DM-J10010L-2EC Geared Motor

User Manual V1.0 2024.8.3

Disclaimer

Thank you for purchasing the DM-J10010L-2EC 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

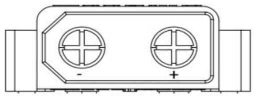
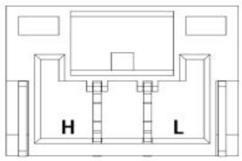
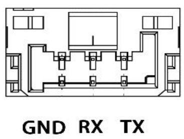
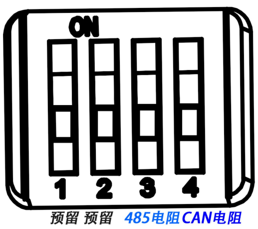
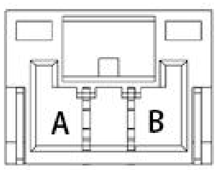
1. Dual encoders provide single-turn absolute position output on the output shaft, ensuring no loss of position even after power failure.
2. Integrated motor and driver design, featuring a compact and highly integrated structure.
3. Supports visual debugging via upper-computer software and firmware upgrades.
4. Capable of reporting motor speed, position, torque, and temperature via CAN bus.
5. Equipped with dual temperature protection.

Packing List

1. Motor (with driver) ×1

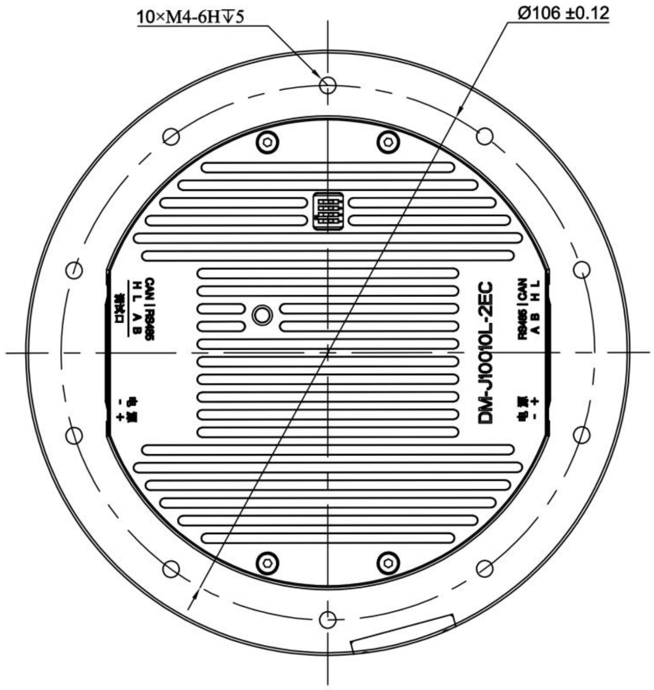
2. Power cable: XT30 male-to-female
3. Power cable ×1CAN communication terminal: GH1.25 2-pin cable ×1
4. Debug serial signal cable: GH1.25 3-pin cable ×1

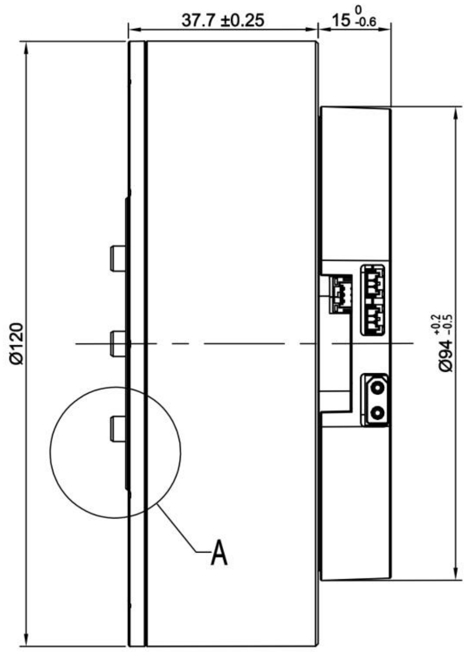
Interface and Wiring Description

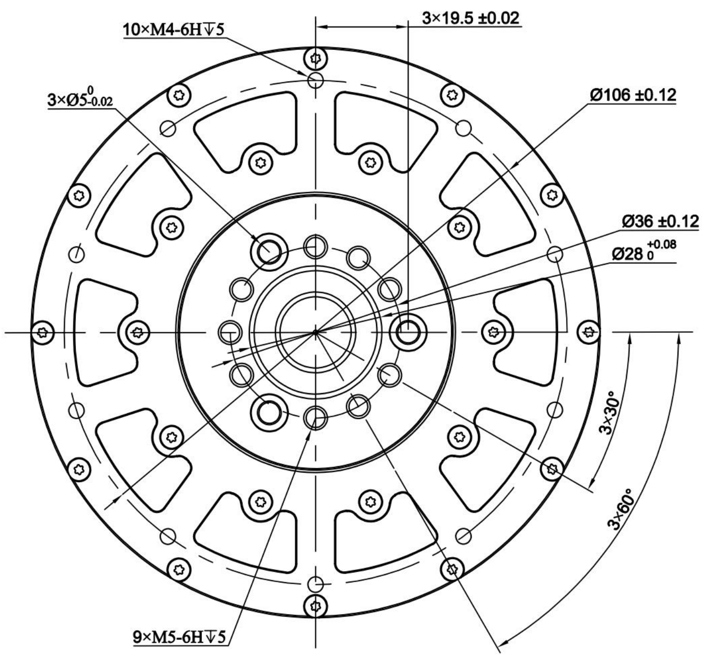
Specific Name － Number	Interface Label	Description
Power Connection Port － 1		1. Connect the power supply via XT30 male-to-female power cable. Rated voltage: 24V (supports 24－48V). Supplies power to the motor. 2. The motor includes two power interfaces. Either interface can be used independently, or multiple motors can be connected in series. For wiring convenience, it is recommended to connect no more than 2 motors in series.
Power Connection Port － 2		
CAN Communication Terminal － 1		1. Connect to an external control device via the CAN communication terminal to receive CAN control commands and send motor status feedback. 2. The motor has two CAN terminals; either one can be used.
CAN Communication Terminal － 2		
Debug Serial Port － 1		Connect via GH1.25 3-pin cable. Use a USB to CAN debugging tool (or general USB-to-serial module) to connect to a PC for parameter configuration and firmware upgrades via the debugging assistant.
Terminal Resistor DIP Switch － 1		3——485 120Ω terminal resistor 4——CAN 120Ω terminal resistor 1、2 are reserved and currently unused.
RS485 Communication Terminal － 1		RS485 communication is not currently enabled.
RS485 Communication Terminal － 2		

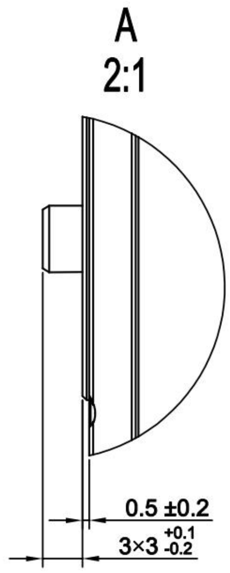
Motor Dimensions and Installation

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









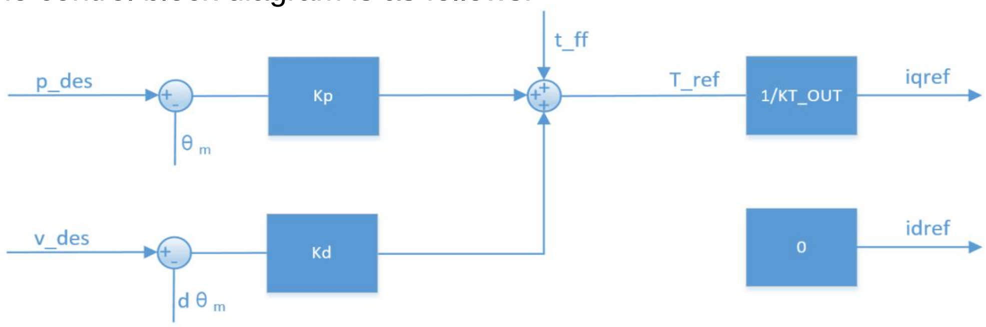
Indicator Light Status

Normal Status	Green-Solid On	ERR bit is 1, indicating enabled mode and normal operating status
	Red-Solid On	ERR bit is 0, indicating 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

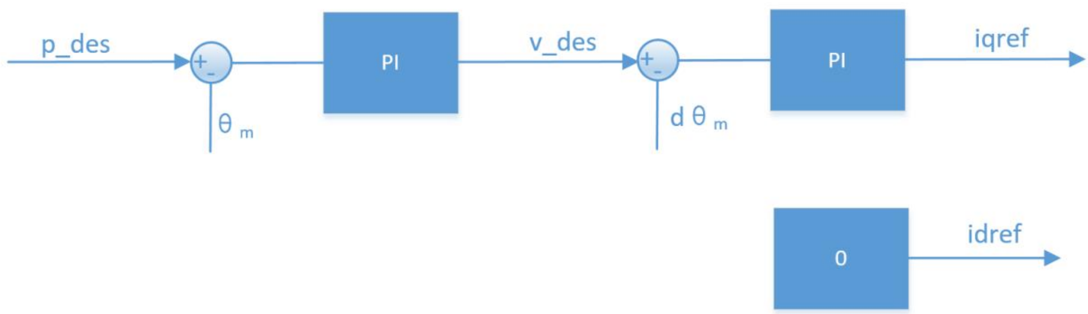
MIT mode is designed to be compatible with the original MIT mode. It allows seamless switching while enabling flexible configuration of control ranges (P_MAX, V_MAX, T_MAX). The ESC converts received CAN data into control variables to calculate the torque value, which serves as the current reference 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

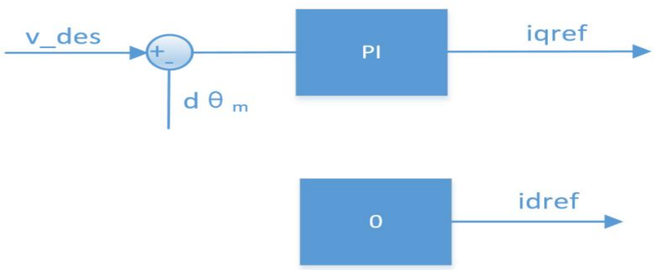
The position-velocity mode uses a three-loop cascaded control scheme. The position loop serves as the outermost loop, and its output is the setpoint for the velocity loop. The velocity loop’s output is used as the setpoint for the inner current loop, which controls the actual current output. The control 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, and both use the float data type.

❖ Velocity Mode

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



Note:
The unit of v_des is rad/s, and the data type is float.
To enable automatic parameter calculation using the debugging assistant, the damping factor must be set to a non-zero positive value.
Typically, it ranges from 2.0 to 10.0:A value that is too small may cause speed oscillation and significant overshootA value that is too large may result in a longer rise time The recommended setting is 4.0.

❖ Force-Position Hybrid Mode

Control Message	D[0]	D[1]	D[2]	D[3]	D[4]	D[5]	D[6]	D[7]
0x300+ID	p_des				v_des		i_des	

P_des: Position command, unit: rad, data type: float, little-endian (low byte first, high byte last).
V_des: Speed limit value, unit: rad/s, scaled by 100, data type: unsigned 16-bit integer, little-endian.
Range: 0 – 10000. Values above 10000 will be clamped to 10000, corresponding to an actual speed limit range of 0 – 100 rad/s.

I_des: Torque current limit (per unit), scaled by 10000, data type: unsigned 16-bit integer, little-endian.
Range: 0 – 10000. Values above 10000 will be clamped to 10000, corresponding to an actual per-unit current limit of 0 – 1.0.

Per-unit current value = actual current value ÷ maximum current value
For J10010L, the maximum current is 99.74A.

Usage

Control is implemented using the standard CAN frame format, with a default baud rate of 1 Mbps. Based on function, communication is divided into command frames and feedback frames:Command frames: Contain control data received from the upper controller, used for motor command execution, parameter reading, and writing.Feedback frames: Sent from the motor to the upper controller, providing motor status and parameter data.

❖ Read Parameters

Message ID	Attributes	D[0]	D[1]	D[2]	D[3]	D[4]	D[5]	D[6]	D[7]
0x7FF	STD	CANID_L	CANID_H	0x33	RID	xx(don't care)			

RID refers to the register address. See appendix <Register List and Range>.
If the read is successful, the motor returns the data from the specified register with the following frame format:

Message ID	Attributes	D[0]	D[1]	D[2]	D[3]	D[4]	D[5]	D[6]	D[7]
MST_ID	STD	CANID_L	CANID_H	0x33	RID	Data			

The returned data is little-endian, with the lowest byte in D4 and the highest byte in D7. The same format applies throughout.

❖ Write Parameters

Message ID	Attributes	D[0]	D[1]	D[2]	D[3]	D[4]	D[5]	D[6]	D[7]
0x7FF	STD	CANID_L	CANID_H	0x55	RID	Data			

RID is the same as above. If the write is successful, the response frame returns the written data in the same format as the sent frame.

报文 ID	属性	D[0]	D[1]	D[2]	D[3]	D[4]	D[5]	D[6]	D[7]
MST_ID	STD	CANID_L	CANID_H	0x55	RID	Data			

Writing to a register takes effect immediately, but the change is not stored persistently. After a power cycle, the change will be lost unless a store parameters command is sent to write the modified values to onboard memory.

❖ Store Parameters

Message ID	Attributes	D[0]	D[1]	D[2]	D[3]	D[4]	D[5]	D[6]	D[7]
0x7FF	STD	CANID_L	CANID_H	0xAA	xx(don't care)				

Upon successful storage, the return format is:

Message ID	Attributes	D[0]	D[1]	D[2]	D[3]
MST_ID	STD	CANID_L	CANID_H	0xAA	01

❖ Mode Switching

Multiple control modes are supported and can be switched between. The currently supported modes are:

Code	Mode
1	MIT
2	Position-Velocity
3	Velocity
4	Force-Position Hybrid

The control mode can be changed by modifying the value of the mode register. When switching modes, the motor will first clear all command values, including position, speed, and torque feedforward as well as Kp and Kd in MIT mode. When switching from another mode to a position control mode, it is recommended to first read the exact position (register 0x50) to avoid mechanical impact. Switching should ideally be done when the motor is at zero speed.

Mode changes are not saved to flash. They will be lost after power-down. Upon restart, the control mode will revert to the last mode saved in flash.

❖ CAN Baud Rate Modification

The motor supports modification to specific CAN baud rates. The currently supported baud rates are listed below:

Code	Baud Rate
0	125K
1	200K
2	250K
3	500K
4	1M

After changing the baud rate, the CAN interface will automatically reinitialize and begin communicating at the new baud rate.

❖ Feedback Frame

The Feedback Frame ID is configured via the debugging assistant (Master ID) and defaults to 0. It mainly reports the motor's position, speed, and torque . The specific 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

ID: Controller ID, corresponding to the lower 8 bits of the CAN ID.

ERR: Status indicator, with types as follows:

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
*T_MOS: Average temperature of the MOSFETs on the driver board (unit: °C)
T_Rotor: 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 is equal to the configured CAN ID value.
P_des: Position command
V_des: Velocity command
Kp: Position proportional gainKd: Position derivative gain
T_ff: Torque feedforward value

All parameters follow the mapping relationships described in the previous section.
The ranges of p_des, v_des, and t_ff can be configured via the debugging assistant.
Kp range: [0, 500]
Kd range: [0, 5]
A standard CAN data frame contains only 8 bytes.
In MIT mode, the control command format packs five parameters — Position , Velocity, Kp, Kd, and Torque — into those 8 bytes.
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 a USB-to-CAN debugging tool to connect the motor to the computer, and configure motor parameters or perform firmware upgrades via the debugging assistant.
The motor’s debug serial port is connected to the PC via a GH1.25 3-pin cable, and the CAN communication terminal is connected to the USB-to-CAN debugging tool via a GH1.25 2-pin cable. Configuration and firmware upgrades can be performed through the debugging assistant.
Once the serial port, CAN port, and power interface are all connected, open the debugging assistant on the PC, select the corresponding serial device, and open the serial port. At this point, power on the motor—status information will be printed in the serial terminal, and the Control Mode will indicate the current drive mode.

Key Parameters

Please refer to the following parameters for proper motor usage:

Motor Parameters	Rated Voltage	48 V(Support 24-48V)
	Rated Phase (Power) Current	23.5 A
	Peak Phase (Power) Current	95 A
	Rated Torque	40 NM
	Peak Torque	120 NM
	Rated Speed	70rpm@24V ;100rpm@48V
	Max No-Load Speed	100rpm@24V ; 200rpm@48V
Motor Characteristics	Gear Ratio	10:1
	Pole Pairs	21
	Phase Inductance	85uh
	Phase Resistance	0.11Ω
Structure & Weight	Outer Diameter	120 mm
	Height	53 mm (excluding the positioning pin protrusion; protruding section dimensions: diameter 3 mm × height 3 mm)
	Motor Weight	≈ 1372 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 ≤ 58 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 ≤ 95 A)	Exits "enabled mode" when exceeded
	Motor Under-voltage Protection (supply must be ≥ 15 V)	Exits "enabled mode" when below threshold

Appendix: Register List and Ranges

Register Address (Decimal)	Variable	Description	R/W	Range	Data Type
0	UV_Value	Undervoltage protection	RW	(10.0, 3.4E38]	float
1	KT_Value	Torque coefficient	RW	[0.0, 3.4E38]	float
2	OT_Value	Overtemperature	RW	[80.0, 200)	float
3	OC_Value	Overcurrent protection	RW	(0.0, 1.0)	float
4	ACC	Acceleration	RW	(0.0, 3.4E38)	float
5	DEC	Deceleration	RW	[-3.4E38, 0.0)	float
6	MAX_SPD	Maximum speed	RW	(0.0, 3.4E38]	float
7	MST_ID	Feedback ID	RW	[0, 0x7FF]	uint32
8	ESC_ID	Receive ID	RW	[0, 0x7FF]	uint32
9	TIMEOUT	Timeout alarm duration	RW	[0, 2^32 - 1]	uint32
10	CTRL_MODE	Control mode	RW	[1, 4]	uint32
11	Damp	Motor viscous coefficient	RO	/	float
12	Inertia	Motor inertia	RO	/	float
13	hw_ver	Reserved	RO	/	uint32
14	sw_ver	Software version	RO	/	uint32
15	SN	Reserved	RO	/	uint32
16	NPP	Motor pole pairs	RO	/	uint32
17	Rs	Motor phase resistance	RO	/	float
18	Ls	Motor phase inductance	RO	/	float
19	Flux	Motor flux linkage	RO	/	float
20	Gr	Gear reduction ratio	RO	/	float
21	PMAX	Position mapping range	RW	(0.0, 3.4E38]	float
22	VMAX	Speed mapping range	RW	(0.0, 3.4E38]	float
23	TMAX	Torque mapping range	RW	(0.0, 3.4E38]	float
24	I_BW	Current loop bandwidth	RW	[100.0, 10000.0]	float
25	KP_ASR	Speed loop Kp	RW	[0.0, 3.4E38]	float
26	KI_ASR	Speed loop Ki	RW	[0.0, 3.4E38]	float
27	KP_APR	Position loop Kp	RW	[0.0, 3.4E38]	float
28	KI_APR	Position loop Ki	RW	[0.0, 3.4E38]	float
29	OV_Value	Overvoltage protection	RW	TBD	float
30	GREF	Gear torque efficiency	RW	(0.0, 1.0]	float
31	Deta	Speed loop damping factor	RW	[1.0, 30.0]	float
32	V_BW	Speed loop filter	RW	(0.0, 500.0)	float
33	IQ_c1	Current loop gain factor	RW	[100.0, 10000.0]	float
34	VL_c1	Speed loop gain factor	RW	(0.0, 10000.0]	float
35	can_br	CAN baud rate code	RW	[0, 4]	uint32
36	sub_ver	Sub-version	RO	/	uint32
50	u_off	Phase U offset	RO	/	float
51	v_off	Phase V offset	RO	/	float
52	k1	Compensation factor 1	RO	/	float
53	k2	Compensation factor 2	RO	/	float
54	m_off	Angle offset	RO	/	float
55	dir	Direction	RO	/	float
80	p_m	Motor position	RO	/	float
81	xout	Output shaft position	RO	/	float