DM-J4310-2ECV1.1Geared Motor

User Manual V1.0 2023.11.16

Disclaimer

Thank you for purchasing the DM-J4310-2ECV1.1 geared motor (hereinafter referred to as "the motor").

Before using this product, please carefully read and follow the instructions in this document and all safety guidelines provided. Failure to do so may result in harm to yourself or others, or cause damage to the product or surrounding property.

By using this product, you are deemed to have read this document thoroughly and to have understood, acknowledged, and accepted all the terms and contents of this document and any related materials.

You agree to use this product only for legitimate purposes and assume full responsibility for its usage and any resulting consequences.

The manufacturer shall not be held liable for any damage, injury, or legal responsibility caused directly or indirectly by the use of this product.

Precautions

1. Please strictly operate the motor within the specified working environment and the maximum allowable winding temperature range. Failure to do so may result in permanent and irreversible damage to the product.
2. Prevent foreign objects from entering the rotor; otherwise, abnormal rotor operation may occur.
3. Before use, check whether all components are intact. Do not use the product if any parts are missing, aged, or damaged.
4. Ensure correct wiring and that the motor is installed properly and securely.
5. Do not touch the electronic rotor section during operation to avoid accidents. The motor may become hot during high-torque output; be cautious to prevent burns.
6. Users must not disassemble the motor without authorization, as this may affect control accuracy or lead to abnormal operation.

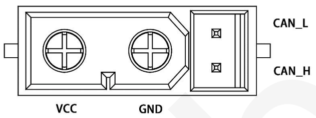
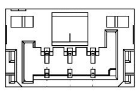
Motor Features

1. Dual encoders provide single-turn absolute position output on the output shaft, retaining position data even in the event of power loss.
2. Integrated motor and driver design with a compact and highly integrated structure.
3. Supports upper-computer visual debugging and firmware upgrades.
4. Capable of providing feedback on motor speed, position, torque, and temperature via CAN bus.
5. Equipped with dual temperature protection.
6. Supports trapezoidal acceleration and deceleration in position control mode.

Packing List

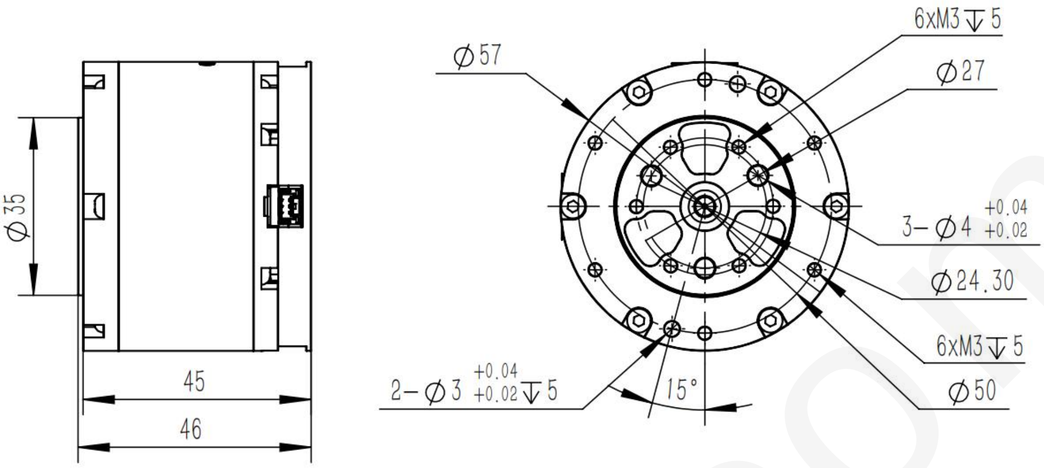
1. Motor (with driver) ×1
2. Power cable (with CAN communication terminal): XT30 (2+2)-F connector cable ×1
3. Debugging serial signal cable: GH1.25 3-pin connector cable ×1

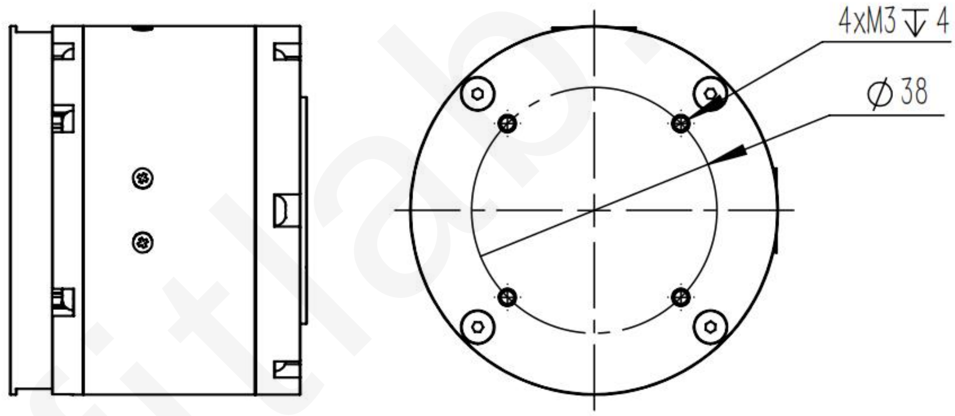
Interface and Wiring Description

Specific Name - No.	Interface Label	Description
Power Interface – 1 with CAN communication terminal		1. Connect the power supply using the XT30 (2+2)-F connector cable. The rated voltage is 24V, supplying power to the motor. 2. Connect the CAN communication terminal to external control equipment to receive CAN control commands and send motor status feedback. 3. The motor includes two power interfaces, either of which can be used independently or daisy-chained for multi-motor setups to simplify wiring.
Power Interface – 2 with CAN communication terminal		
Debug Serial Port – 3		Connect via GH1.25 3-pin cable. Use a USB to CAN debugging tool (or a general USB-to-serial module) to connect to a PC for parameter configuration and firmware upgrades via the debugging assistant software.

Motor Dimensions and Installation

Please refer to the motor mounting hole dimensions and positions to install the motor onto the corresponding equipment.





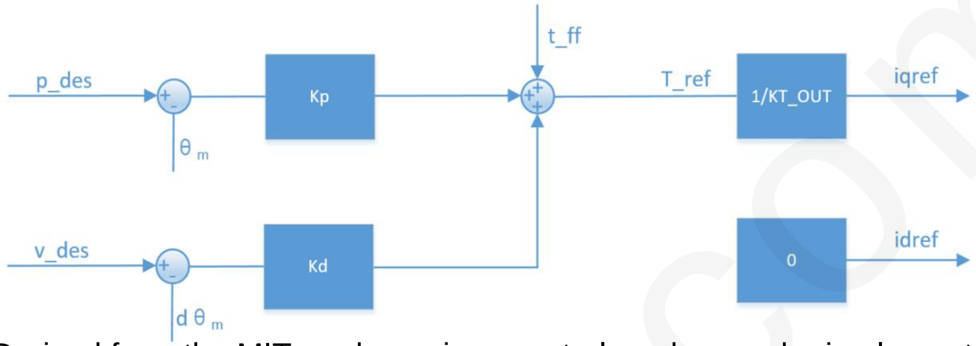
Indicator Light Status

Normal Status	Green-Solid On	Enabled mode, normal operating status
	Red-Solid On	Disabled mode
Abnormal Status	Red – Blinking	Indicates a fault. Corresponding fault types include:8 – Overvoltage 9 – Undervoltage A – Overcurrent B – MOS Overtemperature C – Motor Coil Overtemperature D – Communication Loss E – Overload You can check the fault type via the feedback frame or through the debugging assistant interface.

Operating Modes

❖ MIT Mode

MIT mode is designed to be compatible with the original MIT mode. It allows seamless switching while enabling flexible configuration of control ranges (P_ MAX, V_MAX, T_MAX). The ESC converts received CAN data into control variables to calculate the torque value, which serves as the current reference for the current loop. The current loop then regulates to achieve the specified torque current.
The control block diagram is as follows:



Derived from the MIT mode, various control modes can be implemented.

For example:

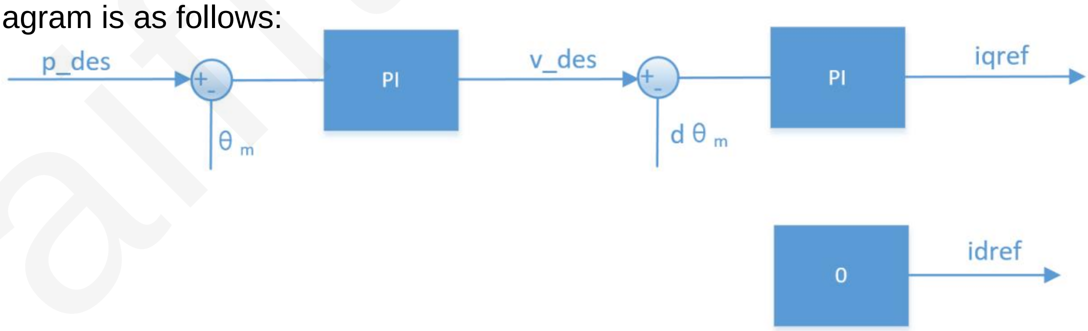
When kp = 0 and kd 0, setting v_des enables constant speed rotation;

When kp = 0 and kd = 0, setting t_ff enables constant torque output.

Note:When controlling position, kd must not be set to 0, otherwise it may cause motor oscillation or even loss of control.

❖ Position-Velocity Mode

The position-velocity mode uses a three-loop cascaded control scheme.
The position loop serves as the outermost loop, and its output is the setpoint for the velocity loop. The velocity loop ’ s output is used as the setpoint for the inner current loop, which controls the actual current output. The control block diagram is as follows:



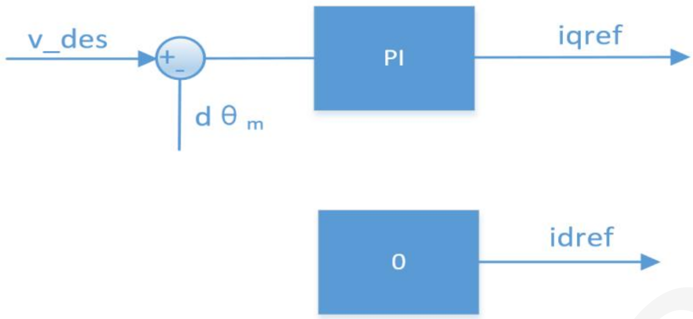
p_des is the target position for control, and v_des limits the maximum absolute speed during motion.
When using the recommended control parameters from the debugging assistant in position cascaded mode, high control accuracy can be achieved with relatively smooth operation. However, the response time is relatively longer.
Configurable parameters include not only v_des but also acceleration/ deceleration settings. If additional oscillations occur during control, increasing the acceleration/deceleration values may help.

Note:

p_des and v_des are in units of rad and rad/s respectively, with data type float. The damping factor must be set to a non-zero positive value. Please refer to the notes in velocity mode.

❖ Velocity Mode

Velocity mode allows the motor to run steadily at the set speed. The control block diagram is as follows:



Note:

v_des is in units of rad/s, data type float. If you need to use the debugging assistant to automatically calculate parameters, you must set the damping factor to a non-zero positive number. Typically, a value between 2.0 and 10.0 is used. A damping factor that is too small may result in speed oscillations and significant overshoot, while one that is too large will lead to a longer rise time. The recommended value is 4.0.

Usage

Control is performed using the CAN standard frame format with a fixed baud rate of 1 Mbps. Frames are divided by function into receive frames and feedback frames.

Receive frames carry the control data sent to the motor and are used to issue commands.

Feedback frames are used by the motor to report its status back to the upper-level controller.

Depending on the selected operating mode, the format and frame ID of the receive frame will vary. However, the feedback frame format remains the same across all modes.

❖ Feedback Frame

The feedback frame ID is set via the debugging assistant (MasterID), with a default value of 0. It primarily returns information about the motor ’ s position, speed, and torque. The frame format is defined as follows:

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

0 – Disabled
1 – Enabled
8 – Overvoltage
9 – Undervoltage
A – Overcurrent
B – MOS overtemperature
C – Motor coil overtemperature
D – Communication lost
E – OverloadPOS: Motor position information*VEL: Motor speed information*T: Motor torque information*TMOS: Average temperature of the MOSFETs on the driver board (unit: °C)TRotor: Average temperature of the motor ’ s internal coil (unit: °C)

* Position, speed, and torque are converted from floating-point to signed fixed-point format using a linear mapping:
Position uses 16-bit data
Speed and torque use 12-bit data each

❖ 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]

Frame ID = configured CAN ID value

P_des: Position command
V_des: Velocity command
Kp: Position proportional gain Kd:
Position derivative gain
T_ff: Torque feedforward value

All parameters conform to the mapping relationships described in the previous section.
p_des, v_des, and t_ff ranges can be configured via the debugging assistant.
Kp range: 【0,500】
Kd range: 【0,500】
Since a standard CAN data frame contains only 8 bytes, the MIT control command format
packs five parameters—Position, Velocity, Kp, Kd, and Torque—into those 8 bytes as follows: Position: 16 bits (2 bytes)
Velocity: 12 bits
Kp: 12 bits
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			

Frame ID = configured CAN ID value + 0x100
P_des: Position command, float, little-endian (low byte first, high byte last)
V_des: Velocity command, float, little-endian (low byte first, high byte last)
In this mode, the CAN ID used to send commands is 0x100 + ID. The velocity command
(v_des) defines the maximum speed during the movement to the target position—i.e., the speed during the constant-velocity phase.

❖ Control Frame in Velocity Mode

Control Message	D[0]	D[1]	D[2]	D[3]
0x200+ID	v_des			

Frame ID = configured CAN ID value + 0x200
V_des: Velocity command, float, little-endian (low byte first, high byte last)
In this mode, the CAN ID used to send commands is 0x200 + ID.

Using the Debugging Assistant

Use the USB to CAN debugging tool to connect the motor to the PC, and perform parameter configuration and firmware upgrade via the debugging assistant.

The motor's debug serial port is connected to the PC using a GH1.25 3-pin cable.

The CAN communication terminal within the motor’s power interface is connected to the USB to CAN debugging tool using the XT30 (2+2)-F connector cable.
Through the debugging assistant, you can configure motor parameters and perform firmware upgrades.

Once the serial port, CAN interface, and power interface of the motor are all properly connected, open the debugging assistant software on the PC, select the corresponding serial device, and open the serial port.

At this point, power on the motor. The serial port will output information, and the Control Mode will indicate the current drive mode.

Characteristic Curve

At a constant speed of 120 rpm and room temperature of 25°C, the performance curve was measured as follows:

Key Parameters

Please refer to the following parameters for proper motor usage:

Motor Parameters	Rated Voltage	24 V
	Rated Phase (Power) Current	2.5 A
	Peak Phase (Power) Current	7.5 A
	Rated Torque	3 NM
	Peak Torque	7 NM
	Rated Speed	120 rpm
	Max No-Load Speed	200 rpm
Motor Characteristics	Gear Ratio	10:1
	Pole Pairs	14
	Phase Inductance	340 uH
	Phase Resistance	650 mΩ
Structure & Weight	Outer Diameter	56 mm
	Height	46 mm
	Motor Weight	≈ 300 g
Encoder	Encoder Resolution	14-bit
	Number of Encoders	2
	Encoder Type	Magnetic encoder (single-turn, absolute output-shaft position)
Communication	Control Interface	CAN@1Mbps
	Tuning Interface	UART @ 921 600 bps
Control & Protection	Control Modes	MIT mode / Velocity mode / Position mode
	Driver Over-temperature Protection (threshold)	120 °C — exits "enabled mode" when exceeded
	Motor Over-temperature Protection (user-set, recommended ≤ 100 °C)	Exits "enabled mode" when exceeded
	Motor Over-voltage Protection (user-set, recommended ≤ 32 V)	Exits "enabled mode" when exceeded
	Communication-loss Protection	If no CAN command within set period → exits "enabled mode"
	Motor Over-current Protection (user-set, recommended ≤ 9.8 A)	Exits "enabled mode" when exceeded
	Motor Under-voltage Protection (supply must be ≥ 15 V)	Exits "enabled mode" when below threshold