MJBX series

Rotary Actuator

泰科机器人
TECH ROBOTS

Operation Instruction

PREFACE

Thank you for purchasing and using the MJBX Series Rotary Actuator of our company. We will provide you with high - quality product services.

About the MJBX series Rotary Actuator

The MJBX Series Rotary Actuator is a robot joint launched by our company. It is designed based on the modular concept, featuring light weight and high precision.

The integrated MJBX Series Rotary Actuator not only boasts a compact structure, easy installation and high cost-effectiveness, but also helps you save costs invested in multiple links of collaborative robot development, such as design and assembly. Meanwhile, we continuously upgrade, optimize our products and provide customized services to offer a richer range of product options, enabling you to design your robots in a more free and flexible way.

About this Instruction

This instruction is intended for the users, commissioning personnel, and maintenance personnel of the robot joint actuator.

The Main Contents Of this Instruction Include:

1. Safety precautions and warranty information for the MJBX Series Rotary Actuator;
2. Introduction of the MJBX Series Rotary Actuator;
3. Installation of the MJBX Series Rotary Actuator;
4. Troubleshooting and handling methods for common faults of the MJBX Series Rotary Actuator.
5. User Manual/operating Instructions of the MJBX Series Rotary Actuator.

More Information

If you need to know more information and materials about our company and other products, the contact information is as follows:

- Company full name: Techrobots (Shenzhen) Co., Ltd.,
- Address: 2nd Floor, Building 12, Nangang NO.2 Industrial Park, 1026 Songbai Road, Nanshan District, Shenzhen, China
- Tel: +86 (755) 26712958
- After sales Technology: +86 189 2524 7616
- Email：tech@techsoft-robots.com
- Website: www.tech - robots.com

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Version Description

Version	Release Time	Revision Details
V1.0	2025/03/07	First Revision
V1.1	2025/04/29	Update the series project code, add model descriptions, update the specification parameters for models without force control, update the interface definition description and diagrams of the drivers used in the joints, and update the wire color specifications for the communication cables.
V2.0	2025/06/18	1.The drivers used for MJB20 and MJB25 have been updated to version MJB20-25 V1.1, with the interface definition descriptions and diagrams updated accordingly. 2.The drivers used for MJB14 and MJB17 have been updated to version MJA14-RGT V2.3, with the interface definitions and diagrams of their RS232 and analog interface terminals updated.
V2.1	2025/08/15	1.Add the wire color definition for the force control sensor cable and include the corresponding schematic diagram. 2.Revise the power cable wiring specification for MJB20 and MJB25 to 18AWG. 3.Update the Model of the discharge version. 4.Replace the picture in the model description with a table format.

Table of Contents

Chapter 1 Safety Information

Before installing and using the MJBX series Rotary Actuator, please carefully read the information in this chapter. The following lists the necessary safety information for using the MJBX series Rotary Actuator. This information is intended to protect you, the drive, and related equipment when you use the product. Incorrect use may lead to personal injury or property damage.

Warning! Danger signs that pose a risk to human safety during operation, as well as instructions for use to prevent such situations from occurring.

Attention! Danger signs indicating that the drive may damage the product or equipment, as well as the usage instructions to avoid such situations.

Attention! This area is indicated to be sensitive to static electricity, and it is required to handle it in an environment with static electricity protection.

1.1 Warnings

Warning! The voltage of the driver may cause an electric shock! When the power is turned on, do not directly touch the live parts.

Warning! To avoid the risk of arc discharge, do not connect or disconnect the wiring between the driver and the power supply when the power is turned on!

Warning! The surface of the driver may get hot during operation.

Warning! During the operation of the driver, the controlled motor is in motion. Please keep away from all moving parts to avoid injury.

Special Warning!

1.2 Precautions

Attention! To be operated by professionals

Only professionals with corresponding qualifications are permitted to carry out tasks such as transportation, assembly, setting, and maintenance. Qualified professionals refer to those who are familiar with the transportation, installation, assembly, commissioning, and operation of the motor and possess the relevant minimum qualifications required to fulfill their duties:

■ Transportation: It can only be carried out by personnel with knowledge of handling electrostatic - sensitive components.

■ Mechanical installation: It can only be carried out by personnel qualified in mechanics.

■ Electrical installation: It can only be carried out by personnel qualified in electrical engineering.

■Setting: It can only be carried out by qualified personnel with knowledge of electrical engineering and drive technology.

Qualified personnel must be aware of and comply with IEC60364/IEC60664 and national accident prevention regulations.

Read the documents: Read the corresponding documents before installation and commissioning. Incorrect use of the motor may cause harm to people or property damage. Therefore, the operator must ensure that all personnel working on the motor have read and understood this instruction and comply with the safety instructions in this instruction.

Attention! Comply with technical data and specifications

Comply with the technical data and specifications regarding connection conditions (please refer to the nameplate and relevant sections in this document). Exceeding the permitted voltage or current values may damage the motor, such as causing overheating.

Attention! Conduct a Risk Assessment

Machine manufacturers must conduct a risk assessment of the machine and take appropriate measures to ensure that unexpected movement does not cause any personal injury or property damage. Through the risk assessment, additional requirements may be imposed on professionals.

Attention! Safe Transportation

Only use lifting tools to lift and move equipment weighing over 20kg. Lifting without assistance may cause back injuries.

Attention! Beware of High Surface Temperatures

During operation, depending on their protection class, the surfaces of the motors can become extremely hot. Be cautious of burns when touching them.

Attention! Joint Stroke Limit

When the MJBX series Rotary Actuator is used as a single axis, it can rotate continuously in either direction. However, when the device is integrated into a robot with multiple axes/degrees of freedom and the "daisy chain" wiring at the center of the output plate is used to connect joint-to-joint or joint-to-arm, the maximum rotation angle in either direction is +/- 360° (mechanical). Exceeding this angle limit may damage the wiring and void the warranty.

Chapter 2 Product Warranty

2.1 Product Quality Assurance

The MJBX series Rotary Actuator comes with a 12 - month limited warranty.

If within 12 months after the Rotary Actuator is put into use, defects occur due to poor manufacturing or materials, Techrobots shall provide necessary spare parts for replacement or repair of the relevant components. However, if the equipment defects are caused by improper handling or failure to follow the relevant information stated in the user guide, this product quality assurance shall become invalid.

Without violating the principles of this product quality assurance, if the product is beyond the warranty period, Techrobots reserves the right to charge the customer for replacement or repair costs.

The ownership of the replaced equipment or components returned to Techrobots shall belong to Techrobots.

Outside the warranty period, if the equipment shows defects, TechRobots Intelligent shall not be liable for any damages or losses caused thereby, including but not limited to production losses or damage to other production equipment.

2.2 Disclaimer

Techrobots is committed to continuously improving product reliability and performance, and thus reserves the right to upgrade products without prior notice. Techrobots endeavors to ensure the accuracy and reliability of the content in this instruction, but shall not be held responsible for any errors or omissions therein.

Failures resulting from the following situations are not covered by this warranty:

1. Installation, wiring, or connection to other control devices not in accordance with the requirements of the user instruction.
2. Use beyond the specifications or standards indicated in the user instruction.
3. Product damage caused by improper transportation.
4. Damage caused by accidents or collisions.
5. Natural disasters such as fires, earthquakes, tsunamis, lightning strikes, strong winds, and floods.
6. Failures caused by reasons other than the liability of Tech - Robots Intelligent apart from the above - mentioned situations.

Chapter 3 Introduction of MJBX series Rotary Actuator

3.1 Overview of the MJBX series Rotary Actuator

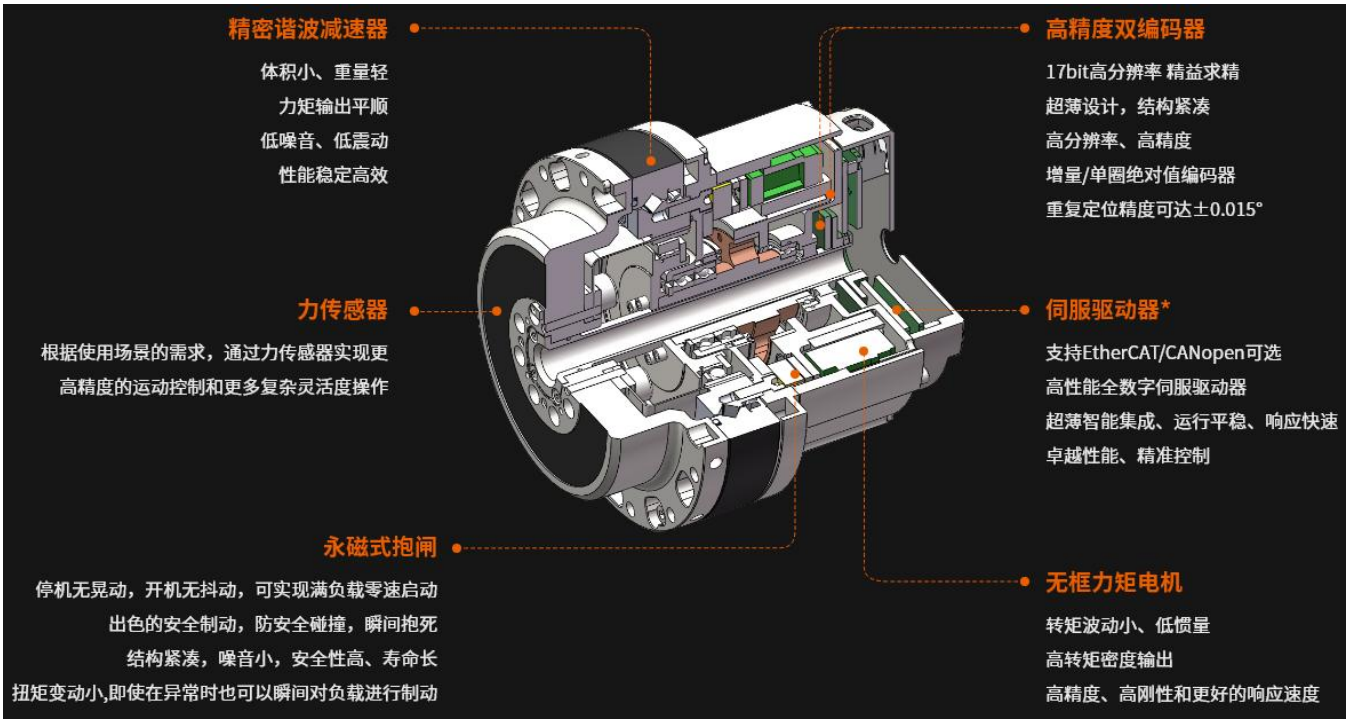


Figure 3.1-1 Cross-sectional diagram

The MJBX series Rotary Actuator integrates a harmonic reducer, frameless torque motor, incremental encoder, absolute encoder, and servo driver into one unit, featuring a compact structure for easy installation. It adopts independently developed servo drivers and dual encoders to achieve full closed-loop control, with a single-joint repeat positioning accuracy of less than 60 arcseconds. The MJBX series Rotary Actuator is available in multiple models including 14, 17, 20, and 25, making robot development simpler, more convenient, and more flexible.

Harmonic Reducer

It features a hollow and ultra-flat design, with advantages such as a large transmission ratio, stable transmission, minimal and uniform tooth surface wear, high transmission efficiency and precision, and small backlash. It is often used as a rotating joint for robot shoulder and elbow joints, among other applications.

Force Sensor

Based on the requirements of the application scenario, higher-precision motion control and more complex and flexible operations are achieved through force sensors.

Frameless Torque Motor

It features a hollow, ultra-thin design with a large inner bore, which can reduce the size of robot joints, lighten the robot's weight, and improve its movement efficiency.

Servo Driver

The servo driver is integrated inside the rotary actuator, utilizing a 48V DC power supply for power and

CANopen/EtherCAT bus control. Since there is no need to equip each joint axis of the robot with a separate servo driver, this saves a significant amount of electrical cabinet installation space and makes the equipment system much more compact. As the power and communication ports of multiple joint modules can be connected in series according to a daisy-chain topology, and coupled with the hollow-shaft frameless motor and harmonic reducer used in the MJBX, the electrical cables of the robot arm joints integrated with MJBX series Rotary Actuator can be directly routed in series inside the cavity of the robotic arm—rather than being hung side by side on the surface of the robotic arm like traditional robots. This not only results in a very neat appearance of the robot but, more importantly, reduces the motion load of the robot during operation, as there are no twisting and bending of multiple parallel cables at the joints. At the same time, the reduced number of cables will also lighten the weight of the robotic arm, all of which help improve the robot's working efficiency.

Note: The servo drivers for some models are external. Customization is supported; For details, please consult the sales or technical staff of Tech Robot.

Encoder

The output end of the MJBX adopts 17-bit absolute encoder feedback, enabling a repeat positioning accuracy of ±0.015°. Meanwhile, the MJBX is equipped with one encoder each at its input end and output end internally.

3.2 Packing List of the MJBX series Rotary Actuator

- MJBX Rotary Actuator*1，Please consult the sales if additional accessories are required.
- EtherCAT Communication Accessories*1（EtherCAT Version Options）
- CANopen Communication Accessories*1（CANopen Version Options）
- Serial Port Cable*1

3.3 Technical Parameters of MJBX series Rotary Actuator

3.3.1 Force Control-Enabled Specification Parameters

Parameter type	Unit	MJB14T	MJB17T	MJB20T	MJB25T
Harmonic Reducer Parameters					
Reduction Ratio	--	100	120	120	120
Gearbox Backlash	arcsec	≤20	≤20	≤20	≤20
Transmission Accuracy	arcmin	＜1	＜1	＜1	＜1
Average Lifespan	Hour	20000	20000	20000	20000
Output Capability					
Permissible Starting and Stopping Torque	N·m	34	66	108	207
Average Load Torque	N·m	13.5	49	80	133
Maximum Instantaneous Torque	N·m	66	107	182	376
Maximum Allowable Bending Torque	N·m	80	140	230	420
Rated Speed	rpm	35	29	35	24.5
Maximum Speed	rpm	40	33	40	29.1
Repeatability	arcsec	<60	<60	<60	<60
Absolute Positioning Accuracy	arcsec	<300	<300	<300	<300
Servo System					
Motor Power	W	100	180	250	500

Rated Voltage	VDC	48	48	48	48
Rated Current	A(rms)	3.8	5	8	10.5
Peak Current	A(rms)	8.8	14.5	15	25.8
Incremental Encoder	P/R	8000	8000	8000	8000
Absolute Encoder	Bit	17	17	17	17
Communication Protocol		CANopen / EtherCAT			
Dimensions					
Diameter	mm	70	80	90	110
Length	mm	88	99.3	92.8	107.6
Through Hole Diameter	mm	7	7	7	9.8
Weight	kg	0.84	1.2	1.5	2.3
Single - Dimensional Force Sensor					
Supply Voltage	VDC	5	5	5	5
Rated Load	Nm	17	60	110	210
Response Time	Hz	5000	5000	5000	5000
Accuracy	-	±0.1%FS	±0.1%FS	±0.1%FS	±0.1%FS
Other Specification					
Brake		Permanent Magnet Brake			
IP Degree		IP40			
Operating Environment		Operating Temperature: 0～40°C (Optional: -40 to 60°C) Storage Temperature: -40～ 80°C Ambient Humidity: 90% Relative Humidity (Non-condensing)			

Pls informed that we provide OEM/ODM customization services. If you have other technical requirements, please contact us for consultation.

3.3.2 Specifications and parameters without force control

Items	Unit	MJB14B	MJB17B	MJB20B	MJB25B
Parameters of Harmonic Drive Reducer					
Reduction Ratio	--	100	120	120	120
Gearbox Backlash	arcsec	⩽20	⩽20	⩽20	⩽20
Transmission Accuracy	arcmin	＜1	＜1	＜1	＜1
Average Lifespan	Hour	20000	20000	20000	20000
Output Capability					
Permissible Starting and Stopping Torque	N • m	34	66	108	207
Average Load Torque	N • m	13.5	49	80	133
Maximum Instantaneous Torque	N • m	66	107	182	376
Maximum Allowable Bending Torque	N • m	80	140	230	420
Rated Speed	rpm	35	29	35	24.5
Maximum Speed	rpm	40	33	40	29.1
Repeatability	arcsec	<60	<60	<60	<60

Absolute Positioning Accuracy	arcsec	<300	<300	<300	<300
Servo System					
Motor Power	W	100	180	250	500
Rated Voltage	VDC	48	48	48	48
Rated Current	A(rms)	3.8	5	8	10.5
Peak Current	A(rms)	8.8	14.5	15	25.8
Incremental Encoder	P/R	8000	8000	8000	8000
Absolute Encoder	Bit	17	17	17	17
Communication Protocol		CANopen/EtherCAT			
Dimensions					
Diameter	mm	70	80	90	110
Length	mm	88	99.3	92.8	107.6
Through Hole Diameter	mm	7	7	7	9.8
Weight	kg	0.84	1.2	1.5	2.3
Other Specification					
Brake		Permanent Magnet Brake			
Sensor		None			
IP Degree		IP40			
Operating Environment		Operating Temperature: 0～40°C (Optional: -40 to 60°C), Storage Temperature: -40～ 80°C, Ambient Humidity: 90% Relative Humidity (Non-condensing)			

Pls informed that we provide OEM/ODM customization services. If you have other technical requirements, please contact us for consultation.

3.4 Model Description of MJBX series Rotary Actuator

MJB	14	T	-100	-2	E	SA17	D5	E	-RevB1
Series	Model	Force Sensor Brake	Reduction Ratio	Motor Voltage	Incremental Encoder	Absolute Encoder	Drive Model	Default Communication Config.	Version Number
MJB	14 17 20 25	A： No Force Sensor and no Brake B：No Force Sensor but with a Brake C: With Force Sensor but no Brake D: With Force Sensor and a Brake	100/120/160	2:24V 4:48V	E:：with Incremental Encoder Empty：without Incremental Encoder	S:Single Turn M:Multi-Turn A:Absolute Value 17:Encoder Single-	D5：MJA-RGT D9：MJB20-25	E: EtherCAT C：CANopen	A1：Design Version Number

Sample： MJB14T-100-2E-SA17-D5E-RevB1

Chapter 4 Installation of MJBX series Rotary Actuator

4.1 Mechanical installation

Please conduct structural design and assembly in combination with the drawings of various models of actuators provided by our company.

In a joint-to-joint configuration, when assembling multiple MJBX joint modules together or adding an arm to the output plate of an MJBX joint module, the required screw specifications and tightening torque values are listed in the table below. It is recommended to use hexagon socket steel screws with a corrosion-resistant coating such as zinc.

Model	Fastener Size	Torque
MJB14T	M3	2.3N.M
MJB14B	M3	2.3N.M
MJB17T	M3	2.3N.M
MJB17B	M3	2.3N.M
MJB20T	M3	2.3N.M
MJB20B	M3	2.3N.M
MJB25T	M4	5N.M
MJB25B	M4	5N.M

Figure 4.1-1 List of MJBX Mounting Screws

Note: It is recommended to apply removable thread-locking adhesive to all screws.

Joint Cascade Installation Example

1）Secure each joint to the connected arm rod.

2）Pass the joint's power cables and communication cables through the opening in the arm rod, feeding them through both the top and bottom. Organize and secure the cables properly to avoid pinching.

3）After confirming that the cables are not pinched, apply even force to assemble the joint with the arm rod, and secure them using the screws listed in the table above.

4）Insert the red and black power cables into the driver's V+ (48V+) and V- (48V-) terminals respectively. After insertion, gently pull the cables to confirm they are securely connected. Insert the communication cable into the driver's Communication IN (Input) port.

***Supplement**

When disassembling the joint, first remove the power cables and communication cables. To remove the power cables, use a small screwdriver to press the white spring of the connector, then gently pull out the cables. After that, remove the joint fixing screws, and finally apply even force to pull the joint out.

4.2 Electrical Installation

4.2.1 Power Supply Connection

The rated operating voltage of the MJBX series joint modules is 48VDC. A voltage fault will occur when the bus voltage exceeds the limit. The power supply is required to handle regenerative loads (For example, install a discharge module that absorbs regenerative energy at the power supply; For details on the discharge module, Pls refer to the description in Section 5.4 of this manual).

Model	Power supply voltage （VDC）	Average current (A)	Peak current （A）
MJB14	48（±10%）	3.8	11.6
MJB17	48（±10%）	5	14.5
MJB20	48（±10%）	8	15
MJB25	48（±10%）	10.5	25.8

Figure 4.2-1 List of the recommended power supplies for various MJB models

Note: The values listed in the above table are the current values of a single joint under the condition of continuous load and rated speed. However, during normal robot movement, not all joints will consume these current values simultaneously.

For reference, the specifications of the power supply used in our company's robots under standard load are listed below:

Recommended Power Supply Specifications for 6-Axis and 7-Axis Robots (3KG Load)：48V 1000W

Recommended Power Supply Specifications for Dual-Arm 7-Axis Robots (3KG * 2 Load)：48V 1500W

4.2.2 Joint Power Wiring and Communication Wiring

The communication cable assembly of the MJB module is routed through the center of the reducer output plate, allowing users to easily connect in a "daisy chain" configuration for communication between robot joints.14AWG/18AWG/20AWG red (+) and 14AWG/18AWG/20AWG black (-) wires provide 48VDC power for the next joint.A twisted pair consisting of 28AWG white (high) and 28AWG green (low) enables CANopen communication with the next joint (while 28AWG red, black, green and white wires enable EtherCAT communication with the next joint).

Note: In a joint-to-joint configuration, if bolts are used to connect two MJB units together, extreme care must be taken to avoid damaging these cables.

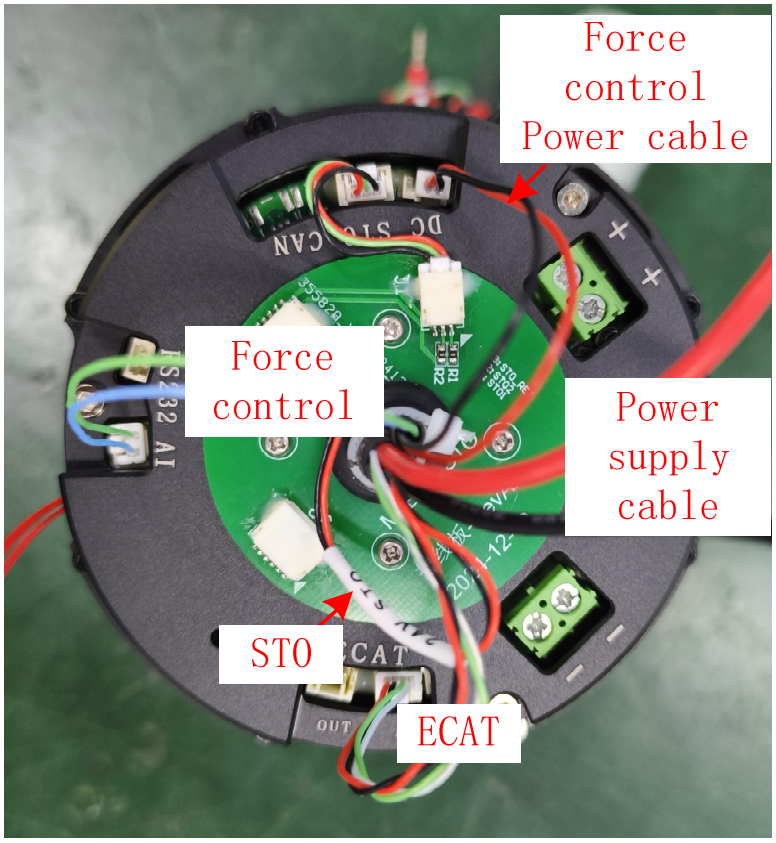


Figure 4.2-2 Cable Schematic Diagram of MJB20 and MJB25 through the Hollow Joint

In the MJBX series joint modules, except for the difference in wire color of the force control sensor wires, the wire color definitions of other communication wires and power wires are the same.

Function Name		Color	Size			
			MJB14	MJB17	MJB20	MJB25
Power Cable	48VDC+	Red	20AWG	20AWG	18AWG	18AWG
	48VDC-	Black	20AWG	20AWG	18AWG	18AWG
CANopen	CAN_H	Green	27AWG			
	CAN_L	White	27AWG			
	CAN_GND	Black	27AWG			
EtherCAT	RX+	Black	27AWG			
	RX-	Red	27AWG			
	TX+	White	27AWG			
	TX-	Green	27AWG			
STO	STO_1	Red	27AWG			
	STO_2	Green	27AWG			
	GND	Black	27AWG			

Figure 4.2-3 Table of Size, Color and Function for Daisy-Chain Cables

For the specific wiring definitions of the joint module, please refer to the relevant sections of this manual.

Function Name		Color		Size
MJB14、MJB17	MJB20、MJB25	MJB14、MJB17	MJB20、MJB25	
Positive Terminal of 5V Power Supply	Positive Terminal of 5V Power Supply	Red	Red	27AWG
Power Supply Negative / Signal Output Negative	Power Supply Negative / Signal Output Negative	Black	Black	27AWG
CH1Output Positive	Analog Output	Yellow	Green/Yellow	27AWG
CH2Output Positive	-	Green	Blue/Green	27AWG

Figure 4.2-4 Table of Wire Sequence, Size, Color and Function for Force Control Sensors

Note: The force transmission wires of MJB20 and MJB25 modules have two color combinations: one is green + blue, and the other is yellow + green.

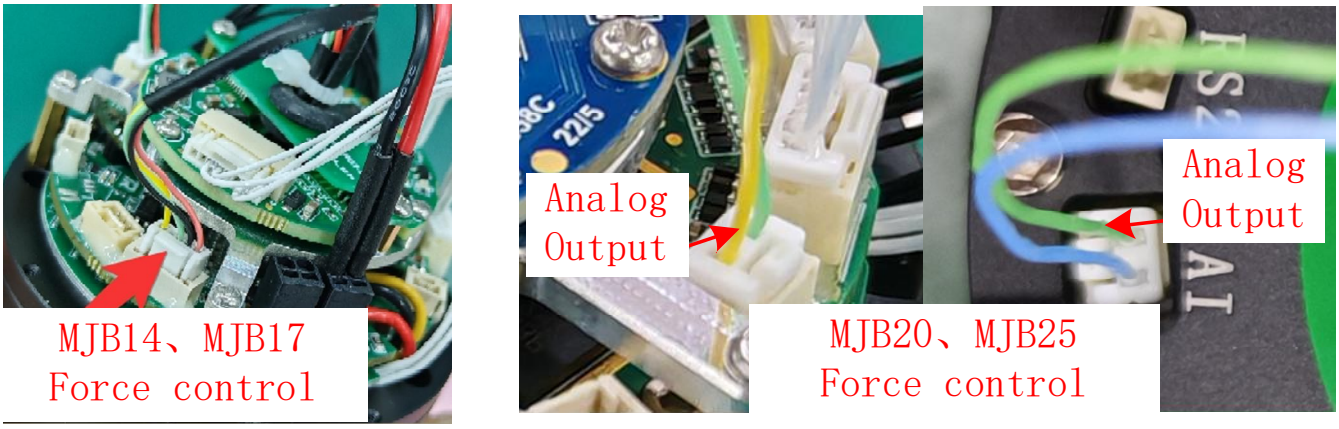


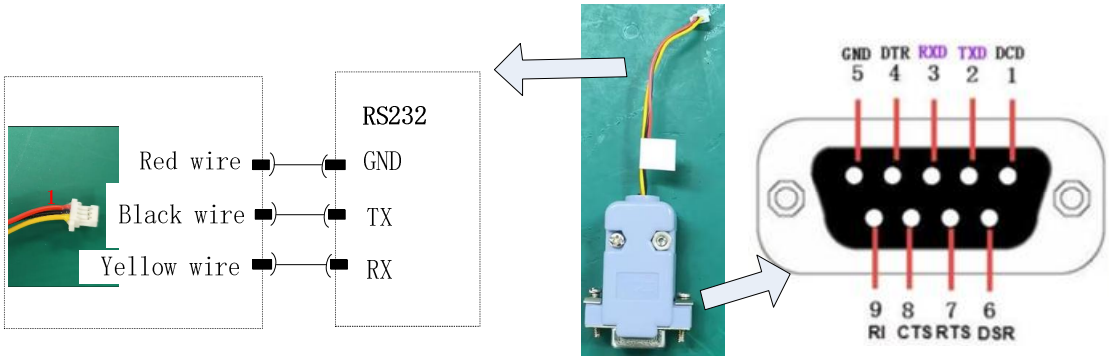
Figure 4.2-5 Wire Color Diagram of Force Control Sensor

The communication wiring for the MJB module is as follows:

Accessory 1: EtherCAT Communication Cable

A	Standard RJ45 Ethernet port, used for connecting to the controller
B	EtherCAT Communication Port, connected to the EtherCAT Port of the Joint Module

Accessory 2: Serial Cable



Chapter 5 Control of MJBX series Rotary Actuator

The drives assembled in the MJB14 and MJB17 series joint modules are of the MJA14-RGT model, while the drives assembled in the MJB20 and MJB25 series joint modules are of the MJB20-25 model. When testing the modules, please operate and control them according to the specific model of the drive.

5.1 MJA14-RGT Joint Drive and Interface Definition

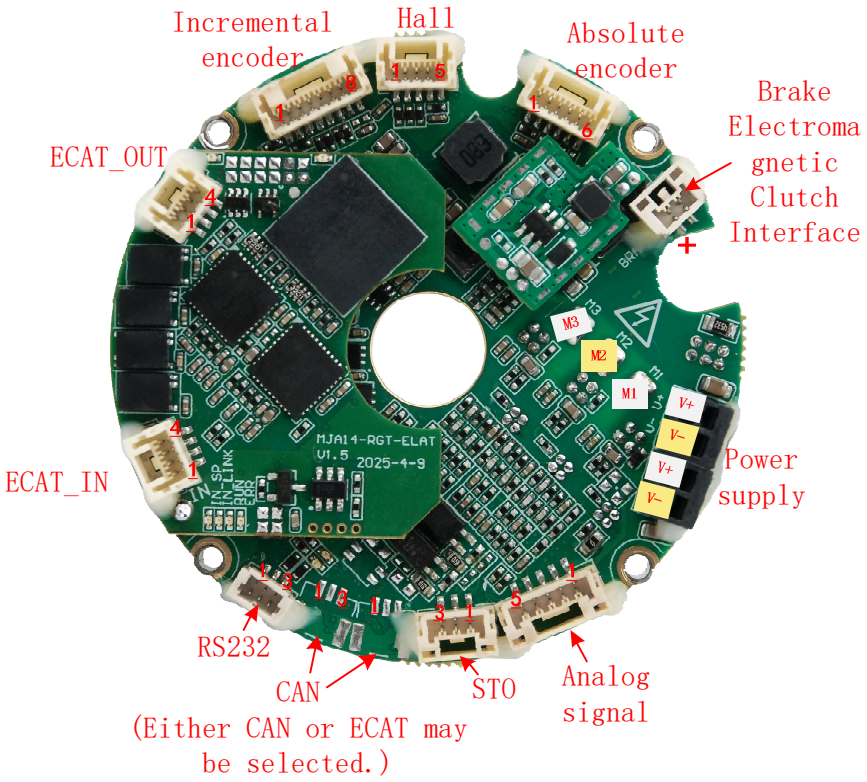


Figure 5.1-1 Schematic Diagram and Definition of the RGT Drive Interface on MJB14 and MJB17

Incremental Encoder Interface		
Pin	**Name**	**Function**
1	A+	Encoder A+
2	A-	Encoder A-
3	B+	Encoder B+
4	B-	Encoder B-
5	Z+	Encoder Z+
6	Z-	Encoder Z-
7	5V	+5V ENC
8	GND	Signal Ground

Differential Analog Input		
Pin	**Name**	**Function**
1	V_OUT	External power supply: 5V, optional 12V,

BISS Absolute Encoder Interface		
Pin	**Name**	**Function**
1	5V	5VLogic Power Supply (Internally Provided)
2	GND	Signal Ground
3	SL+	Absolute Encoder Data Signal
4	SL-	Absolute Encoder Data Signal
5	MA+	Absolute Encoder Data Signal
6	MA-	Absolute Encoder Data Signal

Power Supply and Motor UVW		
Pin	**Name**	**Function**
V+	Power Supply+	DC48V+
V-	Power Supply-	DC48V-
U	Motor Phase U	Motor Phase U

		current limited to 100mA
2	GND	GND
3	ANALOG2+	Analog Differential Input 2 Positive
4	ANALOG_GND	Analog Input Negative
5	ANALOG1+	Analog Differential Input 1 Positive

V	Motor Phase V	Motor Phase V
W	Motor Phase W	Motor Phase W

Brake		
1	+	Motor Electromagnetic Brake+
2	-	Motor Electromagnetic Brake-

EtherCAT in/out Communication Interface		
1	TX+	TX+
2	TX-	TX-
3	RX+	RX+
4	RX-	RX-

CAN Communication Interface		
1	CANH	CANH
2	CANL	CANL
3	CAN_GND	CAN_GND

Hall Signal Input		
Pin	**Name**	**Function**
1	HA	Digital Hall Signal Hall1
2	HB	Digital Hall Signal Hall2
3	HC	Digital Hall Signal Hall3
4	5V	5VLogic Power Supply (Internally Provided)
5	GND	Signal Ground

RS232		
1	GND	Signal Ground
2	RS232_TX	Data Transmission
3	RS232_RX	Data Reception

STO（5V Specification）		
Pin	**Name**	**Function**
1	STO1	5V_STO Input
2	STO2	5V_STO Input
3	STO_RET	STO Ground Return

Figure 5.1-2 Schematic Diagram of the MJA14-RGT (EtherCAT Version) Interface

5.2 MJB20-25 Joint Drive and Interface Definition

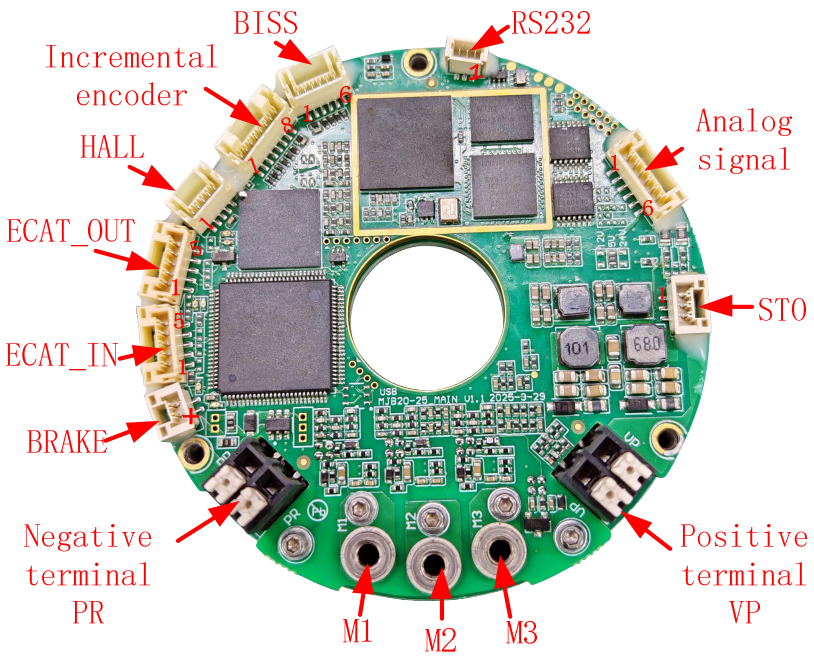


Figure 5.2-1 Schematic Diagram and Definition of the MJB20-25 Drive Interface on MJB20 and MJB25

Incremental Encoder Interface		
Pin	**Name**	**Function**
1	A+/SIN+	Encoder A+
2	A-/SIN-	Encoder A-
3	B+/COS+	Encoder B+
4	B-/COS-	Encoder B-
5	Z+/RES+	Encoder Z+
6	Z-/RES-	Encoder Z-
7	+5V	+5V ENC
8	GND	Signal Ground
BISS Absolute Encoder Interface		
Pin	**Name**	**Function**
1	+5V	5VLogic Power Supply (Internally Provided)
2	GND	Signal Ground
3	B+/DATA+	Encoder B+/ Positive of Absolute Encoder Data Signal
4	B-/DATA-	Encoder B-/ Negative of Absolute Encoder Data Signal
5	A+/CLK+	Encoder A+/ Positive of Absolute Encoder Clock Signal
6	A-/CLK-	Encoder A-/ Negative of Absolute Encoder Clock Signal

STO（5V Specification）		
1	STO1	STO Input
2	STO2	STO Input
3	STO_RET	STO_RET

Hall Signal Input		
1	HA	Digital Hall Signal Hall1
2	HB	Digital Hall Signal Hall2
3	HC	Digital Hall Signal Hall3
4	5V	5VLogic Power Supply (Internally Provided)
5	GND	Signal Ground

Power Supply and Motor UVW		
VP	Power Supply+	DC48V+
PR	Power Supply-	DC48V-
M1	Motor Phase U	Motor Phase U
M2	Motor Phase V	Motor Phase V
M3	Motor Phase W	Motor Phase W
RS232		
1	GND	Signal Ground
2	TX	RS232 Data Transmission
3	RX	RS232 Data Reception

Brake		
1	-	Motor Electromagnetic Brake+
2	+	Motor Electromagnetic Brake-

*EtherCAT or CANopen, Choose one of them		
EtherCAT IN/OUT		**CAN**
1	TX+	--
2	TX-	GND
3	RX+	CANH
4	RX-	CANL
5	PE	PE

Analog Quantity / Analog Signal		
1	ANALOG1+	Analog Differential Input 1 Positive
2	ANALOG1-	Analog Differential Input 1 Negative
3	ANALOG2+	Analog Differential Input 2 Positive
4	ANALOG2-	Analog Differential Input 2 Negative
5	GND	Signal Ground
6	24V&12V	Positive of Output Power Supply

Figure 5.2-2 Schematic Diagram of the MJB20-25 Interface

5.3 Technical Parameters of Driver

Model	MJA14-RGT	MJB20-25
Supply Voltage	10~95VDC	10~95VDC
Rated Current	10A	25A
Peak Current	20A	50A
Maximum Power	500W	500W
Hollow Diameter	10mm	20mm
Overall Dimensions / External Dimensions	56*16mm	70mm
Weight	15g	15g
Communication Method	EtherCAT/CANopen、RS232	
Analog Signal IO	2 Channels of ±10V Analog Input	2 Channels of ±10V Analog Input, Optional Function
STO Function	Standard Version 5VSTO	
Feedback Method	Main Encoder: Panasonic Incremental Encoder; SSI, BISS, EnDat, Absolute A; Tamagawa and Panasonic Absolute Encoders; Nikon and Sanyo Absolute Encoders	
Brake	Voltage Optional	
Encoder Control	Single Loop / Double Loop	
Temperature	Normal Operation：-40-65℃，Storage：-55℃~85℃	Normal Operation：-40℃~55℃，Storage：-55℃~75℃
Humidity	0% ～ 95%，No Condensation	
Pollution	Pollution Degree 2	
Drop Test	IEC68-2: 1990	

5.4 Regarding the Discharge Module

When operating and using the MJBX Joint Module, an external regenerative energy absorption module is required. If the regenerative energy is not handled, excessive regenerative energy generated during the joint operation may cause damage to the joint module, and our company will not be liable for such damage.

5.4.1 Regenerative Resistor Theory

When a load accelerates, electrical energy is converted into mechanical energy. During deceleration, the opposite process occurs: mechanical energy is converted into electrical energy. This is known as regeneration. A portion of the regenerative energy is dissipated due to friction in the mechanical system. A larger amount of energy is consumed by components such as motor windings, cables, and internal parts of the drive, and is dissipated as heat (following the I^2R principle). The remaining energy is fed back to the DC bus inside the drive. If there is a capacitor on the DC bus, the energy fed back will charge the capacitor. If excessive energy accumulates on the capacitor, the voltage across it will rise to the drive’s overvoltage protection threshold, causing the drive to shut down its output. To prevent this, a regenerative circuit is required: when the bus voltage rises to a certain level, the circuit diverts the excess energy to an external resistor—which is the component we commonly refer to as a regenerative resistor.

5.4.2 Techrobots Discharge Module (Discharge Board)

When using the MJBX Joint Module, connect the positive and negative terminals of the 48V switching power supply, the 48V power cable of the joint module, and this discharge board in parallel respectively. The physical appearance of the discharge module configured by our company is shown in the figure below:

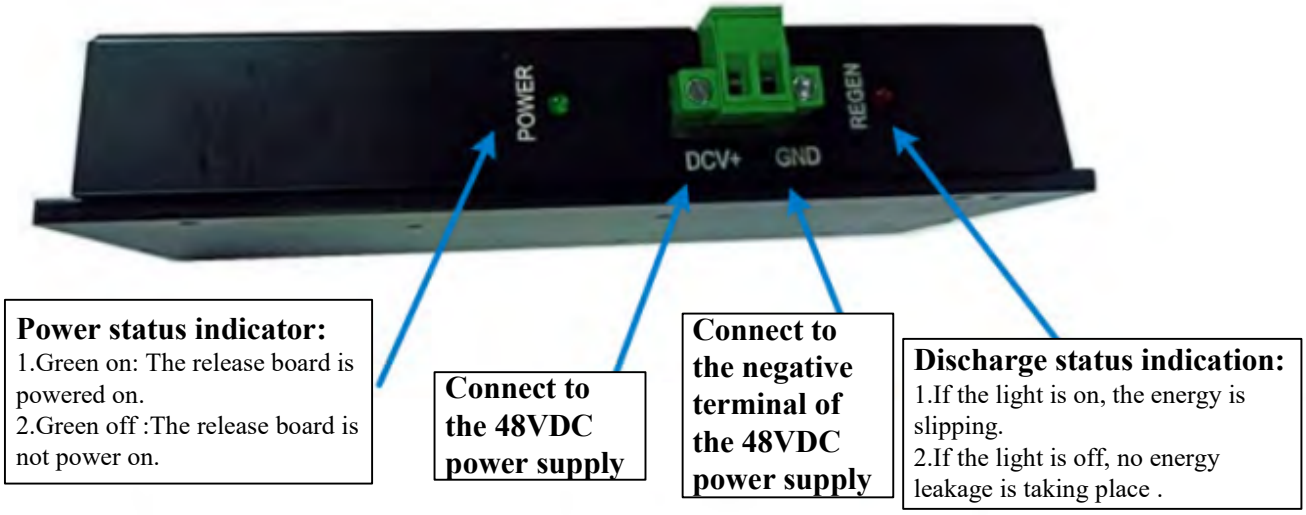


Figure 5.4-1 Physical Diagram of the Discharge Board

Model	XFB_56V V2.0
Resistance Value of Regenerative Resistor	10Ω
Power Rating of Regenerative Resistor	100W
Turn-On Voltage	56V. If other turn-on voltage specifications are required, please contact our technical staff.

Figure 5.4-2 Specification Sheet of the Discharge Board

Warning

If the continuous power output during operation is excessively high, the resistor surface may become extremely hot during use (with a risk of the resistor burning out). Do not touch the regenerative resistor directly to prevent burns. When using the regenerative resistor, ensure adequate heat dissipation measures are implemented.

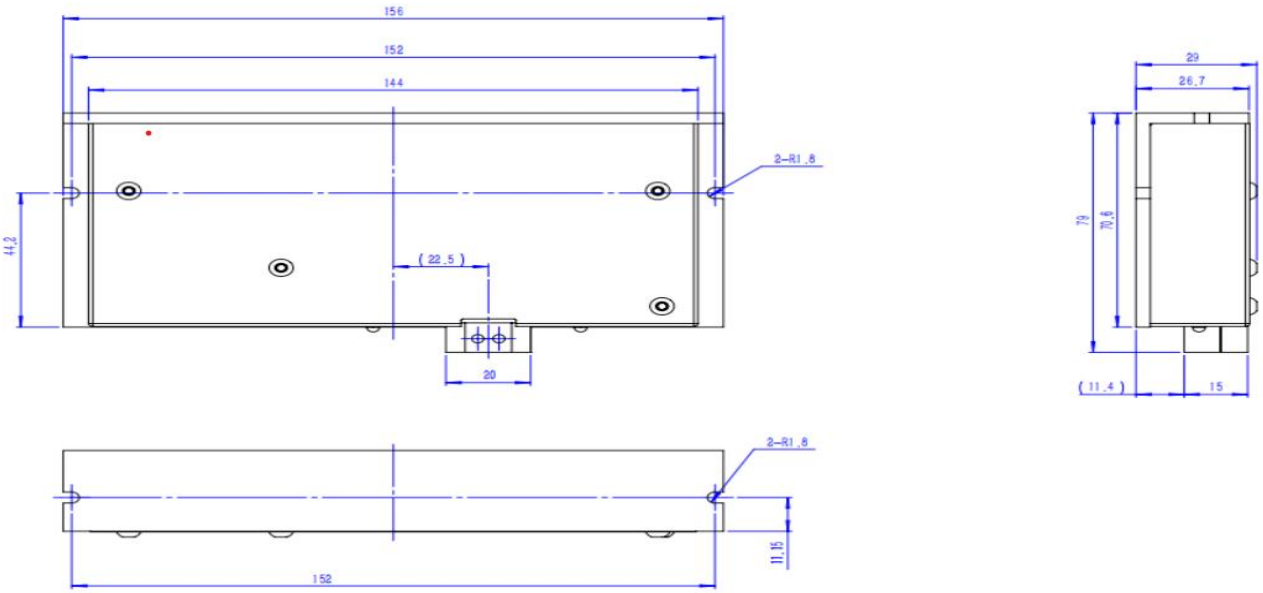


Figure 5.4-3 Installation Dimension Drawing of the Discharge Board

5.5 Software Debugging of the Joint Module

The drive control parameters in the MJBX Joint Module are pre-configured at the factory. Users only need to connect the module to an EtherCAT or CANopen network for control.

For the CANopen joint module, we will provide a CANopen slave EDS file for users to configure the master station; for the EtherCAT joint module, we will provide a slave file in XML format for users to configure the master station.

If users need to monitor the joint's operation data via serial communication, they can contact our technical department to obtain relevant materials and information.

Chapter 6 Troubleshooting and Handling Methods for Common Faults of MJBX series Rotary Actuator

NO	Problem Information	Possible Causes	Handling Methods
1	The module fails to power on normally when the power supply is connected.	There is a short circuit, or the V+ and V- connections are reversed.	Check for short circuits. Check if the V+/V- of the joint module power supply are connected in reverse.
2	Communication Abnormality	Poor contact of the communication cable or communication terminal	Check if the communication terminals have cold solder joints, or re-plug and re-pull the communication cable.
3	Following Error	Exceeding the following error set by the user Position command error	Reset the following error; adjust the controller's position command.
4	Abnormal Encoder Reading	The encoder wiring is loose or the encoder is damaged	Reconnect the encoder wires securely Replace the encoder
5	The robot joint can be rotated by hand before power is applied.	Joint Module Brake Malfunction	Replace the brake
6	The encoder has a jump (in reading).	Currently, the joint module adopts a single-turn absolute encoder. If the power is cut off and restarted when the encoder's range is exceeded, the encoder reading will return to the normal range of the encoder.	When in use, try to operate within the single-turn range of the encoder or save the position via the upper computer.
7	The joint module produces excessive noise and generates excessive heat.	Abnormal Reducer	Replace the reducer

NO	Fault Code(Hex)	Fault Information
1	3120	Under-voltage
2	3130	Phase loss
3	3240	Short circuit
4	3310	Overvoltage
5	4310	The driver is overheated
6	7121	The motor is stuck
7	7300	Feedback error
9	7382	The commutation process fails when the motor is powered on
10	8311	Exceeding the peak current
11	8480	Speed tracking error
12	8481	Exceed the speed limit
13	8611	Position tracking error
14	8680	Exceed the position limit

15	FF20	STO (Safe Torque Off) is activated

Figure 6.1-1 Meanings of Common Error Codes for Joint Drivers

