SV-DA200 Series
AC Servo Drive
EtherCAT Technical Guide

INVT INDUSTRIAL TECHNOLOGY (SHANGHAI) CO., LTD

Change history

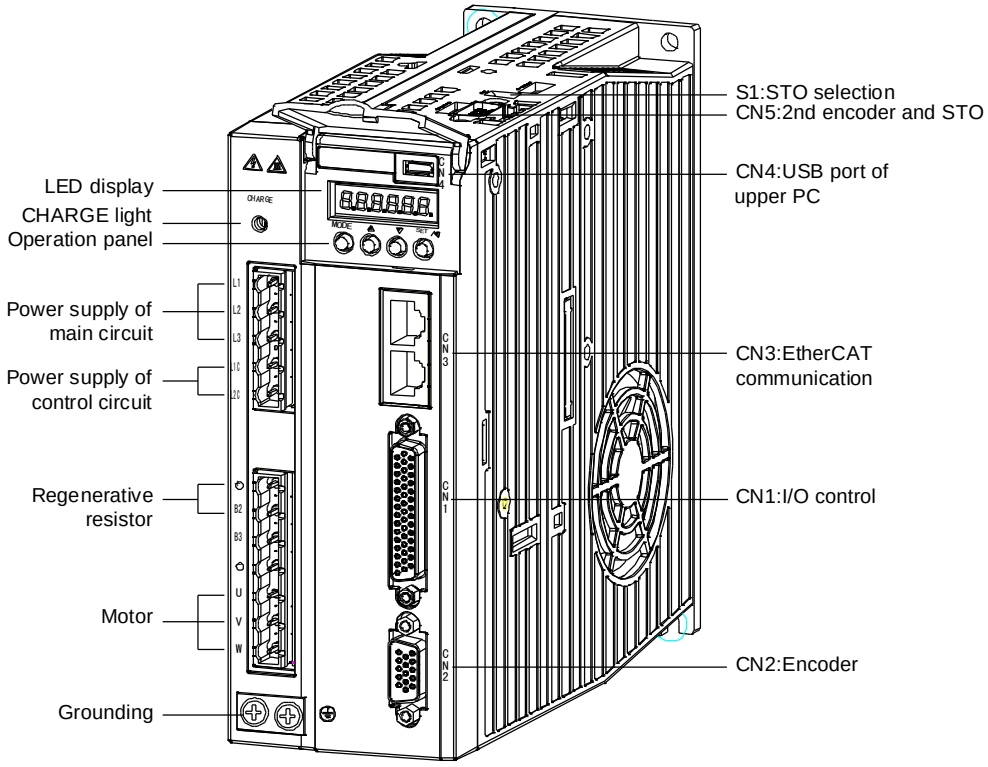
Release date	Version	Description
May 2021	V1.00	First release.
June 2022	V1.10	1) Added unbiased control function with related parameters P2.91, P2.92; 2) Upated section 1.1. DA260-N version V2.66 has a built-in hardware dynamic brake (set via. P4.30); 3) Added P2.86–P2.92, P3.42, P4.77 (Detection time for motor phase loss), updated P4.78 (Temperature protection threshold of medium-power motor) and P4.79 (Quick stop method), and deleted P4.45; 4) Added the description of P0.15 (set to 23) and updated the function definition of P4.43 in section 2.1; 5) Updated the Default PDO mapping in section 2.2.4; 6) Added fault Er01-2, Er01-3, Er01-4, Er01-5, Er17-1, Er18-2, Er18-3.

Contents

1 Hardware configuration

1.1 Hardware overview

With a built-in EtherCAT communication card, SV-DA200&DA260 EtherCAT servo drive has similar external appearance with standard SV-DA200, but different from SV-DA200 in CN1 terminal pins, which are described in section 1.3. CN3 is the EtherCAT communication wiring terminal that adopts RJ45 interface, of which the upper is for wire inlet and the lower is for wire outlet. The entire machine diagram is as follows.

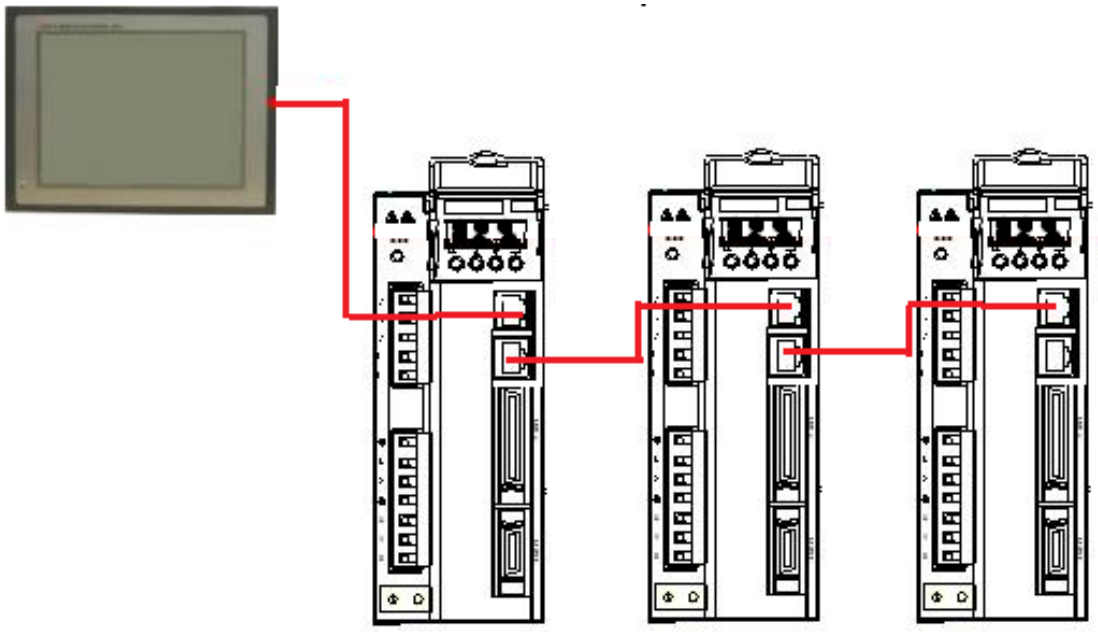


Main differences between DA200-N and DA260-N:

No.	Function	DA200-N	DA260-N
1	CN5	Available	Unavailable
2	Incremental encoder	Available	Unavailable
3	Digital input	7 channels	First 4 channels
4	Digital output	4 channels	First 3 channels
5	Analog input/output	Available	Unavailable
6	Frequency-divided output	Available	Unavailable
7	Main circuit terminals L1C, L2C	Required	Not required
8	Dimension of 2R0-2 servo	Volume D	Volume B

1.2 Drive wiring

An EtherCAT network often consists of a master (IPC or CNC) and multiple slaves (servo drives or bus expansion terminals). Each EtherCAT slave has two standard Ethernet interfaces. The following figure shows the wiring.

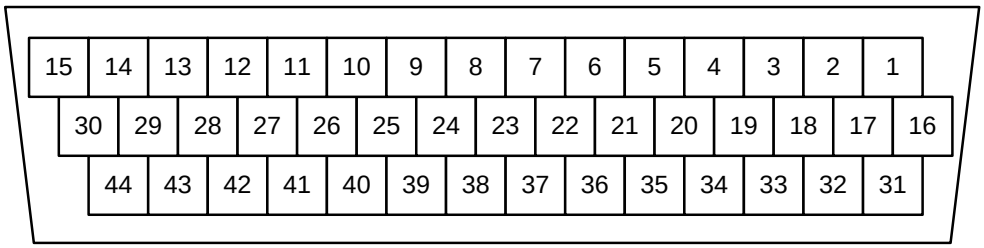


1.3 CN1 terminal definition

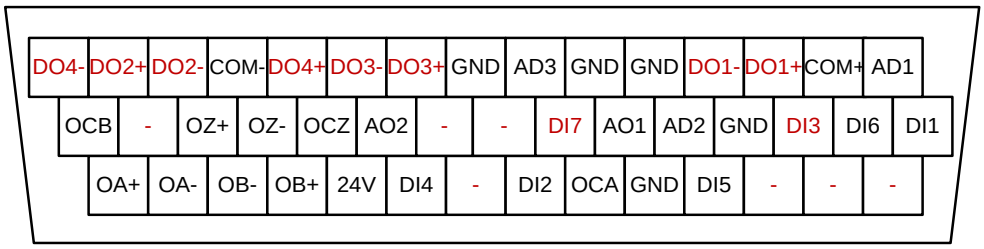
The inputs and outputs of SV-DA200 EtherCAT model have differences with those of the standard model. The following table lists the pins of the CN1 terminal (DB44) of the medium power range (7.5kW and higher), marking the differences from the standard model in red. Except that pin 1 of the CN1 terminal of the small power range (0.1kW–5.5kW) is reserved, all the others are the same as those of the medium power range.

Pin	Symbol	Function	Pin	Symbol	Function
1	AD1	Analog input 1 (Medium power)	23	-	Reserved
2	COM+	Common terminal of digital input	24	-	Reserved
3	DO1+	Digital output 1 +	25	AO2	Analog output 2
4	DO1-	Digital output 1 -	26	OCZ	Z-phase open collector output
5	GND	Analog signal ground	27	OZ-	Z-phase differential output -
6	GND	Analog signal ground	28	OZ+	Z-phase differential output +
7	AD3	Analog input 3	29	-	Reserved
8	GND	Analog signal ground	30	OCB	B-phase open collector output
9	DO3+	Digital output 3 +	31	-	Reserved
10	DO3-	Digital output 3 -	32	-	Reserved
11	DO4+	Digital output 4 +	33	-	Reserved

Pin	Symbol	Function	Pin	Symbol	Function
12	COM-	Common ground of digital output	34	DI5	Digital input 5
13	DO2-	Digital output 2 -	35	GND	Analog signal ground
14	DO2+	Digital output 2 +	36	OCA	A-phase open collector output
15	DO4-	Digital output 4 -	37	DI2	Digital input 2
16	DI1	Digital input 1	38	-	Reserved
17	DI6	Digital input 6	39	DI4	Digital input 4
18	DI3	Digital input 3	40	+24V	Internal 24V
19	GND	Analog signal ground	41	OB+	B-phase differential output +
20	AD2	Analog input 2	42	OB-	B-phase differential output -
21	AO1	Analog output 1	43	OA-	A-phase differential output -
22	DI7	Digital input 7	44	OA+	A-phase differential output +



CN1 plug pin layout

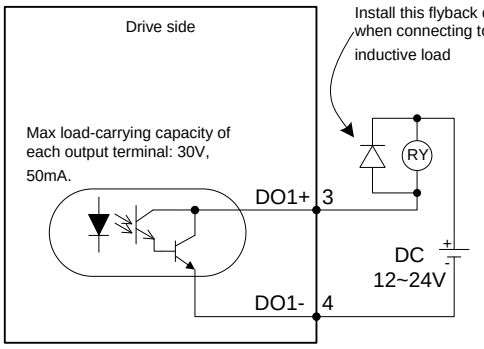


CN1 plug signal layout

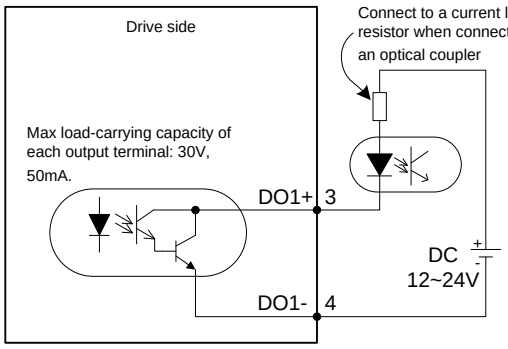
The EtherCAT servo drive model has three analog inputs (AD1 is 16-bit analog input, but it is unavailable to the small power range, and therefore pin1 of CN1 is not used), two analog outputs, seven digital inputs, and four digital differential outputs. This servo drive model and the standard model are similar in the external wiring of analog input, analog output, and digital input. For details, see section 4.5 in SV-DA200 Series AC Servo Drive.

The following shows the external wiring of digital differential output, using DO1 as an example.

Wiring when using the user-provided power supply:

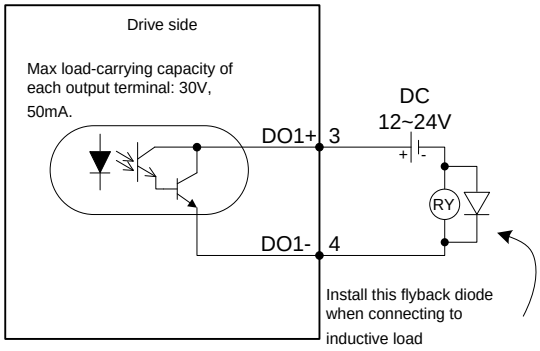


① connect to relay coil

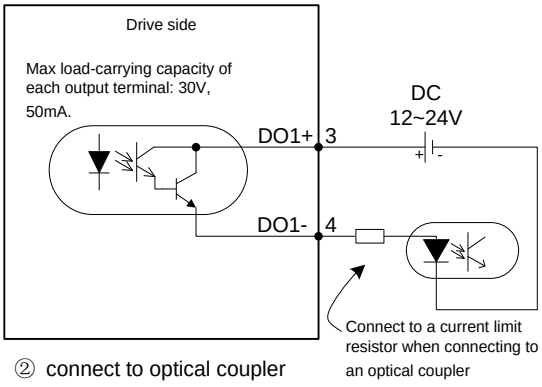


② connect to optical coupler

Alternative wiring:

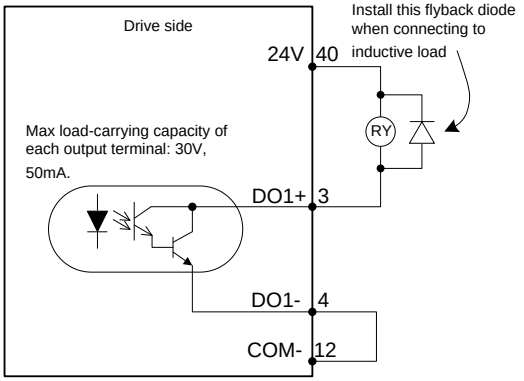


① connect to relay coil

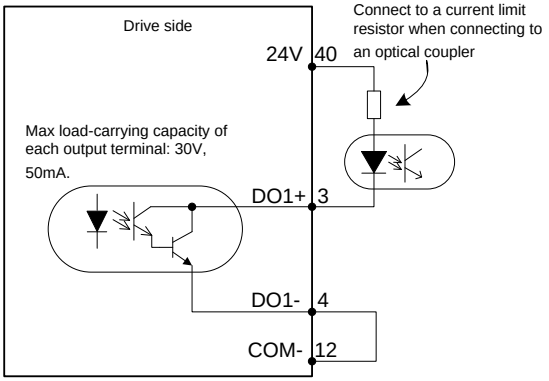


② connect to optical coupler

Wiring when using the local-provided power supply:

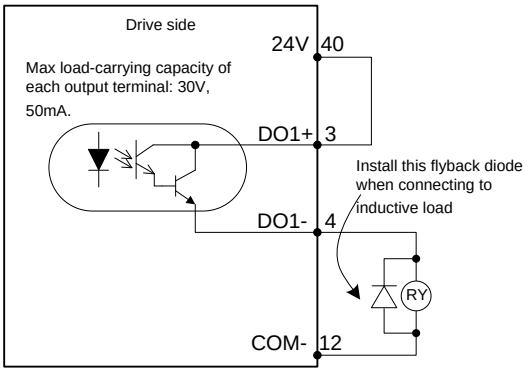


① connect to relay coil

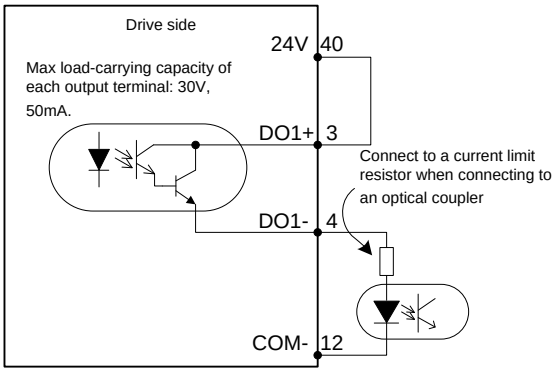


② connect to optical coupler

Alternative wiring:



① connect to relay coil



② connect to optical coupler

2 Software configuration

2.1 Basic settings of EtherCAT application

Set the following parameters through the LED panel or ServoPlorer software before using SV-DA200 for EtherCAT communication.

1. Set parameter **P0.03** [Control mode] to **8 (EtherCAT)**.
2. In most cases, you do not need to set the node number parameter since you can use the default physical node sequence addressing, such as Twincat. If you need to set the node number (such as for Omron PLC), set P4.00 [EtherCAT communication node] through the LED panel or ServoPlorer software. The default value -1 indicates not setting the parameter.
3. Set parameter **P4.08** [EtherCAT synchronization type]. (0: Free-Run; 2: DC Sync0)
4. Set parameter **P4.07** [EtherCAT synchronization cycle]. (0: 250μs; 1: 500μs; 2: 1ms; 3: 2ms; 4: 4ms; 5: 8ms)
5. Set P4.09 [EtherCAT fault detection time]. (Set the detection time of offline fault or PDO data loss fault as needed.)
6. Set parameter **P4.25** [EtherCAT control unit type]. (0: Manufacturer unit; 1:CIA402 Unit; 2:CIA402 OMRON; 3:CIA402 Standard)
7. Set parameter **P4.26** [EtherCAT PDO input offset]. (Range: 0–63. Unit: 125μs)
8. Set parameter **P4.27** [Compensation value of EtherCAT position interpolation mode]. (Range: 0–10)
9. The digital output is servo controlled by default. If you want to enable the master to control the digital output through EtherCAT communication, set **P4.28 [**Enabling EtherCAT based control on digital output] to 1 (Enable); control the digital output through 0x60FE in TPDO.

Note:

1. You need to re-power on the drive or reset the drive in soft manner for the changes of the first five parameters and P4.28 to take effect. The changes of P4.25–4.27 take effect immediately.
2. When the control mode (0x6040) is set to position interpolation mode (8), P4.07 [EtherCAT synchronization cycle] is the same as CNC interpolation cycle.
3. The options of P4.25 [EtherCAT control unit type] are as follows:

   0: Manufacturer unit, supporting the NC function of Beckhoff TwinCAT.

   The position unit is pulse, speed unit is rpm, acceleration unit is ms (the time needed for accelerating from zero speed to rated motor speed).

   The touch probe of z signal is supported. The captured values of external IO are stored in manufacturer parameters. For details, refer to the following text.

   1: CIA402 unit, supporting most of motion controllers, such as CodeSys, BaoYuan and ACS EtherCAT master.

   The position unit is pulse, speed unit is pulse/s, and acceleration unit is pulse/s².

   The touch probe of z signal and the IO capture of standard touch probe are supported.

   2: CIA402 OMRON, supporting OMRON NJ controller.

   The content is basically the same as that for option 0, 1.

Change 0x6041 status feedback to satisfy OMRON NJ state machine requirement.

3: CIA402 standard, supporting minor motion controllers.

The capture of only standard IO is supported.

4. The default number of pulses per revolution of SV-DA200 is 10000, which can be changed through P0.22 [Pulse per revolution of motor]. The change takes effect after reset. The number can also be changed by modifying P0.25 [Numerator of electronic gear ratio] and P0.26 [Denominator of electronic gear ratio] after setting P0.22 to 0. Note that the setting of P0.22 cannot be greater than the actual revolution rate of encoder.
5. P4.26 and P4.27 need to be modified only when the master cycle is unstable or packet loss or other problems occurred to communication.
6. P4.26 [EtherCAT PDO input offset] is used to adjust the time from receiving DC signal to processing PDO so that PDO input time can be changed in the middle of the master cycle, reducing the data loss caused by the unstable master clock. This parameter needs to be set according to the cycle setting of P4.07. If P4.07 is 1ms, the range of P4.26 is 0–7. The value 0 indicates no offset while the value 7 indicates the offset of 7*125μs. The actual setting depends on actual conditions for the purpose of stable data receiving.
7. P4.27 [Compensation value of EtherCAT position interpolation mode] is effective only in DC mode and position interpolation mode (8). This is to ensure that position command smoothing effect can be achieved if one or multiple cycle position commands are lost when P4.26 is set properly. If it is set to a non-zero value, compensation is made based on previous position increment when position command loss occurred, and the compensation cycle is equal to the value specified by P4.27.
8. **P4.43** [EtherCAT related control and run cycle selection] is 0x0003 by default. It is controlled by bit. The definition is as follows.

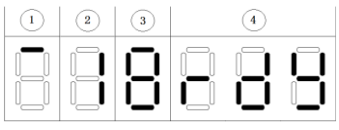
Bit	Description	Other
0	Indicates whether to screen out torque limit (60E0h, 60E1h) commands.	Default: 1, screening out.
1	Indicates whether to screen out the speed limit (607Fh) command.	Default: 1, screening out. 607Fh is always valid in torque mode.
2–3	Reserved	
4	Indicates whether to use 60B1h as the speed feedforward. Default: 0, using the servo internal speed as the feedforward.	When 60B1h is used as the speed feedforward, the unit is puu/s, and P2.10 and P2.11 are still valid.
5	Indicates whether to use 60B0h as the position offset. Default: 0, not using 60B0h as the position offset.	Unit: puu
6	Indicates the range of software limit (607Dh).	Default: 0. Only valid in position mode.
7	Indicates the position command processing mode after limit.	Default: 0. The position command is discarded after limit.
8	Changing EtherCAT run cycle Default: 0, indicating servo controls the cycle.	1: reducing the load rate of the main interrupt task. Set the bit to 1 when the servo reports the fault Er11-0.

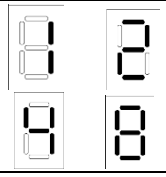
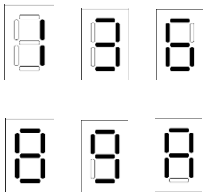
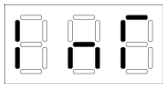
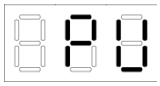
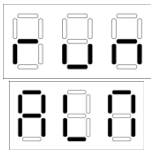
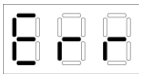
Bit	Description	Other
9–11	Reserved	
12	Indicating the parsing mode of the software limit (607Dh). Default: 0, standard CiA402 protocol.	1: the mode used in V2.61 and earlier versions.
13–15	Reserved	

9. If the PDO parameter list in EtherCAT xml configuration file of SV-DA200 includes torque limit parameters and P4.43 indicates no torque limit screening, a non-zero value needs to be given; otherwise, the servo torque is limited to 0, which causes no acting or alarm reporting. For example, the units of **Positive torque limit and Negtive torque limit** are 1‰ of the rated torque. The setting 1000 indicates 100% of the rated torque. Parameters about torque limit are valid in any control mode.
10. If the EtherCAT xml configuration file of SV-DA200 includes **Max profile velocity** (607Fh**)**, which indicates the max. speed limit in the torque loop, the unit is related to P4.25. If P4.25 is the manufacturer unit mode, the unit is rpm; if P4.25 is another value, the unit is puu/s. If the torque loop needs to be run, set this parameter to a non-zero value.
11. Sending and receiving PDO can be configured dynamically by the master, however, the max. number of each PDO parameter is 10. If the max. number is exceeded, the slave cannot enter the Op status.
12. When P4.08 is set to the DC mode, you can check the clock synchronization calibration status through R0.27.
13. You can view the CANopen state machine information through R0.28. The following table lists the mapping between states and values.

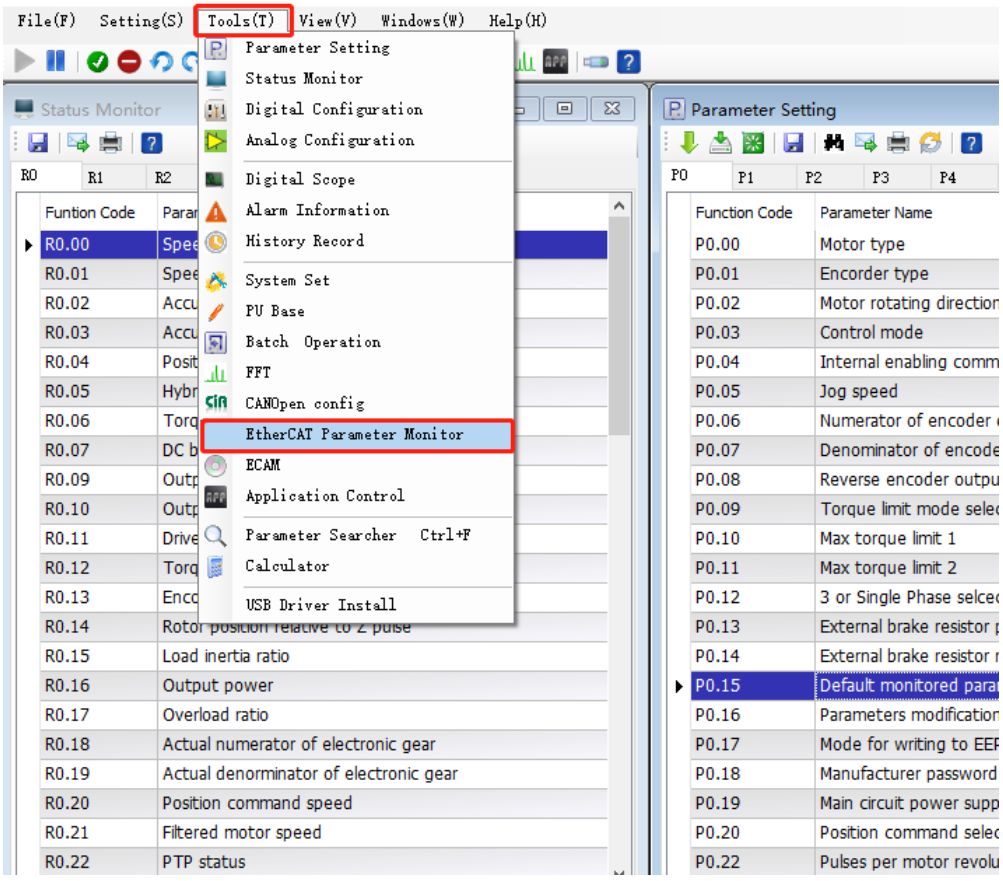
State	Init	Pre-Op	Safe-Op	Op
R0.28 value	11	12	14	18

14. View the EtherCAT configuration file version number through R0.50.
15. View the control word (6040h) from the master through R0.64.
16. View the status word (6041h) from the slave through R0.65.
17. View the run mode (6060h) from the slave through R0.66.
18. When P0.15 is set to 23, The LED pannel displays the EtherCAT communication-related status.

Sign		Name	Definition
		EtherCAT communication monitoring mode	Indicates the initial entry into EtherCAT communication monitoring mode. "ECAT" is displayed.
		EtherCAT communication monitoring status	Displays the physical layer link state of upper and lower network ports, EtherCAT state machine, CiA402 control mode, and servo system status respectively.
①		Physical layer link state of EtherCAT communication interface Port1 (upstream interface)	On: Port1 is connected Off: Port1 is not connected

Sign		Name	Definition
		Physical layer link state of EtherCAT communication interface Port2 (downstream interface)	On: Port2 is connected Off: Port2 is not connected
②		EtherCAT communication state machine	1: Init 2: Pre-Op 4: Safe-Op 8: Op
③		CiA402 control mode	1: Profile position control mode (pp) 3: Profile speed control mode (pv) 6: Homing control mode (hm) 8: Cycle synchronization position control mode (csp) 9: Cycle synchronization speed control mode (csv) A: Cycle synchronization torque control mode (cst)
④		Servo initialization	Strong electricity is not connected or the bus voltage does not reach the main relay switching-on voltage.
		Servo connected with strong electricity	The main relay is switched on but not ready.
		Servo ready (with alarm)	Wait for enabling signal.
		Servo running (with alarm)	1) "run" is blinking at non-zero speed. 2) "ALM" is displayed when an alarm occurred, but the servo is still running.
		Servo fault	Servo is faulty.
		STO-In	STO acts.

19. You can check the PDO parameters configured on the master through the ServoPlorer software.



20. The network cable connection must follow up the top-in and bottom-out rule; otherwise, some nodes may be unable to enter the Op state.

21. This manual is applicable to V2.60/XML V1.70 or later. Some functions are not imported into earlier versions.

2.2 EtherCAT communication

2.2.1 CoE reference model

Figure 2-1shows the CANopen over EtherCAT (CoE) network model inside SV-DA200.

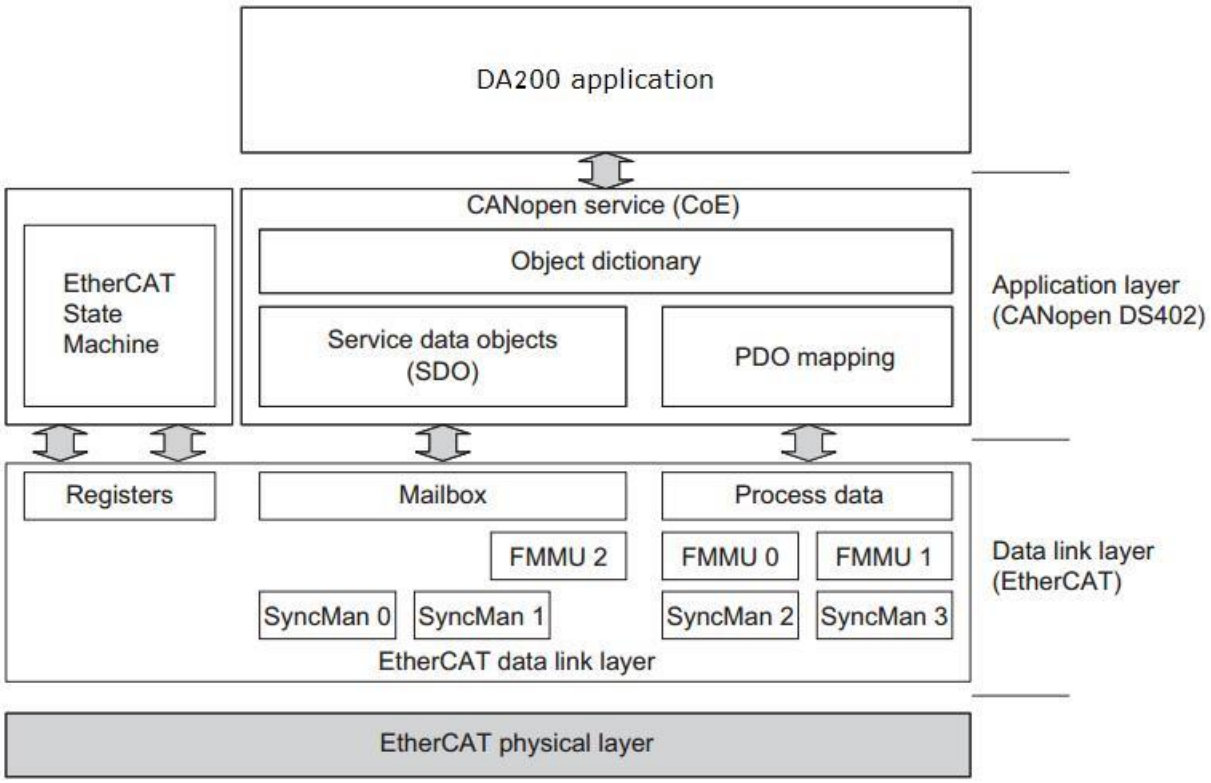


Figure 2-1 CoE model reference

The CoE network reference model consists of data link layer and application layer. Data link layer is in charge of EtherCAT communication protocol while application layer is embedded with CANopen drive profile (DS402) communication protocol. The object dictionary in CoE contains parameters, application data, and process data object (PDO) mapping configuration information.

PDOs are constituted by objects which can conduct PDO mapping in object dictionary. The content in PDO data is defined by PDO mapping. The R/W of PDO data is cyclic, thus removing the need to look up the object dictionary while service data object (SDO) is acyclic communication, and requires a look-up in object dictionary during R/W.

Note: It is necessary to configure FMMU and Sync Manager to ensure SDO and PDO data can be properly analyzed in EtherCAT data link layer, as shown in the following table:

Sync Manager	Assignment(Fixed)	Size	Start Address(Fixed)
Sync Manager 0	Assigned to Receive Mailbox	40 – 512Byte	0x1000
Sync Manager 1	Assigned to Transmit Mailbox	40 – 512Byte	0x1200
Sync Manager 2	Assigned to Receive PDO	1 – 128Byte	0x1400
Sync Manager 3	Assigned to Transmit PDO	1 – 128Byte	0x1480

FMMU settings

FMMU	Settings
FMMU 0	Mapped to Receive PDO
FMMU 1	Mapped to Transmit PDO

FMMU	Settings
FMMU 2	Mapped to Fill Status of Transmit Mailbox

2.2.2 EtherCAT slave information

EtherCAT slave information file (in XML format) is used for master reading and building the configuration between the master and slave. The XML file contains information required by EtherCAT communication setup. INVT provides " INVT_DA200_EtherCAT_V###.xml " file for SV-DA200.

2.2.3 EtherCAT state machine

EtherCAT state machine is used to describe the state and state change of slave application. The request of state change is usually initiated by the master and responded by the slave. The state transition mode is shown as follows:

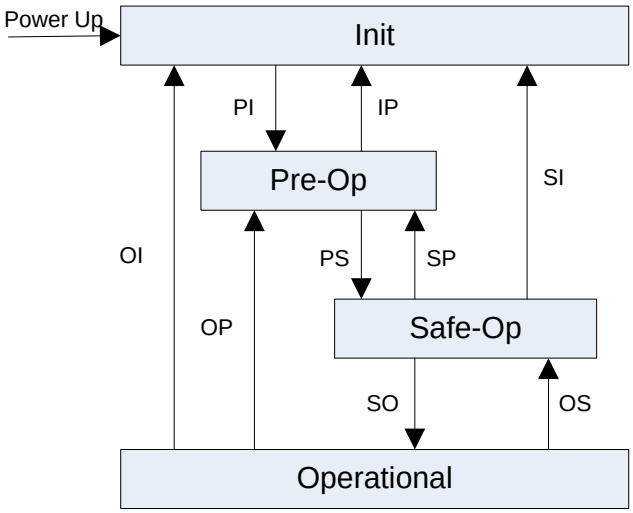


Figure 2-2 Slave state machine diagram

Table 2-1 State description

State	Description
Init	● Mail communication is unavailable. ● PDO communication is unavailable.
Init → Pre-Op	● The master configures link layer address and SM channel, and initiates mail communication. ● The master initializes DC clock synchronization. ● The master requests for the change to the Pre-Op state. ● The master sets the AL control register. ● The slave determines whether the mail is initialized normally.
Pre-Operation (Pre-Op)	● Mail communication is activated. ● PDO communication is unavailable.
Pre-Op → Safe-Op	● The master serves as the channel for process data configuration sync manager channel and FMMU. ● The master configures PDO data mapping and Sync Manager PDO parameters through SOD. ● The master requests for the Safe-Op state change. ● The slave checks whether the configuration of Sync Manager that is in charge of PDO data is correct. If the slave sends the request to initiate synchronization, check whether the distributed

State	Description
	clocks are set correctly.
Safe-Operation (Safe-Op)	● The slave application program transmits actual input data, without output operations. ● Output is set to "safe state".
Safe-Op → Op	● The master sends valid output data. ● The master requests for the change to the Op state.
Operational (Op)	● Mail communication is available. ● PDO communication is available.

2.2.4 PDO process data mapping

Process data of EtherCAT slave is constituted by Sync Manager channel objects, with each object describing the uniform region of EtherCAT process data and containing multiple process data objects. The EtherCAT slave equipped with application control function should support PDO mapping and R/W of SM PDOs Assign objects.

PDO mapping

PDO mapping designs the mapping relation between the object dictionary to PDOs application object. Index 0x1600 and 0x1A00 in the object dictionary are stored in RxPDO and TxPDO mapping table respectively. The following shows an example of PDO mapping.

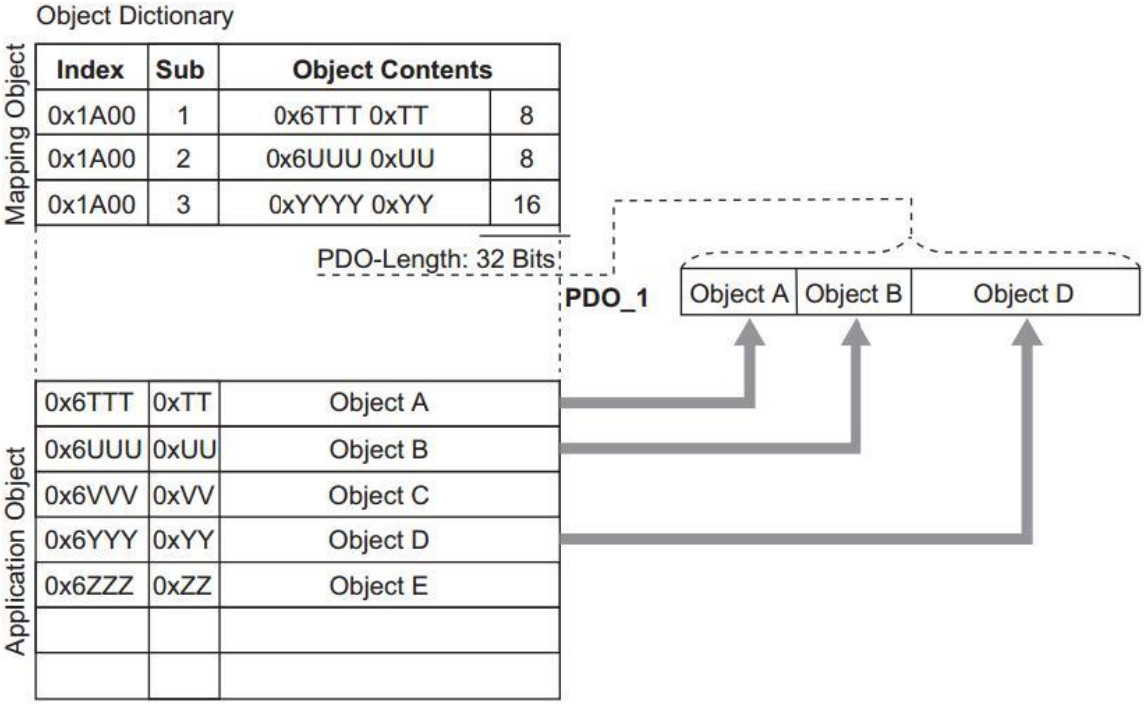


Figure 2-3 PDO mapping example

PDO allocation

In order to realize process data interaction of EtherCAT communication, it is necessary to distribute PDOs to Sync Manager. Sync Manager PDO distributes objects (Sync Manager PDO Assign objects: 0x1C12 and 0x1C13) to establish the relationship between PDOs and Sync Manager.

The following shows an example of Sync Manager PDO allocation.

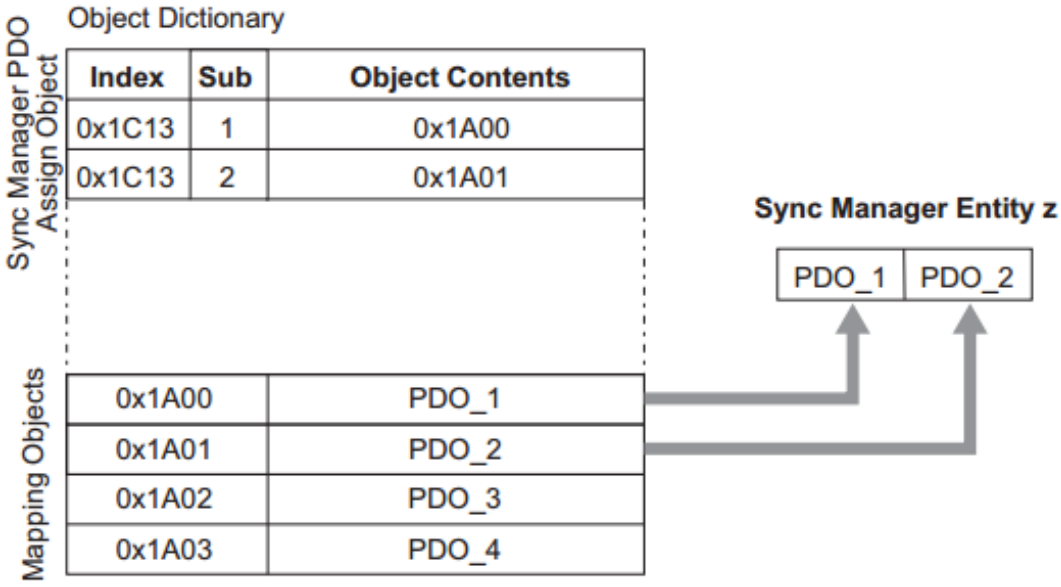


Figure 2-4 PDO allocation example

Note:

PDO mapping objects (0x1600–0x1603 and 0x1A00–0x1A03) and SM PDO Assign objects (0x1C12 and 0x1C13) can only be effective in write operation under Pre-Op state.

PDO mapping procedure

1. Stop PDO allocation function (Set sub-index 0 of 0x1C12 and 0x1C13 to 0).
2. Stop PDO mapping function (Set sub-index 0 of 0x1600–0x1603 and 0x1A00–0x1A03 to 0).
3. Set the mapping entry of PDO mapping objects (0x1600–0x1603 and 0x1A00–0x1A03).
4. Set the mapping entry value of PDO mapping objects (0x1600–0x1603 and 0x1A00–0x1A03).
5. Set PDO allocation objects (set sub-index 1 of 0x1C12 and 0x1C13).
6. Re-open PDO allocation function (set sub-index 0 of 0x1C12 and 0x1C13 to 1).

Default PDO mapping

RxPDO (0x1600)	CW (0x6040)	Target Position (0x607A)	Target Velocity (0x60FF)	Mode of Operation (0x6060)	Target torque (0x6071)	Touch probe control (0x60B8)	Max profile velocity (0x607F)
TxPDO (0x1A00)	SW (0x6041)	Position Actual Value (0x6064)	Speed Actual Value (0x606C)	Torque Actual Value (0x6077)	Operation Mode Display (0x6061)	Digital inputs (0x60FD)	Touch Probe Value (0x60BA)

Note: For detailed PDO mapping information, see the xml file.

2.2.5 Network synchronization based on distributed clocks

Distributed clocks can make all EtherCAT devices use the same system time, thus controlling the synchronous execution of each device task. Among the slave clocks connected to the master, EtherCAT network takes the first slave clock equipped with distributed clock function as the reference clock for the whole network, and the remaining slaves and masters take the reference clock as their basis for synchronization.

SV-DA200 EtherCAT communication card adopts the following synchronization modes, which can be switched through synchronization control registers (ESC 0x980 and 0x981).

- Free-Run (ESC*register: 0x980 = 0x0000, P4.08 = 0)

In this mode, the local application program cycle, communication cycle, and master cycle of the servo drive are independent of each other.

- DC mode (ESC register: 0x980 = 0x0300, P4.08 = 2)

In this mode, the local application program is in synchronization with Sync0 time.

Note: ESC is the abbreviation of EtherCAT Slave Controller.

Index	Sub	Name	Access	PDO mapping	Type	Value
0x1C32	Sync Manager channel 2 (process data output) Synchronization					
	1	Synchronization type	RO	No	UINT	Current status of DC mode 0:Free-run 2:DC Mode(Synchronous with Sync0)
	2	Cycle time	RO	No	UDINT	Sync0 event cycle[ns](This value is set by master via ESC register) range:12500 * n(n = 2,4,8,16)[ns]
0x1C33	Sync Manager channel 2 (process data input) Synchronization					
	3	Shift time	RO	No	UINT	-
	6	Calc and copy time	RO	No	UINT	-

The timing diagram of the DC mode is as follows.

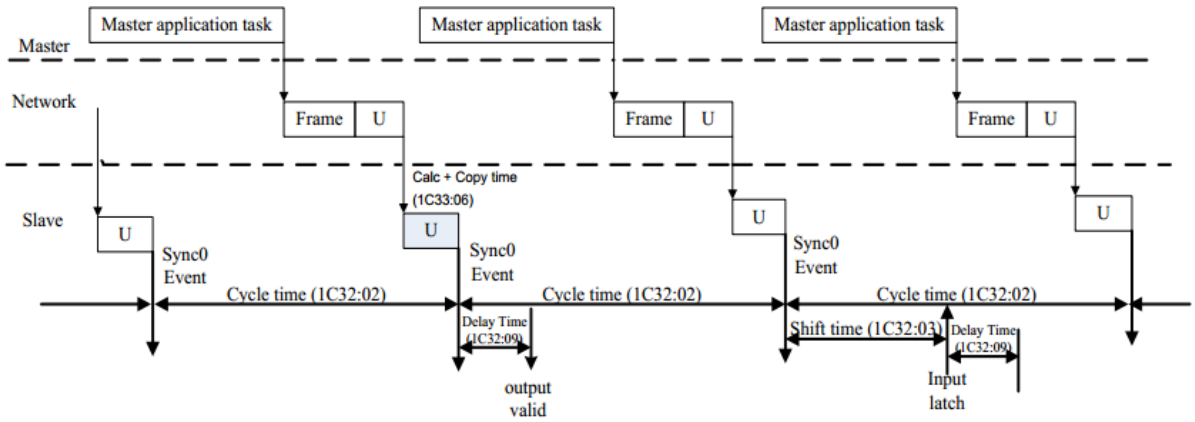


Figure 2-5 Timing diagram of the DC mode

2.2.6 Emergency messages

When the drive generates an alarm, CoE initiates an Emergency message, informing you of the error information of the present drive.

Emergency object:

Byte	0	1	2	3	4	5	6	7
Content	Emergency Error Code		Error register	Panel Error Code		N/A		

2.3 Compatible communication specifications

EtherCAT	**Applicable communication standard**	IEC 61158 Type12, IEC 61800-7 CiA402 Drive Profile
	Physical layer	100BASE-TX (IEEE802.3)
	Bus connection	CN7 (RJ45): EtherCAT Signal IN CN8 (RJ45): EtherCAT Signal OUT
	Cable	CAT5
	SyncManager	SM0: output mail, SM1: input valid SM2: output process data, SM3: input process data
	FMMU	FMMU0: mapping to process data (RxPDO) output area FMMU1: mapping to process data (RxPDO) output area FMMU2: mapping to mail state
	PDO data	Dynamic PDO mapping
	Mailbox (CoE)	Emergency, SDO request, response, and SDO information **Note: TxPDO/RxPDO and remote TxPDO/TxPDO are not supported.**
	Distributed clock (DC)	Free-run, DC mode (activate via parameters) Supported DC cycle: 250 us–2 ms
	Slave Information IF	256Bytes (read-only)
	LED indicator	EtherCAT Link/Activity indicator(L/A) × 2 EtherCAT Status indicator × 1 EtherCAT Error indicator × 1
CiA402 Drive Profile		● Homing mode(6) ● Profile position mode(1) ● Profile velocity mode(3) ● Cyclic synchronous position mode(8) ● Cyclic synchronous speed mode(9) ● Cyclic synchronous torque mode(10) ● Touch probe function

3 CiA402 device protocol

The master controls SV-DA200 servo drive through the control word (CW, 0x6040), and acquires present drive status by reading the status word (SW, 0x6041). The servo drive achieves motor control according to master control commands.

3.1 CoE state machine

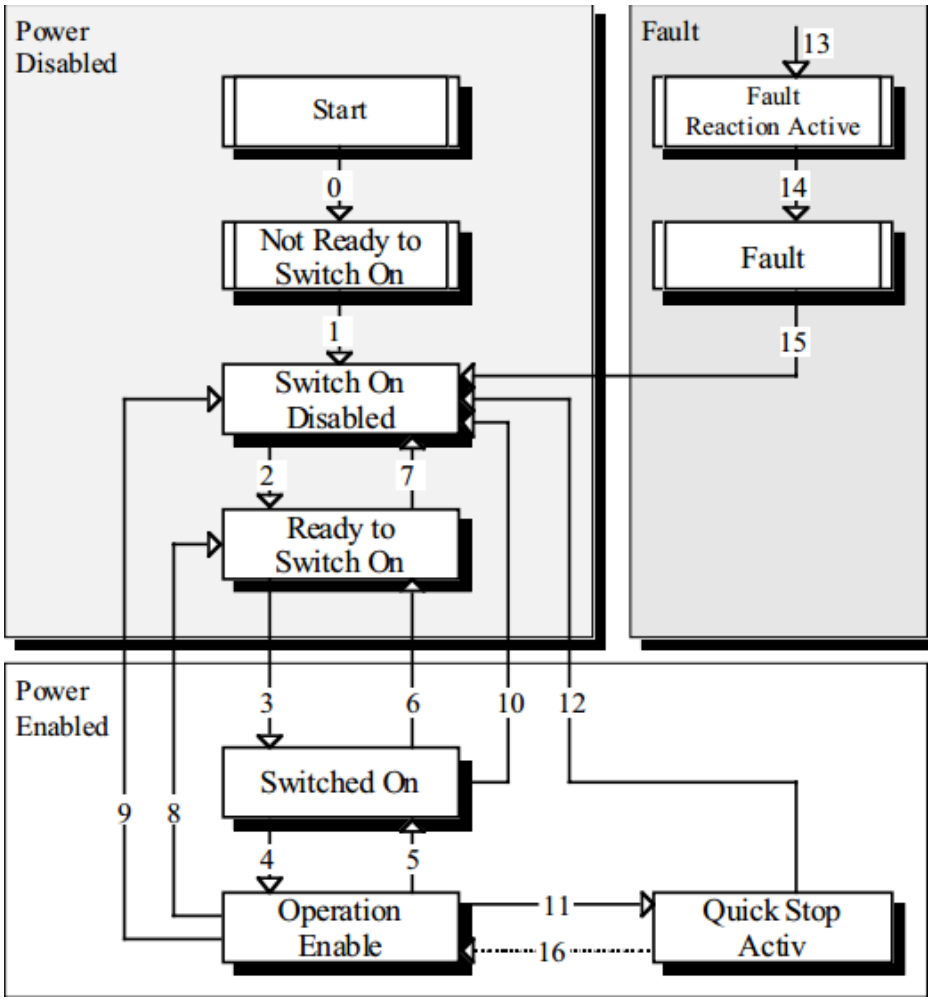


Figure 3-1 CoE state machine

State	Description
Not Ready to Switch On	The drive is being initialized.
Switch On Disabled	Drive initialization is completed.
Ready to Switch On	The drive is waiting to enter Switch On state, and the motor is unexcited.
Switched On	The drive is ready, and the main circuit power is normal.
Operation Enable	The drive is enabled, and the motor is controlled based on the control mode.
Quick Stop Active	The drive stops based on the set mode.
Fault Reaction Active	The drive detects an alarm, stops according to the set mode, and the motor still has an excitation signal.
Fault	The drive in the fault state, and the motor has no excitation signal.

3.1.1 Detail of CW 0x6040

CW 6040h contains the following content:

- Bits used for status control.
- Bits related to the control mode.
- Control bits defined by the manufacturer.

Each bit of 6040h is described as follows.

15 11	10 9	8	7	6 4	3	2	1	0
manufacturer specific	reserved	halt	Fault reset	Operation mode specific	Enable operation	Quick stop	Enable voltage	Switch on
O	O	O	M	O	M	M	M	M
MSB			LSB					

Note:

MSB: Most significant bit; LSB: Least significant bit; O: Optional; M; Mandatory.

Bits 0–3 and 7 (used for status control)

Command	Bit of the *controlword*					Transitions
	Fault reset	Enable operation	Quick stop	Enable voltage	Switch on	
Shutdown	0	X	1	1	0	2,6,8
Switch on	0	0	1	1	1	3*
Switch on	0	1	1	1	1	3**
Disable voltage	0	X	X	0	X	7,9,10,12
Quick stop	0	X	0	1	X	7,10,11
Disable operation	0	0	1	1	1	5
Enable operation	0	1	1	1	1	4,16
Fault reset	↑	X	X	X	X	15

Note:

X is irrelevant; ↑ is a rising edge jump.

Bits 4, 5, 6, and 8 (bits related to control mode)

Bit	Operation mode		
	Profile position mode	Profile velocity mode	Homing mode
4	New set-point	reserved	Homing operation start
5	Change set immediately	reserved	reserved
6	abs/rel	reserved	reserved
8	Halt	Halt	Halt

Bits 9 and 10: Reserved.

Bits 11–15: Defined by the manufacturer.

3.1.2 Detail of SW 0x6041

SW 6041_h contains the following content:

- Present status bit of the drive.
- Status bits related to the control mode.
- Status bits defined by the manufacturer.

Each bit of 6041_h is described as follows.

Bit	Description	M / O
0	Ready to switch on	M
1	Switched on	M
2	Operation enabled	M
3	Fault	M
4	Voltage enabled	M
5	Quick stop	M
6	Switch on disabled	M
7	Warning	O
8	Manufacture specific	O
9	Remote	M
10	Target reached	M
11	Internal limit active	M
12 – 13	Operation mode specific	O
14 – 15	Manufacturer specific	O

Bits 0–3, 5, and 6

Value (binary)	State
xxxx xxxx x0xx 0000	Not ready to switch on
xxxx xxxx x1xx 0000	Switch on disabled
xxxx xxxx x01x 0001	Ready to switch on
xxxx xxxx x01x 0011	Switched on
xxxx xxxx x01x 0111	Operation enabled
xxxx xxxx x00x 0111	Quick stop active
xxxx xxxx x0xx 1111	Fault reaction active
xxxx xxxx x0xx 1000	Fault

Note: X indicates irrelevant.

Bit 4: Voltage enabled, when this bit is 1, it indicates the main circuit power is normal.

Bit 7: Warning, when this bit is 1, it indicates the drive generates an alarm.

Bit 8: DC calibration status. When this bit is 1, it indicates the drive clock is synchronized with DC Sync0.

Bit 9: Remote, when this bit is 1, it indicates the slave is in OP state, and the master can control the drive via PDO remotely.

BIT 10: Target reached, this bit differs in meaning in different control modes. When this bit is 1: in position mode, it indicates target position is reached; in speed mode, it indicates the reference speed is reached; in torque mode, it indicates the torque reaches the reference torque; in homing mode, it indicates homing is completed; when Halt is started, it indicates the motor is in zero-speed state.

BIT 11: Internal limit active. When this bit is 1: in position mode, it indicates the position limit is reached; in speed mode, it indicates the speed limit is reached; in torque mode, it indicates the torque limit is reached.

Bits 12 and 13: The values vary depending on the control mode.

Bit	Operation mode		
	pp	pv	hm
12	Set-point Acknowledge	Speed zero state	Homing attained
13	Following error	Max slippage error	Homing error

BIT 14: motor zero-speed status.

BIT 15: STO status

3.2 Profile position mode

3.2.1 Basic description

The servo driver (slave node) receives a position command from the upper computer (master node). After electronic gear ratio conversion, the command is used as the target position for internal position control. In this way, position control is implemented.

Position command encoder unit = Position command user unit x Numerator of actual gear ratio / Denominator of actual gear ratio

For detailed gear ratio setting, see section 2.1.

3.2.2 Operating method

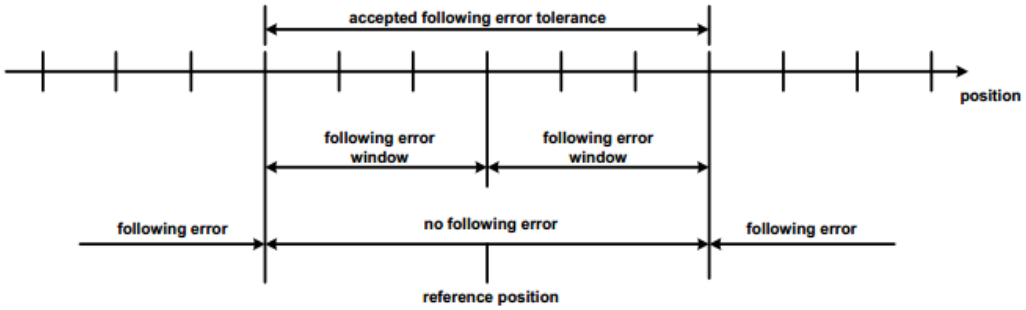
1. Set [6060_h: Mode of operations] to 1 (Profile position mode).
2. Set [6081_h: Profile velocity] to the scheduled speed (the unit is relative to P4.25). The corresponding parameter of the drive is P5.21 (in user unit).
3. Set [6083_h: Profile acceleration] to the scheduled ACC/DEC time (the unit is relative to P4.25). Note: In this mode, both 6083_h and 6084_h correspond to P5.37 in the drive (in user unit).
4. Set [$607A_h$: Target position] to the target position (unit: user unit). It corresponds to PtP0.01 in the drive.
5. Set [6040_h: Control word] to enable the servo drive and trigger the target position to be effective (set to 0x0F for enabling. See section 4.5 for details).
6. Query [6064_h: Position actual value] to acquire the actual motor position feedback.
7. Query [6041_h: Status word] to acquire servo drive status feedback (following error, set-point acknowledge, target reached and internal limt active).

3.2.3 Other objects

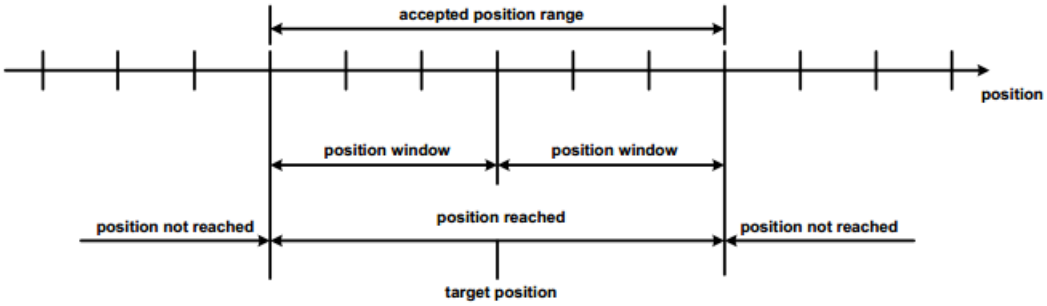
1. Query [6064_h: Position actual value] to acquire the actual position feedback of the motor (unit: user

unit).

2. Query [6063_h: Position actual value*] to acquire the actual position feedback increment of the motor (unit: user unit).
3. Set [6065_h: Following error window] to modify position out-of-tolerance range (unit: user unit).
4. Query [$60F4_h$: Following error actual value] to acquire the actual motor position deviation (unit: user unit).



Reference position



Position reached

3.2.4 Mode-related objects

Index	Name	Type	Attr.
6040_h	Control word	UNSIGNED16	RW
6041_h	Status word	UNSIGNED16	RO
6060_h	Modes of operation	INTEGER8	RW
6061_h	Modes of operation display	INTEGER8	RO
6063_h	Position actual value*	INTEGER32	RO
6064_h	Position actual value	INTEGER32	RO
6065_h	Following error window	UNSIGNED32	RW
6067_h	Position window	UNSIGNED32	RW
$607A_h$	Target position	INTEGER32	RW
6081_h	Profile velocity	UNSIGNED32	RW
6083_h	Profile acceleration	UNSIGNED32	RW
6093_h	Position factor	UNSIGNED32	RW
$60F4_h$	Following error actual value	INTEGER32	RO

Note: For detailed description of each object, see CiADS402 standards.

3.2.5 CW 0x6040of profile position mode

15 9	8	7	6	5	4	3 0
(see 3.1.1)	Halt	(see 3.1.1)	abs / rel	Change set immediately	New set-point	(see 3.1.1)
MSB						LSB

Name	Value	Description
New set-point	0	Does not assume *target position*
	1	Assume *target position*
Change set immediately	0	Finish the actual positioning and then start the next positioning
	1	Interrupt the actual positioning and start the next positioning
abs / rel	0	*Target position* is an absolute value
	1	*Target position* is a relative value
Halt	0	Execute positioning
	1	Stop axle with *profile deceleration* (if not supported with *profile acceleration*)

3.2.6 SW 0x6041 of profile position mode

15 14	13	12	11	10	9 0
(see 3.1.2)	Following error	Set-point acknowledge	(see 3.1.2)	Target reached	(see 3.1.2)
MSB					LSB

Name	Value	Description
Target reached	0	Halt = 0: *Target position* not reached Halt = 1: Axle decelerates
	1	Halt = 0: *Target position* reached Halt = 1: Velocity of axle is 0
Set-point acknowledge	0	Trajectory generator has not assumed the positioning values (yet)
	1	Trajectory generator has assumed the positioning values
Following error	0	No following error
	1	Following error

3.2.7 Application examples

1. Set 6060_h to 1 to select Profile Position Mode.

2. Set 6040_h to enable the drive and trigger the position command to be effective.

✧ Single set-point

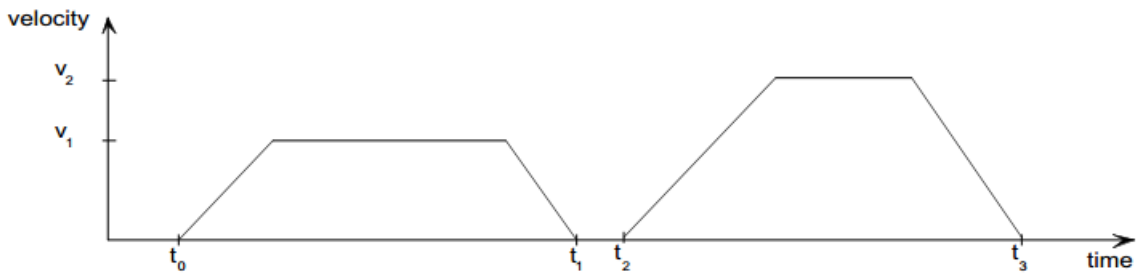


Figure 3-2 Single set-point diagram

Perform the following steps if the target position transmitted is in the increment mode:

(1) Set 6040_h to 0x4F (in which bit 6 is to set increment mode, bits 3–0 are to enable the drive).

(2) Set $607A_h$ as the target position command.

(3) Set 6040_h to 0x5F, and trigger the position command to be effective (the 0->1 jump edge of bit 4 is to trigger target position command to be effective).

(4) The drive sets 6041h.bit12 to 1 after receiving 6040h.bit4 = 1, and the master clears bit 4 of 6040h to be ready for sending a next target position command.

Perform the following steps if the target position transmitted is in the absolute mode:

(1) Set 6040_h to 0x0F.

(2) Set $607A_h$ as the target position command.

(3) Set 6040_h to 0x1F to trigger the position command to be effective.

(4) The drive sets 6041_h.bit12 to 1 after receiving 6040_h.bit4 = 1, and the master clears bit 4 of 6040_h to be ready for sending a next target position command.

✧ "Change set immediately" mode

Figure 3-3 "Change set immediately" mode

Perform the following steps it the target position transmitted is in the increment mode:

(1) Set 6040_h to 0x6F (in which bit 6 is for setting the increment mode, bit 5 is for setting the immediate effective mode, and bits 3–0 are for enabling the drive).

(2) Set $607A_h$ as the target position command.

(3) Set 6040_h to 0x7F, and trigger the position command to be effective (in which 0->1 jump edge of bit 4 is for triggering the target position command to be effective).

(4) The drive sets 6041_h.bit12 to 1 after receiving 6040_h.bit4 = 1, and the master clears bit 4 of 6040_h to be ready for sending a next target position command.

Perform the following steps if the target position transmitted is in the absolute mode:

(1) Set 6040_h to 0x2F (in which bit 5 is for setting the immediate effective mode, and bits 3–0 are for enabling the drive).

(2) Set $607A_h$ as the target position command.

(3) Set 6040_h to 0x3F to trigger the position command to be effective.

(4) The drive sets 6041_h.bit12 to 1 after receiving 6040_h.bit4 = 1, and the master clears bit 4 of 6040_h to be ready for sending a next target position command.

Repeat step (2) if multiple targets need to be transmitted.

Note: SV-DA200 supports 8-level target position buffering.

✧ PTP stop

There are two stop modes during PTP run.

a. Stop through quickstop bit of CW, that is, the CW sends 0XB, then the servo is switched from emergency stop to zero speed clamp.

b. Stop through halt bit of CW, which is related to 402 parameter 0x605D.

When 0x605D stop mode is -1, enabling is kept and direct stop is performed. That is, when 0x605D stop mode is -1 and CW sends 0x10F, the servo stops at the current position and keeps enabling.

When 0x605D stop mode is 0, CW sends 0x10F, and the servo coasts to stop.

If the servo needs to continue to run, PTP needs to be triggered again.

3.3 Cyclic synchronous position mode

3.3.1 Basic description

The theory of cyclic synchronous position mode is similar to that of position interpolation mode. Interpolation of the position command is achieved by the master while the master also offers additional speed feedforward commands and torque feedforward commands.

Interpolation cycle defines the update interval of the target position. Under this mode, the interpolation cycle is the same with EtherCAT synchronization cycle.

3.3.2 Operating method

1. Set [6060_h: Mode of operations] to **8** (Cyclic synchronous position mode).
2. Set [P4.07: EtherCAT **sync cycle**] to the same position interpolation cycle with that of the master and **re-power on**.
3. Set P0.37 [Position command mode] to 0 (Incremental) or 1 (Absolute).
4. Set [6040_h: Control word] to enable the servo drive (set to 0x0F for enabling. Refer to section 3.1 for other bits).
5. Set [$607A_h$: Target position] to the target position (unit: user unit); the corresponding parameter of the drive is P4.12.
6. Query [6064_h: Position actual value] to acquire the actual motor position feedback.
7. Query [6041_h: Status word] to acquire servo drive status feedback (following error, target reached, and internal limit active).

3.3.3 Mode-related objects

Index	Name	Type	Attr.
6040_h	Control word	UNSIGNED16	RW
6041_h	Status word	UNSIGNED16	RO
6060_h	Modes of operation	INTEGER8	RW
6061_h	Modes of operation display	INTEGER8	RO
6064_h	Position actual value	INTEGER32	RO
6065_h	Following error window	UNSIGNED32	RW
6067_h	Position window	UNSIGNED32	RW
6093_h	Position factor	UNSIGNED32	RW
$60F4_h$	Following error actual value	INTEGER32	RO

Note: For detailed description of each object, see CiADS402 standards.

3.3.4 Application examples

1. Set 6060_h to **8** to select Cyclic Synchronous Position Mode.
2. Set 6040_h to enable the drive, and send **0x0F**.
3. Set $607A_h$ to the target position and then absolute position to conduct the position control.

3.4 Homing Mode

3.4.1 Basic description

In homing mode, the drive finds the origin position by itself. You can set the running speed of homing mode.

Note:

In this mode, it is required to connect the limit switch and origin switch signal to digital input terminal CN1 of the drive. If the limit switch signal is connected to the upper PC or PLC, it is necessary to apply the homing process conducted by the upper PC.

3.4.2 Operating method

1. Set [6060_h: Mode of operations] to **6** (Homing mode).
2. Set [6098_h: Homing method], which can range from 1 to 35 (refer to DS402 standard for details).
3. Set [$607C_h$: Homing offset] to set the origin offset, corresponding to P5.14 of the drive.
4. Set [6099_h Sub-1: Homing speeds] to modify the speed in finding limit switch during homing (the unit is related to P4.25), corresponding to P5.12 of the drive.
5. Set [6099_h Sub-2: Homing speeds] to modify the speed in finding zero position during homing (the unit is related to P4.25), corresponding to P5.13 of the drive.
6. Set [$609A_h$: Homing acceleration] to set the ACC/DEC time of homing, corresponding to P5.09 of the drive (the unit is related to P4.25).
7. Set [6040_h: Control word] to enable the servo drive. The homing operation starts (bit 4) from the change of **0->1** and interrupts homing process from the change of **1->0**.
8. Monitor the limit switch and home switch to complete homing.
9. Query [6041_h: Status word] to acquire servo drive status feedback (Homing error, Homing attained, and Target reached).

3.4.3 Mode-related objects

Index	Name	Type	Attr.
6040_h	Control word	UNSIGNED16	RW
6041_h	Status word	UNSIGNED16	RO
6060_h	Modes of operation	INTEGER8	RW
6061_h	Modes of operation display	INTEGER8	RO
$607C_h$	Homing offset	INTEGER32	RW
6098_h	Homing method	UNSIGNED32	RW
6099_h	Homing speeds	ARRAY	RW
$609A_h$	Homing acceleration	UNSIGNED32	RW

Note: For detailed description of each object, see CiADS402 standards.

3.4.4 Application examples

Perform the following steps when the homing mode is applied:

1. Set 6060_h to **6** to select the homing mode.
2. Set 6098_h to select the homing mode to be used.
3. Set 6040_h to enable the drive and trigger homing action: send **0x0F** first, and then send **0x1F** to trigger homing.
4. Homing will be interrupted if **0x0F** is sent, and the drive will be disabled if **0x0** is sent.
5. Check whether homing is completed according to bit 12 of 6041_h, and check whether a fault occurs during homing according to bit 13.

3.4.5 Homing mode SW

15 14	13	12	11	10	9 0
(see 10.3.2)	Homing error	Homing attained	(see 10.3.2)	Target reached	(see 10.3.2)

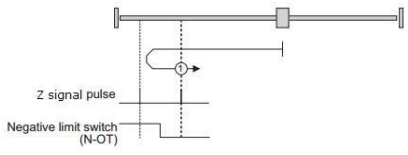
MSB LSB

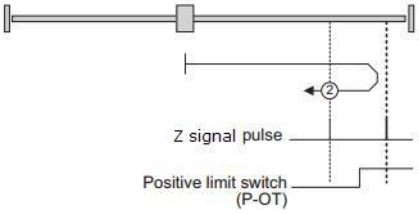
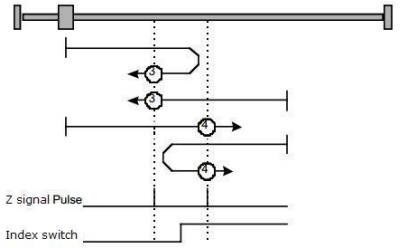
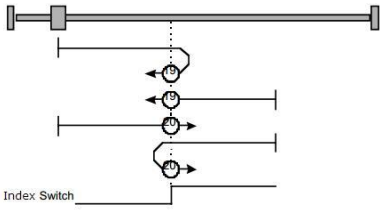
Name	Value	Description
Target reached	0	Halt = 0: Home position not reached Halt = 1: Axle decelerates
	1	Halt = 0: Home position reached Halt = 1: Axle has velocity 0
Homing attained	0	Homing mode not yet completed
	1	Homing mode carried out successfully
Homing error	0	No homing error
	1	Homing error occurred; Homing mode carried out not successfully; The error cause is found by reading the error code

3.4.6 Homing mode description

There are four types of signals related to homing mode, they are: positive limit switch (POT), negative limit switch (NOT), reference point switch (Index) and encoder Z signal (C-phase).

Definition of homing mode:

Homing method (DS402)	Start direction	Target position	Reference point position	Homing method (P5.10)	Description
1	Negative	NOT	Z pulse	1	Using Z pulse and negative limit switch: The drive moves towards negative limit switch at high speed, then returns at low speed and searches for target zero position (the first encoder Z pulse position after leaving NOT) after reaching NOT. 

Homing method (DS402)	Start direction	Target position	Reference point position	Homing method (P5.10)	Description
2	Positive	POT	Z pulse	0	Using Z pulse and positive limit switch: The drive moves towards positive limit switch at high speed, then returns at low speed and searches for target zero position (the first encoder Z pulse position after leaving NOT) after reaching POT. 
3	Positive	Index	Z pulse	2	The initial direction movement of the drive depends on the switch state of the reference point. The target zero position is the first Z pulse position on the left or right side of the Index.
4	Positive	Index	Z pulse	12	
17	Negative	NOT	NOT	21	These four types of homing methods are similar to 1–4 phases except that the target zero position is related to the change of limit switch or Index switch rather than using Z pulse. The following figure is diagram for 19 and 20, which are similar to method 3 and 4.
18	Positive	POT	POT	20	
19	Negative	Index	Index	23	
20	Positive	Index	Index	22	
35	-	Present position value	Present position value	8	The present position is the system zero point.

3.5 Profile velocity mode

3.5.1 Basic description

In the profile velocity mode, the drive receives the speed command sent by the master, and conducts speed planning according to the acceleration planning parameters.

3.5.2 Operating method

1. Set [6060_h: Mode of operations] to **3** (Profile velocity mode).
2. Set [6083_h: Profile acceleration] to modify acceleration curve (the unit is related to P4.25). It corresponds to P0.54 of the drive.
3. Set [6084_h: Profile deceleration] to modify deceleration curve (the unit is related to P4.25). It corresponds to P0.55 of the drive.
4. Set [6040_h: Control word] to enable the servo drive and start the motor.
5. Set [$60FF_h$: Target velocity] to set the target speed (the unit is related to P4.25). It corresponds to P4.13 of the drive.
6. Query [6041_h: Status word] to acquire servo drive status feedback (Speed zero, Max slippage error, Target reached, and Internal limit active).

3.5.3 Other objects

Query [$606C_h$: Velocity actual value] to acquire actual speed feedback (the unit is related to P4.25).

3.5.4 Mode-related objects

Index	Name	Type	Attr.
6040_h	Control word	UNSIGNED16	RW
6041_h	Status word	UNSIGNED16	RO
6060_h	Modes of operation	INTEGER8	RW
6061_h	Modes of operation display	INTEGER8	RO
$606C_h$	Velocity actual value	INTEGER32	RO
6083_h	Profile acceleration	UNSIGNED32	RW
6084_h	Profile deceleration	UNSIGNED32	RW
$60FF_h$	Target velocity	INTEGER32	RW

Note: For detailed description of each object, see CiADS402 standards.

3.5.5 Application examples

Perform the following steps when profile velocity is used:

1. Set 6060_h to 3 to select Profile Speed Mode.
2. Set 6040_h to enable the drive. Send 0x0F to enable or 0x0 to disable.
3. Set $60FF_h$ to modify the target speed command.
4. Set 6083_h and 6084_h to modify ACC/DEC time.

3.6 Cyclic synchronous velocity mode

3.6.1 Basic description

The cyclic synchronous speed mode is basically the same as the profile velocity mode except that the speed command interpolation of the former is completed by the master, and the master can provide additional torque feedforward command.

Interpolation cycle defines update interval of target speed. In this mode, the interpolation cycle is the same as EtherCAT synchronization cycle.

3.6.2 Operating method

1. Set [6060_h: Mode of operations] to **9** (Cyclic synchronous speed mode).
2. Set [6083_h: Profile acceleration] to modify ACC curve (the unit is related to P4.25), corresponding to P0.54 of the drive.
3. Set [6084_h: Profile deceleration] to modify DEC curve (the unit is related to P4.25), corresponding to P0.55 of the drive.
4. Set [6040_h: Control word] to enable the servo drive and start the motor.
5. Set [$60FF_h$: Target velocity] to set the target speed (the unit is related to P4.25), corresponding to P4.13 of the drive.
6. Query [6041_h: Status word] to acquire servo drive status feedback (Speed zero, Max slippage error, Target reached, and Internal limit active).

3.6.3 Other objects

Query [$606C_h$: Velocity actual value] to acquire actual speed feedback (the unit is related to P4.25).

3.6.4 Mode-related objects

Index	Name	Type	Attr.
6040_h	Control word	UNSIGNED16	RW
6041_h	Status word	UNSIGNED16	RO
6060_h	Modes of operation	INTEGER8	RW
6061_h	Modes of operation display	INTEGER8	RO
$606C_h$	Velocity actual value	INTEGER32	RO
6083_h	Profile acceleration	UNSIGNED32	RW
6084_h	Profile deceleration	UNSIGNED32	RW
$60FF_h$	Target velocity	INTEGER32	RW

Note: For detailed description of each object, see CiADS402 standards.

3.6.5 Application examples

Perform the following steps when profile velocity mode is used:

1. Set 6060_h to 9 to select Cyclic synchronous velocity mode.
2. Set 6040_h to enable drive. Send 0x0F to enable or 0x0 to disable.
3. Set $60FF_h$ to modify the target speed command.
4. Set 6083_h and 6084_h to modify ACC/DEC time.

3.7 Cyclic synchronous torque mode

3.7.1 Basic description

Cyclic synchronous torque mode is basically the same as profile torque mode except that the torque command interpolation is completed by the master. The interpolation cycle defines the update interval of target torque. In this mode, the interpolation cycle is the same as EtherCAT sync cycle.

3.7.2 Operating method

1. Set [6060_h: Mode of operations] to 10 (Cyclic synchronous torque mode).
2. Set [6040_h: Control word] to enable servo drive to start the motor.
3. Set [6071_h: Target torque] to set the target torque (unit: 0.1% of rated torque), corresponding to P4.14 of the drive.
4. Set [$607F_h$: Max Profile Velocity] to set the max. speed (the unit is related to P4.25).
5. Set [$60E0_h$: Positive torque limit] to set the positive torque limit (unit: 0.1% of the rated torque).
6. Set [$60E1_h$: Negative torque limit] to set the reverse torque limit (unit: 0.1% of the rated torque).
7. Set [6072_h: Max torque] to set the max torque limit (unit: 0.1% of the rated torque).
8. Query [6041_h: Status word] to acquire servo drive status feedback (target reached).

3.7.3 Other objects

1. Set [6072h: Max torque] to modify the max. torque limit (unit: 0.1% of the rated torque).
2. Query [6074h: Torque demand value] to acquire actual internal torque command (unit: 0.1% of the rated torque).
3. Query [6076h: Motor rated torque] to acquire rated motor torque (unit: mNm).
4. Query [6077h: Torque actual value] to acquire actual torque feedback (unit: 0.1% of the rated torque).
5. Query [6078h: Current actual value] to acquire actual output current (unit: mA).

3.7.4 Mode-related objects

Index	Name	Type	Attr.
6040_h	Control word	UNSIGNED16	RW
6041_h	Status word	UNSIGNED16	RO
6060_h	Modes of operation	INTEGER8	RW
6061_h	Modes of operation display	INTEGER8	RO
6071_h	Target torque	INTEGER16	RO
6072_h	Max torque	UNSIGNED16	RW
6073_h	Max current	UNSIGNED16	RO
6075_h	Motor rated current	UNSIGNED32	RO
6076_h	Motor rated torque	UNSIGNED32	RO
6077_h	Torque actual value	INTEGER16	RO
6078_h	Current actual value	INTEGER16	RO
6079_h	DC link circuit voltage	UNSIGNED32	RO
$607F_h$	Max Profile Velocity	UNSIGNED32	RW

Note: For detailed description of each object, see CiADS402 standards.

3.7.5 Application examples

Perform the following steps when Cyclic synchronous Torque is used:

1. Set 6060_h to **10** to select Cyclic synchronous Torque Mode.
2. Set 6040_h to enable the drive. Send **0x0F** to enable or **0x0** to disable.
3. Set 6071_h to modify the target torque command.
4. Set 6087_h to modify the torque slope time.

3.8 Touch probe function

3.8.1 Basic description

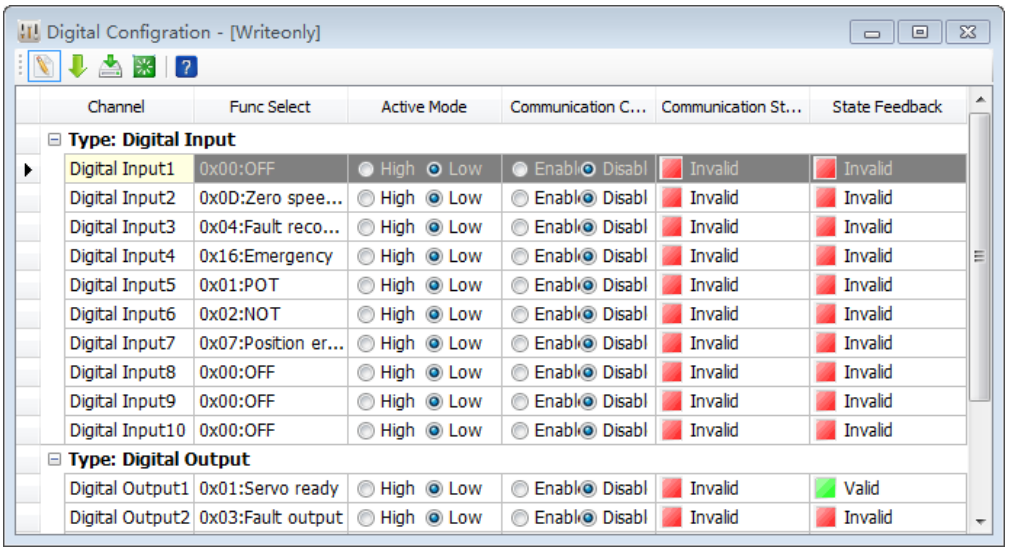
The touch probe function is used to latch the position feedback when a trigger signal or an event occurs. For SV-DA200, only the encoder Z signal (C-phase), and touch probe1 and touch probe2 signals can be used as trigger signals.

When the encoder Z signal is used as a trigger signal, only the rising edge of Z signal can be captured, and the captured results are stored in $60BA_h$ and $60BC_h$.

Both rising edge capture and falling edge capture are supported when touch probe1 is used. The capture results for the rising edge are stored in $60BA_h$ or $60BC_h$, while the capture result for the falling edge are stored in $60BB_h$ or $60BD_h$.

By default, digital input 1 of CN1 is used as a trigger input port of touch probe1, and digital input 2 of CN1 is used as a trigger input port of touch probe2.

Taking digital input 1 as an example, if you want to use touch probe1, you need to make the digital input function invalid or set P3.00 to 0 through the ServoPlorer software. Then restart the system for the change to take effect.



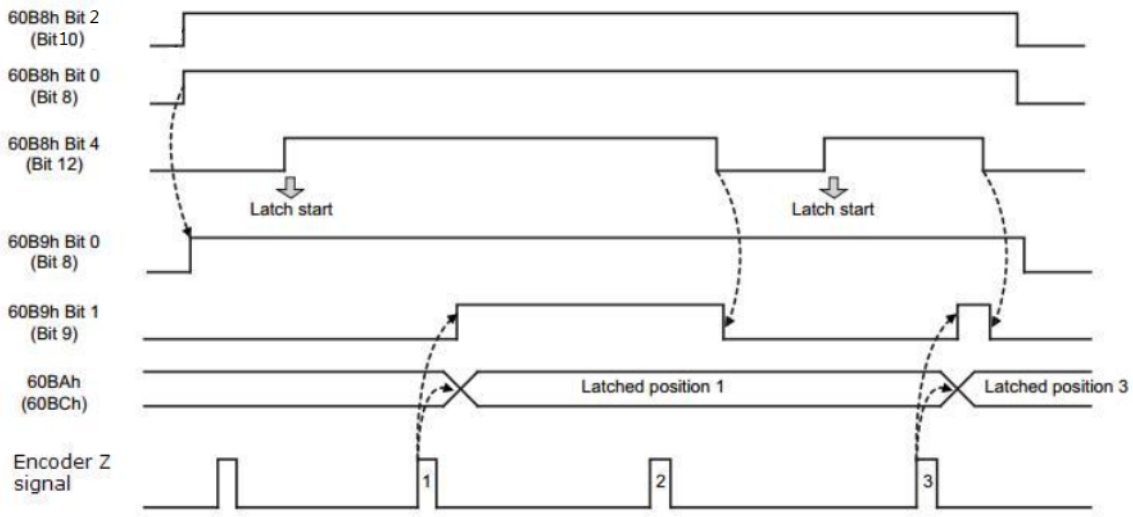
3.8.2 Mode-related objects

Index	Name	Type	Attr.
$60B8_h$	Touch Probe Control word	UNSIGNED16	RW
$60B9_h$	Touch Probe Status word	UNSIGNED16	RO
$60BA_h$	Probe 1 positive edge value(Encoder zero signal)	INTEGER32	RO
$60BB_h$	Probe 1 negative edge value	INTEGER32	RO
$60BC_h$	Probe 2 positive edge value(Encoder zero signal)	INTEGER32	RO
$60BD_h$	Probe 2 negative edge value	INTEGER32	RO

3.8.3 CW and SW description

Bit	$60B8_h$	$60B9_h$
0	Probe 1 enable (0:Disable;1:Enable)	Probe 1 enabled
1	Probe 1 continuous mode (0:Single; 1: continuous)	Probe 1 positive edge (or encode zero signal) value stored
2	Probe 1 zero pulse (0:I/O1;1:Z)	Probe 1 negative edge value stored
3	-	-
4	Probe 1 enable latch on positive edge (used also for encode zero signal)	-
5	Probe 1 enable latch on negative edge	-
6	-	Probe 1 positive edge value stored (continuous mode only, bit toggles if latch status changed)
7	-	Probe 1 negative edge value stored (continuous mode only, bit toggles if latch status changed)
8	Probe 2 enable (0:Disable;1:Enable)	Probe 2 enabled
9	Probe 2 continuous mode (0:Single; 1: continuous)	Probe 2 positive edge (or encode zero signal) value stored
10	Probe 2 zero pulse (0:I/O1;1:Z)	Probe 2 negative edge value stored
11	-	-
12	Probe 2 enable latch on positive edge (used also for encode zero signal)	-
13	Probe 2 enable latch on negative edge	-
14	-	Probe 2 positive edge value stored (continuous mode only, bit toggles if latch status changed)
15	-	Probe 2 negative edge value stored (continuous mode only, bit toggles if latch status changed)

3.8.4 Application examples (Z signal single trigger mode)



4 Object dictionary

4.1 Object specifications

4.1.1 Object type

Object name	Definition
VAR	Individual variable value such as UNSIGNED8, Boolean, Float, INTEGER16, and so on
ARRAY	Array of multiple data that consists of basic variables of the same type. Sub-index 0 is UNSIGNED8 type which indicates the number of data in the array. Sub-index is not taken as part of the ARRAY data.
RECORD	Structure that consists of basic variables of the same or differing types. Sub-index 0 is UNSIGNED8 type which indicates the number of data in the array, and is not taken as part of the RECORD data.

4.1.2 Data type

See CANopen Standard 301.

4.2 Overview of object group 1000h

Index	Object type	Name	Data type	Access	Mappable
CANopen DS301					
1000_h	VAR	Device type	UNSIGNED32	RO	N
1001_h	VAR	Error register	UNSIGNED8	RO	Y
1008_h	VAR	Manufacturer device name	STRING	RO	N
1009_h	VAR	Manufacturer hardware version	STRING	RO	N
$100A_h$	VAR	Manufacturer software version	STRING	RO	N
1018_h	RECORD	Identity Object	IDENTITY	RO	N
1600_h–03_h	RECORD	Receive PDO mapping	PDOMAPPING	RW	N
$1A00_h$–03_h	RECORD	Transmit PDO mapping	PDOMAPPING	RW	N
$1C00_h$	RECORD	Sync manager type	UNSIGNED8	RW	N
$1C12_h$	ARRAY	Receive PDO assign	UNSIGNED16	RW	N
$1C13_h$	ARRAY	Transmit PDO assign	UNSIGNED16	RW	N
$1C32_h$	RECORD	Sync manager output para.	SMPAR	RW	N
$1C33_h$	RECORD	Sync manager input para.	SMPAR	RW	N

4.3 Overview of object group 6000h

Index	Object type	Name	Data type	Access	Mappable
CANopen DS402					
$603F_h$	VAR	Error code	UNSIGNED16	RO	Y

Index	Object type	Name	Data type	Access	Mappable
6040_h	VAR	Control word	UNSIGNED16	RW	Y
6041_h	VAR	Status word	UNSIGNED16	RO	Y
$605D_h$	VAR	Halt option code	INTEGER16	RW	N
6060_h	VAR	Mode of operation	INTEGER8	RW	Y
6061_h	VAR	Mode of operation display	INTEGER8	RO	Y
6063_h	VAR	Position actual value*	INTEGER32	RO	N
6064_h	VAR	Position actual value	INTEGER32	RO	Y
6065_h	VAR	Following error window	UNSIGNED32	RW	N
6066_h	VAR	Following error time out	UNSIGNED16	RW	N
$606C_h$	VAR	Velocity actual value	INTEGER32	RO	Y
6071_h	VAR	Target torque	INTEGER16	RW	Y
6072_h	VAR	Max torque	UNSIGNED16	RW	Y
6073_h	VAR	Max current	UNSIGNED16	RO	N
6075_h	VAR	Motor rated current	UNSIGNED32	RO	N
6076_h	VAR	Motor rated torque	UNSIGNED32	RO	N
6077_h	VAR	Torque actual value	INTEGER16	RO	Y
6079_h	VAR	DC link circuit voltage	UNSIGNED32	RO	N
$607A_h$	VAR	Target position	INTEGER32	RW	Y
$607B_h$	ARRAY	Position range limit	INTEGER32	RW	N
$607C_h$	VAR	Home offset	INTEGER32	RW	N
$607F_h$	VAR	Max profile velocity	UNSIGNED32	RW	Y
6081_h	VAR	Profile velocity	UNSIGNED32	RW	Y
6083_h	VAR	Profile acceleration	UNSIGNED32	RW	Y
6084_h	VAR	Profile deceleration	UNSIGNED32	RW	Y
6091_h	ARRAY	Gear ratio	UNSIGNED32	RW	N
6093_h	ARRAY	Position factor	UNSIGNED32	RW	N
6098_h	VAR	Homing method	INTEGER8	RW	N
6099_h	ARRAY	Homing speeds	UNSIGNED32	RW	N
$609A_h$	VAR	Homing acceleration	UNSIGNED32	RW	N
$60B0_h$	VAR	Position offset	INTEGER32	RW	Y
$60B1_h$	VAR	Velocity offset	INTEGER32	RW	Y
$60B2_h$	VAR	Torque offset	INTEGER16	RW	Y
$60B8_h$	VAR	Touch probe control value	UNSIGNED16	RW	Y
$60B9_h$	VAR	Touch probe status value	UNSIGNED16	RO	Y
$60BA_h$	VAR	Touch probe 1 positive value	INTEGER32	RO	Y

Index	Object type	Name	Data type	Access	Mappable
$60BB_h$	VAR	Touch probe 1negative value	INTEGER32	RO	Y
$60BC_h$	VAR	Touch probe 2 positive value	INTEGER32	RO	Y
$60BD_h$	VAR	Touch probe 2negative value	INTEGER32	RO	Y
$60E0_h$	VAR	Positive Torge Limit	UNSIGNED16	RW	Y
$60E1_h$	VAR	Negative Torge Limit	UNSIGNED16	RW	Y
$60F4_h$	VAR	Following error actual value	INTEGER32	RO	Y
$60FD_h$	ARRAY	Digital inputs	UNSIGNED32	RO	Y
$60FE_h$	ARRAY	Digital outputs	UNSIGNED32	RW	Y
$60FF_h$	VAR	Target velocity	INTEGER32	RW	Y
6502_h	VAR	Support drive mode	UNSIGNED32	RO	N

4.4 Overview of object groups 2000h–4000h

0x2000–0x3000 manufacturer parameter list (applicable to SV-DA200 V2.60/XML V1.70 or later):

Index	Data type	Name	Access	Mappable
SV-DA200 manufacture parameters				
0x2000	int32	P0.00 Motor model (1)	RW	N
0x2001	int16	P0.01 Encoder type (1)	RW	N
0x2002	int16	P0.02 Forward rotation of motor (1)	RW	N
0x2003	int16	P0.03 Control mode (1)	RW	N
0x2004	int16	P0.04 Internal servo enabling (1)	RW	N
0x2005	int16	P0.05 JOG speed (1)	RW	N
0x2006	int32	P0.06 Numerator of frequency division output coefficient (1)	RW	N
0x2007	int32	P0.07 Denominator of frequency division output coefficient (1)	RW	N
0x2008	int16	P0.08 Reversal of frequency division output (1)	RW	N
0x2009	int16	P0.09 Torque limit mode setting (1)	RW	N
0x200A	int16	P0.10 Max. torque limit 1 (0.1)	RW	N
0x200B	int16	P0.11 Max. torque limit 2 (0.1)	RW	N
0x200D	int16	P0.13 Power of the external braking resistor (1)	RW	N
0x200E	int16	P0.14 Resistance of the external braking resistor (1)	RW	N
0x200F	int16	P0.15 Default monitoring parameters (1)	RW	N
0x2010	int16	P0.16 Parameter modification operation locked (1)	RW	N

Index	Data type	Name	Access	Mappable
0x2011	int16	P0.17 EEPROM write mode (1)	RW	N
0x2012	uint16	P0.18 Factory password (1)	RW	N
0x2014	int16	P0.20 Position command selection (1)	RW	N
0x2016	int32	P0.22 Pulse per revolution of motor (1)	RW	N
0x2017	int16	P0.23 Pulse input form (1)	RW	N
0x2018	int16	P0.24 Reversal of pulse input direction (1)	RW	N
0x2019	int32	P0.25 Numerator of 1st electronic gear ratio (1)	RW	N
0x201A	int32	P0.26 Denominator of electronic gear ratio (1)	RW	N
0x201B	int32	P0.27 Numerator of 2nd electronic gear ratio (1)	RW	N
0x201C	int32	P0.28 Numerator of 3rd electronic gear ratio(1)	RW	N
0x201D	int32	P0.29 Numerator of 4th electronic gear ratio(1)	RW	N
0x2021	int16	P0.33 Smooth filtering of position command (0.1)	RW	N
0x2022	int16	P0.34 FIR filtering of position command (0.1)	RW	N
0x2023	int32	P0.35 Software limit of forward position control (1)	RW	N
0x2024	int32	P0.36 Software limit of reverse position control	RW	N
0x2025	int16	P0.37 Position command mode (1)	RW	N
0x2026	int16	P0.38 Fully-closed loop enable (1)	RW	N
0x2028	int16	P0.40 Speed command selection (1)	RW	N
0x2029	int16	P0.41 Setting of speed command direction (1)	RW	N
0x202A	int32	P0.42 Gain of analog input 1 (1)	RW	N
0x202B	int16	P0.43 Reversal of analog input 1 (1)	RW	N
0x202D	int16	P0.45 Dead zone of analog input 1 (0.001)	RW	N
0x202E	int16	P0.46 Internal speed 1/Speed limit 1 (1)	RW	N
0x202F	int16	P0.47 Internal speed 2/Speed limit 2 (1)	RW	N
0x2030	int16	P0.48 Internal speed 3/Speed limit 3 (1)	RW	N
0x2031	int16	P0.49 Internal speed 4/Speed limit 4 (1)	RW	N
0x2032	int16	P0.50 Internal speed 5 (1)	RW	N
0x2033	int16	P0.51 Internal speed 6 (1)	RW	N
0x2034	int16	P0.52 Internal speed 7 (1)	RW	N
0x2035	int16	P0.53 Internal speed 8 (1)	RW	N
0x2036	int32	P0.54 ACC time (1)	RW	N
0x2037	int32	P0.55 DEC time (1)	RW	N
0x2038	int16	P0.56 ACC time of S curve (1)	RW	N

Index	Data type	Name	Access	Mappable
0x2039	int16	P0.57 DEC time of S curve (1)	RW	N
0x203A	int16	P0.58 Zero speed clamp mode (1)	RW	N
0x203B	int16	P0.59 Speed threshold of zero speed clamp (1)	RW	N
0x203C	int16	P0.60 Torque command selection (1)	RW	N
0x203D	int16	P0.61 Torque command direction setting (1)	RW	N
0x203E	int32	P0.62 Gain of analog input 2 (1)	RW	N
0x203F	int16	P0.63 Reversal of analog input 2 (1)	RW	N
0x2041	int16	P0.65 Dead zone of analog input 2 (0.001)	RW	N
0x2042	int16	P0.66 Internal torque command (0.1)	RW	N
0x2043	int16	P0.67 Speed limit mode setting (1)	RW	N
0x2044	int16	P0.68 RAMP time of torque command (1)	RW	N
0x2045	int16	P0.69 DEC time of fast stop (1)	RW	N
0x2046	int16	P0.70 Absolute encoder mode setting (1)	RW	N
0x2047	int16	P0.71 Absolute encoder multi-turn zeroing (1)	RW	N
0x205A	int16	P0.90 Max. speed limit of control mode switching (1)	RW	N
0x205B	int32	P0.91 Positioning reference of control mode switching (1)	RW	N
0x205C	int16	P0.92 Exit mode of position mode switching (1)	RW	N
0x205D	int16	P0.93 Exit mode of switching speed to position (1)	RW	N
0x2063	int16	P0.99 Speed detection FIR filter level (1)	RW	N
0x2100	int16	P1.00 Inertia online automatic estimation (1)	RW	N
0x2101	int16	P1.01 1st inertia ratio (1)	RW	N
0x2102	int16	P1.02 2nd inertia ratio (1)	RW	N
0x2103	int16	P1.03 1st Machine rigidity setting (1)	RW	N
0x2104	int32	P1.04 Inertia offline automatic estimation (1)	RW	N
0x2105	int16	P1.05 Operation mode of inertia identification (1)	RW	N
0x2106	int16	P1.06 Movable range of inertia Identification (0.1)	RW	N
0x2107	int16	P1.07 ACC time constant of inertia Identification (1)	RW	N
0x2108	int16	P1.08 Speed level of inertia identification (1)	RW	N
0x2113	int16	P1.19 Valid resonance detection bit (0.1)	RW	N

Index	Data type	Name	Access	Mappable
0x2114	int16	P1.20 Resonance detection mode (1)	RW	N
0x2115	int16	P1.21 1st mechanical resonance frequency (1)	RW	N
0x2116	int16	P1.22 2nd mechanical resonance frequency (1)	RW	N
0x2117	int16	P1.23 1st notch filter frequency (1)	RW	N
0x2118	int16	P1.24 1st notch filter Q value (0.01)	RW	N
0x2119	int16	P1.25 1st notch filter depth selection (1)	RW	N
0x211A	int16	P1.26 2nd notch filter frequency (1)	RW	N
0x211B	int16	P1.27 2nd notch filter Q value (0.01)	RW	N
0x211C	int16	P1.28 2nd notch filter depth selection (1)	RW	N
0x211D	int16	P1.29 3rd notch filter frequency (1)	RW	N
0x211E	int16	P1.30 3rd notch filter Q value (0.01)	RW	N
0x211F	int16	P1.31 3rd notch filter depth selection (1)	RW	N
0x2120	int16	P1.32 4th notch filter frequency (1)	RW	N
0x2121	int16	P1.33 4th notch filter Q value (0.01)	RW	N
0x2122	int16	P1.34 4th notch filter depth selection (1)	RW	N
0x2123	int16	P1.35 Vibration control mode of position command (1)	RW	N
0x2124	int16	P1.36 1st vibration control frequency (0.1)	RW	N
0x2125	int16	P1.37 1st vibration control filter factor (0.01)	RW	N
0x2126	int16	P1.38 2nd vibration control frequency (0.1)	RW	N
0x2127	int16	P1.39 2nd vibration control filter factor (0.01)	RW	N
0x2200	int16	P2.00 1st speed gain (0.1)	RW	N
0x2201	int16	P2.01 1st speed integration time constant (0.1)	RW	N
0x2202	int16	P2.02 1st position gain (0.1)	RW	N
0x2203	int16	P2.03 1st speed detection filter (1)	RW	N
0x2204	int16	P2.04 1st torque filter (0.01)	RW	N
0x2205	int16	P2.05 2nd speed gain (0.1)	RW	N
0x2206	int16	P2.06 2nd speed integration time constant (0.1)	RW	N
0x2207	int16	P2.07 2nd position gain (0.1)	RW	N
0x2208	int16	P2.08 2nd speed detection filter (1)	RW	N
0x2209	int16	P2.09 2nd torque filter (0.01)	RW	N
0x220A	int16	P2.10 Speed feed-forward gain (0.1)	RW	N
0x220B	int16	P2.11 Speed feed-forward filter time (0.01)	RW	N
0x220C	int16	P2.12 Torque feed-forward gain (0.1)	RW	N
0x220D	int16	P2.13 Torque feed-forward filter time (0.01)	RW	N

Index	Data type	Name	Access	Mappable
0x220E	int16	P2.14 1st IPPI coefficient (1)	RW	N
0x220F	int16	P2.15 2nd IPPI coefficient (1)	RW	N
0x2214	int16	P2.20 2nd gain setting (1)	RW	N
0x2216	int16	P2.22 Position control switching mode (1)	RW	N
0x2217	int16	P2.23 Delay time of position control switching (1)	RW	N
0x2218	int16	P2.24 Switching level of position control (1)	RW	N
0x2219	int16	P2.25 Switching delay of position control (1)	RW	N
0x221A	int16	P2.26 Switching time of position gain (1)	RW	N
0x221B	int16	P2.27 Switching mode of speed control (1)	RW	N
0x221C	int16	P2.28 Delay time of speed control switching (1)	RW	N
0x221D	int16	P2.29 Switching level of speed control (1)	RW	N
0x221E	int16	P2.30 Switching delay of speed control (1)	RW	N
0x221F	int16	P2.31 Switching mode of torque control (1)	RW	N
0x2220	int16	P2.32 Delay time of torque control switching (1)	RW	N
0x2221	int16	P2.33 Switching level of torque control (1)	RW	N
0x2222	int16	P2.34 Switching delay of torque control (1)	RW	N
0x2229	int16	P2.41 Disturbance observer valid (1)	RW	N
0x222A	int16	P2.42 Compensation gain of disturbance observer (1)	RW	N
0x222B	int16	P2.43 Cut-off frequency of disturbance observer (1)	RW	N
0x222C	int16	P2.44 Torque command offset (0.1)	RW	N
0x2232	int16	P2.50 Fully-closed loop vibration suppressor valid (1)	RW	N
0x2233	int16	P2.51 Fully-closed loop vibration suppressor cut-off frequency (0.1)	RW	N
0x2234	int16	P2.52 Fully-closed loop vibration suppressor compensation gain (1)	RW	N
0x2235	uint16	P2.53 Medium-frequency vibration control switch (1)	RW	N
0x2236	uint16	P2.54 Medium-frequency vibration control frequency (1)	RW	N
0x2237	uint16	P2.55 Fine tuning of medium-frequency vibration control inertia (1)	RW	N
0x2238	uint16	P2.56 Medium-frequency vibration control attenuation gain (1)	RW	N

Index	Data type	Name	Access	Mappable
0x2239	int16	P2.57 Fine tuning of medium-frequency vibration control filter time parameter 1 (1)	RW	N
0x223A	int16	P2.58 Fine tuning of medium-frequency vibration control filter time parameter 2 (0.01)	RW	N
0x223C	int16	P2.60 Speed observer valid (1)	RW	N
0x223D	int16	P2.61 Speed observer gain (1)	RW	N
0x2246	int16	P2.70 Friction compensation max-speed (1)	RW	N
0x2247	int16	P2.71 Positive torque coefficient of friction compensation (0.1)	RW	N
0x2248	int16	P2.72 Negative torque coefficient of friction compensation (0.1)	RW	N
0x2249	int16	P2.73 Friction compensation valid (1)	RW	N
0x224A	int16	P2.74 Automatic mode switch (1)	RW	N
0x224B	int16	P2.75 Automatic mode gain (0.1)	RW	N
0x224C	int16	P2.76 Fine tuning of automatic mode inertia (1)	RW	N
0x224D	int16	P2.77 Filter in disturbance observer of automatic mode 1 (0.1)	RW	N
0x224E	int16	P2.78 Filter in disturbance observer of automatic mode 2 (0.1)	RW	N
0x224F	int16	P2.79 Phase compensation of automatic mode speed command (1)	RW	N
0x2250	int16	P2.80 Speed observer gain of automatic mode (1)	RW	N
0x2251	int32	P2.81 Speed command filtering of automatic mode (0.1)	RW	N
0x2252	int32	P2.82 Phase advance correction of automatic mode speed command (0.1)	RW	N
0x2253	int32	P2.83 Disturbance compensation torque filtering time of automatic mode (0.01)	RW	N
0x2254	int32	P2.84 Speed feedback input filtering time of automatic mode speed observer (0.01)	RW	N
0x2255	int16	P2.85 Torque feedforward selection (1)	RW	N
0x2256	int32	P2.86 Flux-weakening control switch	RW	N
0x2257	int32	P2.87 Voltage utilization in flux-weakening control	RW	N
0x2258	int32	P2.88 Open-loop flux-weakening bandwidth	RW	N
0x2259	int32	P2.89 Closed-loop flux-weakening bandwidth	RW	N
0x225A	int32	P2.90 Max. flux-weakening current of closed-loop flux-weakening	RW	N

Index	Data type	Name	Access	Mappable
0x225B	int16	P2.91 Unbiased control gain	RW	N
0x225C	int16	P2.92 Unbiased control decay coefficient	RW	N
0x2300	uint16	P3.00 Input configuration of digital 1 (1)	RW	N
0x2301	uint16	P3.01 Input configuration of digital 2 (1)	RW	N
0x2302	uint16	P3.02 Input configuration of digital 3 (1)	RW	N
0x2303	uint16	P3.03 Input configuration of digital 4 (1)	RW	N
0x2304	uint16	P3.04 Input configuration of digital 5 (1)	RW	N
0x2305	uint16	P3.05 Input configuration of digital 6 (1)	RW	N
0x2306	uint16	P3.06 Input configuration of digital 7 (1)	RW	N
0x2307	uint16	P3.07 Input configuration of digital 8 (1)	RW	N
0x2308	uint16	P3.08 Input configuration of digital 9 (1)	RW	N
0x2309	uint16	P3.09 Input configuration of digital 10 (1)	RW	N
0x230A	uint16	P3.10 Output configuration of digital 1 (1)	RW	N
0x230B	uint16	P3.11 Output configuration of digital 2 (1)	RW	N
0x230C	uint16	P3.12 Output configuration of digital 3 (1)	RW	N
0x230D	uint16	P3.13 Output configuration of digital 4 (1)	RW	N
0x230E	uint16	P3.14 Output configuration of digital 5 (1)	RW	N
0x230F	uint16	P3.15 Output configuration of digital 6 (1)	RW	N
0x2310	uint16	P3.16 Function configuration of DI capture encoder (1)	RW	N
0x2314	int32	P3.20 Offset of analog input 1 (0.001)	RW	N
0x2315	int16	P3.21 Filter of analog input 1 (0.1)	RW	N
0x2316	int32	P3.22 Voltage protection of analog input 1 (0.001)	RW	N
0x2317	int32	P3.23 Offset of analog input 2 (0.001)	RW	N
0x2318	int16	P3.24 Filter of analog input 2 (0.1)	RW	N
0x2319	int32	P3.25 Voltage protection of analog input 2 (0.001)	RW	N
0x231A	int16	P3.26 Function selection of analog input 1 (1)	RW	N
0x231B	int16	P3.27 Function selection of analog input 2 (1)	RW	N
0x231C	int16	P3.28 Analog speed compensation gain (0.1)	RW	N
0x231D	int16	P3.29 Analog torque compensation gain (0.1)	RW	N
0x231E	int16	P3.30 Analog output 1 selection (1)	RW	N
0x231F	int32	P3.31 Voltage gain of analog output 1 (1)	RW	N
0x2320	int16	P3.32 Analog output 2 selection (1)	RW	N
0x2321	int32	P3.33 Voltage gain of analog output 2 (1)	RW	N

Index	Data type	Name	Access	Mappable
0x2322	int32	P3.34 Offset voltage of analog output 1 (0.001)	RW	N
0x2323	int32	P3.35 Offset voltage of analog output 2 (0.001)	RW	N
0x2324	int16	P3.36 Analog output monitor setting (1)	RW	N
0x2328	int16	P3.40 Travel limit switch setting(1)	RW	N
0x2329	int16	P3.41 Emergency stop switch shield (1)	RW	N
0x232A	int16	P3.42 Safe speed limit	RW	N
0x232B	int16	P3.43 Digital input filter (1)	RW	N
0x232C	int16	P3.44 Command pulse input invalid setting disabled (1)	RW	N
0x232D	int16	P3.45 Clearing mode of retention pulse (1)	RW	N
0x2332	int32	P3.50 Range of position arrival (1)	RW	N
0x2333	int16	P3.51 Output mode of position arrival (1)	RW	N
0x2334	int16	P3.52 Hold time of position arrival output terminal (1)	RW	N
0x2335	int16	P3.53 Speed matching range (1)	RW	N
0x2336	int16	P3.54 Speed reaching range (1)	RW	N
0x2337	int16	P3.55 Zero speed range (1)	RW	N
0x2338	int16	P3.56 Locked time of servo after braking (1)	RW	N
0x2339	int16	P3.57 Braking delay of electromagnetic brake (1)	RW	N
0x233A	int16	P3.58 Motor speed of brake release (1)	RW	N
0x233B	int16	P3.59 Torque reaching range (0.1)	RW	N
0x2346	int16	P3.70 Analog input 3 function selection (1)	RW	N
0x2347	int32	P3.71 Zero offset of analog input 3 (0.001)	RW	N
0x2348	int16	P3.72 Dead zone of analog input 3 (0.001)	RW	N
0x2349	int32	P3.73 Gain of analog input 3 (1)	RW	N
0x234A	int16	P3.74 Reversal of analog input 3 (1)	RW	N
0x234B	int32	P3.75 Voltage protection of analog input 3 (0.001)	RW	N
0x234C	int16	P3.76 Analog input 3 filter (0.1)	RW	N
0x234D	int16	P3.77 Deadzone mode of analog input (1)	RW	N
0x235A	int16	P3.90 Pulse input filter (1)	RW	N
0x235B	int16	P3.91 1st encoder filter (1)	RW	N
0x235C	int16	P3.92 2nd encoder filter (1)	RW	N
0x2400	int16	P4.00 EtherCAT communication address (1)	RW	N
0x2401	int16	P4.01 RS485 local communication address (1)	RW	N

Index	Data type	Name	Access	Mappable
0x2402	int16	P4.02 CAN communication baud rate (1)	RW	N
0x2403	int16	P4.03 RS485 communication baud rate (1)	RW	N
0x2404	int16	P4.04 RS485 communication parity mode (1)	RW	N
0x2405	int16	P4.05 CAN communication node (1)	RW	N
0x2406	int16	P4.06 RS485 communication fault clearing mode (1)	RW	N
0x2407	int16	P4.07 EtherCAT synchronous cycle	RW	N
0x2408	int16	P4.08 EtherCAT synchronous type (1)	RW	N
0x2409	int16	P4.09 EtherCAT fault detection time (1)	RW	N
0x240A	int16	P4.10 Upper PC type (1)	RW	N
0x240B	int16	P4.11 Bus servo enabling (1)	RW	N
0x240C	int32	P4.12 Bus position command (1)	RW	N
0x240D	int32	P4.13 Bus speed command (0.1)	RW	N
0x240E	int16	P4.14 Bus torque command (0.1)	RW	N
0x240F	int16	P4.15 Switching command of control mode (1)	RW	N
0x2410	int16	P4.16 Gain switching command (1)	RW	N
0x2411	int16	P4.17 Switching command of electronic gear ratio (1)	RW	N
0x2412	int16	P4.18 Inertia ratio switching command (1)	RW	N
0x2413	int16	P4.19 Zero speed clamp command (1)	RW	N
0x2414	int16	P4.20 Retention pulse clearing (1)	RW	N
0x2415	int16	P4.21 Torque limit switching command (1)	RW	N
0x2416	int16	P4.22 External fault command (1)	RW	N
0x2417	int16	P4.23 Emergency stop command (1)	RW	N
0x2418	int16	P4.24 Input command of vibration control switching (1)	RW	N
0x2419	int16	P4.25 EtherCAT control unit type (1)	RW	N
0x241A	int16	P4.26 EtherCAT PDO input offset (1)	RW	N
0x241B	int16	P4.27 Compensation value of EtherCAT position interpolation mode (1)	RW	N
0x241C	int16	P4.28 Digital output control enabling of EtherCAT (1)	RW	N
0x241D	int16	P4.29 Main cycle period of EtherCAT (1)	RW	N
0x241E	int16	P4.30 Stop mode (1)	RW	N
0x241F	int16	P4.31 Max speed limit (1)	RW	N
0x2420	int16	P4.32 Overspeed level (1)	RW	N
0x2421	int32	P4.33 Pulse range of position deviation (1)	RW	N

Index	Data type	Name	Access	Mappable
0x2422	int16	P4.34 Brake overload detection selection (1)	RW	N
0x2424	int16	P4.36 Undervoltage protection of main power supply (1)	RW	N
0x2425	int16	P4.37 Undervoltage detection time of main power supply (1)	RW	N
0x2427	int16	P4.39 Speed deviation setting (1)	RW	N
0x2428	int16	P4.40 Forward speed limit (1)	RW	N
0x2429	int16	P4.41 Reverse speed limit (1)	RW	N
0x242A	int32	P4.42 Internal speed of high resolution (0.1)	RW	N
0x242B	uint16	P4.43 Torque limit screening and run cycle selection	RW	N
0x242C	int16	P4.44 Runaway speed threshold	RW	N
0x2432	int32	P4.50 Offset of encoder Z phase (1)	RW	N
0x2433	int16	P4.51 Switching time 1 of torque limit (1)	RW	N
0x2434	int16	P4.52 Switching time 2 of torque limit (1)	RW	N
0x2435	int16	P4.53 Current loop response adjustment (0.1)	RW	N
0x2436	int32	P4.54 Initialization time after power on (1)	RW	N
0x2437	int16	P4.55 Communication baud rate of the encoder (1)	RW	N
0x243A	int16	P4.58 Z pulse width of frequency-division output (1)	RW	N
0x243B	int32	P4.59 Z pulse offset of frequency-division output (1)	RW	N
0x243C	int32	P4.60 Frequency division molecular of external linear encoder (1)	RW	N
0x243D	int32	P4.61 Frequency division denominator of external linear encoder (1)	RW	N
0x243E	int16	P4.62 Direction reversal of external linear encoder (1)	RW	N
0x243F	int16	P4.63 External linear encoder Z phase break detection disabling (1)	RW	N
0x2440	int32	P4.64 Large mixed deviation setting (1)	RW	N
0x2441	int16	P4.65 Mixed deviation clearing (1)	RW	N
0x2442	int16	P4.66 Z phase of external linear encoder (1)	RW	N
0x2443	int16	P4.67 External linear encoder pulse output mode of AB phase (1)	RW	N
0x2444	int32	P4.68 External linear encoder (2^{nd} encoder) resolution (1)	RW	N

Index	Data type	Name	Access	Mappable
0x2445	int16	P4.69 Frequency division output source (1)	RW	N
0x2446	int16	P4.70 External linear encoder (2nd encoder) Z signal type (1)	RW	N
0x244D	int16	P4.77 Detection time for motor phase loss	RW	N
0x244E	int16	P4.78 Temperature protection threshold of medium-power motor (1)	RW	N
0x244F	int16	P4.79 Quick stop method(1)	RW	N
0x2450	uint16	P4.80 Configuration of PZD setting parameter 1 (1)	RW	N
0x2451	uint16	P4.81 Configuration of PZD setting parameter 2 (1)	RW	N
0x2452	uint16	P4.82 Configuration of PZD setting parameter 3 (1)	RW	N
0x2453	uint16	P4.83 Configuration of PZD feedback parameter 1 (1)	RW	N
0x2454	uint16	P4.84 Configuration of PZD feedback parameter 2 (1)	RW	N
0x2455	uint16	P4.85 Configuration of PZD feedback parameter 3 (1)	RW	N
0x2456	uint16	P4.86 PPO type of DP communication (1)	RW	N
0x2457	int32	P4.87 CANopen communication cycle (1)	RW	N
0x2458	int16	P4.88 CANopen heartbeat cycle (1)	RW	N
0x2459	int16	P4.89 Automatic stop at CANopen disconnection (1)	RW	N
0x245A	int16	P4.90 Fault restore (1)	RW	N
0x245B	int16	P4.91 Parameters saving (1)	RW	N
0x245C	int16	P4.92 Restore to the factory value (1)	RW	N
0x245D	int16	P4.93 Reading enable of fault record (1)	RW	N
0x245E	int16	P4.94 Clearing enable of fault record (1)	RW	N
0x245F	int16	P4.95 Group number of fault record (1)	RW	N
0x2460	int16	P4.96 Initial angle test of the encoder (1)	RW	N
0x2461	int16	P4.97 EEPROM operation of absolute encoder (1)	RW	N
0x2462	int16	P4.98 EEPROM block of absolute encoder (1)	RW	N
0x2463	int32	P4.99 Reserved (1)	RW	N
0x2500	int16	P5.00 Program JOG mode selection (1)	RW	N
0x2501	int32	P5.01 JOG movement (1)	RW	N
0x2502	int16	P5.02 JOG speed setting (1)	RW	N

Index	Data type	Name	Access	Mappable
0x2503	int16	P5.03 JOG ACC/DEC time (1)	RW	N
0x2504	int16	P5.04 JOG waiting time (1)	RW	N
0x2505	int16	P5.05 JOG cycle times (1)	RW	N
0x2509	int32	P5.09 Homing ACC/DEC time (1)	RW	N
0x250A	int16	P5.10 Homing mode (1)	RW	N
0x250B	int16	P5.11 Automatic homing after power on (1)	RW	N
0x250C	int16	P5.12 1st speed setting of high speed homing (1)	RW	N
0x250D	int16	P5.13 2nd speed setting of high speed homing (1)	RW	N
0x250E	int32	P5.14 Home setting (1)	RW	N
0x250F	int16	P5.15 Homing trigger command (1)	RW	N
0x2510	int16	P5.16 Correlated action of homing (1)	RW	N
0x2511	int16	P5.17 Speed to designated target after homing (1)	RW	N
0x2512	int16	P5.18 ACC/DEC time to designated target after homing (1)	RW	N
0x2513	int32	P5.19 Position to designated target after homing (1)	RW	N
0x2514	int16	P5.20 PTP trigger command (1)	RW	N
0x2515	int16	P5.21 00 Target speed (1)	RW	N
0x2516	int16	P5.23 02 target speed (1)	RW	N
0x2517	int16	P5.24 03 target speed (1)	RW	N
0x2518	int16	P5.25 04 target speed (1)	RW	N
0x2519	int16	P5.26 05 target speed (1)	RW	N
0x251A	int16	P5.27 06 target speed (1)	RW	N
0x251B	int16	P5.28 07 target speed (1)	RW	N
0x251C	int16	P5.29 08 target speed (1)	RW	N
0x251D	int16	P5.30 09 target speed (1)	RW	N
0x251E	int16	P5.31 10 target speed (1)	RW	N
0x251F	int16	P5.32 11 target speed (1)	RW	N
0x2520	int16	P5.33 12 target speed (1)	RW	N
0x2521	int16	P5.34 13 target speed (1)	RW	N
0x2522	int16	P5.35 14 target speed (1)	RW	N
0x2523	int16	P5.36 15 target speed (1)	RW	N
0x2524	int16	P5.37 00 ACC/DEC time (1)	RW	N
0x2525	int16	P5.23 02 target speed (1)	RW	N

Index	Data type	Name	Access	Mappable
0x2526	int16	P5.38 01 ACC/DEC time (1)	RW	N
0x2527	int16	P5.39 02 ACC/DEC time (1)	RW	N
0x2528	int16	P5.40 03 ACC/DEC time (1)	RW	N
0x2529	int16	P5.41 04 ACC/DEC time (1)	RW	N
0x252A	int16	P5.42 05 ACC/DEC time (1)	RW	N
0x252B	int16	P5.43 06 ACC/DEC time (1)	RW	N
0x252C	int16	P5.44 07 ACC/DEC time (1)	RW	N
0x252D	int16	P5.45 08 ACC/DEC time (1)	RW	N
0x252E	int16	P5.46 09 ACC/DEC time (1)	RW	N
0x252F	int16	P5.37 10 ACC/DEC time (1)	RW	N
0x2530	int16	P5.48 11 ACC/DEC time (1)	RW	N
0x2531	int16	P5.49 12 ACC/DEC time (1)	RW	N
0x2532	int16	P5.50 13 ACC/DEC time (1)	RW	N
0x2533	int16	P5.51 14 ACC/DEC time (1)	RW	N
0x2534	int16	P5.52 15 ACC/DEC time (1)	RW	N
0x2535	uint16	P5.53 00 delay time (1)	RW	N
0x2536	uint16	P5.54 01 delay time (1)	RW	N
0x2537	uint16	P5.55 02 delay time (1)	RW	N
0x2538	uint16	P5.56 03 delay time (1)	RW	N
0x2539	uint16	P5.57 04 delay time (1)	RW	N
0x253A	uint16	P5.58 05 delay time (1)	RW	N
0x253B	uint16	P5.59 06 delay time (1)	RW	N
0x253C	uint16	P5.60 07 delay time (1)	RW	N
0x253D	uint16	P5.61 08 delay time (1)	RW	N
0x253E	uint16	P5.62 09 delay time (1)	RW	N
0x253F	uint16	P5.63 10 delay time (1)	RW	N
0x2540	uint16	P5.64 11 delay time (1)	RW	N
0x2541	uint16	P5.65 12 delay time (1)	RW	N
0x2542	uint16	P5.66 13 delay time (1)	RW	N
0x2543	uint16	P5.67 14 delay time (1)	RW	N
0x2544	uint16	P5.68 15 delay time (1)	RW	N
0x2545	uint16	P5.69 PTP trigger buffer switch (1)	RW	N
0x2546	int32	P5.70 Single-turn resolution of disk (1)	RW	N
0x2547	uint16	P5.71 Zero-returning switch of disk (1)	RW	N
0x2548	uint16	P5.72 Multi-turn mode (1)	RW	N

Index	Data type	Name	Access	Mappable
0x2549	uint16	P5.73 Digital trigger mode of PTP (1)	RW	N
0x254A	uint16	P5.74 Digital output mode of PTP (1)	RW	N
0x254B	uint16	P5.75 Enable interruption pause of the PTP (1)	RW	N
0x2600	int16	P6.00 Forward low JOG speed (1)	RW	N
0x2601	int16	P6.01 Reverse low JOG speed (1)	RW	N
0x2602	int16	P6.02 Position latch function switch (1)	RW	N
0x2603	int16	P6.03 Position latch save mode (1)	RW	N
0x2604	int16	P6.04 Forward high JOG speed (1)	RW	N
0x2605	int16	P6.05 Reverse high JOG speed (1)	RW	N
0x2606	int16	P6.06 Terminal JOG valid (1)	RW	N
0x3000	int32	R0.00 Motor speed (0.1)	RO	N
0x3001	int32	R0.01 Speed command (0.1)	RO	N
0x3002	int64	R0.02 Feedback pulse accumulation (1)	RO	N
0x3003	int64	R0.03 Command pulse accumulation (1)	RO	N
0x3004	int32	R0.04 Retention pulse (1)	RO	N
0x3005	int32	R0.05 Hybrid control deviation (1)	RO	N
0x3006	int32	R0.06 Current torque (0.1)	RO	N
0x3007	int32	R0.07 DC voltage of main circuit (0.1)	RO	N
0x3008	int32	R0.08 Voltage of control power (0.1)	RO	N
0x3009	int32	R0.09 Output voltage (0.1)	RO	N
0x300A	int32	R0.10 Output current (0.01)	RO	N
0x300B	int32	R0.11 Drive temperature (0.1)	RO	N
0x300C	int32	R0.12 Torque limit (0.1)	RO	N
0x300D	int32	R0.13 Feedback value of the encoder (1)	RO	Y
0x300E	int32	R0.14 Rotor position relative to Z pulse (1)	RO	N
0x300F	int16	R0.15 Inertia ratio of load (1)	RO	N
0x3010	int32	R0.16 Output power (0.1)	RO	N
0x3011	int32	R0.17 Motor load ratio (0.1)	RO	N
0x3012	int32	R0.18 Molecule of actual electric gear ratio (1)	RO	N
0x3013	int32	R0.19 Denominator of actual electric gear ratio (1)	RO	N
0x3014	int32	R0.20 Position command speed (0.1)	RO	N
0x3015	int32	R0.21 Motor speed (filtering) (0.1)	RO	N
0x3016	int16	R0.22 PTP state (1)	RO	N
0x3017	int32	R0.23 Absolute position feedback of encoder (1)	RO	N

Index	Data type	Name	Access	Mappable
0x3018	int16	R0.24 EEPROM data state of the encoder (1)	RO	N
0x3019	int16	R0.25 Turns of multi-circle encoder (1)	RO	Y
0x301A	int16	R0.26 Available encoder type (1)	RO	N
0x301B	int16	R0.27 Synchronous correction state of EtherCAT clock (1)	RO	N
0x301C	int16	R0.28 State of CANopen state machine (1)	RO	N
0x301D	int16	R0.29 Node no. of PROFIBUS-DP slave station (1)	RO	N
0x301E	int16	R0.30 System state (1)	RO	N
0x301F	uint16	R0.31 IGBT state (1)	RO	N
0x3020	int16	R0.32 Current mode (1)	RO	N
0x3021	uint32	R0.33 Power-on time (1)	RO	N
0x3022	uint32	R0.34 Operation time (1)	RO	N
0x3023	int16	R0.35 DSP software version (0.01)	RO	N
0x3024	int16	R0.36 FPGA software version (0.01)	RO	N
0x3025	int16	R0.37 Communication card software version (0.01)	RO	N
0x3026	int32	R0.38 Drive serial No.1 (1)	RO	N
0x3027	int32	R0.39 Drive serial No.2 (1)	RO	N
0x3028	int32	R0.40 Drive serial No.3 (1)	RO	N
0x3029	int32	R0.41 Drive serial No.4 (1)	RO	N
0x302A	int32	R0.42 Drive serial No.5 (1)	RO	N
0x302B	int32	R0.43 Drive serial No.6 (1)	RO	N
0x302C	int32	R0.44 Linear encoder position relative to Z (2^{nd} encoder) (1)	RO	N
0x302D	int32	R0.45 Speed feedback of 2^{nd} encoder (0.1)	RO	N
0x302E	int32	R0.46 Observing speed of speed observer (0.1)	RO	N
0x302F	int32	R0.47 Feedback speed of speed observer (0.1)	RO	N
0x3030	int32	R0.48 Observing disturbance torque via disturbance observer (0.1)	RO	N
0x3031	int32	R0.49 Compensation value of fully-closed vibration suppressor (0.1)	RO	N
0x3032	int16	P0.50 EtherCAT configuration file version no. (0.01)	RO	N
0x3033	int16	R0.51 Observe load inertia ratio in real time (1)	RO	N

Index	Data type	Name	Access	Mappable
0x3034	int32	R0.52 Position feedback accumulation of linear encoder (1)	RO	N
0x3035	int32	R0.53 Gantry synchronization position deviation (1)	RO	N
0x3036	int32	R0.54 Linear encoder (2nd encoder) position feedback value (1)	RO	N
0x3037	int32	R0.55 Encoder turn number offset after clearing multi-turn position (1)	RO	N
0x3038	int32	R0.56 Encoder feedback value offset after clearing multi-turn position (1)	RO	N
0x3039	int64	R0.57 Position feedback accumulation of 2nd encoder (1)	RO	N
0x303A	int32	R0.58 Position inside the single-turn of the disk (1)	RO	N
0x303C	int32	R0.60 Temperature of medium-power motor (1)	RO	N
0x3063	int16	R0.99 Fault code (1)	RO	N
0x3100	uint16	R1.00 Current state of digital input (1)	RO	N
0x3101	uint16	R1.01 Current state of digital output (1)	RO	N
0x3102	int32	R1.02 Original voltage of analog input 1 (0.001)	RO	N
0x3103	int32	R1.03 Original voltage of analog input 2 (0.001)	RO	N
0x3104	int32	R1.04 Original voltage of analog input 3 (0.001)	RO	N
0x3105	int32	R1.05 Voltage of analog input 1 (0.001)	RO	N
0x3106	int32	R1.06 Voltage of analog input 2 (0.001)	RO	N
0x3107	int32	R1.07 Voltage of analog input 3 (0.001)	RO	N
0x3108	int32	R1.08 Voltage of analog output 1 (0.001)	RO	N
0x3109	int32	R1.09 Voltage of analog output 2 (0.001)	RO	N
0x310A	int32	R1.10 Voltage of analog output 3 (0.001)	RO	N
0x310B	int32	R1.11 Cumulative value of pulse input (1)	RO	N
0x310C	int32	R1.12 Pulse position command (1)	RO	N
0x310D	int32	R1.13 Pulse speed command (0.1)	RO	N
0x310E	int32	R1.14 Analog compensation speed (0.1)	RO	N
0x310F	int32	R1.15 Analog compensation torque (0.1)	RO	N
0x3110	int32	R1.16 One-loop value of DI capture encoder	RO	N
0x3111	int32	R1.17 Cumulative value of DI capture encoder	RO	N

Index	Data type	Name	Access	Mappable
0x3112	int32	R1.18 One-loop value of DI capture encoder of 2nd encoder	RO	N
0x3113	int32	R1.19 Cumulative value of DI capture encoder of 2nd encoder	RO	N
0x3114	uint32	R1.20 Display of drive state bit	RO	N

0x4000 manufacture parameter list:

Index	Object Type	Name	Data Type	Access	Mappable
SV-DA200 manufacture parameters					
4000_h	VAR	Error code	UNSIGNED16	RO	Y
4001_h	VAR	Driver temperature	INTEGER16	RO	N
4002_h	VAR	Parameter save	INTEGER16	RW	N
4003_h	VAR	Parameter restore	INTEGER16	RW	N
4020_h	VAR	Encoder Feedback Cap 1	INTEGER32	RW	N
4021_h	VAR	multi number of turns Cap 1	INTEGER16	RW	N
4022_h	VAR	multi number of turns Cap 2	INTEGER16	RW	N
4100_h	VAR	Analog outoput 1 value	INTEGER32	RW	Y
4101_h	VAR	Analog outoput 2 value	INTEGER32	RW	Y
4300h	ARRAY	driver paramets	UNSIGNED32	RW	N

4.5 Encoder feedback

300D $_h$ Encoder feedback, corresponding to R0.31.

3019 $_h$ Number of turns of multi-turn encoder, corresponding to R0.25.

The preceding two parameters can be read from both SDO and PDO (applicable only to SV-DA200 V2.60/XML V1.70 and later).

The following three parameters store capture values only when touch probe1/2 is configured for capture:

4020 $_h$ Encoder Feedback Cap, used to store encoder positions during touch probe1 for touch probe1 capturing.

4021 $_h$ multi number of turns Cap1: used to store the multi-turn value of encoder during touch probe1 capturing.

4022 $_h$ multi number of turns Cap2: used to store the multi-turn value of encoder during touch probe2 capturing.

4.6 Digital input

The EtherCAT servo has only seven digital inputs. For details, see the CN1 terminal definition table.

In the default xml file, the digital input parameter 0x60FD is stored in the PDO reading parameter list.

The bit12 of P4.43 is 0 (Standard CiA402 protocol) by default. Each bit is described in the following table.

Bit	P4.25=2 (CIA402 OMRON)	Bit	P4.25≠2
0	Disabling reverse driving is valid.	0	Disabling reverse driving is valid.
1	Disabling forward driving is valid.	1	Disabling forward driving is valid.
2	The home switch is valid.	2	The home switch is valid.
3–15	Reserved	3–15	Reserved
16	Z signal	16–22	DI1–DI7
17–23	DI1–DI7	23–31	Reserved
24	Reserved		
25	Stop in emergency manner.		
26–31	Reserved		

Note:

The low-order 16 bits are the function bits, without fixed digital inputs. If you want to make "Disabling forward/reverse driving" valid, set **P3.40 to 0.**

Set the Bit12 of P4.43 to 1. Each bit is described in the following table:

Bit	Mapping
0–6	DI1–DI7
7–31	Reserved

To ensure quick response to data transfer, the PDO read/write list can contain a maximum of 10 parameters; otherwise, communication exceptions may occur. This function is applicable only to SV-DA200 V2.60/XML V1.70 and later.

4.7 Digital output control

The EtherCAT servo has only four differential outputs. For details, see the CN1 terminal definition table.

The digital output is servo controlled by default. If you want to enable the master to control the digital output through EtherCAT communication, set P4.28 [Enabling EtherCAT based control on digital output] to 1 (Enable); the digital output is controlled by writing 0x60FE through SDO or PDO.

The default xml digital output control parameters are stored in the PDO writing parameter list. The parameters have been deleted from XML V2.62 and later. If you need to use PDO control, configure 0x60FE in the PDO writing list on the master.

Each bit is described in the following table.

Sub-index 1 (Output)		Sub-index 2 (Bit mask)	
Bit	**Description**	**Bit**	**Description**
0	Brake status. 0: Closed. 1: Opened. It can be read only through the SDO. It is controlled by bit 0 of bit mask.	**0**	Brake status switch. 0: Closed. 1: Opened.
1–15	Reserved	**1–31**	Reserved
16–19	DO1–DO4		
20–31	Reserved		

To ensure quick response to data transfer, the PDO read/write list can contain a maximum of 10 parameters; otherwise, communication exceptions may occur. This function is applicable only to SV-DA200 V2.60/XML V1.70 and later.

4.8 Analog output control

EtherCAT servo is configured with two analog outputs, corresponding to EtherCAT parameters 0x4100 and 0x4101.

The analog output is servo controlled by default. If it is controlled by the master through EtherCAT communication, set P3.30 [**Analog output 1 selection]** to 0 (disabled), P3.32 [**Analog output 2 selection]** to 0 (enabled), or write 0x4100 and 0x4101 through SDO or PDO.

The xml analog output control parameters (factory default) are not put in the PDO parameter list. If you need to use the PDO control, 0x4100 and 0x4101 need to be configured to the PDO writting list in the master.

Function Code	Parameter Name	Current Value
P3.30	Function selection of Analog output 1	0:OFF
P3.32	Function selection of Analog output 2	0:OFF
P3.31	Gain of analog output 1	10
P3.33	Gain of analog output 2	10

The units of 0x4100 and 0x4101 are related to P3.31 and P3.33.

The EtherCAT reference value divided by the corresponding voltage gain is going to be the actual output voltage.

For example, 0x4100 is set to 1, voltage gain is set to 10, and the output analog voltage is 0.1V.

To ensure quick response to data transfer, the PDO read/write list can contain a maximum of 10 parameters; otherwise, communication exceptions may occur. This function is applicable only to SV-DA200 V2.60/XML V1.70 and later.

4.9 Drive parameters

Drive parameter 0x4300 carries three indices. This object can be used to set and read factory parameters.

Subindex 1 is the parameter address, 32-bit unsigned data.

Subindex 2 is the parameter value, 32-bit unsigned data.

Subindex 3 is the operation result, 32-bit unsigned data.

Reading:

a. Write subindex 1 to the data address to be read.

b. Read subindex 2 to obtain the parameter value.

c. Read subindex3 to obtain the reading result, which should be 0.

Setting:

a. Write subindex 1 to the parameter address to be set.

b. Write the value to subindex 2.

c. Read subindex 3 to obtain the set result, which should be 4.

For the parameter address, see SV-DA200 CANOpen address. Taking P0.05 (Jog speed) as example, the index of CANOpen is 0x2005, the subindex is 0, and therefore the address parameter is 0x200500.

The result of TwinCAT reading is shown as follows:

4.10 Torque compensation

Torque compensation parameter 0x60B2, corresponding to P2.44 torque offset, can be set through PDO and SDO.

It is used to set the compensation value that is added to the variable load of the torque command. It is applicable to the vertical axis scenarios, and it is valid in all control modes except torque control mode.

The default xml analog output control parameters are not included in the PDO parameter list. If PDO based control is requried, add the 0x60B2 torque compensation parameter to the PDO writing list. This function is applicable only to SV-DA200 V2.60/XML V1.70 and later.

5 Troubleshooting

5.1 EtherCAT communication fault code obtaining interface

1. Obtain fault codes through Emergency of EtherCAT.

2. Access 0x4000 (16-bit) through SDO or PDO to read the current fault code informattion. The format of fault codes are as follows.

Bits	Definition
15–8	Main fault code *
7–4	Reserved
3–0	Sub fault code

*: For details about main and sub codes, refer to the following table.

3. Access 0x603F (402 standard protocol fault code, 16-bit) through SDO or PDO to read the present fault.

For details about the mapping between 0x603F and servo factory code, refer to the following fault code table.

5.2 EtherCAT communication faults and solutions

Fault code	0x603F	Fault name	Fault cause	Solution
Er24-8	0x8100	EtherCAT fault–Initialization fault	Poor contact of EtherCAT chip	Replace the servo.
Er24-9	0x8100	EtherCATfault–EEPROM fault	EtherCAT EEPROM has no data or data reading failed	Download xml file to EtherCAT EEPROM with TwinCAT or other tools.
Er24-a	0x8100	EtherCATfault–DC Sync0 signal is abnormal	Set to DC sync operation mode, and DC Sync0 interruption signal is not detected during a period of time.	Check whether data loss occurred due to interference. Check whether EtherCAT master works normally.
Er24-b	0x8100	EtherCAT fault–Offline fault	Network cable is inserted improperly or EtherCAT master operation is abnormal after the drive is enabled.	Check whether network cable is connected properly which should be top-in and bottom-out. Check whether there is interference. Check EtherCAT master operates normally.
Er24-c	0x8100	EtherCATfault-PDO data loss fault	No PDO data is received after the drive is enabled for a period of time.	Check EtherCAT master operates normally; Check if data loss is caused by interference.

5.3 SV-DA200 faults and solutions

Fault code	0x603F	Fault name	Fault cause	Solution
Er01-0	0x2320	IGBT fault	The drive actual output current exceeds the specified value. 1. Drive fault (such as drive circuit or IGBT fault). 2. Motor cables U, V, and W are short connected, or motor cables are grounded or contacted improperly. 3. The motor breaks down. 4. The motor cables U, V, and W are connected in reverse phases. 5. Improper parameter settings cause systematic divergence. 6. The ACC/DEC time in the start or stop process is too short. 7. Transient load is too heavy.	1. Remove the motor cables and then enable the drive. If the fault persists, replace the drive. 2. Check whether motor cables and wiring are in good condition. 3. Decrease P0.10 and P0.11 to lower the max. output torque. 4. Adjust the loop parameter to stabilize the system, and reduce the value of P0.12. 5. Prolong ACC/DEC time properly. 6. Replace with a drive with larger power. 7. Replace the motor.
Er01-1	0x7110	Braking pipe fault (7.5kW and higher)	Braking unit is faulty.	Replace the drive.
Er01-2	0x2331	U-phase driving pipe fault (7.5kW and higher)	U-phase driving pipe is faulty.	Replace the drive.
Er01-3	0x2332	V-phase driving pipe fault (7.5kW and higher)	V-phase driving pipe is faulty.	Replace the drive.
Er01-4	0x2333	W-phase driving pipe fault (7.5kW and higher)	W-phase driving pipe is faulty.	Replace the drive.
Er01-5	0xFF00	IPM fault	IPM module is faulty.	Replace the drive.
Er02-0	0x7301	Encoder fault–Encoder disconnection	1. The encoder is not connected. 2. The encoder plug contact is loose. 3. One of encoder signal	1. Connect the encoder according to the correct wiring method. Ensure the encoder plug contact is proper. Replace the encoder
Er02-1	0x7300	Encoder fault–Encoder		

Fault code	0x603F	Fault name	Fault cause	Solution
		feedback deviation too large	cables U, V, W, A, B, and Z is disconnected. 4. Encoder phases A and B are reverse. 5. Noise causes communication interruption or data exceptions. 6. The encoder communicates properly but with data exceptions. 7. The FPGA that communicates with the encoder reports timeout. 8. The drive does not support the encoder type.	cable if the cable is broken. 2. Check whether the encoder power voltage is normal. 3. Reduce the interference source of encoder cable to the minimum extent. Route the encoder cables and motor cables separately, and connect the shielded wire of encoder cable to FG. 4. Check whether the encoder type supported by the drive is consistent with the motor encoder type according to P0.01 if an encoder disconnection fault is reported upon power-on.
Er02-2	0x7300	Encoder fault–Parity error		
Er02-3	0x7300	Encoder fault–CRC error		
Er02-4	0x7300	Encoder fault–Frame error		
Er02-5	0x7300	Encoder fault–Short frame error		
Er02-6	0x7305	Encoder fault–Encoder timeout		
Er02-7	0x7306	Encoder fault–Multi-turn absolute value loss		
Er02-8	0x5114	Encoder fault–Encoder battery low-voltage alarm	When a multi-turn absolute encoder is used, the external battery voltage of the encoder is between 3.0V–3.2V.	1. Ensure the encoder battery cable is connected properly. 2. Use the multimeter to check whether the external battery voltage is lower than 3.2V. If yes, replace the battery. 3. Replace the battery when the drive power is on. Otherwise, encoder data will be lost.
Er02-9	0x5115	Encoder fault–Encoder battery undervoltage fault	When a multi-turn absolute encoder is used, the external battery voltage of the encoder is between 2.5V–3.2V.	1. Ensure the encoder battery cable is connected properly. 2. Use the multimeter to check whether the external battery voltage is lower than 3.0V. If yes, replace the battery. 3. Replace the battery when the drive power is on. Otherwise, encoder data will be lost.

Fault code	0x603F	Fault name	Fault cause	Solution
Er02-a	0x7300	Encoder fault–Encoder overheating	The encoder feedback temperature is higher than the temperature threshold for protection against overheating.	1. Ensure the temperature threshold for protection against overheating is correct. 2. Stop the motor to lower the encoder temperature.
Er02-b	0x7300	Encoder fault–Encoder EEPROM writing error	If the motor is used with a communication encoder, a communication transmission or data check error occurs when the drive updates data to the encoder EEPROM.	1. Ensure encoder cables are connected properly and eliminate the conditions that disturb encoder communication. 2. Make multiple writing attempts. If the fault is reported repeatedly, replace the motor.
Er02-c	0x7300	Encoder fault–No data in encoder EEPROM	If the motor is used with a communication encoder, no data is found in the encoder EEPROM when the motor attempts to read data from it during power-on.	1. Select the present motor model through P0.00, and execute the write operation on the encoder EEPROM parameter through P4.97. 2. Mask this fault by setting P4.98. The motor parameters in the drive EEPROM are used for initialization.
Er02-d	0x7300	Encoder fault–Encoder EEPROM data check error	If the motor is used with a communication encoder, a data check error occurs when the motor attempts to read data from the encoder EEPROM during power-on.	1. Ensure encoder cables are connected properly and eliminate the conditions that disturb encoder communication. 2. Select the motor model based on the setting of P0.00 and execute the operation of writing data to the encoder EEPROM through P4.97 so that data in the encoder EEPROM is updated. 3. Mask this fault by setting P4.98. The motor parameters in the drive EEPROM are used for initialization.

Fault code	0x603F	Fault name	Fault cause	Solution
Er03-0	0x7200	Current sensor fault–Phase-U current sensor fault	1. The current sensor or detection circuit is abnormal. 2. Power-on is made when the motor shaft is in non-static state.	Re-power on when the motor shaft in static state. If the fault is reported repeatedly, replace the drive.
Er03-1	0x7200	Current sensor fault–Phase-V current sensor fault		
Er03-2	0x7200	Current sensor fault–Phase-W current sensor fault		
Er04-0	0x6100	System initialization fault	There are failed self-check items after power-on initialization is complete.	1. Repower on. 2. If the fault occurs repeatedly, replace the drive.
Er05-1	0x6320	Setting fault–Motor model not exist	P0.00 is set incorrectly.	1. Ensure the motor model is correct. 2. Ensure the motor parameter model matches the drive power class.
Er05-2	0x6320	Setting fault–Motor and drive model not match		
Er05-3	0x6320	Setting fault–Incorrect software limits	Software limits are set incorrectly. The setting of P0.35 is equal to or less than that of P0.36.	Set P0.35 and P0.36 correctly.
Er05-4	0x6320	Setting fault–Incorrect homing mode	P5.10 is set incorrectly.	Set P5.10 correctly based on the descrption.
Er05-5	0x6320	Setting fault–PTP-control travel overflow	The single increment of a PTP idle travel exceeds (2^{31} - 1).	Single travel cannot exceed (2^{31}-1) in the absolute position mode.
Er07-0	0x7112	Regenerative discharge overload fault	1. The braking resistor power is low. 2. The motor speed is too high or the deceleration is too quick, which causes the failure to absorb the regenerate energy within specified time. 3. The action limit of the external braking resistor is restricted to the duty ratio 10%.	1. Change the internal brake resistor to the external brake resistor, and enlarge the power. 2. Modify DEC time, and lower the regenerative discharge action rate. 3. Reduce motor speed. 4. Improve the capacity of the motor and drive.

Fault code	0x603F	Fault name	Fault cause	Solution
Er08-0	0x7200	AI overvoltage fault–AI 1	The voltage inputted to the analog input 1 port exceeds the value defined with P3.22.	1. Set P3.22, P3.25, and P3.75 properly. 2. Check whether the terminal wiring is in good condition. 3. Set P3.22, P3.25, and P3.75 to 0 to disable protection.
Er08-1	0x7200	AI overvoltage fault–AI 2	The voltage inputted to the analog input 2 port exceeds the value defined with P3.25.	
Er08-2	0x7200	AI overvoltage fault–AI 3	The voltage inputted to the analog input 3 port exceeds the value defined with P3.75.	
Er09-0	0x5520	EEPROM fault–Read/write error	1. Data is damaged in the data storage area when the drive reads data from the EEPROM. 2. Writing data to the EEPROM is disturbed.	1. Re-try after re-power on. 2. If the fault occurs repeatedly, replace the drive.
Er09-1	0x5530	EEPROM fault–Data check error	1. The data read from EEPROM differs from data being written. 2. The drive DSP software version is updated.	1. Reset all the parameters. 2. If the fault occurs repeatedly, replace the drive.
Er10-0	0x7400	Hardware fault–FPGA fault	The FPGA on the control board reports a fault.	1. Re-power on. 2. If the fault occurs repeatedly, replace the drive.
Er10-1	0x7500	Hardware fault–Communication card fault	The external communication card is faulty.	1. Re-power on. 2. If the fault occurs repeatedly, replace the communication card.
Er10-2	0x2300	Hardware fault–To-ground short circuit fault	One of the motor cables V and W is short connected to the ground, which is found in to-ground short circuit detection during drive power-on.	1. Ensure motor cables are connected properly. 2. Replace motor cables or check for ageing of insulation.
Er10-3	0x5430	Hardware fault–External input fault	This fault occurs when the digital terminal configured with the external fault input function acts.	1. Remove the external fault input to clear the enabling fault. 2. Re-power on the drive.

Fault code	0x603F	Fault name	Fault cause	Solution
Er10-4	0x5430	Hardware fault–Emergency stop fault	This fault occurs when the digital terminal configured with the emergency stop function acts.	1. Remove the emergency stop input to clear the enabling fault. 2. Re-power on the drive.
Er10-5	0x7500	Hardware fault–RS485 communication fault	Strong EMI of RS485 communication circuit causes the serial communication alarm of the drive.	1. Use twisted shielded pairs for RS485 communication. 2. Route communication cables and motor power cables separately.
Er11-0	0x6100	Software fault–Motor control task re-entry	1. The DSP CPU utilization is too high. 2. The DSP has bugs.	1. Remove unnecessary software functions. 2. Contact the customer service personnel to update the DSP.
Er11-1	0x6100	Software fault–Periodic task re-entry		
Er11-2	0x6100	Software fault–Illegal operation		
Er12-0	0x6320	I/O fault–Duplicate DI assignment	Two or more digital inputs are configured with the same function.	Set P3.00–P3.09 and ensure each setting is unique.
Er12-1	0x6320	I/O fault–Duplicate AI assignment	When the drive is a standard model, the function of AI3 is set to speed command.	Set parameter P3.70 (AI3 function) to another value.
Er12-2	0x5430	I/O fault–Pulse input frequency too high	The pulse input frequency detected by the drive is higher than the specified frequency. 1. External input pulse signal frequency is too high. 2. The internal pulse frequency detection circuit of the drive is damaged.	1. Reduce the external input pulse signal frequency. 2. If the fault persists though the external input signal is normal, replace the drive.
Er13-0	0x3110	Main circuit overvoltage fault	The detected DC voltage of the drive main circuit is higher than the specified voltage. 1. The grid voltage is too high.	1. Check whether the grid input voltage exceeds the allowed value. 2. Check whether the internal/external braking resistor is loosened or

Fault code	0x603F	Fault name	Fault cause	Solution
			2. Under the braking condition, no braking resistor or pipe is connected, or the braking resistor is damaged. 3. The DEC time in the stop process is too short. 4. The internal DC voltage detection circuit of the drive is damaged.	damaged. 3. Prolong the DEC time. 4. Check R0.07 when the drive is disabled. If it is abnormal and does not match the grid input voltage, replace the drive.
Er13-1	0x3120	Main circuit undervoltage fault	The detected DC voltage of the drive main circuit is lower than the specified voltage. 1. The grid voltage is too low. 2. The buffer relay is not closed. 3. The drive output power is too high. 4. The internal DC voltage detection circuit of the drive is damaged.	1. Check whether the grid input voltage exceeds the allowed value. 2. Re-power on, and check whether there is pull-in noise of the power-on buffer relay. 3. Check R0.07 when the drive is disabled. If it is abnormal and does not match the grid input voltage, replace the drive.
Er14-0	0x5115	Control power undervoltage fault	The detected control power DC voltage of the drive is lower than the specified voltage. 1. The grid voltage is too low. 2. The DC voltage detection circuit of the internal control power of the drive is damaged.	1. Check whether the grid input voltage is lower than the allowed value. 2. Check R0.08 when the drive is disabled. If it is abnormal and does not match the grid input voltage, replace the drive.
Er17-0	0x3230	Drive overload fault	Short-time load of the drive is too heavy.	1. The load is too heavy which causes the drive overload. 2. Check whether phase dislocation or phase loss occurred to UVW wiring of the motor, and check whether the encoder is correct. 3. Check whether the motor is compatible with the drive.

Fault code	0x603F	Fault name	Fault cause	Solution
Er17-1	0xFF00	Drive overload fault	The drive load is too heavy (during low speed running).	1. The load is too heavy which causes the drive overload. 2. Check whether phase dislocation or phase loss occurred to UVW wiring of the motor, and check whether the encoder is correct.
Er18-0	0x3230	Motor overload fault	1. Long-term overload running. 2. The load is too heavy during the short time.	1. Replace with the drive and motor of larger power.
Er18-1	0x FF00	Motor overtemperature fault	Motor temperature exceeds the protection value	1. Replace with the motor of larger power. 2. Check whether UVW phase sequence is correct.
Er18-2	0xFF00	Motor power cable fault	Motor power cable is not connected or loose.	Check the UVW wiring of the motor.
Er18-3	0xFF00	Motor phase loss fault	Phase loss occurred to the motor.	Check the UVW wiring of the motor for phase loss.
Er19-0	0x8400	Speed fault–Overspeed fault	The motor speed absolute value exceeds the setting of P4.32. 1. The motor stalls or motor phases U, V, and W are in reverse sequence. 2. The electronic gear ratio or motor speed loop control parameters are not set properly. 3. The setting of P4.32 is less than that of P4.31 [Max. speed limit]. 4. The encoder feedback signal is interfered.	1. Check whether the electronic gear ratio parameters are set properly. 2. Check the setting of speed loop control parameters. 3. Check whether the motor cable phase sequence is correct. 4. Check whether the motor encoder is wired properly. 5. Replace the motor with a new one with a higher speed.
Er19-1	0x8400	Speed fault–FWD overspeed fault	The speed feedback exceeds the setting of P4.40 by more than 20ms.	1. Ensure the encoder is normal. 2. Set P4.40 properly.
Er19-2	0x8400	Speed fault–REV overspeed fault	The speed feedback exceeds the setting of P4.41 by more than 20ms.	1. Ensure the encoder is normal. 2. Set P4.41 properly.

Fault code	0x603F	Fault name	Fault cause	Solution
Er19-3	0x6320	Speed fault–Incorrect overspeed parameter setting	The setting of P4.40 is less than 0 or that of P4.41 is greater than 0.	1. Ensure the encoder is connected properly. 2. Set P4.40 or P4.41 properly.
Er19-4	0xFF00	Runaway fault	The motor phase sequence is incorrect or the initial angle is incorrect.	1. Ensure the motor phases are in correct sequence. 2. Set P4.96. 3. Check whether P4.44 is set correctly.
Er20-0	0x8400	Speed out-of-tolerance-range fault	In non-torque mode, the deviation between the motor speed and speed command exceeds the setting of P4.39. 1. The motor phases U, V, and W are in reverse sequence or motor cables are not connected. 2. The motor load is too heavy, which causes motor stalling. 3. The drive force is insufficient, which causes motor stalling. 4. The speed loop control parameters are not set properly. 5. The setting of P4.39 is too low.	1. Check motor cable phase sequence and ensure the wiring is correct. 2. Check whether the transmission belt or chain is too tight, or the workbench reaches edges or encounters obstacles. 3. Check whether the loop control parameters are set properly or the drive has been damaged, or the servo system model is appropriate. 4. Increase the value of P4.39. 5. Set P4.39 to 0 to disable speed out-of-tolerance fault detection.
Er21-0	0x8500	Position overtravel–Forward overtravel	In position mode or fully-closed loop mode, the FWD limit switch is touched or the accumulated feedback pulse exceeds P0.35.	1.Check whether FWD limit switch signal is correct. 2. Check whether P0.35 is set properly.
Er21-1	0x8500	Position overtravel–Reverse overtravel	In position mode or fully-closed loop mode, the FWD limit switch is touched or the accumulated feedback pulse exceeds P0.36.	1.Check whether REV limit switch signal is correct. 2.Check whether P0.36 is set properly.

Fault code	0x603F	Fault name	Fault cause	Solution
Er22-0	0x8611	Out-of-tolerance fault–Position out of tolerance	1. Server response time is too slow. Therefore the residual pulses exceed the setting of P4.33. 2. The motor load is too heavy, which causes motor stalling. 3. Pulse input frequency is too high, exceeding the max. motor speed. 4. The step variable in the position command input exceeds the setting of P4.33.	1. Check whether the transmission belt or chain is too tight, or the workbench reaches the edges or encounters obstacles. 2. Increase the position loop gain parameters or speed feedforward gain, or pulse range of position deviation (P4.33). 3. Modify electric gear ratio. 4. Reduce the step variable in the position command input.
Er22-1	0x8611	Out-of-tolerance fault–Hybrid control deviation too large	In fully-closed loop control, the feedback position deviation between the grating ruler and encoder exceeds the setting of P4.64.	1. Check the connection between the motor and load. 2. Check the connection between the grating ruler and drive. 3. Ensure P4.60, P4.61, and P4.62 are set properly.
Er22-2	0x8611	Position increment overflow fault	Position command's single variation after being converted by the electric gear ratio exceeds 2^{31}-1.	1. Reduce the single variable in the position command. 2. Modify the electric gear ratio to appropriate range.
Er23-0	0x4210	Drive overtemperature fault	1. The ambient temperature of the drive exceeds the specified temperature. 2. The drive is overloaded.	1. Reduce the ambient temperature and improve the ventilation condition. 2. Replace the servo system with a new one with greater power. 3. Increase the ACC/DEC time and reduce the load.
Er24-0	0x6320	PROFIBUS-DP communication fault–PWK ID error	The PWK parameter ID is incorrect.	View the manual and ensure that the PWK parameter ID is the same as the corresponding parameter ID.
Er24-1	0x6320	PROFIBUS-DP communication fault–PWK out of range	The PWK parameter value is out of the allowed range.	View the manual and ensure that the PWK parameter value is within the allowed range.

Fault code	0x603F	Fault name	Fault cause	Solution
Er24-2	0x6320	PROFIBUS-DP communication fault–PWK parameter read-only	The PWK parameter is read only	View the manual and ensure that the PWK parameter can be read and written.
Er24-3	0x6320	PROFIBUS-DP communication fault–PZD parameter does not exist	The PZD setting parameter ID is incorrect.	View the manual and ensure that the PZD setting parameter ID is the same as the corresponding parameter ID.
Er24-4	0x6320	PROFIBUS- DP communication fault–PZD parameter attribute does not match	The PZD setting parameter property is not instant effective.	View the manual and ensure that the PZD setting parameter property is instant effective.
Er25-4	0xFF00	Application fault–encoder offset angle test timeout	Abnormity occurs during the encoder offset angle test.	Check whether the motor shaft can rotate freely, and execute again after re-power on.
Er25-5	0xFF00	Application fault–encoder offset angle test failed	The current feedback wave fluctuates violently during the encoder offset angle test.	Reduce P4.53 parameter setting, and execute again after repower-on.
Er25-6	0xFF00	Application fault–Homing offside	The limit switch or software limit is enabled during homing.	Modify the setting of P5.10 and then execute homing after re-power on.
Er25-7	0xFF00	Application fault–Inertia identifying failed	1. During inertia identifying, the motor stops rotating with vibration of longer than 3.5s. 2. The actual ACC time for inertia identifying is too short. 3. The inertia identifying speed is lower than 150r/min.	1. Improve the mechanical rigidity properly. 2. Increase the setting of P1.07. 3. Increase the setting of P1.06.

6 References

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