

## Active Laser Beam Stabilization

- [Laser beam stabilization "Compact"](#)
- [Laser beam stabilization "Dynamic"](#)
- [Real-time position detector "XY4QD"](#)
- [Laser shutter "Beamblock"](#)
- [Automatic laser beam adjustment](#)
- [Download product information and manuals](#)

### Overview

We offer two different products for real-time laser beam stabilization. Both systems are very stable and do not require any user interactions. They are equipped with useful operation and safety features for a fast integration into different laser setups. The [Compact](#) stabilization system is very compact and flexible, whereas the [Dynamic](#) stabilization system offers a higher bandwidth.



In addition we offer a fast [real-time beam position detector](#) and a [laser shutter](#). Both components can be used as integral parts of the beam stabilization systems but also as stand-alone products.

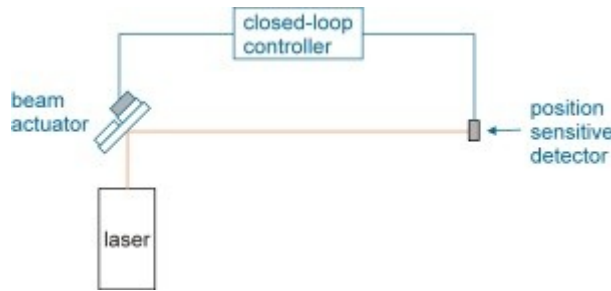
Finally, we offer the [Self-learning](#) adjustment and positioning system that enables the adjustment of a laser beam in free space.

### Applications

- Automated positioning of laser beams
- Fast delivery of laser beams to changing applications
- Laser beam stabilization
- Precise motion and vibration control
- Compensation of laser beam pointing
- Compensation of spatial deviations between a laser and its application
- Robust and reliable laser beam alignment

## Working Principle

The working principle is shown in the figure below: Actuated mirrors adjust the laser beam to any direction defined by position-sensitive detectors.



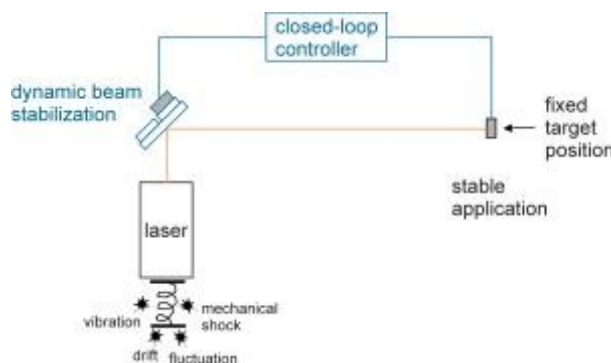
The beam stabilization systems automatically adjust a laser beam to a defined position. They also level out changes in the laser beam direction and stabilizes its position in real-time, which means an active compensation for internal and external vibration sources as well as fast and automated correction of laser beam misalignment or pointing.

They make use of one or two Piezo-controlled mirror actuators and position-sensitive 4-quadrant diodes. In the set-up with one 4-quadrant-diode, the diode is located close to an application, where a stable position of the laser beam is required. By addition of a second detector and a beam shuttle, the laser beam can be delivered to a second application.

If the application is highly sensitive to angular deviations, a second Piezo-driven mirror actuator with 4-QD can be used to fix two points in space.

## Application example

Compensation for laser drift. The Dynamic beam stabilization eliminates critical changes of laser beam direction due to vibration, mechanical shock, thermal drift, or other fluctuations of the laser output.



## Common features of all systems

- Closed-loop active control
- Positioning of cw- and pulsed (repetition rate > 100 Hz) lasers
- Positioning of ultrafast (ps, fs) lasers
- Control electronics can be optimised for different repetition rates
- System can be adapted for variable laser powers and wavelengths

- Mirror mounts can be adjusted manually for fast pre-alignment
- Control range and accuracy depend on the beam size and the distance between mirror and detector
- Flexible connectors
- OEM versions available

Back to [top](#)

## "Compact" laser beam stabilization



### Special features

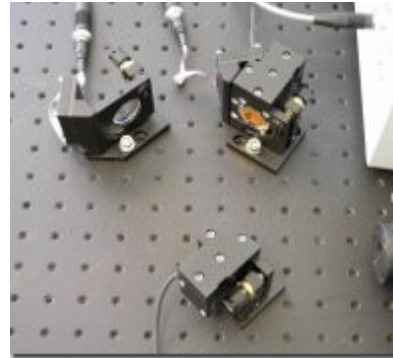
- very compact
- very stable
- no user interaction required
- very cost-effective solution
- can be used with different actuators

### Specification

- Adjustment time: Realtime operation (bandwidth: up to 100 Hz)
- Range: The maximum tilting range of the Piezo actuator is 2 mrad
- The controller, the high-voltage power supply and the amplifiers for the Piezos are integrated into a very compact housing (Eurocard size).
- Display of laser power level directly at the detectors
- Data output of position
- Additional operation and safety features (see manual)

Back to [top](#)

# "Dynamic" laser beam stabilization



## Special features

- high bandwidth
- very stable
- no user interaction required
- all electronics in 19" rack
- adaptable for very low laser powers

## Specification

- Adjustment time: Realtime operation (bandwidth: up to 300 Hz)
- Range: The maximum tilting range of the Piezo actuator is 2 mrad
- The controller, the high-voltage power supply and the amplifiers for the Piezos are integrated into a 19" rack.
- Display of laser power level on controller front panel
- Data output of position
- Additional operation and safety features (see manual)
- High sensitivity of detectors (down to tens of nJ or a few nW)

## Specification Dynamic-2

- Band width: up to 1 kHz
- Tilting range: up to 4 mrad

Back to [top](#)

## Real-time position detector "XY4QD"



This detector with integrated signal processing determines laser fluctuations with highest spatial and temporal resolution. The measuring principle allows for the inspection of single laser pulses. Thus, the position detector enables the characterization and quality assurance of lasers. Optionally the detector can be equipped with LED displays for power level and x and y position.

### Specification real-time position detector

- Bandwidth: up to > 100 kHz
- Sensitive area: 10 mm x 10 mm
- Spectral range: 320 - 1,100 nm
- Length/width/height: 50 mm x 41 mm x 20 mm
- Connectors: MCX

Back to [top](#)

## Lasershutter "Beamblock"



The laser shutter system "Beamblock" is especially designed for blocking laser beams with high intensities. It comprises a laser shutter and a shutter control unit that enables different operation modes (external, confirm, manual).

### **Specification shutter**

- Aperture: 10 mm
- Connector: LEMO 00
- Length/width/height: 55 mm x 38 mm x 50 mm
- Weight: 190 g

### **Specification shutter control**

- Input "OK/external": Logic / TTL level, socket LEMO 00
- Output "Shutter": 0V / 12V, socket LEMO 00
- Length/width/height: 90 mm x 58 mm x 38 mm
- Weight: 120 g

### **System data**

- Opening time for beam release: 15 ms
- Closure time for beam blocking: 48 ms

### **Customization**

We can also provide customized versions. The following photo shows the example of a miniaturized shutter for the compact integration in setups with limited space.

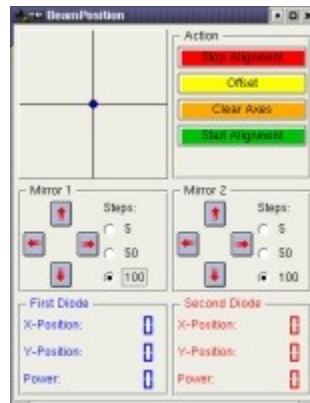


### **Data of shown miniature shutter**

- Aperture: 5mm
- Bistable design
- Length/width/height: 25 mm x 12 mm x 10 mm
- Weight: 7g
- Mounting thread: M2

Back to [top](#)

# Self-learning laser beam positioning for moving targets

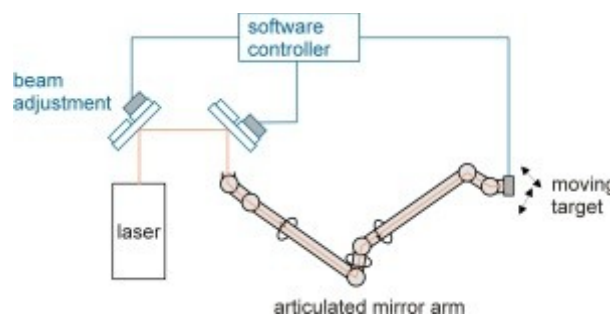


This system is based on a micro-controller and a self learning software algorithm. The algorithm finds the orthogonal axis of the detectors enabling a fast adjustment of the laser beam by means of a standard two-mirror alignment process.

It makes use of two picomotor<sup>™</sup>-driven mirrors and two position-sensitive 4-quadrant diodes. The mirrors adjust a laser beam onto any direction defined by the 4-quadrant-diodes. In a preferred setup, the diodes are directly connected to an instrument with a changing orientation in space (e.g. handpiece with articulated mirror arm).

## Application example

Beam alignment through articulated mirror arm. The Self-Learning beam positioning determines the orientation of the target and adjusts the laser beam onto the optical axis. This setup compensates for mechanical tolerances of the articulated mirror arm.



## Specification

- Adjustment time: depends on the laser parameters, the angular displacement between detectors and mirrors, and the desired accuracy.
- Range: The tilting range of the picomotor<sup>™</sup> actuator is more than 10°. However, the maximum range will be limited by the distance to the detectors, which must be hit.
- Display of laser power.

Back to [top](#)

## Download product information:

### Brochures and informations

- Brochure "Compact"
- Brochure "Dynamic"
- Application note "Dynamic"
- Description beam positioning
- Description Real-time position detector "XY4QD"
- Description laser shutter "Beamblock"
- Picture

### Manuals

- Manual "Dynamic"
- Manual "XY4QD"
- Manual "Beamblock"

Back to [Product list](#)

All versions are subject to change without prior notice.

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