This manual is applicable to MG40~MG50

MG | Motor Drive System Instruction ■

MG Application scenarios

Mechanical dog

Inspection trolley

Mechanical exoskeleton

MG

Cooperative robotic arm

Disclaimer

Thank you for purchasing the MG series motor drive system from Lingkong Technology. Before use, please read this statement carefully. Once used, it is regarded as the recognition and acceptance of all the contents of this statement. Please strictly abide by the manual, product instructions and relevant laws, regulations, policies and guidelines when installing and using this product. During the process of using the product, the user undertakes to be responsible for their own actions and all consequences arising therefrom. Lingkong Technology shall not be held legally responsible for any losses caused by improper use, installation or modification by the user.

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Product Introduction

The MG series high-performance brushless motor is matched with the DG series drive system, which adopts a 32-bit high-performance MCU, high-bandwidth operational amplifier, and low-internal resistance flat-packaged MOSFET. Combined with an optimized version of FOC control technology, it is specially designed for high-precision, high-response, and high-torque application scenarios. The integrated design of the motor and drive facilitates the integration of the user's system. The drive integrates a high-precision absolute encoder, combined with a simple and easy-to-use dual closed-loop control algorithm, which significantly improves the accuracy of torque, position and speed feedback.
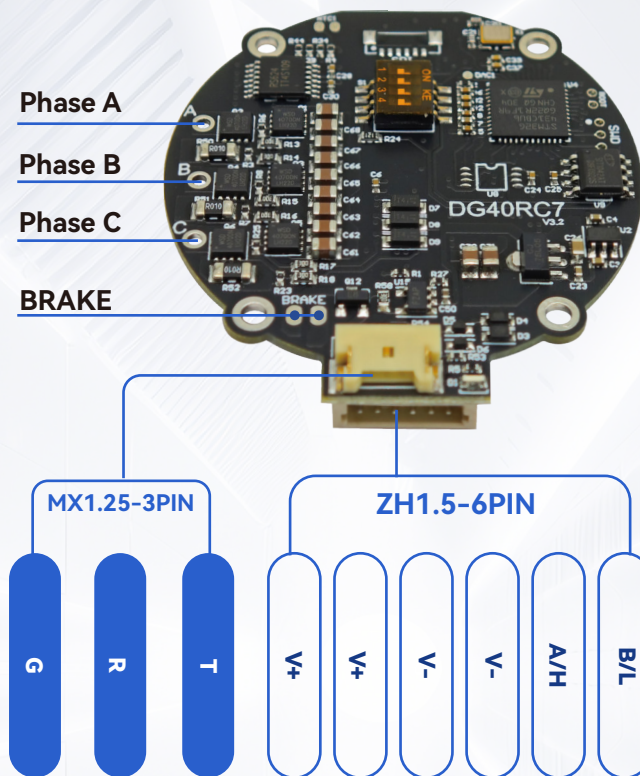
01 Driver parameters

Working voltage	DG40R/C7	7.4–32V
Electric current	DG40R/C7	6A
Maximum current	DG40R/C7	8A
The torque loop controls the frequency		24KHz
The speed loop controls the frequency		8KHz
The position loop controls the frequency		8KHz
Drive PWM frequency		32KHz
Encoder resolution		18bit
Bus type		RS485 Or CAN
RS485 Baud rate		9600,19200,38400,57600,115200(Default),230400, 460800,1Mbps,2Mbps
CAN baud rate		125Kbps,250Kbps,500Kbps,1Mbps(Default)

Naming rules

MG 40 10 E - i10 B 18bit RS485
①   ②   ③   ④   ⑤   ⑥   ⑦   ⑧

①	Series
②	The outer diameter dimension of the stator core
③	Height dimensions of the stator core
④	E: Dual encoder without: single encoder
⑤	Gear reduction ratio 1:10
⑥	B: With brake. No: Without brake
⑦	The encoder resolution corresponding to the driver
⑧	Driver communication bus type

K·TECH

02 Drive interface

DG40R/C7 Drive board

Phase A
Phase B
Phase C
BRAKE

MX1.25-3PIN

ZH1.5-6PIN

| G | R | T | V+ | V+ | V- | V- | A/H | B/L |

MG40/MG50 motor connectors:MX1.25-3PIN / ZH1.5-6PIN

Interface definition Description

Interface	Note
B/L	RS485-B Or CAN-L
A/H	RS485-A Or CAM-H
V-	Negative Power Supply
V-	Negative Power Supply
V+	Positive Power Supply
V+	Positive Power Supply
T	UART Transmitter
R	UART Receiver
G	Signal GND

03 Line connection

A 120Ω resistor is connected to both ends of the bus, and the control circuit is connected as shown in the following figure
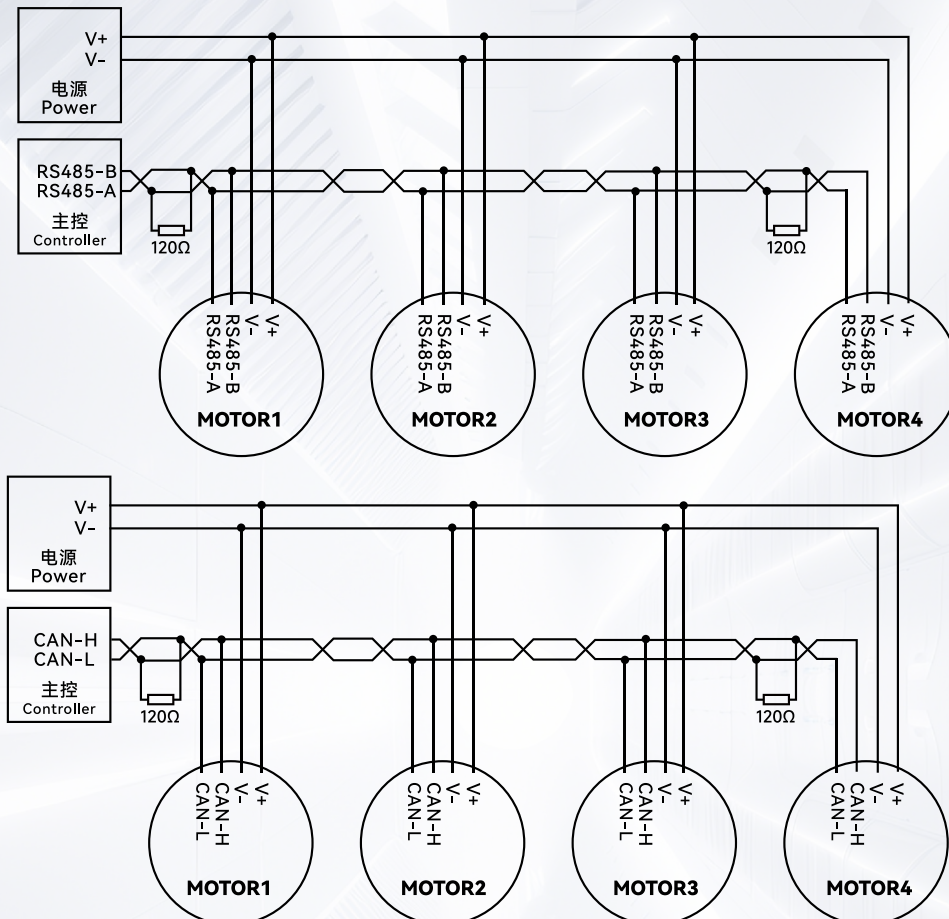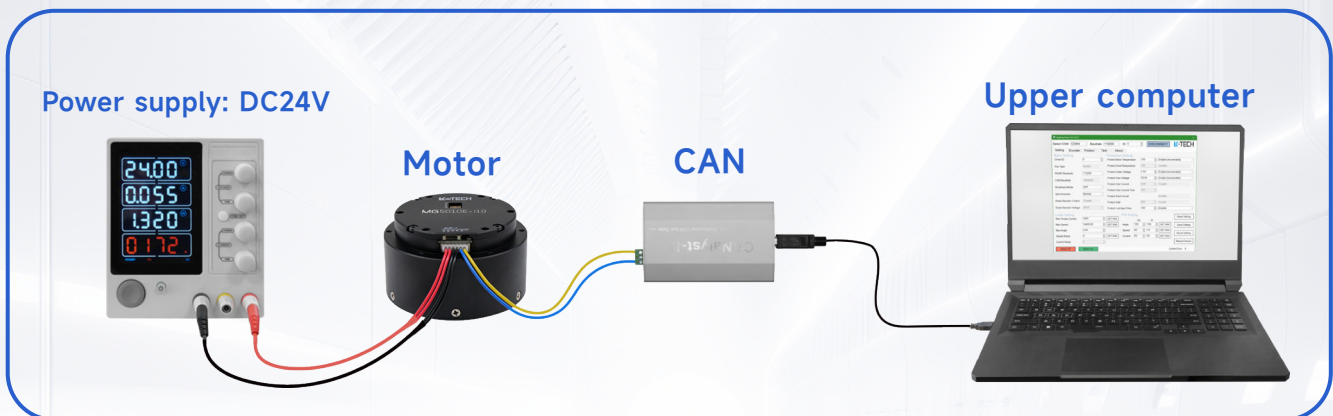

MF motor connection

Connect the MG motor to the power supply with the matching cable and then link it to the PC end through the USB serial port module for parameter adjustment on the upper computer

Note: Avoid reversing the positive and negative terminals of the power supply. Select an appropriate power supply voltage range and output power. Refer to the following figure:

Serial port connection reference diagram

Reference diagram of communication connection

Power supply: DC24V

Motor

RS485

Upper computer

Power supply: DC24V

Motor

CAN

Upper computer

⊙ Download links for the software, Demo and the source code of the upper computer ： http://en.lkmotor.cn/
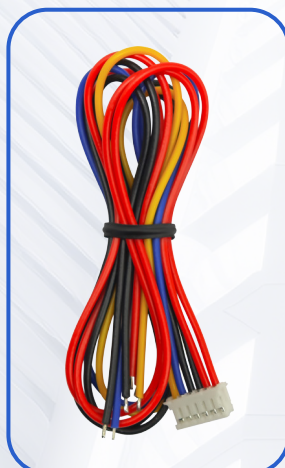
04 Setting instructions

⊙ Connecting accessories

The motor drive and the upper computer can be connected through the USB serial port module (optional) and the connection cable (customizable length).
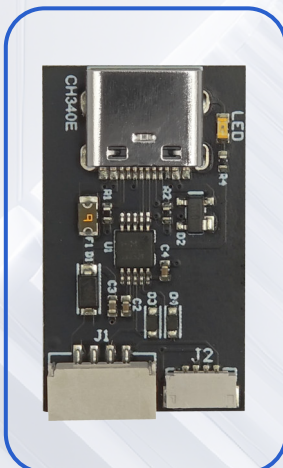
USB serial port module

ZH1.5-6PIN Connecting wire

MX1.25Dupont Line

MX1.25Connecting wire

◉ Software installation

1.Download the USB serial port module driver (CP210x_VCP_Windows.zip) software package, install the driver, and after completion, you can view:
Device Manager – Port

Device Manager ⟹ Port(COM and LPT)
USB-SERIAL CH340(COM3)

2. Download the upper computer (LingKong Motor Tool V2.35) file. No installation is required. Double-click LK Motor Tool V2.35.The exe application enters the operation interface.

◉ Settings on the upper computer (LingKong Motor Tool V2.35)

For the upper computer connection Settings, select COM (choose according to the actual situation), set the baud rate to 115200 (default), and ID1 (default).Click the "CONNECT" button to complete the connection. The indicator light (green) will remain on constantly.
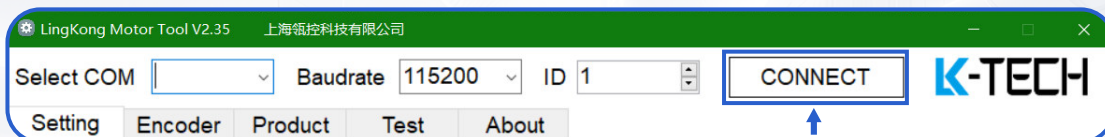
◉ Basic Settings: On the Setting page, click the "Read Setting" button to read the motor and setting information.

Basic Setting

Bus Type	Communication bus type selection is not supported for the time being.
RS485 Baudrate	Set the driver RS485 baud rate, supporting 9600, 19200, 38400,57600 115200(default), 230400, 460800, 1Mbps, 2Mbps.
CAN Baudrate	Set the driver CAN baud rate, supporting 100K, 125K, 250K, 500K, and 1Mbps(default). After the baud rate is set, you need to click "save setting", "reboot device" or "Power on again".The parameters can take effect.
Bradcast Mode	Broadcast mode, supporting simultaneous control of 4 motors. The motor ID needs to be modified to 1-4#, the RS485 baud rate should be changed to 1M or 2Mbps, and the CAN baud rate to 500K or 1Mbps. Only torque mode command control is supported. After the Settings are completed, you need to click "save setting", "reboot device" or "Power on again" for the parameters to take effect.
Spin Direction	Set the rotation direction of the motor: Normal, counterclockwise rotation is positive; Reverse, clockwise rotation is negative. After setting, click "save setting", "reboot device" or "Power on again" for the parameters to take effect. Click "Align" to recalibrate.(MG series does not support modification for the time being.)
Brake Resistor Control	The brake resistor is set, and only the type of motor with the matching brake resistor is supported.
Brake Resistor Voltage	Set the on-off brake resistor and the on-off voltage. After the Settings are completed, you need to click "save setting", "reboot device" or "Power on again" for the parameters to take effect.

Basic Setting

1.Driver ID : Set the ID of the driver.

2.The dip switch sets the ID. The Driver ID is 0. The corresponding relationship of the ids is as shown in the following table.

ID	Switch3	Switch2	Switch1
#1	OFF	OFF	OFF
#2	OFF	OFF	ON
#3	OFF	ON	OFF
#4	OFF	ON	ON
#5	ON	OFF	OFF
#6	ON	OFF	ON
#7	ON	ON	OFF
#8	ON	ON	ON

The ID can be set from 1 to 32, and the 4th bit ON of R indicates that the bus terminal resistor (120Ω) is connected.

⚠ Attention：After the new ID is set, you need to click "save setting", "reboot device" or "Power on again" for the parameters to take effect.

Protection Setting

Protect Motor Temperature	Set the motor protection temperature. Turn off the motor when the temperature is higher than the value.
Protect Driver Temperature	Set the drive protection temperature, which is not yet available.
Protect Under Voltage	Set the minimum protection voltage, in unit (V).
Protect Over Voltage	Set the maximum protection voltage, in unit (V).
Protect Over Current	Overcurrent protection (phase current) is set and is not yet open.
Protect Over Current Time	The overcurrent protection time has been set and it is not yet open.
Protect Short Circuit	Short-circuit protection is set up and is not yet available.
Protect Stall	Locked rotor protection has been set up and is not yet open.
Protect Lost Input Time	Set the signal loss protection time (ms).

⚠ **Attention**: "Disable" does not set protection; Enable(recoverable) set protection; Enable(not recoverable) to set protection (not recoverable) and the motor needs to be restarted.

Limits Setting

Max Torque Current	Set the maximum torque current limit, with an effective adjustment range of 0-2000 (ratio).
Max Speed	Set the maximum speed limit, with an effective adjustment range of 0- 72,000 DPS (degrees per second).
Max Angle	Set the maximum Angle limit, unit: degrees.
Speed Ramp	Set the acceleration, with the unit of dps/s. The actual acceleration of the motor depends on the PI parameter, motor load and drive voltage, etc.
Current Ramp	Setting the torque current growth rate is not yet available.

⚠ **Attention**: The "Set RAM" button writes parameters to RAM and loses them after power failure. Write parameters to ROM for permanent saving. You need to click "save setting", "reboot device" or "Power on again" for the parameters to take effect.

PID Setting

Angle	The Angle loop control parameters, Kp and Ki modify the PI parameter of the Angle loop.
Speed	The speed loop control parameters, Kp and Ki modify the PI parameter of the speed loop.
Current	Torque loop control parameters, Kp and Ki modify the PI parameter of the torque loop.

⚠ **Attention**: The "Set RAM" button writes parameters to RAM and loses them after power failure. Write parameters to ROM for permanent saving. You need to click "save setting", "reboot device" or "Power on again" for the parameters to take effect.

Encoder Setting

On the Encoder page, click the Read button to read the information of the motor and the encoder

LingKong Motor Tool V2.36

Select COM `COM4` ▾   Baudrate `115200` ▾   ID `1` ▴▾   **DISCONNECT**   K-TECH

| Setting | **Encoder** | Product | Test | About |

Motor / Encoder Setting

Motor Poles	`28` ▴▾
Encoder Type	`16Bit Encoder`
Encoder Position	`Reverse`
Motor Phase Sequence	`Reverse`
Motor/Encoder Offset	`404`
Motor/Encoder Align Ratio	`1000`
Motor/Encoder Align Voltage	`2.50` ▴▾ Align
Motor Zero Position (Rom)	`0` Set

Reducer / Encoder Setting

Reduction Ratio	`6` ▴▾
Reducer/Encoder Align Value	`4707` Clear
Reducer Zero Position	`0` Set

Save

Read

Motor Off   Motor On   Comm Error : 12

Motor Poles	To set the number of magnetic poles of a motor, the default parameters are usually sufficient.
Encoder Type	Check the encoder type and resolution. This parameter is a read-only parameter.
Encoder Position	Read the position information of the encoder. This parameter is a read-only parameter and generally has no impact on the motor's driving performance.
Motor Phase Sequence	The connection sequence of motor phase lines.
Motor/Encoder Offset	The calibration deviation values of the motor and encoder are read-only parameters and generally have no impact on the motor's driving performance.
Motor/Encoder Align Ratio	The ratio of motor to encoder calibration, this parameter is a read-only parameter, generally around 1000. The closer it is to 1000, the better the calibration effect.
Motor/Encoder Align Voltage	The calibration voltage for motors and encoders is generally sufficient using the default parameters. When the load is large, it can be appropriately increased to enhance the calibration effect.
Motor Zero Position(ROM)	At the 0 o'clock position of the motor, after clicking the Set button, the driver will save the current position as the starting position of the motor. The value is the deviation value of the encoder read and cannot be modified.

| **Reduction Ratio**	Reduction ratio
Reducer/Encoder Align Value	Calibration value of reducer/encoder, this parameter is a read-only parameter.
Reducer Zero Position	At the 0 point position of the reducer, after clicking the Set button, the drive will save the current position as the 0 point position. The value is the deviation value of the read encoder and cannot be modified.

Align: Start the calibration of the motor and encoder. Before this step, it is necessary to ensure that the number of magnetic poles of the motor is set correctly and select an appropriate calibration voltage (the default parameter is sufficient).

After clicking the "Align" button, the motor will rotate back and forth to perform calibration. After calibration is completed, it needs to be powered on again, and the parameters will be automatically saved to the driver.

⚠ **Attention:**

1.The calibration of the motor and encoder is best carried out when the motor is no-load. If the motor does not rotate smoothly during the calibration process, please check for motor faults or excessive mechanical friction.

2.After the parameters are modified, click "save setting", "reboot device" or "Power on again" for the parameters to take effect.

Product Information

On the Product page, click the "Read Info" button to read the motor model, motor version, driver model, driver hardware version, and driver software version.
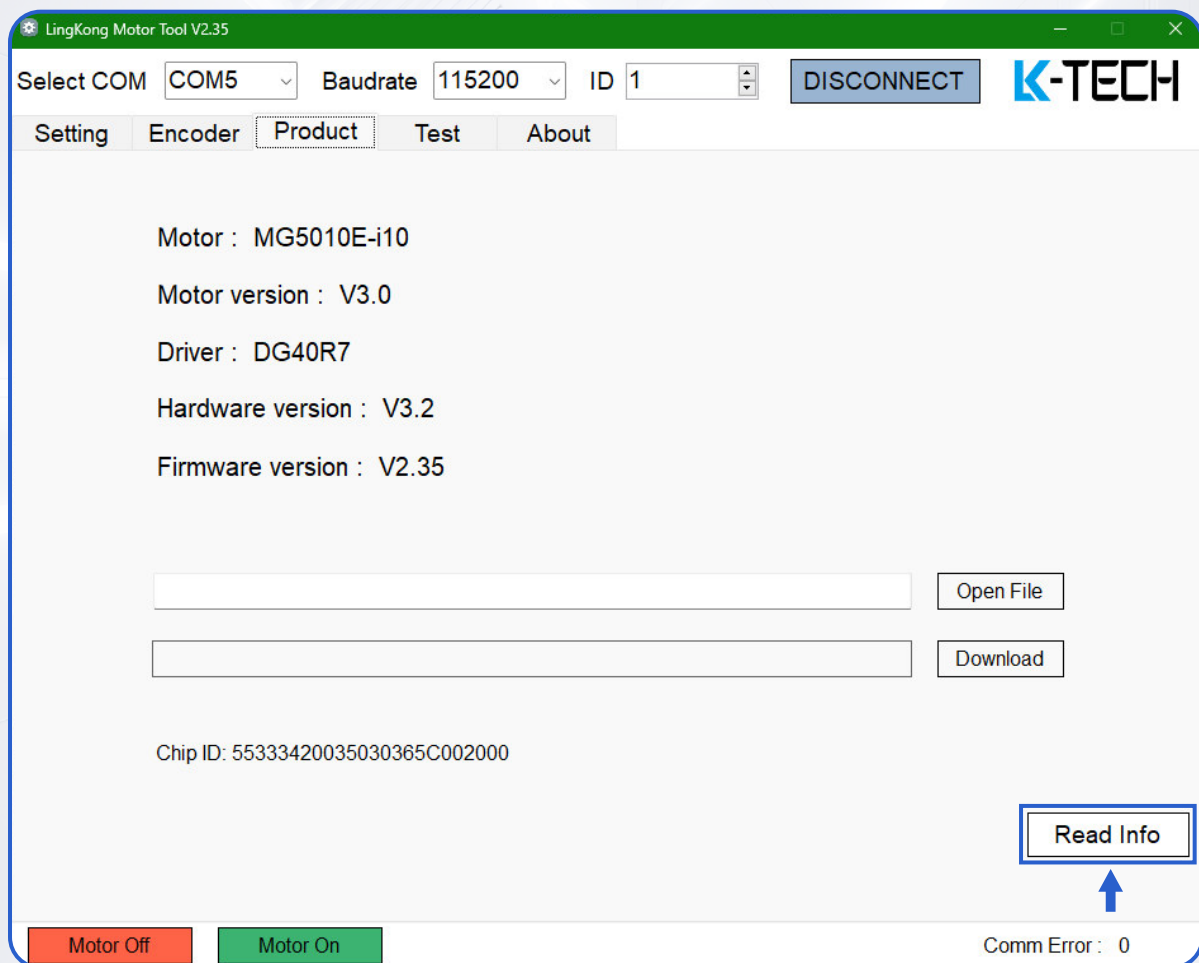
Firmware Upgrade	Firmware upgrade
Open File	Find and open the location where the firmware is stored, and make sure the firmware is consistent with the motor model. This function is only supported for operation on the upper computer (LingKong Motor Tool).
Download	Download and upgrade the firmware. When the progress bar runs successfully, "Write finished" appears. Click "OK" to complete the upgrade.

⚠ **Attention:** After the firmware upgrade is completed, the motor will calibrate automatically.

Test Information

On the Test page, there are multiple control mode options to meet the different needs of users.

Control Mode: Click on the lower triangle to choose from multiple control modes

Torque Control	0×A1	Torque mode. Control the magnitude of the output torque current and the rotation direction of the motor.Counterclockwise rotation is "+", clockwise rotation is "-", the effective adjustment range is ±2000 (ratio), for example, set to 200 and click the Send button, the motor will rotate in a counterclockwise and equal-torque manner.
Speed Control	0×A2	Speed mode. Control the speed and direction of the motor's rotation。 Counterclockwise rotation is "+", clockwise rotation is "-", unit: degrees per second (dps). For example, if the reduction ratio is set to 3600 and the Send button is clicked, the motor will rotate counter-clockwise at 3600 DPS and the output end will rot-ate counterclockwise at 360dps. (The input is the motor speed. The actual output speed needs to be divided by the reducer)
Multi Loop Angle Control 1	0×A3	Multi-turn position Mode 1, multi-turn position mode.Absolute position, with positive and negative values, direction depends on the difference between the starting point and the ending point, unit: degrees. For example, if the reduction ratio is 10 and the starting point is set to 0 with 36,000 clicks, the motor will rotate 36,000 degrees at the maximum speed, that is, the output end will rotate counterclockwise by 10 turns. (The input is the motor Angle. The actual output Angle needs to be divided by the reducer)
Multi Loop Angle Control 2	0×A4	Multi-turn position Mode 2, multi-turn position + speed mode.The Speed limit function has been added. The Speed (dps) value limits the rotational speed and is generally set not to exceed the maximum speed. (The input is the motor Angle. The actual output Angle needs to be divided by the reducer)
Single Loop Angle Control 1	0×A5	Single-lap position mode 1, single-lap position + direction mode.Absolute positi-on, only positive value, effective range 360 multiplied by the reduction ratio. For example, if the reduction ratio is 10 and the starting point is set to 900, click the Send button and rotate the output end counterclockwise to 90 degrees (check Rev and rotate it clockwise to 90 degrees). (The input is the motor Angle. The actual output Angle needs to be divided by the reducer)
Single Loop Angle Control 2	0×A6	Single-lap position Mode 2, single-lap position + direction + speed mode.The Sp-eed limit function has been added. The Speed (dps) value limits the rotational sp-eed, and the setting generally does not exceed the maximum speed of the motor. (The input is the motor Angle. The actual output Angle needs to be divided by the reducer)
Increment Angle Control 1	0×A7	Incremental position Mode 1, incremental position + direction mode.Relative posi-tion, with positive and negative values, increases counterclockwise with + and de-creases clockwise with -. Unit: degrees. For example, if the reduction ratio is set to 900 and the "Send" button is clicked, the output end will increase counterclockwi-se by 90 degrees from the original position. (The input is the motor Angle. The actual output Angle needs to be divided by the reducer)
Increment Angle Control 2	0×A8	Incremental position Mode 2, incremental position + direction + velocity mode.The Speed limit function has been added. The Speed (dps) value limits the rotational speed. (The input is the motor Angle. The actual output Angle needs to be divided by the reducer)

⚠Attention 1. With power on, the motor returns to the 0 point position along the original path direction.
2. When power is restored, the motor returns to the 0 point position along the shortest path direction

Motor Status And Error Display

Bus Voltage	Read the bus voltage (V).
Bus Current	Read the busbar current (A), which is not yet open.
Motor Temp	Read the motor temperature (℃).
Torque Current	Read the torque current value. ±2048 corresponds to ±16.5A (sampling torque current).
Speed	Read the motor speed (dps).
Encoder	Reading the encoder position is related to the encoder resolution and the encoder value within a 360-degree range.
IA/IB/IC	Read the phase current (ratio) of the motor.

UVP	Under Voltage Protection.
OVP	Over Voltage Protection.
DTP	Driver Temperature Protection.
MTP	Motor Temperature Protection.
OCP	Over Current Protection.
SCP	Short Circuit Protection.
MSP	Motor Stall Protection.
LIP	Lose Input Protection.

Read State1	Read status 1, read the current motor temperature, voltage, and error status.
Read State2	Read status 2, and read the current motor temperature, torque current, speed, and encoder values.
Read State3	Read status 3 to read the current motor temperature and phase current.
Clear Error	Clear the incorrect state of the motor.
Brake	The brake is in the power-off state and the brake is activated
Brake Release	The brake is energized and the brake is released

Clear Text	Clear the instruction text and the send and receive instruction text produced on the test page
Read Multi Loop Angle	Read the multi-turn Angle position (°).
Read Multi Loop Angle	Read the single-turn Angle position (°).
Clear Motor Loops	Clear the number of motor turns.
Set Motor Zero(RAM)	Set the 0 point position of the motor to the RAM. It is not yet open.

Motor Off	Turn off the motor and the indicator light will flash slowly (2 seconds per time).
Motor ON	Turn on the motor.

⚠Attention：The indicator light for the motor in the incorrect state flashes rapidly (0.3 seconds per time). The "Motor Off" status indicator light flashes slowly and needs to be turned ON by clicking "Motor ON".

Motor Operation Command And Reply Window

TX: Send instructions   RX: Reply instruction

```
TX: 3E 1F 01 00 5E
RX: 3E 1F 01 02 60 32 20 52
TX: 3E 12 01 00 51
RX: 3E 12 01 3A 8B 44 47 34 30 52 37 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 4D 47 35 30 31 30 45 2D 69
31 30 00 00 00 00 00 00 00 00 00 55 33 34 20 03 50 30 36 5C 00 20 00 40 01 2C 01 EB 00 78
TX: 3E 16 01 00 55
RX: 3E 16 01 2C 81 1C 07 00 00 74 AE 00 00 EE 03 C8 00 01 FF FF FF 00 00 00 00 00 0A FF FF C7 0F 00 00
01 FF FF FF 00 00 00 00 00 FF FF FF 34 12 AA 55 1A
RX:
TX: 3E 14 01 00 53
RX: 3E 14 01 68 BB 00 00 04 04 00 00 02 00 02 02 00 00 00 01 64 64 BC 02 B8 0B 3C 00 64 00 C8 00 64 00
00 FF 28 0A 00 01 4C 04 6C 07 DC 05 0A 00 64 00 C8 00 64 00 C4 09 64 00 64 00 00 00 28 00 0E
RX: 00 00 00 32 00 32 00 00 00 E8 03 FF FF 00 F9 15 00 FF FF FF FF 00 00 00 00 00 00 00 00 00 00 FF FF
00 00 00 00 00 00 00 00 78 56 AA 55 81
TX: 3E 10 01 00 4F
RX: 3E 10 01 00 4F
```

Clear Text

⚠ Attention: The instruction description refers to the RS485 communication protocol.