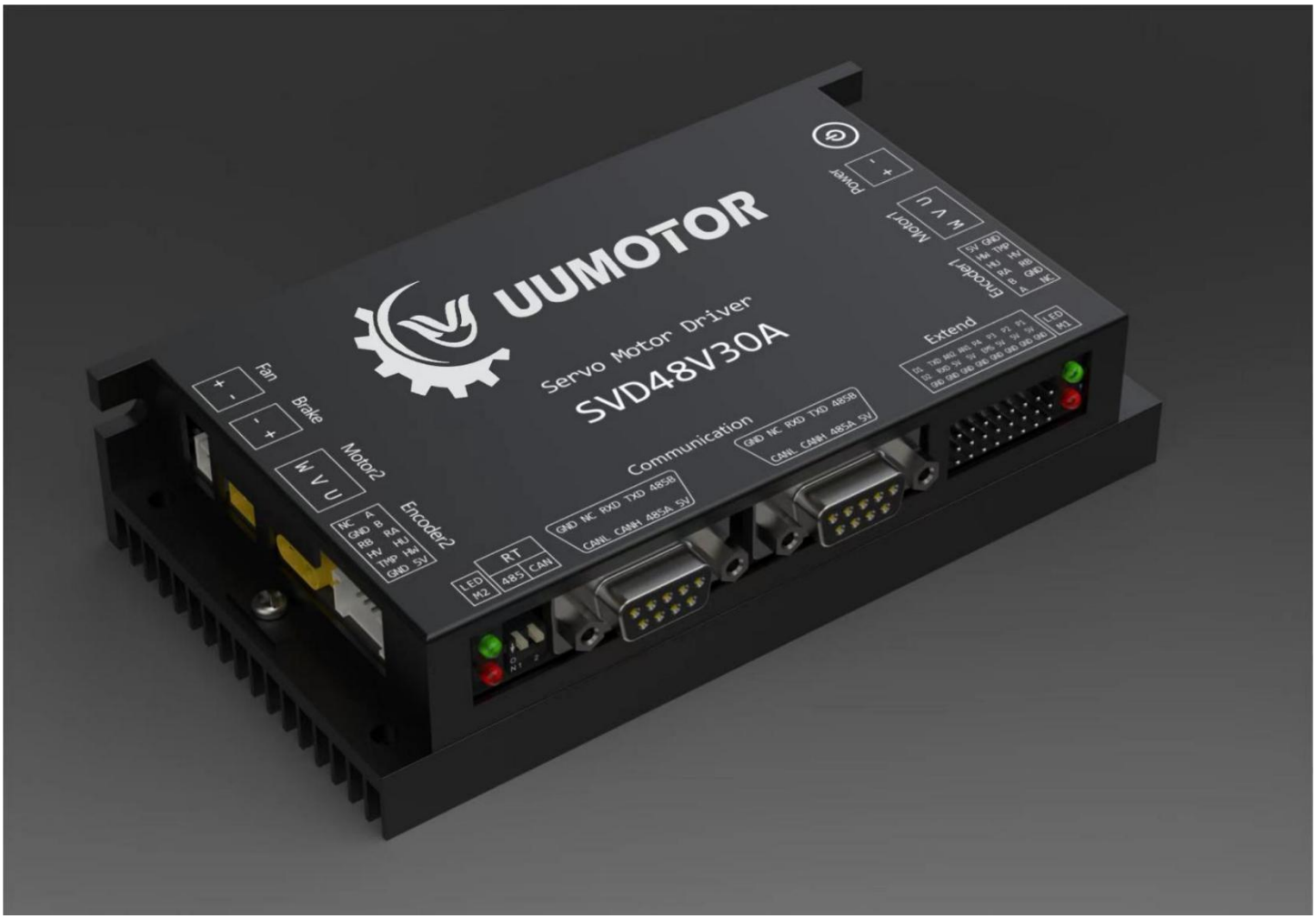


SVD48V series hub motor servo driver

User Manual (V2.0)

Directory

1 Foreword

SVD48V series in-wheel motor servo driver is a one-to-two low-voltage motor drive product launched by UU Motor Technology Co., Limited. This series can adapt to two 100W~800W in-wheel motors at the same time, adopts FOC drive mode with encoder, supports optical encoder with Hall, and magnetic encoder solution. The driver has RS485, RS232 , CAN communication interface, and PWM or pulse input, they can all control the motor operation. Using RS485 or CAN bus can realize the parallel operation of multiple drives, which is suitable for two-wheel or multi-wheel drive platform. The driver adopts a single control chip to achieve one-to-two, so that the two motors driven have better speed synchronization, and fault protection is more timely and reliable, especially suitable for two-wheel-drive AGV platforms.

SV-Config for this series The PC -side host computer debugging software provides parameter list setting and real-time waveform display interface, which is convenient for setting various parameters, and can also test the performance of the driver and motor in real time, providing very friendly help for parameter adaptation.

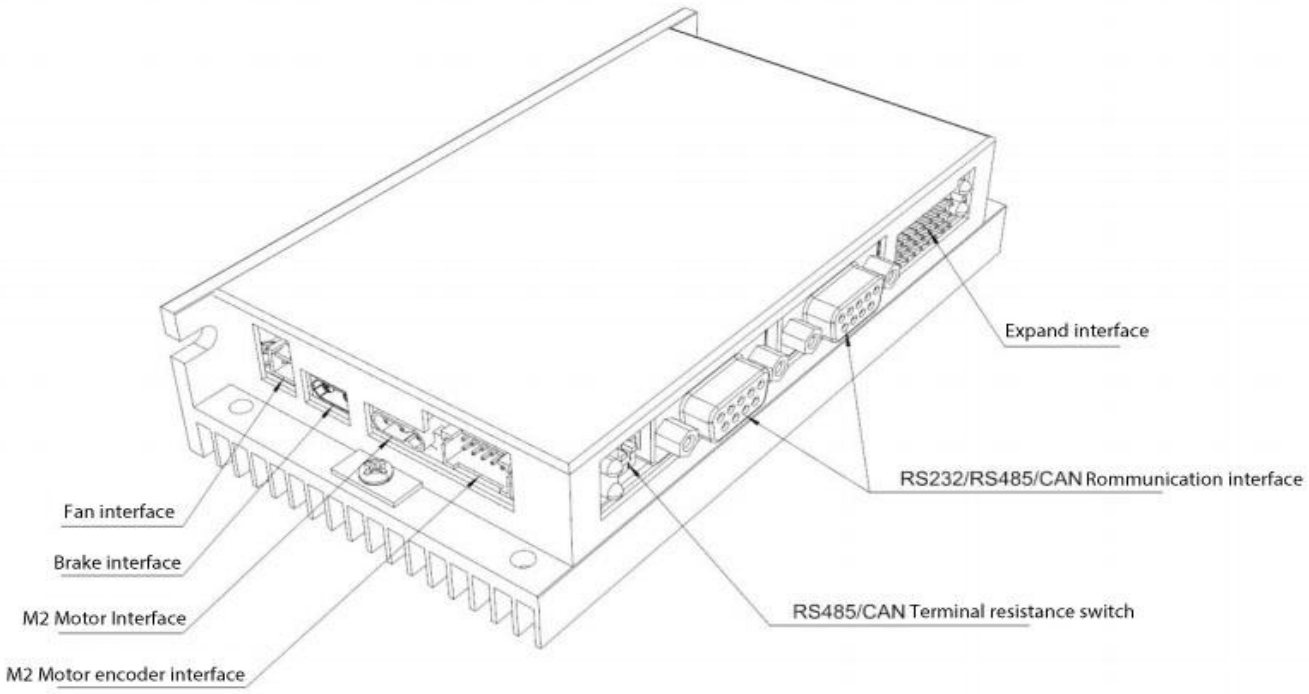
Basic parameters

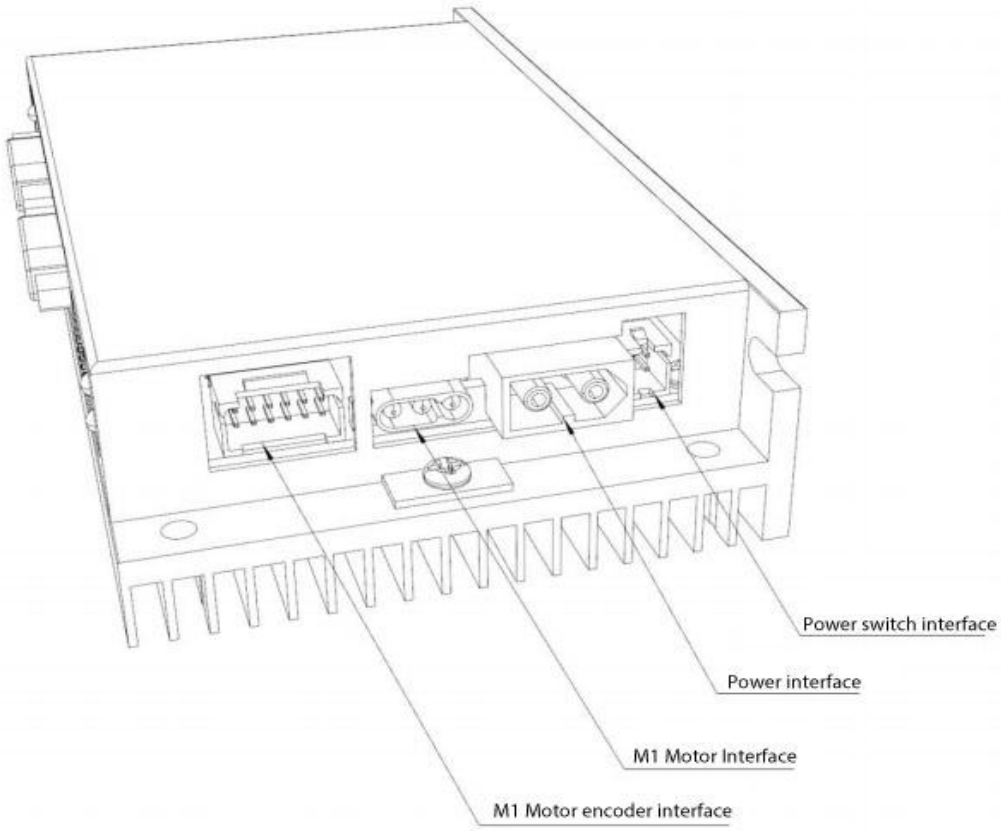
model	SVD48V30A	SVD48V50A
Operating Voltage	24V-48VDC	24V-48VDC
Maximum input continuous current	20A	40A
Output highest Iq current	30A	50A
Adapted motor power	100-400W	400-800W
Maximum speed support	1000.0 RPM (20 pole pairs)	
Minimum RPM Support	1.0RPM	
Minimum working voltage	18V	
Maximum working voltage	60V	
Overvoltage Protection Threshold	Software settings	
control mode	Speed mode, position mode, torque mode	
control interface	RS485, RS232, CAN, PWM, analog input	
Host computer support	SV-Config host computer, RS232 interface	
Encoder input	A/B/Z type, A/B+HALL type, support String Dynamics custom RS485 interface magnetic encoder	
Working temperature	-20℃ ~ +55℃	
Dimensions	143 x 80 x 33 mm	

Applicable fields

1. All kinds of AGV;
2. Industrial robot;
3. warehousing robot;
4. unmanned delivery vehicles;

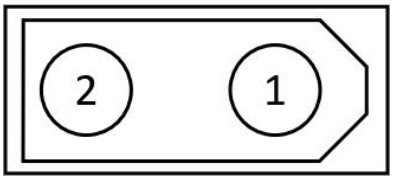
2 Interface definition





2.1 Power interface

No.	mark	name	Remark
1	GND	positive input power	Power input 24V~48V
2	VCC	Input power negative	

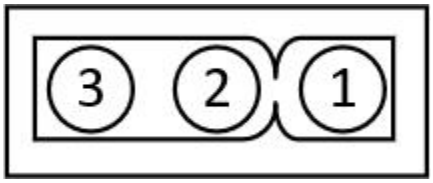


Power interface

power interface is AMASS XT60 , pay attention to the polarity of the power supply.

2.2 Motor cable interface

No.	mark	name	Remark
1	U	Motor power line U	The wiring sequence of the motor cable interface must be correct, otherwise overload protection or speeding will occur at startup.
2	V	Motor power line V	
3	W	Motor power line W	

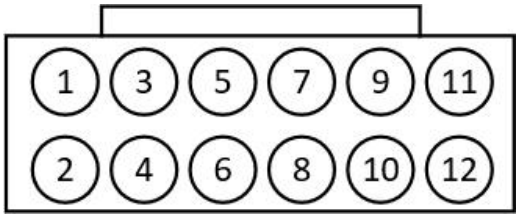


Motor cable interface

motor line interface is AMASS XT30 , pay attention to the motor line sequence.

2.3 Encoder interface

No.	Mark	name	Remark
1	A+	Optical encoder A phase positive input	Optical encoder input supports single-ended and differential signals
2	A-	Optical encoder A phase negative input	
3	B+	Optical encoder B phase positive input	
4	B-	Optical encoder B phase negative input	
5	Z+ (RS485A)	Optical encoder Z-phase positive input	Magnetic encoder with RS485 input can be selected by separate software
6	Z-(RS485B)	Optical encoder Z-phase negative input	
7	HU	Hall U-phase input	Three-phase Hall signal input (used with optical encoder)
8	HV	Hall V phase input	
9	HW	Hall W-phase input	
10	GND	output power ground	Note: The total current limit of all external 5V power supplies is 1A
11	5V	Output power +5V	
12	GND	output power ground	



Encoder interface

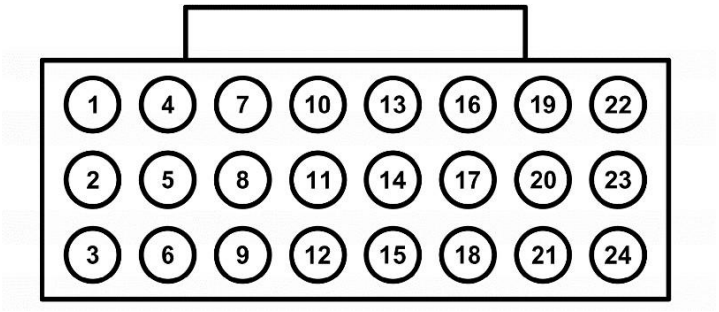
The encoder interface is a PHB-2x6 connector.
Support AB+HALL type absolute optical encoder input;
Support ABZ type optical encoder input, ABZ signal can be software-configured differential and single-ended input. Support software to change to the RS485 interface magnetic encoder input customized by String Dynamics .

2.4 Extension ports

No.	mark	name	Remark
1	D1	download port	
2	D2	download port	
3	GND	output power ground	Input voltage range: 0~5V
4	TXD	TTL interface sender	High level 3.3V, low level 0V
5	RXD	TTL interface receiver	High level 3.3V, low level 0V
6	GND	output power ground	Input voltage range: 0~5V
7	AN2	Throttle analog input port	Input voltage range: 0~5V
8	5V	Output power +5V	Input voltage range: 0~5V
9	GND	output power ground	

10	AN1	Brake analog input port	Input voltage range: 0~5V
11	5V	Output power +5V	Input voltage range: 0~5V
12	GND	output power ground	
13	P4	PPM input 4 channels	Internal pull down
14	EMS	emergency stop	Internal pull-up, grounding is valid
15	GND	output power ground	Input voltage range: 0~5V
16	P3	PPM input 3 channels	Internal pull down
17	5V	Output power +5V	Input voltage range: 0~5V
18	GND	output power ground	
19	P2	PPM input 2 channels	Internal pull down
20	5V	Output power +5V	Input voltage range: 0~5V
21	GND	output power ground	
22	P1	PPM input 1 channel	Internal pull down
23	5V	Output power +5V	Input voltage range: 0~5V
24	GND	output power ground	

Note: The total current limit of all external 5V power supplies is 1A

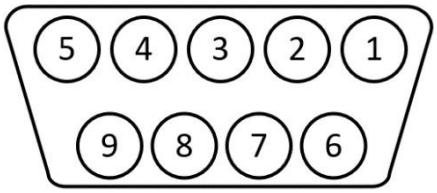


Extension ports

expansion interface is PHB-2x8 connector

2.5 Communication Interface

.No.	mark	name	Remark
1	RS485B	RS485 communication B signal	RS485 commun ication interface
2	RS232_TXD	RS232 send	RS232 communication interface, support RS232 DB9 male head plugs straight in. Note: RS485 will not work if an RS232 connector with flow control is used
3	RS232_RXD	RS232 receive	
4	NC	NC	NC
5	DGND	output power ground	Note: The total current limit of all external 5V power supplies is 1A
6	5V	Output power +5V	
7	RS485A	RS485 communication A signal	RS485 communication interface
8	CANH	CANH signal	CAN communication interface
9	CANL	CANL signal	



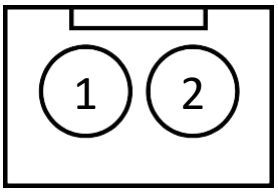
Communication Interface

The communication interface is two DB9 connector females.

Compatible with the RS232 DB9 pin without flow control, you can directly connect to the RS232 interface for communication by using the standard RS232 serial line without flow control. The signals of the two DB9s are exactly the same, the user can use one DB9 to connect the control host, and the other can use daisy-chain to expand the use of multiple drives.

2.6 Fan reserved port

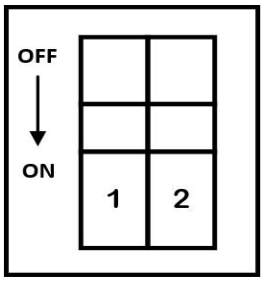
No.	mark	name	Remark
1	VOUT	Fan 5V output	If there is a need for heat dissipation, an external 5V fan can be connected to increase the driving capacity of large loads
2	GND	power ground	



Fan interface

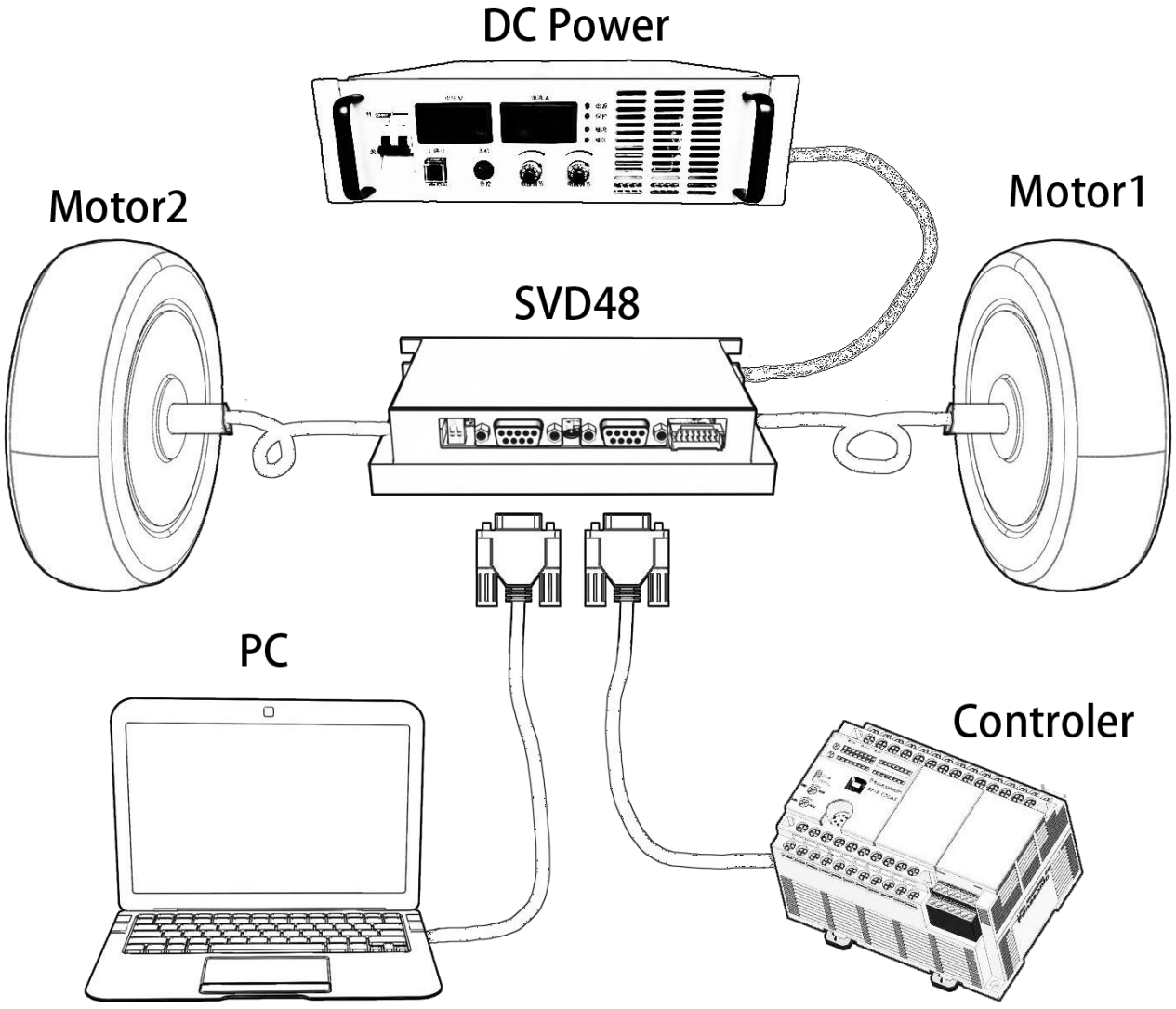
2.7 DIP switch

No.	mark	name	Remark
1	ON	Connect the RS485 terminating resistor	Turn the switch up to disconnect the terminating resistor; turn the switch down to connect the terminating resistor
	OFF	Disconnect the RS485 terminating resistor	
2	ON	Connect the CAN terminating resistor	
	OFF	Disconnect the CAN terminating resistor	



DIP switch

3 System wiring diagram



System wiring diagram

4 Communication Protocols

4.1 RS232 and RS485 communication protocol

4.1.1 read register

request packet

drive address	function code	register address	Number of registers	CRC upper 8 bits	CRC lower 8 bits
0x01~0xFF	0x03	see register definitions, 2 bytes	Number of registers	xx	xx

reply packet

drive address	function code	number of bytes	data	CRC upper 8 bits	CRC lower 8 bits
0x01~0xFF	0x03	number of bytes	high up ahead, low behind	xx	xx

error response packet

drive address	function code	exception code	CRC upper 8 bits	CRC lower 8 bits
0x01~0xFF	0x83	01 or 02 or 03, see exception Answer Definition	xx	xx

4.1.2 write register

request packet

drive address	function code	register address	data (2 bytes)	CRC upper 8 bits	CRC lower 8 bits
0x01~0xFF	0x06	see register definition 2 bytes	High is first, low is back	xx	xx

reply packet

Baotou	function code	register address	data (2 bytes)	CRC upper 8 bits	CRC lower 8 bits
0XEE	0x06	see register definitions, 2 bytes	High is first, low is back	xx	xx

error response packet

drive address	function code	exception code	CRC upper 8 bits	CRC lower 8 bits
0XEE	0x86	01 or 02 or 03, see exception Answer Definition	xx	xx

4.1.3 write multiple registers

request packet

driver address	Function code	register start site	register number	number of bytes	data	CRC high 8 bit	CRC low 8 bit
0XEE	0x10	see register definition 2 bytes	2 bytes	1 byte	high up ahead, low behind	xx	xx

reply packet

driver address	function code	register start address	Number of registers	CRC upper 8 bits	CRC lower 8 bits
0XEE	0x10	see register definition, 2 bytes	register number, 2 bytes	xx	xx

error response packet

drive address	function code	exception code	CRC upper 8 bits	CRC lower 8 bits
0XEE	0x90	01 or 02 or 03, see exception Answer Definition	xx	xx

illustrate

RS232 and RS485 are basically the same, the difference is that the Slave ID of RS232 is fixed to 0xee. The communication format is compatible with Modbus protocol.

Write register and read register can access the register data of M1 and M2 motors at the same time. Write register data and return register data are arranged according to the register byte width. Writing a register will also return the value of the current register after writing the register, and reading a register will return the value of the specified register. The data of multiple bytes is arranged in the low order first and the high order last. The CRC check starts from the Slave ID to the last data. The verification method adopts ModbusCRC16, see **appendix 1** .

4.1.4 abnormal response

exception code	definition	describe
01	Invalid function code	The function code is wrong, that is, the function code is not 0x03 or 0x06 or 0x10
02	invalid register address	Register address error, that is, the register address is an unrecognized register
03	invalid data value	The data value is wrong, the set value is abnormal (out of the set range) range), or the data length is abnormal.

4.1.5 Communication example

Function	describe
read a single register	Read motor M1 current (5410) Send: EE 03 54 10 00 01 60 83 Instruction details: EE drive address 03 function code 54 10 Register start address 00 01 Number of registers 60 83 Checksum of CRC16 Return: EE 03 02 00 03 92 2D Instruction details: EE drive address 03 function code 02 Number of bytes 00 03 Motor M1 current 92 Checksum of 2D CRC16
read multiple registers	Read motor M1 current (5410), M2 current (5411) Send: EE 03 54 10 00 02 61 C3 Instruction details: EE drive address 03 function code 54 10 Register start address 00 02 Number of registers 61 Checksum of C3 CRC16 Return: EE 03 04 00 07 00 02 FD D4 Instruction details: EE drive address

	03 Function code 02 Number of bytes 00 07 Motor M1 current 00 02 Motor M1 current Checksum of FD D4 CRC16
Write a single register (06 function code)	Set the motor M1 control mode (0x5100) to torque mode Send: EE 06 51 00 00 02 68 0E Instruction details: EE drive address 03 function code 51 00 Register start address 00 02 Control mode is torque mode 68 0E Checksum of CRC16 Return: EE 06 51 00 00 02 68 0E Instruction details: EE drive address 03 function code 51 00 Register start address 00 02 Control mode is torque mode 68 0E Checksum of CRC16
Write a single register (10 function codes)	Set the motor M1 control mode (0x5100) to torque mode Send: EE 10 51 00 00 01 02 00 02 60 EF Instruction details: EE drive address 03 function code 51 00 Register start address 00 01 Number of registers 02 Number of bytes 00 02 Control mode is torque mode 60 EF CRC16 checksum Return: EE 10 51 00 00 01 AA 07 Instruction details: EE drive address 03 function code 21 00 Register start address 00 01 Number of registers AA 07 Checksum of CRC16

Write multiple registers (10 function codes)	Set the motor M1 control mode (0x5100) and the motor M2 control mode (0x5101) to torque mode Send: EE 10 51 00 00 02 04 00 02 00 02 EA 45 Instruction details: EE drive address 03 function code 51 00 Register start address 00 02 Number of registers 04 Number of bytes 00 02 Motor M1 control mode is torque mode 00 02 Motor M2 control mode is torque mode EA 45 Checksum of CRC16 Return: EE 10 51 00 00 02 AB 47 Instruction details: EE drive address 03 function code 51 00 Register start address 00 02 Number of registers Checksum of AB 47 CRC16

5 register definition

Register addresses are all hexadecimal data.

5.1 Board parameters

register address	definition	describe	Attributes	Types of	Defaults
3001	Slave ID	User ID address for RS485 and CAN Range: 0~255	RO	uint16	1
3002	Software version	For example, 0x0112 means V1.1.2	RO	uint16	0x0100
3003	hardware version	For example, 0x0122 means V1.2.2	RO	uint16	0x0100
3004	Bootloader Version	For example, 0x0112 means V1.1.2	RO	uint16	0x0100
3005	Product ID	For example, 0x0011 means V1.1.2	RO	uint16	0x0100
3006	RS485 Baud Rate	0:9600 1:19200 2:38400 3:57600 4:115200 5:128000 6:256000 7:460800 8: 500000	RW	uint16	4
3007	CAN baud rate	0: 25 Kbit/s 1: 50 Kbit/s 2: 100 Kbit/s 3: 125 Kbit/s 4: 250 Kbit/s 5: 500 Kbit/s 6: 1000 Kbit/s	RW	uint16	6
3008	control input	0: PWM input 1: RS485 2: CAN 3: TTL 5: Analog	RW	uint16	0

3009	Maximum bus voltage	X0.1V ; the overvoltage protection voltage of the driver. If the bus voltage is greater than this value before starting the motor , the drive will report an error. During operation, the regenerative braking causes the voltage to rise. When it rises to the protection voltage, the driver will limit the regenerative current, so that the bus voltage is generally not higher than the voltage of 8V; when the voltage is higher than the voltage of 15V, the driver will turn off output, and an error is reported. It is recommended that the 6S lithium battery power supply is set to 28V; the 14S lithium battery power supply is set to 54V	RW	uint16	
300A	Overload timeout between	ms; timeout after overload, trigger protection after timeout	RW	uint16	
300B	Encoder power-on calibration	When the drive is powered on, the motor will be calibrated once	RW		

5.2 Board control parameters

5.2.1 Basic parameter function

register address	definition	describe	Attributes	Types of	Defaults
3100	save parameters	0: Do not save parameters to FLASH 1: Save parameters to FLASH	WO	uint16	
3180	Drive in-position flag	fixed at 1 The host computer is used as a heartbeat package	RO	uint16	

5.2.2 CAN actively upload package parameters

register address	definition	describe	Attributes	Types of	Defaults
3200	CAN active packet sending configuration 0	31~16bit: register address Bits 15~0: Active packet sending cycle packet sending period is 0, close the configuration The value range of the packet sending period is 5~65535	RW	uint32	0
3202	CAN active packet sending configuration 1	31~16bit: register address Bits 15~0: Active packet sending cycle If the packet sending period is 0, close the configuration The value range of the packet sending period is 5~65535	RW	uint32	0
3204	CAN active packet sending configuration 2	31~16bit: register address Bits 15~0: Active packet sending cycle packet sending period is 0, close the configuration The value range of the packet sending period is 5~65535	RW	uint32	0
3206	CAN active packet sending configuration 3	31~16bit: register address Bits 15~0: Active packet sending cycle packet sending period is 0, close the configuration The value range of the packet sending period is 5~65535	RW	uint32	0
3208	CAN active packet sending configuration 4	31~16bit: register address Bits 15~0: Active packet sending cycle packet sending period is 0, close	RW	uint32	0

		the configuration The value range of the packet sending period is 5~65535			
320A	CAN active packet sending configuration 5	31~16bit: register address Bits 15~0: Active packet sending cycle packet sending period is 0, close the configuration The value range of the packet sending period is 5~65535	RW	uint32	0
320C	CAN active packet sending configuration 6	31~16bit: register address Bits 15~0: Active packet sending cycle packet sending period is 0, close the configuration The value range of the packet sending period is 5~65535	RW	uint32	0
320E	CAN active packet sending configuration 7	31~16bit: register address Bits 15~0: Active packet sending cycle packet sending period is 0, close the configuration The value range of the packet sending period is 5~65535	RW	uint32	0
3210	CAN Active Packet Configuration 8	31~16bit: register address Bits 15~0: Active packet sending cycle packet sending period is 0, close the configuration The value range of the packet sending period is 5~65535	RW	uint32	0
3212	CAN active packet sending configuration 9	31~16bit: register address Bits 15~0: Active packet sending cycle packet sending period is 0, close the configuration The value range of the packet sending period is 5~65535	RW	uint32	0

3214	CAN active packet sending configuration 10	31~16bit: register address Bits 15~0: Active packet sending cycle packet sending period is 0, close the configuration The value range of the packet sending period is 5~65535	RW	uint32	0
3216	CAN active packet sending configuration 11	31~16bit: register address Bits 15~0: Active packet sending cycle packet sending period is 0, close the configuration The value range of the packet sending period is 5~65535	RW	uint32	0

5.2.3 RS232 actively upload parameters

register address	definition	describe	Attributes	Types of	Defaults
3300	Upload the number of waveforms	Value range: 0~12. 0 disables the active upload function	RW	uint16	
3301	upload package cycle	If the packet sending period is 0, close the configuration The value range of the packet sending period is 5~65535.	RW	uint16	0
3302	Parameter register address 0	Parameter register address	RW	uint16	0
3303	Parameter register address 1	Parameter register address	RW	uint16	0
3304	Parameter register address 2	Parameter register address	RW	uint16	0
3305	Parameter register address 3	Parameter register address	RW	uint16	0
3306	Parameter register address 4	Parameter register address	RW	uint16	0
3307	Parameter register address 5	Parameter register address	RW	uint16	0
3308	Parameter register address 6	Parameter register address	RW	uint16	0
3309	Parameter register address 7	Parameter register address	RW	uint16	0
330A	Parameter register address 8	Parameter register address	RW	uint16	0
330B	Parameter register address 9	Parameter register address	RW	uint16	0
330D	Parameter register address 10	Parameter register address	RW	uint16	0
330E	Parameter register address 11	Parameter register address	RW	uint16	0

5.3 Basic parameters of the motor

5.3.1 M1 Basic parameters of the motor

register address	definition	describe	Attributes	Types of	Defaults
5000	Motor inductance Lq	Range: 0~0.1H	RW	float	
5008	Motor inductance Ld	Range: 0~0.1H	RW	float	
5010	Motor internal resistance Rs	Range: 0~127.99Ω	RW	float	
5018	Motor pole pairs	Range: 1~128	RW	uint16	
501C	maximum speed	Unit: rpm Range: 0~65535	RW	uint16	
5020	Maximum current	Unit: A Range: 0~512A	RW	uint16	
5024	Motor KV	Unit: 0.1rpm/V Range: 0~65535	RW	uint16	
5028	direction of rotation	0: positive 1: Reverse	RW	uint16	
502C	sensor type	0: Encoder 1: HALL 2: String encoder	RW	uint16	

5.3.2 M2 motor

register address	definition	describe	Attributes	Types of	Defaults
5002	Motor inductance Lq	Range: 0~0.1H	RW	float	
500A	Motor inductance Ld	Range: 0~0.1H	RW	float	
5012	Motor internal resistance Rs	Range: 0~127.99Ω	RW	float	
5019	Motor pole pairs	Range: 1~128	RW	uint16	

501D	maximum speed	Unit: rpm Range: 0~32767	RW	uint16	
5021	Maximum Iq current	Unit: A Range: 0~512A	RW	uint16	
5025	Motor KV	Unit: 0.1rpm/V Range: 0~32768	RW	uint16	
5029	direction of rotation	0: positive 1: Reverse	RW	uint16	
502D	sensor interface	0: Encoder 1: HALL 2: String moving magnetic encoder	RW	uint16	

5.4 Motor motion parameters

5.4.1 M1 motor motion parameters

register address	definition	describe	Attributes	Types of	Defaults
5100	control mode	0: speed mode; 1: position mode; 2: Torque Mode 3: Voltage Mode 4: Skateboard Mode 5: Karting mode	RW	uint16	0
5104	Location mode	0: absolute position; 1: relative position;	RW	uint16	0
5108	acceleration maximum acceleration	Unit rpm/s	RW	uint16	
510C	Deceleration maximum deceleration	Unit rpm/s	RW	uint16	
5110	speed smoothing time	S-type acceleration time	RW	uint16	

5.4.2 M2 motor motion parameters

register address	definition	describe	Attributes	Types of	Defaults
5101	control mode	0: speed mode; 1: position mode; 2: Torque Mode 3: Voltage Mode 4: Skateboard Mode 5: Karting mode	RW	uint16	0
5105	Location mode	0: absolute position; 1: relative position;	RW	uint16	0
5109	acceleration maximum acceleration	Unit rpm/s	RW	uint16	
510D	Deceleration maximum deceleration	Unit rpm/s	RW	uint16	
5111	speed smoothing time	S-type acceleration time	RW	uint16	

5.5 Motor PID parameter

5.5.1 M1 motor PID parameters

register address	definition	describe	Attributes	Types of	Defaults
5200	Speed Kp	Range: 0~127.999	RW	float	
5208	Speed Ki	Range: 0~127.999	RW	float	
5210	Speed Kd	Range: 0~127.999	RW	float	
5218	Location Kp	Range: 0~127.999	RW	float	
5220	LocationKi	Range: 0~127.999	RW	float	
5228	Location Kd	Range: 0~127.999	RW	float	
5230	Current loop gain	Range: 0~1.0	RW	float	

5238	Speed feed forward gain	Range: 0~1.0	RW	float	
5240	speed loop dead zone	Range: 0~100	RW	uint16	

5.5.2 M2 motor PID parameters

register address	definition	describe	Attributes	Types of	Defaults
5202	Speed Kp	Range: 0~127.999	RW	float	
520A	Speed Ki	Range: 0~127.999	RW	float	
5212	Speed Kd	Range: 0~127.999	RW	float	
521A	Location Kp	Range: 0~127.999	RW	float	
5222	LocationKi	Range: 0~127.999	RW	float	
522A	Location Kd	Range: 0~127.999	RW	float	
5232	Current loop gain	Range: 0~1.0	RW	float	
523A	Speed feed forward gain	Range: 0~1.0	RW	float	
5241	speed loop dead zone	Range: 0~100	RW	uint16	

5.6 Motor control parameters

5.6.1 M1 Motor Control Parameters

register address	definition	describe	Attributes	Types of	Defaults
5300	control commands	0: stop 1: start 2: Clear the alarm	RW	uint16	0
5304	given speed	Unit: rpm; Range: -32768~32767	RW	int16	0
5308	given current	Unit: x0.1A Range: -32768~32767	RW	int16	0

530C	given location	Optical encoder: line number*4LSB Magnetic encoder: coding range*1LSB; Range: -2147483648 ~ 2147483647	RW	Int32	0

5.6.2 M2 Motor Control Parameters

register address	definition	describe	Attributes	Types of	Defaults
5301	control commands	0: stop 1: start 2: Clear the alarm	RW	uint16	0
5305	given speed	Unit: rpm; Range: -32768~32767	RW	int16	0
5309	given current	Unit: x0.1A Range: -32768~32767	RW	int16	0
530E	given location	Optical encoder: line number*4LSB Magnetic encoder: coding range*1LSB; Range: -2147483648 ~ 2147483647	RW	Int32	0

5.7 Motor status parameters

5.7.1 M1 Motor status parameters

register address	definition	describe	Attributes	Types of	Defaults
5400	Motor running status	0: stop 1: Running	RO	int16	0
5404	Motor temperature	Unit: 0.1℃ Range: -2000~2000	RO	int16	0
5408	bus voltage	Unit: 0.1V Range: 0~2000	RO	int16	0
540C	MOS tube temperature	Unit: 0.1℃; Range: -2000~2000	RO	uint16	0
5410	Motor speed	Unit: rpm Range: -32768~32767	RO	int16	0
5414	Motor current	Unit: 0.1A Range: -5000~5000	RO	int16	0
5418	Motor absolute position	Optical encoder: line number*4LSB Magnetic encoder: coding range*1LSB Range: -2147483648 ~ 2147483647	RO	int32	0

5420	error code	See Troubleshooting; Read Only	RO	uint32_t	0

5.7.2 M2 Motor status parameters

register address	definition	describe	Attributes	Types of	Defaults
5401	Motor running status	0: stop 1: Running	RO	int16	0
5405	Motor temperature	Unit: 0.1℃ Range: -2000~2000	RO	int16	0
5409	bus voltage	Unit: 0.1V Range: 0~2000	RO	int16	0
540D	MOS tube temperature	Unit: 0.1℃; Range: -2000~2000	RO	uint16	0
5411	Motor speed	Unit: rpm Range: -32768~32767	RO	int16	0
5415	Motor current	Unit: 0.1A Range: -5000~5000	RO	int16	0
541A	Motor absolute position	Optical encoder: line number*4LSB Magnetic encoder: coding range*1LSB Range: -2147483648 ~ 2147483647	RO	int32	0
5422	error code	See Troubleshooting; Read Only	RO	uint32_t	0

5.8 Motor sensor parameters

5.8.1 Encoder parameters

5.8.1.1 M1 Encoder parameters

register address	definition	describe	Attributes	Types of	Defaults
5500	calibration	0: No calibration 1: Perform calibration	RW	uint16	
5504	Encoder lines / bits	Range: 0~32767	RW	uint16	
5508	Encoder installation direction	0: positive 1: Reverse	RW	uint16	

550C	Encoder Bias	Unit: ° Range: -360°~360°	RW	int16	
5580	Encoder temperature	Unit: x0.1℃ Range: -2000~2000	RO	int16	
5584	Calibration status	0: Calibration successful 1: Calibrating 2: Calibration failed	RO	uint16	

5.8.1.2 M2 **Encoder parameters**

register address	definition	describe	Attributes	Types of	Defaults
5501	calibration	0: No calibration 1: Perform calibration	RW	uint16	
5504	Encoder lines / bits	Range: 0~32767	RW	uint16	
5509	Encoder installation direction	0: positive 1: Reverse	RW	uint16	
550D	Encoder Bias	Unit: ° Range: -360°~360°	RW	uint16	
5581	Encoder temperature	Unit: x0.1℃ Range: -2000~2000	RO	int16	
5585	Calibration status	0: Calibration successful 1: Calibrating 2: Calibration failed	RO	uint16	

5.8.2 **Hall Sensor parameters**

5.8.2.1 M1 Hall **Sensor parameters**

register address	definition	describe	Attributes	Types of	Defaults
5600	calibration	0: No calibration 1: Perform calibration	RW	uint16	
5620	Hall installation	0: 120° 1: 60°	RW	uint16	
5624	Calibration current	Range: 0~50A	RW	uint16	

5640	Angle table	Contains 8 angular data units: ° Range: -360°~360°	RW	int16	0
5680	Encoder temperature	Unit: x0.1℃ Range: -2000~2000	RO	int16	0
5684	Calibration status	0: Calibration successful 1: Calibrating 2: Calibration failed	R0	uint16	0
5688	HALL status	Range: 0~7	R0	uint16	0
568C	HALL current angle	Unit: ° Range: -360°~360°	R0	int16	0

5.8.2.2 M2 Hall **Sensor parameters**

register address	definition	describe	Attributes	Types of	Defaults
5601	calibration	0: No calibration 1: Perform calibration	RW	uint16	
5605	Calibration current	Range: 0~30A	RW	uint16	
5621	Hall installation	0: 120° 1: 60°	RW	uint16	
5609	Calibration current	Range: 0~30A	RW	uint16	
5650	Angle table	Contains 8 int16 angle data units: ° Range: -360°~360°	RW	int16	0
5681	Encoder temperature	Unit: x0.1℃ Range: -2000~2000	RO	int16	0
5685	Calibration status	0: Calibration successful 1: Calibrating 2: Calibration failed	R0	uint16	0
5689	HALL status	Range: 0~7	R0	uint16	0
568D	HALL current angle	Unit: ° Range: -360°~360°	R0	int16	0

5.9 Throttle brake control parameters

5.9.1 Basic parameters

register address	definition	describe	Attributes	Types of	Defaults
2200	maximum acceleration	Unit: A/s	RW	uint16	
2201	Wheel diameter	Unit: mm	RW	uint16	
2202	Number of motor teeth	Range: 1~32767	RW	uint16	
2203	number of teeth	Range: 1~32767	RW	uint16	
2280	input type	0:Uart 1: PPM control	RW	uint16	
2281	PPM1 base value	Value range 10000~20000	RW	uint16	15000
2282	PPM2 benchmark	Value range 10000~20000	RW	uint16	15000
2283	PPM3 benchmark	Value range 10000~20000	RW	uint16	15000

5.9.2 control parameter

register address	definition	describe	Attributes	Types of	Defaults
2000	Throttle dead zone range	Value range 1~20	RW	uint16	5
2001	throttle curve	0: Linear curve 1: custom curve	RW	uint16	
2002	Throttle custom curve points	Value range 2~16	RW	uint16	
2010	normal mode Throttle maximum force	Percentage of maximum current, value range 0~100	RW	uint16	
2011	normal mode Initial throttle force	Value range 0~50	RW	uint16	

2012	normal mode accelerator acceleration	Value range 0~100	RW	uint16	
2013	normal mode Maximum speed	Calculated according to the number of teeth of the motor wheel and the diameter of the wheel	RW	uint16	
2020	sport mode Throttle maximum force	Percentage of maximum current, value range 0~100			
2021	sport mode Initial throttle force	Value range 0~50	RW	uint16	
2022	sport mode accelerator acceleration	Value range 0~100	RW	uint16	
2023	sport mode Maximum speed	Calculated according to the number of teeth of the motor wheel and the diameter of the wheel	RW	uint16	
2030	Turbo mode Throttle maximum force	Percentage of maximum current, value range 0~100	RW	uint16	
2031	Turbo mode Initial throttle force	Value range 0~50	RW	uint16	
2032	Turbo mode accelerator acceleration	Value range 0~100	RW	uint16	
2033	Turbo mode Maximum speed	Calculated according to the number of teeth of the motor wheel and the diameter of the wheel	RW	uint16	
2060	custom throttle curve	Contains 32 uint16 data	RW	uint16	
2080	Brake dead zone range	Value range 1~10	RW	uint16	
2081	brake curve	0: Linear curve 1: custom curve	RW	uint16	
2082	Brake custom curve points	Value range 2~16	RW	uint16	
2090	normal mode maximum braking force	Value range: 0~100	RW	uint16	
2091	normal mode initial braking	Value range: 0~100	RW	uint16	

	force				
2092	normal mode braking acceleration	Value range 0~100	RW	uint16	
20A0	sport mode maximum braking force	Value range: 0~100	RW	uint16	
20A1	sport mode initial braking force	Value range: 0~100	RW	uint16	
20A2	sport mode braking acceleration	Value range 0~100	RW	uint16	
20B0	Turbo mode maximum braking force	Value range: 0~100	RW	uint16	
20B1	Turbo mode initial braking force	Value range: 0~100	RW	uint16	
20B2	Turbo mode braking acceleration	Value range 0~100	RW	uint16	
20E0	custom throttle curve	Contains 32 uint16 data	RW	uint16	

5.9.3 Remote control parameters

register address	definition	describe	Attributes	Types of	Defaults
2100	sport mode	0: Normal mode 1: Sport mode 2: Turbo model	RW	uint16	0
2101	speed direction	0: Forward rotation 1: Invert	RW	uint16	0
2102	Throttle stroke	The value range is 10000~20000. It is defined according to the throttle range of the remote control. When the dial is in the middle position, the value is 15000.	RW	uint16	
2103	Brake stroke	The value range is 10000~20000. It is defined according to the throttle range of the remote control. When the dial is in the middle position, the value is 15000.	RW	uint16	
2130	current driving speed	Current driving speed, the unit is km/h, read only	RW	uint16	
2131	battery power	Value range 0~100;	RW	uint16	
2132	Output Power	Output power, unit W, voltage V*current A	RW	uint16	
2133	Motor 1 temperature	Unit: 0.1℃; Range: -2000~2000	RO	int16	
2134	Motor 2 temperature	Unit: 0.1℃; Range: -2000~2000	RO	int16	
2135	drive temperature	Unit: 0.1℃; Range: -2000~2000	RO	int16	

5.10 Software upgrade (RS232)

5.10.1 card reader status

request packet

drive address	function code	parameter address	CRC upper 8 bits	CRC lower 8 bits
0XEE	0x41	0x10	xx	xx

reply packet

drive address	function code	parameter address	number of bytes	data	CRC upper 8 bits	CRC lower 8 bits
0XEE	0x41	0x10	0x01	xx	xx	xx

5.10.2 write card status

request packet

drive address	function code	parameter address	number of bytes	data	CRC upper 8 bits	CRC lower 8 bits
0XEE	0x42	0x10	0x01	xx	xx	xx

no reply packet

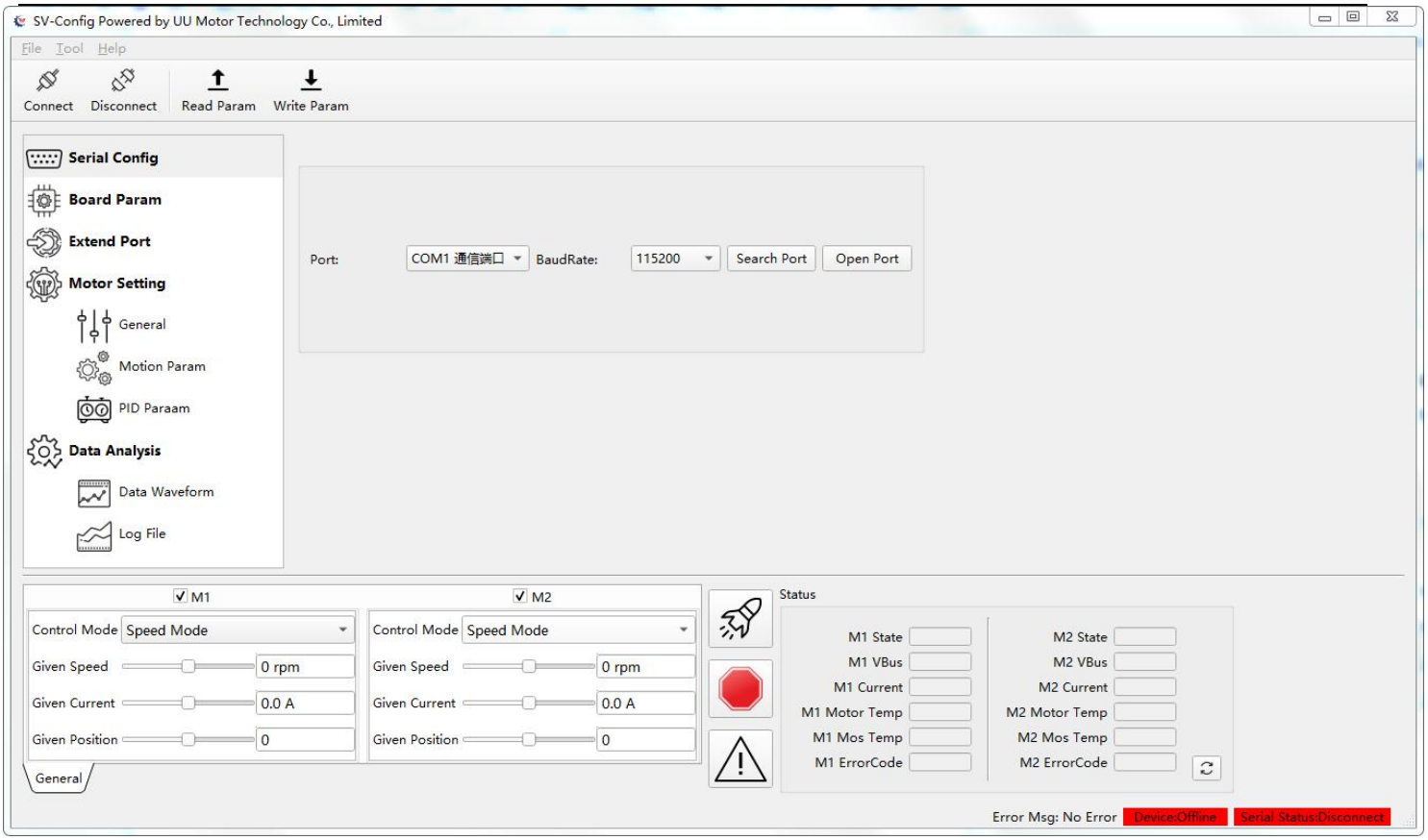
6 Instructions for use of control mode

6.1 Preparation before use

Before use, please make sure that the controller and the motor are connected correctly, and ensure that the power supply voltage is within the specified range. For your safety, please keep the in-wheel motor off the ground and keep the motor in a suspended state when powering on for the first time. Use the RS232 serial cable to connect the driver to the PC (computer), and then power on the driver (select 24V or 48V according to the matching motor).

6.2 Connect the device

Open SV-Config on the PC side, select the corresponding serial port number, select 115200 for the baud rate, and then open the serial port.



Click 

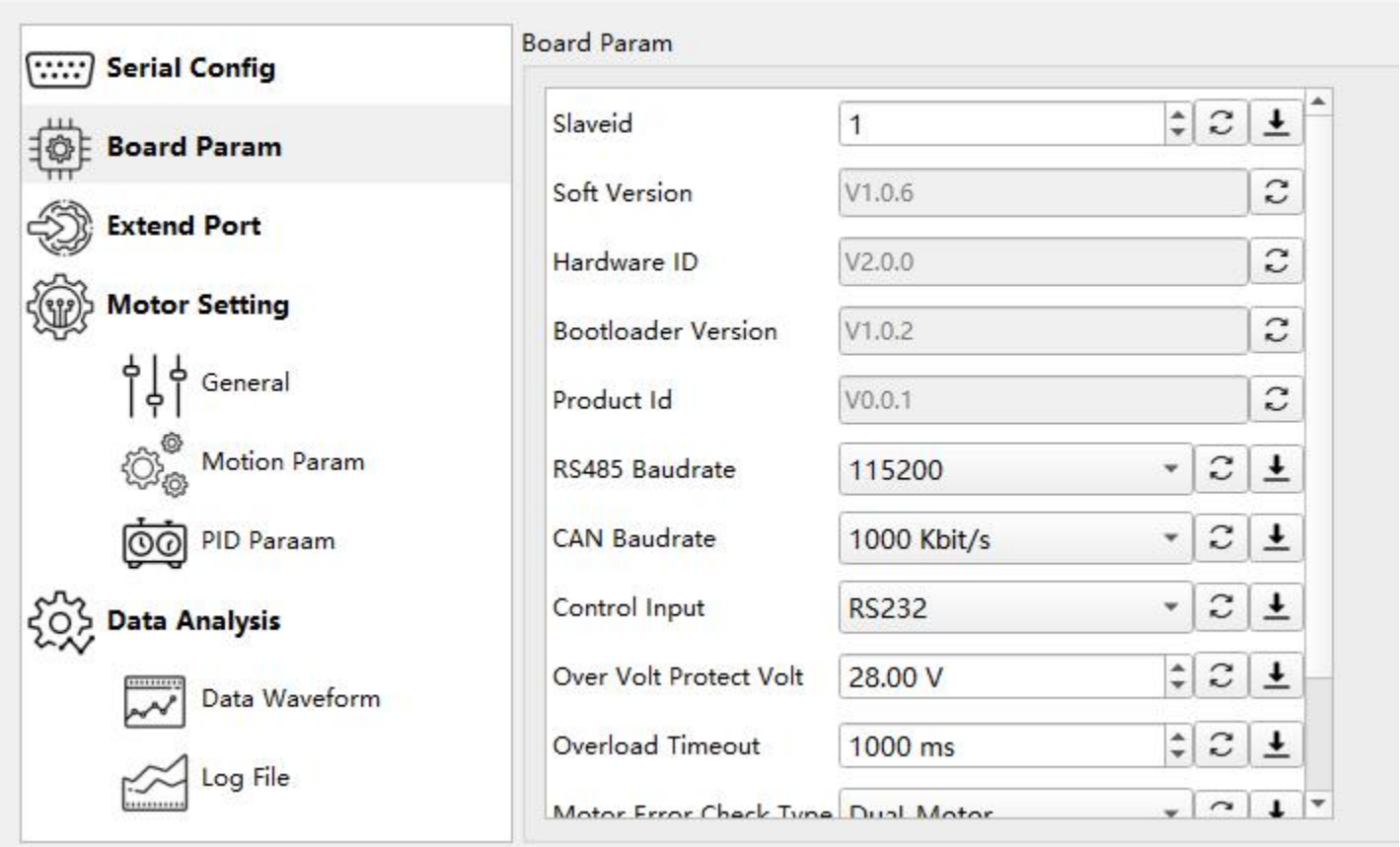
, the bottom right shows green and the device is connected successfully.

6.3 toolbar button

1. Serial port connection, after opening the serial port once, you can quickly open the serial port through this button.
2. Disconnect, close the serial port.
3. Read parameters, read all parameters from the drive.
4. Write parameters, write all the parameters of the host computer SV-Conifg to the drive, **note: the parameters must be written after stopping the motor .**
5.  start up button.
6.  stop button
7.  Clean error information button, when driver has error, click this to clean error info.

6.4 Confirm board information

In the functional area, select board parameters, configure CAN/RS485 communication address ID, and configure RS485 and CAN baud rates respectively. Set the overvoltage protection voltage, and control interface type.



6.5 Confirm the general parameters of the motor

General parameters of the motor, check whether the information of the motor and encoder is correct.

Here you can use the parameter import function to import

We provide factory parameter configuration files. It is also possible to import profiles that the user has previously exported. The parameters imported into the configuration file will be updated to the setting value list, but they are not delivered and saved to the drive. After modifying the setting values, you can directly save the parameters to the drive through the "Write Parameters" button .

6.5.1 General Motor Parameters

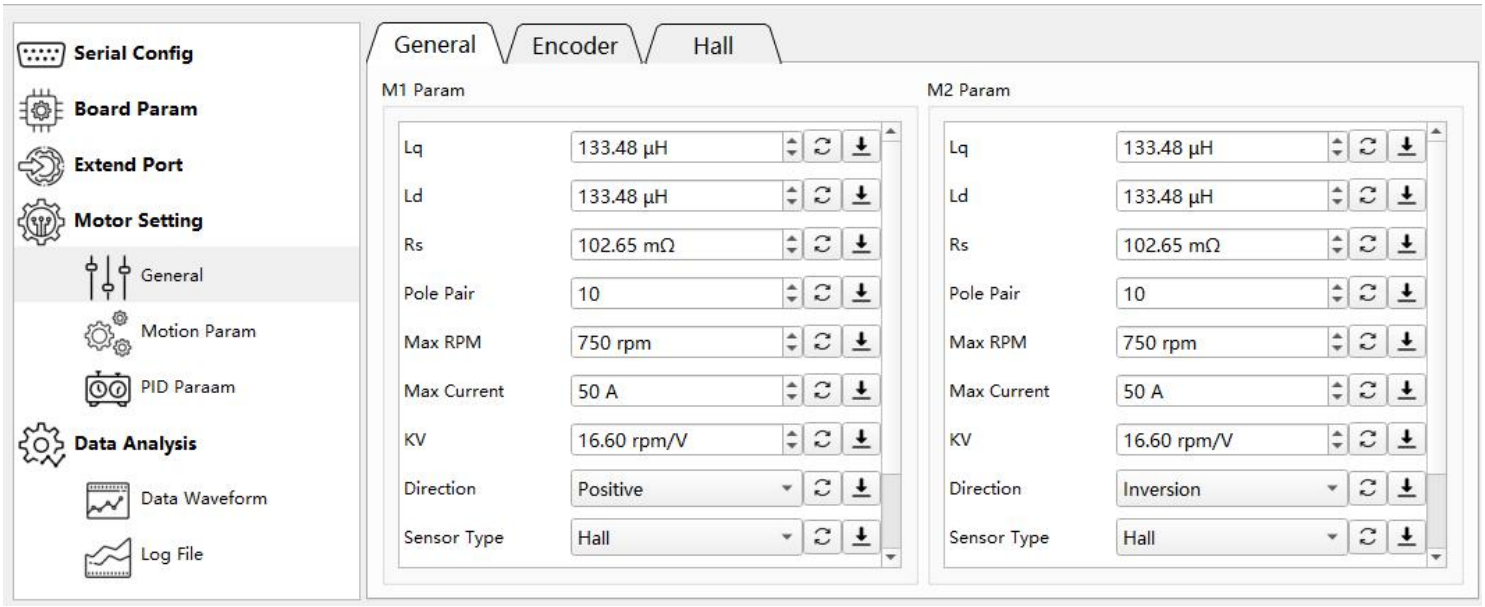
Motor Maximum RPM : Modified according to the maximum speed of the selected motor and the maximum speed required by the user. The given speed is not allowed to be greater than the maximum speed of the motor.

maximum current of the motor : This refers to the maximum current that the driver can drive the motor, which generally corresponds to the maximum peak current of the motor.

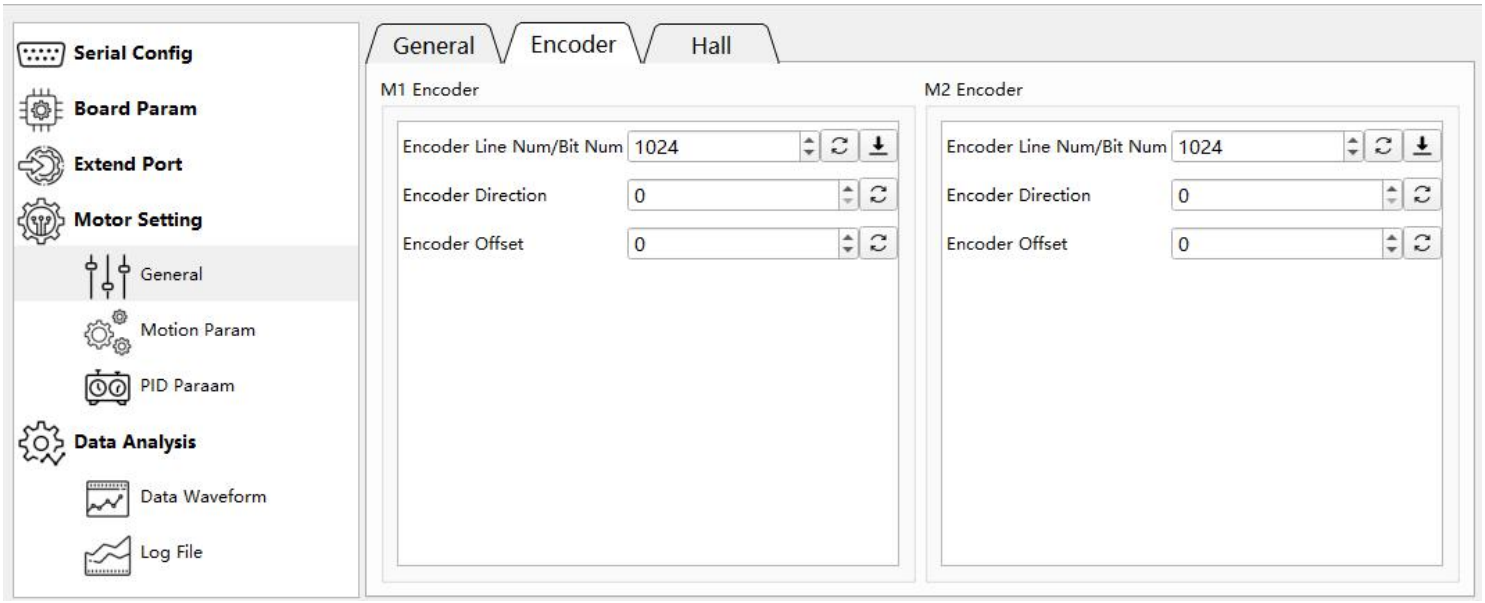
The greater the flow, the greater the motor peak torque. The maximum current that can be set cannot exceed the maximum current specified by the drive model.

Motor direction : the direction of motor movement.

Sensor Type : Encoder, Hall, String Encoder

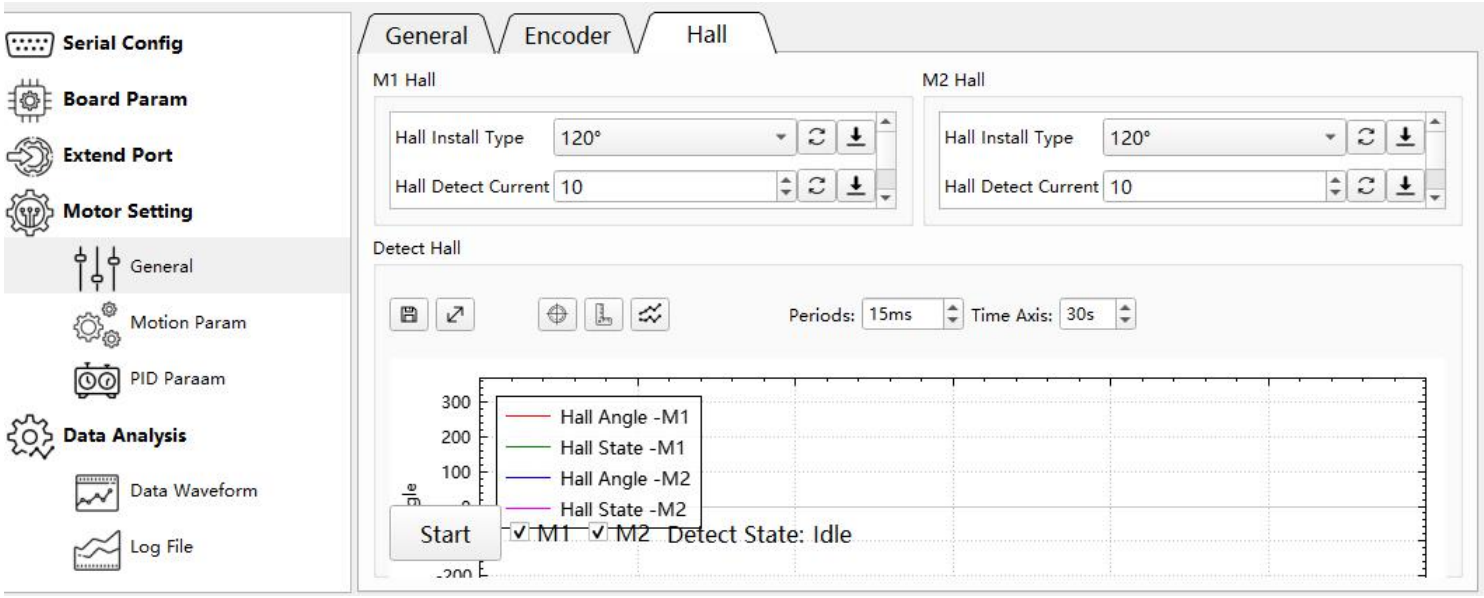


6.5.2 Motor encoder parameters



Encoder lines/bits : Optical encoders are lines, magnetic encoders are bits.

6.5.3 Motor Hall Parameters



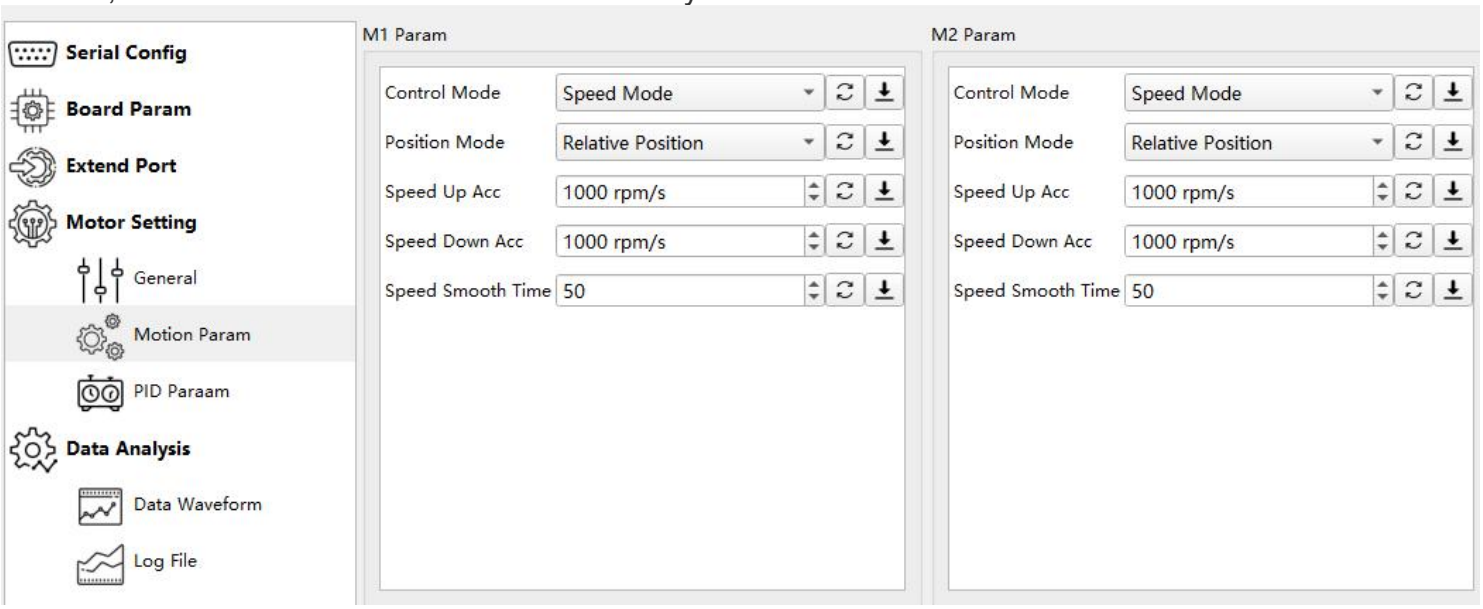
6.6 Confirm motion parameters

First, confirm the control mode, which is divided into three types: speed mode, position mode, and torque mode. The position mode also needs to set absolute position or relative position control.

Acceleration Acceleration: The maximum acceleration of motor acceleration.

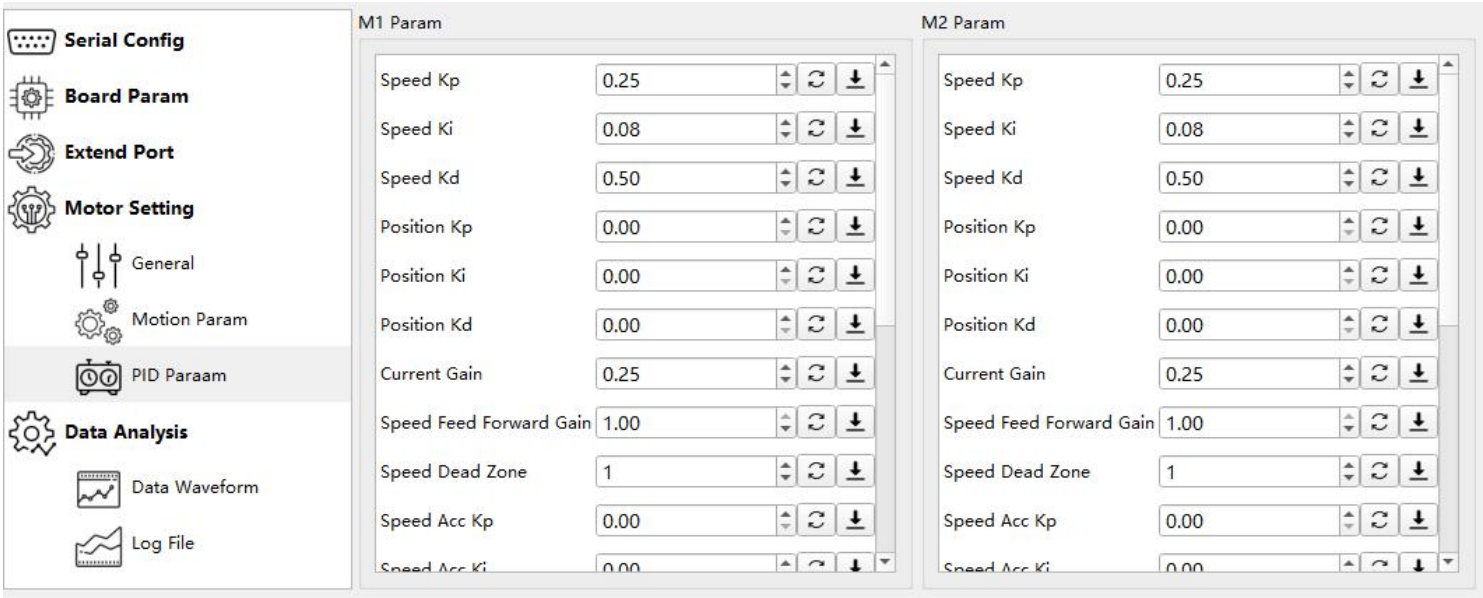
Deceleration acceleration: The maximum acceleration of motor deceleration.

Speed optimization time: refers to the time when the speed acceleration transitions from 0 to the maximum acceleration. Smooth transition to speed changes use. Properly increasing the speed smoothing time and appropriately reducing the acceleration and deceleration ramp time can ensure the real-time response of the speed control to a certain extent, and at the same time ensure the stability.



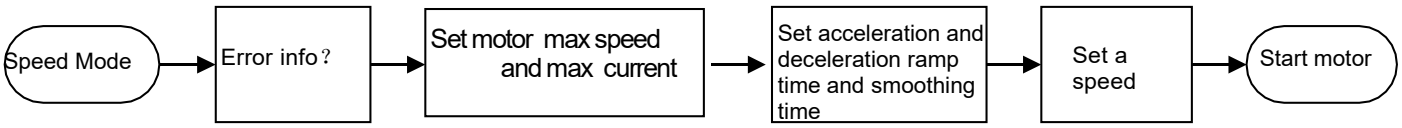
6.7 Confirm PID parameter

The PID parameters can be tested according to the default value first, and the effect can be modified in real time if the effect is not satisfied. After writing the parameters, it will take effect in real time. But when all motors stop, the parameters will be written to Flash and saved.



6.8 speed mode

The process of using the speed mode:



6.9 Location mode

The position mode is divided into absolute position mode and relative position mode. The position mode works together with the speed loop. Before running a given position, set the relevant parameters of the speed mode.

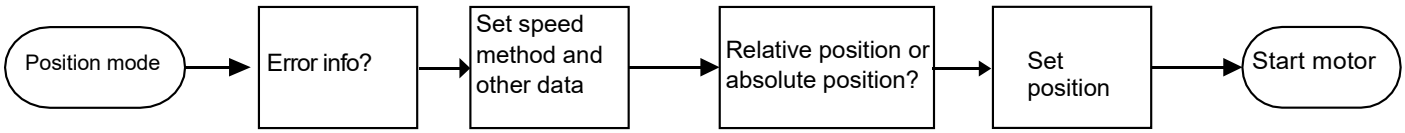
Reference speed : the maximum operating speed in position mode.

Given position : The given value of the position mode. The corresponding position information is given according to the absolute position and the relative position.

Relative position : the given value is the increment of the position, such as 1024 line encoder, given 4096, the motor will make one revolution.

Absolute position : The given value is the absolute value of the position. The absolute value of the position is initialized to 0 from the time of power-on, and then increases continuously, exceeding int32 Returns to 0 after the range.

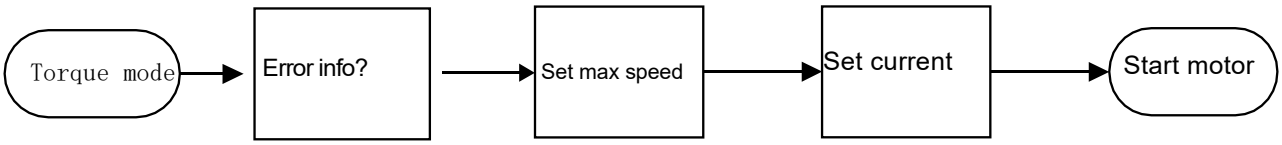
Location mode usage process:



6.10 Torque Mode

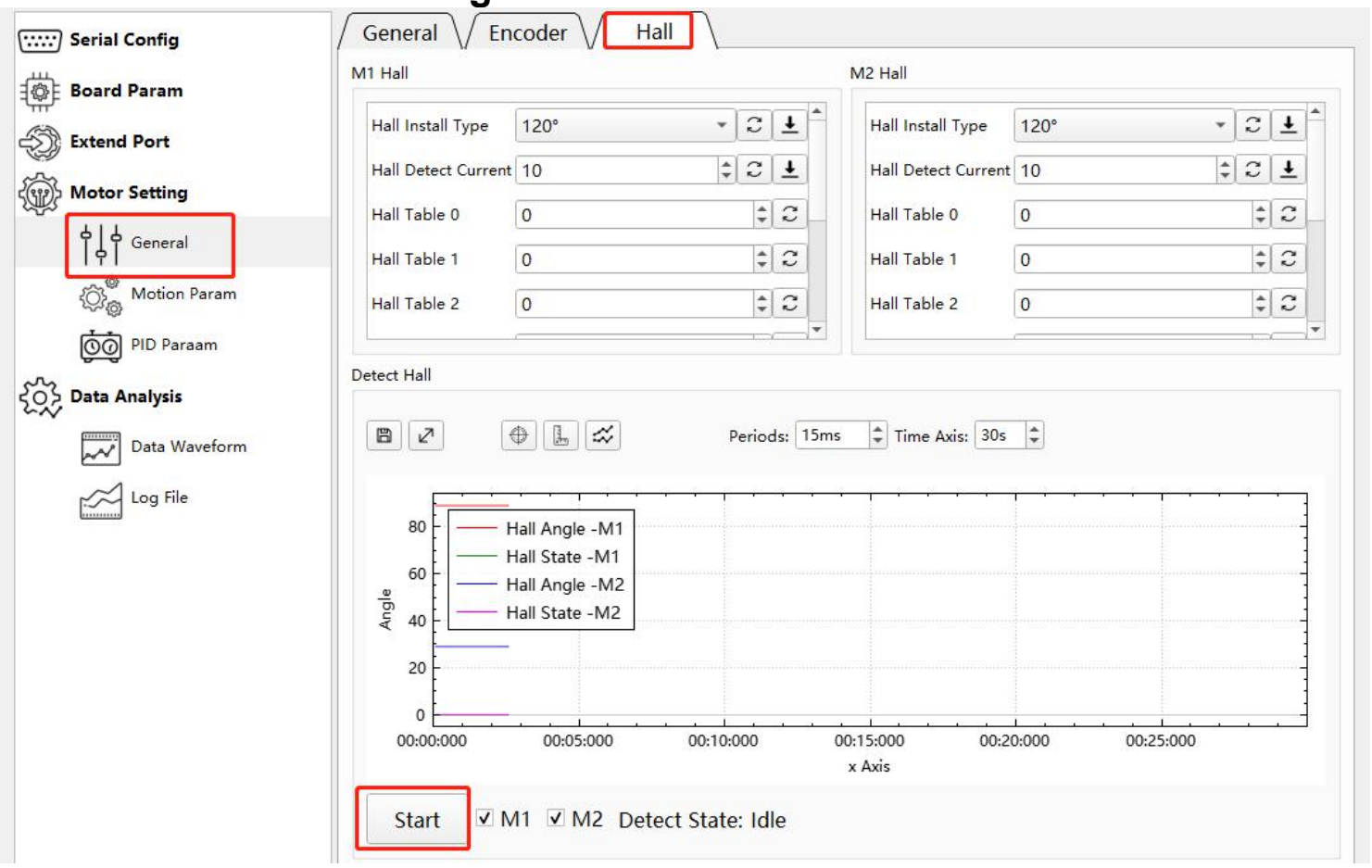
The torque mode only has a current loop in theory, but in order to limit the safety problems caused by the high speed caused by the light load, we provide the maximum speed limit, that is, set the given speed as the maximum limit speed. So before setting a given current, set the desired maximum limit speed. In this way, even if a larger given current is set, the motor will not exceed the given speed under no-load condition.

Torque mode usage process:



7 Hall calibration

7.1 Calibrate the Hall angle



Calibration can only be performed after all parameters are set .

1. Select the Hall installation type.
2. Set the size of the calibration current.
3. Click the Start button and wait for the calibration to succeed .

Hall sensors need to be recalibrated in the following situations:

1. Change the line sequence of the three-phase line of the motor.
2. Replace the new motor.
3. The motor rotates in the opposite direction.

When the motor rotates in the opposite direction, modify the direction in the general parameters, write it to the drive, and then recalibrate.

After calibration, press the start button to control the motor.

8 Appendix I CRC Check Calculation Routine

```
/***
Function name：
Calc_Crc(uint8_t\*pack_buff,uint8_tpack_len)
notes： Modbus protocol CRC verification
Input value： pack_buff,data,pack_len: length of verification value：
return the CRC verification code of two bytes
***/
uint16 Calc_Crc(uint8_t*pack_buff,uint8_t pack_len)
{
    uint8_t len = pack_len;
    uint16 crc_result = 0xffff;
    int crc_num = 0;
    int xor_flag = 0;
    for (int i = 0; i < len; i++)
    {
        crc_result ^= pack_buff[i];
        crc_num = (crc_result & 0x0001);
        for (int m = 0; m < 8; m++)
        {
            if (crc_num == 1)
                xor_flag = 1;
            else
                xor_flag = 0;
            crc_result >>= 1;
            if (xor_flag)
                crc_result ^= 0xa001;
            crc_num = (crc_result & 0x0001);
        }
    }
}
```

9 Appendix II Troubleshooting Quickly

9.1 Led error indicator

	Indicator display type	mistake
POST error flashing green light	Green light 1 flash	Abnormal current sampling
	Green light 2 flashes	Abnormal overcurrent protection circuit
	Green light 3 flashes	Abnormal drive motor cable
	Green light 4 flashes	Bus voltage too high or too low
	Green light 5 flashes	Drive 12V abnormal
	Green light 6 flashes	Drive 5V abnormal
	Green light 7 flashes	Motor circuit open
	Green light 8 flashes	Drive temperature is too high
Running error red light flashing	Red light 1 flash	Emergency stop button pressed
	Red light 2 flashes	Encoder input abnormal
	Red light 3 flashes	Motor overcurrent protection
	Red light 4 flashes	Motor overload protection
	Red light 5 flashes	Overvoltage protection
	6 flashes of red light	Undervoltage protection
	Red light 7 flashes	Drive temperature is too high

9.2 Handling according to error code

	bit	Fault type	Possible Causes	Solution
Self-check error code	0	Abnormal current sampling	Abnormal power supply or current sensor abnormality	Please contact after sales
	1	Abnormal overcurrent protection circuit	Abnormal hardware circuit	Please contact after sales
	2	Abnormal drive motor cable	The motor line is shorted to ground, or the driver MOS tube is short road	Check whether the motor wire is short-circuited to ground, if not, please contact the after-sales service
	3	Bus voltage is too high or too high Low	Abnormal supply voltage	Please check whether the supply voltage is within the specified range
	4	Drive temperature	Drive temperature is too high or	If the drive temperature is within the specified range, please contact

		detected abnormal often	The hardware circuit is abnormal	After-sales
	5	Drive 12V abnormal	Abnormal hardware circuit	Please contact after sales
	6	Drive 5V abnormal	External output 5V short-circuit road or overcurrent	The total current of the external 5V load cannot exceed 1A, if If it exceeds 1A, please use another power supply
	7	Motor circuit open	The motor wire is not connected	Check the motor cable connection
run error code	8	Drive temperature is too high	long-term high-load operation	Add a 5V fan while optimizing drive enclosure cooling environment
	9	Motor temperature is too high	long-term high-load operation	Reduce the motor load, or use a higher power motor
	10	Motor overcurrent protection	Motor wire short circuit	Replace the motor
	11	Motor overload protection	Motor is subject to specified overload Guard Time Stall	1. Appropriate software to increase overload protection time; 2. Please use a higher power motor
	12	Overvoltage protection	Unstable supply voltage	1. It is recommended to use a higher current power supply, or use a battery pack for power supply; 2. Properly increase the motor acceleration ramp time
	13	Undervoltage protection	Unstable supply voltage	1. It is recommended to use a higher current power supply, or use a battery pack for power supply; 2. Properly increase the motor deceleration ramp time
	14	Encoder input abnormal	The encoder plug is disconnected or The encoder is damaged	1. Check whether the encoder line is connected normally; 2. Replace the encoder or motor
	15	wrong hardware version	wrong firmware upgrade	Re-upgrade the correct firmware

9.3 Treat according to the phenomenon

No.	Phenomenon	Possible Causes	Approach
1	Overload protection at start-up	1. motor line UVW and Hall UVW line sequence is wrong; 2. The motor parameters are set incorrectly	1. Swap the motor line UVW in turn to make a no-load attempt; 2. Connect the host computer to check the number of pole pairs and Is the encoder line number correct?
2	As soon as the motor is started, the speeding	Motor line UVW and Hall UVW line wrong order	Swap the motor line UVW in turn and try to do no-load
3	Motor does not start	1. The drive has detected an error exception; 2. Parameter setting is incorrect	1. Connect to the host computer to check the error code, and make judgment and processing according to the error code; 2. Connect to the host computer to check whether the parameters of the driver and motor are correct, and re-write all parameters using the configuration file provided by the manufacturer. number
4	Motor shakes too much	PID parameter mismatch	Connect the host computer to re-adjust the PID parameters. First adjust the I parameter to the minimum, then reduce the P parameter, increase the D parameter appropriately, and then increase it appropriately I parameter
5	The vehicle vibrates	PID parameter mismatch	Reduce the I parameter and appropriately increase the P parameter
6	Acceleration and deceleration are too severe	Acceleration and deceleration ramp time is too small	Properly increase the acceleration and deceleration ramp time
7	Easy to shake during acceleration and deceleration	The given speed fluctuates greatly	Properly increase the speed smoothing time