

LOW-VOLTAGE BUILT-IN BRUSHLESS DRIVER

EA-BLDC20-120-L2-R USER MANUAL

V1.03

English Edition



Revision Summary

The following table summarizes the revisions and updates made to this document.

Version	Date	Revision Description	Revised By
V1.01	2021-01-26	Initial release	Shen Yangyang
V1.02	2021-09-25	Contact information updated	Hua Rongyu
V1.03	2022-01-11	PLC wiring diagram updated	Shen Yangyang

Before Use

Read and observe all safety information before operating this product to protect personnel and equipment.

**DANGER**

- Before wiring or installing the driver, make sure the power supply is switched off.
- Components on the internal circuit board are vulnerable to electrostatic discharge. Do not touch the circuit board unless proper anti-static precautions have been taken.
- Do not modify internal components or wiring.
- Do not use this product in locations exposed to moisture, corrosive gas, flammable gas, or similar hazardous substances. Electric shock or fire may result.
- Install the driver and accessories away from heat sources, open flames, and flammable materials.
- Before starting the machine, adjust the parameters to match the application. Incorrect settings may cause uncontrolled operation or malfunction.
- Confirm that the emergency-stop device can be activated at any time before starting the machine.
- At power-on, make sure the motor shaft is stationary and cannot be rotated by mechanical inertia or other external forces.
- Do not change wiring while power is on. Electric shock or personal injury may result.

**WARNING**

- Do not apply DC power to the driver COM terminal.
- The rated power-supply voltage is DC 24 V ($\pm 20\%$).
- Test the driver and motor without load before connecting the load.
- Do not switch the power supply on and off frequently. When repeated switching is necessary, limit it to no more than once per minute.
- Do not use this product for vertical lifting or lowering of a load.
- Only qualified personnel may install, wire, and service the driver.

Notes

- Some illustrations may show the housing or safety covers removed to explain product details. During operation, reinstall all covers, complete the wiring correctly, and follow this manual.
- Illustrations are for explanation only and may differ slightly from the actual product without affecting its function.
- Product documentation may be revised without prior notice. Obtain the approved version from the supplier or authorized technical support.
- Contact the supplier or authorized technical support for product-use questions.

Contents

1. Product Inspection and Description

1.1 Product Inspection

1.2 Nameplate / Model Description

2. Product Dimensions, Environmental Conditions, and Installation

2.1 Product Dimension Drawing

2.2 Operating, Storage, and Transportation Conditions

2.2.1 Storage Conditions

2.2.2 Operating Conditions

2.3 Installation Instructions

3. Wiring

3.1 Wiring Diagram

3.2 Ports

3.2.1 Power Interface

3.2.2 Control Terminal

3.2.3 Motor Interface

3.2.4 Keypad Interface

4. Operation Instructions

4.1 Terminal Control

4.2 Keypad Control

4.3 PC Software

5. Status Display and Fault Maintenance

6. RS485 Communication

6.1 RS485 Network

6.2 RS485 Cable

6.3 System Settings

6.4 Data-Frame Format

6.5 Register List

6.6 Common Command Examples

7. Basic Inspection and Maintenance

1. Product Inspection and Description

1.1 Product Inspection

To prevent problems caused during purchase or transportation, carefully check the following items:

- Confirm that the received product is the intended model by checking the model number on the package nameplate and comparing it with the model description in the next section.
- Visually inspect the product for damage or scratches.
- Check for loose or missing screws.
- Check for missing accessories against the complete component list.

Contact the supplier or sales representative promptly if any issue is found.

A complete operable driver assembly includes:

- EA-BLDC20-120-L2-R driver - 1 unit
- 12-pin I/O terminal - 1 piece
- Port connection wires, AWG24 - 5 pieces

1.2 Nameplate / Model Description

Model designation:

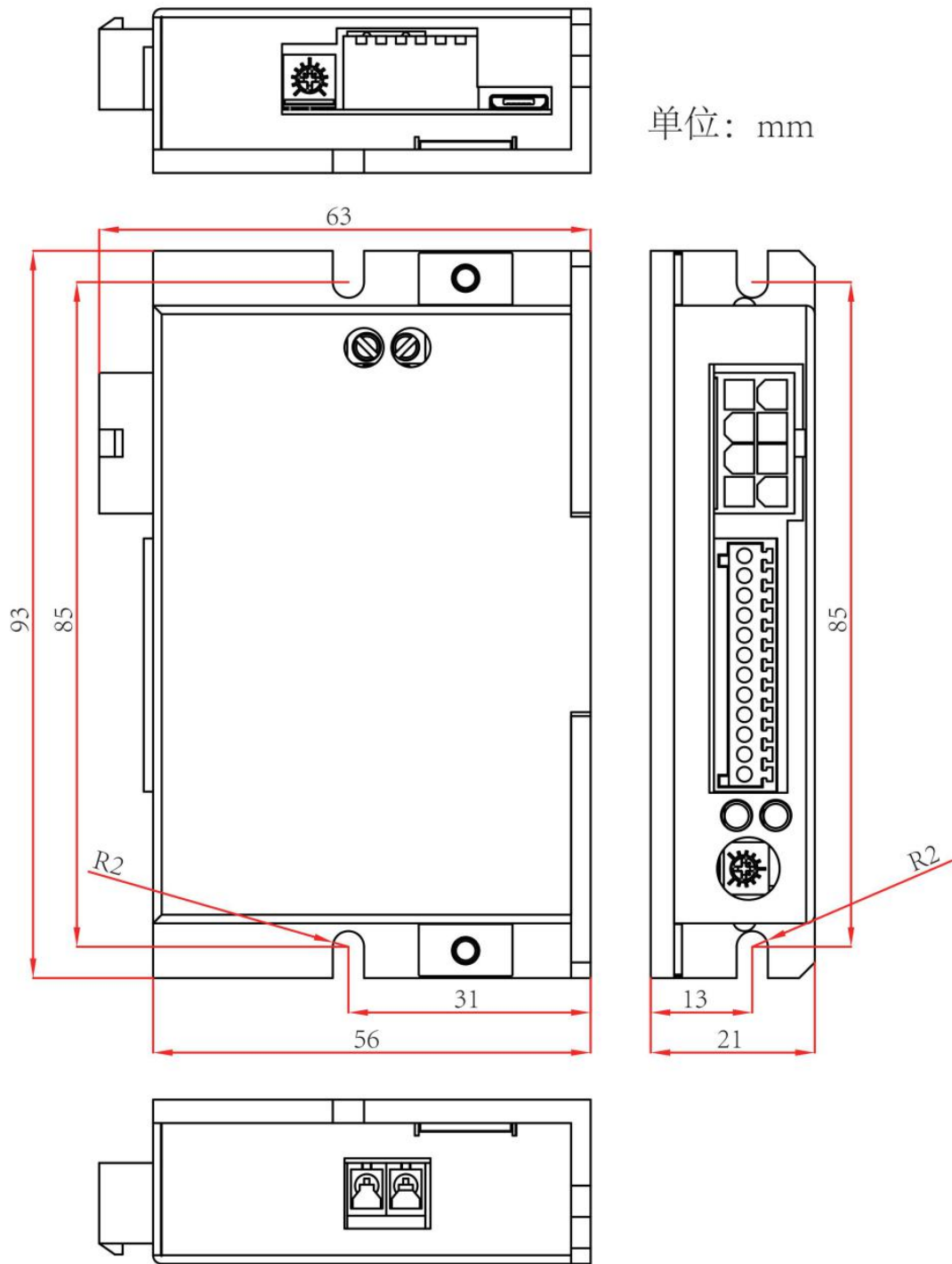
Code	Meaning
EA	Product prefix
BLD	Brushless DC driver
C20	C20 series
120	Rated output power: 120 W
L2	Low-voltage input: DC 24 V
R	RS485 communication

Item	Specification
Model	EA-BLDC20-120-L2-R
Rated input voltage	DC 24 V ($\pm 20\%$)
Output current	7.5 A; adjustable through the keypad
Output power	DC 24 V, 120 W
Applicable motor	DC 24 V brushless motor, rated power up to 120 W
Speed-control accuracy	Closed-loop speed control, $\pm 0.5\%$
Default maximum speed	3000 rpm
Default motor pole pairs	5 pole pairs; other values can be set through the keypad
Speed reference	Built-in AI1 speed knob by default; external analog input, RS485, or multi-speed control can be selected
Digital inputs	DI1-DI5, NPN, active low
Digital outputs	DO1 fault output and DO2 speed output; open collector
Built-in knobs	Speed and acceleration/deceleration-time adjustment
Analog input	External analog voltage, 0-5 V or 0-10 V, or PWM
HDI input	Supported
Bus control	RS485 Modbus RTU; 1200-57600 bit/s; frame interval at least 30 ms
PC software	Supported
Operation panel	Optional C20-series external keypad for parameter setting and data reading

Item	Specification
Protection functions	Undervoltage, overvoltage, overcurrent, overload, stall, short circuit, phase loss, and overtemperature
Operating temperature	-10 to 40 °C at rated current; above 40 °C, reduce rated current by 2.5% per 1 °C; maximum 50 °C
Storage temperature	-33 to 65 °C
Humidity	Below 90% RH, non-condensing
Cooling	Natural air cooling
Protection rating	IP20
Installation type	Built-in, wall-mounted
Brake	Electromagnetic braking

2. Product Dimensions, Environmental Conditions, and Installation

2.1 Product Dimension Drawing



Original technical drawing; text contained in the figure is retained. Units: mm.

2.2 Operating, Storage, and Transportation Conditions

Do not expose the driver to harsh environments such as dust, direct sunlight, corrosive or flammable gas, grease, moisture, dripping water, or vibration.

The salt content in the air must be below 0.01 mg/cm² per year.

Protection rating: IP20. Protection against solid foreign objects larger than 12 mm; no moisture protection.

Condition	Operating	Storage / Transportation
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Condition	Operating	Storage / Transportation
Ambient temperature, individually installed	-10 to 40 °C; -20 to -10 °C or 40 to 50 °C only with derating	Storage: -33 to 65 °C; Transportation: -20 to 50 °C
Ambient temperature, side-by-side	-10 to 30 °C; -20 to -10 °C or 30 to 40 °C only with derating	-
Relative humidity	Maximum 85% RH	Maximum 90% RH; no condensation
Atmospheric pressure	86-106 kPa	70-106 kPa
Altitude	Below 1000 m; derate above 1000 m	-
Vibration / shock	No continuous vibration or excessive shock	Do not drop the package; no excessive shock

2.2.1 Storage Conditions

- Store in a clean, dry, dust-free location.
- Keep temperature and relative humidity within the specified limits.
- Avoid corrosive gases and liquids.
- Keep the packaged unit on a shelf or flat surface.

2.2.2 Operating Conditions

At rated current, operate between -10 and 40 °C. Above 40 °C, reduce rated current by 2.5% for each 1 °C increase. Maximum ambient temperature is 50 °C.

From 1000 to 2000 m altitude, reduce rated current by 1% or reduce the permitted ambient temperature by 0.5 °C for every 100 m increase. Contact the supplier for use above 2000 m.

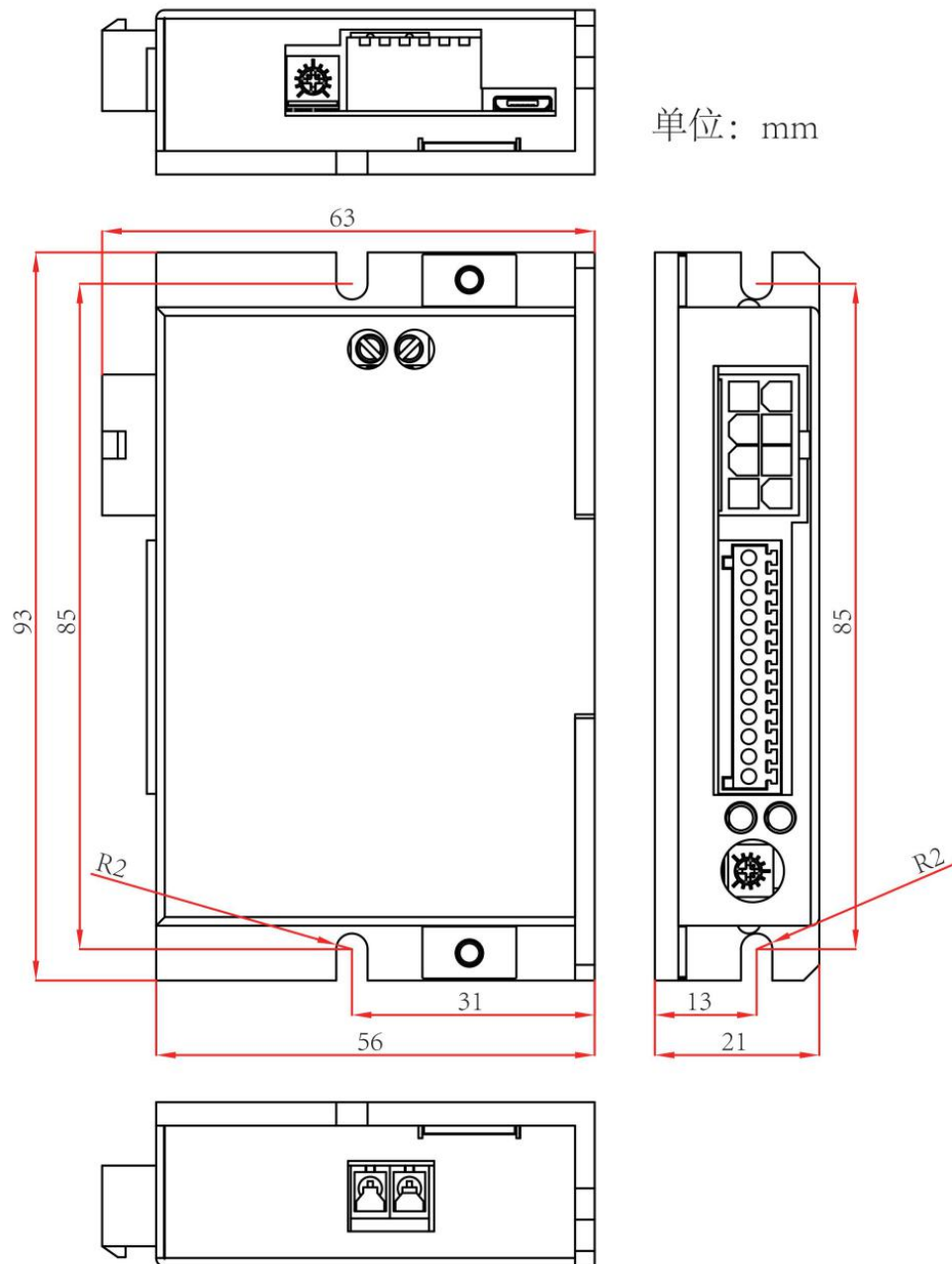
For long-term operation, keep ambient temperature below 40 °C and provide good ventilation.

The installation location must have no large heat source, dripping water, steam, dust, oily dust, corrosive or flammable gas, airborne metal particles, vibration, or strong electromagnetic interference.

2.3 Installation Instructions

The driver is wall mounted. Use M4 screws with washers on a metal mounting surface with good heat dissipation and provide reliable grounding. Improper installation may create a fire hazard.

When multiple drivers are installed side by side, keep at least 50 mm spacing. Increase spacing when side ports or RS485 cables require additional routing clearance.

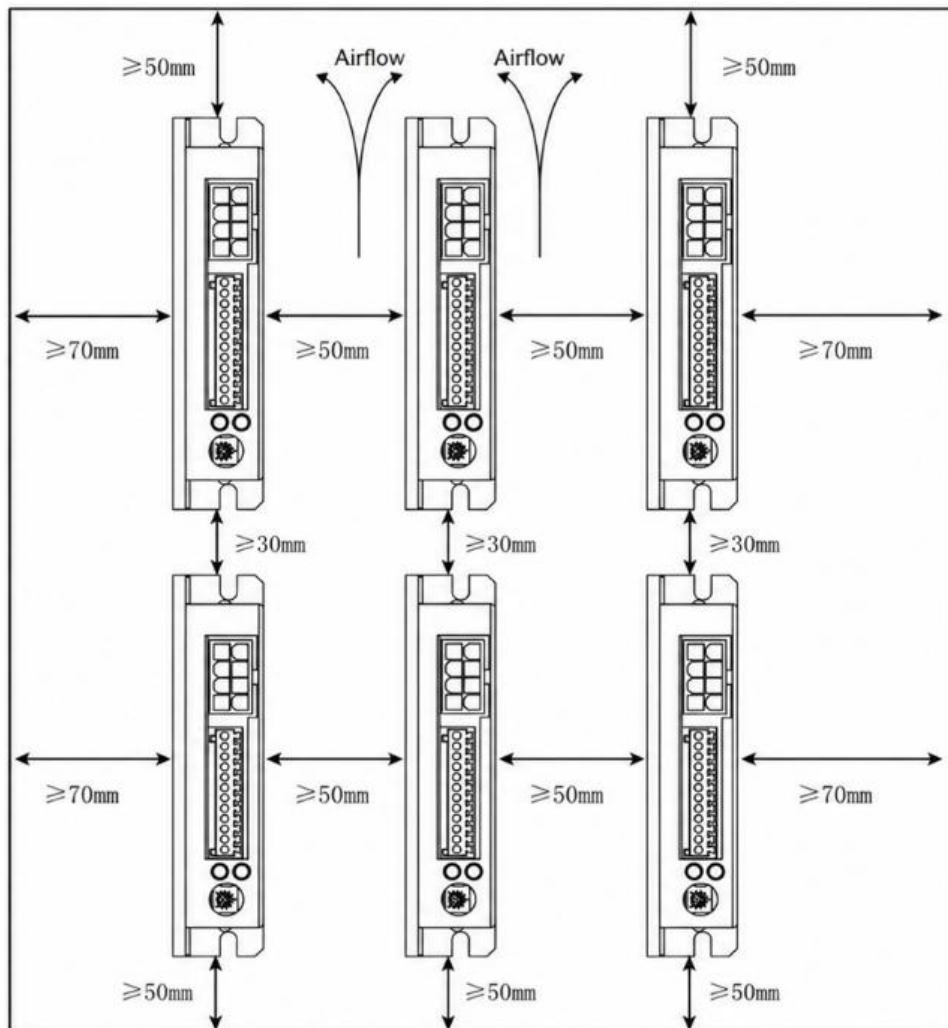
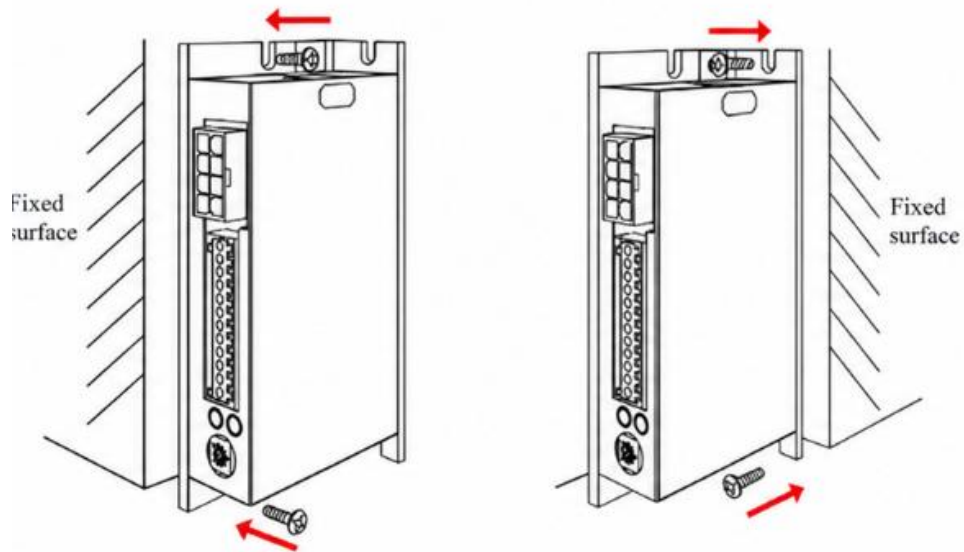


Mounting screw arrangement.

Recommended installation spacing. Written dimensions take precedence over the drawing scale.

Installation precautions

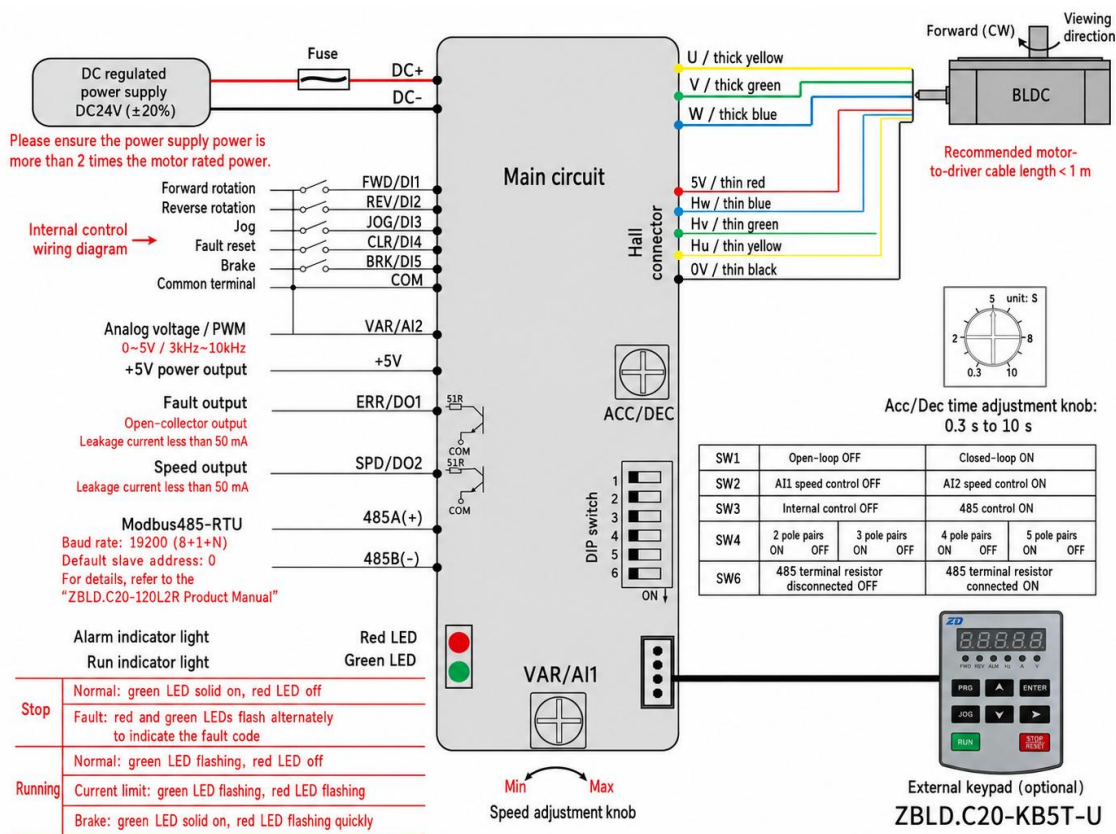
- Do not pull the driver-to-motor cable tight.
- Tighten all mounting screws.
- Use M4 screws with washers at the mounting locations.
- Recommended tightening torque: 1.2-1.5 N·m.
- Align the motor shaft center concentrically with the equipment shaft.
- Tighten all motor mounting screws.



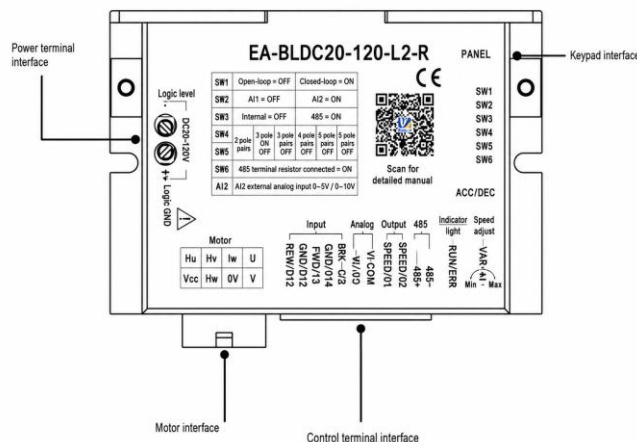
3. Wiring

3.1 Wiring Diagram

The following figure shows the wiring arrangement for the EA-BLDC20-120-L2-R.



Original wiring diagram; text contained in the figure is retained.



Wiring precautions

- Switch off the power supply before wiring. Wiring must be performed by qualified personnel.
- Do not connect the power cable to terminals other than the power input.
- Ground the grounding terminal reliably.
- Tighten terminal screws to prevent vibration-related loosening.
- Select conductor size according to applicable electrical regulations.
- Use a power supply with a capacity greater than twice the rated motor power.
- Keep the motor-to-driver cable shorter than 1 m whenever possible.
- After wiring, verify all connections, check for omitted wiring, and confirm there is no terminal-to-terminal or ground short circuit.

3.2 Ports

3.2.1 Power Interface

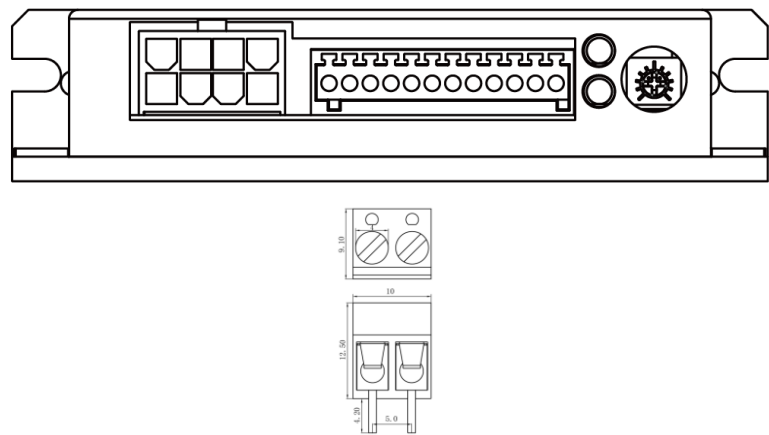
Two-pole screw terminal. Use a flat-blade screwdriver with a blade width of 4 mm or less. The input is DC 24 V. Follow the markings and do not reverse the polarity.

3.2.2 Control Terminal

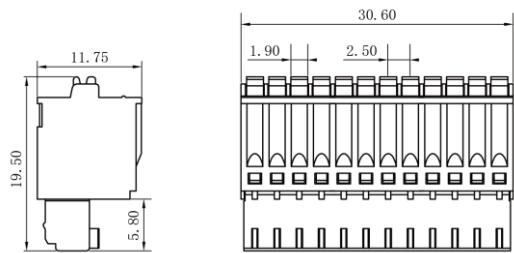
Twelve-pole pluggable spring terminal. Use a flat-blade screwdriver with a blade width of 2 mm or less. Press the button above the wiring hole, insert the conductor, release the button, and confirm that the conductor is retained.

3.2.3 Motor Interface

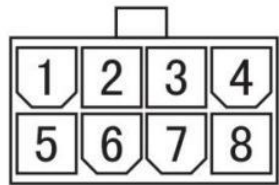
The low-voltage motor uses an 8-pin pluggable connector. Connect each signal and wire color according to the pin-assignment table.



Power-interface and port layout.



Control-terminal dimensions.



Motor-interface pin assignment.

Pin	1	2	3	4	5	6	7	8
Signal	HU	HV	W	U	VCC	HW	0 V	V
Wire color	Yellow	Green	Thick blue	Thick yellow	Red	Blue	Black	Thick green

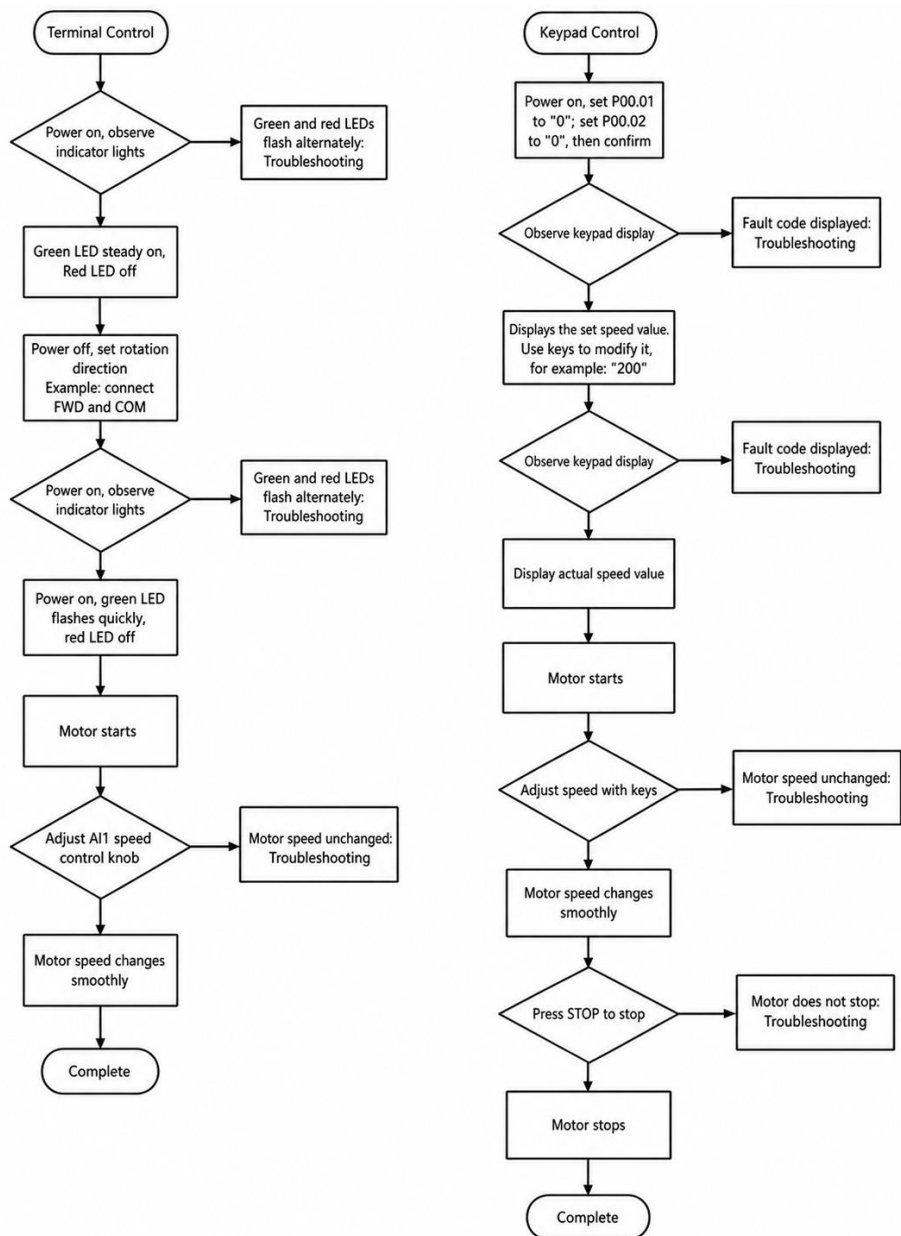
3.2.4 Keypad Interface

The keypad interface is USB. Use the separately purchased cable supplied for the compatible C20-series external keypad.

4. Operation Instructions

Precautions

- Terminal control is the factory default. Keypad control requires the optional C20-KB5T-U external keypad.
- The function codes in this manual apply to the EA-BLDC20-120-L2-R and compatible C20-series products.
- Operation must be performed by personnel who understand the product.
- Perform no-load commissioning before normal operation. The following flowcharts show terminal control and keypad control using factory-default settings.



4.1 Terminal Control

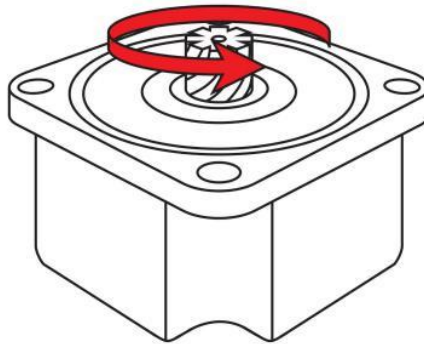
4.1.1 Port Description

Users without the optional keypad can refer to the default function-code values in Section 4.2.3.

Category	Port	Function
Input	FWD/DI1	Forward rotation
Input	REV/DI2	Reverse rotation

Category	Port	Function
Input	JOG/DI3	Jog
Input	CLR/DI4	Fault reset
Input	BRK/DI5	Electromagnetic brake
Common	COM	Input/output common terminal
Analog	VAR/AI2	Analog voltage or PWM, 0-5 V / 10 V
Output	+5V	+5 V power output
Output	ERR/DO1	Fault output, open collector
Output	SPD/DO2	Speed output, open collector
RS485	A+	RS485 positive
RS485	B-	RS485 negative

The default motor direction may vary with the number of pole pairs. Always perform a no-load test and confirm direction before use.



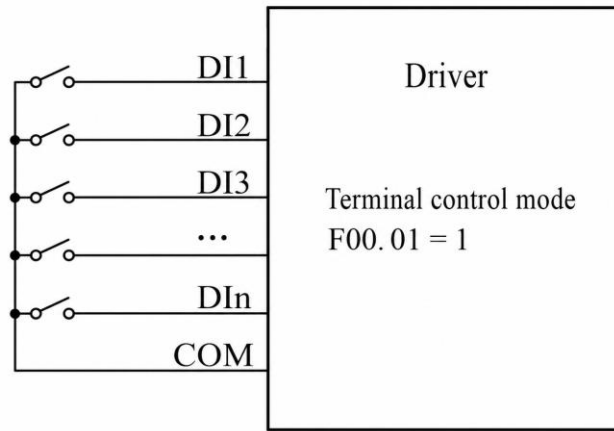
Forward direction.



Reverse direction.

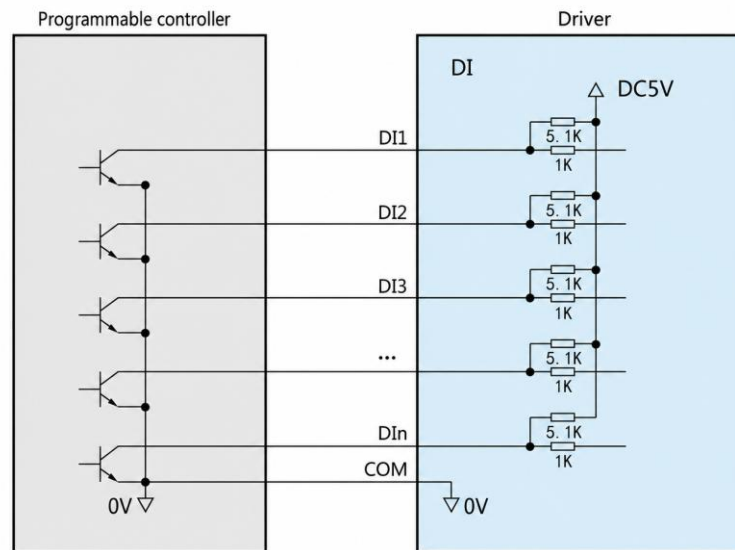
4.1.2 Input Terminals

- Short FWD to COM to run forward.
- Short REV to COM to run in reverse.
- Short JOG to COM for low-speed jog operation.
- Short CLR to COM to reset a fault.
- Short BRK to COM during operation to apply electromagnetic braking. Except for an emergency stop, reduce speed before braking, especially with high inertia.



Terminal-control connection principle.

External PLC NPN control is shown in the following figure.

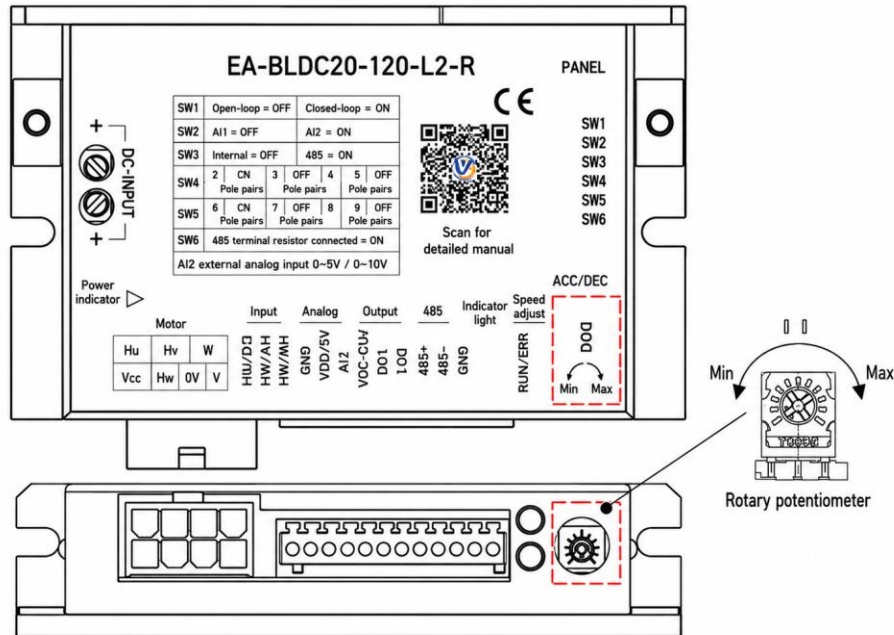


NPN connection.

Do not connect FWD and REV simultaneously. Avoid changing direction at high speed. Ensure motor speed is below the calculated safe braking speed before using the brake function.

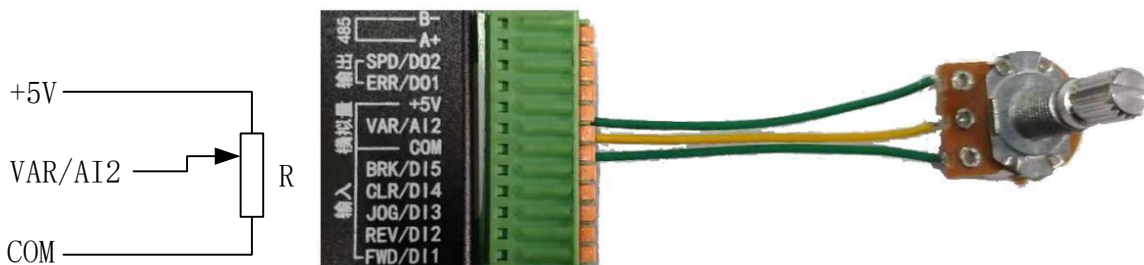
4.1.3 Analog AI1 Speed Reference - Built-in Knob Potentiometer

The built-in AI1 knob is the factory-default speed reference. Turn clockwise to increase speed and counterclockwise to decrease speed. Adjust with a flat-blade screwdriver having a tip diameter of 3 mm or less.



4.1.4 Analog AI2 Speed Reference - External Voltage

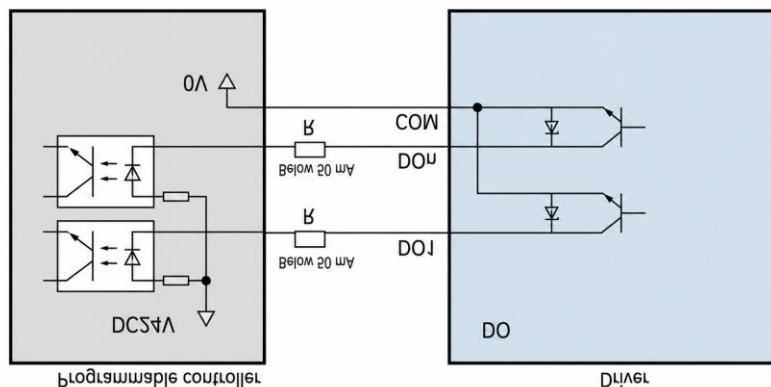
Set F00.02 to 2 using the keypad. Speed is controlled by the external input voltage, 0-5 V by default. A 10 kΩ external potentiometer is recommended. For 0-10 V input, set F05.39 to 10.



External potentiometer connection.

4.1.5 Output Terminals

The outputs are open-collector outputs with sink current below 50 mA. DO1 is fault output by default and DO2 is speed output by default. Change F06.01 and F06.02 to select other functions.



PLC output connection.

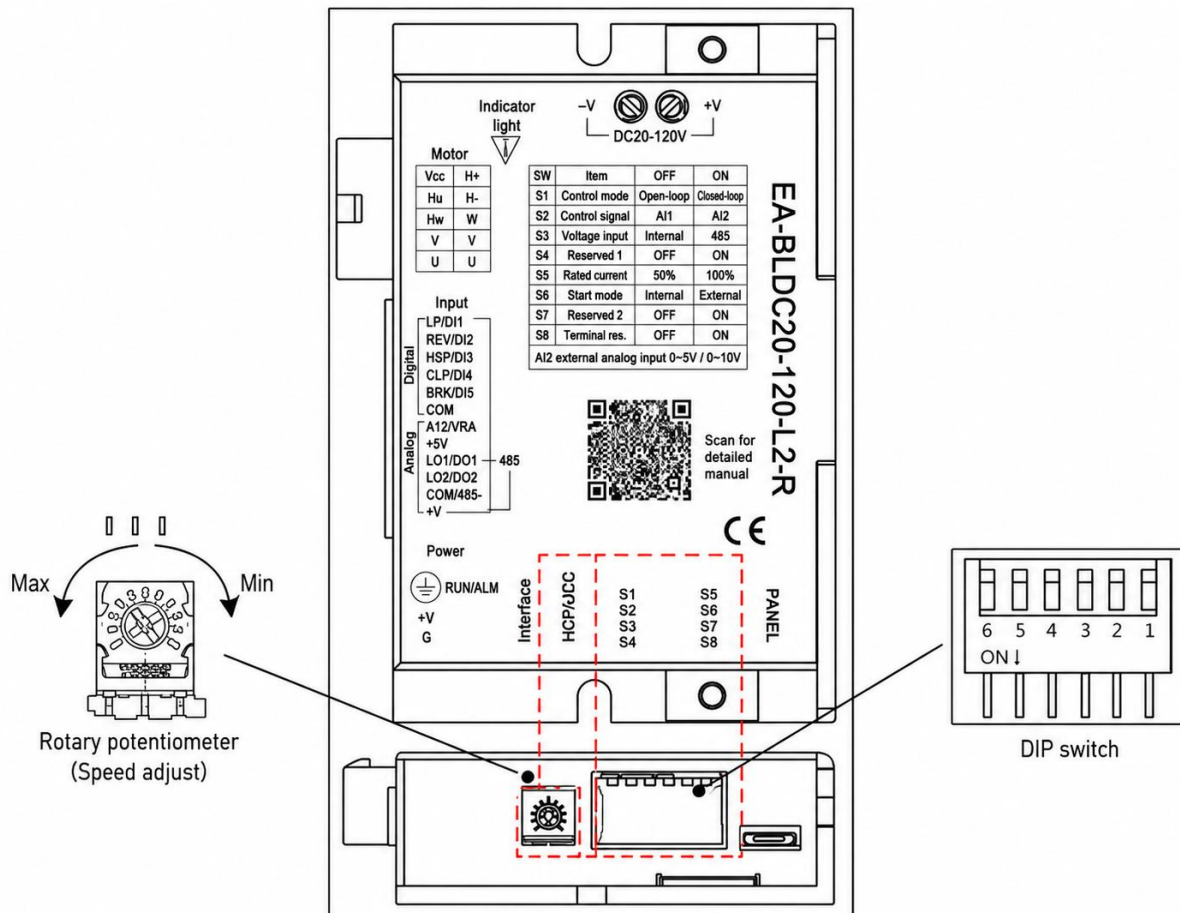
COM is the driver 0 V reference.

4.1.6 RS485 Communication Port

The product supports RS485 communication using the Modbus RTU protocol described in Chapter 6.

4.1.7 Analog ACC/DEC Acceleration/Deceleration Time Reference

The built-in ACC/DEC knob is the factory-default acceleration/deceleration-time reference. Turn clockwise to increase the time and reduce acceleration; turn counterclockwise to reduce the time and increase acceleration. To set acceleration and deceleration separately, set F00.08 to 0, then set F00.11 and F00.12.



4.1.8 DIP Switches

The driver has six DIP switches, SW1-SW6. The down position is ON.

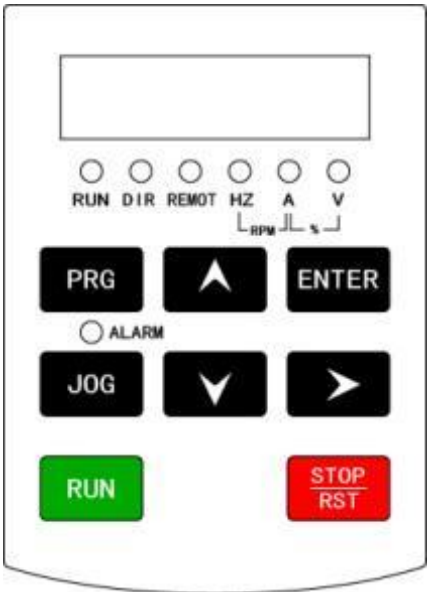
Switch	Function	OFF	ON
SW1	Open-loop / closed-loop selection	Open loop	Closed loop
SW2	Analog reference selection	AI1	AI2
SW3	Control method	Internal	RS485
SW4/SW5	Motor pole-pair setting	See combinations below	See combinations below
SW6	Termination resistor	Disconnected	RS485 termination connected

Pole pairs	SW4	SW5
2	ON	ON
3	OFF	ON
4	ON	OFF
5	OFF	OFF

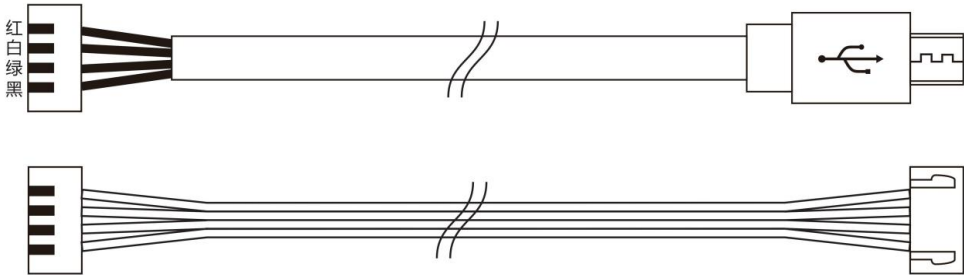
4.2 Keypad Control

4.2.1 Keypad Description

The optional C20-KB5T-U external keypad can set driver parameters and read driver status. Select the matching USB keypad cable.



External keypad.



键盘连接线，长度500mm

Keypad connection cables.

No.	Item	Description
1	Digital display	Five-digit display for function codes, operating parameters, and fault alarms
2	RUN indicator	Off: stopped; flashing: parameter identification; on: running
2	DIR indicator	Off: forward; on: reverse
2	REMOT indicator	Off: keypad control; flashing: terminal control; on: communication control
2	ALARM indicator	Off: no fault; flashing: pre-alarm; on: fault
3	Hz	Frequency unit
3	A	Current unit
3	V	Voltage unit
3	RPM	Speed unit
3	%	Percentage
4	PRG	Enter or exit the first-level menu

No.	Item	Description
4	ENTER	Enter menu levels and confirm parameter settings
4	Up key	Increase data or function-code value
4	Down key	Decrease data or function-code value
4	Right-shift key	Move the cursor or cycle through display items; select a digit while editing a parameter

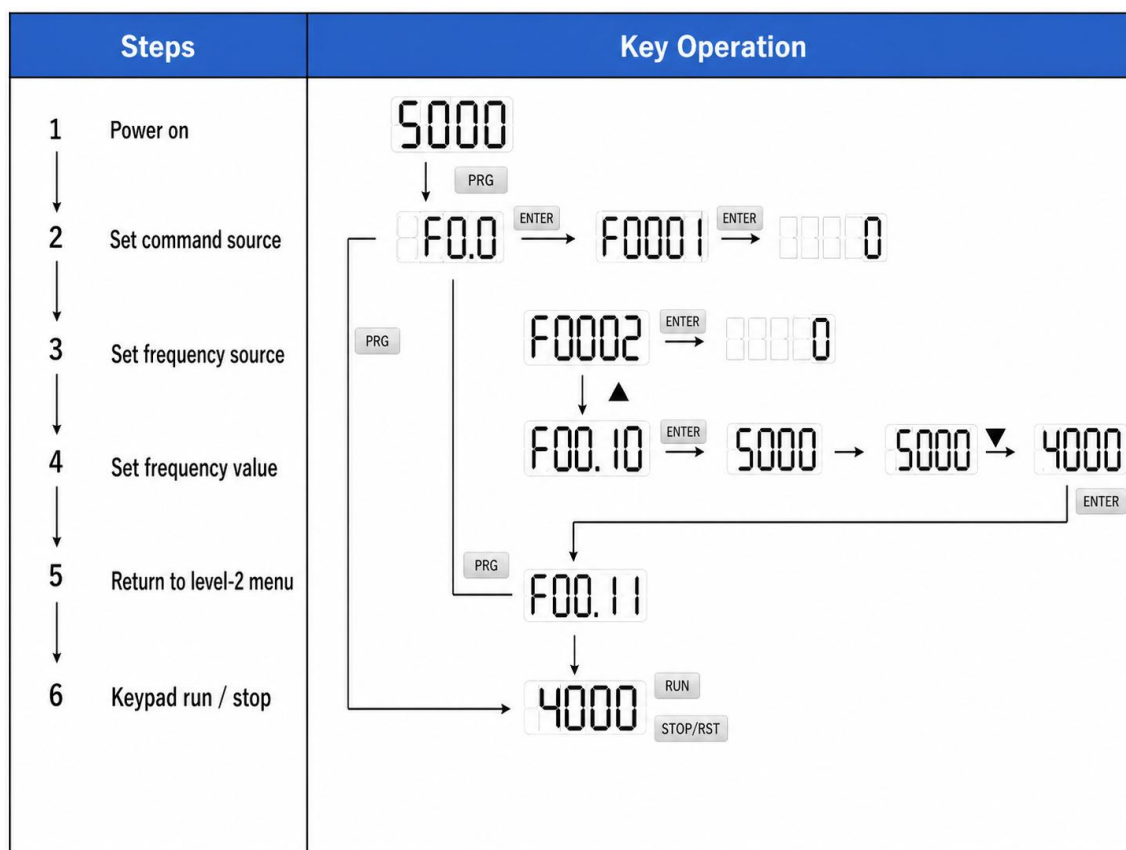
JOG	Jog key	Starts jog operation; available on the external keypad only
RUN	Run key	Starts operation
STOP/RST	Stop/Reset key	Stops the driver during operation; resets a fault in the fault state

4.2.2 Keypad Operation

The driver uses a three-level menu:

- Function-code group, first-level menu, for example F00.
- Function-code number, second-level menu, for example F00.00.
- Function-code value, third-level menu, for example 50.00 Hz.

If no digit flashes in the third-level menu, the function code cannot be changed. It may be read-only or writable only while the driver is stopped.



Keypad menu operation; text contained in the figure is retained.

4.2.3 Function Codes

C20 driver parameters are grouped by function. Groups F00-F10 are used; other groups are reserved. R/W = readable and writable; R/W* = writable while stopped and readable at any time; RO = read-only; N = reserved.

F00 Basic Function Group

Parameter	Name	Setting Range	Default	Attribute
F00.00	Control mode	0 Test mode; 1 Hall open loop; 2 Hall closed loop; 3 DIP-switch setting, SW1 on supported models	3	R/W*
Parameter	Name	Setting Range	Default	Attribute
F00.01	Run-command selection	0 Keypad command, LED off; 1 Terminal command, LED flashing; 2 Communication command, LED on; 3 DIP-switch setting, SW3 on supported models	3	R/W
F00.02	Speed-reference selection	0 Keypad digital setting; 1 Analog AI1, knob potentiometer; 2 Analog AI2, external voltage; 3 Modbus communication; 4 Multi-speed; 5 DIP-switch setting, SW2/SW3; 6 Simple PLC, F04 group; 7 High-speed pulse input, HDI selected by F05.00; 8 CAN communication on supported models	5	R/W
F00.03	Upper operating-frequency limit	F00.04-500.00 Hz	250.00 Hz	R/W*
F00.04	Lower operating-frequency limit	0.00 Hz-F00.03	5.00 Hz	R/W*
F00.05	Communication run-command channel	0 Modbus; 1 CAN on supported models	0	R/W*
F00.06	Pole-pair setting source	0 Function code F02.05; 1 DIP switch on supported models	1	R/W*
F00.07	Current setting source	0 Function code F02.04; 1 Analog setting on supported models	1	R/W*
F00.08	Acceleration/deceleration time setting source	0 Function codes F00.11 and F00.12; 1 Analog setting for keypad and terminal models	1	R/W*

Parameter	Name	Setting Range	Default	Attribute
F00.09	Jog frequency	0.00 Hz-F00.03	10.00 Hz	R/W
F00.10	Keypad frequency	0.00 Hz-F00.03	250.00 Hz	R/W
F00.11	Acceleration time 1	0.1-600.0 s	1.0 s	R/W
F00.12	Deceleration time 1	0.1-600.0 s	1.0 s	R/W
F00.13	Rotation-direction selection	0 Default direction; 1 Opposite direction; 2 Reverse operation disabled	0	R/W
F00.14	Carrier frequency	8.0-20.0 kHz	Model dependent	R/W*
F00.15	Parameter restore selection	0 No action; 1 Restore function-code defaults; 2 Restore CANopen communication defaults; 3 Restore all parameters	0	R/W*

F01 Start/Stop Control Group

Parameter	Name	Setting Range	Default	Attribute
F01.05	Stop mode	0 Deceleration stop; 1 Coast stop	1	R/W
F01.06	Forward/reverse dead time	0.000-9.999 s	0.200 s	R/W
F01.07	Reserved	0-1	0	R/W*
F01.08	Electronic-brake current limit	0.1%-200.0%	5.0%	R/W
F01.09	Electronic-brake adjustment time	0.1-999.9 s	5.0 s	R/W
F01.10	Stop speed	0.00-50.00 Hz; valid for deceleration stop	0.20 Hz	R/W
F01.11	Direction-change limit frequency	0.0-500.0 Hz; valid for deceleration stop	50.0 Hz	R/W
F01.12	Electronic-brake torque hold time	0.1-600.0 s	0.0 s	R/W
F01.13	Brake during deceleration stop	0 Disabled; 1 Enabled when F01.05=0	1	R/W
F01.14	Reduction-ratio numerator	1-9999. Displayed speed = motor speed / (numerator / denominator)	1	R/W
F01.15	Reduction-ratio denominator	1-9999	1	R/W

F02 Motor Parameter Group

F02.00	Rated motor power	15-2200 W	Model dependent	R/W*
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F02.00	Rated motor power	15-2200 W	Model dependent	R/W*
F02.01	Rated motor frequency	0.01-500 Hz	Model dependent	R
F02.02	Rated motor speed	1-9999 rpm	Model dependent	R
F02.03	Rated motor voltage	0-1200 V	Model dependent	R
F02.04	Rated motor current	0.8-999.9 A	Model dependent	R/W*
F02.05	Motor pole pairs	1-20	5	R/W*
F02.08	Special parameter setting	Bit 0: 0 Hall count in default direction, 1 reversed Hall count, F09.29/F09.30. Bit 1: 0 display actual speed, 1 display set speed	0	R/W*

F03 Control Parameter Group

F03.00-F03.18	Reserved	Reserved	16.0	N
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F04 Simple PLC and Multi-speed Group

F04.00	Simple PLC mode	0 Stop after one run	0	R/W
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Parameter	Name	Setting Range	Default	Attribute
F04.01-F04.16	Multi-speed 0 through Multi-speed 15	-100.0% to 100.0%	0.0%	R/W
F04.17	Segment 0 run time	0.0-999.9 s or min	0.0 s	R/W
F04.18	Segment 1 run time	0.0-999.9 s or min	0.0 s	R/W
F04.19	Segment 2 run time	0.0-999.9 s or min	0.0 s	R/W
F04.20	Segment 3 run time	0.0-999.9 s or min	0.0 s	R/W
F04.21	Segment 4 run time	0.0-999.9 s or min	0.0 s	R/W
F04.22	Segment 5 run time	0.0-999.9 s or min	0.0 s	R/W
F04.23	Segment 6 run time	0.0-999.9 s or min	0.0 s	R/W
F04.24	Segment 7 run time	0.0-999.9 s or min	0.0 s	R/W
F04.25	Segment 8 run time	0.0-999.9 s or min	0.0 s	R/W
F04.26	Segment 9 run time	0.0-999.9 s or min	0.0 s	R/W
F04.27	Segment 10 run time	0.0-999.9 s or min	0.0 s	R/W
F04.28	Segment 11 run time	0.0-999.9 s or min	0.0 s	R/W

Parameter	Name	Setting Range	Default	Attribute
F04.29	Segment 12 run time	0.0-999.9 s or min	0.0 s	R/W
F04.30	Segment 13 run time	0.0-999.9 s or min	0.0 s	R/W
F04.31	Segment 14 run time	0.0-999.9 s or min	0.0 s	R/W
F04.32	Segment 15 run time	0.0-999.9 s or min	0.0 s	R/W
F04.33	PLC restart mode	0 Restart from segment 1; 1 Continue at the stage frequency present when interrupted	0	R/W*
F04.34	Multi-segment time unit	0 Seconds; 1 Minutes	0	R/W*

F05 Input Terminal Parameter Group

F05.00	HDI function selection	0 DI3 as normal I/O input; 1 DI3 as HDI high-speed pulse input	0	R/W*
F05.01	DI1 terminal function	0 No function; 1 Forward run; 2 Reverse run; 3 Three-wire control; 4 Forward jog; 5 Reverse jog; 6 Coast stop; 7 Fault reset; 8 Electronic brake; 9 External fault input; 10-13 Reserved; 14 Forward limit; 15 Reverse limit; 16 Multi-speed 1; 17 Multi-speed 2; 18 Multi-speed 3; 19 Multi-speed 4; other values reserved	1	R/W*
F05.02	DI2 terminal function	Same options as F05.01	2	R/W*
F05.03	DI3 terminal function	Same options as F05.01	4	R/W*
F05.04	DI4 terminal function	Same options as F05.01	7	R/W*
F05.05-F05.08	DI5-DI8 terminal function	Same options as F05.01	0	R/W*
F05.09	Reserved	-	0	R/W*
F05.10	Input-terminal polarity	0x000-0x1FF	0x000	R/W
F05.11	Digital-input filter time	0.000-1.000 s	0.010 s	R/W
F05.12	Virtual-terminal setting	0x000-0x10F; 0 disabled, 1 enabled. Bit 0 DI1, Bit 1 DI2, Bit 2 DI3, Bit 3 DI4, Bit 4 DI5, Bit 5 DI6, Bit 6 DI7, Bit 7 DI8	0x000	R/W*

Parameter	Name	Setting Range	Default	Attribute
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Parameter	Name	Setting Range	Default	Attribute
F05.13	Terminal-control run mode	0 Two-wire control 1; 1 Two-wire control 2; 2 Three-wire control 1; 3 Three-wire control 2	0	R/W*
F05.14	DI1 ON delay	0.000-9.999 s	0.000 s	R/W
F05.15	DI1 OFF delay	0.000-9.999 s	0.000 s	R/W
F05.16	DI2 ON delay	0.000-9.999 s	0.000 s	R/W
F05.17	DI2 OFF delay	0.000-9.999 s	0.000 s	R/W
F05.18	DI3 ON delay	0.000-9.999 s	0.000 s	R/W
F05.19	DI3 OFF delay	0.000-9.999 s	0.000 s	R/W
F05.20	DI4 ON delay	0.000-9.999 s	0.000 s	R/W
F05.21	DI4 OFF delay	0.000-9.999 s	0.000 s	R/W
F05.22	DI5 ON delay	0.000-9.999 s	0.000 s	R/W
F05.23	DI5 OFF delay	0.000-9.999 s	0.000 s	R/W
F05.24	DI6 ON delay	0.000-9.999 s	0.000 s	R/W
F05.25	DI6 OFF delay	0.000-9.999 s	0.000 s	R/W
F05.26	DI7 ON delay	0.000-9.999 s	0.000 s	R/W
F05.27	DI7 OFF delay	0.000-9.999 s	0.000 s	R/W
F05.28	DI8 ON delay	0.000-9.999 s	0.000 s	R/W
F05.29	DI8 OFF delay	0.000-9.999 s	0.000 s	R/W
F05.30-F05.31	Reserved	0.000-9.999 s	0.000 s	R/W
F05.32	AI1 lower-limit voltage	0.00 V-F05.34	0.50 V	R/W
F05.33	AI1 lower-limit corresponding setting	-300.0%-300.0%	0.0%	R/W
F05.34	AI1 upper-limit voltage	F05.32-10.00 V	8.50 V	R/W
F05.35	AI1 upper-limit corresponding setting	-300.0%-300.0%	100.0%	R/W
F05.36	AI1 input filter time	0.000-9.999 s	0.030 s	R/W
F05.37	AI2 lower-limit voltage	0.00 V-F05.39	0.20 V	R/W
F05.38	AI2 lower-limit corresponding setting	-300.0%-300.0%	0.0%	R/W

Parameter	Name	Setting Range	Default	Attribute
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Parameter	Name	Setting Range	Default	Attribute
F05.39	AI2 upper-limit voltage	F05.37-10.00 V	4.80 V	R/W
F05.40	AI2 upper-limit corresponding setting	-300.0%-300.0%	100.0%	R/W
F05.41	AI2 input filter time	0.000-9.999 s	0.030 s	R/W
F05.42	AI3 lower-limit voltage	0.00 V-F05.44	0.50 V	R/W
F05.43	AI3 lower-limit corresponding setting	-300.0%-300.0%	0.0%	R/W
F05.44	AI3 upper-limit voltage	F05.42-10.00 V	8.50 V	R/W
F05.45	AI3 upper-limit corresponding setting	-300.0%-300.0%	100.0%	R/W
F05.46	AI3 input filter time	0.000-9.999 s	0.030 s	R/W
F05.47	AI4 lower-limit voltage	0.00 V-F05.49	0.50 V	R/W
F05.48	AI4 lower-limit corresponding setting	-300.0%-300.0%	0.0%	R/W
F05.49	AI4 upper-limit voltage	F05.47-10.00 V	8.50 V	R/W
F05.50	AI4 upper-limit corresponding setting	-300.0%-300.0%	100.0%	R/W
F05.51	AI4 input filter time	0.000-9.999 s	0.030 s	R/W
F05.52	HDI lower-limit frequency	0.00 kHz-F05.54	0.00 kHz	R/W
F05.53	HDI lower-limit corresponding setting	-100.0%-100.0%	0.0%	R/W
F05.54	HDI upper-limit frequency	F05.52-20.00 kHz	19.99 kHz	R/W
F05.55	HDI upper-limit corresponding setting	-100.0%-100.0%	100.0%	R/W
F05.56	HDI input filter time	0.000-9.999 s	0.030 s	R/W

F06 Output Terminal Parameter Group

F06.00	Reserved	0-1	0	R/W*
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F06.00	Reserved	0-1	0	R/W*
F06.01	DO1 output selection	0 Invalid; 1 Running; 2 Forward running; 3 Reverse running; 4 Jog running; 5 Driver fault; 6 Overload warning; 7 Underload warning; 8 Communication virtual-terminal output; 9 Low DC-bus voltage; 10 Speed output, Hall signal; other values reserved	5	R/W
F06.02	DO2 output selection	Same options as F06.01	10	R/W
F06.03	DO3 output selection	Same options as F06.01	0	R/W
F06.04	DO4 output selection	Same options as F06.01	0	R/W
F06.05	Output-terminal polarity selection	00-0F	00	R/W

Parameter	Name	Setting Range	Default	Attribute
F06.06	DO1 ON delay	0.000-9.999 s	0.000 s	R/W
F06.07	DO1 OFF delay	0.000-9.999 s	0.000 s	R/W
F06.08	DO2 ON delay	0.000-9.999 s	0.000 s	R/W
F06.09	DO2 OFF delay	0.000-9.999 s	0.000 s	R/W
F06.10	DO3 ON delay	0.000-9.999 s	0.000 s	R/W
F06.11	DO3 OFF delay	0.000-9.999 s	0.000 s	R/W
F06.12	DO4 ON delay	0.000-9.999 s	0.000 s	R/W
F06.13	DO4 OFF delay	0.000-9.999 s	0.000 s	R/W

F07 Fault and Protection Group

F07.00	Driver or motor overload/underload pre-alarm selection	0x000-0x131. Units digit: 0 motor pre-alarm relative to rated motor current; 1 driver pre-alarm relative to rated driver current. Tens digit: 0 continue after overload/underload alarm; 1 continue after underload alarm but stop on overload; 2 continue after overload alarm but stop on underload; 3 stop on either overload or underload fault. Hundreds digit: 0 detect continuously; 1 detect at constant speed only	0x000	R/W
F07.01	Overload pre-alarm detection level	F07.03-200%	140%	R/W
F07.02	Overload pre-alarm detection time	0.1-999.9 s	1.0 s	R/W
F07.03	Underload pre-alarm detection level	0%-F07.01	50%	R/W
F07.04	Underload pre-alarm detection time	0.1-999.9 s	1.0 s	R/W
F07.05	Motor overload protection	0 Disabled; 1 Enabled	0	R/W*
F07.06	Motor overload protection coefficient	20.0%-120.0%	100.0%	R/W
F07.07	MOS self-test enable	0 Disabled; 1 Enabled	0	R/W*
F07.08	Automatic current-limit level	10.0%-420.0% of driver rating	260.0%	R/W*

Parameter	Name	Setting Range	Default	Attribute
F07.09	Fault auto-reset time	0.0-999.9 s	5.0 s	R/W
F07.10	Number of fault auto-resets	0 Disabled; 1-9999 reset attempts	0	R/W
F07.11	Stall detection time	0.0-999.9 s	3.0 s	R/W*
F07.12	Stall current limit	1.0%-200.0% of driver rated current	70.0%	R/W*

Parameter	Name	Setting Range	Default	Attribute
F07.13	UP/DN keypad function	0 Fine adjustment of speed reference, valid only for keypad speed reference; 1 UP forward jog and DN reverse jog, valid on keypad stop/run screens	0	R/W
F07.14	Undervoltage detection time	0-9.999 s	1.0 s	R/W
F07.15	Phase-loss detection time	0-999.9 s	3.0 s	R/W
F07.16	User password	0 Clear password; 1-9999 enable password protection	0	R/W
F07.19	Fan control	0 Fan on during operation; 1 Fan runs continuously	-	-

F08 Communication Group

F08.00	RS485 slave address	1-247; 0 is broadcast	1	R/W*
F08.01	RS485 baud rate	0 1200; 1 2400; 2 4800; 3 9600; 4 19200 default; 5 38400; 6 57600 bps. Some models do not permit baud-rate changes	4	R/W*
F08.02	RS485 data/parity setting	0 No parity N,8,1; 1 Even E,8,1; 2 Odd O,8,1; 3 No parity N,8,2. Some models do not permit parity changes	0	R/W*
F08.03	RS485 response delay	0-200 ms	5 ms	R/W*
F08.04	RS485 timeout-fault time	0.0 disabled; 0.1-60.0 s	0.0 s	R/W*
F08.05	Reserved	-	0	R/W*
F08.06	RS485 processing action	0x0-0x1. Units digit: 0 write operation returns a response; 1 write operation returns no response	0x00	R/W*

Parameter	Name	Setting Range	Default	Attribute
F08.10	CAN slave address	1-127	1	R/W*

Parameter	Name	Setting Range	Default	Attribute
F08.11	CAN baud rate	0 10 kbit/s, unsupported on some models; 1 20 kbit/s; 2 50 kbit/s; 3 100 kbit/s; 4 125 kbit/s default; 5 250 kbit/s; 6 500 kbit/s; 7 1 Mbit/s	4	R/W*
F08.12	CAN response delay	0-200 ms	5 ms	R/W*
F08.13	CAN protocol selection	0 CAN Modbus; 1 CANopen on supported models	0	R/W*
F08.14	CAN function setting	CANopen bits 0-7: Bit 0 action when not Operational during running, 0 stop and report E.CAN5, 1 retain previous state. Bit 1 heartbeat timeout action, 0 stop and report E.CAN4, 1 retain previous state. Bit 2 CAN receive/transmit fault detection, 0 disable E.CAN2/E.CAN3, 1 enable. CAN Modbus bits 8-15: Bit 8 broadcast response, 0 no response, 1 response	0x00	R/W*

F09 Monitoring Parameter Group

F09.00	Set frequency	0.00 Hz-F00.03	0.00 Hz	RO
F09.01	Output frequency	0.00 Hz-F00.03	0.00 Hz	RO
F09.02	Ramp set frequency	0.00 Hz-F00.03	0.00 Hz	RO
F09.03	Output voltage	0.0-1200.0 V	0.0 V	RO
F09.04	Output current	0.00-100.00 A	0.00 A	RO
F09.05	Set speed	0-65535 rpm	0 rpm	RO
F09.06	Motor speed	0-65535 rpm	0 rpm	RO

F09.07	Output power	0-2200 W	0 W	RO
F09.08	DC-bus voltage	0.0-2000.0 V	0 V	RO
F09.09	Hall value	0-7	0	RO
F09.10	Software version	1.00-99.99	1.00	RO

F09.07	Output power	0-2200 W	0 W	RO
F09.11	Current fault type	0 No fault; 1 Hardware acceleration overcurrent E.OCH1; 2 Hardware deceleration overcurrent E.OCH2; 3 Hardware constant-speed overcurrent E.OCH3; 4 Acceleration overcurrent E.OC1; 5 Deceleration overcurrent E.OC2; 6 Constant-speed overcurrent E.OC3; 7 Acceleration overvoltage E.OV1; 8 Deceleration overvoltage E.OV2; 9 Constant-speed overvoltage E.OV3; 10 DC-bus undervoltage E.UV; 11 Motor overload E.OL1; 12 Driver overload E.OL2; 13 Hall fault E.HALL; 14 Stall fault E.LOC; 15 Rectifier-module overtemperature E.OH1; 16 Inverter-module overtemperature E.OH2; 17 External fault E.EF; 18 RS485 communication fault E.485; 19 Current-detection fault E.CUr; 20 Inverter U-phase fault E.OUT1; 21 Inverter V-phase fault E.OUT2; 22 Inverter W-phase fault E.OUT3; 23 Electronic overload E.OL3; 24 Underload fault E.LL; 25 MOS short-circuit fault E.Sht; 26 Keypad communication fault E.boAd; 27 EEPROM storage fault E.EEP; 28 MOS conduction fault E.Cnd; 29 Hardware overcurrent-feedback fault E.OCHF; 30 Output phase-loss fault E.POUT; 31 CAN bus-off E.CAN1; 32 CAN transmit error E.CAN2; 33 CAN receive error E.CAN3; 34 Internal communication fault E.Conn; 35 CANopen heartbeat timeout E.CAN4; 36 CANopen NMT operation fault E.CAN5	0	RO

F09.07	Output power	0-2200 W	0 W	RO
F09.12	Previous fault 1	Same fault-code list	0	RO
F09.13	Previous fault 2	Same fault-code list	0	RO
F09.14	Previous fault 3	Same fault-code list	0	RO
F09.15	Previous fault 4	Same fault-code list	0	RO

Parameter	Name	Setting Range	Default	Attribute
F09.16	Inverter temperature	-20.0 to 120.0 °C	0.0 °C	RO
F09.17	Digital input-terminal status	0000-1FF; Bit 0 DI1, Bit 1 DI2, Bit 2 DI3, Bit 3 DI4, Bit 4 DI5	0	RO
F09.18	Digital output-terminal status	0000-000F; Bit 0 DO1, Bit 1 DO2	0	RO
F09.19	AI1 input voltage	0.00-10.00 V	0.00 V	RO
F09.20	AI2 input voltage	0.00-10.00 V	0.00 V	RO
F09.21	AI3 input voltage	0.00-10.00 V	0.00 V	RO
F09.22	Peak current	0.00-100.00 A	0.00 A	RO
F09.23	DIP-switch status	0x00-0xFF	0x00	RO
F09.24	Rated-current setting	0.00-100.00 A	0.00 A	RO
F09.25	AI4 input voltage	0.00-10.00 V	0.00 V	RO
F09.26	HDI input frequency	0.00-20.00 kHz	0.00 kHz	RO
F09.27	Simple PLC cycle count	0-9999	0	RO
F09.28	Pole-pair setting	1-20	0	RO
F09.29	Hall count, high 16 bits	0-65535	0	RO
F09.30	Hall count, low 16 bits	0-65535	0	RO

4.3 PC Software

4.3.1 Software Overview

DriverStudio is PC software for online commissioning of C20-series brushless drivers equipped with RS485 communication.

Main functions include:

- Parameter configuration and management
- Motor-parameter monitoring
- Motor motion control
- User-defined simple PLC and multi-speed settings
- Current and historical fault monitoring
- Advanced user operations

4.3.2 Software Acquisition

Obtain the approved installation package and operating instructions from the supplier or authorized technical support.



5. Status Display and Fault Maintenance

Precautions

- Except for faults that require keypad parameter changes, disconnect power before troubleshooting or maintenance.
- Before use, confirm that the indicator lamps or keypad operate normally.
- Do not move, wire, or service the driver while an indicator is lit.
- After initial troubleshooting, perform a trial run.
- Maintenance must be carried out by personnel familiar with the product.
- Do not remove the housing if the fault cannot be resolved; contact the supplier or qualified technical support.

5.1 LED Fault Indication

Operating state	Normal indication	Other indication
Stopped	Green continuously on; red off	Fault: red and green flash alternately to indicate the fault number
Running	Green flashing; red off	Current limiting: green and red flash; braking: green continuously on and red flashes rapidly

One green flash represents 5 and one red flash represents 1. Fault number = green flashes × 5 + red flashes.

Fault No.	Fault	LED indication	Main causes	Corrective action
1-6	Hardware/software overcurrent during acceleration, deceleration, or constant speed	0-1 green and 1-5 red	Acceleration/deceleration too fast; low voltage; driver power too low; sudden load; phase-to-phase short circuit; strong interference	Increase acceleration/deceleration time; check input voltage; use a larger driver; inspect the load; inspect/replace cable or motor; remove interference
7-9	Overvoltage during acceleration, deceleration, or constant speed	1 green and 2-4 red	High input voltage; rapid forward/reverse switching; motor driven by external force and regenerating	Check supply voltage; increase direction-change time; add external braking equipment
10	DC-bus undervoltage	1 green and 5 red	Low supply voltage; acceleration too fast causing supply protection; supply dip; driver hardware fault	Check supply; increase acceleration time; reset fault; obtain technical service

Fault No.	Fault	LED indication	Main causes	Corrective action
11	Motor overload	2 green, 1 red	Low supply voltage; motor power or rated-current setting too high; stalled motor or sudden load change	Check supply; set the rated motor current correctly; reduce load and inspect the motor/mechanism
12	Driver overload	2 green, 2 red	Low supply voltage; acceleration too fast; excessive load	Check supply; increase acceleration time; select the next larger driver

Fault No.	Fault	LED indication	Main causes	Corrective action
13	Hall fault	2 green, 3 red	Hall wiring open; strong external interference	Check Hall wiring; remove interference
14	Stall fault	2 green, 4 red	Excessive load; motor mechanically jammed	Check mechanical connection and motor cable
16	Driver overtemperature	3 green, 1 red	Excessive load; driver hardware fault	Lower temperature; derate the driver
19	Current-detection fault	3 green, 4 red	Driver hardware damaged	Replace the driver
27	Parameter-storage fault	5 green, 2 red	Maximum number of writes during one power cycle reached	Power cycle the driver
29	Overcurrent-feedback fault	5 green, 4 red	Driver hardware damaged	Replace the driver
30	Output phase loss	5 green, 5 red	U/V/W output phase missing; driver hardware damaged	Check U/V/W connections; replace the driver if required

5.2 Keypad Fault Indication

When an external keypad is connected, the following codes are displayed after a fault stop.

Fault No.	Code	Fault name	Typical causes	Corrective action
1	E.OCH1	Hardware overcurrent during acceleration	Acceleration/deceleration too fast; low voltage; undersized driver; sudden load; ground/phase short circuit; interference	Increase ramp time; check input voltage; use a larger driver; inspect load/cable/motor; remove interference
2	E.OCH2	Hardware overcurrent during deceleration	Same as E.OCH1	Same as E.OCH1
3	E.OCH3	Hardware overcurrent at constant speed	Same as E.OCH1	Same as E.OCH1
4	E.OC1	Software overcurrent during acceleration	Same as E.OCH1	Same as E.OCH1
5	E.OC2	Software overcurrent during deceleration	Same as E.OCH1	Same as E.OCH1
6	E.OC3	Software overcurrent at constant speed	Same as E.OCH1	Same as E.OCH1
7	E.OV1	Overvoltage during acceleration	High input voltage; electronic braking too strong	Check supply voltage; adjust electronic-brake parameters
8	E.OV2	Overvoltage during deceleration	Same as E.OV1	Same as E.OV1
9	E.OV3	Overvoltage at constant speed	Same as E.OV1	Same as E.OV1

Fault No.	Code	Fault name	Typical causes	Corrective action
10	E.UV	DC-bus undervoltage	Low supply; acceleration too fast causing supply protection; momentary power loss; driver hardware fault	Check supply; increase acceleration time; reset; obtain technical service
11	E.OL1	Motor overload	Low supply; incorrect motor rated-current setting; motor stalled or load changed abruptly	Check voltage; set rated current; reduce load and inspect motor/mechanism
12	E.OL2	Driver overload	Acceleration too fast; low supply; excessive load	Increase acceleration time; check supply; use a larger driver
13	E.HALL	Hall fault	Hall wire open; strong interference	Check Hall wiring; remove interference
14	E.LOC	Stall fault	Excessive load; motor jammed; motor phase-to-phase short circuit	Use a larger driver; inspect mechanics and wiring
15	E.OH1	Module overtemperature 1	Ambient temperature too high; thermistor damaged; inverter module damaged	Reduce ambient temperature; replace the complete unit
16	E.OH2	Module overtemperature 2	Same as E.OH1	Same as E.OH1
17	E.EF	External input fault	External-fault input is active	Check the external input source
18	E.485	RS485 communication fault	Incorrect baud/parity; wiring fault; wrong address; strong interference	Verify settings, wiring, and address; use shielded cable and improve noise immunity
19	E.CUr	Current-detection fault	Internal circuit fault	Replace the driver
20	E.OUT1	Inverter U-phase fault	Acceleration too fast; inverter circuit damaged; interference	Increase acceleration time; replace power devices/driver; remove interference
21	E.OUT2	Inverter V-phase fault	Same as E.OUT1	Same as E.OUT1
22	E.OUT3	Inverter W-phase fault	Same as E.OUT1	Same as E.OUT1
23	E.OL3	Electronic overload	Overload pre-alarm enabled	Check load and overload threshold
24	E.LL	Electronic underload	Underload pre-alarm enabled	Check load and underload threshold
25	E.Sht	Short-circuit fault	MOS/inverter short circuit; phase-to-ground short circuit	Replace driver; check wiring
26	E.boAd	Keypad communication fault	Keypad cable connection/interference problem	Reconnect cable; shorten cable and remove interference

Fault No.	Code	Fault name	Typical causes	Corrective action
27	E.EEP	Parameter-storage fault	EEPROM damaged; write limit reached during one power cycle	Reset or power cycle; obtain technical service
28	E.Cnd	Conduction self-test fault	Motor not connected during self-test; MOS/inverter damaged	Check motor wiring; replace driver
29	E.OCHF	Overcurrent-feedback fault	Driver hardware damaged	Replace driver
30	E.POUT	Output phase loss	U/V/W phase missing; driver hardware fault	Check driver-to-motor wiring; obtain technical service
31	E.CAN1	CAN bus-off	Excessive CAN errors	Check and reconnect the CAN network
32	E.CAN2	CAN transmit error	Too many transmit error frames	Check nodes, wiring, and baud rate
33	E.CAN3	CAN receive error	Too many receive error frames	Check baud rate and interference sources
34	E.Conn	Internal communication fault	Internal hardware damaged	Replace driver
35	E.CAN4	Heartbeat timeout	Consumer timeout reached for a CANopen node	Clear the fault; confirm node is online; check CANopen configuration
36	E.CAN5	NMT operation fault	NMT initialize/stop command received while motor is running	Clear the fault; stop the motor before changing NMT state

6. RS485 Communication

6.1 RS485 Communication Network

Use a bus topology. Connect each RS485 transceiver to the main bus and keep each branch no longer than 10 m; longer branches can cause reflections and communication errors.

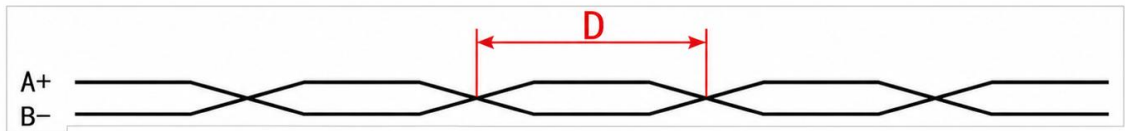
- Use shielded twisted-pair cable. Install a 120 Ω termination resistor at each physical end of the bus. Ground the shield reliably at one point unless the site standard specifies otherwise.
- With power off, measure resistance between A+ and B-. A correctly terminated bus should measure approximately 60 Ω because the two 120 Ω resistors are in parallel.
- Connect no more than 32 devices to one network.
- For long-distance communication, interconnect the COM reference of the RS485 circuits.

Simplified topology: RS485 master / PLC - A+, B-, COM bus - Driver 1 - Driver 2 - ... - Driver 32.

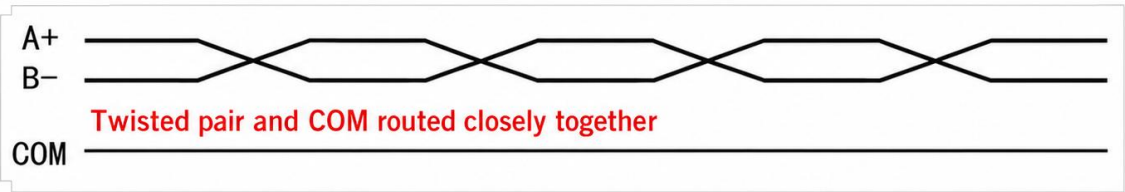
6.2 RS485 Communication Cable

Use twisted-pair cable. A twist pitch below 2 cm improves high-frequency noise rejection and reduces radiation.

For short-distance, low-speed communication, shielded twisted pair may be used with the shield connected to PE at both ends. For long-distance, high-speed communication, the shield may add distributed capacitance and delay the signal.



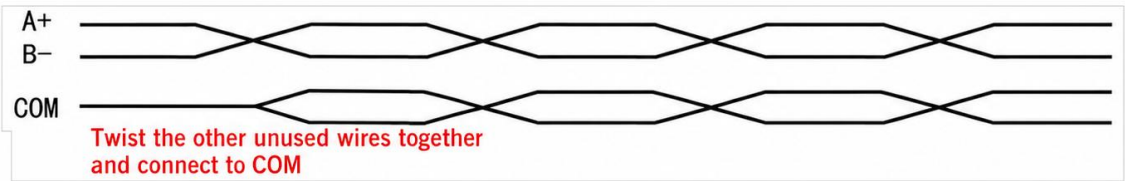
Twisted-pair geometry; text contained in the figure is retained.



Recommended cable arrangement 1.



Recommended cable arrangement 2.

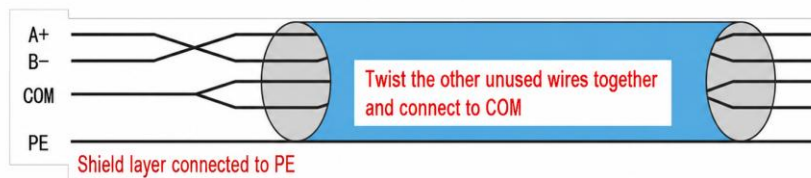


Recommended cable arrangement 3.

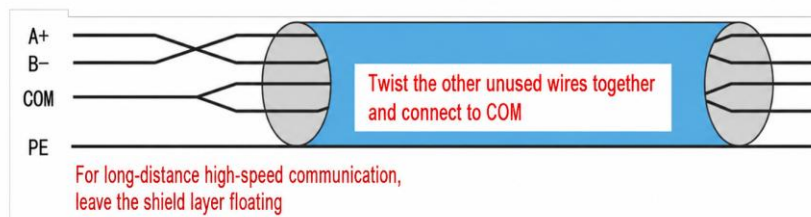
Wiring distance	Recommended signal cable
Within 200 m	0.3 mm ² twisted-pair sheathed cable
200-500 m	0.5 mm ² twisted-pair sheathed cable
500-1200 m	0.75 mm ² shielded twisted-pair sheathed cable
Above 1200 m	1.0 mm ² shielded twisted-pair sheathed cable; add a repeater at 1200 m

6.2.1 Recommended RS485 Wiring Methods

Use a continuous bus. Avoid star wiring, long branches, reversed A+/B- polarity, and termination resistors at intermediate nodes.



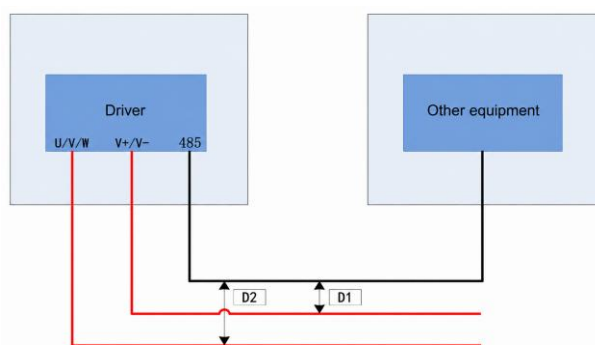
Recommended cable arrangement 4.



Recommended cable arrangement 5.

6.2.2 Recommended RS485 Cable Routing

Route interference cables and RS485 cables perpendicular whenever possible. When parallel routing is unavoidable, maintain $D1 > 10$ cm between power cables and RS485 signal cables, and $D2 > 20$ cm between U/V/W motor-power cables and RS485 signal cables. Outside the cabinet, route power, U/V/W, and RS485 cables separately. Apply the same spacing when cables share a tray.



RS485 cable-routing example; text contained in the figure is retained.

6.3 System Settings

Set the following function codes before connecting the EA-BLDC20-series driver to an RS485 bus.

Parameter	Name	Setting Range	Default	Attribute
F00.00	Control mode	0 Test; 1 Hall open loop; 2 Hall closed loop; 3 DIP-switch setting, SW1 valid	3	R/W*
F00.01	Run-command selection	0 Keypad; 1 Terminal; 2 Communication; 3 DIP-switch setting, SW3 valid	3	R/W
F00.02	Speed-reference selection	0 Keypad; 1 AI1; 2 AI2; 3 Modbus; 4 Multi-speed; 5 DIP switch; 6 Simple PLC; 7 HDI; 8 CAN for supported models	5	R/W
F00.05	Communication command channel	0 Modbus; 1 CAN for supported models	0	R/W*
F08.00	RS485 slave address	1-247; 0 broadcast	1	R/W*
F08.01	RS485 baud rate	0 1200; 1 2400; 2 4800; 3 9600; 4 19200; 5 38400; 6 57600 bit/s	4	R/W*
F08.02	Data bits / parity	0 N-8-1; 1 E-8-1; 2 O-8-1; 3 N-8-2	0	R/W*
F08.03	Response delay	0-200 ms	5	R/W*

Parameter	Name	Setting Range	Default	Attribute
F08.04	Communication timeout	0.0 disabled; 0.1-60.0 s	0.0 s	R/W*
F08.05	Reserved	-	0	R/W*
F08.06	Write-response action	0x00 response to write; 0x01 no response to write	0x00	R/W*

6.4 Data-Frame Format

Modbus RTU default serial format: 19200 bit/s, 1 start bit, 8 data bits, no parity, and 1 stop bit.

Address	Function	Data	CRC low	CRC high
ADDR, 1 byte	CMD, 1 byte	n bytes	1 byte	1 byte

If the interval between two characters exceeds 1.5 character times, the data is invalid. An interval greater than 3.5 character times marks the end of a frame.

Field	Definition
Address	0x00 broadcast, no slave reply; 0x01-0x7F slave address; 0x80-0xFF reserved
Function	0x03 read registers; 0x06 write one register; 0x10 write multiple registers
Data	Format depends on the function
CRC	CRC16 over address + function + data; polynomial $x^{16}+x^{15}+x^2+1$; low byte sent first

6.4.1 Function 0x03 - Read Registers

Master request field	Length	Content / Description
Address	1 byte	0x01-0xF7
Function	1 byte	0x03
Register address	2 bytes	0x2000-0x30FF, high byte then low byte
Register count	2 bytes	0x0001, high byte then low byte
CRC	2 bytes	CRC16 low byte then high byte

Normal slave response field	Length	Content / Description
Address	1 byte	0x01-0xF7
Function	1 byte	0x03
Byte count	1 byte	Total number of data bytes
Data	2 bytes per register	High byte then low byte
CRC	2 bytes	CRC16 low byte then high byte

Exception response field	Length	Content / Description
Address	1 byte	0x01-0xF7
Function	1 byte	0x83
Exception code	1 byte	See Section 6.4.4
CRC	2 bytes	CRC16 low byte then high byte

All register addresses and data values are two bytes, high byte first. Function 0x03 can read W/R, W/R*, or R registers.

Example	Master request	Slave response
Read register 0x2001 from slave 0x01	01 03 20 01 00 01 CRCL CRCH	01 03 02 00 01 CRCL CRCH
Exception response	01 03 20 01 00 01 CRCL CRCH	01 83 [exception] CRCL CRCH

6.4.2 Function 0x06 - Write One Register

Master request / normal response field	Length	Content / Description
Address	1 byte	0x01-0xF7
Function	1 byte	0x06
Register address	2 bytes	0x2000-0x30FF
Data	2 bytes	Value to write, high byte then low byte
CRC	2 bytes	CRC16 low byte then high byte

Exception response field	Length	Content / Description
Address	1 byte	0x01-0xF7
Function	1 byte	0x86
Exception code	1 byte	See Section 6.4.4
CRC	2 bytes	CRC16 low byte then high byte

Function 0x06 can write W/R or W/R* registers. The normal slave response repeats the request.

Example	Master request	Slave response
Write 0x0001 to register 0x2001 of slave 0x01	01 06 20 01 00 01 CRCL CRCH	01 06 20 01 00 01 CRCL CRCH
Exception response	01 06 20 01 00 01 CRCL CRCH	01 86 [exception] CRCL CRCH

6.4.3 Function 0x10 - Write Multiple Registers

Master request field	Length	Content / Description
Address	1 byte	0x00-0xF7
Function	1 byte	0x10
Start register	2 bytes	0x2000-0x30FF
Register quantity	2 bytes	N
Data byte count	1 byte	2 × N
Data	2 × N bytes	Each value high byte then low byte
CRC	2 bytes	CRC16 low byte then high byte

Normal slave response field	Length	Content / Description
Address	1 byte	0x01-0xF7
Function	1 byte	0x10
Start register	2 bytes	0x2000-0x30FF
Register quantity	2 bytes	N
CRC	2 bytes	CRC16 low byte then high byte

Exception response field	Length	Content / Description
Address	1 byte	0x01-0xF7
Function	1 byte	0x90
Exception code	1 byte	See Section 6.4.4
CRC	2 bytes	CRC16 low byte then high byte

Example	Frame
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Example	Frame
Write registers 0x2000 and 0x2001 on slave 0x01	Master: 01 10 20 00 00 02 04 [Data 1] [Data 2] CRCL CRCH
Normal response	Slave: 01 10 20 00 00 02 CRCL CRCH
Exception response	Slave: 01 90 [exception] CRCL CRCH

6.4.4 Modbus Exception Codes

Code	Meaning	Description
0x01	Illegal function	The slave does not support the command or cannot process it in the current state.
0x02	Illegal data address	The requested data address is outside the valid range.
0x03	Illegal data value	The received data contains a value that is not permitted.
0x04	Operation failed	The parameter setting is invalid, for example writing a function code without enabling writes at 0x200E.
0x05	Password error	The password written to the verification address is incorrect.
0x06	Data-frame error	Frame length is incorrect or the RTU CRC is invalid.
0x07	Read-only parameter	A write request targeted a read-only parameter.
0x08	Cannot change while running	A write request targeted a parameter that cannot be changed during operation.

6.5 Register List

Function	Address	Data Meaning	Attribute
Communication control command	2000H	0001H Forward; 0002H Reverse; 0003H Forward jog; 0004H Reverse jog; 0005H Stop; 0006H Coast/emergency stop; 0007H Fault reset; 0008H Jog stop; 0009H Brake stop	W/R
Communication speed reference	2001H	0-3000 rpm, unit 1 rpm	W/R
Motor pole pairs	2002H	1-20	W/R*
Acceleration time	2003H	1-6000, unit 0.1 s	W/R
Deceleration time	2004H	1-6000, unit 0.1 s	W/R
Control mode	2005H	0 Test; 1 Open loop; 2 Closed loop; 3 DIP-switch setting, model dependent	W/R*
Run-command selection	2006H	0 Keypad; 1 Terminal; 2 Communication; 3 DIP switch, model dependent	W/R
Speed-reference selection	2007H	0 Keypad; 1 AI1; 2 AI2; 3 Modbus; 4 Multi-speed; 5 DIP switch; 6 Simple PLC	W/R
Local communication address	2008H	1-127; 0 broadcast	W/R*
Communication baud rate	2009H	0 1200; 1 2400; 2 4800; 3 9600; 4 19200 default; 5 38400; 6 57600 bit/s	W/R*
Function-code write enable	200EH	0 Function codes F00-F10 cannot be written by communication; 1 Writing enabled	W/R
Restore defaults	200FH	0 No action; 1 Restore default parameters	W/R*
Driver status word 1	2100H	0001H Forward; 0002H Reverse; 0003H Stopped; 0004H Fault; 0005H OFF; 0006H Electronic brake	R
Driver status word 2	2101H	Bit0 bus voltage established; Bit4 overload; Bits5-6 keypad/terminal/communication control; Bit7 keypad connected	R
Driver fault code	2102H	See fault-code table	R
Driver identification	2103H	C20 series: 0x0020	R
Set frequency	3000H	0-Fmax, unit 0.01 Hz	R
Output frequency	3001H	0-Fmax, unit 0.01 Hz	R
Ramp reference frequency	3002H	0-Fmax, unit 0.01 Hz	R
Output voltage	3003H	0.0-2000.0 V, unit 0.1 V	R
Output current	3004H	0.00-300.00 A, unit 0.01 A	R
Set speed	3005H	0-3000 rpm, unit 1 rpm	R
Motor output speed	3006H	0-3000 rpm, unit 1 rpm	R
Motor output power	3007H	0-2200 W	R
DC-bus voltage	3008H	0.0-2000.0 V, unit 0.1 V	R
Hall value	3009H	0-7	R
Software version	300AH	1.00-99.00	R

Function	Address	Data Meaning	Attribute
Most recent fault	300BH	See fault-code table	R
Inverter temperature	300CH	-20.0 to 120 °C, hardware dependent	R
Input-terminal status	300DH	000-1FF	R
Output-terminal status	300EH	00-0F	R
Analog input 1 voltage	300FH	0.00-10.00 V, unit 0.01 V	R
Analog input 2 voltage	3010H	0.00-10.00 V, unit 0.01 V	R
Analog input 3 voltage	3011H	0.00-10.00 V, unit 0.01 V	R
Reserved	3012H	0-65535	R
Hall count high 16 bits	3013H	0-65535, software-version dependent	R
Hall count low 16 bits	3014H	0-65535, software-version dependent	R

Attribute definitions: W/R = writable and readable in any state; W/R* = writable only while stopped and readable in any state; R = read-only.

6.6 Common Command Examples

Operation	Data Frame	Description
Forward run	TX: 01 06 20 00 00 01 43 CA; RX: same	Write 0x0001 to 2000H
Reverse run	TX: 01 06 20 00 00 02 03 CB; RX: same	Write 0x0002 to 2000H
Stop	TX: 01 06 20 00 00 05 42 09; RX: same	Write 0x0005 to 2000H
Fault reset	TX: 01 06 20 00 00 07 C3 C8; RX: same	Write 0x0007 to 2000H
Set speed 3000 rpm	TX: 01 06 20 01 0B B8 D4 88; RX: same	Write 0x0BB8 to 2001H
Enable function-code write	TX: 01 06 20 0E 00 01 23 C9; RX: same	Write 0x0001 to 200EH
Read F00.10	TX: 01 03 00 0A 00 01 A4 08; RX: 01 03 02 13 88 B5 12	Value 50.00 Hz, 0x1388
Write F00.10 = 25.00 Hz	TX: 01 06 00 0A 09 C4 AE 0B; RX: same	Value 0x09C4
Read status word 1	TX: 01 03 21 00 00 01 8E 36; RX: 01 03 02 00 05 78 47	Read 2100H
Read status word 2	TX: 01 03 21 01 00 01 DF F6; RX: 01 03 02 00 41 78 74	Read 2101H
Read fault code	TX: 01 03 21 02 00 01 2F F6; RX: 01 03 02 00 0A 38 43	Fault 0x0A, undervoltage
Read failure	TX: 01 03 00 32 00 01 25 C5; RX: 01 83 02 C0 F1	F00.50 invalid address, exception 0x02
Write failure	TX: 01 06 00 00 00 05 49 C9; RX: 01 86 03 02 61	Invalid data for F00.00, exception 0x03

7. Basic Inspection and Maintenance

7.1 Basic Inspection

Inspection Stage	Inspection Items
General inspection	Periodically check mounting points, terminals, wiring, motor shaft, and mechanical connections for looseness. Prevent oil, water, metal powder, harmful gas, and dust from entering the driver. Verify wiring order whenever wiring is changed.
Before operation, power off	Confirm power is disconnected and the motor is stopped before wiring. Insulate terminal connections. Check wiring correctness. Remove conductive or flammable objects from the driver. Set external control switches to OFF. Verify emergency-stop and power-isolation circuits. Confirm the applied voltage is correct.
Before operation, power on	Check that cables do not rub against moving parts or become stretched. Investigate excessive vibration or noise. Confirm all parameters are suitable for the machine. Avoid extreme parameter settings. Change parameters only while stopped. Confirm LED and keypad indications and commands are normal.

7.2 Maintenance and After-sales Service

Routine maintenance

- Store and use the product under suitable environmental conditions.
- Clean the exterior of the driver and motor to prevent dust and dirt accumulation.
- Do not disassemble mechanical parts during cleaning.
- Clean gaps in the driver housing to prevent foreign-object entry.
- Avoid prolonged operation in extreme environments.

Component service life

Electrolytic capacitors: service life is strongly affected by ambient temperature and operating conditions. At the maximum rated operating temperature of 105 °C, the referenced service life is 7000 hours. Under ideal conditions, each 10 °C reduction approximately doubles service life. For long-term storage, periodically apply rated voltage to maintain electrolyte activity.

Knob potentiometer: total rotation angle $250^{\circ} \pm 10^{\circ}$; rotational life 100 cycles; $\Delta R/R \leq \pm(2\% + 3\%)$.

Long-shaft potentiometer: at 600 rotations per hour, 5000-8000 rotations in 24 hours, effective rotation angle above 90%, total life 10000 ± 200 rotations; total resistance change within $\pm 15\%$ of the initial value.

Mean time between failures: MTBF > 500,000 h.

After-sales service

- Contact the supplier or authorized technical support for operating questions.
- The product warranty is valid for one year from the shipment date and includes free repair during the warranty period under normal use.
- When returning a product for repair, provide a detailed description of the fault or observed symptoms.

The user is responsible for damage caused by improper use, unauthorized repair or modification, dropping or transportation after receipt, operation outside the specified limits, fire, earthquake, lightning, windstorm, corrosion, other natural disasters, or ingress of water, oil, metal fragments, or other foreign matter. Components that have exceeded their stated service life are excluded.