

PHILL™ DATASHEET

Invisible-Light Labs GmbH



PHILL V7.01

PHILL is a cutting-edge resonance actuation and tracking device, specifically designed for resonant sensors. It features a self-sustaining oscillator (SSO) and utilizes a frequency counter-based architecture, which is enhanced with wide band-pass and digital low-pass filtering. Such configuration optimally conditions signals by converting sinusoidal signals into precise rectangular waveforms. This initiation of the pulse generation mechanism effectively drives the resonator, ensuring accurate frequency data and robust stability without intermodulation noise.

PHILL offers the same frequency stability as systems using a Phase-Locked Loop (PLL) with a lock-in-based approach. Unlike PLL systems, PHILL maintains frequency stability without ever losing 'lock'. This is due to its ability to freely select the oscillator bandwidth in the frequency counter, independent of circuit constraints. Additionally, PHILL simplifies operations by eliminating the need for PID parameter adjustments to track the resonator phase, combining ease of use, robustness, response speed and precision in performance.

FEATURES

- Resonance Mode selection
- Frequency data acquisition
- Positive feedback oscillation driving and measurement in one system
- Extremely stable oscillation frequency tracking and driving
- Integrated pre-amplifier
- OEM-Software
- Robust and easy-to-use

APPLICATIONS

- NEMS and MEMS chip sensor measurements
- Quartz crystal balance measurements
- Temperature control of resonator
- Calibration of the oscillation frequency of resonators

KEY CHARACTERISTICS

- Plug-and-play Micro-USB connection to PC
- Communicates between EMILIE and your spectrometer software
- Data visualization and processing for stand-alone systems

SPECIFICATIONS

Table 1. General specifications

Supply voltage	5V DC
Current consumption	4 A
I/O	Sensor In (BNC), Drive (BNC), Frequency Out (BNC), EMILIE Connector (SUB-D)
Host connection	Micro-USB 2.0, 480 MBit/s, Ethernet 10/100/1000 MBit/s
Operating environment	IEC 61010, indoor, installation category II, pollution degree 2
Storage temperature	+5°C - +35°C
Operating temperature	+5°C - +35°C
Device weight	0,7 kg
Dimensions	230 mm x 172 mm x 55 mm

Table 2. Analog Input

Input frequency range	1 kHz - 1 MHz
Input impedance	10 kΩ
Input voltage	±1 V DC
A/D conversion	12 bits, 80 MSa/s

Table 3. Analog Output

Frequency counter output frequency	3 kHz - 1 MHz
Resonator drive output frequency	1 kHz - 1 MHz
Frequency counter output voltage	±3 V DC
Resonator drive output voltage	±3 V DC
D/A conversion	14 bits, 200 MSa/s

Table 4. Preamplification

Amplification stages	1, 3, 10, 30
Bandwidth	1 MHz
Slew rate	30 V/μs

Table 5. Band-pass filter

Center frequency range	1 kHz - 1 MHz
Maximum Q-Factor	1000
Gain	1
Fractional frequency fluctuation	10^{-9} @ 100kHz input signal and 1s averaging

Table 6. Frequency counter

Resolution @ 100 kHz with no averaging	1 Hz
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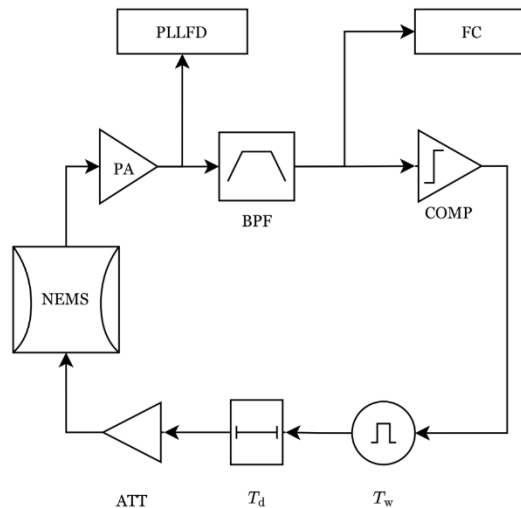
Table 7. Frequency output filter

Cut off	1 Hz - 10 kHz
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Table 8. Scope

Input channels	Signal input, bandpass out, drive
Trigger channels	Signal input, bandpass out
Trigger modes	Edge
Sampling rates	100 kSa/s to 20 MSa/s
Vertical resolution	14 bits
Bandwidth limit mode, vertical resolution increase	Sample decimation, averaging

CONCEPT



Block representation of the SSO tracking scheme

LAYOUT

