

CC-Link Comm. Type 2-Phase Closed-loop Stepper Motor Driver



AiC-D-CL Series PRODUCT MANUAL

For your safety, read and follow the considerations written in the instruction manual, other manuals and Autonics website.

The specifications, dimensions, etc. are subject to change without notice for product improvement. Some models may be discontinued without notice.

Features

- Closed-loop system with real-time position control
- High speed & high torque drive without missing steps
- Multi-axis simultaneous control with CC-Link communication
- Windows-based software (atMotion) for easy parameter setting and monitoring
- 7 segment display for alarm / status reading
- Built-in brake type motors available (AiC-D-B-CL Series)

Safety Considerations

- Observe all 'Safety Considerations' for safe and proper operation to avoid hazards.
- ⚠ symbol indicates caution due to special circumstances in which hazards may occur.

⚠ Warning Failure to follow instructions may result in serious injury or death.

01. **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.
02. **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.
03. **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.
04. **Install the unit after considering counter plan against power failure.**
Failure to follow this instruction may result in personal injury, economic loss or fire.
05. **Check 'Connections' before wiring.**
Failure to follow this instruction may result in fire.
06. **Do not disassemble or modify the unit.**
Failure to follow this instruction may result in fire or electric shock.
07. **Install the driver in the housing or ground it.**
Failure to follow this instruction may result in personal injury, fire or electronic shock.
08. **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.
09. **Emergency stop directly when error occurs.**
Failure to follow this instruction may result in personal injury or fire.

⚠ Caution Failure to follow instructions may result in injury or product damage.

01. **When connecting the power input, use AWG18 (0.75 mm²) cable or over.**
02. **Brake is non-polar. When connecting the brake, use AWG24 (0.2 mm²) cable or over.**
Failure to follow this instruction may result in fire or malfunction due to contact failure.
03. **To use the motor safely, do not apply external force to the motor.**
04. **It is recommended to use STOPPER for the vertical load.**
05. **Install over-current prevention device (e.g. the current breaker, etc.) to connect the driver with power.**
Failure to follow this instruction may result in fire.
06. **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.
07. **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.
08. **Use the unit within the rated specifications.**
Failure to follow this instruction may result in fire or product damage.
09. **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.
10. **The driver may overheat depending on the environment.**
Install the unit at the well-ventilated environment and forced cooling with a cooling fan.
Failure to follow this instruction may result in product damage or degradation by heat.
11. **Keep the product away from metal chip, dust, and wire residue which flow into the unit.**
Failure to follow this instruction may result in fire or product damage.
12. **Use the designated motor only.**
Failure to follow this instruction may result in fire or product damage.

Cautions during Use

- Follow instructions in 'Cautions during Use'. Otherwise, it may cause unexpected accidents.
- Power supply should be insulated and limited voltage/current or Class 2, SELV power supply device.
- Re-supply power after 1 sec from disconnected power.
- In case of unwanted noise generating from peripherals and power, use ferrite core in the wiring.
- Using USB type 485 converter may cause unstable communication. It is recommended to use 485 converter with separated power. (Autonics product SCM-38I is recommended.)
- The thickness of cable should be same or thicker than the below specifications when connecting the cable for connector.
 - Power connector: AWG18
 - Motor + Encoder connector: AWG22, AWG24
 - I/O connector: AWG28
- Keep the distance between power cable and signal cable over 10 cm.
- Motor vibration and noise may occur in a specific frequency range.
 - Change the motor installation method or attach the damper.
 - Use the unit out of the corresponding frequency range due to changing motor RUN speed.
- Maintain and inspect regularly the following lists.
 - Unwinding bolts and connection parts for the unit installation and load connection
 - Abnormal sound from ball-bearing of the unit
 - Damage and stress of lead cable of the unit
 - Connection error with motor
 - Inconsistency between the axis of motor output and the center, concentric (eccentric, declination) of the load, etc.
- This product does not contain a protection function for a motor unit.
- This unit may be used in the following environments.
 - Indoors (in the environment condition rated in 'Specifications')
 - Altitude max. 2,000 m
 - Pollution degree 2
 - Installation category II

Manual

For proper use of the product, refer to the manuals and be sure to follow the safety considerations in the manuals.
Download the manuals from the Autonics website.

Software

Download the installation file and the manuals from the Autonics website.

■ atMotion

The program allows to manage the motor driver's parameter setting and monitoring data.

Ordering Information

This is only for reference, the actual product does not support all combinations.
For selecting the specified model, follow the Autonics website.
Select a model that matches the ordering information of the motor and the driver.

AiC - D - ① ② ③ - ④ - CL

① Frame size

Number: Frame size (unit: mm)

③ 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)	-

② Axial length

S: Short
M: Medium
L: Long

④ Motor type

No mark: Standard type
B: Built-in brake type

Product Components

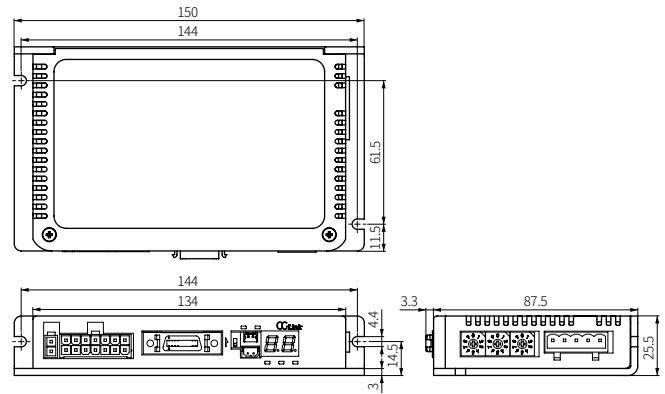
- Product
- Instruction manual
- Brake connector (AiC-D-B-CL Series)
- Power connector
- I/O connector
- RS485 comm. connector
- CC-Link comm. connector

Sold Separately

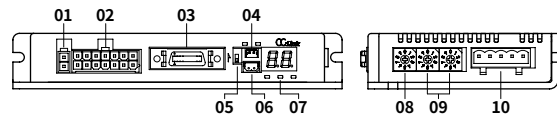
- Power cable: CJ-PW-□
- Motor + Encoder cable: C1D14M(B)-□ (fixed type), C1DF14M(B)-□ (flexible type)
- I/O cable: CO20-MP□-R (specifications: AiC-CL TAG)

Dimensions

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



Unit Descriptions



- 01. Power connector
- 02. Motor + Encoder connector
- 03. I/O connector
- 04. RS485 comm. connector
- 05. CC-Link station setting DIP switch
- 06. Brake connector (AiC-D-B-CL Series)
- 07. Status display part / indicators
- 08. CC-Link comm. speed setting rotary switch
- 09. CC-Link comm. station setting rotary switch
- 10. CC-Link comm. connector

Status Display Part / Indicators

Display part / Indicator	Color	Descriptions
Status display part (7 segment)	Red	Displays communication ID when normal status Displays the corresponding number, operation when alarm / warning occurs
Servo ON / OFF indicator (SERVO)	Orange	Turns ON when servo is ON, Turns OFF when servo is OFF
In-Position indicator (INP.)	Yellow	Turns ON when motor is placed at command position after positioning input
Power / Warning indicator (PWR)	Green	Turns ON when the unit operates in normal after power is applied Flashes depending on the warning type
Alarm indicator (AL)	Red	Flashes depending on the alarm type
CC-Link Comm. status indicator (L.ERR / L.RUN)	Green	Turns ON when comm. operates normally (L.RUN)
	Red	Turns ON when comm. fails (L.ERR)

Alarm / Warning

The status display part displays segment depending on Alarm / Warning type.
Depending on the alarm / warning type, it flashes for 0.4 sec interval.
For more information of Alarm / Warning, refer to 'User manual'.


■ Alarm


Display	Alarm type	Display	Alarm type
C.1	Comm. station setting error	E.7	Encoder connection error
C.2	Comm. speed setting error	E.B	Regenerative voltage error
C.3	Comm. station setting change	E.9	Motor alignment error
C.4	Comm. speed setting change	E.R	Command speed error
C.5	Comm. failure	E.b	Input voltage error
E.1	Overcurrent error	E.C	In-Position error
E.2	Overspeed error	E.d	Memory error
E.3	Position tracking error	E.E	Emergency stop
E.4	Overload error	E.F	Program mode error
E.5	Overheat error	E.G	Index mode error
E.6	Motor connection error	E.H	Home search mode error

■ Warning

Display	Warning type
U.1	+Software limit
U.2	-Software limit
U.3	+Hardware limit
U.4	-Hardware limit
U.5	Overload warning

Specifications

Model	AiC-D-20□A-CL	AiC-D-28□B-CL	AiC-D-35□B-CL
Power supply	24 VDC≒		
Permissible voltage range	90 to 110% of rated voltage		
Max. RUN power⁰¹⁾	≤ 60 W		
Stop power⁰²⁾	≤ 10 W		
Max. RUN current⁰³⁾	0.6 A / Phase	1.0 A / Phase	1.2 A / Phase
Stop current	20 to 100% of max. RUN current (factory default: 50%)		
Certification	CE 		
Resolution	500 (factory default), 1000, 1600, 2000, 3600, 4000, 5000, 6400, 7200, 10000 PPR	500 (factory default), 1000, 1600, 2000, 3600, 5000, 6400, 7200, 10000, 16000 PPR	

Model	AiC-D-42□A-□-CL	AiC-D-56□A-□-CL	AiC-D-60□A-□-CL
Power supply	24 VDC≒		
Permissible voltage range	90 to 110% of rated voltage		
Max. RUN power⁰¹⁾	≤ 60 W	≤ 120 W	≤ 240 W
Stop power⁰²⁾	≤ 10 W	≤ 12 W	≤ 15 W
Max. RUN current⁰³⁾	1.7 A / Phase	3.5 A / Phase	
Stop current	20 to 100% of max. RUN current (factory default: 50%)		
Certification	CE 		
Resolution	500 (factory default), 1000, 1600, 2000, 3200, 3600, 5000, 6400, 7200, 10000 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 50%


03) 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 14, Fine Gain
Max. rotation speed	3000 rpm
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
Rotation direction	CW (factory default), CCW
Operation mode	Jog mode, Continuous mode, Index mode, Program mode
Home search mode	General mode, Limit mode, Zero point mode, Torque mode
Index steps	64 step
Program steps	256 step
Program function	Power On Program Start, Power On Home Search
Control command	ABS, INC, HOM, ICJ, IRD, OPC, OPT, JMP, REP, RPE, END, POS, TIM

I/O voltage level	[H]: 5 - 30 VDC≒, [L]: 0 - 2 VDC≒
Input	Exclusive input: 3, General input: 8
Output	General output: 7
External power supply	VEX (recommended: 24 VDC≒), GEX (GND)
Insulation resistance	≥ 100 MΩ (500 VDC≒ megger)
Dielectric strength	Between the all charging part and the case: 1,000 VAC~ 60 Hz for 1 minute
Vibration	1.5 mm double amplitude at frequency of 10 to 55 Hz 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)
Unit weight (packaged)	≈ 320 g (≈ 470 g)

Communication Interface

■ CC-Link

Comm. specifications	CC-Link Ver.1.10
Association approval	
Station type	Remote device station
Connection cable	CC-Link Exclusive Cable
Baud rate	156 k, 625 k, 2.5 M, 5 M, 10 M bps
Station number	01 to 64
No. of occupied station	1 station occupied, 2 stations occupied
Comm. distance	Dependign on baud rate
Remote I/O	1 station occupied: Ryn / RXn 32 points each 2 stations occupied: Ryn / RXn 64 points each
Remote register	1 station occupied: RWrn / RWwn 4 points each 2 stations occupied: RWrn / RWwn 8 points each
Command code	Point table R/W, parameter R/W, read only, special command monitor only, network connection, drive control, motion control, drive status
Comm. setting switch	10 bit rotary switch (0 to 9): 3, 1 bit DIP switch (ON / OFF)

■ RS485


Comm. protocol	Modbus RTU
Applied standard	Compliance with EIA RS485
Max. connections	1 (fixed)
Baud rate	9600, 19200, 38400, 57600, 115200 (factory default) bps
Start bit	1 bit (fixed)
Data bit	8 bit (fixed)
Parity bit	None (fixed)
Stop bit	2 bit (fixed)

Troubleshooting

Malfunction	Causes	Troubleshooting
When communication is not connected	The communication cable is not connected.	Check communication cable wiring. Check communication cable connected 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.
When motor rotates to the opposite direction of the designated direction	MotorDir parameter setting is not correct.	Check the MotorDir parameter settings.
When motor drives unstable	Connection between motor and encoder is unstable.	Check the driver and motor are connected correctly.
	Control Gain value is not correct.	Change the Control Gain parameter as the appropriate value.

Connectors

■ Power connector

	Pin	Function
1	24VDC≒	
2	GND	

■ Motor + Encoder connector


Pin	Function	Pin	Function
1	GND	8	+5 VDC≒
2	Encoder A	9	Encoder \bar{A}
3	Encoder B	10	Encoder \bar{B}
4	Encoder Z	11	Encoder \bar{Z}
5	PE	12	N · C
6	Motor A	13	Motor B
7	Motor \bar{A}	14	Motor \bar{B}

■ I/O connector

Pin	Function	Pin	Function
1	VEX	11	+Limit
2	IN0	12	-Limit
3	IN1	13	OUT0
4	IN2	14	OUT1
5	IN3	15	OUT2
6	IN4	16	OUT3
7	IN5	17	OUT4
8	IN6	18	OUT5
9	IN7	19	OUT6
10	ORG	20	GEX


■ RS485 communication connector

- Teh following connector is for parameter setting and operation test instead of driver operation.
- Disconnect the RS485 cable when using CC-Link Communication.

	Pin	Function
1	RS485 DATA +	
2	RS485 DATA -	

■ Brake connector

- Only available in built-in brake type.

	Pin	Function
1	Brake -	
2	Brake +	

■ CC-Link communication connector

Pin	Function	Pin	Function
1	F.G.	4	DB
2	SLD	5	DA
3	DG	-	-

■ Suitable specifications

- The following connectors can be used with equivalent or substitute.
- CC-Link dedicated cable must be used and the performance can not be guaranteed when using other cables.

Type	Connector specifications	Manufacture
Power connector	CHD1140-02, connector terminal: CTD1140	HANLIM
Motor + Encoder connector	5557-14R, connector terminal: □ 20 / 28 / 35 mm: 5556T2 □ 42 / 56 / 60 mm: 5556T	Molex
I/O connector	10150-3000PE, housing: 10350-52F0-008	3M
RS485 comm. connector	51065-0200, connector terminal: 50212-8000	Molex
Brake connector	5264-02, connector terminal: 5263PBT	Molex
CC-Link comm. connector	2ESDV-05P-OR	Dinkle

Switch

■ CC-Link station setting DIP switch

Setting	CC-Link station setting
ON	2 stations occupied
OFF	1 station occupied (factory default)

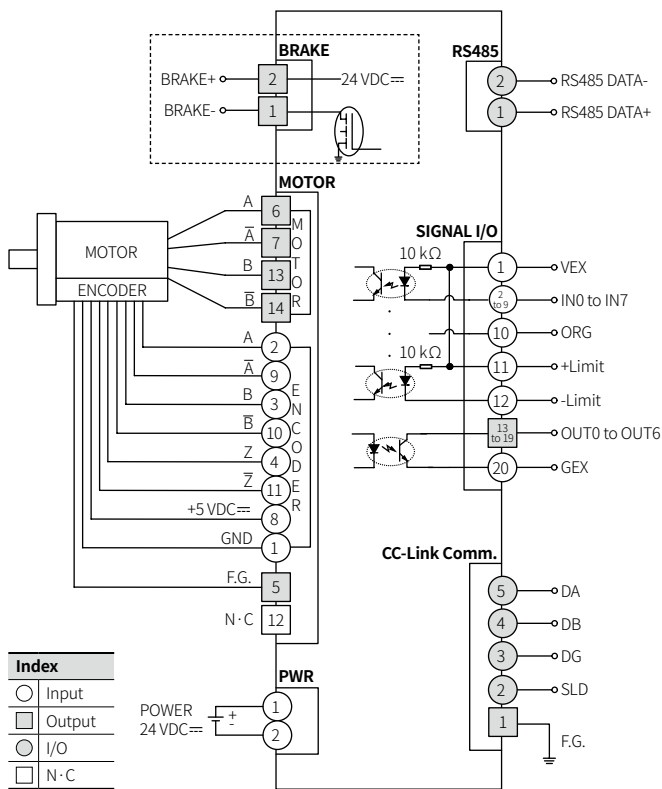
■ CC-Link communication speed setting rotary switch

Setting	Baud rate (bps)	Setting	Baud rate (bps)
0	156k	5	Disable
1	625k	6	
2	2.5M	7	
3	5M	8	
4	10M	9	

■ CC-Link comm. station setting rotary switch

Setting	Station No. (×10)	Station No. (×1)
0	0×10	0
1	1×10	1
2	2×10	2
3	3×10	3
4	4×10	4
5	5×10	5
6	6×10	6
7		7
8	Disable	8
9		9

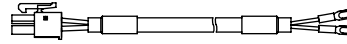
Connections



• is only available in built-in brake type.

Sold Separately : Power Cable

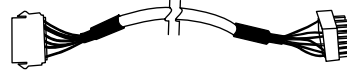
■ CJ-PW-□



- Recommended to use ferrite core at both ends of the cable.
- The model name is 010, 020 which indicates the cable length.
E.g.) CJ-PW-010: 1 m power cable

Sold Separately : Motor + Encoder Cable

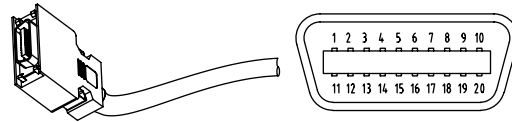
■ Fixed type: C1D14M-□, Flexible type: C1DF14M-□



- Recommended to use ferrite core at both ends of the cable.
- The model name is 1, 2, 3, 5, 7, 10, 15, 20 which indicates the cable length.
E.g.) C1DF14M-10: 10 m flexible type Motor + Encoder cable
- For built-in brake type, use dedicated cable.
(fixed type: C1D14MB-□, moving type: C1DF14MB-□)

Sold Separately : I/O Cable

■ CO20-MP□-R (specifications: AiC-CL TAG)



Pin	Function (Name TAG)	Cable color	Dot line color-number
1	VEX	Yellow	Black-1
2	IN0		Red-1
3	IN1		Black-2
4	IN2		Red-2
5	IN3		Black-3
6	IN4		Red-3
7	IN5		Black-4
8	IN6		Red-4
9	IN7		Black-5
10	ORG		Red-5
11	+Limit	White	Black-1
12	-Limit		Red-1
13	OUT0		Black-2
14	OUT1		Red-2
15	OUT2		Black-3
16	OUT3		Red-3
17	OUT4		Black-4
18	OUT5		Red-4
19	OUT6		Black-5
20	GEX		Red-5

- Recommended to use ferrite core at both ends of the cable.
- The model name is 010, 020, 030, 050, 070, 100, 150, 200 which indicates the cable length.
E.g.) CO20-MP070-R: 7 m I/O cable