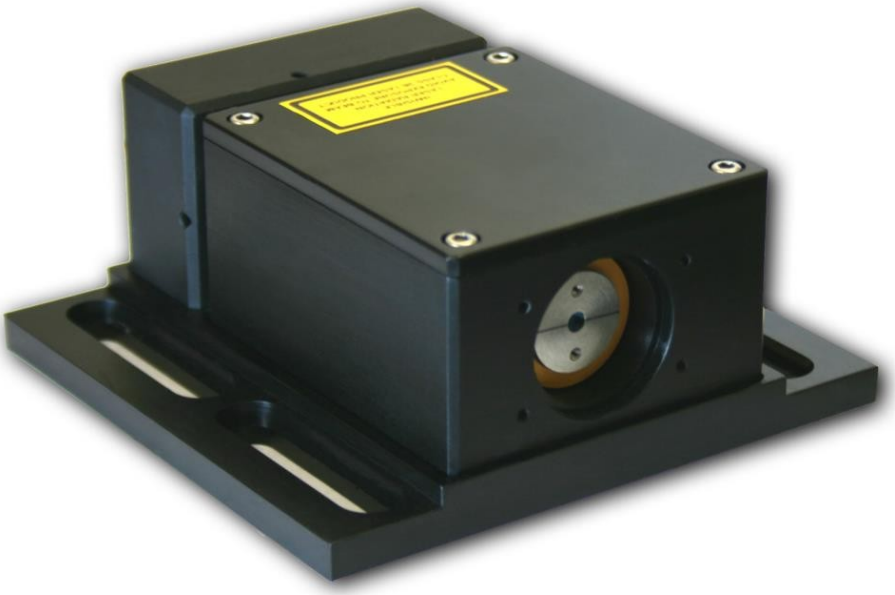
DBR
Laser Module



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General Warnings and Cautions

The following general warnings and cautions are applicable to this instrument.

WARNING

This instrument is intended for use by qualified personnel who recognize shock hazards or laser hazards and are familiar with safety precautions required to avoid possible injury. Read the instruction manual thoroughly before using to become familiar with the instrument's operations and capabilities.

CAUTION

There are no serviceable parts inside the instrument. Work performed by persons not authorized by Vescent Photonics may void the warranty.

CAUTION

Although ESD protection is designed into the instrument, operation in a static-fee work area is recommended.

WARNING

To avoid electrical shock hazard, connect the instrument to properly earth-grounded, 3-prong receptacles only. Failure to observe this precaution can result in severe injury or death.

WARNING

Do not clean outside surfaces of any Vescent Photonics products with solvents such as acetone. Front panels on electronics modules may be cleaned with a mild soap and water solution. Do not clean optics modules.

Limited Warranty

Vescent Photonics warrants this product to be free from defects in materials and workmanship for a period of one year from the date of shipment. If this product proves defective during the applicable warranty period, Vescent Photonics, at its option, either will repair the defective product without charge or will provide a replacement in exchange for the defective product. The customer must notify Vescent of the defective product within the warranty period and prior to product return. The customer will be responsible for packaging and shipping the defective product back to Vescent Photonics, with shipping charges prepaid.

Vescent Photonics shall not be obligated to furnish service under this warranty from damage caused by service or repair attempts made without authorization by Vescent Photonics; from damage caused by operation of equipment outside of its specified range as stated in either the product specification or operators manual; from damage due to improper connection to other equipment or power supplies.

This warranty is in lieu of all other warranties including any implied warranty concerning the suitability or fitness of the product for a particular use. Vescent Photonics shall only be liable for cost of repairs or replacement of the defective product within the warranty period. Vescent Photonics shall not be liable for any damages to persons or property resulting from the use of the product or caused by the defect or failure of this product. Vescent Photonics' liability is expressly limited to the warranty set out above. By accepting delivery of this product, the purchaser expressly agrees to the terms of this limited warranty.

Vescent Photonics

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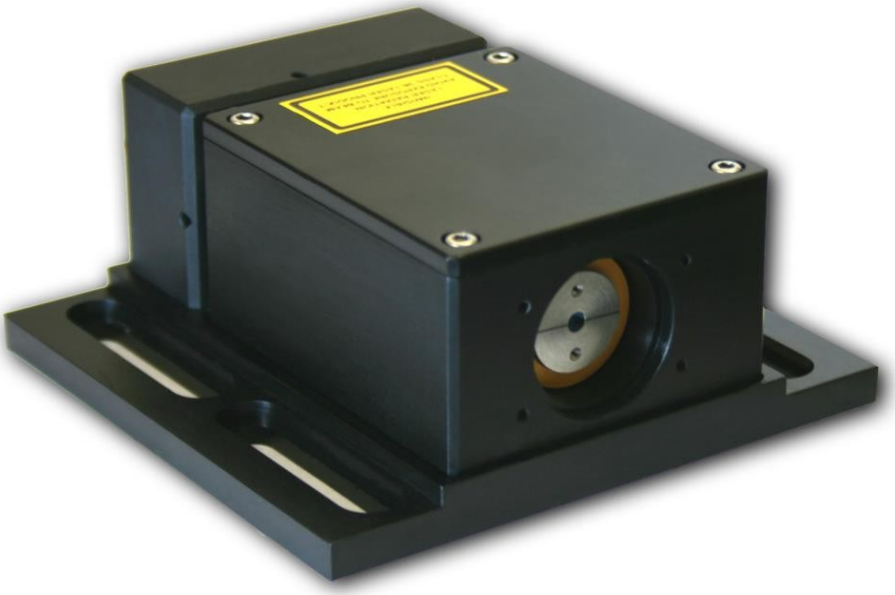
Absolute Maximum Ratings

Note: All modules designed to be operated in laboratory environment

Parameter	Rating
Environmental Temperature	>15°C and <30°C
Environmental Humidity	<60%
Environmental Dew Point	<15°C
Stage 2 Temperature of DBR Laser Diode	>15°C and <40°C
Laser Diode Current	180mA

1. DBR Laser Module

Model No. D2-100



1.1. Description

The DBR laser module is comprised of a distributed feedback (DBR) laser diode in a precision temperature-controlled housing with beam conditioning optics and an optical isolator. DBR laser diodes are fabricated with the feedback grating patterned directly over the gain section of the diode. They are highly immune to vibrations and by virtue of a very short cavity (~ 1 mm), they can be current tuned over more than 50 GHz. The result is a robust laser capable of very fast servo control for easy locking to atomic transitions. The module contains no moving parts or piezo-electrics and is therefore inherently robust and rugged.

DBR lasers have 2-3 times larger temperature and current tuning coefficients as compared to external-cavity diode lasers. Vescent carefully controls these parameters with two stages of temperature control and a precision low-noise current controller with fast servo input.

The DBR laser is collimated by a 0.55 NA lens mounted to a movable plate for pointing adjustments. The module also comes with a 35 dB optical isolator and a pair of anamorphic prisms. (Note that prior to fiber coupling we recommend a second stage of isolation.)

The temperature controllers use an 8-pin circular connector on the back of the DBR subassembly. The injection current connection to the laser diode is through an SMA connector also on the back of the DBR subassembly.

The DBR laser chip is contained in a thermal package allowing temperature control between 0° to 50° C. Vescent can replace the package if it exceeds its lifetime.

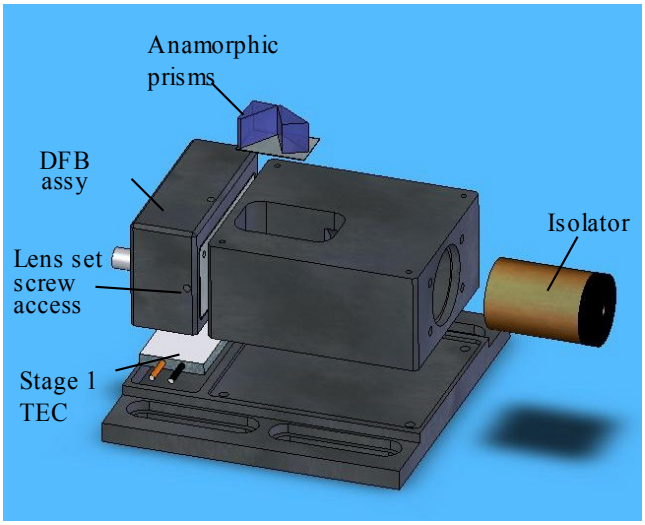


Figure 1: The DBR laser module.

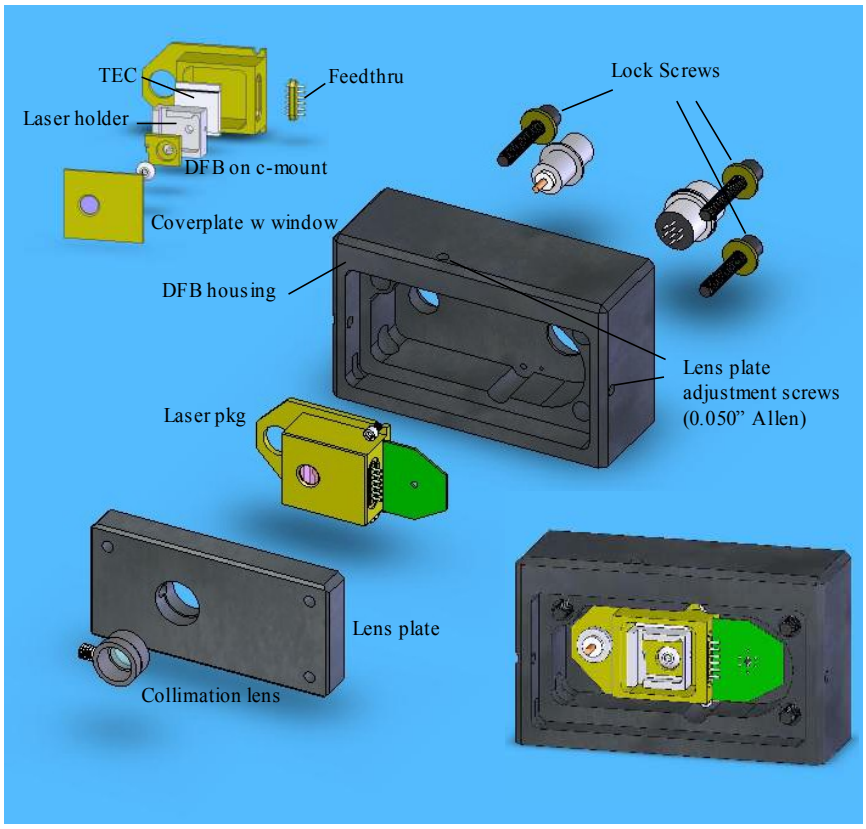


Figure 2: Exploded view of the DBR subassembly.

1.2. Specifications

	Min.	Typical	Max.	Units
Wavelength		780.24		nm
Output power	30	40	50	mW
Beam diameter	0.8	1.1	1.7	mm ($1/e^2$ dia.)
Polarization		Horizontal		
Optical isolation		35		dB
Operating current		150	180	mA
Threshold Current	40	50	70	mA
Temperature range Stage 1, housing Stage 2, laser	 15 0	 20 15	 40 50 [1]	°C
Temperature stability		See Laser Controller, Model No. D2-105		
Safety Class		3B		
Beam height		0.95		inches
Total package Size (L x W x H)		3.75 x 4 x 2		inches

1.3. Inputs, Outputs, and Controls

Vertical and horizontal pointing

The vertical and horizontal alignment of the laser system is factory set and should not need adjustment. However, if your specific application requires it or the system is misaligned, the DBR subassembly has adjustments to steer the beam for alignment to the spectroscopy module or other modules. The beam pointing is adjusted by loosening the three lock screws ½ turn past the crack point and adjusting the x and y positioning setscrews on the top and left side (facing out along the laser beam) of the module (see Figure 3). For more detailed instructions, see section 1.4.

[1]Operation above 40° C can reduce the lifetime of the laser diode

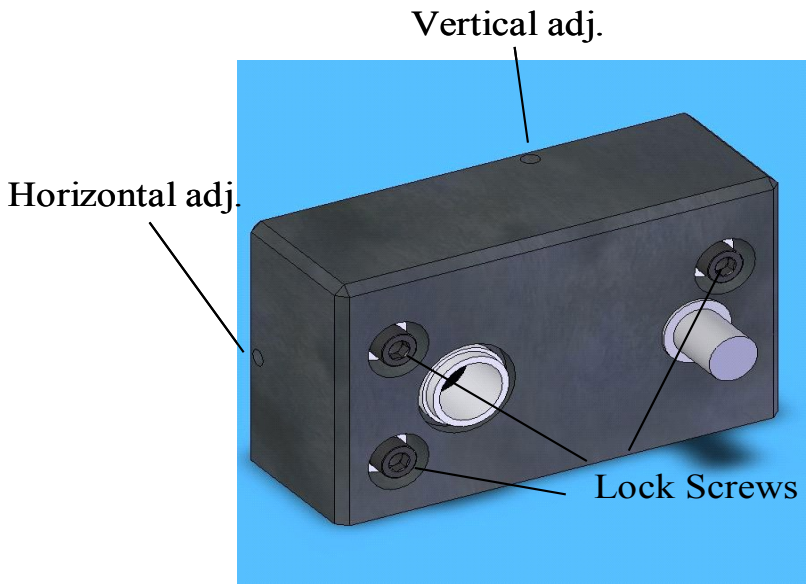


Figure 3: Lock screws and beam pointing controls.

Beam Conditioning

The collimation of the output beam is set at the factory and should not be adjusted unless absolutely necessary. Remove the isolator subassembly from the baseplate with the 4 screws accessible from the bottom. The locking set screw on the right side of the DBR subassembly can then be loosened and the lens repositioned with a 9 mm spanner wrench (Thorlabs, SPW301). Tighten the locking screw and reattach the isolator subassembly.

Laser diodes all have astigmatism, which means the horizontal and vertical axis have different foci. Vescent uses a powerful asphere with a short focal length and an anamorphic prism pair to create a small diameter circular beam. This reduces the costs of the isolator and other downstream modules by reducing the clear aperture requirements. While the aspheres and anamorphic prisms produce a circular beam, astigmatism dictates that a single lens will not simultaneously collimate both orthogonal axes of the beam with the result that in the far field the beam is again elliptical.

The far-field pattern is the most important for ascertaining the quality of the diode output. The near-field pattern often shows stray light from the diode waveguide and ASE that doesn't propagate as part of the primary beam. However, aberrations and beam clipping due to an insufficient lens NA will show up as fringes-on the far field pattern. Vescent has taken care in the design of the DBR laser module to keep aberrations and clipping to a minimum, resulting in a clean beam in the far field.

Cable Connector

The connections to the TECs and thermisters are made to an 8-pin circular connector. The pin definitions are:

Pin	Signal
1	TEC1+
2	TEC1-
3	Rth-1
4	Rth1-RTN
5	TEC2+
6	TEC2-
7	Rth2
8	Rth2-RTN

NOTE: Earlier models use a push-pull connector for the 8-pin connector to the DBR module. To remove take care to apply opposition forces with the thumb and forefinger knuckles against the housing. Excessive force could displace the output beam and require realignment.

Laser Current (SMA)

Current is provided to the DBR chip through an SMA connector. The central conductor of the SMA connects to the laser anode, and the shield connects to the laser cathode. *This is a direct, unprotected connection to the DBR chip, so care must be taken to avoid ESD damage.*

1.4. Aligning the DBR Laser Module

The module should not need adjustments, but if necessary the following procedure can be used to fine tune the beam positioning.

1. Loosen the three locking screws on the back of the DBR module ½ turn past the crack point.
2. With a 0.050” Allen driver, adjust the vertical adjustment setscrew on the top of the DBR housing to level the beam.
3. Adjust the horizontal adjustment 4-40 set screw on the left side of the DBR housing (See Figure 3).
4. Alternatively, use the spectroscopy module as a beam target. Place the spectroscopy module as far down the table as possible, bolt it down, and center the beam to the input hole.
5. Gently retighten the three locking screws.