TINSMITH M SERIES ROBOT JOINT MODULE

CanOpen_Mannual

M4215 M5730 M8010 and M8025 Robot Joint Module

Characteristic

1. Isolate CANopen communication according to CiA301 V4.2.0 specification
   A.Support SDO, TPDO, RPDO.
   B.Support speed mode, position mode (contour mode, interpolation mode)
   C.Support heartbeat production and consumption
2. 15 bit absolute encoder, one lap pulse up to 32768.
3. Multi-stage DD motor structure, large torque output.
4. Harmonic reducer, motor, driver and encoder are integrated.
5. Low noise, low vibration, high speed positioning, high reliability.
6. FOC field oriented vector control, support position / speed closed loop.
7. Can work at zero hysteresis given pulse state, following zero hysteresis.
8. 16-bit electronic gear features.
9. CANopen upper computer is provided, which can monitor motor state and modify parameters.
10. Position mode, support pulse + direction signal, encoder to follow.
11. Speed mode, support PWM duty cycle signal speed regulation
12. It has the function of blocking rotation, over current protection and over voltage protection.
13. Absolute value of low power consumption and multi-turn
    A. All-in-one servo 485/CAN communication version can add multi-turn function.
    B. When the motor is powered, there is a charging circuit inside to charge the battery.
    When the motor is powered off, the battery current consumption is only 0.07mA.
    C. After the motor has no power supply, the motor shaft is driven to rotate to wake up the encoder and continue to memorize the position.
    D. Multi-turn memory range -60000 ~ 60000 laps.
    E. Simple setting of the origin, it can be set as the origin at any position.
    F. Multiple zero return methods: communication zero return, automatic zero return on power-on, and zero point signal output.
    G. Error protection: battery power failure alarm.

Technical Parameter

	Parameter	M4215E14B50L	M4215E14B80L
Overall parameter	Motor rated voltage	36VDC±10%	36VDC±10%
	Motor rated current	2.2A	2.2A
	Output torque after deceleration	9NM	14NM
	Weight	1KG	1KG
	Speed range after deceleration	0~30RPM	0~20RPM
Reducer parameter	Reduction ratio	50	80
	Rated torque	7NM	10NM

	Peak start-stop torque	23NM	30NM
	Allowable maximum value of average load torque	9NM	14NM
	Momentary allowable maximum torque	46NM	61NM
	Backlash	＜20 arc seconds	＜ 20arc seconds
	Design life	8500hour	8500hour
Motor parameter	Torque	0.5NM	0.5NM
	Rated speed	1500RPM	1500RPM
	Maximum rotational speed	2000RPM	2000RPM
	Power	50W	50W
	Resistance	2.65	2.65
	Inductance	1.1mh	1.1mh
	Rotary inertia	$0.9139x10^{-4}$ KG/M ^{2}	$0.9139x10^{-4}$ KG/M ^{2}
Feedback signal		Multi-loop absolute encoder (single-loop 15 bit multi-loop 9 bit)	
Cooling mode		Natural cooling	
Position Control Mode	**Maximum input pulse frequency**	500KHz	
	Pulse instruction mode	Pulse + direction, A phase +B phase	
	Electronic gear ratio	Set up ~65535 to 65535	
	Location sampling frequency	2KHZ	
Protection function		Over-current alarm	
Communication interface		Easycan (CAN communication, rate 1 M)	
Environment	**Ambient temperature**	0~40°	
	Max. permissible temperature of motor	85°	
	Humidity	5~95%	

Model	Parameters	M5730BE17B50L	M5730BE17B80L	M5730BE17B100L
Overall parameters	Motor rated voltage	36VDC±10%	36VDC±10%	36VDC±10%
	Motor rated current	3.5 A	3.5 A	3.5 A
	Output torque after deceleration	34NM	35NM	51NM
	Weight	1KG	1KG	1KG
	Speed range after deceleration	0~30RPM	0~18RPM	0~15RPM
Reducer parameters	Reduction ratio	50	80	100
	Rated torque	21NM	29NM	31NM
	Peak start-stop torque	44NM	56NM	70NM
	Allowable maximum value of average load torque	34NM	35NM	51NM

	Momentary allowable maximum torque	91NM	113NM	143NM
	Backspace	<20 arc seconds	<20 arc seconds	<20 arc seconds
	Design life	8500H	8500H	8500H
Motor parameters	Torque	1NM	1NM	1NM
	Rated speed	1500RPM	1500RPM	1500RPM
	Maximum rotational speed	2000RPM	2000RPM	2000RPM
	Power	100W	100W	100W
	Resistance	0.86	0.86	0.86
	Inductance	0.8mh	0.8mh	0.8mh
	Rotary inertia	0.69 x 10^{-4} KG/M^2	0.69 x 10^{-4}KG/M^2	0.69 x 10^{-4}KG/M^2
Feedback signal		Multi-loop absolute encoder (single-loop 15 bit multi-loop 9 bit)		
Cooling mode		Natural cooling		
Position Control Mode	**Maximum input pulse frequency**	500KHz		
	Pulse instruction mode	Pulse + direction, A phase +B phase		
	Electronic gear ratio	Set up ~65535 to 65535		
	Location sampling frequency	2KHz		
Protection function		Over-current alarm		
Communication interface		Easycan (CAN communication, rate 1 M)		
Environment	**Ambient temperature**	0~40°		
	Maximum permissible temperature of motor	85°		
	Humidity	5~95%		

Model	Parameter	M8010E17B50L	M8010E17B80L	M8010E17B100L
Overall parameter	Motor rated voltage	36VDC±10%	36VDC±10%	36VDC±10%
	Motor rated current	3.5A	3.5A	3.5A
	Output torque after deceleration	21NM	29NM	31NM
	Weight	1KG	1KG	1KG
	Speed range after deceleration	0~30RPM	0~18RPM	0~15RPM
Reducer parameter	Reduction ratio	50	80	100
	Output rated torque	21NM	29NM	31NM
	Peak start-stop torque	44NM	56NM	70NM
	Limit average torque	34NM	35NM	51NM
	Backlash	<20 arc seconds	<20 arc seconds	<20 arc seconds

	Design life	8500hour	8500hour	8500hour
Motor parameter	Torque	1NM	1NM	1NM
	Rated speed	1500RPM	1500RPM	1500RPM
	Maximum rotational speed	2000RPM	2000RPM	2000RPM
	Power	100W	100W	100W
	Resistance	0.86	0.86	0.86
	Inductance	0.8mh	0.8mh	0.8mh
	Rotary inertia	$0.69x10^{-4}$	$0.69x10^{-4}$	0.69x10-4
		KG / M^2	KG / M^2	*KG / M2*
Feedback signal		Multi-loop absolute encoder (single-loop 15 bit multi-loop 9 bit)		
Cooling mode		Natural cooling		
Position Control Mode	**Maximum input pulse frequency**	500KHz		
	Pulse instruction mode	Pulse + direction, A phase +B phase		
	Electronic gear ratio	Set up 1~65535 to 1~ 65535		
	Location sampling frequency	2KHz		
Protection function		Clogged rotation alarm, over current alarm		
Communication interface		Easycan (CAN communication, rate 1 M)		
Environment	**Ambient temperature**	0~40°		
	Maximum permissible temperature of motor	85°		
	Humidity	5~95%		

Model Parameter		M8025E25B50L	M8025E25B80L	M8025E25B100L
Overall parameter	Motor rated voltage	36VDC±10%	36VDC±10%	36VDC±10%
	Motor rated current	7A	7A	7A
	Output torque after deceleration	51NM	85NM	100NM
	Weight	2.5KG	2.5KG	2.5KG
	Speed range after deceleration	0~30RPM	0~18RPM	0~10RPM
Reducer parameter	Reduction ratio	50	80	100
	Output rated torque	51NM	85NM	100NM
	Peak start-stop torque	127NM	178NM	190NM
	Backlash	<20 arc seconds	<20 arc seconds	<20 arc seconds
	Design life	8500hour	8500hour	8500hour
Motor parameter	Torque	2NM	2NM	2NM
	Rated speed	1000RPM	1000RPM	1000RPM
	Maximum rotational speed	1500RPM	1500RPM	1500RPM
	Power	200W	200W	200W

	Resistance	0.53	0.53	0.53
	Inductance	0.5mh	0.5mh	0.5mh
	Rotary inertia	1.74x10-4	1.74x10-4	1.74x10-4
		KG / M^2	KG / M^2	KG / M^2
Feedback signal		Multi-loop absolute encoder (single-loop 15 bit multi-loop 9 bit)		
Cooling mode		Natural cooling		
Position Control Mode	Maximum input pulse frequency	500KHz		
	Pulse instruction mode	Pulse + direction, A phase +B phase		
	Electronic gear ratio	Set up 1~65535 to 1~ 65535		
	Location sampling frequency	2KHz		
Protection function		Clogged rotation alarm, over current alarm		
Communication interface		Easycan (CAN communication, rate 1 M)		
Environment	Ambient temperature	0~40°		
	Maximum permissible temperature of motor	85°		
	Humidity	5~95%		

Driver interface

1. Power interface

The integrated servo power terminal is as shown in the figure below

Terminal serial No.	Name	Function
1	+V	Positive DC power supply, +24V~36V. Positive and negative connection will directly short circuit the power supply, may also damage the drive
2	GND	Direct current source. Positive and negative connection will directly short circuit the power supply, may also damage the drive

2. Communication and output interface

DB9 male									
1	2	3	4	5		6	7	8	9
PU+	PU-	DIR+	DIR-	WR+		ZO	COM	CANL	CANH
Blue	Blue black	Green	Green black	Red white		Yellow	Black white	Brown	White

Terminal serial number	Name	Function
1	PU+	Pulse control signal: the rising edge of the pulse is valid; PU- is 3.3~5V at high level, and 0~0.5V at low level. For reliable response to pulsed signals, the pulse width should be greater than 1.2μs. If +12V or +24V is used, a series resistor is required.
2	PU-	
3	DIR+	Direction signal: high/low level signal, in order to ensure the reliable commutation of the motor, the direction signal should be established at least 5μs before the pulse signal. DIR-3.3~5V at high level, 0~0.5V at low level.
4	DIR-	
5	WR+	Alarm signal output, the internal output is optocoupler NPN. Normally, it is in high impedance state, and it is connected to COM during alarm.
6	ZO	Encoder zero output. There is a zero signal optocoupler NPN output conduction signal.
7	COM	The output signal is common to the 485 power supply.
8	CANL	Can Communication port CANL, built-in isolated power supply.
9	CANH	Can Communication port CANH, built-in isolated power supply.

3. Status indication and alarm

After starting up, the red and green light will be on once to check whether the LED works normally.Then the green light is on and the red light is off as normal. If the alarm state is encountered, the reason can be determined by the red flashing, and the alarm code can also be read by Modbus.

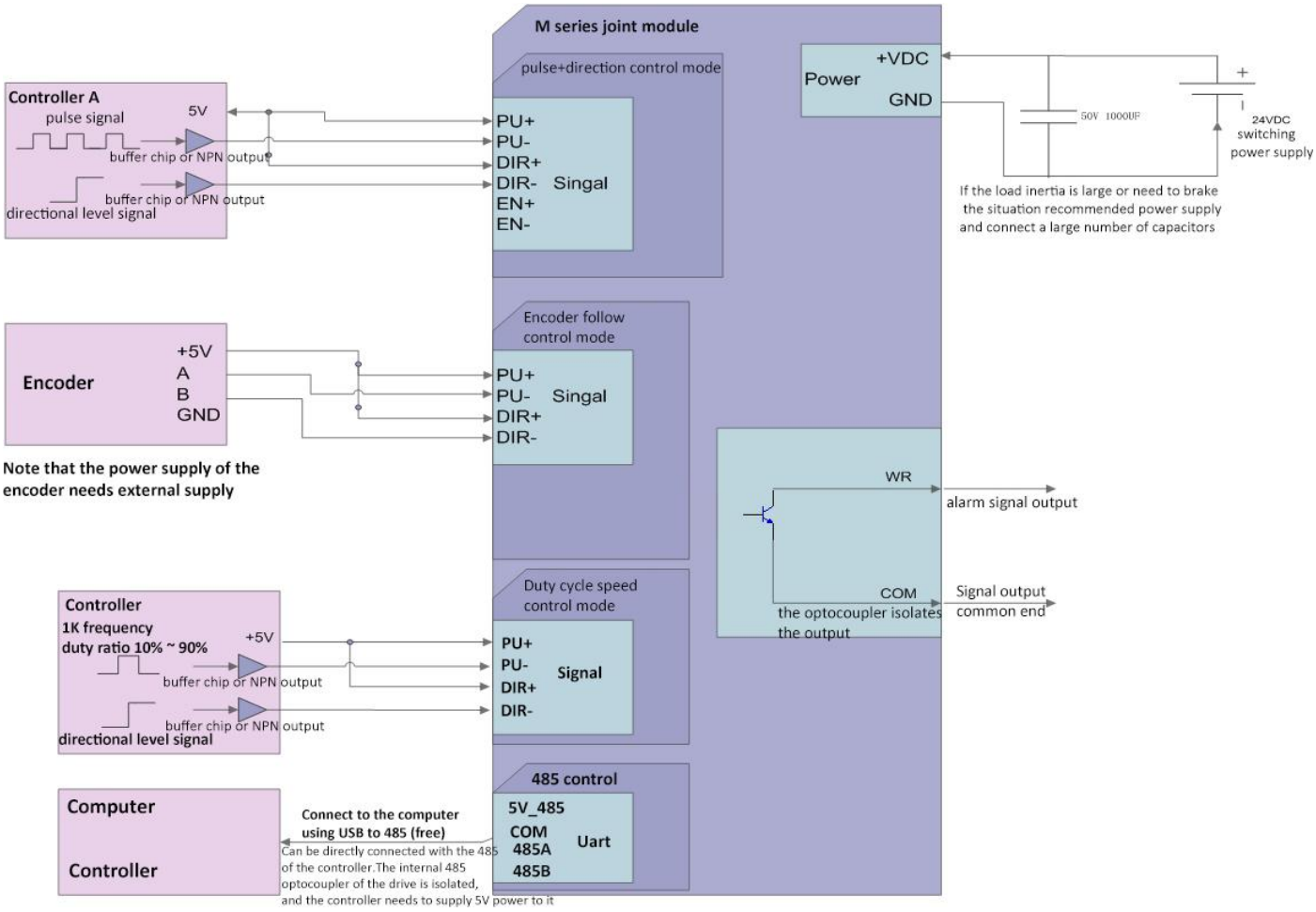
Alarm code	Red light flash	Alarm reason	Alarm processing
0x20	Double long flashing	Communication drop alarm	Resend the heartbeat packet to recover. Motor stops.
0x10	One long flashing	Battery power down alarm	It will be restored after resetting the multi-turn origin. The motor does not stop.
0x12	One long flashing and twice short flashing	Locked-rotor alarm	Downtime. EN enable 1, or control word clear alarm position 1, can be recovered.
0x14	One long flashing and 4 short flashing	Stall warning	Downtime. EN enable 1, or control word clear alarm position 1, can be recovered.
0x15	One long flashing and 5 short flashing	Over-voltage alarm	Alarm over 52V. If it is power generation that leads to a voltage boost, a discharge module is needed.

Mark: Blocking alarm, blocking time can be set, see register instructions for details

Green light status	Motor status
Always bright	Working normally, the battery is fully charged
Flashing	Working properly, the battery is charging
High frequency flicker	Working normally, battery dropped

Driver wiring diagram and control mode

1. Driver typical wiring diagram



2.Command pulse + direction position control mode

Pulse command form	CCW	CW	Parameter setting value
Pulse train symbol	PUL DIR		Command pulse+direction

If you need 3200 pulses per cycle

Electronic gear set to 32768 (pulse number of one turn of encoder) vs 3200 (pulse number of one turn to be set)

The approximate ratio is 256 to 25

If 8192 pulses are required (default parameter)

Electronic gear set to 32768 (pulse number of one turn of encoder) vs. 8192 (pulse number of one turn to be set)

The approximate ratio is 4 to 1

Note: it can be divided as much as possible. The electronic gear molecule is 32768. If the value is too large, it will affect the following performance

Instruction pulse frequency = (required motor running speed /60) * the number of pulses in one turn

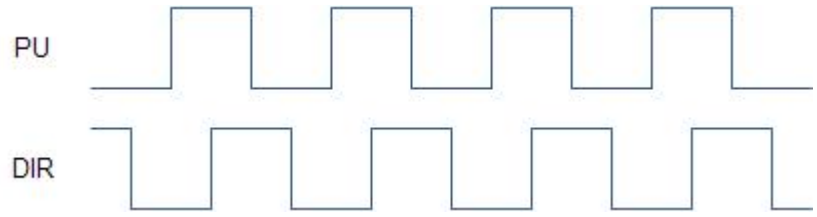
For example, you need to click 1000RPM and the pulse count is 8192

Pulse frequency = 1000/60 * 8192= 136533Hz

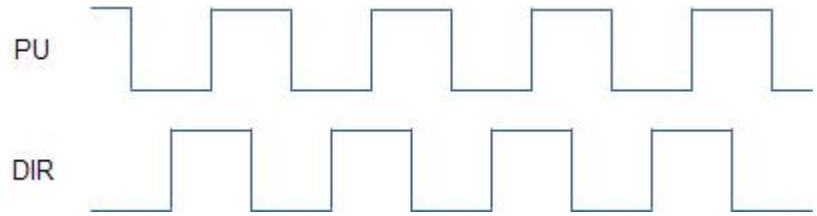
3. Orthogonal instruction pulse position control mode

By setting the special function (address 0x19) to 2, the encoder is in follow mode after being repowered. This mode can be used for encoder following, such as a shaft connected to the encoder, the encoder output is connected to the driver (wiring mode is like the typical wiring diagram of the driver), the driver can control the servo motor, according to the input signal of the encoder, with the control of the encoder. The ratio of the rotation Angle of the encoder and motor can be set by adjusting the electronic gear.

Forward pulse:



Reverse pulse:



Direction of motor rotation: PU rising edge ahead of DIR rising edge is positive. PU rising edge hysteresis DIR rising edge is reversed.

Parameter debugging

According to the load of the motor, the parameters need to be adjusted to achieve the best effect.

1. Internal acceleration and deceleration curve

Whether to use internal acceleration and deceleration curves is selected according to the different output signals of the controller.

Use the internal acceleration curve:

When the motor acceleration is less than 60000, the driver will enable the internal acceleration and deceleration curve, and the specific acceleration will be the same as the set value.

Usage: the use of internal acceleration curve, will produce the phenomenon of lag pulse, some do not need to follow the occasion, you can use internal acceleration curve. Some controllers, pulse directly to the corresponding speed frequency, there is no acceleration and deceleration, the use of internal acceleration and deceleration curve, can reduce the difficulty of controller programming.

Disallow internal acceleration curve:

When the motor acceleration is greater than or equal to 60000, the acceleration and deceleration of the external pulse allow the driver, but the internal acceleration is invalid.

Use occasions: such as engraving machine, the controller output pulse is acceleration and deceleration, do not need to drive internal acceleration curve, if used at this time, will lag behind the actual pulse.

2.Wire rod load

First of all, let's talk about torque. We'll start with a 400W motor, 1.3nm.The load is 5mm screw pitch, which means that the motor shaft rotates for a circle and the load moves 5mm. In this case,

Load equivalent moment arm = 5mm / 3.14 = 1.592 mm

So the thrust that the motor can provide is

Thrust force through screw drive = 1.3nm/(1.592mm*0.001) = 816 N

So the weight that can push the load is about 80KG, and this is vertical, and the horizontal push can be a little bit larger.

Since the screw load motor moves a short distance in one turn, the parameters of the drive (acceleration can be large, such as 20000, and position ring KP can be large, such as 3000). Servo motors are best suited for this type of load.

3.Pulley load

Servo motors are actually not very suitable for this kind of load. Because the pulley is generally larger in diameter, such as 30mm in diameter.When the motor turns around, the distance of load movement is 30mm*π = 94.2, which is many times larger than the 5mm screw rod mentioned above.

So the thrust that the motor can provide is

Thrust through belt drive = 1.3nm/(30mm*0.001) = 43.3N

The weight that can push the load is about 4.3kg. Therefore, the servo motor is not suitable for the synchronous wheel, because the distance of the load moving in one circle of the synchronous wheel is too long and the moment arm is too long.If this kind of occasion to use servo motor, you can choose to directly as small as possible the synchronous wheel or through the motor shaft small synchronous wheel, the load end is connected to the large synchronous wheel, so deceleration several times, can achieve better results.In this case, the driver parameter (the acceleration setting is small, such as 5000) is set to reduce the acceleration and deceleration because of the load's high equivalent inertia.

4.Disk load

This kind of load servo can not be directly driven, generally need to connect the reducer. For example, a disk 200mm in diameter and 10KG in weight.The radius is 100mm, and the weight equivalent radius is 50mm.The moment arm is large.If the servo to receive this kind of load, compare with the reducer and then load.

If the disc is not particularly heavy, some positioning accuracy and rigidity can be sacrificed to control.The specific method is to set the motor acceleration to a relatively small amount, such as about 1000.Set speed KI to 2000 and cancel integration.Change position KP to 1000. Change

these parameters. Ordinary disk loads can also be used.

5. Power-on default communication control

Just set the electronic gear numerator to 0, after saving, power on again, the modbus enable default is 1.

Low-power multi-turn absolute value description

1. Characteristic

A. All-in-one servo 485/CAN communication version can add multi-turn function.

B. When the motor is powered, there is a charging circuit inside to charge the battery. When the motor is powered off, the battery current consumption is only 0.07mA.

C. After the motor has no power supply, the motor shaft is driven to rotate to wake up the encoder and continue to memorize the position.

D. Multi-turn memory range -60000 ~ 60000 laps.

E. Simple setting of the origin, it can be set as the origin at any position.

F. Multiple zero return methods: communication zero return, automatic zero return on power-on, and zero point signal output.

G. Error protection: battery power failure alarm.

2. Multi-turn absolute value zero setting method

When the battery is dead or disconnected, the information in multiple circles is lost, and the motor will flash a long red light and then a short flash, indicating that the position of the multiple circles is lost. Or the motor is newly installed in the mechanical equipment, and the zero point needs to be set, which can be set as follows. (It can be set through the software provided by us, or directly by sending CAN commands).

1. Electronic gear molecule send 60006
2. Electronic gear molecule send 60016

After completing the settings according to the above steps, the electronic gear molecule will automatically return to the original value (32768 if it is not changed by default), and then the total number of steps (current position) of the PU will become 0 (or +-single digit) . This means that the correct settings are complete. If there is no above result, you need to reset it. After setting the origin, the battery power-down alarm will be restored.

3. Instructions for multi-turn absolute value

A. Communication control

Under CAN communication control, when the motor is powered on, the current position data is the position of the motor in multiple turns, so the current position is read when the position is known when the motor is powered on. Then send the absolute position command to make the motor go to the required position.

B. Automatically return to origin after power-on

The setting method is as follows:

Special function Send 6

Parameter save and send 1

(After the parameter is saved and sent 1, it will display 2 to indicate that the save is successful)

After the setting is completed, the motor will automatically go back to the origin next time it is powered on. If it is automatic return to the origin, it needs to be judged by human being in place, and then the automatic program will be executed. Or the power-on delay is long enough to ensure

that the origin search is completed.

The speed of finding the origin is set by the ones digit of the motor acceleration. The ones digit 0~9 means the speed of finding the origin is 100~1000RPM. For example, if the acceleration is 10005, the speed of finding the origin is 600RPM.

C. Output origin signal

The COM and ZO pins of the motor are NPN output signals. When the absolute position is greater than 0, the two pins are in a high impedance state. When the absolute position is less than 0, the two pins are turned on. After power-on in this way, the PLC or the single-chip microcomputer can send pulses to make the motor reverse, stop after getting the ZO signal, and then slowly turn to the signal to disappear, here is the zero point.

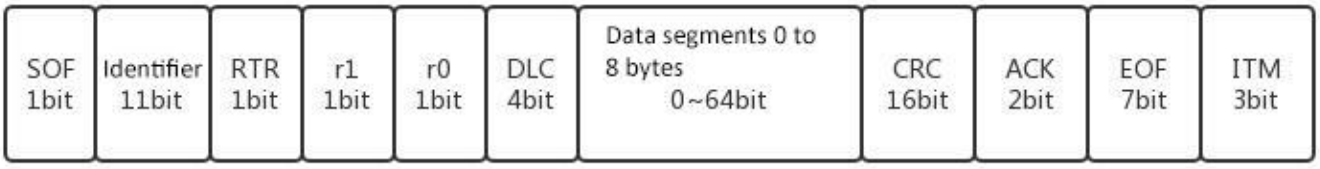
CANOPEN communication mode

5.01 hardware connection

PLC or controller, CANL/CANH can be connected to the motor. Note that there is no 120 ohm resistor inside the motor, and a 120 ohm resistor needs to be placed at the farthest distance from the controller.

5.02 CAN communication format

CANopen communication protocol adopts data frame standard format.The format of data frame is shown in the following figure: CANopen communication protocol adopts the standard format of data frame.The format of data frame is as follows:



SOF: inter-frame space

Identifier: Range 0 to 255, representing the address of the target device.When the host sends data to the slave, the identifier is the slave's address.When the slave sends data to the host, the identifier is the host address.

RTR： 0：data frame.（1：remote frame）. EasyCan only uses data frames.

r1 ： 0：Standard identifier.（1：Extended identifier）. EasyCan uses only standard identifiers.

r0 ： Receive location.

DLC：Data length code.

Data Segment: See the table below for the specific protocol.

5.03 EDS file declaration

EDS (Spreadsheet) files are the identification files or similar codes of the slave station connected by the PLC to identify the type of slave station (which is similar to 401, 402, 403, or which device belongs to 402). This file contains all the information of the slave station, such as the manufacturer, serial number, software version, supported baud rate type, the OD that can be mapped and the attributes of each OD and other parameters, similar to the GSD file of Profibus.Therefore, before hardware configuration, we first need to import the EDS file from the station into the upper configuration software.

5.04 The object list

Canopen address description

A complete CANopen address format is: 60400010 (control word)

- 60400010（highlight）： Index(16 bit address).
- 60400010（highlight）：Subindex（8 bit address）the form represents register addressing
- 60400010（highlight）：the bit 0x08 indicates the data length to be stored in this register is 1 Byte, the bit 0x10 indicates the data length to be stored in this register is 2 bytes, the bit 0x20 indicates the data length to be stored in this register is 4 bytes,
- R: readable, W: writable, S: savable, M: mappable,

Parameter list of device information class:

Name	Canopen address	Read Only/Read&Write	Parameter scope	Parameter description
Device type	10000020	Read only	0x20192	Servo driver, according to DS402 specification
0x1018 number of subindexes	10180010	Read only	4	The 1018 object has four subindexes
Vendor ID	10180120	Read only	0x331	Vendor ID（Vendor_ID）is 0X331
Product code	10180220	Read only	0x1	Product code（Product_code）is 0x1
Version number	10180320	Read only	0x100	Verision number（Version_number）is 0x100
Serial number	10180420	Read only	0x1	Serial number（serial_number）is 0x1
PDO synchronous ID	10050020	Read only	0x80	The synchronization ID of PDO is 0x8 by default

List of heartbeat parameters:

Name	Canopen address	Read only/Read&Write	Read&Write	Parameter description
The heartbeat generates interval time	10170010	RWM	0~65535	0:It doesn't produce a heartbeat 1~65535: interval time, unit milliseconds
0x1016 number of subindexes	10160008	R	1	default 1, 1 subindex
Consumption of time between heartbeats	10160120	RWM	See the instruction below.	

0x10160120		
31~24	23~16	15~0bit
Invalid	0~7F (the address of the heartbeat generator) defaults to 7F	The range 0~65535 (0: no heartbeat monitoring is enabled 1~65535: unit ms, if no heartbeat is received within this time range, the processing will stop) is 2000 by default

Control class parameter list:

Name	Canopen address	modb usaddr	Read only/read&w	Parameter scope	Parameter description

		ess	rite		
Modbus enable	26000010	0x00	Read&write	0~1	0：modbus forbid 1：modbus enable
Drive output enabled	26010010	0x01	Read&write	0~1	0：Drive output forbid 1：Drive output enabled
Trapezoidal velocity (Position Mode Speed)	60810020	0x02	Read&write	0~3000 r/min	Maximum speed in position mode (operating mode 1)
Motor acceleration	60830020	0x04	Read&write	0~65535 (r/min)/s	When the parameter is less than 60000, acceleration and deceleration curve will be generated inside the driver; when the parameter is greater than 60000, acceleration and deceleration pulse will not be generated inside the driver
Weak magnetic Angle	26040010	0x06	Read&write	0~306 r/min	Internal parameters do not need to be set separately
Velocity ring proportionality coefficient	60F90110	0x07	Read&write	0~10000	On behalf of 0.0 ~ 10.0 The higher the value, the stronger the rigidity The ones digit is even: the pulse input polarity is valid at the time of disconnection The ones digit is odd: the pulse input polarity is valid at the time of conduction
Velocity loop integration time	60F90210	0x08	Read&write	2~2000 ms	The integration time is 2~2000ms The smaller the number, the stronger the rigidity
Proportional coefficient of position ring	60FB0110	0x09	Read&write	60~30000	Location KP, the bigger the number, the stronger the rigidity. The units digit is even: the alarm output is normally on (normal is normally on, and the alarm is normally closed). The unit digit is odd: the alarm output is normally closed (normal is normally closed, and the alarm is normally on).
Rate feed-for ward	60FB0210	0x0a	Read&write	0~12.0V/KRPM	327 stands for 1V/KRPM and does not need to be set
DIR polarity	26090010	0x0b	Read&write	0~1	0：External DIR does not allow clockwise rotation 1：The external DIR guide rotates clockwise
Electronic gear molecule	260A0010	0x0c	Read&write	0~65535	16-bit electronic gear molecule. If the electronic gear molecule is 0, it can achieve special functions as described above
Electronic gear denominator	260B0010	0x0d	Read&write	1~65535	16-bit electronic gear denominator
The incremental position	260C0020	0x0e	Read&write		Number of steps required (write direct updates)

Alarm code	260E0010	0x10	Read&write		
Actual current	60780010	0x11	RM	0~32767	The actual current is x/2000(A
Motor actual speed	606C0010	0x12	Read&write	-30000~30000 r/min	Actual motor speed=motor current speed/10
System voltage	60790010	0x13	Read only	0~32767	Actual voltage is x/327（V）
System temperature	26120010	0x14	Read only	0~100	Degree centigrade
PWM of system output	26130010	0x15	Read only	-32768~32767	Represent-100%~100%
Data save flag	26140010	0x16	Read&write	0~1	0：parameter not saved 1：Save the parameters 2：finish storage
Device location	26150010	0x17	Read&write	0~255	Device address（CAN communication needs to be saved and the new address will take effect after power is reenergized）
Actual position	60640020 60630020	0x18	RM		the current actual position of motor
Stationary maximum allowable output	26180010	0x1a	Read&write	0~609	0~609 corresponds to the allowable maximum output 0~60.9%. Bit 1~9 corresponds to the blocking alarm time.1 bit 0 block rotation does not alarm
Mode selection	26190010	0x1b	Read&write	0~100	0：pulse+direction mode 2：encoder follows the pattern Speed mode, duty cycle speed regulation (10%~90% for 0~1000RPM) 6.battery state, power automatically go back to multi-turn zero 7. With brake motor, brake multi-turn absolute value function, power on multi-turn position update in the absolute position register. 8.With brake motor, brake multi-turn absolute value function, power back to the origin automatically 9.Power on the default CANopen control, pulse is invalid. 30~32768: the Angle to which the power automatically turns on, the algorithm is: X*360°/32768
Target location cache	607A0020	0x1c	Read&write		CANopen location cache.This parameter is used for incremental location, absolute location, or to implement updates, controlled by the control word.
Speed mode speed	60FF0020	0x1e	RWM	-3000~3000	Target speed in speed mode (mode 3)
CAN communication synchronous control word	261C0010	0x20	Read&write	0~65535	0:Turn off synchronization mode.When greater than 0, the internal 2ms time benchmark is synchronized and the synchronization mode is enabled.When the value is 255, the synchronization is

					synchronized through the DIR signal, which needs to input a signal to switch between high and low levels every 0.1ms.
maximum allo wable current	261D0010	0x21	Read&write	0~10009	Unit mA, corresponding to the maximum operating permissible current of 0~10.009A 1~9, corresponding to the maximum current of 1~9 seconds will stop the alarm When the ones digit is 0, the maximum current is maintained all the time without alarm
Input port state	60FD0010	0x22	RM		
Control word	60400010	0x23	RWM		See the table below for details
Status word	60410010	0x24	RM		See the table below for details
Work mode	60600008	0x25	RWM		Work mode 1：position mode 3：speed mode 6：Origin finding model 7：Motion interpolation based on CANopen
Return to origin method	60980008	0x26	RW	17~21	See 5.09 for details on the origin finding pattern

The bits of the control word (6040H) are defined as follows:

location：	15:9	8	7	6	5	4	3	2	1	0
definition：	None	stop	Fault reset	0: absolute position 1: Phase position	Location Effective Immediately	Execute the new setpoint	Allows operation	Allows scram	voltage output	start

Bit0：After setting 1, the external impulse control is invalid.

Bit4：Each time you write a 1, you run to the new position value.Automatically set to 0 after executing the new position value;

Bit8：When the value is 1, the motor stops abruptly, but the motor is still in the self-locking state.

The bits of the status word (6041H) are defined as follows:

Location	7	6	5	4	3	2	1	0
Definition	None	None	Allows scram	voltage output	Servo alarm	Allows operate	start	ready to start
location	15	14	13	12	11	10	9	8
definition	None	None	Origin error finding	Finding the origin is done	None	Goal to achieve	None	None

Bit10：In position mode, the target position arrives set to 1.In speed mode, set to 1 when the given speed is reached.

5.05 SDO Communication format

SDO is mainly used to transfer low-priority objects between devices, typically for configuration and management of slave devices, such as modifying PID parameters of current loop, speed loop, position loop, PDO configuration parameters, etc. Such data transmission is the same as Modbus, that is, after sent by the master station, data response needs to be returned from the slave station.This communication mode is only suitable for parameter setting, not suitable for data transmission which requires high real-time performance.

The communication mode of SDO is divided into upload and download. The upper computer can read and write the internal OD of the servo according to the special SDO read and write instruction.In the CANopen protocol, the contents of the Object dictionary can be modified through SDO (Service Data Object). The following describes the structure of the SDO command and the guidelines it follows.

The basic format of the SDO read command is as follows:

CS command:

Host read command: 0x40= Read.

The read-back command from the slave: 0x4F= read-back one byte. 0x4B= Read the reply two bytes. 0x43= Read the reply four bytes.

Host send (read data)									
Arbitration section	Control section	Data section							
CAN identifier	DLC(Data segment length)	1	2	3	4	5	6	7	8
0x600 + device_ID	0x08	0x40	Object Index		Sub-index	Blank			

Slave reply (read data)									
Arbitration section	Control section	Data section							
CAN identifier	DLC(Data segment length)	1	2	3	4	5	6	7	8
0x600 + device_ID	0x08	CS designator	Object Index		Sub-index	Returning data			

The basic format of the SDO write command is as follows:

Host write command: 0x2F= write a byte. 0x2B= Write two bytes. 0x23= Write 4 bytes.

Slave reply write command: 0x60= write successful reply. 0 x80 = error.

Host sends (writes data)									
Arbitration section	Control section	Data section							
CAN identifier	DLC(Data segment length)	1	2	3	4	5	6	7	8
0x600 + device_ID	0x08	CS designator	Object Index		Sub-index	Written data			

Slave reply (writes data)									
Arbitration section	Control section	Data section							
CAN identifier	DLC(Data segment length)	1	2	3	4	5	6	7	8
0x600 + device_ID	0x08	CS designator	Object Index		Sub-index	Blank			

5.06 SDO Position mode

5.06.1Absolute position mode SDO controls process

Internal address	Variable name	Setting value	Datagram（ID=1）	Mark
60400010	Control word	0xF	601 2B 40 60 00 0F 00 581 60 40 60 00	Start + voltage output + allow emergency stop + allow operation Reply written successfully
60600008	Work mode	0x1	601 2F 60 60 00 01 581 60 40 60 00	Working mode is set to position mode Reply written successfully
60640020	Actual position (1)	read	601 40 64 60 00 581 43 64 60 00 C3 00 00 00	Read current position Restoring current position to C3 (decimal 195)
60810020	Trapezoidal speed	1000	601 23 81 60 00 E8 03 00 00 581 60 81 60 00	Trapezoidal speed write 1000RPM (omit if using default on this bar) Reply written successfully
60830020	Trapezoidal acceleration	20000	601 23 83 60 00 20 4E 00 00 581 60 83 60 00	Trapezoid add/subtract to 20000RPM/S(omit if using default bar) Reply written successfully
60400010	Control word	0x2F	601 2B 40 60 00 2F 00 581 60 40 60 00	Absolute position control mode + new position is executed immediately Reply written successfully
607A0020	Location cache(2)	50000pu	601 23 7A 60 00 50 C3 00 00 581 60 7A 60 00	The location cache writes 50000 pulses Reply written successfully
60410010	Status word	Read	601 40 41 60 00 581 40 41 60 00 37 04	Read status word The status word 10BIT is 1, go to the target position

(1) Note: In the absolute position mode, the current position needs to be read before execution, because the motor encoder is the single-turn absolute value, and the actual position just on power is the single-turn position of the encoder.If it is the multi-turn absolute value of the battery, after the power reading is the position of the multi-turn absolute value.

(2) Note: the mode of executing the new position immediately, the cache writes the data, and the motor immediately moves to the target position.

5.06.2 Relative position mode SDO controls the process

Internal address	Variable name	Setting value	Datagram（ID=1）	Mark
60400010	Control word	0xF	601 2B 40 60 00 0F 00 581 60 40 60 00	Start + voltage output + allow emergency stop + allow operation Reply written successfully
60600008	Work mode	0x1	601 2F 60 60 00 01 581 60 40 60 00	Working mode is set to position mode Reply written successfully
607A0020	Location	50000pu	601 23 7A 60 00 50 C3 00 00	The location cache writes 50000 pulses

	cache		581 60 7A 60 00	Reply written successfully
60810020	Trapezoidal speed	1000	601 23 81 60 00 E8 03 00 00 581 60 81 60 00	Trapezoidal speed write 1000RPM (omit if using default on this bar) Reply written successfully
60830020	Trapezoidal acceleration	20000	601 23 83 60 00 20 4E 00 00 581 60 83 60 00	Trapezoid add/subtract to 20000RPM/S(omit if using default bar) Reply written successfully
60400010	Control word	0x4F	601 2B 40 60 00 4F 00 581 60 40 60 00	Relative position control mode Reply written successfully
60400010	Control word	0x5F	601 2B 40 60 00 5F 00 581 60 40 60 00	Go to the new position Reply written successfully
60410010	Status word	read	601 40 41 60 00 581 40 41 60 00 37 04	Read status word The status word 10BIT is 1, go to the target position

Note: After that, we only need to issue a new position cache and then issue 0x5F to the control word. The motor starts to run. After reaching the target position, the status word 10BIT is 1.

5.07 SDO Speed mode

5.07.1 Speed mode SDO controls the process

Internal address	Variable name	Setting value	Datagram (ID=1)	Mark
60600008	Work mode	3	601 2F 60 60 00 03 581 60 40 60 00	The working mode is set to speed mode Reply written successfully
60FF0020	Speed mode speed	1000	601 23 FF 60 00 F4 01 00 00 581 60 FF 60 00	Set the running speed to 1000RPM/S Reply written successfully
60400010	Control word	0xF	601 2B 40 60 00 0F 00 581 60 40 60 00	Start speed Reply written successfully
60410010	Status word	Read	601 40 41 60 00 581 4B 41 60 00 37 04	Read status word The status word 10BIT is 1, and the target speed is reached
60400010	Status word	0x10F	601 2B 40 60 00 0F 01 581 60 40 60 00	Stop Reply written successfully
60410010	Status word	Read	601 40 41 60 00 581 4B 41 60 00 37 04	Read status word The status word 10BIT is 1, and the target speed is reached

5.08 PDO Communication mode

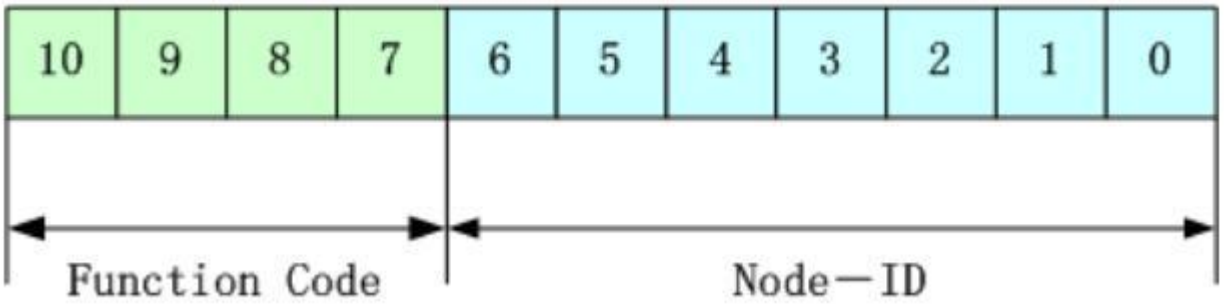
PDO can transmit up to 8 bytes of data at a time. There is no other protocol preset (meaning the content of the data is predefined), and it is mainly used to transmit data that needs to be exchanged at high frequencies. PDO transport broke the existing data transmission and concept, adopts new data exchange mode, both sides before transmission equipment in each area, sending and receiving equipment defined data in the

data exchange direct send the data related to each other's data reception area, reduce the time of the question-and-answer inquiries, so as to greatly improve the efficiency of bus communication, and extremely high utilization rate of bus have been obtained

5.08.1 PDO COB-ID description

COB - ID is the unique way of CANopen Communication protocols, it is the full name of the Communication Object Identifier - Communication Object - ID, the COB - ID for the PDO defines the corresponding transport level, with the transport level, controller and the servo can in their own software configuration defined in the same transport level and its transmission, so the controller and the servo is used in the same transport level, and the content of transmission, the data transmission is transparent, is both of us know to transfer the data content,There is no need to send data when the other side also need to reply whether the data transmission is successful.

The default ID assignment table is based on the 11-bit CANopen 2.0a (CANopen 2.0b protocol COB-ID is 29 bits) defined with A 4-bit function code part and A 7-bit node-ID part, as shown in the figure below.



Note：

Node-ID —— That is, the servo station number, the node-id range is 1 ~ 127;

Function Code ——Function code for data transmission, which defines the transmission level of various PDO, SDO and management packets. The smaller the function code is, the higher the priority is.

CANopen predefines the master/slave connection set CAN identifier assignment table

Object	COB-ID
SYNC	080H
PDO1（send）	181H-1FFH
PDO1（receive）	201H-27FH
PDO2（send）	281H-2FFH
PDO2（receive）	301H-37FH
PDO3（send）	381H-3FFH
PDO3（receive）	401H-47FH
PDO4（send）	481H-4FFH
PDO4（receive）	501H-57FH
SDO（send/server）	581H-5FFH
SDO（receive/customer）	601H-67FH
NMT(Heartbeat production and consumption)	701H-77FH

5.08.2 RPDO Configuration instruction

Receiving PDO is the data received by the servo, which is sent by PLC or controller, the function code of RPDO1 (COB-ID) is 0x200+ Servo station number

Note: The address of the servo motor is automatically set to the RPDO station number.The factory default is 1.

RPDO1 (COB-ID: 0x200+ servo station number) default configuration table (CSP control word working mode target position) :

Host -> motor (RPDO1)									
Arbitration section	Control section	Data section							
CAN identifier	DLC(Data segment length)	1	2	3	4	5	6	7	8
0x200 + device_ID	0x07	Control word(6040)		Work mode(6060)	Target location cache (607A)				

RPDO1Index	sub-index	Description	Data type	Parameter scope	Data description
1600	00	RPDO1 Number of mapping groups	Unsigned8	3	Default 3, cannot be changed.
	01	RPDO1 Map 1	Unsigned32	60400010	The default map is to the control word
	02	RPDO1 Map 2	Unsigned32	60600008	The default map is to the work mode
	03	RPDO1 Map 3	Unsigned32	607A0020	Map to the target location cache by default
1400	01	COB-ID：Send/receive the frame ID of this PDO	Unsigned32	0x200+ (0~127)	The actual COB-ID is 0x200+ this parameter.Setting the device address via SDO sets this value as well.
	02	Transport type	Unsigned8	255	255 (Asynchronous mode) ：The servo updates the data immediately after receiving it.
	03	Inhibit time (1/10ms)	Unsigned16	1	The default is 1

RPDO2 (COB-ID: 0x300+ Servo station number) Default configuration table (PV target position trapezoidal speed)：

Host > Motor (RPDO2)									
Arbitration section	Control section	Data section							
CAN identifier	DLC(Data segment length)	1	2	3	4	5	6	7	8
0x300 + device_ID	0x08	Target location cache (607A)				Trapezoidal velocity (6081)			

RPDO2 Index	Sub-index	Description	Data type	Parameter scope	Parameter description

1601	00	RPDO2 Number of mapping groups	Unsigned8	2	Default 2, cannot be changed.
	01	RPDO2 map1	Unsigned32	607A0020	Map to the target location cache by default
	02	RPDO2 map2	Unsigned32	60810020	Default maps to trapezoidal speed
1401	01	COB-ID:Send/receive the frame ID of this PDO	Unsigned32	0x300+ (0~127)	The actual cob-id is 0x300+ this parameter.Setting the device address via SDO sets this value as well
	02	Transport type	Unsigned8	255	255（Asynchronous mode）：The servo updates the data immediately after receiving it.
	03	Inhibit time Time constraints are prohibited in production(1/10ms)	Unsigned16	1	The default is 1

RPDO3（COB-ID：0x400+Servo station number）Default configuration table (CSV control word mode target speed) :

Host > Motor (RPDO3)									
Arbitration section	Control section	Data section							
CAN identifier	DLC(Data segment length)	1	2	3	4	5	6	7	8
0x400 + device_ID	0x07	Control word（6040）		Work mode（6060）	Speed mode speed（60FF）				

RPDO3 Index	Sub-index	Description	Data mode	Parameter scope	Data description
1602	00	RPDO3 Number of mapping groups	Unsigned8	3	Default 3, cannot be changed.
	01	RPDO3 Map 1	Unsigned32	60400010	Maps to the control word by default
	02	RPDO3Map 2	Unsigned32	60600008	Maps to working mode by default
	03	RPDO3Map 3	Unsigned32	60FF0020	Maps to speed mode speed by default
1402	01	COB-ID :Send/receive the frame ID of this PDO	Unsigned32	0x400+ (0~127)	The actual COB-ID is 0x400+ this parameter.Setting the device address via SDO sets this value as well.
	02	Transport type	Unsigned8	255	255（asynchronous mode）：The servo updates the data immediately after receiving it.
	03	Inhibit time Time constraints are prohibited in production(1/10ms)	Unsigned16	1	The default is 1

RPDO4（COB-ID：0x500+Servo station number）Default configuration table (P target location)：

Host -> motor (RPDO4)									
Arbitration section	Control section	Data section							
CAN identifier	DLC(data section length)	1	2	3	4	5	6	7	8

0x500 + device_ID	0x4	Target location cache（607A）				

RPDO4 Index	Sub-index	Description	Data type	Parameter scope	Parameter description
1603	00	RPDO4 number of mapping groups	Unsigned8	1	Default 1, cannot be changed.
	01	RPDO4 Map1	Unsigned32	607A0020	Map to target location cache by default
1403	01	COB-ID：Send/receive the frame ID of this PDO	Unsigned32	0x500+ (0~127)	The actual COB-ID is 0x500+ this parameter.Setting the device address via SDO sets this value as well.
	02	Transport type	Unsigned8	1	1（Synchronous mode）:Data update is performed after receiving 1 SYNC signal
	03	Inhibit time Time constraints are prohibited in production(1/10ms)	Unsigned16	1	The default is 1

5.08.3 TPDO Configuration instructions

TPDO1: Relative to the servo, sending PDO refers to the data sent by the servo, which is sent by the servo motor. The function code (COB-ID) of TPDO1 is 0x180+ the servo station number

Note: The address of the servo motor will be automatically set to the station number of TPDO.The factory default is 1.

TPDO1 (COB-ID: 0x180+ Servo station number) Default configuration table (actual location + status word) :

Motor -> host（TPDO1）									
Arbitration section	Control section	Data section							
CAN identifier	DLC(data section length)	1	2	3	4	5	6	7	8
0x180 + device_ID	0x6	actual location（6064）				Status word（6041）			

TPDO1 Index	Sub-index	Description	Data type	Parameter scope	Parameter instruction
1A00	00	TPDO1 number of mapping groups	Unsigned8	2	Default 2, cannot be changed
	01	TPDO1 Map 1	Unsigned32	60640020	Map to actual location by default
	02	TPDO1 Map 2	Unsigned32	60410010	Map to status word by default
1800	01	COB-ID：Send/receive the frame ID of this PDO	Unsigned32	0x180+（0~127）	The actual COB-ID is 0x180+ this parameter.Setting the device address via SDO sets this value as well.
	02	Transport type	Unsigned8	255	255（Asynchronous mode）：The servo will reply to TPDO1 immediately after receiving RPDO1 data
	03	Inhibit time Time constraints are prohibited in production(1/10ms)	Unsigned16	3	The default is 1

TPDO2（COB-ID：0x280+Servo station number）Default configuration table (actual location + status word) :

Motor -> host（TPDO2）										
Arbitration section	Control section	Data section								
CAN identifier	DLC(data section length)	1	2	3	4	5	6	7	8	
0x280 + device_ID	0x6	actual location（6064）				Status word（6041）				

TPDO2 Index	Sub-index	Description	Data type	Parameter scope	Parameter instruction
1A01	00	TPDO2 number of mapping groups	Unsigned8	2	Default 2, cannot be changed.
	01	TPDO2 Map 1	Unsigned32	60640020	Map to actual location by default
	02	TPDO2 Map 2	Unsigned32	60410010	Map to status word by default
1801	01	COB-ID：Send/receive the frame ID of this PD	Unsigned32	0x280+（0~127）	The actual COB-ID is 0x280+ this parameter.Setting the device address via SDO sets this value as well.
	02	Transport type	Unsigned8	255	255（Asynchronous mode): The servo will reply TPDO2 immediately after receiving RPDO2 data
	03	Inhibit time Forbidden bound time(1/10ms)	Unsigned16	3	the default is 1

TPDO3（COB-ID：0x380+servo station number）Default configuration table (current speed + status word)：

Motor > Host（TPDO3）										
Arbitration section	Control section	Data section								
CAN identifier	DLC(data section length)	1	2	3	4	5	6	7	8	
0x380 + device_ID	0x6	current speed（606C）				status word（6041）				

TPDO2 Index	Sub-index	Description	Data type	Data scope	Parameter instruction
1A02	00	TPDO2 number of mapping groups	Unsigned8	2	Default 2, cannot be changed.
	01	TPDO2 Map 1	Unsigned32	606C0010	Map to current speed by default
	02	TPDO2 Map 2	Unsigned32	60410010	Map to status word by default
1802	01	COB-ID: Send /receive the frame ID of this PDO	Unsigned32	0x380+（0~127）	The actual COB-ID is 0x380+ this parameter.Setting the device address via SDO sets this value as well.
	02	Transport type	Unsigned8	255	255（Asynchronous mode）: The servo will reply to TPDO3 immediately after receiving RPDO3 data
	03	Inhibit time	Unsigned16	3	The default is 1

		Time constraints are prohibited in production(1/10ms)			

TPDO4（COB-ID：0x480+servo station number）Default configuration table (actual location + status word) :

Motor > Host（TPDO4）											
Arbitration section	Control section	Data section									
CAN identifier	DLC(data section length)	1	2	3	4	5	6	7	8		
0x480 + device_ID	0x6	actual location（6064）				status word（6041）					

TPDO4 Index	Sub-index	Description	Data type	Parameter scope	Parameter instruction
1A03	00	TPDO4 number of mapping groups	Unsigned8	2	Default 2, cannot be changed
	01	TPDO4 Map1	Unsigned32	60640020	Map to actual location by default
	02	TPDO4 Map 2	Unsigned32	60410010	Map to status word by default
1803	01	COB-ID：send/receive the frame ID of this PDO	Unsigned32	0x480+（0~127）	The actual COB-ID is 0x480+ this parameter.Setting the device address via SDO sets this value as well.
	02	Transport type	Unsigned8	255	255（Asynchronous mode）:The servo will reply to TPDO4 immediately after receiving RPDO4 data
	03	Inhibit time Time constraints are prohibited in production(1/10ms)	Unsigned16	3	The default is 1

5.08.4 SYNC Sync signal

The SYNC synchronization signal is used for location cache synchronization of RPDO4.After receiving the position of RPDO4 by the motor, the motor will not execute, and the host can send the location cache of multiple addresses respectively, and then start running at the same time through SYNC signal after sending the cache.

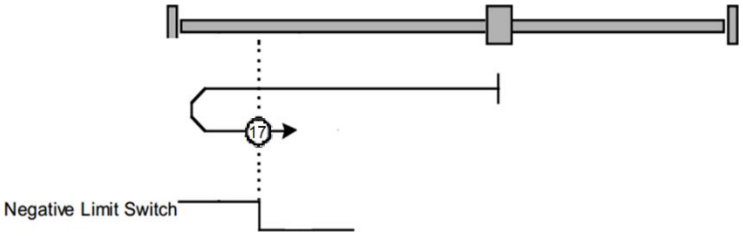
SYNC The signal format is as follows:

Host > Motor（SYNC）										
Arbitration section	Control section	Data section								
CAN identifier	DLC(data section length)	1	2	3	4	5	6	7	8	
0x80	0x0	None				None				

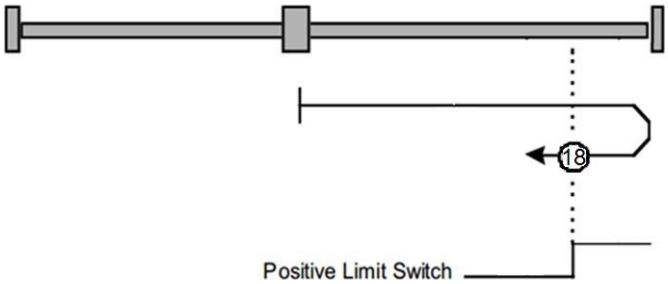
5.09 Origin finding model

According to CANopen DS402 standard protocol, a variety of return to zero mode is defined, currently support the 17~22 return to zero mode.The specific movement trajectories of various return to zero modes are shown as follows:

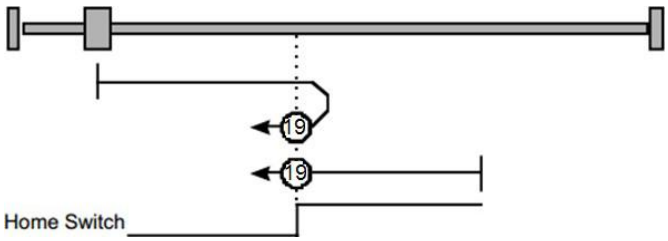
17：The negative limit is connected to the DIR port of the motor. The high level in the figure below indicates that there is a 5V voltage difference between DIR+ and DIR-.



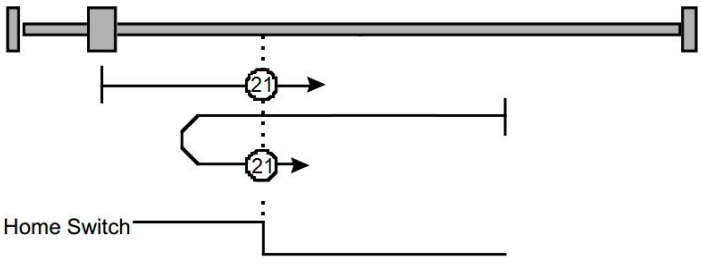
18: The positive limit is connected to the PU port of the motor. The high level in the figure below indicates that there is a 5V voltage difference between PU+ and PU-.



19: The origin switch is connected to the DIR port of the motor. The high level in the figure below indicates a voltage difference of 5V between DIR+ and DIR-.



21: The origin switch is connected to the DIR port of the motor. The high level in the figure below indicates a voltage difference of 5V between DIR+ and DIR-.



Control the origin finding process:

Control	The variable name	Setting value	Message (ID=1)	Mark

object				
60980008	Return to origin method	0x11(Decimal number 17)	601 2F 98 60 00 11 581 60 98 60 00	The method of finding the origin is set to 17 Reply written successfully
60600008	Work mode	0x6	601 2F 60 60 00 06 581 60 40 60 00	Working mode is set to position mode Reply written successfully
60410010	Status word	Read	601 40 41 60 00 581 40 41 60 00 14 00	Read status word The state word 12BIT is 0, still looking for the origin process
60410010	Status word	Read	601 40 41 60 00 581 40 41 60 00 14 14	Read status word The status word 12BIT is 1, finding the origin is complete

5.10 PDO Location model

5.10.1 Absolute position model

Absolute position mode, using RPDO1, RPDO2 and TPDO1, TPDO2.The control process is as follows:

Control object	The variable name	Setting value	Message（ID=1）	Mark
To find the origin				Refer to 5.09 origin finding procedure. This step is omitted if multiple absolute values are used
RPDO2 TPDO2	Target position + trapezoidal velocity Current position + status word	50000+1000 Return value	301 50 C3 00 00 E8 03 00 00 281 17 43 00 00 04 04	（target location 50000）+ trapezoidal speed 1000 Current position 0x4316（17175decimal system）+status word 0x404 Note: This command is to obtain the current location. 1. If the motor is a single turn absolute value, the current position range is 0~32768. 2.If it is with the battery of multiple absolute value to record the number of turns.The returned data can be multiple turns of position. 3.If you go through the process of finding the origin of the limit switch, the return value is a number around 0.
RPDO1 TPDO1	Control word + working mode + target position Current position + status word	0x2F+0x1+50000 Return value	201 2F 00 01 50 C3 00 00 181 55 43 00 00 37 00	（Absolute location + immediate execution）+position mode+target position 50000 Current position 0x4355+status word 0x037 Note: The current position does not reach the given 0xC350 status word 10bit is 0, not reached the target position.
RPDO2 TPDO2	Target position + trapezoidal velocity Current position + status word	50000+1000 Return value	301 50 C3 00 00 E8 03 00 00 281 50 c3 00 00 37 04	（target location 50000）+trapezoidal velocity 1000 Current position 0x50c3（50000 decimal system）+ status word 0x437 Note: reach the given position 0xC350, the status word

				10bit is 1, reach the target position.
RPDO2 TPDO2	Target position + trapezoidal velocity Current position + status word	10000+1000 Return value	301 10 27 00 00 E8 03 00 00 281 50 c3 00 00 37 00	（target location 10000）+trapezoidal velocity1000 Current position 0x50c3（50000 decimal system）+status word 0x037. Note: the new target position 10000 has not been reached, the status word 10bit is 0, you can continue to issue the same command.
RPDO2 TPDO2	Target position + trapezoidal velocity Current position + status word	10000+1000 Return value	301 10 27 00 00 E8 03 00 00 281 10 27 00 00 37 04	（target location10000）+trapezoidal velocity1000 Current position 0x2710（10000decimal system）+status word 0x437 Note: The new target position 10000 has arrived, and the status word 10bit is 1. You can start issuing new position commands

5.10.2 Speed mode

Speed mode, using RPDO3 and TPDO3.The control process is as follows:

Control object	variable name	setting value	message（ID=1）	mark
RPDO3 TPDO3	Control word+work mode+target speed Current location+status word	0xF+0x3+600 reply value	401 0F 00 03 58 02 00 00 381 00 00 00 00 37 00	Motor Enable + Speed Mode + Target Speed 600 Current speed 0 + status word 0x037
RPDO3 TPDO3	Control word+work mode+target speed Current location+status word	0xF+0x3+-600 reply value	401 0F 00 03 A8 FD FF FF 381 58 02 00 00 37 00	Motor Enable + Speed Mode + Target Speed 600 Current speed 600 + status word 0x037
RPDO3 TPDO3	Control word+work mode+target speed Current location+status word	0xF+0x3+-600 reply value	401 0F 00 03 A8 FD FF FF 381 A8 FD FF FF 37 04	Motor Enable + Speed Mode + Target Speed 600 Current speed 600 + status word 0x437

5.10.3 Position interpolation mode

In position interpolation mode, the motor that needs to be controlled is first set to different addresses in advance, such as addresses 1,2,3.Then it is directly sent to the RPDO4 of the motor, and the three motors are sent separately. At this time, the motor is only temporarily saved and will not work. After the controller sends a SYNC synchronization signal, the motor will work at the same time.The appeal process needs to be completed within 2ms.The interpolation cycle is completed every 2ms.

object	Variable name	Setting value	Message（ID=1）	Mark
Address1 RPDO4 Address1 TPDO4	target location current location + status word	50000 Reply value	501 50 C3 00 00 481 78 0D 00 00 37 04	Target location 50000 Address1 motor Current location 0xD78（3448 decimal system）+status word 0x437 Note: This command is to obtain the current location.The motor will not execute

				1. If the motor is a single turn absolute value, the current position range is 0~32768. 2. If it is with the battery of multiple absolute value to record the number of turns.The returned data can be multiple turns of position.
Address2 RPDO4 Address2 TPDO4	target location current location + status word	50000 Reply value	501 50 C3 00 00 481 4D 18 00 00 37 04	target location 50000 address 2motor Current location 0x4D18（6221decimal system）+status word 0x437
Address3 RPDO4 Address3 TPDO4	target location current location + status word	50000 Reply value	501 50 C3 00 00 481 68 29 00 00 37 04	Target location 50000 address 3motor Current location 0x2968（10600decimal system）+status word 0x437
SYNC	Sync signal	None	80	All three motors are executed simultaneously

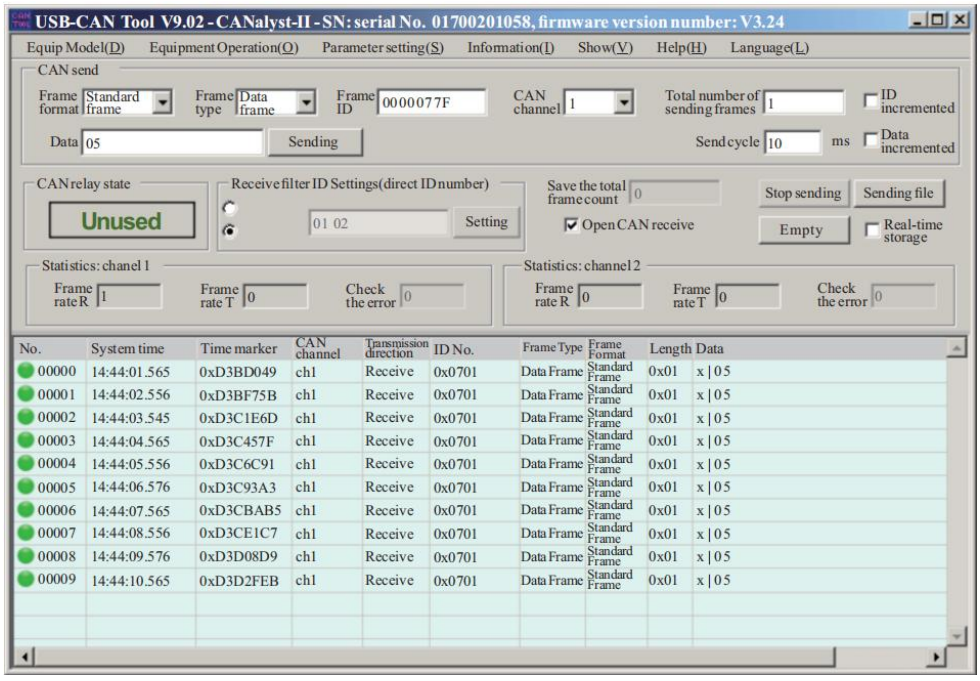
Note: The above procedure is performed every 2ms to complete the interpolation.

5.11 Heartbeat production and consumption

5.11.1 Heartbeat production

The object that controls heartbeat generation is the interval time between heartbeat generation (index 0x1017 subindex 0), which is in milliseconds.The default is 1000ms. Each second generates a heartbeat pack.Plug in the motor and, with normal communication, receive one heartbeat pack every second.The diagram as below

Note: The content of heartbeat packet 05 represents normal operation and 04 represents alarm.



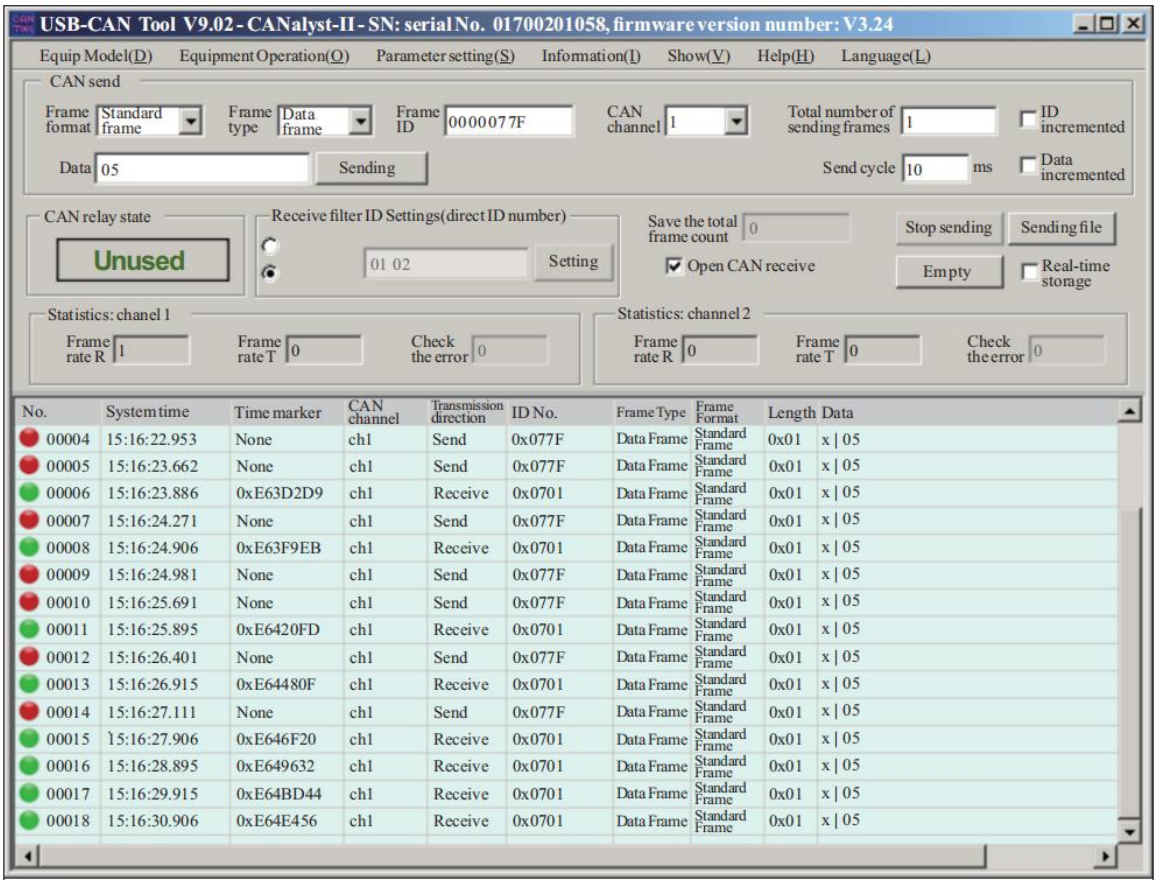
5.11.2 The consumption of the heartbeat

Heartbeat consumption is used to automatically stop when disconnected from the machine.The object controlling heartbeat consumption is as

follows:

0x10160120		
31~24	23~16	15~0bit
Invalid	0~7F（the address of the heartbeat generator）the default value is 7 f	Scope 0~65535（0：Heart rate monitoring is not enabled 1~65535：unit ms，If no heartbeat is received within this time range, the processing stops）the default is 2000.

The default parameter is 0x7F07D0. A CAN instruction must be received every 2 seconds, otherwise the motor will alarm and stop.The motor will not be tested until the first day heartbeat pack is received.If you drop the line and receive the heartbeat packet again, the battery will resume operation.



5.12 NMT instruction

Host computer -> Motor (NMT)			
Arbitration section	Control section	Data section	
CAN identifier	DLC(length of data segment)	1	2
0x000	0x2	CS	Node-ID

The CANID of the NMT node status switch command is 0x000, has the highest CAN priority, and the data is 2 bytes:

The first byte represents the command type:

0x01: Start command (puts node into operation state). SDO,PDO, and heartbeat are all valid (heartbeat sends 0x5).

0x02: Stop command (puts the node into the stopped state). SDO,PDO, heartbeat are all invalid. The NMT instruction is valid.

0x80: Preoperation command. The PDO is invalid. Sdos are valid and heartbeats are valid (heartbeats send 0x7F).

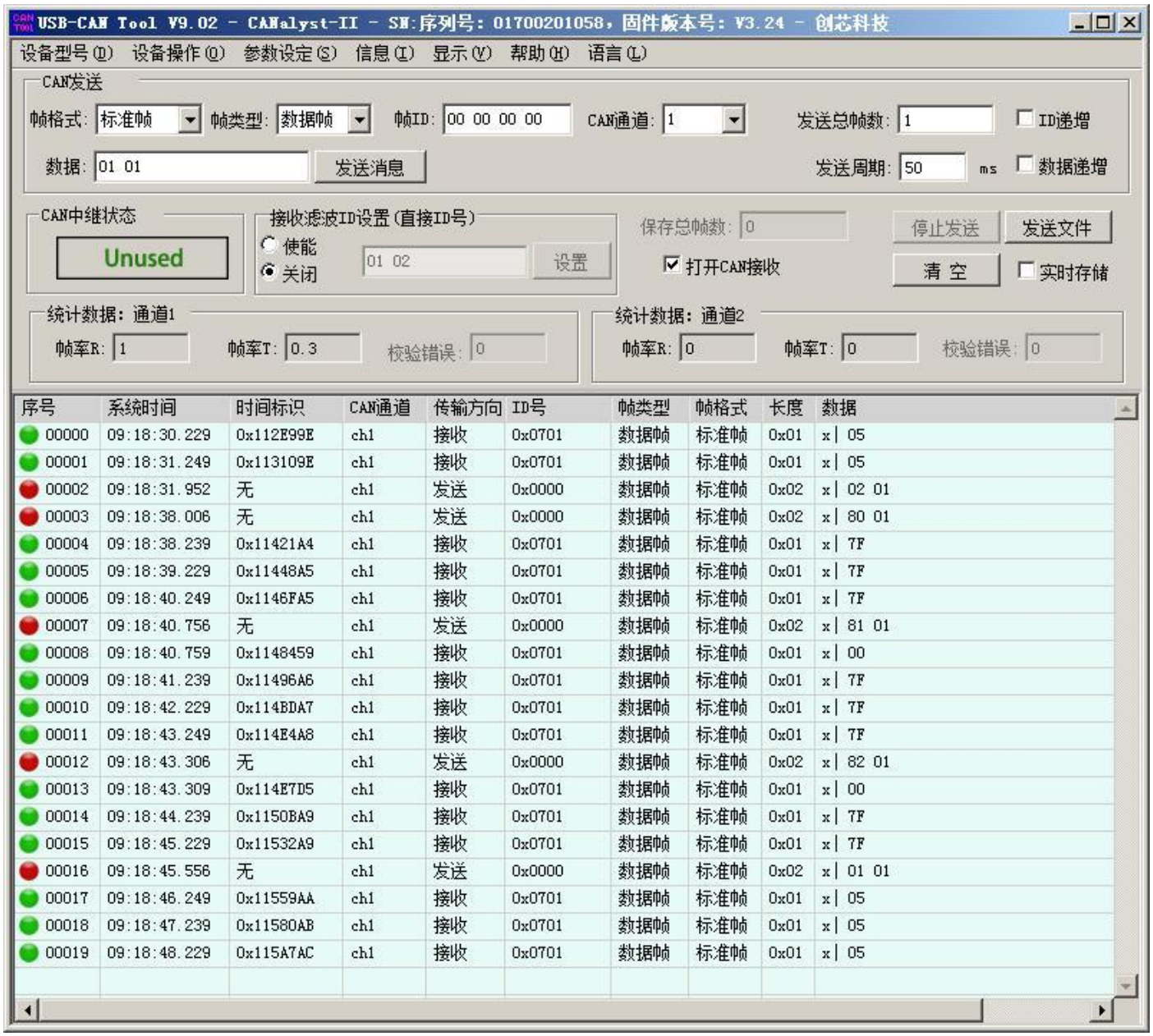
0x81: Resets the node application layer. The motor parameter restores the saved value. The heartbeat is 0 once and 0x7F again.

0x82: Reset node communication. Re-initialize the CAN device. The heartbeat is 0 once and 0x7F again.

The second byte represents the node-id of the controlled node:

0x0: The operation is performed on all nodes on the network.

0x1 to 0x7f: Run the NMT command on the node whose ID is 0x01 to 0x7F



5.13 Modify the baud rate

The modified baud rate can be sent through the host computer software provided by us, or it can be sent using other USBCAN. Specifically, send it as follows:

A. Modbus enable (canopen address 26000010) Send 1

B. Motor acceleration (canopen address 60830020) send 803 (Note 803: 1M 802: 500K 801: 250K 800: 125K)

C. Weakening angle (canopen address 26040010) send 129

D. Modbus enable (canopen address 26000010) send 506

It will take effect after power on again.

Note: It is not necessary to send the parameters to save, because this is to change the internal parameters. Just follow the steps above to send.