Autonics

Controller Integrated
2-Phase Closed-Loop Stepper Motor Driver
[AC type, Frame size 60/86, RS485 Comm.]
AiCA-D SERIES
INSTRUCTION MANUAL

Thank you for choosing our Autonics product.
Please read the following safety considerations before use.

■ Safety Considerations

※Please observe all safety considerations for safe and proper product operation to avoid hazards.
※※ symbol represents caution due to special circumstances in which hazards may occur.

⚠ **Warning** Failure to follow these instructions may result in serious injury or death.
⚠ **Caution** Failure to follow these instructions may result in personal injury or product damage.

⚠ Warning

1. **Fail-safe device must be installed when using the unit with machinery that may cause serious injury or substantial economic loss. (e.g. nuclear power control, medical equipment, ships, vehicles, railways, aircraft, combustion apparatus, safety equipment, crime/disaster prevention devices, etc.)**
Failure to follow this instruction may result in personal injury, economic loss or fire.
2. **Do not use the unit in the place where flammable/explosive/corrosive gas, high humidity, direct sunlight, radiant heat, vibration, impact or salinity may be present.**
Failure to follow this instruction may result in explosion or fire.
3. **Do not connect, repair or inspect the unit while connected to a power source.**
Failure to follow this instruction may result in fire or electric shock.
4. **Install the unit after considering counter plan against power failure.**
Failure to follow this instruction may result in personal injury, economic loss or fire.
5. **Re-supply power after min. 20 sec from disconnected power.**
Failure to follow this instruction may result in product damage or malfunction.
6. **Check 'Connections' before wiring.**
Failure to follow this instruction may result in fire.
7. **For installing the unit, ground it exclusively and use over AWG 18 (0.75 mm²) ground cable.**
Failure to follow this instruction may result in electric shock.
8. **Do not disassemble or modify the unit.**
Failure to follow this instruction may result in fire or electric shock.
9. **Insulate the connector not to be exposed.**
Failure to follow this instruction may result in fire or electric shock.
10. **Install the driver in the housing or ground it.**
Failure to follow this instruction may result in personal injury, fire or electric shock.
11. **Do not touch the unit during or after operation for a while.**
Failure to follow this instruction may result in burn or electric shock due to high temperature of the surface.
12. **Do not remove the connector during or after operation for a while.**
Failure to follow this instruction may result in electric shock or product damage.
13. **Emergency stop directly when error occurs.**
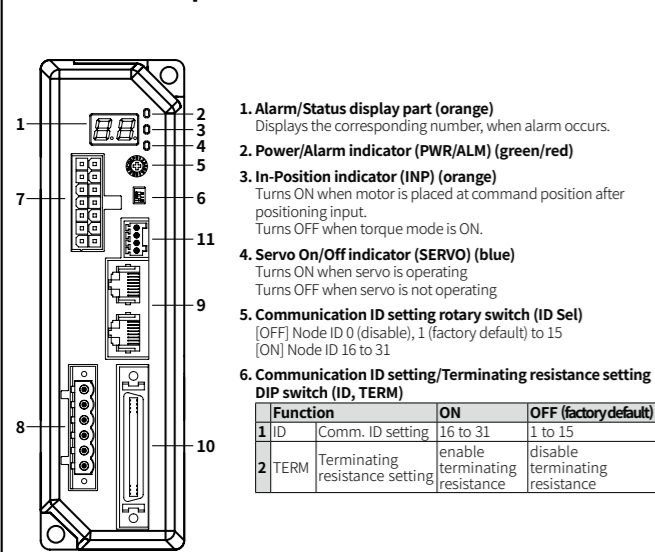Failure to follow this instruction may result in personal injury or fire.

⚠ Caution

1. **When connecting the power input, use AWG 18 (0.75 mm²) cable or over.**
2. **Brake is non-polar. When connecting the brake, use AWG 22 (0.3 mm²) cable or over.**
Failure to follow this instruction may result in fire or malfunction due to contact failure.
3. **Install overcurrent prevention device (e.g. the current breaker, etc) to connect the driver with power.**
Failure to follow this instruction may result in fire.
4. **Check the control input signal before supplying power to the driver.**
Failure to follow this instruction may result in personal injury or product damage by unexpected driver movement.
5. **Install a safety device to maintain the vertical position after turn off the power of this driver.**
Failure to follow this instruction may result in personal injury or product damage by releasing holding torque of the motor.
6. **Use the unit within the rated specifications.**
Failure to follow this instruction may result in fire or product damage.
7. **Use a dry cloth to clean the unit and do not use water or organic solvent.**
Failure to follow this instruction may result in fire or electric shock.
8. **The driver may overheat depending on the environment.**
Install the unit in the well ventilated place and forced cooling with a cooling fan.
Failure to follow this instruction may result in product damage or degradation by heat.
9. **Keep metal chip, dust and wire residue from flowing into the unit.**
Failure to follow this instruction may result in product damage or fire.
10. **Use the designated motor only.**
Failure to follow this instruction may result in fire or product damage.

■ Product Components

Before use the product, check all components are contained. The components are contained each one.
- Motor driver
- Instruction manual
- Power connector
- Communication protect connector
- I/O connector
- Brake connector ※1
※1: The brake connector is only included in built-in brake model.

■ Unit Descriptions

1. Alarm/Status display part (orange)
Displays the corresponding number, when alarm occurs.
2. Power/Alarm indicator (PWR/ALM) (green/red)
3. In-Position indicator (INP) (orange)
Turns ON when motor is placed at command position after positioning input.
Turns OFF when torque mode is ON.
4. Servo On/Off indicator (SERVO) (blue)
Turns ON when servo is operating
Turns OFF when servo is not operating
5. Communication ID setting rotary switch (ID Sel)
[OFF] Node ID 0 (disable), 1 (factory default) to 15
[ON] Node ID 16 to 31
6. Communication ID setting/Terminating resistance setting
DIP switch (ID, TERM)

	Function	ON	OFF (factory default)
1	ID Comm. ID setting	16 to 31	1 to 15
2	TERM Terminating resistance setting	enable terminating resistance	disable terminating resistance

■ Specifications

Model ※1		AiCA-D-60MA(-B)	AiCA-D-60LA(-B)	AiCA-D-86MA(-B)	AiCA-D-86LA(-B)
Main power	Power supply	200-240 VAC∼ 50/60 Hz			
	STOP ※2	Max. 60 W		Max. 65 W	
	Max. during operation	Max. 160 W	Max. 220 W	Max. 250 W	Max. 300 W
	Max. Run current ※3	2.0 A/Phase			
Auxiliary power ※4	Power supply	24 VDC═			
	Input current	0.3 A		0.5 A	
STOP current		20 to 100 % of max. RUN current			
Rotation speed ※5		0 to 3000 rpm			
Resolution ※5		500 (factory default), 1000, 1600, 2000, 3200, 3600, 5000, 6400, 7200, 10000 PPR			
Applied motor		AiA-M-60MA(-B)	AiA-M-60LA(-B)	AiA-M-86MA(-B)	AiA-M-86LA(-B)
Speed filter		0 (disable), 2, 4, 6, 8, 10, 20, 40, 60 (factory default), 80, 100, 120, 140, 160, 180, 200 ms			
Motor GAIN		0 (factory default) to 30, Fine Gain			
Positioning range		-2,147,483,648 to +2,147,483,647			
In-Position		Fast Response: 0 (factory default) to 7, Accurate Response: 0 to 7			
Motor rotation direction ※5		CW, CCW			
Status indicator		• Alarm/Status display part: orange LED 7seg. • Power/Alarm indicator: green/red LED • In-Position indicator: orange LED • Servo On/Off indicator: blue LED			
I/O	Input ※6	Exclusive input: 20, general input: 9			
	Output	Exclusive output: 4, general output: 10			
External power supply		VEX (24 VDC═ fixed): 2, GEX (GND): 2			
Operation mode		Jog, Continuous, Index, Program, Position, Torque mode			
Index step		64 steps			
Program function	Step	256 steps			
	Control command	ABS (move absolute position), INC (move incremental position), HOM (home search), ICJ (jump input condition), IRD (waiting input), OPC (ON/OFF of output port), OPT (on pulse from output port), JMP (jump), REP (start repetition), RPE (end repetition), END (end program), POS (position set), TIM (timer), CMP (compare output), TOQ (torque control)			
	Start	Power ON program auto-start function			
	Home start	Power ON home search auto-start function			
RS485 Comm.	Comm. Speed ※5	9600, 19200, 38400, 57600, 115200 (factory default) bps			
Multiaxial control		31-axis			
ID setting switch		16-bit rotary switch (0 to F), 1-bit DIP switch (ON/OFF)			
Alarm		Overcurrent, overspeed, position tracking, overload, overheat, motor connection, encoder connection, overvoltage, undervoltage, motor misalignment, command speed, in-position, memory, emergency stop, program mode, index mode, home search mode, brake			
Warning		±Software limit, ±hardware limit, overload			
Input resistance		4.7 kΩ (Anode Pull-up)			
Insulation resistance		Over 200 MΩ (at 500 VDC═ megger)			
Dielectric strength		1,500 VAC∼ 60 Hz for 1 min			
Vibration		1.5 mm amplitude at frequency of 10 to 55 Hz (for 1 min) in each X, Y, Z direction for 2 hours			
Shock		300 m/s² (approx. 30 G) in each X, Y, Z direction for 3 times			
Environ-ment	Ambient temp.	0 to 50 °C, storage: -10 to 60 °C			
	Ambient humi.	35 to 85 %RH, storage: 10 to 90 %RH			
Protection structure		IP20 (IEC standard)			
Sold separately		• I/O cable: CO50-MP□-R ※7 (standard: AiC TAG) • Motor+encoder cable - normal: C1D14M-□ ※8 / moving: C1DF14M-□ ※8 • Communication cable: SCM-WF48, SCM-US48I, SCM-38I			
Approval		C€ Ⓡⓗⓢ			
Weight ※9		• Standard type: Approx. 1,080 g (approx. 800 g) • Built-in brake type: Approx. 1050 g (approx. 780 g)			

※1: The model name indicates driver type. (none: standard type, B: built-in brake type)
E.g.) AiCA-D-60MA-B: built-in brake type stepping motor driver.
※2: Based on the ambient temperature 25 °C, ambient humidity 55 %RH and STOP current 20 %.
※3: RUN current varies depending on the input RUN frequency and max. RUN current at the moment varies also.
※4: Auxiliary power is only available in built-in brake type. Corresponding specification is not available in standard type.
※5: Settable with the dedicated program (atMotion).
※6: Brake ON/OFF function can be changed in general input IN8 in case of built-in brake type only.
※7: □ of model name indicates cable length (010, 020, 030, 050, 070, 100, 150, 200)
E.g.) CO50-MP070-R: 7 m I/O cable.
For corresponding EMC standard, cable length should be below 2m.
※8: □ of model name indicates cable length (1, 2, 3, 5, 7, 10, 15, 20)
E.g.) C1DF14M-10: 10 m moving type motor+encoder cable.
※9: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

7. Motor+Encoder connector (CN1)

Pin	Function	Pin	Function
1	GND	8	+5VDC═
2	Encoder A	9	Encoder A̅
3	Encoder B	10	Encoder B̅
4	Encoder Z	11	Encoder Z̅
5	PE	12	N·C
6	Motor A	13	Motor B
7	Motor A̅	14	Motor B̅

8. Power connector (CN2)

Pin	Function
1	Regenerative resistance
2	
3	
4	AC power input
5	
6	PE

9. Communication connector (CN3)

Pin	Function
1	N·C
2	N·C
3	RS485 DATA+
4	N·C
5	N·C
6	RS485 DATA-
7	N·C
8	N·C

10. I/O connector (CN4)

Pin	Function	Pin	Function	Pin	Function	Pin	Function
1	N·C	14	MD1/HMD1	27	IN1	40	Compare2(Trigger)
2	N·C	15	Pause	28	IN2	41	OUT0
3	Reset	16	Servo On/Off	29	N·C	42	OUT1
4	Start	17	Home	30	IN3	43	OUT2
5	Stop	18	Alarm Reset	31	IN4	44	OUT3
6	EMG	19	+Limit	32	IN5	45	OUT4
7	Step0/+Run/+Jog	20	-Limit	33	IN6	46	OUT5
8	Step1/-Run/-Jog	21	ORG	34	IN7	47	OUT6
9	Step2/SSP0	22	SD	35	IN8/Brake ON/OFF ※1	48	OUT7
10	Step3/SSP1	23	In-Position	36	VEX	49	OUT8
11	Step4/MSP0	24	VEX	37	GEX	50	OUT9
12	Step5/MSP1	25	GEX	38	Alarm		
13	MD0/HMD0	26	IN0	39	Compare1 (Trigger)		

※1: Brake ON/OFF function is added for built-in brake type.

11. Brake connector (CN5)

Pin	Function
1	24VDC═
2	GND
3	Brake+
4	Brake-

※Corresponding connector is for built-in brake type only.

[Connector specifications]

Type		Recommended specifications	Manufacture
CN1	Motor+Encoder	5557-14R (connector terminal: 5556T)	Molex
CN2	Power	5ESDVM-06P-OR	Dinkle
CN3	Communication	RJ45: 2	
CN4	I/O connector	10150-3000PE (Housing: 10350-52F0-008)	3M
CN5	Brake connector	ESC250V-S2330704P	Dinkle

■ Configuration Diagram & Cautions for Wiring

※In case of unwanted noise generating from peripherals and power, use ferrite core in the wiring.
※The thickness of cable should be same or thicker than the below specifications when connecting the cable for connector.
① CN1 (motor+encoder connector): AWG 22　② CN2 (power connector): AWG 18　③ CN3 (communication connector): AWG 28
④ CN4 (I/O connector): AWG 22　⑤ CN5 (brake connector): AWG 22

When connecting wires, please purchase separately.
• Noise filter for signal line
Connect to wiring to suppress external noise.
Depending on frequency, filtered noise may different.

Type	Model	Manufacture
Motor line I/O signal line	28A5776-0A2	Lairdtech
Power line	28A5131-0A2	
Comm. line	28A2025-0A2	

When connecting power, please purchase separately.
• Regenerative resistance
Connect Pin no. 1, 2 on power connector (CN2).
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.

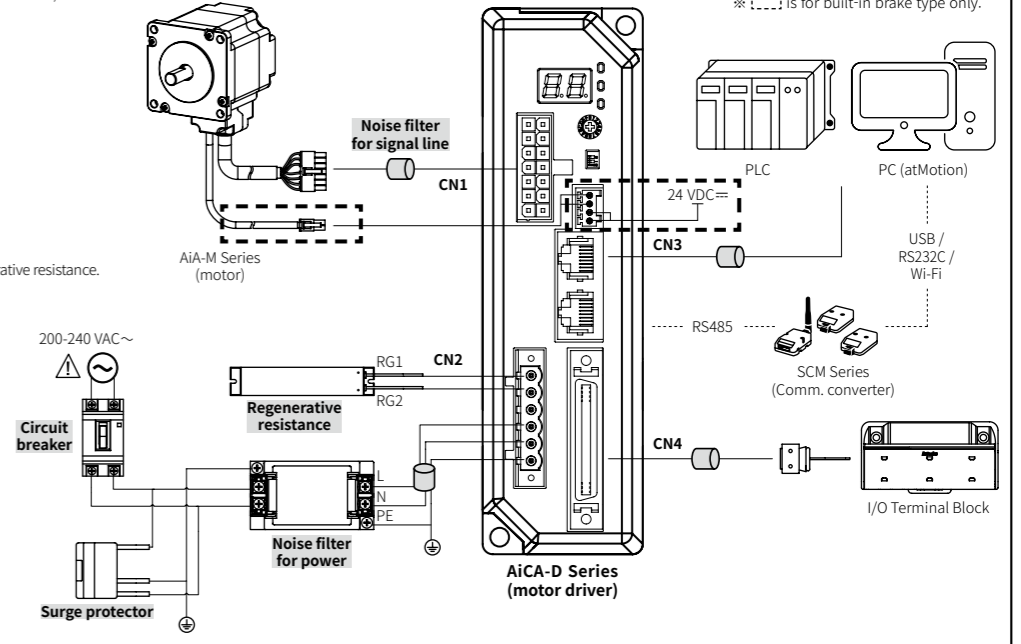| Model	Specification	Manufacture
IRC100	• Resistance: 100Ω ±5%, • Rated power: 60 W (standby), 100 W (heatsink attached)	Rara Electronics Corp.

• Noise filter for power
Connect the power to suppress external noise.
The wires should be connected as short as possible and grounded.

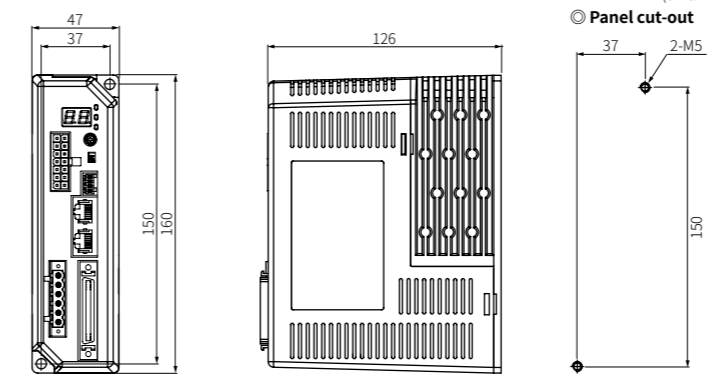| Model	Specification	Manufacture
RNS-2006	• Rated voltage: 250 V • Rated current: 6 A • Max. leakage current: 1 mA	Orient Electronics

• Surge protector
Protect the product from external noise and surge by connecting power.
※Be sure to disconnect the surge protector when testing internal pressure.
it may result in product damage.

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

• Circuit breaker

AiA-M Series (motor)
AiCA-D Series (motor driver)
PLC
PC (atMotion)
24 VDC═
USB / RS232C / Wi-Fi
RS485
SCM Series (Comm. converter)
200-240 VAC∼
Circuit breaker
Regenerative resistance
Noise filter for power
Surge protector
Noise filter for signal line
I/O Terminal Block
CN1, CN2, CN3, CN4, RG1, RG2

■ Dimensions

(unit: mm)

◎ **Panel cut-out**
47, 37, 126, 37, 2-M5, 150, 160, 150

■ Installation

- Install on the metal plate with high thermal conductivity for heat dissipation of the driver.
- Install in the well-ventilated area and install the cooling fan in the unventilated environment.
- Failure to heat dissipation may result in damage or malfunction due to the stress on the product.
Check the environment of use within the rated specifications and install on the well-heat dissipated area.
- In case of installing the drivers more than two, keep distance at least 20mm in the horizontal direction and at least 25mm in the vertical direction.

Horizontal direction: Min. 20 mm
Vertical direction: Min. 25 mm
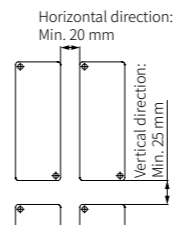
■ Alarm/Warning Display

Depending on the alarm/warning type, it displays as a segment on the Alarm/Status display part.
Depending on the alarm type, it flashes for 0.4 sec interval and it turns ON for 0.8 sec and it turns OFF for 0.8 sec repeatedly.

Alarm/Status	ALM (flashing)	Alarm type	Alarm/Status	ALM (flashing)	Alarm type
E1	1	Overcurrent error	EA	10	Motor misalignment
E2	2	Overspeed error	Eb	11	Command pulse error
E3	3	Position tracking error	EC	12	In-Position error
E4	4	Overload error	Ed	13	Memory error
E5	5	Overheat error	EE	14	Emergency stop
E6	6	Motor connection error	EF	15	Program mode error
E7	7	Encoder connection error	EG	16	Index mode error
E8	8	Overvoltage error	EH	17	Home search mode error
E9	9	Undervoltage error	EJ	18	Brake error ※1

※1: Corresponding alarm is built-in brake type only.

When warning occurs, it may result in damage of the product. (maintain operation)
Take appropriate troubleshoot for each warning.

Alarm/Status	Warning type
Y1	+Software limit
Y2	-Software limit
Y3	+Hardware limit
Y4	-Hardware limit
Y5	Overload warning
Y6	Position override warning

■ Manual

For the detail information and instructions, please refer to user manual, communication manual, library manual and quick manual, and be sure to follow cautions written in the technical descriptions (catalog, website).
Visit our website (www.autonics.com) to download manuals.

■ Motion Device Management Program [atMotion]

atMotion provides GUI control for easy and convenient parameter setting and monitoring data management of multiple devices.
Visit our website (www.autonics.com) to download the user manual and software.

Item	Minimum requirements
System	IBM PC compatible computer with Intel Pentium III or above
Operations	Microsoft Windows 98 / NT / XP / Vista / 7 / 8 / 10
Memory	256 MB+
Hard disk	1 GB+ of available hard disk space
VGA	Resolution: 1024 x 768 or higher
Others	RS232C serial port (9-pin), USB port

■ Troubleshooting

Malfunction	Causes	Troubleshooting
When communication is not connected	The communication cable is not connected.	Check communication cable wiring. Check communication cable connection correctly.
	The communication port or speed settings are not correct.	Check communication port and speed settings are correct.
When motor does not excite	Servo is not On.	Check that servo On/Off input signal is Off. In case of On, servo is Off and excitation of motor is released.
	Alarm occurs.	Check the alarm type and remove the cause of alarm.
When motor rotates to the opposite direction of the designated direction	MotorDir parameter setting is not correct.	Check the MotorDir parameter settings.
When motor drive is unstable	Connection between motor and encoder is unstable.	Check the Motor+Encoder connection cable.
	Motor gain value is not correct.	Change the Motor Gain parameter as the certain value.

■ Cautions during Use

1. Follow instructions in 'Cautions during Use'. Otherwise, it may cause unexpected accidents.
2. It is recommended to use 485 converter with the separate power. (Autonics product, SCM-38I, recommended)
3. Use designated cable to extend motor+encoder wire.
4. Install vertically so that the Alarm/Status display part located on top.
5. Keep the distance between power cable and signal cable more than 10cm.
6. Do not intput external signal until the driver is initialized (In-Position LED ON) after power is applied.
7. Motor vibration and noise can occur in specific frequency period.
① Change motor installation method or attach the damper.
② Use and set the gain value.
8. For using motor, it is recommended to maintenance and inspection regularly.
① Unwinding bolts and connection parts for the unit installation and load connection
② Strange sound from ball bearing of the unit
③ Damage and stress of lead cable of the unit
④ Connection error with motor
⑤ Inconsistency between the axis of motor output and the center, concentric (eccentric, declination) of the load, etc.
9. This product does not prepare protection function for a motor.
10. This unit may be used in the following environments.
① Indoors (in the environment condition rated in 'Specifications')
② Altitude max. 2,000 m
③ Pollution degree 2
④ Installation Category II

18, Bansong-ro 513Beon-gil, Haeundae-gu, Busan, Republic of Korea, 48002
www.autonics.com | +82-51-519-3232 | sales@autonics.com

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※The above specifications, dimensions, etc. are subject to change and some models may be discontinued without notice.
※Be sure to follow cautions written in the instruction manual, user manual and the technical descriptions (catalog, website).