STEP ATTENUATORS
for INFRARED LASER BEAMS

THz QCL CO_2 CO FEL OPO Ho- Er-fiber Nd:YAG Ti:S

102

fixed steps

high power

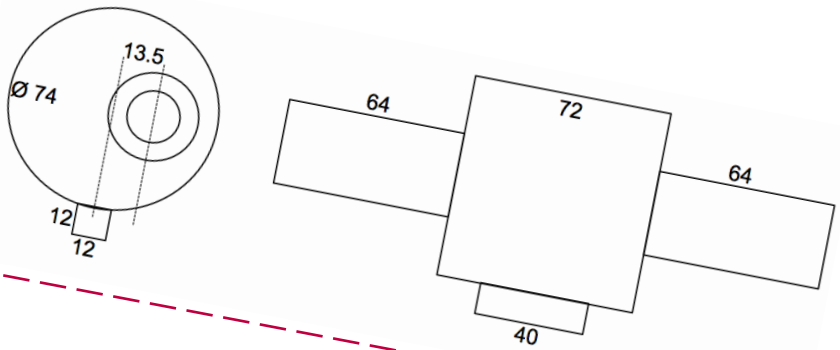
broadband IR

LASNIX step attenuators are precision instruments to reduce laser beam power. All beam parameters apart from power stay unaffected. The attenuators are designed for simple alignment and ease of use.

The attenuation principle is based on proprietary **free-standing metal grid** technology introduced by LASNIX in 1984. Originally developed for high-power CO_2 lasers, these grids have been tailored to accomodate the complete infrared spectrum from 0.7 to 1200 µm. Remarkably high power handling up to 300 W c.w. has been achieved.

Since the grids are freely suspended, i.e. have **no substrate**, they can not deviate or offset the beam—in contrast to usual, substrate-based optical elements. Dispersion and phase effects on femtosecond pulses are negligible.

In the attenuator, precision fabricated metal grids diffract a calibrated percentage of power out of the beam. The rejected power is absorbed in the walls of the water-coolable housing. The attenuated output beam passes undeviated (in diffraction terms, this beam represents the zeroth order). The mode structure and all other beam properties, including the divergence and M^2 parameters are fully preserved, as well as the (arbitrary) polarization.



Applications:

easy power setting

beam quality assurance

nonlinear interactions

detector calibration

heterodyne systems

LASNIX

LASNIX STEP ATTENUATOR MODELS

beam quality guarantee:

- **angular beam deviation ..... < 5 µrad**
- **wavefront distortion ..... < 1/100 λ**
- **beam offset ..... < 1 µm**
- **mode distortion ..... < 0.2 db**
- **polarization distortion ..... < 0.05 db**
- **back reflection ..... < -30 db**

attenuator specifications:

- **spectral flatness ..... +/- 0.5 db**
- **resettability of step ..... +/- 0.05 db**
- **additivity of steps ..... +/- 0.03 db**

Standard attenuator models cover wide infrared bands between 0.7 and 1200 µm.

The power loss per grid is between 3 and 10 db, corresponding to a transmittance between 50% and 10%. For several grids the total loss (in db) is exactly the sum of individual losses. For example, five 5-db elements would allow the six different power settings 100%, 31%, 10%, 3%, 1% down to 0.3%. Options S allows to choose elements with arbitrary losses; this option is available with any of the 102-series models. Under option S the lowest transmittance is 0.0003%, attainable when all five elements are specified to have 11 db loss.

Input powers up to 300 W c.w. (or quasi-c.w.) are allowed with standard models. The specified limits apply to relatively wide beams which fill at least half the specified aperture area in a smooth manner. This corresponds to a fundamental mode having a $1/e^2$ beam width of about 2/3 of the aperture diameter. For narrower beams the power limits scale down linearly. For example, a limit of 200 W reduces to 100 W when the $1/e^2$ width narrows from 2/3 to 1/3 of the aperture diameter.

The angular alignment within the clear aperture is uncritical. The laser beam input can be from either side.

For mounting with standard posts two tapped holes, M4 and 8-32, are provided at the base.

Cooling water flow is necessary only when the input power exeeds 30 W.

Model No.	Wavelength Range	Attenuation (nom.) per element	Attenuation total	Power Limit	Fluence Limit	Clear Aperture	Length	Weight
	µm	*db*	*db*	*W*	*J/cm²*	*mm*	*mm*	*kg*
110	0.7-4.3	7-7-8-8-8	38	10	1	5	141	0.6
111	0.9-4.3	7-7-8-8-8	38	20	1	11	137	0.6
102	8-36	3-5-8-9-10	35	200	20	19	200	0.7
102-C	4-36	3-5-8-9-10	35	200	20	19	350	0.9
102-H	2-36	3-5-8-9-10	35	120	20	11	350	0.9
102-E	3-36	3-5-8-9-10	35	60	20	5	141	0.6
102-L	8-36	3-5-8-9-10	35	70	20	6	90	0.5
OPTION-S		*min. 3, max. 11*	*15 ... 55*					
204	8-36	4-5-8-9-10	36	300	20	40	427	2.5
224	70-320	3-5-10-10-10	38	300	20	40	427	2.5
234	280-1200	3-5-10-10-10	38	300	20	40	587	3.5

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