

PART # 50209-001. REV D

User Notes

4X BEAM EXPANDER P/N SPZ17022

AND OPTIONAL BEAM SPLITTER P/N SPZ17027



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4X Beam Expander P/N SPZ17022 and Optional Beam Splitter P/N SPZ17027 User Notes

The 4X beam expander images a point approximately 8mm from the front end of the expander onto the CCD image plane while enlarging it 4X in size. This increases the effective camera resolution by a factor of 4X.

INSTRUCTIONS FOR USE:

GENERAL

The 4X Beam Expander is designed to work with C-mount threaded cameras that have 4.5mm imager back focal spacing or with CS (12.5mm) back focal spacing. It will not work with C-mount (17.5mm) back focal cameras. In addition, beam splitters, fiber adapters and UV converter accessories are available to use with the beam expander that allow it to cover a variety of beam situations, powers and energies.

ASSEMBLY

Note: The instructions below are for a 4.5mm back focal spaced camera, but most of the instructions are the same when using a 12.5mm spaced CS-mount camera. The main difference is that the 8mm spacer must be removed when installing on a CS-mount camera.

1. As received, the expander consists of the lens assembly made up of:

- a. 1-8mm spacer
- b. 3-4mm spacers and
- c. 1 expander housing

Below, a Spiricon camera is shown with its 3 ND filters mounted.



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NOTE: A combination of three (3) 4mm spacer/ND filters must be used in whatever arrangement yields the best attenuation for your setup. The ND filters and the empty spacers can be used in any combination but the total number must equal 3. If necessary the 8mm spacer can be removed and replaced with 2 additional 4mm/ND filters.

-For a 4.5mm back focal camera the total spacer/filter combination must equal 20mm. -For a 12.5mm CS back focal camera the total spacer/filter combination must equal 12mm.

2. To use ND filters instead of empty spaces, unscrew the required amount of 4mm spacers from the 4X Expander assembly and thread the remaining part into the same amount of ND filters already mounted on the camera. This creates an initial setup using 3 ND filters or spacers. Your camera should look like the picture shown below.



3. The camera will now image a laser beam at the 8mm distance from the front of the 4X expander housing. The laser beam must be directed into the clear aperture of the front lens. You will need to change the pixel scaling in BeamGage to adjust to the magnification of the beam expander.

OPERATION

- 4. Place the beam or source to be examined so the spot to be imaged is 8mm in front of the expander and is coaxial with the lens center. In order to minimize interference effects, it is best to do the following:
 - a. There will not be interference effects if the beam is converging or diverging (focal spot), so long as the entire beam clears the input aperture w/o clipping the edge of the aperture.
 - b. It is best to mount the darker (higher ND value) filters closest to the expander so there will not be back reflections from the rear surface of the filter.
 - c. If spacers and filters are combined, it is best to mount the filters closet to the expander and the spacers closet to the camera.



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5. To get correct numerical readings from the BeamGage software, set the Optical Scaling in Computations tab to the correct 1/Scaling factor printed on a label on the expander housing.

If the scaling factor is 4.0, Set Optical scaling to 1/4.0 = 0.25 as shown in image:

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6. The expansion factor has been measured with 3 spacers containing no ND filters and is shown on a label on the barrel of the beam expander. In standard operation, the beam expander mounted on camera will ordinarily have some filters in red (ND1), black (ND2) or green (ND3) housings. This changes the optical distance to the focal plane and thus the expansion factor and entails an additional correction factor.

To calculate the exact Optical Scaling, calculate by following method: In order to precisely calculate the Optical Scaling for setup containing ND filters do the following calculation:

For each Red (ND1) and Green (ND3) filter, the offset is 0.66. For Black (ND2) filter the offset 1.126

Example of Optical Scaling calculation when ND filters installed:

Scaling Factor, printed on a label on the expander housing: 3.976 In case 2 Black (ND2) filters and 1 Red (ND1) filter is mounted, total Filter offset = 2x 1.126 + 0.66 = 2.912.91/13 = 0.224Real Optical Factor = 3.976 - 0.224 = 3.752Optical Scaling to update in BeamGage Computation tab/ Optical Scaling = 1/3.752 = 0.267

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CAUTION: The damage threshold for the ND filters is 50 Watts/cm² or 1J/cm². Make sure that the power/energy density in the beam as it hits the ND filters does not exceed this amount. At power levels >5 Watts the ND filters may start to thermal lensing and deform the observed beam profile. To avoid damage consider using one or more of the beam splitters described below.

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Use with Beam Splitters

If the peak power density entering the 4X beam expander exceeds 800W/cm² or the energy density 4J/cm², then the expander optics are likely to be damaged by the beam. This could well be the case when imaging a focal spot.

In this case, or even at lower intensities, it is recommended to use one or two wedge beam splitters SPZ17027 and SPZ17026 as pictured below. If you are attempting to image a focal spot the presence of one or both of the splitters may make it difficult to place the spot at the 8mm imaging plane. Check the dimensions shown below and apply them to your situation.

If further attenuation is needed, you can attach a 3rd beam splitter to the second. Each beam splitter reduces the intensity ~20 times and adds another ~35mm to the beam path.



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USE WITH OPTICAL FIBERS

The 4X beam expander can be used to image the tip of an optical fiber connector. To do so, purchase the fiber mounting bracket and mount it on to the end of the 4X beam expander as shown below. You must also purchase the appropriate fiber adapter for the type of fiber you are using. This accessory will work with all the fiber adapters listed below, but are calibrated to give exactly 4X beam expansion (where the fiber tip is exactly 8mm from the end) for FC type fibers only.



	Ordering information for 4X Expander Accessories							
ltem	Descruption	P/N						
Wedge beam splitter for 4X beam expander	Wedge beam splitter for mounting to the front of the 4X beam expander.	SPZ17027						
Additional beam splitter(s)	Wedge beam splitter for mounting to the first one SPZ17027. An additional filter SPZ17026 can be mounted to the second filter SPZ17026 if needed.	SPZ17026						
Fiber adapter bracket	Mounting bracket for fiber adapters. Use with one of the adapters below	SPG01649						
FC fiber adapter	FC fiber adapter which mounts to bracket above	7Z08229						
LC fiber adapter	LC fiber adapter which mounts to bracket above	7Z08228						
ST fiber adapter	ST fiber adapter which mounts to bracket above	7Z08226						
SC fiber adapter	SC fiber adapter which mounts to bracket above	7Z08227						
SMA fiber adapter	SMA fiber adapter which mounts to bracket above	1G01236						
UV converter	UV fluorescent plate which mounts 8mm in front of 4X beam expander. This plate converts UV radiation in the spectral range 193nm to 370nm into visible and images it onto the CCD while expanding the size 4X.	SPZ17019						







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