SECTION I
INSPECTION PROCEDURE

Examine the shipping carton for damage. If the shipping carton or packing material is damaged it should be kept for the carrier's inspection. Notify the carrier and NEOS Technologies. Check the contents of the shipment for completeness, mechanical damage, and then test the equipment electronically. Operating procedures are contained in Section VI. If the contents are incomplete, or the equipment does not pass the electrical testing please notify NEOS Technologies.

If there is any problem with the use of this equipment, or if the equipment fails to function as expected contact NEOS Technologies, do not try to trouble shoot or repair this equipment. Consult with a NEOS service engineer. If the equipment needs repair or replacement, contact NEOS Technologies, Inc for a Return Authorization Number.

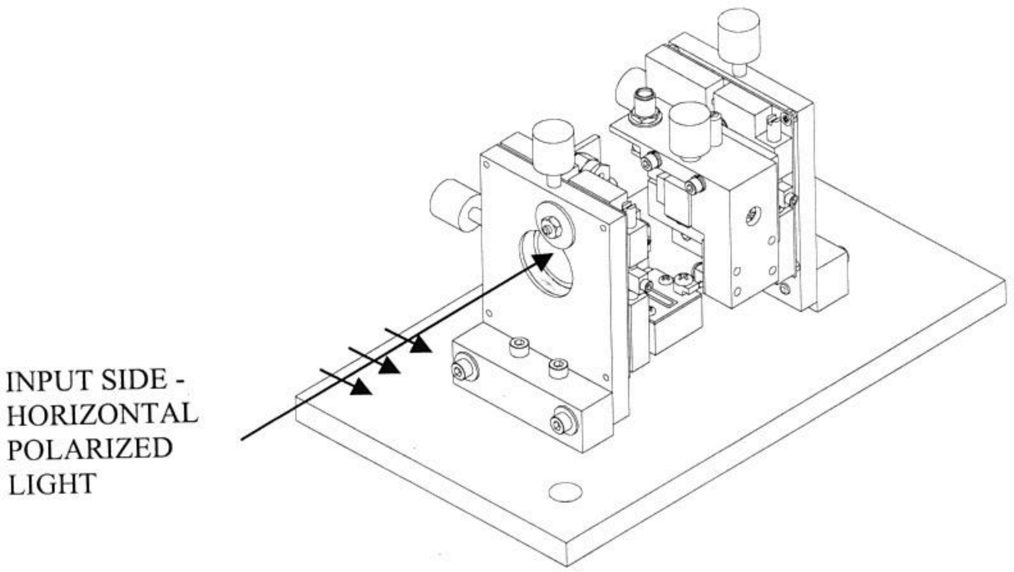
SECTION II

DESCRIPTION

The off axis 45035-3-6.5DEG-1.06-XY acousto-optic beam deflector (AOBD) is fabricated from TeO_2 crystals with a $LiNbO_3$ slow shear wave transducer. The off axis deflector differs from the normal on axis deflector in that the acoustic beam is launched into the TeO_2 6.5 degrees off of the 110 propagating axis. This design eliminates a mid-band degeneracy that results in a loss of diffraction efficiency over a narrow frequency range in the operating band of 25 MHz and 45 MHz.

45035-3-6.5DEG-1.06-XY with 72003 consist, of two AOBD's mounted at right angle to form a X-Y scanning system with the necessary mount to allow for adjustment. The input polarization necessary is such that the polarization is parallel to the acoustic direction for the first device and is indicated on the mount. The devices are uni-directional and will not have the same diffraction efficiency or bandwidth in the reverse direction.

The AOBD can be driven by any good driver with a 50 Ohm nominal output; however, it is recommended that a NEOS Technologies driver be used to drive this deflector to achieve optimum performance. The RF input power should not exceed 2 Watts CW as NEOS Technologies will not warranty damage from RF power applied exceeding 2 Watts.



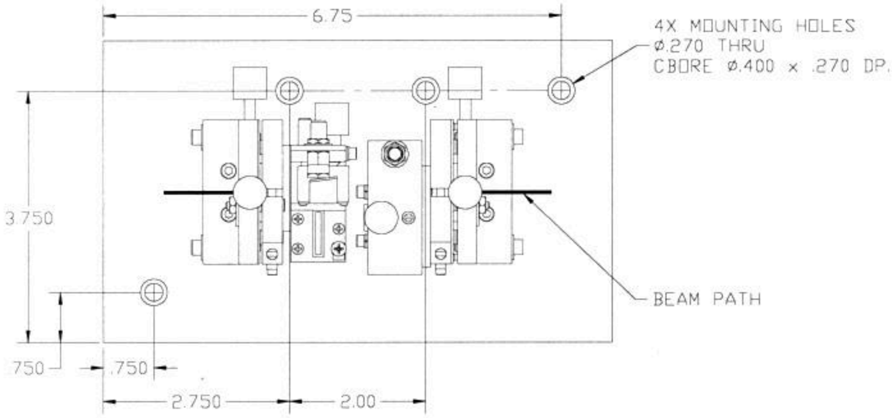
53D1970

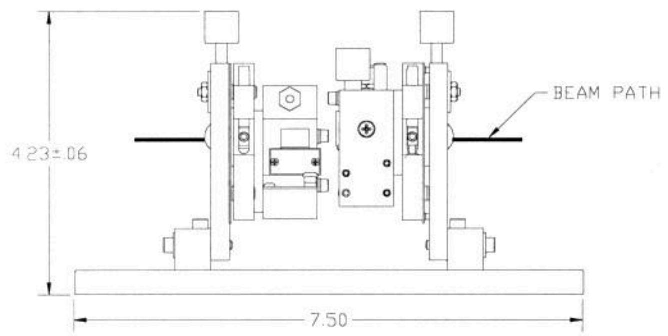
SECTION III
SPECIFICATIONS
45035-3-6.5DEG-1.06-XY with 72003

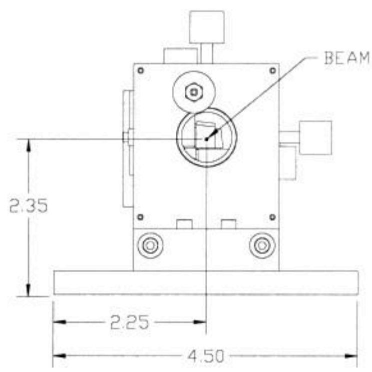
PARAMETER	SPECIFICATION
Interactive Material	TeO_2
Acoustic Mode	Shear Wave
Operating Wavelength	1064 nm
Window Configuration	AR "V" Coated
Static Transmission	> 97 %
Operating Frequency	25 to 45 MHz
Intensity Variation	< 2 dB
Diffraction Efficiency	> 65 % mid-band per device
Light Polarization	Linear, parallel to acoustic propagation
Acoustic Aperture Size	3 mm
Process Time	4.5 μs
Resolution (T.BW product)	90 spots with no less than 50 μs scan time and full illumination of the aperture
Δ Deflection Angle	32 mrad (should be 16 on either side)
Deflection Angle	56 mrad @ 35 MHz and 1064 nm 1.6 mrad/MHz
RF Power Level	< 2 Watts
Impedance	50 Ohms
VSWR	< 2:1 across band
Package:	53D1970
Acceptance Test Procedure:	42A12572
Acceptance Test Results form:	52A11839
Recommended Drivers:	
Analog System Digital Frequency Synthesizer:	64020-200-2ASDFS-2-A
Analog Module Digital Frequency Synthesizer:	64020-200-2AMDFS-A (x2)
Voltage Controlled Oscillator System:	21025-45-2ASVCO-2
Voltage Controlled Oscillator Module:	21025-45-2AMVCO (x2)

SECTION IV

OUTLINE DRAWING







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45035-3-6.5DEG-1.06-XY with 72003 MOUNT

Dimensions are in inches Tolerances: Decimal: .xx = .01 .xxx =.005

Dimensions in [ ] are in mm. Milimeter: .xx = .25mm .xxx = .127mm

Angle: = ± 30'

SECTION V

CALCULATIONS

The maximum aperture of each device is 3 millimeters by 3 millimeters. The input laser beam diameter should fully illuminate the aperture in order to achieve the proper number of resolvable spots. The access time (ΔT) can be determined from the following:

- The process time (ΔT) is equal to the Beam diameter (d_0) in the acoustic direction divide by the Velocity of sound (V) in the material..

Where: $d_0 = 3mm$ $V = 0.66mm/\mu s$

$$\Delta T = \frac{d_0}{V} = \frac{3}{0.66} = 4.5\ \mu s$$

- The number of resolvable spots (TBW) for Acousto-Optic Beam Deflector is the product of Δ f and ΔT
  Where: the RF bandwidth (Δf) of the device is 20MHz.

$$TBW = \Delta f \Delta T = 20\ MHz\ X\ 4.5\ \mu s = 90$$

90 resolvable spots with no less than 50μs chirp time and uniform illumination of the aperture to avoid lensing effects.

- The actual number of resolvable spots (N) are dependent on the uniformity of the illumination of the aperture (truncation of the laser beam) and scan chirp time.

$$N = (1 - \frac{\Delta T}{T + \Delta T})(\frac{\Delta T\, \Delta f}{a})$$

Where: T = Chirp time
ΔT = process time
a = A parameter for uniformity of illumination.
a = 1 for uniform illumination.
a = 1.34 for gaussian illumination clipped at the $\frac{1}{e^2}$ intensity points.

- The RF chirp applied to the AOBD causes a lensing effect as well as a deflection of the laser beam. The focal length (FL_a) of the acoustic cylinder lens, lensing effect is:

$$FL_a = V_a{}^2 / (\frac{dfa}{dt} \bullet \lambda)$$

Where: $\frac{dfa}{dt}$ is the slope of the frequency change vs time.

- The angle between the diffracted and the zero order beam, the deflection angle, $\varnothing_d$, is defined by:

$$\varnothing_d = 2\theta_{Bragg} = \frac{\lambda f}{V} =. \frac{\lambda f}{0.66mm/\mu sec}$$

Where: f = RF frequency in MHz
λ = optical wavelength
θ = Bragg angle of the Acousto-Optic Beam Deflector

The frequencies "f "are from 25 to 45 MHz with the center frequency = 35 MHz.

SECTION VI
OPERATING PROCEDURE

Connect to the first AOBD, a RF source that will provide nominally two (2) Watt of CW power between 25 and 45 MHz with a 50 Ohm cable. See the Acceptance Test Results Form for this system for required RF power for optimal performance. Project the collimated, horizontal linear polarized light beam into the center of the aperture of the first AOBD on the input side. It's important that the light enter this aperture since this device is unidirectional. Apply the RF power at 35 MHz to the first AOBD. View the output of the device with an IR viewer projected onto a card or view with an IR card. Adjust the Bragg angle and view the output light at a distance of about 1 meter from the output side of the AOBD's, as an array of light spots will result when approaching the Bragg angle. When this array of spots becomes evident, maximize the intensity of the diffracted (-) first order beam (away from the connector), by varying Bragg angle, the vertical and horizontal position of the AOBD.

Connect to the second AOBD, a RF source that will provide nominally two (2) Watt of CW power between 25 and 45 MHz with a 50 Ohm cable. With the RF still applied to the first AOBD, apply RF power at 35 MHz to the second AOBD. Adjust the Bragg angle and view the output light, as an array of light spots will result when approaching the Bragg angle. When this array of spots becomes evident, maximize the intensity of the diffracted (-) first order beam (away from the connector of the second device), by varying Bragg angle, the vertical and horizontal position of the second AOBD. Four spots will be seen in this array of spots: the first order beam from each of the AOBDs, the residual un-diffracted input beam, and the resultant output beam. Maximize the intensity of the resultant output beam by adjusting each AOBD. In most AOBD's you may also see some diffracted light in the positive first order and negative second order, however the intensity of these orders are very low. Note: The output beam's optical path will be deflected from the original path by 56 mrad down and 56 mrad to the left when the AOBD's are at 35 MHz and 1064nm wavelength. This should be taken into the optical design of the user.

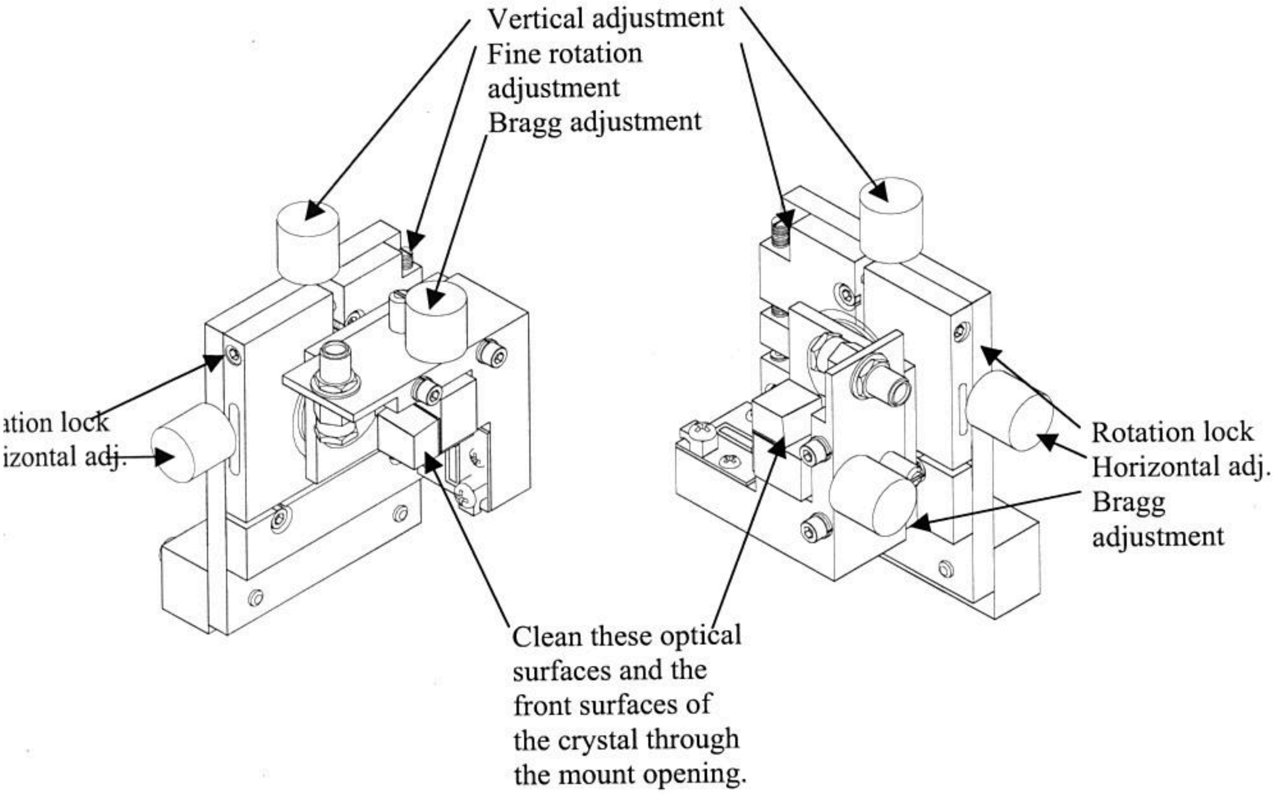
The orthogonality of the axis of the output beam scan plane may be adjusted if needed. See figure 1. Loosen the rotation locks on each of the AOBD's mount. The AOBD's can be rotated by hand to the required scan plane. The rotation locks are tightened lightly to hold the position the AOBD's. The rotation is then adjusted for fine rotation with the rotation adjusters on the AOBD's mounts. The locks are then tighten to lock the position of the AOBD's. The Bragg angle of the AOBD's must be re-adjusted when the AOBD's are rotated.

Check the diffraction efficiency at 25 MHz and 45 MHz RF drive frequencies or sweep the RF over the 20 MHz bandwidth. By sweeping one AOBD fast and the other AOBD slowly a falling raster scan is created. Measure the intensity of the scanning beam and adjust the Bragg angle of each AOBD to obtain the best flatness in intensity across the band for the output of each AOBD.

However, in no case should the RF power exceed two (2) watts.

Figure 1

45035-3-6.5DEG-1.06-X and Y AOBDs with Mounts



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SECTION VII

OPTICAL CLEANING

Periodic cleaning of the AOBD's optical windows is a normal part of maintaining an optical system. When the AOBDs are installed in an optical system, make sure that there is access to allow removal of the AOBDs and mounts from the system. When removed from the system, follow the alignment procedure in this manual to reinstall, realign and, adjust the AOBDs. Make sure that the AOBDs are reinstalled in the correct position as the devices are unidirectional.

To clean the AOBD windows, remove the screws that hold the AOBD mount to the base plate and remove the mounts with the AOBDs. Clean the AOBDs without removing the AOBD from the mount.

- Blow off any visible dust with canned air. Do not use an air gun unless it is filtered and water and oil free!
- Fold (4 times) a new lens tissue into a triangle to make a cleaning tool.
- Dip the tip of the lens tissue into <u>fresh</u> acetone or spray <u>fresh</u> acetone from a squeeze bottle onto it. Then shake excess fluid out of the lens tissue. Do not handle the wet area of the tissue, as your finger oil will be absorbed and contaminate the optical surface of the crystal.
- Wipe (only once) across the crystal window in an even motion, starting near the transducer and drawing the tissue across the optical surface toward the other end. Do not damage the bond wires! Do not reuse the tissue as the mounting silver epoxy may be spread onto the window of the crystal.
- Repeat with a new tissue each time and for each surface that needs cleaning.
- Clean both the optical window that is easily accessible and the one accessible through the opening in the mount.
- Replace the AOBD mount and screws.
- Realign the AOBDs in your system and adjust the Bragg angle for maximum diffraction efficiency.

<u>Notes:</u>

- The lens tissue must be lint free and the best grade available.
- Only use each tissue once, for only one surface. Do not reuse the tissue, as it will redistribute the removed dust or mounting silver epoxy.
- The acetone must be electronic grade. The acetone <u>must</u> be <u>fresh</u> from a <u>new</u> bottle, as the acetone will absorb water from the air and cause streaks. Discard any acetone, which has been exposed to the air for more than 4 hours. If the bottle is half- empty, do not use.