Preface

We appreciated for your choice of CA100 Series Economical Servo drive!

The general-purpose servo drive of CA100 series is the economical small- and medium-power AC servo unit developed by Shenzhen Simphoenix Electric Technology Co., Ltd.. The series of products has a power range of 200W ~ 9.8kW, featuring compact structure, elegant appearance, efficient heat dissipation, improved protection and high reliability. Using RS485 and CAN communication interface, it supports MODBUS, CANopen communication protocol, and when working with the host computer, it allows the networking operation of multiple servo drives. Also, the advanced control strategy is built in, which is able to make fast response, small vibration, accurate positioning and high precision. It applies a variety of advanced auxiliary debugging algorithm to facilitate debugging and application expansion, and is widely used in fields such as CNC machine tools, packaging machinery, printing machinery, woodworking machinery, textile machinery, automated production and so on.

This manual is for CA100 series servo drive, which focuses on the relevant rules and precautions of installation, wiring, commissioning and operation and troubleshooting for the CA100 series servo drives.

This manual is a randomly attached. Please keep it properly for future service and maintenance of the drive.

Since we are committed to the continuous improvement of the products, the information provided by us is subject to change without notice.

For the latest changes and more details, please visit <u>www.simphoenix.com.cn</u>).

User's Manual of CA100 Series Servo drives (Simplified)
Version: V102B00
Date of revision: V103B00

Table of Contents

Chapter 1 Product Information

1.1 Servo drive and motor models

CA100 – T 3R0 A P

Product Serial Number

Voltage class	
F	380 V
T	220 V

Rated current	
R80	0.8 A
4R5	4.5 A
10R	10.0 A
105	105 A

Encoder interface	
S	Serial
P	Incremental (A / B / Z / U / V / W)
…	…

Interface information	
A	Analog/pulse command type
B	Communication/pulse command type
C	Analog/communication command type
…	…
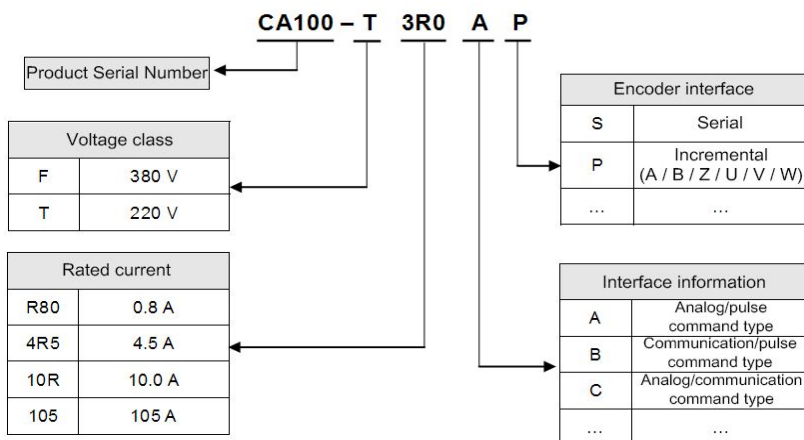
Figure 1-1 Descriptions of servo drive model

CM105 - 80 T 240 30 A1 C N -3

Product Serial Number

Frame No.

Voltage of adapter driver	
F	AC380V
T	AC220V

Rated torque	
202	200Nm
201	20Nm
200	2Nm
020	0.2Nm

Rated speed	
30	30X100 rpm
25	25X100 rpm
10	10X100 rpm

Design code

Brake	
B	With power-off brake
N	With no brake

Type of shaft extension	
A	Epitaxial type (no keyway)
C	Epitaxial type (standard keyway)

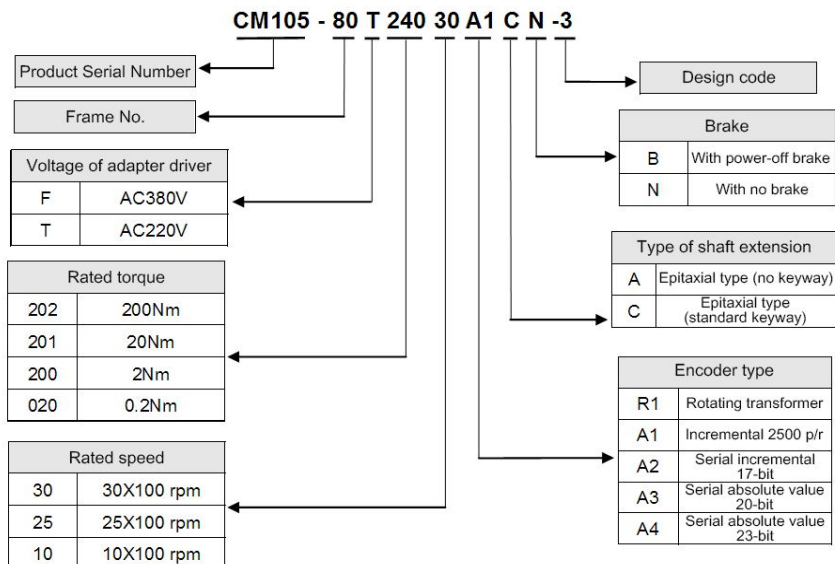| Encoder type	
R1	Rotating transformer
A1	Incremental 2500 p/r
A2	Serial incremental 17-bit
A3	Serial absolute value 20-bit
A4	Serial absolute value 23-bit

Figure 1-2 CM105 series servo motor models

Note: Servo motor code and adapter drive refer to Appendix 6.4 Model List of Servo drive and Servo Motor.

1.2 Part name and specifications

The front enclosure is open

Panel display

Be used when confirming the status of the servo unit, the alarm number and the value of the input parameter.

Refer to "3.1 Panel display"

Panel operator keyboard

Be used when setting the function codes.

Refer to "3.1 Names and functions of keys in panel operator"

Analog monitoring port

Use a dedicated cable (optional) to monitor the motor speed, torque and other signals in the form output by analog voltage.

Refer to "3.4.3 List of AO monitoring parameters"

Front enclosure

Model and input voltage level

Displays different input voltage levels and drive models.

Refer to "1.1 Servo drive and motor models"

CA100-T4R5A
220V

Charge LED

It lights up when the main circuit power is ON, and when the main circuit is OFF, the indicator will light up if there is voltage remaining in the servo unit. Do not touch the power terminals when it lights up, otherwise it will cause electric shock.

CHARGE

Communication interface (CN1)

Standard RS485 communication interface, which can perform MODBUS communication via the upper computer.

Refer to "Chapter 5 Communication Protocol"

Main circuit power terminal

Main circuit power input terminal.

"Refer to 2.3.1 Example of main circuit wiring"

L1
L2
L3
B1
B2
B3

Braking resistor connection terminal

Connect the interface of regenerative resistor, and select the built-in regenerative resistor or external regenerative resistor via a different wiring.

Refer to "2.5 Connection of regenerative braking resistor"

I/O port (CN2)

Command ports for all command signals, such as: pulse input port, speed torque analog input port, DIDI digital port and encoder frequency dividing output port.

Refer to "2.7 I/O signal cable connection"

Connection terminal of servo motor

Is the terminal connecting to the main circuit (power line) of the servo motor.

"Refer to 2.3.1 Names and functions of main circuit terminals"

U
V
W
E

Encoder connection port (CN3)

A port for connection to an encoder on a servo motor.

Refer to "2.6 Connection of encoder signal line"

Earthing terminal

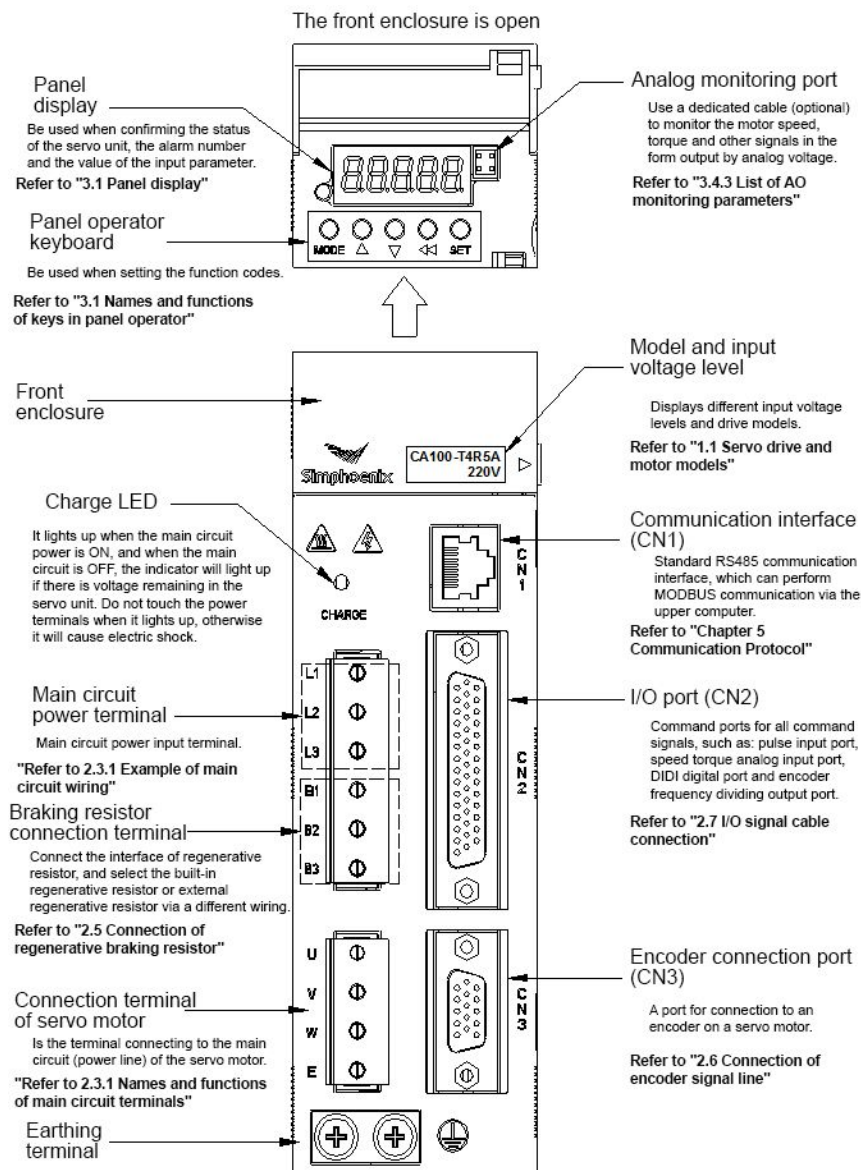Figure 1-3 Names of all parts of drive

■ **General specifications**

Table 1-1 General specifications of CA100 series servo

Basic specifications	Drive model		CA100-	T1R8 T3R0 T4R5 T6R0 ,T7R5 T10R	Single-phase/three-phase AC220V -15%～+10% 50/60Hz
			CA100-	F4R0 F6R0 F8R5 F12R, F20R F25R	Three-phase AC380V -15% ～ +10% 50/60Hz
	Control mode		position , speed , torque, position / speed , position /torque, speed /torque		
	Feedback		Incremental encoder 2500P/R		
	Using condition s	Temperature	Working Temperature: 0°C~+45°C (For ambient temperature over +45°C, please use it at lower rated values)		
			Storage Temperature: -20°C~+60°C °C		
		Humidity	90%RH below, no condensation		
		Ventilation	0.5G(4.9m/s²)		
		Protection	IP10		
		Altitude	1000m below (>1000m, please reduce the rated values)		
		Others	1. No electrostatic interference, strong electric field, strong magnetic field, radiation and so on; 2. Free of corrosive gas, combustible gas, water, oil, and medicine spray; 3. The environment with less dusts, dirt, salts and metal powders.		
	Structure		Base installation type		
Speed control	Control input		1. Internal command 8 segments, which can be switched within 8 segments of internal speed through control input; 2. External analog command; 3. ZEROSPD.		
	Control output		Speed reaching the judgment: 3 judgment ways		
	Analog input		● Input speed commands according to the analog voltage, and the max. input voltage is ±12V; ● DC 300rpm/V[Default], and input ratio setting can be changed.		
	Torque limit command		It is applicable to separately limit the positive and negative torque.		
	Speed ratio		1:3000		
	Speed variation speed	Load fluctuation	0 - 100% load: ±0.02% below (≤ rated revolution)		
		Voltage fluctuation	Rate voltage ± 10%: 0% (≤rated revolution)		

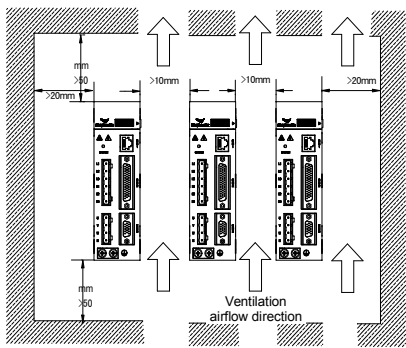|		Temperature fluctuation	25 ±25°C: ± 0.1% below (≤rated revolution)
Position Mode	Torque control precision	±5% (recurrent)	
	Soft start time	0 ～30s (Acceleration and deceleration can be set separately)	
	Frequency response characteristics	1.5kHz(Max)	
	Command pulse	Command pulse	1. symbol＋ pulse　column, 2. A, B Orthogonal pulse, 3. CCW+CW　pulse　column
		Command pulse	Live　drive（＋5V level）, open collector（＋5V, ＋12V, ＋24V level, see relevant circuit instructions for specific connection.)
		Command pulse	Max. 500 Kpps(difference) / 200 Kpps (collector)
	Electronic gear ratio	Setting of 3 groups of electronic gears, 1~32767	
	Control input	Deviation counter clearing signal,　command pulse forbidden input , internal position 8 segments	
	Control output	Orientation completion signal, orientation approaching judgment	
Torque Control	Control input	1. Internal torque 4 segments, can be judged by the control input 2. Analog command input	
	Control output	Torque approaching judgment	
	Analog input	● Conduct torque command input according to the analog voltage, and the max. input voltage is ±12V, ● DC 30%/V [Default], and input ratio setting can be changed.	
	Speed limit	3 kinds of limiting modes	
Input and output signal	Input signal	8DI terminal , 2AI terminal	
	Output signal	5DO terminal 2AO terminal (for commissioning and monitoring)	
	pulse　output	A, B, Z differential signal output, Z pulse　Open collector output	
	Protection	Overcurrent, overvoltage ,　undervoltage, overload, mains circuit detected to be abnormal, radiator overheating, overspeed, abnormal encoder, abnormal CPU and abnormal parameters.	
	Communication	RS485 1:N (N<240), and other communication methods can be extended.	
	Indicator	Built-in keyboard,　Power Charge,	

1.3 Install the servo drive

Figure 1-4 Installing method of servo drive
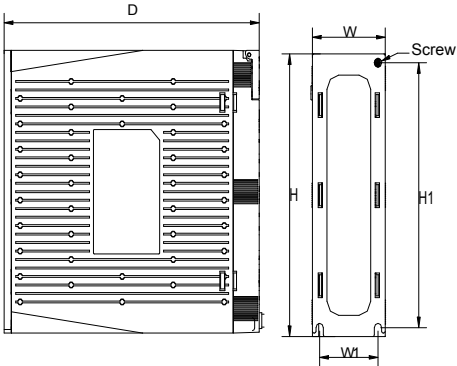
1-5 Servo drive mounting dimensions

The structural dimensions of each model are shown in the following table:

Table 1-2 Mounting sizes of servo drive of all models

Model of servo drive	W (mm)	W1 (mm)	H1 (mm)	H (mm)	D (mm)	Screw spec.
CA100-T1R8A, CA100-T3R0A	50	40	150	160	175	M4
CA100-T4R5A CA100-T6R0A, CA100-T7R5A	70	60	150	160	175	M4
CA100-T10RA CA100-F4R0A, CA100-F6R0A CA100-F8R5A, CA100-F12RA	100	89	169	180	200	M5
CA100-F20RA, CA100-F25RA	126	80	268	278	210	M5

Chapter 2 Connection & Wiring

2.1 Install servo system

Figure 2-1 Servo drive wiring diagram

2.2Terminal arrangement of servo drive

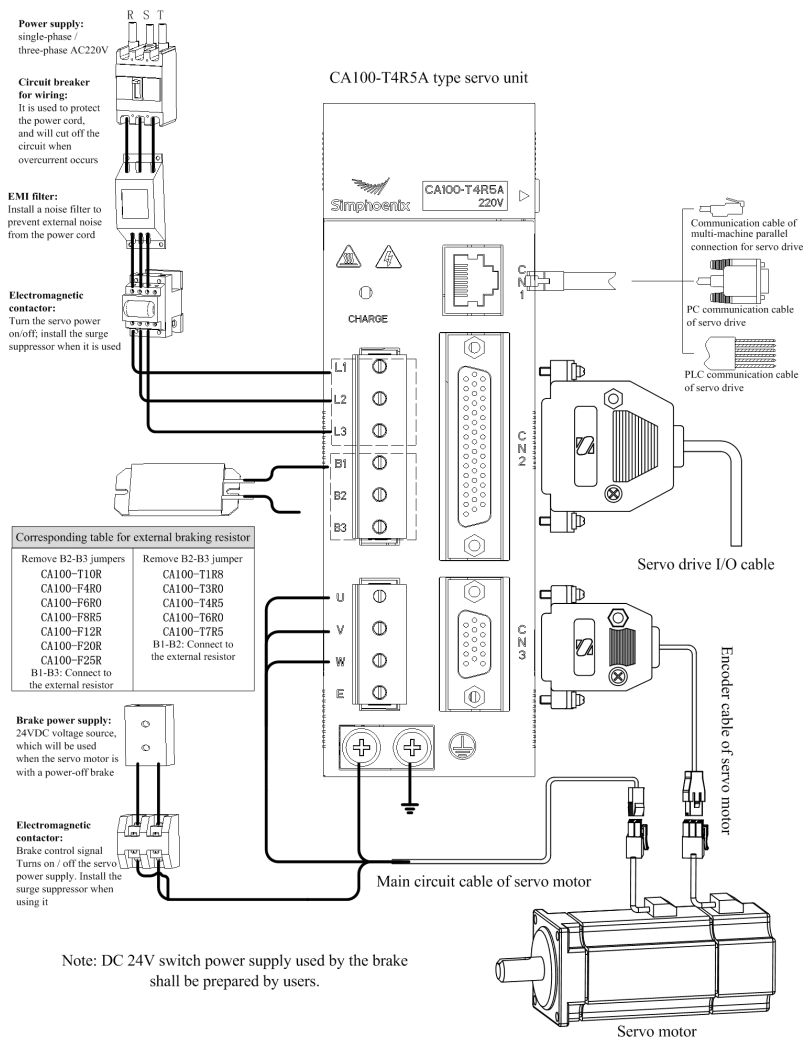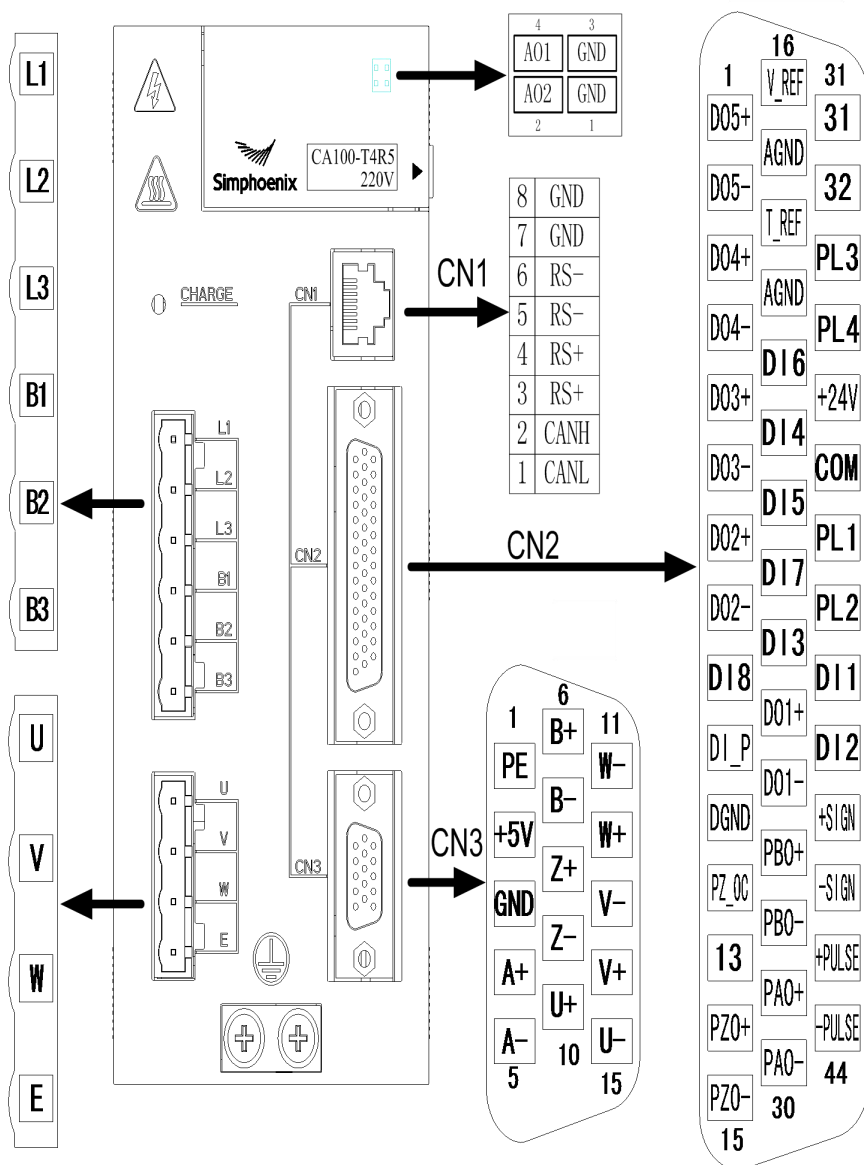Figure 2-2 Servo drive terminal pin distribution

2.3 Wiring of main circuit

2.3.1 Wiring example of main circuit

Power supply	Single-phase AC220V	CA100-T1R8，T3R0，T4R5 (L3 is empty terminal)
	Three-phase AC220V	CA100-T4R5，T6R0，T7R5，T10R
	Three-phase AC380V	CA100-F4R0，F6R0，F8R5，F12R，F20R，F25R

1QF: Circuit breaker for wiring   PL: fault indicator
FIL: Noise filter   1D: freewheeling diode
KM: Electromagnetic contactor   1SA: Surge suppressor
1Ry: relay   2SA: Surge suppressor

Note 1: For the connection mode of regenerative braking resistor, refer to "2.5 Connection of regenerative braking resistor"
Note 2: D02 is defaulted as the ALM signal terminal, namely the CN2-7MLM +; CN2-8 is ALM-
Note 3: In case of single-phase drive, the L3 in dashed line will not be connected; and in case of three-phase drive, the L3 in dashed line shall be connected
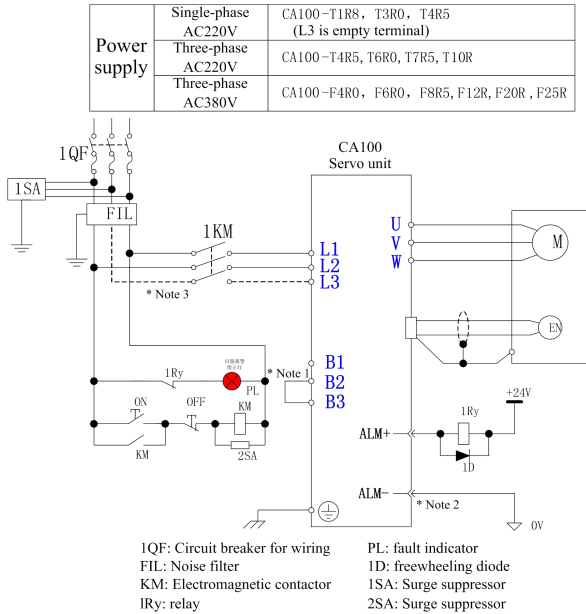
Figure 2-3 Wiring diagram of main circuit the drive

2.3.2 General notes for main circuit wiring

● Never thread the power cord and signal cable in a same pipe, and do not bundle it together. At time of wiring, the power cord and signal lines should be separated by at least 30cm or more, otherwise, it may lead to malfunction;

● Even after the power is turned off, there may be a high voltage resided in the servo drive. Do not touch the power supply terminal within 5 minutes after power off;

● After confirming that the CHARGE indicator is off, perform the inspection again;

● Do not frequently turn ON/OFF power supply, and if you need to turn ON/OFF power repeatedly, please control it less than 1 time per minute. Since there is a large capacitance in the power supply of the servo drive, a large charge current (charging time of several hundred milliseconds) will flow through when it is power ON. Therefore, if turning ON/OFF the power frequently, the performance of the main circuit components in the servo drive will be degraded.

● Do not connect the input power cord to the output terminals U, V and W, otherwise the servo drive will be damaged.

- The wiring length of I/O signal cable is up to 3m, and the main circuit cable and encoder cable are up to 30m.
- Use a thick cable (2.0mm2 or more) as much as possible for the earthing cable
- When the servo motor and the machine are insulated from each other, connect the servo motor directly to ground.

Table 2-1 Functional descriptions of main circuit terminal

Designation	Name	Drive model (CA100-)	Function and connection
L1 **L2** **L3**	Mains loop power supply input terminal	T1R8□□, T3R0□□	L1, L2: Single phase AC220V, power input L3: Blank terminal
		T4R5□□	L1, L2, L3: Three-phase AC220V power input In case of single-phase power supply, input the single-phase AC220V power supply to the terminals of L1 and L2
		T6R0□□, T7R5□□T10R□□	L1, L2, L3: **Three-phase** AC220V power input
		F4R0□□, F6R0□□F8R5□□, F12R□□F20R□□, F25R□□	L1, L2, L3: **Three-phase AC380V** power input
B1 **B2** **B3**	External regenerative brake resistor connecting terminal	T1R8□□, T3R0□□	There's no built-in braking resistor External braking: B1 and B2 indirect braking resistor Note: It is different from the wiring of external resistor wiring of model C2, C3 and C4
		T4R5□□, T6R0□□T7R5□□	**Built-in brake:** B2 and B3 short connected **External braking:** B1 and B2 external braking resistor, while removing the B2 and B3 jumpers; the external braking resistor needs to be purchased separately Note: It differs from the external braking resistor wiring of model C1, C3 and C4
		T10R□□, F4R5□□F6R0□□, F8R5□□F12R□□, F20R□□F25R□□	**Built-in brake:** B2 and B3 short connected **External braking:** B1 and B3 external braking resistor, while removing the B2 and B3 jumpers; the external braking resistor needs to be purchased separately Note: It differs from the external braking resistor wiring of model C1 and C2

U V W	Servo motor connection terminal	Connection terminals of servo motor power lines connects, respectively, with the U, V and W of the motor. **(Note: If the phase sequence is wrong, the motor will then not rotate or there is a runaway alarm).**
E	Protective ground terminal	Connect to the power supply ground terminal and the motor ground terminal for grounding treatment.

2.3.3 Specifications of cable diameter of main circuit

(1) AC220V series

Table 2-2 Specification of AC220V main circuit cable

Designation	Terminal name	Model CA100-T□□□					
		1R8	3R0	4R5	6R0	7R5	10R
L1\L2\L3	Power terminal	1.25 mm^2			2.00 mm^2		3.50 mm^2
U\V\W	Servo motor connection terminal	1.25 mm^2			2.00 mm^2		3.50 mm^2
B1\B2\B3	External braking resistor connection terminal	1.25 mm^2					2.00 mm^2
E	Earthing	Greater than 2.00mm^2					

(2) AC380V series

Table 2-3 Specifications of cables of AC380V main circuit

Symbol	Terminal name	Model CA100- F□□□				
		4R0/6R0	8R5	12R	20R	25R
L1 \L2\L3	Power terminal	2.00mm^2	2.00mm^2	3.50mm^2	4.0mm^2	6.00mm^2
U\V\W	Servo motor connection terminal	2.00mm^2	2.00mm^2	3.50mm^2	4.00m^2	6.00mm^2
B1\B2\B3	External braking resistor terminal	2.00mm^2		3.50mm^2	4.0mm^2	6.00mm^2
E	Earthing	2.00 mm^2 and above		2.50mm^2	2.50mm^2	2.50mm^2

2.3.4 Definitions of power line terminals U, V and W

Table 2-4 Connection terminal of motor power cord at servo motor side

Connector at motor side					Drive side	
Motor type	Terminal view	Terminal sequence diagram	Correspondence table of wiring at motor side and drive side		Terminal sequence diagram	Drive model**CA100-**
CM105 60~90 series			Pin No.	Definition		T1R8A T3R0A, T4R5A T6R0A, T7R5A
			1	U		
			2	V		
			3	W		
			4	PE		
CM105 110~180 series			Pin No.	Definition		T10RA F4R0A, 6R0A F8R5A, F12RA F20RA, 25RA
			1	PE		
			2	U		
			3	W		
			4	V		

2.4 Cable connection method of contracting brake

2.4.1 Definitions of brake terminal

Table 2-5 Contracting brake connector at servo motor side

Motor model	Type of brake terminal	View of terminal at motor side	Pin definition
CM105-60□□□□□□□	172165-1 (AMP)		1-------24V 2--------0V
CM105-80□□□□□□□ CM105-90□□□□□□□ CM105-110□□□□□□□ CM105-130□□□□□□□	XS12-3P (Silvery white)		1-------24V 2--------0V
CM105-180□□□□□□□	XS16K4 (Black)		1-------24V 2--------0V

Note: Contracting brake cables shall be provided by customers, and we will provide no attached cables.
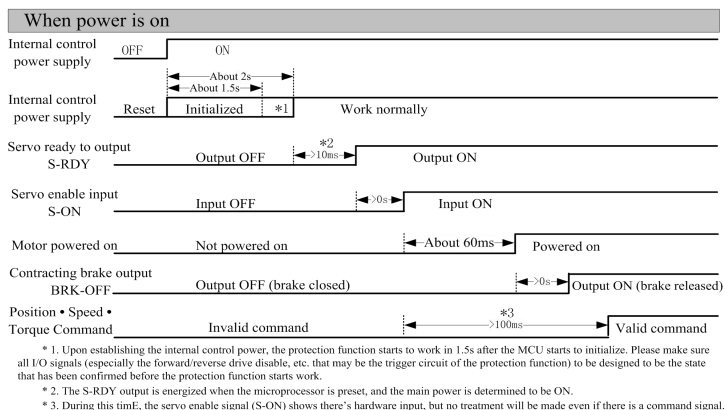
2.4.2 Brake timing at different states

When power is on

* 1. Upon establishing the internal control power, the protection function starts to work in 1.5s after the MCU starts to initialize. Please make sure all I/O signals (especially the forward/reverse drive disable, etc. that may be the trigger circuit of the protection function) to be designed to be the state that has been confirmed before the protection function starts work.

* 2. The S-RDY output is energized when the microprocessor is preset, and the main power is determined to be ON.

* 3. During this timE, the servo enable signal (S-ON) shows there's hardware input, but no treatment will be made even if there is a command signal.

Figure 2-4 Brake timing when power on

When an exception occurs (alarm)
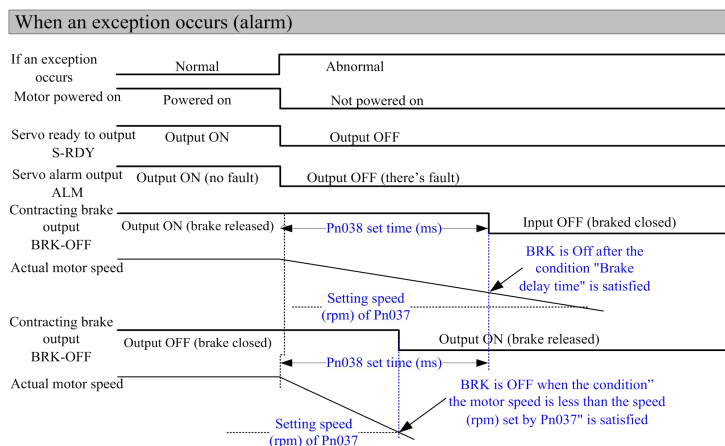
Figure 2-5 Brake timing when an exception (alarm) occurs

When the alarm signal is cleared

Alarm clearing signal input AL-CLR

Input OFF | > DI terminal filter time (can be set in Pn019) | External input AL_CLR signal ON | Input OFF

Motor powered on

Not powered on | About 60ms | Powered on

Contracting brake output BRK-OFF

Output OFF (brake closed) | About 4ms | Output ON (brake released)

Servo ready to output S-RDY

Output OFF | Output ON

Servo alarm output ALM

Output OFF (there's fault) | Output ON (no fault)

Position Speed Torque Command

Invalid command | *1 >100ms | Valid command

* 1. During this time, the servo enable signal (S-ON) shows there's hardware input, but no treatment will be made even if there is a command signal.

Figure 2-6 Brake timing when alarm is cleared

Servo during motor rotation Power on→Power off

Servo enable input S-ON

Input OFF | Input ON | Input OFF

Motor powered on

Not powered on | About 60ms | Powered on | 1~5ms | Not powered on

Position Speed Torque Command

Above 100ms | Invalid command | Valid command | Invalid command

Contracting brake output BRK-OFF

4ms | Output OFF (brake closed) | Output ON (brake released) | Output OFF

Pn038 set time (ms)
t1 *1

Actual motor speed

When Pn038 is set faster

— — — — — Pn037 setting speed (rpm) — — — — —

Contracting brake output BRK-OFF

Output OFF (braked closed) | Output ON (brake released) | Output OFF

Pn038 set time (ms)

Actual motor speed

t1 *1

When Pn037 is set faster

— — — — — Pn037 setting speed (rpm) — — — — —

* 1. t1 means the fastest time for the motor rotation speed to fall below the set value of Pn037 [electromotive brake speed threshold when the motor rotates], or the setting of Pn038 [waiting delay time of electromagnetic brake action when motor rotates].
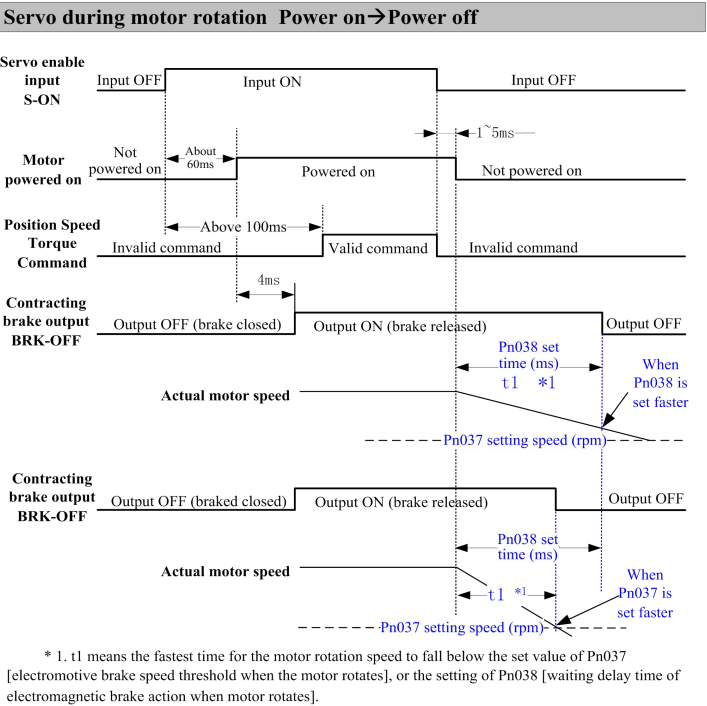
Figure 2-7 Brake timing when servo rotates

Servo when motor is stationary (servo locked) Turned on→Turned off

* 1. When the motor is stopped and servo is closed, the brake signal (BRK) is set to be closed (the brake is held) until the motor is powered off (servo free).
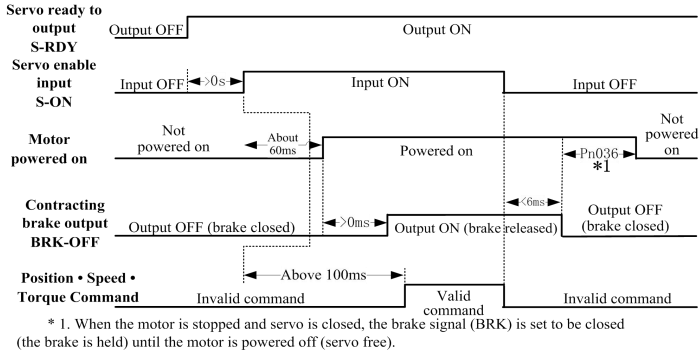
Figure 2-8 Brake timing when servo is locked

2.5 Connection of regenerative brake resistor

Table 2-6 Wiring table of regenerative brake resistor

S/N	Drive model	If there's built-in resistor	Actions during external connection
1	CA100-T1R8□□	No	Connect the external resistor to the B1 • B2 terminal of drive
2	CA100-T3R0□□	No	Connect the external resistor to the B1 • B2 terminal of drive
3	CA100-T4R5□□	Yes	Remove the jumper between B2 • B3, and connect the external resistor to the terminals of B1 • B2
4	CA100-T6R0□□	Yes	Remove the jumper between B2 • B3, and connect the external resistor to the terminals of B1 • B2
5	CA100-T7R5□□	Yes	Remove the jumper between B2 • B3, and connect the external resistor to the terminals of B1 • B2
6	CA100-T10R□□	Yes	Remove the jumper between B2 • B3, and connect the external resistor to the terminals of B1 • B3
7	CA100-F4R0□□	Yes	Remove the jumper between B2 • B3, and connect the external resistor to the terminals of B1 • B3
8	CA100-F6R0□□	Yes	Remove the jumper between B2 • B3, and connect the external resistor to the terminals of B1 • B3
9	CA100-F8R5□□	Yes	Remove the jumper between B2 • B3, and connect the external resistor to the terminals of B1 • B3

10	CA100-F12R□□	Yes	Remove the jumper between B2 • B3, and connect the external resistor to the terminals of B1 • B3
11	CA100-F20R□□	Yes	Remove the jumper between B2 • B3, and connect the external resistor to the terminals of B1 • B3
12	CA100-F25R□□	Yes	Remove the jumper between B2 • B3, and connect the external resistor to the terminals of B1 • B3

Table 2-7 Model selection of regenerative braking resistance

Drive model		Built-in regenerative braking resistance spec.		Allowable minimum external resistance (Ω)	Absorbable max. braking energy of capacitor E_c (J)
		Resistance (Ω)	Capacity (W)		
Single phase AC220V	CA100-T1R8□□	---	---	50	14
	CA100-T3R0□□	---	---	50	19
Single/three-phase AC220V	CA100-T4R5□□	50	60	45	32
Three-phase AC220V	CA100-T6R0□□	50	60	25	43
	CA100-T7R5□□	25	100	20	52
	CA100-T10R□□	25	100	15	52
Three-phase \AC380V	CA100-F4R0□□	100	100	60	54
	CA100-F6R0□□	50	100	45	64
	CA100-F8R5□□	50	100	45	77
	CA100-F12R□□	50	100	45	88
	CA100-F20R□□	40	150	30	132
	CA100-F25R□□	40	150	30	132

2.6Encoder signal line connection
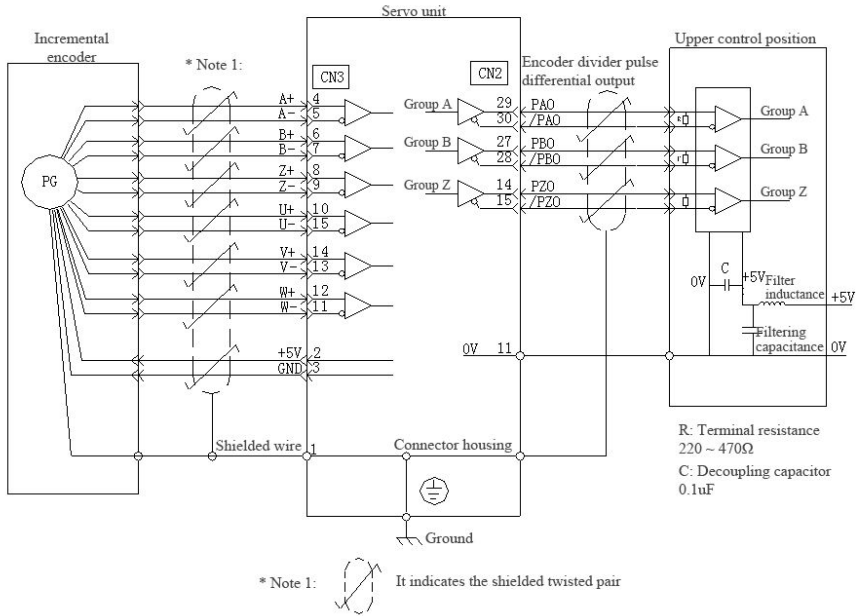
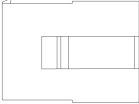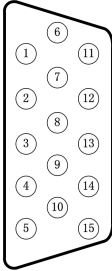# 2.6.1 Wiring example of incremental encoder

Figure 2-9 Incremental encoder wiring diagram

2.6.2 Definition of encoder terminal at servo motor side

Amp connector:

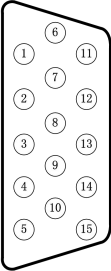Table 2-8 Difination of Amp head wiring

Encoder line connector at motor side				Drive encoder terminal	
Motor type	Terminal appearance	Terminal sequence diagram	Correspondence table of wiring at motor side and drive side	Terminal sequence diagram	Type of drive

Motor type	Terminal appearance	Terminal sequence diagram	Pin	Function definition	Pin	Terminal sequence diagram	Type of drive
CM105 60~90 series			1	PE	1		CA100- T1R8A T3R0A T4R5A T6R0A T7R5A
			2	+5V	2		
			3	GND	3		
			9	A+	4		
			13	A-	5		
			4	B+	6		
			14	B-	7		
			7	Z+	8		
			5	Z-	9		
			15	W-	11		
			11	W+	12		
			12	V-	13		
			10	V+	14		
			8	U-	15		
			6	U+	10		

Aviation connector:

Table 2-9 Definition of aviation connector wiring

Connector of encoder cable at motor side						Drive encoder terminal	
Motor type	Terminal appearance	Terminal sequence diagram	Correspondence table of wiring at motor side and drive side			Terminal sequence diagram	Type of drive
			Pin	Function definition	Pin		
CM105 110~180 series			1	PE	1		CA100- T10RA F4R0A F6R0A F8R5A F12RA F20RA F25RA
			2	+5V	2		
			3	GND	3		
			4	A+	4		
			7	A-	5		
			5	B+	6		
			8	B-	7		
			6	Z+	8		
			9	Z-	9		
			15	W-	11		
			12	W+	12		
			14	V-	13		
			11	V+	14		
			13	U-	15		
			10	U+	10		

2.7 I/O signal wire connection

2.7.1 Connection of I/O terminal under three control modes
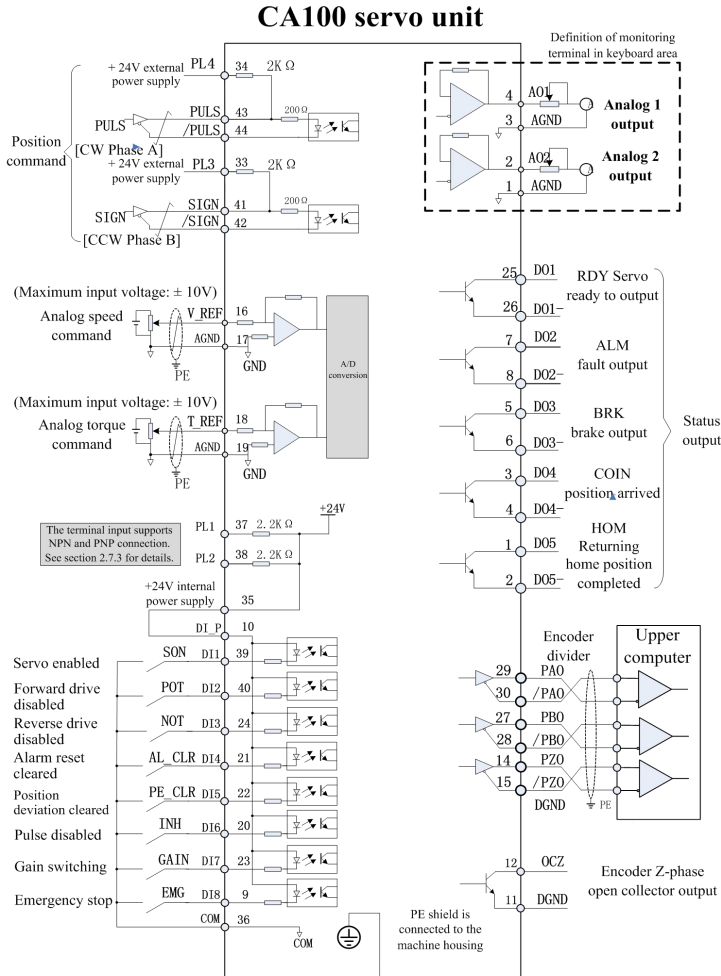
CA100 servo unit

Figure 2-10 Position, speed and torque control wiring diagram

2.7.2 Pulse command input interface circuit

The input interface circuit of command pulse is used to receive the command pulse signal sent by the upper computer to the drive. The output of the upper computer can be differential linear drive output or open-collector output. The wiring of the two output modes is different and the performance of the circuit differs. **In addition, please use twisted-pair cable.** The following describes the 43-44 (command pulse input) and 41-42 (command pulse input) terminals of the CN2 connector.

Table 2-10 Definition of pulse command terminal signal

Signal name		Pin No.	Function	
positi on com mand	SIGN	41	Pulse command input mode: Differential drive input Open collector	Input pulse pattern: Direction + pulse Phase A/B orthogonal pulse CW / CCW pulse
	/SIGN	42		
	PULS	43		
	/PULS	44		
	PL3/PL4	33/34	External power input interface of command pulse	
	+24V	35	Internal 24V power supply for servo; use this pin wiring if the pulse is powered internally for 24V.	
	COM	36		
	PL1	37	24V power supply of 2.2kΩ resistor has been connected in serial.	
	PL2	38		

Table 2-11 Timing of different command pulses

Pulse command form	Logic state	Pulse waveform
Pulse + direction	Pn005=0000 positive logic	PULSE ⊓⊓⊓ ⊓⊓ ⊓⊓⊓ ⊓ T1 T2 T3 SIGN Forward Reverse
	Pn005=0100 negative logic	PULSE ⊓⊓⊓ ⊓⊓ ⊓⊓⊓ ⊓ T1 T2 T3 SIGN Forward Reverse
Two-phase orthogonal pulse (4 frequency doubling)	Pn005=0000 positive logic	PULSE T4 T4 T4 T4 SIGN Forward Reverse
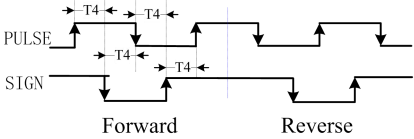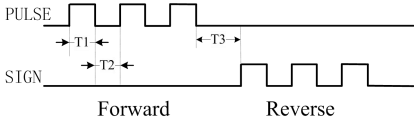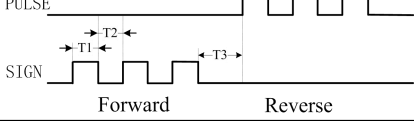
Pulse command form	Logic state	Pulse waveform
CCW/CW pulse	Pn005=0100 negative logic	Forward Reverse
	Pn005=0000 positive logic	Forward Reverse
	Pn005=0100 negative logic	Forward Reverse

Table 2-12 Correspondence between pulse input frequency and pulse width

Pulse mode	Max input frequency	Minimum allowable time width				Voltage specification
		T1	T2	T3	T4	
Differential input	500 kHz	1 s	1 s	1 s	2 s	5 V
Open collector	200 kHz	2.5 s	2.5 s	2.5 s	5 s	24 V

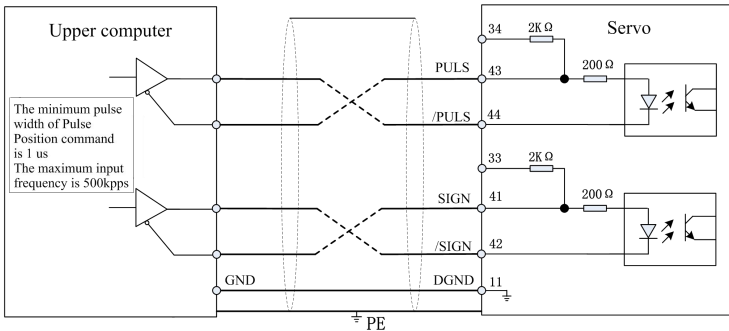**Differential pulse command input:**

Figure 2-11 Wiring diagram of differential pulse command input

➢ **Open-collector position pulse command input:**

(1) Powered by using external independent 24V power
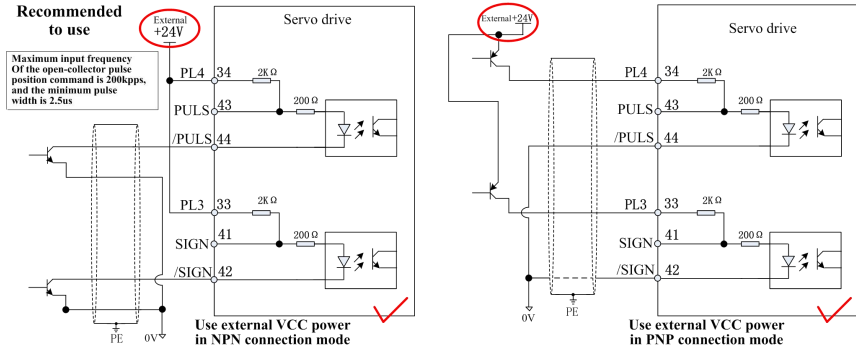

Figure 2-12 Open-collector pulse input wiring diagram (external independent 24V power)

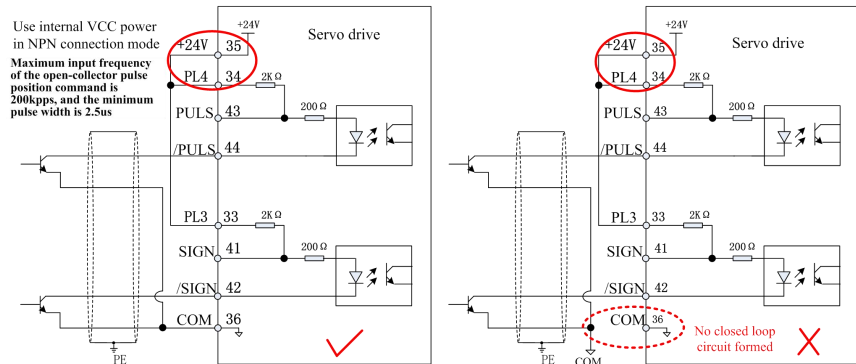(2) Powered by using built-in 24V power of drive

Figure 2-13 Open-collector pulse input wiring diagram (built-in 24V in drive)

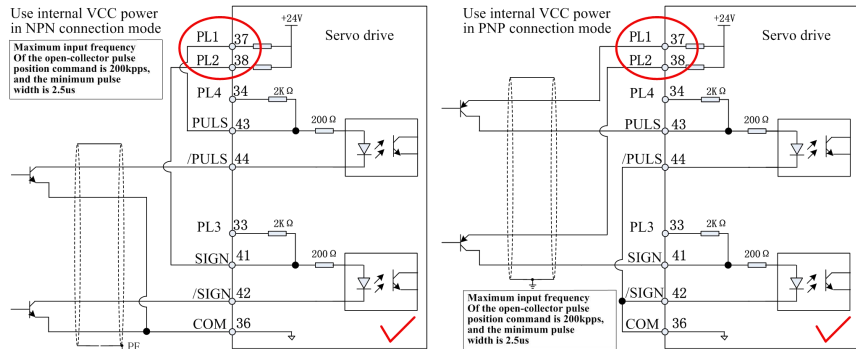(3) Using the internal PL1/PL2 (already in series with 2.2kΩ resistor) power wiring

Figure 2-14 Open-collector pulse command input wiring diagram (internal PL1/PL2)

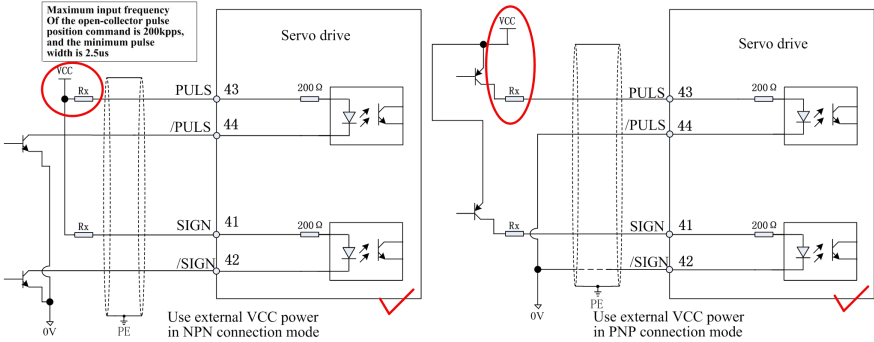(4)   Using external VCC power supply and external current limiting resistor

Figure 2-15 Open-collector pulse input wiring diagram (external VCC power)

Calculation formula of current limiting resistor Rx: Rx =(Vcc – 1.5 V)/ 10mA

Rx recommended resistance is as follows:

VCC voltage	Rx resistance	Rx power
24 V	2.2 k	0.5 W
12 V	1.0 k	0.5 W
5 V	0.2 k	0.25 W

2.7.3 Digital input (DI) interface circuit

The following describes the digital input terminals of the CN2 connector.

Connection is made via a relay or open collector transistor circuit. When connecting by relay, please use a relay of small current, otherwise it may cause poor contact or circuit can not be broken over.

Table 2-13 DI input signal description

Signal name		Default function	Pin No.	Function
DI input	DI1	SON	39	Servo enabled, motor power on
	DI2	POT	40	Forward drive disabled
	DI3	NOT	24	Reverse drive disabled
	DI4	AL_CLR	21	Alarm clearing
	DI5	GAIN	22	Gain switching
	DI6	ZCLMP	20	Zero speed clamp achieved
	DI7	INH	23	Input position pulse disabled
	DI8	EMG	9	Emergency stop
	DI_P	Terminal power supply	10	Access point of DI terminal power supply
	+24V	+24V	35	Internal 24V power supply
	COM	COM	36	

DI input terminal of CA100 series servo drive adopts the two-way optocoupler design input, which allows flexible wiring, and users can choose NPN mode or PNP mode based upon their needs. Following shows the wiring of various ways by using the actual wiring diagram.

Notes:
1. Disconnect the 24V with DI_P terminal when using the external power supply.
2. PNP and NPN input mixing are not supported between multiple DI terminals.

➢ **When the upper computer outputs by relay:**
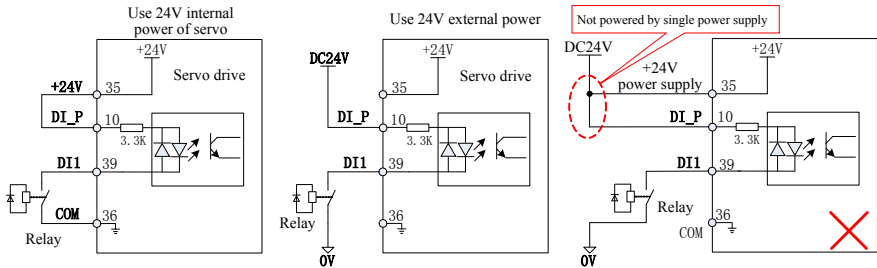
Figure 2-16 Digital input wiring diagram when the upper computer outputs by relay

➢ **When the upper computer outputs by NPN:**
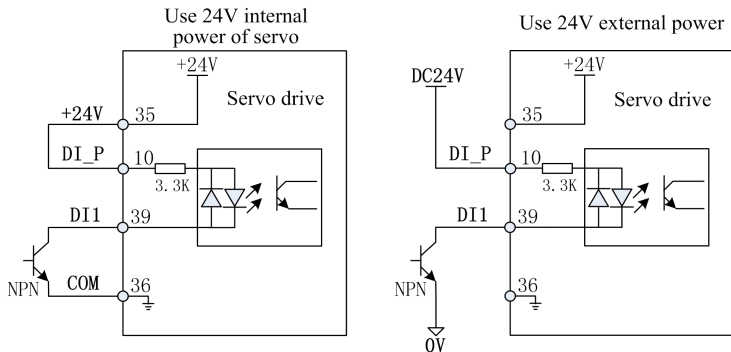
Figure 2-17 Digital input wiring diagram when the upper computer outputs by NPN

➢ **When the upper computer outputs by PNP:**
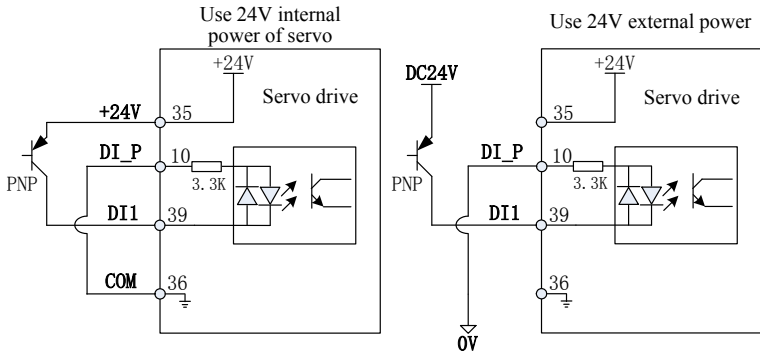
Figure 2-18 Digital input wiring diagram when the upper computer outputs by PNP

2.7.4 Digital output interface circuit

The following describes mainly the digital output terminals on the CN2 connector, for which taking DO1 for example, the interface circuits of DO1 ~ DO5 are the same.

Table 2-14 DO output signals

Signal name		Default function	Pin No.	Functions
DO output	DO1+	RDY	25	Servo is ready
	DO1-		26	
	DO2+	ALM	7	Servo error (alarm)
	DO2-		8	
	DO3+	ZSP	5	Zero speed output signal
	DO3-		6	
	DO4+	BRK	3	Electromagnetic brake
	DO4-		4	
	DO5+	RUN	1	Servo operation
	DO5-		2	
	+24V	+24V	35	Internal 24V power supply
	COM	COM	36	

➢ **When the upper computer is the relay input:**

Figure 2-19 Correct wiring when the digital output terminals are connected to the relay
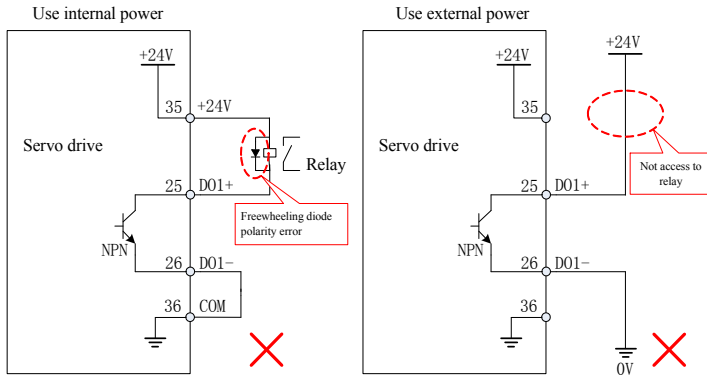
Figure 2-20 Wiring error when the digital output termina is connected to the relay

➢ **When the upper computer is optocoupler input:**
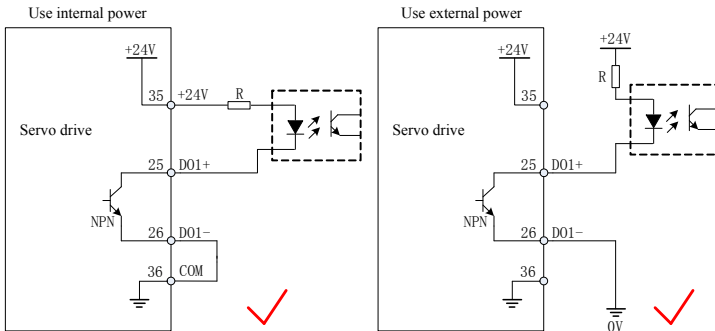
Figure 2-21 Correct wiring when the digital output terminal is connected to the optocoupler
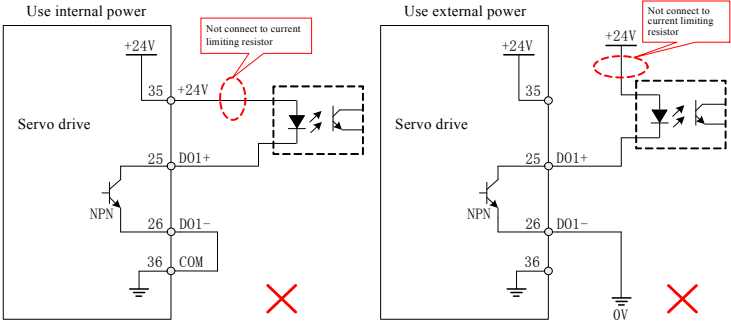
Figure 2-22 Incorrect wiring when the digital output terminal is connected to the optocoupler

The maximum allowable voltage and current capacity of servo drive digital output transistor are as follows:

● Max. voltage: DC30V
● Max. current: DC50Ma

2.7.5 Encoder dividing output signal interface circuit

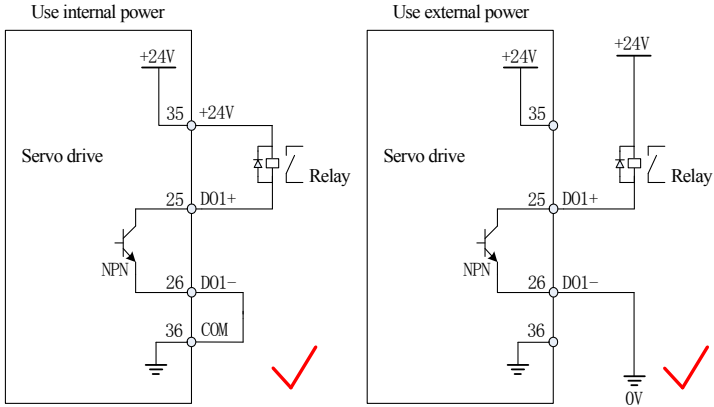The following describes the 29-30 (A-phase frequency output), 27-28 (B-phase frequency output and14-15 (Z- phase frequency output) of drive CN2 connectors.

The encoder divider output signal outputs the differential signal through the differential driver. It usually sends position feedback signal at time of the position control as an upper computer. When it is at side the upper computer, use the differential receiver circuit to receive signal.

Table 2-15 Descriptions of encoder frequency dividing output output signal

Signal name		Pin No.	Function	
Frequency dividing output	PAO	29	Phase-A frequency dividing output signal	Phase-A frequency dividing output signal
	/PAO	30		
	PBO	27	Phase-B frequency dividing output signal	
	/PBO	28		
	PZO	14	Phase-Z frequency dividing output signal	Origin pulse output signal
	/PZO	15		
	PZ_OC	12	Z-phase divider output open-collector output	
	DGND	11		
	PE	Enclosure	Shield	
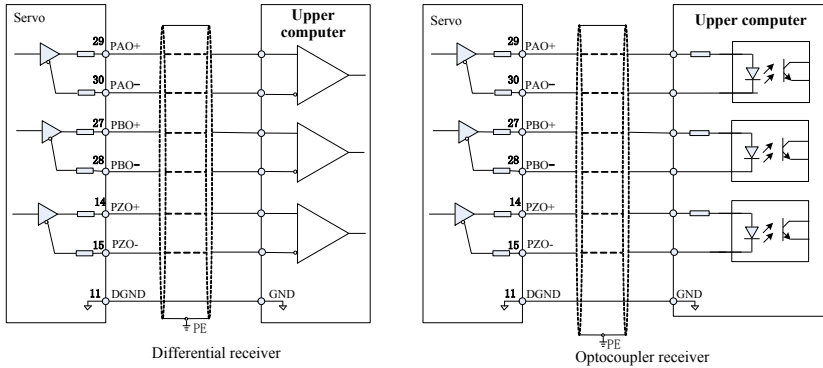
Figure 2-23 Connection between encoder divider output and upper computer

Moreover, the encoder divider output signal Z phase offers the open-collector output signal, and when the servo drive forms the position control system together with upper computer, it can then provide feedback signal. Receive the signals by using an optocoupler circuit, a relay circuit or a bus receiver circuit at the side of the upper computer.
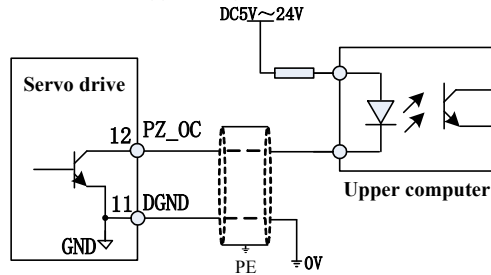
Figure 2-24 Connection between encoder (Open collector output) and upper computer

The maximum allowable voltage and current capacity of internal optocoupler of servo drive are as follows:

● Voltage: DC30V (max)
● Current: DC50Ma (max)

2.7.6   Analog input interface circuit

Table 2-16 Descriptions of analog input signal

Command	Signal name	Pin No.	Function
Analog quantity	V_REF	16	General analog input signal, Resolution12-bit, input voltage: max ± 12V
	T_REF	18	General analog input signal, Resolution 12-bit, input voltage: max ± 12V
	AGND	17/19	Analog input signal

Since the analog signal is the speed command or torque command signal, please use twisted pair, and the input standard is as follows:

• Range of analog signal voltage: ± 10V, Resolution is 12 bits;

• Maximum allowable voltage: ±12V;

• Input impedance: 14kΩ and above.

Chapter 3 Running, Debugging and Parameter Settings

3.1Panel operator

By using the panel operator, you can see the state, the implementation of auxiliary functions, set parameters, and monitor part of the parameters of the servo unit, as shown in Figure 3-1:
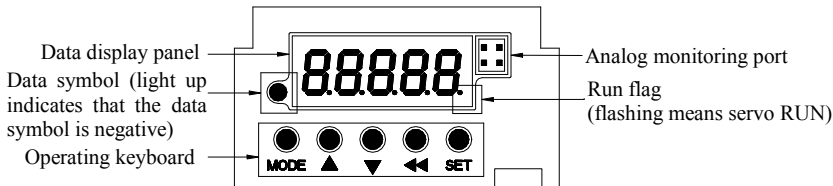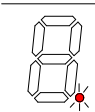
Figure 3-1 Panel operator
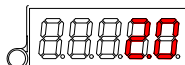
The keys and corresponding functions are shown in the following table:

Table 3-1 Key functions

No.	Name of button	Function	Way of Function
1	MODE	Switch between modes	Press
2	▲ UP	Increase the set value	Press /Press & hold
3	▼ DOWN	Decrease the set value	Press / Press & hold
4	◄◄ SHIFT	Move to left	Press
5	SET	Go to sub-menu and	Press

Table 3-2 Panel display and monitoring

Display status	Meaning	Display status	Meaning
---	The parameter cannot be changed at running status or it is a read-only parameter.	Er000	Alarm status
0	After the power is on, normal monitoring parameters are displayed and Default is set to 0.	SAVED	Parameter is successfully changed
	The last decimal point is flashing, which indicates the motor **is powered on, i.e., the servo driver is running.**	JOG	Indicating trial run

▐█8000	Negative 8000	DI8 DI7 DI6 DI5 DI4 DI3 DI2 DI1 ▐█0.0.0.0.0.	The left picture indicates that input signal (DI) is effective, i.e., at On status. If the signal is not effective, the numbering tube on the panel will not light up.
888.2.0	Positive 2.0	▐█0.0.0.0.0. DO5DO4DO3DO2DO1	The left picture indicates that output signal (DO) is effective, i.e., at On status. If the signal is not effective, the numbering tube on the panel will not light up.

3.2 JOG

In order to ensure safety and carry out trial operation correctly, please check and confirm following matters at first.

(1) Check for correct the power supply, and pay attention to distinguish **three-phase 220V** and **three-phase 380V**。

(2) Check if the drive is reliably grounded.

(3) Check if the servo motor and servo drive is of correct model.

(4) Check if the fastening part of the motor is loose, and all the four screws fastening the motor must be tightened.

(5) The servo motor axis must have a good concentricity with the equipment axial bar.

(6) Check if the drive has selected the correct model of the motor (view and change through the parameter Pn001; for the motor model number, please see the Section 6.4 "Product Model Table of Servo Drives and Servo Motors").

The motor rotation direction defined in this manual: when facing the motor shaft extension, if the rotating shaft rotates counterclockwise, it is viewed as forward rotation; if it rotates clockwise, it is viewed as reverse rotation.

Forward
Counterclockwise
(CCW)
Reverse
Clockwise (CW)
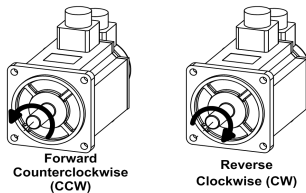
Figure 3-2 Definition of rotating direction

Upon the completion of the inspection, power on the drive for JOG test run. The operation process is as follows:
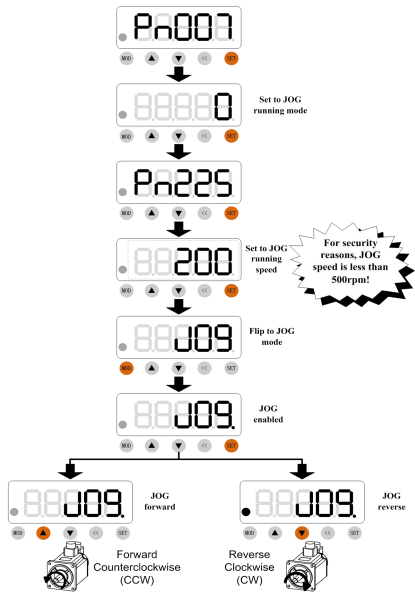
Figure 3-3 JOG process

In case of any unstable revolution or abnormal sound of the motor during trial run, please firstly check the system connection and mechanical installation. If the connection and mechanical installation is normal, it is necessary to adjust the speed loop gain Pn20 and the speed loop integral time Pn206.

3.3 Parameter and Property Definition

Table 3-3　Parameter Property Table

Description of Parameter Groups		Description of the Function Code Symbol	
Pn0xx	System parameter	**R**	User cannot modify read-only parameters
Pn1xx	Torque control parameter	■	This parameter cannot be changed under Servo On status.
Pn2xx	Speed control parameter	▲	Parameter values will not be saved after power-off.
Pn3xx	Position control parameter	●	After the parameter is modified, it will not be valid until powered on again.
Pn4xx	Gain adjustment parameter	☆	Relevant with the drive's model.
Enxx	Fault recording parameter	**H**	Hexadecimal parameter, to be changed for each digit.
JOG	Jog mode	※	This function needs configuring DI/DO. Refer to DI/DO functional configuration table.

Erxx	Alarm parameter	**P**	Position control
		S	Speed control
		T	Torque control

For example, the writing method of "Value Settings":

	Selection of control mode	Torque Speed Position				
Pn007	**Range**	**Resolution**	**Default**	**Condition precedent**	**Change limit**	
	0～6	1	3	■	x	

Indicate the control mode to which the parameter applies

Indicate the range of parameters that can be set

Indicate the "minimum" setting unit that can be set in the parameter

Indicate factory settings

Indicate the condition precedent for the change when the parameter changes

Indicate whether the parameter can be changed

3.4 Keyboard menus

3.4.1 List of parameters

➢ **Group Pn0: System parameters**

➢ **Pn0 group: system parameters**

Function Code	Name	Range	Resolution	Default	Property	Mode
Pn000	Program version	**8xxx**	1	☆	**R**	**P S T**
Pn001	Motor code	Check settings in Appendix 1 according to motor model.	1	☆	■/●	**P S T**
Pn002	Factory parameter	0000~FFFF	1	☆	**R**	**P S T**
Pn003	Macro parameter	0: Void 1: JOG mode 2: TRQ Internal torque mode 3: SPD internal speed mode 4: POS internal position mode 5: TRQ external torque mode 6: SPD external speed mode 7: POS external position mode (pulse +direction) 8: Custom made macro parameter 1	1	☆	■/▲	**P S T**

Function Code	Name	Range	Resolution	Default	Property	Mode
Pn004	Parameter management	**Units: EPROM setting** 0: Modify EPROM after parameter setting 1: parameter setting and restoring after powering on again **Tens: fault parameter clearing** 0: No action 1: Clearing default En parameter (zero clearing after finishing) **Hundreds: Restore to factory parameter** 0: No action 1: Restore to Default. (zero clearing after finishing 0) **Thousands: reserved**	1	0000	■/●/H	P S T
Pn005	Drive logical selection	**Units: torque logical** 0: torque control Positive Logic 1: torque control Negative Logic **Tens: speed logical** 0: Speed control Positive Logic 1: Speed control Negative Logic **Hundreds: Position control logistics** 0: Position control Positive Logic 1: Position control Negative Logic **Thousands: reserved**	1	0000	■/H	P S T
Pn006	Drive function selection	**Units: SON function selection** 0: DI terminal (SON) control servo start ※ 1: After power-on, the software compulsive servo starts immediately. **Tens: power-off save mode of the parameter at unit.** 0: Not saved when powered off 1: Saved when powered off **Hundreds: if the units' digit is cleared for the servo in the case of fault.** 0: Clear the unit in the case of fault 1: Do not clear the unit in the case of fault **Thousands: receving and feedback pulse counting /zero clearing method selection** 0: Count when servo ON (enabling, clear when OFF 1: Count when Power O, clear when OFF.	1	0000	H	P S T

Pn007	Control mode	0: JOG mode [Jog, trial run] 1: Torque control 2: Speed control 3: Position control 4: Speed / position control ※ 5: Torque / position mode ※ 6: Torque / speed mode ※ 7: reserved 8: CANopen control mode	1	3	■	P S T
Pn008	Torque command source	0: analog command 1: internal command 2: analog command or internal command※ 3: communication command (The address is shared with internal torque command 1)	1	0	■	T
Pn009	Speed command source	0: analog command 1: internal command※ 2:analog command or internal command※(use analog command to supersede internal speed command 1) 3: communication command (The address is shared with internal torque command 1)	1	0	■	S
Pn010	Position command source	0: Pulse command 1: Internal command 3: Communication command (The address is shared with internal torque command 1)	1	0	■	P
Pn011	DI1 function/effective logic	**Units + Tens : DI function configuration** 0x00~0x1C(00~28, refer to Section 3.6, refer to DI function configuration) **Hundreds :DI function effective logic** 0 : ON (switch on) DI function effective 1 : OFF (switch off) DI function effective For wiring, refer to section 2.3.1. **Thousands : retained**	1	0001	■/H	P S T
Pn012	DI2 function/effective logic			0004		
Pn013	DI3 function/effective logic			0005		
Pn014	DI4 function/effective logic			0003		
Pn015	DI5 function/effective logic			000B		
Pn016	DI6 function/effective logic			0009		
Pn017	DI7 function/effective logic			000F		
Pn018	DI8 function/effective logic			0002		
Pn019	DI digital input Filtering duration	1~200ms	1ms	3		P S T
Pn020	Normal monitoring display items	0~24 (Refer to the monitoring display table)	1	0		P S T
Pn021	DO1 digital output function	**Units + Tens : DO function configuration** 0x00~0x1C(0~12) refer to section 3.5 - DO function	1	0001	H	P S T
Pn022	DO2 digital output function			0002		

Pn023	DO3 digital output function				0003		
Pn024	DO4 digital output function				0004		
Pn025	DO5 digital output function				0009		
Pn026	AO monitoring configuration	**Tens + Units : AO1 monitoring function configuration** 0x00~0x05，refer to section 3.4.3 for reference **Thousands + Hundreds : AO2 monitoring function configuration** 0x00~0x05，refer to section 3.4.3 for reference 00: Motor's actual revolution 3000rpm/2.5V 01: Speed command 3000rpm/2.5V 02: Motor torque (2.5V/300%) 03: Position deviation (500P/2.5V) 04: position command speed 3000rpm/2.5V 05: Compulsory output	1	0000	H	P S T
Pn027	Analog channel functional setting	**Units: speed analog command polarity** 0: Bipolar 1: Positive unipolar and negative unipolar forced to be 0. 2: Negative unipolar **Tens: torque analog command polarity** 0: Bipolar 1: Positive unipolar and negative unipolar forced to be 0. 2: Negative unipolar **Hundreds: Reserved** **Thousands: Reserved**	1	0000	■/H	P S T
Pn028	Speed analog command filtering time	0.2~100.0ms	0.1 ms	2.0		P S T
Pn029	Speed analog command ratio	10~3000(rpm)/V	1	300		S
Pn030	Speed analog command zero offset	-342~342	1x5.86 mV	0		P S T
Pn031	Speed analog command dead zone	0~5000mv	1	0		P S T
Pn032	Torque analog command filtering time	0.2~100.0ms	0.1	2.0		P S T
Pn033	Torque analog command ratio	1~300%/V	1	30		S
Pn034	Torque analog command zero offset	-342~342	1x5.86 mV	0		P S T

Pn035	Torque analog command dead zone	0~5000mv	1	0		**P S T**
Pn036	Break OFF to motor no-electricity delay time	0~5000 (the motor's actual revolution lower than 25rpm is viewed as static brake off.	1ms	100		**P S**
Pn037	Electromagnet ism brake action speed when the motor is running	0~6000rpm	1rpm	50		**P S**
Pn038	Motor brake waiting delay when the motor is running	100~10000ms	1ms	500		**P S**
Pn039	Max. speed limit 制	0~6000rpm	1	☆		**P S T**
Pn040	Selection of servo shutdown mode	**Units: overtravel shutdown mode** 0: get down at free run, free run status 1: get down at zero speed, position is locked after stop 2: get down at zero speed, free run after stop **Tens:EMG stop** 0: Shutdown at free run, free run status. 1: Press pn1.12, the torque stops, free run status. **Hundreds: reserved** **Thousand: communication failure shutdown mode** 0: get down at free run, free run status 1: Run according to the last received instruction	1	0000	■/H	**P S T**
Pn041	Communicatio n Status	reserved	1	0000	**R**	**P S T**
Pn042	Servo axis address	0~127	1	1	■	**P S T**

Pn043	RS485 communication configuration	**Units: baud rate** 0: 2400bps 1: 4800bps 2: 9600bps 3: 19200bps 4: 38400bps 5: 57600bps 6: 115200bps **Tens: Modbus data format** 0: 1-8-1 No check (Modbus,RTU) 1: 1-8-1 Even check (Modbus,RTU) 2: 1-8-1 Odd check (Modbus,RTU) 3: 1-8-2 No check (Modbus,RTU) 4: 1-8-1 No check (Modbus,ASCII) 5: 1-8-1 Even check (Modbus,ASCII) 6: 1-8-1 Odd check (Modbus,ASCII) 7: 1-8-2 No check (Modbus,ASCII) 8: 1-7-1 No check (Modbus,ASCII) 9: 1-7-1 Even check (Modbus,ASCII) A: 1-7-1 Odd check (Modbus,ASCII) B: 1-7-2 No check (Modbus,ASCII) **Hundreds: Reserved** **Thousands: Reserved**	1	0003	■/H	P S T
Pn044	CANopen communication configuration	**Units：CAN communication rate** 0: 20Kbps 1: 50Kbps 2: 100Kbps 3: 125Kbps 4: 250Kbps 5: 500Kbps 6: 800Kbps 7: 1Mbps **Tens: EEPROM If PDO is saved to EEPROM after change of parameters.** (Note: SDO will be automatically saved to EEPROM after change of parameters. 0: PDO will not be saved to EEPROM after change of parameters. 1: PDO will be saved to EEPROM after change of parameters. **Hundreds: Resetting after PDO communication fault** 0: To be reset by keyboard or DI terminal after PDO communication fault. 1: automatically reset once the fault disappears after the PDO communication fault. **Thousands: Reserved**	1	0005	■/H	P S T
Pn045	Local response delay	0~5000ms	1ms	1	■	P S T
Pn046	Communication failure judging time	10~10000ms	1ms	10	■	P S T

Pn047	Manualy fault clearing	set value to "1" to reset the current fault manualy, and auto-return to "0" after the fault is cleared	1	0		**PST**
Pn048	Energy consumption breaking rate threshold	0.1~100.0%	0.1	30.0		**PST**
Pn051	DI mandatory input	**Tens + Units : DI mandatory input value** 0x00 : DI1~DI8 mandatory input low level 0xFF : DI1~DI8 mandatory input high level **Thousands + Hundreds : DI mandatory input enabling** 0x00 : DI1~DI8 mandatory input invalid 0xFF : DI1~DI8 mandatory input valid	1	0000	▲/H	**P S T**
Pn052	DO mandatory output	**Tens + Units: DO mandatory output value** 0x00 : DO1~DO5 mandatory output off 0x1F : DO1~DO5 mandatory output on **Thousands + Hundreds : DI mandatory output enabling** 0x00 : DO1~DO5 mandatory output invalid 0x1F : DO1~DO5 mandatory output valid	1	0000	▲/H	**P S T**
Pn053	AO1 forced output value	0~7200 0 correspondent analog quantity 0V 3600 correspondent analog quantity 5V 7200 correspondent analog quantity 10V	1	0		**P S T**
Pn054	AO2 forced output value	0~7200 0 correspondent analog quantity 0 V 3600 correspondent analog quantity 5 V 7200 correspondent analog quantity 10 V	1	0		**P S T**

> ➤ **Pn1 group: Torque control parameters**

Function Code	Name	Range	Resolution	Default	Property	Mode
Pn100	Torque function selection	**Units: torque limit selection** 0: Basic limit: internal + external 1: Min [basic limit , analog limit] ※ 2: Basic limit +internal torque segment ※ **Tens : torque reaching judging method** 0: Press Pn1.13 for nonpolarity judgment 1: Press Pn1.13 for polarity judgment 2: Judging reaching as per the torque command **Hundreds: Reserved** **Thousands: Reserved**	1	0	■/H	P S T
Pn101	Selection of torque control time speed limit	0: Basic limit [Pn1.02] 1: Min [basic limit , analog limit] ※ 2: Min [basic limit ,Internal speed segment] ※	1	0	■	T
Pn102	Speed limit under torque control	0~3000rpm	1	100		T
Pn103	Torque feed-forward gain	0~100.0%	0.1	0		P S
Pn104	Torque feed-forward filtering time	0.1~500.0ms	1	20		P S
Pn105	Torque filter 1	0.0~50.0ms	0.1	0.0		P S T
Pn106	Torque filter 2	0.0~50.0ms	0.1	0.0		P S T
Pn107	Torque command acceleration and deceleration time	0~60000ms	1	0		T
Pn108	Forward torque limit	0~300%	1%	300%		P S T
Pn109	Backward torque limit	-300~0%	1%	-300%		P S T
Pn110	External forward torque limit ※	0~300%	1%	100%		P S T
Pn111	External backward torque limit ※	-300~0%	1%	-100%		P S T
Pn112	Emergency stop torque limit	0~300%	1%	300%		P S
Pn113	Torque reaching judging value	-300~300%	1%	100%		P S T
Pn114	Torque reaching judging return difference	0~300%	1%	5%		P S T
Pn115	Internal torque command 1 ※o communication torque command	-300~300%	1%	0		T
Pn116	Internal torque 2 ※	-300~300%	1%	0		T
Pn117	Internal torque 3 ※	-300~300%	1%	0		T

| Pn118 | Internal torque 4※ | -300~300% | 1% | 0 | | T |
| Pn119 | JOG running torque limit | 0~300% | 1 | 100 | | |

> **Pn2 group: Speed control parameters**

Functi on Code	Name	Range	Resol ution	Defaul t	Prope rty	Mode
Pn200	Selection of zero speed clamping function	**Units: trigger mode** 0: Not use zero speed clamping function 1: Zero speed judging +ZCLAMP-ON ※ 2: ZCLAMP ON ※ 3: Zero speed judging **Tens: clamping mode** 0: Enter position control, position locking 1: Conduct speed control still, external force will rotate **Hundreds: Reserved** **Thousands: Reserved**	1	0000	■/H	S
Pn201	Zero speed clamping speed judging value	5~1000rpm	1	10		S
Pn202	Zero speed detection range	0~1000rpm	1	5		S
Pn203	Speed feed-forward gain	0~100%	1	0		P
Pn204	Speed feed-forward filtering time	0~64.0ms	1	1.0		P
Pn205	Speed loop gain 1	1~800	1	30		P S
Pn206	Speed loop integral time 1	0~500	1	10		P S
Pn207	Speed detection filtering 1	0~20.0ms	0.1	0		P S T
Pn208	Speed loop gain 2	1~200	1	30		P S
Pn209	Speed loop integral time 2	0~100	1	10		P S
Pn210	Speed detection filtering 2	0~20.0ms	0.1	0		P S T
Pn211	Speed loop stiffness coefficient	0~100	1	50		P S
Pn212	Speed command acceleration speed	0~30000ms	1	0		S
Pn213	Speed command deceleration time	0~30000ms	1	0		S
Pn214	Consistent speed judging mode	0: Detection based on the speed command 1: Judging as per Pn2.15 nonpolarity 2: Judging as per Pn2.15 polarity	1	0		S T
Pn215	Consistent speed detection value	-3000~3000rpm	1	☆		S T
Pn216	Consistent speed detection range	0~100rpm	1	20		S T

Pn217	Internal speed 1※ or communication speed command	-3000~+3000rpm	1	200		**S**
Pn218 ~ Pn224	Internal speed 2~Internal speed 8 ※	-3000~+3000rpm	1	200		**S**
Pn225	JOG running speed	-3000~3000rpm	1	100		
Pn226	Reserved					
Pn227	JOG command acceleration time	0~30000ms	1	500		JOG
Pn228	JOG command deceleration time	0~30000ms	1	500		JOG
Pn229	Reserved					

➢ **Pn3 group: Position control parameters**

Function Code	Name	Range	Resolution	Default	Property	Mode
Pn300	Position control command form selection	**Units: command pulse form** 0: pulse + direction 1: Forward/reverse pulse 2: Orthogonal pulse **Tens: PE_CLR clearing signal form**※ 0: Clear deviation counter under ON status 1: Clear deviation counter when OFF turns to ON 2: Clear deviation counter under OFF status 3: Clear deviation counter when ON turns to OFF **Hundreds: clearing action** 0: Servo OFF or CLR signal clearing 1: Only clear CLR signal 2: Clear when alarming **Thousand: Multi-segment position triggering** 0: after PTRG is triggered, complete remain pulses 1: after PTRG is triggered, run as per new position segment.	1	0000	■/H	P
Pn301	Position command filtering time	0~1000ms	1	0		P
Pn302	Position loop feed-forward gain	0~100%	1%	0		P
Pn303	Position loop feed-forward filtering time	0.2~64.0ms	0.1	1.0		P
Pn304	Position loop gain 1	1~100	1	10		P
Pn305	Position loop gain 2	1~100	1	5		P

Function Code	Name	Range	Resolution	Default	Property	Mode
Pn306	Electronic gear -numerator 1	1~32767	1	1		**P**
Pn307	Electronic gear -numerator 2	1~32767	1	1		**P**
Pn308	Electronic gear -numerator 3	1~32767	1	1		**P**
Pn309	Electronic gear -denominator	1~32767	1	1		**P**
Pn310	Locating completion judging value	0~50000pulse	1	10		**P**
Pn311	Locating completion return difference	0~50000pulse	1	5		**P**
Pn312	Locating approaching judging value	0~50000pulse	1	25		**P**
Pn313	Position excessive deviation alarm value	0~500.00 circles	1	100.00		**P**
Pn314	Internal position command 1 circle number or communication command circle number	-30000~30000 circles	1	0		**P**
Pn315	Internal position command 1 pulse number or communication command pulse	-9999~9999pulse	1	0		**P**
Pn316	Internal position command 1 speed or communication command speed	0~3000rpm	1	200		**P**
Pn317	Circle number of internal position command 2	-30000~30000 circles	1	0		**P**
Pn318	Internal position command 2 pulse number	-9999~9999pulse	1	0		**P**
Pn319	Internal position command 2 speed	0~3000rpm	1	200		**P**
Pn320	Internal position command 3 circle number	-30000~30000 circles	1	0		**P**
Pn321	Internal position command 3 pulse number	-9999~9999pulse	1	0		**P**
Pn322	Internal position command 3 speed	0~3000rpm	1	200		**P**
Pn323	Internal position command 4 circle number	-30000~30000 circles	1	0		**P**
Pn324	Internal position command 4 pulse number	-9999~9999pulse	1	0		**P**
Pn325	Internal position command 4 speed	0~3000rpm	1	200		**P**
Pn326	Internal position command 5 circle number	-30000~30000 circles	1	0		**P**

Pn327	Internal position command 5 pulse number	-9999~9999pulse	1	0		**P**
Pn328	Internal position command 5 speed	0~3000rpm	1	200		**P**
Pn329	Internal position command 6 circle number	-30000~30000 circles	1	0		**P**
Pn330	Internal position command 6 pulse number	-9999~9999pulse	1	0		**P**
Pn331	Internal position command6 speed	0~3000rpm	1	200		**P**
Pn332	Internal position command 7 circle number	-30000~30000 circles	1	0		**P**
Pn333	Internal position command 7 pulse number	-9999~9999 pulse	1	0		**P**
Pn334	Internal position command 7 speed	0~3000rpm	1	200		**P**
Pn335	Internal position command 8 circle number	-30000~30000 circles	1	0		**P**
Pn336	Internal position command 8 pulse number	-9999~9999pulse	1	0		**P**
Pn337	Internal position command 8 speed	0~3000rpm	1	200		**P**
Pn338	Selection of control by regression through the origin	**Units : Way of starting** 0: Disable the function of regression through the origin 1: reserved 2: Triggered at GOH rising edge 3: Triggered at the first Servo On rising edge **Tens: regression direction and origin selection** 0 : forward (anti-clockwise) , take REF rising edge+the first Z pulse when reverse leave the reference point as origin 1 : reverse (clockwise) ,take REF rising edge+the first Z pulse when reverse leave the reference point as origin 2 : Directly take the REF rising edge as origin **Hundreds: selection of reference point** 0 : forward (anti-clockwise) find REF rising edge as origin 1: reverse (clockwise) find REF rising edge as origin 2-5 : reserved **Thousands: reserved**	0000	■/H	**P**
Pn339	The origin back to the first speed (high speed)	1~3000rpm	1	100		**P**

Pn340	The origin back to the first speed (low speed)	1~3000rpm	1	50		P
Pn341	reserved					
Pn342	Reserved					
Pn343	Internal position command acceleration and deceleration time	1~1500ms	1	1	■	P
Pn344	Internal position command type	0：relative positioning 1：absolute positioning	1	1	■	P

> **Pn4 group: Gains adjustment parameters**

Functio n Code	Name	Range	Resol ution	Default	Prope rty	Mode
Pn400	Gain type application switch	**Units: P/PI Mode switch** 0: With torque command as condition pnx 1: With speed command as condition Pnx 2: With speed command as condition Pnx 3: With position deviation pulse as condition Pnx 4: Use external terminal P-SEL as the condition ※ 5: No mode switch function **Tens: Gain switching condition** 0: With torque command as condition pnx 1: With speed command as condition Pnx 2: With acceleration command as condition Pnx 3: With position deviation pulse as condition Pnx 4: Use external terminal G-SEL as condition※ 5: First gain fixed 6: Second gain fixed **Hundreds: auto gain enabling** 0: Manual adjustment of gain 1: Auto adjustment of gain **Thousands: Positioning ventilation automatic tuning.** 0: Closed 1: Enable	1	1000	H	P S
Pn401	reserved					
Pn402	Mode switch-torque value	0~300%	1	200		P S
Pn403	Mode switch-speed value	0~5000rpm	1	☆		P S
Pn404	Mode switch-accelerati on	0~30000rpm/s	1	☆		P S

Pn405	Mode switch-position deviation	0~50000pulse	1	0		**P**
Pn406	Gain switching-torque value	0~300%	1	200		**P S**
Pn407	Gain switching-speed value	0~5000rpm	1	0		**P S**
Pn408	Gain switching-acceleration	0~30000rpm/s	1	0		**P S**
Pn409	Gain switching-position deviation	0~50000pulse	1	0		**P**
Pn410	Gain switching waiting time 1	0~10000ms	1	0		**P S**
Pn411	Gain switching waiting time 2	0~10000ms	1	0		**P S**
Pn412	Gain switching time 1	0~10000ms	1	0		**P S**
Pn413	Gain switching time 2	0~10000ms	1	0		**P S**
Pn4.14	Reserved					
Pn4.15	Mapping application parameter 1	0x0000~0x00C7	1	0x0001	■/●	**P**
Pn4.16	Mapping application parameter 2	0x0000~0x00C7	1	0x0006	■/●	**P**
Pn4.17	Mapping application parameter 3	0x0000~0x00C7	1	0x0007	■/●	**P**
Pn4.18	Mapping application parameter 4	0x0000~0x00C7	1	0x0055	■/●	**P**
Pn4.19	Mapping application parameter 5	0x0000~0x00C7	1	0x0056	■/●	**P**
Pn4.20	Mapping status parameter 1	0x0000~0x0032	1	0x0000	■/●	**P**
Pn4.21	Mapping status parameter 2	0x0000~0x0032	1	0x0002	■/●	**P**
Pn4.22	Mapping status parameter 3	0x0000~0x0032	1	0x000A	■/●	**P**
Pn4.23	Mapping status parameter 4	0x0000~0x0032	1	0x000B	■/●	**P**
Pn4.24	Mapping status parameter 5	0x0000~0x0032	1	0x000C	■/●	**P**
Pn4.25~ Pn4.34	Factory commissioning parameter					
Pn4.35	Overload rate	0~100	1%	100%		**P S T**
Pn4.36	Shaking resisting level after positioning completion	1~6	1	2		**P**
Pn4.37	Position low-speed shaking filtering	0~200	1ms	60		**P**
Pn4.38	Gains after positioning completion	5~100	1	50		**P**

3.4.2   List of panel monitoring parameters

Pn020	Monitor display corresponded internal variables	Range
0	Motor speed	0~±3000RPM
1	Motor current	0 ~ 3 times the rated current
2	Motor torque	0~±300%
3	Position command speed	0~±6000RPM
4	Speed control command	Mechanical rotation speed of motor (RPM)
5	Torque command	0~±300%
6	Torque analog command voltage	0~±12.00V
7	Torque simulated command value	0~±300%
8	Speed analog command voltage	0~±12.00V
9	Speed analog command value	0~±3000RPM
10	Encoder position	0~9999
11	Position deviation low-order	0~±99999 pulse
12	Position deviation high-order	0~50 laps
13	Drive bus voltage	0~400.0V/800.0V
14	Current temp. of drive	-40.0~100.0
15	Cumulative load rate	0~100%
16	Regenerative braking load rate	0~100%
17	DIDO condition monitoring	Refer to 3.4.4
18	Cumulative communication failure	0~65536
19	U-phase current sensing	2048±20
20	V-phase current sensing	2048±20
21	Cumulative running time low-order	0~9999.9S
22	Cumulative running time high-order	0~500
23	Low-order of system state monitoring	Hexadecimal, for troubleshooting bu manufacturer
24	High-order of system state monitoring	
25	Feedback pulse accumulated value 1	(0~±32768)*32768 laps
26	Feedback pulse accumulated value 2	(0~±32768)*1 lap

27	Feedback pulse accumulated value 3	0~±9999 pp
28	Received pulse accumulated value 1	(0~±32768)*1 lap [Before gear ratio]
29	Received pulse accumulated value 2	0~±9999 pp [Before gear ratio]

3.4.3 List of AO monitoring parameters

Pn026	AO monitoring configuration	Torque Speed Position			
	Range	Resolution	Default	Condition precedent	Change limit
	--	1	0000	△	x
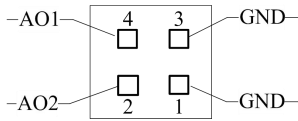
Analog monitoring terminal definition
(see in vertical to panel)
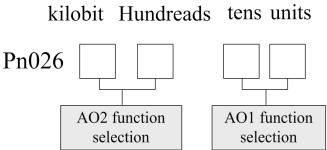
Monitoring terminal definition: (see in vertical to panel)

Parameter setting	Function
00	Actual motor speed 3000rpm/2.5V
01	Speed command 3000rpm/2.5V
02	Motor torque (2.5V/300%)
03	Positional deviation (500P/2.5V)
04	Position commanded speed 3000rpm/2.5V
05	Pushed output

3.4.4 DO/DI function configuration table

➢**Description of DI function configurations**

The hundreds of Pn011~Pn018 is defaulted as 0 (internal optocoupler conduction DI function is valid), and the corresponding DI function and its description are as follows:

DI function configurations					
S/N	**Symbol**	**FUNCTION ASSIGNED BY DI**	**Functional description**		
00	NULL	No functional configurations	Input status has no effect on the system		
01	SON	Servo enabled	OFF	Servo is not enabled and the motor is not energized	
			ON	Servo enabled, motor power on	
02	EMG	Emergency stop	OFF	The servo works properly	
			ON	Servo shuts down, and motor power is failed	
03	AL_CLR	Alarm clearing	When the alarm is cleared, the alarm is cleared when OFF is switched to ON Note: Only part of the alarm can be cleared		
04	POT	Forward drive disabled	OFF	Allow forward rotation	
			ON	Forward rotation disabled	
05	NOT	Reverse drive disabled	OFF	Reverse rotation allowed	
			ON	Reverse rotation disabled	
06	TCCW	External forward torque limit	OFF	CCW is not limited by Pn110 in forward	
			ON	CCW is limited by Pn110 in forward	
			Note: The forward torque is limited by Pn108 regardless of whether TCCW is valid or not		
07	TCW	External reverse torque limit	OFF	CW reverse is not limited by Pn111	
			ON	CW reverse is limited by Pn111	
			Note: The reverse torque is limited by Pn109 regardless of whether TCW is valid or not		
08	Reserved	Reserved	Reserved		
09	ZCLMP	Zero speed clamp	ON	Refer to Pn200 function	
			OFF	Invalid	
0A	CMOD	Control mode switching of drive	Pn007	COMD terminal	Control mode
			4	OFF	Speed control
				ON	Position control
			5	OFF	Torque control

				ON	Position control
			6	OFF	Torque control
				ON	Speed control
0B	GAIN	Gains switching	OFF	Use the first group of gains	
			ON	Use the second group of gains	
			Note: Be coordinated with the parameter Pn400		
0C	PCSEL	Control mode switching	OFF	The speed loop is controlled by PI	
			ON	The speed loop is controlled by P	
			Note: Be cooperated with Pn400		
0D 0E	GEAR1 GEAR2	Electronic gear selection 1 Electronic gear option 2	GEAR 2	GEAR 1	Electronic gear numerator
			OFF	OFF	Electronic gear- numerator 1 Pn306
			OFF	ON	Electronic gear- numerator 2 Pn307
			ON	OFF	Electronic gear- numerator 3 Pn308
0F	INH	Position pulse input disabled	OFF	External position pulse command is valid	
			ON	Ignore external position pulse command	
10	PE_CLR	Position deviation clearing	OFF	Invalid (refer to Pn300)	
			ON	Clearing position deviation counter	
11 12 13	POS1 POS2 POS3	Internal position command 1 Internal position command 2 Internal position command 3	POS3	POS2	POS1	Position command
			OFF	OFF	OFF	Internal position 1
			OFF	OFF	ON	Internal position 2
			OFF	ON	OFF	Internal position 3
			OFF	ON	ON	Internal position 4
			ON	OFF	OFF	Internal position 5
			ON	OFF	ON	Internal position 6
			ON	ON	OFF	Internal position 7
			ON	ON	ON	Internal position 8
14 15 16	SPD1 SPD2 SPD3	Internal speed command 1 Internal speed command 2 Internal speed command 3	SPD3	SPD2	SPD1	Speed command
			OFF	OFF	OFF	Analog/internal speed 1
			OFF	OFF	ON	Internal speed 2
			OFF	ON	OFF	Internal speed 3
			OFF	ON	ON	Internal speed 4
			ON	OFF	OFF	Internal speed 5
			ON	OFF	ON	Internal speed 6
			ON	ON	OFF	Internal speed 7

			ON	ON	ON	Internal speed 8
17 18	TRQ1 TRQ2	Internal torque command 1 Internal torque command 2	TRQ2	TRQ1	Torque command	
			OFF	OFF	Analog torque command / [Pn115]	
			OFF	ON	Internal torque command 2[Pn116]	
			ON	OFF	Internal torque command 3[Pn117]	
			ON	ON	Internal torque command 4[Pn118]	
19	PTRG	Internal position command triggered	Control is active when to the internal position, and to be valid terminal for rising edge			
1A	CINV	Invert command	Only be valid in speed or torque control			
			OFF	Normal command		
			ON	Current invert command		
1B	REF	DSZR reference point	OFF	Invalid		
			ON	Refer to parameter Pn338		
1C	GHOM	DSZR trigger signal	OFF	Invalid		
			ON	Origin regression triggered（rising edge valid）, refer to the parameter Pn338		

➢ **Description of DO function configurations**

Hundreds of Pn021~Pn025 is configured as 0, and the corresponded DO function and its description are as follows:

Description of DO terminal functions				
Settings	**Symbol**	**Function**	**Functional description**	
00	NULL	No functional configurations	OFF state	
01	RDY	Servo is ready	OFF	Abnormality occurs when the servo drive is powered on, or there is an alarm
			ON	Servo power on and initialization are normal, with no alarm
02	ALM	Servo error (alarm)	OFF	Servo shuts down, and motor power is failed
			ON	Servo works normally
03	ZSP	Zero speed	OFF	Not reach zero speed
			ON	Reach zero speed; refer to Pn200 parameters

04	BRK	Electromagnetic brake	OFF	Electromagnetic brake enabled
			ON	Electromagnetic brake released
05	COIN	Positioning completed	OFF	Positioning not completed
			ON	Positioning completed (refer to parameter Pn310)
06	NEAR	Positioning approaching	OFF	Position deviation counter is greater than Pn312
			ON	Position deviation counter is less than Pn312
07	SPA	Speed reached	OFF	Speed not reached
			ON	Speed reached, refer to parameter Pn214
08	TQA	Torque reaching	OFF	Torque not reached
			ON	Torque reached, refer to parameter Pn113
09	RUN	Servo running	OFF	Servo motor is not energized
			ON	Servo motor is energized and runs
0A	SPL	Speed limit	OFF	Motor speed is failed to reach the limit
			ON	Motor speed reaches the limit
0B	TQL	Torque limit	OFF	Motor torque is failed to reach the limited value
			ON	Motor torque reaches the limited value
0C	HOM	Returning home position	OFF	Returning home position not completed
			ON	Returning home position completed（when the move is complete，state will change from OFF to ON and last for 300ms then go back to OFF again）

Chapter 4 Warning, Alarm Diagnosis and Solutions

When the servo drive generates a warning signal, the auxiliary display field shows a warning code. Some warnings have no effect on the operation of the servo drive, while some warnings that may affect the operation of the inverter should be eliminated as much as possible. Otherwise, a more serious failure may occur. When the servo drive alarm failure occurs, the drive protection functions, and shut down according to the set stop mode.

4.1Alarm list

Alarm Code	Name	Possible Causes	Resolutions
ER.001	Servo drive overcurrent	Please check if the parameter is set reasonably.	Lacking phase of the motor, external short circuit, parameters not reasonably set.
ER.002	IPM fault	[IPM short circuit, overheating]	Drive output short circuit and long-term overload.
ER.003	Overload [exceeding instant max. load]	The motor blocked or excessive load	Check the machinery or choose the drive with high power.
ER.004	servo drive busbar calibration fault	busbar calibration fault or over voltage of busbar	Check AC power source and busbar voltage
ER.005	Fault of the channel adopted by the U-phase current	Detected circuit fault of U-phase current or disconnection of Drive U-phase	Check the wiring of the control board or if the mains circuit is reliably connected.
ER.006	Fault of the channel adopted by the V-phase current	Detected circuit fault of U-phase current or disconnection of Drive V-phase	Check the wiring of the control board or if the mains circuit is reliably connected.
ER.007	Detected fault of W-phase current	The control board is not reliably connected or output open circuit.	Check the wiring of the control board or if the mains circuit is reliably connected.
ER.008	Regenerative braker overload	Actual breaking rate （ monitor value pn020=16） is higher than pn0.48 setting threshold， Breaking load overload。	Please check the acctual breaking rate；change the proper breaking resistance；Set proper breaking threshold
ER.009	DC bus undervoltage	DC bus voltage lower than the alarm point	Check if the input power supply is reliably connected.
ER.010	DC bus overvoltage	DC bus voltage higher than the alarm point	Check if the brake resistor is correctly and reliably connected or adjust the "acceleration and deceleration time".

ER.011	Motor overspeed	The the encoder is not reliably connected or damaged.	Check if the encoder is reliably connected.
ER.012	Drive radiator overheating	Ambient temperature too high, radiating fan faulty	Check or change the radiating fan.
ER.013	Reserved	Reserved	Reserved
ER.014	EPROM reading/writing fault	Verification error	Check if the control board is reliably connected.
ER.015	Parameter copy fault	Unable to copy parameters to other drives	Different program version and machine model, abnormal connection or disconnection of communication cables
		Check if the communication cable is connected or not, or connected reliable.	
ER.016	Excessive position deviation	Excessive deviation between the set position and the actual position.	Check if the machine has reached the limit or if the Pn313 is set unreasonably.
ER.017	Serial encoder fault	Encoder not connected, poor contact and encoder fault.	Connect the encoder cable reliably.
ER.018	Encoder ABZ signal abnormal	ABZ signal not connected or poor contact.	Connect the encoder cable reliably.
ER.019	Encoder UVW signal abnormal	UVW signal not connected or poor contact.	Connect the encoder, or make sure reliable connection.
ER.020	Encoder abnormal	Encoder connected, but logistics code error.	Check the encoder cable or if the encoder can work normally.
ER.021	Speed measuring abnormal	Excessive high velocity measurement of the encoder.	The encoder signal is severely interfered or the encoder is faulty.
ER.022	Encoder initial signal interfered	The encoder is interfered.	The encoder signal is severely interfered or the encoder is faulty.
ER.023	Electromagnetic interfe rence 1	Motor not powered on, and the driving locking circuit interfered.	Check for reasonable wiring of the secondary loop, and reliable grounding of the drive, or consult the manufacturer's customer service center.
ER.024	Electromagnetic interfe rence 2	When the motor is running, the driving locking is interfered.	Refer to the resolution for ER.023.
ER.025	Electromagnetic interfe rence 3	Motor not powered on, and the drive is triggered by overcurrent signal.	Refer to the resolution for ER.023.
ER.026	Electromagnetic interfe rence 4	IPM alarms hen the motor is not powered, and the radiator temperature <70°.	Refer to the resolution for ER.023.
ER.027	Motor connection abnormal	Not connected.	Please connect the motor correctly.

ER.028	Lacking phase of main loop input, lacking phase of L1, L2, L3	The power supply is at open circuit.	Check the input line of the power supply.
ER.029	Drive 24V abnormal	Drive 24V power supply is faulty, or the drive's internal flat cables are not reliably connected.	Check the drive's flat cables, and check the drive's internal 24V.
ER.030	Communication faults	The communication is interfered.	Check if the communication wire is reliably connected.
ER.031	Single plate tooling testing QC label, NG	Factory group parameters	Factory group parameters
ER.032	QC testing label before aging, NG	Factory group parameters	Factory group parameters
ER.033	Label for 12-hour aging testing, NG	Factory group parameters	Factory group parameters
ER.034	Label for whole machine testing after aging, NG	Factory group parameters	Factory group parameters
ER.039	Control panel faulty ID	Factory group parameters	Factory group parameters
ER.040	Motor selection logistics error	Factory group parameters	Factory group parameters

4.2Fault history

Function Code	Function Description	Range	Resolution	Default	Property	
En0.00	Last fault record	0~128	1	0	R	Historical fault record
En0.01	Historical fault 1	0~128	1	0	R	
En0.02	Historical fault 2	0~128	1	0	R	
En0.03	Historical fault 3	0~128	1	0	R	
En0.04	Historical fault 4	0~128	1	0	R	
En0.05	Historical fault 5	0~128	1	0	R	
En0.06	Historical fault 6	0~128	1	0	R	
En0.07	Historical fault 7	0~128	1	0	R	
En0.08	motor revolution	-6000~6000	1rpm	0	R	Last faulty running status
En0.09	Target revolution	-6000~6000	1rpm	0	R	
En0.10	U-phase instant sampling	-400~400%	1%	0	R	
En0.11	V-phase instant sampling	-400~400%	1%	0	R	
En0.12	Output feedback current label	0.0~3000.0A	0.1A	0	R	
En0.13	Output voltage	0~1000.0V	0.1V	0	R	
En0.14	DC side voltage	0~1000.0V	0.1V	0	R	
En0.15	Equipment max. temperature	-40.0~150.0	0.1℃	0	R	
En0.16	Running status word at higher bit:			0	R/H	
En0.17	Running status word at lower bit:			0	R/H	
En0.18	Accumulative running time during the last fault.	0~65535	1H	0	R	
En0.19	Interval between last two times of faulty running	0~65535	1H	888	R	

Chapter 5 Communication Protocol

5.1 Overview of Modbus protocol

The Modbus protocol is a general-purpose protocol applied to industrial controllers. The protocol has become an industrial common standard due to its use convenience, and is widely used in the integration of main controllers and slave devices. Devices of the different brands can be connected to industrial network via this protocol.

Modbus defines three modes of transmission, they are the ASCII, RTU and TCP, for which CA100 servo drive supports ASCII and RTU.

5.2 Interface and transmission mode

CA100 uses RS485 as the Modbus physical interface, and a host controls one or more (up to 127) servo drives.

Terminal marking	Application	Function
RS+	Data receiving and sending terminal (+)	When connecting to PC/PLC with RS485 communication interface, please connect to (+) signal
RS-	Data receiving and sending terminal (-)	When connecting to PC/PLC with RS485 communication interface, please connect to (-) signal

It uses the transmission mode of asynchronous serial and half-duplex, by which, only one side (the host and the slave) can send data at the same time, while the other can only receive data.

5.3 Data structure

1) **12 transmission formats of data are optional:**
   a)   1-bit start bit -8-bit data bit -1-bit stop bit-no parity (factory set) (Modbus,RTU)
   b)   1-bit start bit -8-bit data bit -1-bit stop bit-even parity, (Modbus,RTU)
   c)   1-bit start bit -8-bit data bit -1-bit stop bit-odd parity, (Modbus,RTU)
   d)   1-bit start bit -8-bit data bit -2-bit stop bit-no parity, (Modbus,RTU)
   e)   1-bit start bit -8-bit data bit -1-bit stop bit-no parity, (Modbus,ASCII)
   f)   1-bit start bit -8-bit data bit -1-bit stop bit-even parity, (Modbus,ASCII)
   g)   1-bit start bit -8-bit data bit -1-bit stop bit-odd parity, (Modbus,ASCII)
   h)   1-bit start bit -8-bit data bit -2-bit stop bit-no parity, (Modbus,ASCII)
   i)   1-bit start bit -7-bit data bit -1-bit stop bit-no parity, (Modbus,ASCII)

j)   1-bit start bit -7-bit data bit -1-bit stop bit-even parity, (Modbus,ASCII)

k)   1-bit start bit -7-bit data bit -1-bit stop bit-odd parity, (Modbus,ASCII)

l)   1-bit start bit -7-bit data bit -2-bit stop bit-no parity, (Modbus,ASCII)

2) Baud rate

Seven Baud rates available: 2400 bps, 4800 bps, 9600 bps, 19200 bps, 38400bps, 79600bps and 115200bps

3) Communication rule

The start interval between data frames is greater than the 3.5-byte transmission period (standard), but the minimum interval is not less than 0.5ms.

5.4Servo drive parameter configuration

CA100 servo drive can be easily changed for its function parameters via communication. It uses RS485 interface, supports Modbus protocol, and be compatible with ASCII and RTU modes. 12 kinds of data formats and 7 baud rate settings available, and can be connected to up to 127 drivers. For the related function codes, please refer to Pn042, Pn043 and Pn045.

CA100 series servo drive related Modbus function code is as follows:

0x03: Read the settings of the servo drive application parameters and the real-time value of the state parameter;

0x06: Write data into the servo drive application parameters;

Access address of application parameters:

Parameter identifier	RAM access address	EEPROM access address
Pn0.00 ~ Pn0.54	0x2000 ~ 0x2036	0xE000 ~ 0xE036
Pn1.00 ~ Pn1.24	0x2037 ~ 0x204F	0xE037 ~ 0xE04F
Pn2.00 ~ Pn2.29	0x2050 ~ 0x206D	0xE050 ~ 0xE06D
Pn3.00 ~ Pn3.44	0x206E ~ 0x209A	0xE06E ~ 0xE09A
Pn4.00 ~ Pn4.44	0x209B ~ 0x20C7	0xE09B ~ 0xE0C7
CF0.00 ~ CF0.35	0x20C8 ~ 0x20EB	0xE0C8 ~ 0xE0EB
En0.00 ~ En0.19	0x20EC ~ 0x20FF	0xE0EC ~ 0xE0FF

Note 1: CF0.00~CF0.35 is only for debugging use by manufacturer

Note 2: En0.00~En0.19 is **read-only parameter**

Note 3: Modbus function codes: 0x03, 0x06

Status parameter access address:

Pn020 corresponded value:	Address
0~24	0x3000 ~ 0x3018
25~40 (internal monitoring variables)	0x3019 ~ 0x3028
41~50 (custom monitoring variables)	0x3029 ~ 0x3032

Note 1: Modbus function code: 0x03

Access address of mapping parameters:

Register name	Access address	Description
Mapping application parameter 1	0x4000	The access parameter is set by Pn.415
Mapping application parameter 2	0x4001	The access parameter is set by Pn.416
Mapping application parameter 3	0x4002	The access parameter is set by Pn.417
Mapping application parameter 4	0x4003	The access parameter is set by Pn.418
Mapping application parameter 5	0x4004	The access parameter is set by Pn.419
Mapping state parameter 1	0x4005	The access parameter is set by Pn.420
Mapping state parameter 2	0x4006	The access parameter is set by Pn.421
Mapping state parameter 3	0x4007	The access parameter is set by Pn.422
Mapping state parameter 4	0x4008	The access parameter is set by Pn.423
Mapping state parameter 5	0x4009	The access parameter is set by Pn.424

Note 1: The mapping parameters are used to access multiple application parameters or state parameters that are not consecutive. This method requires only one frame of data for access.

Note 2: Modbus function code: 0x03 (Mapping application parameter and mapping state parameter), 0x06 (mapping application parameter).

Pay special attention to the use of communication:

When the parameters for long-term or power-down save are not required, the parameter value can be written to the RAM area, and the date required to be stored for a long time or power-down saved data can be written to the EEPROM. However, the frequent writing of EEPROM will reduce the ROM life.

Application example:

(1) Send position commend by communication in position mode

This can be done by setting the position command source as the internal command (Pn010 = 1), and adjust the parameter Pn314 (laps of internal position command 1), Pn315 (number of pulse of internal position command 1) and Pn316 (speed of internal position command 1).

Set the Pn314 (laps of internal position command 1) to 2:

The host sends the request data frame:

Slave address	Function code	High-order address of register	Low-order address of register	Data high-order	Data low-order	CRC low-order	CRC high-order
01	06	20	7C	00	02	C2	13

Slave makes response to data frame (slave returns the same data as being requested by host):

Slave address	Function code	High-order address of register	Data high-order	Data low-order	CRC low-order	CRC high-order
01	06	20	00	02	C2	13

Set the Pn315 (pulse number of internal position command 1) to 500:

The host sends the request data frame:

Slave address	Function code	High-order address of register	Low-order address of register	Data high-order	Data low-order	CRC low-order	CRC high-order
01	06	20	7D	01	F4	12	05

Slave makes response to data frame (slave returns the same data as being requested by host):

Slave address	Function code	High-order address of register	Low-order address of register	Data high-order	Data low-order	CRC low-order	CRC high-order
01	06	20	7D	01	F4	12	05

Set Pn316 (Speed of internal position command 1) to 1,500rpm:

The host sends the request data frame:

Slave address	Function code	High-order address of register	Low-order address of register	Data high-order	Data low-order	CRC low-order	CRC high-order
01	06	20	7E	05	DC	E0	DB

Slave makes response to data frame (slave returns the same data as being requested by host):

Slave address	Function code	High-order address of register	Low-order address of register	Data high-order	Data low-order	CRC low-order	CRC high-order
01	06	20	7E	05	DC	E0	DB

Note: When the speed or torque command needs to be given by communication under speed or torque mode, it can also be achieved in a similar way, for which set the speed command source (Pn009) or the torque command source (Pn008) as the internal command, and modify the setting value of the internal speed 1 (Pn217) or internal torque 1 (Pn115) by communication.

(2) Composite mode of position/speed mode is switched via communication

The parameter Pn051 can be modified by communication to forcibly switch the execution mode into DI terminal 1 of CMOD, to allow the switching of composite mode. The following is a case where DI8 is set as the CMOD terminal of mode switching.

The host sends the request data frame:

Slave address	Function code	Register address high-order	Low-order address of register	Data high-order	Data low-order	CRC low-order	CRC high-order
01	06	20	33	80	80	12	65

Slave makes response to data frame (slave returns the same data as being requested by host):

Slave address	Function code	Register address high-order	Low-order address of register	Data high-order	Data low-order	CRC low-order	CRC high-order
01	06	20	33	80	80	12	65

(3) The host reads the monitoring parameters (speed, corresponded address 0x3000)

The host sends the request data frame:

Slave address	Function code	High-order of register start address	Low-order of register start address	High-order of number of register	Low-order of number of register	CRC low-order	CRC high-order
01	03	30	00	00	01	8B	0A

Monitoring group data frame returned by slave:

Slave address	Function code	Data length	Data high-order of 1st register	Data low-order of 1st register	CRC low-order	CRC high-order
01	03	02	03	E8	B8	FA

Chapter 6 Appendixes

6.1 Specifications of servo power and encoder cables

Servo motor series	Motor flange	Drive CA100-	Motor power wire model	Type of motor encoder wire
CM105	60、80、90	T3R0 A T4R5 A	SP-WM0313DI-01　3m SP-WM0513DI-01　5m SP-WM1013DI-01　10m	SP-WD0315AI-01　3m SP-WD0515AI-01　5m SP-WD1015AI-01　10m
CM105	110、130	T3R0 A T4R5 A T6R0 A T7R5 A	SP-WM0320DH-01　3m SP-WM0520DH-01　5m SP-WM1020DH-01　10m	SP-WD0315AH-01　3m SP-WD0515AH-01　5m SP-WD1015AH-01　10m
		T10R A F4R0 A F6R0 A F8R5 A F12R A	SP-WM0320EH-01　3m SP-WM0520EH-01　5m SP-WM1020EH-01　10m	
		F20R A F25R A	SP-WM0355EH-01　3m SP-WM0555EH-01　5m SP-WM1055EH-01　10m	
CM105	180	F8R5 A F12R A	SP-WM0320EJ-01　3m SP-WM0520EJ-01　5m SP-WM1020EJ-01　10m	
		F20R A F25R A	SP-WM0355EJ-01　3m SP-WM0555EJ-01　5m SP-WM1055EJ-01　10m	

6.2Descriptions of servo communication lines

Servo communication line:
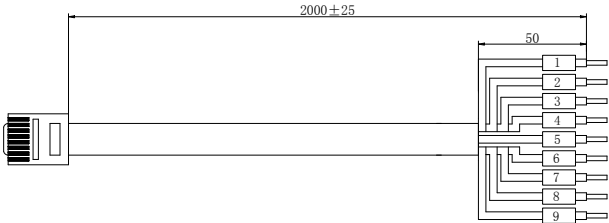
Model: SP-WC0208CF-01(2000mm)

Model: SP-WC0208CF-01(2000mm)

Drive CN1	A		B		Description
CN1 Signal name	Pin No.	Signal name	Signal name	Pin No.	
C N 1	1	CANL	CANL	1	Twisted pair
	2	CANH	CANH	2	
	3	RS+	RS+	3	Twisted pair
	5	RS-	RS-	5	
	4	RS+	RS+	4	Twisted pair
	6	RS-	RS-	6	
	7	GND	GND	7	--
	8	GND	GND	8	--
	Shield		Shield		--

6.3Macro associated self-setting parameters

V8006 and above versions supports the following macro definitions

6.3.1 Pn003=1   JOG mode

Parameter	Pn003=1 JOG running mode	
	Settings	Description
Pn007	0	JOG mode
Pn225	200	Speed rpm
Pn119	100	Torque limit %
Pn227	500	Acceleration time in JOG mode
Pn228	500	Deceleration time in JOG mode

6.3.2 Pn003=2   Running mode of internal torque

Parameter	Pn003=2 Running mode of internal torque	
	Settings	Description
Pn007	1	Torque mode
Pn008	1	Internal torque
Pn020	0	Observed rotating speed
Pn100	0000	Torque uses basic limit
Pn101	0	Speed selects Pn102
Pn102	500	Speed limit
Pn115	100	Internal torque command 1

➢ **Function definition of terminal during macro definition of internal torque mode:**

Function code	Input terminal No.	Function ID	Function symbol	Name of function
Pn011	DI1	0001	SON	Servo enabled
Pn012	DI2	0004	POT	Forward overtravel
Pn013	DI3	0005	NOT	Reverse overtravel
Pn014	DI4	0003	AL_CLR	Fault clearing
Pn015	**DI5**	**001A**	**CINV**	**Invert command**
Pn016	**DI6**	**0009**	**ZCLMP**	**Zero speed clamp**
Pn017	**DI7**	**0017**	**TRQ1**	**Torque command selection 1**
Pn018	**DI8**	**0018**	**TRQ2**	**Torque command selection 2**
Pn021	DO1	0001	RDY	Servo is ready
Pn022	DO2	0002	ALM	Servo failure

Pn023	DO3	0004	BRK	Contracting brake
Pn024	DO4	0008	TQA	Torque arrives
Pn025	DO5	000B	TQL	Torque limits

6.3.3 Pn003=3   Running mode of internal speed

Parameter	Pn003=3 Running mode of internal speed	
	Settings	Description
Pn007	2	Speed mode
Pn009	1	Internal speed
Pn020	0	Observed rotating speed
Pn100	0000	Torque uses basic limit
Pn217	100	Internal speed 1

➢ **Function definition of terminal during macro definition of internal speed mode:**

Function code	Input terminal No.	Function ID	Function symbol	Name of function
Pn011	DI1	0001	SON	Servo enabled
Pn012	DI2	0004	POT	Forward overtravel
Pn013	DI3	0005	NOT	Reverse overtravel
Pn014	DI4	0003	AL_CLR	Fault clearing
Pn015	DI5	001A	CINV	Invert command
Pn016	DI6	0014	SPD1	Speed command selection 1
Pn017	DI7	0015	SPD2	Speed command selection 2
Pn018	DI8	0016	SPD3	Speed command selection 3
Pn021	DO1	0001	RDY	Servo is ready
Pn022	DO2	0002	ALM	Servo failure
Pn023	DO3	0004	BRK	Contracting brake
Pn024	DO4	0003	ZSP	Zero speed
Pn025	DO5	0007	SPA	Speed reached

6.3.4 Pn003=4 Running mode of internal position

Parameter	Pn003=4 Running mode of internal position	
	Settings	Description
Pn007	3	position mode
Pn010	1	Internal position
Pn020	11	Position deviation low-order
Pn306	1	Electronic gear-numerator 1
Pn309	1	Electronic gear-denominator
Pn314	1	Number of laps 1 of internal position command
Pn315	0	Internal position command pulse 1
Pn316	500	Internal position command speed 1

➢ **Function definition of terminal during macro definition of internal position mode:**

Function code	Input terminal No.	Function ID	Function symbol	Name of function
Pn011	DI1	0001	SON	Servo enabled
Pn012	DI2	0004	POT	Forward overtravel
Pn013	DI3	0005	NOT	Reverse overtravel
Pn014	DI4	0003	AL_CLR	Fault clearing
Pn015	**DI5**	**0011**	**POS1**	**Internal position selection 1**
Pn016	**DI6**	**0012**	**POS2**	**Internal position selection 2**
Pn017	**DI7**	**0013**	**POS3**	**Internal position selection 3**
Pn018	DI8	0019	PTRG	Internal position triggered
Pn021	DO1	0001	RDY	Servo is ready
Pn022	DO2	0002	ALM	Servo failure
Pn023	**DO3**	**0004**	**BRK**	**Contracting brake**
Pn024	**DO4**	**0005**	**COIN**	**Positioning completed**
Pn025	**DO5**	**000C**	**HOM**	**Returning home position completed**

6.3.5 Pn003=5   Running mode of external torque

Parameter	Pn003=5 Running mode of external torque	
	Settings	Description
Pn007	1	Torque mode
Pn008	0	Analog command torque
Pn020	0	Observed rotating speed
Pn032	2.0	Filtering time of torque analog command, ms
Pn033	30	Torque analog command prop. 1~300%/V
Pn034	0	Zero offset of torque analog command 1*5.86mV
Pn035	0	Dead zone of torque analog command, mV
Pn100	0000	Torque uses basic limit
Pn107	0	Torque command acceleration / deceleration time, ms

➢ **Function definition of terminal during macro definition of external torque mode:**

Function code	Input terminal No.	Function ID	Function symbol	Name of function
Pn011	DI1	0001	SON	Servo enabled
Pn012	DI2	0004	POT	Forward overtravel
Pn013	DI3	0005	NOT	Reverse overtravel
Pn014	DI4	0003	AL_CLR	Fault clearing
Pn015	**DI5**	**001A**	**CINV**	**Invert command**
Pn016	**DI6**	**0009**	**ZCLMP**	**Zero speed clamp**
Pn017	**DI7**	**0006**	**TCCW**	**Torque limit at external forward side**
Pn018	**DI8**	**0007**	**TCW**	**Torque limit at external reverse side**
Pn021	DO1	0001	RDY	Servo is ready
Pn022	DO2	0002	ALM	Servo failure
Pn023	**DO3**	**0004**	**BRK**	**Contracting brake**
Pn024	**DO4**	**0008**	**TQA**	**Torque reached**
Pn025	**DO5**	**000B**	**TQL**	**Torque limited**

6.3.6 Pn003=6 Running mode of external speed

Parameter	Pn003=6 Running mode of external speed	
	Settings	Description
Pn007	2	Speed mode
Pn009	0	Analog command speed
Pn020	0	Observed rotating speed
Pn028	2.0	Filtering time of torque analog command, ms
Pn029	300	Torque analog command prop. 10~3000rpm/V
Pn030	0	Zero offset of torque analog command 1*5.86mV
Pn031	0	Dead zone of torque analog command, mV
Pn100	0000	Torque uses basic limit
Pn212	0	Speed command acceleration time, ms
Pn213	0	Torque command deceleration time, ms

➤ **Functional definition of terminal during macro definition of external speed mode:**

Function code	Input terminal No.	Function ID	Function symbol	Name of function
Pn011	DI1	0001	SON	Servo enabled
Pn012	DI2	0004	POT	Forward overtravel
Pn013	DI3	0005	NOT	Reverse overtravel
Pn014	DI4	0003	AL_CLR	Fault clearing
Pn015	**DI5**	**001A**	**CINV**	**Invert command**
Pn016	**DI6**	**0009**	**ZCLMP**	**Zero speed clamp**
Pn017	**DI7**	**0006**	**TCCW**	**Torque limit at external forward side**
Pn018	**DI8**	**0007**	**TCW**	**Torque limit at external reverse side**
Pn021	DO1	0001	RDY	Servo is ready
Pn022	DO2	0002	ALM	Servo failure
Pn023	**DO3**	**0004**	**BRK**	**Contracting brake**
Pn024	**DO4**	**0003**	**ZSP**	**Zero speed**
Pn025	**DO5**	**0007**	**SPA**	**Speed reached**

6.3.7 Pn003=7   External position running mode

Parameter	Pn003=7 External position running mode	
	Settings	Description
Pn007	3	position mode
Pn010	0	External pulse command
Pn020	11	Position deviation
Pn300	0000	Defaulted position control command form
Pn306	1	Electronic gear-numerator 1
Pn309	1	Electronic gear- denominator

➢ **Functional definition of terminal during external position mode macro definition:**

Function code	Input terminal No.	Function ID	Function symbol	Name of function
Pn011	DI1	0001	SON	Servo enabled
Pn012	DI2	0004	POT	Forward overtravel
Pn013	DI3	0005	NOT	Reverse overtravel
Pn014	DI4	0003	AL_CLR	Fault clearing
Pn015	**DI5**	**0010**	**PE_CLR**	**Deviation clearing**
Pn016	**DI6**	**000F**	**INH**	**Pulse disabled**
Pn017	**DI7**	**000B**	**GAIN**	**Gain switching**
Pn018	DI8	0002	EMG	Emergency stop
Pn021	DO1	0001	RDY	Servo is ready
Pn022	DO2	0002	ALM	Servo failure
Pn023	**DO3**	**0004**	**BRK**	**Contracting brake**
Pn024	**DO4**	**0005**	**COIN**	**Positioning completed**
Pn025	**DO5**	**000C**	**HOM**	**Origin regression completed**

6.4 Models of servo drive and servo motor products

Note 1: The motor code will be set in Pn001

Model list of CM105 series servo motor and adapter drive

220V						
Rated torque (Nm)	Speed (rpm)	Capacity (W)	Frame size	Motor model	Drive modelCA100-	Motor code
0.60	3000	200	60	CM105-60T06030A1□□□	T1R8 A	2001
1.27	3000	400	60	CM105-60T13030A1□□□	T3R0 A	2025
			80	CM105-80T13030A1□□□	T3R0 A	2028
2.00	3000	600	110	CM105-110T20030A1□□□	T3R0 A	2024
2.40	3000	750	80	CM105-80T24030A1□□□	T3R0 A	2027
3.50	2000	730	80	CM105-80T35020A1□□□	T3R0 A	2026
	3000	1100	80	CM105-80T35030A1□□□	T4R5 A	2052
4.00	2000	800	110	CM105-110T40020A1□□□	T4R5 A	2048
	2500	1000	80	CM105-80T40025A1□□□	T4R5 A	2050
			130	CM105-130T40025A1□□□	T4R5 A	2049
	3000	1200	110	CM105-110T40030A1□□□	T6R0 A	2074
5.00	2500	1300	130	CM105-130T50025A1□□□	T6R0 A	2075
	3000	1500	110	CM105-110T50030A1□□□	T6R0 A	2076
6.00	2000	1200	110	CM105-110T60020A1□□□	T4R5 A	2054
	2500	1500	130	CM105-130T60025A1□□□	T6R0 A	2077
	3000	1800	110	CM105-110T60030A1□□□	T6R0 A	2079
7.70	2500	2000	130	CM105-130T77025A1□□□	T7R5 A	2082
10.00	1000	1000	130	CM105-130T10110A1□□□	T4R5 A	2051
	1500	1500	130	CM105-130T10115A1□□□	T6R0 A	2078
	2500	2600	130	CM105-130T10125A1□□□	T10R A	2107
15.00	1500	2300	130	CM105-130T15115A1□□□	T10R A	2106
380V						
Rated torque (Nm)	Speed (rpm)	Capacity (W)	Frame size	Motor model	Drive modelCA100-	Motor code
10.00	1000	1000	130	CM105-130F10110A1□□□	F4R0 A	4012
	1500	1500	130	CM105-130F10115A1□□□	F4R0 A	4013
	2500	2600	130	CM105-130F10125A1□□□	F6R0 A	4031
15.00	1500	2300	130	CM105-130F15115A1□□□	F6R0 A	4030
	2500	3800	130	CM105-130F15125A1□□□	F12R A	4067
19.00	1500	3000	180	CM105-180F19115A1□□□	F8R5 A	4049
21.50	2000	4500	180	CM105-180F22120A1□□□	F12R A	4068
27.00	1500	4300	180	CM105-180F27115A1□□□	F12R A	4070
	2000	5600	180	CM105-180F27120A1□□□	F20R A	4084
35.00	1000	3700	180	CM105-180F35110A1□□□	F12R A	4069

	1500	5500	180	CM105-180F35115A1□□□□	F12R A	4071
	2000	7300	180	CM105-180F35120A1□□□□	F20R A	4085
380V						
Rated torque (Nm)	Speed (rpm)	Capaci ty (W)	Fra me size	Motor model	Drive modelCA10 0-	Motor code
48.00	1500	7500	180	CM105-180F48115A1□□□□	F20R A	4083
	2000	10000	180	CM105-180F48120A1□□□□	F25R A	4101