Spectroscopy Module

Vescent Photonics, Inc.
www.vescentphotonics.com
4865 E. 41st Ave
Denver, CO 80216
Phone: (303)-296-6766
Fax: (303)-296-6783

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

Printed Jun 10, 2008

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

1. Spectroscopy Module

Model No. D2-110

1.1. Description

The spectroscopy module provides saturated absorption spectroscopy to atomic rubidium. It contains a rubidium absorption cell, TEC, balanced photodetector, and associated mirrors and beamsplitting optics. Nominally, it takes two 1% samples from the input beam. Temperature control stabilizes the number density of atoms in the cell, and a balanced photodetection circuit compensates for intensity drifts giving stable control over the lock point for side locking applications. Two beamsteering adjustments are provided for optimizing overlap of the counter-propagating beams, and positioning on the signal photodiode. The photodiode output is shot-noise limited out to ~12 MHz for photocurrents of 50 μA and above. The high bandwidth of the feedback enables tight solid locking that is immune to vibrations and shock.

Note: The spectroscopy module should not be placed closer than 3" from the DBR laser module because the magnetic fields from the isolator can interfere with the hyperfine transitions causing lock instability and dc shifts.

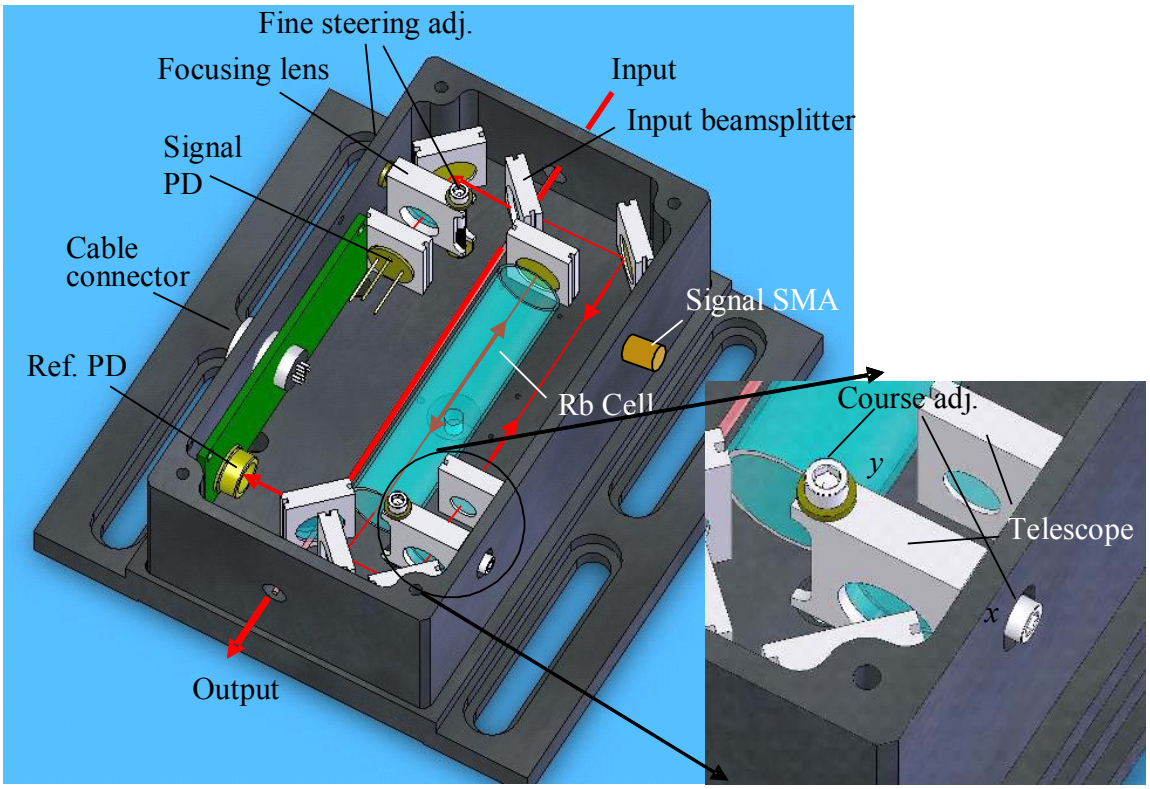


Figure 1: Spectroscopy Module with cover removed.

1.2. Specifications

	Value	Units
Photodiode Amplifier		
Transimpedance (signal)	20,000	Ω
Bandwidth (signal)	12	MHz
Noise @ 10 MHz (shot level)	80	nV/√Hz
Set Temperature	~35	°C
Temperature Stability	~0.01	°C
Beam Height	0.95	inches
Total package Size (L x W x H)	4.25 x 4 x 2	inches

1.3. Inputs, Outputs, and Controls

Input Connector (8-pin circular)

Power and temperature control signals from the Laser Servo are made through an 8-pin circular connector. The pin definitions (pin numbers are marked on the connectors) are listed below, where Rth and Rth_Rtn are the two ends of the thermistor.

Pin	Signal
1	TEC+
2	TEC-
3	+15 V
4	Rth_Rtn
5	Rth
6	-15
7	NC
8	GND

Signal Output (SMA)

To minimize electro-magnetic interference, the photodiode signal to the Laser Servo is output through an SMA connector.

Course vertical and horizontal beam positioning

The spectroscopy module contains a 3x Galilean beam expander. The output lens is mounted on a spring-loaded mount with 2-56 screws that serve as a course adjustment for the beam positioning onto the signal photodiode and also to control the retro reflection of the reflecting mirror (Figure 1, inset).

Fine vertical and horizontal beam positioning

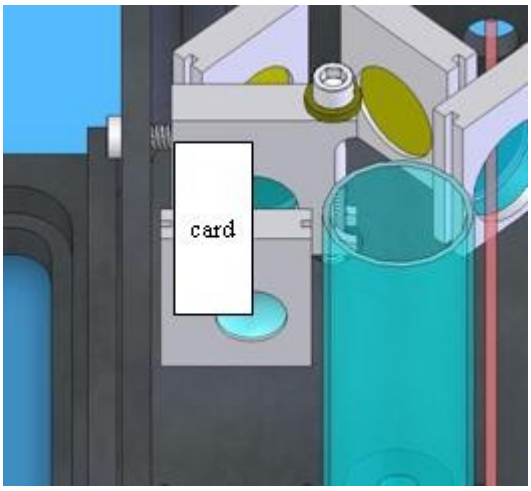
The spectroscopy module contains a focusing lens for the signal photodiode on a spring-loaded mount with 2-56 screws for fine adjustment of the beam onto the photodiode (Figure 1).

1.4. Aligning the Spectroscopy Module

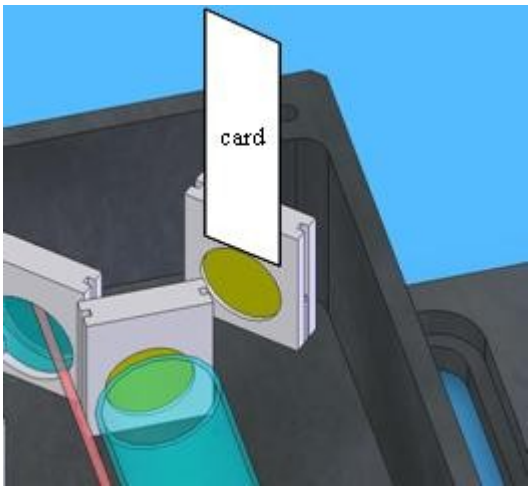
The spectroscopy module is shipped factory aligned and should need only minor adjustment. However, it is not uncommon that alignment is required after initial set up. To realign, follow this procedure:

1. Loosen the three locking screws on the back of the DBR module ½ turn past the crack point.
2. Fashion two small 1 cm x 3 cm cards from an index card for use as viewing screens.
3. Remove the cover on the Spectroscopy Module.
4. Use the card and the vertical and horizontal positioning controls on the DBR module to center the beam onto the 6 mm diverging lens. This is the most critical alignment.

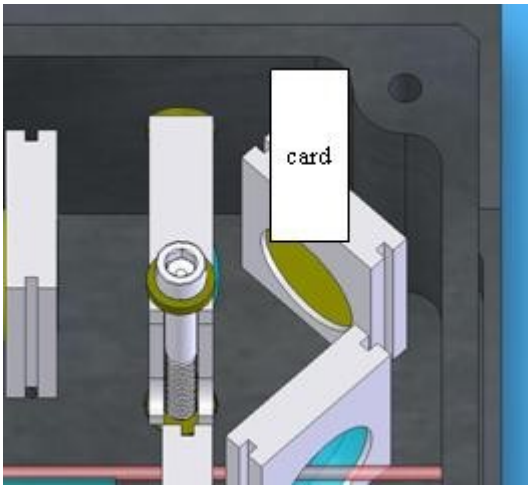
5. At this point the beam should be going through the center of the input and output apertures on the module, the center of the 6 mm lens, and the second pick off should be impinging on the reference photodiode (see Figure 1). Make adjustments as necessary.



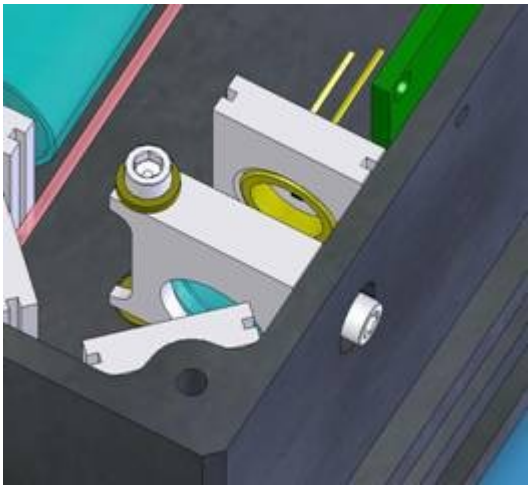
6. Retighten the locking screws on the DBR module.
7. Use the card to ascertain the position of the returned beam on the first corner mirror.



8. Use the course positioning controls to place the retro-reflected beam as close as possible to the incoming beam.
9. Use the card to probe the opposite corner mirror (along short side) to see if the retro beam is now passing back through the input beamsplitter.



10. If the beam is visible on the card, center it with the course positioning controls. If not, repeat from Step 8.
11. Check to see that the beam is relatively well centered on the retro reflecting mirror at the end of the Rb cell. If not, the beam is not centered well enough on the 6 mm divergent lens. Start again from Step 4.
12. Fold the second card lengthwise (light goes through a single layer) and block the reference photodiode while monitoring the SMA OUTPUT on an oscilloscope or voltmeter.
13. Use the Course and fine steering controls to maximize the signal (actual signal is negative) on the voltmeter. Generally, the fine steering controls have little effect. You might find them useful if you wish to use the course controls to center the beam on the retro mirror and find this moves the beam off center from the signal diode.



The fine steering controls and signal PD

14. Remove the card from the reference photodiode.

15. Adjust the trimpot until a desired lockpoint for sidelocking crosses zero volts (with oscilloscope connected to the ERROR INPUT monitor, or until an eyeball average of the hyperfine transitions lies near zero volts. This step determines how well the balancing circuit cancels intensity drifts. (Note: for peak locking applications this is not important since dc drifts have no affect on the lockpoint.)

16. The spectroscopy module is now ready for use. Replace the cover.