

AG-HT PIEZOELECTRIC ROTARY STAGE

ABSTRACT

The DS describes the main features of the AG-HT piezoelectric rotary stage. It includes technical data and drawings.

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REVISION HISTORY

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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
- No electromagnetic (EM) interferences
- High load capability
- Stackable to achieve higher torque
- Blocked when unpowered
- High Vacuum (HV) version available

2. Applications

- Aeronautics
- Military
- Space

3. Description

The AG-HT piezoelectric rotary stage grants an accurate rotational positioning while providing significant torque. It is based on the patented Deformation Wave Precession mechanism, which exploits the deformation of a rotor ring and friction to convert the linear actuation of piezo stacks into a rotating motion. This design is particularly good for aerospace and military applications thanks to its compactness, simplicity, and reliability. No lubricants and gears are required, and the backlash is absent in both direct and reverse motion. The motor is self-locked when unpowered, and does not suffer from EM interferences. The FEM analysis makes it possible to precisely design it in order to offer the best solution for specific applications.

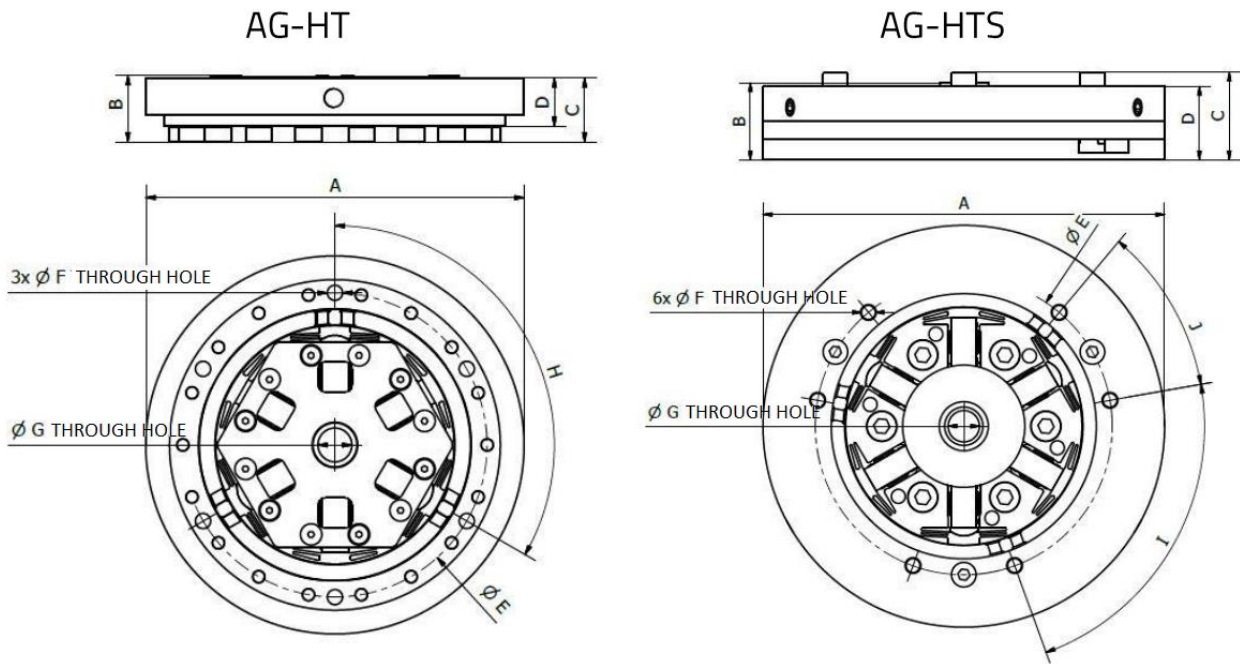
The AG-HT system can be customized:

- The torque can change
- The speed can change
- The resolution can be tuned on request
- The encumbrance can be changed
- Flanges for mounting the stage and loads on top of it can be added as desired

The AG-HTS version was developed in the framework of the Pre2Pos project. The Pre2Pos project was part of the Horizon 2020 Innovation Programme from the European Union (Grant Agreement No. 733209).

4. Dimensions

Fig. 1: Main dimensions of the AG-HT piezo stage



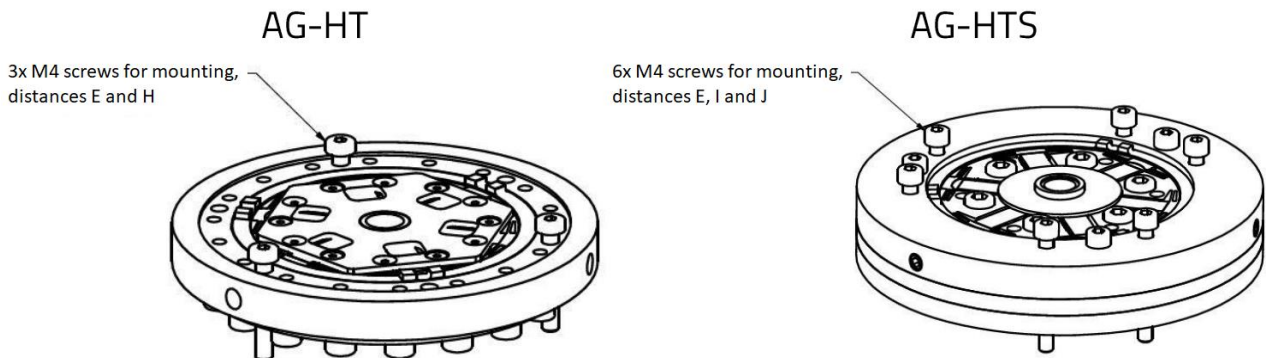
Tab. 1: Main dimensions of the AG-HT piezo stage

	A	B	C	D	E	F	G	H	I	J
AG-HT	110.0	18.5	16.9	12.8	80.6	4	9.0	120°	-	-
AG-HTS	115.0	25.0	22.0	21.0	85.0	4	9.0	-	80°	40°

All dimensions are given in mm unless specified

5. Mounting

Fig. 2: Mechanical interfaces



6. Variants

6.1. AG-HT

AG-HT is the standard version of the actuator. It is smaller and gives higher performances compared to AG-HTS, but is not fit for space applications.

6.2. AG-HTS

AG-HTS is the space-grade version of the actuator. It is larger and gives lower performances compared to the standard AG-HT, but is HV compatible, radiation resistant, and redundant. It is ideal for deployment and hold-down mechanisms and release mechanisms, thanks to the high stability of its rotation.

7. Technical data

Tab. 2: Mechanical data

	AG-HT variant	AG-HTS ^[1] variant	Unit
Rotation axis	ϑz	ϑz	
Range	±360	±360	deg
No-load speed	0.10	0.04	RPM
Stall torque (powered)	20	9	Nm
Holding torque (unpowered)	45	20	Nm
Step (bidirectional)	0.34	0.15	mrad
Mass	0.98	1.10	kg
Dimensions	18.5 x Ø110	25.0 x Ø115	mm
Materials	Core	HS 10-2-5-8	Inconel 718 ^[2]
	Rotating ring	ISO K50	Inconel 718 ^[2]
	Stator ring	ISO K20	Inconel 718 ^[2]
	Actuator	PZT ceramic	PZT ceramic

Tab. 3: Drive properties

^[3]	AG-HT variant	AG-HTS ^[1] variant	Unit
Drive type	Piezo stack	Piezo stack	
Piezo stack capacitance	760	760	nF
Input voltage	0 to +150	0 to +150	V
Operating frequencies	0 to 30	0 to 40	Hz
Power supply specification	230 V, 50 Hz	-	

Tab. 4: Environmental characteristics

^[4]	AG-HT variant	AG-HTS ^[1] variant	Unit
Temperature range	-	+10 to +80	°C
Maximum vacuum	-	0.001	Pa
Sine vibration	-	1.25	g ^[5]
Random vibration	-	0.525	g ² /Hz ^[6]
Shock	-	2000	g ^[7]

^[1] AG-HTS specifications are still pending for final validation and release

^[2] The core mechanism is coated with TiN+MoS₂ to increase wear resistance

^[3] Final data on the improved electronics will be available in the future

^[4] Final qualification data of AG-HTS will be available in the future in accordance with European Space Agency guidelines

^[5] Frequency range 1-125 Hz

^[6] Frequency range 1-2000 Hz

^[7] Frequency range 1-10000 Hz with a SRS envelope calculated with a Q-Factor of 10

NOTES:

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