

CVCA₁ – CRYO VOICE COIL ACTUATOR 1



Features

- Electromagnetic force actuator
- UHV compatible (completely sealed by welding)
- Contactless: no friction or wear
- Compact and robust design
- 5K to 375K operational range
- Dynamic operation
- Push-pull capacity
- Electrical connection via standard 1mm contacts
- Compatible with industrial motion controllers
- Coil to magnet alignment tool included

Description / Applications

The Cryo Voice Coil Actuator (CVCA) is an electromagnetic linear force actuator for cryogenic operation. The all-welded titanium construction with integrated power feedthrough pins hermetically encapsulates the coil making it also UHV compatible. The contactless nature of a voice coil actuator makes it especially suited for applications requiring smooth accurate positioning over the full stroke or for high lifetime applications like wafer probing.

Specifications

General info							
Type of motion		Linear					
Dimensions		See drawings below					
Operational environmental conditions		5 K to 375 K, ambient to UHV					
Weight of coil assembly (stator)		41 g					
Weight of magnet assembly (mover)		48 g					
Max. allowable coil temperature		140 °C (180 °C wire specification)					
Motion							
Travel range		6 mm (-2,5 to +3,5)					
Radial clearance		0,35 mm both directions					
Materials							
Coil assembly		Titanium					
Magnet assembly		Magnetically soft steel and magnets, nickel plated					
Electromechanical characteristics ¹⁾			10 K ²⁾	50 K	77 K	300 K (air)	
Coil resistance	R	Ohm	0,043	0,18	0,43	3,58	
Voltage at peak force	V _{FP}	V	0,09	0,35	0,81	7,06	
Current at peak force	I _{FP}	A	2,08	1,92	1,88	1,5	
Back EMF constant	k _{BEMF}	V/m/s	3,83	4,17	4,26	4	
Coil inductance	L	mH	0,62 @ 100Hz				
Force sensitivity	k _F	N/A	3,83	4,17	4,26	4	
Actuator constant	k _a	N/VW	18,47	9,81	6,43	2,07	
Max continuous force ³⁾	F _{SS}	N	8	5	4,5	3	
Peak force ⁴⁾	F _p	N	>8	>8	8	6	
Power at peak force ⁵⁾	P _p	W	0,19	0,67	1,55	8,4	
Power at max. continuous force ⁵⁾	P _{SS}	W	0,19	0,26	0,49	2,1	
Power at 1N continuous force ⁵⁾	-	W	0,003	0,01	0,024	0,23	
Electrical time constant ⁶⁾	τ _E	ms	14,4	3,44	1,44	0,17	
Mechanical time constant ⁷⁾	τ _M	ms	0,14	0,5	1,14	10,7	
Thermal resistance coil assembly ⁸⁾	R _{stator}	K/W	789	139	113	79	
Thermal resistance magnet assembly ⁸⁾	R _{mover}	K/W	1,22	1,22	1,22	1,22	
Electronics							
Controller/driver		Current amplifier					
Notes							
¹⁾ At zero position, ²⁾ Actual initial coil temperature at 10 K tests was approx. 50 K because of thermal resistances, 10 K values from analysis. ³⁾ At 100 K coil temperature rise, ⁴⁾ Allowed for 10 seconds. Values ≤50 K limited by used current amplifier. ⁵⁾ P = (F / k _a) ² , ⁶⁾ L/R, ⁷⁾ (m _{mover} * R) / (k _F * k _{BEMF}), ⁸⁾ Theoretical from FEA. Coil assembly is based on radiation between windings and conduction through bobbin.							

