DM-J10010-2EC Geared Motor

User Manual   2024.5.19

Disclaimer

Thank you for purchasing the DAMIAO DM-J10010-2EC speed reducer motor (hereinafter referred to as "the Motor"). Before using this product, please carefully read and comply with this document and all safety guidelines provided by DAMIAO DM-J10010-2EC. Failure to do so may cause harm to you or others, or damage the product or surrounding items. By using this product, you acknowledge that you have read, understood, and accepted all terms and contents of this document and any related materials. You agree to use the product solely for legitimate purposes and assume full responsibility for its use and any resulting consequences. DAMIAO DM-J10010-2EC shall not be liable for damages, injuries, or any legal liabilities arising from the direct or indirect use of this product.

Precautions

1. The motor must be operated strictly within the specified working environment and maximum allowable temperature range of the windings; otherwise, permanent irreversible damage may occur to the product.

2. Prevent foreign objects from entering the rotor, as this may cause abnormal operation.

3. Before use, check all components for integrity. If any parts are missing, aged, or damaged, stop using the device.

4. Ensure proper wiring and secure, correctly installed motor.

5. Do not touch the electronic rotor during operation to prevent accidents. The motor may overheat when delivering high torque, so take precautions to avoid burns.

6. Users must not disassemble the motor without authorization, as this may compromise its control accuracy or even cause malfunction.

Motor Features

1. Dual encoder with single-turn absolute position output, ensuring position accuracy even during power loss.
2. The motor and driver are integrated, which has compact structure and high integration degree.

3. Supports visual debugging on the host computer and firmware upgrades.

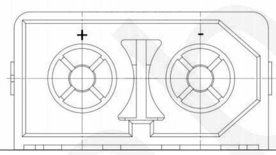
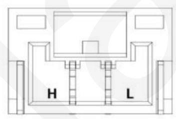
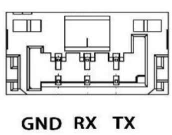
4. The CAN bus can be used to feedback the motor speed, position, torque, and temperature.

5. It has the function of double temperature protection.

Packing List

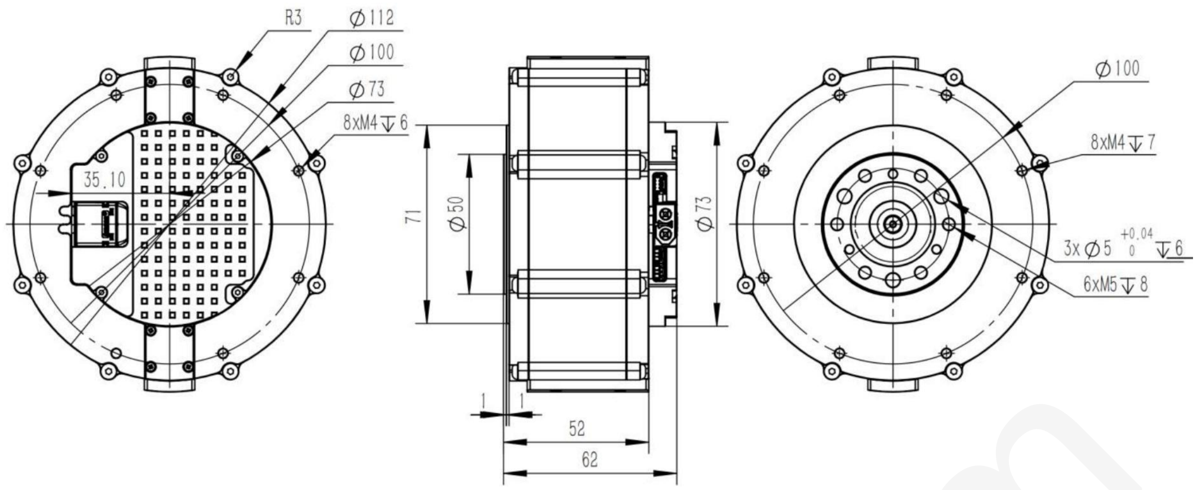
1. Motor (including drive) × 1
2. Power cable: XT60200mm power cable (1 unit)
3. CAN communication terminal: GH1.25 connector-2-pin (crossed pins, 300mm) × 1
4. Debugging the serial signal line: GH1.25 connector-3-pin (reverse polarity, 300mm) × 1

Interface and Wiring Description

Specific Name-Number	Interface annotation	explain
Power Connection Port – 1		The XT60 connects to the power supply via its orbital power cable, with a rated voltage of 48V (supporting 24-48V) to power the motor.
CAN Communication Terminal – 2		The CAN communication terminal connects to external control devices, receiving CAN control commands and providing feedback on motor status information.
Debug Serial Port – 3		Connect the motor to the PC using the GH1.25 cable (3-pin) with a USB-to-CAN diagnostic tool (or a universal USB-to-serial module), then configure parameters and perform firmware upgrades via Damiao Technology's diagnostic assistant.

Motor Dimensions and Installation

Refer to the motor mounting hole dimensions and positions to install the motor on the corresponding equipment.



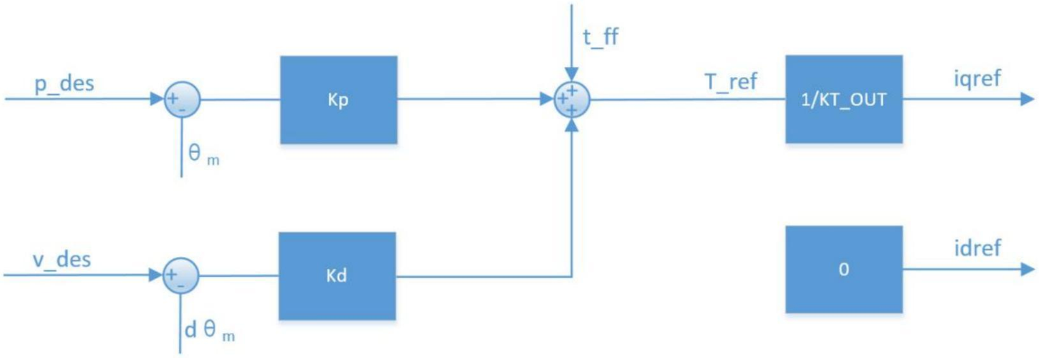
Indicator Light Status

Normal Status	Green-Solid On	The ERR bit is 1, indicating the enabled mode and normal operating state.
	Red-Solid On	The ERR bit is 0, indicating disabled mode
Abnormal Status	Red – Blinking	indicates a fault, corresponding to the following fault type: 8-over pressure; 9-under pressure; 8-over pressure; 9-under pressure; A—Overcurrent; B—MOS Overtemperature; A—Overcurrent; B—MOS Overtemperature; C-Motor coil overheating; D-Communication loss; E—— overload； You can check the fault through the feedback frame or the Dami Technology Debug Assistant interface.

Operating Modesr

MIT pattern

The MIT mode is designed to be compatible with the original MIT mode, enabling seamless switching while allowing flexible control range settings (P_MAX, V_MAX, T_MAX). The electric controller converts received CAN data into control variables, calculates torque values, and provides current setpoints for the current loop. The current loop then adjusts according to its regulation rules to ultimately achieve the specified torque current. The control block diagram is shown below:

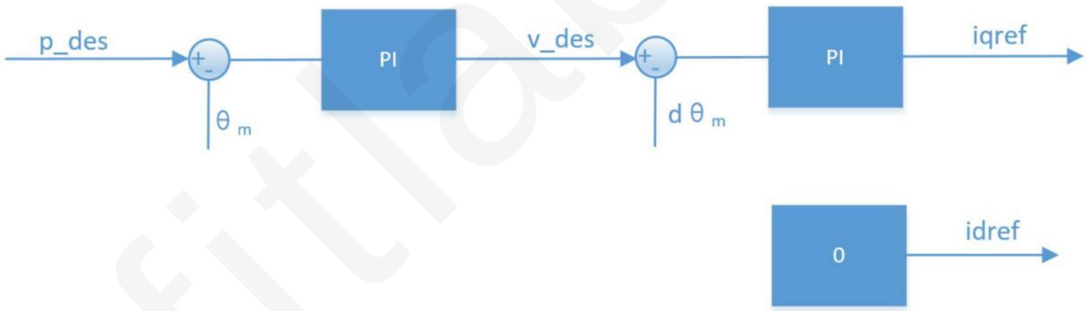


The MIT model can be adapted to various control configurations. For instance, when kp=0 and kd≠0, a constant-speed rotation can be achieved by setting v_des. Similarly, when kp=0 and kd=0, torque output can be controlled by setting t_ff.

Note: When controlling position, do not set kd to 0, as this may cause motor oscillation or even loss of control.

Position-Velocity Mode

The position cascade control mode employs a three-loop series configuration. The outermost position loop provides the speed loop's setpoint, while the inner current loop receives the speed loop's output to regulate actual current. The control block diagram is shown below:



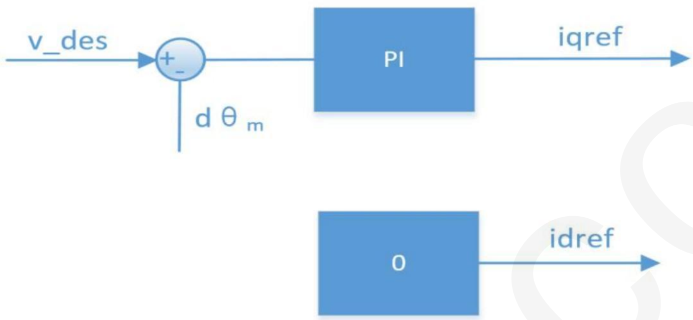
p_des is the target position for control, while v_des defines the maximum absolute speed during motion.

When the cascade mode is controlled using the parameters recommended by the debugging assistant, it achieves better control accuracy and a smoother process, though with longer response time. In addition to v_des, other configurable parameters include acceleration/deceleration settings. If additional oscillations occur during control, increasing acceleration/deceleration can mitigate them.

Note: p_des and v_des are measured in rad and rad/s respectively, with data type float. The damping factor must be set to a positive non-zero value. Refer to the speed mode precautions.

Velocity Mode

The speed mode enables the motor to operate stably at the set speed, as shown in the control block diagram below.



Note: v_des is measured in rad/s and stored as a float. To enable the debugging assistant to automatically calculate parameters, set the damping factor to a non-zero positive value (typically 2.0–10.0). A low damping factor may cause speed oscillations and excessive overshoot, while a high damping factor may result in prolonged rise time. The recommended setting is 4.0.

Control Protocol Description

The control system employs CAN standard frame formats with a fixed baud rate of 1Mbps. Functionally, these frames are categorized into receiving frames and feedback frames. Receiving frames contain control data for motor command execution, while feedback frames transmit real-time status data from the motor to the upper-level controller. Although the specific frame formats and IDs vary depending on the selected motor mode, the feedback frames remain consistent across all operational modes.

Feedback frame

The feedback frame ID is set by the debug assistant (Master ID), with a default value of 0. It primarily provides feedback on the motor's position, speed, and torque. The frame format is defined as:

feedback message	D[0]	D[1]	D[2]	D[3]	D[4]	D[5]	D[6]	D[7]
MST_ID	ID|ERR<<4	POS[15:8]	POS[7:0]	VEL[11:4]	VEL[3:0]|T[11:8]	T[7:0]	T_MOS	T_Rotor

among：

ID represents the controller ID, taking the lower 8 bits of CAN_ID

ERR indicates a status, corresponding to the following status type:

0-Disability;

1—Enable;

8—overpressure;

9-Under-voltage;

A—— excess current；

B—MOS overtemperature;

C-Motor coil overheating;

D-Communication loss;

E—— overload；

POS indicates the motor's position information

VEL indicates the motor speed information

T represents the torque information of the motor

T_MOS is the average temperature of the upper MOS, in ℃

T_Rotor is the average temperature of the motor's internal coils, measured in ℃

The position, speed and torque are converted to signed fixed-point data by linear mapping, where the position is 16-bit, and the speed and torque are 12-bit.

Control Frame in MIT Mode

control message	D[0]	D[1]	D[2]	D[3]	D[4]	D[5]	D[6]	D[7]
ID	p_des [15:8]	p_des [7:0]	v_des [11:4]	v_des[3:0]| Kp[11:8]	Kp [7:0]	Kd [11:4]	Kd[3:0]| t_ff[11:8]	t_ff[7:0]

The frame ID equals the set CAN ID value P_des: position given

V_des: Speed given

Kp: Position Ratio Coefficient

Kd: Positional differential coefficient

T_ff: Torque setpointAll parameters adhere to the mapping relationships specified in the previous section. The values of p_des, v_des, and t_ff can be configured via the debugging assistant, while Kp ranges from 0 to 500 and Kd ranges from 0 to 5.

A standard CAN data frame is 8 bytes long. MIT's control command format encodes five parameters—Position, Velocity, Kp, Kd, and Torque—into 8 bytes using bit combinations. Specifically: Position occupies 2 bytes (16 bits), Velocity 12 bits, Kp 12 bits, and Kd 12 bits.

Control Frame in Position-Velocity Mode

control message	D[0]	D[1]	D[2]	D[3]	D[4]	D[5]	D[6]	D[7]
0x100+ID	p_des				v_des			

The frame ID is the set CAN ID value plus an offset of 0x100.

P_des: Position given, floating-point type, with the lower bit first and the higher bit last

V_des: Speed given, floating-point, lower bits first, higher bits last

The CAN ID for the command is 0x100+ID. The given speed is the maximum speed under trapezoidal acceleration, i.e., the speed value during the constant speed phase.

Control Frame in Velocity Mode

control message	D[0]	D[1]	D[2]	D[3]
0x200+ID	v_des			

The frame ID is the set CAN ID value plus an offset of 0x200.

V_des: A floating-point variable with fixed speed, where the lower bit is first and the higher bit is last. The CAN ID for this command is 0x200+ID.

Using the Debugging Assistant

Use Damiao Technology's USB-to-CAN debugging tool to connect the computer and motor, then configure motor parameters and perform firmware upgrades via Damiao Technology Assistant.

The motor debugging serial port connects to the PC via a GH1.25 cable with 3 pins, while the CAN communication terminal connects to the USB-to-CAN debugging tool through a GH1.25

cable with 2 pins. The Damiao Technology debugging assistant is used to configure motor parameters and perform firmware upgrades.

After connecting the motor's serial port, CAN port, and power interface, launch the Damiao Technology Debug Assistant on your computer. Select the corresponding serial port device and enable the serial port. When powering the motor, the serial port will display information, with the Control Mode indicating the current driving mode.

Detailed debugging process reference: Debug Assistant User Manual (Dami Driver Control Protocol) V1.4.pdf

Download link：

https://gitee.com/kit-miao/damiao/tree/master/%E5%85%B3%E8%8A%82%E7%94%B5%E6%9C%BA/%E6%8E%A7%E5%88%B6%E5%8D%8F%E8%AE%AE

Key Parameters

Please refer to the following parameters for proper motor usage:

Motor Parameters	Rated voltage	48V
	Rated current	20A
	Peak point current	70A
	Rating torque	40NM
	Peak torque	150NM
	Rated speed	100rpm
	No-load maximum speed	150rpm;
Motor Characteristics	Reduction gear ratio	10: 1
	Number of pole-pairs	21
	Phase inductance	100uh
	Phase resistance	0.13Ω
Structure and Weight	External diameter	112mm (The body is not a standard cylindrical shape, with a maximum outer dimension of 120mm)
	Altitude	62mm
	Motor weight	Approximately 1485 grams
Encoder	Encoder bit count	14 people
	Number of encoders	2
	Encoder type	magnetic encoding (single-turn output shaft with one absolute position)
Communication	Control interface	CAN@1Mbps
	Parameter passing interface	UART@921600bps
Control and protection	Control model	MIT pattern
		Speed mode
		position mode
	Protect	Enable over-temperature protection with a protection temperature of 120°C. The motor will exit the enable mode if overheated.
		Motor over-temperature protection. Set according to usage requirements, recommended not exceeding 100°C. The motor will exit the 'enabled mode' if overheated.
		Motor overvoltage protection. Set according to usage requirements, recommended not to

		exceed 52V. Overvoltage will exit the 'enabled mode.
		Communication loss protection. If no CAN commands are received within the set period, the system will automatically exit the enable mode.
		Motor overcurrent protection. Set according to usage requirements, recommended not to exceed 90A. Overcurrent will exit the 'enabled mode'.
		Motor under-voltage protection: If the power supply voltage drops below the set threshold, the system exits the enable mode. The minimum required voltage is 15V.