

SV-X3EB Series EtherCAT User Manual



Contents

1 Product specifications	4
2 Network connections	5
2.1 Communication port.....	5
2.2 Multiple servo parallel networking.....	5
2.3 Network length and baud rate settings.....	5
3 EtherCAT communication overview	6
3.1 Supported drive modes.....	6
3.2 EtherCAT communication specification.....	6
3.2.1 EtherCAT frame configuration.....	6
3.2.2 EtherCAT State Machine.....	6
3.2.3 PDO (Process Data Object).....	7
3.2.4 SDO (Service Data Object).....	9
3.2.5 Distributed clock.....	9
3.2.6 CiA402 PDS (Power Drive Systems) Specification.....	9
3.2.7 EtherCAT slave address setting.....	10
3.3 Servo drive status panel display.....	11
4 Modes of operation	12
4.1 Servo configuration.....	12
4.2 Profile Position Mode, pp.....	12
4.2.1 Controlword setting in pp mode (60400010h).....	13
4.2.2 Statusword setting in pp mode (60410010h).....	14
4.2.3 Object dictionary list in pp mode.....	15
4.3 Profile Velocity Mode, pv.....	15
4.3.1 Controlword setting in pv mode (60400010h).....	16
4.3.2 Statusword setting in pv mode (60410010h).....	17
4.3.3 Object dictionary list in pv mode.....	17
4.4 Profile Torque Mode, pt.....	17
4.4.1 Controlword setting in pt mode (60400010h).....	18
4.4.2 Statusword setting in pt mode (60410010h).....	19
4.4.3 Object dictionary list in pt mode.....	19
4.5 Homing mode, hm.....	19
4.4.1 Controlword setting in hm mode (60400010h).....	20
4.4.2 Statusword setting in hm mode (60410010h).....	21
4.4.3 Object dictionary list in hm mode.....	21
4.4.4 Homing methods.....	22
4.6 Cyclic synchronous position mode, csp.....	30
4.6.1 Controlword setting in csp mode (60400010h).....	31
4.6.2 Statusword setting in csp mode (60410010h).....	31
4.6.3 Object dictionary list in csp mode.....	31
4.7 Cyclic synchronous velocity mode, csv.....	32
4.7.1 Controlword setting in csv mode (60400010h).....	33
4.7.2 Statusword setting in csv mode (60410010h).....	33
4.7.3 Object dictionary list in csv mode.....	33

4.8 Cyclic synchronous torque mode, cst	34
4.8.1 Controlword setting in cst mode (60400010h)	35
4.8.2 Statusword setting in cst mode (60410010h)	35
4.9.3 Object dictionary list in cst mode.....	35
4.9 Instruction units.....	36
4.10 Servo driver internal function codes.....	36
5 Error (alarm) List	39
5.1 Error (alarm) list.....	39
5.2 Troubleshooting	41
5.3 SDO Abort code.....	45
6 Parameters and Object Dictionary List.	47
6.1 X3EB DI DO function code.....	47
6.2 Object dictionary list 1000H common parameter.....	49
6.3 Object dictionary list 2100H.....	53
Group 2100h: Basic setting	53
Group 2101h: Gain adjustment.....	54
Group 2102h: Vibration suppression	56
Group 2103h: Speed & Torque Control.....	57
Group 2104h: Digital Input/output	59
Group 2105h: Analog input/output	61
Group 2106h: Expansion Parameters (Protection, auxiliary functions)	62
Group 2107h: Auxiliary functions	64
Group 2108h: Internal position command.....	65
Group 2109h: Communication setting.....	69
Group 2111h Expansion position control function	70
Group 2114h: Panel and Communication Interface.....	71
Group 2115h: Status Parameters	72
6.4 Object dictionary list 6000H.....	74

1 Product specifications

Protocol	EtherCAT
Standard	CoE (PDO, SDO)
Synchronous mode	Distributed Clock_synchronous
Duplex mode	Full duplex
Baud rate	100M bit/s
Physical layer	100BASE-TX
Cable length	Between nodes: up to 100 m
Number of slaves (shafts) connected	Up to 128
ESI/XML file	Yes
Maximum number of PDO assigns	RxPDO: 4 [Table] TxPDO: 4 [Table]
Supported Drive Modes (6502h)	profile position mode homing mode profile velocity mode profile torque mode Cyclic synchronous position mode Cyclic synchronous velocity mode Cyclic synchronous torque mode
Digital inputs	9
Digital Outputs	5
RS485	Supported
EtherCAT Communication ports	2 ports (RJ45 connector)
Synchrhouns cycle time supported	1ms, 2ms, 3ms, 4ms, 5ms, 6ms, 7ms, 8ms

2 Network connections

2.1 Communication port

Standard RJ45 port is used and definitions are as below:

Pin	Function
1	TX+
2	TX-
3	RX+
4	Empty
5	Empty
6	RX-
7	Empty
8	GND

2.2 Multiple servo parallel networking

When multiple EtherCAT servo drives are networked, the network cable should be inserted in strict order: upper port for signal-in and lower port for signal-out (note that the terminating resistor cannot be added). As for the P09.18 (2109-13h) servo station number, it should be decided by host controller.

2.3 Network length and baud rate settings

The EtherCAT servo drive is fixed to support 100M bit/s communication velocity, and the maximum communication length between 2 stations is 100 meters.

3 EtherCAT communication overview

EtherCAT is an abbreviation of Ethernet for Control Automation Technology.

3.1 Supported drive modes

X3EB series EtherCAT drive is based on CANOpen application layer profile CiA402 and supports below drive modes.

CiA402 drive mode	Support
Cyclic synchronous position mode (CSP)	Yes
Cyclic synchronous velocity mode (CSV)	Yes
Cyclic synchronous torque mode (CST)	Yes
Profile position mode (PP)	Yes
Profile velocity mode (PV)	Yes
Profile torque mode (PT)	Yes
Homing mode (HM)	Yes

3.2 EtherCAT communication specification

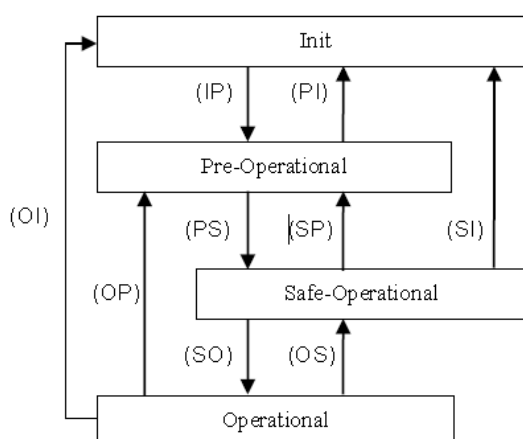
3.2.1 EtherCAT frame configuration

The EtherCAT frame is composed of Ethernet Header + Ethernet Data + FCS.

14byte	46~1500byte	4byte
Ethernet Header	Ethernet Date	FCS

3.2.2 EtherCAT State Machine

The figure below shows a transition diagram for the state (ESM state) of EtherCAT application layer:



ESM state	Operation
Init	The communication part is initializing and the transmission and reception with both SDO (Mailbox) and PDO are impossible
Init To Pre-OP (IP)	The master configures the slave station address register. If mailbox communication is supported, configure the mailbox related registers. If a distributed clock is supported, configure the DC related registers. The master writes to the status control register to request the Pre-OP

ESM state	Operation
	status.
Pre-OP)	Possible to send and receive data through SDO (Mailbox)
Pre-OP To Safe-OP (PS)	The master uses the mailbox to initialize the process data map. The master uses SM channel to configure process data. The master configures the FMMU. The master writes to the status control register requesting the Safe-OP status.
Safe-OP	The transmission (from slave to master) with PDO as well as the transmission and reception over SDO (Mailbox) are possible. Process data communication is possible but read-only.
Safe-OP To Op (SO)	The master sends valid output data. The master writes to the status control register and requests the Op status.
Op	Possible to send and receive both SDO (Mailbox) and PDO.

PDS state \ ESM state	Init	PreOP	SafeOP	Op
Not ready to switch on	Yes	No	No	No
Switch on disabled	Yes	Yes	Yes	Yes
Ready to switch on	No	Yes	Yes	Yes
Switched on	No	Yes	Yes	Yes
Operation enabled	No	Yes *4)	Yes *4)	Yes
Fault reaction active	Yes	Yes	Yes	Yes
Fault	Yes	Yes	Yes	Yes

3.2.3 PDO (Process Data Object)

The real time data transfer over EtherCAT is done by the data exchange with PDO (Process Data Object).

PDO is composed of RxPDO SM2 (0x1C12) transferring from master to slave and TxPDO SM3 (0x1C13) transferring from slave to master.

Servo drive supports 5 groups of PDO mapping. Each PDO supports up to 20 mapping objects. TxPDO1 and RxPDO1 supports renewed mapping; the other 4 groups of PDO support fixed mapping (1604h and 1A104 is compatible with Omron controller).

PDO	Mapping object	PDO configuration
1600h (RPDO1) (9Byte)	Controlword(6040h)	60400010
	Modes of operation (6060h)	60600008
	Target position (607Ah)	607A0020
	Touch probe function (60B8h)	60B80010
1601h (RPDO2) (19Byte)	Controlword (6040h)	60400010
	Modes of operation (6060h)	60600008
	Target torque(6071h)	60710010
	Target position (607Ah)	607A0020
	Max motor velocity (6080h)	60800020
	Touch probe function (60B8h)	60B80010
1602h (RPDO3) (15Byte)	Target velocity (60FFh)	60FF0020
	Controlword (6040h)	60400010
	Modes of operation (6060h)	60600008
	Max torque (6072h)	60720010
	Target position (607Ah)	607A0020
	Touch probe function (60B8h)	60B80010
	Target velocity(60FFh)	60FF0020

PDO	Mapping object	PDO configuration
1603h (RPDO4) (21Byte)	Controlword (6040h)	60400010
	Modes of operation (6060h)	60600008
	Target torque(6071h)	60710010
	Max torque (6072h)	60720010
	Target position (607Ah)	607A0020
	Max motor velocity (6080h)	60800020
	Touch probe function (60B8h)	60B80010
	Target velocity(60FFh)	60FF0020
1604h (RPDO5) (12Byte)	Controlword (6040h)	60400010
	Modes of operation (6060h)	60600008
	Target torque (6071h)	60710010
	Target position (607Ah)	607A0020
	Max profile velocity (607Fh)	607F0020
	Touch probe function (60B8h)	60B80010
	Positive torque limit value(60E0h)	60E00010
	Negative torque limit value (60E1h)	60E10010
	Target velocity(60FF)	60FF0020
1A00h (TXPDO1) (25Byte)	Error code (603Fh)	603F0010
	Statusword (6041h)	60410010
	Position actual value (6064h)	60640020
	Modes of operation display(6061h)	60610008
	Touch probe status (60B9h)	60B90010
	Touch probe pos1 pos value (60BAh)	60BA0020
	Following error actual value (60F4h)	60F40020
	Digital inputs (60FDh)	60FD0020
	Servo internal error code (213Fh)	213F0010
1A01h (TXPDO2) (29Byte)	Error code (603Fh)	603F0010
	Statusword (6041h)	60410010
	Modes of operation display(6061h)	60610008
	Position actual value (6064h)	60640020
	Velocity actual value(606Ch)	606C0020
	Torque actual value(6077h)	60770010
	Touch probe status (60B9h)	60B90010
	Touch probe pos1 pos value (60BAh)	60BA0020
	Touch probe pos1 neg value (60BBh)	60BB0020
Digital inputs (60FDh)	60FD0020	
1A02h (TXPDO3) (25Byte)	Error code (603Fh)	603F0010
	Statusword (6041h)	60410010
	Modes of operation display(6061h)	60610008
	Position actual value (6064h)	60640020
	Velocity actual value(606Ch)	606C0020
	Torque actual value(6077h)	60770010
	Touch probe status (60B9h)	60B90010
	Touch probe pos1 pos value (60BAh)	60BA0020
Digital inputs (60FDh)	60FD0020	
1A03h (TXPDO4) (25Byte)	Error code (603Fh)	603F0010
	Statusword (6041h)	60410010
	Modes of operation display(6061h)	60610008
	Position actual value (6064h)	60640020
	Velocity actual value(606Ch)	606C0020
	Torque actual value(6077h)	60770010
	Touch probe status (60B9h)	60B90010
	Touch probe pos1 pos value (60BAh)	60BA0020
Digital inputs (60FDh)	60FD0020	
1A04h (TXPDO5) (22Byte)	Statusword (6041h)	60410010
	Modes of operation display(6061h)	60610008
	Position actual value (6064h)	60640020
	Velocity actual value(606Ch)	606C0020
	Torque actual value(6077h)	60770010
	Touch probe status (60B9h)	60B90010
	Touch probe pos1 pos value (60BAh)	60BA0020
	Touch probe pos2 pos value (60BCh)	60BC0020
Following error actual value (60F4h)	60F40020	

PDO	Mapping object	PDO configuration
	Error code (603Fh)	603F0010
	Digital inputs (60FDh)	60FD0020

3.2.3.1 Sync Manager PDO assign object

X3EB can use 1C12h for RxPDO (SyncManager2) and 1C13h for TxPDO (SyncManager3), as a Sync Manager PDO assign object.

Index	Sub-index	Mapping object
0x1C12	0	Any group of RxPDO 1600~1604
0x1C13	0	Any group of TxPDO 1A00~1A04

3.2.3.2 PDO Mapping Object

PDO mapping data contains Index (2 bytes), Sub-index (1 byte) and data length (1 byte). Sub-index 0 means number of PDO mapping object; Sub-index 1 to n means the content of PDO element 1 to n. Each PDO mapping object contains up to 4-byte data object, i.e. one PDO can contain up to 4*n data length.

Byte	Byte 3~2	Byte 1	Byte 0
Meaning	Index	Sub-index	Data length

Index and Sub-index determine the position information of such object in Object Dictionary List. Data length determines the number of bits of such object, such as 8-bit, 16-bit and 32-bit, in the form of a hexadecimal character string.

For example, PDO mapping content 60400010h means Index is 0x6040, Sub-index is 0x00 and data length is 16-bit (single word).

3.2.4 SDO (Service Data Object)

SDO is an aperiodic data communication defined by CoE. Master station reads and writes mailbox data SM channel to achieve aperiodic data exchange. X3EB servo drive can modify drive parameters through SDO.

3.2.5 Distributed clock

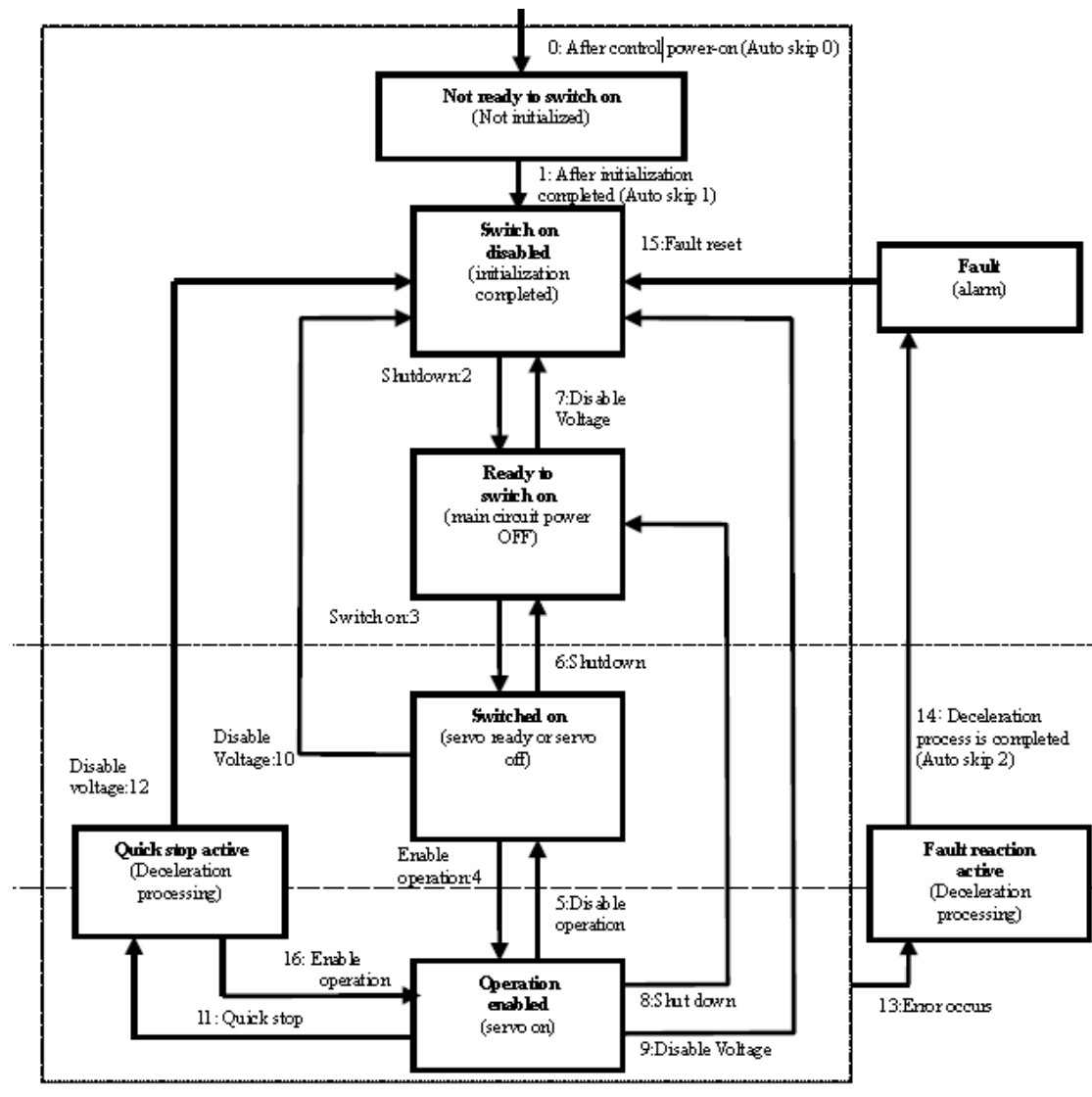
The synchronization of the EtherCAT communication is based on DC. A slave can be synchronized by sharing the same standard clock (System Time) based on DC. The local cycle of the slave is triggered by the SYNC0 event or FreeRun. The process (servo process) of the slave is triggered by the SYNC0 event cycle, so a slave process is always synchronous with the SYNC0 event.

The master needs to perform propagation delay compensation (offset compensation) at the time of communication initialization, and also needs to perform drift compensation periodically.

3.2.6 CiA402 PDS (Power Drive Systems) Specification

PDS Phase	Low-level power	High-level power	Drive status
Phase 1	OK	NO	NO
Phase 2	OK	OK	NO
Phase 3	OK	OK	OK

The figure below defines state transition (FSA) of PDS related to the power control triggered by the user command or error detection etc. (After that, describe "PDS state" in this document.)



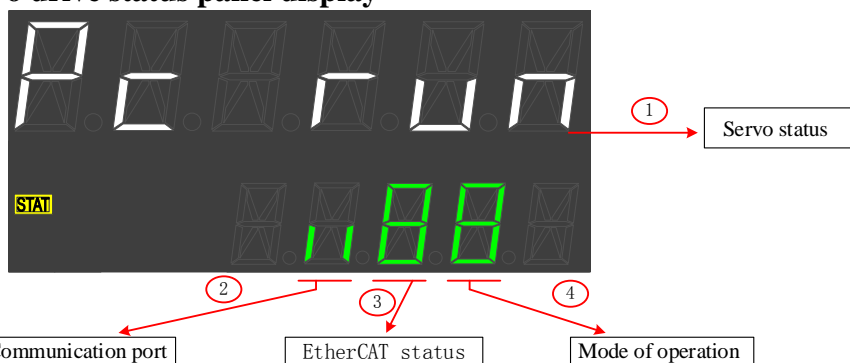
3.2.7 EtherCAT slave address setting

EtherCAT slave address is set in parameter P09.18.

When P09.18=0, slave station alias is set by ESC address written by master station. For other values, station alias is set accord to P09.18 value. When master station is using automatic incremental addressing, station alias is skipped.

User can set P09.18 value by panel operation or by Servo Studio software. Same node address is not allowed in the same network.

3.3 Servo drive status panel display



Display area	Meaning	Contents
1: Servo status display	Servo status	not rdy: servo not ready ok rdy: servo ready Pc run: motor connected AL XX : servo alarm Err XX: servo error
2: Communication port display	Physical status of the two communication ports	No display: no port is connected 1: upper port connected 1 : lower port connected 11: both ports connected
3: EtherCAT status display	The normal sequence should be 1-2-4-8	1: init 2: Pre-op 4: Safe-op 8: Op
4: Mode of operation display	Mode of operation	0: No mode 1: pp 3: pv 4: pt 6: hm 7: ip (Interpolating Position Mode, not supported) 8: csp 9: csv A: cst

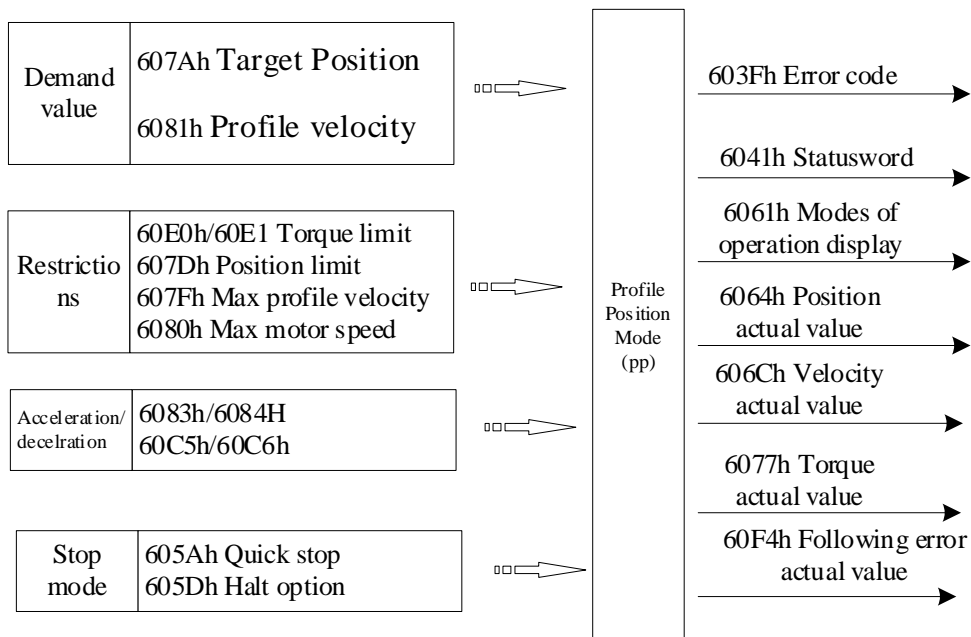
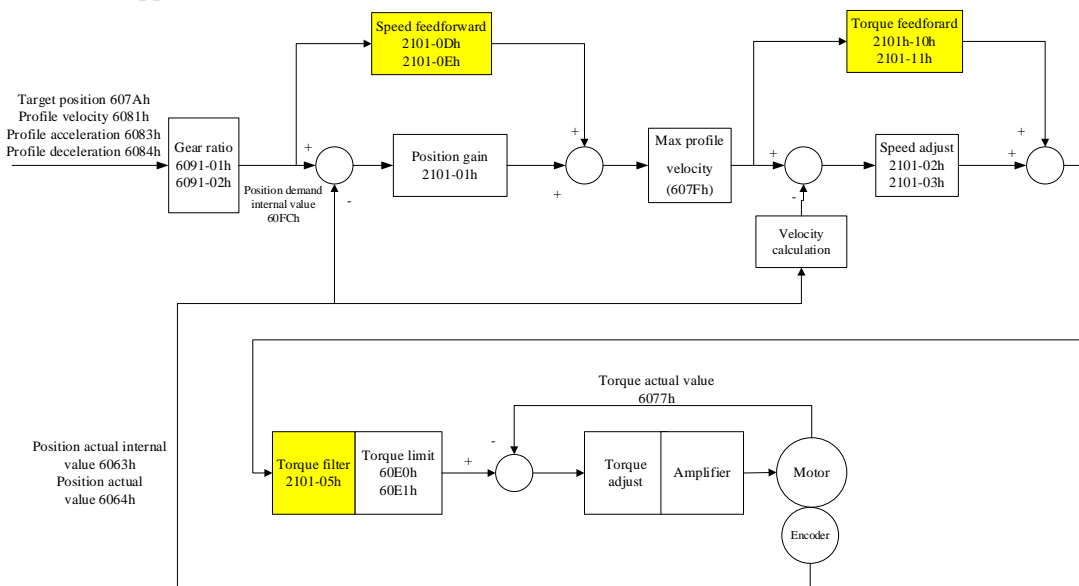
4 Modes of operation

4.1 Servo configuration

Before using X3EB for EtherCAT communication, user may need to configure servo parameters manually.

4.2 Profile Position Mode, pp

This is a position control mode to operate by designating the target position, target velocity, addition-subtraction velocity, etc. and creating a position command in the servo driver. Set 6060H=1 for pp mode.

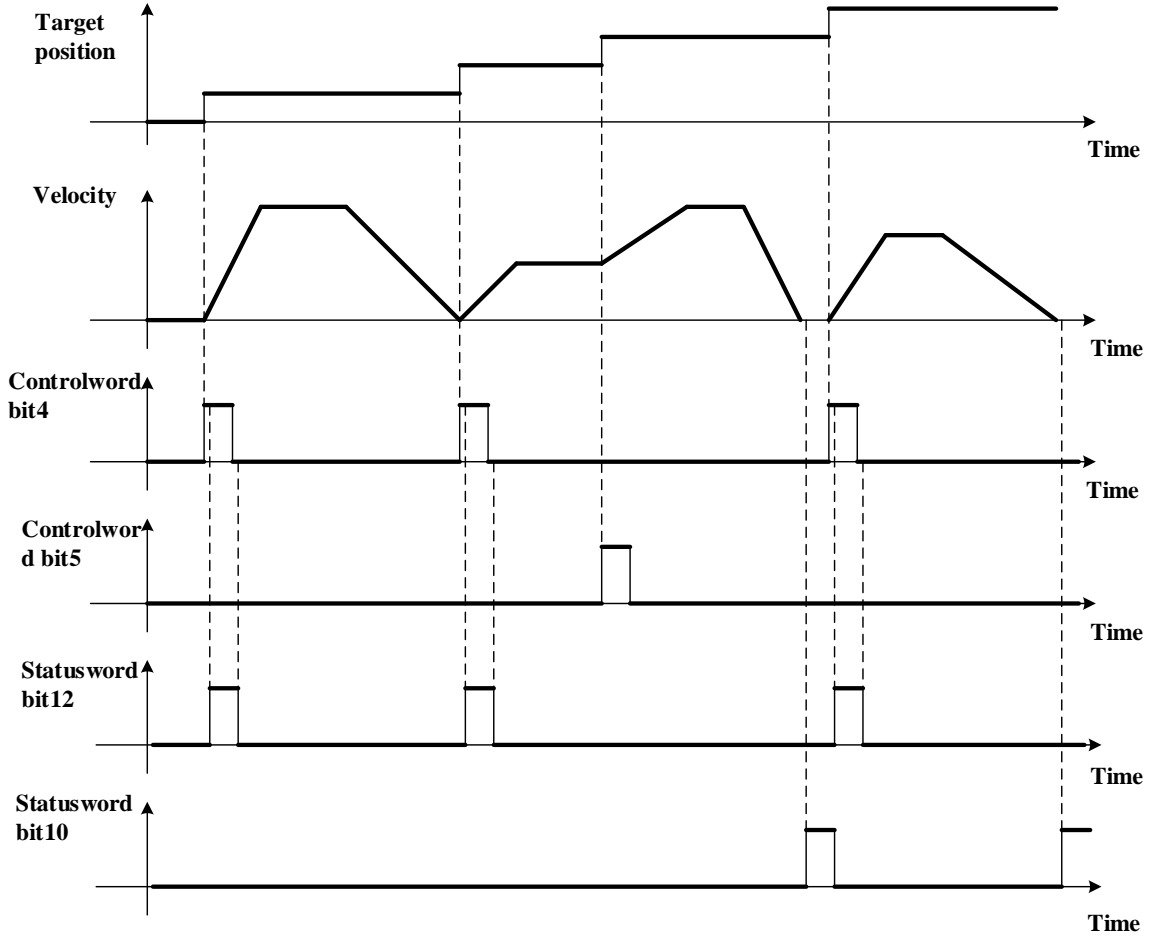


4.2.1 Controlword setting in pp mode (60400010h)

Index	Sub-Index	Name / Description	Units	Range	Data Type	Access	PDO	Op-mode	EEPROM			
6040h	00h	Controlword • Set a command to a servo driver including the PDS state transition.	-	0 - 65535	U16	rw	RxPDO	ALL	No			
		Bit information details										
		15 - 10	9	8	7	6	5	4	3	2	1	0
		r	oms change on set-point	h	fr	absolute/ relative	oms change set immediately	new set-point	eo	qs	ev	so
		r	= reserved (not supported)		fr	= fault reset			eo	= enable operation		
		oms	= operation mode specific (control mode dependent bit)				qs	= quick stop				
		h	= halt				ev	= enable voltage				
							so	= switch on				

bit9, 6-4(operation mode specific):

Bit	Name	Value	Definition
4	new set-point	0->1	It is a trigger to activate a positioning operation and update a set value. Imports new positioning tasks (607Ah (Target position) and 6081h (Profile velocity) etc.).
5	change set immediately	0	After the positioning operation at present is completed, next positioning operation starts.
		1	Suspends the positioning operation at present and starts next positioning operation at once. The additional option of the operation change timing is set with the cio bit (bit3-2) of 60F2h (Positioning option code).
6	absolute/ relative	0	Handles 607Ah (Target position) as an absolute position
		1	Handles 607Ah (Target position) as a relative position. The additional option in relative positioning is set with the relative option (bit1-0) of 60F2h (Positioning option code).
9	change on set-point	-	Refer to the table below This is not supported by this software version.



4.2.2 Statusword setting in pp mode (60410010h)

Index	Sub-Index	Name / Description	Units	Range	Data Type	Access	PDO	Op-mode	EEPROM																																														
6041h	00h	Statusword • Displays the servo driver state.	-	0 - 65535	U16	ro	TxPDO	ALL	No																																														
		Bit information details																																																					
		<table border="1" style="width:100%; text-align:center;"> <tr> <td>15 - 14</td> <td>13</td> <td>12</td> <td>11</td> <td>10</td> <td>9</td> <td>8</td> <td>7</td> <td>6</td> <td>5</td> <td>4</td> <td>3</td> <td>2</td> <td>1</td> <td>0</td> </tr> <tr> <td>r</td> <td colspan="2">oms</td> <td>ila</td> <td>oms</td> <td>rm</td> <td>r</td> <td>w</td> <td>sod</td> <td>qs</td> <td>ve</td> <td>f</td> <td>oe</td> <td>so</td> <td>rtso</td> </tr> <tr> <td></td> <td>following error</td> <td>set-point acknowledge</td> <td></td> <td>target reached</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>	15 - 14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	r	oms		ila	oms	rm	r	w	sod	qs	ve	f	oe	so	rtso		following error	set-point acknowledge		target reached																		
15 - 14	13	12	11	10	9	8	7	6	5	4	3	2	1	0																																									
r	oms		ila	oms	rm	r	w	sod	qs	ve	f	oe	so	rtso																																									
	following error	set-point acknowledge		target reached																																																			
		r = reserved (not supported)			w = warning																																																		
		oms = operation mode specific (control mode dependent bit)			sod = switch on disabled																																																		
		ila = internal limit active			qs = quick stop																																																		
		rm = remote			ve = voltage enabled																																																		
					f = fault																																																		
					oe = operation enabled																																																		
					so = switched on																																																		
					rtso = ready to switch on																																																		

Bit 0~9, 11: 0 means invalid; 1 means valid. For other bits please refer to below:

Bit	Name	Remarks
10	Target reached	60400010h bit 8 = 0 , 0: target not reached 1: target reached; 60400010h bit 8 = 1 ,

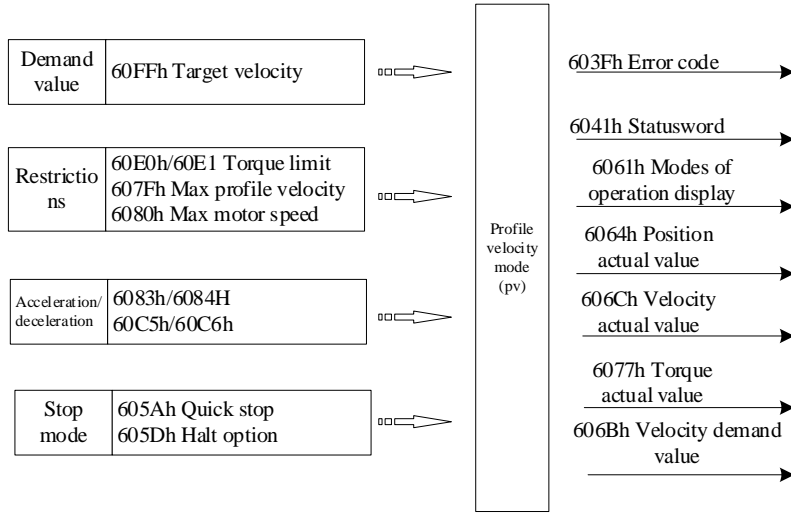
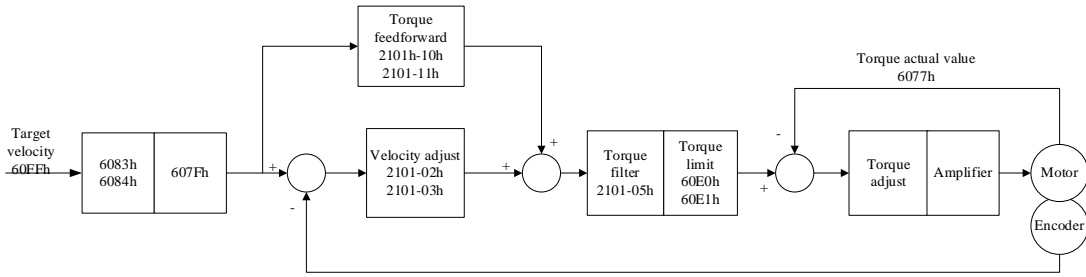
		0: in deceleration 1: velocity is 0
12	Set-point acknowledge	0: The new set-point is 0, the motion is done (in process) for the last target position, and the buffer is empty; 1: Data for a new positioning task has been imported into the buffer and it is not empty.
13	Following error	0: Following error actual value is within range (6065h); 1: Following error actual value is out of range (6065h).
14	Reserved	
15	Homing finished	0: invalid 1: homing finished. For absolute system, when set 2 nd place from right of P09.14 to 2, after homing finished, it will store value of bit15 (maintain at power off); set P20.06=7 can clear the stored value.

4.2.3 Object dictionary list in pp mode

Index	Sub-index	Name	Access	Data type	Default
603Fh		Error code	ro	unsigned16	0
6040h		Controlword	rw	unsigned16	0
6041h		Statusword	ro	unsigned16	0
6060h		Modes of operation	rw	integer8	0
6061h		Modes of operation display	ro	integer8	0
6062h		Position demand value	ro	integer32	0
6063h		Position actual internal value	ro	integer32	0
6064h		Position actual value	ro	integer32	0
6065h		Following error window	rw	unsigned32	1000000
6067h		Position window	rw	unsigned32	100
6068h		Position window time	rw	unsigned16	1
606Bh		Velocity demand value	ro	integer32	0
606Ch		Velocity actual value	ro	integer32	0
607Ah		Target position	rw	integer32	0
607Ch		Home offset	rw	integer32	0
607Dh	01h	Min position limit	rw	integer32	-2147483648
	02h	Max position limit	rw	integer32	2147483647
607Eh		Polarity	rw	unsigned8	0
6081h		Profile velocity	rw	unsigned32	100
6083h		Profile acceleration	rw	unsigned32	100
6084h		Profile deceleration	rw	unsigned32	100
6093h	01h	Position factor: numerator	rw	unsigned32	131072
	02h	Position factor: feed constant	rw	unsigned32	10000
60F4h		Following error actual value	ro	integer32	0
60FCh		Position demand internal value	ro	integer32	0

4.3 Profile Velocity Mode, pv

This is a velocity control mode to operate by designating the target velocity, addition-subtraction velocity, etc. and creating a position command in the servo driver. Set 6060H=3.



4.3.1 Controlword setting in pv mode (60400010h)

Index	Sub-Index	Name / Description	Units	Range	Data Type	Access	PDO	Opmode	EEPROM																						
6040h	00h	Controlword	-	0 - 65535	U16	rw	RxPDO	ALL	No																						
• Set a command to a servo driver including the PDS state transition.																															
Bit information details																															
<table border="1" style="width:100%; text-align:center;"> <tr> <td>15 - 10</td> <td>9</td> <td>8</td> <td>7</td> <td>6</td> <td>5</td> <td>4</td> <td>3</td> <td>2</td> <td>1</td> <td>0</td> </tr> <tr> <td>r</td> <td>oms</td> <td>h</td> <td>fr</td> <td>r</td> <td>r</td> <td>r</td> <td>eo</td> <td>qs</td> <td>ev</td> <td>so</td> </tr> </table>										15 - 10	9	8	7	6	5	4	3	2	1	0	r	oms	h	fr	r	r	r	eo	qs	ev	so
15 - 10	9	8	7	6	5	4	3	2	1	0																					
r	oms	h	fr	r	r	r	eo	qs	ev	so																					
<table style="width:100%;"> <tr> <td style="width:50%;"> r = reserved (not supported) oms = operation mode specific (control mode dependent bit) h = halt </td> <td style="width:50%;"> fr = fault reset eo = enable operation qs = quick stop ev = enable voltage so = switch on </td> </tr> </table>										r = reserved (not supported) oms = operation mode specific (control mode dependent bit) h = halt	fr = fault reset eo = enable operation qs = quick stop ev = enable voltage so = switch on																				
r = reserved (not supported) oms = operation mode specific (control mode dependent bit) h = halt	fr = fault reset eo = enable operation qs = quick stop ev = enable voltage so = switch on																														

4.3.2 Statusword setting in pv mode (60410010h)

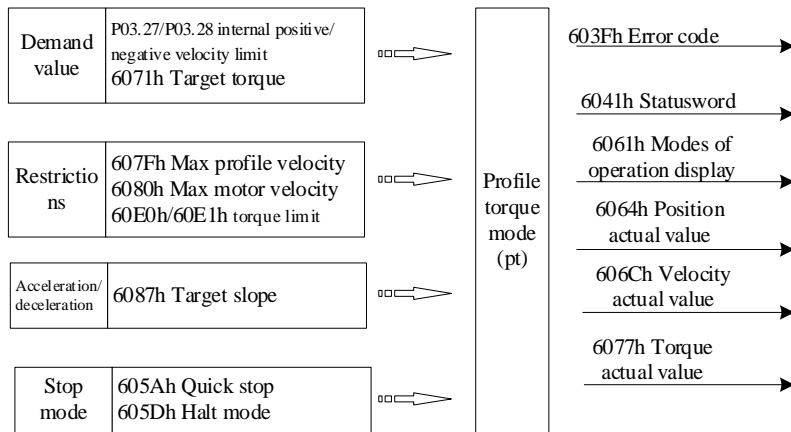
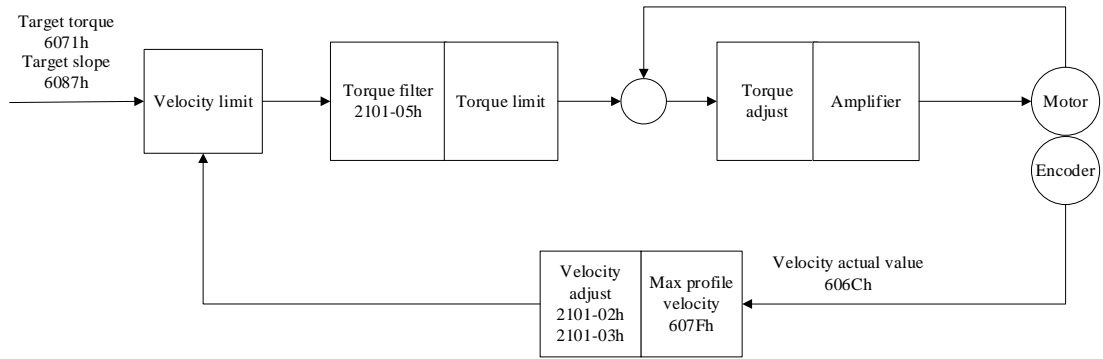
Index	Sub-Index	Name / Description	Units	Range	Data Type	Access	PDO	Op-mode	EEPROM																																															
6041h	00h	Statusword • Displays the servo driver state. Bit information details	-	0 - 65535	U16	ro	TxPDO	ALL	No																																															
		<table border="1"> <thead> <tr> <th>15 - 14</th> <th>13</th> <th>12</th> <th>11</th> <th>10</th> <th>9</th> <th>8</th> <th>7</th> <th>6</th> <th>5</th> <th>4</th> <th>3</th> <th>2</th> <th>1</th> <th>0</th> </tr> </thead> <tbody> <tr> <td></td> <td>oms</td> <td></td> <td></td> <td>oms</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>r</td> <td>max slippage error</td> <td>speed</td> <td>ila</td> <td>target reached</td> <td>rm</td> <td>r</td> <td>w</td> <td>sod</td> <td>qs</td> <td>ve</td> <td>f</td> <td>oe</td> <td>so</td> <td>rtso</td> </tr> </tbody> </table>	15 - 14	13	12	11	10	9	8	7	6	5	4	3	2	1	0		oms			oms											r	max slippage error	speed	ila	target reached	rm	r	w	sod	qs	ve	f	oe	so	rtso									
15 - 14	13	12	11	10	9	8	7	6	5	4	3	2	1	0																																										
	oms			oms																																																				
r	max slippage error	speed	ila	target reached	rm	r	w	sod	qs	ve	f	oe	so	rtso																																										
		r = reserved (not supported)						w = warning																																																
		oms = operation mode specific (control mode dependent bit)						sod = switch on disabled																																																
		ila = internal limit active						qs = quick stop																																																
		rm = remote						ve = voltage enabled																																																
								f = fault																																																
								oe = operation enabled																																																
								so = switched on																																																
								rtso = ready to switch on																																																

4.3.3 Object dictionary list in pv mode

Index	Sub-index	Name	Access	Data type	Default
603Fh		Error code	ro	unsigned16	0
6040h		Controlword	rw	unsigned16	0
6041h		Statusword	ro	unsigned16	0
6060h		Modes of operation	rw	integer8	0
6061h		Modes of operation display	ro	integer8	0
6063h		Position actual internal value	ro	integer32	0
6064h		Position actual value	ro	integer32	0
606Bh		Velocity demand value	ro	integer32	0
606Ch		Velocity actual value	ro	integer32	0
606Dh		Velocity window	rw	unsigned16	100
606Eh		Velocity window time	rw	unsigned16	1
606Fh		Velocity threshold	rw	unsigned16	10
607Ch		Home offset	rw	integer32	0
607Dh	01h	Min position limit	rw	integer32	-2147483648
	02h	Max position limit	rw	integer32	2147483647
607Eh		Polarity	rw	unsigned8	0
6083h		Profile acceleration	rw	unsigned32	100
6084h		Profile deceleration	rw	unsigned32	100
6094h	01h	Velocity encoder factor: numerator	rw	unsigned32	1
	02h	Velocity encoder factor: denominator	rw	unsigned32	1
60C5h		Max acceleration	rw	unsigned32	200
60C6h		Max deceleration	rw	unsigned32	200
60FFh		Target velocity	rw	integer32	0

4.4 Profile Torque Mode, pt

This is a torque control mode to operate by designating the target torque, addition-subtraction velocity, etc. and creating a position command in the servo driver. Set 6060H=4.



4.3.1 Controlword setting in pt mode (60400010h)

Index	Sub-Index	Name / Description	Units	Range	Data Type	Access	PDO	Op-mode	EEPROM																						
6040h	00h	Controlword • Set a command to a servo driver including the PDS state transition.	-	0 - 65535	U16	rw	RxPDO	ALL	No																						
Bit information details																															
<table border="1" style="width:100%; border-collapse: collapse; text-align: center;"> <tr> <td style="width:10%;">15 - 10</td> <td style="width:10%; border: 2px solid black;">9</td> <td style="width:10%;">8</td> <td style="width:10%;">7</td> <td style="width:10%; border: 2px solid black;">6</td> <td style="width:10%; border: 2px solid black;">5</td> <td style="width:10%; border: 2px solid black;">4</td> <td style="width:10%;">3</td> <td style="width:10%;">2</td> <td style="width:10%;">1</td> <td style="width:10%;">0</td> </tr> <tr> <td>r</td> <td style="border: 2px solid black;">oms ----- r</td> <td>h</td> <td>fr</td> <td style="border: 2px solid black;">r</td> <td style="border: 2px solid black;">r</td> <td style="border: 2px solid black;">r</td> <td>eo</td> <td>qs</td> <td>ev</td> <td>so</td> </tr> </table>										15 - 10	9	8	7	6	5	4	3	2	1	0	r	oms ----- r	h	fr	r	r	r	eo	qs	ev	so
15 - 10	9	8	7	6	5	4	3	2	1	0																					
r	oms ----- r	h	fr	r	r	r	eo	qs	ev	so																					
<table style="width:100%; border: none;"> <tr> <td style="width:50%; border: none;">r = reserved (not supported)</td> <td style="width:50%; border: none;">fr = fault reset</td> </tr> <tr> <td style="border: none;">oms = operation mode specific (control mode dependent bit)</td> <td style="border: none;">eo = enable operation</td> </tr> <tr> <td style="border: none;">h = halt</td> <td style="border: none;">qs = quick stop</td> </tr> <tr> <td style="border: none;"></td> <td style="border: none;">ev = enable voltage</td> </tr> <tr> <td style="border: none;"></td> <td style="border: none;">so = switch on</td> </tr> </table>										r = reserved (not supported)	fr = fault reset	oms = operation mode specific (control mode dependent bit)	eo = enable operation	h = halt	qs = quick stop		ev = enable voltage		so = switch on												
r = reserved (not supported)	fr = fault reset																														
oms = operation mode specific (control mode dependent bit)	eo = enable operation																														
h = halt	qs = quick stop																														
	ev = enable voltage																														
	so = switch on																														

4.3.2 Statusword setting in pt mode (60410010h)

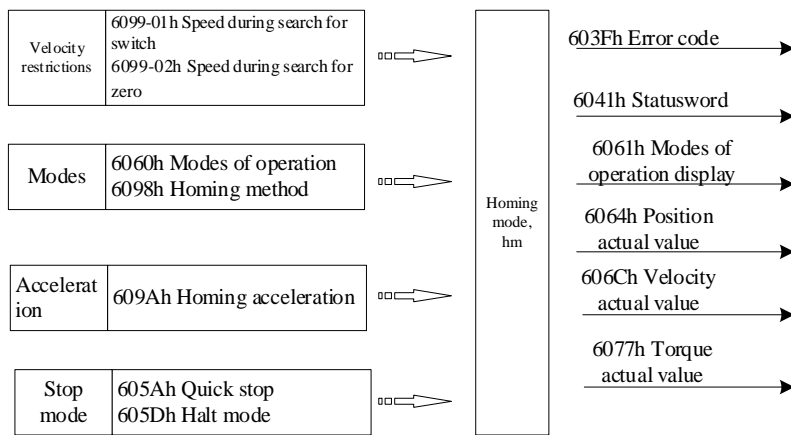
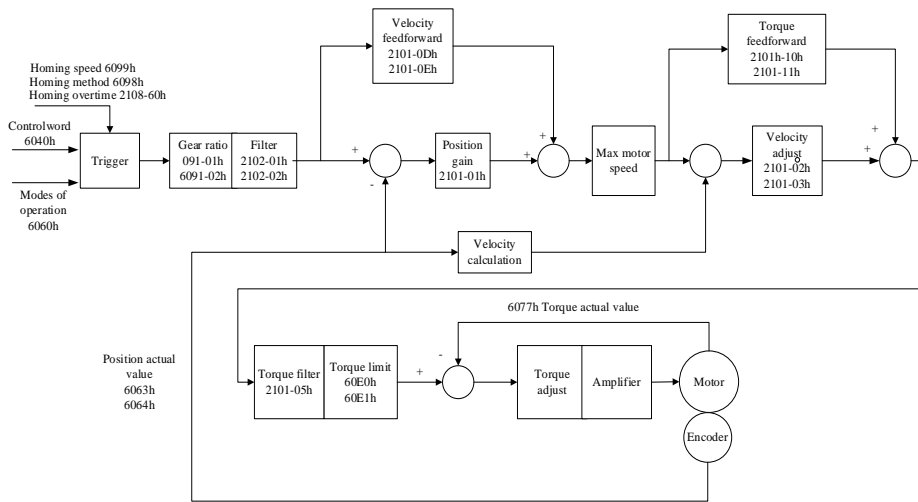
Index	Sub-Index	Name / Description	Units	Range	Data Type	Access	PDO	Op-mode	EEPROM																																
6041h	00h	Statusword • Displays the servo driver state. Bit information details	-	0 - 65535	U16	ro	TxPDO	ALL	No																																
		<table border="1"> <thead> <tr> <th>15 - 14</th> <th>13</th> <th>12</th> <th>11</th> <th>10</th> <th>9</th> <th>8</th> <th>7</th> <th>6</th> <th>5</th> <th>4</th> <th>3</th> <th>2</th> <th>1</th> <th>0</th> </tr> </thead> <tbody> <tr> <td>r</td> <td>oms</td> <td>oms</td> <td>ila</td> <td>oms target reached</td> <td>rm</td> <td>r</td> <td>w</td> <td>sod</td> <td>qs</td> <td>ve</td> <td>f</td> <td>oe</td> <td>so</td> <td>rtso</td> </tr> </tbody> </table>	15 - 14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	r	oms	oms	ila	oms target reached	rm	r	w	sod	qs	ve	f	oe	so	rtso									
15 - 14	13	12	11	10	9	8	7	6	5	4	3	2	1	0																											
r	oms	oms	ila	oms target reached	rm	r	w	sod	qs	ve	f	oe	so	rtso																											
		<p>r = reserved(not supported)</p> <p>oms = operation mode specific (control mode dependent bit)</p> <p>ila = internal limit active</p> <p>rm = remote</p> <p>w = warning</p> <p>sod = switch on disabled</p> <p>qs = quick stop</p> <p>ve = voltage enabled</p> <p>f = fault</p> <p>oe = operation enabled</p> <p>so = switched on</p> <p>rtso = ready to switch on</p>																																							

4.4.3 Object dictionary list in pt mode

Index	Sub-index	Name	Access	Data type	Default
603Fh		Error code	ro	unsigned16	0
6040h		Controlword	rw	unsigned16	0
6041h		Statusword	ro	unsigned16	0
6060h		Modes of operation	rw	integer8	0
6061h		Modes of operation display	ro	integer8	0
606Ch		Velocity actual value	ro	integer32	0
6071h		Target torque	rw	integer16	0
6074h		Torque demand	ro	integer16	0
6077h		Torque actual value	ro	integer16	0
607Dh	01h	Min position limit	rw	integer32	-2147483648
	02h	Max position limit	rw	integer32	2147483647
6080h		Max motor velocity	rw	unsigned32	4500
6087h		Torque slope	rw	unsigned32	0

4.5 Homing mode, hm

This is a position control mode to execute an origin return operation by designating the origin return method, operation velocity, etc. and creating a position command in the servo driver. Set 6060H=6.



4.4.1 Controlword setting in hm mode (60400010h)

Index	Sub-Index	Name / Description	Units	Range	Data Type	Access	PDO	Op-mode	EEPROM																						
6040h	00h	Controlword • Set a command to a servo driver including the PDS state transition.	-	0 - 65535	U16	rw	RxPDO	ALL	No																						
Bit information details																															
<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="width:10%;">15 - 10</td> <td style="width:10%; text-align:center;">9</td> <td style="width:10%; text-align:center;">8</td> <td style="width:10%; text-align:center;">7</td> <td style="width:10%; text-align:center;">6</td> <td style="width:10%; text-align:center;">5</td> <td style="width:10%; text-align:center;">4</td> <td style="width:10%; text-align:center;">3</td> <td style="width:10%; text-align:center;">2</td> <td style="width:10%; text-align:center;">1</td> <td style="width:10%; text-align:center;">0</td> </tr> <tr> <td style="text-align:center;">r</td> <td style="text-align:center;">oms</td> <td style="text-align:center;">h</td> <td style="text-align:center;">fr</td> <td style="text-align:center;">r</td> <td style="text-align:center;">r</td> <td style="text-align:center;">start homing</td> <td style="text-align:center;">eo</td> <td style="text-align:center;">qs</td> <td style="text-align:center;">ev</td> <td style="text-align:center;">so</td> </tr> </table>										15 - 10	9	8	7	6	5	4	3	2	1	0	r	oms	h	fr	r	r	start homing	eo	qs	ev	so
15 - 10	9	8	7	6	5	4	3	2	1	0																					
r	oms	h	fr	r	r	start homing	eo	qs	ev	so																					
<table style="width:100%;"> <tr> <td style="width:50%;">r = reserved (not supported)</td> <td style="width:50%;">fr = fault reset</td> </tr> <tr> <td>oms = operation mode specific (control mode dependent bit)</td> <td>eo = enable operation</td> </tr> <tr> <td></td> <td>qs = quick stop</td> </tr> <tr> <td></td> <td>ev = enable voltage</td> </tr> <tr> <td>h = halt</td> <td>so = switch on</td> </tr> </table>										r = reserved (not supported)	fr = fault reset	oms = operation mode specific (control mode dependent bit)	eo = enable operation		qs = quick stop		ev = enable voltage	h = halt	so = switch on												
r = reserved (not supported)	fr = fault reset																														
oms = operation mode specific (control mode dependent bit)	eo = enable operation																														
	qs = quick stop																														
	ev = enable voltage																														
h = halt	so = switch on																														

Bit4 0->1: The homing operation starts.

6068h		Position window time	rw	unsigned16	1
606Bh		Velocity demand value	ro	integer32	0
606Ch		Velocity actual value	ro	integer32	0
607Ch		Home offset	rw	integer32	0
607Dh	01h	Min position limit	rw	integer32	-2147483648
	02h	Max position limit	rw	integer32	2147483647
6098h		Homing method	rw	integer8	0
6099h	01h	Velocity during search for switch	rw	unsigned32	100
	02h	Velocity during search for zero	rw	unsigned32	10
609Ah		Homing acceleration	rw	unsigned32	100

4.4.4 Homing methods

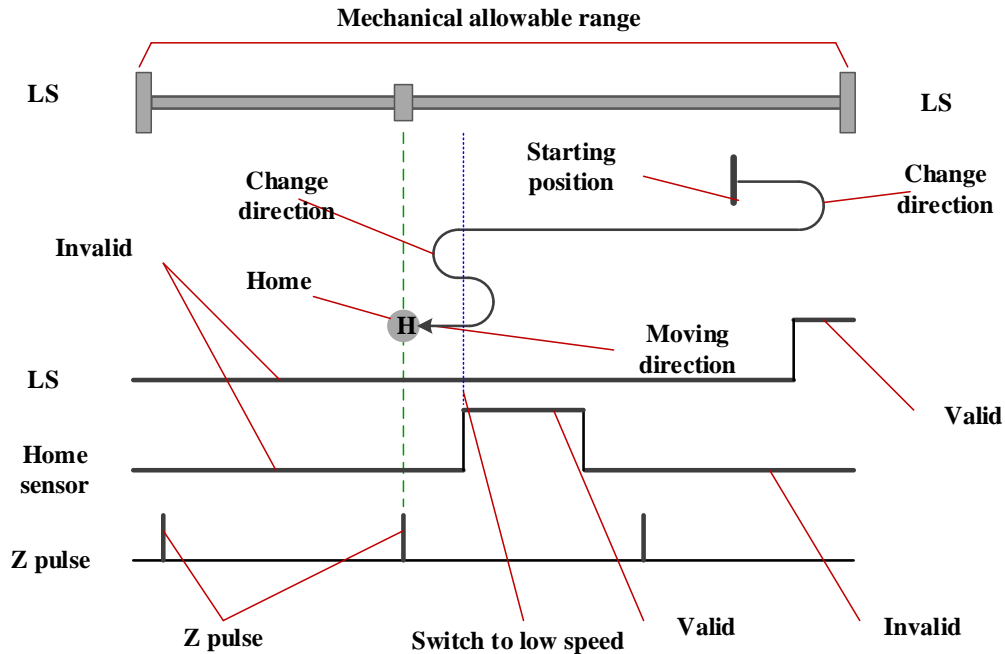
CiA402 internally defines 31 homing methods.

+Ve: positive direction LS: Limit switch
- Ve: negative direction HS: Home switch

Value	Definition
0	No homing method assigned
1	-Ve LS & Index Pulse
2	+Ve LS & Index Pulse
3	+Ve HS & Index Pulse direction reversal
4	+Ve HS & Index Pulse no direction change
5	-Ve HS & Index Pulse direction reversal
6	-Ve HS & Index Pulse no direction change
7	on +Ve HS -Index Pulse
8	on +Ve HS +Index Pulse
9	After +ve HS reverse +Index Pulse
10	After +ve HS +Index Pulse
11	on -Ve HS -Index Pulse
12	on -Ve HS +Index Pulse
13	After -ve HS reverse +Index Pulse
14	After -ve HS +Index Pulse
15	Reserved
16	Reserved
17	Same as 1 without Index Pulse
18	Same as 2 without Index Pulse
19	Same as 3 without Index Pulse
20	Same as 4 without Index Pulse
21	Same as 5 without Index Pulse
22	Same as 6 without Index Pulse
23	Same as 7 without Index Pulse
24	Same as 8 without Index Pulse
25	Same as 9 without Index Pulse
26	Same as 10 without Index Pulse
27	Same as 11 without Index Pulse
28	Same as 12 without Index Pulse
29	Same as 13 without Index Pulse
30	Same as 14 without Index Pulse
31	Reserved

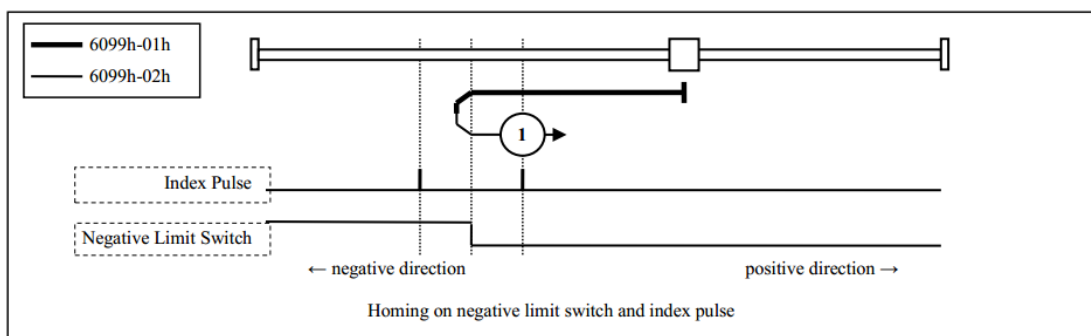
32	Reserved
33	On Index Pulse +Ve direction
34	On Index Pulse -Ve direction
35	Current position = home

Illustration:



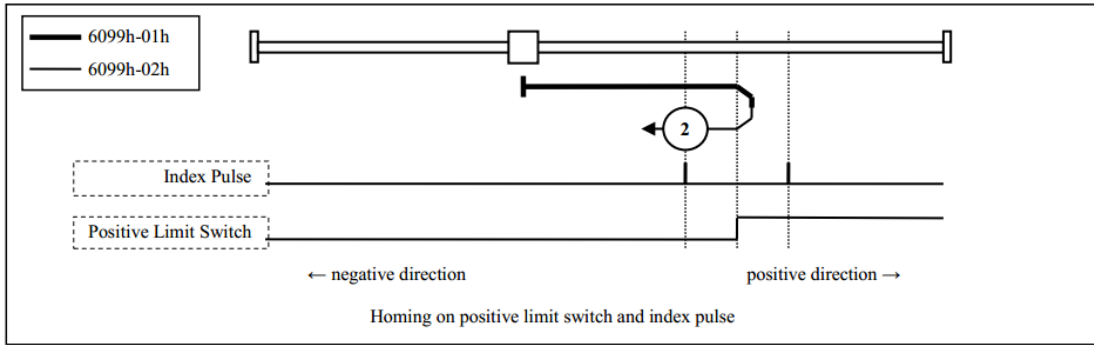
Method 1

- This Method, if Negative limit switch is inactive, the initial operation direction turns into the negative direction. (An inactive state is shown in the state of low level by a figure)
- Home detection position is the first Index pulse detection position in the Positive side position of after a Negative limit signal becomes inactive.
- (See figure)
- When NOT is not assigned, Homing error will occur (Homing error = 1)



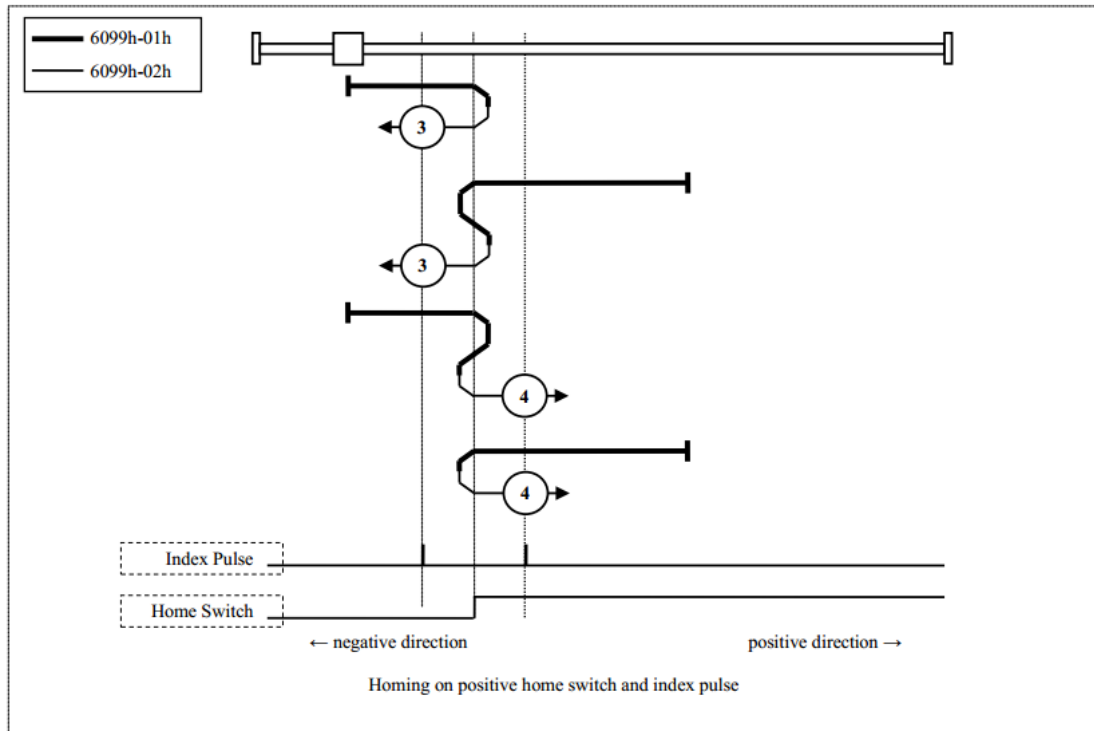
Method 2

- This Method, if Positive limit switch is inactive, the initial operation direction turns into the positive direction. (An inactive state is shown in the state of low level by a figure)
- Home detection position is the first Index pulse detection position in the Negative side position of after a Positive limit signal becomes inactive.
- (See figure)
- When POT is not assigned, Homing error will occur (Homing error = 1).



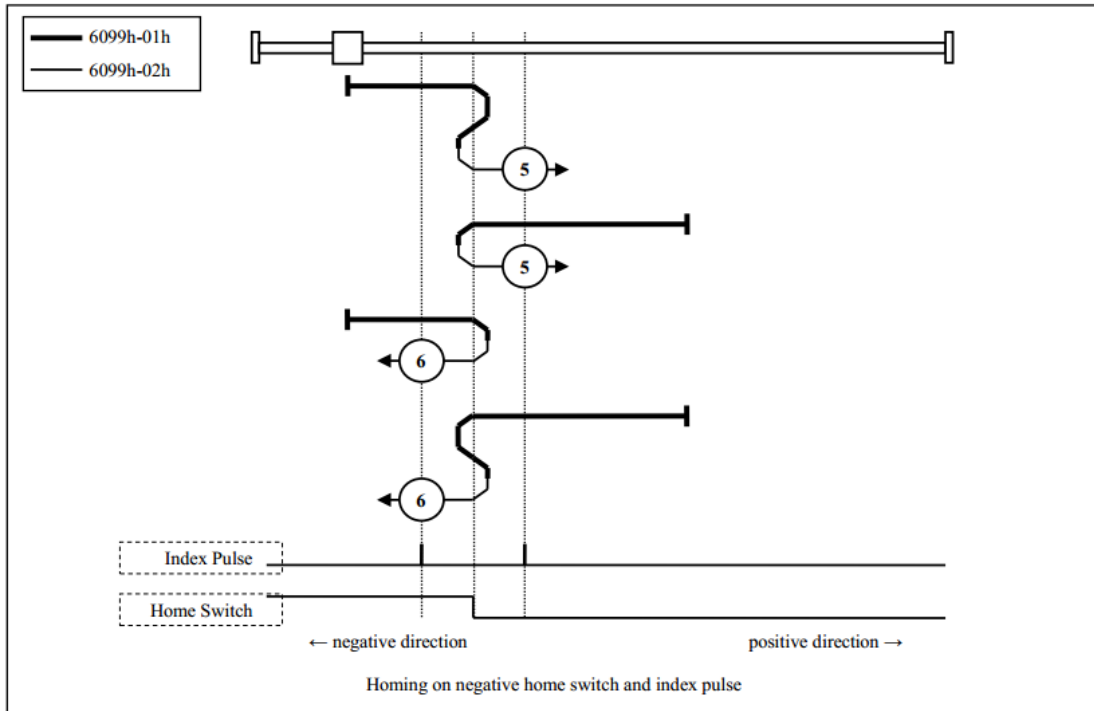
Method 3, 4

- These Methods, the initial operation direction changes in the state of Home switch at startup
- Home detection position is the first Index pulse detection position in the Negative side or Positive side after the change of state of Home switch.
- (See figure)
- When HOME is not assigned, Homing error will occur(Homing error = 1).



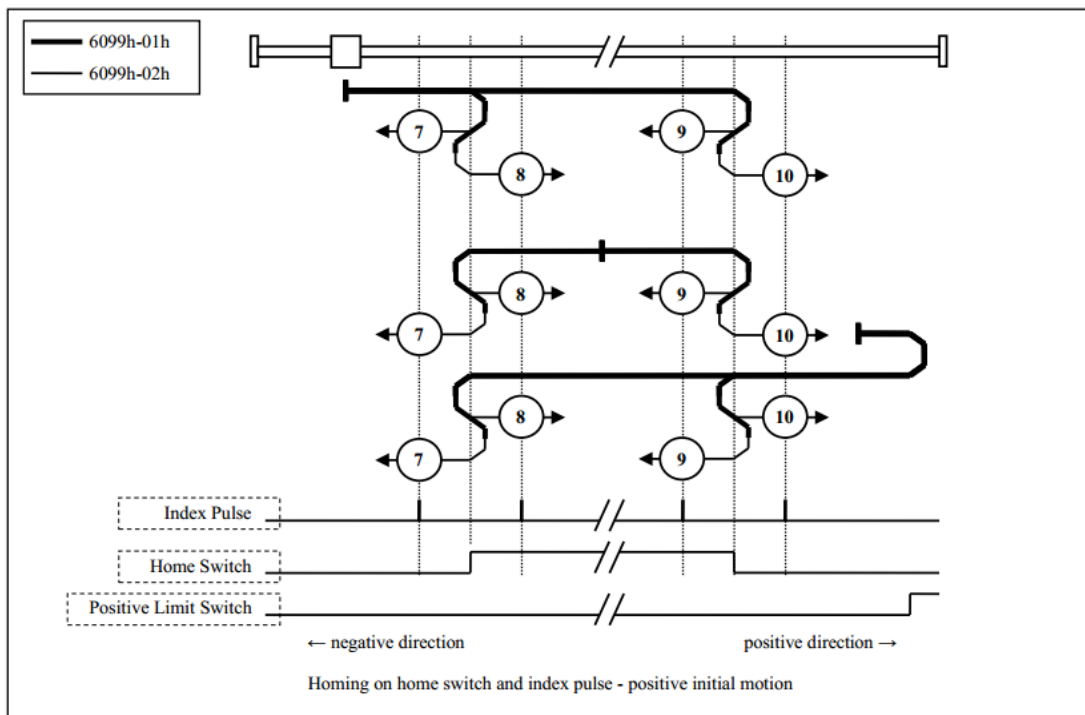
Method 5, 6

- These Methods, the initial operation direction changes in the state of Home switch at startup
- Home detection position is the first Index pulse detection position in the Negative side or Positive side after the change of state of Home switch.
- (See figure)
- When HOME is not assigned, Homing error will occur(Homing error = 1)



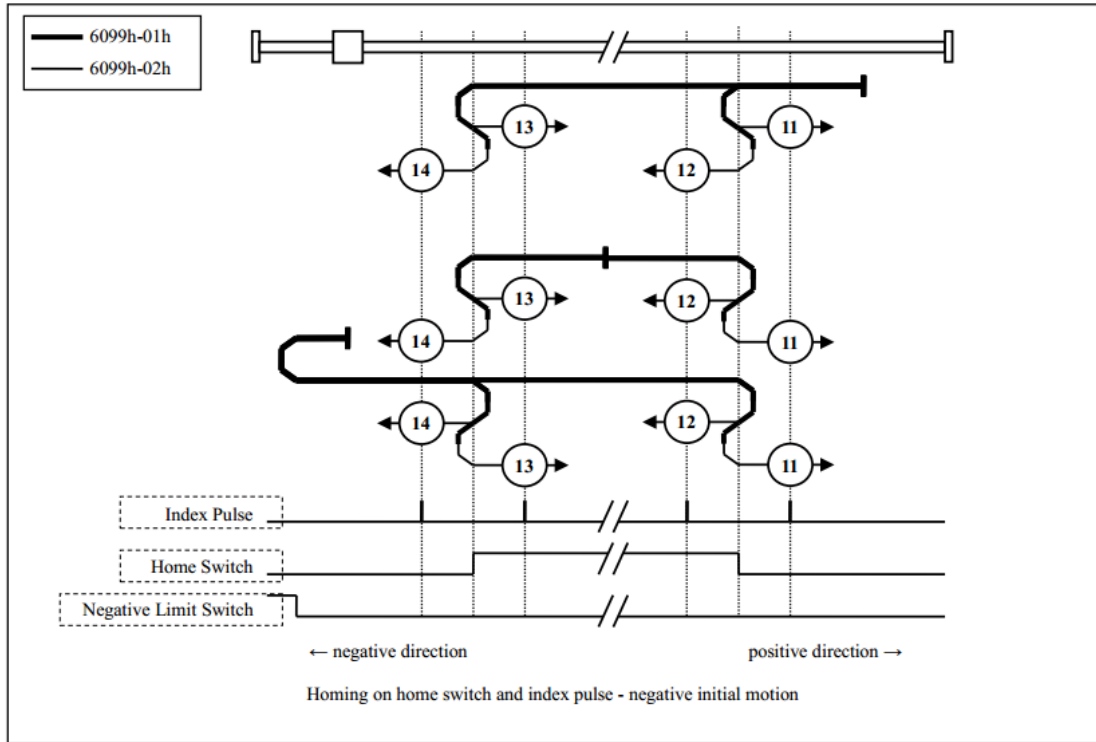
Method 7, 8, 9, 10

- These Methods, use Home switch and Index pulse.
- Method 7 and 8 initial operation directions, when Home switch is active at the time of a start of operation, becomes the Negative direction.
- Method 9 and 10 initial operation directions, when Home switch is active at the time of a start of operation, becomes the Positive direction.
- Home detection position is the near Index pulse in the rising or falling edge of Home switch.
- (See figure)
- When HOME and POT are not assigned, Homing error will occur(Homing error = 1)



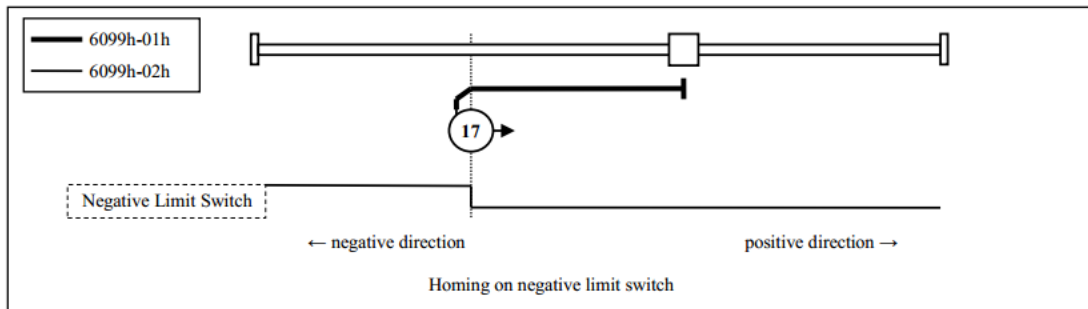
Method 11, 12, 13, 14

- These Methods, use Home switch and Index pulse.
- Method 11 and 12 initial operation directions, when Home switch is active at the time of a start of operation, becomes the Positive direction.
- Method 13 and 14 initial operation directions, when Home switch is active at the time of a start of operation, becomes the Negative direction.
- Home detection position is the near Index pulse in the rising or falling edge of Home switch.
- (See figure)
- When HOME and NOT are not assigned, Homing error will occur(Homing error = 1)



Method 17

- This Method resembles Method 1.
- The difference is home detection position is not Index pulse. It is becoming the position where Limit switch changed.
- (See figure)
- When NOT is not assigned, Homing error will occur(Homing error = 1)



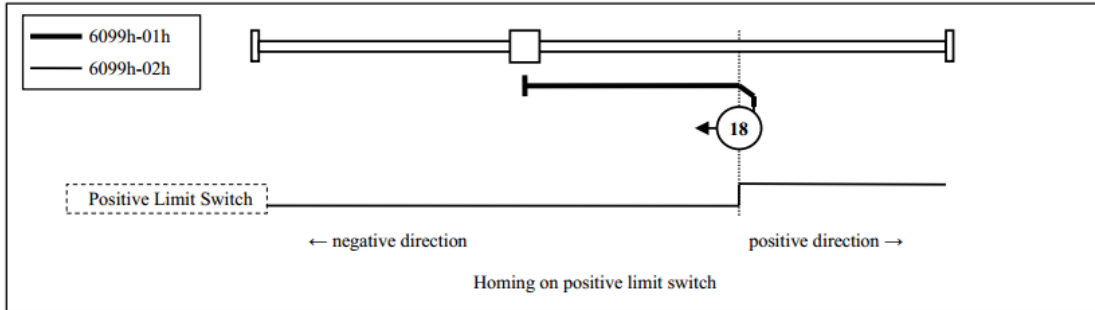
Method 18

- This Method resembles Method2.

The difference is home detection position is not Index pulse. It is becoming the position where Limit switch changed.

(See figure)

- When POT is not assigned, Homing error will occur(Homing error = 1)



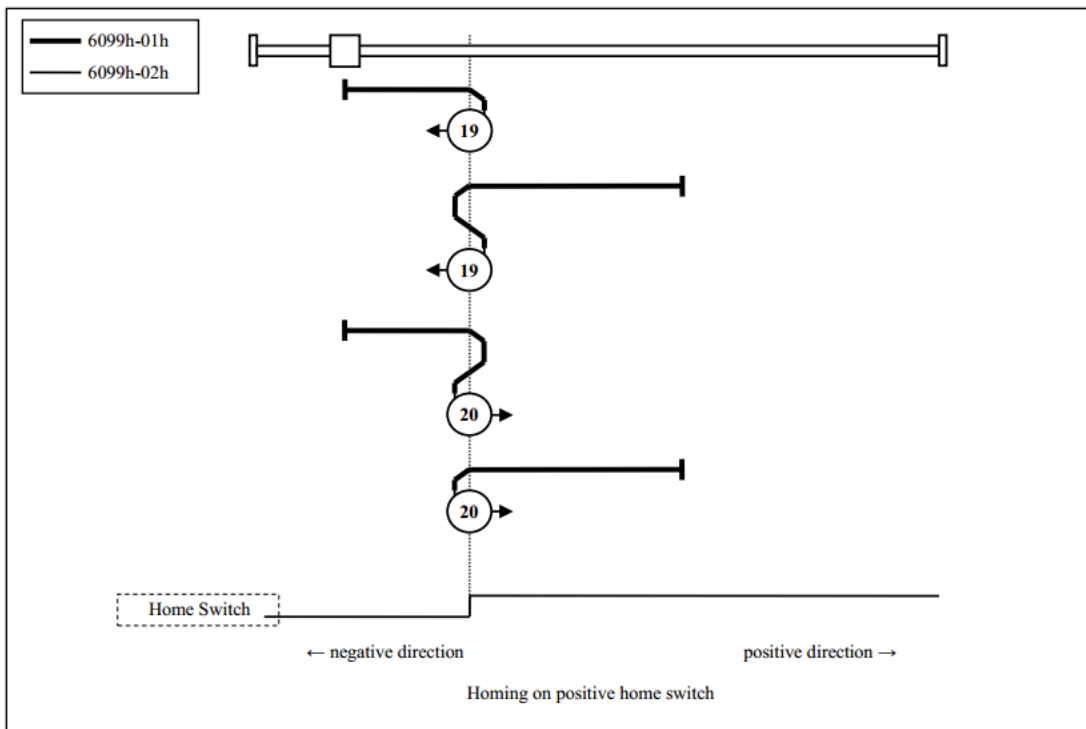
Method 19, 20

- These Methods resembles Method3 and 4.

The difference is home detection position is not Index pulse. It is becoming the position where Home switch changed.

(See figure)

- When HOME is not assigned, Homing error will occur(Homing error = 1).



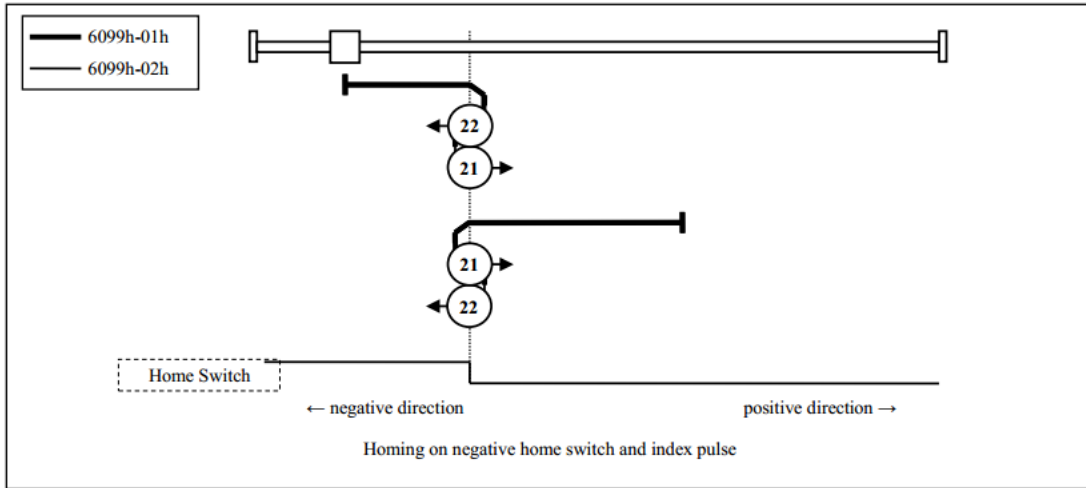
Method 21, 22

- These Methods resembles Method5 and 6.

The difference is home detection position is not Index pulse. It is becoming the position where Home switch changed.

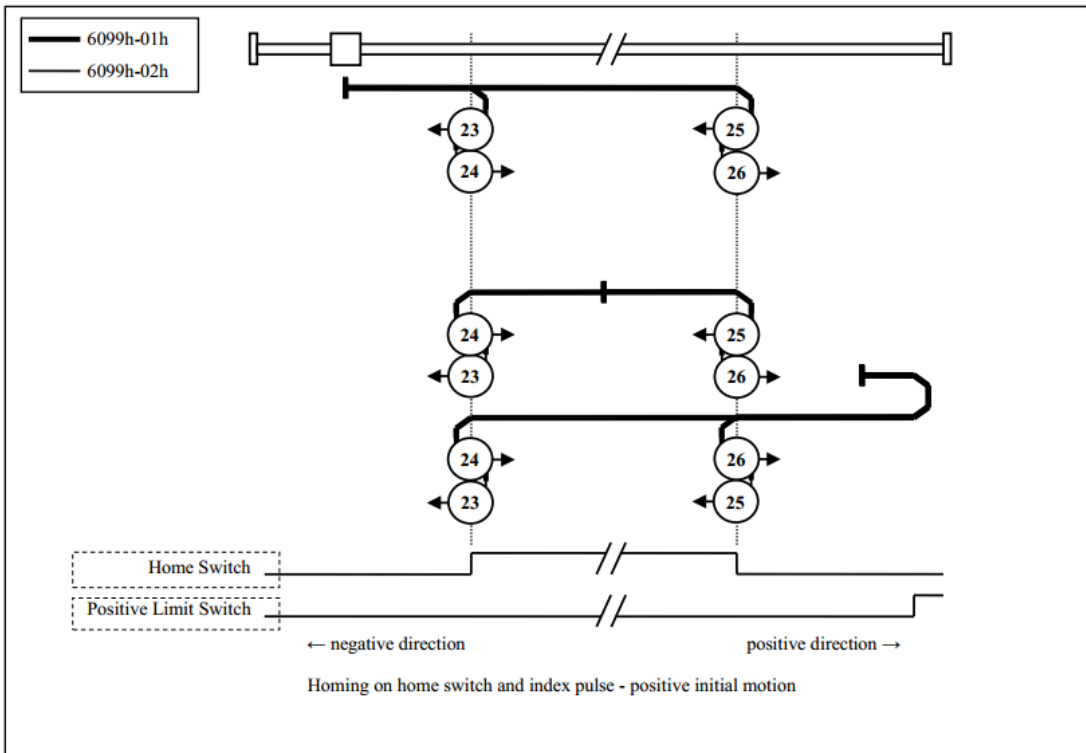
(See figure)

- When HOME is not assigned, Homing error will occur(Homing error = 1).



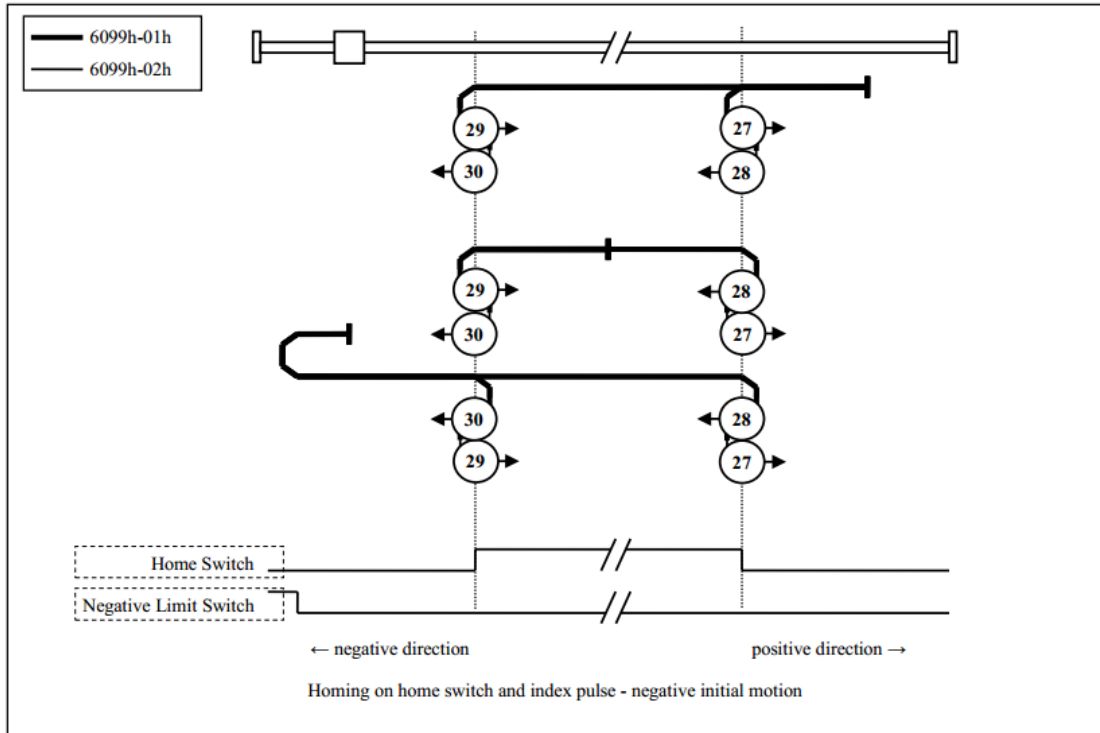
Method 23, 24, 25, 26

- These Methods resembles Method7,8,9 and 10.
- The difference is home detection position is not Index pulse. It is becoming the position where Home switch changed.
- (See figure)
- When HOME and POT are not assigned, Homing error will occur(Homing error = 1)



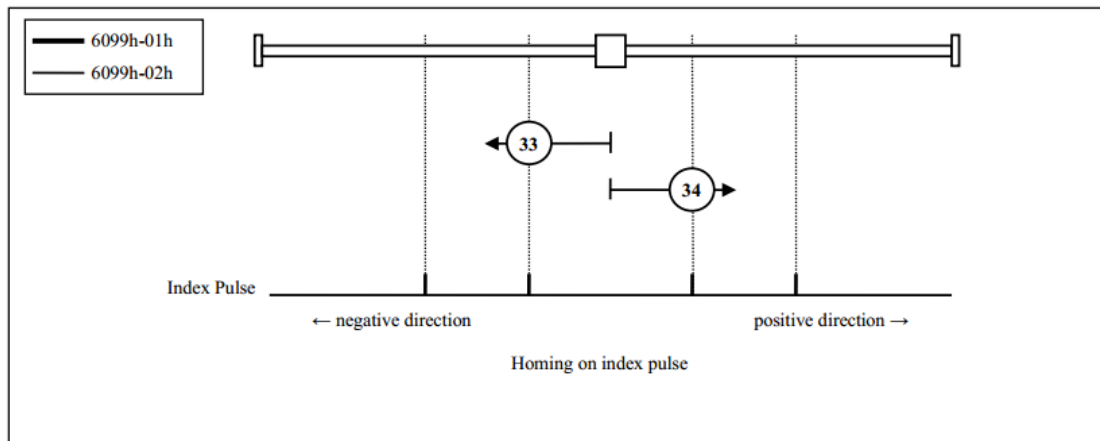
Method 27, 28, 29, 30

- These Methods resembles Method11,12,13 and 14.
- The difference is home detection position is not Index pulse. It is becoming the position where Home switch changed.
- (See figure)
- When HOME and NOT are not assigned, Homing error will occur(Homing error = 1).



Method 33, 34

- These Methods, use only Index pulse.
- Index pulse detected in operates in the direction shown in a figure is home detection position. (See figure)



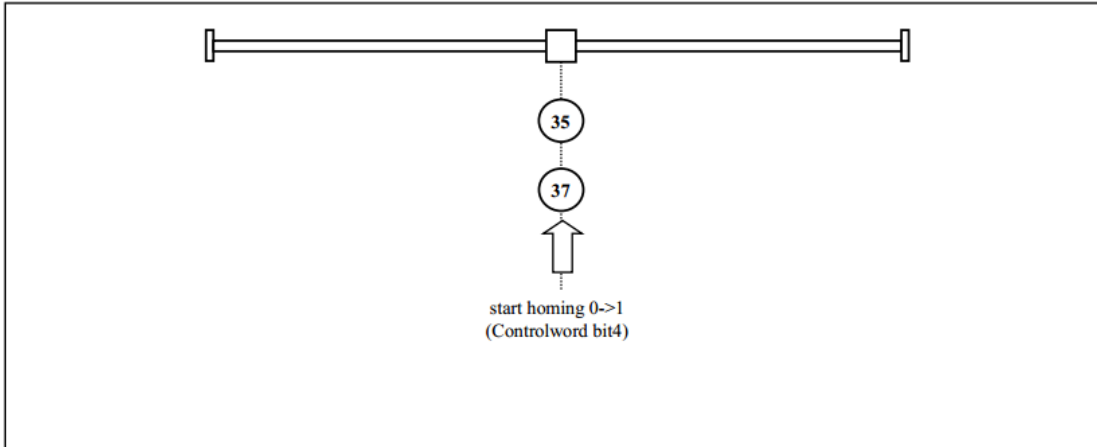
Method 35, 37

- Used to set the coordinate system (position information) of the servo driver. The following objects is initialized(Preset) on the basis of that position on homing startup.

6062h(Position demand value) = 6064h(Position actual value) = 607Ch(Home offset)
 6063h(Position actual internal value) = 60FCh(Position demand internal value) = 0
 (NOTE) 607Ch(Home offset) is added to 6062h and 6064h.

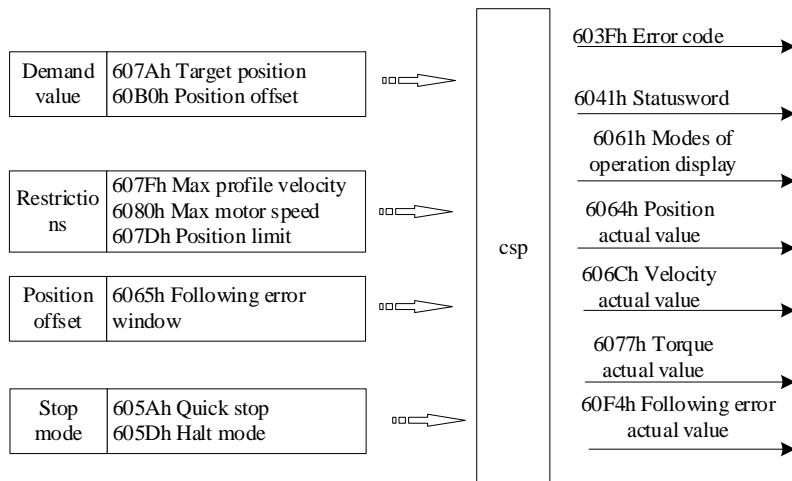
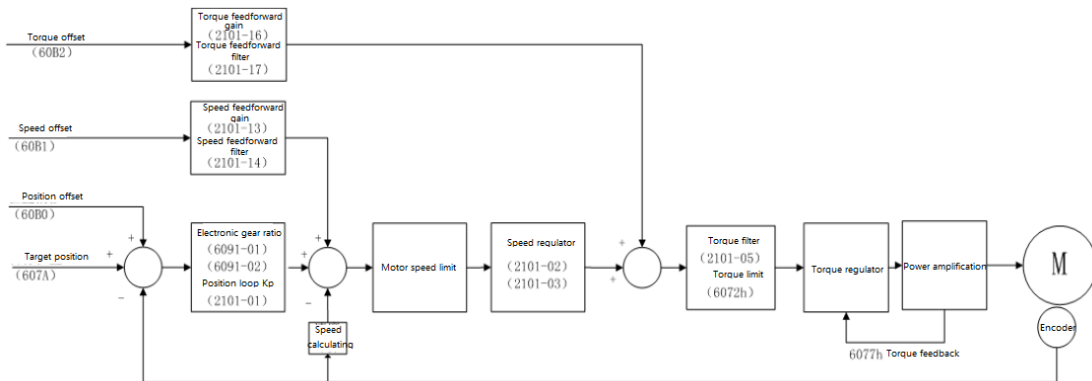
- Practicable even if the PDS state is not Operation enabled.
- After 100ms or more expiration from stopping the command position, run Method 35 or 37.
- Although Method35 and 37 are the same functions, use Method37 according to the ETG standard

at the time of a new design



4.6 Cyclic synchronous position mode, csp

This is a position control mode to operate by creating a command position in the host controller (master) and updating (transmitting) the command position in an interpolation cycle. Set 6060H=8.



4.6.1 Controlword setting in csp mode (60400010h)

Index	Sub-Index	Name / Description	Units	Range	Data Type	Access	PDO	Op-mode	EEPROM																						
6040h	00h	Controlword • Set a command to a servo driver including the PDS state transition.	-	0 - 65535	U16	rw	RxPDO	ALL	No																						
Bit information details																															
<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="width:10%;">15 - 10</td> <td style="width:10%; text-align:center;">9</td> <td style="width:10%; text-align:center;">8</td> <td style="width:10%; text-align:center;">7</td> <td style="width:10%; text-align:center;">6</td> <td style="width:10%; text-align:center;">5</td> <td style="width:10%; text-align:center;">4</td> <td style="width:10%; text-align:center;">3</td> <td style="width:10%; text-align:center;">2</td> <td style="width:10%; text-align:center;">1</td> <td style="width:10%; text-align:center;">0</td> </tr> <tr> <td style="text-align:center;">r</td> <td style="text-align:center;">oms</td> <td style="text-align:center;">h</td> <td style="text-align:center;">fr</td> <td style="text-align:center;">r</td> <td style="text-align:center;">r</td> <td style="text-align:center;">r</td> <td style="text-align:center;">eo</td> <td style="text-align:center;">qs</td> <td style="text-align:center;">ev</td> <td style="text-align:center;">so</td> </tr> </table>										15 - 10	9	8	7	6	5	4	3	2	1	0	r	oms	h	fr	r	r	r	eo	qs	ev	so
15 - 10	9	8	7	6	5	4	3	2	1	0																					
r	oms	h	fr	r	r	r	eo	qs	ev	so																					
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oms = operation mode specific (control mode dependent bit)	eo = enable operation																														
h = halt	qs = quick stop																														
	ev = enable voltage																														
	so = switch on																														

4.6.2 Statusword setting in csp mode (60410010h)

Index	Sub-Index	Name / Description	Units	Range	Data Type	Access	PDO	Op-mode	EEPROM																														
6041h	00h	Statusword • Displays the servo driver state.	-	0-65535	U16	ro	TxPDO	ALL	No																														
Bit information details																																							
<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="width:10%;">15 - 14</td> <td style="width:10%; text-align:center;">13</td> <td style="width:10%; text-align:center;">12</td> <td style="width:10%; text-align:center;">11</td> <td style="width:10%; text-align:center;">10</td> <td style="width:10%; text-align:center;">9</td> <td style="width:10%; text-align:center;">8</td> <td style="width:10%; text-align:center;">7</td> <td style="width:10%; text-align:center;">6</td> <td style="width:10%; text-align:center;">5</td> <td style="width:10%; text-align:center;">4</td> <td style="width:10%; text-align:center;">3</td> <td style="width:10%; text-align:center;">2</td> <td style="width:10%; text-align:center;">1</td> <td style="width:10%; text-align:center;">0</td> </tr> <tr> <td style="text-align:center;">r</td> <td colspan="2" style="text-align:center;">oms</td> <td style="text-align:center;">ila</td> <td style="text-align:center;">r</td> <td style="text-align:center;">rm</td> <td style="text-align:center;">r</td> <td style="text-align:center;">w</td> <td style="text-align:center;">sod</td> <td style="text-align:center;">qs</td> <td style="text-align:center;">ve</td> <td style="text-align:center;">f</td> <td style="text-align:center;">oe</td> <td style="text-align:center;">so</td> <td style="text-align:center;">rtso</td> </tr> </table>										15 - 14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	r	oms		ila	r	rm	r	w	sod	qs	ve	f	oe	so	rtso
15 - 14	13	12	11	10	9	8	7	6	5	4	3	2	1	0																									
r	oms		ila	r	rm	r	w	sod	qs	ve	f	oe	so	rtso																									
<table style="width:100%;"> <tr> <td style="width:50%;">r = reserved (not supported)</td> <td style="width:50%;">w = warning</td> </tr> <tr> <td>oms = operation mode specific (control mode dependent bit)</td> <td>sod = switch on disabled</td> </tr> <tr> <td>ila = internal limit active</td> <td>qs = quick stop</td> </tr> <tr> <td></td> <td>ve = voltage enabled</td> </tr> <tr> <td></td> <td>f = fault</td> </tr> <tr> <td></td> <td>oe = operation enabled</td> </tr> <tr> <td>rm = remote</td> <td>so = switched on</td> </tr> <tr> <td></td> <td>rtso = ready to switch on</td> </tr> </table>										r = reserved (not supported)	w = warning	oms = operation mode specific (control mode dependent bit)	sod = switch on disabled	ila = internal limit active	qs = quick stop		ve = voltage enabled		f = fault		oe = operation enabled	rm = remote	so = switched on		rtso = ready to switch on														
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	ve = voltage enabled																																						
	f = fault																																						
	oe = operation enabled																																						
rm = remote	so = switched on																																						
	rtso = ready to switch on																																						

Bit 0~9, 11: 0 means invalid; 1 means valid. For other bits please refer to below:

Bit	Name	Remarks
10	Target reached	60400010h bit 8 =0 , 0: target not reached 1: target reached; 60400010h bit 8 =1 , 0: in deceleration 1: velocity is 0
12	Drive follows command value	0: Operation is not performed according to the target position.; 1: Operation is performed according to the target position.
15	Homing finished	0: invalid 1: homing finished. For absolute system, when set 2 nd place from right of P09.14 to 2, after homing finished, it will store value of bit15 (maintain at power off); set P20.06=7 can clear the stored value.

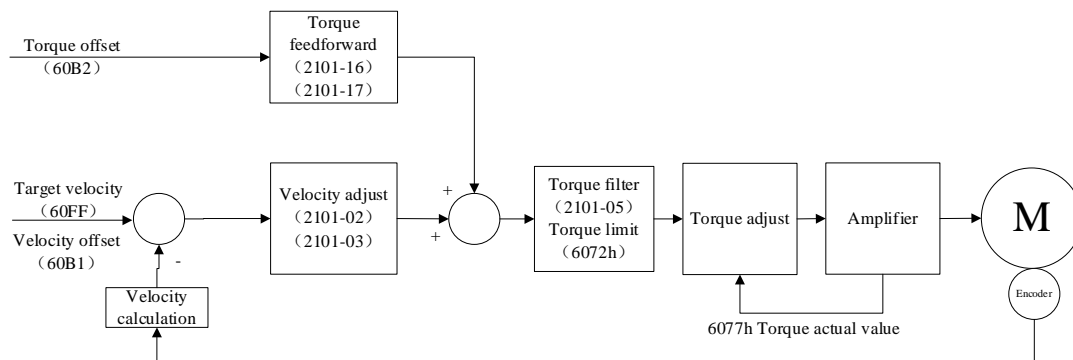
4.6.3 Object dictionary list in csp mode

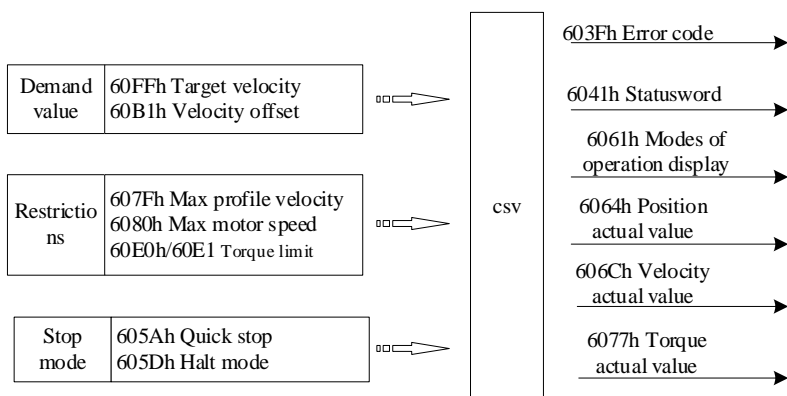
Index	Sub-index	Name	Access	Data type	Default
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603Fh		Error code	ro	unsigned16	0
6040h		Controlword	rw	unsigned16	0
6041h		Statusword	ro	unsigned16	0
6060h		Modes of operation	rw	integer8	0
6061h		Modes of operation display	ro	integer8	0
6062h		Position demand value	ro	integer32	0
6063h		Position actual internal value	ro	integer32	0
6064h		Position actual value	ro	integer32	0
6065h		Following error window	rw	unsigned32	1000000
6067h		Position window	rw	unsigned32	100
6068h		Position window time	rw	unsigned16	1
606Bh		Velocity demand value	ro	integer32	0
606Ch		Velocity actual value	ro	integer32	0
607A		Target position	rw	integer32	0
607Ch		Home offset	rw	integer32	0
607Dh	01h	Min position limit	rw	integer32	-2147483648
	02h	Max position limit	rw	integer32	2147483647
60B0h		Position offset	rw	integer32	0
60B1h		Velocity offset	rw	integer32	0
60B2h		Torque offset	rw	integer32	0
60F4h		Following error actual value	ro	integer32	0
60FCh		Position demand internal value	ro	integer32	0

4.7 Cyclic synchronous velocity mode, csv

This is a velocity control mode to operate by creating a command velocity in the host controller (master) and updating (transmitting) the command velocity in an interpolation cycle. Set 6060H=9.





4.7.1 Controlword setting in csv mode (60400010h)

Index	Sub-Index	Name / Description	Units	Range	Data Type	Access	PDO	Opmode	EEPROM																						
6040h	00h	Controlword • Set a command to a servo driver including the PDS state transition. Bit information details	-	0 - 65535	U16	rw	RxPDO	ALL	No																						
<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="width:10%;">15 - 10</td> <td style="width:10%; text-align:center;">9</td> <td style="width:10%; text-align:center;">8</td> <td style="width:10%; text-align:center;">7</td> <td style="width:10%; text-align:center;">6</td> <td style="width:10%; text-align:center;">5</td> <td style="width:10%; text-align:center;">4</td> <td style="width:10%; text-align:center;">3</td> <td style="width:10%; text-align:center;">2</td> <td style="width:10%; text-align:center;">1</td> <td style="width:10%; text-align:center;">0</td> </tr> <tr> <td style="text-align:center;">r</td> <td style="text-align:center;">oms</td> <td style="text-align:center;">h</td> <td style="text-align:center;">fr</td> <td style="text-align:center;">r</td> <td style="text-align:center;">r</td> <td style="text-align:center;">r</td> <td style="text-align:center;">eo</td> <td style="text-align:center;">qs</td> <td style="text-align:center;">ev</td> <td style="text-align:center;">so</td> </tr> </table>										15 - 10	9	8	7	6	5	4	3	2	1	0	r	oms	h	fr	r	r	r	eo	qs	ev	so
15 - 10	9	8	7	6	5	4	3	2	1	0																					
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oms = operation mode specific (control mode dependent bit)	eo = enable operation																														
h = halt	qs = quick stop																														
	ev = enable voltage																														
	so = switch on																														

4.7.2 Statusword setting in csv mode (60410010h)

Index	Sub-Index	Name / Description	Units	Range	Data Type	Access	PDO	Opmode	EEPROM																														
6041h	00h	Statusword • Displays the servo driver state. Bit information details	-	0 - 65535	U16	ro	TxPDO	ALL	No																														
<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="width:10%;">15 - 14</td> <td style="width:10%; text-align:center;">13</td> <td style="width:10%; text-align:center;">12</td> <td style="width:10%; text-align:center;">11</td> <td style="width:10%; text-align:center;">10</td> <td style="width:10%; text-align:center;">9</td> <td style="width:10%; text-align:center;">8</td> <td style="width:10%; text-align:center;">7</td> <td style="width:10%; text-align:center;">6</td> <td style="width:10%; text-align:center;">5</td> <td style="width:10%; text-align:center;">4</td> <td style="width:10%; text-align:center;">3</td> <td style="width:10%; text-align:center;">2</td> <td style="width:10%; text-align:center;">1</td> <td style="width:10%; text-align:center;">0</td> </tr> <tr> <td style="text-align:center;">r</td> <td style="text-align:center;">r</td> <td style="text-align:center;">drive follows command value</td> <td style="text-align:center;">ila</td> <td style="text-align:center;">r</td> <td style="text-align:center;">mm</td> <td style="text-align:center;">r</td> <td style="text-align:center;">w</td> <td style="text-align:center;">sod</td> <td style="text-align:center;">qs</td> <td style="text-align:center;">ve</td> <td style="text-align:center;">f</td> <td style="text-align:center;">oe</td> <td style="text-align:center;">so</td> <td style="text-align:center;">rtso</td> </tr> </table>										15 - 14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	r	r	drive follows command value	ila	r	mm	r	w	sod	qs	ve	f	oe	so	rtso
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r	r	drive follows command value	ila	r	mm	r	w	sod	qs	ve	f	oe	so	rtso																									
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oms = operation mode specific (control mode dependent bit)	sod = switch on disabled																																						
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r = reserved(not supported)	f = fault																																						
	oe = operation enabled																																						
	so = switched on																																						
	rtso = ready to switch on																																						

Bit	Name	Remarks
12	Drive follows command value.	0: Operation is not performed according to the target velocity. 1: Operation is performed according to the target velocity.

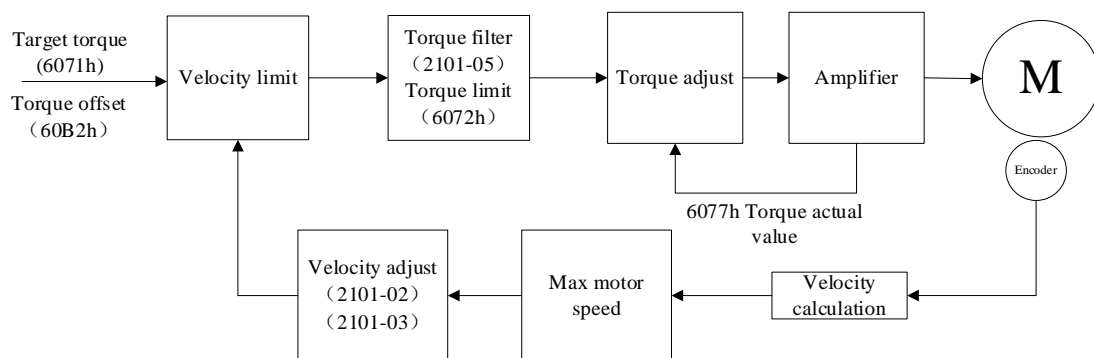
4.7.3 Object dictionary list in csv mode

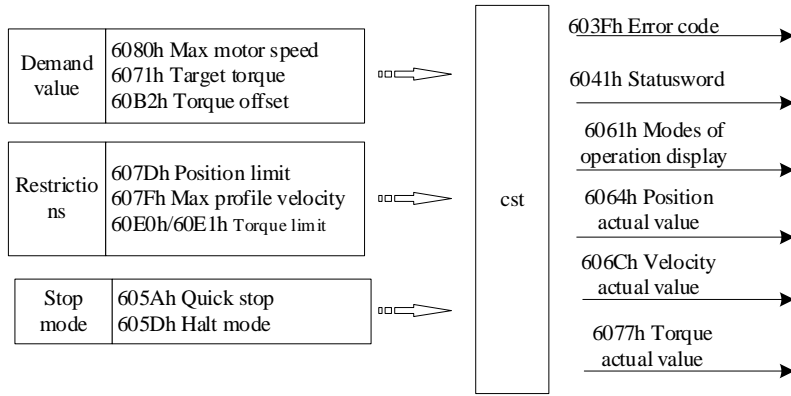
Index	Sub-index	Name	Access	Data type	Default
603Fh		Error code	ro	unsigned16	0

6040h		Controlword	rw	unsigned16	0
6041h		Statusword	ro	unsigned16	0
6060h		Modes of operation	rw	integer8	0
6061h		Modes of operation display	ro	integer8	0
6063h		Position actual internal value	ro	integer32	0
6064h		Position actual value	ro	integer32	0
606Bh		Velocity demand value	ro	integer32	0
606Ch		Velocity actual value	ro	integer32	0
606Dh		Velocity window	rw	unsigned16	100
606Eh		Velocity window time	rw	unsigned16	1
606Fh		Velocity threshold	rw	unsigned16	10
607Ch		Home offset	rw	integer32	0
607Dh	01h	Min position limit	rw	integer32	-2147483648
	02h	Max position limit	rw	integer32	2147483647
607Eh		Polarity	rw	unsigned8	0
6083h		Profile acceleration	rw	unsigned32	100
6084h		Profile deceleration	rw	unsigned32	100
6094h	01h	Velocity encoder factor: numerator	rw	unsigned32	1
	02h	Velocity encoder factor: denominator	rw	unsigned32	1
60C5h		Max acceleration	rw	unsigned32	60000
60C6h		Max deceleration	rw	unsigned32	60000
60B1h		Velocity offset	rw	unsigned32	0
60B2h		Torque offset	Rw	unsigned32	0
60FFh		Target velocity	rw	integer32	0

4.8 Cyclic synchronous torque mode, cst

This is a torque control mode to operate by creating a command torque in the host controller (master) and updating (transmitting) the command torque in an interpolation cycle. Set 6060H=10.





4.8.1 Controlword setting in cst mode (60400010h)

Index	Sub-Index	Name /Description	Units	Range	Data Type	Access	PDO	Opmode	EEPROM																								
6040h	00h	Controlword • Set a command to a servo driver including the PDS state transition. Bit information details	-	0 - 65535	U16	rw	RxPDO	ALL	No																								
		<table border="1"> <tr> <td>15 - 10</td> <td>9</td> <td>8</td> <td>7</td> <td>6</td> <td>5</td> <td>4</td> <td>3</td> <td>2</td> <td>1</td> <td>0</td> </tr> <tr> <td>r</td> <td>oms r</td> <td>h</td> <td>fr</td> <td>r</td> <td>r</td> <td>r</td> <td>eo</td> <td>qs</td> <td>ev</td> <td>so</td> </tr> </table>	15 - 10	9	8	7	6	5	4	3	2	1	0	r	oms r	h	fr	r	r	r	eo	qs	ev	so									
15 - 10	9	8	7	6	5	4	3	2	1	0																							
r	oms r	h	fr	r	r	r	eo	qs	ev	so																							
		r = reserved (Not supported) fr = fault reset oms = operation mode specific eo = enable operation (control mode dependent bit) qs = quick stop h = halt ev = enable voltage so = switch on																															

4.8.2 Statusword setting in cst mode (60410010h)

Index	Sub-Index	Name /Description	Units	Range	Data Type	Access	PDO	Opmode	EEPROM																																
6041h	00h	Statusword • Displays the servo driver state. Bit information details	-	0 - 65535	U16	ro	TxPDO	ALL	No																																
		<table border="1"> <tr> <td>15 - 14</td> <td>13</td> <td>12</td> <td>11</td> <td>10</td> <td>9</td> <td>8</td> <td>7</td> <td>6</td> <td>5</td> <td>4</td> <td>3</td> <td>2</td> <td>1</td> <td>0</td> </tr> <tr> <td>r</td> <td>r</td> <td>drive follows command value</td> <td>ila</td> <td>oms r</td> <td>rm</td> <td>r</td> <td>w</td> <td>sod</td> <td>qs</td> <td>ve</td> <td>f</td> <td>oe</td> <td>so</td> <td>rtso</td> </tr> </table>	15 - 14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	r	r	drive follows command value	ila	oms r	rm	r	w	sod	qs	ve	f	oe	so	rtso									
15 - 14	13	12	11	10	9	8	7	6	5	4	3	2	1	0																											
r	r	drive follows command value	ila	oms r	rm	r	w	sod	qs	ve	f	oe	so	rtso																											
		r = reserved(Not supported) w = warning oms = operation mode specific sod = switch on disabled (control mode dependent bit) qs = quick stop ila = internal limit active ve = voltage enabled rm = remote f = fault oe = operation enabled so = switched on rtso = ready to switch on																																							

Bit	Name	Remarks
12	Drive follows command value.	0: Operation is not performed according to the target torque. 1: Operation is performed according to the target torque.

4.9.3 Object dictionary list in cst mode

Index	Sub-index	Name	Access	Data type	Default
603Fh		Error code	ro	unsigned16	0

6040h		Controlword	rw	unsigned16	0
6041h		Statusword	ro	unsigned16	0
6060h		Modes of operation	rw	integer8	0
6061h		Modes of operation display	ro	integer8	0
606Ch		Velocity actual value	ro	integer32	0
6071h		Target torque	rw	integer16	0
6074h		Torque demand	ro	integer16	0
6077h		Torque actual value	ro	integer16	0
607Dh	01h	Min position limit	rw	integer32	-2147483648
	02h	Max position limit	rw	integer32	2147483647
607Fh		Max profile velocity	rw	unsigned32	4500
6087h		Torque slope	rw	unsigned32	0

4.9 Instruction units

Velocity instruction unit:

Third place from right of hexadecimal value of P09.13 (2109-0Eh) determines velocity instruction unit.

0: RPM ,

1: command instruction/s.

Acceleration/deceleration instruction unit:

Fourth place from right of hexadecimal value of P09.13 (2109-0Eh) Acceleration/deceleration instruction unit.

0: ms of acceleration time from 0RPM to 1000RPM.

1: command instruction /s².

4.10 Servo driver internal function codes

Parameter address	Name	Remarks	Default
2100_02h (P00.01)	Modes of operation	0: position control 1: velocity control 2: torque control 7: EtherCAT	7
2100_09h~2100_0Dh (P0.08~P0.12)	Gear ratio	Can use 2 nd place from right of hexadecimal value of P09.13 (2109-0Eh) for switchover.	
2103-0Ah (P3.09)	Internal positive torque limit	To use with 60E0h, the smaller value prevails.	5000
2103_0bh (P03.10)	Internal negative	To use with 60E1h, the smaller value prevails.	5000

	torque limit		
2103_1Ch (P3.27)	Internal positive velocity limit	Can be used as max positive profile velocity. Can be replaced by 6080h.	3000
2103_1Dh (P3.28)	Internal negative velocity limit	Can be used as max negative profile velocity. Can be replaced by 6080h.	3000
2107_09h (P7.08)	Soft limit function selection	Enable 607Dh soft limit function. Hex. From right to left 1st/2 nd digit: General function 3 rd digit: 0: Disable soft limit 1: Enable soft limit at power-on 2: Enable soft limit after origin return	0
2109_0Eh (P9.13)	EtherCAT communication configuration 1	Hex. From right to left 1 st digit: 2 nd digit: Electronic gear ratio selection 0: Using electronic gear ratio inside the drive 1: Enable 608Fh/6091h/6092h electronic gear 3 rd digit: Command Unit selection 0: rpm 1: Command/second 4 th digit: Acceleraton Unit selection 0:Acceleration time ms for 0RPM-1000RPM 1: Command /s ²	1100
2109_0Fh (P9.14)	EtherCAT communication configuration 2	Hex. From right to left 1 st digit: 2 nd digit:Origin completion flag storage setting in absolute system 0: Stored 1: Not stored 3 rd digit: Reserved 4 th digit: Touch probe function selection	0
2109_11 (P9.16)	EtherCAT disconnection detection	Err.77 occurs when the times of Ethercat disconnection detection or synchronization data loss reach this value.	12
2109_12h (P9.17)	EtherCAT speed limit selection	0: The maximum speed in CSP mode is limited by the max. speed of the motor. ERR.78 occurs when exceeding the max. speed. 1: The max. speed is limited by 6080. Note that positioning error may occur if exceeds the max. speed.	1
2109_12h (P9.18)	EtherCAT station No. setting	0: The slave ALIAS address is determined by the address written into ESC EPROM from host controller. Other values: The slave ALIAS address is determined by P09.18. (Just ignore the ALIAS address when the host controller uses auto-incremental addressing)	1
2114_03h	Write and	When P20.02=0xA55A, 2000 groups of	0

(P20.02)	save communicati on parameters	parameters can be stored to EPROM written by host controller. When P20.06=10, no save.	
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5 Error (alarm) List

5.1 Error (alarm) list

603Fh shows corresponding CiA protocol error code. When there is an error, user can read from object dictionary list 603Fh. If the error is not listed below, please refer to standard user manual.

Code	Description	Stop mode	Reset (Y/N)	Record memory	603Fh
Err.001	System parameter abnormal	Stop immediately	N	No memory	6320h
Err.002	Product model selection fault	Stop immediately	N	No memory	6320h
Err.003	Fault during parameter storage	Stop immediately	N	No memory	7600h
Err.004	FPGA fault	Stop immediately	N	No memory	6320h
Err.005	Product matching fault	Stop immediately	N	No memory	6320h
Err.006	Program abnormal	Stop immediately	N	No memory	6320h
Err.007	Encoder initialization abnormal	Stop immediately	N	Memory	7305h
Err.008	Short circuit to ground detection fault	Stop immediately	N	Memory	2330h
Err.009	Overcurrent fault A	Stop immediately	N	Memory	2310h
Err.010	Overcurrent fault B	Stop immediately	Y	Memory	2310h
Err.012	Incremental encoder Z breakage or absolute encoder number of turns abnormal	Stop immediately	Y	Memory	7305h
Err.013	Encoder communication abnormal	Stop immediately	Y	Memory	7305h
Err.014	Encoder data abnormal	Stop immediately	Y	Memory	7305h
Err.015	Encoder battery undervoltage	Stop immediately	N	Memory	7305h
Err.016	Velocity deviation too large	Configurable	Y	Memory	8400h
Err.017	Torque saturation overtime	Configurable	Y	Memory	8300h
Err.018	Control power undervoltage	Configurable	Y	Memory	3220h
Err.019	Tripping error	Configurable	Y	Memory	8400h
Err.020	Overvoltage	Stop immediately	Y	Memory	3210h
Err.021	Undervoltage	Decelerate to stop	Y	Configurable	3220h
Err.022	Current sampling fault	Stop immediately	Y	Memory	7200h
Err.023	AI sampling voltage too large	Stop immediately	Y	Memory	7200h
Err.024	Overvelocity	Stop immediately	Y	Memory	8400h
Err.025	Electrical angle identification failure	Stop immediately	Y	No memory	FF00h
Err.026	Load identification failure	Stop immediately	Y	No memory	FF00h
Err.027	DI parameter setting fault	Stop immediately	Y	No memory	6320h
Err.028	DO parameter setting fault	Stop immediately	Y	No memory	6320h
Err.040	S-ON instruction invalid fault	Configurable	Y	No memory	FF00h
Err.042	Pulse division output overvelocity	Configurable	Y	Memory	FF00h
Err.043	Position deviation too large	Configurable	Y	Memory	8611h
Err.044	Main circuit input phase loss	Configurable	Y	Memory	3130h
Err.045	Drive output phase loss	Configurable	Y	Memory	3130h
Err.046	Drive overload	Configurable	Y	Memory	3230h

Code	Description	Stop mode	Reset (Y/N)	Record memory	603Fh
Err.047	Motor overload	Configurable	Y	Memory	3230h
Err.048	Electronic gear setting fault	Configurable	Y	No memory	6320h
Err.049	Heat sink too hot	Configurable	Y	Memory	4210h
Err.050	Pulse input abnormal	Configurable	Y	Memory	8500h
Err.051	Full-closed loop position deviation too large	Configurable	Y	Memory	8611h
Err.054	User forced fault	Configurable	Y	Memory	FF00h
Err.055	Absolute position resetting fault	Configurable	Y	Memory	FF00h
Err.056	Main circuit outage	Decelerate to stop	Y	Memory	5100h
Err.060	First start after writing customized software	Stop immediately	N	Configurable	6320h
Err.065	CAN bus off	Configurable	Y	Memory	7500h
Err.066	Abnormal NMT instruction	Configurable	Y	Memory	7500h
Err.067	CAN bus failure	Decelerate to stop	Y	Memory	7500h
Err. 068	External overvelocity(reserved)	Stop immediately	Y	Memory	7500h
Err. 069	Hybrid deviation too large	Configurable	Y	Memory	7500h
Err. 071	Node protection or heartbeat timeout	Configurable	Y	Memory	7500h
Err. 072	CANOpen synchronization failure	Configurable	Y	Memory	7500h
Err.073	CANOpen track buffer underflow	Configurable	Y	Memory	7500h
Err.074	CANOpen track buffer overflow	Configurable	Y	Memory	7500h
Err.075	EtherCAT slave initialization failure	stop	no	yes	7500h
Err.076	EtherCAT synchronization failure	stop	yes	yes	7500h
Err.077	EtherCAT communication breakage	stop	yes	yes	7500h
Err.078	EtherCAT command abnormal	stop	yes	yes	7500h
Err.079	EtherCAT S-ON no mode of operation	stop	yes	yes	7500h
AL.080	Undervoltage warning	No stop	Y	No memory	3220h
AL.081	Drive overload warning	No stop	Y	Memory	3230h
AL.082	Motor overload warning	No stop	Y	Memory	3230h
AL.083	Parameter modification needs power restart	No stop	Y	No memory	6320h
AL.084	Servo not ready	No stop	Y	No memory	FF00h
AL.085	EEPROM frequency writing warning	No stop	Y	No memory	7600h
AL.086	Positive over-travel warning	No stop	Y	No memory	FF00h
AL.087	Negative over-travel warning	No stop	Y	No memory	FF00h
AL.088	Positive instruction overvelocity	No stop	Y	No memory	8500h
AL.090	Absolute encoder angle initialization warning	No stop	Y	Memory	FF00h
AL.093	Regenerative overload	No stop	Y	Memory	3210h
AL.094	Regenerative resistor too small	No stop	Y	No memory	3210h
AL.095	Emergency stop	Decelerate to stop	Y	No memory	FF00h
AL.096	Homing error	Decelerate to stop	Y	No memory	FF00h
AL.097	Encoder battery undervoltage	No stop	Y	No memory	7305h

5.2 Troubleshooting

Code	Description	Causes	Troubleshooting measures
Err.001	System parameter abnormal	1. Control circuit power suddenly drops; 2. After updating servo software, some previously saved parameters exceed settings range.	1. Make sure input power is within specified range; 2. Set P20.06=1 to initialized system parameters.
Err.002	Product model selection fault	1. Encoder cable connection broken or loose; 2. Invalid drive or motor model.	1. Check and fasten encoder cable; 2. Replace with valid drive or motor model.
Err.003	Fault during parameter storage	1. Parameter reading/writing too frequent; 2. Parameter storage component fault; 3. Control circuit power unstable; 4. Drive fault.	1. Check if upper controller is reading/writing E2PROM too frequent; 2. Check control circuit power cable and ensure control circuit power voltage is within specified range.
Err.004	FPGA fault	Software version fault.	Check if software version is correct.
Err.005	Product matching fault	1. Encoder cable connection broken or loose; 2. Use third-party encoder which is not supported; 3. Motor capacity and drive capacity don't match. Motor capacity class is larger than or two levels off the drive; 4. Product model code doesn't exist.	1. Check and fasten encoder cable; 2. Replace products that don't match; 3. Choose correct encoder type or replace the drive.
Err.006	Software abnormal	1. System parameter abnormal; 2. Drive internal fault.	Set P20.06=1 to initialized system parameters and restart power.
Err.007	Encoder initialization abnormal	Encoder signal abnormal at power on.	Check or replace encoder cable.
Err.008	Short circuit to ground detection fault	1. UVW wiring fault; 2. Motor breakdown; 3. Drive fault.	1. Check if UVW is short circuited to ground. If so replace cable; 2. Check if motor cable or grounding resistance is abnormal. If so replace the motor.
Err.009	Overcurrent fault A	1. Instruction input is too fast; 2. Regenerative resistor too small or short circuited; 3. Motor cable bad contact; 4. Motor cable grounding; 5. Motor UVW short circuited; 6. Motor burnt; 7. Software detected power transistor overcurrent	1. Check instruction input time sequence and input after S-RDY; 2. Replace regenerative resistor; 3. Check and fasten encoder cable; 4. Replace motor if UVW insulation resistor is broken; 5. Check if UVW is short circuited; 6. Replace motor if UVW don't have equal resistance; 7. Reduce load, use bigger drive and motor, increase acceleration/deceleration time.
Err.010	Overcurrent fault B	Same as Err.009	Same as Err.009
Err.012	Incremental encoder Z breakage or absolute encoder number of turns abnormal	Incremental encoder: Z-phase signal loss due to cable breakage or encoder fault; Absolute encoder: battery shortage, encoder cable plugging & unplugging during power off, or after P06.47=1 not initialize the encoder.	1. Rotate motor shaft manually, if error still occurs, replace cable or encoder; 2. Replace battery if undervoltage; 3. P20.06=7 and initialize.
Err.013	Encoder communication abnormal	1. Communicational encoder cable breakage; 2. Encoder not grounded; 3. Communication verification abnormal.	1. Check or replace encoder cable; 2. Check if encoder is grounded properly.
Err.014	Encoder data abnormal	1. Serial encoder breakage or bad contact; 2. Serial encoder data reading/writing abnormal	Check or replace encoder cable.
Err.015	Encoder battery	Encoder battery voltage is less than	Replace encoder battery.

	undervoltage	P06.48 and ten's place of P06.47 is 1.	
Err.016	Velocity deviation too large	Velocity instruction and velocity feedback deviation exceeds settings of P06.45.	1. Increase P06.45 value; 2. Increase acceleration/deceleration time or increase system responsiveness; 3. Set P06.45=0 to disable velocity deviation too large function.
Err.017	Torque saturation overtime	Torque maintains saturated for time longer than settings of P06.46.	1. Increase P06.46 value; 2. Check if UVW is broken.
Err.018	Control power undervoltage	Poor input wiring or input power failure	1. Check input power and wiring 2. Replace driver
Err.019	Tripping error	Motor stall due to incorrect wiring	1. Check UVW and encoder wiring 2. Check drive and motor
Err.020	Overvoltage	1. Input power voltage exceeds 280VAC; 2. Regenerative resistor breakage or not matching; 3. Load inertia exceeds allowable range; 4. Drive broken.	1. Check input power voltage; 2. Check or replace regenerative resistor; 3. Increase acceleration/deceleration time or replace more suitable drive/motor.
Err.021	Undervoltage	1. Input power voltage drops; 2. Instantaneous power off; 3. P06.36 setting is too high; 4. Drive broken	1. Make sure input power is stable; 2. Reduce P06.36 value if input power is normal. (Memory is configurable by P07.19)
Err.022	Current sampling fault	Drive internal current sampling fault.	Replace servo drive.
Err.023	AI sampling voltage too large	1. AI wrong wiring; 2. AI external input power voltage too high	Do correct AI wiring and set input power voltage within $\pm 10V$.
Err.024	Overvelocity	1. Velocity instruction exceeds maximum velocity setting value; 2. Wrong UVW phase sequence; 3. Velocity response over modulation; 4. Drive faulty	1. Lower velocity instruction 2. Check if UVW phase sequence is correct; 3. Adjust velocity loop gains to reduce over shoot; 4. Replace drive
Err.025	Electrical angle identification failure	1. Load or inertia too large; 2. Wrong encoder cable wiring	1. Reduce load or increase current loop gains 2. Replace encoder cable.
Err.026	Load identification failure	1. Load or inertia too large. Motor cannot run at specified curves; 2. Verification process aborted by other faults.	1. Reduce load or increase current loop gains 2. Make sure verification process correct.
Err.027	DI parameter setting fault	1. Different DOs are assigned with same function; 2. Physical DI and communicational DI have definition conflicts	Reassign DI functions
Err.028	DO parameter setting fault	Different DOs are assigned with same function	Reassign DO functions
Err.040	S-ON instruction invalid fault	Input S-ON signal after motor is energized by other auxiliary functions	
Err.042	Pulse division output overvelocity	Pulse division output is over upper limit.	Adjust pulse division output settings.
Err.043	Position deviation too large	1. Servo motor UVW wiring is wrong; 2. Servo drive gain settings are too low; 3. Position instruction pulse frequency is too high; 4 Position instruction acceleration is too large; 5. P00.19 setting is too low; 6. Servo drive/motor faulty; 7. Brake release abnormal. Motor is locked by external forces, gravity etc.	1. Reconnect the cables 2. Increase servo gains 3. Reduce instruction frequency, acceleration or adjust gear ratio 4. Set up smoothing parameters; 5. Adjust the value of P00.19 6. Replace the drive 7. Check brake power and servo motor is not blocked.
Err.044	Main circuit input phase loss	1. Input power cable bad contact; 2. Phase loss fault, i.e. during power	1. Check input power cables 2. Measure R/S/T phase-to-phase

		on, one phase of R/S/T is too low for over 1s. 3. For the drive of 1KW or more, input single 220VAC	voltage to ensure 3 phases are balanced and input power is up to standard. 3.Set P06. 30 to 1, disable this alarm
Err.045	Drive output phase loss	1. Motor UVW bad contact; 2. Motor broken	1. Check UVW wiring 2. Replace motor
Err.046	Drive overload	1. Motor UVW or encoder cable bad contact or loose 2. Motor blocked or brake not released 3. Wrong UVW/encoder cable wiring for multiple drives/motors 4. Motor/drive too small for load 5. Phase loss or wrong phase sequence 6. Motor or drive broken	1. Check UVW/encoder cable wiring 2. Check motor is not blocked and brake is released 3. Check there is no wrong UVW/encoder cable wiring for multiple drives/motors 4. Increase acceleration/deceleration time or choose bigger drive/motor 5. Check UVW wiring 6. Replace drive/motor
Err.047	Motor overload	Same as Err.046	Same as Err.046
Err.048	Electronic gear setting fault	Electronic gear ratio exceeds setting range	Set correct electronic gear
Err.049	Heat sink too hot	1. Fan broken 2. Ambient temperature is too high 3. Too many times of restarting power after overload 4. Inappropriate installation directions and spacing 5. Servo drive faulty 6. Motor or drive broken	1. Check fan. Replace fan or drive 2. Measure ambient temperature and improved cooling conditions for servo drive 3. Check error records and see if there has been overload error. Restart after 30s. Increase acceleration/deceleration time. 5. Install the servo drive according to specifications in this manual. 6. Power off and wait for 5 minutes. If this error persists, replace drive.
Err.050	Pulse input abnormal	1. Input pulse frequency is larger than maximum frequency setting 2. Input pulse is interfered.	1. Adjust P06.38 2. Check wiring grounding conditions. Use twisted-pair shielded cable. Separate UVW cable from encoder cable.
Err.051	Fully-closed loop position deviation too large	1. External encoder abnormal. 2. Relative settings too conservative.	1. Check external encoder wirings. Replace external encoder. 2. Check parameters of fully-closed loop deviation and protective functions.
Err.054	User forced fault	User uses DI of function 32 FORCE_ERR to forcibly enter faulty state.	Disconnect DI of function 32.
Err.055	Absolute position resetting fault	Absolute encoder absolute position resetting faulty.	Contact HCFA.
Err.056	Main circuit outage	Power outage or main circuit abnormal	Check if there is instantaneous power failure. Increase power voltage capacity.
Err.060	First start after writing customized software	First start after download customized software to the standard driver	Initialize the servo drive.
Err.065	CAN bus off	CAN bus disconnection or receive or send abnormal	Check wiring and connect again
Err.066	Abnormal NMT instruction	Receive NMT stop or reset instruction at servo -ON	NMT node reset, do not stop or reset CAN node at servo-ON
Err.067	CAN bus failure	CAN bus disconnection or receive or send abnormal	Check wiring and connect again
Err.068	External overvelocity(reserved)	1. Velocity instruction exceeds maximum velocity setting value; 2. Wrong UVW phase sequence; 3. Velocity response over modulation; 4. Drive faulty	1. Lower velocity instruction 2. Check if UVW phase sequence is correct; 3. Adjust velocity loop gains to reduce over shoot; 4. Replace drive
Err.069	Hybrid deviation too large	1.External encoder disconnection 2.External encoder damage 3. Drive error	1. Check or replace external encoder and wiring 2. Check or replace external encoder

			and wiring 3. Check mechanical drive and repair
Err.071	Node protection or heartbeat timeout	Do not receive any response when node protection and heartbeat monitoring reaches specified time	Check node and NMT node reset
Err.072	CANOpen synchronization failure	Synchronization failure with host controller at CANOpen IP mode	NMT node reset or 6040 send failure reset instruction
Err.073	CANOpen track buffer underflow	Synchronous clock lost more than 2 times at CANOpen IP or CSP mode	Check interference in communication and host controller operate normally. NMT node reset or 6040 send failure reset instruction
Err.074	CANOpen track buffer overflow	Synchronization clock goes too fast or the actual clock frequency is inconsistent with setting value in CANOpen IP or CSP mode	Check interference in communication and host controller operate normally. NMT node reset or 6040 send failure reset instruction
Err.075	EtherCAT slave initialization failure	EtherCAT slave initialization failure	Check slave parameter settings.
Err.076	EtherCAT synchronization failure	EtherCAT synchronization failure	NMT node reset or 6040 send failure reset instruction
Err.077	EtherCAT communication breakage	Number of communication breakage exceeds allowable value	6040 send failure reset instruction
Err.078	EtherCAT command abnormal	Velocity instruction value exceeds 6080h setting.	NMT node reset or 6040 send failure reset instruction
Err.079	EtherCAT S-ON no mode of operation	At S-ON, 6060h modes of operation setting is not supported.	NMT node reset or 6040 send failure reset instruction
AL.080	Undervoltage warning	DC bus voltage is relatively low.	1. Check main circuit. 2. Adjust P06.36
AL.081	Drive overload warning	Same as Err.046	Same as Err.046
AL.082	Motor overload warning	Same as Err.046	Same as Err.046
AL.083	Parameter modification needs power restart	Modify parameters which needs restarting.	Restart power
AL.084	Servo not ready	S-ON when servo is not ready.	S-ON after detecting S-RDY signal.
AL.085	E2PROM frequency writing warning	Operating E2PROM too frequent.	Reduce E2PROM using frequency. Use communication2 which do not save in E2PROM.
AL.086	Positive over-travel warning	1. P_OT & N_OT valid simultaneously 2. Servo over-travel in some directions. Can be removed automatically.	Trigger positive limit switch, check operation mode, move the servo towards negative direction. After leaving positive limit switch, this alarm will be removed automatically.
AL.087	Negative over-travel warning	Same as AL.086	Trigger negative limit switch, check operation mode, move the servo towards positive direction. After leaving negative limit switch, this alarm will be removed automatically.
AL.088	Positive instruction overvelocity	1. Electronic gear ratio too large 2. Pulse frequency too high	1. Reduce electronic gear ratio 2. Reduce pulse frequency
AL.090	Absolute encoder angle initialization warning	Angle is over 7.2 degree.	Replace motor
AL.093	Regenerative overload	1. Regenerative resistor wrong wiring or bad contact; 2. Internal resistor wiring breakage; 3. Resistor capacity insufficient; 4. Resistor resistance too large and causing long time braking; 5. Input voltage exceeds	1. Check resistor wiring 2. Check internal resistor wiring; 3. Increase resistor capacity 4. Reduce resistor resistance; 5. Reduce input voltage 6. Set correct parameters 7. Replace drive

		specifications 6. Resistor resistance, capacity or heating time constant parameters settings are wrong; 7. Drive faulty	
AL.094	Regenerative resistor too small	1. External regenerative resistor is less than minimum value 2. Wrong parameter settings	1. Replace resistor 2. Check parameters P00.21~P00.24
AL.095	Emergency stop	Emergency stop is triggered.	This is a normal DI function (function 30)
AL.096	Homing error	1. Homing time exceeds P08.95 2. P08.90 is set is 3, 4, or 5 and contacted limit switches 3. Contact limit switches twice when not using limit switches as origin points.	1. Increase the value of P08.95; 2. Reduce homing velocitys P08.92, P08.93
AL.097	Encoder battery undervoltage	Encoder battery voltage is lower than what's set in P06.48.	Replace battery.

5.3 SDO Abort code

When the SDO data exchange (read/write) fails, the error message containing Abort code, called Abort message is returned. The abort message is an error only for the SDO data exchange. There is not any abort message for the PDO data exchange. The contents of abort code can differ according to the access conditions.

Abort code	Description
0503 0000h	Toggle bit not changed
0504 0000h	SDO protocol timeout
0504 0001h	Client/Server command specifier not valid or unknown
0504 0002h	Invalid block size (block mode only)
0504 0003h	Invalid serial number (block mode only)
0504 0004h	CRC error (block mode only)
0504 0005h	Out of memory
0601 0000h	Not supported access to an object
0601 0001h	Attempt to read to a write only object
0601 0002h	Attempt to write to a read only object
0602 0000h	The object does not exist in the object directory
0604 0041h	The object can not be mapped into the PDO
0604 0042h	The number and length of the objects to be mapped would exceed the PDO length
0604 0043h	General parameter incompatibility
0604 0047h	General internal incompatibility in the device
0606 0000h	Access failed due to a hardware error
0607 0010h	Data type does not match, length of service parameter does not match
0607 0012h	Data type does not match, length of service parameter too high
0607 0013h	Data type does not match, length of service parameter too low
0609 0011h	Subindex does not exist
0609 0030h	Value range of parameter exceeded (only for write access)
0609 0031h	Value of parameter written too high
0609 0032h	Value of parameter written too low
0609 0036h	Maximum value is less than minimum value
060A 0023h	No available resources: SDO connection
0800 0000h	General error
0800 0020h	Data cannot be transferred or stored the application
0800 0021h	Data cannot be transferred or stored to the application because of local control
0800 0022h	Data cannot be transferred or stored to the application because of the present device state

0800 0023h	Object dictionary dynamic generation fails or no object dictionary is present
0800 0024h	No available data

6 Parameters and Object Dictionary List

6.1 X3EB DI DO function code

- DI function codes

Value	Mark	Name	Remarks
1	S_ON	Servo enable	Invalid-Servo disabled Valid-Servo enabled
2	ERR_RST	Error reset	Valid when detecting edge changes.
3	GAIN_SEL	Gain switchover	Invalid-Speed control loop is PI control. Valid- Speed control loop is P control.
4	CMD_SEL	Command switchover	Invalid: present command is A Valid: present command is B
5	PERR_CLR	Pulse deviation clear	Invalid-No operation Valid-Clear pulse deviation
6	MI_SEL1	16-stage instruction switchover	Select 16 position instruction or speed instruction to execute via DI terminal.
7	MI_SEL2	16-stage instruction switchover	
8	MI_SEL3	16-stage instruction switchover	
9	MI_SEL4	16-stage instruction switchover	
10	MODE_SEL	Control mode switchover	Switchover of control modes based on Modes of operation (3, 4 or 5).
12	ZERO_SPD	Zero-speed clamp	Valid-Zero-speed clamp enabled Invalid- Zero-speed clamp disabled
13	INHIBIT	Pulse input inhibition	Valid- Pulse input inhibition Invalid-Pulse input allowed
14	P_OT	Positive over-travel	Use with limit switches for over-travel protections.
15	N_OT	Negative over-travel	Use with limit switches for over-travel protections.
16	P_CL	External forward torque limit	Valid-External torque limit is valid Invalid- External torque limit is invalid
17	N_CL	External reverse torque limit	Valid- External torque limit is valid Invalid- External torque limit is invalid
18	P_JOG	Positive JOG	Valid- Input according to the specified instruction Invalid-Instruction input stop
19	N_JOG	Negative JOG	Valid- Input according to the specified instruction Invalid-Instruction input stop
20	GEAR_SEL1	Electronic gear selection	GEAR_SEL1 invalid, GEAR_SEL2 invalid: electronic gear 1 GEAR_SEL1 valid, GEAR_SEL2 invalid: electronic gear 2 GEAR_SEL1 invalid, GEAR_SEL2 valid: electronic gear 3 GEAR_SEL1 valid, GEAR_SEL2 valid: electronic gear 4
21	GEAR_SEL2	Electronic gear selection	
22	POS_DIR	Position instruction negation	Invalid-No reverse ; Valid-Reverse
23	SPD_DIR	Speed instruction negation	Invalid-No reverse ; Valid-Reverse

24	TOQ_DIR	Torque instruction negation	Invalid-No reverse ; Valid-Reverse
25	PSEC_EN	Internal multi-stage enable	Invalid-Disable internal multi-stage instruction ; Valid- Enable internal multi-stage instruction
26	INTP_ULK	Interrupt positioning release	Valid: when P08.86 is set to 2 or 4
27	INTP_OFF	Interrupt positioning inhibit	Valid: when P08.86 is set to non-zero value
28	HOME_IN	Homing origin point	Can be used as origin position signal or deceleration position signal
29	STHOME	Homing start	Start homing operation
30	ESTOP	Emergency stop	Invalid-No effect Valid-Emergency stop enabled
31	STEP	Step enable	Valid-Step enabled ; Invalid- Instruction is 0, positioning
32	FORCE_ERR	Forced error protection	Invalid-No effect Valid- Forced error protection
34	INTP_TRIG	Interrupt positioning trigger	Valid: when P08.86 is set to non-zero value, can only use D18 or D19.
35	INPOSHALT	Internal position instruction generation pause	Invalid-No effect Valid- Decelerate and pause executing internal multi-stage position and interrupt positioning
36	ANALOG	Analog input inhibition	Invalid-No effect , Valid- Analog input inhibition
37	ENC_SEN	SEN enable absolute position data sending	Invalid-No effect; Valid- OAOBOZ send absolute position data, cannot enable servo
39	Touch1	Probe 1	Invalid-No effect Valid: Touch probe function1 is enabled
40	Touch2	Probe 2	Invalid-No effect Valid: Touch probe function2 is enabled

- DO function codes

Value	Mark	Name	Remarks
1	S_RDY	Servo ready	Valid- Servo ready Invalid- Servo not ready
2	S_ERR	Servo error	Valid when detecting error
3	S_WARN	Servo warning	Valid when alarm output
4	TGON	Motor rotation	Valid-Motor rotation is valid Invalid- Motor rotation is invalid.
5	V_ZERO	Motor speed is 0	Valid- Motor speed is 0 Invalid- Motor speed is not 0
6	V_CMP	Speed conformity	Speed control, valid when absolute deviation of motor speed and speed instruction is less than the settings of P04.44.
7	COIN	Positioning completed	Position control, valid when pulse deviation is less than the settings of P04.47.
8	NEAR	Positioning near	Position control, valid when pulse deviation is less than the settings of P04.50.
9	T_LT	Torque in limit	Valid - Motor torque is in limit Invalid - Motor torque is not in limit
10	V_LT	Speed in limit	Valid - Motor speed is in limit Invalid - Motor speed is not in limit
11	BKOFF	Brake release	Valid –Brake release , motor rotate Invalid –Motor shaft lock
12	T_ARR	Torque reached	Valid when torque feedback reaches the settings of P04.55; allowable fluctuations set in P04.56.
13	V_ARR	Speed reached	Valid when speed feedback reaches the settings of P04.45; allowable fluctuations ± 10 rpm.
15	INTP_DONE	Interrupt positioning complete	Interrupt positioning completion is ON.
16	DB_OUT	Dynamic brake output	Requires external relay or contactor and current limiting resistor
17	HOME	Homing complete	
18	INTP_WORK	Interrupt positioning working	Interrupt positioning execution
19	PCOM1	Position 1 comparison trigger signal	Output trigger signal when position 1 reaches the corresponding range
20	PCOM2	Position 2 comparison trigger signal	Output trigger signal when position 2 reaches the corresponding range
21	PCOM3	Position 3 comparison trigger signal	Output trigger signal when position 3 reaches the corresponding range
22	PCOM4	Position 4 comparison trigger signal	Output trigger signal when position 4 reaches the corresponding range

6.2 Object dictionary list 1000H common parameter

Index	Sub-index	Name	Data type	Default setting
1000h	00h	Device type	Unsigned32	0x20192 (131474)
1001h	00h	Error register	Unsigned8	0x0
1002h	00h	Manufacturer state register	Unsigned32	
1003h	00h	Pre-defined error area: Number of errors	Unsigned32	

	01h~FEh	Standard error area		
1005h	00h	Sync COB-ID	Unsigned32	
1006h		Communication cycle period	Unsigned32	
1007h		Synchronous window length	Unsigned32	
1008h		Manufacturer device name	VISIBLE_STRING	HCFA X3E Servo Driver
1009h		Manufacturer hardware version	VISIBLE_STRING	0.1
1010h	00	The highest Sub-index	Unsigned32	1
	01	Sotre all parameters	Unsigned32	0
100Ah		Manufacturer software version	VISIBLE_STRING	4.1
100Ch		Guard time	Unsigned16	
100Dh		Life time factor	Unsigned8	
1010h		Store parameters	Unsigned32	
1011h		Restore default parameters	Unsigned32	
1012h		COB-ID time stamp object	Unsigned32	
1013h		High resolution time stamp	Unsigned32	
1014h		EMCY COB-ID	Unsigned32	
1015h		Inhibit time EMCY	Unsigned16	
1016h		Consumer heartbeat time	Unsigned32	
1017h		Producer heartbeat time	Unsigned16	
1018h	0	Identity object		4
	1	Supplier ID		0x 000116C7
	2	Product code		0x 003E0402
	3	Revision No.		0x002
	4	Serial No.		0x001
1019h		Synchronous counter overflow value	Unsigned8	
1020h		Verify configuration	Unsigned32	
1021h		Store EDS		
1022h		Store format	Unsigned16	
1023h		OS command		
1024h		OS command mode	Unsigned8	
1025h		OS debugger interface		
1026h		OS prompt	Unsigned8	
1027h		Module list	Unsigned16	
1028h		Emergency consumer object	Unsigned32	

Index	Sub-index	Name	Data type	Default setting
1029h		Error behavior object.	Unsigned8	
10F1h	0	Index setting error		2
	1	Local error response		0x001
	2	Synchronous error counting limit		0x00C (12)
1C00	0	Synchronous management type Sub-index		4
	1	Sub-index1		0x01
	2	Sub-index2		0x02
	3	Sub-index3		0x03
	4	Sub-index4		0x04
1400		RxPDO communication parameter (group 1)		Only for CANOpen
1401		RxPDO communication parameter (group 2)		Only for CANOpen
1402		RxPDO communication parameter (group3)		Only for CANOpen
1403		RxPDO communication parameter (group 4)		Only for CANOpen
1600		RxPDO mapping parametr (group 1)		
1601		RxPDO mapping parametr (group 2)		
1602		RxPDO mapping parametr (group 3)		
1603		RxPDO mapping parametr (group 4)		
1604		RxPDO mapping parametr (group 5)		Applicable for Omron
1800		TxPDO communication parameter (group 1)		Only for CANOpen
1801		TxPDO communication parameter (group 2)		Only for CANOpen
1802		TxPDO communication parameter (group 3)		Only for CANOpen
1803		TxPDO communication parameter (group 4)		Only for CANOpen
1A00		TxPDO mapping parametr (group 1)		
1A01		TxPDO mapping parametr (group 2)		
1A02		TxPDO mapping parametr (group 3)		
1A03		TxPDO mapping parametr (group 4)		
1A04		TxPDO mapping parametr (group 5)		Applicable for Omron
1C12	0	RxPDO assignment Index		1
	1	Sub-index1		0x1600 (5632)
1C13	0	TxPDO assignment Index		1
	1	Sub-index1		0x1A00 (6656)
1C32	0	Synchronous output parameter Index		32
	1	Synchronous types		0x0002 (0: free run 2: DC SYNC0)
	2	Cycle times		(Unit , ns)
	4	Supported synchronous types		0x0005 (5)
	5	Minimum cycle time		0x0003D090 (250000)
	6	Calculating and copying time		0x00001388 (5000)
	8	Obtain synchrization time		0x0000 (0)
	9	Delay time		0x00000000 (0)

	A	Synchronization 0 cycle time		0x00989680 (10000000)
	B	Synchronous event loss		0x0000 (0)
Index	Sub-index	Name	Data type	Default setting
1C33	0	Synchronous input parameter Index		32
	1	Synchronous types		0x0002 (0: free run 2: DC SYNC0)
	2	Cycle times		(Unit , ns)
	4	Supported synchronous types		0x0005 (5)
	5	Minimum cycle time		0x0003D090 (250000)
	6	Calculating and copying time		0x00000000 (0)
	8	Obtain synchroniztion time		0x0000 (0)
	9	Delay time		0x000000000 (0)
	A	Synchronization 0 cycle time		0x00989680 (10000000)
	B	Synchronous event loss		0x0000 (0)
	C	Minimum cycle time		0x0000 (0)
	20	Synchronization error		FALSE

6.3 Object dictionary list 2100H

Group 2100h: Basic setting

Index	Sub-index	Name	Unit	Data type	Data range	Effective	Modes of operation	PDO mapping
2100h	00h	Basic setting	-	-	-	-	-	-
2100h	01h	Motor positive direction definition	1	U16	0-1	Immediate	ALL	NO
2100h	02h	Modes of operation	1	U16	0-7	Restart	ALL	NO
2100h	03h	Real time auto-tuning	1	U16	0-3	Immediate	ALL	NO
2100h	04h	Stiffness grade setting	1	U16	0-31	Immediate	ALL	NO
2100h	05h	Load inertia ratio	0.01	U16	0-6000	Immediate	ALL	NO
2100h	06h	Position instruction source	1	U16	0-3	Restart	ALL	NO
2100h	08h	Pulse train form	1	U16	0-5	Restart	csp pp hm	NO
2100h	09h	Instruction units per motor one revolution (32-bit)	1Unit	U32	0-1073741824	Immediate	csp pp hm	NO
2100h	0Bh	Electronic gear numerator 1 (32-bit)	1	U32	0-1073741824	Immediate	csp pp hm	NO
2100h	0Dh	Electronic gear denominator (32-bit)	1	U32	1-1073741824	Immediate	csp pp hm	NO
2100h	0Fh	Pulse output counts per motor one revolution (32-bit)	1PPR	U32	16-1073741824	Restart	csp pp hm	NO
2100h	11h	Pulse output positive direction definition	1	U16	0-1	Restart	ALL	NO
2100h	12h	Pulse output OUT_Z polarity	1	U16	0-3	Restart	csp pp hm	NO
2100h	13h	Pulse output function selection	1	U16	0-3	Restart	csp pp hm	NO
2100h	14h	Position deviation too large threshold (32-bit)	1P	U32	1-1073741824	Immediate	ALL	NO
2100h	16h	Regenerative resistor setting	1	U16	0-1	Immediate	ALL	NO
2100h	17h	External regenerative resistor capacity	1W	U16	1-65535	Immediate	ALL	NO
2100h	18h	External regenerative resistor resistance value	1Ω	U16	1-1000	Immediate	ALL	NO
2100h	19h	External regenerative resistor heating time constant	0.1s	U16	1-30000	Immediate	ALL	NO
2100h	1Ah	Regenerative voltage threshold	1	U16	0-65535	Immediate	ALL	NO
2100h	1Bh	Step value setting	1	I16	-9999-9999	Immediate	csp pp hm	NO
2100h	1Ch	High pulse train form	1	U16	0-5	Restart	csp pp hm	NO

Group 2101h: Gain adjustment

Index	Sub-index	Name	Unit	Data type	Data range	Effective	Modes of operation	PDO mapping
2101h	00h	Gain adjustment	-	-	-	-	-	-
2101h	01h	Position loop gain 1	0.1/s	U16	10-20000	Immediate	csp pp hm	NO
2101h	02h	Speed loop gain 1	0.1HZ	U16	10-20000	Immediate	csp pp hm csv pv	NO
2101h	03h	Speed loop integral time 1	0.01ms	U16	15-51200	Immediate	csp pp hm csv pv	NO
2101h	04h	Speed detection filter 1	1	U16	0-15	Immediate	ALL	NO
2101h	05h	Torque instruction filter 1	0.01ms	U16	0-10000	Immediate	ALL	NO
2101h	06h	Position loop gain 2	0.1/s	U16	10-20000	Immediate	csp pp hm	NO
2101h	07h	Speed loop gain 2	0.1HZ	U16	10-20000	Immediate	csp pp hm csv pv	NO
2101h	08h	Speed loop integral time 2	0.01ms	U16	15-51200	Immediate	csp pp hm csv pv	NO
2101h	09h	Speed detection filter 2	1	U16	0-15	Immediate	ALL	NO
2101h	0Ah	Torque instruction filter 2	0.01ms	U16	0-10000	Immediate	ALL	NO
2101h	0Bh	Speed regulator PDFF coefficient	0.1%	U16	0-1000	Immediate	csp pp hm csv pv	NO
2101h	0Ch	Speed feedforward control selection	1	U16	0-1	Restart	csp pp hm	NO
2101h	0Dh	Speed feedforward gain	0.1%	U16	0-1500	Immediate	csp pp hm	NO
2101h	0Eh	Speed feedforward filtering time	0.01ms	U16	0-6400	Immediate	csp pp hm	NO
2101h	0Fh	Torque feedforward control selection	1	U16	0-2	Restart	csp pp hm csv pv	NO
2101h	10h	Torque feedforward gain	0.1%	U16	0-1000	Immediate	csp pp hm csv pv	NO
2101h	11h	Torque feedforward filtering time	0.01ms	U16	0-6400	Immediate	csp pp hm csv pv	NO
2101h	12h	Digital input GAIN_SEL function selection	1	U16	0-1	Immediate	csp pp hm csv pv	NO
2101h	13h	Position control gain switchover mode	1	U16	0-10	Immediate	csp pp hm csv pv	NO

2101h	14h	Position control gain switchover delay	0.1ms	U16	0-1000	Immediate	csp pp hm csv pv	NO
2101h	15h	Position control gain switchover class	1	U16	0-20000	Immediate	csp pp hm csv pv	NO
2101h	16h	Position control gain switchover hysteresis	1	U16	0-20000	Immediate	csp pp hm csv pv	NO
2101h	17h	Position control gain switchover time	0.1ms	U16	0-10000	Immediate	csp pp hm csv pv	NO
2101h	18h	Speed control gain switchover mode	1	U16	0-5	Immediate	csv pv	NO
2101h	19h	Speed control gain switchover delay	0.1ms	U16	0-1000	Immediate	csv pv	NO
2101h	1Ah	Speed control gain switchover class	1	U16	0-20000	Immediate	csv pv	NO
2101h	1Bh	Speed control gain switchover hysteresis	1	U16	0-20000	Immediate	csv pv	NO
2101h	1Ch	Torque control gain switchover mode	1	U16	0-3	Immediate	cst pt	NO
2101h	1Dh	Torque control gain switchover delay	0.1ms	U16	0-1000	Immediate	cst pt	NO
2101h	1Eh	Torque control gain switchover class	1	U16	0-20000	Immediate	cst pt	NO
2101h	1Fh	Torque control gain switchover hysteresis	1	U16	0-20000	Immediate	cst pt	NO
2101h	20h	Observer enable	1	U16	0-2	Restart	ALL	NO
2101h	21h	Observer cutoff frequency	1Hz	U16	0-500	Restart	ALL	NO
2101h	22h	Observer phase compensation time	0.01ms	U16	0-10000	Immediate	ALL	NO
2101h	23h	Observer inertia coefficient	1	U16	0-10000	Restart	ALL	NO

Group 2102h: Vibration suppression

Index	Sub-index	Name	Unit	Data type	Data range	Effective	Modes of operation	PDO mapping
2102h	00h	Vibration suppression	-	-	-	-	-	-
2102h	01h	Position instruction smoothing filter	0.1ms	U16	0-65535	Immediate	csp pp hm	NO
2102h	02h	Position instruction FIR filter	0.1ms	U16	0-1280	Immediate	csp pp hm	NO
2102h	03h	Adaptive filtering mode	1	U16	0-4	Immediate	ALL	NO
2102h	04h	Adaptive filtering loads	1	U16	0-1	Immediate	ALL	NO
2102h	05h	First notch filter frequency (manual)	1Hz	U16	50-5000	Immediate	ALL	NO
2102h	06h	First notch filter width	1	U16	0-12	Immediate	ALL	NO
2102h	07h	First notch filter depth	1	U16	0-99	Immediate	ALL	NO
2102h	08h	Second notch filter frequency (manual)	1Hz	U16	50-5000	Immediate	ALL	NO
2102h	09h	Second notch filter width	1	U16	0-12	Immediate	ALL	NO
2102h	0Ah	Second notch filter depth	1	U16	0-99	Immediate	ALL	NO
2102h	0Bh	Third notch filter frequency	1Hz	U16	50-5000	Immediate	ALL	NO
2102h	0Ch	Third notch filter width	1	U16	0-12	Immediate	ALL	NO
2102h	0Dh	Third notch filter depth	1	U16	0-99	Immediate	ALL	NO
2102h	0Eh	Fourth notch filter frequency	1Hz	U16	50-5000	Immediate	ALL	NO
2102h	0Fh	Fourth notch filter width	1	U16	0-12	Immediate	ALL	NO
2102h	10h	Fourth notch filter depth	1	U16	0-99	Immediate	ALL	NO
2102h	14h	Position instruction FIR filter 2	0.1ms	U16	0-1280	Immediate	csp pp hm	NO
2102h	15h	First vibration attenuation frequency	0.1Hz	U16	0-1000	Immediate	csp pp hm csv pv	NO
2102h	16h	First vibration attenuation filter setting	0.1	U16	0-10	Immediate	csp pp hm csv pv	NO
2102h	17h	Second vibration attenuation frequency	0.1Hz	U16	0-1000	Immediate	csp pp hm csv pv	NO
2102h	18h	Second vibration attenuation filter setting	0.1	U16	0-10	Immediate	csp pp hm csv pv	NO
2102h	20h	Resonance point 1 frequency	1Hz	U16	0-5000	Display parameters	ALL	NO
2102h	21h	Resonance point 1 bandwidth	1	U16	0-20	Display parameters	ALL	NO
2102h	22h	Resonance point 1 amplitude	1	U16	0-1000	Display parameters	ALL	NO
2102h	23h	Resonance point 2 frequency	1Hz	U16	0-5000	Display parameters	ALL	NO
2102h	24h	Resonance point 2 bandwidth	1	U16	0-20	Display parameters	ALL	NO
2102h	25h	Resonance point 2 amplitude	1	U16	0-1000	Display parameters	ALL	NO

Group 2103h: Speed & Torque Control

Index	Sub-index	Name	Unit	Data type	Data range	Effective	Modes of operation	PDO mapping
2103h	00h	Speed & Torque Control	-	-	-	-	-	-
2103h	01h	Speed instruction source selection	1	U16	0-6	Restart	csv pv	NO
2103h	04h	Speed instruction digital setting	1rpm	I16	-9000-9000	Immediate	csv pv	NO
2103h	05h	JOG speed setting	1rpm	U16	0-3000	Immediate	csv pv	NO
2103h	09h	Torque limit source	1	U16	0-3	Immediate	csp pp hm csv pv	NO
2103h	0Ah	Internal forward torque limit	0.1%	U16	0-5000	Immediate	csp pp hm csv pv	NO
2103h	0Bh	Internal reverse torque limit	0.1%	U16	0-5000	Immediate	csp pp hm csv pv	NO
2103h	0Ch	External forward torque limit	0.1%	U16	0-5000	Immediate	csp pp hm csv pv	NO
2103h	0Dh	External reverse torque limit	0.1%	U16	0-5000	Immediate	csp pp hm csv pv	NO
2103h	0Fh	Acceleration time 1	1ms	U16	0-65535	Immediate	csv pv cst pt	NO
2103h	10h	Deceleration time 1	1ms	U16	0-65535	Immediate	csv pv cst pt	NO
2103h	11h	Acceleration time 2	1ms	U16	0-65535	Immediate	csv pv	NO
2103h	12h	Deceleration time 2	1ms	U16	0-65535	Immediate	csv pv	NO
2103h	14h	Zero-speed clamp function	1	U16	0-2	Immediate	csv pv cst pt	NO
2103h	15h	Zero-speed clamp threshold value	1rpm	U16	0-1000	Immediate	csv pv cst pt	NO
2103h	17h	Torque instruction source	1	U16	0-4	Restart	cst pt	NO
2103h	1Ah	Torque instruction digital setting value	0.1%	I16	-3000-3000	Immediate	cst pt	NO
2103h	1Bh	Speed limit source in torque control	1	U16	0-1	Immediate	cst pt	NO
2103h	1Ch	Internal positive speed limit	1	U16	0-9000	Immediate	cst pt	NO
2103h	1Dh	Internal negative speed limit	1	U16	0-9000	Immediate	cst pt	NO
2103h	1Eh	Hard-limit torque limit	0.1%	U16	0-4000	Immediate	ALL	NO
2103h	1Fh	Hard-limit torque limit detection time	1	U16	0-2000	Immediate	ALL	NO
2103h	20h	Internal speed instruction segment number selection mode	1	U16	0-1	Restart	csv pv	NO
2103h	21h	Acceleration time selection for	1	U16	0-1	Immediate	csv	NO

		internal speed segment 1-8					pv	
2103h	22h	Deceleration time selection for internal speed segment 1-8	1	U16	0-1	Immediate	csv pv	NO
2103h	23h	Acceleration time selection for internal speed segment 9-16	1	U16	0-1	Immediate	csv pv	NO
2103h	24h	Deceleration time selection for internal speed segment 9-16	1	U16	0-1	Immediate	csv pv	NO
2103h	25h	Segment 1 speed	1rpm	I16	-9000-9000	Immediate	csv pv	NO
2103h	26h	Segment 2 speed	1rpm	I16	-9000-9000	Immediate	csv pv	NO
2103h	27h	Segment 3 speed	1rpm	I16	-9000-9000	Immediate	csv pv	NO
2103h	28h	Segment 4 speed	1rpm	I16	-9000-9000	Immediate	csv pv	NO
2103h	29h	Segment 5 speed	1rpm	I16	-9000-9000	Immediate	csv pv	NO
2103h	2Ah	Segment 6 speed	1rpm	I16	-9000-9000	Immediate	csv pv	NO
2103h	2Bh	Segment 7 speed	1rpm	I16	-9000-9000	Immediate	csv pv	NO
2103h	2Ch	Segment 8 speed	1rpm	I16	-9000-9000	Immediate	csv pv	NO
2103h	2Dh	Segment 9 speed	1rpm	I16	-9000-9000	Immediate	csv pv	NO
2103h	2Eh	Segment 10 speed	1rpm	I16	-9000-9000	Immediate	csv pv	NO
2103h	2Fh	Segment 11 speed	1rpm	I16	-9000-9000	Immediate	csv pv	NO
2103h	30h	Segment 12 speed	1rpm	I16	-9000-9000	Immediate	csv pv	NO
2103h	31h	Segment 13 speed	1rpm	I16	-9000-9000	Immediate	csv pv	NO
2103h	32h	Segment 14 speed	1rpm	I16	-9000-9000	Immediate	csv pv	NO
2103h	33h	Segment 15 speed	1rpm	I16	-9000-9000	Immediate	csv pv	NO
2103h	34h	Segment 16 speed	1rpm	I16	-9000-9000	Immediate	csv pv	NO

Group 2104h: Digital Input/output

Index	Sub-index	Name	Unit	Data type	Data range	Effective	Modes of operation	PDO mapping
2104h	00h	Digital Input/output	-	-	-	-	-	-
2104h	01h	Normal DI filter selection	1us	U16	0-10000	Immediate	ALL	NO
2104h	02h	DI1 terminal function selection	1	U16	0-63	Restart	ALL	NO
2104h	03h	DI2 terminal function selection	1	U16	0-63	Restart	ALL	NO
2104h	04h	DI3 terminal function selection	1	U16	0-63	Restart	ALL	NO
2104h	05h	DI4 terminal function selection	1	U16	0-63	Restart	ALL	NO
2104h	06h	DI5 terminal function selection	1	U16	0-63	Restart	ALL	NO
2104h	07h	DI6 terminal function selection	1	U16	0-63	Restart	ALL	NO
2104h	08h	DI7 terminal function selection	1	U16	0-63	Restart	ALL	NO
2104h	09h	DI8 terminal function selection	1	U16	0-63	Restart	ALL	NO
2104h	0Ah	DI9 terminal function selection	1	U16	0-63	Restart	ALL	NO
2104h	0Ch	DI1 terminal logic selection	1	U16	0-1	Restart	ALL	NO
2104h	0Dh	DI2 terminal logic selection	1	U16	0-1	Restart	ALL	NO
2104h	0Eh	DI3 terminal logic selection	1	U16	0-1	Restart	ALL	NO
2104h	0Fh	DI4 terminal logic selection	1	U16	0-1	Restart	ALL	NO
2104h	10h	DI5 terminal logic selection	1	U16	0-1	Restart	ALL	NO
2104h	11h	DI6 terminal logic selection	1	U16	0-1	Restart	ALL	NO
2104h	12h	DI7 terminal logic selection	1	U16	0-1	Restart	ALL	NO
2104h	13h	DI8 terminal logic selection	1	U16	0-1	Restart	ALL	NO
2104h	14h	DI9 terminal logic selection	1	U16	0-1	Restart	ALL	NO
2104h	16h	DO1 terminal function selection	1	U16	0-31	Restart	ALL	NO
2104h	17h	DO2 terminal function selection	1	U16	0-31	Restart	ALL	NO
2104h	18h	DO3 terminal function selection	1	U16	0-31	Restart	ALL	NO
2104h	19h	DO4 terminal function selection	1	U16	0-31	Restart	ALL	NO
2104h	1Ah	DO5 terminal function selection	1	U16	0-31	Restart	ALL	NO
2104h	1Bh	DO6 terminal function selection	1	U16	0-31	Restart	ALL	NO
2104h	1Ch	DO7 terminal function selection	1	U16	0-31	Restart	ALL	NO
2104h	1Dh	DO8 terminal function selection	1	U16	0-31	Restart	ALL	NO
2104h	1Eh	DO9 terminal function selection	1	U16	0-31	Restart	ALL	NO
2104h	20h	DO1 terminal logic selection	1	U16	0-1	Restart	ALL	NO
2104h	21h	DO2 terminal logic selection	1	U16	0-1	Restart	ALL	NO
2104h	22h	DO3 terminal logic selection	1	U16	0-1	Restart	ALL	NO
2104h	23h	DO4 terminal logic selection	1	U16	0-1	Restart	ALL	NO
2104h	24h	DO5 terminal logic selection	1	U16	0-1	Restart	ALL	NO
2104h	25h	DO6 terminal logic selection	1	U16	0-1	Restart	ALL	NO
2104h	26h	DO7 terminal logic selection	1	U16	0-1	Restart	ALL	NO
2104h	27h	DO8 terminal logic selection	1	U16	0-1	Restart	ALL	NO
2104h	28h	DO9 terminal logic selection	1	U16	0-1	Restart	ALL	NO
2104h	2Ah	FUNINL signal unassigned state (Hex)	1	U16	0-65535	Immediate	ALL	NO
2104h	2Bh	FUNINH signal unassigned state (Hex)	1	U16	0-65535	Immediate	ALL	NO
2104h	2Ch	Motor rotational signal (TGON) threshold	1rpm	U16	0-1000	Immediate	ALL	NO
2104h	2Dh	Speed conformity signal (V_CMP) width	1rpm	U16	10-1000	Immediate	csv pv	NO
2104h	2Eh	Speed reached signal (V_ARR) width	1rpm	U16	10-9000	Immediate	ALL	NO
2104h	30h	Positioning completion (COIN) threshold	1P	U16	1-65535	Immediate	csp pp hm	NO
2104h	31h	Positioning completion output setting	1	U16	0-7	Immediate	csp pp hm	NO
2104h	32h	Positioning completion holding time	1ms	U16	1-65535	Immediate	csp pp hm	NO
2104h	33h	Positioning near (NEAR) threshold	1P	U16	1-65535	Immediate	csp pp hm	NO
2104h	34h	Servo OFF delay time after holding brake taking action when speed is 0	1ms	U16	0-9999	Immediate	ALL	NO
2104h	35h	Speed setting for holding brake to take action in motion	1rpm	U16	0-3000	Immediate	ALL	NO
2104h	36h	Waiting time for holding brake to take action in motion	1ms	U16	0-9999	Immediate	ALL	NO

2104h	37h	Z-phase pulse OC output enabled	1	U16	0-3	Immediate	ALL	NO
2104h	38h	Torque reached (T_ARR) threshold	0.1%	U16	0-3000	Immediate	ALL	NO
2104h	39h	Torque reached signal width	0.1%	U16	0-3000	Immediate	ALL	NO
2104h	3Ah	Z-phase pulse width adjustment	1	U16	0-100	Immediate	ALL	NO
2104h	3Bh	Zero-speed output threshold	1rpm	U16	0-1000	Immediate	ALL	NO

Group 2105h: Analog input/output

Index	Sub-index	Name	Unit	Data type	Data range	Effective	Modes of operation	PDO mapping
2105h	00h	Analog input/output	-	-	-	-	-	-
2105h	01h	AI1 minimum input	0.01V	I16	-1000-1000	Immediate	ALL	NO
2105h	02h	Corresponding value of AI1 minimum input	0.1%	I16	-1000-1000	Immediate	ALL	NO
2105h	03h	AI1 maximum input	0.01V	I16	-1000-1000	Immediate	ALL	NO
2105h	04h	Corresponding value of AI1 maximum input	0.1%	I16	-1000-1000	Immediate	ALL	NO
2105h	05h	AI1 zero offset	1mV	I16	-500-500	Immediate	ALL	NO
2105h	06h	AI1 dead-zone setting	0.1%	U16	0-200	Immediate	ALL	NO
2105h	07h	AI1 input filtering time	0.1ms	U16	0-65535	Immediate	ALL	NO
2105h	08h	AI2 minimum input	0.01V	I16	-1000-1000	Immediate	ALL	NO
2105h	09h	Corresponding value of AI2 minimum input	0.1%	I16	-1000-1000	Immediate	ALL	NO
2105h	0Ah	AI2 maximum input	0.01V	I16	-1000-1000	Immediate	ALL	NO
2105h	0Bh	Corresponding value of AI2 maximum input	0.1%	I16	-1000-1000	Immediate	ALL	NO
2105h	0Ch	AI2 zero offset	1mV	I16	-500-500	Immediate	ALL	NO
2105h	0Dh	AI2 dead-zone setting	0.1%	U16	0-200	Immediate	ALL	NO
2105h	0Eh	AI2 input filtering time	0.1ms	U16	0-65535	Immediate	ALL	NO
2105h	0Fh	AI setting 100% speed	1rpm	U16	0-9000	Immediate	ALL	NO
2105h	10h	AI setting 100% torque	0.01	U16	0-500	Immediate	ALL	NO
2105h	11h	AI1 function selection	1	U16	0-5	Immediate	ALL	NO
2105h	12h	AI2 function selection	1	U16	0-5	Immediate	ALL	NO

Group 2106h: Expansion Parameters (Protection, auxiliary functions)

Index	Sub-index	Name	Unit	Data type	Data range	Effective	Modes of operation	PDO mapping
2106h	00h	Expansion Parameters (Protection, auxiliary functions)	-	-	-	-	-	-
2106h	01h	Electronic gear numerator 2(32-bit)	1	U32	0-1073741824	Immediate	csp pp hm	NO
2106h	03h	Electronic gear numerator 3(32-bit)	1	U32	0-1073741824	Immediate	csp pp hm	NO
2106h	05h	Electronic gear numerator 4(32-bit)	1	U32	0-1073741824	Immediate	csp pp hm	NO
2106h	07h	Position deviation clearance function	1	U16	0-3	Immediate	csp pp hm	NO
2106h	0Ah	Electronic gear ratio switchover delay	1	U16	0-1	Restart	csp pp hm	NO
2106h	0Bh	Potential energy load torque compensation	1%	I16	-100-100	Immediate	csp pp hm csv pv	NO
2106h	0Ch	P05.10 memory selections	1	U16	0-2	Immediate	csp pp hm csv pv	NO
2106h	0Dh	Forward friction torque compensation	0.1%	I16	-3000-3000	Immediate	csp pp hm csv pv	NO
2106h	0Eh	Reverse friction torque compensation	0.1%	I16	-3000-3000	Immediate	csp pp hm csv pv	NO
2106h	0Fh	Viscous friction compensation	0.1%	I16	-3000-3000	Immediate	csp pp hm csv pv	NO
2106h	10h	Friction compensation time constant	0.1ms	U16	0-10000	Immediate	csp pp hm csv pv	NO
2106h	11h	Friction compensation low-speed zone	1rpm	U16	0-500	Immediate	csp pp hm csv pv	NO
2106h	14h	Parameter identification rate	1	U16	100-1000	Restart	csp pp hm csv pv	NO
2106h	15h	Parameter identification acceleration time	1	U16	50-10000	Restart	csp pp hm csv pv	NO
2106h	16h	Parameter identification deceleration time	1	U16	50-10000	Restart	csp pp hm csv pv	NO
2106h	17h	Parameter identification mode selection	1	U16	0-1	Restart	csp pp hm	NO

							csp pv	
2106h	18h	Initial angle identification current limit	0.1%	U16	0-2000	Restart	ALL	NO
2106h	19h	Instantaneous power failure protection	1	U16	0-2	Immediate	ALL	NO
2106h	1Ah	Instantaneous power failure deceleration time	1ms	U16	0-10000	Immediate	ALL	NO
2106h	1Bh	Servo OFF stop mode selection	1	U16	0-2	Restart	ALL	NO
2106h	1Ch	Second category fault stop mode selection	1	U16	0-2	Restart	ALL	NO
2106h	1Dh	Over-travel input setting	1	U16	0-1	Restart	ALL	NO
2106h	1Eh	Over-travel stop mode selection	1	U16	0-2	Restart	ALL	NO
2106h	1Fh	Input power phase loss protection	1	U16	0-1	Immediate	ALL	NO
2106h	20h	Output power phase loss protection	1	U16	0-1	Immediate	ALL	NO
2106h	21h	Emergency stop torque	0.1%	U16	0-5000	Immediate	ALL	NO
2106h	22h	Tripping protection function	1	U16	0-1	Immediate	ALL	NO
2106h	23h	Overload warning value	1%	U16	1-100	Immediate	ALL	NO
2106h	24h	Motor overload protection coefficient	1%	U16	10-300	Immediate	ALL	NO
2106h	25h	Undervoltage protection point	1%	U16	50-130	Immediate	ALL	NO
2106h	26h	Over-speed error point	1%	U16	50-120	Immediate	ALL	NO
2106h	27h	Maximum input pulse frequency	1KHZ	U16	10-9000	Restart	csp pp hm	NO
2106h	28h	Short circuit to ground detection protection selection	1	U16	0-1	Immediate	ALL	NO
2106h	29h	Encoder interference detection delay	1	U16	0-99	Immediate	ALL	NO
2106h	2Ah	Input pulse filtering setting	1	U16	0-500	Restart	csp pp hm	NO
2106h	2Bh	Input pulse inhibition setting	1	U16	0-3	Restart	csp pp hm	NO
2106h	2Ch	Deviation clearance input setting	1	U16	0-1	Restart	csp pp hm	NO
2106h	2Dh	High speed DI filtering setting	1us	U16	0-10000	Restart	ALL	NO
2106h	2Eh	Speed deviation too large threshold	1rpm	U16	0-10000	Immediate	csp pp hm csp pv	NO
2106h	2Fh	Torque saturation overtime setting	1ms	U16	0-30000	Immediate	ALL	NO
2106h	30h	Absolute system setting	1	U16	0-19	Immediate	ALL	NO
2106h	31h	Encoder battery undervoltage threshold	0.1V	U16	0-33	Immediate	ALL	NO
2106h	32h	High-speed pulse input filter	1	U16	0-500	Restart	ALL	NO

Group 2107h: Auxiliary functions

Index	Sub-index	Name	Unit	Data type	Data range	Effective	Modes of operation	PDO mapping
2107h	00h	Auxiliary function	-	-	-	-	-	-
2107h	01h	Panel display	1	U16	0-65535	Immediate	ALL	NO
2107h	02h	Panel monitoring parameter setting 1	1	U16	0-69	Immediate	ALL	NO
2107h	03h	Panel monitoring parameter setting 2	1	U16	0-69	Immediate	ALL	NO
2107h	04h	Panel monitoring parameter setting 3	1	U16	0-69	Immediate	ALL	NO
2107h	05h	Panel monitoring parameter setting 4	1	U16	0-69	Immediate	ALL	NO
2107h	06h	Panel monitoring parameter setting 5	1	U16	0-69	Immediate	ALL	NO
2107h	09h	Function selection 1	1	U16	0-65535	Immediate	ALL	NO
2107h	0Ah	Function selection 2	1	U16	0-65535	Immediate	ALL	NO
2107h	0Bh	User password	1	U16	0-65535	Immediate	ALL	NO
2107h	0Ch	Instant power failure immediate memory function	1	U16	0-1	Immediate	ALL	NO
2107h	0Dh	User password screen-lock time	1 分钟	U16	1-30	Immediate	ALL	NO
2107h	0Fh	Fast deceleration time	1ms	U16	0-9999	Restart	ALL	NO
2107h	11h	Function selection 3	1	U16	0-65535	Restart	ALL	NO
2107h	12h	Maximum division number pre motor one revolution	1	U16	0-99	Immediate	csp pp hm	NO
2107h	14h	Function selection 5	1	U16	0-65535	Restart	ALL	NO
2107h	15h	Function selection 6	1	U16	0-65535	Restart	ALL	NO
2107h	16h	Function selection 7	1	U16	0-65535	Immediate	ALL	NO
2107h	17h	Function selection 8	1	U16	0-65535	Immediate	ALL	NO
2107h	18h	Alarm reset time	1	U16	0-1	Immediate	ALL	NO
2107h	19h	Positive soft-limit(32-bit)	1	I32	-2147483648- 2147483647	Restart	ALL	NO
2107h	1Bh	Negative soft-limit(32-bit)	1	I32	-2147483648- 2147483647	Restart	ALL	NO

Group 2108h: Internal position command

Index	Sub-index	Name	Unit	Data type	Data range	Effective	Modes of operation	PDO mapping
2108h	00h	Internal position command	-	-	-	-	-	-
2108h	01h	Internal position execution pattern selection	1	U16	0-5	Restart	csp pp hm	NO
2108h	02h	Starting stage number	1	U16	1-16	Immediate	csp pp hm	NO
2108h	03h	Ending stage number	1	U16	1-16	Immediate	csp pp hm	NO
2108h	04h	Restarting pattern of residual stages after pausing	1	U16	0-1	Immediate	csp pp hm	NO
2108h	05h	Position instruction type selection	1	U16	0-1	Restart	csp pp hm	NO
2108h	06h	Unit for waiting time	1	U16	0-1	Immediate	csp pp hm	NO
2108h	07h	Internal position control 1st stage length (32-bit)	1	I32	-1073741824- 1073741824	Immediate	csp pp hm	NO
2108h	09h	Internal position control 1st stage max speed	1rpm	U16	1-9000	Immediate	csp pp hm	NO
2108h	0Ah	Internal position control 1st stage acceleration/deceleration time	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	0Bh	Waiting time after internal position control 1st stage completed	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	0Ch	Internal position control 2nd stage length (32-bit)	1	I32	-1073741824- 1073741824	Immediate	csp pp hm	NO
2108h	0Eh	Internal position control 2nd stage max speed	1rpm	U16	1-9000	Immediate	csp pp hm	NO
2108h	0Fh	Internal position control 2nd stage acceleration/deceleration time	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	10h	Waiting time after internal position control 2nd stage completed	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	11h	Internal position control 3rd stage length (32-bit)	1	I32	-1073741824- 1073741824	Immediate	csp pp hm	NO
2108h	13h	Internal position control 3rd stage max speed	1rpm	U16	1-9000	Immediate	csp pp hm	NO
2108h	14h	Internal position control 3rd stage acceleration/deceleration time	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	15h	Waiting time after internal position control 3rd stage completed	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	16h	Internal position control 4th stage length (32-bit)	1	I32	-1073741824- 1073741824	Immediate	csp pp hm	NO
2108h	18h	Internal position control 4th stage max speed	1rpm	U16	1-9000	Immediate	csp pp hm	NO
2108h	19h	Internal position control 4th stage acceleration/deceleration time	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	1Ah	Waiting time after internal position control 4th stage completed	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	1Bh	Internal position control 5th stage	1	I32	-1073741824-	Immediate	csp	NO

		length (32-bit)			1073741824		pp hm	
2108h	1Dh	Internal position control 5th stage max speed	1rpm	U16	1-9000	Immediate	csp pp hm	NO
2108h	1Eh	Internal position control 5th stage acceleration/deceleration time	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	1Fh	Waiting time after internal position control 5th stage completed	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	20h	Internal position control 6th stage length (32-bit)	1	I32	-1073741824- 1073741824	Immediate	csp pp hm	NO
2108h	22h	Internal position control 6th stage max speed	1rpm	U16	1-9000	Immediate	csp pp hm	NO
2108h	23h	Internal position control 6th stage acceleration/deceleration time	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	24h	Waiting time after internal position control 6th stage completed	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	25h	Internal position control 7th stage length (32-bit)	1	I32	-1073741824- 1073741824	Immediate	csp pp hm	NO
2108h	27h	Internal position control 7th stage max speed	1rpm	U16	1-9000	Immediate	csp pp hm	NO
2108h	28h	Internal position control 7th stage acceleration/deceleration time	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	29h	Waiting time after internal position control 7th stage completed	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	2Ah	Internal position control 8th stage length (32-bit)	1	I32	-1073741824- 1073741824	Immediate	csp pp hm	NO
2108h	2Ch	Internal position control 8th stage max speed	1rpm	U16	1-9000	Immediate	csp pp hm	NO
2108h	2Dh	Internal position control 8th stage acceleration/deceleration time	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	2Eh	Waiting time after internal position control 8th stage completed	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	2Fh	Internal position control 9th stage length (32-bit)	1	I32	-1073741824- 1073741824	Immediate	csp pp hm	NO
2108h	31h	Internal position control 9th stage max speed	1rpm	U16	1-9000	Immediate	csp pp hm	NO
2108h	32h	Internal position control 9th stage acceleration/deceleration time	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	33h	Waiting time after internal position control 9th stage completed	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	34h	Internal position control 10th stage length (32-bit)	1	I32	-1073741824- 1073741824	Immediate	csp pp hm	NO
2108h	36h	Internal position control 10th stage max speed	1rpm	U16	1-9000	Immediate	csp pp hm	NO
2108h	37h	Internal position control 10th stage acceleration/deceleration time	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	38h	Waiting time after internal position control 10th stage completed	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	39h	Internal position control 11th stage	1	I32	-1073741824-	Immediate	csp	NO

		length (32-bit)			1073741824		pp hm	
2108h	3Bh	Internal position control 11th stage max speed	1rpm	U16	1-9000	Immediate	csp pp hm	NO
2108h	3Ch	Internal position control 11th stage acceleration/deceleration time	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	3Dh	Waiting time after internal position control 11th stage completed	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	3Eh	Internal position control 12th stage length (32-bit)	1	I32	-1073741824- 1073741824	Immediate	csp pp hm	NO
2108h	40h	Internal position control 12th stage max speed	1rpm	U16	1-9000	Immediate	csp pp hm	NO
2108h	41h	Internal position control 12th stage acceleration/deceleration time	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	42h	Waiting time after internal position control 12th stage completed	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	43h	Internal position control 13th stage length (32-bit)	1	I32	-1073741824- 1073741824	Immediate	csp pp hm	NO
2108h	45h	Internal position control 13th stage max speed	1rpm	U16	1-9000	Immediate	csp pp hm	NO
2108h	46h	Internal position control 13th stage acceleration/deceleration time	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	47h	Waiting time after internal position control 13th stage completed	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	48h	Internal position control 14th stage length (32-bit)	1	I32	-1073741824- 1073741824	Immediate	csp pp hm	NO
2108h	4Ah	Internal position control 14th stage max speed	1rpm	U16	1-9000	Immediate	csp pp hm	NO
2108h	4Bh	Internal position control 14th stage acceleration/deceleration time	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	4Ch	Waiting time after internal position control 14th stage completed	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	4Dh	Internal position control 15th stage length (32-bit)	1	I32	-1073741824- 1073741824	Immediate	csp pp hm	NO
2108h	4Fh	Internal position control 15th stage max speed	1rpm	U16	1-9000	Immediate	csp pp hm	NO
2108h	50h	Internal position control 15th stage acceleration/deceleration time	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	51h	Waiting time after internal position control 15th stage completed	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	52h	Internal position control 16th stage length (32-bit)	1	I32	-1073741824- 1073741824	Immediate	csp pp hm	NO
2108h	54h	Internal position control 16th stage max speed	1rpm	U16	1-9000	Immediate	csp pp hm	NO
2108h	55h	Internal position control 16th stage acceleration/deceleration time	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	56h	Waiting time after internal position control 16th stage completed	1ms	U16	0-65535	Immediate	csp pp hm	NO
2108h	57h	Interrupt positioning setting	1	U16	0-4	Restart	csp	NO

							pp hm	
2108h	59h	Homing start modes	1	U16	0-4	Restart	csp pp hm	NO
2108h	5Ah	Homing modes	1	U16	0-8	Restart	csp pp hm	NO
2108h	5Bh	Limit switch and Z-phase signal at homing modes	1	U16	0-5	Restart	csp pp hm	NO
2108h	5Dh	Origin search high speed	1rpm	U16	1-3000	Immediate	csp pp hm	NO
2108h	5Eh	Origin search low speed	1rpm	U16	1-300	Immediate	csp pp hm	NO
2108h	5Fh	Acceleration/deceleration time at origin search	1ms	U16	1-10000	Immediate	csp pp hm	NO
2108h	60h	Homing time limit	1ms	U16	1-65535	Immediate	csp pp hm	NO
2108h	61h	Origin point coordinate offset (32-bit)	1	I32	-1073741824- 1073741824	Immediate	csp pp hm	NO
2108h	63h	Mechanical origin point offset (32-bit)	1	I32	-1073741824- 1073741824	Immediate	csp pp hm	NO

Group 2109h: Communication setting

Index	Sub-index	Name	Unit	Data type	Data range	Effective	Modes of operation	PDO mapping
2109h	00h	Communication setting	-	-	-	-	-	-
2109h	01h	Modbus axis address	1	U16	1-247	Immediate	ALL	NO
2109h	02h	Modbus baud rate	1	U16	0-6	Immediate	ALL	NO
2109h	03h	Modbus data format	1	U16	0-3	Immediate	ALL	NO
2109h	04h	Communication overtime	1ms	U16	0-9999	Immediate	ALL	NO
2109h	05h	Communication response delay	1ms	U16	0-9999	Immediate	ALL	NO
2109h	06h	Communication DI enabling setting 1	1	U16	0-65535	Restart	ALL	NO
2109h	07h	Communication DI enabling setting 2	1	U16	0-65535	Restart	ALL	NO
2109h	08h	Communication DI enabling setting 3	1	U16	0-65535	Restart	ALL	NO
2109h	09h	Communication DI enabling setting 4	1	U16	0-65535	Restart	ALL	NO
2109h	0Ah	Communication DO enabling setting 1	1	U16	0-65535	Restart	ALL	NO
2109h	0Bh	Communication DO enabling setting 2	1	U16	0-65535	Restart	ALL	NO
2109h	0Ch	Communication instruction holding time	1	U16	0-60	Immediate	ALL	NO
2109h	0Dh	CAN communication configuration 1	1	U16	0-65535	Restart	ALL	NO
2109h	0Eh	CANOpen/EtherCAT communication configuration 2	1	U16	0-65535	Restart	ALL	NO
2109h	0Fh	CANOpen/EtherCAT communication configuration 3	1	U16	0-65535	Restart	ALL	NO
2109h	10h	CANOpen Synchronous offset fine-tuning	1	U16	0-65535	Restart	ALL	NO
2109h	11h	EtherCAT disconnection detection	1	I16	-20-20	Immediate	ALL	NO
2109h	12h	EtherCAT speed limit selection	1	U16	0-65535	Immediate	ALL	NO
2109h	13h	EtherCAT station No. setting	1	U16	0-65535	Immediate	ALL	NO

Group 2111h Expansion position control function

Index	Sub-index	Name	Unit	Data type	Data range	Effective	Modes of operation	PDO mapping
2111h	00h	Expansion position control function	-	-	-	-	-	-
2111h	01h	External encoder using method	1	U16	0-2	Restart	csp pp hm	NO
2111h	02h	External encoder pitch(32-bit)	1	U32	0-1073741824	Restart	csp pp hm	NO
2111h	04h	Full-closed hybrid deviation threshold(32-bit)	1	U32	0-1073741824	Immediate	csp pp hm	NO
2111h	06h	Hybrid deviation counting setting	1%	U16	0-100	Restart	csp pp hm	NO
2111h	07h	Hybrid vibration suppression gain	0.1/s	U16	0-30000	Immediate	csp pp hm	NO
2111h	08h	Hybrid vibration suppression time constant	0.1ms	U16	0-30000	Immediate	csp pp hm	NO
2111h	0Ah	Full-closed hybrid deviation external unit(32-bit)	1	I32	-1073741824-1073741824	Display parameter	csp pp hm	NO
2111h	0Ch	Internal encoder counting external unit(32-bit)	1	I32	-1073741824-1073741824	Display parameter	csp pp hm	NO
2111h	0Eh	External encoder counting value(32-bit)	1	I32	-1073741824-1073741824	Display parameter	csp pp hm	NO
2111h	11h	Position comparison output mode	1	U16	0-3	Restart	csp pp hm	NO
2111h	12h	First position(32-bit)	1	I32	-1073741824-1073741824	Immediate	csp pp hm	NO
2111h	14h	2nd position(32-bit)	1	I32	-1073741824-1073741824	Immediate	csp pp hm	NO
2111h	16h	3rd position(32-bit)	1	I32	-1073741824-1073741824	Immediate	csp pp hm	NO
2111h	18h	4th position(32-bit)	1	I32	-1073741824-1073741824	Immediate	csp pp hm	NO
2111h	1Ah	Effective time 1	1ms	U16	0-65535	Immediate	csp pp hm	NO
2111h	1Bh	Effective time 2	1ms	U16	0-65535	Immediate	csp pp hm	NO
2111h	1Ch	Effective time 3	1ms	U16	0-65535	Immediate	csp pp hm	NO
2111h	1Dh	Effective time 4	1ms	U16	0-65535	Immediate	csp pp hm	NO
2111h	1Eh	Display delay	1ms	U16	0-65535	Immediate	csp pp hm	NO

Group 2114h: Panel and Communication Interface

Index	Sub-index	Name	Unit	Data type	Data range	Effective	Modes of operation	PDO mapping
2114h	00h	Panel and communication interface	-	-	-	-	-	-
2114h	01h	Panel JOG	1	U16	0-2000	Restart	ALL	NO
2114h	02h	Fault reset	1	U16	0-9	Restart	ALL	NO
2113h	03h	writing storage	1	U16	0-65535	Immediate	ALL	NO
2114h	04h	Parameter identification function	1	U16	0-5	Restart	ALL	NO
2114h	06h	Analog input automatic offset adjustment	1	U16	0-2	Restart	ALL	NO
2114h	07h	System initialization function	1	U16	0-99	Restart	ALL	NO
2114h	09h	Communication operation instruction input	1	U16	0-65535	Immediate	ALL	NO
2114h	0Ah	Communication operation status output	1	U16	0-65535	Display parameter	ALL	NO
2114h	0Ch	Multi-stage operation selection by communication	1	U16	0-16	Immediate	csp pp hm csv pv	NO
2114h	0Dh	Homing start by communication	1	U16	0-9	Immediate	csp pp hm	NO

Group 2115h: Status Parameters

Index	Sub-index	Name	Unit	Data type	Data range	Effective	Modes of operation	PDO mapping
2115h	00h	Status Parameters	-	-	-	-	-	-
2115h	01h	Servo status	1	U16	0-65535	Display parameter	ALL	NO
2115h	02h	Motor speed feedback	1rpm	I16	-9000-9000	Display parameter	ALL	NO
2115h	04h	Speed instruction	1rpm	I16	-9000-9000	Display parameter	ALL	NO
2115h	05h	Internal torque instruction (relative to rated torque)	0.1%	I16	-5000-5000	Display parameter	ALL	NO
2115h	06h	Phase current effective value	0.01A	U16	0-65535	Display parameter	ALL	NO
2115h	07h	DC bus voltage	0.1V	U16	0-65535	Display parameter	ALL	NO
2115h	08h	Absolute position counter (32-bit)	1Unit	I32	-1073741824-1073741824	Display parameter	ALL	NO
2115h	0Ah	Electrical angle	0.1°	U16	0-65535	Display parameter	ALL	NO
2115h	0Bh	Mechanical angle (relative to encoder zero point)	0.1°	U16	0-65535	Display parameter	ALL	NO
2115h	0Ch	Load inertia identification value	0.01 kg c m ²	U16	0-65535	Display parameter	ALL	NO
2115h	0Dh	Speed value relative to input instruction	1rpm	I16	-9000-9000	Display parameter	ALL	NO
2115h	0Eh	Position deviation counter (32-bit)	1P	I32	-1073741824-1073741824	Display parameter	ALL	NO
2115h	10h	Input pulse counter (32-bit)	1Unit	I32	-1073741824-1073741824	Display parameter	ALL	NO
2115h	12h	Feedback pulse counter (32-bit)	1P	I32	-1073741824-1073741824	Display parameter	ALL	NO
2115h	14h	Position instruction deviation counter unit (32-bit)	1Unit	I32	-1073741824-1073741824	Display parameter	ALL	NO
2115h	16h	Digital input signal monitoring	1	U16	0-511	Display parameter	ALL	NO
2115h	18h	Digital output signal monitoring	1	U16	0-511	Display parameter	ALL	NO
2115h	19h	Encoder status	1	U16	0-65535	Display parameter	ALL	NO
2115h	1Ah	Total power-on time(32-bit)	0.1s	U32	0-2147483647	Display parameter	ALL	NO
2115h	1Ch	AI 1 voltage after adjustment	1mV	I16	-32768-32767	Display parameter	ALL	NO
2115h	1Dh	AI 2 voltage after adjustment	1mV	I16	-32768-32767	Display parameter	ALL	NO
2115h	1Eh	AI 1 voltage before adjustment	1mV	I16	-32768-32767	Display parameter	ALL	NO
2115h	1Fh	AI 2 voltage before adjustment	1mV	I16	-32768-32767	Display parameter	ALL	NO
2115h	20h	Module temperature	1°C	U16	0-65535	Display parameter	ALL	NO
2115h	21h	Number of turns of absolute encoder (32-bit)	1	I32	-1073741824-1073741824	Display parameter	ALL	NO
2115h	22h	High bit for number of turns of absolute encoder	1	I16	-1073741824-1073741824	Display parameter	ALL	NO
2115h	23h	Single turn position of absolute encoder (32-bit)	1Unit	I32	-1073741824-1073741824	Display parameter	ALL	NO
2115h	24h	High bit for single turn position of absolute encoder	1Unit	I16	-1073741824-1073741824	Display parameter	ALL	NO
2115h	25h	Version code 1	0.01	U16	0-65535	Display parameter	ALL	NO
2115h	26h	Version code 2	0.01	U16	0-65535	Display parameter	ALL	NO
2115h	27h	Version code 3	0.01	U16	0-65535	Display parameter	ALL	NO
2115h	28h	Product series code	1	U16	0-65535	Display parameter	ALL	NO
2115h	29h	Fault record display	1	U16	0-9	Immediate	ALL	NO
2115h	2Ah	Fault code	1	U16	0-65535	Display	ALL	NO

						parameter		
2115h	2Bh	Time stamp upon selected fault (32-bit)	0.1s	U32	0-2147483647	Display parameter	ALL	NO
2115h	2Dh	Motor speed upon selected fault	1rpm	I16	-9000-9000	Display parameter	ALL	NO
2115h	2Eh	U-phase current upon selected fault	0.01A	U16	0-65535	Display parameter	ALL	NO
2115h	30h	DC bus voltage upon selected fault	0.1V	U16	0-65535	Display parameter	ALL	NO
2115h	31h	Input terminal status upon selected fault	1	U16	0-511	Display parameter	ALL	NO
2115h	32h	Output terminal status upon selected fault	1	U16	0-511	Display parameter	ALL	NO
2115h	33h	Customized software version code	0.01	U16	0-65535	Display parameter	ALL	NO
2115h	34h	Load ratio	1%	U16	0-500	Display parameter	ALL	NO
2115h	35h	Regenerative load ratio	1%	U16	0-500	Display parameter	ALL	NO
2115h	36h	Internal warning code	1	U16	0-65535	Display parameter	ALL	NO
2115h	37h	Internal instruction present stage code	1	U16	0-99	Display parameter	ALL	NO
2115h	38h	Customized product serial code	1	U16	0-65535	Display parameter	ALL	NO
2115h	39h	High 32 place value of absolute position counter	1	I32	-1073741824-1073741824	Display parameter	ALL	NO
2115h	3Bh	High 32 place value of feedback pulse counter (32-bit)	1	I32	-1073741824-1073741824	Display parameter	ALL	NO

6.4 Object dictionary list 6000H

Index	Sub-index	Type	Name	Data type	Access	Mapping type	Unit
213Ah		VAR	Number of turns of absolute encoder (32-bit)	DINT	ro	T	
213Bh		VAR	Single turn position of absolute encoder (32-bit)	DINT	ro	T	
213Ch		VAR	Absolute encoder position (high 32-bit)	DINT	ro	T	
213Dh		VAR	Absolute encoder position (low 32-bit)	DINT	ro	T	
213Fh		VAR	Internal servo code	UINT	ro	T	
2141h		VAR	Analog input value 1	UINT	ro	T	
2142h		VAR	Analog input value 2	UINT	ro	T	
213Fh		VAR	Error code	UINT	ro	T	
603Fh		VAR	Error code	UINT	ro	T	
6040h		VAR	Controlword	UINT	rw	R	
6041h		VAR	Statusword	UINT	ro	T	
605Ah		VAR	Quick stop mode selection	INT	rw	R	
605Dh		VAR	Pause mode selection	INT	rw	R	
6060h		VAR	Modes of operation	SINT	rw	R	
6061h		VAR	Modes of operation display	SINT	ro	T	
6062h		VAR	Position demand value	DINT	ro	T	User instructionUnit
6063h		VAR	Position actual internal value	DINT	ro	T	Encoder Unit
6064h		VAR	Position actual value	DINT	ro	T	User instruction Unit
6065h		VAR	Following error window	UDINT	rw	R	User instruction Unit
6066h		VAR	Position deviation time window	UINT	rw	R	ms
6067h		VAR	Position window	UDINT	rw	R	User instruction Unit
6068h		VAR	Position window time	UINT	rw	R	ms
606Bh		VAR	Velocity demand value	DINT	ro	T	Determined by the hundred's digit of P09.13 ,0: RPM , 1: User instruction
606Ch		VAR	Velocity actual value	DINT	ro	T	Determined by the hundred's digit of P09.13 ,0: RPM , 1: User instruction
606Dh		VAR	Velocity window	UINT	rw	R	Determined by the hundred's digit of P09.13 ,0: RPM , 1: User instruction
606Eh		VAR	Velocity window time	UINT	rw	R	ms
606Fh		VAR	Velocity threshold	UINT	rw	R	Determined by the hundred's digit of P09.13 ,0: RPM , 1: User instruction
6071h		VAR	Target torque	INT	rw	R	0.1%
6072h		VAR	Max torque	UINT	rw	R	0.1%
6074h		VAR	Torque demand	INT	ro	T	0.1%
6077h		VAR	Torque actual value	INT	ro	T	0.1%
6078h		VAR	Actual current value	INT	ro	T	0.1%
6079h		VAR	DC bus voltage	UDINT	ro	T	0.001V
607Ah		VAR	Target position	DINT	rw	R	User instruction
607Ch		VAR	Home offset	DINT	rw	R	User instruction
607Dh	0	ARRAY	Soft-limit:Maximum number of Sub-index	UINT	ro	N	
607Dh	1	ARRAY	Min position limit	DINT	rw	R	User instruction
607Dh	2	ARRAY	Max position limit	DINT	rw	R	User instruction
607Eh		VAR	Polarity	USINT	rw	R	
607Fh		VAR	Max profile velocity	UDINT	rw	T	Determined by the hundred's digit of P09.13 ,0: RPM , 1: User instruction
6080h		VAR	Max motor velocity	UDINT	rw	T	rpm
6081h		VAR	Profile velocity	UDINT	rw	R	Determined by the hundred's digit of P09.13 ,0: RPM , 1: User instruction /s
6083h		VAR	Profile acceleration	UDINT	rw	R	Determined by the thousand's digit of P09.13. 0: Time required for 0-1000RPM (ms) , 1: User instruction /s^2

6084h		VAR	Profile deceleration	UDINT	rw	R	Determined by the thousand's digit of P09.13,0: Time required for 0-1000RPM (ms) , 1: User instruction /s ²
6085h		VAR	Deceleration for quick stop	UDINT	rw	R	Determined by the thousand's digit of P09.13,0: Time required for 0-1000RPM (ms) , 1: User instruction /s ²
6087h		VAR	Torque slope	UDINT	rw	R	Time required for 100.0% torque(ms)
608Fh	0	ARRAY	Position encoder resolution	USINT	ro	N	
608Fh	1	ARRAY	Encoder resolution per motor revolution	UDINT	ro	T	Encoder Unit
608Fh	2	ARRAY	Number of motor revolution	UDINT	ro	T	Revolution
6091h	0	ARRAY	Electronic gear ratio: Maximum number of Sub-indexes	UINT	ro	R	
6091h	1	ARRAY	Electronic gear ratio: Numerator	UDINT	rw	R	
6091h	2	ARRAY	Electronic gear ratio: Denominator	UDINT	rw	R	
6092h	0	ARRAY	Feed constant: Maximum number of Sub-indexes	UINT	ro	R	
6092h	1	ARRAY	Feed constant: Numerator	UDINT	rw	R	
6092h	2	ARRAY	Feed constant: Denominator	UDINT	rw	R	
6093h	0	ARRAY	Position factor: Maximum number of Sub-indexes	UINT	ro	N	
6093h	1	ARRAY	Position factor: Numerator	UDINT	rw	R	
6093h	2	ARRAY	Position factor: Feed constant	UDINT	rw	R	
6094h	0	ARRAY	Speed encoder factor: Maximum number of Sub-indexes	UINT	ro	N	
6094h	1	ARRAY	Speed encoder factor: Numerator	UDINT	rw	R	
6094h	2	ARRAY	Speed encoder factor: Denominator	UDINT	rw	R	
6095h	0	ARRAY	Speed factor: Maximum number of Sub-indexes	UINT	ro	N	
6095h	1	ARRAY	Speed factor 1: Numerator	UDINT	rw	R	
6095h	2	ARRAY	Speed factor 1: Denominator	UDINT	rw	R	
6097h	0	ARRAY	Acceleration factor: Maximum number of Sub-indexes	UINT	ro	N	
6097h	1	ARRAY	Acceleration factor: Numerator	UDINT	rw	R	
6097h	2	ARRAY	Acceleration factor: Denominator	UDINT	rw	R	
6098h		VAR	Homing method	UINT	rw	R	
6099h	0	ARRAY	Homing speed: Maximum number of Sub-indexes	UINT	ro	N	Determined by the hundred's digit of P09.13,0: RPM,1: User instruction /s
6099h	1	ARRAY	Velocity during search for switch	UDINT	rw	R	Determined by the hundred's digit of P09.13,0: RPM,1: User instruction /s
6099h	2	ARRAY	Velocity during search for zero	UDINT	rw	R	Determined by the hundred's digit of P09.13,0: RPM,1: User instruction /s
609Ah		VAR	Homing acceleration	UDINT	rw	R	Determined by the thousand's digit of P09.13,0: time required for 0-1000RPM (ms) , 1: User instruction /s ²
60B0h		VAR	Position offset	DINT	rw	R	User instruction
60B1h		VAR	Speed offset	DINT	rw	R	Determined by the hundred's digit of P09.13,0: RPM,1: User instruction /s
60B2h		VAR	Torque offset	INT	rw	R	0.1%
60B8h		VAR	Touch probe function	UINT	rw	R	
60B9h		VAR	Probe Statusword	UINT	ro	T	
60BAh		VAR	Touch probe pos1 pos value	DINT	ro	T	
60BBh		VAR	Touch probe pos1 neg value	DINT	ro	T	
60BCh		VAR	Touch probe pos2 pos value	DINT	ro	T	
60BDh		VAR	Probe 2 falling edge Position actual value	DINT	ro	T	
60C0h		VAR	Interpolation submode selection	INT	rw	R	
60C1h	0	ARRAY	Interpolation data record: Maximum number of Sub-indexes	UINT	ro	N	
60C1h	1	ARRAY	Interpolation offset	UDINT	rw	R	

60C2h	0	ARRAY	Interpolation time perild: Maximum number of Sub-indexes	UINT	ro	N	
60C2h	1	ARRAY	Interpolation time Unit	USINT	rw	R	
60C2h	2	ARRAY	Interpolation time Index	SINT	rw	R	
60C5h		VAR	Max acceleration	UDINT	rw	R	Determined by the thousand's digit of P09.13, 0: Time required for 0-1000RPM(ms); 1: User instruction /s^2
60C6h		VAR	Max deceleration	UDINT	rw	R	Determined by the thousand's digit of P09.13, 0: Time required for 0-1000RPM(ms); 1: User instruction /s^2
60E0h		VAR	Positive Max torque limit	UINT	rw	R	0.1%
60E1h		VAR	Negative Max torque limit	UINT	rw	R	0.1%
60F2h		VAR	Positioning option code	UINT	rw	R	
60F4h		VAR	Following error actual value	DINT	ro	T	User instruction
60F8h		VAR	Max. slip	DINT	rw	R	
60FCh		VAR	Position demand internal value	DINT	ro	T	User instruction
60FDh		VAR	Digital inputs	UDINT	ro	T	
60FEh	0	ARRAY	DO: Maximum number of Sub-indexes	UINT	ro	N	
60FEh	1	ARRAY	DO status	UDINT	rw	R	
60FEh	2	ARRAY	Bit masking	UDINT	rw	R	
60FFh		VAR	Target velocity	UDINT	rw	R	Determined by the hundred's digit of P09.13 ,0: RPM , 1: User instruction /s
6502h		VAR	Supported Drive Modes	UDINT	ro	T	

6000h object dictionary description

Object 213A_h: Number of turns for absolute encoder 32bit			
Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	213A _h	Sub-index	00 _h
Name	Single turn position for absolute encoder 32bit	Access attribute	ro
Data structure	Variable	PDO mapping type	TPDO
Data type	Integer32	Data range	-2147483648~2147483647
Modes of operation	ALL	Default	0
When displaying the actual number of turns for absolute encoder, it's same as P21.32.			

Object 213B_h: Single-turn position for absolute encoder 32 bit			
Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	213B _h	Sub-index	00 _h
Name	Single turn position for absolute encoder 32bit	Access attribute	ro
Data structure	Variable	PDO mapping type	TPDO
Data type	Integer32	Data range	-2147483648~2147483647
Modes of operation	ALL	Default	0
When displaying the actual single-turn position for absolute encoder, it's same as P21.34.			

Object 213C_h: Absolute encoder position (lower 32bit)			
Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	213C _h	Sub-index	00 _h
Name	Absolute encoder position (lower 32bit)	Access attribute	ro
Data structure	Variable	PDO mapping type	TPDO
Data type	Integer32	Data range	-2147483648~2147483647
Modes of operation	ALL	Default	0
Displays actual absolute encoder position (lower 32bit)			

Object 213D_h: Absolute encoder position (higher 32bit)			
Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	213D _h	Sub-index	00 _h
Name	Absolute encoder position (higher 32bit)	Access attribute	ro
Data structure	Variable	PDO mapping type	TPDO
Data type	Integer32	Data range	-2147483648~2147483647
Modes of operation	ALL	Default	0
Display actual absolute encoder position (higher 32bit)			

Object 213F_h: Error code inside the servo			
Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	213F _h	Sub-index	00 _h
Name	Error code	Access attribute	ro
Data structure	Variable	PDO mapping type	TPDO
Data type	unsigned16	Data range	0~65535
Modes of operation	ALL	Default	0
The Error code is same as the ones on the panel.			

Object 2141_h: Analog input 1			
Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	2141 _h	Sub-index	00 _h
Name	Analog input 1	Access attribute	ro
Data structure	Variable	PDO mapping type	TPDO
Data type	Integer16	Data range	-32768~32767
Modes of operation		Default	0
Display the value of analog input 1, same as P21.27.			

Object 2142_h: Analog input 2			
Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	2142 _h	Sub-index	00 _h
Name	Analog input 2	Access attribute	ro
Data structure	Variable	PDO mapping type	TPDO
Data type	Integer16	Data range	-32768~32767
Modes of operation		Default	0
Display the value of analog input 2, same as P21.28.			

Object 603F_h: Error code			
Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	603F _h	Sub-index	00 _h
Name	Error code	Access attribute	ro
Data structure	Variable	PDO mapping type	TPDO
Data type	unsigned16	Data range	0~65535
Modes of operation	ALL	Default	0
Display CiA protocol error code. Note: This not internal error code. For error code, refer to 213Fh.			

Object 6040_h: Controlword			
Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	6040 _h	Sub-index	00 _h
Name	Controlword	Access attribute	rw
Data structure	Variable	PDO mapping type	RPDO
Data type	unsigned16	Data range	0~65535
Modes of operation	ALL	Default	0
Used for enabling and clearing alarms, starting the specified command in different modes.			
bit	Definition		
0	Servo ready	0: Invalid 1: Valid	

1	Main circuit connected	0: Invalid 1: Valid
2	Quick stop	1: Invalid 0: Valid
3	Servo operation	0: Invalid 1: Valid
4~6	Relative to Modes of operation	
7	Fault reset	Bit7 rising edge is effective. When Bit7=1, other instructions becomes invalid.
8	Pause	0: Invalid 1: Valid
9~15	Reserved	

Note: 1. It is meaningless to assign the value to each bit of Statusword. It must be combined with other bits to form a certain control instruction.

2. Bit0 ~bit3 must be sent in order to switch the servo process according to CiA402 state machine and correctly import into the expected state

Object 6041_h: Statusword

Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	6041 _h	Sub-index	00 _h
Name	Statusword	Access attribute	ro
Data structure	Variable	PDO mapping type	TPDO
Data type	unsigned16	Data range	0~65535
Modes of operation	ALL	Default	0

bit	Definition	
0	Servo ready	0: Invalid 1: Valid
1	Start servo running	0: Invalid 1: Valid
2	Servo operation	0: Invalid 1: Valid
3	Servo fault	0: Invalid 1: Valid
4	Main circuit voltage connected	0: Invalid 1: Valid
5	Quick stop	1: Invalid 0: Valid
6	Servo not running	0: Invalid 1: Valid
7	Alarm	0: Invalid 1: Valid
8	For manufacturer's use	Reserved
9	Remote control	0: Invalid 1: Valid
10	Target arrival(Relative to Modes of operation)	0: Invalid 1: Valid
11	Internal software limit	0: Invalid 1: Valid
12	Relative to Modes of operation	
13	Relative to Modes of operation	
14	For manufacturer's use	Reserved
15	Homing completion	0: Invalid 1: Valid In absolute system, when the second digit of P09.14 is set to 2, bit15 will be set to 1 (hold at power-failure) after homing completion. When P20.06=7, clear the bit15 status bit.

The following are the basic statuswords (X represents any value)

Not ready to switch: XXXX XXXX X0XX 0000	Switch on disable: XXXX XXXX X1XX 0000
Ready to switch on: XXXX XXXX X01X 0001	Switch on: XXXX XXXX X01X 0011
Operation enable: XXXX XXXX X01X 0111	Quick stop active: XXXX XXXX X00X 0111
Fault: XXXX XXXX X0XX 1000	Fault reaction active: XXXX XXXX X0XX 1111

Note: After Controlword6040h sends commands in sequence, the Statusword6041h displays the current status of the servo.

Object 605A_h: Quick stop mode selection

Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	605A _h	Sub-index	00 _h
Name	Quick stop mode selection	Access attribute	rw
Data structure	Variable	PDO mapping type	NO

Data type	Integer16	Data range	0~7
Modes of operation	ALL	Default	1

When Controlword6040hbit2=0, the quick stop mode is determined by 605Ah.

Setting value	Stop mode
0	Free to stop, and stay free
1	Deceleration to stop based on 6084h deceleration time, and stay free
2	Deceleration to stop based on 6085h deceleration time, and stay free
3	Deceleration to stop based on 6085h deceleration time, and stay free
4	No definition. Do not set.
5	Deceleration to stop based on 6084h deceleration time, and keep position locked
6	Deceleration to stop based on 6085h deceleration time, and keep position locked
7	Deceleration to stop based on 6085h deceleration time, and keep position locked

Note: When 605A h is set to 0, the stop mode is affected by P05.26. If P05.26 is set to 0, the emergency stop mode is "free to stop". If P05.26 is set to 1 or 2, emergency stop will decelerate to stop based on 6084h and stay free after stop.

If 605Ah is set to any one of 1, 2, 3, 5, 6, 7, the emergency stop will follow as described in the above table in all modes.

Object 605D_h: Pause mode selection

Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	605D _h	Sub-index	00 _h
Name	Pause mode selection	Access attribute	rw
Data structure	Variable	PDO mapping type	NO
Data type	Integer16	Data range	-32768~32767
Modes of operation	ALL	Default	1

The Pause is decided by 605Dh when Controlword6040hbit8 is enabled.

Setting value	Stop mode
0	Not supported and do not set.
1	Decelerate based on 6084h deceleration time and keep position locked
2	Decelerate based on 6085h deceleration time and keep position locked

Note: When 605D h is set to 1 or 2, the pause mode will follow as described in the above table in all modes.

Object 6060_h: Modes of operation

Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	6060 _h	Sub-index	00 _h
Name	Modes of operation	Access attribute	rw
Data structure	Variable	PDO mapping type	RPDO
Data type	integer8	Data range	0~10
Modes of operation	ALL	Default	0

Select the Modes of operation

Setting value	Definition	
0	Reserved	
1	Profile position mode (PP)	Refer to Section 4.2
2	Velocity mode	Not supported
3	Profile velocity mode (PV)	Refer to Section 4.3
4	Profile torque mode (PT)	Refer to Section 4.4
5	Reserved	
6	Homing method (HM)	Refer to Section 4.5
7	Interpolation position mode (IP)	Refer to Section 4.6
8	Cycle sync position mode (CSP)	Refer to Section 4.7
9	Cycle sync velocity mode (CSV)	Refer to Section 4.8
10	Cycle sync torque mode (CST)	Refer to Section 4.9

Object 6061_h: Modes of operation display

Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	6061 _h	Sub-index	00 _h
Name	Modes of operation display	Access attribute	ro
Data structure	Variable	PDO mapping type	TPDO

Data type	integer8	Data range	0~10
Modes of operation	ALL	Default	0
Display the Modes of operation			
Setting value	Definition		
0	Reserved		
1	Profile position mode(PP)	Refer to Section 4.2	
2	Velocity mode	Not supported	
3	Profile velocity mode (PV)	Refer to Section 4.3	
4	Profile torque mode (PT)	Refer to Section 4.4	
5	Reserved		
6	Homing method (HM)	Refer to Section 4.5	
7	Interpolation position mode(IP)	Refer to Section 4.6	
8	Cycle sync position mode (CSP)	Refer to Section 4.7	
9	Cycle sync velocity mode (CSV)	Refer to Section 4.8	
10	Cycle sync torque mode (CST)	Refer to Section 4.9	

Object 6062_h: Position demand value			
Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	6062 _h	Sub-index	00 _h
Name	Position demand value	Access attribute	ro
Data structure	Variable	PDO mapping type	TPDO
Data type	Integer32	Data range	-2147483648~2147483647
Modes of operation	PC	Default	0
Display position instruction in real time (User unit)			

Object 6063_h: Position actual internal value			
Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	6063 _h	Sub-index	00 _h
Name	Position actual internal value	Access attribute	ro
Data structure	Variable	PDO mapping type	TPDO
Data type	Integer32	Data range	-2147483648~2147483647
Modes of operation	ALL	Default	0
Display motor absolute position actual value in real time, same as P21.17(Encoder Unit)			

Object 6064_h: Position actual value			
Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	6064 _h	Sub-index	00 _h
Name	Position actual value	Access attribute	ro
Data structure	Variable	PDO mapping type	TPDO
Data type	Integer32	Data range	-2147483648~2147483647
Modes of operation	ALL	Default	0
Display user absolute position actual value in real time, same as P21.15.(Instruction Unit)			

Object 6065_h: Following error window			
Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	6065 _h	Sub-index	00 _h
Name	Following error window	Access attribute	rw
Data structure	Variable	PDO mapping type	RPDO
Data type	unsigned32	Data range	0~ 4294967295
Modes of operation	PP/CSP/HM	Default	1000000000
The difference between Position demand value 6062 _h and Position actual value 6064 _h exceeds $\pm 6065_{\text{h}}$, position deviation excess Err.043 occurs.			

Object 6066_h: Position deviation time window			
Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	6066 _h	Sub-index	00 _h
Name	Position deviation time window	Access attribute	rw
Data structure	Variable	PDO mapping type	RPDO
Data type	Unsigned16	Data range	0~65535
Modes of operation	PP/CSP/HM	Default	0

If the value of 60F4_h exceeds the setting range of 6065_h, and the duration exceeds the setting value of 6066_h, bit13 of 6041_hStatusword will be set to 1.

Object 6067_h: Position window			
Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	6067 _h	Sub-index	00 _h
Name	Position window	Access attribute	rw
Data structure	Variable	PDO mapping type	RPDO
Data type	unsigned32	Data range	0~ 4294967295
Modes of operation	PP/CSP/HM	Default	1000000000

In position mode, when the difference between the Position demand value6062_h and user's Position actual value6064_h is within ± 6067 _h, and the time reaches 6068_h, then the position reached and bit10 of Statusword 6041_h becomes 1.
In position mode, when the servo is enabled, this flag is ON.

Object 6068_h: Position window time			
Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	6068 _h	Sub-index	00 _h
Name	Position window time	Access attribute	rw
Data structure	Variable	PDO mapping type	RPDO
Data type	Unsigned16	Data range	0~65535
Modes of operation	PP/CSP/HM	Default	0

In position mode, the holding time refers to the time when the difference between the Position demand value6062_h and user's Position actual value6064_h is within ± 6067 _h, the position reaches and the bit10 of Statusword 6041_h becomes 1.
In position mode, when the servo is enabled, this flag is ON.
Note: Use this function, set P04.48 to 2. Take the larger value of 6068_h and P04.49 positioning completion holding time as reference.

Object 606B_h: Velocity demand value			
Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	606B _h	Sub-index	00 _h
Name	Velocity demand value	Access attribute	ro
Data structure	Variable	PDO mapping type	TPDO
Data type	integer 32	Data range	-2147483648~2147483647
Modes of operation	PV/CSV	Default	0

Display actual velocity instruction . If converted into velocity unit, it is same as P21.03.

Object 606C_h: Velocity actual value			
Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	606C _h	Sub-index	00 _h
Name	Velocity actual value	Access attribute	ro
Data structure	Variable	PDO mapping type	TPDO
Data type	integer 32	Data range	-2147483648~2147483647
Modes of operation	ALL	Default	0

Display Velocity actual value. If converted into velocity unit, it is same as P21.01.

Object 606D_h: Velocity window

Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	606D _h	Sub-index	00 _h
Name	Velocity window	Access attribute	rw
Data structure	Variable	PDO mapping type	RPDO
Data type	Unsigned16	Data range	0~65535
Modes of operation	PV/CSV	Default	65535

When the difference between the Target velocity 606F_h and user actual speed 606C_h is within $\pm 606D_h$, and the time reaches 606E_h, then the speed arrives. The bit10 of Statusword 6041_h becomes 1 and DO becomes enabled.
In Profile velocity mode and sync cycle velocity mode, this flag is ON when the servo becomes enabled.

Object 606E_h: Velocity window time

Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	606E _h	Sub-index	00 _h
Name	Velocity window time	Access attribute	rw
Data structure	Variable	PDO mapping type	RPDO
Data type	Unsigned16	Data range	0~65535
Modes of operation	PV/CSV	Default	0

When the difference between the Target velocity 606F_h and user actual speed 606C_h is within $\pm 606D_h$, and the time reaches 606E_h, then the speed arrives. The bit10 of Statusword 6041_h becomes 1 and DO becomes enabled.
In Profile velocity mode and sync cycle velocity mode, this flag is ON when the servo becomes enabled.

Object 606F_h: Velocity threshold

Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	606F _h	Sub-index	00 _h
Name	Velocity threshold	Access attribute	rw
Data structure	Variable	PDO mapping type	RPDO
Data type	Unsigned16	Data range	0~65535
Modes of operation	PV	Default	65535

When the user velocity feedback 606C_h is within $\pm 606F_h$ and the time reaches 606E_h setting value, it means that the user speed is 0 and bit12 of 6041_h becomes 1.
In Profile velocity mode, this flag turns ON. This flag has nothing to do with the enabling of the servo.

Object 6071_h: Target torque

Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	6071 _h	Sub-index	00 _h
Name	Target torque	Access attribute	rw
Data structure	Variable	PDO mapping type	RPDO
Data type	integer16	Data range	-5000~5000
Modes of operation	PT/CST	Default	0

Torque setting in PT/CST mode, Unit0.1%.
100.0% corresponds to 1 time of rated motor torque.

Object 6072_h: Max torque

Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	6072 _h	Sub-index	00 _h
Name	Max torque	Access attribute	rw
Data structure	Variable	PDO mapping type	RPDO
Data type	unsigned16	Data range	0~5000
Modes of operation	ALL	Default	5000

Set the Max torque of the motor , Max torque instruction (Unit0.1%)
Take the smaller value between 6072_hMax torque and internal torque limit parameter (P03.08 , 03.09).

Object 6074_h: Torque demand

Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	6074 _h	Sub-index	00 _h

Name	Torque demand	Access attribute	ro
Data structure	Variable	PDO mapping type	RPDO
Data type	integer16	Data range	-5000~5000
Modes of operation	ALL	Default	0
Display the internal torque value in real time in the servo operation, Unit0.1%. 100.0% corresponds to 1 time of rated motor torque.			

Object 6077_h: Torque actual value

Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	6077 _h	Sub-index	00 _h
Name	Torque actual value	Access attribute	ro
Data structure	Variable	PDO mapping type	TPDO
Data type	integer16	Data range	-5000~5000
Modes of operation	ALL	Default	0
Display the torque feedback inside the servo in real time. 100.0% corresponds to 1 time of rated motor torque. Same as P21.04. Unit0.1%			

Object 6078_h: Actual current value

Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	6078 _h	Sub-index	00 _h
Name	Actual current value	Access attribute	ro
Data structure	Variable	PDO mapping type	TPDO
Data type	integer16	Data range	-32768~32767
Modes of operation	ALL	Default	0
Display the actual current value in real time (Unit: 0.1% of rated value)			

Object 6079_h: DC bus voltage value

Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	6079 _h	Sub-index	00 _h
Name	DC bus voltage value	Access attribute	ro
Data structure	Variable	PDO mapping type	TPDO
Data type	Unsigned32	Data range	0~ 4294967295
Modes of operation	ALL	Default	0
Display bus voltage (Unit: 1mv), same as the bus voltage in P21.06.			

Object 607A_h: Target position

Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	607A _h	Sub-index	00 _h
Name	Target position	Access attribute	rw
Data structure	Variable	PDO mapping type	RPDO
Data type	Integer32	Data range	-2147483648~2147483647
Modes of operation	PP/CSP	Default	0
Set the Target position in profile position mode and sync cycle position mode. In profile position mode: If running the absolute instructions, the user's absolute position 6064h = 607Ah after positioning completion; If running relative instructions, the user's travel distance increment will be equal to 607Ah after positioning completion.			

Object 607C_h: Home offset

Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	607C _h	Sub-index	00 _h
Name	Home offset	Access attribute	rw
Data structure	Variable	PDO mapping type	RPDO
Data type	Integer32	Data range	-2147483648~2147483647
Modes of operation	HM	Default	0
1. After the homing returns, the position the motor stops is the mechanical origin. We can set the relationship between the mechanical origin and mechanical zero by setting 607Ch: Mechanical origin = Mechanical zero + 607C (Home offset). When 607C=0, the mechanical origin coincides with the mechanical zero. 2.Home offset is effective: The homing return operation has been completed after power-ON, bit15 of Statusword 6041h			

becomes 1.

3. In homing modes, first select the homing return method(6098h) from the host controller, then set the homing speed (6099-1h 6099-2h) and homing acceleration speed(609Ah). After the homing trigger signal is given, the servo will automatically find the mechanical origin according to the setting and complete the relative position relationship between the mechanical origin and the mechanical zero.

For example: By homing method 35, take the current position as mechanical origin. After the origin returns, the user's current position 6064h= 607Ch, the motor shaft will not operate.

Mechanical origin: A fixed position on the machine, corresponding to the origin switch, limit switch, Z signal of the motor, etc.

Mechanical zero: Absolute position 0 on the machine

Object 607D_h: Soft limit			
Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	607D _h	Sub-index	00 _h
Name	Number of Sub-index of soft limit	Access attribute	Rw
Data structure	/	PDO mapping type	RPDO
Data type	Unsigned8	Data range	0~512
Modes of operation	ALL	Default	2
When Position actual value reaches the internal software limit, it will stop at the limit value and the over-travel warning (Err.86 or Err.87) occurs. Bit 15 of Statusword6041h becomes 1 and the software limit becomes effective. At this time, inputting reverse motion instruction to exit the position over-travel status and bit 15 will be cleared.			
In the torque mode and velocity mode, the software limit is limited by P05.28. When P05.28=1, software limit becomes invalid. Turning on the software P05.28=0, P07.08=1 or 2, do as follows:			
Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	607D _h	Sub-index:	01 _h
Name	Mini. Software position limit	Access attribute	Rw
Data structure	/	PDO mapping type	RPDO
Data type	Integer32	Data range	-2147483648~2147483647
Modes of operation	ALL	Default	-2147483648
Software limit function: The third digit of P07.08 from the right 0: Disable software limit 1: Enable software limit after power-on 2: Enable software limit after homing returns Set the minimum value of the software absolute position limit. At -2147483648, it means the negative direction is not limited. Mini. Software position limit = (607D-01h)			
Attributes	Value	Attributes	Value
Index	607D _h	Sub-index:	02 _h
Name	Max. Software position limit	Access attribute	Rw
Data structure	/	PDO mapping type	RPDO
Data type	Integer32	Data range	-2147483648~2147483647
Modes of operation	ALL	Default	2147483647
Software limit function: The third digit of P07.08 from the right 0: Disable software limit 1: Enable software limit after power-on 2: Enable software limit after homing returns Set the max. value of the software absolute position limit. At 2147483647, it means the positive direction is not limited. Max. Software position limit = (607D-02h)			

Object 607E_h: Polarity			
Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	607E _h	Sub-index	00 _h
Name	Polarity	Access attribute	rw
Data structure	Variable	PDO mapping type	RPDO
Data type	Unsigned8	Data range	0~1
Modes of operation		Default	0
1 Set the polarity for torque instruction, position instruction and speed instruction. When using, the speed, position and torque polarity should be 0 (Bit5~7 is 0) or set 224(Bit5~7 is 1). After setting 607Eh, this function will become effective after restarting the power.			
Bit	Definition		
0	Reserved		
1	Reserved		
2	Reserved		
3	Reserved		
4	Reserved		
5	Torque instruction 6071h/60B2h× (-1)		
6	Velocity instruction 60FFh/60B1h× (-1)		

7	Position instruction 607Ah/60B0h× (-1)
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Object 607F_h: Max. speed limit			
Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	607F _h	Sub-index	00 _h
Name	Max profile velocity	Access attribute	rw
Data structure	Variable	PDO mapping type	TPDO
Data type	Unsigned32	Data range	0~4294967295
Modes of operation	PV/PT/CSV/CST	Default	13107200

Max. speed limit in PV/PT/CSV/CST mode. Unit: Instruction Unit/S
 In velocity mode, the max. speed limit take the smaller value between 607F and 6080 as the reference.
 In torque mode, the max. speed limit take the smaller value between 607F, 6080 and internal speed limit (P03.27,P03.28) as the reference.

Object 6080_h: Max motor velocity			
Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	6080 _h	Sub-index	00 _h
Name	Max motor velocity	Access attribute	rw
Data structure	Variable	PDO mapping type	TPDO
Data type	Unsigned32	Data range	0~4294967295
Modes of operation	ALL	Default	5000

Set the Max motor velocity by using 6080_h to protect the motor. This is valid in all control modes: Unit: Rpm/min
 1. In velocity mode, Max motor velocity takes the smaller value between 607F and 6080 as the reference.
 2. In torque mode, Max motor velocity takes the smaller value between 607F, 6080 and internal speed limit (P03.27,P03.28) as the reference.
 3. In position mode, Max motor velocity takes 6080 as the reference.
 In position mode, the first digit of function code P09.17 from the right can be set whether to be limited by 6080h or not:
 1) When P09.17=0, 6080h does not have the speed limit. Err.78 occurs when exceeding the max. rotation speed.
 2) When P09.17=1, the max. rotation speed of motor coincides with 6080h setting value.

Object 6081_h: Profile velocity			
Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	6081 _h	Sub-index	00 _h
Name	Profile velocity	Access attribute	rw
Data structure	Variable	PDO mapping type	RPDO
Data type	Unsigned32	Data range	0~4294967295
Modes of operation	PP	Default	0

It represents the speed of offset instruction at constant speed in profile position mode. Unit: User instruction Unit/S
 The actual operation speed of 6081h is limited by the smaller value between 607F and 6080.

Object 6083_h: Profile acceleration			
Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	6083 _h	Sub-index	00 _h
Name	Profile acceleration	Access attribute	rw
Data structure	Variable	PDO mapping type	RPDO
Data type	Unsigned32	Data range	0~4294967295
Modes of operation	PP/PV	Default	13107200

Set the acceleration speed at the fourth digit of P09.13 from the right on the operation panel. Unit
 When it is 0:
 In profile position mode, it means the acceleration speed the position gives from 0rpm to 1000rpm. Unit: rpm/ms.
 In Profile velocity mode, it means the acceleration speed the velocity instruction gives from 0rpm to 1000rpm. Unit: rpm/ms. ;
 When it is 1: User instruction Unit/S²

Object 6084_h: Profile deceleration			
Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	6084 _h	Sub-index	00 _h
Name	Profile deceleration	Access attribute	rw
Data structure	Variable	PDO mapping type	RPDO
Data type	Unsigned32	Data range	0~4294967295
Modes of operation	ALL	Default	131072000
<p>1. Set the deceleration speed at the fourth digit of P09.13 from the right on the operation panel. Unit When it is 0: In profile position mode, it means the deceleration speed the position instruction gives from 1000rpm to 0rpm. Unit: rpm/ms. In Profile velocity mode, it means the deceleration speed the velocity instruction gives from 1000rpm to 0rpm. Unit: rpm/ms. When it is 1: User instruction Unit/ S²</p> <p>2. Quick stop in ALL modes: Set 605A=1 or 5 , the quick stop will decelerate to stop based on 6084h setting value in all modes.</p> <p>3. Pause in ALL modes: Set 605D=1 , the pause will decelerate to stop based on 6084h setting value in all modes.</p>			

Object 6085_h: Quick stop deceleration speed			
Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	6085 _h	Sub-index	00 _h
Name	Quick stop deceleration speed	Access attribute	rw
Data structure	Variable	PDO mapping type	RPDO
Data type	Unsigned32	Data range	0~4294967295
Modes of operation	ALL	Default	4294967295
<p>1. Set the acceleration speed at the fourth digit of P09.13 from the right, Unit. When it is 0: It means the deceleration speed that the motor decelerates from 1000rpm to 0rpm at 605Ah quick stop. Unit: rpm/ms When it is 1: User instruction Unit/ S²</p> <p>2. Quick stop in ALL modes: Set 605h to any value of 2,3,6 and 7, the quick stop will decelerate to stop based on 6085h setting value in all modes.</p> <p>3. Pause in ALL modes : Set 605D to 2 , the pause will decelerate to stop based on 6085h setting value in all modes.</p>			

Object 6087_h: Torque slope			
Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	6087 _h	Sub-index	00 _h
Name	Torque slope	Access attribute	rw
Data structure	Variable	PDO mapping type	RPDO
Data type	Unsigned32	Data range	0~4294967295
Modes of operation	PT/CST	Default	1000
The torque instruction acceleration in profile torque mode: Torque instruction increment per second (Unit: 1%/s)			

Object 608F_h: Position encoder resolution			
Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	608F _h	Sub-index	00 _h
Name	Position encoder resolution	Access attribute	Ro
Data structure	/	PDO mapping type	TPDO
Data type	Unsigned8	Data range	0~2
Modes of operation	ALL	Default	2
Attributes	Value	Attributes	Value
Index	608F _h	Sub-index	01 _h
Name	Motor encoder resolution	Access attribute	Rw
Data structure	/	PDO mapping type	RPDO
Data type	Unsigned32	Data range	1~4294967295
Modes of operation	ALL	Default	131072
Attributes	Value	Attributes	Value
Index	608F _h	Sub-index	02 _h
Name	Motor resolution corresponding to the number of motor revolution	Access attribute	Rw

Data structure	/	PDO mapping type	RPDO
Data type	Unsigned32	Data range	1~4294967295
Modes of operation	ALL	Default	1
The electronic gear ratio is formed by 6091h and 6092h. For specific relationship, refer to 6091h electronic gear ratio.			

Object 6091_h: Electronic gear ratio			
Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	6091 _h	Sub-index	00 _h
Name	Number of electronic gear ratio Index	Access attribute	Rw
Data structure	/	PDO mapping type	RPDO
Data type	Unsigned8	Data range	0~512
Modes of operation	ALL	Default	2
Attributes	Value	Attributes	Value
Index	6091 _h	Sub-index	01 _h
Name	Electronic gear ratio: Numerator	Access attribute	Rw
Data structure	/	PDO mapping type	RPDO
Data type	Unsigned32	Data range	1~4294967295
Modes of operation	ALL	Default	1
Attributes	Value	Attributes	Value
Index	6091 _h	Sub-index	02 _h
Name	Electronic gear ratio: Denominator	Access attribute	Rw
Data structure	/	PDO mapping type	RPDO
Data type	Unsigned32	Data range	1~4294967295
Modes of operation	ALL	Default	1
<p>Electronic gear ratio = 608Fh * 6091h / 6092h =</p> $\frac{608Fh : 01(\text{Motor encoder resolution})}{608Fh : 02(\text{Encoder resolution corresponds to number of revolution})} * \frac{6091h : 01(\text{Number of motor revolution})}{6091h : 02(\text{Number of drive revolution})}$ $\frac{6092h : 01(\text{Upper feed})}{6092h : 02(\text{Number of drive revolution})}$ <p>For example: Upper instruction should be set to be one turn with 10000 drive shafts: 6091h (1: 1) 6092h (10000: 1)</p> <p>Internal speed = 60FFh * 6091h Numerator * 6092h Denominator * 60 / 6091h Denominator / 6092h Numerator. Speed feedback coincides with instruction. The third digit of P09.13 from the right determines the speed unit. 0: RPM, 1: User instruction/s, Speed Unit is determined by 6091h and 6092h.</p> <p>X3E series servo drives supports 2 kinds of electronic gear ratio. One is the default parameter inside the drive; The other one is to enable 608Fh/ 6091h/6092h. The two schemes are switched by the second digit of P09.13 from the right side. When the second digit of P09.13 from the right is set to 0, 608Fh/ 6091h/6092h is enabled. At this time, P00.08 and P00.10/P00.12 will function; When the second digit of P09.13 from the right is set to 1, 608Fh/ 6091h/6092h is disabled. At this time, P00.08 and P00.10/P00.12 do not function.</p> <p>Allowable range for electronic gear ratio: Encoder resolution / 10000000 ≤ Gear ratio ≤ Encoder resolution / 2.5 The final electronic gear ratio can be confirmed as follows: P21.70 is set to 3, P21.71 and P21.72 can respectively display the lower 16-bit and higher 16-bit of numerator of the final electronic gear ratio; P21.73 and P21.74 can respectively display the lower 16-bit and higher 16-bit of denominator of the final electronic gear ratio.</p>			

Object 6092_h: Feed constant			
Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	6092 _h	Sub-index	00 _h
Name	Number of Sub-index	Access attribute	Rw
Data structure	/	PDO mapping type	RPDO
Data type	Unsigned8	Data range	0~512
Modes of operation	ALL	Default	2

Attributes	Value	Attributes	Value
Index	6092 _h	Sub-index	01 _h
Name	Feed constant: Numerator	Access attribute	Rw
Data structure	/	PDO mapping type	RPDO
Data type	Unsigned32	Data range	1~4294967295
Modes of operation	ALL	Default	131072 (17bit encoder)
Attributes	Value	Attributes	Value
Index	6092 _h	Sub-index	02 _h
Name	Feed constant: Denominator	Access attribute	Rw
Data structure	/	PDO mapping type	RPDO
Data type	Unsigned32	Data range	1~4294967295
Modes of operation	ALL	Default	1
The electronic gear ratio is formed by 608Fh and 6091h. For specific relationship, refer to 6091h electronic gear ratio.			

Object 6093_h: Position factor			
Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	6093 _h	Sub-index	00 _h
Name	Number of Sub-index	Access attribute	Rw
Data structure	/	PDO mapping type	RPDO
Data type	Unsigned8	Data range	0~512
Modes of operation	ALL	Default	2
Attributes	Value	Attributes	Value
Index	6093 _h	Sub-index	01 _h
Name	Position factor: Numerator	Access attribute	Rw
数据结构	/	PDO mapping type	RPDO
Data type	Unsigned32	Data range	1~4294967295
Modes of operation	ALL	Default	1
Attributes	Value	Attributes	Value
Index	6092 _h	Sub-index	02 _h
Name	Position factor: Denominator	Access attribute	Rw
Data structure	/	PDO mapping type	RPDO
Data type	Unsigned32	Data range	1~4294967295
Modes of operation	ALL	Default	1
Reserved			

Object 6094_h: Speed encoder factor			
Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	6094 _h	Sub-index	00 _h
Name	Number of Sub-index	Access attribute	Rw
Data structure	/	PDO mapping type	RPDO
Data type	Unsigned8	Data range	0~512
Modes of operation	ALL	Default	2
Attributes	Value	Attributes	Value
Index	6094 _h	Sub-index	01 _h
Name	Speed encoder factor: Numerator	Access attribute	Rw
Data structure	/	PDO mapping type	RPDO
Data type	Unsigned32	Data range	1~4294967295
Modes of operation	ALL	Default	1
Attributes	Value	Attributes	Value
Index	6094 _h	Sub-index	02 _h
Name	Speed encoder factor: Denominator	Access attribute	Rw
Data structure	/	PDO mapping type	RPDO
Data type	Unsigned32	Data range	1~4294967295
Modes of operation	ALL	Default	1
Reserved			

Object 6095_h: Speed factor			
Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	6095 _h	Sub-index	00 _h
Name	Number of Sub-index	Access attribute	Rw
Data structure	/	PDO mapping type	RPDO
Data type	Unsigned8	Data range	0~512
Modes of operation	ALL	Default	2
Attributes	Value	Attributes	Value
Index	6095 _h	Sub-index	01 _h
Name	Speed factor: Numerator	Access attribute	Rw
Data structure	/	PDO mapping type	RPDO
Data type	Unsigned32	Data range	1~4294967295
Modes of operation	ALL	Default	1
Attributes	Value	Attributes	Value
Index	6095 _h	Sub-index	02 _h
Name	Speed factor: Denominator	Access attribute	Rw
Data structure	/	PDO mapping type	RPDO
Data type	Unsigned32	Data range	1~4294967295
Modes of operation	ALL	Default	1
Reserved			

Object 6097_h: Acceleration speed factor			
Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	6095 _h	Sub-index	00 _h
Name	Number of Sub-index	Access attribute	Rw
Data structure	/	PDO mapping type	RPDO
Data type	Unsigned8	Data range	0~512
Modes of operation	ALL	Default	2
Attributes	Value	Attributes	Value
Index	6095 _h	Sub-index	01 _h
Name	Acceleration speed factor: Numerator	Access attribute	Rw
Data structure	/	PDO mapping type	RPDO
Data type	Unsigned32	Data range	1~4294967295
Modes of operation	ALL	Default	1
Attributes	Value	Attributes	Value
Index	6092 _h	Sub-index	02 _h
Name	Acceleration speed factor: Denominator	Access attribute	Rw
Data structure	/	PDO mapping type	RPDO
Data type	Unsigned32	Data range	1~4294967295
Modes of operation	ALL	Default	1
Reserved			

Object 6098_h: Homing method			
Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	6098 _h	Sub-index	00 _h
Name	Homing method	Access attribute	rw
Data structure	Variable	PDO mapping type	RPDO
Data type	Integer8	Data range	0~35
Modes of operation	HM	Default	0
31 kinds of homing methods are specified based on homing switch signal, limit switch signal, encoer Z-phase signal,etc. For details, refer to Section 4.5 Homing method.			

Object 6099_h: Homing speed			
Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	6099 _h	Sub-index	00 _h
Name	Number of Sub-index	Access attribute	Rw
Data structure	/	PDO mapping type	RPDO

Data type	Unsigned8	Data range	0~512
Modes of operation	HM	Default	2
Attributes	Value	Attributes	Value
Index	6099 _h	Sub-index	01 _h
Name	Velocity during search for switch	Access attribute	Rw
Data structure	/	PDO mapping type	RPDO
Data type	Unsigned32	Data range	1~4294967295
Modes of operation	HM	Default	218453
Attributes	Value	Attributes	Value
Index	6099 _h	Sub-index	02 _h
Name	Velocity during search for zero	Access attribute	Rw
Data structure	/	PDO mapping type	RPDO
Data type	Unsigned32	Data range	1~4294967295
Modes of operation	HM	Default	21845

Set the speed unit type at the third digit of P09.13 from the right side. When set to 1, the speed unit is user instruction /S; When set to 0, it is rpm.

Two kinds of speed in Homing method: Speed 60990120h can be set as the higher value, used to make quick prediction; Speed 60990220h can be set as the lower speed, used for accurate positioning.

Object 609A_h: Homing acceleration

Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	609A _h	Sub-index	00 _h
Name	Homing acceleration	Access attribute	rw
Data structure	Variable	PDO mapping type	RPDO
Data type	unsigned32	Data range	0~4294967295
Modes of operation	HM	Default	1310720

Set the speed unit type at the third digit of P09.13 from the right side. When set to 1, the speed unit is user instruction /S; When set to 0, it is rpm.

Set the acceleration/deceleration speed at homing mode.

When P09.13=16#X0XX , it means the acceleration time that the motor accelerate from 0rpm to 1000rpm , ms

Object 60B0_h: Position offset

Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	60B0 _h	Sub-index	00 _h
Name	Position offset	Access attribute	rw
Data structure	Variable	PDO mapping type	RPDO
Data type	Integer32	Data range	-2147483648~2147483647
Modes of operation	CSP	Default	0

Set the position offset in sync cycle position mode, Target position=607Ah+60B0h

Object 60B1_h: Speed offset

Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	60B1 _h	Sub-index	00 _h
Name	Speed offset	Access attribute	rw
Data structure	Variable	PDO mapping type	RPDO
Data type	Integer32	Data range	-2147483648~2147483647
Modes of operation	CSV	Default	0

Set the speed offset in sync cycle speed mode. Target velocity=60FFh+60B1h.

Object 60B2_h: Torque offset

Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	60B2 _h	Sub-index	00 _h
Name	Torque offset	Access attribute	rw
Data structure	Variable	PDO mapping type	RPDO
Data type	Integer32	Data range	-32768~32767
Modes of operation	CSP/CSV/CST	Default	0

Set the torque offset in sync cycle torque mode. Target torque=6071h+60B2h

Object 60B8_h: Touch probe function

Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	60B8 _h	Sub-index	00 _h
Name	Touch probe function	Access attribute	rw
Data structure	Variable	PDO mapping type	RPDO
Data type	Unsigned16	Data range	0~65535
Modes of operation	/	Default	0

Select the types of Touch probe function at the highest bit of P09.14(the fourth digit from right side), corresponding to 60B9hTouch probe functionStatusword.

Some DI signal and Z-phase signal are too narrow, it cannot make sure that all the rising edge and falling edge signals can be captured. So pay attention to the following when using:

1. Try to avoid using both rising and falling edges for the same probe
2. When using Z-signal, only the rising edge can be used, not the falling edge.

Bit	Description	
	P09.14==16#0000	P09.14==16#1000
0	Probe 1 enabled 0: Disable probe 1 1: Enable probe 1	Probe 1 enabled 0: Disable probe 1 1: Enable probe 1
1	Probe 1 trigger mode 0: Single trigger 1: Continuous trigger	Probe 1 trigger mode 0: Single trigger 1: Continuous trigger
2	Probe 1 trigger signal selection 0: DI8 trigger 1: Z-signal trigger	Probe 1 trigger signal selection 0: DI8 trigger 1: Z-signal trigger
3	Reserved	Reserved
4	Probe 1 rising edge lock 0: Disable probe 1 rising edge lock 1: Enable probe 1 rising edge lock	Probe 1 rising edge lock 0: Disable probe 1 rising edge lock 1: Enable probe 1 rising edge lock
5	Probe 1 falling edge lock 0: Disable probe 1 falling edge lock 1: Enable probe 1 falling edge lock	Probe 1 falling edge lock 0: Disable probe 1 falling edge lock 1: Enable probe 1 falling edge lock
6~7	Reserved	Reserved
8	Probe 2 enabled 0: Disable probe 2 1: Enable probe 2	Probe 2 enabled 0: Disable probe 2 1: Enable probe 2
9	Probe 2 trigger mode 0: Single trigger 1: Continuous trigger	Probe 2 trigger mode 0: Single trigger 1: Continuous trigger
10	Probe 2 trigger signal selection 0: DI9 trigger 1: Z-signal trigger	Probe 2 trigger signal selection 0: DI9 trigger 1: Z-signal trigger
11	Reserved	Reserved
12	Probe 2 rising edge lock 0: Disable probe 2 rising edge lock 1: Enable probe 2 rising edge lock	Probe 2 rising edge lock 0: Disable probe 2 rising edge lock 1: Enable probe 2 rising edge lock
13	Probe 2 falling edge lock 0: Disable probe 2 falling edge lock 1: Enable probe 2 falling edge lock	Probe 2 falling edge lock 0: Disable probe 2 falling edge lock 1: Enable probe 2 falling edge lock
14~15	Reserved	Reserved

Object 60B9_h: Probe Statusword

Object description		Object entry description	
Attributes	Value	Attributes	Value

Index	60B9 _h	Sub-index	00 _h
Name	Probe Statusword	Access attribute	ro
Data structure	Variable	PDO mapping type	TPDO
Data type	Unsigned16	Data range	0~65535
Modes of operation	/	Default	0

Select the types of probe Statusword at the highest bit of P09.14(the fourth digit from right side), corresponding to 60B8hTouch probe function.

Bit	Description	
	P09.14==16#0000	P09.14==16#1000
0	Probe 1 enabled 0: Disable probe 1 1: Enable probe 1	Probe 1 enabled 0: Disable probe 1 1: Enable probe 1
1	Probe 1 rising edge lock 0: Not execute probe 1 rising edge lock 1: Execute probe 1 rising edge lock	Probe 1 rising edge lock 0: Not execute probe 1 rising edge lock 1: Execute probe 1 rising edge lock
2	Probe 1 falling edge lock 0: Not execute probe 1 falling edge lock 1: Execute probe 1 falling edge lock	Probe 1 falling edge lock 0: Not execute probe 1 falling edge lock 1: Execute probe 1 falling edge lock
3~5	Reserved	Reserved
6	Probe 1 trigger signal selection 0: DI8 trigger 1: Z-phase signal trigger	Reserved
7	Probe 1 trigger DI level selection 0: DI8 low level trigger 1: DI8 high level trigger	Reserved
8	Probe 2 enabled 0: Disable probe 2 1: Enable probe 2	Probe 2 enabled 0: Disable probe 2 1: Enable probe 2
9	Probe 2 rising edge lock 0: Not execute probe 2 rising edge lock 1: Execute probe 2 rising edge lock	Probe 2 rising edge lock 0: Not execute probe 2 rising edge lock 1: Execute probe 2 rising edge lock
10	Probe 2 falling edge lock 0: Not execute probe 2 falling edge lock 1: Execute probe 2 falling edge lock	Probe 2 falling edge lock 0: Not execute probe 2 falling edge loc 1: Execute probe 2 falling edge lock
11~13	Reserved	Reserved
14	Probe 2 trigger signal selection 0: DI9 trigger 1: Z-signal trigger	Reserved
15	Probe 2 trigger DI level selection 0: DI9 low level trigger 1: DI9 high level trigger	Reserved

Object 60BA _h : Touch probe pos1 pos value			
Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	60BA _h	Sub-index	00 _h

Name	Touch probe pos1 pos value	Access attribute	ro
Data structure	Variable	PDO mapping type	TPDO
Data type	Integer32	Data range	-2147483648~2147483647
Modes of operation	/	Default	0
Record the position command when the probe 1 rising edge is valid(Instruction Unit , 6062h)			

Object 60BB_h: Touch probe pos1 neg value

Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	60BB _h	Sub-index	00 _h
Name	Touch probe pos1 neg value	Access attribute	ro
Data structure	Variable	PDO mapping type	TPDO
Data type	Integer32	Data range	-2147483648~2147483647
Modes of operation	/	Default	0
Record the position command when the probe 1 falling edge is valid(Instruction Unit , 6062h)			

Object 60BC_h: Touch probe pos2 pos value

Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	60BC _h	Sub-index	00 _h
Name	Touch probe pos2 pos value	Access attribute	ro
Data structure	Variable	PDO mapping type	TPDO
Data type	Integer32	Data range	-2147483648~2147483647
Modes of operation	/	Default	0
Record the position command when the probe 2 rising edge is valid(Instruction Unit , 6062h)			

Object 60BD_h: Touch probe 2 falling edge Position actual value

Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	60BD _h	Sub-index	00 _h
Name	Touch probe 2 falling edge Position actual value	Access attribute	ro
Data structure	Variable	PDO mapping type	TPDO
Data type	Integer32	Data range	-2147483648~2147483647
Modes of operation	/	Default	0
Record the position command when the probe 2 falling edge is valid(Instruction Unit , 6062h)			

Object 60C0_h: Interpolation sub-mode selection

Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	60C0 _h	Sub-index	00 _h
Name	Interpolation sub-mode selection	Access attribute	rw
Data structure	Variable	PDO mapping type	RPDO
Data type	Integer16	Data range	-32768~32767
Modes of operation	IP	Default	0
Interpolation curve selection in position interpolation mode			
Value	Interpolation mode		
-32768~-1	For manufacturer use		
0	Linear interpolation		
1~32767	Reserved		

Object 60C1_h: Interpolation data record

Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	60C1 _h	Sub-index	00 _h
Name	Number of Sub-index	Access attribute	Rw
Data structure	/	PDO mapping type	RPDO
Data type	Unsigned8	Data range	0~512
Modes of operation	IP	Default	1

Attributes	Value	Attributes	Value
Index	60C1 _h	Sub-index	01 _h
Name	Interpolation offset	Access attribute	Rw
Data structure	/	PDO mapping type	RPDO
Data type	Integer32	Data range	-2147483648~2147483647
Modes of operation	IP	Default	0

For the position instruction in interpolation position mode, the interpolation offset is absolute offset instruction. Every time the sync cycle comes, the host controller sends offset instruction to the slave once. Unit: p/s

Object 60C2_h: Interpolation cycle

Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	6099 _h	Sub-index	00 _h
Name	Number of Sub-index	Access attribute	Rw
Data structure	/	PDO mapping type	RPDO
Data type	Unsigned8	Data range	0~512
Modes of operation	IP	Default	2

Attributes	Value	Attributes	Value
Index	60C2 _h	Sub-index	01 _h
Name	Interpolation time Unit	Access attribute	Rw
Data structure	/	PDO mapping type	RPDO
Data type	Unsigned8	Data range	0~512
Modes of operation	IP	Default	1

Set the interpolation cycle in interpolation position mode.(Unit: ms)
60C20108h is the time constant of interpolation cycle. (ms)

Attributes	Value	Attributes	Value
Index	60C2 _h	Sub-index	02 _h
Name	Interpolation time Index	Access attribute	Rw
Data structure	/	PDO mapping type	RPDO
Data type	Integer8	Data range	-255~255
Modes of operation	IP	Default	-3

60C20208h is the unit of interpolation cycle time. -3 represents ms of time unit.

Object 60C5_h: Max acceleration

Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	60C5 _h	Sub-index	00 _h
Name	Max acceleration	Access attribute	rw
Data structure	Variable	PDO mapping type	RPDO
Data type	Unsigned32	Data range	0~4294967295
Modes of operation	PP/PV/HM	Default	100000000

Set the acceleration speed unit at the fourth digit of P09.13 from the right side.
When it is 0: It represents the acceleration speed of offset instruction acceleration in profile position/Profile velocity mode. Set the max. acceleration speed in profile position mode, Profile velocity mode and homing mode, which is limited by 6083h.
The max. acceleration speed which accelerates from 0rpm to 1000rpm. Unit: rpm/ms
When it is 1: User instruction Unit/S^

Object 60C6_h: Max deceleration

Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	60C6 _h	Sub-index	00 _h
Name	Max deceleration	Access attribute	rw
Data structure	Variable	PDO mapping type	RPDO
Data type	Unsigned32	Data range	0~4294967295
Modes of operation	PP/PV/HM	Default	100000000

Set the deceleration speed unit at the fourth digit of P09.13 from the right side
When it is 0: It represents the deceleration speed of offset instruction acceleration in profile position/Profile velocity mode. Set the max. deceleration speed in profile position mode, Profile velocity mode and homing mode, which is limited by 6084h
The max. deceleration speed which decelerates from 1000rpm to 0rpm. Unit: rpm/ms

When it is 1: User instruction Unit/S²

Object 60E0_h: Positive direction Max torque limit

Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	60E0 _h	Sub-index	00 _h
Name	Positive direction Max torque limit	Access attribute	rw
Data structure	Variable	PDO mapping type	RPDO
Data type	Unsigned16	Data range	0~65535
Modes of operation	ALL	Default	10000

Limit the max. torque in positive direction. Unit: 0.1%

Object 60E1_h: Negative direction Max torque limit

Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	60E1 _h	Sub-index	00 _h
Name	Negative direction Max torque limit	Access attribute	rw
Data structure	Variable	PDO mapping type	RPDO
Data type	Unsigned16	Data range	0~65535
Modes of operation	ALL	Default	10000

Limit the max. torque in negative direction. Unit: 0.1%

Object 60F2_h: Positioning option code

Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	60F2 _h	Sub-index	00 _h
Name	Positioning option code	Access attribute	rw
Data structure	Variable	PDO mapping type	RPDO
Data type	Unsigned16	Data range	0~65535
Modes of operation	PP/IP	Default	0

Reserved

Object 60F4_h: Following error actual value

Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	60F4 _h	Sub-index	00 _h
Name	Following error actual value	Access attribute	ro
Data structure	Variable	PDO mapping type	TPDO
Data type	Integer32	Data range	-2147483648~2147483647
Modes of operation	PP/HM/CSP	Default	0

Display the actual position deviation (user position unit)

Object 60F8_h: Max slippage

Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	60F8 _h	Sub-index	00 _h
Name	Max. slippage	Access attribute	ro
Data structure	Variable	PDO mapping type	RPDO
Data type	Integer32	Data range	-2147483648~2147483647
Modes of operation	PV	Default	100000000

Monitor if the maximum slip has reached, for async motor.

Object 60FC_h: Position demand internal value

Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	60FC _h	Sub-index	00 _h
Name	Position demand internal	Access attribute	ro

	value		
Data structure	Variable	PDO mapping type	TPDO
Data type	Integer32	Data range	0~4294967295
Modes of operation	PP/HM/CSP	Default	0
Display the real-time position instruction of the motor. Position demand value (6062h)× Position factor (6093h) = Position instruction of motor 60FCh (encoder Unit)			

Object 60FD_h: Digital inputs

Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	60FD _h	Sub-index	00 _h
Name	Digital inputs	Access attribute	ro
Data structure	Variable	PDO mapping type	TPDO
Data type	Unsigned32	Data range	0~4294967295
Modes of operation	ALL	Default	33488899 (1 1111 1111 0000 0000 0000 0011)
Display Digital inputs			
Bit	Definition		
0	Negative limit switch (DI function code 15 , Default is 1 when no level input.)		
1	Positive limit switch (DI function code 14 , Default is 1 when no level input.)		
2	Origin switch (DI function code 28 , Default is 1 when no level input.)		
3~9	Reserved (Default: low level, that is 0)		
10	Z-pulse (No need to set)		
11	External DI input 1: Touch probe function1 (DI function code 39)		
12	External DI input 2: Touch probe function2 (DI function code 40)		
13	Emergency stop (DI function code 30)		
16	Corresponding to DI1 (P4.01) terminal logic and function selection. Default is 1 when no level input		
17	Corresponding to DI2 (P4.02) terminal logic and function selection. Default is 1 when no level input		
18	Corresponding to DI3 (P4.03) terminal logic and function selection. Default is 1 when no level input		
19	Corresponding to DI4 (P4.04) terminal logic and function selection. Default is 1 when no level input		
20	Corresponding to DI5 (P4.05) terminal logic and function selection. Default is 1 when no level input		
21	Corresponding to DI6 (P4.06) terminal logic and function selection. Default is 1 when no level input		
22	Corresponding to DI7 (P4.07) terminal logic and function selection. Default is 1 when no level input		
23	Corresponding to DI8 (P4.08) terminal logic and function selection. Default is 1 when no level input		
24	Corresponding to DI9 (P4.09) terminal logic and function selection. Default is 1 when no level input		
25~31	Reserved (Default: low level, that is 0)		

Object 60FE_h: Forced DO output

Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	60FE _h	Sub-index	00 _h
Name	Number of Sub-index	Access attribute	Rw
Data structure	/	PDO mapping type	RPDO
Data type	Unsigned8	Data range	0~512
Modes of operation	ALL	Default	2
Attributes	Value	Attributes	Value
Index	60FE _h	Sub-index	01 _h
Name	Forced DO output status	Access attribute	Rw
Data structure	/	PDO mapping type	RPDO
Data type	Unsigned32	Data range	0~4294967295
Modes of operation	ALL	Default	0
Attributes	Value	Attributes	Value
Index	60FE _h	Sub-index	02 _h
Name	Bit shielding	Access attribute	Rw
Data structure	/	PDO mapping type	RPDO
Data type	Unsigned32	Data range	0~4294967295
Modes of operation	ALL	Default	0

This function can be forced to output DO. X3E EtherCAT supports DO1~DO5.

Bit	Definition
0	Reserved
1~15	Reserved
16~24	Forced DO output

1. How to use: For example, forced DO1~DO5 output function

1) Enable forced DO1~DO5 function, set 60FEh-02h=2031616 (1 1111 0000 0000 0000 0000)

2) Forced output DO1~DO5 becomes valid, set 60FEh-01h=2031616 (1 1111 0000 0000 0000 0000)

2. Dynamic brake output signal: Set P04.54 to 1, output dynamic brake signal by dedicated DO5

3. OCZ output signal: Set P04.54 to 2, output OCZ signal by dedicated DO4.

Object 60FF_h: Target velocity

Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	60FF _h	Sub-index	00 _h
Name	Target velocity	Access attribute	rw
Data structure	Variable	PDO mapping type	RPDO
Data type	Integer32	Data range	-2147483648~2147483647
Modes of operation	PV/CSV	Default	0

Set instruction speed instruction in Profile velocity/sync cycle speed mode.

Object 6502_h: Supported servo operation mode

Object description		Object entry description	
Attributes	Value	Attributes	Value
Index	6502 _h	Sub-index	00 _h
Name	Servo operation mode	Access attribute	ro
Data structure	Variable	PDO mapping type	TPDO
Data type	Unsigned32	Data range	0~4294967295
Modes of operation	ALL	Default	1005

Display the servo operation mode the drive supported.

Bit	Definition	
0	Profile position mode (PP)	Supported, refer to section 4.2 (CANOpen, EtherCAT)
1	Velocity mode	Not supported
2	Profile velocity mode (PV)	Supported, refer to section 4.3 (CANOpen, EtherCAT)
3	Profile torque mode (PT)	Supported, refer to section 4.4 (CANOpen, EtherCAT)
4	Reserved	
5	Homing method (HM)	Supported, refer to section 4.5 (CANOpen, EtherCAT)
6	Interpolation position mode (IP)	Supported, refer to section 4.6 (CANOpen, EtherCAT)
7	Cycle sync position mode (CSP)	Supported, refer to section 4.7 (CANOpen, EtherCAT)
8	Cycle sync velocity mode (CSV)	Supported, refer to section 4.8 (EtherCAT)
9	Cycle sync torque mode (CST)	Supported, refer to section 4.9 (EtherCAT)
10~31	Reserved	