Flexible Optical B.V.

Electromagnetic Tip-tilt Mirror

technical passport

OKO TECHNOLOGIES,

Table 1: *Technical parameters of the fast steering mirror.*

ParameterActive axes	θ_x, θ_y (4 points suspension)
Axes Orthogonality	+/- 2 % Off the normal axis (can be corrected in software)
Number of actuators	2
Control voltage range (with respect to the ground electrode)	$0 \ldots + 5$V (recommended) $0 \ldots + 5.5$V (maximum)
Dimensions, mm	$57 \times 57 \times 40$
Body material	Al
Weight	220 g
Motion and positioning	
Control type	open loop
Range, minimal	+/- 7.5 mrad optical
Resolution	defined by DAC interface
Resonant frequency	110 Hz
Frontplate used	
Diameter	25mm
Thickness	3mm
Mirror coating	UV Enhanced Al
Front Surface Flatness (@532nm)	$\lambda/4$
Clear Aperture	$> 90\%$ of the diameter
Driver	
Shipped with	tip-tilt driver unit# D4V1d018
Interface	USB 2.0
Number of output channels	3
Resolution	16 bits (65536 levels)
Maximum update frequency	1 kHz
Output voltage range	0..5V (Tunable)
Mirror serial number	TEM-16.02

1 Technical specifications

Figure 1: *Electromagnetic tip tilt mirror*

The electromagnetic tip tilt mirror, shown in Fig. 1, is controlled by 2 electromagnetic actuators. See Table 1 for the typical technical parameters of the platform. The typical frequency range of the mirror is up to 100 Hz, the optical tip-tilt range is +/- 5 mrad.

2 Connection to the control electronics

The unit can be powered up by 12 Volts DC adapter and is controlled by an analog voltage of 0 to 5 Volts. The computer interface is provided by USB DAC4.

2.1 Four-channels USB driver

A four-channel driver combines USB DAC4. To use the driver, connect it to the computer via provided USB cable. To start using the driver, you might need to install FDTI Direct Driver from the OKO website using the following link `okotech.nl/dac4tt/dac4.zip` Updated drivers can be downloaded from `www.ftdichip.com`. The DAC4 module uses architecture similar to that of DAC40, so the programming is very similar. For more details, please read DAC40 manual from `/Dac4` folder or simply modify the sample programs downloaded from the OKO server.

Figure 2: *Four-channel usb DAC driver*

Figure 3: *Output connector of a four-channel usb DAC driver and input connector of the tip-tilt mirror*
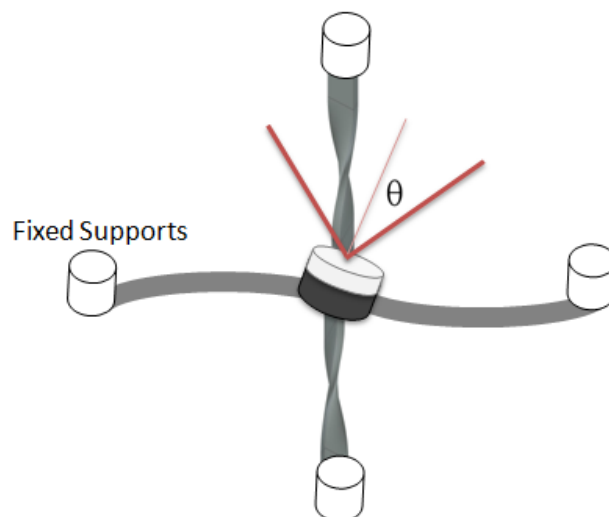

Figure 4: *The tip-tilt suspension scheme*

3   Control of the mirror

The mirror is suspended on two springs (see Fig. 4), with a fixed pivot at the center. To test the mirror, connect the provided DAC module with the tip-tilt device and power it up with the supplied 12 Volt DC adapter. Once the DAC drivers are successfully installed, you can download the tip-tilt demo program from `okotech.nl/tiptiltdemo/ttdemo.zip` You can run the programs from the command line window or double clicking on them and monitor a reflected laser beam on a screen to see the results.

4 Warranty

The equipment is covered by a one-year factory-defect warranty.

If the mirror is damaged during shipping, it will be replaced by a similar device within two months. A photo of the damaged device should be sent to Flexible Optical B.V. (OKO Technologies) within 3 days after the damaged device is received.

EXCEPT WHEN OTHERWISE STATED IN WRITING FLEXIBLE OPTICAL B.V. (OKO TECHNOLOGIES) AND/OR OTHER PARTIES PROVIDE THE SYSTEM "AS IS" WITHOUT WARRANTY OF ANY MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE ENTIRE RISK AS TO THE QUALITY AND PERFORMANCE OF THE EQUIPMENT IS WITH YOU.

IN NO EVENT UNLESS REQUIRED BY APPLICABLE LAW OR AGREED TO IN WRITING WILL FLEXIBLE OPTICAL B.V. (OKO TECHNOLOGIES) BE LIABLE TO YOU FOR DAMAGES, INCLUDING ANY GENERAL, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE THE HARDWARE AND SOFTWARE DESCRIBED IN THIS DOCUMENT.

5 Contact person

All questions about the technology, quality and applications of adaptive mirror should be addressed to:
Flexible Optical B.V.
Polakweg 10-11,
2288 GG Rijswijk
The Netherlands

Date:

Signature:

(Muhammad Wasif,
Researcher)