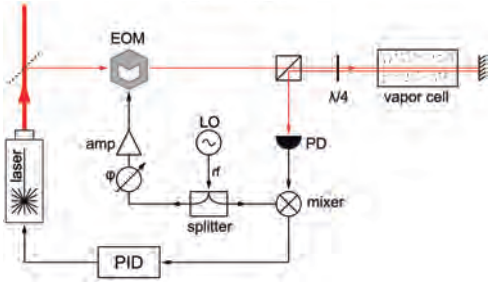
N E W P A R T N E R

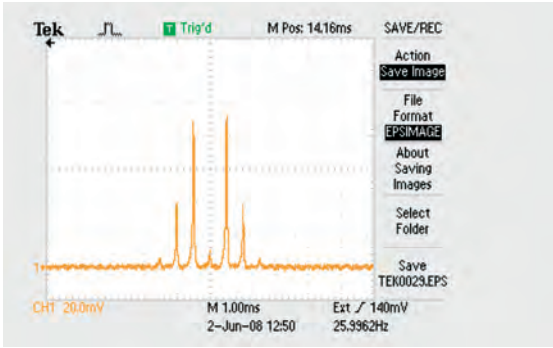
QUBIG GmbH was started in 2008 by two young researchers in ultracold atomic physics with the intention to make sophisticated and proven developments of a highly specialized fundamental research lab available to a broader community. Both managing directors, Dr. Anton Öttl and Enrico Vogt, have extensive scientific know-how and practical experience in laser optics, high-frequency technology and mechanical design acquired at several renowned international research institutes. QUBIG GmbH headquarters and production are both located in Bavaria, Germany.

High-Quality electro-optic Modulators

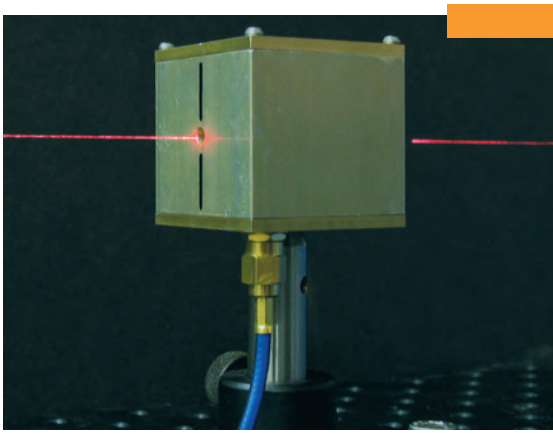
QUBIG GmbH offers a line of cutting-edge, highly efficient electro-optic modulators (EOM) mainly for applications in laser spectroscopy and frequency stabilization. Their resonant high-Q electro-optic modulators provide exceptional ease of handling and require remarkably low radio-frequency (rf) drive power. The output power of a regular VCO/function generator is typically adequate, thereby eliminating the need for costly high-voltage drivers. These state-of the-art EOMs are designed by and tailored for researchers working with free-space optical setups requiring a straightforward device to create sidebands for frequency locking techniques.

FM Spectroscopy Laser Lock





Parameter	Value	Unit	Comments
Resonance Frequencies	20, 80, 120	MHz	1 MHz - 3 GHz upon request
Quality factor	~ 100		typically
Modulation depth	~ 0.8	rad/Volts	frequency dependent
Electro-optic crystal	LiNbO3	Y-cut	KTP upon request
damage threshold	2	W / mm2	High power version available
Crystal size	3 x 3 x 30	mm	2 x 2 x 20 upon request
Wavelength range	0.5 – 4	Ìm	
AR Coating (R<0.5%)	650 - 900	nm	Other coatings available
Optical transmission	>95	%	
Laser polarization	s / p		Linear polarisation
Max. rf power	1	W	High power version available
Impedance	50	Ohm	
Rf bandwidth (tuning range)	1	%	Of the resonance frequency
Connectors	SMA		BNC, SMB upon request
Cube dimensions	40	mm	25 mm , 30 mm available
Clear Aperture	3	mm	



Features:

- fixed frequency high Q resonance
- high efficiency – low drive power
- large aperture & easy alignment
- can be mounted in any orientation for s- and p-polarization
- reliable, compact design
- optimized to work with common function generators

Applications:

- optical sideband generation
- laser frequency stabilization (fm lock)
- cavity-laser lock (Pound-Drever-Hall technique)
- high-speed polarization rotators
- frequency shifting

Options:

- custom wavelengths from 1MHz – 3GHz possible
- tunable frequency and high power version to come
- different electro-optic crystals
- custom optical bandwidth
- custom dimensions and connectors
- broadband modulation

Operating principle: A tuned rf cavity (tank circuit) boosts the applied voltage by a factor of ~100 across the electro-optic crystal. The alternating voltage induces a change in the crystals refractive index, thereby modulating the phase of a linearly polarized laser field passing through it. Since a time-varying phase is equivalently a frequency, this modulation is expressed in the formation of sidebands on a monochromatic laser at +/- the drive frequency. Many applications in laser technology, like frequency locking rely on such a well defined triplet of frequencies, where two sidebands are +/-90 degrees out of phase with the carrier. The amplitude of these sidebands is given by Bessel functions in terms of the modulation index, being essentially proportional to the drive voltage. By driving the EOM harder it is possible to create higher-order sidebands and completely suppress the carrier. This happens at a modulation index ~ 2.4. The maximum intensity that can be transferred into each first sideband is about 33% of the total (modulation index ~ 1.8), therefore these EOMs are also suitable as frequency shifters, especially in frequency ranges not easily accessible by acousto-optic modulators (AOM). Moreover, in contrast to AOMs the additionally generated frequencies are all perfectly within the same spatial mode of the laser beam, which is especially useful when multiple frequencies are needed, e.g. for repumping in atomic physics.