



# AM SERIES

Akribis Miniature Stages

**where precision matters**



Akribis is a Latinized Greek word that means “Precision”. On the Akribis logo, the letter “α” is formed by a line and a circle, representing linear and rotary motions. These are supported by a tetrahedron structure, the same structure as the diamond crystal which has many exceptional physical properties.

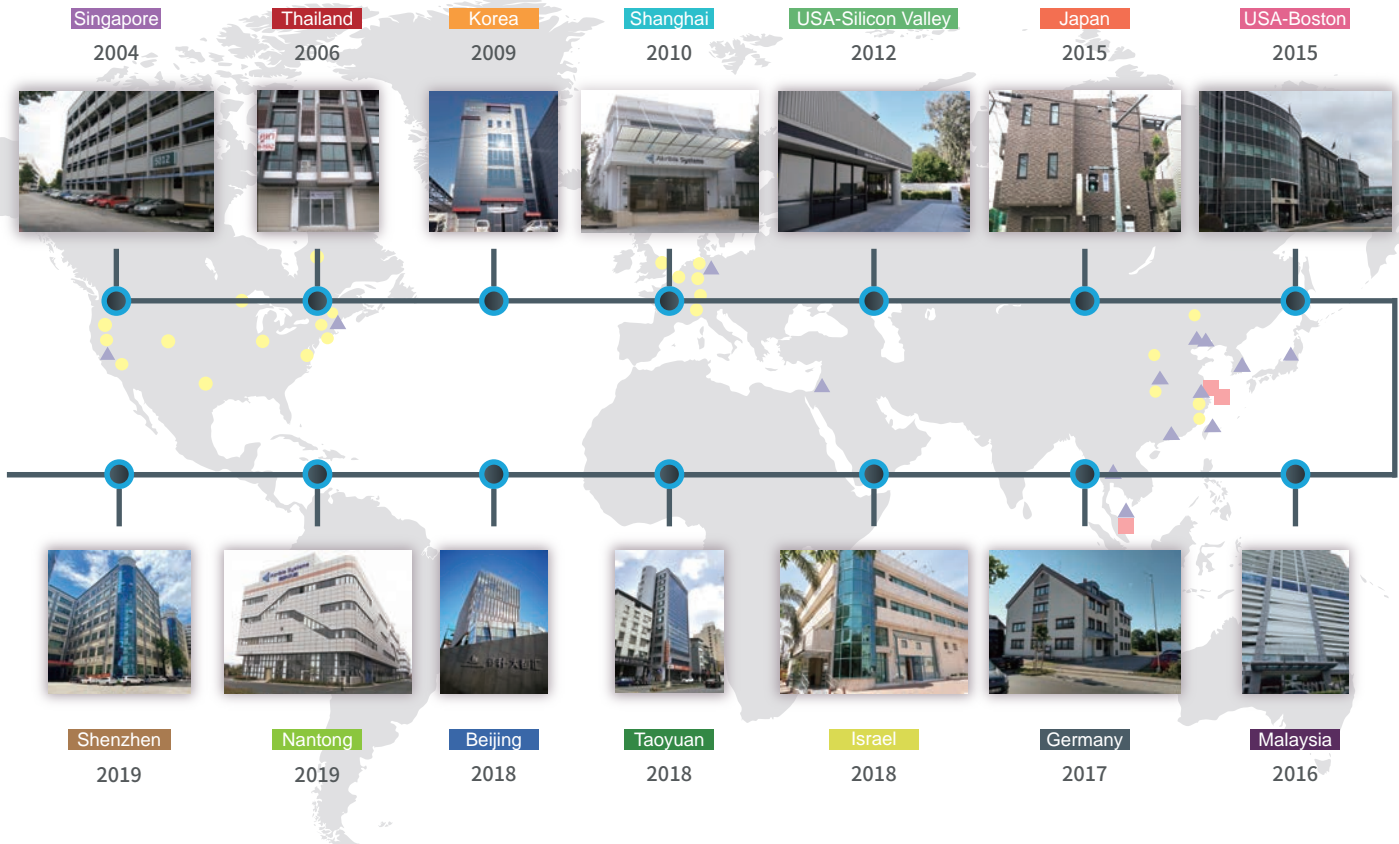
The logo signifies that Akribis Systems’ sound engineering expertise is the basis of the company’s foundation, and this enables us to provide customers with precise, direct drive motion control solutions.

Akribis Systems Pte Ltd was founded in Aug 2004. We design and manufacture direct drive motors, stages and precision systems that are used in equipment for manufacturing, inspection and testing. Akribis Systems supports a wide range of industries including semiconductor, solar, flat panel, hard disk, LED, printed circuit board, printing, photonics and biomedical manufacturing.

From the beginning, the company has been focusing on innovation and development of new technologies and solutions in motion control, with more than 44 patents applied. Backed by a very strong and committed engineering team, the company continues to develop custom motors and systems for the most demanding applications.

The corporate headquarters of Akribis Systems is situated in Singapore. We have manufacturing facilities in Singapore and in Shanghai, Nantong, Shenzhen, China.

Our sales network includes our sales offices in USA, South Korea, Japan, Thailand, Malaysia and Taiwan, and is reinforced by our comprehensive distribution channels in Asia, Europe and North America.



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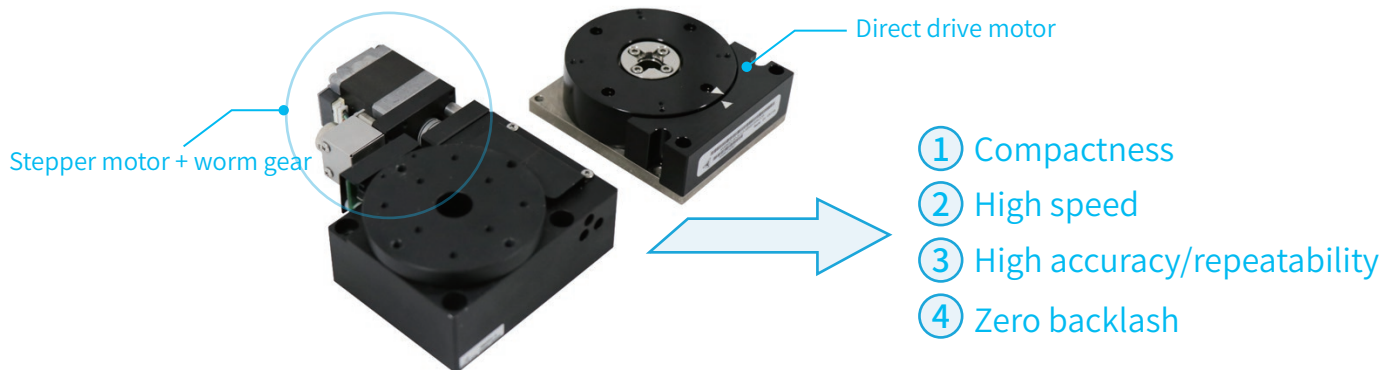
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# AM series

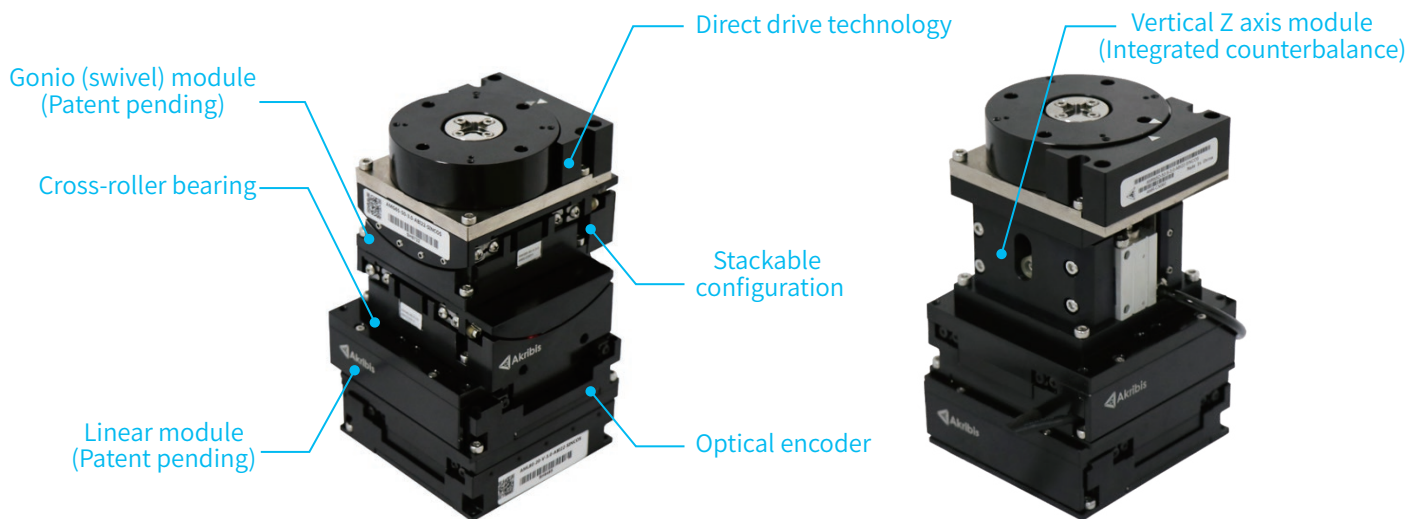
## Introduction

AM series is a family of Akribis direct drive stages. “M” denotes “Miniature”, indicating its compactness. The elegant mechatronics design integrates the technology of motor, mechanics, and sensors.

## Why direct drive?

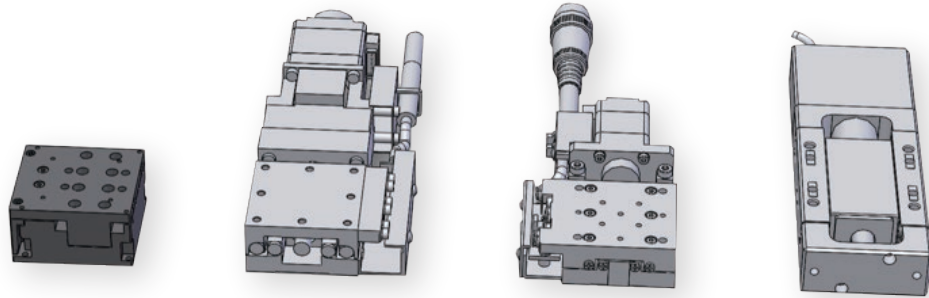


## Features



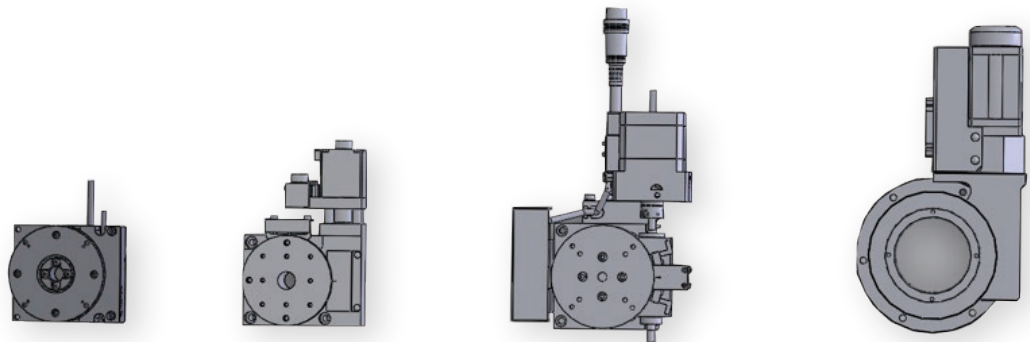
## Comparison

### AML



Brand	Unit	Akribis	Brand X	Brand Y	Brand Z
Motor	-	Direct drive motor	Stepper motor + ball screw	Stepper motor + ball screw	Stepper motor + ball screw
Guide	-	Cross-roller bearing	Ball bearing	Cross-roller bearing	Ball bearing
Feedback	-	Optical encoder	N/A	N/A	Motor mounted encoder
Table size	mm	40×40	40×40	40×40	25×25
Dimension	mm	43×40×23	142.5×56.8×24.0	97×55×20.5	133.5×45×20
Repeatability	μm	±0.3	±0.5	±0.3	±0.75
Lost motion	μm	0	1	1	N/A
Backlash	μm	0	0.5	0.5	N/A
Max.speed	mm/s	400	10	10	1
Stroke	mm	10	13	10	25

### AMR



Brand	Unit	Akribis	Brand X	Brand Y	Brand Z
Motor	-	Direct drive motor	Stepper motor + ball screw	Stepper motor + worm	Stepper motor + worm
Feedback	-	Optical	N/A	N/A	None
Diameter	mm	65	60	68	84
Dimension	mm	65×76×25	123.5×79×35	140×109×30	212.6×110×50
Max.speed	degree/s	720	64	20	20
Lost motion	arcsec	0	0.2	N/A	N/A
Backlash	arcsec	0	0.6	0.06	N/A
Stroke	degree	50	11	270	N/A



# AML Series Linear Module

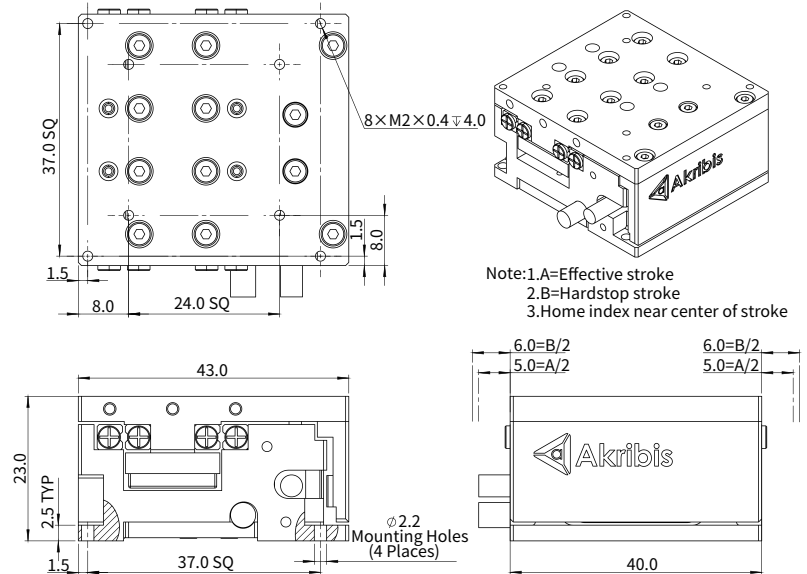
- ▶ Compact design
- ▶ Direct drive technology
- ▶ High precision optical encoder
- ▶ High response
- ▶ Stackable configuration

## AML40-10

Specifications	Unit	Value
Effective Stroke	mm	10
Continuous Force	N	2.3
Peak Force	N	6.9
Resolution	μm	ABI22: SINCOS
		ABI21: 0.2
		AT2: SINCOS
		AT2: 0.05
Repeatability	μm	ABI22 SINCOS: ±0.4 (4096X)
		AB21 0.2 : ±1.0
		AT2 0.05 : ±0.5
		AT2 SINCOS: ±0.3 (1024X)
Straightness	μm	±1.5
Flatness	μm	±1.5
Rated Payload <sup>①</sup>	kg	0.4
No-load Moving Mass	kg	0.06
No-load Total Mass	kg	0.16
Max. Allowable Roll Moment Load	Nm	1.0
Max. Allowable Pitch Moment Load	Nm	1.6
Max. Allowable Yaw Moment Load	Nm	1.8

① The rated load is based on the load in which the acceleration of the mass is at least 1G.

### Dimension Drawing

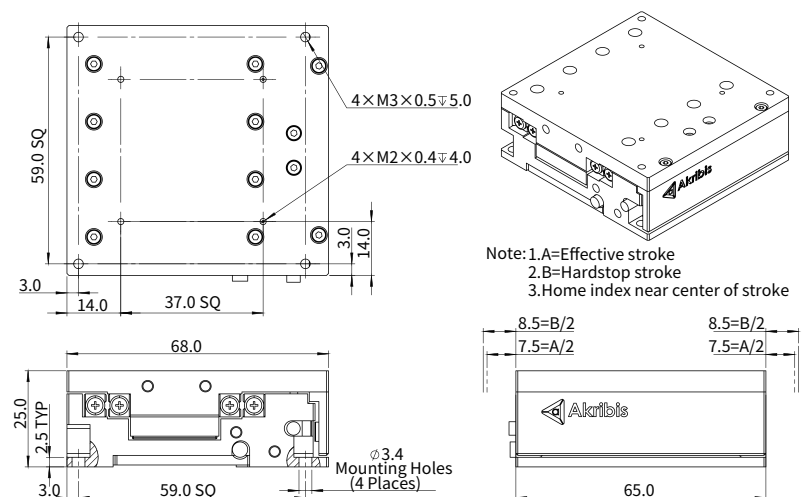


## AML65-15

Specifications	Unit	Value
Effective Stroke	mm	15
Continuous Force	N	5.9
Peak Force	N	17.7
Resolution	μm	ABI22: SINCOS
		ABI21: 0.2
		AT2: SINCOS
		AT2: 0.05
Repeatability	μm	ABI22 SINCOS: ±0.4 (4096X)
		AB21 0.2 : ±1.0
		AT2 0.05 : ±0.5
		AT2 SINCOS: ±0.3 (1024X)
Straightness	μm	±1.5
Flatness	μm	±1.5
Rated Payload <sup>①</sup>	kg	1.1
No-load Moving Mass	kg	0.18
No-load Total Mass	kg	0.39
Max. Allowable Roll Moment Load	Nm	5.4
Max. Allowable Pitch Moment Load	Nm	7.0
Max. Allowable Yaw Moment Load	Nm	8.4

① The rated load is based on the load in which the acceleration of the mass is at least 1G.

### Dimension Drawing

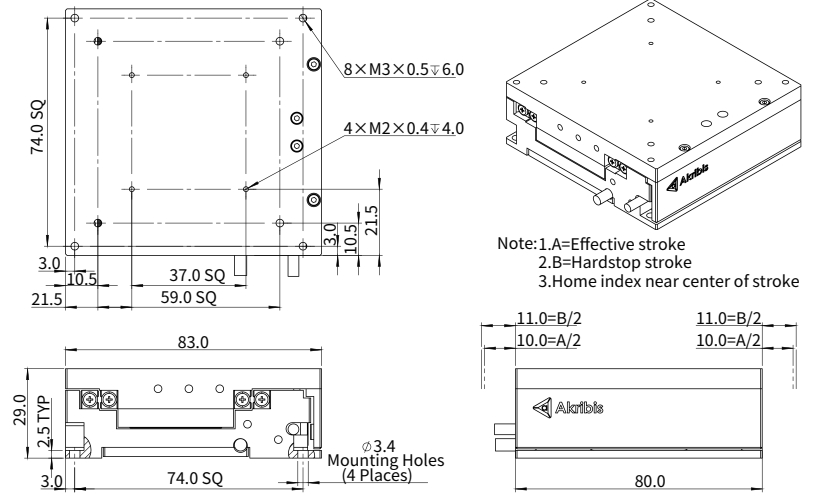


## AML80-20

Specifications	Unit	Value
Effective Stroke	mm	20
Continuous Force	N	9.6
Peak Force	N	28.8
Resolution	μm	ABI22: SINCOS
		ABI21: 0.2
		AT2: SINCOS
		AT2: 0.05
Repeatability	μm	ABI22 SINCOS: ±0.4 (4096X)
		AB21 0.2: ±1.0
		AT2 0.05: ±0.5
		AT2 SINCOS: ±0.3 (1024X)
Straightness	μm	±1.8
Flatness	μm	±1.8
Rated Payload <sup>①</sup>	kg	1.3
No-load Moving Mass	kg	0.34
No-load Total Mass	kg	0.71
Max. Allowable Roll Moment Load	Nm	9.0
Max. Allowable Pitch Moment Load	Nm	9.7
Max. Allowable Yaw Moment Load	Nm	11.7

① The rated load is based on the load in which the acceleration of the mass is at least 1G.

### Dimension Drawing



## Ordering Part Numbering

**AML1 T E0A 1 A 1 A**

Model:

AML1:AML40-10  
AML2:AML65-15  
AML3:AML80-20

Cover Type:

T:Black Anodized

Encoder Type:

E0A:ABI-22 (SINCOS)  
E0G:ABI-21 (0.2μm)  
ECA:ATOM2 (SINCOS)  
ECJ:ATOM2 (0.05μm)

① For motor only. Encoder is DB connector.

② ABI-21 uses steel tape scale only.

③ ATOM2 uses glass scale only.

Guide Option:

A:Anti-creep cross roller  
B:Non anti-creep cross roller

Termination:

1:Flying Lead<sup>①</sup>

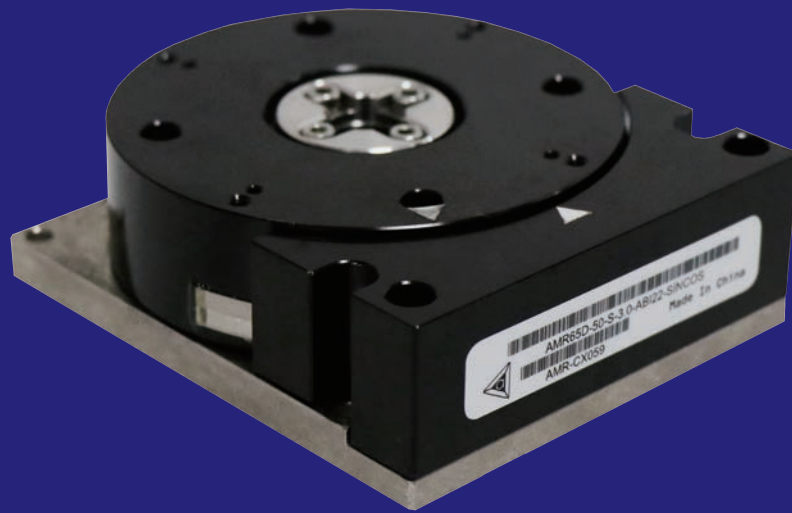
Cable Length(m):

A:0.5 / B:3.0

Scale Type:

1:Steel tape,11ppm/K<sup>②</sup>  
2:Glass G8 Soda Lime,8ppm/K<sup>③</sup>





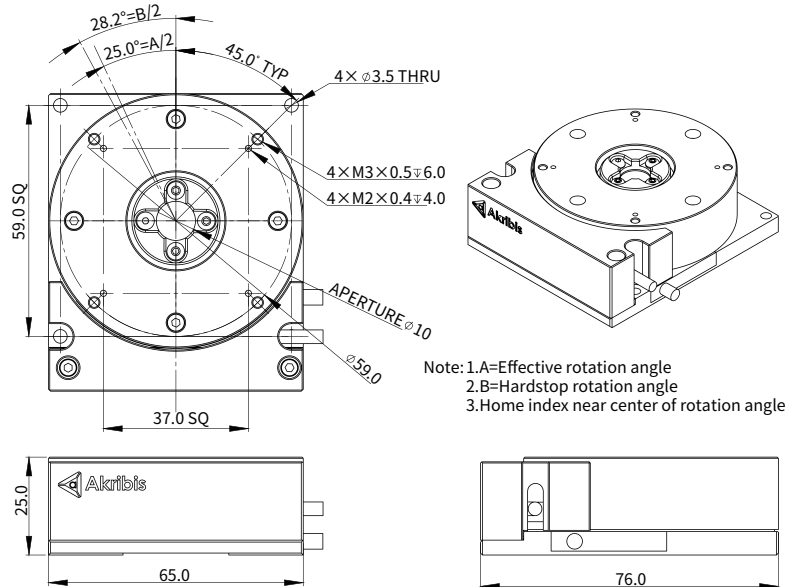
# AMR Series Rotary Module

- ▶ Compact design
- ▶ Direct drive technology
- ▶ Cogging free
- ▶ High precision optical encoder
- ▶ Stackable configuration

## AMR65D

Specifications	Unit	Value
Effective Stroke	degree	50
Continuous Torque	Nm	0.13
Peak Torque	Nm	0.51
Resolution	lines/rev	ABI22 (SINCOS): 2568
		AT2 (SINCOS): 10272
Repeatability	arc sec	ABI22 SINCOS: $\pm 0.5$ (4096X)
		AT2 SINCOS: $\pm 0.5$ (1024X)
Max. Speed	degree/s	720
Rotor Inertia	kg.m <sup>2</sup>	0.00014
No-load Total Mass	kg	0.52
Max. Axial Load	N	30
Max. Moment Load	Nm	0.84

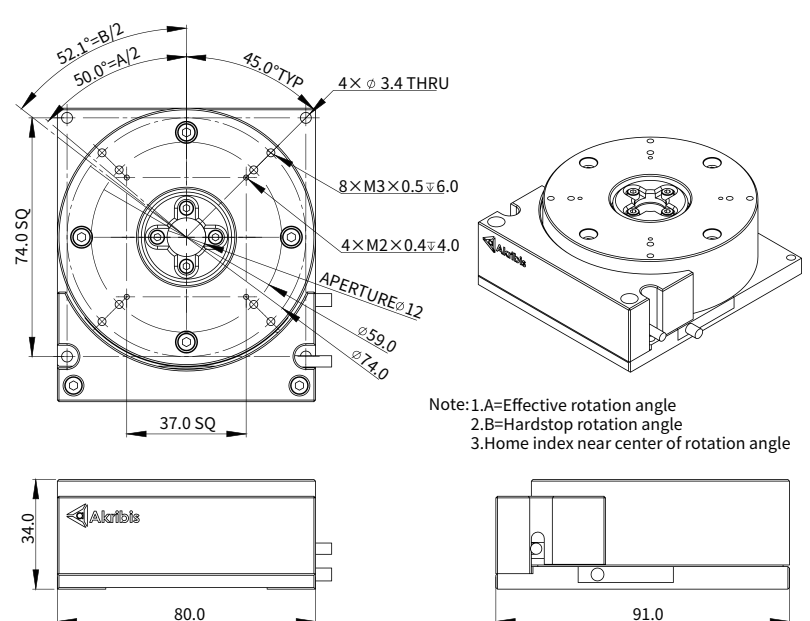
### Dimension Drawing



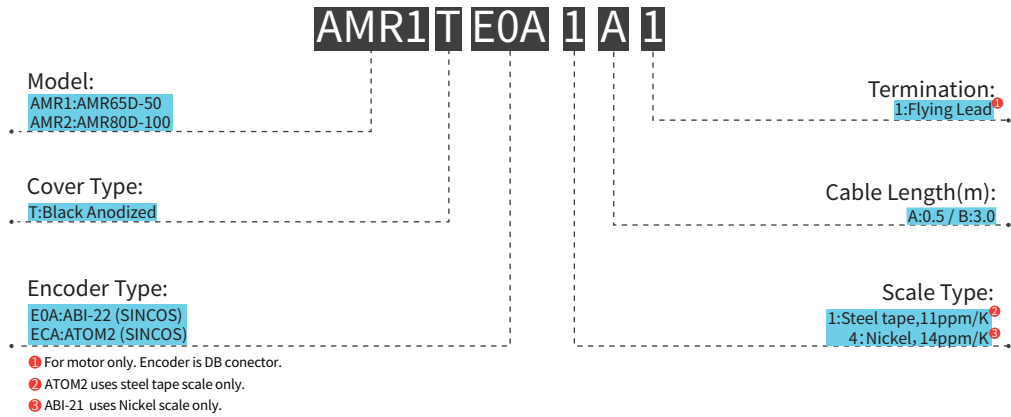
## AMR80D

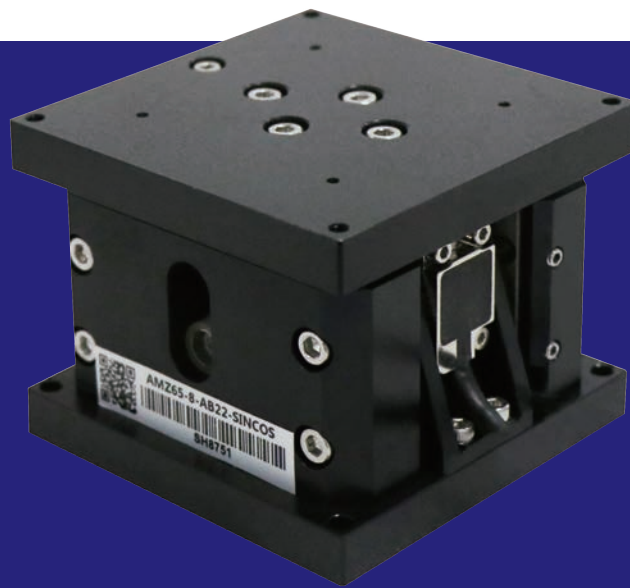
Specifications	Unit	Value
Effective Stroke	degree	100
Continuous Torque	Nm	0.2
Peak Torque	Nm	0.79
Resolution	lines/rev	ABI22 (SINCOS): 3142
		AT2 (SINCOS): 12568
Repeatability	arc sec	ABI22 SINCOS: $\pm 0.5$ (4096X)
		AT2 SINCOS: $\pm 0.5$ (1024X)
Max. Speed	degree/s	720
Rotor Inertia	kg.m <sup>2</sup>	0.00016
No-load Total Mass	kg	1.1
Max. Axial Load	N	60
Max. Moment Load	Nm	2.0

### Dimension Drawing



## Ordering Part Numbering





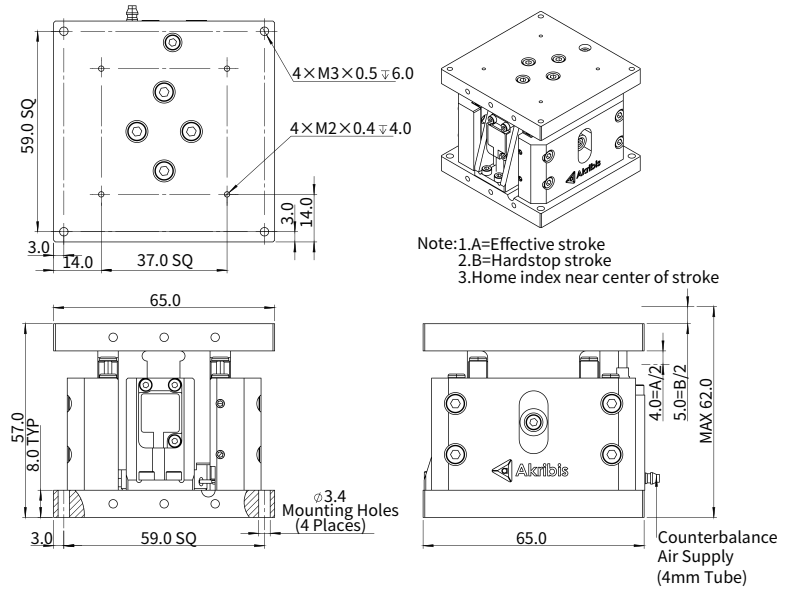
# AMZ Series Vertical Z Module

- ▶ Compact design
- ▶ Direct drive technology
- ▶ High response
- ▶ High precision optical encoder
- ▶ Stackable configuration

## AMZ65

Specifications	Unit	Value
Effective Stroke	mm	8
Continuous Force	N	7.35
Peak Force	N	29.4
Resolution	μm	ABI22: SINCOS
		ABI21: 0.2
		AT2: SINCOS
		AT2: 0.05
Repeatability	μm	ABI22 SINCOS: ±0.2 (4096X)
		AB21 0.2: ±1.0
		AT2 0.05: ±0.5
		AT2 SINCOS: ±0.1 (1024X)
Straightness	μm	±1.5
Flatness	μm	±1.5
Rated Payload <sup>1</sup>	kg	0.5
No-load Moving Mass	kg	0.29
No-load Total Mass	kg	0.60
Max. Allowable Roll Moment Load	Nm	7.4
Max. Allowable Pitch Moment Load	Nm	4.0
Max. Allowable Yaw Moment Load	Nm	4.8

### Dimension Drawing



<sup>1</sup> The rated load is based on the load in which the acceleration of the mass is at least 1G

\* Cylinder counterbalance pressure maximum 0.6MPa allowed, which provides maximum 17N counterbalance force.

## Ordering Part Numbering

**AMZ1 T EOA 1 A 1**

Model:

AMZ1:AMZ65-8

Termination:

1:Flying Lead<sup>1</sup>

Cover Type:

T:Black Anodized

Cable Length(m):

A:0.5 / B:3.0

Encoder Type:

E0A:ABI-22 (SINCOS)  
E0G:ABI-21 (0.2um)  
ECA:ATOM2 (SINCOS)  
ECJ:ATOM2 (0.05um)

Scale Type:

1:Steel tape, 11ppm/K<sup>2</sup>  
2:Glass G8 Soda Lime, 8ppm/K<sup>2</sup>

<sup>1</sup> For motor only. Encoder is DB connector.

<sup>2</sup> ABI-21 uses steel tape scale only.

<sup>3</sup> ATOM2 uses glass scale only.



# AMS Series Linear Module

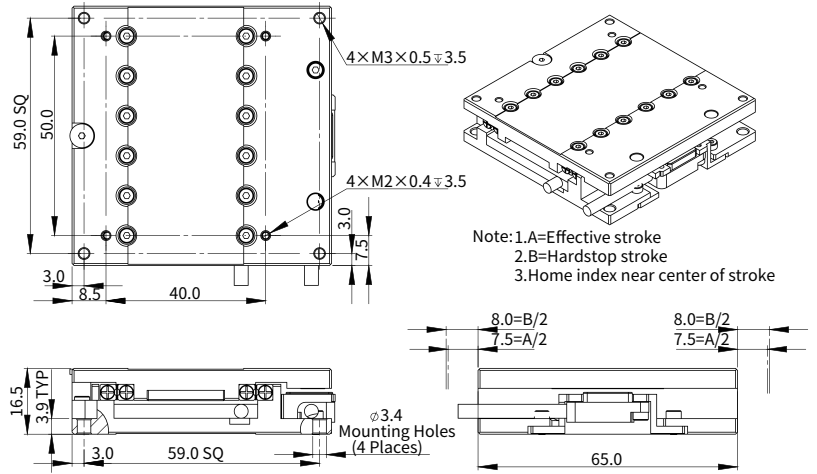
- ▶ Low profile
- ▶ Direct drive technology
- ▶ High response
- ▶ High precision optical encoder
- ▶ Stackable configuration

## AMS65X

Specifications	Unit	Value
Effective Stroke	mm	15
Continuous Force	N	4.6
Peak Force	N	8.4
Resolution	μm	ABI22: SINCOS
		ABI21: 0.2
		AT2: SINCOS
		AT2: 0.05
Repeatability	μm	ABI22 SINCOS: ±0.4 (4096X)
		AB21 0.2: ±1.0
		AT2 0.05: ±0.5
		AT2 SINCOS: ±0.3 (1024X)
Straightness	μm	±1.5
Flatness	μm	±1.5
Rated Payload <sup>①</sup>	kg	0.3
No-load Moving Mass	kg	0.18
No-load Total Mass	kg	0.42
Max. Allowable Roll Moment Load	Nm	1.6
Max. Allowable Pitch Moment Load	Nm	2.0
Max. Allowable Yaw Moment Load	Nm	2.4

① The rated load is based on the load in which the acceleration of the mass is at least 1G

### Dimension Drawing



## Ordering Part Numbering

**AMS1 E E0A 1 A 1 A**

Model:

AMS1:AMS65X-15

Cover Type:

E:EN

Encoder Type:

E0A:ABI-22 (SINCOS)  
E0G:ABI-21 (0.2um)  
ECA:ATOM2 (SINCOS)  
ECJ:ATOM2 (0.05um)

- ① For motor only. Encoder is DB connector.
- ② ABI-21 uses steel tape scale only.
- ③ ATOM2 uses glass scale only.

Guide Option:

A:Anti-creep cross roller  
B:Non anti-creep cross roller

Termination:

1:Flying Lead<sup>①</sup>

Cable Length(m):

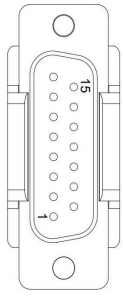
A:0.5 / B:3.0

Scale Type:

1:Steel tape, 11ppm/K<sup>②</sup>  
2:Glass G8 Soda Lime, 8ppm/K<sup>③</sup>

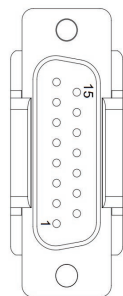
# Encoder Pin Assignment

## ABI21

I/O Connector	Pinout	Signal	Function
	Pin 3	Reserved	Do Not Connect
	Pin 4	A-	TTL A- Signal
	Pin 5	A+	TTL A+ Signal
	Pin 6	Reserved	Do Not Connect
	Pin 9	B-	TTL B- Signal
	Pin 10	B+	TTL B+ Signal
	Pin 12	+5V	Encoder Supply(5V)
	Pin 13	GND	Encoder Supply(0V)
	Pin 14	Index+	Index+ Signal
	Pin 15	Index-	Index- Signal
Case	Shielded	Outer Shielded	

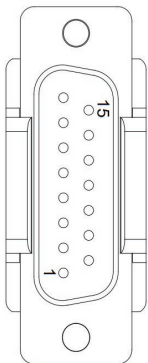
Note: Data from 'Datasheet for ABI-21 (EN)-20.08.04-Open'.

## ABI22

I/O Connector	Pinout	Signal	Function
	Pin 1	Index-	Index- Signal
	Pin 2	Index+	Index+ Signal
	Pin 3	Reserved	Do Not Connect
	Pin 6	Reserved	Do Not Connect
	Pin 7	Cos+	Cosine+ Signal
	Pin 8	Sin+	Sine+ Signal
	Pin 11	Reserved	Do Not Connect
	Pin 12	+5V	Encoder Supply(5V)
	Pin 13	GND	Encoder Supply(0V)
	Pin 14	Cos-	Cosine- Signal
	Pin 15	Sin-	Sine- Signal
	Case	Outer shielded	Outer Shielded

Note: Data from 'Datasheet for ABI-21 (EN)-20.08.04-Open'.

## ATOM Ri

I/O Connector	Digital		Analogue		Function
	Pinout	Signal	Pinout	Signal	
	Pin 7,8	5V	Pin 4,5	5V	Power
	Pin 2,9	0V	Pin 12,13	0V	
	Pin 14	A+	Pin 9	V1+	Incremental Signals
	Pin 6	A-	Pin 1	V1-	
	Pin 13	B+	Pin 10	V2+	
	Pin 5	B-	Pin 2	V2-	
	Pin 12	Z+	Pin 3	V0+	Reference Mark
	Pin 4	Z-	Pin 11	V0-	
	Pin 11	E+	-	-	Alarm
	Pin 3	E-	-	-	
	Pin 1	X	Pin 6	Vx	Set-up
	-	-	Pin 14	CAL	Remote CAL
	Case	-	Case	-	Shielded
	Pin 10,15	-	Pin 7,8,15	-	Do Not Connect

Note: Data from 'L-9517-9563-05-B\_Data\_sheet\_ATOM\_en'.



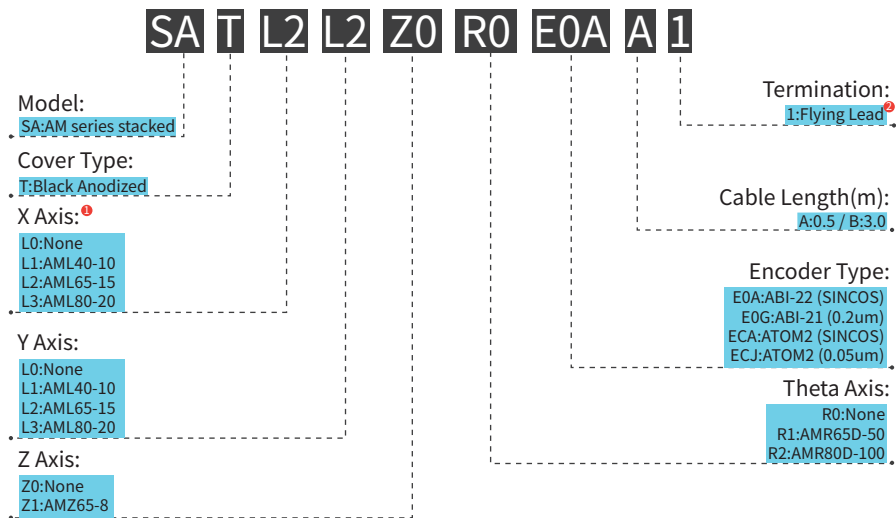
# AM Series Stacked



# AM Series Stack-up

In AM series, the stacked option is available. Each AM module can be stacked directly with each other. The flexible modular design provides possible solution to different applications. If needs customization, please contact us.

## Ordering Part Numbering



- ① The upper axis' platform size should be smaller than or equal to lower axis'. (for example, AML65 can be stacked on AML65 or AML80).
- ② For motor only. Encoder is DB connector.

# Controller&Driver

AGD200



AGD301



AME3



# AGD Series – Integrated Controller and Drive Unit

## AGD200

AGD200 series is a family of compact, high performance motion control units with 2 integrated servo amplifiers, allowing it driving 2 motors and control third axis through an external drive. It is equipped with Ethernet, USB, CAN bus, RS232 and RS485 communication ports to interface with any host devices. With 16 kHz sampling frequency, this product is ideal for any tightly coordinated motion systems. It supports a very wide range of bus-voltage from 12Vdc to 90Vdc and each axis can supply up to 5.6Arms continuous current and 11.2Arms peak current concurrently.

Equipped with a plethora of I/Os: 11 isolated digital inputs, 4 isolated digital output, 4 analog inputs, 4 analog outputs and 8 differential inputs, this product is fully capable of handling standalone applications. The typical use case of this product is in 3D printers, security surveillance camera systems, mobile robots, and factory automations.



## AGD200

Description	AGD200-ET-2D01	AGD200-ET-2D02	AGD200-ET-2D05
Number of Axes	2 (3 <sup>rd</sup> axis with external drive)		
Power Supply	12-90 VDC		
Logic Power Supply (Optional)	12-36 VDC		
Continuous Current	1.4 Arms	2.8 Arms	5.6 Arms
Peak Current	2.8 Arms	5.6 Arms	11.2 Arms
Isolated Inputs <sup>1</sup>	11		
Isolated Outputs <sup>2</sup>	4		
Differential Inputs	8		
Differential Outputs	4		
Analog Inputs <sup>3</sup>	4 (12-bit, 16 bits analog input with extension board)		
Analog Outputs	4 (16-bit)		
Brake Output <sup>4</sup>	2		
Encoder Inputs	3 Ports (each port is software configurable as AquadB, Absolute Biss-C or EnDat2.2 <sup>5</sup> ). Ports 1 and 2 support also Sin/Cos 1Vpp encoders		
Motor Types	Voice Coil, Brushed/Brushless Linear or Rotary Motor, Steppers (open and closed loop, micro-stepping)		
Communication	Ethernet, CAN bus, RS232, USB, RS485		
Control Sampling Rate	16 KHz (profiler, position, velocity, optional force, current)		
Operational Modes	Position, Velocity, Force or Current (Torque) modes		
Motion Modes	Point to Point, Repetitive, Jog, ECAM, Gearing, Joystick, Handwheel, Pulse & Direction, Gantry, CNC sequential contour (G-codes) ,Vector and Tracking motion modes. Motion parameters, such as speed, acceleration, deceleration, and target position can be all modified on-the-fly.		
Features	Encoder Error Mapping: 1D, 2D or 3D, Auto-Loop Shaping (auto-tuning), Frequency Domain System Identification and Modelling, Flexible Gain Scheduling, Position Lock and Event, Ultra-Precision Mode (UPM), Input-Shaping, Profile-Shaping, Machine Vibration Control, Spring and Friction Compensation, Complex-Kinematics (robot kinematics), etc.		
Programming Interfaces	Standalone User Program – high level script-based program executed in the controller (up to 8 multi-threading programs with priority setting for each thread). IDE integrated in PCSuite Windows .Net API – available in NuGet Manager. Standard TCP/IP communication – ASCII string commands or binary CAN format.		

- <sup>1</sup> Digital isolated input can be configured as NPN or PNP, in groups of 3 or 4.
- <sup>2</sup> Digital isolated output can sink up to 500mA or source up to 300mA.
- <sup>3</sup> 16-bit analog inputs available in some product options. Consult your sales channel.
- <sup>4</sup> Brake output up to 48VDC, 3A each.
- <sup>5</sup> EnDat 2.2 supported by dedicated FPGA version (consult with sales engineer).

# AGD Series – Integrated Controller and Drive Unit

## AGD301

AGD301 series is a family of standalone, high performance 3-axis motion control units with integrated servo amplifiers, It is equipped with Ethernet, USB, CAN bus, RS232 and RS485 communication ports to interface with any host devices such as PC, PLC, HMI, etc. With 16 kHz sampling (profiler, position, velocity, optional force and current control loops) frequency, this product is ideal for any tightly coordinated motion systems, such as XYZ or XY-Theta stage, flexible-link gantry stages, Z-Theta or XZ-Theta pick and place modules, etc.

AGD301 can drive up to 3 voice coils, brushed or brushless servo motors or stepper motors, allowing very flexible configuration of the motors in the multi-axis system. It supports a very wide range of bus-voltage from 12Vdc to 90Vdc and each axis can supply up to 5.6Arms continuous current and 11.2Arms peak current concurrently. It is suitable to drive very small voice coil or brushed motors at 12Vdc, and is also capable drive 3 big motors with 0.5kW continuous power each.



## AGD301

Description	AGD301-ET-2D05	AGD301-ET-2D09-001
Number of Axes	3	
Power Supply	12-90 VDC	
Logic Power (optional)	12-36VDC	
Continuous Current	5.6 Arms per axis	9 Arms per axis <sup>①</sup>
Peak Current	11.2 Arms per axis	18.2 Arms per axis
Isolated Inputs <sup>②</sup>	27	
Isolated Outputs <sup>③</sup>	17	
Bi-Directional Differential I/Os (RS422)	8	
Analog Inputs <sup>④</sup>	4 (12-bit)	4 (16-bit)
Analog Outputs	4 (16-bit)	
PT100/PT1000 Inputs <sup>⑤</sup>	3	
Brake Output <sup>⑥</sup>	3	
Hall Sensors Inputs <sup>⑦</sup>	3	
Regeneration Output	1	
Encoder Inputs	3 Ports (each port is software configurable as AquadB, Sin/Cos 1Vpp, Absolute BiSS-C or EnDat2.2).	
Motor Types	Voice Coil, Brushed/Brushless Linear or Rotary Motor, Steppers (open and closed loop, micro-stepping)	
Communication	Ethernet, RS232, CAN, USB, RS485	
Control Sampling Rate	16 kHz sampling rate for current, velocity and position control loops	
Operational Modes	Position, Velocity, optional Force or Current modes	
Motion Modes	Point to Point, Repetitive, Jog, ECAM, Gearing, Joystick, Handwheel, Pulse & Direction, Gantry, CNC sequential contour (G-codes), Vector and Tracking motion modes. Motion parameters, such as speed, acceleration, deceleration, and target position can be all modified on-the-fly.	
Features	Encoder Error Mapping: 1D, 2D or 3D, Auto-Loop Shaping (auto-tuning), Frequency Domain System Identification and Modelling, Flexible Gain Scheduling, Position Lock and Event, Ultra-Precision Mode (UPM), Input-Shaping, Profile-Shaping, Machine Vibration Control, Spring and Friction Compensation, Complex-Kinematics (robot kinematics), etc.	
Programming Interfaces	Standalone User Program – script-based program executed in the controller (up to 8 multi-threading programs with priority setting for each thread). IDE integrated in PCSuite Windows .Net API – available in NuGet Manager. Standard TCP/IP communication – ASCII string commands or binary CAN format.	

① Digital isolated input can be configured as NPN or PNP, in groups of 3 or 4.

② Digital isolated output can sink up to 500mA or source up to 300mA.

③ 16-bit analog inputs available in some product options. Consult your sales channel.

④ Hardware switch to select between PT100 and PT1000.

⑤ Brake output up to 48VDC, 3A each.

⑥ Part of general purpose inputs with internal 5V power supply.

⑦ Limited to 20 Arms for 3 axes in total.

# 3-axis EtherCAT Driver

## AME3-90V-0510

AME3-90V-0510 (Akribis 3-axis Module Ethercat Driver) is 3-axis, high performance, DC powered drive . This product allows position, velocity and torque control using EtherCAT.

Each of the axis support cyclic synchronous position/velocity/torque, profile position velocity, Interpolated position mode (PVT) and homing. In micro stepping, mode, stepper command pulses and master encoder for camming or gearing is supported.

This product features with 19x High speed inputs, 3x MOSFET outputs, 6x CMOS High speed outputs, where the 3x MOSFETS outputs are 24V compatible can power motor brakes.

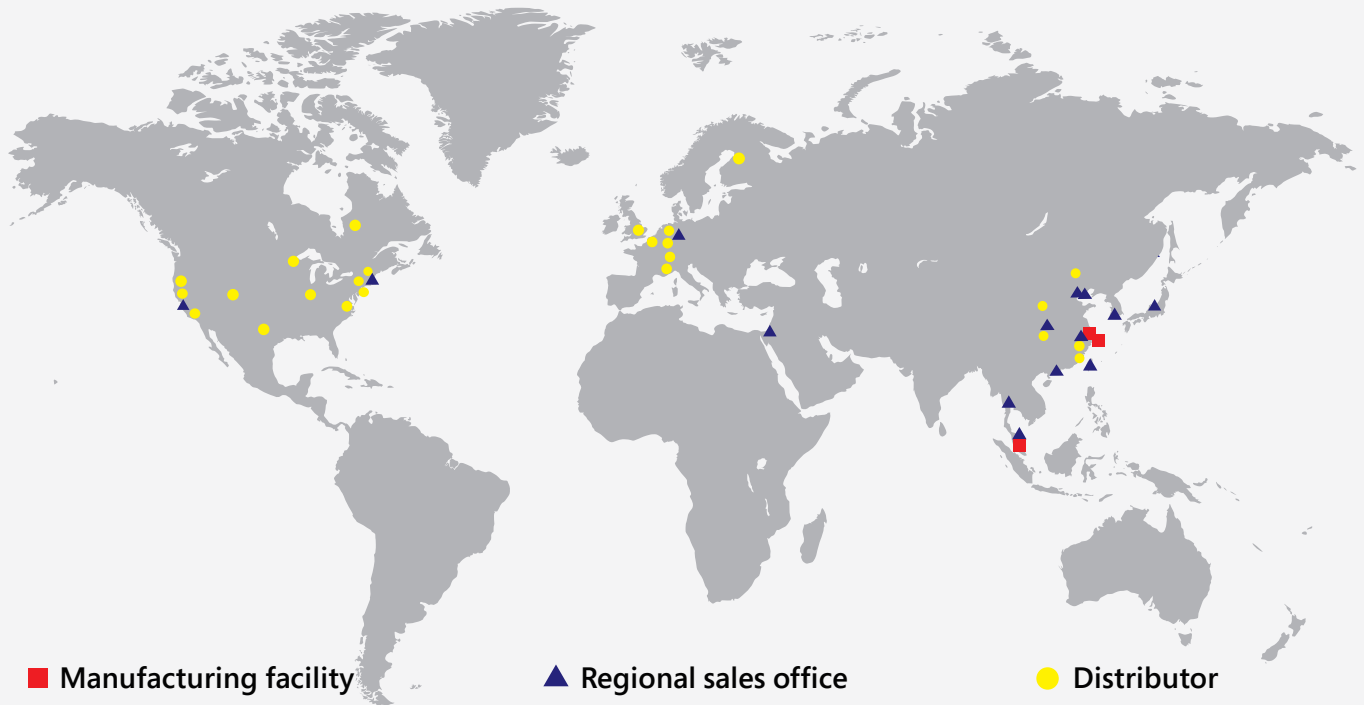


## AME3-90V-0510

Description	AME3-90V-0510	
Vbus Voltage	+14 V to +90 V	
VAux Voltage	+21.6V to 26.4V, 12.3W max with all encoders @ 500mA	
Input Power Current Consumption (peak)	30 A (1 second)	
Input Power Current Consumption (continuous)	15 A	
Output Power (each axis)	Peak Current	10 A
	Peak Time	1 Second
	Continuous Current	5 A
Encoder Feedback Interface Support	Analog 1Vpp (incremental encoder)	
	Digital A quad B (incremental encoder)	
	EnDat (absolute encoder)	
	BISS C (absolute encoder)	
	SSI (absolute encoder)	
	Hall Sensor	
EtherCAT Interface	100BASE-TX cabling system	
	2x RJ45 (EtherCAT Network port)	
Control I/O Interface	19x HS Digital Input (*High speed)	
	3x MOSFET Digital Output	
	6x CMOS HS Digital Output (*High speed)	
	3x Differential Analog Input (12-bit)	
Operating Temperature	0°C - 45°C	



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