

NEOS TECHNOLOGIES

A Gooch & Housego Company

OPERATING MANUAL

**50 MHz CENTER FREQUENCY OFF AXIS
ACOUSTO-OPTIC BEAM DEFLECTOR**

MODEL NUMBER:

**45050-5-6.5DEG-.8-XY
WITH 72003 MOUNT**

DOCUMENT NUMBER: 51A15120

Document approved for release: W Seale Date: 4/18/05

US OFFICE: NEOS Technologies, Inc. ♦ 4005 Opportunity Drive ♦ Melbourne, FL 32934 ♦ USA
Tel: (321) 242-7818 ♦ Fax: (321) 242-1019 ♦ Email: neos@neostech.com

UK OFFICE: Gooch & Housego ♦ The Old Magistrates Court ♦ Ilminster, Somerset TA19 0AB ♦ UK
Tel: +44 1460 52271 ♦ Fax: +44 1460 54972 ♦ Email: sales@goochandhousego.com

TABLE OF CONTENTS

<u>SECTION</u>	<u>DESCRIPTION</u>	<u>PAGE</u>
I.	INSPECTION PROCEDURE	3
II.	DESCRIPTION	4
III.	SPECIFICATIONS	5
IV.	OUTLINE DRAWING	6
V.	CALCULATIONS	7
VI.	OPERATING PROCEDURE	8
VII.	CLEANING PROCEDURE	10

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.

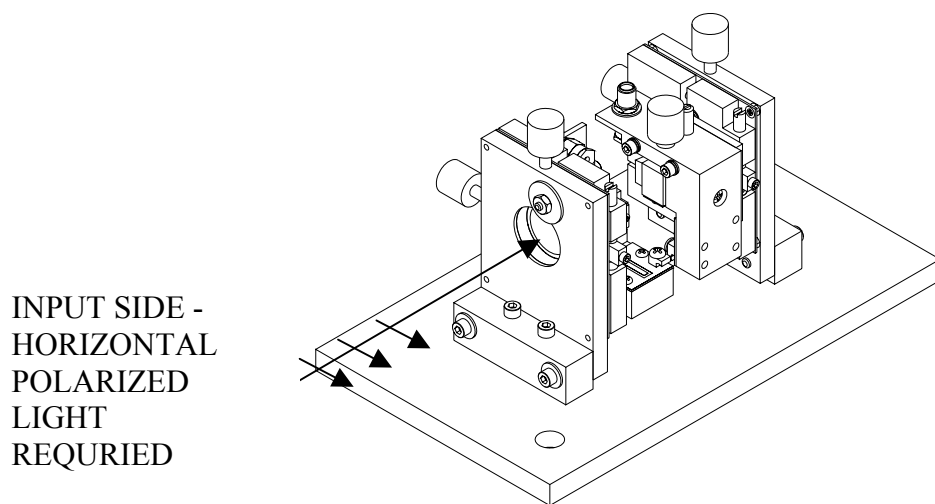
SECTION II

DESCRIPTION

. The off axis 45050-5-6.5DEG-.8-XY acousto-optic beam deflector (AOBD) is fabricated from TeO_2 crystals with LiNbO_3 slow shear wave transducers. 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 35 MHz and 65 MHz.

45050-5-6.5DEG-.8-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 light polarization necessary to achieve the specifications for this X-Y system 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 work in the reverse direction.

Each of the AOBDs 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 these 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

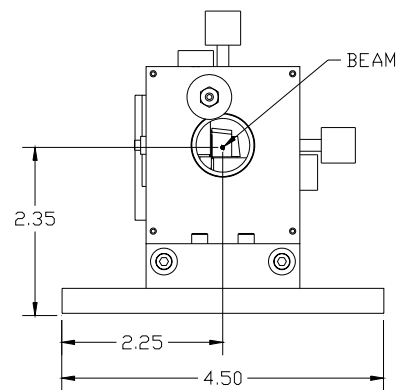
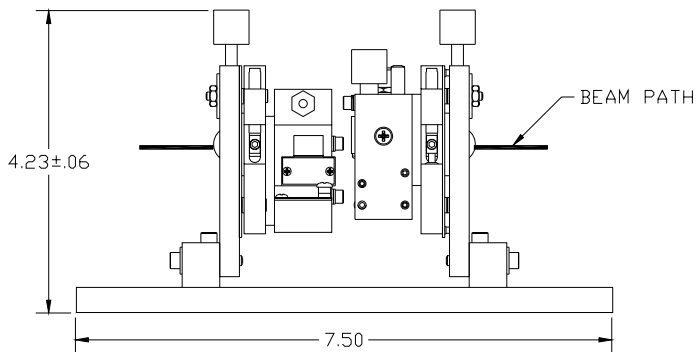
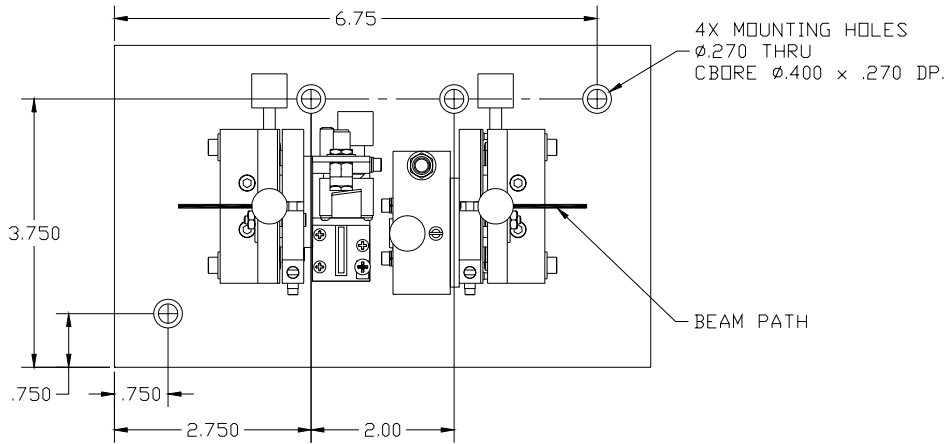
MODEL NUMBER: 45050-5-6.5DEG-.8-XY WITH 72003

<u>PARAMETER</u>	<u>SPECIFICATION</u>
Interactive Material	TeO ₂
Acoustic Mode	Shear
Operating Wavelength	780 to 850 nm
Window Configuration	AR Coated
Static Transmission	>95 %
Operating Frequency	35 to 65 MHz.
Intensity Variation	2 dB
Diffraction Efficiency	>70 % mid-band per device
Light Polarization	Linear, parallel to acoustic propagation
Acoustic Aperture Size	5 mm
Process Time	7.5 μ s
Resolution (T.BW product)	225 spots with no less than 60 μ s scan time and full illumination of the aperture
Acoustic Velocity	.66 mm/ μ s
Δ Deflection Angle	39 mrad @ 850 nm
Deflection Angle	65 mrad @ 50 MHz, 850 nm
RF Power Level	2 Watts max
Impedance	50 Ohms
VSWR	<2:1
Package: 72003	53D1970
Acceptance Test Procedure:	42A14795
Acceptance Test Results form:	52A14800
Recommended Drivers:	

Analog synthesized driver system: 64010-200-2ASDFS-2

Analog synthesized driver modules: 64010-200-2AMDFS (X2)

SECTION IV
OUTLINE DRAWING



53D1970

45050-5-6.5DEG-.8-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: = \pm 30'

SECTION V
CALCULATIONS

The maximum aperture of each device is 5 millimeters by 5 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: $d_0 = 5\text{mm}$

$V = 0.66\text{mm}/\mu\text{s}$

$$\Delta T = \frac{d_0}{V} = \frac{5}{0.66} = 7.5 \mu\text{s}$$

- The number of resolvable spots (TBW) for Acousto-Optic Beam Deflector is the product of Δf and ΔT
Where: the RF bandwidth (Δf) of the device is 30MHz.

$$\text{TBW} = \Delta f \Delta T = 30 \text{ MHz} \times 7.5 \mu\text{s} = 225$$

225 resolvable spots with no less than 60 μs 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.

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

Where: $T = \text{Chirp time}$

$\Delta T = \text{process time}$

$a \equiv A$ parameter for uniformity of illumination.

Where: $a = 1$ 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:

$$FL_a = V_a^2 / \left(\frac{d f a}{dt} \cdot \lambda\right)$$

Where: $\frac{d f a}{dt}$ 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:

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

Where: $f = \text{RF frequency in MHz}$

$\lambda = \text{optical wavelength}$

$\theta = \text{Bragg angle of the Acousto-Optic Beam Deflector}$

The frequencies "f" are from 35 to 65 MHz with the center frequency = 50 MHz.

SECTION VI

OPERATING PROCEDURE

Connect to the first device, a RF source that will provide nominally two (2) Watts of CW power between 35 and 65 MHz. 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 50 MHz to the first AOBD. 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. View the spots with an IR viewer or IR card. 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.

Apply the RF power at 50 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 AOBD's, the residual undiffracted beam, and the resultant output beam. Maximize the intensity of the resultant output beam. 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 65 mrad down and 65 mrad to the left when the AOBD's are at 50 MHz and 850 nm λ . 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 are 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 adjusted when the AOBD's are rotated.

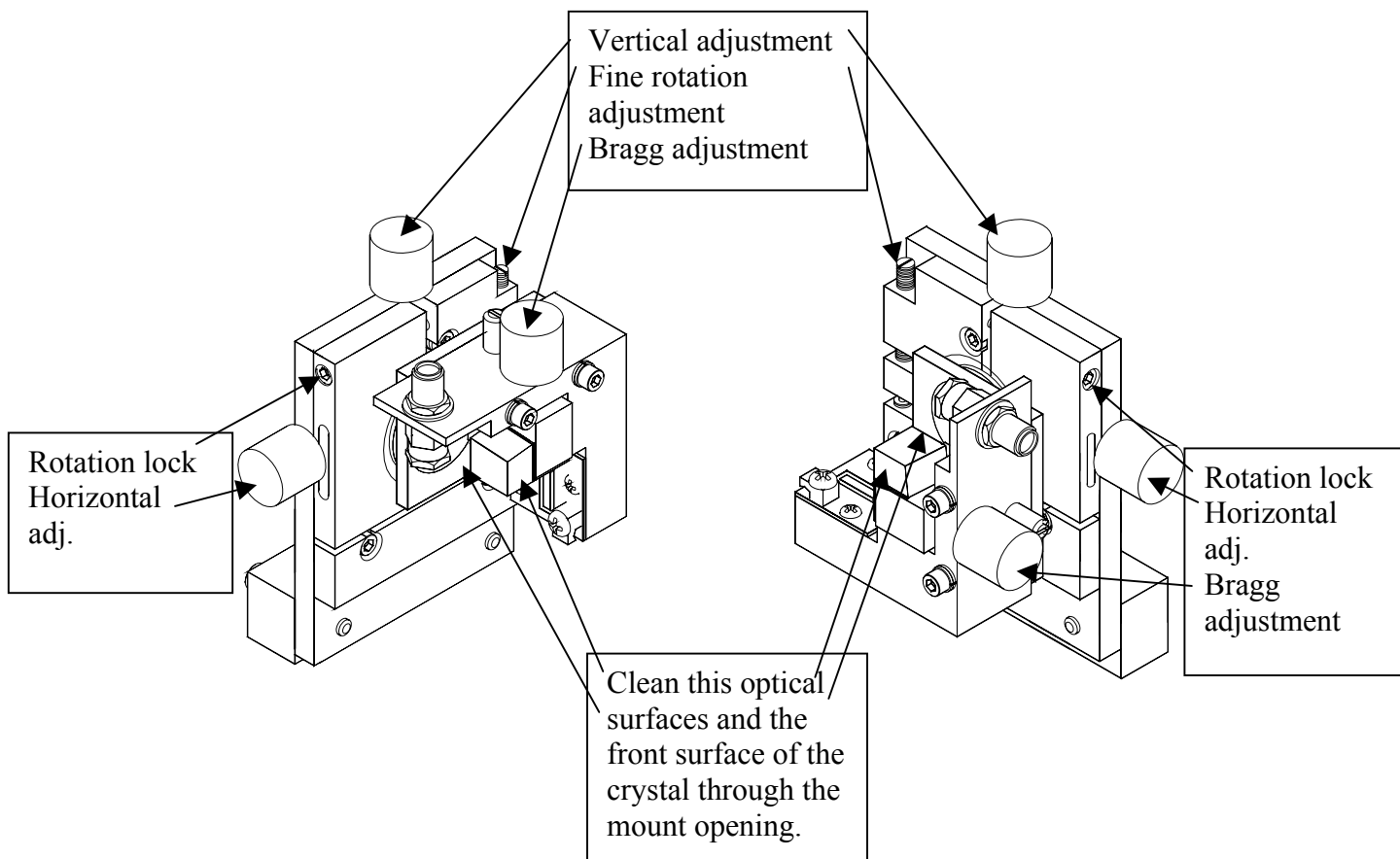
Check the diffraction efficiency at 35 MHz and 65 MHz RF drive frequencies or sweep the RF over the 30 MHz band. Slightly adjust the Bragg angle adjustments to obtain the best flatness of diffracted light intensity across the band of 35 to 65 MHz for the output beam for each AOBD.

The RF power should be adjusted to achieve the maximum required diffraction efficiency. 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

45A15162



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 fresh acetone or spray fresh 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.

Notes:

- 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 must be fresh from a new 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.