Quick Setup Guide

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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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1. Quick Setup Instructions

1.1. Electronic Modules Initial Setup

Place the three electronics modules (System Power, Laser Controller and Laser Servo) in a row as shown on the right (order is not important).

On the back of the modules, attach the two power bridges across adjacent modules. See picture below.

On the Laser Controller, in the bottom left corner, make sure that the LASER switch is in the OFF/RESET (down) position.

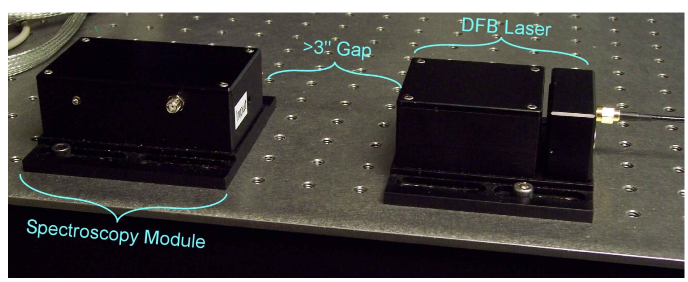
Make sure the power switch on the System Power module is in the OFF (down) position. Plug power cable into back of System Power module.

1.2. Optic Modules Initial Setup

Place the DBR Module on an optics table and bolt to table with 4 1/4-20 screws.

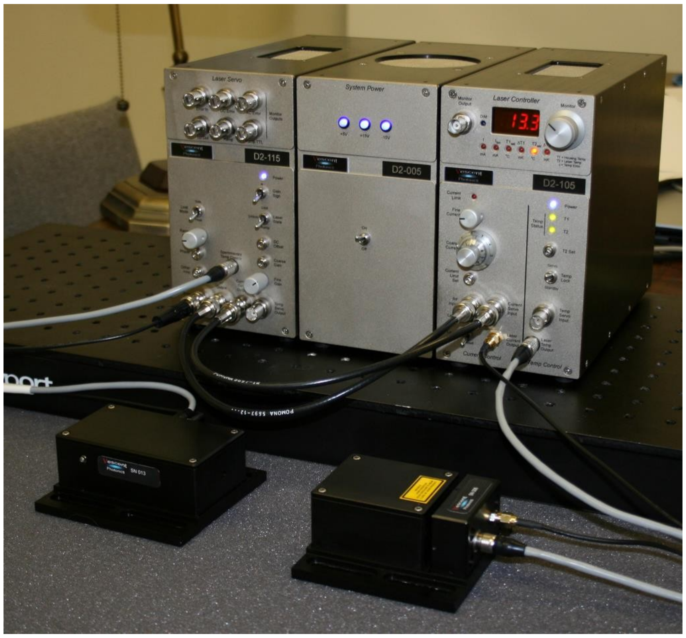
Align the Spectroscopy Module to the DBR Module, but place Spectroscopy Module at least 3” away from the DBR Module.

To help with optical alignment, loosen the four screws that hold each module and gently register the modules by pushing against the screws in the same direction. (This is how they were aligned at Vescent.)



1.3. Cabling & Power

Locate the 6ft SMA cable circular connector cable assembly. Plug the SMA connector into the LASER CURRENT OUTPUT plug and LASER TEMP OUTPUT on the Laser Controller. Make sure that the nearby Laser switch is in the OFF/RESET position (down). While grounded, remove the SMA terminator connected to the DBR Laser. Connect the other end of the SMA cable and circular connector to the DBR module.



Find the 6ft SMA / BNC cable and circular connector cable assembly. Plug the BNC end into the ERROR INPUT on the Laser Servo. Plug the SMA end into the Spectroscopy Module. Connect the circular connectors.

Take one short (~1ft) BNC cable and connect it from the CURRENT SERVO INTPUT on the Laser Controller to the CURRENT SERVO OUTPUT on the Laser Servo.

For Peak-Lock Only: Connect one short (~1ft) BNC from the RF INPUT on the Laser Controller to the RF OUTPUT on the Laser Servo.

Optional: For greater long-term stability, connect one short (~1ft) BNC from the TEMP SERVO INPUT on the Laser Controller to the TEMP SERVO OUTPUT on the Laser Servo. This shifts long term drift to the temperature servo.

Flip the switch on the System Power Module to the ON position. Three LED's (+5V, +15V, -15V) on the System Power modules should glow blue.

Both the Laser Controller module and the Laser Servo module should have a blue LED glowing next to the label POWER. If not, check that the power bridges are properly connected on the back.

1.4. Laser Controller

Flip the TEMP LOCK switch on the Laser Controller into the SERVO position. A green light next to T2 should turn on in ~30 seconds. In ~3 minutes, the T1 green light should also turn on. You may use the laser before stage 1 temperature (T1) is fully stabilized. The LEDs turn red if the temperature servo senses an error condition, or if the laser is not between 0 and 50°C. They will show red until LASER TEMP OUTPUT is connected (open condition), and when the TEMP LOCK is in the STANDBY position.

Rotate the display selector knob in the upper right corner of the Laser Controller until the "I_{lim}" indicator is lit. Make sure the current limit value shown is below 180 mA.

The Laser Controller has two safety interlocks. If either interlock is tripped, the laser will turn off and stay off until the interlock condition has been fixed AND the Laser switch has been moved from "off/reset" position to the "on" position. To turn the laser on for the first time follow the subsequent procedure:

1. Place the front panel Laser switch in the "off/reset" position.
2. Place the included terminator on to the back-panel "remote interlock" BNC.

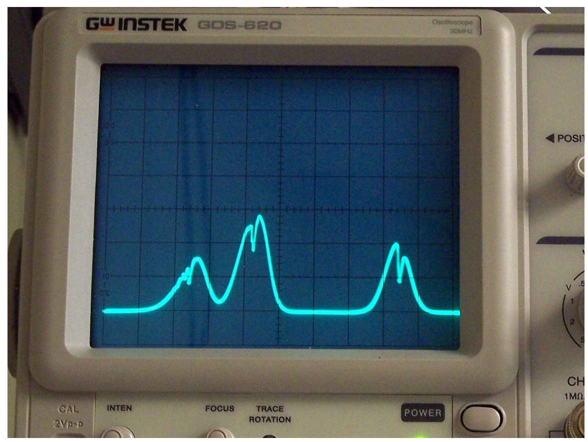
3. Take the key that was taped to back of the Laser Controller and place it in the back-panel Laser Enable keyhole and rotate the key 90 degrees (the key should be horizontal).
4. Now that both interlocks are enabled, flip the Laser switch into the “on” position. The green “Laser On” light should turn on and 5 seconds later the laser should turn on.

Rotate the display selector knob in the upper right corner of the Laser Controller until the LED underneath the label “I” is lit. Adjust the COURSE CURRENT to the value given in the accompanying paperwork to place the laser on the D2 hyperfine transitions.

1.5. Laser Servo

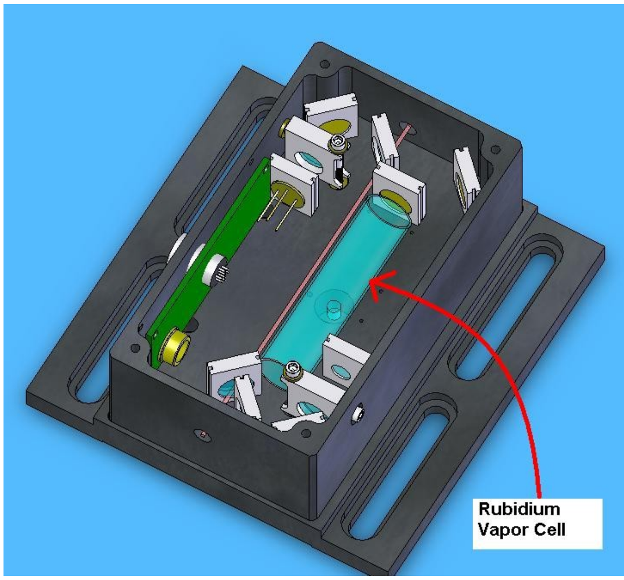
On the Laser Servo, place the LASER STATE switch into the RAMP position. Turn the RAMP AMP knob to max (clockwise). Connect a BNC cable from RAMP TTL on the **back** of the Laser Servo to the trigger input on your oscilloscope. Set trigger to ***positive*** slope.

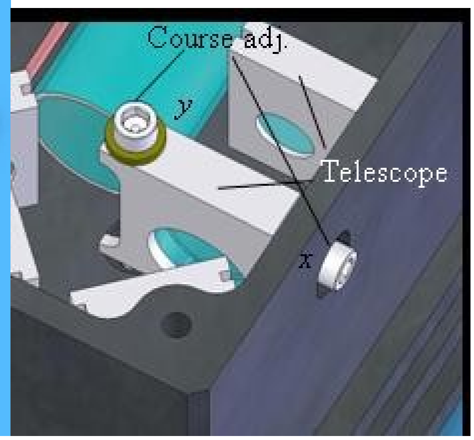
You should see the rubidium hyperfine transitions on the ERROR IN monitor. Adjust the laser current to move the transitions to the left and right. You should see something similar to the figure on the right. There are four Doppler broadened peaks. (The picture shows three of them.)



If you don’t see the hyperfine transitions don’t panic. More than likely the pickoff beams in the spectroscopy module need adjustment. Make sure all four screws are holding down the DBR and spectroscopy modules. Loosen the spectroscopy module screws and try making small adjustments while looking at the ERROR IN signal. You can also try scanning the laser current.

If you still cannot get spectroscopy, remove the screws to the top of the spectroscopy module and adjust the course steering mirror (see below).





If you still cannot get the right signal strength, see the full instructions on aligning the spectroscopy module in the Spectroscopy Manual.

1.6. Locking the laser

1.6.1. Setting up the oscilloscope for locking.

Connect a BNC cable from RAMP TTL on the **back** of the Laser Servo to the trigger input on your oscilloscope. Set trigger to ***positive*** slope. Connect a BNC cable from the DC ERROR to your oscilloscope. Connect a BNC cable from ERROR INPUT to your oscilloscope.

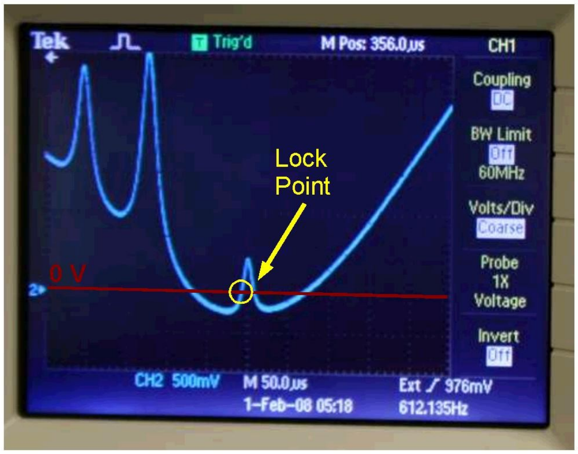
Adjust the Coarse and Fine Current control to place a transition peak at the center of the oscilloscope screen. Reduce the ramp amplitude so you can clearly see the hyperfine transitions (adjust fine current as necessary). As you lower the ramp amplitude and bring it back, you will see the spectroscopy on the oscilloscope expand and contract about a single point on the oscilloscope. The point should be near the center of the oscilloscope. Adjust the horizontal position on the oscilloscope to put this point in the ***exact middle*** of the oscilloscope screen. If you move the spectroscopy so that a hyperfine peak is centered on the oscilloscope, it will be easier to see exactly where this point is. Now as you change the ramp amplitude, the value of the trace at the center of the oscilloscope should not change. Adjust the horizontal position again if necessary.

1.6.2. Side Lock

Note: The laser locks to the point where DC ERROR crosses zero voltage with a ***positive*** slope and when the oscilloscope is triggering to the RAMP TTL with positive slope.

Adjust the laser current and ramp amplitude so you can clearly see the transition that you want to side lock to. Do not ramp too far. The desired transition should occupy most of the screen. You might see that while near a transition the value of DC ERROR moves up and down slightly as the ramp value is changed. Lower the ramp until this effect is gone.

Optional: For long term frequency stability on side lock, monitor ERROR IN on the oscilloscope, open up the top of the Spectroscopy Module, and adjust the trimpot such that your desired lock point crosses 0V on the oscilloscope.



Flip the LOCK MODE switch into the SIDE LOCK position. The laser will lock to a positive (upward) slope at the zero crossing point. If the spot you want to lock to has a negative slope, flip the GAIN SIGN switch on the Laser Servo to make the slope positive. The figure shows the lockpoint on the DC ERROR signal. (Note: the GAIN SIGN switch flips the entire spectrum upsidedown.) Adjust the DC Offset with the pot tweaker until the desired lock point is at zero volts.

Adjust the COURSE gain pot to roughly the number of turns transition you are locking, shown in the accompanying paperwork shipped with your laser system. (Turn to left till it clicks, then turn to the right the specified number of turns.)

Center the spectroscopy such that the lock point is exactly in the center of the oscilloscope. Flip the lock switch on the right from RAMP to LOCK. The DC error signal should now be reading 0V with visible noise.

Adjust the COURSE and FINE GAIN knob to minimize the noise in the DC ERROR. Too high a gain usually kicks the laser out of lock or gives rise to sustained oscillations.

Look at the LD OUT monitor. If the value is less than about 50mV then the laser successfully locked to the desired transition. If it is greater then 50mV the servo jumped to another lock point or is railed.

If the laser did not properly lock see the Laser Lock trouble-shooting section () on page .

1.6.3. Peak Lock

Note: The laser locks to the point where the DC ERROR crosses zero voltage with a ***positive*** slope and when the oscilloscope is triggering to the RAMP TTL with positive slope.

Adjust the laser current and ramp amplitude so you can clearly see the transition that you want to lock to.

If not connected, connect one of the short (~1ft) BNC's from RF OUTPUT on the Laser Servo to the RF INPUT on the Laser Controller. This is the RF dither signal.

Monitor DC ERROR. Flip the LOCK MODE switch to the PEAK position. You should see a signal that is the derivative of the spectroscopy signal. It may have a large DC offset that you will have to adjust with the DC Offset trimpot.

Note: The PHASE and DITHER AMP adjustments are factory set. You do not need to adjust these values.

The laser will lock to where the error signal crosses zero voltage with a positive slope. If your desired lock point has a negative slope, flip the GAIN SIGN switch on the Laser Servo to invert the signal and make the slope positive.

The figure shows an oscilloscope trace of DC ERROR (blue) and ERROR IN (yellow) for the ^{87}Rb F=2→ F'=2, 3 hyperfine crossover transition. Using the DC OFFSET, center the DC ERROR signal vertically about zero to insure that the lock point is at the center of the peak.

Adjust the COURSE gain pot to roughly the number of turns transition you are locking, shown in the accompanying paperwork shipped with your laser system. (Turn to left till it clicks, then turn to the right the specified number of turns.)

Adjust the laser current such that the center of the desired peak is exactly in the center of the oscilloscope. Switch LASER STATE from RAMP to LOCK. The ERROR IN signal should be held constant at the height of the desired peak and DC ERROR should be at zero volts with visible noise. If the ERROR IN value jumped when you clicked LOCK, then the laser jumped to the wrong transition or the servo is railed.

Adjust the COURSE and FINE GAIN knob to minimize the noise in the DC ERROR. Too high a gain usually kicks the laser out of lock or gives rise to sustained oscillations.

If the laser did not properly lock see the Laser Lock trouble-shooting section () on page .