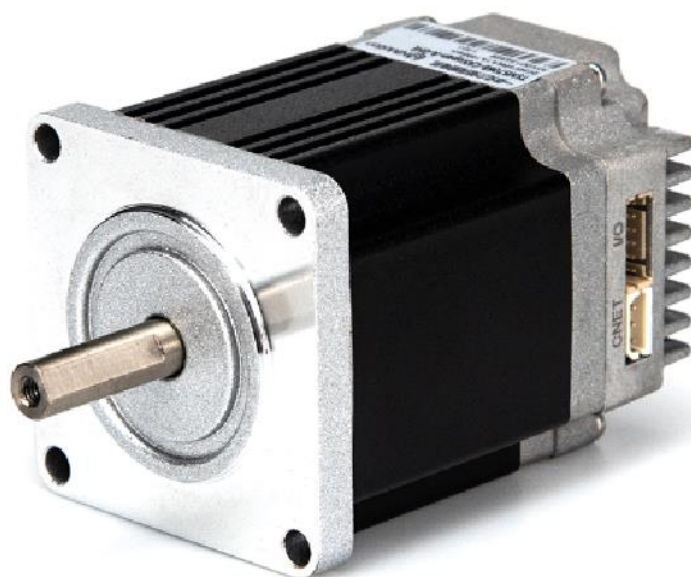


TSM57 Series RS485&CANopen Integrated Torque Servo Motor

Instruction Manual



Safety Instructions

 Danger (May cause death or serious injury!)	
Wiring job, be sure to by professional electrical engineer according to the connection diagram installation operation.	Danger of electric shock and fire.
Before wiring ,make sure that the power supply is off.	Danger of electric shock and fire.
The ground wire of the integrated motor and the input terminal of the power must be firmly installed.	Danger of electric shock and fire.
Do not bend ,pull or clamp the connecting cable forcibly.	Danger of fire.
When using on the lifting device, please take measures to protect the position of the movable part.	Danger of injury.
Please set up circuit breakers and other safety devices to prevent external circuit short circuit and equipment failure can cut off the power supply in time.	Danger of electric shock and fire.
Do not use it in places with severe vibration and impact.	Danger of fire.
After the driver is powered off, the bus voltage will remain for a period of time. Do not touch the power input terminal within two minutes.	Danger of electric shock and fire.
For the power supply of the integrated motor, please use the primary and secondary reinforced insulated DC power supply.	Danger of electric shock.
Please cut off the power supply of the integrated motor during power failure, otherwise the integrated motor will start suddenly after restoring the power supply.	Danger of injury.
When the integrated motor is running, please ensure safety before releasing the holding force of the integrated motor.	Danger of injury.
Do not use the integrated motor near inflammable, explosive, corrosive environment and places easy to touch water.	Danger of electric shock and fire.
 Warning (May result in injury or damage to objects!)	
The integrated motor is strictly prohibited from being impacted: If it is impacted, the integrated motor encoder may be damaged or offset with the magnet position, affecting the accuracy or operation of the motor.	Risk of equipment failure.
Do not turn the motor shaft when the integrated motor power is OFF: If the motor shaft is turned at more than 400rpm when the electromechanical power is OFF, the integrated motor may cause drive damage due to regenerative current.	Risk of equipment failure.
When using the integrated motor, do not exceed its specification value.	Danger of injury and motor fault.
Do not hold the integrated motor output shaft or cable during handling.	Danger of injury and motor fault.
Please install the protective cover on the rotating part (output shaft) of the integrated motor.	Danger of injury.
Do not stack obstacles hindering ventilation around the integrated motor to ensure heat dissipation.	Danger of motor fault.
Do not touch the integrated motor when it is running or within a short time after it stops running. Please post a warning sign in a conspicuous position.	Danger of scalding.
Please use the integrated motor according to the specified parameters.	Danger of motor fault and fire.

Please install an emergency stop device or emergency stop circuit outside the integrated motor to ensure safe shutdown in case of failure or abnormal operation.	Danger of injury.
Please do not touch the shell during insulation resistance measurement or insulation withstand voltage test.	Danger of electric shock.
When the integrated motor is abnormal, please stop running immediately and cut off the power supply to avoid fire or injury.	Danger of injury and fire.
When using, ensure that the grounding resistance of the system is less than 4Ω. When multiple integrated motors are used in parallel, the grounding resistance between the ground of each integrated motor is less than or equal to 0.1Ω. The interface of the master controller and the slave station of the integrated servo motor should be in common ground, and the grounding resistance should be less than or equal to 0.1Ω. The integrated motor shell shall be installed on the integrated motor bracket through the installation hole. The bracket shall be reliably connected to the ground, and the grounding resistance shall be less than or equal to 0.1Ω.	Danger of motor fault.
The power supply of the integrated motor needs to be connected with a capacitor above 4700uF, which is used to absorb the regenerative current generated by the external force and excessive deceleration of the motor and reduce the peak starting current of the high speed response of the large inertia load. Otherwise, it will cause serious damage of the motor.	Danger of motor fault.
 Caution	
Do not disassemble or modify the integrated motor, otherwise it may cause injury. For inspection or repair, please contact NiMotion, inc.	
When the integrated motor is scrapped, please disassemble it as far as possible and treat it as industrial waste.	
Before use, please read and fully understand the "Safety Instructions" to use the integrated motor correctly.	
This product is designed and manufactured for use in general industrial equipment. Don't use it for any other purpose. We hereby state that we will not be liable for any damages caused by ignoring this advice.	

Summary

Preface

Thank you for using the TSM57 Series RS485 & CANopen Integrated Torque Servo Motor products! Please read this guide carefully before using.

This manual is the instruction manual for the TSM57 Integrated Torque Servo Motor, covering motor selection, technical specifications, terminal definitions, cable wiring, and other contents. For detailed functions, communication protocols, and other information, please refer to the communication manual or contact NiMotion Technical Support.

If any changes are made to this user manual, the latest version shall prevail without prior notice.

About Manuals and Acquire

- Unauthorized reprinting or copying of all or part of the contents of this manual is prohibited.
- Please understand that the performance, specifications and appearance of the product may be changed without prior notice due to improvements.
- We strive to make the content of this manual as correct as possible. If you find any problems or errors or omissions, please contact NiMotion, inc.
- This manual is not shipped with the product. To obtain the electronic PDF file, you can obtain it in the following ways:
 - Log in to the official website of NiMotion, inc. (<https://www.nimotion.com>), "Member Center - Data download", log in to search keywords and download.
 - Scan the QR code on the product to obtain product related information.

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1. Product Inspection and Model Description

1.1 Unpacking Inspection

Upon unpacking, please carefully inspect the items listed below:

- Whether the product is the one you ordered: Please verify that the model and specification on the nameplate are consistent with your order.
- Whether the product is damaged: Visually inspect the appearance for damage or scratches.
- Whether screws are loose or missing: Check for any unsecured or fallen screws.
- For motors without brake: Check if the shaft rotates smoothly. Rotate the motor shaft by hand; if it can rotate smoothly, the motor shaft is normal.
- For motors with brake: Check if the brake is functioning properly. Rotate the motor shaft by hand; if the shaft is locked, the brake is normal.
- If any of the above situations occur, please contact our company for a proper solution.

The complete operational product components shall include:

- Integrated Torque Servo Motor.
- Required communication cable.
- Required communication interface components.

1.2 Product Model

1.2.1 Naming Rules

<u>TSM</u>	<u>57</u>	<u>XX</u>	<u>B</u>	<u>- 485</u>	<u>- 0</u>	<u>H</u>	<u>E</u>
①	②	③	④	⑤	⑥	⑦	⑧
①	TSM: Integrated Torque Servo Motor Series		②	Motor Base Width: 57-57mm			
③	Motor Power: 06-60W		④	Encoder performance: B-2500 lines			
⑤	Communication method: CANopen-CANopen、485-RS485						
⑥	Shaft Extension Length: 0-Standard Length Shaft; 1-Non-Standard Length Shaft						
⑦	Shaft Key Type: S-Smooth Shaft; F-Flat Milled; K-Half Moon Key; H-Parallel Key; M-Through-hole Mounting						
⑧	Special Processing Code: S-No Special Processing; A-Gear; B-Lead Screw; E-Center Threaded Hole...						

Figure 1-1 Product Naming Rules

1.2.2 Mounting Dimensions

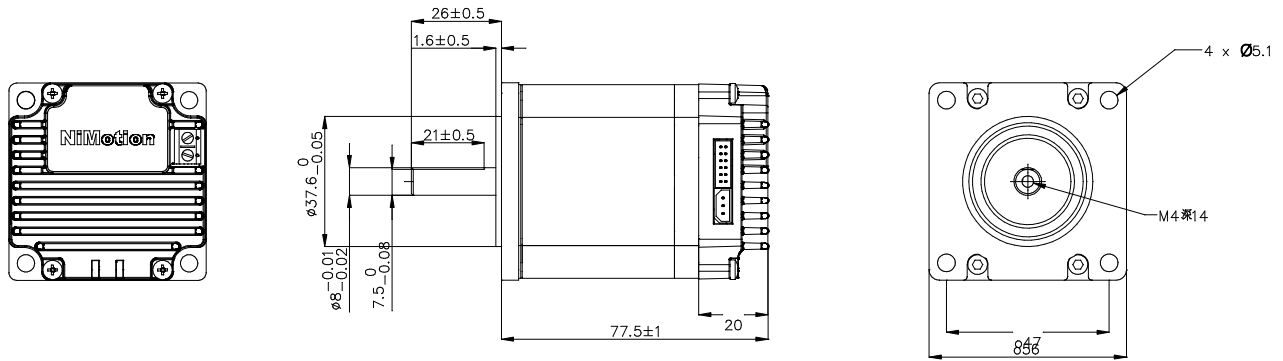


Figure1-2 Product Structure Diagram

Table1-1 Product Dimension Table

Model	Length (X in Figure)(mm)	Shaft diameter	Brake	Rotor inertia (kg·m ²)	Weight (Kg)
TSM5706B-CANopen/485-0HE	77.5	Φ8	No	4.3*10 ⁻⁵	0.56

1.3 Torque Curve

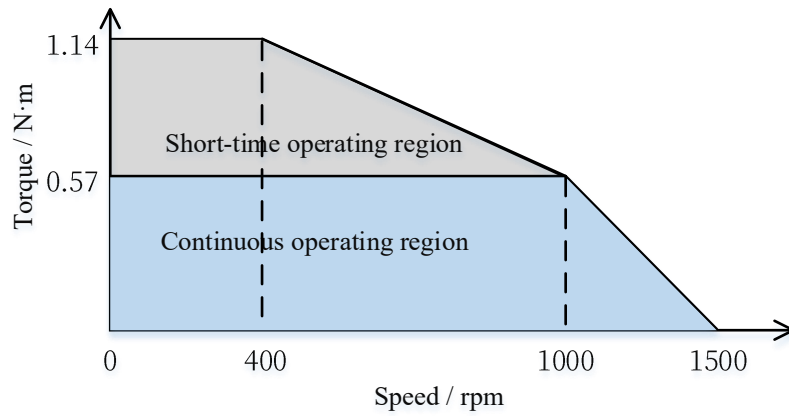


Figure1-3 TSM5706B-485/CANopen-X Torque-Frequency Characteristic Curve (24V, 3.8A)

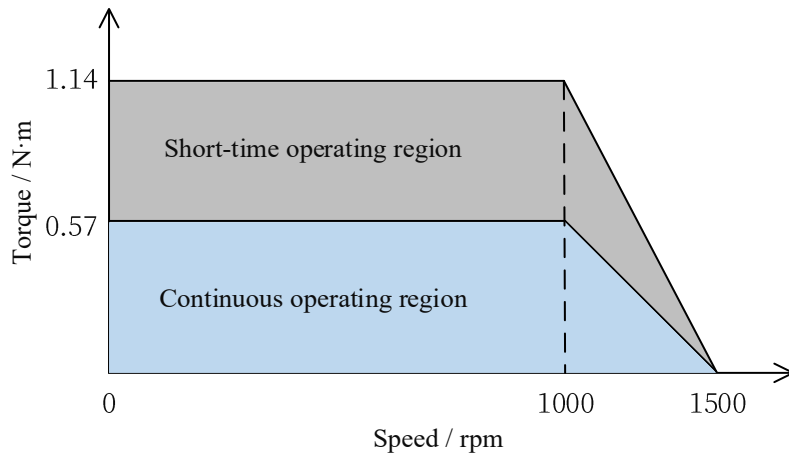


Figure1-4 TSM5706B-485/CANopen-X Torque-Frequency Characteristic Curve (48V, 3.8A)

2.Specifications

2.1Technical Specifications

Table_2-1 Motor Technical Specification

Model		TSM5706B-485/CANopen-X
Input Power Supply Voltage Range		16~52 (72V customizable) (VDC)
Rated Voltage (VDC)		24
Rated Speed (rpm)		1000
Rated Current (A)		3.8
Rated Torque (N·m)		0.57
Rated Power (W)		60
Working Environment	Temperature (°C)	0~40
	Humidity (RH)	10%~85% non-condensing
	Altitude (m)	<1000
	Installation Environment	No corrosive gases, flammable substances, oil mist, etc., and no strong vibrations.
	Installation Method	Horizontal or vertical
Drive Method		Adopts FOC (Field-Oriented Control) technology and SVPWM.
Encoder		Integrated 2500-line magnetic encoder
Brake Resistor		Built-in + external, and the two cannot be used in parallel. Built-in 16W. External brake resistor can be realized by configuring the EXTERNAL_BRAKE function of the physical terminal. Configurable functions: 1. General DO port; 5. Brake output; 6. External brake resistor; 30. Brake power-saving drive output.
Control Signal	DI (Digital Input)	Quantity: 3 All adopt high-speed bidirectional optocouplers, supporting PWM pulse frequency range of 500KHz~2MHz. High level: 12~24V, Low level: 0~0.5V Configurable functions: 1. Used as a switch 2. Used as a pulse input channel
	DO (Digital Output)	Quantity: 1 Output type: MOS open-drain output Current: 2A @ 55V, maximum pulse frequency 2MHz Configurable functions: 1. General DO port; 2. Motor run/stop; 3. Target reached; 4. Alarm output (The DO switching status changes when the motor status meets the above conditions)
	AI (Analog Input)	Quantity: 1 Input mode: Single-ended input; Signal type: Voltage signal; Resolution: 12 bit Voltage: 0~10 V Accuracy: Reference error ≤ 1% Configurable functions: Dead zone, filtering, offset, gain, direction

Table_2-2 Motor Technical Specification

Model		TSM5706B-485/CANopen-X
Communication Protocol	CANopen	CAN interface; 3-wire non-isolated; 3.3V CAN2.0A protocol Application layer: CANopen protocol Communication baud rate: 1Mbps, 800kbps, 500kbps, 250kbps, 125kbps, 100kbps, 50kbps, 20kbps, 10kbps, default is 1Mbps
	RS485	RS485 interface; 3-wire non-isolated Modbus-RTU protocol Communication baud rate: 1Mbps, 500kbps, 256kbps, 115.2kbps, 57.6kbps, 38.4kbps, 19.2kbps, 9.6kbps, default is 115.2kbps
Control Mode	CiA402 mode	Profile Position Mode (PP), Profile Velocity Mode (PV), Profile Torque Mode (PT), Velocity Mode (VM), Interpolation Mode (IP) Homing Mode (HM) (Switch homing method, Stall homing method) Cyclic Synchronous Position Mode (CSP), Cyclic Synchronous Velocity Mode (CSV), Cyclic Synchronous Torque Mode (CST)
	NiMotion mode	NiMotion Velocity Mode, NiMotion Position Mode, NiMotion Torque Mode
Fault Diagnosis		Overvoltage / Undervoltage / Overtemperature / Hardware fault / Stall / Overload / Overspeed / Initialization fault / Memory fault / Overlimit detection / Homing timeout / Tracking fault / Target position overflow fault / Faults such as excessively small curve planning parameters
Fault Reset		Alarms are auto-reset, while faults are manual-reset.
Special Features	Soft Limit	Set the position range via software; if the range is exceeded, the motor will lock the shaft and trigger an alarm.
	Parameter Identification	It is equipped with parameter identification and PI parameter auto-tuning functions.
	Power Limiting	When the supply voltage exceeds the rated voltage, the power limiting function is activated to restrict the motor's operating power below the rated power.
	Position Recovery	Can be configured for single-turn position value recovery or multi-turn absolute position value recovery.
	Gain Switching	Two sets of gain parameters can be preset, and automatic switching between the two sets of gains is performed according to different motor operating states.
	Resonance Suppression	Effective vibration suppression frequency range ≥ 300 Hz
	Low Frequency Suppression	Effective vibration suppression frequency range ≤ 100 Hz
	Parameter Save and Restore	Implement the functions of parameter saving and restoring default parameters.
	Online Upgrade	Update timely according to the actual product requirements to improve maintainability and efficiency.

2.2Indicator

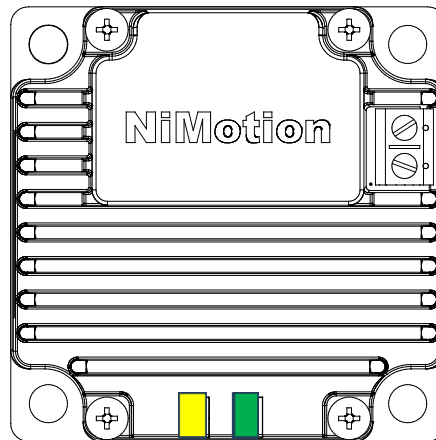


Figure2-1 Indicator Light

Table2-3 Indicator Meaning

Meaning	Green light (RUN)	Yellow light (COM)
Communication normal	Solid ON	Flashing(1s frequency)
Communication normal, with warning	Solid ON	Flashing(0.5s frequency)
Communication normal, with fault	Solid ON	Flashing(0.25s frequency)
Communication normal, hardware fault	Solid ON	Solid OFF
Communication abnormal, with warning	Flashing(0.5s frequency)	Flashing(0.5s frequency)
Communication abnormal, with fault	Flashing(0.5s frequency)	Flashing(0.25s frequency)
Abnormal power supply or serious fault	Solid OFF	Solid OFF

2.3 Definition of Terminal

2.3.1 Power Port

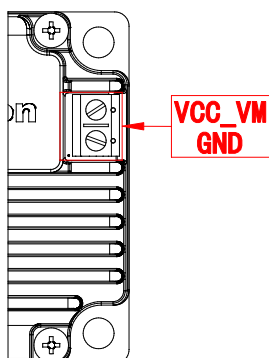


Figure 2-2 Power Port

Table2-4 Power Port Definition

Pin	Function	Remark
1	GND	-
2	VCC	16~52VDC

Warning: The positive and negative poles of the power cable must not be reversed, as this may cause product damage. Damage caused by such incorrect connection is not covered by the manufacturer's warranty service.

2.3.2 Communication Port

The communication port CNET is used for CAN or RS485 communication connection, as shown in the figure below.

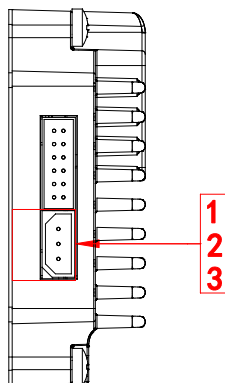


Figure2-3 Communication Port

Table 2-5 Communication Interface Definition

Pin	RS485	CANopen
1	485-	CAN_H
2	485+	CAN_L
3	GND	GND

2.3.3 I/O Input and Output Ports

Digital input and output connection port.

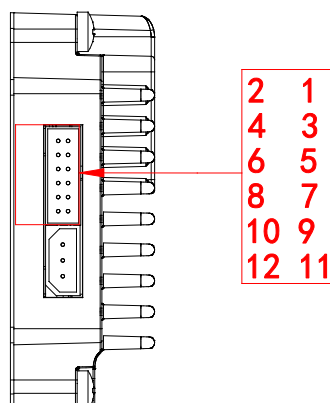


Figure2-4 I/O Port

Table2-6 I/O Port Definition

Pin	Pin position	Function
1	DI1+	DI inputs can be connected to sensors or switches in the following three scenarios: • NPN sensor: Connect DI+ to 24V, and DI- to OUT. • PNP sensor: Connect DI+ to OUT, and DI- to GND. • Switch: Connect DI+ to 24V, connect DI- to one terminal of the switch, and connect the other terminal of the switch to GND.
2	DI1-	
3	DI2+	
4	DI2-	
5	DI3+	
6	DI3-	
7	DO1	Connect to LED, etc.
8	EXTERNAL_BRAKE	Connect to the non-power side of the bleeder resistor, brake, etc.
9	GND	-
10	-	Reserved
11	-	Reserved
12	AI1	Analog input 0~10V

2.3.4 I/O Terminal Connection

DI1, DI2, DI3 (input terminals) are connected to NPN sensors.

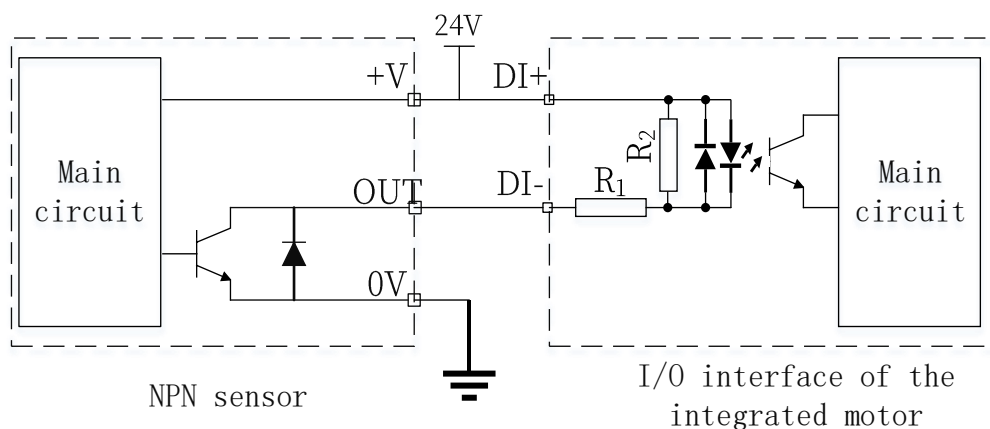


Figure2-5 Schematic Diagram of DI Input Port Connected to NPN Sensor

+V, DI+ _24V, 0V_GND, and DI- are connected to the sensor OUT.

DI1, DI2, DI3 (input terminals) are connected to PNP sensors.

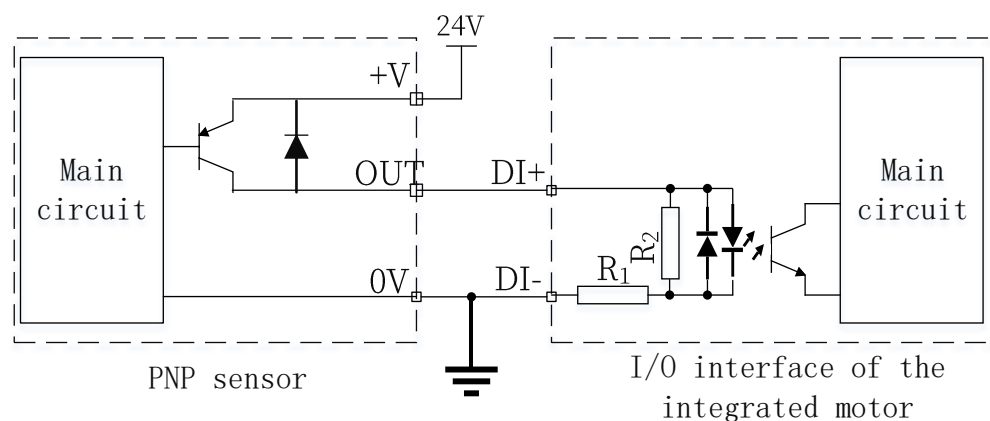


Figure2-6 Schematic Diagram of DI Input Port Connected to PNP Sensor

+24V connected to +V, 0V connected to GND, and the sensor OUT connected to DI+.

DI1, DI2, DI3 (input terminals) connected to switches

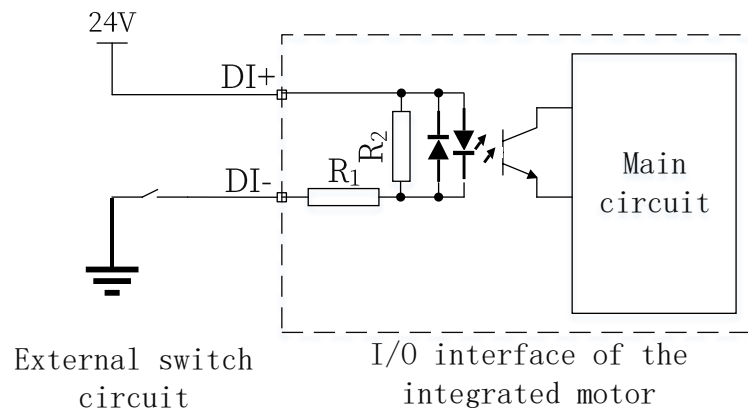


Figure2-7 Schematic Diagram of DI Input Port Connected to Switch

+24V connected to DI+, switch connected to DI-, and the other terminal of the switch connected to the power supply negative pole.

DI1, DI2, DI3 (input terminals) connected to pulse input

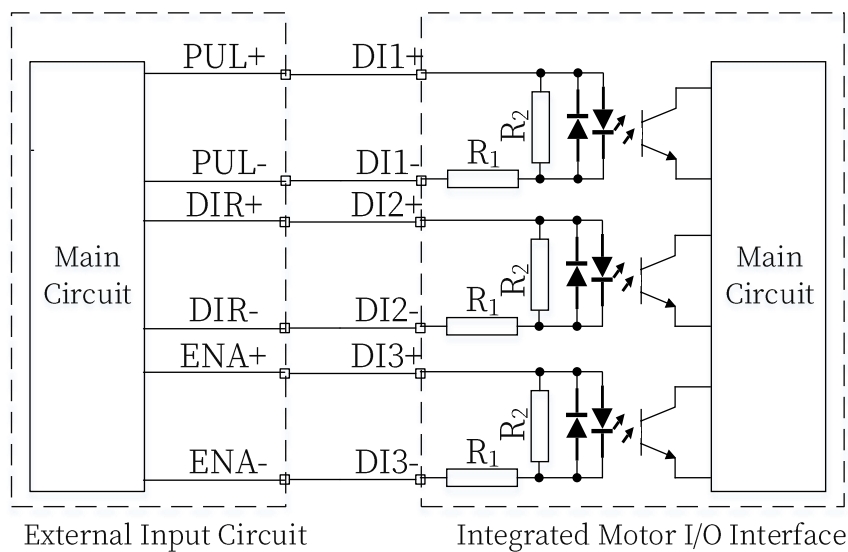


Figure2-8 Schematic Diagram of DI Input Port Connected to Pulse Input

DO1 (output terminal) connected to LED

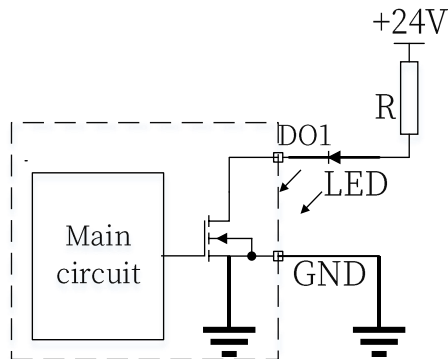


Figure2-9 Schematic Diagram of DO1 Output Port Connected to LED Indicator

The positive terminal of the power supply VCC is connected to the anode of the LED after the current-limiting resistor, the DO1 terminal of the I/O interface is connected to the cathode of the LED, and the GND terminal of the I/O interface is connected to the negative terminal of the power supply.

EXTERNAL_BRAKE (Output terminal) External brake coil

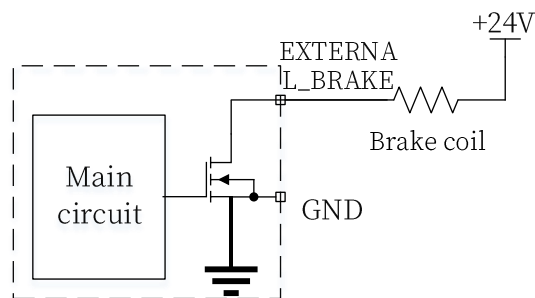


Figure2-10 Schematic Diagram of External Brake Coil Connected to EXTERNAL_BRAKE Output Interface

One end of the brake coil is connected to the +24V power supply, and the other end is connected to EXTERNAL_BRAKE. The motor GND is connected to the ground of the +24V power supply.

EXTERNAL_BRAKE (Output terminal) External braking resistor

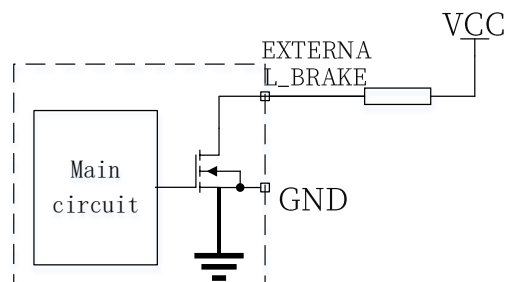


Figure2-11 Schematic Diagram of EXTERNAL_BRAKE Port Connected to Braking Resistor

One end of the braking resistor is connected to the +24V power supply, and the other end is connected to EXTERNAL_BRAKE. The motor GND is connected to the ground of the +24V power supply.

AI port connected to analog input

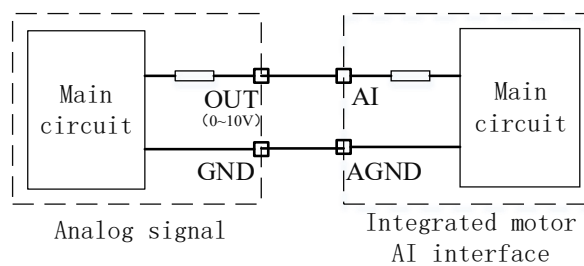


Figure2-12 Schematic Diagram of AI Port Connected to Analog Input

The AI input terminal of the motor is connected to the analog signal OUT interface, and the motor GND is connected to the analog signal ground.

3.Install and Connect

3.1Installation Precautions

3.1.1 Installation Places

- ① Please install it in the control cabinet without direct sunlight, and do not place flammable materials around it.
- ② Do not use this product in a corrosive environment such as hydrogen sulfide, sulfite, chlorine, ammonia, chlorinated gas, acid, alkali, salt, or in an inflammable gas environment or combustible materials.
- ③ No cutting fluid, oil mist, iron powder, iron filings and other places.
- ④ Well-ventilated, dry and dust-free place.
- ⑤ A place without vibration.
- ⑥ Do not use gasoline, diluent, alcohol, acid and alkaline cleaning agent, so as to avoid the shell discoloring or damage.

3.1.2 Installation Requirements

- ① The installation direction of the integrated motor should be consistent with the direction of the heat sink and the heat dissipation duct of the system to ensure good heat dissipation effect.
- ② The wiring end face of the integrated motor shall reserve at least 30mm space for easy maintenance and operation.
- ③ The integrated motor wiring should be tied at a distance of 30 ~ 40mm from the motor to prevent the loosening of the plug for a long time.
- ④ Before powering the integrated motor, make sure that the communication cables and power cables are connected correctly. If you need to use the IO function, you should connect the corresponding IO cables (Recommend using our company's standard cable).
- ⑤ According to the company's selected communication cable to correctly select the installation network, optional terminal matching head installed in the network terminal position, to achieve signal terminal matching.

3.1.3 Installation Cautions

- ① When connecting with the machine, please use the coupling, and keep the axis of the servo motor and the axis of the machine in a straight line.
- ② Do not make the wire "bend" or exert "tension" on it;
- ③ When connecting the connectors, make sure that there are no foreign objects such as garbage or metal sheets in the connectors.
- ④ When carrying out the operation under the condition of keeping the cable connected, please be sure to hold the main body of the integrated motor. If only catch cables carrying, could damage the connector or cut cables.
- ⑤ If the use of curved cable, should be fully paid attention in the wiring operation, do not apply stress to the connector part. If stress is applied to the connector portion, it may cause connector damage.
- ⑥ During product installation, be sure to confirm the screw type and length required in the product structure diagrams (Figure1-2). The locking depth of the assembled screws must not exceed the depth of the mounting threaded holes shown in the diagrams. Using excessively long screws will cause damage to the motor.

3.2 Cable Wiring and grounding Requirement

3.2.1 Wiring Requirements

Alternating electromagnetic fields around AC cables, especially in the power supply and integrated motor cables, may interfere with the integrated motor and other equipment. Please note the following requirements:

① The integrated motor power cord adopts 16AWG ~ 24AWG twisted-pair copper wire, and the temperature resistance should be greater than or equal to 105°C (the value is the recommended value, please select according to the actual working conditions).

② The communication cable adopts the characteristic impedance of 120Ω, 22AWG ~ 24AWG twisted-pair shielded line, and the temperature resistance should be greater than or equal to 105°C (the value is the recommended value, please select according to the actual working conditions).

③ The length of the IO channel signal cable does not exceed 1m, the use of 24AWG copper wire, the temperature resistance should be greater than or equal to 105 °C (the value is the recommended value, please select according to the actual working conditions), greater than 1m signal to choose a shielded cable.

④ All kinds of cable wiring should be divided into bundles and slots. Different types of cables should be crossed, and cables should be at right angles to each other. The I/O signal cable and communication cable are more than 0.2m away from the system power cable.

3.2.2 Grounding Requirements

The product adopts common ground design internally, and the power supply, communication cable and IO port are common ground design. In order to make the product correctly grounding, please observe the following precautions:

① In order to prevent electric shock, please be sure to ground the ground terminal. For the method of grounding, please follow the relevant national or regional electrical regulations.

② In order to prevent electric shock, please confirm that the protective grounding conductor conforms to the technical specifications and local safety standards, and minimize the length of the grounding wire.

③ When using multiple devices, follow the instructions for grounding all devices. Improper grounding of the device may cause maloperation of the equipment.

④ The grounding terminal must be reliably grounded, otherwise it will lead to abnormal work or even damage of the equipment.

⑤ Do not share the ground terminal with the neutral wire (N-terminal) of the power supply.

⑥ Protective grounding conductor must use yellow-green copper conductor cable, and cannot be connected with circuit breakers and other switchgear.

⑦ Recommended installation on the conductive metal surface, to ensure that the entire conductive bottom of the equipment and the installation surface is good lap.

Common Power Supply Ground

In the communication networking of multiple integrated motors, if there are multiple power supplies in the system, the power supply should be common ground (common GND, that is, the negative pole of the power supply). The ground resistance of the electrical system involved in Unicom's communication bus is $< 4\Omega$.

Common Signal Ground

The main controller, communication bus master station and communication converter communication port connected to the communication bus of the integrated motor shall be isolated by electrical isolation technology, and the ground of the communication ground (RS485_GND, CAN_GND) and the communication interface of the integrated motor shall be common (common GND, namely communication interface GND).

Protective Grounding

The integrated motor shell should be installed to the motor bracket through the mounting hole, and the bracket should be reliably connected to the ground. The resistance between the integrated motor shell, the accessible grounding metal shell and the grounding terminal should not exceed 0.1Ω .

3.3 Communication Distance

3.3.1 RS485 Communication

RS485 communication transmission medium can choose type A and type B two kinds of wire, A is shielded twisted pair, B is ordinary twisted pair. However, Type A wire is specified in the EN50170 standard, and Type A has a larger extension length than type B, as shown in Table 3-1 and Table 3-2.

Table3-1 Communication Transmission Medium of RS485

Parameters	Type A	Type B
Characteristic impedance (Ω)	135~165	100~130
Capacitance per unit length (PF/m)	<30	<60
Loop resistance (Ω /km)	110	——
Wire core diameter (mm)	0.64	>0.53
Wire core cross-sectional area (mm^2)	>0.34	>0.22

Table3-2 Communication Distance and Baud Rate of RS485

Baud rate (bps)	Bus length (m) (Type A)	Bus length (m) (Type B)	Note
1.5M	100	Not Recommended	This parameter is the estimation in the ideal state and is for reference only. The actual application is affected by many factors. Please refer to the actual application
1M	200	100	
500k	400	200	
256k	800	600	
115.2k	1000	1000	
57.6k	1200	1200	
38.4k	1200	1200	
19.2k	1200	1200	
9.6k	1200	1200	

Under the ideal environment (the load RS485 bus device is one, the baud rate is 9600bps, the use of high-quality communication wire) the longest communication distance of RS485 bus theory is about 1200m.

RS485 bus communication distance reduction factors: there are a number of loads RS485 equipment, wire characteristic impedance does not meet the standard, the wire diameter is small, non-quality converter, equipment lightning protection complex and baud rate is too high factor, will shorten the RS485 communication distance.

For how to reduce interference and the impact of communication distance reduction: Both to increase the transmission distance, but also to ensure the stability of the transmission signal. It is usually necessary to stay away from interference sources (large mechanical equipment) as far as possible, increase shielding measures, increase repeaters, reduce the transmission rate (baud rate), and use high-quality communication cables and converters and so on.

3.3.2 CAN Communication

Table3-3 Communication Distance and Baud Rate of CAN

Baud rate (bit/s)	Bus length (m)	Nominal bit time(μ s)	Sampling point location	Sampling point range	Note
1M	25	1	87.5% (875 ns)	75%~90%	This parameter is the estimation in the ideal state and is for reference only. The actual application is affected by many factors. Please refer to the actual application
800k	50	1.25	87.5% (1.09375 μ s)	75%~90%	
500k	100	2	87.5% (1.75 μ s)	85%~90%	
250k	250	4	87.5% (3.5 μ s)	85%~90%	
125k	500	8	87.5% (7 μ s)	85%~90%	
50k	1000	20	87.5% (17.5 μ s)	85%~90%	
20k	2500	50	87.5% (43.75 μ s)	85%~90%	
10k	5000	100	87.5% (87.5 μ s)	85%~90%	

The above tabulated data are the parameters in the ideal state. In practical application, when the distance of the wire to transmit the signal is too long, the signal will be distorted due to environmental problems (such as electromagnetic, electric field interference) and the characteristic impedance of the wire itself.

How to optimize the communication distance of the CAN bus: reduce the length of the branch, add appropriate matching resistance to the long branch, use shielded cables and correct grounding, reduce the number of CAN bus nodes, reduce the transmission rate (baud rate), increase the CAN repeater or hub, etc.

3.4 Other Cable Wiring

3.4.1 Wiring Diagram of Communication

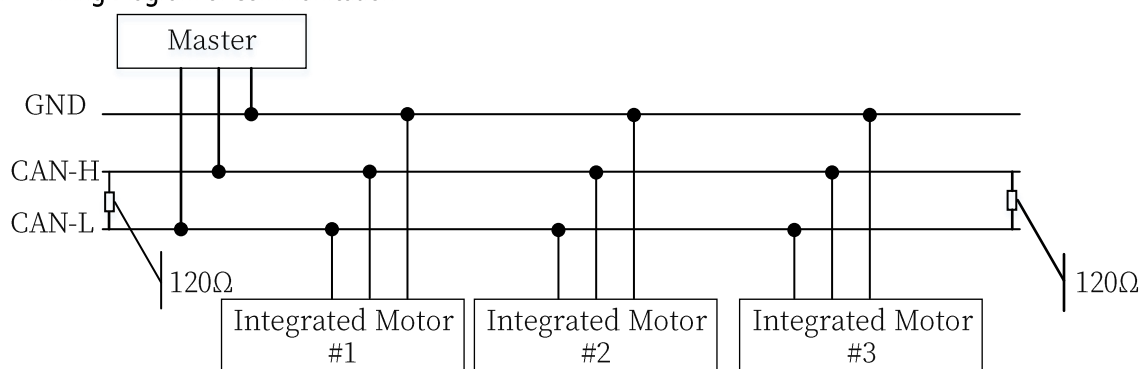


Figure3-1 Wiring Diagram of CANopen Communication

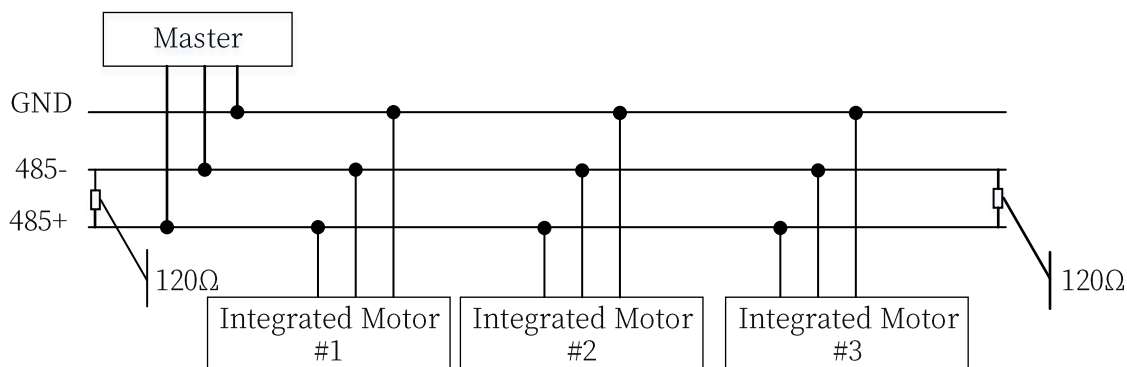


Figure3-2 Wiring Diagram of RS485 Communication

3.4.2 Debugging Wiring

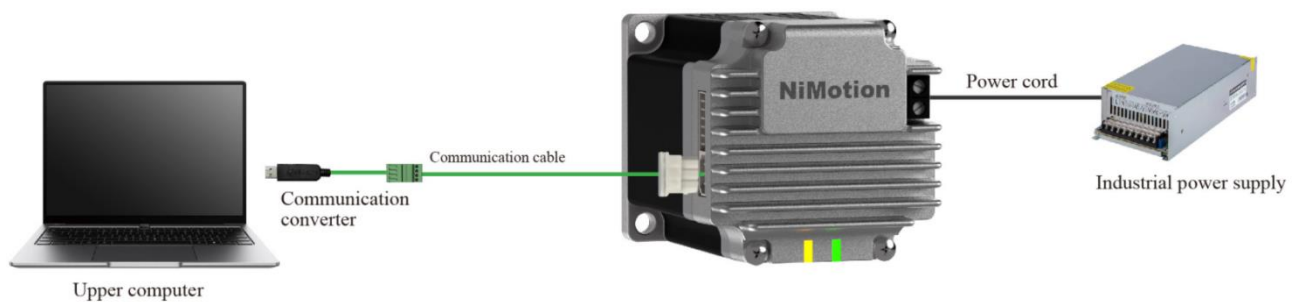


Figure 3-3 Wiring Diagram for Integrated Motor Commissioning

3.4.3 External Control Wiring

① Control via communication bus

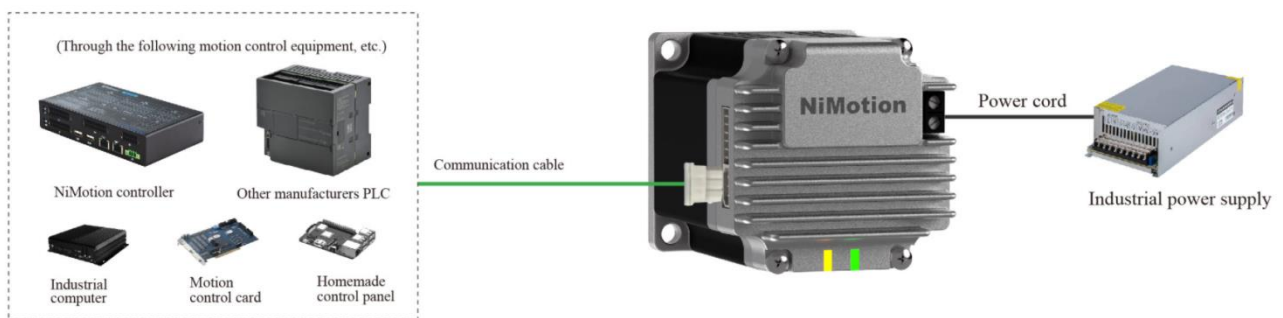


Figure 3-4 External Control Wiring Diagram (Controlled via Communication Bus)

② Control via IO port

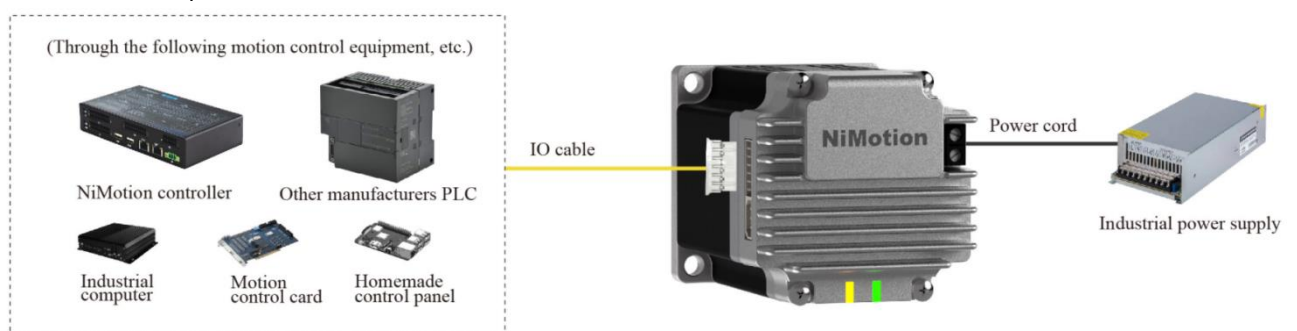


Figure 3-5 External Control Wiring Diagram

③ Controlled via IO port (sensor)



Figure 3-6 External Control Wiring Diagram

3.4.4 Communication Networking Wiring

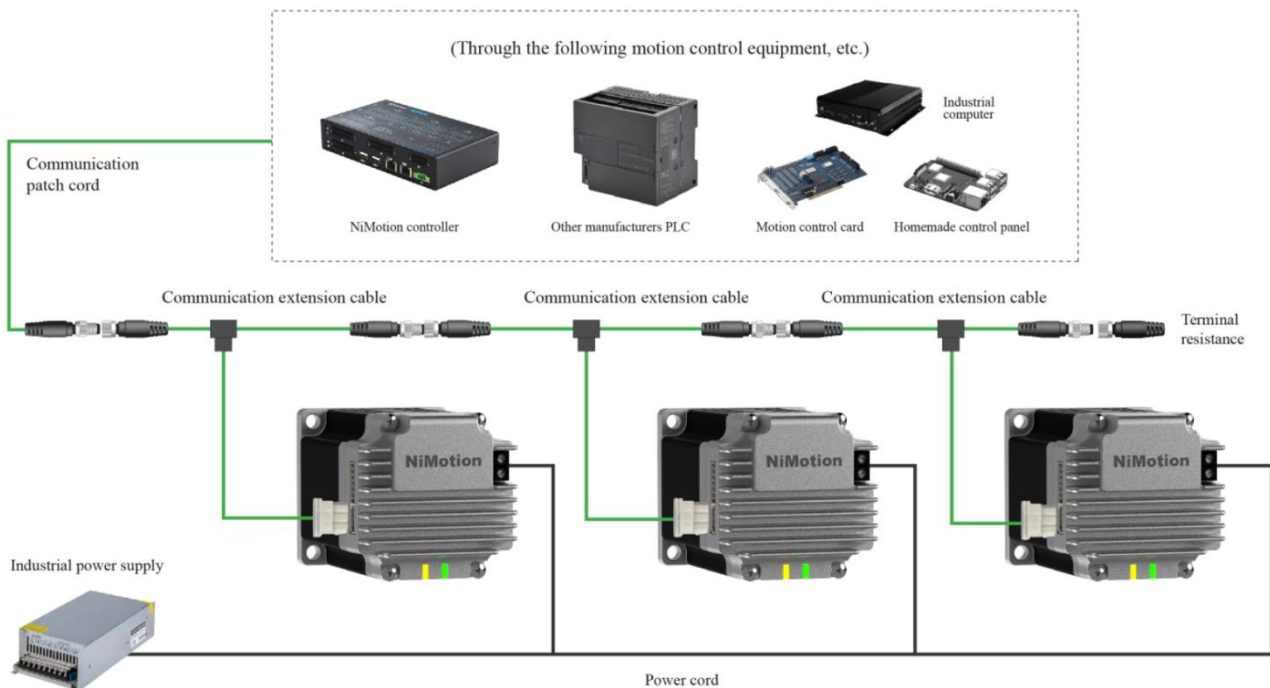


Figure3-7 Network Wiring Diagram (CANOpen & RS485)

3.4.5 Network wiring requirements

a. RS485 networking requirements

- ① RS485 can use a variety of types of media for transmission, but should use in accordance with the "GBT 19582.2-2008 Modbus protocol implementation guide on serial links" standard cable.
- ② RS485 bus please be sure to use Daisy chain connection, all nodes RS485 signal reference connected together.
- ③ The terminal matching resistor must be configured at the end of the cable to prevent RS485 signal from reflection.
- ④ The node branch should be as short as possible: long branches cause obvious characteristic impedance mismatch, and then cause signal reflection, so the branch should be ensured as short as possible, generally not more than 30cm.
- ⑤ The number of bus nodes: depends on the actual application conditions and transmission media hardware characteristics.

b. CAN networking requirements

- ① Cables shall be connected in accordance with GBT 41588.3-2022 Road Vehicle Controller LAN (CAN) Part 3: Low-Speed Fault-tolerant, media-related Interfaces.
- ② The CAN bus please be sure to use Daisy chain connection, and the reference ground of CAN signal of all nodes is connected together.
- ③ The terminal matching resistor must be configured at the end of the cable to prevent CAN signal reflection.
- ④ The length of the branch node should not be too long, generally not more than 30cm.
- ⑤ The number of bus nodes: depends on the actual application conditions and transmission media hardware characteristics.

4. Product Selection

4.1 Cable Selection

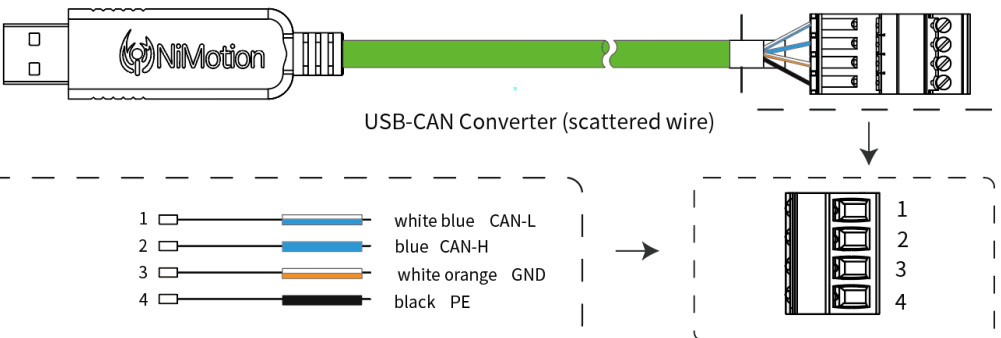
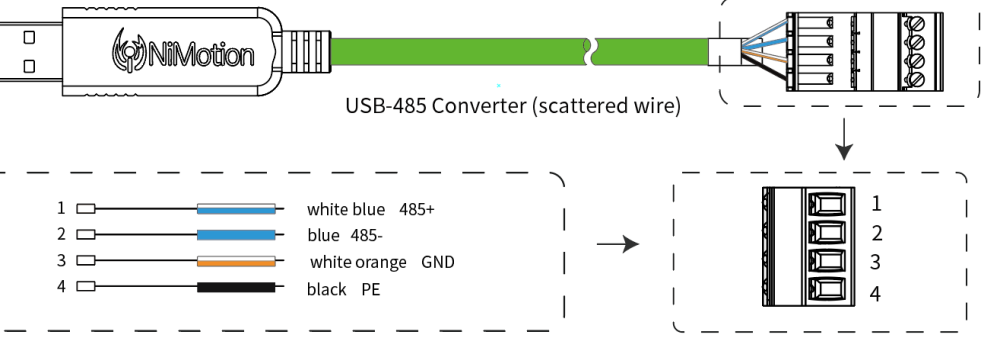
Table 4-1 Cable Selection

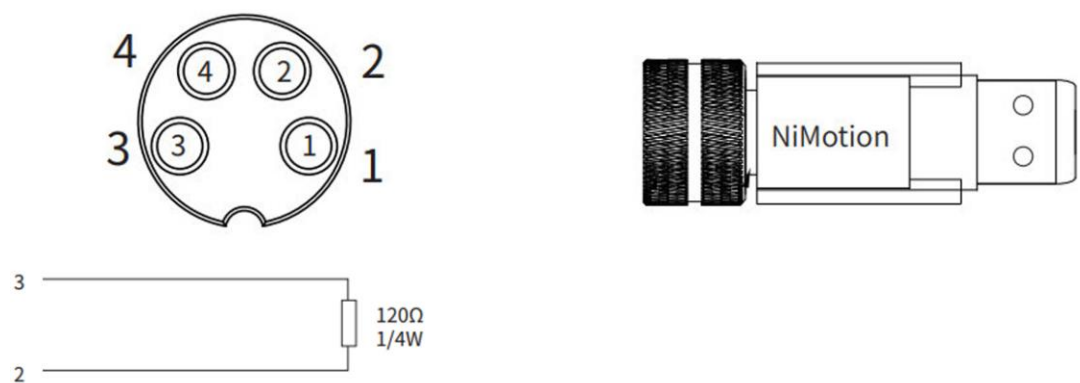
TSM Series Integrated Torque Servo Motor Cable Selection Table	
Cable name	Cable Wiring Definition Diagram
Power cable STX001B	
Communication cable STX002A	1000±10mm "J1" "J2" PE 1 2 3 "J2" Line Color (" — "none) 1 white CAN-H/485- 2 red CAN-L/485+ 3 black GND 4 black PE

Table 4-2 Cable Selection

TSM Series Integrated Torque Servo Motor Cable Selection Table																																					
Cable name	Cable Wiring Definition Diagram																																				
IO cable STX004	Diagram of IO cable STX004 showing a yellow cable with connectors J1 and J2, a length of 1000±10mm, and a PE ground. A detailed pinout for J1 and J2 is provided. J1 Pinout: <table border="1"> <tr><td>12</td><td>11</td></tr> <tr><td>10</td><td>9</td></tr> <tr><td>8</td><td>7</td></tr> <tr><td>6</td><td>5</td></tr> <tr><td>4</td><td>3</td></tr> <tr><td>2</td><td>1</td></tr> </table> "J2" Line Color ("—" "none") <table border="1"> <tr><td>1</td><td>white</td></tr> <tr><td>2</td><td>yellow</td></tr> <tr><td>3</td><td>green</td></tr> <tr><td>4</td><td>blue</td></tr> <tr><td>5</td><td>brown</td></tr> <tr><td>6</td><td>powder</td></tr> <tr><td>7</td><td>purple</td></tr> <tr><td>8</td><td>grey</td></tr> <tr><td>9</td><td>red</td></tr> <tr><td>10</td><td>black</td></tr> <tr><td>11</td><td>Light blue</td></tr> <tr><td>12</td><td>Light green</td></tr> </table>	12	11	10	9	8	7	6	5	4	3	2	1	1	white	2	yellow	3	green	4	blue	5	brown	6	powder	7	purple	8	grey	9	red	10	black	11	Light blue	12	Light green
12	11																																				
10	9																																				
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1	white																																				
2	yellow																																				
3	green																																				
4	blue																																				
5	brown																																				
6	powder																																				
7	purple																																				
8	grey																																				
9	red																																				
10	black																																				
11	Light blue																																				
12	Light green																																				
CAN&RS485 T-node extension cable SDCX001-KZ- B	Diagram of CAN&RS485 T-node extension cable SDCX001-KZ-B showing a green cable with connectors J1 and J2, a central T-node connector, and a PE ground. Detailed pinouts for J1, J2, and the T-node are provided. J1 Pinout (M8 4 pin plug): <table border="1"> <tr><td>Pin4</td><td>Pin2</td></tr> <tr><td>Pin3</td><td>Pin1</td></tr> </table> J2 Pinout (M8 4 pin plug): <table border="1"> <tr><td>Pin2</td><td>Pin4</td></tr> <tr><td>Pin1</td><td>Pin3</td></tr> </table> T-node Pinout: <table border="1"> <tr><td>GND</td><td>White orange</td></tr> <tr><td>CANL/RS485+</td><td>White blue</td></tr> <tr><td>CANH/RS485-</td><td>blue</td></tr> </table>	Pin4	Pin2	Pin3	Pin1	Pin2	Pin4	Pin1	Pin3	GND	White orange	CANL/RS485+	White blue	CANH/RS485-	blue																						
Pin4	Pin2																																				
Pin3	Pin1																																				
Pin2	Pin4																																				
Pin1	Pin3																																				
GND	White orange																																				
CANL/RS485+	White blue																																				
CANH/RS485-	blue																																				

Table 4-3 Cable Selection

TSM Series Integrated Torque Servo Motor Cable Selection Table	
Cable name	Cable Wiring Definition Diagram
Converter SCM-USBCA NI-L	 USB-CAN Converter (scattered wire)
Converter SCM- USB485A-L	 USB-485 Converter (scattered wire)

TSM Series Integrated Torque Servo Motor Cable Selection Table	
Cable name	Cable Wiring Definition Diagram
Terminating resistor STRX001-120	
1. Communication cable: Used for communication with the integrated motor, connecting the integrated motor to a computer for parameter setting and debugging. 2. Power cable: Used to supply power to the integrated motor. 3. IO cable: IO pins – for connecting IO ports to the control terminal; Communication pins – for connecting communication ports to the debugging terminal. 4. Terminal resistor: Installed at the end of the communication bus line to improve anti-interference capability.	

5. Alarm Function

Table 5-1 Alarm Function List

Alarm Code	Alarm Contents	Default Alarm Type	Self reset or not
0x2300	Motor overcurrent alarm	Fault	No
0x4012310	Limited power alarm	Alarm	Yes
0x4012311	Motor overload alarm	Alarm	Yes
0x3002312	Motor stalled alarm	Pause and lock the shaft	No
0x1013210	Power supply overvoltage alarm	Fault	Yes
0x1013220	Power undervoltage alarm	Fault	Yes
0x14210	Overtemperature alarm	Fault	Yes
0x14220	Low temperature alarm	Fault	Yes
0x5080	Drive failure	Fault	No
0x5540	Flash operation failure	Fault	No
0x5541	Flash initialization failure	Fault	No
0x4005542	Flash validation error warning	Alarm	Yes
0x5543	No parameters in flash user area	Fault	No
0x4005544	The power off location is incorrectly stored	Alarm	No
0x4005545	Data saved in a power failure is not stored	Alarm	No
0x6000	Hardware initialization failure	Fault	No
0x16320	Parameter setting error	Fault	Yes
0x6321	Registration failure	Fault	No
0x7305	Z pulse fault	Fault	No
0x7306	Encoder failure	Fault	No
0x4017307	Encoder warning	Alarm	Yes
0x4017308	Encoder calibration failure	Alarm	Yes
0x17310	Overspeed	Fault	Yes
0x3017501	Communication failure	Alarm	Yes
0x4017502	Illegal address	Alarm	Yes
0x4017503	Illegal data value	Alarm	Yes
0x4017505	Confirmation in communication	Alarm	Yes
0x4017506	Slave in communication	Alarm	Yes
0x401750C	Request data is larger than mapping data	Alarm	Yes
0x401750D	The number of request data is not equal to the number of mapping data	Alarm	Yes
0x401750E	The address of the packet node is incorrect	Alarm	Yes
0x408311	Torque-limiting protection	Alarm	Yes

Alarm Code	Alarm Contents	Default Alarm Type	Self reset or not
0x8610	The origin regression timeout	Fault	No
0x8611	Out of position	Fault	No
0x3018613	Software limit error	Pause and lock the shaft	No
0x3018614	The limit switch is incorrect	Pause and lock the shaft	No
0x4018615	Curve planning calculation error	Alarm	Yes
0x18616	Target location overflow	Fault	No
0x5018617	Curve planning parameters are too small	ignore	Yes
0xFF01	Motor parameter identification failure	Fault	No
0x0401FF02	Parameter saving fault	Alarm	Yes
Note: Please refer to the corresponding communication manual for more details of alarm failure.			

6. Daily Inspection and Maintenance

Table 6-1 Detailed Schedule of Routine Maintenance and Inspection

Inspection Item	Inspection Interval	Inspection & Maintenance Points	Remarks
Vibration and Noise Inspection	Daily	Visual and auditory inspection	-
Fixing and Connections	At least once a week	Regularly check for loose screws at the motor mounting points, between the motor rotor and mechanical connections, and on the terminal block and mechanical components.	-
Visual Inspection	Once a week	Wipe with a cloth or clean with an air gun.	-
Comprehensive Inspection	At least once every 20,000 hours or once every 5 years.	-	-

Warranty Statement

Warranty Period

The product quality warranty period is 1 year from purchase. However, for motors equipped with a brake, the warranty is subject to the axis acceleration/deceleration cycles not exceeding the service life. (Within the allowable angular acceleration and deceleration, the service life is 5,000,000 cycles, referring to the number of acceleration/deceleration cycles before a sharp change in brake backlash occurs.)

Warranty Coverage

If the product is used properly in strict accordance with this manual and a fault is confirmed within the warranty period, free repair service will be provided.

Non-warranty repair cases within the warranty period:

- ① Damage caused by improper use, inappropriate repair or modification;
- ② Damage caused by dropping, impact or other transportation factors after delivery;
- ③ Damage caused by use beyond the designed specifications of the equipment;
- ④ Damage caused by fire, earthquake, lightning strike, wind disaster, chloride corrosion, abnormal voltage or other natural disasters;
- ⑤ Damage caused by intrusion of water, oil, metal or other foreign substances;
- ⑥ Damage caused by parts with standard mechanical life exceeding their respective service life.

The warranty is limited to the main body of the purchased product.

Other associated damages caused by product failure are not covered by our repair and compensation.

Important Usage Instructions

- This product is developed, designed and manufactured in accordance with standards applicable to general industrial applications. It has not been developed or tested in compliance with technical specifications for equipment and systems in special fields involving personal safety, medical treatment, national defense, military industry, etc.
- Installation, commissioning, wiring, operation, maintenance and inspection of this product must be performed by qualified personnel with relevant professional knowledge and skills.
- The tightening torque of fasteners for product installation shall be set properly according to the strength grade of screws and material of the mounting surface to prevent loosening or breakage.
- If a failure of this product integrated into equipment may cause major accidents or losses, special safety design and corresponding safety devices shall be configured before installation.
- If you plan to use this product in special applications such as nuclear power control equipment, aerospace equipment, medical equipment, high-purity equipment or other safety-related devices, you must confirm pre-sales technical details with our company fully.
- This product has passed quality control according to standard procedures to ensure stable operation. However, it may still malfunction due to unexpected external factors (such as noise interference, electrostatic shock, power fluctuation, circuit abnormality or sudden component failure). Users must implement fault protection design and ensure that the operating environment and procedures comply with safety regulations.
- If the motor shaft operates without electrical grounding, the motor bearings may suffer from electric corrosion due to the product structure and installation environment, which may lead to increased bearing noise.
- If the product is used in an environment with high concentrations of sulfur or sulfide gases (such as H_2S , SO_2 , NO_2 , Cl_2 , etc.), chip resistor open circuits or poor contact may occur due to sulfuration. Please take corresponding measures during the system design stage.
- The input voltage of this product must strictly comply with the rated parameters. If the input voltage significantly exceeds the rated range, it will cause irreversible damage to internal core components, with safety risks such as smoking and fire. Please inspect and confirm the input voltage before use.

Version Change Record

Version Number	Brief Description of Revisions	Date
A	Create	2026-03-25



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Beijing NiMotion Control Technology Co.,Ltd.