Digipdh



Overview

DigiPDH is the perfect tool for laser frequency stabilization based on the Pound-Drever-Hall principle.

It extends the modulation / demodulation capabilities of TEM's *LaseLock*[®] universal laser locking device into the radio frequency (RF) range.

DigiPDH comprises a digital sinusoid signal generator with adjustable frequency between 3MHz and 120MHz and a corresponding phase-sensitive RF receiver with up to 12MHz IF (error signal) bandwidth.



Principle of Operation



The *DigiPDH* receiver mixes the RF input signal (from a photodiode, e.g.) with the local oscillator, thus providing the error signal as a DC signal or at some user-selected intermediate frequency (IF). The conversion gain is adjustable from 0 to +20dB. The generic IF bandwidth of 12MHz is reduced to 1MHz by default. In order to obtain the full bandwidth, the user can simply remove a socketed capacitor.

Within a Pound-Drever-Hall setup, the signal generator acts as local oscillator for laser phase or frequency modulation. Its adjustable output power of up to +10dBm at 50 ohms suffices to drive resonant EOMs. It also features

a return power measurement that helps to find the resonance frequency by minimizing the reflected power.

Versions, Options and Customization

DigiPDH is available as single-channel or dual-channel version. In the latter, the two LOs and RF receivers can be used independently or in a combined way, i. e. at the same frequency with fixed phase relation, for example for to stabilize two subsequent SHG stages.

The second channel could as well be used to drive an AOM as a chopper in a FM spectroscopy set-up.

TEM Messtechnik offers a variety of customizations for the DigiPDH. For example, the receiving mixers can be extended into I/Q receivers, i. e. providing the IF (error signal) as sine and cosine signals. In combination with the reflected power detection, the 2-channel DigiPDH can be transformed into a vector network analyzer.

Integration with LaseLock®

DigiPDH neatly integrates into TEM Messtechnik's *LaseLock®* general laser stabilization system. The IF outputs provide the error signal for the control loop and are therefore internally connected to the *input "a"* or "b", resp., of the LaseLock signal processor.



Application example



TEM Messtechnik recently presented a very robust iodine FM spectroscopy unit. Using DigiPDH integrated in a LaseLock device, the system could lock a Coherent Prometheus diode-pumped Nd:YAG ring laser to the hyperfine spectrum of iodine.

The stability was ~8.5Hz (Allan deviation at 1000s averaging time, measured versus the optical frequency comb generator at PTB.

Technical Data

- Oscillator frequency: adjustable 3 ... 120MHz
- Oscillator output power -40 ... +10 dBm @ 50 ohms
- Oscillator output return power / SWR measurement
- Phase detector sensitivity -20dBm for 1Vpp error signal
- Phase adjustment range 0 ... 360°
- Error signal bandwidth max. 12MHz (default: 1MHz)
- optional: reference frequency input
- optional: I/Q phase detection
- Available as single channel or dual channel version

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