

Variable Attenuator — Precision control by the principle of polarization

Introduction

Precision laser applications require fine power control. A variable attenuator with large dynamic range and precision control is designed to fulfill this purpose. It is suitable for intensity attenuation over a wavelength range from UV to IR.

Operation Principle

This variable attenuator consists of a specially-designed opto-mechanical adapter and precision opto-mechanical holder. The key optics involved are a half-wave plate and thin film polarizer. The half-wave plate is usually made of birefringent crystal cut parallel to the optical axis. It is used to change the polarization direction of the incident beam.

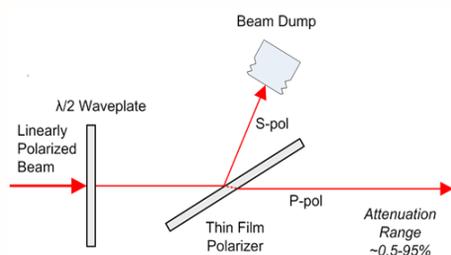


Figure 1. Principle of polarization attenuator

A thin film Brewster type polarizer placed after the half-wave plate reflects s-polarized light while transmitting p-polarized light. The intensity ratio of s- to p-polarized beams may be continuously varied by rotating the wave plate. The intensity of either the exit beam, or their intensity ratio, can be controlled over a wide dynamic range. P-polarization can be selected for maximum transmission. Full range of attenuation from maximum to minimum can be achieved by rotating the half-wave plate from 0 to 45 degrees. For constant monitoring of power, the beam dump can be replaced with a power meter.

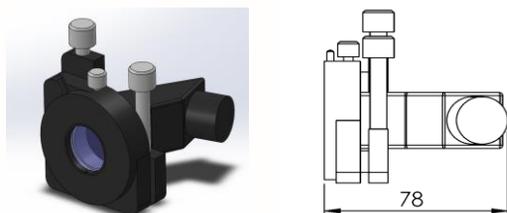


Figure 2. Layout of the polarization attenuator

The key specifications of the polarization attenuator at different operating wavelengths are listed below. Compared to similar products in the market, we offer a large dynamic range of attenuation, which is useful for precision laser process control.

Wavelength	355/532/1064nm
Type	Transmission Mode
Clear Aperture	14mm
Beam Shift	0.5mm
Extinction Ratio	>200:1
Attenuation Range	0.5%-95%
Damage Threshold	>5J/cm ² @1064nm, 20ns, 20Hz
Weight	<300g

Table 1. Key specifications of polarization attenuator

Applications

The following listed characteristics enable the polarization attenuator to precisely control the laser intensity with fine adjustment steps. Using a suitable type of polarizer, this principle can be realized at very high-power levels.

- Divides laser beam into two parallel beams of manually adjustable intensity ratio
- Large dynamic range
- Negligible transmitted beam deviation
- High Optical damage threshold
- Transmission attenuation range 0.5% - 95.0%

The application of polarization optics design is not limited to attenuation of laser intensity; other applications include phase control (phase retarding), interferometer, etc.

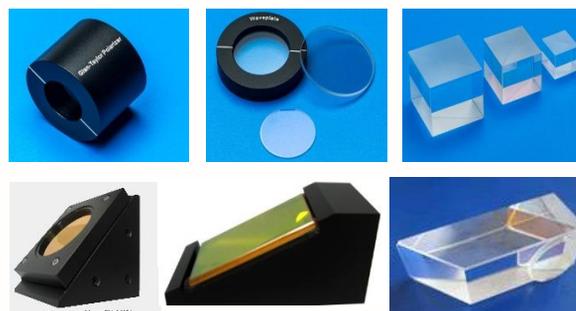


Figure 3. Varieties of polarization laser optics

Conclusion

As a global enterprise, leading photonics innovation since 2002, WOE has built up customization engineering capability for precision laser optics. For more detailed selection of laser optics/infrared optics/vision optics, please refer to WOE website or catalogue. Customization of advanced models including high extinction ratio attenuators, two output beams model, and motorized variable attenuators, can be requested for.

