

# D2-125 High-Speed Laser Servo

## Reconfigurable Loop Filter

The D2-125 laser servo is designed for low-noise servo control of lasers and other experimental systems. The  $PI^2D$  loop filter, with two-stage integral feedback, provides tight locking to cavities and atomic or molecular transitions.



The D2-125 provides full user control over the loop filter parameters, enabling servo loop optimization for a wide variety of plants such as current tuning, acousto- and electro-optic modulators, voice coils, and piezo actuators, etc.

The D2-125 has an internal ramp generator for determining the initial lock point. It offers a high-bandwidth servo signal for the main lock and an auxiliary servo output with low bandwidth for stabilizing a temperature loop or a PZT. The user can also program jumps in the servo signal for changing the laser frequency.

The D2-125 features Lock Guard. Designed to increase the life of the lock and therefore the quality of your data, Lock Guard will detect when the system loses lock.

Based on user-adjustable threshold and timing parameters, it will automatically reset the integrators to the last known lock point, allowing the system to recover from excessive challenges, including interruption of the error signal altogether.

Options for the D2-125 include peak locking, and AC power input.

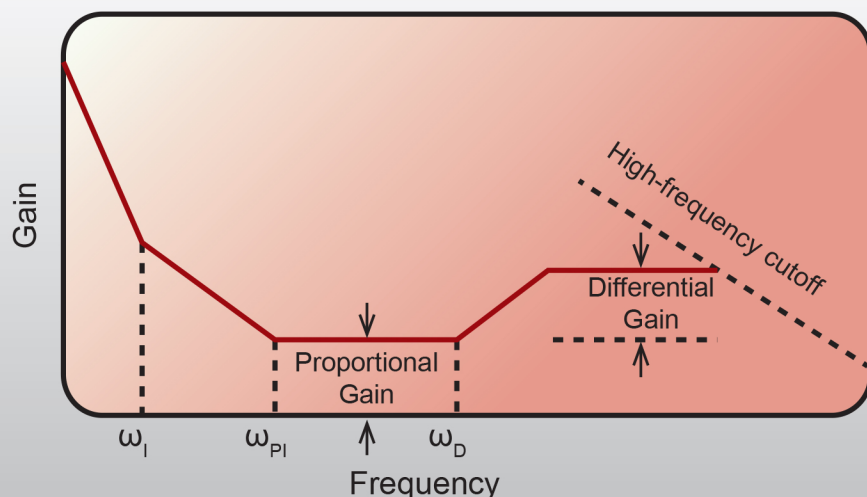
### Features:

- 10 MHz bandwidth
- Two servo loops for feedback to both laser current and temperature or a PZT
- Smooth lockup
- Absolute and relative frequency jump controls
- Integrator hold function
- Internal ramp generator
- All-analog design removes digital clock noise
- Lock Guard auto re-locking
- Peak Lock line center locking
- Ramp Centering for servoing at non-zero set point

### Applications:

- Atom & ion trapping, including BEC
- Frequency metrology and combs
- Pound-Drever-Hall cavity locking
- Laser stabilization and control
- Position control
- AOM amplitude stabilization

# D2-125 Laser Servo



*Transfer function of the D2-125. Reconfigurable PI<sup>2</sup>D loop filter parameters enable optimization for a wide variety of servo plants.*

D2-125 Specifications	
General	
Bandwidth <sup>1</sup>	10 MHz
Input Impedance	50 $\Omega$
Input Voltage <sup>2</sup>	$\pm 0.5$ V
Input Voltage Noise <sup>2</sup>	$<5$ nV/ $\sqrt{\text{Hz}}$
Output Voltage Range <sup>3</sup>	$\pm 10$ V
Loop Filter	
$\omega_I$ (First Integrator)	Off, 10 Hz - 200 kHz
$\omega_{PI}$ (Second Integrator)	Off, 100 Hz - 2 MHz
$\omega_D$ (Differential)	Off, 500 Hz - 10 MHz
Proportional Gain	-40 to +32 dB
Differential Gain	5 to 15 dB
Auxiliary Servo Output	Integral: 60 ms to 6 s
Monitors	
DC & AC Error, Input, Ramp & Ramp TTL, Servo Output	
Options	
-PL	Peak Lock
-IP	Internal Power <sup>4</sup>

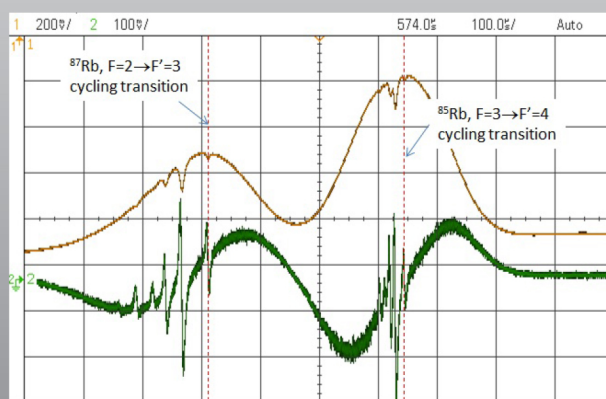
All specifications subject to change without notice.

<sup>1</sup>Oscillation frequency when servo is locked to itself in proportional mode

<sup>2</sup>Referenced to a 50  $\Omega$  input load

<sup>3</sup>Driving a high-impedance load

<sup>4</sup>Wall voltages of 100, 110, or 230 VAC specified at time of order



*Doppler-broadened and Doppler-free spectra of D2 hyperfine transitions of Rb*

The Peak Lock option for the D2-125 provides a modulation signal and demodulates the incoming error signal with adjustable phase. The resulting first derivative error signal (green in figure) allows locking at the peak of a transition without an external modulation source and lock-in amplifier.