ADAMPOWER

User Manual

UC57

CANopen

Integrated Stepper Motor Controller

Contents

UC57 CANopen communication

Integrated stepper motor controller

1. Overview

1.1 Product introduction

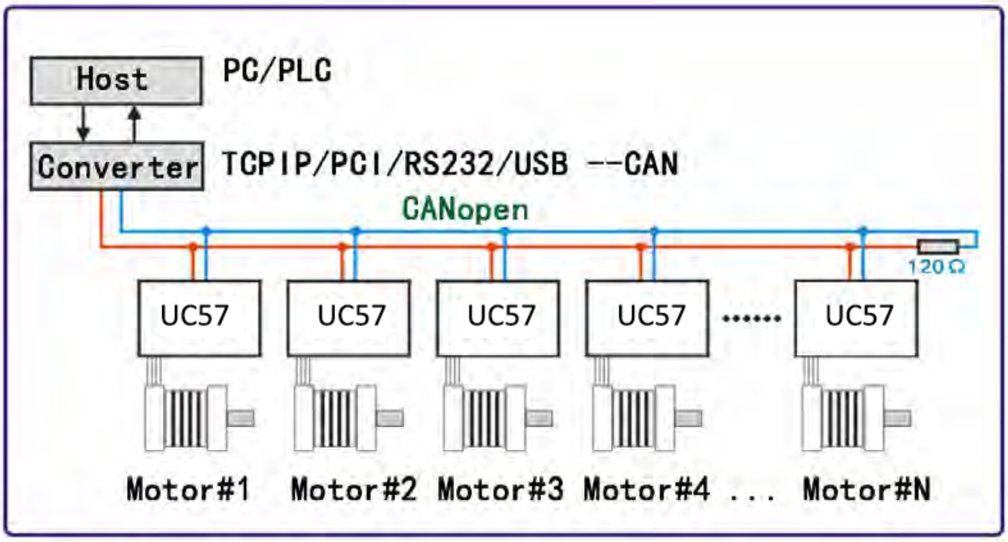
UC57 is a highly integrated stepper motor driver launched by Adampower. It supports the CiA301 and CiA402 sub-protocols of the CANopen protocol. It can be connected to PLC, industrial computer, controller and other host computers with only two communication lines. Through the built-in motion Control instructions can realize a network of up to 100-axis stepper motors.

UC57 uses the latest 32-bit DSP digital chip and has advanced drive control algorithms and noise suppression technology to ensure smooth motor operation. Stable, low noise, and temperature controllable. Users can set any ID address within 1-255 and any current value within 0-8A through the host computer.

Maximum output peak current of the UC57 bus driver is 5.6A. It can be assembled into NEMA17 size integrated stepper motor.

UC57 can be set to 1-256 subdivisions and adopts built-in micro-subdivision technology , which can achieve high subdivision effects even under low subdivision conditions, ensuring that the motor operates with uniform step intervals and no large or small step problems.

3 input signal ports and 2 output signal ports, supporting position, speed, and return-to-origin control modes. with highest communication rate in 1Mbps. especially suitable for long-distance multi-axis applications, which can reduce wiring and enhance the reliability of drive operation.



1.2 Product Characteristics

√ New generation 32-bit DSP technology, high cost performance, good stability, low noise and low vibration.

√ Supports CiA301 and CiA402 sub-protocols of CANopen protocol, and can mount up to 100 devices.

√ The current,subdivision and shaft locking current can be set through instructions; control the start and stop of the motor and query the real-time running status.

√ Built-in single-axis controller function: Users can set the starting speed, acceleration time, deceleration time, maximum speed and Parameters, such as the total number of pulses realize the trapezoidal acceleration and deceleration position control function.

√ Support position control, speed control and return-to-origin working modes.

√3-channel photoelectrically isolated programmable input interface, receiving external control signals to realize functions such as enable, start and stop, emergency stop and limit.

√ 2-channel photoelectrically isolated programmable output interface to output driver status and control signals.

√ Current control is smooth and precise, and the motor generates little heat.

√ When the step pulse stops for more than 200ms, the motor current is halved.

√ Excellent stability in low-frequency and small subdivisions, output peak current range 0 - 5.6A.

√ With overvoltage, undervoltage, overcurrent and other protection functions.

1.3 Application area

Mainly used in electronic equipment, semiconductors, medical instruments, environmental protection equipment, automatic detection equipment, small automatic processing equipment and other automation equipment with multiple motor shaft applications and compact requirements for equipment space.

2. Electrical, Mechanical and environmental

2.1 Electrical

Parameters	UC57			
	Min. Value	Typical Value	Max. Value	Unit
Continuous output	0	-	5.6	A
Input Power voltage	20	24/36	50	VDC
Logic input current	6	10	16	mA
Logic input voltage	36	38	40	VDC
Pulse frequency	0	-	100	kHz
Resistance	100	-	-	MΩ

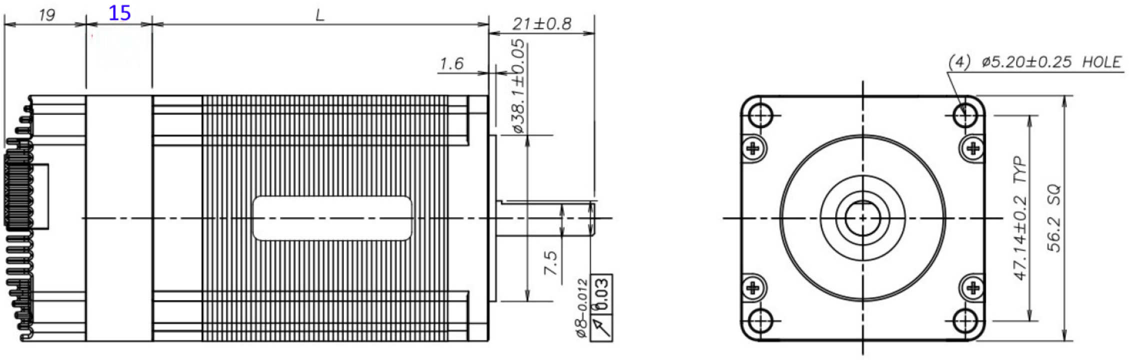
2.2 Environment

Cooling method	Heat sink cooling	
usage environment	usage occasions	Try to stay away from other heating devices and avoid dust, oil mist, and corrosive gases and Strong vibration areas, prohibition of combustible gases and conductive dust
	Temperature	0 ~ 50°C
	humidity	40 ~ 90%RH(No condensation)
	vibration	10 ~ 55 Hz/0.15mm
Storage temperature	-20 ~ 80 °C	

2.3 Dimensions and Motors

UC57 is designed for NEMA23 stepper motor, we supply NEMA23 integrated stepper motor with torque 1.0, 2.0 and 3.0Nm, if just choose UC57 stepper motor controller with requirement for low vibration, please inform us for setting parameters before sale.

Model No.	Holding Torqure(Nm)	Motor Length(mm)	overall length(mm)	Encoder
UC5710IEC	1.0	56	75	1000 line Magnetic Encoder
UC5720IEC	2.0	76	95	
UC5730IEC	3.0	90	109	
UC5710IEP	1.0	56	90	1000 line ABZ Optoelectronic encoder
UC5720IEP	2.0	76	105	
UC5730IEP	3.0	90	124	



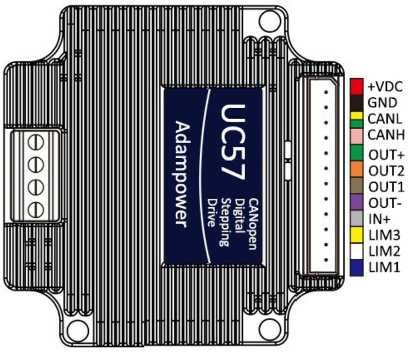
Note: NEMA23 integrated stepper motor with Optoelectronic encoder, the length add 15mm

2.4 Installation

When installing the driver, please use an upright side installation to create strong air convection on the surface of the heat sink; If necessary, install a fan near the driver to forcibly dissipate heat and ensure that the driver operates within a reliable operating temperature range (the operating temperature of the driver is usually within 60 °C， and motor is within 80°C)

3. Controller port and wiring

3.1 Port definition



Control Signal port:

Port	pin	symbols	Name	Function
CN1	1	IN1	input, default positive limit	Support 5/24VDC control signal, only NPN,OC or C signal input, port function support modification by software
	2	IN2	input, default origin	
	3	IN3	input, default negative limit	
	4	IN-	input, signal power negative	signal common negative terminal
	5	OUT-	output, signal power positive	signal common negative terminal
	6	OUT1	output signal, default alarm	high current output, built in pull-up resistor,and freewheeling diode
	7	OUT2	output signal, controller status	
	8	OUT+	output, signal power negative	signal common positive terminal
	9	CANH	Communication port	CAN communication port
	10	CANL		
	11	GND	Power supply Ground	Power supply Ground
	12	VDC	Power Supply 12~ 36VDC	Recommended DC24V

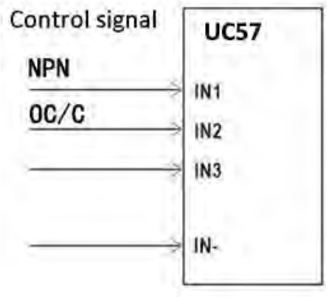
Stepper Motor Port:

Port	pin	symbols	Name	Function
CN2	1	A+	Stepper Motor phase A & B	Suitable for 2 phase hybrid stepper motor, especially perfect math the NEMA17 size stepper motor.
	2	A-		
	3	B+		
	4	B-		

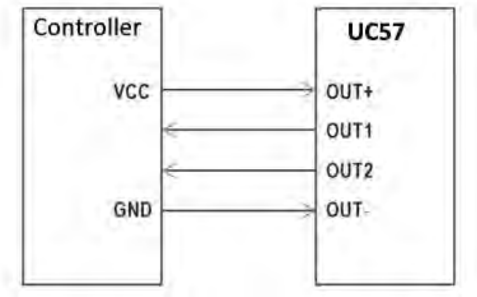
Status indicator light:

Port	Fault type	number of flashes	Function
CN3	Normal	0	no fault, indicator light is always on
	Overcurrent	1	Overcurrent, or phase to phase short circuit fault.
	Overvoltage	2	Overvoltage fault(voltage > 43DVDC)
	Hardware	3	Hardware malfunction
	Phase Loss	4	Motor open circuit or poor contact failure
	EEPROM error	5	EEPROM error
	Undervoltage	6	Under voltage fault (voltage <9VDC)
Note: The indicator light flashes in a cyclic cycle of 3 seconds. When the fault is cleared by the user, the indicator light is always on.			

Wiring diagram:



Input signal wiring diagram



Output signal wiring diagram

4. CANopen protocol

4.1 CANopen protocol

4.1.1 CANbus and CANopen

CAN stands for Controller Area Network, which stands for Controller Area Network. Originally designed by BOSCH, a German company, for monitoring and control of automobiles, the application of CAN is no longer limited to the automotive industry, but has developed into fields such as process industry, mechanical industry, robotics, CNC machine tools, medical devices, and sensors. Compared to other buses, CAN buses have the following characteristics:

1. Multi master control: When the bus is idle, all units can start sending messages. When multiple units start sending messages at the same time, the unit that sends high priority ID messages can obtain the right to send.
2. Communication speed: According to the size of the entire network, a suitable communication speed can be set, and the CAN bus supports communication speeds up to 1Mbit/s.
3. Communication verification: The CAN protocol adopts CRC and can provide corresponding error handling functions to ensure the reliability of data communication.
4. Error detection, notification, and recovery: All units can detect errors, and the unit that detects an error will immediately notify all other units at the same time. At the same time, CAN can identify the type of error, and when a continuous data error occurs on the bus, the unit that caused the fault can be isolated from the bus

The CAN bus communication interface specifies the physical layer and data link layer functions of the CAN protocol, but does not specify the application layer, which is not complete in itself. A high-level protocol is needed to define how to use the 11/29 bit identifier COB-ID and 8-byte data in CAN messages. Therefore,UC57 driver introduces CANopen communication protocol

The CANopen protocol is one of the standards defined by CAN in Automation (CiA) and gained widespread recognition shortly after its release. Especially in Europe, the CANopen protocol is considered a leading standard in CAN based industrial systems.

The CANopen protocol consists of a series of sub protocols, which are further divided into communication sub protocols and device sub protocols.

The communication sub protocol proposes the concept of an object dictionary and defines the objects and parameters of the communication sub protocol area in the object dictionary. Each CANopen device must comply with at least the communication sub protocol, which has been expanded based on different industries or device application fields.

CiA301 is the most basic communication sub protocol, which standardizes the framework of CANopen networks and also defines communication methods and behavioral norms between different CANopen devices.

The UC57 driver supports the CiA 301 communication sub protocol and the CiA 402 device sub protocol for the driver.

4.1.1 CANopen Function

Object Dictionary

Object Dictionary (OD: Object Dictionary) is the core concept of CANopen, and every CANopen device in the network has an object dictionary.

An object dictionary is an ordered collection of data objects that describe all communication and device parameters of the device, And its position in the object dictionary is determined through a 16 bit index and an 8-bit subindex.

Message Format

As the application layer protocol of CAN bus,The CANopen protocol mainly defines the arbitration domain (11 bits) and data domain (up to 8 bytes) in CAN messages.

601	40	60	61	00	00	00	00	00
COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 0	Byte 1	Byte 2	Byte3

In the CANopen protocol, it is stipulated that the 11 arbitration bits are divided into the upper 4 function codes And the node address of the lower 7 bits (Node ID),Known as COB-ID (Communication Object Identifier) The structure of the CANopen identifier is shown in the table below, the range of node addresses is from 1 to 127

CANopen predefined master/slave connection set										
10	9	8	7	6	5	4	3	2	1	0
Function Code				Node ID						

The UC57 driver supports the following types of CANopen messages:

1. PDO (Process Data Object, process data object) message
2. SDO (Service Data Object, Service Data Object) message
3. NMT (Network Management Object, Network Management Object) message
4. SYNC (Synchronisation Object, synchronization) message
5.EMCY (Emergency Object, emergency event) message

The following table shows the function codes and corresponding COB-IDs of various messages predefined in the communication sub-protocol CiA301.

Object	Function Code	COB-ID
NMT	0000	0h
SYNC	0001	80h
PDO1（TX）	0011	181h-lFFh
PDO1（RX）	0100	201h-27Fh
PDO2（TX）	0101	281h-2FFh
PDO2（RX）	0110	301h-37Fh
PDO3（TX）	0111	381h-3FFh
PDO3（RX）	1000	401h-47Fh
PDO4（TX）	1001	481h-4FFh
PDO4（RX）	1010	501h-57Fh
SDO（TX）	1011	581h-5FFh
SDO（RX）	1100	601h-67Fh
Heart Beat	1110	701h-77Fh

Process Data Object (PDO)

The SDO protocol is used to operate object dictionaries, process data with low real-time performance, and data with high real-time requirements, Usually transmitted via PDO.

The PDO communication method is based on the producer/consumer (Producer/Consumer) model. Data is sent from a device (producer),the data is sent to another device (consumer) or many other devices (broadcast mode) and is transmitted in unacknowledged mode.
Data transfers are limited to 1 to 8 bytes. CANopen devices describe two parameters of PDO: communication parameters (Communication Parameter) and Mapping Parameter (Mapping Parameter) to complete receiving or sending.

The UC57 driver supports 4 channels of RPDO and 4 channels of TPDO, and communicates with each PDO communication port in accordance with the CiA 301 sub-protocol, The communication parameters and mapping parameters are described.

Service Data Object (SDO)

SDO messages are mainly used to access the object dictionary of the device and configure the devices in the CANopen network. SDO pass the communication mode is based on the client/server model, that is, the sent message must be confirmed by the receiver.
The visitor is called the client, and the device where the object dictionary is accessed and responds to read and write requests is called the server.
The protocol stipulates that reading the value of the object dictionary 4ed is called uploading, and modifying the value of the parameter, it is called Download

The UC57 driver supports two transmission methods: the fast SDO protocol and the normal SDO protocol described in CiA301.

Network Management Object(NMT)

NMT network management is based on the master-slave structure (Master/Slaver). The master station can perform operations on the slave station through NMT messages. After the CANopen device is powered on or reset, the device will first enter the Initialization state. After the program initialization is completed, the device will automatically send a boot-up message and then automatically enter the pre-operation mode

(Pre-Operational) status. After that, the slave device will change between different states according to the NMT message sent by the master station.

Synchronization Object(SYNC)

The synchronization object SYNC provides a reference clock for the network to synchronize devices in the network.
SYNC belongs to the communication relationship between producers and consumers, SYNC objects are sent by a SYNC producer and can be received by all other devices in the networkSYNC. Assuming that the devices in the network support synchronous PDO function, SYNC can be used to achieve simultaneous actions of multiple devices.The COB-ID of the SYNC message is 0x80, which has a high priority and ensures the normal transmission of SYNC.In addition, SYNC messages may not contain data to reduce the amount of data in SYNC messages.

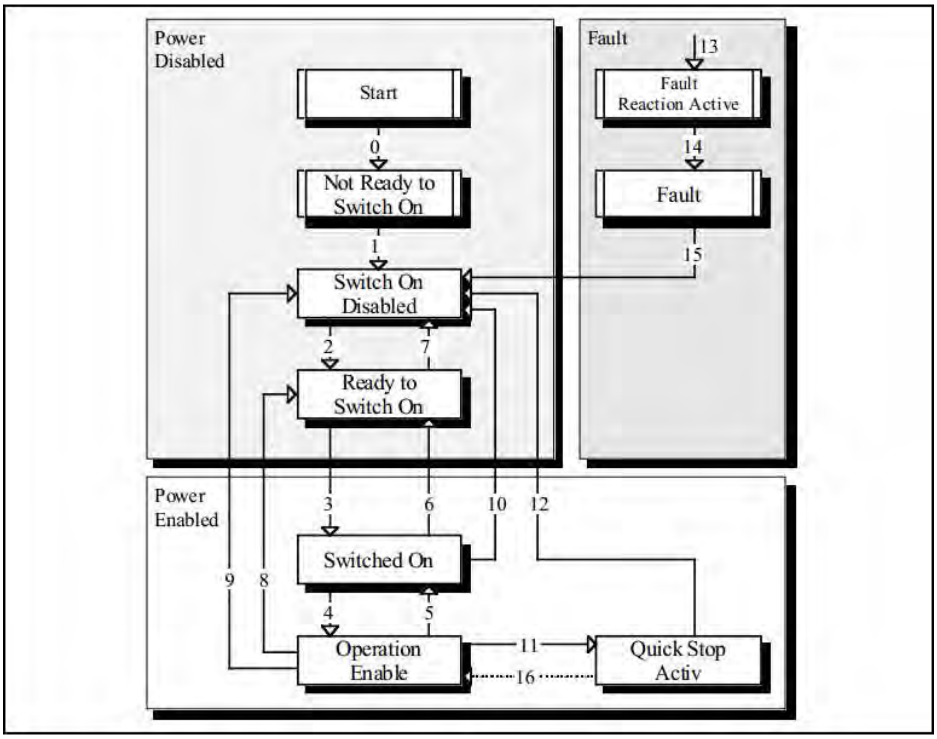
Emergency Object(EMCY)

The device can report its internal faults to the CANopen network through the emergency object EMCY.EMCY belongs to the producer/consumer communication model, and all devices in the network can consume this message. The EMCY message occupies all 8 bytes of data.
Among them, byte 0 and byte 1 are error codes, which correspond to the device Various types of errors that occur.
Byte 2 is an error register, whose value is stored in unit 1001h of the object dictionary, and corresponds to various types of faults that occur in the device.The contents of bytes 3 to 7 are error fields defined by the manufacturer, which can be specific types of faults.
Through the EMCY object, the master station can easily grasp the specific situation of faults that occur in the slave station.

4. 2 CiA402 control protocol

4.2.1 CiA402 Satus

The CiA402 protocol defines the standard state machine for motion control devices, as well as various operating modes and their definitions in the object dictionary.A standard state machine describes the state of a device and the possible control sequence of its drivers. Each step represents a specific internal or external behavior, and the device's state also determines which commands can be received.



Status	Description
Not Ready to Switch on	Power on, the driver initialized and an internal self-test performed, and the brake has also been activated.
Switch on Disabled	CANopen communication started, and the SDO communication service used to set the parameters of the driver
Ready to Switch on	The driver continues with parameter settings, but the motor is not excited
Switch on	The driver motor is ready, and the output stage voltage will be finally connected in this state, But it cannot execute the driving function
Operation Enable	The driver motor is enabled, and the driver is operating normally.
Quick Stop Active	The quick stop function has been activated, the drive function has been activated,
Fault Reaction Active	The driver detected an alarm and stopped according to the set method, but the motor is still enabled
Fault	Error occurred, allow change driver's parameters

The driver state is controlled by the bit0~bit3, and bit7 bits of the control word (object 6040h), The specific description is shown in the table below:

Command	Control Word					Status switching
	Bit7	Bit3	Bit2	Bit1	Bit0	
Shutdown	0	X	1	1	0	2,6,8
Switchon	0	0	1	1	1	3
Switch on + Enable operation	0	1	1	1	1	3+4
Disable voltage	0	X	X	0	X	7, 9, 10, 12
Quick stop	0	X	0	1	X	7, 10, 11
Disable Operation	0	0	1	1	1	5
Enable Operation	0	1	1	1	1	4,16
Fault reset	0→1	X	X	X	X	15

Each state can be displayed through the bit 0~bit 3, bit 5, and bit 6 of the status word (object 6041h), The specific description is shown in the table below:

Control Word						Status
Bit6	Bit5	Bit3	Bit2	Bit1	Bit0	
0	X	0	0	0	0	Not ready to switch on
1	X	0	0	0	0	Switch on disabled
0	1	0	0	0	1	Ready to switch on
0	1	0	0	1	1	Switched on
0	1	0	1	1	1	Operation enabled
0	0	0	1	1	1	Quick stop active
0	X	1	1	1	1	Fault reaction active
0	X	1	0	0	0	Fault

4.2.2 Control word and Satus word

The start stop control command and status description of the driver are mainly achieved through the control word 6040h and the status word 6041h, Therefore, it is necessary to proficiently use control words and status words. The following table briefly describes the definitions of each control word and status word.

Control word	Command	Description
6040h	00	Initialization 0: the status of the low 4 bits of 6041 is: 0000, motor is released;
	06	Initialization 1: the status of the low 4 bits of 6041 is: 0001, motor is released;
	07	Initialization 2: the status of the low 4 bits of 6041 is: 0011, motor is enabled;
	0F	Initialization 3: the status of the low 4 bits of 6041 is: 0111, motor is enabled;
	0F	Start command in speed mode (6061=3);
	0F->1F	Start command in return to origin mode (6061=6);
		Absolute motion start command in position mode (6061=1)
	4F>5F	Relative motion start command in position mode (6061=1)

Status word	definition	Function Description
6041h	Bit0~Bit 3	6040=0：xxxx xxxx xxxx 0000 6040=6：xxxx xxxx xxxx 0001 6040=7：xxxx xxxx xxxx 0011 6040=F：xxxx xxxx xxxx 0111
	Bit7	0: Driver is Normal
		1: Driver alarm
	Bit8	0: Return to origin is not completed
		1: Return to origin has been completed
	Bit11	0: indicate the status of Bit4 of 6040h is 0
		1: indicate the status of Bit4 of 6040h is 1
	Bit13	0: Motor Release
		1: Motor Enabled
	Bit14	0: Motor is stopping
		1: Motor is running
	Bit15	0: In Position mode, the movement is not in place.
		1: In Position mode, the movement is in place

Example: Initialize the driver after power-on. After initialization, it enters the normal working state.
This operation is generally performed after power-on.

Main Site	Slave Site	Status word of slave site
00: 01 00	NMT initialization	NMT Initialization
601：2B 40 60 00 00 00 00 00	581：60 40 60 00 00 00 00 00	6041：xxxx xxxx xxxx 0000
601：2B 40 60 00 06 00 00 00	581：60 40 60 00 00 00 00 00	6041：xxxx xxxx xxxx 0001
601：2B 40 60 00 07 00 00 00	581：60 40 60 00 00 00 00 00	6041：xxxx xxxx xxxx 0011
601：2B 40 60 00 0F 00 00 00	581：60 40 60 00 00 00 00 00	6041：xxxx xxxx xxxx 0111

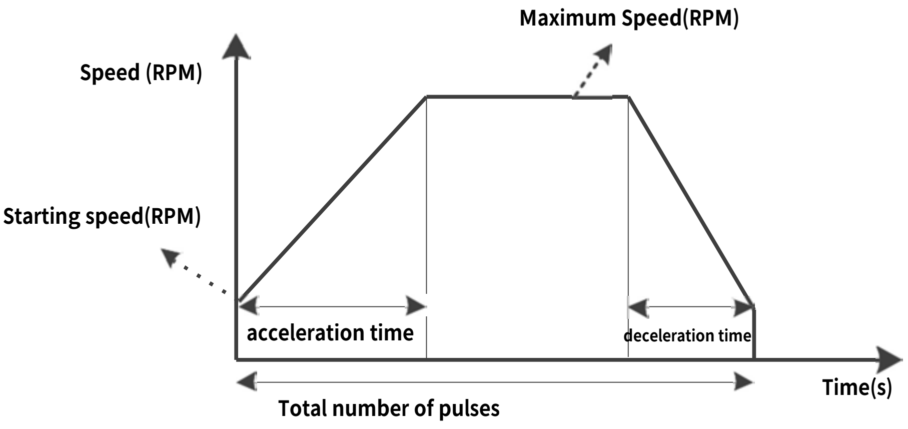
4.2.3 Working mode

CANopen sets the operating mode of the driver through the object 6060h (Mode of Operation),
And reflect the current working mode status of the drive through object 6061h (Mode of operation display).
UC57 currently supports three working modes: Profile Position Mode, Profile Velocity Mode, and Homing Mode

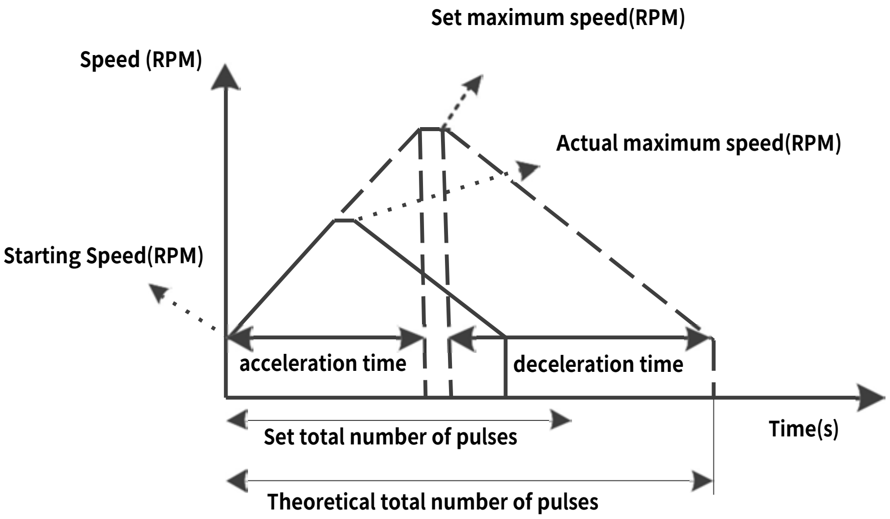
Index	Subindex	Name	Type	Attribute	PDO Mapping	Parameter Range	Default
606h	00	working mode	i8	RW	YES	0: undefined 1: Profile Position mode 2. Profile Velocity mode 3. Homing mode	0

4.2.4 Profile position mode

The position mode is achieved using a trapezoidal acceleration and deceleration curve,
Users can achieve precise position control by setting the starting speed (address 200E0010h), maximum speed (address 60810020h), acceleration time (address 60830020h), deceleration time (address 60840020h), and total pulse count (address 607A0020h) through the bus.
The trapezoidal acceleration and deceleration curve is shown in the following figure.
Position mode acceleration and deceleration curve:



When the total number of pulses set by the user is small, the motor may need to decelerate before accelerating to the maximum speed (i.e. the motor does not accelerate to the maximum speed set by the user during actual operation), and the speed curve is shown in the following figure.The solid line in the figure shows the actual operating curve of the motor, while the dashed line represents the curve that needs to be run to accelerate to the set maximum speed.
The theoretical total pulse count is the minimum total pulse count calculated based on user set parameters (starting speed, maximum speed, acceleration time, deceleration time).
When the total number of pulses set by the user is less than the theoretical total number of pulses, the motor will run according to the solid line shown in the figure below.



Position mode acceleration and deceleration curve (not accelerated to the set maximum speed)

Contents of related object dictionary

Index	Subindex	Name	Type	Attribute	Range	Default
6060h	00	Working mode	i8	RW	0, 1, 3, 6	1
607Ah	00	Total number of pulses	i32	RW	-1000000 ~ 10000000	5000
6081h	00	Max. Speed	U32	RW	5 ~ 3000 RPM	120 RPM
6083h	00	acceleration time	U32	RW	1 ~ 1200	rps/s
6084h	00	deceleration time	U32	RW	1 ~ 1200	rps/s

Control word and status word

The control words in position mode are controlled through bit4~bit6, and bit8:

Byte	Name	Value	Description
Bit4	New set-point	0	no target position
		1	set target position
Bit5	Change set immediately	0	Complete current position before starting next position
		1	Interrupt current position and start next position
Bit6	absolute/relative	0	target position is absolute value
		1	target position is relative value
Bit8	Halt	0	End the current position
		1	Decelerate and stop through the set deceleration

⚠ Notice:
According to above table.
The absolute position motion command control word is sent as 0x0F ->0x1F,
Send relative position motion command control word as 0x4F ->0x5F.

The bit 10 and bit 15 of the status word display the driver status

Byte	Name	Value	Description
Bit10	Target Reached	0	Halt=0, target position has not been reached Halt=1, deceleration

		1	Halt=0, target position reached
			Halt=1, speed is 0.

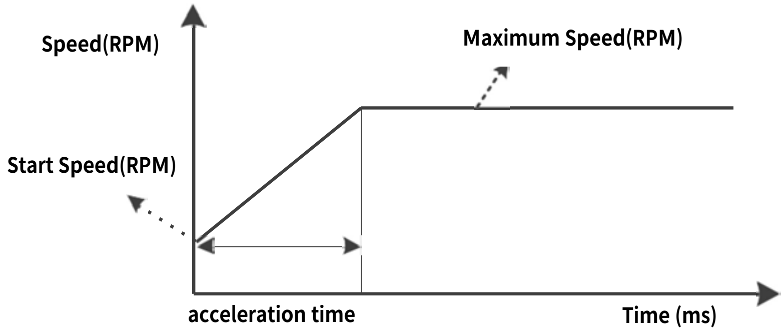
Bit12	Set-point acknowledge	0	Target position to be take into effect
		1	Target position takes effect
Bit15	Pend	0	Not in place
		1	In place

For example, make the motor move relative to the parameters
(acceleration time 100ms, deceleration time 100ms, maximum speed 60r/min, total pulse count 5000).
Assuming the drive slave station number is 1, the CANopen instruction controls the following table:

Main Site	Slave Site	Function	Description
00: 01 00	Function,depending on PDO mapping	Initialize NMT Status	Initial NMT Status
601: 2B 40 60 00 00 00 00 00	581: 60 40 60 00 00 00 00 00	Initialize servo state	Initialize servo state
601: 23 83 60 00 64 00 00 00	581: 60 83 60 00 00 00 00 00	set acceleration time:	100 ms
601: 23 84 60 00 64 00 00 00	581: 60 84 60 00 00 00 00 00	set deceleration time:	100 ms
601: 23 81 60 00 3C 00 00 00	581: 60 81 60 00 00 00 00 00	set maximum speed:	60RPM
601: 23 7A 60 00 88 13 00 00	581: 60 7A 60 00 00 00 00 00	set number of pulses:	5000 pulses
601: 2F 60 60 00 01 00 00 00	581: 60 60 60 00 00 00 00 00	switch working mode to :	Position mode
601: 2B 40 60 00 06 00 00 00	581: 60 40 60 00 00 00 00 00	Switch Driver's status Refer to 402 protocol	switch driver status
601: 2B 40 60 00 07 00 00 00	581: 60 40 60 00 00 00 00 00		
601: 2B 40 60 00 0F 00 00 00	581: 60 40 60 00 00 00 00 00		
601: 2B 40 60 00 4F 00 00 00	581: 60 40 60 00 00 00 00 00	Send relative motion	command 1
601: 2B 40 60 00 5F 00 00 00	581:60 40 60 00 00 00 00 00	Send relative motion	command 2

4.2.5 Profile Velocity mode

Unlike profile position mode, The acceleration curve of the profile velocity mode is shown in the following figure.
The speed mode only requires three parameters to be set: starting speed (address 200E00h), maximum speed (address 608100h), and acceleration time (address 608300h).
After accelerating to the maximum speed according to these three parameter settings,
the motor runs at a constant speed at the maximum speed.
Profile Velocity mode acceleration curve:



Contents of related object dictionary:

Index	Subindex	Name	Type	Attribute	Range	Default
6060h	00	Working mode	i8	RW	0, 1, 3, 6	3
60FFh	00	Max. Speed	i32	RW	-1000~ 1000RPM	0
6083h	00	acceleration time	U32	RW	1 ~ 2000	rps/s
6084h	00	deceleration time	U32	RW	1 ~ 2000	rps/s

Control word and Status word
In Profile Velocity mode, the Control word is controlled through bit8

Byte	Name	Value	Description
Bit8	Halt	0	Perform movement
		1	Stop motion

Status word is controlled through bit10, bit12

Byte	Name	Value	Description
Bit10	Target Reached	0	Halt=0, target position has not been reached Halt=1, deceleration

		1	Halt=0, target position reached
			Halt=1, speed is 0.

Bit12	Speed	0	Speed is not 0.
		1	Speed is 0.

For example, making the motor follow the parameters Rotate with an acceleration time of 100ms, deceleration: 100ms, and a maximum speed of 60RPM.
Assuming the drive slave station number is 1, the CANopen instruction controls the following table:

Main Site	Slave Site	Function	Description
00: 01 00	Function,depending on PDO mapping	Initialize NMT Status	Initial NMT Status
601: 2B 40 60 00 00 00 00 00	581: 60 40 60 00 00 00 00 00	Initialize servo state	Initialize servo state
601: 23 83 60 00 64 00 00 00	581: 60 83 60 00 00 00 00 00	set acceleration time:	100 ms
601: 23 84 60 00 64 00 00 00	581: 60 84 60 00 00 00 00 00	set deceleration time:	100 ms
601: 23 FF 60 00 3C 00 00 00	581: 60 81 60 00 00 00 00 00	set maximum speed:	60RPM
601: 2F 60 60 00 03 00 00 00	581: 60 60 60 00 00 00 00 00	switch working mode to:	Velocity mode
601: 2B 40 60 00 06 00 00 00	581: 60 40 60 00 00 00 00 00	Switch Driver's status Refer to 402 protocol	Switch driver status
601: 2B 40 60 00 07 00 00 00	581: 60 40 60 00 00 00 00 00		
601: 2B 40 60 00 0F 00 00 00	581: 60 40 60 00 00 00 00 00		

4.2.6 Homing mode

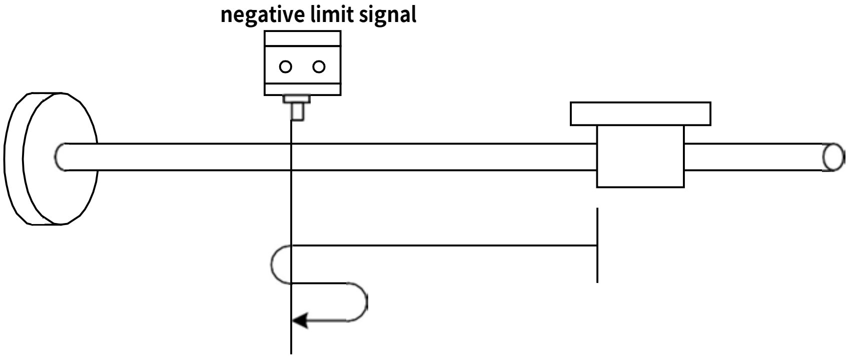
In the Homing mode, the origin signal needs to be connected to the input end of the driver, and the driver completes the search and positioning of the mechanical origin internally.
At the same time, the working mode object 6060h value needs to be set to 6,
When the working mode status object 6061h register is read as 6, operations related to HM working mode can be performed.
The objects involved in this mode are as follows

Related object dictionary content:

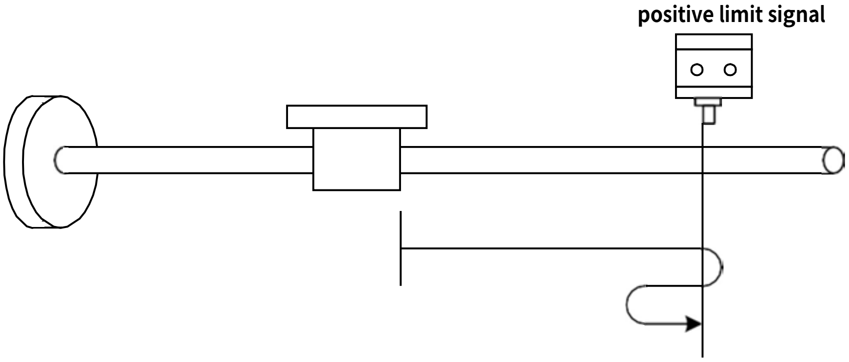
Index	Subindex	Name	Type	Attribute	Range	Default
6060h	00	Working mode	i8	RW	0, 1, 3, 6	6
6098h	00	Homing Mode	U8	RW	17: negative limit mode 18: positive limit mode 24: forward homing 29: reverse homing 41: reverse homing, stop 42: forward homing, stop	0
6099h	01	Homing Speed	U32	RW	1~1000RPM	120 RPM
6099h	02	query homing speed	U32	RW	1 ~ 1000RPM	60RPM
609Ah	00	acceleration time	U32	RW	1 ~ 2000	rps/s
607Ch	00	Homing offset compensation	i32	RW	-0x7FFFFFFF ~0x7FFFFFFF	0

The drive supports 6 homing modes:

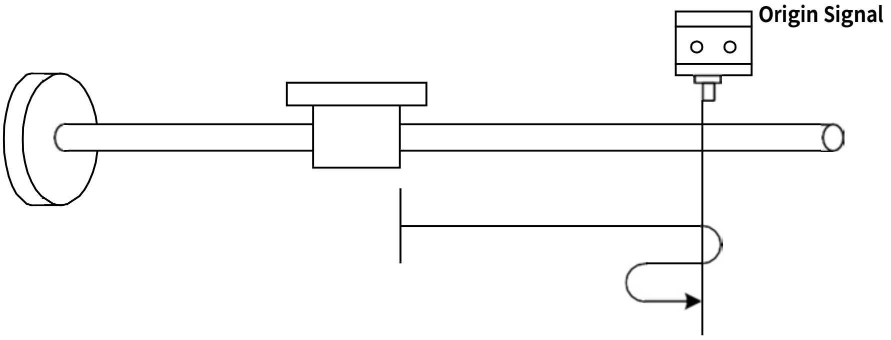
1. 6098h=17: Look for the negative limit signal in the opposite direction.
When encountering the negative limit signal, slow down and stop, then move back a certain distance,
After that, slowly reverse the search for the negative limit signal, find it, stop, and complete the return to the origin action



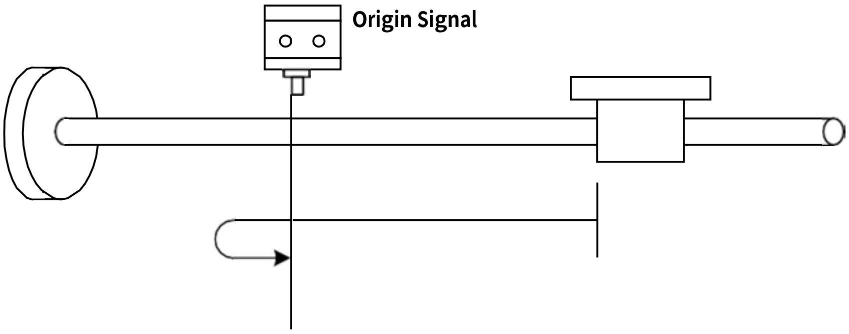
2. 6098h=18: Look for the positive limit signal in the positive direction.
When encountering the positive limit signal, slow down and stop, then move back a certain distance,
Afterwards, search for the positive limit signal in a slow forward direction, stop after finding it, and complete the return to the origin action.



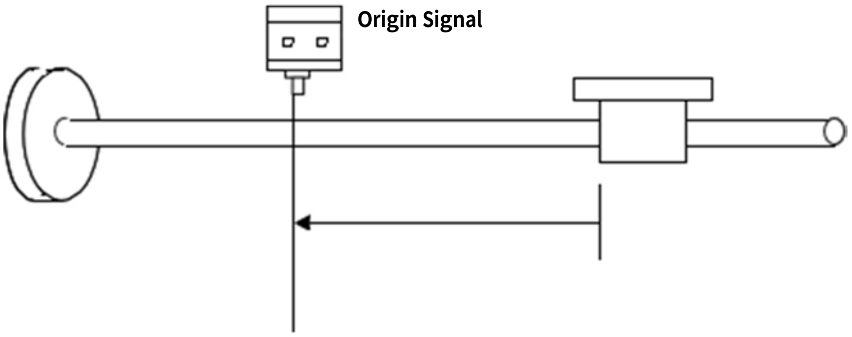
3. 6098h=24: Find the origin in the positive direction.
When encountering the origin, slow down and stop, then retreat a certain distance,
Afterwards, search for the origin in a slow forward direction, stop when found, and complete the return to origin action.
When encountering the positive limit during the process of returning to the origin, the reverse motion continues to search for the origin.



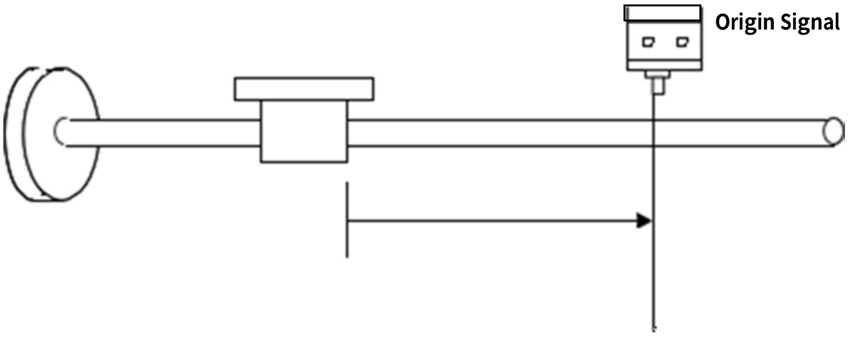
4. 6098h=29: Find the origin in the opposite direction. When encountering the origin, slow down and stop,
Afterwards, search for the origin in a slow forward direction, stop when found, and complete the return to origin action.
When encountering a negative limit during the process of returning to the origin, reverse motion continues to search for the origin



5. 6098h=41: Find the origin in the opposite direction.
When encountering the origin, stop immediately and complete the homing action. If negative limit is encountered, stop.



6. 6098h=42: Find the origin in the positive direction.
When encountering the origin, stop immediately and complete the return to the origin action.
If negative limit is encountered, stop.



609901h object as origin search speed, The object at 609902h has a slow search speed for the origin, and the lower the value at 6009902h, the higher the search accuracy, In addition, if it is necessary to set the origin position to a position that deviates from the mechanical origin, it can be achieved by setting the origin offset of 607Ch.

The control word in homing mode is controlled through bit4 and bit8

Byte	Name	Value	Description
Bit4	Homing operation start	0	Homing mode is not active
		0 → 1	start Homing mode
		1	Homing mode is actived
		1 → 0	Interrupt Homing mode
Bit8	Halt	0	Execute the command of bit4
		1	Stop the motor through homing acceleration

⚠ Note: According to the table above ,
the control word for returning to the origin command is sent as 0x0F ->0x1F.

The bit 8 and bit 10 of the status word display the drive status

Byte	Name	Value	Description
Bit8	Homing attained	0	Homing mode is not completed
		1	Homing mode is completed
Bit10	Target Reached	0	Halt=0, target position has not been reached Halt=1, deceleration

		1	Halt=0, target position reached
			Halt=1, speed is 0.

For example, to complete the work of returning to the origin, select the forward limit+origin mode
to return to the origin mode, Return to origin speed of 120RPM,
The query speed for returning to the origin is 60RPM, with an acceleration and deceleration time of 100ms.
The origin is not compensated.
Assuming the drive slave station number is 1, the CANopen instruction controls the following table:

Main Site	Slave Site	Function	Description
00: 01 00	Function,depending on PDO mapping	Initialize NMT Status	Initial NMT Status
601: 2B 40 60 00 00 00 00 00	581: 60 40 60 00 00 00 00 00	Initialize servo state	Initialize servo state
601: 2F 98 60 00 64 00 00 00	581: 60 98 60 00 00 00 00 00	set to Homing mode,	set as Homing mode
601: 23 99 60 00 78 00 00 00	581: 60 99 60 00 00 00 00 00	set homing speed is:	120RPM
601: 23 99 60 01 3C 00 00 00	581: 60 99 60 01 00 00 00 00	set homing query speed:	60RPM
601: 23 9A 60 00 64 00 00 00	581: 60 9A 60 00 00 00 00 00	set acceleration/deceleration	time: 100ms
601: 2F 60 60 00 06 00 00 00	581: 60 60 60 00 00 00 00 00	Switch working mode:	Homing mode
601: 2B 40 60 00 06 00 00 00	581: 60 40 60 00 00 00 00 00	Refer to 402 protocol	Switch driver status
601: 2B 40 60 00 07 00 00 00	581: 60 40 60 00 00 00 00 00		
601: 2B 40 60 00 0F 00 00 00	581: 60 40 60 00 00 00 00 00 00		
601: 2B 40 60 00 1F 00 00 00	581: 60 40 60 00 00 00 00 00	send Homing command	Send Homing Command

5. Object Dictionary

The UC57 CANopen type stepper motor driver parameter register consists of three parts, namely the 1000h~1FFFh register defined by CIA301, the 2000h~2FFFh register customized by the manufacturer, and the 6000h~6FFFh register defined by CIA402. The 1000h~1FFFh register is the basic communication parameter related to CANopen defined by CIA301, including SDO, PDO, and mapping registers;

The 2000h~2FFFh register is a register content customized by the manufacturer, including subdivision and current modification, which can be achieved within this set of parameters;

The 6000h~6FFFh registers are motion parameters related to motion control defined by CIA402, including position mode and speed Mode, Homing mode and other operating mode registers, as well as related motion parameter registers.

Index	Subindex	Name	Description	Type	Attribute	PDO Mapping	Default Value
CiA 301 basic communicatioon parameters							
1000h	00	Device Type	Support CIA301、CIA402 protocol	U32	RO	NO	0x00040192
1001h	00	Error register	Driver current error status Bit0：generic error, such as phase loss Bit1：current Bit2：voltage Bit3：temperature Bit4：communication error Bit5：device profile specific Bit6：Reserved Bit7：manufacturer specific	U8	RO	NO	0
1003h	00	number of subindex		U8	RO	NO	8
	01~08	Error memory	Recent errors that have caused emergency messages, supporting 5 error storage units;	U32	RO	NO	0
1009h	00	Hardware version		U16	RO	NO	1.0
100Ah	00	Software version		U16	RO	NO	1.0
1014h	00	Emergency message COB	EMNC Emergency message COB	U32	RW	NO	0x80
1017h	00	Producer heartbeat interval: ms		U16	RW/S	NO	0
1018h	00	Manufacturer	Subindex	U8	RO	NO	4
	01	Vendor ID		U32	RO	NO	0x00000322
	02	Product Code		U32	RO	NO	0x00000000
	03	REVISION_NR		U32	RO	NO	0x00000000
	04	SERIAL_NR		U32	RO	NO	0x00000000
1200h	00	number of subindex		U8	RO	NO	2
	01	COB-ID	COB-ID（received from slave）	U32	RO	NO	600h+Node- ID
	02	COB-ID	COB-ID（Setn from slave）	U32	RO	NO	580h+Node- ID
1400h	00	number of subindex		U8	RO	NO	5
	01	RPDO0-COB-ID	Identifier COB-ID	U32	RO	NO	200+Node- ID
	02	Transmission		U8	RW/S	NO	FFh
	03	Prohibited time		U16	RW/S	NO	0
	05	Event Timer		U16	RW/S	NO	0
1401h	00	number of subindex		U8	RO	NO	5
	01	RPDO1-COB-ID	Identifier COB-ID	U32	RO	NO	300+Node- ID
	02	Transmission		U8	RW/S	NO	FFh
	03	Prohibited time		U16	RW/S	NO	0
	05	Event Timer		U16	RW/S	NO	0

1402h	00	number of subindex		U8	RO	NO	5
	01	RPDO1-COB-ID	Identifier COB-ID	U32	RO	NO	400+Node- ID
	02	Transmission		U8	RW/S	NO	FFh
	03	Prohibited time		U16	RW/S	NO	0
	05	Event Timer		U16	RW/S	NO	0
1403h	00	number of subindex		U8	RO	NO	5
	01	RPDO1-COB-ID	Identifier COB-ID	U32	RO	NO	500+Node- ID
	02	Transmission		U8	RW/S	NO	FFh
	03	Prohibited time		U16	RW/S	NO	0
	05	Event Timer		U16	RW/S	NO	0
1600h	00	number of subindex		U8	RO	NO	3
	01	RPDO0-Map 1	mapped to 6040h register	U32	RW/S	NO	60400010h
	02	RPDO0-Map 2	mapped to 60FFh register	U32	RW/S	NO	60FF0020h
	03	RPDO0-Map 3	mapped to 6060h register	U32	RW/S	NO	60600008h
	04	RPDO0-Map 4	Unmapped	U32	RW/S	NO	-
1601h	00	number of subindex		U8	RO	NO	2
	01	RPDO0-Map 1	mapped to 607Ah register	U32	RW/S	NO	607A0020h
	02	RPDO0-Map 2	mapped to 6081h register	U32	RW/S	NO	60810020h
	03	RPDO0-Map 3	Unmapped	U32	RW/S	NO	-
	04	RPDO0-Map 4	Unmapped	U32	RW/S	NO	-
1602h	00	number of subindex		U8	RO	NO	0
	01	RPDO0-Map 1	Unmapped	U32	RW/S	NO	-
	02	RPDO0-Map 2	Unmapped	U32	RW/S	NO	-
	03	RPDO0-Map 3	Unmapped	U32	RW/S	NO	-
	04	RPDO0-Map 4	Unmapped	U32	RW/S	NO	-
1603h	00	number of subindex		U8	RO	NO	0
	01	RPDO0-Map 1	Unmapped	U32	RW/S	NO	-
	02	RPDO0-Map 2	Unmapped	U32	RW/S	NO	-
	03	RPDO0-Map 3	Unmapped	U32	RW/S	NO	-
	04	RPDO0-Map 4	Unmapped	U32	RW/S	NO	-
1800h	00	number of subindex		U8	RO	NO	5
	01	RPDO1-COB-ID	Identifier COB-ID	U32	RO	NO	180+Node- ID
	02	Transmission		U8	RW/S	NO	FFh
	03	Prohibited time		U16	RW/S	NO	0
	05	Event Timer		U16	RW/S	NO	0
1801h	00	number of subindex		U8	RO	NO	5
	01	RPDO1-COB-ID	Identifier COB-ID	U32	RO	NO	280+Node- ID
	02	Transmission		U8	RW/S	NO	FFh
	03	Prohibited time		U16	RW/S	NO	0
	05	Event Timer		U16	RW/S	NO	0
1802h	00	number of subindex		U8	RO	NO	5
	01	RPDO2-COB-ID	Identifier COB-ID	U32	RO	NO	380+Node-ID
	02	Transmission		U8	RW/S	NO	FFh
	03	Prohibited time		U16	RW/S	NO	0
	05	Event Timer		U16	RW/S	NO	0
1803h	00	number of subindex		U8	RO	NO	5
	01	RPDO3-COB-ID	Identifier COB-ID	U32	RO	NO	480+Node-ID
	02	Transmission		U8	RW/S	NO	FFh
	03	Prohibited time		U16	RW/S	NO	0
	05	Event Timer		U16	RW/S	NO	0
1A00h	00	number of subindex		U8	RO	NO	3
	01	RPDO0-Map 1	mapped to 6041h register	U32	RW/S	NO	60410010h
	02	RPDO0-Map 2	mapped to 60FDh register	U32	RW/S	NO	60fd0020h
	03	RPDO0-Map 3	mapped to 606h register	U32	RW/S	NO	60610008h
	04	RPDO0-Map 4	Unmapped	U32	RW/S	NO	-

1A01h	0	number of subindex		U8	RO	NO	0
	1	RPDO0-Map 1	mapped to 6064h register	U32	RW/S	NO	60640020h
	2	RPDO0-Map 2	mapped to 606Ch register	U32	RW/S	NO	606c0020h
	3	RPDO0-Map 3	Unmapped	U32	RW/S	NO	-
	4	RPDO0-Map 4	Unmapped	U32	RW/S	NO	-
1A02h	0	number of subindex		U8	RO	NO	0
	1	RPDO0-Map 1	Unmapped	U32	RW/S	NO	-
	2	RPDO0-Map 2	Unmapped	U32	RW/S	NO	-
	3	RPDO0-Map 3	Unmapped	U32	RW/S	NO	-
	4	RPDO0-Map 4	Unmapped	U32	RW/S	NO	-
1A03h	0	number of subindex		U8	RO	NO	0
	1	RPDO0-Map 1	Unmapped	U32	RW/S	NO	-
	2	RPDO0-Map 2	Unmapped	U32	RW/S	NO	-
	3	RPDO0-Map 3	Unmapped	U32	RW/S	NO	-
	4	RPDO0-Map 4	Unmapped	U32	RW/S	NO	-

5.1 Defined Object Dictionary

The UC57 related object dictionary is shown in the table below:

Index	Subindex	Name	Description	Type	Attribute	PDO Mapping	Default Value
Defined Object Dictionary							
2000H	00	Node ID	Set through 0x2008 register	U16	RO	YES	-
2001H	00	Motor Status	0：Motor is stationary； 1：Motor is running；	U16	RO	YES	0
2003H	00	Input signal status	3 input signal status Bit0~Bit2： X0~X2　input level status；	U16	RO	YES	0
2004H	00	output signal status	2 output signal status Bit0~Bit1： Y0~Y1 output status	U16	RO	YES	0
2005H	00	Set Current	1~25（*0.1A RMS）	U16	RW/S	YES	15
2006H	00	subdivision setting	0—200（Pu/rev）； 1—400 （Pu/rev）； 2—800 （Pu/rev）； 3—1600（Pu/rev）； 4—3200（Pu/rev）； 5—6400（Pu/rev）； 6—12800（Pu/rev）； 7—25600（Pu/rev）； 8—1000 （Pu/rev）； 9—2000（Pu/rev）； 10—4000（Pu/rev）； 11—5000（Pu/rev）； 12—8000（Pu/rev）； 13—10000（Pu/rev）； 14—20000（Pu/rev）； 15—40000（Pu/rev）；	U16	RW/S	YES	13
2007H	00	Lock Current	0：automatic half；　　1：full；	U16	RW/S	YES	0
2008H	00	Define Node Id	1~127；	U16	RW/S	YES	1
2009H	00	Baud rate setting	0: 50 kbps 1:100 kbps 2:125 kbps 3:250 kbps 4:500 kbps 5: 1000kbps	U16	RW/S	YES	2

Index	Subindex	Name	Description	Type	Attribute	PDO Mapping	Default Value
Defined Object Dictionary							
200AH	00	Stop at Limit	0: Stop, 1: Emergency stop, 2: invalid	U16	RW/S	YES	0
200BH	00	Control method	0 ： Bus control	U16	RW/S	YES	0
200CH	00	Function code value write to EEPROM	0 ： RW/S attribute write to EEPROM ； 1 ：No	U16	RW	YES	1
200EH	00	Start Speed	Range 0-1000RPM	U16	RW	YES	10
200FH	00	Motor Status	0: release, 1: enable, 2:invalid	U16	RW	YES	2
2010H	00	Register parameter setting	0: invalid 1: Factory default 2: Save all RW attributer toEEPROM	U16	RW	YES	0
2011h	00	Fault reset	0: Invalid	U16	RW	YES	0
2012h	00	Zero current position	Clear the current position in absolute position mode. 0: Invalid 1: Clear the current position to zero	U16	RW	YES	0
2030h	00	number of subindex		U16	RO	NO	16

	01	effective level of input port	Bit0: Input X0 control position;
			Bit1: Input X1 control position;
			Bit2: Input X2 control position;
			Bit3~Bit15: reserved;
			0: Default;
			1: Level reversal;
			The default input level: rising edge or high level is valid for this driver
				U16	RW/S	YES	0

	02	X0 Function selection		U16	RW/S	YES	
	03	X1 Function selection		U16	RW/S	YES	0
	04	X2 Function selection		U16	RW/S	YES	0
	0C	effective level of output port	Bit0: Output Y0 control position Bit1: Output Y1 control position 0: Default 1: Level reversal	U16	RW/S	YES	0
	0D	Y0 Function selection	0: Undefined 1: Alarm signal; 2: Driver status signal; 3: Return to origin completion signal; 4: In place signal; 5: Output high level 6: Output low level	U16	RW/S	YES	0
	0E	Y1 Function selection		U16	RW/S	YES	0
2040H	00	Current loop proportional coefficient	Unit: 0.1% Factory default, normally no need adjustment Range: 10-500	U16	RW/S	YES	220
2041H	00	Current loop integral gain	Unit: 0.1% Factory default, normally no need adjustment Range: 1-500	U16	RW/S	YES	3
2FF7h	00	Running time	Device power on timing	U32	RO	YES	

5.2 CiA402 Object Dictionary

The UC57 related CiA402 object dictionary is shown in the table below:

Index	Subindex	Name	Description	Type	Attribute	PDO Mapping	Default Value
CiA402 Object Dictionary							

603Fh	0	Driver fault codes	Bit0: overcurrent;
			Bit1: overvoltage;
			Bit2: Operational amplifier failure;
			Bit3: phase loss;
			Bit4: EEPROM read and write error;
			Bit5: Undervoltage
				U16	RO	YES	0

6040h	0	control word		U16	RW	YES	0
6041h	0	status word		U16	RO	YES	0

Index	Subindex	Name	Description	Type	Attribute	PDO Mapping	Default Value
CiA402 Object Dictionary							
605Dh	00	Halt control	0: Stop, maintain enable status; 1: Emergency stop, maintain enable status;	I16	RW	NO	0

6060h	00	Working mode	0: Undefined;
			1: Profile position mode;
			3: Profile velocity mode;
			6: Homing mode;
				I8	RW	YES	0

6061h	00	Working mode status	0: Undefined;
			1: Profile position mode;
			3: Profile velocity mode;
			6: Homing mode;
				I8	RO	YES	0

6064h	00	Driver actual position, unit: pulses		I32	RO	YES	0
606Ch	00	The motor's current speed, unit: RPM		I32	RO	YES	0
607Ah	00	Total number of pulses	The total number of pulses in Profile position mode operation (including the total number of steps in acceleration, constant speed, and deceleration stages) Scope: -1000000~1000000 ；	I32	RW	YES	5000
607Ch	00	Origin compensation value, -1000000~1000000 P		I32	RW	YES	0
6081h	00	Max. Speed	profile position mode, speed range: 5 ~ 1000RPM	U32	RW	YES	60RPM
6083h	00	Acccerlation time: 1~ 2000rps/s		U32	RW	YES	50
6084h	00	Deceleratoin time: 1~ 2000rps/s		U32	RW	YES	50
6098h	00	Homing mode	17 ： negative limit mode 18 ： positive limit mode 24: Forward origin mode; 29: Reverse origin mode; 41: Finding the origin in the opposite direction - stop immediately 42: Finding the origin in the positive direction - stop immediately	U8	RW	YES	0
6099h	00	number of subindex		U8	RO	NO	2
	01	Homing high Speed range: 1-1000RPM；		U32	RW	YES	120RMP
	02	Homing low Speed range: 1-1000RPM；		U32	RW	YES	60RMP
609Ah	00	homing acccerlation/deceleratoin time: 1~ 2000rps/s		U32	RW	YES	50

60FDh	00	status of the input port	Bit0: Negative limit state;
			Bit1: Positive limit state;
			Bit2: Origin state;
			Bit3~Bit15: reserved;
			Bit16~Bit31: user-defined;
				U32	RO	YES	0

60FFh	00	Max. Speed	profile velocity mode, speed range: -1000 ~ 1000RPM	I32	RW	YES	120

6. Troubleshooting and Alarm

The UC57 driver has four types of alarm messages,

After the driver alarms, the alarm indicator light flashes several times according to different alarm codes,

The specific alarm codes and processing methods are shown in the table below

Error code	Fault information	Indicator flashes	reset
Err1: 0x01	**overcurrent or phase short circuit**	**Flashing 1 time in a loop**	**Lock/power off reset**
Err2: 0x02	**overvoltage(voltage>DC60V)**	**Flashing 2 times in a loop**	**Lock/auto reset**
Err3: 0x03	**hardware failure**	**Flashing 3 times in a loop**	**Lock/power off reset**
Err4: 0x04	**open circuit or poor connection**	**Flashing 4 times in a loop**	**Lock/power off reset**
Err5: 0x05	**EEPROM read/write errors**	**Flashing 5 times in a loop**	**Lock/power off reset**
Err6: 0x06	**undervoltage**	**Flashing 6 times in a loop**	**Lock/auto reset**

7. Appendix: quick wiring motion control function guide

At present, there are control units on the market with CANopen master station communication modules, such as PLCs, control cards, etc.
Some of them come with motion control libraries that support the CANopen CIA402 control protocol.
Users can directly call the motion control library functions that come with the control unit to complete the control of this driver without needing to have too much knowledge of the CANopen protocol.
The other part only has the CANopen communication module, which can parse EDS files, but does not support motion control libraries compatible with CANopen CIA402. In this case, users usually need to write motion control functions or function blocks according to the CANopen CIA402 standard protocol to control the driver to complete functions such as jog, JOG, or zero return. Users are required to have a certain understanding of the CANopen protocol.

A quick guide for users who need to write their own motion control library functions or function blocks.
The commonly used driver control functions are as follows:

Function	INPUT	OUTPUT	Description
MC_POWER	6040h	6041h	Enable
MC_RESET	6040h	-	Reset
MC_STOP	6040h	-	Stop
MC_HOME	6040h,6060h,6098h,6099h,607Ch	6041h	Homing
MC_MOVABS	6040h,6060h,607Ah,6081h,6083h,6084h	6041h	Absolute positioning
MC_MOVREL	6040h,6060h,607Ah,6081h,6083h,6084h	6041h	Relative positioning
MC_MOVVEL	6040h,6060h,60FFh,6083h,6084h	6041h	Speed command
MC_JOG	6040h,6060h,60FFh,6083h,6084h	6041h	JOG command

According to the CANopen CIA402 protocol, the control of the motor driver is mainly achieved through
Control word 6040h and status word 6041h completed,
The following is a detailed introduction to how each function can control the driver by calling control words and status words

MC_POWER: Driver Enable

Step	Operation/Condition	Description
1	6040h = 0x00, 6041h.bit0~bit3 = 0x00	Motor Release Status
2	6040h = 0x06, 6041h.bit0~bit3 = 0x01	Motor Release Status
3	6040h = 0x07, 6041h.bit0~bit3 = 0x03	Motor Release Status
4	6040h = 0x0F, 6041h.bit0~bit3 = 0x07	Motor Release Status

MC_RESET: Driver Reset

Step	Operation/Condition	Description
1	6040h .bit7=0	Reset ready
2	6040h .bit7=1	Reset completed

MC_STOP: Driver STOP

Step	Operation/Condition	Description
1	6040h.bit8=0	Stop ready
2	6040h.bit8=1 60FFh=0	Stop completed
3	606Ch=0	Stop completed

MC_HOME: HOMING

Step	Operation/Condition	Description
1	6060h=6	Working mode -->Homing mode
2	6061h=6	Homing mode status
3	607Ch=Origin Offset	Set Origin Offset
4	6040h.bit4=0	Homing ready
5	6040h.bit4=1	Homing
6	6041h.bit10=1 and 6041h.bit13=1	Homing failure
	6041h.bit10=1 and 6041h.bit12=1	Homing completed

MC_MOVABS: ABSOLUTE POSITIONING

Step	Operation/Condition	Description
1	6060h=1	Working mode -->Position mode
2	6061h=1	Position mode status
3	607Ah = position 6081h= speed 6083h= acceleration 6084= deceleratoin	Write the motion parameters
4	6040h= 0x0F	positioning ready
5	6041h.bit12=0	positioning ready
6	6040h= 0x1F	positioning trigger
7	6041h.bit12=1	waiting for positioning
8	6040h.bit4=0	reset positioning trigger
9	6041h.bit10=1 and 6041h.bit12=0 or 607Ah=6064h or 6041.bit15=1	target position rechead

MC_MOVREL: RELATIVE POSITIONING

Step	Operation/Condition	Description
1	6060h=1	Working mode -->Position mode
2	6061h=1	Position mode status
3	607Ah = position 6081h= speed 6083h= acceleration 6084= deceleratoin	Write the motion parameters
4	6040h= 0x4F	positioning ready
5	6041h.bit12=0	positioning ready
6	6040h= 0x5F	positioning trigger
7	6041h.bit12=1	waiting for positioning
8	6040h.bit4=0	reset positioning trigger
9	6041h.bit10=1 and 6041h.bit12=0 or 6041.bit15=1	target position rechead

MC_MOVVEL: VELOCITY COMMAND

Step	Operation/Condition	Description
1	6040h=0x0F	Reset control word, bit8 Halt
2	60FFh = 0 6083h= acceleration 6084= deceleratoin	Write the motion parameters
3	6060h= 3	Swith to Profile Velocity mode
4	6061h= 3	Profile velocity mode status
5	60FFh = target speed	Set target speed
6	6041h.bit10=1	target speed reached
7	60FFh=0 or 6040h.bit8=1	Stop

MC_JOG: JOG MOTION COMMAND

Step	Operation/Condition	Description
1	6040h=0x0F	Reset control word, bit8 Halt
2	60FFh = 0 6083h= acceleration 6084= deceleratoin	Write the motion parameters
3	6060h= 3	Swith to Profile Velocity mode
4	6061h= 3	Profile velocity mode status
5	Forward: 60FFh = target speed Reverse: 60FFh = - target speed Other: 60FFh = 1	Forward and reverse movement
6	6041h.bit10=1	target speed reached
7	60FFh=0 or 6040h.bit8=1	Stop