

PHI-SS-MI PIEZOELECTRIC ROTARY MICRO STAGE

ABSTRACT

The DS describes the main features of the PHI-SS-MI piezoelectric rotary micro stage. It includes technical data and drawings.

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Release Date: 06 Oct. 2022
Last Revision: 06 Oct. 2022

REVISION HISTORY

List of changes from original release to current revision.

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

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1. Features

- Travel range – $\pm 360^\circ$
- High precision
- No backlash
- No need for lubricant
- Minimized run-out
- High axial load-to-weight ratio – Up to 10
- Resolution in the mrad range
- 50 to 150 V operation

2. Applications

- Industrial – EDM, machine tools
- Research – Microscopy
- Metrology – Telescopes, laser refraction
- Multi-axis solutions

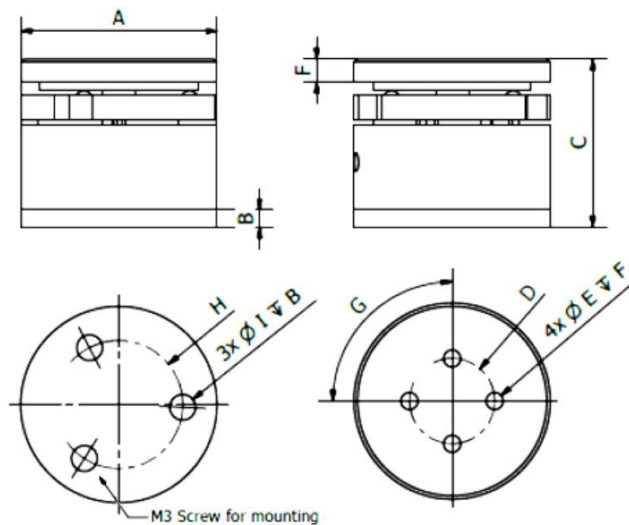
3. Description

PHI-SS-MI is the smallest element of the PHI-SS family of piezoelectric actuators by Phi Drive. As such, it is fully compatible with the PHI-SS Driver/amplifier by Phi Drive. The miniaturized rotary table is designed for precision positioning and is based on inertial piezoelectric actuation. There are no gears and no need for lubricants. The minimum achievable steps, which are smaller than 1 mrad, and the high load-to-weight ratio in a tiny package make the PHI-SS-MI a valuable device.

The PHI-SS-MI system can be customized to meet specific needs.

4. Dimensions

Fig. 1: Main dimensions of the PHI-SS-MI rotary table



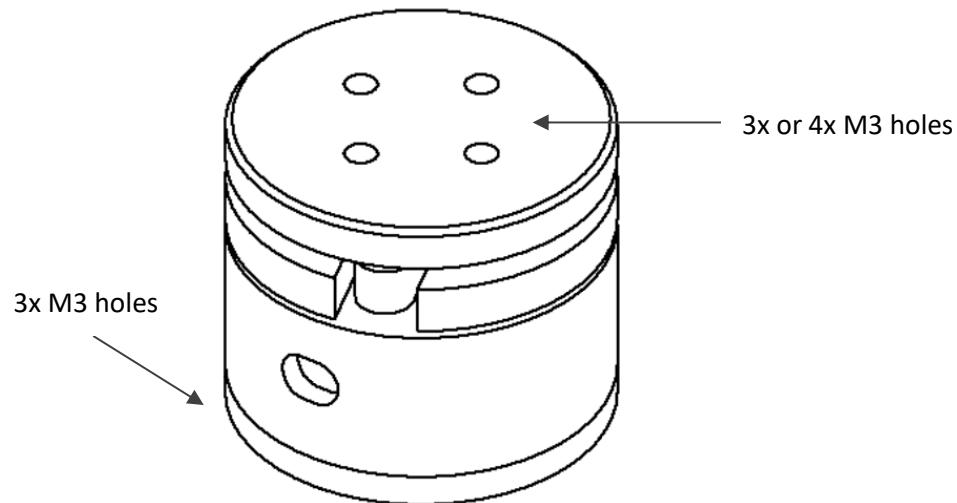
Tab. 1: Main dimensions of the PHI-SS-MI rotary table

A	B	C	D	E	F	G	H	I
23	2	19.7	5	2	2.7	90	7.5	3

All dimensions are given in mm for lengths and in deg for angles

5. Mounting

Fig. 2: Mechanical interfaces



6. Open-loop control

The PHI-SS-MI rotary piezoelectric table does not include an encoder. Therefore, closed-loop control can be implemented only if an external device provides a feedback for the angular positioning. However, the PHI-SS-MI table can still be used in open-loop with a remarkable accuracy.

The PHI-SS Driver by Phi Drive allows for a direct control on both voltage and frequency of the command signal. An experimental linear law relates the input signal frequency with the resulting rotational speed of the table:

$$\omega = 0.0041 \cdot f + 0.3633,$$

where ω is expressed in RPM and f in Hz. Another experimental linear law relates the input signal voltage with the resulting minimum angular variation, which represents the best achievable resolution at that specific input signal voltage:

$$\Delta\alpha = 4.3713 \cdot V - 94.131,$$

Where $\Delta\alpha$ is expressed in μrad and V in V. Notice that there is not a dependence on the load mass in any of these laws.

7. Technical data

Tab. 2: Mechanical data

		PHI-SS-MI	Unit
Speed (maximum)		13	RPM
Step (minimum)		100 to 560	μrad
Load mass (maximum)		0.50	kg
Stage mass		0.05	kg
Dimensions		20 x Ø23	mm
Materials	Body	Steel	
	Actuator	PZT ceramic	
	Case	Steel	

Tab. 3: Electrical data

		PHI-SS-MI	Unit
Drive type		Piezo stack	
Piezo stack capacitance		75	nF
Input voltage		0 to +150	V
Maximum frequency		3000	Hz

Tab. 4: Electrical connections

		PHI-SS-MI
Cable length		Custom
Connector		Circular, 4 poles
Insulation		PTFE
AWG		28

NOTES:

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