NEOS TECHNOLOGIES
A Gooch & Housego Company

OPERATING MANUAL

HIGH POWER LASER AOM
WITH OPTICS
MODEL NUMBER:

35210-BR

DOCUMENT NUMBER: 51A16076A

Document approved for release: W Seale   Date: 8/30/05

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

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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 of any damage. 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.

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SECTION II

DESCRIPTION

ACOUSTO OPTIC MODULATOR

The 35210 is a fused silica modulator designed for high power argon or doubled Nd:YAG lasers and features high speed (15 ns rise time) and high diffraction efficiency. The modulator will perform best with linearly polarized light, perpendicular to the mounting surface.

It is recommended that a NEOS driver (31210-6AM) be used to drive this modulator for the system to achieve optimum performance. However, the modulator can be driven by any 210 MHz 6 Watt driver with a nominal 50 Ohm output.

If using your own adjustment stages then you need adjustments for Bragg angle, horizontal (along the acoustic axis), and vertical (across the acoustic axis) adjustments for the AO Modulator and a pair of lens to focus to the required beam size (0.1 mm) to achieve the rise time and to re-collimate the output beam. See the calculations page to determine the required lens and Bragg angle for the wavelength your using.

An optional Focusing Optics Assembly (71004) is available and is recommended as an accurate means of positioning the modulator with respect to a 0.1 mm diameter focused light beam. The 71004 includes a Bragg angle adjustment / translation stage and a focusing lens assembly. The focusing lens assembly is supplied with two 80 millimeter input and output lenses. The input laser beam for these lenses must be approximately 0.5 millimeter in diameter with a wavelength of 514 nm. Other custom Focusing Optics Assemblies are available to meet you needs for other beam diameters and wavelengths.

SECTION III
SPECIFICATIONS

PARAMETER	SPECIFICATION
Interactive Material	Fused Silica
Acoustic Mode	Longitudinal
Operating Wavelength	300 to 700 nm
Window Configuration	Brewster
Static Transmission	>99 % @ 488 nm
Operating Frequency	210 MHz
Diffraction Efficiency	>70 % @ 488 nm
Light Polarization	Linear, Perpendicular to acoustic propagation
Acoustic Aperture Size (in air)	0.13 mm
Rise Time	< 15 ns
Optical Waist Size to achieve Rise Time	0.1 mm
Deflection Angle	17 mrad @ 488 nm
RF Power Level	6 Watts
Impedance	50 Ohms
VSWR	< 1.5:1 @ 210 MHz
Package:	53B3408
Acceptance Test Procedure:	42A14792
Acceptance Test Results form:	52A01409

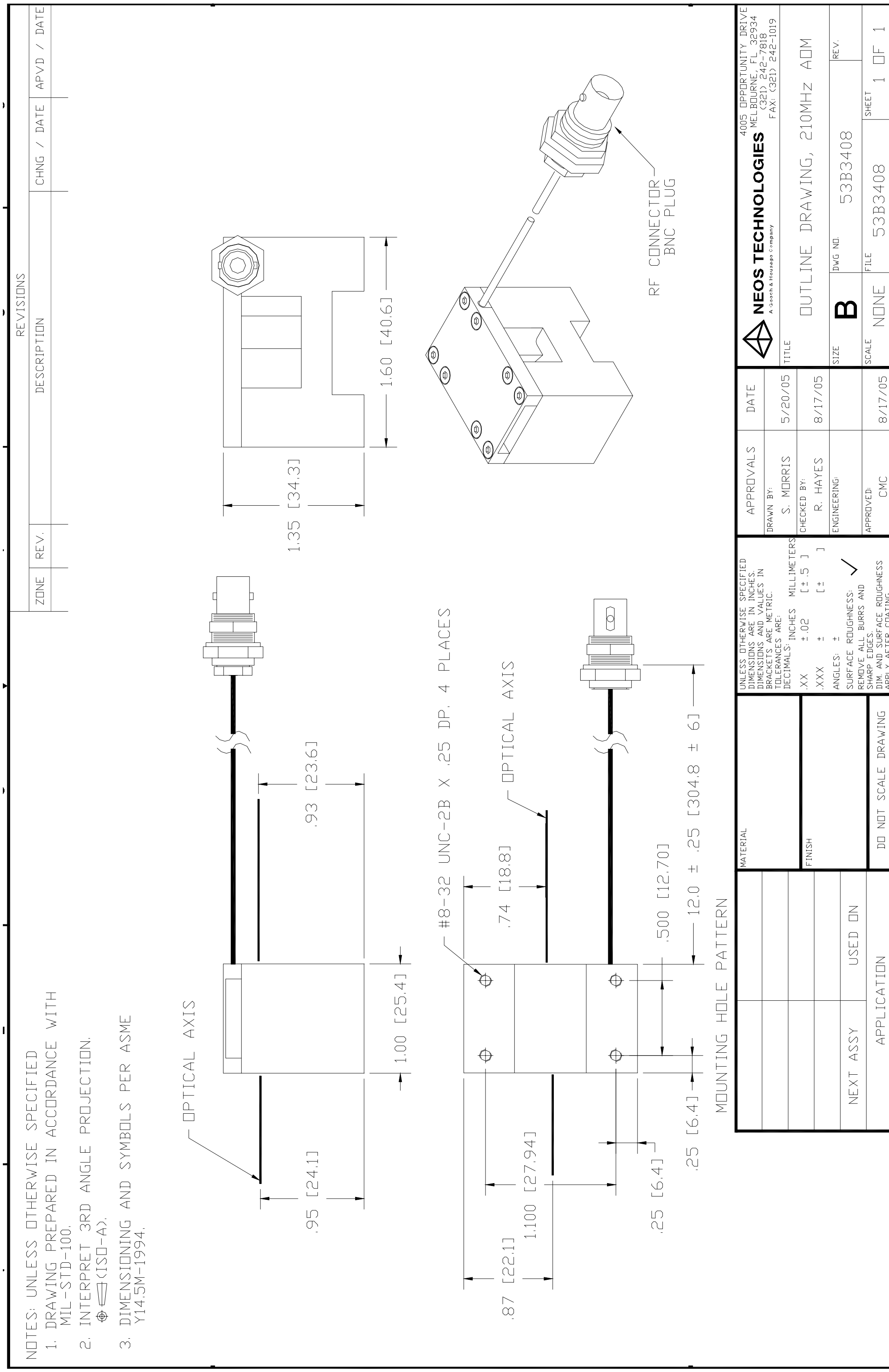
Recommended Driver:

Analog System Driver: 31210-6AS
Analog Module Driver: 31210-6AM

Digital System Driver: 31210-6DS
Digital Module Driver: 31210-6DM

SECTION IV

OUTLINE DRAWING



SECTION V

CALCULATIONS

- The equations to determine the AOM rise time "t_r" are as follows:

  First determine the waist size by the equation, $d_0 = \frac{4f\lambda}{\pi d_1}$

  Where: f = lens focal length in mm (Should be between 80 to 150 mm depending upon λ.)
  λ = the optical wavelength in 10^{-6}m
  d_1= the input optical beam diameter in mm
  d_0= the waist diameter inside the modulator in 10^{-6} m

  Knowing the waist size inside the modulator, then the modulator rise time can be calculated from the relationship:

$$t_r = \frac{1.3 d_0}{2V}$$

  Where: V = the acoustic velocity of the modulator material which is 5960 m/s

- The focal length of the lens to produce the rise time is the F# of the lens times the input spot diameter:

$$F\# \, d_1 = f_{lens}$$

For: λ =	.633 μm	.513 μm	.350 μm
F number of lens (F#) =	121	150	219

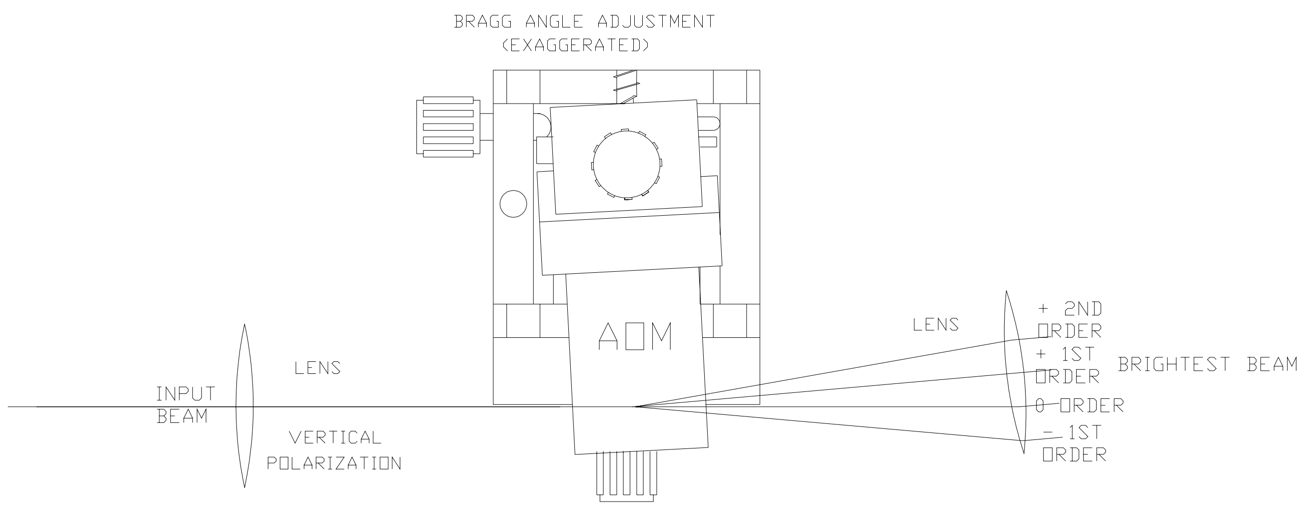
  Note: The beam waist inside the modulator will affect diffraction efficiency of the modulator.

- The deflection angle "$\varnothing_d$" is defined as the acoustic drive frequency in megahertz times the wavelength, divided by the acoustic velocity of the material:

$$\varnothing_d = 2\theta_{Bragg} = \frac{f_a \lambda}{V} = \frac{210 \times 10^6 \lambda}{5960 \text{ m/sec}}$$

  Where: θ_{Bragg} = Bragg angle of the modulator.

Bragg angle adjustment



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SECTION VI

OPERATING PROCEDURE

Mount the modulator in the optical path with the laser beam passing through the device window centered on the window vertically and close to the transducer (connector end). The modulator is polarization sensitive and requires light polarized linearly, perpendicular to the acoustic propagation.

The modulator mount assembly must have sufficient adjustments to peak the modulator efficiency Bragg angle, horizontal position (along the acoustic axis), and vertical position (across the acoustic axis) and the lenses must be supplied to achieve the rise time. Be extremely careful not to focus the laser beam on the gold bond wires on the acoustic transducer, which may vaporize the bond wires. NEOS will not warranty any such damage.

Using a 50 Ohm coaxial cable, connect the "RF out" of the driver to the modulator. Apply the RF power to the modulator. If using the NEOS driver system, be sure the mode switch is in the CW position. Make sure that the RF power does not exceed 10 Watt. NEOS will not warranty any failure resulting from the application of too much RF power.

With the laser beam going through the optical crystal, and close to the transducer, adjust the Bragg angle, by rotating the modulator, to allow the diffracted first order beam away from the transducer (connector end) to be the most intense. See figure 2.

Install the input lens, one "f" away, and adjust the height of the modulator to achieve diffraction. Make changes in the Bragg adjustment screw to obtain optimum efficiency. Adjust, if necessary, the RF driver for power level to obtain maximum diffraction efficiency. If the driver and modulator are purchased together, the driver will be adjusted for optimum performance before shipment. Install the output lens, one
"f" away, to collimate the output beam.

For optimum results, the Bragg angle must be precisely adjusted. The angle between the Reflected and the zero order beam is approximately equal to: 22.3 milliradians at 633 nanometers, 19 milliradians at 532 nanometers, 18 milliradians at 514 nanometers and 13 milliradians at 350 nanometers for this device.

The modulator has been designed and verified to satisfy the specifications.

SECTION VII

OPTICAL CLEANING

Periodic cleaning of the AO device is a normal part of maintaining an optical system. When the device is installed in an optical system, make sure that there is access to allow removal of the protective cover and room to clean the device. If removal from the system is necessary, then follow the alignment procedure in this manual to reinstall, realign and, adjust the AO device.

To clean the AO device:

- Remove the protective cover.
- 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 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.
- Replace the protective cover.
- Realign the device 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.