NEOS TECHNOLOGIES
A Gooch & Housego Company

OPERATING MANUAL

CAVITY DUMPER
MODEL NUMBER:

13389-BR

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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. 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

INTRA-CAVITY AO MODULATOR ASSEMBLY

13389-BR

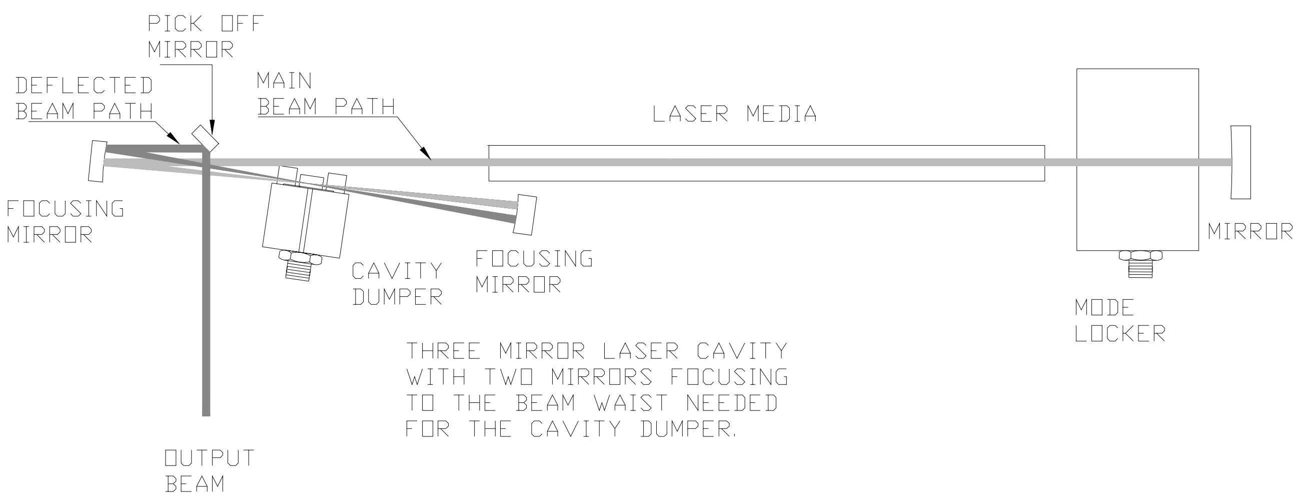
The Cavity Dumper device is a fused silica optic in a Brewster window configuration with a Lithium Niobate transducer. The Cavity Dumper is typically used in a mode locked laser to select one of the circulating laser pulses inside the laser cavity and direct it out of the laser or to a different optical path. The Cavity Dumper can handle a peak optical power of up to 2000 megawatts / cm^2. The RF drive power input should not exceed 0.5 watt CW or 10 watts peak, @ 5% duty cycle with a 10 ns width pulse. NEOS will not warranty any such damage resulting from too much RF power. Optimum diffraction efficiency will be provided with a rise time of 6 nanoseconds correlating to a waist diameter in the SiO_2 crystal of 0.44 millimeter. See section V for calculations.

The 13389-BR is an intra-cavity AO Device and typically requires a three (3) mirror cavity, with two of the mirrors focusing the laser beam to the required beam waist for the Cavity Dumper assembly. See figure 1 for a typical configuration. The diffracted beam must be output past the edge of one of the mirrors or picked off with another mirror. The Cavity Dumper should be mounted on a fixture to provide sufficient adjustment to peak the Cavity Dumper efficiency (Brewster angle, Bragg angle, horizontal, and vertical position). Adjustment must also be provided to adjust the focusing mirrors cavity configuration in order to adjust cavity gain and stability. The NEOS 71016 accessory mount is available for mounting the Cavity Dumper.

The Cavity Dumper can be driven with any good driver with a nominal 50 Ohm output of 389 MHz typically, however, it is recommended that a NEOS driver be used to drive this Cavity Dumper to achieve optimum performance due to the timing required to sync on the laser pulses. The NEOS 643ZZ.ZZZ-SYN-Y-X Driver is designed to provide a RF drive signal that is synchronous to the pulse rate of the mode locked laser cavity. The phase of the RF and time delay of the output signal relative to a reference signal can be adjusted to select a single output pulse from the laser. The 3ZZ.ZZZ in the model number of the driver is the output frequency of the driver, which is a multiple of the laser cavity resonate frequency. The "X" is a customer selectable division factor, which sets the output pulse repetition rate from the driver.

When using or adjusting the cavity dumper, 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. The Cavity Dumper has been designed and verified to satisfy the specifications.

TYPICAL CONFIGURATION FOR A THREE MIRROR LASER CAVITY



45A18851 Figure 1

SECTION III
SPECIFICATIONS
13389-BR

PARAMETER	SPECIFICATION
Interactive Material	SiO_2
Acoustic Mode	longitudinal
Operating Wavelength	Used for Various λ Specifications shown for 633 nm
Window Configuration	Brewster, λ/10 over aperture
Transmission	>99 %
Operating Frequency	3ZZ.ZZZ* MHz, 389 MHz typically
Diffraction Efficiency	>5.5 % @ 500 mW CW drive power
Light Polarization	Linear, Perpendicular to Acoustic Propagation
Acoustic Aperture Size	250 μm in air
Rise Time	<6 ns
Optical Waist Size to achieve Rise Time	44 μm
Deflection Angle	41 mrad @ 633 nm
RF Power Level Average or CW: Peak:	500 mW maximum 10 Watts peak, @ 5 % duty cycle with 10 ns pulse
Impedance	50 Ohms
VSWR	<1.5:1 @ 389 MHz, <6:1 @ 299, 479 MHz
Package:	53A5314
Acceptance Test Procedure:	42A14786
Acceptance Test Results Form:	52A03226
Recommended Drivers:	
Synchronous Driver:	64 ZZ.ZZZ*-SYN-Y-X
Non-synchronous Driver:	11389-5AM

* A multiple of the laser cavity resonate frequency.

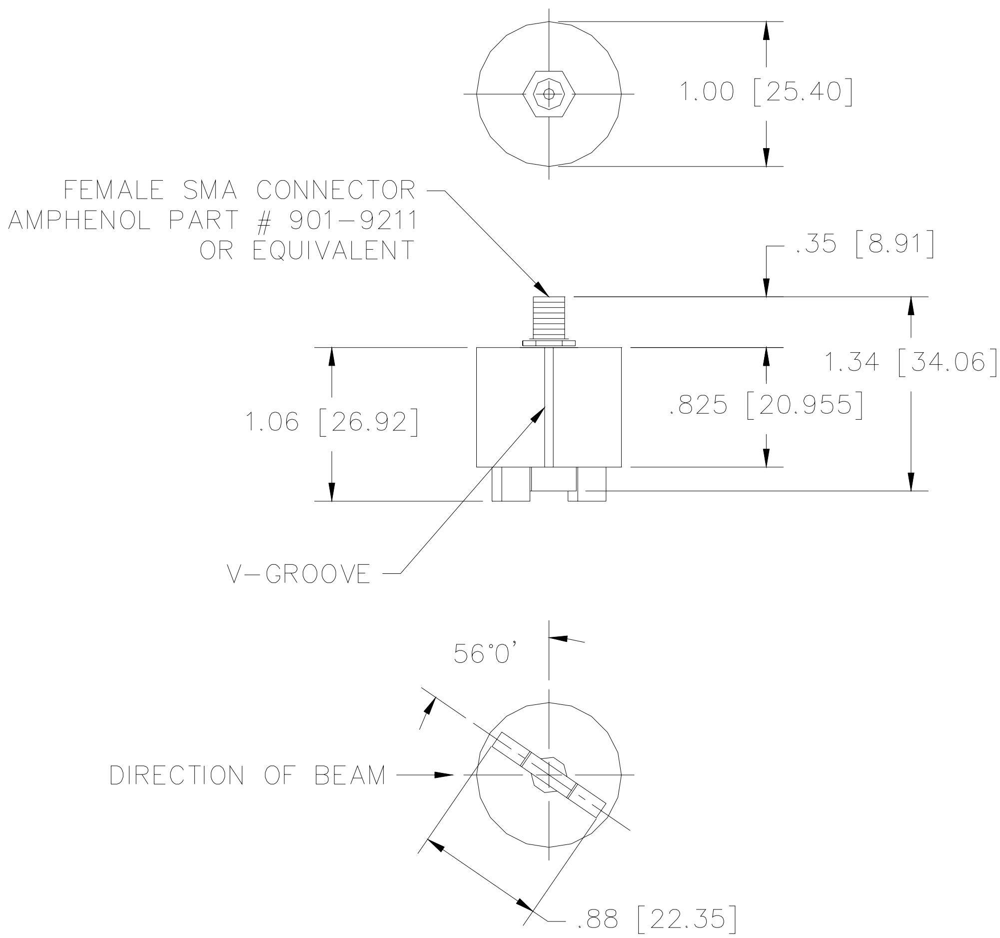
The NEOS 71016 accessory mount is available for use with the Cavity Dumper

SECTION IV

OUTLINE DRAWING

NOTES: UNLESS OTHERWISE SPECIFIED

1. V–GROOVE ORIENTATION PERPENDICULAR TO BEAM



53A5314 **13389 CAVITY DUMPER DEVICE**

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

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

Angle: = ± 30'

.

SECTION V
CALCULATIONS

- The equations to determine the Cavity Dumper rise time are as follows:

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

Where: f = mirror 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 Cavity Dumper, then the rise time can be calculated from the relationship:

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

Where: V = the acoustic velocity which is 5960 m/sec

- The focal length of the mirror is the F# of the mirror times the beam diameter inside the cavity:

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

f_{mirror} should be between 80 to 130 mm depending upon λ.

- 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:

$$\varnothing_d = 2\theta_{Bragg} = \frac{f_a\lambda}{V} = \frac{3ZZ.ZZZ^* \times 10^6\ \lambda}{5960\text{m/sec}}$$

SECTION VI

OPERATING PROCEDURE

The Cavity Dumper is polarization sensitive and requires linear polarized laser light, perpendicular to the acoustic propagation axis. The modulator mount assembly needs sufficient adjustments to peak the modulator efficiency. This includes Brewster angle, Bragg angle, and centering on the beam waist both in height and position of the beam waist to the transducer. The NEOS 71016 accessory mount is available for use with the Cavity Dumper

The alignment in a typical Cavity Dumped laser configuration can be done as follows:
If using a three-mirror cavity, align the laser and get it lasing without the Cavity Dumper in the optical path. Adjust the spacing of the focusing mirrors to achieve the needed stable cavity configuration and gain. See figure 1.

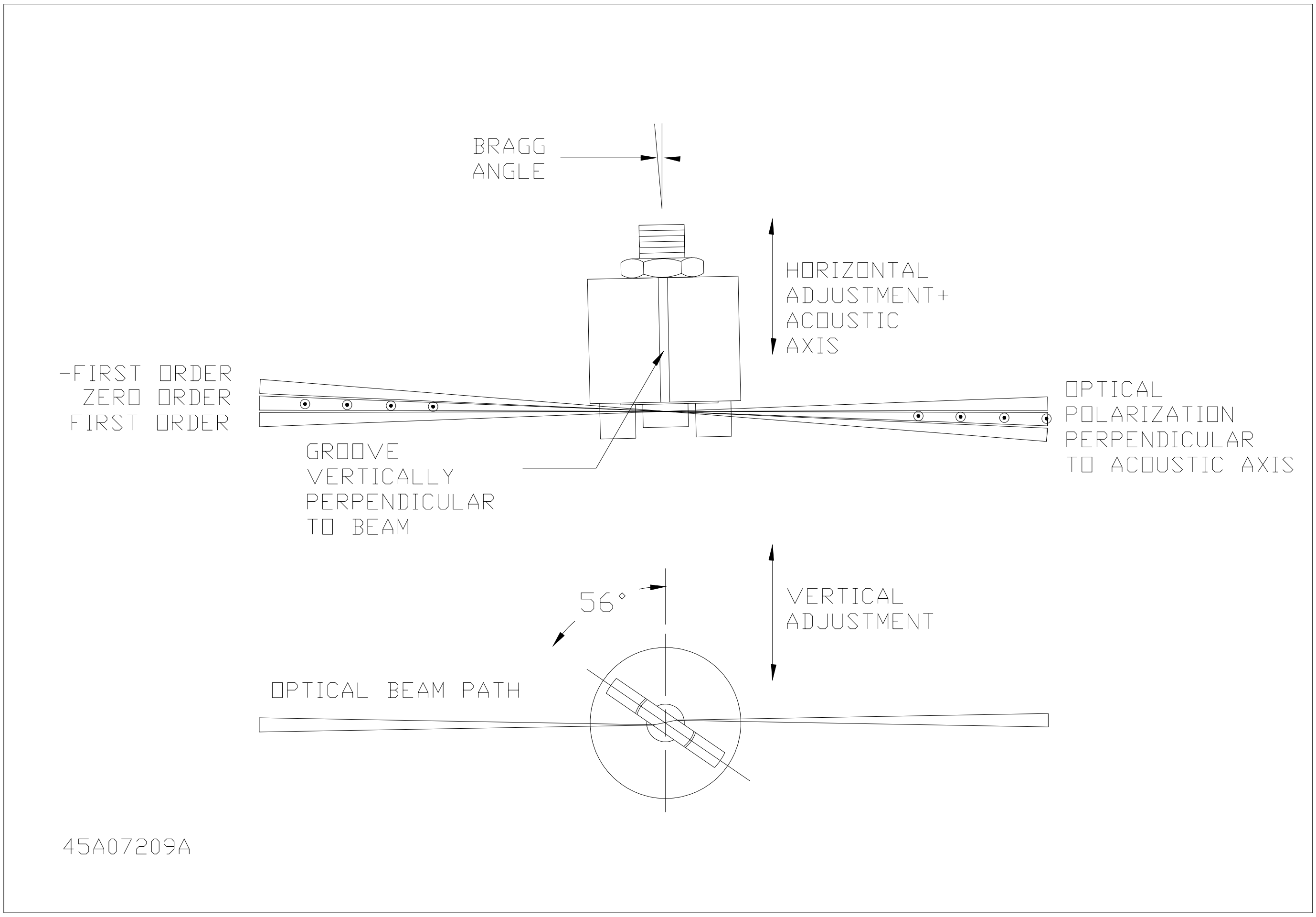
Then insert the Cavity Dumper device into the optical path centered on the beam waist between the focusing mirrors. Adjust the Brewster angle of the Cavity Dumper device so that the groove on the device is perpendicular to the optical path. Reestablish lasing by adjusting one of the focusing mirrors in X and Y. The mirror spacing may also need to be adjusted for cavity gain. 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.

With the mode switch in the CW position on the NEOS driver system, make sure that the RF power does not exceed 0.5 Watt CW. NEOS will not warranty any failure resulting from the application of too much RF power. Using a 50 Ohm coaxial cable, connect the "RF out" of the driver to the Cavity Dumper. Apply the RF power to the Cavity Dumper.

Adjust the position of the laser beam passing through the optical crystal in the horizontal and vertical so that the optical beam is close to the transducer. Adjust the Bragg angle, by rotating the Cavity Dumper, as shown in figure 2 to allow the diffracted first order beam (ether + or -) to be the most intense. This is the output beam. This beam should be directed past the edge of one of the focusing mirrors or picked off with another mirror. The output may need to be re-collimated with a lens depending on the method used to output the beam.

See the 64 ZZ.ZZZ*-SYN-Y-X driver manual for instructions on pulse and CW operation of the Cavity Dumper and for requirements for synchronization of the driver to the laser using a detected laser pulse or a sync signal from the mode locker driver. The modulator has been designed and verified to satisfy the specifications before shipment.

Figure 2



Alignment of the Cavity Dumper inside the laser cavity.

SECTION VII

OPTICAL CLEANING

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

To clean the Cavity Dumper device, remove the device from the cavity. Caution must be used when handling the device as finger oil will cause damage to the crystal.

- 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, starting near at one end and drawing the tissue across the optical surface in an even motion towards the other end. Do not damage the bond wires!
- Repeat with a new tissue each time and for each surface that needs cleaning.
- Reinstall the device into the cavity and rotate the Brewster angle to reestablish lasing.
- Re-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.
- 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.