

Finisar[®]

WaveShaper[™] 1000/SP

Programmable Single Polarization Filter

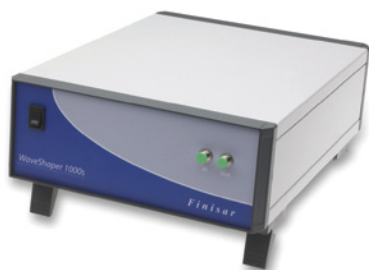


Control of Picosecond and Femtosecond Laser Pulses

The WaveShaper 1000/SP is a Polarization Maintaining (PM) programmable optical filter which provides full control of the amplitude and phase spectra across the entire operating wavelength range.

Typical applications include the creation and shaping of short laser pulses in the picosecond and down to the femtosecond regime. The WaveShaper 1000/SP operating around 1 μm has been optimized to control the optical signals of Neodymium and Ytterbium fiber lasers; the WaveShaper 1000/SP operating around 1.55 μm has been optimized to control the signal of Erbium lasers. The WaveShaper/SP is typically applied in a Master Oscillator Power Amplifier (MOPA) configuration following the seed laser.

The WaveShaper 1000/SP transmits and processes the signal which is launched into the slow axis of the input PM fiber. The signal launched into the fast axis is not transmitted and will be extinguished by more than 20 dB. This instrument is available as a bench-top unit (1000S/SP) as well as an OEM module which can be integrated into systems (1000M/SP). The fiberized setup ensures stable turn-key operation without manual re-adjustments.



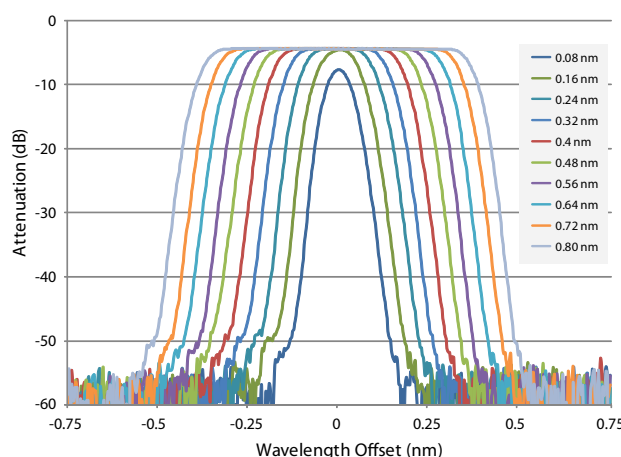
KEY FEATURES

- ▶ Arbitrarily programmable shape of attenuation and phase
- ▶ Resolution bandwidth 0.1 nm
- ▶ Group delay adjustable
- ▶ Large attenuation range
- ▶ Single Polarization Operation
- ▶ Fully fiberized with PM pigtailed on input and output
- ▶ USB control interface
- ▶ Benchtop and Modular versions available
- ▶ No moving parts; based on LCoS technology

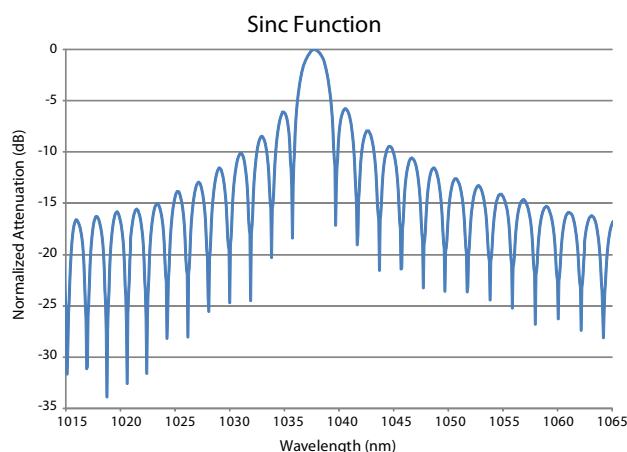
APPLICATIONS

- ▶ Material Processing
- ▶ Short Pulse Laser Research
- ▶ Medical
 - Dermatology
 - Ophthalmology
- ▶ Microscopy
- ▶ Spectroscopy
- ▶ Coherent Quantum Control
- ▶ Optical Communications

Bandpass filter with various widths created by 1.5 μm WaveShaper 1000/SP



Sinc filter shape created by 1 μm WaveShaper 1000/SP



APPLICATION EXAMPLES FOR SHORT PULSE LASERS

Material Processing

Material processing is one of the largest application areas for short pulsed lasers. Precision micromachining requires athermal ablation which is achieved through the rapid delivery of energy from ultra-short pulses in the picosecond and femtosecond regime.

Microscopy

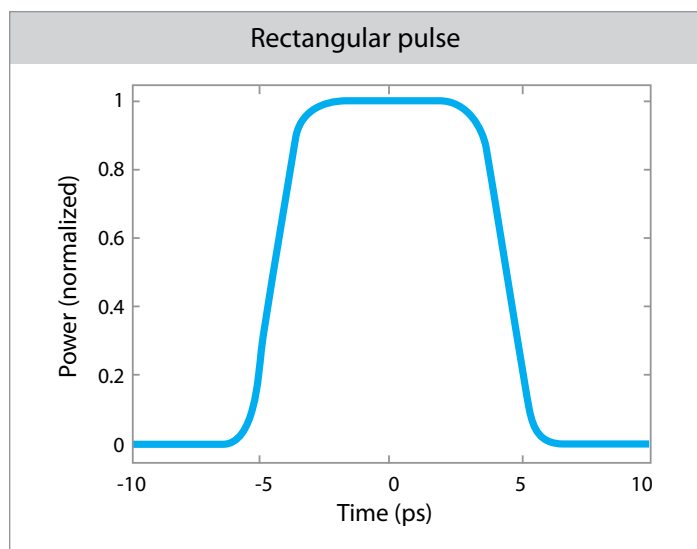
In biology and medicine multi-photon optical microscopy is applied to produce sharper images at greater physical depths and with less background scatter by exploiting nonlinear processes. A crucial requirement of higher-order photon excitation processes is high intensity light for maximization of interaction rate. Here ultra-short laser pulses are favoured due to high peak intensity and relatively low energy per pulse.

Coherent Quantum Control

In coherent quantum control schemes desired transitions can be selectively excited using short optical pulses and pulse pairs with high peak power and defined amplitude and phase characteristics. Using the Pulse Shaping capabilities of the WaveShaper 1000/SP supports optimization of such optical pulses.

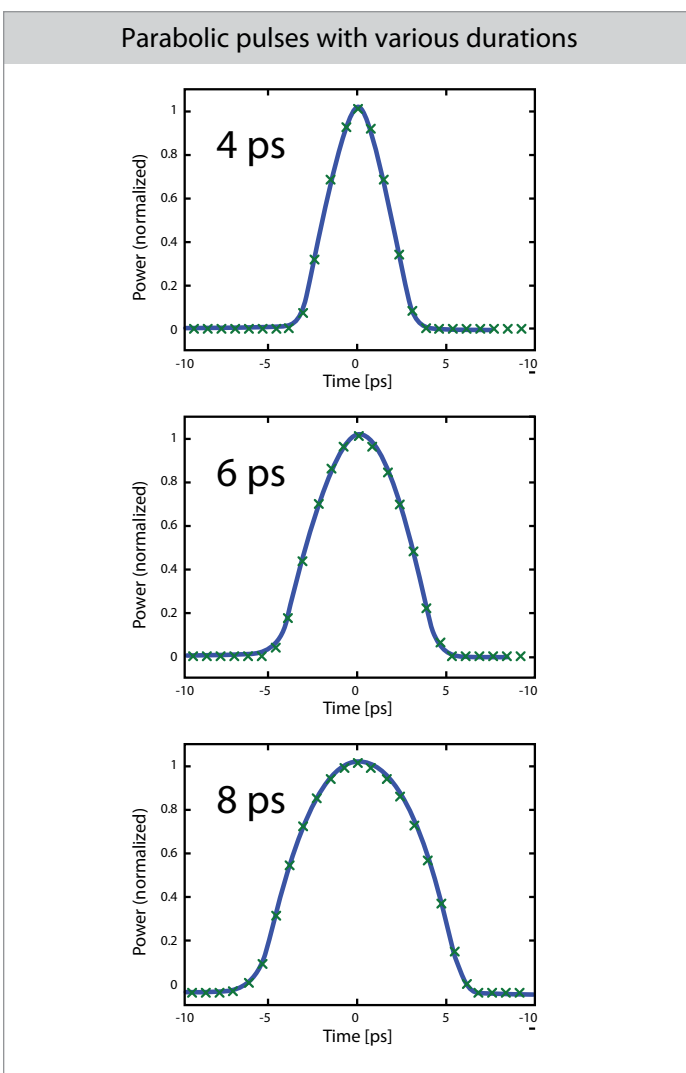
Fiber Communications

Advanced communication systems rely heavily on fiber-optics for transmitting signals over globally distributed networks. The ever-increasing demand for higher transmission bandwidth drives advanced signal coding schemes. To increase spectral efficiency, stringent requirements are placed on the temporal waveform of the data which results in a need to control the amplitude and the phase of the signal.



Examples of some of the pulse shapes which can be generated using a WaveShaper 1000/SP in combination with a short pulse laser and appropriate compressive elements.

In addition to the pulse control capabilities of the WaveShaper 1000/SP, Finisar also supplies the worlds highest quality pulse-compression gratings through its LightSmyth subsidiary. With > 94% diffraction efficiency optimized for linear P-polarization, LightSmyth gratings minimize optical losses in the system, which is especially critical for high energy lasers. To find out more about the exceptional power-handling and performance of the LightSmyth range of pulse-compression gratings, please visit www.lightsmyth.com.



SPECIFICATIONS

Specifications are guaranteed except where stated as typical (typ).

Model		1000/SP 1 μm Programmable Single Polarization Filter (Note 1)	1000/SP 1.5 μm Programmable Single Polarization Filter
Operating Range		1015 nm to 1065 nm	1527.4 nm to 1567.5 nm (191.250 THz to 196.275 THz)
Loss and Dispersion (Note 2, 3)	Insertion Loss (incl. Connectors, Note 4)	6.5 dB (typ. 5 dB)	6.5 dB (typ. 4.5 dB)
	Insertion Loss Non-Uniformity (Note 4)	typ. < 1 dB	< 0.7 dB (typ. < 0.5 dB)
	Return Loss	> 25 dB	
	Group Delay Ripple	< ± 0.75 ps	
Polarization Extinction Ratio		> 20 dB	
Filter Control (Note 2, 3)	Filter Shape	Arbitrary	
	Filter Bandwidth	0.1 nm to 50 nm	0.08 nm to 40.1 nm (10 GHz to 5 THz)
	Filter Center Setting Resolution	0.05 nm	8 pm (1 GHz)
	Filter Center Setting Accuracy	± 0.1 nm	± 20 pm (± 2.5 GHz)
	Bandwidth Setting Resolution	0.05 nm	8 pm (1 GHz)
	Bandwidth Setting Accuracy	± 0.1 nm	± 40 pm (± 5 GHz)
	Bandwidth Setting Repeatability	± 0.1 nm	± 20 pm (± 2.5 GHz)
	Group Delay Control Range	- 13 ps to + 13 ps	- 25 ps to + 25 ps
	Settling Time	500 ms	
Attenuation Control	Attenuation Control Range	0 to 25 dB	0 to 35 dB
	Attenuation Setting Resolution	0.01 dB	0.01 dB
	Attenuation Setting Accuracy	± 1.0 dB from 0 to 10 dB, $\pm 10\%$ from 10 to 20 dB	± 1.0 dB from 0 to 10 dB, $\pm 10\%$ from 10 to 30 dB
Mechanical, Electrical and Environmental	Maximum Total Input Optical Power	500 mW	
	Maximum CW Power Spectral Density	20 mW	
	Operating Temperature	15 °C to 35 °C (S-series) 15 °C to 55 °C (M-series)	
	Operating Humidity	10 % to 80 %	
	Operating Voltage	100 V to 240 V (S-series) 5 V (M-series)	
	Power Consumption	< 50 VA	
	Communications Interface	USB 2.0	
	Connector Type	FC/APC	
	Fiber Type	Corning Type PM 980, signal in slow-axis	Corning Type PM 1550, signal in slow-axis
	Size	316 mm x 241 mm x 88 mm (S-Series) 220 mm x 120 mm x 37 mm (M-Series)	
	Weight	3.8 kg (S-Series) 0.8 kg (M-Series)	

- Notes:**
1. Specifications for the 1000/SP 1 μm Programmable Single Polarization Filter are preliminary
 2. For WaveShaper 1000/SP 1 μm : Measured over 0.5 dB passband on a 1 nm band-pass filter
 3. For WaveShaper 1000/SP 1.5 μm : Measured over 0.5 dB passband on a 0.8 nm band-pass filter
 4. Measured on signal in slow axis

Part Numbers:	WaveShaper 1000S/SP, 1 μm , FC/APC Connectors:	WS-AA-1000S-1U-H
	WaveShaper 1000M/SP, 1 μm , FC/APC Connectors:	WS-AA-1000M-1U-H
	WaveShaper 1000S/SP, 1.5 μm , FC/APC Connectors:	WS-AA-1000S-SP-H
	WaveShaper 1000M/SP, 1.5 μm , FC/APC Connectors:	WS-AA-1000M-SP-H

Finisar®

1389 Moffett Park Drive
Sunnyvale, CA 94089-1133, USA

Telephone: +1 408-548-1000
Sales: +1 408-541-5690
www.finisar.com