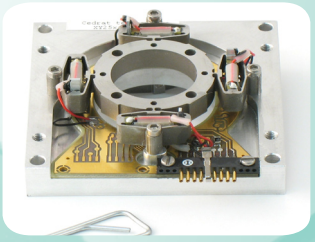

Piezo Microscanning Mechanism XY25XS

Microscanning is a key technique in high-resolution IR imaging field. It allows to increase the system resolution and improve the performance of imaging systems. This technique requires accuracy and high response time.

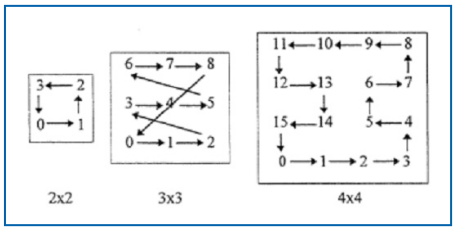

Figure1: Typical microscanning patterns.

Objective

Microscanning technique consists in taking multiple images of the same scene, according to different pattern (Fig.1), while displacing each time the image over the detector plan by a distance equal to a fraction of the detector pitch (fig.2). The under-sampled frames of the scene are then used to form a single high-resolution frame. The XY 25XS piezo stage shifts a focussing lens in the focal plane array along 2 axis X & Y (fig.3).

Structure

The piezoelectric stage XY 25XS (Fig.4) is based on standard Amplified Piezo Actuator (APA®) and owns high stiffness. The stage can be equipped with Strain Gauges to get a very fine accuracy. Parasitic rotations are very limited. This compact stage can be customised in order to meet specifications in terms of mechanical integration and environment on board IR camera (Fig.5).

MODE	BINARY CODE	STEP SIZE* (µm)
2 x 2	0 1	19
3 x 3	1 0	12.67
4 x 4	1 1	9.5

Figure 2: Microscanning modes.

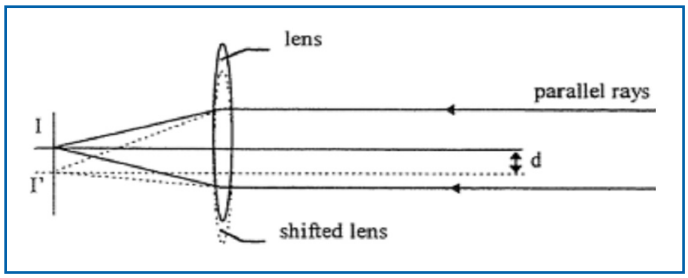

Figure 3 : Lens based microscanning system.

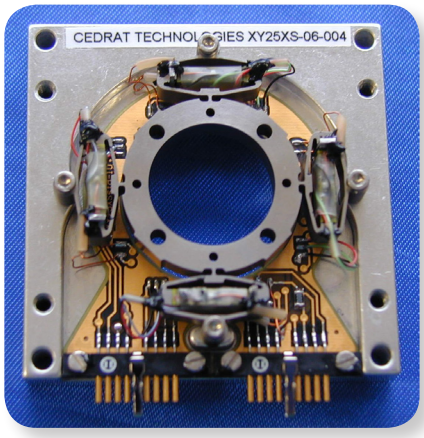

Figure4: Standard XY 25XS piezoelectric. stage.

Figure 5: Catherine IR Camera using an OEM XY 25XS version, courtesy of Thales Optronique.

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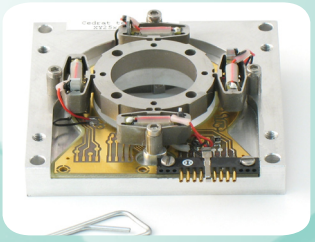

Piezo Microscanning Mechanism XY25XS

Performances

Typical performances are given in the following table (Fig.6). This table is not exhaustive as many other XY Piezo Stages can be designed by CEDRAT TECHNOLOGIES starting with similar or other standard amplified piezo actuators.

In summary, XY 25XS piezo stage offers:

- Solid state design
- High speed
- Life time > 10^{10} cycles
- Low chromatic aberration
- Low electric consumption
- Centring in case of failure
- Thermally compensation
- Ease of implementation

Compared to:

- Prism pair (chromatic aberration)
- Liquid crystals & polarizer (50% input signal attenuation)
- Tilting a mirror (COR shifting)
- Moving FPA (complicated & limited performances),

Remarks

Benefits of the CEDRAT TECHNOLOGIES XY piezo scanner for your IR Camera:

- Elimination of deleterious artifacts from staring arrays
- Elimination of aliasing and spurious response
- Quantitative resolution improvement
- Qualitative Image resolution improvement
- Minimum Resolvable Temperature (MRT) Difference improvement
- Stabilisation improvement / nulling out the residual gimbal jitter

Figure 6: Characteristics of the standard XY 25XS piezoelectric stage.

References	Unit	XY25XS
Notes		-
Sensor option		SG
Active axis		TX, TY
Max. No-load displacement [Tx, Ty]	µm	20
Max. out of plane Z displacement	µm	0,50
Max. parasitic Z rotation	µrad	50
Max. parasitic X Y rotations	µrad	10
Voltage range	V	-20...150
Stiffness	N/µm	2,50
Height (Z axis)	mm	18,0
Dimensions (X & Y axis)	mm	50*50
Resolution	nm	0,2
Mass	g	80
Unloaded resonance frequency (in the actuation's direction)	Hz	2200
Respnse time	ms	0,23
Capacitance (per electrical port)	µF	0,50
Mechanical interfaces (payload)		1 Ø 17 mm hole + 4 Ø 1,8 mm on Ø 20 mm
Mechanical interfaces (frame)		4 Ø 2,8 mm holes on [] 45
Electrical interfaces		2 RG178B/U coaxial cables

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