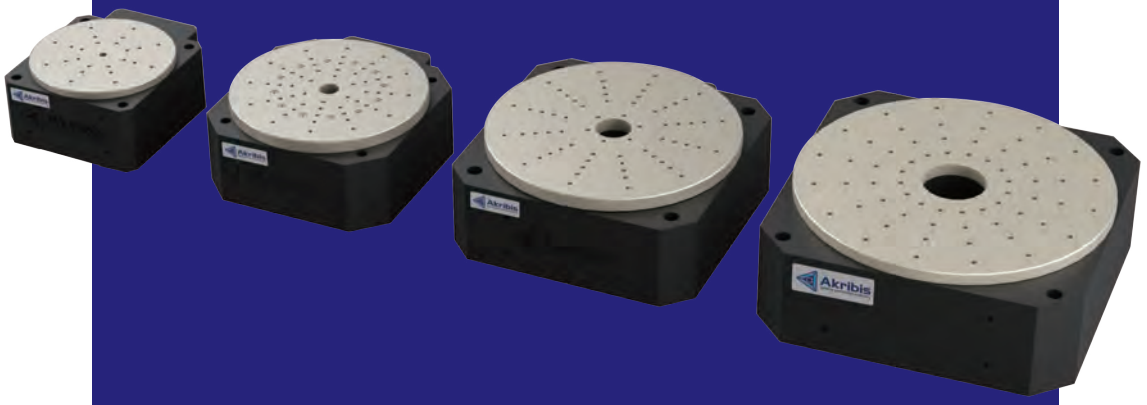


AAR-A SERIES

- Contactless operation between stator and rotor
- Zero stiction
- No particle emission
- Central hole design
- Conical bearings
- High repeatability and precision
- High speed stability

EN-25.9.1

Akribis Systems

Introduction

The Akribis AAR-A series is a type of turntable that uses air bearing.Air bearing is sliding bearing that uses gas as a lubricant. A high-pressure gas creates an air film that lifts the components until static balance is achieved, allowing the mating surfaces between the stator and rotor to be in a contactless state. The absence of friction between components not only prevents wear and extends the lifespan but also provides benefits such as high precision and repeatability.

The AAR-A series air bearing turntable operates on the principle of hydrostatic pressure, where the bearing load capacity depends on the pressure of the external air supply. When not pressurized, the mating surfaces of the bearing's stator and rotor are in direct contact, preventing the rotating surface from moving to avoid wear. Upon introducing compressed air through a tube, the pressure gradually accumulates, pushing the rotor mating surface away and creating a gap until reaching a balanced state.

The currently common ultra-precision air bearing turntables often adopt a structure with a cruciform shape (Fig. 1) or a cross shape (Fig. 2) for the air bearings. The yellow part represents the air film gap, the orange part is the rotor, and the blue part is the stator. However, Akribis utilizes a specially designed conical structure for the air bearing (Fig. 3). Compared to the first two structures, the conical structure can significantly reduce the height of the turntable, providing higher rigidity and load-bearing capacity within the same volume and minimizing the impact of structural cumulative errors. Although the conical structure has these outstanding advantages, its precision manufacturing difficulty is much higher than other types of air bearings. Akribis has achieved mass production of this turntable through ultra-precision processing equipment and a rigorous process route planning, successfully completing long-term reliability verification for the product.

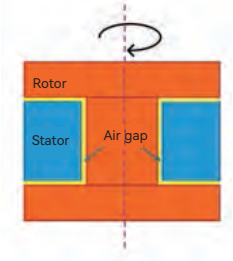


Fig. 1 : Cross-shaped

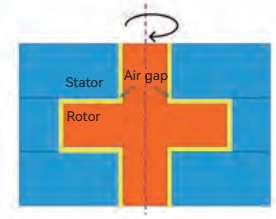


Fig. 2 : H-shaped

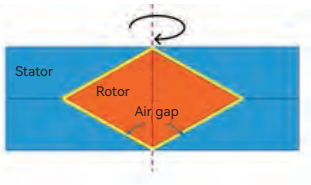


Fig. 3 : Conical shape

Features

- Contactless operation between stator and rotor: no friction, no backlash, and no need for lubricating oil maintenance, resulting in a long lifespan
- Zero stiction: enabling high-speed and high-acceleration movements
- No particle emission: making it suitable for cleanroom applications without environmental pollution
- Central hole design: convenient passage of cables or vacuum pipes
- Conical bearings: lower height and reduced stacking errors
- High repeatability and precision (Fig. 4): rotation precision nanometer level, repeatability less than ±0.5 arcsec
- High speed stability: speed ripple as low as 0.03%

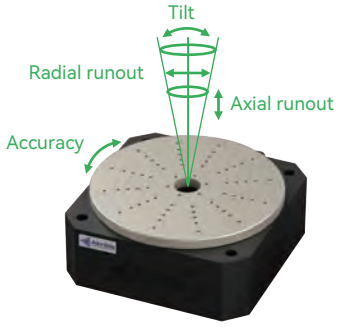


Fig. 4 : Definition of axial error, radial error, tilt error

Applications

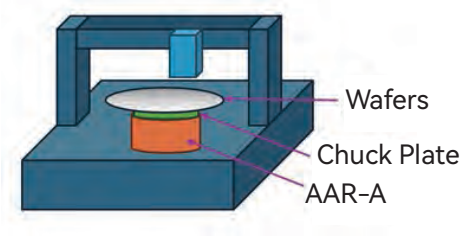
Suitable for optical detection, optical communication, optical alignment, precision laser processing, wafer inspection, wafer alignment, wafer grinding/thinning machines, roundness gauges, eccentricity gauges, precision concentric assembly, clamping, etc.

★ It's important to note that air bearing turntables are not suitable for vacuum environments, environments with significant dust or oil exposure, and situations where compressed air or nitrogen cannot be provided. This is because hydrostatic air bearing turntables require a continuous supply of pressurized gas to maintain the air film thickness, making them unsuitable for operation in a vacuum. Additionally, the entry of oil or dust can cause wear on the bearing mating surfaces, leading to damage. Therefore, it is recommended to use a filter valve on the input gas side to filter the supplied gas, with at least a 1μm filtration accuracy level.

AAR-A Series

Applications

Wafer inspection application where AAR-A is used in:



Customer request VS test result

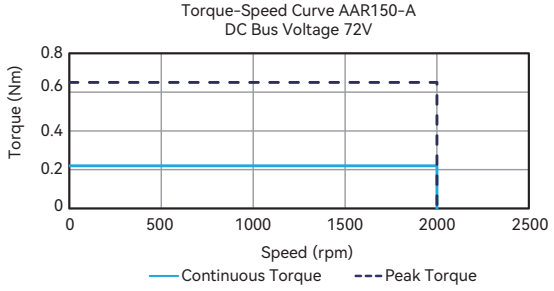
	Unit	Customer Request	Test Result
Repeatability	arcsec	±2	±0.28
Accuracy (after error mapping)	arcsec	±20	±1
Axial error	nm	200	60
Radial erro	nm	200	160
Chuck axial runout	μm	6	3
Chuck radial runout	μm	20	4
Chuck repeat axial runout	μm	0.3	0.02
Parallelism between Chuck and Marble Surface	μm	3	3

Air Bearing Turntable	■ Continuous Torque(T_{cn}) ■ Peak Torque (T_{pk}) Unit: Nm 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0	Repeatability (arcsec)	Page
 AAR150-A	0.22 0.65	< 2	4
 AAR200-A	0.43 1.30	< 1	5
 AAR250-A	1.27 3.81	< 1	6
 AAR300-A	2.4 7.3	< 1	7

AAR150-A

Performance Parameters	Symbol	Unit	Value
Continuous Torque (NC)@100℃ ❶	T_{cw}	Nm	0.22
Peak Torque	T_{pk}	Nm	0.65
Torque Constant ±10%	K_t	Nm/Arms	0.094
Back EMF Constant ±10%	K_e	Vpeak/rpm	0.008
Motor Constant @25℃	K_m	Nm/Sqrt(W)	0.06
Resistance (L-L) @25℃ ±10% ❷	R_{25}	Ohms	1.61
Inductance (L-L) ±20% ❸	L	mH	0.30
Electrical Time Constant	τ_e	ms	0.19
Continuous Current (NC)@100℃ ❶	I_{cn}	Arms	2.3
Peak Current	I_{pk}	Arms	6.9
Continuous Power Dissipation (NC)@100℃ ❶	P_{cn}	W	16.5
Max. Coil Temperature	T_{max}	℃	100
Thermal Dissipation Constant (NC) ❶	K_{thn}	W/℃	0.22
Max. Bus Voltage	U_{bus}	Vdc	72
Pole Numbers	2P	-	8
Rec. Max Speed @Continuous Torque (48V)	Ω_{max}	rpm	2000
Rec. Max Speed @Peak Torque (48V)	Ω_{max}	rpm	2000
Mechanical Parameters			
Overall Mass	m_w	kg	5
Rotor Inertia	J_r	kg·m²	0.00217
Total Axial Error ❹	-	μm	<0.1
Total Radial Error ❹	-	μm	<0.1
Total Tilt Error ❹	-	arc sec	2.0
Max. Load (Axial)	-	kg	10
Max. Load (Radial)	-	kg	5
Max. Load (Tilt)	-	Nm	3
Encoder Parameters			
Optical Incremental Encoder (SIN/COS)	-	lines/rev	8192
Accuracy with Error Mapping	-	arc sec	±3
Repeatability	-	arc sec	< 2
Other Information			
Operating Pressure ❺	-	bar	5.5
Insulation Class	Class B（130℃）		
Protection	IP00		
Compliance with Global Standards	RoHS, CE		
Ambient Temperature	Operation	18℃ to 22℃ Optimum Working Temperature 20±0.5℃	
	Storage	15℃ to 25℃ ❻	
Ambient Humidity	Operation	20%RH to 60%RH（non-condensing）	
	Storage	10%RH to 70%RH（non-condensing）	
Recommended Ambience	Indoor (no direct sunlight); No corrosive gas, inflammable gas, oil mist or dust.		

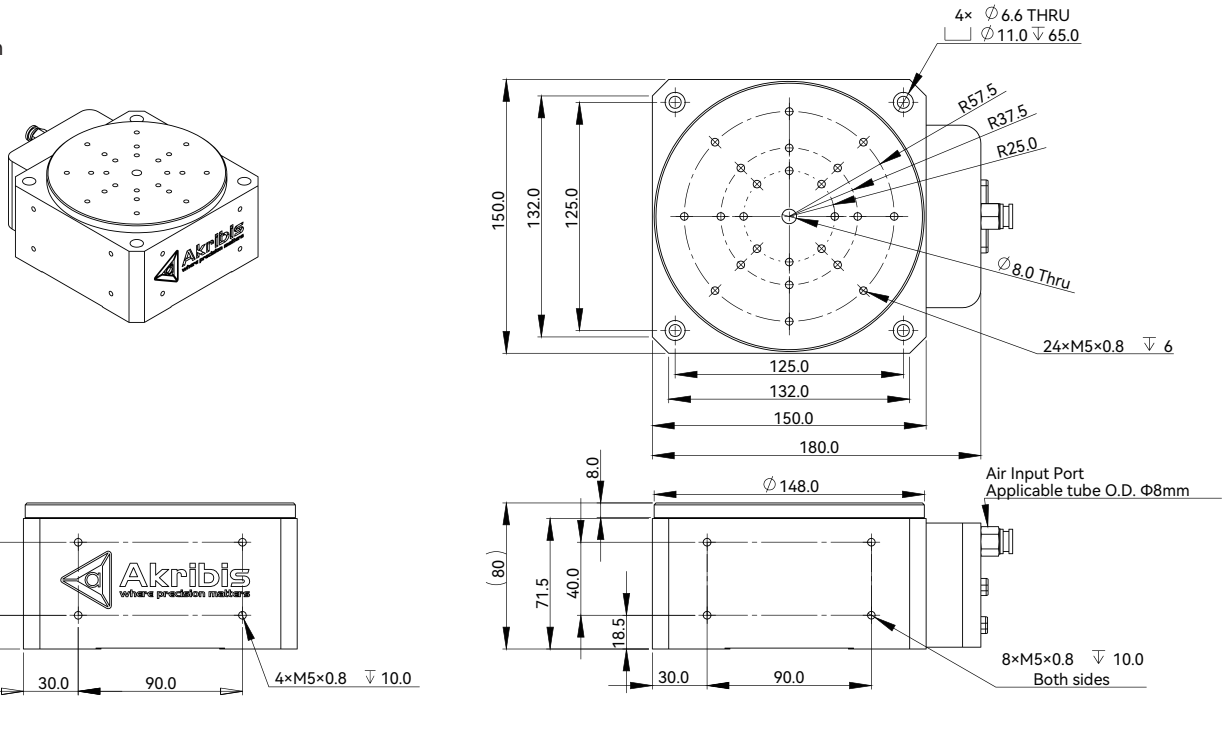
Torque-Speed Curve



❶Measurement is taken at ambient temperature 25℃. Value depends on the thermal environment.
Abbreviations: NC-Natural Cooling.
❷Resistance is measured by DC current.
❸Inductance is measured by current frequency of 1 kHz.
❹Total error specification defined in the datasheet is based on constant loading and temperature condition.
❺A filter with filtration level of 1μm should be added before gas enters the turntable.
The table must not be rotated when there is no ventilation.It can only be rotated when the air pressure is stable.
❻Before taking it out of the storage environment, it should be placed in the using environment for 24 hours, and the rated pressure gas ventilation should be maintained during the standing process to prevent frost and condensation.

The contents of datasheet are subject to change without prior notice.

Dimension

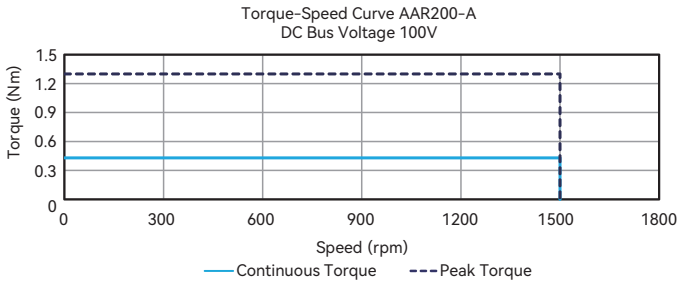


Note: The height size marked with "( )" in the turntable two-dimensional drawing will change according to whether compressed air is injected and whether the rotation movement is carried out.

AAR200-A

Performance Parameters		Symbol	Unit	Value
Continuous Torque (NC)@100ºC ❶		T_{cw}	Nm	0.43
Peak Torque		T_{pk}	Nm	1.3
Torque Constant ±10%		K_t	Nm/Arms	0.18
Back EMF Constant ±10%		K_e	Vpeak/rpm	0.015
Motor Constant @25ºC		K_m	Nm/Sqrt(W)	0.11
Resistance (L-L) @25ºC ±10% ❷		R_{25}	Ohms	1.92
Inductance (L-L) ±20% ❸		L	mH	0.54
Electrical Time Constant		τ_e	ms	0.28
Continuous Current (NC)@100ºC ❶		I_{cn}	Arms	2.4
Peak Current		I_{pk}	Arms	7.2
Continuous Power Dissipation (NC)@100ºC ❶		P_{cn}	W	21.4
Max. Coil Temperature		T_{max}	℃	100
Thermal Dissipation Constant (NC) ❶		K_{thn}	W/℃	0.285
Max. Bus Voltage		U_{bus}	Vdc	100
Pole Numbers		2P	-	8
Rec. Max Speed @Continuous Torque (100V)		Ω_{max}	rpm	1500
Rec. Max Speed @Peak Torque (100V)		Ω_{max}	rpm	1500
Mechanical Parameters				
Overall Mass		m_w	kg	10
Rotor Inertia		J_r	kg·m²	0.0106
Total Axial Error ❹		-	μm	<0.1
Total Radial Error ❹		-	μm	<0.1
Total Tilt Error ❹		-	arc sec	0.7
Max. Load (Axial)		-	kg	31
Max. Load (Radial)		-	kg	15
Max. Load (Tilt)		-	Nm	10
Encoder Parameters				
Optical Incremental Encoder (SIN/COS)		-	lines/rev	8192
Accuracy with Error Mapping		-	arc sec	±2
Repeatability		-	arc sec	< 1
Other Information				
Operating Pressure ❺		-	bar	5.5
Insulation Class		Class B (130℃)		
Protection		IP00		
Compliance with Global Standards		RoHS, CE		
Ambient Temperature	Operation	18℃ to 22℃ Optimum Working Temperature 20±0.5℃		
	Storage	15℃ to 25℃ ❻		
Ambient Humidity	Operation	20%RH to 60%RH (non-condensing)		
	Storage	10%RH to 70%RH (non-condensing)		
Recommended Ambience		Indoor (no direct sunlight); No corrosive gas, inflammable gas, oil mist or dust.		

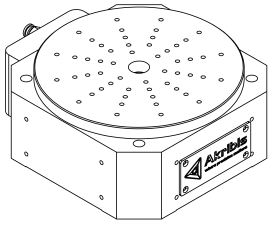
Torque-Speed Curve

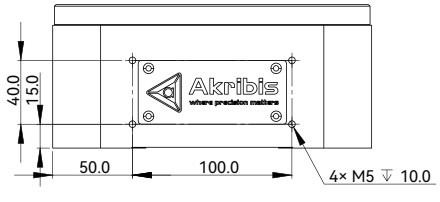


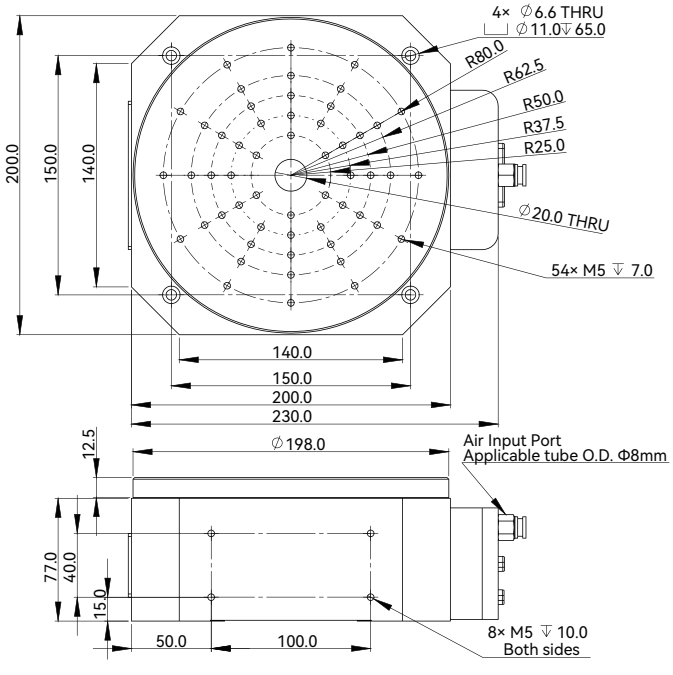
❶ Measurement is taken at ambient temperature 25℃. Value depends on the thermal environment.
Abbreviations: NC-Natural Cooling.
❷ Resistance is measured by DC current.
❸ Inductance is measured by current frequency of 1 kHz.
❹ Total error specification defined in the datasheet is based on constant loading and temperature condition.
❺ A filter with filtration level of 1μm should be added before gas enters the turntable.
The table must not be rotated when there is no ventilation.It can only be rotated when the air pressure is stable.
❻ Before taking it out of the storage environment, it should be placed in the using environment for 24 hours, and the rated pressure gas ventilation should be maintained during the standing process to prevent frost and condensation.

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Dimension



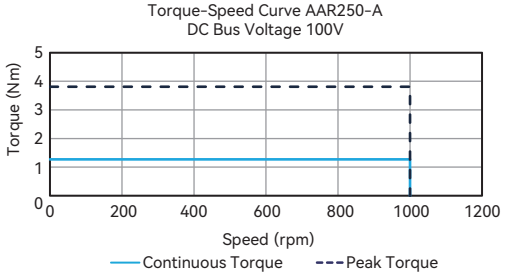




AAR250-A

Performance Parameters		Symbol	Unit	Value
Continuous Torque (NC)@100ºC ❶		T_{cw}	Nm	1.27
Peak Torque		T_{pk}	Nm	3.81
Torque Constant ±10%		K_t	Nm/Arms	0.405
Back EMF Constant ±10%		K_e	Vpeak/rpm	0.346
Motor Constant @25ºC		K_m	Nm/Sqrt(W)	0.27
Resistance (L-L) @25ºC ±10% ❷		R_{25}	Ohms	1.52
Inductance (L-L) ±20% ❸		L	mH	0.50
Electrical Time Constant		τ_e	ms	0.33
Continuous Current (NC)@100ºC ❶		I_{cn}	Arms	3.1
Peak Current		I_{pk}	Arms	9.4
Continuous Power Dissipation (NC)@100ºC ❶		P_{cn}	W	29.0
Max. Coil Temperature		T_{max}	℃	100
Thermal Dissipation Constant (NC) ❶		K_{thn}	W/℃	0.39
Max. Bus Voltage		U_{bus}	Vdc	100
Pole Numbers		2P	-	14
Rec. Max Speed @Continuous Torque (100V)		Ω_{max}	rpm	1000
Rec. Max Speed @Peak Torque (100V)		Ω_{max}	rpm	1000
Mechanical Parameters				
Overall Mass		m_w	kg	15
Rotor Inertia		J_r	kg·m²	0.0271
Total Axial Error ❹		-	μm	<0.1
Total Radial Error ❹		-	μm	<0.25
Total Tilt Error ❹		-	arc sec	0.5
Max. Load (Axial)		-	kg	66
Max. Load (Radial)		-	kg	35
Max. Load (Tilt)		-	Nm	30
Encoder Parameters				
Optical Incremental Encoder (SIN/COS)		-	lines/rev	11840
Accuracy with Error Mapping		-	arc sec	±2
Repeatability		-	arc sec	< 1
Other Information				
Operating Pressure ❺		-	bar	5.5
Insulation Class		Class B（130℃）		
Protection		IP00		
Compliance with Global Standards		RoHS, CE		
Ambient Temperature	Operation	18℃ to 22℃ Optimum Working Temperature 20±0.5℃		
	Storage	15℃ to 25℃ ❻		
Ambient Humidity	Operation	20%RH to 60%RH（non-condensing）		
	Storage	10%RH to 70%RH（non-condensing）		
Recommended Ambience		Indoor (no direct sunlight); No corrosive gas, inflammable gas, oil mist or dust.		

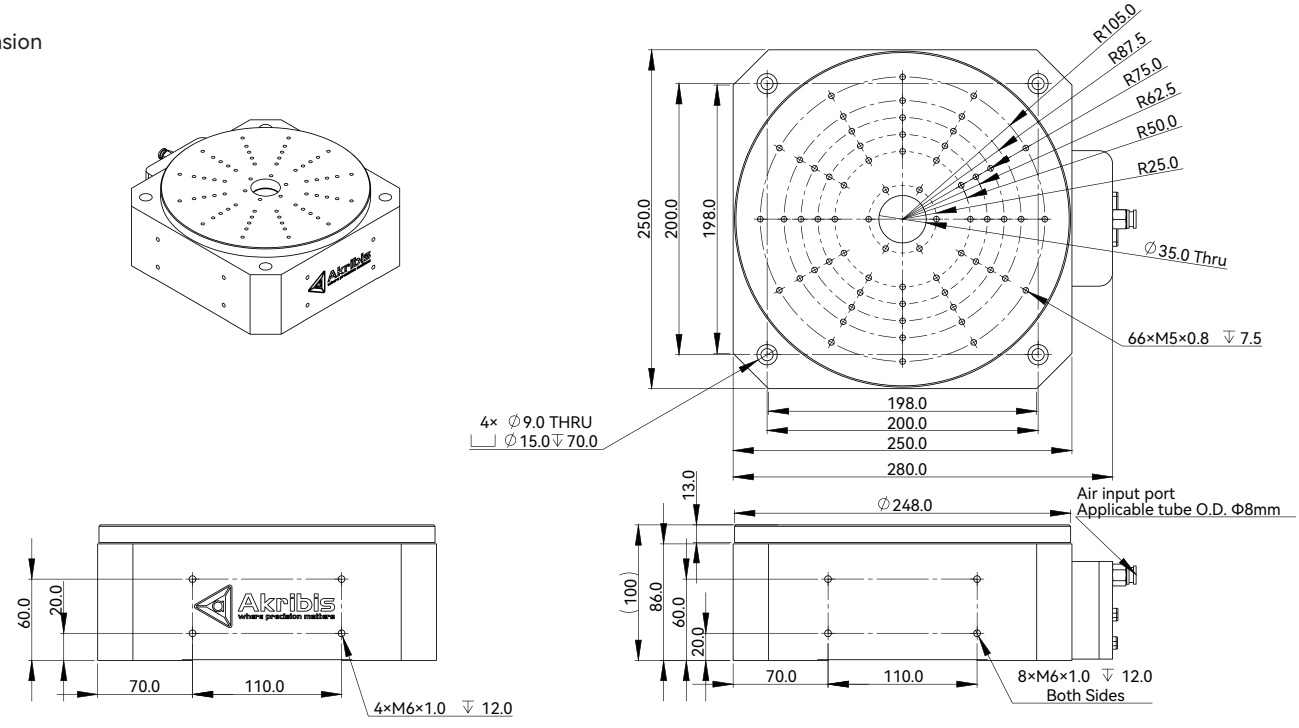
Torque-Speed Curve



❶Measurement is taken at ambient temperature 25℃. Value depends on the thermal environment.
Abbreviations: NC-Natural Cooling.
❷Resistance is measured by DC current.
❸Inductance is measured by current frequency of 1 kHz.
❹Total error specification defined in the datasheet is based on constant loading and temperature condition.
❺A filter with filtration level of 1μm should be added before gas enters the turntable.
The table must not be rotated when there is no ventilation.It can only be rotated when the air pressure is stable.
❻Before taking it out of the storage environment, it should be placed in the using environment for 24 hours,
and the rated pressure gas ventilation should be maintained during the standing process to prevent frost and condensation.

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Dimension



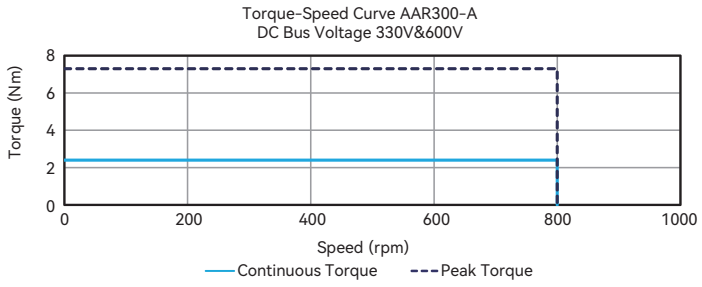
Note: The height size marked with "( )" in the turntable two-dimensional drawing will change according to whether compressed air is injected and whether the rotation movement is carried out.

AAR-A Series

AAR300-A

Performance Parameters		Symbol	Unit	Value
Continuous Torque (NC)@100℃ ❶		T_{cw}	Nm	2.4
Peak Torque		T_{pk}	Nm	7.3
Torque Constant ±10%		K_t	Nm/Arms	0.948
Back EMF Constant ±10%		K_e	Vpeak/rpm	0.081
Motor Constant @25℃		K_m	Nm/Sqrt(W)	0.39
Resistance (L-L) @25℃ ±10% ❷		R_{25}	Ohms	3.92
Inductance (L-L) ±20% ❸		L	mH	1.64
Electrical Time Constant		τ_e	ms	0.42
Continuous Current (NC)@100℃ ❶		I_{cn}	Arms	2.6
Peak Current		I_{pk}	Arms	7.7
Continuous Power Dissipation (NC)@100℃ ❶		P_{cn}	W	49.7
Max. Coil Temperature		T_{max}	℃	100
Thermal Dissipation Constant (NC) ❶		K_{thn}	W/℃	0.66
Max. Bus Voltage		U_{bus}	Vdc	600
Pole Numbers		2P	-	28
Rec. Max Speed @Continuous Torque (330V)		Ω_{max}	rpm	800
Rec. Max Speed @Peak Torque (330V)		Ω_{max}	rpm	800
Mechanical Parameters				
Overall Mass		m_w	kg	25
Rotor Inertia		J_r	kg·m²	0.052
Total Axial Error ❹		-	μm	<0.1
Total Radial Error ❹		-	μm	<0.25
Total Tilt Error ❹		-	arc sec	0.5
Max. Load (Axial)		-	kg	100
Max. Load (Radial)		-	kg	50
Max. Load (Tilt)		-	Nm	45
Encoder Parameters				
Optical Incremental Encoder (SIN/COS)		-	lines/rev	18000
Accuracy with Error Mapping		-	arc sec	±2
Repeatability		-	arc sec	< 1
Other Information				
Operating Pressure ❺		-	bar	5.5
Insulation Class		Class B（130℃）		
Protection		IP00		
Compliance with Global Standards		RoHS, CE		
Ambient Temperature	Operation	18℃ to 22℃ Optimum Working Temperature 20±0.5℃		
	Storage	15℃ to 25℃ ❻		
Ambient Humidity	Operation	20%RH to 60%RH（non-condensing）		
	Storage	10%RH to 70%RH（non-condensing）		
Recommended Ambience		Indoor (no direct sunlight); No corrosive gas, inflammable gas, oil mist or dust.		

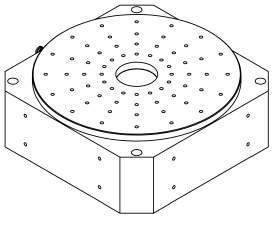
Torque-Speed Curve

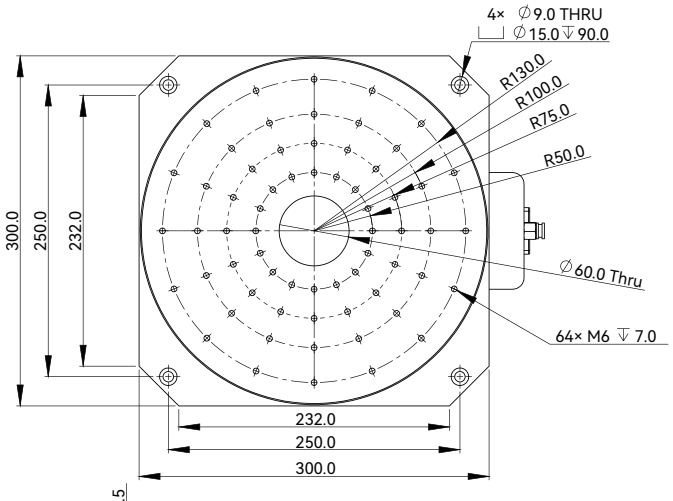


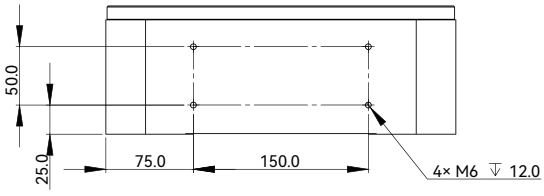
❶Measurement is taken at ambient temperature 25℃. Value depends on the thermal environment.
Abbreviations: NC-Natural Cooling.
❷Resistance is measured by DC current.
❸Inductance is measured by current frequency of 1 kHz.
❹Total error specification defined in the datasheet is based on constant loading and temperature condition.
❺A filter with filtration level of 1μm should be added before gas enters the turntable.
The table must not be rotated when there is no ventilation.It can only be rotated when the air pressure is stable.
❻Before taking it out of the storage environment, it should be placed in the using environment for 24 hours, and the rated pressure gas ventilation should be maintained during the standing process to prevent frost and condensation.

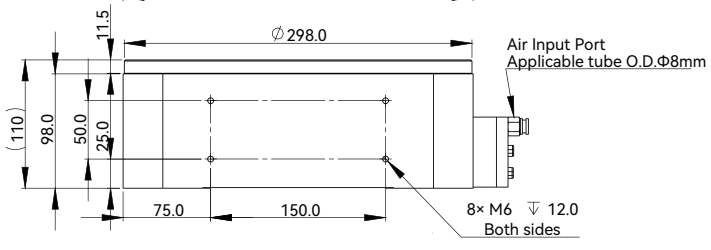
The contents of datasheet are subject to change without prior notice.

Dimension









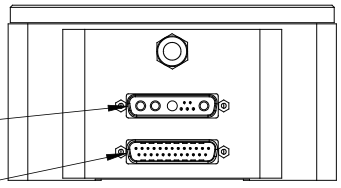
Note: The height size marked with "( )" in the turntable two-dimensional drawing will change according to whether compressed air is injected and whether the rotation movement is carried out.

Motor Cable Connection

MOTOR POWER

PIN	DESCRIPTION
A1	Motor Phase A
A2	Motor Phase B
A3	Motor Phase C
1	T1
3	T2
A4	PE

THERMAL SENSOR WIRE
(K TYPE - PT100)



POWER CONNECTOR
(FM 9W4P-K120)

ENCODER + HALL CONNECTOR
(A-DS 25 LL/G)

ABI (SIN/COS)

PIN	DESCRIPTION
3	5VDC
6	INDEX-
7	INDEX+
14	COSINE+
15	COSINE-
17	SINE+
18	SINE-
20	GND

HALL

PIN	DESCRIPTION
5	HB
10	HA
11	HC
16	5VDC
21	GND

Part Numbering

AAR150-A-080-N-KX-M-HD-000-XW-10-R4A9-000

Motor Model:
AAR150-A
AAR200-A
AAR250-A
AAR300-A

Motor Height:
080
090
100
110

Cooling Type:
N[1]

Thermal Sensor:
KX = PT100(RTD)

Winding Code:
M[2]

Design Control Code:
000[6]

Encoder:
R4A9

Rotation Error:
10/25[5]

Cable Length:
XW[4]

Cable Length:
000

Sensor Cable:
HD[3]

1. N = Natural Cooling
2. M = Mid Speed Winding
3. HD = With Built-in Hall Sensor C/W D-Sub Connector
4. XW = Without Ferrite Bead C/W D-Sub 9W4 Male Connector
5. 10/25 = Axial error 100/250nm ; Radial error 100/250 nm
6. 000 = Standard Model (For more options, please consult cust-service@akribis-sys.com)