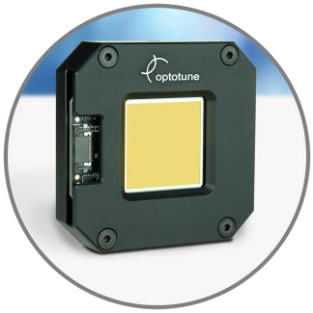
Fine steering mirror FMR-20



Optotune's FMR devices have been designed with fine-tilt, high-angular resolution applications in mind. With a large clear aperture of 20 x 20 mm^2 they can scan various beam patterns at 250 Hz bandwidth, with ±2.3 mrad tilt range. With the Optotune ICC-4C-2000 (sold separately) they are a plug and play fine steering solution.

Main features:

- One large optical surface for 2 DOF motion
- Linear (current vs angle)
- Bearingless design – no particles generated, no wear, no friction
- Suitable for high power laser applications[1]

Tailoring to specific geometric, actuation, and optical requirements possible upon request.

Main specifications

Mirror size	20 x 20	mm
Device dimensions (width x height x depth)	50.8 x 50.8 x 12	mm
Weight	53	g
Mechanical tilt angle (p-p)	7 (0.4) in x and y	mrad (°), RMS
Motion pattern	2D programmable	
Typ. transition (rise) time[2]	1.3	ms
Settling time[2]	4	ms
Resolution (with ICC-4C-2000)	4	µrad
Bandwidth	250 (at ±2.3 mrad)	Hz
Position control	Open loop	
External sensor for feedback control	Can be added	
Static motor constant	17.5 (1.0)	mrad/A (°/A)
Dynamic motor constant	1.2 * 10^4	rad/(A*s^2)
Scale drift	1000	ppm/K
Compliance	RoHS, REACH, CE, UL94 V-0	

Optical specifications

Surface finish	Protected gold, dielectric NIR, custom	

[1] For high power laser applications, the standard dielectric coating or a custom coating is required. To provide a beam dump for the transmitted light and to ensure system level laser safety is not Optotune's responsibility.

[2] Transition time is considered to be the time it takes from one setpoint to the next, within a 12.5% margin. Quickest transition times are reached with optimized current input, available on the ICC-4C-2000. The settling time can be as small as three times the transition time. Transition time only moderately depends on the step size, here given for 3.5 mrad (half range).

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Reflectivity Protected gold Dielectric NIR	 >95%, at 800-2000 nm, AOI 0-45° >98%, at 750-1100 nm, AOI 0-45°	
Surface flatness	2	λ, P-V, at 549 nm
Surface quality[3]	5/ 5x0.4; L1x0.06; C3x0.25,	similar to scratch-dig 60/40
Mirror thickness	2	mm

Electrical specifications

Drive current (bi-directional)	RMS: < 300; Peak < 1000	mA
Power consumption (average)	<2	W
Nominal actuator resistance per channel	9.8	Ohm
Temperature sensor[4]	ILM75BTP,147 or compatible	
EEPROM[5]	M24C64-FMC6TG or compatible	

Overview of available standard products

Standard product	Coating	Typical wavelength range
FMR-20-PG-0.2x0.2D-M	Protected gold	800 nm – 2200 nm
FMR-20-DNIR-0.2x0.2D-M	Dielectric NIR	750 nm – 1100 nm

Accessories

ICC-4C-2000	Controller
ICC-4C-2000 Extension Kit	• Extension (adapter) board for FMR-20 • 15 cm extension cable for adapter board • DIN Rail clamp kit
ICC-4C Power Adapter	Power Adapter, please specify type (EU, CH, US, UK, CN)

[3] ISO norm 10110.

[4] I2C address: 1001100x (R: 0x98 / W: 0x99).

[5] Containing calibration data. I2C address: 1010000x (R: 0xA0 / W: 0xA1).

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Mechanical Layout

The black aluminum housing of the FMR-20 supports mounting on standard optical posts (M4). The electrical connection to the ICC-4C-2000 (sold separately) is made using the FFC cable at the side. One ICC-4C-2000 has four output channels and supports two FMR-20 devices. See separate datasheet for more information.

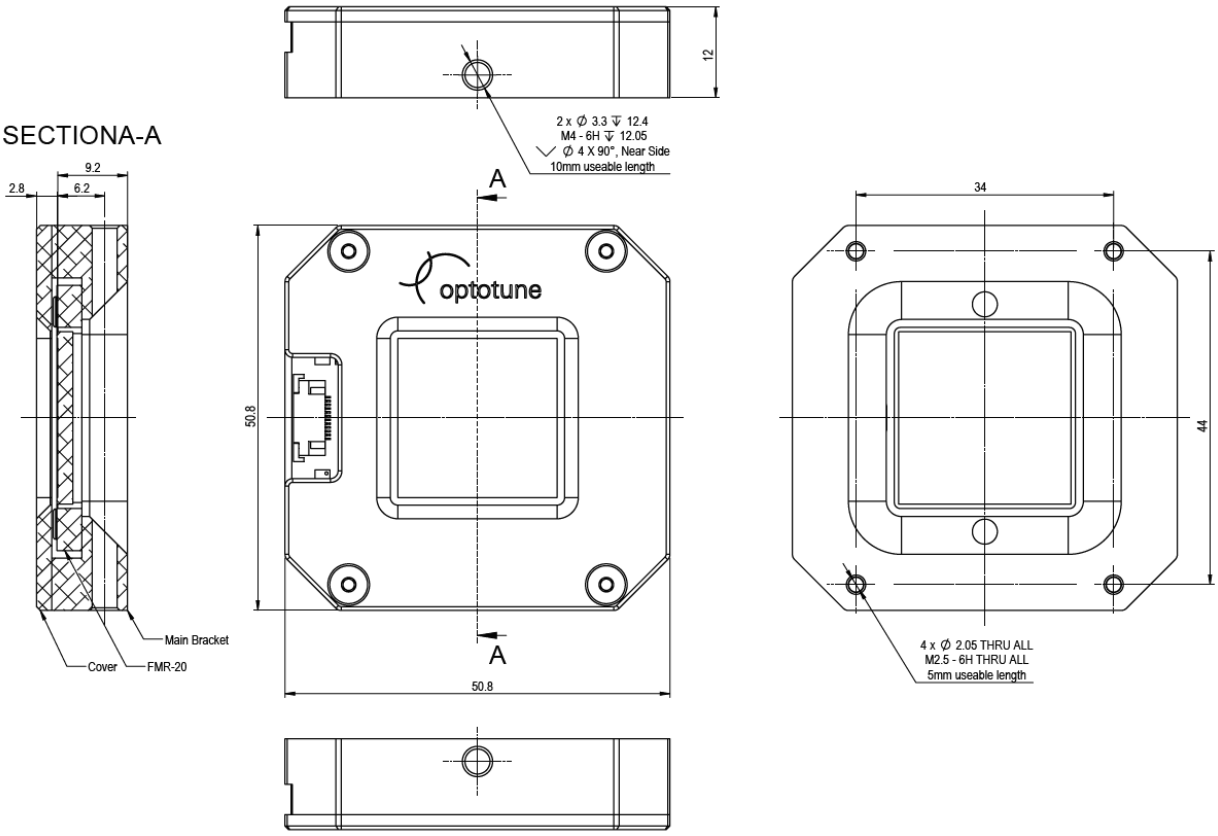
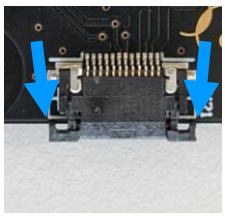


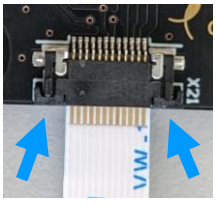
Figure 1: Mechanical drawing of the FMR-20

Connecting the Flex Cable

The Molex flex cable can be plugged directly into the connector of the adaptor board. Open the connector clamp with tweezers. Insert the flex cable fully with the copper pads facing upwards. Close the black clamp by pushing both sides simultaneously.

IMPORTANT: Do NOT hotplug the flex cable from the device!





Please install the latest software and firmware from our website:

- Optotune Cockpit (GUI)
- ICC-4C-2000 Firmware
- ICC-4C SDK in Python or C#

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Pinout

1	Axis X+
2	Axis X-
3	Axis Y+
4	Axis Y-
5	Vcc (3.3V)
6	I2C_SDA
7	I2C_SCL
8	GND
9	N.C.
10	N.C.
11	N.C.
12	N.C.

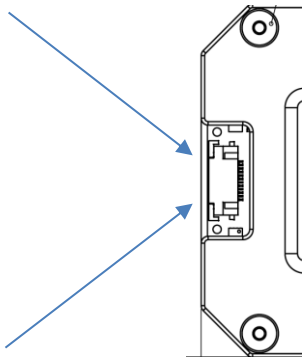

Figure 2: Pinout of the FMR-20.

Compatible Kinematic Mount

The housing of the FMR-20 is compatible with the following optional kinematic mount (not included): Edmund Optics #58-861. This tip-tilt stage allows to do a manual angular coarse adjustment. This item is to be purchased directly from Edmund Optics.

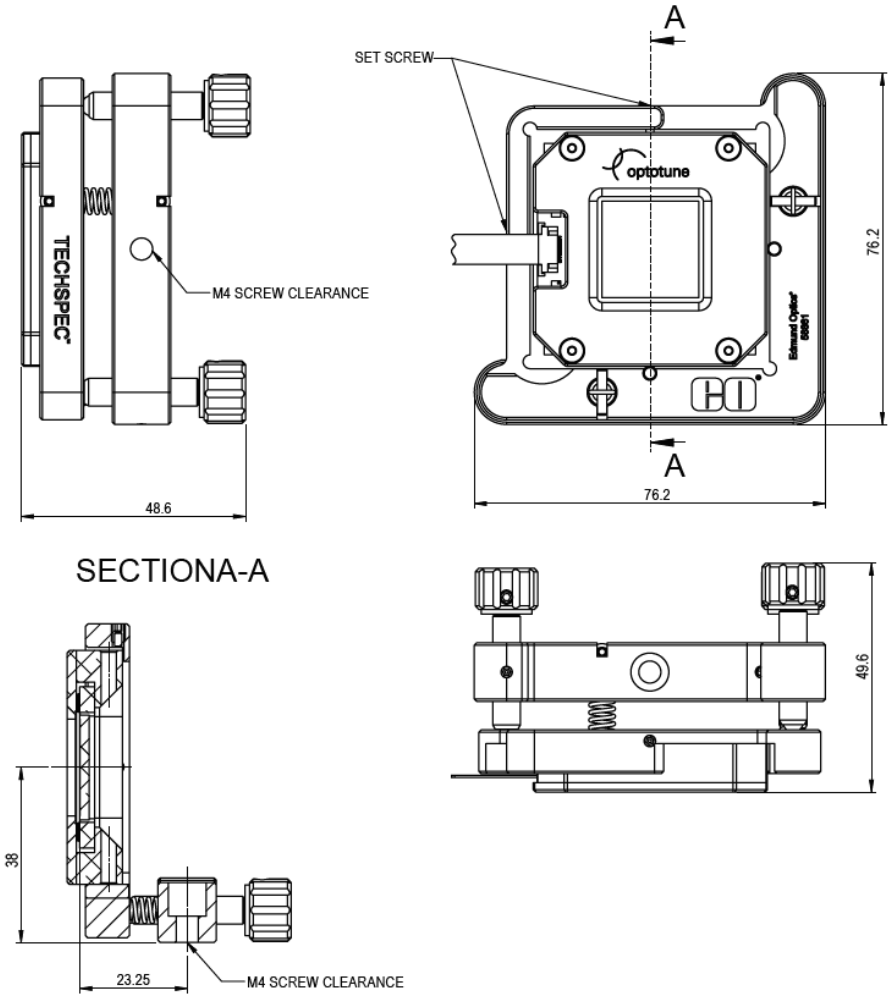

Figure 3: Compatible kinematic mount for the FMR-20.

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Reflectivity

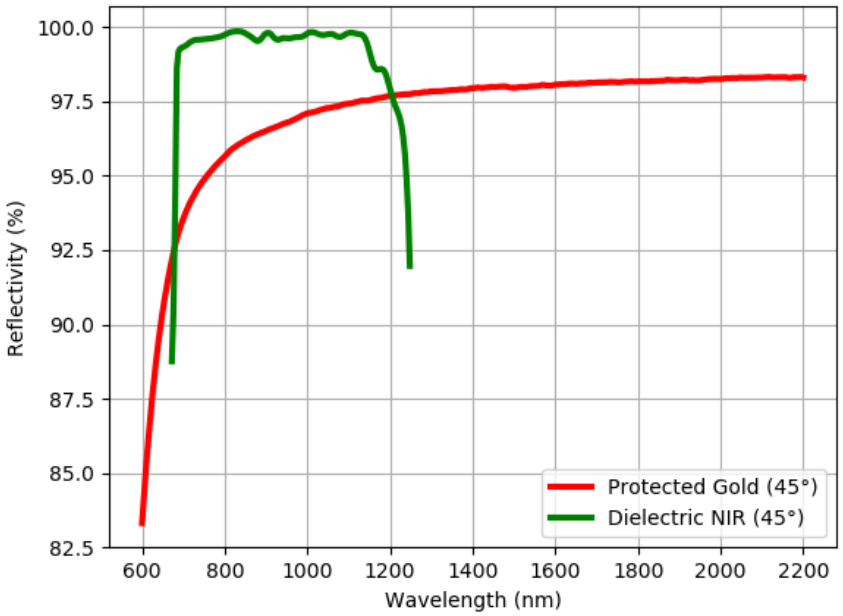

Figure 4: Reflectance spectra of standard coatings.

Static response

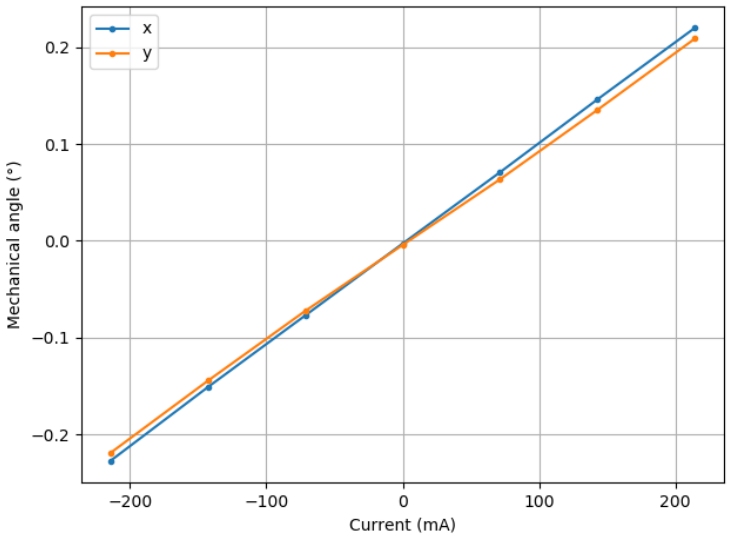

Figure 5: Typical static response as a function of current for the two axes.

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Frequency response

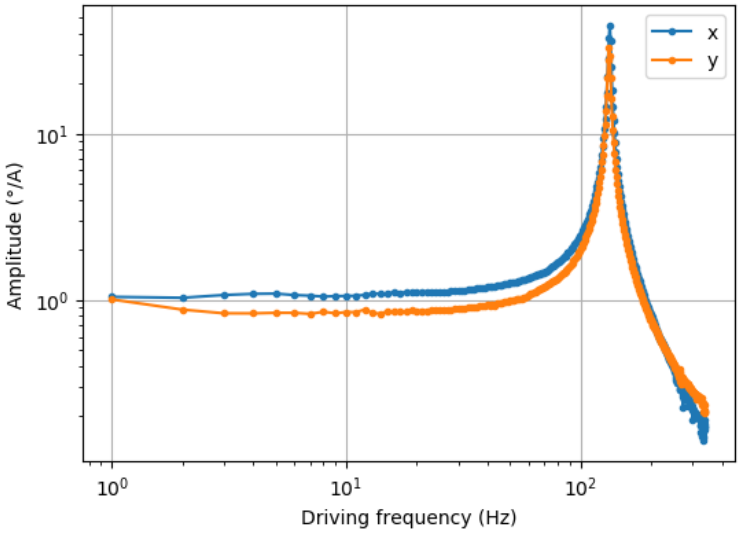

Figure 6: Typical frequency response for the two axes. The resonance frequencies for x and y are at 132 Hz and 133 Hz, respectively.

Step response

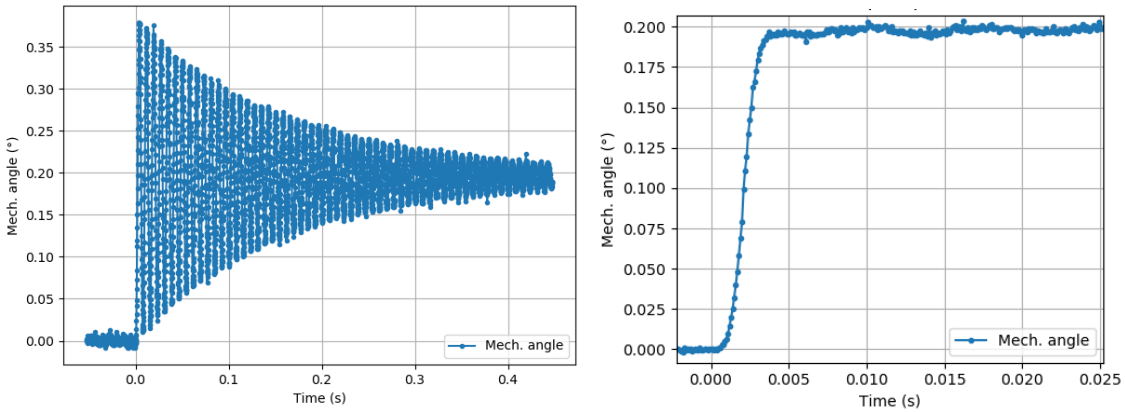

Figure 7: Step response of the FMR-20 with a sharp current step input (left) and optimized current input (right). Exciting the resonance can be avoided by filtering the input (available on the ICC-4C-2000 controller), which reduces the step response time from about 1 s to about 4 ms.

Safety and compliance

The product fulfills the RoHS, REACH, CE and UL94 V-0 compliance standards. The customer is solely responsible for complying with all relevant safety regulations for integration and operation.

For more information on optical, mechanical, and electrical parameters, please contact sales@optotune.com

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