EtherCAT User's Manual

(Version: V1.08)

ESTUN AUTOMATION TECHNOLOGY CO., LTD.

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Version update history

Date	Version	Description
2012-11-09	V1.00	Initial release.
2013-05-31	V1.01	The section 5.8 Interpolation position mode is added.
2014-02-28	V1.02	Appendix B and Appendix C are added.
2014-04-17	V1.03	Revision: Appendix A
2014-12-05	V1.04	ProNet-70DEA-EC and ProNet-04AEF-EC
2015-03-04	V1.05	Revision: The main circuit of ProNet-10DEA-EC ~ProNet-70DEA-EC
		Revision：Pn511
2016-07-29	V1.06	Add：5.9 Profile torque mode
		Add：5.10 Cyclic synchronous position mode
		Add：5.11 Cyclic synchronous torque mode
		Add：5.12 Touch Probe function
		Add：5.13 Torque limit Function
		Add：5.14 Digital Input/Output
		Revision：5.5 Homing mode
		Revision：5.7.3 Parameters related to position control
		Revision： Chapter 6 EtherCAT communication example
		Revision： Appendix A
		Revision： Appendix D
		Revision：Pn006、Pn510、Pn511、Pn513、Pn517、Pn528
2017-12-20	V1.07	Add：ProNet-□□□EG-EC
		Add：5.16 Absolute Encoder Setup

Date	Version	Description
		Add：5.17 Conversion factors
		Revision：3.2 EtherCAT slave information
		Revision：5.16 Absolute Encoder Setup(Fn010、Fn011)
2018-07-10	V1.08	Add：EM3A

Content

Chapter 1 Brief introduction of EtherCAT

1.1 What is EtherCAT

EtherCAT is an open network based on Ethernet to achieve real time control. It could support high speed and synchronized control. By using efficient network topology, the network structure with too many concentrator and complicated connections are avoided. It is very suitable to use this protocol in motion control and other factory automation applications.
EtherCAT is registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.

1.2 EtherCAT general introduction

EtherCAT technology breaks the limits of normal internet solution. Through this technology, we don't need to receive Ethernet data, decode the data, and then copy the process data to different devices. EtherCAT slave device could read the data marked with this device's address information when the frame passes this device. As the same, some data will be written into the frame when it passes the device. In this way, data reading and data writing could be done within several nanoseconds.
EtherCAT uses standard Ethernet technology and support almost kinds of topologies, including the line type, tree type, star type and so on. Its physical layer could be 100 BASE-TXI twisted-pair wire, 100BASE-FX fiber or LVDS (low voltage differential signaling). It could also be done through switch or media converters or in order to achieve the combination of different Ethernet structure.
Relying on the ASICs for EtherCAT in the slave and DMA technology that reads network interface data, the processing of the protocol is done in the hardware. EtherCAT system could update the information for 1000 I/O within 30μs. It could exchange a frame as big as 1486 bytes within 300μs. This is almost like 12000 digital output or input. Controlling one servo with 100 8-byte I/O data only takes 100μs. Within this period, the system could update the actual positions and status presented by command value and control data. Distributed clock technology could make the cyclic synchronous error lower than 1μs.

1.3 Product introduction

ProNet servo drive achieves EtherCAT communication through EC100 network module. It is a real time Ethernet communication and the application layer applies CANopen Drive Profile (CiA 402).

Besides supporting the PV, PP, IP, HM, PT and other control mode defined in CANopen DS402, this module also supports CSP, CSV (ProNet-□□□EG-EC only)Touch Probe Function and Torque limit Function. Clients could switch the control mode by changing correspondent parameters. It is available from simple velocity control to high speed high precision position control.

1.4 CoE terms

The tables below lists the terms used in CANopen and EtherCAT.

Abbreviation	Description
APRD	Auto Increment Physical Read: a command of EtherCAT Date link layer.
APWR	Auto Increment Physical Write: a command of EtherCAT Date link layer.
APRW	Auto Increment Physical ReadWrite: a command of EtherCAT Date link layer.
ARMW	Auto Increment Physical Read Multiple Write: a command of EtherCAT Date link layer.
BRD	Broadcast Read: a command of EtherCAT Date link layer.
BRW	Broadcast Write: a command of EtherCAT Date link layer.
CiA	CAN in Automation
CoE	CANopen over EtherCAT
DC	Distributed Clocks Mechanism to synchronize EtherCAT slaves and master.
ECAT	EtherCAT
EEPROM	Electrically Erasable Programmable Read Only Memory.
ESC	EtherCAT Slave Controller
ESM	EtherCAT State Machine
ETG	EtherCAT Technology Group(http://www.ethercat.org)
EtherCAT	Real-time Standard for Industrial Ethernet Control Automation Technology(Ethernet for Control Automation Technology)
FMMU	Filedbus Memory Management Unit
INIT	INIT state of EtherCAT state machine
LRD	Logical Read: a command of EtherCAT Date link Layer
LWR	Logical Write: a command of EtherCAT Date link Layer
LRW	Logical ReadWrite: a command of EtherCAT Date link Layer
OP	Operational state of EtherCAT state machine
OD	Object Dictionary
PDO	Process Data Object
PREOP	Pre-Operational state of EtherCAT state machine
RXPDO	Receive PDO, i.e. Process Date that will be received by ESC
SAFEOP	Safe-Operational state of EtherCAT state machine
SDO	Service Data Object

Abbreviation	Description
SyncManager	ESC unit for coordinated data exchange between master and slaver controller
TXPDO	Transmit PDO, i.e. Process Date that will be transmitted by ESC

1.5 Data type

The table below lists all the data types and their range that will be used in this manual.

Code	Data type	Range
UINT8	Unsigned integer 8	0 to 255
INT8	Integer 8	-128 to +127
UINT16	Unsigned integer 16	0 to 65535
INT16	Integer 16	-32768 to +32767
UINT32	Unsigned integer 32	0 to 4294967295
INT32	Signed integer 32	–2147483648 to +2147483627
STR	string	-

1.6 Communication specifications

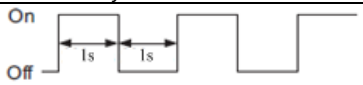
EtherCAT communication	**Applied communication standard**	IEC 61158 Type12, IEC 61800-7 CiA402 Drive Profile
	Physical layer	100BASE-TX (IEEE802.3)
	Interface	CN3 (RJ45): EtherCAT Signal IN CN4 (RJ45): EtherCAT Signal OUT
	Wiring	Level-5 twisted pair wire
	SyncManager	SM0: output mailbox, SM1: input mailbox SM2: input process data, SM3: Output process data
	FMMU	FMMU0: mapped to output area of process data(RXPDO) FMMU1: mapped to transmit area of process data(TxPDO) FMMU2: mapped to mailbox status
	EtherCAT Commands (Data Link Layer)	APRD, FPRD, BRD, LRD, APWR, FPWR, BWR, LWR, ARMW, FRMW **Note:** APRW, FPRW, BRW, LRW Commands are not supported.
	PDO data	Dynamic PDO mapping

	Mailbox (CoE)	Emergency Message, SDO Request, SDO Response, SDO information **Note:** Don't support TXPDO/RxPDO and remote TxPDO/RxPDO.
	Distributed data(DC)	Free-run, DC mode(activated by configuration) supported DC cycle time: 250us – 8ms
	SII	256 bytes(read only)
	LED light	EtherCAT system indicator(SYS)×1 EtherCAT run indicator(RUN)×1 EtherCAT error indicator(ERR)×1
CiA402 Drive Profile		Homing mode Profile position mode Profile velocity mode Profile torque mode Interpolated position mode Cyclic synchronous position mode Cyclic synchronous velocity mode (ProNet-□□□EG-EC only) Cyclic synchronous torque mode Touch probe function Torque limit function

1.7 LED indicators

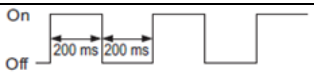
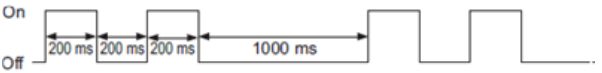
SYS

SYS light is used to show the software status in the module.

LED light(green/yellow)		**Introduction**
Status	**Description**	
Off	Continuously off	No power supply or reset status
Flashing(yellow)		Boot mode
On (green)	Continuously on	Module's internal program has finished initiation and operates well.

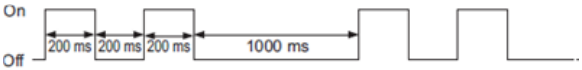
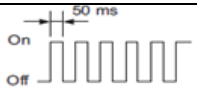
RUN

RUN light is used to indicate the communication status of EtherCAT

LED indicator(green)		Introduction
Status	**Description**	
Off	Continuously off	System initiation
Blinking		pre-operation status
Double flashing		safety operation mode
On	Continuously on	Operation status

ERR

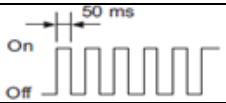
ERR light is used to indicate the error in EtherCAT communication.

LED light(red)		Introduction
Status	**Description**	
Off	Continuously off	No error
Blinking		Due to register problem or object configuration problem, the status changing required by the master couldn't be achieved.
Single flash		Sync error. Communicatio n data error
Double flash		Application program supervision overtime. SyncManager watchdog overtime
Flickerin g		Initiating error
On	Continuously on	PDI

		supervision overtime

LINK/ACT (green light on RJ45 COM1/COM2)

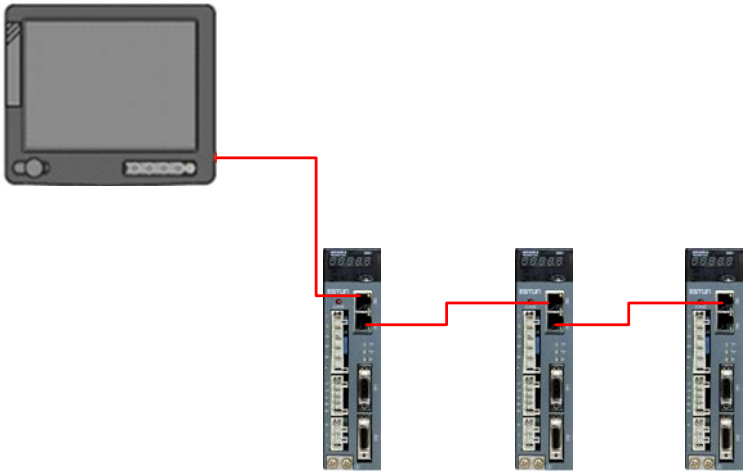
LINK/ACT light is used to indicate the physical communication and if there is data exchange.

LED light(green)		**Introduction**
Status	**Description**	
Off	Continuously off	Physical level communication has not been started. EtherCAT controller has not been started.
Flickering		slave is exchanging data
On	Continuously on	There is connection in link layer but there is no date exchange

Chapter 2 Installation and connection

2.1 Installation and connection

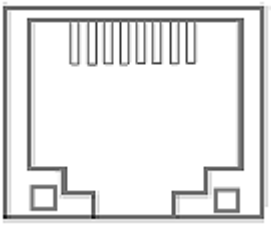
EtherCAT network is normally composed of one master (for example, industrial PC) and some slaves (for example, servo drives, filed bus terminals and so on). Every EtherCAT slave has two standard Ethernet interfaces.



EtherCAT network

2.2 EtherCAT interface specification

EtherCAT interface should be connected by twisted pair wire.
Electrical feature: according to IEEE802.3 standard
Interface: RJ45 8 pin modularize connector (According to ISO 8877)



RJ45 connector

RJ45 connector

connector	description
CN3	EtherCAT IN port
CN4	EtherCAT OUT port

Pin layout

Pin No.	Signal name	abbreviation	signal transmit direction
1	Data transmit +	TD +	Output
2	Data transmit –	TD-	Output
3	Data receive +	RD+	Input
4	Not used	–	–
5	Not used	–	–
6	Data receive –	RD-	Input
7	Not used	–	–
8	Not used	–	–
Interface grounding	grounding	FG	–

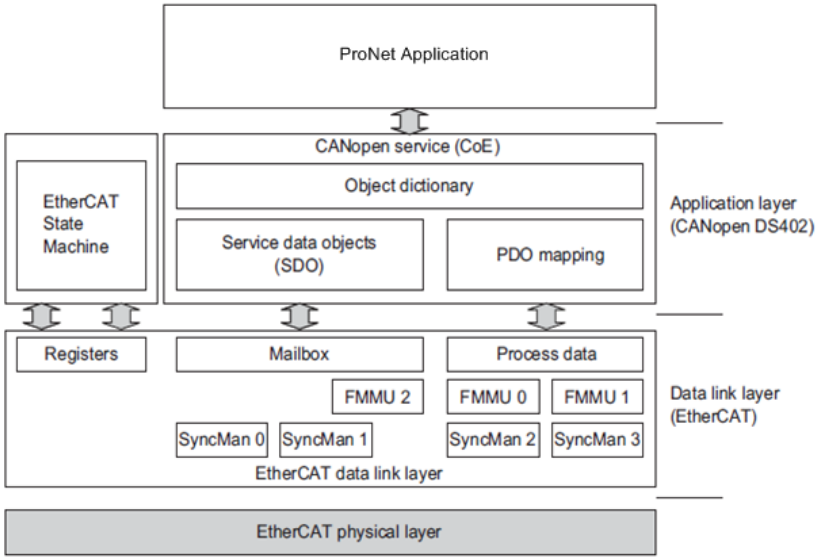
2.3 Wire specification

- Level 5 or above.
- Shield

Note: Identify the cable model is suitable for the interface. Identify items are as follows: conductor specification, single cable/pair cable, two pair/ four pair, external diameter etc.

Chapter 3 EtherCAT communication

3.1 CANopen over EtherCAT model



Communication model

EtherCAT (CoE) network model is composed of two parts: data link layer and application layer. Data link layer is mainly in charge of EtherCAT communication protocol. Application layer is mainly oriented to CANOpen drive profiles (DS402) communication protocol. Object dictionary in CoE includes parameters, application data and PDO mapping information.

Process data object (PDO) is composed of objects in the object dictionary that could operate PDO mapping. The content of PDO data is defined by PDO mapping. PDO data's read and write are periodical without checking OD. However, mail communication (SDO) is not periodic. When they are read or written, it is necessary to check OD.

Note: To decode SDO data and PDO data on EtherCAT data link layer correctly, FMMU and Sync Manager have to configure as follows

Sync Manager Configuration

Sync Manager	Assignment(Fixed)	Size	Start Address(Fixed)
Sync Manager 0	Assigned to Receive Mailbox	128byte(Fixed)	0x1000
Sync Manager 1	Assigned to Transmit Mailbox	128byte(Fixed)	0x1080
Sync Manager 2	Assigned to Receive PDO	0 to 200byte	0x1100
Sync Manager 3	Assigned to Transmit PDO	0 to 200byte	0x1D00

FMMU Settings

FMMU	Settings
FMMU 0	Mapped to Receive PDO
FMMU 1	Mapped to Transmit PDO
FMMU 2	Mapped to Fill Status of Transmit Mailbox

3.2 EtherCAT slave information

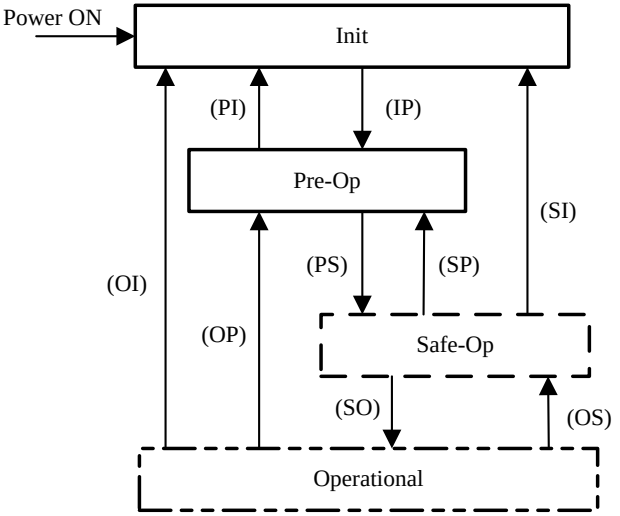
EtherCAT slave information (XML document) could be read by the master to build the master-slave configuration. ESTUN ProNet servo drive offers document as below

ESTUN_ProNet_V.xml***

*** is version number. The latest version is ESTUN_ProNet_V206. xml.

3.3 EtherCAT network state machine

EtherCAT state machine is used to describe the states that one slave applies and the state change. State change request is normally launched by the master and answered by the slave.
The graph below describes the slave's state machine.



Status	Description
Init	No mailbox communication No process data communication

Status	Description
Init to Pre-Op	Master configures data link layer address and initiate mailbox communication Master initializes DC clock synchronization. Master requests to change into Pre-op status. Master sets AL control register. Slave checks if mailbox initialization is good.
Pre-Operation (Pre-Op)	Mailbox communication is activated. Process data communication is not available.
Pre-Op to Safe-Op	Master configures SyncManager channels and FMMU channels for process data. Master configures PDO mapping and the sync manager PDO assignment parameters via SDO. Master requests 'Safe-Operational' state. Slave checks whether the sync manager channels for process data communication and, if required, the distributed clocks settings are correct.
Safe-Operation(Safe-Op)	Slave's program will transmit actual input data and will not execute output. Output is set as safety status.
Safe-Op to Op	Master transmits effective output data. Master asks to change into OP status.
Operational(Op)	Process data communication is available now.

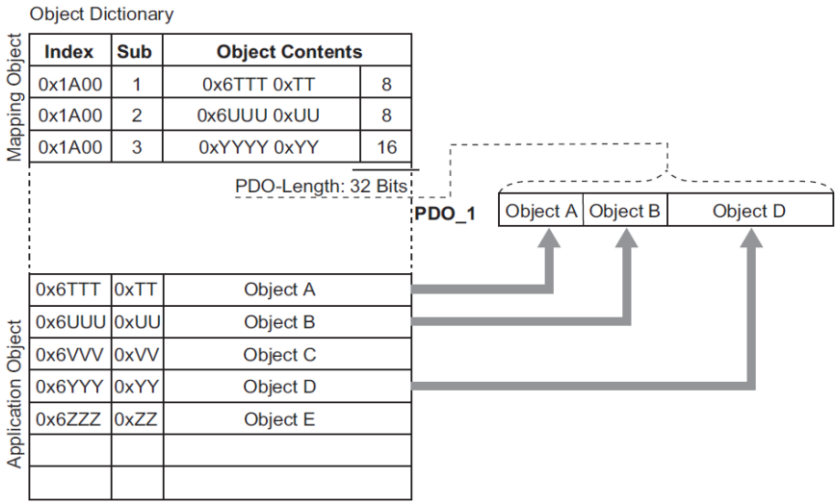
3.4 PDO mapping

Process data of EtherCAT slaves is composed by SyncMangaer channels. Each SyncMangaer channel describes the consistent area of process data. EtherCAT slaves with application control function should support PDO mapping and SM-PDO-Assign object reading.

PDO mapping

PDO mapping is related to the mapping from object dictionary to PDO's application objects (real time process data).

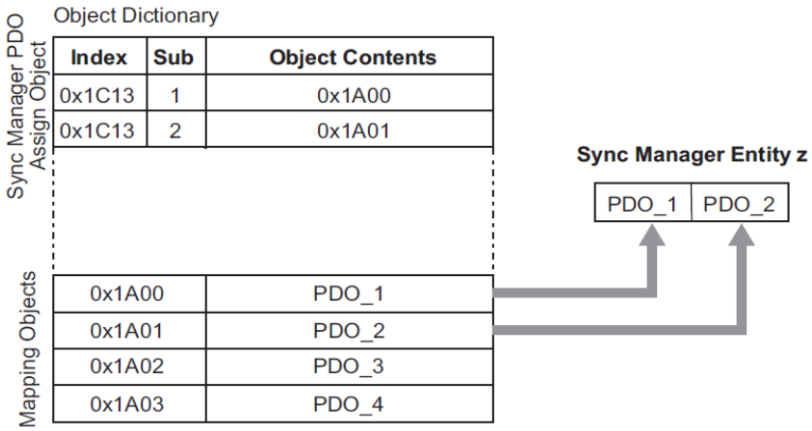
The index 0x1600 and 0x1A00 in object dictionary are separately reserved for the mapping tables of RXPDO and TxPDOs. The graph as below is one example. Each PDO mapping can add 10 objects at most, and total number of the bytes is 32 at most.



PDO mapping example

PDO configuration

Sync manager object (SMCO) is composed of multiple PDOs. SM-PDO-Assign object (0x1C12 and 0x1C13) describes the relationship between PDOs and Sync Manager as below



PDO configuration example

Note: The PDO mapping objects (index 1600h to 1603h, 1A00h to 1A03h) and the Sync Manager PDO assign objects (Index 1C12h and 1C13h) can be written only in Pre-Operation state.

PDO mapping process

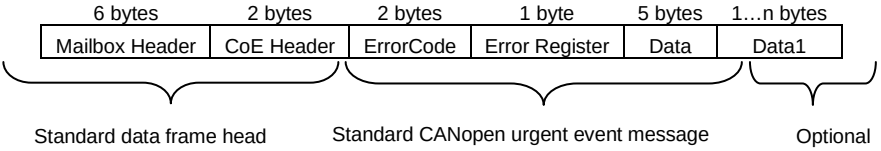
Stop PDO allocating function (set the sub-index 0 of 0x1c12 and 0x1c13 into 0).

Stop PDO mapping function (set sub-index 0 of 0x1600～0x1603 and

0x1A00～0x1A03 into 0).
Set the number of mapping entries in PDO mapping objects (Set sub-index 0 of object 0x1600h to 0x1603h/0x1A00h to 0x1A03h).
Set the assignment of the Sync manager and PDO (Set sub index 1 of object 0x1C12h and 0x1C13h)
Enable the assignment of the Sync manager and PDO (Set sub index 0 of object 0x1C12h and 0x1C13h to 1).
Over again open PDO assignment function (set the sub-index 0 of 0x1c12 and 0x1c13 into 1)

3.5 Emergency message

When the servo drive generates an alarm, Coe will activate an emergency message and inform consumers the current servo drive model number and error code.
Emergency message structure:



Byte	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Data	Emergency Error Code		Error Register (Object 1001h)	Reserved	Manufacturer Specific Error Field			
					ProNet Alarm/Warning Code		Reserved	

Chapter 4 Network synchronization based on distributed clocks

Any slave in the EtherCAT network can be used as reference clock for the whole network. It provides system time. And the distribute clock in slave device synchronizes with the reference clock. It enables slave's local application to synchronize with reference clock events.

EC-netX50 model achieves the synchronous mode as following. Switching synchronous mode can be controlled by synchronous control register (ESC 0x980 and 0x981).

- Free-Run mode (ESC register 0x981: 0x980 = 0x0000)

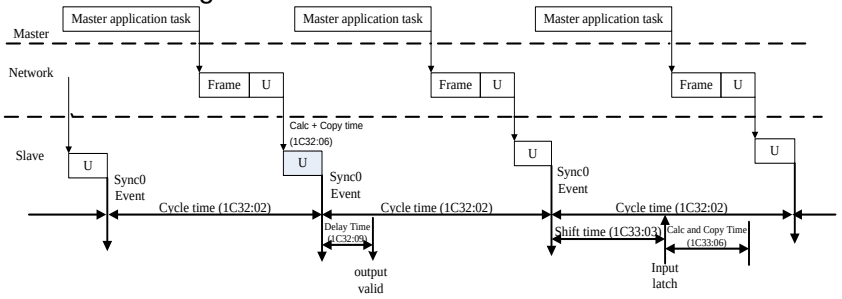
In this mode, local application cycle, communication cycle and master cycle is independent.

DC mode (ESC register 0x981: 0x980 = 0x0300)

In this mode, local application is synchronous with Sync0.

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	UINT	Sync0 event cycle [ns] (The value is set by master via ESC register.) range: 125000*n (n = 2–16) [ns]
0x1C33	Sync Manager channel 3 (process data input) Synchronization					
	3	Shift time	RW	No	UINT	125000*n (n = 0–63) [ns] Range: 0 to (Sync0 event cycle - 125000) [ns] Time between Sync0 event and the Inputs Latch.
	6	Calc and copy time	RO	No	UINT	–

Time schedule figure in DC mode is as follows:

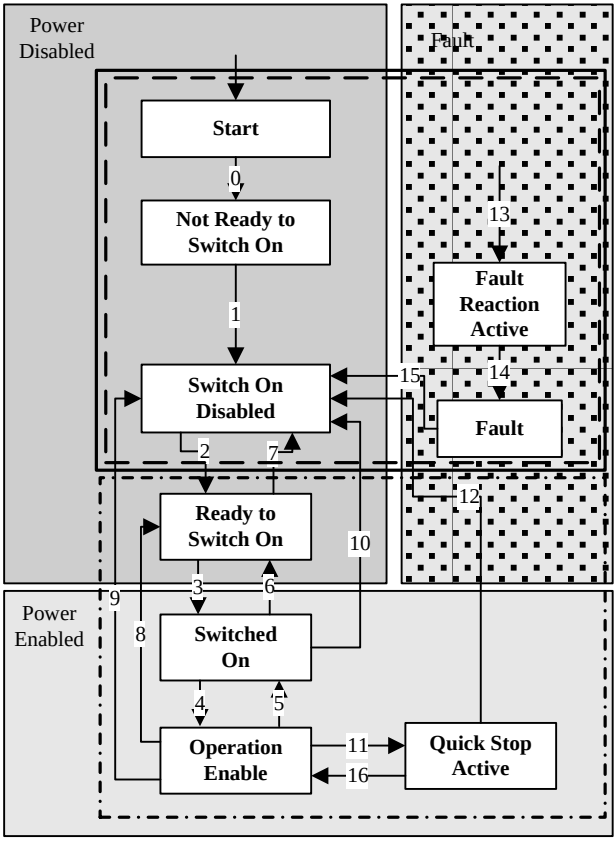


Time schedule figure in DC mode

Chapter 5 CiA402 device protocol

ProNet's device control is used mainly to achieve the motion control in different control modes. The master controls the servo drive through control word and knows the status of the servo drive by reading the servo drive's status word.

5.1 CANopen over EtherCAT(CoE) state machine



CANopen state machine

As above, the state machines could be divided into 3 parts: "power disabled", "power enabled" and "fault". All the states will be into "Fault" status after alarm. After power enabled, servo drive will finish initiating and then enter SWITECH_ON_DISA status. Now we could configure the servo drive, for example, set the working mode of the servo drive as profile position mode.

At this time, the main power supply is still shut down and the servo motor is now excitated. After the state transition 2, 3 and 4, the servo

drive will be in OPERATION ENABLE mode. At this time, the main power will be switched on and servo drive starts to control the servo motor according to the configured working mode. So, before this state, we must ensure the servo drive's parameters are correct. State Transition 9 will be used to shut down the main power supply. Once alarm happens to the servo drive, the servo drive's state will be in FAULT state.

States	Description
Not Ready to Switch On	Servo drive is initiating.
Switch On Disabled	Initiation completed.
Ready to Switch On	Servo drive enters Switch On state. The servo motor is not servo-on yet.
Switched On	Servo drive ready and main power is on
Operation Enable	Servo on and control the servo motor according to the control mode.
Quick Stop Active	Servo drive stops in pre-defined method
Fault Reaction Active	Servo drive detects alarm and stop according to pre-defined method. Servo motor is still on.
Fault	Servo off

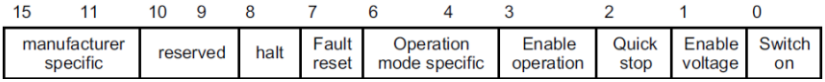
5.2 Parameters for device control

Index	Object	Name	Type	Attr.
6040 $_h$	VAR	Controlword	UINT16	RW
6041 $_h$	VAR	Statusword	UINT16	RO
605A $_h$	VAR	Quick stop option code	INT16	RW
605B $_h$	VAR	Shutdown option code	INT16	RW
605C $_h$	VAR	Disabled operation option code	INT16	RW
605D $_h$	VAR	Halt option code	INT16	RW
605E $_h$	VAR	Fault reaction option code	INT16	RW

5.2.1 controlword

Index	6040 h
Name	Control word
Object Code	VAR
Data Type	UINT16
Access	RW
PDO Mapping	YES
Units	--
Value Range	--
Default Value	0

Control word bit description:



Bit0 ~ 3 and Bit7:

The transmission of state machine will be triggered by the command composed by these 5 bits.

Device control command list

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

Note: X means this bit could be ignored.

Bit4, 5, 6,:

In different control mode, these 3 bits' definition will be different.

Bit	Control mode		
	profile position mode	profile velocity mode	homing mode
4	New set point	reserved	Start homing operation
5	Change set immediately	reserved	reserved
6	abs/rel	reserved	reserved

Bit8:
Halt. Set to 1 means servo motor stops according to the value of 605D.

The other bits: All reserved.

5.2.2 statusword

Index	6041 $_h$
Name	statusword
Object Code	VAR
Data Type	UINT16
Access	RO
PDO Mapping	YES
Units	--
Value Range	--
Default Value	--

Statusword bit introduction is as below

bit	introduction
0	Ready to switch on
1	Switched on
2	Operation enabled
3	Fault
4	Voltage enabled
5	Quick stop
6	Switch on disabled
7	Warning
8	Reserved
9	Remote
10	Target reached
11	Internal limit active
13~12	Operation mode specific
14	Reserved

bit	introduction
15	Homeflag (Absolute servo drive saves when power off)

Bit0 ~ 3 , Bit5 and Bit6:

The combination of these bits represents the status of the servo drive

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

Bit4: Voltage enabled

When this bit is **1**, it means the main power is on.

Bit5: Quick stop

When this bit is **0**, it means the servo drive will stop the servo motor according to the configuration(605A $_h$: quick_stop_option_code)

Bit7: Warning

When the bit is **1**, it means the servo drive detects alarm.

Bit9: Remote

The bit always is **1** , it means Controlword can be deal with.

Bit10: Target reached

In different control mode, this bit has different meanings.

In PP/PV/PT/CSP/CSV/CST mode, when the set value is reached, this bit will be set as 1. When Halt is activated and speed decreases to zero, this bit will be set as 1.

In HM mode, when homing is completed, this bit will be set as 1. When Halt is activated and speed decreases to zero, this bit will be set as 1.

Bit11: Internal limit active

When this bit is **1**, it means that the internal torque has surpassed the set value, or machine has run into external positive /negative limit switch.

Bit12, 13:

These two bits in different control mode have different meaning.

Bit	Control mode		
	profile position mode	profile velocity mode	homing mode
12	Set-point acknowledge	Speed	Homing attained
13	Following error	Max slippage error	Homing error

Bit15: Homeflag

When absolute servo drive Pn002.2 is 0,this bit is effective. When this bit is 1,it means homing is completed and save when power off.

The other bits: All reserved

5.2.3 shutdown_option_code

When **Operation Enable** mode is transit to **Ready** to **Switch On** status, Shutdown_option_code will be used to define how to stop the servo motor.

Index	605B $_h$
Name	Shutdown option code
Object Code	VAR
Data Type	INT16
Access	RW
PDO Mapping	NO
Units	--
Value Range	0,1
Default Value	0

value	Introduction
0	Servo drive is OFF. Servo motor will stop according to Pn004.0.
1	After the servo motor decelerates and stops according to 0x6084, the servo excitation signal will be shut down.

5.2.4 disable_operation_option_code

When the status of **Operation Enable** transits to **Switched On** status, **disable_operation_option_code** will decide how to halt.

Index	605C $_h$
Name	Disable operation option code
Object Code	VAR
Data Type	INT16
Access	RW
PDO Mapping	NO
Units	--
Value Range	0,1
Default Value	0

Value	Introduction
0	Servo drive is OFF. Servo motor will stop according to Pn004.0.
1	After the servo motor decelerates and stops according to 0x6084, the servo excitation signal will be shut down.

5.2.5 quick_stop_option_code

When the **Operation Enable** status transits to **Quick Reaction Active** status, quick_stop_option_code will define how to stop.

Index	605A $_{h}$
Name	quick_stop_option_code
Object Code	VAR
Data Type	INT16
Access	RW
PDO Mapping	NO
Units	--
Value Range	0,1,2,5,6
Default Value	0

Value	Introduction
0	Servo drive is OFF. Servo motor will stop according to Pn004.0.
1	After the servo motor decelerates and stops according to 0x6084, the servo excitation signal will be shut down.
2	After the servo motor decelerates and stops according to 0x6085, the servo excitation signal will be shut down.
5	After the servo motor decelerates and stops according to 0x6084, it will still stay in **QuickStop** status.
6	After the servo motor decelerates and stops according to 0x6085, it will still stay in **QuickStop** status.

5.2.6 halt_option_code

When bit8 of Controlword is 1, halt option code will define how to halt. .

Index	605D $_h$
Name	halt_option_code
Object Code	VAR
Data Type	INT16
Access	RW
PDO Mapping	NO
Units	--
Value Range	1,2
Default Value	0

Value	Introduction
1	Servo motor decelerates and stops according to 0x6084.
2	Servo motor decelerates and stops according to 0x6085.

5.2.7 fault_reaction_option_code

When it alarms, **fault_reaction_option_code** will decide how to halt. .

Index	605D $_h$
Name	fault_reaction_option_code
Object Code	VAR
Data Type	INT16
Access	RW
PDO Mapping	NO
Units	--
Value Range	0
Default Value	0

Value	Introduction
0	Servo drive is OFF. Servo motor will stop according to Pn004.0.

5.3 Control mode

ProNet servo drive supports 8 control modes:
Homing mode
Profile position mode

Profile velocity mode
Profile torque mode
Interpolated position mode
Cyclic synchronous position mode
Cyclic synchronous velocity mode (ProNet-□□□EG-EC only)
Cyclic synchronous torque mode
Touch probe function
Torque limit function

This chapter will mainly describe these 8 control methods as above.

5.4 Control mode parameters

Index	Object	Name	Type	Attr.
6060 h	VAR	modes_of_operation	INT8	RW
6061 h	VAR	modes_of_operation_display	INT8	RO

modes_of_operation

Servo drive's control mode is defined by modes_of_operation.

Index	6060 h
Name	modes_of_operation
Object Code	VAR
Data Type	INT8
Access	RW
PDO Mapping	YES
Units	--
Value Range	1,3,4,6,7,8,9,10
Default Value	1

Value	Introduction
0	Not any control mode
1	PROFILE POSITION MODE
3	PROFILE VELOCITY MODE
4	PROFILE TORQUE MODE
6	HOMING MODE
7	INTERPOLATED POSITION MODE
8	CYCLIC SYNCHRONIZATION POSITION
9	CYCLIC SYNCHRONIZATION VELOCITY MODE (ProNet-□□□EG-EC only)
10	CYCLIC SYNCHRONOUS TORQUE MODE

modes_of_operation_display

Servo drive's current control mode could be read from the modes_of_operation_display.

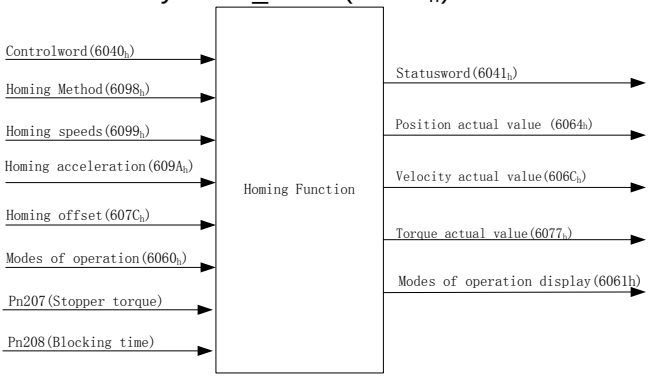
Index	6061 h
Name	modes_of_operation_display
Object Code	VAR
Data Type	INT8
Access	RO
PDO Mapping	YES
Units	--
Value Range	1,3,4,6,7,8,9,10
Default Value	1

Note: Only through the parameters of **modes_of_operation_display**, we could get the control mode of the servo drive.

5.5 Homing mode

ProNet servo drive now supports multiple homing methods. Clients could choose the homing method that suits the motor type and application.

Clients can set homing method, homing speed and acceleration. After the servo drive finds the reference point, we could also set the distance between homing position and reference point as much as the value defined by home_offset (607C h).



5.5.1 Control word

15 ~ 9	8	7 ~ 5	4	3 ~ 0
*	Halt	*	Homing operation start	*

*: please refer to previous chapters

Name	Value	Description
Homing operation start	0	Homing mode inactive
	0 → 1	Start homing mode
	1	Homing mode active
	1 → 0	Interrupt homing mode
Halt	0	Execute the instruction of bit 4
	1	Stop axle with homing acceleration

5.5.2 State word

15	14	13	12	11	10	9 ~ 0
Homeflag	*	homing_error	homing_attained	*	target_reached	*

*: Please refer to the previous chapters

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
Homeflag*	0	Home position not find
	1	Home position has found (only for absolute encoder)

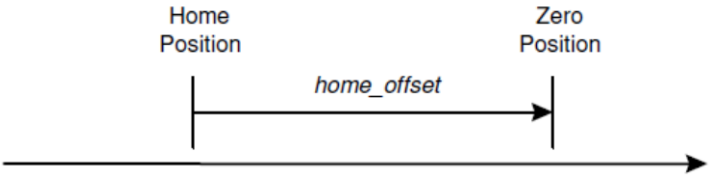
*: only for absolute encoder servo drive.

5.5.3 Parameters related to homing mode

Index	Object	Name	Type	Attr.
607C h	VAR	home_offset	INT32	RW
6098 h	VAR	homing_method	INT8	RW
6099 h	ARRAY	homing_speeds	UINT32	RW
609A h	VAR	homing_acceleration	INT32	RW
3049 h	VAR	Pn207（stopper torque）	UINT16	RW
304A h	VAR	Pn208（blocking time）	UINT16	RW

home_offset

Home_offset defines the distance between home position and zero position. If 607C is set to 0, the home position coincides in zero position. If 607C is not set to 0, the home position is mechanical home= mechanical zero +$607C_h$. When homing has completed, the value of actual position 0x6064 is the value of $607C_h$(home_offset).



Homing mode

Index	607C $_h$
Name	home_offset
Object Code	VAR
Data Type	INT32
Access	RW
PDO Mapping	YES
Units	position units
Value Range	--
Default Value	0

homing_method

There are 4 signals as homing signals: positive limit switch, negative limit switch, reference switch and Zero impulse （C pulse）.

Index	6098 $_h$
Name	homing_method
Object Code	VAR
Data Type	INT8
Access	RW
PDO Mapping	YES
Units	--
Value Range	1,2,3,4,5~14*,17,18,19,20,21~30*,33~34*,35,-1~-4*
Default Value	1

*: only for ProNet-□□□EG-EC.

homing method table

Method	Direction	Target position	Reference Position	DS402
1	Negative	NOT	Zero impulse	1
2	Positive	POT	Zero impulse	2
3	Negative	Reference switch	Zero impulse	3
4	Positive	Reference switch	Zero impulse	4
5	Negative	Reference switch	Zero impulse	5
6	Positive	Reference switch	Zero impulse	6
7	Positive	Reference switch	Zero impulse	7
8	Positive	Reference switch	Zero impulse	8
9	Positive	Reference switch	Zero impulse	9
10	Positive	Reference switch	Zero impulse	10
11	Negative	Reference switch	Zero impulse	11
12	Negative	Reference switch	Zero impulse	12
13	Negative	Reference switch	Zero impulse	13
14	Negative	Reference switch	Zero impulse	14
17	Negative	NOT	NOT	17
18	Positive	POT	POT	18
19	Negative	Reference switch	Reference switch	19
20	Positive	Reference switch	Reference switch	20
21	Negative	Reference switch	Reference switch	21
22	Positive	Reference switch	Reference switch	22
23	Positive	Reference switch	Reference switch	23
24	Positive	Reference switch	Reference switch	24
25	Positive	Reference switch	Reference switch	25
26	Positive	Reference switch	Reference switch	26

27	Negative	Reference switch	Reference switch	27
28	Negative	Reference switch	Reference switch	28
29	Negative	Reference switch	Reference switch	29
30	Negative	Reference switch	Reference switch	30
33	Negative	Current position	Zero impulse	33
34	Positive	Current position	Zero impulse	34
35	--	Current position	Current position	35
-4	Positive	Target torque	Zero impulse	Reserved
-3	Negative	Target torque	Zero impulse	Reserved
-2	Positive	Target torque	Target torque	Reserved
-1	Negative	Target torque	Target torque	Reserved

homing_speeds

Two kinds of speed are used in finding the reference position: The speed to find reference position and the speed to find zero position.

Index	6099 h
Name	homing_speeds
Object Code	ARRAY
No. of Elements	2
Data Type	INT32

Sub-Index	01 h
Name	speed_during_search_for_switch
Object Code	VAR
Data Type	INT32
Access	RW
PDO Mapping	YES
Units	speed units (0.1r/min)
Value Range	--
Default Value	5000

Sub-Index	02 $_h$
Name	speed_during_search_for_zero
Object Code	VAR
Data Type	INT32
Access	RW
PDO Mapping	YES
Units	speed units (0.1r/min)
Value Range	--
Default Value	100

Pn207（stopper torque）

It is used for homing method -4、-3、-2、-1.When the drive hits an end so that the torque set in Pn207 is reached for the blocking time set in Pn208,movement in the opposite direction or makes the current position for the origin.

Index	3049$_h$
Name	Pn207（stopper torque）
Object Code	VAR
Data Type	UINT16
Access	RW
PDO Mapping	NO
Units	1% rated torque
Value Range	0-200
Default Value	20

Pn208（blocking time）

It is used for homing method -4、-3、-2、-1.When the drive hits an end so that the torque set in Pn207 is reached for the blocking time set in Pn208,movement in the opposite direction or makes the current position for the origin.

Index	$304A_h$
Name	Pn208（Blocking time）
Object Code	VAR
Data Type	UINT16
Access	RW
PDO Mapping	NO
Units	0.125ms
Value Range	0-10000
Default Value	100

homing_acceleration

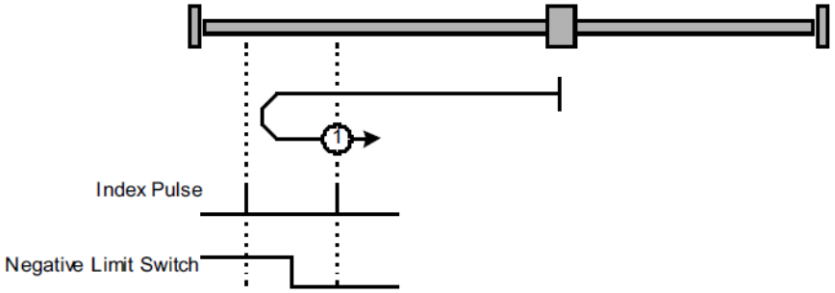
Acceleration and deceleration in homing are all defined by homing_acceleration.

Index	$609A_h$
Name	homing_acceleration
Object Code	VAR
Data Type	INT32
Access	RW
PDO Mapping	YES
Units	acceleration units (0.1 r/min/s)
Value Range	--
Default Value	0

5.5.4 Homing method

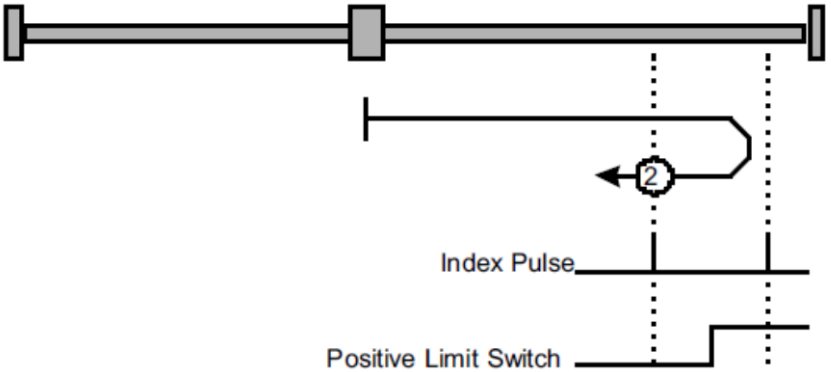
Homing method 1: Use C pulse and negative limit switch

Servo drive needs to move at first toward negative direction fast till reaching the negative limit switch and then decelerate till stop. And then, servo motor will be bounced back slowly and find the target homing position. Under this homing method, the target homing position is the first C pulse away from the limit switch.



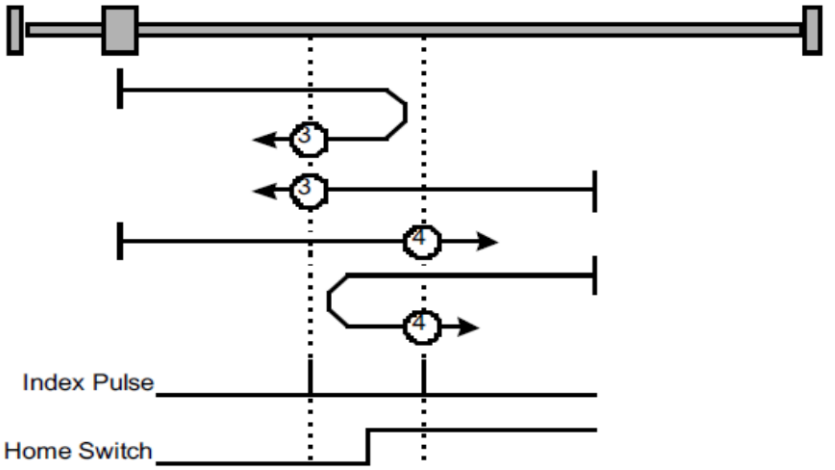
Homing method 2: Use C pulse and positive limit switch

At first servo motor will move fast toward positive direction and decelerate to stop after reaching the positive limit switch. And then servo motor will be bounced back slowly to find homing position. Under this homing method, the target homing position is the first C pulse away from the limit switch.



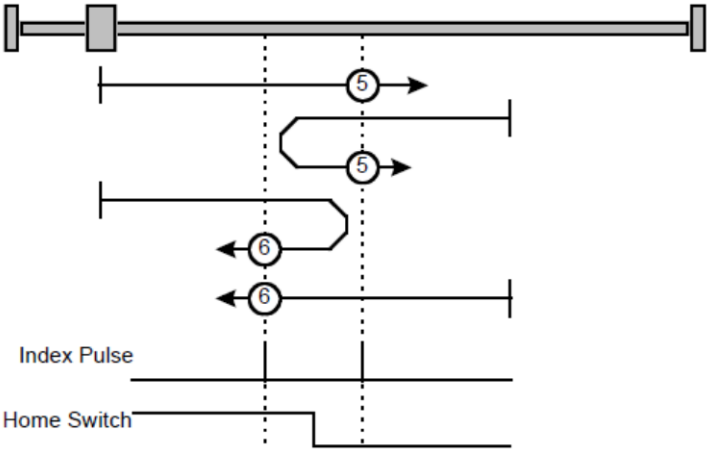
Homing method 3 and 4: Use C pulse and positive reference point limit switch

It is used that reference point limit switch is on positive direction and negative direction is zero. That is on the end of movement positive direction. Servo drive's initial moving direction is relied on the status of reference point limit switch. The target homing position is on the left side or right side of the reference limit switch. The distance between the reference position switch and homing position is one C pulse.



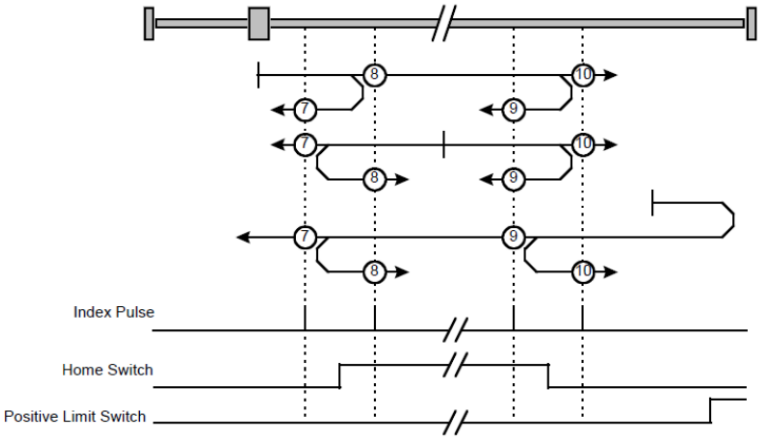
Homing method 5 and 6: Use C pulse and negative reference point limit switch

It is used that reference point limit switch is on negative direction and positive direction is zero. That is on the edge of movement negative direction. Servo drive's initial moving direction is relied on the status of reference point limit switch. The target homing position is on the left side or right side of the reference limit switch. The distance between the reference position switch and homing position is one C pulse.



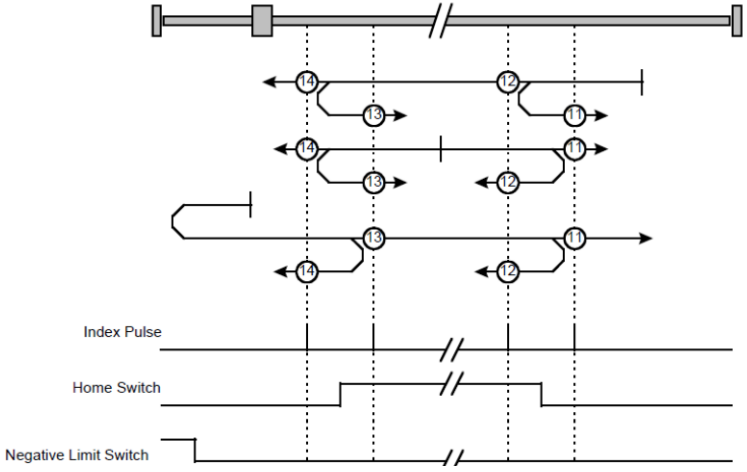
Homing method 7~10: Use C pulse，reference point limit switch and positive limit switch

It is used that reference point limit switch is in the middle. And homing is according to C pulse，reference point limit switch and positive limit switch. The final mechanical point is the position of C pulse.



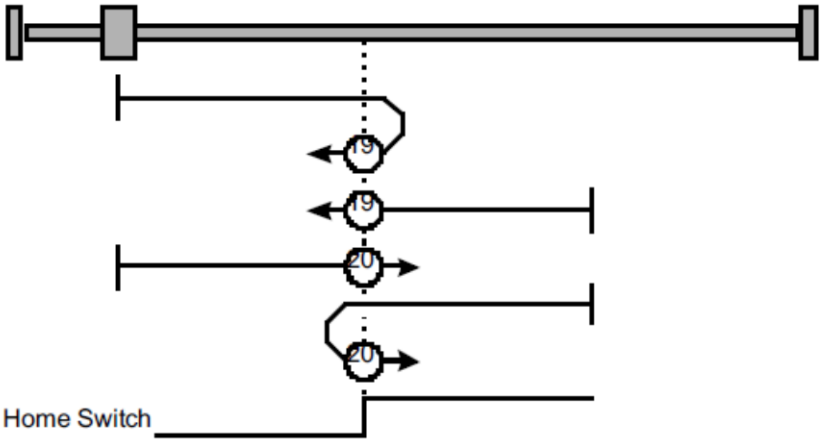
Homing method 11~14: Use C pulse，reference point limit switch and negative limit switch

It is used that reference point limit switch is in the middle. And homing is according to C pulse，reference point limit switch and negative limit switch. The final mechanical point is the position of C pulse.



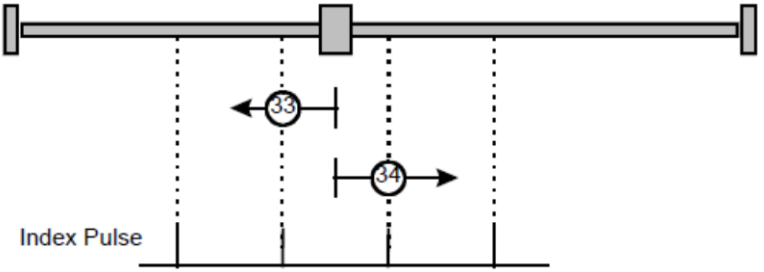
Homing method 17 ~ 30: Not use C pulse

Homing methods 17~30 are similar to method 1~14, but the target homing position is not relied on C pulse any more but on the change of limit switch or reference point. For example, as below, method 19 and method 20 are just similar to method 3 and method 4.



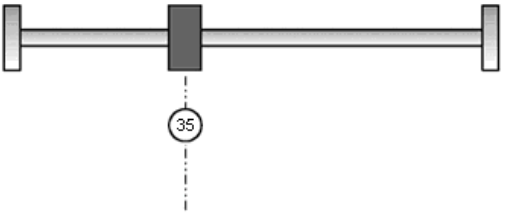
Homing method 33 and 34: Homing on the position on reaching C pulse from current position

Homing method 33: The drive moves slowly into the negative direction, stops until reaches C pulse. Homing method 34 is similar to method 34.



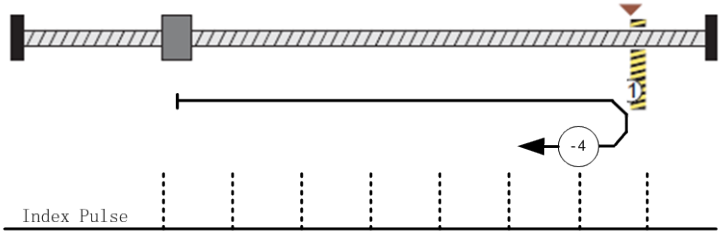
Homing method 35: Homing on the current position

In this method, the current position shall be taken to be the home position.



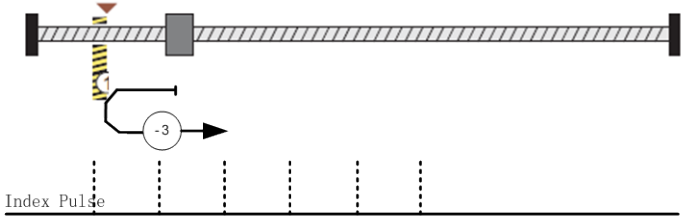
Homing method -4 Movement in positive direction, hitting an end and reversing to travel，the target homing position is the first C pulse

In this method, the motor moves in positive direction. When it hits an end so that the torque set in Pn207 is reached for the blocking time set in Pn208,movement in the opposite direction, and the target homing position is the first C pulse.



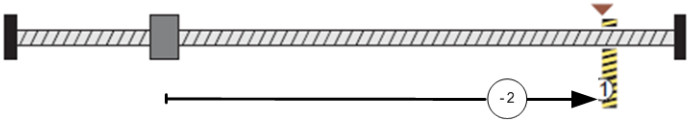
Homing method -3 Movement in negative direction, hitting an end and reversing to travel，the target homing position is the first C pulse

In this method, the motor moves in negative direction. When it hits an end so that the torque set in Pn207 is reached for the blocking time set in Pn208,movement in the opposite direction, and the target homing position is the first C pulse.



Homing method -2:Movement in positive direction, hitting an end, makes the current position for the origin.

In this method, the motor moves in positive direction. When the drive hits an end so that the torque set in Pn207 is reached for the blocking time set in Pn208,and makes the current position for the origin.

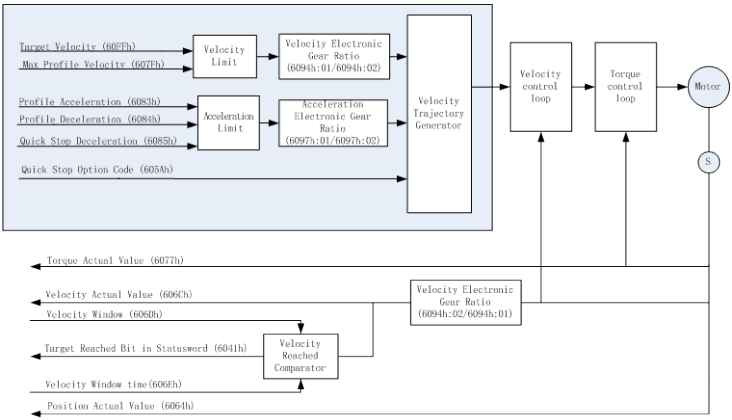


Homing method -1:Movement in negative direction, hitting an end, makes the current position for the origin.

In this method, the motor moves in negative direction. When the drive hits an end so that the torque set in Pn207 is reached for the blocking time set in Pn208,and makes the current position for the origin.

5.6 Profile velocity mode

In the profile velocity mode, the speed is output in accordance with the acceleration and deceleration, until it reaches the target velocity. The following figure shows the block diagram of the profile velocity mode.



5.6.1 Control word

15 ~ 9	8	7 ~ 4	3 ~ 0
*	Halt	*	*

*: Refer to previous chapters

Name	Value	Description
Halt	0	Execute the motion
	1	Stop axle

5.6.2 State word

15 ~ 14	13	12	11	10	9 ~ 0
*	MaxSlippageError	Speed	*	Target reached	*

*: Refer to previous chapters

Name	Value	Description
Target reached	0	Halt = 0: Target velocity not reached Halt = 1: Axle decelerates
	1	Halt = 0: Target velocity reached

		Halt = 1: Axle has velocity 0
Speed	0	Speed is not equal 0
	1	Speed is equal 0
Max slippage error	0	Maximum slippage not reached
	1	Maximum slippage reached

5.6.3 Parameters related to velocity mode

Index	Object	Name	Type	Attr.
6069 $_h$	VAR	velocity_sensor_actual_value	INT32	RO
606B $_h$	VAR	velocity_demand_value	INT32	RO
606C $_h$	VAR	velocity_actual_value	INT32	RO
606D $_h$	VAR	velocity_window	UINT16	RW
606E $_h$	VAR	velocity_window_time	UINT16	RW
606F $_h$	VAR	velocity_threshold	UINT16	RW
6070 $_h$	VAR	velocity_threshold_time	UINT16	RW
60FF $_h$	VAR	target_velocity	INT32	RW

velocity_sensor_actual_value

The master could read **velocity_sensor_actual_value** to know the current velocity. The parameter's unit is internal speed unit.

Index	6069 $_h$
Name	velocity_sensor_actual_value
Object Code	VAR
Data Type	INT32
Access	RW
PDO Mapping	YES
Units	speed units (0.1 r/min)
Value Range	--
Default Value	--

velocity_demand_value

Master can read **velocity_demand_value** to know the current reference speed value of the servo drive. The unit of this parameter is user's velocity unit.

Index	606B $_h$
Name	velocity_demand_value
Object Code	VAR
Data Type	INT32
Access	RO
PDO Mapping	YES
Units	speed units (0.1 r/min)
Value Range	--
Default Value	--

velocity_actual_value

The master can read **velocity_ actual _value** to know the current velocity of the servo motor. The unit of this parameter is user's velocity unit.

Index	606C $_h$
Name	velocity_actual_value
Object Code	VAR
Data Type	INT32
Access	RO
PDO Mapping	YES
Units	speed units (0.1 r/min)
Value Range	--
Default Value	--

velocity_window

The difference between **velocity_actual_value** (606C $_h$) and **target_velocity** (60FF $_h$) is defined as actual velocity error window. If the actual velocity error window is always smaller than **velocity_window**(606D $_h$) within the time set by **velocity_window_time**(606E $_h$), then bit 10 of status word (target_reached) will be set as 1 to indicate that the set velocity has been reached.

Index	606D h
Name	velocity_window
Object Code	VAR
Data Type	UINT16
Access	RW
PDO Mapping	YES
Units	speed units (0.1 r/min)
Value Range	--
Default Value	20

velocity_window_time

Velocity window comparator is composed of **velocity_window_time** and **velocity_window**.

Index	606E $_{h}$
Name	velocity_window_time
Object Code	VAR
Data Type	UINT16
Access	RW
PDO Mapping	YES
Units	ms
Value Range	--
Default Value	0

velocity_threshold

Velocity_threshold indicates a range close to zero speed in order to define if the servo motor has already stopped.

Index	606F $_{h}$
Name	velocity_threshold
Object Code	VAR
Data Type	UINT16
Access	RW
PDO Mapping	YES
Units	speed units (0.1 r/min)
Value Range	--
Default Value	10

velocity_threshold_time

Velocity_threshold_time is used to set the shortest time when servo motor's speed is under velocity threshold. The unit is: **ms**. When the time that servo motor's speed is lower than the threshold is more than **velocity_threshold_time**, status word bit 12(speed is zero) will be set as **1**.

Index	6070 $_{h}$
Name	velocity_threshold_time
Object Code	VAR
Data Type	UINT16
Access	RW
PDO Mapping	YES
Units	ms
Value Range	--
Default Value	0

target_velocity

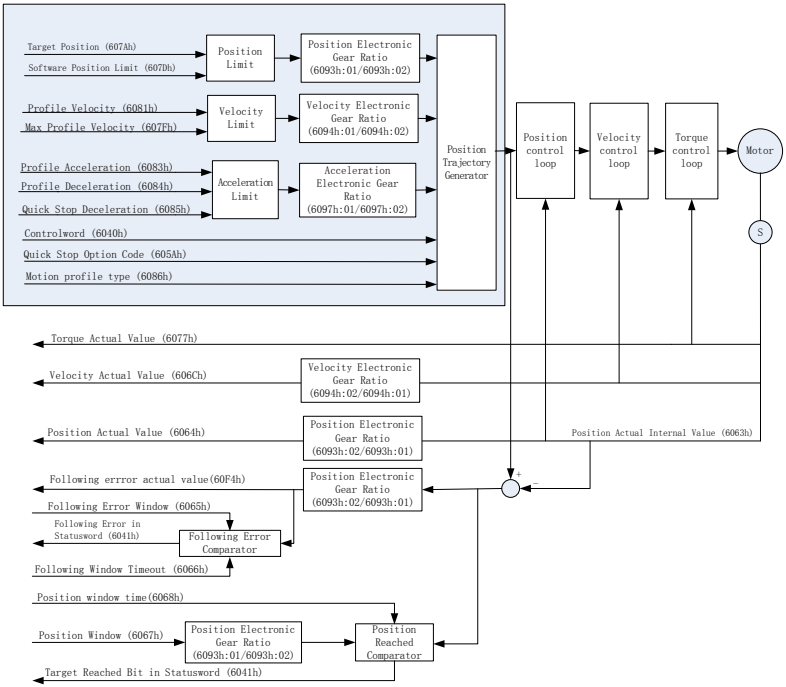
Target_velocity is reference speed.

Index	60FF $_h$
Name	target_velocity
Object Code	VAR
Data Type	INT32
Access	RW
PDO Mapping	YES
Units	speed units
Value Range	--
Default Value	0

5.7 Profile position mode

In the profile position mode, the motor position is controlled in accordance with the target position, target velocity , acceleration and deceleration, until it reaches the target position.

The following figure shows the block diagram of the profile position mode.



5.7.1 Control word

15 ~ 9	8	7	6	5	4	3 ~ 0
*	Halt	*	abs / rel	change set immediately	New set-point	*

*: Please refer to previous chapters

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)

5.7.2 State word

15 ~ 14	13	12	11	10	9 ~ 0
*	Following error	Set_point acknowledge	*	Target reached	*

*: please refer to previous chapters

N-ame	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

5.7.3 Parameters related to position control

Index	Name	Type	Attr.	PDO Mapping	M/O
6040_h	Control word	UINT16	RW	YES	M
6041_h	Statusword	UINT16	RO	YES	M
$607A_h$	target_position	INT32	RW	YES	M
$607D_h$	Software_position_limit	INT32	RW	NO	O
6081_h	profile_velocity	UINT32	RW	YES	M
6082_h	end_velocity	UINT32	RW	YES	O

Index	Name	Type	Attr.	PDO Mapping	M/O
6083_h	profile_acceleration	UINT32	RW	YES	O
6084_h	profile_deceleration	UINT32	RW	YES	O
6085_h	quick_stop_deceleration	UINT32	RW	YES	O
6086_h	motion_profile_type	INT16	RW	YES	M

target_position

Target_position is reference position and this position could be an incremental value or an absolute value. It is up to bit6 of control word.

Index	607A $_h$
Name	target_ position
Object Code	VAR
Data Type	INT32
Access	RW
PDO Mapping	YES
Units	position units
Value Range	--
Default Value	0

profile_velocity

Profile_velocity is the speed that the servo motor could finally reach after acceleration.

Index	6081 $_h$
Name	profile_velocity
Object Code	VAR
Data Type	UINT32
Access	RW
PDO Mapping	YES
Units	speed units (0.1 r/min)
Value Range	--
Default Value	0

end_velocity

End_velocity is the speed when servo motor reaches the **target_position**. Normally we set this value as **0** in order to stop the servo motor when the servo motor reaches the requested position.

But in continuous multiple position, this value could be set as a non-zero value.

Index	6082 h
Name	end_velocity
Object Code	VAR
Data Type	UINT32
Access	RW
PDO Mapping	YES
Units	speed units (0.1 r/min)
Value Range	--
Default Value	0

profile_acceleration

Profile_acceleration is the acceleration speed before reaching the target position.

Index	6083 h
Name	profile_acceleration
Object Code	VAR
Data Type	UINT32
Access	RW
PDO Mapping	YES
Units	acceleration units (0.1 r/min/s)
Value Range	--
Default Value	100000 R/10min/s

profile_deceleration

Profile_deceleration is the deceleration speed before reaching the target position.

Index	6084 h
Name	profile_deceleration
Object Code	VAR
Data Type	UINT32
Access	RW
PDO Mapping	YES
Units	acceleration units (0.1 r/min/s)
Value Range	--
Default Value	100000 R/10min/s

quick_stop_deceleration

Quick_stop_deceleration is the deceleration speed in Quick Stop.

Index	6085 h
Name	quick_stop_deceleration
Object Code	VAR
Data Type	UINT32
Access	RW
PDO Mapping	YES
Units	acceleration units (0.1 r/min/s)
Value Range	--
Default Value	200000 R/10min/s

motion_profile_type

Motion_profile_type is used to select the motion curve. Now we only support trapezoid speed curve and S speed curve.

Index	6086 h
Name	motion_profile_type
Object Code	VAR
Data Type	INT16
Access	RW
PDO Mapping	YES
Units	--
Value Range	0：trapezoid speed curve 2：S speed curve
Default Value	0

profile_jerk1

Profile_jerk1 is used to set the jerk of speed profile. The value is more smaller,the speed changing is more smooth.

Index	60A4 -01h
Name	profile_jerk1
Object Code	VAR
Data Type	UINT32
Access	RW
PDO Mapping	YES
Units	jerk units
Value Range	1-20
Default Value	5pulse/(s*100μs*100μs)

5.7.4 Function description

There are two methods to allocate a reference position.

Single step setting:

After reaching the target position, servo drive will inform the master that **Reach the target position**. And the servo drive will start new motion after getting new target position. Before getting the new reference position, the velocity of the servo motor is zero.

Continuous setting:

After reaching the target position, the servo motor will keep moving toward next target position which is set in advance. In this way, the servo motor could move continuously without pause. Between two

reference positions, the servo motor doesn't need to decelerate to zero.

Above two methods could be switched to each other by using control word bit 4, bit 5 and statues word bit 12 (**set_point_acknowledge**) in real time. Through handshaking mechanism, we could pause the position control in the process and use these bits above to reset the target position and then re-active and operate.

Single step setting procedure:

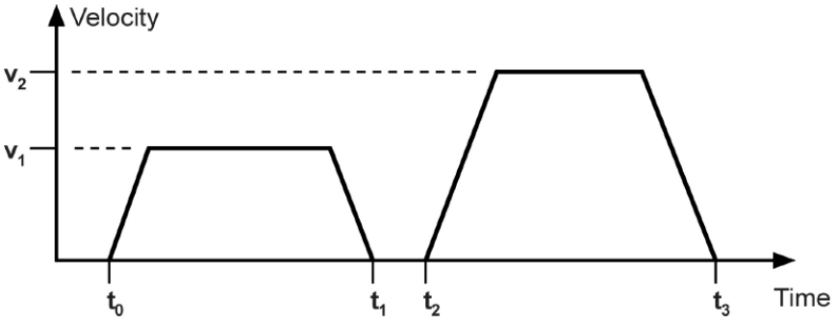
At first, set the NMT status into Operational and set the control mode parameter (6060 $_h$) as **1**.

According to the actual demand, we could set the target position (**target_positon**: 607A $_h$) and so on.

We need set bit4 (**new_set_point**) of the control word as **1**, bit 5 (**change_set_immediately**) as **0**, bit 6 (absolute/comparative) should be determined by whether the reference target position is an absolute value or a comparative value.

We use bit12 (**set_point_acknowledge**) of the status word to configure the servo drive acknowledge mechanism. And then we start to operate position control.

After reaching the target position, servo drive will need to respond through bit 10 (**target_reached**) of the status word. And then servo drive will follow the program to keep moving or accept new target position.



Continuous step setting procedure:

1 At first, we need to set NMT status into operational and set control mode (6060 $_h$) as 1. According to actual demand, we need to set the first target position (**target_position**: 607A $_h$), target speed, acceleration/deceleration and other relevant parameters.

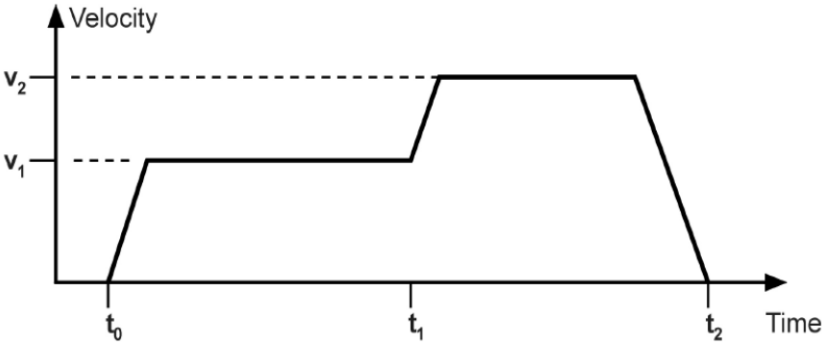
Set bit 4 (**new_set_point**) of control word as **1**. Set bit 5 (**change_set_immediately**) as 0. Set bit6 (absolute/comparative) according to the type of object position.

Set bit 12 (**set_point_acknowledge**) of the status word and then start to operate position control.

Set the second target position (**target_position**: 607A $_h$), target speed, acceleration/deceleration speed.

Set bit4 (**new_set_point**) as **1**, bit 5 (**change_set_immediately**) as **0**. Set Bit6 (absolute/comparative) according to the target position type.

After reaching the first target position, the servo drive will not stop and keep moving toward the second target position. After reaching the second target position, the servo drive will respond through status word bit 10 (**target_reached**). And then the servo motor will follow the program to keep moving or accept new target position.



5.8 Interpolation position mode

5.8.1 Control word

15 ~ 9	8	7	6	5	4	3 ~ 0
*	Halt	*	*	*	Enable ip mode	*

*: please refer to previous chapters

Name	Value	Description
Enable ip mode	0	Interpolated position mode inactive
	1	Interpolated position mode active
Halt	0	Execute the instruction of bit 4
	1	Stop axle

5.8.2 State word

15 ~ 14	13	12	11	10	9 ~ 0
*	*	ip mode active	*	Target reached	*

*: please refer to previous chapters

Name	Value	Description
Target reached	0	Halt = 0: Target position not (yet) reached Halt = 1: Axle decelerates
	1	Halt = 0: Target position reached Halt = 1: Velocity of axle is 0
ip mode active	0	Interpolated position mode inactive
	1	Interpolated position mode active

5.8.3 Parameters related to interpolation position control

Index	Object	Name	Type	Attr.
60C0 **h**	VAR	Interpolation sub mode select	INT16	RW
60C1 **h**	ARRAY	Interpolation data record	INT32	RW
60C2 **h**	RECORD	Interpolation time period		RW

Interpolation sub mode select

Interpolation sub mode select is used to select the method of interpolation under IP control.

ProNet servo drive only offers linear interpolation.

Index	60C0h
Name	Interpolation sub mode select
Object Code	VAR
Data Type	INT16
Access	RW
PDO Mapping	NO
Value Range	0
Default Value	0
Comment	0: Linear interpolation

Interpolation data record

Interpolation data record is used to reserve interpolation potion data. Our servo drive's interpolation command only uses the first data whose subindex is 1.

Index	60C1h
Subindex	0
Object Code	ARRAY
Data Type	INT32
Access	RO
PDO Mapping	YES
Value Range	INT8
Default Value	2
Comment	number of entries

Index	60C1h
Subindex	1
Object Code	ARRAY
Data Type	INT32
Access	RW
PDO Mapping	YES
Value Range	INT32
Default Value	0
Comment	the first parameter of ip function

Index	60C1h
Subindex	2
Object Code	ARRAY
Data Type	INT32
Access	RW
PDO Mapping	YES
Value Range	INT32
Default Value	0
Comment	The second parameter of ip function

Interpolation time period

Interpolation time period is used to reserve the time data of interpolation position.

Index	60C2h
Subindex	0
Object Code	RECORD
Data Type	INT8
Access	RO
PDO Mapping	NO
Value Range	2
Default Value	2
Comment	number of entries

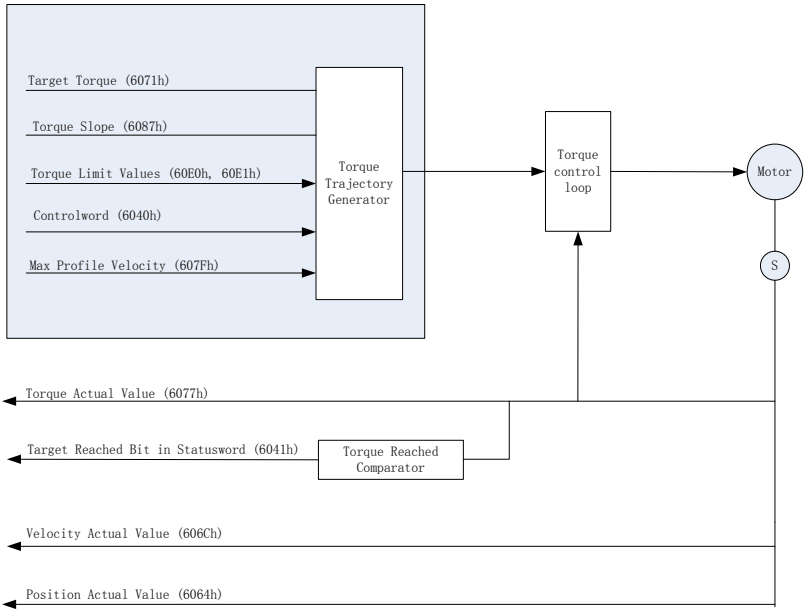
Index	60C2h
Subindex	1
Object Code	
Data Type	UINT8
Access	RW
PDO Mapping	YES
Value Range	0~255
Default Value	1
Comment	Interpolation time units

Index	60C2h
Subindex	2
Object Code	
Data Type	INT8
Access	RW
PDO Mapping	YES
Value Range	-4~0
Default Value	-3
Comment	Interpolation time index

5.9 Profile torque mode

Profile torque mode operates the controller outputs a target torque. Servo drive outputs signal to control the motor according to the target torque and acceleration. Speed limit is $607F_h$.

The following figure shows the block diagram of the profile torque mode.



5.9.1 Control word of profile torque mode

15 ~ 9	8	7 ~ 4	3 ~ 0
*	Halt	*	*

*: refer to previous chapters

Name	Value	Description
Halt	0	Execute the motion
	1	Stop axle

5.9.2 Status word of profile torque mode

15 ~ 11	10	9 ~ 0
*	Target reached	*

*: refer to previous chapters

Name	Value	Description
Target reached	0	• Halt = 0: Target torque not reached • Halt = 1: Axle decelerates
	1	• Halt = 0: Target torque reached • Halt = 1: Axle has velocity 0

5.9.3 Relevant parameters of profile torque mode

Index	Name	Type	Attr.	PDO Mapping	M/O
6071_h	Target_Torque	INT16	RW	YES	M
6087_h	Torque_Slope	UINT32	RW	YES	M
6077_h	Torque_Actual_Value	INT16	RO	YES	M
$607F_h$	Max profile velocity	UINT32	RW	YES	O

Target_Torque

The object **Target_Torque** is store target torque set value.

Index	6071h
Name	Target_Torque
Object Code	VAR
Data Type	INT16
Access	RW
PDO Mapping	YES
Value Range	0-3000(1‰rated torque)
Default Value	0

Torque_Slope

The object **Torque_Slope** determines the destination torque acceleration to store.

Index	6087h
Name	Torque_Slope
Object Code	VAR
Data Type	UINT16
Access	RW
PDO Mapping	YES
Value Range	0-100000 (1‰rated torque/s)
Default Value	100

Torque_Actual_Value

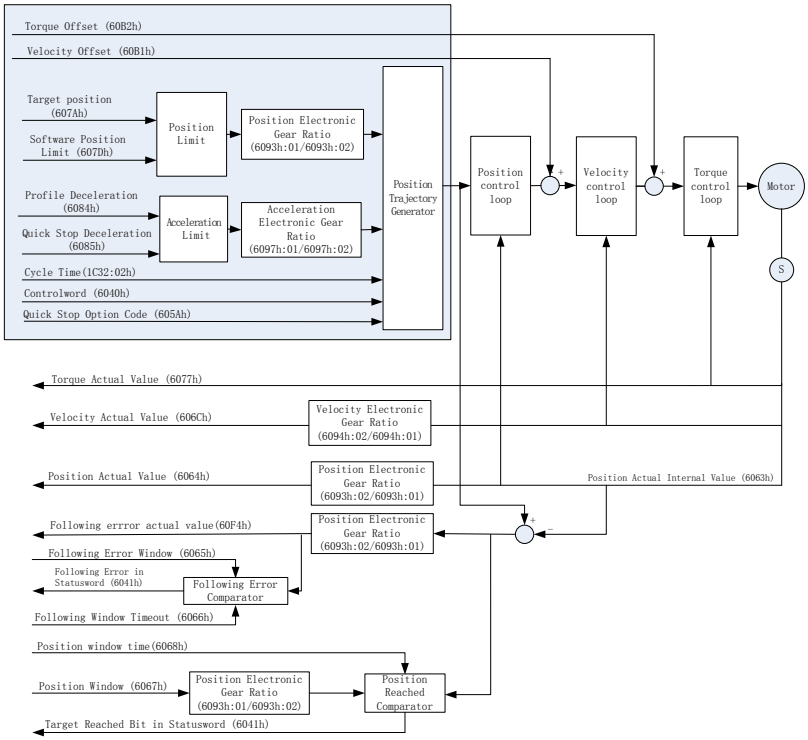
Index	6077h
Name	Torque_Actual_Value
Object Code	VAR
Data Type	INT16
Access	RO
PDO Mapping	YES
Value Range	-
Default Value	-

Max profile velocity

Index	607Fh
Name	Max profile velocity
Object Code	VAR
Data Type	UINT32
Access	RW
PDO Mapping	YES
Value Range	-
Default Value	Value set in Pn406

5.10 Cyclic synchronous position mode

Cyclic synchronous position mode is similar to position interpolation mode. In this control mode, the master could offer extra speed and torque to achieve speed and torque feed forward control. The interpolation cycle time defines the time for target position updating. In this case, interpolation cycle time is the same as sync time.



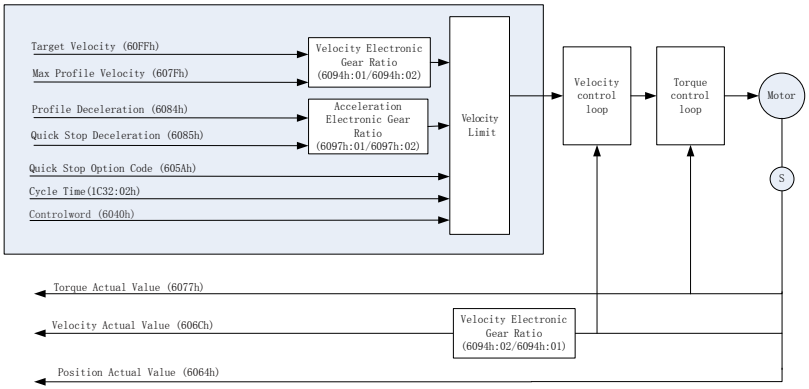
Refer to the objects are as follows:

Index	Name	Type	Attr.	PDO Mapping	M/O
6040_h	Controlword	UINT16	RW	YES	M
6041_h	Statusword	UINT16	RO	YES	M
6064_h	Position_actual_value	INT32	RO	YES	M
$607A_h$	target_position	INT32	RW	YES	M
$607D_h$	Software_position_limit	INT32	RW	NO	O
6085_h	quick_stop_deceleration	UINT32	RW	YES	O
$60B1_h$	Velocity offset	INT32	RW	YES	O
$60B2_h$	Torque offset	INT16	RW	YES	O
$60E0_h$	Positive Torque Limit Value	UINT16	RW	YES	O
$60E1_h$	Negative Torque Limit Value	UINT16	RW	YES	O

5.11 Cyclic synchronous velocity mode (ProNet-□□□EG-EC only)

In cyclic synchronous velocity mode，the host controller give a target speed value to the servo drive periodically. And the servo drive

control the motor according to the target velocity value. The following figure shows the control mode：

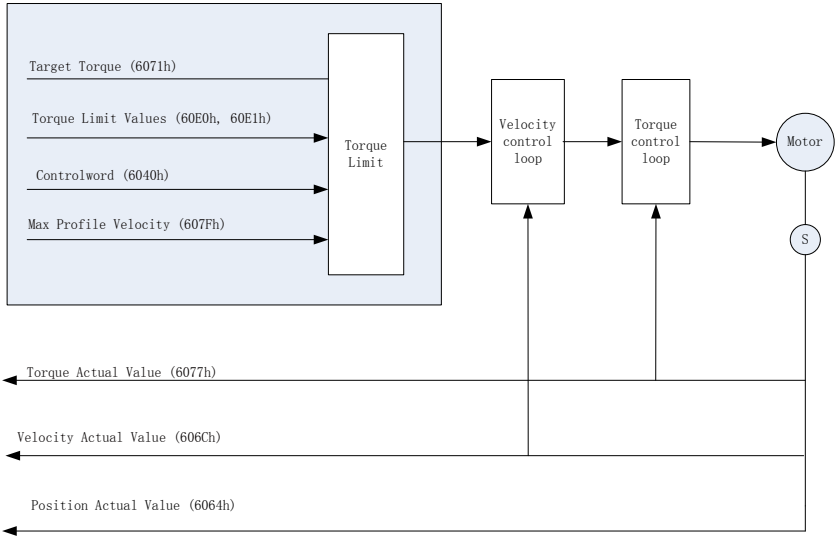


Refer to the objects are as follows:

Index	Object	Name	Type	Attr.
6069 $_h$	VAR	velocity_sensor_actual_value	INT32	RO
606B $_h$	VAR	velocity_demand_value	INT32	RO
606C $_h$	VAR	velocity_actual_value	INT32	RO
60FF $_h$	VAR	target_velocity	INT32	RW

5.12 Cyclic synchronous torque mode

In cyclic synchronous torque mode，the host controller give a target torque value to the servo drive periodically. And the servo drive control the motor according to the target torque value. The following figure shows the control mode：



Refer to the objects as follows:

Index	Name	Type	Attr.	PDO Mapping	M/O
6071_h	Target torque	INT16	RW	YES	M
6077_h	Torque actual value	INT16	RO	YES	M
$60E0_h$	Positive Torque Limit Value	UINT16	RW	YES	O
$60E1_h$	Negative Torque Limit Value	UINT16	RW	YES	O

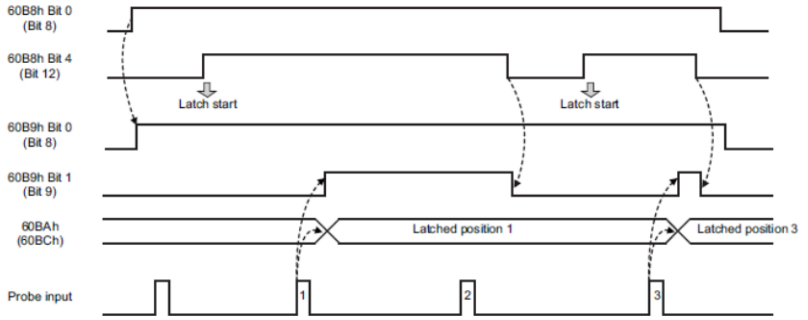
5.13 Touch Probe function

Touch probe function can store the location of the motor when the trigger condition occurs. So controller can use the location to calculate. Refer to the objects as follows:

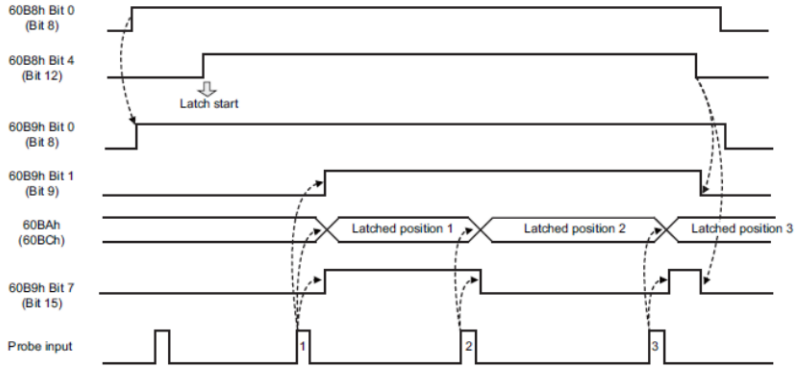
Index	Name	Type	Attr.	PDO Mapping	M/O
$60B8_h$	Touch Probe Function	UINT16	RW	YES	M
$60B9_h$	Touch Probe Status	UINT16	RO	YES	M
$60BA_h$	TouchProbePos1PosValue	INT32	RO	YES	M
$60BB_h$	TouchProbeNeg1PosValue (ProNet-□□□EG-EC only)	INT32	RO	YES	M
$60BC_h$	TouchProbePos2PosValue	INT32	RO	YES	M
$60BD_h$	TouchProbeNeg2PosValue (ProNet-□□□EG-EC only)	INT32	RO	YES	M

The application principle are as follows：

- Single Trigger Mode (60B8h bit1 = 0, or bit9 = 0)



- Continuous Trigger Mode (60B8h bit1 = 1, or bit9 = 1)



Touch Probe Function（0x60B8）

The object is configured to the touch probe function.

Index	60B8h
Name	Touch Probe Function
Object Code	VAR
Data Type	UINT16
Access	RW
PDO Mapping	YES
Value Range	0-0xFFFF
Default Value	0

Touch Probe Function（60B8h）

The definition of each bit is as follows:

Bit	Value	Definition

0	0	Switch off touch probe 1
	1	Enable touch probe 1
1	0	Single trigger mode （Latches the position at the first trigger event.）
	1	Continuous trigger mode （.Latches the position every trigger event.）
2	0	Triggers with touch probe 1 input
	1	Triggers with encoder zero signal(phase-C)
3	0	Reserved
4	0	Switch off sampling at positive edge of touch probe 1
	1	Enable sampling at positive edge of touch probe 1
5	0	Switch off sampling at negative edge of touch probe 1
	1	Enable sampling at negative edge of touch probe 1
6,7	0	Reserved
8	0	Switch off touch probe 2
	1	Enable touch probe 2
9	0	Single trigger mode （Latches the position every trigger event.）
	1	Continuous trigger mode （Latches the position at the first trigger event.）
10	0	Triggers with touch probe 2 input
	1	Triggers with encoder zero signal(phase-C)
11	0	Reserved
12	0	Switch off sampling at positive edge of touch probe 2
	1	Enable sampling at positive edge of touch probe 2
13	0	Switch off sampling at negative edge of touch probe 2
	1	Enable sampling at negative edge of touch probe 2
14,15	0	Reserved

The terminals of probe1 input and probe2 input are allocated to CN1* by Pn509 and Pn510. Specific content refers to appendix B.
* The terminals of probe1 input and probe2 input are allocated to CN1_3 and CN1_4 by Pn209.(ProNet-□□□EG-EC only)

Touch Probe Status(60B9$_h$)

Touch Probe Status(60B9$_h$) shows the touch probe status.

Index	60B9h
Name	Touch Probe Status
Object Code	VAR
Data Type	UINT16
Access	RO
PDO Mapping	YES
Value Range	—
Default Value	—

Touch Probe Status（60B9h）

The definition of each bit is as follows:

Bit	Value	Definition
0	0	Switch off touch probe 1
	1	Enable touch probe 1
1	0	Switch off sampling at positive edge of touch probe 1
	1	Enable sampling at positive edge of touch probe 1
2	0	Switch off sampling at negative edge of touch probe 1
	1	Enable sampling at negative edge of touch probe 1
3-5	0	Reserved
6,7	0	In continuous trigger mode, the numbers of executions of touch probe 1 record by bit6 and bit7. The numbers repeat between 0~3.
8	0	Switch off touch probe 2
	1	Enable touch probe 2
9	0	Switch off sampling at positive edge of touch probe 2
	1	Enable sampling at positive edge of touch probe 2
10	0	Switch off sampling at negative edge of touch probe 2
	1	Enable sampling at negative edge of touch probe 2
11-13	0	Reserved
14,15	0	In continuous trigger mode, the numbers of executions of touch probe 2 record by bit14 and bit15. The numbers repeat between 0~3.

TouchProbePos1PosValue（60BA$_h$）

TouchProbePos1PosValue（60BA$_h$）shows the location of the motor when the positive edge of Touch Probe1 trigger condition occurs.

Index	60BAh
Name	TouchProbePos1PosValue
Object Code	VAR
Data Type	INT32
Access	RO
PDO Mapping	YES
Value Range	—
Default Value	—

TouchProbeNeg1PosValue（60BB$_h$）(ProNet-□□□EG-EC only)

TouchProbeNeg1PosValue（60BBh）shows the location of the motor when the negative edge of Touch Probe1 trigger condition occurs.

Index	60BBh
Name	TouchProbeNeg1PosValue
Object Code	VAR
Data Type	INT32
Access	RO
PDO Mapping	YES
Value Range	—
Default Value	—

TouchProbePos2PosValue（60BC$_h$）

TouchProbePos2PosValue（60BC$_h$）shows the location of the motor when the positive edge of Touch Probe2 trigger condition occurs.

Index	60BCh
Name	TouchProbePos2PosValue
Object Code	VAR
Data Type	INT32
Access	RO
PDO Mapping	YES
Value Range	—
Default Value	—

TouchProbeNeg2PosValue（60BD$_h$）(ProNet-□□□EG-EC only)

TouchProbeNeg2PosValue（60BD$_h$）shows the location of the motor when the negative edge of Touch Probe2 trigger condition occurs.

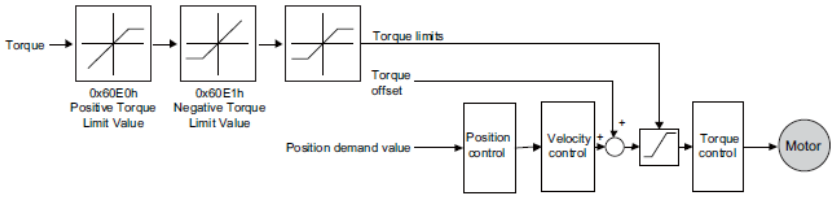
Index	60BDh
Name	TouchProbeNeg2PosValue
Object Code	VAR
Data Type	INT32
Access	RO
PDO Mapping	YES
Value Range	—
Default Value	—

Pn209、Pn210 (ProNet-□□□EG-EC only)

Pn209 is Touch Probe input channel signal selection.
Pn210 is Touch Probe input signal filtering time.

5.14 Torque limit Function

The torque is limited by 0x60E0,0x60E1. The following figure shows the block diagram of the torque limit function.



PosTorLimit(0x60E0)

PosTorLimitL:positive torque limit,unit:0.1% rated torque

Index	60E0h
Name	PosTorLimit
Object Code	VAR
Data Type	UINT16
Access	RW
PDO Mapping	YES
Value Range	0-3000
Default Value	3000

NegTorLimit(0x60E1)

NegTorLimit: negative torque limit,unit: 0.1% rated torque

Index	60E1h
Name	NegTorLimit
Object Code	VAR
Data Type	UINT16
Access	RW
PDO Mapping	YES
Value Range	0-3000
Default Value	3000

5.15 Digital Input /Output

In some situations, some switches (such as the origin signal and limit signal) are not sent to the servo drive directly, but sent by the host. You need to use the object 60FE-01h (Physical outputs) to transfer the relevant signals.

31…21	20	19	18	17	16	15…0
reserved	CN1_19	CN1_18	CN1_17	CN1_16	CN1_15	reserved

Bit16-bit19 correspond to CN1 interfaces. And only the bit of bitmask(60FE:02h) is set to 1, the corresponding bit is effective. For the bus transfer need, also need to enable bus transmission by Pn512/Pn513.

Index	60FE $_{h}$
Name	Digital outputs
Object Code	ARRAY
No. of Elements	2
Data Type	UINT32

Sub-Index	01 $_{h}$
Name	Physical outputs
Object Code	VAR
Data Type	UINT32
Access	RW
PDO Mapping	YES
Default Value	0

Sub-Index	02 h
Name	Bit mask
Object Code	VAR
Data Type	UINT32
Access	RW
PDO Mapping	YES
Default Value	0

If the host needs to monitor switch input signals of the servo drive, the host can read the object 60FDh (Inputs Digital) to obtain. The definition is as follows:

Bit	Definition
0	Reverse overtravel switch
1	Forward overtravel switch
2	Reference point switch
3~15	Reserved
16	CN1_15
17	CN1_16
18	CN1_17
19	CN1_18
20	CN1_19
21	CN1_20
22~31	Reserved

5.16 Absolute Encoder Setup(Fn010、Fn011)

Setting up the absolute encoder in the following cases.

·When starting the machine for the first time,set Pn002.2 to 0.

·When an encoder error alarm (A.45～A.48, A.51) is generated.

Please use the panel operator or bus in the servo drive for setup. Use

SDO to reset absolute encoder multiturn data and alarm as follows：

1. Writing 1 into 321B by SDO can enabled Fn010.
2. Writing 1 into 321C by SDO can enabled Fn011.

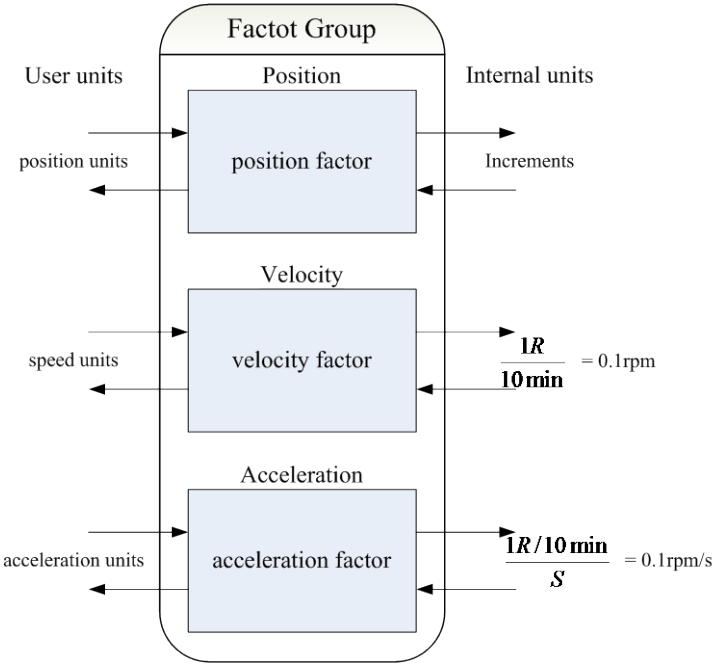
Note:

1. Encoder setup operation is only possible when the servo is OFF.
2. If the absolute encoder alarms(A.45～A.48，A.51) are displayed,

cancel the alarm by using the same method as the setup. They cannot be cancelled with the servo drive alarm reset input signal(/ALM-RST).
3. Any other alarms that monitor the inside of the encoder should be cancelled by turning OFF the power.

5.17 Conversion factors (factor group)

Servo controllers will be used in a huge number of applications: As direct drive, with gear or for linear drives. To allow an easy parameterization for all kinds of applications, the servo controller can be parameterized in such a way that all values like the demand velocity refer to the driven side of the plant. The necessary calculation is done by the servo controller.



The default setting of the Factor Group is as follows:

Value	Name	Unit	Remark
Length	position units	Increments	Increments per revolution *
Velocity	speed units	1R /10min	0.1rpm
Acceleration	Acceleration units	1R/10min/s	0.1rpm/s
Jerk	jerk units	pulse/(s*100μs*100μs)	Range:1-20,more smaller,more smooth

* : Common incremental encoder: 10000P/R
Resolver: 65536P/R
17bit incremental encoder: 131072P/R
17bit absolute encoder: 131072P/R
20bit absolute encoder: 1048576P/R

5.17.1 Related parameters

Index	Object	Name	Type	Attr.
6093 h	ARRAY	position factor	UINT32	RW
6094 h	ARRAY	velocity factor	UINT32	RW
6097 h	ARRAY	acceleration factor	UINT32	RW

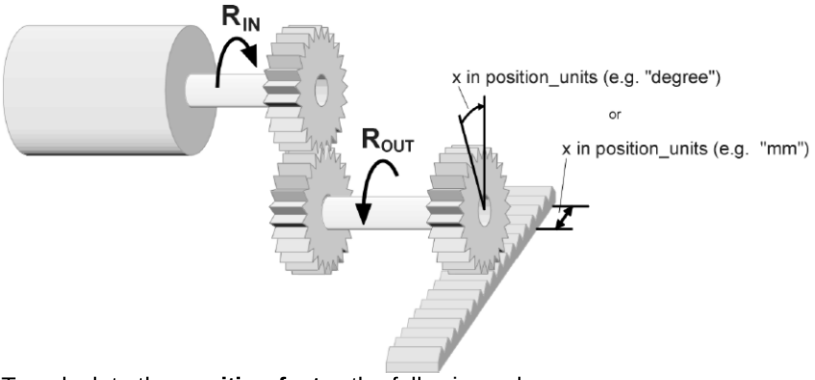
5.17.2 Position factor

The object **position factor** converts all values of length of the application from **Position units** into the internal unit **increments** (*encoder resolution* equals 1 Revolution). It consists of numerator and divisor:

Index	6093 h
Name	position factor
Object Code	ARRAY
No. of Elements	2
Data Type	UINT32

Sub-Index	01 h
Description	numerator
Access	RW
PDO Mapping	YES
Units	—
Value Range	—
Default Value	When power on, this value will be initiated to parameter Pn201

Sub-Index	02 h
Description	division
Access	RW
PDO Mapping	YES
Units	—
Value Range	—
Default Value	When power on, this value will be initiated to parameter Pn202



To calculate the **position factor** the following values are necessary:
gear_ratio Ratio between revolutions on the driving side (RIN) and revolutions on the driven side (ROUT).
feed_constant Ratio between revolutions on the driven side (ROUT) and equivalent motion in **position_units** (e.g. 1 rev = 360°)

The calculation of the **position_factor** is done with the following equation:

$$\textbf{position factor} = \frac{\text{numerator}}{\text{division}} = \frac{\text{gear\_ratio} * \text{encoder\_resolution}}{\text{feed\_constant}}$$

Note:

Encoder type	Encoder_resolution(Unit: Inc)
Common incremental encoder	10000
Resolver	65535
17 bit encoder	131072
20 bit encoder	1048576

5.17.3 Velocity factor

The object **velocity factor** converts all speed values of the application from **speed_units** into the internal unit **revolutions 0.1rpm**. It consists of numerator and divisor

Index	6094 h
Name	velocity factor
Object Code	ARRAY
No. of Elements	2
Data Type	UINT32

Sub-Index	01 h
Description	numerator
Access	RW
PDO Mapping	YES
Units	——
Value Range	——
Default Value	1

Sub-Index	02 h
Description	division
Access	RW
PDO Mapping	YES
Units	——
Value Range	——
Default Value	1

In principle the calculation of the **velocity factor** is composed of two parts: A conversion factor from internal units of length into **position_units** and a conversion factor from internal time units into user defined time units (e.g. from seconds to minutes). The first part equals the calculation of the **position_factor.** For the second part another factor is necessary for the calculation:

time_factor_v Ratio between internal and user defined time units.

(z.B. **1** ***min*** = **1/10** ***10 min***)

gear_ratio Ratio between revolutions on the driving side (RIN) and revolutions on the driven side (ROUT).

feed_constant Ratio between revolutions on the driven side (ROUT) and equivalent motion in position_units (e.g. 1 R =

360°)

The calculation of the **velocity factor** is done with the following equation:

$$\textbf{velocity factor} = \frac{\text{numerator}}{\text{division}} = \frac{\text{gear\_ratio} * \text{time\_factor\_v}}{\text{feed\_constant}}$$

5.17.4 Acceleration factor

The object **acceleration_factor** converts all acceleration values of the application from **acceleration_units** into the internal unit （0.1rpm）。It consists of numerator and divisor:

Index	6097 $_{h}$
Name	acceleration factor
Object Code	ARRAY
No. of Elements	2
Data Type	UINT32

Sub-Index	01 $_{h}$
Description	numerator
Access	RW
PDO Mapping	YES
Units	——
Value Range	——
Default Value	1

Sub-Index	02 $_{h}$
Description	division
Access	RW
PDO Mapping	YES
Units	——
Value Range	——
Default Value	1

The calculation of the **acceleration_factor** is also composed of two parts: A conversion factor from internal units of length into **position_units** and a conversion factor from internal time units squared into user defined time units squared (e.g. from seconds2 to minutes2). The first part equals the calculation of the **position_factor.** For the second part another factor is necessary for the calculation

time_factor_a Ratio between internal time units squared and user defined time units squared （z.B.： 1**min**^{2} = 1min*min = 60s*1min =60/10 **10min/s**）

gear_ratio Ratio between revolutions on the driving side (RIN) and revolutions on the driven

	side (ROUT).
feed_constant	Ratio between revolutions on the driven side (ROUT) and equivalent motion in position_units (e.g. 1 R = 360°)

The calculation of the **acceleration_factor** is done with the following equation:

$$\textbf{acceleration factor} = \frac{\text{numerator}}{\text{division}} = \frac{\text{gear\_ratio} * \text{time\_factor\_a}}{\text{feed\_constant}}$$

Chapter 6 EtherCAT communication example

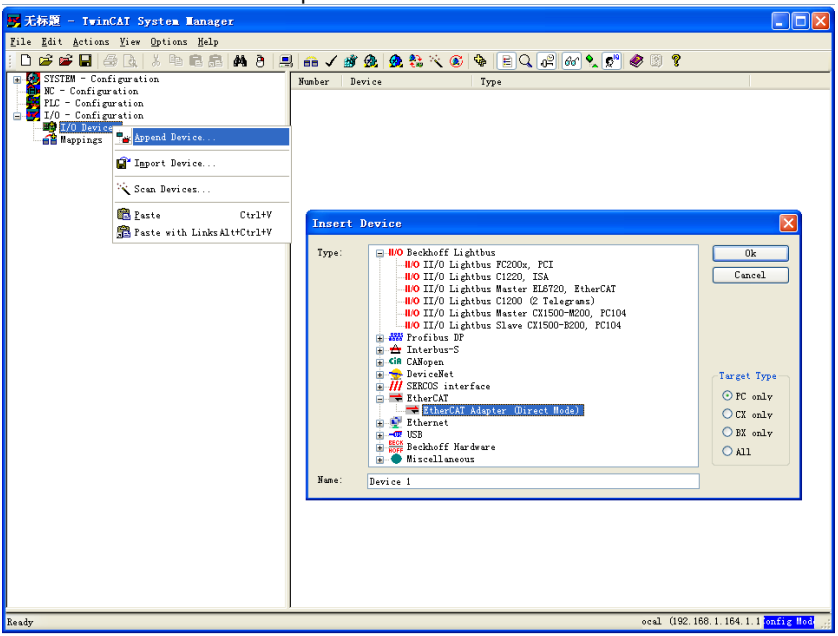
In this example, we use Beckhoff TwinCAT software as the real time master. Please prepare as below before the test:

- Identify the network interface model number and install the network interface correctly.
- 2) Install Beckhoff TwinCAT software.
- 3) Copy the device description document (.XML document) to the directory **C:\TwinCAT\IO\EtherCAT**. (You could contact Estun to have this XML document)
- Set drive's parameter Pn006.0=4, select EtherCAT communication mode.
- Pn704 can set the address（Station Alias）.

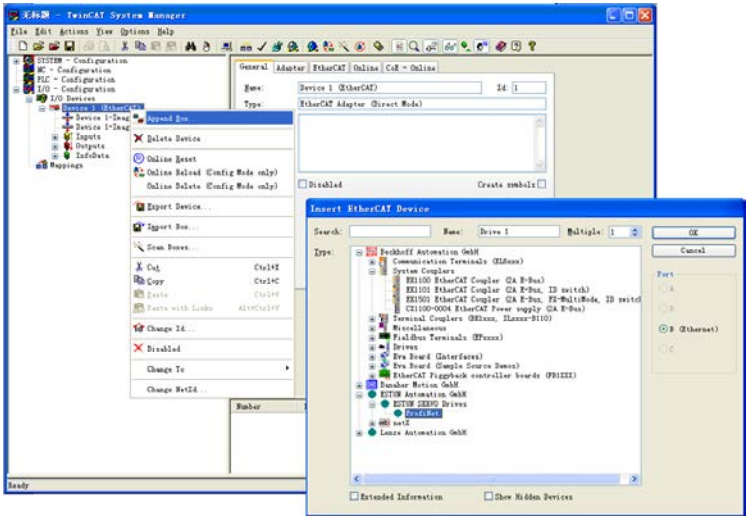
After finishing copying, reactivate TwinCAT software. Then TwinCAT will list an ESTUN ProNet servo drive EtherCAT bus option.

And then please follow steps as below:

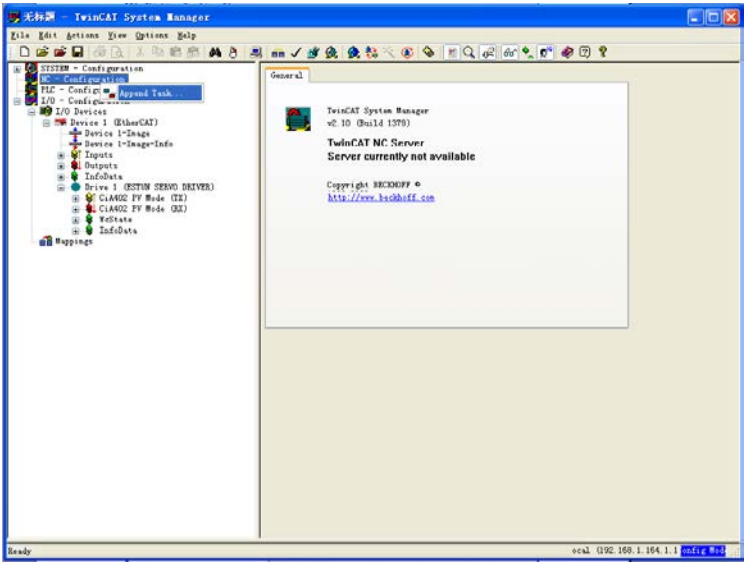
1 Use the right button of the mouse to single click **I/O Device** and choose EtherCAT network adapter. Name it as **Device 1**.



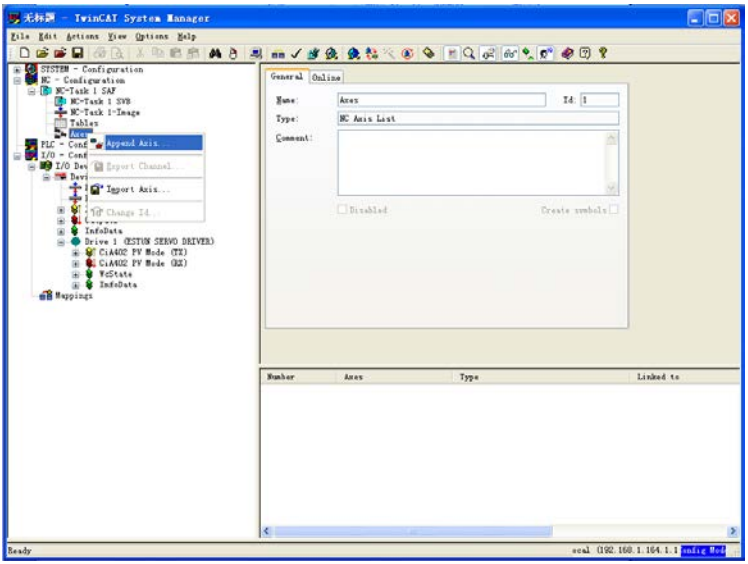
Use the right button of the mouse to single click **Device 1** and add a slave ProNet device.



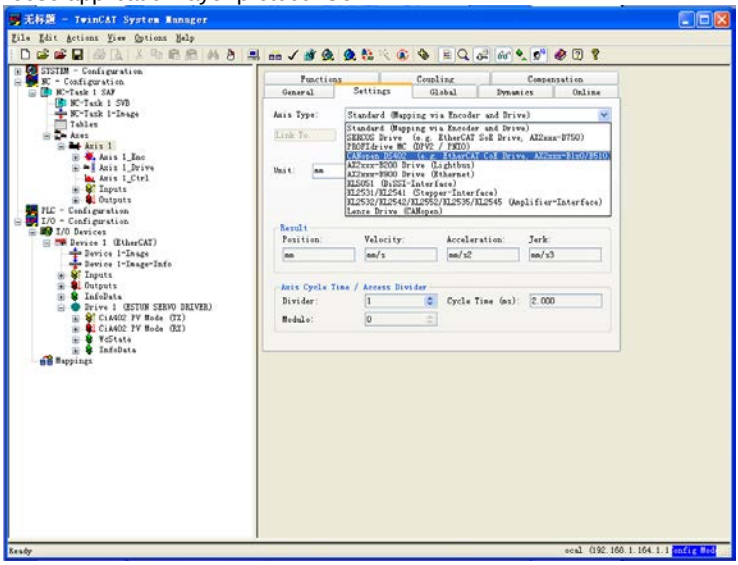
3. Add one NC task and name it as **Task 1**.



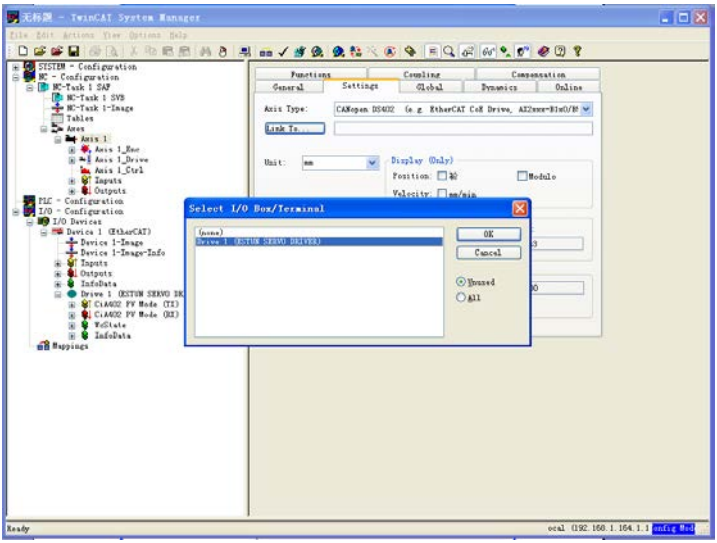
Add **Axis 1** under NC task.



Choose application layer protocol **CoE**.

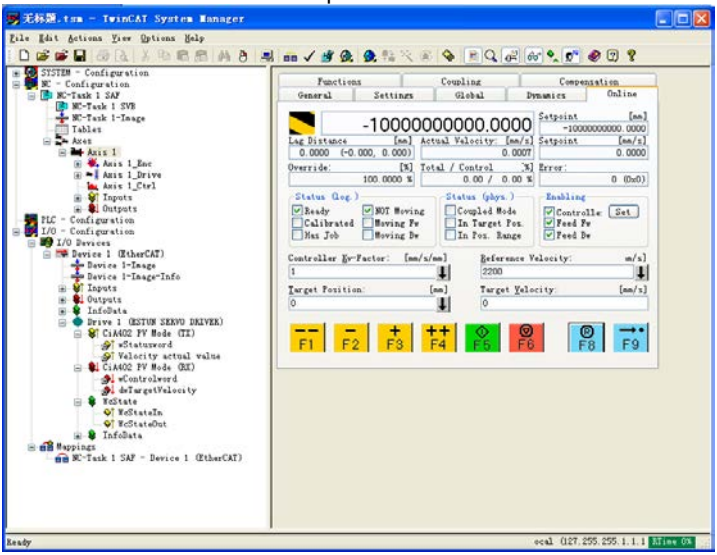


Click **Link to** button and map servo drive axis to the device.



Click **activate configuration** button on the toolbar and activate configuration.

Click **online** label and start to operate on servo axis.



Appendix A Object dictionary

Index	Sub index	Name	Type	Access.	PDO	Support								Unit
						All	PP	PV	HM	IP	CSP	PT	CST	
1000	0	Device type	UINT32	RO	NO	●								
1001	0	Error register	UINT8	RO	NO	●								
1003	Pre-defined error field													
	0	Number of entries	UINT8	RO	NO	●								
	1	Standard error field1	UINT32	RO	NO	●								
	…	…	UINT32	RO	NO	●								
	7	Standard error field7	UINT32	RO	NO	●								
	8	Standard error field8	UINT32	RO	NO	●								
1018	Identity Object													
	0	Number of entries	UINT8	RO	NO	●								
	1	Vender ID	UINT32	RO	NO	●								
	2	Product code	UINT32	RO	NO	●								
	3	Revision number	UINT32	RO	NO	●								
	4	Serial number	UINT32	RO	NO	●								
1600	1st Receive PDO Mapping													
	0	Number of entries	UINT8	RW	NO	●								
	1	Mapping entry 1	UINT32	RW	NO	●								

Index	Sub index	Name	Type	Access.	PDO	Support								Unit
						All	PP	PV	HM	IP	CSP	PT	CST	
	2	Mapping entry 2	UINT32	RW	NO	•								
	3	Mapping entry 3	UINT32	RW	NO	•								
	4	Mapping entry 4	UINT32	RW	NO	•								
	5	Mapping entry 5	UINT32	RW	NO	•								
	6	Mapping entry 6	UINT32	RW	NO	•								
	7	Mapping entry7	UINT32	RW	NO	•								
	8	Mapping entry 8	UINT32	RW	NO	•								
1601	2nd Receive PDO Mapping													
	0	Number of entries	UINT8	RW	NO	•								
	1	Mapping entry 1	UINT32	RW	NO	•								
	2	Mapping entry 2	UINT32	RW	NO	•								
	3	Mapping entry 3	UINT32	RW	NO	•								
	4	Mapping entry 4	UINT32	RW	NO	•								
	5	Mapping entry 5	UINT32	RW	NO	•								
	6	Mapping entry 6	UINT32	RW	NO	•								
	7	Mapping entry7	UINT32	RW	NO	•								
	8	Mapping entry 8	UINT32	RW	NO	•								

Index	Sub index	Name	Type	Access.	PDO	Support								Unit
						All	PP	PV	HM	IP	CSP	PT	CST	
1602	3rd Receive PDO Mapping													
	0	Number of entries	UINT8	RW	NO	•								
	1	Mapping entry 1	UINT32	RW	NO	•								
	2	Mapping entry 2	UINT32	RW	NO	•								
	3	Mapping entry 3	UINT32	RW	NO	•								
	4	Mapping entry 4	UINT32	RW	NO	•								
	5	Mapping entry 5	UINT32	RW	NO	•								
	6	Mapping entry 6	UINT32	RW	NO	•								
	7	Mapping entry7	UINT32	RW	NO	•								
	8	Mapping entry 8	UINT32	RW	NO	•								
1603	4th Receive PDO Mapping													
	0	Number of entries	UINT8	RW	NO	•								
	1	Mapping entry 1	UINT32	RW	NO	•								
	2	Mapping entry 2	UINT32	RW	NO	•								
	3	Mapping entry 3	UINT32	RW	NO	•								
	4	Mapping entry 4	UINT32	RW	NO	•								
	5	Mapping entry 5	UINT32	RW	NO	•								

Index	Sub index	Name	Type	Access.	PDO	Support								Unit
						All	PP	PV	HM	IP	CSP	PT	CST	
	6	Mapping entry 6	UINT32	RW	NO	•								
	7	Mapping entry7	UINT32	RW	NO	•								
	8	Mapping entry 8	UINT32	RW	NO	•								
1A00	1st Transmit PDO Mapping													
	0	Number of entries	UINT8	RW	NO	•								
	1	Mapping entry 1	UINT32	RW	NO	•								
	2	Mapping entry 2	UINT32	RW	NO	•								
	3	Mapping entry 3	UINT32	RW	NO	•								
	4	Mapping entry 4	UINT32	RW	NO	•								
	5	Mapping entry 5	UINT32	RW	NO	•								
	6	Mapping entry 6	UINT32	RW	NO	•								
	7	Mapping entry7	UINT32	RW	NO	•								
	8	Mapping entry 8	UINT32	RW	NO	•								
1A01	2nd Transmit PDO Mapping													
	0	Number of entries	UINT8	RW	NO	•								

Index	Sub index	Name	Type	Access.	PDO	Support								Unit
						All	PP	PV	HM	IP	CSP	PT	CST	
	1	Mapping entry 1	UINT32	RW	NO	•								
	2	Mapping entry 2	UINT32	RW	NO	•								
	3	Mapping entry 3	UINT32	RW	NO	•								
	4	Mapping entry 4	UINT32	RW	NO	•								
	5	Mapping entry 5	UINT32	RW	NO	•								
	6	Mapping entry 6	UINT32	RW	NO	•								
	7	Mapping entry7	UINT32	RW	NO	•								
	8	Mapping entry 8	UINT32	RW	NO	•								
1A02	3rd Transmit PDO Mapping													
	0	Number of entries	UINT8	RW	NO	•								
	1	Mapping entry 1	UINT32	RW	NO	•								
	2	Mapping entry 2	UINT32	RW	NO	•								
	3	Mapping entry 3	UINT32	RW	NO	•								
	4	Mapping entry 4	UINT32	RW	NO	•								
	5	Mapping entry 5	UINT32	RW	NO	•								
	6	Mapping entry 6	UINT32	RW	NO	•								

Index	Sub index	Name	Type	Access.	PDO	Support								Unit
						All	PP	PV	HM	IP	CSP	PT	CST	
	7	Mapping entry7	UINT32	RW	NO	•								
	8	Mapping entry 8	UINT32	RW	NO	•								
1A03	4thTransmit PDO Mapping													
	0	Number of entries	UINT8	RW	NO	•								
	1	Mapping entry 1	UINT32	RW	NO	•								
	2	Mapping entry 2	UINT32	RW	NO	•								
	3	Mapping entry 3	UINT32	RW	NO	•								
	4	Mapping entry 4	UINT32	RW	NO	•								
	5	Mapping entry 5	UINT32	RW	NO	•								
	6	Mapping entry 6	UINT32	RW	NO	•								
	7	Mapping entry7	UINT32	RW	NO	•								
	8	Mapping entry 8	UINT32	RW	NO	•								
1C00	Sync Manager Communication Type													
	0	Number of used Sync Manager channels	UINT8	RW	NO	•								
	1	Communication type sync manager 0	UINT32	RW	NO	•								
	2	Communication type sync manager 1	UINT32	RW	NO	•								

Index	Sub index	Name	Type	Access.	PDO	Support								Unit
						All	PP	PV	HM	IP	CSP	PT	CST	
	3	Communication type sync manager 2	UINT32	RW	NO	●								
	4	Communication type sync manager 3	UINT32	RW	NO	●								
1C12	Sync Manager PDO assignment 2													
	0	Number of assigned PDOs	UINT8	RW	NO	●								
	1	Index of assigned RxPDO 1	UINT16	RW	NO	●								
	2	Index of assigned RxPDO 2	UINT16	RW	NO	●								
1C13	Sync Manager PDO assignment 3													
	0	Number of assigned PDOs	UINT8	RW	NO	●								
	1	Index of assigned TxPDO 1	UINT16	RW	NO	●								
	2	Index of assigned TxPDO 2	UINT16	RW	NO	●								

Index	Sub index	Name	Type	Access.	PDO	Support								Unit
						All	PP	PV	HM	IP	CSP	PT	CST	
3000	0	Pn000	UINT16	RW	NO	•								
3001	0	Pn001	UINT16	RW	NO	•								
3002	0	Pn002	UINT16	RW	NO	•								
3003	0	Pn003	UINT16	RW	NO	•								
3004	0	Pn004	UINT16	RW	NO	•								
3005	0	Pn005	UINT16	RW	NO	•								
3006	0	Pn006	UINT16	RW	NO	•								
3007	0	Pn007	UINT16	RW	NO	•								
3008	0	Pn008	UINT16	RW	NO	•								
3010	0	Pn100	UINT16	RW	NO	•								
3011	0	Pn101	UINT16	RW	NO	•								
3012	0	Pn102	UINT16	RW	NO	•								
3013	0	Pn103	UINT16	RW	NO	•								
3014	0	Pn104	UINT16	RW	NO	•								
3015	0	Pn105	UINT16	RW	NO	•								
3016	0	Pn106	UINT16	RW	NO	•								
3017	0	Pn107	UINT16	RW	NO	•								

Index	Sub index	Name	Type	Access.	PDO	Support								Unit
						All	PP	PV	HM	IP	CSP	PT	CST	
3018	0	Pn108	UINT16	RW	NO	•								
3019	0	Pn109	UINT16	RW	NO	•								
301A	0	Pn110	UINT16	RW	NO	•								
301B	0	Pn111	UINT16	RW	NO	•								
301C	0	Pn112	UINT16	RW	NO	•								
301D	0	Pn113	UINT16	RW	NO	•								
301E	0	Pn114	UINT16	RW	NO	•								
301F	0	Pn115	UINT16	RW	NO	•								
3020	0	Pn116	UINT16	RW	NO	•								
3021	0	Pn117	UINT16	RW	NO	•								
3022	0	Pn118	UINT16	RW	NO	•								
3023	0	Pn119	UINT16	RW	NO	•								
3024	0	Pn120	UINT16	RW	NO	•								
3025	0	Pn121	UINT16	RW	NO	•								
3026	0	Pn122	UINT16	RW	NO	•								
3027	0	Pn123	UINT16	RW	NO	•								
3028	0	Pn124	UINT16	RW	NO	•								

Index	Sub index	Name	Type	Access.	PDO	Support								Unit
						All	PP	PV	HM	IP	CSP	PT	CST	
3029	0	Pn125	UINT16	RW	NO	•								
302A	0	Pn126	UINT16	RW	NO	•								
302B	0	Pn127	UINT16	RW	NO	•								
302C	0	Pn128	UINT16	RW	NO	•								
302D	0	Pn129	UINT16	RW	NO	•								
302E	0	Pn130	UINT16	RW	NO	•								
302F	0	Pn131	UINT16	RW	NO	•								
3030	0	Pn132	UINT16	RW	NO	•								
3068	0	Pn401	UINT16	RW	NO	•								
3069	0	Pn402	UINT16	RW	NO	•								
306A	0	Pn403	UINT16	RW	NO	•								
306B	0	Pn404	UINT16	RW	NO	•								
306C	0	Pn405	UINT16	RW	NO	•								
306D	0	Pn406	UINT16	RW	NO	•								
306E	0	Pn407	UINT16	RW	NO	•								
306F	0	Pn408	UINT16	RW	NO	•								
3070	0	Pn409	UINT16	RW	NO	•								

Index	Sub index	Name	Type	Access.	PDO	Support								Unit
						All	PP	PV	HM	IP	CSP	PT	CST	
3071	0	Pn410	UINT16	RW	NO	•								
3072	0	Pn411	UINT16	RW	NO	•								
3073	0	Pn412	UINT16	RW	NO	•								
3074	0	Pn413	UINT16	RW	NO	•								
3075	0	Pn414	UINT16	RW	NO	•								
307D	0	Pn505	UINT16	RW	NO	•								
307E	0	Pn506	UINT16	RW	NO	•								
307F	0	Pn507	UINT16	RW	NO	•								
3080	0	Pn508	UINT16	RW	NO	•								
3081	0	Pn509	UINT16	RW	NO	•								
3082	0	Pn510	UINT16	RW	NO	•								
3083	0	Pn511	UINT16	RW	NO	•								
3084	0	Pn512	UINT16	RW	NO	•								
3085	0	Pn513	UINT16	RW	NO	•								
3086	0	Pn514	UINT16	RW	NO	•								
3088	0	Pn516	UINT16	RW	NO	•								
3089	0	Pn517	UINT16	RW	NO	•								

Index	Sub index	Name	Type	Access.	PDO	Support								Unit
						All	PP	PV	HM	IP	CSP	PT	CST	
30FC	0	Pn700	UINT16	RW	NO	•								
30FD	0	Pn701	UINT16	RW	NO	•								
3100	0	Pn704	UINT16	RW	NO	•								
3138	0	Pn840	UINT16	RW	NO	•								
320A	0	Un000	UINT16	RO	NO	•								
320B	0	Un001	UINT16	RO	NO	•								
320C	0	Un002	UINT16	RO	NO	•								
320D	0	Un003	UINT16	RO	NO	•								
320E	0	Un004	UINT16	RO	NO	•								
320F	0	Un005	UINT16	RO	NO	•								
3210	0	Un006	UINT16	RO	NO	•								
3211	0	Un007	UINT16	RO	NO	•								
3212	0	Un008	UINT16	RO	NO	•								
3213	0	Un009	UINT16	RO	NO	•								
3214	0	Un010	UINT16	RO	NO	•								
3215	0	Un011	UINT16	RO	NO	•								
3216	0	Un012	UINT16	RO	NO	•								

Index	Sub index	Name	Type	Access.	PDO	Support								Unit
						All	PP	PV	HM	IP	CSP	PT	CST	
3217	0	Un013	UINT16	RO	NO	•								
3218	0	Un014	UINT16	RO	NO	•								
321F	0	CO_Fn000	UINT16	RW	NO	•								
3220	Fn001													
	0	CO_Fn001_NoOfEntries	UINT8	RW	NO	•								
	1	CO_Fn001	UINT16	RW	NO	•								
	2	LoadDoneStatus	UINT16	RO	NO	•								
3221	0	CO_Fn008	UINT16	RW	NO	•								
3222	0	InertiaControl	UINT16	RW	NO	•								
3223	Inertia													
	0	Inertia_NoOfEntries	UINT8	RW	NO	•								
	1	InertiaStatus	UINT16	RO	NO	•								
	2	J_inertia	UINT32	RO	NO	•								
3224	Edition													
	0	Edition_NoOfEntries	UINT8	RO	NO	•								
	1	AC_V	UINT16	RO	NO	•								
	2	Edition.all	UINT16	RO	NO	•								
	3	CpldEdition	UINT16	RO	NO	•								
3225	Alam													
	0	Alam_NoOfEntries	UINT8	RO	NO	•								

Index	Sub index	Name	Type	Access.	PDO	Support								Unit
						All	PP	PV	HM	IP	CSP	PT	CST	
	1	Pn[Fn000Addr+0]	UINT16	RO	NO	•								
	2	Pn[Fn000Addr+1]	UINT16	RO	NO	•								
	3	Pn[Fn000Addr+2]	UINT16	RO	NO	•								
	4	Pn[Fn000Addr+3]	UINT16	RO	NO	•								
	5	Pn[Fn000Addr+4]	UINT16	RO	NO	•								
	6	Pn[Fn000Addr+5]	UINT16	RO	NO	•								
	7	Pn[Fn000Addr+6]	UINT16	RO	NO	•								
	8	Pn[Fn000Addr+7]	UINT16	RO	NO	•								
	9	Pn[Fn000Addr+8]	UINT16	RO	NO	•								
	A	Pn[Fn000Addr+9]	UINT16	RO	NO	•								
3226	0	CO_Fn010	UINT16	RW	NO	•								
3227	0	CO_Fn011	UINT16	RW	NO	•								
3228	0	RotateM	UINT16	RO	NO	•								
3229	0	Rotate	UINT16	RO	NO	•								
3301	0	SinglePos	UINT32	RO	NO	•								
3302	0	JLoad	UINT16	RW	NO	•								
3303	0	VibFr	UINT16	RW	NO	•								
3305	0	Pn690	UINT16	RW	NO	•								
6007	0	Abort connection option code	INT16	RW	NO	•								

Index	Sub index	Name	Type	Access.	PDO	Support								Unit
						All	PP	PV	HM	IP	CSP	PT	CST	
603F	0	Error code	UINT16	RW	YES	•								
6040	0	Control word	UINT16	RW	YES	•								
6041	0	Status word	UINT16	RO	YES	•								
605A	0	Quick stop option code	INT16	RW	NO	•								
605B	0	Shutdown option code	INT16	RW	NO	•								
605C	0	Disable operation option code	INT16	RW	NO	•								
605D	0	Stop option code	INT16	RW	NO	•								
605E	0	Fault reaction option code	UINT16	RW	NO	•								
6060	0	Modes of operation	INT8	RW	YES	•								
6061	0	Modes of operation display	INT8	RO	YES	•								
6062	0	Position demand value	INT32	RO	YES		•			•	•			position units
6063	0	Position actual value*	INT32	RO	YES		•			•	•			inc
6064	0	Position actual value	INT32	RO	YES		•		•	•	•	•	•	position units
6065	0	Following error window	UINT32	RW	YES		•				•			position units
6066	0	Following error time out	UINT16	RW	YES		•				•			ms
6067	0	Position window	UINT32	RW	YES		•			•	•			position units
6068	0	Position window time	UINT16	RW	YES		•			•	•			ms

Index	Sub index	Name	Type	Access.	PDO	Support								Unit
						All	PP	PV	HM	IP	CSP	PT	CST	
6069	0	Velocity sensor actual value	UINT16	RW	YES			•						speed units
606B	0	Velocity demand value	INT32	RO	YES			•						speed units
606C	0	Velocity actual value	INT32	RO	YES		•	•	•	•	•	•	•	speed units
606D	0	Velocity window	UINT16	RW	YES			•						speed units
606E	0	Velocity window time	UINT16	RW	YES			•						ms
606F	0	Velocity threshold	UINT16	RW	YES			•						speed units
6070	0	Velocity threshold time	UINT16	RW	YES			•						ms
6071	0	Target Torque	INT16	RW	YES							•	•	
6077	0	Torque actual value	INT16	RO	YES	•								
6078	0	Current actual value	INT16	RO	YES	•								
607A	0	Target position	INT32	RW	YES		•				•			position units
607C	0	Home offset	INT32	RW	YES		•		•	•	•			position units
607D	Software Position Limit													
	0	Number of entries	UINT8	RO	NO		•			•	•			
	1	Min position limit	INT32	RW	NO		•			•	•			position units
	2	Max position limit	INT32	RW	NO		•			•	•			position units
607E	0	Polarity	USINT	RW	NO	•								

Index	Sub index	Name	Type	Access.	PDO	Support								Unit
						All	PP	PV	HM	IP	CSP	PT	CST	
607F	0	Max profile velocity	UINT32	RW	YES	•								speed units
6081	0	Profile velocity	UINT32	RW	YES		•							speed units
6082	0	End velocity	UINT32	RW	YES		•							speed units
6083	0	Profile acceleration	UINT32	RW	YES		•	•						acceleration units
6084	0	Profile deceleration	UINT32	RW	YES		•	•						acceleration units
6085	0	Quick stop deceleration	UINT32	RW	YES		•	•		•				acceleration units
6086	0	Motion profile type	INT16	RO	YES		•	•		•				
6087	0	Torque Slope	UINT32	RW	YES							•		
6093	Position factor													
	0	Number of entries	UINT32	RW	NO		•		•	•	•			
	1	numerator	UINT32	RW	NO		•		•	•	•			
	2	divisor	UINT32	RW	NO		•		•	•	•			
6094		Velocity encoder factor												
	0	Number of entries	UINT32	RW	NO	•								
	1	numerator	UINT32	RW	NO	•								
	2	divisor	UINT32	RW	NO	•								
6097	Acceleration factor													

Index	Sub index	Name	Type	Access.	PDO	Support								Unit
						All	PP	PV	HM	IP	CSP	PT	CST	
	0	Number of entries	UINT32	RW	NO	•								
	1	numerator	UINT32	RW	NO	•								
6098	0	Homing method	INT8	RW	YES				•					
6099	Homing speeds													
	0	Number of entries	UINT8	RW	YES				•					
	1	Speed during search for switch	UINT32	RW	YES				•					speed units
	2	Speed during search for zero	UINT32	RW	YES				•					speed units
609A	0	Homing acceleration	UINT32	RW	YES				•					acceleration units
60B1	0	Velocity Offset	INT32	RW	YES						•			
60B2	0	Torque Offset	INT	RW	YES						•			
60B8	0	Touch Probe Function	UINT16	RW	YES	•								
60B9	0	Touch Probe Status	UINT16	RO	YES	•								
60BA	0	Touch Probe Pos1 Pos Value	INT32	RO	YES	•								
60BB	0	Touch Probe Neg1 Pos Value	INT32	RO	YES	•								
60BC	0	Touch Probe Pos2 Pos Value	INT32	RO	YES	•								
60BD	0	Touch Probe Neg2 Pos Value	INT32	RO	YES	•								
60C1	Interpolation data record													
	0	Number of entries	UINT8	RO	NO					•				

Index	Sub index	Name	Type	Access.	PDO	Support								Unit
						All	PP	PV	HM	IP	CSP	PT	CST	
	1	1st set-point	INT32	RW	YES					●				position units
60C2	Interpolation time period													
	0	Number of entries	UINT8	RO	NO					●				
	1	Interpolation time period value	UINT8	RW	NO					●				
	2	Interpolation time index	UINT16	RW	NO					●				
60E0	0	Positive Torque Limit Value	UINT16	RW	YES	●								
60E1	0	Negtive Torque Limit Value	UINT16	RW	YES	●								
60FA	0	Control effort	INT32	RO	YES		●			●				
60FC	0	Position demand value	INT32	RO	YES		●			●	●			position units
60FD	0	Digital inputs	UINT32	RO	YES	●								
60FE	Digital outputs													
	0	Number of entries	UINT8	RO	NO	●								
	1	Physical outputs	UINT32	RW	YES	●								
	2	Bit mask	UINT32	RW	YES	●								
60FF	0	Target velocity	INT32	RW	YES		●							0.1rpm
60A4	Profile jerk													
	0	Number of entries	UINT8	RO	NO		●							
	1	Profile jerk 1	UINT32	RW	NO		●							acceleration units
6502	0	Supported drive modes	UINT32	RO	NO	●								

Appendix B Parameters

B.1 Parameter list (ProNet-□□□EA-EC&ProNet-□□□EF-EC)

Parameter No.	Description	Unit	Range	Default	Setting invalidation
Pn000	**Binary** Pn000.0: Servo ON Pn000.1: Forward rotation input signal prohibited (P-OT) Pn000.2: Reverse rotation input signal prohibited (N-OT) Pn000.3: Alarm output when instantaneous power loss	—	0~1111	0	After restart
Pn001	**Binary** Pn001.0: CCW,CW selection	—	0~1111	0	After restart
Pn003	**Binary** Pn003.0: Reserved Pn003.1: Reserved Pn003.2: Low speed compensation Pn003.3: Overload enhancement	—	0~1111	0	After restart
Pn004	**Hex** Pn004.0: Stop mode Pn004.1: Error counter clear mode	—	0~0x3425	0	After restart
Pn005	**Hex** Pn005.2: Out-of-tolerance alarm selection Pn005.3: Servomotor model	—	0~0x33D3	0	After restart
Pn006	**Hex** Pn006.0: Bus mode Pn006.1: Reserved Pn006.2: Low frequency jitter suppersion switch	—	0~0x2133	0x0024	After restart
Pn100	**Hex** Pn100.0: Load inertia setting Pn100.1: Online autotuning setting	—	0~0x0036	0x0011	After restart
Pn101	Machine rigidity setting	—	0~36	6	Immediately
Pn102	Speed loop gain	Hz	1~4000	250	Immediately
Pn103	Speed loop integral time constant	0.1ms	1~4096	200	Immediately
Pn104	Position loop gain	1/s	0~1000	40	Immediately
Pn105	Torque reference filter time constant	0.01ms	0~2500	100	Immediately
Pn106	Load inertia percentage	—	0~20000	100	Immediately
Pn107	2nd speed loop gain	Hz	1~4000	205	Immediately
Pn108	2nd speed loop integral time constant	0.1ms	1~4096	200	Immediately
Pn109	2nd position loop gain	Hz	0~1000	40	Immediately
Pn110	2nd torque reference filter time constant	0.01ms	0~2500	100	Immediately
Pn111	Speed bias	rpm	0~300	0	Immediately
Pn112	Feedforward	%	0~100	0	Immediately
Pn113	Feedforward filter	0.1ms	0~640	0	Immediately
Pn114	Torque feedforward	%	0~100	0	Immediately
Pn115	Torque feedforward filter	0.1ms	0~640	0	Immediately

Parameter No.	Description	Unit	Range	Default	Setting invalidation
Pn116	**P/PI switching condition** 0: Torque reference percentage 1: Value of offset counter 2: Value of acceleration speed setting 3: Value of speed setting 4: Fixed PI	—	0~4	0	After restart
Pn117	Torque switching threshold	%	0~300	200	Immediately
Pn118	Offset counter switching threshold	reference pulse	0~10000	0	Immediately
Pn119	Setting acceleration speed switching threshold	10rpm/s	0~3000	0	Immediately
Pn120	Setting speed switching threshold	rpm	0~10000	0	Immediately
Pn121	**Gain switching condition** 0: Fix to 1st group gain 1: External switch gain switching 2: Torque percentage 3: Value of offset counter 4: Value of acceleration speed setting 5: Value of speed setting 6: Speed reference input 7: actual motor speed	—	0~6	0	After start
Pn122	Switching delay time	0.1ms	0~20000	0	Immediately
Pn123	Threshold switching level		0~20000	0	Immediately
Pn124	Reserved	—	—	—	—
Pn125	Position gain switching time	0.1ms	0~20000	0	Immediately
Pn126	Hysteresis switching	—	0~20000	0	Immediately
Pn127	Low speed detection filter	0.1ms	0~100	10	Immediately
Pn128	Speed gain acceleration relationship during online autotuning	—	0~3	3	Immediately
Pn129	Low speed correction coefficient	—	0~30000	0	Immediately
Pn130	Friction load	0.1%	0~3000	0	Immediately
Pn131	Friction compensation speed hysteresis area	rpm	0~100	0	Immediately
Pn132	Sticking friction load	0.1%/1000rpm	0~1000	0	Immediately
Pn133	Reserved	—	—	—	—
Pn134	Reserved	—	—	—	—
Pn135	Reserved	—	—	—	—
Pn136	Reserved	—	—	—	—
Pn137	Reserved	—	—	—	—
Pn138	Reserved	—	—	—	—
Pn139	Reserved	—	—	—	—
Pn140	Reserved	—	—	—	—
Pn141	Reserved	—	—	—	—
Pn142	Reserved	—	—	—	—
Pn143	Reserved	—	—	—	—
Pn144	Reserved	—	—	—	—

Parameter No.	Description	Unit	Range	Default	Setting invalidation
Pn304	Parameter speed	rpm	-6000~6000	500	Immediately
Pn305	JOG speed	rpm	0~6000	500	Immediately
Pn306	Soft start acceleration time	ms	0~10000	0	Immediately
Pn307	Soft start deceleration time	ms	0~10000	0	Immediately
Pn308	Speed filter time constant	ms	0~10000	0	Immediately
Pn309	S curve risetime	ms	0~10000	0	Immediately
Pn310	**Speed reference curve form** 0:Slope 1:S curve 2:1st order filter 3:2nd order filter	—	0~3	0	After restart
Pn311	S form selection	—	0~3	0	Immediately
Pn407	Notch filter 1 frequency	Hz	50~5000	5000	Immediately
Pn408	Notch filter 1 depth	—	0~11	1	Immediately
Pn409	Notch filter 2 frequency	Hz	50~5000	5000	Immediately
Pn410	Notch filter 2 depth	—	0~11	1	Immediately
Pn411	Low frequency jitter frequency	0.1Hz	10~500	100	Immediately
Pn412	Low frequency jitter damp	—	0~200	25	Immediately
Pn500	Positioning error	Puls	0~5000	100	Immediately
Pn501	Coincidence difference	rpm	0~100	10	Immediately
Pn502	Zero clamp speed	rpm	0~3000	10	Immediately
Pn503	Rotation detection speed TGON	rpm	0~3000	20	Immediately
Pn504	Offset counter overflow alarm	256Puls	1~32767	1024	Immediately
Pn505	Servo ON waiting time	ms	-2000~2000	0	Immediately
Pn506	Basic waiting flow	10ms	0~500	0	Immediately
Pn507	Brake waiting speed	rpm	10~100	100	Immediately
Pn508	Brake waiting time	10ms	10~100	50	Immediately
Pn509	Allocate input signal to terminal	—	0~0xFFFF	0x3210	After restart
Pn510	Allocate input signal to terminal	—	0~0xFFFF	0x7654	After restart
Pn511	Allocate output signal to terminal	—	0~0x0999	0x0210	After restart
Pn512	Bus control input node low-bit enable	—	0~1111	0	Immediately
Pn513	Bus control input node low-bit enable	—	0~1111	0	Immediately
Pn514	Input port filter	0.2ms	0~1000	1	Immediately
Pn515	Alarm port filter	0.2ms	0~3	1	Immediately
Pn516	Input port signal inversion	—	0~1111	0	Immediately
Pn517	Input port signal inversion	—	0~1111	0	Immediately
Pn518	Dynamic brake time	0.5ms	50~2000	125	Immediately
Pn519	Serial encoder error time	0.1ms	0~10000	3	Immediately
Pn520	Position complete time	0.1ms	0~60000	500	Immediately
Pn521	If connect externally regenerative resistor 0: connect externally regenerative resistor between B1 and B2 1: dose not connect externally regenerative resistor, relay on internal capacitance (This parameter is in effect only on	—	0~1	1	Immediately

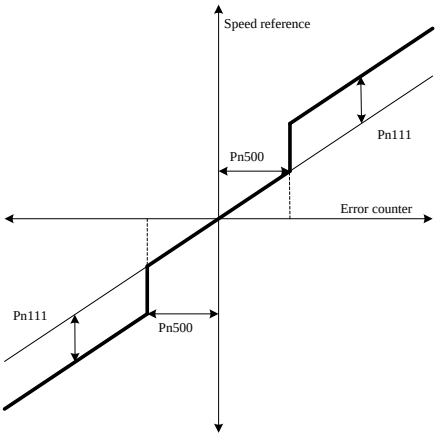
Parameter No.	Description	Unit	Range	Default	Setting invalidation
	ProNet-02/04 /ProNet-E-02/04)				
Pn522	Reserved	—	—	—	—
Pn523	Reserved	—	—	—	—
Pn524	Reserved	—	—	—	—
Pn525	Overload alarm threshold	%	100~150	100	Immediately
Pn526	Temperature threshold of motor overheat alarm (Only enabled in ProNet–75/1A/1E/2B)	℃	50~180	110	Immediately
Pn528	Output signal inverse	—	0~1111	0	Immediately
Pn529	Torque detection output signal threshold value	%	3~300	100	Immediately
Pn530	Torque detection output signal time	ms	1~1000	10	After restart
Pn700	**Hex** Pn700.0: MODBUS communication baud rate Pn700.1: MODBUS protocol selection Pn700.2:Communication protocol selection Pn700.3: Reserved	—	0~0x0182	0x0151	After restart
Pn701	MODBUS axis address	—	1~247	1	After restart
Pn702	Reserved	—	—	—	—
Pn703	Reserved	—	—	—	—
Pn704	EtherCAT communication contact	—	1~127	1	After restart
Pn840	**Hex** Pn840.0: Encoder model selection Pn840.1: Reserved Pn840.2: Reserved Pn840.3: Reserved	—	0x0003~ 0x0718	—	After restart

B.2 Parameters in detail (ProNet-□□□EA-EC&ProNet-□□□EF-EC)

Parameter No.	Description	Setting Validation	Control Mode	Function and Meaning
Pn000	Binary	After restart	ALL	**Pn000.0 Servo ON** [0] External S-ON enabled. [1] External S-ON disabled. Servo motor excitation signal is turned ON automatically after S-RDY is output. **Pn000.1 Forward rotation input signal prohibited（P-OT）** [0] External P-OT enabled. Operate in the time sequence setting in Pn004.0 when travel limit occurs. [1] External P-OT disabled. **Pn000.2 Reverse rotation input signal prohibited (N-OT)** [0] External N-OT enabled. Operate in the time sequence setting in Pn004.0 when travel limit occurs. [1] External N-OT disabled. **Pn000.3 Alarm output when instantaneous power loss** [0] Instantaneous power loss for one period with no alarm output [1] Instantaneous power loss for one period with alarm output
Pn001	Binary	After restart	Pn001.0 ALL Pn001.1 T Pn001.2 P，S Pn001.3 P	**Pn001.0 CCW,CW selection** [0] Sets CCW as forward direction [1] Sets CW as forward direction
Pn003	Binary	After restart	ALL	**Pn003.0 Reserved** **Pn003.1 Reserved** **Pn003.2 Low speed compensation** [0] Without low speed correction [1] With low speed correction to avoid servomotor creeping, but the degree of correction is determined by the setting in Pn219. **Pn003.3 Overload enhancement** [0] Without overload enhancement function [1] With overload enhancement function, which can enhance the overload capacity when servomotor exceeds the 2 times rated overload. It is used in frequent power ON/OFF occasions.

Pn004	Hex	After restart	Pn004.0 ALL Pn004.1 P Pn004.2 P Pn004.3 P	**Pn004.0 Stop Mode** [0] Stops the servomotor by applying DB and then releases DB. [1] Coast to a stop. [2] Stops the servomotor by DB when servo OFF, stops the servomotor by plug braking when overtravel, then places it into coast (power OFF) mode. [3] Makes the servomotor coast to a stop state when servo OFF, stops the servomotor by plug braking when overtravel, then places it into coast (power OFF) mode. [4] Stops the servomotor by DB when servo OFF, stops the servomotor by plug braking when overtravel, then places it into zero clamp mode. [5] Makes the servomotor coast to a stop state when servo OFF, stops the servomotor by plug braking when overtravel, then places it into zero clamp mode. **Pn004.1 Error counter clear mode** [0] Clear error pulse when S-OFF, do not when overtravel. [1] Do not clear error pulse. [2] Clear error pulse when S-OFF orovertravel (excep for zero clamp)
Pn005	Hex	After restart	Pn005.0 P, S Pn005.1 ALL Pn005.2 P	**Pn005.2 Out-of-tolerance alarm selection** [0] Out-of-tolerance alarm disabled [1] Out-of-tolerance alarm enabled. Outputs alarm when the value of error counter exceeds Pn504 setting value. [2] Reserved [3] Reserved **Pn005.3 Servomotor model selection①** [0] EMJ [1] EMG [2] Reserved [3] EMB
Pn006	Hex	After restart		**Pn006.0 Bus type selection** [0] ~ [3] No bus [4] EtherCAT **Pn006.1 Reserved** **Pn006.2 Low-frequency vibration suppression switch** [0] Low-frequency vibration suppression function disabled [1] Low-frequency vibration suppression function enabled

Pn100	Online autotuning setting	After restart	P, S	**Pn100.0 Load inertia setting** [0] Manual setting [1,2,3] Normal mode [4,5,6] Vertical load [1,4] Load inertia without variation [2,5] Load inertia with little variation [3,6] Load inertia with great variation **Pn100.1 Online autotuning setting** [0] Manual setting [1] Standard [2] Steadily [3] High precision **Note:** 1.Autotuning is invalid when servomotor max.speed is less than 100rpm. Manual gain adjustment is used. 2.Autotuning is invalid when servomotor acceleration/deceleration speed is less than 5000rpm/s. Manual gain adjustment is used. 3.Autotuning is invalid when mechanical clearance is too big during operation. Manual gain adjustment is used. 4.Autotuning is invalid when the difference of different speed load is too great. Manual gain adjustment is used.
Pn101	Machine rigidity setting	Immediately	P, S	The response speed of servo system is determined by this parameter. Normally, the rigidity should be set a little larger. However, if it is too large, it would suffer mechanical impact. It should be set a little smaller when large vibration is present. This parameter is only valid in autotuning.
Pn102	Speed loop gain	Immediately	P, S	This parameter determines speed loop gain. Unit: Hz
Pn103	Speed loop integral time constant	Immediately	P, S	Decreases the value of this parameter to shorten positioning time and enhance speed response. Unit: 0.1ms
Pn104	Position loop gain	Immediately	P	This parameter determines position loop gain. Decreases this value to enhance servo rigidity, but vibration will occur if the value is too large. Unit: 1/s
Pn105	Torque reference filter time constant	Immediately	P, S, T	Torque reference filter can eliminate or lighten mechanical vibration, but incorrect setting will result to mechanical vibration. Unit:0.01ms
Pn106	Load inertia percentage	Immediately	P, S	Setting value=(load inertia/rotor inertia) ×100 Unit: %
Pn107	2nd speed loop gain	Immediately	P, S	The meanings of these parameters are the same as Pn102~Pn105. These parameters are only needed to set when two types of gain function are enabled.
Pn108	2nd speed loop integral time constant	Immediately	P, S	
Pn109	2nd position loop gain	Immediately	P	

Pn110	2nd torque reference filter time constant	Immediately	P, S, T	
Pn111	Speed bias	Immediately	P	This parameter setting can shorten positioning time. However, if it is too large or does not cooperate with Pn111 correctly, vibration will occur. The relationship with speed reference, error counter, positioning error is shown in the following chart. 
Pn112	Feedforward	Immediately	P	It is used to set position feedforward. The response speed is faster and position error is less when this parameter setting is higher. Vibration will occur if the value is set too large. Unit: %
Pn113	Feedforward filter	Immediately	P	It is used to ease mechanical vibration due to position feedforward. The feedforward lag will be enlarged and result to vibration if the value is set too large. Unit: 0.1ms
Pn114	Torque feedforward	Immediately	P, S	It is used to set torque feedforward, and enhance response speed. Set the load inertia percentage(Pn106) correctly to enable this function in manual gain adjustment mode. Unit: %
Pn115	Torque feedforward filter	Immediately	P, S	It is used to ease mechanical vibration due to torque feedforward. Unit: 0.1ms
Pn116	P/PI switching condition	After restart	P, S	0: Torque reference percentage 1: Value of offset counter 2: Value of acceleration speed setting 3: Value of speed setting 4: Fixed PI
Pn117	Torque switching threshold	After restart	P, S	Threshold of torque to switch PI control to P control. Unit: %
Pn118	Offset counter switching threshold	Immediately	P	Threshold of error counter to switch PI control to P control. Unit: pulse
Pn119	Setting acceleration speed switching threshold	Immediately	P, S	Threshold of acceleration speed to switch PI control to P control. Unit: 10rpm/s

Pn120	Setting speed switching threshold	Immediately	P, S	Threshold of speed to switch PI control to P control. Unit: rpm
Pn121	Gain switching condition	After restart	P, S	0: Fix to 1st group gain 1: External switch gain switching(G-SEL) 2: Torque percentage 3: Value of offset counter 4: Value of acceleration speed setting（10rpm） 5: Value of speed setting 6: Speed reference input 7: actual motor speed
Pn122	Switching delay time	Immediately	P, S	Delay time of switching gain when switching condition is satisfied.
Pn123	Switch threshold level	Immediately	P, S	Gain switching trigger level
Pn124	Reserved	—	—	—
Pn125	Position gain switching time	Immediately	P	This parameter is used to smooth transition if the change of the two groups of gain is too large.
Pn126	Hysteresis switching	Immediately	P, S	This parameter is used to set the operation hysteresis of gain switching.
Pn127	Low speed detection filter	Immediately	P, S	This parameter is used to filter in low speed detection. The speed detection will be lagged if the value is too large.
Pn128	Speed gain acceleration relationship during online autotuning	Immediately	P, S	The increasing multiple of speed loop gain is the same rigidity during online autotuning. The speed loop gain is larger when this value is higher.
Pn129	Low speed correction coefficient	Immediately	P, S	The intensity of anti-friction and anti-creeping at low speed. Vibration will occur if this value is set too large.
Pn130	Friction Load	Immediately	P, S	Frictin load or fixed load compensation
Pn131	Friction compensation speed hysteresis area	Immediately	P, S	Threshold of friction compensation start
Pn132	Sticking friction load	Immediately	P, S	Sticking damp which is in direct proportion to speed.
Pn133	Reserved	—	—	—
Pn134	Reserved	—	—	—
Pn135	Reserved	—	—	—
Pn136	Reserved	—	—	—
Pn137	Reserved	—	—	—
Pn138	Reserved	—	—	—
Pn139	Reserved	—	—	—
Pn140	Reserved	—	—	—
Pn141	Reserved	—	—	—
Pn142	Reserved	—	—	—
Pn143	Reserved	—	—	—
Pn144	Reserved	—	—	—

Pn304	Parameter speed	Immediately	S	The parameter can be set to positive or negative. When control mode is set to D, it determines the speed of motor . The servomotor speed is determined by this parameter when Pn005.1=D.	
Pn305	JOG speed	Immediately	S	It is used to set JOG rotation speed, and the direction is determined by the pressing key during JOG operation.	
Pn306	Soft start acceleration time	Immediately	S	The time for trapeziform acceleration to accelerate to 1000rpm. Unit: ms	
Pn307	Soft start deceleration time	Immediately	S	The time for trapeziform deceleration to decelerate to 1000rpm. Unit: ms	
Pn308	Speed filter time constant	Immediately	S	1st order filter time constant Unit: ms	
Pn309	S curve risetime	Immediately	S	The time for transition from one point to another point in S curve.	
Pn310	Speed reference curve form	After restart	S	0:Slope 1:S curve 2:1st order filter 3:2nd order filter	
Pn311	S form selection	After restart	S	This value determines the transition form of S curve.	
Pn407	Notch filter 1 frequency	Immediately	P, S, T	Notch filter 1 frequency	1. In some conditions, vibration will be picked up and response will be lagged after notch filter is set. 2. When notch filter frequency is set to 5000, the notch filter is invalid.
Pn408	Notch filter 1 depth	Immediately	P, S, T	Notch filter 1 depth	
Pn409	Notch filter 2 frequency	Immediately	P, S, T	Notch filter 2 frequency	
Pn410	Notch filter 2 depth	Immediately	P, S, T	Notch filter 2 depth	
Pn411	Low frequency vibration frequency	Immediately	P, S	Frequency of low frequency vibration with load.	
Pn412	Low frequency vibration damp	Immediately	P, S	Attenuation damp of low frequency vibration with load. It does not need to change.	
Pn500	Positioning error	Immediately	P	Outputs /COIN signal when error counter is less than this value.	
Pn501	Coincidence difference	Immediately	P	Outputs /VCMP signal when the difference between speed reference value and speed feedback value is less than this value.	
Pn502	Zero clamp speed	Immediately	S	The servomotor is locked in the form of temporary position loop when the speed corresponding to the analog input is less than this value.	
Pn503	Rotation detection speed TGON	Immediately	P, S, T	When the servomotor speed exceeds this parameter setting value, it means that the servomotor has already rotated steadily and outputs /TGON signal.	
Pn504	Offset counter overflow alarm	Immediately	P	When the value in error counter exceeds this parameter setting value, it means that error counter alarm has occurred and outputs alarm an signal.	

Pn505	Servo ON waiting time	Immediately	P, S, T	These parameters are only enabled when the port output parameters are allocated with /BK signal output. These parameters are used to keep braking (prevent from gravity glissade or continuous outside force on servomotor) time sequence. **Servo ON waiting time:** ①For the parameter is plus,/BK signal is output firstly when servo-ON signal is input, and then servomotor excitation signal is created after delaying the parameter setting time. ②For the parameter is minus, servomotor excitation signal is output firstly when servo-ON signal is input, and then /BK signal is created after delaying the parameter setting time. **Basic waiting flow:** Standard setting: /BK output (braking action) and servo-OFF are at the same time. Now, the machine movable part may shift slightly due to gravity according to mechanical configuration and character; it can be eliminated by using the parameters when the servomotor is at stop or at a low speed. **Brake waiting speed:** /BK signal is output when the servomotor speed is decreased below the parameter setting value at servo-OFF. **Brake waiting time:** BK signal is output when the delay time exceeds the parameter setting value after servo-OFF. /BK signal is output as long as either of the brake waiting speed or brake waiting time is satisfied.
Pn506	Basic waiting flow	Immediately	P, S, T	
Pn507	Brake waiting speed	Immediately	P, S, T	
Pn508	Brake waiting time	Immediately	P, S, T	
Pn509	Allocate input port to signal, one port with four bits(hex)	After restart	P, S, T	Pn509.0 corresponding port CN1_15 Pn509.1 corresponding port CN1_16 Pn509.2 corresponding port CN1_17

Pn510	Allocate input port to signal, one port with four bits(hex)	After restart	P, S, T	Pn509.3 corresponding port CN1_18 Pn510.0 corresponding port CN1_19 Terminal PRI：CN1_15< CN1_16< CN1_17< CN1_18< CN1_19 Corresponding signal of each data is shown as following： 0：S-ON 1：P-CON 2：POT 3：NOT 4：ALMRST 5：CLR 6：PCL 7：NCL 8：G_SEL 9：JDPOS_JOG+ A：JDPOS_JOG- B：JDPOS_HALT C：HmRef D：Touch Probe1 input E：Touch Probe2 input
Pn511	Output signal allocation	After restart	P, S, T	Pn511.0 corresponding port CN1_11,CN1_14 Pn511.2 corresponding port CN1_13,CN1_14 Corresponding signal of each data is shown as follows: 0：/COIN/VCMP 1：/TGON 2：/S-RDY 3：/CLT 4：/BK 5：Reserved 6：Reserved 7：Reserved 8：/HOME 9：Reserved
Pn512	Bus control input node low-bit enabled	Immediately	P, S, T	Bus communication input port enabled: [0]：Disabled [1]：Enabled Pn512.0→CN1_15 Pn512.1→CN1_16 Pn512.2→CN1_17 Pn512.3→CN1_18 Pn513.0→CN1_19
Pn513	Bus control input node low-bit enabled	Immediately	P, S, T	
Pn514	Input port filter	Immediately	P, S, T	It is used to set input port filter time. The signal will be lagged if the parameter setting is too high.
Pn515	Reserved	—	—	—
Pn516	Input port signal inversion	Immediately	P, S, T	[0]：Do not inverse signal. [1]：Inverse signal

Pn517	Input port signal inversion	Immediately	P, S, T	Pn516.0→CN1_15 inversion Pn516.1→CN1_16 inversion Pn516.2→CN1_17 inversion Pn516.3→CN1_18 inversion Pn517.0→CN1_19 inversion
Pn518	Reserved	—	—	—
Pn519	Reserved	—	—	—
Pn520	Reserved	—	—	—
Pn521	Binary	Immediately	P,S,T	If a regenerative resistor if connected externally 0：connect externally regenerative resistor between B1 and B2 1：Dose not connect externally regenerative resistor, relay on internal capacitance.（This parameter is in effect only on ProNet-02/04/ ProNet-E-02/04）
Pn522	Reserved	—	—	—
Pn523	Reserved	—	—	—
Pn524	Reserved	—	—	—
Pn525	Overload alarm threshold	Immediately	P, S, T	When load percentage is larger than overload alarm threshold, A04 will occur soon. Pn525 is recommended to set below 120, otherwise the servo drive and motor will be damaged.
Pn526	Temperature threshold of motor overheat alarm (Only enabled in ProNet–75/1A/1E/2B)	Immediately	P, S, T	When servomotor winding temperature exceeds Pn526 setting, A19 will occur. (Only enabled in ProNet–75/1A/1E/2B)
Pn528	Output signal inverse	Immediately	P, S, T	[0]: Do not inverse signal. [1]: Inverse signal Pn528.0→ CN1_11,CN1_14 inversion Pn528.1→ CN1_12,CN1_14 inversion Pn528.2→ CN1_13,CN1_14 inversion
Pn529	Torque detection output signal threshold value	Immediately	P, S, T	When motor torque output is higher than Pn529 setting value, /TCR is ON. When motor torque output is lower than Pn529 setting value, /TCR is OFF. Unit:%
Pn530	Torque detection output signal time	After restart	P, S, T	Torque detection output signal time. Unit: ms

Pn700	Hex	After restart	ALL	**Pn700.0 MODBUS communication baud rate** [0] 4800bps [1] 9600bps [2] 19200bps **Pn700.1 MODBUS protocol selection** [0] 7, N, 2 (MODBUS,ASCII) [1] 7, E, 1 (MODBUS,ASCII) [2] 7, O, 1 (MODBUS,ASCII) [3] 8, N, 2 (MODBUS,ASCII) [4] 8, E, 1 (MODBUS,ASCII) [5] 8, O, 1 (MODBUS,ASCII) [6] 8, N, 2 (MODBUS,RTU) [7] 8, E, 1 (MODBUS,RTU) [8] 8, O, 1 (MODBUS,RTU) **Pn700.2 Communication protocol selection** [0] No protocol SCI communication [1] MODBUS SCI communication **Pn700.3 Reserved**
Pn701	MODBUS Axis address	After restart	ALL	Axis address of MODBUS protocol communication
Pn702	Reserved	—	—	—
Pn703	Reserved	—	—	—
Pn704	EtherCAT communication contact	After restart	ALL	EtherCAT Aix address of communication
Pn840	Hex	After restart	ALL	**Pn840.0** Encoder model selection [0]-[2] Reserved（For factory using） [3] 17-bit absolute encoder [4] Reserved [5] Resolved [6] Reserved [7] Reserved [8] 20-bit incremental encoder **Pn840.1** Reserved（For factory using） **Pn840.2** Reserved（For factory using） **Pn840.3** Reserved（For factory using）

Note

①: When connecting to EMJ-04A□H□□, Pn005.3 should be set as “1”.

②: “the max value of servo receiving pulse frequency” ,it means the sufficient max value of pulse frequency receiving by servo hardware.

B.3 Parameter List (ProNet-□□□EG-EC)

Parameter No.	Name	Unit	Setting Range	Factory Setting	Setting Invalidation
Pn000	**Binary** Pn000.0: Servo ON Pn000.1: Forward rotation input signal prohibited (P-OT) Pn000.2: Reverse rotation input signal prohibited (N-OT) Pn000.3: Alarm output when instantaneous power loss	—	0~1111	0	After restart
Pn001	**Binary** Pn001.0: CCW,CW selection Pn001.1: Analog speed limit enabled Pn001.2: Analog torque limit enabled Pn001.3: 2nd electronic gear enabled	—	0~1111	0	After restart
Pn002	**Binary** Pn002.0: Electronic gear switching mode Pn002.1: Reserved Pn002.2: Absolute encoder selection Pn002.3: Reserved	—	0~0111	0010	After restart
Pn003	**Binary** Pn003.0: Reserved Pn003.1: Reserved Pn003.2: Low speed compensation Pn003.3: Overload enhancement	—	0~1111	0	After restart
Pn004	**Hex** Pn004.0: Stop mode Pn004.1: Error counter clear mode Pn004.2: Reference pulse form Pn004.3: Inverses pulse	—	0~0x3425	0	After restart
Pn005	**Hex** Pn005.0: Torque feedforward mode Pn005.1: Control mode Pn005.2: Out-of-tolerance alarm selection Pn005.3: Servomotor model	—	0~0x33E3	0	After restart
Pn006	**Hex** Pn006.0: Bus mode Pn006.1: Reserved Pn006.2: Low-frequency vibration suppression switch Pn006.3: Reference input filter for open collector signal	—	0~0x2134	0x0024	After restart

Parameter No.	Name	Unit	Setting Range	Factory Setting	Setting Invalidation
Pn007	**Binary** Pn007.0: Wider the width of C pulse or not Pn007.1: Reserved Pn007.2: Reserved Pn007.3: Torque filter	—	0~0x1111	0	After restart
Pn008	**Binary** Pn008.0: Alarm classification selection Pn008.1: SON effective mode Pn008.2: Reserved Pn008.3: Reserved	—	0000~0011	0	After restart
Pn009	**Binary** Pn009.0: Sensor type selection Pn009.1: Reserved Pn009.2: Electronic gear selection Pn009.3: Reserved	—	0~1111	0	After restart
Pn010	**Hex** Pn010.0: Automatic identification function of motor enabled Pn010.1: Reserved Pn010.2: Reserved Pn010.3: Reserved	—	0~0x0101	0x0001	After restart
Pn100	**Online autotuning** Pn100.0: Load inertia setting Pn100.1: Online autotuning setting Pn100.2: Reserved Pn100.3: Reserved	—	0~0x0036	0x0000	After restart
Pn101	Machine rigidity setting	—	0~36	6	Immediately
Pn102	Speed loop gain	rad/s	1~4000	250	Immediately
Pn103	Speed loop integral time constant	0.1ms	1~4096	200	Immediately
Pn104	Position loop gain	1/s	0~1000	40	Immediately
Pn105	Torque reference filter time constant	0.01ms	0~2500	100	Immediately
Pn106	Load inertia ratio	%	0~20000	100	Immediately
Pn107	2nd speed loop gain	rad/s	1~4000	250	Immediately
Pn108	2nd speed loop integral time	0.1ms	1~4096	200	Immediately
Pn109	2nd position loop gain	rad/s	0~1000	40	Immediately
Pn110	2nd torque reference filter time constant	0.01ms	0~2500	100	Immediately
Pn111	Speed bias	rpm	0~300	0	Immediately
Pn112	Feedforward	%	0~100	0	Immediately
Pn113	Feedforward filter time constant	0.1ms	0~640	0	Immediately
Pn114	Torque feedforward	%	0~100	0	Immediately
Pn115	Torque feedforward filter time constant	0.1ms	0~640	0	Immediately
Pn116	P/PI switching condition	—	0~4	4	After restart
Pn117	Torque switching threshold	%	0~300	200	Immediately

Parameter No.	Name	Unit	Setting Range	Factory Setting	Setting Invalidation
Pn118	Offset counter switching threshold	puls	0~10000	0	Immediately
Pn119	Setting acceleration speed switching threshold	10rpm/s	0~3000	0	Immediately
Pn120	Setting speed switching threshold	rpm	0~10000	0	Immediately
Pn121	Gain switching condition	—	0~8	0	After start
Pn122	Switching delay time	0.1ms	0~20000	0	Immediately
Pn123	Threshold switching level	—	0~20000	0	Immediately
Pn124	Actual speed threshold	rpm	0~2000	0	Immediately
Pn125	Position gain switching time	0.1ms	0~20000	0	Immediately
Pn126	Hysteresis switching	—	0~20000	0	Immediately
Pn127	Low speed detection filter	0.1ms	0~100	10	Immediately
Pn128	Speed gain acceleration relationship during online autotuning	—	0~3	3	Immediately
Pn129	Low speed correction coefficient	—	0~30000	0	Immediately
Pn130	Friction load	0.1%	0~3000	0	Immediately
Pn131	Friction compensation speed hysteresis area	rpm	0~100	0	Immediately
Pn132	Sticking friction load	0.1%/1000rpm	0~1000	0	Immediately
Pn146	Notch filters 1 trap width	—	0~15	2	Immediately
Pn147	Notch filters 2 trap width	—	0~15	2	Immediately
Pn200	PG divided ratio	Puls	16~16384	16384	After restart
Pn201	16 bit 1st electronic gear numerator	—	1~65535	1	After restart
Pn202	16 bit electronic gear denominator	—	1~65535	1	After restart
Pn203	16 bit 2nd electronic gear numerator	—	1~65535	1	After restart
Pn204	Position reference Acceleration /deceleration time constant	0.1ms	0~32767	0	Immediately
Pn205	Position reference filter form selection	—	0~1	0	After restart
Pn206	Reserved for manufacturer	—	0~300	100	—
Pn207	Lock torque during homing method （-1,-2,-3,-4）	%	0~200	20	Immediately
Pn208	Lock time during homing method（-1,-2,-3,-4）	0.125ms	0~10000	100	Immediately
Pn209	Touch Probe input channel selection	—	0~0x0022	0x0021	After restart
Pn210	Touch Probe input signal filtering time	0.01μs	0~1000	0	Immediately
Pn300	Analog speed reference input gain	rpm/v	0~3000	150	Immediately
Pn301	Analog speed given zero bias	10mv	-1000~1000	0	Immediately
Pn302	Reserved	—	—	—	—
Pn303	Reserved	—	—	—	—
Pn304	Parameter speed	rpm	-6000~6000	500	Immediately
Pn305	JOG speed	rpm	0~6000	500	Immediately
Pn306	Soft start acceleration time	ms	0~10000	100	Immediately
Pn307	Soft start deceleration time	ms	0~10000	100	Immediately
Pn308	Speed filter time constant	ms	0~10000	0	Immediately
Pn309	S curve risetime	ms	0~10000	0	Immediately
Pn310	**Speed reference curve form**	—	0~3	0	After restart

Parameter No.	Name	Unit	Setting Range	Factory Setting	Setting Invalidation
	0:Slope 1:S curve 2:1st order filter 3:2nd order filter				
Pn311	S form selection	—	0~3	0	Immediately
Pn312	DP communication JOG speed	rpm	-6000~6000	500	Immediately
Pn316	Internal speed 1	rpm	-6000~6000	100	Immediately
Pn317	Internal speed 2	rpm	-6000~6000	200	Immediately
Pn318	Internal speed 3	rpm	-6000~6000	300	Immediately
Pn319	Internal speed 4	rpm	-6000~6000	-100	Immediately
Pn320	Internal speed 5	rpm	-6000~6000	-200	Immediately
Pn321	Internal speed 6	rpm	-6000~6000	-300	Immediately
Pn322	Internal speed 7	rpm	-6000~6000	500	Immediately
Pn400	Torque reference gain	0.1V/100%	10~100	33	Immediately
Pn401	Forward internal torque limit	%	0~400	300	Immediately
Pn402	Reverse internal torque limit	%	0~400	300	Immediately
Pn403	Forward external torque limit	%	0~350	100	Immediately
Pn404	Reverse external torque limit	%	0~350	100	Immediately
Pn405	Plug braking torque limit	%	0~300	300	Immediately
Pn406	Speed limit during torque control	rpm	0~6000	1500	Immediately
Pn407	Notch filter 1 frequency	Hz	50~5000	5000	Immediately
Pn408	Notch filter 1 depth	—	0~23	0	Immediately
Pn409	Notch filter 2 frequency	Hz	50~5000	5000	Immediately
Pn410	Notch filter 2 depth	—	0~23	0	Immediately
Pn411	Low frequency jitter frequency	0.1Hz	50~500	100	Immediately
Pn412	Low frequency jitter damp	—	0~200	25	Immediately
Pn413	Torque control delay time	0.1ms	1~2000	100	Immediately
Pn414	Torque control speed hysteresis	rpm	10~1000	50	Immediately
Pn415	Analog torque given zero bias	10mv	-1000~1000	0	Immediately
Pn416	Reserved	—	0 ~ 1000	10	—
Pn500	Positioning error	puls	0~5000	10	Immediately
Pn501	Coincidence difference	rpm	0~100	10	Immediately
Pn502	Zero clamp speed	rpm	0~3000	10	Immediately
Pn503	Rotation detection speed	rpm	0~3000	20	Immediately
Pn504	Offset counter overflow alarm	256Puls	1~32767	1024	Immediately
Pn505	Servo ON waiting time	ms	-2000~2000	0	Immediately
Pn506	Basic waiting flow	10ms	0~500	0	Immediately
Pn507	Brake waiting speed	rpm	10~100	100	Immediately
Pn508	Brake waiting time	10ms	0~100	50	Immediately
Pn509	Allocate input signal to terminal	—	0~0xFFFF	0x3210	After restart
Pn510	Allocate input signal to terminal	—	0~0xFFFF	0x7654	After restart
Pn511	Allocate output signal to terminal	—	0~0x0BBB	0x0210	After restart
Pn512	Bus control input terminal enabled	—	0~1111	0	Immediately

Parameter No.	Name	Unit	Setting Range	Factory Setting	Setting Invalidation
Pn513	Bus control input terminal enabled	—	0~1111	0	Immediately
Pn514	Input port filter	0.2ms	0~1000	1	Immediately
Pn515	Alarm port filter	0.2ms	0~3	1	Immediately
Pn516	Input port signal inversion	—	0~1111	0	Immediately
Pn517	Input port signal inversion	—	0~1111	0	Immediately
Pn518	Dynamic brake time	0.5ms	50~2000	1250	Immediately
Pn519	Serial encoder error time	0.1ms	0~10000	3	Immediately
Pn520	Position complete time	0.1ms	0~60000	500	Immediately
Pn521	Pn521.0 If connected externally regenerative resistor Pn521.1 Reserved for manufacturer Pn521.2 Reserved for manufacturer Pn521.3 Reserved for manufacturer	—	0 ~ 1111	1000	After restart
Pn522	Reserved	—	—	—	—
Pn523	Reserved	—	—	—	—
Pn524	Reserved	—	—	—	—
Pn525	Overload alarm threshold	%	100~150	100	Immediately
Pn526	Temperature threshold of motor overheat alarm (Only enabled in ProNet–75/1A/1E/2B)	℃	50~180	110	Immediately
Pn527	Reserved	10mv	0 ~ 520	500	—
Pn528	Output signal inverse	—	0~1111	0	Immediately
Pn529	Torque detection output signal threshold value	%	3~300	100	Immediately
Pn530	Torque detection output signal time	ms	1~10000	5000	After restart
Pn531	Reserved for manufacturer	—	—	—	—
Pn600	Position pulse in JPOS0 point to point control (high level)	10000puls	-9999~9999	0	Immediately
Pn601	Position pulse in JPOS0 point to point control (low level)	puls	-9999~9999	0	Immediately
	……				
Pn630	Position pulse in JPOS15 point to point control (high level)	10000 puls	-9999~9999	0	Immediately
Pn631	Position pulse in JPOS15 point to point control (low level)	puls	-9999~9999	0	Immediately
Pn632	JPOS0 point to point speed control	rpm	0~6000	500	Immediately
	……				
Pn647	JPOS015 point to point speed control	rpm	0~6000	500	Immediately
Pn648	JPOS0 point to point control 1st order filter time	0.1ms	0~32767	0	Immediately
	……				
Pn663	JPOS15 point to point control 1st order filter time	0.1ms	0~32767	0	Immediately
Pn664	JPOS0 point to point stop time	50ms	0~300	10	Immediately
	……				
Pn679	JPOS15 point to point stop time	50ms	0~300	10	Immediately
Pn680	Reserved	—	—	—	—

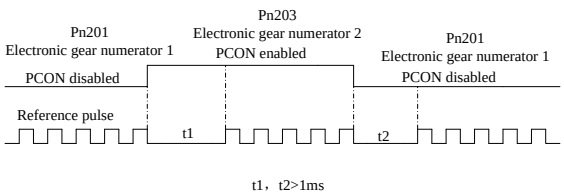
Parameter No.	Name	Unit	Setting Range	Factory Setting	Setting Invalidation
Pn681	**Hex** Pn681.0:Single/cyclic, start/reference point selection Pn681.1:Change step and start mode Pn681.2:Change step input signal mode Pn681.3:Reserved	—	0~0x0133	0x0000	Immediately
Pn682	Programme mode	—	0~1	0	Immediately
Pn683	Programme start step	—	0~15	0	Immediately
Pn684	Programme stop step	—	0~15	1	Immediately
Pn685	Search travel speed in position control (contact reference); Speed of finding reference point (hitting the origin signal ORG) in position homing control.	rpm	0~3000	1500	Immediately
Pn686	Leave travel switch speed in position control(contact reference); Speed of finding reference point (leaving the origin signal ORG) in position homing control.	rpm	0~200	30	Immediately
Pn687	Position teaching pulse	10000puls	-9999~9999	0	Immediately
Pn688	Position teaching pulse	puls	-9999~9999	0	Immediately
Pn689	Reserved	—	—	—	—
Pn690	Encoder multi-turn upper limit	r	0~65535	100	After restart
Pn691	Setting value of encoder multi-turn when power off	r	0~65535	0	After restart
Pn692	Actual value of encoder multi-turn when power off	r	0~65535	0	After restart
Pn700	**Hex** Pn700.0: MODBUS communication baud rate Pn700.1: MODBUS protocol Pn700.2:Communication protocol selection Pn700.3: Reserved	—	0~0x0182	0x0151	After restart
Pn701	MODBUS axis address	—	1~247	1	After restart
Pn702	Reserved	—	—	—	—
Pn703	**Hex** Pn703.0: Reserved Pn703.1: Synchronous frame early detection	—	0~0x0015	0x0004	After restart
Pn704	EtherCAT communication contact	—	1~127	1	After restart
Pn705	32 bit 1st electronic gear numerator (H)	—	0~9999	0	After restart
Pn706	32 bit 1st electronic gear numerator (L)	—	0~9999	1	After restart
Pn707	32 bit electronic gear denominator (H)	—	0~9999	0	After restart
Pn708	32 bit electronic gear denominator (L)	—	0~9999	1	After restart

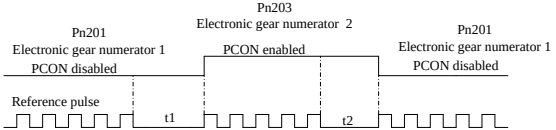
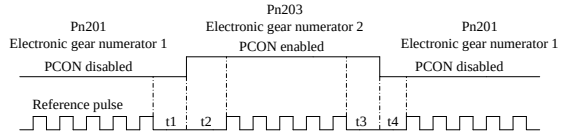
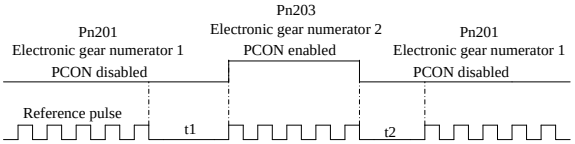
Parameter No.	Name	Unit	Setting Range	Factory Setting	Setting Invalidation
Pn709	32 bit 2st electronic gear numerator (H)	—	0~9999	0	After restart
Pn710	32 bit 2st electronic gear numerator (L)	—	0~9999	1	After restart
Pn840	**Hex** Pn840.0: Encoder model selection Pn840.1: Motor designing sequence Pn840.2: Servo drive model selection Pn840.3: Reserved	—	0x0000~ 0x0F3E	—	After restart

Note: The setting range and factory setting of Pn401 to Pn405 depend on the actual overload capacity.

B.4 Parameters in detail (ProNet-□□□EG-EC)

Parameter No.	Description	Setting Validation	Control Mode	Function and Meaning
Pn000	Binary	After restart	ALL	**Pn000.0 Servo ON** [0] External S-ON enabled. [1] External S-ON disabled. Servo motor excitation signal is turned ON automatically after S-RDY is output. **Pn000.1 Forward rotation input signal prohibited (P-OT)** [0] External P-OT enabled. Operate in the time sequence setting in Pn004.0 when travel limit occurs. [1] External P-OT disabled. **Pn000.2 Reverse rotation input signal prohibited (N-OT)** [0]External N-OT enabled. Operate in the time sequence setting in Pn004.0 when travel limit occurs. [1] External N-OT disabled. **Pn000.3 Alarm output when instantaneous power loss (ALM)** [0]Instantaneous power loss for one period with no alarm output [1]Instantaneous power loss for one period with alarm output
Pn001	Binary	After restart	Pn001.0 ALL Pn001.1	**Pn001.0 CCW,CW selection** [0] Sets CCW as forward direction [1] Sets CW as forward direction

Parameter No.	Description	Setting Validation	Control Mode	Function and Meaning
			T Pn001.2 P, S Pn001.3 P	**Pn001.1 Analog speed limit enabled** [0] Sets the value of Pn406 as the speed limit value during torque control. [1] Use the lower speed between V-REF and Pn406 as an external speed limit input. **Pn001.2 Analog torque limit enabled** [0] Sets Pn401~Pn404 as torque limit. [1] Sets the value corresponding to Tref input analog voltage as torque limit. **Pn001.3 2nd electronic gear enabled** [0] 2nd electronic gear is disabled, PCON signal is used to switch P/PI [1] 2nd electronic gear is enabled, PCON signal is only used as 2nd electronic gear when Pn005.1 is set to 1.
Pn002	Binary	After restart	ALL	**Pn002.0 Electronic gear switching mode** [0] Corresponding time sequence  [1] Corresponding time sequence

Parameter No.	Description	Setting Validation	Control Mode	Function and Meaning
				 t1，t2>1ms Time sequence when Pn002.0=0 or 1  t1，t2，t3，t4>1ms Error time sequence  t1，t2>1ms **Pn002.1 Reserved** **Pn002.2 Absolute encoder selection** [0] Use absolute encoder as an absolute encoder [1] Use absolute encoder as an incremental encoder

Parameter No.	Description	Setting Validation	Control Mode	Function and Meaning
				Pn002.3 Reserved
Pn003	Binary	After restart	ALL	**Pn003.0 Reserved** **Pn003.1 Reserved** **Pn003.2 Low speed compensation** [0] Without low speed correction [1] With low speed correction to avoid servomotor creeping, but the degree of correction is determined by the setting in Pn129. **Pn003.3 Overload enhancement** [0] Without overload enhancement function [1] With overload enhancement function, which can enhance the overload capacity when servomotor exceeds the 2 times rated overload. It is used in frequent power ON/OFF occasions.
Pn004	Hex	After restart	Pn004.0 ALL Pn004.1 P Pn004.2 P Pn004.3 P	**Pn004.0 Stop Mode** [0] Stops the servomotor by applying DB and then releases DB. [1] Coast to a stop. [2] Stops the servomotor by DB when servo OFF, stops the servomotor by plug braking when overtravel, then places it into coast (power OFF) mode. [3] Makes the servomotor coast to a stop state when servo OFF, stops the servomotor by plug braking when overtravel, then places it into coast (power OFF) mode. [4] Stops the servomotor by DB when servo OFF, stops the servomotor by plug braking when overtravel, then places it

Parameter No.	Description	Setting Validation	Control Mode	Function and Meaning
				into zero clamp mode. [5] Makes the servomotor coast to a stop state when servo OFF, stops the servomotor by plug braking when overtravel, then places it into zero clamp mode. **Pn004.1 Error counter clear mode** [0] Clear error pulse when S-OFF, do not when overtravel. [1] Do not clear error pulse. [2] Clear error pulse when S-OFF orovertravel (excep for zero clamp) **Pn004.2 Reference pulse form** [0] Sign + Pulse [1] CW+CCW CW + CCW [2] A + B (×1) [3] A + B (×2) [4] A + B (×4) **Pn004.3 Inverses pulse** [0] Do not inverse PULS reference and SIGN reference. [1] Do not inverse PULS reference; Inverses SIGN reference. [2] Inverse PULS reference;Do not inverse SIGN reference. [3] Inverse PULS reference and SIGN reference.

Parameter No.	Description	Setting Validation	Control Mode	Function and Meaning
Pn005	Hex	After restart	Pn005.0 P, S Pn005.1 ALL Pn005.2 P	**Pn005.0 Torque feedforward form** [0]Use general torque feedforward, external analog(Tref) feedforward input is invalid. [1]Use general torque feedforward, external analog(Tref) feedforward input is valid. [2]Use high-speed torque feedforward, external analog(Tref) feedforward input is invalid. [3]Use high-speed torque feedforward, external Analog (Tref) feedforward input is valid. **Pn005.1 Control mode** [0]Speed control (analog reference) **PCON: OFF, PI control； ON, P control** [1]Position control (pulse train reference) **PCON: OFF, PI control； ON, P control** [2]Torque control (analog reference) **PCON is invalid.** [3]Speed control (contact reference)←→speed Control (zero reference) **PCON, PCL, NCL: OFF Switches to speed control(zero reference)** [4]Speed control (contact reference)←→speed control(analog reference) **PCON, PCL, NCL: OFF Switches to speed control (analog reference)** [5]Speed control (contact reference)←→position control(pulse train reference)

Parameter No.	Description	Setting Validation	Control Mode	Function and Meaning
				PCON, PCL, NCL: OFF Switches to position control(pulse train reference) [6]Speed control (contact reference)←→torque Control (analog reference) **PCON, PCL, NCL: OFF Switches to position control (analog reference)** [7]Position control (pulse train reference)←→speed Control (analog reference) **PCON: OFF position control (pulse train reference)；ON speed control (analog reference)** [8]Position control (pulse train reference)←→Torque Control (analog reference) **PCON: OFF position control (pulse train reference)；ON torque control (analog reference)** [9]Torque control (analog reference)←→speed Control (analog reference) **PCON: OFF Torque control (analog reference)；ON Speed control (analog reference)** [A]Speed control (analog reference)←→zero clamp Control **PCON: OFF Speed control (analog reference)；ON zero clamp control** [B]Positin control (pulse train reference)←→position control (INHIBIT) **PCON: OFF Position control (pulse train reference)；ON position control (INHIBIT)**

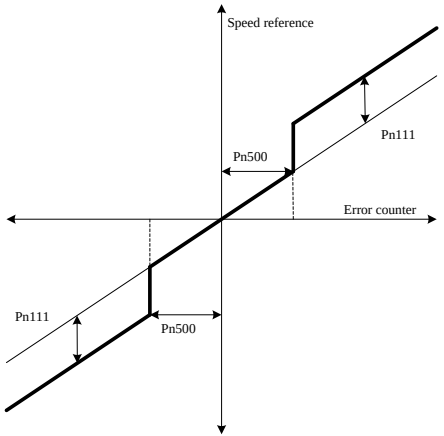
Parameter No.	Description	Setting Validation	Control Mode	Function and Meaning
				[C]Position control (contact reference) **PCON: Used to change step** **PCL, NCL: Used to search reference point or start** [D]Speed control (parameter reference) **PCON invalid** **Pn005.2 Out-of-tolerance alarm selection** [0] Out-of-tolerance alarm disabled [1] Out-of-tolerance alarm enabled. Outputs alarm when the value of error counter exceeds Pn504 setting value. [2] Reserved [3] Reserved **Pn005.3 Servomotor model selection** [0] EMJ [1] EMG [2] EML [3] EMB [4] Reserved [5] Reserved
Pn006	Hex	After restart	P, S	**Pn006.0 Bus type selection** [0] No bus [1] PROFIBUS-DP V0/V1 [2] PROFIBUS-DP V2 [3] CANopen [4] EtherCAT **Pn006.1 Reserved**

Parameter No.	Description	Setting Validation	Control Mode	Function and Meaning
				Pn006.2 Low-frequency vibration suppression switch [0] Low-frequency vibration suppression function disabled [1] Low-frequency vibration suppression function enabled **Pn006.3 Reference input filter for open collector signal** [0] When pulse is difference input, the max value of servo receiving pulse frequency ≤4M [1] When pulse is difference input, the max value of servo receiving pulse frequency ≤650K [2] When pulse is difference input, the max value of servo receiving pulse frequency≤150K Notes: "the max value of servo receiving pulse frequency" ,it means the sufficient max value of pulse frequency receiving by servo hardware.
Pn007	Binary	After restart	ALL	Pn007.0: Wider the width of C pulse or not [0] Standard width of C pulse [1] Wider the width of C pulse Pn007.1: Reserved Pn007.2: Reserved Pn007.3: Torque filter [0] Standard torque filter [1] New torque filter
Pn008	Binary	After restart	—	Pn008.0: Alarm classification selection Pn008.1: SON effective mode Pn008.2: Reserved

Parameter No.	Description	Setting Validation	Control Mode	Function and Meaning
				Pn008.3: Reserved
Pn009	Binary	After restart	P	Pn009.0: Sensor type selection Pn009.1: Reserved Pn009.2: Electronic gear selection Pn009.3: Reserved
Pn010	Hex	After restart	P, S, T	Pn010.0: Automatic identification motor function enabled [0] Disabled auto identity function [1] Enabled auto identity function (get the models of servo drive, servo motor, encoder automatically, and load the servo drive parameters, but not read the motor parameters from Pn parameters. Pn010.1: Reserved Pn010.2: Reserved Pn010.3: Reserved
Pn100	Online autotuning	After restart	P, S	**Pn100.0 Load inertia setting** [0] Manual setting [1,2,3] Normal mode [4,5,6] Vertical load [1,4] Load inertia without variation [2,5] Load inertia with little variation [3,6] Load inertia with great variation **Pn100.1 Online autotuning setting** [0] Manual setting [1] Standard

Parameter No.	Description	Setting Validation	Control Mode	Function and Meaning
				[2] Steadily [3] High precision **Note:** Autotuning may be invalid in the following cases: 1.Autotuning is invalid when servomotor max.speed is less than 100rpm. 2.Autotuning is invalid when servomotor acceleration /deceleration speed is less than 5000rpm/s. 3.Autotuning is invalid when mechanical clearance is too big during operation. 4.Autotuning is invalid when the difference of different speed load is too great. 4.Autotuning is invalid when mechanical vibration and friction are too big during operation. Pn100.2: Reserved Pn100.3: Reserved
Pn101	Machine rigidity setting	Immediately	P, S	The response speed of servo system is determined by this parameter. Normally, the rigidity should be set a little larger. However, if it is too large, it would suffer mechanical impact. It should be set a little smaller when large vibration is present. This parameter is only valid in autotuning.
Pn102	Speed loop gain	Immediately	P, S	This parameter determines speed loop gain. Unit: rad/s
Pn103	Speed loop integral time	Immediately	P, S	Decreases the value of this parameter to shorten positioning time and enhance speed response.

Parameter No.	Description	Setting Validation	Control Mode	Function and Meaning
	constant			Unit: 0.1ms
Pn104	Position loop gain	Immediately	P	This parameter determines position loop gain. Decreases this value to enhance servo rigidity, but vibration will occur if the value is too large. Unit: 1/s
Pn105	Torque reference filter time constant	Immediately	P, S, T	Torque reference filter can eliminate or lighten mechanical vibration, but incorrect setting will result to mechanical vibration. Unit:0.01ms
Pn106	Load inertia ratio	Immediately	P, S	Setting value=(load inertia/rotor inertia) ×100 Unit: %
Pn107	2nd speed loop gain	Immediately	P, S	The meanings of these parameters are the same as Pn102~Pn105. These parameters are only needed to set when the gain function are enabled.
Pn108	2nd speed loop integral time	Immediately	P, S	
Pn109	2nd position loop gain	Immediately	P	
Pn110	2nd torque reference filter time constant	Immediately	P, S, T	
Pn111	Speed bias	Immediately	P	This parameter setting can shorten positioning time. However, if it is too large or does not cooperate with Pn111 correctly, vibration will occur. The relationship with speed reference, error counter, positioning error is shown in the following chart.

Parameter No.	Description	Setting Validation	Control Mode	Function and Meaning
				
Pn112	Feedforward	Immediately	P	It is used to set position feedforward. The response speed is faster and position error is less when this parameter setting is higher. Vibration will occur if the value is set too large. Unit: %
Pn113	Feedforward filter time constant	Immediately	P	It is used to ease mechanical vibration due to position feedforward. The feedforward lag will be enlarged and result to vibration if the value is set too large. Unit: 0.1ms
Pn114	Torque feedforward	Immediately	P, S	It is used to set torque feedforward, and enhance response speed.

Parameter No.	Description	Setting Validation	Control Mode	Function and Meaning
				Set the load inertia ratio (Pn106) correctly to enable this function in manual gain adjustment mode. Unit: %
Pn115	Torque feedforward filter time constant	Immediately	P, S	It is used to ease mechanical vibration due to torque feedforward. Unit: 0.1ms
Pn116	P/PI switching condition	After restart	P, S	[0]Torque reference percentage [1]Value of offset counter [2]Value of acceleration speed setting [3]Value of speed setting [4]Fixed PI
Pn117	Torque switching threshold	After restart	P, S	Threshold of torque to switch PI control to P control. Unit: %
Pn118	Offset counter switching threshold	Immediately	P	Threshold of error counter to switch PI control to P control. Unit: puls
Pn119	Setting acceleration speed switching threshold	Immediately	P, S	Threshold of acceleration speed to switch PI control to P control. Unit: 10rpm/s
Pn120	Setting speed switching threshold	Immediately	P, S	Threshold of speed to switch PI control to P control. Unit: rpm
Pn121	Gain switching condition	After restart	P, S	[0]Fix to 1st group gain [1]External switch gain switching(G-SEL)

Parameter No.	Description	Setting Validation	Control Mode	Function and Meaning
				[2]Torque percentage [3]Value of offset counter [4]Value of acceleration speed setting (10rpm/s) [5]Value of speed setting [6] Position reference input [7]actual motor speed [8] Position reference(Pn123) + actual speed (Pn124)
Pn122	Switching delay time	Immediately	P, S	The required time for switching the gain. Unit:0.1ms
Pn123	Switch threshold level	Immediately	P, S	Gain switching trigger level
Pn124	Actual speed threshold	Immediately	P, S	When Pn121=8, Pn124 is valid. Unit: rpm
Pn125	Position gain switching time	Immediately	P	This parameter is used to smooth transition if the change of the two groups of gain is too large.Unit:0.1ms
Pn126	Hysteresis switching	Immediately	P, S	This parameter is used to set the operation hysteresis of gain switching.
Pn127	Low speed detection filter	Immediately	P, S	This parameter is used to filter in low speed detection. The speed detection will be lagged if the value is too large. Unit:0.1ms
Pn128	Speed gain acceleration relationship during online autotuning	Immediately	P, S	The increasing multiple of speed loop gain is the same rigidity during online autotuning. The speed loop gain is larger when this value is higher.

Parameter No.	Description	Setting Validation	Control Mode	Function and Meaning
Pn129	Low speed correction coefficient	Immediately	P, S	The intensity of anti-friction and anti-creeping at low speed. Vibration will occur if this value is set too large.
Pn130	Friction Load	Immediately	P, S	Frictin load or fixed load compensation Unit: 0.1%
Pn131	Friction compensation speed hysteresis area	Immediately	P, S	Threshold of friction compensation start Unit: rpm
Pn132	Sticking friction load	Immediately	P, S	Sticking damp which is in direct proportion to speed.Unit: 0.1%/1000rpm
Pn146	Notch filters 1 trap width	Immediately	P, S, T	Notch filters 1 trap width
Pn147	Notch filters 2 trap width	Immediately	P, S, T	Notch filters 2 trap width
Pn200	PG divided ratio	After restart	P, S, T	Analog encoder output orthogonal difference pulses. The meaning of this value is the number of analog encoder output orthogonal difference pulses per one servomotor rotation.
Pn201	16 bit 1st electronic gear numerator	After restart	P	The parameters are valid,when Pn009.2=0. The electronic gear enables the reference pulse to relate with the servomotor travel distance, so the host controller doesn't change the mechanical deceleration ratio and encoder pulses. In fact, it is the setting of frequency doubling or frequency division to the reference pulses. $\frac{Numerator(Pn201\ or\ Pn203)}{Denominator(Pn202)}$
Pn202	16 bit electronic gear denominator	After restart	P	
Pn203	16 bit 2nd electronic gear	After restart	P	

Parameter No.	Description	Setting Validation	Control Mode	Function and Meaning
	numerator			
Pn204	Position reference acceleration /deceleration time constant	Immediately	P	This value is used to smooth the input pulses. The effect of smoothness is better when the value is higher, but lag will occur if the value is too large. Unit:0.1ms
Pn205	Position reference filter form selection	After restart	P	[0]: 1st order filter [1]: 2nd order filter
Pn206	Reserved for manufacturer	—	—	—
Pn207	Lock torque during homing method （-1,-2,-3,-4）	Immediately	P	The value limits the torque during homing method （-1,-2,-3,-4）, Unit:%rated torque.
Pn208	Lock time during homing method （-1,-2,-3,-4）	Immediately	P	The allowed time for the stalled during homing method （-1,-2,-3,-4）. Unit : 0.125ms
Pn209	Touch Probe input channel selection	After restart	P	Pn209.0 Touch Probe Channel 1 input selection [0] CN1_3 [1] CN1_3 [2] CN1_4 Pn209.1 Touch Probe Channel 2 input selection [0] CN1_3

Parameter No.	Description	Setting Validation	Control Mode	Function and Meaning
				[1] CN1_3 [2] CN1_4
Pn210	Touch Probe input signal filtering time	Immediately	P	The time for filtering the input signal. Unit is 0.01μs
Pn300	Analog speed reference input gain	Immediately	S	The corresponding speed to 1V analog input Unit: rpm/V
Pn301	Analog speed given zero bias	Immediately	S	This parameter is used to set zero bias of analog speed given, and it is related with the analog speed reference input gain (Pn300). Analog speed reference=(Speed reference input analog voltage —Analog speed reference zero bias)×Analog speed reference input gain Unit: 10mv
Pn302	Reserved	—	—	—
Pn303	Reserved	—	—	—
Pn304	Parameter speed	Immediately	S	The parameter can be set to positive or negative. When control mode is set to D, it determines the speed of motor. The servomotor speed is determined by this parameter when Pn005.1=D. Unit: rpm
Pn305	JOG speed	Immediately	S	It is used to set JOG rotation speed, and the direction is determined by the pressing key during JOG operation. Unit: rpm
Pn306	Soft start	Immediately	S	The time to accelerate to 1000rpm on slope speed

<table>
<tr><th>Parameter No.</th><th>Description</th><th>Setting Validation</th><th>Control Mode</th><th>Function and Meaning</th></tr>
<tr><td></td><td>acceleration time</td><td></td><td></td><td>reference.
Unit: ms</td></tr>
<tr><td>Pn307</td><td>Soft start deceleration time</td><td>Immediately</td><td>S</td><td>The time to decelerate to 1000rpm on slope speed reference.
Unit: ms</td></tr>
<tr><td>Pn308</td><td>Speed filter time constant</td><td>Immediately</td><td>S</td><td>Speed reference 1st order filter time constant
Unit: ms</td></tr>
<tr><td>Pn309</td><td>S curve risetime</td><td>Immediately</td><td>S</td><td>The time for transition from one point to another point in S curve.
Unit: ms</td></tr>
<tr><td>Pn310</td><td>Speed reference curve form</td><td>After restart</td><td>S</td><td>[0]Slope
[1]S curve
[2]1st order filter
[3]2nd order filter</td></tr>
<tr><td>Pn311</td><td>S form selection</td><td>After restart</td><td>S</td><td>This value determines the transition form of S curve.</td></tr>
<tr><td>Pn312</td><td>DP communication JOG speed</td><td>Immediately</td><td>P, S, T</td><td>Communication speed of bus JOG.
Unit: rpm</td></tr>
<tr><td>Pn316</td><td>Speed internal 1</td><td>Immediately</td><td>S</td><td rowspan="6">Internal speed is enabled when Pn005.1=3~6<table><tr><th colspan="3">Input signal</th><th rowspan="2">Operating speed</th></tr><tr><th>/P-CON</th><th>/P-CL</th><th>/N-CL</th></tr></table></td></tr>
<tr><td>Pn317</td><td>Speed internal 2</td><td>Immediately</td><td>S</td></tr>
<tr><td>Pn318</td><td>Speed internal 3</td><td>Immediately</td><td>S</td></tr>
<tr><td>Pn319</td><td>Speed internal 4</td><td>Immediately</td><td>S</td></tr>
<tr><td>Pn320</td><td>Speed internal 5</td><td>Immediately</td><td>S</td></tr>
<tr><td>Pn321</td><td>Speed internal 6</td><td>Immediately</td><td>S</td></tr>
</table>

<table>
<tr><th>Parameter No.</th><th>Description</th><th>Setting Validation</th><th>Control Mode</th><th colspan="4">Function and Meaning</th></tr>
<tr><td rowspan="8">Pn322</td><td rowspan="8">Speed internal 7</td><td rowspan="8">Immediately</td><td rowspan="8">S</td><td rowspan="4">OFF(H)</td><td>OFF(H)</td><td>OFF(H)</td><td>Zero speed or switch to other control modes</td></tr>
<tr><td>OFF(H)</td><td>ON(L)</td><td>SPEED1</td></tr>
<tr><td>ON(L)</td><td>OFF(H)</td><td>SPEED2</td></tr>
<tr><td>ON(L)</td><td>ON(L)</td><td>SPEED3</td></tr>
<tr><td rowspan="4">ON(L)</td><td>OFF(H)</td><td>OFF(H)</td><td>SPEED4</td></tr>
<tr><td>OFF(H)</td><td>ON(L)</td><td>SPEED5</td></tr>
<tr><td>ON(L)</td><td>OFF(H)</td><td>SPEED6</td></tr>
<tr><td>ON(L)</td><td>ON(L)</td><td>SPEED7</td></tr>
<tr><td>Pn400</td><td>Torque reference gain</td><td>Immediately</td><td>T</td><td colspan="4">The meaning of this parameter is the needed analog input voltage to reach the rated torque.</td></tr>
<tr><td>Pn401</td><td>Forward torque internal limit</td><td>Immediately</td><td>P, S, T</td><td colspan="4" rowspan="4">Servomotor output torque limit value (depending on the actual overload capacity) .Unit:%</td></tr>
<tr><td>Pn402</td><td>Reverse torque internal limit</td><td>Immediately</td><td>P, S, T</td></tr>
<tr><td>Pn403</td><td>Forward external torque limit</td><td>Immediately</td><td>P, S, T</td></tr>
<tr><td>Pn404</td><td>Reverse external torque limit</td><td>Immediately</td><td>P, S, T</td></tr>
</table>

Parameter No.	Description	Setting Validation	Control Mode	Function and Meaning	
Pn405	Plug braking torque limit	Immediately	P, S, T		
Pn406	Speed limit during torque control	Immediately	T	Servomotor output torque limit value during torque control Unit: rpm	
Pn407	Notch filter 1 frequency	Immediately	P, S, T	Notch filter 1 frequency Unit:Hz	1. In some conditions, vibration will be picked up and response will be lagged after notch filter is set. 2. When notch filter frequency is set to 5000, the notch filter is invalid.
Pn408	Notch filter 1 depth	Immediately	P, S, T	Notch filter 1 depth	
Pn409	Notch filter 2 frequency	Immediately	P, S, T	Notch filter 2 frequency Unit:Hz	
Pn410	Notch filter 2 depth	Immediately	P, S, T	Notch filter 2 depth	
Pn411	Low frequency vibration frequency	Immediately	P, S	Frequency of low frequency vibration with load. Unit:0.1Hz	
Pn412	Low frequency vibration damp	Immediately	P, S	Attenuation damp of low frequency vibration with load.	
Pn413	Torque control delay time	Immediately	T	These parameters are only enabled in position control mode.	
Pn414	Torque control speed hysteresis	Immediately	T		
Pn415	Analog torque given zero bias	Immediately	T	This parameter is used to set zero bias of analog torque given, and it is related with torque reference input gain (Pn400), Analog torque reference=(Torque reference input analog	

Parameter No.	Description	Setting Validation	Control Mode	Function and Meaning
				voltage —Analog torque reference zero bias)×Analog torque reference input gain. Unit:10mv
Pn416	Reserved	—	—	—
Pn500	Positioning error	Immediately	P	Outputs /COIN signal when error counter is less than this value.Unit:puls
Pn501	Coincidence difference	Immediately	P	Outputs /VCMP signal when the difference between speed reference value and speed feedback value is less than this value. Unit: rpm
Pn502	Zero clamp speed	Immediately	S	The servomotor is locked when the speed corresponding to the analog input is less than this value. Unit: rpm
Pn503	Rotation detection speed	Immediately	P, S, T	When the servomotor speed exceeds this parameter setting value, it means that the servomotor has already rotated steadily and outputs /TGON signal. Unit: rpm
Pn504	Offset counter overflow alarm	Immediately	P	When the value in error counter exceeds this parameter setting value, it means that error counter overflows and outputs an alarm signal. Unit:256Puls
Pn505	Servo ON waiting time	Immediately	P, S, T	These parameters are only enabled when the port output parameters are allocated with /BK signal output. These parameters are used to keep braking (prevent from gravity glissade or continuous outside force on servomotor) time sequence. **Servo ON waiting time:**

Parameter No.	Description	Setting Validation	Control Mode	Function and Meaning
Pn506	Basic waiting flow	Immediately	P, S, T	①For the parameter is plus,/BK signal is output firstly when servo-ON signal is input, and then servomotor excitation signal is created after delaying the parameter setting time. ②For the parameter is minus, servomotor excitation signal is output firstly when servo-ON signal is input, and then /BK signal is created after delaying the parameter setting time. **Basic waiting flow:** Standard setting: /BK output (braking action) and servo-OFF are at the same time. Now, the machine movable part may shift slightly due to gravity according to mechanical configuration and character; it can be eliminated by using the parameters when the servomotor is at stop or at a low speed. **Brake waiting speed:** /BK signal is output when the servomotor speed is decreased below the parameter setting value at servo-OFF. **Brake waiting time:** BK signal is output when the delay time exceeds the parameter setting value after servo-OFF. /BK signal is output as long as either of the brake waiting speed or brake waiting time is satisfied.
Pn507	Brake waiting speed	Immediately	P, S, T	
Pn508	Brake waiting time	Immediately	P, S, T	

Parameter No.	Description	Setting Validation	Control Mode	Function and Meaning
Pn509	Allocate input port to signal, one port with four bits(hex)	After restart	P, S, T	Pn509.0 → CN1_15 Pn509.1 → CN1_16 Pn509.2 → CN1_17 Pn509.3 → N1_18 Pn510.0 → CN1_19 Terminal PRI is CN1_15< CN1_16< CN1_17< CN1_18< CN1_19 Corresponding signal of each data is shown as following: [0]S-ON [1]P-CON [2]P-OT [3]N-OT [4]ALMRST

Parameter No.	Description	Setting Validation	Control Mode	Function and Meaning
Pn510	Allocate input port to signal, one port with four bits(hex)	After restart	P, S, T	[5]CLR [6]P-CL [7]N-CL [8]G-SEL [9]JDPOS-JOG+ [A]JDPOS-JOG- [B]JDPOS-HALT [C]HmRef [D]SHOM [E]ORG [F]ZCLAMP
Pn511	Output signal allocation	After restart	P, S, T	Pn511.1 → CN1_11， CN1_14 Pn511.2 → CN1_13， CN1_14 Corresponding signal of each data is shown as follows: [0]COIN/VCMP [1]TGON [2]S-RDY [3]CLT [4]BK [5]PGC [6]OT [7]RD [8]HOME

Parameter No.	Description	Setting Validation	Control Mode	Function and Meaning
				[9]TCR [A]R-OUT1 [B]R-OUT2
Pn512	Bus control input terminal enabled	Immediately	P, S, T	Bus control input terminal enabled: [0]: Disabled [1]: Enabled Pn512.0→CN1_15 Pn512.1→CN1_16 Pn512.2→CN1_17 Pn512.3→CN1_18 Pn513.0→CN1_19
Pn513	Bus control input terminal enabled	Immediately	P, S, T	
Pn513	Bus control input terminal enabled	Immediately	P, S, T	
Pn514	Input port filter	Immediately	P, S, T	It is used to set input port filter time. The signal will be lagged if the parameter setting is too high.Unit:0.2ms
Pn515	Alarm port filter	Immediately	P, S, T	It is used to set alarm port filter time, The signal will be lagged if the parameter setting is too high.Unit:0.2ms

Parameter No.	Description	Setting Validation	Control Mode	Function and Meaning
Pn516	Input port signal inversion	Immediately	P, S, T	[0]: Do not inverse signal. [1]: Inverse signal Pn516.0→CN1_15 inversion Pn516.1→CN1_16 inversion Pn516.2→CN1_17 inversion Pn516.3→CN1_18 inversion Pn517.0→CN1_19 inversion
Pn517	Input port signal inversion	Immediately	P, S, T	
Pn518	Dynamic brake time	Immediately	P, S, T	Motor dynamic brake time Unit: ms
Pn519	Serial encoder error time	Immediately	P, S, T	In the range of this parameter, there will be no warning of serial encoder error Unit: 0.1ms
Pn520	Position complete time	Immediately	P, S, T	This parameter set position complete time Unit: 0.1ms
Pn521	Binary	After restart	P,S,T	Pn521.0 If connected externally regenerative resistor 0: connect externally regenerative resistor between B1 and B2 1: Dose not connect externally regenerative resistor, relay on internal capacitance. (This parameter is in effect only on ProNet-A5/01/02/04) Pn521.1 Reserved Pn521.2 Reserved Pn521.3 Reserved
Pn522	Reserved	—	—	—

Parameter No.	Description	Setting Validation	Control Mode	Function and Meaning
Pn523	Reserved	—	—	—
Pn524	Reserved	—	—	—
Pn525	Overload alarm threshold	Immediately	P, S, T	When load percentage is larger than overload alarm threshold, A04 will occur soon. Pn525 is recommended to set below 120, otherwise the servo drive and motor will be damaged. Unit:%
Pn526	Temperature threshold of motor overheat alarm	Immediately	P, S, T	When servomotor winding temperature exceeds Pn526 setting, A19 will occur. Unit: ℃ (Only enabled in ProNet–75/1A/1E/2B)
Pn528	Output signal inverse	Immediately	P, S, T	[0]: Do not inverse signal. [1]: Inverse signal Pn528.0→CN1_11，CN1_14 Pn528.1→CN1_12，CN1_14 Pn528.2→CN1_13，CN1_14
Pn529	Torque detection output signal threshold value	Immediately	P, S, T	When motor torque output is higher than Pn529 setting value,/TCR is ON. When motor torque output is lower than Pn529 setting value,/TCR is OFF. Unit: %
Pn530	Torque detection output signal time	After restart	P, S, T	Torque detection output signal time. Unit: ms

Parameter No.	Description	Setting Validation	Control Mode	Function and Meaning
Pn531	Reserved for manufacturer	—	—	—
Pn600	Position pulse in JPOS0 point to point control (high level)	Immediately	P	The two parameters are used in combination, and the algebraic sum of them is the position JPOS0 needs to reach. (The number of servomotor rotation revolutions is related with the programme mode of point to point control.) Pn600 Unit: 10000puls Pn601 Unit: 1 puls
Pn601	Position pulse in JPOS0 point to point control (low level)	Immediately	P	
	……			The meaning of other point to point control related parameters are the same.
Pn630	Position pulse in JPOS15 point to point control (high level)	Immediately	P	The two parameters are used in combination, and the algebraic sum of them is the position of JPOS0 needs to reach. (The number of servomotor rotation revolutions is related with the programme mode of point to point control.) Pn630 Unit: 10000 puls Pn631 Unit: 1 puls
Pn631	Position pulse in JPOS15 point to point control (low level)	Immediately	P	
Pn632	JPOS0 point to point speed control	Immediately	P	JPOS0 Point to point speed control Unit: rpm
	……			The speed of other point to point control

Parameter No.	Description	Setting Validation	Control Mode	Function and Meaning
Pn647	JPOS015 point to point speed control	Immediately	P	The speed of JPOS15 point to point control Unit: rpm
Pn648	JPOS0 point to point control 1st order filter time	Immediately	P	1st order filter time of JPOS0 point to point control can stop or start the servomotor mildly.Unit: 0.1ms
	……			1st order filter of other point to point control.
Pn663	JPOS15 point to point control 1st order filter time	Immediately	P	1st order filter time of JPOS15 point to point control can stop or start the servomotor mildly. Unit: 0.1ms
Pn664	JPOS0 point to point control stop time	Immediately	P	JPOS0 point to point control stop time Unit: 50ms
	……			Other point to point control stop time
Pn679	JPOS15 point to point control stop time	Immediately	P	JPOS15 point to point control stop time Unit: 50ms
Pn680	Reserved	—	—	—
Pn681	**Hex**	Immediately	P	**Pn681.0 Single/cyclic, start/reference point selection** [0] Cyclic operation, PCL start signal, NCL search reference point in forward direction. [1] Single operation, PCL start signal, NCL search reference point in forward direction. [2] Cyclic operation, NCL start operation, PCL search

Parameter No.	Description	Setting Validation	Control Mode	Function and Meaning
				reference point in forward direction. [3] Single operation, NCL start operation, PCL search reference point in forward direction. **Pn681.1 Change step and start mode** [0] Delay to change step, no need of start signal, delay to start after S-ON. [1] PCON change step, no need of start signal, PCON delay to start after S-ON, but inside pulse can not stop when PCON off. [2] Delay to change step, need start signal, canceling start signal can immediately stop inside pulse. Return to programmed start point process step when reset. [3] PCON change step, need start signal, canceling start signal can immediately stop inside pulse. Return to programmed start point process step when reset. **Pn681.2 Change step input signal mode** [0] Change step input signal electrical level mode [1] Change step input signal pulse mode **Pn681.3 Reserved**
Pn682	Programme mode	Immediately	P	[0]: Incremental programme

Parameter No.	Description	Setting Validation	Control Mode	Function and Meaning
				[1]: Absolute programme
Pn683	Programme start step	Immediately	P	Select the start point of the point to point control
Pn684	Programme stop step	Immediately	P	Select the stop point of the point to point control.
Pn685	Search travel speed in position control (contact reference); Speed of finding reference point (Hitting the origin signal ORG) in position homing control.	Immediately	P	Search the servomotor speed in the direction of reference point towards travel switch.Unit: rpm
Pn686	Leave travel switch speed in position control (contact reference); Speed of finding reference point (Leaving the origin signal ORG) in position	Immediately	P	Search the servomotor speed when the reference point leaves travel switch. Unit: rpm

Parameter No.	Description	Setting Validation	Control Mode	Function and Meaning
	homing control.			
Pn687	Position teaching pulse	Immediately	P	The two parameters are used in combination, and the algebraic sum of them is the current position of position teaching. When performing the position teaching by utility function, the algebraic sum of the two parameters are given to the current position Pn687 unit: 10000puls Pn688 unit: 1 puls
Pn688	Position teaching pulse	Immediately	P	
Pn689	Reserved	—	—	—
Pn690	Encoder multi-turn upper limit	After restart	P	When the upper limit （Pn690 ）is exceeded in the forward rotation direction, the multi-turn data is 0.When the lower limit 0 is exceeded in the reverse rotation direction, the multi-turn data is Pn690.
Pn691	Setting value of encoder multi-turn when power off	After restart	P	Record the value of encoder multi-turn setting by soft when power off
Pn692	Actual value of encoder multi-turn when power off	After restart	P	Record the actual value of encoder multi-turn when power off
Pn700	Hex	After restart	ALL	**Pn700.0 MODBUS communication baud rate**

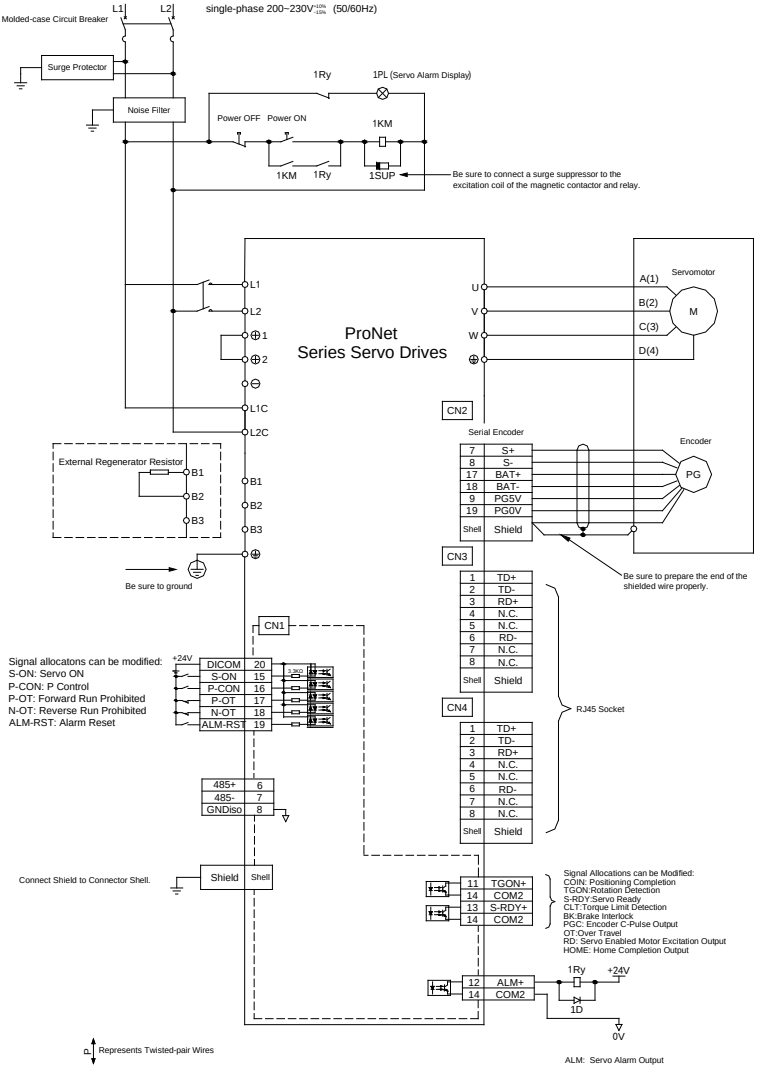
Parameter No.	Description	Setting Validation	Control Mode	Function and Meaning
				[0] 4800bps [1] 9600bps [2] 19200bps **Pn700.1 MODBUS protocol** [0] 7, N, 2 (MODBUS,ASCII) [1] 7, E, 1 (MODBUS,ASCII) [2] 7, O, 1 (MODBUS,ASCII) [3] 8, N, 2 (MODBUS,ASCII) [4] 8, E, 1 (MODBUS,ASCII) [5] 8, O, 1 (MODBUS,ASCII) [6] 8, N, 2 (MODBUS,RTU) [7] 8, E, 1 (MODBUS,RTU) [8] 8, O, 1 (MODBUS,RTU) **Pn700.2 Communication protocol selection** [0] No protocol SCI communication [1] MODBUS SCI communication **Pn700.3 Reserved**
Pn701	MODBUS axis address	After restart	ALL	Axis address of MODBUS protocol communication
Pn702	Reserved	—	—	—
Pn703	Hex	After restart	ALL	Pn703.0: Reserved Pn703.1: Synchronous frame early detection

Parameter No.	Description	Setting Validation	Control Mode	Function and Meaning
				[0]Close [1]Open
Pn704	EtherCAT communication contact	After restart	ALL	EtherCAT Aix address of communication
Pn705	32 bit 1st electronic gear numerator (H)	After restart	ALL	The parameters are valid,when Pn009.2=1. The electronic gear enables the reference pulse to relate with the servomotor travel distance, so the host controller doesn't change the mechanical deceleration ratio and encoder pulses. In fact, it is the setting of frequency doubling or frequency division to the reference pulses. $\frac{Numerator(Pn705 * 10000 + Pn706 \ or \ Pn709 * 10000 + Pn710)}{Denominator(Pn707 * 10000 + Pn708)}$
Pn706	32 bit 1st electronic gear numerator (L)	After restart	ALL	
Pn707	32 bit electronic gear denominator (H)	After restart	ALL	
Pn708	32 bit electronic gear denominator (L)	After restart	ALL	
Pn709	32 bit 2nd electronic gear numerator (H)	After restart	ALL	
Pn710	32 bit 2nd electronic gear numerator (L)	After restart	ALL	
Pn840	Hex	After restart	ALL	**Pn840.0** Encoder model selection [0]-[E] Reserved for manufacturer

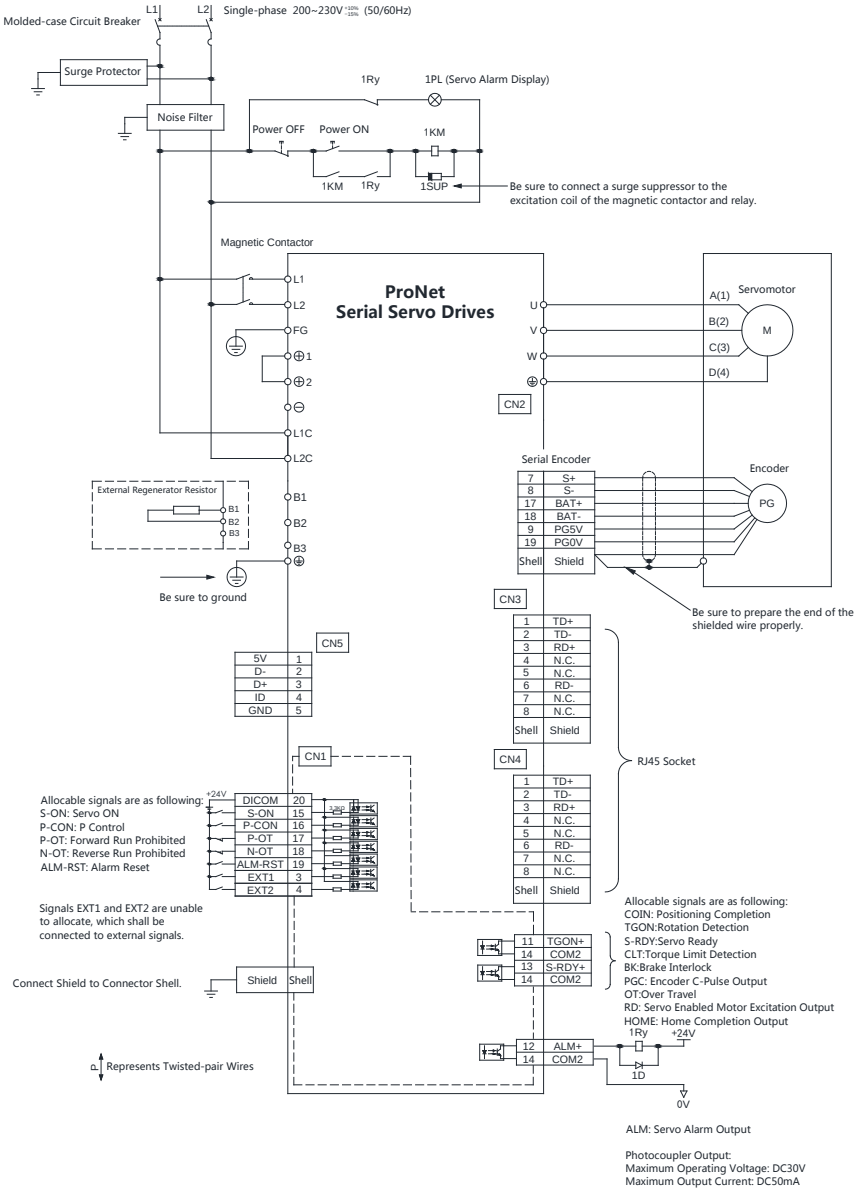
Parameter No.	Description	Setting Validation	Control Mode	Function and Meaning
				Pn840.1 Motor designing sequence [0]-[1] Reserved for manufacturer **Pn840.2** Servo drive model selection [E] 0.05kW servo drive [F] 0.1kW servo drive [0] 0.2kW servo drive [1] 0.4kW servo drive [2] 0.75kW servo drive [3] 1.0 kW servo drive [4] 1.5kW servo drive [5] 2.0kW servo drive [6] 3.0kW servo drive [7] 5.0kW servo drive [8] 7.0kW /7.5kW servo drive [9] 11kW servo drive [A] 15kW servo drive [B] 22kW servo drive **Pn840.3** Reserved (For factory using)

Appendix C Standard Wiring Examples

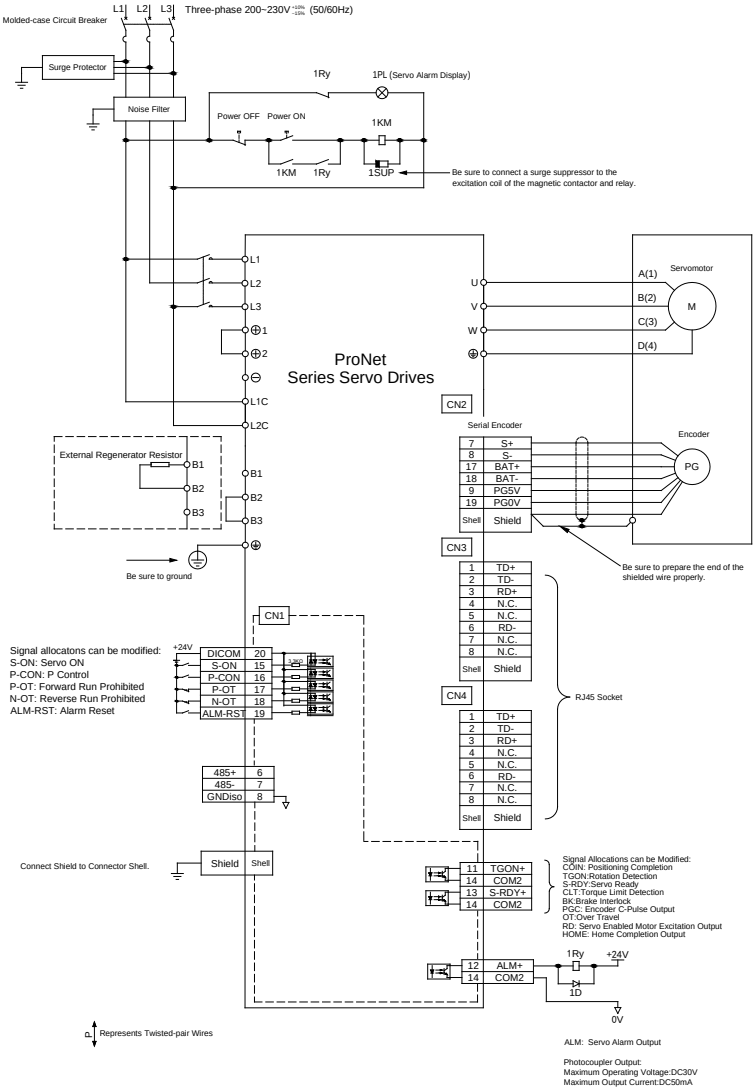
C.1 Single-phase 200VAC (ProNet-A5AEA-EC ~ ProNet-04AEA-EC ProNet-02AEF-EC~ ProNet-04AEF-EC)



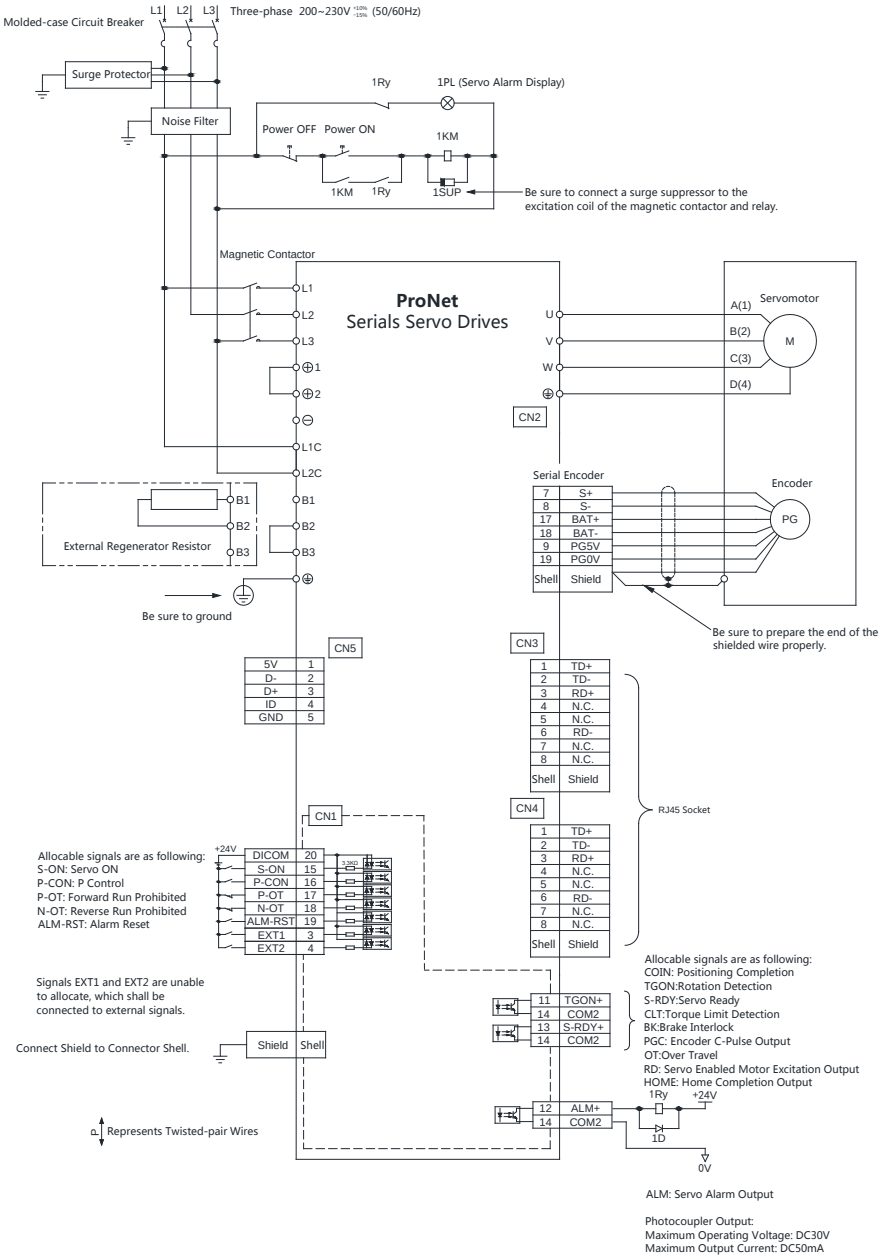
C.2 Single-phase 200VAC (ProNet-A5AEG-EC ~ ProNet-04AEG-EC)



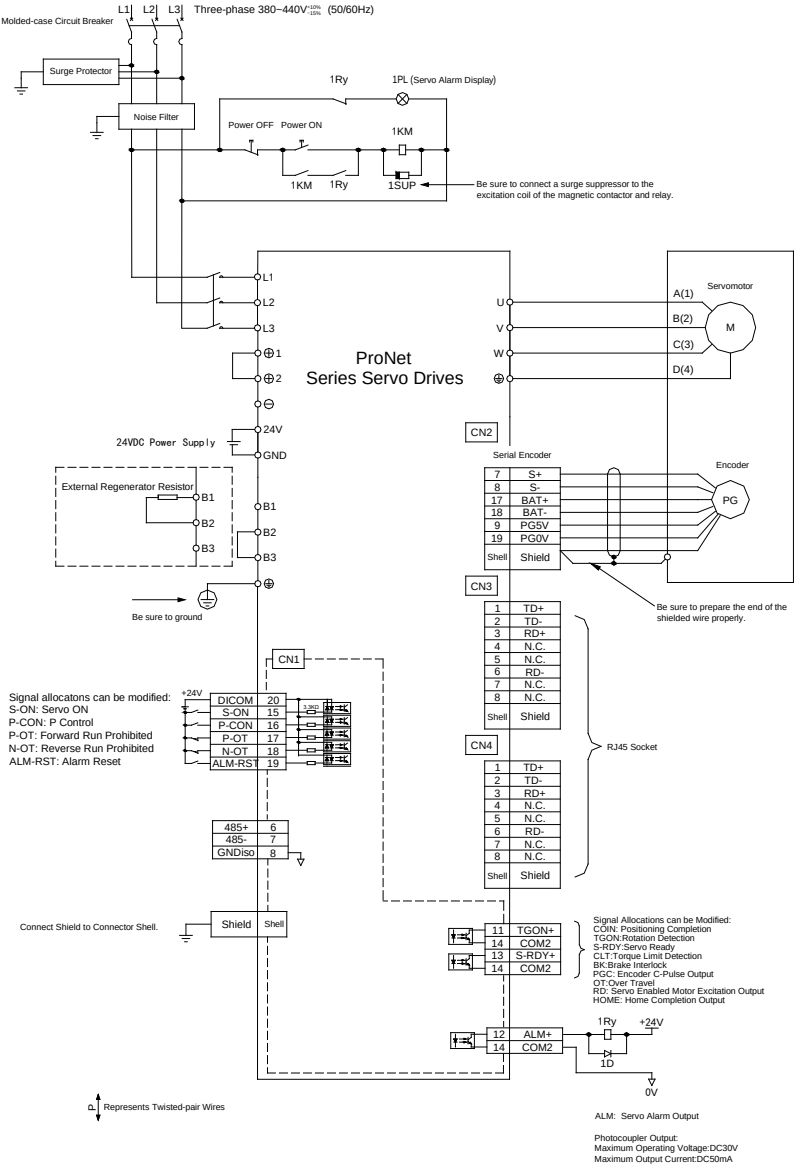
C.3 Three-phase 200VAC（ProNet-08AEA-EC ~ ProNet-50AEA-EC
ProNet-08AEF-EC ~ ProNet-20AEF-EC）



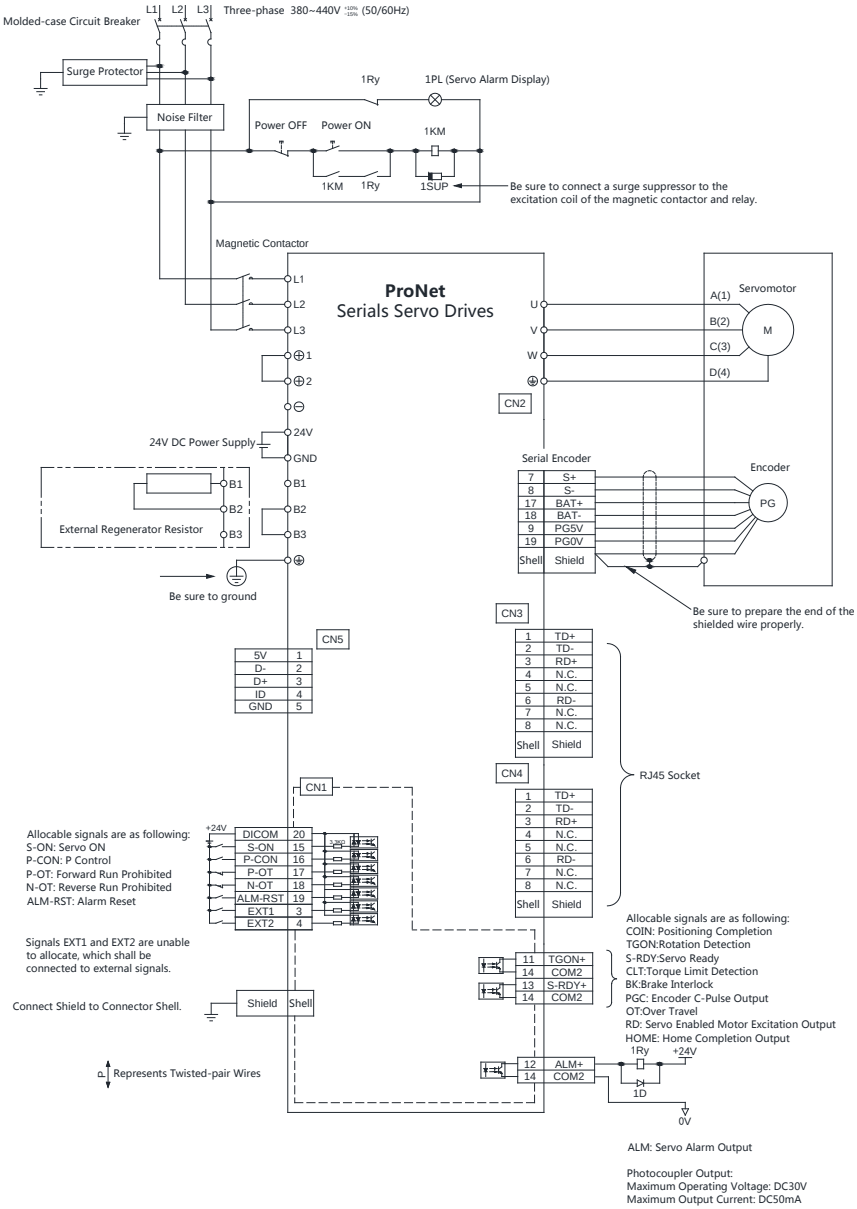
C.4 Three-phase 200V（ProNet-08AEG-EC ~ ProNet-50AEG-EC）



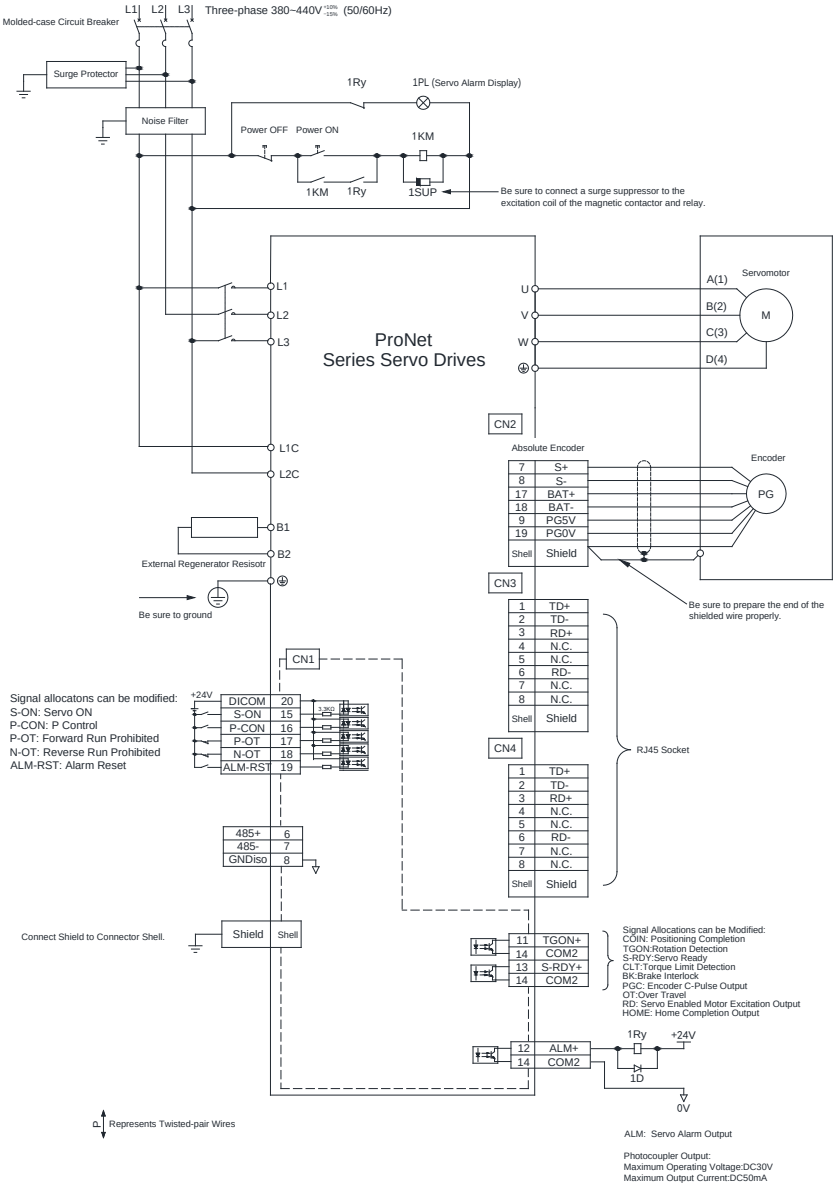
C.5 Three-phase 400VAC (ProNet-10DEA-EC ~ ProNet-70DEA-EC)



C.6 Three-phase 400VAC（ProNet-10DEG-EC ~ ProNet-50DEG-EC）



C.7 Three-phase 400VAC (ProNet-1ADEA-EC to ProNet-2BDEA-EC)



Appendix D Alarm Display

Alarm Display	Alarm Output	Alarm Name	Meaning
A. 01	×	Parameter breakdown	The checksum results of parameters are abnormal.
A. 02	×	AD shift channels breakdown	AD related electrical circuit is faulty.
A. 03	×	Overspeed	The servomotor speed is excessively high and the servomotor is out of control.
A. 04	×	Overload	The servomotor is operating continuously under a torque largely exceeding ratings.
A. 05	×	Position error counter overflow	Internal counter overflow.
A. 06	×	Position error pulse overflow	Position error pulse exceeded parameter (Pn504).
A. 07	×	The setting of electronic gear or given pulse frequency is not reasonable.	The setting of electronic gear is not reasonable or the given pulse frequency is too high.
A. 08	×	The 1st channel of current detection is wrong.	Something wrong with the inside chip of the 1st channel.
A. 09	×	The 2nd channel of current detection is wrong.	Something wrong with the inside chip of the 2nd channel.
A. 10	×	Incremental Encoder is break off.	At least one of Incremental Encoder PA,PB,PC is broken off.
A. 12	×	Overcurrent	An overcurrent flowed through the IPM.
A. 13	×	Overvoltage	Main circuit voltage for servomotor rotation is excessively high.

Alarm Display	Alarm Output	Alarm Name	Meaning
A. 14	×	Undervoltage	Main circuit voltage for servomotor rotation is excessively low.
A. 15	×	Bleeder resistor error	Bleeder resistor is faulty.
A. 16	×	Regeneration error	Regenerative circuit error.
A. 18	×	IGBT superheat alarm	IGBT temperature is too high.
A. 19	×	Motor overheat alarm	Motor temperature is too high.
A. 20	×	Power line phase shortage	One phase does not bring into main circuit power supply.
A. 21	×	Instantaneous power off alarm	An power off for more than one period is occurred in AC.
A. 22	×	Motor temperature detection sensor is break off.	Encoder cable is error.
A. 23	×	Brake overcurrent alarm	Bleeder resistor is too small, or bleeder module is faulty.
A. 25	×	Motor power line U over current	Mechanical stuck or motor power line U phase sequence is wrong.
A. 26	×	Motor power line V over current	Mechanical stuck or motor power line V phase sequence is wrong.
A. 27	×	Motor power line V over current	Mechanical stuck or motor power line W phase sequence is wrong.
A. 28	×	Nikon encoder temperatur is too high	Nikon Encode internal Temperature (unit: ℃)
A. 38	×	Encoder LED error	Encoder is faulty.
A. 39	×	Encoder EEPROM error	Encoder is faulty.
A. 41	×	Reserved	Reserved

Alarm Display	Alarm Output	Alarm Name	Meaning
A．42	×	Servomotor type error	The parameter setting of servo drive does not match the servomotor.
A．43	×	Servo drive type error	The parameter setting of servo drive does not match the servomotor.
A．44	×	Reserved	Reserved
A．45	×	Absolute encoder multiturn information error	Absolute encoder multiturn information is faulty.
A．46	×	Absolute encoder multiturn information overflow	Absolute encoder multiturn information overflow.
A．47	×	Battery voltage below 2.5V	Absolute encoder multiturn information is lost.
A．48	×	Battery voltage below 3.1V	Battery voltage is too low.
A．49	×	The position of the encoder was changed.	Not connect the battery, the battery voltage is low, or the encoder had been damaged.
A．50	×	Serial encoder communication overtime	Encoder disconnected; encoder signal disturbed; encoder error or encoder decoding circuit error.

Alarm Display	Alarm Output	Alarm Name	Meaning
A. 51	×	Absolute encoder overspeed alarm detected	Absolute encoder multiturn information may be faulty. Error reasons: 1.The battery is not connected or the battery voltage is insufficient. 2. The power supply to servo drive is not turned ON when the battery voltage is normal, or the servomotor running acceleration is too high due to external reason.
A. 52	×	Absolute state of serial encoder error	Encoder or the encoder decoding circuit is faulty.
A. 53	×	Serial encoder calcaution error	Encoder or the encoder decoding circuit is faulty.
A. 54	×	Parity bit or end bit in serial encoder control domain error	Encoder signal is disturbed or the encoder decoding circuit is faulty.
A. 55	×	Serial encoder communication data checking error	Encoder signal is disturbed or the encoder decoding circuit is faulty.
A. 56	×	End bit in serial encoder control domain error	Encoder signal is disturbed or the encoder decoding circuit is faulty.
A. 58	×	Serial encoder data empty	The EEPROM data of serial encoder is empty.
A. 59	×	Serial encoder data format error	The EEPROM data format of serial encoder is incorrect.
A. 61	×	Communication unsuccessful	CPU of communication module operated abnormally.

Alarm Display	Alarm Output	Alarm Name	Meaning
A．62	×	Servo drive can not receive the period data of communication module.	Receive channel of servo drive data or send channel of communication module is faulty.
A．63	×	Communication module can not receive the servo drive response data.	Communication module is faulty.
A．64	×	Communication module and bus connectionless	Bus communication is faulty.
A．65	×	Interpolation given position was overflowed	The interpolation given speed is greater than maximum motor speed, and location of the cumulative is overflowed.
A．70	×	EtherCAT synchronization error	EtherCAT master set the period does not meet the requirements or SYNC0 is not synchronized with the drive.
A．71	×	Internal error of ESC chip	An error has occurred inside the communication chip.
A．80	×	CPU parallel port communication abnormal	CPU data line, address line or FRAM is faulty.
A．81	×	Power line was disconnected	The input signals U, V or W of motor was disconnected.
A．82	×	Torque output alarm	The torque output of the motor exceeds the set value.
A．98	×	Pn parameter ferroelectric memory failed	Pn parameter storage operation was unsuccessful.

Alarm Display	Alarm Output	Alarm Name	Meaning
A．00	○	Not an error	Normal operation status.

○: Output transistor is ON. ×: Output transistor is OFF.

A.45, A.46, A.47, A.48, A.51 only can be reset when the absolute encoder related alarm is cleared.

The multiturn data should be cleared because of the multiturn information is incorrect.

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