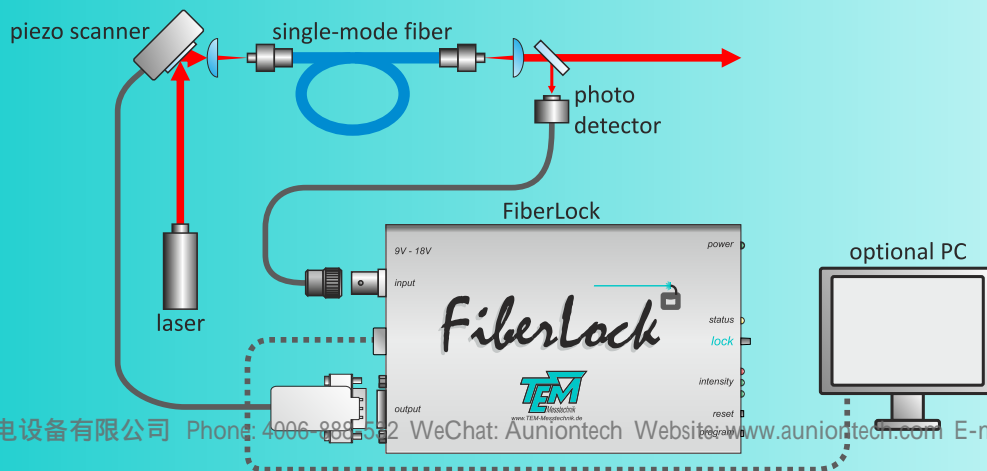# FiberLock®

Automatic single-mode fiber coupling

- single-mode fiber coupling is set up within seconds
- automatic multidimensional tracking
- compensation of thermal and mechanical drifts
- easy optimization of coupling optics
- NoiseEater mode
- 3D visualtization of the coupling efficiency and intensity logging

Principle

FiberLock

Usually, coupling into single-mode fibers is a time-consuming task since mechanical positioning with sub-micrometer precision has to be performed. Expensive moving or tilting units with very good long-term stability have to be used.

With the *FiberLock*, the laser beam is scanned two-dimensionally by special piezo actuators with up to kHz frequencies and by up to several hundreds of micrometers. The light transmitted through the fiber is detected by a photo detector and is then displayed in 'real-time' as a 3D-view on a PC. Thus, the coupling can be monitored and optimized, e.g. by shifting or tilting of the focussing optics. This three-dimensionally displayed coupling profile can be viewed from any direction.

bad focus   improved focus   optimized focus
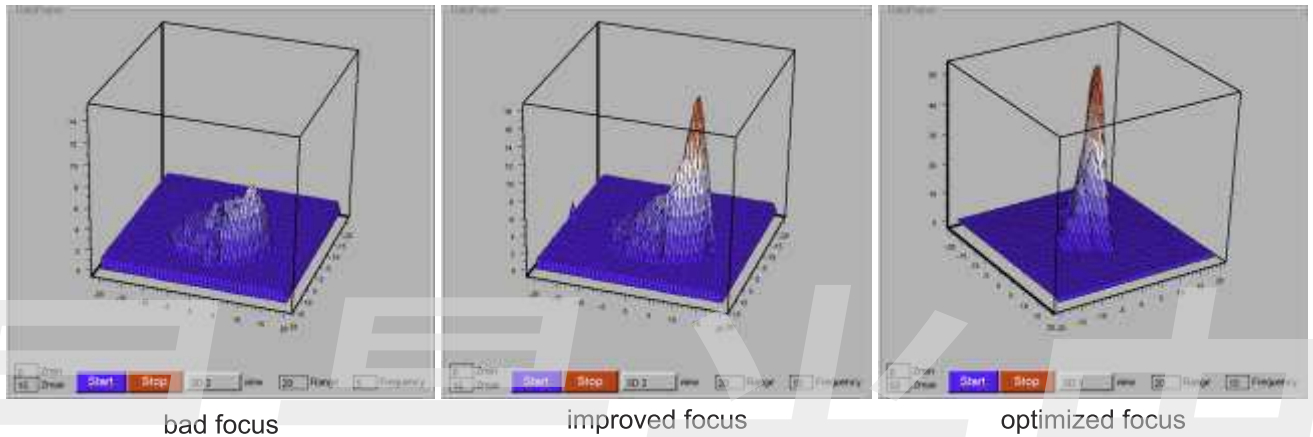
Lock: Once an intensity peak is found, the *FiberLock* can lock the piezo scanner to the point of maximum coupling efficiency. This is done with small circular modulations of the scanner angle and 2D lock-in regulator. While in lock, other degrees of freedom (e.g. the focus) can be optimized "live" in a fast and convenient way.

NoiseEater mode: In addition to locking to the maximum intensity, the *FiberLock* can smooth intensity fluctuations by constantly adjusting the quality of the fiber coupling. The circular modulation of the scanner is now changed to follow a geodesic orbit, which cancels all intensity noise introduced by the fiber coupling or elsewhere along the optical path.
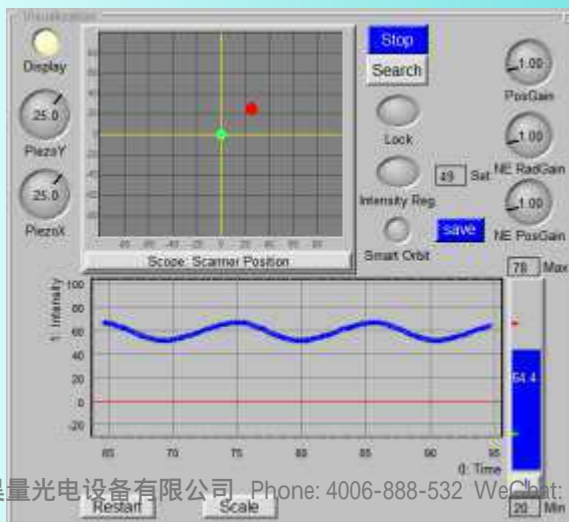
In lock, the regulator gain and the size and shape of the modulation circle can be adjusted to account for different noise environments and beam shapes. A display for the scanner position and a chart recorder for the intensity make these further adjustments easy to perform.

Intensity thresholds control the LEDs on the front of the FiberLock to allow easy operation without a PC.

Control Electronics

FiberLock electronics: contains all necessary electronic components in a compact package:

- an input amplifier with adjustable gain allows to stabilize on a wide range of signals (0 - 10V or transimpedance input).
- a fast piezo amplifier is integrated (+/- 30V for the standard actuator, other voltages, e.g. 0 - 150V, on request).
- a 32-bit microcontroller handles the signal processing, including a scan generator, two lock-in regulators, data processing for the 3D display and USB communication.

Software

Kangoo: comprehensive control program
- visualization of all µController parameters
- logging of intensity values vs. time
- 2D scanning and 3D data visualization
- fully scriptable
- compatible with Windows 7, Vista, XP, 2k, 9x (and Linux via wine)
- plain-text communication with the µController for simple integration with other control software
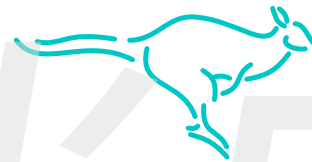
Opto-Mechanics

BeamScan LV: standard 2D actuator
- large angle scans (~25mrad)
- medium speed (~ 1khz)
- 10 x 15mm mirror
- low voltage operation (+/- 30V)
- mounts on standard 1" or 25mm mirror mounts

BeamScan 1-inch: high-speed 2D actuator
- medium angle scans (~2mrad)
- high speed (up to ~10kHz)
- high-voltage operation (0 - 150V)
- standard 1" or 25mm mounts
- flexible mirror size

We supply a wide range of actuators for optics applications, which are easily paired with the FiberLock electronics, and we are happy to build custom-made designs. Please contact us for details.

FiberLock

Dimensions:

control electronics: 170 x 130 x 35 mm, for mounting on optical tables
BeamScan LV piezo actuator: 40 x 40 x 20 mm (fits 1" mirror mounts)
    mirror size: 10x15mm

Interfaces: USB
protocol: clear text ASCII commands, internal script language
    including visualization and measurement software
    incl. user-spec. adaptations, LabView VIs on request

FiberLock **Control Unit**

µC: AVR32 controller
electrical supply: 9 - 18V DC power Adapter, 1.5A
power consumption: < 30W (10W typ.)

number of input channels: 1 (with voltage or current pre-amplifier)
number of piezo driver outputs: 2 (+/- 30V or 0 - 120V)

Subject to change without notice

Development, Manufacturing and Distribution

TEM Messtechnik

10/2014