

# Servo Controller

- Pound Drever Hall Locking Scheme
- High Speed Servo Controller
- Modulator Demodulator

## Optical Cooling & Trapping Ultrastable Laser Systems

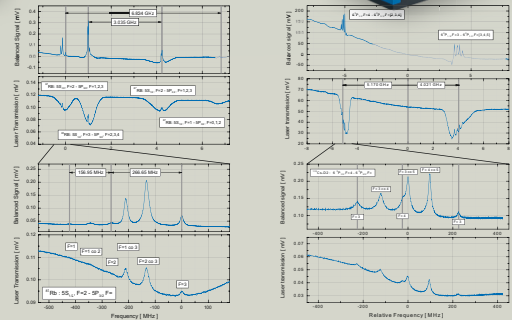
### LOCKING SCHEMES

- Side Of Fringe
- Top Of Fringe
- Pound Drever Hall
- Bjorklund

### MOT & REFERENCE CELLS

- Rubidium Cesium
- Potassium Lithium

<sup>7</sup> Li	<sup>85</sup> Rb	<sup>39</sup> K	<sup>133</sup> Cs
671 nm	780 nm	766 nm	852 nm



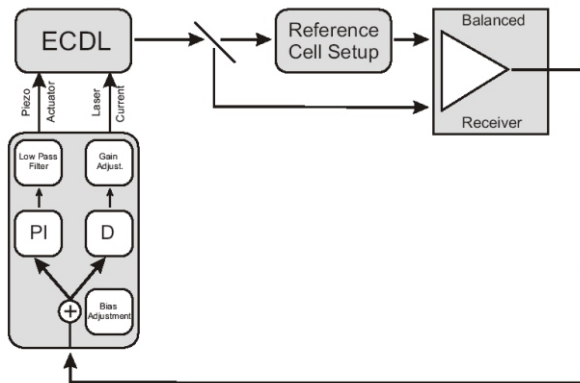
D2 Transitions in Rb, central wavelength 780.27nm

D2 Transitions in Cs, central wavelength 852.347 nm

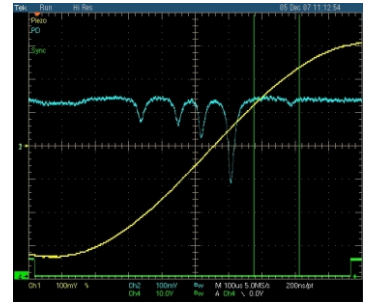
## Application Examples

Several types of laser stabilization schemes are known in literature. We summarized some of the most common types of locking schemes as block diagram. The oscilloscope screen shot shows a typical view of the spectroscopy, before applying the lock.

### Side of Fringe Type of Lock

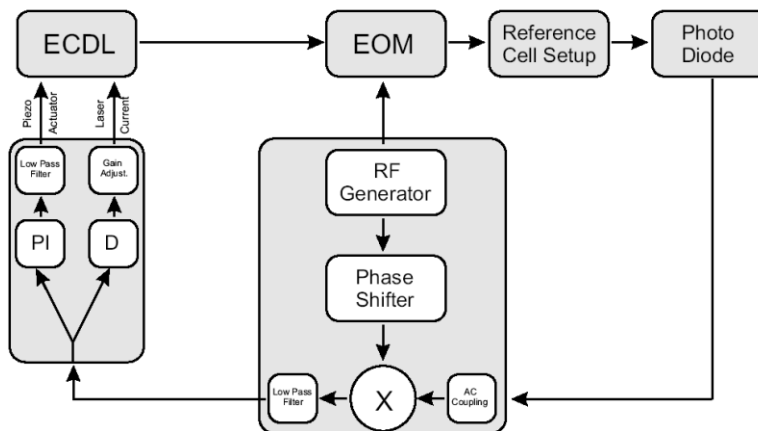


Rubidium D2 Line

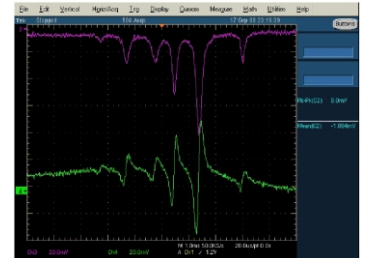


Saturated Rb Spectrum

### Pound Drever Hall Type of Lock



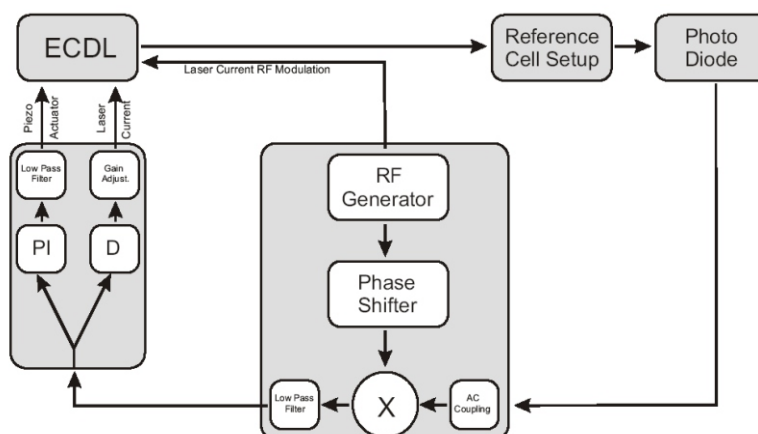
Rubidium D2 Line



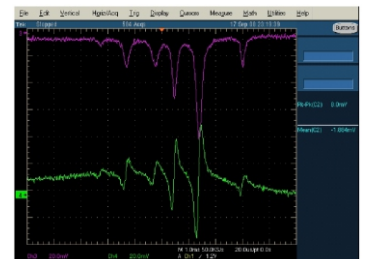
Red Curve:  
Saturated Rb Spectrum

Green Curve:  
Phase Modulated Spectrum

### Bjorklund Type of Lock



Rubidium D2 Line



Red Curve:  
Saturated Rb Spectrum

Green Curve:  
RF Modulated Spectrum

## Product Features

High speed FPGA controlled proportional integral (PI) servo controller for external cavity diode laser systems as well as DFB diode lasers. Model LB2001 allows to stabilize the laser frequency via piezo- and laser current feedback path.

High frequency Modulator/Demodulator for Pound Drever Hall type of lock. Model Lb2005 is prepared for operation with the Servo Controller LB2001 for generating a Top of Line type of lock.

Both Models enable an easy, intuitive and highly stable Top of Line type of lock.



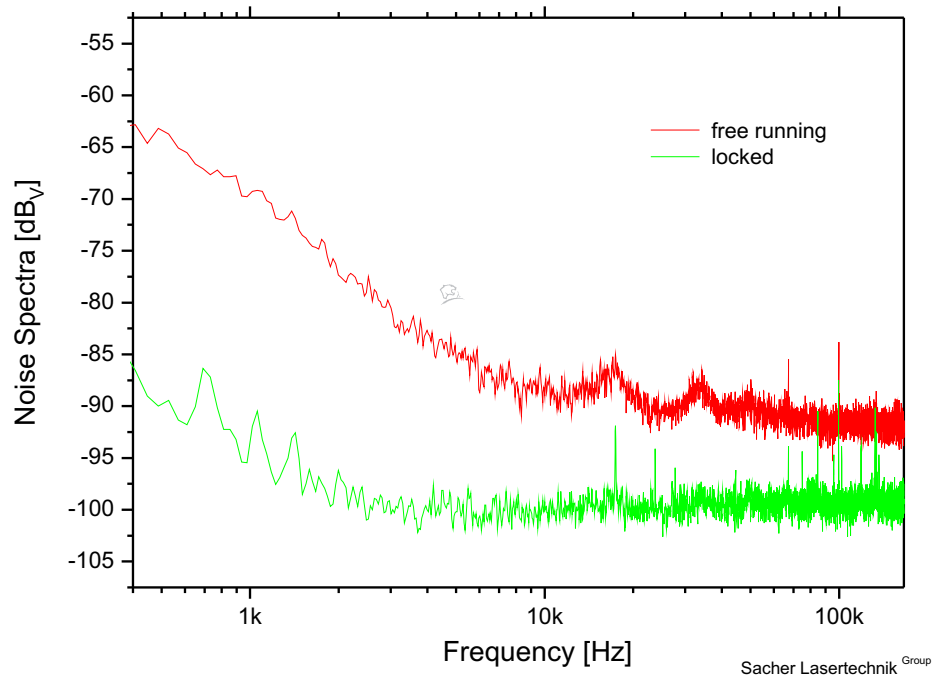
## Specifications

<b>Servo Controller (Lockbox)</b>		<b>Modulator Demodulator (Pound Drever Hall)</b>	
PI Corner Frequency (high)	1Hz .. 1MHz (HF Path)	Modulation Frequency	1kHz .. 100MHz
PI Corner Frequency (low)	1 Hz .. 100kHz (LF Path)	Phase Delay	0° .. 360°
Amplification	-40dB .. +40dB	Modulation Amplitude	up to 0dBm
Input Impedance	1MΩ	Modulation Amplitude	up to 20dBm (optional)
Output Impedance (high)	50Ω	Input Impedance	50Ω (Photodetector)
Output Impedance (low)	1MΩ	Output Impedance	50Ω (RF Modulation)
Low Frequency Limit		Output Impedance	50Ω (Error Signal)
Integration Hold Mode		Frequency Generation	2 x DDS
<b>Internal Data</b>		<b>Internal Data</b>	
Processor	300MHz FPGA	Processor	300MHz FPGA
D/A Converters	sleeping mode	System Clock	3GHz
System Bandwidth	10MHz	System Bandwidth	up to 100MHz
<b>Common Data (Remote Control)</b>		<b>Common Data (General)</b>	
Interface	USB	Dimension (WxHxD)	270 x 110 x 320 mm
Remote Control	Software Package	Weight	< 5kg
		Line Voltage	115V / 230V +/- 10%
<b>Flexibility</b>		Line Frequency	50 .. 60Hz
Stand-Alone Unit		Warm-up Time	10min
Laser Manufacturer independent		Storage Conditions	-25 .. 70°C
		Operating Temperature	0 .. 40°C

## Application Example

### Noise Reduction and Linewidth Narrowing

Comparison of noise spectra for 780nm DFB diodelaser



The graph shows the effect of applying the high bandwidth type of lock to the noise figure of the laser system. The red curve shows the noise figure of a free running DFB laser. The green curve shows the noise figure of the locked DFB laser. This significant reduction of the RIN noise results into a linewidth narrowing of the laser.

## About Sacher Lasertechnik

### Company Profile

Sacher Lasertechnik is leading manufacturer of tunable external cavity diode lasers (ECDLs) with more than 20 years of experience. The product range includes anti-reflection coated diode lasers, ECDLs in Littrow and in Littman/Metcalf configuration as well as driver electronics for the LD and sophisticated measuring electronics. Please contact us with your measurement requirements. We would be proud to support you with our competence.

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