

Variable Anamorphic Prism Pair

Manual

Article Number: APP J 390-420

APP J 600-1100

APP J 1100-1500

Manual: M-002 Version 02

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Serial Number: _____

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(May 2010 Subject to changes without notice)

Dear Customer,

welcome to the TOPTICA community!

We have designed this product to be easy to use and reliable so that you can focus on your actual work. Should you have questions regarding its use or need advice on how to integrate it into your setup, please do not hesitate to ask. We will provide you with quick and competent help through our service staff and product managers.

You can contact us in the following ways:

- internet: www.toptica.com. In our support section you can find a list of frequently asked questions and a service contact form
- email: service@toptica.com
- phone: +49-89-85837-0.

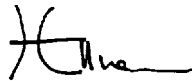
Our customers in the USA and Canada may contact TOPTICA Photonics Inc.:

- email: service@toptica-usa.com
- phone: +1-585-657-6663

Please have your product-ID/serial number ready when contacting us so we can quickly retrieve all relevant information from our databases.

We are constantly refining and improving our products and therefore highly value feedback from our customers. We would therefore like to encourage you to let us know what you like about our products and of course also if there is something we could improve.

Best regards,



Harald Ellmann
Service Manager
TOPTICA Photonics AG

Contents

1	General	2
2	Safety Instructions and Warnings	2
	2.1 General Safety Terms	2
	2.2 Identification of Manufacturer	3
3	Definitions	4
4	Principle of Operation	4
5	Alignment	5
	5.1 Basic Alignment Steps	5
6	Appendix A: Reflection Losses	8
7	Appendix B: Package Contents	9
8	Guarantee and Service	10

1 General

TOPTICA's variable anamorphic prism pairs are specially designed for applications where the anamorphic magnification has to be changed frequently or where a precise adjustment of the magnification is required and standard, fixed magnification setups are inappropriate.

The variable mount of the prism pair (U.S. patent 2001/0050821) allows to realize any magnification between 2 and 5, or compression between 0.2 and 0.5 respectively, while keeping the exiting beam parallel to the incident beam with a constant beam displacement of 8 mm.

Its very versatile housing can easily be mounted in standard mirror mounts, on standard posts or can be included directly into any application.

2 Safety Instructions and Warnings

The following Safety Instructions and Warnings should be read and complied with during operation or alignment of the TOPTICA Variable Anamorphic Prism Pair. Failure to do so could result in personal injury.

2.1 General Safety Terms

The following safety terms are used in this manual:

The **DANGER !** heading in this manual explains danger that could result in personal injury or death.

The **CAUTION !** heading in this manual explains hazards that could damage the instrument or the laser it is used with.

A **NOTE !** heading gives information that may be beneficial in the use of the instrument.

DANGER ! Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

DANGER ! Very powerful lasers may be used with the anamorphic prism pair. Therefore it is imperative that great care and proper warning markers are used with the unit.

DANGER ! The anamorphic prism pair is an appliance for the operation with lasers and thus cannot be regarded as a separate laser device at the time of delivery. Therefore, the user is responsible for carrying out the legally specified protective measures for lasers (details of the laser safety class, markings on the Variable Anamorphic Prism Pair housing and on site, laser warning systems during operation, instruction of the operating personnel, etc.).

DANGER ! Be careful when opening the Variable Anamorphic Prism Pair housing during operation. Laser beam reflections may cause serious injuries to your eyes. Always wear safety goggles for internal adjustments and attenuate the laser beam to laser power of Class 1 level. Take care not to look into the laser beam or any laser beam reflections. Always check whether laser beam reflections occur.

CAUTION ! Optical feedback caused by back reflections from the Variable Anamorphic Prism Pair can damage your laser source. Sources of back reflections can be misaligned prisms and laser light with wavelengths other than those of the specified anti-reflection coating. Make sure to avoid back reflections.

2.2 Identification of Manufacturer

Manufacturer (name and address), Product ID number and compliance with CE standards are given by the identification label:



Size: 35 mm x 19 mm

Color: Silver/black

Location: APP J housing

3 Definitions

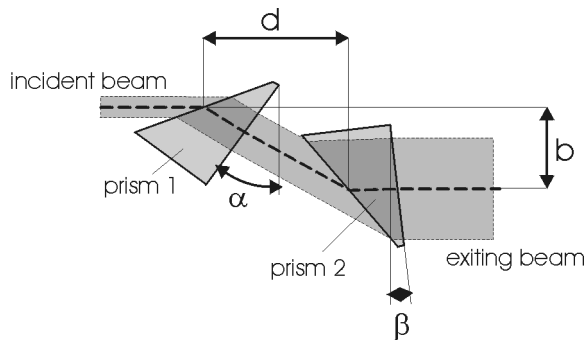


Figure 1 Definitions of laser beam path and prism setup

- α : orientation angle of first prism relative to a plane perpendicular to the incident beam (positive in clockwise direction)
- β : orientation angle of second prism relative to the same plane (positive in clockwise direction)
- d : distance between prisms one and two, measured between the midpoints of the two entrance faces
- b : beam displacement

4 Principle of Operation

Following Snell's law, a beam entering a medium of high refractive index (e.g. glass) out from a medium with lower refractive index (e.g. air) at non-normal incidence angles is refracted towards the normal of the interface between the two media. At a plane surface there is always an anamorphic magnification connected with this refraction, i.e., the beam diameter in the plane of incidence is magnified by a certain factor, only depending on the angle of incidence and the refraction index of the two materials. Exiting the high index material, the beam again is refracted, but now away from the normal of the respective interface. Accordingly an anamorphic compression or de-magnification takes place as soon as the angle of incidence is not zero.

The overall anamorphic magnification of an optical element with plane surfaces is the product of the magnification factor at the entrance face (>1) and the compression factor at the exit face (<1) and is always smaller than the magnification of the entrance face only. While for plane parallel plates the two factors cancel exactly (overall magnification of 1), prisms can also be adjusted to attain a net magnification different from 1.

Anamorphic prisms are designed to minimize the effect of one of the faces (i.e. one surface is hit near normal incidence) and to minimize reflection losses (i.e. one surface has an anti reflection coating for normal incidence and the other surface is hit at an angle of incidence near Brewster's angle).

NOTE ! Anamorphic prisms should be used with p-polarized light, i.e. with a polarization being parallel to the plane of incidence. The reflection losses then are very low. The use of s-polarized light will result in reflection losses of 30-70%, depending on the angle of incidence. All other beam parameters like beam quality, magnification, beam displacement etc. are not affected by the polarization.

To increase the range of possible magnifications and due to the fact that a single anamorphic prism always leads to a deflection of the incident beam, anamorphic prisms are most often used in pairs. The second prism is rotated by 180° , used at the same angle of incidence as the first prism and therefore compensates the deflection of the first prism, directing the output beam parallel to the incident beam (see Figure 1). The overall magnification of the prism pair then is the square of the magnification of a single prism.

The exiting beam is displaced relatively to the incident beam by an amount b depending on the distance d of the two prisms (see Figure 1).

Anamorphic prism pairs can of course also be used for anamorphic compression by simply changing the role of incident and exiting beam (i.e. looking at Figure 1 from right to left instead of left to right).

5 Alignment

DANGER ! Be careful when opening the variable anamorphic prism pair housing during operation. Laser beam reflections may cause serious injuries to your eyes. Always wear safety goggles for internal adjustments and attenuate the laser beam to a laser power of Class 1 level. Take care not to look into the laser beam or any laser beam reflections. Always check whether laser beam reflections occur.

CAUTION ! Optical feedback caused by back reflections from the variable anamorphic prism pair can damage your laser source. Sources of back reflections can, e.g., be misaligned prisms and laser light with wavelengths other than those of the specified anti-reflection coating.

5.1 Basic Alignment Steps

1. Requirements:

- 1.1 Let the beam propagate in a horizontally and vertically well defined direction. If you use an optical table for example, adjust it parallel to the optical table and parallel to a row of holes.
- 1.2 Mark the position of the beam in a certain distance from the place where the APP will be installed (Mark A).
- 1.3 Mark a second point (Mark B) 8 mm away from the first in the direction of the beam displacement.
- 1.4 Mount the APP in the beam path of the laser with the housing edges parallel to the beam. Use a standard post, for example, to achieve a correct horizontal orientation and adjust the edges parallel to the rows of holes for a correct lateral orientation.
- 1.5 Open the housing.

2. Choose an appropriate angular orientation of prism 1.

For an estimate Figure 2 shows the theoretical dependence of overall anamorphic magnification and orientation of prism 1 for a wavelength range of 390 - 1500 nm.

NOTE ! The values given in Figure 2 are calculated for ideal prisms and a wavelength range of 390 - 1500 nm. Different wavelengths lead to slightly different dependences and production tolerances can lead to deviations.

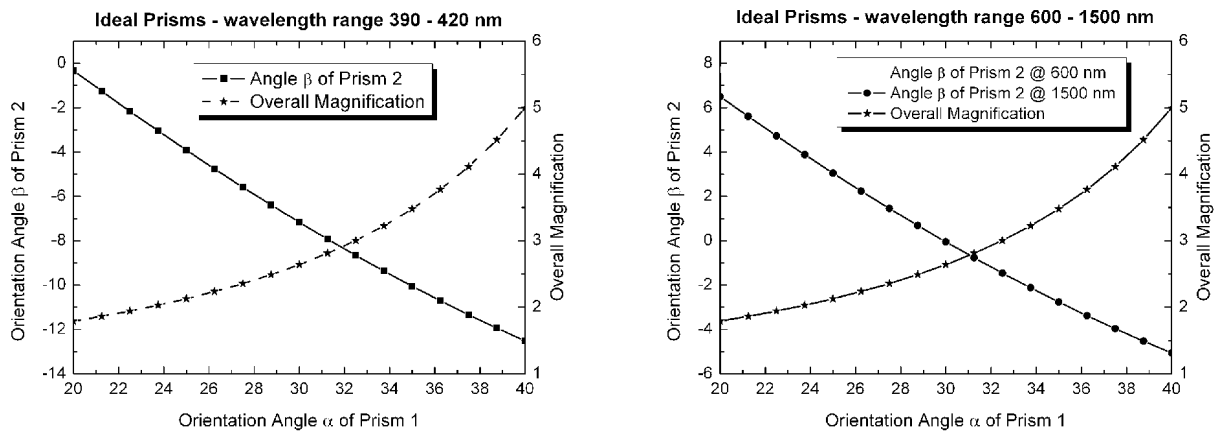


Figure 2 Angle and Magnification values of ideal prism for wavelength range between 390 nm and 1500 nm.

- 2.1 Make sure the beam enters the entrance aperture centered.
- 2.2 Loosen Screw 1 (see Figure 3) and carefully loosen Screws 2 and 3 until Prism 1 can be rotated with a small force.
- 2.3 Choose the desired magnification and determine the orientation of Prism 1 e.g. by the help of Figure 2.
- 2.3 Fasten Screw 1.

3. Rotate Prism 2 until the exiting beam propagates parallel to the incoming beam.

As an estimate Figure 2 shows calculated angular orientations of Prism 2 as a function of the orientation of Prism 1 for a wavelength range of 390 - 1500 nm.

- 3.1 Loosen Screw 4 until Prism 2 can be shifted and rotated.
- 3.2 Shift Prism 2 into the middle of the range of possible positions.
- 3.3 Rotate Prism 2 until the exiting beam hits mark B (cf. step 1.3).

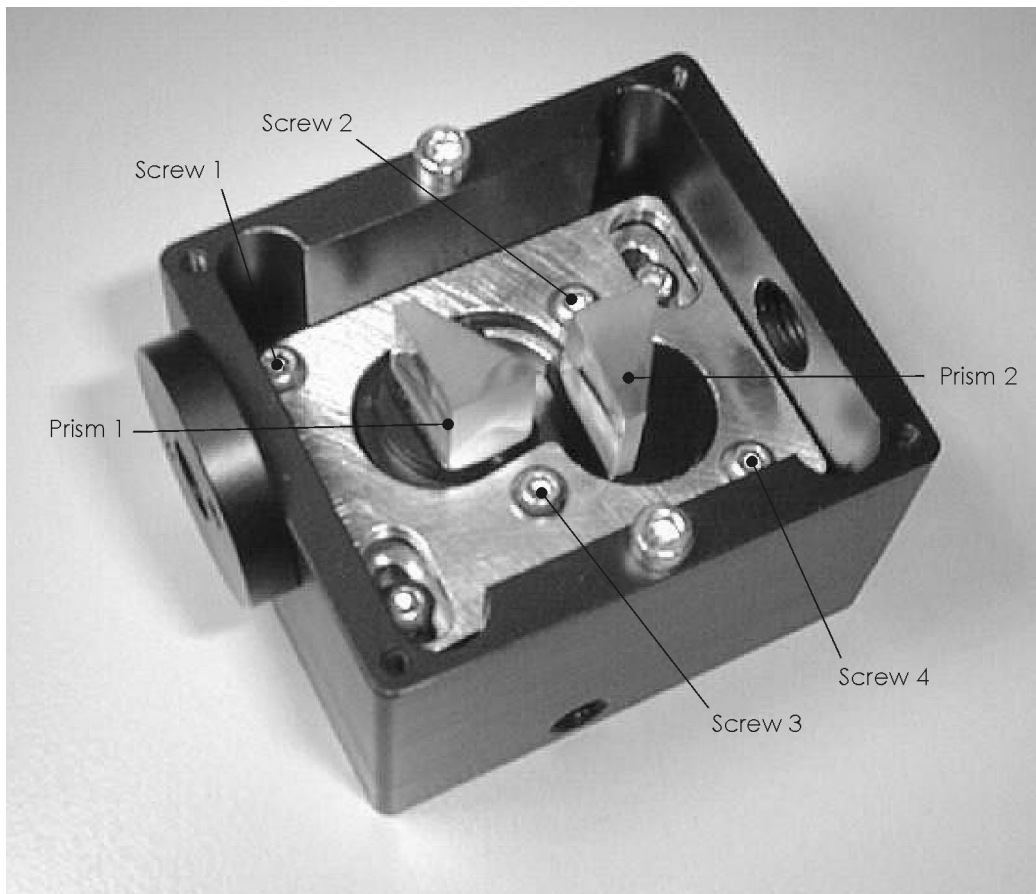


Figure 3 Inside view of the Variable Anamorphic Prism Pair

4. Shift Prism 2 until the beam displacement between incoming and exiting beam is 8 mm
i.e. the exiting beam is in the center of the exit aperture.

- 4.1 Check the position of the beam at the exit aperture of the Variable Anamorphic Prism Pair and shift Prism 2 until it is centered. Prism 2 must be close to Prism 1 for high magnifications and away from Prism 1 for low magnifications.
- 4.2 Repeat steps 3.3 and 4.1 until the beam hits mark B and exits the housing through the center of the exit aperture.

5. Finish the Alignment

- 5.1 Fasten Screw 4.
- 5.2 If the magnification is not correct, loosen Screw 1 again, rotate Prism 1 a little towards the appropriate direction and repeat steps 3.1 to 5.1.
- 5.3 Fasten Screws 2 and 3.
- 5.4 Close the housing.

6 Appendix A: Reflection Losses

Anamorphic prism pairs should be used with p-polarized light. They are designed for angles of incidence near Brewster's angle. For these angles they induce very low reflection losses at the uncoated surface (left surfaces in Figure 1) and the beam hits the second surface near normal incidence. The second surface is anti reflection coated for normal incidence. Depending on the version of your APP J, the usable wavelength range of the coating extends from 390 - 420 nm, from 600 - 1100 nm or from 1100 - 1500 nm. For s-polarized light the losses at the uncoated surface can exceed 50 %.

Figure 4 shows calculated overall reflection losses as a function of orientation of prism 1 under the assumption of correct alignment and a perfect AR-coating at the second surfaces.

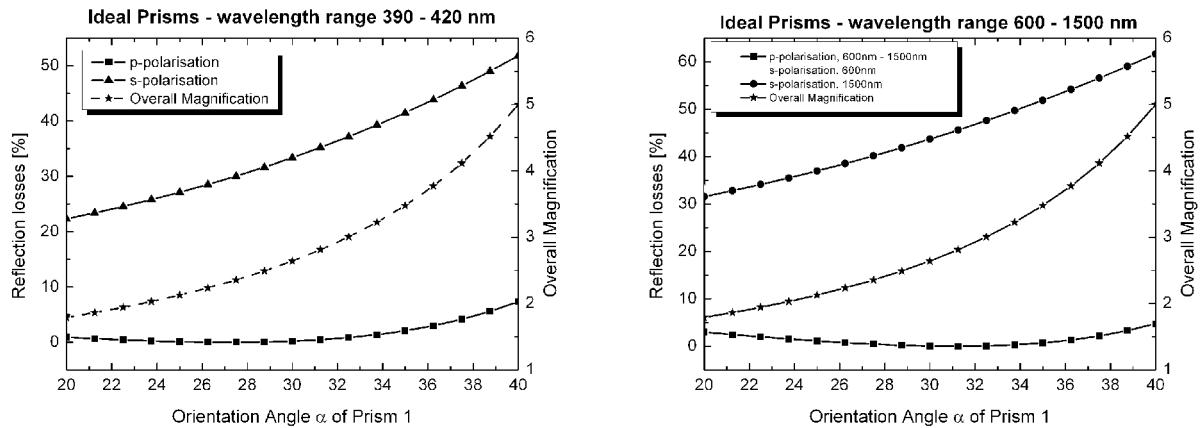


Figure 4 Calculated Overall Reflection Losses for wavelength range between 390 - 1500 nm.

7 Appendix B: Package Contents

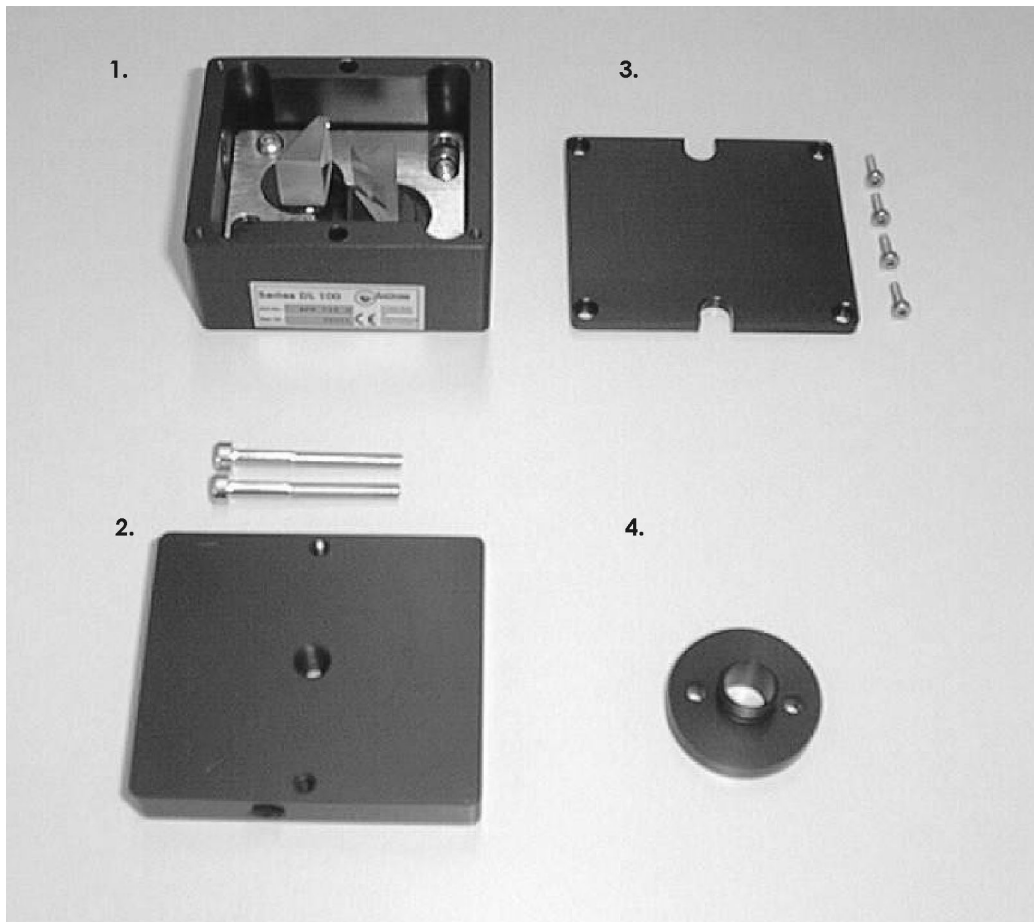


Figure 5 The Variable Anamorphic Prism Pair

1. Variable anamorphic prism pair in housing

Prism Material:	SF 11
Prism angle:	29° 26'
Optical surfaces:	larger surface uncoated smaller surface AR-coated for 390 - 420 nm (APP J 390 - 420) 600 - 1100 nm (APP J 600 - 1100) 1100 - 1500 nm (APP J 1100 - 1500)
Possible magnifications:	2-5
Beam displacement:	adjustable to 8 mm for all magnifications
Clear aperture:	Ø 8.5 mm at both sides
2. Adaptor plate with three M6 threads for horizontal and vertical mounting on standard posts, can be attached to the bottom of the housing.
3. Housing cover and fixing screws
4. Adaptor ring for mounting in standard 25 mm and 1" mirror mounts, can be screwed at entrance or exit aperture of the housing.

8 Guarantee and Service

On the following page you will find the **Guarantee Registration Form** in which the warranty conditions are defined. Please fill in the Guarantee Registration Form immediately after you have received your device and return it to TOPTICA Photonics AG by mail or fax.

As a first step towards obtaining technical support, please contact your local distributor or visit the support pages on our web site: <http://www.toptica.com/support/>

In case you wish to return a product for diagnosis and/or repair, please contact us prior to sending it so we can issue a **Return Material Authorization** (RMA) number for you.

You can contact us in the following ways:

- internet: www.toptica.com. In our support section you can find a list of frequently asked questions and a service contact form
- email: service@toptica.com
- phone: +49-89-85837-0.

Our customers in the USA and Canada may contact TOPTICA Photonics Inc.:

- email: service@toptica-usa.com
- phone: +1-585-657-6663

Guarantee Registration Form



QM form: F-015	Status of form: 22.02.05	Version of form: 01	Page: 1 of 1
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return to

sender:

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D- 82166 Graefelfing/Munich
Germany

FAX: +49 89 85837-200

Guarantee Conditions

The products of TOPTICA Photonics AG are produced with the greatest possible care using high-quality components and are checked in detail before being delivered. Therefore, as the manufacturer, TOPTICA Photonics AG gives a guarantee of durability according to the following terms:

- TOPTICA Photonics AG guarantees the buyer that there will be no defects in the product based on defective material or processing, for a period of 12 months from first delivery (guarantee period).** Natural wear and tear as well as defects resulting from improper use or use contrary to the specifications, from failure to observe operating instructions, from insufficient maintenance and care or from modifications, interventions or attempted repairs that are neither carried out nor authorized by TOPTICA Photonics AG, are not covered by the guarantee.
- Unless expressly stated in the order acknowledgement or the invoice semiconductor light emitting devices like laser diodes, tapered amplifier chips etc. whether sold as single parts or integrated in systems are not covered by the guarantee.**
- If a defect covered by the guarantee arises during the guarantee period, TOPTICA Photonics AG shall rectify such defect within a reasonable period at its own discretion by repairing or replacing the product or the defective part.
- The guarantee period shall commence upon delivery of the product by TOPTICA Photonics AG or by a third party that obtained the product directly from TOPTICA Photonics AG for the purpose of selling it to the buyer.
The claim under the guarantee shall be excluded if the defect is not notified to TOPTICA Photonics AG in writing immediately after having been discovered, and no later than one month after expiry of the guarantee period.
For the purpose of rectifying a defect covered by the guarantee, the product or the relevant part shall be sent to TOPTICA Photonics AG at the expense and risk of the buyer. The product shall be returned at the expense and risk of TOPTICA Photonics AG.
- No claims may be derived from this guarantee other than claims for rectification of the defects falling within the scope hereof, in accordance with the present terms. In particular, the buyer is not entitled under this guarantee to claim damages or a reduction in price from TOPTICA Photonics AG, or to rescind the contract. Potential, more far-reaching claims of the buyer against its seller shall not be affected by this guarantee.
- Important!: The obligation of TOPTICA Photonics AG under this guarantee is subject to the condition that the buyer gives his/her express consent to them by sending the signed duplicate of this form to TOPTICA Photonics AG immediately after delivery, also truthfully indicating the model number, the serial number and the date on which the product was delivered.**
- The buyer may not assign claims under this guarantee to third parties without the prior written consent of TOPTICA Photonics AG.
- This guarantee is governed by substantive German law to the exclusion of the provisions of the UN-Convention on Contracts for the International Sale of Goods (CISG). The Regional Court [Landgericht] Munich I shall be the court of exclusive international, local and subject-matter jurisdiction for legal disputes arising under or in connection with this guarantee.

I request the above mentioned guarantee for the purchased products and herewith consent to the above mentioned Guarantee Conditions:

Model No.: _____ Date: _____

Serial No.: _____ Signature: _____

Date of Delivery: _____ Name/Title: _____

To be completed by the buyer and returned to TOPTICA Photonics AG by mail or fax (+49 - 89 - 85837 - 200).