

**DELIXI**

**CDS500-EC总线型伺服驱动器  
使用说明书  
(EtherCAT通讯规格篇)**

(版本:A0)

安装、使用产品前，请仔细阅读使用说明书，并妥善保管、备用。

**德力西(杭州)变频器有限公司**  
**DELIXI HANGZHOU INVERTER CO., LTD.**

## To users

- Precautions for on-site installation and operation respected user:

Thank you for choosing Delixi (Hangzhou) Inverter Co., Ltd. CDS500-ECbus type Servo driver, in order for you to use this product better, please pay attention to the following points:

1. Before the servo drive is installed and debugged, please tighten the components, especially the connecting bolts of the wires. Failure to tighten them will cause the connection to heat up and cause a fire.
2. The design of the installation site should be reasonable, and a good ventilation environment should be maintained.
3. The incoming and outgoing power cables of the servo drive cannot be reversely connected, as the reverse connection will cause the servo drive to explode.
4. Directly use the main circuit of the servo drive to switch on and off the motor to control the start and stop of the motor, which will cause the servo drive to fail frequently.
5. The servo drive should be configured according to the actual load power (load working current) during model selection. When there is a heavy load, the model selection can be enlarged by one to two gears. If the model selection is too small, the servo drive will skip the current flow. or overload fault.
6. The protection level of the servo drive is IP10, that is, it can protect the solid foreign objects with a diameter of 12.5mm or more from entering completely, and there is no waterproof protection.
7. For the servo drive that has been stored for more than half a year, the voltage should be slowly increased through the voltage regulator when it is powered on, otherwise there is a danger of electric shock and explosion.
8. When the connection between the servo drive and the motor exceeds 50 meters, it is necessary to increase the AC output reactor, otherwise the servo drive and the motor are in danger of being damaged.

Dear users, in order to ensure the long-term safe operation of the products you are using, you should carefully check the products and conduct regular power outage cleaning and maintenance. If you encounter difficulties during the inspection process, please call and write to inform our company, our service number is:0571-85243785, we will send professional and technical personnel to the site according to the difficulties you encounter to assist your unit in handling and ensure the safe and reliable operation of the product.

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# 1 Introduction

This chapter mainly introduces **EtherCAT Slaves Communication** reference materials, etc., as well as relevant introductory guidance for users.

## 1.1 References

This product is designed with reference to the following documents:

serial number	document name	illustrate	Version	date
ETG. 1000. 2	ETG1000_2P_S_R_V1i0i0_EcatPhysicalLayerExtP. pdf	Physical Layer Services and Protocol Specifications	V100	10/03/2017
ETG. 1000. 3	ETG1000_3_CHN_EcatDLLServices_V1i0i2_C01	Data Link Layer Service Definition	V102	
ETG. 1000. 4	ETG1000_4_CHN_EcatDLLProtocols_V1i0i2_C01	Data Link Layer Protocol Specification	V102	
ETG. 1000. 5	ETG1000_5_CHN_EcatALServices_V1i0i2_C01	Application layer service definition	V102	
ETG. 1000. 6	ETG1000_6_CHN_EcatALProtocols_V1i0i2_C01	Application Layer Protocol Specification	V102	
ETG. 1020	ETG1020_v1i1i0_S_D_Protocol Enhancements	Protocol Enhancements	V100	
ETG. 2000	ETG2000_S_D_V1i0i9i3_EtherCAT Slave Information Specification	Slave Information Specification	V1093	
	EtherCAT_Communication_EN	EtherCATcommunication		
	LAN9253 DataSheet. pdf	Slave Controller Data Sheet		

Note: For the differences between the contents of this manual and the reference materials in the list, the contents of this manual shall prevail.

## 1.2 Getting Started

byPPTake the control mode as an example to operate on the motor.

### 1.2.1 ready to connect

1.The slave device (bus servo drive) is connected to the master through a network cable.

2.EtherCAT communication requires the master and slave terminals to load the ESI file (XML format) that records the slave station information. The ESI file provided by our company needs to be saved in the ESI folder designated by the master station.

3. To set Station Alias, there are two main ways to address the network of slave devices:

**automatic allocation:**The master station automatically assigns addresses to the slave stations in the order of the nodes, and sets the value of the Configured Station Alias (0004h) of the SII = 0 (default mode).

**Manual assignment:**The slave station can modify the SSI Station alias address by modifying the SDO 3811 Station addr (slave station address) method, and the range of Station Alias can be set to be 0 to 65535.

### 1.2.2 connectprocess

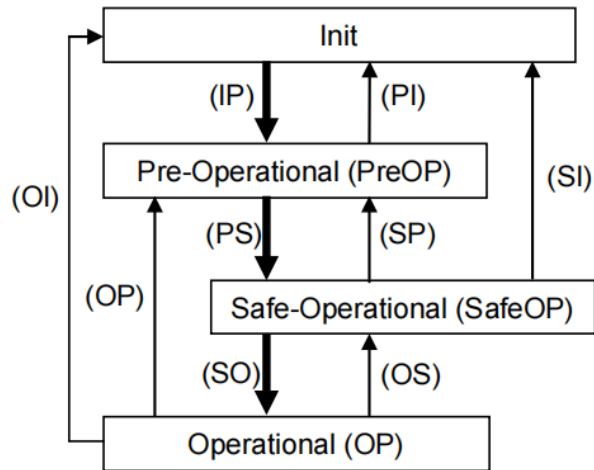
Take DC mode as an example,

1. Before establishing communication, select the communication period (500us, 1ms, 2ms, 4ms),

2. Execute the setting of the ESC register (SyncManager for MailBOX, etc.), and the slave ESM state machine transitions from Init to PreOP.

3. Execute ESC register (DC, PDO with SyncManager, etc.) setting, the slave station ESM state machine transitions from PreOP to SafeOP.

4. ESM then transitions from SafeOP to OP, as shown in the figure below.



EtherCAT application layer state transition diagram

### 1.2.3 Set the PDO object

Under PP control, an example of absolute positioning operation setting shown below is described below.

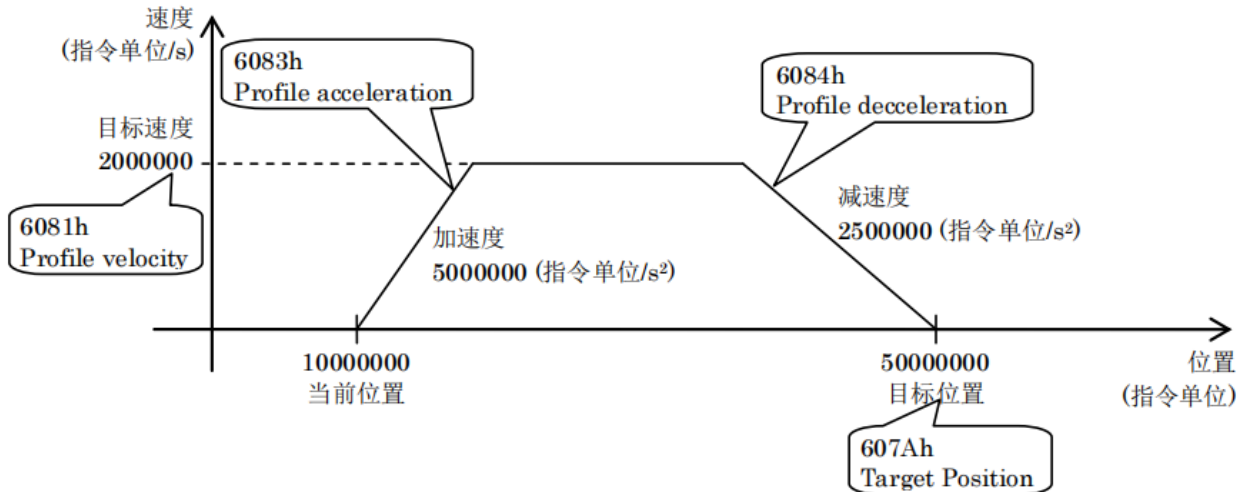
Change the control mode (6060h: Modes of operation). Please set 6060h=1 (PP).

Change the target position (607Ah: Target Position). Please set 607Ah=50000000 (command unit). In addition, when the setting of 607Dh (Software position limit) is enabled, the motion range is limited.

Change the target velocity (6081h: Profile velocity). Please set 6081h=2000000 (command unit/s). In addition, the operating speed is limited according to the set values of 607Fh (Max profile velocity) and 6080h (Max motor speed).

Change the acceleration (6083h: Profile acceleration). Please set 6083h=5000000 (command unit/s<sup>2</sup>). In addition, the speed is limited according to the set value of 60C5h (Max acceleration).

Change deceleration (6084h: Profile deceleration). Please set 6084h=2500000 (command unit/s<sup>2</sup>). In addition, the operation speed is limited according to the set value of 60C6h (Max deceleration).



#### 1. 2. 4 Motor action

EtherCAT communication is the so-called PDS (Power Drive Systems) state, which represents the state of the servo drive.

The PDS can be changed through object 6040h (Controlword), and the status can be referenced through 6041h (Statusword). The change command must be sent to the next state only after confirming that the state has changed through 6041h (Statusword).

First, transition the PDS state from Switch on disabled to Ready to switch on. Set 6040h=0006h (2: Shutdown), and confirm that 6041h is changed from xx40h to xx21h.

Second, change the PDS state from Ready to switched on to Switched on. Set 6040h=0007h (3: Switch on), and confirm that 6041h is changed from xx21h to xx23h.

Again, change the PDS state from Switched on to Operation enabled. Set 6040h=000Fh (4: Enable operation), and confirm that 6041h is changed from xx23h to xx27h. When 6041h=xx27h, it becomes the state of servo enable ON.

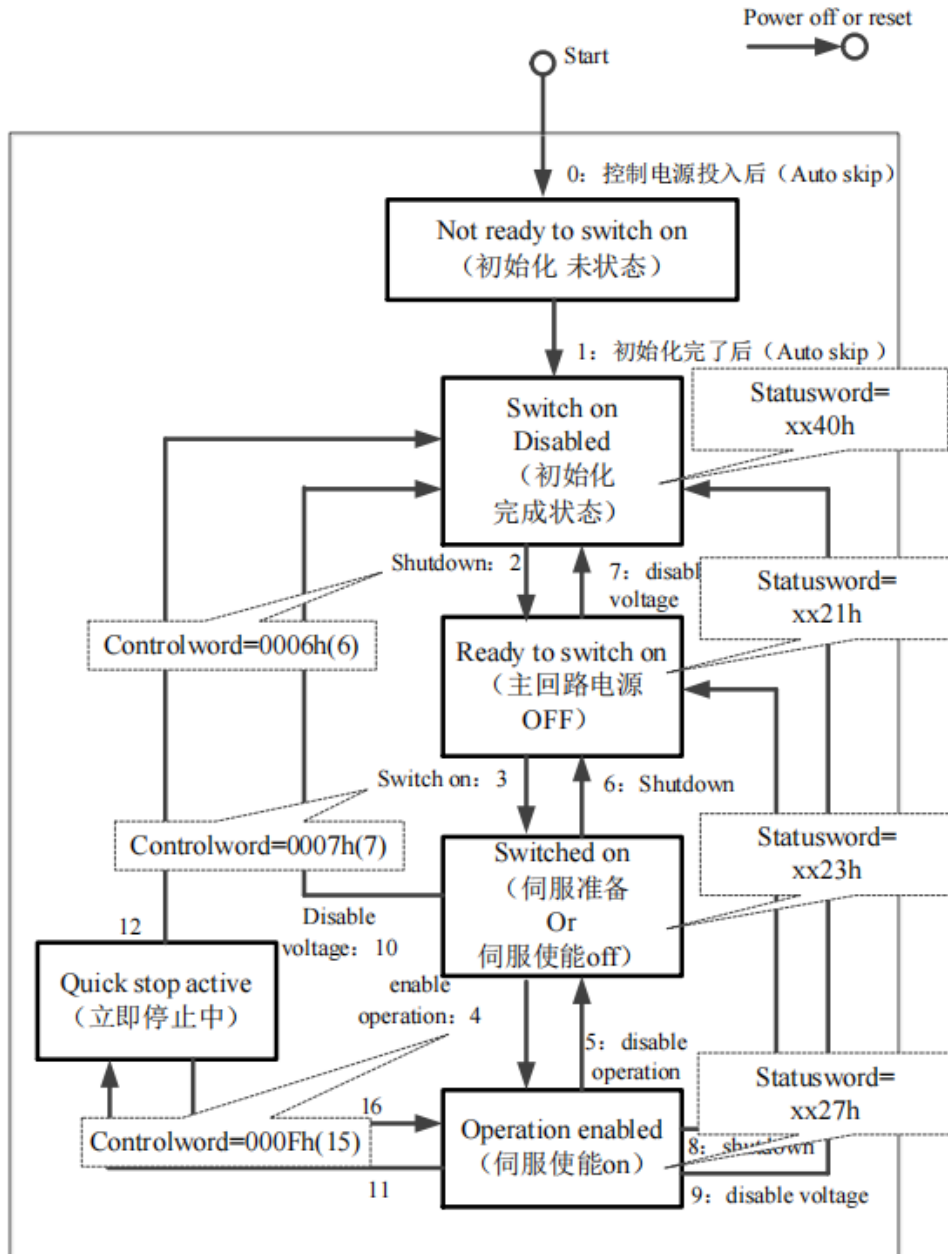
To start pp operation, change bit4 (new set point) of 6040h from 0 to 1.

Bit5 (change set immediately), bit6 (absolute/relative), and bit9 (change on set-point) are set to 0.

Please set 6040h=001Fh. The motor starts to move.

Turn off the servo enable by changing the PDS state from Operation enabled to Switched on. Set 6040h=0007h (5: Disable operation), and confirm that 6041h changes from xx27h to xx23h.





### 1.2.5 When the motor does not move

If there is no servo enable ON, the PDS state inside the drive, before the transition, the master station may be sending a command to the next state. After confirming that the PDS state transition is completed, the transition command to the next state is sent.

If the servo is ON but the motor does not operate, the object setting may be incorrect and the setting may be omitted. Please confirm the target setting value. In particular, it is necessary to confirm whether there is a restriction due to the maximum value of the setting object 6080h (Max motor speed) and the motion range of the setting object 607Dh (Software position limit). When bit11 (internal limit active) of 6041 (Statusword) is 1, internal limit is applied. Please rule out internal constraints.

If an alarm occurs, refer to the "EtherCAT-related protection functions" in this document or

the "protection function/warning function" of the servo bottom alarm.  
Rule out the cause of the alarm.

## 2. System overview stated

### 2.1 Overview of EtherCAT

EtherCAT is Ethernet for Control Automation Technology abbreviation. Yes Beckhoff Automation GmbH Open network communication between master and slave developed for real-time Ethernet, by ETG (EtherCAT Technology Group) to manage.

Note: This product complies with the EtherCAT Conformance Test

EtherCAT® is registered trademark and patented technology,  
licensed by Beckhoff Automation GmbH, Germany.

The logo for EtherCAT Conformance tested. It features the word "EtherCAT" in a bold, sans-serif font, with a registered trademark symbol (®) to the right. Below "EtherCAT" is the phrase "Conformance tested" in a smaller, regular font. To the right of the text is a stylized graphic consisting of two horizontal arrows: the top one points to the right and the bottom one points to the left, both with a slight upward curve at their ends.

### 2.2 EtherCAT Networking Composition

EtherCAT The networking connection form is linear connection, the master station (FAA local area network system consisting of a controller) and multiple slave stations are cascaded through network cables. The bus topology probably simplifies the wiring work and reduces the installation workload.

EtherCAT Wire connection is recommended for bus wiring.



**Notice:**The two communication network ports of the servo drive follow the principle of "bottom in and top out", that is, the master station must communicate with the first servo LIN1. The network port below the port is connected, and then the network port above the first servo is connected to the network port below the second servo, and so on. The number of nodes that the slave can connect to depends on the performance of the master station, when selecting. Please refer to the matching master station specifications to confirm.

In the process of communication transmission, it will inevitably be affected by the surrounding electromagnetic environment. It is recommended that users use industrial-grade Cat5e network cables.

## 2.3 List of specifications

project	Specification
physical layer	100BASE-TX (IEEE802.3)
rate	100[Mbps] (full duplex)
network topology	Line

connecting cables	JC-CATwisted pair (shielded twisted pair)		
cable length	longest between nodes50m		
communication port	2 Port (RJ45)		
EtherCATNetwork port indicator	[Run]Running instructions [L/A IN]Port 1 Link/Activation Indication [L/A OUT]Port 2 Link/Activation Indication		
Station Alias (ID)	Predetermined area:0~65535 Set address:3811h		
Explicit Device ID	not support		
Mailbox Agreement	COE (CANopen Over EtherCAT)		
SyncManager	4		
FMMU	3		
Mode of Operation control mode	Mode of operation		
	Location	CSP	Cyclic synchronous position mode (Cyclic position control mode)
		PP	Profile position mode (Profile position control mode)
		HM	Homing mode (Back to origin control mode)
		CSV	Cyclic synchronous velocity mode (Cyclic speed control mode)
		PV	Profile velocity mode (Profile speed control mode)
	torque	CST	Cyclic synchronous torque mode (Cyclic torque control mode)
		TQ	Torque profile mode (Profile torque control mode)
Touch Probe	none		
samestep signal	DC (SYNCOevent synchronization) SM (SMevent synchronization) FreeRun (free running, asynchronous)		
Cyclic time (DC communication cycle)	250,500, 1000, 2000, 4000[ μ s]		
communication object	SDO [service data object], PDO [process data object]		
Maximum number of assigned PDOs in a single station	TxPDO:4 [indivual] RxPDO:4 [indivual]		

The maximum number of bytes of a single station PDO	TxPDO:24[byte] RxPDO:24[byte]
SDO information	SDOrequest andSDOanswerinformation

### 3. EtherCAT Communication Specifications

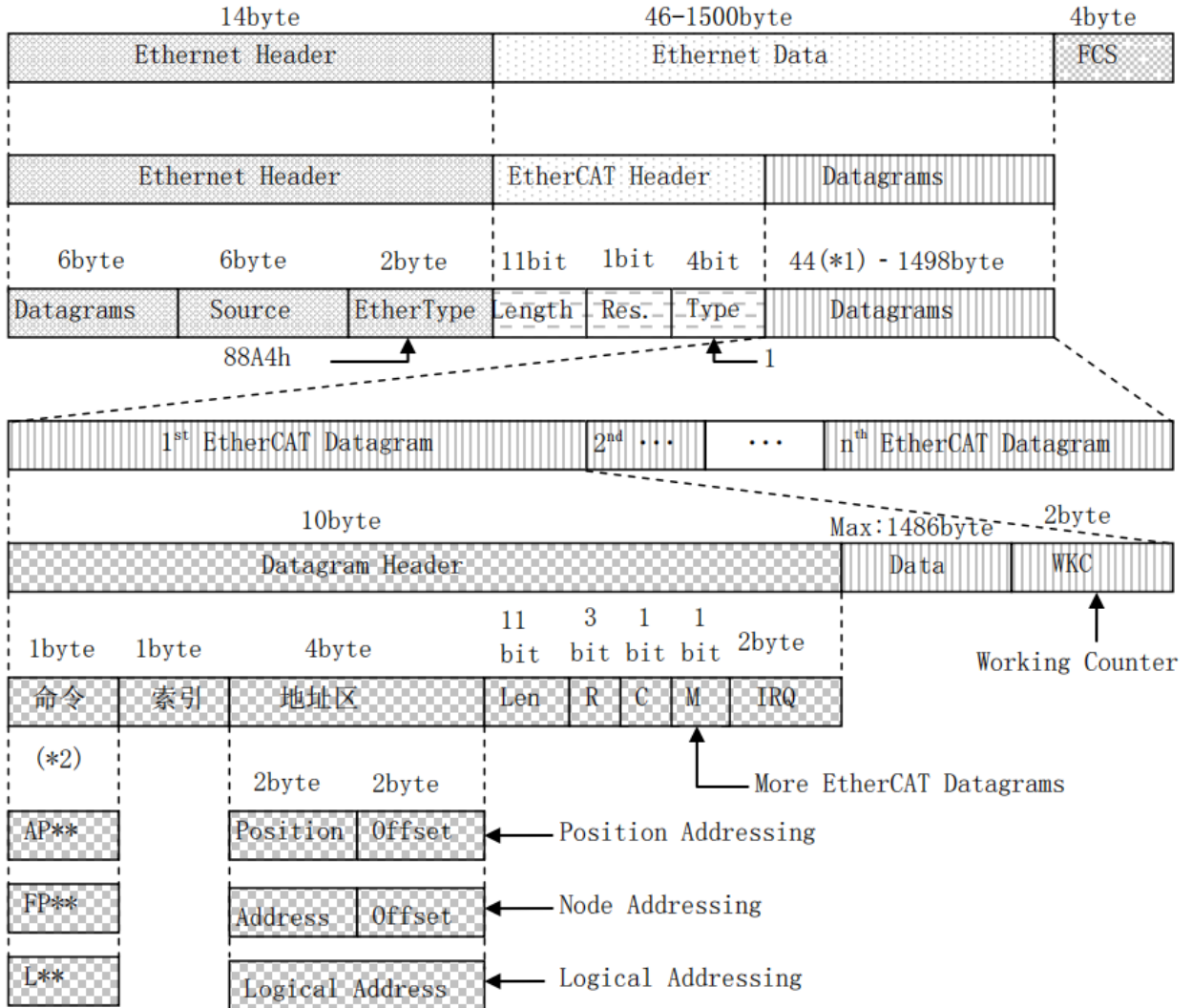
#### 3.1 EtherCAT Frame Structure

EtherCAT is based on Ethernet Real-time controllable industrial communication protocol, only for IEEE 802.3 Ethernet Specifications have been expanded without making any changes to the basic structure, so the standard can be transferred Ethernet data within the frame.

because Ethernet Header of EtherType for "88A4h", so the following Ethernet Data as EtherCAT frame to process.

EtherCAT frame is made by EtherCAT frame header and 1 more than EtherCAT Sub-packet composition, further subdivided EtherCAT sub-message. only EtherCAT frame header Type=1 of EtherCAT frame according to ESC to be processed.

The EtherNet/EtherCAT frame structure is as follows:

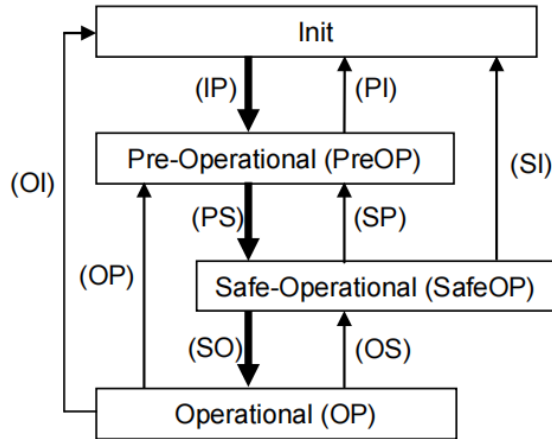


\*1: When the Ethernet frame is shorter than 64 bytes, 1 to 32 bytes are added. (Ethernet Header + Ethernet Data + FCS)

### 3.2 State Machine ESM (EtherCAT State Machine)

EtherCAT state machine (ESM) is responsible for coordinating the state relationship between the master and slave applications at initialization and runtime.

The state change request is executed by the master station, the master station makes a control request to the application layer service, the latter generates application layer control events in the slave station, and the slave station responds through the local application layer state write service after the state change request succeeds or fails Application layer control services. If the state change fails, the slave maintains the state and sets an error flag. The picture below is ESM state transition diagram of



※In the state transition diagram (IP), etc. are the abbreviations for state transitions.

(IP):Init→Pre-Operational

(PS):Pre-Operational→Safe-OperationalWait

Init: initialization state;

Pre-Operational: pre-operational state;

Safe-Operational: safe operation state;

Operational: Operating status;

Slave state machine state	action	communication action		
		SDO (Postbox) send and receive	PDO sending letter	PDO receive letters
Init	Initialization of the communication unit, the state where SDO (mailbox) and PDO cannot send and receive messages	-	-	-
Pre-Operational (referred to asPreOP)	SDO (mailbox) can send and receive messages	Yes	-	-
Safe-Operational (referred to asSafeOP)	Only SDO (mailbox) sending and receiving, PDO sending	Yes	Yes	-
Operational (referred to asOP)	SDO (mailbox) sending and receiving, PDO sending and receiving are all feasible states	Yes	Yes	Yes

**Note:**The access from the master to the ESC register is independent of the above table and can be done at any time.

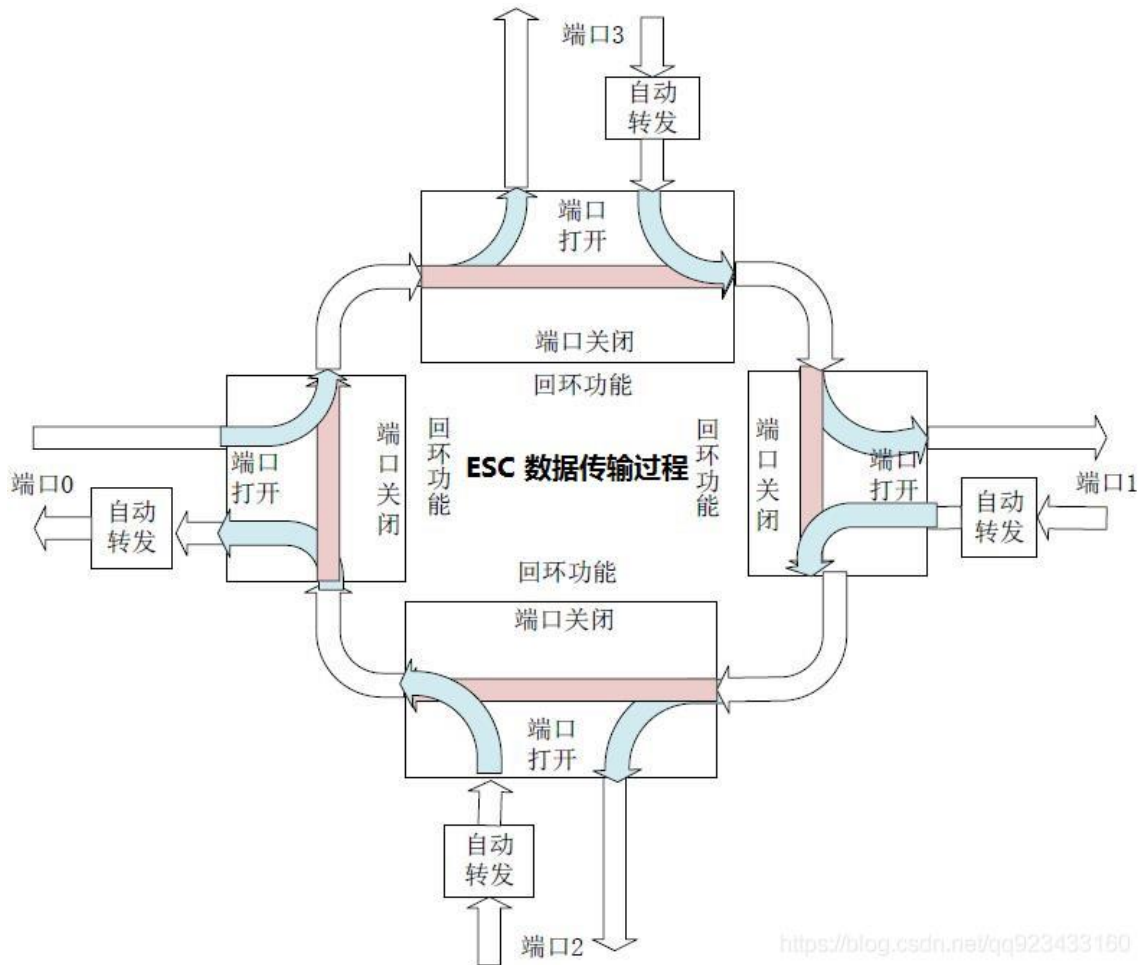
PDO (Process Data Object) process data object is used to transmit periodic communication data.

SDO (Service Data Object) service data object is used to transmit aperiodic communication data.

Commands or interface operations during ESM state switching may cause abnormal communication errors.

### 3.3 Slave Controller ESC

#### 3.3.1 ESC Overview



Each ESC has four data transceiver ports, and all can receive and transmit Ethernet frames.

If the four ports of the ESC have external links, the internal transmission sequence of the data frame is fixed as port 0 → port 3 → port 1 → port 2 → port 0, if a port has no external link, the port is closed, the data frame will automatically skip this port and transfer to the next port that is not closed. It is precisely because of the four-port transceiver mechanism of the ESC that it can form a variety of physical topologies, such as tree, line and star structures.



### 3.3.2 address space

CDS500-EC has 16Kbyte physical address space. initial 4Kbyte (0000h~0FFFh) is used as register space, the middle 4Kbyte (1000h~1FFFh) is the process data, as RAM The field is used, and the high 4Kbyte (2000h~3FFFh) is used by the system control status register. For register details, please refer to IP (ET1810/ET1811/ET1812) data sheet.

ESC register byte address	length (Byte)	illustrate	Initial value*1
<b>ESC Information (Slave Controller Information)</b>			
0000h	1	Type Register	04h
0001h	1	Revision Register	02h
0002h-0003h	2	Build Register	0040h
0004h	1	FMMUs Supported Register	03h
0005h	1	SyncManagers Supported Register	04h
0006h	1	RAM Size Register	08h
0007h	1	Port Descriptor Register	0fh
0008h-0009h	2	ESC Features Supported Register	184h
<b>Station Address (station address)</b>			
0010h-0011h	2	Configured Station Register	-
0012h-0013h	2	Configured Station Alias Register	-
<b>Write Protection (write protection)</b>			
0020h	1	Write Register Enable Register	-
0021h	1	Write Register Protection Register	-
0030h	1	ESC Write Register Enable Register	-
0031h	1	ESC Write Register Protection Register	-
<b>Data Link Layer (data link layer)</b>			
0040h	1	ESC Reset ECAT Register	-
0041h	1	ESC Reset PDI Register	-
0100h-0103h	2	ESC DL Control Register	-
0108h-0109h	2	Physical Read/Write Offset Register	-
0110h-0111h	2	ESC DL Status Register	-
<b>Application Layer (application layer)</b>			
0120h-0121h	2	AL Control Register	-
0130h-0131h	2	AL Status Register	-
0134h-0135h	2	AL Status Code Register	-
0138h	1	RUN LED Override Register	-
0139h	1	ERR LED Override Register	-
<b>PDI (Process Data Interface) (Handling data interface)</b>			
0140h	1	PDI Control Register	-

0141h	1	ESC Configuration Register	-
0142h-0143h	2	ASIC Configuration Register	-
0144h-0145h	2	RESERVED Register	-
0150h	1	PDI Configuration Register	-
0151h	1	Sync/Latch PDI Configuration Register	-
<b>Interrupts (interrupt)</b>			
0200h-0201h	2	ECAT Event Mask Register	-
0204h-0207h	2	AL Event Mask Register	-
0210h-0211h	2	ECAT Event Request Register	-
0220h-0223h	2	AL Event Request Register	-
ESC register byte address	length (Byte)	illustrate	Initial value*1
<b>Error Counters (error counter)</b>			
0300h-0307h	2	RX Error Counter Registers	-
0308h-030Bh	2	Forwarded RX Error Counter Registers	-
030Ch	1	ECAT Processing Unit Error Counter Register	-
030Dh	1	PDI Error Counter Register	-
030Eh	1	PDI Error Code Register	-
0310h-0313h	2	Lost Link Counter Registers	-
0300h-0307h	2	RX Error Counter Registers	-
<b>Watchdogs (watchdog)</b>			
0400h-0401h	2	Watchdog Divider Register	
0410h-0411h	2	Watchdog Time PDI Register	
0420h-0421h	2	Watchdog Time Process Data Register	
0440h-0441h	2	Watchdog Status Process Data Register	
0442h	1	Watchdog Counter Process Data Register	
0443h	1	Watchdog Counter PDI Register	
<b>EEPROM Interface (EEPROM interface)</b>			
0500h	1	EEPROM Configuration Register	
0501h	1	EEPROM PDI Access State Register	
0502h-0503h	2	EEPROM Control/Status Register	
0504h-0507h	2	EEPROM Address Register	
0508h-050Fh	2	EEPROM Data Register	
0500h	1	EEPROM Configuration Register	
0501h	1	EEPROM PDI Access State Register	
<b>FMMU (Fieldbus Memory Management Unit)</b>			
0600h-067Fh	2	FMMU[2:0] Registers (8x16 bytes)	
+0h-3h	4	FMMUx Logical Start Address Register	
+4h-5h	2	FMMUx Length Register	
+6h	1	FMMUx Logical Start Bit Register	
+7h	1	FMMUx Logical Stop Bit Register	

+8h-9h	2	FMMUx Physical Start Address Register	
+Ah	1	FMMUx Physical Start Bit Register	
+Bh	1	FMMUx Type Register	
+Ch		FMMUx Activate Register	
+Dh-Fh	3	FMMUx Reserved Register	
<b>SyncManager (Sync Manager)</b>			
0800h-083Fh		SyncManager[3:0] Registers (8x8 bytes)	
+0h-1h	2	SyncManager x Physical Start Address Register	
ESC register byte address	length (Byte)	illustrate	Initial value*1
+2h-3h	2	SyncManager x Length Register	
+4h	1	SyncManager x Control Register	
+5h	1	SyncManager x Status Register	
+6h	1	SyncManager x Activate Register	
+7h	1	SyncManager x PDI Control Register	
<b>DC - Receive Times (DC clock, receive time)</b>			
0900h-0903h	4	Receive Time Port 0 Register	
0904h-0907h	4	Receive Time Port 1 Register	
0908h-090Bh	4	Receive Time Port 2 Register	
<b>DC - Time Loop Control Unit</b>			
0910h-0917h	8	System Time Register	
0918h-091Fh	8	Receive Time ECAT Processing Unit Register	
0920h-0927h	8	System Time Offset Register	
0928h-092Bh	4	System Time Delay Register	
092Ch-092Fh	4	System Time Difference Register	
0930h-0931h	4	Speed Counter Start Register	
0932h-0933h	2	Speed Counter Diff Register	
0934h	1	System Time Difference Filter Depth Register	
0935h	1	Speed Counter Filter Depth Register	
<b>DC - Cyclic Unit Control</b>			
0980h	1	Cyclic Unit Control Register	
<b>DC - SYNC Out Unit</b>			
0981h	1	Activation Register	
0982h-0983h	2	Pulse Length of SyncSignals Register	
0984h	1	Activation Status Register	
098Eh	1	SYNC0 Status Register	
098Fh	1	SYNC1 Status Register	
0990h-0997h	8	Start Time Cyclic Operation Register	
0998h-099Fh	8	Next SYNC1 Pulse Register	
09A0h-09A3h	4	SYNC0 Cycle Time Register	

09A4h-09A7h	4	SYNC1 Cycle Time Register	
<b>DC – Latch In Unit</b>			
09A8h	1	LATCH0 Control Register	
09A9h	1	LATCH1 Control Register	
09AEh	1	LATCH0 Status Register	
09AFh	1	LATCH1 Status Register	
09B0h-09B7h	8	LATCH0 Time Positive Edge Register	
09B8h-09BFh	8	LATCH0 Time Negative Edge Register	
09C0h-09C7h	8	LATCH1 Time Positive Edge Register	
ESC register byte address	length (Byte)	illustrate	Initial value*1
09C8h-09CFh	8	LATCH1 Time Negative Edge Register	
09A8h	1	LATCH0 Control Register	
<b>DC – SyncManager Event Times</b>			
09F0h-09F3h	4	EtherCAT Buffer Change Event Time Register	
09F8h-09FBh	4	PDI Buffer Start Time Event Register	
09FCh-09FFh	4	PDI Buffer Change Event Time Register	
...			

### 3.4 SII area (0000h~003Fh)

ESC configuration area (EEPROM word address 0000h~0007h) Inside, Configured Station Alias After the drive power is turned on, according to ESC automatic read, write ESC register. Will SII EEPROM The changed value is reflected in ESC register, the power supply needs to be turned on again.

besides IP nuclear (ET1810/ET1811/ET1812) initial value is set. For details, please refer to IP nuclear (ET1810/ET1811/ET1812) data sheet

SII EEPROM Word Address	+0h	+1h	+2h	+3h	+4h	+5h	+6h	+7h
0000h	EtherCAT Slave Controller Configuration Area							
0008h	Vendor ID		Product Code		Revision Number		Serial Number	
0010h	Hardware Delays				Bootstrap Mailbox Config			
0018h	Mailbox Sync Man Config							
0020h : 0030h	Reserved							
0038h							Size	Version
0040h : :	Additional Information (Subdivided in Categories)							
	Category Strings							
	Category Generals							
	Category FMMU							
	Category SyncManager							
	Category TxPDO / RxPDO for each PDO							

### 3.5 SDO (Service Data Object)

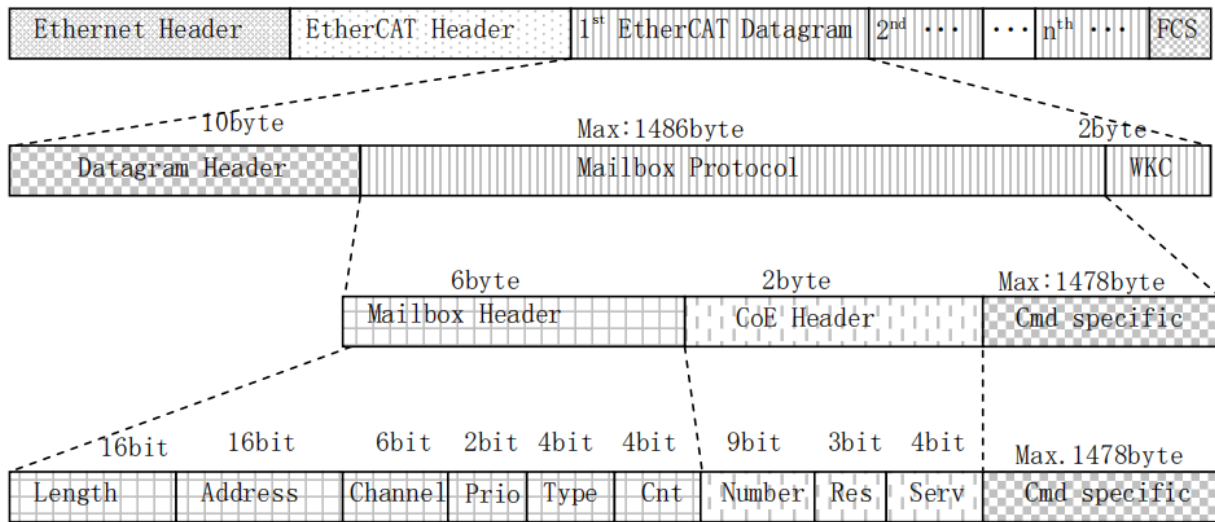
CDS500-EC Support SDO (Service Data Object). SDO data exchange use Mailbox communication, so SDO The data refresh time becomes unstable.

The master station reads and writes data in the records in the object dictionary, and can perform object setting and monitoring of various states of the slave stations. arrive SDO The response of the read and write actions takes time.

Note: use PDO Please do not use the refreshed object SDO to refresh, will be PDO value override.

#### 3.5.1 Mailbox frame structure

Mailbox/SDO The frame structure is shown below. For details, please refer to ETG Specifications (ETG1000-5 and ETG1000-6).



Frame paragraphs are broken down as follows:

frame paragraph	data area	type of data	Function
MailBox Header	Length	WORD	Mailbox data length
	Address	WORD	The station address of the source
	Channel	Unsigned6	(Reserved)
	Priority	Unsigned2	priority
	Type	Unsigned4	Mailbox type 00h: Error 01h: (Reserved) 02h: EoE (not corresponding) 03h: CoE 04h: FoE (not corresponding) 05h: SoE (not corresponding) 06h-0Eh: (Reserved) 0Fh: VoE (not corresponding)
	Cnt	Unsigned3	Mailbox counter
	Reserved	Unsigned1	(Reserved)
	frame paragraph	data area	type of data
CoE Header	Number	Unsigned9	Reserved
	Reserved	Unsigned3	Reserved
	Service	Unsigned4	informational
Cmd specific	Indicator	Unsigned1	Data Set Size License

	Transfer Type	Unsigned1	Normal transfer/Expedited transfer option
	Data Set Size	Unsigned2	Specify the data size
	Complete Access	Unsigned1	The choice of the access method of the object (not corresponding)
	Command Specfier	Unsigned3	Upload Download Choice of request/response etc.
	Index	WORD	the index of the object
	Subindex	BYTE	Subindex of the object
	...	...	Object data or Abort message, etc.

### 3.5.2 Mailbox timeout

This servo drive is in Mailbox. The following timeout settings are made during communication.

#### 1. MailboxRequest timeout:100ms

The master station sends a request to the slave station (drive), if the WKC is updated, and the slave station is considered to receive the request normally. until WKC Repeatedly retries until it is updated, but until this set time WKC If it has not been updated, the master side times out.

#### 2. MailboxResponse timeout:10s

The master receives the reply requested by the slave (drive), if this WKC If it is updated, it is regarded as a normal reception response. Until this set time, if unable to receive WKC The updated response times out on the master side.

This 10s time is the maximum time for the slave station to respond.

### 3.5.3 exception information

#### 1. Error code

Error codereturn and 603Fh (Error code) same value.

0000h~FEFFh according to IEC61800-7-201 define.

FF00h~FFFFh Defined by the manufacturer and shown below.

Index	Sub-Index	Name/Description	Range	Date Type	Access	PDO	Op-mode
603Fh	00h	ErrCode	0-65535	U16	Ro	TxPDO	All
		The alarm that the servo drive has now occurred (only the main number). When the alarm does not occur, the display 0000h. When an alarm occurs, the alarm is displayed. FF**h Alarm (main) number (00h~FFh)					

	(example) FF0ch ... 0ch=12dErr12 (overpressure protection) occurs FF0fh...0fh=15dErr15 (Motor overload)
--	---

## 2. Error register

Error register return and 1001h (Error register) same value.

Index	Sub-Index	Name/Description	Range	Date Type	Access	PDO	Op-mode															
1001h	00h	ErrCode	0-65535	U16	Ro	TxPDO	All															
		Displays the alarm type (status) that is occurring in the servo drive. When the alarm does not occur, the display 0000h. No warning is displayed.																				
		<table border="1"> <thead> <tr> <th>Bit</th> <th>content</th> </tr> </thead> <tbody> <tr> <td>0</td> <td rowspan="4">not support</td> </tr> <tr> <td>1</td> </tr> <tr> <td>2</td> </tr> <tr> <td>3</td> </tr> <tr> <td>4</td> <td>AL status codeA defined alarm occurs*1</td> </tr> <tr> <td>5</td> <td>not support</td> </tr> <tr> <td>6</td> <td>reserve</td> </tr> <tr> <td>7</td> <td>AL status codeAn undefined alarm occurs*2</td> </tr> </tbody> </table>						Bit	content	0	not support	1	2	3	4	AL status codeA defined alarm occurs*1	5	not support	6	reserve	7	AL status codeAn undefined alarm occurs*2
Bit	content																					
0	not support																					
1																						
2																						
3																						
4	AL status codeA defined alarm occurs*1																					
5	not support																					
6	reserve																					
7	AL status codeAn undefined alarm occurs*2																					
		*1: "Alarm defined by AL status code" refers to EtherCAT communication related errors E-800 to 7, E-810 to 7. E-850~7. *2: "AL status code undefined alarm" refers to errors other than EtherCAT communication-related errors E-880 to 7 and EtherCAT communication-related errors.																				

## 3.6 PDO (Process Data Object)

CDS500-EC support PDO (Process Data Object).

based on EtherCAT real-time data transfer through PDO (Process Data Object) for data exchange.

PDO There are transfers from master to slave RxPDO and transferred from the slave to the master TxPDO.

	sending side	receiving side
RxPDO	Main site	Slaves
TxPDO	Slaves	Main site

Note: Please do not use SDO to read and write objects that are being updated by PDO



### 3.6.1 PDO mapping object

PDO Mapping means, from an object dictionary to PDOA map of application objects.

CDS500-EC series PDO The table for mapping, you can use RxPDO use 1600h~1603h, TxPDO use 1A00h~1A03h the mapping object. The maximum number of application objects that a mapping object can map is as follows:

RxPDO: 24 [byte], TxPDO: 24 [byte]

The following means PDO Mapping setting example.

<Setting example>

Assign application objects 6040h, 6060h, 607Ah, 60B8h to map object 1600h (Receive PDO mapping 1: RxPDO\_1) Case

Index	Sub	Object contents
1600h	00h	04h (4 mapping objects)
	01h	6040 00 10h
	02h	6060 00 08h
	03h	607A 00 20h
	04h	60B8 00 10h
	05h	0000 00 00h
	...	
	18h	0000 00 00h

6040	00h	Controlword	U16
6060	00h	Mode of operation	U8
607A	00h	Target Position	U32
60B8	00h	Touch probe function	U16

### 3.6.2 PDO allocation objects

for PDO data exchange, must be assigned PDO mapping table to SyncManager. PDO mapping table and SyncManager relationship is described in PDO Allocate objects. CDS500-EC series, as PDO to allocate objects, you can

use RxPDO (SyncManager2) use 1C12h, TxPDO (SyncManager3) use 1C13h.

The maximum number of application objects that a mapping object can map is as follows:

RxPDO: 4 [Table] (1600h~1603h).

TxPDO: 4 [Table] (1A00h~1A03h).

Usually, because mapping objects 10 is enough, so the default does not need to be changed.

PDO Example of setting the allocation object:

Assign map object 1600h to the allocation object 1C12h (Sync manager channel 2) Case.

Index	Sub	Object contents
-------	-----	-----------------

1C12h	00h	01h (1 mapping object)
	01h	1600h
	02h	0000h
	03h	0000h
	04h	0000h

## 4. Object General Rules

### 4.1 Object Structure

All objects are represented by 4-bit hexadecimal numbers (16bit Index4).

The object dictionary of CoE (CANopen over EtherCAT) specified by CiA402 and the object dictionary of CDS500-EC series are composed as follows:

Object dictionary specified by CiA402		Object Dictionary for CDS500-EC Series	
Index	content	Index	content
0000h~0FFFh	data type area	0000h~0FFFh	data type area
1000h~1FFFh	COE communication area	1000h~1FFFh	COE communication area
2000h~5FFFh	Manufacturer-defined area	2000h~2FFFh	reserve
		3000h~3FFFh	Servo parameter area
		4000h~5FFFh	reserve
6000h~9FFFh	Profile area	6000h~6FFFh	Drive Profile area
		7000h~9FFFh	reserve
A000h~FFFFh	reserve	A000h~FFFFh	reserve

## 5. COE communication area

### 5.1 Device Information

Index	Sub-Index	Name	Remark
1000h	00h	Device type	Equipment type
1001h	00h	Error register	Store real-time error register
1008h	00h	Manufacturer device name	CDS500-EC
1009h	00h	Manufacturer hardware version	0.7

100Ah	00h	Manufacturer software version	1.0.0
1010h	-	Store parameters	
	00h	Number of Entries	
	01h	Save all parameters	
	02h	Save communication parameters	
	03h	Save application parameters	
	04h	Save manufacturer parameters	Write 0x65766173 to save the factory parameters
1011h	-	Restore parameters	
	00h	Number of Entries	
	01h	Restore all default parameters	
	02h	Restore communication default parameters	
	03h	Restore application default parameters	
	04h	Restore manufacturer default parameters	Write 0x64616F6C to restore factory settings
1018h	-	Identity object	
	00h	Number of Entries	
	01h	Vendor ID	Vendor ID 8BF
	02h	Product Code	20200704
	03h	Revision Number	1
	04h	Serial Number	1

## 5.2 Synchronization Manager

Index	Sub-Index	Name	Remark
1C00h	-	Sync manager communication type	
	00h	Number of Entries	
	01h	Comm. Type, Sync Manager 0	
	02h	Comm. Type, Sync Manager 1	
	03h	Comm. Type, Sync Manager 2	
	04h	Comm. Type, Sync Manager 3	
1C12h	-	Sync manager channel 2	
	00h	Number of Entries	
	01h	Sync Manager 2, RxPDO Mapping 0	
	02h	Sync Manager 2, RxPDO Mapping 1	
	03h	Sync Manager 2, RxPDO Mapping 2	
	04h	Sync Manager 2, RxPDO Mapping 3	
1C13h	-	Sync manager channel 3	

	00h	Number of Entries	
	01h	Sync Manager 3, TxPDO Mapping 0	
	02h	Sync Manager 3, TxPDO Mapping 1	
	03h	Sync Manager 3, TxPDO Mapping 2	
	04h	Sync Manager 3, TxPDO Mapping 3	
1C32h	-	Sync manager 2 synchronization	
	00h	Number of Entries	
	01h	Synchronization Type	
	02h	Cycle Time	
	03h	shift time	
	04h	Synchronization Types supported	
	05h	Minimum Cycle Time	
<b>Index</b>	<b>Sub-Index</b>	<b>Name</b>	<b>Remark</b>
1C32h	06h	Calc and Copy Time	
	08h	Get Cycle Time	
	09h	Delay Time	
	0ah	Sync0 Cycle Time	
	0bh	SM-Event Missed	
	0ch	Cycle Time Too Small	
	20h	Sync Error	
1C33h	-	Sync manager 3 synchronization	
	00h	Number of Entries	
	01h	Synchronization Type	
	02h	Cycle Time	
	03h	shift time	
	04h	Synchronization Types supported	
	05h	Minimum Cycle Time	
	06h	Calc and Copy Time	
	08h	Get Cycle Time	
	09h	Delay Time	
	0ah	Sync0 Cycle Time	
	0bh	SM-Event Missed	
	0ch	Cycle Time Too Small	
	20h	Sync Error	

### 5.3 PDO mapping

Index	Sub-Index	Name	Remark
1600h	-	Receive PDO mapping1	
	00h	Number of Entries	
	01h	RPDO 1 Mapping Information 1	
	02h	RPDO 1 Mapping Information 2	
	03h	RPDO 1 Mapping Information 3	
	04h	RPDO 1 Mapping Information 4	
	05h	RPDO 1 Mapping Information 5	
	06h	RPDO 1 Mapping Information 6	
	07h	RPDO 1 Mapping Information 7	
	08h	RPDO 1 Mapping Information 8	
1601h	-	Receive PDO mapping2	
	00h	Number of Entries	
Index	Sub-Index	Name	Remark
1601h	01h	RPDO 2 Mapping Information 1	
	02h	RPDO 2 Mapping Information 2	
	03h	RPDO 2 Mapping Information 3	
	04h	RPDO 2 Mapping Information 4	
	05h	RPDO 2 Mapping Information 5	
	06h	RPDO 2 Mapping Information 6	
	07h	RPDO 2 Mapping Information 7	
	08h	RPDO 2 Mapping Information 8	
1602h	-	Receive PDO mapping3	
	00h	Number of Entries	
	01h	RPDO 3 Mapping Information 1	
	02h	RPDO 3 Mapping Information 2	
	03h	RPDO 3 Mapping Information 3	
	04h	RPDO 3 Mapping Information 4	
	05h	RPDO 3 Mapping Information 5	
	06h	RPDO 3 Mapping Information 6	
	07h	RPDO 3 Mapping Information 7	
	08h	RPDO 3 Mapping Information 8	
1603h	-	Receive PDO mapping4	
	00h	Number of Entries	
	01h	RPDO 4 Mapping Information 1	
	02h	RPDO 4 Mapping Information 2	
	03h	RPDO 4 Mapping Information 3	
	04h	RPDO 4 Mapping Information 4	
	05h	RPDO 4 Mapping Information 5	
	06h	RPDO 4 Mapping Information 6	
07h	RPDO 4 Mapping Information 7		

	08h	RPDO 4 Mapping Information 8	
1A00h	-	Transimit PDO mapping 1	
	00h	Number of Entries	
	01h	TPDO 1 Mapping Information 1	
	02h	TPDO 1 Mapping Information 2	
	03h	TPDO 1 Mapping Information 3	
	04h	TPDO 1 Mapping Information 4	
	05h	TPDO 1 Mapping Information 5	
	06h	TPDO 1 Mapping Information 6	
	07h	TPDO 1 Mapping Information 7	
	08h	TPDO 1 Mapping Information 8	
1A01h	-	Transimit PDO mapping 2	
	00h	Number of Entries	
	01h	TPDO 2 Mapping Information 1	
	02h	TPDO 2 Mapping Information 2	
<b>Index</b>	<b>Sub-Index</b>	<b>Name</b>	<b>Remark</b>
1A01h	03h	TPDO 2 Mapping Information 3	
	04h	TPDO 2 Mapping Information 4	
	05h	TPDO 2 Mapping Information 5	
	06h	TPDO 2 Mapping Information 6	
	07h	TPDO 2 Mapping Information 7	
	08h	TPDO 2 Mapping Information 8	
1A02h	-	Transimit PDO mapping 3	
	00h	Number of Entries	
	01h	TPDO 3 Mapping Information 1	
	02h	TPDO 3 Mapping Information 2	
	03h	TPDO 3 Mapping Information 3	
	04h	TPDO 3 Mapping Information 4	
	05h	TPDO 3 Mapping Information 5	
	06h	TPDO 3 Mapping Information 6	
	07h	TPDO 3 Mapping Information 7	
	08h	TPDO 3 Mapping Information 8	
1A03h	-	Transimit PDO mapping 4	
	00h	Number of Entries	
	01h	TPDO 4 Mapping Information 1	
	02h	TPDO 4 Mapping Information 2	
	03h	TPDO 4 Mapping Information 3	
	04h	TPDO 4 Mapping Information 4	
	05h	TPDO 4 Mapping Information 5	

	06h	TPDO 4 Mapping Information 6	
	07h	TPDO 4 Mapping Information 7	
	08h	TPDO 4 Mapping Information 8	

## 6. Servo parameter area

### 6.1 Overview of Servo Parameters

Each servo parameter SDO corresponds to a function code. For the explanation of the servo function code, please refer to "CDS500-EC User Manual". If the user wants to modify the servo parameters, he can modify the function code table through SDO or through the local configuration tool, and the results of the two are the same.

### 6.2 Object Description

#### 6.2.1 Motor parameter object

Index	Sub-index	Function description	Corresponding function code	Remark
3000h	00h	Motor number H.0 0 0 0         ABCD [A] Encoder type 0: 2500 line incremental 1: reserved 2: 17-bit absolute 3: 23-bit absolute [B] Flange No. 0: reserved 1-5: 40, 60, 80, 90, 100	F0.0.00	

		6-A: 110, 130, 150, 180, 200 [C] Voltage class 0: 220V 1: 380V [D] Motor model number See motor table 1-1 for details		
3001h	00h	Motor rated power	F0.0.01	1~655.35kw
3002h	00h	Motor rated voltage	F0.0.02	1~2000V
3003h	00h	Motor rated current	F0.0.03	1~655.35A
3004h	00h	Motor rated torque	F0.0.04	1~655.35Nm
3005h	00h	Motor maximum torque	F0.0.05	1~655.35Nm
3006h	00h	Motor rated speed	F0.0.06	1~9000rpm
3007h	00h	*Motor maximum speed	F0.0.07	1~9000rpm
3008h	00h	*Number of motor pole pairs	F0.0.08	1~360p
3009h	00h	*Motor rotor inertia	F0.0.09	1~655.35 kg.m <sup>2</sup>
3010h	00h	*Stator resistance (phase)	F0.0.10	1~65.535 Ω
3011h	00h	*Stator inductance (phase)	F0.0.11	1~655.35mH
3012h	00h	*Back EMF coefficient	F0.0.12	1~655.35mV/rpm
3013h	00h	Encoder pulses per revolution	F0.0.13	0~1073741824 pulse
Index	Sub-index	Function description	Corresponding function code	Remark
3015h	00h	encoder zero	F0.0.15	1073741824~1073741824 pulse
3017h	00h	Motor torque coefficient	F0.0.17	0~655.35Nm/A
3018h	00h	Motor parameter write enable 0: Disable 1: enable	F0.0.18	

6.2.3 Basic control parameter object

Index	Sub-index	Function description	Corresponding function code	Remark
3100h	00h	control mode 0: Position Mode (PT) 1: Position Mode (PR) 2: Speed Mode (S) 3: Torque mode (T) 4: Position Mode (PT) ↔ Speed Mode (S) 5: Position Mode (PT) ↔ Torque Mode (T) 6: Reserved 7: Reserved	F1.0.00	



		8: Reserved 9: Test run mode (SR) 10: Jog mode (JOG)		
3101h	00h	positive direction 0: The direction of the motor shaft is counterclockwise 1: The direction of the motor shaft is clockwise	F1.0.01	
3102h	00h	Crossover output control H.0 0 0 0         ABCD [A] Z pulse extension width 0: original width 1~F: A*6.4us [B] Z pulse polarity 0: positive polarity 1: Negative polarity [C] Crossover source 0: encoder (test: a & b, 90) 1: External pulse (test: dir+pulse) [D] Crossover direction 0: positive 1: Reverse	F1.0.02	
3103h	00h	Frequency division output pulses per revolution	F1.0.03	32~32768 pulses
<b>Index</b>	<b>Sub-index</b>	<b>Function description</b>	<b>Corresponding function code</b>	<b>Remark</b>

3104h	00h	<p>Parking method  H.0 0 0 0           ABCD  [A] Type 2 fault stop mode  0: Free parking, free state  1: Zero speed stop, free state  [B] Overtravel parking method  0: Zero speed stop, position locked  1: Free parking, free state  2: Zero speed stop, free state  [C] EMGS emergency stop mode  0: Free parking, free state  1: Zero speed stop, free state  [D] SON(OFF) parking method  0: Free parking, free state  1: Zero speed stop, free state</p>	F1.0.04	
3105h	01h	SON brake ON delay (release brake delay)	F1.0.05	1~1000ms
3105h	02h	Delay from brake output ON to command receiving	F1.0.06	1~1000ms
3105h	03h	In static state, the delay from the brake OFF to the motor is not energized	F1.0.07	1~1000ms
3105h	04h	Rotating state, the speed threshold when the brake is OFF	F1.0.08	1~3000rpm
3105h	05h	Rotating state, brake OFF delay time	F1.0.09	1~1000ms
3105h	06h	Rotating state, the delay time from the brake OFF to the motor is not energized	F1.0.10	1~1000ms

3106h	00h	Control word: H.0 0 0 0         ABCD [A] Reserved [B] Clear fault 0: invalid 1: Valid [C] Emergency stop 0: invalid 1: Valid [D] Enable 0: invalid 1: Valid	F1.0.11	
Index	Sub-index	Function description	Corresponding function code	Remark
3107h	00h	fan control 0: Run at runtime 1: keep running 2: Always closed 3: Operation according to temperature	F1.0.12	
3108h	00h	Absolute encoding type 0: Single-turn absolute encoder 1: Multi-turn absolute encoder	F1.0.13	
3109h	01h	The minimum value of the braking resistance allowed by the drive	F1.0.14	1~1000 Ω
3109h	02h	Built-in braking resistor power	F1.0.15	1~65535W
3109h	03h	Built-in braking resistor resistance	F1.0.16	1~1000 Ω
3109h	04h	Braking resistor selection 0: Use built-in braking resistor 1: Use external braking resistor (natural cooling) 2: Use an external braking resistor (cooled by strong wind) 3: No braking resistor is used, it is all absorbed by capacitors	F1.0.17	
3109h	05h	External braking resistor power	F1.0.18	1~65535W
3109h	06h	External braking resistor resistance	F1.0.19	F1.0.14~1000 Ω
3109h	07h	Brake opening rate	F1.0.20	0~200%

3109h	08h	Resistor heat dissipation coefficient	F1.0.21	1~100%
3109h	09h	Resistance single heating coefficient	F1.0.22	1~100%

#### 6.2.4 Position Control Parameter Object

Index	Sub-index	Function description	Corresponding function code	Remark
3112h	00h	Number of pulses per revolution of pulse command When F1.1.02 > 0, F1.1.04 to F1.1.07 are invalid, and the electronic gear switching function is not supported.	F1.1.02	
3113h	01h	Electronic gear ratio numerator 1	F1.1.04	1~32767
3113h	02h	Electronic gear ratio denominator 1	F1.1.05	1~32767
3113h	03h	Electronic gear ratio numerator 2	F1.1.06	1~32767
3113h	04h	Electronic gear ratio denominator 2	F1.1.07	1~32767
3114h	01h	Pulse command low-pass filter coefficient	F1.1.10	0~2000
3114h	02h	Pulse command average filter coefficient	F1.1.11	0~2000
3114h	03h	Pulse command signal filter coefficient	F1.1.12	0~1000
3115h	01h	Position deviation clearing method 0: Clear the position deviation when the servo is OFF and fault 1: Clear position deviation when fault occurs (reserved) 2: CLRPE signal to clear position deviation (reserved)	F1.1.14	
Index	Sub-index	Function description	Corresponding function code	Remark
3115h	02h	Positioning complete (COIN) output condition 0: The absolute value of the position deviation is less than F1.1.16 1: When the absolute value of the position deviation is less than F1.1.16 and the command after position command filtering is 0. 2: Output when the absolute value of the position deviation is less than F1.1.16 and the position command is 0.	F1.1.15	

3115h	03h	Positioning completion range	F1.1.16	1~65535
3115h	04h	Positioning proximity range	F1.1.17	1~65535

#### 6.2.5 Speed control parameter object

Index	Sub-index	Function description	Corresponding function code	Remark
3121h	01h	S acceleration smooth 0	F1.2.07	0~10000 ms
3121h	02h	S deceleration smooth 0	F1.2.08	0~10000 ms
3121h	03h	Feedback speed display filter (F9.0.00)	F1.2.21	0~30000 ms
3121h	04h	Forward maximum speed	F1.2.22	0~6000rpm
3121h	05h	Reverse maximum speed	F1.2.23	0~6000rpm
3121h	06h	Source of speed limit 0: Digital value (F1.2.22 and F1.2.23) (in torque mode: F1.3.12 and F1.3.13) 1: AI1 (different directions are determined by the minimum value of F1.2.22 and F1.2.23) (in torque mode: different directions are determined by the minimum value of F1.3.12 and F1.3.14) 2: reserved 3: Select F1.2.22 or F1.2.23 as forward and reverse speed limit through DI as forward and reverse speed limit (in torque mode: select F1.3.12 or F1.3.13 as forward and reverse speed limit through DI as forward and reverse speed limit)	F1.2.24	
3121h	07h	reserve	F1.2.25	
3121h	08h	Zero speed fixed speed range	F1.2.26	0~6000rpm
3121h	09h	Motor rotation speed range	F1.2.27	0~1000rpm
3121h	10h	Speed consistency deviation	F1.2.28	0~100rpm
3121h	11h	speed detection threshold	F1.2.29	0~6000rpm
3121h	12h	Zero speed detection range	F1.2.30	0~6000rpm

## 6.2.6 Torque Control Parameter Object

Index	Sub-index	Function description	Corresponding function code	Remark
3130h	01h	Torque source selection 0: Digital 0 (F1.3.02) 1: Digital 1 (F1.3.03) 2: AI1 3: AI2 (reserved)	F1.3.00	
3130h	02h	Positive internal torque limit	F1.3.04	0~450.0 %
3130h	03h	Reverse internal torque limit	F1.3.05	0~450.0 %
3130h	04h	Positive external torque limit	F1.3.06	0~300.0 %
3130h	05h	Reverse external torque limit	F1.3.07	0~300.0 %
3130h	06h	Torque Limit Source 0: Positive and negative internal torque limit 1: Positive and negative external torque limit 2: AI1 as positive and negative torque limit 3: reserved 4: Positive and negative external torque limit and the minimum value of AI1 as torque limit (selected by TLLM, TRLM) 5: Reserved 6: Positive and negative internal torque limit and AI1 switching as torque limit (selected by TLLM, TRLM) 7: Reserved	F1.3.08	
3130h	07h	Output torque display filter	F1.3.09	0~3000 ms
3130h	08h	Type of given torque 0: Biphase limit 1: Single-phase limit	F1.3.10	
3130h	09h	Feedback current display filter (F9.0.22) / output torque display (F9.0.03)	F1.3.11	0~3000 ms
3130h	10h	Positive speed limit	F1.3.12	0~3000rpm
3130h	11h	Inverse speed limit	F1.3.13	0~3000rpm
3130h	12h	Torque reaches the reference value	F1.3.14	0~300.0 %
3130h	13h	Torque reaches effective value	F1.3.15	0~300.0 %
3130h	14h	Torque reaches invalid value	F1.3.16	0~300.0 %
3130h	15h	Torque Arrival (TTOQ) Control	F1.3.17	

		0: Basic torque hysteresis F1.3.14~ F1.3.16 1: Delayed automatic shutdown, terminal SON (OFF) reset 2 to 3: reserved		
3130h	16h	Torque arrival stop delay	F1.3.18	0~30000 ms
3130h	17h	Torque reaches starting speed	F1.3.19	0~4000rpm
3130h	18h	Torque reaches stop speed	F1.3.20	0~1000rpm

6.2.7 DI/DO parameter object

Index	Sub-index	Function description	Corresponding function code	Remark
3200h	01h	DI1 function selection (SON) 0: NON No function 1: SON servo on 2: ARST fault reset 3~4: reserved 23: MULPOS internal position command enable (rising edge valid) 24: ORGP origin detection 25: SHOM starts return-to-origin 26: CWL inversion limit bit 27: CCWL forward limit bit 28: CLRPE Clear position deviation 29: CCLR clear pulse counter register 30: EMGS emergency stop 31: reserved 32: HOLD Internal position control command hold 33: SPDLRS speed limit source switching	F2.0.00	
3200h	02h	DI2 function selection (EMGS)	F2.0.01	
3200h	03h	DI3 function selection (CCWL)	F2.0.02	
3200h	04h	DI4 function selection (CWL)	F2.0.03	
3200h	05h	DI5 function selection (CCLR)	F2.0.04	
3200h	06h	DI6 function selection (INHP)	F2.0.05	
3200h	07h	DI7 function selection (TRLM)	F2.0.06	
3200h	08h	DI8 function selection (TLLM)	F2.0.07	

3201h	01h	<p>DI1 functional properties                      H.0 0 0   ABC                      [A] Filter time selection                      0: Filter time 0 from F2.0.20                      1: Filter time 1 from F2.0.21                      2: Filter time 2 from F2.0.22                      3: Filter time 3 from F2.0.23                      [B] Delay time selection                      0: Delay time 0 from F2.0.24                      1: Delay time 1 from F2.0.25                      2: Delay time 2 from F2.0.26                      3: Delay time 3 from F2.0.27                      [C] Terminal logic                      0: positive logic                      1: Inverse logic</p>	F2.0.10	
Index	Sub-index	Function description	Corresponding function code	Remark
3201h	02h	DI2 function properties	F2.0.11	
3201h	03h	DI3 functional properties	F2.0.12	
3201h	04h	DI4 functional properties	F2.0.13	
3201h	05h	DI5 functional properties	F2.0.14	
3201h	06h	DI6 functional properties	F2.0.15	
3201h	07h	DI7 functional properties	F2.0.16	
3201h	08h	DI8 functional properties	F2.0.17	
3202h	01h	DI filter time 0	F2.0.20	0~1000ms
3202h	02h	DI filter time 1	F2.0.21	0~1000ms
3202h	03h	DI filter time 2	F2.0.22	0~1000ms
3202h	04h	DI filter time 3	F2.0.23	0~1000ms
3203h	01h	DI delay time 0	F2.0.24	0~10000 ms
3203h	02h	DI delay time 1	F2.0.25	0~10000 ms
3203h	03h	DI delay time 2	F2.0.26	0~10000 ms
3203h	04h	DI delay time 3	F2.0.27	0~10000 ms
3204h	01h	<p>DO1 function selection (SRDY)                      0: NON No function                      1: SRDY servo ready                      2: SVON servo start                      3: ZSPD zero speed detection                      4: VCOMP speed consistent output                      5: COIN positioning complete output                      6: NEAR Positioning proximity output                      7: TQL torque limit output</p>	F2.0.28	



		<p>8: VLT speed limit output            9: BRK servo brake output            10: ALRM Servo alarm output            11: WARN Servo warning output            12: HOME Return to origin complete output            13: TSPD speed reach output            14: TTOQ torque arrival output            15: ANG initial angle identification completed            16: TGON Motor rotation output            17: VARR speed detection            18: ZPHD Zero fixed output            19: MOD0 Servo current running mode 0            20: MOD1 Servo current running mode 1            21: MOD2 Servo current running mode 2            22: MOD3 Servo current running mode 3</p>		
3204h	02h	DO2 function selection (ALRM)	F2.0.29	
3204h	03h	DO3 function selection (TTOQ)	F2.0.30	
3204h	04h	DO4 function selection (BRK)	F2.0.31	
3204h	05h	reserve	F2.0.32	
Index	Sub-index	Function description	Corresponding function code	Remark
3205h	01h	<p>DO1 property configuration            H.0 0                           AB            [A] Delay time selection            0: Delay time 0 from F2.0.38            1: Delay time 1 from F2.0.39            2: Delay time 2 from F2.0.40            3: Delay time 3 from F2.0.41            [B] Terminal logic            0: positive logic            1: Inverse logic</p>	F2.0.33	
3205h	02h	DO2 property configuration	F2.0.34	
3205h	03h	DO3 property configuration	F2.0.35	
3205h	04h	DO4 property configuration	F2.0.36	
3205h	05h	reserve	F2.0.37	
3206h	01h	DO delay time 0	F2.0.38	0~10000 ms

3206h	02h	DO delay time 1	F2.0.39	0~10000 ms
3206h	03h	DO delay time 2	F2.0.40	0~10000 ms
3206h	04h	DO delay time 3	F2.0.41	0~10000 ms

6.2.8 Analog parameter object

Index	Sub-index	Function description	Corresponding function code	Remark
3210h	01h	AI1 Bias	F2.1.00	-5.000~5.000 V
3210h	02h	AI1 filter coefficient	F2.1.01	0~2000.0 ms
3210h	03h	AI1 dead zone + (positive)	F2.1.02	0~5.000V
3210h	04h	AI1 Deadband - (Negative)	F2.1.03	-5.000~0 V
3210h	05h	AI1 zero drift voltage	F2.1.04	-5.000~5.000 V
3210h	06h	Zero drift function selection H.0 0     AB [A] Functional Mode 0: Mode 0 1: Mode 1 [B] Startup method 0: No correction 1: Single keyboard/communication 2: Power-on delay 1 (delay 0.5s) 3: Power-on delay 2 (delay 1.0s) 4: Power-on delay 3 (delay 1.5s) 5: Power-on delay 4 (delay 2.0s)	F2.1.05	
3210h	07h	Analog input 10V corresponding speed value	F2.1.06	-6000~6000rpm
Index	Sub-index	Function description	Corresponding function code	Remark
3210h	08h	Analog input 10V corresponding torque value	F2.1.07	-500.0~500.0 %
3211h	01h	AO1 analog output given 0: Motor speed (1V: 1000rpm) 1: Speed command (1V: 1000rpm) 2: Torque command (1V: 100% rated) 3: Position deviation (0.05V: 1 pulse) 4: Pulse command frequency (0.01V: 1kHz) 5: AI1 voltage 6: Reserved 7: Output current (0.01V: 1A)	F2.1.08	

		8: Bus voltage (1V: 100V) 9: AO1 digital given (F2.1.09) 10: Calibration mode (AO1+/AO1-,F2.1.09)		
3211h	02h	AO1 number given	F2.1.09	-9.999~9.999 V
3211h	03h	AO1 output bias	F2.1.10	-9.999~9.999 V
3211h	04h	AO1 output gain	F2.1.11	-9.999~9.999 times
3220h	01h	AI1 measured value 1	F2.2.00	-9.999~9.999 V
3220h	02h	AI1 shows value 1	F2.2.01	-9.999~9.999 V
3220h	03h	AI1 measured value 2	F2.2.02	-9.999~9.999 V
3220h	04h	AI1 shows value 2	F2.2.03	-9.999~9.999 V
3228h	01h	AO1 + measured value 1	F2.2.08	-9.999~9.999 V
3228h	02h	AO1 + target value 1	F2.2.09	-9.999~9.999 V
3228h	03h	AO1 + measured value 2	F2.2.10	-9.999~9.999 V
3228h	04h	AO1 + target value 2	F2.2.11	-9.999~9.999 V
3228h	05h	AO1-measured value 1	F2.2.12	-9.999~9.999 V
3228h	06h	AO1 - target value 1	F2.2.13	-9.999~9.999 V
3228h	07h	AO1-measured value 2	F2.2.14	-9.999~9.999 V
3228h	08h	AO1-target value 2	F2.2.15	-9.999~9.999 V

#### 6.2.9 Rigid Parametric Object

Index	Sub-index	Function description	Corresponding function code	Remark
3400h	01h	Position loop gain 1 When the position gain is increased, the position responsiveness can be improved and the position control error can be reduced. However, if the setting is too large, vibration and noise are likely to occur.	F4.0.00	0~3000 1/s
3400h	02h	speed gain 1 When the speed gain is increased, the speed response can be improved, but if the setting is too large, vibration and noise are likely to be generated.	F4.0.01	0~3000Hz
3400h	03h	Speed integral 1 When the speed integral is reduced, the speed responsiveness can be improved, but if the setting is too small, vibration and noise will be easily generated.	F4.0.02	20~50000 0.01ms
3400h	04h	Torque command filter 1	F4.0.03	0~5000 0.01ms

Index	Sub-index	Function description	Corresponding function code	Remark
3400h	05h	Position loop gain 2	F4.0.04	0~3000 1/s
3400h	06h	speed gain 2	F4.0.05	0~3000Hz
3400h	07h	Speed Integral 2	F4.0.06	20~50000 0.01ms
3400h	08h	Torque command filter 2	F4.0.07	0~5000 0.01ms
3400h	09h	reserve	F4.0.08	
3400h	10h	Speed feedforward enable 0: invalid 1: enable	F4.0.09	
3400h	11h	Velocity feedforward filter time	F4.0.10	0~65535 0.01ms
3400h	12h	Speed feed forward gain When the speed control command changes smoothly, increasing the gain can improve the speed following error. If the speed control command does not change smoothly, reducing the gain value can reduce the operating vibration of the mechanism.	F4.0.11	0~200 %
3400h	13h	Torque feedforward enable	F4.0.12	0~1
3400h	14h	Torque feedforward filter time	F4.0.13	0~655350.01ms
3400h	15h	Torque feedforward gain	F4.0.14	0~200%
3400h	16h	Speed command filter	F4.0.15	0~50000.01ms
3400h	17h	Velocity Feedback Filtering	F4.0.16	0~50000.01ms
3400h	18h	reserve	F4.0.17	
3400h	19h	Torque Feedback Filtering	F4.0.18	0~5000 0.01ms
3400h	20h	M-method velocity feedback filter	F4.0.19	0~65535 0.01ms
3400h	21h	Gain switching control 0: no switching, from first gain 1: High and low speed switching 2: Speed threshold	F4.0.20	
3400h	22h	Gain switching level	F4.0.21	0~65535
3400h	23h	Gain switching hysteresis	F4.0.22	0~65535
3400h	24h	Gain switching delay time	F4.0.23	0~65535ms
3400h	25h	Gain switching duration	F4.0.24	0~65535ms
3400h	26h	Pseudo-differential feedforward control coefficients	F4.0.25	0~100

## 6.2.10 adaptive parameter object

Index	Sub-index	Function description	Corresponding function code	Remark
3410h	01h	Rigid Table Enable	F4.1.00	
3410h	02h	Rigidity class	F4.1.01	0~31
3410h	03h	Inertia ratio	F4.1.02	0.95~110
3410h	04h	Offline inertia identification mode enabled 0: Disable 1: enable	F4.1.03	
3410h	05h	Complete a single identification of the number of motor turns	F4.1.04	0~1000.0 turn
Index	Sub-index	Function description	Corresponding function code	Remark
3410h	06h	Inertia identification maximum speed	F4.1.05	300~2000rpm
3410h	07h	Offline inertia identification time interval	F4.1.06	0~65535ms
3410h	08h	Offline inertia identification acceleration and deceleration time	F4.1.07	50~65535ms
3410h	09h	reserve	F4.1.08	
3410h	10h	reserve	F4.1.09	
3410h	11h	reserve	F4.1.10	
3410h	12h	reserve	F4.1.11	
3410h	13h	position recognition enable	F4.1.12	

#### 6.2.12 Fault and protection object

Index	Sub-index	Function description	Corresponding function code	Remark
3500h	01h	Motor overload protection enable 0: invalid 1: enable	F5.0.00	
3500h	02h	Motor overload protection factor	F5.0.01	0~200 %
3500h	03h	Motor overload pre-alarm coefficient	F5.0.02	50~100%
3500h	04h	Motor overspeed level	F5.0.03	0~200 %
3500h	05h	Motor overspeed time	F5.0.04	0
3500h	06h	Position out of tolerance enable 0: invalid 1: enable	F5.0.05	0~1
3500h	07h	Location out of tolerance level	F5.0.06	0~65.535 turn

		Number of pulses per motor revolution $\times$ F5.0.06 (number of turns)		
3500h	08h	Speed out of tolerance level	F5.0.07	1~20000rpm
3500h	09h	Speed out of tolerance detection time	F5.0.08	0~6000ms
3500h	10h	Input phase loss protection 0: invalid 1: enable	F5.0.09	0~1
3500h	11h	Output phase loss protection 0: invalid 1: enable	F5.0.10	0~1
3500h	12h	Overvoltage factor	F5.0.11	0~200 %
3500h	13h	Overvoltage time	F5.0.12	1~65535ms
3500h	14h	Undervoltage factor	F5.0.13	0~200 %
3500h	15h	undervoltage time	F5.0.14	0~65535ms
3500h	16h	Brake opening factor	F5.0.15	0~200 %
3500h	17h	Brake closing factor	F5.0.16	0~200 %
3500h	18h	Speed loop saturation protection time	F5.0.17	0~65535ms
3500h	19h	discharge cycle	F5.0.18	0.5~1000.0 ms
3500h	20h	Power-down judgment enable	F5.0.19	0~1
3500h	21h	Power-down judgment cycle	F5.0.20	0~65535 2ms
3500h	22h	All analog zero-drift fault threshold	F5.0.21	0~10.000V
Index	Sub-index	Function description	Corresponding function code	Remark
3510h	01	first fault code	F5.1.00	Err00~Err99
3510h	02	Second fault code	F5.1.01	Err00~Err99
3510h	03	third fault code	F5.1.02	Err00~Err99
3510h	04	Speed 1 at fault	F5.1.03	-9000~9000rpm
3510h	05	Current at fault 1	F5.1.04	0~655.35A
3510h	06	Bus voltage at fault 1	F5.1.05	0~2000V
3510h	07	DI input state 1 at fault The display effect is the same as F9.0.19	F5.1.06	-
3510h	08	DO output state 1 at fault The display effect is the same as F9.0.20	F5.1.07	-
3510h	09	reserve	F5.1.08	-
3510h	10	Power-on time at fault 1	F5.1.09	0~65535h
3510h	11	Run time at failure 1	F5.1.10	0~65535h

3510h	12	Speed 2 at fault	F5.1.11	-9000~9000rpm
3510h	13	Current 2 at fault	F5.1.12	0~655.35A
3510h	14	Bus voltage 2 at fault	F5.1.13	0~2000V
3510h	15	DI input state 2 at fault	F5.1.14	-
3510h	16	DO output state 2 at fault	F5.1.15	-
3510h	17	reserve	F5.1.16	-
3510h	18	Power-on time when fault occurs 2	F5.1.17	0~65535h
3510h	19	Run time on failure 2	F5.1.18	0~65535h
3510h	20	Speed 3 at failure	F5.1.19	-9000~9000rpm
3510h	twenty one	fault current 3	F5.1.20	0~655.35A
3510h	twenty two	Bus voltage at fault 3	F5.1.21	0~2000V
3510h	twenty three	DI input state 3 at fault	F5.1.22	-
3510h	twenty four	DO output state 3 at fault	F5.1.23	-
3510h	25	reserve	F5.1.24	-
3510h	26	Power-on time at fault 3	F5.1.25	0~65535h
3510h	27	Run time at failure 3	F5.1.26	0~65535h
3520h	01	Fourth fault code	F5.2.00	Err00~Err99
3520h	02	Fifth fault code	F5.2.01	Err00~Err99
3520h	03	sixth fault code	F5.2.02	Err00~Err99
3520h	04	Speed 1 at fault	F5.2.03	-9000~9000rpm
3520h	05	Current at fault 1	F5.2.04	0~655.35A
3520h	06	Bus voltage at fault 1	F5.2.05	0~2000V
3520h	07	DI input state 1 at fault The display effect is the same as F9.0.19	F5.2.06	-
3520h	08	DO output state 1 at fault The display effect is the same as F9.0.20	F5.2.07	-
3520h	09	reserve	F5.2.08	-
3520h	10	Power-on time at fault 1	F5.2.09	0~65535h
3520h	11	Run time at failure 1	F5.2.10	0~65535h
3520h	12	Speed 2 at fault	F5.2.11	-9000~9000rpm
3520h	13	Current 2 at fault	F5.2.12	0~655.35A
3520h	14	Bus voltage 2 at fault	F5.2.13	0~2000V
3520h	15	DI input state 2 at fault	F5.2.14	-
3520h	16	DO output state 2 at fault	F5.2.15	-
3520h	17	reserve	F5.2.16	-
3520h	18	Power-on time when fault occurs 2	F5.2.17	0~65535h
3520h	19	Run time on failure 2	F5.2.18	0~65535h

3520h	20	Speed 3 at failure	F5.2.19	-9000~9000rpm
3520h	twenty one	fault current 3	F5.2.20	0~655.35A
3520h	twenty two	Bus voltage at fault 3	F5.2.21	0~2000V
3520h	twenty three	DI input state 3 at fault	F5.2.22	-
3520h	twenty four	DI input state 3 at fault	F5.2.23	-
3520h	25	reserve	F5.2.24	-
3520h	26	Power-on time at fault 3	F5.2.25	0~65535h
3520h	27	Run time at failure 3	F5.2.26	0~65535h

6.2.12 distribution parameter object

Index	Sub-index	Function description	Corresponding function code	Remark
3811h	01	Drive station number	F8.0.11	0~65535
3811h	02	Mailing address selection 0: off (automatic assignment) 1: Open (get the station number)	F8.1.03	0~1
3812h	00	PLC type	F8.0.12	0~255
3813h	00	Limit keep running	F8.0.13	0~1



## 7. Drive Profile area

### 7.1 List of objects

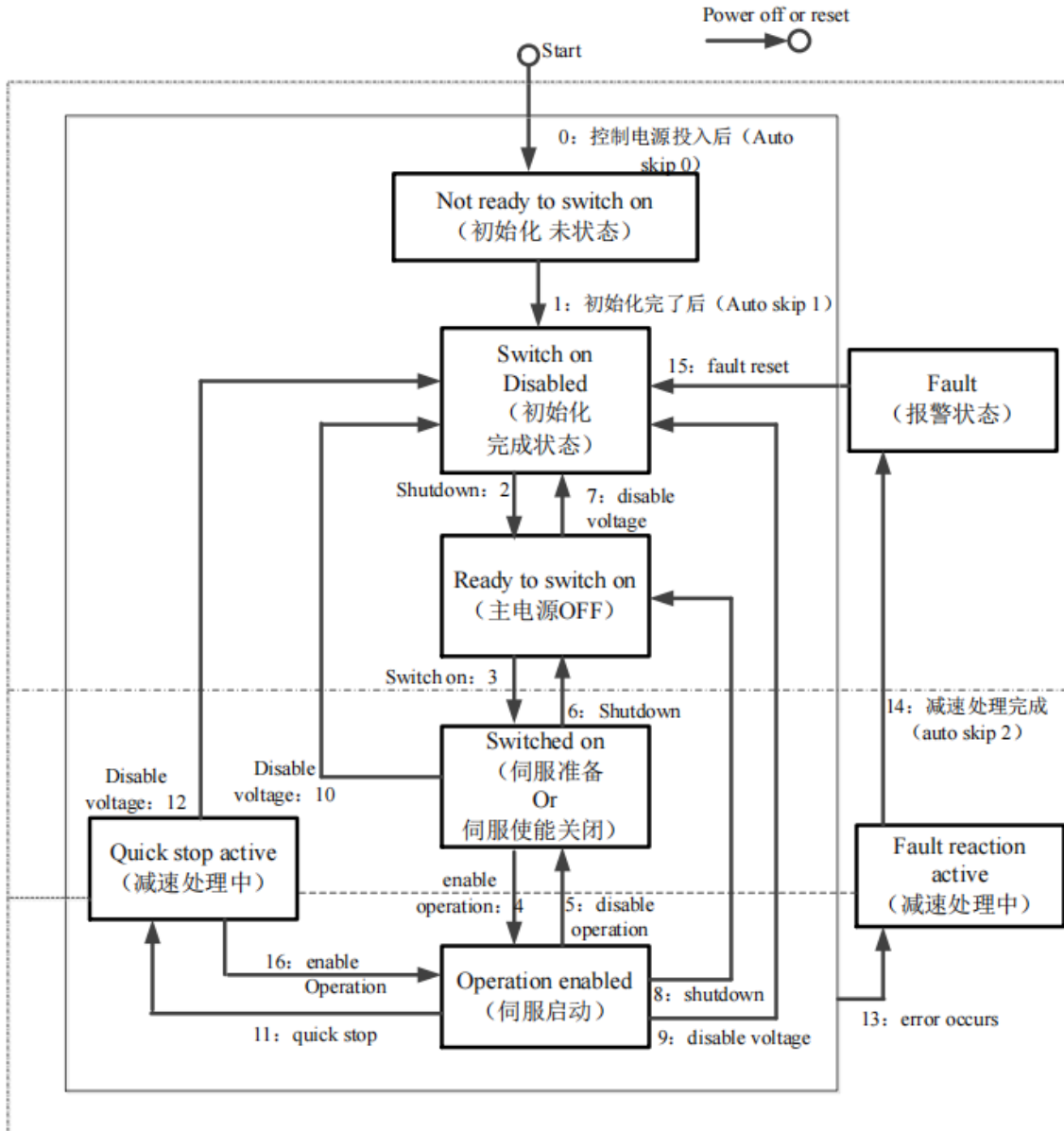
Index	Sub-index	Function description	Remark
603Fh	00h	Abort connection option code	
6040h	00h	Controlword	
6041h	00h	Statusword	
605Ah	00h	Quick stop option code	
605Bh	00h	Shutdown option code	
605Ch	00h	Disable operation option code	
605Dh	00h	Halt option code	
605Eh	00h	Fault reaction option code	
6060h	00h	Modes of operation	
6061h	00h	Modes of operation display	
6062h	00h	Position demand value	
6063h	00h	Position actual internal value	
6064h	00h	Position actual value	
6065h	00h	Following error window	
6066h	00h	Following error time out	
6067h	00h	Position window	
6068h	00h	Position window time	
6069h	00h	Velocity sensor actual value	
606Bh	00h	Velocity demand value	
606Ch	00h	Velocity actual value	
606Dh	00h	Velocity window	
606Eh	00h	Velocity window time	
606Fh	00h	Velocity threshold	
6070h	00h	Velocity threshold time	
6071h	00h	Target torque	
6072h	00h	Max torque	
6073h	00h	Max current	
6074h	00h	Torque demand	
6075h	00h	Motor rated current	
6076h	00h	Motor rated torque	
6077h	00h	Torque actual value	
6078h	00h	Current actual value	
6079h	00h	DC link circuit voltage	
607Ah	00h	Target position	
607Bh	01h	Min position range limit	
607Bh	02h	Max position range limit	
607Ch	00h	Home offset	
607Dh	01h	Min position limit	

Index	Sub-index	Function description	Remark
607Dh	02h	Max position limit	
607Eh	00h	Polarity	
607Fh	00h	Max profile velocity	
6080h	00h	Max motor speed	
6081h	00h	Profile velocity	
6082h	00h	End velocity	
6083h	00h	Profile acceleration	
6084h	00h	Profile deceleration	
6085h	00h	Quick stop deceleration	
6086h	00h	Motion profile type	
6087h	00h	Torque slope	
6088h	00h	Torque profile type	
608Fh	01h	Encoder increments	
608Fh	02h	Motor revolutions	
6091h	01h	Motor revolutions	
6091h	02h	Shaft revolutions	
6092h	01h	Feed	
6092h	02h	Shaft revolutions	
6098h	00h	Homing method	
6099h	01h	Speed during search for switch	
6099h	02h	Speed during search for zero	
609Ah	00h	Homing acceleration	
60A3h	00h	Profile jerk use	
60A4h	01h	Profile jerk1	
60A4h	02h	Profile jerk2	
60B0h	00h	Position offset	
60B1h	00h	Velocity offset	
60B2h	00h	Torque offset	
60B8h	00h	Touch probe function	
60B9h	00h	Touch probe status	
60BAh	00h	Touch probe pos1 pos value	Probe function is not supported yet
60BBh	00h	Touch probe pos1 neg value	Probe function is not supported yet
60BCh	00h	Touch probe pos2 pos value	Probe function is not supported yet
60BDh	00h	Touch probe pos2 neg value	Probe function is not supported yet
60C2h	01h	Interpolation time period value	
60C2h	02h	Interpolation time index	
60C5h	00h	Max acceleration	
60C6h	00h	Max deceleration	

60E3h	01h	1st supported homing method	
...			
60E3h	20h	32nd supported homing method	
60F2h	00h	Positioning option code	
<b>Index</b>	<b>Sub-index</b>	<b>Function description</b>	<b>Remark</b>
60F4h	00h	Following error actual value	
60FAh	00h	Control effort	
60FCh	00h	Position demand internal value	
60FDh	00h	Digital inputs	
60FEh	01h	Physical outputs	
60FEh	02h	bit mask	
60FFh	00h	Target velocity	
6502h	00h	Supported drive modes	

## 7.2 PDS (Power Drive Systems) Specifications

According to user commands or abnormal detection, etc., the power supply control of the servo drive is related to PDS. The state transitions are defined in the following figure.



move to Operation enabled (servo enable on), please raise to 100ms. At the above time, input the action command. The table below shows PDS state transition events (transition conditions) and actions during transition.

PDS, the state transition is performed at the same time as the handshake is obtained (via 6041h: Statusword Confirm that the state has transitioned before sending the next migration command).

PDS conversion		event	action
0	Auto skip 0	After the power is turned on, or after the application layer is reset, it will automatically migrate.	After the power is turned on, or the application layer is reset After automatic migration.
1	Auto skip 1	Automatic conversion after initialization is complete.	Communication is established.
2	Shut down	The case of receiving a Shutdown command.	Nothing special.

3	Switch on	When the switch on command is received while the power is on.	Nothing special.
4	Enable operation	When receiving the Enable operation command.	The drive function is valid. In addition, all previous set point data are cleared.
5	Disable operation	When receiving the Disable operation command.	Drive function is invalid
6	Shutdown	When the Shutdown command is received while the power is on. Detects when the power is OFF.	Nothing special.
7	Disable voltage	The condition of receiving the Disable voltage command. When receiving a Quick stop command. When the ESM state is PreOP, SafeOP, or OP, it is migrated to Init.	Nothing special.
8	Shutdown	When the shutdown command is received while the power is on.	Drive function is invalid
9	Disable voltage	The condition of receiving the Disable voltage command.	Drive function is invalid
10	Disable voltage	The condition of receiving the Disable voltage command. When receiving a Quick stop command. When the ESM state is PreOP, SafeOP, or OP, it is migrated to Init.	Nothing special.
11	Quick stop	When receiving a Quick stop command.	Execute the Quick stop function.
12	Disable voltage	When the Quick stop selection code is the set value of 1, 2, and 3, and the Quick Stop operation is completed. When the Quick stop selection code is the set value of 5, 6, and 7, and after the Quick Stop operation is completed, the Disable voltage command is received. Detects when the power is OFF.	The drive function becomes invalid.
13	Error occurs	Anomaly detected condition.	Execute the Fault reaction function.
14	Auto skip 2	After the abnormal detection deceleration process is completed, it is automatically migrated.	Drive function is invalid
15	Fault reset	When the fault-causing factor is removed, the fault reset command is received. Fault factor does not exist,	Execute a reset of the Fault state.
16	Enable operation	When the Quick stop selection code is the set value of 5, 6, or 7, the Enable operation command is received.	The drive function is effective.

### 7.3 Controlword (6040h)

PDSCommands to control slave stations (servo drives) such as state transitions are passed through 6040h (Control Word) setting.

Index	Sub-index	Name/Description	Range	Data Type	Access	PDO	Op-mode																																
6040h	00h	Controlword	0~65535	U16	Rw	RxPDO	All																																
set pair PDSControl commands for servo drives such as state transitions. bit information																																							
<table border="1" style="width: 100%; text-align: center;"> <tr> <td>15</td><td>14</td><td>13</td><td>12</td><td>11</td><td>10</td><td>9</td><td>8</td> </tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td>oms</td><td>h</td> </tr> <tr> <td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td> </tr> <tr> <td>fr</td><td colspan="3">r</td><td>eo</td><td>qs</td><td>ev</td><td>so</td> </tr> </table>								15	14	13	12	11	10	9	8							oms	h	7	6	5	4	3	2	1	0	fr	r			eo	qs	ev	so
15	14	13	12	11	10	9	8																																
						oms	h																																
7	6	5	4	3	2	1	0																																
fr	r			eo	qs	ev	so																																
r = reserved (not corresponding)    fr = fault reset oms = operation mode specific    eo = enable operation (Control mode dependent bit)    qs = quick stop h = halt    ev = enable voltage <div style="text-align: right;">so = switch on</div>																																							

Command	Bits of the controlword					PDS conversion
	Bit7	Bit3	Bit2	Bit1	Bit0	
	Fault Reset	Enable Operation	Quik Stop	Enable Voltage	Switch On	
Shutdown	0	-	1	1	0	2,6,8
Switch on	0	0	1	1	1	3
Switch on+Enable operation	0	1	1	1	1	3+4
Enable operation	0	1	1	1	1	4,16
Disable voltage	0	-	-	0	-	7,9,10,12
Quick stop	0	-	0	1	-	7,10,11
Disable operation	0	0	1		1	5
Fault reset	0-->1	-	-	-	-	13

**Note:**

- ① The bit logic of the quick stop command is valid under 0.  
Be careful to perform other bit logic and the opposite action.
- ② bit8 (halt): When 1, execute motor deceleration and pause by 605Dh (Halt selection code).  
After a pause, the enable must be turned off to restart the action.
- ③ bit9,6-4 (operation mode specific):



xxxx xxxx x01x 0001 b	Ready to switch on	Initialization complete status
xxxx xxxx x01x 0011b	Switched on	Servo enable off/servo ready
xxxx xxxx x01x 0111b	Operation enabled	Servo enable on
xxxx xxxx x00x 0111b	Quick stop active	stop now
xxxx xxxx x0xx 1111b	Fault reaction active	Abnormal (alarm) judgment
xxxx xxxx x0xx 1000 b	Fault	Abnormal (alarm) status

bit4 (voltage enabled) : 1 case, indicates that the supply voltage is applied to PDS.

bit5 (quick stop) : 0 in the case of PDS take over quick stop. Require quick stop of bit logic is invalid below. Please be careful to perform other bit logic and opposite actions.

bit7 (warning) : 1, indicating that a warning is occurring. when warning PDS state remains unchanged, and the motor continues to operate.

bit9 (remote) : 0 (local), it means 6040 (Controlword) cannot be processed. 1 (remote), it means 6040 (Controlword) is in a processable state. ESM state is transitioned to PreOP when the above becomes 1.

bit13,12,10 (operation mode specific) : The following, indicating that the control mode is inherent to the bit change. (For details, please refer to the chapter related to each control mode)

Op-mode	Bit13	Bit12	Bit10
pp	following error	set-point acknowledge	target reach
pv	-	speed	target reach
tq	-	-	target reach
hm	homing error	homing attained	target reach
csp	following error	drive follows command value	-
csv	-	drive follows command value	-
cst	-	drive follows command value	-

bit11 (internal limit active) : The main reason for the internal limit is when it occurs 6041h (Statusword) of bit11 (internal limit active) becomes 1.

bit15,14 (reserved) : this bit is unused (0 fixed).

## 7.5 Control Mode Setting

### 7.5.1 Supported drive modes (6502h)

This servo drive can confirm the supported control mode according to 6502h (Supported drive mode).

Index	Sub-index	Name/Description	Range	Data Type	Access	PDO	Op-mode
6502h	00h	Supported drive mode	0~4294967295	U32	Ro	TxPDO	All



Indicates supported control modes (Mode of operation). value isl, indicates the modes supported in this mode. bitinformation							
15~16			15~10			9	8
r						rm	r
0			0			1	1
7	6	5	4	3	2	1	0
csp	r	hm	r	tq	pv	r	pp
1	0	1	0	1	1	0	1

Index	Sub-index	Name/Description	Range	Data Type	Access	PDO	Op-mode
6502h	00h	<b>bit</b>	<b>Mode of operation</b>		<b>write</b>	<b>correspond</b>	
		0	Profile position mode		pp	YES	
		2	Profile velocity mode		pv	YES	
		3	Torque profile mode		tq	YES	
		5	Homing mode		hm	YES	
		7	Cyclic synchronous position mode		csp	YES	
		8	Cyclic synchronous velocity mode		csv	YES	
		9	Cyclic synchronous torque mode		cst	YES	

7.5.2 Control mode (6060h)

The control mode is set by6060h (Modes of operation) conduct.

Index	Sub-index	Name/Description	Range	Data Type	Access	PDO	Op-mode	
6060h	00h	Mode of operation	-128~127	I8	rw	RxPDO	All	
		Set the control mode of the servo drive. Non-corresponding control mode setting is prohibited.						
		<b>bit</b>	<b>Mode of operation</b>		<b>write</b>	<b>correspond</b>		
		-128~-1	Reserved		-	-		
		0	No mode changed/No mode assigned		-	-		
		1	Profile position mode		pp	YES		
		3	Profile velocity mode		pv	YES		
		4	Torque profile mode		tq	YES		
		6	Homing mode		hm	YES		
		8	Cyclic synchronous position mode		csp	YES		
		9	Cyclic synchronous velocity mode		csv	YES		
10	Cyclic synchronous torque mode		cst	YES				
11~127	Reserved							

because 6060h (Modes of operation) Yes default=0 (No mode change/no mode assigned), please be sure to set the value of the control mode to be used after the power is turned on.

6060h The set value of is0 and 6061h The set value of is0, if the PDS state migrated to Operation enabled, occur Err88.1 (Control mode setting abnormal protection).

initial state 6060h=0 (No mode assigned) to switch to a supported control mode (pp, pv, tq, hm, csp, csv, cst), set again 6060h=0 situation as "No mode changed", the switching of the control mode cannot be executed. (The previous control mode is maintained).

### 7.5.3 Control mode confirmation (6061h)

Confirmation basis of the control mode inside the servo drive 6061h (Modes of operation display) implement. 6060h (Modes of operation) after setting, please confirm whether it is possible to set the object action by detection.

Index	Sub-index	Name/Description	Range	Data Type	Access	PDO	Op-mode
6061h	00h	Mode of operation display	-128~127	I8	rw	TxPDO	All
Indicates the current control mode.							
		<b>bit</b>	<b>Mode of operation</b>	<b>write</b>	<b>correspond</b>		
		-128~1	Reserved	-	-		
		0	No mode changed/No mode assigned	-	-		
		1	Profile position mode	pp	YES		
		3	Profile velocity mode	pv	YES		
		4	Torque profile mode	tq	YES		
		6	Homing mode	hm	YES		
		8	Cyclic synchronous position mode	csp	YES		
		9	Cyclic synchronous velocity mode	csv	YES		
		10	Cyclic synchronous torque mode	cst	YES		
		11~127	Reserved				

## 8. Control mode function

## 8.1 Position control mode (PP, CSP, HM)

### 8.1.1 Related objects common to position control

#### 1. Objects commonly associated with position control (commands) • setting)

Index	Sub-index	Name	Units	Range	Data type	Access	PDO
6040h	00h	ControlWord	-	0~65535	U16	rw	RxPDO
6072h	00h	Max torque	0.1%	0~65535	U16	rw	RxPDO
607Ah	00h	Target position	command unit	-2147483648~2147483647	I32	rw	RxPDO
607Dh	00h	Software position limit	-	-	-	-	-
		Number of entries	-	2	U8	ro	No
		Min position limit	command unit	-2147483648~2147483647	I32	rw	RxPDO
		Max position limit	command unit	-2147483648~2147483647	I32	rw	RxPDO
607Fh	00h	Max profile velocity	Command unit/s	0~4294967295	U32	rw	RxPDO
6080h	00h	Max motor speed	r/min	0~4294967295	U32	rw	RxPDO
6081h	00h	Profile velocity	Command unit/s	0~4294967295	U32	rw	RxPDO
6082h	00h	End velocity	Command unit/s	0~4294967295	U32	rw	RxPDO
6083h	00h	Profile acceleration	Command unit/s <sup>2</sup>	0~4294967295	U32	rw	RxPDO
6084h	00h	Profile deceleration	Command unit/s <sup>2</sup>	0~4294967295	U32	rw	RxPDO
60B1h	00h	Velocity offset	Command unit/s	-2147483648~2147483647	I32	rw	RxPDO
60B2h	00h	Torque offset	0.1%	-32768~32767	I16	rw	RxPDO
60C5h	00h	Max acceleration	Command unit/s <sup>2</sup>	0~4294967295	U32	rw	RxPDO
60C6h	00h	Max deceleration	Command unit/s <sup>2</sup>	0~4294967295	U3	rw	RxPDO

#### Location class

Index	Sub-index	Name	Units	Range	Data type	Access	PDO	Op-mode
607Ah	00h	Target position	command unit	-2147483648~2147483647	I32	rw	RxPDO	PP CSP

		Set target location
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**Speed class**

Index	Sub-index	Name	Units	Range	Data type	Access	PDO	Op-mode
607Fh	00h	Velocity actual value	command unit	2147483648~2147483647	I32	rw	RxPDO	ALL
		Indicates the command position						
6080h	00h	Control effort	command unit	2147483648~2147483647	I32	rw	RxPDO	ALL
		Indicates the internal command speed (position loop output).						
6081h	00h	Control effort	command unit	2147483648~2147483647	I32	rw	RxPDO	ALL
		Indicates the internal command speed (position loop output).						

**Torque class**

Index	Sub-index	Name	Units	Range	Data type	Access	PDO	Op-mode
6072h	00h	Max torque	0.1%	-32768~32767	I32	rw	RxPDO	ALL
		Set the maximum torque of the motor. The maximum value is limited by the maximum torque read from the motor according to internal processing. The maximum torque of the motor varies depending on the applicable motor.						
60B2h	00h	Torque offset	mNm	0~4294967295	U32	rw	RxPDO	ALL
		Not currently supported						

**Acceleration and deceleration**

Index	Sub-index	Name	Units	Range	Data type	Access	PDO	Op-mode
6083h	00h	Profile acceleration	command unit/s <sup>2</sup>	0~4294967295	U32	rw	RxPDO	PP PV
		set upProfileacceleration. set as0, the internal processing asideal with.						
6084h	00h	Profile deceleration	command unit/s <sup>2</sup>	0~4294967295	U32	rw	RxPDO	PP PV
		set upProfiledeceleration. set as0, the internal processing asideal with.						
60C5h	00h	Max acceleration	command unit/s <sup>2</sup>	0~4294967295	U32	rw	RxPDO	PP PV HM
		Set the maximum acceleration. set as0, the internal processing asideal with.						

60C6h	00h	Min deceleration	command unit/s <sup>2</sup>	0~4294967295	U32	rw	RxPDO	PP PV HM
Set the maximum deceleration. set as0, the internal processing asIdeal with.								

2. Objects commonly associated with location control (monitoring class)

Index	Sub-index	Name	Units	Range	Data type	Access	PDO
6041h	00h	Statusword	-	0~65535	U16	ro	TxPDO
6062h	00h	Position demand value	command unit	-2147483648~2147483647	I32	ro	TxPDO
6063h	00h	Position actual internal value	pulse	-2147483648~2147483647	I32	ro	TxPDO
6064h	00h	Position actual value	command unit	-2147483648~2147483647	I32	ro	TxPDO
6065h	00h	Following error window	command unit	0~4294967295	U32	rw	RxPDO
6066h	00h	Following error time out	1ms	0~65535	U16	rw	RxPDO
6067h	00h	Position window	command unit	0~4294967295	U32	rw	RxPDO
6068h	00h	Position window time	1ms	0~65535	U16	rw	RxPDO
606Ch	00h	Velocity actual value	Command unit/s	-2147483648~2147483647	I32	ro	TxPDO
6074h	00h	Torque demand	0.1%	-32768~32767	I16	ro	TxPDO
6076h	00h	Motor rated torque	Mn m	0~4294967295	U32	ro	TxPDO
6077h	00h	Torque actual value	0.1%	-32768~32767	I16	ro	TxPDO
60F4h	00h	Following error actual value	command unit	-2147483648~2147483647	I32	ro	TxPDO
60FAh	00h	Control effort	Command unit/s	-2147483648~2147483647	I32	ro	TxPDO
60FCh	00h	Position demand internal value	pulse	-2147483648~2147483647	I32	ro	TxPDO

Location class

Index	Sub-index	Name	Units	Range	Data type	Access	PDO	Op-mode
6062h	00h	Position demand value	instruction unit	-2147483648~2147483647	I32	ro	TxPDO	PP CSP HM
		Indicates the command position (= IPOS).						
6063h	00h	Position actual internal value	instruction unit	-2147483648~2147483647	I32	ro	TxPDO	ALL
		Indicates the actual position of the motor. Encoder units other than full closed loop control are used, and external displacement sensor units are used for full closed loop control.						
6064h	00h	Position actual value	instruction unit	-2147483648~2147483647	I32	ro	TxPDO	ALL
		represents the actual position of the motor (= APOS)						
60F4h	00h	Following error actual value	instruction unit	-2147483648~2147483647	I32	ro	TxPDO	PP CSP HM
		represents the position deviation (= PERR).						
60FCh	00h	Position demand internal value	instruction unit	-2147483648~2147483647	I32	ro	TxPDO	PP CSP HM
		Indicates the internal command position.						

Speed class

Index	Sub-index	Name	Units	Range	Data type	Access	PDO	Op-mode
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606Ch	00h	Velocity actual value	Command unit/s	-2147483648~2147483647	l32	ro	TxPDO	ALL
		Indicates the real speed of the motor (= FSPD).						
60FAh	00h	Control effort	Command unit/s	-2147483648~2147483647	l32	ro	TxPDO	ALL
		Indicates the internal command speed (position loop output)						

Torque class

Index	Sub-index	Name	Units	Range	Data type	Access	PDO	Op-mode
6074h	00h	Torque demand	0.1%	-32768~32767	l16	ro	TxPDO	ALL
		Indicates the internal command torque.						
6076h	00h	Motor rated torque	mNm	0~4294967295	U32	ro	TxPDO	ALL
		Read the rated torque from the motor and set it automatically.						
6077h	00h	Velocity actual value	0.1%	-32768~32767	l16	ro	TxPDO	ALL
		Indicates the actual torque, the same value as the actual current value. This output value is a reference value and is not guaranteed to be an actual value.						

Statusword (6041h) < Position ControlmodelCommon functions>

This item describes the following functions.

bit10:target reached (positioning completed)

bit13:following error (Position deviation is too large)

For other functions related content, please refer to the "Related Objects" of each position control mode

Index	Sub-index	Name/Description	Range	Data Type	Access	PDO	Op-mode
6041h	00h	Controlword	0~65535	U16	Ro	TxPDO	All
		Indicates the status of the servo drive.					





6080h	00h	Max motor speed	r/min	0~4294967295	U32	rw	RxPDO
6081h	00h	Profile velocity	Command unit/s	0~4294967295	U32	rw	RxPDO
6082h	00h	End velocity	Command unit/s	0~4294967295	U32	rw	RxPDO
6083h	00h	Profile acceleration	Command unit/s <sup>2</sup>	0~4294967295	U32	rw	RxPDO
6084h	00h	Profile deceleration	Command unit/s <sup>2</sup>	0~4294967295	U32	rw	RxPDO
60B1h	00h	Velocity offset	Command unit/s	-2147483648~2147483647	I32	rw	RxPDO
60B2h	00h	Torque offset	0.1%	-32768~32767	I16	rw	RxPDO
60C5h	00h	Max acceleration	Command unit/s <sup>2</sup>	0~4294967295	U32	rw	RxPDO
60C6h	00h	Max deceleration	Command unit/s <sup>2</sup>	0~4294967295	U3	rw	RxPDO

2. Objects associated with pp control mode (monitoring classes)

Index	Sub-index	Name	Units	Range	Data type	Access	PDO
6041h	00h	Statusword	-	0~65535	U16	ro	TxPDO
6062h	00h	Position demand value	command unit	-2147483648~2147483647	I32	ro	TxPDO
6063h	00h	Position actual internal value	pulse	-2147483648~2147483647	I32	ro	TxPDO
6064h	00h	Position actual value	command unit	-2147483648~2147483647	I32	ro	TxPDO
6065h	00h	Following error window	command unit	0~4294967295	U32	rw	RxPDO
6066h	00h	Following error time out	1ms	0~65535	U16	rw	RxPDO
6067h	00h	Position window	command unit	0~4294967295	U32	rw	RxPDO
6068h	00h	Position window time	1ms	0~65535	U16	rw	RxPDO
606Ch	00h	Velocity actual value	Command unit/s	-2147483648~2147483647	I32	ro	TxPDO

6074h	00h	Torque demand	0.1%	-32768~32767	I16	ro	TxPDO
6076h	00h	Motor rated torque	Mn m	0~4294967295	U32	ro	TxPDO
6077h	00h	Torque actual value	0.1%	-32768~32767	I16	ro	TxPDO
60F4h	00h	Following error actual value	command unit	-2147483648~2147483647	I32	ro	TxPDO
60FAh	00h	Control effort	Command unit/s	-2147483648~2147483647	I32	ro	TxPDO
60FCh	00h	Position demand internal value	pulse	-2147483648~2147483647	I32	ro	TxPDO

Statusword (6041h) <function in pp control mode>

Index	Sub-index	Name/Description	Range	Data Type	Access	PDO	Op-mode			
6041h	00h	Controlword	0~65535	U16	Ro	TxPDO	All			
		Indicates the status of the servo drive.								
		bit information								
		15	14	13	12	11	10	9	8	
		r		oms		ila	oms		rm	r
				Follow Error	set-point acknowledge		Target Reached			
		7	6	5	4	3	2	1	0	
		w	sod	qs	ve	r	oe	so	rtso	
		r = reserved (not corresponding)    w = warning sod = switch on disabled oms = operation mode specific    qs = quick stop (Control mode dependent bit)    ve = voltage enabled ila = internal limit active    f = fault oe = operation enabled rm = remote    so = switched on rtso = ready to switch on								

		<p><b>target reached:</b>  <b>halt=0</b>(normal usage):  <b>0</b>:Positioning not completed  <b>1</b>: Positioning completed  <b>halt=1</b>(according tohaltstop):  <b>0</b>:axis deceleration  <b>1</b>:axis stop (axis speed is0)</p> <p><b>set-point acknowledge:</b>  <b>0</b>:new-setpointfor0, and, after executing the action of the current target position (in execution) buffer is empty  <b>1</b>: The new positioning task is put into the buffer with data, the buffer is not empty</p> <p><b>following error:</b>  <b>0</b>:60F4h (Following error actual value)  (= 6062h (Position demand value) – 6064h (Position actual value)) value, not exceeding6065h (Following error window) setting range, or, 60F4hvalue exceeds6065hthe set value, without6066hset time.  <b>1</b>:60F4h (Following error actual value) value, more than6065h (Following error window) the state of the set range, 6066h (Following error time out) over the set time.</p>
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### 3. Action of pp control mode

#### Action example 1: (basic set-point)

(1) master, set607Ah (Target position) value, the6040h (Controlword) ofbit4 (new set-point) Depend on0

change to1. In this case, please also set6081h (Profile velocity).

6081h (Profile velocity) for0, the motor does not operate.

(2) slave, confirm6040h (Controlword) ofbit4 (new set-point) on the rising edge

(0→1), 607Ah (Target position)

Start the positioning action as the target position. At this point, change6041h (status word) bit12 (set-point acknowledge) Depend on0arrive1.

(3) master, confirm6041h (Statusword) ofbit12 (set-point acknowledge) has been replaced by0become1, 6040h (Controlword) ofbit4 (new set-point) return0.

(4) slave, confirm6040h (Controlword) ofbit4 (new set-point) has been0, 6041h (status word) bit12 (set-point acknowledge) becomes0.

(5) reaches the target position, 6041h (Controlword) ofbit10 (target reached) Depend on0change to1.

**Operation example 2: (operation data change without buffering: single set-point)**

6040h (Controlword) of bit5 (change set immediately) Yes1, if the data for the positioning action has been changed during the action,

The current positioning operation is interrupted, and the next positioning operation is started immediately.

(1) master, confirm 6041h (Statusword) of bit12 (set-point acknowledge) Yes0, change 607Ah (Target position)

After the value of , the 6040h (Controlword) of bit4 (new set-point) Depend on 0 change to 1.

**Note:** At this time, please do not change the more deceleration.

(2) slave, confirm 6040h (Controlword) of bit4 (new set-point) on the rising edge (0→1), 607Ah (Target position)

Immediately updated as the new target location. at this time, 6041h (Statusword) of bit12 (set-point acknowledge) Depend on 0 change to 1.

(3) master, confirm 6041h (Statusword) of bit12 (set-point acknowledge) has been replaced by 0 become 1, 6040h (Controlword) of bit4 (new set-point) return 0.

(4) slave, confirm 6040h (Controlword) of bit4 (new set-point) has been 0, 6041h (Statusword) of bit12 (set-point acknowledge) for 0.

**Note:** 6081h (Profile velocity) can be changed in the same steps ((1) to (4)).

change 607Ah (Target position) and 6081h (Profile velocity), according to the above (1)~(4) steps, while more

new 607Ah (Target position) and 6081h (Profile velocity).

### 8.1.3 Cyclic position control mode (csp mode)

A position control mode in which the target position, target speed, acceleration/deceleration, etc. are specified, and the position command is generated inside the servo driver and then operated.

#### 1, CSPControl mode associated objects (instructions • setting)

Index	Sub-index	Name	Units	Range	Data type	Access	PDO
6040h	00h	ControlWord	-	0~65535	U16	rw	RxPDO
6072h	00h	Max torque	0.1%	0~65535	U16	rw	RxPDO
607Ah	00h	Target position	command unit	-2147483648~2147483647	I32	rw	RxPDO
607Dh	00h	Software position limit	-	-	-	-	-

		Number of entries	-	2	U8	ro	No
		Min position limit	command unit	-2147483648~2147483647	I32	rw	RxPDO
		Max position limit	command unit	-2147483648~2147483647	I32	rw	RxPDO
607Fh	00h	Max profile velocity	Command unit/s	0~4294967295	U32	rw	RxPDO
6080h	00h	Max motor speed	r/min	0~4294967295	U32	rw	RxPDO
60B1h	00h	Velocity offset	Command unit/s	-2147483648~2147483647	I32	rw	RxPDO
60B2h	00h	Torque offset	0.1%	-32768~32767	I16	rw	RxPDO

Controlword (6040h) function in csp control mode

Index	Sub-index	Name/Description	Range	Data Type	Access	PDO	Op-mode																																								
6040h	00h	Controlword	0~65535	U16	Rw	RxPDO	All																																								
set pairPDSControl commands for servo drives such as state transitions. bitinformation																																															
<table border="1" style="width:100%; border-collapse: collapse; text-align: center;"> <tr> <td style="width:12.5%;">15</td> <td style="width:12.5%;">14</td> <td style="width:12.5%;">13</td> <td style="width:12.5%;">12</td> <td style="width:12.5%;">11</td> <td style="width:12.5%;">10</td> <td style="width:12.5%;">9</td> <td style="width:12.5%;">8</td> </tr> <tr> <td colspan="6">r</td> <td>oms</td> <td>h</td> </tr> <tr> <td>7</td> <td>6</td> <td>5</td> <td>4</td> <td>3</td> <td>2</td> <td>1</td> <td>0</td> </tr> <tr> <td>fr</td> <td colspan="3">oms</td> <td>eo</td> <td>qs</td> <td>ev</td> <td>so</td> </tr> <tr> <td></td> <td>r</td> <td>r</td> <td>r</td> <td></td> <td></td> <td></td> <td></td> </tr> </table>								15	14	13	12	11	10	9	8	r						oms	h	7	6	5	4	3	2	1	0	fr	oms			eo	qs	ev	so		r	r	r				
15	14	13	12	11	10	9	8																																								
r						oms	h																																								
7	6	5	4	3	2	1	0																																								
fr	oms			eo	qs	ev	so																																								
	r	r	r																																												
r = reserved (not corresponding) fr = fault reset oms = operation mode specific eo = enable operation (Control mode dependent bit, cspmode, not used) qs = quick stop h = halt ev = enable voltage so = switch on																																															

2. Objects associated with csp control mode (monitoring classes)

Index	Sub-index	Name	Units	Range	Data type	Access	PDO
6041h	00h	Statusword	-	0~65535	U16	ro	TxPDO
6062h	00h	Position demand value	command unit	-2147483648~2147483647	I32	ro	TxPDO
6063h	00h	Position actual internal value	pulse	-2147483648~2147483647	I32	ro	TxPDO

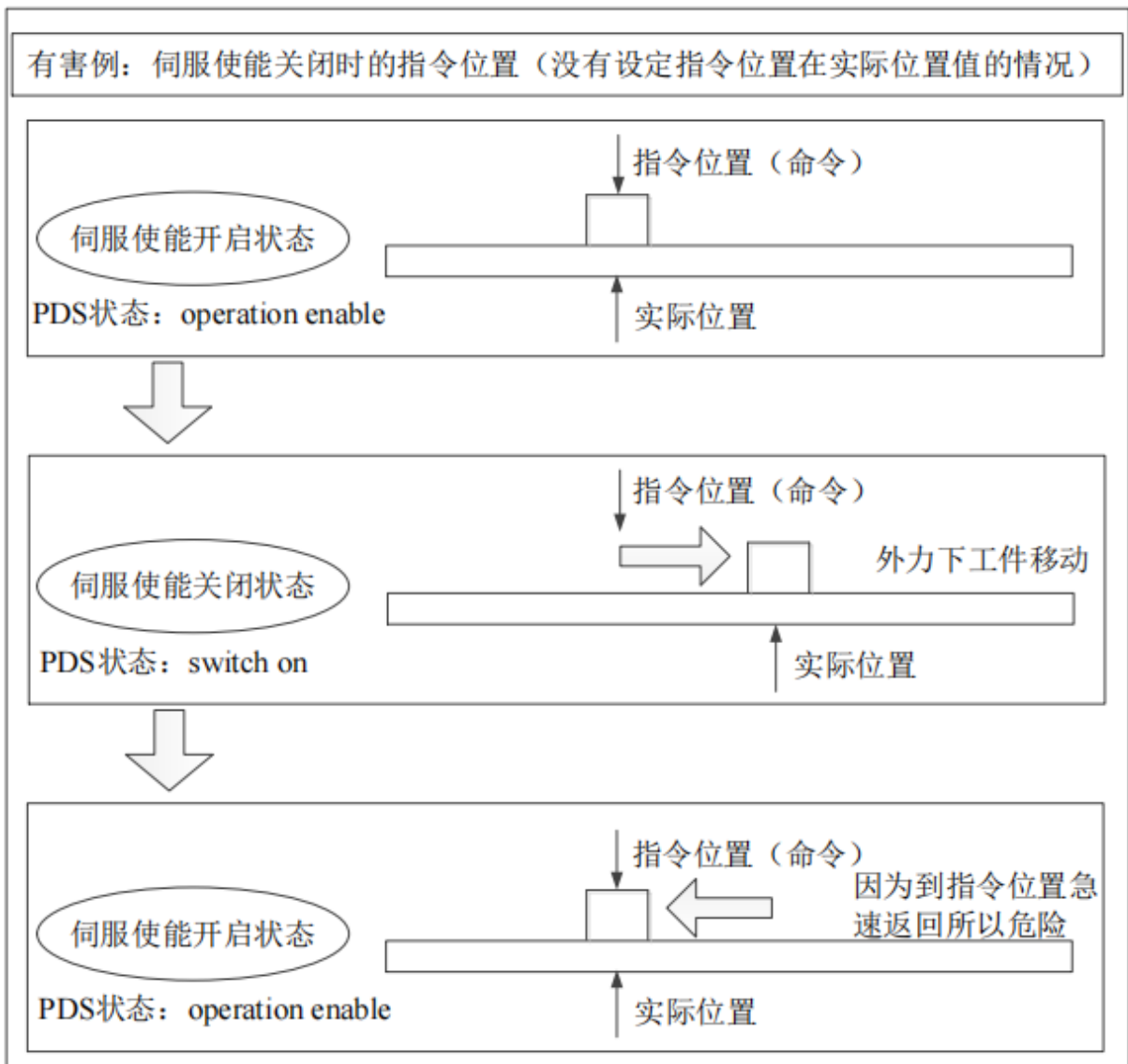
6064h	00h	Position actual value	command unit	-2147483648~2147483647	I32	ro	TxPDO
6065h	00h	Following error window	command unit	0~4294967295	U32	rw	RxPDO
6066h	00h	Following error time out	1ms	0~65535	U16	rw	RxPDO
6067h	00h	Position window	command unit	0~4294967295	U32	rw	RxPDO
6068h	00h	Position window time	1ms	0~65535	U16	rw	RxPDO
606Ch	00h	Velocity actual value	Command unit/s	-2147483648~2147483647	I32	ro	TxPDO
6074h	00h	Torque demand	0.1%	-32768~32767	I16	ro	TxPDO
6076h	00h	Motor rated torque	Mn m	0~4294967295	U32	ro	TxPDO
6077h	00h	Torque actual value	0.1%	-32768~32767	I16	ro	TxPDO
60F4h	00h	Following error actual value	command unit	-2147483648~2147483647	I32	ro	TxPDO
60FAh	00h	Control effort	Command unit/s	-2147483648~2147483647	I32	ro	TxPDO
60FCh	00h	Position demand internal value	pulse	-2147483648~2147483647	I32	ro	TxPDO

Statusword (6041h) <function in csp control mode>

Index	Sub-index	Name/Description	Range	Data Type	Access	PDO	Op-mode	
6041h	00h	Controlword	0~65535	U16	Ro	TxPDO	All	
		Indicates the status of the servo drive.						
		bitinformation						
		15	14	13	12	11	10	9
	r		oms		ila	oms	rm	r



60C2h (Interpolation time period), indicating an update 607Ah (Target Position) and 60B0h (Position offset) 2 the period of an object. This value is set to and 1C32h-02h (Cycle time) for the same period. The host device (host) must pass the 60C2h (Interpolation time period) periodically to update the target position. Servo enable off state, please configure 607Ah (Target Position) + 60B0h (Position offset) follow 6064h (Position actual value) such host processing. When the servo is turned off, if the motor moves by external force, the next time the servo is turned on, it will return to the input target position, so it is very dangerous. Also, from mcspSwitch to a control mode other than the control mode to csp  
 In the control mode, please also perform follow-up processing.



8.1.4 Home position control mode (hm mode)



Return-to-origin method, a position control mode in which the motion speed is specified, and a position command is generated inside the servo drive to execute the return-to-origin action.

If it is used in the incremental mode, after the control power is turned on, it is necessary to perform the return-to-origin operation before performing the positioning work.

1, hmControl mode associated objects (instructions • setting)

Index	Sub-index	Name	Units	Range	Data type	Access	PDO
6040h	00h	ControlWord	-	0~65535	U16	rw	RxPDO
6098h	00h	Homing method	-	-128~127	I8	Rw	RxPDO
6099h	-	Homing speeds	-	-	-	-	-
	00h	Number of entries	-	2	U8	Ro	NO
	01h	Speed drinking search for switch	command unit/s <sup>2</sup>	0~4294967295	U32	rw	RxPDO
	02h	Speed drinking search for zero	command unit/s <sup>2</sup>	0~4294967295	U32	rw	RxPDO
609Ah	00h	Homing acceleration	command unit/s <sup>2</sup>	0~4294967295	U32	rw	RxPDO
6072h	00h	Max torque	0.1%	0~65535	U16	rw	RxPDO
607Fh	00h	Max profile velocity	Command unit/s	0~4294967295	U32	rw	RxPDO
6080h	00h	Max motor speed	r/min	0~4294967295	U32	rw	RxPDO
60B1h	00h	Velocity offset	Command unit/s	-2147483648~2147483647	I32	rw	RxPDO
60B2h	00h	Torque offset	0.1%	-32768~32767	I16	rw	RxPDO
60C5h	00h	Max acceleration	Command unit/s <sup>2</sup>	0~4294967295	U32	rw	RxPDO
60C6h	00h	Max deceleration	Command unit/s <sup>2</sup>	0~4294967295	U3	rw	RxPDO

2, hmObjects associated with the control mode (monitoring classes)

Index	Sub-index	Name	Units	Range	Data type	Access	PDO
6041h	00h	Statusword	-	0~65535	U16	ro	TxPDO
6062h	00h	Position demand value	command unit	-2147483648~2147483647	I32	ro	TxPDO
6063h	00h	Position actual internal value	pulse	-2147483648~2147483647	I32	ro	TxPDO
6064h	00h	Position actual value	command unit	-2147483648~2147483647	I32	ro	TxPDO

6065h	00h	Following error window	command unit	0~4294967295	U32	rw	RxPDO
<b>Index</b>	<b>Sub-index</b>	<b>Name</b>	<b>Units</b>	<b>Range</b>	<b>Data type</b>	<b>Access</b>	<b>PDO</b>
6066h	00h	Following error time out	1ms	0~65535	U16	rw	RxPDO
6067h	00h	Position window	command unit	0~4294967295	U32	rw	RxPDO
6068h	00h	Position window time	1ms	0~65535	U16	rw	RxPDO
606Ch	00h	Velocity actual value	Command unit/s	-2147483648~2147483647	I32	ro	TxPDO
6074h	00h	Torque demand	0.1%	-32768~32767	I16	ro	TxPDO
6076h	00h	Motor rated torque	Mn m	0~4294967295	U32	ro	TxPDO
6077h	00h	Torque actual value	0.1%	-32768~32767	I16	ro	TxPDO
60F4h	00h	Following error actual value	command unit	-2147483648~2147483647	I32	ro	TxPDO
60FAh	00h	Control effort	Command unit/s	-2147483648~2147483647	I32	ro	TxPDO
60FCh	00h	Position demand internal value	pulse	-2147483648~2147483647	I32	ro	TxPDO

Controlword (6040h)hmFunctions in Control Mode

Index	Sub-index	Name/Description	Range	Data Type	Access	PDO	Op-mode																																								
6040h	00h	Controlword	0~65535	U16	Rw	RxPDO	All																																								
		set pairPDSControl commands for servo drives such as state transitions. bitinformation																																													
		<table border="1" style="width: 100%; text-align: center;"> <tr> <td>15</td><td>14</td><td>13</td><td>12</td><td>11</td><td>10</td><td>9</td><td>8</td> </tr> <tr> <td colspan="6">r</td> <td>oms</td> <td>h</td> </tr> <tr> <td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td> </tr> <tr> <td>fr</td> <td colspan="3">oms</td> <td>eo</td> <td>qs</td> <td>ev</td> <td>so</td> </tr> <tr> <td></td> <td>r</td> <td>r</td> <td>start homing</td> <td></td> <td></td> <td></td> <td></td> </tr> </table>						15	14	13	12	11	10	9	8	r						oms	h	7	6	5	4	3	2	1	0	fr	oms			eo	qs	ev	so		r	r	start homing				
15	14	13	12	11	10	9	8																																								
r						oms	h																																								
7	6	5	4	3	2	1	0																																								
fr	oms			eo	qs	ev	so																																								
	r	r	start homing																																												
		r = reserved(not corresponding) fr = fault reset oms = operation mode specific eo = enable operation (Control mode dependentbit) qs = quick stop h = halt ev = enable voltage																																													

			so = switch on start homing: 0-->1The return-to-origin operation starts.
--	--	--	---

Homing method (6098h)

Index	Sub-index	Name/Description	Range	DataType	Access	PDO	Op-mode
6098h	00h	Homing method	-128~127	I8	rw	RxPDO	All
		Homing method: Currently supports 17~30, 35, 37					

Homing speeds (6099h)

Index	Sub-index	Name/Description	Range	DataType	Access	PDO	Op-mode
6099h	-	-	-	-	-	-	-
		Set the return-to-origin position control mode (hm) speed.					
	00h	Number of entries	2	u8	ro	RxPDO	HM
		express6099h (Homing speeds) ofSub-Indexthe number of					
	01h	Speed during search	0~4294967295	U32	rw	RxPDO	HM
		set toSwitchThe speed of the motion detected by the signal. The maximum value is handled internally with6080h (Max motor speed)and2147483647The arbitrarily smaller side is restricted.					
02h	Homing speed	0~4294967295	U32	rw	RxPDO	HM	
	Set the motion speed to the origin detection. ifSwitchThe edge of the signal is used as the origin detection position, in order to reduce the detection error, set the value as small as possible. The maximum value is handled internally with6080h (Max motor speed)and2147483647The arbitrarily smaller side is restricted.						

Homing acceleration (609Ah)

Index	Sub-index	Name/Description	Range	DataType	Access	PDO	Op-mode
609Ah	00h	Homing acceleration	0~4294967295 5	U32	rw	RxPDO	All
		Set the return-to-origin position control mode (hm) and the acceleration and deceleration. Return-to-origin position control mode (hm) is also used for this object. eachHoming methodAt the final stop (when the origin position is valid), the setting of this object is not required, and the servo locks and stops.					

		If set to 0, which is handled internally as ideal with.
--	--	---

2. hmObjects associated with the control mode (monitoring classes)

Index	Sub-index	Name	Units	Range	Data type	Access	PDO
6041h	00h	Statusword	-	0~65535	U16	ro	TxPDO
6062h	00h	Position demand value	command unit	-2147483648~2147483647	I32	ro	TxPDO
6063h	00h	Position actual internal value	pulse	-2147483648~2147483647	I32	ro	TxPDO
6064h	00h	Position actual value	command unit	-2147483648~2147483647	I32	ro	TxPDO
6065h	00h	Following error window	command unit	0~4294967295	U32	rw	RxPDO
6066h	00h	Following error time out	1ms	0~65535	U16	rw	RxPDO
6067h	00h	Position window	command unit	0~4294967295	U32	rw	RxPDO
6068h	00h	Position window time	1ms	0~65535	U16	rw	RxPDO
606Ch	00h	Velocity actual value	Command unit/s	-2147483648~2147483647	I32	ro	TxPDO
6074h	00h	Torque demand	0.1%	-32768~32767	I16	ro	TxPDO
6076h	00h	Motor rated torque	Mn m	0~4294967295	U32	ro	TxPDO
6077h	00h	Torque actual value	0.1%	-32768~32767	I16	ro	TxPDO
60E3h	-	Supported homing method	-	-	-		-
	00h	Number of entries		1~254	U8	Ro	TxPDO
	01h	1st supported homing method		0~32767	U16	Ro	TxPDO
	...	...	...	...	...	..	...
	20h	32nd supported homing methods		0~32767	U16	Ro	TxPDO

60F4h	00h	Following error actual value	command unit	-2147483648~2147483647	l32	ro	TxPDO
60FAh	00h	Control effort	Command unit/s	-2147483648~2147483647	l32	ro	TxPDO
60FCh	00h	Position demand internal value	pulse	-2147483648~2147483647	l32	ro	TxPDO

Statusword (6041h) <function in pp control mode>

Index	Sub-index	Name/Description	Range	Data Type	Access	PDO	Op-mode			
		Controlword	0~65535	U16	Ro	TxPDO	All			
		Indicates the status of the servo drive. bit information								
		15	14	13	12	11	10	9	8	
		r		oms		ila	oms		rm	r
				Homing Error	Homing attained		Target Reached			
		7	6	5	4	3	2	1	0	
		w	sod	qs	ve	f	oe	so	rtso	
6041h	00h	<p>r = reserved (not corresponding)    w = warning  sod = switch on disabled  oms = operation mode specific    qs = quick stop  (Control mode dependent bit)    ve = voltage enabled  ila = internal limit active    f = fault  oe = operation enabled  rm = remote so = switched on  rtso = ready to switch on</p> <p>target reached:  0: in action  1: stop state</p> <p>homing attained:  0: Return-to-origin operation has not been completed  1: Return to origin operation completed normally  In the following state, it is 0.  ◆ When the power is turned on  ◆ ESM status from Init move to PreOP Time  ◆ When the return-to-origin operation starts  without motor action Homing action (Method 35, Method 37) at  startup, homing attained also set to 0. However, set to 0 for a short time  (approximately 2 ms).</p>								

		<p><b>Homing error:</b>  <b>0:</b>A return-to-origin error has not occurred.  <b>1:</b>A return-to-origin error occurs (the return-to-origin operation cannot be performed normally).</p>
--	--	---

Support homing method (60E3)

Index	Sub-index	Name/Description	Range	Data Type	Access	PDO	Op-mode
60E3h	-	Supported homing method	-	-	-	TxPDO	-
		expressed support homing method.					
	00h	Number of entries	1~254	u8	ro	TxPDO	HM
		express 60E3h (Supported homing method) supported homing method number.					
	01h	1st supported homing method	0~32767	U16	ro	TxPDO	HM
		express support for the 1st individual homing method.					
...	...	...	...	...	...	...	...
20h	32nd supported homing methods						
	express support for the 32nd homing method						

3. Action of hm control mode (Homing action)

When using in incremental mode, to initialize the position information before starting normal operation, execute Homing action.

◆ After the origin position is detected, the following objects (presets) are initialized based on this position.

6062h (Position demand value) = 6064h (Position actual value) = 607Ch (Home offset)

6063h (Position actual internal value) = 60FCh (Position demand internal value) = 0

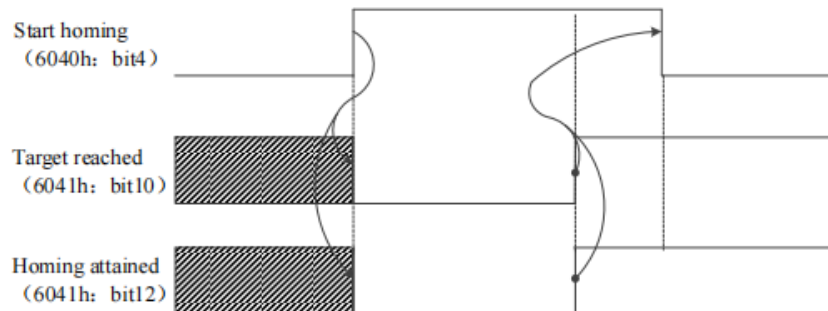
◆ If the home position return is performed, the position information is initialized (preset). Therefore, it is necessary to obtain again based on the old location information.

obtained data (Touch probe location, etc.).

◆ **Homing** Whether or not to change during the action 607Ch (Home offset), are not reflected in the execution Homing action. next time

**Homing**The action is reflected again (initialization of the position information at the time of completion).

- ◆ 607C(me offset) only in homing mode35,37valid below.
- ◆ ifSwitchSignal(T, NOT, HOME) edge as the origin detection position, please assign each clamping compensationPinarriveSI1, SI2, SI3. If it is not assigned correctly, an error will be reported for the return to origin. (Notice:DS5CServo seriesP5-22Set the address for the positive limit, Default is1, which corresponds to the servo terminalSI1;P5-23inverse limitNOTSet the address, the default is2, which corresponds to the servo terminalSI2; P5-27Set the address for the origin, the default is3, which corresponds to the servo terminalSI3. )
- ◆ each described laterMethodIn the figure, the following terms indicate the contents.  
**Index pulse** :encoder'sZPhase signal  
**Home switch** :Near origin input (ME) theoretical signal state  
**Positive limit** :Forward drive prohibition input (POT) the theoretical signal state of  
**Negative limit** :Negative direction drive inhibit input (NOT) the theoretical signal state of
- ◆ The update of the action command (send letter), the servo enable start command (Operation enabledinstruction), please go through an appointment100 mslose
- ◆ The following meanshmTiming of control modes.



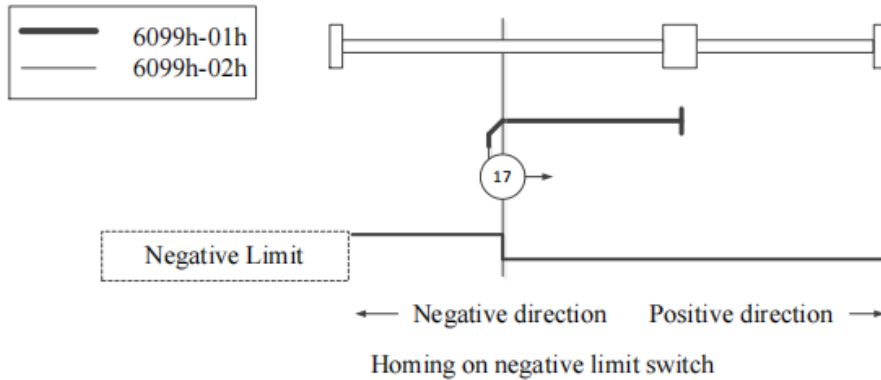
- ◆ **Homing error**Occurrence condition according toHomingaction, an exception occurs (Homing error = 1) conditions are as follows.

Homing error conditions	Details
Startup other than Operation enabled	Start Homing when the PDS state is not Operation enabled (except method 35, 37)
Start at target speed 0	Homing is activated when the set value of 6099h-01h and 6099h-02h is 0 (except when 6099h-02h of method 33 and 34 and 6099h-01h and 6099h-02h of method 35 and 37 are 0)
Check out both Limit switches	Two Limit switches of Positive/Negative are detected when Homing starts or during Homing operation
Use Limit switch	In the method of inversion by the limit switch, the falling edge of the limit switch is detected in the deceleration operation due to the inversion after the detection of the rising edge of the limit switch.

Home switch, Limit switch not assigned	IO terminal not assigned
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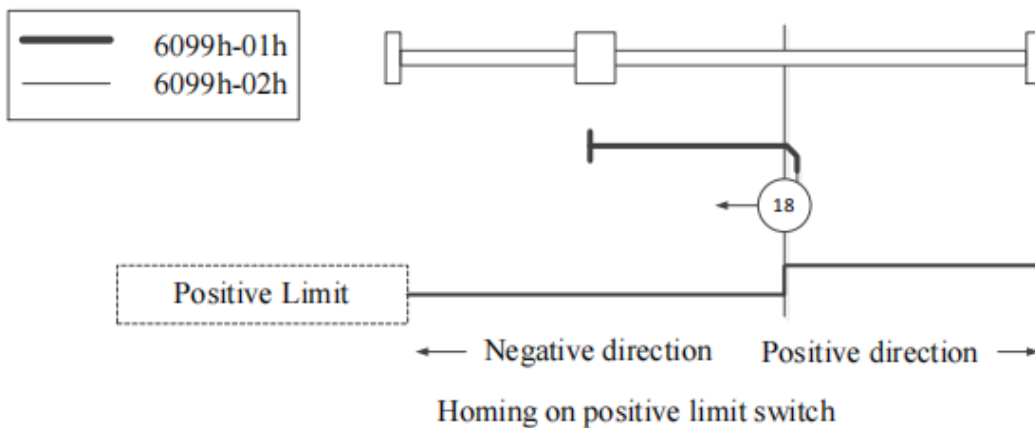
**Method 17**

- ◆ This method is similar to Method 1.
- The difference is that the origin checkout position is not Index pulse, but Limit switch changing location. (Please refer to the picture below)
- ◆ NOT When unassigned, Homing error = 1.



**Method 18**

- ◆ This method is similar to Method 2.
- The difference is that the origin checkout position is not Index pulse, but Limit switch changing location. (Please refer to the picture below)
- ◆ POT When unassigned, Homing error = 1.



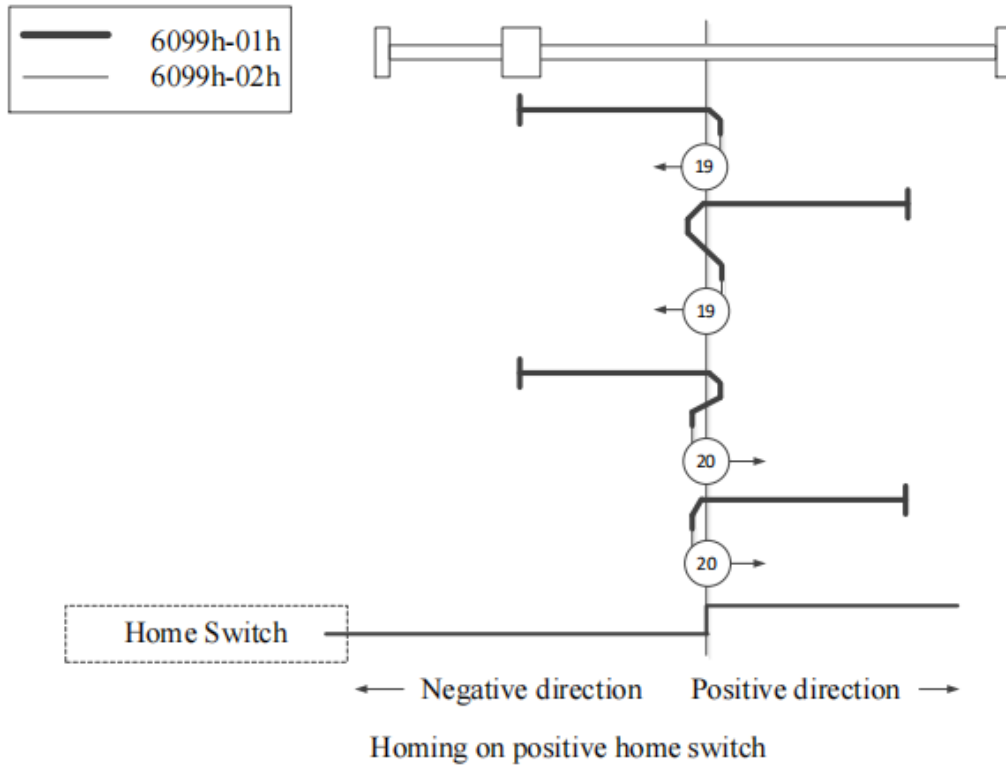
**Method 19, 20**

- ◆ This method is similar to Method 3, 4.



The difference is that the origin checkout position is not Index pulse, but Home switch changing location. (Please refer to the picture below)

- ◆ HOME When unassigned, Homing error = 1.

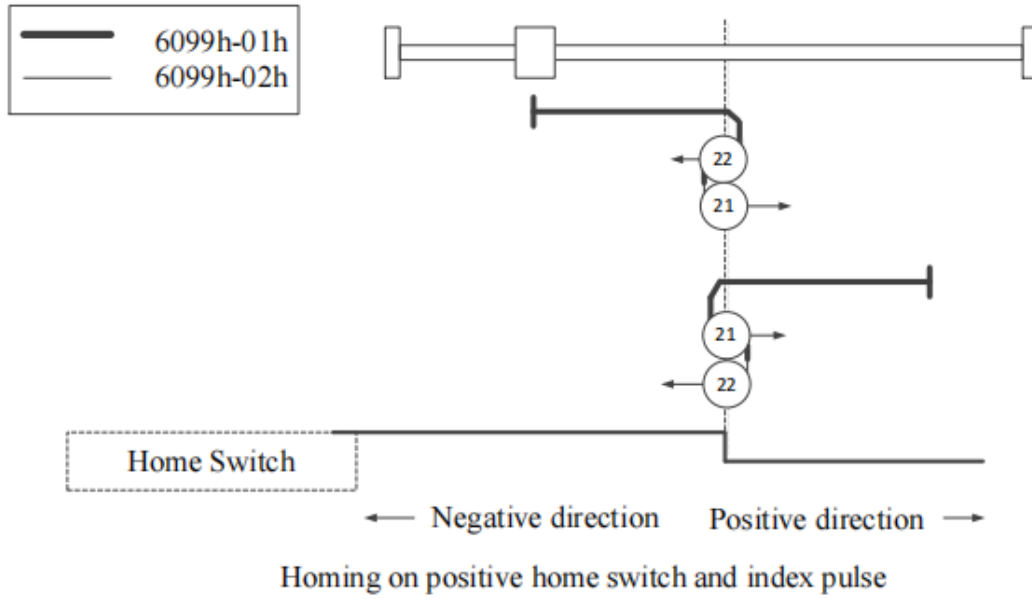


Method 21, 22

- ◆ This method is similar to Method 5, 6.

The difference is that the origin checkout position is not Index pulse, but Home switch changing location. (Please refer to the picture below)

- ◆ HOME When unassigned, Homing error = 1.

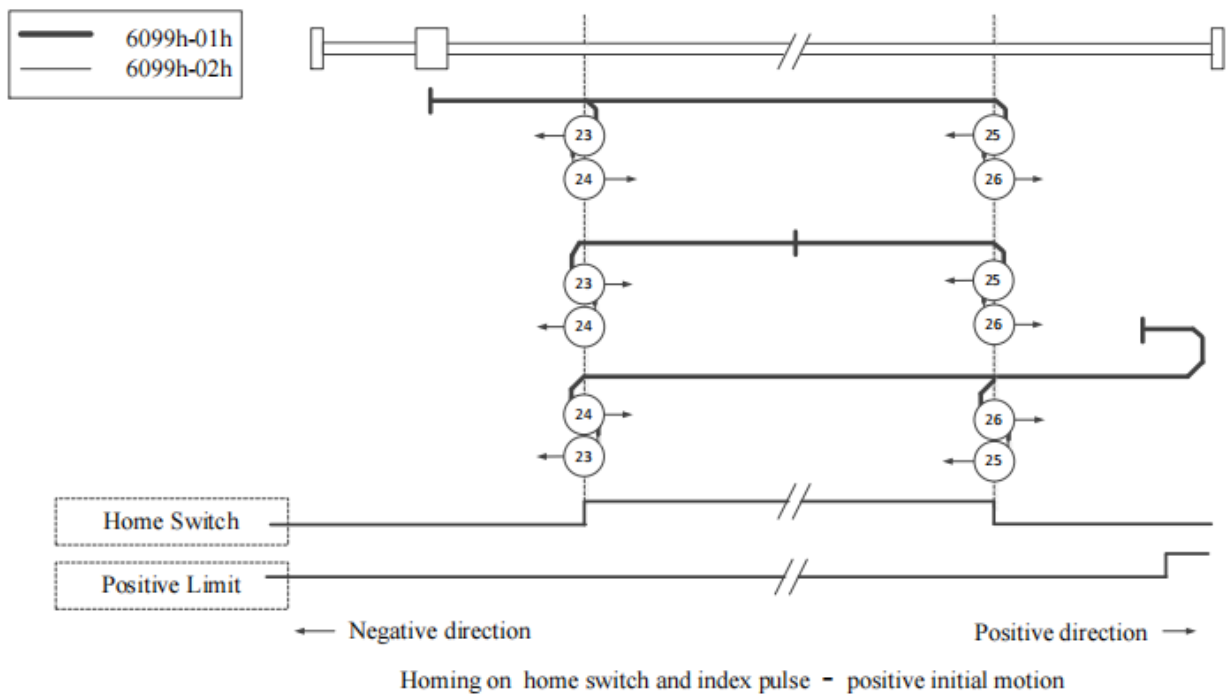


Method 23, 24, 25, 26

- ◆ This method is similar to Method 7, 8, 9, 10.

The difference is that the origin checkout position is not Index pulse, but Home switch changing location. (Please refer to the picture below)

- ◆ HOME, POT When unassigned, Homing error = 1.



Method 27, 28, 29, 30

- ◆ This method is similar to Method 11, 12, 13, 14.



## 8.2 Speed Control Mode (PV, GSV)

### 8.2.1 Related objects common to speed control

#### 1. Objects commonly associated with speed control (command • setting)

Index	Sub-index	Name	Units	Range	Data type	Access	PDO
6040h	00h	ControlWord	-	0~65535	U16	rw	RxPDO
6072h	00h	Max torque	0.1%	0~65535	U16	rw	RxPDO
607Fh	00h	Max profile velocity	Command unit/s	0~4294967295	U32	rw	RxPDO
6080h	00h	Max motor speed	r/min	0~4294967295	U32	rw	RxPDO
60B1h	00h	Velocity offset	Command unit/s	-2147483648~2147483647	I32	rw	RxPDO
60B2h	00h	Torque offset	0.1%	-32768~32767	I16	rw	RxPDO
60FFh	00h	Target Velocity	Command unit/s	0~4294967295	U32	rw	RxPDO

#### Speed class

Index	Sub-index	Name	Units	Range	Data type	Access	PDO	Op-mode
6080h	00h	Max motor speed	r/min	0~4294967295	U32	rw	RxPDO	ALL
		Set the maximum speed of the motor. When the control power is turned on, the maximum speed read from the motor is set. The maximum value is limited by the maximum speed read from the motor according to internal processing. tq, cst, the speed is limited by the set value of this object.						
6081h	00h	Profile velocity	Command unit/s	- 2147483648~2147483647	I32	rw	RxPDO	ALL
		Set the target speed. The maximum value is based on the internal processing607Fh (Max profile velocity) to limit.						
60B1h	00h	Velocity offset	Command unit/s	0~4294967295	U32	rw	RxPDO	-
		Version not supported						

2. Objects commonly associated with speed control (monitoring class)

Index	Sub-index	Name	Units	Range	Data type	Access	PDO
6041h	00h	Statusword	-	0~65535	U16	ro	TxPDO
6062h	00h	Position demand value	command unit	-2147483648~2147483647	I32	ro	TxPDO
6063h	00h	Position actual internal value	pulse	-2147483648~2147483647	I32	ro	TxPDO
6064h	00h	Position actual value	command unit	-2147483648~2147483647	I32	ro	TxPDO
606Bh	00h	Velocity demand value	Command unit/s	-2147483648~2147483647	I32	rw	TxPDO
606Ch	00h	Velocity actual value	Command unit/s	-2147483648~2147483647	I32	ro	TxPDO
6074h	00h	Torque demand	0.1%	-32768~32767	I16	ro	TxPDO
6076h	00h	Motor rated torque	Mn m	0~4294967295	U32	ro	TxPDO
6077h	00h	Torque actual value	0.1%	-32768~32767	I16	ro	TxPDO

Location class

Index	Sub-index	Name	Units	Range	Data type	Access	PDO	Op-mode
6063h	00h	Position actual internal value	command unit	- 2147483648~2147483647	I32	ro	TxPDO	ALL
		Indicates the actual position of the motor.						
6064h	00h	Position actual value	command unit	- 2147483648~2147483647	I32	ro	TxPDO	ALL
		represents the actual position of the motor (= APOS).						

Speed class

Index	Sub-index	Name	Units	Range	Data type	Access	PDO	Op-mode
60FAh	00h	Velocity demand value	command unit	- 2147483648~2147483647	I32	ro	TxPDO	ALL
		Indicates the internal command speed (position loop output).						

606Ch	00h	Velocity actual value	command unit	- 2147483648~2147483647	132	ro	TxPDO	ALL
Indicates the actual speed of the motor (=FSPD).								

### Torque class

Index	Sub-index	Name	Units	Range	Data type	Access	PDO	Op-mode
6074h	00h	Torque demand	0.1%	-32768~32767	116	ro	TxPDO	ALL
Indicates the internal command torque.								
6076h	00h	Motor rated torque	mNm	0~4294967295	U32	ro	TxPDO	ALL
Read the rated torque from the motor and set it automatically.								
6077h	00h	Velocity actual value	0.1%	-32768~32767	116	ro	TxPDO	ALL
Indicates the actual torque, the same value as the actual current value. This output value is a reference value and is not guaranteed to be an actual value.								

### 8.2.2 Profile speed control mode (pv mode)

Specify the target speed, acceleration and deceleration, etc., and generate the speed control mode of the position command action inside the servo drive.

#### 1. Objects associated with pv control mode (instructions • setting)

Index	Sub-index	Name	Units	Range	Data type	Access	PDO
6040h	00h	ControlWord	-	0~65535	U16	rw	RxPDO
607Fh	00h	Max profile velocity	Command unit/s	0~4294967295	U32	rw	RxPDO
6083h	00h	Profile acceleration	Command unit/s <sup>2</sup>	0~4294967295	U32	rw	RxPDO
6084h	00h	Profile deceleration	Command unit/s <sup>2</sup>	0~4294967295	U32	rw	RxPDO
60C5h	00h	Max acceleration	Command unit/s <sup>2</sup>	0~4294967295	U32	rw	RxPDO
60C6h	00h	Max deceleration	Command unit/s <sup>2</sup>	0~4294967295	U3	rw	RxPDO

In addition, there are objects commonly associated with speed control.

Index	Sub-index	Name	Units	Range	Data type	Access	PDO
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6072h	00h	Max torque	0.1%	0~65535	U16	rw	RxPDO
6080h	00h	Max motor speed	r/min	0~4294967295	U32	rw	RxPDO
60B1h	00h	Velocity offset	Command unit/s	-2147483648~2147483647	I32	rw	RxPDO
60B2h	00h	Torque offset	0.1%	-32768~32767	I16	rw	RxPDO
60FFh	00h	Target velocity	Command unit/s <sup>2</sup>	0~4294967295	U3	rw	RxPDO

Controlword (6040h) function in pv control mode

Index	Sub-index	Name/Description	Range	Data Type	Access	PDO	Op-mode		
6040h	00h	Controlword	0~65535	U16	Rw	RxPDO	All		
		set pairPDSControl commands for servo drives such as state transitions. bitinformation							
		15	14	13	12	11	10	9	8
		r						oms	h
		7	6	5	4	3	2	1	0
fr	oms			eo	qs	ev	so		
		r	r	r					
r = reserved (not corresponding) fr = fault reset oms = operation mode specific eo = enable operation (Control mode dependentbit, PVmode, not used) qs = quick stop h = halt ev = enable voltage so = switch on									

**Speed class**

Index	Sub-index	Name	Units	Range	Data type	Access	PDO	Op-mode
607Fh	00h	Max profile velocity	command unit	0~4294967295	U32	ro	TxPDO	PP PV HM
		limited inProfileposition mode (pp), return-to-origin position mode (hm), Profilespeed mode (pv) under the speed limit value. The maximum value is processed by the internal6080h(Max motor speed) limit.						
6080h	00h	Max motor speed	r/min	0~4294967295	U32	ro	TxPDO	PV TQ CSV CST
		Set the maximum speed of the motor. When the control power is turned on, the maximum speed read from the motor is set.						

		The maximum value is limited by the maximum speed read from the motor according to internal processing. tq, cst, the speed is limited by the set value of this object.
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### Acceleration and deceleration

Index	Sub-index	Name	Units	Range	Data type	Access	PDO	Op-mode
6083h	00h	Profile acceleration	command unit/s <sup>2</sup>	0~4294967295	U32	ro	TxPDO	PP PV
		set upProfileacceleration. set as0, the internal processing as1deal with.						
6084h	00h	Profile deceleration	command unit/s <sup>2</sup>	0~4294967295	U32	ro	TxPDO	PP PV
		set upProfiledeceleration. set as0, the internal processing as1deal with.						
60C5h	00h	Max acceleration	command unit/s <sup>2</sup>	0~4294967295	U32	ro	TxPDO	PP PV HM
		Set the maximum acceleration. set as0, the internal processing as1deal with.						
60C6h	00h	Min deceleration	command unit/s <sup>2</sup>	0~4294967295	U32	ro	TxPDO	PP PV HM
		Set the maximum deceleration. set as0, the internal processing as1deal with.						

### 2, the object associated with the pv control mode (monitoring)

Index	Sub-index	Name	Units	Range	Data type	Access	PDO
6041h	00h	Statusword	-	0~65535	U16	ro	TxPDO
6065h	00h	Following error window	command unit	0~4294967295	U32	rw	RxPDO
6066h	00h	Following error time out	1ms	0~65535	U16	rw	RxPDO



6067h	00h	Position window	command unit	0~4294967295	U32	rw	RxPDO
6068h	00h	Position window time	1ms	0~65535	U16	rw	RxPDO

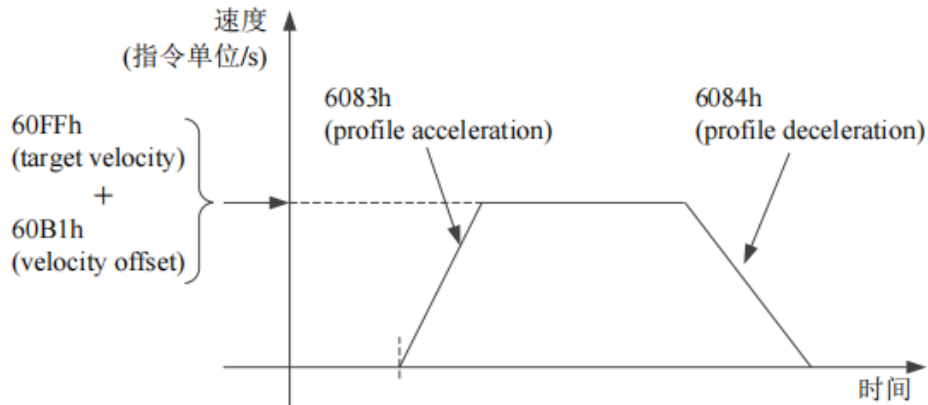
Statusword (6041h) <function in pp control mode>

Index	Sub-index	Name/Description	Range	Data Type	Access	PDO	Op-mode			
6041h	00h	Controlword	0~65535	U16	Ro	TxPDO	All			
		Indicates the status of the servo drive.								
		bitinformation								
		15	14	13	12	11	10	9	8	
		r		oms		ila	oms		rm	r
				r	speed		Target Reached			
		7	6	5	4	3	2	1	0	
		w	sod	qs	ve	f	oe	so	rsto	
		r = reserved (not corresponding)    w = warning <span style="margin-left: 300px;">sod = switch on disabled</span>								
		oms = operation mode specific    qs = quick stop (Control mode dependent bit)    ve = voltage enabled								
ila = internal limit active    f = fault <span style="margin-left: 300px;">oe = operation enabled</span>										
rm = remote    so = switched on <span style="margin-left: 300px;">rtso = ready to switch on</span>										
target reached: halt=0 (normal usage): 0: Positioning not completed 1: Positioning completed halt=1 (according to halt stop): 0: axis deceleration 1: axis stop (axis speed is 0)										
Speed:										

		0: Motor is operating 1: The motor is stopped
--	--	--

### 3. Actions in pv control mode

- ◆ Profile In the speed control mode, the speed command value is generated based on the following parameters.
- ◆ Target velocity (60FFh)
- ◆ Velocity offset (60B1h)
- ◆ Profile acceleration (6083h)
- ◆ Profile deceleration (6084h)
- ◆ The target speed is 60FFh (Target velocity).
- ◆ Velocity feedforward is 60B1h (Velocity offset) is not currently supported.
- ◆ The update (transmission) of the action command is that after the servo enable is turned on, please pass the 100ms Enter again.
- ◆ As test information, provide 606Ch (Velocity actual value)



- ◆ 60FFh (Target velocity) is passed through 607Fh (Max profile velocity) as well as 6080h (Max motor speed) conduct limit.

### 8.2.3 Cyclic speed control mode (csv mode)

According to the host device (Main site) A speed control mode in which the command speed is generated, and the command speed is updated (transmitted) according to the compensation cycle, and the operation is performed. use DC or SM2 Sync mode.

1, csv Control mode associated objects (instructions • setting)

Index	Sub-index	Name	Units	Range	Data type	Access	PDO
6040h	00h	ControlWord	-	0~65535	U16	rw	RxPDO
607Fh	00h	Max profile velocity	Command unit/s	0~4294967295	U32	rw	RxPDO

In addition, there are objects commonly associated with speed control.

Index	Sub-index	Name	Units	Range	Data type	Access	PDO
6072h	00h	Max torque	0.1%	0~65535	U16	rw	RxPDO
6080h	00h	Max motor speed	r/min	0~4294967295	U32	rw	RxPDO
60B1h	00h	Velocity offset	Command unit/s	-2147483648~2147483647	I32	rw	RxPDO
60B2h	00h	Torque offset	0.1%	-32768~32767	I16	rw	RxPDO
60FFh	00h	Target velocity	Command unit/s <sup>2</sup>	0~4294967295	U3	rw	RxPDO

Controlword (6040h) CSV Functions in Control Mode

Index	Sub-index	Name/Description	Range	Data Type	Access	PDO	Op-mode																																									
6040h	00h	Controlword	0~65535	U16	Rw	RxPDO	All																																									
		set pairPDSControl commands for servo drives such as state transitions. bitinformation																																														
		<table border="1" style="width:100%; text-align:center;"> <tr> <td>15</td><td>14</td><td>13</td><td>12</td><td>11</td><td>10</td><td>9</td><td>8</td> </tr> <tr> <td colspan="6">r</td> <td>oms</td> <td>h</td> </tr> <tr> <td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td> </tr> <tr> <td>fr</td> <td colspan="3">oms</td> <td>eo</td> <td>qs</td> <td>ev</td> <td>so</td> </tr> <tr> <td></td> <td>r</td> <td>r</td> <td>r</td> <td></td> <td></td> <td></td> <td></td> </tr> </table>							15	14	13	12	11	10	9	8	r						oms	h	7	6	5	4	3	2	1	0	fr	oms			eo	qs	ev	so		r	r	r				
		15	14	13	12	11	10	9	8																																							
r						oms	h																																									
7	6	5	4	3	2	1	0																																									
fr	oms			eo	qs	ev	so																																									
	r	r	r																																													
r = reserved (not corresponding) fr = fault reset oms = operation mode specific eo = enable operation (Control mode dependent bit, PV <sub>mode</sub> , not used) qs = quick stop h = halt ev = enable voltage so = switch on																																																

2, csv Control mode associated objects (monitoring)

Index	Sub-index	Name	Units	Range	Data type	Access	PDO
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6041h	00h	Statusword	-	0~65535	U16	ro	TxPDO
6063h	00h	Following error window	command unit	0~4294967295	U32	ro	TxPDO
6064h	00h	Following error time out	1ms	0~65535	U16	ro	TxPDO
606Bh	00h	Position window	command unit	0~4294967295	U32	ro	TxPDO
606Ch	00h	Position window time	1ms	0~65535	U16	ro	TxPDO
6074h	00h	Torque demand	0.1%	-32768~32767	I16	ro	TxPDO
6076h	00h	Motor rated torque	Mn m	0~4294967295	U32	ro	TxPDO
6077h	00h	Torque actual value	0.1%	-32768~32767	I16	ro	TxPDO

Statusword (6041h) <CSVFunctions in Control Mode>

Index	Sub-index	Name/Description	Range	Data Type	Access	PDO	Op-mode			
6041h	00h	Controlword	0~65535	U16	Ro	TxPDO	All			
		Indicates the status of the servo drive.								
		bit information								
		15	14	13	12	11	10	9	8	
		r		oms		ila	oms		rm	r
				r	follow drive command vaule		r			
		7	6	5	4	3	2	1	0	
		w	sod	qs	ve	f	oe	so	rtso	
		r = reserved (not corresponding)    w = warning sod = switch on disabled oms = operation mode specific    qs = quick stop (Control mode dependent bit)    ve = voltage enabled ila = internal limit active    f = fault oe = operation enabled rm = remote    so = switched on rtso = ready to switch on								

		<p>follow drive command vaule:</p> <p>0:Action not performed according to target speed</p> <p>1:Execute actions according to the target speed</p>
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The so-called "execute action according to the target speed" must meet the following conditions:

- ◆ PDSstatus isOperation enabled
- ◆ not in deceleration processing (Halt, Quickstop, Shutdown, Disable operation, Falut)
- ◆ noHaltstop state
- ◆ Torque limit does not occur

### 3. Actions of csv control mode

- ◆ CyclicIn the speed control mode, the motion model (trajectory) is generated not on the slave but on the master.
- ◆ The target speed is60FFh (Target velocity)
- ◆ Velocity feedforward60B1h (Velocity offset) is not currently supported.
- ◆ The update (transmission) of the action command is that the servo enable is turned on (Operation enabledinstruction), please go through an appointment100 msinput later.
- ◆ 60C2h (Interpolation time period) means, update60FFh (Target velocity) and60B1h (Velocity offset) Period of two objects. This value is set to and1C32h-02h (Cycle time) for the same period.
- ◆ As monitoring information, provide606Ch (Velocity actual value) Wait.
- ◆ 60FFh (Target velocity) value through6080h (Max motor speed)

## 8.3 Torque control mode (tq, cst)

### 8.3.1 Related objects common to torque control

1,torqueObjects that control common associations (commands) • setting)

Index	Sub-index	Name	Units	Range	Data type	Access	PDO
6040h	00h	ControlWord	-	0~65535	U16	rw	RxPDO
6071h	00h	Target torque	0.1%	-32768~32767	I16	rw	RxPDO
6072h	00h	Max torque	0.1%	0~65535	U16	rw	RxPDO
6080h	00h	Max motor speed	r/min	0~4294967295	U32	rw	RxPDO
6087h	00h	Torque slope	0.1%/s	0~4294967295	U32	rw	RxPDO
60B2h	00h	Torque offset	0.1%	-32768~32767	I16	rw	RxPDO

### Speed class

Index	Sub-index	Name	Units	Range	Data type	Access	PDO	Op-mode
6080h	00h	Max motor speed	r/min	0~4294967295	U32	rw	RxPDO	ALL

		<p>Set the maximum speed of the motor.</p> <p>When the control power is turned on, the maximum speed read from the motor is set.</p> <p>The maximum value is limited by the maximum speed read from the motor according to internal processing.</p> <p>tq, cst, the speed is limited by the set value of this object.</p>
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**Torque class**

Index	Sub-index	Name	Units	Range	Data type	Access	PDO	Op-mode
6071h	00h	Target torque	0.1%	-32768~32767	I16	rw	RxPDO	Tq cst
		set torqueProfilemodel (tq), CyclicSynchronous torque mode (cst) target torque. if more than6072h(Max torque) value, use6072hto limit.						
6072h	00h	Torque slope	0.1%	0~65535	U16	rw	RxPDO	ALL
		Set the maximum torque of the motor. The maximum value is limited by internal processing with the maximum torque read from the motor. The maximum torque of the motor varies depending on the motor.						
6087h	00h	Torque actual value	0.1%	0~4294967295	U32	rw	RxPDO	Tq cst
		Indicates the actual torque, the same value as the actual current value. This output value is a reference value and is not guaranteed to be an actual value.						
60B2h	00h	Torque offset	0.1%	-32768~32767	I16	rw	RxPDO	-
		Version not supported						

2, torqueObjects associated with the control schema (monitoring)

Index	Sub-index	Name	Units	Range	Data type	Access	PDO
6041h	00h	Statusword	-	0~65535	U16	ro	TxPDO
6063h	00h	Following error window	command unit	0~4294967295	U32	ro	TxPDO
6064h	00h	Following error time out	1ms	0~65535	U16	ro	TxPDO
606Ch	00h	Position window time	1ms	0~65535	U16	ro	TxPDO
6074h	00h	Torque demand	0.1%	-32768~32767	I16	ro	TxPDO
6075h	00h	Motor rated current	1ma	0~4294967295	U32	ro	TxPDO
6076h	00h	Motor rated torque	Mn m	0~4294967295	U32	ro	TxPDO

6077h	00h	Torque actual value	0.1%	-32768~32767	l16	ro	TxPDO
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Location class

Index	Sub-index	Name	Units	Range	Data type	Access	PDO	Op-mode
6063h	00h	Position actual internal value	instruction unit	- 2147483648~ 2147483647	I32	ro	TxPDO	ALL
		Indicates the actual position of the motor. Encoder units other than full closed loop control are used, and external displacement sensor units are used for full closed loop control.						
6064h	00h	Position actual value	instruction unit	- 2147483648~ 2147483647	I32	ro	TxPDO	ALL
		represents the actual position of the motor (= APOS)						

Speed class

Index	Sub-index	Name	Units	Range	Data type	Access	PDO	Op-mode
606Ch	00h	Velocity actual value	Command unit/s	- 2147483648~ 2147483647	I32	ro	TxPDO	ALL
		Indicates the real speed of the motor (= FSPD).						

Torque class

Index	Sub-index	Name	Units	Range	Data type	Access	PDO	Op-mode
6074h	00h	Torque demand	0.1%	- 32768~32767	l16	ro	TxPDO	ALL
		Indicates the internal command torque.						
6075h	00h	Motor rated current	1ma	0~429496729 5	U32	ro	TxPDO	ALL

		The motor rated current is automatically set.						
6076h	00h	Motor rated torque	Mn m	0~429496729 5	U32	ro	TxPDO	ALL
		Read the rated torque from the motor and set it automatically.						
6077h	00h	Torque actual value	0.1%	- 32768~32767	l16	ro	TxPDO	ALL
		Indicates the actual torque,the same value as the actual current value. This output value is a reference value and is not guaranteed to be an actual value.						
6078h	00h	Current actual value	0.1%	- 32768~32767	l16	ro	TxPDO	ALL
		Indicates the actual current value.						

### 8.3.2 Profile torque control mode (tq mode)

A torque control mode in which the target torque, acceleration/deceleration, etc. are specified, and a position command is generated inside the servo drive.

1, tqcontrolmode|The associated object image (instruction · setting)

Index	Sub-index	Name	Units	Range	Data type	Access	PDO
6040h	00h	ControlWord	-	0~65535	U16	rw	RxPDO
6088h	00h	Torque profile type	-	-32768~32767	l16	rw	RxPDO

### Related objects common to other torque control

Index	Sub-index	Name	Units	Range	Data type	Access	PDO
6071h	00h	Target torque	0.1%	-32768~32767	l16	rw	RxPDO
6072h	00h	Max torque	0.1%	0~65535	U16	rw	RxPDO
6080h	00h	Max motor speed	r/min	0~4294967295	U32	rw	RxPDO
6087h	00h	Torque slope	0.1%/s	0~4294967295	U32	rw	RxPDO
60B2h	00h	Torque offset	0.1%	-32768~32767	l16	rw	RxPDO

Controlword (6040h) Function in tq control mode

Index	Sub-index	Name/Description	Range	DataType	Access	PDO	Op-mode
6040h	00h	Controlword	0~65535	U16	Rw	RxPDO	All



set pairPDSControl commands for servo drives such as state transitions.							
bitinformation							
15	14	13	12	11	10	9	8
r						oms	h
7	6	5	4	3	2	1	0
fr	oms			eo	qs	ev	so
	r	r	r				
<p>r = reserved (not corresponding) fr = fault reset  oms = operation mode specific eo = enable operation  (Control mode dependent bit, tqmode, not used) qs = quick stop  h = halt ev = enable voltage  so = switch on</p>							

Torque class

Index	Sub-index	Name	Units	Range	Data type	Access	PDO	Op-mode
6087h	00h	Torque slope	0.1%	0~429496729 5	U32	rw	RxPDO	Tq cst
		Set the parameter value to give the inclination torque command. CyclicSynchronous torque mode (cst) is valid only during deceleration stop. If set to0, which is internally processed withloperate.						
6088h	00h	Torque profile type	-	-32768~32767	I16	rw	RxPDO	tq
		To change the torque, set the torque to be usedProfiletype. 0: Straight slope 1:Not supported						

2, tqObjects associated with the control schema (monitoring)

Index	Sub-index	Name	Units	Range	Data type	Access	PDO
6041h	00h	Statusword	-	0~65535	U16	ro	TxPDO
6073h	00h	Max current	0.1%	0~65535	U16	ro	NO

Objects commonly associated with other torque control (monitoring class)

Index	Sub-index	Name	Units	Range	Data type	Access	PDO
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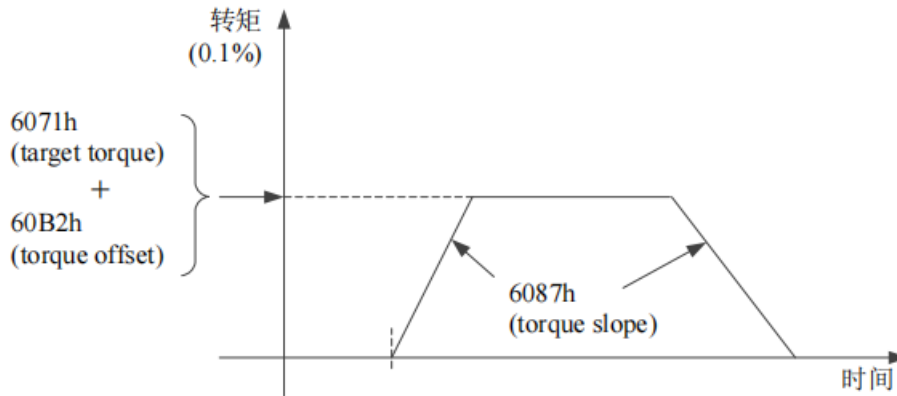
6063h	00h	Following error window	command unit	0~4294967295	U32	ro	TxPDO
6064h	00h	Following error time out	1ms	0~65535	U16	ro	TxPDO
606Ch	00h	Position window time	1ms	0~65535	U16	ro	TxPDO
6074h	00h	Torque demand	0.1%	-32768~32767	I16	ro	TxPDO
6075h	00h	Motor rated current	1ma	0~4294967295	U32	ro	TxPDO
6076h	00h	Motor rated torque	Mn m	0~4294967295	U32	ro	TxPDO
6077h	00h	Torque actual value	0.1%	-32768~32767	I16	ro	TxPDO
6078h	00h	Current actual value	0.1%	-32768~32767	I16	ro	TxPDO

Statusword (6041h) <tqFunctions in Control Mode>

Index	Sub-index	Name/Description	Range	Data Type	Access	PDO	Op-mode																																			
6041h	00h	Controlword	0~65535	U16	Ro	TxPDO	All																																			
<p>Indicates the status of the servo drive. bitinformation</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>15</th> <th>14</th> <th>13</th> <th>12</th> <th>11</th> <th>10</th> <th>9</th> <th>8</th> </tr> </thead> <tbody> <tr> <td colspan="2" rowspan="2">r</td> <td colspan="2">oms</td> <td rowspan="2">ila</td> <td>oms</td> <td rowspan="2">rm</td> <td rowspan="2">r</td> </tr> <tr> <td>r</td> <td>speed</td> <td>Target Reached</td> </tr> <tr> <th>7</th> <th>6</th> <th>5</th> <th>4</th> <th>3</th> <th>2</th> <th>1</th> <th>0</th> </tr> <tr> <td>w</td> <td>sod</td> <td>qs</td> <td>ve</td> <td>f</td> <td>oe</td> <td>so</td> <td>rtso</td> </tr> </tbody> </table> <p>r = reserved(not corresponding)    w = warning  sod = switch on disabled  oms = operation mode specific    qs = quick stop  (Control mode dependentbit)    ve = voltage enabled  ila = internal limit active    f = fault  oe = operation enabled  rm = remote so = switched on  rtso = ready to switch on</p> <p>target reached:  halt=0(normal usage):  0:Torque does not reach target  1: Reach torque target  halt=1(according tohaltstop):  0:axis deceleration  1:axis stop (axis speed is0)</p>								15	14	13	12	11	10	9	8	r		oms		ila	oms	rm	r	r	speed	Target Reached	7	6	5	4	3	2	1	0	w	sod	qs	ve	f	oe	so	rtso
15	14	13	12	11	10	9	8																																			
r		oms		ila	oms	rm	r																																			
		r	speed		Target Reached																																					
7	6	5	4	3	2	1	0																																			
w	sod	qs	ve	f	oe	so	rtso																																			

3. Action of tq control mode

- ◆ ProfileIn the torque control mode, the torque command value is generated based on the following parameters.
- ◆ Target torque (6071h)
- ◆ Torque offset (60B2h) (not currently supported)
- ◆ Torque slope (6087h)
- ◆ To update the action command (send a letter), after the servo enable is turned on, please pass an appointment100msinput later.
- ◆ As monitoring information, provide6077h (Torque actual value)Wait.



- ◆ 6071h (Target torque) value is 6072h (Max torque), 2312h (P3-28), 2313h (P3-29), through the minimum value limit.
- ◆ speed through 6080h (Max motor speed) limit.

### 8.3.3 Cyclic torque control mode (cst mode)

Torque mode in which the command torque is generated by the host device (host) and the command torque is updated (transmitted) according to the compensation cycle. please atDCorSM2Used in synchronous mode.

1, tqcontrolmodelThe associated object image (instruction · setting)

Index	Sub-index	Name	Units	Range	Data type	Access	PDO
6040h	00h	ControlWord	-	0~65535	U16	rw	RxPDO

### Related objects common to other torque control

Index	Sub-index	Name	Units	Range	Data type	Access	PDO
6071h	00h	Target torque	0.1%	-32768~32767	I16	rw	RxPDO
6072h	00h	Max torque	0.1%	0~65535	U16	rw	RxPDO
6080h	00h	Max motor speed	r/min	0~4294967295	U32	rw	RxPDO
6087h	00h	Torque slope	0.1%/s	0~4294967295	U32	rw	RxPDO
60B2h	00h	Torque offset	0.1%	-32768~32767	I16	rw	RxPDO

Controlword (6040h) Function in tq control mode

Index	Sub-index	Name/Description	Range	Data Type	Access	PDO	Op-mode		
6040h	00h	Controlword	0~65535	U16	Rw	RxPDO	All		
		set pairPDSControl commands for servo drives such as state transitions. bitinformation							
		15	14	13	12	11	10	9	8
		r						oms	h
		7	6	5	4	3	2	1	0
		fr	oms			eo	qs	ev	so
	r	r	r						
r = reserved (not corresponding) fr = fault reset oms = operation mode specific eo = enable operation (Control mode dependentbit, cstmode, not used) qs = quick stop h = halt ev = enable voltage so = switch on									

2. cst0bjects associated with the control schema (monitoring)

Index	Sub-index	Name	Units	Range	Data type	Access	PDO
6041h	00h	Statusword	-	0~65535	U16	ro	TxPDO
6073h	00h	Max current	0.1%	0~65535	U16	ro	NO

Objects commonly associated with other torque control (monitoring class)

Index	Sub-index	Name	Units	Range	Data type	Access	PDO
6063h	00h	Following error window	command unit	0~4294967295	U32	ro	TxPDO
6064h	00h	Following error time out	1ms	0~65535	U16	ro	TxPDO
606Ch	00h	Position window time	1ms	0~65535	U16	ro	TxPDO
6074h	00h	Torque demand	0.1%	-32768~32767	I16	ro	TxPDO
6075h	00h	Motor rated current	1ma	0~4294967295	U32	ro	TxPDO
6076h	00h	Motor rated torque	Mn m	0~4294967295	U32	ro	TxPDO
6077h	00h	Torque actual value	0.1%	-32768~32767	I16	ro	TxPDO

6078h	00h	Current actual value	0.1%	-32768~32767	l16	ro	TxPDO
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Statusword (6041h) <cstFunctions in Control Mode>

Index	Sub-index	Name/Description	Range	Data Type	Access	PDO	Op-mode																																					
6041h	00h	Controlword	0~65535	U16	Ro	TxPDO	All																																					
Indicates the status of the servo drive. bit information																																												
<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th>15</th> <th>14</th> <th>13</th> <th>12</th> <th>11</th> <th>10</th> <th>9</th> <th>8</th> </tr> </thead> <tbody> <tr> <td colspan="2" rowspan="2" style="text-align: center;">r</td> <td colspan="2" style="text-align: center;">oms</td> <td rowspan="2" style="text-align: center;">ila</td> <td colspan="2" style="text-align: center;">oms</td> <td rowspan="2" style="text-align: center;">rm</td> <td rowspan="2" style="text-align: center;">r</td> </tr> <tr> <td style="text-align: center;">r</td> <td colspan="2" style="text-align: center;">Drive following command vaule</td> <td style="text-align: center;">r</td> </tr> <tr> <th>7</th> <th>6</th> <th>5</th> <th>4</th> <th>3</th> <th>2</th> <th>1</th> <th>0</th> </tr> <tr> <td style="text-align: center;">w</td> <td style="text-align: center;">sod</td> <td style="text-align: center;">qs</td> <td style="text-align: center;">ve</td> <td style="text-align: center;">f</td> <td style="text-align: center;">oe</td> <td style="text-align: center;">so</td> <td style="text-align: center;">rsto</td> </tr> </tbody> </table>								15	14	13	12	11	10	9	8	r		oms		ila	oms		rm	r	r	Drive following command vaule		r	7	6	5	4	3	2	1	0	w	sod	qs	ve	f	oe	so	rsto
15	14	13	12	11	10	9	8																																					
r		oms		ila	oms		rm	r																																				
		r	Drive following command vaule		r																																							
7	6	5	4	3	2	1	0																																					
w	sod	qs	ve	f	oe	so	rsto																																					
r = reserved (not corresponding)    w = warning <span style="margin-left: 300px;">sod = switch on disabled</span> oms = operation mode specific    qs = quick stop (Control mode dependent bit)    ve = voltage enabled ila = internal limit active    f = fault <span style="margin-left: 300px;">oe = operation enabled</span> rm = remote    so = switched on <span style="margin-left: 300px;">rtso = ready to switch on</span>																																												
Drive following command vaule: 0: No action is performed according to the target torque 1: Action according to target torque																																												

### 3. Action of cst control mode

- ◆ Cyclic Torque Control Mode, ModeProfile(Track) generation is not done on the slave but on the master.
- ◆ The target torque is 6071h (Target torque)
- ◆ Torque feedforward is 60B2h (Torque offset), feedforward is not currently supported.
- ◆ The update (send) of the action command is performed in the servo ON, please go through an appointment 100ms input later.
- ◆ 60C2h (Interpolation time period) means, update 6071h (Target torque) and 60B2h (Torque offset) period of the two objects. This value is set to and 1C32h-02h (Cycle time) for the same period.
- ◆ As monitoring information, provide 6077h (Torque actual value) Wait.
- ◆ 6071h (Target torque) value is subject to 6072h (Max torque) limit.
- ◆ The speed limit is 6080h (Max motor speed)

## 8.4 Mode common functions

### 8.4.1 Select deceleration code (deceleration stop time setting)

PDSYesOperation enabled In the state (servo enabled state), set the motor deceleration and stop method when the main power supply is interrupted or an alarm occurs.

will passCoE(CiA402) defines the deceleration function (selection code) and the servo (DS5C) side deceleration functions (coasting stop, deceleration stop) are used in combination.

List of PDS selection codes

Index	Sub-index	Name	Units	Range	Data type	Access	PDO
605Ah	00h	Quick stop option code	-	0~7	l16	rw	NO
605Bh	00h	Shutdown option code	-	0~1	l16	rw	NO
605Ch	00h	Disable operation option code	-	0~1	l16	rw	NO
605Dh	00h	Halt option code	-	1~3	l16	rw	NO
605Eh	00h	Fault reaction option code	-	0~2	l16	rw	NO

Index	Sub-index	Name	Units	Range	Data type	Access	PDO	Op-mode
6084h	00h	Profile deceleration	command unit/s <sup>2</sup>	0~4294967295	U32	rw	TxPDO	PP PV HM CSP CSV
		set upProfiledeceleration. set as0, the internal processing as1deal with.						
6085h	00h	Quick stop deceleration	command unit/s <sup>2</sup>	0~4294967295	U32	rw	RxPDO	PP PV HM CSP CSV
		• if605Ah (Quick stop option code) Yes"2"or"6", set upQuick stopThe deceleration parameter used when the motor decelerates and stops.						

		• 605Dh (Halt option code) and 605Eh (Fault reaction option code) Yes "2" is also used.						
6087h	00h	Torque slope	0.1%	0~4294967295	U32	ro	RxPDO	Tq cst
		<ul style="list-style-type: none"> <li>• Set the parameter value to give the inclination torque command.</li> <li>• Cyclic Synchronous torque mode (cst) is valid only during the deceleration stop time.</li> </ul>						
Index	Sub-index	Name	Units	Range	Data type	Access	PDO	Op-mode
609Ah	00h	Homing acceleration	command unit/s <sup>2</sup>	0~4294967295	U32	rw	RxPDO	PP PV HM
		<ul style="list-style-type: none"> <li>• Set the return-to-origin position control mode (hm) and the acceleration and deceleration.</li> <li>• Return-to-origin position control mode (hm) is also used for this object.</li> <li>• each Homing method The setting value of this object does not need to be used when the final stop (when the origin position is detected), the servo lock will stop.</li> </ul>						
60C6h	00h	Min deceleration	command unit/s <sup>2</sup>	0~4294967295	U32	ro	RxPDO	PP PV HM
		Set the maximum deceleration. set as 0, the internal processing as 1 ideal with.						

1. Quick stop option code (605Ah)

Index	Sub-index	Name/Description	Range	Data Type	Access	PDO	Op-mode
605Ah	00h	Quick stop option code	0~7	116	Rw	NO	All
		<p>pp, csp, csv, pv</p> <p>0: Via the servo side (Sequence at Servo-off) after the motor stops, migrate to Switch on disabled.</p> <p>1: pass 6084h (Profile deceleration) after the motor stops, migrate to Switch on disabled.</p> <p>2: pass 6085h (Quick stop deceleration) after the motor stops, migrate to Switch on disabled.</p> <p>3: pass 60C6h (Max deceleration) after the motor stops, migrate to Switch on disabled.</p> <p>5: pass 6084h (Profile deceleration) after the motor stops, migrate to Quick stop active.</p> <p>6: pass 6085h (Quick stop deceleration) after the motor stops, migrate to Quick stop active.</p> <p>7: pass 60C6h (Max deceleration) after the motor stops, migrate to Quick stop active.</p> <p>hm</p>					

		<p>0: Via the servo side (Sequence at Servo-off) after the motor stops, migrate to Switch on disabled.</p> <p>1: pass 609Ah (Homing acceleration) after the motor stops, migrate to Switch on disabled.</p> <p>2: pass 6085h (Quick stop deceleration) after the motor stops, migrate to Switch on disabled.</p> <p>3: pass 60C6h (Max deceleration) after the motor stops, migrate to Switch on disabled.</p> <p>5: pass 609Ah (Homing acceleration) after the motor stops, migrate to Quick stop active.</p> <p>6: pass 6085h (Quick stop deceleration) after the motor stops, migrate to Quick stop active.</p> <p>7: pass 60C6h (Max deceleration) after the motor stops, migrate to Quick stop active.</p> <p>Cst, tq</p> <p>0: Via the servo side (Sequence at Servo-off) after the motor stops, migrate to Switch on disabled.</p> <p>1, 2: pass 6087h (Torque slope) after the motor stops, migrate to Switch on disabled.</p> <p>3: Through torque 0 After the motor stops, migrate to Switch on disabled.</p> <p>5, 6: pass 6087h (Torque slope) after the motor stops, migrate to Quick stop active.</p> <p>7: Through torque 0 After the motor stops, migrate to Quick stop active.</p>
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according to Quick stop Example of command deceleration stop action:

A: if 6040h: bit 2 (Control word: quick stop) from 1 change to 0 Start to decelerate to stop. decelerating PDS status becomes Quick stop active.

B: Detects the actual speed at 10r/min The motor stops when the following occurs. after stop PDS status is Switch on disabled, or becomes Quick stop active.

2、Shutdown option code (605Bh)

Index	Sub-index	Name/Description	Range	Data Type	Access	PDO	Op-mode
		Shutdown option code	0~1	18	Rw	RxPDO	All
605Bh	00h	<p>set up PDS Order "Shutdown", "Disable voltage" timing when receiving. The definition varies according to the control mode.</p> <p>Settings other than the following values are prohibited.</p> <p>(1) PDS Order "Shutdown" when receiving pp, csp, csv, pv</p> <p>0: Via the servo side (Sequence at Servo-off) after the motor stops, migrate to Ready to switch on.</p> <p>1: pass 6084h (Profile deceleration) after the motor stops, migrate to Ready to switch on.</p>					



		<p><b>hm</b>  0: Via the servo side (Sequence at Servo-off) after the motor stops, migrate toReady to switch on.  1:pass609Ah (Homing acceleration) after the motor stops, migrate toReady to switch on.</p> <p><b>cst, tq</b>  0: Via the servo side (Sequence at Servo-off) after the motor stops, migrate toReady to switch on.  1:pass6087h (Torque slope) after the motor stops, migrate toReady to switch on.</p> <p>(2) PDSOrder "Disable voltage" when receiving  <b>pp, csp, csv, pv</b>  0: Via the servo side (Sequence at Servo-off) after the motor stops, migrate toSwitch on disabled.  1:pass6084h (Profile deceleration) after the motor stops, migrate toSwitch on disabled.</p> <p><b>hm</b>  0: Via the servo side (Sequence at Servo-off) after the motor stops, migrate toSwitch on disabled.  1:pass609Ah (Homing acceleration) after the motor stops, migrate toSwitch on disabled.</p> <p><b>cst, tq</b>  0: Via the servo side (Sequence at Servo-off) after the motor stops, migrate toSwitch on disabled.  1:pass6087h (Torque slope) after the motor stops, migrate toSwitch on disabled.</p>
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according toShutdownExample of command deceleration stop action:

A: if receivingPDSOrder "Shutdown" starts to decelerate and stop.  
deceleratingPDSstate holdOperation enabled.

B: Detects the actual speed at10r/minThe motor stops when the following occurs.  
after stopPDSStatus isReady to switch on.

### 3、Disable operation option code (605Ch)

set receptionPDSOrder "Disable operation" to decelerate and stop the motor.

Index	Sub-index	Name/Description	Range	Data Type	Access	PDO	Op-mode
605Ch	00h	Disable operation option code	0~1	18	Rw	RxPDO	All

		<p>set receptionPDSOrder"Disable operation" timing. The definition varies according to the control mode.</p> <p>Settings other than the following values are prohibited.</p> <p>pp, csp, csv, pv</p> <p>0: Via the servo side (Sequence at Servo-off) after the motor stops, migrate toSwitched on.</p> <p>1:pass6084h (Profile deceleration) after the motor stops, migrate toSwitched on.</p> <p>hm</p> <p>0: Via the servo side (Sequence at Servo-off) after the motor stops, migrate toSwitched on.</p> <p>1:pass609Ah (Homing acceleration) after the motor stops, migrate toSwitched on.</p> <p>cst, tq</p> <p>0: Via the servo side (Sequence at Servo-off) after the motor stops, migrate toSwitched on.</p> <p>1:pass6087h (Torque slope) after the motor stops, migrate toSwitched on.</p>
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according toDisable operationAn example of commanding deceleration to stop.

A: if receivingPDSOrder"Disable operation" starts to decelerate and stop.  
deceleratingPDSstate holdOperation enabled.

B: Detects the actual speed10r/minThe following motors stop.  
after stopPDSstatus bitSwitched on.

#### 4、Halt option code (605Dh)

6040h (Controlword) ofbit8 (Halt) for1When setting the motor deceleration stop method.

Index	Sub-index	Name/Description	Range	Data Type	Access	PDO	Op-mode
605Dh	00h	<p>Halt option code</p> <p>set receptionPDSOrder"Disable operation" timing. The definition varies according to the control mode.</p> <p>Settings other than the following values are prohibited.</p> <ul style="list-style-type: none"> <li>• set upHalttiming of actions. The definition varies according to the control mode.</li> </ul> <p>Settings other than the following values are prohibited.</p> <p>pp, csp, csv, pv</p> <p>1:pass6084h (Profile deceleration) after the motor stops, keepOperation enabled.</p> <p>2:pass6085h (Quick stop deceleration) after the motor stops, keepOperation enabled.</p> <p>3:pass6072h (Max torque), 60C6h (Max deceleration) after the motor stops, keepOperation enabled.</p> <p>hm</p> <p>1:pass609Ah (Homing acceleration) after the motor stops, keepOperation enabled.</p>	0~3	18	Rw	RxPDO	All

		<p>2:pass6085h (Quick stop deceleration) after the motor stops, keepOperation enabled.</p> <p>3:pass6072h (Max torque), 60C6h (Max deceleration) after the motor stops, keepOperation enabled.</p> <p>cst, tq</p> <p>1, 2:pass6087h (Torque slope) after the motor stops, keepOperation enabled.</p> <p>3: Through torque0After the motor stops, keepOperation enabled.</p>
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according toHaltExample of function deceleration stop operation

A: if6040h:bit8 (Controlword:halt) from0change to1Start to decelerate to stop.

deceleratingPDSstate holdOperation enabled.

B: Detects the actual speed10r/minThe following motors stop. after stopPDSstate holdOperation enabled.

#### 4、 Fault reaction option code (605Eh)

Set the motor stop method when an alarm occurs.

Index	Sub-index	Name/Description	Range	DataType	Access	PDO	Op-mode
		Fault reaction option code	0~2	116	Rw	NO	All
605Eh	00h	<p>• Set the sequence when an alarm occurs. The definition varies according to the control mode. Setting other than the lower value is prohibited. (1)Err80.0~80.7, 81.0~81.7, 85.0~85.7, 88.0~88.7when it happens pp, csp, csv, pv</p> <p>0: Via the servo side (Sequence at alarm) after the motor stops, migrate toFault.</p> <p>1:pass6084h (Profile deceleration) after the motor stops, migrate toFault.</p> <p>2:pass6085h (Quick stop deceleration) after the motor stops, migrate toFault.</p> <p>hm</p> <p>0: Via the servo side (Sequence at alarm) after the motor stops, migrate toFault.</p> <p>1:pass609Ah (Homing acceleration) after the motor stops, migrate toFault.</p> <p>2:pass6085h (Quick stop deceleration) after the motor stops, migrate toFault.</p> <p>cst, tq</p> <p>0: Via the servo side (Sequence at alarm) after the motor stops, migrate toFault.</p> <p>1, 2:pass6087h (Torque slope) after the motor stops, migrate toFault.</p> <p>(2) by the above (1) when an alarm other than the specified</p> <p>0, 1, 2: Via the servo side (Sequence at alarm) after the motor stops, migrate toFault.</p>					

Operation example of deceleration and stop due to alarm

A: Starts to decelerate and stop when an alarm occurs. deceleratingPDSStatus isFault reaction active.

B: Detects the actual speed10r/minThe following motors stop. after stopPDSStatus isFault.

### 8.4.2 Touch Probe Function (Position Clamp Request/Release)

Not currently supported

### 8.4.3 Digital inputs (60FDh)

Digital inputsof eachBitis throughCDS500-ECFunction code parameters of series servoF2.0.00~F2.0.07to achieve configuration, you can also

Via the servo parameter3200h subindex to achieve pairpositive limit switch (POT) , negative limit switch (NOT), home switch (HOME) input function configuration.

Index	Sub-index	Name/Description	Range	Data Type	Access	PDO	Op-mode		
60FDh	00h	Digital inputs	0~429496 7295	U32	ro	TxPDO	All		
		Indicates the theoretical input state to the external input signal. bitinformation							
		31	30	29	28	27	26	25	twenty four
		r							
		twenty three	twenty two	twenty one	20	19	18	17	16
		r							
		15	14	13	12	11	10	9	8
		r							
		7	6	5	4	3	2	1	0
		r					hs	pls	nls
r = reserved(not corresponding) pls= positive limit switch nls = negative limit switch hs=home switch  eachBitThe details are as follows:									

		<p>0input stateOFF 1input stateON</p> <p>60FD (Digital inputs) of bit0 (negative limit switch), bit1 (positive limit switch), bit2 (home switch) The values of ) represent the signal states of the negative direction drive limit input, the positive direction drive limit input, and the near-origin input, respectively.</p>
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## 9. EtherCAT related protection functions

### 9.1 Abnormal (alarm) list

#### 9.1.1 EtherCAT communication related abnormality (alarm)

Alarm number		illustrate	wrong reason	
host	auxiliary			
80	0	incorrectESMrequest exception protection	<p>Accept state transition requests that cannot be transitioned from the current state:</p> <p>Init→Safeop Init→OP PreOP→OP</p> <p>after errorESMStatus: The current status isInit, PreOP, SafeOPstop at the current state, OPturn toSafeOP</p> <p>ESCregisterAL Status Code:0011h</p>	Com tra the
	1	undefinedESM require exception protection protect	<p>Receive state transition requests other than the following:</p> <p>1:Request Init State 2:Request Pre-Operational State 3:Request Bootstrap State 4:Reauest Safe-operational State 8:Request Operational State</p>	Com tra the

			after errorESMStatus: The current status isInit, PreOP, SafeOPstop at the current state, OPturn toSafeOP ESCregisterAL Status Code:0012h	
	2	boot state to seek exception protection	Accept the following state transition requests: <b>3:Request Bootstrap State</b> after errorESMstate:Init ESCregisterAL Status Code:0013h	Con tra the
	3	PLLunfinished Always protect	After synchronizationls, the phase combination of communication and servo (PLLlock) still cannot be completed after errorESMstate:PreOP ESCregisterAL Status Code:002Dh	com con pro Whe com dev are
	4	PDOwatchdog exception protection	PDOWhen communicating (SafeOPorOPstatus), via ESCregister address0400 (Watchdog Divider) and0420 (Watchdog Time Process Data)set time0220 (AL Event Request) ofbit10NoON. after errorESMstate:Safe OP ESCregisterAL Status Code:001Bh	Com dev Whe fix int con wat del lar con the wit com and exc cab
<b>Alarm number</b>		<b>illustrate</b>	<b>wrong reason</b>	
<b>host</b>	<b>auxiliary</b>			
80	6	PLLexception protection protect	ESMstatus is inSafeOPorOPstate, the phase of communication and servo (PLLlock) mismatch after errorESMstate:SafeOP ESCregisterAL Status Code:0032h	com con pro com dev are
	7	Abnormal synchronization signal protection	After the synchronization process is completed, according toSYNC0orIRQInterrupt processing occurs after an error is reported above the set thresholdESMstate:SafeOP ESCregisterAL Status Code:002Ch	com con pro com

				dev are
81	0	Synchronization cycle setting Fixed exception protection	To set an unsupported sync period: The synchronization period is set at 500us, 1ms, 2ms, 4ms After the error is reported ESMstate: PreOP ESCregisterAL Status Code: 0035h	Con syn
	1	different email settings Always protect	mailbox SM0/1 In case of wrong setting value: The sending and receiving areas of mailboxes overlap, SM2/3 Coincidence, the address of the sending and receiving area is odd; The starting address of the mailbox is SyncManager0: 1000h~10FFh, SyncManager1: 1200h~12FFh out of range SyncManager0/1 length (ESCregister: 0802h, 0803h/080Ah, 080Bh) is set incorrectly: SyncManager0: 32~256byte out of range SyncManager1: 40~256byte out of range SyncManager0/1 of Control Register (ESCregister: 0804h/080Ch) is set incorrectly: Will 100110b other than set to 0804h: bit5-0 Will 100110b other than set to 080Ch: bit5-0 after error ESMstate: Init ESCregisterAL Status Code: 0016h	acc des con Syn
	4	PDO watchdog set abnormal protection protect	PDO The watchdog setting is wrong. PDO The watchdog trigger is valid (SyncManager: register 0804h of bit6 Yes1), PDO watchdog detection timeout value (register 0400h, 0402h) setting value does not meet the "communication cycle * 2" case after error ESMstate: PreOP ESCregisterAL Status Code: 001Fh	Con wat tim
	5	DC abnormal setting Protect	DC the setting is wrong. ESCregister 0981h (Activation) of bit2-0 Set to a value other than the following bit2-0=000b; bit2-0=011b after error ESMstate: PreOP ESCregisterAL Status Code: 0030h	con
<b>Alarm number</b>		<b>illustrate</b>	<b>wrong reason</b>	
<b>host</b>	<b>auxiliary</b>			
81	6	SM event model abnormal setting Protect	Unsupported SM time mode is set, 1C32/1C33-01 set up 00, 01, 02 value other than . ESCregister 0981 of bit2-0=000band only 1C32h-01hand 1C33h-01hof SM2 set as	con 01h sam

			after errorESMstate:PreOP ESCregisterAL Status Code:0028h	inO the
	7	SyncManager 2/3Abnormal setting Protect	SM2/3is set to an incorrect value SM2/3The physical address is not set correctly (ESCregister: 0810h/0818h): the sending and receiving area overlaps, and theSM2/3 Coincidence, start address is odd, start address finish address is out of range SM2/3length setting (ESCregister:0812h/081A)andRxPDO, TxPDOdifferentSM2/3the control register (ESCregister: 0814h/081Ch) incorrectly set will100110bother than set tobit5-0 after errorESMstate:PreOP ESCregisterAL Status Code:001Dh/001Eh	acc des cor Syn
85	0	TxPDOdistribute exception protection	TxPDOMapped data size exceedstwenty fourbyte after errorESMstate:PreOP ESCregisterAL Status Code:0024h	
	1	RxPDOdistribute exception protection	RxPDOMapped data size exceedstwenty fourbyte after errorESMstate:PreOP ESCregisterAL Status Code:0025h	
	2		Lost Link Abnormal Protection	
	3		SII EEPROM Abnormal Protection	
88	1	control mode setting Fixed exception protection	6060hThe set value is0and6061hThe set value is0Time BundlePDSThe status transitions to "Operation enabled" 6060hWhen an unsupported control mode is set In full closed loop control,6060hModes other than position control When it is set after errorESMStatus: stop at currentESMstate ESCregisterAL Status Code:0000h	com of
	2	in actionESM require exception protection protect	PDSStatus is "Operation enabled"or"Quick stop active" , otherESMstate transition command after errorESMState: Based on the state transition request from the host computer ESCregisterAL Status Code:0000h	Con tra fro can
<b>Alarm number</b>		<b>illustrate</b>	<b>wrong reason</b>	
<b>host</b>	<b>auxiliary</b>			
88	3	abnormal movement exception protection	input signalEXT1/EXT2When unassigned, passTouch probe functionSelect the case of external trigger;	



			<p>The calculation result of the electronic gear ratio is in1/1000arrive1000circumstances other than times;          Calculation process of electronic gear ratio, denominator or numerator unsigned over64bitCase;          The final calculation result of the electronic gear ratio, the denominator or numerator unsigned exceeds32bitCase;          after errorESMStatus: stop at          currentESMstateESCregisterAL Status Code:0000h</p>
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9.1.2 EtherCAT communication non-related abnormality (alarm)

Alarm number		illustrate	wrong reason	Solution
host	auxiliary			
80	0	incorrectESMrequest exception protection	<p>Accept state transition requests that cannot be transitioned from the current state:            Init→Safeop            Init→OP            PreOP→OP            after errorESMStatus: The current status isInit, PreOP, SafeOPstop at the current state, OPturn toSafeOP            ESCregisterAL Status Code:0011h</p>	Confirm the state transition request of the host device
	1	undefinedESM require exception protection protect	<p>Receive state transition requests other than the following:            1:Request Init State            2:Request Pre-Operational State            3:Request Bootstrap State            4:Reauest Safe-operational State            8:Request Operational State            after errorESMStatus: The current status isInit, PreOP, SafeOPstop at the current state, OPturn toSafeOP ESCregisterAL Status Code:0012h</p>	Confirm the state transition request of the host device

## 9.2 Abnormal (alarm) reading

0000h~FEFFh according to IEC61800-7-201 define.

FF00h~FFFFh User-specific definitions can be made as follows.

the defined value (FF00h~FFFFh) lower 8bit The following table shows the main code of the alarm number of the servo error (alarm). (do not read

Take the auxiliary code of the alarm number. )

In addition, the main code of the alarm number is used for 16Base number representation.

## 9.3 Abnormal (alarm) reset

Abnormal (alarm) resettable EtherCAT How to reset the associated protection function

Error (alarm) can be cleared by any of the following methods ①②③.

in addition, EtherCAT For protection functions other than related, please refer to the basic functional specifications of the technical documentation.

Method ①: AL Control of bit 4 (Error Ind Ack) set as "1".

Thereafter, 6040h (Control word) of bit 7 by setting 0→1 (send Fault reset command), the abnormal (alarm) clearing is completed.

After the abnormal (alarm) clearing is completed, PDS state transition from Fault convert to Switch on disabled.

Method ②: Execute abnormal (alarm) reset (panel) through the servo drive itself F0-00, PC software).

After the abnormal (alarm) clearing is completed, PDS status from Fault move to Switch on disabled.

Method ③: Servo drive external alarm reset input (A-CLR) from OFF status to ON state.

After the abnormal (alarm) clearing is completed, PDS state transition is from Fault move to Switch on disabled.