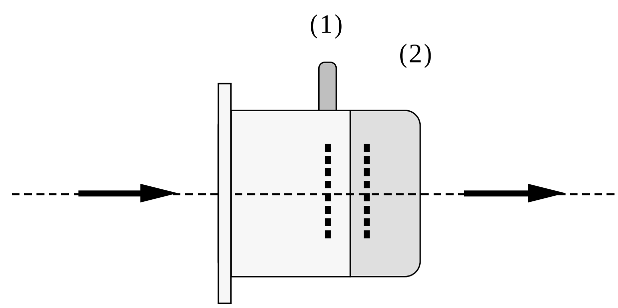
Instructions LASNIX Infrared Attenuator/Polarizer
Model 401

1. HANDLING. The LASNIX infrared attenuator/polarizer operates on the principle of two rotatable linear polarizers. The polarizer elements consist of very thin, structured metal membranes.

WARNING:
The metal membranes are mechanically fragile.
Do not touch or blow air. Do not use cleaning liquids.

2. WATER COOLING. Connect cooling water when you apply infrared power exceeding 5 W c.w. (or quasi-c.w.). A flow rate of about 0.1 l/min. is sufficient.

3. INSTALLATION. The CO_2 laser beam must enter from the side of the mounting flange:



Four mounting holes 3.2 mm in diameter at a spacing of 40 mm are provided in the flange. The attenuator/polarizer functions do not depend on the angular alignment within the clear aperture. Due to a slight inclination of the elements no reflected light can leave the housing.

WARNING:
Radiation reflected from the polarizer elements can leave the housing when the wrong side is used for radiation input.

4. OPERATION. Each of both polarizer elements (1) and (2) transmits linearly polarized radiation. The orientation of the transmitted electric field is parallel to the lever (1) and to the front marking (2), respectively. Perpendicularly polarized components are reflected by the polarizer elements and

Polarizer function:

The polarization direction of the output beam is solely defined by element (2): the orientation of the electric field is along the groove marked on the front plate. The rotational motion of the front plate, and thus of element (2), can be blocked by the fixing screw.

Thus, a linearly polarized output beam is obtained irrespective of the polarization state of the input beam, be it linear, elliptic or random.

Attenuator function:

With fixed output polarization, i.e. fixed element (2), the output power is varied by rotating the lever of element (1).

The maximum transmittance T_{max} occurs for a linearly polarized input beam with both elements oriented in parallel ($\varphi_1 = \varphi_2 = 0^o$). In this (preferred) case the transmittance T decreases continuously by a rotation of element (1): T decreases according to $T = T_{max} (\cos \varphi_1)^4$ where φ_1 is the rotation angle. The % scale provided indicates this dependence.

A third scale is provided (0-40 db) to directly read the attenuation A (db) which is related to the transmittance according to $T = T_{max}\ 10^{-A/10}$, as is illustrated in the following table (F = 1/T):

A(db)	T(%)	F	A(db)	T(%)	F
0	100	1.00	6	25.1	3.98
0.01	99.97	1.0023	7	20.0	5.01
0.1	97.7	1.023	8	15.9	6.31
1	79.4	1.26	9	12.6	7.94
2	63.1	1.59	10	10	10
3	50.1	2.00	20	1.0	100
4	39.8	2.51	30	0.1	1000
5	31.6	3.16	40	0.01	10000

5. POWER HANDLING.

The maximum power (c.w. oder quasi-c.w.) is 30 W, and the maximum pulse energy density is 1 J/cm^2.

WARNING: The specified power handling limit applies to a in a smooth manner. This is the case, for example, with a near fundamental mode having a $1/e^2$ diameter of at least 4 mm.

USING NARROW BEAMS:

For smaller beam diameters the power limit is reduced to :

20 W at 3 mm,
12 W at 2 mm,
5 W at 1 mm.

USING SINGLE PULSES:

The specified limit of pulse energy density of 1 J/cm^2 applies to single short pulses, provided the intensity does not exceed the plasma breakdown threshold. The latter is near 500 MW/cm^2.

USING REPETITIVE PULSES;

The specified quasi-c.w. power limit applies to repetitively pulsed beams, with the added requirement that each pulse is within the specified pulse energy density limit.

Thus for example, model 401 accomodates at a repetition rate of 300 pps pulse energies up to 0.1 J.

6. HAZARD FROM DAMAGED ELEMENT.

In a first stage of permanent damage the metal membane becomes distorted. This change does not appreciably alter the attenuation/polarization properties of the element. However, it is possible that in this situation part of the input radiation is reflected out of the attenuator, in a near-backward direction towards the laser.