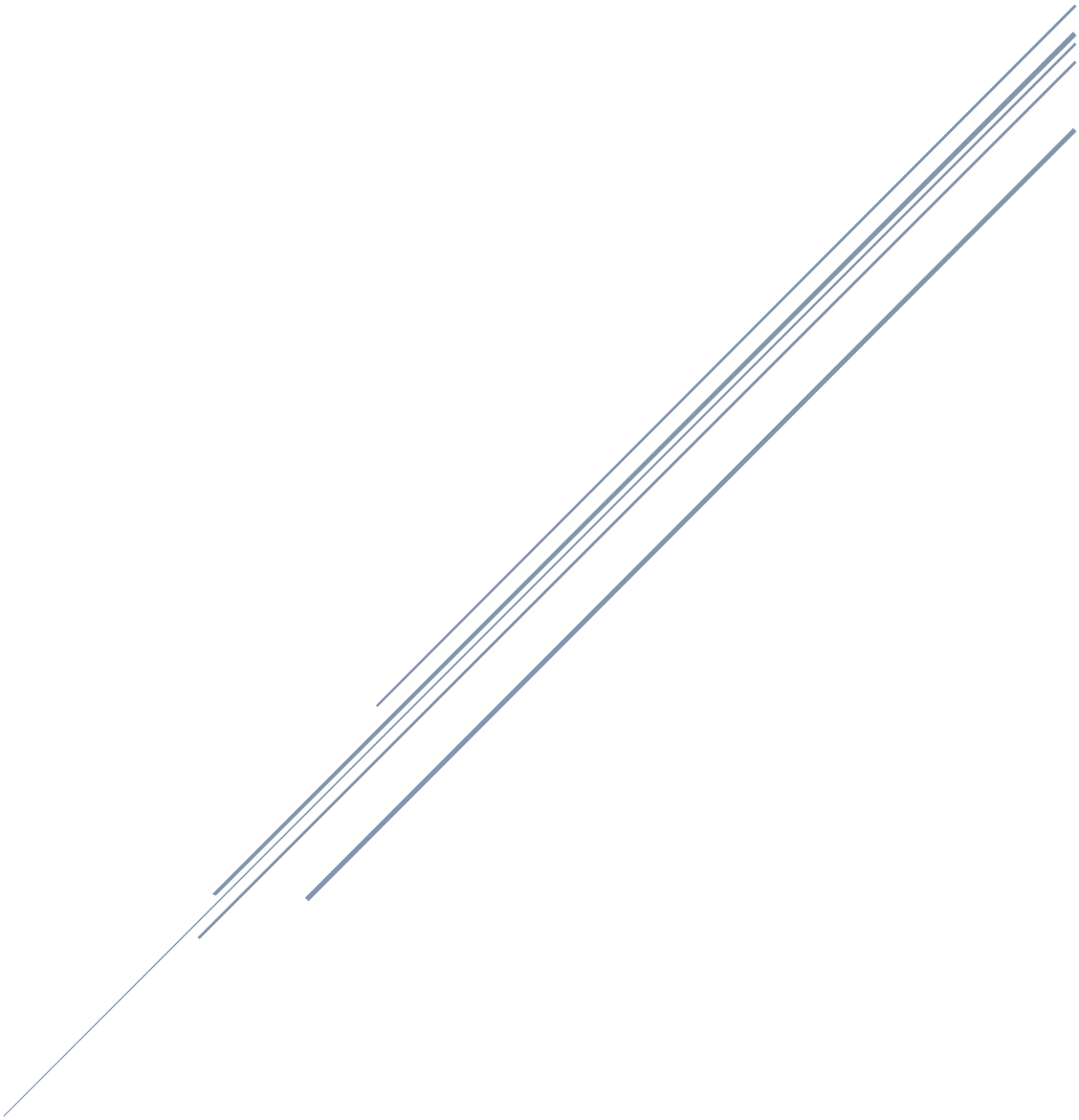
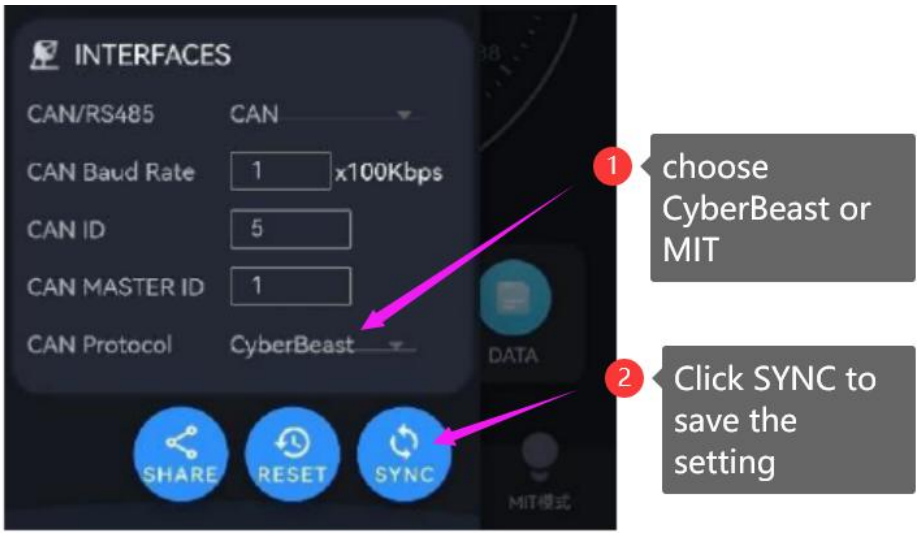
GIM4310 GIM4305 MOTOR DRIVER PROTOCOL SPECIFICATION

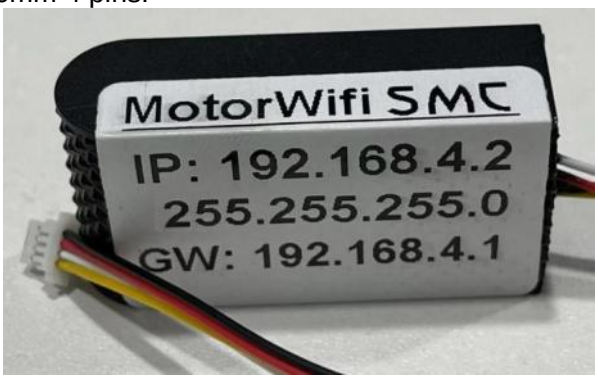


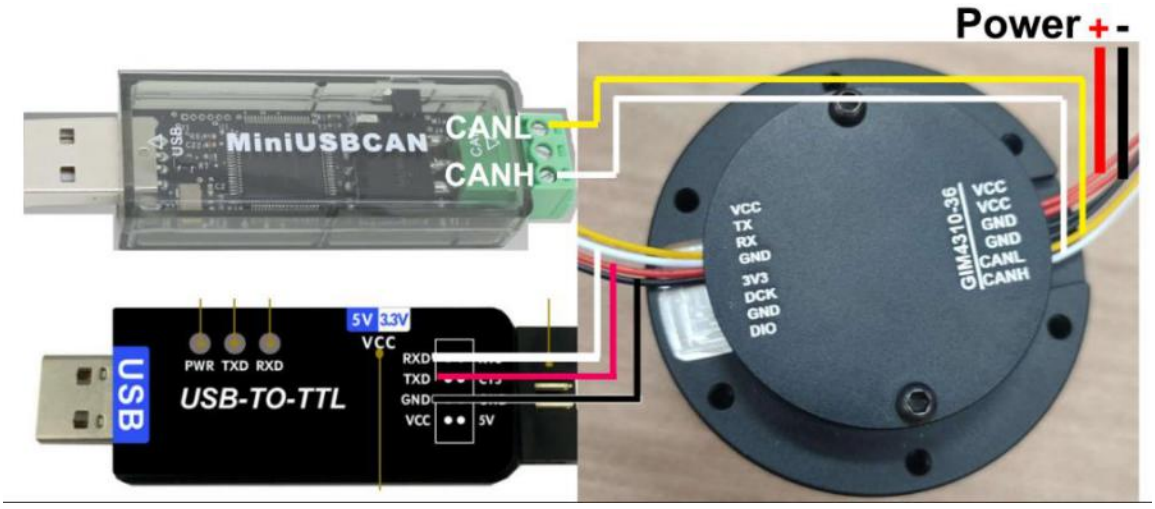
Brief Introduction

This GIM4310 GIM4305 driver support original MIT CAN protocol or Cyberbeast CAN protocol. You can choose the CAN protocol on the Windows PC App and Android App.



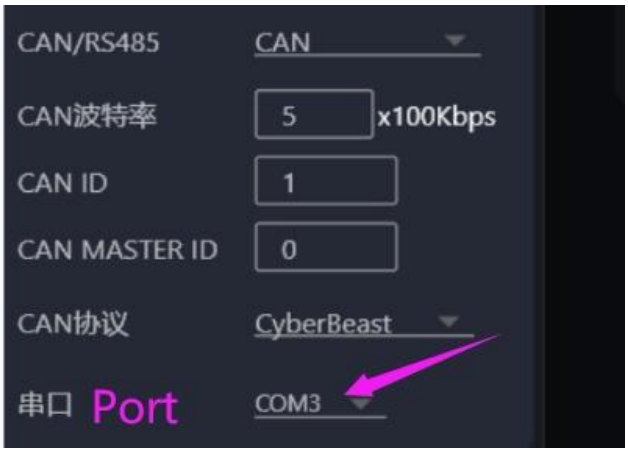
You can connect the Windows PC App to the driver by a up to 1Mbps USB-to-TLL adaptor or our MotorWifi adaptor. You can connect the Android App to the driver by our MotorWifi adaptor. The driver connector is JST SH 1.0mm 4 pins.



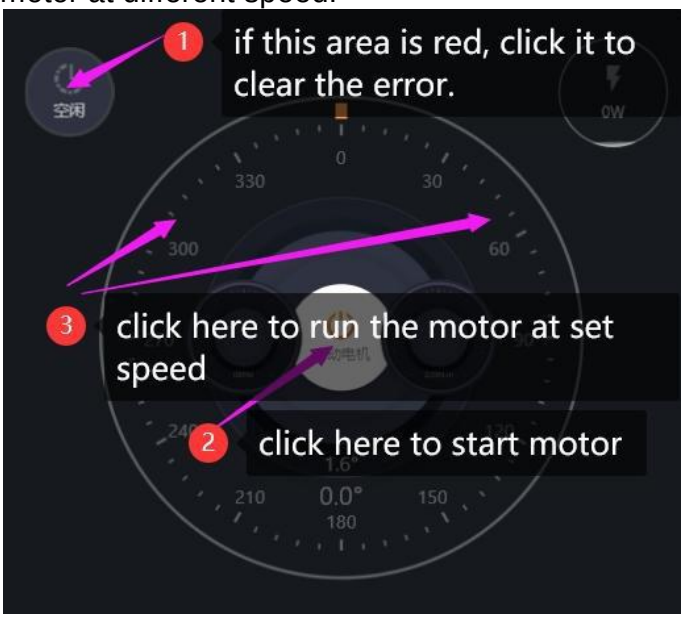


1. You power on the motor.
2. Plug the USB to TTL to the PC,
3. Open the PC app. Then you can connect to the driver.

If you can not connect to the PC app, please go to the Port to choose the correct Port, such as COM3 or others.



When you connect the PC app to the driver successfully, you can see a circle in RED color, click to clear the error, then you can start the motor and then run the motor at different speed.



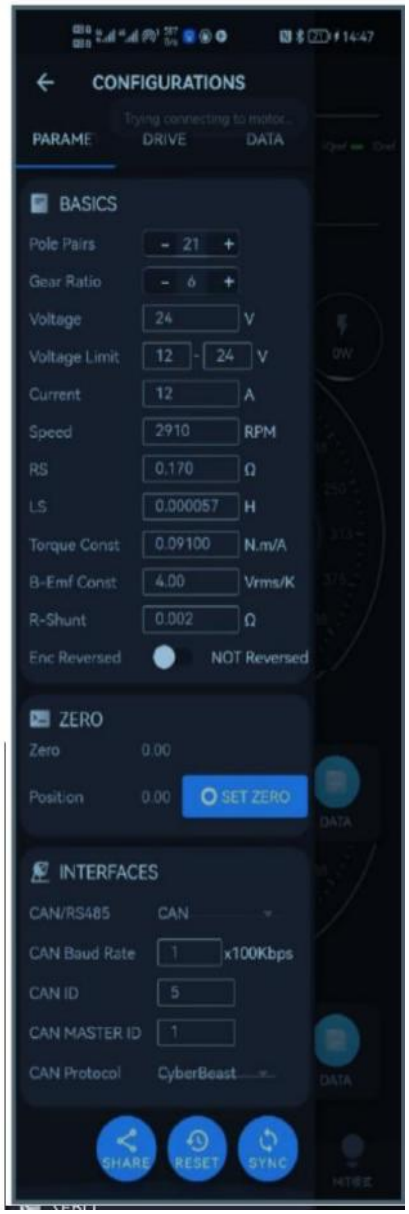
Please note that you are not suggest to run the motor in torque mode while the motor is without load. It might damage the motor. You can run torque mode while the motor is with load.

Windows PC App requirements:

- Windows 10 with RAM of 2G or more
- With WIFI capabilities for MotorWifi

- With USB 3.0 for USB-to-TTL
- The screen resolution need to be **1920x1080** or above

The following is a copy of the program interface.



You can change the driver settings, parameters, communication method by CAN or RS485, CAN communication baud rate, CAN id, CAN protocol of MIT or CyberBeast. You also can choose Speed, torque, or position control, to start and stop the motor, running motor testing by the app.

Please note that **don't run the torque control test** while the motor is **without load**. It might burn the motor by torque control while there is no load.

rev1.8

Part I
MIT CAN Protocol Instruction

Driver CAN command

Send CAN command to driver to control the motor position, speed, and current.

Special CAN command

1 Enter motor control mode {0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFC}

2 Exit motor control mode {0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFD}

3 Set current position as zero position {0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFE}

Identifier 0x00+Driver ID Standard Frame Frame Format: DATA DLC: 8 bytes

MIT driver CAN command

	DATA[0]	DATA[1]	DATA[2]	DATA[3]		DATA[4]	DATA[5]	DATA[6]		DATA[7]
Data bit	7-0	7-0	7-0	7-4	0-3	7-0	7-0	7-4	3-0	7-0
Content	high 8 bits	low 8 bits	high 8 bits	low 4 bits	high 4 bits	low 8 bits	high 8 bits	low 4 bits	high 4 bits	low 4 bits
	Motor position		Motor speed		KP		KD		torque	
Value	-95.5 to 95.5 rad		-45 to 45 rad/s						-18 to 18 Nm	

Motor CAN feedback

Identifier 0x00 + Driver ID Standard Frame Frame Format: DATA DLC: 8 bytes

	DATA[0]	DATA[1]	DATA[2]	DATA[3]	DATA[4]		DATA[5]
Data bit	7-0	7-0	7-0	7-0	7-4	3-0	7-0
Content	8 bits	high 8 bits	low 8 bits	High 8 bits	low 4 bits	high 4 bits	low 8 bits
	Driver ID	Motor position		Motor speed		Motor torque	
Value		-95.5 to 95.5 rad		-45 to 45 rad/s		-18 to 18 Nm	

For example:

1 Turn the motor one turn 360 degree = 6.28 rad. Poistion: 6.28; Velocity: 0.0; kp: 15.0; kd: 0.2; Torque: 0

Step 1 Enter motor control mode, Send following command through CAN

CAN id	Len	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7	Format	Type
001	8	FF	FF	FF	FF	FF	FF	FF	FC	Standard	Data

Step2 Send following command through CAN to run the motor to turn

CAN id	Len	Data0	Data1	Data2	Data3	Data4	Data5	Data6	Data7	Format	Type
001	8	88	6A	7F	F0	7A	0A	37	FF	Standard	Data

rev1.8

Part II
CyberBeast CAN Protocol Instruction

REVISION HISTORY

Version	Date	Revisions
1.0	2021.3.20	First version with CAN/RS485 protocols supported
1.1	2021.5.10	'Retrieve Indicator' command added to 'Status Commands' list to retrieve indicators in runtime
1.2	2021.5.20	Change float format from Q24 to IEEE
1.3	2021.7.15	"Refresh Configuration" command added
1.4	2021.9.2	'CAN Baud Rate', 'Flux Weakening Default KP' and 'Flux Weakening KI' added to 'Configuration List'
1.5	2022.3.2	✓ 'Encoder Direction' added to 'Configuration List' ✓ 'Gear Mechanical Angle' added to 'Indicator List'
1.6	2022.7.25	Change command values with each added with 0x70, i.e., 0x11 changed to 0x81, and so on.
1.7	2022.8.5	'CAN Protocol' added to 'Configuration List'
1.8	2022.8.9	'Zero Position'/'Power-off Position' meaning changed from multi-turn to angle in one revolution

Command list with samples.

Command type	Command name	Command	Samples (in hex)
Configuration	Reset Configuration	0x81	0x81 00 00 00 00 00 00 00
	Refresh Configuration	0x82	0x82 00 00 00 00 00 00 00
	Modify Configuration	0x83	0x83 00 1C 00 00 00 00 00 CyberBeast CAN 0x83 00 1C 00 01 00 00 00 MIT CAN
	Read Configuration	0x84	0x84 00 1C 00 00 00 00 00
Control	Start Motor	0x91	0x91 00 00 00 00 00 00 00
	Stop Motor	0x92	0x92 00 00 00 00 00 00 00
	Torque Control	0x93	0x93 CC CC 7C 41 B8 0B 00 15.8Nm 3s
	Speed Control	0x94	0x94 00 00 4A 42 B8 0B 00 50.5RPM 3s
	Position Control	0x95	0x95 00 10 49 40 B8 0B 00 180degree 3s
	PTS	0x96	
	Stop Control	0x97	0x95 00 00 00 00 00 00 00
Parameter	Modify Parameter	0xA1	0xA1 00 00 00 00 00 00 00
	Read Parameter	0xA2	0xA2 00 00 00 00 00 00 00
Status	Get Version	0xB1	0xB1 00 00 00 00 00 00 00
	Get Fault	0xB2	0xB2 00 00 00 00 00 00 00
	Acknowledge Fault	0xB3	0xB3 00 00 00 00 00 00 00
	Read Indicator	0xB4	0xB4 00 00 00 00 00 00 00 Read the voltage

1 SCOPE

Protocols specified in this document apply to:

1) MIT60 80 series motor drivers
2) Hardware interfaces: CAN/RS485/RS232

2 BASICS

Basic functions:

1) Motor configurations
2) Motor control
3) Retrieve/Modify motor parameters
4) Retrieve motor runtime indicators

3 SPECIFICATION

BASICS

Hardware Specification

CAN	RS485/RS232
1. Baud Rate: < 1Mbps 2. ID：customized 3. Frame Format: Data 4. Frame Type: Standard 5. DLC：8	1. Baud Rate: customized 2. Stop Bits: 1bit 3. Data Bits: 8bit 4. Parity: No

Table 1 Hardware Specification

General Specification

Item	Specification	Comment
Frame Length	8 Bytes	
Byte Order	LSB	
Frame	Refers to 3.2	
Modulation	No (Base Band)	

Table 2 General Specification

FRAME SPECIFICATION

The first byte of the frame is called COMMAND as listed in Table 3:

Command type	Command name	Command	Samples (in hex)
Configuration	Reset Configuration	0x81	0x81 00 00 00 00 00 00 00
	Refresh Configuration	0x82	0x82 00 00 00 00 00 00 00
	Modify Configuration	0x83	0x83 00 1C 00 00 00 00 00 CyberBeast CAN 0x83 00 1C 00 01 00 00 00 MIT CAN
	Read Configuration	0x84	0x84 00 1C 00 00 00 00 00
Control	Start Motor	0x91	0x91 00 00 00 00 00 00 00
	Stop Motor	0x92	0x92 00 00 00 00 00 00 00
	Torque Control	0x93	0x93 CC CC 7C 41 B8 0B 00 15.8Nm 3s
	Speed Control	0x94	0x94 00 00 4A 42 B8 0B 00 50.5RPM 3s
	Position Control	0x95	0x95 00 10 49 40 B8 0B 00 180degree 3s
	PTS	0x96	
	Stop Control	0x97	0x95 00 00 00 00 00 00 00
Parameter	Modify Parameter	0xA1	0xA1 00 00 00 00 00 00 00
	Retrieve Parameter	0xA2	0xA2 00 00 00 00 00 00 00
Status	Get Version	0xB1	0xB1 00 00 00 00 00 00 00
	Get Fault	0xB2	0xB2 00 00 00 00 00 00 00
	Acknowledge Fault	0xB3	0xB3 00 00 00 00 00 00 00
	Read Indicator	0xB4	0xB4 00 00 00 00 00 00 00 Read the voltage 0xB4 13 00 00 00 00 00 00 Read the voltage

Table 3 COMMAND list

Reset Configuration

Upon receiving this COMMAND, all configuration items should be reset to default values.

- Host→Driver

BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE6	BYTE7
0x81	NULL	NULL	NULL	NULL	NULL	NULL	NULL

NULL can be any value, which does not affect result of the command execution.

- Driver→Host

BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE6	BYTE7
0x81	RES	NULL	NULL	NULL	NULL	NULL	NULL

RES is the result code as listed:

RES	Comment
0x00	Success
0x01	Failure
0x02	Failure, Unknown Command
0x03	Failure, Unknown ID
0x04	Failure, Read-Only Register
0x05	Failure, Unknown Register
0x06	Failure, String format
0x07	Failure, Data Format error
0x08	Failure, Write-only Register

Table 4 Result Code list

Refresh Configuration

Upon receiving this COMMAND, all previously modified configurations should be applied.

- Host→Driver

BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE6	BYTE7
0x82	NULL	NULL	NULL	NULL	NULL	NULL	NULL

- Driver→Host

BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE6	BYTE7
0x82	RES	NULL	NULL	NULL	NULL	NULL	NULL

Modify Configuration

Upon receiving this COMMAND, configuration item according to ConfType/ConfID should be modified and applied immediately or after reboot.

- Host→Driver

BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE6	BYTE7
0x83	ConfType	ConfID	NULL	DATA0	DATA1	DATA2	DATA3

Where ConfType indicates configuration item's value type as listed:

ConfType	Comment
0x00	32-bit signed integer
0x01	32-bit signed float

Table 5 Configuration Type

And ConfID indicates Configuration item ID as listed:

ConfType	ConfID	Comment	Permision	Effective
0x00 (32-bit signed integer)	0x00	Pole Pairs	R/W	Immediately
	0x01	Rated Current (A)	R/W	Immediately
	0x02	Max Speed (RPM)	R/W	Immediately
	0x06	Rated Voltage (V)	R/W	Immediately
	0x07	PWM Frequency (Hz)	R/W	After reboot
	0x08	Default KP of Current Loop	R/W	Immediately
	0x09	Default KI of Current Loop	R/W	Immediately
	0x0C	Default KP of Speed Loop	R/W	Immediately
	0x0D	Default KI of Speed Loop	R/W	Immediately
	0x0E	Default KP of Position Loop	R/W	Immediately
	0x0F	Default KI of Position Loop	R/W	Immediately
	0x10	Default KD of Position Loop	R/W	Immediately
	0x11	Gear Ratio	R/W	Immediately
	0x12	CAN ID	R/W	Immediately
	0x13	Host/Master CAN ID	R/W	Immediately
	0x14	Zero Position (Gear)	R/W	Immediately
	0x15	Power-Off Position (Gear)	R	Immediately
	0x16	Over Voltage Threshold (V)	R/W	Immediately
	0x17	Under Voltage Threshold (V)	R/W	Immediately
	0x18	CAN Baud Rate	R/W	Immediately
	0x19	Default KP of Flux Weakening	R/W	Immediately
	0x1A	Default KI of Flux Weakening	R/W	Immediately
	0x1B	Encoder Direction >0：Default <0：Opposite	R/W	Immediately
	0x1C	Protocol over CAN 0：CyberBeast (Default) 1：MIT	R/W	Immediately
0x01 (32-bit signed float)	0x00	Rs (Ω)	R/W	Immediately
	0x01	Ls (H)	R/W	Immediately
	0x02	Back EMF Constant (Vrms/kRPM)	R/W	Immediately
	0x03	Torque Constant (N.m/A)	R/W	Immediately
	0x04	Sampling Resistor (Ω)	R/W	Immediately
	0x05	Amplification Gain	R/W	Immediately

Table 6 Configuration list

DATA0~DATA3 are value of configuration item with byte order of LSB. When ConfType=0x00 they can be converted into target value:
targetValue = ((int32_t)DATA3<<24) | ((int32_t)DATA2<<16) | ((int32_t)DATA2<<8) | DATA0

And when ConfType=0x01 they should be treated as IEEE float with byte order of LSB。

Zero Position and Power-Off Position are 14-bit integers, which are able to be used as parameters to control motor, and in this situation, they should be converted to RAD:

position(RAD) = position(int) * 2 π /16384 (16384=0x4000)

- Driver→Host

BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE6	BYTE7
0x83	ConfType	ConfID	RES	NULL	NULL	NULL	NULL

Read Configuration

Upon receiving this COMMAND, configuration item according to ConfType/ConfID should be returned to Host。

- Host→Driver

BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE6	BYTE7
0x84	ConfType	ConfID	NULL	NULL	NULL	NULL	NULL

- Driver→Host

BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE6	BYTE7
0x84	ConfType	ConfID	RES	DATA0	DATA1	DATA2	DATA3

Please refer to Table 5 for ConfType definitions and Table 6 for ConfID definitions. For DATA0~DATA3 please refer to 3.2.3.

Start Motor

Upon receiving this COMMAND, motor should be started and enter running state.

- Host→Driver

BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE6	BYTE7
0x91	NULL	NULL	NULL	NULL	NULL	NULL	NULL

- Driver→Host

BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE6	BYTE7
0x91	RES	NULL	NULL	NULL	NULL	NULL	NULL

Stop Motor

Upon receiving this COMMAND, motor should be stopped and exit running state.

- Host→Driver

BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE6	BYTE7
0x92	NULL	NULL	NULL	NULL	NULL	NULL	NULL

- Driver→Host

BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE6	BYTE7
0x92	RES	NULL	NULL	NULL	NULL	NULL	NULL

Torque Control

Upon receiving this COMMAND, motor should enter Torque Control mode and reach the torque target according to the command parameter.

- Host→Driver

BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE6	BYTE7
0x93	Torque0	Torque1	Torque2	Torque3	Duration0	Duration1	Duration2

Send command Example: 0x93 CC CC 7C 41 B8 0B 00 15.8Nm 3s

BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE6	BYTE7
0x93	Torque0	Torque1	Torque2	Torque3	Duration0	Duration1	Duration2
Sample	CC	CC	7C	41	B8	0B	00
	41 7C CC CC = 15.8				00 0B B8 = 3000 ms = 3s		
	Value = sign * Fraction * 2^Exponent						

BYTE1								BYTE2								BYTE3								BYTE4							
Torque0								Torque1								Torque2								Torque3							
CC								CC								7C								41							
41								7C								CC								CC							
0	1	0	0	0	0	0	1	0	1	1	1	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0
s	Exponent							Fractional part																							
	=130							=(1.11111001100110011001100) bit																							
	=310+(-127)=3							=(1.11111001100110011001) bit																							
	=(1.11111001100110011001)bit * 2^3 = (1111.11001100110011001) bit																														
	(1111) bit = 15, (0.11001100110011001) bit = 0.8																														
S=0 for +, S=1 for -, 0x 41 7C CC CC = 15.8																															

Where Torque0~Torque3 are value of target torque with byte order of LSB and in unit of N.m. It is represented using IEEE format and can be converted into float value with correct byte order.

Duration0~Duration2 are 24-bit unsigned integer indicating torque control execution time in unit of ms.

- Driver→Host

BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE6	BYTE7
0x93	RES	Temp	Pos0	Pos1	ST0	ST1	ST2

The following is a replied command sample 0x93 00 18 C8 7F 7F F7 FF with data description.

BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE6		BYTE7
0x93	RES	Temp	Pos0	Pos1	ST0	ST1		ST2
Sample	00	18	C8	7F	7F	F	7	FF
						7-4	3-0	
					High	Low	High	Low
	response	temperature	Position		Speed		Torque	

Notes: RES:

RES	Comment
0x00	Success
0x01	Failure
0x02	Failure, Unknown Command
0x03	Failure, Unknown ID
0x04	Failure, Read-Only Register
0x05	Failure, Unknown Register
0x06	Failure, String format
0x07	Failure, Data Format error
0x08	Failure, Write-only Register

Temp is the temperature of the motor or driver board, the higher temperature of them will be list as Temp value.

Pos0 and Pos1 is the position of the motor, it is LSB, 16 bit integer. Unit is RAD. 3.14 equal 180 degree.

Position_float = pos_int * 25 / 65535 -12.5

ST0, ST1, and ST2 are the speed and torque. Speed unit is RPM. Torque unit is Nm.

Speed_float = speed_int*130 / 4095 – 65

Torque_float = torque_int * (450 * torque_constant * gear_ratio) / 4095 – 225 * torque_constant * gear_ratio

Speed Control

Upon receiving this COMMAND, motor should enter Speed Control mode and reach the speed target according to the command parameter.

- Host→Driver

BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE6	BYTE7
0x94	Speed0	Speed 1	Speed 2	Speed 3	Duration0	Duration1	Duration2

Example: 0x94 00 00 4A 42 B8 0B 00 50.5RPM 3s

Where Speed0~ Speed3 are value of target speed with byte order of LSB and in unit of RPM. It is represented using IEEE format and can be converted into float value with correct byte order.

Duration0~Duration2 are 24-bit unsigned integer indicating speed control execution time in unit of ms.

- Driver→Host

BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE6	BYTE7
0x94	RES	Temp	Pos0	Pos1	ST0	ST1	ST2

Position Control

Upon receiving this COMMAND, motor should enter Position Control mode and reach the position target according to the command parameter.

- Host→Driver

BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE6	BYTE7
0x95	Pos0	Pos 1	Pos 2	Pos 3	Duration0	Duration1	Duration2

Example: 0x95 00 10 49 40 B8 0B 00 180degree 3s

Where Pos0~ Pos3 are value of target position with byte order of LSB and in unit of RAD. It is represented using IEEE format and can be converted into float value with correct byte order.

Duration0~Duration2 are 24-bit unsigned integer indicating position control execution time in unit of ms.

- Driver→Host

BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE6	BYTE7
0x95	RES	Temp	Pos0	Pos1	ST0	ST1	ST2

PTS Control

Not supported.

Stop Control

Upon receiving this COMMAND, current ongoing control command should be stopped immediately, and if there is no ongoing control command it is just ignored.

- Host→Driver

BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE6	BYTE7
0x97	NULL	NULL	NULL	NULL	NULL	NULL	NULL

- Driver→Host

BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE6	BYTE7
0x97	RES	NULL	NULL	NULL	NULL	NULL	NULL

Modify Parameter

Upon receiving this COMMAND, parameter corresponding to ParaID should be modified and applied immediately.

- Host→Driver

BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE6	BYTE7
0xA1	ParaID	NULL	NULL	DATA0	DATA1	DATA2	DATA3

Where ParaID indicates parameter ID as listed:

ParaID	Comment	Permission	Effective
0x00	Runtime KP of Current Loop	R/W	Immediately
0x01	Runtime KI of Current Loop	R/W	Immediately
0x02	Runtime KP of Speed Loop	R/W	Immediately
0x03	Runtime KI of Speed Loop	R/W	Immediately
0x04	Runtime KP of Position Loop	R/W	Immediately
0x05	Runtime KI of Position Loop	R/W	Immediately
0x06	Runtime KD of Position Loop	R/W	Immediately
0x07	Runtime KP of Flux Weakening	R/W	Immediately
0x08	Runtime KI of Flux Weakening	R/W	Immediately

Table 7 Parameter list

Where DATA0~DATA3 are parameter value with IEEE float format and can be converted into float with byte order of LSB.

- Driver→Host

BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE6	BYTE7
0xA1	ParaID	RES	NULL	NULL	NULL	NULL	NULL

Read Parameter

Upon receiving this COMMAND, parameter corresponding to ParaID should be returned to host.

- Host→Driver

BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE6	BYTE7
0xA2	ParaID	NULL	NULL	NULL	NULL	NULL	NULL

For ParaID definitions please refer to Table 7.

- Driver→Host

BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE6	BYTE7
0xA2	ParaID	RES	NULL	DATA0	DATA1	DATA2	DATA3

For DATA0~DATA3 please refer to 3.2.12.

Get Version

Current version of motor driver should be returned to host upon receiving this COMMAND.

- Host→Driver

BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE6	BYTE7
0xB1	NULL	NULL	NULL	NULL	NULL	NULL	NULL

- Driver→Host

BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE6	BYTE7
0xB1	RES	NULL	NULL	DATA0	DATA1	DATA2	DATA3

Where DATA0~DATA3 32-bit unsigned integer indicating version number:

version = ((int32_t)DATA3<<24) | ((int32_t)DATA2<<16) | ((int32_t)DATA2<<8) | DATA0

Get Fault

Fault may occur during motor running time, and host should get fault status periodically using this COMMAND.

- Host→Driver

BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE6	BYTE7
0xB2	NULL	NULL	NULL	NULL	NULL	NULL	NULL

- Driver→Host

BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE6	BYTE7
0xB2	RES	FaultNo	NULL	NULL	NULL	NULL	NULL

Where FaultNo indicates fault number as listed:

FaultNo	Comment
0x00	No Fault
0x01	FoC Frequency Too High
0x02	Over Voltage
0x04	Under Voltage
0x08	Over Temperature
0x10	Start Failure
0x40	Over Current
0x80	Software Exception

Table 8 Fault List

Acknowledge Fault

On any fault, motor would stop running and wait host command. If you want to continue running, this COMMAND should be sent to erase fault status and return to normal state. If fault is not acknowledged in runtime, motor driver will decline any COMMANDs from host.

- Host→Driver

BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE6	BYTE7
0xB3	NULL	NULL	NULL	NULL	NULL	NULL	NULL

- Driver→Host

BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE6	BYTE7
0xB3	RES	NULL	NULL	NULL	NULL	NULL	NULL

Read Indicator

Upon receiving this COMMAND, indicator according to IndID should be returned to host.

- Host→Driver

BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE6	BYTE7
0xB4	IndID	NULL	NULL	NULL	NULL	NULL	NULL

Where IndID indicates indicator ID as listed:

IndID	Comment
0x00	Bus Voltage (V) B4 00 1D 2F 3A 69 C5 41
0x01	Driver Board Temperature B4 00 1D 2F 00 00 10 42
0x02	Motor Temperature B4 00 1D 2F 00 00 10 42
0x03	Power (W)
0x04	Ia (A)
0x05	Ib (A)
0x06	Ic (A)
0x07	Ialpha (A)
0x08	Ibeta(A)
0x09	Iq (A) B4 00 1D 2F FF 67 53 3E
0x0A	Id (A) B4 00 1D 2F FF 27 2A 3E
0x0B	Target Iq (A) B4 00 1D 2F 3F FC 33 42
0x0C	Target Id(A) B4 00 1D 2F 00 00 00 00
0x0D	Vq (V) B4 00 1D 2F C0 79 5B 41
0x0E	Vd (V) B4 00 1D 2F F8 03 76 BE
0x0F	Valpha (V)
0x10	Vbeta (V)
0x11	Electronical Angle of Rotor (RAD)
0x12	Mechanical Angle of Rotor (RAD)
0x13	Mechanical Angle of Gear (RAD)

Table 9 Indicator list

- Driver→Host

BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE6	BYTE7
0xB4	IndID	RES	NULL	DATA0	DATA1	DATA2	DATA3

Where DATA0~DATA3 indicates indicator value with IEEE float format, and can be converted into float with byte order of LSB.