

Versatile Beam Expansion – From tunable to automation

Introduction

The function of a beam expander is to take an input collimated light and expand (or reduce) its output beam diameter. For example, the BXZ-9.4-0.5-3X zoom beam expander allows for the laser output beam diameter to be magnified by 0.5 to 3 times of its input beam diameter.

Operation Principle

Beam expanders primarily make use of two types of optical designs, namely Keplerian and Galilean. Keplerian design involves the use of a positive lens pair. While, Galilean design makes use of a negative and a positive lens pair. For our RONAR-SMITH® zoom beam expanders (BXZ series), the Galilean design is adopted. Galilean designs are generally shorter than Keplerian ones with the same magnification level. Such designs, without tight focusing, prevent the ionisation of air when high energy lasers are used.

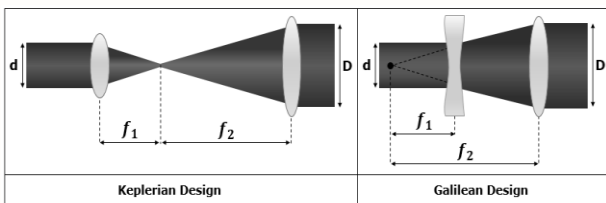


Figure 1. Design of beam expander

The key specifications of the different zoom beam expanders are listed below. Compared to similar products in the market, we offer versatile tunability and automatic control at different laser wavelengths.

Wavelength	257nm, 355nm, 532nm, 1064nm, 1550nm, 1940nm, 2.800um, 9.4um, 10.6um
Magnification	0.25—10X
Divergence adjustability	Yes
Angle of incidence	$0 \pm 0.06^\circ$
Pointing stability	< 1.0 mrad
Other specifications	Refer to catalogue

Table 1. Key specifications of zoom beam expander

With in-house design capability, a typical zoom beam expander outline is shown in Figure 2. All designs come with detailed specification table and operation manual.

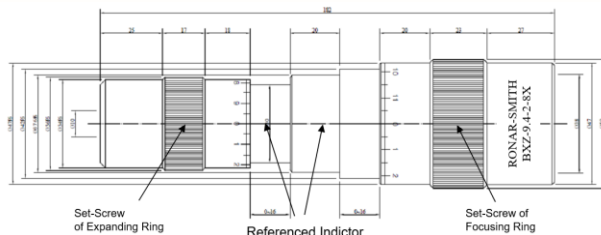


Figure 2. Outline of a typical zoom beam expander.

Applications

(a) Automatic tunable beam expander

Following the global trend in automation, we came up with a new series of automatic beam expanders. The unique design of an integrated printed circuit board provides an integrated communication port, a memory based calibration function, and a high accuracy of 10um.

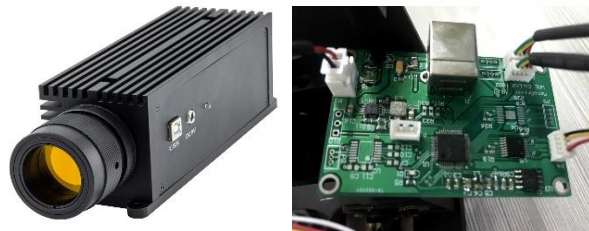


Figure 3. Automatic beam expander and in-house developed control board

(b) Reflective design

To minimize the tight focusing effect in the Keplerian design, we came up with new modules based on reflective focusing optics. It could be used as a stand-alone module, or integrated with other transmission-based beam expanders.

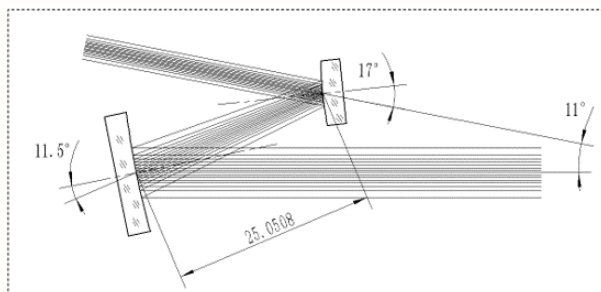


Figure 4. Design of reflective beam expander

Conclusion

As a global player, leading photonics innovation since 2002, WOE has built up customization engineering capability for transmissive/reflective/diffractive optics design and precision motion control.

