Newport

User Manual

Manually Variable Optical Delay Line

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Section 1. Specifications:

The specifications of the manually variable optical delay line are summarized in Table 1. The insertion loss and return loss are measured without connectors.

Table 1 Manually variable optical delay line specifications

Insertion Loss	1.0 dB nominal
Insertion Loss Variation	+/- 0.3 dB max. over entire delay range for 330 ps model
	+/- 0.5 dB max. over entire delay range for 600 ps model
Return Loss	50 dB min.
Delay Range	0 ~ 330 ps continuous for 330 ps model
	0 ~ 600 ps continuous for 600 ps model
Readout Scale Resolution	0.05 mm
Wavelength	1270 ~ 1650 nm
PDL	0.1 dB max. for single mode fiber
Fiber Type	Single mode fiber: SMF-28 standard
	Polarization maintaining fiber: PM Panda fiber standard
Extinction Ratio	>18 dB for PM fiber
Operation Temperature	0°C to 40°C
Storage Temperature	-40°C to 60°C
Maximum Power	300 mW min.
Dimensions	1.00” (H) x 2.10” (W) x 4.15” (L) for 330 ps model
	1.00” (H) x 2.10” (W) x 6.00” (L) for 600 ps model

Section 2. Overview:

Newport Corporation' F-VDL manually variable optical delay line provides precision optical path variation of more than 18 cm, which corresponds to 600 picoseconds maximum delay in time domain. The delay time can be manually adjusted from 0 to 600 picoseconds continuously based on a sliding delay indicator on the package. As shown in Figure 1, F-VDL employs a compact and rugged package design that makes the device ideal for network equipment and test instrument integration. It can also be used in laboratories for precision optical path length control or timing alignment. The major applications of F-VDL include time division multiplexing (TDM), pulse alignment, optical spectrum analysis, and interferometry.

The F-VDL family consists two members: a 600 ps (18 cm) optical delay model and a 330 ps (10 cm) optical delay model. Each model can have single mode (SM) fiber or polarization maintaining (PM) fiber interfaces for different customer applications.

Newport Corporation also has a motorized variable optical delay line, which can be easily controlled with high precision by front panel or computer commands. Please contact Newport Corporation for details.

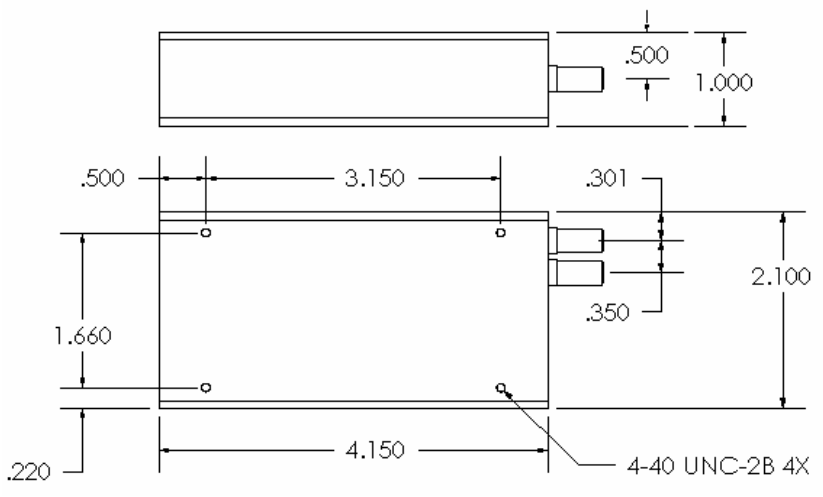
Figure 1. Newport Corporation' manually variable optical delay line— F-VDL. In this picture, a manual dial (shining metallic color) is shown at the left end and input/output fibers are at right end of the delay block. The delay length ruler is on the backside and is not shown in the picture.

Section 3. Unpacking:

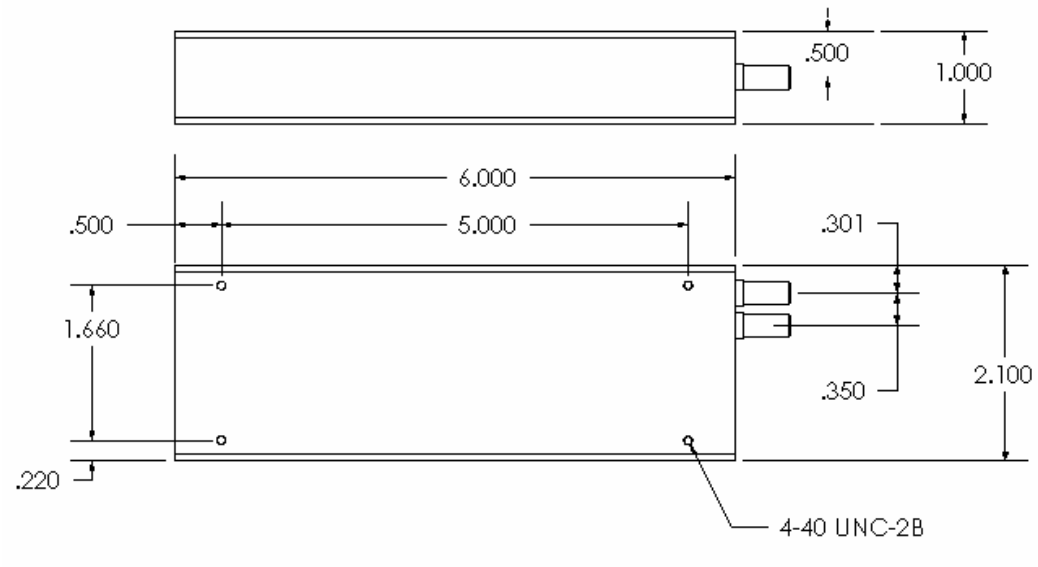
F-VDL device requires careful handling. It is important to carry the device by holding the delay block part. Direct force applied to the optical fibers may damage the optical fiber connection and degrade device performance.

Section 4. Device Description:

F-VDL consists of a delay block and two input/output fiber ports. Unless specified, the two fiber ports are symmetrical and therefore interchangeable. A manual adjustment dial and a linear delay indicator are mounted on the delay block. There are four 4-40 tapped mounting holes (0.14 inch or 3.5 mm in depth) on the bottom side of the delay block to facilitate PC board mounting or other package configurations. The dimensions and mechanical layout of the F-VDL manually variable optical delay line are shown in Figure 2.



(a)



(b)

Figure 2. Mechanical layout of the F-VDL manually variable optical delay line: (a) 330 ps model, and (b) 600 ps model

Section 5. Installation:

F-VDL can be mounted on PC board or used as a stand-alone device. When mounting to a PC board, please use the correct mounting screws (English 4-40 size) with appropriate length. The screw holes are only 0.14 inch or 3.5 mm deep. Please refer to Fig. 2 for mounting holes locations. Do not over fasten the mounting screws.

Section 6. Device Operation:

6.1 Fiber connections

Before connection to optical system, it is strongly recommended that the fiber connectors be cleaned according to standard procedures used in industry. Unless specified in a special device, the F-VDL is a bi-directional device and therefore fiber connectors can be used as either input or output ports.

For PM fiber connections, the user should identify the orientation of the source polarization, because the polarization maintaining F-VDL model is designed for *single* linear polarization state aligned along the slow axis of PM fiber or fiber connector key.

6.2 Delay time calculation and ruler scale

Once the F-VDL is connected to the fiber optical system, one can use the manual dial to adjust delay time. The delay time change can be calculated from the ruler readings on the side of the F-VDL. As shown in Figure 3, the ruler readings are centimeters with millimeter divisions. In F-VDL device, the total delay length change is 2 times the length change reading on the ruler. The delay time change can be calculated from:

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

where ΔL is the length change from ruler, and $c = 3\times10^8$ m/sec. is the speed of light in vacuum. For high accuracy, one needs to consult a physical constant table to find out a more accurate speed of the light and consider the refractive index of the air in calculation.

The sliding scale is a differential type: the stationary scale has 1.00 mm divisions and the moving scale has 0.95 mm divisions. The resolution is 0.05 mm in moving distance reading (0.1 mm round-trip) which corresponding to 0.33 ps delay changes. The manual dial can also be used to estimate the delay length change. Each turn equals to a 2 ΔL = 1.219 mm delay length change, which corresponds to a Δt = 4.06 picoseconds delay time change.

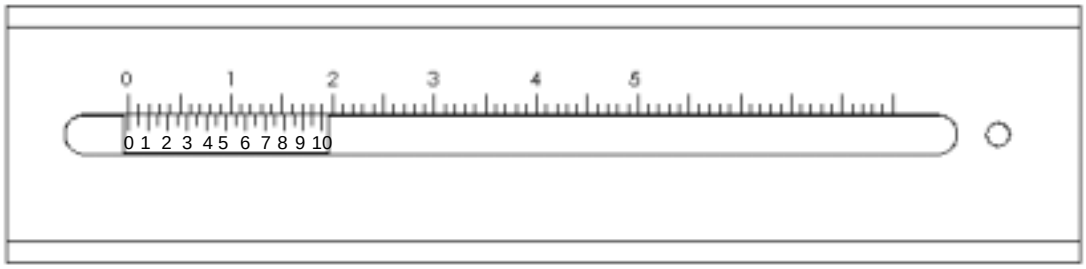


Figure 3. Delay length change ruler for the F-VDL device. The marked unit in the stationary scale is in centimeters with millimeter subdivisions.

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

6.3 Polarization properties

The F-VDL device 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 input polarization state from one to the other at the output.

For high polarization stabilities, one can use the polarization maintaining F-VDL device that has PM fiber pigtails at both input and output ports. As previously mentioned, the PM F-VDL is designed for single linear polarization state input aligned at the specified PM fiber axis. If the input polarization state is aligned at 90-degree orientation 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 PM F-VDL orientation before operating the device. Unless specified otherwise, the factory default setting is for slow axis orientation.

Section 7. Technical Support

Newport Corporation is committed to high quality standard and customer satisfaction for its products. If there is any question regarding the quality and the use of F-DEP, or future suggestions, please feel free to contact Newport Corporation.

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