Instruction Manual for the Product

Applicable series: H series

Version: V1.0

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Preface

Thanks for choosing MYACTUATOR.

Under the premise of years of experience accumulation in serving customers, H series joint module is a highly integrated joint module provided by the company for users, which integrates external rotor motor, encoder and servo drive, and has the characteristics of compact structure, easy installation, stable operation, small size and large torque.

This manual introduces the parameters, usage methods, precautions and other information of the H series module, please read carefully before starting to operate.

If you need to know more about our company's other products, please contact us.

CN WEB

EN WEB

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Imprint Notice

 The product manual is only used as a reference for users and does not constitute the basis for meeting the user's overall usage requirements. Please be sure to evaluate it in combination with the user's overall system. The content of the manual strives to be detailed and accurate, but oversights are inevitable. If you find any errors, please provide your valuable feedback.

The company reserves the right to modify and improve this manual at any time without prior notice. For the latest version of the manual, please visit the official website (www.myactuator.com) to download it by yourself, or contact the company to obtain it.

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1. Safety precautions

This product is a high-precision product. Only professionals with corresponding qualifications can perform tasks such as installation, debugging, and maintenance. Corresponding personnel must understand and comply with IEC60364/IEC60664 and national accident prevention regulations. Please read the manual carefully before installing, operating, or repairing this product. Wrong operation may damage the module or even cause casualties. Be sure to follow the safety precautions in this manual.

This manual has the following safety symbols:

Warn! May endanger personal safety

Note! It is possible to damage the product or even the entire device

Be careful! Beware of surface temperatures

In this manual, we record hazardous situations as much as possible, and please see Table 1-1 for details. Relevant personnel are requested to understand and follow the following precautions. In addition, there are too many uncertain factors that cannot be considered and recorded. In actual application processes It is necessary to prevent and handle it according to the actual situation.

Table 1-1 Safety precautions

Unboxing	
	**Please check whether the outer packaging of the device is intact** Before unpacking, please check whether the outer packaging of the device is intact and whether it is damaged, damp, deformed, etc.
	**Please do not unbox violently** Please unpack in accordance with the hierarchical order, and violent knocking is strictly prohibited.

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	**Please check whether the module and its accessories are complete** Please refer to the list to check whether the module name is correct, whether the accessories are complete, whether there is any damage on the surface of the equipment and its accessories, etc. If there is any problem, please do not install it and contact our company in time.

Installation and maintenance phase	
	**Please assemble the module in place** When assembling the module, assemble it in place according to the screw torque standards to ensure that there will be no danger of accidental falling.
	**Do not plug or unplug the power cord while the power is on** Make sure the power indicator light goes out before wiring and maintaining the device.
	**Do not plug or unplug communication lines while the power is on** When the GND of the control terminal and the module are not connected, the voltage is inconsistent. The voltage difference between the two at the moment of connection may damage the communication interface.
	**Do not disassemble the module and its associated equipment while the power is on** It is strictly prohibited to disassemble any device or accessory of the equipment while the power is on, otherwise there is a risk of electric shock.
	**Please keep the module shell grounded and use shielding layer properly** If the module shell is not grounded, it may cause charge accumulation in the shell, affecting the normal operation of the motor, and even causing harm to the human body. The wiring cable must meet the

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	corresponding wire diameter and shielding requirements, and the shielding layer of the shielded cable must be reliably grounded.
	**Please use a multi-turn encoder power battery that meets the specifications** In order to prevent the multi-turn value from being lost due to power outage, the multi-turn encoder is powered by a specific battery with the required specification of 2.7~3.6V. Please do not use other types of batteries. If the module is damaged, our company will not provide technical support for it. .
	**It is strictly prohibited to connect the power supply to the output of the device** It is strictly prohibited to connect the power supply to the output terminal of the device to avoid damage to the device or even fire.
	**Please do a risk assessment** Please conduct a risk assessment before use and take appropriate measures to ensure personal safety and equipment safety.
	**Please observe the technical data and specifications** Please refer to the parameters of each model in the manual to set reasonable parameters to prevent damage to the module.
	**Please set appropriate protection limits** Set appropriate position limits, speed limits, current limits, etc. Exceeding the limits may damage the motor or even threaten personal safety.
	**Please perform a no-load test run before using the module** To prevent accidents, please perform a no-load test run on the module.
	**Do not disassemble or replace parts by yourself** Product failure due to abnormal use will void the warranty rights of the product.

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	**Do not hit or squeeze the module and its components with gravity** The module is a precision device. Do not use a hammer to hit the module hard. Please place it carefully to prevent the module from falling off the table and causing cracks and other damage.
	**The use environment complies with regulations** The working environment temperature of the module is -10~55℃. When the temperature is low, it is recommended to use low-temperature grease to improve the operating resistance of the module. Please keep the environment free of dust, corrosive gases, flammable gases, etc.
	**Be careful of high temperature burns** During the operation of the module, the surface may be very hot, please pay attention to protection. When the surface temperature exceeds 40℃, please avoid long-term contact, which may cause low-temperature burns. When the surface temperature exceeds 85℃, please avoid touching it, which may cause minor burns.

Storage	
	**Storage environment meets standards** Please refer to the manual to strictly require transportation and storage temperature and humidity, and avoid direct sunlight, strong magnetic fields, strong electric fields, strong vibrations and other places.
	**Storage time should not be too long** Avoid storing time for too long. If the storage time is too long, please take more stringent protective measures and necessary inspection and maintenance.
	**Do not mix and transport equipment that may cause damage** Please pack the module strictly before transporting it. It is strictly prohibited to transport it mixed with equipment that may affect it.

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	**Regular inspection and maintenance** Please perform daily and regular inspection and maintenance on the module, and keep maintenance records.

Others	
	**Do not remove the anti-tear warranty label** Do not remove the anti-tear warranty label, otherwise you will lose your warranty rights.
	**Please dispose of it as industrial waste** Please dispose of the module and its accessories as industrial waste.

2. Quality Assurance

2.1. After-sales policy

This product strictly implements the following after-sales services in accordance with the “Law of the People's Republic of China on the Protection of Consumers' Rights and Interests” and the “Law of the People's Republic of China on Product Quality”.

①All users who purchase this product can enjoy the return and exchange service if there is a product quality problem within 7 days. When returning or exchanging, you should provide a valid proof of purchase and return invoice, and ensure that the returned product has intact functions, no damage to appearance, and complete accessories;

②Users who purchase this product will enjoy free warranty service within one year from the day after receipt. In the event of man-made damage, manual disassembly, etc., no warranty service will be provided; if after testing, it is confirmed that the motor needs to be replaced, the merchant will need to negotiate with customers whether to purchase additional repair parts;

③If there is a quality problem with the product within 7 to 15 days from the day after receipt, you can enjoy the exchange service after confirmation. When exchanging goods, you should provide a valid proof of purchase and return invoice, and ensure that

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the returned product has intact functions, no damage to appearance, and complete accessories;

④The following situations are found not to be covered by the warranty:

●Failure to install and connect other control equipment according to the requirements of the user manual may cause the motor to burn out;
●When used, the specifications or standards shown in the user manual are exceeded (such as wrong motor parameter settings);
●The storage method and working environment exceed the specified range in the user manual (such as pollution, salt damage, condensation, etc.);
●Product damage caused by abnormal working conditions (such as falling, impact, liquid intrusion, violent impact, etc.);
●Product damage caused by force majeure (natural disasters, fires, floods, etc.);
●Users dismantle the product by themselves, causing damage to the motor;
●Exceeds the warranty period provided by the post-sale policy;
●Unable to provide valid proof of purchase;
●Failures other than those mentioned above are not caused by Suzhou Micro Actuator Technology Co., Ltd.'s responsibility.

In the event of a joint module failure, you must contact Suzhou Micro Actuator Technology Co., Ltd as soon as possible to obtain a solution. Users are not allowed to disassemble and assemble the joint module for any reason, otherwise the warranty service will be terminated.

2.2. Disclaimer

Please read this statement carefully before use. Once used, it is deemed to be recognition and acceptance of the entire content of this statement. Please install and use this product in strict compliance with the manual, product instructions, and relevant laws, regulations, policies, and guidelines. In the process of using the product, users promise to be responsible for their own actions and all consequences arising therefrom. Myactuator will not be held legally responsible for any losses caused by improper use,

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installation, or modification by users. The final right to interpret the disclaimer belongs to Myactuator.

3. Basic parameters of the module

The H series module integrates a frameless torque motor, absolute encoder and servo driver. It has a compact structure, strong integration, and is easy to install. H series modules are currently available in H-50-15, H-70-15, H-90-15, making robot development more convenient and flexible.

3.1. Module nameplate and model

Table 3-1 shows the models of this series.

Table 3-1 Product model description

Model	Abbreviation
RMD-H-50-15-90-C	H-50-15
RMD-H-70-15-200-C	H-70-15
RMD-H-90-15-250-C	H-90-15

The nameplate of this series model is as follows.

RMD	-	H	-	50	-	15	-	90	-	C
Brand name		Hollow series		Pedestal number		Stator height		Motor power		Communication

Taking RMD-50-15-90-C as an example, the module product model parameters are explained in Table 3-2, the abbreviations H-50-15, H-70-15, and H-90-15 are used hereinafter.

Table 3-2 Product Model Parameter Explanation

Parameter	Explanation
RMD	The brand name of Myactuator.
H	Hollow series module.
50	There are three pedestal models: 50, 70 and 90.
15	The stacking height of the stator, the unit is mm.

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90	Motor power, this series of 50, 70, 90 three corresponding to 90, 200, 250 power.
C	Indicates the communication interface type of the module, which is CANBUS.

3.2. Module appearance size

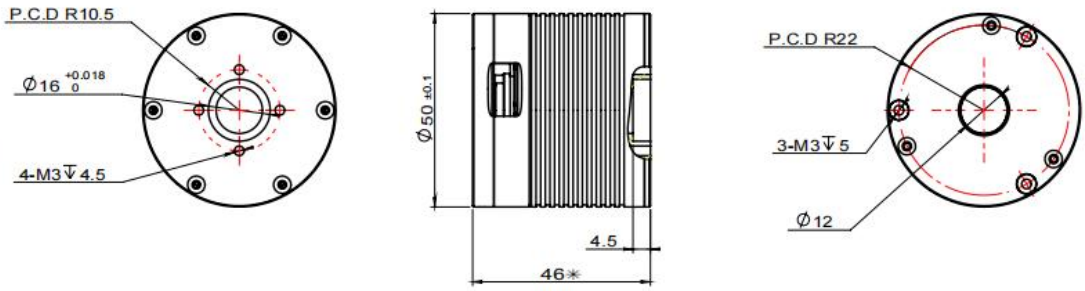

Figure 3-1 H-50-15 appearance dimension drawing

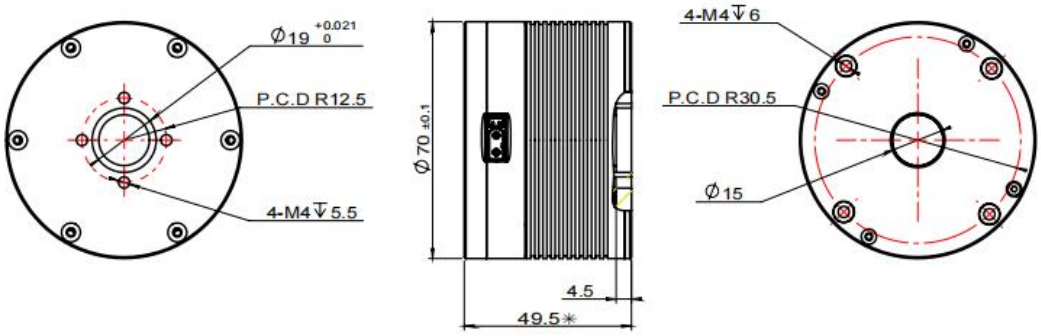

Figure 3-2 H-70-15 appearance dimension drawing

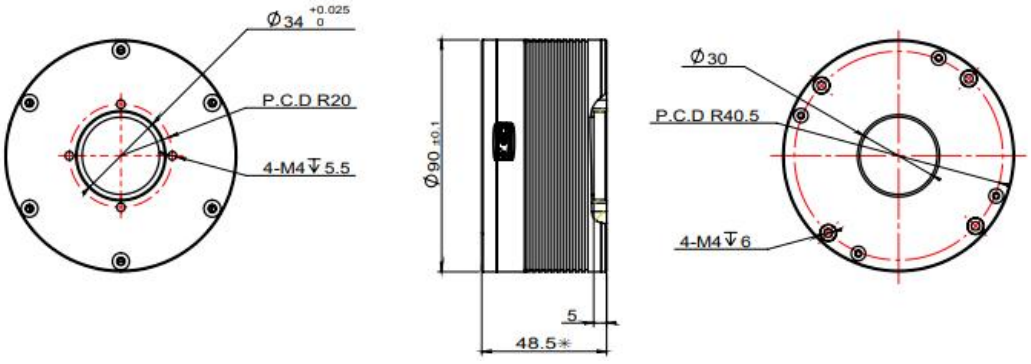

Figure 3-3 H-90-15 appearance dimension drawing

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3.3. Module parameters

Table 3-3 Module parameter list

Parameter	H-50-15	H-70-15	H-90-15
Input Voltage(V)	24	48	48
Peak Speed (RPM)	3200	2550	2250
No-load Current (A)	0.4	0.6	0.8
Rated Speed (RPM)	2500	2400	1600
Rated Torque (N.m)	0.35	0.8	1.5
Rated Power (W)	91.6	200	252
Rated Current (A)	4.9	4.4	6.6
Peak Torque (N.m)	0.9	2	3.75
Peak Current (A)	12.4	12.3	19.8
EMF constant (Vdc/Krpm)	7.93	17	21.1
Torque constant (N.m/A)	0.07	0.18	0.23
Wire Resistance (Ω)	0.4	0.5	0.35
Line Inductance (mH)	0.19	0.55	0.28
Polar	13	13	16
Cogging torque (mN.m)	12	30.83	64
Wiring Method	Y		
Maximum axial load (N)	489	1870	2350
Maximum radial load (N)	100	440	770
Inertia (Kg.cm^2)	0.005	0.01	0.05
Encoder type and interface	ABS-17bit		
Repeatability	< 0.01 Degree		
Communication method	CAN		
Weight (kg)	0.24	0.47	0.71
Length (mm)	46	49.5	48.5

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Outer diameter (mm)	50	70	90
Wire hole diameter (mm)	16	19	34
Insulation level	F		

3.4. Output characteristic curves

The following is the output characteristic curves of H series modules.

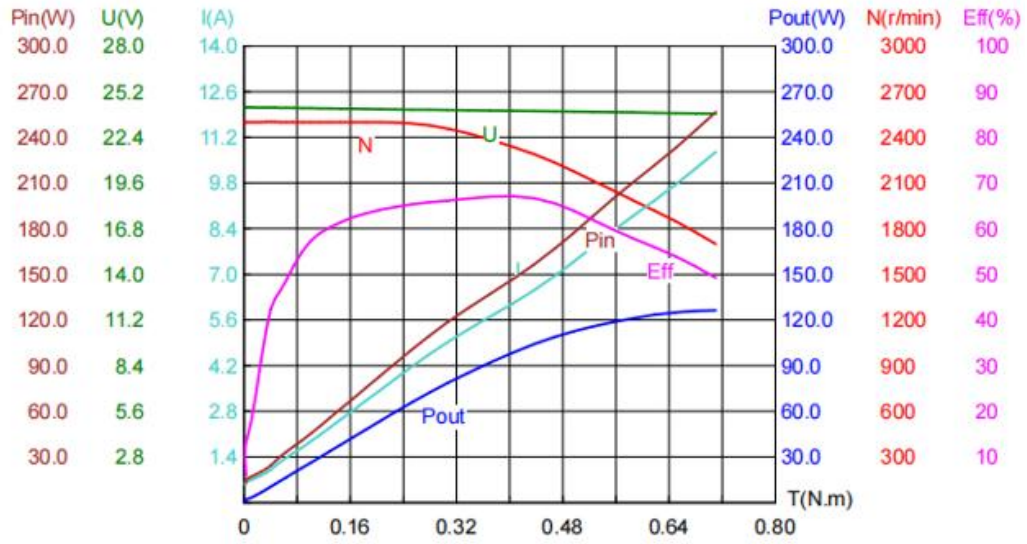

Figure 3-4 H-50-15 module output characteristic curve

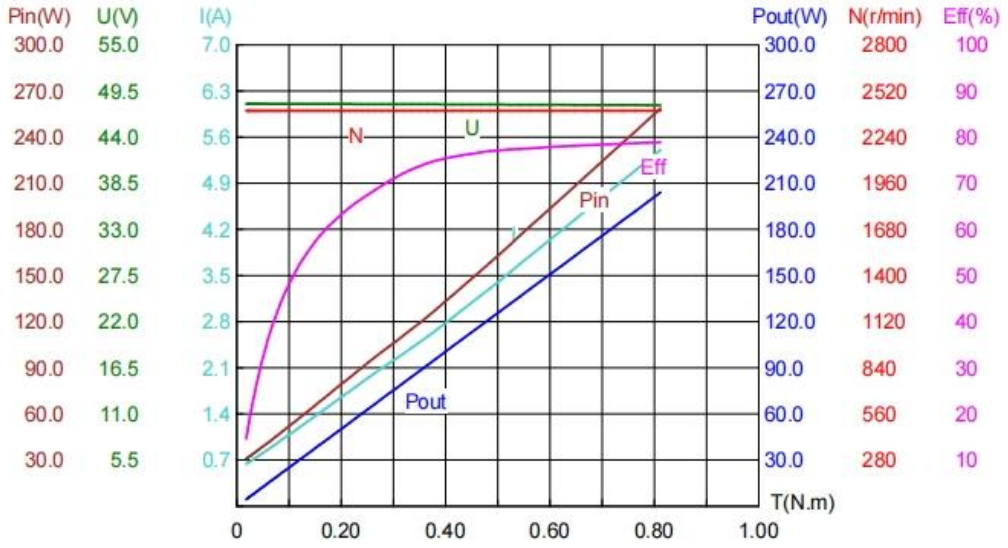

Figure 3-5 H-70-15 module output characteristic curve

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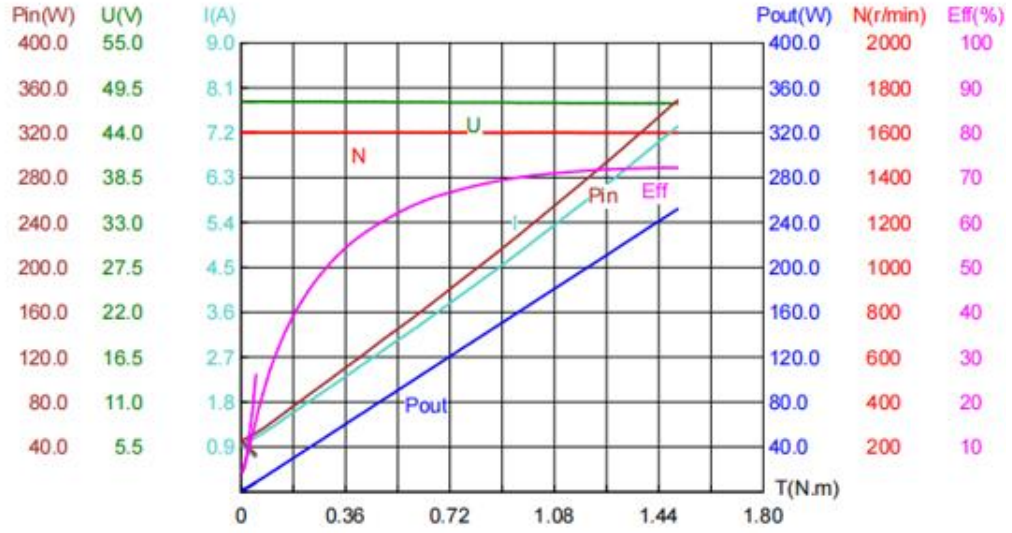

Figure 3-6 H-90-15 module output characteristic curve

3.5. Temperature rise characteristics

The following is the temperature rise data of some models of modules. The test method is to give the module a specific load at room temperature (25°C) and test its temperature rise after a certain holding time.

Table 3-4 H-50-15 temperature rise test data

Load	Torque (Nm)	Output Maximum Speed(RPM)	Time (h)	Temperature (°C)
1.0x	0.35	2500	1h	28-62

Table 3-5 H-70-15 temperature rise test data

Load	Torque (Nm)	Output Maximum Speed(RPM)	Time (h)	Temperature (°C)
1.0x	0.8	2400	1h	29-68

Table 3-6 H-90-15 temperature rise test data

Load	Torque (Nm)	Output Maximum Speed(RPM)	Time (h)	Temperature (°C)
1.0x	1.5	1600	1	29-77

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Concentrate:

1. Test conditions: the speed of the motor remains the same, after 10s of load operation, 5s of no-load operation, and 1h cycle test.

2. The test bench is made of metal, which has good thermal conductivity, which helps the heat generated by the motor to be transferred out faster during operation, so the above temperature is for reference only.

4. Mechanical installation requirements

Please carry out structural design and assembly based on the drawings of each model module provided by our company. Please refer to this chapter for details of the screw types and techniques required for assembly. During the assembly process, all fixed screws must be threaded with thread glue, and the position of thread glue must be consistent, and the amount of thread glue must be consistent. Use the diagonal method to tighten the screws. The specific tightening steps are as follows:

1. Tighten the screw to the end but do not tighten it;

2. Slightly tighten the screws in diagonal steps;

3. Tighten the screws using a torque wrench in diagonal steps.

Foreign matter such as metal shavings, dust particles, various types of sealant, etc. may be stuck to the installation surface, which will prevent reliable cooperation between the installation surfaces and further cause jitter and noise of the module. Therefore, please clean the installation surface carefully before installation.

5. Electrical installation requirements

5.1. About the input power supply

The power supply uses 48VDC power supply, and the maximum withstand voltage of the module power interface is DC60V, and the input voltage exceeds 60V, which can easily lead to driver failure. When a switch is used to control the joint for power, there may be an over voltage at the moment of power-up shock, this power supply mode needs to connect an electrolytic capacitor in parallel after the switch and before the joint

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power input (reference specification: 820uF, 50V; 1000uF, 100V), as shown in Figure 5-1, to suppress overshoot of the input voltage at the moment of power-up phenomenon.

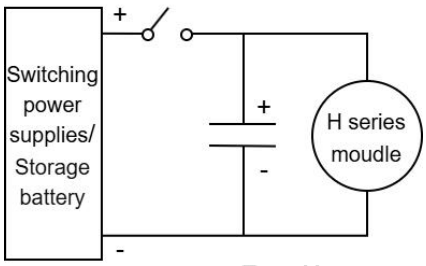

Figure 5-1 Protection circuits in the case of switching power supplies

There is no need to consider the effect of back EMF when using battery power, because the back EMF of the module directly charges the battery. In order to make the system more safe and reliable, the over voltage/under voltage protection voltage of the module can be modified according to the actual test situation, and the modification method is as follows: debugging the host computer - advanced parameters - protection parameters - over voltage/under voltage protection voltage, as shown in Figure 5-2.

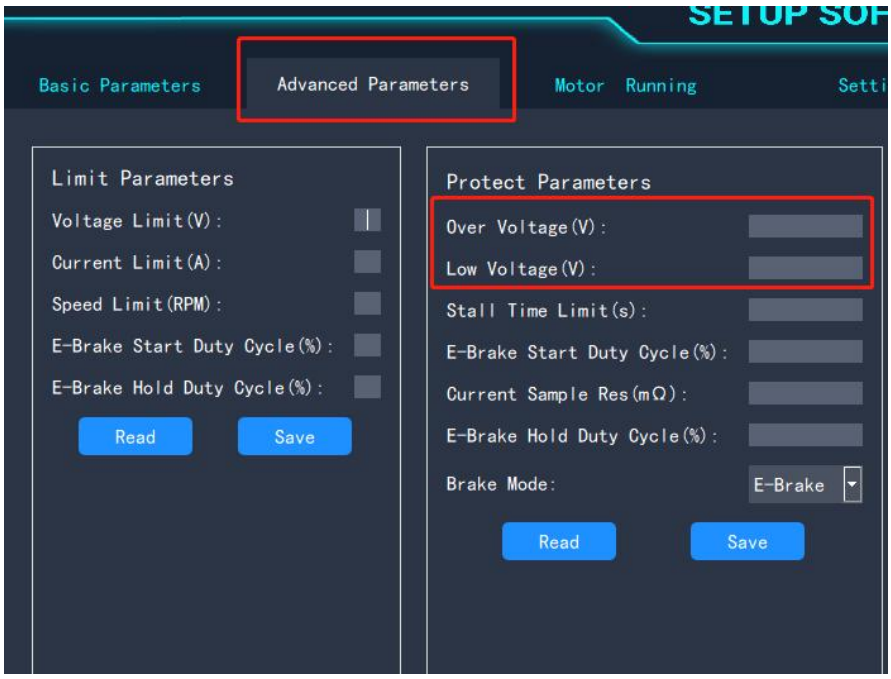

Figure 5-2 Schematic diagram of over voltage/under voltage protection voltage modification

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5.2. Interface description

The interface is described as follows.

Table 5-1 H-50-15 interface description

	Port	Port description
	VCC	The positive pole of the power supply
	GND	The negative pole of the power supply
	CAN_H	CAN network signal interface
	CAN_L	CANnetwork signal interface

Table 5-2 H-70-15、H-90-15 interface description

	Port	Port description
	VCC	The positive pole of the power supply
	GND	The negative pole of the power supply
	CAN_H	CAN network signal interface
	CAN_L	CAN network signal interface

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5.3. Indicator Description

Table 5-3 Explanation of the status of the indicator

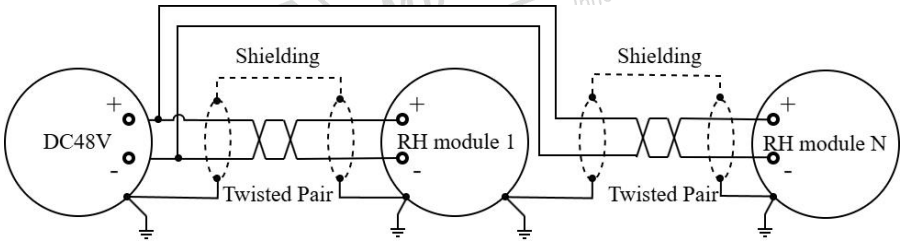
Expression	Situation
The green light is always on	The motor is operating normally
The green light flashes rapidly	There is a level 1 error in the motor
The green light flashes slowly	There is a level 2 error in the motor

If there is an error in the operation of the motor, please read the specific error information from the host computer or CAN command, and refer to the "Setup Software Instruction Manual" and "Servo Motor Control Protocol" for the specific error reason.

6. Cable connection between multi-joint modules

6.1. Description of the power supply wiring

There are two power wiring modes for this series of joint modules: single-axis direct connection and chain topology connection, as shown in Figure 6-1. When it is applied to the collaborative work of multiple modules, the performance of the two wiring methods is different, the wiring resistance of single-axis direct connection is small, and the line loss voltage drop is small; The chain topology has a bit large wiring resistance and a little large line loss voltage drop, so it is recommended to use a single-axis direct connection for high-power modules and a chain-type topology connection for low-power modules. Note: Do not connect to other electrical devices in series, as it may cause unpredictable voltage drops or voltage boosts that may cause module failure.



(a)Schematic diagram of a single-axis direct connection

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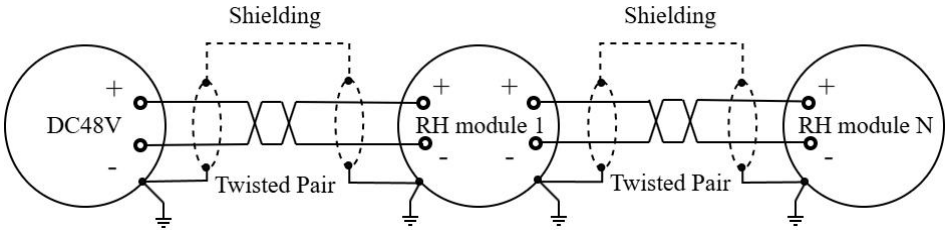

(b)Schematic diagram of the chain topology

Figure 6-1 Schematic diagram of multi-module power supply

6.2. CAN communication wiring instructions

The CAN communication line is made of twisted pair cables, which are shielded separately, and it is important to ensure that the ID of each module is unique before establishing CAN communication. In addition, the CAN communication controller and module use the ground connection method for power supply, as shown in Figure 6-2. In order to eliminate signal reflections in the communication cables, a 120Ω termination resistor is required in parallel at the CAN communication interface of both the controller and the end module.

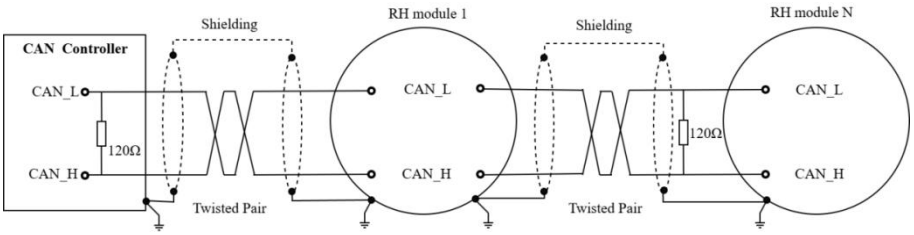

Figure 6-2 Schematic diagram of CAN communication wiring

7. Kinetic Energy Recovery

7.1. Reasons for kinetic energy recovery

During normal operation of the module, the power supply outputs electrical energy to it. When the module is operating in deceleration, the circuit loop engages in the process of kinetic energy recovery. Figure 7-1 shows a simplified circuit diagram of the module during normal operation and deceleration. The amount of kinetic energy recovered is related to torque and rotational speed, and it is directly proportional to the product of torque and rotational speed. Therefore, the faster the speed and the greater

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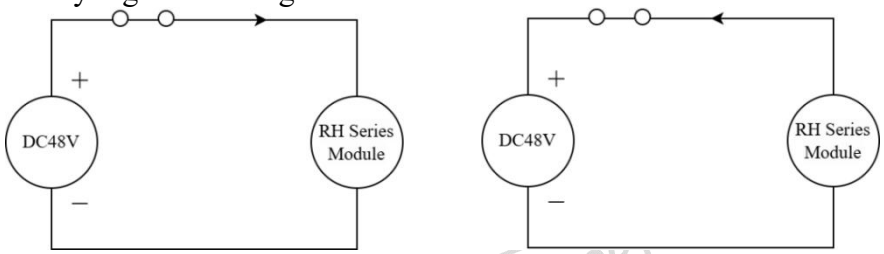
the load, the more kinetic energy is recovered. If the power supply voltage rises above the maximum allowable bus voltage set by the drive, the module will report an error for excessively high bus voltage.



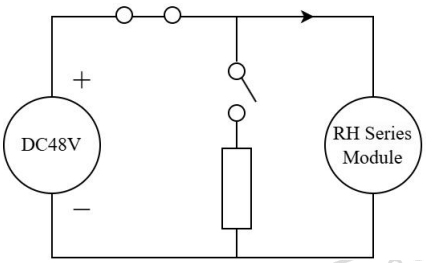
(a)Normal operating state (b)Deceleration operating state

Figure 7-1 Diagram of module operating states

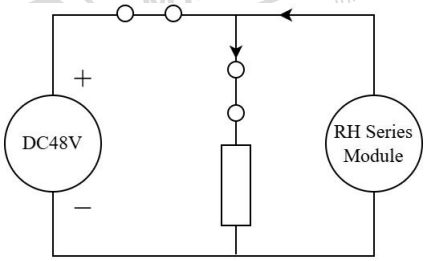
7.2. Handling methods

1. Adding a bleeder resistor

By paralleling a resistor, when the module is in a deceleration operating state, the recovered kinetic energy is consumed through the resistor, thereby preventing the power supply voltage from becoming too high due to kinetic energy recovery. As shown in Figure 7-2, the disconnection/connection of the resistor can be operated through a logic control circuit.



(a) The resistor is disconnected when the voltage is normal



(b) The resistor is connected when the voltage is too high

Figure 7-2 Diagram of module operating state with bleeder resistor connected

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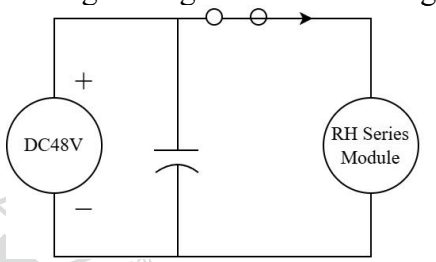
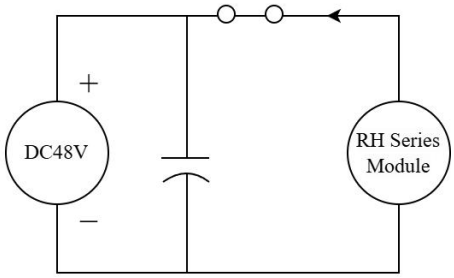
2. Adding a super capacitor

During normal operation, the switching power supply supplies power to both the super capacitor and the module. When the module is in a deceleration operating state, the super capacitor rapidly recovers part of the kinetic energy, thereby preventing the power supply voltage from becoming too high. As shown in Figure 7-3.



(a) Charging the capacitor when the voltage is normal

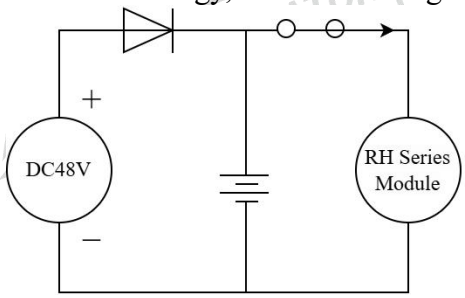


(b) Capacitor kinetic energy recovery when the voltage is too high

Figure 7-3 Diagram of module operating state with super capacitor added

3. Adding a storage battery

During normal operation, both the switching power supply and the storage battery supply power to the module simultaneously. When the module is in a deceleration state, the storage battery recovers the kinetic energy, as shown in Figure 7-4.



(a)Storage battery powers the system when the voltage is normal

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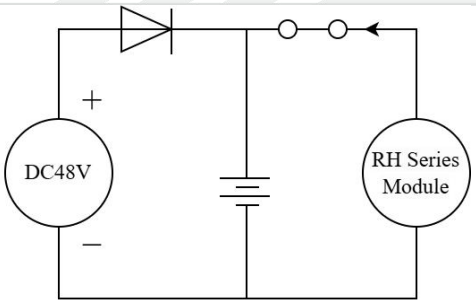

(b)Storage battery recovers kinetic energy when the voltage is too high

Figure 7-4 Diagram of module operating state with storage battery added

8. Encoder Description

8.1. Resolution and Position Feedback

The resolution of the module encoder is more than 17bit, and the resolution refers to the number of positions output by the rotation of the motor shaft, that is, the number of positions output by the module of this series of modules in one circle is 2^{17}, the position change range is 0~131071, and the conversion formula between the angle and the single turn position is:

$$\text{single turn position} = \text{angle} \div 360 \times 131072$$

For example, a lap angle of 30° corresponds to a lap position of $30 \div 360 \times 131072$.

8.2. Instructions for the use of the mechanical zero calibration function

Users can use the mechanical zero point calibration function to flexibly set the mechanical zero point value according to the use of the module, and there are two ways to set it:

1. Connect and debug the setup software, and set the zero point in the basic parameter interface, see the "Setup Software Instruction Manual" of the company for details;

2. CAN command setting, please refer to our company's "Servo Motor Control Protocol" for details.

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9. Connect and debug the Setup Software

Please download the latest debugging software from the company's official website, and the installation and debugging method is detailed in the "Setup Software Instruction Manual".

10. Communication Instruction Description

The RH series module adopts our company's customized communication instructions, and the communication control instructions are detailed in the "Servo Motor Control Protocol".

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