

EtherCAT motion control

User manual

Wuxi Xinje Electric Co., Ltd.

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Basic explanation

- Thank you for purchasing Xinje XG series programmable controller.
- This manual mainly introduces the motion control function of EtherCAT.
- Before using the product, please read this manual carefully and operate on the premise of fully understanding the contents of the manual.
- For the introduction of software and programming, please refer to relevant manuals.
- Please deliver this manual to the end user.

User instructions

- Only operators with certain electrical knowledge can conduct wiring and other operations on the product. If there is any unclear use, please consult our technical support personnel.
- The examples listed in the manual and other technical materials are only for the user's understanding and reference, and certain actions are not guaranteed.
- When using this product in combination with other products, please confirm whether it conforms to relevant specifications and principles.
- When using the product, please confirm whether it meets the requirements and safety by yourself. When the failure of the product may cause machine failure or loss, please set backup and safety functions by yourself.

Declaration of liability

- Although the contents of the manual have been carefully checked, errors are inevitable and we cannot guarantee complete consistency.
- We will often check the contents of the manual and make corrections in subsequent versions. Please give us your valuable comments.
- If there is any change to the contents described in the manual, please understand without notice.

Contact us

If you have any questions about the use of this product, please contact the agent and office who purchased the product, or contact the company directly.

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Preface

This manual mainly describes the EtherCAT communication between XG2 series (master station) and servo driver DS5C series (slave station).

This manua	l is based	l on the follo	wing infor	mation.
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No.	Document	Note	Version	Date
ETG.1000.2	ETG1000_2_CHN_EcatPhysicalLayer_V1i0i2_C01	Physical layer service definition and protocol specification	V1.0.2	2013-06-24
ETG.1000.3	ETG1000_3_CHN_EcatDLLServices_V1i0i2_C01	Data link layer service definition	V1.0.2	2013-06-24
ETG.1000.4	ETG1000_4_CHN_EcatDLLProtocols_V1i0i2_C01	Data link layer protocol specification	V1.0.2	2013-06-24
ETG.1000.5	ETG1000_5_CHN_EcatALServices_V1i0i2_C01	Application layer service definition	V1.0.2	2013-06-24
ETG.1000.6	ETG1000_6_CHN_EcatALProtocols_V1i0i2_C01	Application layer protocol specification	V1.0.2	2013-06-24
ETG.1020	ETG1020_v1i1i0_S_D_Protocol Enhancements	Protocol enhancements	V1.1.0	2014-04-22
ETG.2000	ETG2000_S_D_V1i0i9i3_EtherCAT Slave Information Specification	Slave station information	V1.0.9.3	2017-11-27
ETG.6010	ETG6010_V1i1i0_D_R_CiA402_ImplDirective	Implementation instructions of CiA402 drive configuration file	V1.1.0	2014-11-19
-	EtherCAT_Communication_EN	EtherCAT communication	-	-
-	EtherCAT_Introduction_CN	EtherCAT– Ethernet fieldbus	-	-
ET1100	EtherCAT_ET1100_Datasheet_all_v1i8	Slave station controller	-	2010-05-03

Note:

(1) For the differences between the contents of this manual and the following reference materials, the contents of this manual shall prevail.

(2) It is not guaranteed that all contents of reference materials not recorded in this manual are recorded.

1. EtherCAT overview

1-1. EtherCAT introduction

EtherCAT, the full name is Ethernet for Control Automation Technology, which is developed by Beckhoff Atuomation GmbH. It is a kind of real-time Ethernet used for open network communication between master station and slave station. As a mature industrial Ethernet technology, EtherCAT has the characteristics of high performance, low cost and easy to use.

XG2 series controller (master station) and DS5C servo driver (slave station) comply with the standard EtherCAT protocol, supports the maximum 32-axis slave stations, 32-axis synchronization cycle is 1ms, 2-way touch probe function, position, speed, torque and other control modes, is widely applicable to various industries.

1-2. System composition (master and slave station)

The connection form of EtherCAT is: the network system of linear connection master station (FA controller) and multiple slave stations.

The number of nodes that can be connected by the slave station depends on the processing or communication period of the master station, the number of bytes transmitted, etc.

Item	Specification
Physical layer	100BASE-TX (IEEE802.3)
Baud rate	100[Mbps] (full duplex)
Topology	Line
Connection cable	JC-CA twisted pair (shielded twisted pair)
Cable length	Maximum 50m between nodes
Com port	2 Port (RJ45)
EtherCAT Indicators (LED)	[Run] RUN Indicator
	[L/A IN] Port0 Link/Activity Indicator (Green)
	[L/A OUT] Port1 Link/Activity Indicator (Green)
Station Alias (ID)	Setting range: 0~65535
	Setting address: 2700h
Explicit Device ID	Not support
Mailbox protocol	COE (CANopen Over EtherCAT)
SyncManager	4
FMMU	3

1-3. Communication specification

			Modes of operation			
		csp Cycl	lic synchronous position mode			
	position	PP Prof	ile position mode			
Modes of operation		hm Hor	ning mode			
	Correct.	csv Cycl	lic synchronous velocity mode			
	Speed	pv Prof	ile velocity mode			
	Torque	cst Cycl	lic synchronous torque mode			
	Torque	tq Torq	que profile mode			
Touch Probe	2 channels					
Synchronization mode	DC (SYNCO event synchronization mode)					
	SM (SM Event synchronization)					
Cyclic time (DC	500,1000,2000,4000[µs					
communication period)						
Communication object	SDO[Service data object], PDO[Process data object]					
Maximum PDO allocation per	TxPDO: 4 [piece] RxPDO: 4 [piece]					
station						
Single station PDO Max bytes	TxPDO: 24[byte]	RxPDO: 24	[byte]			
Mailbox communication	1ms					
interval in PreOP mode						
Mailbox	SDO requests and SDO	information	n			

Note: SDO and PDO refer to state machine.

1-4. EtherCAT communication connection

The wiring of EtherCAT motion control system is very simple. Thanks to EtherCAT, the star topology of Ethernet can be replaced by a simple linear structure. Taking Xinje DS5C series servo as an example, because EtherCAT does not need hub and switch, XG2 series PLC body and DS5C series servo are equipped with EtherCAT communication network port, so the consumption of cable and bridge is greatly reduced, the workload of connection design and joint calibration is also greatly reduced, which is convenient for saving installation cost.

Linear type connection is recommended for EtherCAT bus connection. The wiring mode is as follows:



Note: only LIN2 port in XG2 series PLC supports EtherCAT communication. The two communication network ports of the servo driver follow the principle of "down in and up out", that is, the link2 port of XG2 must be connected with the network port under the LIN1 port of the first servo, and then the network port above the first servo is connected with the network port under the second servo, and so on.

In the process of communication transmission, it will inevitably be affected by the surrounding electromagnetic environment. It is recommended that the user use the industrial CAT5e network cable, which can also be purchased in our company.

2. EtherCAT Communication specification

2-1. EtherCAT frame structure

EtherCAT is an industrial communication protocol based on real-time control of Ethernet. It only expands the IEEE 802.3 Ethernet specification and does not change the basic structure, so it can transmit the data within the standard Ethernet frame.

Because the EthernetType of the Ethernet Header is [88A4h], the subsequent Ethernet data is processed as the EtherCAT frame.

The EtherCAT frame is composed of the EtherCAT frame header and more than one EtherCAT sub message, which is further subdivided. Only the EtherCAT frame with type = 1 of the EtherCAT frame header is processed according to ESC.

14byte 46-1500byte 4byte Ethernet Header Ethernet Data FCS Ethernet Header EtherCAT Header Datagrams 44(*1)-1498byte 6byte 6byte 2byte 1bit 4bit 11bit Datagrams Source EtherType Length Res. Type Datagrams 88A4h 1 Nth EtherCAT Datagram 1st Ethernet Header 2nd … ... Max:1486byte -----2byte 10byte Datagram Header Data WKC 1byte 4byte 1byte 11bit 3bit 1bit 1bit 2byte Working Counter command index Address area Len R C M IRQ 2byte 2byte More EtherCAT Datagrams AP** Position Offset Position Addressing FP** Address Offset Node Addressing L** Logical Address Logical Addressing

EtherNet/EtherCAT frame structure

*1: Ethernet frame is shorter than 64 byte, 1-32 byte is added. (Ethernet Header + Ethernet Data + FCS)

2-2. ESM (EtherCAT State Machine)

The 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, and the master station puts forward the control request to the application layer service. The latter generates the application layer control event in the slave station, and the slave station responds to the application layer control service through the local application layer state write service after the state change request succeeds or fails. If the status change fails, the slave station keeps the status and puts the error flag.

The figure below shows the state transformation diagram of ESM:



Init: Initialization status;

Pre-Operational: Pre operation status;

Safe-Operational: Safe operation status;

Operational: Operation status;

		Communication action			
		SDO			
Slave station status	Actions in various states	(email)	PDO	PDO	
		receive	send	receive	
		and send			
Init	Communication initialization, SDO, PDO unable to	_	_	_	
IIIIt	receive and send message	-	-	-	
Pre-Operational	Only SDO receiving and sending status	Ves	_	_	
(PreOP)	Sho receiving and schuling status	105	-	-	
Safe-Operational	Status of SDO receiving and sending only PDO sending	Vas	Vas		
(SafeOP)	Status of SDO receiving and sending only, 1 DO sending	105	105	-	
Operational (OP)	SDO receiving and sending, PDO receiving and sending	Vas	Vac	Vac	
Operational (OF)	all feasible status	105	1 65	108	

Note:

The access from the master station to the ESC register is independent of the above table and is available at any time.

PDO (process data object) is used to transfer periodic communication data.

SDO (service data object) is used to transmit non periodic communication data.

Command or interface operation during ESM state switching may cause abnormal communication error.

2-3. Slave station controller ESC

2-3-1. Principle overview

ESC refers to the EtherCAT slave controller. The communication process is completely processed by ESC, which has four data receiving and transmitting ports, each with a TX and RX. Each port can send and receive Ethernet data frames. The data flow direction in ESC is fixed: port 0 - > port 3 - > port 1 - > port 2 - > port 0 are transmitted in sequence. If ESC detects that a port has no external PHY, it will automatically close the port and automatically forward to the next port through the internal loopback.



2-3-2. Address space

The DS5C series holds 8kbyte of physical address space.

The first 4kbyte (0000h-0FFFh) is used as register space, and the other 4kbyte (1000h-1FFFFh) is used as process data PDO in RAM field. For details of registers, please refer to the data table of IP (ET1810 / ET1811 / ET1812).

ESC register by address	Length(Byte)	Explanation	Initial value*1				
ESC Information							
0000h	1	Туре	04h				
0001h	1	Revision	02h				
0002h~0003h	2	Build	0040h				
0004h	1	FMMUs supported	03h				
0005h	1	SyncManagers supported	04h				
0006h	1	RAM Size	08h				

0007h	1	Port Descriptor	OFh
00071	2	FSC Features supported	0184h
000011-000711	2	Station Address	010-11
0010b~0011b	2	Configured Station Address	_
0010h-0011h 0012h-0013h	2	Configured Station Alias	
001211-001511	<i>2</i>	configured Station Allas	
		 Data Link Laver	
0100h-0103h	1	ESC DL Control	
010011-010511	4		Γ
0110b-0111b	2	ESC DI Status	
011011~01111	2	Application Laver	
01206-01216	2	AL Control	
$0120h \sim 0121h$	2	AL Status	
0130h~0131h	2	AL Status Code	
013411~013511	2	AL Status Code	
		PDI	
0140b	1	PDI Control	08h
0140h	1	ESC Configuration	00h
014111 0150b	1	PDI Configuration	0Cli
0150h	1	SVNC/LATCH PDI Configuration	- 66h
0152h 152h	2	Extend PDI Configuration	0011
015211~15511	2	Extend I DI Configuration	-
		 Watchdogs	
0400h~0401h	2	Watchdog Divider	L
0400h-0401h	2	Watchdog Time PDI	
$0420h_{2}0421h$	2	Watchdog Time Process Data	
$0420h \sim 0421h$	2	Watchdog Status Process Data	
044011-044111 0442h	1	Watchdog Counter Process Data	
0442h	1	Watchdog Counter PDI	
044511	1	watchdog Counter i Di	
		EMMLI	
0600h-062Fh	3x16	EMMI Le[2:0]	
+0h-3h	3,10	Logical Start Address	
+00-50		Longth	
+41-511 +6h	1	Logical Start bit	[
+7h	1	Logical Start bit	
+7n	2	Physical Start Address	
+Δh	1	Physical Start bit	
+2 M +Bh	1		
	1		[
	2	Reserved	
	3		-
	Dia	tributed Clocks (DC) SVNC Out Unit	
	DIS	anouted Clocks (DC) -5 The Out Onit	

0981h	1	Activation	-
0984h	1	Activation Status	-
098Eh	1	SYNCO Status	-
0990h~0993h	4	Start Time Cyclic Operation/Next SYNC0 Pulse	-
09A0h~09A3h	4	SYNC0 Cycle Time	-

2-4. SII area (0000h~003Fh)

In the ESC configuration area (EEPROM word address 0000h~0007h), after the power of the drive is started, the configured station alias automatically reads and writes the ESC register according to ESC. When the value of SII EEPROM is reflected in the ESC register, the power supply needs to be started again. In addition, the initial value of IP core (ET1810 / ET1811 / ET1812) is set. Please refer to the data table of IP core (ET1810 / ET1811 / ET1812) for details.

2-5. SDO (Service Data Object)

DS5C series supports SDO (service data object). The data exchange of SDO uses mailbox communication, so the data refresh time of SDO becomes unstable.

The master station reads and writes data in the records in the object dictionary, which can set the object and monitor various states of the slave station. The response to a read-write action to SDO takes time. For objects refreshed with PDO, please do not refresh with SDO, and overwrite with PDO value.

2-5-1. Mailbox frame structure

The frame structure of mailbox/SDO is as follows. Please refer to ETG specification for details (ETG1000-5 and ETG1000-6).

Ethernet Header	EthernC	AT Hea	ider 1	l st Ether	CAT Data	gram	2nd…	•••	Nth····	FCS
10byte				Max:1486	byte				2byte	
Datagram Hea	der			N	Mailbox Pr	otocol				WKC
			6byte			2byte		M	ax:1478by	/te
		Mailbox Header CoE Header				Cmd Specific				

16bit 16bit	6bit	2bit 4bit 4bi		4bit	9bit	3bit	4bit	М	ax:1478b	yte
Length Address	Channel	Prio	Туре	Cnt	Int Number Res Serv		C	md Speci	fic	

Frame	Data area	Data type	Function
MailBox Header	Length	WORD	Mailbox data length
	Address	WORD	Address of the sender

	Channel	Unsigned6	(Reserved)
	Prority	Unsigned2	Priority
	Туре	Unsigned4	Mailbox type
		C C	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)
CoE Header	Number	Unsigned9	Reserved
	Reserved	Unsigned3	Reserved
	Service	Unsigned4	Message type
Cmd specific	Size Indicator	Unsigned1	Data Set Size use permission
	Transfer Type	Unsigned1	Normal transfer/Expedited transfer
	Data Set Size	Unsigned2	Data size
	Complete Access	Unsigned1	Object access method selection (not
			corresponding)
	Command Specfier	Unsigned3	Upload / download
			Selection of requirements / responses, etc
	Index	WORD	Object Index
	Subindex	BYTE	Object Subindex
			Object data or abort message, etc

2-5-2. Mailbox overtime

This servo driver performs the following timeout settings in mailbox communication.

Timeout of mailbox request: 100ms

The master station sends a request to the slave station (driver). If the WKC of the transmission data of the request frame is updated, the slave station is considered to receive the request normally. Until WKC is updated, retry again and again. However, if WKC is not updated until this set time, the master station side will time out.

Timeout for mailbox response: 10s

The master receives a response from a request from a slave (driver), which is considered normal if the WKC is updated. Until this set time, if the response of WKC being updated cannot be received, the master station side will time out.

The maximum time required by slave station (driver) response completion.

2-5-3. Alarm information

(1) Error code

Error code returns same value as 603Fh (Error code).

0000H ~ FEFFh is defined according to IEC61800-7-201.

FF00h ~ FFFFh are defined by the manufacturer, as shown below.

Index	Sub-Index	Name/Description	Range	Date Type	Access	PDO	Op-mode	
603Fh	00h	Error code	0-65535	U16	ro	TxPDO	All	
		The present alarm of the	The present alarm of the servo driver (only the main number).					
		When the alarm does no	ot occur, it wi	ll display 0000I	H.			
		When an alarm occurs,	an alarm is di	isplayed.				
		FF**h						
		Alarm (main) number (00h~FFh)						
		(Example) FF03h 03h=3d E-030 (overvoltage)						
		FF55h 55h=85d E-850(TxPDO configuration abnormal protection), E-851(RxPDO						
		configuration abnormal protection), any of them occurs.						
		As an exception, A000h is displayed in the case of E-817 (syncmanager 2 / 3 setting						
		error).						

(2) Error register

Error register returns same value as 1001h (Error register).

Index	Sub-Index	Na	ame/Deso	cription	Range	Date Type	Access	PDO	Op-mode
1001h	00h		Error re	gister	0-65535	U16	ro	TxPDO	All
		Displ	lays the t	ype of alarm	n (status) that i	s occurring t	o the servo d	rive.	
		When	n the alar	m does not	occur, it will d	isplay 0000H	H.		
		Do no	ot display	y warnings.					
			Bit Content						
			0						
			1		Not s	upport			
			2						
			3						
			4	Alarm oc	currence defin	ned by Al sta	tus code *1		
			5		Not s	upport			
			6		Rese	erved			
			7	Alarm occ	currence undef	ined by Al st	atus code *2		
		*1: 7	*1: The "alarm defined by AL status code" refers to the EtherCAT				EtherCAT C	ommunication	
		Association abnormal E-800-7, E-810-7, E-850-7.							
		*2: 7	*2: The "AL status code undefined alarm" refers to the EtherCAT C					ommunication	
			Associati	ion abnorm	al E-880~7	and the exc	ception of l	EtherCAT C	ommunication
			Associati	ion.					

2-6. PDO (Process Data Object)

The DS5C series supports PDO (process data object).

The real-time data transfer based on EtherCAT is carried out through the data exchange of PDO (process data object).

PDO has RxPDO transferred from master station to slave station and TxPDO transferred from slave station to master station.

	Sending side	Receiving side
RxPDO	Master station	Slave station
TxPDO	Slave station	Master station

2-6-1. PDO mapping objects

PDO mapping refers to the mapping from object dictionary to application object of PDO.

Tables for DS5C series PDO mapping can use 1600h~1603h mapping objects for RxPDO and 1A00h~1A03h mapping objects for TxPDO.

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

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

The following is an example of setting a PDO map.

< setting example >

Allocation of application objects 6040h, 6060h, 607Ah, 60B8h to mapping object 1600h (Receive PDO mapping 1: RxPDO_1).

Index	Sub	Object contents
1600h	00h	04h
	01h	6040 00 10 h
	02h	6060 00 08 h
	03h	607A 00 20 h
	04h	60B8 00 10 h
	05h	0000 00 00 h
	18h	0000 00 00 h

6040h	00h	Controlword	U16
6060h	00h	Mode of operation	I8
607Ah	00h	Target Position	I32
60B8h	00h	Touch probe function	U16

2-6-2. PDO distribution objects

In order to exchange PDO data, a table for PDO mapping must be assigned to syncmanager. The relationship between the table used for PDO mapping and syncmanager is described to PDO allocation object. As PDO allocation object, DS5C can use 1C12h for RxPDO (syncmanager2) and 1C13h for TxPDO (syncmanager3).

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

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

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

Usually, because one mapping object is enough, there is no need to change by default. Example of setting PDO assignment object: Allocation mapping object 1600h to allocation object 1C12h (sync Manager Channel 2).

Index	Sub	Object contents
1C12h	00h	01h
	01h	1600h
	02h	0000h
	03h	0000h
	04h	0000h

Allocation mapping object 1600h to allocation object 1C13h (sync Manager Channel 3).

Index	Sub	Object contents
1C13h	00h	01h
	01h	1A00h
	02h	0000h
	03h	0000h
	04h	0000h

2-7. Communication synchronization mode

2 Se e serres eun s	enered and romo wing		
Synchronization	Content	Synchronization method	Feature
mode			
DC	SYNC0 Event	Synchronize the time	High-precision
	synchronization	information of other slave	Compensation treatment shall be carried out
		stations based on the time	at the main station side
		of the first axis	
SM2	SM2 Event	Synchronize according to	No transmission delay compensation, poor
	synchronization	RxPDO receiving time	accuracy
			Need to keep transmission time on controller
			side (special hardware, etc.)
FreeRun	Asynchronous	Asynchronous	Simple processing
			Poor real-time performance

DS5C series can select the following synchronization modes.

2-7-1. DC (SYNC0 Event synchronization)

DS5C series has 64-bit DC (distributed clock).

The synchronization of EtherCAT communication is based on this DC. According to the DC slave station, synchronization is realized through the system time with the same reference. The local cycle from the slave station starts with the sync0 event. Since the slave processing (servo processing) starts from the sync0 event cycle, it is always synchronized with the sync0 event.

The master station needs to carry out transmission delay compensation (offset compensation) and regular deviation compensation during communication initialization. The following figure shows the process of synchronous completion from the input of control power to the event of sync0 and the processing of slave station (servo processing).



2-7-2. SM2 (SM2 Event synchronization)

The local cycle from the slave station starts with SM2 event.

Since the processing of the slave station starts from the SM2 event cycle, it is always synchronized with SM2 event.

Because SM2 event occurs when PDO receiving is completed, it is necessary to ensure that the upper (Master) side sends the message regularly. If the fluctuation (deviation) of sending time is too large, synchronization cannot be completed, or an alarm occurs.

If this happens, use DC (sync0 event synchronization).

2-8. LED

The XG2 series has two EtherCAT indicators (LEDs), L/A IN and L/A OUT.

L/A IN and L/A OUT indicator indicate the link status and action status of the physical layer of each port. The light color is green.

LED state	Content
OFF	Link not established
Flickering	Link established, with data receiving and sending
ON	Link established, no data receiving and sending

3. EtherCAT parameter configuration

3-1. EtherCAT configuration interface

Create a new project. In the picture below, open EtherCAT in the PLC configuration branch of the project area.

1		Xinje	e PLC Program Tool	
File Edit Search View Onlin	e Configure Option Window Help			
📄 😅 📕 👗 🖻 🖺) 🗇 🔿 M 🖻 🖻 🎒 🚳 🐥 🌺 🏫	· 🖸 🗖 🔒 🍵	🔒 🖽 🔣 🗟 🔁 · 📟	
THE THE ALL AND ALL AN	- +1+ +++ <> - <r> -(S> { } + + + + + + + + + + + + + + + + +</r>	टा 🕅 🚺 - 🚺	T · C · S 🗔 @ @ 🗮 🕍 👼	
Project # ×	PLC1 - Ladder			
E PLC1 ∧				
Code				
	0			
Func Block	L			
Source File				
Header File				
EX Function Library				
System function librar				
Config Block				
Sequence Block				
Comment Editor				
Data Monitor				
Set Reg Init Value				
PLC Config				
Password				
PLC Serial Port				
ethernet				
Pulse				
BD BD				
ED ED	Information			
	Error List Output			
	Description	Project F	Row Col	
WBOX				

The EtherCAT parameter configuration interface is divided into master station configuration area, slave station display area and slave station configuration area.

Configuration area of master station: set EtherCAT periodic synchronous communication interval, upper computer timeout, ESM state switching of all slaves. (ESM: Ethernet state machine, refer to [state machine])
 Display area of slave station: scan or manually add the slave station, and the corresponding configuration information of the slave station selected by the cursor will show on the right side.

(3) Slave configuration area: corresponds to the configuration information of the currently selected slave station.

EthercatConfig		×
Scan Update	General Expert process data Launch parameters IO Mapping COE-Online ESC Reg	
Master PLC Master	Offset time(us): 0 🗢 FuncMappingNum: 0 🗢	
Slave StationID:0 Alias:0 MADHT1105BA1 -StationID:1 Alias:0 XINTE-DSSC	SM Watchdog: 🔽 FuncModeule: Servo Module 🗸	
StationID:2 Alias:0 XINJE-DS5C	Slave Information Init	
	State Machine	
4	Current State 3	
	State	
	Error Message	
L		
	Upload Download Activate OK	Cancel

3-2. Master station configuration

Master Station Co	onfiguration					>
Basic Configurat	ion					
Sync unit c	ycle(us): 1000	▲ ▼				
Timeout	Add re	gister comments				
ParamsCopy						
Params	-Slave Selectio	n				
StartParams	ReferenceSlav	0	<u>+</u>			
ShiftTime	e:					
🗌 功能模块		⊻ Select All				
	TargetSlave:	StationID:0	Alias:0	MADHT1105BA	1	
		StationID:1	Alias:O	XINJE-DS5C	CoE Drive	Rev2.0
		StationID:2	Alias:O	XINJE-DS5C	CoE Drive	Rev2.0
					OK	Concel
					OV	Cancer

Parameter	Explanation
Synchronization	The communication cycle between master station and slave station is $500 \sim 10000$ (unit: μ s)
unit cycle	(that is, the sending data time interval between master station and slave station) and SFD2990
	is set to the same value.
	Note: if 16 or less axis slave station is connected, it can be set to 500; if 32 or less axis slave
	station is connected, it can be set to 1000.
Timeout	Communication timeout setting of upper computer and related functions of EtherCAT.
Parameter copy	Tick the parameters to be copied (the contents include startup parameters and offset time, see
	2-5 and 2-7 for the meaning), and copy them to the target slave station based on the parameters
	of [reference slave station] (the number here refers to station ID). The target slave station can
	be selected in full or selected in part.

3-3. Slave station list

ł	Scan Update		
	Master PLC Master		
Γ	Slave		
	StationID:0	Alias:O	MADHT1105BA1
	-StationID:1	Alias:O	XINJE-DS5C
	-StationID:2	Alias:O	XINJE-DS5C
4			

Parameter	Explanation	
Scan	Scan to obtain the topology of the current slave, and find out whether there is a matching slave	
	XML file locally. If not, try to read the EEPROM and object dictionary of the slave to generate	
	temporary XML. There is no need to stop the PLC.	
	Note: the scanned slave station distinguishes the first station by station ID, station ID: 0 represents	
	the first station, and so on.	
Add	Add the XML file of the slave station (the corresponding XML file is required, which is stored in	
	the EtherCAT / folder under the installation directory of Xinje PLC programming software). The	
	default configuration of the slave station is related to XML.	
Сору	Copy the selected configuration item and add it to the last.	
Delete	Delete the selected configuration item.	
Up	Move up the selected configuration item.	
Down	Move down the selected configuration item.	
Update	Update the slave station list.	

Note: the order in the slave station list must be consistent with the actual connection order. If not, after clicking [activate] (meaning of activation 3-4 [activate]), the upper computer system will give the following prompt, and the equipment will not work normally.

3-4. Slave station configuration

		\times
General Expert process data Launch para	ameters IO Mapping COE-Online ESC Reg	
Offset time(us): 0	FuncMappingNum: 0	
SM Watchdog: 🗹	FuncModeule: Servo Module 🗸	
Claus Information Trit		
State Machine		
Current State Reguested		
State Error Message		
	Upload Download Activate OK Canc	el

Parameter	Explanation
Download	Download the configuration parameters to the flash of PLC without stopping PLC.
	Note:
	(1) The downloaded configuration is stored in the flash of PLC. Click activate to take effect.
	(2) The download here is only for PLC debugging (also can be saved in case of power failure).
	Please tick the EtherCAT parameter option when downloading the PLC project, otherwise there is no
	Etherecat configuration data when uploading the PLC project.
Upload	The configuration information in PLC is uploaded to the upper computer without stopping PLC.
Activate	The configuration data in the current PLC will take effect immediately. It will switch from any state
	of the slave station to Init, and then to OP state (Init \rightarrow PreOP \rightarrow Safeop \rightarrow OP). The effect is
	equivalent to stopping the PLC and then running the PLC. It is not necessary to stop PLC (for the
	meaning of slave station state, see the state machine in the general interface).
Ok	Exit the interface and save the currently modified data.
	Note: only the data will be saved, and the activation parameters will not take effect without
	downloading.
Cancel	Exit the interface without saving, which is equivalent to pressing the X button in the upper right
	corner.

3-5. General

		\times
	General Expert process data Launch parameters IO Mapping COE-Online ESC Reg	
	Offset time(us): 0 🗣 FuncMappingNum: 0 🗣	
1	SM Watchdog: 🔽 FuncModeule: Servo Module 🗸	
	Slave Information Init	
	State Machine	
	Current State Requested State	
	Error Message	
	Upload Download Activate OK Cancel	

Parameter	Explanation
Offset time	Its specific meaning is shown in the communication sequence diagram. The shift time
	in the diagram represents the experienced offset time.
SM watchdog	If the watchdog is selected, it will force set 0x420 (watchdog timing time) of ESC
	register to 1000.
	Note: the function of the watchdog is to reset the system when the program dead or
	crashes.
Initialzation	Restore all the configuration of the selected slave station to the default configuration,
	which needs to be downloaded again to take effect.
Slave information	It is used to download EEPROM during servo production and updating, and its
	download function is not open to users by default.
PreOP, OP, Init, SafeOP	Switch the slave station to specified state.
Current state	The current status of the slave. The current slave status can be monitored through SD
	[8021 + 20 * I]. * 1
Requested state	Status of the slave request. Mode switching control requirements can be monitored
	through SD [8029 + 20 * I] . *1
Error message	Error is reported when slave station state switching error. You can confirm the status
	switching error message through SD [8028 + 20 * I] . *1
Function module	It is used to map the EtherCAT slave station to the specified function module. For
	example, if the slave station 0 is the servo, the module selection is set as the servo
	module. At this time, the predefined functions of the motion control module will be
	associated with some necessary PDO objects. If you want to customize the operation,
	you can select user define. At this time, PDO data can be modified arbitrarily by the
	value of IO mapping. (note that IO module is not open temporarily, and its effect is
	equivalent to user define)

Function mapping	Used to bind the EtherCAT slave to the specified module function. For example, there
number	are two slave stations, namely, station 0 and station 1. You can set the [function
	mapping number] of station 0 to 1, and station 1 to 0. At this time, the slave station 1
	is controlled by station 0 in the motion control module, while the slave station 0 is
	controlled by station 1 in the motion control module.

*1: See Chapter 9 "description of relevant registers" for details.

		Communication action		
		SDO		
Slave station status	Actions in various states	(mail)	PDO	PDO
		receive	send	receive
		and send		
T. : t	Communication initialization, SDO, PDO unable to			
Init	receive and send messages	-	-	-
Pre-Operational	the status of only SDO cands and massives massage	Vaa		
(PreOP)	the status of only SDO sends and receives message	res	-	-
Safe-Operational	the status of only SDO sends and receives, PDO sends	Vaa	Vaa	
(SafeOP)	message	res	res	-
Organitional (OD)	all feasible status of SDO receiving and sending, PDO	Vaa	Vaa	Vac
Operational (OP)	receiving and sending	res	res	res

Note: the access from the master station to the ESC register is independent of the above table and is available at any time.

PDO (process data object) is used to transfer periodic communication data.

SDO (service data object) is used to transmit non periodic communication data.

Command or interface operation during ESM state switching may cause abnormal communication error.



Communication sequence diagram

Related concepts and key time points are as follows:

PDI	Process data interface
DC	Distributed clock
ESC	EtherCAT slave station controller
MCU	Microprocessor
PDI interruption	This interrupt is triggered when the master sends data to the slave
PDI falling edge	EOF is the completion of acquiring data frame from the slave station ESC
PDI rising edge	The slave MCU has obtained the current PDO data from ESC

PDI output	Copy PDO data from ESC to MCU and wait for MCU to process, which takes time t1
DC interrupt	Timing interrupt with reference clock as time reference, whose cycle is cycleTime (i.e.
	synchronization unit cycle), is responsible for triggering data processing of slave station (the
	same as Xnet data processing)
DC rising edge	Trigger data processing of each slave station
PDI input	Copy PDO data from MCU to ESC and wait for master station to read next cycle, which takes
	time t3

3-6. Expert process data

ncMan	lager		PC	DO list	t						
	Size	Туре	Inc	dex	Size	. 1	Name		Sign	SM	_
1		Mailha	#x1	1600	9.0	R	leceive PDO ma	apping 1		2	
		Mailbo	#x1	1601	19.0	R	leceive PDO ma	apping 2			
)	9.0	Output	#x1	1602	15.0	R	leceive PDO ma	apping 3			
3	23.0	Input	#x1	1603	21.0	R	leceive PDO ma	apping 4			
		F	#x1	1 a00	23.0	Т	'ransmit PDO m	napping 1		3	
			#x1	1 a0 1	25.0	Т	'ransmit PDO m	napping 2			
PDO Ass	ign		#x1	1 a02	25.0	Т	'ransmit PDO m	napping 3			
- H 40	200		#x1	1 a03	25.0	Т	'ransmit PDO m	napping 4			
✓] #x16	000										
#x16	601 602										
#x16 #x16 #x16	601 602 603		i pc	DO: A	dd E	idit De	elete Move	up Move down			
#x16 #x16 #x16	601 602 603		i PE	DO: A dex:Su	dd E	idit De Size	elete Move Offset	up Move down Name	Туре		
_ #x16 _ #x16 _ #x16	601 602 603		PE Ind #x6	D O: A dex:Su 6040:0	Add E ibIdx	idit De Size 2.0	elete Move Offset 0.0	up Move down Name Controlword	Type UINT		
_ #x16 _ #x16 _ #x16	601 602 603		: PE Ind #x6 #x6	DO: A dex:Su 6040:0 6060:0	Add E IbIdx IO	dit De Size 2.0 1.0	elete Move Offset 0.0 2.0	up Move down Name Controlword Modes of operation	Type VINT SINT		
_ #x16 _ #x16 _ #x16	301 502 503		PC Ind #x6 #x6 #x6	DO: A dex:Su 6040:0 6060:0 607A:0	Add E 1bIdx 10 10	dit De Size 2.0 1.0 4.0	elete Move Offset 0.0 2.0 3.0	up Move down Name Controlword Modes of operation Target position	Type VINT SINT DINT		
_ #x16 _ #x16 _ #x16	301 302 303		PC Int #x6 #x6 #x6 #x6	DO: A dex:Su 6040:0 6060:0 607A:0 6088:0	Add E 1010 100 100 100	Size 2.0 1.0 4.0 2.0	elete Move 0ffset 0.0 2.0 3.0 7.0	up Move down Name Controlword Modes of operation Target position Touch probe func	Type VINT SINT DINT VINT		
_ #x16 _ #x16 _ #x16	301 302 303		PC Int #xt #xt #xt	DO: A dex:Su 6040:0 6060:0 607A:0 60B8:0	Add E abIdx 10 10 10 10	dit De Size 2.0 1.0 4.0 2.0	elete Move 0ffset 0.0 2.0 3.0 7.0	up Move down Name Controlword Modes of operation Target position Touch probe func	Type VINT SINT DINT VINT		
_ #x16 _ #x16 _ #x16	301 302 303		PC Int #x2 #x6 #x6	DO: A dex:Su 6040:0 6060:0 607A:0 60B8:0	Add E abIdx 10 10 10	dit De Size 2.0 1.0 4.0 2.0	elete Move 0ffset 0.0 2.0 3.0 7.0	up Move down Name Controlword Modes of operation Target position Touch probe func	Type UINT SINT DINT UINT		
_ #x16 _ #x16 _ #x16	301 302 303		PE Int #x2 #x6 #x6	DO: A dex:Su 6040:0 6060:0 607A:0 60B8:0	Add E ibIdx 10 10 10	Edit De Size 2.0 1.0 4.0 2.0	elete Move 0ffset 0.0 2.0 3.0 7.0	up Move down Name Controlword Modes of operation Target position Touch probe func	Type UINT SINT DINT UINT		
_ #x16 _ #x16 _ #x16	301 302 303		PE Int #x6 #x6	DO: A dex:Su 6040:0 6060:0 607A:0 60B8:0	Add E ibIdx i0 i0 i0	dit De Size 2.0 1.0 4.0 2.0	elete Move 0ffset 0.0 2.0 3.0 7.0	up Move down Name Controlword Modes of operation Target position Touch probe func	Type UINT SINT DINT UINT		
#x16 #x16 #x16	601 602 603		PE Ind #x6 #x6	DO: A dex:Su 6040:0 6060:0 607A:0 60B8:0	Add E abIdx 10 10 10	dit De Size 2.0 1.0 4.0 2.0	elete Move 0ffset 0.0 2.0 3.0 7.0	up Move down Name Controlword Modes of operation Target position Touch probe func	Type UINT SINT DINT UINT		

Parameter	Explanation
Synchronization	SM0, 1: for the interaction of mailbox data (SDO); SM2, 3 for the interaction of PDO data (its
manager	type input and output are relative to the master station).
	Note:
	(1) PDO (process data object) is used to transfer periodic communication data.
	(2) SDO (service data object) is used to transmit non periodic communication data.
PDO	Specifies the PDO of the corresponding SM, up to 4 can be selected, and the size does not
distribution	exceed 24 bytes. (the larger the PDO data is, the longer the transmission time is, and it may not
	be completed in the synchronization unit cycle. Therefore, it is impossible to guarantee the
	stability of data transmission when there are many slave stations and each slave station has a
	large PDO data.)
PDO list	Some PDO maps predefined in the servo XML, RxPDO represents PDO transmitted from the
	master station to the slave station, 1600h ~ 1603h can be used, TxPDO represents PDO
	transmitted from the slave station to the master station, and 1A00h ~ 1A03h can be used.

PDO content	The PDO objects to be mapped are specified from the object dictionary, and the objects are
	periodically exchanged through PDO. (RxPDO must have 6040h, 6060h, 607Ah, TxPDO must
	have 6041h, 6061h, 6064h, 606Ch)

3-7. Launch parameter

1			Aards	Bits	Error =>	Error ->	Next row	Notes
*	#x6060:00	Modes of operation	8	8			0	Op mode
2	#x60C2:01	Interpolation ti	1	8			0	Interpolation time period
3	#x60C2:02	Interpolation ti	-3	8			0	Interpolation time index

There are three default configurations in the startup parameters, of which 6060h is the operation mode of the slave station, with the default value of 8 (CSP mode); 60C2-1 and 60C2-2 are the synchronization unit cycle, 60C2-1 is the value of the synchronization unit cycle, and 60C2-2 is the unit of the synchronization unit cycle, for example, the default synchronization unit cycle is 100×10^{-5} s, that is, 1000us. (this parameter will change automatically with the synchronization period configured by the master station, and does not need to be modified manually.).

You can configure startup parameters and their execution order through [add], [edit], [delete], [move up] and [move down].

Note: the execution order is from top to bottom. You can write different values to the same parameter, indicating that the parameters are set in the order from top to bottom.

[Error -> Exit]: indicates that if there is an error in configuring this parameter, all the following configurations will be skipped.

[Click error -> jump] and [next line] to specify to jump to the specified line to continue configuration when an error occurs.

3-8. IO mapping

The allocated RxPDO and TxPDO will be mapped to the register starting from the [start address], and the register types can be HD and D. Modifying the [start address] will automatically arrange the addresses according to the parameter order. If there is a duplicate address with other stations, an error will be reported and the address will be automatically arranged to a non duplicate address.

Parameter types in IO mapping can be divided into read-only (RO) and read-write (RW). Parameter types can be seen in CoE-Online. In particular, 6040h (RW) is only writable in homing mode (6060h is 6), and 607A (RW) is not writable in any mode.

If a new PDO is added to the IO mapping, it will be automatically sorted in the order of RxPDO first and TxPDO later. The corresponding register addresses will also be allocated in order. If the allocated address conflicts with other set slave addresses, the unused addresses will be automatically selected.

Х

General Expert p	process data Launch parameters I	O Mapping COE-Or	line ESC Reg			
Initial Word addr: map:	HD ~ Bit map: HM ~ Shift	10024				
Index:SubIdx	Name	Address	Туре	Bit length	Value	
⊕ -#x6040∶00	Control Word	10024	UINT	16	0	
⊕-#x607A:00	TargetPosition	HD10026	DINT	32	0	
⊕-#x60FF:00	TargetVelocity	HD10028	DINT	32	0	
i∎-#x6071∶00	TargetTorque	HD10030	INT	16	0	
i∎-#x6060∶00	ModeOfOperation	HD10032	SINT	8	0	
i∎-#x6098∶00	Homing method	НD10064	SINT	8	⁰ The new	PDO will be
⊕-#x609A∶00	Homing acceleration	НD10066	UDINT	32	o displayed	here
⊕-#x6041∶00	Status Word	НD10034	UINT	16	0 displayed	nere.
	ActualPosition	HD10036	DINT	32	0	
⊕-#x606C:00	Velocity actual value	HD10038	DINT	32	0	
⊕-#x6077:00	ActualTorque	НД20040	INT	16	Address c	an be changed
	ModeOfOperationDisplay	1020042	SINT	8	0	un be changed.
			· · · · · · · · · · · · · · · · · · ·			
			Upload	Download	Activate	OK Cancel

Note: the address automatically assigned due to address conflict is from HD1000 and is not used. The following picture:

153	名称	+Pti	出用	位长	約値	
	Control Read	100000	1000	10	16060	
R26040:00	Control Sord	102000	DINI	10	16960	
6078-00	Targetrosition	102002	DINI	32	0	
N6071:00	TargetVelocity	102004	TNT	16	0	
N6060-00	Hede060meration	302000	STAT	8	0	
N6098-00	Keeing asthod	M02000	INTET	8	0	
LE093-00	Maning acceleration	MD2012	IDINT	32	0	
N6041-00	Statue Ward	MD2014	ITNT	16	0	
	Astu-TP-sition	102014	DINT	32	0	
DYDUD/S ULL	ACTUBLE0511100	nuzuin				
Rx6064:00	Velocity actual value	MD2018	DINT	32	0	
\$x6064:00 \$x606C:00	Velocity actual value ActualTorgue	MD2018 MD2018	DINT	32	0	
Rc6064:00 Rc606C:00 Rc6077:00 Rc6061:00	Vetualrosition Vetuallorgue ModeOfOperationDisplay	m2018 m01000 m01002 slave statio	DINT INT SINT	16 8 he addres	5 5 s HD2020~H	ID20
x6064:00 x606C:00 x6077:00 x6061:00	Actual of the Actual value ActualTorque ModeOfDperationDisplay	slave station the auto as	on 2 uses t	he addres	s HD2020~F	ID20 000
xx0054:00 xx606C:00 xx6077:00 xx6061:00	Actual ostiton Valocity actual value ActualTorque ModeOfDperationDisplay	slave station	סח אד גאד sixד on 2 uses t ssigned add	he addres	s HD2020~F tart with HD1	ID20 000
Rc0064:00 Rc6067:00 Rc6061:00	Actual of the Actual value Actual for que ModeOfDperationDisplay	slave static	on 2 uses t	he addres	s HD2020~H tart with HD1	ID20 000
Re064:00 ht6060:00 ht6071:00 ht6061:00	Actual of the Actual value Actual Corque ModeOfDperationDisplay	slave static	on 2 uses t	he addres	s HD2020~H tart with HD1	ID20 000
http://doi.org	Actual osliton Valocity actual value ActualTorque ModeOfDperationDisplay	slave static	on 2 uses t	he addres	s HD2020~H tart with HD1	ID20 000
hr6064:00 hx866C:00 hx6071:00 hx6071:00	Actual of the Actual value Actual for que ModeOfDperationDisplay	slave stati	on 2 uses t	he addres	s HD2020~H tart with HD1	ID20 000
8x6084:00 8x6062:00 8x6071:00 8x6071:00	Actual of the Actual value Actual Corque ModeOfDperationDisplay	slave static	on 2 uses t	he addres	s HD2020~H tart with HD1	ID20 000

3-9. COE-Online interface

an Update	General Expert	t process data Launch parameters	IO Mapping CO	E-Online ESC Reg	5	
ter	All object d	lictionaries 🔘 Receiving PDO (Rx	PDO) 🔘 Send PDO	(TxPDO)		
Master	Index:SubIndex	x Name	Flag	Value	Communication error message	
	#x1000:00	Device type	ro		this function is not supported of	
	-#x1001:00	Error Register	ro		this function is not supported of	
tationLD:U Alias:U MADHTI105BAI	-#x1008:00	Device name	ro		this function is not supported of	
tationID:1 Alias:0 XINJE-DS5C	-#x100A:00	Software version	ro		this function is not supported of	
tationLD:2 Alias:0 XINJE-DS5C		Identity	ro	>4<		
	##x1600:00	1st Receive PDO Mapping	rw	>8<		
		2nd Receive PDO Mapping	rw	>8<		
	⊕-#x1602:00	3rd Receive PDO Mapping	rw	>8<		
	#x1603:00	4th Receive PDO Mapping	rw	>8<		
		1st Transmit PDO Mapping	rw	>8<		
		2nd Transmit PDO Mapping	rw	>8<		
	⊕-#x1A02:00	3rd Transmit PDO Mapping	rw	>8<		
	#x1A03:00	4th Transmit PDO Mapping	rw	>8<		
	##x1C00:00	Sync manager type	ro	>1<		
	##x1C12:00	RxPDO assign	rw	>4<		
	#x1C13:00	TxPDO assign	rw	>4<		
	#x1C32:00	SM output parameter	rw	>14<		
		SM input parameter	ro	>14<		
	-#x2000:00	DRV's Parameter PO-00	rw		this function is not supported of	
	-#x2001:00	DRV's Parameter PO-01	rw		this function is not supported of	
	-#x2002:00	DRV's Parameter PO-02	rw		this function is not supported of	
	-#x2003:00	DRV's Parameter PO-03	rw		this function is not supported of	
	-#x2004:00	DRV's Parameter PO-04	rw		this function is not supported of	
	±v2005-00	DRV's Paramatar PO-05	rw			

COE-Online has the function of reading and writing all object Dictionaries Online. When the interface is opened, the data will be updated all the time. Select the slave of COE online from the list of slave stations on the left. Double click the RW type object dictionary to make online modification.

Object type	Explanation
0x1000	Device type
0x1001	Servo driver alarm type (status)
0x1008	Manufacturer equipment name
0x1009	Manufacturer hardware version
0x100A	Manufacturer software version
0x1018	Device information

COE-Online contains object types:

0x1C00	Synchronous management communication type (SyncManager)
0x1C12, 0x1C13	Process data object (PD0) mapping
1600h~1603h, 1A00h~1A03h	PDO mapping object
0x1C32, 0x1C33	Synchronous management SM2/3
0x6000-0x6fff	Cia402 Profile COE object
0x2000-0x5fff	Xinje customized object

3-10. ESC register

ESC refers to EtherCAT slave controller, and ESC register interface is the interface for monitoring and modifying slave registers.

can Update	General Expe	rt process dat	a Launch par	ameters IO	O Mapping COE-Online ESC Reg	
aster	StartAddress:	0x 0000	Length:	10	Reload	
J Master	Address	Dec	Hex		Instructions	Т
ave	0000	0	0x0000		TypeR	- 1
-StationID:0 Alias:0 MADHT1105BA1	0002	0	0x000x0		BuilO	
-StationID:1 Alias:0 XINJE-DS5C	0004	0	0x000x0		FMMUs supportedSync	
StationID:2 Alias:0 XINTE-DS5C	0006	0	0x0000		RAM SizePort	
	0008	0	0x000x0		ESC Features supporte0	
	000A	0	0x000x0		Reserved 🕑	
	000C	0	0x0000		Reserved	
	000E	0	0x000x0		Reserved	
	0010	0	0x0000		Configured Station Addres0	
	0012	0	0x000x0		Configured Station AliaO	
	0014	0	0x000x0		Reserved	
	0016	0	0x000x0		Reserved	
	0018	0	0x000x0		Reserved	
	001A	0	0x0000		Reserved	
	0010	0	0x0000		Reserved	
	001E	0	0x0000		Reserved	
			0.0000	-	Write Register KnahleW	_
	Bit	Value		Flag	Instructions	
					(2)	
					\mathbf{r}	

Parameter	Explanation
Start address	Set the starting value (hexadecimal) of the register to be monitored.
Length	Number of registers to be monitored, decimal.
Reload	Click to display the value. The current value is displayed only once.
Interface 1	Only the value of each register is displayed and cannot be modified.
Interface 2	The meaning of each bit of the register determines the read/write permission according to the
	flag. R-readable, w-writable, w (CLR) - write as clear as 0.

Note: the value modification of some registers will disconnect the communication. If there is no special case, it is not necessary to modify.

4. Object dictionary (CoE-Online)

4-1. Object dictionary area assignment

All objects are configured in the object dictionary of each group through the 16-bit index configuration address represented by 4-bit hex.

The object dictionary of CoE (CANopen over EtherCAT) specified by CiA402 and the object dictionary of DS5C series are as follows:

Object dict	ionary according to CiA402	Object dictionary of DS5C 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	h~5FFFh User-defined area		servo parameter area		
		3000h~3FFFh	Reserved		
		4000h~4FFFh	Reserved		
		5000h~5FFFh	Reserved		
6000h~9FFFh	000h~9FFFh Profile area		Driver Profile area		
		7000h~9FFFh	Reserved		
A000h~FFFFh	Reserved	A000h~FFFFh	Reserved		

4-2. COE communication area (0x1000-0x1FFF)

4-2-1. Object list

(1) Device infor	mation object	
Index	Sub-Index	Name
1000h	00h	Device type
1001h	00h	Error register
1008h	00h	Manufacturer device name
1009h	00h	Manufacturer hardware version
100Ah	00h	Manufacturer software version
1018h	-	Diagnosis history
	00h	Number of entries
	01h	Vendor ID
	02h	Product code
	03h	Revision number
	04h	Serial number

(2) RxPDO object mapping

Index	Sub-Index	Name
1600h	-	Receive PDO mapping 1
	00h	Number of entries

	01h	1st receive PDO mapped
	02h	2nd receive PDO mapped
	03h	3rd receive PDO mapped
	04h	4th receive PDO mapped
	05h	5th receive PDO mapped
	18h	24th receive PDO mapped
1601h	-	Receive PDO mapping 2
	00h	Number of entries
	01h	1st receive PDO mapped
	02h	2nd receive PDO mapped
	03h	3rd receive PDO mapped
	04h	4th receive PDO mapped
	05h	5th receive PDO mapped
	18h	24th receive PDO mapped
1602h	-	Receive PDO mapping 3
	00h	Number of entries
	01h	1st receive PDO mapped
	02h	2nd receive PDO mapped
	03h	3rd receive PDO mapped
	04h	4th receive PDO mapped
	05h	5th receive PDO mapped
	18h	24th receive PDO mapped
1603h	-	Receive PDO mapping 4
	00h	Number of entries
	01h	1st receive PDO mapped
	02h	2nd receive PDO mapped
	03h	3rd receive PDO mapped
	04h	4th receive PDO mapped
	05h	5th receive PDO mapped
	18h	24th receive PDO mapped

(3) TxPDO object mapping

Index	Sub-Index	Name
1A00h	-	Transmit PDO mapping 1
	00h	Number of entries
	01h	1st transmit PDO mapped
	02h	2nd transmit PDO mapped
	03h	3rd transmit PDO mapped
	04h	4th transmit PDO mapped
	05h	5th transmit PDO mapped
	18h	24th transmit PDO mapped
1A01h	-	Transmit PDO mapping 2
	00h	Number of entries

	01h	1st transmit PDO mapped
	02h	2nd transmit PDO mapped
	03h	3rd transmit PDO mapped
	04h	4th transmit PDO mapped
	05h	5th transmit PDO mapped
	18h	24th transmit PDO mapped
1A02h	-	Transmit PDO mapping 3
	00h	Number of entries
	01h	1st transmit PDO mapped
	02h	2nd transmit PDO mapped
	03h	3rd transmit PDO mapped
	04h	4th transmit PDO mapped
	05h	5th transmit PDO mapped
	18h	24th transmit PDO mapped
1A03h	-	Transmit PDO mapping 4
	00h	Number of entries
	01h	1st transmit PDO mapped
	02h	2nd transmit PDO mapped
	03h	3rd transmit PDO mapped
	04h	4th transmit PDO mapped
	05h	5th transmit PDO mapped
	18h	24th transmit PDO mapped

(4) PDO object distribution

Index	Sub-Indx	Name
1C12h	-	Sync manager channel 2
	00h	Number of assigned PDOs
	01h	Assigned RxPDO 1
	02h	Assigned RxPDO 2
	03h	Assigned RxPDO 3
	04h	Assigned RxPDO 4
1C13h	-	Sync manager channel 3
	00h	Number of assigned PDOs
	01h	Assigned TxPDO 1
	02h	Assigned TxPDO 2
	03h	Assigned TxPDO 3
	04h	Assigned TxPDO 4

(5) PDO synchronous management channel

Index	Sub-Indx	Name
1C32h	-	Sync manager 2 synchronization
	00h Number of sub-objects	
	01h	Sync mode
	02h	Cycle time
	03h	Shift time
	04h	Sync modes supported

	05h	Minimum cycle time
	06h	Calc and copy time
	08h	Command
	09h	Delay time
	0Ah	Sync0 cycle time
	0Bh	Cycle time too small
	0Ch	SM-event missed
	0Dh	Shift time too short
	0Eh	RxPDO toggle failed
	20h	Sync error
1C32h	-	Sync manager 2 synchronization
	00h	Number of sub-objects
	01h	Sync mode
	02h	Cycle time
	03h	Shift time
	04h	Sync modes supported
	05h	Minimum cycle time
	06h	Calc and copy time
	08h	Command
	09h	Delay time
	0Ah	Sync0 cycle time
	0Bh	Cycle time too small
	0Ch	SM-event missed
	0Dh	Shift time too short
	OEh	RxPDO toggle failed
	20h	Sync error

4-2-2. Device information

This section describes the equipment information.

Index	Sub-		Nam	e/Description	Range	Date	Access	PDO	Op-
	Index					Туре			mode
1000h	00h	Dive	ce type		0~4294967295	U32	ro	NO	All
		Indic	ates the	device type. In case of	servo driver, the va	lue is fixe	d to 040201	92h.	
1001h	00h	Error	register		0~65535	U16	ro	TxPDO	All
		Displ	ays the t	ype of alarm (status) th	at is occurring to the	he servo d	river.		
		When	n the ala	rm does not occur, it wi	ll display 0000H.				
		Do no	ot displa	y warnings.					
			Bit		Content				
			0						
			1	١	Not support				
			2						
			3						
			4	Alarm occurrence	Alarm occurrence defined by AL status code *1				
			5	Not support					
			6		Reserved				
			7	Alarm occurrence u	ndefined by AL sta	tus code *	2		

		*1) The "alarm defined by AL status code" refers to the EtherCAT Communication Association						
		Error E-800~7, E-810~7, E-850~7.						
		*2) The "AL status code undefined a	larm" refers to the	EtherCA	Г Communi	cation Asso	ciation	
		Error E-880~7 and the error except EtherCAT Communication Association.						
1008h	00h	Manufacturer device name				TxPDO	All	
		Device name.						
1009h	00h	Manufacturer hardware version	-	-	ro	TxPDO	All	
		Hardware version.						

Index	Sub-Index	Name/Description	Range	DateType	Access	PDO	Op-mode	
1018h	00h	Number of entries	0~255	U8	ro	TxPDO	All	
		Sub-index number for t	his object. The valu	ue is fixed to (04H.			
	01h	Vendor ID	0~4294967295	U32	ro	TxPDO	All	
		Manufacturer ID of Eth	erCAT. The value	is fixed to 000)00 556h.			
	02h	Product code	0~4294967295	U32	ro	TxPDO	All	
		Product code. The valu	Product code. The value is 10305070h.					
	03h	Revision umber	0~4294967295	U32	ro	TxPDO	All	
		Product version number. The value is 02040608h.						
	04h	Divece type	0~4294967295	U32	ro	TxPDO	All	
		Product serial number.	The value is 00000	000h.				

4-2-3. Sync manager communication type (1C00h)

The action mode assigned to each syncmanager is set by 1C00h object.

The value is fixed for the servo driver.

Index	Sub-	Name/Description	Range	DateType	Access	PDO	Op-mode			
	Index									
1C00h	00h	Number of used sync manager channels	0~255	U8	ro	TxPDO	All			
		The number of child indexes for this object. The value is fixed to 04H.								
	01h	Communication type sync manager 0	0~4	U8	ro	TxPDO	All			
		Set the purpose of sync Manager 0.								
		0: unused.								
	1: Mailbox receive (master station→slave station)									
		2: Mailbox send (slave station→master station)								
		3: RxPDO (master station \rightarrow slave station)								
		4: TxPDO (slave station→master station)								
	Because sync manager0 uses mailbox to receive messages, the value is fixed to						1			
	02h	Communication type sync manager 1	0~4	U8	ro	TxPDO	All			
		Set the purpose of sync Manager 1.								
		0: unused.								
	 Mailbox receive (master station→slave station) Mailbox send (slave station→master station) 									
		3: RxPDO (master station \rightarrow slave station)								
		4: TxPDO (slave station \rightarrow master station)								
		Because sync manager1 uses mailbox to send messages, the value is fixed to 2.								
	03h	Communication type sync manager 2	0~4	U8	ro	TxPDO	All			
		Set the purpose of sync Manager 2.								
		0: unused.								
---	-----	--	------------	--------------	-------------	----------	--	--	--	--
		1: Mailbox receive (master station→slave	station)							
		2: Mailbox send (slave station→master sta	tion)							
		3: RxPDO (master station→slave station)								
		4: TxPDO (slave station→master station)								
		because sync manager2 uses process data output (RxPDO), the value is fixed to 3.								
0)4h	Communication type sync manager 3 0~4 U8 ro TxPDO All								
		Set the purpose of sync Manager 3.								
		0: unused.								
		1: Mailbox receive (master station→slave	station)							
		2: Mailbox send (slave station→master sta	tion)							
		3: RxPDO (master station \rightarrow slave station)								
		4: TxPDO (slave station→master station)								
		Because sync manager3 uses process data	output (Rx	PDO), the va	lue is fixe	ed to 4.				

4-2-4. PDO mapping

1. PDO distribution object (1C12h~1C13h)

The type of PDO	mapping table alloc	ated by syncmana	ger is set by	1C12h to	1C13h objects
The type of 1 DO	mapping more anot	ated by Synemane	iger is set by	10121110	101511 00 00000.

Index	Sub-Index	Name/Description	Range	Date Type	Access	PDO	Op-mode			
1C12h	00h	Number of assigned PDOs	0~4	U8	rw	NO	All			
		The number of subindexes for this object.								
	01h	Assigned RxPDO 1	1600h~1603h	U16	rw	NO	All			
		Specify the RxPDO mapping	object.							
	02h	Assigned RxPDO 2	1600h~1603h	U16	rw	NO	All			
		Specify the RxPDO mapping object.								
	03h	Assigned RxPDO 3	1600h~1603h	U16	rw	NO	All			
		Specify the RxPDO mapping object.								
04h		Assigned RxPDO 4	1600~1603	U16	rw	NO	All			
		Specify the RxPDO mapping object.								
1C13h	00h	Number of assigned PDOs	0~4	U8	rw	NO	All			
		The number of subindexes for this object. The value is fixed to 04h.								
	01h	Assigned TxPDO 1	1A00h~1A03h	U16	rw	NO	All			
		Specify the TxPDO mapping object.								
	02h	Assigned TxPDO 2	1A00h~1A03h	U16	rw	NO	All			
		Specify the TxPDO mapping object.								
	03h	Assigned TxPDO 3	1A00h~1A03h	U16	rw	NO	All			
		Specify the TxPDO mapping object.								
	04h	Assigned TxPDO 4	1A00h~1A03h	U16	rw	NO	All			
		Specify the TxPDO mapping	object.							

Subindex01h-04h of 1C12h and 1C13h can only be changed when the ESM state is PreOP and subindex00h = 0. In addition, the status is the return port code (06010003h).

After the setting is changed, set the subindex number of subindex00h, and reflect PDO distribution object setting by converting ESM state to SafeOP.

2. PDO mapping object (1600h~1603h, 1A00h~1A03h)

Index	Sub-Index	Name	e/Description	Range	DateType	Access	PDO	Op-mode
1600h	00h	Num	ber of entries	0~4294967295	U8	rw	NO	All
		Subindex	number of the obje	ct.				
	01h	1st recei	ve PDO mapped	0~4294967295	U32	rw	NO	All
		Set the first	st mapping object.					
		bit	31 16	158	7	0		
			Index number	Sub-index numbe	r Bit le	ngth		
	02h	2nd recei	ve PDO mapped	0~4294967295	U32	rw	NO	All
		Setting me	ting method is same to Subindex01h.					
	03h	3rd recei	ve PDO mapped	0~4294967295	U32	rw	NO	All
		Setting me	ethod is same to Sul	bindex01h.				
	04h	4th recei	ve PDO mapped	0~4294967295	U32	rw	NO	All
		Setting me	ethod is same to Sul	bindex01h.				
	05h	5th recei	ve PDO mapped	0~4294967295	U32	rw	NO	All
		Setting me	thod is same to Sub	bindex01h.				
	06h	6th recei	ve PDO mapped	0~4294967295	U32	rw	NO	All
		Setting me	thod is same to Su	bindex01h.				
	18h	24th rece	ive PDO mapped	0~4294967295	U32	rw	NO	All
		Setting me	thod is same to Su	bindex01h.				
1601h	-	Receive P	DO mapping 2, the	Subindex specifica	ation is same	to 1600h.		
1602h	-	Receive P	DO mapping 3, the	Subindex specifica	ation is same	to 1600h.		
1603h	-	Receive P	DO mapping 4, the	Subindex specifica	tion is same	to 1600h.		

As a table for PDO mapping objects, objects of 1600h~1603h for RxPDO and 1A00h~1A03h for TxPDO can be used. After subindex 01h, it represents the information of the mapped application layer object.

Do not map duplicate objects. The change of the repeated setting is unknown.

Subindex01h-18h of 1600h-1603h can only be changed when the ESM state is PreOP and subindex00h = 0. In addition, the status returns abort code (06010003h).

After the setting is changed, set the subindex number of subindex0h, and reflect PDO distribution object setting by converting ESM state to SafeOP.

Index	Sub-Index	Name	e/Description	Range	DateType	Access	PDO	Op-mode
1A00h	00h	Num	ber of entries	0~4294967295	U8	rw	NO	All
		Subindex	number of the object	et.				
	01h	1st transi	nit PDO mapped	0~4294967295	U32	rw	NO	All
		Set the first	st mapping object.					
		bit	3116	158	7	. 0		
			Index number	Sub-index number	r Bit length			
		-						
	02h	2nd trans	mit PDO mapped	0~4294967295	U32	rw	NO	All
		Setting me	thod is same to Sul	bindex01h.				
	03h	3rd transi	mit PDO mapped	0~4294967295	U32	rw	NO	All
		Setting me	etting method is same to Subindex01h.					
	04h	4th transi	mit PDO mapped	0~4294967295	U32	rw	NO	All
		Setting me	thod is same to Sul	bindex01h.				

	1	1									
	05h	5th transmit PDO mapped	0~4294967295	U32	rw	NO	All				
		Setting method is same to Sub	oindex01h.								
	06h	6th transmit PDO mapped	0~4294967295	U32	rw	NO	All				
		Setting method is same to Sub	etting method is same to Subindex01h.								
	18h	24th transmit PDO mapped	0~4294967295	U32	rw	NO	All				
		Setting method is same to Sub	oindex01h.								
1A01h	-	Transmit PDO mapping 2, the	Transmit PDO mapping 2, the Subindex specification is same to 1600h.								
1A02h	-	Transmit PDO mapping 3, the Subindex specification is same to 1600h.									
1A03h	-	Transmit PDO mapping 4, the	Subindex specific	ation is same	to 1600h.						

Do not map duplicate objects. The change of the repeated setting is unknown.

Subindex01h-18h of 1A00h-1A03h can only be changed when the ESM state is PreOP and subindex00h = 0. In addition, the status returns abort code (06010003h).

After the setting is changed, set the subindex number of subindex0h, and reflect PDO distribution object setting by converting ESM state to SafeOP.

4-2-5. Sync manager 2/3 synchronization (1C32h, 1C33h)

The setting of Sync manager2 is executed as 1C32h (Sync maneger 2 synchronization). The setting of Sync manager3 is executed as 1C33h (Sync maneger 3 synchronization).

Index	Sub-Index	Name/Description	Range	Date Type	Access	PDO	Op-mode			
1C32	00h	Number of entries	0~20h	U8	ro	NO	All			
		Subindex number of the o	bject. The value is fix	ted to 20h.						
	01h	Sync mode	0-65535	U16	rw	NO	All			
		Set the synchronization m	ode of Sync Manager	2.						
		00h: FreeRun (not synchr	onized)							
		01h: SM2 (synchronized	with SM 2 Event)							
		02h: DC SYNC0 (synchro	onized with Sync0 Ev	ent)						
	02h	Cycle time	0~4294967295	U32	rw	NO	All			
		Set the cycle of Sync Mar	nager.							
		Please set it among 5000	Please set it among 500000 (500µs), 1000000 (1ms), 2000000(2ms), 4000000(4ms). If a							
		value other than the above is set, E-810 (abnormal protection of synchronization cycl								
		setting) will occur.				_				
	03h	Shift time	0~4294967295	U32	rw	NO	All			
		Offset time.								
	04h	Sync modes supported	0~65535	U16	ro	NO	All			
		Set the supported synchro	nization type.							
		BIT0: FreeRun mode supported								
		0: not support; 1: Free	eRun mode supported	l						
		This servo driver is set	This servo driver is set to 1.							
		BIT1: SM synchronization mode supported								
		0: not support; 1: SM2 event synchronization supported								
		This servo driver is set	to 1.							
		BIT4-2: DC synchronizat	ion mode supported							

Sync manager 2 synchronization (1C32h)

-		-								
		000b: not support								
		001b: DC sync0 event s	upported							
		This servo driver is set t	o 001b.							
		BIT6-5: output offset supp	orted							
		00b: not support								
		01b: offset of local clock	k supported							
		This servo driver is set t	o 00b.							
		BIT15-7: Reserved								
1C32	05h	Minimum cycle time	0~4294967295	U32	ro	NO	All			
		The minimum value of the communication cycle that can be set.								
	06h	Calc and copy time	0~4294967295	U32	ro	NO	All			
		The time from SM2 event, sync0 event to ESC read completion.								
		This time can also be extended when there is a deviation in the signal.								
	08h	Command	0~65535	U16	ro	NO	All			
		Not support								
ľ	09h	Delay time	0~4294967295	U32	ro	NO	All			
		Not support								
	0Ah	Sync0 cycle time	0~4294967295	U16	ro	NO	All			
		When DC SYNC0 (1C32h-01h=02h), the value of ESC register 09A0h is set.								
		Except DC SYNC0, the setting is 0.								
	0Bh	Cycle time too small	0~65535	U16	ro	NO	All			
		Not support								
	0Ch	SM-event missed	0~65535	U16	ro	NO	All			
		Not support	L	11						
	0Dh	Shift time too short	0~65535	U16	ro	NO	All			
		Not support	L	11						
	0Eh	RxPDO toggle failed	0~65535	U16	rw	NO	All			
		Not support	1	ı						
	20h	Sync error	0~1	BOOL	ro	NO	All			
		Sync error	1	ıI		1				

This setting value is a reference value, not a guaranteed value.

Sync manager 3 synchronization (1C33h)

Index	Sub-Index	Name/Description	Range	DateType	Access	PDO	Op-mode			
1C33h	00h	Number of entries	0~20h	U8	ro	NO	All			
		The Subindex number of the	he Subindex number of this object. The value is fixed to 20h.							
	01h	Sync mode	0~65535	U16	rw	NO	All			
		Set the synchronization mo	ode of Sync Manage	r 2.						
		00h: FreeRun (not synchro	Dh: FreeRun (not synchronized)							
		1h: SM2 (synchronized with SM 2 Event)								
	02h: DC SYNC0 (synchronized with Sync0 Event)									
	02h	Cycle time	0~4294967295	U32	rw	NO	All			
		Set the cycle of Sync Manager.								
		Please set it among 500000 (500µs), 1000000 (1ms), 2000000(2ms), 4000000(4ms). If a								
		value other than the above	e is set, E-810 (abi	normal prote	ction of syr	nchroniza	ation cycle			
		setting) will occur.	setting) will occur.							
	03h	Shift time	0~4294967295	U32	rw	NO	All			
		Offset time.								

		<u></u>		1		T	T				
	04h	Sync modes supported	0~65535	U16	ro	NO	All				
		Set the supported synchron	nization type.								
		BIT0: FreeRun mode supp	ported								
		0: not support; 1: Free	eRun mode supporte	d							
		This servo driver is set	to 1.								
		BIT1: SM synchronization	n mode supported								
		0: not support; 1: SM2	2 event synchronizat	ion supported	d						
		This servo driver is set	to 1.								
		BIT4-2: DC synchronizati	Γ4-2: DC synchronization mode supported								
		000b: not support	000b: not support 001b: DC sync0 event supported								
		001b: DC sync0 event s									
		This servo driver is set	This servo driver is set to 001b.								
		BIT6-5: output offset supp	ported								
		00b: not support	00b: not support								
		01b: offset of local cloc	1b: offset of local clock supported								
		This servo driver is set	to 00b.								
		BIT15-7: Reserved									
1C33h	05h	Minimum cycle time	0~4294967295	U32	ro	NO	All				
		The minimum value of the	e communication cyc	cle that can b	e set.						
	06h	Calc and copy time	0~4294967295	U32	ro	NO	All				
		The time from SM2 event	, sync0 event to ESC	read comple	etion.						
		This time can also be exte	nded when there is a	deviation in	the signal.						
	08h	Command	0~65535	U16	ro	NO	All				
		Not support									
	09h	Delay time	0~4294967295	U32	ro	NO	All				
		Not support		·							
	0Ah	Sync0 cycle time	0~4294967295	U16	ro	NO	All				
		The same value with 1C32	2h-0Ah								
	0Bh	Cycle time too small	0~65535	U16	ro	NO	All				
		Not support		•							
	0Ch	SM-event missed	0~65535	U16	ro	NO	All				
		Not support					L				
	0Dh	Shift time too short 0~65535 U16 ro NO									
		Not support									
	0Eh	RxPDO toggle failed	0~65535	U16	rw	NO	All				
		Not support				1	1				
	20h	Sync error	0~1	BOOL	ro	NO	All				
		Sync error				I	1				
		~									

This setting value is a reference value, not a guaranteed value.

1. DC (SYNC0 event synchronization)

synchronization method	Features
Synchronize the time information of	High precision, need to compensate at the main
other slave stations based on the time	station side
of the first axis	

The specification of DC synchronous mode in this servo driver is as follows:



2. SM2 (SM2 event synchronization)

synchroniz	ation me	ethod	Features						
Synchronize	with	RxPDO	No	transmission	delay	compensation	accuracy		
receiving time			difference						
			The transmission time must be ensured on the upper						
			side (special hardware, etc.)						

The specifications of SM2 synchronous mode in this servo driver are as follows:



4-3. Driver Profile area (0x6000~0x6FFF)

4-3-1. Object list

Index	Sub-Index	Name
603Fh	00h	Abort connection option code
6040h	00h	Controlword
6041h	00h	Statusword
605Ah	00h	Quick stop option code
605Bh	00h	Shutdown option code
605Bh	00h	Disable operation option code
605Bh	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	-	Position range limit
	00h	Highest sub-index supported
	01h	Min position range limit
607Bh	02h	Max position range limit
607Ch	00h	Home offset

607Dh	-	Software position limit
	00h	Number of entries
	01h	Min position limit
	02h	Max position limit
606Eh	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	-	Position encoder resolution
	00h	Highest sub-index supported
	01h	Encoder increments
	02h	Motor revolutions
6091h	-	Gear ratio
	00h	Number of entries
	01h	Motor revolutions
	02h	Shaft revolutions
6092h	-	Feed constant
	00h	Highest sub-index supported
	01h	Feed
	02h	Shaft revolutions
6098h	00h	Homing method
6099h	-	Homing speeds
	00h	Number of entries
	01h	Speed during search for switch
	02h	Speed during search for zero
609Ah	00h	Homing acceleration
60A3h	00h	Profile jerk use
60A4h	-	Profile jerk
	00h	Highest sub-index supported
	01h	Profile jerk1
	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
60BBh	00h	Touch probe pos1 neg value
60BCh	00h	Touch probe pos2 pos value
60BDh	00h	Touch probe pos2 neg value
60C2h	-	Interpolation time period

00h	Highest sub-index supported
01h	Interpolation time period value
02h	Interpolation time index
00h	Max acceleration
00h	Max deceleration
-	Supported homing method
00h	Number of entries
01h	1st supported homing method
20h	32nd supported homing method
00h	Positioning option code
00h	Following error actual value
00h	Control effort
00h	Position demand internal value
00h	Digital inputs
-	Digital outputs
00h	Number of entries
01h	Physical outputs
02	Bit mask
00h	Target velocity
00h	Supported drive modes
	00h 01h 02h 00h 00h - 00h 01h 20h 00h 00h 00h 00h 00h 00h 00h 00h 00h

4-3-2. PDS (Power Drive Systems) specification

According to the user command or abnormal detection, the state transition of the PDS associated with the power control of the servo driver is defined as follows.



After migrating to operation enabled(servo is enabled), please increase the time to more than 100ms and input the action command.

The following table shows the PDS state migration events (migration conditions) and actions during migration. For the migration of PDS, the status migration is performed at the same time as the handshake is obtained (through 6041h: Statusword confirm the status has been converted and then send the next migration instruction).

]	PDS conversion Event		Action
0	Auto skip 0	After the power supply is put into operation, or after	After the power supply is put
		the application layer is reset, it will automatically	into operation, or after the
		migrate.	application layer is reset, it will
			automatically migrate.
1	Auto skip 1	Automatic conversion after initialization.	Communications are
			established.
2	Shut down	The condition of receiving the shutdown instruction.	Nothing special.
3	Switch on	When the power supply is on, the condition of	Nothing special.
		receiving the switch on command.	
4	Enable operation	The condition of receiving the enable operation	The drive function is effective.
		instruction.	In addition, all previous set
			point data are cleared.
5	Disable operation	The situation of receiving the disable operation	Invalid driver function.

		instruction	
6	Shutdown	When the neuror supply is ON the condition of	Nothing special
0	Shutdown	when the power supply is ON, the condition of	Nothing special.
		and it is that the new new new new is OFF	
7	Dischla voltage	The condition of maxima Dischle valtage	Nothing angula
/	Disable voltage	The condition of receiving Disable voltage	Nothing special.
		instruction. The condition of fecerving Quick stop	
		When the ESM status is ProOP. SafeOP or OP, the	
		andition of migrating to init	
0	Shutdown	When the neuror supply is ON, the condition of	Driver function is involid
0	Shutdown	when the power supply is ON, the condition of	Driver function is invalid.
0	Disable voltage	the condition of manipung Disable voltage	Driver function is involid
9	Disable voltage	instruction	Driver function is invalid.
10	Disable voltage	the condition of measuring Disable voltage	Nothing special
10	Disable voltage	instruction the condition of receiving Quick stop	Nouning special.
		instruction	
		When the ESM status is ProOP SafeOP or OP the	
		condition of migrating to init	
11	Quick stop	the condition of receiving Quick stop instruction	Execute Quick stop function
12	Disable voltage	When the quick stop selection code is the set value	Driver function is invalid
12	Disable voltage	of 1, 2 and 3, and the quick stop action is completed	Driver function is invalid.
		When the quick stop selection code is the set value	
		of 5, 6 and 7, and the quick stop action is completed	
		the condition of receiving disable voltage	
		instruction	
		Check the condition that the power supply is off	
13	Error occurs	Abnormal detection	Execute Fault reaction function
14	Auto skip 2	After the abnormal detection and deceleration	Driver function is invalid.
	r	processing is completed, it will be migrated	
		automatically.	
15	Fault reset	The situation of receiving the fault result instruction	If the fault factor does not exist.
		after the fault is removed.	reset the fault status.
16	Enable operation	When the quick stop selection code is the set value	Driver function is valid.
		of 5, 6 and 7, the condition of receiving Enable	
		operation instruction.	

4-3-3. Controlword (6040h)

PDS status migration, etc. The command to control the slave station (servo driver) is set through 6040h (control word).

Index	Sub-Index	Name/E	Descriptior	n R	lange	DateTy	pe A	ccess		PDO	Op-mode
6040h	00h	Cont	rolword	0~	0~65535		U16		R	xPDO	All
		Set the co	ntrol command to the servo driver such as PDS st			state co	nvei	rsion.			
		Bit inform	nation								_
		15	14	13	12	11	10	9		8	
]	R			om	IS	h	
		7	6	5	4	3	2	1		0	
		fr		R		eo	qs	ev	7	so]

	r = reserved (not corresponding)	fr = fault reset	
	oms = operation mode specific	eo = enable operation	
	(control mode based on bit)	qs = quick stop	
	$\mathbf{h} = \mathbf{halt}$	ev = enable voltage	
		so = switch on	

Command	bit7	bit3	bit2	bit1	bit0	DDS conversion
Command	fault	Enable	quick	Enable	Switch	PDS conversion
	reset	operation	stop	voltage	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	1	5
Fault reset	0->1	-	-	-	-	13

The bit logic of the quick stop instruction is valid at 0.

Please execute other bit logic and the opposite actions.

Bit8 (HALT): 1, the motor deceleration pause is executed by 605Dh (halt selection code).

After the pause, the enable must be turned off to restart the action.

bit9, 6-4(operation mode specific):

The following shows the inherent change of OMS bit in the control mode (OP mode). (for details, please refer to the chapter of related objects of each control mode.)

Op-mode	Bit9	Bit6	Bit5	Bit4
pp	change on set-point	absolute /elative	change set immediately	new set-point
pv	-	-	-	-
tq	-	-	-	-
hm	-	-	-	start homing
csp	-	-	-	-
csv	-	-	-	-
cst	-	-	-	_

4-3-4. Statusword (6041h)

PDS status migration, etc. the command to control the slave station (servo driver) is set through 6040h (control word).

Index	Sub-Index	Name/	Descriptio	on	Range	Date	Туре	Access	PDO	Op-mode		
6041h	00h	Sta	tatusword		Statusword 0~65		0~65535	U	J16	ro	TxPDO	All
		Indicates the status of the serve			rvo driver.							
		Bit inform	nation									
		15	14	13	12	11	10	9	8			
		1	r	0	oms	ila	oms	rm	r			
		7	6	5	4	3	2	1	0			
		W	sod	qs	ve	f	oe	SO	rsto			

 1		
	r = reserved (not corresponding)	w = warning
		sod = switch on disabled
	oms = operation mode specific	qs = quick stop
	(control mode based on bit)	ve = voltage enabled
	ila = internal limit active	f = fault
		oe = operation enabled
	rm = remote	so = switched on
		rtso = ready to switch on

Bit6,5,3-0 (switch on disabled/quick stop/fault/operation enabled/switched on/ready to switch on): confirm PDS status according to this bit. The following shows the status and related bit.

StatusWord	PDS State		
xxxx xxxx x0xx 0000 b	Not ready to switch on	Initialization incomplete state	
xxxx xxxx x1xx 0000 b	Switch on disabled	Initialization completion status	
xxxx xxxx x01x 0001 b	Ready to switch on	Initialization completion status	
xxxx xxxx x01x 0011 b	Switched on	Servo enable off/ servo ready	
xxxx xxxx x01x 0111 b	Operation enabled	Servo enable on	
xxxx xxxx x00x 0111 b	Quick stop active	Stop immediately	
xxxx xxxx x0xx 1111 b	Fault reaction active	Error (alarm) judge	
xxxx xxxx x0xx 1000 b	Fault	Error (alarm) status	

bit4 (voltage enabled): In case of 1, it means that the power supply voltage is applied to PDS.

bit5 (quick stop): In the case of 0, PDS receives the quick stop request. The bit logic of quick stop is valid at 0. Please excute other bit logic and the opposite actions.

bit7 (warning): In the case of 1, a warning is occurring. When warning, PDS status will not change and motor will continue to operate.

bit9 (remote): In the case of 0(local), indicates the status that 6040 (controlword) cannot process. In the case of 1 (remote), indicates 6040 (Controlword) is in a manageable state. The ESM state changes to 1 when the transition is above PreOP.

bit13,12,10 (operation mode specific): the following means inherent change of OMS bit in control mode. (For details, please refer to the chapter of related objects of each control mode)

Op-mode	bit13	bit12	Bit10
рр	following error	set-point acknowledge	target reached
pv	-	speed	target reached
tq	-	-	target reached
hm	homing error	homing attained	target reached
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 that the bit11 (internal limit active) of 6041h (status word) changes to 1.

bit15,14 (reserved): this bit is not used (fixed 0).

4-3-5. Control mode setting

1. Supported drive modes (6502h)

This servo driver can confirm the supported modes of operation according to 6502h (supported drive modes).

Index	Sub-Index	Na	nme/I	Descriptio	n		Range		Dat	teType	Access	PDO	Op-mode
6502h	00h	Supp	ortec	l drive mo	odes	0~	42949672	295		U32	ro	TxPDO	All
		Supp	orted	Mode of	operati	ion.							
		A val	value of 1 indicates the mode supported in this mode.										
		Bit in	Bit information										
			3116					15	.10		9	8	
			r					r			cst	csv	
				0				0			1	1	
		7	7	6	5		4	3		2	1	0	
		cs	sp	r	hm		r	tq	1	pv	r	pp	
		1		0	1		0	1		1	0	1	
		bit		Mod	e of ope	erat	tion	A	Abbr corresponding		ponding		
		0	Pro	file positi	on mod	le			pp	Y	ES		
		2	Pro	file veloc	ity mod	le			pv	Y	ES		
		3	Tor	que profil	le mode	е			tq	Y	ES		
		5	5 Homing mode					1	hm	Y	ES		
		7	7 Cyclic synchronous po				sition mod	le d	csp	YES			
		8	Cyclic synchronous ve				ocity mod	le	csv	Y	ES		
		9	Сус	clic synch	ronous	tor	que mode		cst	Y	ES		

2. Modes of operation (6060h)

The control mode is set through 6060h (modes of operation).

Index	Sub-Index	Name/D	escription	Range	Date	Туре	Access	PDO)	Op-mode
6060h	00h	Mode of	operation	-128~127	-	I8	rw	RxPD	0	All
		Set the con	trol mode of s	ervo driver						
		Non corres	ponding contr	ol mode setting inhi	bit.					
		bit	Мо	ode of operation		Abbr	Corresp	onding		
		-128~ -1	Reserved			-	-			
		0	No mode ch	anged/No mode assi	gned	-	-			
		1	Profile posit	ion mode		pp	YES			
		3	Profile veloc	city mode		pv	YES			
		4	Torque profi	ile mode		tq	YE	ES		
		6	Homing mo	de		hm	YE	S		
		8	Cyclic synch	nronous position mo	de	csp	YE	ES		
		9	Cyclic synch	nronous velocity mo	le	csv	YE	ES		
		10	Cyclic synch	Cyclic synchronous torque mode				ES		
		11~127	Reserved		-	-				

Because 6060h (modes of operation) is default = (no mode change / no mode assigned), please set the control

mode value to be used after the power is put into operation. When the set value of 6060h is 0 and the set value of 6061h is 0, if the PDS state is migrated to operation enabled, E-881 (control mode setting abnormal protection) occurs.

After the initial state of 6060h = 0 (no mode assigned) is transferred to the supported control mode (PP, PV, TQ, HM, CSP, CSV, CST), set 6060h = 0 again is seemed as "no mode changed", and the control mode can not be switched. (keep the previous control mode).

3. Modes of operation display (6061h)

The confirmation of the control mode inside the servo driver is performed according to 6061h (modes of operation display). After 6060h (modes of operation) is set, please confirm whether it is feasible to set this object action through detection.

Index	Sub-Index	Nam	e/Description	Range	Dat	eType	Access	PDO	Op-mode
6061h	00h	Mode of	operation display	-128~127		I8	ro	TxPDC) All
		Current con	ntrol mode.						
		bit	Mode of o	peration		Abbr	Correspo	nding	
		-128~ -1	Reserved			-	-		
		0	No mode changed/N	No mode assig	ned	-	-		
		1	Profile position mod	le		рр	YES	5	
		3	Profile velocity mod	le		pv	YES	5	
		4	Torque profile mod	e		tq	YES		
		6	Homing mode			hm	YES	5	
		8	Cyclic synchronous	position mode	e	csp	YES	5	
		9	Cyclic synchronous	velocity mode	e	csv	YES	5	
		10	Cyclic synchronous	torque mode		cst	YES	5	
		11~127	Reserved			-	-		

5. Motion instruction

5-1. Instruction list

Instruction	Function	Loop representation and available soft components	Chapter
ΜΟΤΟ	relative position	MOTO pos vel acc avNs	5_2_1
MOTO	motion		5-2-1
ΜΟΤΟΛ	Absolute position	MOTOA pos vel acc avNs	5 2 2
WIOTOA	motion	MOTOA pos vei acc axins	5-2-2
MOTOS	Multiple speed motion	MOTOS data para axNs	5-2-3
MOSTOP	Stop moving	MOSTOP para axNs	5-2-4
MOGOON	Keep moving	MOGOON axNs	5-2-5
MOSYN	Synchronous binding	MOSYN para syn_axNs axNs	5-2-6
MOUSYN	Synchronous release	MOUSYN axNs	5-2-7
MOWRITE	Write current location	MOWRITE data axNs	5-2-8
MOREAD	Read current location	MOREAD data axNs	5-2-9

List of bus motion control related instructions

5-2. Instruction introduction

All command functions described in this chapter are only applicable to CSP mode (cyclic position control mode).

5-2-1. Relative position motion [MOTO]

(1) Instruction overview

The command is relative position motion, which can modify the absolute position, velocity and acceleration/ deceleration time of moving target in real time.

Relative position motion [MOTO]								
16-bit		32-bit	МОТО					
instruction		instruction						
Execution	Rising/falling edge coil trigger	Suitable model	XG2					
condition								
Hardware	V3.6	Software	V3.6					

(2) Operand

Operand	Function	Туре
S0	Specify relative position	32-bit integer or register
S1	Specify motion speed	32-bit integer or register
S2	Specify acceleration deceleration time	32-bit integer or register
S3	Specify axis number	16-bit constant or register

(3) Suitable software component

Operand		Word													Bi	t		
		System							Constant	Mo	dule	System						
	D	FD	TD	CD	DX	DY	DM	DS	K/H	D	QD	Х	Y	М	S	Т	C	Dn.m
S0	٠								•									
S1	•								•									
S2	٠								•									
S3	•								•									

Note: D represents D, HD; TD represents TD, HTD; CD represents CD, HCD, hscd, HSD; DM represents DM, DHM; DS represents DS, DHS. M represents m, HM, SM; s represents s, HS; t represents T, HT; C represents C, HC.

(4) Function and action

《Instruction format》

MO		<u>S0</u> .	<u>S1</u> .	$(S2 \cdot)$	S 3
	МОТО	HD0	HD100	K50	K1

• When M0 is from off to on, S3 axis accelerates to S1 speed with S2 acceleration time, and relative movement S0 stops.

S0: is the relative value of the position, which can be set as a positive or negative value. If it is a positive value, the motor will rotate forward; if it is a negative value, the motor will reverse. Unit: pulse.

S1: set to a positive value. If set to a negative value, it moves according to the absolute value.

S2: the time of accelerating from 0 to the specified moving speed, unit: ms.

S3: axis number N, N range is 1-32.

- The relative position is the distance from the current position to the target position. For example: the current position is 100, and the set position relative value is 300. Relative to the position before the command is executed, if the motor wants to move to the target point, it needs to send 300 pulses from the current position (that is, the set relative position value).
- When M0 is from off to on, the absolute target position (SD2030 + 60* (n-1)) changes the corresponding position relative value based on the original position value, and the motor takes this value as the target position.
- In the process of motion, the absolute target position can be modified in real time by modifying the register value (SD2030 + 60* (n-1)), and the set value is the absolute position value. Command will relative move to stop according to the modified target position. But completion signal SM2003 + 20* (n-1) will not ON.

For example, suppose that the relative value of the position in the instruction is 1000, and the current position is 0. After the trigger condition is set, the instruction will run to the position of 600. (1) at this time, modify the target position in the register (SD2030 + 60 * (n-1)) to 400 or (- 400), then the S3 axis will decelerate to stop in the forward direction, and then decelerate to stop in the reverse direction to the position 400 or (- 400); (2) at this time, modify the target position register (SD2030 + 60 * (n-1)) to 1200, the S3 axis will move forward to the position of 1200 to slow down and stop. (when the motor is enabled, write the value directly to the register SD2030 + 60 * (n-1), the motor will run to the corresponding position, and the forward and reverse rotation of the motor can be realized without executing the instruction.)

• The servo enabled, and the initial value of speed register (SD2032 + 60 * (n-1)) is 1000. When M0 is from off to on, the value of (SD2032 + 60 * (n-1)) becomes S1.

In the process of motor movement, the movement speed can be modified in real time by modifying (SD2032 + 60 * (n-1)) register value, and the motor will change to a new speed after acceleration and deceleration time.

If the speed is set to 0, the motor stops with acceleration and deceleration time. Since the speed has been

reduced to 0 before the set target position is not reached, there will be no motion completion signal, that is, the moving flag (SM2001 + 20 * (n-1)) will not be reset. At this time, if a new speed (SD2032 + 60 * (n-1)) is given, the motor will run again.

(5) Related register

When the PLC is running and the servo is enabled on, the parameters such as the absolute position of the moving target, the moving speed and the acceleration and deceleration time can be modified through the corresponding SD register. The modified SD register value takes effect in $6 \sim 16$ ms. However, modifying the corresponding register in the instruction will not affect the target position, motion speed and acceleration / deceleration time. One channel of EtherCAT bus can be connected to 32 axes, with corresponding axis No.1 to 32. Users can modify the motion parameters of each axis (n = 1-32) through the parameters in the table.

Address	Definition	Туре	Unit	Note
SD2030+60*(N-1)	Absolute	32-bit	Pulse number	Coordinate position, which is converted
	position	integer		by the number of pulses given by the
				target position. In the process of stopping
				or running, modifying the position setting
				value will move to the set target at the set
				speed. The position setting is the absolute
				position value.
SD2032+60*(N-1)	Speed setting	32-bit	Pulse	
		integer	number/second	
SD2034+60*(N-1)	acceleration	32-bit	ms	the time accelerating from 0 to max speed
	time	integer		
SD2036+60*(N-1)	Deceleration	32-bit	ms	The time decelerating from max speed to
	time	integer		0

Table 5-2-	1: setting	parameter	value	(N=1~32)
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Table 5-2-2: state bit parameter (N=1~32)

Address	Definition	Note
SM2000+20*(N-1)	servo enable flag	ON: servo enable state
SM2001+20*(N-1)	Running flag	ON: pulse outputting
SM2003+20*(N-1)	motion completion flag	ON: instruction action completion
SM2004+20*(N-1)	axis error flag	ON: error

(6) Example

The current position of the motor is 2000, and the MOTO command is required to run to the target position of 10000 pulses at the speed of 5000Hz. Change the speed to 6000Hz halfway, and let the motor run to the absolute target position of 20000 pulses. The acceleration and deceleration time is 50ms.

■ In relative position mode, the execution diagram is as follows:



■ In the relative position mode, the schematic diagram of motor running distance is as follows:



The current position is 2000, and 8000 pulses need to be sent when running to the target position of 10000 pulses in relative position mode.



■ The ladder chart in relative mode:

Explanation:

PLC starts to run, the initial positive pulse coil SM2 will send the number of pulses, speed and acceleration deceleration time to the corresponding registers.

Servo enable is ON, M0 is from OFF to ON, it starts to execute MOTO command of relative position movement.

M1 is from OFF to ON, it sends the absolute target position to the corresponding register.

M2 is from off to on, the new speed is sent to the corresponding register.

When the pulse is sent, the running flag bit SM2001 is reset and the corresponding coil is reset.

5-2-2. Absolute position motion [MOTOA]

(1) Instruction overview

The command moves in absolute position, and can modify the absolute position, velocity and acceleration / deceleration time of the moving target in real time.

Absolute position r	notion [MOTOA]		
16-bit instruction		32-bit	МОТОА
		instruction	
Execution	Rising/falling edge of the coil	Suitable model	XG2
condition			
Hardware	V3.6	Software	V3.6

(2) Operand

Operand	Function	Туре
S0	target position	32-bit integer or register
S1	motion speed	32-bit integer or register
S2	The time accelerating from 0 to S1	32-bit integer or register
S3	axis number	16-bit constant or register

(3) Suitable soft component

Operand		word									Bit							
				Sy	stem				Constant	Mo	dule				Syste	em		
	D	FD	TD	CD	DX	DY	DM	DS	K/H	\mathbb{D}	QD	Х	Y	М	S	Т	С	Dn.m
S0	•								•									
S1	•								•									
S2	•								•									
S3	٠								•									

Note: D represents D, HD; TD represents TD, HTD; CD represents CD, HCD, hscd, HSD; DM represents DM, DHM; DS represents DS, DHS.

M represents m, HM, SM; s represents s, HS; t represents T, HT; C represents C, HC.

(4) Function and action

«instruction format»

MO		<u>S0</u> .	S1 ·	<u>S2</u> .	S 3
	ΜΟΤΟΑ	HD0	HD100	K50	K1

• When M0 is from off to on, S3 axis accelerates to S1 with S2 acceleration time, and absolute movement stops at S0 position.

S0: it is absolute position value, which can be set as positive or negative value. If the value is equal to the current position value, the motor will not rotate; if the value is greater than the current position value, the motor will rotate forward; if the value is less than the current position value, the motor will rotate reverse.

S1: set to a positive value. If set to a negative value, it moves according to the absolute value.

S2: the time accelerating from 0 to the specified moving speed, unit: ms.

S3: axis number n, N range is 1-32.

• Absolute position is the distance from zero point to target position.

For example: the current position is 100, and the setting absolute position is 300. Relative to the zero point, if the motor wants to move to the target point (i.e. the setting absolute position), it needs to send another 200 pulses at the current position.

- When M0 changes from off to on, the absolute target position (SD2030 + 60 * (n-1)) changes to S0. If the value of (SD2030 + 60 * (n-1)) increases, the motor will rotate forward; if the value of (SD2030 + 60 * (n-1)) decreases, the motor will rotate reverse.
- In the process of motion, the absolute target position can be modified in real time by modifying the register value (SD2030 + 60 * (n-1)), and the set value is the absolute position value. Command moves to stop according to the modified target position. But the completion signal SM2003 + 20 * (n-1) will not ON.

For example, if the target position in the instruction is 1000, and the trigger condition is set, the instruction will run to 600. (1) at this time, modify the target position in the (SD2030 + 60 * (n-1)) register to 400 or (-400), then the S3 axis will decelerate the forward motion to stop, and then accelerate the reverse motion to 400 or (-400) to stop; (2) at this time, modify the target position in the (SD2030 + 60 * (n-1)) register to 1200, then the S3 axis will move forward to the position of 1200 to decelerate and stop. (positive and reverse rotation of motor can be realized)

• When the servo enable changes from off to on, the value of speed setting register (SD2032 + 60 * (n-1)) immediately changes to 1000. When M0 changes from off to on, the value of (SD2032 + 60 * (n-1)) changes to S1.

In the process of motor movement, the movement speed can be modified in real time by modifying (SD2032 + 60 * (n-1)) register value, and the motor will change to a new speed with acceleration and deceleration time.

If the speed is set to 0, the motor stops with acceleration and deceleration time. Since the speed has been reduced to 0 before the set target position is not reached, there will be no motion completion signal, that is, the moving flag (SM2001 + 20 * (n-1)) will not be reset. At this time, if a new speed (SD2032 + 60 * (n-1)) is given, the motor will run again.

(5) Relative register

The special registers related to the position motion are the same as the relative position motion instructions. See table 5-2-1 and table 5-2-2 in chapter 5-2-1 for details.

(6) Example

The current position of motor 1 is 2000, which requires MOTOA command to move to the target position of 10000 pulses at 5000Hz. Change the speed to 6000Hz halfway, and let the motor run to the absolute target position of 20000 pulses. The acceleration and deceleration time is 50ms.

■ In absolute position mode: the execution diagram is as follows:



■ In absolute position mode, the schematic diagram of motor running distance is as follows:



The current position is 2000, and 8000 pulses need to be sent when the target position reaches 10000 pulses in absolute position mode.

- SM2 DMOV K10000 -||-HD0 DMOV K5000 HD2 DMOV K50 HD4 M0 ΜΟΤΟΑ HD0 HD2 HD4 K1 ┤ٲ┝ M1 DMOV K20000 SD2030 ┥१┝ M2 DMOV K6000 SD2032 –l†⊢ SM2001 RST M0 ╢ RST M1 RST M2
- In absolute position mode, the ladder chart is as follows:

Explanation:

PLC starts to run, the initial positive pulse coil SM2 will send the number of pulses, speed and acceleration deceleration time to the corresponding registers.

Servo enable on, M0 is from off to on, start to execute absolute position motion MOTOA command.

M1 is from off to on, the absolute target position is sent to the corresponding register.

M2 is from off to on, the new speed is sent to the corresponding register.

When the pulse is sent, the running flag bit SM2001 is reset and the corresponding coil is reset.

5-2-3. Multistage speed motion [MOTOS]

(1) Instruction overview

This command can not modify the target position in the process of motion, but can modify the motion speed of the current segment.

Multistage spe	ed motion [MOTOS]		
16-bit		32-bit	MOTOS
instruction		instruction	
Execution	Rising/falling edge of the coil	Suitable model	XG2
condition			
Hardware	V3.6	Software	V3.6

(2) Operand

Operand	Function	Туре
S0	data start address	32-bit register
S1	parameter start address	32-bit register
S2	axis number	16-bit constant or register

(3) suitable soft component

Operand		Word										Bi	t					
		System						System Constant Mo			dule	System						
	D	FD	TD	CD	DX	DY	DM	DS	K/H	\mathbb{D}	QD	Х	Y	М	S	Т	С	Dn.m
S0	۲																	
S 1	•																	
S2	•								•									

Note: D represents D, HD; TD represents TD, HTD; CD represents CD, HCD, HSCD, HSD; DM represents DM, DHM; DS represents DS, DHS.

M represents m, HM, SM; s represents S, HS; t represents T, HT; C represents C, HC.

(4) Instruction and action

《Instruction format》

MO		S 0 ·	S1 ·	<u>S2</u> .
	MOTOS	HD0	HD100	K1

• When M0 is from off to on, after setting S1 parameters, S2 axis will execute multistage speed motion(relative or absolute position motion) with S0 specified target and speed.

S0: data starting address. The position and speed of each pulse segment can be set.

S1: starting address of the parameter. Motion mode, number of motion segments and acceleration and deceleration time can be set.

S2: axis number n, N range is 1-32.

• When the servo enable changes from off to on, the value of speed setting register (SD2032 + 60 * (n-1)) immediately changes to 1000. When M0 changes from off to on, the value of (SD2032 + 60 * (n-1)) changes to the speed value of the first segment of S0.

In the process of motor movement, the movement speed can be modified by modifying the register value of (SD2032 + 60 * (n-1)). The motor will change to a new speed with acceleration and deceleration time, and the modified movement speed is only valid for the current movement segment.

If the speed is set to 0, the motor stops with acceleration and deceleration time. Since the speed has been reduced to 0 before the set target position is not reached, there will be no motion completion signal, that is, the in motion flag (SM2001 + 20 * (n-1)) will not be reset. At this time, if a new speed (SD2032 + 60 * (n-1)) is given, the motor will run again.

- There is acceleration and deceleration time when the speed of each section changes, and the rising slope is the same as that of the first section.
- The current pulse can be monitored in the segment register (SD2016 + 60 * (n-1)).
- In the process of movement, it is not allowed to modify the target position, acceleration and deceleration time, movement mode and the total number of pulse segments by modifying the value in SD register.

(5) Related register

Address	Contents	Note
S0+0 (double word)	Position	
S0+2 (double word)	Speed	Segment 1
S0+4	Reserved	
S0+6	Reserved	
S0+8	Reserved	
S0+(N-1)*10+0 (double word)	Position	
S0+(N-1)*10+2 (double word)	Speed	Segment N
S0+(N-1)*10+4	Reserved	
S0+(N-1)*10+6	Reserved	
S0+(N-1)*10+8	Reserved	

Data start address:

• Parameter start address:

Address	Content
S1+0 (double word)	32-bit integer, motion relative absolute mode (0: relative; 1: absolute)
S1+2 (double word)	32-bit integer, total number of moving segments (1-100)
S1+4 (double word)	32-bit integer, acceleration time (acceleration time from 0 to the first speed, and the
	subsequent speed changes according to the same acceleration), unit: ms
S1+6 (double word)	32-bit integer, deceleration time (deceleration time from the last speed to 0), unit: ms

(6) Example

Send four pulses with MOTOS command, change the speed to 6000Hz during the second section, and the set value and acceleration and deceleration time of each section are shown in the table below:

Name	frequency (Hz)	pulse number
segment 1	5000	10000
segment 2	1000	26000
segment 3	7500	-20000
segment 4	4000	25000
acceleration and deceleration	50ms	
time		

Execution diagram:



■ In the relative position mode, the schematic diagram of motor running distance is as follows:



The current position is 5000. In the relative position mode, the first section sends 10000 pulses, which should be turned forward to 15000 pulses; the second section sends 26000 pulses, which should be turned forward to 41000 pulses; the third section sends - 20000 pulses, which should be turned backward to 21000 pulses; the fourth section sends 25000 pulses, which should be turned forward to 46000 pulses.

■ The ladder chart in relative position mode:

SM2					
		DMOV	K10000	HD0	
		DMOV	K5000	HD2]
		DMOV	K26000	HD10	<u> </u>
		DMOV	K1000	HD12	
		DMOV	K-20000	HD20	
		DMOV	K7500	HD22	<u> </u>
		DMOV	K25000	HD30	
		DMOV	K4000	HD32	
		DMOV	K0	HD100	
		DMOV	K4	HD102	
		DMOV	K50	HD104	<u> </u>
		DMOV	K50	HD106	
M0 ↑	MOTOS	HD0	HD100	K1	-
M1		DMOV	K6000	SD2032	-
SM2001 ────↓			RST	M0	<u> </u>
			RST	M1	

Explanation:

PLC starts to run, the initial positive pulse coil SM2 will send the number of pulses, speed, motion mode, total number of operation sections and acceleration and deceleration time to the corresponding registers.

Servo enable on, M0 from off to on, start to execute MOTOS command of multi segment speed movement. M1 from off to on, the new speed is sent to the corresponding register.

When the pulse is sent, the running flag bit SM2001 is reset and the corresponding coil is reset.

■ In absolute position mode, the schematic diagram of motor running distance is as follows:



The current position is 5000. In absolute position mode, 5000 pulses should be sent when the first section goes forward to 10000 pulses; 16000 pulses should be sent when the second section goes forward to 26000 pulses; -46000 pulses should be sent when the third section goes backward to -20000 pulses; 45000 pulses should be sent when the fourth section goes forward to 25000 pulses.

■ The ladder chart in absolute position mode:

SM2				
		DMOV	K10000	HD0 -
			r	
		DMOV	K5000	HD2
		DMOV	K26000	HD10
		DMOV	K1000	HD12
		DMOV	K-20000	HD20
		DMOV	K7500	HD22
		DMOV	K25000	HD30
		DMOV	K4000	HD32
		DMOV	K1	HD100
			1	
		DMOV	K4	HD102
		DMOV	K50	HD104
			1	
		DMOV	K50	HD106
MO				
	MOTOS	HD0	HD100	K1
M1				
		DMOV	K6000	SD2032
SM2001				
			RST	M0
			RST	M1
			· · · · · · · · · · · · · · · · · · ·	

Explanation:

PLC starts to run, the initial positive pulse coil SM2 will send the number of pulses, speed, motion mode, total number of operation sections and acceleration and deceleration time to the corresponding registers.

Servo enable on, M0 from off to on, start to execute MOTOS command of multi segment speed movement. M1 from off to on, the new speed is sent to the corresponding register.

When the pulse is sent, the running flag bit SM2001 is reset and the corresponding coil is reset.

5-2-4. Stop motion [MOSTOP]

(1) Instruction overview

The instruction can stop the movement in multiple modes.

Stop motion [N	MOSTOP]		
16-bit		32-bit	MOSTOP
instruction		instruction	
Execution	Rising/falling edge of the coil	Suitable model	XG2
condition			
Hardware	V3.6	Software	V3.6

(2) Operand

Operand	Function	Туре
S0	stop mode or deceleration distance	32-bit integer
S1	axis number	16-bit constant

(3) Suitable soft component

Operand		Word												Bit					
	System								Constant	Mo	dule	System							
	D	FD	TD	CD	DX	DY	DM	DS	K/H	\mathbb{D}	QD	Х	Y	М	S	Т	С	Dn.m	
S0	٠								•										
S1	٠								•										

Note: D represents D, HD; TD represents TD, HTD; CD represents CD, HCD, HSCD, HSD; DM represents DM, DHM; DS represents DS, DHS.

M represents M, HM, SM; S represents S, HS; T represents T, HT; C represents C, HC.

(4) Function and action

《Instruction format》

MO		S 0 ·	S1 ·
î⊢	MOSTOP	HD0	K1

• When M0 is from off to on, S1 axis stops in different ways according to the value of S0 parameter. The MOSTOP command is executed. After the axis movement stops, the in motion flag (SM2001 + 20 * (n-1)) is set to off, but the command completion flag (SM2003 + 20 * (n-1)) is not set to on.

S0: the mode of pulse stop or deceleration distance can be set.

S1: axis number n, N range is 1-32.

- According to the different parameters of S0, the stop modes are divided into emergency stop and slow stop. Several modes are as follows:
 - Emergency stop (K-1):

When S0 is k-1 or other negative numbers, the motor performs an emergency stop.



Attention: stop the movement immediately, there will be mechanical damage.

■ Slow stop (K0):

When S0 is K0: decelerate to stop according to the deceleration time set in (SD2036 + 60 * (n-1)).



■ Fixed length stop (positive):

When S0 is positive: slow stop is executed, and deceleration distance is the given positive value;

(1) If the given deceleration distance is less than the minimum deceleration distance Smin (calculated according to the deceleration time set in (SD2036 + 60 * (n-1)), first decelerate forward to stop, and then move backward to the given deceleration distance;

(2) If the given deceleration distance is greater than the minimum deceleration distance Smin, decelerate to the stop according to the given deceleration distance. If the distance is too large, the motor will continue to run at a constant speed for a period of time and then slow down to stop.

(3) If the deceleration distance is greater than the minimum deceleration distance and exceeds the limit, the motor will automatically take the limit as the target position.



5-2-5. Continue moving [MOGOON]

(1) Instruction overview

The command can make the motor to move to the target position after stopping halfway.

Continue movi	ing [MOGOON]		
16-bit		32-bit	MOGOON
instruction		instruction	
Execution	Rising/falling edge of the coil	Suitable	XG2
condition		model	
Hardware	V3.6	Software	V3.6

(2) Operand

Operand	Function	Туре
S	Axis number	16-bit constant or register

(3) Suitable soft component

Operand	Word												Bit						
				Sy	vstem		Constant	Mo	dule	System									
	D	FD	TD	CD	DX	DY	DM	DS	K/H	D	QD	Х	Y	М	S	Т	С	Dn.m	
S	•								•										

Note: D represents D, HD; TD represents TD, HTD; CD represents CD, HCD, HSCD, HSD; DM represents DM, DHM; DS represents DS, DHS.

M represents M, HM, SM; S represents S, HS; T represents T, HT; C represents C, HC.

(4) Function and action

«Instruction format»



• When M0 changes from off to on, the s-axis continues its unfinished motion. After the instruction is executed and the movement is completed, the instruction completion flag (SM2003 + 20 * (n-1)) is set to on.

S: Axis number n, the range of n is 1-32.

- In combination with MOSTOP, the pause function can be realized.
- If the MOSTOP command is executed and other commands are executed for the same motion axis, the execution of the MOGOON command will not work.

5-2-6. Synchronous binding [MOSYN]

EL COMPT

(1) Instruction overview

This command binds the master shaft and the slave shaft (or high-speed counting) for synchronous movement.

Synchronous b	Synchronous binding [MOSYN]												
16-bit	-	32-bit	MOSYN										
instruction		instruction											
Execution	Rising/falling edge of the coil	Suitable model	XG2										
condition													

Hardware	V3.6	Software	V3.6

(2) Operand

Operand	Function	Туре
S0	Multiple of synchronous speed	32-bit floating-point register
S1	Master shaft number or high speed counting	16-bit constant or register
S2	Slave shaft number	16-bit constant or register

(3) Suitable soft component

Operand		Word												Bit					
	System								Constant	Mo	dule	System							
	D	FD	TD	CD	DX	DY	DM	DS	K/H	D	QD	Х	Y	Μ	S	Т	С	Dn.m	
S0	٠								•										
S 1	٠								•										
S2	٠								•										

Note: D represents D, HD; TD represents TD, HTD; CD represents CD, HCD, HSCD, HSD; DM represents DM, DHM; DS represents DS, DHS.

M represents M, HM, SM; S represents S, HS; T represents T, HT; C represents C, HC.

(4) Function and action

«Instruction format»

MO		S 0 ·)	S1 ·	$(S2 \cdot)$
	MOSYN	HD0	K1	K4

• When M0 is from off to on, the position of master shaft and slave shaft will be locked at the moment of execution to keep synchronization.

S0: multiple of synchronous motion speed (floating point), i.e. multiple of synchronous motion speed = slave shaft speed / master shaft speed;

S1: master shaft No. n, N range is $1 \sim 32$ or $-1 \sim -4$.;

S2: slave shaft No. n, N range is $1 \sim 32$;

• According to the different S0 parameters, the synchronization speed types are different:

(1) When S0 is a negative number, the slave shaft keeps synchronous motion with the master shaft with the reverse synchronous speed multiple |S0|.

(2) When S0 is 0, the slave shaft is bound to the master shaft, but the slave shaft speed is 0.

(3) When S0 is a positive number, the slave shaft keeps synchronous motion with the master shaft with the synchronous speed multiple S0.

• According to the different S1 parameters, the types of master shafts are different:

(1) When S1 is $1 \sim 32$, the master shaft is the pulse output shaft.

(2) When S1 is $-1 \sim -4$, the master shaft is a high-speed counter. -1 corresponds to high-speed counter HSC0, -2 corresponds to high-speed counter HSC2, -3 corresponds to high-speed counter HSC4, -4 corresponds to high-speed counter HSC6, and the input port of each high-speed counter refers to the high-speed count input terminal of PLC.

• It shall be bound when the master shaft and slave shaft stop.

In the unbound state, if the master shaft stops and the slave shaft executes its own command, then the slave shaft cannot bind at this time, and the slave shaft will stop after executing its own command.

• The synchronous speed multiple can be modified by modifying the register value (multiple must be floating-point number) of (SD2038 + 60 * (n-1)). After the real-time effect, the synchronous movement

will be carried out according to the modified speed multiple.

- When S1 is set to 1-32, it can be used with MOTO, MOTOA, MOTOS, MOSTOP instructions after binding to realize synchronous movement.
- When S1 is set to -1 to -4, it can be used with hand pulse generator to realize synchronous motion after binding.
- When the hand pulse generator is used, the weak vibration of the motor will be caused due to too large following multiple. At this time, it can be adjusted by modifying the value of register SD2059 + 60 * (n-1).

		-	-	
Address	Definition	Туре	Unit	Note
SD2038+60*(N-1)	Multiple of	32-bit		Slave shaft speed/master shaft speed
	synchronous motion	floating		
	speed	number		
SD2044+60*(N-1)	Positioning complete	32-bit	Pulse	Determine the threshold value of
	width	integer	number	positioning completion. If the difference
				between the given value and the feedback
				value of the encoder is less than this value,
				the moving flag is off
SD2059+60*(N-1)	Filter coefficient	32-bit		The setting range is 0 ~ 9999. This
		integer		parameter can be modified when using the
				hand pulse generator and the weak
				vibration of the motor is caused by too
				large follow multiple.

Table 5-2-3: setting value parameter (N=1~32)

Table 5-2-4: state bit parameter (N=1~32)

Address	Definition	Note
SM2000+20*(N-1)	servo enable flag	ON: servo enable state
SM2001+20*(N-1)	Moving flag	ON: pulse outputting
SM2004+20*(N-1)	shaft error flag	ON: error

(5) Example 1

With the command of MOSYN, the motor 1 of master shaft is bound with the motor 4 of slave shaft, and the slave shaft follows the master shaft to run 10000 pulses at the speed of 5000Hz. Acceleration and deceleration are 50ms. The speed of the slave shaft is 0.5 times that of the master shaft.

The ladder chart is shown as below:



Explanation:

PLC starts to run, the initial positive pulse coil SM2 will send the pulse number, speed, acceleration and deceleration time and the multiple of synchronous speed to the corresponding register.

Servo enable on, M0 from off to on, bind the master shaft and slave shaft.

M1 from off to on, execute MOTO command of relative position movement.

When the pulse is sent, the running flag bit SM2001 is reset and the corresponding coil is reset.

(6) Example 2

The high-speed counter HSC0 is bound to the slave shaft 4 motor with the instruction of MOSYN to realize the movement of the slave shaft following the hand shaking pulse generator. The speed of the slave shaft is twice that of the master shaft.

The ladder chart is shown as below:

	MOSYN	K2.	0	K- 1	1	K4	
M1	- CNT	_AB	Н	SC0	K	99999999	

Explanation:

Servo enable on, M0 from off to on, bind high-speed counter HSC0 with driven shaft.

M1 starts from off to on to perform high-speed counting of counter HSC0. At this time, turn the handwheel, K4 axis will follow the handwheel.

5-2-7. Synchronization release [MOUSYN]

(1) Instruction overview

This instruction will release the synchronous motion between master shaft and slave shaft (or high speed counting).

Synchronization release [MOUSYN]							
16-bit		32-bit	MOUSYN				
instruction		instruction					
Execution	Rising/falling edge of the coil	Suitable model	XG2				
condition							
Hardware	V3.6	Software	V3.6				

(2) Operand

Operand	Function	Туре
S	Slave shaft number	16-bit constant or register

(3) Suitable soft component

Operand		Word												Bi	t			
	System					Constant	Mo	dule	System									
	D	FD	TD	CD	DX	DY	DM	DS	K/H	D	QD	Х	Y	М	S	Т	С	Dn.m
S	٠								•									

Note: D represents D, HD; TD represents TD, HTD; CD represents CD, HCD, HSCD, HSD; DM represents DM, DHM; DS represents DS, DHS.

M represents M, HM, SM; S represents S, HS; T represents T, HT; C represents C, HC.

(4) Function and action

«Instruction format»



- When M0 is from off to on, the two axis synchronization will be released instantly.
 S: Slave shaft No. n, N range is from 1 to 32.
- The binding shall be released when both the master shaft and the slave shaft are stopped.
- In the process of synchronous movement, the slave shaft can also be stopped by the emergency stop mode of MOSTOP command, and the binding can be released at the same time. At this time, the slave shaft stops abruptly and the master shaft continues to move; this stop mode has sudden change in speed and is not recommended to be used frequently.

5-2-8. Write current position [MOWRITE]

(1) Instruction overview

This command can modify the current absolute position value of the motion axis for correcting the position.

Write current position [MOWRITE]								
16-bit		32-bit	MOWRITE					
instruction		instruction						
Execution	Rising/falling edge of the coil	Suitable model	XG2					
condition								
Hardware	V3.6	Software	V3.6					

(2) Operand

Operand	Function	Туре
S0	current position value	32-bit integer or register
S1	shaft number	16-bit constant or register

(3) Suitable soft component

Operand		Word									Bit							
		System							Constant	Mo	dule	le System						
	D	FD	TD	CD	DX	DY	DM	DS	K/H	D	QD	Х	Y	М	S	Т	С	Dn.m
S0	•																	
S1	٠								•									

Note: D represents D, HD; TD represents TD, HTD; CD represents CD, HCD, HSCD, HSD; DM represents DM, DHM; DS represents DS, DHS.

M represents M, HM, SM; S represents S, HS; T represents T, HT; C represents C, HC.

(4) Function and action

«Instruction format»



• When M0 is from off to on, modify the current absolute position value of the motion axis (SD2008 + 60 * (n-1)) to S0.

S0: Specifies the current absolute position value of the motion axis.

S1: movement axis number n, N range is 1-32.

- This instruction is invalid in the process of multi segment speed movement and synchronous movement. This instruction is invalid after MOSTOP is used.
- When the current position value (SD2008 + 60 * (n-1)) is modified, the current displacement (SD2006 + 60 * (n-1)) and the current displacement pulse number (HSD108 + 20 * (n-1)) remain unchanged, and the target position given pulse number (HSD100 + 20 * (n-1)) and the target position feedback pulse number (HSD104 + 20 * (n-1)) change accordingly.
- When the motor is enabled on, the parameters in table 5-2-5 and table 5-2-6 can be cleared to 0.
- When the current position of the shaft (SD2008 + 60 * (n-1)) is greater than 224 (16777216), the accuracy will get worse, and the motion will shake. At this time, MOWRITE can be used to clear the current position, but the current displacement (SD2006 + 60 * (n-1)) will not be affected, and continue to accrue.
- There are four ways to modify the current location value:

(1)When returning to the original point through (SM2014 + 20*(n-1)) and (SM2015 + 20*(n-1)), the current position value will change;

(2) When PLC stops, manually modify the register value of target position feedback pulse number (HSD104 + 20 * (n-1)) and the current position value will also change;

(3) During PLC operation, the register value (HSD104 + 20 * (n-1)) can also be modified by executing the MOWRITE instruction, and the current position value will also be changed.

(4) When the PLC is running and the servo is not enabled, the external force causes the servo position to change. (HSD104 + 20 * (n-1)) register value will follow the change. When the servo is enabled on, the value is valid.

(5) Related register

Table 5-2-5	State of	quantity	parameter	(N=1~32)
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Address	Definition	Туре	Unit	Note
SD2006+60* (N-1)	Current	32-bit	Pulse	Displacement relative to last stop position
	displacement	integer	number	
SD2008+60* (N-1)	Current position	32-bit	Pulse	Coordinate position, converted from the
		integer	number	number of pulses feedback by the target
				position

Fable 5-2-6:	Self hold state parameter	$(N=1\sim32)$	1
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Address	Definition	Туре	Unit	Note
HSD100+20* (N-1)	Given pulse number of	64-bit	Encoder	relative zero
	target position	integer	count	
HSD104+20* (N-1)	Target position feedback	64-bit	Encoder	Relative zero
	pulse number	integer	count	
HSD108+20* (N-1)	Current pulse number of	64-bit	Encoder	Displacement of single
	displacement	integer	count	movement instruction

5-2-9. Read current position [MOREAD]

(1) Instruction overview

This instruction is used to read the current absolute position value.

Read current position [MOREAD]									
16-bit		32-bit	MOREAD						
instruction		instruction							
Execution	Rising/falling edge of the coil	Suitable model	XG2						
condition									
Hardware	V3.6	Software	V3.6						

(2) Operand

Operand	Function	Туре
S0	read current position	32-bit integer or register
S1	Shaft number	16-bit constant or register

(3) Suitable soft component

Operand	Word										Bit							
	System							Constant	Mo	dule		System						
	D	FD	TD	CD	DX	DY	DM	DS	K/H	D	QD	Х	Y	М	S	Т	С	Dn.m
S0	•																	
S1	٠								•									

Note: D represents D, HD; TD represents TD, HTD; CD represents CD, HCD, HSCD, HSD; DM represents DM, DHM; DS represents DS, DHS.

M represents M, HM, SM; S represents S, HS; T represents T, HT; C represents C, HC.

(4) Function and action

«Instruction format»



• When M0 is from off to on, the read instruction refreshes the state parameters in SD and reads the current absolute position value of S1 motion axis (SD2008 + 60 * (n-1)) into S0 register.

S0: Specifies the register address stored the read value of current absolute position.

S1: slave shaft No. n, N range is 1-32;

• If necessary, the parameters of SD status register can be transmitted with EMOV or DMOV instructions, and double words are required for monitoring.

5-2-10. Return to origin

The bus command does not need to be programmed to return to the origin. Set the near point signal (SFD3036 + 60 * (n-1)), the origin signal (SFD3037 + 60 * (n-1)), the high-speed VH (SFD3040 + 60 * (n-1)), the low-speed VL (SFD3042 + 60 * (n-1)) and the crawling speed (SFD3044 + 60 * (n-1)). When the servo is enabled on, the operation of each axis returning to the original point can be realized through the forward return to the original point system coil (SM2014 + 20 * (n-1)) and the reverse return to the original point system coil
(SM2015 + 20 * (n-1)). The parameters are shown in table 5-2-7.

	-	Table	5-2-7: return to	origin pa	rameters
Address	Definition	Туре	Unit	Initial value	Note
SFD3034 +60*(N-1)	Minimum limit terminal setting	16-bit integer		0xFF	Specify the number of terminal X, 0xFF is no terminal, negative number means anti logic, and the anti logic of X0 is set to - 30000
SFD3035 +60*(N-1)	Maximum limit terminal setting	16-bit integer		0xFF	Specify the number of terminal X, 0xFF is no terminal, negative number means anti logic, and the anti logic of X0 is set to - 30000
SFD3036 +60*(N-1)	Near point signal terminal setting	16-bit integer		0xFF	Specify the number of terminal X, 0xFF is no terminal, negative number means anti logic, and the anti logic of X0 is set to - 30000
SFD3037 +60*(N-1)	Origin terminal setting	16-bit integer		0xFF	Specify the number of terminal X, 0xFF is no terminal, negative number means anti logic, and the anti logic of X0 is set to - 30000
SFD3038 +60*(N-1)	Homing mode	16-bit integer		0	 0: No Z-phase mode. Find the near point according to the regression speed VH, then find the origin according to the regression speed VL, slow down after finding the edge of the origin according to the crawl speed in reverse; 2: Z-phase mode. Find the approach point according to the regression speed VL, decelerate after finding the edge of the origin point according to the regression speed VL, decelerate after finding the edge of origin point according to the crawl speed in reverse, and then find the edge of origin point according to the crawl speed in reverse, and then find the positive direction 10: Hard limit return mode. When the positive and negative hard limits are met, the origin will be found in reverse at -VH speed, and the speed will change to VH when touching the falling edge of the origin, and the subsequent action is the same as mode 0. 12: Hard limit return to Z-phase mode. When the positive and negative hard limits are met, the origin will be found in reverse at -VH speed, and the speed will change to VH when touching the falling edge of the origin, and the subsequent action is the same as mode 0.

Table 5-2-7:	return	to a	origin	parameters
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					as mode 2.
SFD3040	Regression	32-bit	pulse	0	
+60*(N-1)	speed VH	integer	number/second		
SFD3042	Regression	32-bit	pulse	0	
+60*(N-1)	speed VL	integer	number/second		
SFD3044	Crawling	32-bit	pulse	0	
+60*(N-1)	speed	integer	number/second		

There are three modes to return to the origin, namely, no Z-phase signal mode, Z-phase signal mode and hard limit return mode.

1. No Z-phase signal mode

■ In the case of reverse return to the origin and no near point signal:



Action description:

The motor returns to the origin with high-speed VH. In the process of returning to the origin, the speed changes to 0 when touching the falling edge of the origin signal, and then the motor returns to the origin with the creeping speed in reverse. When it touches the rising edge of the origin signal, the motor stops returning to the origin.

■ In the case of reverse return to the origin and with near point signal:



Action description:

The motor returns to the origin with high-speed VH. In the process of returning to the origin, it encounters the falling edge of the near point signal. The motor speed drops to the low-speed VL and continues to return to the origin. The speed drops to 0 when touching the falling edge of the origin signal, and then it reverses to the origin with the crawling speed. When it encounters the rising edge of the origin signal, it stops returning to the origin.

■ In the case of positive return to the origin and no near point signal:



if the origin signal is too long:

Action description:

The motor returns to the origin with high-speed VH. In the process of returning to the origin, when it encounters the rising edge of the origin signal, the speed drops to 0 and starts to return to the origin with the creeping speed. When it encounters the falling edge of the origin signal, the motor stops returning to the origin.

■ In the case of positive return to the origin and with near point signal:

If the origin signal is too long:



If the origin signal is too short:



Action description:

The motor returns to the origin with high-speed VH. In the process of returning to the origin, it encounters the rising edge of the near point signal. The motor speed drops to the low-speed VL of returning to the origin and continues to return to the origin. When it encounters the rising edge of the origin signal, the speed drops to 0 and starts to return to the origin with the creeping speed in reverse direction. When it encounters the falling edge of the origin signal, it stops returning to the origin.

2. Z-phase signal mode

■ In the case of reverse return to the origin and no near point signal:



Action description:

The motor returns to the origin with high-speed VH. In the process of returning to the origin, the speed changes to 0 when touching the falling edge of origin signal, and then returns to the origin with the creeping speed in reverse direction. When it touches the rising edge of the origin signal, it starts to find the z-phase signal of the servo motor, and stops returning to the origin when it finds the z-phase signal.

■ In the case of reverse return to the origin and with near point signal:



Action description:

The motor returns to the origin with high-speed VH. In the process of returning to the origin, it encounters the near point signal. The motor speed drops to the low-speed VL and continues to return to the origin. The speed changes to 0 when touching the falling edge of origin, and then it reverses to the origin with the crawling speed. When it touches the rising edge of the origin signal, it starts to find the z-phase signal of the servo motor, and stops returning to the origin when it finds the z-phase signal.

■ In the case of positive return to the origin and no near point signal:



Action description:

The motor returns to the origin with high-speed VH. In the process of returning to the origin, the speed drops to 0 when it touches the rising edge of the origin signal, and then it reverses to the origin with crawling speed. When it touches the falling edge of the far point signal, it starts to find the z-phase signal of the servo motor, and stops returning to the origin when it finds the z-phase signal.

■ In the case of positive return to the origin and with near point signal:

If the origin signal is too long:



If the origin signal is too short:



Action description:

The motor returns to the origin with high-speed VH. In the process of returning to the origin, it encounters the near point signal. The motor speed drops to the low-speed VL and continues to return to the origin. When it encounters the rising edge of the origin signal, the speed drops to 0 and starts to return to the origin with the creeping speed. When it encounters the falling edge of the origin signal, it starts to find the z-phase signal of the servo motor and stops returning to the origin when it finds the z-phase signal.

3. Hard limit return mode

(1) Return to the origin in the positive direction, and the initial position exists on the right side of the origin:



After accelerating to the reverse crawling speed, touch the origin falling edge and decelerate to 0 to complete the action of returning to the origin.

(2) Forward return to the origin, the initial position exists on the right side of the origin, and just accelerates to the maximum limit.



Accelerate to VH high speed, just touch the maximum limit rising edge, then decelerate and accelerate in reverse direction;

Reverse accelerate to -VH, after touching the falling edge of the origin, decelerate and reverse acceleration;

Reverse accelerate to VH, after touching the rising edge of the origin, decelerate and reverse acceleration;

(3) Return to the origin in the forward direction, and the initial position is at the maximum limit.



After accelerating to the reverse crawling speed, touch the origin falling edge and decelerate to 0 to complete the action of returning to the origin.

(4) Forward return to the origin, the origin signal is short and close to the near point signal, touching the near point signal.



VH decelerates and reverses accelerates after touching the rising edge of the maximum limit at high speed;

Reverse accelerate to -VH, after touching the falling edge of the origin, decelerate and reverse acceleration;

In the reverse acceleration section, the speed changes to VL when touching the rising edge of near point signal, keeps the VL moving forward to touch the rising edge of the origin, then decelerates and accelerates in the reverse direction;

(5) Forward return to the origin, the near point signal is between the origin and the maximum limit, and the initial position is at the maximum limit.





After accelerating to the reverse crawling speed, touch the origin falling edge and decelerate to 0 to complete the action of returning to the origin.

(6) Forward return to the origin, the near point signal is between the origin and the maximum limit, and the initial position is between the near point and the origin.



VH decelerates and reverses accelerates after touching the rising edge of the maximum limit at high speed;
 Reverse accelerates to -VH, after touching the falling edge of the origin, decelerate and reverse acceleration;
 Reverse accelerates to VH, after touching the rising edge of the origin, decelerate and reverse acceleration;
 After accelerating to the reverse crawling speed, touch the origin falling edge and decelerate to 0

to complete the action of returning to the origin.

(7) Forward return to the origin, the near point signal is between the origin and the maximum limit, and the initial position is between the origin and the near point.



VH high speed touches rising edge of near point signal and decelerates to VL, decelerates and reverses accelerates after touching the rising edge of maximum limit;

Reverse accelerate to -VH, after touching the falling edge of the origin, decelerate and reverse acceleration;

Reverse accelerates to VH, after touching the rising edge of the origin, decelerate and reverse acceleration;

After accelerating to the reverse crawling speed, touch the origin falling edge and decelerate to 0 to complete the action of returning to the origin.

(8) Reverse to the origin, the initial position is on the left of the origin.



After touching the rising edge of the minimum limit at high speed, the -VH decelerates and accelerates in reverse direction;

Reverse accelerate to VH, after touching the falling edge of the origin, decelerate and reverse acceleration;

Reverse accelerate to -VH, after touching the falling edge of the origin, decelerate and reverse acceleration;

(9) Reverse to the origin, the initial position is on the left of the origin, and just accelerate to the minimum limit.



Accelerate to -VH high speed, just touch the rising edge of the minimum limit, then decelerate and accelerate in reverse direction;

Reverse accelerate to VH, after touching the falling edge of the origin, decelerate and reverse acceleration;

Reverse accelerate to -VH, after touching the falling edge of the origin, decelerate and reverse acceleration;

After accelerating to the reverse crawling speed, touch the rising edge of the origin and decelerate to 0 to complete the action of returning to the origin.

(10) Reverse to the origin, the initial position is at the minimum limit.



After touching the falling edge of the origin, decelerate and accelerate in reverse direction;

Reverse accelerate to -VH, after touching the falling edge of the origin, decelerate and reverse acceleration;

(11) Reverse to the origin, the initial position is on the left side of the origin, touching the near point signal.



After touching the rising edge of the minimum limit at high speed, the VH decelerates and accelerates in reverse direction;

Reverse accelerate to VH, after touching the falling edge of the origin, decelerate and reverse acceleration;

In the reverse acceleration section, the speed changes to -VL when touching the falling edge of near point, keeps the reverse motion of -VL and touches the falling edge of origin, decelerates and accelerates in the reverse direction;

After accelerating to the reverse crawling speed, touch the rising edge of the origin and decelerate to 0 to complete the action of returning to the origin.

(12) Reverse to origin, the initial position is between the minimum limit and the near point.



After touching the rising edge of the minimum limit at high speed, the -VH decelerates and accelerates in reverse direction;

Reverse accelerate to VH, after touching the falling edge of the origin, decelerate and reverse acceleration;

Reverse accelerate to -VH, after touching the falling edge of the origin, decelerate and reverse acceleration;

(13) Reverse to the origin, the initial position is at the minimum limit.



Accelerate to VH high speed and reverse motion;

After touching the falling edge of the origin, decelerate and accelerate in reverse direction;

Reverse accelerate to -VH, after touching the falling edge of the origin, decelerate and reverse acceleration;

After accelerating to the reverse crawling speed, touch the rising edge of the origin and decelerate to 0 to complete the action of returning to the origin.

(14) Reverse to the origin, the initial position between the near point and the origin.



-VH high speed touches near point signal falling edge and decelerates to -VL, after touching the minimum limit rising edge decelerates and reverses acceleration;

Reverse accelerate to VH, after touching the falling edge of the origin, decelerate and reverse acceleration;

Reverse accelerate to -VH, touch the falling edge of the origin to slow down and reverse acceleration;

4. Hard limit return to z-phase mode

The return to the origin logic is the same as the hard limit return mode, and the number of z-phase is the same as the z-phase mode.

Notes:

(1) In the process of reverse return to the origin, for "no z-phase mode" and "z-phase mode", if the motor encounters the minimum limit, the motor stops moving. At this time, if it is unable to perform the reverse return to the origin, it can perform the forward return to the origin; otherwise, in the process of the forward return to the origin, if encountering the maximum limit, motor stops the movement. At this time, the forward return to the origin cannot be performed. You can perform the reverse return to the origin. "Hard limit return mode" is a mode that deal with the case of touching the hard limit.

(2) Execute forward return to origin SM2014 + 20 * (n-1), and the minimum limit will not work; similarly, execute reverse return to origin SM2015 + 20 * (n-1), and the maximum limit will not work.

5-2-11. Jogging

Positive and negative inching function can be realized by controlling coils SM2011 + 20 * (n-1) and SM2012 + 20 * (n-1).

Set the number of pulses sent by PLC once in the inching step register (SD2040 + 60 * (n-1)) and the inching frequency in the inching speed register (SD2042 + 60 * (n-1)). Through the control of system coil (SM2011 + 20 * (n-1)), the forward inching of each axis is realized. Through the control of the system coil (SM2012 + 20 * (n-1)), the reverse inching of each axis is realized.

Inching signal SM2011 + 60 * (n-1), SM2012 + 60 * (n-1) will reset automatically immediately after setting. In order to continue jogging, the HMI or PLC program should be used to set the jogging signal on continuously within 100ms interval, and the motion axis will speed up until the jogging speed runs at a uniform speed.

(1) Method 1

With MOTO command, the target position is set as the larger number within the target limit value to achieve continuous inching.



Ladder chart is shown as below:

Explanation:

SM2: as soon as the PLC runs, it will pass the value into the corresponding register.

M0: forward jog button. When M0 is pressed, the motor rotates forward, and when M0 is reset, the motor

stops immediately.

M1: reverse jog button. When M1 is pressed, the motor rotates forward, and when M1 is reset, the motor stops immediately.

(2) Method 2

100ms timer is used to set the inching coil once. Motor 1 is in continuous forward and reverse inching motion at a frequency of 1500hz.

The ladder diagram is as follows:



Explanation:

In this example, when the motor is enabled, set the step length SD2040 to 1500 and the inching frequency SD2042 to 1500 Hz.

M0: forward jog. Press M0 forward jog button on the touch screen, and the motor starts to jog forward at 1500hz. Release the M0 forward inching button, and the motor stops.

M2: reverse jog. Press M2 reverse jog button on the touch screen, and the motor starts to reverse jog at 1500hz. Release M2 reverse inching button, and the motor stops.

The registers and coils involved in jog operation are shown in table 5-2-8 below:

Table 5-2-0. register and con								
Address	Definition	Туре	Unit	Initial	Explanation			
				value				
SFD3024+60*(N-1)	Inching step	32-bit	Pulse number	1000				
	initial value	integer						
SFD3026+60*(N-1)	Inching speed	32-bit	Pulse	1000				
	initial value	integer	number/second					
SD2040+60*(N-1)	Inching step	32-bit	Pulse number	0				
		integer						
SD2042+60*(N-1)	Inching speed	32-bit	Pulse	0				
		integer	number/second					
SM2011+60*(N-1)	Forward jog				After enabling, the			
					system will reset			
					automatically			
SM2012+60*(N-1)	Reverse jog				After enabling, the			
					system will reset			
					automatically			

 Table 5-2-8: register and coil

Note:

(1) The inching parameters in the SFD register need to be modified when the servo enable is off.

(2) The parameters of SD register need to be modified when servo enable is on.

5-2-12. Full closed loop

In some applications, the device uses grating ruler or encoder to control the position with high precision, and the full closed-loop motion is achieved by forming position and speed loops through high-speed counting and servo feedback.

The function involves coil and register:

(1) control bit

Address	Definition	Note
SM2016+20*(N-1)	Full closed loop	Set on: switch the system to the full closed-loop motion state, and the
	enable	execution of motion instructions shall be subject to the high-speed
		counting position. The operation will take effect in 50ms at most.
		Set off: switch the system from full closed-loop motion state to normal
		motion state, i.e. the execution of motion command is subject to the
		position of servo encoder. The operation will take effect in 50ms at
		most.

(2) set the parameter

Address	Definition	Туре	Unit	Initial	Note
				value	
SFD3006	Full closed-loop pulse	16-bit		0	When the register is set to the
+60*(N-1)	ratio numerator	integer			high-speed count value, the motor will
					rotate once as many high-speed count
					values as the PLC receives. The full
					closed-loop pulse ratio is the ratio of
					SFD3006 + 60 * (n-1) and SFD3004 +

				60 * (n-1). The denominator is the pulses per revolution of the servo motor. By default, the numerator can be set to 131072 (consistent with the number of pulses per revolution of the servo), and the full closed-loop pulse ratio is 1:1. SD2014 is consistent with the setting
				HSCD [2 * I] value
SFD3028	High speed counter	16-bit	0	0: HSC0
+60*(N-1)	setting corresponding to	integer		1: HSC2
	full closed loop			
SFD3052	Initial value of full	Floating	0	When the servo is enabled, this register
+60*(N-1)	closed loop position	number		value will be assigned to $SD2052 + 60 *$
	gain			n
SFD3058	Full closed loop	Floating	0	Deviation limit value of full closed-loop
+60*(N-1)	position deviation limit	number		command and feedback

Address	Definition	Туре	Unit	Note
SD2052+	Full closed loop	Floating		This parameter can adjust the speed of acceleration
60*(N-1)	position gain	number		process, that is, the speed of response command. It is
				recommended to take the ratio of servo pulse and full
				closed-loop high-speed count as the initial value, and then
				slowly increase to debug. The smaller the gain, the slower
				the full closed-loop response, the larger the deviation
				between the instruction and the feedback, and even cause
				the alarm of position deviation (the limit value of position
				deviation is SFD2058 + 60 * n floating-point data type); if
				the gain is too large, vibration and overshoot will occur.
				Set a suitable gain as needed.

(3) State quantity

()					
Address	Definit	tion	Туре	Unit	Note
SD2014	Current	full	32-bit	Pulse	Coordinate position is converted from the pulse number of full
+60*(N-1)	closed	loop	integer	number	closed-loop position feedback. When SFD3006 + 60 * n is
	position				131072, this value is completely consistent with the value of
					high-speed counting.

	Definition Type U	Note
HSD112+20*(N-1) full closed loop position feedback pulses 64-bit integer 64-bit encoder position encoder position	PrimePrimeOull closed loop64-bitposition feedback64-bitintegerencoencoenco	The full closed-loop (end) encoder (grating scale) counting as a unit, relative to the zero position

(4) Example

There is a thread rod device, the servo motor at one end of the screw rod drives the slider, and the position of the screw rod is fed back through the bound encoder counting. The slider is required to realize high-precision positioning through the encoder counting, and adjust the full closed-loop state to the best state.

Steps:

(1) Select the first axis as the motion axis, and set the basic parameters of the full closed loop: SFD3006: 131072. Indicates that SD2014/HSD112 is consistent with the set HSCD[2 * I] at this time; SFD3028: 0. Indicates the HSC0 of the first high-speed counter at this time;

SFD3052: 200. The initial gain value can be given a moderate value first. If the initial value of gain is too small, the position deviation will be reported, and if it is too large, the overshoot will cause large vibration;

SFD3058: 1000. Given deviation limit value 1000.

(2)Confirm whether the current servo state meets the working conditions:

SD2000=2 SM2000=ON SM2001=OFF.

After the above conditions are met, turn on the coil SM2016, and confirm that SFD3052 has been written into SD2052; and the value of HSD112/SD2014 is the same as that of HSCD0.

(3) In the fully closed-loop state, MOTO and MOTOA motion instructions are supported. MOTO is used as reference, and CNT_AB instruction of corresponding channel are written in the program. At this time, the unit of target position set by the instruction is based on the position unit of position sensor (i.e. the count of SD2014 + 60 * (n-1) or HSCD[2 * I]), and the position of servo motor is only used as reference.

SM0	CNT_AB HSC0 K999999999	
M1 ↑	MOTO HD0 HD2 HD4 K1	

(4) Execute the MOTO instruction, if the motor does not operate in the ideal state, adjust the SFD3052 value, enable SM2016 again, and then observe whether the motor operates in the best state.

Note: please write SFD value in non motion state.

(5) Phenomenon diagnosis and treatment

When using full closed-loop function, the problem can be solved by observing the error type of SD2002 + 60 * (n-1). If SD2002 + 60 * (n-1) reports position deviation, it may be one of the following situations:

- SFD3052+60*(N-1) The position gain setting value is too small;
- SFD3058+60*(N-1) The deviation limit value is set too small;
- Set too high pulse frequency for MOTO or MOTOA command;
- The positive direction of high-speed counting is inconsistent with the motor's moving direction; processing method: the moving direction is consistent by modifying the value of SFD3047 + 60 * (n-1).
- The current device / The mechanical principle of the equipment does not meet the full closed-loop operation conditions. (whether the grating ruler or encoder synchronizes the current axis correctly)

5-3. System coil and register

The instruction refresh cycle is set according to the EtherCAT synchronization unit cycle and must be consistent with the synchronization unit cycle setting. For example, SFD2990 is set to 1000 when the period of synchronization unit of 32 axis system is set to 1000 μ s.

Address	Definition	Initial	Note
		value	
SFD2990	Instruction refresh cycle (unit:	1000	The set value is consistent with the current
	us)		synchronization unit cycle of EtherCAT. Set
			value range: 500, 1000, 2000, 4000.
SFD2991	Slave station number	32	
SFD2992	Error retry time	3	

Note: if SFD2990 does not keep the same cycle with the synchronization unit, the correct operation cannot be guaranteed.

Each axis of the motion instruction corresponds to a set of motion parameters. Currently, it supports 32 axes. The following table corresponds to the axis parameter address, and N represents the axis number.

Address	Definition	Туре	Unit	Initial	Note
				value	
SFD3000	Operation	16-bit		0	0: position control with trajectory
+60*(N-1)	mode	integer			planning
					1: Interpolation position mode
SFD3001	motor encoder	16-bit			1: Incremental encoder
+60*(N-1)	type	integer			2: Single turn absolute encoder
					3: Multi turn absolute encoder
SFD3002	Encoder ppr/1	32-bit		131072	The counter value fed back by the
+60*(N-1)	turn	integer			encoder rotated for one turn, and the
					register is set according to the actual
					number of motor encoder lines. (if the
					motor encoder is a 17-bit encoder, the
					register is set to the 17th power of 2,
					which is 131072)
SFD3004	Moving	32-bit	Pulse	131072	The reference equivalent of motion
+60*(N-1)	quantity/1 turn	integer	number		(lead of screw rod). If the parameter unit
					is pulse number, it is based on the
					reference of displacement. The setting
					number of pulses is required for one
					revolution of the motor. This register is
					set to the number of pulses, then the
					PLC sends as many pulses as the motor
					turns one circle.
SFD3006	Full	16-bit		0	The numerator is high-speed count and
+60*(N-1)	closed-loop	integer			motion equivalent pulse ratio, and
	pulse ratio				denominator is the number of pulses per
	numerator				revolution of servo motor. By default,
					they can be set to $SFD3004 + 60 * (n-1)$

 Table 5-3-1: basic parameter (N=1~32)

					(the same as the number of pulses per
					revolution of servo motor). At this time,
					SD2014 is consistent with the set high
					speed count value HSCD [2 * i].
SFD3010	Origin position	64-bit		0	After performing the operation of
+60*(N-1)		integer			returning to the original point, the
~ /		C			system will automatically assign the
					value to $SD2008 + 60 * (n-1)$ for setting
					the original point position
SFD3014	Minimum	32-bit	Pulse	-100000000	Minimum soft limit position setting. If
+60*(N-1)	position limit	integer	number	0	the current position $SD2008 + 60 *$
	r · · · · ·				(n-1) is less than this value. SD2002 +
					60 * (n-1) will generate 20002 alarm.
					indicating the minimum soft limit over
					travel
SFD3016	Maximum	32-bit	Pulse	1000000000	Maximum soft limit position setting If
+60*(N-1)	position limit	integer	number	100000000	the current position $SD2008 + 60 *$
	position mint	meger	numoti		(n-1) is greater than this value SD2002
					+ 60 * (n-1) will generate 20001 alarm
					indicating the maximum soft limit over
					travel.
SFD3018	Maximum	32-bit	Pulse	6553600	Set according to the maximum speed or
+60*(N-1)	speed limit	integer	number/s		rated speed of the motor Exceeding the
00 (111)	Sp ••••		1141110 01, 5		maximum speed limit will move at the
					maximum speed.
SFD3020	Maximum	32-bit	ms	10	PLC will automatically calculate the
+60*(N-1)	acceleration	integer			acceleration slope according to the set
00 (111)	time				acceleration and deceleration time and
					calculate the time from 0 to the highest
					speed with this slope. If the deceleration
					time from 0 to the maximum speed limit
					is less than the maximum acceleration
					time, the movement will be based on the
					maximum acceleration time Cannot be
					set to a value of 0 or less
SFD3022	Maximum	32-bit	ms	10	PLC will automatically calculate the
+60*(N-1)	deceleration	integer			deceleration slope according to the set
()	time				acceleration and deceleration time and
					calculate the time from the highest
					speed to 0 during deceleration based on
					the slope. If the time from the maximum
					speed limit to 0 is less than the
					maximum deceleration time it will
					move according to the maximum
					acceleration time.
SFD3024	Inching step	32-bit	Pulse	100	When enabled, the PLC will jog at this
+60*(N-1)	initial value	integer	number		step by default.
SFD3026	Inching speed	32-bit	Pulse	1000	When enabled, the PLC will jog at this
+60*(N-1)	initial value	integer	number/s		speed by default.

SED3028	High speed	16-hit	0	
$+60*(N_{-}1)$	counter setting	integer	Ū	
100 (11-1)	counter setting	integer		
	to full closed			
GED2020	loop	1(1)	2500	
SFD3029	Opper limit of	10-01	2500	Positive integer: upper deviation value
+60*(N-1)	position	integer		-1: Deviation value ignored
	feedback			
	deviation			
SFD3034	Minimum limit	16-bit	0xFF	Specify the number of the minimum
+60*(N-1)	terminal setting	integer		electrical limit x terminal, 0xFF is no
				terminal, and negative number indicates
				anti logic. Note: the positive logic of X0
				is set to 0, and the negative logic is set
				to - 30000.
SFD3035	Maximum limit	16-bit	0xFF	Specify the number of the maximum
+60*(N-1)	terminal setting	integer		limit x terminal, 0xFF is no terminal,
				and a negative number indicates anti
				logic. Note: the positive logic of X0 is
				set to 0, and the negative logic is set to
				-30000.
SFD3036	Near point	16-bit	0xFF	Specify the number of the X terminal of
+60*(N-1)	signal terminal	integer		the near point signal 0xFF is no
00 (111)	setting			terminal and a negative number
	seemig			indicates anti logic Note: the positive
				logic of X0 is set to 0 and the negative
				logic is set to -30000
SED3037	Origin terminal	16-bit	0xFF	Specify the number of X terminal of
$+60*(N_{-}1)$	setting	integer	UNI I	origin signal OvEE is no terminal and
100 (11-1)	setting	integer		negative number indicates anti logic
				Note: the positive logic of V0 is set to 0
				and the negative logic of X0 is set to 0,
GED2020	Det met en i i in	1614		and the negative logic is set to -30000.
SFD3038	Return to origin	10-D1	0	0. no z-phase mode. Find the hear point
+60*(N-1)	mode	integer		according to the regression speed VH,
				then find the origin according to the
				regression speed VL, find the edge of
				the origin, then slow down, and then
				find the edge of the origin according to
				the crawl speed in reverse;
				2: Z-phase mode. Find the approach
				point according to the regression speed
				VH, then find the origin point according
				to the regression speed VL, find the
				edge of the origin point, then decelerate,
				then find the edge of the origin point
				according to the crawl speed in reverse,
				and then find the Z phase of the servo
				encoder along the positive direction
				10: Hard limit return mode. When the

r					1
					positive and negative hard limits are met, the origin will be found in reverse at -VH speed, and the speed changes to VH when touching the origin falling edge and the subsequent action is the
					same as mode 0.
					12: hard limit return z-phase mode.
					When the positive and negative hard
					limits are met, the origin will be found
					in reverse at -VH speed, and the speed
					will change to VH when touching the
					falling edge of origin signal, and the
					subsequent action is the same as mode
SED2040	Degragaion	22 hit	Dulco	0	2. The high gread of the origin regression
5FD5040 +60*(N 1)	speed VH	32-011	ruise	0	speed of the origin regression
SFD3042	Regression	32-bit	Pulse	0	The low speed of the origin return
+60*(N-1)	speed VL	integer	number/s	0	speed.
SFD3044	Crawling speed	32-bit	Pulse	0	Slow crawling speed of origin return.
+60*(N-1)		integer	number/s		
SFD3047	Motion	16-bit		0	Motion direction logic. 0 positive logic,
+60*(N-1)	direction logic	integer			that is, the command speed is positive,
					the motor is rotating forward, the
					command speed is negative, and the
					motor is reversing. 1 is negative logic,
					i.e. the instruction speed is positive, the
					motor reverses, the instruction speed is
CED2049	Initial andreas of	22 1.4	Dealara	20	negative, and the motor rotates forward.
SFD3048	Initial value of	32-bit	Pulse	20	initial value of positioning completion
+00 (11-1)	completion	integer	number		the actual encoder feedback are within
	width				the width PLC will have the positioning
					completion signal, and there is no need
					to wait until the movement stops
					completely.
SFD3052	Initial value of	32-bit			When the servo is enabled, this register
+60*(N-1)	full closed loop	floating			value will be assigned to $SD2052 + 60 *$
	position gain	number			(n-1)
SFD3058	Full closed	32-bit			Deviation limit value of full closed-loop
+60*(N-1)	loop position	floating			command and feedback
	deviation limit	number			

During the operation of the motor, the PLC status can be monitored through the following registers:

Fable 5-3-2:	status qua	ntity parameter	(N=1~32)
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Address	Definition	Туре	Unit	Note
SD2006+60*(N-1)	Current	32-bit	Pulse	The displacement relative to the last stop
	displacement	integer	number	position, i.e. the displacement in this
				instruction
SD2008+60*(N-1)	Current position	32-bit	Pulse	Absolute position, converted from the

		integer	number	actual feedback pulse number of the
				motor
SD2010+60*(N-1)	Current speed	32-bit	Pulse	Calculation of actual feedback speed of
		integer	number/s	motor
SD2012+60*(N-1)	Instantaneous	32-bit	Pulse	Speed given value of current control cycle
	speed setting	integer	number/s	
SD2014+60*(N-1)	Current full closed	32-bit	Pulse	The absolute position of full closed loop
	loop position	integer	number	is converted from the pulse number of full
				closed loop position feedback. When
				SFD3006 + 60 * (n-1) and SFD3004 + 60
				* (n-1) are the same, this value is
				completely consistent with the value of
				high-speed counting.
SD2016+60*(N-1)	Current segment	32-bit		
	(indicates segment	integer		
	n)			

Table 5-3-3: setting value parameter (N=1~32)

			8 1	
Address	Definition	Туре	Unit	Note
SD2030+	Position setting	32-bit	Pulse	Coordinate position, which is converted by the
60*(N-1)		integer	number	number of pulses given by the target position. Modify
				the set value of this position, and the motor will move
				to the set position according to the set speed (SD2032
				+ 60 * (n-1)).
SD2032+	Speed setting	32-bit	Pulse	
60*(N-1)		integer	number/s	
SD2034+	Acceleration time	32-bit	ms	The time accelerating from 0 to the max speed
60*(N-1)		integer		
SD2036+	deceleration time	32-bit	ms	the time decelerating from the max speed to 0
60*(N-1)		integer		
SD2038+	Synchronous	32-bit		Tracking axis speed / tracked axis speed
60*(N-1)	motion speed ratio	integer		
SD2040+	Jog step length	32-bit	Pulse	When the servo is enabled, the system will
60*(N-1)		integer	number	automatically assign SFD3024 + 60 * (n-1) as the
				initial value to this register. After the servo is enabled,
				the register value can be modified online in real time.
SD2042+	Jog speed	32-bit	Pulse	When the servo is enabled, the system will
60*(N-1)		integer	number/s	automatically assign SFD3026 + 60 * (n-1) as the
				initial value to this register. After the servo is enabled,
				the register value can be modified online in real time.
SD2044+	Positioning	32-bit	Pulse	Determine the threshold value of positioning
60*(N-1)	complete width	integer	number	completion. If the difference between the given value
				and the feedback value of the encoder is less than the
				value, the moving flag is off. When the servo is
				enabled, the system will automatically assign
				SFD3048 + 60 * (n-1) as the initial value to the
				register. After the servo is enabled, the register value
				can be modified online in real time.
SD2052+	full closed loop	32-bit		This parameter can adjust the speed of acceleration

60*(N-1)	position gain		floating	process that is the speed of response command. It is
00 (111)	position guin		number	recommended to take the ratio of servo pulse and full
			number	recommended to take the ratio of servo pulse and run
				closed-loop high-speed count as the initial value, and
				then slowly increase to debug. The smaller the gain,
				the slower the full closed-loop response, the larger the
				deviation between the instruction and the feedback,
				and even cause the alarm of position deviation (the
				limit value of position deviation SFD2058 + 60*n is
				floating-point data type); if the gain is too large,
				vibration and overshoot will occur. Set a suitable gain
				as needed. When the full closed-loop is enabled, the
				system will automatically assign SFD3052 + 60 *
				(n-1) as the initial value to the register. After the full
				closed-loop is enabled, the value of the register can be
				modified online in real time.
SD2059	Synchronous		32-bit	Range: 0~9999.
+60*(N-1)	motion	filter	integer	
	coefficient		-	

Table 5-3-4: self-hold status parameter (N=1~32)								
Address	Definition	Туре	Unit	Note				
HSD100+20*(N-1)	Given pulse number of	64-bit	Encoder	Encoder count value relative to				
	target position	integer	counting	absolute zero				
HSD104+20*(N-1)	target position feedback	64-bit	Encoder	Encoder count value relative to				
	pulse number	integer	counting	absolute zero				
HSD108+20*(N-1)	current displacement pulse number	64-bit integer	Encoder counting	Count value relative to the starting encoder position of the current motion instruction				
HSD112+20*(N-1)	full closed loop position feedback pulse number	64-bit integer	Full closed loop encoder counting	The total closed-loop (end) encoder (grating scale) counting is the unit, relative to the zero position				

 Table 5-3-5: status bit parameter (N=1~32)

Address	Definition	Note
SM2000+20*(N-1)	servo enable flag	ON: servo is enabled
SM2001+20*(N-1)	moving flag	ON: Pulse is outputting. It is set to off as soon as the movement
		stops.
SM2003+20*(N-1)	instruction complete	ON: Command execution completed. Set off at the beginning of
	flag	instruction execution.
SM2004+20*(N-1)	axis error flag	ON: error
SM2005+20*(N-1)	min limit status	ON: The current position is less than the minimum position limit or
		the minimum limit signal
SM2006+20*(N-1)	max limit status	ON: The current position is greater than the maximum position
		limit or the maximum limit signal
SM2009+20*(N-1)	slave axis binding	ON: The current axis is bound
	flag	

	Table 5-3-6: control bit parameter $(N=1\sim32)$					
Address	Definition	Note				
SM2010+20*(N-1)	Servo enable	ON: servo enable OFF: servo disable				
SM2011+20*(N-1)	Jog forward	After enabling, the system will reset automatically				
SM2012+20*(N-1)	Jog reverse	After enabling, the system will reset automatically				
SM2013+20*(N-1)	Clear servo	After enabling, the system will reset automatically				
	alarm					
SM2014+20*(N-1)	Forward return	After enabling, the system will reset automatically				
	to origin					
SM2015+20*(N-1)	Reverse return	After enabling, the system will reset automatically				
	to origin					
SM2016+20*(N-1)	full closed loop	Set on: switch the system to the full closed-loop motion state, and the				
	enable	execution of motion instructions shall be subject to the high-speed				
		counting position. The operation will take effect in 50ms at most.				
		Set off: switch the system from full closed-loop motion state to normal				
		motion state, i.e. the execution of motion command is subject to the				
		position of servo encoder. The operation will take effect in 50ms at				
		most.				
SM2017+20*(N-1)	deceleration	After enabling, the system will reset automatically				
	stop motion					

 Table 5-3-6: control bit parameter (N=1~32)

5-4. Error and state information

During the movement, some errors may occur. Refer to table 5-4-1 for specific error and status information code.

Address	Definition	Value	Explanation	Internal operation	Solution
				mode	
SD2000	Servo state	0	Cut off		Check the communication wiring
+60*(N-1)					between servo and PLC
(single		1	READY		
word)		2	ON		
SD2002	Error	20001	Maximum soft	Emergency stop	The alarm flag and code can be
+60*(N-1)	information		limit over		cleared manually when reverse
(double			travel		jogging out of the over travel area
word)		20002	Minimum soft	Emergency stop	The alarm flag and code can be
			limit over		cleared manually when reverse
			travel		jogging out of the over travel area
		20003	Maximum	Emergency stop	The alarm flag and code can be
			electrical limit		cleared manually when reverse
			over travel		jogging out of the over travel area
		20004	Minimum	Emergency stop	The alarm flag and code can be
			electrical limit		cleared manually when reverse
			over travel		jogging out of the over travel area
		20005	Overspeed	Deceleration stop	Reduce command target speed
			alarm		

 Table 5-4-1: control bit parameter (N=1~32)

	20006	Position	Emergency stop,	Check whether the servo P0-05 is
		deviation	turn off the enable	set correctly. The correct setting
		alarm		should be 0. Check whether the
				machine has locked rotor which
				causes excessive deviation of
				position command and position
				feedback. After elimination,
_				enable it again
	20010	Servo alarm	Emergency stop,	The servo alarm information can
			turn off the enable	be cleared manually through
				SM2013 + 20 * (n-1) or F0-00 of
				the servo panel. The servo alarm
				information that cannot be
				cleared needs to be cleared
				according to the servo manual.
				After the alarm is cleared, the
				alarm flag and alarm code can be
F				cleared manually
	20011	servo	Emergency stop,	Check communication parameter
		communication	turn off enable,	setting and connection of
		error	and switch PLC	communication
			operation state to	
			online download	
-	20020	Manager	state	Change to a manually annual
	20020	Movement	invalid execution	change to a reasonable command
		torgat point	instruction	target location
		target point	msuuction	
		alarm		
-	20021	Movement	Invalid instruction	Change to a reasonable command
	20021	command	execution	target speed
		target speed	execution	unger speed
		overrun		
	20022	Segment	Invalid execution	Change to a reasonable number of
		number of	of motion	segments
		multi segment	instruction	
		motion		
		instruction		
		exceeds the		
		limit		
	20023	Acceleration	Invalid execution	Change to a reasonable
		and	of motion	acceleration and deceleration time
		deceleration	instruction	
		time of motion		
		command		
		exceeds the		
		limit		
	20024	Reserved		
	20025	Axis number	Invalid execution	Check command binding axis

		of bound axis	of motion	number
_		is out of limit	instruction	
	20026	Input point	Cannot return to	Check the setting of relevant
		setting of	zero	input points for zero return,
		return to zero		including the setting of near point
		terminal is out		terminal and origin terminal
		of limit		
	20030	The current	Invalid execution	Wait until the moving flag bit
		motion state	of motion	SM2001 + 20 * (n-1) is off and
		does not meet	instruction	the servo enabled flag SM2000 +
		the conditions		20 * (n-1) is on before executing
		for instruction		the command
		execution		
	20031	The motion	Invalid binding	Wait until the flag bit SM2001 +
	20001	state of the	instruction	20 * (n-1) of the bound axis in
		bound axis	execution	motion is off and the flag
		does not meet	execution	SM2000 + 20 * (n-1) of the serve
		the conditions		anable is on before executing the
		for binding		MOSVN command
		instruction		MOSTN command.
		instruction		
-	20022	execution	C) (2010 + 20 *	
	20032	Current axis	SM2010 + 20 *	Check whether the single word
		motion mode	(n-1) set on	SFD3000 + 60 * (n-1) is 0. After
		setting error	invalid, unable to	correction, perform the servo
		SFD3000 + 60	enable servo	enable operation again.
		* (n-1) setting		
_		error		
_	20033	Reserved		
	20034	When the user	The enable	Check the causes of servo enable
		performs the	operation is invalid	such as servo enable mode, and
		enable		execute enable operation again
		operation, the		after correction
		motor is		
		already in the		
		enabled state		
	20035	Motor type not	Motor cannot	Check the value of register
		set	enable	SFD3001 + 60 * (n-1), and after
				correction, the PLC will run
				again.
				SFD3001+60* (N-1) motor type
				code:
				1: Incremental encoder motor
				2: Single turn absolute encoder
				motor
				3: Multi turn absolute encoder
				motor
				4. Stepping motor
				5: Xinie encoder
F	20036	Current home	Current motion	1: Check whether soft limit is
	20030	Current nome		1. CHEEK WHELHEI SUIT IIIIII IS

		return	failure	stop	touched
		alarm			2: Is the homing process complete
SD2004	Number of bus				(1) Check the communication
+60*(N-1)	communication				parameters of P7 group of servo
(double	error				driver
word)					(2) Check whether the
					communication wiring between
					servo and PLC is normal

6. EtherCAT operation process and use cases

6-1. EtherCAT operation flow chart



6-2. EtherCAT bus function

The following table shows the parameters that must be configured under CSP, CSV, CST, PP, PV and TQ modes.

Register	Explanation
RXPDO[0x6040]	The control word must be added to the PDO configuration. In CSP, CSV and CST modes,
	it is invalid to modify through IO mapping, which is controlled by the NC module
RXPDO[0x6060]	Mode control word, which must be added to PDO configuration, can be modified through
	IO mapping in task mode
RXPDO[0x607A]	Target location, i.e. program given location, must be added to the PDO configuration
TXPDO[0x6041]	Status word, must be added to PDO configuration
TXPDO[0x6061]	Mode status word, must be added to PDO configuration
TXPDO[0x6064]	Actual location, must be added to PDO configuration
TXPDO[0x606C]	Actual speed, must be added to PDO configuration
SFD2990(PLC	Same cycle as EtherCAT synchronization unit
register)	

6-2-1. CSP mode

CSP (periodic synchronous position mode), whose movement track is calculated by the upper computer, sends the target position to the slave station periodically.

1. Associated objects

-		
Register	Explanation	Unit
	Given the position, it is invalid to modify it through IO mapping in CSP	Command
KAPDO[0x00/A]	mode, which is controlled by NC module	unit
TXPDO[0x6064]	Position feedback (motor actual position)	Command
		unit
TXPDO[0x606C]	Speed feedback	Command
		unit/s
RXPDO[0x6060]	Set to 8	-

2. Position control with trajectory interpolation

SFD3000+60*(N-1) (PLC register): set to 0

In this mode, the original xnet motion control instructions, system coils and registers can be supported (see Chapter 5 of the manual for details)

3. Interpolation mode mode

SFD3000+60*(N-1) (PLC register): set to 1

SM1995 (interrupt enable bit): set ON

In this mode, the user-defined interpolation position can be realized by modifying the value of SD2030 + 60 * (n-1) in real time in the I9900 interrupt.

4. Operation example: (take Xinje DS5C servo as an example)

(1) Click [scan] or [add] slave station on the EtherCAT interface, and the [general] interface uses the

default configuration.

	EthercatConfig	×
Scan Update	General Expert process data Launch parameters IO Mapping COE-Online ESC Reg	_
Master PLC Master	Offset time(us): 0 + FuncMappingNum: 0 +	
Slave — StationID:0 Alias:0 XINJE-DS5C CoE Drive	SM Watchdog: 🖌 FuncModeule: Servo Module 🗸	
	Slave Information Init	
	State Machine	
	Current State Requested State	
	Error Message	
	Upload Download Activate OK Cancel	ł

(2) Select 1600 and 1A00 in [expert process data] \rightarrow [PDO assign]. (the default configuration can meet the basic use of CSP, and other PDO parameters can be added if necessary.)

			Eth	erca	atConfig	J							×
Ganaral	Expert proce	ess data	Launch parameters		Manajara	005.00		ESC Bea					
General	Deport proof		Laurier parameters			t	ne	ESC Neg					
SyncM	anager				- TOO IIS								
SM	Size	Туре			Index	Size		Name			Sign	SM	
0		Mailb	юх		#x1600	13.0		1st RxPDC	Mapping			2	
1		Mailb	ox I		#X1601	6.0		2nd FXPU	Mapping				
2	13.0	Outp	ut		#x1602	4.0		Ath ByPDC	Mapping	choose list			
3	13.0	Input	:		#x1003	13.0		1st TyPDO	Mapping			3	
les	s than 24	bytes			#x1a01	12.0		2nd TxPD0) Mapping			5	
		-			#x1a02	12.0		3rd TxPDO	Mapping				
PDO A	ssign				#x1a03	12.0		4th TxPDO	Mapping				
⊥ #x □ #x	1603 1603		se 1000, 1A00		PDO:	Add Ed	it D Size	elete Mov	eup Mo et Na	ve down	Туре		
					#x6040	:00	2.0	0.0	Co	ntrol Word	UINT		
					#x607A	:00	4.0	2.0	Ta	rgetPosition	DINT		
					#x60FF	:00	4.0	6.0	Ta	rget Velocity	DINT		
					#x6071	:00	2.0	10.0	Ta	rgetTorque	INT		
					#x6060	:00	1.0	12.0	Mo	deOfOperation	SINT		
					def clic	ault set k and t	ting o ad	s contain Id new fu	basic o nction.	peration parame	eters,		
								Up	load	Download Ac	ctivate	ОК	Cancel

(3) Confirm that the 6060h value in [start parameter] is 8.

neral	Expert process data	Launch parameters 10	Mapping	COE-Online	ESC Reg			
Add	Edit Delete Move	up Move down		6060h va	lue is 8, it is C	SP mode		
Row	Index: subindex	Name	Value	Bits len	Error -> exit	Error -> jump	Next row	Notes
1	#x6060:00	Modes of operation	8	8			0	Op mode
2	#x60C2:01	Interpolation time period	1	8			0	Interpolation time period
3	#x60C2:02	Interpolation time index	-3	8			0	Interpolation time index
				synchroniz	zation cycle			
	 the launch pa In addition to 	rameters will be as	signed t paran	to the objectors othe	ect dictionary	when the P	LC is pov	vered on.
	In addition to	these three delad	r paran	leters, our	er parameter:	s can be aud	eu as nee	eus.

4 [IO mapping] the default starting address is HD1000, which can be changed if necessary.

(5) After parameter configuration, click [download] \rightarrow [activate]. After activation, the parameters will take effect.

Image: Launch parameters 10 Mapping COE-Online ESC Reg Ital addr: Word map: IHD × Bit map: HM × Shift: 10000 start address can be changed, register type can be D, HD vdex:Subldx Name Address Type Bit length Value vdex:Subldx Name HD 10000 UINT 32 0 vdex:Subldx Name HD 10006 INT 16 0 vdex:Subldx Name HD 100012 DINT 32 0 vdex:Subldx ActualPosition HD 10014 DINT 32 0 vdex:Subldx: ModeOfOperationDisplay HD 10018 SINT		EthercatCo	onfig				
Hall add: Word map: HD Bit map: HN Shift: 10000 start address can be changed, register type can be D, HD rdxs:Subidx Name Address Type Bt length Value rdxs:Subidx Control Word HD 10000 UINT 32 0 rdx6040:00 TargetPosition HD 10002 DINT 32 0 rdx6040:00 TargetPosition HD 10006 INT 16 0 rdx6040:00 MadeoOdeoperation HD 10008 SINT 8 0 rdx6041:00 Status Word HD 10010 UINT 16 0 rdx6041:00 Status Word HD 10010 UINT 16 0 rdx6041:00 Status Word HD 10010 UINT 16 0 rdx6041:00 Status Word HD 10012 DINT 32 0 rdx6041:00 ActualPostion HD 10016 INT 16 0 rdx604:00 ActualPostion HD 10018 SINT 8 0 rdx6067:00 ModeoOperationDisplay HD 10018 SINT </th <th>ieneral Expert pro</th> <th>ocess data Launch parameters IO Mapp</th> <th>ing COE-Online</th> <th>ESC Reg</th> <th></th> <th></th> <th></th>	ieneral Expert pro	ocess data Launch parameters IO Mapp	ing COE-Online	ESC Reg			
Index. Sublidx Name Address Type Bit length Value #x6040:00 Control Word HD10000 UINT 16 0 #x6040:00 Target Position HD10002 DINT 32 0 #x6077:00 Target Velocity HD10006 INT 16 0 #x6071:00 Target Torque HD10006 INT 16 0 #x6060:00 ModeOfOperation HD10008 SINT 8 0 #x6041:00 Status Word HD1010 UINT 16 0 #x6040:00 Actual Position HD10012 DINT 32 0 #x6040:00 Actual Position HD10012 DINT 32 0 #x6040:00 Velocity actual value HD10014 DINT 32 0 #x6041:00 Velocity actual value HD10016 INT 16 0 #x6041:00 ModeOfOperationDisplay HD10018 SINT 8 0 #x6041:00 ModeOfOperationDisplay HD10018 SINT 8 0 #x6041:00<	nitial addr: Word	d HD V Bit map: HM V Shift:	10000	start addre	ss can be chang	ged, register typ	e can be D, HD
#k6040:00Control WordHD 10000UINT160#k607A:00TargetPositionHD 10002DINT320#k607F:00TargetVelocityHD 10006INT320#k6071:00TargetTorqueHD 10006INT160#k6060:00ModeOfOperationHD 10008SINT80#k601:00Status WordHD 10010UINT160#k604:00ActualPositionHD 10012DINT320#k606:00Velocity actual valueHD 10012DINT320#k606:00Velocity actual valueHD 10016INT160#k607:00ActualPositionHD 10016INT160#k6061:00ModeOfOperationDisplayHD 10018SINT80#k6061:00ModeOfOperationDisplayHD 10018SINT80#k6061:00ModeOfOperationDisplayHD 10018SINT80#k6061:00ModeOfOperationDisplayHD 10018SINT80#k6061:00ModeOfOperationDisplayHD 10018SINT80#k6061:00ModeOfOperationDisplayHD 10018SINT80#k6061:00ModeOfOperationDisplayHD 10018SINT80#k6061:00ModeOfOperationDisplayHD 10018SINT80#k6061:00ModeOfOperationDisplayHD 10018SINT80#k6061:00ActualForqueActualForqu	Index:SubIdx	Name	Address	Туре	Bit length	Value	
#x607A:00 TargetPosition HD10002 DINT 32 0 #x607F:00 TargetVelocity HD10004 DINT 32 0 #x6071:00 TargetTorque HD10006 INT 16 0 #x6070:00 ModeOfOperation HD10008 SINT 8 0 #x6080:00 ModeOfOperation HD10010 UINT 16 0 #x6080:00 ActualPosition HD10012 DINT 32 0 #x6080:00 ActualPosition HD10012 DINT 32 0 #x6080:00 Velocity actual value HD10012 DINT 32 0 #x6080:00 Velocity actual value HD10018 SINT 8 0 #x6097:00 ActualTorque HD10018 SINT 8 0 #x6097:00 ModeOfOperationDisplay HD10018 SINT 8 0 #x6097:00 ActualFostion non repeated address will report an error, and the non repeated address will expected address will report an error, and the non repeated address will expected address will expected address an error <	±−#x6040:00	Control Word	HD10000	UINT	16	0	
#x60FF:00 Target Velocity HD10004 DINT 32 0 #x6071:00 Target Torque HD10006 INT 16 0 #x6060:00 ModeO/Operation HD10008 SINT 8 0 #x6061:00 Status Word HD10010 UINT 16 0 #x6064:00 ActualPosition HD10012 DINT 32 0 #x6060:00 Velocity actual value HD10016 INT 32 0 #x6060:00 Velocity actual value HD10016 INT 16 0 #x6060:00 Velocity actual value HD10016 INT 16 0 #x607:00 ActualTorque HD10018 SINT 8 0 #x607:00 ModeO/OperationDisplay HD10018 SINT 8 0 #x606	#x607A:00	TargetPosition	HD10002	DINT	32	0	
+#x6071:00 Target Torque HD 10006 INT 16 0 +#x6060:00 ModeOfOperation HD 10008 SINT 8 0 +#x6041:00 Status Word HD 10010 UINT 16 0 +#x6064:00 ActualPosition HD 10012 DINT 32 0 +#x6067:00 Velocity actual value HD 10016 INT 16 0 +#x6061:00 ActualTorque HD 10016 INT 16 0 +#x6061:00 ModeOfOperationDisplay HD 10018 SINT 8 0 +#x6061:00 ModeOfOperationDisplay HD 10018 SINT 10 1	#+++++++++++++++++++++++++++++++++++++	TargetVelocity	HD10004	DINT	32	0	
+#x6060:00 ModeOfOperation HD 10008 SINT 8 0 +#x6041:00 Status Word HD 10010 UINT 16 0 +#x6064:00 ActualPosition HD 10012 DINT 32 0 +#x6060:00 Velocity actual value HD 10014 DINT 32 0 +#x6061:00 ActualTorque HD 10016 INT 16 0 +#x6061:00 ModeOfOperationDisplay HD 10018 SINT 8 0 +#x6061:00 HD address will be arranged automatically, the repeated address will reportion and activate	- #x6071:00	Target Torque	HD10006	INT	16	0	
+ #x6041:00 Status Word HD10010 UINT 16 0 + #x6064:00 ActualPosition HD10012 DINT 32 0 + #x606C:00 Velocity actual value HD10014 DINT 32 0 + #x607:00 ActualTorque HD10016 INT 16 0 + #x6061:00 ModeOfOperationDisplay HD10018 SINT 8 0 + #x6061:00 ModeOfOperationDisplay HD10018 SINT 8 0 - #x6061:00 the address will be arranged automatically, the repeated address will report - - -	#x6060:00	ModeOfOperation	HD10008	SINT	8	0	
+#x6064:00 ActualPosition HD10012 DINT 32 0 +#x606C:00 Velocity actual value HD10014 DINT 32 0 +#x607:00 ActualTorque HD10016 INT 16 0 +#x6061:00 ModeOfOperationDisplay HD10018 SINT 8 0 +#x6061:00 ModeOfOperationDisplay HD10018 SINT 8 0 -#x6061:00 the address will be arranged automatically, the repeated address will report - - -	-#x6041:00	Status Word	HD10010	UINT	16	0	
++++++++++++++++++++++++++++++++++++	-#x6064:00	ActualPosition	HD10012	DINT	32	0	
++x60077:00 Actual Torque HD 10016 INT 16 0 ++x60651:00 ModeOfOperationDisplay HD 10018 SINT 8 0 ++x60651:00 ModeOfOperationDisplay HD 10018 SINT 8 0 ++x6067:00 HD address will be arranged automatically, the repeated address will be selected automatically. repeated address will report + - - - - - + - - - - - + - - - - - - + - - - - - - - + - <td>- #x606C:00</td> <td>Velocity actual value</td> <td>HD10014</td> <td>DINT</td> <td>32</td> <td>0</td> <td></td>	- #x606C:00	Velocity actual value	HD10014	DINT	32	0	
Hb10018 SINT 8 0 Hb10018 stranged automatically, the repeated address will report an error, and the non repeated address will be selected automatically. Image: Sint Sint Sint Sint Sint Sint Sint Sint	- #x6077:00	ActualTorque	HD10016	INT	16	0	
Image: state address will be arranged automatically, the repeated address will report an error, and the non repeated address will be selected automatically. Image: state address will be arranged automatically, the repeated address will report an error, and the non repeated address will be selected automatically. Image: state address will be arranged automatically, the repeated address will be selected automatically. Image: state address will be arranged automatically, the repeated address will be selected automatically. Image: state address will be arranged address will be selected automatically. Image: state address will be arranged address will be selected automatically. Image: state address will be address will	-#x6061:00	ModeOfOperation Display	HD10018	SINT	8	0	
		the address will an error, and th	be arranged a e non repeate	automatically d address wi	, the repeated a I be selected au click the dow	address will repo itomatically. nload and active	ort ate after setting

(6) After activation, the slave station state machine (SD8021) will go from $1 \rightarrow 2 \rightarrow 4 \rightarrow 8$, 8 indicates the op status, at this time, SDO and PDO can receive and send messages.

(7) SFD3000 is set to 0, SM2010 is set to on to enable the slave station (if set ON SM2010 when power on, the slave will be enabled after master station status SD8000 switches to 8), and the motor is operated by Xnet motion control command (MOTO, MOTOA, etc.).

(8) In CSP mode, the current given position can be monitored by HD1002 (mapping of 607Ah), the actual position of the current motor can be monitored by HD1012 (mapping of 6064h), and the current actual speed can be monitored by HD1014 (mapping of 606Ch).



PLC1-自由监控				4 ×
监控 添加	修改删除删除全	部 上移	下移置顶	置底
寄存器	监控值	字长	进制	注释
HD 1008	8	双字	10进制	Station ID:0,#x6060:0
HD1002	28209496	双字	10进制	Station ID:0,#x607A:0
HD1012	28209496	双字	10进制	Station ID:0,#x6064:0
HD1014	60	双字	10进制	Station ID:0,#x606C:0
SM2010	ON	位	-	轴1使能
D0	13107200	双字	10进制	指定轴1的相对位置
D2	131072	双字	10进制	指定轴1的运动速度
D4	10	双字	10进制	指定轴1的加减速时间
SD2008	13107199	双字	10进制	轴1当前位置
HSD104	13107202	双字	10进制	轴1目标位置反馈脉冲数
SFD3000	0	单字	10进制	轴1运行模式
SFD3001	2	单字	10进制	轴1电机类型

6-2-2. CSV mode

CSV (periodic synchronous speed mode) makes the motor run at a constant speed through the speed given by the upper computer.

Related parameters

Register	Explanation	Unit
RXPDO[0x60FF]	Set speed	Command
		unit/s
TXPDO[0x6064]	Position feedback	Command unit
TXPDO[0x606C]	Speed feedback	Command
		unit/s
RXPDO[0x6080]	Maximum motor speed, which can be limited through online modification of COE-Online	r/min
RXPDO[0x6060]	Set to 9	-
SFD[3029+60*(N-1)]	Set to -1	-

Note: in CSV mode, only the five parameters SM2000 + 20 * (n-1) (servo enable flag), SM2010 + 20 * (n-1) (servo enable), SD2002 + 60 * (n-1) (error message) and SM2013 + 20 * (n-1) (clear servo alarm) in the system coil and register related to master station motion control (not parameters in COE-Online) are valid, and the rest parameters are invalid. (refer to section 5-3 of this manual for details of parameters)

Operation example: (take Xinje DS5C servo as an example)

(1) Click [scan] or [add] slave station on the EtherCAT interface, and the [general] interface uses the default configuration.

	EthercatConfig
Scan Update	General Expert process data Launch parameters IO Mapping COE-Online ESC Reg
Master PLC Master	Offset time(us): 0 🜩 FuncMappingNum: 0 🜩
Slave — StationID:0 Alias:0 XINJE-DS5C CoE Drive	SM Watchdog: 🖌 FuncModeule: Servo Module 🗸
	Slave Information Init
	State Machine
	Current State
	Requested State
	Error Message
	Upload Download Activate OK Cancel

(2) Select 1600 and 1A00 in [expert process data] \rightarrow [PDO assign]. (the default configuration can meet the basic use of CSV, and other PDO parameters can be added if necessary.)

			Eth	ercatC	Config							×
Connel	Evnet proce	ee data 🛛	1	10 M				Dee				
General	Expert proce		Launch parameters		pping U	UE-Unline	e ESC	, Reg				
SyncMa	anager				PDO list							
SM	Size	Type		- Ir	ndex	Size	N	ame		Sign	SM	
0	5126	Mailbo	~	#	¢x1600	13.0	1s	t RxPDO Map	ping		2	
1		Mailbo	x	#	‡x1601	6.0	2n	d RxPDO Ma	pping			
2	13.0	Output		#	\$x1602	6.0	3n	d RxPDO Map	ping choose lie	st 💭		
3	13.0	Input		#	\$x1603	4.0	4t	h RxPDO Map	pping			
los	a than 24	butos		#	\$x1a00	13.0	1s	t TxPDO Map	ping		3	
les	s man 24	bytes			1x1a01	12.0	2n	d IxPDO Ma	pping			
PDO As	sign				7x1a02	12.0	30	d IXPDO Map	ping			
		MO	1000 100		A Iduj	12.0	-40		iping			
✓ #x1	600 CIICK S	M2, cho	bose 1600~160	13								
#x1	601 CIICK S	M3, cho It choos	ose 1A00~1A0	13								
	602 derau	it choos	e 1000, 1A00									
	603			- E F	PDO: A	d Edit	Delet	e Move up	Move down			
					ndex:Sub	ldx !	Size	Offset	Name	Туре		
				t	±x6040.00) 2	0	0.0	Control Word	UINT		
				t	*x607A:0) 4	1.0	2.0	TargetPosition	DINT		
				#	\$x60FF:00) 4	1.0	6.0	Target Velocity	DINT		
				#	\$x6071:00) 2	2.0	10.0	TargetTorque	INT		
				#	\$x6060:00) 1	.0	12.0	ModeOfOperation	SINT		
					defa	ilt setti	nas c	ontain ha	sic operation paran	neters		
					click	and to	add r	omulii bu	on	leters,		
					CHCK		auu i	iew functi	011.			
								Upload	Download	Activate	ОК	Cancel

3 Confirm that the 6060h value in [start parameter] is 9.

		Lenered				_		
eneral	Expert process data	Launch parameters IO I	Mapping	COE-Online	ESC Reg			
Add	Edit Delete Move	up Move down		6060h=9,	CSV mode			
Row	Index: subindex	Name	Value	Bits len	Error -> exit	Error -> jump	Next row	Notes
1	#x6060:00	Modes of operation	9	8			0	Op mode
2	#x60C2:01	Interpolation time period	100	8			0	Interpolation time period
3	#x60C2:02	Interpolation time index	-5	8			0	Interpolation time index

(4) [IO mapping] the default starting address is HD1000, which can be changed if necessary.

(5) After parameter configuration, click [download] \rightarrow [activate]. After activation, the parameters will take effect.
	EthercatCo	nfig				
eneral Expert pro	ocess data Launch parameters IO Mappi	COE-Online	ESC Reg			
nitial addr: map:	HD ∨ Bit map: HM ∨ Shift:	10000	default start ac	dress is 1000	0, register can l	be D, HD
Index:SubIdx	Name	Address	Туре	Bit length	Value	
±−#x6040:00	Control Word	HD10000	UINT	16	0	
⊡ #x607A:00	TargetPosition	HD10002	DINT	32	0	
#x60FF:00	TargetVelocity	HD10004	DINT	32	0	
- #x6071:00	TargetTorque	HD10006	INT	16	0	
-#x6060:00	ModeOfOperation	HD10008	SINT	8	0	
<i>⊢#</i> x6041:00	Status Word	HD10010	UINT	16	0	
- #x6064:00	ActualPosition	HD10012	DINT	32	0	
-#x606C:00	Velocity actual value	HD10014	DINT	32	0	
#x6077:00	ActualTorque	HD10016	INT	16	0	
⊡-#x6061:00	ModeOfOperationDisplay	HD10018	SINT	8	0	
			click dow	nload and ac	tivate after set	ting
			Upload	Download	Activate	OK Cancel

(6) After activation, the slave station state machine (SD8021) will go from $1 \rightarrow 2 \rightarrow 4 \rightarrow 8$, 8 indicates the op status, at this time, SDO and PDO can receive and send messages. After the state is switched to OP, 6080h (maximum motor speed) can be modified through COE-Online.

(7) After SM2010 is set to on to enable the slave station, HD1004 (mapping of 60FFh) can be assigned as the given speed in CSV mode. (real time speed interpolation can be realized by modifying HD1004 in I9900 interrupt)

(8) In CSV mode, the current given speed can be monitored by HD1004 (mapping of 60FFh), the actual position of the current motor can be monitored by HD1012 (mapping of 6064h), and the current actual speed can be monitored by HD1014 (mapping of 606Ch).

PLC1-自由监控	È			P ×
: 监控 添加	修改删除册	1除全部 .	上移 下移	置顶 置底
寄存器	监控值	字长	进制	注释
HD 1008	9	双字	<mark>10</mark> 进制	Station ID:0,#x6060:0
HD1004	131072	双字	<u>10</u> 进制	Station ID:0,#x60FF:0
HD1012	36426019	双字	<u>10</u> 进制	Station ID:0,#x6064:0
HD1014	130440	双字	<u>10</u> 进制	Station ID:0,#x606C:0
SM2010	ON	位	-	轴1 使能

6-2-3. CST mode

CST (periodic synchronous torque mode) makes the motor run at a constant torque by setting the torque on the upper computer.

Related parameters		
Register	Explanation	Unit
RXPDO[0x6071]	Set torque	0.1%
TXPDO[0x6064]	Position feedback	Command unit
TXPDO[0x606C]	Speed feedback	Command unit/s
TXPDO[0x6077]	Torque feedback	0.1%
RXPDO[0x6080]	Max motor speed	r/min
RXPDO[0x6060]	Set to 10	-
SFD[3029+60*(N-1)]	Set to -1	-

Note: in CST mode, only SM2000 + 20 * (n-1) (servo enable flag), SM2010 + 20 * (n-1) (servo enable), SD2002 + 60 * (n-1) (error message) and SM2013 + 20 * (n-1) (clear servo alarm) are valid in the system coil and register related to master station motion control (not parameters in COE-online), and the other parameters are invalid. (refer to section 5-3 of the manual for details of parameters)

Operation example: (take Xinje DS5C servo as an example)

(1) Click [scan] or [add] slave station on the EtherCAT interface, and the [general] interface uses the default configuration.

	EthercatConfig	×
Scan Update	General Expert process data Launch parameters IO Mapping COE-Online ESC Reg	
Master PLC Master	Offset time(us): 0 - FuncMappingNum: 0 -	
Slave — StationID:0 Alias:0 XINJE-DS5C CoE Drive	SM Watchdog: 🖌 FuncModeule: Servo Module V	
	Slave Information Init	
	State Machine	
	Current State	
	Requested State	
	Upload Download Activate OK Cano	el

(2) Select 1600 and 1A00 in [expert process data] \rightarrow [PDO allocation]. The default configuration can meet the basic use of CST. If necessary, add other PDO parameters, such as 6080h in 1600, to facilitate changing the maximum motor speed to limit torque.

			Eth	ercatConfig	J						×
General SyncMa	Expert proce	ss data	Launch parameters	IO Mapping PDO list	COE-Onlin	e ESC	Reg				
SM Size Type 0 Mailbox 1 1 Mailbox I 2 2 17.0 Output 3 13.0 Input less than 24 bytes 1 PDO Assign Implement ✓ #x1600 click SM2, choose 1600~1603 #x1601 click SM3, choose 1A00~1A03 Implement #x1602 default choose 1600, 1A00 Implement				Index #x1600 #x1601 #x1602 #x1603 #x1a00 #x1a01 #x1a02 #x1a03 33 33	Size 17.0 6.0 4.0 13.0 12.0 12.0 12.0	Na 1st 2nc 3rd 4th 1st 2nc 3rd 4th	Ime FXPDO Map d RxPDO Map RxPDO Map RxPDO Map TxPDO Map d TxPDO Map TxPDO Map TxPDO Map	ping pping ping current se ping ping ping ping	Sign lected list	SM 2 3	
#x1	603			: PDO: Index:Su #x6040 #x607A #x606F #x6071 #x6080 #x6080	Add Edit ubldx 2 00 2 00 4 00 4 00 00 4 00 4 0	Delete Size 2.0 4.0 2.0 1.0 4.0 4.0 4.0	Move up Offset 0.0 2.0 6.0 10.0 12.0 13.0 6080h, ea	Move down Name Control Word TargetPosition TargetVelocity TargetTorque ModeOfOperation Max motor speed asy to change max	Type UINT DINT DINT INT SINT UDINT	eed	
							Upload	Download	Activate	ОК	Cancel

3 Confirm that the 6060h value in [start parameter] is 10.

		Etherc	atConfig					
ieneral	Expert process data	Launch parameters 10	Mapping	COE-Online	ESC Reg			
Add	Edit Delete Move	up Move down		6060b=1	LO CST mod	ρ		
Row	Index: subindex	Name	Value	Bits len	Error -> exit	Error -> jump	Next row	Notes
1	#x6060:00	Modes of operation	10	8			0	Op mode
2	#x60C2:01	Interpolation time period	100	8			0	Interpolation time period
3	#x60C2:02	Interpolation time index	-5	8			0	Interpolation time index
	1				1			
					Upload	Downlo	ad Ac	Cancel

(4) [IO mapping] the default starting address is HD1000, which can be changed if necessary.

(5) After parameter configuration, click [download] \rightarrow [activate]. After activation, the parameters will take effect.

	EthercatCo	nfig				×
General Expert pro	ocess data Launch parameters IO Mappi	ng COE-Online E	SC Reg			
Initial addr: Word map:	HD ✓ Bit map: HM ✓ Shift:	10000	default start ad	ldress 1000, r	egister type ca	an be D, HD
Index:SubIdx	Name	Address	Туре	Bit length	Value	
	Control Word	HD10000	UINT	16	0	
⊕-#x607A:00	TargetPosition	HD10002	DINT	32	0 the new	wly added PDO will
⊕-#x60FF:00	Target Velocity	HD10004	DINT	32	0 be sort	ed automatically
i +x6071:00	TargetTorque	HD10006	INT	16	and IO	manning will be
	ModeOfOperation	HD10008	SINT	8	0 allocat	ed in order
i∉-#x6080:00	Max motor speed	HD10020	UDINT	32	0	
⊞-#x6041:00	Status Word	HD10010	UINT	16	0	
te-#x6064:00	ActualPosition	HD10012	DINT	32	0	
te-#x606C:00	Velocity actual value	HD10014	DINT	32	0	
te-#x6077:00	ActualTorque	HD10016	INT	16	0	
±-#x6061:00	ModeOfOperationDisplay	HD10018	SINT	8	0	
			click d	ownload and	activate after	setting
						_
			Upload	Download	Activate	OK Cancel

(6) After activation, the slave station state machine (SD8021) will go from $1 \rightarrow 2 \rightarrow 4 \rightarrow 8$, 8 indicates the op status, at this time, SDO and PDO can receive and send messages.

(7) After SM2010 is set on to enable the slave station, HD1006 (mapping of 6071h) can be assigned as the given torque in CST mode. (real time torque interpolation can be realized by modifying HD1006 in I9900 interrupt)

(8) In CST mode, the current given torque can be monitored by HD1006 (mapping of 6071h), the current actual position can be monitored by HD1012 (mapping of 6064h), the current actual speed can be monitored by HD1014 (mapping of 606Ch), the current actual torque can be monitored by HD1016 (mapping of 6077h), and the maximum motor speed can be limited by 6080h.

PLC1-自由监控				4 ×
监控 添加	修改删除删除全	部 上移	下移置顶	置底
寄存器	监控值	字长	进制	注释
HD 1008	10	双字	<mark>10</mark> 进制	Station ID:0,#x6060:0
HD 1006	300	双字	<u>10</u> 进制	Station ID:0,#x6071:0
HD 10 10	30	双字	<u>10</u> 进制	Station ID:0,#x6080:0
HD1014	-679904	双字	10进制	Station ID:0,#x6064:0
HD 10 16	65459	双字	10进制	Station ID:0, #x606C:0
HD 10 18	11	双字	10进制	Station ID:0,#x6077:0
SM2010	ON	位	-	轴1使能

6-2-4. HM mode

HM mode (i.e. homing mode) is used for initialization of the slave position.

1. Associated objects

Register	Explanation					
RXPDO[0x6040]	Control word, modify the control word to open the origin return					
RXPDO[0x6098]	homing mode					
RXPDO[0x609A]	homing acceleration speed					
RXPDO[0x6060]	Set to 6 when the motor is not enabled					
SDO[0x6099]	Speed of returning to origin, online modification through					
	COE-Online					

2. Control word (6040h)

Set to (0x06 > 0x0f > 0x1f) in sequence, enable the driver and let the motor start to operate, startup the homing function.

3. Homing method (6098h)

At present, the homing modes supported by Xinje DS5C series servo are 1-14, 17-30, 33, 34, 35, 37. If the slave station of other brands is used, the way to return to the origin shall be subject to the slave station Manual of the corresponding brand.

■ Method 1:

When using method 1 to return to origin, if the reverse limit switch is in the non triggered state, the initial moving direction is left. The first z-phase pulse on the right of the position where the zero position becomes invalid at the negative limit switch.



Homing on negative limit switch and index pulse

■ Method 2:

When using method 2, if the forward limit switch is not triggered, the initial direction of movement is right. The home position is at the first z-phase pulse on the left of the position where the forward limit switch becomes invalid.



Homing on positive limit switch and index pulse

■ Method 3, 4:

Using methods 3 or 4, the initial direction of movement depends on the state of the origin switch. The origin position is on the reverse side of the origin switch or on the z-phase position initially detected in the forward direction.



Homing on positive home switch and index pulse

■ Method 5, 6:

Using method 5 or 6, the initial direction of movement depends on the state of the origin switch. The origin position is on the reverse side of the origin switch or on the z-phase position initially detected in the forward direction.



Homing on negative home switch and index pulse

■ Method 7~14:

The origin switch and z-phase signal are used in 7-14;

The initial action direction of modes 7 and 8 is negative if the origin switch has been activated at the beginning of the action;

The initialization action direction of modes 9 and 10 is positive if the origin switch has been activated at the beginning of the action;

The initialization action direction of modes 11 and 12 is a positive direction if the origin switch has been activated at the beginning of the action;

The initialization action direction of modes 13 and 14 is negative if the origin switch has been activated at the beginning of the action;

The position of the final return origin is the z-phase signal near the rising or falling edge of the origin switch.



Homing on home switch and index pulse - positive initial motion



Homing on home switch and index pulse - Negative initial motion

■ Method 17:

This method is similar to method 1.

The difference is that the detection position of the origin is not the Index pulse, but the position where the limit switch changes. (please refer to the figure below)

When NOT is not assigned, Homing error = 1.



■ Method 18:

This method is similar to method2.

The difference is that the detection position of the origin is not the Index pulse, but the position where the limit switch changes. (please refer to the figure below)

When the POT is not assigned, Homing error = 1.



Homing on positive limit switch

Method 19, 20:

This method is similar to method 3, 4.

The difference is that the origin detection location is not Index pulse, but the location where the Home switch changes. (please refer to the figure below)

When HOME is not assigned, Homing error = 1.



■ Method 21, 22:

This method is similar to method 5, 6.

The difference is that the origin detection location is not Index pulse, but the location where the Home switch changes. (please refer to the figure below)

When HOME is not assigned, Homing error = 1.



Homing on positive home switch and index pulse

Method 23, 24, 25, 26:

This method is similar to method 7, 8, 9, 10.

The difference is that the origin detection location is not Index pulse, but the location where the Home switch changes. (please refer to the figure below)

When HOME and POT are not allocated, Homing error = 1.



Homing on home switch and index pulse - positive initial motion

■ Method 27, 28, 29, 30:

This method is similar to method 11, 12, 13, 14.

The difference is that the origin detection location is not Index pulse, but the location where the Home switch changes. (please refer to the figure below)

When HOME and NOT are not assigned, Homing error = 1.



Homing on home switch and index pulse - Negative initial motion

Method 33, 34:

Using methods 33 or 34, the homing direction is negative or positive, respectively. The original position is located near the Z phase of the selected direction.



■ Method 35, 37:

In modes 35 and 37, the position after power on is the origin position.



4. Operation example: (take Xinje DS5C servo as an example)

(1) Terminal distribution. P5-22 is the setting address of positive limit, the default value is 1, i.e. corresponding to servo terminal SI1; P5-23 is the setting address of inverse limit NOT, the default value is 2, i.e. corresponding to servo terminal SI2; P5-27 is the setting address of origin, the default value is 3, i.e. corresponding to servo terminal SI3.

(2) Click [scan] or [add] slave station on the EtherCAT interface, and the [general] interface uses the default configuration.

	EthercatConfig	×
Scan Update	General Expert process data Launch parameters IO Mapping COE-Online ESC Reg	
Master		
PLC Master	Offset time(us): 0 🗣 FuncMappingNum: 0	
Slave — StationID:0 Alias:0 XINJE-DS5C CoE Drive	SM Watchdog: 🗸 FuncModeule: Servo Module 🗸	
	Slave Information Init	
	State Machine	
	Current State	
	Requested State	
	Error Message	
	Upload Download Activate OK Canc	xel

(3) Choose 1600 and 1A00 in [expert process data] \rightarrow [PDO allocation] and add 6098h to 1600.

eneral	Expert proce	ess data 🛛 L	aunch parameters	IO Mapping (:0E-Online	ESC Reg				
SyncMa	anager			PDO list						
SM	Size	Type		Index	Size	Name		Sign	SM	
0	5126	Mailhau		#x1600	14.0	1st RxPDO Ma	pping		2	
1		Mailbox	(#x1601	6.0	2nd RxPDO M	apping			
ו כ	14.0	Output	C 1	#x1602	6.0	3rd RxPDO Ma	apping			
2	13.0	locut		#x1603	4.0	4th RxPDO Ma	apping			
,	13.0	input		#x1a00	13.0	1st TxPDO Ma	pping		3	
				#x1a01	12.0	2nd TxPDO Ma	apping			
	reign			#x1a02	12.0	3rd TxPDO Ma	pping			
FDO A	ssign			#x1a03	12.0	4th TxPDO Ma	pping			
] #x1	603			PDO: A	dd Edit Idx Sia	Delete Move u	p Move down Name	Туре		
				#x6040:0	0 2.0	0.0	Control Word	UINT		
				#x607A:0	0 4.0	2.0	Target Position	DINT		
				#x60FF:0	0 4.0	6.0	TargetVelocity	DINT		
				#x6071:0	0 2.0) 10.0	Target Torque	INT		
				#x6060:0	0 1.0) 12.0	ModeOfOperation	SINT		
				#x6098:0	0 1.0) 13.0	Homing method	SINT		
					add	6098h in PDO	D, easy to change h	noming m	ethod	

(4) Confirm that the 6060h value in [start parameter] is 6.

		Etherc	atConfig	3					×
General : Add	Expert process data Edit Delete Move	Launch parameters 10 e up Move down	Mapping	COE-Online	ESC Reg				
Row 1 2 3	Index: subindex #x6060:00 #x60C2:01 #x60C2:02	Name Modes of operation Interpolation time period Interpolation time index	Value 6 100 -5	Bits len 8 8 8	Error -> exit	Error -> jump	Next row 0 0 0	Notes Op mode Interpolation time period Interpolation time index	
					Upload	d Downlo	ad Ac	tivate OK Can	icel

(5) [IO mapping] the default starting address is HD1000, which can be changed if necessary.

(6) After parameter configuration, click [download] \rightarrow [activate]. After activation, the parameters will take effect.

	EthercatCo	nfig				×
General Expert pro	d HD v Bit map: HM v Shift:	ng COE-Online E	SC Reg default starting	address 100	10, regis	ster type can be D, HD
Index:SubIdx	Name	Address	Туре	Bit length	Value	
	Control Word	HD10000	UINT	16	0	
	TargetPosition	HD10002	DINT	32	0	
	TargetVelocity	HD10004	DINT	32	0	
	TargetTorque	HD10006	INT	16	0	the newly added PDO
	ModeOfOperation	HD10008	SINT	8	0	will be sorted automatically
	Homing method	HD10020	SINT	8	0	and IO mapping will be
⊞−#x6041:00	Status Word	HD10010	UINT	16	0	allocated in order
	ActualPosition	HD10012	DINT	32	0	
⊕-#x606C:00	Velocity actual value	HD10014	DINT	32	0	
⊞-#x6077:00	ActualTorque	HD10016	INT	16	0	
	ModeOfOperation Display	HD10018	SINT	8	0	
			click	download a	nd acti	ivate after setting
			ciici		nu acti	wate after setting
			Upload	Download	Activat	te OK Cancel

(7) After activation, the slave station state machine (SD8021) will go from $1 \rightarrow 2 \rightarrow 4 \rightarrow 8$, 8 indicates the op status, at this time, SDO and PDO can receive and send messages.

(8) After the status is switched to OP, you can modify the speed and acceleration of origin return through COE-Online.

ieneral Expert p	rocess data	Launch parameters	IO Mapping	COE-Online	ESC Reg	
All object dictio	naries 🔿 R	eceiving PDO (RxPD	0) 🔿 Send f	DO (TxPDO)		
Index:SubIndex	Name			Flag	Value	Communication error message
#x6084:00	Profile dec	eleration		rw		function disable
#x6085:00	Quick stop	deceleration		rw		function disable
#x6086:00	Motion pro	file type		rw		function disable
#x6087:00	Torque slo	pe		rw		function disable
#x6088:00	Torque pro	ofile type		rw		function disable
#x608F:00	Position er	ncoder resolution		ro	>2<	
- #x6091:00	Gear ratio			ro	>2<	
₽-#x6092:00	Feed cons	tant		ro	>2<	
#x6098:00	Homing me	ethod		rw		function disable
- #x6099:00	Homing sp	eeds		ro	>2<	
-01	Speed dur	ing search for switch		rw		function disable
-02	Speed dur	ing search for zero		rw		function disable
- #x609A:00	Homing ac	celeration		rw		function disable
-#x60A3:00	Profile jerk	use		rw		function disable
- #x60A4:00	Profile jerk			ro	>2<	6099-01: homing high speed
- #x60B0:00	Position of	fset		rw		function disable 6099-02: homing low speed
-#x60B1:00	Velocity of	fset		rw		function disable 609A: hominh acceleration spee
- #x60B2:00	Torque off	set		rw		function disable 6099 is SDO, only can modify or
-#x60B8:00	Touch Pro	be Function		rw		function disable COE interface
-#x60B9:00	Touch Pro	be Status		ro		function disable 609A is PDO, can be added to I
#x60BA:00	Touch Pro	be Pos1 Pos Value		ro		function disable manning
-#x60BB:00	Touch Pro	be Pos1 Neg Value		ro		function disable
- #x60BC:00	Touch Pro	be Pos2 Pos Value		ro		function disable
-#x60BD:00	Touch Pro	be Pos2 Neg Value		ro		function disable
-#x60C0:00	Interpolatio	on sub mode select		rw		function disable
- #x60C1:00	Interpolatio	on data record		ro	>2<	

(9) Set the homing mode (6098h). The setting range is 1-37 (currently supported modes 1-14, 33, 34, 35, 37).

(10) Turn HD1000 (mapping of 6040h) from 6 to 15, enable the slave station, and then turn 15 to 31, start the homing function. During the homing process, if the homing signal is triggered, it will slow down and stop according to the corresponding homing mode. If you need to return to the original point again, first change 6040h to 6, and then repeat the above operation.

6-2-5. PP mode

PP (profile position control mode) is a position control mode that acts after generating position instructions inside the servo driver by specifying the target position, target speed, acceleration and deceleration, etc. Please use this control mode in the communication period of more than 500 μ s.

1. Association parameter

Register	Explanation	Unit
RXPDO[0x6040]	Control bit	-
RXPDO[0x6060]	Set to 1	-
RXPDO[0x607A]	Position setting	Command unit
RXPDO[0x6072]	max torque	0.1%
RXPDO[0x607F]	max internal speed	Command unit /s
RXPDO[0x6080]	max motor speed	r/min
RXPDO[0x6081]	internal speed setting	Command unit /s
RXPDO[0x6083]	internal acceleration speed	Command unit /s ²

PP control mode associated object (instruction · setting)

RXPDO[0x6084]	internal deceleration speed	Command unit /s ²
RXPDO[0x60C5]	max acceleration speed	Command unit /s ²
RXPDO[0x60C6]	max deceleration speed	Command unit /s ²
RXPDO[0x6065]	Set the number of follow error pulses	Command unit
RXPDO[0x6066]	Follow error timeout	ms
RXPDO[0x6067]	Position window	Command unit
RXPDO[0x6068]	Position window time	ms

Note:

(1) 6081h (profile velocity) is limited by the smaller of 607Fh (max profile velocity) and 6080h (max motor speed).

(2) Changing the set value of 607Fh (max profile velocity) or 6080h (max motor speed) in the action is not reflected in the action.

Object associated with PP control mode (instruction • monitoring)

Register	Explanation	Unit
TXPDO[0x6041]	Status word	-
TXPDO[0x6063]	internal actual position	Command unit
TXPDO[0x6064]	position feedback (motor actual position)	Command unit
TXPDO[0x606C]	speed feedback	Command unit /s
TXPDO[0x6077]	actual torque	0.1%
TXPDO[0x60F4]	actual follow error	Command unit

2. control word (6040h) < pp control mode function >

Index	Sub-Index	N	ame/Descr	iption	Ra	inge	DateType		Acces	ss	PDO		Op-mode
6040h	00h		Controlwo	ord	0~6	5535	535 U16		rw		RxPDO		All
		Set th	ne control	command	to the se	ervo drive	er such as F	DS s	state c	conve	ersion.		
		Bit ir	formation										
		15	14	13	3	12	1	l	1	0	9	8	
						r					om	h	
		7	6		5		4		3	2	1	0	
		fr			om	s			eo	qs	ev	so	
			Abs /rel	Change	set imm	ediately	New set p	oint					
		$\mathbf{r} = \mathbf{r}\mathbf{e}$	eserved (no	ot correspo	onding)	fı	= fault res	et					
		oms	= operation	operation mode specific eo = enable opera					tion				
		(cont	ol mode is based on bit) $qs = quick stop$										
		h = h	alt			ev	= enable v	oltag	e				
						so	= switch o	ı					

Bit4-6 (operation mode specific):

Bit	Name	Value	Definition
4	new set-point	0->1	Start the positioning action and trigger the setting value update.
			Get the new location determination task (607Ah (target position), 6081h
			(profile velocity), etc.).
5	change set immediately	0	Complete the positioning action that is currently running. In the process
			of motion, if the target position 607A, acceleration 6083, deceleration
			6084 are changed, and then the control command is sent, it will not run
			according to the new motion parameters. After the last motion is
			completed, the new motion will be executed .

		1	Interrupt the current positioning action, and immediately start the downward positioning action. That is, in the process of motion, change		
			the target position 607A, acceleration 6083, deceleration 6084, and then		
			send the control command, for example, change the control word 0x6F		
			$(111) \rightarrow 0x7F$ (127) (relative mode) or $0x2F$ (47) $\rightarrow 0x3F$ (63)		
			(absolute mode), and immediately run according to the new motion		
			parameters.		
6	absolute/ relative	0	607Ah (Target position) treated as absolute position.		
		1	607Ah (Target position) treated as relative position.		

Do not change the acceleration and deceleration (*) during motor operation.

If the acceleration and deceleration are changed, please change bit4 (new set-point) from 0 to 1 after the motor stops.

6083h (Profile acceleration) 6084h (Profile deceleration)

60C5h (Max acceleration)

60C6h (Max deceleration)

3. Status word (6041h) < pp control mode function >

Index	Sub-Index	Na	ime/D	escription	R	ange	ange DateType A		ess	ss PDO		mode	
6041h	00h		Statu	sword	0~6	55535	5535 U16		D TxPDO		All		
		Indic	ates th	ne status of th	e serv	o driver							
		Bit in	nforma	ation									
		15	14	13			12	11		10	9	8	
			r			oms		Ila		oms	rm	r	
				Following H	Error	set- po	int acknowledg	e	Ta	rget Reached			
		7	6	5			4	3		2	1	0	
		w	sod	Qs		ve		F		oe	SO	rsto	
		$\mathbf{r} = \mathbf{r}\mathbf{e}$	eserve	d (not corresp	ondir	ng)	g) w = warning						
							sod = swi	tch on o	disat	oled			
		oms	= opei	ation mode s	pecifi	c	qs = quic	k stop					
		(control mode is based on bit)				t) ve = voltage enabled							
		ila = internal limit active			e		f = faul	t					
							oe = ope	ration e	enabl	led			
		rm =	remot	e			so = swith	tched of	n				
						rtso = ready to switch on							

bit13,12,10 (operation mode specific):

Bit	Name	Value	Definition			
10	target reached	0	halt=0 (normal): positioning incomplete			
			alt=1 (stop as halt): shaft decelerating			
		1	halt=0 (normal): positioning complete			
			halt=1 (stop as halt): shaft stop (shaft speed is 0)			
12	set-point	0	The new-setpoint is 0, and the buffer is empty after the current target position			
	acknowledge		action is executed (in execution)			
		1	The new location task puts data into the buffer, which is not empty			
13	following error	0	60F4h (Following error actual value)			
			(=6062h(Position demand value)-6064h(Position actual value)) is not over the			
			range of 6065h (Following error window), or 60F4h value is over setting value			
			of 6065h, not pass the time setting in 6066h			

	-	
	1	60F4h (Following error actual value) value is over the setting range of 6065h
		(Following error window), above the setting time of 6066h (Following error
		time out), continue

4. Action description of PP control mode

The bit6 (absolute / relative) of 6040h (Controlword) can be used to determine whether to adopt relative mode or absolute mode.

Action 1: basic set-point

(1) master station, after setting the value of 607Ah (Target position), 6040h (Controlword) bit4 (new set-point changes from 0 to 1. At this time, please set 6081h (Profile velocity).

6081h (Profile velocity) is 0, motor has no motion.

(2) slave station, confirm 6040h (Controlword) bit4 (new set-point) rising edge $(0\rightarrow 1)$, 607Ah (Target position) start positioning as target position. At this time, 6041h (status word) bit12 (set-point acknowledge) is from 0 to 1.

(3) master station, confirm 6041h (Statusword) bit12 (set-point acknowledge) has changed from 0 to 1, 6040h (Controlword) bit4 (new set-point) returns 0.

(4) slave station, confirm 6040h (Controlword) bit4 (new set-point) has been 0, 6041h (status word) bit12 (set-point acknowledge) changed to 0.

(5) when reached the target position, 6041h (Controlword) bit10 (target reached) changed from 0 to 1.



< Set-point example >

Action 2: action data change without buffer: single set-point

When bit5 (change set immediately) of 6040h (control word) is 1, if the data used for positioning action in the action has been changed, the current positioning action will be interrupted and the next positioning action will be started immediately.

(1) Master station, confirm that bit12 (set point acknowledge) of 6041h (status word) is 0, change the value of 607AH (target position), change bit4 (new set point) of 6040h (control word) from 0 to 1.

Note: at this time, please do not change the acceleration and deceleration.

(2) Slave station, confirm the rising edge $(0 \rightarrow 1)$ of bit4 (New set-point) of 6040h (control word), 607AH (target position) and 6081H (profile velocity) as the new target location and new internal execution speed to update immediately. At this time, bit12 (set point acknowledge) of 6041h (status word) is changed from 0 to 1.

3 Master station, confirm that bit12 (set point acknowledge) of 6041h (status word) has changed from 0 to 1, bit4 (new set point) of 6040h (control word) returns 0.

(4) Slave station, confirm that the bit4 (new set point) of 6040h (control word) has been 0, 6041h (status word) bit12 (set point acknowledge) is 0.



< handshaking procedure for the single set-point method >

5. Operation example

Take connecting Panasonic servo and Xinje DS5C servo as an example.

(1) click [scan] or [add] slave station on Ethercat interface, the general interface keeps default settings.

EthercatConfig					
Scan Update	General Expert process data Launch parameters IO Mapping COE-Online ESC Reg				
Master					
PLC Master	Offset time(us): 0 🗢 Func Mapping Num: 0 🗢				
Slave — StationID:0 Alias:0 XINJE-DS5C CoE Drive	SM Watchdog: 🗹 FuncModeule: Servo Module 🗸				
	Slave Information Int				
	State Machine				
	Current State				
	Requested State				
	Error Message				
	Upload Download Activate OK Cancel				

(2) [expert process data] \rightarrow [PDO assign] choose 1600, 1A00, add PDO parameters related to mode (1600 and 1A00 cannot add more than 24 bytes respectively).

				Etherca	atConfig								×
General	Expert proce	ess data	Launch naram	eters 10.1	Manning	COE-On	ine F	SC Reg					
Contraction			counter param		PDO lis	t		Loo nog					
SyncM	anager												
SM	Size	Туре			Index	Size		Name			Sign	SM	
0		Mailbo	ox		#x1600	29.0		1st RxPD	O Mapp	ping		2	
1		Mailbo	ox I		#x1601	6.0		2nd RxPL	O Map	ping		·	
2	29.0	Outpu	ıt		#x1602	6.0		3rd HxPD	O Mapp	present selec	ted 🔪		
3	13.0	Input			#x1603	4.0		4th FXPD	O Mapp	ing list		2	
not e	exceed 24	bytes			#x1a00	12.0		2nd TyPE	O Map	ning		5	
		- C			#x1a02	12.0		3rd TxPD	O Mapr	ping			
PDO A	ssign				#x1a03	12.0		4th TxPD	O Mapp	ping			
					PDO:	Add Ed	lit De Size	elete Mo Off	ve up set	Move down Name	Туре		
				_	#x6040:	00	2.0	0.0		Control Word	UINT		
					#x607A	00	4.0	2.0		TargetPosition	DINT		
					#x60FF:	00	4.0	6.0	•	Target Velocity	DINT		
					#x60/1:	00	2.0	10	0	Target Torque	INI		
					#x6081	00	4.0	12	0	Profile velocity	UDINT		
				_	#x6083:	00	4.0	17	0	Profile acceleration	UDINT		
				_	#x6084:	00	4.0	21	0	Profile deceleration	UDINT		
				_	#x607F:	00	4.0	25	0	Max profile velocity	UDINT		
					clic	k add	if the	ere is otl	ner ne	eeds besides defau	ılted setti	ings	
								U	pload	Download	Activate	ОК	Cancel

(3) confirm the value of 6060h in [launch parameters] is 1.

		Etherca	atConfig					
eneral	Expert process data	Launch parameters IO	Mapping	COE-Online	ESC Reg			
Add	Edit Delete Mov	e up Move down		/ PP mod	le			
Row	Index: subindex	Name	Value	Bits len	Error -> exit	Error -> jump	Next row	Notes
1	#x6060:00	Modes of operation	1	8			0	Op mode
2	#x60C2:01	Interpolation time period	100	8			0	Interpolation time period
3	#x60C2:02	Interpolation time index	-5	8			0	Interpolation time index
				synchro	onization cyc	le is 1000us		
				-				
	41			ي الم الم م	والمتعالمة والمتعاد	اله سر وارد و ا		annead an
	In a	dition to those def	vill be as	signed to	object dictio	nary when u r can be add	ie PLC is	powered on.
	In a	dation to these dea	auit para	meters, or	ner paramte	r can be add	eu as ne	eus.

(4) [IO mapping] the default starting address is HD1000, which can be changed if necessary.

(5) After parameter configuration, click [download] – [activate]. After activation, the parameters will take effect.

	EthercatCo	onfig			
General Expert pro	ocess data Launch parameters IO Map	oing COE-Online	ESC Reg		
Initial addr: Word map:	HD V Bit map: HM V Shift:	10000	start addres	s can be chang	ged, register type can be D, HD
Index:SubIdx	Name	Address	Туре	Bit length	Value
₽-#x6040:00	Control Word	HD10000	UINT	16	0
te⊢#x607A:00	TargetPosition	HD10002	DINT	32	0
	TargetVelocity	HD10004	DINT	32	0
±−#x6071:00	TargetTorque	HD10006	INT	16	0
ie−#x6060:00	ModeOfOperation	HD10008	SINT	8	0
ie-#x6081:00	Profile velocity	HD10020	UDINT	32	0
ie−#x6083:00	Profile acceleration	HD10022	UDINT	32	0
⊕-#x6084:00	Profile deceleration	HD10024	UDINT	32	0
#~#x607F:00	Max profile velocity	HD10026	UDINT	32	0
±−#x6041:00	Status Word	HD10010	UINT	16	0
±-#x6064:00	ActualPosition	HD10012	DINT	32	0
⊕-#x606C:00	Velocity actual value	HD10014	DINT	32	0
#x6077:00	ActualTorque	HD10016	INT	16	0
±-#x6061:00	ModeOfOperationDisplay	HD10018	SINT	8	0
	the address will b an error and the	be arranged au non repeated	itomatically, th address will be	ne repeated ad e selected auto	dress will report omatically
			click	download and	activate after setting
			Upload	Download	Activate OK Cancel

(6) After activation, the slave station state machine (SD8021) will go from $1 \rightarrow 2 \rightarrow 4 \rightarrow 8$, 8 indicates the OP status, at this time, SDO and PDO can receive and send messages.

(7) Modify the control word 6040 (absolute mode: $6 \rightarrow 15 \rightarrow 31$ relative mode: $6 \rightarrow 79 \rightarrow 95$) to enable the slave station, and make the motor move by setting the target position, target speed, acceleration and deceleration and other parameters.

(8) In PP mode, you can set and monitor data through I/O mapping address. For example, the control word of axis 1 can be modified by HD1000 (mapping of 6040h) to enable or disable the motor, and the given position of current axis 1 can be monitored by HD1004 (mapping of 607AH).

信捷PLC编程工具软件 - C:\Users\Ad	ministrator\Desktop\PP.xdp			
文件(E) 编辑(E) 查找\替换(S)	显示(V) PLC操作(P) PLC设置(C) 选项(O)	窗口(W) 帮助(H)		
🗋 😅 📕 👗 🗈 🖺	🔶 🔶 🐴 🖻 🗮 🎒 🚱 .	₽ 🎙 🕆 🛯) 🔒 🔓 🖽 👿	
Ins sIns Del sDel F5 F6			<u> </u>	• • • • •
工程 # ×	PLC1 - 梯形图 ↓ ▷ ×	PLC1-自由监控		4 ×
- □ PLC1 ^		监控 添加 修改 删除	删除全部 上移下移 置	顶置底
		寄存器 监控值	字长 进制	注释
1. 命令语编程		HD1000 6	双字 10进制	Station ID:0, #x6040:0
	Lad	HD2000 6	双字 10进制	Station ID:1,#x6040:0
		HD3000 6	双字 10进制	Station ID:2, #x6040:0
────────────────────────────────────		HD1014 110 0011 0001	双字 2进制	Station ID:0, #x6041:0
		HD2014 110 0011 0001	双字 2进制	Station ID: 1, #x6041:0
数据监控		HD3014 110 0011 0001	双字 2进制	Station ID:2,#x6041:0
		HD1002 1	双字 10进制	Station ID:0, #x6060:0
		HD2004 1	双字 10进制	Station ID: 1, #x6060:0
密码 ■		HD3004 1	双字 10进制	Station ID:2,#x6060:0
—		HD2004 1	双字 10进制	Station ID: 1, #x6060:0
		HD1016 1	双字 10进制	Station ID:0,#x6061:0
		HD2022 1	双字 10进制	Station ID: 1, #x6061:0
		HD3022 1	双字 10进制	Station ID:2,#x6061:0
ED ED模块		HD1004 50000000	双字 10进制	Station ID:0,#x607A:0
B. 4GBOX		HD2002 50000000	双字 10进制	Station ID:1,#x607A:0
	4 11	HD3002 50000000	双字 10进制	Station ID:2,#x607A:0
WBOX	信息 平 ×	HD1006 131073	双字 10进制	Station ID:0,#x6081:0
	错误列表 输出	HD2006 665300	双字 10进制	Station ID:1,#x6081:0
	·	HD3006 131073	双字 10进制	Station ID:2,#x6081:0
1000 10 尺模坎信息		HD1008 131073	双字 10进制	Station ID:0, #x6083:0
 ■ ED模块信息 		HD2008 131073	双字 10进制	Station ID: 1, #x6083:0
□指令分类 □1程	· · · · · · · · · · · · · · · · · · ·	HD3008 0	双字 10讲制	Station ID:2,#x6083:0
行 0,列 0 步数:0 覆盖	PLC1:XG2-26T4	通讯方式:Com , 站号:1		运行 ,扫描周期:0.0ms

6-2-6. PV mode

PV (profile speed control mode) is a speed control mode that specifies the target speed, acceleration and deceleration, etc., and generates position command action inside the servo driver. Please use this control mode in the communication period of more than 500 μ s.

1. Related parameters

PV control mode related object (command · setting type)

Register	Explanation	Unit
RXPDO[0x6040]	Control word	-
RXPDO[0x6060]	Set to 3	-
RXPDO[0x60FF]	Speed setting	Command unit/s
RXPDO[0x6072]	Max torque	0.1%
RXPDO[0x607F]	Max internal speed	Command unit /s
RXPDO[0x6080]	Max motor speed	r/min
RXPDO[0x6083]	Internal acceleration speed	Command unit /s ²
RXPDO[0x6084]	Internal deceleration speed	Command unit /s ²
RXPDO[0x60C5]	Max acceleration speed	Command unit /s ²
RXPDO[0x60C6]	Max deceleration speed	Command unit /s ²
RXPDO[0x606D]	Velocity window	Command unit /s
RXPDO[0x606E]	Velocity time out	ms
RXPDO[0x606F]	Velocity threshold	Command unit /s
RXPDO[0x6070]	Velocity threshold time	ms

PV control mode related object (command \cdot monitoring type)

Register	Explanation	Unit
TXPDO[0x6041]	Status word	-
TXPDO[0x6064]	Position feedback (motor actual position)	Command unit
TXPDO[0x606C]	Speed feedback	Command unit /s
TXPDO[0x6077]	Actual torque	0.1%

2. Control word (6040h) < the function of pv control mode >

Index	Sub-Index	Name	/Descriptio	n		Range		DateT	ype	Access	3	PDO	Op-mode
6040h	00h	Co	ontrolword		(0~65535		U1	6	rw	R	xPDO	All
		Set the c	ontrol com	mand t	to th	e servo	drive	er such a	s PDS	state co	onversi	ion.	<u>.</u>
		Bit infor	mation										
		15	14	13		12		11		10	9	8	
						r					om	h	
		7	6		5			4	3	2	1	0	
		fr			on	ns			eo	qs	ev	so	
			r		r			r					
		r = reser	ved (No co	rrespo	nden	nce)		fr = fau	lt rese	et			
		oms = op	peration mo	ode spe	ecific	c		eo = en	able o	peration	1		
		(control	mode is bas	sed on	bit)			qs = qu	ick sto	op			
		h = halt						ev = en	able v	voltage			
								so = sw	vitch o	n			

PV mode, without OMS bit.

Modify control word 6040 (6 \rightarrow 15) to enable slave station.

3. Control word (6041h) < the function of pv control mode >

Index	Sub-Index	Nan	ne/Descr	iption	Ra	nge	DateType	Aco	cess	PDO	Op-mode
6041h	00h		Statuswor	rd	0~65	5535	U16		ro	TxPDO	All
		Indicat	es the sta	atus of th	e servo dr	iver.					
		Bit info	ormation								
		15	14	13	12	11	10		9	8	
			r	01	ns	ila	oms		rm	r	
				r	speed		Target reac	hed			
		7	6	5	4	3	2		1	0	
		w	sod	qs	ve	f	oe		SO	rsto	
		r = rese	erved (N	o corresp	ondence)		w = warning	5			
							sod = switch	n on d	lisabled		
		oms =	operation	n mode sj	pecific		qs = quick	stop			
		(contro	ol mode i	s based o	n bit)		ve = voltag	ge ena	bled		
		ila = in	ternal lir	nit active	;		f = fault				
							oe = operati	on en	abled		
		rm = re	emote				so = switche	ed on			
							rtso = ready t	o swi	tch on		

bit10 (target reached (Velocity reached)):

The difference between the total value of 60FFh (target velocity) and 60B1h (velocity offset) and 606Ch (velocity actual value) is within the range set by 606Dh (velocity window). If the time set by 606Eh (velocity window time) passes, the bit10 of 6041h (status word) becomes 1.

Bit	Name	Value	Definition
10	Target	0	halt=0 (normal): speed control not complete
	reached		halt=1 (stop as halt): shaft decelerating
		1	halt=0 (normal): speed control completed
			halt=1 (stop as halt): shaft stop (shaft speed is 0)

bit12 (speed):

606Ch (velocity actual value) passes the value set by 606Fh (velocity threshold), and if it is higher than the time set by 6070h (velocity threshold time), bit12 of 6041h (status word) becomes 0. If 606Ch (velocity actual value) is lower than the value set by 606Fh (velocity threshold), bit12 of 6041h (status word) becomes 1, indicating that the motor stops.

Bit	Name	Value	Definition
10	speed	0	Motor in operation
		1	Motor stop

4. Action description of PV control mode

PV control mode generates speed command based on the following parameters:

- Target Velocity (60FFh) Profile acceleration (6083h)
- Profile deceleration (6084h)

Turn off the motor enabling, set the COE object word 6060 to 3, set the target speed 60FFh, the acceleration and deceleration speed 6083h and 6084h, and the speed 6080h and the torque limit 6072h; the target speed 60FFh, limit the maximum speed through 6080h (max motor speed), the torque is limited by 6072h (max torque), and the speed feedforward is 60B1h (velocity offset), which is not supported temporarily. Turn on the motor to enable, and the motor shall start to operate according to the set value.



5. Operation example

Take connecting Panasonic servo and Xinje DS5C servo as an example.

(1) [scan] or [add] slave station on Ethercat interface, please use default setting for [general] interface.

	EthercatConfig	×
Scan Update	General Expert process data Launch parameters IO Mapping COE-Online ESC Reg	
Master PLC Master	Offset time(us): 0 - FuncMappingNum: 0 -	
Slave — StationID:0 Alias:0 XINJE-DS5C CoE Drive	SM Watchdog: 🗸 FuncModeule: Servo Module 🗸	
	Slave Information Init	
	State Machine	
	Current State	
	Requested State	
	Upload Download Activate OK O	Cancel

(2) Choose 1600, 1A00 in [expert process data] \rightarrow [PDO assign]. PDO parameters associated with the mode can be added (1600 and 1A00 can not be added more than 24 bytes respectively).

	Expert proce	ess data Lau	unch parameters	IO Mapping C	OE-Online	ESC Reg				
/ncMar	nager			PDO list						
м	Size	Туре		Index	Size	Name		Sign	SM	
		Mailbox		#x1600	29.0	1st RxPDO Map	ping		2	
		Mailbox I		#x1601	6.0	2nd RxPDO Ma	pping procent cold	uctool /		
	29.0	Output		#x1602	6.0	3rd RxPDO Mag	present sele	cted		
	13.0	Input		#x1603	4.0	4th RxPDO Mag	oping list			
	10.0	mpor		#x1a00	13.0	1st TxPDO Map	ping		-3	
				#x1a01	12.0	2nd TxPDO Ma	pping			
	sian			#x1a02	12.0	3rd TxPDO Map	ping			
DO Ass	agn			#x1a03	12.0	4th TxPDO Map	ping			
#x16	502									
#x16 #x16	602 603			PDO: A	dd Edit I	Delete Move up	Move down Name	Туре		
#x16 #x16	602 503			PDO: A	dd Edit I Idx Siz 0 2.0	Delete Move up e Offset 0.0	Move down Name Control Word	Type		
#x16 #x16	602 503			PDO: A	dd Edit I Idx Siz 0 2.0 0 4.0	Delete Move up e Offset 0.0 2.0	Move down Name Control Word Target Position	Type UINT DINT		
#x16 #x16	602 603			PDO: A Index:Sub #x6040.0 #x607A:0 #x60FF:0	dd Edit I Idx Siz 0 2.0 0 4.0 0 4.0	Pelete Move up e Offset 0.0 2.0 6.0	Move down Name Control Word Target Position Target Velocity	Type UINT DINT DINT		
] #x16] #x16	502 503			PDO: A Index:Sub #x6040:0 #x607A:0 #x60FF:0 #x60F1:0	dd Edit I Idx Siz 0 2.0 0 4.0 0 4.0 0 2.0	Delete Move up e Offset 0.0 2.0 6.0 10.0	Move down Name Control Word Target Position Target Velocity Target Torque	Type UINT DINT DINT INT		
) #x16] #x16	502 503			PDO: A Index:Sub #x6040:0 #x607A:0 #x60FF:0 #x60F1:0 #x6060:0	dd Edit I Idx Siz 0 2.0 0 4.0 0 4.0 0 2.0 0 2.0 0 1.0	Delete Move up e Offset 2.0 6.0 10.0 12.0	Move down Name Control Word Target Position Target Velocity Target Torque ModeOfOperation	Type UINT DINT DINT INT SINT		
] #x16] #x16	602 603			PDO: A Index:Sub #x6040:0 #x607A:0 #x607F:0 #x6071:0 #x6060:0 #x6081:0	dd Edit I Idx Siz 0 2.0 0 4.0 0 4.0 0 2.0 0 1.0 0 4.0	Delete Move up e Offset 2.0 6.0 10.0 12.0 13.0	Move down Name Control Word TargetPosition TargetVelocity TargetTorque ModeOfOperation Profile velocity	Type UINT DINT DINT INT SINT UDINT		
] #x16] #x16	602 603			PDO: A Index:Sub #x6040:0 #x607A:0 #x60FF:0 #x6061:0 #x6081:0 #x6083:0	dd Edit I Idx Siz 0 2.0 0 4.0 0 4.0 0 2.0 0 1.0 0 4.0 0 4.0 0 4.0	Delete Move up e Offset 2.0 6.0 10.0 12.0 13.0 17.0	Move down Name Control Word Target Position Target Velocity Target Torque ModeOfOperation Profile velocity Profile acceleration	Type UINT DINT DINT INT SINT UDINT UDINT		
] #x16] #x16	602 603			PDO: A Index:Sub #x607A:0 #x607A:0 #x607F:0 #x6071:0 #x6060:0 #x6081:0 #x6083:0 #x6084:0	dd Edit I Idx Siz 0 2.0 0 4.0 0 4.0 0 2.0 0 1.0 0 4.0 0 4.0 0 4.0 0 4.0 0 4.0	Delete Move up e Offset 2.0 6.0 10.0 12.0 13.0 17.0 21.0	Name Control Word Target Position Target Velocity Target Torque ModeOfOperation Profile velocity Profile acceleration Profile deceleration	Type UINT DINT DINT INT SINT UDINT UDINT UDINT		
#x16 #x16	602 603			PDO: A Index:Sub #x6040:0 #x607A:0 #x607F:0 #x6071:0 #x6060:0 #x6081:0 #x6083:0 #x6084:0 #x6087F:0	dd Edit I Idx Siz 2.0 0 4.0 0 0 4.0 0 0 4.0 0 0 4.0 0 0 4.0 0 0 4.0 0 0 4.0 0 0 4.0 0 0 4.0 0 0 4.0 0 0 4.0 0 0 4.0 0	Delete Move up e Offset 0.0 2.0 6.0 10.0 12.0 13.0 17.0 21.0 25.0	Move down Name Control Word Target Position Target Velocity Target Torque ModeOfOperation Profile velocity Profile cocleration Profile deceleration Max profile velocity	Type UINT DINT DINT INT SINT UDINT UDINT UDINT UDINT		

(3) Confirm the value of 6060h in [launch parameters] is	3.
--	----

		Etherca	atConfig						×
General	Expert process data	Launch parameters 10	Mapping C	0E-Online	ESC Reg				_
Add	Edit Delete Move	up Move down		PV mode					
Row	Index: subindex	Name	Value	Bits len	Error -> exit	Error -> jump	Next row	Notes	
1	#x6060:00	Modes of operation	3	8			0	Op mode	
2	#x60C2:01	Interpolation time period	100	8			0	Interpolation time period	
3	#x60C2:02	Interpolation time index	-5	8			0	Interpolation time index	
			sy	nchroniza	ation period	is 1000us			
	The	aunch parameters	will be as	signed to	the object o	lictionary w	oen the P	I C is nowered on	
	In ac	dition to these thr	on dofaul	t naramot	are other na	rameters ca	n ho add	ed as needs	
	Indu	idition to these this	ee uelaui	t paramet	ers, other pe	l'ameters ca	n be aud	eu as neeus.	
					Upload	Downloa	ad Ac	tivate OK	Cancel

4 [IO mapping] starting address can be customized.

(5) After parameter configuration, click [download] – [activate]. After activation, the parameters will take effect.

	EthercatCo	onfig				
eneral Expert pr	rocess data Launch parameters 10 Mapp	ing COE-Online	ESC Reg			
nitial addr: Wor map	rd HD ∨ Bit map: HM ∨ Shift:	10000	start address o	can be modifie	e <mark>d, op</mark> tional reg	gister type D, HD
Index:SubIdx	Name	Address	Туре	Bit length	Value	
E−#x6040:00	Control Word	HD10000	UINT	16	0	
- #x607A:00	TargetPosition	HD10002	DINT	32	0	
#x60FF:00	Target Velocity	HD10004	DINT	32	0	
<i>−</i> #x6071:00	Target Torque	HD10006	INT	16	0	
<i>−</i> #x6060:00	ModeOfOperation	HD10008	SINT	8	0	
<i>+</i> #x6081:00	Profile velocity	HD10020	UDINT	32	0	
- #x6083:00	Profile acceleration	HD10022	UDINT	32	0	
⊢#x6084:00	Profile deceleration	HD10024	UDINT	32	0	
⊢#x607F:00	Max profile velocity	HD10026	UDINT	32	0	
<i>⊢#</i> x6041:00	Status Word	HD10010	UINT	16	0	
⊢#x6064:00	ActualPosition	HD10012	DINT	32	0	
⊢#x606C:00	Velocity actual value	HD10014	DINT	32	0	
⊢#x6077:00	ActualTorque	HD10016	INT	16	0	
<i>⊢ #</i> x6061:00	ModeOfOperationDisplay	HD10018	SINT	8	0	
			clic	k download a	nd activate aft	er setting
				-		
			Upload	Download	Activate	OK Cancel

(6) After activation, the slave station state machine (SD8021) will go from $1 \rightarrow 2 \rightarrow 4 \rightarrow 8$, 8 indicates the OP status, at this time, SDO and PDO can receive and send messages.

7 Modify the control word 6040 ($6 \rightarrow 15$) to enable the slave station, and make the motor move by setting the target speed, acceleration and deceleration speed and other parameters.

(8) In PV mode, you can set and monitor data through I/O mapping address. For example, the control word of axis 1 can be modified by HD4000 (mapping of 6040h) to enable or disable the motor, the actual position of the current motor of axis 1 can be monitored by HD4018 (mapping of 6064h), and the current actual speed of axis 1 can be monitored by HD4020 (mapping of 606Ch).



6-2-7. Tq mode

Tq (profile torque control mode) is a torque control mode that specifies the target torque, acceleration and deceleration, etc., and acts after the position command is generated inside the servo driver. Please use this control mode in the communication period of more than 500 µs.

1. Related parameters

Tq control mode associated object (instruction · setting type)

Register	Explanation	Unit
RXPDO[0x6040]	Control word	-
RXPDO[0x6060]	Set to 4	-
RXPDO[0x6071]	Target torque setting	0.1%
RXPDO[0x6072]	Max torque	0.1%
RXPDO[0x6080]	Max motor speed	r/min
RXPDO[0x6087]	Set torque slope	0.1%/s
RXPDO[0x6088]	Set the type of used torque profile	-

Torque type

Index	Sub-index	Name	Units	Range	Datatype	Access	PDO	OP-mode	
6087h	00h	Torque slope	0.1 %	0~4294967295	U32	rw	RxPDO	Tq cst	
		Set the parameter val	et the parameter value to give the incline torque command.						
		Cyclic synchronous t	Cyclic synchronous torque mode (CST) is only valid when deceleration stops.						
		If set to 0, internal pr	rocessing	operates with 1.					
6088h	00h	Torque profile type	-	-32768~32767	I16	rw	RxPDO	tq	
		To make a torque cha	ange, set	the type of used to	orque profile				
		0: linear slope							
		1: Not supported							

Tq control mode associated object (instruction · monitoring type)

Register	Explanation	Unit
TXPDO[0x6041]	Status word	
TXPDO[0x6064]	Position feedback (motor actual position)	Command unit
TXPDO[0x606C]	Speed feedback	Command unit /s
TXPDO[0x6077]	Actual torque	0.1%

2. Control word (6040h) <tq control mode function>

Index	Sub-Index	Name/I	Description	n I	Range	DateType	Ac	cess	PD	0	Op-mode
6040h	00h	Con	trolword	0-	·65535	U16		rw	RxPl	DO	All
		Set the co	Set the control command to the servo driver such as						onversi	on.	
		Bit inform	nation								
		15	14	13	12	11	1	0	9	8	
					r				om	h	
		7	б		5	4	3	2	1	0	
		fr		0	ms		eo	qs	ev	SO	
			r		r	r					
		r = reserv	ed (not co	rrespond	ed)	fr = fault rest	set				

	oms = operation mode specific	eo = enable operation
	(control mode is based on bit)	qs = quick stop
	h = halt	ev = enable voltage
		so = switch on

Tq mode, not use oms bit.

Slave station can be enabled through modifying the control word 6040 ($6 \rightarrow 15$).

3. Status word (6041h) < tq control mode function >

Index	Sub-Index	Nan	ne/Des	cription		Range	;	DateType	Acce	ess	PDO	Op-mode
6041h	00h	5	Statusw	vord		0~6553	5	U16	r	0	TxPDO	All
		Indicat	es the s	status of	the s	ervo drive	er.					<u>.</u>
		Bit info	ormatic	n								
		15	14	13	12	11		10		9	8	
		I	R			ila		oms		rm	r	
				r	r			Target reache	ed			
		7	6	5	4	3		2		1	0	
		W	Sod	qs	ve	f		oe		so	rsto	
		r = reset	erved (1	not corre	spon	ided)		w = warning	g			
								sod = switch	1 on dis	sabled	l	
		oms =	operati	on mode	spec	cific		qs = quick	stop			
		(contro	ol mode	is based	l on l	bit)		ve = voltag	ge enab	led		
		ila = in	ternal l	limit acti	ve			f = fault				
								oe = opera	tion en	abled		
		rm = re	emote					so = switch	ned on			
								rtso = ready	to swit	tch on	l	

bit13,12,10 (operation mode specific):

Bit	Name	Value	Definition
10	target	0	halt=0 (normal): 6074h (Torque demand) target torque not achieved
	reached		halt=1 (stop as halt): shaft decelerating
		1	halt=0 (normal): 6074h (Torque demand) target torque achieved
			halt=1 (stop as halt): shaft stop (shaft speed is 0)
12	reserved	-	Not used
13	reserved	-	Not used

4. Action description of tq control mode

The Tq control mode generates torque commands based on the following parameters:

Target torque (6071h)

Torque slope (6087h)

The target torque is 6071h (target torque), the torque slope is 6087h (torque slope), the maximum speed is limited by 6080h (max motor speed), the minimum value in 6072h (max torque), 2312h (P3-28), 2313h (P3-29) limits the maximum torque (P3-28, P3-29 here are the setting parameter addresses of Xinje DS5C series servo), torque offset (60b2h) (not supported temporarily).

Operation steps:

Turn off the motor enabling, set the COE object word 6060 as 4, set the target torque of 6071h (target torque), the maximum speed of 6080h (max motor speed) and the maximum torque of 6072h (max torque);
 Turn on the motor enabling, the motor shall increase the output torque according to the set torque slope until

the set value and the speed does not exceed the set maximum speed.



5. Operation example

Take connecting Panasonic servo and Xinje DS5C servo as an example.

(1) Click [scan] or [add] in the Ethercat interface, [general] interface please keep default settings.

EthercatConfig		×
Scan Update	General Expert process data Launch parameters IO Mapping COE-Online ESC Reg	
Master PLC Master Slave StationID:O Alias:O MADMT1105BAI StationID:1 Alias:O XINJE-DSC StationID:2 Alias:O XINJE-DSC	Offset time(us): 0 PuncMappingNum: 0 ↓ SM Watchdog: PuncModeule: Servo Module ↓ Slave Information Init State Machine Current State Requested Fror Message	
	Upload Download Activate OK Cano	el

(2) Choose 1600, 1A00 in [expert process data] \rightarrow [PDO assign], PDO parameters associated with the mode can be added (1600 and 1A00 can not be added more than 24 bytes respectively).

			Eth	ercatConfig	I				
ieneral	Expert proce	ess data	Launch parameters	IO Mapping	COE-Online	ESC Reg			
SyncM	anager			PDO lis	t				
SM	Size	Size Type Index Size Name						Sign	SM
0	Size	Maille		#x1600	29.0	1st RxPDO Ma	apping		2
1		Mailb	ox	#x1601	6.0	2nd RxPDO M	apping		
	20.0	Mailo	OX 1	#x1602	6.0	3rd RxPDO Ma	apping present sel	ected	
	12.0	Outp	JL	#x1603	4.0	4th RxPDO Ma	apping list		10 C
5	13.0	Input		#x1a00	13.0	1st TxPDO Ma	apping		3
ann	ot exceed	1 24 Dy	rtes	#x1a01	12.0	2nd TxPDO M	apping		
				#x1a02	12.0	3rd TxPDO Ma	apping		
DO A	ssign			#x1a03	12.0	4th TxPDO Ma	apping		
1 +	0031								
HX HX	1600								
_ +**	1001								
	1602				_				
	1005			PDO:	Add Edit	Delete Move u	p Move down		
				Index:Su	ubldx Si	ze Offset	Name	Туре	
				#x6040	00 2.0	0.0	Control Word	UINT	
				#x607A	:00 4.0	2.0	Target Position	DINT	
				#x60FF	00 4.0	6.0	Target Velocity	DINT	
				#x6071	00 2.0	0 10.0	Target Torque	INT	
				#x6060	00 1.0	12.0	ModeOfOperation	SINT	
				#x6081	00 4.0	13.0	Profile velocity	UDINT	
				#x6083	00 4.0	17.0	Profile acceleration	UDINT	
						210	Profile deceleration	UDINT	
				#x6084	00 4.0	21.0			
				#x6084 #x607F	00 4.0	25.0	Max profile velocity	UDINT	
				#x6084 #x607F	00 4.0 00 4.0 ddition to	the default o	Max profile velocity configuration, if the	UDINT ere are oth	er needs, click add

(3) confirm the value of 6060h in [launch parameters] is 4.

	EthercatConfig ×							
General Add	Expert process data Edit Delete Move	Launch parameters IO up Move down	Mapping C	OE-Online tq mode	ESC Reg			
Row	Index: subindex	Name	Value	Bits len	Error -> exit	Error -> jump	Next row	Notes
1	#x6060:00	Modes of operation	4	8			0	Op mode
2	#x60C2:01	Interpolation time period	100	8			0	Interpolation time period
3	#x60C2:02	Interpolation time index	-5	8			0	Interpolation time index
			5	vnchroniz	ation cycle is	s 1000us		
			J	,		1000005		
	The launch pa	arameters will be as	signed to	the obje	ct dictionary	when the P	LC is pow	vered on.
	In addition to	these default para	meters, o	ther para	meters can b	be added as	needs.	
	Upload Download Activate OK Cancel							

(4) The starting address of [IO mapping] can be customized.

(5) After parameter configuration, click [download] – [activate]. After activation, the parameters will take effect.

	EthercatCo	nfig				×		
General Expert pro	cess data Launch parameters 0 Mapp	ing COE-Online	ESC Ben					
Initial addr: Word map:	HD V Bit map: HM V Shift:	10000	start address ca	n be modifie	d, optional regi	ster type D, HD		
Index:SubIdx	Name	Address	Туре	Bit length	Value			
	Control Word	HD10000	UINT	16	0			
⊕-#x607A:00	TargetPosition	HD10002	DINT	32	0			
⊕-#x60FF:00	TargetVelocity	HD10004	DINT	32	0			
	Target Torque	HD10006	INT	16	0			
	ModeOfOperation	HD10008	SINT	8	0			
	Profile velocity	HD10020	UDINT	32	0			
te-#x6083:00	Profile acceleration	HD10022	UDINT	32	0			
te- #x6084:00	Profile deceleration	HD10024	UDINT	32	0			
	Max profile velocity	HD10026	UDINT	32	0			
	Status Word	HD10010	UINT	16	0			
	ActualPosition	HD10012	DINT	32	0			
te- #x606C:00	Velocity actual value	HD10014	DINT	32	0			
te- #x6077:00	ActualTorque	HD10016	INT	16	0			
±-#x6061:00	ModeOfOperationDisplay	HD10018	SINT	8	0			
click download and activate after setting								
			Upload	Download	Activate	OK Cancel		

(6) After activation, the slave station state machine (SD8021) will go from $1 \rightarrow 2 \rightarrow 4 \rightarrow 8$, 8 indicates the OP status, at this time, SDO and PDO can receive and send messages.

(7) Modify the control word 6040 ($6 \rightarrow 15$) to enable the slave station, and make the motor move by setting the target torque, torque slope and other parameters.

(8) In Tq mode, you can set and monitor data through I/O mapping address. For example, the control word of axis 1 can be modified by HD3000 (mapping of 6040h) to enable or disable the motor, the actual torque of current motor of axis 1 can be monitored by HD3026 (mapping of 6077h), and the torque slope of axis 1 can be set by HD3014 (mapping of 6087h).

□ 信捷PLC编程工具软件 - C:\U	sers\Ac	lministra	ator\Desktop	CST.xdp		_							X
文件(E) 编辑(E) 查找\替	奂(<u>S</u>)	显示(⊻)	PLC操作(P)	PLC设置	(<u>C</u>) 送	虹顶(<u>O</u>) 1	窗口(W)	帮助(<u>H</u>)					
📄 😅 🛃 👗 🖻		ן 🗘	P 🕅			()	•	1		1 🔒	調	Q Q Q	
H KH KH KKH KKH KKH KKH KKH KKH KKH KKH	⊢ - /- 5 F6	1]- sF5	-₩ sF6 F7	-(R)(S)- sF8 sF7	{_}} ·	F11 sF1	- 1 F12	<mark>≭</mark> ॻ	- èt 📘	· T ·	C	· <mark>S</mark> 🔜 @ Q	ШЦ.
工程	4 ×	PLC1	- 梯形图				$4 $ $\times 4 $ b	PLC1-自由	由监控				Ψ×
□ 函数功能块	*						_	监控	添加修改	删除删除	全部	上移下移置顶置底	
1 配置功能块		<u> </u>						寄存器	监控值	字长	进制	注释	*
□□□								HD3000	6	双字	10	Station ID:0,#x6040:0	
			L]					HD1000	6	双字	10	Station ID:1,#x6040:0	
数据监控								HD2000	6	双字	10	Station ID:2,#x6040:0	
								HD3012	1	双字	2进制	Station ID:0,#x6088:0	E
								HD1012	0	双字	2进制	Station ID:1,#x6088:0	
🔤 密码								HD2012	0	双字	2进制	Station ID:2,#x6088:0	
● PLC 串口	=							HD3002	4	双字	10	Station ID:0,#x6060:0	
	-							HD1002	4	双字	10	Station ID: 1, #x6060:0	
								HD2002	4	双字	10	Station ID:2,#x6060:0	
BD 模块								HD3014	100	双字	10	Station ID:0, #x6087:0	
ED ED模块								HD1014	100	双字	10	Station ID: 1, #x6087:0	
HIN EtherCAT								HD2014	100	双字	10	Station ID:2,#x6087:0	
NC NC								HD3004	500	双字	10	Station ID:0,#x6071:0	
WBOX								HD1004	300	双字	10	Station ID: 1, #x6071:0	
□-·□ PLC信息								HD2004	100	双字	10	Station ID:2, #x6071:0	
	-							HD1006	3000	双字	10	Station ID: 1, #x6072:0	
		•					•	HD2006	3000	双字	10	Station ID:2,#x6072:0	-
行 0,列 0 步数:0	覆盖			PL	C1:XG2	-26T4	通讯方式	ቲ:Com , 호	枵:1			运行,扫描周期:0	.0ms

6-2-8. Mode switching

The mode switching function is to switch between three position control modes (CSP, PP, HM) in the servo enabled state, which is convenient for users to realize multi-mode switching control in project engineering. The specific functions are as follows:

" $\sqrt{}$ " indicates that switching between modes is supported; " \times " indicates that switching between modes is not supported;

Switching	CSP→PP	CSP→HM	PP→CSP	PP→HM	HM→CSP	HM→PP
mode						
Switching	\checkmark	\checkmark	×	×	\checkmark	\checkmark
result						

Note: this function is only applicable to Xinje XG2 series controller as master station and DS5C series servo as slave station at present. This function also has certain requirements for product version, as follows:

Product name	Firmware version
XG2 series PLC	V3.6x (firmware date: 20190212 and later)
DS5C series servo	V3.7.20 (firmware date: 20190222 and later)

6-2-9. Touch probe

1. Function overview

The probe function is the position locking function. When the trigger condition (EXT1/EXT2/Z phase) is met, the probe function is triggered and the motor encoder value when the condition is triggered is locked. According to the setting of probe control word 60b8, single or multiple triggering can be realized.

Note:

(1) Probe function is not supported in hm mode.

(2) Currently, only external signals are supported as trigger sources.



Composition of touch probe functions

If the trigger position is at the same point of motor rotation for one cycle, the difference between the two latched probe values in theory shall be the number of pulses emitted by motor encoder for one cycle.

It should be noted that it takes a certain time from the generation of external trigger signal to the reception of signal by driver and the execution of latch operation. Therefore, the value of probe latch must have error with the actual value, and the error size is related to motor speed, hardware performance and software processing.

2. Touch probe related objects

Register	Explanation	Unit	
	Touch probe function		
KAPDO[0x00B8]	Execute the function setting of touch probe	-	
	Touch probe status		
	Indicates the status of the touch probe function	-	
	Touch probe pos1 pos value	Command unit	
TAPDO[0x00BA]	Indicates the clamping position of the rising edge of touch probe1		
	Touch probe pos1 neg value	Command unit	
	Indicates the clamping position of the falling edge of touch probe1		
	Touch probe pos2 pos value	Command unit	
TAPDO[0x00BC]	Indicates the clamping position of the rising edge of touch probe2	Command unit	
	Touch probe pos2 neg value	Command unit	
	Indicates the clamping position of the falling edge of touch probe2	Command unit	

3. Touch probe function setting (60B8h)

The start of touch probe action, basic objects for various settings.

Corresponding bit Description:

Bit	Value	Explanation	
0	0	switch off Touch probe 1	Touch probal stop/mup
0	1	enable Touch probe 1	Touch prober stop/run
1	0	Trigger first event	Touch probe1 time mode selection
1	1	Continuous	(single trigger / continuous trigger)
2	0	Trigger with Touch probe1 input	Touch probe1 trigger mode selection
Z	1	Trigger with zero impulse signal of position encoder	(external input / Z phase)
3	-	Reserved	not used
4	0	switch off sampling at positive edge of touch probe1	Touch probal rising adaption
4	1	enable sampling at positive edge of touch probe1	Touch prober fising edge selection
5	0	switch off sampling at negative edge of touch probe1	Touch probal falling adap selection
	1	enable sampling at negative edge of touch probe1	

6-7	-	reserved	Not used		
0	0	switch off Touch probe 2	-Stop/run Touch probe2		
0	1	enable Touch probe 2			
0	0	Trigger first event	Touch probe2 event mode selection		
9	1	Continuous	(single trigger / continuous trigger)		
10	0	Trigger with Touch probe2 input	Touch probe2 trigger selection		
10	1	Trigger with zero impulse signal of position encoder	(external input / Z phase)		
11	-	Reserved	Not used		
10	0	switch off sampling at positive edge of touch probe2	Touch probat rising adaption		
12	1	enable sampling at positive edge of touch probe2	Touch probez fising edge selection		
12	0	switch off sampling at negative edge of touch probe2	Touch probal falling adda salastion		
13	1	enable sampling at negative edge of touch probe2	Touch probez rannig edge selection		
14-15	-	reserved	Not used		

Note:

(1) At present, Z-phase trigger mode is not supported, only external signal is supported as trigger source;

(2) For the same probe, do not set the rising edge and the falling edge at the same time.

4. Touch Probe status (60B9h)

Indicates the status of the touch probe function.

Corresponding bit description:

Bit	Value	Explanation						
0	0	Touch probe1 is switch off	Probe 1 action stop					
0	1	Touch probe1 is enabled	Probe 1 in action					
1	0	Touch probe1 no positive edge value stored	Rising edge probe 1 not completed					
	1	Touch probe1 positive edge value stored	Rising edge probe 1 completed					
2	0	Touch probe1 no negative edge value stored	Falling edge probe 1 not completed					
	1	Touch probe1 negative edge value stored	Falling edge probe 1 completed					
3-5	-	reserved	Not used					
6-7	-	Not supported	Not used					
0	0	Touch probe2 is switch off	Probe 2 action stop					
0	1	Touch probe2 is enabled	Probe 2 in action					
9	0	Touch probe2 no positive edge value stored	Rising edge probe 2 not completed					
	1	Touch probe2 positive edge value stored	Rising edge probe 2 completed					
10		Touch probe2 no negative edge value stored	Falling edge probe 2 not completed					
		Touch probe2 negative edge value stored	Falling edge probe 2 completed					
11-13	-	Reserved	Not used					
14-15	-	Not supported	Not used					

5. Touch probe action startup

When bit0/bit8 of 60B8h (touch probe function) is from "0 (stop) \rightarrow 1 (start)", obtain various setting conditions (60b8h: bit1 ~ 7 / bit9 ~ 15), and start touch probe action.

To make the changes of various setting conditions valid, bit0 / bit8 please return to "0 (stop)" and then to "1 (start)" again.

To switch the control mode then to use the probe function, also return bit0 / bit8 to "0 (stop)" and then to "1 (start)" again.

6. Touch probe event mode

According to bit1 / bit9 (event mode selection) of 60B8 (touch probe function), you can select "0 (trigger first event single triggering mode)" and "1 (continuous triggering mode)".

(1) Trigger first event single triggering mode (60B8: bit1=0/bit9=0)

After startup, only the first trigger signal is embedded in the mode. To get it again, it is necessary to start touch probe again.



(2) Continuous triggering mode (60B8: bit1=0/bit9=0)

After startup, the mode detecting out trigger signal embedding every time. The acquired value is held to the next coming probe signal.


7. Operation example: (take Xinje DS5C servo as an example)

(1) External wiring and probe terminal assignment: P5-62 and P5-63 are used for terminal assignment of probe function, probe1 can only be assigned to P-, probe2 can only be assigned to D- (in bus control mode, P- and D- of servo driver can only be used as probe terminals), when P- is assigned, write 5 in P5-62, and when D- is assigned, write 6 in P5-63.

(2) click [scan] or [add] in Ethercat interface, [general] interface please keep default settings.

	EthercatConfig	
Scan Update	General Expert process data Launch parameters IO Mapping COE-Online ESC Reg	
Master PLC Master	Offset time(us): 0 ♀ FuncMappingNum: 0 ♀	
Slave	SM Watchdor:	
Stationitulu Alastu Aling-USSC Coe Drive	Slave Information Init	
	State Machine Current State Requested State	
	Error Message	
	Upload Download Activate OK Cance	ł

(3) When the signal connected to the driver P- or D- jumps, the probe function is triggered and the probe value is locked in the corresponding COE object word $0x60BA \sim 0x60BD$. When reading the probe value, you need to add the corresponding probe value object (0x60BA-0x60BD) to TxPDO for data collection.

Choose 1600 and 1A00 in [expert process data] \rightarrow [PDO assign], add 60B8h in 1600, add 60BAh and 60BCh in 1A00 (here, take collecting the rising edge of two probe signals as an example, if collecting the falling edge, add 60BBh and 60BDh).

			Eth	ercatCor	ıfig								×
General	Expert proce	ess data	Launch parameters	IO Mappin	g COE	Online	ESC R	eg					
SyncMa	anager			E PDC) list								
SM	Size	Type		Index	c !	Size	Nam	e		Sign	SM		
0	0.20	Mailbo	~	#x16	600 1	5.0	1st F	xPDO Map	ping		2		
1		Mailbo	x	#x16	601 6	.0	2nd I	RxPDO Map	oping				
2	15.0	Output	+	#x16	602 6	i.0	3rd F	&PDO Map	ping				
3	13.0	Input		#x16	603 4	.0	4th F	&PDO Map	ping				
	10.0	mpor		#x1a	00 1	3.0	1st T	xPDO Map	ping		3		
L				#x1a	01 1	2.0	2nd	TxPDO Map	ping				
				#x1a	02 1	2.0	3rd T	xPDO Map	ping				
FDUA	ssign			#x1a	03 1	2.0	4th T	xPDO Map	ping				
✓ #x1	1600												
☐ #x1	1601												
#x1	602												
_ #x1	1603			E PDC): Add	Edit D	elete	Move up	Move down				
				Index	c:Subldx	Size	Э	Offset	Name	Туре			
				#x60	40:00	2.0		0.0	Control Word	UINT			
				#x60	7A:00	4.0		2.0	TargetPosition	DINT			
				#x60)FF:00	4.0		6.0	TargetVelocity	DINT			
				#x60	71:00	2.0		10.0	Target Torque	INT			
				#x60	60:00	1.0		12.0	ModeOfOperation	SINT			
				#x60)B8:00	2.0		13.0	Touch Probe Function	UINT			
				_									
				_									
				_									
L]
							[Lipland	Download	Activate	04		maal
								opioad	Download	Activate	UK	La	Incer

			Etr	ercatConti	g						
ieneral	Expert proces	ss data	Launch parameters	IO Mapping	COE-Online	ESC Reg					
SyncM	anager			PDO li	st						
SM	Size	Type		Index	Size	Name			Sign	SM	
0	0.20	Maille		#x1600) 15.0	1st RxPD	O Mapp	ing		2	
1		Mailb	DX	#x1601	6.0	2nd RxP	DO Map	ping			
י כ	15.0	Outou	#	#x1602	6.0	3rd RxPE)O Mapp	ing			
2	22.0	loout		#x1603	4.0	4th RxPE	O Mapp	ing			
5	23.0	Input		#x1a00) 23.0	1st TxPD	O Mapp	ing		3	
				#x1a01	12.0	2nd TxPI	DO Mapp	bing			
				#x1a02	2 12.0	3rd TxPE	O Mapp	ing			
PDO A	ssign			#x1a03	12.0	4th TxPD	O Mapp	ing			
✓ #x #x	a00 a01										
	a02										
#x`	a03			PDO:	Add Edit	Delete Mo	ove up	Move down			
				Index:S	ubldx Si	ze Of	fset	Name	Туре		
				#x6041	:00 2.	D 0.0)	Status Word	UINT		
				#x6064	4.00	0 2.0)	ActualPosition	DINT		
				#x6060	2:00 4.0	0 6.0)	Velocity actual value	DINT		
				#x6077	2.00	0 10	.0	ActualTorque	INT		
				#x6061	:00 1.	0 12	.0	ModeOfOperationDis	SINT		
				#x60B/	A:00 4.0	0 13	.0	Touch Probe Pos1 P	DINT		
				#x60B0	C:00 4.	0 17	.0	Touch Probe Pos2 P	DINT		
				#x60B	9:00 2.	0 21	.0	Touch Probe Status	UINT		

4 [IO mapping] default starting address is HD1000, which can be changed if necessary.

(5) After parameter configuration, click [download] – [activate]. After activation, the parameters will take effect.

eral Expert pr	ocess data Launch parameters IO Map	ping COE-Online	ESC Reg			
al addr: Wor	d HD v Bit map: HM v Shif	t: 2000	The default s	start address is	1000, the	register type can be D, HE
dex:Subldx	Name	Address	Type	Bit length	Value	
#x6040:00	Control Word	HD2000	UINT	16	0	
#x607A:00	TargetPosition	HD2002	DINT	32	0	
#x60FF:00	TargetVelocity	HD2004	DINT	32	0	
#x6071:00	TargetTorque	HD2006	INT	16	0	
#x6060:00	ModeOfOperation	HD2008	SINT	8	0	The newly added PDO
#x60B8:00	Touch Probe Function	HD2010	UINT	16	0	will be sorted automatical
#x6041:00	Status Word	HD2012	UINT	16	0	and IO mapping will be
#x6064:00	ActualPosition	HD2014	DINT	32	0	allocated in order
#x606C:00	Velocity actual value	HD2016	DINT	32	0	
#x6077:00	ActualTorque	HD2018	INT	16	0	
#x6061:00	ModeOfOperation Display	HD2020	SINT	8	0	
#x60BA:00	Touch Probe Pos1 Pos Value	HD2022	DINT	32	0	
#x60BC:00	Touch Probe Pos2 Pos Value	HD2024	DINT	32	0	
#x60B9:00	Touch Probe Status	HD2026	UINT	16	0	
			(lick download	and activ	ate after setting

(6) After activation, the slave station state machine (SD8021) will go from $1 \rightarrow 2 \rightarrow 4 \rightarrow 8$, 8 indicates the OP status, at this time, SDO and PDO can receive and send messages.

(7) After SM2010 is set to on to enable the slave station, the probe function can be started by modifying HD2010 (mapping of 69B8h).

(8) After the probe function is started, the rising edge embedding value of probe 1 can be monitored by HD2022 (mapping of 60BAh), the rising edge embedding value of probe 2 can be monitored by HD2024 (mapping of 60BCh), the status of current probe can be monitored by HD2026 (mapping of 60B9h), the current actual position of motor can be monitored by HD2014 (mapping of 6064h), and the current actual speed can be monitored by HD2014 (mapping of 606Ch).

PLC1	- 梯形图						4	$\triangleright \times$
0							- MOTO D0 D2 D4 K1 99999999 65538	5 50
7	SM2003						(R)	

PLC1-自	由监控			p ×
监控	添加修改删除	ѝ 删除:	全部 上和	多 下移 🏭 сн 🚺 🚎 📀 🚦
寄存器	监控值	字长	进制	注释
SM2010	ON	位	-	轴1使能
HD2008	8	单字	10进制	Station ID:0, #x6060:0
HD2010	1 0011 0001 0011	双字	2 进制	Station ID:0,#x60B8:0
HD2026	1 0000 0001	双字	<mark>2</mark> 进制	Station ID:0, #x60B9:0
HD2014	13	双字	10进制	Station ID:0,#x6064:0
HD2016	-16	双字	10进制	Station ID:0,#x606C:0
HD2022	0	双字	10进制	Station ID:0, #x60BA:0
HD2024	0	双字	10进制	Station ID:0, #x60BC:0
D0	99999999	双字	10进制	指定轴1的相对位置
D2	65535	双字	10进制	指定轴1的运动速度
D4	50	双字	10进制	指定轴1的加减速时间

6-3. Application of other brands slave station

Take the configuration of Panasonic servo and CSP mode as an example.

(1) Connect the XG2 host with the Panasonic servo in the same way as the communication structure diagram described in section 1-4.

(2) In the case of confirming the normal communication between PLC and Xinje PLC programming tool software, click [scan] or [add] slave station on the EtherCAT interface, and the [general] interface uses the default configuration.

Note: [scan] to obtain the topology of the current slave, it will try to read the EEPROM and object dictionary of the slave to generate temporary XML. If there is a ready-made XML file locally (it exists in the EtherCAT/ folder under the XDPpro installation directory), you can directly [add] it to the list of slave stations without stopping the PLC.

Ethercat参数配置	
扫描 添加 复制 删除 上移 下移 更新 主站	常规 查察过程對据 启动参数 IO映射 CoE-Online ESC寄存器
PLC Master	偏移时间 (uz): 500 🚖 功能映射号: 0 🚖
从站 ——StationID:0 Alias:1 MBDHT2510BA1	SM看门狗: マ 功能復快选择: Servo Module -
	从站信息。初始化
	状态机 Pre-OP OP OP
	Init Safe-OP
	当前状态 Pre0P
	请水朳心 If eur 错误信息
	上传 下戦 凝活 頑定 取消

(3) choose 1600, 1A00 in [expert process data] \rightarrow [PDO assign]. (The default configuration can meet the basic use of CSP, and other PDO parameters can be added if necessary)

eneral	Expert proces	ss data	Launch parameters	IO Mapping (COE-Online	ESC Reg			
SyncM	anager			PDO list					
SM	Size	Type		Index	Size	Name		Sign	SM
0	5120	Mailler		#x1600	13.0	1st RxPDO Ma	apping		2
1		Mailbo	JX	#x1601	6.0	2nd RxPDO M	apping		
2	13.0	Outou	+	#x1602	6.0	3rd RxPDO Ma	apping		
2 2	13.0	Inout	-	#x1603	4.0	4th RxPDO Ma	apping current		
5	13.0	input		#x1a00	13.0	1st TxPDO Ma	pping selected	d list	3
m	ax 24 bytes	5		#x1a01	12.0	2nd TxPDO Ma	apping		
				#x1a02	12.0	3rd TxPDO Ma	apping		
FUO A	ssign			#x1a03	12.0	4th TxPDO Ma	apping		
#x #x	1602 default 1603	t select	1600, 1A00	PDO: A	dd Edit	Delete Move u	p Move down		
#x #x	1602 default 1603	t select	1600, 1A00	PDO: A	dd Edit	Delete Move u ze Offset	p Move down Name	Туре	
#x #x	1602 default 1603	t select	1600, 1A00	PDO: A	dd Edit oldx Sia 10 2.0	Delete Move u ee Offset	p Move down Name Control Word	Type UINT	
#x #x	1602 default 1603	t select	1600, 1A00	PDO: A	add Edit oldx Sia 0 2.0 0 4.0	Delete Move u ce Offset 0.0 2.0	p Move down Name Control Word TargetPosition	Type UINT DINT	
#x #x	1602 default 1603	t select	1600, 1A00	PDO: A	add Edit oldx Sia 0 2.0 0 4.0 0 4.0	Delete Move u ze Offset 0 0.0 2.0 6.0	p Move down Name Control Word TargetPosition TargetVelocity	Type UINT DINT DINT	
#x #x	1602 default 1603	t select	1600, 1A00	PDO: A Index:Sub #x6040:0 #x607A:0 #x607F:0 #x607F:0	add Edit oldx Sia 00 2.0 10 4.0 10 4.0 10 2.0	Delete Move u te Offset 0.0 2.0 6.0 10.0	p Move down Name Control Word TargetPosition TargetVelocity TargetTorque	Type UINT DINT DINT INT	
#x #x	1602 default 1603	t select	1600, 1A00	PDO: A Index:Sub #x6040:0 #x607A:0 #x607F:0 #x6071:0 #x6060:0	dd Edit oldx Sia 00 2.0 00 4.0 00 4.0 00 2.0 00 4.0 00 1.0	Delete Move u te Offset 0.0 2.0 0.1 2.0 0.1 10.0 0.1 12.0	p Move down Name Control Word TargetPosition TargetVelocity TargetTorque ModeOfOperation	Type UINT DINT DINT INT SINT	
#x #x	1602 default 1603	t select	1600, 1A00	PDO: A Index:Sub #x6040:0 #x607A:0 #x60FF:0 #x60FF:0 #x6060:0	dd Edit oldx Siz 00 2.0 00 4.0 00 4.0 00 2.0 00 4.0 00 1.0	Delete Move u te Offset 0 2.0 0 6.0 10.0 10.0 12.0 12.0	p Move down Name Control Word TargetPosition TargetVelocity TargetTorque ModeOfOperation	Type UINT DINT DINT INT SINT	
#x #x	1602 default 1603	t select	1600, 1A00	PDO: A Index:Sut #x6040:0 #x607A:0 #x607F:0 #x6071:0 #x6060:0	add Edit oldx Siz 00 2.0 00 4.0 00 4.0 00 2.0 00 1.0 00 1.0 00 1.0	Delete Move u re Offset 0 0.0 2.0 6.0 10.0 10.0 12.0 9	p Move down Name Control Word TargetPosition TargetVelocity TargetTorque ModeOfOperation	Type UINT DINT DINT INT SINT s for basi	c operation,
#x #x	1602 default 1603	t select	1600, 1A00	PDO: A Index:Sut #x6040:0 #x607A:0 #x60FF:0 #x60F1:0 #x6060:0 defa for c	add Edit bldx Six 10 2.0 10 4.0 10 4.0 10 2.0 10 4.0 10 2.0 10 1.0 10 1.0 10 1.0 10 1.0 10 1.0	Delete Move u re Offset 0.0 2.0 0.0 10.0 12.0 12.0 guration includes, please clice 10.0	p Move down Name Control Word TargetPosition TargetVelocity TargetTorque ModeOfOperation des the parameter ck add	Type UINT DINT DINT INT SINT s for basi	c operation,
#x #x	1602 default 1603	t select	1600, 1A00	PDO: A Index:Sut #x6040:0 #x607A:0 #x607F:0 #x6071:0 #x6060:0 defa for c	add Edit bldx Si: 10 2.0 10 4.0 10 4.0 10 2.0 10 4.0 10 2.0 10 1.0 10 1.0 10 1.0 10 1.0 10 1.0	Delete Move u re Offset 0.0 2.0 0.0 10.0 10.0 12.0 guration includes, please clice	p Move down Name Control Word TargetPosition TargetVelocity TargetTorque ModeOfOperation des the parameter ck add	Type UINT DINT DINT INT SINT s for basi	c operation,
#x #x	1602 default 1603	t select	1600, 1A00	PDO: A Index:Sut #x6040:0 #x607A:0 #x607F:0 #x6071:0 #x6060:0 defa for c	add Edit bldx Six 10 2.0 10 4.0 10 4.0 10 2.0 10 4.0 10 2.0 10 1.0 10 1.0 10 1.0 10 1.0 10 1.0	Delete Move u te Offset 0.0 2.0 0.0 0.0 0.0 0.0 0.0 0.0	p Move down Name Control Word TargetPosition TargetVelocity TargetTorque ModeOfOperation des the parameter ck add	Type UINT DINT DINT INT SINT s for basi	c operation,

(4) Confirm the value in **【**Launch parameters **】** 6060h is 8.

		Etherca	atConfig)					×
General	Expert process data	Launch parameters 0	Mapping	COE-Online	ESC Reg				
Add	Edit Delete Move	up Move down		CSP mode	e				
Row	Index: subindex	Name	Valve	Bits len	Error -> exit	Error -> jump	Next row	Notes	
1	#x6060:00	Modes of operation	8	8			0	Op mode	
2	#x60C2:01	Interpolation time period	1	8			0	Interpolation time period	
3	#x60C2:02	Interpolation time index	-3	8			0	Interpolation time index	
				synchroni	zation period	ł			
	The launch	parameters will ass	ion valu	ies to the c	biect diction	arv when th	e PLC is	powered on	
	In addition	to these default pa	ramete	rs other na	rameters ca	be added a	as needs		
	induction	to these deludit pu	unete	is, other pu	indiffecters edi	i be dudeu i	as needs.		
-									
									-
					Upload	Downlo	ad Ac	ctivate OK	Cancel

(5) 【IO mapping】 default start address is HD1000, it can be changed as needs.

6 After parameter configuration, click [download] – [activate]. After activation, the parameters will take effect.

	EthercatCo	nfig				×
General Expert pro	d HD v Bit map: HM v Shift:	ing COE-Online	ESC Reg	an be chang	ed, register type car	ו be D, HD
Index:SubIdx	Name	Address	Туре	Bit length	Value	
	Control Word	HD10000	UINT	16	0	
	TargetPosition	HD10002	DINT	32	0	
	TargetVelocity	HD10004	DINT	32	0	
	TargetTorgue	HD10006	INT	16	0	
	ModeOfOperation	HD10008	SINT	8	0	
	Status Word	HD10010	UINT	16	0	
	ActualPosition	HD10012	DINT	32	0	
	Velocity actual value	HD10014	DINT	32	0	
	ActualTorque	HD10016	INT	16	0	
	ModeOfOperationDisplay	HD10018	SINT	8	0	
T	he address will be arranged aut he non repeated address will be	omatically. If the selected auto	he address is rep matically.	peated, an er	ror will be reported	and
			Click	download ai	Activate after sett	ing Cancel

(7) After activation, the slave state machine (SD8021) will change from $1 \rightarrow 2 \rightarrow 4 \rightarrow 8$, and 8 represents OP state. At this time, SDO and PDO can receive and send message

(8) Set SFD3000 to 0, set SM2010 on to enable the slave station (if set on SM2010 as soon as power is on, the slave station will be enabled after the master station status (SD8000) is switched to 8), and make the motor run through Xnet motion control commands (MOTO, MOTOA, etc.).

(9) In CSP mode, HD1002 (mapping of 607Ah) can be used to monitor the current given position, HD1012 (mapping of 6064h) can be used to monitor the actual position of the current motor, and HD1014 (mapping of 606Ch) can be used to monitor the current actual speed.



PLC1-自由监控				7 ×
监控 添加	修改删除删除全	部 上移	下移置顶	置底
寄存器	监控值	字长	进制	注释
HD 1008	8	双字	10进制	Station ID:0,#x6060:0
HD1002	28209496	双字	10进制	Station ID:0,#x607A:0
HD1012	28209496	双字	10进制	Station ID:0,#x6064:0
HD1014	60	双字	10进制	Station ID:0,#x606C:0
SM2010	ON	位	-	轴1使能
D0	13107200	双字	10进制	指定轴1的相对位置
D2	131072	双字	10进制	指定轴1的运动速度
D4	10	双字	10进制	指定轴1的加减速时间
SD2008	13107199	双字	10进制	轴1当前位置
HSD104	13107202	双字	10进制	轴1目标位置反馈脉冲数
SFD3000	0	単字	10进制	轴1运行模式
SFD3001	2	単字	10进制	轴1电机类型

7. NC configuration interface

7-1. Function overview

The NC control function of Xinje PLC programming software is a pure software motion control based on PC. Its function is similar to the traditional motion control module and motion control card. Because NC and PLC run on the same CPU, the data exchange between motion control and logic control is more direct and fast, NC is more flexible and powerful than traditional motion controller. Due to the powerful function of bus motion control, more parameters are involved. This function is specially developed to facilitate customers to configure parameters of all axis registers of slave station.

7-2. Function description

7-2-1. Open NC

When the Xinje PLC programming software is opened and the PLC is successfully connected, open [Project] \rightarrow [NC], and a communication configuration interface will pop up.



7-2-2. General interface

		NC	×
General	Multi-axis Control		
	Instruction refresh period (us):	1000	
	Slave Numbers:	32	
	Error retries:	3	

The value of the function interface will be refreshed in real time.

Parameter	Explanation
Instruction refresh period	Synchronization unit period. That is, the time interval between master station and
	slave station which can be monitored by SFD2990.
Slave numbers	Range 1~32, can be monitored by SFD991.
Error retries	Can be monitored by SFD2992.

7-2-3. Multi-axis control interface

			NC		×
General Multi-a	exis Control				
Add Del S	ingle-axis-Contro				
Axis	Actual-Pos	Setp-Pos	Setp-Velo	ErrInfo	
✓ Axis0	0	0	0	No error	
✓ Axis1	0	0	0	No error	
Enable	Clear-Alam				

Parameter	Explanation
Add	Add the axis
Del	Delete the axis
Single-axis-control	Single axis debugging for the axis selected by the mouse
Enable	Enable the axis selected by the check box
Clear-alarm	Clear the alarm for the axis selected by the check box

Note:

(1) The multi-axis debugging interface is in real-time refresh state.

- (2) When enable is turned on, the check box of the axis cannot be operated.
- (3) When you delete an axis, you cannot delete an axis whose check box is selected.
- (4) Single axis debugging can also be carried out by double clicking the selected axis.
- (5) Motion operations operate only on the axis selected by the check box.

7-2-4. Single-axis-control interface

Select the axis to be debugged, and the background color of the selected axis is blue. Click [single-axis-control] to display the following interface to configure the parameters of the axis. Double click the selected axis to enter the single axis control interface.

			NC		×
General Mut	ti-axis Control	_			
Add Del	Single-axis-Control				
Axis	Actual-Pos	Seto-Pos	Setp-Velo	Errinfo	
Axis0	0	0	0	No error	
✓ Axis1	0	0	0	No error	
1					

		Single-a	axis Control			
meters Debug						
nport Export - Expand C	ollage Refresh-fixed-params Do	wnload-offline-para	ims			
Name	Address	Offline Value	Online Value	Туре	Unit	Information
Basic parameters						
The operation mode	SFD3000+60*(N-1) = SFD3000	0	0	16bit integer		0: position control with trai
Motor encoder type	SFD3001+60*(N-1) = SFD3001	1	1	16bit integer		1: incremental encoder2: s
Encoder line number	SFD3002+60*(N-1) = SFD3002	131072	131072	32bit integer		The register is set accordi
Amount of mobile	SFD3004+60*(N-1) = SFD3004	131072	131072	32bit integer	Pulse num	The reference equivalent
Direction of motion lo	SFD3047+60*(N-1) = SFD3047	0	0	16bit integer		Direction of motion logic.0
Position the completi	SFD3048+60*(N-1) = SFD3048	65	65	32bit integer	Pulse num	Position the initial value of
Movement restrictions				_		
Minimum position limit	SFD3014+60*(N-1) = SFD3014	-100000000	-100000000	32bit integer	Pulse num	Minimum soft limit position
Maximum position limit	SFD3016+60*(N-1) = SFD3016	100000000	100000000	32bit integer	Pulse num	Maximum soft limit position
Maximum speed limit	SFD3018+60*(N-1) = SFD3018	6553600	6553600	32bit integer	Pulse num	According to the highest s
Maximum acceleratio	SFD3020+60*(N-1) = SFD3020	10	10	32bit integer	ms	The PLC will automatically
Maximum deceleratio	SFD3022+60*(N-1) = SFD3022	10	10	32bit integer	ms	The PLC will automatically
The initial value of th	SFD3024+60*(N-1) = SFD3024	100	100	32bit integer	Pulse num	When enabled, the PLC d
Initial point velocity	SFD3026+60*(N-1) = SFD3026	1000	1000	32bit integer	Pulse num	When enabled, the PLC d
Maximum position fe	SFD3029+60*(N-1) = SFD3029	2500	2500	16bit integer		Positive integer: deviation
Minimum limit interval	SFD3034+60*(N-1) = SFD3034	255	255	16bit integer		Specify the minimum electr
Maximum limit interva	SFD3035+60*(N-1) = SFD3035	255	255	16bit integer		Specify the number of the
Back to the origin						
The origin position	SFD3010+60*(N-1) = SFD3010	0	0	64bit integer		After performing the return
Close signal terminal	SFD3036+60*(N-1) = SFD3036	255	255	16bit integer		Specify the number of the
Origin terminal setting	SFD3037+60*(N-1) = SFD3037	255	255	16bit integer		Specifies the number of th
Return to origin mode	SFD3038+60*(N-1) = SFD3038	0	0	16bit integer		0: no Z phase mode.At re
- Regression velocity	SFD3040+60*(N-1) = SFD3040	20000	20000	32bit integer	Pulse num	High speed of origin regre
- Regression velocity VL	SFD3042+60*(N-1) = SFD3042	5000	5000	32bit integer	Pulse num	Low speed of origin regres
Crawling speed	SFD3044+60*(N-1) = SFD3044	1000	1000	32bit integer	Pulse num	Slow creep rate of origin r
Fully closed-loop						
- Fully closed-loop puls	SFD3006+60*(N-1) = SFD3006	0	0	32bit integer		High speed than equivale
The fully closed-loop	SFD3028+60*(N-1) = SFD3028	0	0	16bit integer		
Initial value of fully cl	SFD3052+60*(N-1) = SFD3052	0	0	floating-poi		When servo enabled, this
Fully closed-loop posi	SFD3058+60*(N-1) = SFD3058	0	0	floating-poi		The deviation limits for all

Parameter	Explanation
Import	Import the saved single axis parameter file, and the parameters are displayed in the
	column of "offline value".
Export→export to file	Save the parameters selected in the check box to a file.
Export→export to axis	Copy the online value selected in the check box to one axis (can copy to multi-axis at
	the same time), the axis selection interface is shown below.



Parameter	Explanation
Expand	Expand to display all parameters
Collage	Only all primary nodes are displayed, not child nodes
Refresh-fixed-parameter	Refresh online values
Download-offline-parameter	Download the offline value selected in the check box to the PLC

Note:

(1) Open the interface and all parameters are not selected.

(2) If the "offline value" is not consistent with the "online value" after editing, the check box will be automatically checked; if it is consistent, the check box will be cancelled.

(3) At present, all parameters displayed in the interface are fixed parameters, which cannot be refreshed in real time. Click refresh fixed parameters to refresh the online values of fixed parameters.

(4) Modify the online value of the fixed parameter by modifying the offline value, and click [download offline parameter] to write the parameter value in the checked state. After writing, click refresh fixed parameter to refresh the online value of fixed parameter to check whether the modification is successful.

(5) [download offline parameters] the offline parameters downloaded are the ones selected in the check box. If they are not selected, they will not be downloaded.

(6) The exported content of the [export] function is the parameter selected in the check box. If the parameter is not selected, it will not be exported.

7-2-5. Debug interface

				Single-axis Co	ontrol			×
Parameters Det	bug							
Operate			[] [
Enable		Clear-Alam	Left-Inching	Right-Inching	Return to origin	Reverse origin	Slow down	
Jog Setting								
Jog speed:	0		[pulse/s]					
Jog step:	0		[pulse]					
Set up Location setting	: 0		[pulse]					
Speed setting:	0		[pulse/s]					
Acceleration time	e: 0		[ms]					
	U. U		fuel					
Deceleration tim	ie: 0		[ms]					
Status								
location: 0		[pulse]						
Current 0 speed: 0		[pulse/s]						
Error: N	lo error							
Limit state:								

Parameter	Explanation
Enable	Display enable status and give enable signal at the same time
Clear alarm	Clear the alarm
Left-inching, right-inching	Jog operation
Return to origin, reverse origin	Return to origin in forward or reverse direction
Slow down	Stop as the setting deceleration time
Jog setting	Jog operation setup
Set up	Motion parameter setup
Status	Display current motion status

Note: the parameters in [jog setting] and [set up] can be modified and refreshed in real time after the drive is enabled, and can be executed according to the newly set parameters. If enable is turned off and enabled again, the data set in "online value" in "parameter configuration interface" will still be displayed.

8. Oscilloscope function

8-1. Operating conditions of oscilloscope

The oscilloscope function can only be used when the EtherCAT slave is connected and the programming software is in the X-NET monitoring mode.

8-2. Oscilloscope interface

Click the oscilloscope icon as shown in the figure to open the oscilloscope interface.



The interface is shown as below:



Parameter	Explanation
Start	The oscilloscope starts to work
Stop	Oscilloscope stops working
Import	Open saved oscilloscope data
Export	Save all the oscilloscope data (curve configuration, cursor, trigger, image data, oscilloscope
	working time, etc.) under the current situation

Shaft	Display different Y-axes of the same display area into different regions.			
	Note: this function is valid only when the curve is configured with different axes; when there			
	is only one axis, axis splitting cannot be realized. When the user configures different axes,			
	multiple Y-axes are displayed. Only when there are more than one y-axis, the function of axis			
	splitting can be realized.			
Interval (us)	The time interval between the two sampling points, the unit is us (default is the value of the			
	synchronization unit cycle in EtherCAT)			
Pos	Locate a curve starting from one time or value			
Time	Display start, end and oscilloscope working time			

Interface operation instructions

Parameter	Explanation
Zoom in	Hold the left mouse button and drag to select the area to be enlarged. The default zooming method is
	to zoom in both horizontally and vertically (region magnification). Right click the menu displayed in
	the display area to modify the zoom mode (horizontal zoom in and vertical zoom in).
Zoom out	Right click the display area and click restore to original/restore to previous zoom in the display menu
	to zoom out
Drag	There are three ways to drag: 1) hold the Ctrl + left button, the cursor changes to hand type and drag
	the image; 2 press and hold the middle button (wheel) of the mouse to drag the image; 3 when the
	horizontal zoom and vertical zoom in the right-click menu are not selected (there is no zoom function
	at this time), press and hold the left mouse button to drag the image.

Right mouse button function:

Parameter	Explanation
Save chart	Save the image of the current interface in picture format
Export data	Save the image data in Excel format
Restore to original scale	Display the entire curve
Display node value	When the mouse moves to a node on the curve, the coordinate axis value of the node
	is displayed
Restore to previous scale	The image zoom out to the previous display scale and area
Scale horizontally	Zoom in / out X axis only
Zoom vertically	Zoom in / out Y axis only (region can be zoomed only if both horizontal and vertical
	scaling are selected)

Note: when the interface displays data for more than one minute, the data curve before one minute will be cleared, but the data still exists. Users need to click export data in the right-click menu to view all data.

8-4. Oscilloscope configuration interface

Display type	0 X Y		
General conf Channel Cu Add Del Group Swi	guration Irsor Trigge Edit tch	er	
Configurat Axis-Var	Color	Display	Belong-Axis

8-4-1. Oscilloscope type configuration

Parameter	Explanation
ΥT	Abscissa is time variable, ordinate is single register variable, only single register variable is needed
	to configure curve
XY	Abscissa and ordinate are both register variables. When configuring the curve, two register
	variables need to be configured

8-4-2. Axis variable configuration

Axis-Var	Color	Display	Belong-Axis

Parameter	Explanation
Add	Add the curve
Delete	Delete the curve
Edit	Edit curve properties

Note: when the oscilloscope starts to work, can not add or delete curves, only can edit curve attributes.

8-4-3. Register configuration

Cick add to show the register configuration interface:

Configura	ation Register
Channel configuration	
Y 轴 Reg: Bai	tch monitoring 1
Mode	Style
⊖ Bit ⊖ Float	Decimal O Unsigned
○ Word ○ QWord	
DWord Double	
Chart display Settings	
X-Axis: Col	Axis1 V
Y-Axis: 🖲 Display 🔿 Hid	le
	OK Cancel

Parameter	Explanation		
X axis	Register type (HD, D, SD) + register offset (number)+ register data type		
Y axis	Register type (HD, D, SD) + register offset (number)+ register data type		
Color	Curve display color (click the color block to modify the curve color)		
Display	The curve displays on the oscilloscope display interface or not		
Axis1	Which axis is the curve displayed on the oscilloscope display interface (for the realization of the		
	axis splitting function)		

Note:

(1) When the oscilloscope type is YT, the [X-axis] cannot be configured, and the abscissa displays the time.

(2) When the oscilloscope starts to work, it can only adjust the color, display and axis attribute of the curve, and the register of XY axis cannot be modified.

8-4-4. Cursor configuration

General con Channel	figuration ursor Trigg	er
X-Axis	Y-Axis Del	Val
Name	Туре	Color

Parameter	Explanation
X axis	Add X-axis cursor (vertical cursor, perpendicular to X-axis)
Y axis	Add Y-axis cursor (horizontal cursor, perpendicular to Y-axis)
Delete	Delete the cursor
Value	Display cursor difference data

8-4-5. Difference interface

Click [value] to show below window:

			Cursor Difference	×
Time	X-Axes	Y-Axes		
				=

Parameter	Note
Time	Show / hide the status time area (this area is only available when the oscilloscope type is YT).
X-axes	Show / hide Channel/ X-Axes area
Y-axes	Show/ hide Y-Axes area

Note:

(1) Display rules of status time area:

A. Display two time: computer time (PC time); oscilloscope working display time

B. Time data source: the value of the x-axis cursor on the x-axis (time axis).

(2) Channel area display rules:

A. Data source: Y-axis register data corresponding to X-axis cursor (data on Y-axis corresponding to X-axis in coordinate system). For example, the time of x-axis cursor on x-axis is 1s, and the data at 1s of y-axis register variable is used as display data source.

B. Channel column: displays all the register variables monitored on the oscilloscope.

(3) Display rules of Y-axes area:

- A. Data source: data of y-axis cursor on vertical axis.
- B. For each additional y-axis, a piece of data is added and displayed in the table.

8-4-6. Trigger configuration

General con	figuration	er		
Channel C	ursor			
Add De	el Edit Po	s: 1/8	•	
Name	Status	Release	Enable	

Parameter	Note
Add	Add the trigger
Del	Delete the trigger
Edit	Edit the trigger
Pos	The location on the screen after the trigger is triggered

Note:

(1) Trigger position description: for example, if the trigger position is 1/8, the trigger will stop and will not stop immediately. When the data obtained after trigger can occupy 7/8 of the current interface, the display will stop.

(2) After the trigger is triggered, the state changes to red. At the same time, a dotted line is displayed on the trigger position on the interface to indicate the trigger position.

(3) When the trigger version is XY, it stops immediately after the trigger is triggered.

After click [add], it will show below window:

触发器配	置 🗾
对象:	
条件:	(AND 🔻
方式:	Risingedge 🔹
阀值:	0
行为:	StopDisplay 🔹
使能:	💿 True 🔘 False
	确定 取消

Parameter	Note
Object	Configured register variables
Condition	Logical relationship between triggers of the same register object
Mode	Trigger edge (Risingedg, fallingedge)
Threshold	Trigger threshold
Action	The action after triggering (StopDisplay, ReStartDisplay)

Enable Enable the trigger

8-4-7. Examples of oscilloscope application

For example: Xinje XG2 series PLC controls two DS5C servo drivers, the CSP mode is used to make the motor forward and reverse, and the actual position waveform is monitored.

The oscilloscope interface configuration is as follows:



Among them, HD1012 is the mapping of axis 1-6064h, and HD1032 is the mapping of axis 2-6064h.

Click [start] to run the oscilloscope. At this time, the oscilloscope displays the current positions of the two axes. When the axis is not running, it will be two straight lines (the waveform will have a small jitter, and the proportion of ordinates will be obvious when the two axes are running). After the two axes are running, the waveform will change, and the coordinate proportion will be automatically adjusted during the operation of the oscilloscope. If you want to view the waveform, click [stop] and right click [restore to the original zoom ratio], you can view the complete waveform (the waveform will only be displayed within 60s, but all data will be saved. Right click menu [export data] can display data in Excel form).

The waveform is shown as below:



There are two coordinate axes on the left, axis 2 ordinate on the left and axis 1 ordinate on the right.

If it needs to be divided into two coordinate axes, click [sub axis] (the axis variable needs to be set to two different axes).

After [sub axis], the figure is as follows:



Click the cursor configuration [X axis] [Y axis] to generate a cursor (two cursors are configured for X axis and Y axis in the figure), and the cursor position can be dragged by the mouse.



Click the cursor configuration [value] to enter the cursor difference interface, which can monitor the specific value of the register with the cursor.

bsolute P hart Posi	08:24:49:580	08:24:18:9	-20 670-	
Chart Posi	00.50.007		02 -30.010s	
	00:50:067	00:19:389	-30.678s	
Channel	CO	C1	C1-C0	
НD1012	14135	29738	15603	
HU1032	45858	1990265	1944407	
I-AX15	UZ	L3	L3-L2	
Axis(1)	220503.194	1552946 514	657352 463	

StatusTime area:

Absolute Position represents the current actual time (that is, computer time) indicated by the cursor. Chart Position indicates the working time of oscilloscope (i.e. abscissa of cursor position).

Channel area:

The data in the region represents the value of the register corresponding to the cursor position. Combined with the [status time] area, the real-time value of the register can be monitored. As shown in the figure, the value of register HD1012 in 50.067s is 14135 and that in register HD1032 is 45858. In 19.389s, the value of register HD1012 is 29738 and the value of register HD1032 is 1990265; [C1-C0] represents the difference between the positions of two cursors (Note: when the number of cursors set on one axis is greater than or equal to 2, the cursor difference interface will automatically generate cursor difference data)

Axis area:

The data in the area represents the value corresponding to the cursor of [Y axis], as shown in the figure, the value of [C2] in Axis1 is 228583.194, the value in Axis2 is 895594.051; the value of [C3] in Axis1 is 897091.24, and the value in Axis2 is 1552946.514; and [C3-C2] represents the difference between the corresponding values of the two cursors.

The trigger configuration is show as below:

触发器配	置 💽
对象:	HD1012 -
条件:	(AND -
方式:	Risingedge 🔹
阀值:	50000
行为:	StopDisplay 🔻
使能:	💿 True 🔘 False
	确定 取消

Configure two triggers, the object of which are all HD1012, the condition is AND, the mode is rising edge, the threshold value is 50000 and the other is 100000, the action is StopDisplay, enable is True.

触发器:	添加删	除编辑(☆置: 4	4/8	•
名称	状态	边沿	使能		
HD1012		Rising	True		
HD1012		Rising	True		

Trigger position is set to 4/8, the results of oscilloscope operation are as follows:



The dotted line in the figure is the trigger position of the trigger. When the trigger is triggered, the trigger position accounts for 4/8 of the current waveform diagram, and the oscilloscope will stop (that is, the dotted line position accounts for half of the current waveform diagram). You can see that the trigger status has turned red, indicating that both triggers have been triggered. If the trigger condition is selected AND, it means that the trigger will stop only when both triggers are triggered, so the trigger position register value is 100000 (if the trigger condition is OR, any one of the triggers will stop if it is triggered; if one of the two trigger conditions is AND the other is OR, the trigger condition will be judged as OR).

9. EtherCAT instruction

9-1. SDO read [EC_SDORD]

(1) Instruction overview

The SDO value is read from the target station and stored in the local register.

SDO read [EC	_SDORD]		
Execution	Edge triggering	Suitable model	XG2
condition			
Hardware	V3.6 and above	Software	V3.6 and above

(2) Operand

Operand	Function	Range	Туре
S0	EtherCAT slave station no.: Station	0~63	16-bit constant or single word register
	ID		
S1	Object index	0x1000~0xffff	16-bit constant or single word register
S2	Object subIndex	0~255	16-bit constant or single word register
S3	Value register		Single word register
S4	Status register		Single word register
S5	Completion flag bit		Bit

(3) Suitable software component

Operand	Word										Bit							
		System							Constant	Mo	dule				Syst	em		
	D	FD	TD	CD	DX	DY	DM	DS	K/H	D	QD	Х	Y	Μ	S	Т	С	Dn.m
S0	٠								•									
S1	٠								•									
S2	٠								•									
S3	٠																	
S4	٠																	
S5												٠	٠	•	•	•	•	

Note: D is D and HD; TD is TD and HTD; CD is CD, HCD, HSCD and HSD; DM is DM and DHM; DS is DS and DHS. M is M, HM and SM; S is S and HS; T is T and HT; C is C and HC.

(4) Function and action

NO.		\bigcirc SO \cdot	S1 ·	$(S2 \cdot)$	S3 ·	<u>S4</u> ·	S5 .
	EC_SDORD	K0	H6060	K0	D0	D2	MO

- Instruction meaning: Read the value in slave object dictionary 0x6060: 00 of StationID0 to D0.
- Instruction description: EC_SDORD is used to read the value in slave object dictionary.

Cran Undate	General Fund	t nanona data 🗍 lavar	ah naramatan	IO Manaina	COE-Online	ESC Per						
Scan Opdate	General Dope	it process data Laurio	un parameters	IO Mapping	COL OTIMIC	Eachey						
laster	All object dictionaries Receiving PDO (FxPDO) Send PDO (TxPDO)											
LC Master	Index:SubInd	x Name			Flag	Value	Communic	ation error message				
	#x605A.00	Quickston option	code		rw.		function dis	able				
ave	- #x605B:00	Shutdown option	code		rw		function dis	sable				
StationID:0 Alias:0 XINJE-DS5C CoE Drive	- #x605C:00	Disable operation	option code		rw.		function di	able				
	- #x605D-00	Halt option code	- option ocdo		rw		function dis	able				
	-#x605E-00	Fault reaction on	tion code		rw.		function dis	able				
A	# 6060 10	Modes of operation	07		rw.		function di	able				
	- #x6061.00	Modes of operation	on display	-	ro		function dis	able				
slave station number	-#x6062.00	Position demand	value		m		function dis	able				
	-#x6063.00	Position actual in	temal value		ro		function di	able				
	- # 6064.00	Position actual va	alue		m		function dis	able				
Index	#x6065.00	Following error wi	indow		rw.		function di	able				
	#x6066.00	Following error wi	indow time		rw		function di	sable				
	-#x6067:00	Position window			rw.		function dis	able				
	-#x6068:00	Position window t	time		rw.		function dis	able				
	- #x606B.00	Velocity demand	value		ro		function dis	sable				
	-#x606C:00	Velocity actual va	alue		ro		function dis	able				
	-#x606D:00	Velocity window			rw		function dis	able				
Subindex	- #x606E:00	Velocity window t	time		DW.		function dis	able				
	- #x606E.00	Velocity threshold	1		rw		function di	able				
	-#x6070:00	Velocity threshold	time		DW .		function dis	able				
	-#x6071:00	Target torque			rw.		function dis	able				
	- #x6072.00	Max torque			rw.		function dis	able				
	-#x6073.00	Max current			m		function di	able				
	- #x6074.00	Torque demand	value		m		function dis	able				
	-#x6075:00 Motor rated current			ro	function disable							
	±x6076:00 Motor rated torque ro											
						[] Jaharad	Daumland	Activate	OK	Canad		

The figure shows the slave and the corresponding object dictionary index, read the value in slave object dictionary 0x6060: 00 of StationID0 to D0.

VO		\bigcirc SO \cdot	S1 ·	$(S2 \cdot)$	S 3 ·	<u>S4</u> .	S5 .
	EC_SDORD	K0	H6060	K0	D0	D2	M0

S0: K0 or write 0 in the corresponding register. Note: the first slave station ID is 0, not 1.

- S1: H6060 or write K24672 in the corresponding register (H6060).
- S2: It is 00 at present, write K0 or 0 in the corresponding register.
- S3: The read value is saved in local register D0.
- S4: The processing status of instruction.

S5: Instruction processing completion flag. Whether the value is read successfully or not, it only indicates that the instruction processing is finished and will not reset actively.

The status code of operand S4 is shown in below table:

Operand	Status code	Meaning	Note
	0	Wait for processing	Set to 0 once the instruction is triggered
	1	In processing	
	2	Instruction processing	
	2	successful	
	3	No instruction	Confirm the firmware and software version is
			matched
S1	4	No slave station	Confirm the S0 parameter is correct, check the
54			slave station connection
	5	Slave station busy	
	6	Instruction processing overtime	
	7	Parameter error	Check S1, S2 parameters
	8	Unknown error	Check the program
	20	Write value too large	Check S1, S2 parameters
	21	Slave station in unread status	

22	the object is write only	
23	the object is read only	
24	No SDO	
25	No subindex of SDO	

When using EC_SDORD, it should be standardized according to the meaning of instruction operands. The S5 instruction completion flag in the instruction indicates that the instruction processing has been completed when it is set. At this time, other EtherCAT communication instructions can be read and written. No matter the current reading and writing is successful or not, S5 will be set. Therefore, during programming, other EtherCAT communication instructions need to wait for it to be set ON before executing, as shown in the following figure:



After operand S5 (M1) is set ON, check the status of S4 (D2). According to the status code, if the instruction is processed successfully, the read register can be set value. Since the completion mark M1 will not reset actively, it needs to be reset manually, so RST M1.

9-2. SDO write [EC_SDOWR]

(1) Instruction overview

Write the local register value in target slave station object SDO.

SDO object write [EC_SDOWR]											
Execution	Edge triggering	Suitable model	XG2								
condition											
Firmware	V3.6 and above	Software	V3.6 and above								

(2) Operand

Operand	Function	Range	Туре
S0	EtherCAT slave station no.: Station	0~63	16-bit constant or single word
	ID		register
S1	Object index	0x1000~0xffff	16-bit constant or single word
			register
S2	Object subIndex	0~255	16-bit constant or single word
			register
S3	Write value register		single word register
S4	write value byte length		16-bit constant or single word
			register
S5	Status register		single word register
S6	Completion flag bit		Bit

(3) Suitable software component

Operand		Word											Bit					
		System							Constant	Mo	dule	System						
	D	FD	TD	CD	DX	DY	DM	DS	K/H	\mathbb{D}	QD	Х	Y	М	S	Т	С	Dn.m
S0	•								•									
S1	•								•									
S2	•								•									
S3	٠																	
S4	٠								•									
S5	•																	
S6												•	•	•	•	•	•	

Note: D is D and HD; TD is TD and HTD; CD is CD, HCD, HSCD and HSD; DM is DM and DHM; DS is DS and DHS. M is M, HM and SM; S is S and HS; T is T and HT; C is C and HC.

(4) Function and action

VO		<u>S0</u> ·	S1 ·	(s_2)	S 3 ·	<u>S4</u> .	<u>(\$5</u>)	<u>S6</u> .
	EC_SDOWR	K0	H6060	K0	D0	K2	D2	MO

- Instruction meaning: write 2 bytes starting from D0 in slave object dictionary 0x6060:00 of StationID0.
- Instruction description: EC_SDOWR is used to write value in slave object dictionary.

can Update	General Expert pr	rocess data Launch parameters 10	Mapping COE-Online	ESC Reg					
aster	All object diction	naries O Receiving PDO (RxPDO) (Send PDO (TxPDO)						
LC Master	Index:SubIndex	Name	Flag	Value	Communication error message				
	+x605A.00	Quickstop option code	rw.		function disable				
ave	- #x605B:00	Shutdown option code	rw		function disable				
StationID:0 Alias:0 XINJE-DS5C CoE Drive	- #x605C:00	Disable operation option code	rw		function disable				
	- #x605D:00	Halt option code	rw		function disable				
	-#x605E:00	Fault reaction option code	rw		function disable				
	# (6060 10	Modes of operation	DV .		function disable				
•	#x6061:00	Modes of operation display	ro		function disable				
slave station number	-#x6062:00	Position demand value	ro		function disable				
Index	-#x6063:00	Position actual internal value	ro		function disable				
	-#6064:00	Position actual value	ro		function disable				
	#x6065:00	Following error window	rw		function disable				
	#x6066:00	Following error window time	rw		function disable				
	-#x6067:00	Position window	rw		function disable				
	-#x6068:00	Position window time	rw		function disable				
	- #x606B:00	Velocity demand value	ro		function disable				
	-#x606C:00	Velocity actual value	ro		function disable				
Cubinday	-#x606D:00	Velocity window	rw						
Subindex	-#x606E:00	Velocity window time	rw		function disable				
	-#x606F:00	Velocity threshold	rw		function disable				
	-#x6070:00	Velocity threshold time	rw		function disable				
	-#x6071:00	Target torque	rw		function disable				
	-#x6072:00	Max torque	rw		function disable				
	-#x6073:00	Max current	ro		function disable				
	-#x6074:00	Torque demand value	ro		function disable				
	-#x6075:00	Motor rated current	ro						
	#x6076:00	Motor rated torque	ro						

The figure shows the slave and the corresponding object dictionary index.



S0: K0 or write 0 in corresponding register. Note: the first station ID is 0 but not 1.

- S1: H6060 or write K24672 in corresponding register (H6060).
- S2: It is 00 at present, write K0 or 0 in corresponding register.
- S3: The value starting from D0 will be written in object SDO.
- S4: Write in length, eg. K2 is 2 bytes (one single word register). K4 will occupy two registers eg. D0 D1.

S5: Instruction processing status.

S6: Instruction processing completion flag. Whether the value is written successfully or not, it only indicates that the instruction processing is finished and will not reset actively.

Operand	Status code	Meaning	Note
	0	Wait for processing	Set to 0 once the instruction is triggered
	1	In processing	
	2	Instruction processing	
	2	successful	
	3	No instruction	Confirm the firmware and software version is
			matched
	4	No slave station	Confirm the S0 parameter is correct, check the
			slave station connection
\$4	5	Slave station busy	
54	6	Instruction processing overtime	
	7	Parameter error	Check S1, S2 parameters
	8	Unknown error	Check the program
	20	Write value too large	Check S1, S2 parameters
	21	Slave station in unread status	
	22	the object is write only	
	23	the object is read only	
	24	No SDO	
	25	No subindex of SDO	

The status code of operand S4 is shown in below table:

When using EC_SDOWR, it should be standardized according to the meaning of instruction operands. The S6 instruction completion flag in the instruction indicates that the instruction processing has been completed when it is set. At this time, other EtherCAT communication instructions can be read and written. No matter the current reading and writing is successful or not, S6 will be set. Therefore, during programming, other EtherCAT communication instructions need to wait for it to be set ON before executing, as shown in the following figure:



After operand S6 (M1) is set ON, check the status of S5 (D2). According to the status code, if the instruction is processed successfully, the read register can be set value. Since the completion mark M1 will not reset actively, it needs to be reset manually, so RST M1.

9-3. ESC read [EC_REGRD]

(1) Instruction overview

Read ESC register value of target station to local register.

ESC register read [EC_REGRD]											
Execution	Edge triggering	Suitable model	XG2								
condition											
Hardware	V3.6 and above	Software	V3.6 and above								

(2) Operand

Operand	Function	Range	Туре							
S0	EtherCAT slave station no.: Station	0~63	16-bit constant or single word							
	ID		register							
S1	ESC register starting address	0x000~0xfff	16-bit constant or single word							
			register							
S2	Read byte length	0~255	single word register							
S3	Save value register starting address		single word register							
S4	Status register		single word register							
S5	Completion flag bit		Bit							

(3) Suitable softw component

Operand		Word													Bi	t		
	System						Constant	Mo	dule		System							
	D	FD	TD	CD	DX	DY	DM	DS	K/H	\mathbb{D}	QD	Х	Y	М	S	Т	С	Dn.m
S0	•								•									
S1	•								•									
S2	•																	
S3	•																	
S4	•																	
S5												•	٠	•	٠	٠	٠	

Note: D is D and HD; TD is TD and HTD; CD is CD, HCD, HSCD and HSD; DM is DM and DHM; DS is DS and DHS. M is M, HM and SM; S is S and HS; T is T and HT; C is C and HC.

(4) Function and action

VO		\bigcirc S0 \cdot	S1 ·	<u>S2</u> .	S3 ·	<u>S4</u> ·	<u>(\$5.</u>)
	EC_REGRD	K0	H100	D4	D0	D2	MO

- Instruction meaning: read ESC register value of StationID0 to D0.
- Instruction description: EC_REGRD is used to read ESC value of slave station.

			Etł	nercatCor	nfig				
Scan Update	General Expert	process data La	unch parameters	IO Mappin	g COE-Online ESC Reg				
Master	StartAddress:0x	0000	Length:	10	Reload				
PLC Master									
	Address	Dec	Hex		Instructions				^
lave	0000	0	0×0000		TypeR				
StationID:0 Nias:0 XINJE-DS5C CoE Drive	0002	0	0x0000		Buil0				
	0004	0	0x0000		FMMUs supportedSy	ync			
	0006	0	0x0000		RAM SizePor				
	8000	0	0x0000		ESC Features suppo	orte0			
	A000	0	0x0000		Reserved				
1 /	000C	0	0x0000		Reserved				
	000E	0	0×0000		Reserved				
slave station number	0010	0	0x0000		Configured Station A	Addres0			
	0012	0	0x0000		Configured Station A	NiaO			
	0014	0	0x0000		Reserved				
	0016	0	0x0000		Reserved				
ESC address	0018	0	0x0000		Reserved				
	0016	0	0x0000		Reserved				
	0010	0	0x0000		Reserved				
	0012	0	0x0000		Write Desister Enabl	le .			
	0020	U	00000		White Register Eriable	ie			
	Bit	Value	R	lag		Instructions			
					U	pload Download	Activate	OK	Cancel

The figure is ESC parameter interface, if it needs to read ESC address H100 of slave station StationID0, please see below example.



S0: K0 or write 0 in corresponding register. Note: the first station ID is 0 but not 1.

S1: H100 or write K256 (H100) in corresponding register.

S2: ESC address corresponds to one byte. If D4 is written 1, it means read the value of H100 to D0. If it is written 2, it means read H100 H102 to D0 D1.

S3: The read value is saved in local register D0.

S4: The instruction processing status.

S5: Instruction processing completion flag. Whether the value is written successfully or not, it only indicates that the instruction processing is finished and will not reset actively.

The status code of operand S4 is shown in below table:

Operand	Status code	Meaning	Note		
	0	Wait for processing	Set to 0 once the instruction is triggered		
	1	In processing			
	2	Instruction processing			
	2	successful			
	3	No instruction	Confirm the firmware and software version is		
			matched		
S4	4	No slave station	Confirm the S0 parameter is correct, check the		
			slave station connection		
	5	Slave station busy			
	6	Instruction processing overtime			
	7	Parameter error	Check S1, S2 parameters		
	8	Unknown error	Check the program		
	20	Address parameter overlimit	Check S1 parameters		

21	Length invalid	Check S1, S2 parameters
22	Slave station position error	Check whether there is the slave station
23	Request failure	Retry

When using EC_REGRD, it should be standardized according to the meaning of instruction operands. The S5 instruction completion flag in the instruction indicates that the instruction processing has been completed when it is set. At this time, other EtherCAT communication instructions can be read and written. No matter the current reading and writing is successful or not, S5 will be set. Therefore, during programming, other EtherCAT communication instructions need to wait for it to be set ON before executing, as shown in the following figure:



After operand S5 (M1) is set ON, check the status of S4 (D2). According to the status code, if the instruction is processed successfully, the read register can be set value. Since the completion mark M1 will not reset actively, it needs to be reset manually, so RST M1.

9-4. ESC write [EC_ESCWR]

(1) Instruction overview

Write the value in local register to target slave station ESC address.

ESC object write [EC_ESCWR]								
Execution	Edge triggering	Suitable model	XG2					
condition								
Hardware	V3.6 and above	Software	V3.6 and above					

(2) Operand

Operand	Function	Range	Туре
S0	EtherCAT slave station no.: Station	0~63	16-bit constant or single word
	ID		register
S1	ESC register starting address	0x000~0xfff	16-bit constant or single word
			register
S2	Write value starting register		single word register
S3	Write value byte length		16-bit constant or single word
			register
S4	Status register		single word register
S5	Completion flag bit		Bit

(3) Suitable soft component

Operand		Word											Bit					
		System							Constant	Mo	dule				Syst	em		
	D	FD	TD	CD	DX	DY	DM	DS	K/H	\mathbb{D}	QD	Х	Y	М	S	Т	С	Dn.m
S0	٠								•									
S1	•								•									
S2	٠																	
S3	٠								•									
S4	•																	
S5												٠	•	•	•	٠	•	

Note: D is D and HD; TD is TD and HTD; CD is CD, HCD, HSCD and HSD; DM is DM and DHM; DS is DS and DHS. M is M, HM and SM; S is S and HS; T is T and HT; C is C and HC.

(4) Function and action

VO		<u>S0</u> ·	S1 ·	S2 ·)	S3 ·)	<u>S4</u> .	S5.
	EC_REGWR	K0	H100	D0	K1	D2	MO

• Instruction meaning: write the value starting from D0 into ESC register of slave station StationID0.

• Instruction description: EC_REGWR is used to write value in slave station ESC address.

Scan Update General Expert process data Lunch parameters IO Mapping COCO-Inine ESC Reg Matter PLC Master 10 Reload Advess Adves				EthercatCo	nfig	×
Master StarkAddress.0k 0000 Length: 10 Reload Save StarkAddress.0k 0000 Length: 10 Reload Address Addres Addres Address	Scan Update	General Exper	t process data l	Launch parameters 10 Mappi	ng COE-Online ESC Reg	
PLC Master Address Dec Hex Instructions Save 0000 0 0x0000 TypeR 0002 0 0x0000 FMMUs supportedSync 0006 0 0x0000 FMMUs supportedSync 0008 0 0x0000 FAMUs supportedSync 0006 0 0x0000 Reserved 0000 0 0x0000 Reserved 0000 0 0x0000 Reserved 00010 0 0x0000 Reserved 00010 0 0x0000 Reserved 00010 0 0x0000 Reserved 00110 0 0x0000 Reserved 00114 0 0x0000 Reserved 0015 0 0x0000 Reserved 0016 0 0x0000 Reserved 0017 0 0x0000 Reserved 0018 0 0x0000 Reserved 0019 0 0x0000 </td <td>Master</td> <td>StartAddress:0</td> <td>« 0000</td> <td>Length: 10</td> <td>Reload</td> <td></td>	Master	StartAddress:0	« 0000	Length: 10	Reload	
New Instructions Address Dec Hex Instructions Address	PLC Master					
Save O000 0 0x0000 Type F StationID:0 lass 0 XINJE-DSSC.CoE Drive 0002 0 0x0000 FMMUs supportedSync Slave station number 0004 0 0x0000 FAM SizePor 0006 0 Slave station number 0004 0 0x0000 FReserved 0000 00000 FReserved 0000 00000 FReserved 0001 0 0x0000 FReserved 0001 0 0x0000 FReserved 0001 0 0x0000 FReserved 0012 0 0x0000 Reserved 0012 0 0x0000 FReserved 0012 0 0x0000 FReserved 0012 0 0x0000 FReserved 0012 0 0x0000 FReserved 0014 0 0x0000 FReserved 0016 0 0x0000 FReserved 0018 0 0x0000 FReserved 0016 0 0x0000 FReserved 0016 0 0x0000 FReserved 0016 0 0		Address	Dec	Hex	Instructions	^
StationID® Mas:0 XINJE-DSSC CoE Drive 0002 0 0x0000 Bull0 0004 0 0x0000 FMMUs supportedSync 0006 0 0x0000 slave station number 0006 0 0x0000 Reserved 00000 00000 Reserved 0006 0 0x0000 Reserved 0014 0 0x0000 Reserved 001A 0 0x0000 Reserved 001E 0 0x0000 Reserved 0020 0 0x0000 Write Register Enable	Slave	0000	0	0x0000	TypeR	
Image: constraint of the state of	StationID:0 Nias:0 XINJE-DS5C CoE Drive	0002	0	0x0000	Buil0	
0006 0 0x0000 RAM StePor 0008 0 0x0000 ESC Features supporte0 000A 0 0x0000 Reserved 000C 0 0x0000 Reserved 000E 0 0x0000 Reserved 000E 0 0x0000 Reserved 0010 0 0x0000 Reserved 0012 0 0x0000 Reserved 0014 0 0x0000 Reserved 0014 0 0x0000 Reserved 0018 0 0x0000 Reserved 0018 0 0x0000 Reserved 00112 0 0x0000 Reserved 0012 0 0x0000 Reserved 0013 0 0x0000 Reserved 0014 0 0x0000 Reserved 0015 0 0x0000 Reserved 0020 0 0x0000 Write Register Enable		0004	0	0x0000	FMMUs supportedSync	
0008 0 0x0000 ESC Features supporte0 slave station number 000C 0 0x0000 Reserved 0010 0 0x0000 Reserved 000E 0 0x0000 0012 0 0x0000 Configured Station Ala0 0012 0 0x0000 Reserved 0014 0 0x0000 Reserved 0018 0 0x0000 Reserved 0018 0 0x0000 Reserved 001A 0 0x0000 Reserved 0014 0 0x0000 Reserved 001A 0 0x0000 Reserved 0015 0 0x0000 Reserved 0012 0 0x0000 Reserved 0014 0 0x0000 Reserved 001C 0 0x0000 Reserved 0015 0 0x0000 Reserved 001C 0 0x0000 Reserved 0020 0 0x0000 Witte Register Enable V V V		0006	0	0×0000	RAM SizePor	
Bit Value Reserved 001E 0 0x0000 Reserved 000E 0 0x0000 Reserved 0010 0 0x0000 Configured Station Addres0 0012 0 0x0000 Reserved 0016 0 0x0000 Reserved 0018 0 0x0000 Reserved 0012 0 0x0000 Reserved 0014 0 0x0000 Reserved 0018 0 0x0000 Reserved 0012 0 0x0000 Reserved 0013 0 0x0000 Reserved 0016 0 0x0000 Reserved 0016 0 0x0000 Reserved 0016 0 0x0000 Reserved 0017 0 0x0000 Reserved 0018 0 0x0000 Reserved 0020 0 0x0000 Reserved 0020 0 0x000		8000	0	0×0000	ESC Features supporte0	
slave station number 000C 0 0k0000 Reserved 0010 0 0k0000 Configured Station Aldres0 0012 0 0k0000 Configured Station Aldres0 0012 0 0k0000 Reserved 0010 0 0k0000 Reserved 0014 0 0k0000 Reserved 0016 0 0k0000 Reserved 0018 0 0k0000 Reserved 001A 0 0k0000 Reserved 001A 0 0k0000 Reserved 001A 0 0k0000 Reserved 001E 0 0k0000 Reserved 001E 0 0k0000 Reserved 001E 0 0k0000 Reserved 001E 0 0k0000 Reserved 0020 0 0k0000 Reserved 001E 0 0k0000 Reserved 001E 0 0k0000 Reserved 0020 0 0k0000 Reserved 0 0 0 0 0 0 0 0 0 0 0		A000	0	0x0000	Reserved	
slave station number 000E 0 0k0000 Reserved 0010 0 0k0000 Configured Station Aldres0 0012 0 0k0000 Reserved 0014 0 0k0000 Reserved 0016 0 0k0000 Reserved 0017 0 0k0000 Reserved 0016 0 0k0000 Reserved 0016 0 0k0000 Reserved 0017 0 0k0000 Reserved 0016 0 0k0000 Reserved 0012 0 0k0000 Reserved 0012 0 0k0000 Reserved 0020 0 0k0000 Reserved 0020 0 0k0000 Reserved 0020 0 0k0000 Reserved 0 0 0 0 0 0 0 0 0 0 0 0		000C	0	0x0000	Reserved	
slave station number 0010 0 0x0000 Configured Station Addres0 ESC address 0012 0 0x0000 Reserved 0018 0 0x0000 Reserved 0010 0 0x0000 Reserved 0011 0 0x0000 Reserved 0016 0 0x0000 Reserved 0017 0 0x0000 Reserved 0018 0 0x0000 Reserved 0010 0 0x0000 Reserved 0011 0 0x0000 Reserved 0010 0 0x0000 Reserved 0011 0 0x0000 Reserved 0012 0 0x0000 Reserved 0012 0 0x0000 Reserved 0012 0 0x0000 Reserved 0020 0 0x0000 Write Register Enable Bit Value Rag Instructions		000E	0	0x0000	Reserved	
Bit Value Pag Instructions Bit Value Pag Instructions	slave station number	0010	0	0x0000	Configured Station AddresU	
Bit Value Rag Instructions Bit Value Rag Instructions		0012	0	0.0000	Configured Station AliaU	
Bit Value Rag Instructions Bit Value Rag Instructions		0014	0	0x0000	Reserved	
ESC address 001A 0 0x0000 Reserved 001C 0 0x0000 Reserved 001C 001E 0 0x0000 Reserved 0020 0 001E 0 0x0000 Write Register Enable v Bit Value Rag Instructions Upload Download Activate OK		0018	0	0~000	Received	
OUTR 0 0x0000 Reserved OUTE 0 0x0000 Reserved OUTE 0 0x0000 Write Register Enable Bit Value Rag Instructions	ESC address	0010	0	0~0000	Beserved	
001E 0 0k0000 Reserved 0020 0 0k0000 Write Register Enable Bit Value Rag Instructions		0010	0	0x0000	Reserved	
0020 0 0x0000 Write Register Enable v Bit Value Rag Instructions		001E	0	0x0000	Reserved	
Bit Value Rag Instructions Instructions Instructions Instructions		0020	0	0x0000	Write Register Enable	~
Upload Download Activate OK Cancel		Bit	Value	Flag	Instructions	
Upload Download Activate OK Cancel						
Upload Download Activate OK Cancel						
Upload Download Activate OK Cancel						
Upload Download Activate OK Cancel						
Upload Download Activate OK Cancel						
Upload Download Activate OK Cancel						
Upload Download Activate OK Cancel	L					
					Upload Download Activate OK	Cancel

The figure is ESC parameter interface. If it needs to write value in ESC address H100 of slave station ID0, the example is shown as below:



S0: K0 or write 0 in corresponding register. Note: the first station ID is 0 but not 1.

S1: H100 or write K256 (H100) in corresponding register.

S2: write in register starting address.

S3: ESC address corresponds to one byte. K1 means write D0 value to H100. K2 means write D0, D1 value to H100, H102.

S4: instruction processing status.

S5: instruction processing completion flag. Whether the value is written successfully or not, it only indicates that the instruction processing is finished and will not reset actively.

Operand	Status code	Meaning	Note
	0	Wait for processing	Set to 0 once the instruction is triggered
	1	In processing	
	2	Instruction processing	
	2	successful	
	3	No instruction	Confirm the firmware and software version is
			matched
	4	No slave station	Confirm the S0 parameter is correct, check the
S1			slave station connection
54	5	Slave station busy	
	6	Instruction processing overtime	
	7	Parameter error	Check S1, S2 parameters
	8	Unknown error	Check the program
	20	Address parameter overlimit	Check S1 parameters
	21 Length invalid		Check S1, S2 parameters
	22	Slave station position error	Check whether there is the slave station
	23	Request failure	Retry

The status code of operand S4 is shown in below table:

When using EC_REGWR, it should be standardized according to the meaning of instruction operands. The S5 instruction completion flag in the instruction indicates that the instruction processing has been completed when it is set. At this time, other EtherCAT communication instructions can be read and written. No matter the current reading and writing is successful or not, S5 will be set. Therefore, during programming, other EtherCAT communication instructions need to wait for it to be set ON before executing, as shown in the following figure:



After operand S5 (M1) is set ON, check the status of S4 (D2). According to the status code, if the instruction is processed successfully, the read register can be set value. Since the completion mark M1 will not reset actively, it needs to be reset manually, so RST M1.

9-5. ESM status switch [EC_SETSS]

(1) Instruction overview

Slave station state machine instruction switching.

ESM status switch [EC_ESCWR]								
Execution	Edge triggering	Suitable model	XG2					
condition								
Hardware	V3.6 and above	Software	V3.6 and above					

(2) Operand

. ,	1					
Operand	Function				Range	Туре
S0	EtherCAT	slave	station	no.:	0~63, 0xFFFF means switch all the	16-bit constant or single
	Station ID				slave stations	word register
S1	ESM status				1, 2, 4, 8	16-bit constant or single
						word register

(3) Suitable soft component

Operand	Word											Bit						
	System								Constant	Mo	dule		System					
	D	FD	TD	CD	DX	DY	DM	DS	K/H	\mathbb{D}	QD	Х	Y	М	S	Т	С	Dn.m
S0	•								•									
S1	•								•									

Note: D is D and HD; TD is TD and HTD; CD is CD, HCD, HSCD and HSD; DM is DM and DHM; DS is DS and DHS.

M is M, HM and SM; S is S and HS; T is T and HT; C is C and HC.

(4) Function and action



- Instruction meaning: switch ESM state machine of slave station ID0 to 8.
- Instruction description: slave station ESM (EtherCAT Status Machine) can be switched through instruction. The state 1: INT, 2: Pre-OP, 4: Safe-OP, 8: OP.

The instruction must be triggered by the rising edge. After the instruction is executed, the slave station is requested to switch to the specified state. There is no guarantee of immediate switching or successful switching. The switching status can be confirmed by SD [8021 + 20*i]. If it is unable to switch, the status switching error message can be confirmed through SD [8028 + 20*i].
Appendix

Appendix 1. Related registers

A 1.	1 1		· · ·	1 4 1	• ,
$\Delta nnendiv$	1 - 1	NIACTER	station.	reisted	registers
TUPPOINTAIA	1-1.	Inaster	station	related	registers
					0

Register	Туре	Note
SD8000	Single word	Master station state, the value should be the bit or of all
		the slave station state
SD8001	Single word	Master station error code, refer to error code table
SD8002	Single word	Master station error count
SD8003	Single word	Set to 1 clear the error code
SD8004	Double word	Communication overtime error count
SD8006	Double word	Data packet format error count
SD8008	Double word	Data packet not match error count
SD8010	Double word	Current communication interval, unit: ns
SD8012	Double word	Current processing time, unit: ns
SD8014~SD8019		Reserved

Appendix 1-2. Slave station related registers (i means slave station no., starting from 0)

Register	Туре	Note
SD[8020+20*i]	Single word	Slave station connection status
		0: disconnected 1: connected
SD[8021+20*i]	Single word	Slave station communication status
		1: INIT
		2: PreOP
		4: SafeOP
		8: OP
		Other: error
SD[8022+20*i]	Double word	Slave station error code, refer to error code table
SD[8024+20*i]	Double word	Slave station error count
SD[8026+20*i]	Single word	Set to 1 clear slave station error count
SD[8027+20*i]	Single word	Servo application layer status: (refer to CANopen402)
		$SMS_NOREADY_SWON = 0,$
		SMS_SWON_DISABLE,
		SMS_READY_SWON,
		SMS_SWON,
		SMS_OP_ENABLE,
		SMS_QSTOP_ACTIVE,
		SMS_FAULT_REACTIVE,
		SMS_FAULT
SD[8028+20*i]	Single word	Mode switching error code, whose value is the storage value of $0x134$
		in ESC register during communication mode switching
SD[8029+20*i]	Single word	Mode switching control bit.
		Write:
		0x8001: switch to Init

		0x8002: switch to PreOP
		0x8004: switch to SafeOP
		0x8008: switch to OP
		Read:
		Same to SD[8021+20*i]
SD[8030]~SD[8039]	Reserved	

Appendix 2. Error code

Appendix 2	2-1.	Master	station	error	code	(SD8001))
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Error code	Note
0	No error
1	Master station initialization error
10	CRC parity error of master station configuration file
12	Master station configuration file write flash
13	Master station flash loading configuration file error
14	The master station is waiting for periodic communication to stop
16	The master station configuration file does not contain configuration information
17	The number of slaves configured by master station exceeds the maximum limit
18	Master station configuration file has no slave configuration information
100	Request master station error
101	No slave stations were found
102	Not switch to PreOP mode
103	Send pdo configuration error
104	Receive pdo configuration error
105	Master station activation error
106	Obtain send domain data error
107	Obtain receive domain data error
108	Enable cycle communication error
109	Recover cycle communication error
110	Pause cycle communication error
200	Slave station information does not match
201	Slave station obtained configuration data error
202	Slave station pdo configuration error
203	Slave station module mapping configuration error
400	coeOnline instruction file error
401	coeOnline slave station not match
402	coeOnline instruction file crc parity error
403	coeOnline file no monitoring instruction
404	coeOnline obtained edit instruction error
405	coeOnline executed edit instruction error
406	coeOnlineInitialization error
500	Oscilloscope initialization failure
501	Failed to configure the oscilloscope
550	Slave station scan initialization failed
551	Slave station scan request file CRC error
552	Slave station scan request file format error

600	ESC register function initialization failure
602	ESC register request format error
900	Startup parameter configuration error

Appendix 3. EtherCAT communication related servo driver alarm

Appendix 3-1. Alarm list

Alarm code	Explanation	Reason	Solution
E-800	Incorrect	Accept the requires cannot tranform from the current	Confirm the state transformation of
	ESM	status:	the upper device. Set ON
	requires	Init→Safeop	SM2013+20*(N-1) or set servo
	fault	Init→OP	parameter F0-00=1 to clear the
	protection	PreOP→OP	alarm.
		ESM status after alarm: when the current status is	
		Init, PreOP, it stops in current status, and transforms	
		to SafeOP when OP.	
		ESC register AL Status Code: 0011h	
801	Undefined	Accept status transform requires except the	Confirm the state transformation of
	ESM	followings:	the upper device. Set ON
	requires	1: Request Init State	SM2013+20*(N-1) or set servo
	fault	2: Request Pre-Operational State	parameter F0-00=1 to clear the
	protection	3: Request Bootstrap State	alarm.
		4: Reauest Safe-operational State	
		8: Request Operational State	
		ESM status after alarm: when the current status is	
		Init, PreOP, SafeOP, it stops in current status, and	
		transforms to SafeOP when OP.	
		ESC register AL Status Code: 0012h	
802	Leading	Accept the following status transforming requires:	Confirm the state transformation of
	status	3: Request Bootstrap State	the upper device. Set ON
	requires	ESM status after alarm: Init	SM2013+20*(N-1) or set servo
	fault	ESC register AL Status Code: 0013h	parameter F0-00=1 to clear the
	protection		alarm.
803	PLL not	After 1s of synchronization, the phase combination	Confirm the setting of DC, and
	finish fault	(PLL locking) of communication and servo still	whether transmission delay
	protection	cannot be completed.	compensation and deviation
		ESM status after alarm: PreOP	compensation are correct.
		ESC register AL Status Code: 002Dh	Set ON SM2013+20*(N-1) or set
			servo parameter F0-00=1 to clear
			the alarm.
804	PDO	For PDO communication (SafeOP or OP status), bit	Confirm whether the transmission
	watchdog	10 that setting time 0220 (AL Event Request)	time of PDO from the upper device is
	fault	through ESC register address 0400 (Watchdog	fixed (whether it is interrupted);
	protection	Divider) and 0420 (Watchdog Time Process Data) is	Contirm that the PDO watchdog
		not ON. ESM status after alarm: Safe OP	detection delay value is too large;
		ESC register AL Status Code: 001Bh	Confirm whether there is any problem

806	PLL fault	ESM state is the case that the phase (PLL lock) of	in the wiring of EtherCAT communication cable and whether there is serious noise on the cable. Set ON SM2013+20*(N-1) or set servo parameter F0-00=1 to clear the alarm. Confirm the setting of DC, and
	protection	communication and servo does not match in SafeOP or OP state. ESM status after alarm: SafeOP ESC register AL Status Code: 0032h	confirm whether transmission delay compensation and deviation compensation are correct. The alarm can be cleared through cutting off the control power or set servo parameter F0-00 = 1.
807	Synchroniza tion signal fault protection	After the completion of synchronization, according to SYNC0 or IRQ, interrupt processing occurs above the setting threshold. ESM status after alarm: SafeOP ESC register AL Status Code: 002Ch	Confirm the setting of DC, and confirm whether transmission delay compensation and deviation compensation are correct. The alarm can be cleared through cutting off the control power or set servo parameter F0-00 = 1.
810	Synchroniza tion period setting error protection	Cannot support the setting period: Synchronization period should be 500us, 1ms, 2ms, 4ms. ESM status after alarm: PreOP ESC register AL Status Code: 0035h	Set correct synchronization period. Set ON SM2013+20*(N-1) or set servo parameter F0-00=1 to clear the alarm.
811	Mailbox setting fault protection	Bad SM0 / 1 setting for mailbox: The receiving and sending area of the mailbox overlaps, overlaps with SM2/3, and the address of the receiving and sending area is odd; The mailbox start address is out of the range of SyncManager0: 1000h~10FFh, SyncManager1: 1200h~12FFh. SyncManager0/1 length (ESC register: 0802h, 0803h/080Ah, 080Bh) setting error: SyncManager0: out of the range of 32~256byte SyncManager1: out of the range of 40~256byte SyncManager0/1 Control Register (ESC register: 0804h/080Ch) setting error conditions: Not set 100110b to 0804h: bit5-0 Not set 100110b to 080Ch: bit5-0 ESM status after alarm: Init ESC register AL Status Code: 0016h	Set SyncManager as ESI file. Set ON SM2013+20*(N-1) or set servo parameter F0-00=1 to clear the alarm.
814	PDO watchdog setting fault protection	PDO watchdog setting error. PDO watchdog trigger is valid (syncmanager: bit6 of register 0804h is 1), the setting value of PDO watchdog detection timeout value (register 0400h, 0402h) does not meet the condition of "communication cycle * 2" ESM status after alarm: PreOP	Set the watchdog detection timeout value correctly. Set ON SM2013+20*(N-1) or set servo parameter F0-00=1 to clear the alarm.

		ESC register AL Status Code: 001Fh	
815	DC setting	The setting of DC is wrong.	Confirm the DC setting.
	error	Bit2-0 of ESC register 0981h (activation) is set to a	Set ON SM2013+20*(N-1) or set
	protection	value other than the following.	servo parameter F0-00=1 to clear
	-	bit2-0=000b; bit2-0=011b	the alarm.
		ESM status after alarm: PreOP	
		ESC register AL Status Code: 0030h	
816	SM event	Unsupported SM time mode is set. 1C32 / 1C33-01	Confirm that the settings of
	mode setting	sets values other than 00, 01 and 02.	1C32h-01h and 1C33h-01h are the
	error	Bit2-0 = 000b of ESC register 0981 and only SM2	same and the values are in 00h, 01h
	protection	of 1C32h-01h and 1C33h-01h are set.	and 02h.
	-	ESM status after alarm: PreOP	Set ON SM2013+20*(N-1) or set
		ESC register AL Status Code: 0028h	servo parameter F0-00=1 to clear
			the alarm.
817	SyncManag	SM2/3 is set to error value.	Set correct value of SyncManager2/3
	er 2/3	The physical address of SM2/3 is set incorrectly	as ESI file.
	setting error	(ESC register: 0810h / 0818h): the receiving and	Set ON SM2013+20*(N-1) or set
	protection	sending areas overlap, coincide with SM2/3, the	servo parameter F0-00=1 to clear
		starting address is odd, and the completion address	the alarm.
		of the starting address is outside the range	
		SM2/3 length setting (ESC register: 0812h/081A) is	
		different from RxPDO, TxPDO.	
		The control register (ESC register: 0814h/081ch) of	
		SM2/3 is not set correctly.	
		Not set 100110b to bit5-0.	
		ESM status after alarm: PreOP	
		ESC register AL Status Code: 001Dh/001Eh	
850	TxPDO	Data size of TxPDO mapping exceeds 24 bytes.	Confirm that the data size of TxPDO
	distribution	ESM status after alarm: PreOP	mapping is set within 24 bytes.
	error	ESC register AL Status Code: 0024h	Set ON SM2013+20*(N-1) or set
	protection		servo parameter F0-00=1 to clear
			the alarm.
851	RxPDO	Data size of RxPDO mapping exceeds 24 bytes.	Confirm that the data size of RxPDO
	distribution	ESM status after alarm: PreOP	mapping is set within 24 bytes.
	error	ESC register AL Status Code: 0025h	Set ON SM2013+20*(N-1) or set
	protection		servo parameter F0-00=1 to clear
			the alarm.
881	Control	When the set value of 6060h is 0 and the set value of	Confirm the setting value of 6060h.
	mode setting	6061h is 0, the PDS status will be converted to	Set ON SM2013+20*(N-1) or set
	error	"operation enabled".	servo parameter F0-00=1 to clear
	protection	6060h is set to not corresponding control mode.	the alarm.
		In full closed-loop control, 6060h is not set to	
		position control mode.	
		ESM status after alarm: stop in the current ESM	
		status	
002	FOM	ESC register AL Status Code: 0000h	
882	ESM	when PDS status is "Operation enabled" or "Quick	Confirm the state transformation
	requires in	stop active", other ESM status conversion	requirements from the upper device.
1	operation	commands are received.	Set ON SM2013+20*(N-1) or set

			F0.00.14.1
	error	ESM status after alarm: based on the requirement of	servo parameter F0-00=1 to clear
	protection	state transformation from upper device.	the alarm.
		ESC register AL Status Code: 0000h	
883	abnormal	When the input signal EXT1 / EXT2 is not	Set ON SM2013+20*(N-1) or set
	action	allocated, select the external trigger condition	servo parameter F0-00=1 to clear
	protection	through Touch probe function;	the alarm.
		The calculation result of electronic gear ratio is	
		1/1000 to 1000 times;	
		The calculation process of electronic gear ratio,	
		when the denominator or numerator is not signed	
		and more than 64-bit;	
		The final calculation result of electronic gear ratio,	
		when the denominator or numerator is not signed	
		and more than 32-bit;	
		ESM status after alarm: stop in current ESM status	
		ESC register AL Status Code: 0000h	

Appendix 3-2. Read the alarm

 $0000 H \sim FEFFh$ is defined according to IEC61800-7-201.

FF00h ~ FFFFh can be defined according to users, as follows.

The lower 8 bits of the defined value (FF00h \sim FFFFh) shown in the following table indicates the main code of the alarm number of the servo abnormal (alarm). (the secondary code of the alarm number is not read.)

In addition, the main code of alarm number is represented by hexadecimal number.

Index	Sub-Index	Name/Description	Range	DateType	Access	PDO	Op-mode		
603Fh	00h	Error code	0-65535	U16	ro	TxPDO	All		
		Now the alarm of the ser	Now the alarm of the servo driver (only the main number).						
		When the alarm does not	When the alarm does not occur, it will display 0000H.						
		When an alarm occurs, an alarm is displayed.							
		FF**h							
		Alarm (main) No. (00h \sim FFH)							
		(Example) FF03h $03h = 3d$ E-030 (overvoltage protection) occurs							
		FF55h 55h = 85d E-850 (TxPDO configuration error protection), E-851 (RxPDO							
		configuration error protection)							
		any one of them occurs							
		As an exception, A000h	is displayed in	n the case of E-	817 (Syncm	anager 2/3 se	etting error).		

Appendix 3-3. Clear the alarm

Reset method of protection function associated with EtherCAT that can be cleared in case of abnormal (alarm)

The following methods (1) (2) (3) can be used for abnormal (alarm) clearing no matter which method. In addition, for protection functions other than EtherCAT association, please refer to the basic function specifications of technical manual.

Method (1): bit4 (Error Ind ACK) of AL control is set to "1".

After that, bit7 of 6040h (control word) is cleared by setting $0 \rightarrow 1$ (sending Fault result command). After the alarm is cleared, the PDS status is converted from Fault to Switch on disabled.

Method ②: carry out abnormal (alarm) clearing by servo driver (panel F0-00, upper computer software). After the alarm is cleared, the PDS status is transferred from Fault to Switch on disabled.

Method ③: the external alarm clear input (A-CLR) of servo driver changes from OFF state to ON state. After the alarm is cleared, the PDS status is migrated from Fault to Switch on disabled.

Abbreviation	Full name
EtherCAT	Ethernet for Control Automation Technology
COE	CANopen Over EtherCAT
FMMU	Fieldbus Memory Management Unit
SM	Sync Manager
рр	Profile position
pv	Profile velocity
tq	Torque profile
csp	Cyclic synchronous position mode
hm	Homing mode
CSV	Cyclic synchronous velocity mode
cst	Cyclic synchronous torque mode
DC	Distributed Clock
SDO	Service Data Object
PDO	Process Data Object
TxPDO	-
RxPDO	-
ESM	EtherCAT State Machine
ESC	EtherCAT Salve Controller
DHV	Physical layer device that converts data from the Ethernet controller to
РПТ	electric or optical signals.
PDI	Process Data Interface or Physical Device Interface
EEPROM	Electrically Erasable Programmable Read Only Memory
ESI	EtherCAT Slave Information, stored in ESI EEPROM (formerly known as
1:01	SII)

Appendix 4. Phraseology

Appendix 5. List of object dictionaries

Index	Subindex	Name	Unit	Data arange	Data type	Flag	PDO
1000h	00h	device type	-	0-429496795	U32	RO	N0
1001h	00h	error register	-	0-65535	U16	RO	N0
1008h	00h	Device name	-	-	-	RO	N0
1009h	00h	Hardware version	-	-	-	RO	N0
100Ah	00h	software version	-	-	-	RO	N0
	00h	Identity	-	-	-	RO	-
	01h	vendor ID	-	0-255	U8	RO	N0
1018h	02h	product code	-	0-429496795	U32	RO	N0
	03h	Revision	-	0-429496795	U32	RO	N0
	04h	Serial number	-	0-429496795	U32	RO	N0
	00h	1st RxPDO mapping	-	0-24	U8	RW	N0
	01h	SubIndex 001	-	0-4294967295	U32	RW	N0
1600h	02h	SubIndex 002	-	0-4294967295	U32	RW	N0
100011	03h	SubIndex 003	-	0-4294967295	U32	RW	N0
			-	0-4294967295	U32	RW	N0
	18h	SubIndex 024	-	0-4294967295	U32	RW	N0
	00h	2nd RxPDO mapping	-	0-24	U8	RW	N0
	01h	SubIndex 001	-	0-4294967295	U32	RW	N0
16011	02h	SubIndex 002	-	0-4294967295	U32	RW	N0
1601n	03h	SubIndex 003	-	0-4294967295	U32	RW	N0
			-	0-4294967295	U32	RW	N0
	18h	SubIndex 024	-	0-4294967295	U32	RW	N0
	00h	3rd RxPDO mapping	-	0-24	U8	RW	N0
	01h	SubIndex 001	-	0-4294967295	U32	RW	N0
1 (00)	02h	SubIndex 002	-	0-4294967295	U32	RW	N0
1602h	03h	SubIndex 003	-	0-4294967295	U32	RW	N0
			-	0-4294967295	U32	RW	N0
	18h	SubIndex 024	-	0-4294967295	U32	RW	N0
	00h	4th RxPDO mapping	-	0-24	U8	RW	N0
	01h	SubIndex 001	-	0-4294967295	U32	RW	N0
1 (02)	02h	SubIndex 002	-	0-4294967295	U32	RW	N0
1603h	03h	SubIndex 003	-	0-4294967295	U32	RW	N0
			-	0-4294967295	U32	RW	N0
	18h	SubIndex 024	-	0-4294967295	U32	RW	N0
	00h	1st TxPDO mapping	-	0-24	U8	RW	N0
	01h	SubIndex 001	-	0-4294967295	U32	RW	N0
1 4 001	02h	SubIndex 002	-	0-4294967295	U32	RW	N0
1A00h	03h	SubIndex 003	-	0-4294967295	U32	RW	N0
			-	0-4294967295	U32	RW	N0
	18h	SubIndex 024	-	0-4294967295	U32	RW	N0
	00h	2nd TxPDO mapping	-	0-24	U8	RW	N0
	01h	SubIndex 001	-	0-4294967295	U32	RW	N0
1 4 0 11	02h	SubIndex 002	-	0-4294967295	U32	RW	N0
IAUIh	03h	SubIndex 003	-	0-4294967295	U32	RW	N0
			-	0-4294967295	U32	RW	N0
	18h	SubIndex 024	-	0-4294967295	U32	RW	N0
1 4 0 21	00h	3rd TxPDO mapping	-	0-24	U8	RW	N0
IA02h	01h	SubIndex 001	-	0-4294967295	U32	RW	N0

Appendix 5-1. COE communication area (0x1000-0x1FF	F)
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	1				-		
	02h	SubIndex 002	-	0-4294967295	U32	RW	N0
	03h	SubIndex 003	-	0-4294967295	U32	RW	N0
			-	0-4294967295	U32	RW	N0
	18h	SubIndex 024	-	0-4294967295	U32	RW	N0
	00h	4th TxPDO mapping	-	0-24	U8	RW	N0
	01h	SubIndex 001	-	0-4294967295	U32	RW	N0
1 4 0 21	02h	SubIndex 002	-	0-4294967295	U32	RW	N0
TAUSh	03h	SubIndex 003	-	0-4294967295	U32	RW	N0
			-	0-4294967295	U32	RW	N0
	18h	SubIndex 024	-	0-4294967295	U32	RW	N0
	00h	Sync mangager communication type	-	0-255	U8	RO	N0
	01h	SubIndex 001	-	0-4	U8	RO	N0
1C00h	02h	SubIndex 002	-	0-4	U8	RO	N0
	03h	SubIndex 003	-	0-4	U8	RO	N0
	04h	SubIndex 004	-	0-4	U8	RO	N0
	00h	RxPDO assign	-	0-4	U8	RW	N0
	01h	SubIndex 001	-	1600h-1603h	U16	RW	NO
1C12h	02h	SubIndex 002	_	1600h-1603h	U16	RW	NO
1012	03h	SubIndex 003	_	1600h-1603h	U16	RW	NO
	04h	SubIndex 004	_	1600h-1603h	U16	RW	NO
	00h	TxPDO assign	_	0-4	U8	RW	NO
	01h	SubIndex 001	_	1A00h-1A03h	U16	RW	NO
1C13h	02h	SubIndex 002	_	1A00h-1A03h	U16	RW	NO
10101	03h	SubIndex 003	_	1A00h-1A03h	U16	RW	NO
	03h 04h	SubIndex 004	_	1A00h-1A03h	U16	RW	NO
	00h	SM output parameter	_	0-20h	U8	RO	NO
	01h	Synchronization Type	_	0-65535	U16	RW	NO
	02h	Cycle Time	ne	0-4294967295	U32	RW	NO
	02h	SubIndex 003	ns	0-4294967295	U32	RW	NO
	03h 04h	Synchronization Type supported	-	0-65535	U16		NO
	041 05h	Minimum Cycle Time	ne	0-03535	1132		NO
	0511 06h	Calc and Cope Time	115	0.4294907295	U32		NO
1C22h	085	Cat Cycle Time	115	0.65525	U32 U16		NO
10.5211	00h	Delay Time	115	0.4204067205	U10 U22		NO
	0.4.h	Sunal Cuala Tima	115	0.4294907293	U32 U32		NO
	OPh	Synco Cycle Time	-	0-4294907293	U32		NO
	OCh	Sivi - Event Missed	-	0-03333			NO
	ODh	Shift Time Teo Short	-	0.65525	U10		NO
	ODI OE1	Shift Time 100 Short	-	0-03333			NO
	0En	Subindex 0014	-	0-03333			NO
	20n	Sync Error	-	0-1	BOOL		NO
	00n	SM input parameter	-	0-200			NO
	011	Synchronization Type	-	0-65535	U16		NU
	02h		ns	0-4294967295	U32		NU
	03h	SubIndex 003	ns	0-4294967295	U32		NU
	04h	Synchronization Type supported	-	0-65535	U16		NU
1 (222)	05h	Minimum Cycle Time	ns	0-4294967295	032	RO	N0
IC33h	06h	Calc and Cope Time	ns	0-4294967295	032	RO	NO
	08h	Get Cycle Time	ns	0-65535	U16	RO	N0
	09h	Delay Time	ns	0-4294967295	U32	RO	NO
	0Ah	Sync0 Cycle Time	-	0-4294967295	U32	RO	N0
	0Bh	SM -Event Missed	-	0-65535	U16	RO	N0
	0Ch	Cycle Time Too Small	-	0-65535	U16	RO	N0
	0Dh	Shift Time Too Short	-	0-65535	U16	RO	N0

0Eh	SubIndex 0014	-	0-65535	U16	RW	N0
20h	Sync Error	-	0-1	BOOL	RO	N0

Appendix 5	5-2.	Servo	parameter area
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Index	Subindex	Name
2000h	00h	P0-00
2001h	00h	P0-01
2002h	00h	P0-02
2003h	00h	P0-03
205Fh	00h	P0-95
	•	
2100h	00h	P1-00
2101h	00h	P1-01
2102h	00h	P1-02
2103h	00h	P1-03
214Ah	00h	P1-74
2200h	00h	P2-00
2201h	00h	P2-01
2202h	00h	P2-02
2203h	00h	P2-03
2263h	00h	P2-99
2300h	00h	P3-00
2301h	00h	P3-01
2302h	00h	P3-02
2303h	00h	P3-03
232Eh	00h	P3-46

Index	Subindex	Name
2500h	00h	P5-00
2501h	00h	P5-01
2502h	00h	P5-02
2503h	00h	P5-03
2547h	00h	P5-71
2700h	00h	P7-00
2701h	00h	P7-01
2702h	00h	P7-02
2703h	00h	P7-03
2715h	00h	P7-21
2800h	00h	P8-00
2801h	00h	P8-01
2802h	00h	P8-02
2803h	00h	P8-03
281Ah	00h	P8-26

Appendix 5-3. Servo driver Profile area (0x6000~0x6FFF)

Index	Subindex	Name	Unit	Data range	Data type	Flag	PDO
6007h	00h	Abort connection option code		0-3	I16	RW	NO
603Fh	00h	Error Code		0 - 65535	U16	RO	TxPDO
6040h	00h	Controlword		0 - 65535	U16	RW	RxPDO
6041h	00h	Statusword		0 - 65535	U16	RO	TxPDO
605Ah	00h	Quickstop option code	-	0 - 7	I16	RW	NO
605Bh	00h	Shutdown option code	-	0 - 1	I16	RW	NO
605Ch	00h	Disable operation option code	-	0 – 1	I16	RW	NO
605Dh	00h	Halt option code	-	1-3	I16	RW	NO
605Eh	00h	Fault reaction option code	-	0-2	I16	RW	NO
6060h	00h	Modes of operation		128-127	I8	RW	RxPDO
6061h	00h	Modes of operation display		128-127	I8	RO	TxPDO
6062h	00h	Position demand value [PUU]	Command unit	-2147483648 – 2147483647	I32	RO	TxPDO
6063h	00h	Position actual internal	pulse	-2147483648 -	I32	RO	TxPDO

		value		2147483647			
		value	G 1	214/40304/			-
6064h	00h	Position actual value	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 windows	Command unit	0 - 4294967295	U32	RW	RxPDO
6068h	00h	Position window time	1ms	0 - 65535	U16	RW	RxPDO
6069h	00h	Velocity sensor actual value			I32	RO	TxPDO
606Ah	00h	Sensor selection code				RW	
606Bh	00h	Velocity demand value	Command unit /s	-2147483648 – 2147483647	I32	RO	TxPDO
606Ch	00h	Velocity actual value	Command unit /s	-2147483648 – 2147483647	I32	RO	TxPDO
606Dh	00h	Velocity window	Command unit	0 - 4294967295	U32	RW	RxPDO
606Eh	00h	Velocity window time	1ms	0-65535	U16	RW	RxPDO
606Fh	00h	Velocity threshold	Command unit	0 - 4294967295	U32	RW	RxPDO
6070h	00h	Velocity threshold time	1ms	0 - 65535	U16	RW	RxPDO
6071h	00h	Target torque	0.10%	-32768 - 32767	I16	RW	RxPDO
6072h	00h	Max torque	0.10%	0 - 65535	U16	RW	RxPDO
6073h	00h	Max current	0.10%	0 - 65535	U16	RO	NO
6074h	00h	Torque demand value	0.10%	-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	0.10%	-32768 - 32767	I16	RO	TxPDO
6078h	00h	Current actual value	0.10%	-32768 - 32767	I16	RO	TxPDO
6079h	00h	DC link circuit voltage				RO	
607Ah	00h	Target position	Command unit	-2147483648 – 2147483647 E208	I32	RW	RxPDO
	-	Position range limit	-	-	-	-	-
	00h	Number of entries	-	2	U8	RO	NO
607Bh	01h	SubIndex 001	Command unit	-2147483648 – 2147483647	I32	RW	RxPDO
	02h	SubIndex 002	Command unit	-2147483648 – 2147483647	I32	RW	RxPDO
607Ch		Home Offset	Command unit	-2147483648 – 2147483647	I32	RW	RxPDO
	-	Software position limit	-	-	-	-	-
	00h	Number of entries	-	2	U8	RO	NO
607Dh	01h	SubIndex 001	Command unit	-2147483648 – 2147483647	I32	RW	RxPDO
	02h	SubIndex 002	Command unit	-2147483648 – 2147483647	I32	RW	RxPDO
607Eh	00h	Polarity	-	0-255	U8	RW	NO
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	0-4294967295	U32	RW	RxPDO

			unit /a				
			ullit /S				
6082h	00h	End velocity	unit /s	0 – 4294967295	U32	RW	RxPDO
6083h	00h	Profile acceleration	Command unit /s ²	0 - 4294967295	U32	RW	RxPDO
6084h	00h	Profile deceleration	Command unit / s ²	0 - 4294967295	U32	RW	RxPDO
6085h	00h	Quick stop deceleration	Command unit / s ²	0 - 4294967295	U32	RW	RxPDO
6086h	00h	Motion profile type	-	-32768 - 32767	I16	RW	RxPDO
6087h	00h	Torque slope	0.1%/S	0 - 4294967295	U32	RW	RxPDO
6088h	00h	Torque profile type	-	-65535	I16	RW	RxPDO
	-	Position encoder resolution	-	-	_	-	-
(00) F	00h	Number of entries	-	2	U8	RO	NO
608Fh	01h	SubIndex 001	pulse	1 - 4294967295	U32	RO	NO
	02h	SubIndex 002	r (motor)	1 - 4294967295	U32	RO	NO
	-	Gear ratio	-	-	_	-	-
600.11	00h	Number of entries	-	2	U8	RO	NO
6091h	01h	SubIndex 001	r (motor)	1 - 4294967295	U32	RW	NO
	02h	SubIndex 002	r (shaft)	1 - 4294967295	U32	RW	NO
	-	Feed constant	-	-	_	-	-
	00h	Number of entries	-	2	U8	RO	NO
6092h	01h	SubIndex 001	Command	1 – 4294967295	U32	RW	NO
	02h	SubIndex 002	r (shaft)	1 - 4294967295	1132	RW	NO
6093h	02h	Position factor	No supported	1 129 1907 295	032	10,0	110
6098h	00h	Homing method	-	-128 - 127	18	RW	RyPDO
007011	-	Homing speeds	_	-	-	_	-
	00h	Number of entries		2	I IS	RO	NO
6099h	01h	SubIndex 001	Command unit /s	0 - 4294967295	U32	RW	RxPDO
	02h	SubIndex 002	Command unit/s	0 – 4294967295	U32	RW	RxPDO
609Ah	00h	Homing acceleration	-	0 - 4294967295	U32	RW	RxPDO
60A3h	-	Profile jerk use					
60A4h	00h	Profile jerk	- 				
	01h	SubIndex 001	The version c	annot support these	two parai	meters, f	or backup
	02h	SubIndex 002					
60B0h	00h	Position offset	These three p	arameters are used f	or driving	g three lo	op control.
60B1h	00h	Velocity offset	Since the serv	o underlying algorit	thm does	not supp	ort
60B2h	00h	Torque offset	feedforward c the modificati	control, these three p ion will not affect th	arameter e effect.	s are not	used, and
60B8h	00h	Touch probe function	-	0 - 65535	U16	RW	RxPDO
60B9h	00h	Touch probe status	-	0 - 65535	U16	RO	TxPDO
60BAh	00h	Touch probe pos1 pos value	Command unit	-2147483648 – 2147483647	I32	RO	TxPDO
60BBh	00h	Touch probe pos1 neg value	Command unit	-2147483648 – 2147483647	I32	RO	TxPDO
60BCh	00h	Touch probe pos2 pos value	Command unit	-2147483648 – 2147483647	I32	RO	TxPDO
60BDh	00h	Touch probe pos2 neg value	Command unit	-2147483648 – 2147483647	I32	RO	TxPDO
60C0h		Interpolation sub mode select	No supported			I	-

	-	Interpolation data record]				
(0.011	00h	Number of entries					
60CTh	01h	SubIndex 001	1				
	02h	SubIndex 002					
	-	Interpolation time period	-	-	-	-	-
(0.001	00h	Number of entries	-	2	U8	RO	TxPDO
60C2h	01h	SubIndex 001	-	0-4294967295	U32	RW	TxPDO
	02h	SubIndex 002	-	0-4294967295	U32	RW	TxPDO
60C5h		Max acceleration	Command unit /s ²	0 – 4294967295	U32	RW	RxPDO
60C6h		Max deceleration	Command unit/s ²	0 – 4294967295	U32	RW	RxPDO
60E0h	00h	Positive torque limited	No supported	ł			
60E1h	00h	Negtive torque limited	No supported	ł			
	-	Supported homing method	-	-	-	-	TxPDO
	00h	Number of entries	-	1 - 254	U8	RO	TxPDO
60E3h	01h	1st supported homing method	-	0 - 32767	U16	RO	TxPDO
	20h	32nd supported homing method	-	0 - 32767	U16	RO	TxPDO
60F2h	00h	Positioning option code					
60F4h	00h	Following error actual value	Command unit	-2147483648 – 2147483647	I32	RO	TxPDO
60FA	00h	Following error actual value	Command unit/s	-2147483648 – 2147483647	I32	RO	TxPDO
60FCh	00h	Position demand value	pulse	-2147483648 – 2147483647	I32	RO	TxPDO
60FDh	00h	Digital inputs	No supported	d			
	-	Digital outputs					
	00h	Number of entries		1			
ouren	01h	Physical outputs	INO supported	1			
	02h	Bit mask	1				
60FFh	00h	Target velocity	Command unit /s	0 - 4294967295	U32	RW	RxPDO
6502h	00h	Supported drive modes		0-4294967295	U32	RO	TxPDO

Note:

 The object dictionary default value of 607Bh (Position range limited) and 607Dh (softward position limited): Min range limited: -2147483648; Max range limited: 2147483647. This parameter modification does not work.

(2) 6086h (Motion profile type)

0: step type 1: slope type

This parameter is only fit for HM mode. In PP, PV mode, trajectory planning is directly used for slope type.

In CSP and CSV mode, it is unnecessary to use this parameter, and the trajectory planning is completed in the master station.

- (3) 6088h (Torque profile type)
 - 0: step type 1: slope type

In TQ mode, the slope type is used for torque planning directl, this parameter does not work.

Appendix 6. Key points for attention

(1) Do not activate the parameters when the servo is enabled. If you want to activate the parameters, please activate them in the servo disabled state, otherwise the correct execution of the action cannot be guaranteed;

(2) If it is necessary to power down and power on the driver or the host, please power off and power on both, otherwise the correct execution of the action cannot be guaranteed.

(3) In CSP, CSV and CST modes, do not manually modify the value of 6040h (control word) during motor operation.



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