

## High Power Laser Beam Expander | BEHP

RoHS

Catalog  
Code

W3200

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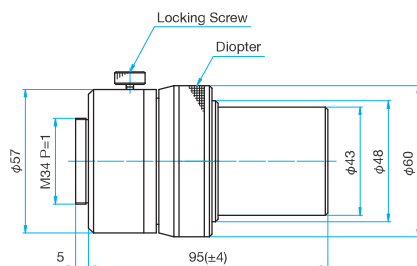
These laser beam expanders are designed for use with a high-power laser. Fine adjustment of the collimator is available with the diopter correction function. The lens design takes into account the wavefront aberration, so it can be used in an optical system with high precision, such as a laser interferometer or laser processing.

- The optical system of the beam expander utilizes an air gap configuration that does not use an adhesive bonding of lens.
- By turning the diopter ring that is attached to the center of the beam expander, you can make variable beams such as a focused beam, collimated beam, and a divergent beam. It is used when you want to vary the position of the beam waist and where precision collimation adjustment is necessary.



Outline Drawing

(in mm)



## Specifications

Lens Material	Synthetic fused silica
Configuration of lens	2 group 4plates Galilean
Acceptance range of incident angle	$\pm 1^\circ$
Coating	Antireflection coating (Design wavelength: 633nm)
A range of the length of lens barrel	$\pm 5\text{mm}$

## Guide

- We also can provide a holder for our laser beam expander (KLH-BE) for the fine adjustment with tilt angle and to secure the beam expander. [WEB Reference](#) [Catalog Code](#) W4147
- It is also available to provide beam expander of wavelength other than products on-line and in our catalog and achromatic in two wavelengths or more.

## Attention

- It is not possible to create a collimated light obtained by reducing the beam diameter using in the opposite direction a beam expander. In this case, please use the appropriate optical system by determining the position of the beam waist and divergence angle of the laser beam.

## Specifications

Part Number	Design wavelength [nm]	Beam magnification	Input Clear aperture [mm]	Primary material: Aluminum Finish: Black Anodized	
				Laser Damage Threshold* [J/cm <sup>2</sup> ]	
BEHP-3-266	266	3	φ10	2	
BEHP-5-266	266	5	φ6	2	
BEHP-10-266	266	10	φ3	2	
BEHP-3-355	355	3	φ10	4	
BEHP-5-355	355	5	φ6	4	
BEHP-10-355	355	10	φ3	4	
BEHP-3-532	532	3	φ10	5	
BEHP-5-532	532	5	φ6	5	
BEHP-10-532	532	10	φ3	5	
BEHP-3-1064	1064	3	φ10	7	
BEHP-5-1064	1064	5	φ6	7	
BEHP-10-1064	1064	10	φ3	7	

\* Laser pulse width 10ns, repetition frequency 20Hz

## Compatible Optic Mounts

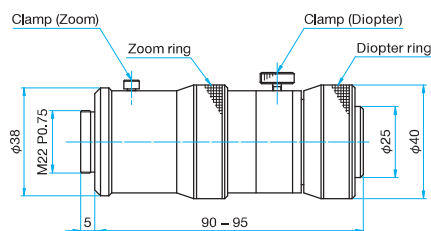
KLH-BE-M34H

It is capable of 1× to 3× times changing high-power zoom Laser beam expander.  
 Fine adjustment of the collimator is available with diopter correction function.  
 It can be used in an optical system with high precision, such as a laser interferometer and processing by the lens design that takes into account the wavefront aberration.

- The optical design of the beam expander is an air gap configuration that does not use an adhesive to bond the lenses. This allows the beam expander to be used with a high-power laser. By the Galileo type lens configuration, it reduces the number of aberration correction lens, and enables the shorter overall length of the beam expander.
- By turning the diopter ring that is attached to the center of the beam expander, you can make variable beams such as the focused beam, collimated beam, and the divergent beam. It is used when you want to vary the position of the beam waist and if strict collimation adjustment is necessary.



**Outline Drawing** (in mm)



## Guide

- ▶ We provide the laser beam expander holders (KLH-BE) for optical-axis adjustment of the laser beam expander.  
[WEB Reference](#) Catalog Code W4147
- ▶ We can also provide a beam expander for wavelengths not listed on-line or in our catalog, please contact our Sales Division with your request.

## Attention

- ▶ It is not possible to create a collimated light obtained by reducing the beam diameter using in the opposite direction a beam expander. In this case, please use the appropriate optical system by determining the position of the beam waist and divergence angle of the laser beam.

## Specifications

Specifications							Primary material: Aluminum Finish: Black Anodized
Part Number	Variable magnification	Design wavelength [nm]	Input Clear aperture [mm]	Laser Damage Threshold* [J/cm²]	Coating	Material	Weight [kg]
<b>BEZHP-1/3-532</b>	1 – 3	532	φ5	5.0	Antireflection coating	Synthetic fused silica	0.3

\* Laser pulse width 10ns, repetition frequency 20Hz

## Compatible Optic Mounts

KLH-BE-M22H

# Laser Beam Expanders With diopter correction function

BE/LBED

RoHS

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This is an optical system for expanding a small collimated laser beam to a larger one.

Fine adjustment of the collimator is available using the diopter correction function.

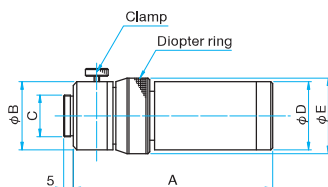
You can use in a high precision optical system like an interferometer or laser processing with lens designed for wave front aberration.

- The beam expander optical system is air-space with no bonded lenses and can be used for high powered laser applications.
- With the Galilean type lens configuration, it reduces the number of aberration corrections and shortens the length of the beam expander.
- By turning the diopter ring on the beam expander, you can have a varied collimated beam with beam divergence on the focused beam. A beam waist or an accurate adjustment of the collimation is required.
- There is a wide variety with different magnification and wavelengths to choose from.
- With the different types of BE-V and LBED visible lasers, can be attached to a He-Ne (05-LHP) lasers with an adapter (included).



Outline Drawing

(in mm)



## Guide

- ▶ We provide the laser beam expander holders (KLH-BE) for optical-axis adjustment of the laser beam expander.  
▶ WEB Reference Catalog Code W4147
- ▶ We can also fabricate achromatic beam expanders with multiple wave lengths other than those found in on-line and in our catalog, call our Sales Division for more information.
- ▶ Fabrication of beam expander for high-energy pulsed laser is also available. ▶ Reference B200

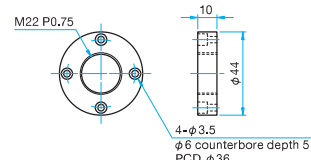
## Attention

- ▶ By using in the opposite direction, it will not create a reduction in diameter of the collimated beam. Please use the appropriate optical system by determining the position of the beam waist and the divergence angle of the laser beam.

## Accessories for visible light (BE-V/LBED)

### Connection adapters for He-Ne laser

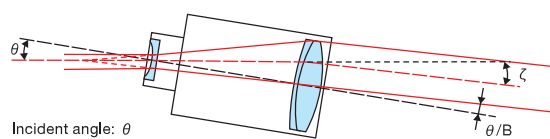
■ # 4-40UNC, L=3/8...4 screws



### ■ For adjustment of the laser beam expander

If the incident beam is inclined to the optical axis of the laser beam expander, a larger collimated light is emitted from the direction of the incident beam is inclined.

Therefore, it is necessary to precisely align the optical axis of the beam expander for the incident beam.

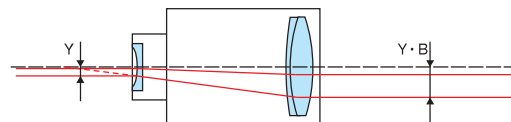


Incident angle:  $\theta$   
Magnification: B  
Deviation angle of beam:  $\zeta = \theta - \theta/B$

If the center of the incident beam is translated from the optical axis of the laser beam expander, the emission is emitted with enlarged and magnified amounts of deviation of the incident beam. For this reason, if you need the expanded beam with no chipping or deformation, the incident beam must be strictly in accordance with the center of the optical axis.

We recommend the laser beam expander holder (KLH-BE) to adjust the beam expanders tilt and the center of the optical axis.

▶ WEB Reference Catalog Code W4147



## Compatible Optic Mounts

KLH-BE-M22H, M34H

Specifications										Primary material: Aluminum Finish: Black Anodized
Part Number	Design wavelength [nm]	Expansion ratio	Input aperture (MAX) [mm]	Barrel length A [mm]	φB [mm]	Mounting thread C	φD [mm]	Diameter φE [mm]	Laser Damage Threshold* [J/cm <sup>2</sup> ]	Weight [kg]
BE-2-266	266	2.0	φ15.5	72.0±4	φ57	M34 P1	φ48	φ60	1.4	0.3
BE-3-266	266	3.0	φ10.5	79.5±4	φ57	M34 P1	φ48	φ60	1.4	0.3
BE-4-266	266	4.0	φ9.0	90.5±4	φ57	M34 P1	φ48	φ60	1.4	0.3
BE-5-266	266	5.0	φ7.0	119.5±4	φ57	M34 P1	φ48	φ60	1.4	0.4
BE-7.5-266	266	7.5	φ4.5	129.0±4	φ57	M34 P1	φ48	φ60	1.4	0.4
BE-10-266	266	10.0	φ3.5	173.0±4	φ57	M34 P1	φ48	φ60	1.4	0.4
BE-2-355	355	2.0	φ15.5	75.0±4	φ57	M34 P1	φ48	φ60	2	0.3
BE-3-355	355	3.0	φ10.5	83.0±4	φ57	M34 P1	φ48	φ60	2	0.3
BE-4-355	355	4.0	φ9.0	94.5±4	φ57	M34 P1	φ48	φ60	2	0.3
BE-5-355	355	5.0	φ7.0	125.0±4	φ57	M34 P1	φ48	φ60	2	0.4
BE-7.5-355	355	7.5	φ4.5	134.5±4	φ57	M34 P1	φ48	φ60	2	0.4
BE-10-355	355	10.0	φ3.5	181.0±4	φ57	M34 P1	φ48	φ60	2	0.5
BE-2-V	400 – 700	2.0	φ6.0	42.0 <sup>+3</sup> <sub>-2</sub>	φ36	M22 P0.75	φ26	φ40	4	0.12
LBED-3	400 – 700	3.0	φ5.4	42.0 <sup>+3</sup> <sub>-2</sub>	φ36	M22 P0.75	φ26	φ40	4	0.12
BE-4.1-V	400 – 700	4.1	φ4.1	62.0±3	φ36	M22 P0.75	φ26	φ40	4	0.13
LBED-5	400 – 700	5.0	φ3.2	50.5±3	φ36	M22 P0.75	φ26	φ40	4	0.12
BE-6-V	400 – 700	6.0	φ4.3	102.0±3	φ36	M22 P0.75	φ36	φ40	4	0.17
BE-7.6-V	400 – 700	7.6	φ3.4	80.0±3	φ36	M22 P0.75	φ36	φ40	4	0.15
BE-8.4-V	400 – 700	8.4	φ3.1	89.5±3	φ36	M22 P0.75	φ36	φ40	4	0.16
LBED-10	440 – 700	10.0	φ2.6	109.5±3	φ36	M22 P0.75	φ36	φ40	4	0.18
BE-12.6-V	450 – 700	12.6	φ2.1	138.0±3	φ36	M22 P0.75	φ36	φ40	4	0.2
BE-14.3-V	460 – 700	14.3	φ1.8	158.5±3	φ36	M22 P0.75	φ36	φ40	4	0.2
BE-16.8-V	480 – 700	16.8	φ2.1	190.0±3	φ36	M22 P0.75	φ46	φ40	4	0.3
BE-18.5-V	500 – 700	18.5	φ1.9	211.0±3	φ36	M22 P0.75	φ46	φ40	4	0.3
BE-21-V	510 – 700	21.0	φ1.7	241.0±3	φ36	M22 P0.75	φ46	φ40	4	0.3
BE-1.5-LD	780 – 830	1.5	φ16.1	51.0 <sup>+4</sup> <sub>-2</sub>	φ57	M34 P1	φ48	φ60	4	0.3
BE-2-LD	780 – 830	2.0	φ15.3	53.0±4	φ57	M34 P1	φ48	φ60	4	0.3
BE-3-LD	780 – 830	3.0	φ10.1	64.0±4	φ57	M34 P1	φ48	φ60	4	0.3
BE-4-LD	780 – 830	4.0	φ8.9	95.5±4	φ57	M34 P1	φ48	φ60	4	0.3
BE-5-LD	780 – 830	5.0	φ7.2	125.5±4	φ57	M34 P1	φ48	φ60	4	0.4
BE-7.5-LD	780 – 830	7.5	φ4.7	135.5±4	φ57	M34 P1	φ48	φ60	4	0.4
BE-10-LD	780 – 830	10.0	φ3.6	186.5±4	φ57	M34 P1	φ48	φ60	4	0.5
BE-1.5-1064	1064	1.5	φ16.0	52.0 <sup>+4</sup> <sub>-3</sub>	φ57	M34 P1	φ48	φ60	4	0.3
LBED-2Y	1064	2.0	φ15.1	49.0 <sup>+4</sup> <sub>-0</sub>	φ57	M34 P1	φ48	φ60	4	0.3
LBED-3Y	1064	3.0	φ10.2	64.5±4	φ57	M34 P1	φ48	φ60	4	0.3
LBED-4Y	1064	4.0	φ8.6	93.5±4	φ57	M34 P1	φ48	φ60	4	0.3
BE-5.3-1064	1064	5.3	φ6.8	127.5±4	φ57	M34 P1	φ48	φ60	4	0.4
BE-7-1064	1064	7.0	φ5.1	179.5±4	φ57	M34 P1	φ48	φ60	4	0.5
BE-10-1064	1064	10.0	φ3.6	188.5±4	φ57	M34 P1	φ48	φ60	4	0.5

\* Laser pulse width 10ns, repetition frequency 20Hz

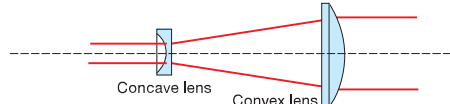
### Lens configuration

Beam expander is divided into two main types depending on the configuration of the lens.

#### Galilean type

Combination of convex and concave type

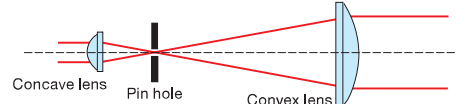
- Features. ● Can shorten the overall length of the beam expander.
- High performance with small number of lenses.
  - Usable with high powered lasers.



#### Keplerian type

Uses two convex lenses. (It is not used for this product.)

- Features. ● You can insert a pin hole in the expander.
- You can obtain a clean Gaussian beam emitted by the effect of the pinhole spatial filter.



Note: Do not use with high energy lasers  
It can cause a spark in the focal point of the laser causing the transmitted wave front to collapse.

### Diopter and diopter correction function

By using the diopter correction function, it is available to adjust the divergent light beam to the parallel beam.

If it is necessary to use exact optical laser system, recommended to use the beam expander with diopter correction function.

And if the parallel light beam incident into the beam expander, the light would be emitted in expanded beam.

However, since most laser is slightly divergent, the beam will not be emitted by parallel beam.

In addition, parallel light emitted from the beam expander will be shifted in various factors. Such as LD (laser diode) which has a possibility that wavelength will change, and by the changes of the temperature.

# Laser Beam Expanders | LBE

RoHS

Catalog Code

W3092

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Expanders

Others

Beam expanders are useful laser accessories when the beam diameter must be increased. However, their main function is to decrease the divergence of the laser beams which are to be projected over long distances. These precision beam expanders have been designed for use with HeNe lasers but they can be used for any laser working in the visible part of the spectrum (400 – 700nm).

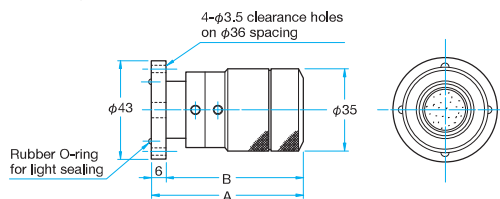
- Laser beam expanders designed to use with high powered lasers that are made of lenses attached together without using glue (air-gap).
- These beam expanders are light weight and short bodied and because they are Galileo type design, they have little aberration and correction.
- The visible type can be mounted directly to any He-Ne laser.



## Outline Drawing

(in mm)

#4-40UNC, L=3/8...4



## Guide

- For wavelength or magnification which is not shown on-line or in the catalog, please ask our Sales Division.
- We provide the laser beam expander holders (KLH-BE) for optical-axis adjustment of the laser beam expander.

[WEB Reference](#) [Catalog Code](#) W4147

## Attention

- Make sure that the beam expander is well aligned with the laser light axis. If the beam expander is inclining, the output light will also be inclined.
- It is not possible to obtain a decreased beam diameter by using the beam expander on the opposite side. Use it properly to obtain an adequate optical solution.
- The light may not be collimated when it become divergent or convergent.

## Typical Laser for He-Ne (400 – 700nm)

Primary material: Aluminum  
Finish: Black Anodized

Part Number	Expansion ratio	Barrel length A [mm]	B [mm]	Input aperture [mm]	Laser Damage Threshold* [J/cm <sup>2</sup> ]	Weight [kg]
<b>LBE-3</b>	3	62.9	56.9	φ3.8	4	0.12
<b>LBE-5</b>	5	61.9	55.9	φ2.7	4	0.12
<b>LBE-10</b>	10	127.9	121.9	φ1.7	4	0.18

\* Laser pulse width 10ns, repetition frequency 20Hz

## Typical Laser for LD (780 – 830nm)

Primary material: Aluminum  
Finish: Black Anodized

Part Number	Expansion ratio	Barrel length A [mm]	B [mm]	Input aperture [mm]	Laser Damage Threshold* [J/cm <sup>2</sup> ]	Weight [kg]
<b>LBE-3L</b>	3	63.3	57.3	φ3.8	4	0.12
<b>LBE-5L</b>	5	62.3	56.3	φ2.7	4	0.12
<b>LBE-10L</b>	10	127.9	122.8	φ1.7	4	0.18

\* Laser pulse width 10ns, repetition frequency 20Hz

## Typical Laser for YAG (1064nm)

Primary material: Aluminum  
Finish: Black Anodized

Part Number	Expansion ratio	Barrel length A [mm]	B [mm]	Input aperture [mm]	Laser Damage Threshold* [J/cm <sup>2</sup> ]	Weight [kg]
<b>LBE-3Y</b>	3	63.73	57.8	φ3.8	4	0.12
<b>LBE-5Y</b>	5	62.7	57.8	φ2.7	4	0.12
<b>LBE-10Y</b>	10	128.9	123.8	φ1.7	4	0.18

\* Laser pulse width 10ns, repetition frequency 20Hz

## Compatible Optic Mounts

KLH-BE-M22H



## Contact sheet for Laser Beam Expanders

☐ Estimation ☐ Order

Date

☐ To: Sigma Koki Co., Ltd. **FAX +81-3-5638-6550**

Affiliation (Organization Name)					
Department		Name			
TEL		FAX		E-mail	
Country/Address					
Name & Designation		(Tentative name is okay)			
Drawing Number		Estimate	<input type="checkbox"/> Yes: by Date <input type="checkbox"/> No		
Desired Delivery Date		Budget	JP Yen		
Intention		Outline and Dimensions			
		* Please enter your rough shape and dimensions.			
Quantity		Other			
Wavelength Used	$\lambda =$	nm	* Write more detailed specifications here. (Rough illustration is acceptable.)		
Divergence angle of beam	F =	mrad			
Beam incident diameter		mm			
Magnification of afocal					
Transmitted wavefront	$\lambda /$				
Type of lens	<input type="checkbox"/> Galilean type <input type="checkbox"/> Keplerian type				

Sigma Koki Co., Ltd.

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Objectives

Expanders

Others

This is a beam expander for CO<sub>2</sub> Laser (wavelength : 10.6μm) made of zinc selenide (ZnSe) lens. It will be used in laser marking system and so on.

- Diopter correction function is provided, customer can fine-tune the collimated beam.
- Because it is a beam expander type of the Galilean, it is compact and has good aberration characteristics.
- Since the lens of zinc selenide has an anti-reflection coating, loss of light intensity is kept low.



### Specifications

Material	Zinc selenide (ZnSe)
Design wavelength	10.6μm
Coating	Dielectric multi-layer coating
Transmittance	>98.5%

### Guide

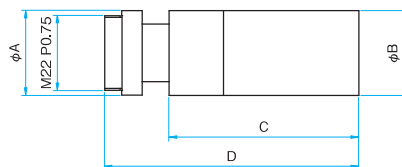
- ▶ Beam expanders other than for CO<sub>2</sub> laser (10.6μm) are available.  
[Reference](#) ▶ B200
- ▶ We provide the laser beam expander holders (KLH-BE) for optical-axis adjustment of the laser beam expander.  
[WEB Reference](#) [Catalog Code](#) W4147

### Attention

- ▶ It is not possible to obtain a decreased beam diameter by using the beam expander on the opposite side. Use it properly to obtain an adequate optical solution.
- ▶ Make sure that the beam expander is well aligned with the laser light axis. If the beam expander is inclining, the output light will also be inclined.

### Outline Drawing

(in mm)



Part Number	φA [mm]	φB [mm]	C [mm]	D [mm]
BE-10600-3	φ25	φ25	50	65
BE-10600-4	φ25	φ25	55	75
BE-10600-5	φ30	φ30	58	78

### Specifications

Part Number	Expansion ratio	Input aperture (MAX) [mm]	Output Clear aperture [mm]	Diameter [mm]
BE-10600-3	3	φ4	φ12	φ25
BE-10600-4	4	φ4	φ16	φ25
BE-10600-5	5	φ4	φ20	φ30

### Important: Treatment of ZnSe optics

Important: Treatment of ZnSe optics  
ZnSe (Zinc selenide) is Poisonous and Deleterious Substances classified as legal, Depending on the specifications, the certificate of delivery may be required acquisition of Poisonous and Deleterious Substances.  
**In addition, ZnSe Optics disposal after use is prohibited.**  
**When lenses that are no longer needed, please return them to us.**  
However, it is only in our products. The above is a case in Japan and please ask your local sales contact about requirements outside Japan.

### Compatible Optic Mounts

KLH-BE-M22H