AC Servo System
TSTA series
Install Operate Manual

TECO

Driving &
Connecting Globally

■ Warning and Caution :

Warning

- **Do not proceed to the assembly of the line while electrifying.**
- **circuit & change components between entering shutting down the power supply and stopping showing CHARGE LED light of the Servo driver.**
- **The output of Servo driver [U, V, W] must not touch the AC power.**

Caution

- **Install the fan if the temperature around is too high while the Servo driver is installed in the Control Board.**
- **Do not proceed to the Anti-Pressure-Test to the Servo driver.**

Confirm if the urgent

Matching up machine to change the user parameter setting before machine performs. If there is no according correct setting number, it could lead to out of control or breakdown.

■ Safety proceeding :

Check the covering letter detail before installing, running, maintaining and examining. Furthermore, only the profession-qualified people can proceed to the line-assembly.

Safety proceeding in the covering letter discriminate between "Warning"&"Caution".

Warning — **Indicating the possibility dangerous situation. It could cause the death or serious damage if being ignored.**

Caution — **Indicating the possibility dangerous situation. It could cause smaller or lighter human injured and damage of equipment.**

Read this covering letter detail before using Servo driver.

Fist of all, thank you for using TECO Servo Driver TSTA Series (“TSTA” for short) and Servo Motors.

TSTA can be controlled by digital board or PC, and provide excellent performance for a wide range of applications and different requirement from customers.

Read this covering letter before using TSTA. Contents of the letter comprises:

- **Servo System checking, installing and procedure of assembly line.**
- **Controller procedure for digital board, status displaying, unusual alarm and strategy explanation.**
- **Servo System control function, running testing and procedures adjusted.**
- **Explanation for all parameter of Servo Driver.**
- **Standard specification of TSTA Series.**

In order to daily examine, maintain and understand the reason of unusual situation and handle strategy, please put this covering letter in safe place to read it anytime.

P.S: The end user should own this covering letter, in order to make the Servo Driver bring the best performance into full play.

Contents

Chapter 2 System Configuration and Wiring

Chapter 3 Description of the Faceplate Control

Chapter 4 Description of Running Operation Testing

Chapter 5 Control Function

Chapter 1 Unpacking Check and Installation

1-1 Unpacking Check

Our Servo Pack have already completely been functionally examined before leaving the factory. In order to protect the products from the damage during transportation, please check the items below before sealing off the pack:

☒ Check if the models of servo driver and motor are the same with the models of ordering. (About the model explanation, please check the chapters below) ☒

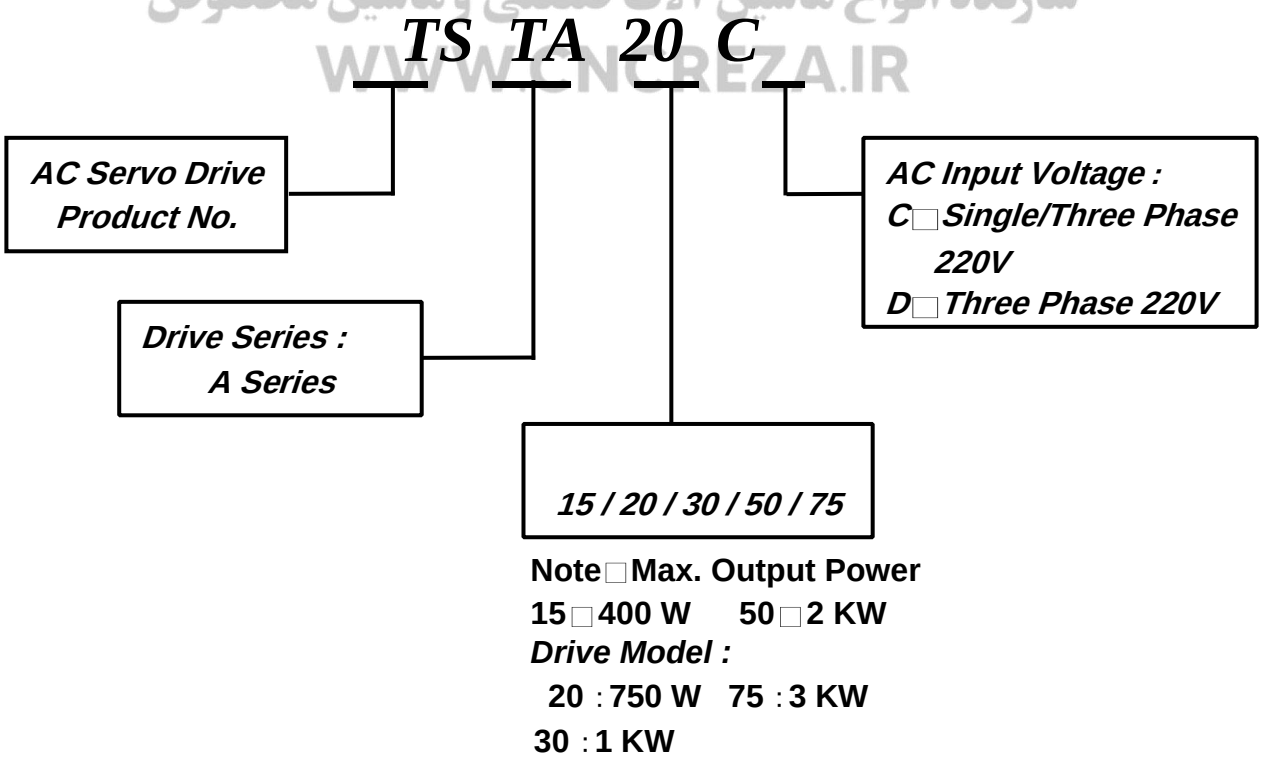
Check if there are damage or scrape out side of the servo driver and motor.

(If there is any damage during transportation, do not power ON) ☒ Check if there are any bad assembly or slipped component in the Servo Drive and Motor ☒ Check if the Motor's rotor and shaft can be rotated smoothly by hand

(The Servo Motor with Mechanical-Brake can not be rotated directly) ☒ There must be the "QC"-seal in each servo drive, if not, please do not proceed Power ON.

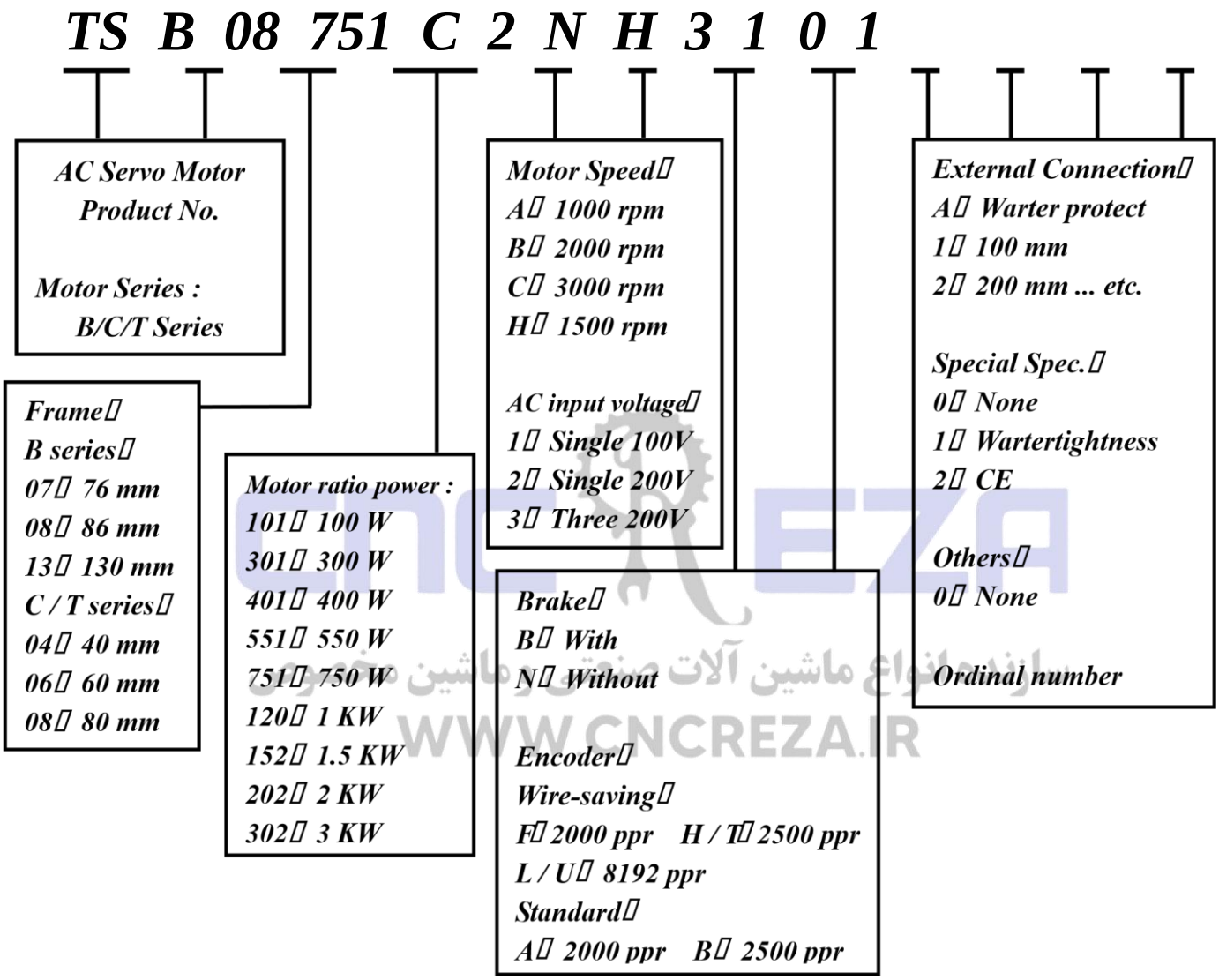
If there is any bug or irregular under the situation above, please contact TECO's Local sales representative or distributor instantly.

1-1-1 Check the Model of Servo Drive

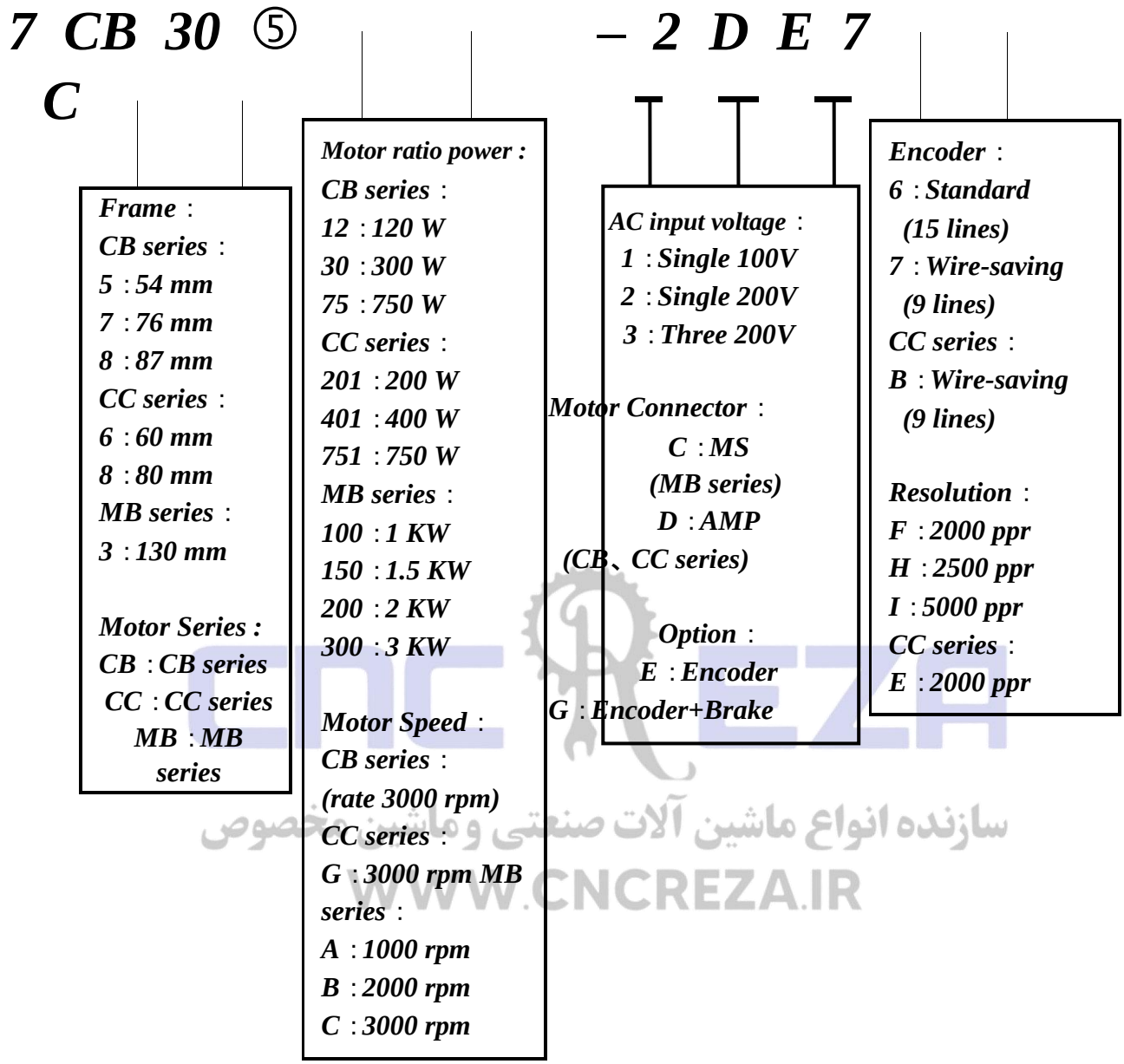


1-1-2 Check the Model of SERVO Motor

TS series :



CB、CC、MB series：



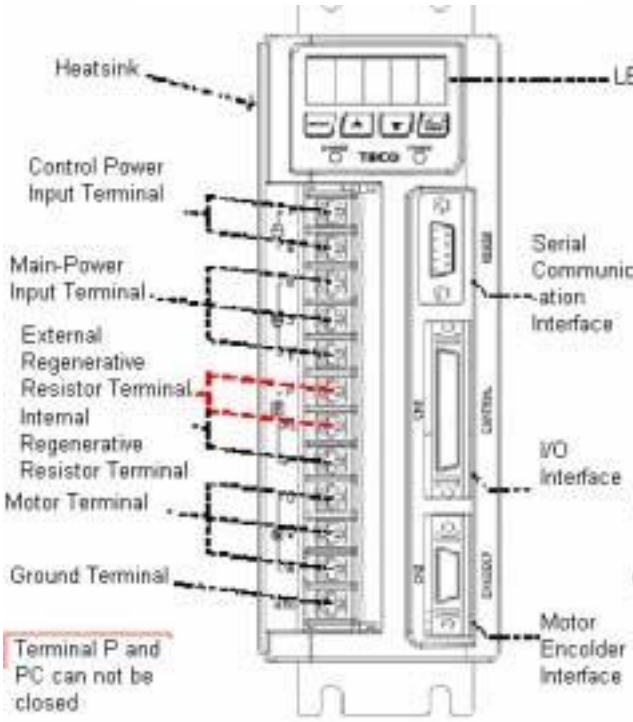
1-1-3 Synopsis of Servo Drives and Motors

Servo Drives	TSTA 15	TSTA 20	TSTA 30	TSTA 50	TSTA 75
Applicative Servo Motors	TSB07301 7CB30	TSB08751 8CB75	TSB13102 3MB100	TSB13152 3MB150	TSB13302 3MB300
	TSC04101	TSB13551 3MB055	TSC08751 TST08751 8CC751	TSB13202 3MB200	—

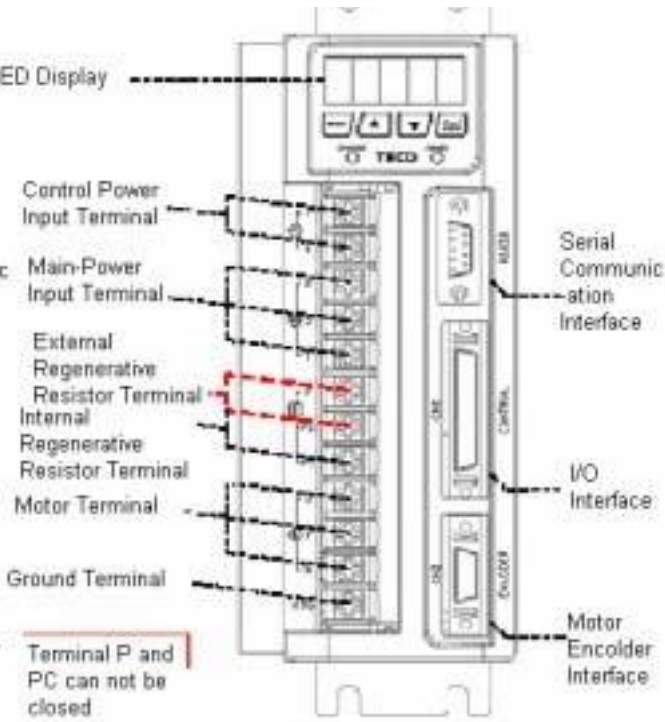
	TSC06201 TST06201 6CC201	TSC06401 TST06401 6CC401	—	—	—

1-2 Parts Description of Servo Drive

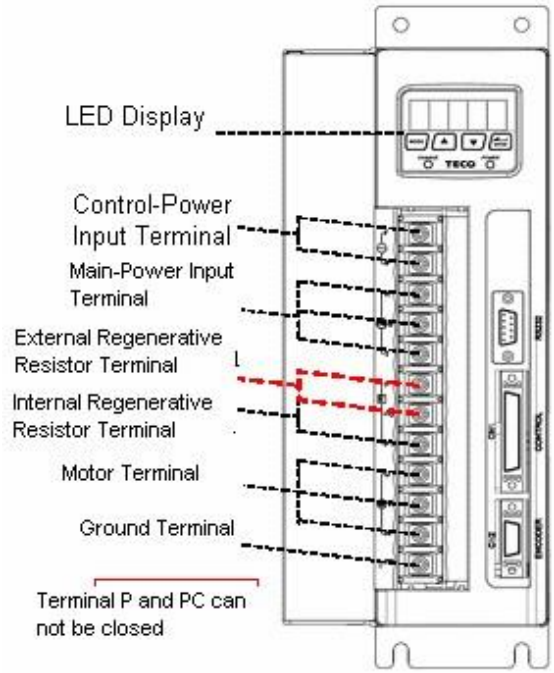
TSTA15 / TSTA20



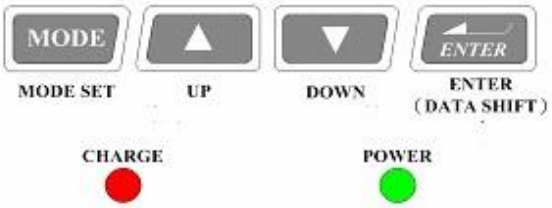
TSTA30



TSTA50 / TSTA75



Keypad



1-3 Control Modes of Servo Drive

There are many kinds of control-mode. The detail modes display as fellow:

Name		Code	Explanation
Single Mode	Position Mode (External Pulse Command)	Pe	Position control for the servo motor is achieved via an external pulse command. Position command is entered at CN1.
	Position Mode (Internal Pulse Command)	Pi	Position control for the servo motor is achieved via by 16 commands stored within the servo controller. Execution of the 16 positions is via Digital Input signals.
	Speed Mode	S	Speed control for the servo motor can be achieved via parameters set within the controller or from an external analog -10 ~ +10 Vdc command. Control of the internal speed parameters is via the Digital Inputs. A maximum of three speeds can be stored internally.
	Torque Mode	T	Torque control for the servo motor can be achieved via parameters set within the controller or from an external analog -10 ~ +10 Vdc command.
Multiple Mode		Pe-S	Pe and S can be switched by digital-input-contact-point.
		Pe-T	Pe and T can be switched by digital-input-contact-point.
		S-T	S and T can be switched by digital-input-contact-point.

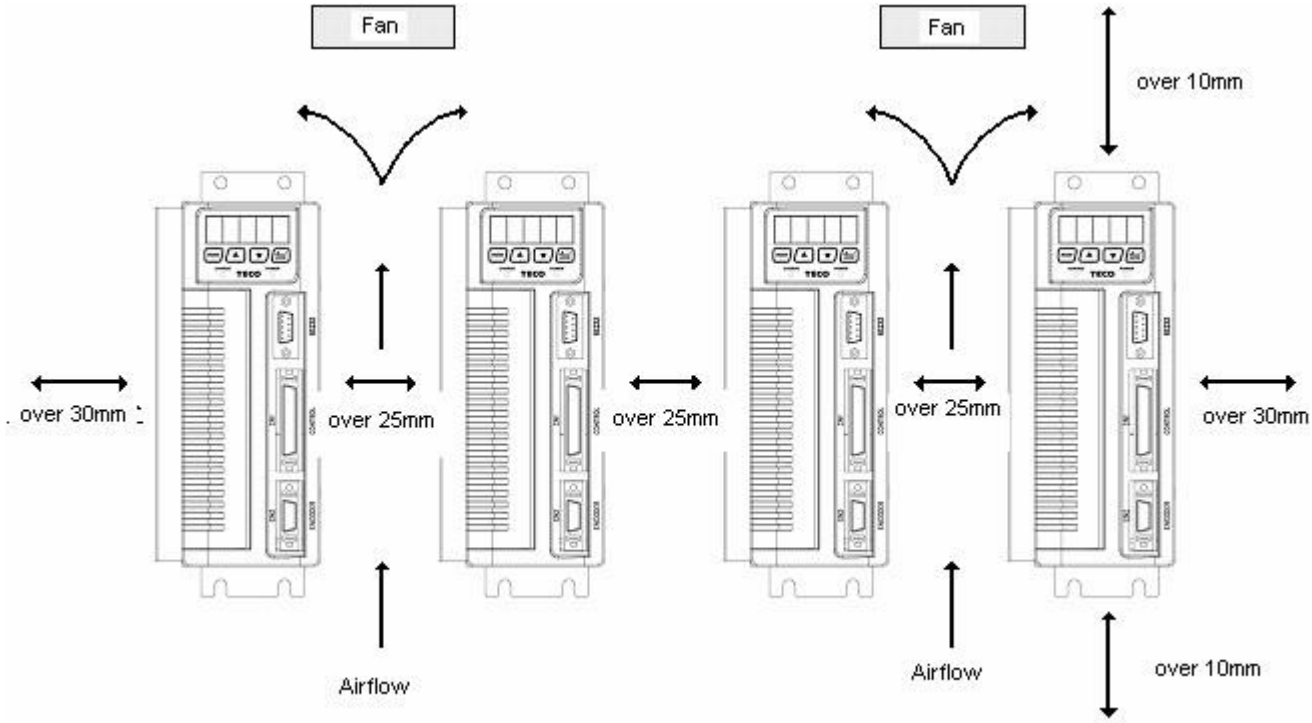
1-4 Installation and Storage of Servo Drive

1-4-1 Installation and Storage Conditions

The product should be kept in the shipping carton before installation. In order to retain the warranty coverage, the AC drive should be stored properly when it is not to be used for an extended period of time. Some storage suggestions are:

- Ambient Temperature: 0 ~ + 55 ℃; Ambient Humidity: Under 85% RH (Under the condition of no frost).
- Stored Temperature: - 20 ~ + 85 ℃; Stored Humidity: Under 85%RH (Under the condition of no frost).
- Vibrating: Under 0.5 G.
- Do not mount the servo drive or motor in a location where temperatures and humidity will exceed specification.
- To avoid the insolation. To avoid the erosion of grease and salt. To avoid the corrosive gases and liquids. To avoid the invading of airborne dust or metallic particles.
- When over 1 Drives are installed in control panel, enough space have to be kept to get enough air to prevent the heat; the fan also must be installed, to keep the ambient temperature under 55 ℃.
- Please Install the drive in a vertical position, face to the front, in order to prevent the heat.
- To avoid the tailing or other unnecessary things falling into the drive when installing.
- The drive must be stable by M5 screws.
- When there were the vibrating items nearby, please using vibration-absorber or installing enti-vibration- rubber, if the vibration can not be avoided.
- When there is any big-size magnetic switch, welding machines or other source of interference. Please install the filter. When the filter is installed, we must install the insulation transformer..

1-4-2 Mounting Direction and Space Requirements



1-5 Installation and Storage of Servo Motor

1-5-1 Installation and Storage Conditions

☒ Ambient Temperature: 0 ~ + 40 ℃; Ambient humidity: Under 90% RH (No Frost). ☒ Storage Temperature: - 20 ~ + 60 ℃; Storage temperature: Under 90%RH (No Frost). ☒ Vibration: Under 2.5 G. ☒ In a well-ventilated and low humidity and dust location.

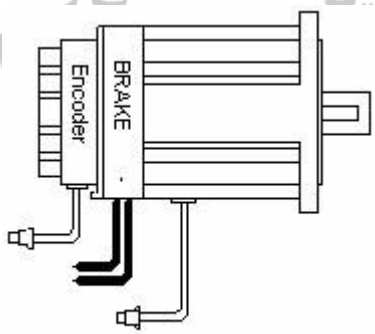
☒ Do not store in a place subjected to corrosive gases, liquids, or airborne dust or metallic particles. ☒ Do not mount the servo motor in a location where temperatures and humidity will exceed specification.

☒ Do not mount the motor in a location where it will be subjected to high levels of electromagnetic radiation.

1-5-2 Installation

1. Horizontal Install: Please let the cable-cavity downside to prevent the water or oil or other liquid flow into the servo motor.

Attention



2. Vertical Install: If the motor shaft is side-up installed and annex to the reduction, it is necessary to attend the oil from the reduction gear flowing into the motor by way of the motor shaft.

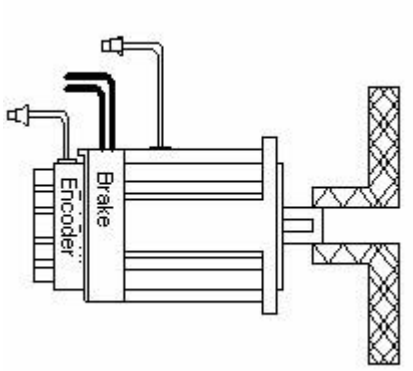
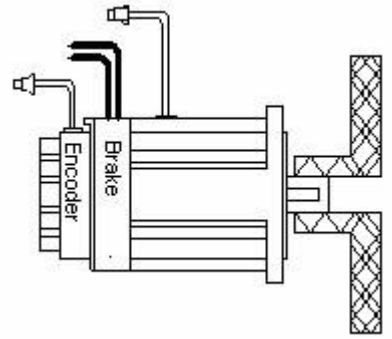
1-5-3 Other Hints

1. Please using oil-seal-motor to avoid the oil from reduction gear flowing into the motor by way of the motor shaft.

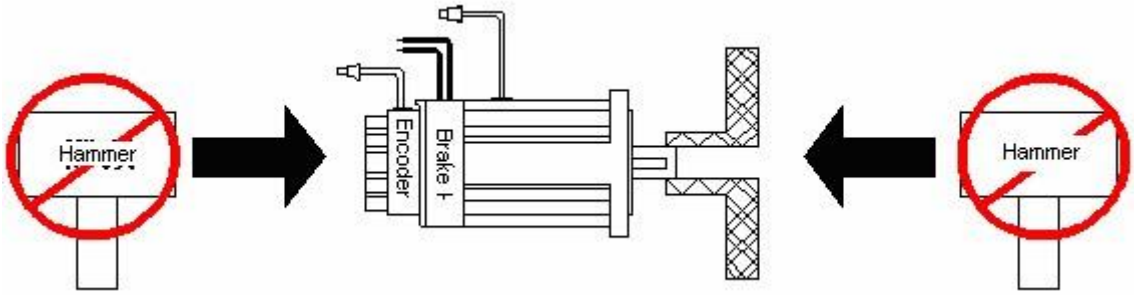
2. The cable need to keep dry.

3. Please fixing the wiring cable certainly, to avoid the cable ablating or breaking.

4. The extending length of the shaft shall be enough, if not, there will be the vibration from motor operating.

Wrong Example	Correct Example
	

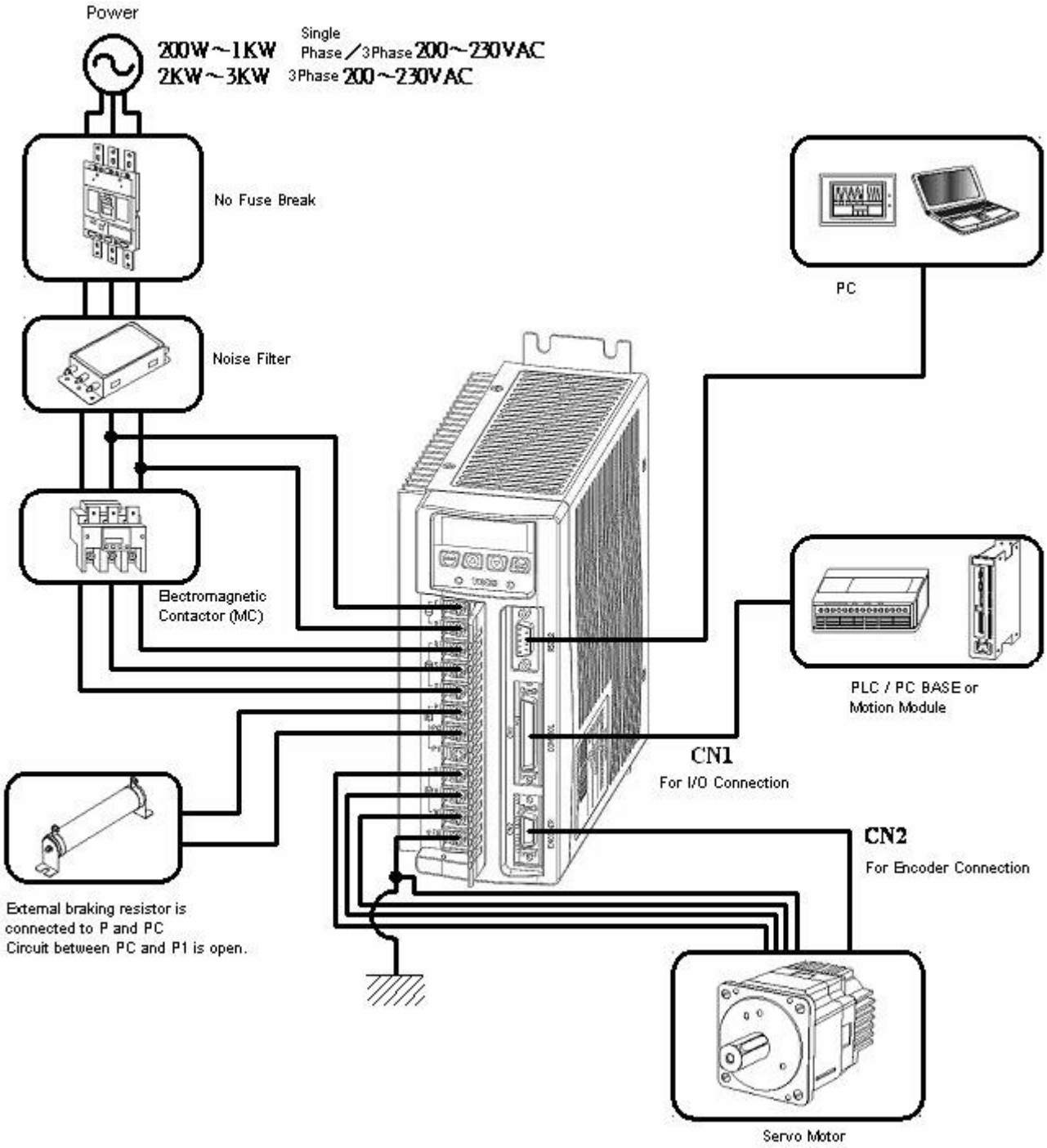
5, Please do not beat the motor when installing or taking it apart. Otherwise the shaft and the encoder of backside will be damaged.

Attention:


Chapter 2 System Configuration and Wiring

2-1 Configuration and Wiring

2-1-1 General Wiring Diagram



2-1-2 Wiring Description for Servo Drive

☒ The wire material must go by “Wiring Specifications.” ☒ Wiring Length: Command Input Wire: Less than 3m.

Encoder Input Wire: Less than 20m. The

Wiring goes by the shortest length.

- Please wire according to the standard wiring schema. Don't connect if no using.
- Motor output terminal (U、V、W) must be connected correctly. Otherwise the servo motor will abnormally function.
- Shielded cable must be connected to FG terminal. Don't install the capacitor or Noise Filter at the output terminal of servo drive.
- At the control-output-signal relay, the direction of surge arrestor's diode must be correctly connected, otherwise it can not output signal, and cause the protect loop of emergency-stop abnormal.
- Please do these below to avoid the wrong operation from noise:

  Please install devices such as the insulated transformer and noise filter at the POWER.

  Keep more than 30 cm between Power wire (power wire or motor wire…etc.) and signal wire, do not install them in the same conduit. Please set "emergency-stop switch" to prevent abnormal operation.
- After wiring, check the connection-situation of each joint (ex: loose soldering, soldering point short, terminal order incorrect…etc.). Tighten the joints to confirm if surly connected to the servo drive, if the screw is tight. There can not be the situations such as cable break, cable pulled and dragged, or be heavily pressed.

※ Especially pay attention to the polarity between servo motor wiring and encoder.

- There is no necessary to add extra regeneration resistance under general situation. If there is any need or problem, please connect to distributor or manufacturer.

2-1-3 Wire Specifications

Connection Terminal			Wire Specifications				
Terminal	Symbol	Name	JSDA-15	JSDA-20	JSDA-30	JSDA-50	JSDA-75
Main Circuit	R、S、T	Main Power Input	2.0mm² A.W.G.14	2.0mm² A.W.G.14	2.0mm² A.W.G.14	2.0mm² A.W.G.14	3.5mm² A.W.G.12

	U、V、W	Motor Connection	2.0mm ² A.W.G.14	2.0mm ² A.W.G.14	2.0mm ² A.W.G.14	2.0mm ² A.W.G.14	3.5mm ² A.W.G.12
	r、s	Control Power Input	1.25mm² A.W.G.16	1.25mm² A.W.G.16	1.25mm² A.W.G.16	1.25mm² A.W.G.16	1.25mm² A.W.G.16
	FG ⏚	Ground	2.0mm ² A.W.G.14	2.0mm ² A.W.G.14	2.0mm ² A.W.G.14	2.0mm ² A.W.G.14	3.5mm ² A.W.G.12
Terminal	Symbol	Name	JSDA-15	JSDA-20	JSDA-30	JSDA-50	JSDA-75
CN1 I/O Control Signal	26,27,28	Speed/Torque Command Input	0.2mm ² or 0.3mm ² -> Twisted-pair-cable connecting to the Analog Grounding wire (including shield cable)				
	30,31	Analog Monitor Output					
	33,34	Power Output +15V & -15V					
	29,32,44	Analog Ground Terminal					
	1~13	General Analog Input	0.2mm ² or 0.3mm ² -> Twisted-pair-cable connecting to the I/O Grounding wire (including shield cable)				
	18~25,43	General Analog Output					
	45,46, 48,49	24V Power & I/O Ground					
	14~17	Position Command Input	0.2mm ² or 0.3mm ² -> Twisted-pair-cable (including shield cable)				
	35~40	Encoder Signal Output					
CN2 Motor encoder	1,2	Output 5V	0.2mm ² or 0.3mm ² -> Twisted-pair-cable (including shield cable)				
	3,4	Output Grounding wire of power supply					
	5~18	Encoder Signal Input					
Commun ication	2,3	Data transfer & receive	0.2mm ² or 0.3mm ² -> Twisted-pair-cable (including shield cable)				
	5	Communication grounding wire					
	1,4,6,8	Floating	—				

P.S.: 1. Please pay attention to the NFB and the capacity of noise filter when using multi ServoDrives.

2. CN1 ->50 Pins (3M Co.)

3. CN2 -> 20 Pins (3M Co.)

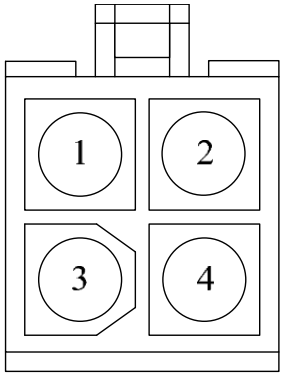
4. RS232 -> 9 Pins D-type Joint.

2-1-4 Motor Terminal Wiring

A Table of Motor-Terminal Wiring

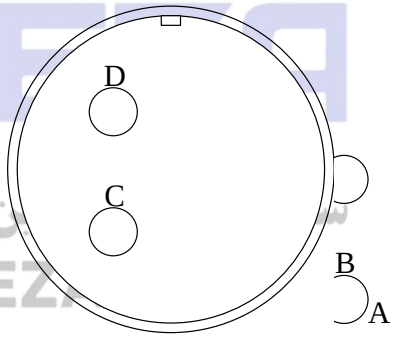
(1) General Joint:

Terminal Symbol	Color	Signal
1	Red	U
2	White	V
3	Black	W
4	Green	FG
Brake control wire	Fine red	DC +24V
	Fine yellow	0V



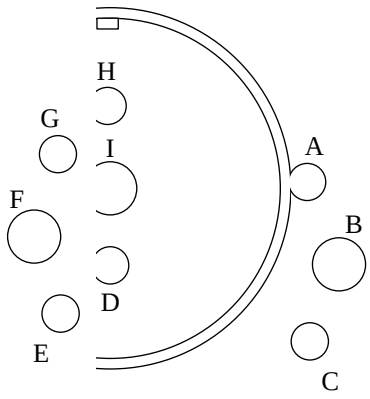
(2)Military Specifications Joint(No Brake):

Terminal	Color	Signal
A	Red	U
B	White	V
C	Black	W
D	Green	FG



(3)Military Specifications Joint(Brake) :

Terminal	Color	Signal	
B	Red	U	
I	White	V	
F	Black	W	
E	Green	FG	
A	Fine red		DC +24V

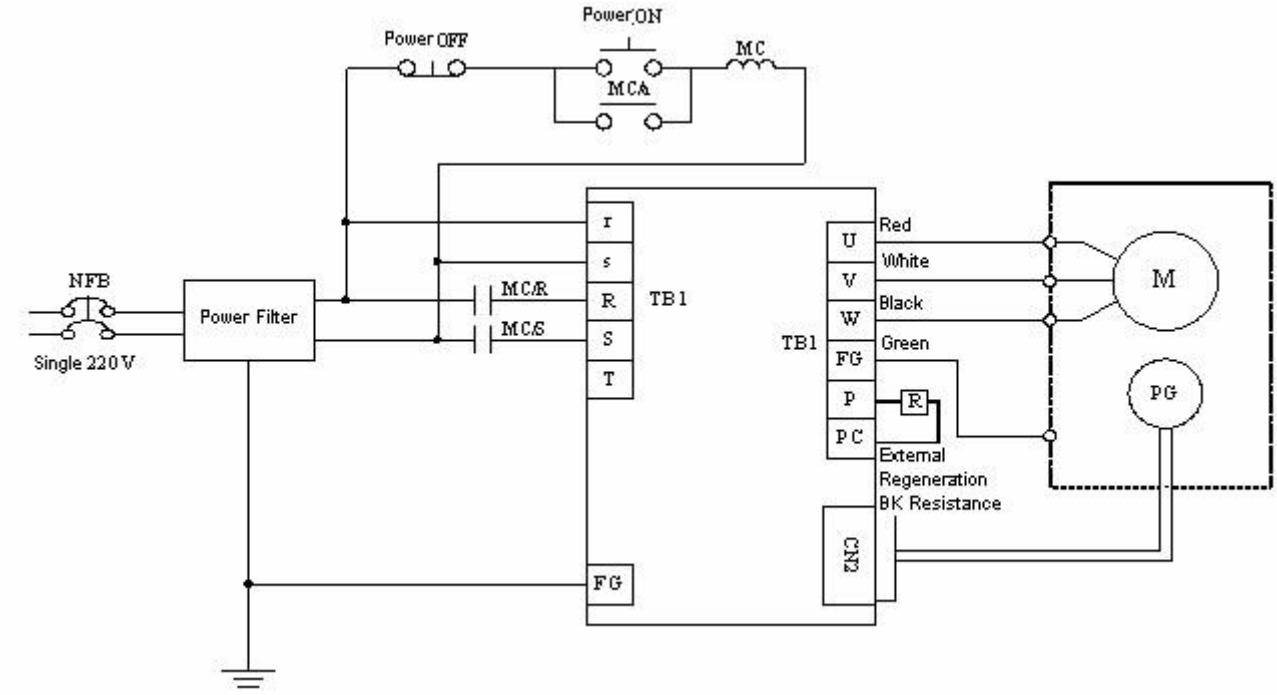


C	Fine yellow	BK control wire	0V	

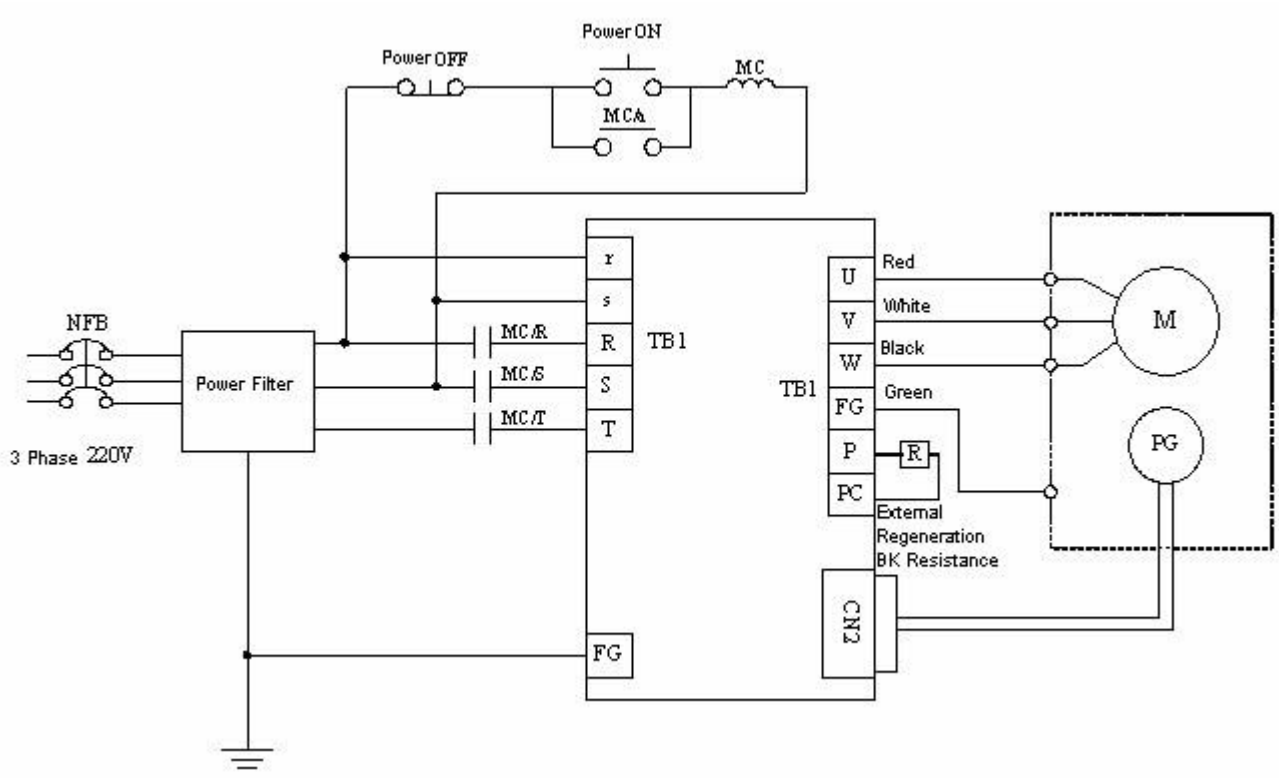
P.S.: The military joint with BK of servo motor has 9 Pins; and the encoder joint has also 9 Pins. Please confirm before wiring.

2-1-5 Standard Diagram of Motor and Power

* The Wiring Example of Single Phase Main Power (Less than 1KW)



* The Wiring Example of 3 Phase Main Power (More than 1KW)



2-1-6 TB Terminal

Name	Terminal Sign	Detail
Control-loop power input terminal	r	Connecting to external AC Power. Single Phase 200~230VAC +10 ~ -15% 50/60Hz ±5%
	s	
Main-loop power input terminal	R	Connecting to external AC Power. Single / 3 Phase 200~230VAC +10 ~ -15% 50/60Hz ±5%
	S	
	T	
External regeneration resistance terminal	P	Please refer to **Cn012** to see resistance value, when using external regeneration resistance. After installing regeneration resistance, set the resistance power in **Cn012**.

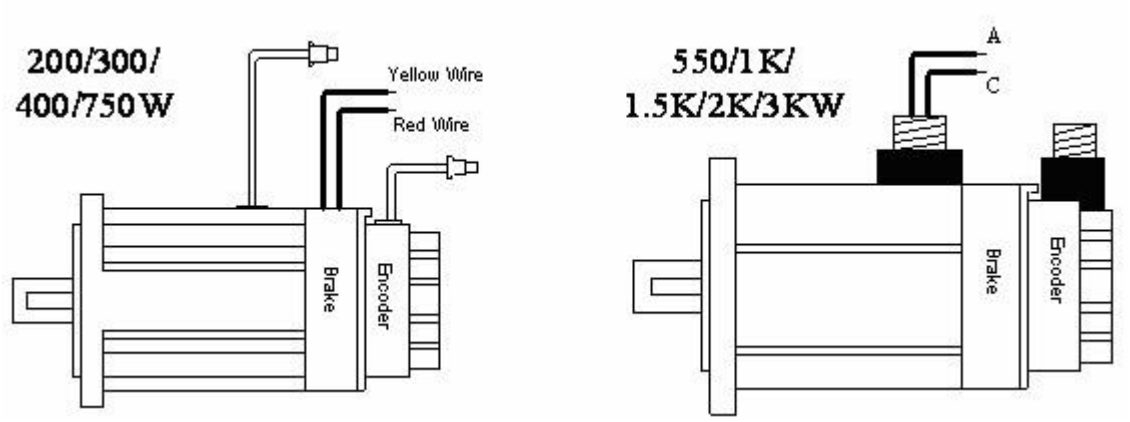
Regeneration terminal common point	PC	*If no using external regeneration resistance, PC-P1 need be close, P doesn't be connected. *When using external regeneration, add regeneration resistance between PC-P, P1 doesn't be wired.
Internal regeneration resistance terminal	P1	
Motor-power output terminal	U	Motor terminal wire is **red**
	V	Motor terminal wire is **white**
	W	Motor terminal wire is **black**
Motor-case grounding terminal	FG	Motor terminal wire is **green or yellow-green.**

2-1-7 BRAKE Wiring

Uninstall BRAKE:

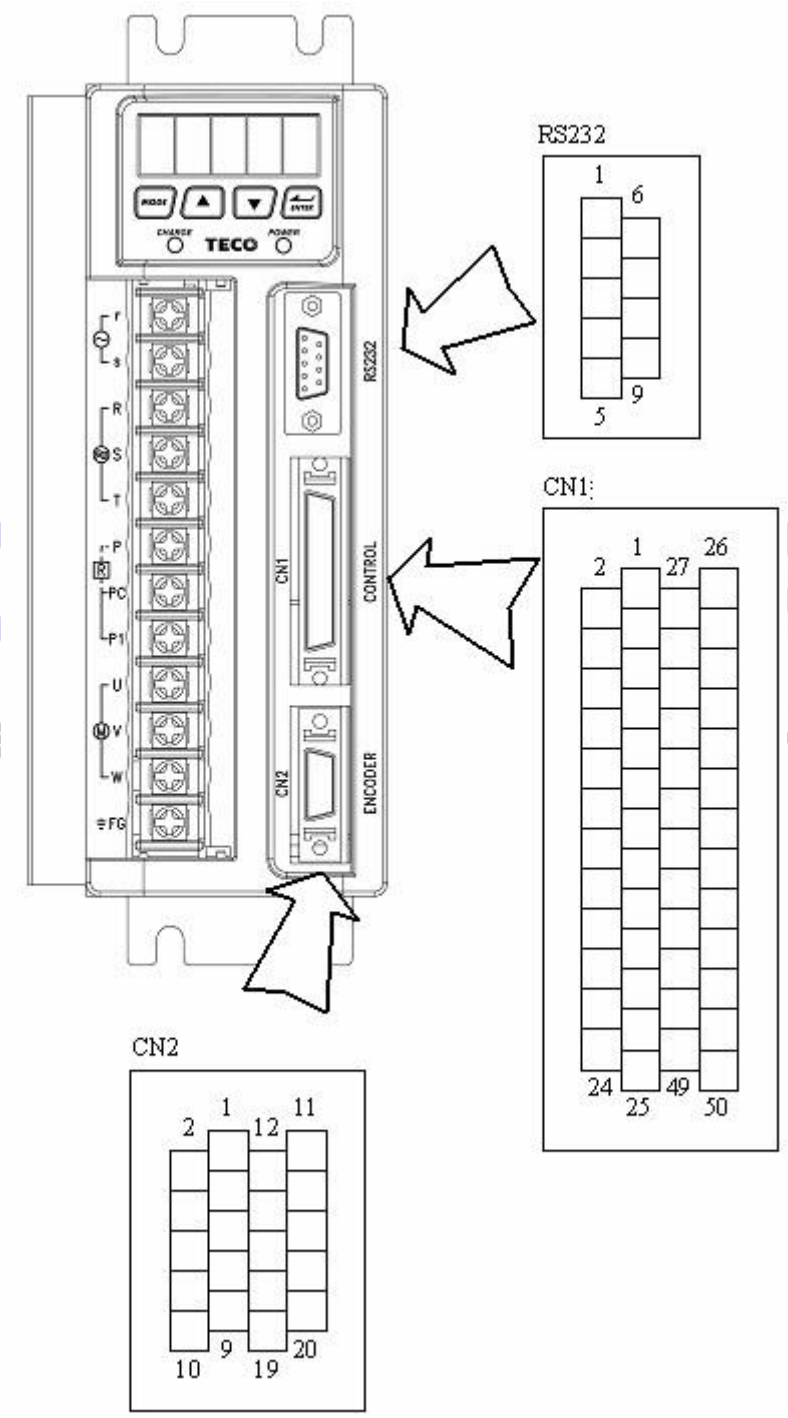
⌘ 200/300/400/750Wseries: Use Red wire and yellow wire connecting to DC +24V voltage**(No polarity)**

⌘ 550/1K/1.5K/2K/3KW series: BK outputs from A & C of **Motor Power Joint**, servo motor can operate normally after uninstalling.



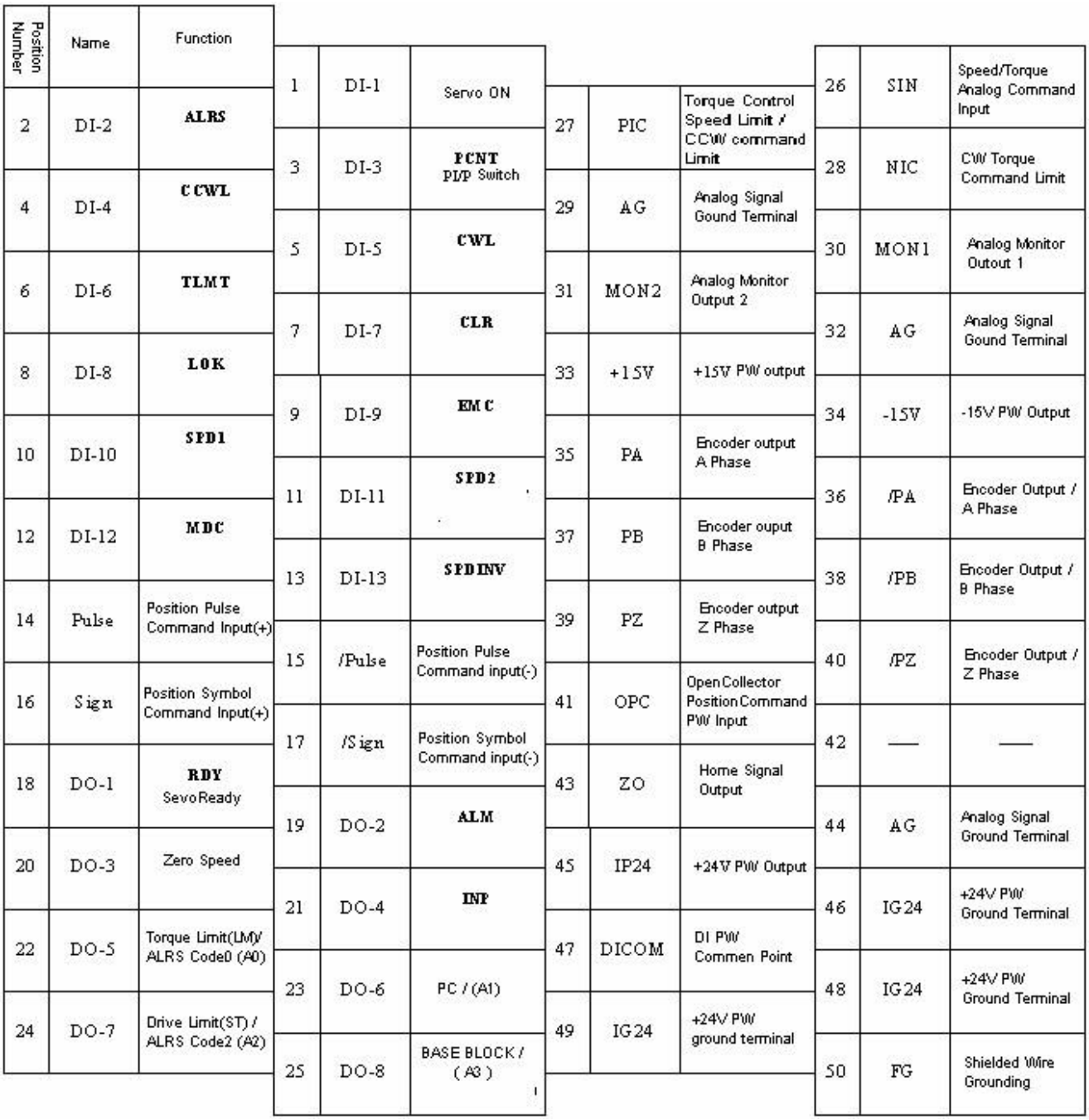
2-2 I/O Signal Terminal

There are 3 groups of I/O terminal, which contain RS232 communication terminal, CN1 control signal terminal and CN2 encoder terminal. The diagram below displays all positions for the terminal.



2-2-1 CN1 Signal Terminal

(1) Diagram of CN1 Terminal:



Position Number	Name	Function
2	DI-2	**ALRS**
4	DI-4	**CCWL**
6	DI-6	**TLMT**
8	DI-8	**LOK**
10	DI-10	**SPD1**
12	DI-12	**MDC**
14	Pulse	Position Pulse Command Input(+)
16	Sign	Position Symbol Command Input(+)
18	DO-1	**RDY** Sevo Ready
20	DO-3	Zero Speed
22	DO-5	Torque Limit(LMV) / ALRS Code0 (A0)
24	DO-7	Drive Limit(ST) / ALRS Code2 (A2)

1	DI-1	Servo ON
3	DI-3	**PCNT** PI/P Switch
5	DI-5	**CWL**
7	DI-7	**CLR**
9	DI-9	**EMC**
11	DI-11	**SPD2**
13	DI-13	**SPDINV**
15	/Pulse	Position Pulse Command input(-)
17	/Sign	Position Symbol Command input(-)
19	DO-2	**ALM**
21	DO-4	**INP**
23	DO-6	PC / (A1)
25	DO-8	BASE BLOCK / (A3)

27	PIC	Torque Control Speed Limit / CCW command Limit
29	AG	Analog Signal Gound Terminal
31	MON2	Analog Monitor Output 2
33	+15V	+15V PW output
35	PA	Encoder output A Phase
37	PB	Encoder ouput B Phase
39	PZ	Encoder output Z Phase
41	OPC	Open Collector Position Command PW Input
43	ZO	Home Signal Output
45	IP24	+24V PW Output
47	DICOM	DI PW Commen Point
49	IG24	+24V PW ground terminal

26	SIN	Speed/Torque Analog Command Input
28	NIC	CW Torque Command Limit
30	MON1	Analog Monitor Outout 1
32	AG	Analog Signal Gound Terminal
34	-15V	-15V PW Output
36	/PA	Encoder Output / A Phase
38	/PB	Encoder Output / B Phase
40	/PZ	Encoder Output / Z Phase
42	——	——
44	AG	Analog Signal Ground Terminal
46	IG24	+24V PW Ground Terminal
48	IG24	+24V PW Ground Terminal
50	FG	Shielded Wire Grounding

P.S.:

1. If there is unused terminal, please do not connect it or let it be the relay terminal.
2. The Shielded Wire of I/O signal should connect to the case of connector.

(2) CN1 Signal Name and Explanation:

(a) General I/O Signal:

Signal Function Symbol Pin No. Wired Mode Signal Function Symbol Pin No.Wired Mode

Position Pulse	**Pulse**	14		Encoder A-Phase Output	**PA**	35		
Command Input	**/Pulse**	15	IO3	Encoder Output / A Phase	**/PA**	36		
Position Symbol	**Sign**	16		Encoder B-Phase Output	**PB**	37	IO4	
Command Input	**/Sign**	17		Encoder Output /B-Phase	**/PB**	38		
Open Collector				Encoder Z-Phase Output	**PZ**	39		

Position	OPC	41	IO3	Encoder /Z-Phase	Output	/PZ	40	Command PW

Input.

Speed / Torque 4		26	Analog Signal Ground Terminal		**AG**		29,32,4
Analog Command Input	**SIN**		+15Terminal V PW Output		**+15V**	33	
Torque Control Speed Limit			IO5	-15V PW Output		34	
Command / CCW Torque Command Limit	**PIC**	27	Terminal		**-15V**		
CW Torque Command Limit	**NIC**	28	DI PW Conmen Terminal		**DICOM**	47	
Analog Monitor	30	+24V PW Output		**IP24**	45 Output 1	**MON1**	IO6
Analog Monitor	31	+24Ground Terminal V		OW	**IG24**	46,48,9 4 Output 2	**MON2**
Home Signal Output	**ZO**	43	IO2 Shielded Connect Point	Wire		**FG**	50

Explanation of General I/O Signal Function

Signal Name	Function Symbol	Mode	I/O Operation and Function	Chapter
Position Pulse Command Input	**Pulse**	Pe	The Driver can receive 3 kinds of Command below: . (Pulse)+ (Sign) . (CCW)/ (CW)Pulse . AB Phase pulse	5-4-1
	/Pulse			
Position Sign Command Input	**Sign**			
	/Sign			
Open Collect Position Command PW Input	**OPC**	Pe	When open collect input in position command, **OPC** and **IP24** can be close, and using internal **24V** power and resistance.	—

Speed Analog command Input	**SIN**	S	In Speed Mode, when, external speed command is operated at SPD1=0, SPD2=0, input the voltage range: **-10V~+10V**, **Sn216** can be set input voltage: ±10V's Motor output speed.	5-3-1 5-3-2 5-3-3 5-3-4
Torque Analog Command Input		T	In Torque Mode, input the voltage range **-10~+10V**, **Tn103** can be set input voltage ±10V's motor output torque.	5-2-15-2-2
Torque Control Speed Limit Command	**PIC**	T	In Torque Mode, when external speed limit is operated at input connect point **SPD1=0 & SDP2=0(P.S),** input voltage range: **0~+10V**, 10V's speed limit stands for motor's ratio speed.	5-2-6
CCW Torque Limit Command		S	In Speed Mode, when external torque limit is be used at input connect point **TLMT=1(P.S.) ,** input voltage range: **0~+10V**, to input 10V will limit the motor CCW torque having 300% of ratio torque.	5-3-10
CW Torque Limit Command	**NIC**	S	In Speed Mode, when external torque limit is be used at input connect point **TLMT=1(P.S.)**, input voltage range: **-10~0V**, to input -10V will limit the motor CW torque have 300% of ratio torque.	5-3-10
Analog Monitor Output 1	**MON1**	ALL	Operating the motor to control the current speed to transform the voltage output in accordance with the rate (±10V/1.5 times ratio speed) CCW stands for positive voltage, CW negative voltage.	5-6-9
Analog Monitor Output 2	**MON2**	ALL	Operating the motor to control the current torque to transform the voltage output in accordance with the rate (±10V/3.5 times ratio torque) CCW torque stands for positive voltage, CW negative voltage.	5-6-9
Encoder Output A Phase	**PA**	ALL	Outputting the Motor Encoder Signal through pulse per rotation handle. The pulse quantity of	5-3-5
Encoder Output / A Phase	**/PA**		every rotating can be set in **Cn005**. When "1" is set in **Cn004,** it is CCW rotation from the motor load terminal direction, and A Phase gets 90 degree ahead B Phase. Signal Output is Line Driver.	
Encoder Output B Phase	**PB**			
Encoder Output / B Phase	**/PB**			
Encoder Output Z Phase	**PZ**			
Encoder Output / Z Phase	**/PZ**			
Home Signal Output	**ZO**	ALL	Z Phase Open Collector output connect point.	—

Analog Signal Ground Terminal	**AG**	ALL	Analog signal grounding: **CN1 - > Pin 26、27、28、30、31、33、34**.	—
+15V PW Output Terminal	**+15V**	ALL	To provide ±15V output power (Max. 10mA), which can be used in servo drive – external voltage command. **Suggestion: Using the variable resistance which is more than 3kΩ.**	—
-15V PW Output Terminal	**-15V**	ALL		
DI PW Conmen Terminal	**DICOM**	ALL	Analog input power supplement common terminal.	—
+24V PW Output	**IP24**	ALL	+24V power output terminal(Max. 0.2A).	—
+24V PW Ground Terminal	**IG24**	ALL	+24V power grounding terminal	—
Shielded Wire Connect Point	**FG**	ALL	Shielded wire which connects signal wire.	—

P.S.: “1” stands for “close loop with **IG24**”; “0” stands for “open loop with **IG24**”. **(b) Digital I/O Signal:**

For many kinds of application, the digital input/output terminal layout of all operation mode are accordingly different. In order to provide more functions, our drives can provide multi terminal layout settings. Users can set these functions for application.

Digital input terminal-layout provides 12 programmable terminal layout. Digital input terminal layout provides 13 (**Pin1~13**) programmable terminal layout; digital output terminal layout provides 4 (**Pin18~2**1) programmable terminal layout. The diagram below shows the default digital output/input terminal layout and functions. Please refer to 5-6-1 to check parameter settings.

Default Digital Input Terminal Layout Functions and Wired Mode

Signal		Function Sign	Pin No.	Wired Mode	Signal		Function Sign	Pin No.	Wired Mode
Servo ON	DI-1	**SON**	1	IO1	Servo Lock	DI-8	**LOK**	8	IO1
Clean Abnormal Alarms	DI-2	**ALRS**	2		Emergency Stop	DI-9	**EMC**	9	

PI/P Switch	DI-3	**PCNT**	3	Internal speed command / Limit select 1	DI-10	**SPD1**	10
CCW Operation Limit	DI-4	**CCWL**	4	Internal speed command / Limit select 2	DI-11	**SPD2**	11
CW Operation Limit	DI-5	**CWL**	5	Control Mode Switch	DI-12	**MDC**	12
External Torque Limit	DI-6	**TLMT**	6	Reverse Direction Speed Command	DI-13	**SPDINV**	13
Pulse error amount delete	DI-7	**CLR**	7	—			

Default Digital Input Terminal Layout Functions and Wired Mode

Signal		Function	Pin	Wired	Signal		Function	Pin	Wired

		Sign	No.	Mode			Sign	No.	Mode
Servo ready	DO-1	**RDY**	18	IO2	Torque limit/ Alarm code A0	DO-5	**LM/A0**	22	IO2
Alarm	DO-2	**ALM**	19		P action / Alarm code A1	DO-6	**PC/A1**	23	
Zero speed	DO-3	**ZS**	20		Operation limit/ Alarm code A2	DO-7	**ST/A2**	24	
Fix position	DO-4	**INP**	21		Base Block/ Alarm code A3	DO-8	**BB/A3**	25	

Digital Input Function

(Except CCWL and CWL are high electric potential, other terminal layout are low electric potential. Please refer to 5-6-1 to see related parameters)

Signal Name	Function Sign	Mode	I/O Function	Chapter
Servo On	**SON**	ALL	**SON** and **IG24** close loop: Servo **ON** ; **SON** and **IG24** open loop: Servo OFF. Attention: Before power on, the input connect point **SON** (servo on) can not be operated to avoid danger.	5-6-3 5-6-4
Abnormal Reset	**ALRS**	ALL	ALRS and IG24 close loop: Relieving the stop-situation from of abnormality. **But the abnormality of encoder or memory will cause the same alarm again. Please reset power after the abnormality is eliminated.**	8-1
PI/P switch	**PCNT**	Pi/Pe/S	**PCNT** and **IG24** close loop will cause the speed loop control transforming to ratio control from ratio integration control.	5-3-11
CCW Operation limit	**CCWL**	ALL	Connect to **CCW** over travel detector: **CCW**L and **IG24** close loop; open loop with **IG24** -> **CCW** over travel operates.	5-4-8 5-6-3 5-6-4
CW Operation limit	**CWL**	ALL	Connect to CW over travel detector: CWL and IG24 close loop; open loop with IG24 -> CW over travel operates.	5-4-8 5-6-3 5-6-4
External torque limit	**TLMT**	Pi/Pe/S	**TLMT** and **IG24** close loop will cause the motor-output-torque-limit to stay in the command-voltage range of torque-limit-terminal-layout (**PIC**、**NIC**).	5-3-10
Pulse error amount delete	**CLR**	Pi/Pe	When **CLR** and **IG24** close loop, delete the pulse amount in the Position Error Counter.	5-4-7
Servo lock	**LOK**	S	When **LOK** and **IG24** close loop will transform speed control mode into position control mode in order to lock the motor at the last position.	5-3-12
Emergency stop	**EMC**	ALL	When **EMC** and **IG24** close loop: Emergency stop -> Servo Off and exit the rotating statue, and Cn008 will decide if the dynamic Brake operates.	5-6-4

<table>
<tr>
<td>Internal speed command / limit select 1
Internal speed command / limit select 2</td>
<td>SPD1
SPD2</td>
<td>S/T</td>
<td>Internal speed setting and limit:
<table>
<tr><th>SPD 2</th><th>SPD 1</th><th>Speed Command (Speed Mode)</th><th>Speed Limit Command (Torque Mode)</th></tr>
<tr><td>0</td><td>0</td><td>External command(SIN)</td><td>External limit(PIC)</td></tr>
<tr><td>0</td><td>1</td><td>Sn201</td><td>Tn105</td></tr>
<tr><td>1</td><td>0</td><td>Sn202</td><td>Tn106</td></tr>
<tr><td>1</td><td>1</td><td>Sn203</td><td>Tn107</td></tr>
</table>
“1”: Close loop with IG24
“0”: Open loop with IG24</td>
<td>5-2-6
5-3-1</td>
</tr>
</table>

(Except CCWL and CWL are the high electric potential, other terminal layout are the low electric potential, please refer to 5-6-1 to check related parameters setting)

<table>
<tr><th>Signal Name</th><th>Function Symbol</th><th>Mode</th><th>I/O Function</th><th>Chapter</th></tr>
<tr><td>Control Mode Switch</td><td>MDC</td><td>Pe/S/T</td><td>When MDC and IG24 close loop, current control mode will transform into default control mode, please refer to Cn001.</td><td>5-1
5-6-2</td></tr>
<tr><td>Position Command Limit</td><td>INH</td><td>Pe</td><td>When INH and IG24 close loop, position command input does not operate (do not accept external pulse command).</td><td>5-4-1</td></tr>
<tr><td>Speed Command Counter Wise</td><td>SPDINV</td><td>S</td><td>When SPDINV and IG24 close loop in speed mode, setting rotating speed will become counter-wise rotating speed.</td><td>5-3-7</td></tr>
<tr><td>Gain Select</td><td>G-SEL</td><td>Pi/Pe/S</td><td>When G-SEL and IG24 close loop, first stage control gain switch to the second control gain.</td><td>5-3-11</td></tr>
<tr><td>Electric Gear ratio Numerator 1~2</td><td>GN1
GN2</td><td>Pi/Pe</td><td>Electric gear ratio: select explanation:
<table>
<tr><th>GN2</th><th>GN1</th><th>Electric Gear Ratio</th></tr>
<tr><td>0</td><td>0</td><td>Pn302</td></tr>
<tr><td>0</td><td>1</td><td>Pn303</td></tr>
<tr><td>1</td><td>0</td><td>Pn304</td></tr>
<tr><td>1</td><td>1</td><td>Pn305</td></tr>
</table>
“1”: Close loop with IG24
“0”: Open loop withIG24</td><td>5-4-3</td></tr>
<tr><td>Internal Position Command Trigger</td><td>PTRG</td><td>Pi</td><td>When PTRG and IG24 close loop (positively-triggered), the motor will select related position command to operate in accordance with the terminal layout POS1~POS4.</td><td>5-4-8</td></tr>
<tr><td>Internal Position Command Hold</td><td>PHOLD</td><td>Pi</td><td>When PHOLD and IG24 close loop(positively-triggered), the motor will stay holding.</td><td>5-4-8</td></tr>
<tr><td>Home</td><td>SHOME</td><td>Pi/Pe</td><td>When SHOME and IG24 close loop(positively-triggered), HOME function operates</td><td>5-4-8</td></tr>
<tr><td>External Origin</td><td>ORG</td><td>Pi</td><td>When ORG and IG24 close loop(positively-triggered), server will use this as external reference point for home position returning.</td><td>5-4-8</td></tr>
</table>

(Except CCWL and CWL are the high electric potential, other terminal layout are the low electric potential, please refer to 5-6-1 to check related parameters setting)

<table>
<tr><th>Signal Name</th><th>Function Symbol</th><th>Mode</th><th>I/O Function</th><th>Chapter</th></tr>
<tr><td>Internal Position Command select 1~4</td><td>POS1
POS2
POS3
POS4</td><td>Pi</td><td>Internal position command select explanation:
<table>
<tr><th>POS4</th><th>POS3</th><th>POS2</th><th>POS1</th><th>Selection of Pn</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td><td>Pn317, Pn318</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>1</td><td>Pn320, Pn321</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>0</td><td>Pn323, Pn324</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>1</td><td>Pn326, Pn327</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>0</td><td>Pn329, Pn330</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>1</td><td>Pn332, Pn333</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>0</td><td>Pn335, Pn336</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>1</td><td>Pn338, Pn339</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>0</td><td>Pn341, Pn342</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>1</td><td>Pn344, Pn345</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>0</td><td>Pn347, Pn348</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>1</td><td>Pn350, Pn351</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>0</td><td>Pn353, Pn354</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>1</td><td>Pn356, Pn357</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>0</td><td>Pn359, Pn360</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>1</td><td>Pn362, Pn363</td></tr>
</table>
“1”: close loop withIG24
“0”: open loop withIG24</td><td>5-4-2</td></tr>
<tr><td>Torque Command Counter Clock Wise</td><td>TRQINV</td><td>T</td><td>When TRQINV and IG24 close loop in torque mode, setting torque command output wise becomes counter wise output.</td><td>5-2-4</td></tr>
</table>

Digital Output Function Explanation

(The terminal layout here from this explanation are all the low electric potential, please refer to 5-6-1 to check parameter settings)

Signal Name	Function Symbol	Mode	I/O Function	Chapter
Servo Ready	**RDY**	ALL	Main power and control power input are normal. Under the situation of no alarm, terminal layouts **RDY** and **IG24** close loop.	—

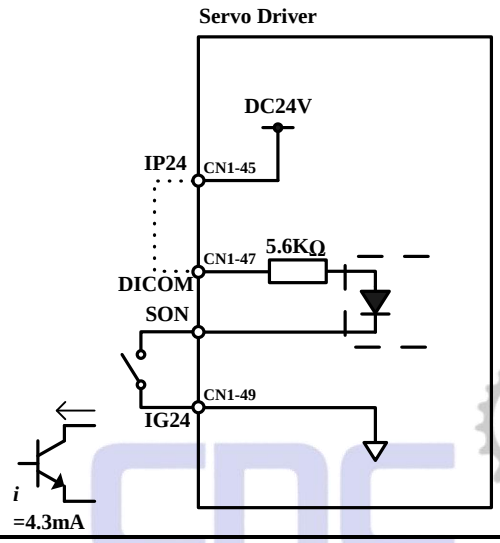
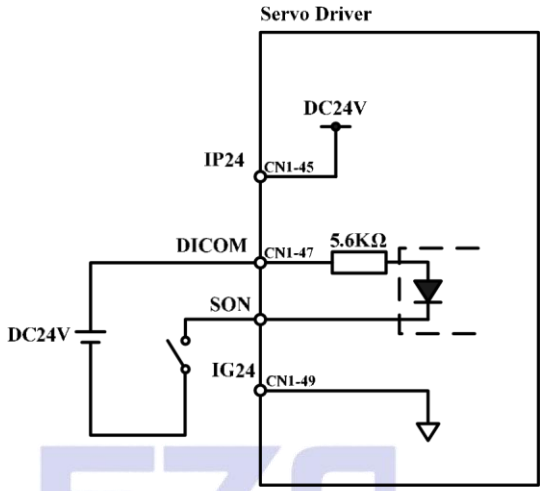
Alarm	**ALM**	ALL	If normally operates, the terminal layouts **ALM** and **IG24** open loop. When alarm occurs, protection-function operates, the terminal and **IG24** close loop.	—
Zero Speed	**ZS**	S	When the motor speed is less than the speed from **Sn215,** the terminal layout **ZS** and **IG24** close loop.	5-3-12
BK Signal	**BI**	ALL	When **Cn008** is set “1” or “3” and the servo on, the terminal layout **BI** and **IG24** close loop; when servo off , terminal layout and **IG24** open loop. (When this terminal layout is generally applied, it is the Brake relay, which is connected to control motor).	5-6-4 5-6-5
In Speed	**INS**	S	When the motor speed has achieved the setting speed from **Cn007, INS** and **IG24** close loop.	5-3-12
In Position	**INP**	Pi/Pe	When the amount of position error counter is less than the amount range which is set in **Pn307, INP and IG24** close loop.	5-4-9
Home	**HOME**	Pi/Pe	When HOME is accomplished, **HOME** and **IG24** close.	5-4-8
Limiting Torque/ Alarm No. 0	**LM/A0**	ALL	When motor output torque is limited by internal torque limit amount (**Cn010&Cn011)** or external torque limit command (**PIC&NIC)**. **LM/A0** and **IG24** close loop. When alarm occurs, this terminal layout is alarm code output **A0**.	8-1
P in Action / Alarm No.1	**PC/A1**	Pe/Pi/S	When speed loop is ratio(P)-control, **PC/A1** and **IG24** close loop. When alarm occurs, this terminal layout is alarm code output **A1**.	8-1
Server in Limiting/ Alarm No.2	**ST/A2**	ALL	When CCW or CW operation-limit occurs, **ST/A2** and **IG24** close loop. When alarm occurs, this terminal layout is alarm code output **A2**	8-1
Base Block 中/ Alarm No.3	**BB/A3**	ALL	When servo motor has not be operated, **BB/A3** and **IG24** close loop. When alarm occurs, this terminal layout is alarm code output **A3**	8-1

(3) CN1 Interface Circuit and Wire Mode:

The diagram below introduces all interface circuit of CN1 and wire-method of host controller.

(a) Digital input interface circuit (**IO1**):

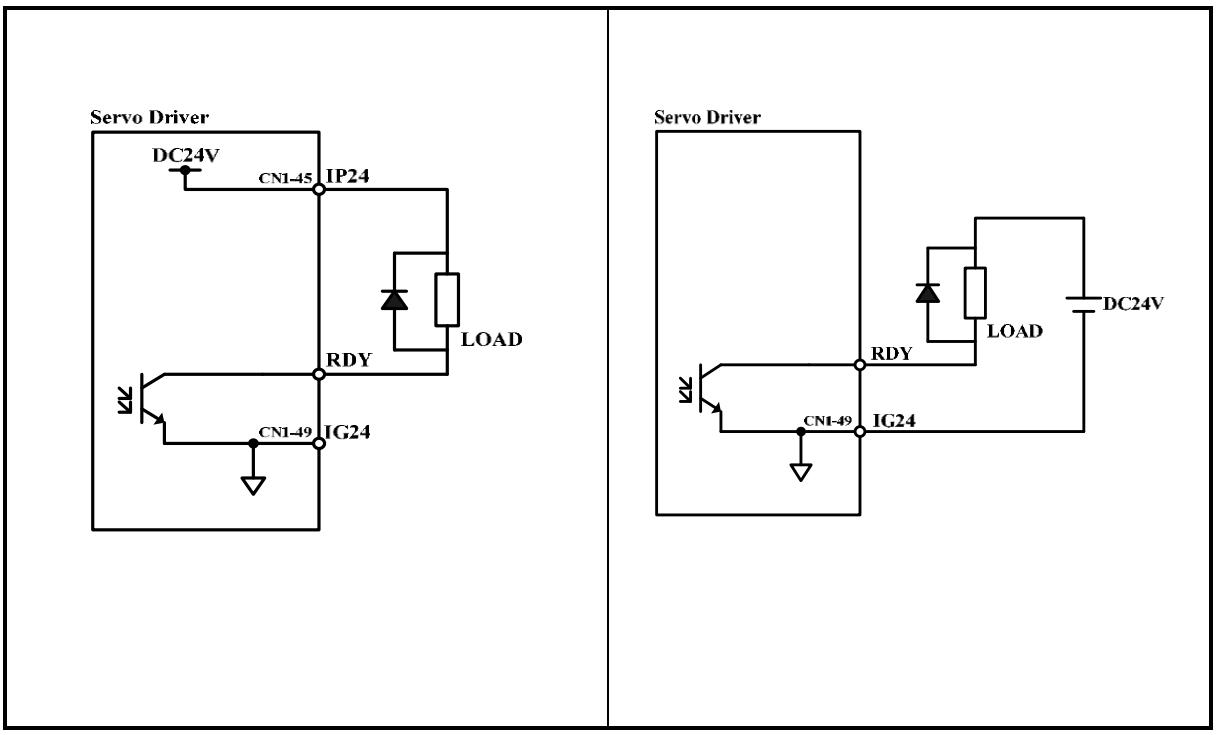
Digital input interface circuit can be operated by relay or collector transistor circuit. The relay should be the low electric current, in order to avoid the faulty contacting. External voltage: 24V.

Internal 24V Power	**External 24V Power**
	

Digital Output Interface Circuit(**IO2**):

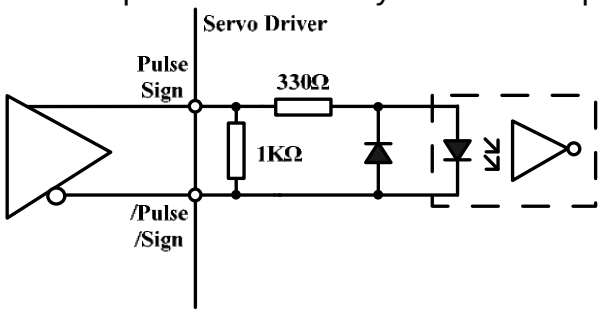
When using external power, please attention to the power polarity. Adverse polarity will case damage. Digital output is “Open Collector”. The maximum of external voltage is 24V; and the maximum electric current is 12mA.

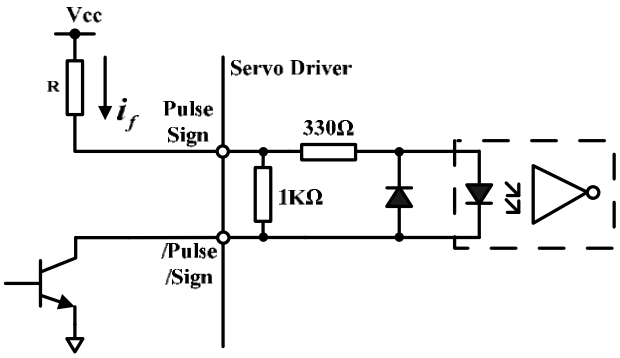
Internal 24V Power	**External 24V Power**

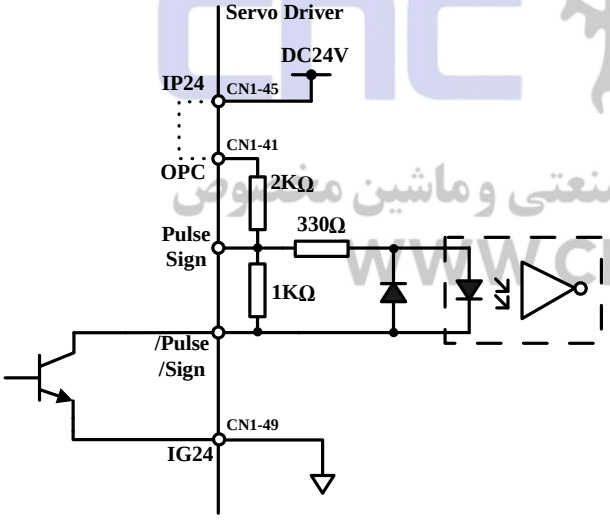


(b) Pulse Command Input Interface Circuit(**IO3**):

Suggesting to use the input method of Line Driver to send the pulse command. The maximum input command frequency is 500kpps. Using the input method of Open Collector will cause the decrease of input command frequency, the maximum input command frequency is 200kpps. The server provides only 24V power, and other power should be prepared. Adverse polarity of power will cause the server damage. The maximum of External power (Vcc) is 24V limited. Input current is about 8~15mA. Please refer to the examples below to select resistance. Please refer to 5-4-1 to check pulse input command timing.

<table>
<tr><th>(Line Driver)</th><th>(Open Collector)</th></tr>
<tr><td>The max pulse command by differential input
 

line driver frequency is 500kpps</td><td> 

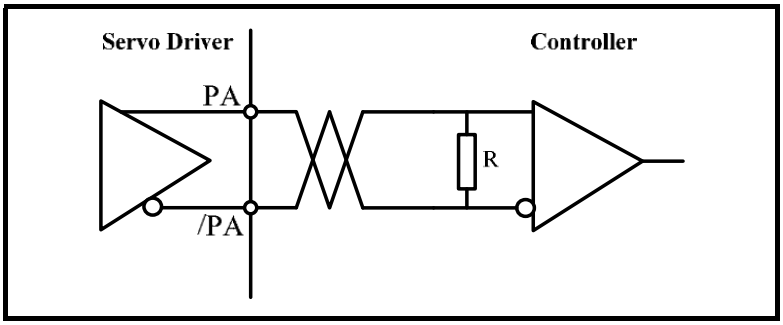
Maximum input command frequency of open collector is 200kpps</td></tr>
<tr><td>Open Collector (Internal 24V)</td><td colspan="3">Open Collector – Selection of Resistance Example</td></tr>
<tr><td> 

The maximum input command frequency of open collector is 200kpps</td><td>External Power
Vcc=24V
R=2KΩ</td><td>External Power
Vcc=12V
R=750Ω</td><td>External Power
Vcc=5V
R=100Ω</td></tr>
</table>

(c) Encoder Output Interface Circuit (**IO4**):

Encoder output interface circuit is the output method of Line Driver, please let end terminal resistance(R=200~330Ω) connect to Line Receiver input terminal.

Encoder Output Interface Circuit (Line Driver)



(d) Analog Input Interface Circuit(**IO5**):

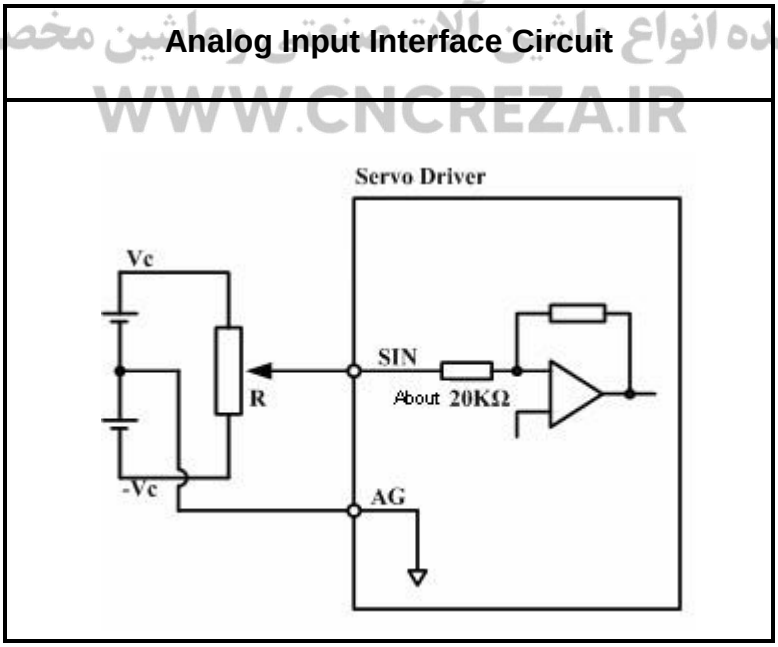
There is sometimes ripple inside the server internal power. Adverse external power polarity will cause server damage. Maximum external power voltage (Vc) should be less than12V; terminal input voltage should not more than10V. Over voltage will cause damage. When using internal power of server, user need to choose the resistance(suggestion: more than 3KΩ), which maximum current is less than 10mA.

SIN Input impedance: 15KΩ

PIC Input impedance: 40KΩ

NIC Input impedance: 20KΩ

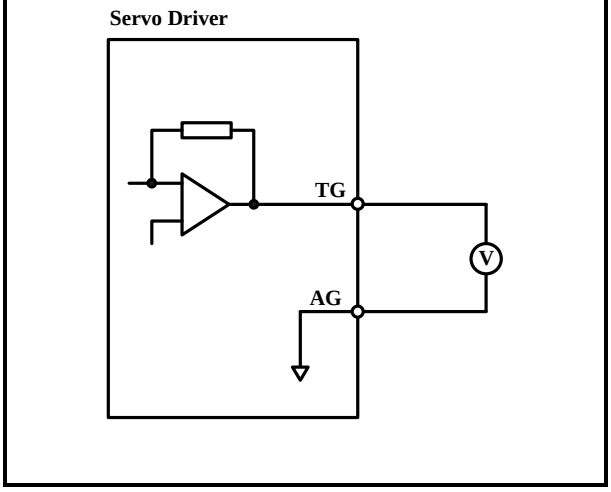
Analog Input Interface Circuit



(e) Analog Output Interface Circuit(**IO6**):

The maximum current of analog output is 5mA, so user need to choose the device, which Impedance is larger.

Analog Input Interface Circuit



2-2-2 CN2 Encoder Signal Terminal Explanation

(1) Diagram of CN2 Terminal:

(a) Diagram of Fewer Wiring Type Encoder:

Pin No.	Terminal Layout	Function
2	+5V	PW Output Terminal
4	0V	PW Grounding Terminal
6	/A	Encoder / A Phase Input
8	/B	Encoder / B Phase Input
10	/Z	Encoder / Z Phase Input

1	+5V	PW Output Terminal
3	0V	PW Grounding Terminal
5	A	Encoder / A Phase Input
7	B	Encoder / B Phase Input
9	Z	Encoder / Z Phase Input

12	—	———
14	—	———
16	—	———
18	—	———
20	FG	Shielded Wire Grounding

11	—	———
13	—	———
15	—	———
17	—	———
19	—	———

(b) Diagram of non-Fewer Wiring Type Encoder:

Pin No.	Terminal Layout	Function
2	+5V	PW Output Terminal
4	0V	PW Grounding Terminal
6	/A	Encoder / A Phase
8	/B	Encoder / B Phase
10	/Z	Encoder / Z Phase

1	+5V	PW Output Terminal
3	0V	PW Grounding Terminal
5	A	Encoder / A Phase
7	B	Encoder / B Phase
9	Z	Encoder / Z Phase

12	/U	Encoder / U Phase
14	/V	Encoder / V Phase
16	/W	Encoder / W Phase
18	—	———
20	FG	Shielded Wire Grounding

11	U	Encoder / U Phase
13	V	Encoder / V Phase
15	W	Encoder / W Phase
17	—	———
19	—	———

P.S.: Do not wire to the terminal, which is un-operated.

(2) Name and Explanation of I/O Signal:

Encoder Output
No. and Color
Milit

Pi	Functi-	General Joint	Joina-ry n	Signal Name	on	t
	Terminal Layout Function					
No		**Cod**	**15**			
.		**e**	**9 wires**	**wires**	**Out**	
			(fewer wer No.	**(non-fe put**	**wiring)**	
				wiring)		

1 Power output + Terminal +5V white Red B 5driver). When the cable is more than V Power for encoder(provided from 2

						20m, user should separately use 2

cables to avoid decreasing voltage of 3 Power output - Terminal 0V Black Black I encoder. When the cable is more than 30m, please contact to the 4 distributorship.

5 A Phase A Green Green A Encoder A Phase: From motor terminal

encoder input

6 A /A Blue Green White C to the driver.

7 B Phase B Red Gray H Encoder B Phase: From motor terminal 8 encoder input /B

Pink Gray white D to the driver.

9 Z Phase Z Yellow Yellow G Encoder Z Phase: From motor terminal 10 encoder input /Z

Orange Yellow white E to the driver.

11 U Phase U Brown **When using fewer-wiring-type** 12

encoder input /U Brown white **motor, do not wire.**

13 V Phase V Blue **When using fewer-wiring-type** 14

encoder input /V Blue white **motor, do not wire.**

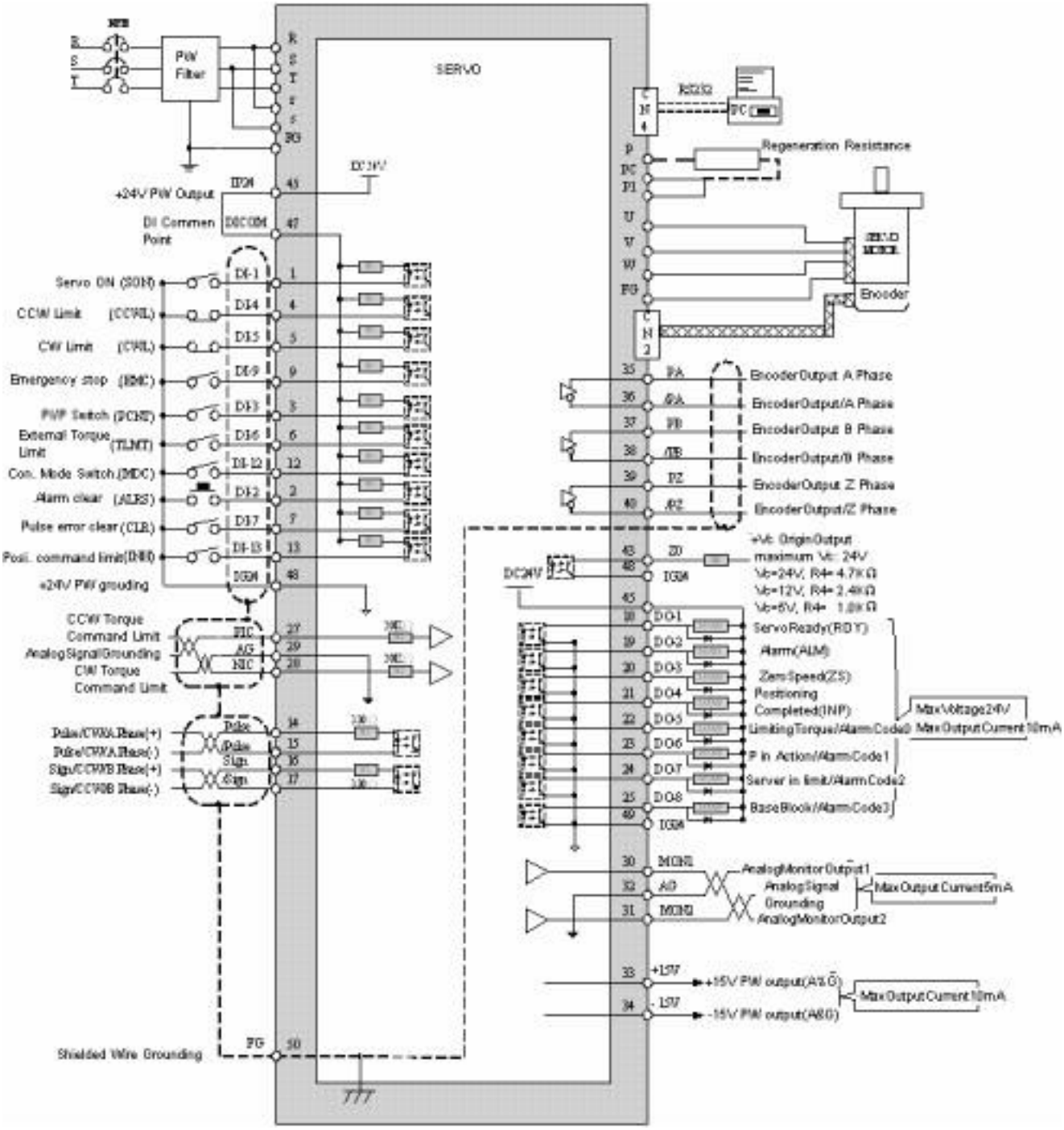
15 W Phase W Orange **When using fewer-wiring-type**

16 encoder input /W Orange white **motor, do not wire.**

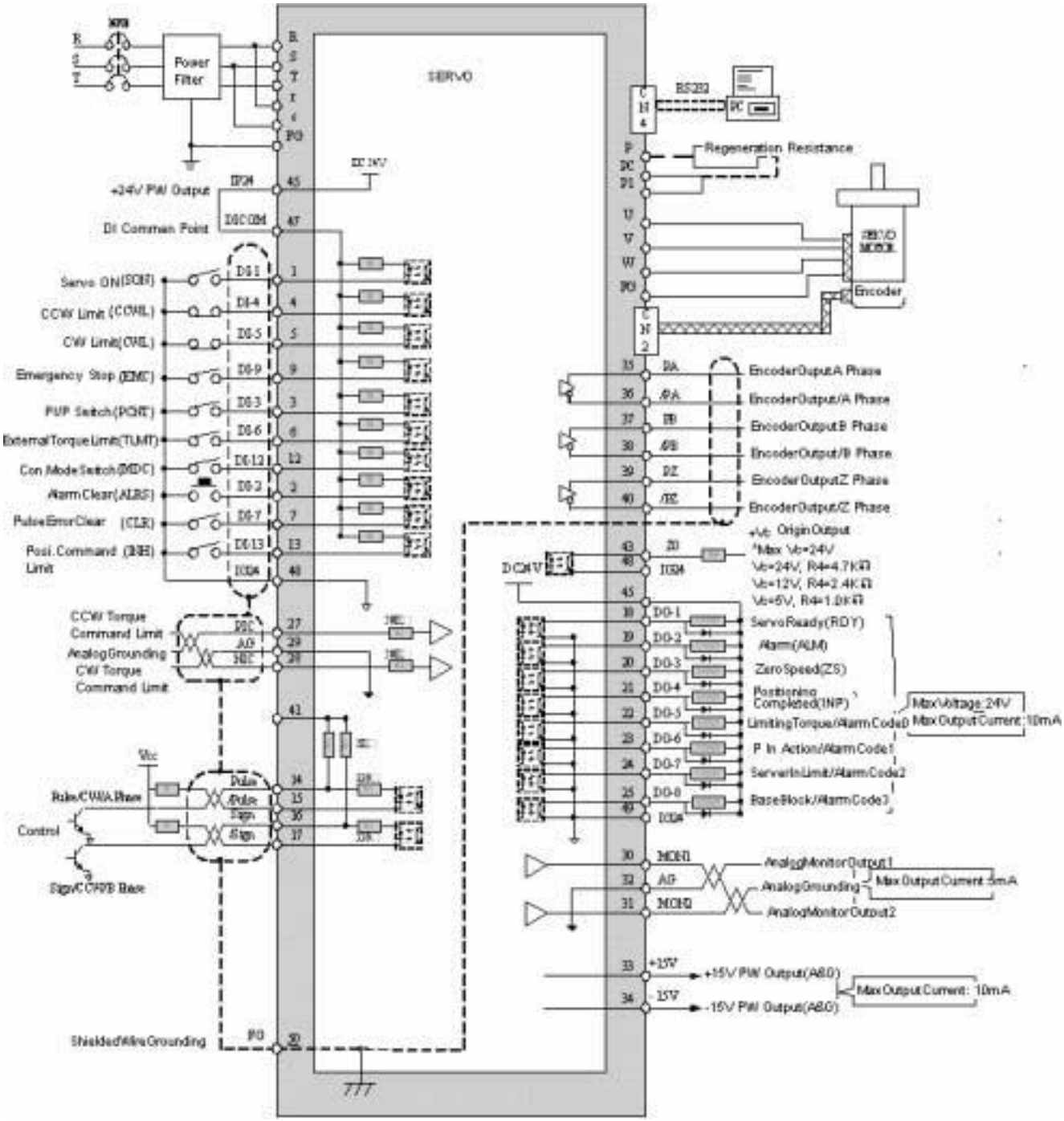
17 18 19	No operated				**Do not wire.**
20	Shielded wire terminal layout	FG	Shielded net wire	F	Shielded wire, which is connected to the signal wire.

2-3 Standard Wiring Diagram of Control Signal

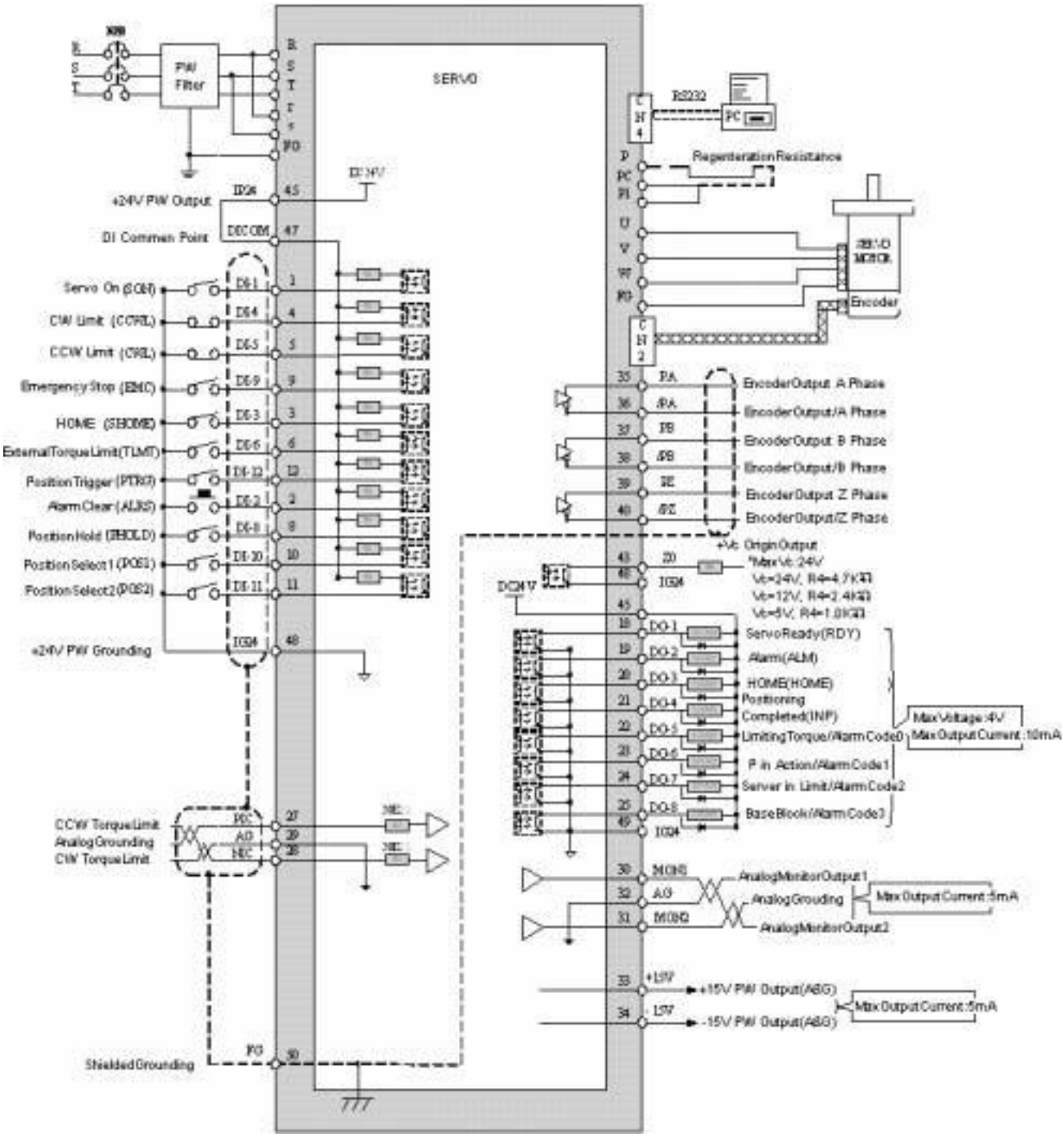
2-3-1 Position Control (Pe Mode) Wiring Diagram(Line Driver)



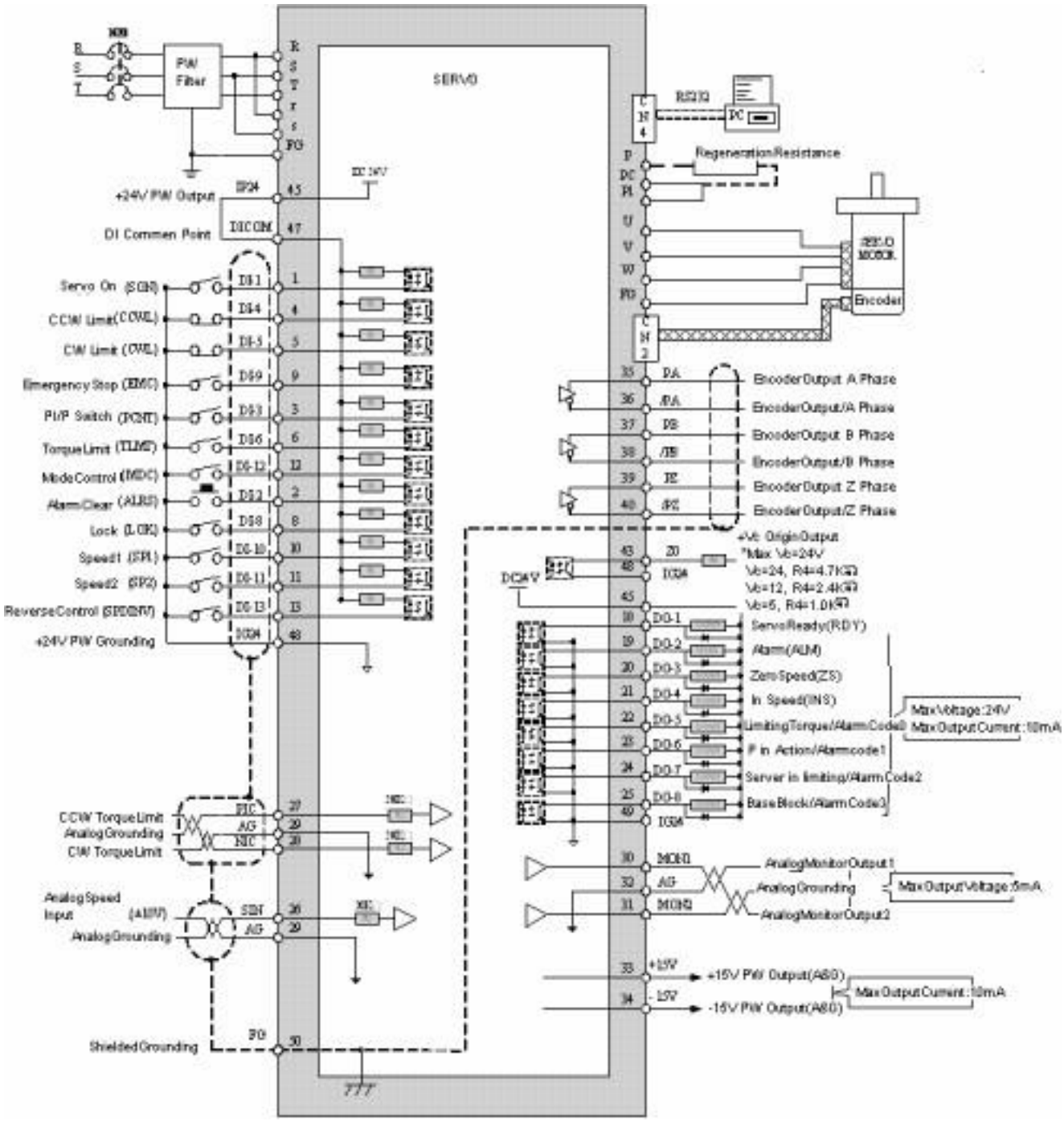
2-3-2 Position Control (Pe Mode) Wiring Diagram(Open Collector)



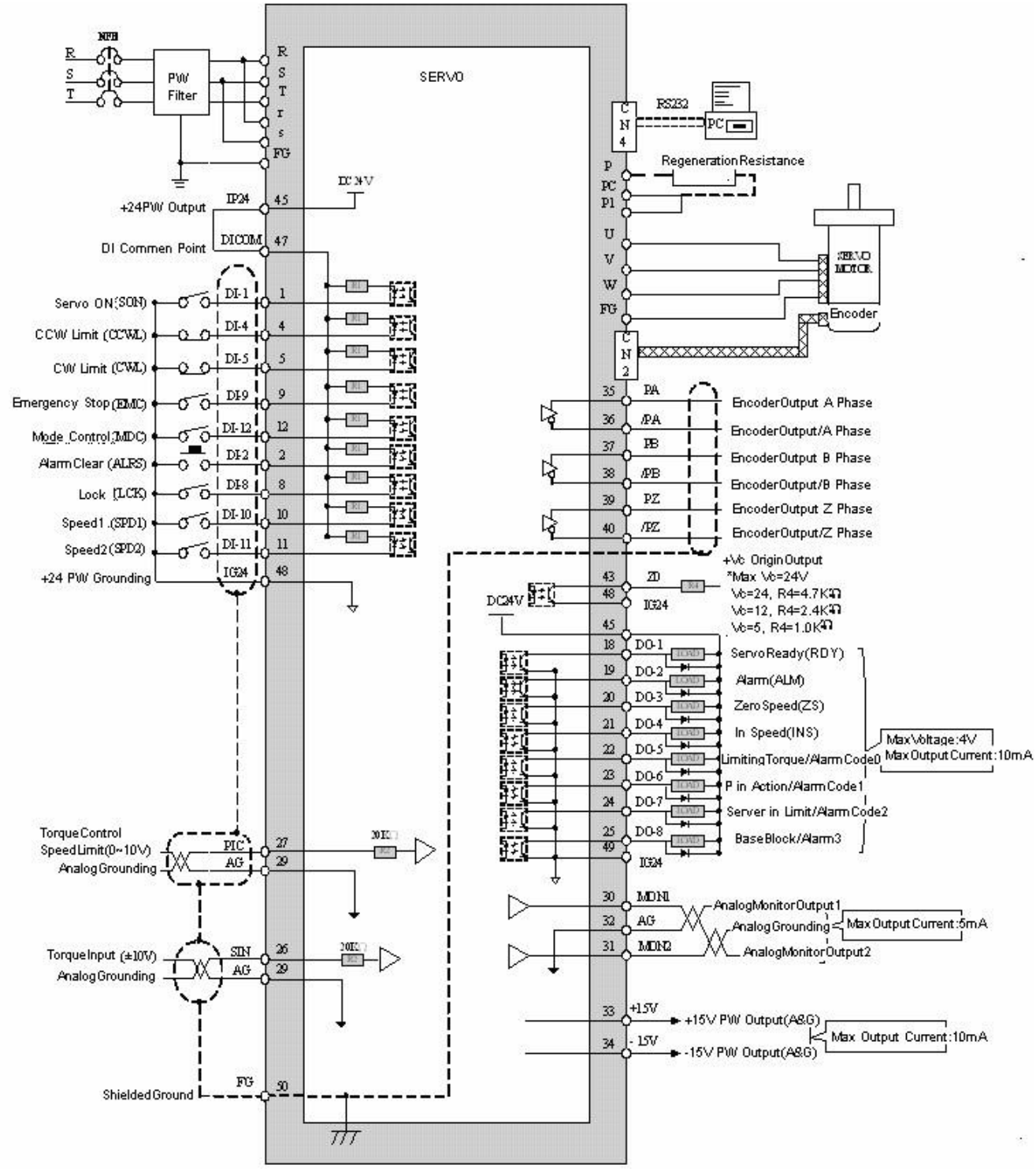
2-3-3 Position Control (Pi Mode)Wiring Diagram



2-3-4 Speed Control(S Mode)Wire Diagram



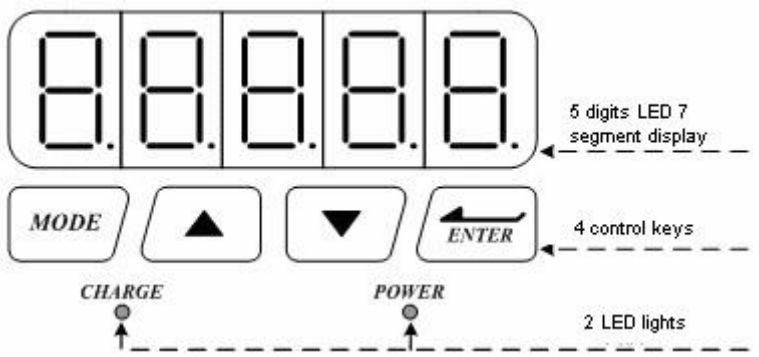
2-3-5 Torque Control (T Mode)Wire Diagram



Chapter 3 Functions on Panel Operator

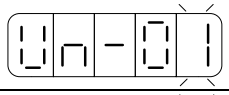
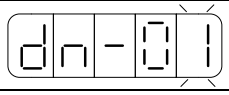
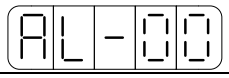
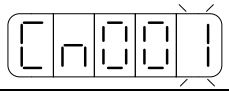
3-1 Functions on Driver Panel Operator

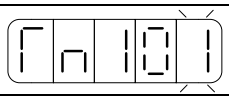
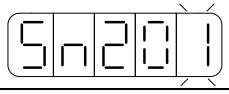
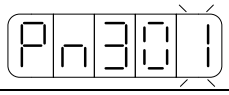
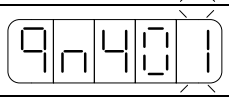
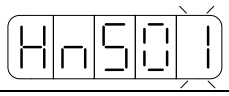
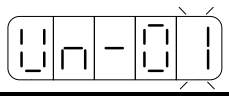
This device includes 5 digits 7 segment LED display, 4 control keys and 2 LED lights as below. When the **POWER-LIGHT**(green) shines, it means this equiptment is power on then it can normally operate; when the **CHARGE-LIGHT** shines, it means: this device still has power inside after power off, then the cable could be taken apart only after this light extinguishes.



Key	Key Name	Functions
MODE	MODE/SET (MODE/SET KEY)	1. To select a basic mode, such as the status display mode, utility function mode, parameter setting mode, or monitor mode. 2. Returning back into selection of parameter from data-setting screen.
▲	No. Increase Key (UP Key)	1. Selection of each item of peremeter. 2. To increase the set value. 3. Press ▲ and ▼ at the same time to clear ALARM.
▼	No. Decrease Key (DOWN Key)	
ENTER	Data Setting Key (ENTER Key)	1. To confirm data and parameter-item. 2. To shift to the next digit on the left. 3. To finish the data setting.

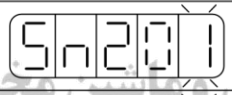
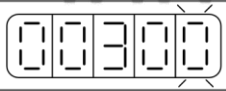
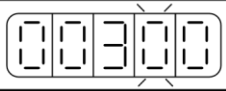
After power on, to use MODE-Key to select 9 kinds of parameter. The order is descripted as blow:

Step	Key	LED Display after Operation	Description
1	Power on		To enter User-Control parameter, after power on.
2	MODE		To enter Diagnosis parameter after pressing MODE-Key once.
3	MODE		To enter Alarm parameter after pressing MODE-Key once.
4	MODE		To enter Control parameter after pressing MODE-Key once.

5	MODE		To enter Torque parameter after pressing MODE-Key once.
6	MODE		To enter Speed parameter after pressing MODE-Key once.
7	MODE		To enter Position parameter after pressing MODE-Key once.
8	MODE		To enter Quick parameter after pressing MODE-Key once.
9	MODE		To enter Hyper-Function parameter after pressing MODE-Key once.
10	MODE		To enter User-Control parameter again after pressing MODE-Key once, and so on.

There is an setting example below. All function keys will be used. User can operate to understand all functions directly.

Ex: If Sn203 will be set as 100rpm, please see below:

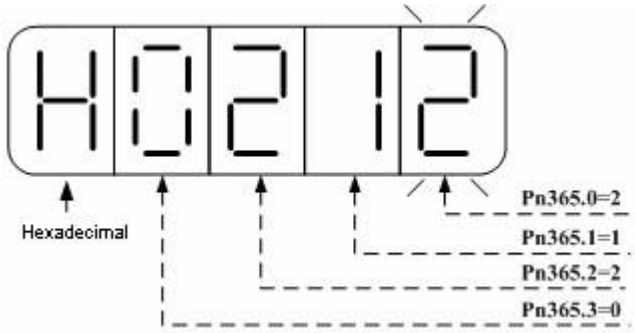
Step	Key	LED Display after Operation	Description
1	Power On		To enter User-Control parameter, after power on.
2	MODE		To enter Speed parameter after pressing MODE-Key 5 times.
3	▲		To select the item in Speed-parameter after pressing UP-Key twice.
4	ENTER		To enter Sn203 screen after pressing ENTER-Key for 2 seconds.
5	ENTER		Digit position left shifting (Flashing LED) after pressing ENTER once.

Step	Key	LED Display after Operation	Description
6	ENTER	00300	Digit position left shifting (Flashing LED) after pressing ENTER-Key once.
7	▼	00100	Adjust third digits position from 3 to 1, after pressing DOWN-Key twice.
8	ENTER	-SET- Sn203	Pressing ENTER-Key for 2 seconds until – SET- appears. It means current setting has been loaded, than it will return back to current parameter item after – SET-.

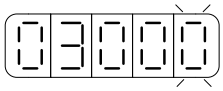
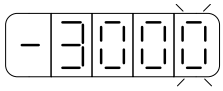
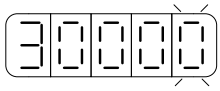
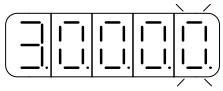
Refer to front example: If there is no any setting, press MODE-Key once to return back to parameter-selection.

Step	Key	LED Display after Operation	Description
1	Power ON	Un-01	To enter User-Control parameter when Power on.
2	MODE	Sn201	To enter Speed parameter after pressing MODE-Key 5 times.
3	▲	Sn203	To select Speed parameter item after pressing UP-Key twice.
4	ENTER	00300	To enter Sn203 screen after pressing ENTER-Key for 2 seconds.
5	MODE	Sn203	To return back to parameter-selection-screen after pressing MODE once.

There are some hexadecimal displayed parameters. Some of parameters in this equipment is displayed by hexadecimal. If the hightest digit shows **H**, it stands for that the parameter is set by hexadecimal. Ex: **Pn365(origin point mode setting) = 0212**, the screen will be showed as below:

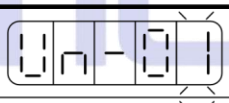
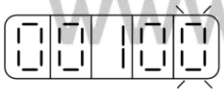
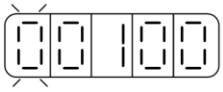
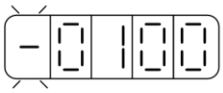
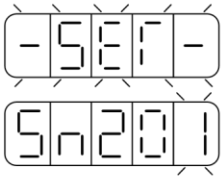


Description of Display in Positive/Negative:

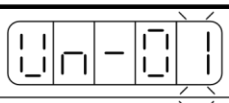
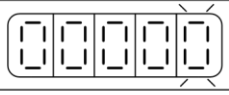
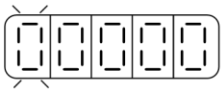
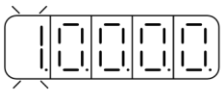
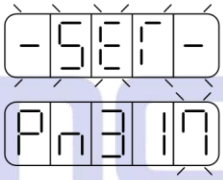
Discription of Positive/Negative Display	Display of Positive	Display of Negative
If the setting number range is equal or less than 4 digits and displayed in Negative, the highest digit will display the minus sign. Ex: **Sn201**(Internal Speed Command 1).	3000	-3000
		
If the setting number range is more than 4 digits and displayed in Negative, the decimals of all digits will shine. Ex: **Pn317**(Internal Position Command 1-Rotation number)	30000	-30000
		

Description of Negative-setting-control:

(1)If the setting number range is equal or less than 4 digits. Ex: Sn201(internal speed command 1)=100 to -100

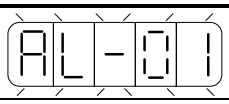
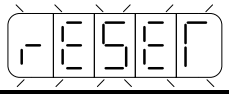
Step	Key	LED Display after Operation	Description
1	Power ON		To enter Unser-Control parameter after power on.
2	MODE		To enter Speed parameter after pressing MODE-Key 5 times.
3	ENTER		To enter Sn201 setting screen after pressing ENTER-Key for 2 seconds.
4	ENTER		To move the adjustable digit to left 4 digits(=highest digit), after pressing ENTER-Key 4 times.
5	▲ or ▼		Pressing UP or DOWN once -> minus sign appears -> pressing again -> minus sign disappear.
6	ENTER		Pressing ENTER-Key for 2 seconds -> -SET- appears -> it stands for current setting has been saved -> The screen will return back to the parameter-item-selection.

(2) If the range can be set more than 4 digits. Ex: **Pn317**(internal position command 1–rotation)=0 is set to -10000

Step	Control Keys	LED Display after Operation	Description
1	Power On		To enter User-Control parameter after power on.
2	MODE		To enter position control parameter after pressing MODE-Key 6 times.
3	▲		To select Pn317 items after pressing UP-Key 16 times.
4	ENTER		To enter Pn317 setting screen after pressing ENTER-Key for 2 second.
5	ENTER		To adjust the adjustable digit to the left for 4 digits after pressing ENTER-Key 4 times.
6	▼		To adjust the ten thousand digits 0 to 1 after pressing DOWN-Key once. All decimal points of all digits will shine, which means current default number is negative.
7	ENTER		Pressing ENTER-Key for 2 seconds until – SET- appears, which means current default number is saved. After – SET- appears, the screen will turn back to item-selection immediately.

User can use panel board at this equipment to clean Alarm without using input terminal **ALRS**.

Here below is the operat-discription:

Step	Control Key	LED Display after Opertion	Description
1	Alarm		If voltage over low alarm, AL-01 shines.
2	▲ ▼		After alarm is cleared, remove input contact point **SON** operation. (= remove servo on) Then press UP-Key and DOWN-Key at the same time. The panel screen shows RESET and returns back to parameter items selection. And the alarm has been currectly cleared.

3-2 Panel Board 3-2-1 Statu Display Function

User can use User-Control parameter to get all informations of current drives and motor rotation. There are the description below:

Parameter Signal	Displayed	Unit	Description

Un-01	Actual motor speed	rpm	Ex: 120 is displayed. It means current motor speed is 120 rpm.
Un-02	Actual motor torque	%	It is displayed in accordance with ratio torque percentage. Ex: 20 is displayed. It means current motor torque output is 20% of ratio torque.
Un-03	Regeneration load ratio	%	Average regeneration power output percentage.
Un-04	Actual load ratio	%	Average power output percentage.
Un-05	Max load ratio	%	Max value of actual load rate
Un-06	Speed command	rpm	Ex: 120 is displayed. It means current motor speed is 120 rpm.
Un-07	Position incorrect value	pulse	The incorrect value of position command and position feedback.
Un-08	Positoin feed back value position feedback value	pulse	The pulse cumulation value of motor encoder.
Un-09	External voltage command	V	Ex: Display: 5.25. Which means external voltage command is 5.25V.
Un-10	Vdc Bus Voltage	V	Ex: Display: 310. Which means mains main circuit voltage is 310V.
Un-11	External speed limit command value	rpm	Ex: Display: 2000. Which means current external speed limit is 2000 rpm.
Un-12	External CCW Torque limit command value	%	Ex: Display 100. Which means current external CCW torque limit command is 100 %.
Un-13	External CW Torque limit command value	%	Ex: Display 100. Which means current external CW toque limit command is 100%.
Un-14	Motor feed back – Rotation value (absolute value)	rev	After power on, it displays motor rotation number in absolute value.
Un-15	Motor feed back – Less then 1 rotation pulse value(absolute value)	pulse	After power on, it displays motor less then 1 rotating pluse value in absolute value.
Un-16	Pulse command – rotation value(absolute value)	rev	After power on, it displays pulse command inputing rotation number in absolute value.
Un-17	Pulse command – Less then 1 rotation pulse value(absolute value)	pulse	After power on, it displays pulse command inputing less then 1 rotation – pulse value in absolute value.
Un-18	Torque command	%	It displays in ratio torque percentage. Ex: Display: 50. Which means current motor torque command is 50% of ratio torque.

Un-19	Load inertia	x0.1	When **Cn002.2=0**(no use auto gain adjust function), it displays current default load inertia ratio in **Cn025**. When **Cn002.2=1**(keep using auto gain adjustfunction), it displays current forecasting load inertia ratio.

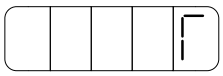
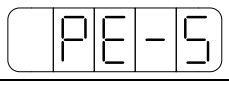
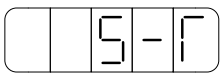
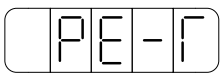
3-2-2 Diagnosis Functions

User can use diagnosis parameter to get all informations of current system. There are the description below:

Parameter Signal	Name and Function
dn-01	Current control mode
dn-02	Output connect terminal signal
dn-03	Input connect terminal signal
dn-04	Software version
dn-05	JOG mode operation
dn-06	Maintain
dn-07	External voltage command bias automatic adjusting
dn-08	Servo series

dn-01 (Current Control Mode Display)

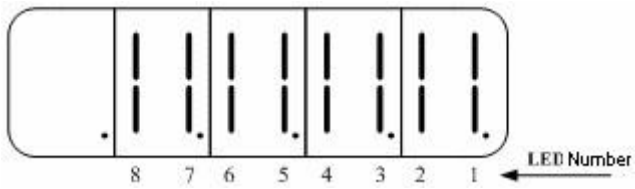
User can use **dn-01** to know the equipment in which control mode. The diagram below is the control mode v.s panel board display:

Control Mode	dn-01 (Control mode display)
Torque control—T	
Speed control—S	
Position control(external pulse command)—Pe	
Position/Speed control switch—Pe/S	
Speed/Torque control switch—S/T	
Position/Torque control switch—Pe/T	

Position control(internal position command) ⊣Pi	

dn-02 (Output terminal signal)

User can use dn-02 to get the situation of current output terminal signal. Here below is the description of the penal borad:



When output terminal signal is low electric potential (close loop with **IG24**), the corresponding LED will shine; when output terminal signal is high electric potential (open loop with **IG24**), the corresponding LED will not shine. The diagram below is the synopsis of LED number and output terminal number, and **DO-1**~**DO-4** are hyper function programmed terminals. Please refer to **5-6-1** to set the function. **DO-5**~**DO-8** are single function output terminal.

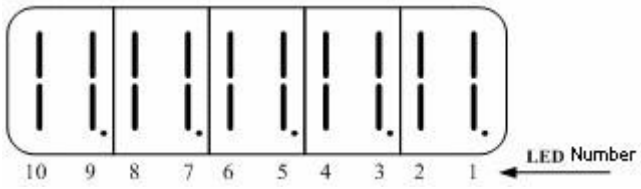
LED No.	Output connect terminal number	Default function
1	DO-1	**RDY**
2	DO-2	**ALM**
3	DO-3	**ZS**
4	DO-4	**INP**
5	DO-5	**LM/A0**
6	DO-6	**PC/A1**
7	DO-7	**ST/A2**
8	DO-8	**BB/A3**

P.S.: Please refer to 5-6-1 to set high or low electric potential in hyper function programmed output terminal.

Signal function output terminal is low electric potential.

dn-03 (Input terminal signal)

User can use **dn-03** to know the situation of current input terminal signal. Here below is the panel board description:

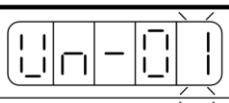
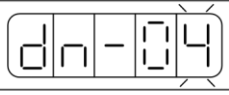
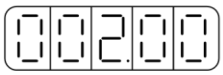
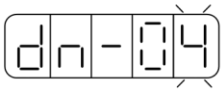


When output terminal signal is low electric potential (close loop with **IG24**), the corresponding LED will shine; when output terminal signal is high electric potential (open loop with IG24), the corresponding LED will not shine. The diagram below is the synopsis of LED number and output terminal number, and **DI-1**~**DI-10** are hyper function programmed terminals. Please refer to **5-6-1** to set the function.

LED Number	Input terminal number	Default function
1	DI-1	**SON**
2	DI -2	**ALRS**
3	DI -3	**PCNT**
4	DI -4	**CCWL**
5	DI -5	**CWL**
6	DI -6	**TLMT**
7	DI -7	**CLR**
8	DI -8	**LOK**
9	DI -9	**EMC**
10	DI -10	**SPD1**

dn-04 (Version of Software)

User can use **dn-04** to know the current software version of this equiptment. Here is the description below:

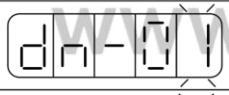
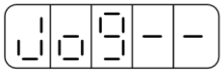
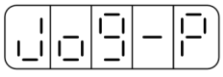
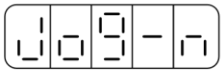
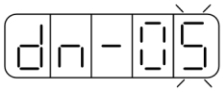
Step	Keys	LED Display	Description
1	Power On		To enter User-Control parameter after power on.
2	MODE		To enter diagnosis parameter after pressing MODE-Key once.
3	▲		To select **dn-04** items after pressing UP-Key 3 times.
4	ENTER		To enter “software version” after pressing ENTER-Key for 2 seconds. (Software version: 2.00)
5	MODE		To turn back to parameter selection after pressing MODE-Key once.

dn-05 (JOG Operation)

User can use **dn-05** to turn on JOG J, here is the description below:

Attention: The JOG is operated in accordance with Sn201(internal speed command 1). Please set Sn201 before executing this function.

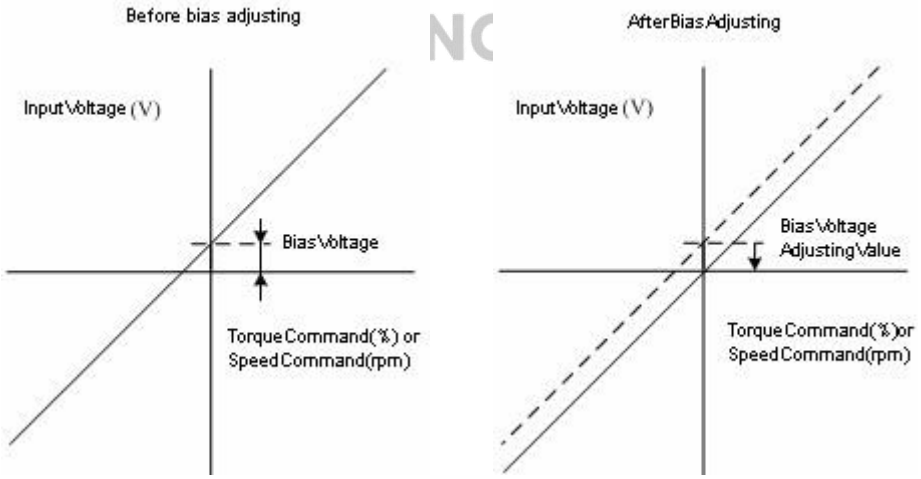
Attention: The motor will power on immediately when entering JOG mode, no matter the motor use input terminal SON or not.

Step	Key	LED display	Description
1	Power on		To enter User-Control parameter after power on.
2	MODE		To enter diagnosis parameter after pressing MODE-Key once.
3	▲		To select dn-05 items after pressing UP-Key 4 times.
4	ENTER		To enter **JOG MODE** after pressing ENTER-Key for 2 secondes. Motor will power on immediatly.
5	▲		Press UP-Key: motor will run in current definited positive direction.
6	▼		Press DOWN-Key: motor will run in current definited negative direction.
7	MODE		To turn back parameter selection after pressing MODE-Key once. The motor power off immediately.

dn-07 (External Voltage command bias automatic adjusting)

When external torque or speed analog command is 0V, the motor might rotate slowly. User can use **dn-07** to automaticly adjust analog command bias. Here below is the step description:

Step	Key	LED Display	Description
1	**Please close loop between analog command terminal SIN(CN1-26) and analog grounding terminal AG(CN1-29) befor adjusting.**		
2	Power on	Un-01	To enter User-Control parameter after power on.
3	MODE	dn-01	To enter diagnosis after pressing MODE-Key once.
4	▲	dn-07	To select **dn-07** after UP-Key 6 times.
5	ENTER	00000	To enter **dn-07** after pressing ENTER-Key for 2 seconds.
6	▲	00001	To press UP-Key once. " 1 " means bias automatic adjusting.
7	ENTER	-SET- dn-07	Pressing ENTER-Key for 2 seconds until – SET- appears, which means bias value is set. After – SET- appears, the screen will turn back to item-selection immediately. If this bias voltage adjusting value want to be saved, please pressing ENTER-Key in **Tn104** or **Sn217**.



dn-08 (Servo Series)

User can use **dn-08** to check the current combination of drives and motor, which is showed as below. If the displayed setting value is different from actual combination, please contact to lock distributors.

dn-08 Display Cn030 Setting	Drives Model	Motor Model	Motor Standards		Encoder Standards
			Watt (W)	Speed (rpm)	
121	JSDA-15	JSMA-LC03AB	300	3000	2500
122		JSMA-LC03AH			8192
131		JSMA-SC02AB	200	3000	2500
132		JSMA-SC02AH			8192
141		JSMA-SC04AB	400	3000	2500
142		JSMA-SC04AH			8192
211	JSDA-20	JSMA-LC08AB	750	3000	2500
212		JSMA-LC08AH			8192
221		JSMA-SC04AB	400	3000	2500
222		JSMA-SC04AH			8192
231		JSMA-SC08AB	750	3000	2500
232		JSMA-SC08AH			8192
241		JSMA-MA05AB	550	1000	2500
242		JSMA-MA05AH			8192
251		JSMA-MH05AB	550	1500	2500
252		JSMA-MH05AH			8192
311	JSDA-30	JSMA-SC08AB	750	3000	2500
312		JSMA-SC08AH			8192
321		JSMA-MA10AB	1000	1000	2500
322		JSMA-MA10AH			8192

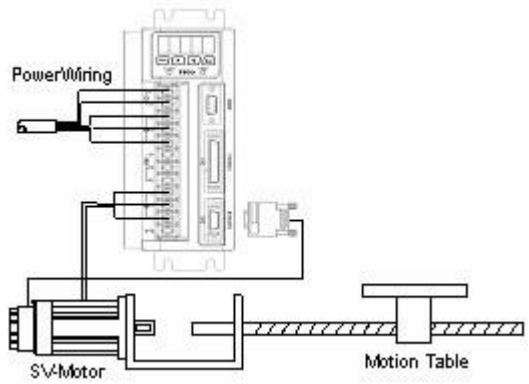
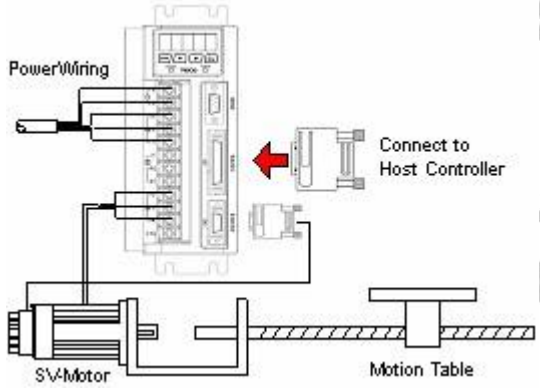
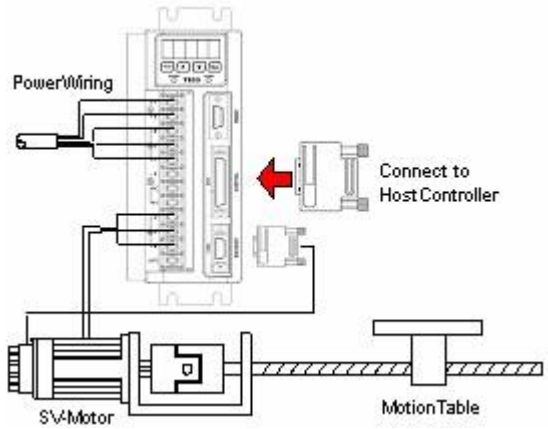
331		JSMA-MB10AB	1000	2000	2500
332		JSMA-MB10AH			8192
341		JSMA-MH10AB	1000	1500	2500
342		JSMA-MH10AH			8192
351		JSMA-MA15AB	1500	1000	2500
352		JSMA-MA15AH			8192

dn-08 Display Cn030 Setting	Drives Model	Motor Model	Motor Standards		Encoder Standards
			Watt (W)	Speed (rpm)	
361	JSDA-30	JSMA-MB15AB	1500	2000	2500
362		JSMA-MB15AH			8192
371		JSMA-MC15AB	1500	3000	2500
372		JSMA-MC15AH			8192
511	JSDA-50	JSMA-MA15AB	1500	1000	2500
512		JSMA-MA15AH			8192
521		JSMA-MB15AB	1500	2000	2500
522		JSMA-MB15AH			8192
531		JSMA-MC15AB	1500	3000	2500
532		JSMA-MC15AH			8192
541		JSMA-MB20AB	2000	2000	2500
542		JSMA-MB20AH			8192
711	JSDA-75	JSMA-MB30AB	3000	2000	2500

712		**JSMA-MB30AH**			**8192**
721		**JSMA-MC30AB**	**3000**	**3000**	**2500**
722		**JSMA-MC30AH**			**8192**

Chapter 4 Operation of Trial Run

Before executing trial run, please confirm all wiring work have been accomplished. The description below is the trial run operation and purpose; and when trial run and host controller operate together, it descripts in accordance with speed control loop (analog voltage command) and position control loop (external pulse command).

<table>
<tr><td colspan="2">(1) Non-loaded servo motor trial run (Reference:4-1)</td></tr>
<tr><td>A. ServoDrives wiring and motor installation</td><td>B. Purpose of trial run</td></tr>
<tr><td> 
</td><td>Confirm if the items below are correct:
. Drives power wiring
. ServoMotor wiring
. Encoder wiring
. ServoMotor rotation direction and speed</td></tr>
<tr><td colspan="2">(2) Non-loaded servo motor with host controller trial run (Reference:4-2)</td></tr>
<tr><td>A. Servo drives wiring and motor installation</td><td>B. Purpose of trial run</td></tr>
<tr><td> 
</td><td>Confirm if the items below are correct:
. Control signal wiring between host controller and servo drives
. Servo motor rotation direction, speed and rotating number
. Brake function, operation limit function and protection function</td></tr>
<tr><td colspan="2">(3) Connect to loaded servo motor with host controller trial run (Reference:4-3)</td></tr>
<tr><td>A. Servo drives wiring and motor installation</td><td>B. Purpose of trial run</td></tr>
<tr><td> 
</td><td>Confirm if the items below are correct:
. Servo motor rotation direction, speed and mechanical operation range
. Set related control parameters</td></tr>
</table>

4-1 Non-loaded Servo Motor Trial Run

Attention
⌘ **In the process of trial run, user must take the servo motor from the mechanical system apart. Ex.: Coupling or belt etc..** In order to prevent the damage of mechanical system in the process of trial run, the servo motor must execut trial run in non-loaded situation.

In this step of trial run, user can check the drive wiring. If there is abnormal wiring, there will also be abnormal trial run of servo motor.

1. **Installation of servo motor:**

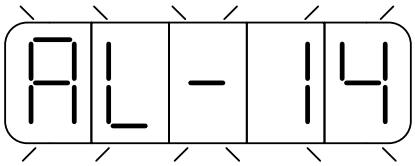
   Fix the servo motor on the mechanical system to prevent the vibration or moving situation in the process of trial run.

2. **Wiring:**

   Check servo drive power wiring, servo motor wiring and encoder wiring. User doesn't use any control signal wire in this step of trial run, so please remove control signal wire(CN1).

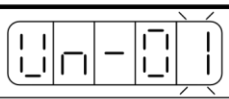
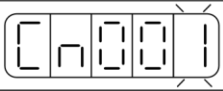
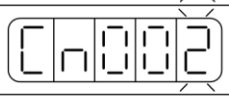
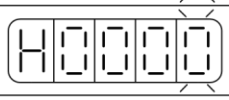
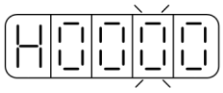
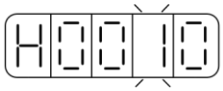
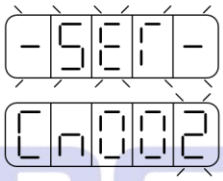
3. **Turn on the servo drive power:**

   Turn on the power of servo drive. If the panel borad shows as below, which means abnormal alarm of servo drive:



Reason: Input terminal **CCWL** and **CWL** operates at the same moment (high or low electric potential, please refere to **5-6-1** to set). Because of the alarm, the servo can not operate normally. User can use the parameter **Cn002.1=1** to turn off the drive limit function temperally at the process of trial run. After the first step of trial,please set the peremeter **Cn002.1=1.**

Setting and operation:

Setp	Keys	LED Display	Description
1	Power on		To enter User-Control parameter after power on.
1	MODE		To enter Control parameter after pressing MODE-Key 3 times.
2	▲		To select **Cn002** items after pressing UP-Key once
3	ENTER		To enter **Cn002** setting screen after pressing ENTER-Key for 2 seconds.
4	ENTER		Left-moving the adjustable digit (shining LED), after pressing ENTER-Key once.
5	▲		Pressing UP-Key once to adjust 2nd digit to 1. Setting to "no operating input terminal **CCWL** and **CWL**".
6	ENTER		Pressing ENTER-Key for 2 seconds until – SET- appears, which means current setting value has been saved. After – SET-, it will immediately turn back to current parameter items selection.

After the setting is complete, please reset the power. If there is still other abnormal alarm, itmeans the drives can not operate normally. (User need refer to **8-2(abnormal clear)**. After the abnormal is cleared, operat the drives again. If the abnormal alarm still can not cleared again, please contact to local distributors to get the information and help.

4. Release mechanical Brake:

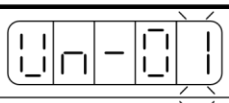
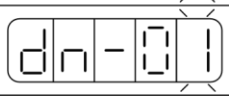
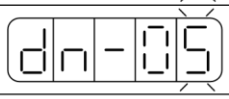
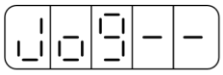
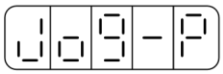
When the motor attaches mechanical Brake, please complete +24V wiring to release mechanical Brake at beginning. In not, there will be abnormal in trial run.

5. Operation of Servo Drives Panel Borad:

Using panel borad to command **JOG** operating to make sure if motor speed and direction is correct. If not, please confirm if the speed control parameter **Sn201**(internal speed command 1) and the user-control parameter **Cn004**(motor rotation direction setting) are correct or not. Here below is the **JOG** operation description:

Attention: The JOG is operated in accordance with Sn201(internal speed command 1), so user need to set Sn201 before operating this function.

Attention: Regardless of using SON to servo on. After entering JOG mode, motor will servo on immediately.

Step	Keys	LED Display	Description
1	Power on		To enter user-control parameter after power on.
2	MODE		To enter diagnosis parameter after pressing MODE-Key once.
3	▲		To select **dn-05** items after pressing UP key 4 times.
4	ENTER		Ater pressing ENTER-Key for 2 seconds, entering **JOG mode**, than the motor will on.
5	▲		Keep pressing UP-Key, motor rotates in accordance with current setting direction.
6	▼		Keep pressing DOWN-Key, motor rotates in accordance with current setting negative direction.
7	MODE		Pressing MODE-Key once → Returning back to parameter selection → Motor will terminate “servo on” immediately.

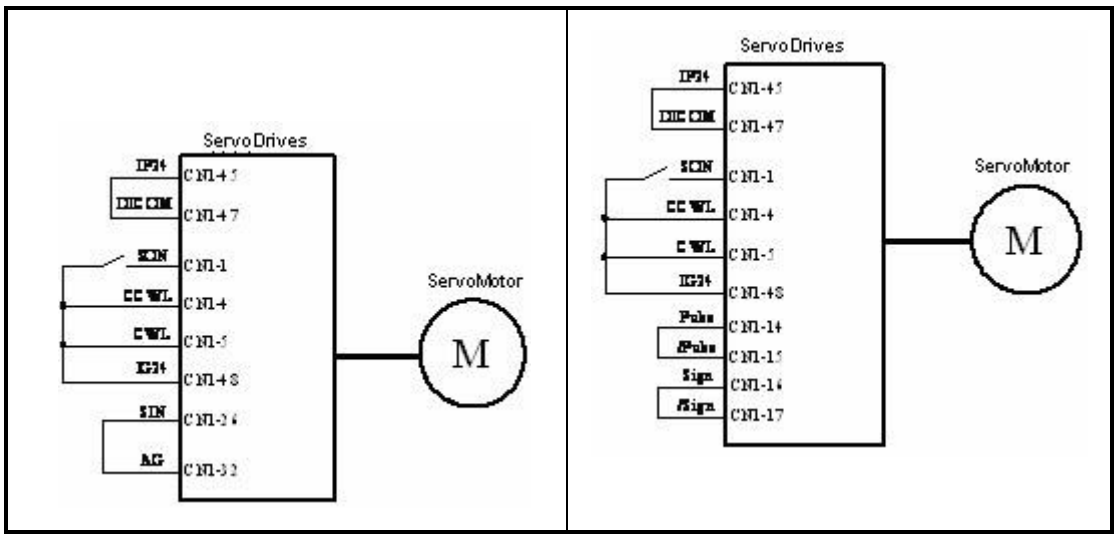
4-2 Non-loaded Servo Motor Trial Run with Host Controller

During this step, user can make sure the control signal wires and the control signal electric potential between servo drives and host controller are correct or not. Motor can connect to the mechanical after finishing this trial run step.

A. Turn on Servo motor:

Please see the diagram below to execute wiring

Speed Control(**Cn001=1**)	Position Control(**Cn001=2**)



a. No command signal input:

In speed control mode, input **0V** to speed analog input terminal.

In position control mode, please connect the external pulse command terminal “Pulse” to”/Pulse”, and “Sign” to “/Sign”.

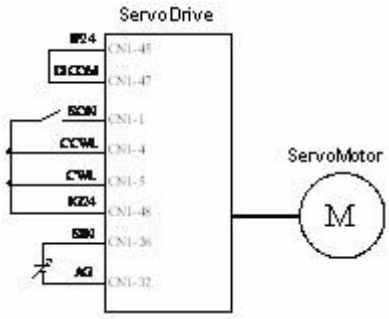
b. Turn the **Servo ON Signal** on:

Connect the **SON** to low electric potential to turn on servo motor and check if there is any abnormal alarm. If yes, user need refer to Chapter **8-2(Abnormal Clear)**.

B. Trial run in Speed control mode(Cn001=1) :

1. Wiring:

Make sure if the servo drives power and control signal wiring are correct. Confirm if the speed analog signal input is 0V. Here below is the diagram:



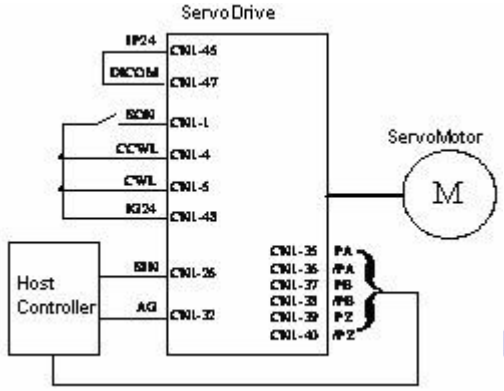
2. Turn on Servo Motor:

Let (**SON**) connect to low electric potential ☞ turn on servo motor. If the motor rotates slowly, please execute **dn-07** to adjust automatically analog command error value(refer to **3-2-2**).

3. **Check the relationship between motor speed and speed analog command input:** Increase the speed analog command voltage by degrees. Check the motor actual speed in **Un0-01** and make sure analog speed command ratio(**Sn216**) and analog speed command limit(**Sn218**) are correct or not. And confirm if the motor rotation is abnormal. If yes, please adjust user-control **Cn004**. Finally, let the **SON** connect to high electric potential and turn off the servo motor.

4. **To complete the wiring to the host controller:**

Confirm the wiring of servo drive and host controller, speed analog signal input(**SIN**), encoder output (**PA, /PA, PB, /PB, PZ, /PZ**) and alarm signal. Here below is the wiring diagram.

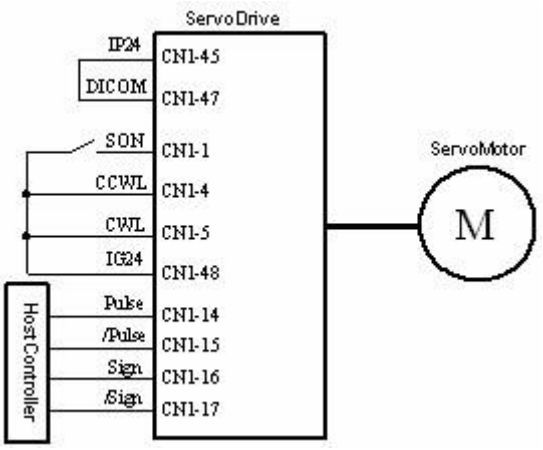


5. **Confirm the rotation number and encoder output of Servo Motor:**

Turn on servo motor ⇗ Executing servo motor rotating number command from host controller ⇗ Checking the motor rotating number in User-Control parameter **Un-14** to see if there is any difference. If yes, please make sure if the parameter encoder signal output **Cn005** is correct. After the setting is complete, connect the **SON** to the high electric potential ⇗ turn off the servo motor. **C. Position control mode trial run(Cn001=2)** :

1. **Wiring:**

Confirm if the power and control signal wiring from servo drive are correct. Here below is the diaram:



2. Setting of electric gear ratio:

Please set the necessary position control parameter electric gear ratio **Pn302~Pn306**(refere to 5**-4-3**) in accordance with the standard of servo motor encoder and motion table application.

3. Turn on Servo Motor:

Connecting the **SON** to the low electric potential to turn on servo motor.

4. Confirm the motor rotation-direction, speed and rotation number:

Outputing the low-speed pulse command from host controller to make servo motor operate at low-speed (compare to the parameter **Un-15** – motor feed back pulse number and **Un-17** – Pulse command number). ➶ Executing rotation number command (compare to the parameter Un-14 – motor feed back rotation number and Un-16 – pulse command rotation number). If there is any abnormal for actual motor feed back, please adjust position control parameter electric gear ratio **Pn302~Pn306. Please recheck until operation is normal.**

If the direction of motor rotation is abnormal, please confirm position control parameter pulsecommand model selection **Pn301.0** and command direction definition **Pn314**. After the setting is accomplished, connect the SON to the high electric potential ➶ turn off the servo motor.

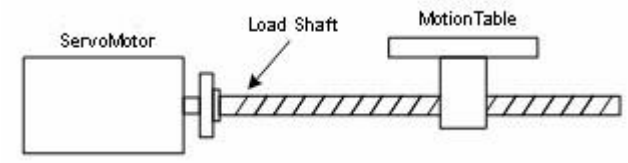
4-3 Trial Run (connecting to loaded servo motor with host controller)

⚠ Attention
⌘ **Please execut the steps below to operate loaded trial run.** Servo motor operates under the situation of loading mechanical system. It will cause injurying or damage if it is not well setting.

Before executing the trial run, please confirm the items below:

④ Please set the related parameters of servo dirve in accordance with the necessary of host controller and mechanical system.

④ Confirm if the servo motr rotating direction and speed setting is in accord with the necessary of mechanical system.



1. **Confirm the ServoDrive Power is off**
2. **Connecting the load-shaft of servo motor:**

   Please refer to Chapter **1-5** to check the installation of servo motor.

3. **Gain adjusting of servo drive:**

   Please be in accordance with load system and refer to Chapter **5-5** to execute servo gain adjusting.

4. **Trial run of host controller:**

   Be commanded by host controller. Please refer to operation command in chapter **4-2** and check the operating situation and execut adjusting depends on situations.

5. **Repeat adjusting and record the setting value:**

   Repeat step 3 and 4 untill the mechanical system operates normally. Record the setting value very certainly to be the data of future maintaining.

Chapter 5 Control Function

5-1 Selection of control mode

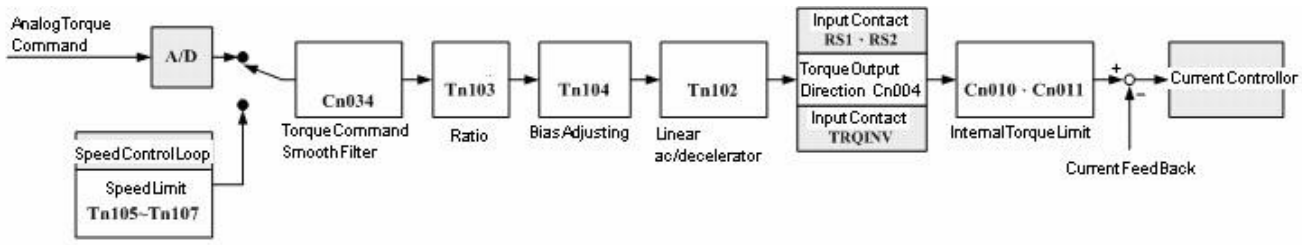
There are torque, speed and position mode in this device. Users can operate single mode, or canuse multi mode to switch control mode. The diagram below is the description of parameter.

Parameter Signal	Name	Setting	Description	Control Mode
★Cn001	Control mode select	0	**Torque control** To use one analog voltage command signal to control torque. Please refere to **5-2**.	ALL
		1	**Speed control** To use input contact **SPD1** and **SPD2** to switch the default 3-stages speed command and to use one analog voltage command signal in the drive to control speed. Please refere to **5-3-1**.	
		2	**Position control (External pulse command)** To use one pulse command signal to control position. Please refer to **5-4-1**.	
		3	**Position / Speed control switch** To use input contact **MDC** to switch position and speed control. Please referto **5-6-2**.	
		4	**Speed / Torque control switch** To use input contact **MDC** to switch speed and torque control. Please refere to **5-6-2**.	
		5	**Position / Torque control switch** To use input contact **MDC** to switch position and torque control. Please refere to **5-6-2**.	
		6	**Position control (internal position command)** To use input contact **POS1~POS4** to switch the default 16-stage position command to control position. Please refere to **5-4-2**.	

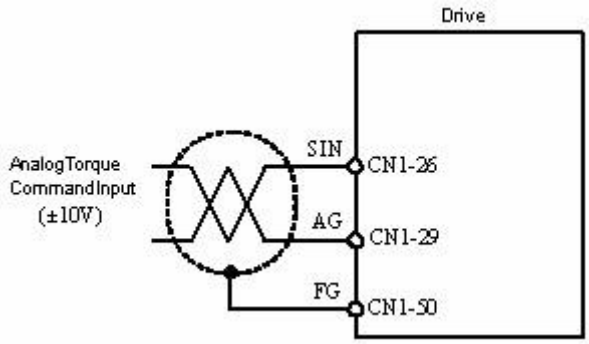
★The setting will be in effect after returning on the power.

5-2 Torque mode

Torque mode is applied in priting machine, coil wiring machine, injection molding machine andother torque control applied area. The diagram below is about torque loop control:



The method of torque command input of this device: Using one group of analog voltage to control motor torque. The diagram below is the wiring:



Attention! User need to confirm the relationship between SIN(analog torque command input) and input contacts RS1, RS2(torque command CW/CCW selection). Refer to Chapter 5-2-4.

5-2-1 Analog torque command ratio

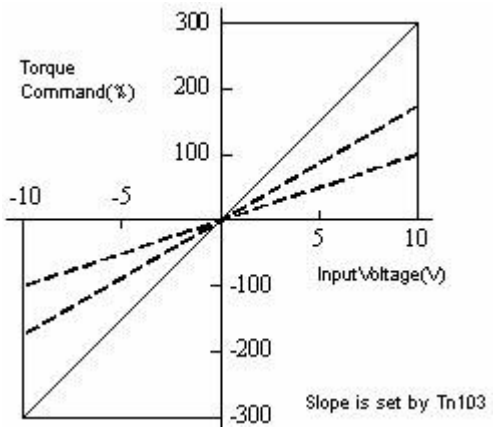
Refering to analog torque command ratio to adjust the slope between voltage command to torque command.

Parameter Signal	Name	Default	Unit	Setting range	Control Mode
Tn103	Analog torque command ratio	300	%/10V	0~300	T

Setting example:

(1) If entering 300 in **Tn103** ⇗ input voltage 10V corresponding 300% ratio torque command; if voltage is 5V ⇗ corresponding 150% ratio torque command.

(2) If entering 200 in**Tn103**⇗ input voltage 10V corresponding 200% ratio torque command; if voltage is 5V ⇗ corresponding 100% ratio torque command.

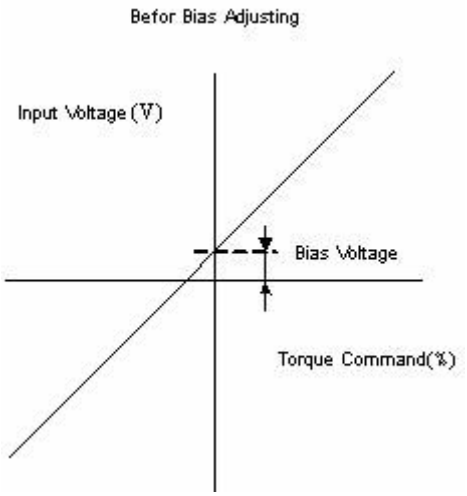


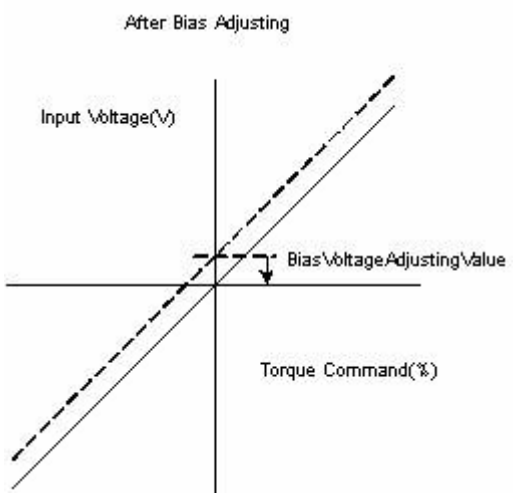
5-2-2 Analog torque command bias adjusting

Even the torque command is 0V, motor could also posibly rotate slowly. The main reason is that external analog voltage has a few bias value. Under this situation, user can directly adjust **Tn104** to adjust the bias value or use auto-adjusting. (Please refer to **3-2-2**).

Attention! Please let the analog torque command contact SIN(CN1-26) and analog grounding contact AG (CN1-29) close loop.

Parameter Signal	Name	Default	Unit	Setting range	Control mode
Tn104	Analog torque command bias adjusting	0	mV	-10000~10000	T





5-2-3 Torque command linear ac/deceleration

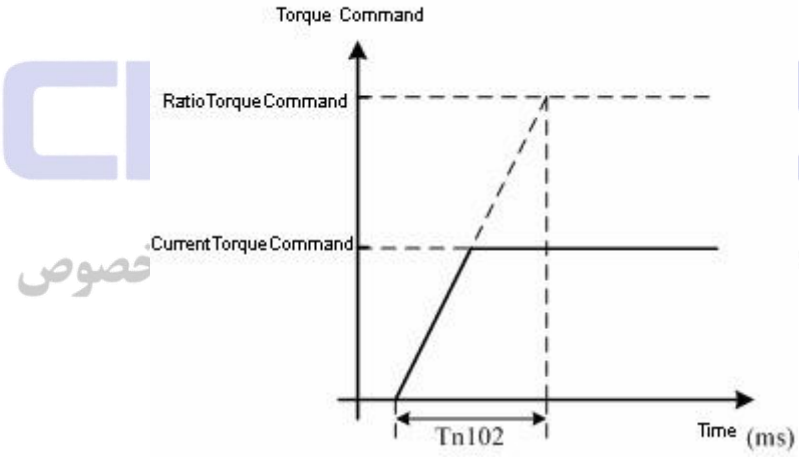
If users need smooth torque command, they can set the torque command linear ac/deceleration constant to achieve smooth result. **If user need this function, please set Tn101 to "1" to operat this function.**

Parameter Signal	Name	Setting	Description	Control mode
★Tn101	Torque command ac/deceleration	0	No operating torque command linear ac/deceleration function	T
		1	Operating torque command linear ac/deceleration function	

The Definition of torque command linear ac/deceleration constant means **The Time** in which the torque command arises from "0" to the ratio torque. Here is the diagram:

Parameter Signal	Name	Defaut	Unit	Setting Range	Control mode
★Tn102	Torque commandac/deceleration Connstant	1	msec	1~50000	T

★The setting will be in effect after returning on the power



Setting example:

(1) Achieve 50% of ratio torque output in 10msec:

$$Tn102 = 10(msec) \times \frac{100\%}{50\%} = 20(msec)$$

(2) Achieve 75% of ratio torque output in 10msec:

$$Tn102 = 10(msec) \times \frac{100\%}{75\%} = 13(msec)$$

5-2-4 Definition of torque output direction

In torque mode, user can use the 3 methods below to definit motor rotating direction:

(1) Input contacts **RS1**, **RS2**(torque command CW/CCW select)

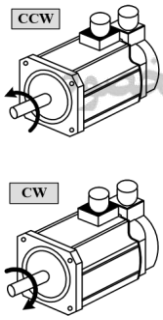
(2)**Cn004**(motor rotate direction definition)

(3) Input contact **TRQINV**(torque command inverse)

Attention! 3 methods can operate at the same time. User need to make sure the final motor direction definition in order to avoid erro.

Input Contact		**Descrpition**	**Control mode**
RS2	**RS1**		
0	0	No torque	T
0	1	Rotating in current torque command direction	
1	0	Rotating in current torque command inverse direction	
1	1	No torque	

P.S.: Input contacts status 1 means on; 0 means off. Please check 5-6-1 to set high electric potential or low electric potential

Parameter Signal	**Name**	**Setting**	**Description**		**Control mode**
Cn004	Motor rotating direction definition (load terminal) 		**Torque Control**	**Speed Control**	S/T
		0	(CCW)	(CCW)	
		1	(CW)	(CCW)	
		2	(CCW)	(CW)	
		3	(CW)	(CW)	

Input contact TRQINV	**Description**	**Control mode**
0	Rotating in current torque command direction	T
1	Rotating in current torque command interse direction	

P.S.: Input contacts status 1 means on; 0 means off. Please check 5-6-1 to set high electric potential or low electric potential

5-2-5 Internal torque limit setting

In the Torque Control, user can set internal torque limit value when needed. Here below is the setting:

Parameter Signal	Name	Default	Unit	Setting range	Control mode
Cn010	CCW Torque command limit value	100	%	0~300	ALL
Cn011	CW Torque command limit value	-100	%	-300~0	ALL

5-2-6 Speed limit of torque mode

In torque control, user can use input contacts **SPD1** and **SPD2** switching the 2 methods to operate the motor speed limit.

(1) Internal speed limit: Internal default 3-stages speed limit

(2) External analog command limit: Using a analog voltage command signal and entering to **PIC(CN1-27)** to control speed limit.

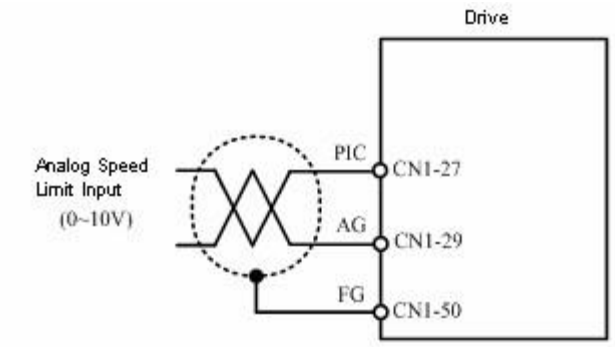
Attention! About the setting of the motor speed limit smooth handling, please refer to 5-3-6.

Please refer to the diagram below:

Input contact SPD2	Input contact SPD1	Speed limit command	Control mode
0	0	External analog command **PIC(CN1-27)**	T
0	1	Internal speed limit1 **Tn105**	
1	0	Internal speed limit2 **Tn106**	
1	1	Internal speed limit3 **Tn107**	

P.S.: Input contacts status 1 means on; 0 means off. Please check 5-6-1 to set high electric potential or low electric potential

Here below is the external analog speed limit command wiring diagram:



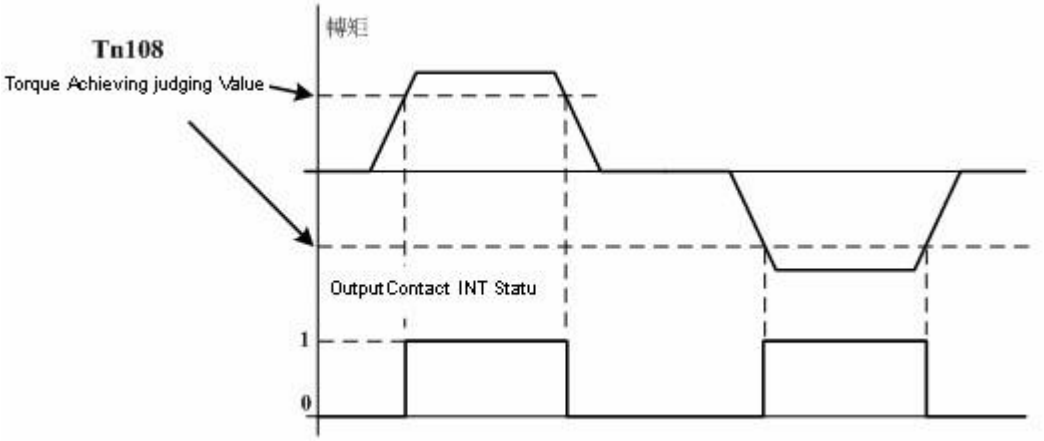
The diagram below is the internal 3-stages speed limit setting. The setting value means motor CCW and CW speed limit value.

Parameter Signal	Name	Default	Unit	Setting range	Control mode
Tn105	Internal speed limit 1	100	rpm	0~3000	T
Tn106	Internal speed limit 2	200	rpm	0~3000	T
Tn107	Internal speed limit 3	300	rpm	0~3000	T

5-2-7 Other torque control functions

When the torque of CW or CCW is more than the speed in **Tn108** (torque achieving judging value), the output contact **INT** operates. Here is the description:

Parameter Signal	Name	Default	Unit	Setting range	Control mode
Tn108	Torque achieving judging value	100	%	0~300	ALL



P.S.: Input contacts status 1 means on; 0 means off. Please check 5-6-1 to set high electric potential or low electric potential

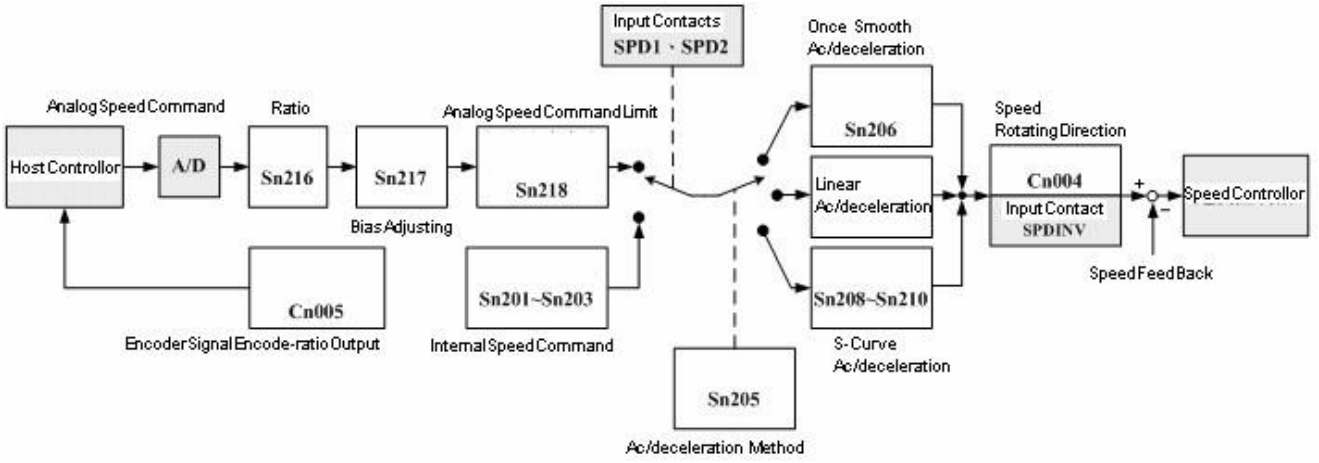
When there were vibrating noice, user can adjust the Cn034 (torque command smooth filter) to avoid it. To add this filter will cause delay of the response speed of servo.

Parameter Signal	Name	Default	Unit	Setting range	Control mode
Cn034	Torque command smoothe filter	0	Hz	0~1000	ALL

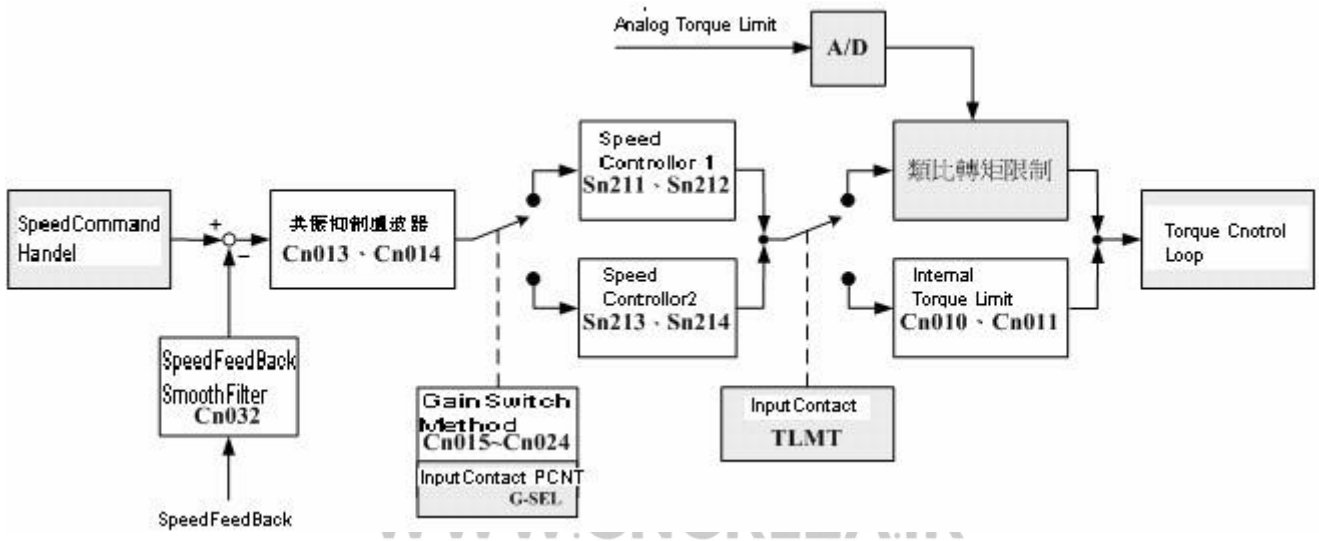
5-3 Speed Mode

The speed mode is necessary during the accurate application. Ex: Weaving machine, drilling machine and CNC machine. The 2 diagrams below is about speed loop control. And the detail functions is descripted in following chapter.

Speed Command Handling



Speed Controllor



5-3-1 Speed Command Selecting

There are 2 kinds of input command method. Using input contacts - **SPD1、SPD2 –** to switch the 2 methods below to operate speed command:

(1) Internal speed command: Internal default 3-stages speed command.

(2) External analog command: Using 1 analog voltage command signal ☞ entering **SIN(CN1-26)** to control speed.

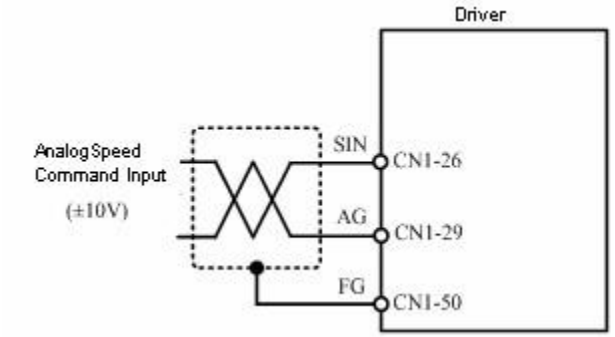
Please refer to this diagram:

Input Contact SPD2	Input ContactSPD1	Speed Command	Control Mode
0	0	External analog command **SIN(CN1-26)**	S

0	1	Internal speed command 1 **Sn201**	
1	0	Internal speed command 2 **Sn202**	
1	1	Internal speed command 3 **Sn203**	

P.S.: Input contacts status 1 means on; 0 means off. Please check 5-6-1 to set high electric potential or low electric potential.

The diagram below is about external analog speed command wiring:



And here is the internal 3 stages spped command setting:

Parameter Signal	Name	Default	Unit	Setting range	Control mode
Sn201	Internal speed command 1	100	rpm	-3000~3000	S
Sn202	Internal speed command 2	200	rpm	-3000~3000	S
Sn203	Internal speed command 3	300	rpm	-3000~3000	S

5-3-2 Analog Speed Command Ratio

Matching up analog speed command ratio to adjust the slope of voltage command with speed command.

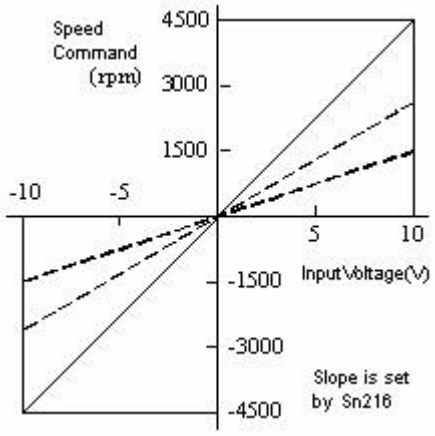
Parameter Signal	Name	Default	Unit	Setting range	Control mode
Sn216	Analog speed command ratio	3000	rpm/10V	100~4500	S

Setting Example:

(1) When **Sn216** is 3000, which stands for input voltage 10V matching up 3000rpm; if input voltage is 5V, it matches up 1500rpm speed command.

(2) When **Sn216** is 2000, which stands for input voltage 10V matching up 2000rpm; if input voltage is 10V,

it matches up 1000rpm speed command.

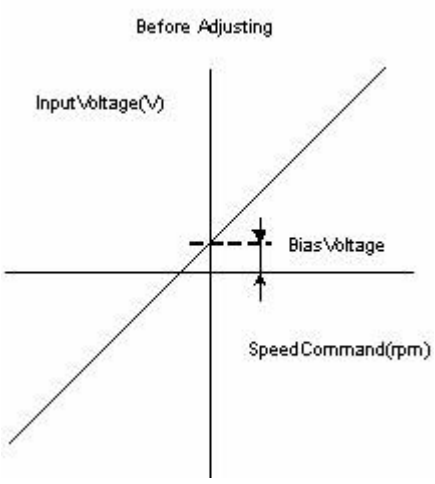


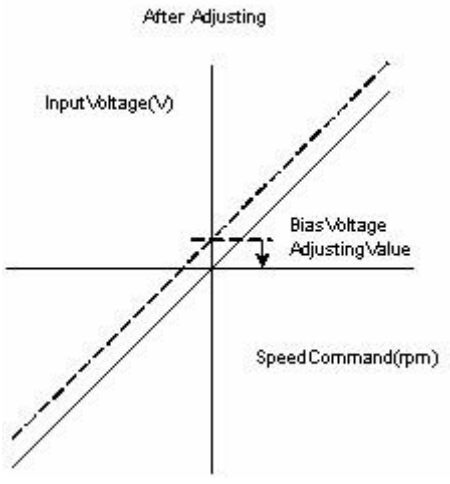
5-3-3 Analog Speed Command Bias Adjusting

Even the analog speed command is 0V, motor could possibly rotate slowly. The main reason is external analog voltage has few bias. User can use **Sn217** to adjust bias value or automatic adjusting under this situation. (Please refer **3-2-2**).

Attention! Please close loop to analog speed contact Sin(CN1-26) and analog grounding contact AG(CN1-29) befor adjusting.

Parameter signal	Name	Default	Unit	Setting range	Control mode
Sn217	Analog speed command bias adjusting	0	mV	-10000~10000	S





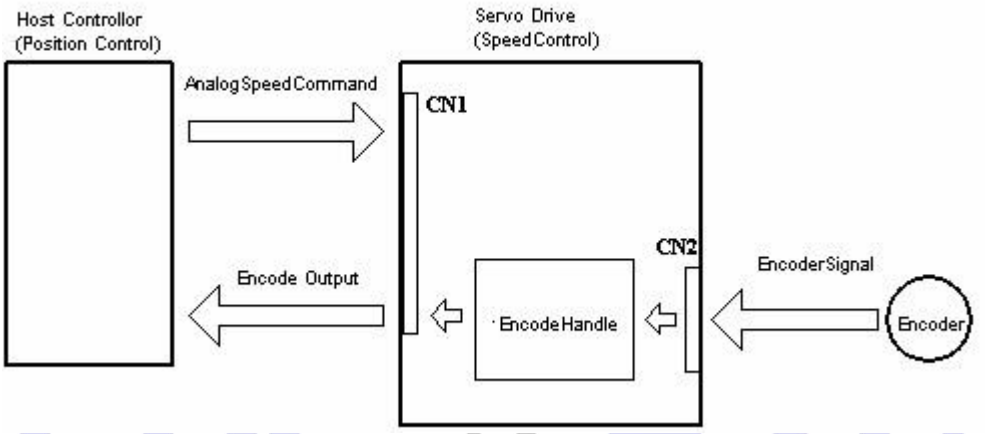
5-3-4 Analog Speed Command Limit

User can limit the analog speed command, here is the setting:

Parameter signal	Name	Default	Unit	Setting range	Control mode
Sn218	Analog speed command limit	3050	rpm	100~4500	S

5-3-5 Encoder Signal – Encode Output

The encoder signal of motor can be encoded handled through this device ⇗ then outputing to host control to become to position control loop. Here is the diagram: :



Encode handling ⇗ Pulse signal number of MotorEncoder's one rotation transform to **Cn005** default pulse signal number.

Parameter signal	Name	Default	Unit	Setting range	Control mode
★Cn005	Encoder signal encode output	Encoder Pulse number / 1 rotating	pulse	1~ encoder pulse number of 1 rotating	ALL

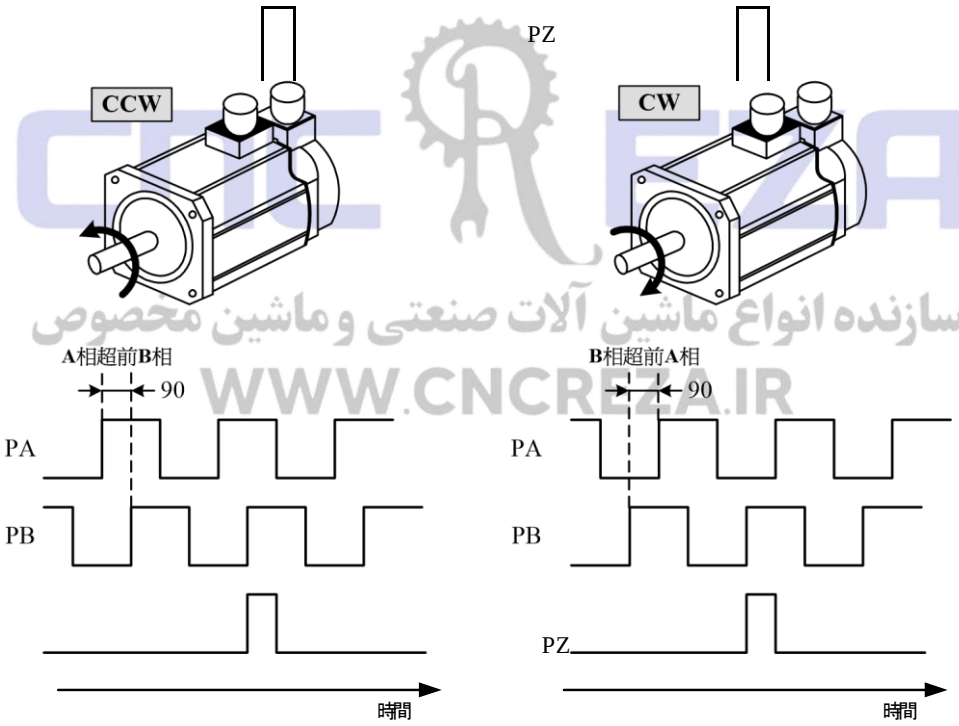
★The setting will be in effect after returning on the power.

Attention! The setting range can not more than motor encoder pulse number of 1 rotating.

Pulse signal definition of encode output:

Code of Terminal layout	Name	Number of Terminal layout	Control mode
PA	Encoder output A Phase signal	CN1-35	ALL
/PA	Encoder output /A Phase signal	CN1-36	
PB	Encoder output B Phase signal	CN1-37	
/PB	Encoder output /B Phase signal	CN1-38	

PZ	Encoder output Z Phase signal	CN1-39	
/PZ	Encoder output /Z Phase signal	CN1-40	



5-3-6 Speed Command Smoothly

When there are overshooting or vibration of motor after entering command, user can execute the 3 kinds of speed command smooth control in this drive and decide to execute which smooth control in accordance with which necessary.

If user executes one of them, please set Sn205 first to turn on all functions.

Parameter Signal	Name	Setting	Description	Control mode

Sn205	Speed command ac/deceleration n method	0	No using speed command ac/deceleration function	S
		1	To use speed command once smooth ac/deceleration function	
		2	To use speed command linear ac/deceleration function	
		3	To use S-curve speed command ac/deceleration function	

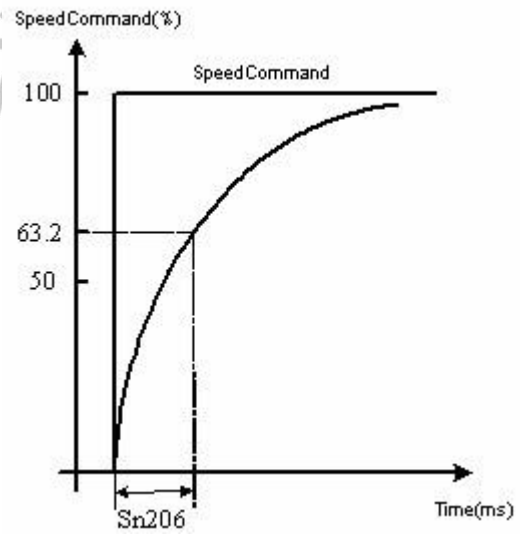
Here is the description of 3 kinds of speed command smooth control.

(1) Speed command once smooth ac/deceleration:

User must set **Sn205=**1 to turn on speed command once smooth ac/deceleration function before using this function.

Parameter Signal	Name	Default	Unit	Setting range	Control mode
Sn206	Speed command once smooth ac/deceleration Time Constant	1	msec	1~10000	S

The definition of Speed command once smooth ac/deceleration Time Constant means the time in which the speed increases from 0 to 63.2%. Here below is the diagram:



Setting example:

(1) If achieving 95% of speed command output in 30msec:

$$Sn206 = \frac{30(msec)}{-\ln(1-95\%)} = 10(msec)$$

(2) If achieving 75% of speed command output in 30msec:

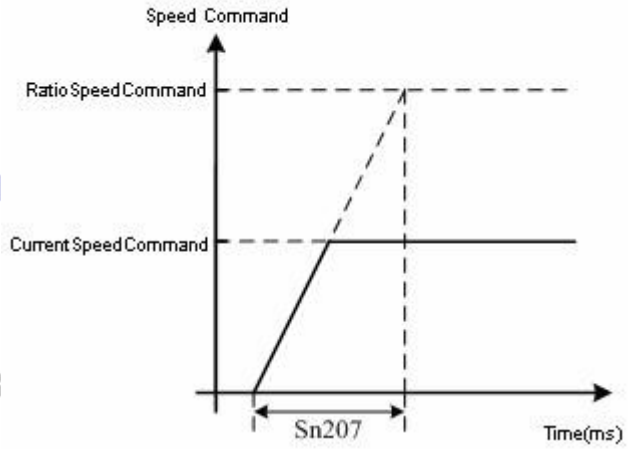
$$Sn206 = \frac{30(msec)}{-\ln(1-75\%)} = 22(msec)$$

(2) Speed command linear ac/deceleration function:

User must set **Sn205=2** to turn on speed command linear ac/deceleration function before using this function.

Parameter Signal	Name	Default	Unit	Setting range	Control mode
Sn207	Speed command linear ac/deceleration constant	1	msec	1~50000	S

The definition of Speed command linear ac/deceleration Constant means the time in which the speed increases (linear) from zero to the ratio speed. Here below is the diagram:



Setting example:

(1) If achieving 50% of ratio speed output in 10msec:

$$Sn207 = 10(msec) \times \frac{100\%}{50\%} = 20(msec)$$

(2) If achieving 75% of ratio speed output in 10msec:

$$Sn207 = 10(msec) \times \frac{100\%}{75\%} = 13(msec)$$

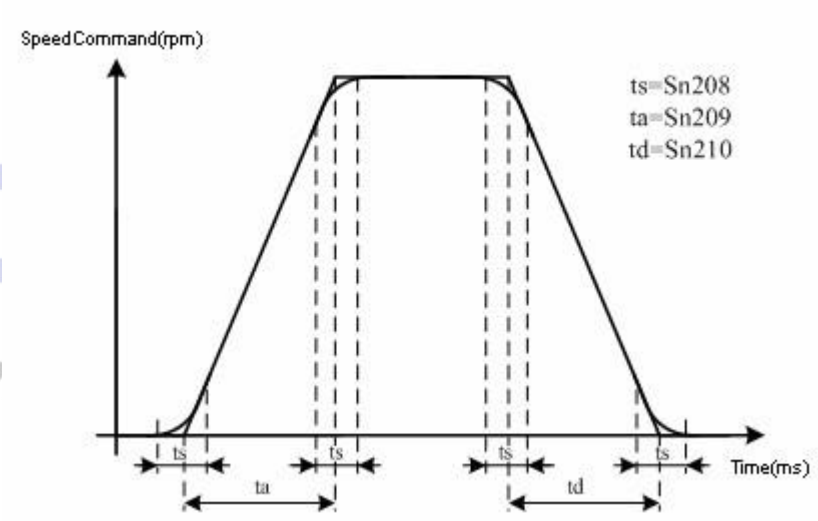
(3) S-Curve Speed Command Ac/Deceleration:

User must set **Sn205=3** to turn on S-Curve speed command ac/deceleration function before using this function.

Parameter Signal	Name	Default	Unit	Setting range	Control mode

Sn207	Speed command linear ac/deceleration constant	1	msec	1~50000	S
Sn208	S-Curve speed command ac/deceleration time setting	1	msec	1~1000	S
Sn209	S-Curve speed command acceleration time setting	200	msec	0~10000	S
Sn210	S-Curve speed command deceleration time setting	200	msec	0~10000	S

Ac/deceleration ☞ Because of strong change of ac/deceleration when on or off, which will cause vibration of mechanical system. Adding S-Curve ac/deceleration in speed command ☞ it can achieve smoothly operating.



Attention! Setting Rule: $t_{2a} > t_s$, $t_{2d} > t_s$

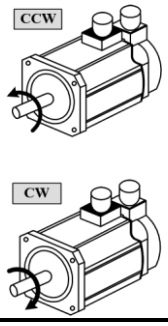
5-3-7 Speed Rotating Direction Definition

In speed mode, use can use **Cn004**(motor rotating direction definition) and input contact **SPDINV** to definite motor rotating definition. Here below is the description:

Attention! The 2 methods can operate at the same time. User must confirm the final motor direction to avoid confusion.

Here is the motor direction setting:

Parameter Signal	Name	Setting	Description		Control mode
Cn004			**Torque control**	**Speed control**	S/T

Motor rotating direction definition (motor load terminal) 	**0**	(CCW)	(CCW)	
	1	(CW)	(CCW)	
	2	(CCW)	(CW)	
	3	(CW)	(CW)	

Input contact SPDINV	Description	Control mode
0	Rotating with current speed command direction	S
1	Rotating with current speed command inverse direction	

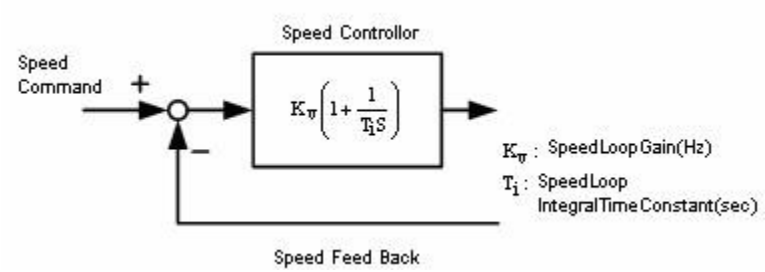
P.S.: Input contacts status 1 means on; 0 means off. Please check 5-6-1 to set high electric potential or low electric potential

5-3-8 Speed Loop Gain

The diagram below is the related parameters of speed control loop. This device provides 2 speed controller. User can use gain switch function to switch them. (Please refer to **5-3-11**)

Parameter Signal	Name	Default	Unit	Setting range	Control mode
Sn211	Speed loop gain 1	40	Hz	10~450	Pe/Pi/S
Sn212	Speed loop integral time constant 1	100	x0.2 msec	1~500	Pe/Pi/S
Sn213	Speed loop gain 2	40	Hz	10~450	Pe/Pi/S
Sn214	Speed loop integral time constant 2	100	x0.2 msec	1~500	Pe/Pi/S

The foto below is about the speed controller of this device. More the speed loop gain is or less the speed loop integral time is, faster the speed control respond. Please refer to **5-5** to check the method of speed loop control gain.



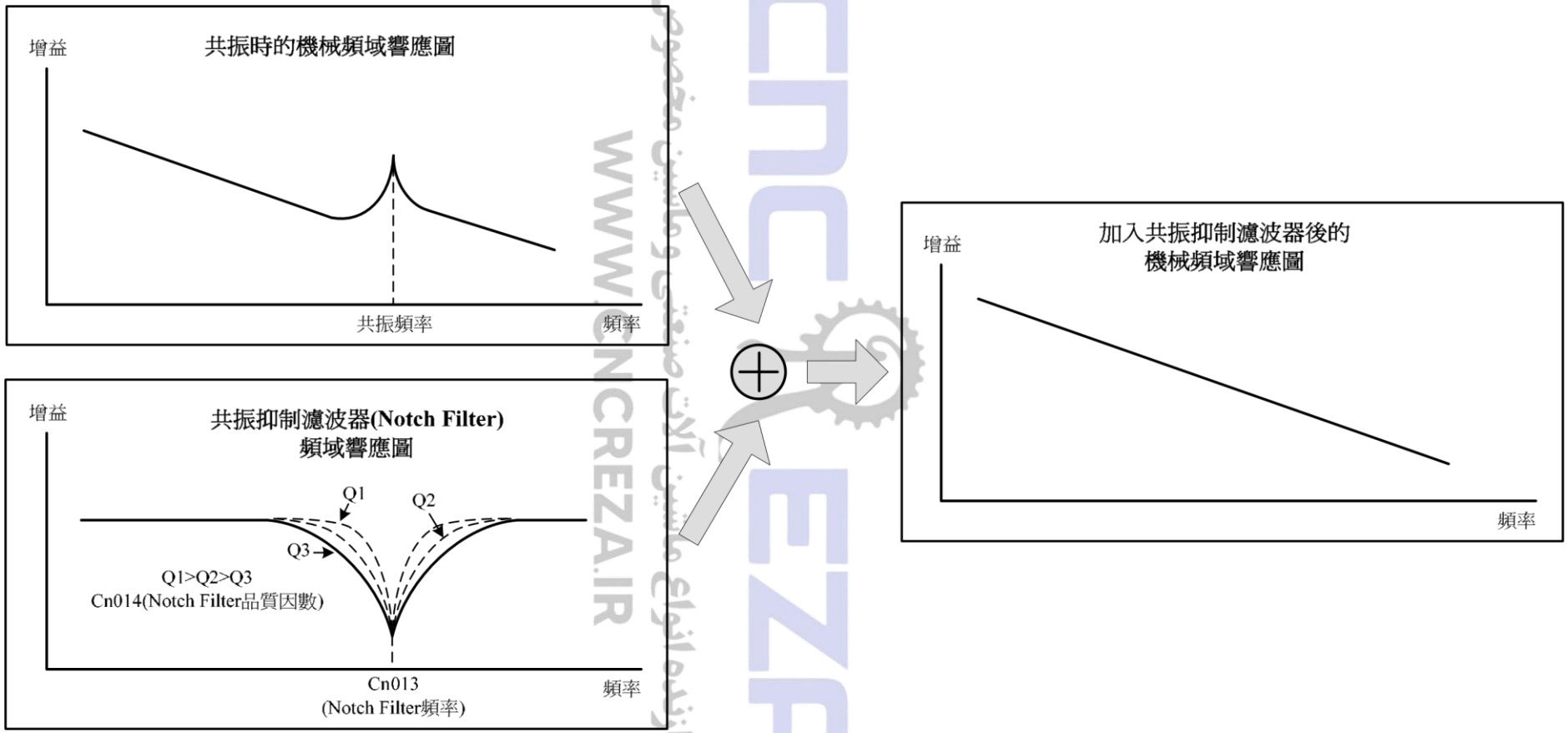
5-3-9 Notch Filter

When the low machine rigidity, the bearing twisting or other vibration situation causing vibration or noise (the mechanical system can not increase controller gain), this device provides Notch Filter to clear this phenomenon.

Inputing vibrating frequency in Cn013(Notch Filter frequency) and matching up **Cn014** () to adjust the frequency range. Lower the Cn014 value is, wider the frequency range is. User can adjust in accordance with actual situation.

Attention! When Cn013 set "0", it means no using Notch Filter. Enter the frequency from vibration in Cn013 (frequency of notch filter), then match with Cn014 (quality factor of notch filter).

Parameter Signal	Name	Default	Unit	Setting range	Control mode
Cn013	Notch Filter frequency	0	Hz	0~1000	Pi/Pe/S
Cn014	Quality Factor of Notch Filter	7	X	1~100	Pi/Pe/S



5-3-10 Torque Limit in Speed Mode

In speed mode, the motor torque limit is achieved by input contact **TLMT** switching the 2 methods below:

(1) Inter toque limit: Using internal default **Cn010**(CCW Torque command limit value) and **Cn011**(CW Torque command limit value).

(2) External analog command: Using 2 groups of analog voltage command signals to enter **PIC(CN1-27)** separately to limit CCW torque and **NIC(CN1-28)** to CCW torque.

Please refer to the diagram below:

Input contact TLMT	CCW torque command limit source	CW torque command limit source	Control mode
0	**Cn010**	**Cn011**	ALL
1	External analog command **PIC(CN1-27)**	External analog command **NIC(CN1-28)**	Pi/Pe/S

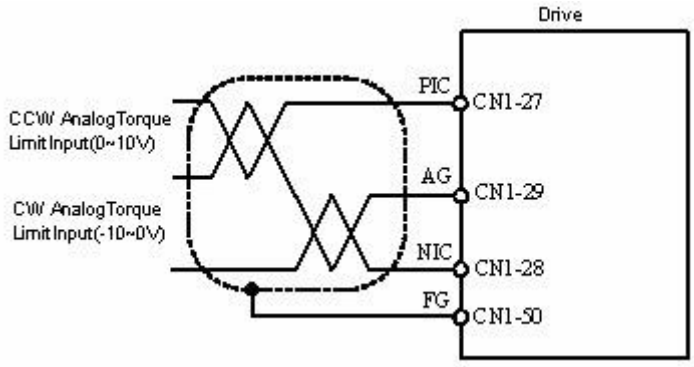
P.S.: Input contacts status 1 means on; 0 means off. Please check 5-6-1 to set high electric potential or low electric potential

Attention! To use external analog torque command limit ☞ If this analog torque command limit is more than internal torque command limit, the internal torque command limit will be the major finally.

The description below is about the internal torque limit setting:

Parameter signal	Name	Default	Unit	Setting range	Control mode
Cn010	CCW torque command limit value	100	%	0~300	ALL
Cn011	CW torque command limit value	-100	%	-300~0	ALL

The diagram below is about the external analog torque limit command wiring:



5-3-11 Gain Switch Function

The gain switch function in this device contains speed loop gain PI/P switching and 2-stage gain switching. The applications are:

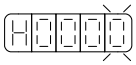
(1) In speed control, to restrain ac/deceleration overshooting.

(2) In position control, to restrain the breadth of vibration and decrease the adjusting time.

(3) To decrease the noise from using Servo Lock function.

Here below are about the related parameter description:

Before PI/P mode ☞ Selecting **Cn015.0** (Selection of PI/P-mode type), and set PI/P-mode switching condition in related parameters. Here is the description:

Parameter Signal	Name	Setting	Description	Control mode
Cn015.0 	Selection of PI/P-mode type	0	Estimate if the torque command is more than **Cn016**	Pi/Pe/S
		1	Estimate if the speed command is more than **Cn017**	
		2	Estimate if the speed command is more than **Cn018**	
		3	Estimate if the position error value is more than **Cn019**	
		4	Using input contact PCNT to switch them	

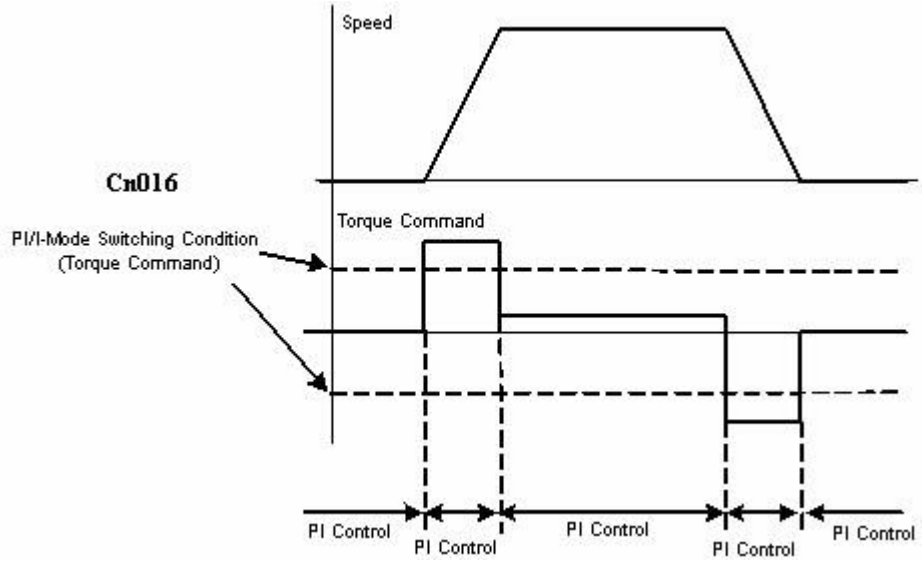
Parameter Signal	Name	Default	Unit	Setting range	Control mode
Cn016	PI/P-mode switching condition (torque command)	200	%	0~399	Pi/Pe/S
Cn017	PI/P-mode switching condition (speed command)	0	rpm	0~4500	Pi/Pe/S
Cn018	PI/P-mode switching condition (acceleration)	0	rps/s	0~18750	Pi/Pe/S
Cn019	PI/P-mode switching condition (position error value)	0	pulse	0~50000	Pi/Pe/S

(1) Estimating torque command to switch PI/P-mode

When torque command is less than **Cn016** switching condition: Controlled by PI;

When torque command is more than **Cn016** switching condition: switching to : Controlled by P only.

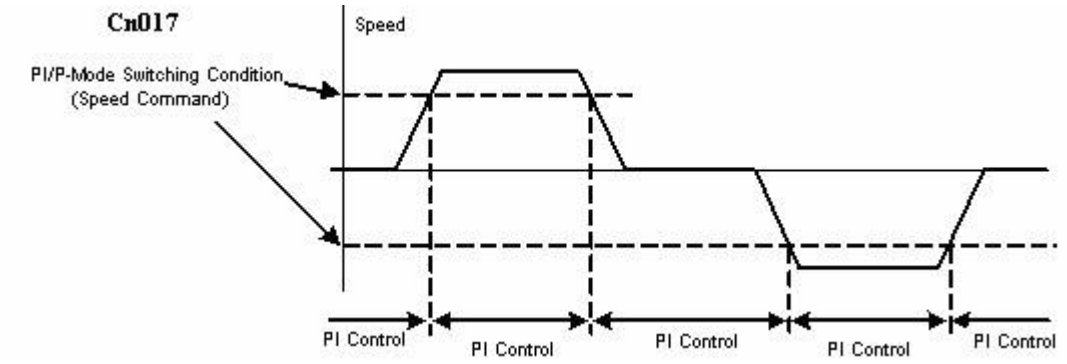
Here is the diagram below:



(2) Estimating speed command to switch PI/P-mode

When speed command is less than **Cn017** switching condition: Controlled by PI; When speed command is more than **Cn017** switching condition: Controlled by P only.

Here is the diagram below:

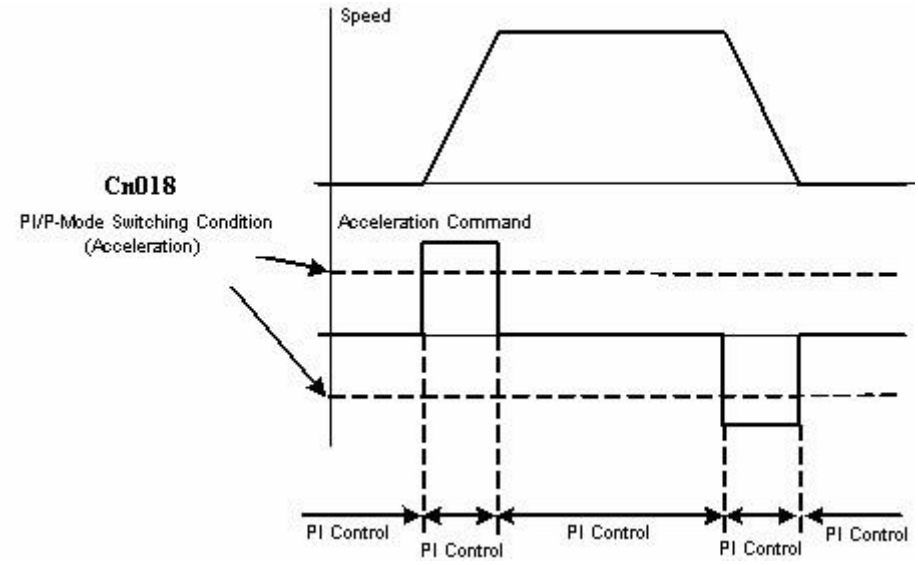


(3) Estimating acceleration command to switch PI/P-mode

When acceleration command is less than **Cn018** switching condition: Controlled by PI;

When acceleration command is more than **Cn018** switching condition: Controlled by P only.

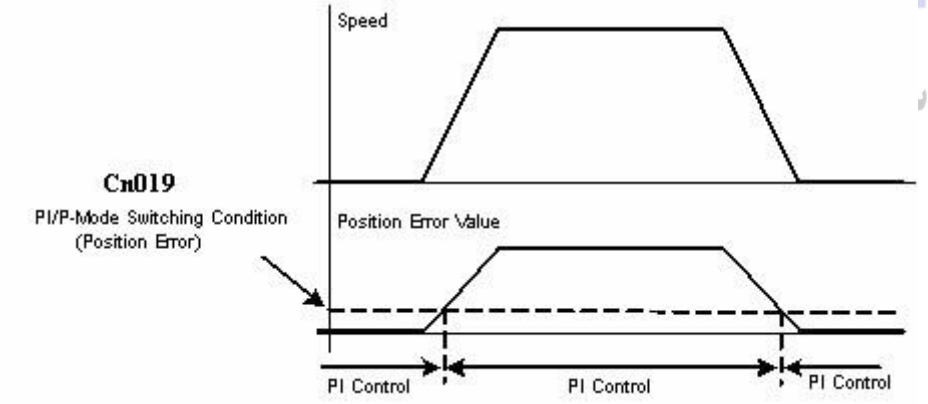
Here below is the diagram:



(4) Estimating position error value to switch PI/P-mode

When position error value is less than **Cn019** switching condition: Controlled by PI; When position error value is more than **Cn019** switching condition: Controlled by P only.

Here below is the diagram:

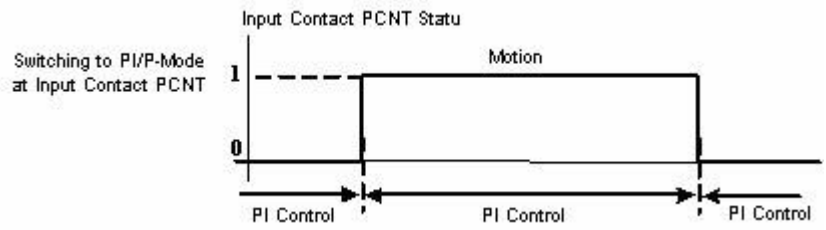


(5) Using input contact **PCNT** to switch PI/P-mode

When input contact **PCNT** doesn't operate: Controlled by PI;

When input contact **PCNT** oerates: Controlled by P only.

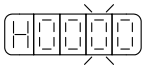
Here below is the diagram:



P.S.: Input contacts status 1 means on; 0 means off. Please check 5-6-1 to set high electric potential or low electric potential.

2 Stages Gain Switching Mode

Select Cn015.1 (estimating-type selection of 2 stages gain mode) and set the switching conditions of 2 stages gain mode at related parameter, before using 2 stages gain switching mode. The difference between PI/P-mode and this mode is that, this mode contains the delay time setting. Here below is the description:

Parameter Signal	Name	Setting	Description	Control Mode
Cn015.1 	Estimating-type selection of 2 stages gain mode	0	Estimating if torque command is more than **Cn021**	Pi/Pe/S
		1	Estimating if speed command is more than **Cn022**	
		2	Estimating if acceleration command is more than **Cn023**	
		3	Estimating of position error value is more than 於 **Cn024**	
		4	Using input contact **G-SEL** to switch	

Parameter Signal	Name	Default	Unit	Setting Range	Control Mode
Cn020	Delay time of 2 stages gain mode	0	x0.2msec	0~10000	Pi/Pe/S
Cn021	Switching condition of 2 stages gain mode (torque command)	200	%	0~399	Pi/Pe/S
Cn022	Switching condition of 2 stages gain mode (speed	0	rpm	0~4500	Pi/Pe/S
	command)				
Cn023	Switching condition of 2 stages gain mode (acceleration command)	0	rps/s	0~18750	Pi/Pe/S

Cn024	Switching condition of 2 stages gain mode (position error value)	0	pulse	0~50000	Pi/Pe/S

P.S.: The 1st gain contains **Pn310**(position loop gain 1), **Sn211**(speed loop gain 1) and **Sn212**(Speed loop integral time constant 1).

The 2nd gain contains **Pn311**(position loop gain 2), **Sn213**(speed loop gain 2) and **Sn214**(speed loop integral time constant 2).

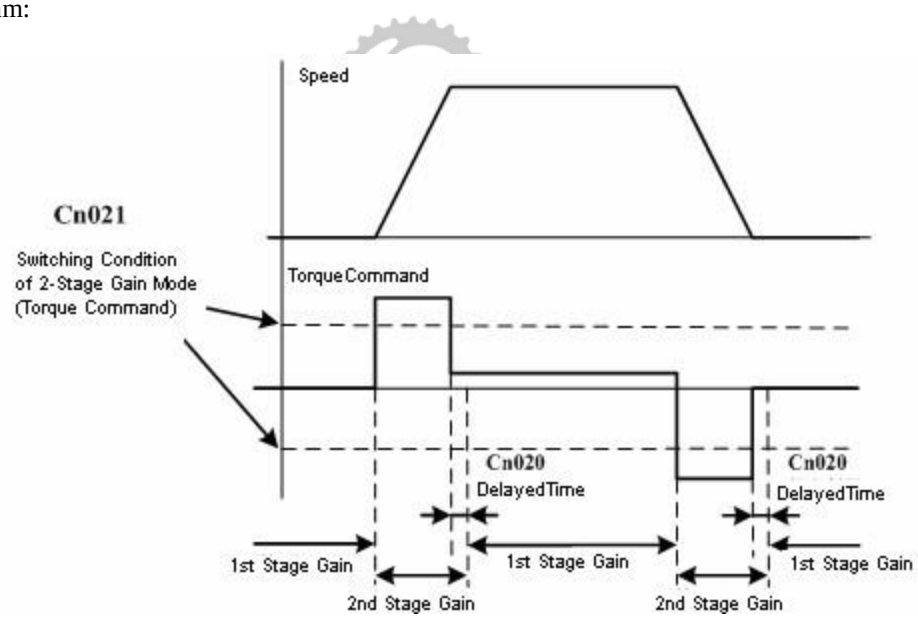
(1) Estimating torque command to switch 2 stages gain mode

When torque command is less than **Cn021** switching condition: Using the 1st gain control;

When torque command is more than **Cn021** switching condition: Swtiching to the 2nd gain control;

When torque command is less than **Cn021** switching condition again: Swtiching to the 1st gain control in accordance with **Cn020** switching delay time.

Here is the diagram:

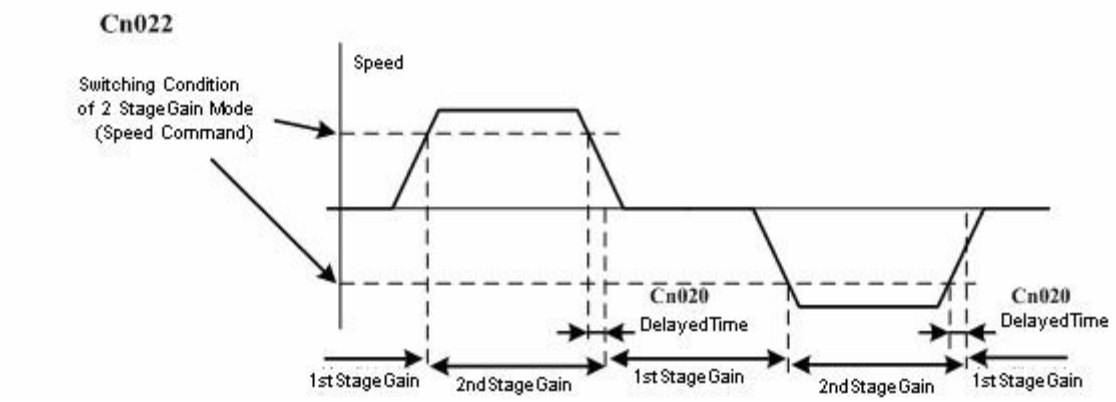


(2) Estimating speed command to switch 2 stages gain mode

When speed command is less than **Cn022** switching condition: Using the 1st gain control;

When speed command is more than **Cn022** switching condition: Switchng to the 2nd gain control;

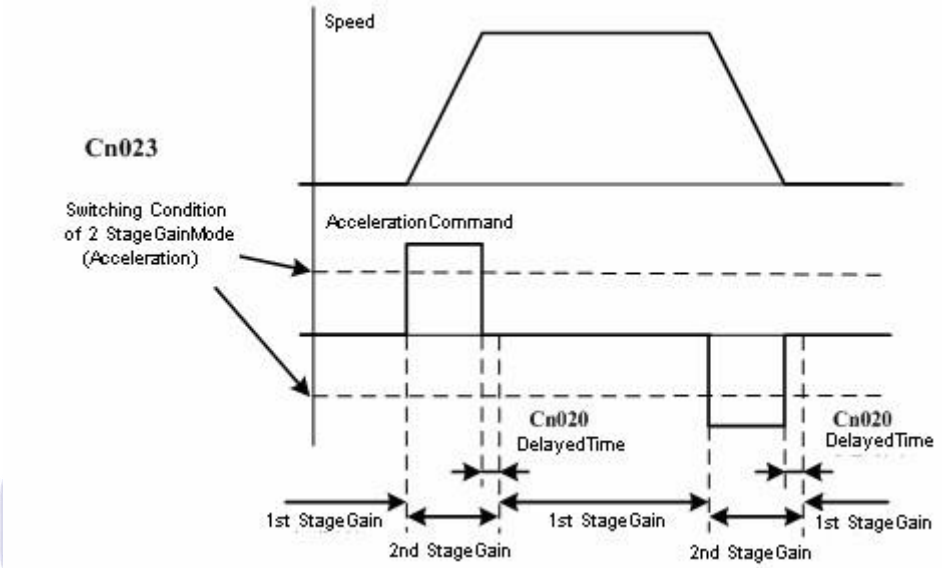
When speed command is less than **Cn022** switching condition again: Switching to the 1st gain control in accordance with Cn020 switching delay time.



(3) Estimating acceleration command to switch 2 stages gain mode

When acceleration command is less than **Cn023** switching condition: Using the 1st gain control. ↱

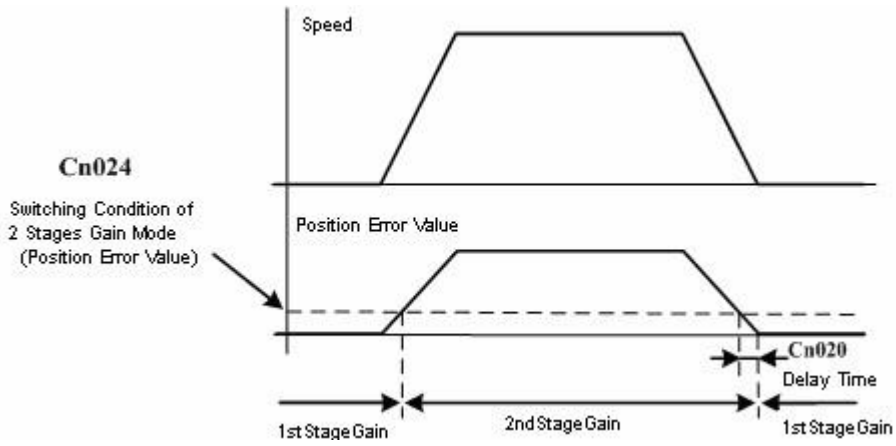
When acceleration command is more than **Cn023** switching condition: Switching to the 2nd gain control ↱ When acceleration command is less than **Cn023** switching condition again: Switching to the 1st gain control in accordance with Cn020 switching delay time.



(4) Estimating position error value to switch 2 stages gain mode

When position error value is less than **Cn024** switching condition: Using the 1st gain control; ↱

When position error value is more than **Cn024** switching condition: Switching to the 2nd gain control; ↱ When position error value is less than **Cn024** switching condition again: Switching to the 1st gain control in accordance with Cn020 switching delay time. Here is the diagram:

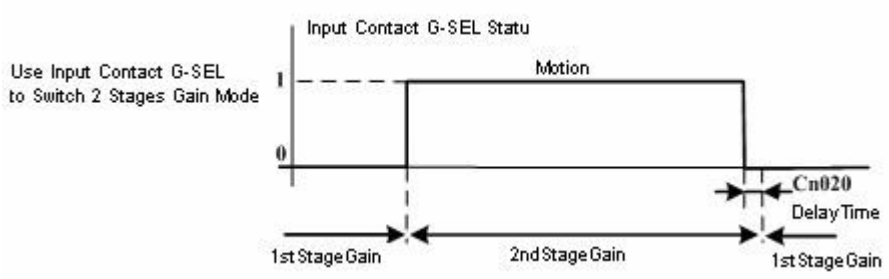


(5) Using input contact **G-SEL** to switch 2 stages gain mode

When the input contact **G-SEL** doesn't work: Using the 1st gain control;

When the input contact **G-SEL** works: Switching to the 2nd gain control;

When the input contact **G-SEL** doesn't work again: Switching to the 1st gain control in accordance with **Cn020** switching delay time. Here is the diagram:



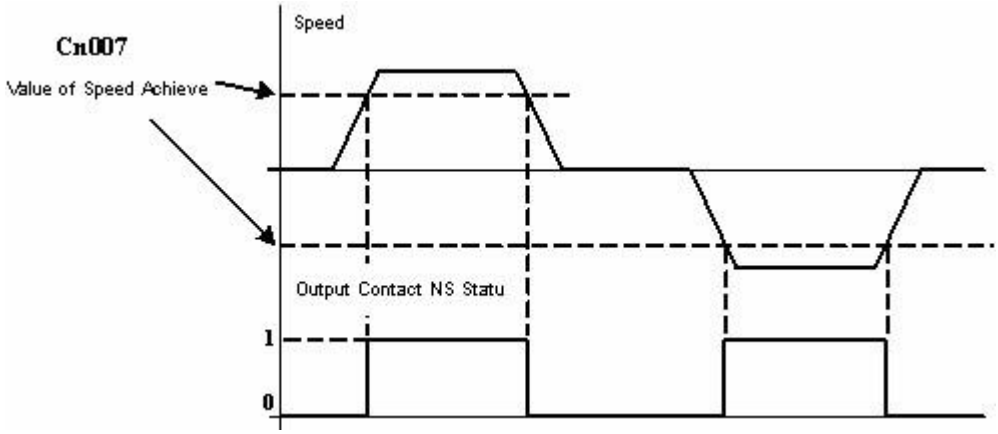
P.S.: Input contacts status 1 means on; 0 means off. Please check 5-6-1 to set high electric potential or low electric potential

5-3-12 Other Speed Control Functions

Speed Achieve Function

When the speed of CW or CCW is more than the speed in **Cn007** (Value of speed achieve), output contact INS will work:

Parameter Signal	Name	Default	Unit	Setting Range	Control Mode
Cn007	Value of speed achieve	1000	rpm	0~4500	S/T

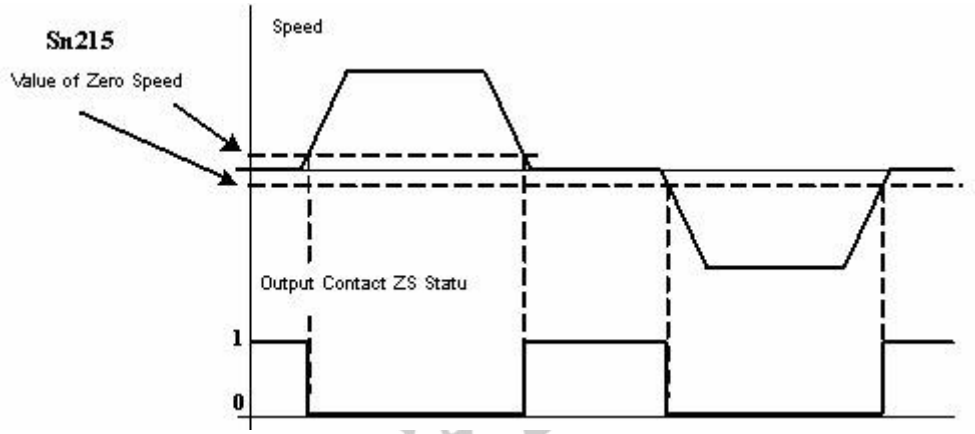


P.S.: Input contacts status 1 means on; 0 means off. Please check 5-6-1 to set high electric potential or low electric potential

Zero Speed Function

When the speed is less than the speed in Sn215 (Value of ZS), the output contact **ZS** works:

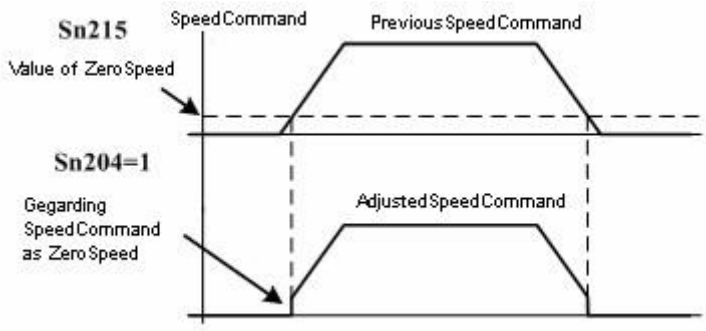
Parameter Signal	Name	Default	Unit	Setting Range	Control Mode
Sn215	Value of zero speed	50	rpm	0~4500	S



P.S.: Input contacts status 1 means on; 0 means off. Please check 5-6-1 to set high electric potential or low electric potential

User can set Sn204 () to "1". When the Zero-Speed is complete, the speed command is regarded as "0":

Parameter Signal	Name	Setting	Description	Control Mode
Sn204	Operation of Zero Speed completed	0	No any operation	S
		1	Regarding speed commans as zero speed	



In speed mode: the Servo Lock is used to lock servo motor when input voltage command is not 0V. When input contact **LOK** operates: Although this device stays in speed mode, it will change to internal position control mode temporally to make the motor be fixed. Please refer to **5-6-**1 to set input contact **LOK** function.

When the system causes abnormal vibration or noise, user can adjust **Cn032** (speed feed back smooth filter) to restrain vibration or noise. To add this filter will delay the respond speed of servo system.

Parameter Signal	Name	Default	Unit	Setting Range	Control Mode
Cn032	Speed feed back smooth filter	0	Hz	0~1000	Pe/Pi/S

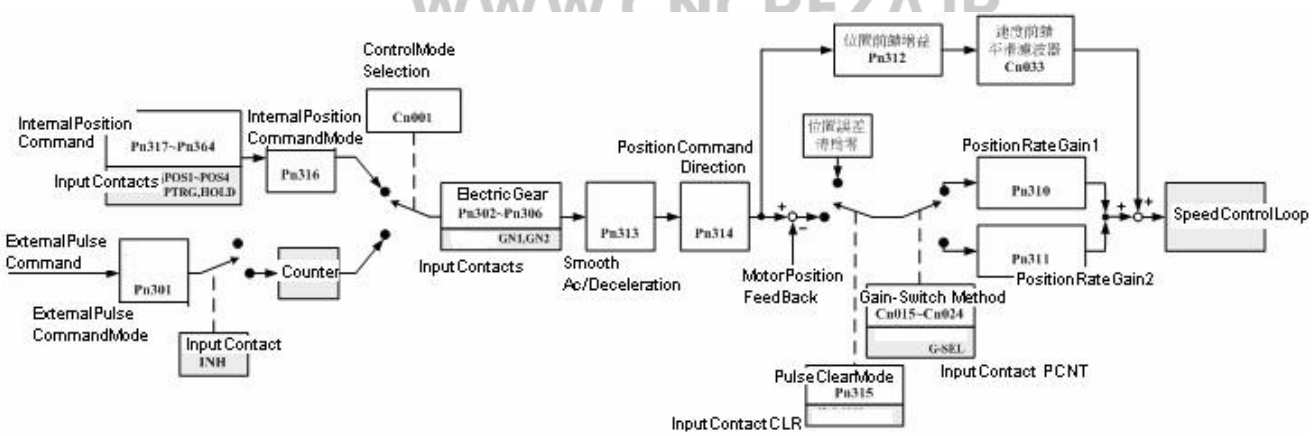
5-4 Position Mode

Position Mode is used to high-precision system. Ex: all kinds of machines or machine tools of industry…etc. . The Position Mode has 2 kinds of input mode: External pulse command input mode and internal position command mode. External pulse command input mode: Receiving the pulse command from host controller to achieve fixed position function; internal position command mode: The user use 16 groups of command parameters (**Pn317~Pn364**), then use input contacts **POS1 ~ POS4** to switch related position command. User set the **Cn001** (control mode selection) depending on necessary applications. Here below is the setting method:

Parameter Signal	Name	Setting	Description	Control Mode
★Cn001	Control mode selection	2	**Position control (External pulse command)**	ALL
			Using one pulse command signal control position, please refer to 5-4-3.	
		6	**Position control (Internal pulse command)**	
			User can use input contacts to switch internal default 16-stages position command to control position. Please refer to 5-4-2.	

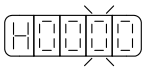
★The setting will be in effect after returning on the power.

The diagram below shows the position loop control. Their detail functions are descripted in fellowing chapters.

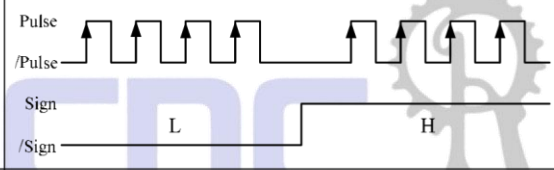
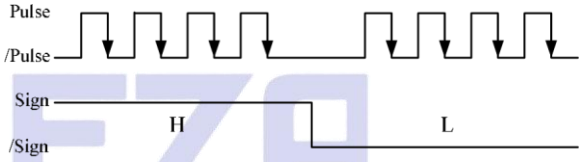
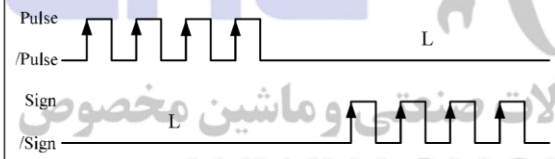
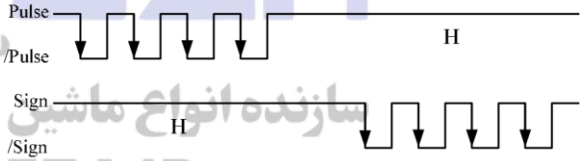
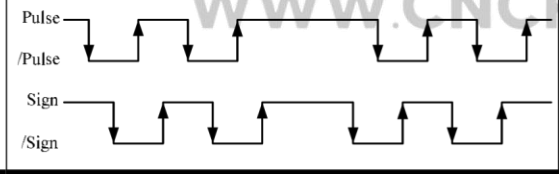
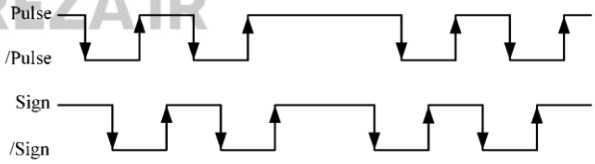


5-4-1 External Pulse Command Mode

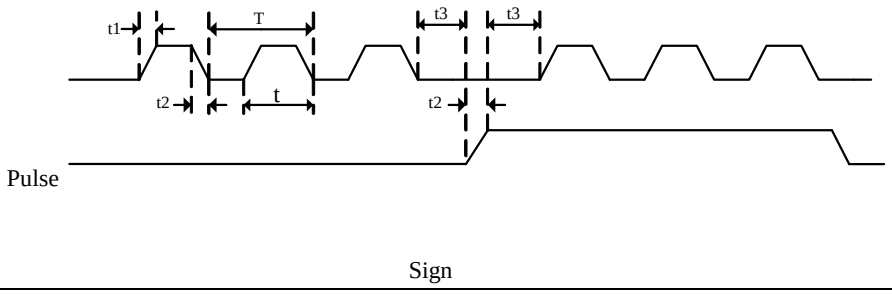
The pulse command comes from external device. There are 3 kinds of pulse types to be selected. Each types can be programmed to be the positive or negative logic. User can set the corresponding type in accordance with external input pulse command type. Here is the method:

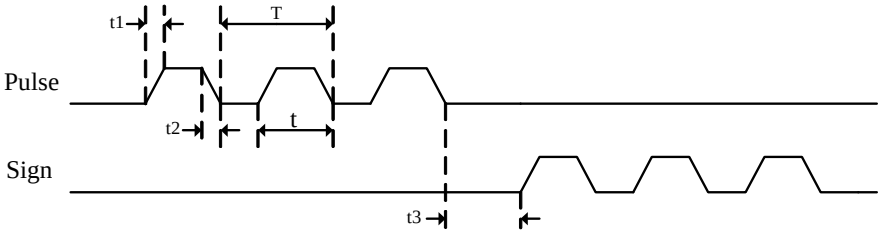
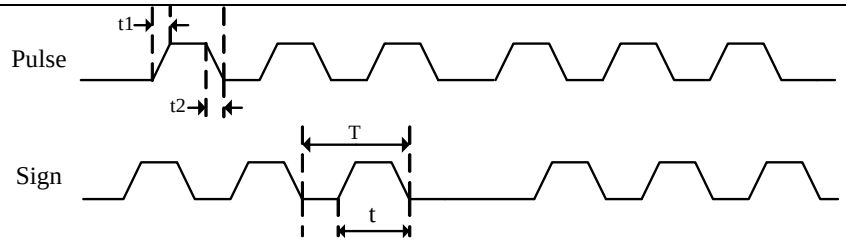
Parameter Signal	Name	Setting	Description	Control Mode
★Pn301.0 	Position pulse command selection	0	(Pulse)+(Sign)	Pe
		1	Pulse from (CCW)and (CW)	
		2	AB-Phase Pulsex2	
		3	AB-Phase Pulsex4	
★Pn301.1 	Position pulse command logic selection	0	Positive Logic	Pe
		1	Negative Logic	

★The setting will be in effect after returning on the power.

Position pulse command types	Positive Logic		Negative Logic	
	CW Command	CCW Command	CW Command	CCW Command
(Pulse)+ (Sign)				
(CCW)/ (CW) Pulse				
AB-Phase Pulse				

There are 2 kinds of interfaces of pulse command: (Open collector) and (Line driver). Please refer to **2-2-1** to check the wiring method. Please input the pulse command in accordance with the time sequence standard below.

Pulse Command Types	Time Sequence Diagram of Pulse Command	Time Standard
(Pulse)+ (Sign)		LineDrive: t1, t2 ≦ 0.1μs t3 ＞3μs τ ≧ 1.0μs (τ/T) ≦ 50%
		OpenCollector: t1, t2 ≦ 0.2μs t3 ＞3μs τ ≧ 2.0μs (τ/T) ≦ 50%

(CCW)/ (CW) Pulse		LineDrive: t1, t2 ≦ 0.1μs t3 ＞3μs τ ≧ 1.0μs (τ/T) ≦ 50% OpenCollector: t1, t2 ≦ 0.2μs t3 ＞3μs τ ≧ 2.0μs (τ/T) ≦ 50%
AB-Phase Pulse		LineDrive: t1, t2 ≦ 0.1μs τ ≧ 1.0μs (τ/T) ≦ 50% OpenCollector: t1, t2 ≦ 0.2μs τ ≧ 2.0μs (τ/T) ≦ 50%

This device provide a input contact **INH**. When this contact operates, pulse command ☞input limit. Which means this device doesn't receive any pulse command. Here is the description :

Input Contact INH	Description	Control Mode
0	Receiving pulse command	Pe
1	No receiving pulse command	

P.S.: Input contacts status 1 means on; 0 means off. Please check **5-6-1** to set high electric potential or low electric potential

5-4-2 Internal Position Command Mode

The command sorce in this mode is from 16 groups of command parameters (**Pn317~Pn364**). It corresponds with programmed input contacts **POS1~POS4** to switch the corresponding position command. Each position command match to one command parameter to set the moving speed of its position command. Please refer to the table below:

Position Command	POS4	POS3	POS2	POS1	Position Command Parameters		Moving Speed Parameters
P1	0	0	0	0	Rotating Number	Pn317	Pn319
					Pulse Number	Pn318	
P2	0	0	0	1	Rotating Number	Pn320	Pn322

					Pulse Number	Pn321	
P3	0	0	1	0	Rotating Number	Pn323	Pn325
					Pulse Number	Pn324	
P4	0	0	1	1	Rotating Number	Pn326	Pn328
					Pulse Number	Pn327	
P5	0	1	0	0	Rotating Number	Pn329	Pn331
					Pulse Number	Pn330	
P6	0	1	0	1	Rotating Number	Pn332	Pn334
					Pulse Number	Pn333	
P7	0	1	1	0	Rotating Number	Pn335	Pn337
					Pulse Number	Pn336	
P8	0	1	1	1	Rotating Number	Pn338	Pn340
					Pulse Number	Pn339	
P9	1	0	0	0	Rotating Number	Pn341	Pn343
					Pulse Number	Pn342	
P10	1	0	0	1	Rotating Number	Pn344	Pn346
					Pulse Number	Pn345	
P11	1	0	1	0	Rotating Number	Pn347	Pn349
					Pulse Number	Pn348	

Position Command	**POS4**	**POS3**	**POS2**	**POS1**	**Position Command Parameters**		**Moving Speed Parameters**
P12	1	0	1	1	Rotating Number	Pn350	Pn352
					Pulse Number	Pn351	

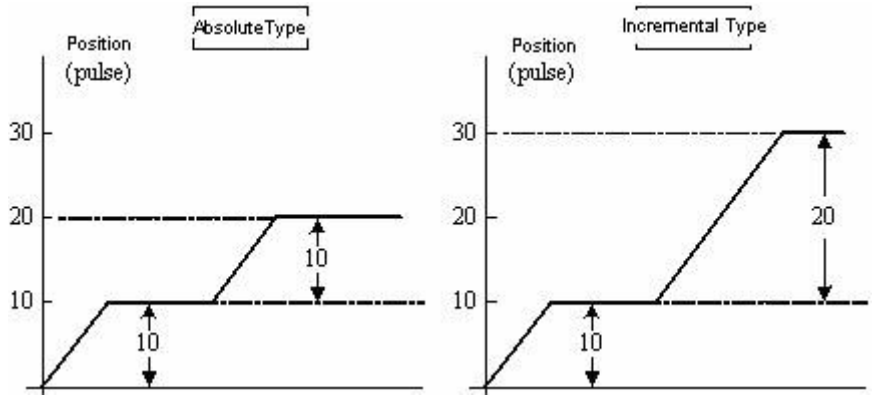
P13	1	1	0	0	Rotating Number	Pn353	Pn355
					Pulse Number	Pn354	
P14	1	1	0	1	Rotating Number	Pn356	Pn358
					Pulse Number	Pn357	
P15	1	1	1	0	Rotating Number	Pn359	Pn361
					Pulse Number	Pn360	
P16	1	1	1	1	Rotating Number	Pn362	Pn364
					Pulse Number	Pn363	

There are absolute and relative types – internal position command mode in accordance with **Pn316**. Here is the setting:

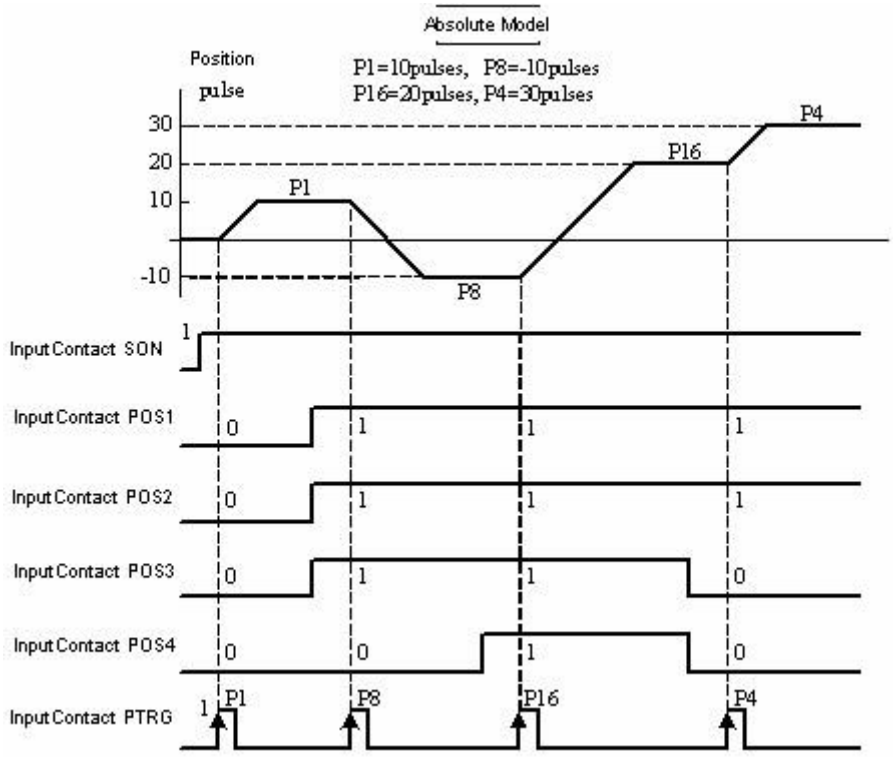
Parameter Signal	Name	Setting	Description	Control Mode
★Pn316	Internal position command mode	0	Absolute fixing position	Pi
		1	Relative fixing position	

★The setting will be in effect after returning on the power.

In absolute and relative fixing mode (separately): Excuting 10 pulse position command ⇗ then excuting 20 pulse command. The diagrams below are about the difference of position routes:



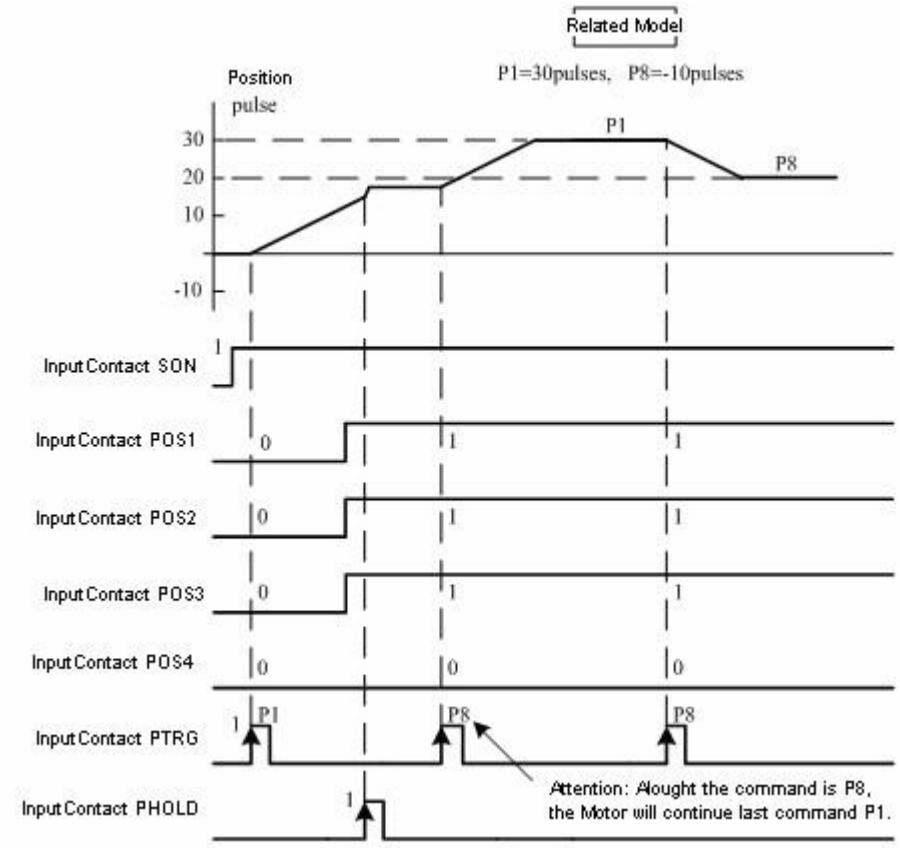
After we use input contacts **POS1~POS4** to select the related position command ⇗ to trigger input contact **PTRG** ⇗ then this device will normally accept this position command ⇗ motor rotates. Please refer to the diagram below:



P.S.: Input contacts status 1 means on; 0 means off. Please check 5-6-1 to set high electric potential or low electric potential

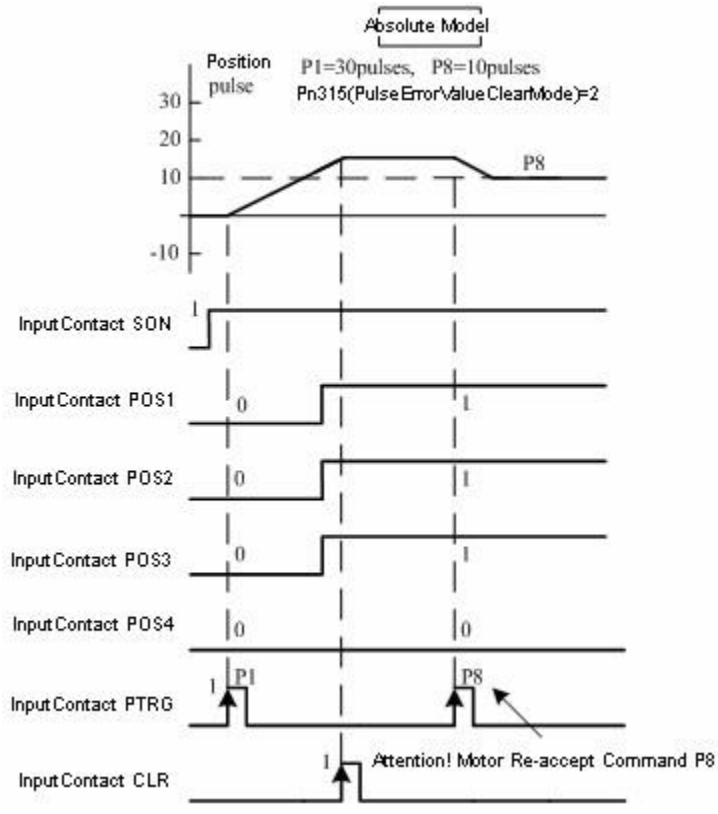
If user would like turn off the motor rotation during the position movement ☞ To trigger the input contact **PHOLD** ☞ and the motor will decelerat and stop.

When the input contact **PTRG** is triggered again ☞ the remaining pulse command will be operated ☞ until the target position(before **PHOLD** triggers) is achieved. Please refer to the diagram below:



P.S.: Input contacts status 1 means on; 0 means off. Please check 5-6-1 to set high electric potential or low electric potential

If user ignores this position command and stop the motor during position movement, user can trigger input contacts **CLR** (**Pn315** must be set **1** or **2**, please refer to **5-4-7**), motor will stop immediately. And the not completely operated pulses will be cleared. When the input contact PTRG is triggered again, the motor will rotate in accordance with the position command of what the early **POS1~POS4** set. Please refer to the diagram:



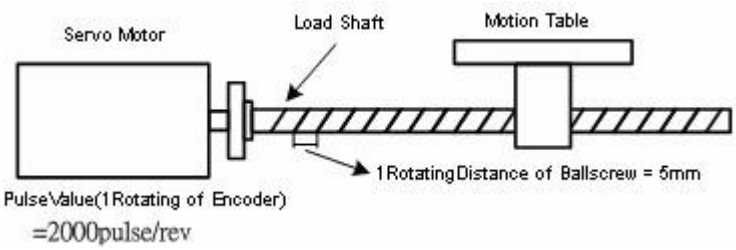
P.S.: Input contacts status 1 means on; 0 means off.
Please check 5-6-1 to set high electric potential or low electric potential

5-4-3 Electronic Gear Ratio

User can use Electronic Gear Ratio to definite the inputted Unit Pulse Command to make the transmission to move to any distance. The Pulse Command from host controller has nothing to do with Transmission System Gear Ratio, Deceleration Ratio or Motor Encoder Pulse Value. Here is the description:

The picture below is about the Servo Motor Transmission Device.

How much Pulse Command must be given by Host Controllor, if the 10mm movement of Motion Table is needed?



Without Using Electronic Gear Ratio Function	Using Electronic Gear Ratio Function

1. 1 Rotating of Ballscrew ⇗ The Motion Table will move 5mm. 2. If the Motion Table need move 10mm, the Ballscrew need to rotate 10mm ÷5mm/rev = 2*Rotating* 3. " 2000pulse/rev×4 = 8000pulse" Command will make the motor 1 rotating. 4. So the Host Controllor need give the "8000pulse/rev×2 rev =16000pulse" command **⇗User must count the Pulse Command depending on the steps above when each movement.**	**⇗Set the Electronic Gear Ratio**(Assume: Definiting 1 Pulse Command = moving 1um, the setting method of Electronic Gear Ratio is contained in the next chapter) 1. 1 Pulse value causes 1um movement. 2. If the Motion Table need move 10mm, the Host Controllor need give the 10mm ÷1um/pulse =10000pulse Command. **⇗To definite the distance of 1 Pulse Command and the Electronic Gear Ratio, then the Host Controllor can easily decide the Pulse Command.**

To decide the Electronic Gear Ratio in accordance the steps below:

1. To Understand the system specifications:

To get the system standards before deciding Electronic Gear Ratio. Ex: Deceleration Ratio, Gear Ratio, moving value of 1 rotating of load shaft, rotating diameter and the Pulse Value of 1 rotating of Motor Encoder (please refer to 1-1-2 Servo Motor Standards).

2. To Definite the moving distance of 1 Pulse Command

To definite the 1 Pulse Command given by Host Controllor and the distance of transmission system movement. Ex: When 1 Pulse Command move 1um ⇗ If the Host Controllor give 2000 pulse command, the transmission device will move: 2000pulse×1um/pulse = 2mm (The Electronic Gear Ratio must be correctly set).

3. To Count the Electronic Gear Ratio

Counting the electronic gear ratio in accordance with the formula below:

$$ElectronicGearRatio = \frac{LoadMoving1DisRotatingPutanceOfLoadShlseValueaft \times 4\_1Rotating}{1PulseCommandMovingDistance} \div$$

If the deceleration ratio between motor and load shaft is n/m (m means Motor Rotating Value, n means Load Shaft Rotating Value), and the formula for Electronic Gear Ratio is:

$$ElectronicGearRatio = \frac{MovingDisPulseValuetanceOfMotionOf1RotatingFoTableForrMotorEnco1RotatingOfderLoadShaft \times 4}{MovingDistanceOf1PulseCommand} \div \times \frac{m}{n}$$

4. Parameter Setting for Electronic Gear Ratio

Reducing the fraction and simplifying the counting for Electronic Gear Ratio to make the Numerator and Denominator to be integer which is less than 50000. Then set the Electronic Gear Ratio – Numerator and Denominator separately into the related parameters. Here is the description below:

Parameter Signal	Name	Default	Unit	Setting Range	Control Mode
Pn302	Numerator of Electronic Gear Ratio 1	1	X	1~50000	Pi/Pe
Pn303	Numerator of Electronic Gear Ratio 2	1	X	1~50000	Pi/Pe
Pn304	Numerator of Electronic Gear Ratio 3	1	X	1~50000	Pi/Pe
Pn305	Numerator of Electronic Gear Ratio 4	1	X	1~50000	Pi/Pe
★Pn306	Denominator of Electronic Gear Ratio	1	X	1~50000	Pi/Pe

The setting will be in effect after returning on the power.

Attention! The Electronice Gear Ratio must accord with the conditions below, otherwise this device can not work normally.

$$\frac{1}{200} \leq ElectroniceGearRatio \leq 200$$

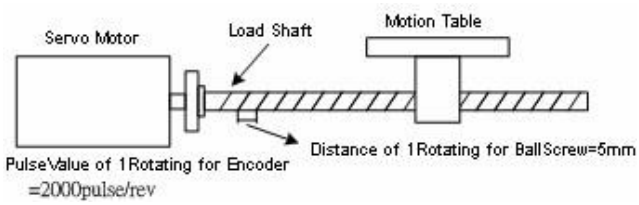
This device contains 4 groups of Numerator of Electronic Gear Rotio. User can use input contacts **GN1** and **GN2** to switch to current necessary Numerator of Electronic Gear Ratio. Please refer to the table below:

Input Contact GN2	Input Contact GN1	Numerator of Electronic Gear Ratio	Control Mode
0	0	Numerator of Electronic Gear Ratio 1 **Pn302**	Pi/Pe
0	1	Numerator of Electronic Gear Ratio 2 **Pn303**	
1	0	Numerator of Electronic Gear Ratio 3 **Pn304**	
1	1	Numerator of Electronic Gear Ratio 4 **Pn305**	

P.S.: Input contacts status 1 means on; 0 means off. Please check 5-6-1 to set high electric potential or low electric potential

<table>
<tr><th>Transmission System</th><th>Setting Process</th></tr>
<tr><td>

Ball Screw



</td><td>

1. Understanding whole system specifications:

Load Shaft(Ball Screw)moving distance of 1 rotating=5mm

Pulse Value/1 rotating of Motor Encoder =2000pulse

2. Definiting the moving distance of 1 Pulse

Command Moving Distance of 1 Pulse Command=1um **3.**

Counting the Electronic Gear Ratio:

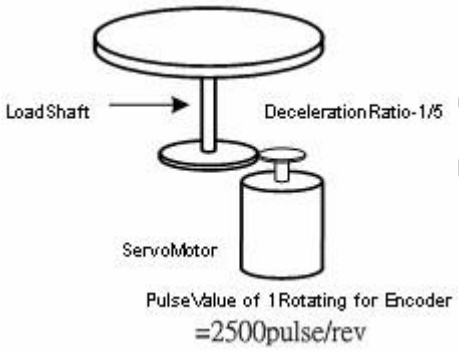
$$\text{Electronic Gear Ratio} = \frac{2000\ pulse/rev \times 4}{5mm/rev \div 1um/pulse} = \frac{8000}{5000}$$

4. Set the parameter of Electronic Gear Ratio:

Numerator of Electronic Gear Ratio	8000
Denominator of Electronice Gear Ratio	5000

</td></tr>
<tr><td>

Mechanical Disc



</td><td>

1. Understanding whole system specifications:

DecelerationRatio=1/5

Load Shaft(MechanicalDisc)MovingValue of 1Rotating=360 °

PulseValue of 1Rotating for Encoder=2500pulse

2. Definiting the moving distance of 1 Pulse

Command: Distance for 1Pulse Command =0.1 ° **3.**

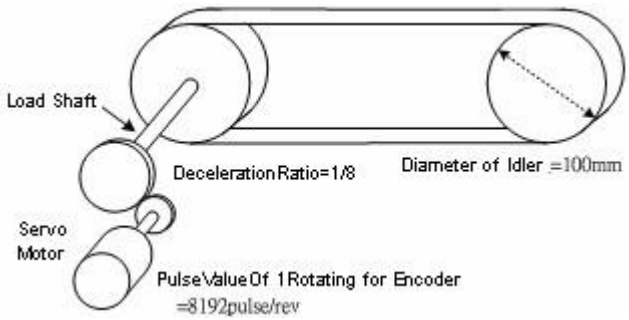
Counting the Electronic Gear Ratio:

$$\text{Electronic Gear Ratio} = \frac{2500\,\text{pulse}/\text{rev} \times 4}{360° \div 0.1°/\text{pulse}} \times \frac{5}{1} = \frac{50000}{3600}$$

4. Set the parameter of Electronic Gear Ratio:

Numerator of Electronic Gear Ratio	50000
Denominator of Electronice Gear Ratio	3600

</td></tr>
</table>

Transmission System	Setting Process
Transmission Belt 	**1. Understanding whole specifications:** Deceleration Ratio=1/8 Load Shaft(Idler) MovingValue of 1Rotating = 3.14×100mm = 314mm PulseValue of 1Rotating for Encoder =8192pulse **2. Definiting the moving distance of 1 Pulse** **Command:** Distance for 1Pulse Command =10um **3.** **Counting the Electronic Gear Ratio:** $\text{Electronic Gear Ratio} = \frac{8192\,\text{pulse/rev} \times 4}{314\,\text{mm} \div 10\,\text{um/pulse}} \times \frac{8}{1} = \frac{262144}{31400}$ **4. Set the parameter of Electronic Gear Ratio:** Reducing the fraction and simplifying the counting for Electronic Gear Ratio to make the Numerator and Denominator to be integer which is less than 50000. Numerator of Electronic Gear Ratio: 32768 Denominator of Electronic Gear Ratio: 3925

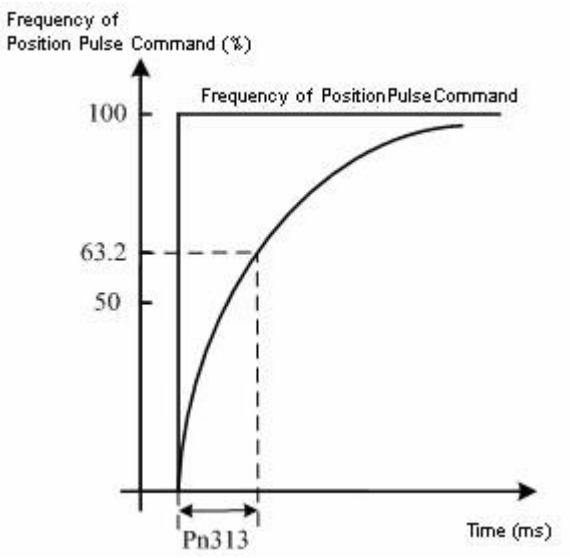
5-4-4 One Time Smooth Ac/Deceleration of Position Command

Using the function ,"**One Time Smooth Ac/Deceleration of Position Command**" will smoothlize the position pulse command of fixed frequency.

Parameter Signal	Name	Default	Unit	Setting Range	Control Mode
★Pn313	Time Constant of One Time Smooth Ac/Deceleration of Position Command	10	msec	0~10000	Pi/Pe

★The setting will be in effect after returning on the power.

The definition of **Time Constant of One Time Smooth Ac/Deceleration of Position Command**: The Time in which The Position Pulse Frequency increases (one time) from zero to 63.2% of Position Pulse Command Frequency. Here below is the Diagram:



Setting Example:

(1) If achieving 95% of Position Pulse Command Frequency Output in 30msec:

$$Pn313 = \frac{30(msec)}{-\ln(1-95\%)} = 10(msec)$$

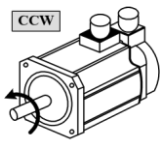
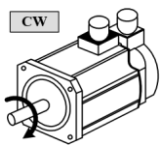
(2) If achieving 75% of Position Pulse Command Frequency Output in 30msec:

$$Pn313 = \frac{30(msec)}{-\ln(1-75\%)} = 22(msec)$$

5-4-5 Definition of Position Command Direction

In position mode, user can use Pn314 (Position Command Direction Definition) to definite motor rotating direction.

The setting is showed as follow:

Parameter Signal	Name	Setting	Description	Control Mode
Pn314	Definition of position command direction (from motor loading terminal)	0	(CW)	★Pi Pe
	 	1	(CCW)	

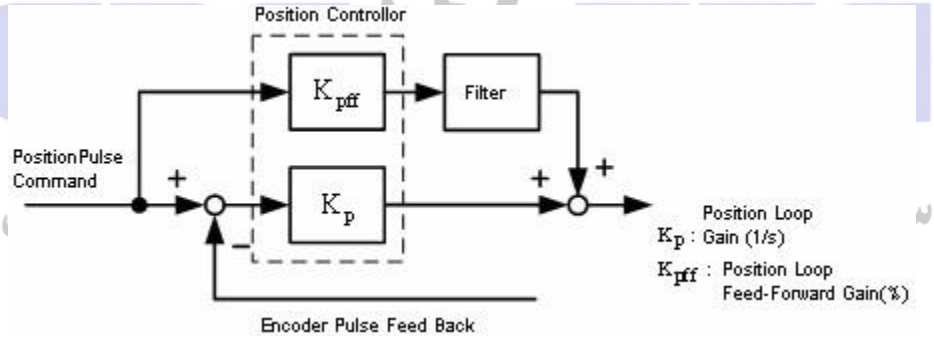
★The setting will be in effect after returning on the power

5-4-6 Adjusting of Position Loop Gain

The table below is about the parameter of position control loop. This device provides 2 groups of position controller. User can use gain switching function to change it. (Please refer to **5-3-11**)

Parameter Signal	Name	Default	Unit	Setting Range	Control Mode
Pn310	Position Loop Gain1	40	1/s	1~450	Pe/Pi
Pn311	Position Loop Gain 2	40	1/s	1~450	Pe/Pi
Pn312	Position Feed-Forward Gain	0	%	0~100	Pe/Pi
Cn033	Speed Feed-Forward Smooth Filter	0	Hz	0~1000	Pe/Pi

The picture below is the position controller. More the position loop gain is, faster the response speed is. Which shortens the adjust-time. User can also use Position Feed-Forward Gain to shorten adjust-time. Please refer to **5-5** to check the method of Position Loop Control Gain Adjusting.



5-4-7 Pulse Incorrect Value Clear

In position mode, user can use **Pn315** (Pulse Incorrect Value Clear Mode) to definite the operation method of input contact **CLR**. The setting is showed as follow:

Parameter Signal	Name	Setting	Description	Control Mode
Pn315	Pulse Incorrect Value Clear Mode	0	When **CLR** works, pulse incorrect walue is clear.	Pe
		1	When **CLR** is turned on: canceling the position command to stop motor rotating; resetting the mechanical Home and clearing the pulse incorrect value.	Pi Pe

		2	When **CLR** is turned on: canceling the position command to stop motor rotating and clearing the pulse incorrect value.	Pi

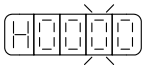
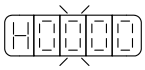
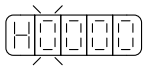
P.S.: Please refer to **5-6-1** to set high or low electric potential at input contact.

5-4-8 Home

When using the function "HOME", user can use input contacts **ORG**, **CCWL**, or **CWL** to be reference HOME; user can also use **Z** Phase to be the referenct HOME and select CW or CCW to search it. Here is the description:

Parameter Signal	Name	Setting	Description	Control Mode
Pn365.0 	When turning on Home, setting of searching direction and selecting reference Home.	0	After Home is turned on, motor will search Home in 1st stege speed **CW** and take the input contacts **CCWL** and **CWL** to be the Reference Home. After Home has been in position, the input contacts **CCWL** and **CWL** will be Inhibit Limit again. When using this function, **Pn365.1** can not be set to **1** or **2**. **Attention! Cn002.1 (selection for CCWL and CWL) must be set to 0.**	Pi/Pe
		1	After Home is turned on, motor will search Home in 1st stege speed **CCW** and take the input contacts **CCWL** and **CWL** to be the Reference Home. After Home has been in position, the input contacts **CCWL** and **CWL** will be Inhibit Limit again. When using this function, **Pn365.1** can not be set to **1** or **2**. **Attention! Cn002.1 (selection for CCWL and CWL) must be set to 0.**	
		2	After Home is turned on, motor will search Home in 1st stege speed **CW** and take the input contact **ORG** to be the reference Home. If **Pn365.1=2**, it will directly find the closest Rising-Edge of **ORG** to be the Home without Reference Home. Then stopping in accordance with **Pn365.3** setting.	
		3	After Home is turned on, motor will search Home in 1st stege speed **CCW** and take the input contact **ORG** to be the reference Home. If **Pn365.1=2**, it will directly find the closest Rising-Edge of **ORG** to be the Home without Reference Home. Then stopping in accordance with **Pn365.3** setting.	
		4	After Home is turned on, motor will search Home in 1st stege speed **CW** and find the closest **Z** Phase Home without Referenct Home. When using this function, **Pn365.1=2** must be set. (After finding **Z** Phase to be the Home, it stops in accordance with **Pn365.3** setting).	

		5	After Home is turned on, motor will search Home in 1st stege speed **CCW** and find the closest **Z** Phase Home without Referenct Home. When using this function, **Pn365.1=2** must be set. (After finding **Z** Phase to be the Home, it stops in accordance with **Pn365.3** setting).	

Parameter Signal	Name	Setting	Description	Control Mode
Pn365.1 	After finding Reference Home, searching Home moving method	0	After finding Reference Home, Motor **returns** in 2nd stage speed to find the closest **Z** Phase pulse to be the Home, then stops in accordance with **Pn365.3** setting method.	Pi/Pe
		1	After finding Reference Home, Motor **continues ahead** in 2nd stage speed to find the closest **Z** Phase pulse to be the Home, then stops in accordance with **Pn365.3** setting method.	
		2	When **Pn365.0=2** or **3**, it finds the rising edge of ORG to be the Home, then stops in accordance with **Pn365.3**; when **Pn365.0=4** or **5**, it finds **Z** Phase pulse to be the Home, then stops in accordance with **Pn365.3**.	
Pn365.2 	Setting of Home turning on Mode	0	Function of turning off Home	Pi/Pe
		1	After power on, only first time excuting Servo On will automatically operates Home function. When Home function is no needed to be repeatedly operated during the servo is working, user can use this mode to omit a input contact which is used to excute Home function.	
		2	Use **SHOME** to turn on Home function. In position mode, user can turn on **SHOME** to operate Home function at any moment.	
Pn365.3 	Setting of stopping mode after finding Home	0	After finding Home signal, **recording** this position to be the Home (**Un-14** encoder feed back rotating number and **Un-15** encoder feed back pulse number are all 0), motor will stop. Motor returns in 2nd stage speed to move to the Home Position after motor stops.	Pi/Pe
		1	After finding Home signal, recording this position to be the Home (**Un-14** encoder feed back rotating number and **Un-15** encoder feed back pulse number are all 0), motor stops.	

User needs to set **Pn365** in accordance with different applications. The table list below is about the setting value:

Pn365.0 / Pn365.1	0	1	2	3	4	5
0	●	●	●	●	×	×
1	×	×	●	●	×	×
2	×	×	●	●	●	●

● means HOME operates normaly; × means there is no HOME operation

The Speed of HOME is descripted as follow:

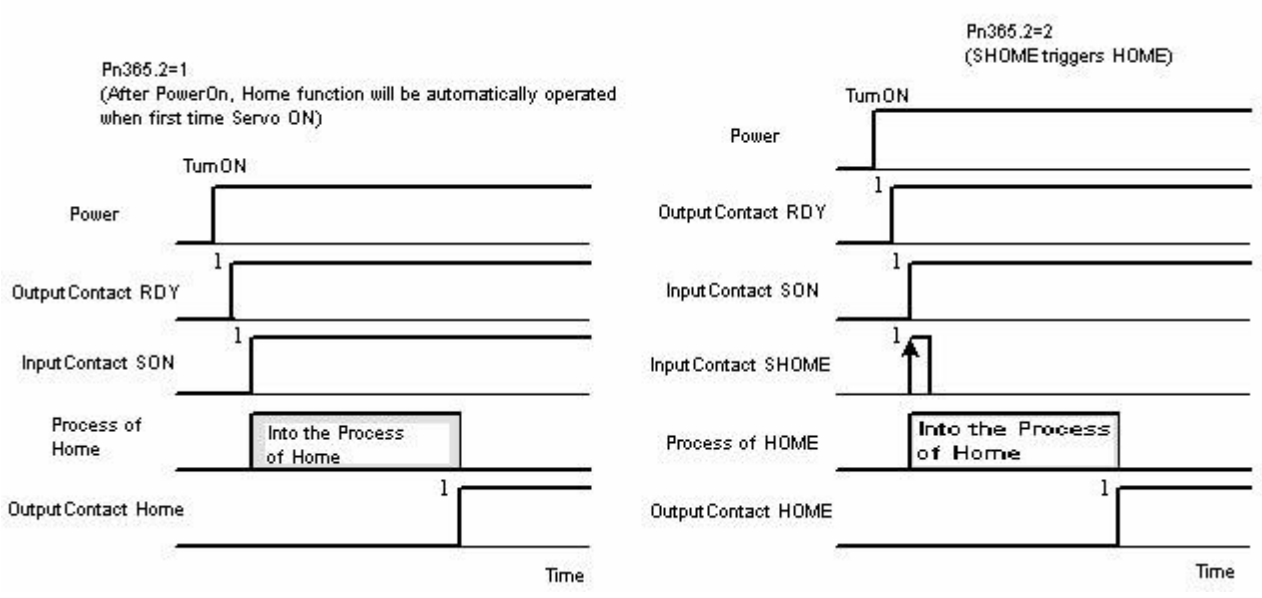
Parameter Signal	Name	Default	Unit	Setting Range	Control Mode
Pn366	1st stage-high speed of HOME	100	rpm	0~2000	Pi/Pe
Pn367	2nd stage-low speed of HOME	50	rpm	0~500	Pi/Pe

User can set the Home incorrect rotating number/pulse number. After Motor finds the Home position in accordance with **Pn365** (Home Mode), it will be the new Home position in accordance with **Pn368** (Home incorrect rotating number) and **Pn369** (Home incorrect pulse number). The setting follows as below:

Parameter Signal	Name	Default	Unit	Setting Range	Control Mode
Pn368	Shift rotating value of HOME	0	rev	-30000~30000	Pi/Pe
Pn369	Shift pulse value of HOME	0	pulse	-32767~32767	Pi/Pe

Timing Charts for Home Turning On Mode

During the process of Home: If user cancels **SON** (Servo On) or any alarm happeds, Home function will stop and **HOME** (completed Home) doesn't work.



P.S.: Input contacts status 1 means on; 0 means off. Please check 5-6-1 to set high electric potential or low electric potential

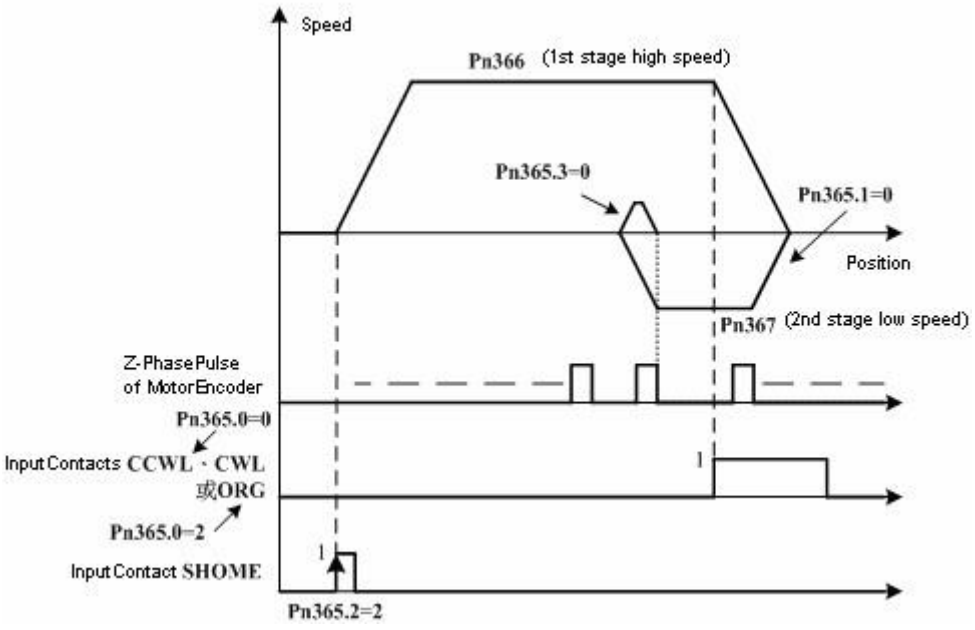
The table list below is about the speed/position timing charts of HOME for different **Pn365** setting:

Pn365.1 \ Pn365.0	0	1	2	3	4	5
0	**(1)**	**(2)**	**(1)**	**(2)**	✖	✖
1	✖	✖	**(3)**	**(4)**	✖	✖
2	✖	✖	**(5)**	**(6)**	**(7)**	**(8)**

✖ means no operating HOME function

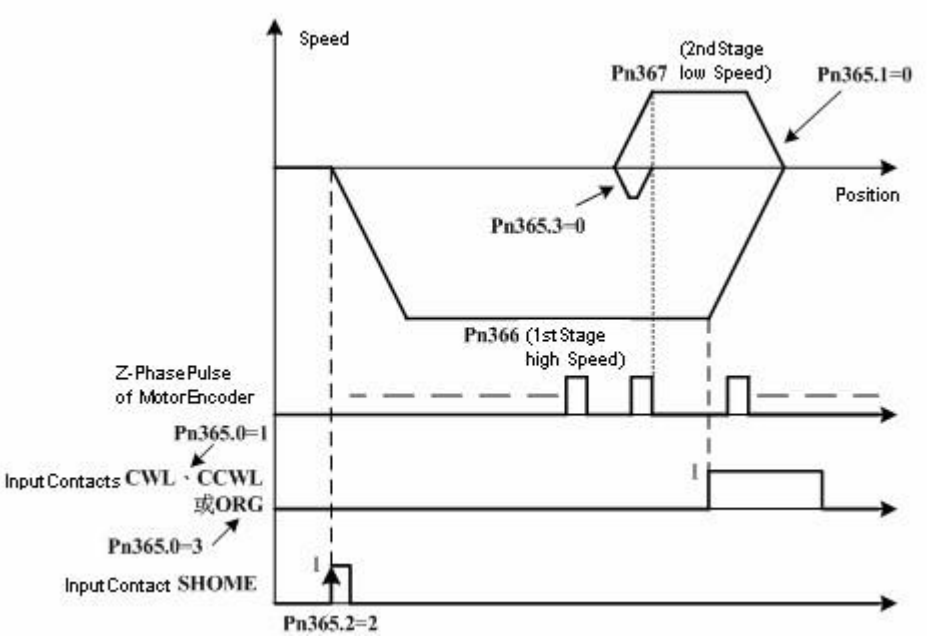
(1)

Pn365.0=0 or **2**(After turning on HOME, **CW** in 1st stage speed to find Reference HOME: **CCWL**, **CWL** or **ORG**)
Pn365.1=0(After finding Reference HOME, **returning** in 2nd speed to find the closest **Z** Phase pulse to be the HOME)
Pn365.2=2(Input Contact SHOME turning on HOME)
Pn365.3=0(**Returning** to HOME)



(2)

Pn365.0=**1**or **3**(After turning on HOME, **CCW** in 1st stage speed to find Reference HOME: **CWL**, **CCWL** or **ORG**)
Pn365.1=0(After finding Reference HOME, **returning** in 2nd stage speed to find the closest **Z** Phase pulse to be the HOME)
Pn365.2=2(Input Contact **SHOME** turning on HOME) **Pn365.3=0**(**Returning** to HOME)



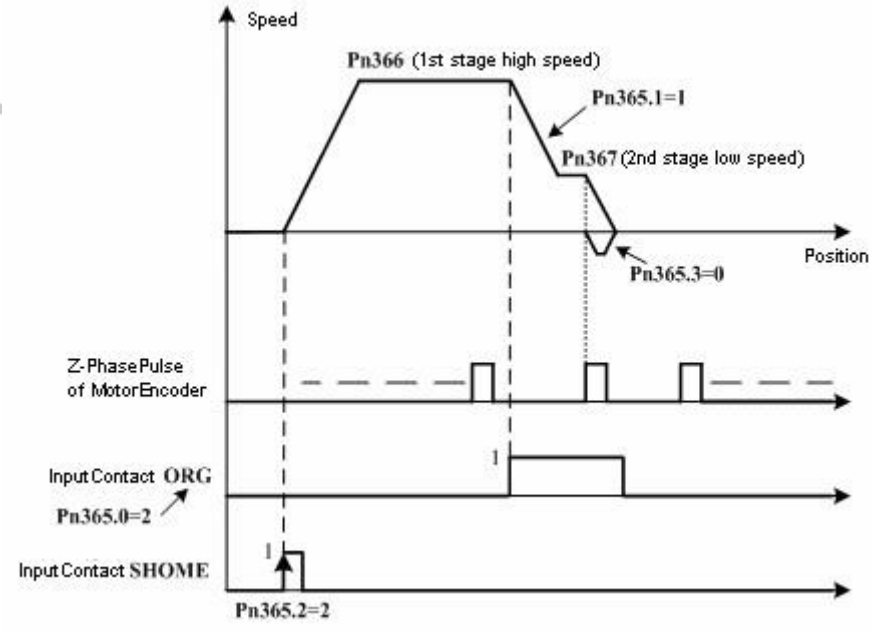
(3)

Pn365.0=**2**(After turning on HOME, **CW** in 1st stage speed to find Reference HOME: **ORG**)

Pn365.1=**1**(After finding Reference HOME, **continue going ahead** in 2nd stage speed to find the closest **Z** Phase to be the HOME)

Pn365.2=**2**(Input Contact **SHOME** turning on HOME)

Pn365.3=**0**(**Returning** to the HOME)



(After turning on HOME, **CCW** in 1st

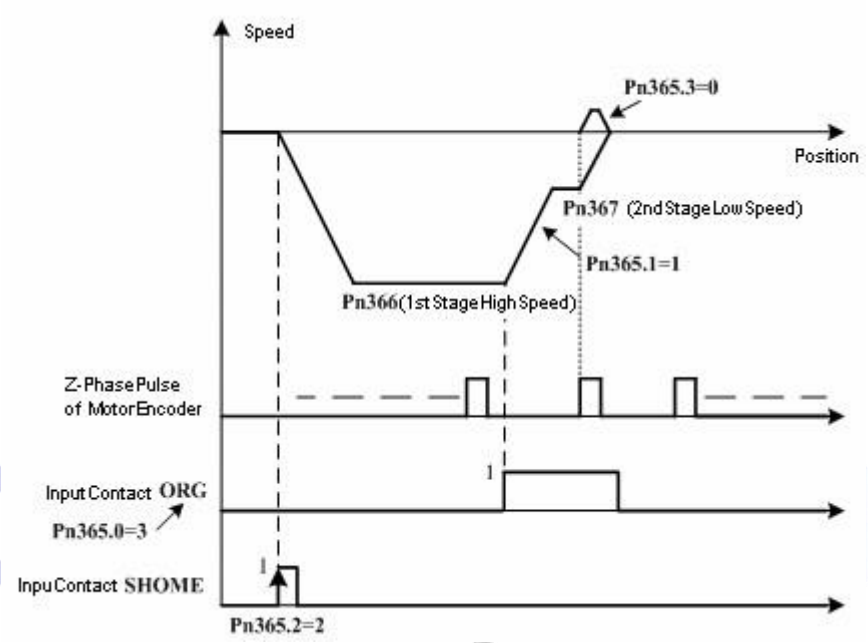
(4)

Pn365.0=**3** stage speed to find the Reference HOME: **ORG**)

Pn365.1=**1**(After finding Reference HOME, **continue going ahead** in 2nd stage speed to find the closest **Z** Phase pulse to be the HOME)

Pn365.2=**2**(Input Contact **SHOME** turning on HOME)

Pn365.3=**0**(**Returning** to the HOME)



(5)

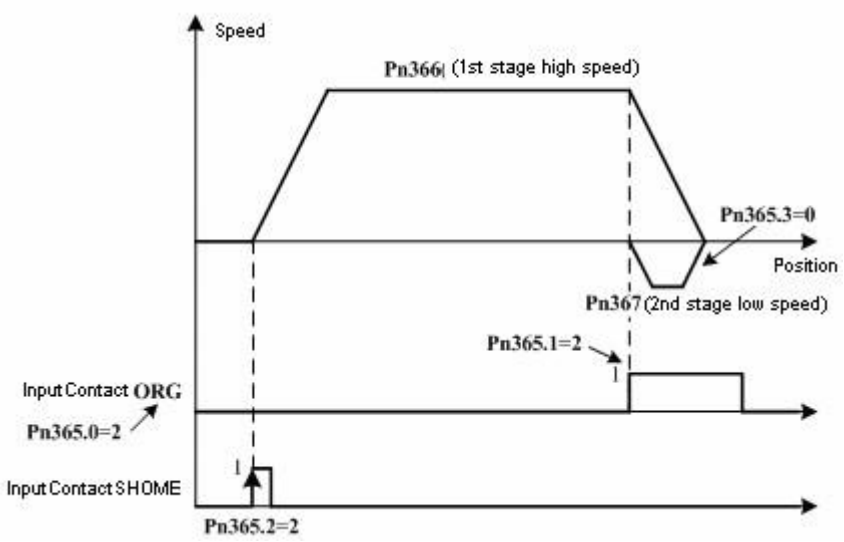
Pn365.0=2(After turning on HOME, **CW** in 1st stage speed to find the Reference HOME: **ORG**)

Pn365.1=2(Finding the Reference HOME: the Rising Edge of **ORG** to be the HOME)

Pn365.2=2(Input Contact **SHOME** turning on HOME)

Pn365.3=0(**Returning** to the HOME)

(After turning on HOME, **CCW** in 1st

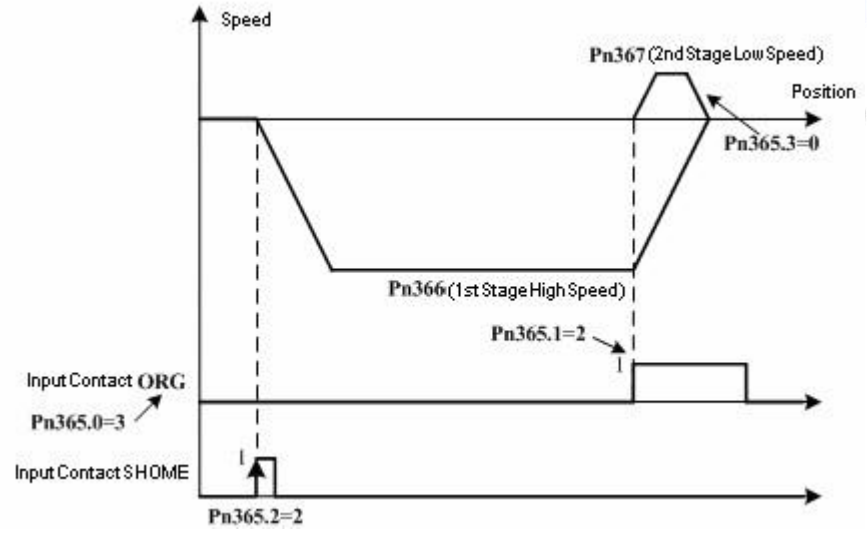


(6)

Pn365.0=3 stage speed to find the Reference HOME: **ORG**)

Pn365.1=2(Finding the Reference HOME: the Rising Edge of **ORG** to be the HOME)

Pn365.2=2(Input Contact **SHOME** turning on HOME) **Pn365.3=0**(**Returning** to the HOME)



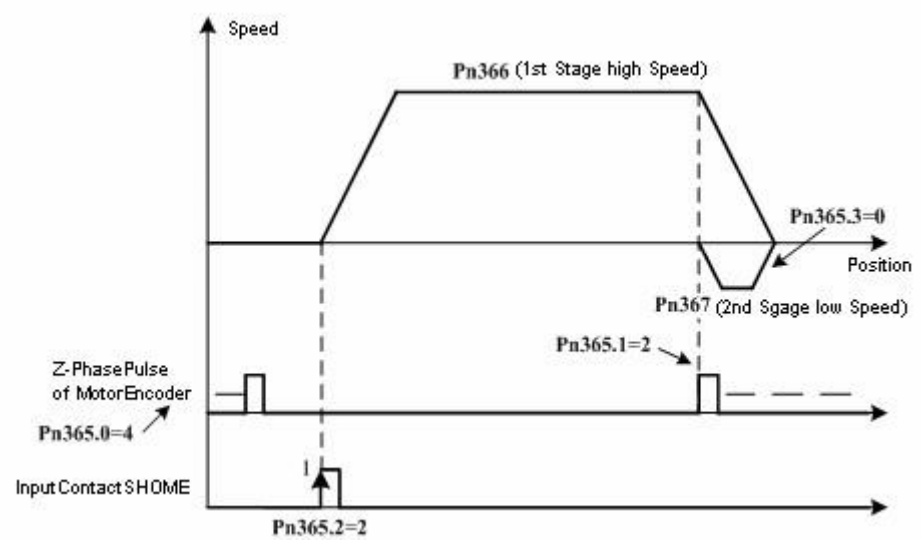
(7)

Pn365.0=4(After turning on HOME, **CW** in 1st stage speed to find the closest HOME of **Z** Phase pulse)

Pn365.1=2(Finding **Z** Phase pulse to be the HOME)

Pn365.2=2(Input Contact **SHOME** turning on HOME) **Pn365.3=0**(**Returning** to the HOME)

(After turning on HOME, **CCW** in 1st

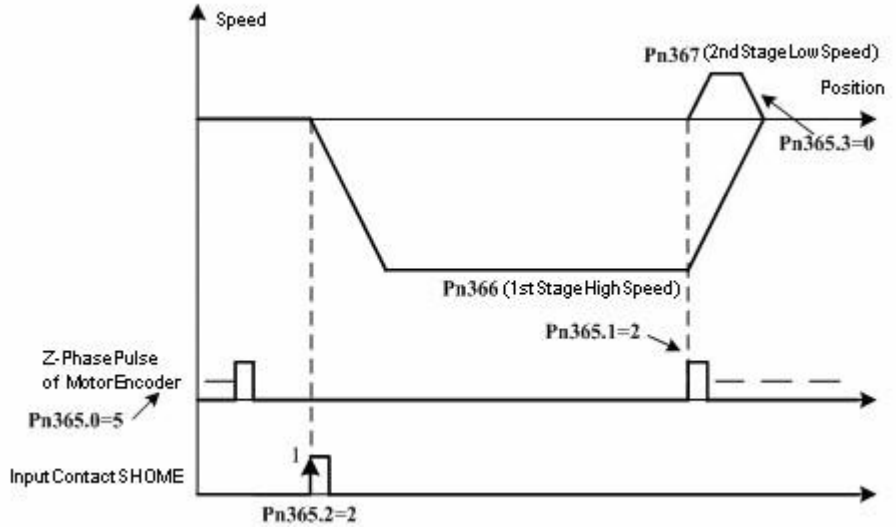


(8)

Pn365.0=5 stage speed to find the closest HOME of **Z** Phase pulse)

Pn365.1=2(Finding the **Z** Phase pulse the be the HOME)

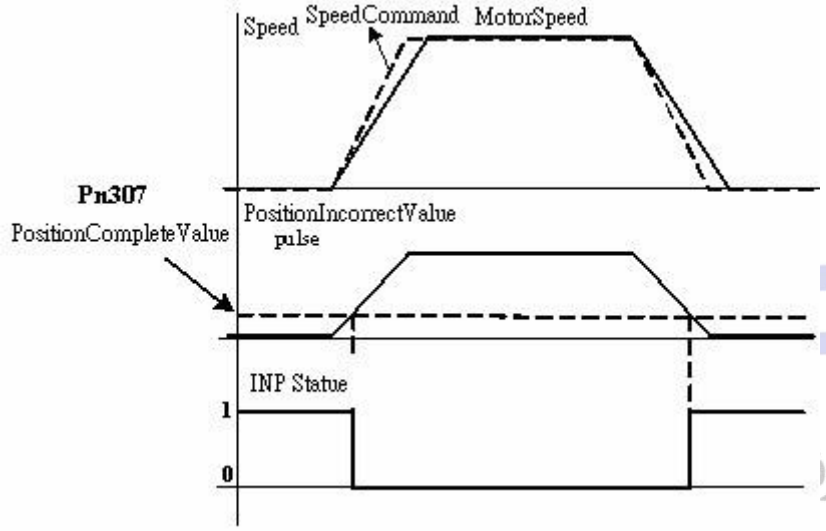
Pn365.2=2(Input Contact **SHOME** turning on HOME) **Pn365.3=0**(**Returning** to the HOME)



5-4-9 Other Position Control Function

When the position incorrect value is less than the pulse value which is set in **Pn307** (Position Complete value), **INP** will work. Here is the Explanation:

Parameter Signal	Name	Default	Unit	Setting Range	Control Mode
Pn307	Position Complete value	10	pulse	0~50000	Pi/Pe



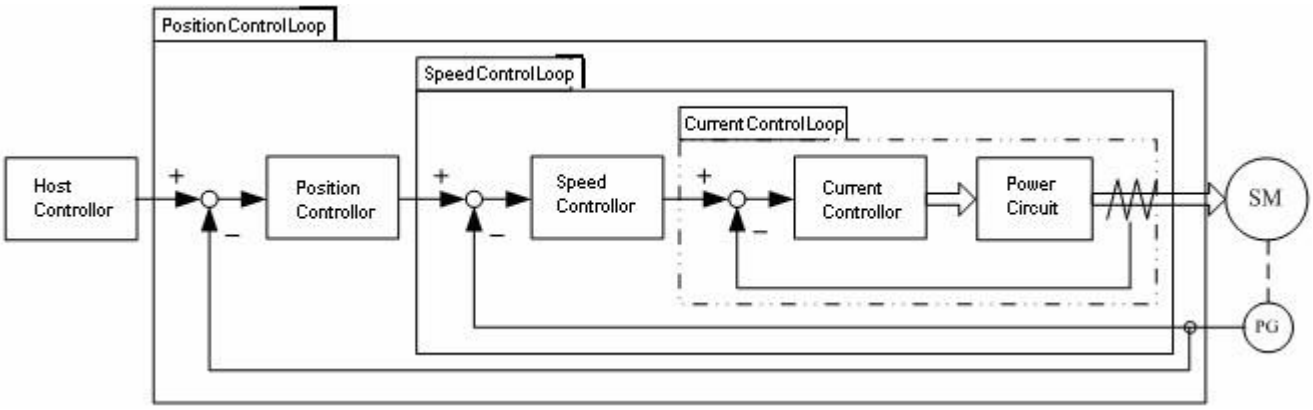
P.S.: Input contacts status 1 means on; 0 means off. Please check 5-6-1 to set high electric potential or low electric potential.

When the Position Incorrect value is more than the pulse value which is set in **Pn308** (Positive Max Position Incorrect value) or **Pn309** (Position Max Position Incorrect value), **AL-11** (Alarm of Over Position Incorrect Value) occurs. Here is the setting:

Parameter Signal	Name	Default	Unit	Setting Range	Control Mode
Pn308	Positive Max Position Incorrect value	50000	pulse	0~50000	Pi/Pe
Pn309	Positive Max Position Incorrect value	50000	pulse	0~50000	Pi/Pe

5-5 Adjusting for Servo Gain

The Servo contains 3 kinds of Loop: Current Control, Speed Control and Position Control. Here is the picture.



Theoretically, the bandwidth of inside control loop must be higher than the bandwidth of outside. Otherwise, whole control system will astaticism, then it will cause vibration or abnormally response. The relation of these 3 control loop bandwidths will be showed as follow:

Current Control Loop Bandwidth (Inside)>Speed Control Loop Bandwidth (Middle Side)>Position Control Loop Bandwidth (Outside)

Because the default current control circuit bandwidth has been already the best situation, the user need to only adjust speed and position control loop gain. The Table List below is the related parameters for gain adjusting.

Parameter Signal	Name	Default	Unit	Setting Range	Control Mode
Sn211	Speed Loop Gain 1	40	Hz	10~450	Pe/Pi/S
Sn212	Speed Loop Integration Time Constant 1	100	x0.2 msec	1~500	Pe/Pi/S
Sn213	Speed Loop Gain 2	40	Hz	10~450	Pe/Pi/S
Sn214	Speed Loop Integration Time Constant 2	100	x0.2 msec	1~500	Pe/Pi/S
Pn310	Position Loop Gain 1	40	1/s	1~450	Pe/Pi
Pn311	Position Loop Gain 2	40	1/s	1~450	Pe/Pi
Pn312	Position Loop Feed-Forward Gain	0	%	0~100	Pe/Pi
Cn025	Load Inertia Ratio	70	x0.1	0~1000	Pe/Pi/S

Speed Loop Gain decides directly the Response Bandwidth of Speed Control Loop. Under the situation of no vibration or noise, higher is the Speed Loop Gain Value, faster is the Speed Response.

If **Cn025**(Load Inertia Ratio) is correctly set: S**peed Loop Bandwidth** = **Sn211** (Speed Loop Gain1) or **Sn213** (Speed Loop Gain2).

$$\text{Load Inertia Ratio} = \frac{\text{Load Inertia transformed to MotorShaft } (J_L)}{\text{Inertia of Servo Motor Rotor } (J_M)} \times 100\%$$

Adding integral items in Speed Control Loop can delete the error of stabilizing Speed and respons fine speed changing quickly. Basically, under the situation of no vibration or noise, reducing Integral Time Constant of Speed Loop can enhance system rigidity. If the Load Inertia Ratio is very high or the system has vibration factors, user must confirm Speed Loop Integral Time Constant is also high enough, otherwise the mechanical system would produce co-vibration easily. Using the formula below to get the Integral Time Constant of Speed Loop:

$$\mathbf{Sn212}\,(\text{Integral Time Constant 1 of Speed Loop}) \geq 5 \times \frac{1}{2\pi \times \mathbf{Sn211}(\text{ Speed Loop Gain1 })}$$

Setting Example:

Assume: **Cn025** (Load Inertia Ratio) is correctly set, target Speed Loop Bandwidth achieves 100Hz, so user sets:

Sn211(Speed Loop Gain 1)=100(Hz)

$$\mathbf{Sn212}\,(\text{ Integral Time Constant1 of Speed Loop }) \geq 5 \times \frac{1}{2\pi \times 100} = 40\ (\times 0.2\text{msec})$$

Position Loop Gain decides directly the response speed of Position Loop. Under the situation ofno vibration or noise from servo, increasing the Position Loop Gain Value can enhance response speed to reduce the time for in position.

Using Position Loop Feed-Forward can enhance response speed. If the Feed-Forward is too high, overshooting and **INP** (In Position Signal) abnormally repeating switching will be possible. So user must observe Speed Curve and **INP** (In Position Signal) at the same time, then increase Feed-Forward Value slowly. If Position Loop Gain is too high, Feed-Forward function will be unobvious.

There are Gain Adjusting Quick-Parameter in this device. The related Gain Adjustin parameters are in the Quick-Parameter folder. Which gives users convenience of adjusting when Gain Adjusted by hand.

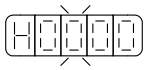
When user change the parameter value, the value will **be saved immediately and in effect right away** without pressing Enter-Key. The table list below shows the Gain Adjusting Quick-Parameter.

Parameter Signal	Name	Default	Unit	Setting Range	Control Mode
◆qn401	Speed Loop Gain 1	40	Hz	10~450	Pe/Pi/S
◆qn402	Integral Time Constant 1 of Speed Loop	100	x0.2 msec	1~500	Pe/Pi/S
◆qn403	Speed Loop Gain 2	40	Hz	10~450	Pe/Pi/S
◆qn404	Integral Time Constant 2 of Speed Loop	100	x0.2 msec	1~500	Pe/Pi/S
◆qn405	Position Loop Gain 1	40	1/s	1~450	Pe/Pi
◆qn406	Position Loop Gain 2	40	1/s	1~450	Pe/Pi
◆qn407	Position Loop Feed-Forward Gain	0	%	0~100	Pe/Pi

◆Be in effect immediately without pressing Enter-Key

5-5-1 Autotuning

This device provides ON-LINE Autotuning, which can quickly and precisely measure Load Inertia and adjut adequate the Gain automatically. Here is the setting:

Parameter Signal	Name	Setting	Description	Control Mode
Cn002.2 	Autotuning	0	No using Autotuning	Pe/Pi/S
		1	Keep using Autotuning	

When user set **0** in **Cn002.2**☞ No Autotuning. User must adjust the related Gain Adjusting parameters below:

Parameter Signal	Name
Cn025	Set for Autotuning

Sn211	Speed Loop Gain 1
Sn212	Integral Time Constant 1 of Speed Loop
Sn213	Speed Loop Gain 2
Sn214	Integral Time Constant 2 of Speed Loop
Pn310	Position Loop Gain 1
Pn311	Position Loop Gain 2
Pn312	Position Loop Feed-Forward Gain

When user set **1** in **Cn002.2**, it means continuing to use Autotuning. The Servo will adjust adequate Servo Gain in accordance with **Cn026** (Rigidity Setting) and had been measured Load Inertia Ratio. Observing Un-19 (Load Inertia Ratio), when the Load Inertia Ratio is getting stable, user can set **0** in **Cn002.2** to cancel Autotuning. At that moment, servo will record the measured Load Inertia Ratio into **Cn025** (Load Inertia Ratio). If servo is used in a applicance of few variation of Load, we suggest users turn off Autotuning when **Un-19** (Load Inertia Ratio) is getting stable.

The Servo provides Autotuning and use high-class control theory “ON-LINE” to measure Load Inertia Ratio to control system to achieve default speed or Position Response Bandwidth.

System must match the conditions below, so the Autotuning can operate normally.

(1) The timing from stop to 2000rpm need be less than 1 second.

(2) Working speed needs be more than 200rpm.

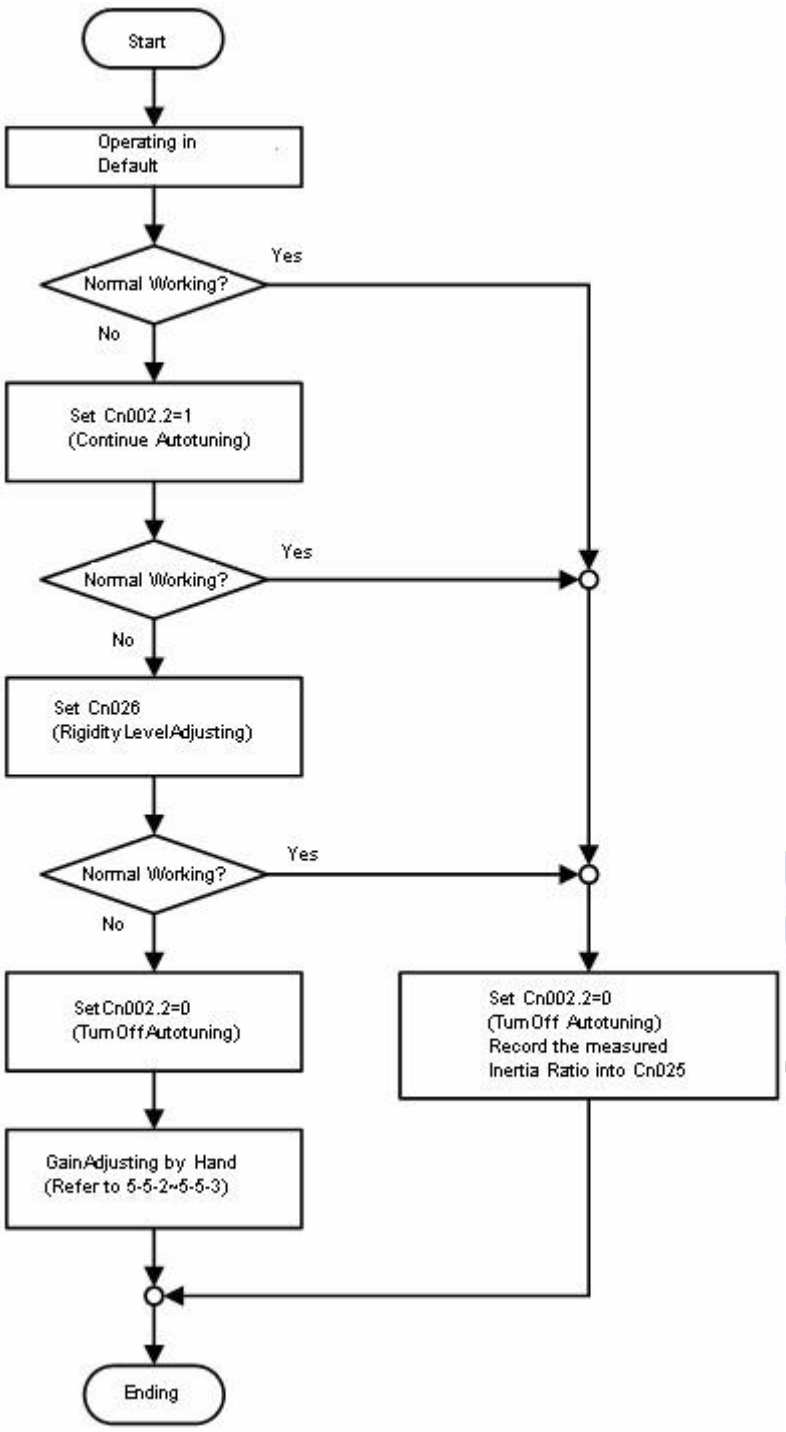
(3) Load Inertia needs be 100 times less than the inertia from motor.

(4) Outside force or the variation of Inertia Ratio can not be over violent.

When Autotuning is used, user should set the Rigidity Level depends on many kinds of Gain in a broad application. The table list below shows the rigidity setting range in a broad application.

Rigidity Setting Cn026	Position Loop Gain Pn310 [1/s]	Speed Loop Gain Sn211 [Hz]	Integral Time Constant of Speed Loop Sn212 [x0.2msec]	Mechanical Rigidity	Application
1	15	15	300	**Low**	The machines drived by Synchronous Belt, Chain or Gear: Man-size Moving Table, Transit Belt.
2	20	20	225		
3	30	30	150	**Middle**	
4	40	40	100		The machines drived by Ballscrew though decelerator: Ordinary machines, Mechanics arms, moving Machine.
5	60	60	75		
6	85	85	50	**High**	
7	120	120	40		The machines drived by Ballscrew: High precision Machines, Metal engraving Machine, Insertion Machine and IC inspection Machine.
8	160	160	30		
9	200	200	25		
A	250	250	20		

The Diagram below show the process for Autotuning.



P.S.: After operate Autotuning (Cn002.2=1): if no set 0 in Cn002.2, it will not record the present measured Load Inertia Ratio when cutting power ☞ When the Autotuning is operated next time again, servo will use the early setting Load Inertia Ratio in Cn025 starting to measure.

5-5-2 Manul Gain Adjusting

Step 1: Please refer to **5-5-1**(Autotuning) to set Rigidity Level then get the correct Load Inertia Ratio.

Step 2: If servo system combines with Host Controllor to become the Position Control, set the Position Loop Gain of Host Controllor to related low value.

Step 3: Manul adjusting **Sn211**(Speed Loop Gain1):

Setting the value in **Sn212** (Integral Time Constant 1 of Speed Loop) higher than the value which is set after Autotuning⇗ Increasing the Speed Loop Gain till there is no vibration or noise ⇗ Then decreasing the Speed Loop Gain slowly and enhancing Position Loop Gain of Host Controllor till there is no vibration or noise. **Step 4:** Manul Adjusting **Sn212**(Integral Time Constant 1 of Speed Loop):

Under the condition of no producing mechanical vibration to decrease the Integral Time Constant of Speed Loop to shorten settling time。

Step 5: Finally, slowly adjusting the Speed Loop Gain, Position Loop Gain of Host Controllor and Integral Time Constant of Speed Loop until servo has the best response.

Step 1: Please refer to 5-5-1 (Autotuning) to set Rigidity Level then get the correct Load Inertia Ratio.

Step 2: Setting the value in **Pn310** (Position Loop Gain1) lower than the value which is set after Autotuning ⇗ Setting to related high value in **Sn212** (Integral Time Constant 1 of Speed Loop).

Step 3: Manul Adjusting **Sn211** (Speed Loop Gain 1):

Increasing the Speed Loop Gain until there is no vibration or noise.

Step 4: Manul Adjusting **Pn310** (Position Loop Gain 1):

Slowly decreasing the Speed Loop Gain again, then increasing the Position Loop Gain until there is no vibration or noise.

Step 5: Manul adjusting **Sn212** (Integral Time Constant 1 of Speed Loop):

Under the condition of no producing mechanical vibration to decreasing the Integral Time Constant of Speed Loop and shorten settling time.

Step 6: Finally, slowly adjusting the Speed Loop Gain, Position Loop Gain and the Integral Time Constant of Speed Loop until the servo has the best response.

5-5-3 Improvement for Response Feature

The Servo provides the function of Gain Switching and Position Loop Feed-Forward Gain to improve system Response Feature. Attention! The 2 functions must be correctly used, so it can improve the Response Feature. Otherwise, the Response will become wores. Here is the description below:

The Gain Switch of this servo contains Speed Loop Gain PI/P Switching and 2-stage Gain Switching. Here is the Applications below:

(1) Restraining the overshooting of ac/deceleration in speed control.

(2) Restraining the vibration range result from In Position and shortening settling time in position control.

(3) Decreasing the noise result from Servo Lock Please refer to **5-3-11**

Using Position Loop Feed-Forward Gain can reduce the error result from position control and enhance the response speed. If the Position Loop Gain is high enough, the effects of this function wonr't be well. So It is used under the situation, in which user needs high response speed, but the gain value can't be high enough.

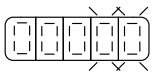
The adjusting steps is showed as follow:

Step 1: Refer to the processes in **5-5-1~5-5-2** to adjust Speed and Position Gain.

Step 2: Slow increase **Pn312**(Position Feed-Forward Gain), and observe the **INP** (Signal of In Position) at the same time to cause it output fast and shorten the settling time. Attention: the Position Loop Feed-Forward Gain can not too high, otherwise it will cause speed overshooting and **INP** (Signal of In Position) repeatly turning on and off.

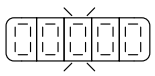
5-6 Other Functions 5-6-1 I/O Programmed Fumctions

This device has 13 DI contacts and 4 DO contacts which is programmable. Here is the description below:

Parameter Signal	Name	Setting	Description		Control Mode
★Hn501.0 ★Hn501.1 	**DI-1** Function		Signal	Contactor Function	ALL
		01	**SON**	Servo On	
		02	**ALRS**	Alarm Clear	
		03	**PCNT**	PI/P Switching	
		04	**CCWL**	CCW Limit	
		05	**CWL**	CW Limit	
		06	**TLMT**	External Torque Limit	
		07	**CLR**	Clear of Pulse Incorrect Value	
		08	**LOK**	Servo Lock	

		09	**EMC**	Emergency Stop	
		10	**SPD1**	Speed 1	
		11	**SPD2**	Speed 2	
		12	**MDC**	Mode Changing	
		13	**INH**	Inhibittion of Position Command	
		14	**SPDINV**	Speed Inverse	
		15	**G-SEL**	Gain Settle	
		16	**GN1**	Electronic Gear Ratio Numerator 1	
		17	**GN2**	Electronic Gear Ratio Numerator 2	
		18	**PTRG**	Position Trigger	
		19	**PHOLD**	Position Hold	
		20	**SHOME**	Start Home	
		21	**ORG**	Reference Origin	
		22	**POS1**	Position 1	
		23	**POS2**	Position 2	
		24	**POS3**	Position 3	
		25	**POS4**	Position 4	
		26	**TRQINV**	Torque Inverse	
		27	**RS1**	Torque CW Selecting	
		28	**RS2**	Torque CCW Selecting	

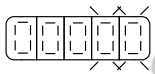
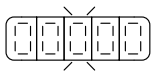
★The setting will be in effect after returning on the power.

Parameter Signal	Name	Setting	Description	Control Mode
★Hn501.2 	**DI-1 Electric Potential**	0	When the contactor is Low Electric Potential (Close loop to IG24), the function works.	ALL
		1	When the contactoris High Electric Potential (Open loop to IG24), thefunction works.	

★The setting will be in effect after returning on the power.

Parameter Signal	Name	Description	Control Mode
★Hn502	**DI-2 Programming**	Please refer to **Hn501** to check the setting method.	ALL
★Hn503	**DI-3 Programming**		
★Hn504	**DI-4 Programming**		
★Hn505	**DI-5 Programming**		
★Hn506	**DI-6 Programming**		
★Hn507	**DI-7 Programming**		
★Hn508	**DI-8 Programming**		
★Hn509	**DI-9 Programming**		
★Hn510	**DI-10 Programming**		
★Hn511	**DI-11 Programming**		
★Hn512	**DI-12 Programming**		
★Hn513	**DI-13 Programming**		

Attention! The functions of DI-1 ~ DI-13 could be repeat, but the contactors electric potential of repeated functions must be the same, otherwise there will be AL-07 (Abnormal alarm of DI/DO programming).

Parameter Signal	Name	Setting	Description		Control Mode
★Hn514.0 ★Hn514.1 	**DO-1 Electric Potential**		Code	Contactor functions	ALL
		01	**RDY**	Servo Ready	
		02	**ALM**	Alarm	
		03	**ZS**	Zero Speed	
		04	**BI**	Brake Signal	
		05	**INS**	In Speed	
		06	**INP**	In Position	
		07	**HOME**	HOME	
		08	**INT**	In Torque	
★Hn514.2 	**DO-1** Electric Potential	0	When the contactor is Low Electric Potential (Close loop to IG24), the function works.		ALL
		1	When the contactoris High Electric Potential (Open loop to IG24), thefunction works.		

★The setting will be in effect after returning on the power.

Parameter Signal	Name	Description	Control Mode
★Hn515	**DO-2 Programming**		ALL

★Hn516	**DO-3 Programming**	Please refer to Hn514 to check setting method	
★Hn517	**DO-4 Programming**		

Attention! The functions of DI-1 ~ DI-4 could be repeat, but the contactors electric potential of repeated functions must be the same, otherwise there will be AL-07 (Abnormal alarm of DI/DO programming).

5-6-2 Control Mode Switching

User can use Input Contoctor **MDC** to switch Control Mode set by **Cn001**. Here is the setting below:

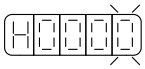
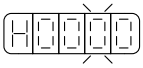
Parameter Signal	Name	Setting	Description		Control Mode
★Cn001	Control Mode Selecting		Input Contactor **MDC** doesn't working	Input Contactor **MDC** works	ALL
		3	Position Control(External Pulse Command)	Speed Control	
		4	Speed Control	Torque Control	
		5	Position Control (External Pulse Command)	Torque Control	

★The setting will be in effect after returning on the power.

P.S.: Input contacts status 1 means on; 0 means off. Please check 5-6-1 to set high electric potential or low electric potential

5-6-3 Contactor Accessory Functions

User can depend upon the Input Contactors SON, CCWL and CWL to decide if turning the related functions on. Here is the setting method below:

Parameter Signal	Name	Setting	Description	Control Mode
★Cn002.0 	**SON Selecting**	0	Use **SON** to switch Servo On。	ALL
		1	Servo on when Power on without using **SON** to turn the Servo on	
Cn002.1 	**CCWL** and **CWL** Selecting	0	Using **CCWL** and **CWL**to switch CCW and CW driving inhibit.	ALL
		1	Switching CCW and CW driving Inhibit without using **CCWL** and **CWL,** ignoring CCW and CW drive inhibit function	

★The setting will be in effect after returning on the power.

5-6-4 Braking Mode

User can set the Brake Combination when the Servo off, Emergency Stop and CCW/CW driving inhibit occur. Here is the setting below:

Parameter Signal	Name	Setting	Description		Control Mode
Cn008	Brake		Dynamic Brake	Mechanical Brake	ALL

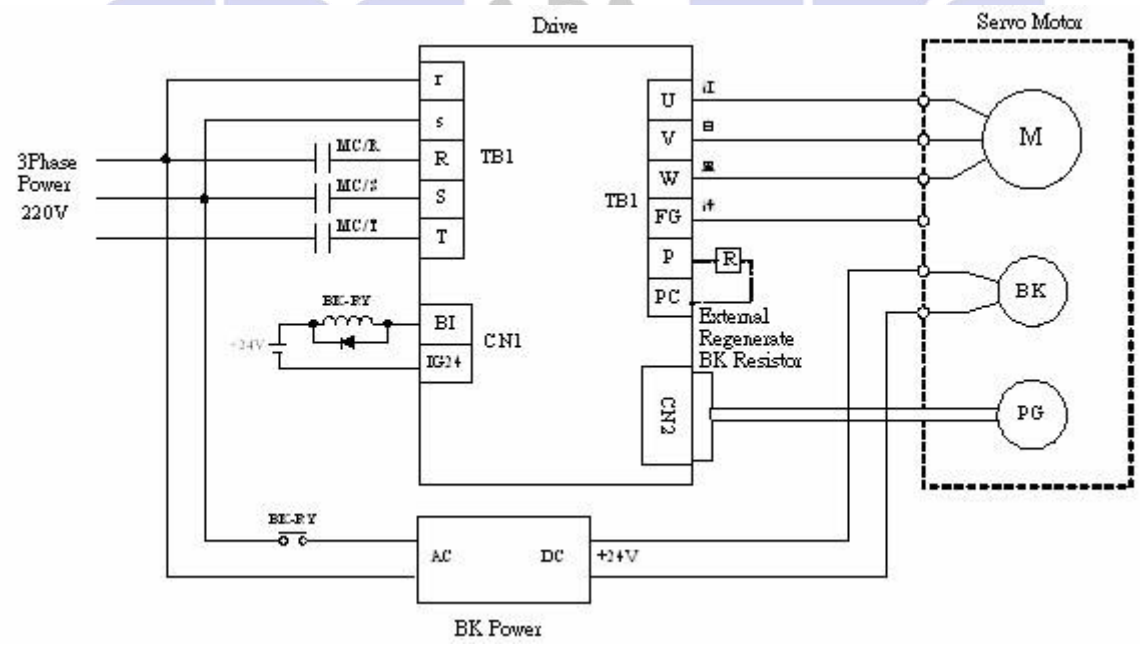
		0	Disable	Disable	
		1	Disable	Enable	
		2	Enable	Disable	
		3	Enable	Enable	

Attention! When the Drive Inhibit occurs in CCW/CW, the priority of Dynamic Brake in Cn009 should be from Cn008, which means assuming Cn008 setting is 0 or 1 (no Dynamic Brake) and Cn009 1 (with Dynamic Brake), the servo will have Dynamic Brake in the end of process.

5-6-5 Timming for Mechanical Brake

When the servo system has vertical Loading: To prevent the Displacement result from gravity when turning off power, the servo motor with Mechanical Brake should generally be used. This device provides Output Contactor **BI** to decide if the Mechanical Brake works or not, then control the Timming of Mechanical Brake in accordance with **Cn003** (Output Time for Mechanical Brake). Here is the description below:

Wiring Diagram



Timming for Mechanical Brake

Parameter Signal	Name	Default	Default	Setting Range	Control Mode
Cn003	Output time for Mechanical Brake Signal	0	msec	-2000~2000	ALL

Attention! Cn008 (BK Mode) must be set to 1 or 3. When the servo system has vertical loading, please set Cn003 to Positive Number.

(1) When the **Cn003**(Output Time for Mechanical Brake Signal) is Positive Number:

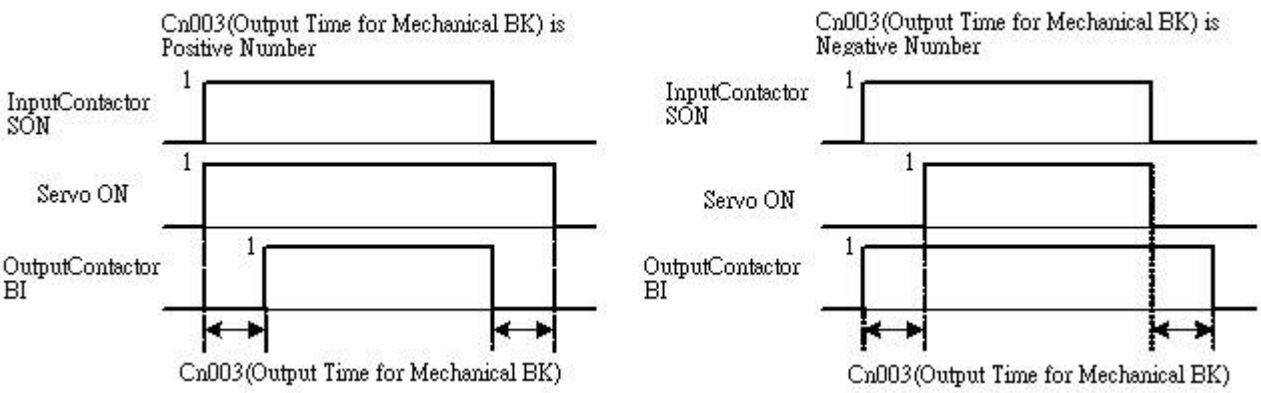
When the input contactor **SON** works, servo will immediately on. After exceeding the timming which is set in **Cn003**, Output Contactor BI works (Mechanical BK stops);

When **SON** doesn't work, BI donesn't work, either (turning on Mechanical BK). After exceeding the timming which is set in **Cn003**, Servo ON stops.

(2) When the **Cn003**(Output Time for Mechanical BK) is Negative Number:

When the input contactor **SON** works, output contactor BI (Stopping of Mechanical BK) will work immediately, After exceedingthe timming which is set in **Cn003**, servo will be on:

When Son doesn't work, Servo ON will be immediately stop. After exceeding the timming which is set in **Cn003**, output contactor **BI** will not work (Mechanical BK will be on).



P.S.: Input contacts status 1 means on; 0 means off. Please check 5-6-1 to set high electric potential or low electric potential.

5-6-6 Drive Inhibit Method for CW/CCW

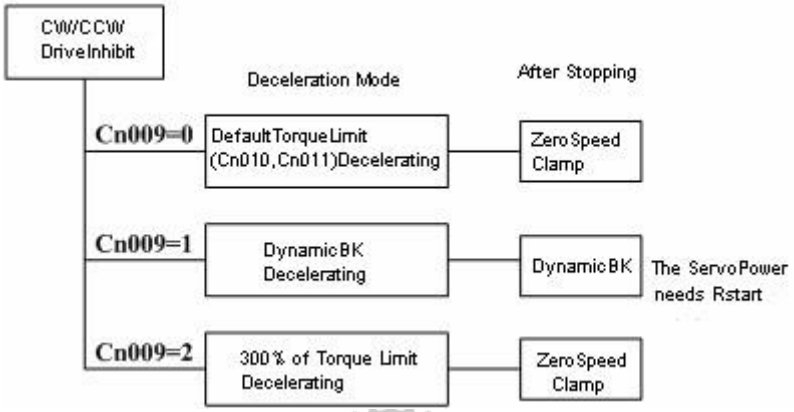
When CW/CCW Inhibit occur: Here below is the setting for stopping motor:

Parameter Signal	Name	Setting	Description	Control Mode
★Cn009	CW/CCW drive inhibit	0	Using default torque limit(**Cn010** 、 **Cn011**)to decelerate ☞ Zero Speed Clamp after stopping.	ALL
		1	Using Dynamic BK to decelerate. ☞ Decelerations status after stopping (Priority from **Cn008**), it is necessary to return on the power to turn on servo system.	

		2	Using ±300% of torque limit to decelerate ⇗ Zero Speed Clamp after stopping.	

★The setting will be in effect after returning on the power.

Attention! When the Drive Inhibit occurs in CCW/CW, the priority of Dynamic Brake in Cn009 should be from Cn008, which means assuming Cn008 setting is 0 or 1 (no Dynamic Brake) and Cn009 1 (with Dynamic Brake), the servo will have Dynamic Brake in the end of process.



5-6-7 Selection for External Regeneration Resistor

When the rotating of servo motor is under the Generator Mode, the power flows to the driver from motor, which is called regenerating power. The applications below will cause servo motor under the Generator (Regeneration) Mode:

(1) In the Timming during deceleration to stopping when servo motor ac/decelerates.

(2) When Vertical Loading.

(3) When operating servo motor from Loading Terminal.

The regeneration power will be absorbed by main loop filtering capacitance. If there is too much regeneration power which can not be absorbed, user must use Regeneration Resistor to absorb otiose regeneration power. Here are the built-in Regeneration Resistor specifications below:

Drive Model	Built-in Regeneration Resistor Specifications		The Regeneration Power(W)(Average Value which Built-in Regenerat Resistor can consume	Minimum allowed Resistance Vaule (Ω)
	Resistance(Ω)	Power(W)		
JSDA-15	50	60	24	50
JSDA-20	50	60	24	41
JSDA-30	25	60	24	23
JSDA-50	20	200	80	15
JSDA-75	12.5	200	80	9

Attention! The consumable Regeneration Power (Average Value) should be the 46% of Ratio Power from Built-in Regeneration Resistor

The Regeneration Resistor which is builted-in this device can consume the Regeneration Power from Ac/Deceleration Running or Vertical Loading. But in the application: driving servo motor at the loading terminal, user must install Regeneration Resistor by themselves, otherwise this device can not work normally. When installing External Regeneration Resistor, please confirm that resistance value is the same with the resistance value builted-in in this device. If using many low-walt Regeneration Resistor to exceed parallel connection to increase the walt of Regeneration Resistor, please confirm all the Resistance value must higher than the Minimum allowed Resistance Value on the Table List above.

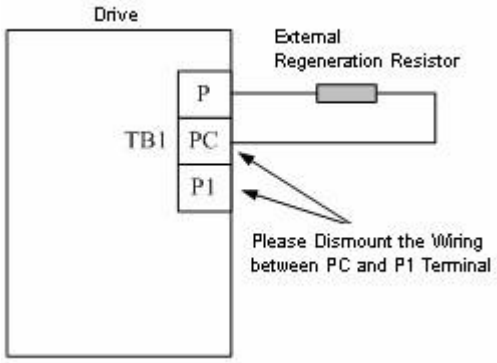
Setting for the Power of External Regeneration Resistor

When using external regeneration resistor, user must select the Watt for Regeneration Resistor correctly in **Cn012.**

Parameter Signal	Name	Default	Unit	Setting Range	Control Mode
Cn012	Watt setting for External Regeneration Resistor	60	W	0~10000	ALL

User must use their own Regeneration Resistor, then dismount the wire between **PC** and **P1** on **TB1** Terminal when installing another resistor, then connect the Regeneration Resistor between **P1** and **PC**. For the safety, user is suggested to use the resistor with thermal.

Here is the wiring diagram below:



When the Regeneration Resistor absorbs the regeneration power, it will produce the high temperature over 100°C. Please be careful to cool it. Please select the heatproof wire when wiring Regeneration Resistor and confirm nothing is connecting to the Regeneration Resistior.

If the Loading of Servo Motor is Horizontal Moving, please use the Table List below to decide if the External Regeneration Resistor is necessary. The table list below is about Allowable Frequencies in Regenerative Mode, which definition is: the no-load speed of motor running from 0 to ratio speed then from from ratio speed to 0. And in the process of re-ac/deceleration, the Regeneration Power which internal regeneration resistor can absorb when Allowable Frequencies in Regenerative Mode.

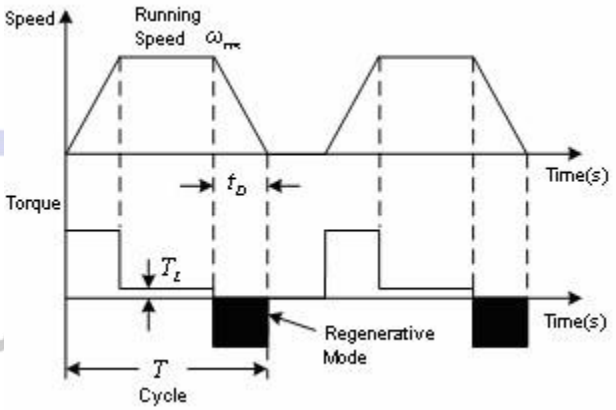
Drive Model	Motor Model	Allowable Frequencies in Regenerative Mode (time/min)	The Power which Main Capacitor can absorb E_C (J)
JSDA-15	JSMA-LC03	433	6
	JSMA-SC02	1775	
	JSMA-SC04	1004	
JSDA-20	JSMA-LC08	118	9
	JSMA-SC04	1004	
	JSMA-SC08	321	
	JSMA-MA05	411	
	JSMA-MH05	186	
JSDA-30	JSMA-SC08	321	13
	JSMA-MA10	213	
	JSMA-MB10	102	
	JSMA-MH10	95	
	JSMA-MA15	145	
	JSMA-MB15	73	
	JSMA-MC15	45	
JSDA-50	JSMA-MA15	484	13
	JSMA-MB15	245	
	JSMA-MC15	152	
	JSMA-MB20	178	
JSDA-75	JSMA-MB30	121	18

Please use the formula below to compute the Allowable Frequencies in Regenerative Mode in accordance with actual Loading and running speed of motor.

$$\text{Allowable Frequencies in Regenerative Mode (time/min)} = \frac{\text{Allowable Frequencies}}{(1+\alpha)} \times \left(\frac{\text{Ratio Speed}}{\text{Max Running Speed}}\right)^2$$

$\alpha =$ Load Inertia / Motor Inertia

If the motor's actual running Frequencies is more than the computed Allowable Frequencies, user needs to install the external regeneration resistor. Please the necessary Watt of external regeneration resistor in accordance with the description below: (Ingoring the impedance from Motor Coil and the Energe which the circuit consumes)



Step	Item	Formula	Description
1	Compute the working Energe of Servo System.	$E_M = J_T \omega_{rm2} / 182$	E_M: Working Energe of Servo system (J) J_T: Inertia which is transformed to motor loading terminal ($kg \cdot m^2$) ω_{rm} : Motor running Speed(rpm)
2	Compute the consumed Energy during deceleration.	$E_L = (\pi / 60) \omega_{rm} T_L t_D$	E_L: The Energy during deceleration (J) T_L: Loading Torque(Nm) t_D: The Time from deceleration to stopping(s)

3	Compute the Energy which main capacitance can absorb	E_C Check the diagram above	E_C : The Energy which main capacitance can absorb (J)
4	Compute the Energy which Regeneration Resistor consumes	$E_R = E_M - (E_L + E_C)$	E_R : The Energy which Regeneration Resistor consumes (J)
5	Compute the Power which Regeneration Resistor needs	$P_R = (E_R/T)/0.4$	P_R : The Power which Regeneration Resistor needs(W) T : Operating cycle for servo system(s)

P.S.1: Compute the 0.4 ☞ Utility Rate for Regeneration Resistor = 40% (in P_R formula).

P.S.2: If the E_L can not be computed, please let the $E_L = 0$, then count it.

When the Servo is used in the Regenerative Mode, which means Motor Output Torque is adverse to Running direction, a great guantity of Loading Energy will fluent back to the driver. Under this situation, please add the item below before the formula step 4 above. Then compute the necessary Watt for external regeneration resistor:

Item	Formula	Description for Symbols
Compute the working Energy during the continual regenerative mode period.	$E_G = (\pi/60)\omega_{rm,G} T_G t_G$	E_G : Working Energy during the regenerative mode period (J) $\omega_{rm,G}$: Motor running speed (rpm) during the regenerative mode period T_G : Loading Torque during the regenerative mode period (Nm) t_G : Regenerative Mode Time(s)

The formula of step 4 will be: $E_R = E_M - (E_L + E_C) + E_G$

5-6-8 Setting for Fan Working

Parameter Signal	Name	Setting	Description	Control Mode
Cn031	Setting for Fan Working **(Only for JSDA-50 and JSDA-75)**	0	Auto (Depend on Temp.)	ALL
		1	Operate while in RUN mode	
		2	Always Run	

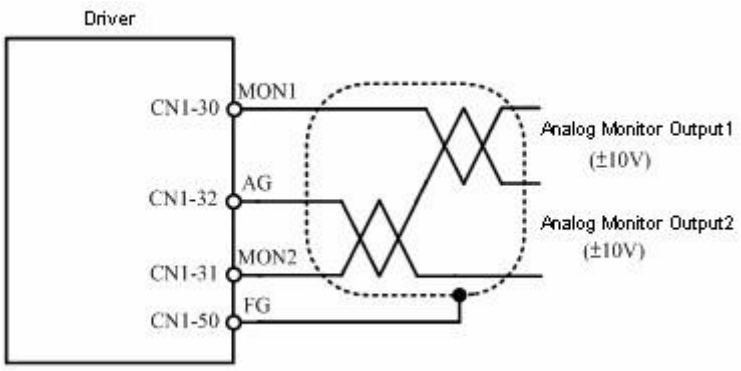
		3	Always Stop	

5-6-9 Analog Monitor

The servo provides 2 Analog Signals to monitor the running situation of motor. Here is the setting below:

Parameter Signal	Name	Setting	Description		Control Mode
Cn006	Selection for Analog Monitor Output		Analog Monitor Output 1 **MON1**	Analog Monitor Output 2 **MON2**	ALL
		0	Actual Speed **(1.5x Ratio Number /±10V)**	Torque Command **(3.5x Ratio Number /±10V)**	
		1	Actual Speed	Speed Command **(1.5x Ratio Number /±10V)**	
		2	Actual Speed	Rotor Position **(0~360°機械角/±10V)**	
		3	Actual Speed	Position Pulse error **(±16~16368pulse/±10V)**	
		4	Actual Speed	U-Phase Current **(3.5x Ratio Number /±10V)**	

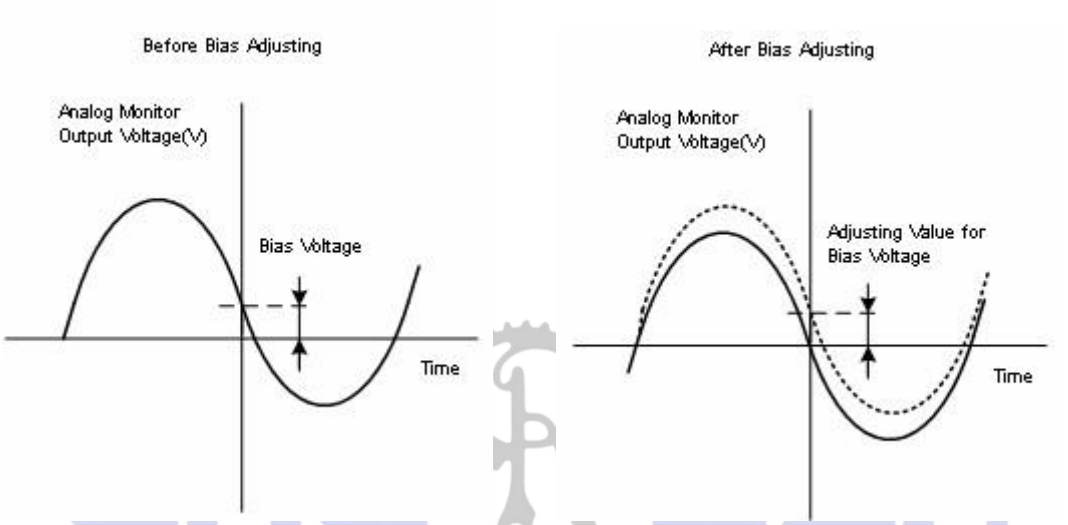
The Diagram below is the Wiring Diagram for Analog Monitor Output:



When there is Analog Monitor Output Voltage Bias, users can manually adjust **Cn027、Cn028** to fix the bias value.

Here is the setting below:

Parameter Signal	Name	Default	Unit	Setting Range	Control Mode
Cn027	Analog Monitor 1 Output Bias Adjusting	4	x40mV	-250~250	ALL
Cn028	Analog Monitor 2 Output Bias Adjusting	4	x40mV	-250~250	ALL



5-6-10 Reset for Parameter

The servo can turn back to the default value with this function. When setting to **1**, the power must be restart:

Parameter Signal	Name	Setting	Description	Control Mode
★Cn029	Reset for Parameter	0	No working	ALL
		1	All parameters return to default value	

★The setting will be in effect after returning on the power.

Chapter 6 Parameter

6-1 Definition

There are following 9 groups for parameters：

Parameter	Definition
Un-xx	Status Display Parameter
dn-xx	Diagnosis Parameter
AL-xx	Alarm Traceback data parameter
Cn-xx	System Parameter
Tn1xx	Torque Control Parameter
Sn2xx	Speed Control Parameter
Pn3xx	Position Control Parameter
qn4xx	Quick Setting Parameter
Hn5xx	Multi-function parameter

P.S: xx stand for the events of parameter groups.

Control Mode Code

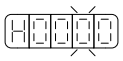
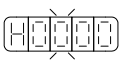
Abbreviation	Control Mode
ALL	All Control Mode
Pi	Position Control Mode (Internal Positional Command)
Pe	Position Control Mode (External Puls Command)
S	Speed Control Mode
T	Torque Control Mode

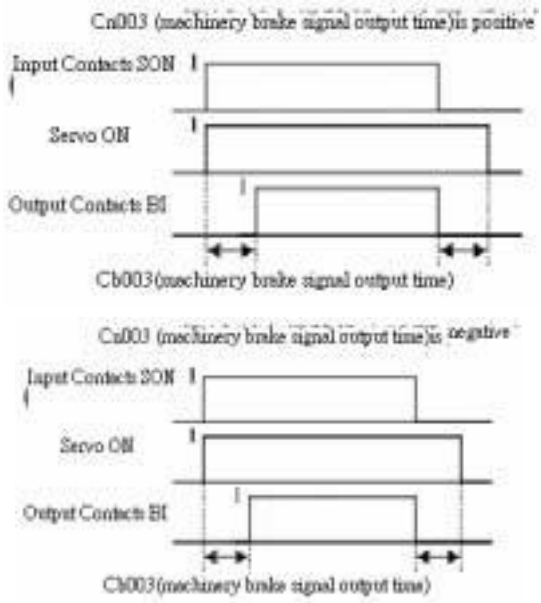
Effective Symbol of Parameter setting

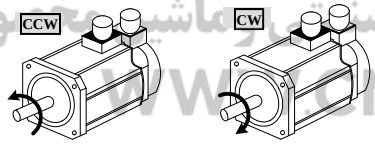
Symbol	Explanation
★	Parameter is effective after the servo drive is restarted.
◆	Parameter is Effective without “Enter”.

6-2 Parameter

System Parameter

Parameter	Name & Function	Default	Unit	Setting Range	Control Mode	Chap.
★Cn001	**Control Mode** Setting: Explanation 0: Torque Control 1: Speed Control 2: Position Control (external puls Command) 3: Position / Speed Control Switching 4: Speed / Torque Control Switching 5: Position / Torque Control Switching 6: Position Control (internal position Command)	2	X	0 | 6	ALL	5-1 5-6-2
★Cn002.0 	**Contact Accessory Function – Enter Contact "SON"** Setting: Explanation 0: Enter Contact”SON”to control “Servo On” 1: Control “Servo ON”without entering Contact “SON”; Servo ON when Power ON.	0	X	0 | 1	ALL	5-6-3
Cn002.1 	**Contact Accessory Function – Eter Contact CCWL & CWL** Setting: Explanation 0: Using entrance contacts CCWL & CWL to control CCW & CW. 1: Control CCW & CW Drive Forbid without using contact CCWL & CWL, ignoring CCW & CW Drive Forbid Function.	0	X	0 | 1		
Cn002.2 	**Auto- Tone up Adjust Setting** Setting: Explanation 0: No using Auto-Tone up Adjust Function 1: Keep using Auto-Tone up Adjust Function.	0	X	0 | 1	Pi Pe S	5-5-1

<table>
<tr><th>Parameter</th><th>Name & Function</th><th>Default</th><th>Unit</th><th>Setting Range</th><th>Control Mode</th><th>Chap.</th></tr>
<tr><td>Cn003</td><td>Mechanical Brakes signal output sequence
Time Sequence :
 

P.S.: Input / output contact status 1 means SWITCH; 0 means SWITCH OFF, please refer to 5-6-1 to set high electric action potential or low electric action potential.</td><td>0</td><td>msec</td><td>-2000
|
2000</td><td>ALL</td><td>5-6-5</td></tr>
<tr><td>Cn004</td><td>Moters rotate direction(Motor Load)
 

When Torque or Speed Command is plus, the setting of Motor Load are:
<table>
<tr><th rowspan="2">Setting</th><th colspan="2">Explanation</th></tr>
<tr><th>Torque Control</th><th>Speed Control</th></tr>
<tr><td>0</td><td>CounterClockWise(CCW)</td><td>CounterClockWise(CCW)</td></tr>
<tr><td>1</td><td>ClockWise(CW)</td><td>CounterClockWise(CCW)</td></tr>
<tr><td>2</td><td>CounterClockWise(CCW)</td><td>ClockWise(CW)</td></tr>
<tr><td>3</td><td>ClockWise(CW)</td><td>ClockWise(CW)</td></tr>
</table></td><td>0</td><td>X</td><td>0
|
3</td><td>S T</td><td>5-2-4
5-3-7</td></tr>
<tr><td>★Cn005</td><td>Encoder Signal Ration output</td><td></td><td>pulse</td><td></td><td>ALL</td><td>5-3-5</td></tr>
</table>

	It stands for that the number of puls-signal numbers of a rotate of the motor-encoder transforming the Cn005-default puls-signal numbers. Ex: Motor-Encoder : One Rotate has 2000pulse output. Set **Cn005**=1000 if gain 1000pulse Ration-output.	Amount per Pulse		1 | Amount per Pulse		

Parameter	Name & Function	Default	Unit	Setting Range	Control Mode	Chap.
Cn006	**Analog Moniter Output Selection** Setting: 0 — Analog moniter output 1 **MON1**: Actual Speed **(1.5timesdefault value/±10V)**; Analog moniter output2 **MON2**: Torque Command **(3.5times rating value/±10V)** 1 — Actual Speed; Speed Command **(1.5times rating value/±10V)** 2 — Actual Speed; Rotor position **(0~360° Mechanical angle/±10V)** 3 — Actual Speed; Position puls err **(±16~16368pulse/±10V)** 4 — Actual Speed; U-Phase current **(3.5 times rating value /±10V)**	2	X	0 | 4	ALL	5-6-9
Cn007	**Speed-achievd determined value** When ClockWise's or CounterClockWise's Speed is over **Cn007** (when the speed achieves the determined value) Setting, output contact **INS**.	1000	rpm	0 | 4500	S T	5-3-12
Cn008	**Brakes Mode** (Servo off)、(EMC)、CCW/CW Brake status in Drive Limit static state. 0 — No / No 1 — No / Yes 2 — Yes / No 3 — Yes / Yes	2	X	0 | 3	ALL	5-6-4
★Cn009	**CW/CCW Drive forbid**		X		ALL	5-6-6

Setting	Explanation	0		0 | 2		
0	ServoMotor decelerate then stop through default torque forbid(**Cn010**、**Cn011**).					
1	ServoMotor decelerate then stop through default torque forbid (**Cn010**、**Cn011**),and drive the dynamic brake (priority to **Cn008**)					
2	ServoMotor decelerate then stop through ±300% Torque forbid decelerate then stop.					

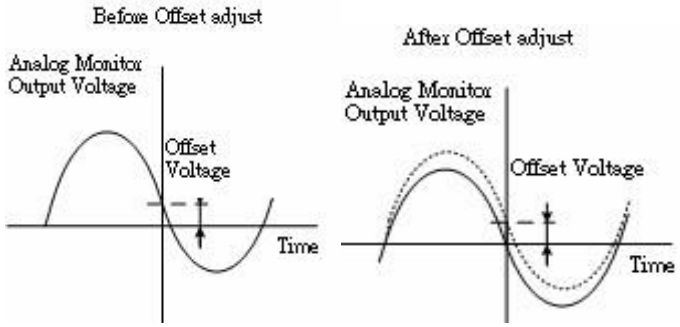
Parameter	Name & Function	Default	Unit	Setting Range	Control Mode	Chap.
Cn010	**CCW direction torque Command forbid number** Ex: If 2 times of default Torque forbid of CCW Torque Command, set **Cn001**=200.	100	%	0 | 300	ALL	5-2-5 5-3-10
Cn011	**CW Torque Command forbid number.** Ex: If 2 times of default Torque forbid of CW Torque Command, set **Cn011**=-200.	-100	%	-300 | 0	ALL	5-2-5 5-3-10
Cn012	**Setting of the duty of External Re-generate resister** Refering to 5-6-7 to choose external Regenerate resister and set its duty at **Cn012**	60	W	0 | 10000	ALL	5-6-7
★Cn013	**Frequency of resonance restrain Filter** Please enter the frequency of vibration in **Cn013**, if the noice of vibration must be eliminated.	0	Hz	0 | 1000	Pi Pe S	5-3-9
★Cn014	**Quality-Factors of the Resonance restrain Filter** Adjusting the range of the frequency, lower the number of **Cn014** is, wider the restrained range of frequency is.	7	X	1 | 100	Pi Pe S	5-3-9
Cn015.0	**Type-Chois of the Switch-estimation in PI/P Mode.**	4	X	0 | 4	Pi Pe S	5-3-11
	Setting: Explanation 0: Estimate if Torque Command over **Cn016** 1: Estimate if Speed Command over **Cn017** 2: Estimate if acceleration Command over **Cn018** 3: Estimate if position mistake over **Cn019** 4: Using Enter Contact **PCNT** to switch it					
Cn015.1	**Choise of Type of SwitchingEstimation in 2 part increase Mode**	4	X	0 | 4		
	Setting: Explanation 0: Estimate if Torque Command over **Cn021** 1: Estimate if Speed Command over **Cn022** 2: Estimate if acceleration Command over **Cn023**					

	3	Estimate if position mistake over **Cn024**					
	4	Using Enter Contact **PCNT** to switch it					
Cn016	**Switch-condition in PI/P Mode(Torque Command)** Set the **Cn015.0=0 first**, when Torque Command under **Cn016** switch-condition, controled by PI ; when Torque Command over **Cn016** switch-condition, controled by P only。		200	%	0 | 399	Pi Pe S	5-3-11
Cn017	**Switch-condition in PI/P Mode(Speed Command)** Set the **Cn015.0=1 first**, when Speed Command is under **Cn017**switch-condition, controled by PI ; when Speed Command is over **Cn017**switch-condition, controlled by P only。		0	rpm	0 | 4500	Pi Pe S	5-3-11

Parameter	Name & Function	Default	Unit	Setting Range	Control Mode	Chap.
Cn018	**Switch-condition in PI/P mode (accelerate Command)** Set the **Cn015.0=2 first**, when acceleration Command is under **Cn018** switch-condition, controled by PI ; when acceleration Command is over **Cn018** switch-condition, controled by P only.	0	rps/s	0 | 18750	Pi Pe S	5-3-11
Cn019	**Switch-condition inPI/P mode(position error number)** Set the **Cn015.0=3 first**, when position error number is under **Cn019** switch-condition , controled by PI ; when position error number is over **Cn019** switch-condition, controled only by P.	0	pulse	0 | 50000	Pi Pe S	5-3-11
Cn020	**Switch-delay time of 2-parts increase mode.** When using 2-parts increase mode, the delay that switching from the second part to the first part can be set.	0	x02 msec	0 | 10000	Pi Pe S	5-3-11
Cn021	**Switch-condition of 2-parts increase mode.(Torque Command)** Set **Cn015.1=0 first**, when Torque Command is under **Cn021** switch-condition, use the first part increase-condrol; when Torque Command is over **Cn021** switch-condition, switch to the second part of increase-control. If Torque Command is under **Cn021** switch-condition again, it will be switched to the first part of increase-control in accordance with **Cn020.**	200	%	0 | 399	Pi Pe S	5-3-11
Cn022	**Switch-condition of 2-parts increase mode. (Speed Command)**	0	rpm	0	Pi Pe	5-3-11

	Set the **Cn015.1=1 first**, when Speed Command is under **Cn022** switch-condition, use the first-part increase-condtrol. When Speed Command is over **Cn022** switch-condition, switch to the second part of increase-control. When Speed Command is under **Cn022** switch-condition again, it will be swithched to the first part of increase-condtrol in accordance with **Cn020**.			| 4500	S	
Cn023	**Switch-condition of 2-parts increase mode.(Accelerate Command)** Set the **Cn015.1=2** first, when accelerate Command is under **Cn023** switch-condition, use the first-part increase-control. When accelerate Command is over **Cn023** switch-condition , switch to the second part of increase control. When accelerate Command is under **Cn023** switch-condition again, it will be switched to the first part of increase-control in **Cn020** switch-delay time.	0	rps/s	0 | 18750	Pi Pe S	5-3-11
Parameter	**Name & Function**	**Default**	**Unit**	**Setting Range**	**Control Mode**	**Chap.**
Cn024	**Switch-condition of 2-parts increase mode. (Position error amount)** Set **Cn015.1=3** first, when the error amount is under **Cn024** switch-condition, use the first part of increase-control; when the position-error amount is over **Cn024** switch-condition, switch to the second part of increase-control; when position-error amount is under **Cn024** switch-condition, switch to the first part of increase-control in accordance with **Cn020** switch-delay time.	0	pulse	0 | 50000	Pi Pe S	5-3-11
Cn025	**Load-Inertia rate** $LoadInertiaRatio = \frac{LoadInertiaToMotor(J_L)}{MotorRotorInertia(JM)} \times 100\%$	70	x0.1	0 | 1000	Pi Pe S	5-5
Cn026	**Rigidity Setting** When using the auto-increase adjustment function, Rigidity Range should be set first in accordance with all appliance. The Rigidity Setting ranges in all kinds of appliance follow as below: Explanation	4	X	1 | A	Pi Pe S	5-5-1

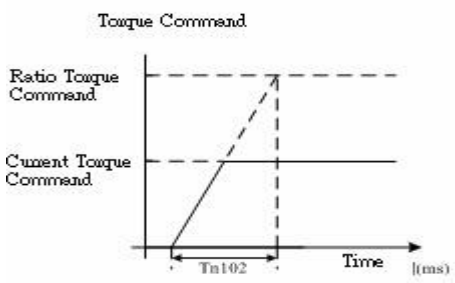
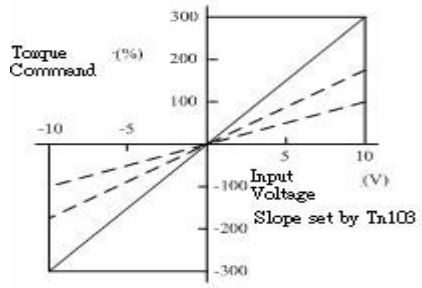
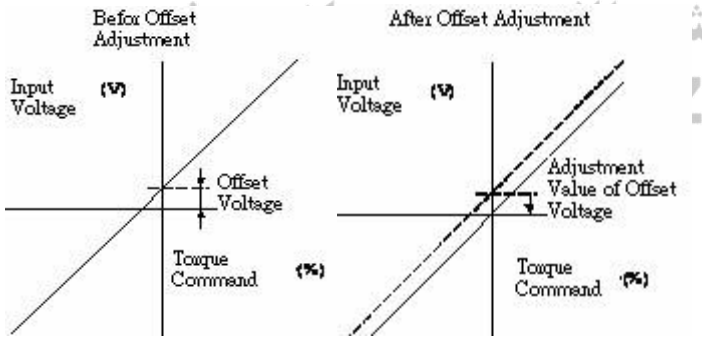
	Setting	Position Loop Gain **Pn310 [1/s]**	Speed Loop Gain **Sn211 [Hz]**	Speed Loop Integration-Time Constant **Sn212 [x0.2msec]**
	1	15	15	300
	2	20	20	225
	3	30	30	150
	4	40	40	100
	5	60	60	75
	6	85	85	50
	7	120	120	40
	8	160	160	30
	9	200	200	25
	A	250	250	20

Parameter	Name & Function	Default	Unit	Setting Range	Control Mode	Chap.
Cn027	**Analog monitor out put –'1' shift adjustment** Analog monitor out put"1" : When there are phenomenon of voltage departure, it could be adjusted. 	4	x40 mV	-250 | 250	ALL	5-6-9
Cn028	**Analog monitor out put –'2' departure adjustment** Analog monitor out put ' 2' : When there are phenomenon of voltage departure, it could be adjusted.	4	x40 mV	-250 | 250	ALL	5-6-9
★Cn029	**Parameter reset** Setting: 0 — Un-functional; 1 — All Parameters return to default	0	X	0 | 1	ALL	5-6-10

★Cn030	**Setting of Servo-Seriation** When the Setting of what **dn-08** display is different between ServoDrive and ServoMotor, please contact with our local distributor to set this parameter.	Default	X	X	ALL	3-2-2
Cn031	**Setting of fan running(Application only to JSDA-50 & JSDA-75)** Setting: 0 Auto-running of temperature sensor.; 1 Running when Servo ON; 2 Keeping Running; 3 Stop Running	0	X	0 | 3	ALL	5-6-8

Torque-Control Parameter

Parameter	Name & Function	Default	Unit	Setting Range	Control Mode	Chap.
★Tn101	**Ac/de-celeration in Torque Command** Setting: 0 No using function of torque command - linear acceleration.; 1 Using function of torque command - linear acceleration.	0	X	0 | 1	T	5-2-3
★Tn102	**Torque Command – Linear ac/deceleration-constant**	1	msec		T	5-2-3

	The constant of torque-command-linear ac/deceleration means the time in which from '0' to 'default amount' .  			1 | 50000		
Tn103	**Analog Torque Command – Ratio adjust** The slope : Adjustment of voltage command v.s. adjustment of Torque command.  	300	%/10V	0 | 300	T	5-2-1
Tn104	**Departure-Adjustment in Analog Torque Command** When there is the phenomenon of Voltage-Departure in analog torque command, it is used to adjust the departure-amount.  	0	mV	-10000 | 10000	T	5-2-2

Parameter	Name & Function	Default	Unit	Setting Range	Control Mode	Chap.
Tn105	**Internal Speed Limit '1'**	100	rpm	0	T	5-2-6

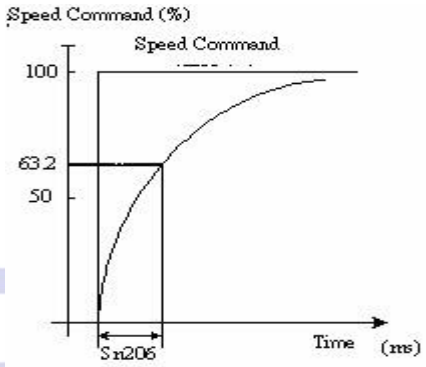
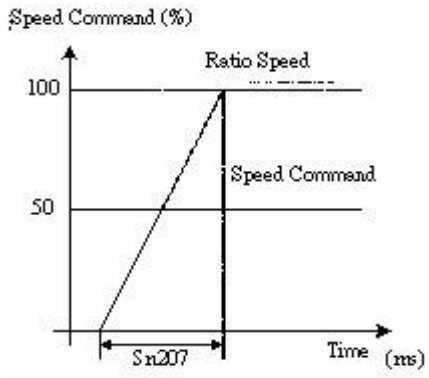
	In “Torque Control”, the input-contacts “**SPD1 & SPD2**” can be used to switch 3 parts of internal speed limit. When internal speed limit is “1”, the status of input contact “**SPD1 & SPD2**” follow as below: **Input-Contact SPD2** | **Input-Contact SPD1** 0 | 1 **P.S:** Contact status”1”stands for ON, “0” is OFF. Refer to 5-6-1 to set high or low action potential.			3000		
Tn106	**Internal Speed Limit “2”** In “Torque Control”, the input-contacts SPD1 & SPD2can be used to 3 parts of internal speed limit. When internal speed limit is “2”, the status of input-contact SPD1 & SPD2 follow as below: **Input Contact SPD2** | **Input Contact SPD1** 1 | 0 **P.S:** Contact status”1”stands for ON, “0” is OFF. Refer to 5-6-1 to set high or low action potential.	200	rpm	0 | 3000	T	5-2-6
Tn107	**Internal Speed Limit “3”** In “Torque Control”, the input-contacts SPD1 & SPD2can be used to 3 parts of internal speed limit. When internal speed limit is “3”, the status of input-contact SPD1 & SPD2 follow as below: **Input Contact SPD2** | **Input Contact SPD1** 1 | 1 **P.S:** Contact status”1”stands for ON, “0” is OFF. Refer to 5-6-1 to set high or low action potential.	300	rpm	0 | 3000	T	5-2-6

Speed-Control Parameter

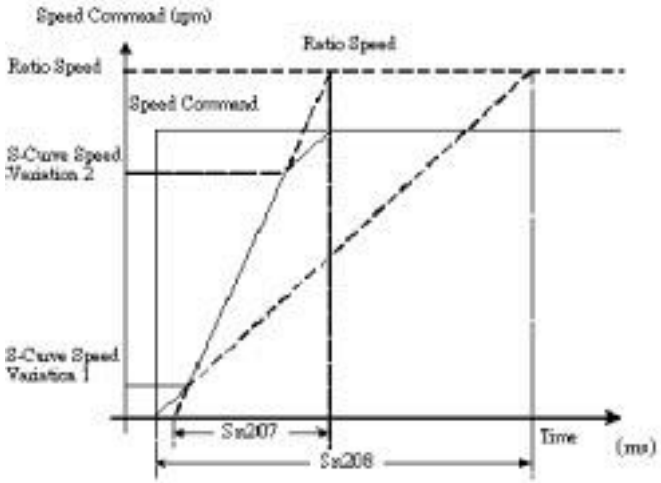
Parameter	Name & Function	Default	Unit	Setting Range	Control Mode	Chap.

<table>
<tr><td>Sn201</td><td>Internal Speed Command “1”
In “Speed Control”, the input-contacts SPD1 & SPD2 can be used to switch 3 parts of internal speed command. When the Internal Speed Command is “1”, the status of Input Contact SPD1 & SPD2 follow as below:
<table><tr><th>Input Contact SPD2</th><th>Input Contact SPD1</th></tr><tr><td>0</td><td>1</td></tr></table>P.S: Contact status”1”stands for ON, “0” is OFF. Refer to 5-6-1 to set high or low action potential.</td><td>100</td><td>rpm</td><td>-3000
|
3000</td><td>S</td><td>5-3-1</td></tr>
<tr><td>Sn202</td><td>Internal Speed Command “2”
In “Speed Control”, the input-contacts SPD1 & SPD2 can be used to switch 3 parts of internal speed command. When the Internal Speed Command is “2”, the status of Input Contact SPD1 & SPD2 follow as below:
<table><tr><th>Input Contact SPD2</th><th>Input Contact SPD1</th></tr><tr><td>1</td><td>0</td></tr></table>P.S: Contact status”1”stands for ON, “0” is OFF. Refer to 5-6-1 to set high or low action potential.</td><td>200</td><td>rpm</td><td>-3000
|
3000</td><td>S</td><td>5-3-1</td></tr>
<tr><td>Sn203</td><td>Internal Speed Command “3”
In “Speed Control”, the input-contacts SPD1 & SPD2 can be used to switch 3 parts of internal speed command. When the Internal Speed Command is “3”, the status of Input Contact SPD1 & SPD2 follow as below:
<table><tr><th>Input Contact SPD2</th><th>Input Contact SPD1</th></tr><tr><td>1</td><td>1</td></tr></table>P.S: Contact status”1”stands for ON, “0” is OFF. Refer to 5-6-1 to set high or low action potential.</td><td>300</td><td>rpm</td><td>-3000
|
3000</td><td>S</td><td>5-3-1</td></tr>
<tr><td>Sn204</td><td>Motion of Zero-Speed judgment
<table><tr><th>Setting</th><th>Explanation</th></tr><tr><td>0</td><td>No Action</td></tr><tr><td>1</td><td>Let the Speed Command be “Zero-Speed”</td></tr></table></td><td>0</td><td>X</td><td>0
|
1</td><td>S</td><td>5-3-12</td></tr>
</table>

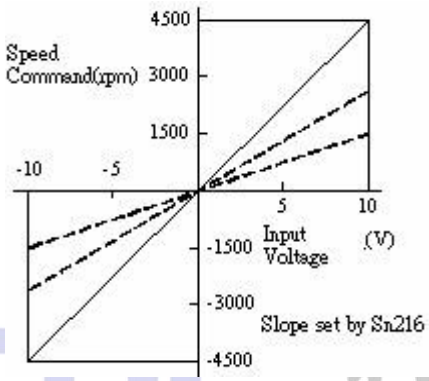
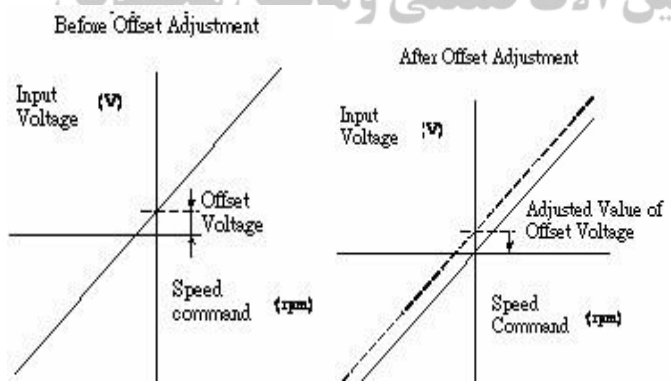
Parameter	Name & Function	Default	Unit	Setting Range	Control Mode	Chap.

<table>
<tr><td>Sn205</td><td>Ac/deceleration of Speed Command
<table><tr><td>Setting</td><td>Explanation</td></tr><tr><td>0</td><td>Not Function</td></tr><tr><td>1</td><td>1 time soft Ac/deceleration</td></tr><tr><td>2</td><td>Linear Ac/deceleration</td></tr><tr><td>3</td><td>S curve to Ac/deceleration</td></tr></table></td><td>0</td><td>X</td><td>0
3</td><td>S</td><td>5-3-6</td></tr>
<tr><td>Sn206</td><td>One Time Soft ac/deceleration-time Constant in SpeedCommand
Set Sn205=1to turn on One-Time ac/deceleration function in SpeedCommand.
The time-constant stands for the time in which the speed arise to 63.2 of Full-Speed.
 
</td><td>1</td><td>msec</td><td>1
10000</td><td>S</td><td>5-3-6</td></tr>
<tr><td>Sn207</td><td>Linear ac/deceleration Constant in SpeedCommand
Set Sn205=2 to turn on Linear ac/deceleration function of SpeedCommand.
The ac/deceleration constantstands for the time in which the speed arise from 0 to the default time.
 
</td><td>1</td><td>msec</td><td>1
50000</td><td>S</td><td>5-3-6</td></tr>
</table>

Parameter	Name & Function	Default	Unit	Setting Range	Control Mode	Chap.
Sn208	**Ac/deceleration Constant in S-curve SpeedCommand**	1	msec	1	S	5-3-6

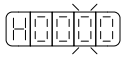
	Set **Sn205**=**3** to turn on S-curve ac/deceleration function in Speed-Command. Set **Sn208** to get softer slope then **Sn207,** and watch **Sn209** and **Sn210** to switch these 2 rising slope.  **Attention:Sn207 must under Sn208, then the smooth effect appear.**			50000		
Sn209	**S-curve varying Speed** Please refer to Sn208	1000	rpm	0 3000	S	5-3-6
Sn210	**S-curve varying Speed – 2** Please refer to Sn208	2000	rpm	0 3000	S	5-3-6
Sn211	**Speed loop gain – 1** Speed loop gain effect directly the frequency response bandwidth of Speed-control loop. If there is no vibration or noise, more Speed-loop-gain amount it has, the faster speed response is. If **Cn025** correctly set, the speed-loop-bandwidth equal to speed-loop-gain.	40	Hz	10 450	Pi Pe S	5-3-8 5-5
Sn212	**The Time-Constant of Speed-loop Integration – 1** Speed-Control Loop with integration-elements can eliminate the speed error and show the slight variations. Decreasing Speed –loop time can increase system rigitidy. The formula below provides the speed-loop-integration time-constant. $SpeedLoopIntegrationTimeConstant \geq 5 \times \frac{1}{2\pi \times SpeedLoopGain}$	100	x0.2 ms	1 500	Pi Pe S	5-3-8 5-5

Parameter	Name & Function	Default	Unit	Setting Range	Control Mode	Chap.
Sn213	**Speed loop gain – 2**	40	Hz	10	Pi	

	Please refer to **Sn211**			450	Pe S	5-3-8 5-5
Sn214	**Speed-loop-integration Time-constant 2**	100	x0.2 msec	1 | 500	Pi Pe S	5-3-8 5-5
	Please refer to **Sn212**					
Sn215	**ZeroSpeed Judgement Value**	50	rpm	0 | 4500	S	5-3-12
	When speed is lower what **Sn215** sets, input the contact **ZS**.					
Sn216	**Analog Speed Command Ratio**	3000	rpm /10V	100 | 4500	S	5-3-2
	Slope, which is used to adjust voltage command v.s. speed command. 					
Sn217	**AgalogSpeed Command Offset adjustment**	0	mV	-10000 | 10000	S	5-3-3
	When there is the phenomenon of analog speed command voltage offset, it is used to adjust the offset value. 					
Sn218	**Analog Speed Command Limit**	3050	rpm	100 | 4500	S	5-3-4
	User can set **Sn218** to limit analog speed command					

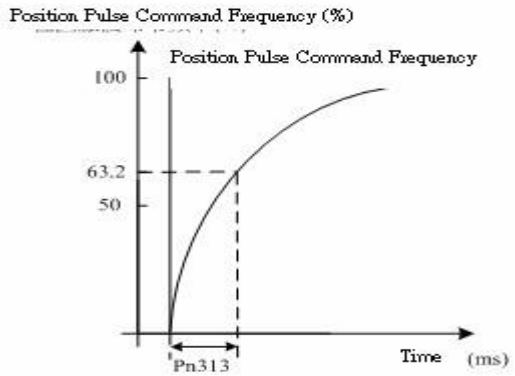
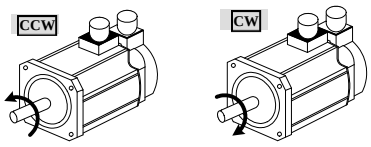
Position Control Parameter

Parameter	Name & Function	Default	Unit	Setting Range	Control Mode	Chap.
	Position PulseCommand Type	0	X		Pe	5-4-1

<table>
<tr><td>★Pn301.0
  </td><td>Setting</td><td>Explanation</td><td></td><td></td><td>0
|
3</td><td></td><td></td></tr>
<tr><td></td><td>0</td><td>(Pulse)+(Sign)</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>1</td><td>(CCW)/(CW) Pulse</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>2</td><td>AB-Phase pulse x 2</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>3</td><td>AB-Phase pulse x 4</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>★Pn301.1
  </td><td colspan="2">Position-Pulse Command Logic</td><td>0</td><td>X</td><td>0
|
1</td><td></td><td></td></tr>
<tr><td></td><td>Setting</td><td>Explanation</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>0</td><td>Positive Logic</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>1</td><td>Negative Logic</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Pn302</td><td colspan="2">Electronic Gear Ratio Numerator 1
Use input contacts GN1 & GN2 to switch 4 groups of Electronic Gear Ratio Numerator. When using the Numerator 1, the statue of the input-contacts GN1 & GN2 are:
<table><tr><th>Input-contact GN2</th><th>Input-contact GN1</th></tr><tr><td>0</td><td>0</td></tr></table>P.S.:Input-contact-statue 1 stands for Switch ON, 0 stands for SwitchOFF. If setting high potential action or low potential action, please refer to 5-6-1 to set.</td><td>1</td><td>X</td><td>1
|
50000</td><td>Pi
Pe</td><td>5-4-3</td></tr>
<tr><td>Pn303</td><td colspan="2">Electronic Gear Ratio Numerator 2
Use input contacts GN1 & GN2 to switch 4 groups of Electronic Gear Ratio Numerator. When using the Numerator 2, the statue of the input-contacts GN1 & GN2 are:
<table><tr><th>Input-contact GN2</th><th>Input-contact GN1</th></tr><tr><td>0</td><td>1</td></tr></table>P.S.:Input-contact-statue 1 stands for Switch ON, 0 stands for SwitchOFF. If setting high potential action or low potential action, please refer to 5-6-1 to set.</td><td>1</td><td>X</td><td>1
|
50000</td><td>Pi
Pe</td><td>5-4-3</td></tr>
</table>

Parameter	Name & Function	Default	Unit	Setting Range	Control Mode	Chap.

<table>
<tr><td>Pn304</td><td>Electronic Gear Ratio Numerator 3
Use input contacts GN1 & GN2 to switch 4 groups of Electronic Gear Ratio Numerator. When using the Numerator 3, the statue of the input-contacts GN1 & GN2 are:
<table><tr><th>Input-contact GN2</th><th>Input-contact GN1</th></tr><tr><td>1</td><td>0</td></tr></table>P.S.:Input-contact-statue 1 stands for Switch ON, 0 stands for SwitchOFF. If setting high potential action or low potential action, please refer to 5-6-1 to set.</td><td>1</td><td>X</td><td>1
|
50000</td><td>Pi
Pe</td><td>5-4-3</td></tr>
<tr><td>Pn305</td><td>Electronic Gear Ratio Numerator 4
Use input contacts GN1 & GN2 to switch 4 groups of Electronic Gear Ratio Numerator. When using the Numerator 4, the statue of the input-contacts GN1 & GN2 are:
<table><tr><th>Input-contact GN2</th><th>Input-contact GN1</th></tr><tr><td>1</td><td>1</td></tr></table>P.S.:Input-contact-statue 1 stands for Switch ON, 0 stands for SwitchOFF. If setting high potential action or low potential action, please refer to 5-6-1 to set.</td><td>1</td><td>X</td><td>1
|
50000</td><td>Pi
Pe</td><td>5-4-3</td></tr>
<tr><td>★Pn306</td><td>Electronic Gear Ratio Denominator
Set Pn306(Electronic Gear Ratio Denominator) to match input-contacts GN1 and GN2's electronic gear ratio numerator. And the final electroni gear ratio must match the condition below, otherwise, it can not normally operate
$\frac{1}{200} \le ElectronicGearRatio \le 200$</td><td>1</td><td>X</td><td>1
|
50000</td><td>Pi
Pe</td><td>5-4-3</td></tr>
<tr><td>Pn307</td><td>Position Fixed Judgement Value
When the Position error value is lower then Pn307's pulse number(Position Fixed Judgement Value), output-contact INP carry into effect.</td><td>10</td><td>pulse</td><td>0
|
50000</td><td>Pi
Pe</td><td>5-4-9</td></tr>
<tr><td>Pn308</td><td>Positive-maximum Position Error Judgement Value
When the Position error value is higher then Pn308's pulse number(Positive maximum position error judgement value), this device give us AL-11(Position error value alert)</td><td>50000</td><td>pulse</td><td>0
|
50000</td><td>Pi
Pe</td><td>5-4-9</td></tr>
<tr><td>Pn309</td><td>Negative Maximum Position Error Judgement Value
When the Position error value is higher then Pn309's pulse number(Negative maximum position error judgement value), this device give us AL-11(Position error value alert)</td><td>50000</td><td>pulse</td><td>0
|
50000</td><td>Pi
Pe</td><td>5-4-9</td></tr>
</table>

Parameter	Name & Function	Default	Unit	Setting Range	Control Mode	Chap.
Pn310	**Position Loop Gain 1** Under the situation that there are no vibration or noise of machinery system. Increasing the position loop gain value can speed up reaction and shorten the time of fixing position. Generally, the position loop bandwidth can not higher then speed loop bandwidth. Here is the suggested formula below: $PositionLoopGain \le 2\pi \times \frac{SpeedLoopGain}{5}$	40	1/s	1 | 450	Pi Pe	5-4-6 5-5
Pn311	**Position Loop Gain 2** Please refer to **Pn310**	40	1/s	1 | 450	Pi Pe	5-4-6 5-5
Pn312	**Position Loop Feed Forward Gain** It can reduce the follow up error of position control and speed up the reaction. If the feed forward gain is too over, it might cause speed overshooting and re-ON/OFF of output contact **INP**(Position Complete signal).	0	%	0 | 100	Pi Pe	5-4-6 5-5
★Pn313	**Position Command : one Time smooth ac/decelerational Time-Constant** It cause the position pulse command of original constant frequency smooth. Position Command-one time smooth ac/decelerational Time-Constant stands for the time in which position pulse command frequency starts from 0 to 63.2%. 	10	msec	0 | 10000	Pi Pe	5-4-4
Pn314	**Position Command direction definition(Load Side)**  Setting | Explanation	1	X	0 | 1	★Pi Pe	5-4-5

	0	(CW)					
	1	(CCW)					
Parameter	**Name & Function**		**Default**	**Unit**	**Setting Range**	**Control Mode**	**Chap.**
Pn315	**Pulse Error amount Eliminate Mode**		0	X	0 | 2	Pe Pi Pe Pi	5-4-7
	Setting	Explanation					
	0	When **CLR** act, it eliminates the Pulse-error-amount.					
	1	When CLR works, it cencels the position command to interrupt Motor's Rotate, reset machinery origin and clean pulse error amount.					
	2	When CLR works, it cencels position command to interrupt Motor's Rotate and clean pulse error amount.					
★Pn316	**Internal Position Command Mode**		0	X	0 | 1	Pi	5-4-2
	Setting	Explanation					
	0	Absolute Position					
	1	Relative Position					
Pn317	**Internal Position Command 1 – Rotation Number**		0	rev	-30000 | 30000	Pi	5-4-2
	Setting the Rotation number of the internal Position Command 1 Using input contacts POS1~POS4 to operate the first part of position command. Please refer to 5-4-2.						
Pn318	**Internal Position Command 1-Pulse Number**		0	pulse	-32767 | 32767	Pi	5-4-2
	Setting the rotation pulse number of internal position Command 1 **Internal Position Command 1 =Pn317(Rotation Number)x Pulse number of One Rotate x4+Pn318(Pulse number)**						
Pn319	**Internal Position Command 1-Move Speed**		0	rpm	0 | 3000	Pi	5-4-2
	Setting the Move Speed of internal Position Command 1						
Pn320	**Internal Position Command 2-Rotation Number**		0	rev	-30000 | 30000	Pi	5-4-2
	Please refer to **Pn317**						
Pn321	**Internal Position Command 2-Pulse Number**		0	pulse	-32767 | 32767	Pi	5-4-2
	Please refer to **Pn318**						
Pn322	**Internal Position Command 2-Move Speed**		0	rpm	0 | 3000	Pi	5-4-2
	Please refer to **Pn319**						

Pn323	**Internal Position Command 3-Rotation Number**	0	rev	-30000 | 30000	Pi	5-4-2
	Please refer to **Pn317**					

Parameter	Name & Function	Default	Unit	Setting Range	Control Mode	Chap.
Pn324	**Internal Position Command 3-Pulse Number**	0	pulse	-32767 | 32767	Pi	5-4-2
	Please refer to **Pn318**					
Pn325	**Internal Position Command 3-Move Speed**	0	rpm	0 | 3000	Pi	5-4-2
	Please refer to **Pn319**					
Pn326	**Internal Position Command 4 -Rotation Number**	0	rev	-30000 | 30000	Pi	5-4-2
	Please refer to **Pn317**					
Pn327	**Internal Position Command 4-Pulse Number**	0	pulse	-32767 | 32767	Pi	5-4-2
	Please refer to **Pn318**					
Pn328	**Internal Position Command 4-Move Speed**	0	rpm	0 | 3000	Pi	5-4-2
	Please refer to **Pn319**					
Pn329	**Internal Position Command 5 -Rotation Number**	0	rev	-30000 | 30000	Pi	5-4-2
	Please refer to **Pn317**					
Pn330	**Internal Position Command 5-Pulse Number**	0	pulse	-32767 | 32767	Pi	5-4-2
	Please refer to **Pn318**					
Pn331	**Internal Position Command 5-Move Speed**	0	rpm	0 | 3000	Pi	5-4-2
	Please refer to **Pn319**					
Pn332	**Internal Position Command 6 -Rotation Number**	0	rev	-30000 | 30000	Pi	5-4-2
	Please refer to **Pn317**					
Pn333	**Internal Position Command 6-Pulse Number**	0	pulse	-32767 | 32767	Pi	5-4-2
	Please refer to **Pn318**					
Pn334	**Internal Position Command 6-Move Speed**	0	rpm		Pi	5-4-2

	Please refer to **Pn319**			0 | 3000		
Pn335	**Internal Position Command 7 -Rotation Number**	0	rev	-30000 | 30000	Pi	5-4-2
	Please refer to **Pn317**					
Pn336	**Internal Position Command 7-Pulse Number**	0	pulse	-32767 | 32767	Pi	5-4-2
	Please refer to **Pn318**					

Parameter	Name & Function	Default	Unit	Setting Range	Control Mode	Chap.
Pn337	**Internal Position Command 7-Move Speed**	0	rpm	0 | 3000	Pi	5-4-2
	Please refer to **Pn319**					
Pn338	**Internal Position Command 8 -Rotation Number**	0	rev	-30000 | 30000	Pi	5-4-2
	Please refer to **Pn317**					
Pn339	**Internal Position Command 8-Pulse Number**	0	pulse	-32767 | 32767	Pi	5-4-2
	Please refer to **Pn318**					
Pn340	**Internal Position Command 8-Move Speed**	0	rpm	0 | 3000	Pi	5-4-2
	Please refer to **Pn319**					
Pn341	**Internal Position Command 9 -Rotation Number**	0	rev	-30000 | 30000	Pi	5-4-2
	Please refer to **Pn317**					
Pn342	**Internal Position Command 9-Pulse Number**	0	pulse	-32767 | 32767	Pi	5-4-2
	Please refer to **Pn318**					
Pn343	**Internal Position Command 9-Move Speed**	0	rpm	0 | 3000	Pi	5-4-2
	Please refer to **Pn319**					
Pn344	**Internal Position Command 10 -Rotation Number**	0	rev	-30000 | 30000	Pi	5-4-2
	Please refer to **Pn317**					
Pn345	**Internal Position Command 10-Pulse Number**	0	pulse	-32767 | 32767	Pi	5-4-2
	Please refer to **Pn318**					

Pn346	**Internal Position Command 10-Move Speed**	0	rpm	0 | 3000	Pi	5-4-2
	Please refer to **Pn319**					
Pn347	**Internal Position Command 11 -Rotation Number**	0	rev	-30000 | 30000	Pi	5-4-2
	Please refer to **Pn317**					
Pn348	**Internal Position Command 11-Pulse Number**	0	pulse	-32767 | 32767	Pi	5-4-2
	Please refer to **Pn318**					
Pn349	**Internal Position Command 11-Move Speed**	0	rpm	0 | 3000	Pi	5-4-2
	Please refer to **Pn319**					

Parameter	Name & Function	Default	Unit	Setting Range	Control Mode	Chap.
Pn350	**Internal Position Command 12 -Rotation Number**	0	rev	-30000 | 30000	Pi	5-4-2
	Please refer to **Pn317**					
Pn351	**Internal Position Command 12-Pulse Number**	0	pulse	-32767 | 32767	Pi	5-4-2
	Please refer to **Pn318**					
Pn352	**Internal Position Command 12-Move Speed**	0	rpm	0 | 3000	Pi	5-4-2
	Please refer to **Pn319**					
Pn353	**Internal Position Command 13 -Rotation Number**	0	rev	-30000 | 30000	Pi	5-4-2
	Please refer to **Pn317**					
Pn354	**Internal Position Command 13-Pulse Number**	0	pulse	-32767 | 32767	Pi	5-4-2
	Please refer to **Pn318**					
Pn355	**Internal Position Command 13-Move Speed**	0	rpm	0 | 3000	Pi	5-4-2
	Please refer to **Pn319**					
Pn356	**Internal Position Command 14 -Rotation Number**	0	rev	-30000 | 30000	Pi	5-4-2
	Please refer to **Pn317**					
Pn357	**Internal Position Command 14-Pulse Number**	0	pulse	-32767 | 32767	Pi	5-4-2
	Please refer to **Pn318**					

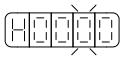
Pn358	**Internal Position Command 14-Move Speed** Please refer to **Pn319**	0	rpm	0 | 3000	Pi	5-4-2
Pn359	**Internal Position Command 15 -Rotation Number** Please refer to **Pn317**	0	rev	-30000 | 30000	Pi	5-4-2
Pn360	**Internal Position Command 15-Pulse Number** Please refer to **Pn318**	0	pulse	-32767 | 32767	Pi	5-4-2
Pn361	**Internal Position Command 15-Move Speed** Please refer to **Pn319**	0	rpm	0 | 3000	Pi	5-4-2
Pn362	**Internal Position Command 16 -Rotation Number** Please refer to **Pn317**	0	rev	-30000 | 30000	Pi	5-4-2

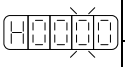
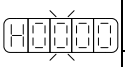
Parameter	**Name & Function**	**Default**	**Unit**	**Setting Range**	**Control Mode**	**Chap.**
Pn363	**Internal Position Command 16-Pulse Number** Please refer to **Pn318**	0	pulse	-32767 | 32767	Pi	5-4-2
Pn364	**Internal Position Command 16-Move Speed** Please refer to **Pn319**	0	rpm	0 | 3000	Pi	5-4-2
Pn365.0 	**After Zero Point Return operates, the Setting of ZeroPoint Direction Searching and Zero Reference.**	0	X	0 | 5	Pi Pe	5-4-8

Setting	Explanation
0	After zero-point-return operates, the Motor searches the origin in first stage of speed ClockWise, and the input contacts **CCWL** or **CWL** is the origin reference point. When origin point – return position is accomplished, input contacts **CCWL** or **CWL** become extreme function. When this function is used, Pn365.1 can not be set **1** or **2**. **Attention: Cn002.1(Contact assistant function – input contact CCWL and CWL function selection) must be set 0**.

	1	After zero-point-return operates, the Motor searches the origin in first stage of speed CounterClockWise, and the input contacts **CCWL** or **CWL** is the origin reference point. When origin point – return position is accomplished, input contacts **CCWL** or **CWL** become extreme function. When this function is used, Pn365.1 can not be set **1** or **2**. **Attention:** **Cn002.1(Contact assistant function – input contact CCWL and CWL function selection) must be set 0**.					
	2	After zero-point-return operates, the Motor searches the origin in first stage of speed **ClockWise**, and the input contact **ORG**(external sensor point input point) will be the origin reference point. If **Pn365.1=2**, it directly searches the closest input contact **ORG**'s edge above to be the machinery origin point without origin reference point. And it stops in compliance with **Pn365.3** .					

Parameter	Name & Function		Default	Unit	Setting Range	Control Mode	Chap.
Pn365.0	**After Zero Point Return operates, the Setting of ZeroPoint Direction Searching and Zero Reference.**		0	X	0 | 5	Pi Pe	5-4-8
	Setting	Explanation					
	3	After zero-point-return operates, the Motor searches the origin in first stage of speed **CounterClockWise**, and the input contact **ORG**(external sensor point input point) will be the origin reference point. If **Pn365.1=2**, it directly searches the closest input contact **ORG**'s edge above to be the machinery origin point without origin reference point. And it stops in compliance with **Pn365.3** .					
	4	After origin point-return operates, the Motor searches the origin in first stage of speed **ClockWise**. It searches directly the closest **Z** phase origin without origin reference point. When this function is used, **Pn365.1=2** nust be set.(Searching the **Z** phase to be the machinery oringin and stopping in compliance with **Pn365.3**)					

	5	After origin point-return operates, the Motor searches the origin in first stage of speed **CounterClockWise**. It searches directly the closest **Z** phase origin without origin reference point. When this function is used, **Pn365.1=2** nust be set.(Searching the **Z** phase to be the machinery oringin and stopping in compliance with **Pn365.3**)					
Pn365.1 	**After finding Origin Reference Point, the Settings of Move Method of searching machinery orign**		0	X	0 | 2		
	Setting	Explanation					
	0	After finding origin reference point, the motor turns back to search the closest **Z** Phase with 2nd stage speed to be the machinery origin, and stops in compliance with **Pn365.3**.					
	1	After finding origin reference point, the motor continues forward to search the closest **Z** Phase with 2nd stage speed to be the machinery origin, and stops in compliance with **Pn365.3**					

Parameter	Name & Function		Default	Unit	Setting Range	Control Mode	Chap.
Pn365.1 	**After finding Origin Reference Point, the Settings of Move Method of searching machinery orign**		0	X	0 | 2	Pi Pe	5-4-8
	Setting	Explanation					
	2	When **Pn365.0=2** or **3**, using input contact ORG's upper edge to be machinery origin, then stops in compliance with **Pn365.3**. When **Pn365.0=4** or **5,** using Z Phase to be the machinery origin, and stops in compliance with **Pn365.3**.					
Pn365.2 	**Origin Return Mode Setting**		0	X	0 | 2		
	Setting	Explanation					
	0	Turn off the Origin Return Function					
	1	After the power is ON, the function operates only when the first Servo ON. When the function is not needed to operate during servo system works, this mode can be used to abridge a input contact which is used to operate the origin return function.					

	2	Input contact SHOME triggers origin return function,and SHOME can be operated anytime in position mode.					
Pn365.3	**The Setting of Stop after Finding Machinery Orgin**		0	X	0 | 1		
	Setting	Explanation					
	0	After finding the signal of machinery origin, **record** this position to be machinery origin (**Un-14** Encoder feedback rotation count and **Un-15** Encoder feedback pulse numberare both **0**), motor decelerates and stop, then the 2nd stage speed turns back to machinery origin position.					
	1	After finding the signal of machinery origin, **record** this position to be machinery origin (**Un-14** Encoder feedback rotation count and **Un-15** Encoder feedback pulse numberare both **0**), motor decelerates and stop.					
Pn366	**Machine Zero Point Return – 1st stage – High Speed**		100	rpm	0 | 2000	Pi Pe	5-4-8
	Setting of machine zero point return – 1st stage move speed						
Pn367	**Machine Zero Point Return – 2nd stage – Low Speed**		50	rpm	0 | 500	Pi Pe	5-4-8
	Setting of machine zero point return – 2nd stage move speed						

Parameter	Name & Function	Default	Unit	Setting Range	Control Mode	Chap.
Pn368	**Machine Zero Point Return Off-Set Rotate Number**	0	rev	-30000 | 30000	Pi Pe	5-4-8
	After the motor return to the machine zero point in compliance with **Pn365**(Machine Zero Point Return Mode), it will again take the **Pn368**(Machine Zero Point Return Off-Set Rotate Number) AND **Pn369**(Machine Zero Point Return Off-Set Pulse number)to it's new machine zero point.					
Pn369	**Zero Point Return OFF-Set Pulse Number**	0	pulse	-32767 | 32767	Pi Pe	5-4-8
	Zero Point Return OFF-Set Position =Pn368(Rotate Number)x Number of Encoder Pulse per Rotation x 4 + Pn369(Pulse Number)					

Prompt-Parameter

Parameter	Name & Function	Default	Unit	Setting Range	Control Mode	Chap.
◆ qn401	**Speed Loop Gain 1** Speed Loop Gain decides directly the Speed Control Loop response bandwidth. If there is no vibration or noise in mechanical system, more speed loop gain value it increases, faster the speed response operates. If **Cn025** is correctly set, **speed loop bandwidth** is equal to speed loop gain.	40	Hz	10 | 450	Pi Pe S	5-3-8 5-5
◆ qn402	**Speed Loop Integration Time Constant 1** Speed control loop plus integration component can eliminate the speed error and responses quickly tiny speed change. Gernerally, If there is no vibration or noise in mechanical system, lower speed loop integration time constant it decreases, higher the system rigidity it inreases. Using the formula below to get the speed loop integration time constant: $SpeedLoopIntegrationTimeConstant \geq 5 \times \frac{1}{2\pi \times SpeedLoopGain}$	100	x0.2 ms	1 | 500	Pi Pe S	5-3-8 5-5

Parameter	Name & Function	Default	Unit	Setting Range	Control Mode	Chap.
◆ qn403	**Speed Loop Gain 2** Please refer to **qn401**	40	Hz	10 | 450	Pi Pe S	5-3-8 5-5
◆ qn404	**Speed Loop Integration Time Constant 2** Please refer to **qn402**	100	x0.2 ms	1 | 500	Pi Pe S	5-3-8 5-5
◆ qn405	**Position Loop Gain 1** If there is no vibration or noise in mechanical system, increasing position loop gain value can increase the respose-speed and decrease position fixing. Generally, Position loop bandwidth can not be higher then speed loop bandwidth. Here is the suggested formula: $PositionLoopGain \leq 2\pi \times \frac{SpeedLoopGain}{5}$	40	1/s	1 | 450	Pi Pe	5-4-6 5-5

◆ **qn406**	**Position Loop Gain 2** Please refer to **qn405**	40	1/s	1 | 450	Pi Pe	5-4-6 5-5
◆ **qn407**	**Position Loop Feed Forward Gain** It can decrease the fellow up error of position control and increase response speed. If feed forward gain value is too high, it could cause speed overshooting and re-ON and OFF of INP output contacts (position complete signal).	0	%	0 | 100	Pi Pe	5-4-6 5-5

Multi-Function Contacts Parameter

Parameter	Name & Function			Default	Unit	Setting Range	Control Mode	Chap.
★Hn501.0 ★Hn501.1	**DI-1**			01	X	01 | 26	ALL	5-6-1
	Seting	Explanation						
		Signal	Functions					
	01	**SON**	Servo ON					
	02	**ALRS**	Alarm Elimenated					
	03	**PCNT**	PI/P switch					
	04	**CCWL**	CCW drive limit					
	05	**CWL**	CW drive limit					
	06	**TLMT**	External Torque limit					
	07	**CLR**	Pulse Error value Elimenated					
	08	**LOK**	Servo Lock					
	09	**EMC**	Emergency Stop					
	10	**SPD1**	Internal Speed Command 1					
	11	**SPD2**	Internal Speed Command 2					
	12	**MDC**	Control Mode Switch					
	13	**INH**	Position Command Limit					
	14	**SPDINV**	Speed Inverse Command					
	15	**G-SEL**	Gain Selection					
	16	**GN1**	Electronic Gear Numerator 1					
	17	**GN2**	Electronic Gear Numerator 2					
	18	**PTRG**	Internal Position Command ON					
	19	**PHOLD**	Internal Position Command Stop					
	20	**SHOME**	HOME					
	21	**ORG**	External reference Home					

	22	**POS1**	Internal Position Command 1					
	23	**POS2**	Internal Position Command 2					
	24	**POS3**	Internal Position Command 3					
	25	**POS4**	Internal Position Command 4					
	26	**TRQINV**	Torque Inverse Command					
★**Hn501.2**	**DI-1voltage level**			0	X	0 | 1		
	Setting	Explanatoin						
	0	When DI-1 is low voltage level (close loop with **IG24**), it woks.						
	1	When DI-1 is high voltage level (open loop with **IG24**), it works.						

Attention: DI-1~DI-13 may repeat, and these repeat's voltage level must be the same, otherwise, AL-07 operates (input/output contacts functions alarm)

Parameter	Name & Function	Default	Unit	Setting Range	Control Mode	Chap.
★**Hn502**	**DI-2**	002	X	001 | 126	ALL	5-6-1
	Plearse refer to **Hn501**					
★**Hn503**	**DI-3**	003	X	001 | 126	ALL	5-6-1
	Plearse refer to **Hn501**					
★**Hn504**	**DI-4**	104	X	001 | 126	ALL	5-6-1
	Plearse refer to **Hn501**					
★**Hn505**	**DI-5**	105	X	001 | 126	ALL	5-6-1
	Plearse refer to **Hn501**					
★**Hn506**	**DI-6**	006	X	001 | 126	ALL	5-6-1
	Plearse refer to **Hn501**					
★**Hn507**	**DI-7**	007	X	001 | 126	ALL	5-6-1
	Plearse refer to **Hn501**					
★**Hn508**	**DI-8**	008	X	001 | 126	ALL	5-6-1
	Plearse refer to **Hn501**					
★**Hn509**	**DI-9**	009	X		ALL	5-6-1

	Plearse refer to **Hn501**			001 | 126		
★Hn510	**DI-10**	010	X	001 | 126	ALL	5-6-1
	Plearse refer to **Hn501**					
★Hn511	**DI-11**	011	X	001 | 126	ALL	5-6-1
	Plearse refer to **Hn501**					
★Hn512	**DI-12**	012	X	001 | 126	ALL	5-6-1
	Plearse refer to **Hn501**					
★Hn513	**DI-13**	014	X	001 | 126	ALL	5-6-1
	Plearse refer to **Hn501**					

Attention: DI-1~DI-13 may repeat, and these repeat's voltage level must be the same, otherwise, AL-07 operates (input/output contacts functions alarm)

Parameter	Name & Function	Default	Unit	Setting Range	Control Mode	Chap.
★Hn514.0 ★Hn514.1	**DO-1** Setting: Explanation Signal: Functions 01 **RDY** Servo Ready 02 **ALM** Alarm 03 **ZS** Zero Speed 04 **BI** Brake 05 **INS** Speed achieve 06 **INP** Location Fixed Completed 07 **HOME** Home	01	X	01 | 07	ALL	5-6-1
★Hn514.2	**DO-1** Setting: Explanation 0: When it operates, the contact is low electric potential. (Close loop with **IG24**)。 1: When it operates, the contact is high electric potential. (Open loop with**IG24**)。	0	X	0 | 1		
★Hn515	**DO-2** Plearse refer to **Hn514**	002	X	001 | 107	ALL	5-6-1

★Hn516	**DO-3**	003	X	001 | 107	ALL	5-6-1
	Plearse refer to **Hn514**					
★Hn517	**DO-4**	006	X	001 | 107	ALL	5-6-1
	Plearse refer to **Hn514**					

Attention: DO-1~DO-4 can not repeat, and these repeat's voltage level must be the same, otherwise, AL-07 operates (input/output contacts functions alarm)

Display Parameter

Parameter	Display	Unit	Explanation
Un-01	Actual Motor Speed	rpm	Ex: If 120 displayed, it means 120 rpm.
Un-02	Actual Motor Torque	%	Ratio Torque percent. Ex: if 20 displayed, it means 20% of ratio torque.
Un-03	Regenerated Load Ratio	%	Average regenerated output percent
Un-04	Actual Load Ratio	%	Average output percent
Un-05	Maximum Load Ratio	%	Maximum value which is ever shown in actual load ratio
Un-06	Speed Command	rpm	Ex: If 120 displayed, it means current speed command is120 rpm
Un-07	Position Error Value	pulse	The different departure value between position command and position feed-back
Un-08	Position Feed-back Value	pulse	The comulate value of Encoder
Un-09	ExternalVoltage Command	V	Ex: If 5.25 displayed, it means external voltage command is 5.25V.
Un-10	(Vdc Bus)Main Loop Voltage	V	Ex: If 310 is displayed, it means main loop voltage is 310V

Un-11	External Spped Limit Command Value	rpm	Ex: If 2000 is displayed, it means current external spped limit command is 2000 rpm.
Un-12	External CCW Torque Limit Command Value	%	Ex: If 100 is displayed, it means current external CCW torque limit command is 100%.
Un-13	External CW Torque LimitCommand Value	%	Ex: If 100 is displayed, it means current external CW torque limit command is 100%.
Un-14	Motor Feed-back Rotate Number (Absolute Value)	rev	After power ON, it shows Motor's Rotate Value in Ablolute Value.
Un-15	MotorFeedBack–PulseNumber/1 Rotate(Absolute Value)	pulse	After power ON, it shows the pluse number of Motor's 1 rotate.
Un-16	PulseCommand–RotateNumber (Absolute Value)	rev	After power ON, it shows the pluse command input rotate number in absolute value.
Un-17	PulseCommand-Pulse Number /1 Rotate(Absolute Value)	pulse	After power ON, it shows pulse command input – pulse number of 1 rotate.
Un-18	Torque Command	%	Shown by ratio torque percent Ex: If 50 is displayed, it means current motor torque command is 50% of ratio torque.
Un-19	Load Inertia Ratio	x0.1	When **Cn002.2=0**(without auto-gain-adjust function), it displays the default load inertia ratio of **Cn025** When **Cn002.2=1**(keep on using auto-gain-adjust function), it displays current estimated load inertia ratio.

Diagnosis Parameter

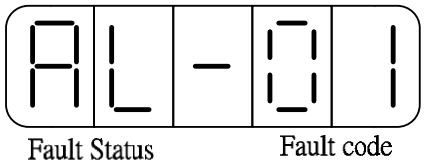
Parameter	Name & Function	Chap.
dn-01	Current Control Mode Display	3-2-2
dn-02	Output Contacts Signal	
dn-03	Input Contacts Signal	
dn-04	Software Edition	
dn-05	JOG Mode Operation	
dn-06	Resume	
dn-07	External Voltage Command OffSet-Value Auto-adjust.	
dn-08	Show Model Type	

Chapter 8 Troubleshooting

8-1 Fault Status Display Operation

When the AC servo drive has a fault, the LED display will show AL. Users please observe the following sections' explanation to repair the fault, then follow up the normal operation procedure to using the AC servo drive. If you still can not repair the fault, please contact your local TECO sales representative for assistance.

Fault Status Display :



For the information of fault code, please refer to next section. Refer to the example, the fault code is 01. (Undervoltage)

The AC servo drive also provide the fault record history for users. The explanation is listed in the following table.

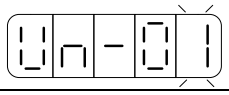
Fault Record History

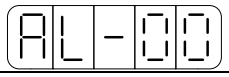
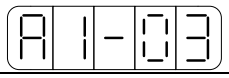
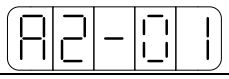
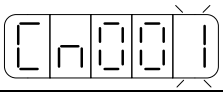
Display	Explanation
AL - XX	The Latest Fault Record.
A1 - XX	Previous First Time Fault Record.
A2 - XX	Previous Second Times Fault Record.
A3 - XX	Previous Third Times Fault Record.
A4 - XX	Previous Fourth Times Fault Record.
A5 - XX	Previous Fifth Times Fault Record.
A6 - XX	Previous Sixth Times Fault Record.
A7 - XX	Previous Seventh Times Fault Record.
A8 - XX	Previous Eighth Times Fault Record.
A9 - XX	Previous Ninth Times Fault Record.

Note : **XX means the Fault Code.**

Example :

Please observe the following steps to refer to the fault record history.

Step	Key	LED Display	Explanation
1	Turn the Power On		When the power is applied to the AC servo drive, the LED display will show Status Display Mode.

2	MODE		Pressing MODE key twice can enter into Fault Record History Mode.
3	▲		Pressing UP arrow key once can enter into Previous First Time Fault Record. Refer to the example, the fault code is 03. (Overload)
4	▲		Pressing UP arrow key once can enter into Previous Senond Times Fault Record. Refer to the example, the fault code is 01. (Undervoltage)
5	MODE		Pressing MODE key once can enter into System Parameter Mode.

8-2 Fault Definition and Corrective Actions

Fault Code	Fault Name and Definition	Corrective Actions	Clearing Method	Fault Status Digital Output			
				CN1-25 BB/A3	CN1-24 ST/A2	CN1-23 PC/A1	CN1-22 LM/A0
00	**Normal**	—	—	If there is no Alarm, **CN1-22~CN1-25** operates inaccordance with default function. Please refer to **2-2-1**.			
01	**Undervoltage** The main circuit voltage is below its minimum specified value. (190Vac)	Use voltmeter to check whether the input voltage is within the specified limit. If it can not be solved, there may be failure inside the Driver. *This message appears when power flow into driver.	Turn ALRS(DI) ON	1	1	1	0
02	**Overvoltage (Regeneration error)** 1、 The main circuit voltage has exceeded its maximum allowable value. (410Vac) 2、 Regeneration voltage is too high.	1、Use voltmeter to check whether the input voltage is within the specified limit. 2、Check the Parameter **Cn012** if be set by regulation. 3、This signal appear when operation: To extend ac/deceleration time or reduce load ratio in permitted range. Otherwise, it need extra regeneration resistance. (Please contact to distributers or manufacturers)	Turn ALRS(DI) ON	1	1	0	1
03	**Overload**		Turn	1	1	0	0

	The drive has exceeded its rated load during continuous operation. If 2 times over then ratio load, alarm occurs after 10sec.	1、Check Motor terminal(U、V、W) and Encolder. 2、Adjusting the Driver gain, once gain is not correctly adjusted, it would cause motor co-vibration and large current to let motor over load. 3、To extend ac/deceleration time or reduce load ratio in permitted range. * This signal appears usually during the process. If alarm, please check “1”.	ALRS(DI) ON				

Fault Code	Fault Name and Definition	Corrective Actions	Clearing Method	Fault Status Digital Output			
				CN1-25 BB/A3	CN1-24 ST/A2	CN1-23 PC/A1	CN1-22 LM/A0
04	**Output transistor abnormal** Driver’s Temperature, current, voltage are over protective range. Output transistor abnormal alarm.	1、Check the motor terminal line(U、V、W) and encoder line. And please refer to the diagram in Chapter 2 to combine external power. 2、Tern off the power, and turn on again after 30 min. If the alarm still exists, there may be the error or noise interference of Output transistor abnormal inside.	Reset Power Supply	1	0	1	1
05	**EncolderABZ-phase signal abnormal** Motor’s encolder breakdown or encoder line not well connected.	1.Check the motor’s encoder line if connect to the driver 2.Check the encoder if short circuit, loose solder or break. 3.Check the encoder signal terminal **CN2-1** and **CN2-2.**	Reset Power Supply	1	0	1	0
06	**Encoder UVW-phase signal error**		Reset Power Supply	1	0	0	1

	Motor's encolder breakdown or encoder line not well connected.						
07	**Multi-function point planning error** **Input/output point function planning error.**	1. Check the parameter **Hn501**~**Hn513-input point planning if match: DI-1**~**DI-13** connector may repeat, but the action voltage level of the repeat-function connector must the same. 2、Check if the parameter: **Hn514**~**Hn517** output contacts function match: **DO-1~DO-4**contact point can not repeat.	Reset Power Supply	1	0	0	0

Fault Code	Fault Name and Definition	Corrective Actions	Clearing Method	Fault Status Digital Output			
				CN1-25 BB/A3	CN1-24 ST/A2	CN1-23 PC/A1	CN1-22 LM/A0
08	**Memory Error** Parameter input error	Take all joint apart, when alarm during power ON, the driver need be changed.	Reset Power Supply	0	1	1	1
09	**Emergent Stop** When the input contact point EMC operates then alarm appears. *High electric potential or low electric potential, please refer to **5-6-1** to set.	1. Stop the input contact point EMC's operation. 2. Inside of the driver is interference. Please refere to Chpter 2 : "The diagram of motor and power and control" & "Diagram of signal and standard wiring."	Turn ALRS(DI) ON	0	1	1	0
10	**Motor over-current**		Turn ALRS(DI)	0	1	0	1

	Motor's current value is **4 times** then motor's ratio current.	1. Check if the motor wiring (U、V、W)and encoder wiring correct or not. 2. Inside of the driver is interference. Please refere to Chpter 2 : "The standard wiring diagram of motor and power to connect outside power.	ON				
11	**Over Position error value** The differenct of Pulse command and encoder feed back pulse is over the default of **Pn308** or **Pn309**.	1. Increase the position loop gain (**Pn310** 及**Pn311**)value. 2. Increase the position loop front back gain (**Pn307**) value to enhance the reaction speed of motor. 3. Extend the time of ac/deceleration or reduce load inertia in available range. 4. Check if the motor wiring (U、V、W)is completed.	Turn ALRS(DI) ON	0	1	0	0

Fault Code	Fault Name and Definition	Corrective Actions	Clearing Method	Fault Status Digital Output			
				CN1-25 BB/A3	CN1-24 ST/A2	CN1-23 PC/A1	CN1-22 LM/A0
12	**Motor overspeed** Motor's speed is 1.5 times then motor's inertia speed.	1. Reduce the speed of enter command. 2. Electric gear ratio's incorrect setting: please check related setting. 3. Adjust speed loop gain appropriately **(Sn211** & **Sn213**) to accelerate the motor's reaction speed.	Turn ALRS(DI) ON	0	0	1	1
13	**CPU Error**		Reset	0	0	1	0

	Control system can not normally operate.	Turn off the power. Turn on again after 30min. If error alarm still exists, it might be the interference of inside of the driver. Please refere to the chapter 2: “motor and power’s standard diagram to connect outside power.	Power Supply				
14	**Dirve forbid error** When input contact point **CCWL** & **CWL**operate at the same time and alarm occur. *High electric potential or low electric potential, please refer to **5-6-1** to set.	1. Stop the input contact point **CCWL** or **CWL** action. 2. Inside of the driver is interference. Please refere to Chpter 2 : “The diagram of motor and power and control” & “Diagram of signal and standard wiring.”	Turn ALRS(DI) ON	0	0	0	1
15	**Driver overheat** Power transistor’s temperature is over 90 degree Celsius.	Re-overload will cause driver overheat, please correct the rotation method.	Turn ALRS(DI) ON	0	0	0	0

Explanation of Error Alarm Elimination :

1. Reset: Use the 2 suggestions below to eliminateerror alarm:
   (a) Reset the input contact point: After error is eliminated, stop input contact **SON** operation (it means clear Servo ON), then enter contact point **ALRS** action. Then the error alarm can be eliminated and let the driver operate normally. High electric potential or low electric potential, please refer to **5-6-1** to set
   (b) Key reset: After error is eliminated, stop input contact SON operation(it means clear Servo ON), then press the butten▲ and ▼ at the same time, hen the error alarm can be eliminated and let the driver operate normally.

2. Power reset: After error is eliminated, reset the Servo (turn off the power and re-input the power), then the error alarm can be eliminated and let the driver work normally.

Suggest strongly when using power reset to eliminate error alarm, stop input contact Son operation (it means clear Servo ON).

※ **Attention: Befor error alarm is eliminated, it need to confirm if the controller release command to the driver. Otherwise it might cause Motor Overshooting.**