

AiCA-EC Series

User Manual MMD-AiCA-ECU1-V2.0_EN

INDUSTRIAL AUTOMATION

Thank you for purchasing an Autonics product.

This user manual contains information about the product and its proper use,
and should be kept in a place where it will be easy to access.

Autonics

Hotline: 1900.6536 - Website: HOPLONGTECH.COM

1. Product Overview

1.1. Features

AiCA-EC series is Ai-Servo with EtherCAT communication. This product supports stable compatibility with various master / slave with open protocol communication EtherCAT and is advantageous for control simultaneous multi-axis synchronized control through 100 Mbps baud rate. In addition, as AC power system, the SMPS is not required for power connection and motor system can maintain higher torque during high speed drive compared to DC type motor.

- Closed-loop system with real-time position control
- High speed & high torque drive without missing steps
- Supports 200 - 240 VAC AC power
- Multi-axis simultaneous control with EtherCAT communication
- Windows-based software (atMotion) for easy parameter setting and monitoring
- 7-segment display for alarm / status reading
- Supports torque mode
- Supports Auto Current Down mode
- Built-in brake type motors available (AiCA-D-B-EC Series)
- Built-in geared/rotary actuator type motors available

1.2. Components and Configuration Diagram

1.2.1. Components

(1) Driver

- Driver
- Instruction manual
- Power connector
- I/O connector
- Brake connector (AiCA-D-B Series)

(2) Motor

- Motor
- Instruction manual

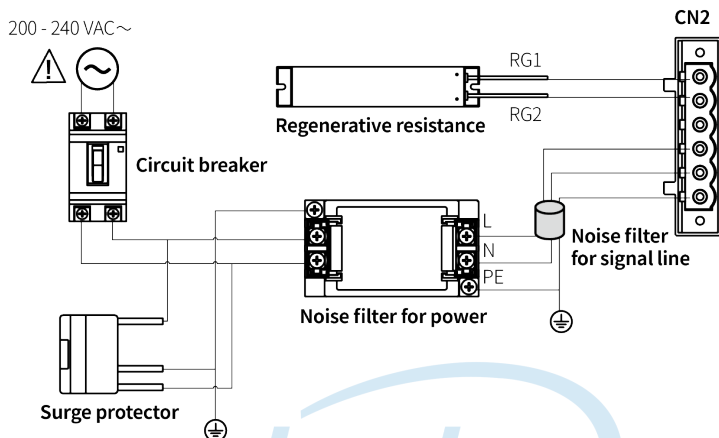


Make sure all of the above components are included with your product package before use.

If a component is missing or damaged, please contact Autonics or the product distributor.

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1.2.2. Configuration



- The thickness of cable should be same or thicker than the below specifications when connecting the cable for connector.
 - motor+encoder connector: AWG22
 - power connector: AWG18
 - I/O connector: AWG28
 - brake connector: AWG 22
- In case communication is unstable due to the noise generated by supplied power or peripheral device, use ferrite core at communication line.

(1) Regenerative resistance

Connect the pin 1, 2 on the power connector.

Use in condition of the high inertia load or the short deceleration time.

Forced cooling is required in condition of high surface temperature of regenerative resistance.

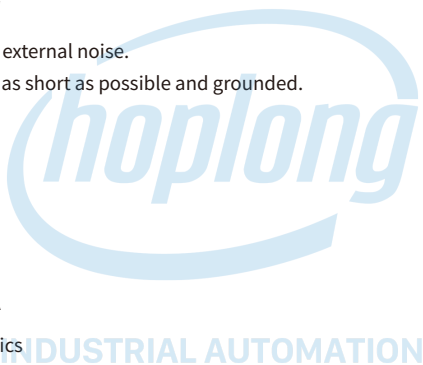
- Model: IRC100
- Specifications
 - Resistance: $100\ \Omega \pm 5\%$,
 - Rated power: 60 W (standby), 100 W (heatsink attached)
- Manufacture: Rara Electronics Corp.

(2) Noise filter for power

Connect the power to suppress external noise.

The wires should be connected as short as possible and grounded.

- Model: RNS-2006
- Specifications
 - Rated voltage: 250 V
 - Rated current: 6 A
 - Max. leakage current: 1 mA
- Manufacture: Orient Electronics



(3) Surge protector

Protect the product from external noise and surge by connecting power.

- Model: LT-C12G801W
- Specifications
 - Nominal discharge current: 2500 A
 - Max. discharge current: 5000 A
 - Voltage protection level: 1.5 kV
- Manufacture: OTOWA Electric Co. Ltd



Be sure to disconnect the surge protector when testing internal pressure.
It may result in product damage.

(4) Noise filter for signal line

Connect to wiring to suppress external noise.
Depending on frequency, filtered noise may different.

Type	Model	Manufacture
Motor line	28A5776-0A2	Lairdtech
Power line	28A5131-0A2	
Communication line	28A2025-0A2	



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1.3. Ordering Information

1.3.1. Driver

Ai	C	A	-	D	-	60	L	A	-	B	-	EC
①	②	③		④		⑤	⑥	⑦		⑧		⑨

Item	Descriptions			
① Series	Ai	Artificial intelligent		
② Category	C	Controller		
③ Power	A	AC power		
④ Item	D	Driver		
⑤ Frame size	20	☐ 20 mm		
	28	☐ 28 mm		
	35	☐ 35 mm		
	42	☐ 42 mm		
	56	☐ 56 mm		
	60	☐ 60 mm		
⑥ Axial length	S	Short size		
	M	Middle size		
	L	Long size		
⑦ Encoder resolution	-		☐ 20 / 28 / 35 mm	☐ 42 / 56 / 60 mm
		A	4,000 PPR (1,000 PPR × 4)	10,000 PPR (2,500 PPR × 4)
		B	16,000 PPR (4,000 PPR × 4)	-
⑧ Brake	No mark	Standard		
	B	Built-in brake type		
⑨ Comm. method	EC	EtherCAT communication		

1.3.2. Motor

Ai	A	-	M	-	60	L	A	-	B
①	②		③		④	⑤	⑥		⑦

Item	Descriptions	
① Series	Ai	Artificial intelligent
② Power	A	AC power
③ Item	M	Motor
④ Motor frame size	60	☐ 60 mm (60×60 mm)
	86	☐ 86 mm (86×86 mm)
⑤ Motor length	M	Middle size ☐ 60 mm: 49 mm ☐ 86 mm: 61 mm
	L	Long size ☐ 60 mm: 70 mm ☐ 86 mm: 75 mm
⑥ Encoder resolution	A	10,000 PPR (2,500 PPR × 4)
⑦ Motor type	No mark	Standard type
	B	Built-in brake type

1.4. Set table

1.4.1. Standard type

Motor frame	Set	Driver	Motor
☐ 60 mm	AiCA-60MA-EC	AiCA-D-60MA-EC	AiA-M-60MA
	AiCA-60LA-EC	AiCA-D-60LA-EC	AiA-M-60LA
☐ 86 mm	AiCA-86MA-EC	AiCA-D-86MA-EC	AiA-M-86MA
	AiCA-86LA-EC	AiCA-D-86LA-EC	AiA-M-86LA

1.4.2. Built-in brake type

Motor frame	Set	Driver	Motor
☐ 60 mm	AiCA-60MA-B-EC	AiCA-D-60MA-B-EC	AiA-M-60MA-B
	AiCA-60LA-B-EC	AiCA-D-60LA-B-EC	AiA-M-60LA-B
☐ 86 mm	AiCA-86MA-B-EC	AiCA-D-86MA-B-EC	AiA-M-86MA-B
	AiCA-86LA-B-EC	AiCA-D-86LA-B-EC	AiA-M-86LA-B

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Built-in geared motor and built-in rotary actuator motor are not provided as set.
Please purchase the motor and driver separately. Refer to each instruction manual for more details.

Built-in Geared

Motor frame	Set	Driver	Motor
☐ 60 mm	-	AiCA-D-60LA-EC	AiA-M-60LA-G5
			AiA-M-60LA-G7.2
			AiA-M-60LA-G10
☐ 86 mm	-	AiCA-D-86LA-EC	AiA-M-86LA-G5
			AiA-M-86LA-G7.2
			AiA-M-86LA-G10

Built-in Rotary Actuator

Motor frame	Set	Driver	Motor
☐ 60 mm	-	AiCA-D-60LA-EC	AiA-M-60LA-R5
			AiA-M-60LA-R7.2
			AiA-M-60LA-R10

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2. Specifications

2.1. Driver

Model	AiCA-D-60MA-□-EC	AiCA-D-60LA-□-EC	AiCA-D-86MA-□-EC	AiCA-D-86LA-□-EC
Max. RUN power ⁰¹⁾	≤ 800 VA			
Stop power ⁰²⁾	≤ 60 VA		≤ 65 VA	
AUX power supply ⁰³⁾	24 VDC			
AUX input current	0.3 A		0.5 A	
Max. RUN current ⁰⁴⁾	2.0 A / Phase			
Stop current	20 to 100% of max. RUN current			
Resolution	500, 1000, 1600, 2000, 3200, 3600, 5000, 6400, 7200, 10000 (default) PPR			

01) When changing the load rapidly, instantaneous peak current may increase. The capacity of power supply should be over 1.5 to 2 times of max. RUN power.

02) Based on ambient temp. 25 °C, ambient humi. 55 %RH, stop current 20%

03) Auxiliary power is only available in built-in brake type and not available in standard type.

04) RUN current varies depending on the input RUN frequency and max. RUN current at the moment varies also.

Run method	2-phase bipolar closed-loop control method
Speed filter	Disable, 2, 4, 6, 8, 10, 20, 40, 60(factory default), 80, 100, 120, 140, 160, 180, 200 ms
Control Gain	0 (factory default) to 31, (31: Fine Gain)
Max. rotation speed	3,000 rpm
In-Position	Fast Response: 0 to 7 (factory default), Accurate Response: 0 to 7
Operation mode	CSP, CSV, CST, PP, PV, HM

Home search	Homing on the negative limit switch and index pulse Homing on the positive limit switch and index pulse Homing on the home switch and index pulse (Positive) Homing on the home switch and index pulse (Negative) Homing without an index pulse (negative limit switch) Homing without an index pulse (positive limit switch) Homing without an index pulse (Positive and Home sensor ON) Homing without an index pulse (Negative and Home sensor ON) Homing on the index pulse (Negative) Homing on the index pulse (Positive) Set the Origin with Home offset Set the Origin and Reset Current Position Torque Homing Search- with Home offset Torque Homing Search+ with Home offset
Input	Exclusive input: 7, General input: 5
Output	Exclusive output: 2 General output: 4
External power supply	VEX (Default: 24 VDC), GEX (GND)
Input resistance	4.7 k Ω (Anode Pull-Up)
Insulation resistance	≥ 200 M Ω (500 VDC megger)
Dielectric strength	1,500 VAC 60 Hz for 1 minute
Vibration	1.5 mm double amplitude at frequency 10 to 55 Hz (for 1 minute) in each X, Y, Z direction for 2 hours
Shock	300 m/s ² (≈ 30 G) in each X, Y, Z direction for 3 times
Ambient temp.	0 to 50°C, storage: -10 to 60°C (no freezing or condensation)
Ambient humi.	35 to 85%RH, storage: 10 to 90%RH (no freezing or condensation)
Protection rating	IP20 (IEC standard)
Approval	CE, KC, ROHS
Unit weight (packaged)	≈ 770 g ($\approx 1,040$ g)

2.1.1. Factory Default

Function	Factory default
Resolution	10,000 PPR
Speed Filter	60 ms
Motor GAIN	0
In-Position	Fast Response 7

2.1.2. EtherCAT Communication Interface

Comm. specifications	EtherCAT
Association approval ⁽⁰¹⁾	
Support protocol	CoE (support CiA402 profile), support FoE
Physical layer	100BASE-TX (IEEE802.3)
Connection cable	CAT5e class or over (Shield type: SF/FTP, S/FTP, SF/UTP)
Max. comm. distance	Within 100 m distance between nodes
Baud rate	10 / 100 Mbps
Distributed clock	DC cycle: 250 us, 500 us, 1 ms, 2 ms, 4 ms, 8 ms
Node ID setting	ECAT ID switch setting: 1 to 99 Physical address setting at Master: 1 to 65535
Topology	Star, Line, Tree

01) EtherCAT® is registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.

2.2. Motor

Model	AiA-M-60MA-□	AiA-M-60LA-□
Max. stop torque	1.1 N m	2.2 N m
Rotor inertia moment	$240 \times 10^{-7} \text{ kg} \cdot \text{m}^2$	$490 \times 10^{-7} \text{ kg} \cdot \text{m}^2$
Rated current	2.0 A / Phase	
Basic step angle	1.8° / 0.9° (Full / Half step)	
Resistance	1.5 Ω / Phase ±10%	2.4 Ω / Phase ±10%
Inductance	3.9 mH / Phase ±20%	8.5 mH / Phase ±20%
Unit weight for standard type (packaged)	≈ 0.75 kg (≈ 0.95 kg)	≈ 1.15 kg (≈ 1.35 kg)
Unit weight for built-in brake type (packaged)	≈ 1.35 kg (≈ 1.53 kg)	≈ 1.75 kg (≈ 1.90 kg)

Model	AiA-M-86MA-□	AiA-M-86LA-□
Max. stop torque	2.8 N m	4.0 N m
Rotor inertia moment	$1,100 \times 10^{-7} \text{ kg} \cdot \text{m}^2$	$1,800 \times 10^{-7} \text{ kg} \cdot \text{m}^2$
Rated current	2.0 A / Phase	
Basic step angle	1.8° / 0.9° (Full / Half step)	
Resistance	2.3 Ω / Phase ±10%	1.9 Ω / Phase ±10%
Inductance	11.5 mH / Phase ±20%	16.2 mH / Phase ±20%
Unit weight for standard type (packaged)	≈ 1.70 kg (≈ 2.00 kg)	≈ 2.30 kg (≈ 2.60 kg)
Unit weight for built-in brake type (packaged)	≈ 2.50 kg (≈ 2.76 kg)	≈ 3.10 kg (≈ 3.36 kg)

2.2.1. Common Specifications

Motor phase	2-phase
Run method	Bipolar
Insulation class	B type (130°C)
Insulation resistance	Between motor coil and case: $\geq 100 \text{ M}\Omega$ (500 VDC megger)
Dielectric strength	Between motor coil and case: 1,000 VAC 50 / 60 Hz for 1 minute
Vibration	1.5 mm double amplitude at frequency 10 to 55 Hz (for 1 minute) in each X, Y, Z direction for 2 hours
Shock	$\leq 50 \text{ G}$
Ambient temp.	0 to 50°C, storage: -20 to 70°C (no freezing or condensation)
Ambient humi.	20 to 85%RH, storage: 15 to 90%RH (no freezing or condensation)
Protection rating	IP30 (IEC34-5 standard)
Approval	CE, EAC
Stop angle error	$\pm 0.09^\circ$ (Full step, no load)
Shaft vibration	0.03 mm T.I.R.
Radial movement ⁰¹⁾	$\leq 0.025 \text{ mm T.I.R.}$
Axial movement ⁰²⁾	$\leq 0.01 \text{ mm T.I.R.}$
Shaft concentricity	0.05 mm T.I.R.
Shaft perpendicularity	0.075 mm T.I.R.

01) Amount of radial shaft displacement when applying radial load (25 N) to the end of the shaft.

02) Amount of axial shaft displacement when applying axial load (50 N) to the shaft.

2.2.2. Encoder

Encoder type	Incremental Rotary Encoder
Power supply	5 VDC $\pm$ 5% (ripple P-P: $\leq$ 5%)
Current consumption	$\leq$ 50 mA (No load)
Resolution	10,000 PPR (2,500 PPR $\times$ 4)
Control output	Line driver Output
Output phase	A, /A, B, /B, Z, /Z
Output waveform	Output Duty rate: T/2 $\pm$ T/4, A-B phase difference: T/4 $\pm$ T/8 (T = 1 cycle of A)
Inflow current	$\leq$ 20 mA
Residual voltage	$\leq$ 0.5 VDC
Outflow current	$\leq$ -20 mA
Output voltage	$\geq$ 2.5 VDC
Response speed	$\leq$ 0.5 μ s (Cable length: 2 m, I sink = 20 mA)
Max. response freq.	300 kHz

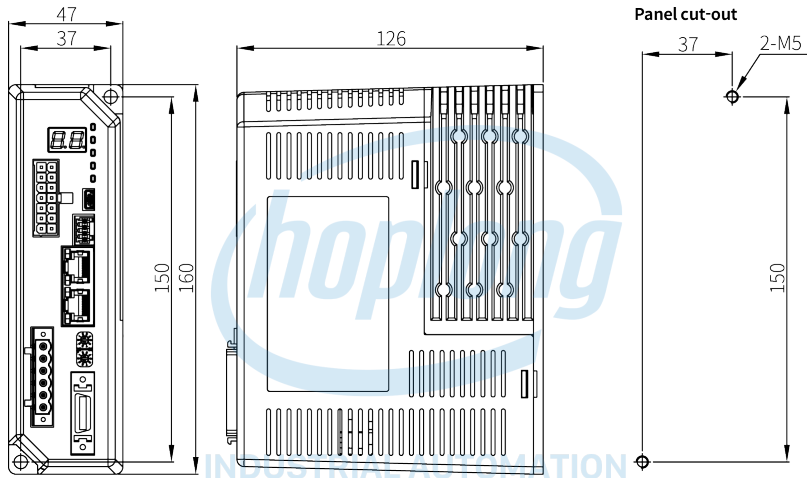
2.2.3. Brake

Frame size	☐ 60 mm	☐ 86 mm
Rated excitation voltage	24 VDC $\pm$ 10%	
Rated excitation current	0.275 A	0.479 A
Static friction torque	0.75 N m	2.6 N m
Rotation part inertia moment	1.9×10^{-6} kg $\cdot$ m ²	12×10^{-6} kg $\cdot$ m ²
Insulation class	B type (130°C)	
B type brake	Brake is released when power ON, brake is locked when power OFF	
Operating time	30 ms	40 ms
Releasing time	10 ms	25 ms

3. Dimensions

3.1. Driver

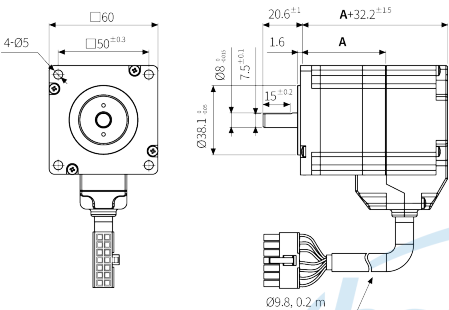
- Unit: mm, For the detailed drawings, follow the Autonics website.



3.2. Motor

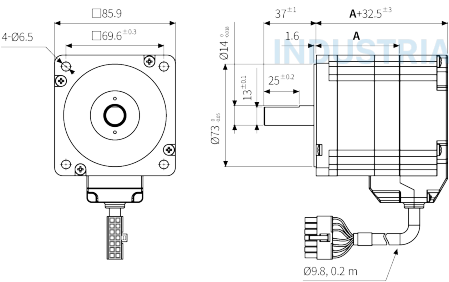
3.2.1. Standard Type

(1) AiA-M-60□A



Axial length	M	L
A	49 mm	70 mm

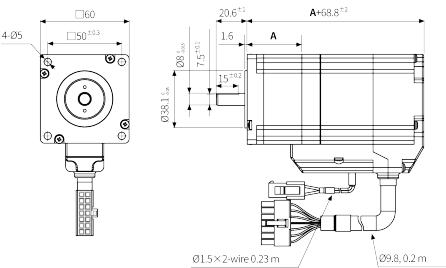
(2) AiA-M-86□A



Axial length	M	L
A	61 mm	75 mm

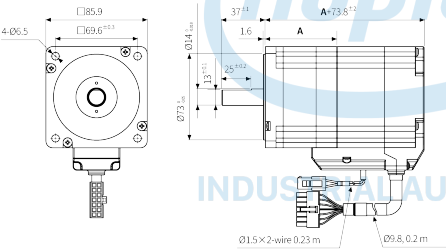
3.2.2. Built-in Brake type

(1) AiA-M-60□A-B



Axial length	M	L
A	49 mm	70 mm

(2) AiA-M-86□A-B



Axial length	M	L
A	61 mm	75 mm