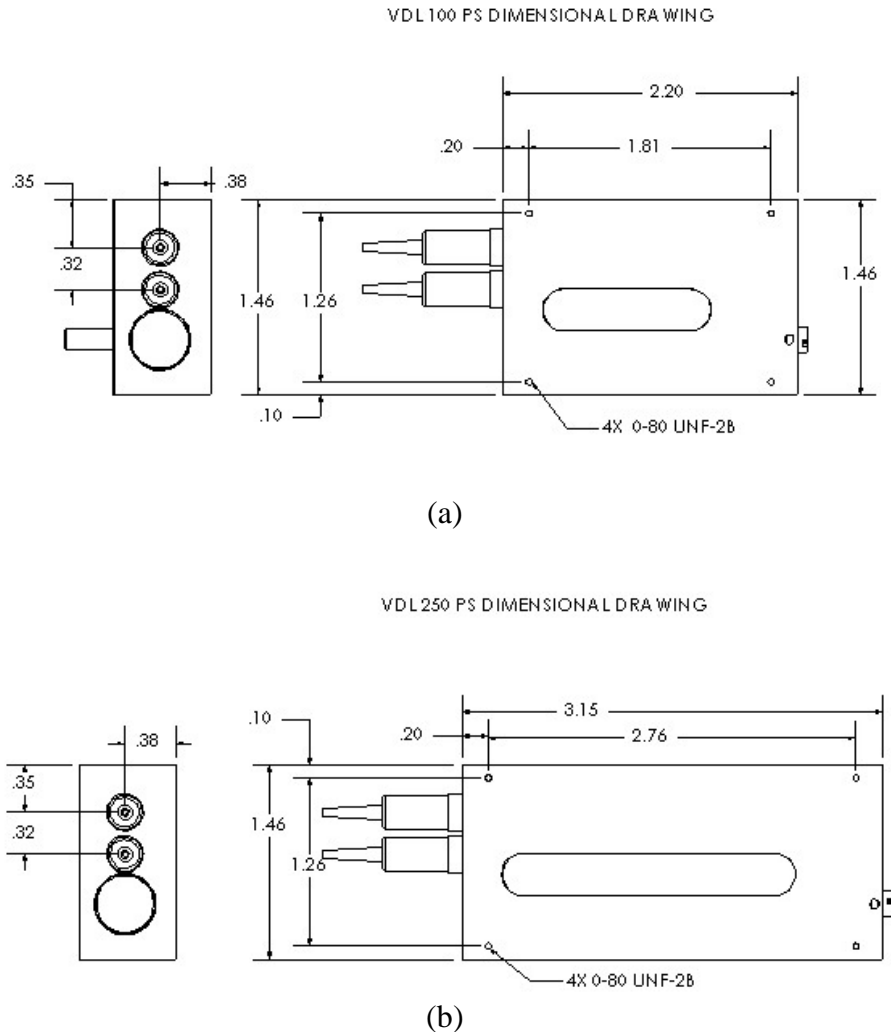


Figure 2 Mechanical layout of the miniature manual variable optical delay line: (a) 100 ps model, and (b) 250 ps model

Section 5. Installation:

The VDL-002 can be mounted on a PCB or used as a stand-alone device. When mounting to a PCB, use mounting screws of the correct size (English 0-80) and length. The screw holes are 0.15 inch (3.8 mm) deep. Refer to Fig. 2 for mounting hole locations. Do not over-tighten the mounting screws.

Section 6. Device Operation:

6.1 Fiber connections

Fiber connectors should be cleaned using industry standard cleaning methods before connection to the system. Unless specified, the VDL-002 is a bi-directional device; the input and output ports are interchangeable.

VDL-002s with polarization maintaining fiber connections are designed for use with slow axis-aligned inputs. Connector keys are aligned to the slow axis of the PM fiber.

For double pass devices, the input and output signals travel on the same pigtail. A circulator (for SM input) or PBS (for PM input) can be used to separate the signals. In an SM input setup, port 1 of the circulator should be connected to the input, port 2 of the circulator to the VDL, and port 3 of the circulator is the output. In a PM input system, one of the single-polarization ports of the PBS should be connected to the input, and the other to the output. The common port should be connected to the VDL.

6.2 Delay time calculation and adjustment

With the VDL-002 connected to the fiber optic system, the delay can be adjusted by using a flat headed screwdriver to turn the screw at the center of the dial. The delay time change can be calculated from the scale on the face of the VariDelay™. Place the magnet pointer on the scale to indicate the delay setting (see Figure 3).

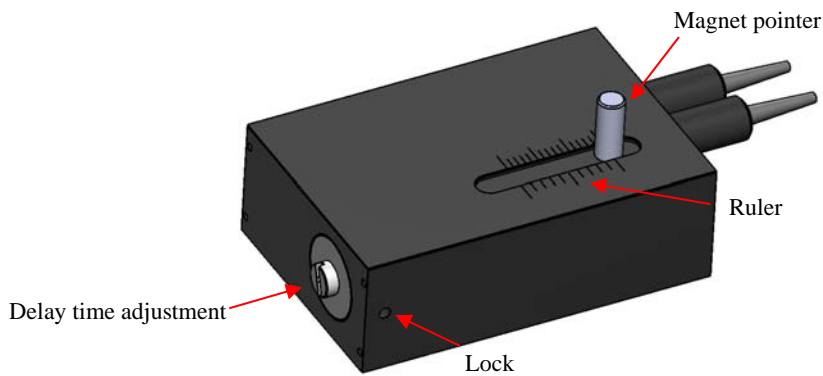


Figure 3 Delay change adjustment and readout using the scale and magnet pointer.

The ruler readings are in millimeters (top) and picoseconds (bottom). The total delay length change is 2 times the length change reading on the ruler. The delay time change can be calculated from

$$\Delta t = \frac{2\Delta L}{c} \quad (1)$$

where ΔL is the length change on the ruler and $c=3\times 10^8$ m/sec. is the speed of light in vacuum. For higher accuracy, the user should consult a physical constant table for a more precise value for the speed of light, and consider the refractive index of air in the calculation.

The manual dial can also be used to estimate the delay length change. Each turn of the dial corresponds to $2\Delta L = 0.6$ mm length change, or $\Delta t = 1.8$ picoseconds delay change.

Warning: Applying excessive force to overextend the delay range may result in damage to the VDL. Please leave 1-2 millimeters at the end of the range to protect the device from excessive travel damage.

Once the delay is set, the position can be locked by tightening the 2-56 set screw on the side of the device (see Figure 3).

6.3 Polarization properties

The VDL-002 employs free space optics to adjust optical path length. Therefore, the polarization state will not change during delay adjustment. However, the standard single mode input/output fibers may transform the polarization state between input and output.

For high polarization stability, a PM input/output version of the VDL-002 is available. As previously mentioned, the PM VDL-002 is designed for use with a single linear polarization state input aligned to the specified PM fiber axis. If the input polarization state is aligned at a 90-degree orientation relative to the specified polarization state, the polarization state may be transformed during propagation. Therefore, it is important to match the source polarization state to the specified orientation before operating the device. Unless otherwise specified, the factory default setting is slow axis orientation.

Section 5. Technical Support

General Photonics is committed to high quality standards and customer satisfaction. For any questions regarding the quality and the use of the VDL-002, or future suggestions, please contact General Photonics Corporation at (909)-590-5473 (telephone) or (909)-902-5536 (fax), or by e-mail at info@generalphotonics.com. General Photonics will respond to all customer questions within 24 hours during regular business hours. You can also write to:

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