NEOS TECHNOLOGIES
A Gooch & Housego Company

OPERATING MANUAL

GERMANIUM ACOUSTO-OPTIC MODULATOR

MODEL NUMBER:

37027-5

DOCUMENT NUMBER: 51A14002

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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 V. 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

The 37027-5 modulator system uses a germanium interaction material with a lithium niobate transducer. The RF input should not exceed 30 watts CW. This modulator system is optimized in design for the 27.12 MHz driver frequency. The optical beam diameter must not exceed 5.0 millimeters which is the height of the acoustic aperture. Be extremely careful not to focus the laser beam on the gold bond wires on the acoustic transducer, as this may vaporize the bond wires. NEOS will not warranty any such damage.

The modulator assembly should be mounted on a fixture to provide sufficient adjustment to peak the modulator efficiency. (Along the acoustic axis, across the acoustic axis , and Bragg angle.)

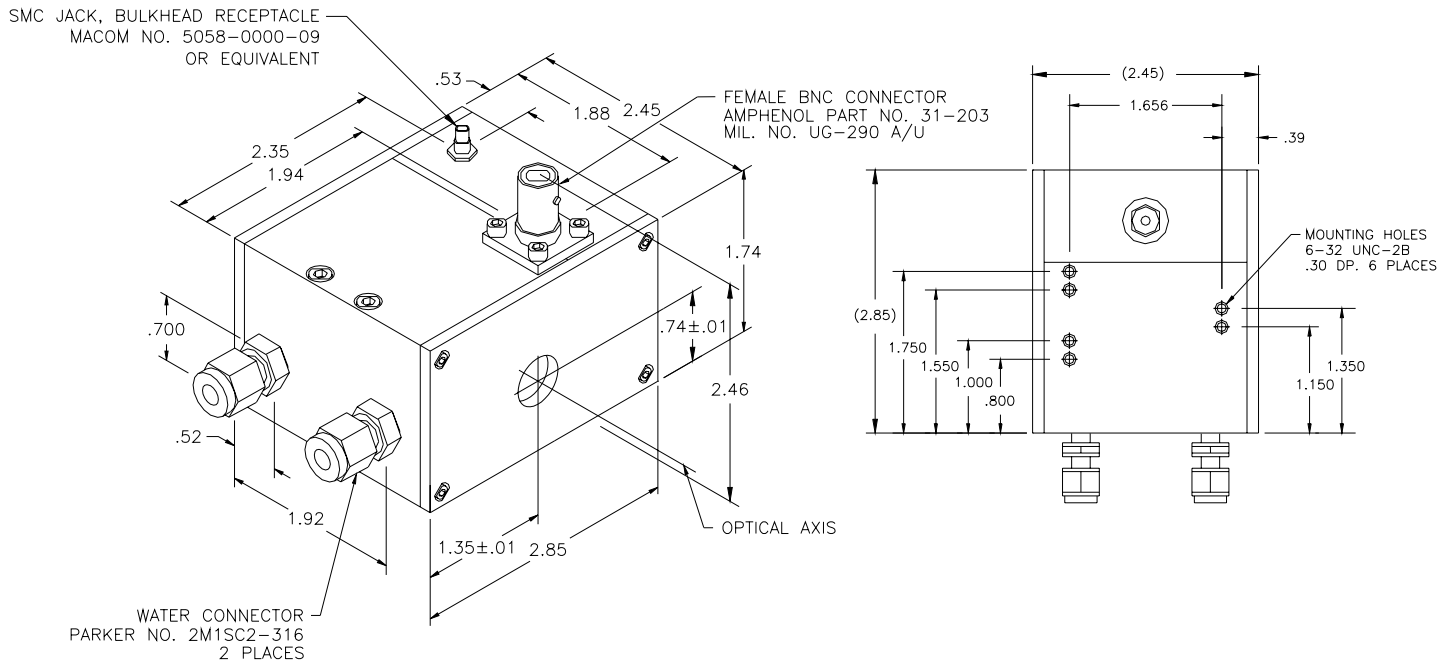
The modulator can be driven by any good driver with a nominal 50 ohm output at 27.12 MHz, however, it is recommended that a NEOS driver be used to drive this modulator to achieve optimum performance.

SECTION III
DEVICE SPECIFICATIONS
37027-5

PARAMETER	SPECIFICATION
Interactive Material	Ge
Acoustic Mode	Longitudinal
Operating Wavelength	10.6 μm
Optical Power Density	5 watt / mm^2 max
Window Configuration	AR Coated
Static Transmission	85 %
Operating Frequency	27.12 MHz
Diffraction Efficiency	>85 %
Light Polarization	Linear, Parallel to acoustic propagation
Acoustic Aperture Size	5 mm
Rise Time	120 ns/mm beam diameter
Deflection Angle	52 mrad @ 10.6μm
RF Power Level	30 watts
Impedance	50 ohms
VSWR	<1.2:1 @ 27.12 MHz
Package:	53B2220
Water Cooled @ 0.1Gallon / Minute With Water Temperature $<30^0$C	
Acceptance Test Procedure:	42A14793
Acceptance Test Results form:	52A06183
Recommended Driver:	39027-30DSA05

SECTION IV

OUTLINE DRAWING



53B2220A

Dimensions are in inches

Tolerances: Decimal: .xx = .01 .xxx =.005

Milimeter: .xx = .25mm .xxx = .127mm

Angle: = ± 30'

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
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:

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

Where: V = the acoustic velocity of the modulator material which is 5500 m/s

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

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

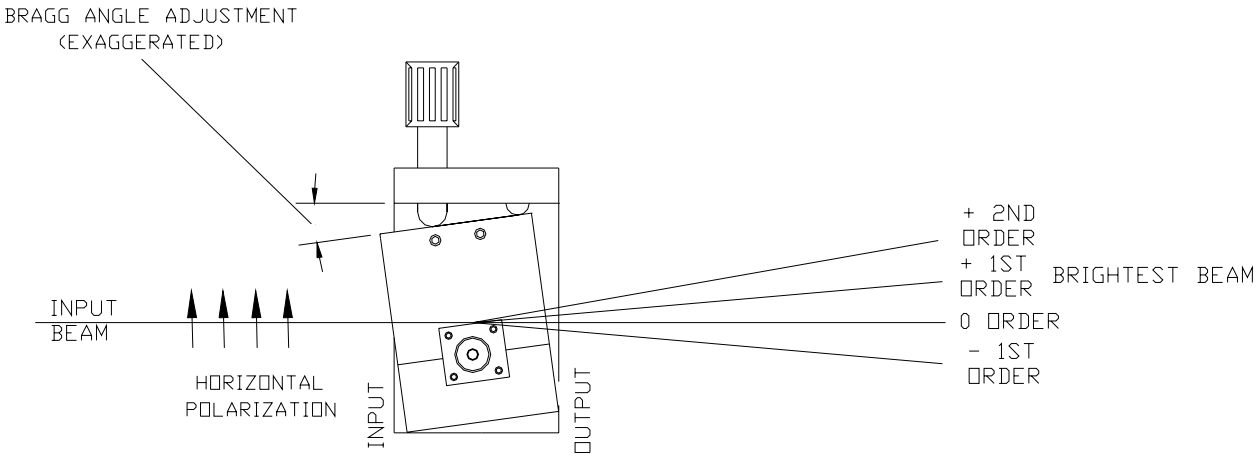
Note: The beam waist inside the modulator will affect diffraction efficiency of the modulator.

- 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:

$$\varnothing_d = 2\theta_{Bragg} = \frac{f_a\lambda}{V} = \frac{27.12 \times 10^6 \lambda}{5500\ \text{m/sec}}$$

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

Figure 2



AOM BRAGG ADJ.

SECTION V
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. It does not matter which aperture the incident light enters the AOM. The modulator requires linear polarization, oriented parallel to the acoustic propagation axis. The modulator mount assembly must have sufficient adjustments to peak the modulator efficiency (Bragg angle, horizontal, and vertical position). Lenses may be required to achieve the rise time desired. 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. Turn on the RF power. 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 30 watts. 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. At a distance of about one meter from the output side the AOM, an array of light spots will result when approaching the Bragg angle. View the spots using a IR viewing card or viewer. When this array becomes evident, maximize the intensity of the diffracted first order beam, by varying the vertical and horizontal position and by rotating the modulator, to allow the diffracted first order beam away from the transducer to be the most intense. See figure 2.

If a lens is needed to archive a faster rise time, install the input lens, one "f" away, and adjust the height of the modulator to achieve diffraction again. 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.

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

To operate the modulator, use the first order diffracted beam with the driver mode switch set to normal. See the driver manual for signals required for modulation.

SECTION VIII.
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 screws that hold the sides to the mount. Caution must be used when placing a Allan driver near the window opening in the cover, as it is best to protect the opening with tape or cover the opening with your finger (without touching the crystal) to protect it. NEOS will not warrant any damage or scratches caused by inserting the screwdriver into the window opening.

- 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 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 sides and screws.
- Realign the device 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.