

## Variable Beam Splitter

### — Precision control by the principle of polarization

#### Introduction

Precision laser applications require fine power control. A variable beam splitter with large dynamic range and precision control is designed to fulfill this purpose. It is suitable for intensity splitting between two polarization states over a wavelength range from UV to IR.

#### Operation Principle

This variable beam splitter consists of a specially-designed precision opto-mechanical holder. The key optics involved are a half-wave plate and polarization beam splitter (PBS). 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. The surfaces of the waveplate and the beamsplitter cube are coated with a AR-coating over the designed wavelength range. The PBS 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 intensity variation between the two beams from maximum to minimum can be achieved by rotating the half-wave plate from 0 to 45 degrees

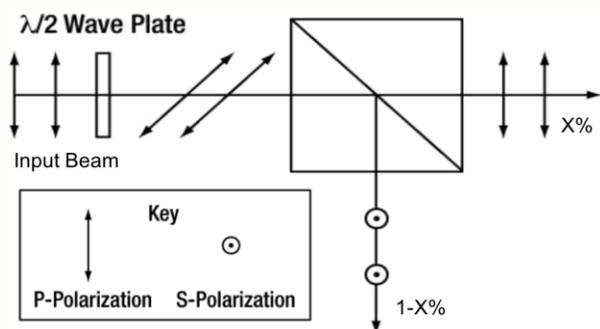


Figure 1. Principle of the variable beam splitter

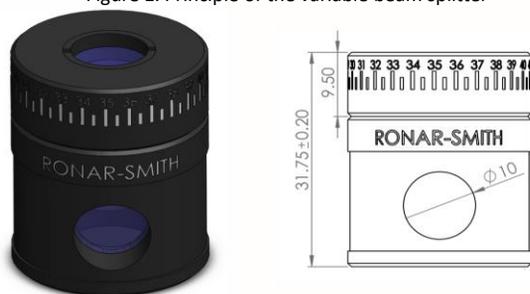


Figure 2. Layout of the variable beam splitter

The key specifications of the variable beam splitters at different operating wavelengths are listed below.

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

Table 1. Key specifications of polarization attenuator

#### Applications

The following listed characteristics enable the variable beam splitter 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%

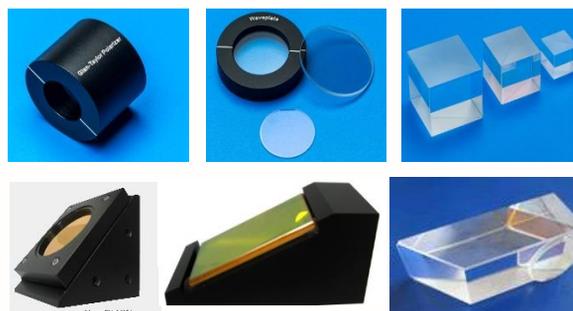


Figure 3. Varieties of polarization laser optics

#### 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.