

C100E EtherCAT AC Servo Drive

Shenzhen Coolmay Technology Co., Ltd

V22.11

Safety Precautions

In order to use this product safely, the user should be familiar with and observes the following important items before proceeding with storage, installation, wiring, operation, inspection or maintenance for the product.

 **DANGER** Indicates a mistake operation possibly can cause danger and physical injure or death.

 **CAUTION** Indicates a mistake operation possibly can cause danger and physical injure, and may result in damage to the product.

 **STOP** Indicates prohibited actions, otherwise can cause damage, malfunction to the products.

1. Service Conditions

 **Danger**

- Do not expose the product in moisture, caustic gas, and ignitable gas situation. Otherwise can cause an electric shock or fire.
- Do not use the product in direct-sunlight, dust, salinity and metal powder places.
- Do not use the product in the places that has water, oil and drugs drops.

2. Wiring

 **Danger**

- Connect the earth terminal (PE) to earth reliably.
- Never connect the input power terminals (L1, L2, L3) to 380V power supply, otherwise can result in the equipment damage and an electric shock or fire.
- The output terminals (U, V, W) must be connected with the servo motor connections (U, V, W) correspondingly, otherwise can result in the servomotor flying speed that may cause equipment damage and the

personnel casualty

- Referring to wire selection guide, please install all wires with an adequate cross-section. Otherwise may cause fire.

3. Operation

 **Caution**

- Before the mechanical equipment starts to run, it must be matched with the appropriate parameter settings. Failure to adjust to the proper setting may result in loss of control or malfunction of the mechanical equipment.
- Before starting operation, please confirm whether the emergency switch can be activated at any time to stop.
- Please test whether the servo motor operates normally without load first, and then connect the load to avoid unnecessary losses.
- Do not turn on and off the power frequently, otherwise it will cause overheating inside the drive.

4. Running

 **Stop**

- When the motor is running, it is forbidden to touch any rotating parts, otherwise it will cause casualties.
- When the equipment is running, it is forbidden to touch the driver and motor, otherwise it will cause electric shock or burns.
- When the equipment is running, it is forbidden to move the connecting cable, otherwise it will cause personal injury or equipment damage.

5. Maintenance and Inspection

 **Stop**

- It is forbidden to touch the inside of the driver and its motor, otherwise it will cause electric shock.
- When the power is turned on, it is forbidden to disassemble the driver panel, otherwise it will cause electric shock.
- Do not touch the terminals within 5 minutes after the power is turned off,

otherwise the residual high voltage may cause electric shock.

- It is forbidden to change the wiring or disassemble the servo motor when the power is turned on, otherwise it will cause electric shock.

6. Scope of use



Caution

- The products involved in this manual are for general industrial use and should not be used on devices that may directly endanger personal safety.

- ◆ Thank you very much for purchasing the products of Gumei Technology
- ◆ Please read this manual carefully before use, and use the product correctly
- ◆ Please keep this manual properly

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Chapte1 Product Introduction

1.1 Description

C100E series ac servo drives are bus servo drives which are added bus communication function on the basis of P series high performance AC servo drives. The EtherCAT bus communication interface is used to realize the real-time control and real-time data transmission of servo system based on the transmission rate of 100 Mb/s of slave station technology. This kind of drives has rich input and output interfaces and supports CSP, CSV, CST, PP and PV, PT, HM running mode. Compared with the traditional pulse servo drives, this kind of drives is especially suitable for long-distance or multi-axis linkage applications. Meanwhile it can greatly reduce wiring and enhance the reliability of drive operation.

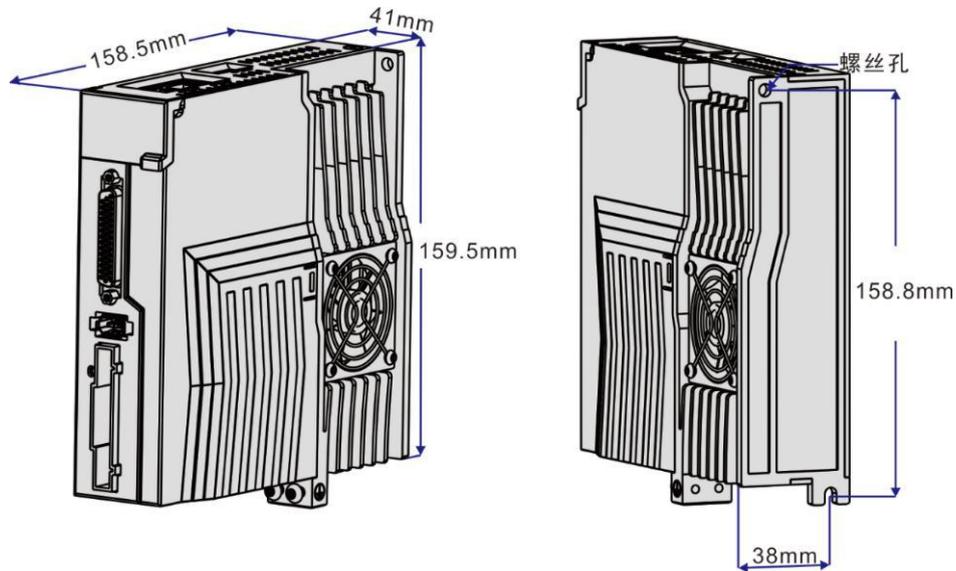
1.2 Feature

- Voltage: AC220V±10%, 1phase/3phases and 50/60Hz.
- EtherCAT communication protocol and addresses are automatically assigned through the master station.
- 8 single terminal common positive isolation inputs. Max input frequency is 10KHz and input voltage 24V.
- 6 optocoupling isolated outputs. Max output capacity is 50mA and withstand voltage is 30VDC.

1.3 Application

C100E servo drives are excellent for the applications in a variety of multi-axis linkage control of small or medium-sized automation machines such as robots, packaging machines and so on.

1.4 Dimension



Pic1.1 C100E Dimension

1.5 Working Environment

Cooling		Natural Cooling or Forced Cooling
Working Environment	Environment	Avoid corrosive gases,dust,oil,magnetic field
	Ambient Temperature	0~50℃
	Humidity	40~90%RH
Storage Temperature		-20℃~65℃
Weight		1.3Kgs

1.6 Cooling Method

- The drive working environment temperature is recommended less than 50 °C and the motor working temperature is less than 120 °C .
- Please install the drive with vertical side in order to make the heat sink and air form a stronger convection. Please install a fan near the drive if

necessary, which forces heat cooling and ensure the drive can work in the reliable working temperature range.

Chapter 2 Drive Specification

Power Range	50W~7500W	Monitor Function	speed / position / instruction pulse accumulation / positional deviation / motor torque motor current / working state
Input Power Supply	1 phase / 3 phases AC220V-15%~+10% 50/60Hz	Control Mode	0: position 1: speed 2: test trial running 3: JOG 6: torque
Protection Function	over speed/over voltage/ over current/ overload/encoder error/power supply problem/ over positioning and etc.	Control Input	1: servo on 2: alarm clearance 3: CCW drive inhibition 4: CW drive inhibition 5: deviation counter zeroing 6: instruction pulse inhibition 7: CCW torque limitation 8: CW torque limitation
Regeneration Brake	built-in / built-out	Max Load	less than 3 times of motor torque
Control Output	servo ready/servo alarm/ positioning completion/ mechanical braking	Display	5 LED digital tubes and 4 operation keys
Position Control	Communication	EtherCAT field bus communication	
	Electronic Gear Ratio	gear ratio precision: 1-131072. gear ratio motor precision: 17 bits and 23 bits.	

Chapter 3 Operation And Display

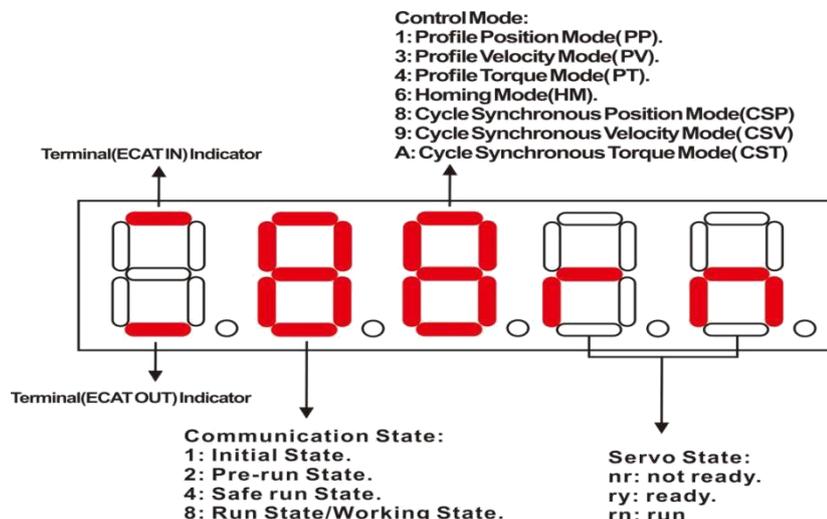
3.1 Key Name And Function

The panel consists of 5 digital LED and 4 buttons including ↑、↓、←、SET to display all system status and set parameters. The operation is hierarchical.← button indicates “back” and SET button indicates “forward” while it also has the meaning of “Enter” and ← button also has the meaning of “Cancel” and “Exit”. ↑button indicates “Increasing ” and ↓button indicates “decreasing”. If you press the↑button or↓button and maintain it, you would get a duplicate result and stay longer, the repetition rate is higher.

3.2 Parameter Setting

Please firstly select “PA-”, and press SET button to enter the status of parameter setting mode. And use ↑or ↓to choose parameters and SET button to display the parameter’s value. You can modify the parameter’s value with ↑or ↓. Press ↑or ↓button one time, the parameter increases or decreases by 1. Pressing and holding ↑or ↓key can make the value increased or decreased continuously. After modifying the value of the parameter,please press SET button and when the LED flashes two times, it means changes are completed . Finally please recharge, then the new parameter is effective.

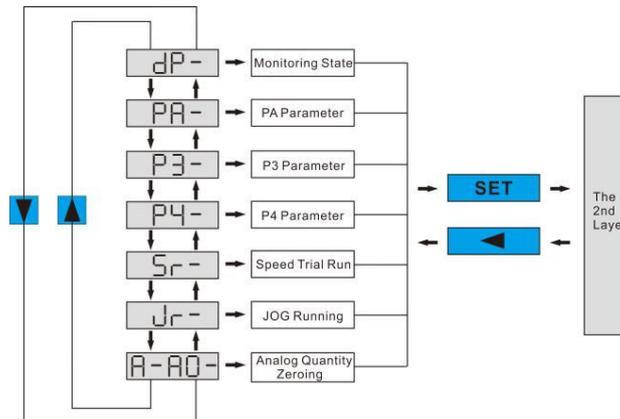
3.3 State Indicator



Pic 3.1 State Indicator

3.4 State Monitoring

The first layer is the main menu and has four operating modes. Press ↑ or ↓ button to change the operation mode. Then press SET button to enter into the second layer and executes a concrete operation. Press ← button returns to the main menu from the second layer.



Pic 3.2 Operation Display Layer

In the first layer, please select “DP--” and press the SET button to enter into monitoring mode. There are 16 displays in total. Users select the desired display mode with ↑ or ↓ button, and then press SET button to enter into the specific states.

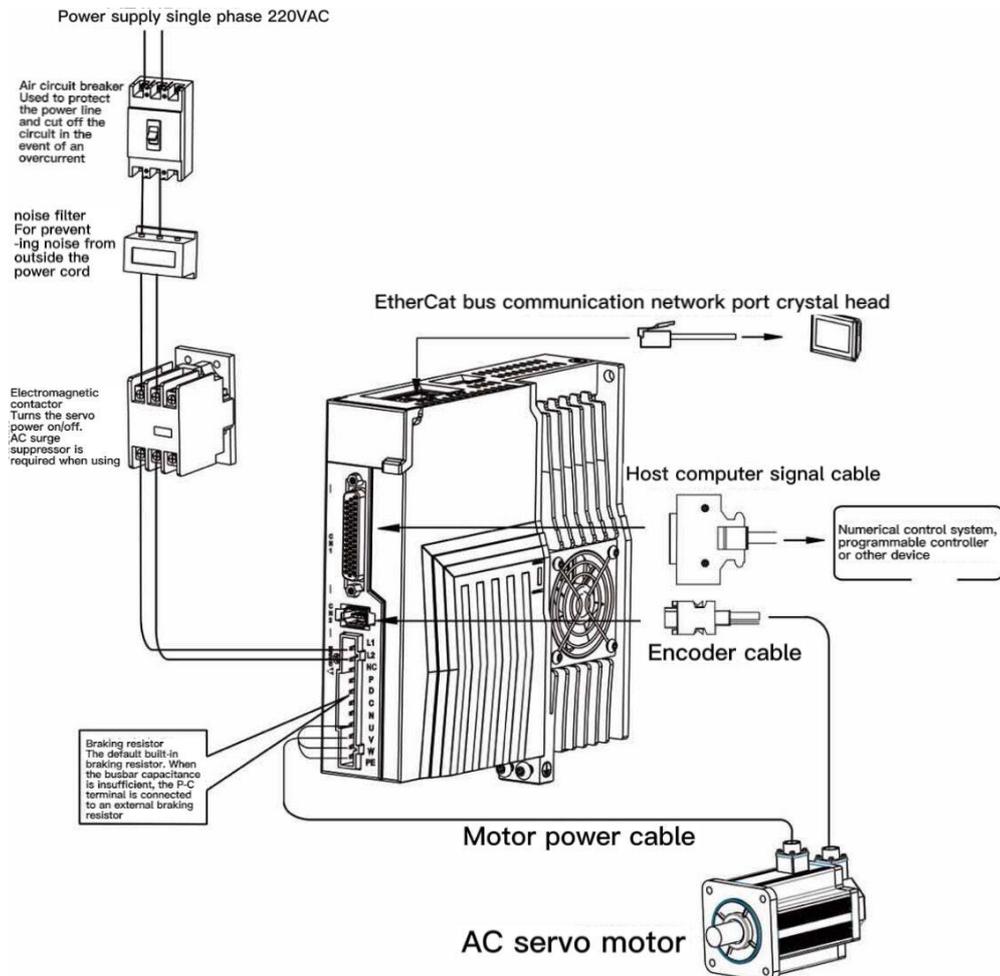
Monitoring	Operation	Example	Definition
dP-SPd	SET ⇨ ⇩ ⇨ ⇩ ⇨ ⇩ ⇨ ⇩ ⇨	r 1000	Motor speed:1000r / min
dP-PoS		P45806	The current position:1245806
dP-PoS.		P. 12	
dP-CPo		C45810	Position command:124580
dP-CPo.		C. 12	
dP-EPo		E 4	Position deviation:4 pulses
dP-EPo.		E. 0	
dP-tt9		t 70	Motor torque 70%
dP- i		i 2.3	Motor current 2.3A

dP-Cnt		Cnt 0	Control mode 0: position control
dP-APo		A 3265	Absolute position of the rotor:3265
dP-In		In 11111	Input terminal
dP-out		out 111	Output terminal
dP-Cod		Cod 1111	Encoder signal
dP-rn		rn - on	Working state
dP-Err		Err 9	No.9 alarm

Chapter 4 System Wiring

4.1 System Wiring

4.1.1 Servo drive wiring diagram



Pic 4.1 System Wiring

4.1.2 Wiring Introduction

Wiring Notes:

- The control cable length should be less than 3 meters and the encoder cable length 20 meters.

- Check that the power supply and wiring of L1,L2 are correct.If the driver only supports single-phase 220VAC, please do not connect it to the 380VAC power supply.
- The output terminals(U,V,W) must be connected with the servo motor connections(U,V,W) correspondently, otherwise the servo motor will stop or over speed. However, by exchanging three-phase terminal cannot cause the motor to reverse; this point is different from asynchronous motor.
- Earthed wiring must be reliable with a single-point connection.
- Pay attention to the correct direction of freewheel diode which is connected with the delay at the output terminal, other can cause the output circuit breakdown.
- In order to protect the servo driver from noise interference that can cause malfunction, please use an insulation transformer and noise filter on the power lines.
- Wiring the power lines(power supply line, main circuit lines,etc) at a distance above 30cm from the control signal wires, do not lay them in one conduit.
- Install a non-fuse circuit breaker that can shut off the external power supply immediately for in case of the servo driver fault.
- Because there are large-capacity electrolytic capacitors inside the servo drive, even if the power supply is cut off, there is still a high voltage in the internal circuit. After cutting off the power supply, wait at least 5 minutes before touching the drive and motor.

4.1.3 Electric Wire Specifications

Connection Terminal	Symbol	Wire Specification
Main Power Supply	L1、 L2	1.5~4mm ²

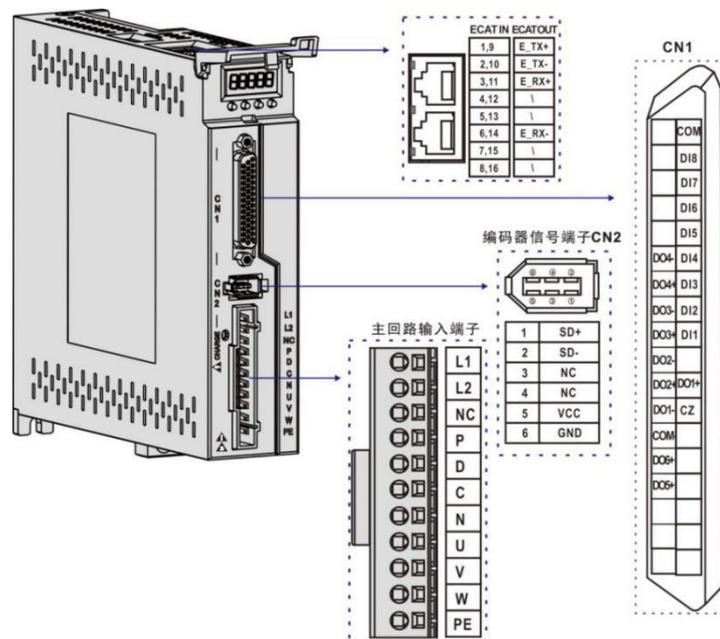
Servo Motor	U、V、W	1.5~4mm ²
Ground	⊕	1.5~4mm ²
Control Signals	CN1	≧ 0.14mm ² (AWG26), Shielded.
Encoder Signals	CN2	≧ 0.14mm ² (AWG26), Shielded.
Regenerative Resistors Terminals	P、D/P、 C	1.5~4mm ²



- Must use a twisted pair wire cable for the encoder signal wiring. If the encoder signal cable is too long(>20m), in which the encoder power supply can be insufficient, may use multi-wire or thick wire for the power supply wiring.

4.2 Servo driver terminals Introduction

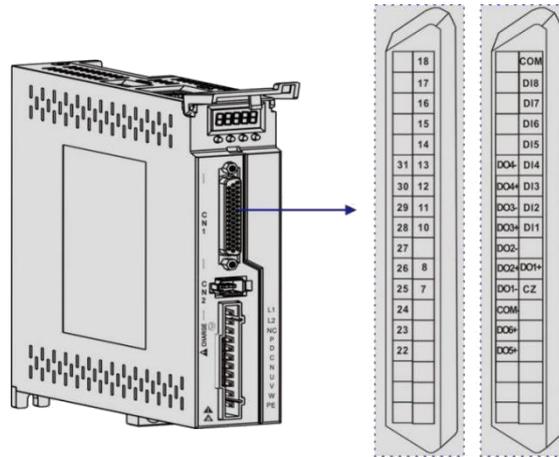
4.2.1 Drive Terminal Definition



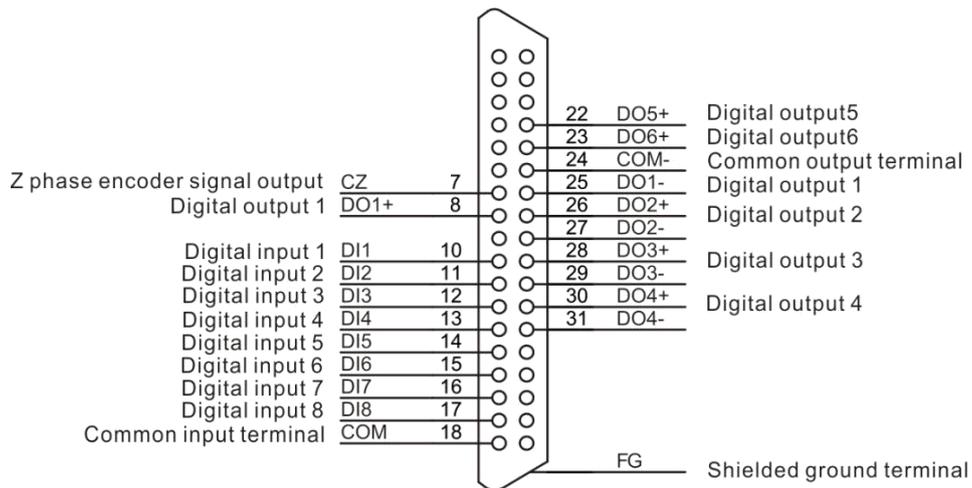
Pic 4.2 C100E Drive Terminals

Terminal	Introduction
CN1	Digital input and output terminal
CN2	Encoder connection terminal
CN3	EtherCAT input terminal
CN4	EtherCAT output terminal

4.2.2 CN1 Terminal



Pic 4.3 CN1 Terminal



Pic 4.3 CN1 Pin Definition

C100E series has 8 input terminals and 6 output terminals. The definition values of input and output can be changed by P3 group parameters, and all kinds of input and output definitions can be completed (low level of input

terminal is valid as default). Only input signals with function numbers between 33 and 48 defined by the input terminal can be sent to the master station and it can be obtained through the Digital Inputs object of 0x60fd in the object dictionary, which in turn maps to the object's bit0-bit15, Where the inputs for probe 1 and probe 2 functions must select high-speed input terminals 1 and 2:

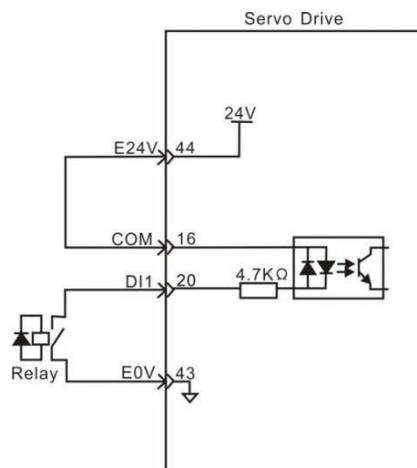
Definition	Symbol	Function
33	NEGLIM	forward limit signal
34	POSLIM	negative limit signal
35	HOME	homing signal
36	QUICK STOP	emergency stop
37	PROBE1	probe 1
38	PROBE2	probe 2

When the defined function number is between 18 and 33, the bit0-bit15 of the DigitalOutputs object of 0x60fe object in the dictionary is mapped to the corresponding port in the order of the defined function number.

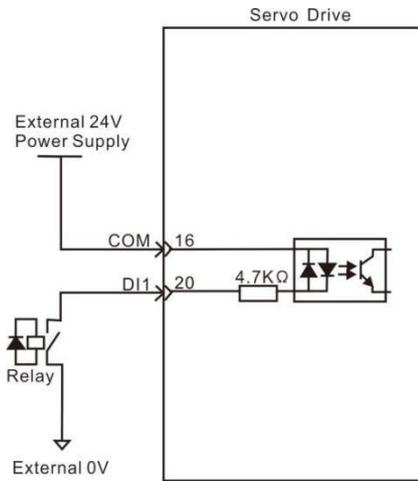
● **Input Circuit Of Digital Quantity Diagram**

For DI1 as an example(the DI1~DI8 interface circuit is the same):

- 1) When the upper device is relay output:
 - A) For internal 24V power supply:

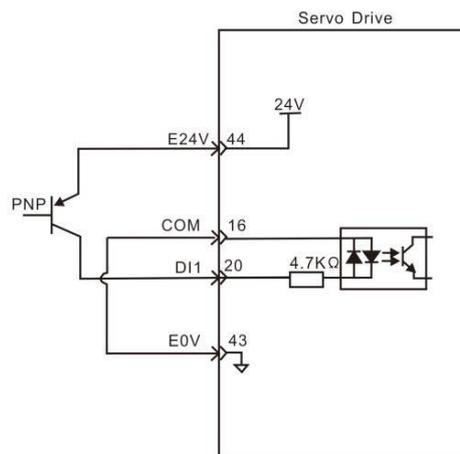
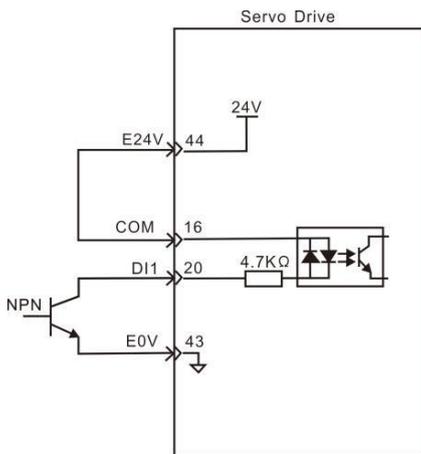


B) For external 24V power supply:

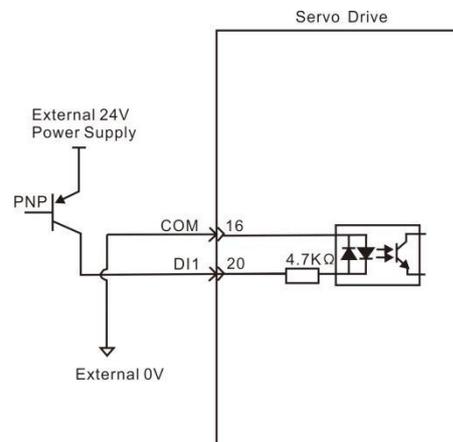
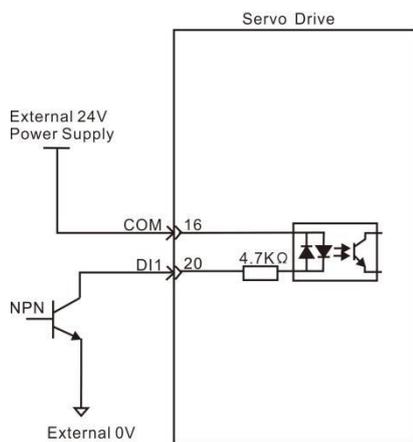


2) When the upper device is collector open output:

A) For internal 24V power supply:



B) For external 24V power supply:



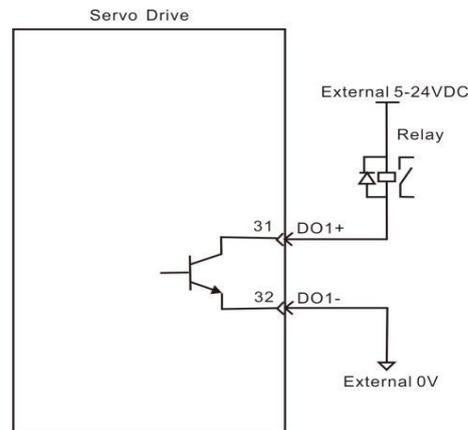


◆ Do not support PNP mixed with NPN input.

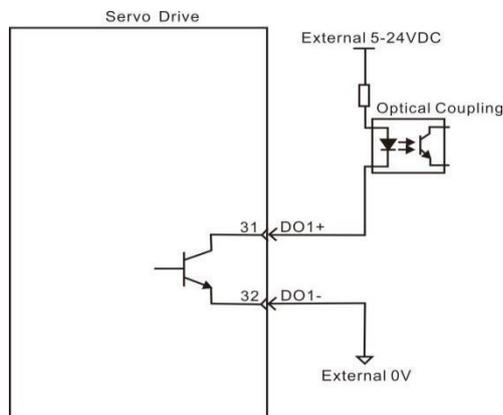
● Output Circuit Of Digital Quantity Diagram

For DO1 as an example(the DO1~DO6 interface circuit is the same):

1) When the upper device is relay input:



2) When the upper device is optocoupler input:

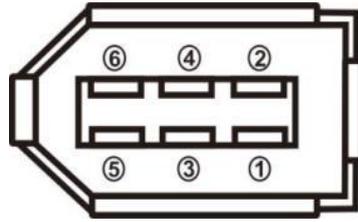


◆ Be sure to connect a continuation diode when the upper device is a relay, otherwise it may damage DO ports or cause strong signal interference.

◆ The maximum allowable voltage and current capacity of the optocoupler output circuit in the servo drive are as follows:

- Voltage: DC30V
- Current: DC50mA

4.2.3 Encoder Terminal



Pic 4.5 CN2 Encoder Connector

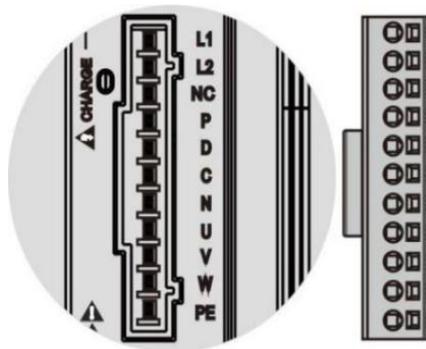
Signal Name		Pin No.	Function
Encoder Power Supply	5V	5	Use 5V power supply (Provided by servo driver). If the cable is longer than 20m, in order to prevent encoder from voltage dropping down, it is better to use multi wires or thick wires for power line and ground line.
	0V	6	
Absolute encoder communication positive end	SD +	1	Absolute encoder communication positive end
Absolute encoder communication negative end	SD-	2	Absolute encoder communication negative end
Null	NC	3	Reserve
Null	NC	4	Reserve
Shielded layer	Metal cover		Connect to the shielded layer of the encoder cable

4.2.4 EtherCAT Network Communication Terminal

Terminal	Picture	Pin No.	Signal	Name
CN3		1, 9	E_TX+	EtherCAT data sending forward end
		2, 10	E_TX-	EtherCAT negative end of

				data transmission
	3, 11	E_RX+		EtherCAT data receiving positive end
	4, 12	/		/
	5, 13	/		/
	6, 14	E_RX-		EtherCAT data receiving negative end
	7, 15	/		/
	8, 16	/		/
	Connector cover	PE		shield grounded
Remark	1) LED1 shows the state of “Link/Activity IN” and the color is orange; 2) LED3 shows the state of “Link/Activity OUT” and the color is orange; 3) LED2 and LED4 are the state of “RUN” and the color is green.			

4.2.5 Main Circuit Terminal



Pic 4.6 Main Circuit Terminal

Terminal Name	Symbol	Explanation
Main Power Supply	L1、L2	Single phase 220VAC -15%~+10%, 50/60Hz.
	NC	Null

Regenerative Resistance	P、D	When use the built-in resistor, please connect P and D.
	P、C	When the external regeneration resistance is required, please disconnect P and D and crossover it to terminal P and C. Leaving N disconnected.
Servo Motor	UVW	UVW phase output to servo motor.
	⊕	Ground with servo motor and power supply.



- ◆ The built-in resistor has been set as default by factory: P and D connector are in short-cut.

4.3 EtherCAT Field Bus Introduction

4.3.1 Communication Specification

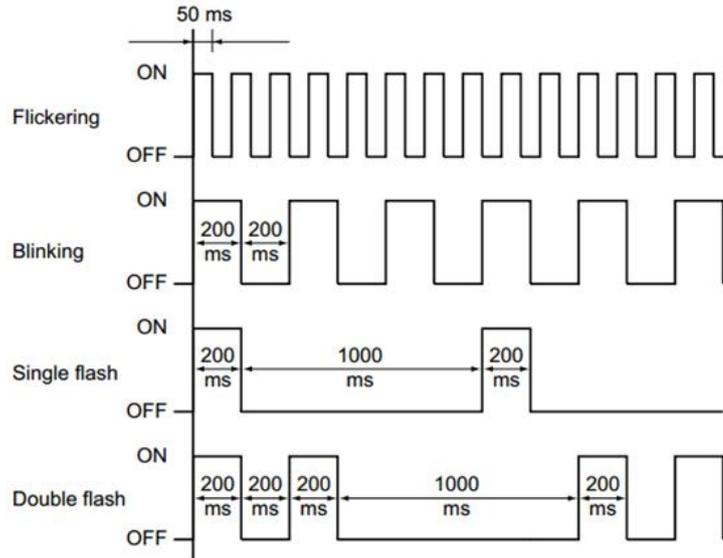
	Item	Description
EtherCAT Communication	Physical Layer	100BASE-TX
	Communication Connector	RJ45 × 2 (terminal CN3A=IN, CN3B=OUT)
	Network Topology	Field bus type
	Baud Rate	2 × 100 Mbps (full duplex)
	Frame Data Length	1484 bytes (max)
	Synchronization Manager	SM0: mailbox reception (master to slave) SM1: mailbox sending (slave to master) SM2: process data output (master to slave) SM3: process data input (slave to master)
	Synchronous Mode	DC Synchronization (SYNC0) Free Run
	Communication Object	SDO: service data object PDO: process data object
	LED Indication	L/A IN (Link/Activity IN) × 1 L/A OUT (Link/Activity OUT) × 1 RUN × 1
Communication	CoE: CANopen over EtherCAT	

	Protocol Standard	
	Equipment Agreement Standard	IEC61800-7 CiA402 drive profile
CiA402 Operator Mode	Cyclic synchronization position mode (CSP)、Cyclic synchronous velocity mode (CSV)、Cyclic synchronous torque mode (CST)、Profile position mode (PP)、Profile velocity mode (PV)、Profile torque mode (PT)、Homing mode (HM)	

4.3.2 LED State Instruction

Name	Color	State	Description
RUN	Green	OFF	Initial state
		Blinking	Pre-operational state
		Single flash	Safe-operational state
		ON	Operational state
L/A IN	Orange	OFF	Physical layer link not established
		ON	Physical layer link establishment
		Flickering	Interactive data after link establishment
L/A OUT	Orange	OFF	Physical layer link not established
		ON	Physical layer link establishment
		Flickering	Interactive data after link establishment

The status of the indicator light is described as follows:



Pic 4.7 Indicator Flashing Time

4.3.3 Communication Object

The parameters include communication parameters, factory defined parameters and 402 group parameters.

Address	Name	Read/Write	Default Value	Range	Introduction
1000h	device type	R	0x00040192		
1001h	wrong register	R	0		
1008h	device name		DSX00E		
1009h	Hardware version		V1.0		
100Ah	software release		V1.0		
1018h+01	Manufacturer ID	R	0x00445653		
1018h+02	Product code	R	0x00000001		
1018h+03	Modified coding	R	0x00000001		
1018h+04	serial number	R	0x00000001		
1600h	RXPDO mapping object0	RW			It can configure the number and content

Address	Name	Read/ Write	Default Value	Range	Introduction
					of RPDO
1701h	RXPDO mapping object258	R	0x60400010 0x607A0020 0x60B80010 0x60FE0120		
1702h	RXPDO mapping object259	R	0x60400010 0x607A0020 0x60FF0020 0x60710010 0x60600008 0x60B80010 0x607F0020		
1703h	RXPDO mapping object 260	R	0x60400010 0x607A0020 0x60FF0020 0x60600008 0x60B80010 0x60E00010 0x60E10010		
1704h	RXPDO mapping object261	R	0x60400010 0x607A0020 0x60FF0020 0x60710010 0x60600008 0x60B80010 0x607F0020 0x60E00010		

Address	Name	Read/ Write	Default Value	Range	Introduction
			0x60E10010		
1705h	RXPDO mapping object 262	R	0x60400010 0x607A0020 0x60FF0020 0x60600008 0x60B80010 0x60E00010 0x60E10010 0x60B20010		
1A00h	TXPDO mapping object0	RW			It can configure the number and content of TPDO
1B01h	TXPDO mapping object258	R	0x603F0010 0x60410010 0x60640020 0x60770010 0x60F40020 0x60B90010 0x60BA0020 0x60BC0020 0x60FD0020		
1B02h	TXPDO mapping object259	R	0x603F0010 0x60410010 0x60640020 0x60770010 0x60610008		

Address	Name	Read/ Write	Default Value	Range	Introduction
			0x60B90010 0x60BA0020 0x60BC0020 0x60FD0020		
1B03h	TXPDO mapping object260	R	0x603F0010 0x60410010 0x60640020 0x60770010 0x60F40020 0x60610008 0x60B90010 0x60BA0020 0x60BC0020 0x60FD0020		
1B04h	TXPDO mapping object261	R	0x603F0010 0x60410010 0x60640020 0x60770010 0x60610008 0x60F40020 0x60B90010 0x60BA0020 0x60BC0020 0x606C0020		
1C12h	RXPDO distribution	RW	0	0x1600 0x1701 ~	

Address	Name	Read/ Write	Default Value	Range	Introduction
				0x1705	
1C13h	TXPDO distribution	RW	0	0x1A00 0x1B01 ~ 0x1B04	
2000h	Basic control parameters	RO			
2000h+1	Initial status display	RW	17	0-23	
2000h+2	Action setting in motor stopping	RW	0	0-200	
2000h+3	Actuator action setting	RW	0	0-200	
2000h+4	The speed of mechanical brake when the motor is running	RW	100	0-3000	
2000h+5	Speed limit in torque control	RW	3000	0-5000	
2000h+6	The delay time of servo on to close	RW	0	0-3000 0	
2000h+7	Input terminal effective level control word	RW	0	0-31	
2000h+8	Output terminal effective level control word	RW	0	0-31	

Address	Name	Read/Write	Default Value	Range	Introduction
2000h+9	Time constant of removing jitter of IO terminal	RW	2	1-1000	
2000h+10	Encoder selection	RW	5	1-5	Encoder types: 4:Absolute value without battery; 5:Absolute value with battery (as default).
2000h+11	Encoder resolution	RW	23	0-32	Select the number of motor encoder lines (23 bits as default)
2000h+12	Motor poles	RW	4	1-360	4 poles as default
2000h+13	PWM duty cycle	RW	50	5-90	
2001h	PID adjustment				
2001h+1	Position proportional coefficient	RW	40	1-1000	
2001h+2	Velocity proportional coefficient	RW	150	5-2000	
2001h+3	Velocity integral constant	RW	75	1-1000	
2001h+4	Position command smoothing filter.	RW	200	1-1000	
2001h+5	Torque filter	RW	100	20-500	
2001h+6	Velocity detection	RW	100	20-500	

Address	Name	Read/ Write	Default Value	Range	Introduction
	filter				
2001h+7	Acceleration time constant	RW	100	1-1000 0	
2001h+8	Deceleration time constant	RW	100	1-1000 0	
2002h	communicational parameter				
2002h+1	Communication virtual input	RW	0	0-1	
2002h+2	Communication virtual output	RW	0	0-1	
2002h+3	fixed address	RW	0	0-3276 7	
2003h	Function number of input terminals				
2003h+1	Digital input DI1 function	RW	1	0-99	
2003h+2	Digital input DI2 function	RW	2	0-99	
2003h+3	Digital input DI3 function	RW	3	0-99	
2003h+4	Digital input DI4 function	RW	4	0-99	
2003h+5	Digital input DI5 function	RW	5	0-99	
2003h+6	Digital input DI6 function	RW	6	0-99	

Address	Name	Read/Write	Default Value	Range	Introduction
2003h+7	Digital input DI7 function	RW	7	0-99	
2003h+8	Digital input DI8 function	RW	8	0-99	
2004h	Output terminal function number				
2004h+1	Digital output DO1 function	RW	18	0-48	
2004h+2	Digital output DO2 function	RW	19	0-48	
2004h+3	Digital output DO3 function	RW	2	0-48	
2004h+4	Digital output DO4 function	RW	3	0-48	
2004h+5	Digital output DO5 function	RW	5	0-48	
2004h+6	Digital output DO6 function	RW	8	0-48	
2005h	Auxiliary function parameters				
2005h+1	Fault reset	RW	0	0-1	
2005h+2	Whether the soft limit is on or not	RW	0	0-1	
2005h+3	Whether the parameters are saved to eeprom	RW	1	0-1	
2006h	Monitoring				

Address	Name	Read/Write	Default Value	Range	Introduction
	parameters				
2006h+1	Drive current	RO			
2006h+2	Driver temperature	RO			
2006h+3	Busbar voltage	RO			
2007h	Servo motor parameters				
2007h+1	Motor type	RW	1		The corresponding motors to each index are as follow table.
2008h	Step mode parameter				
2008h+1	Locking current	RW			
2008h+2	Running current	RW			

C100E Series Motor Table	
0	40-00130
1	40-00330
2	60-00630
3	60-01330
4	60-01930
5	80-01330
6	80-02430 (as default)
7	80-03520
8	80-04025
9	90-02430
10	90-03520

11	90-04025
12	110-02030
13	110-04020
14	110-04030
15	Recover default values

Address	Name	Read/Write	Default Value	Range	Introduction	Address
603Fh	Recent error code	R	TPDO	0	Unsigned 16 bits	The last error code.
6040h	Control word	RW	RPDO	0	Unsigned 16 bits	Control word
6041h	Status word	R	TPDO	0	Unsigned 16 bits	Status word
605Ah	Quick stop code	RW	NO	1	Signed 16 bits	<p>1:It enters the unenabling state after the slope stops.</p> <p>2:Stops quickly and enters into the unenbaling state.</p> <p>5:Slope shutdown completed and maintained in a fast stop state.</p> <p>6:The fast stop is completed and maintained in the fast stop state.</p> <p>Other: invalid</p>

6060h	Mode setting	RW	RPDO	8	Unsigned 8 bits	Working modes: 1:Profile position mode 3:Profile velocity mode 4:Profile torque mode 6:Homing mode 8:Periodic synchronization position mode 9:Periodic synchronous velocity mode 10:Periodic synchronous torque mode
6061h	Code check	R	TPDO	0	Unsigned 8 bits	Display the working state of the drive.
6062h	Position instruction	R	TPDO	0	Signed 32 bits	Instruction unit
6063h	position feedback	R	TPDO	0	Signed 32 bits	Actual position of motor (encoder unit)
6064h	physical location	R	TPDO	0	Signed 32 bits	Display the actual motor position (instruction unit)
6067h	Position arrival threshold	RW	RPDO	130	Unsigned 32 bits	Encoder unit
606Ch	actual velocity	R	TPDO	0	Signed 32 bits	Display the actual motor speed (instruction unit)

6071h	Target torque	RW	RPDO	0	Signed 16 bits	Input value of torque value in torque mode (thousand value)
6072h	max torque	RW	RPDO	3000	Signed 16 bits	The input torque value in torque mode
6077h	Actual torque	R	TPDO	0	Signed 16 bits	Display the actual motor torque
607Ah	target position	RW	RPDO	0	Signed 32 bits	Target position in position mode (instruction unit)
607Ch	Origin offset	RW	RPDO	0	Signed 32 bits	Origin offset
607Dh+01	Min position limit	RW	RPDO	-2000 00000 0	Signed 32 bits	Reverse limit
607Dh+02	Max position limit	RW	RPDO	20000 00000	Signed 32 bits	Forward limit
607Fh	Max speed	RW	RPDO	60000 0	Signed 32 bits	The max running speed
6081h	Ladder velocity	RW	RPDO	25000 0	Unsigned 32 bits	Speed value in uniform speed stage of profile position mode,inc/s
6083h	Ladder acceleration	RW	RPDO	25000 0	Unsigned 32 bits	Acceleration of ladder curve
6084h	Ladder deceleration	RW	RPDO	25000 0	Unsigned 32 bits	Deceleration of ladder curve(acceleration value)
6085h	Quick stop	RW	RPDO	30000	Unsigned	The deceleration for

	deceleration			0	32 bits	emergency stop 605A in the of selection in 1 or 5.
6087h	Torque slope	RW	RPDO	1	Unsigned 32 bits	Torque variation of per unit time (1ms)
6091h+02	Gear ratio: shaft accuracy	RW	RPDO	10000	Unsigned 32 bits	The number of instructions for the external shaft to control the motor to turn a rotate.
6098h	Homing mode	RW	RPDO	17	Signed 8 bits	Look for origin mode (support for 17 and 18, forward and reverse limit switches)
6099h+01	Homing mode high speed	RW	RPDO	150000	Unsigned 32 bits	Search for the velocity value of the origin signal in high speed (instruction / s)
6099h+02	Homing mode low speed	RW	RPDO	10000	Unsigned 32 bits	Search for the velocity value of the Origin signal in low speed (instruction / s)
609Ah	Homing accelerated / decelerated speed	RW	RPDO	200000	Unsigned 32 bits	Acceleration and deceleration for origin mode (instruction / S2)

60B8h	Probe function	RW	RPDO	0x313 1	Unsigned 16 bits	Set probe function. (Details are in the see the functional description of the probe)
60B9h	Probe state	R	TPDO	0	Unsigned 32 bits	Display probe action status.(Details are in the see the functional description of the probe)
60BAh	Probe 1 rising along latch position	R	TPDO	0	Signed 32 bits	Probe 1 rising along latch position
60BBh	Probe 1 falling down latch position	R	TPDO	0	Signed 32 bits	Probe 1 falling down latch position
60BCh	Probe 2 rising along latch position	R	TPDO	0	Signed 32 bits	Probe 2 rising along latch position
60BDh	Probe 2 falling down latch position	R	TPDO	0	Signed 32 bits	Probe 2 falling down latch position
60E0h	Forward torque limit	RW	RPDO	3000	Signed 16 bits	The torque limit of limiting the forward rotation (permillage)

60E1h	Reverse torque limit	RW	RPDO	3000	Signed 16 bits	The torque limit of limiting the reversed rotation (permillage)
60F4h	Position error	R	TPDO		Signed 32 bits	Position error (instruction unit)
60FDh	Input IO status	R	TPDO		Unsigned 32 bits	bit0:origin signal bit1:forward limit bit2:negative limit bit3:emergency stop bit4:probe1 function (High speed input port1) bit5:probe2 function (High speed input port2)
60FE+01	Physical output	RW	RPDO	0	Unsigned 32 bits	
60FEh+02	Physical output enable	RW	NO		Unsigned 32 bits	Not used
60FFh	Target speed	RW	RPDO		Signed 32 bits	Target speed in speed mode. (instruction unit / s)
6502h	Supported operations mode	R	NO		Unsigned 32 bits	The supported operation modes pf the drive.

4.3.4 PA Group Of Parameters

No.	Name	Function	Rang	Default Value
0	Password	1. User code:315. 2. Motor model code:385.	0-9999	315
1	Motor selection	1. Different model codes are corresponding to different default parameters. 2. Change this parameter, first set the password PA0 to 385 to modify this parameter. 3. When change the parameter, please first set the password PA0 to 385 and then to modify this parameter. 4. The default value is80-02430。	40-180	
2	Software version	The software version can be read but can't be modified.		
3	Initial display status	0:Display motor speed. 1:Display the current position is 5-bit low. 2:Display the current position is 5-bit high. 3:Display position command. (command pulse accumulation) is 5-bit low. 4:Display position command. (command pulse accumulation) is 5-bit high. 5:Display position deviation is 5-bit low. 6:Display position deviation is 5-bit high. 7:Display motor torque.	0-23	0

No.	Name	Function	Rang	Default Value
		8:Display motor current. 9:Display control mode. 10:Display temperature. 11:Display speed command.. 12:Display torque command. 13:Display absolute position of the rotor in a roll is 5-bit low. 14:Display absolute position of the rotor in a roll is 5-bit high. 15:Display input terminal state. 16:Display output terminal state. 17:Display encoder input signal. 18:Display voltage value of main line of main circuit. 19:Display alarming code. 20:Display logic chip version number. 21:Display the actuation state of the relay. 22:Display external voltage state. 23:Display external voltage state.		
4	Control mode selection	To set control method: 0: position control mode 1: speed control mode 2: torque control mode	0-5	0

No.	Name	Function	Rang	Default Value
		<p>3:position + speed control mode</p> <p>4:position + torque control mode</p> <p>5:speed + torque control mode</p>		
5	Proportional gain of speed loop	<p>1.Set the proportional gain of speed loop.</p> <p>2.The value is bigger, the gain is higher and rigidity is stronger. The parameter value is set according to your exact servo driving system model and the load. Generally, the greater the load inertia, the bigger the value.</p> <p>3.Please set a little high value if the system condition does not generate oscillation.</p>	5-2000 Hz	200
6	Speed integral constant	<p>1.To set the integral time constant of the speed loop regulator.</p> <p>2.The value is smaller, the integral speed is faster and the servo rigidity is stronger.But if it is too small, it will happen over controlling.</p>	1-1000 ms	75
7	Torque filter	<p>1.To set the characters of torque command filter.</p> <p>2.To suppress resonance generated by torque.</p> <p>3.The value is smaller, the cut-off frequency is lower and vibration with noise generated by the motor is less. If the load inertia is</p>	20-500 %	100

No.	Name	Function	Rang	Default Value
		<p>great, reducing the setting value is recommended. If the value is too small, it would lead to low response, which would result in shaking.</p> <p>4.The value is bigger, the cut-off frequency is higher and the response frequency is quicker. If you need higher torque response frequency, it is recommended to increase the setting value.</p>		
8	Speed detection filter	<p>1. To set the characters of speed detection filter.</p> <p>2. The value is smaller, the cut-off frequency is lower and noise from the motor is smaller. If the load inertia is great, reducing the setting value is recommended. If the value is too small, it would lead to low response, which would result in shaking.</p> <p>3. The value is bigger, the cut-off frequency is higher and the response frequency is quicker. If you need higher torque response frequency, it is recommended to increase the setting value.</p>	20-500 %	100
9	Proportional gain of position loop	<p>1.To set the proportional gain of position loop .</p> <p>2.The value is bigger, the gain is higher and its rigidity is stronger. So the position lag is</p>	1-1000	80

No.	Name	Function	Rang	Default Value
		<p>smaller under the same frequency command pulse condition. But if it is too big, it will happen oscillation.</p> <p>3.The parameter value is set according to your exact servo driving system model and the load.</p>		
10	Command pulses of each motor revolution	<p>1.To set command pulses of each motor revolution.</p> <p>2.When it is set to 0, PA12(numerator of electronic gear for position command pulses), PA13(denominator of electronic gear for position command pulses) are valid.</p>	0-30000	1000 0
11	1 st numerator of electronic gear for position command pulse	<p>1.Set the electric gear ratio for position command pulse.</p> <p>2.In position control mode,it is convenient to match all kinds of pulse source through set the parameter PA12 and PA13, which helps to reach ideal control resolution(angle/pulse).</p> <p>3. $P \times G = N \times C \times 4$</p> <p>P: pulses of input command; G:electric gear ratio; N:numbers of motor rotation ; C:solutions of photoelectric encoder in per rotation, the default value is 2500.</p>	0-32767	0

No.	Name	Function	Rang	Default Value																	
		<p>4.For example, input command pulse P is 6000, servo motor rotate a roll: $G=(N \times C \times 4)/P=(1 \times 2500 \times 4)/6000=5/3$, So PA12 should be set to 5, PA13 should be set to 3.</p> <p>5.The numerator of electronic gear for command pulse is decided by Gear1 and Gear2. The denominator is decided by PA13. The details as following:</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th colspan="2">DI Signal</th> <th rowspan="2">Denominator</th> </tr> <tr> <th>Gear 2</th> <th>Gear 1</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>1st Numerator(PA13)</td> </tr> <tr> <td>0</td> <td>1</td> <td>2nd Numerator(PA13)</td> </tr> <tr> <td>1</td> <td>0</td> <td>3rd Numerator(PA13)</td> </tr> <tr> <td>1</td> <td>1</td> <td>4th Numerator(PA13)</td> </tr> </tbody> </table> <p>Remark: 0=OFF, 1=ON.</p>	DI Signal		Denominator	Gear 2	Gear 1	0	0	1 st Numerator(PA13)	0	1	2 nd Numerator(PA13)	1	0	3 rd Numerator(PA13)	1	1	4 th Numerator(PA13)		
DI Signal		Denominator																			
Gear 2	Gear 1																				
0	0	1 st Numerator(PA13)																			
0	1	2 nd Numerator(PA13)																			
1	0	3 rd Numerator(PA13)																			
1	1	4 th Numerator(PA13)																			
13	Denominator of position command pulse	Refers to parameter PA12.	1-32767	1000 0																	

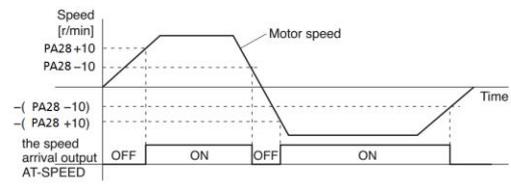
No.	Name	Function	Rang	Default Value
14	Input mode of position command pulse	<p>1.Set the input mode of position command pulse.</p> <p>2.To set one of 4 input modes:</p> <p>0: Pulse+Direction.</p> <p>1: CCW pulse/CW pulse.</p> <p>2: phase A and phase B orthogonal input.</p> <p>3: Internal position input.</p> <p>Remark: CCW: observe from the motor axial direction. It defines CCW in counter clock wise and CW in clock wise.</p>	0-3	0
15	Direction of command pulses	<p>0:Normal direction.</p> <p>1:Reverse position command pulse.</p>	0-1	0
16	The rang of positioning completion	<p>1.Setting the pulse range of positioning completion in position control mode.</p> <p>2.The drive judges whether it has finished positioning completion based on this parameter. When the rest pulses in position deviation counter are less than or equal with the setting value, the COIN(positioning completion) of digital output(DO) is ON, or else OFF.</p>	0-30000 pulses	10
17	Detection of over-travel range	<p>1.Set alarming detection range of over travel..</p> <p>2.In position control mode, if the value in</p>	0-30000 × 100 pulses	400

No.	Name	Function	Rang	Default Value
		position deviation counter is over than the setting value, the drive will alarm.		
18	Invalid over-travel error	<p>Set to:</p> <p>0: The alarming detection of over travel is valid.</p> <p>1: The alarming detection of over travel is invalid, and it stops detecting the error .</p>	0-1	0
19	Position command smooth filter	<p>1.To filter the instruction pulse with exponential acceleration and deceleration, and the value represents the time constant.</p> <p>2.The filter does not lose input pulses, but would occur command delay .</p> <p>3.The filter applies in</p> <p>(1. PC controller without acceleration and deceleration function.</p> <p>(2. The electronic gear frequency is a little big(>10).</p> <p>(3.The command frequency is a little low.</p> <p>(4.When the motor runs, there are step jumps and unsmooth.</p> <p>4.When set to value"0", the filter does not work.</p>	0-1000× 0.1ms	100
20	Invalid input of drive inhibition	0: CCW drive inhibition or CW drive inhibition is effective. If the switch of CCW drive inhibition is ON, CCW drive is permitted.If the switch of CCW drive inhibition is OFF, CCW torque keeps 0.The	0-1	1

No.	Name	Function	Rang	Default Value														
		<p>same as CW drive inhibition. If both CCW and CW drive inhibition are OFF, it will come to error alarms of drive inhibition input.</p> <p>1: Cancel CCW or CW drive inhibition. No matter what state of the switch of CCW or CW drive inhibition is, CCW or CW drive is allowed. Meanwhile, if the switches of CCW and CW drive inhibition are OFF, it will still not alarm..</p>																
21	JOG speed	Set the running speed of JOG operating.	0-6000 r/min	100														
22	The source of speed command	<p>In speed control mode, it sets the source of speed command. It means:</p> <p>0: Analog Terminal AS+,AS- input analog speed command.</p> <p>1: Internal speed command is decided by SP1 and SP2 of digital input(DI):</p> <table border="1" data-bbox="539 1440 1177 1971"> <thead> <tr> <th colspan="2">DI Signal</th> <th rowspan="2">Speed Command</th> </tr> <tr> <th>SP2</th> <th>SP1</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>Internal Speed1(PA24)</td> </tr> <tr> <td>0</td> <td>1</td> <td>Internal Speed2(PA25)</td> </tr> <tr> <td>1</td> <td>0</td> <td>Internal</td> </tr> </tbody> </table>	DI Signal		Speed Command	SP2	SP1	0	0	Internal Speed1(PA24)	0	1	Internal Speed2(PA25)	1	0	Internal	0-5	0
DI Signal		Speed Command																
SP2	SP1																	
0	0	Internal Speed1(PA24)																
0	1	Internal Speed2(PA25)																
1	0	Internal																

No.	Name	Function	Rang	Default Value																							
		<table border="1"> <tr> <td></td> <td></td> <td>Speed2(PA26)</td> </tr> <tr> <td>1</td> <td>1</td> <td>Internal Speed2(PA27)</td> </tr> </table> <p>Note: 1=ON, 0=OFF.</p> <p>2: Analog speed command+internal speed command:</p> <table border="1"> <thead> <tr> <th colspan="2">DI Signal</th> <th rowspan="2">Speed Command</th> </tr> <tr> <th>SP2</th> <th>SP1</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>Analog Speed Command</td> </tr> <tr> <td>0</td> <td>1</td> <td>Internal Speed2(PA25)</td> </tr> <tr> <td>1</td> <td>0</td> <td>Internal Speed2(PA26)</td> </tr> <tr> <td>1</td> <td>1</td> <td>Internal Speed2(PA27)</td> </tr> </tbody> </table> <p>3: JOG speed command, if carries out JOG operation,it is needed to set.</p> <p>4: Keyboard speed c ommand, if carries out Sr operation,it needs to set the parameter.</p> <p>5:IO terminal controls JOG operation.</p>			Speed2(PA26)	1	1	Internal Speed2(PA27)	DI Signal		Speed Command	SP2	SP1	0	0	Analog Speed Command	0	1	Internal Speed2(PA25)	1	0	Internal Speed2(PA26)	1	1	Internal Speed2(PA27)		
		Speed2(PA26)																									
1	1	Internal Speed2(PA27)																									
DI Signal		Speed Command																									
SP2	SP1																										
0	0	Analog Speed Command																									
0	1	Internal Speed2(PA25)																									
1	0	Internal Speed2(PA26)																									
1	1	Internal Speed2(PA27)																									
23	Highest speed limit	<p>Set the highest speed of the ac motor.</p> <p>1.It doesn't matter with rotating direction.</p> <p>2.If the setting value is beyond of rated</p>	0-6000r/min	5000																							

No.	Name	Function	Rang	Default Value
		speed, the real highest speed is set as the rated speed.		
24	Internal speed selection 1	1.Set the internal speed 1. 2.In speed control mode(PA22=0), when SC1 and SC2 are OFF, internal speed 1 is the speed command.	-6000-6000 r/min	100
25	Internal speed selection 2	1.Set the internal speed 2. 2.In speed control mode(PA22=0), when SC1 is ON,while SC2 is OFF, internal speed 2 is the speed command.	-6000-6000 r/min	500
26	Internal speed selection 3	1.Set the internal speed 3. 2.In speed control mode(PA22=0), when SC1 is OFF,while SC2 is ON, internal speed 3 is the speed command.	-6000-6000 r/min	1000
27	Internal speed selection 4	1.Set the internal speed 4. 2.In speed control mode(PA22=0), when SC1 and SC2 are ON, internal speed 4 is the speed command.	-6000-6000 r/min	2000
28	Speed arrival	1.Set the detection timing of the speed arrival output. When the servomotor speed surpasses this parameter, the digital output (DO) ASP (arrival speed) is ON, otherwise is OFF. 2.The comparator has hysteresis function set by PA87. Detection is associated with 10 r/min hysteresis.	0-3000 r/min	3000

No.	Name	Function	Rang	Default Value														
		 <p>3.It also has the polarity setting function:</p> <table border="1" data-bbox="542 571 1053 1041"> <thead> <tr> <th>PA8</th> <th>PA28</th> <th>Comparator</th> </tr> </thead> <tbody> <tr> <td>8</td> <td></td> <td></td> </tr> <tr> <td>0</td> <td>>0</td> <td>No direction for speed</td> </tr> <tr> <td rowspan="2">1</td> <td>>0</td> <td>Only detect CCW speed</td> </tr> <tr> <td>>0</td> <td>Only detect CW speed</td> </tr> </tbody> </table>	PA8	PA28	Comparator	8			0	>0	No direction for speed	1	>0	Only detect CCW speed	>0	Only detect CW speed		
PA8	PA28	Comparator																
8																		
0	>0	No direction for speed																
1	>0	Only detect CCW speed																
	>0	Only detect CW speed																
29	Gain of analog quantity torque command	<p>1.Set the proportion for input voltage of analog torque and the actual motor running torque.</p> <p>2. The setting value unit is 0.1v/100%.</p> <p>3. The default value is 30, corresponding to 3v/100%, while it means if the input voltage is 3V, it would generate 100% rated torque.</p>	10-100 (0.1v/10 0%)	30														
30	The alarm value of torque overload	<p>1.The value is the percentage of rated torque. The limit is independent to direction and CW or CCW direction is protected.</p> <p>2.When PA31>9, motor torque>PA30 and duration>PA31, the drive alarms and the code is Err-29. The motor stops working. It must repower on after clearing errors.</p>	1-300	300														
31	The detection time for torque overload	<p>1.The detection time for torque overload, unit:ms. Detection time=PA31×0.1.</p> <p>2.When set to 0~9, the function of torque overload alarming is prohibited. Generally,the value is set as 0.</p>	0-32767	0														

No.	Name	Function	Rang	Default Value																																		
32	The source of torque command	<p>In torque control mode, it sets the source of torque command. It means:</p> <p>0:Analog torque command, it inputs by analog terminal AS+ and AS-.</p> <p>1:Internal torque command, it is decided by TRO1 and TRQ2 of digital input(DI):</p> <table border="1"> <thead> <tr> <th colspan="2">DI Signal</th> <th rowspan="2">Torque Command</th> </tr> <tr> <th>TRQ2</th> <th>TRQ1</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>Internal Torque1(PA64)</td> </tr> <tr> <td>0</td> <td>1</td> <td>Internal Torque2(PA65)</td> </tr> <tr> <td>1</td> <td>0</td> <td>Internal Torque3(PA66)</td> </tr> <tr> <td>1</td> <td>1</td> <td>Internal Torque4(PA67)</td> </tr> </tbody> </table> <p>Note: 0=OFF, 1=ON</p> <p>2:Analog torque command+internal torque command:</p> <table border="1"> <thead> <tr> <th colspan="2">DI Signal</th> <th rowspan="2">Torque Command</th> </tr> <tr> <th>TRQ2</th> <th>TRQ1</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>Analog Torque Command</td> </tr> <tr> <td>0</td> <td>1</td> <td>Internal Torque2(PA65)</td> </tr> <tr> <td>1</td> <td>0</td> <td>Internal Torque3(PA66)</td> </tr> <tr> <td>1</td> <td>1</td> <td>Internal Torque4(PA67)</td> </tr> </tbody> </table>	DI Signal		Torque Command	TRQ2	TRQ1	0	0	Internal Torque1(PA64)	0	1	Internal Torque2(PA65)	1	0	Internal Torque3(PA66)	1	1	Internal Torque4(PA67)	DI Signal		Torque Command	TRQ2	TRQ1	0	0	Analog Torque Command	0	1	Internal Torque2(PA65)	1	0	Internal Torque3(PA66)	1	1	Internal Torque4(PA67)	0-1	0
DI Signal		Torque Command																																				
TRQ2	TRQ1																																					
0	0	Internal Torque1(PA64)																																				
0	1	Internal Torque2(PA65)																																				
1	0	Internal Torque3(PA66)																																				
1	1	Internal Torque4(PA67)																																				
DI Signal		Torque Command																																				
TRQ2	TRQ1																																					
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0	1	Internal Torque2(PA65)																																				
1	0	Internal Torque3(PA66)																																				
1	1	Internal Torque4(PA67)																																				

No.	Name	Function	Rang	Default Value
33	The input direction of analog torque command	Reverse the input polarity of analog torque.	0-1	0
34	Internal CCW torque limit	<p>1.The setting value is the percentage of rated torque.For example,it is set to 2 times of the rated torque, the value is 200.</p> <p>2. At any time, this restriction is valid.</p> <p>3. If the setting value is over than the max overload capacity, the actual torque limit is the max overload capacity that is permitted.</p>	0-300%	300%
35	Internal CW torque limit	<p>1.The setting value is the percentage of rated torque.For example,it is set to 2 times of the rated torque, the value is 200.</p> <p>2. At any time, this restriction is valid.</p> <p>3. If the setting value is over than the max overload capacity, the actual torque limit is the max overload capacity that is permitted.</p>	-300-0%	-300%
36	External CCW torque limit	<p>1.The setting value is the percentage of rated torque, for example, it is set to 1 time of rated torque, the value is 100.</p> <p>2.Only when the input terminal(FIL) of CCW torque limit is ON is it valid.</p> <p>3.When the limit is valid, the actual torque limit is the Minimum value of max overload</p>	0-300%	100%

No.	Name	Function	Rang	Default Value
		capacity ,internal CCW torque limit and external CCW torque limit.		
37	External CW torque limit	<p>Set external torque limit of the motor CW direction.</p> <p>1.The setting value is the percentage of rated torque, for example, it is set to 1 time of rated torque, the value is -100.</p> <p>2.Only when the input terminal(RIL) of CW torque limit is ON is it valid.</p> <p>3.When the limit is valid, the actual torque limit is the Minimum value of max overload capacity ,internal CCW torque limit and external CCW torque limit.</p>	-300-0%	-100 %
39	Zero offset compensation of analog torque command	Make an offset adjustment for analog torque command with this parameter.	-2000-2000	0
40	Acceleration time constant	<p>The value means the motor of acceleration time from 0r/min to 1000r/min.</p> <p>1.Linear acceleration and deceleration characteristics.</p> <p>2.It only applies in speed control mode and internal position control mode, and other modes are invalid.</p>	1-10000 ms	100
41	Deceleration time constant	<p>The value means the deceleration time of the motor from 1000r/min to 0r/min.</p> <p>1.Linear acceleration and deceleration</p>	1-10000 ms	100

No.	Name	Function	Rang	Default Value
		<p>characteristics.</p> <p>2.It only applies in speed control mode and internal position control mode, while other modes are invalid.</p> <p>3.This parameter should be set to 0 if the drive is used in combination with an external position loop.</p>		
42	S type acceleration and deceleration time constant	It makes the motor start and stop working stably and sets a part of time of S type acceleration and deceleration curve.	0-1000 ms	0
43	Gain of analog speed command	Set the proportion for analog speed input voltage and actual motor running speed.	10-3000 r/min/v	300
44	Direction of analog speed command	<p>Reverse the input polarity of analog speed.</p> <p>1. Set to 0 and analog speed command is positive,the speed direction is CCW.</p> <p>2. Set to 1 and analog speed command is positive,the speed direction is CW.</p>	0-1	0
45	Zero offset compensation of analog speed command	Make an offset adjustment for analog speed command with this parameter.	-5000-5000	0
46	Filter of analog speed command	<p>1.The input low pass filter of analog speed</p> <p>2.The setting value is bigger, the response frequency is quicker to speed input analog quantity and the influence of signal noise is louder.</p>	1-1000 Hz	300

No.	Name	Function	Rang	Default Value
47	The setting of mechanical brake when the motor stops	1.It defines the delay time from BRK=ON and BRK=OFF to the motor current cutting off when the motor stops rotating. 2.To avoid a small displacement or working drop of the motor, the parameter should not be less than the delay time of mechanical braking.	0-200×10ms	0
48	The setting of mechanical brake when the motor rotates	1. It defines the delay time from the motor current cutting off to BRK=ON and BRK=OFF when the motor rotates. 2.To avoid a damage to the brake, the parameter makes the motor slow down and then makes the mechanical brake work. 3. The actual action time is the time it takes to drop from PA48 or current motor speed to PA49, and taking the minimum value.	0-200×10ms	50
49	The working speed of the mechanical brake when the motor rotates	1. It defines the speed value from motor current cut-off to mechanical brake action (output terminal BRK from ON to OFF) during motor working. 2.The actual action time is the time it takes to drop from PA48 or current motor speed to PA49, and taking the minimum value.	0-3000r/min	100
50	Speed limit in torque control mode	1:In torque control mode, the motor running speed is limited in the range of this parameter. 2:It can prevent over speed in light load.	0-5000 r/min	3000
53	Servo force enable	To set : 0: The enable signal is controlled by SON of digital input(DI). 1:Software force to servo on.	0-1	0
54	The delay closing time of servo enable	It defines the time to delay cutting off the motor current after the servo enable signal	0-30000 ms	0

No.	Name	Function	Rang	Default Value								
		is turned off.										
55	Effective level control word of input terminals	<p>1.To reverse the input terminals. For unreversed terminals, it is valid when the switch is closed, while it is invalid when the switch is open. For reversed terminals, it is invalid when the switch is closed, while it is valid when the switch is open.</p> <p>2.Represented by a binary digit of 4 bits. If it is 0, it means the input terminal dose not reverse. While it is 1, it means the terminal reverses.</p> <p>The binary digit represents the input terminals as following:</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="text-align: center;">3</td> <td style="text-align: center;">2</td> <td style="text-align: center;">1</td> <td style="text-align: center;">0</td> </tr> <tr> <td style="text-align: center;">DI4</td> <td style="text-align: center;">DI3</td> <td style="text-align: center;">DI2</td> <td style="text-align: center;">DI1</td> </tr> </table> <p>0: high level is active. 1: low level is active.</p>	3	2	1	0	DI4	DI3	DI2	DI1	0000-11 11	0000
3	2	1	0									
DI4	DI3	DI2	DI1									
57	Effective level control word of output terminals	<p>1.To reverse the output terminals. For reversed terminals,the definitions of breaking over and cut-off is contrary to standard definitions</p> <p>2.Represented by a binary digit of 4 bits. If it is 0, it means the input terminal dose not reverse. While it is 1, it means the terminal reverses.</p> <p>The binary digit represents the input</p>	0000-11 11	0000								

No.	Name	Function	Rang	Default Value								
		terminals as following: <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>3</td> <td>2</td> <td>1</td> <td>0</td> </tr> <tr> <td>DO4</td> <td>DO3</td> <td>DO2</td> <td>DO1</td> </tr> </table> 0: high level is active. 1: low level is active.	3	2	1	0	DO4	DO3	DO2	DO1		
3	2	1	0									
DO4	DO3	DO2	DO1									
58	Removing jitter time constant of I/O input terminal	1.Set the removing jitter filter time for input terminal. 2.The value is smaller, the terminal input response frequency is quicker. 3.The value is bigger, the anti-jamming performance of input terminal is better, but the response frequency becomes slow.	1-20ms	2								
59	Effective command pulse edge	Set to: 0: the rising edge is effective. 1:the falling edge is effective.	0-1	0								
60	Soft reset	Set to: 0:Soft reset is invalid. 1:Soft reset is effective and the system will restart.	0-1	0								
61	System alarm clear	Set to: 0: System alarm clear is invalid. 1: System alarm clear is effective.	0-1	0								
62	Encoder selection	Set to: 4:single-turn absolute encoder. 5:multi-turn absolute encoder.	4-5	Decided by motor								
63	Load inertia ratio	Set the load inertia ratio of the motor rotating inertia.	1-500	100								

No.	Name	Function	Rang	Default Value
		The setting value= $((\text{load inertia} + \text{rotating inertia}) / \text{rotating inertia}) \times 100$.		
64	Internal Torque 1	In torque control mode(PA4=2), when TRQ1=OFF, TRQ2=OFF, internal torque 1 is as the torque command.	-300-300	0
65	Internal Torque 2	In torque control mode(PA4=2), when TRQ1=ON, TRQ2=OFF, internal torque 2 is as the torque command.	-300-300	0
66	Internal Torque 3	In torque control mode(PA4=2), when TRQ1=OFF, TRQ2=ON, internal torque 3 is as the torque command.	-300-300	0
67	Internal Torque 4	In torque control mode(PA4=2), when TRQ1=ON, TRQ2=ON internal torque 4 is as the torque command.	-300-300	0
71	Search for an fixed address	The slave address used for fixed addressing	1-10000	1
72	High-speed IO port filtering settings	Set the high-speed IO-port filter time coefficient	1-1000×50us	40
74	The limit signal is valid	0: No limit signal is enabled; 1: The motor to the positive and negative limit point does not continue to operate in the corresponding direction.	0-1	0
75	Zero-speed detection point	1. If the motor running speed is less than the value of this parameter, the ZSP(zero speed) of digital output(DO) is ON, or else OFF.	0-1000 r/min	10

No.	Name	Function	Rang	Default Value
		2. If ZCLAMP of digital input(DI) is ON and speed command is less than the value of this parameter, the value of speed command is forced to be zero.		
76	Speed consistent setting value	When the difference between the actual speed and the instruction speed is less than this setting, the UCO2N(speed coincidence) is ON, otherwise OFF.	0-1000 r/min	10
77	2 nd numerator of electronic gear for position command pulse	Refers to parameter PA12.	0-32767	0
78	3 rd numerator of electronic gear for position command pulse	Refers to parameter PA12.	0-32767	0
79	4 th numerator of electronic gear for position command pulse	Refers to parameter PA12.	0-32767	0
80	Effective level of command direction signal	Set to: 0:High level is positive direction. 1:Low level is positive direction.	0-1	0
81	PULS signal filter of	1.To filter the input PULS signal. 2.The default value is the max pulse input	0-15	4

No.	Name	Function	Rang	Default Value
	command pulse	frequency: 500KHz(kpps). The value is bigger, the max input frequency is slower. 3.To filter the noise from the signal line in order to avoid incorrect counting happening. If it goes wrong due to the incorrect counting, you can increase the value of this parameter properly. 4. After editing this parameter, please save it and recharge. Then it is effective.		
82	SIGN signal filter of command pulse	1.To filtering the input SIGN signal. 2.The default value is the max pulse input frequency: 500KHz(kpps) The value is bigger, the max input frequency is slower. 3.To filter the noise from the signal line in order to avoid incorrect counting happening. If it goes wrong due to the incorrect counting, you can increase the value of this parameter properly. 4. After edited this parameter, must save it and recharge. Then it is effective.	0-15	1
83	CWL/CCWL inhibit way	When the machine touches the mechanical limit switch and strike CW/CCW limit , you can choose the following methods to prohibit with this parameters. 0: To limit the torque in this direction to be 0. 1: To prohibit the input pulse in this	0-1	0

No.	Name	Function	Rang	Default Value
		direction.		
84	Hysteresis for positioning completion	<p>1.Set pulse completion range in position control mode.</p> <p>2. when the number of remaining pulses in the position deviation counter is less than or equal to the setting value of this parameter, the digital output of COIN(position completion) is ON, otherwise OFF.</p> <p>3.Comparator has the function of hysteresis, which is set by PA85.</p>	0-32767 pulses	65
85	The range of near position	<p>1. To set the pulse range of near position under the position control mode.</p> <p>2. When the pulse number in position deviation counter is smaller than or equal to the setting value of this parameter, the digital output (DO) NEAR(approach position) is ON, otherwise is OFF.</p> <p>3. The comparator has hysteresis function set by PA86.</p> <p>4. Use this function in case that in near positioning, the host controller is accepting the NEAR signal to carry on the preparation to the next step. In general, this parameter value should be bigger than PA16.</p>	0-32767 pulses	6500
86	Hysteresis for approach positioning	Refer to parameter PA85.	0-32767 pulses	650
87	Hysteresis of arrival speed	<p>1. When the motor speed exceeds this parameter, the digital output ASP (speed arrival) is ON, otherwise OFF.</p> <p>2.The comparator has hysteresis function.</p> <p>3.It has polarity setting function:</p>	0-5000 r/min	30

No.	Name	Function			Rang	Default Value											
		PA88	PA28	Comparator													
		0	>0	Speed without direction													
		1	>0	Only detect positive speed													
			<0	Only detect reversal speed													
88	Polarity of arrival speed	Refers to parameter PA87.			0-1	0											
89	Arrival torque	<p>1. When the motor torque exceeds this parameter, the digital output ATRQ (torque arrival) is ON, otherwise OFF.</p> <p>2. The comparator has hysteresis function set by PA90.</p> <p>3. It has polarity setting function:</p> <table border="1"> <thead> <tr> <th>PA91</th> <th>PA89</th> <th>Comparator</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>>0</td> <td>Torque without direction</td> </tr> <tr> <td rowspan="2">1</td> <td>>0</td> <td>Only detect positive speed</td> </tr> <tr> <td><0</td> <td>Only detect reversal speed</td> </tr> </tbody> </table>			PA91	PA89	Comparator	0	>0	Torque without direction	1	>0	Only detect positive speed	<0	Only detect reversal speed	-300%-300%	100
PA91	PA89	Comparator															
0	>0	Torque without direction															
1	>0	Only detect positive speed															
	<0	Only detect reversal speed															
90	Hysteresis of arrival torque	<p>1.If the motor torque is bigger than PA90, the ATRQ(torque arrival) of digital output(DO) is ON, otherwise it is OFF.</p> <p>2.The comparator has hysteresis function set by PA90.</p> <p>3.It also has polarity setting function:</p> <table border="1"> <thead> <tr> <th>PA91</th> <th>PA89</th> <th>Comparator</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>>0</td> <td>Torque without direction</td> </tr> </tbody> </table>			PA91	PA89	Comparator	0	>0	Torque without direction	0-300%	5					
PA91	PA89	Comparator															
0	>0	Torque without direction															

No.	Name	Function	Rang	Default Value											
		<table border="1"> <tr> <td rowspan="2">1</td> <td>>0</td> <td>Only detect positive speed</td> </tr> <tr> <td><0</td> <td>Only detect reversal speed</td> </tr> <tr> <td></td> <td></td> <td></td> </tr> </table>	1	>0	Only detect positive speed	<0	Only detect reversal speed								
1	>0	Only detect positive speed													
	<0	Only detect reversal speed													
91	Polarity of arrival torque	<p>1.If the motor torque is bigger than PA91, the ATRQ(torque arrival) of digital output(DO) is ON, otherwise it is OFF. 2.The comparator has hysteresis function and it is set by PA90. 3.It also has polarity setting function:</p> <table border="1"> <thead> <tr> <th>PA91</th> <th>PA89</th> <th>Comparator</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>>0</td> <td>Torque without direction</td> </tr> <tr> <td rowspan="2">1</td> <td>>0</td> <td>Only detect positive speed</td> </tr> <tr> <td><0</td> <td>Only detect reversal speed</td> </tr> </tbody> </table>	PA91	PA89	Comparator	0	>0	Torque without direction	1	>0	Only detect positive speed	<0	Only detect reversal speed	0-1	0
PA91	PA89	Comparator													
0	>0	Torque without direction													
1	>0	Only detect positive speed													
	<0	Only detect reversal speed													
92	Hysteresis of zero speed detection	<p>1. The motor speed is lower than the value of this parameter, ZSP(zero speed) of digital output is ON, or else OFF. 2. The comparator has hysteresis function.</p>	0-1000 r/min	5											
94	The delay time of brake on	This parameter defines the delay time from the servomotor energized until the action(the digital output(DO) BRK is ON .	0-200ms	0											
95	Motor encoder resolution	Motor encoder resolution, $2^{17}=13107$ and the setting value 17. Please modify it carefully.	10-32	17											
96	Motor polarity	It is motor polarity. Please modify it carefully.	1-360	5											
97	Z zero offset angle	Z the zero offset angle between the signal and the motor.	0-3600	216											
99	Maximum duty cycle on brake	Maximum duty cycle on brake.	5-90	50											

4.3.5 P3 Group Of Parameters

No.	Name	Range	Default Value
P3-0	Digital Input DI1 Function	0-99	1
P3-1	Digital Input DI2 Function	0-99	2
P3-2	Digital Input DI3 Function	0-99	3
P3-3	Digital Input DI4 Function	0-99	4
P3-4	Digital Input DI5 Function	0-99	0
P3-5	Digital Input DI6 Function	0-99	0
P3-13	Low 8-bit current position value	-32768 - 32767	0
P3-14	High 8-bit current position value	-32768 - 32767	0
P3-15	Digital Input DI forced effective1	00000000-11111111	00000000
P3-16	Digital Input DI forced effective2	00000000-11111111	00000000
P3-17	Digital Input DI forced effective3	00000000-11111111	00000000
P3-18	Digital Input DI forced effective4	00000000-11111111	00000000
P3-19	Digital Input DI forced effective5	00000000-11111111	00000000
P3-20	Digital Output DO1 Function	0-99	18
P3-21	Digital Output DO2 Function	0-99	3
P3-22	Digital Output DO3 Function	0-99	5
P3-23	Digital Output DO4 Function	0-99	8
P3-30	Digital Output DO5 Function	0-2	0
P3-31	Virtual Input Terminal Control	00000000-11111111	00000000
P3-32	The State Value Of Virtual Input Terminal	0-1	0

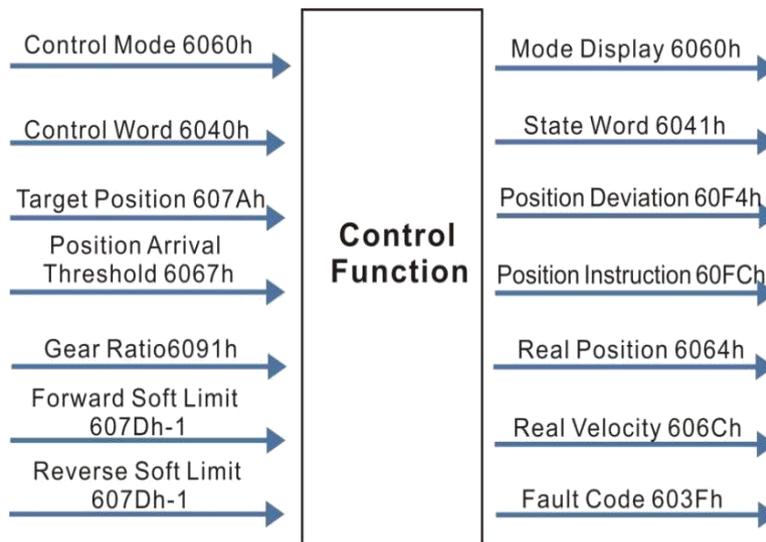
P3-33	Virtual Output Terminal Control	0000-1111	0000
P3-38	The State Value Of Virtual Output Terminal	0-99	5
P3-39	Virtual I/O Input DI1 Function	0-99	6
P3-40	Virtual I/O Input DI2 Function	0-99	7
P3-41	Virtual I/O Input DI3 Function	0-99	8
P3-42	Virtual I/O Input DI4 Function	0-99	9
P3-43	Virtual I/O Input DI5 Function	0-99	10
P3-44	Virtual I/O Input DI6 Function	0-99	11

Chapter 5 Control Mode

5.1 Cycle Synchronous Position Mode CSP

5.1.1 Controlling Diagram

In the cycle synchronization position mode, the controller completes the position instruction and then sends the planned target position 607Ah to the servo driver in the way of cycle synchronization. Position, speed and torque control are completed by the servo driver.



Pic5.1 The input/output objects of cycle position mode

5.1.2 Related Object

Control Word 6040h		
Bit	Name	Description
0	Servo ready	Bit0-bit3 are 1 which means it starts working.
1	Turn on the main circuit	
2	Emergency stop	
3	Servo running	
Remark: CSP mode only supports absolute location instructions.		

State Word 6041h		
Bit	Name	Description
10	Target arrival	0:Not reached the target position; 1: Reached the target position.
11	Software Internal Position Overrun	0:The location instruction is not in excess of the limit. 1:Position instruction overrun
12	Follow instructions from the station	0:The station does not follow the instruction. 1:The station follow the instruction.
13	Following error	0:There is no fault with excessive position deviation. 1:Excessive position deviation fault occurs.

5.1.3 Recommended Configuration

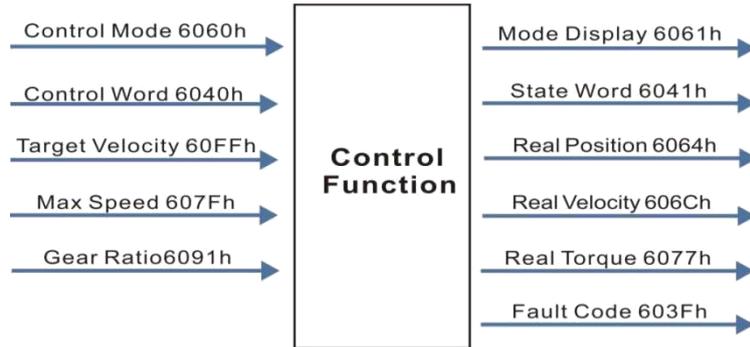
In cycle position mode,the basic configuration is as follows:

RPDO	TPDO	Remark
6040: control word	6041: state word	must choose
607A: target position	6064: position feedback	must choose
6060: mode selection	6061: running mode display	optional

5.2 Cycle Synchronous Velocity Mode CSV

5.2.1 Controlling Diagram

In the cycle synchronization velocity mode, the controller periodically synchronizes the calculates target speed 60FF to the servo driver. Speed and torque adjustment is performed by the servo drive.



Pic 5.2 The input/output objects of cycle velocity mode

5.2.2 Basic Configuration

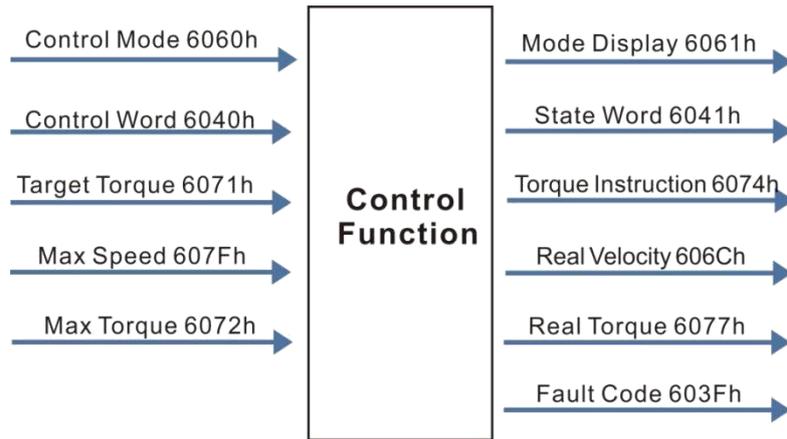
In cycle velocity mode, the basic configuration is as follows:

RPDO	TPDO	Remark
6040: control word	6041: state word	must choose
60FF: target velocity		must choose
	6064: position feedback 606C: speed feedback	optional
6060: mode selection	6061: running mode display	optional

5.3 Cycle Synchronous Torque Mode CST

5.3.1 Controlling Diagram

In this mode, the controller sends the calculated target torque 6071 h periodically and synchronously to the servo drive, and the torque adjustment is performed by the servo drive itself. When the speed reaches the limit, it will enter the speed regulation stage.



Pic 5.3 The input/output objects of cycle torque mode

5.3.2 Basic Configuration

In cycle torque mode, the basic configuration is as follows:

RPDO	TPDO	Remark
6040: control word	6041: state word	must choose
6071: target torque		must choose
	6064: position feedback 606C: speed feedback 6077: torque feedback	optional
6060: mode selection	6061: running mode display	optional

5.4 Profile Position Mode PP

5.4.1 Related Object

This mode is mainly used for point-to-point positioning applications. In this mode, the controller gives the target position (absolute or relative), the speed of the position curve, acceleration and deceleration. The trajectory generator of the servo will generate the target position curve instruction according to the setting and the drive completes position control, speed control, torque control.

Control Word 6040		
Bit	Name	Description
0	Servo ready	4 bits are 1 which means the servo current main circuit is charging and in enabling state.
1	Turn on the main circuit	
2	Emergency stop	
3	Servo running	
4	New target position	From 0 to 1 , it indicates that there is a new location.
5	Updated immediately	0:Not immediately 1:Immediately
6	Absolute position / relative position	0:The target position is absolute position. 1:The target position is relative position.
State Word 6041		
Bit	Name	Description
10	Target arrival	0:Not reached the target position. 1:Reached the target position.
12	Target position updated	0:The target location can be updated. 1:The target location can not be updated.
13	Following error	0:There is no fault with excessive position deviation. 1:Excessive position deviation fault occurs

Index	Sub Index	Name	Visit	Data Type	Unit	Range	Default Value
603F	00	error code	RO	UINT16	-	0-65535	0
6040	00	control word	RW	UINT16	-	0-65535	0
6041	00	status word	RO	UINT16	-	0-65535	0
6060	00	operator mode	RW	INT8	-	0-10	8
6061	00	mode display	RO	INT8	-	0-10	0

6062	00	position instruction	RO	INT32	instruction unit	-	-
6063	00	position feedback	RO	INT32	encoder unit	-	-
6064	00	position feedback	RO	INT32	instruction unit	-	-
6067	00	position arrival threshold	RW	UINT32	encoder unit	0-65535	130
606C	00	actual velocity	RO	INT32	instruction unit/s	-	0
6077	00	actual torque	RO	INT16	0.1%	-3000~3000	0
607A	00	target location	RW	INT32	instruction unit	-231~231-1	0
607F	00	maximum speed	RW	UINT32	instruction unit/s	0-232-1	60000 0
6081	00	profile velocity	RW	UINT32	instruction unit/s	0~232-1	25000 0
6083	00	profile acceleration	RW	UINT32	instruction unit/s ²	0~232-1	25000 0
6091	02	axial resolution	RW	UINT32	-	1~232-1	10000
60FC	00	position instruction	RO	INT32	encoder unit	-	-
60E0	00	forward torque limit	RW	UINT16	0.1%	0-3000	3000
60E1	00	reverse torque limit	RW	UINT16	0.1%	0-3000	3000

5.4.2 Position Curve Generator

1. Control instruction timing1---update immediately:

a) The upper computer first updates other properties of displacement instruction as needed(acceleration time 6083 h, deceleration time 6084 h, profile velocity 6081h and target displacement 607Ah).

b) The upper computer sets the bit4 of 6040h from 0 to 1, which suggests that there are new displacement instructions from the station that need to be enabled.

c) From the station after receiving the rising edge of the bit4 of 6040h, it is determined whether the new displacement instruction can be received:

If the initial state of bit5 of 6040 is 1, and the bit12 of 6041 h is 0, the new displacement instruction 1 can be received from the station. After receiving the new displacement instruction from the station, 6041 of the bit12 is set from 0 to 1, indicating that the new displacement instruction 1 has been received and that the current slave station is unable to continue to receive the new displacement instruction. In immediate update mode, once the new displacement instruction is received (6041 bit12 is changed from 0 to 1), the servo immediately executes the displacement instruction.

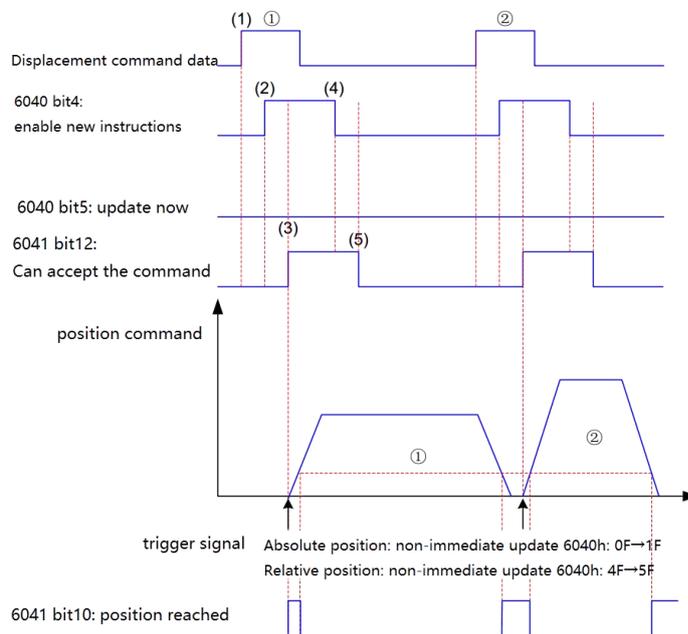
d) After the upper computer receives the bit12 from the state word 6041 h of the station to 1, the displacement instruction data can be released, and the bit4 of the control word 6040 h can be set from 1 to 0, indicating that there is no new position instruction at present.

Because the bit4 of 6040h is valid along the change, this operation does not interrupt the displacement instruction being executed.

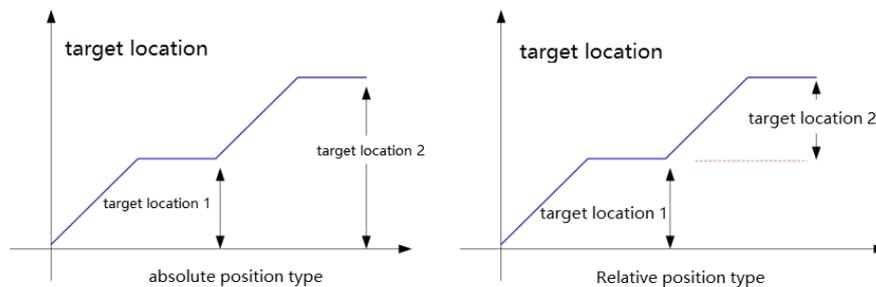
e) When the bit4 of the control word 6040h is detected from 1 to 0, the bit12 of the status word 6041 h can be set from 1 to 0, indicating that the slave station is ready to receive new displacement instructions.

In the immediate update mode, when the bit4 of the control word 6040h is detected from the station from 1 to 0, the bit12 of 6041 h is always cleared to zero.

In the immediate update mode, a new displacement instruction 2 is received during the execution of the displacement instruction 1 of current stage, and the unexecuted displacement instruction in 1 is not discarded. For the relative position instruction, after the second displacement instruction is located, the total displacement increment = 1 target position increment 607Ah +2 target position increment 607Ah. For absolute position instruction, after the second displacement instruction is located, the absolute position = the target position of 2 is 607Ah.



Pic 5.5 Non-immediate update sequence diagram and motor operation curve



Pic 5.6 The difference between absolute position and relative position instruction

5.4.3 Recommended configuration

In profile position mode, the basic configuration is as follows:

RPDO	TPDO	Remark
6040: control word	6041: state word	must choose
607A: target position	6064: position feedback	must choose
6081: profile speed		optional
6083: profile acceleration		optional
6060: mode selection	6061: running mode display	optional

5.5 Profile Velocity Mode PV

5.5.1 Related Objects

In this mode, the controller sends the target speed and acceleration to the servo drive. Speed and torque adjustment is performed by the servo drive.

Control Word 6040		
Bit	Name	Description
0	Servo ready	4 bits are 1, indicating that the servo is charged by the current main circuit and is in an enabling state.
1	Turn on the main circuit	
2	Emergency stop	
3	Servo running	
Status Word 6041		
Bit	Name	Description
10	Target arrival	0: Not reach the target speed. 1: The target speed has arrived.
11	Software internal limit	0: Not reach soft limit. 1: Reach the soft limit.

Index	Sub Index	Name	Visit	Data Type	Unit	Range	Default Value
603F	00	error code	RO	UINT16	-	0-65535	0
6040	00	control word	RW	UINT16	-	0-65535	0
6041	00	status word	RO	UINT16	-	0-65535	0
6060	00	operator mode	RW	INT8	-	0-10	8
6061	00	mode display	RO	INT8	-	0-10	0
607F	00	max speed	RW	UINT32	/s	0-232-1	60000 0
6083	00	profile acceleration	RW	UINT32	instruction unit/s	0-232-1	25000 0
6063	00	position feedback	RO	INT32	encoder unit	-	-
6064	00	position feedback	RO	INT32	instruction unit	-	-
60FF	00	target speed	RW	INT32	instruction	-231~231 -1	0
60E0	00	forward torque limit	RW	UINT16	0.1%	0-3000	3000
60E1	00	reverse torque limit	RW	UINT16	0.1%	0-3000	3000
606C	00	actual speed	RO	INT32	instruction unit/s	-	0
6077	00	actual torque	RO	INT16	0.1%	-3000~ 3000	0

Remark: When the acceleration of the profile is calculated, the velocity can be added only if the converted value is greater than 1.

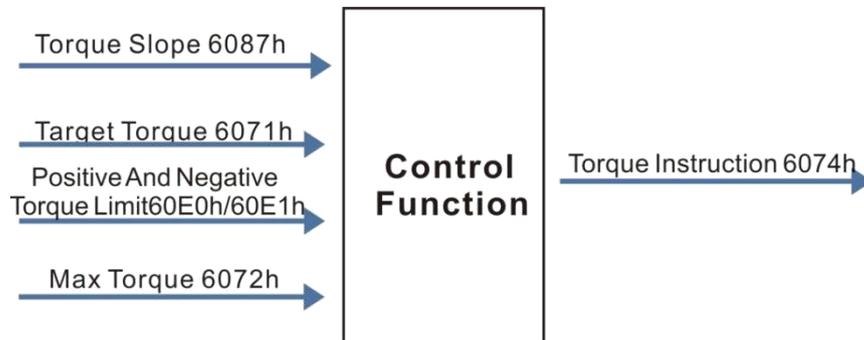
5.5.2 Recommended Configuration

In profile speed mode, the basic configuration is as follows:

RPDO	TPDO	Remark
6040: control word	6041: status word	must choose
607A: target position		optional
	6064: position feedback 606C: speed feedback	optional
60FF: target speed		must choose
6083: profile acceleration		optional
6060: mode selection	6061: running mode display	optional

5.6 Profile Torque Mode PT

In this mode, the upper controller sends the target torque 6071 h and the torque ramp constant 6087h to the servo driver, and the torque adjustment is performed by the servo. When the speed reaches the limiting value, it will enter the speed regulation stage.



Pic5.7 Profile torque mode input/ output block diagram

5.6.1 Related Objects

Control Word 6040		
Bit	Name	Description
0	Servo ready	4 bits are 1, indicating that the servo is charged by the current main circuit and is in an enabling
1	Turn on the main circuit	

2	Emergency stop	state.
3	Servo running	

State Word 6041		
Bit	Name	Description
10	Target arrival	0: Not reached the target position. 1: Reached the target position.
11	Soft internal limit	0: Not reached the soft limit. 1: Reached the soft limit.

Index	Sub Index	Name	Visit	Data Type	Unit	Range	Default Value
603F	00	error code	RO	UINT16	-	0-65535	0
6040	00	control word	RW	UINT16	-	0-65535	0
6041	00	status word	RO	UINT16	-	0-65535	0
6060	00	operator mode	RW	INT8	-	0-10	8
6061	00	mode display	RO	INT8	-	0-10	0
606C	00	actual velocity	RO	INT32	/s	-	-
6071	00	target torque	RW	INT16	0.1%	-3000~3000	0
6072	00	maximum torque	RW	UINT16	0.1%	0-3000	3000
6074	00	torque instruction	RO	INT16	0.1%	-	-
6077	00	actual torque	RO	INT16	0.1%	-	-
6087	00	torque slope	RW	UINT32	0.1%/ms	0-232-1	1

5.6.2 Recommended configuration

In profile torque mode, the basic configuration is as follows:

RPDO	TPDO	Remark
6040: control word	6041: status word	must choose
6071: target torque		must choose
6087: torque slope		
	6064: position feedback 606C: speed feedback 6077: torque feedback	optional
6060: mode selection	6061: running mode display	must choose

5.7 Homing Mode HM

The homing mode is used to find the mechanical origin and locate the position relationship between the mechanical origin and the mechanical zero.

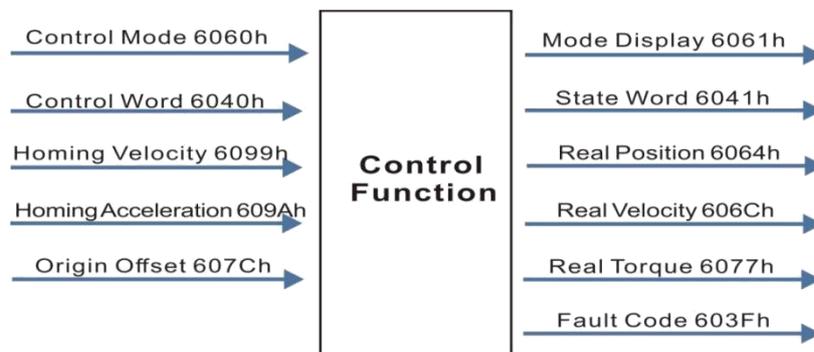
Mechanical origin: a fixed position on the machine, which can correspond to a certain origin switch and the Z signal of the motor.

Mechanical zero: mechanical absolute zero position..

When the homing is finished, the stop position of the motor is the mechanical origin, and the 607Ch automatically sets the relationship between the mechanical origin and the mechanical zero:

Mechanical origin = mechanical zero +607Ch (origin offset)

When 607Ch=0, the mechanical origin coincides with the mechanical zero.



Pic 5.8 Input and output object of origin regression mode

Control Word 6040		
Bit	Name	Description
0	Servo ready	4 bits are 1, indicating that the servo is charged by the current main circuit and is in an enabling state.
1	Turn on the main circuit	
2	Emergency stop	
3	Servo running	
4	Homing	0-->1: Homing. 1-->0: The drive received the homing signal.

Control Word 6041		
Bit	Name	Description
10	Target Arrival	0: Not reached the target position. 1: Reached the target position.
12	Homing	0: Homing has been finished and it can receive zeroing signal. 1: It is homing and can not receive homing signal.
13	Homing Fault	0: There is no fault in zeroing. 1: Homing timeout or excessive deviation error.

The basic configuration is as follows:

RPDO	TPDO	备注
6040: control word	6041: status word	must choose
6098: homing mode		optional
6099-01: search limit switch signal speed		optional
6099-02: search homing signal speed		optional
609A: homing acceleration		optional

	6064: position feedback 606C: speed feedback 6077: torque feedback	optional
6060: mode selection	6061: running mode display	must choose

Note:When to calculate the homing acceleration, it needs to be converted to r/min/ms. Only if the converted value is greater than 1 can the homing speed be changed.

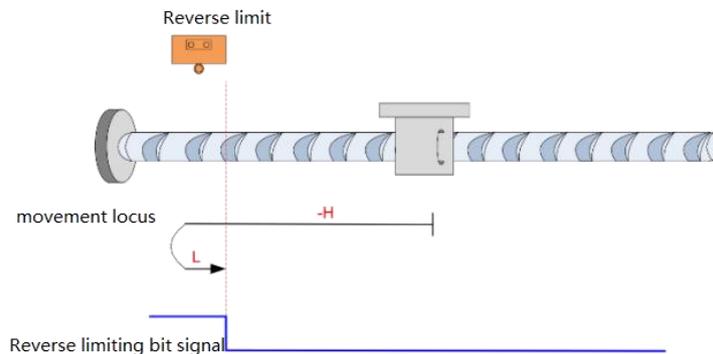
The introduction of homing mode currently supported by C100E :

1) 6098h=17

Mechanical origin: reverse over-range switch.

Deceleration point: reverse over-range switch.

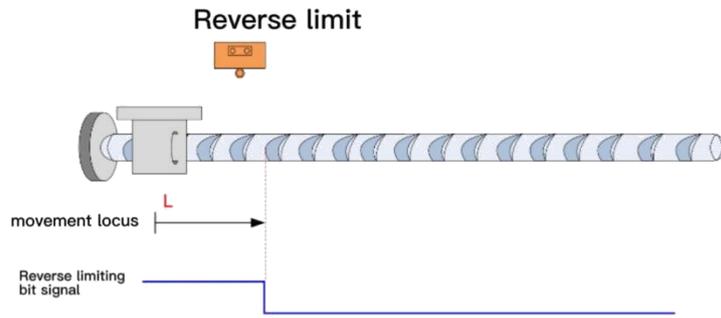
a) The deceleration point signal is invalid when homing starts.



Note: In the figure, "H" stands for high speed 6099-1h and "L" stands for low speed 6099-2 h.

When homing starts and N-OT =0, it reverses with high speed.. When it encounters N-OT rising edge, it decelerates, reverses and forwards with low speed.. When encountering the falling edge of N-OT, it stops running.

b) The deceleration point signal is effective when homing starts.



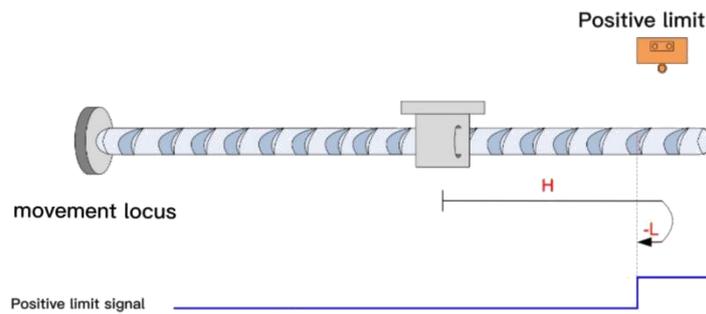
When homing starts and N-OT=1, it starts to homing at low speed directly, and stops at the falling edge of N-OT.

2) 6098h=18

Origin: forward over-range switch..

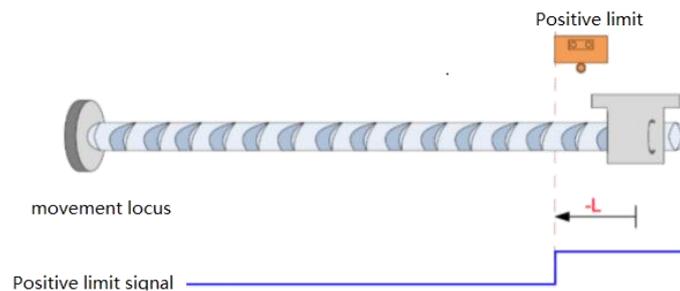
Deceleration point: forward over-range switch..

a) The deceleration point signal is invalid when homing starts.



When homing starts and P-OT=0, it forwards with high speed. When encountering the rising edge of P-OT, it decelerates, reverses and operates at low speed. When encountering the falling edge of P-OT, it stops.

b) The deceleration point signal is effective when homing starts.



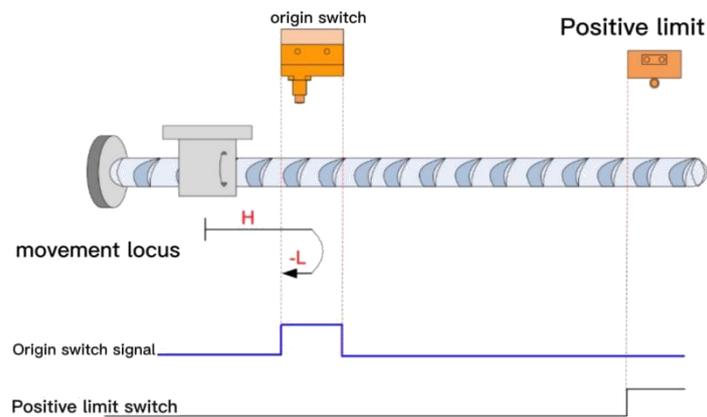
When homing starts and P-OT=1, it reverses with low speed directly. And when encountering the falling edge of P-OT, it shuts down.

3) 6098h=23

Origin: Origin switch.

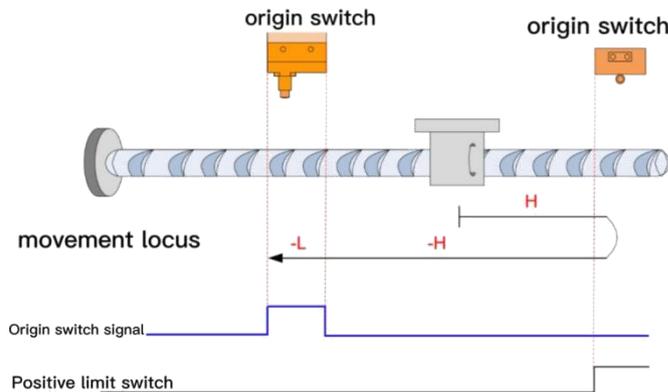
Deceleration point: Origin switch.

The deceleration point signal is invalid when zeroing starts and it did not encounter the forward limit switch.



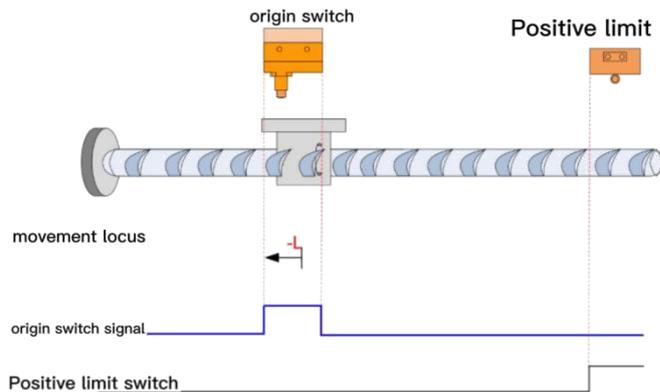
When homing starts and HW=0, it forwards with high speed and does not encounter limit switch. When encountering rising edge of HW, it slows down and reverse with low speed. When encountering the falling edge of HW, it shuts down.

The deceleration point signal is invalid when returning to zero starts, and the forward limit switch is encountered.



When homing starts and HW=0, it forwards with high speed and encounters limit switch. Then it automatically reverses and runs at high speed. When encountering rising edge of HW, it slows down and keeps reversing with low speed. When encountering the falling edge of HW, it shuts down.

The deceleration point signal is effective when returning to zero starts.



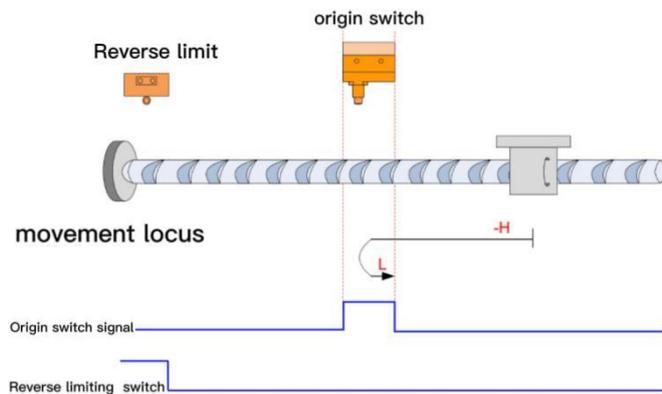
When homing starts and HW=1, it starts zeroing at a reverse low speed directly. When encountering the falling edge of HW, it shuts down.

4) 6098h=27

Origin: Origin switch.

Deceleration point: Origin switch.

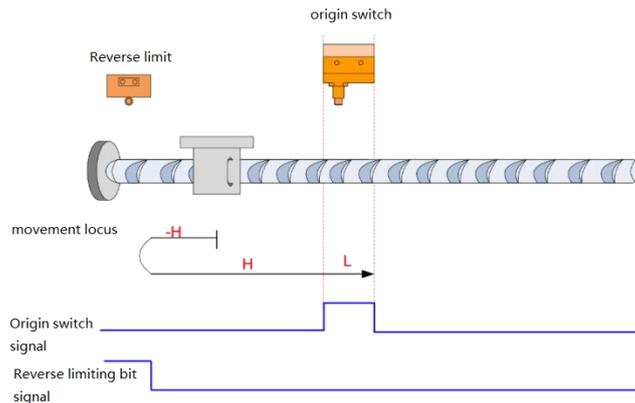
The deceleration point signal is invalid when returning to zero starts and did not encounter limit switch.



When homing starts and HW=0, it returns to zero with reversed high speed

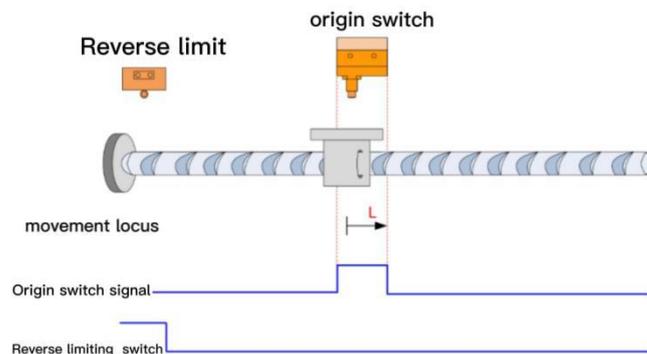
and does not encounter limit switch. When encountering rising edge of HW, it slows down, reverse and forwards with low speed. When encountering the falling edge of HW, it shuts down.

The deceleration point signal is invalid when returning to zero starts and the reverse limit switch is encountered.



When homing starts and HW=0, it returns to zero with reversed high speed and encounters limit switch. Then it automatically reverses and runs at high speed. When encountering rising edge of HW, it slows down and keeps forwarding with low speed. When encountering the falling edge of HW, it shuts down.

The deceleration point signal is valid when zeroing.



When homing starts and HW=1, it forwards with low speed directly. When encountering the falling edge of HW, it shuts down.

5) 6098h=35

The current position is clear ed.

5.8 Probe function

The probe function is the position latch function. It can latch the position information (command unit) when the external DI signal changes.

Supports 2 probes to be enabled at the same time, can record the position information corresponding to the rising edge and falling edge of each probe signal at the same time, and can latch 4 position information at the same time. Probe 1 selects the pulse port as the probe signal, and probe 2 selects the direction port as the probe signal.

0x60B8	00	Probe function	RW	Uint16	-	0~65535	0
0x60B9	00	Probe Status	RO	Uint16	-	-	0
0x60BA	00	Latch position of rising edge of probe 1	RO	int32	Instruction unit	-	0
0x60BB	00	Latch position of falling edge of probe 1	RO	int32	Instruction unit	-	0
0x60BC	00	Latch position of rising edge of probe 2	RO	int32	Instruction unit	-	0
0x60BD	00	Latch position of falling edge of probe 2	RO	int32	Instruction unit	-	0

5.8.1 Set probe function 0x60B8

Bit	description
0	Probe 1 Enable: 0-- Probe 1 is disabled 1-- Probe 1 enable
1	Probe 1 trigger mode 0—Single trigger, trigger only when the trigger signal is valid for the first time 1—Continuous trigger
2	Probe 1 trigger signal selection 0—Pulse port input signal

	1—Reserved, not currently supported
3	NA
4	Probe 1 rising edge enable 0-- The rising edge is not latched 1-- Rising edge latch
5	Probe 1 falling edge enable 0-- Falling edge is not latched 1-- Falling edge latch
6	NA
7	NA
8	Probe 2 Enable: 0-- Probe 2 is disabled 1-- Probe 2 enable
9	Probe 2 trigger mode 0—Single trigger, trigger only when the trigger signal is valid for the first time 1—Continuous trigger
10	Probe 2 trigger signal selection 0—Pulse port input signal 1—Reserved, not currently supported
11	NA
12	Probe 2 rising edge enable 0-- The rising edge is not latched 1-- Rising edge latch
13	Probe 2 falling edge enable 0-- Falling edge is not latched 1-- Falling edge latch
14	NA
15	NA

5.8.2 Read probe status 0x60B9

Bit	description
0	Probe 1 Enable: 0-- Probe 1 is not enabled 1-- Probe 1 enable
1	Probe 1 rising edge latch execution 0-- rising edge latch not executed 1-- Rising edge latch has been executed
2	Probe 1 falling edge latch execution 0-- Falling edge latch not executed 1-- Falling edge latch has been executed
3	NA
4	NA
5	NA
6	NA
7	Probe 1 trigger signal monitoring 0—pulse input port is low level 1—Pulse input port high level
8	Probe 2 Enable: 0-- Probe 1 is not enabled 1-- Probe 1 enable
9	Probe 2 rising edge latch execution 0-- rising edge latch not executed 1-- Rising edge latch has been executed
10	Probe 2 falling edge latch execution 0-- Falling edge latch not executed 1-- Falling edge latch has been

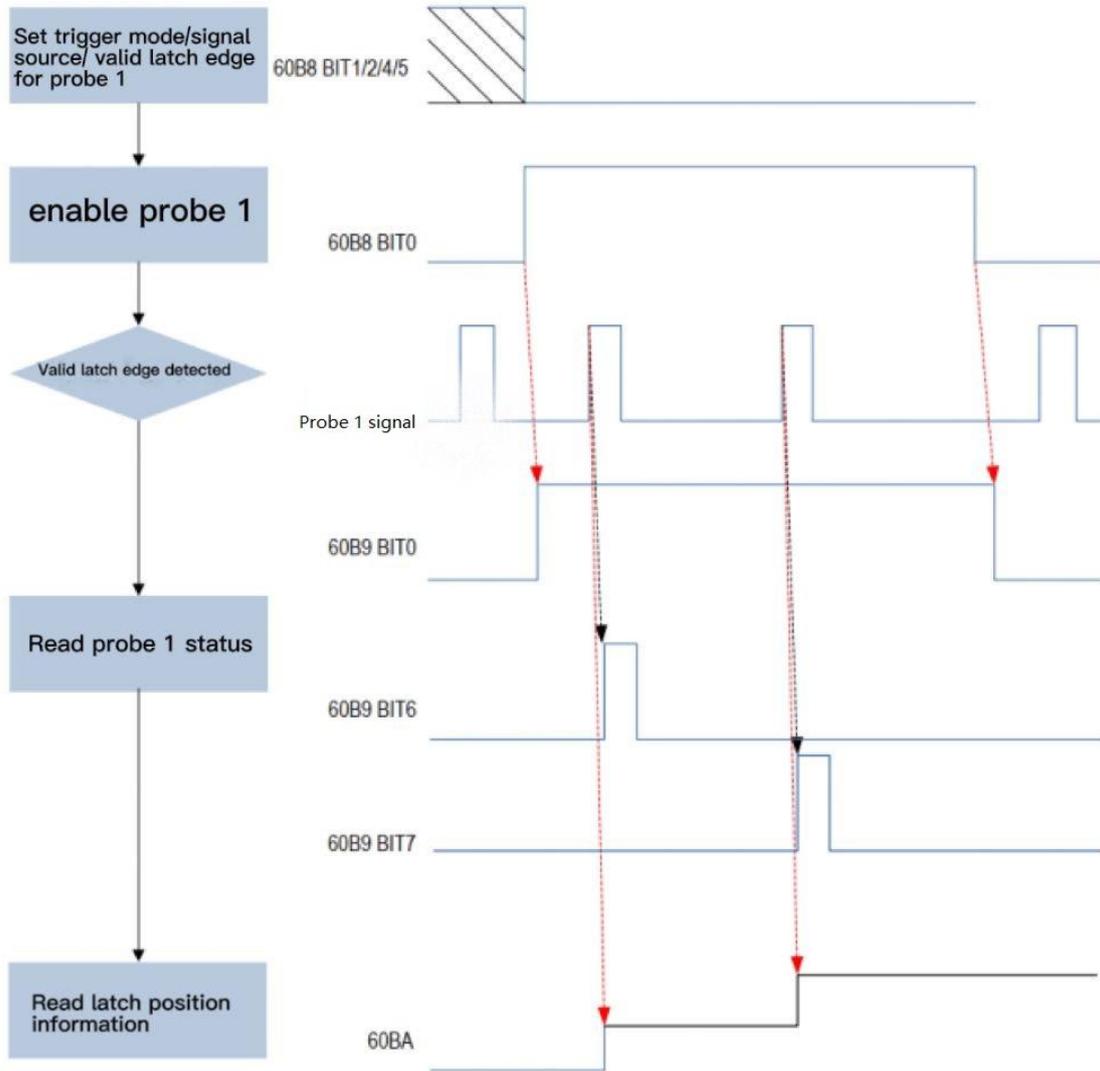
	executed
11	NA
12	NA
13	NA
14	NA
15	Probe 2 Trigger Monitoring 0—The direction input port is low level 1—Direction input port high level

5.8.3 Probe Latch Position

The 4 position information of the probe is recorded in objects 0x60BA~0x60BD respectively. In this example, if it is judged that the probe 1 rising edge position latch function has been executed, the position information can be read by reading 0x60BA (probe 1 rising edge position feedback latch value, command unit).

Example: The trigger signal is the pulse port input probe 1 trigger, the rising edge is latched, and the trigger is continuous. The function setting and status feedback sequence of the probe are shown in the figure

be



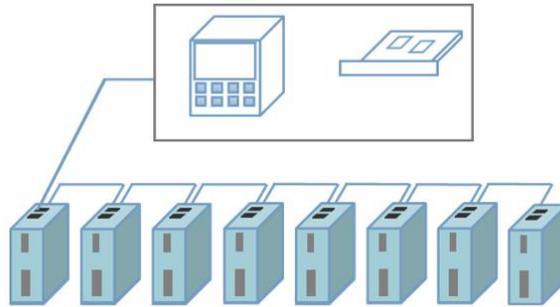
Chapter 6 Fault Code

Symbol	Name	Code 603Fh	Resettable Or Not
1	Over speed	0x8400	Yes
2	Bus overvoltage fault	0x3210	Yes
3	Bus undervoltage fault	0x3220	Yes
4	The position deviation is too large	0x8611	Yes
5	Over heat	0x4210	Yes
6	Speed amplifier saturation	0x1000	Yes
7	Drive inhibit exception	0x1000	Yes
8	Position deviation counter overflow	0x1000	Yes
9	Encoder signal error difference signal detection error	0x7305	Yes
11	Hardware (short) protection IPM smart module failure	0x5400	No
12	Over current	0x2220	No
13	Overload	0x3230	Yes
14	Brake circuit failure	0x1000	Yes
15	Encoder count exception	0x7305	Yes
18	Relay fault	0x1000	Yes
19	The pulses input when the brake is delayed.	0x7110	Yes
20	Parameter storage exception	0x6320	No
21	FPGA module failure	0x7500	No
23	Ad sampling module failure	0x0FFF	No
29	User-defined overload alarm	0x3230	Yes
30	Encoder Z-signal error	0x7305	No
31	Encoder UVW signal error	0x0FFF	No

32	UVW signal has full height or full low level.	0x0FFF	No
33	Save-line encoder signal error	0x7305	No
34	Encoder signal error	0x7305	No
36	The full time charging for the encoder is too long.	0x7305	No
42	AC undervoltage fault	0x3220	No
44	AC phase deficiency	0x3130	No
47	Over voltage happens when powering on	0x3210	No
50	No communication link established.	0x7305	No
51	Communication interrupt	0x7305	No
52	Battery voltage alarms but it can also be used, it needs to be replaced	0x7305	Yes
53	Battery voltage error and is unavailable to use. It must be replaced.	0x7305	Yes
54	Information of multiple cycles is needed to be reset due to other errors which are not battery error	0x7305	Yes
55	Three consecutive errors in CRC effect verification.	0x7305	No
56	The received MODBUS frame data is too long.	0x7305	No
57	Serial communication abnormal error	0x7305	Yes
58	The counting of single turn encoder happened error and it needs to be turned on and restarted.	0x7305	No
59	Validation error occurred in CF domain	0x7305	No
60	50us interrupt timeout	0x1000	No
61	Slave station communication anomaly	0x7500	Yes
62	Exceed the soft limit	0x5443(Positive)/ 0x5444(Negative)	Yes

Chapter 7 C100E Application Description

7.1 Drive Wiring



Pic 7.1 Drive wiring diagram

Note:

- 1) When the EtherCAT interface is connected to other drives, it must put in with ECAT IN and put out with ECAT OUT.
- 2) Cables and conductors shall be fixed to avoid close proximity to the heat sink of the drive and motor, so as to avoid heat and reducing the insulation performance.

7.2 The Example Of Cooperating With TwinCAT Master Station

1) Install TwinCAT software

The twinCAT software in the official website of Beckhoff company supports up to 32-bit win7 systems and does not support win7 64-bit systems.

Windows xp system: it is recommended install tcacat_2110_2230

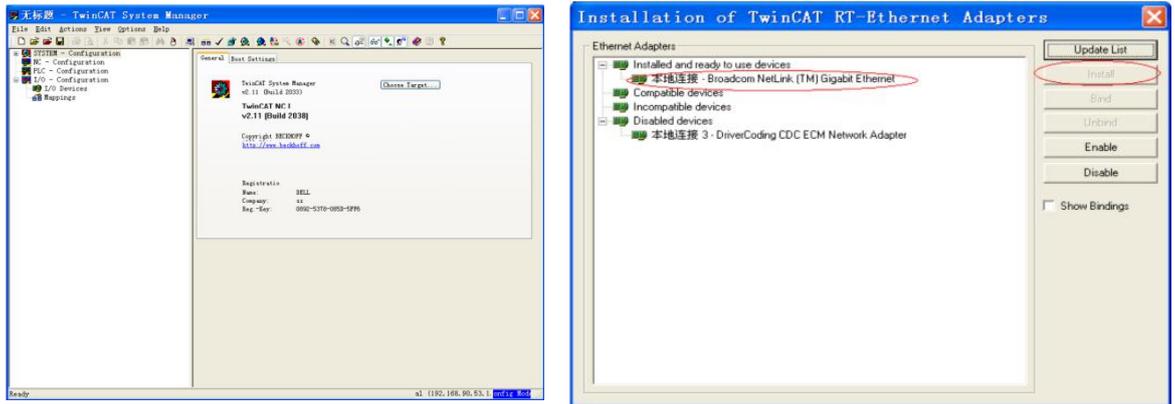
Windows 7 32-bit system: it is recommended to install tcacat_2110_2248

Note: About the network card, please choose a 100 megabit Ethernet card with a Intel chip. Other brands of network cards, there is a risk of not supporting EtherCAT operation.

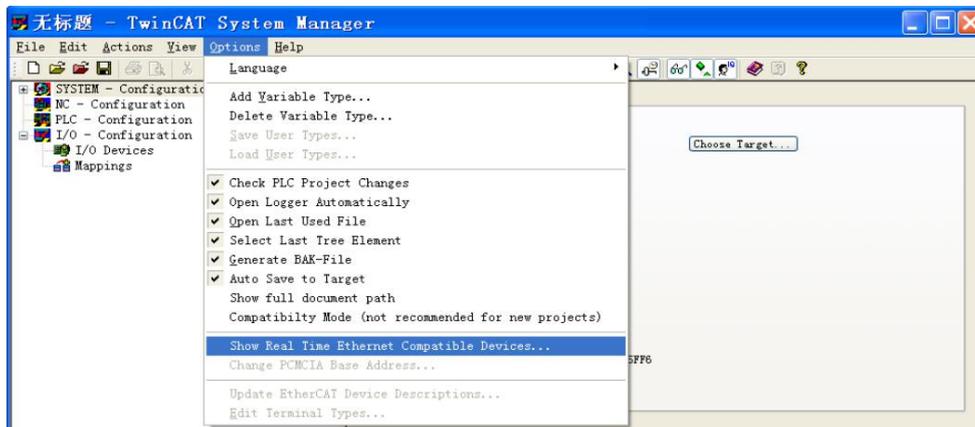
2) Copy the EtherCAT configuration file (DVS_ETHCAT_V1.0.xml) of

ECAT100E to the TwinCAT installation directory:\TwinCAT\IO\EtherCAT.

3) Open TwinCAT.



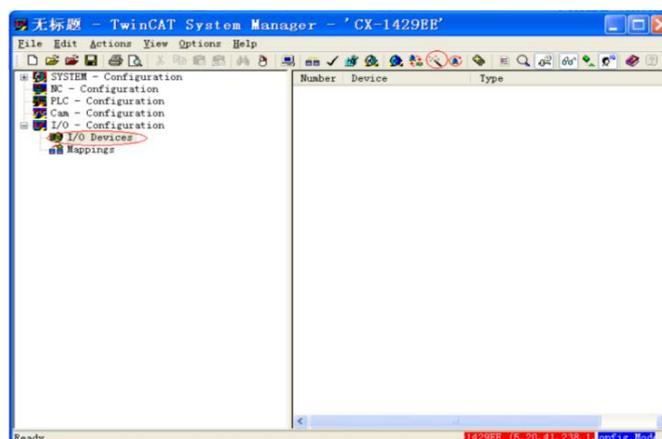
4) Install TwinCAT network card drive.



Open the menu "Show Real Time Ethernet Compatible Devices" as above. Jump out of the following dialog box and click "install" after selecting the local site in the "Incompatble devices" column. After the installation is complete, the network card that has been installed appears in the "Instaled and ready to use devices" column.

5) Device search

After you create a new project page, right-click I / O Devices to start searching for the device, as shown in the following figure:



6) Select "OK"(确定).



7) Select "OK".



8) Select "Yes"("是").



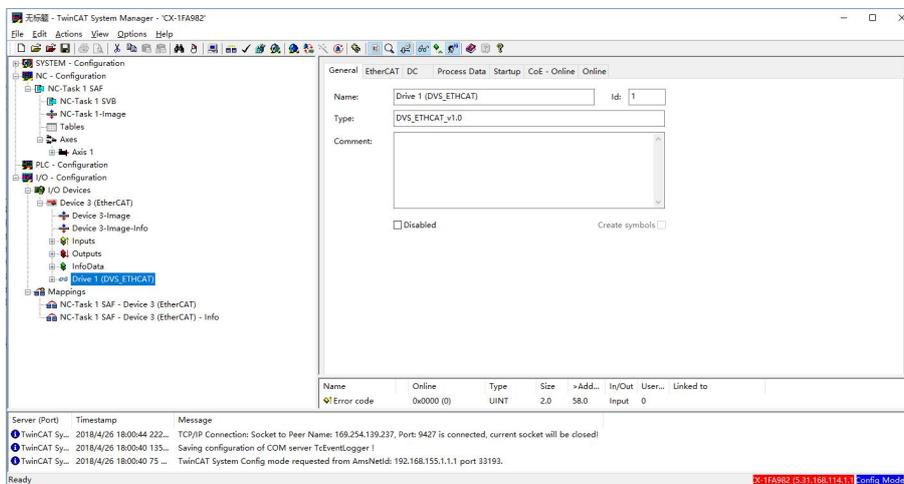
9) Select "Yes"("是").



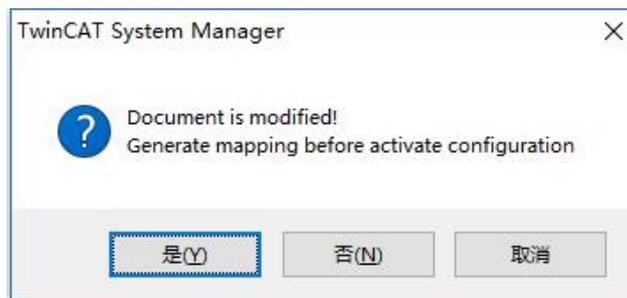
10) Select "No"("否").



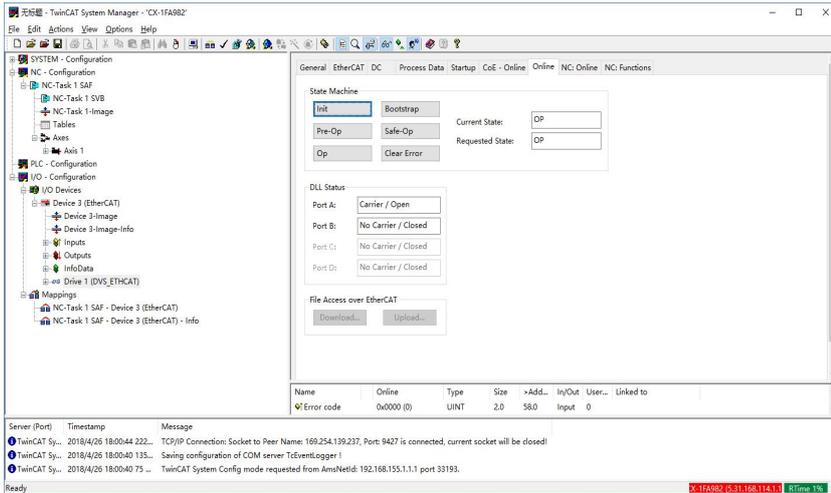
11) The device has been finished to search here as shown in the following figure:



12) According to the default configuration, please click activate and switch to run mode: click “Yes”.

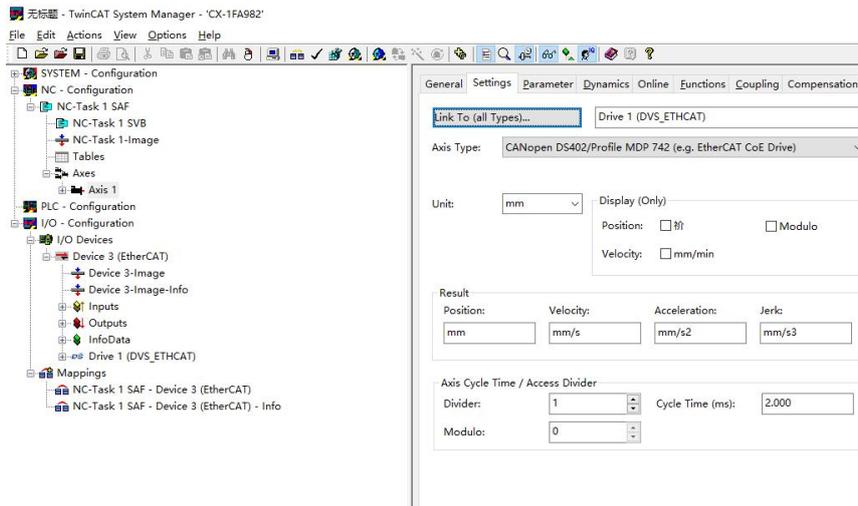


13) According to the default configuration, click activate and switch to run mode: click “Yes”. After "OK", on the "Online" interface, you can see the device entering the OP state, while the running lamp of the driver is kept in the green state.

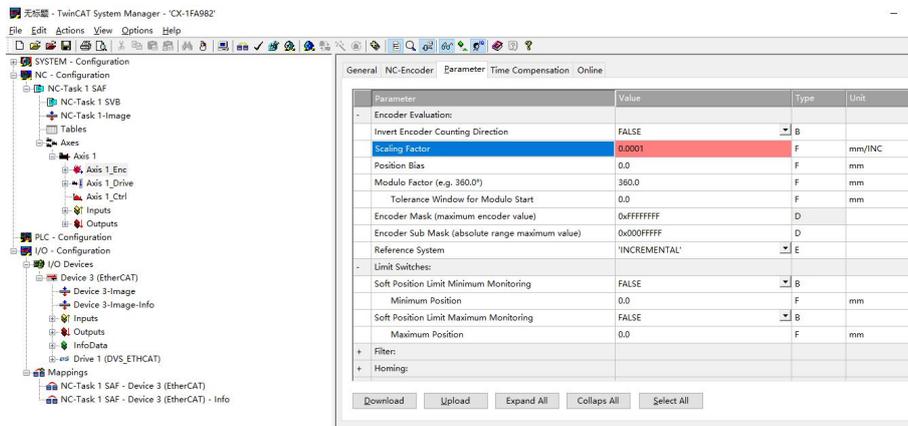


14) Control servo through NC or PLC program.

a) Set units when testing, units : mm.



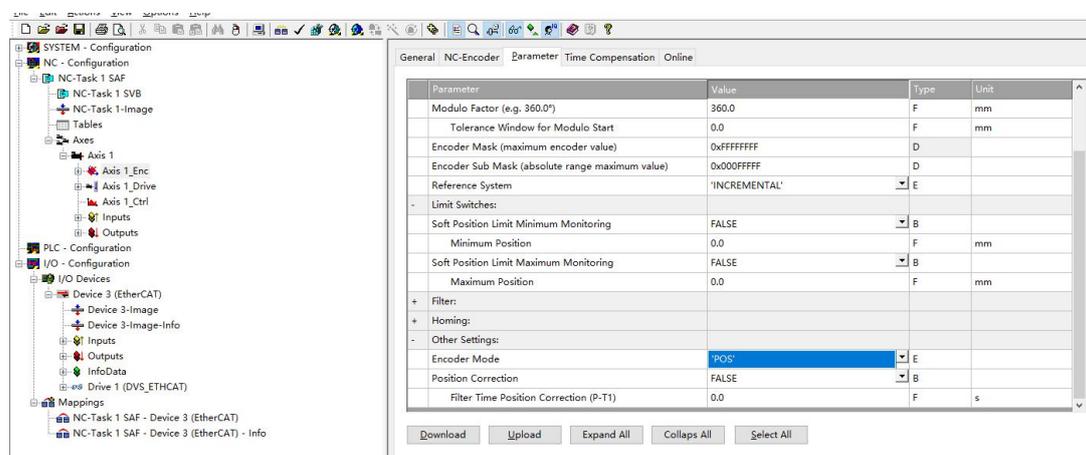
b) Set quantitative(scaling) factor.



Scaling Factor: The distance corresponding to the encoder pulse for each position feedback. For example, if the motor rotates a roll with 1,311,072 pulses, and if the motor rotates a roll for 1 mm, the ScalingFactor is $1/131072=0.00000762939453125$ mm/Inc.

Tip: for no-load debugging, it is customary to set a roll to 60mm, so that the speed of 1mm/s is equivalent to 1 lap / min. Because the rated speed unit of the motor is rpm, debugging with rpm as the speed unit is more intuitive. So the quantitative factor is set to: $60 / 131072$.

c) Set encoder feedback mode to pos.



Other settings:

Encoder mode and there are three options:

- Pos: The encoder is only used to calculate the position and is used when the position loop is in the drive.
- PosVelo: The encoder is only used to calculate position and speed when the position ring is used in TWinCAT NC.
- PosVeloAcc: TWinCAT NC uses encoders to determine position, speed and acceleration.
- Pos: The upper computer is only responsible for sending the position instruction. The servo runs in the periodic synchronous position mode (6060 =8), and the position loop is calculated internally.

- PosVelo: The upper computer establishes the position loop and outputs the speed instruction. The servo runs in the cycle synchronous velocity mode (6060 =9).

d) Point motion test

Temporarily shield system deviation. Click "Set" to jump out of the dialog box, and then click "All". After that, the servo drive is enabled. Through F1 ~F4, it can realize point motion operation.

