MKS SERVO57C V1.0
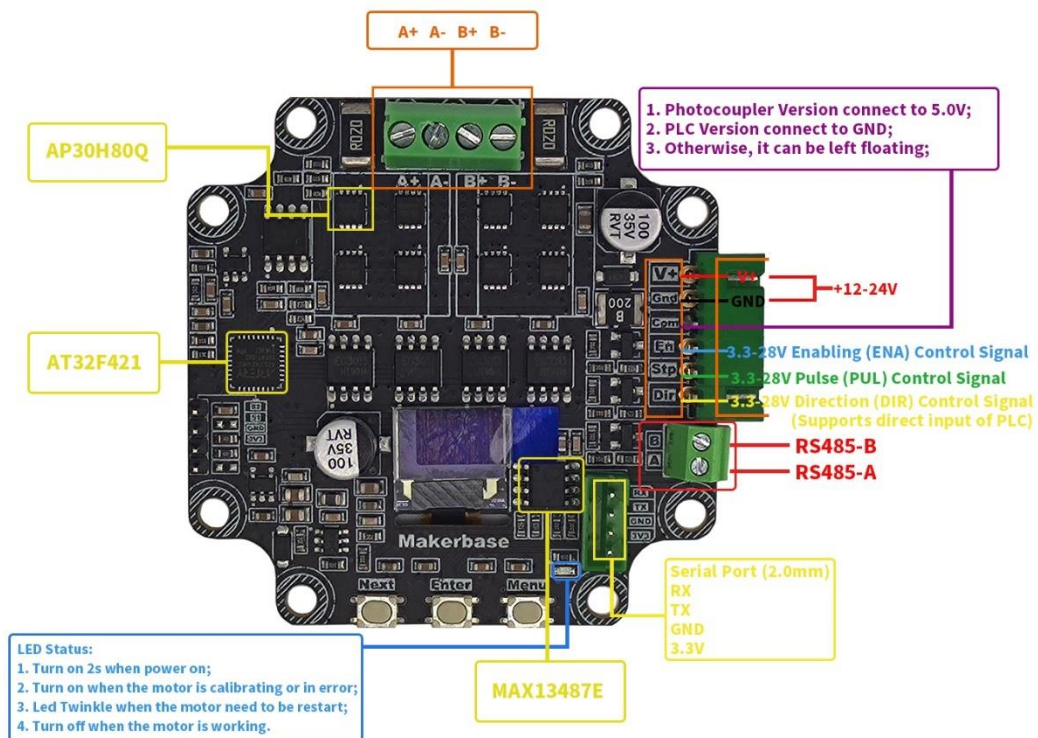# USER MANUAL

Part1.   Feature

1.1 Interface

NOTE1: Power(V+,GND) input voltage range is 12V-24V.

NOTE2: The input signal (EN,STP,DIR) voltage range is 3.3V-24V.

NOTE3: The signal (COM) may connect to 5.0V,GND or floating.

1.2 Key Operation

| Key	Function
Next	move down
Enter	Confirm
Menu	Enter/exit parameter setting menu

1. How to View parameter

    Press the "Menu" key to Enter the Menu
    press the "Next" key to move to the sub-option
    press the "Enter"key, then it show the value.

2. How to setting Parameter：
   Press the "Menu" key to Enter the Menu
   press the "Next" key to move to sub-option
   press the "Enter" key, it show the value.
   press the "Next" key to move to the value
   press the "Enter" key to set the value.

1.3 Parameter description

1. 0.0° – the angle of the motor shaft.(unit degree).
   (Note : It calculated based on the read encoder value, dynamically displayed)
2. 0.00err – the err of the motor shaft angle.
3. 0clk – the pulses have been received.
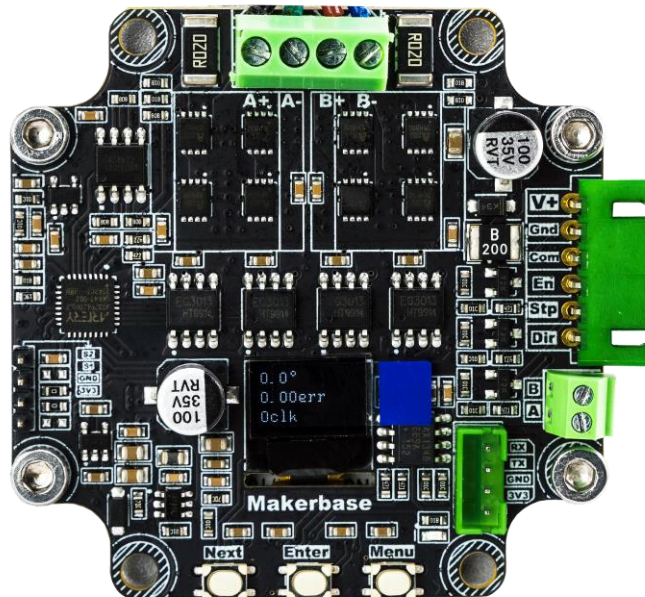
1.4 Work mode

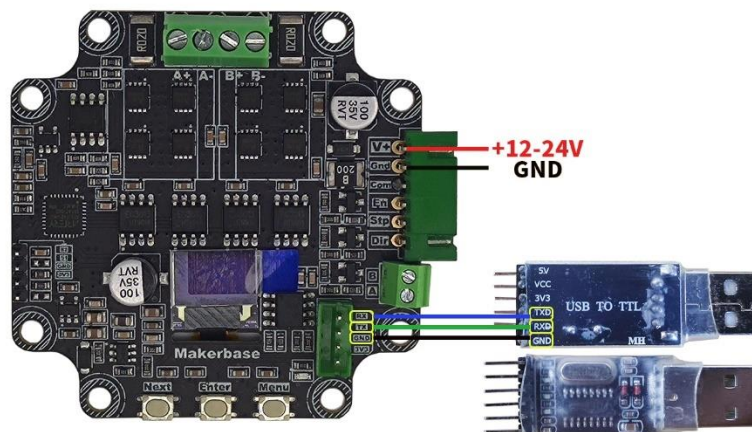| Work mode	Signal input	Encoder	Current
CR_OPEN	EN,STP,DIR	NO	Fixed
CR_CLOSE	EN,STP,DIR	YES	Fixed
CR_vFOC	EN,STP,DIR	YES	adaptive
CR_UART	Serial	YES	adaptive

Note: The default work mode is CR_vFOC

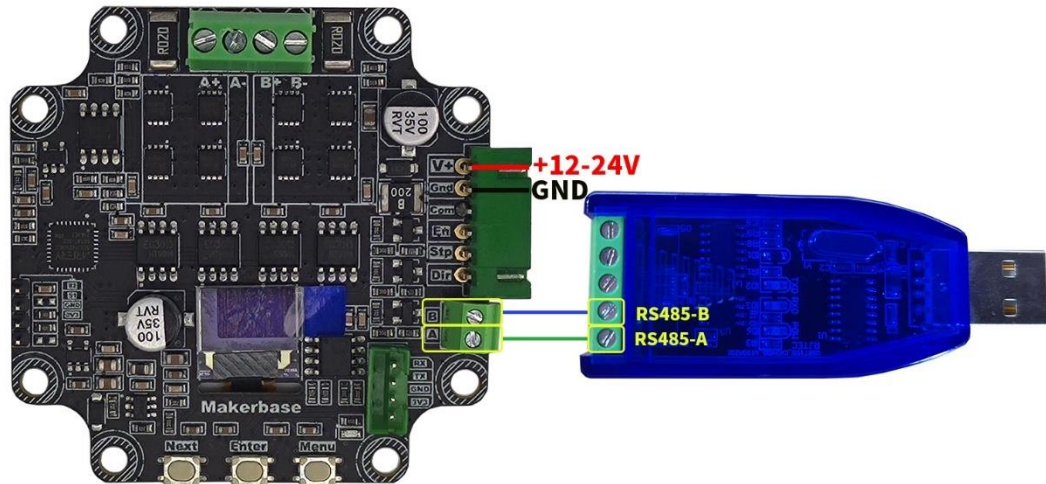# Part2. Wire

2.1 Pulse interface wire
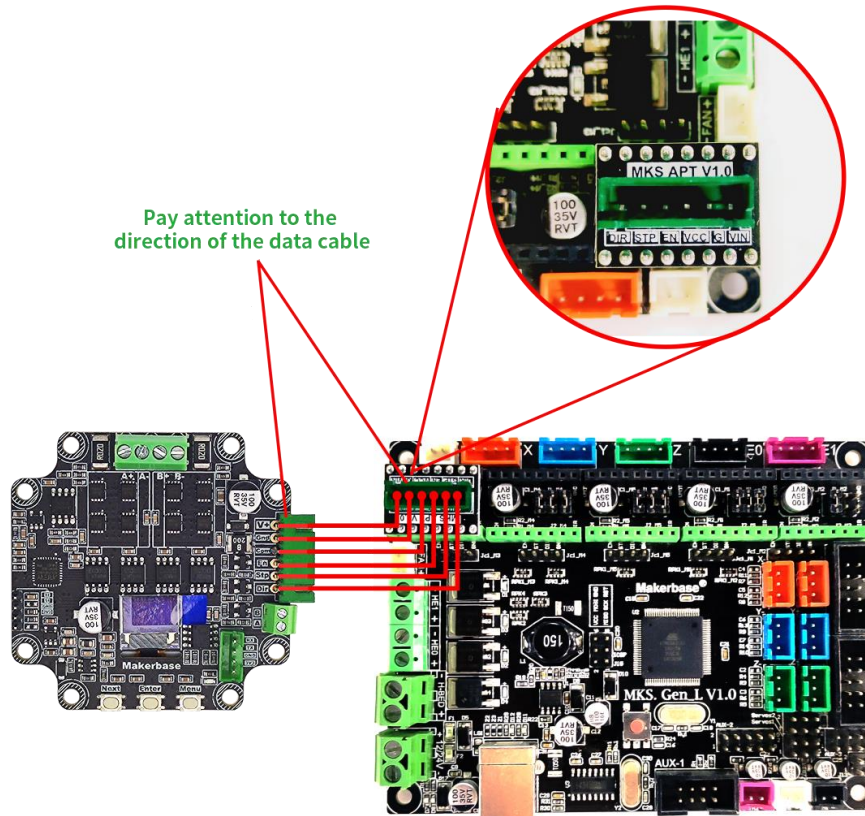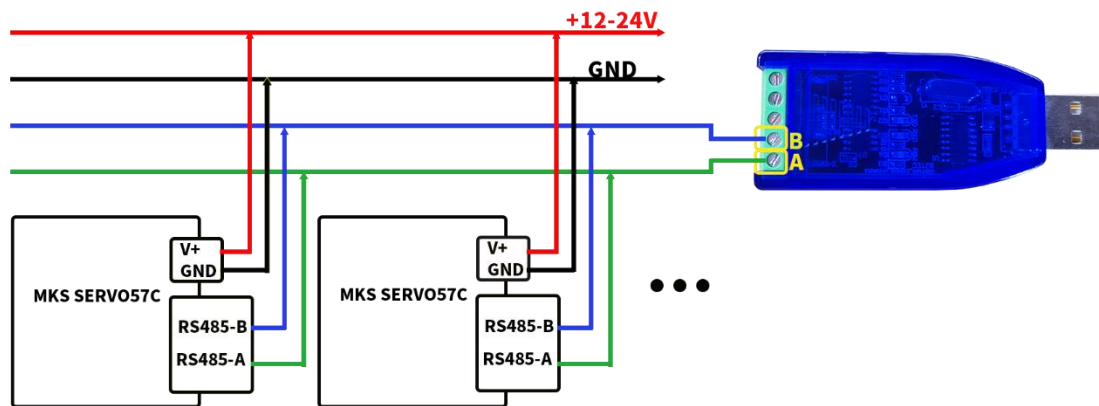

2.2 Uart (TTL) wire

Note: The hardware V1.0 only supports single-slave communication for usart (TTL).

2.3 RS485 wire

1. Single-slave

2. Multiple-slave

Part3.　 Menu description

1. **CAL** : Calibrate the motor.

2. **Mode** : Work mode selection.
   CR_OPEN : Open mode, the motor run without encoder
   CR_CLOSE : Close mode, the motor run with encoder.
   CR_vFOC : FOC mode, pulse(En,Stp,Dir) interface.
   CR_UART : FOC mode, serial interface.
    (Default: CR_vFOC)

3. **Ma** : Set the current.

Work mode	Current （Ma）
CR_OPEN	The working current is fixed, and the working
CR_CLOSE	current is Ma.
CR_vFOC	The working current is adaptive, the maximum
CR_UART	current is Ma.

    (Default: 3200)

4. **MStep** : Set subdivisions.
   Supports subdivision from 1 to 256.
   (Default: 16)
   subdivisions 1,2,4,8,16,32,64,128, and 256 can be set by Menu.
   Other subdivisions such as 67 subdivisions need to be set by serial .

5. **En** : Set the effective level of EN pin.
   H : High level is valid.
   L : Low level is effective.
   Hold : the driver board is always enabled.
   (Default: L)

6. **Dir** : Set the positive direction of motor rotation.
   CW : Clockwise rotation is positive
   CCW : Counterclockwise rotation is positive
   (Default: CW)

7. **Protect** : Set the motor shaft locked-rotor protection function.
   Disable: disable protection
   Enable: enable protection
   (Default: Disable)
   After this option is enabled, the protection will be triggered when
   it is detected to be locked-rotor, and the motor will be release.
   Note: you can release the protection status by pressing the Enter
   button or the serial port command.

8. **MPlyer** : Set internal 256 subdivision.
   (Default: Enable)
   Note: After this option is Enabled, it automatically enable internal 256 subdivision, it can reduce the vibration and noise when the motor at low speed.

9. **UartBaud** : Set the baud rate of serial.
   9600,
   19200,
   25000,
   38400,
   57600,
   115200.
   256000.
   (Default: 38400)

10. **UartAddr** : Set the the slave address of seria.
    01
    ...
    09
    10
    (Default: 01)
    Note: The addresses greater than 10 need to be set by serial command. After it is set, it will be added to this option.

11. **O_Mode** : The motor will go back to zero when power on.
    Disable : do not go back to zero.
    DirMode : go back to zero with direction of CW or CCW (the direction is set in O_Dir menu).
    NearMode : go back to zero ith minimum angle.
    (Default: Disable)

12. **Set 0** : Set the zero point for go back when power on.
    (O_Mode must not be Disable)

13. **O_Speed** : Set the speed of go back to zero point.
    0 : slowest.
    ...
    4 : fastest.

14. **O_Dir** : Set the direction of go back to zero point.
    CW : Clockwise.
    CCW : Counterclockwise.
    (Default: CW)

15. **Restore** : Reload the default parameters.
   After restored the default parameters, it needs to restart the
   motor.
   Note: Press the "Next" key first, then power on, it can quickly
   restore the default parameters.

16. **Exit** :Exit the parameter setting menu.

Part4. Serial data format

Downlink package(PC → SERVO57C)						
Head	Slave addr	Function	Data			Check code
FA	addr	code				CRC

Uplink package (PC ← SERVO57C)						
Head	Slave addr	Function	Data			Check code
FB	addr	code				CRC

1. Downlink package Head is "FA", uplink package Head is "FB".
2. The slave address(addr) range is 00~255. (default is 01).
   00 is the broadcast address;
   01~10 can be set in the UartAddr option of the display menu;
   greater than 10 need to be set by serial commands.
3. The function code (code) executes the corresponding command.
   for example, 0x80 executes the calibration command.
4. The Check code is CHECKSUM 8bit
   For example: command "FA 01 80 00 CRC"
   CRC = (0xFA + 0x01 + 0x80 + 0x00) & 0xFF = 0x17B & 0xFF = 0x7B

Part5.   Serial command description

Note: Please set the serial slave address first.(default:01)

The default address for the following chapters is 01.

5.1 Read parameter command

1. command1 : FA 01 30 CRC

read the encoder value (the motor should be calibrated).

Uplink package (PC ← SERVO57C)					
Head	Slave addr	Function	Data		CRC
FB	01	30	carry	value	CRC
			int32_t	uint16_t	

carry: the carry vaule of the encoder.

value: the current vaule of the encoder.(range 0~0x3FFF)

When value is greater than 0x3FFF, carry +=1.

When Value is less than 0, carry -=1.

Note:The encoder value is updated regardless of whether the motor
is enabled or not.

2. Command2 : FA 01 33 CRC

Read the number of pulses received.

Uplink package (PC ← SERVO57C)				
Head	Slave addr	Function	Data	CRC
FB	01	33	pulses(int32_t)	CRC

3. Command3 : FA 01 39 CRC

read the error of the motor shaft angle.

Uplink package (PC ← SERVO57C)				
Head	Slave addr	Function	Data	CRC
FB	01	39	error(int16_t)	CRC

The error is the difference between the angle you want to control
minus the real-time angle of the motor, 0~FFFF corresponds to
0~360°.

for example, when the angle error is 1°, the return error is
65536/360= 182.444, and so on.

4. Command4 : FA 01 3A CRC

   read the En pins status.

Uplink package (PC ← SERVO57C)				
Head	Slave addr	Function	Data	CRC
FB	01	3A	enable(uint8_t)	CRC

enable =1 Enabled
enable =0 Disabled

5. Command5 : FA 01 3B CRC

   Read the go back to zero status when power on.

Uplink package (PC ← SERVO57C)				
Head	Slave addr	Function	Data	CRC
FB	01	3B	status(uint8_t)	CRC

status =0   going to zero.
status =1   go back to zero success.
status =2   go back to zero fail.

6. command6 : FA 01 3D CRC

   Release the motor shaft locked-rotor protection state.

Uplink package (PC ← SERVO57C)				
Head	Slave addr	Function	Data	CRC
FB	01	3D	status(uint8_t)	CRC

status =1 release success.
status =0 release fail.

7. Command7 : FA 01 3E CRC

   Read the motor shaft protection state.

Uplink package (PC ← SERVO57C)				
Head	Slave addr	Function	Data	CRC
FB	01	3E	status(uint8_t)	CRC

status =1 protected.
status =0   no protected.

5.2 Set parameters command

1. Calibrate the encoder

（Same as the "Cal" option on screen）

Downlink package（PC → SERVO57C）				
Head	Slave addr	Function	Data	CRC
FA	01	80	00	CRC

Uplink package（PC ← SERVO57C）				
Head	Slave addr	Function	Data	CRC
FB	01	80	status(uint8_t)	CRC

status =0 Calibrating….
status =1 Calibrated success.
status =2 Calibrating fail.
Note : The motor must be unloaded.

2. Set the work mode

（Same as the "Mode" option on screen）

Downlink package（PC → SERVO57C）				
Head	Slave addr	Function	Data	CRC
FA	01	82	mode (0~3)	CRC

mode = 0   CR_OPEN
mode = 1   CR_CLOSE
mode = 2   CR_vFOC
mode = 3   CR_UART

Uplink package（PC ← SERVO57C）				
Head	Slave addr	Function	Data	CRC
FB	01	82	status(uint8_t)	CRC

status =1 Set success.
status =0 Set fail.

3. Set the current

(Same as the "Ma" option on screen)

Downlink package (PC → SERVO57C)				
Head	Slave addr	Function	Data	CRC
FA	01	83	ma (00~0D)	CRC

The current = ma x 400 （mA）

Uplink package (PC ← SERVO57C)				
Head	Slave addr	Function	Data	CRC
FB	01	83	status(uint8_t)	CRC

status =1 Set success.

status =0 Set fail.

4. Set subdivision

(Same as the "MStep" option on screen)

Downlink package (PC → SERVO57C)				
Head	Slave addr	Function	Data	CRC
FA	01	84	micstep(00~FF)	CRC

Note:the new micstep will show in the screen of MStep option.

Uplink package (PC ← SERVO57C)				
Head	Slave addr	Function	Data	CRC
FB	01	84	status(uint8_t)	CRC

status =1 Set success.

status =0 Set fail.

5. Set the active of the En pin

(Same as the "En" option on screen)

Downlink package (PC → SERVO57C)				
Head	Slave addr	Function	Data	CRC
FA	01	85	enable(00~02)	CRC

enable = 00   active low   (L)

enable = 01   active high   (H)

enable = 02   active always (Hold)

Uplink package (PC ← SERVO57C)				
Head	Slave addr	Function	Data	CRC
FB	01	85	status(uint8_t)	CRC

status =1 Set success.

status =0 Set fail.

6. Set the direction of motor rotation

(Same as the "Dir" option on screen)

Downlink package (PC → SERVO57C)				
Head	Slave addr	Function	Data	CRC
FA	01	86	dir(00~01)	CRC

dir = 00   CW
dir = 01   CCW

Uplink package (PC ← SERVO57C)				
Head	Slave addr	Function	Data	CRC
FB	01	86	status(uint8_t)	CRC

status =1 Set success.
status =0 Set fail.

7. Set the motor shaft locked-rotor protection function

(Same as the "Protect" option on screen)

Downlink package (PC → SERVO57C)				
Head	Slave addr	Function	Data	CRC
FA	01	88	enable(00~01)	CRC

enable = 01   enabled protection
enable = 00   disabled protection

Uplink package (PC ← SERVO57C)				
Head	Slave addr	Function	Data	CRC
FB	01	88	status(uint8_t)	CRC

status =1 Set success.
status =0 Set fail.

8. Set the subdivision interpolation function

(Same as the "Mplyer" option on screen)

Downlink package (PC → SERVO57C)				
Head	Slave addr	Function	Data	CRC
FA	01	89	enable(00~01)	CRC

enable = 01   enabled interpolation function.
enable = 00   disabled interpolation function.

Uplink package (PC ← SERVO57C)				
Head	Slave addr	Function	Data	CRC
FB	01	89	status(uint8_t)	CRC

status =1 Set success.
status =0 Set fail.

9. Set the baud rate

(Same as the "UartBaud" option on screen)

Downlink package (PC → SERVO57C)				
Head	Slave addr	Function	Data	CRC
FA	01	8A	baud(01~07)	CRC

baud = 01   9600.
baud = 02   19200.
baud = 03   25000.
baud = 04   38400.
baud = 05   57600.
baud = 06   115200.
baud = 07   256000.

Uplink package (PC ← SERVO57C)				
Head	Slave addr	Function	Data	CRC
FB	01	8A	status(uint8_t)	CRC

status =1 Set success.
status =0 Set fail.

10. Set the slave address

(Same as the "UautAddr" option on screen)

Downlink package (PC → SERVO57C)				
Head	Slave addr	Function	Data	CRC
FA	01	8B	addr(00~FF)	CRC

Note:the new address will show in the screen of UartAddr option.

Uplink package (PC ← SERVO57C)				
Head	Slave addr	Function	Data	CRC
FB	01	8B	status(uint8_t)	CRC

status =1 Set success.
status =0 Set fail.

11. Restore the default parameter

（Same as the "Restore" option on screen）

Downlink package （PC → SERVO57C）				
Head	Slave addr	Function	Data	CRC
FA	01	3F	NULL	CRC

Uplink package （PC ← SERVO57C）				
Head	Slave addr	Function	Data	CRC
FB	01	3F	status(uint8_t)	CRC

status =1 restore success.

status =0 restore fail.

Note1: After restored the parameters, you need to restart the motor.

Note2: Press the "Next" key, and power on the motor, the default parameter will be restored.

5.3 Serial control command

Note: This chapter needs to set the working mode to "CR_UART".

1. Set the En pin status in CR_UART mode.

Downlink package （PC → SERVO57C）				
Head	Slave addr	Function	Data	CRC
FA	01	F3	en （00~01）	CRC

en = 00   disable.

en = 01   enable.

Uplink package （PC ← SERVO57C）				
Head	Slave addr	Function	Data	CRC
FB	01	F3	status(uint8_t)	CRC

status = 1 set success.

status = 0 set fail.

2. run the motor forward / reverse in a Constant speed.

Downlink package (PC → SERVO57C)				
Head	Slave addr	Function	Data	CRC
FA	01	F6	VAL(00~FF)	CRC

Direction : The highest 1bit of VAL.

Speed : The lowest 7bit of VAL.

for example:
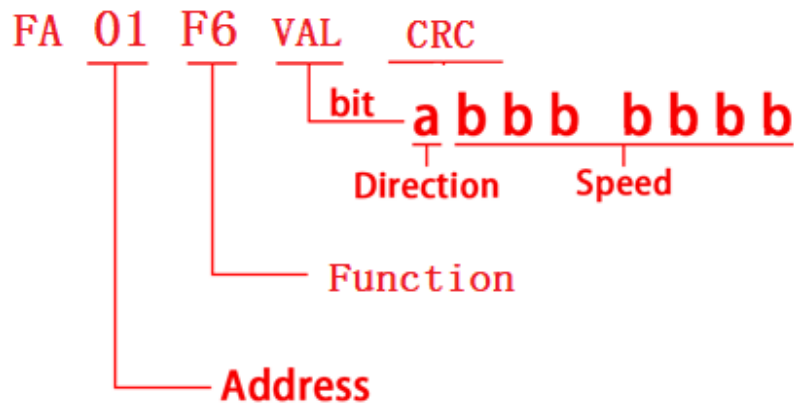
The Vrpm calculation formula is:

Vrpm = (Speed × 30000)/(Mstep × 200)(RPM)   (1.8 degree motor)

For example:

    1.8 degree motor, Mstep = 150, Speed=1

    Vrpm = (1 × 30000)/(150 × 200) = 1

    Part of the speed is as follows:

1.8 degree motor	Vrpm (RPM)	
Speed	Mstep=16	Mstep=150
1	9.375	1
2	18.75	2
3	28.125	3
4	37.5	4
...	...	...
8	75	8
...	...	...
0x10	150	16
0x20	300	32
0x40	600	64
0x7F	1200	127

Uplink package (PC ← SERVO57C)				
Head	Slave addr	Function	Data	CRC
FB	01	F6	status(uint8_t)	CRC

status = 1 run success.

status = 0 run fail.

Note: the Vrpm no great than 2000RPM.

3. stop the motor

Downlink package (PC → SERVO57C)				
Head	Slave addr	Function	Data	CRC
FA	01	F7	NULL	CRC

Uplink package (PC ← SERVO57C)				
Head	Slave addr	Function	Data	CRC
FB	01	F7	status(uint8_t)	CRC

status = 1 stop the motor success.
status = 0 stop the motor fail.

4. Save/Clear the status set in function(F6)

Downlink package (PC → SERVO57C)				
Head	Slave addr	Function	Data	CRC
FA	01	FF	state	CRC

state = C8   Save.
state = CA   Clean.

Uplink package (PC ← SERVO57C)				
Head	Slave addr	Function	Data	CRC
FB	01	FF	status(uint8_t)	CRC

status = 1   success.
status = 0   fail.

note1：The motor can rotates clockwise or counterclockwise at a constant speed when powered on.
note2: After the save is successful, the driver board will be disable, and it needs to be re-enabled.

For example:
    Step1: Send   FA 01 F6 10 CRC
           return   FB 01 F6 01 CRC
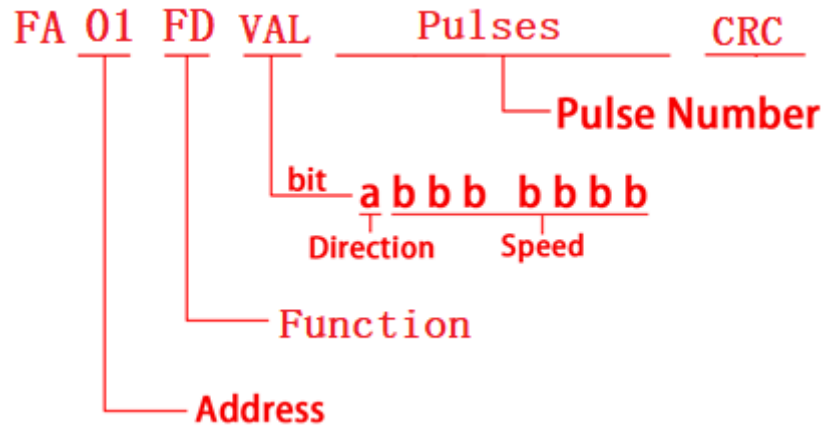   Step2: Send   FA 01 FF C8 CRC
           return   FB 01 FF 01 CRC
the motor will always rotates clockwise in speed(16) when power on.

5. Run the motor by serial command

Downlink package (PC → SERVO57C)				
Head	Slave addr	Function	Data		CRC
FA	01	FD	VAL	pulses	CRC
			uint8_t	uint32_t	

VAL: is the direction and speed.

pulses: is the number of pulses.

The speed (Vrpm) calculation formula is the same as above.

Uplink package (PC ← SERVO57C)				
Head	Slave addr	Function	Data	CRC
FB	01	FD	status(uint8_t)	CRC

status = 0   run fail.

status = 1   run starting….

status = 2   run complete.

Note: the Vrpm no great than 2000RPM.
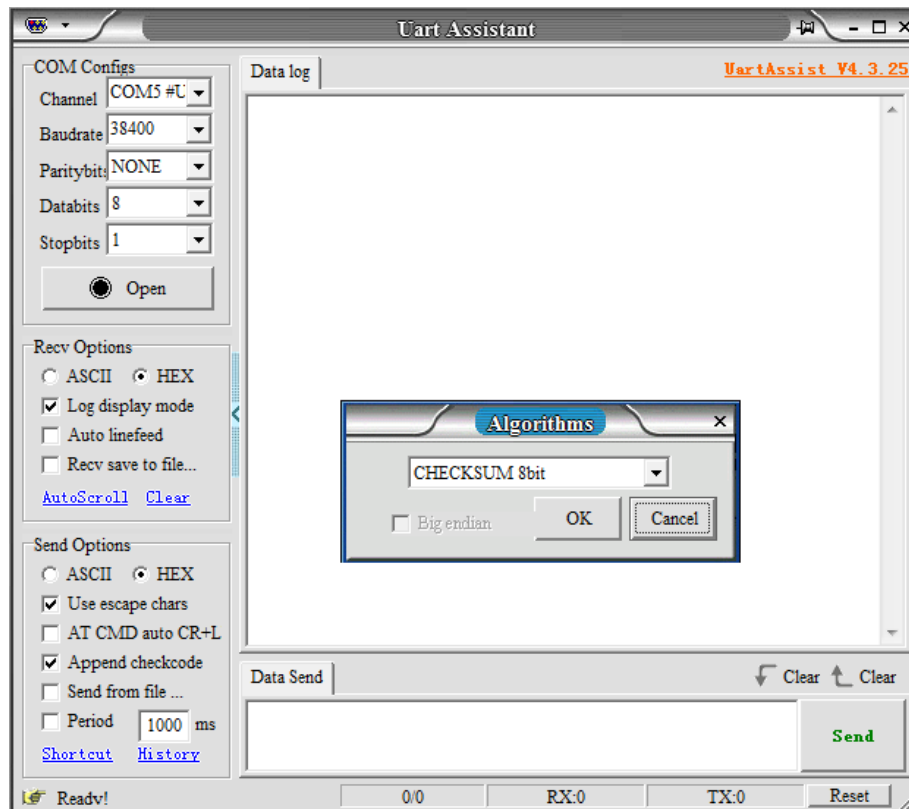
Part6.   Serial example

6.1 Config the SERVO57C

1. Menu → Mode → CR_UART.
2. Menu → UartBaud → 38400.
3. Menu → UartAddr → 01.

6.2 Config the Uart Assistant

1. Select the Channel; (such as COM5).
2. Select the Baudrate; (such as 38400, Must be equal to motor baudrate).
3. Recv Options: select "HEX".
4. Send Options: select "HEX".
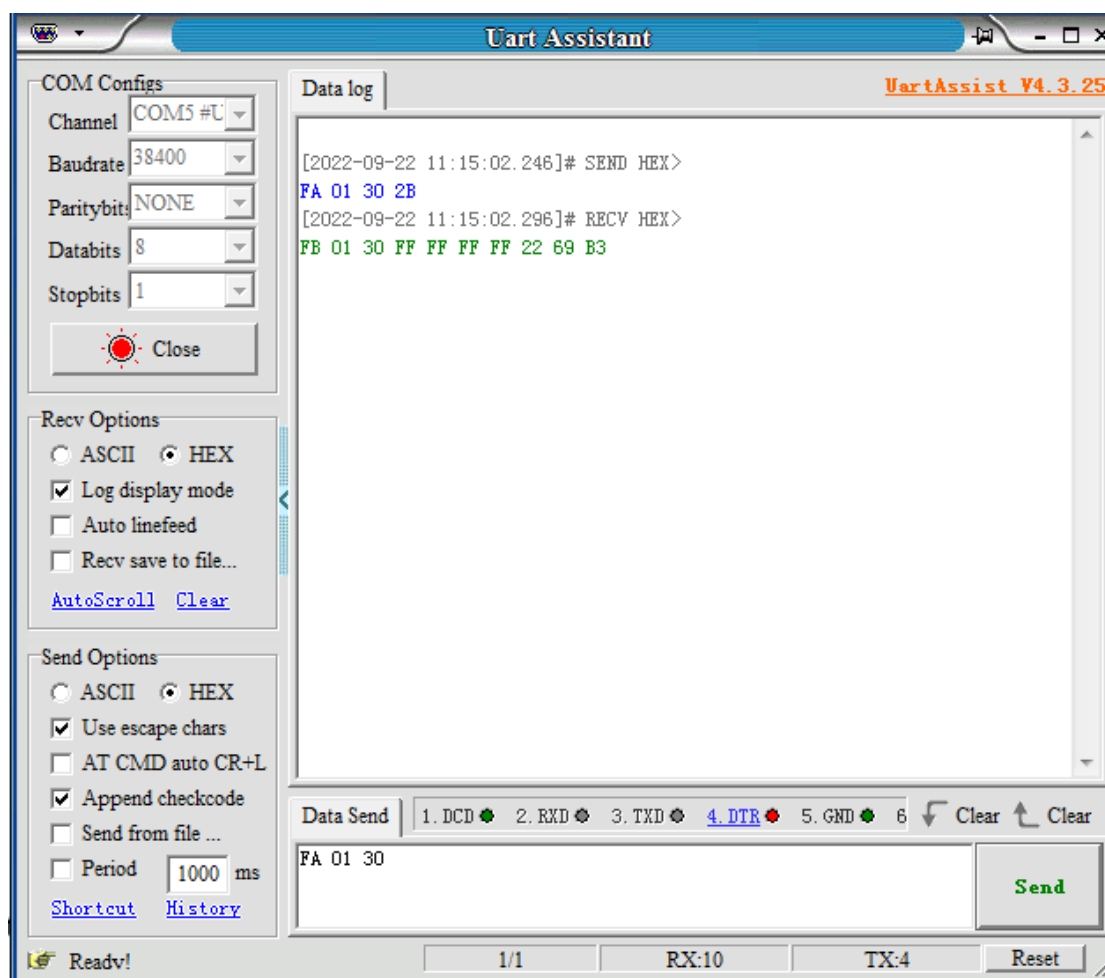5. Append checkcode: select "CHECKSUM-8".
Such as below:

6.3 Read the encoder value

send   "FA 01 30 2B"
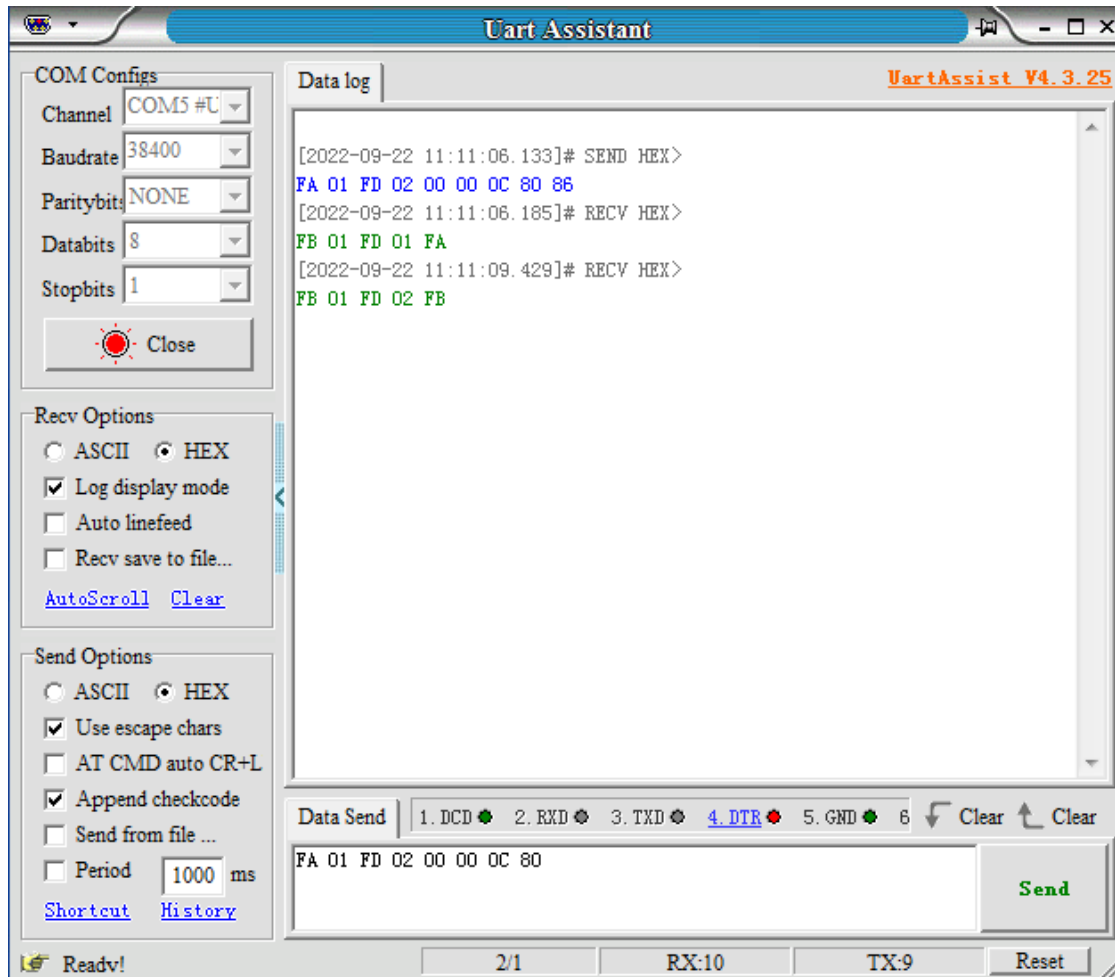return "FB 01 30 FF FF FF FF 22 69 B3"

6.4 Run the motor

Note : Please configure the working mode to "CR_UART".
Send "FA 01 FD 02 00 00 0C 80"
Return1 "FB 01 FD 01 FA"   run starting….
Return2 "FB 01 FD 02 FB"   run complete.

The motor will run one revolution at speed 2. (subdivision 16)

Part7.   FAQ

7.1 NOTE

1. Power input voltage is 12V-24V.
2. Don't hot plug motor cable and data cable.
3. When the motor is calibrating, do not carry a load.
4. After installed the motor, or changed the motor wiring sequence, you need to re-calibrate the motor again.
5. The default work mode is CR_vFOC(EN/STP/DIR interface).
6. Press the "Next" key first, then power on, it can quickly restore the default parameters.
7. If "Phase Line Error!" is displayed before calibration:
   b) Check the motor connection line sequence;
   c) Check the power supply voltage and output power (24V/1A, 12V/2A);;
   d) If the power supply is connected to the motherboard through the MKS APT module, try to connect the MKS APT module to ports such as X, Y, Z, E, etc., and then restart again.
   e) Do not use the MKS APT module for power supply before calibration, and the power supply is directly connected to V+ and Gnd.

7.2 FAQ

No	Question	Solution
1	Not Cal	Calibrate the motor.
2	Reverse Lookup Error!	Calibrate Fail, Check magnet and motor shaft
3	Magnet Loss!	Not install the magent.
4	Magnet Strong!	the magnet too near.
5	Magnet Weak!	the magnet too far.
6	Encoder Error!	Check magnet and motor shaft
7	Offset Current Error!	Reference voltage error
8	Phase Line Error!	The motor line sequence is wrong or the power supply is not enough
9	Wrong Protect!	Locked-rotor protection
10	Coming Back to Origin..	Going back to zero.
11	Reboot Again	The motor need to be restart.

Part8.   Schematic

Please download 《MKS SERVO57C V1.0 Schematic.pdf》 in
https://github.com/makerbase-mks/MKS-SERVO57C

Part9.   contact us

https://makerbase.aliexpress.com/
https://www.youtube.com/channel/UC2i5I1tcOXRJ2ZJiRxwpCUQ
https://github.com/makerbase-mks