WAVELENGTH LOCKING WITH THE LB1005 SERVO CONTROLLER

Features of the LB1005 High-Speed Servo Controller

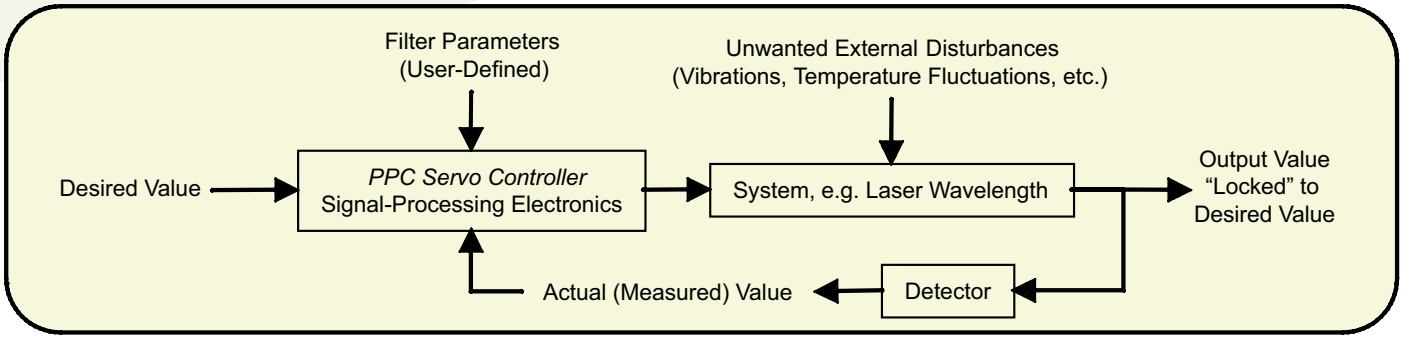
- ***>10-MHz bandwidth***
- ***Adjustable P-I corner frequency***
- ***Adjustable servo gain & low-frequency gain limit***
- ***Adjustable output voltage clamping***

While narrow-linewidth lasers are used throughout atomic, molecular, and optical physics, their short-term wavelength stability is often not adequate for many applications without active stabilization. Feedback (or servo) control forces a system, such as a laser, to stay actively "locked" to a desired value, e.g., a specific wavelength—automatically correcting for external disturbances that might cause the system to deviate from the desired value.

The Precision Photonics Corporation (PPC) LB1005 Servo Controller provides critical signal-processing electronics for performing the feedback control. In the case of wavelength locking, an error signal is generated by transmitting a portion of the laser output through a gas cell or etalon wavelength reference. Any wavelength instability is converted to an amplitude change that can be detected by a photodetector. The resulting error signal is filtered by the LB1005 Servo Controller to form a control signal that is sent back to the laser. (See the schematic below.)

The LB1005 Servo Controller consists of three stages of analog electronics processing: Input Stage, Filter Stage, and Output Stage. (See the figure on the back.) The Filter Stage is the most important because it sets the behavior of the system. The user controls three important filter parameters that impact the stability of the system, and how well the actual output matches the desired value.

Schematic of a General Feedback Control Loop



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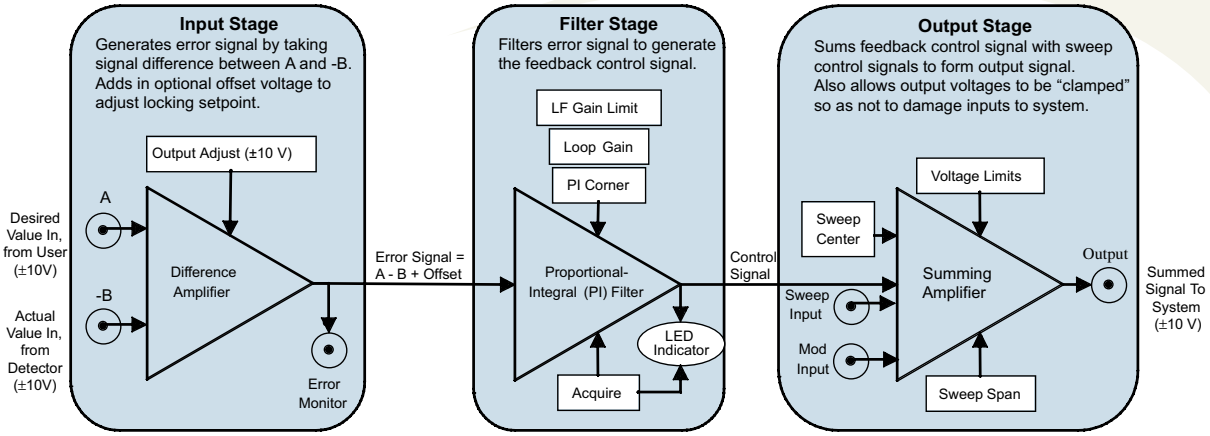
LB1005 Servo Controller Architecture



Example: Wavelength Locking

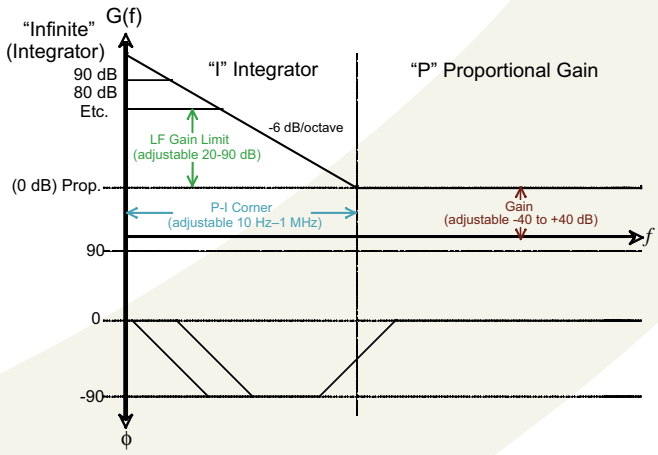
The wavelength of narrow-linewidth tunable lasers drifts due to floor vibrations, small temperature drifts, and even acoustic noise from people talking in the vicinity of the laser. By using the piezo-electric transducer (PZT) input to the laser controller, you can shift the laser wavelength so that it always stays fixed on the side of the much more stable resonance line shape of the sample gas, regardless of possible external disturbances.

To acquire lock, find the locking point by adjusting Sweep Center and Sweep Span (and sometimes Offset Adjust). (See the figures below). Upon locating the locking point, the Acquire switch is used to turn on the feedback control. The Sweep Span is then turned OFF, and the Gain can be adjusted to optimize servo control.

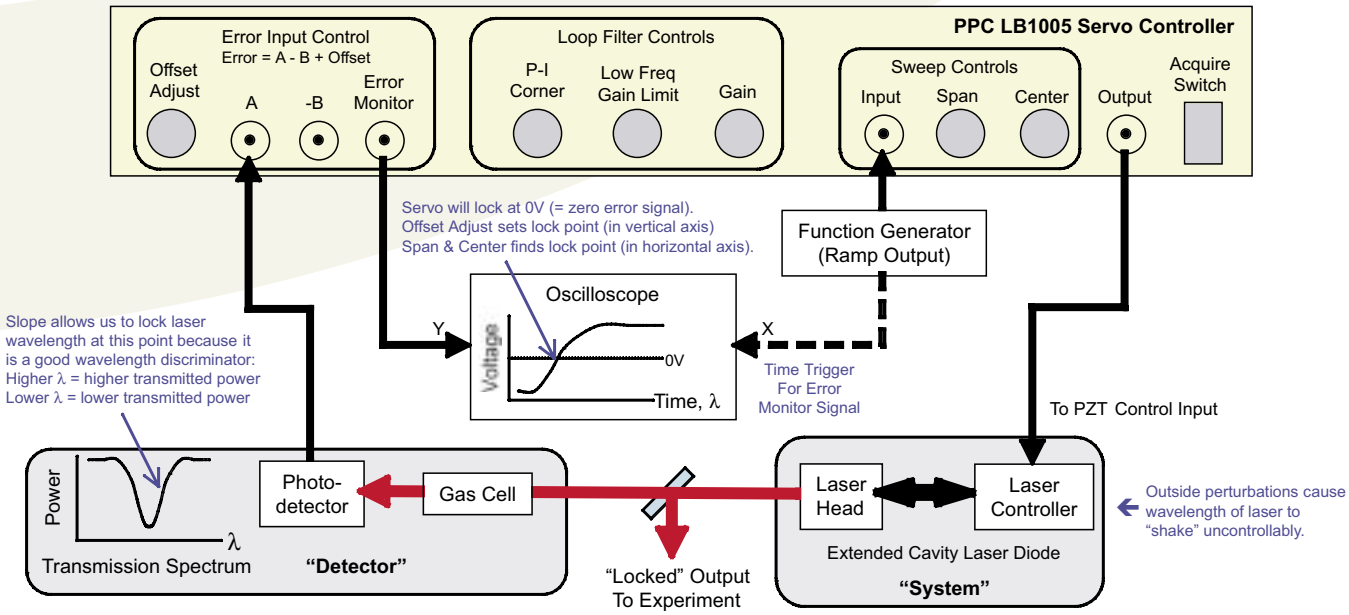
For more information, contact us at info@precisionphotonics.com.

LB1005 Servo Controller Transfer Function

Proportional Integral Filter with Low-Frequency (LF) Gain Limit



Simplified Wavelength-Locking Application Using the LB1005 Servo Controller



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