

TOPTICA OPTICAL ISOLATORS

Single and Dual Stage Designs

Manual

Manual: M-081 Version 06
Copyright © 2022 TOPTICA Photonics, Inc.

TOPTICA Photonics, Inc.
5847 County Road 41
Farmington, NY 14425, USA
Tel.: +1 585 657 6663
Fax: +1 877 277 9897

email: info@toptica.com
<http://www.toptica.com>

(November 2022 Subject to change 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 work. If you have questions or need advice on how to integrate it into your setup, please contact us immediately so we can walk you through the process. We will provide you with quick and competent help through our service staff and product managers.

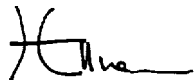
You can contact us in the following ways:

- Internet: service.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: +1-585-657-6663

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

As we are constantly improving our products, we greatly value all customer feedback. We encourage you to tell us what you like about our products as well as any suggestions for improvement.

Best regards,



Harald Ellmann
Director Service
TOPTICA Photonics AG

Contents

1	General	3
1.1	Mounting Requirements	3
2	Quickstart	4
3	Nomenclature	5
4	General Optimization of Isolator Performance	7
5	Wavelength Adjustment of Optimized Dual-Stage Isolators	9
6	Wavelength Adjustment of SSR405/1150/1250/1350 Isolators	10
7	Appendix	12
7.1	Isolator Specifications	12
7.1.1	Single Stage Isolators	12
7.1.2	Double Stage Isolators	13
7.2	How to Interpret Isolator Specifications	14
7.3	Isolator Main Dimensions	15
8	Guarantee and Service	17

1 General

TOPTICA's product line of Faraday Optical Isolators are specially designed and manufactured in-house by the laser experts of TOPTICA to give industry leading performance in both single- and dual-stage configurations. All models are wavelength adjustable and can handle power densities up to 4 kW/cm^2 . High Isolation, transmission, and power densities are achieved with precision PBS polarizers and precisely designed Faraday rotator elements. Most isolators have magnetically locked and removable protective endcaps and mounting fixtures. All internal optical components are angled to eliminate collinear back reflections. Extensive individual, wavelength-specific testing guarantees performance of each isolator.

1.1 Mounting Requirements

The TOPTICA isolator includes a clamp mount and can be integrated into optical systems by an optional mounting plate (supplied by TOPTICA). For mounting dimensions see Section 7.3. The laser input beam or the mount position should be adjusted such that the beam is centered on the input polarizer and coaxial through the isolator body. Isolator performance is inherently sensitive to angular deviations from normal incidence.

2 Quickstart

DANGER ! Take eye safety precautions when working with lasers.

DANGER ! Optical Isolators contain strong magnets that produce invisible, far-reaching magnetic fields that can damage computers, credit cards, TVs, electronic devices, and data storage media and can interfere with the operation of pace makers, hearing aids and other medical devices. Use extreme caution in handling, placement, and storage of Optical Isolators.

NOTE ! Tools Required: Power meter capable of nW sensitivity, end polarizer adjustment tool, and 1.5 mm and 2 mm Allen head ball drivers.

1. Carefully unpack the isolator from its shipping container. Remove the protective amber Kapton tape from the front and rear apertures and from the exit ports of each end cap (if so equipped).
2. The TOPTICA isolator is designed to be inserted in an optical system collinear with the laser beam axis as shown in the diagram below. Note that the arrow printed on the isolator barrel corresponds to the direction of laser propagation.



Figure 1 Isolator quickstart alignment schematic

3. The isolator must be positioned with the laser beam centered on the end cap aperture to provide optimal performance. The isolator base should be secured to the optical bench (using the optional TOPTICA baseplate or other means) to maintain this orientation to the laser source.
4. With a power meter positioned > 18" (45 cm) from the isolator output, loosen the set screw of the clamp and rotate the cylinder inside the clamp until maximum transmission is achieved. Tighten the set screw with the cylinder in this position. The isolator is now ready for use.

3 Nomenclature

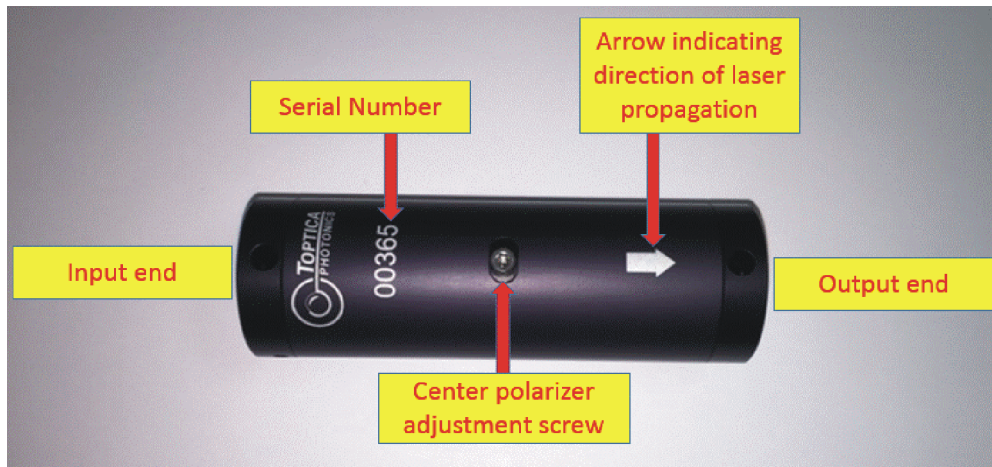


Figure 2 Isolator terminology. In this example, light should pass from left to right during normal operation. Note: only dual-stage isolators have a center polarizer adjustment screw.

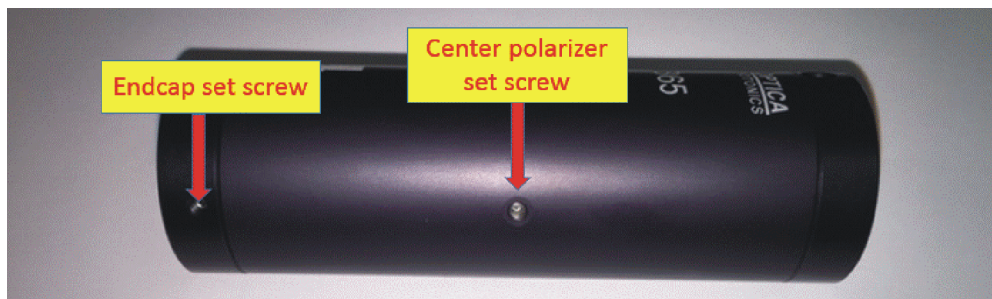


Figure 3 Isolator terminology. Note: only dual-stage isolators have a center polarizer set screw. Not all isolators come with protective end caps.

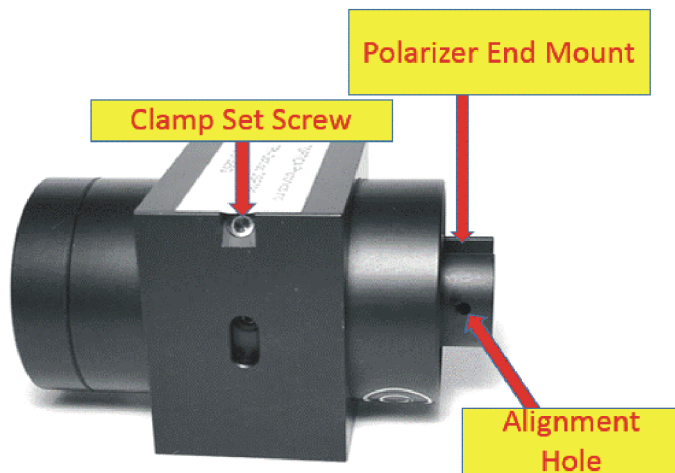


Figure 4 Isolator with end cap removed.
Note: the polarizer end mount is asymmetric.
An alignment hole is provided for reference.

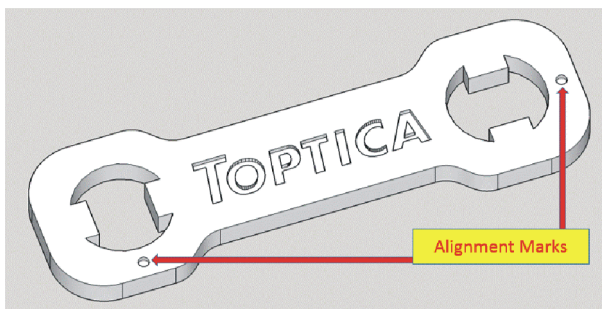


Figure 5 Polarizer end mount adjustment tool.
Note: the alignment marks in the tool correspond to the alignment holes of the polarizer end mounts.

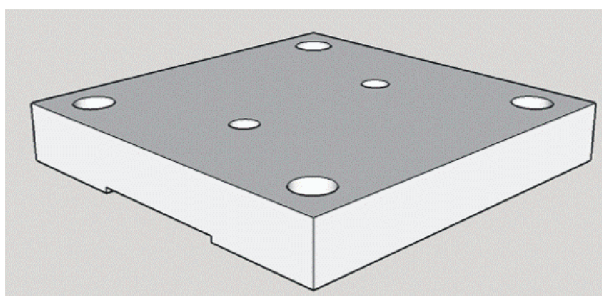


Figure 6 Optional baseplate for mounting the isolator clamp to an optical table (compatible with both Imperial and Metric breadboards).

4 General Optimization of Isolator Performance

DANGER ! Take eye safety precautions when working with lasers.

NOTE ! This general procedure is valid for initial optimization of most single- and dual-stage isolators. This process should also be followed for adjusting the center wavelength of single-stage isolators. A separate abbreviated process can be followed for adjusting the center wavelength of optimized dual-stage isolators, as detailed in Section 5.

1. The isolator position must be maintained collinear to the optical beam path in transmission orientation as described in Section 2.
2. Place the power meter > 45 cm (18") from the exit aperture of the isolator.
3. Remove the end caps from the isolator using a 1.5 mm Allen head ball driver. This allows access to the polarizer end mounts.

CAUTION ! Isolators contain strong magnets. Be very careful to maintain control of tools when approaching isolator.

CAUTION ! Exercise extreme care to not contact any optical surfaces when the end cap is removed. Any modification to an optical surface may degrade optical performance. Replace end cap as quickly as possible to protect the optics from dust and debris.

4. Loosen the isolator clamp M4 x 0.7 mm nylon tip set screw with a 2 mm Allen head driver to allow free rotation of the whole isolator assembly.
5. Measure the transmitted power while rotating the isolator cylinder in the clamp until maximum power transmission is achieved.
6. Tighten the M4 isolator clamp set screw to secure this orientation.



Figure 7 Schematic of isolator in blocking orientation.

7. Place the isolator in blocking orientation by rotating the whole isolator and clamp 180 degrees so that the cylinder transmission arrow is pointing towards the laser source.

8. Reduce ambient lighting to avoid error in measuring low transmitted power levels. Background signal must be < 5 nW.
9. Attach the polarizer adjustment tool to the input polarizer end mount (this should now be facing away from the laser source). The isolator should be securely mounted so that rotation of the tool only rotates the polarizer end mount.

CAUTION ! Do not let the tool contact the exposed optics.

10. Measure the transmitted power while rotating the polarizer end mount until minimum transmitted power is achieved.
11. Replace and tighten the protective end caps.
12. Reposition the isolator in the optical path in the transmission orientation, with the direction arrow on the cylinder pointing away from the laser source.
13. The isolator is now optimized and positioned for use.

5 Wavelength Adjustment of Optimized Dual-Stage Isolators

DANGER ! Take eye safety precautions when working with lasers.

NOTE ! This alignment procedure only changes the center wavelength of dual-stage isolators that have previously been optimized for a different center wavelength.

1. Start with the isolator position maintained collinear to the optical beam path in blocking orientation as described in Figure 7.
2. Place the power meter > 45 cm (18") from the input end (now facing away from laser source) of the isolator.
3. Loosen the center polarizer set screw with a 1.5 mm ball driver.
4. Insert a 2.5 mm Allen head ball driver into the center polarizer recessed adjustment screw.

CAUTION ! Do not turn this screw. Accidental removal of this screw may result in decreased isolator performance and loss of functionality.

5. Reduce ambient lighting to avoid error in measuring low transmitted power levels. Background signal must be < 5 nW.
6. Use the Allen ball driver as a lever to carefully rotate the center polarizer. Measure the transmitted power while rotating the center polarizer until **minimum** transmitted power is achieved.
7. Use a 1.5 mm ball driver to tighten the center polarizer set screw.
8. Reposition the isolator in the optical path in the transmission orientation, with the direction arrow on the cylinder pointing away from the laser source.
9. The isolator is now optimized and positioned for use.

6 Wavelength Adjustment of SSR405/1150/1250/1350 Isolators

DANGER ! Take eye safety precautions when working with lasers.

NOTE ! This alignment procedure is only for the SSR405, SSR1150, SSR1250, and SSR1350 isolators. Due to its compact size, the polarizer end mounts in these models have a unique mechanical fixturing.

NOTE ! Tools needed: Adjustable Spanner Wrench (not included).

CAUTION ! The SSR405 does not have protective end caps. Exercise extreme care to not contact any optical surfaces. Any modification to an optical surface may degrade optical performance.

1. The isolator position must be maintained collinear to the optical beam path in transmission orientation as described in Section 2.
2. Place the power meter > 45 cm (18") from the exit aperture of the isolator.

CAUTION ! Isolators contain strong magnets. Be very careful to maintain control of tools when approaching isolator.

3. Loosen the isolator clamp M3 x 0.5 mm nylon tip set screw with a 1.5 mm Allen head driver to allow free rotation of the whole isolator assembly.
4. Measure the transmitted power while rotating the isolator cylinder in the clamp until maximum power transmission is achieved.
5. Tighten the M3 isolator clamp set screw to secure this orientation.



Figure 8 Schematic of isolator in blocking orientation.

6. Place the isolator in blocking orientation by rotating the whole isolator and clamp 180 degrees so that the cylinder transmission arrow is pointing towards the laser source.
7. Reduce ambient lighting to avoid error in measuring low transmitted power levels. Background signal must be < 5 nW.

NOTE ! For the SSR1150, SSR1250, and SSR1350, remove the output end caps from the isolator using a 1.5 mm Allen head ball driver. This allows access to the output polarizer end mounts (now facing the laser source).

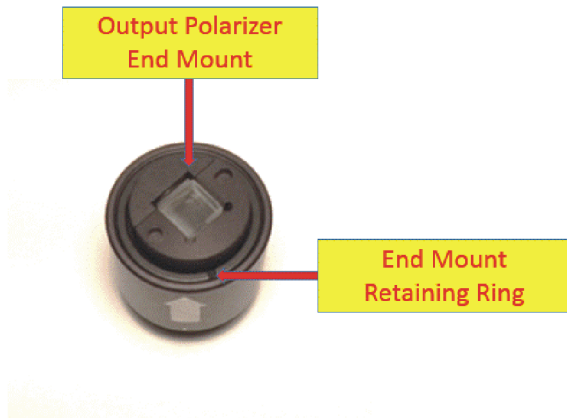


Figure 9 SSR405 polarizer end mount and outer retaining ring

8. Use a spanner wrench to loosen the outer retaining ring. This ring only needs to be loosened, not removed. (Note, there is another retaining ring directly under the outer retaining ring. Do not touch this inner retaining ring).
9. Insert the prongs of the spanner wrench into the holes on the face of the output polarizer end mount (this should now be facing towards the laser source). The isolator should be securely mounted so that rotation of the tool only rotates the polarizer end mount.
10. While being careful to keep the spanner wrench out of the beam path, measure the transmitted power while using the wrench to rotate the polarizer end mount until minimum transmitted power is achieved.
11. Retighten the end mount outer retaining ring.

CAUTION ! Do not let the tool contact the exposed optics.

12. Reposition the isolator in the optical path in the transmission orientation, with the direction arrow on the cylinder pointing away from the laser source.
13. The isolator is now optimized and positioned for use.

7 Appendix

7.1 Isolator Specifications

7.1.1 Single Stage Isolators

Model	SSR405	SSR460	SSR650	SSR690	SSR730	SSR780	SSR835	SSR885	SSR945	SSR1150	SSR1250	SSR1350
Design Wave-length [nm]	405	460	650	690	730	780	835	885	945	1150	1250	1350
Tunable Wavelength Range [nm]	395-425	440-480	630-670	670-710	710-750	750-810	810-860	860-910	905-985	1100-1200	1200-1300	1300-1400
Fixed Operation Range* [± nm]	2.5	3	5	6	6.5	7	7.5	8	9	10	10	10
Clear Aperture	4.7 mm											
Isolation at Design Wave-length (Min/Ave)	35/43 dB											
Transmission (Min/Ave)	85/92 %											
Power Handling	40 W, 4 kW/cm ²											
Operating Temperature Range	15 °C to 40 °C, non-condensing											
Storage & Transport	Shock 25 g/10 ms., Vibration 3 g (15 - 100 Hz), 0 °C to 60 °C non-condensing											

*with respect to design wavelength > 35 dB and > 85 %

7.1.2 Double Stage Isolators

Model	DSR660	DSR700	DSR740	DSR780	DSR820	DSR880	DSR950	DSR1020	DSR1070
Design Wavelength [nm]	660	700	740	780	820	880	950	1020	1070
Tunable Wavelength Range [nm]	640-680	680-720	720-760	760-805	800-865	860-930	930-995	995-1050	1050-1100
Fixed Operation Range* [+/- nm]	6	6.5	7	7.5	8	10	11.5	12	12
Clear Aperture	4.7 mm								
Isolation at Design Wavelength (Min/Ave)	60/67 dB								
Transmission (Min/Ave)	80/90 %								
Power Handling	40 W, 4 kW/cm ²								
Operating Temperature Range	15 °C to 40 °C, non-condensing								
Storage & Transport	Shock 25 g/10 ms., Vibration 3 g (15 - 100 Hz), 0 °C to 60 °C non-condensing								

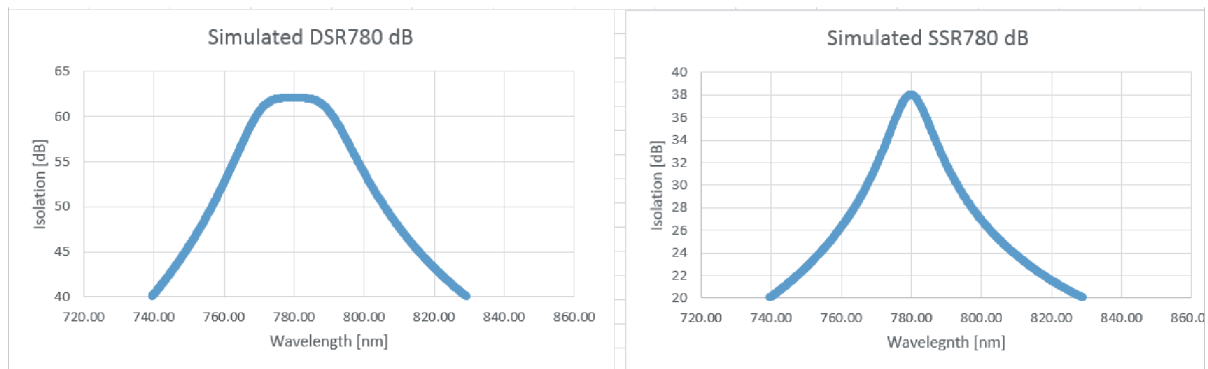
*with respect to design wavelength > 60 dB and > 80 %

7.2 How to Interpret Isolator Specifications

Design Wavelength: Many components of an optical isolator are wavelength dependent. This is the wavelength for which the isolator components are optimized.

Tunable Wavelength Range: This is the full range over which the isolator can be tuned while still achieving nominal specifications (> 35 dB and 85 % transmission for single stage, > 60 dB and 80 % transmission for dual stage).

Fixed Operation Range: This is the bandwidth over which a laser source may be tuned while the isolator is statically held at its design wavelength, such that the isolator will exhibit nominal performance without additional adjustment. For example, if a SSR780 is tuned for optimal performance at 780 nm, a laser source may be adjusted freely between 773 - 787 nm and the isolator will give > 35 dB isolation and > 85 % transmission without adjustment to the isolator. Note: this range does not extend past the tunable wavelength range. For example, if a SSR780 is tuned for optimal performance at 755 nm, performance is still only guaranteed down to 750 nm. For reference, simulated static isolation curves (based on real data) of the SSR780 and DSR780 are below.



Clear Aperture: Aperture of the smallest component of the isolator. For a 4.7 mm clear aperture isolator, we recommend the input beam diameter be < 2.75 mm ($1/e^2$) for optimal performance.

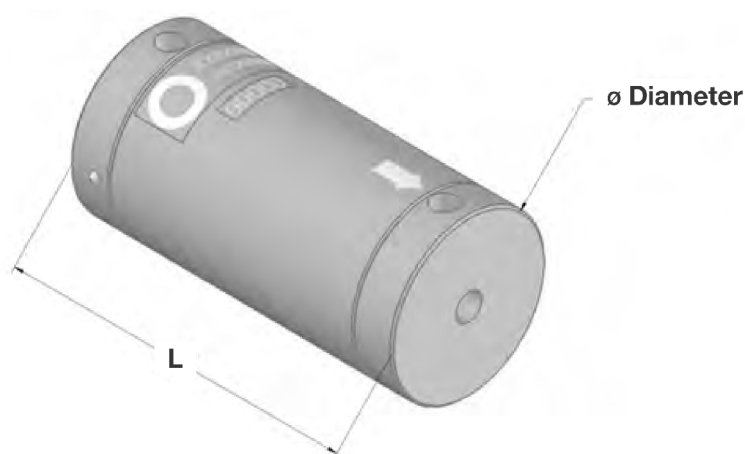
Isolation at Design Wavelength: The isolator performs best at this wavelength. Two specifications are given: one that is a minimum guarantee, and one that is an average of actual production. For example, the SSR product line guarantees a minimum isolation of 35 dB at design wavelength. Production measurements have shown an average of 43 dB.

Transmission: The minimum and average production values of transmission through the isolators over the tunable wavelength range. Transmission is much less dependent on wavelength than isolation.

Power Handling: The first value (40 W) is the total power that may be incident on the isolator. The second value (4 kW/cm²) is the maximum power density that may be incident on the isolator.

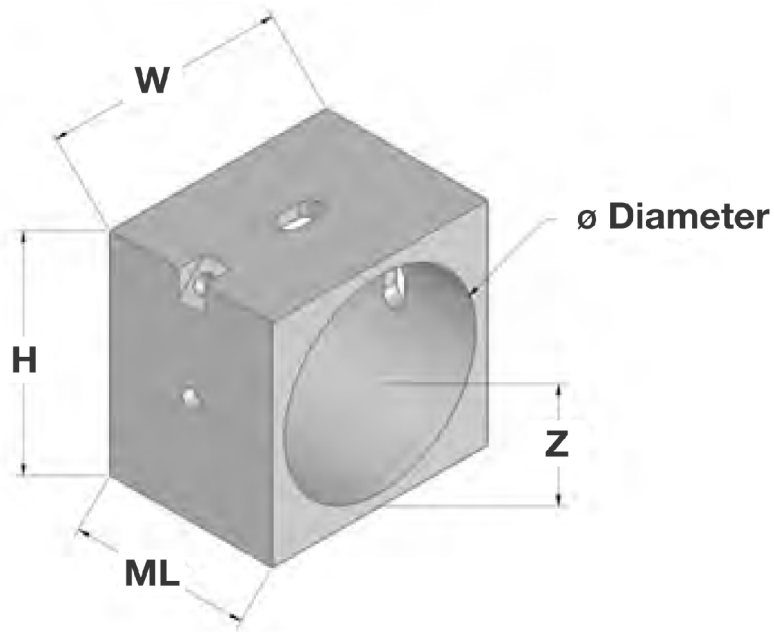
Operating Temperature and Storage and Transport: Maximum environmental conditions under which specified performance can be maintained.

7.3 Isolator Main Dimensions



Model	Dia	L	Clamp Mount
SSR405	22.00	24.00	A
SSR460	22.00	24.00	A
SSR650	35.50	50.00	B
SSR690	35.50	50.00	B
SSR730	35.50	50.00	B
SSR780	35.50	51.00	B
SSR835	35.50	58.50	B
SSR885	35.50	58.50	B
SSR945	40.50	60.50	C
SSR1150	22.00	33.50	A
SSR1250	22.00	33.50	A
SSR1350	22.00	33.50	A
DSR660	35.50	74.00	B
DSR700	35.50	74.00	B
DSR740	35.50	74.00	B
DSR780	35.50	74.00	B
DSR820	35.50	72.80	B
DSR880	35.50	106.40	B
DSR950	40.50	100.80	C
DSR1020	53.50	91.55	D
DSR1070	53.50	97.55	D

All dimensions given in mm.



Model	ML	W	H	Dia	Z	S**
A	12.00	36.00	32.50	22.03	20.00	30.00
B	30.00	40.00	40.00	35.53	20.00	30.00
C	30.00	45.00	45.00	40.53	22.50	30.00
D	30.00	58.00	58.00	53.53	29.00	40.00

**Dimension "S" is the spacing of the 2 mounting threads (not shown) on the bottom surface
 All dimensions given in mm.

8 Guarantee and Service

On the following page you will find the **Guarantee Registration Form** in which the warranty conditions are defined. Please complete in the Guarantee Registration Form immediately after you receive your device and return it to TOPTICA 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: service.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: +1-585-657-6663 (for North America)
+49-89-85837-150 (for International)





QM form: F-10001	Status of form: 10.05.2022	Version of form: 01	Page: 1 of 1
------------------	----------------------------	---------------------	--------------

return to

sender:

TOPTICA Photonics Inc
 Customer Service
 1120 Pittsford Victor Rd
 Pittsford, NY 14534
 USA

FAX: +1 877 277 9897

Guarantee Conditions

The products of TOPTICA Photonics Inc 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 Inc gives a guarantee of durability according to the following terms:

- TOPTICA Photonics Inc 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 Inc, 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, Terahertz transmitters and receivers 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 Inc 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 Inc or by a third party that obtained the product directly from TOPTICA Photonics Inc 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 Inc 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 Inc at the expense and risk of the buyer. The product shall be returned at the expense and risk of TOPTICA Photonics Inc.
- 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 Inc, 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 Inc 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 Inc 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 Inc.
- 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 Inc by mail or fax (+1 877 277 9897).

