XLS10MWH Lens Swap and CO2 Beam Calibration

Matt Ricketts 2/29/2016 (Leap Day)

The MWH offers two Zinch Selenide (ZnSe) focusing optics as part of the lens kits, a 2 inch and 3 inch. The focal length of the fiber laser will be fixed for each optic as the beam is not modified onboard the MWH carriage. The fiber laser reflects off of the beam splitting optic (dichroic mirror) and travels down to the final focusing optic. When the lens is swapped to the 3" focusing lens, the focal length increases accordingly.

While operating the CO_2 and fiber laser simultaneously, the user will find it beneficial (depending on exact application) to have the fiber laser (1.06 um) and CO_2 (10.6um or 9.3um) wavelengths overlap in the Z-axis. To have the CO_2 focal length reduce to that of the fiber, we must modify the CO_2 beam within the carriage. We choose to modify the CO_2 beam so that we can also have the added benefit of operating with an expanded CO_2 beam at the focusing lens, giving us a smaller final spot size than without onboard beam expansion (and HPDFO effect).

The CO_2 expansion optics on board the carriage have been made adjustable for 2 reasons:

1. Allow for exact focal length pairing between the Fiber beam and CO_2 beam using either the 2" or 3" lens kit.
2. Allow for the user to adjust the exact focal length of the CO_2 so they can process their materials in the exact region of the focal length proven to give exceptional results during processing.

The nominal gap spacing on the expansion optic while using the 2" focusing lens is 0.125".

The nominal gap spacing on the expansion optic while using the 3" focusing lens is .025".

To properly set the gap for the lens, it is recommended to engrave 2 rectangles (3.5" x 0.050") on the Focal Length Card Stand (700-2524-00-A).

The first rectangle processed will be the fiber laser. Set the center of the rectangle to the top center of the card, power at ~25%, speed at ~20%. You want a small region where the focal length shows up on the diagonal surface. Process the rectangle with the fiber focal length approximately in the middle of the height of the Focal Length Card Stand.

Process the second rectangle using the CO_2 laser spaced about 0.100" down in Y. The approximate settings will be true for the CO_2 as the fiber.

You will see how the focal length varies between the CO_2 and the Fiber (fixed length). Adjust the location of the expansion optic in the carriage by rotating the threaded brass part. Turn to the right to reduce the optic-to-optic spacing, therefore reducing the expansion effect on the CO_2 beam, increasing the focal length. Turn to the left to increase the focal length.

When swapping focusing lenses, it may be useful to dial in the expansion optic spacing for the CO_2 to ensure you're focal planes overlap how you want.

If you are only using the Fiber laser, you do not need to adjust the CO_2 expansion optic spacing whatsoever.