

The ML-1 Polarization Stabilized HeNe Laser

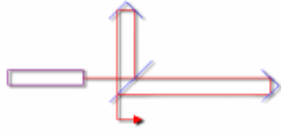
The ML-1 is a small, low cost laboratory HeNe laser. The ML-1 provides a linear-polarized, frequency-stabilized or intensity-stabilized, coherent, light source of continuous wave (CW) visible (red) laser light with a nominal output power of 1 mWatt. The ML-1 laser is ideal for laboratory measurements, spectroscopy, interferometry, and other sensitive distance measurements. The frequency of the ML-1 laser is stabilized and calibrated at the factory to provide an ideal light source wherever a visible calibrated light source is needed.

Applications

- Spectroscopy
- Distance Measurement
- Interferometry (because the laser is unmodulated it can be used in interferometers with unequal arm lengths)
- Secondary standard reference
- Wavelength calibration (for other lasers)
- Alignment of optical systems
- Absolute gravimetry and gradiometry (requiring sub-nanometer distance resolution)

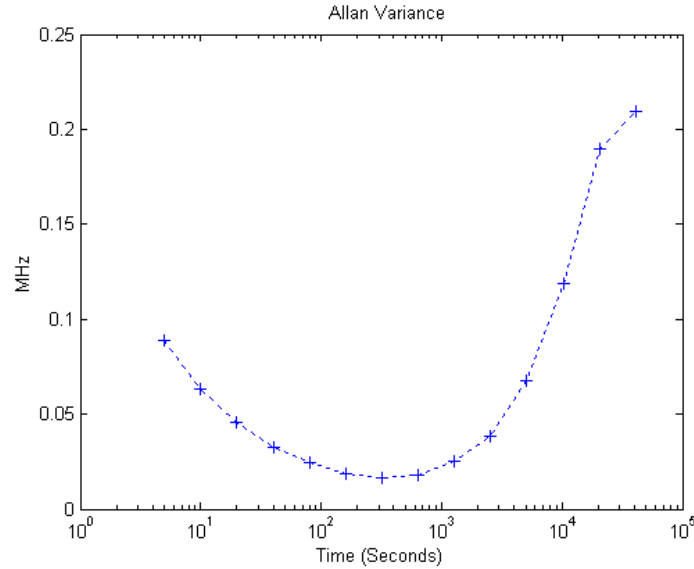
Instrument Features

- Dual Stabilized Modes
- Intensity Stabilized Mode: >0.01% over 1 hr.
- Frequency Stabilized Mode
- RMS Frequency Fluctuations (Measurement made with ML-1 locked to one side of gain curve):
- Short Term (10msec): <100 kHz (2×10^{-10})
- Long Term (days) (<1 degC room temp changes): <800kHz (2×10^{-9})
- Average of red/blue lock frequencies (stable room temperature): 500kHz/24hr or ($f/f = 1 \times 10^{-9}/24hr$)
- Long-Term Power Drift: <1%
- Intensity Fluctuations: <0.1% (rms 1Hz-10MHz)
- Absolute accuracy measured and given to user upon delivery with an accuracy of better than 10MHz (2×10^{-8}) Single Mode Purity: 1:500
- Frequency accuracy on side lock 10MHz
- Output Beam Angular Drift: <1mrad
- After Warm-Up <0.01mrad
- Warm-Up Time: Approx. 15min.
- Transverse Mode: TEM₀₀
- Beam Diameter at 1/e²: 0.63mm
- Beam Divergence: 1.3mrad
- Output Beam Polarization: Linear to >500:1
- Polarization Mode Purity: >500:1
- Frequency Lock Point: Select to red or blue side of line center

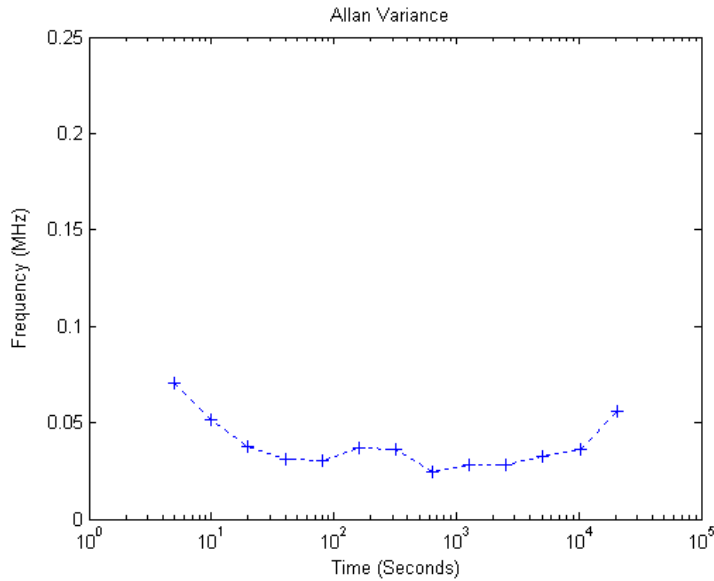


Instrument Performance

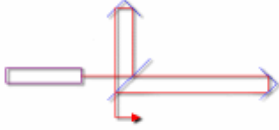
Shown below are two Allan Variances of the laser frequency when the ML1 is "beat" with an iodine-stabilized laser (primary standard frequency source). Each measurement occurred over a 24 hour period. In the first case the room temperature cycled over 2 degC, while in the second case it was stable to better than 0.4 degC. Zero on the vertical axes is an arbitrary offset in the beat frequency between the two lasers.



Allan Variance when room temperature cycles over 2 degC.

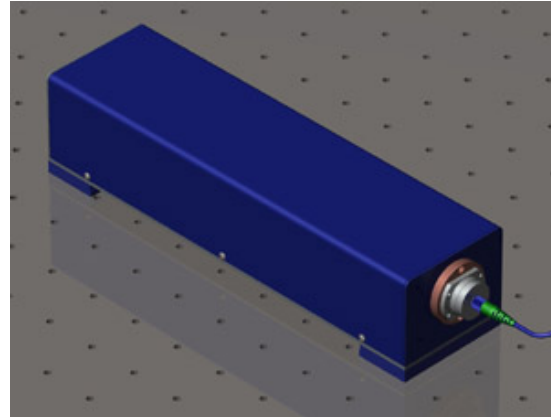
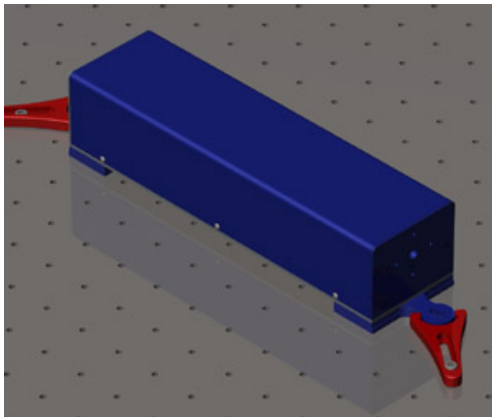


Allan Variance when room temperature cycles over 0.4 degC.



Instrument Configurations

Shown below is the ML1 housed in the thermally-controlled unit. The housing is designed for maximum flexibility in a range of applications. The laser beam exits the housing at a standard height of 2". The thermally insulating feet can be swung in for a small foot print, or out for use with standard optics table clamps (clamps sold separately). Holes in the feet accommodate both english (25.4mm spacing) and metric (25mm spacing) optics table hole spacing. The housing can also accommodate an optional fiber optic mount and optical isolator (the fiber mount is shown in the lower figure, and the isolator is located internally). The figures below show just two possible configurations.



Instrument Dimensions

The dimensions of the housing are 13.0x3.5x3.5", and the laser beam height is 2" from the bottom of the feet.

