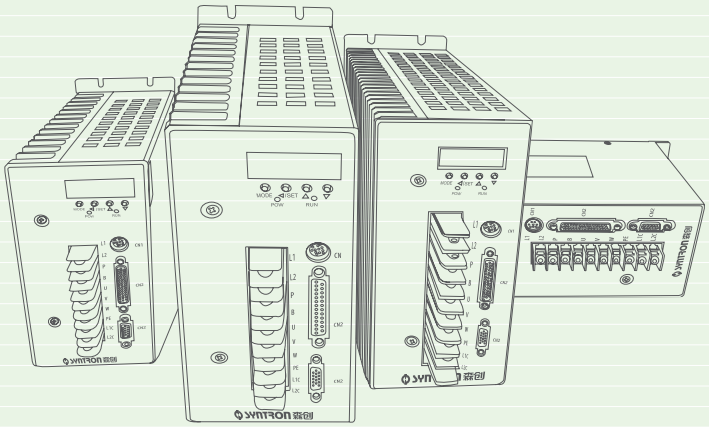
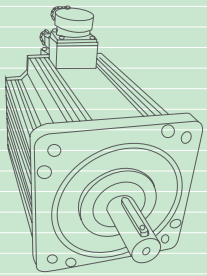
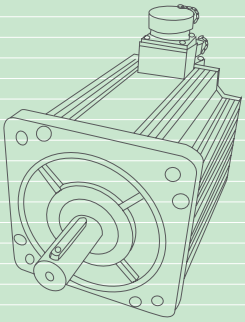
SYNTRON 森创

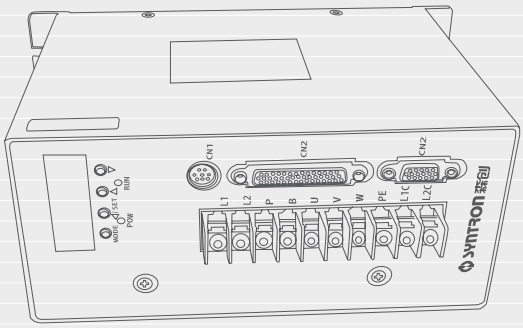
Full-digital AC Servo Motor Driver

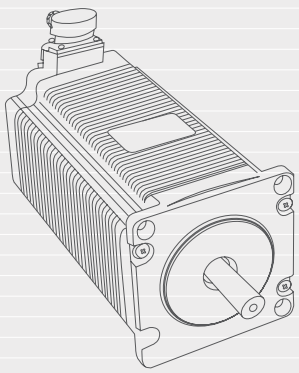
HS-Series User's Mannual

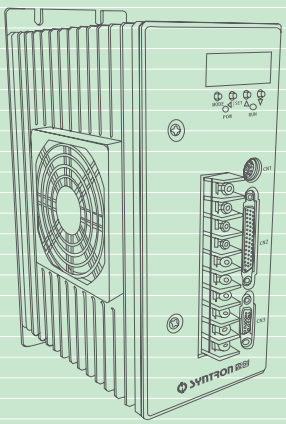












Contents

Chapter I Introduction to and Installation of the Products

1.1 Introduction to the Products

1.1.1 Brief Introduction to the Products

HS- series servo drivers are a series of high-performance and highly reliable full-digital AC servo motor drivers developed by Beijing HollySys Motor Technology Co., Ltd. With American TI Company's fully new-type digital signal processor (DSP) as the core controlling component, the driver has a dual-core processing ability. The advanced full-digital motor control algorithm enables the drivers to accurately control position, speed, acceleration and output torque of the permanent-magnet synchronous servo motors, making them applicable to control of feed servo motors of machining centers, CNC milling machines, CNC drilling machines, CNC horizontal and vertical lathes, CNC grinding machines, large gantry-type equipment, etc. For the best performance, please refer to this manual when installing and debugging this product.

Figure 1-1 below shows structure of the driver:

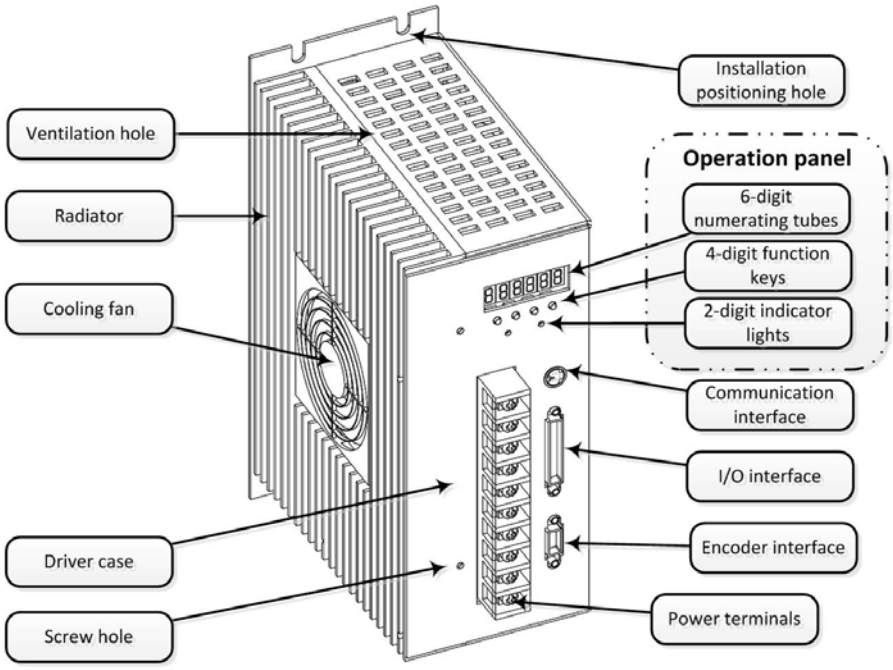


Figure 1-1 Brief Introduction to All Sections of a HS-series Servo Driver

1.1.2 Product Nameplate

On the front right corner of the driver's lateral side is a nameplate indicating the driver's specifications, see Figure 1-2 for its contents:

Figure1-2 Example of HS-series Servo Driver's Nameplate

1.1.3 Model Naming Rule

HS 0150 A - P 02 S

Input Power	2S: single-phase 220V; 2T: 3-phase 220V; 3T: 3-phase 380V
Optional communication parts	0: RS232 + CAN (standard); 1: RS232 + RS485; 2: RS232; 3: RS232 + RS485 + CAN
Optional I/O parts	P: single optocoupler (common anode, standard) C: bidirectional optocoupler (common cathode or common anode)
Version No.	A: standard
Rated output power	0040: 400W 0075:750W 0150:1500W 0300:3000W
Series code	HS-series full digital AC servo motor driver

1.1.4 Models and Specifications

Model	**Applicable motor capacity (W)**	Maximum output power (A)	Maximum Output Voltage (V)
HS0020A-xxxx	200	3.8	195
HS0040A-xxxx	400	7.4	195
HS0060A-xxxx	600	11.0	195
HS0075A-xxxx	750	14.33	195
HS0100A-xxxx	1000	13.94	195
HS0120A-xxxx	1200	15.6	195
HS0150A-xxxx	1500	21.74	195
HS0200A-xxxx	2000	28.85	195
HS0250A-xxxx	2500	32.9	195
HS0300A-xxxx	3000	34.8	195

Table 1-1A Standard Specifications of HS-Series Servo Drivers

Power supply	Rated voltage, frequency	Single-phase 220V: 50/60Hz ±5%
	Allowed voltage fluctuation	+10% ～ -15%
Control features	控制方式 Control mode	SVPWM modulation, closed-loop vector control
	Torque characteristics	Accuracy: ±3% *of rated torque
	Acceleration/deceleration control	Upon sudden change of the speed command, the driver can automatically control acceleration and deceleration as per the preset acceleration/deceleration time
	Electronic gear	Four-stage dynamic switching: 1 ~ 100
	Position control accuracy	±1 Pulse
	Overload capacity	300%
I/O ports	Digital input	8-channel optocoupler isolation input, common-anode connection (standard connection) or common-cathode connection (customized connection)
	Digital output	4-channel optocoupler isolation output, OC output connection, allowable current ≤ 50mA
	Analog input	2-channel: -10V ～ +10V, operational amplifier input buffer interface, without electrical isolation
	Analog output	2-channel: -10V～+10V, DAC can be used for observing internal status parameters
	Encoder input interface	Quadrature photoelectric encoder
	Encoder frequency-dividing output ports	For the standard motor encoder's Phase-A/B signal (default type: 2500-wire), the ports can perform integer (1~255) frequency-dividing output
	Encoder output stretching ports	Output stretching of standard motor encoder Phase-Z signal
	Pulse input ports	6 input modes are available: single-pulse mixed logic, double-pulse mixed logic, and orthogonal-pulse mixed logic
	Bus interface	RS232/RS485 CAN (with a galvanic isolation circuit)
	Built-in power supply	It enables one channel of interface to provide power to external devices: 12V（100mA）

Features of the driver	Kernelsoftware	DSP full-digital control, capable of multiple motor control algorithms, and easy update and upgrading of the software
	Parameter management	Rich parameters for configuration, observation and alarm are available, and can be used according to the operation environment for adjustment, debugging and error correction
	Separate power supplies	Working power supply and control power supply are separate, which effectively improves EMC and EMI performance
	Dynamic brake	It's for quick stopping under any emergency
	Operation panel	Keyboard and LED numerating tube display with self-check and self-diagnosis functions
	Braking mode	A totally new type of regenerative energy-consuming braking, which features quick discharge while ensuring safety of the discharge resistor
Alarm protection functions Alarm protection functions	Overcurrent	An alarm that occurs when the current exceeds the preset overcurrent protection threshold
	Overload	An alarm that's output when the overload alarm value is exceeded, a function to be defined with the corresponding configuration parameters
	Overvoltage	An alarm that's output when the DC bus voltage is too high; a function to be defined with the corresponding configuration parameters
	Undervoltage	An alarm that's output when the DC bus voltage is too low; a function to be defined with the corresponding configuration parameters
	Overheating	An alarm that's output when the radiator's temperature is too high; a function to be defined with the corresponding configuration parameters
	Encoder	An alarm of Pulse-Z error that occurs when the encoder gets disconnected
	Stall	An alarm of motor stall, a function to be set with the corresponding configuration parameters
	Overspeed	An alarm of the motor's galloping; a function to be set with the corresponding configuration parameters
	Over-travel	An alarm that occurs when the position following error has exceeded the set value of tolerance; a function to be set with the corresponding configuration parameters
	Invalid parameter	An alarm that occurs when the parameter's configuration range is out of the normal range of use
	Illegal parameter	An alarm that occurs when the parameter's setting doesn't suit the actual need
	Parameter writing and reading	An alarm that occurs when any error in parameter writing and reading happens
	Driver having no response	An alarm that occurs when the motor doesn't respond to the control command
	Short-circuited winding	An alarm that occurs when any winding is short-circuited
	Open phase protection	Protection against open-phase fault of any of the motor's windings
	ADC's zero point	An alarm that occurs when current sampling ADC's zero point gets abnormal
	Power device	An alarm that occurs when any power device has a fault
	Communication time-out	An alarm that occurs when the time used for communication under bus control mode has exceeded its limit
Environment	Place for use	A place without dust, erosive gases and flammable gases

for use	Temperature	0℃ ～ +40℃
	Humidity	Under 95% RH (with no condensation of moisture)
	Vibration	Vibration frequency ≤ 20Hz: 9.8m/s²; 20Hz ≤ vibration frequency ≤ 50Hz: 2 m/ s²

Table 1-1B HS-series Servo Driver's Standard Specifications and Performance Parameters

1.1.5 Description of Matching between the Driver and Motor

The description here applies to the drivers designed by our company and the designated motors that match them, please don't use this description for other drivers and motors.

Motor model is set by the driver parameter **Fn 006** (the table below only shows part of models).

Motor					Driver
Motor code	**Motor model**	**Rated torque （N.m）**	**Rated speed （rpm）**	**Rated power （W）**	**Driver model**
0100	60CB020C-010000	0.64	3000	200	HS0020A-xxxx
0110	60CB040C-010000	1.27	3000	400	HS0040A-xxxx
0206	80CB075C-50xxxx	2.39	3000	750	HS0075A-xxxx
0510	110MB075D	5.0	1500	750	HS0075A-xxxx
0700	130MB100A	9.55	1000	1000	HS0100A-xxxx
0715	130MB150B	7.16	2000	1500	HS0150A-xxxx
0725	130MB200C-701000	6.5	3000	2000	HS0200A-xxxx
…	…	…	…	…	…

Table 1-2 Description of Motors Matching HS-series Servo Drivers

1.2 Opening the Packing Case and Checking

Each set of HS-series servo driver is composed of the parts and subassemblies described in Table 1-3 below:

Item	Composition
Parts and subassemblies	* Servo driver * Servo motor * Input and output socket connectors
Optional parts	* External regenerative energy discharge resistor * Connecting cables (customized as per the customer's demand)

Table 1-3 Composition of HS-series Servo Drivers

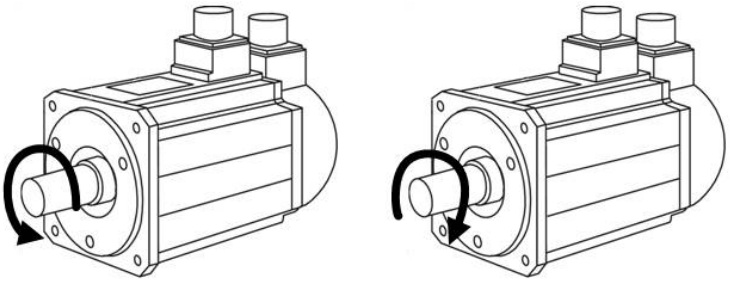
When receiving a product, please confirm the items shown in Table 1-4, if any discrepancy is found, please directly contact the manufacturer.

Items for confirmation	Method of confirmation
Have all the items in the packing list arrived?	Packing list is pasted on the outer package, check whether items packaged are the same as described in the list
Are the items the ones ordered?	Please confirm the label on one side of the driver
Is any part damaged or worn?	Check the product's outer appearance to confirm whether it has been damaged during transport
Is any screw or any other fastener loose?	If necessary, use a screwdriver to check

Table 1-4 Items for Confirmation

1.3 Description of Motor Rotation Direction

Default definition of rotation direction for servo motors working with HS-series servo drivers is as such: when viewed from the side of motor shaft, the motor's counterclockwise rotation is in forward direction, and clockwise rotation is in backward direction (as shown in Figure 1-3). The user can change the motor's default rotation direction by configuring the parameter **Fn 004**.



Forward rotation (counterclockwise) Backward rotation (clockwise)

Figure 1-3 Rotation Direction of a Servo Motor

1.4 Shape and Installation

1.4.1 External Dimensions, Mounting Dimensions and Weight

The driver's shape is as shown in Figure 1-4 to Table 1-5.

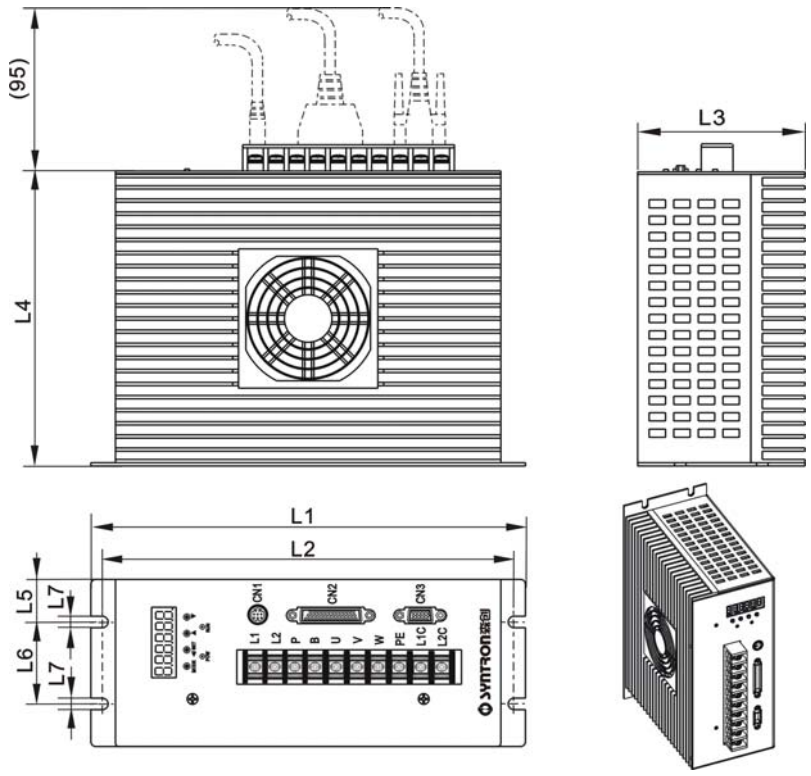


Figure 1-4 HS-Series Servo Driver' External Dimensions

Model	Weight (Kg)	L1 (mm)	L2 (mm)	L3 (mm)	L4 (mm)	L5 (mm)	L6 (mm)	L7 (mm)
HS0020A-xxxx	1.8	210	196	77	135	15.5	46	5
HS0040A-xxxx	1.8	210	196	77	135	15.5	46	5
HS0060A-xxxx	1.8	210	196	77	135	15.5	46	5
HS0075A-xxxx	2.5	230	216	92	144	23	46	5
HS0100A-xxxx	2.5	230	216	92	144	23	46	5
HS0120A-xxxx	2.5	230	216	92	144	23	46	5
HS0150A-xxxx	3.75	265	251	102	180	26	50	7
HS0200A-xxxx	3.75	265	251	102	180	26	50	7
HS0250A-xxxx	3.75	265	251	102	180	26	50	7
HS0300A-xxxx	3.75	265	251	102	180	26	50	7

Table 1-5 External Dimensions and Weight of HS-series Servo Drivers

1.4.2 Mounting Direction and Space

One single driver shall be mounted as shown in Figure 1-5 to meet requirements of mounting interval and distance.

When multiple drivers are mounted in a control cabinet, they shall usually mounted side by side and cooled with wind inlet ports, wind outlet ports and dedicated cooling fans; if they are mounted at different heights, deflectors shall be installed between them to ensure a good

cooling effect. See Figure 1-6:

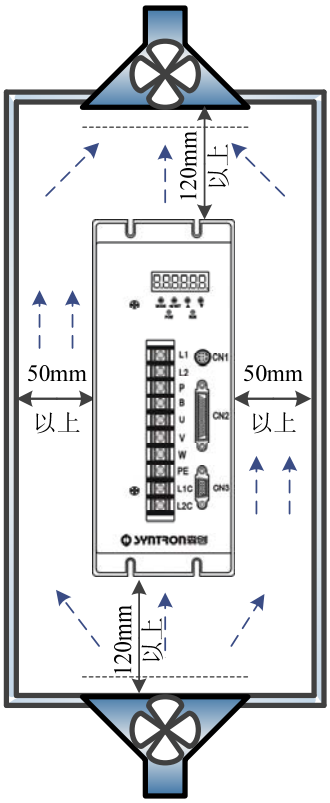


Figure 1-5 Mounting of One Single Driver

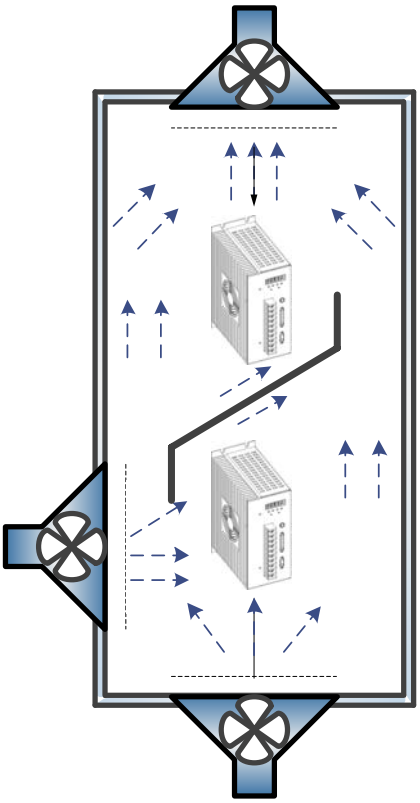


Figure 1-6 Mounting of Multiple Drivers

1.4.3 Confirmation and Requirements of the Places for Mounting and Storage

When selecting the environment for mounting and storage, pay attention to the following requirements:

1) Environment temperature: in case of running in the temperature range of 0℃~+40℃, if the environment's ambient temperature is over 40℃, for every 5℃ of temperature rise, a 30% derating of the driver is needed for operation, and ventilation must be enhanced to improve heat dissipation; if the driver is kept under 0℃ for a long time during transport or storage, please do keep the driver in an environment warmer than 0℃ for a period of time before using it to ensure the IC chips inside the driver can work normally, or the driver is likely to be damaged;
2) Humidity of the mounting and storage place shall be lower than 95% without condensation of moisture;
3) Don't mount or store the driver in an environment full of dust, smog or metal powder;
4) The mounting and storing environment must be without erosive gases and explosive gases;

5) Vibration of the mounting and storage environment must meet such requirement: vibration frequency ≤ 20Hz: 9.8m/s², 20Hz ≤vibration frequency ≤ 50Hz: 2 m/s²;
6) The mounting and storage environment must not be straight shone by the sun

1.5 Precautions

1.5.1 Precautions concerning Motor and Mechanical Load

1.5.1.1 Comparison with Variable-frequency Running

HS-series servo drivers run under full closed-loop vector control, which is capable of automatically adjusting output voltage and current according to change of load; when compared with frequency converters, this control mode is more energy-saving, more accurate in speed control, and wider in speed regulation range. As the controlled motor and driver are in a closed loop, position control and torque control are very convenient.

1.5.1.2 Constant-torque Running

When the motor works in the constant-torque area, its output torque is the torque needed for the machine's running, not the motor's rated torque, but the motor's maximum continuous output torque cannot exceed the rated torque.

1.5.1.3 High-speed Running in Constant-power Area

When a motor works in the constant-power area, the user must not only consider the stronger vibration and higher noise, but also ensure the motor's bearings and mechanical devices work within their respective speed ranges, so he must inquire about these ranges before operation because the machine is not allowed to run faster than the rated speed.

1.5.1.4 Lubrication of Mechanical Devices

When running at a low speed for a long time, the mechanical devices like the reduction box, gear reduction motor, etc. that need be lubricated are likely to be damaged due to deterioration of lubrication effect; please do inquire about their lubrication before such running.

1.5.1.5 Negative-torque Loads

Hoisting loads often involve negative torque, which means the driver will have overcurrent and overvoltage alarms and then the driver will trip, in such conditions, the user should consider selecting braking parts or mechanical safety devices.

1.5.1.6 Reciprocal Loads

When the driver is driving a piston-type reciprocal load, please be aware of occurrence of unstable current, which is far more likely in case of long-time running at a low frequency, so in case of such a load, the driver's capacity should be raised.

1.5.1.7 Mechanical Resonance Points of Load Devices

At a point within a certain output frequency range, the driver will perhaps resonate with the load device; the user may avoid resonance by using a bandstop filter (see 5.7 Resonance Inhibition for details).

1.5.2 Precautions concerning the Driver

1.5.2.1 Use of the Driver Out of Its Rated Voltage

It is not allowed to use the servo driver out of the allowable working voltage range, if such use is necessary, please transform the voltage by using a corresponding step-up or step-down device.

1.5.2.2 Capacitors and Pressure Sensing Devices for Improving the Power Factor

As the driver's output is a pulse wave, if its output side is equipped with capacitors for improving the power factor or pressure sensing devices for lightning protection, they will trip the driver or damage its parts, please do remove them as shown in Figure 1-7.

1.5.2.3 Derating for Use at High Altitudes

At altitudes higher than 1000m above the sea level, as the thin air will make the driver's heat dissipation poorer, it is necessary to derate the driver. Figure 1-8 shows the curve of correlation between the driver's rated current and altitude.

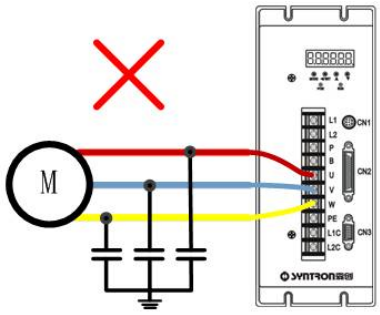


Figure 1-7 No Use of Capacitor at the Controller's Output End

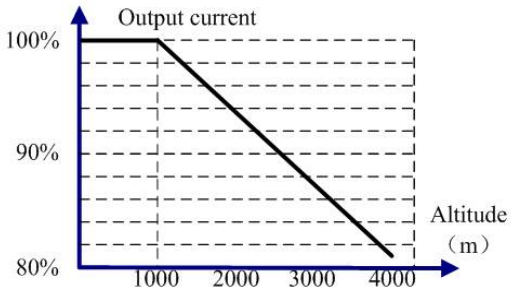


Figure1-8 Curve of Correlation between the Driver'S Rated Current and Altitude

Chapter II Use of the Operation Panel

2.1 Display on the Panel

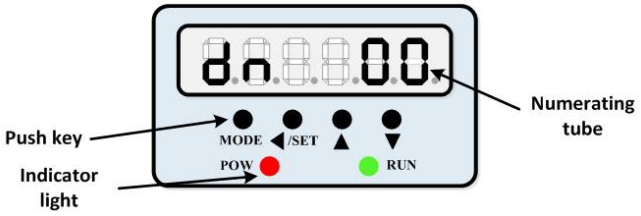


Figure 2- 1 Diagram of the Operation Panel

As shown in Figure 2-1, the operation panel is mainly composed of 6 sets of numerating tubes, 2 indicator lights and 4 push keys. The numerating tubes are used to show the servo driver's current working status, function code and parameter values; the indicator lights and numerating tubes work together to indicate the servo driver's current working status, the push keys are used to select and edit parameters and to perform trial running.

2.2 Description of the Panel

2.2.1 Look-up Table of Displayed Numbers and Letters

Number	1	2	3	4	5	6	7	8	9	0	Decimal point	
Letter	A	b	c	d	E	F	G	H	J	L	n	o
	P	q	r	S	T	U	V	y	Null	-		

Table 2-1 Look-up Table of Displayed Numbers and Letters

2.2.2 Description of Display of Numerating Tubes

The numerating tubes' display interface is divided into three layers: current working status interface, function code selecting Interface (including for "Fn xxx" configuration parameters and "Dn xx" status parameters) and parameter observing (for "Dn xx" status parameter values) and editing (for "Fn xxx" configuration parameters) interface; description of each layer can be referred to in Table 2-2. By touching the push keys, the user can shift between the three layers,

Figure 2-2 shows the concrete operation steps for shifting.

<table>
<tr><th>S/N</th><th>Display Interface</th><th>Display Definition</th><th colspan="2">Description</th></tr>
<tr><td rowspan="5">1</td><td rowspan="5">Current running status interface</td><td rowspan="5">Default status</td><td>Servo enabling is ineffective, the DC bus voltage is lower than the master contactor’s pull-in voltage</td><td>Servo enabling is ineffective, the DC bus voltage is higher than the master contactor’s pull-in voltage</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td colspan="2">【Note】Only when DC bus voltage is higher than the master contactor’s pull-in voltage, can the system enter the “Servo Ready” (SRDY) status.</td></tr>
<tr><td>Servo enabling is effective, and by default the current motor rotation speed is displayed.</td><td>When a fault alarm occurs, the current alarm code is displayed and flashes</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">Function code selecting interface</td><td>Servo status parameters</td><td colspan="2">  </td></tr>
<tr><td>Servo configuration parameters</td><td colspan="2">  </td></tr>
<tr><td rowspan="2">3</td><td rowspan="2">Parameter observing and editing interface</td><td>Status parameter’s observed value</td><td colspan="2">  </td></tr>
<tr><td>Configuration parameter’s edited value</td><td colspan="2">  </td></tr>
</table>

Table 2-2 Description of Numerating Tubes’ Display

2.2.3 Description of Display of Indicator Lights

Different status of POW and RUN indicator lights represents different working status of the driver; Table 2-3 gives the detailed description therefor:

Indicator Light	Definition	Operation Description
POW	DC-Link bus voltage working state	On: DC-link bus voltage exceeds safe voltage value (36V) Off: DC-link bus voltage is lower than safe voltage value (36V) Slow flashing: Regenerative braking circuit works normally (braking power ratio ≤ 80%) Quick flashing: Regenerative braking circuit works at the full load (braking power ratio≥ 80%)

RUN	Running status indicator light	On: System's self-test is completed without fault or alarm Off: The control power supply is not started, or the system is in the process of self-test Slow flashing: The servo is working normally Quick flashing: Alarm of a servo fault

Table 2-3 Description of Display of Indicator Lights

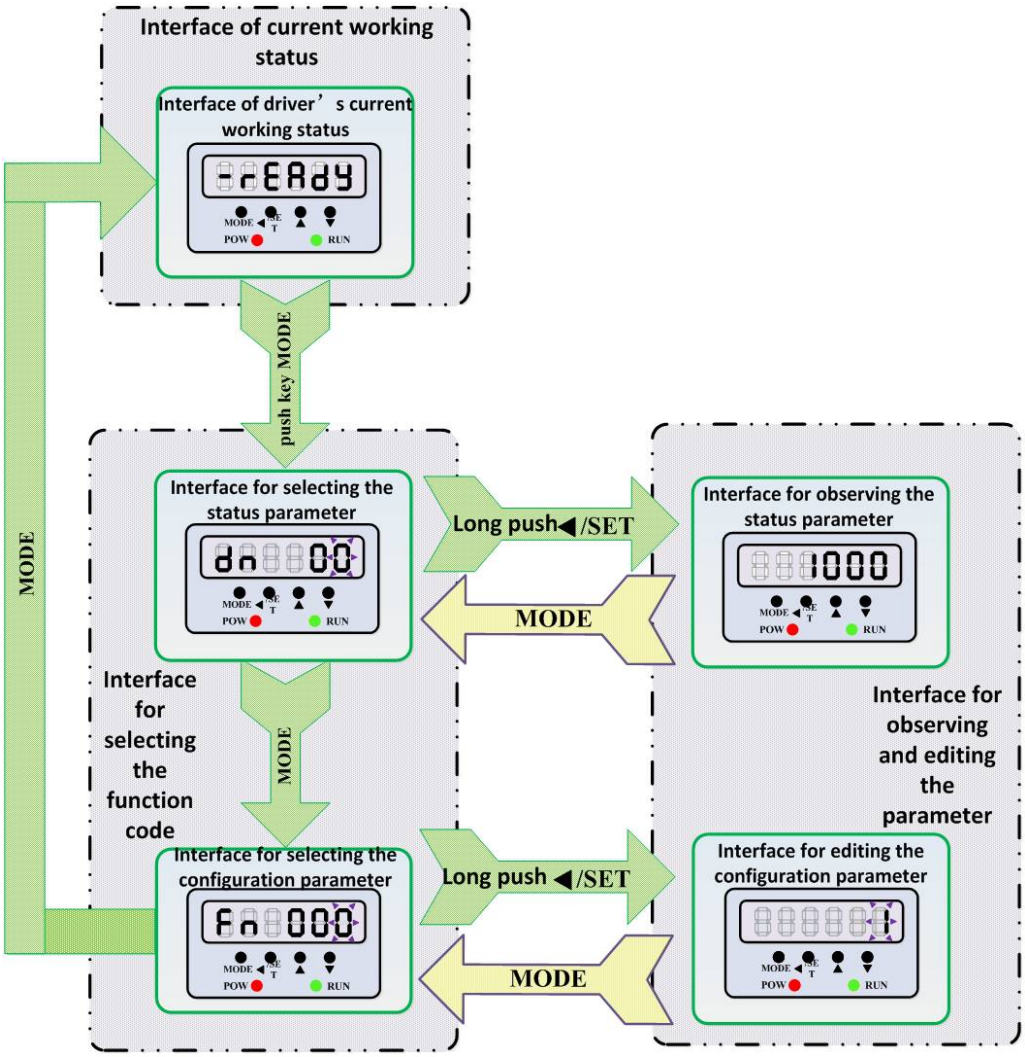


Figure 2-2 Shifting between Numerating Tubes' Display Interfaces

2.2.4 Definition of Push Keys' Functions

The push keys are provided for the user's selection, observation and edition of parameters, and for trial running as well; detailed definition of the keys are as shown in Table 2-4 below.

【Note】During trial running, keys for progressive increase and progressive decrease are effective only when they are kept down for a continuous period. In other conditions, no matter the keys are under a long push or short push, they only respond to the pushing action after they are released.

Push Key	Definition	Operation Description
MODE	Interface shifting	✧ It is used for shifting between the "Interface of Current Working Status", "Interface for Selecting the Status Parameter" and "Interface for Selecting the Configuration Parameter" ✧ It is used for returning from "Interface for Observing and Editing the Parameter" to the "Interface for Selecting the Function Code" when the user is observing or editing the driver's internal parameters 【Note】Figure 2-2 Shifting between Numerating Tubes' Display Interfaces can be referred to.
◀/SET	Confirm & move between digits	✧ In the "Interface for Selecting the Function Code" and "Interface for Editing the Configuration Parameter", by giving a normal short push on the key, the user can select the function code and the digit position of the parameter value he wants to change, the digit position he has selected for change will flash ✧ In the "Interface for Selecting the Function Code", if the user has selected a parameter's No., and held down the key for 1 second, he will enter the "Interface for Observing and Editing the Parameter" ✧ In the "Interface for Editing the Configuration Parameter", by holding down the key for 1 second, the user can confirm and save the changed parameter value ✧ Under JOG mode ("Fn 001"=3), by holding down "Run/Stop" function shifting key for 1 second, namely, holding down this key for 1 second in the "servo enabling ineffective" status, the user can enter the "servo enabling input effective" (ENA-SRV) status; in the "servo enabling effective" status, by giving a normal short push on this key, the user can return to the "Servo Ready" (SRDY) status. Please refer to "5.3 Setting of Basic Operating Functions" for details of working status 【Note】Figure 2-2 Shifting between Numerating Tubes' Display Interfaces can be referred to.
▲	Progressive increase key	✧ In the "Interface for Selecting the Function Code" and "Interface for Editing the Configuration Parameter", the digit that is selected by the user for change will flash, and show increase of its value by increments of "1" ✧ Under JOG mode ("Fn 001"=3), after servo enabling is effective, by holding down this key, the user can make the motor rotate in the forward direction (namely counterclockwise direction CCW)

▼	Progressive decrease key	✧ In the “Interface for Selecting the Function Code” and “Interface for Editing the Configuration Parameter”, the digit that is selected by the user for change will flash, and show decrease of its value by increments of “-1” ✧ Under JOG mode (“Fn 001”=3), after servo enabling is effective, by holding down this key, the user can make the motor rotate in the backward direction (namely clockwise direction CW)

Table 2-4 Definition of Push Keys’ Functions

2.3 Example of Status Parameter Inquiry

Status parameters of HS-series servo drivers are marked by “Dn xx”; during debugging, the operator can observe values of the status parameters he is interested in by using the “Dn xx” status parameters (see 6.1 Status Parameters Dn for details). Figure 2-3 below shows an ordinary example of status parameter inquiry.

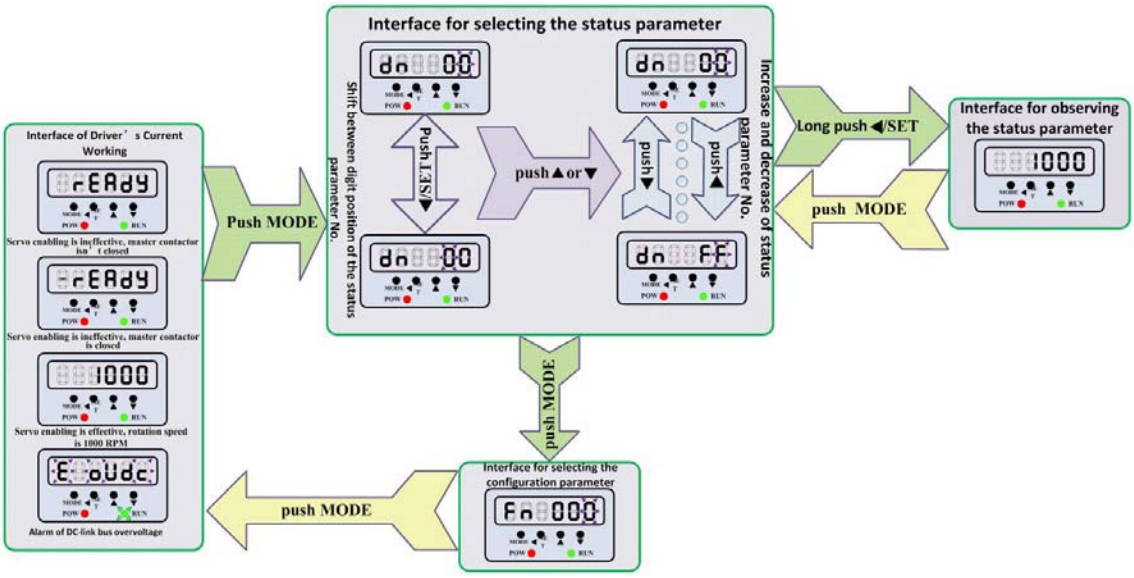


Figure 2-3 Ordinary Diagram of Status Parameter Inquiry

2.4 Example of Inquiry about and Edition of a Configuration Parameter

Configuration parameters of HS-series servo drivers are marked by “Fn xx”; when the user has bought the product, he needs to set the relevant configuration parameters based on the difference between applications. Figure 2-4 below shows an ordinary example of inquiry about and edition of a configuration parameter.

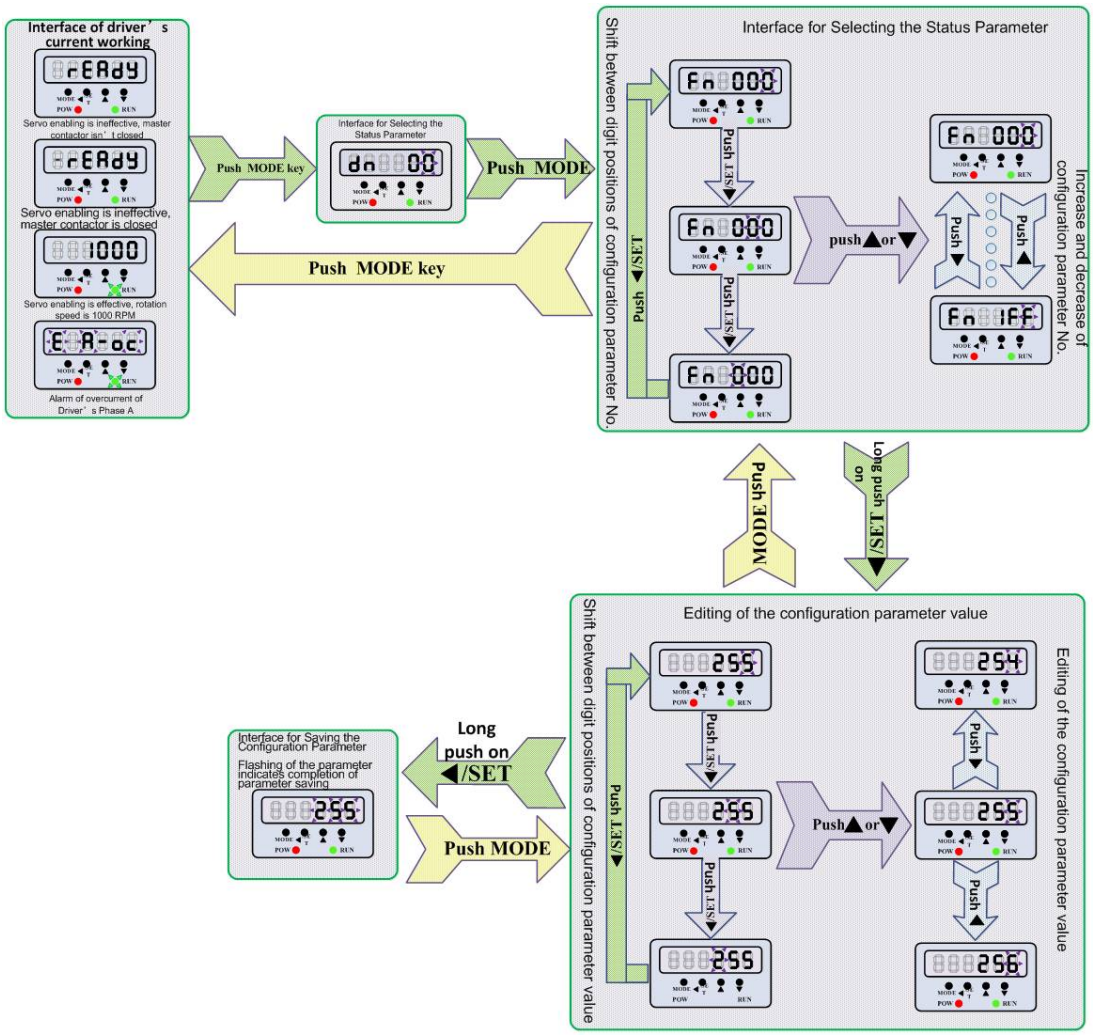


Figure 2-4 Ordinary Diagram of Inquiry about and Editing of Configuration Parameters

Chapter III Wiring

3.1 Selection of Peripheral Devices and Connection with Them

An HS-series servo driver's peripheral devices mainly include the incoming line breaker, electromagnetic contactor, lead-in reactor, noise filter, magnetic filter, braking resistor, upper machine, etc., Figure 3-1 below shows connections between an HS-series servo driver and peripheral devices.

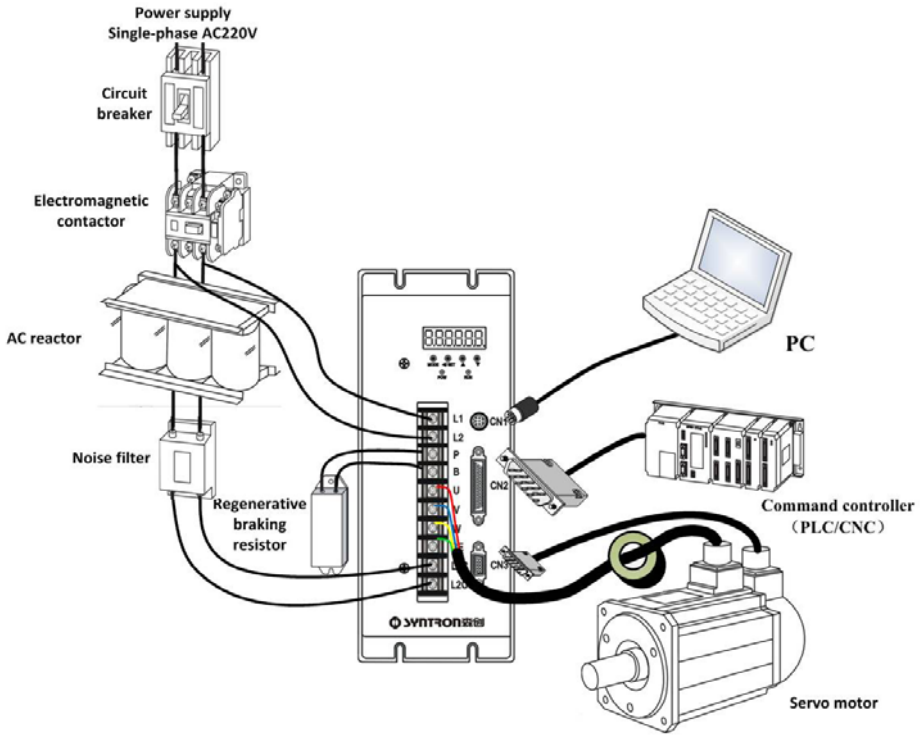


Figure 3-1 Selection of an HS-series Servo Driver's Peripheral Devices and Connection with Them

【Note】Specifications of the incoming line breaker, electromagnetic contactor, lead-in reactor and noise filter must match capacity of the power supply used for the servo driver (with loads considered, too); the regenerative braking resistor is already built in, so no external ones are needed, if an external one is needed, please refer to 3.2.7 Connection of External Braking Resistors for its connection; in order to prevent industrial power supply noise's pollution to the upper machine (CNC, PC, PLC, Intelligent controller cards, etc.), it's better to separate the upper machine's power supply from the industrial power supply, and consider the problems like electromagnetic compatibility, etc.

There are strict requirements for the control ports and power terminals, Table 3-1 shows

specifications of wires and cables for different power terminals and signal ports that the user shall adopt while connecting.

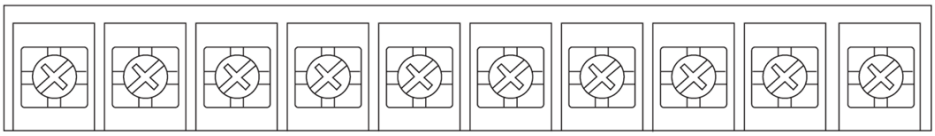
Signal Category	Name of Port/Terminal	Name of Wire/Cable	Specifications of Wire/Cable（mm²）	
Control power supply	L1C/L2C	Ordinary cable or shielded cable	1～3	
Motor power line	U/V/W/PE	Ordinary cable or shielded cable	HS0020A-xxxx	≥1.5
			HS0040A-xxxx	≥1.5
			HS0075A-xxxx	≥ 2
			HS0100A-xxxx	≥ 2
			HS0150A-xxxx	≥ 3
			HS0200A-xxxx	≥ 3
			HS0250A-xxxx	≥ 3
On-off signal input and output	CN2: Signal In1~8/ interface power supply CN2: Signal Out1~4 +/-	Shielded cable	0.5～2	
Analog signal input and output	CN2-16/1 CN2-43/1 CN2-18/2 CN2-29/2	Ordinary cable or shielded twisted-pair cable	0.5～1	
Encoder signal	CN3	Shielded twisted-pair cable	0.5～1	
Pulse signal	CN2-12/27 CN2-13/28			
Communication signal	CN1			

Table 3-1 Specifications of Wires and Cables for Different Power Terminals and Signal Ports

3.2 Connection of Main Circuit's Terminals

3.2.1 Types of Main Circuit's Terminals

Figure 3-2 below shows combination of terminals of main circuit:



L1 L2 P B U V W PE L1C L2C

Figure 3-2 Combination of Double-power-supply Main Circuit's Terminals

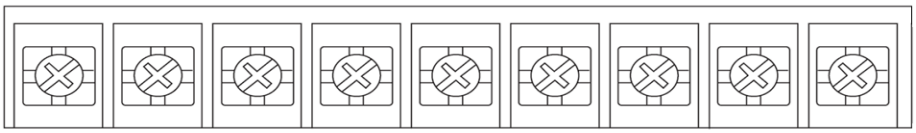


Figure 3-3 Combination of Single-power-supply Main Circuit's Terminals

3.2.2 Description of Main Circuit's Terminals and Their Functions

Description of the main circuit's terminals and their functions are shown in Table 3-2:

Name	Function	Precaution
L1 / L2	Working power supply's single-phase AC input terminals, 220V, 50/60Hz	Circuit breakers shall be used for protection
P / B	Connection of external braking resistors between P/B	Capacity of the external braking resistors should match the driver's capacity and working condition
U / V / W	Driver output terminal	Their connection method must be consistent with the motor's phase sequence
PE	Grounding terminal	Grounding resistance ≤ 4Ω
L1C/ L2C	Control power supply's single-phase AC input terminals, 220V/50/60Hz	In an environment with big interference, power supply filters shall be used and insulated from the working power supply
P/D	Connection of dynamic external braking resistors between P/D	Capacity of the dynamic external braking resistors should match the driver's capacity and working condition

Table 3-2 Description of Types and Functions of Main Circuit's Terminals

3.2.3 Connection on the Main Circuit's Input Side

Pay attention to the following tips when performing connection on the main circuit's input side:

1) Incoming Line Breakers

Main circuit working power supply's input terminals L1 and L2 must be connected to the single-phase (standard configuration) or 3-phase (optional configuration) AC power supply via protective line breakers.

a. Selection of the incoming line breakers' time characteristics must made with consideration of the servo driver's overloading capacity, please refer to the requirements

in Table 3-3.

b. Each servo driver shall be equipped with an independent incoming line breaker.

2) Installation of Leakage Breaker

As the servo driver output a high-frequency switching pulse current capable of producing a high-frequency leakage current, a leakage breaker shall be used on the driver's incoming line side to remove the leakage current (only within the frequency that's hazardous to human health). When wiring, please select the leakage breakers dedicated to the drivers.

a. When selecting a dedicated leakage breaker, please select one whose induction current to control a servo driver is higher than 30mA.

b. One dedicated leakage breaker's induction current to control a servo driver shall be higher than 200mA and exists longer than 0.1s.

c. Use of an isolation transformer between an ordinary circuit breaker and a servo driver can effectively prevent the circuit breaker's misoperation.

3) Incoming Line Electromagnetic Contactor

An incoming line electromagnetic contactor can be used for cutting off the power supply during sequence control. It must not be used for starting the driver. When it is used for forcible deenergization of a driver, the driver sends an undervoltage alarm.

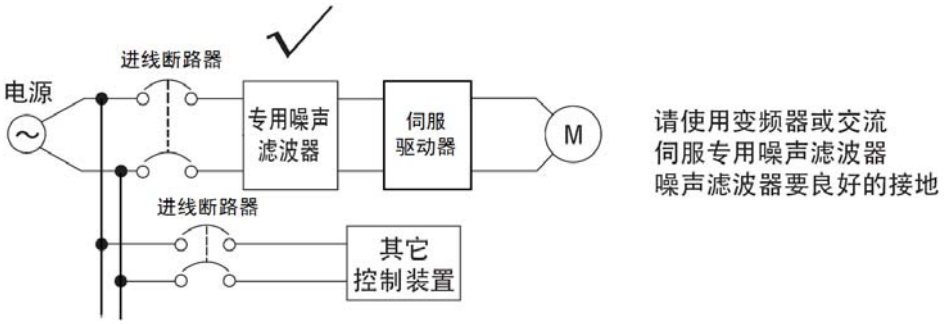
a. Frequent closing and opening operation of the incoming line breaker will cause heating or even burn-out of the driver's charging resistor.

b. A control circuit should be used for the peripheral section, so as to cut off the incoming line electromagnetic contactor when the driver sends an alarm.

4) AC Reactor

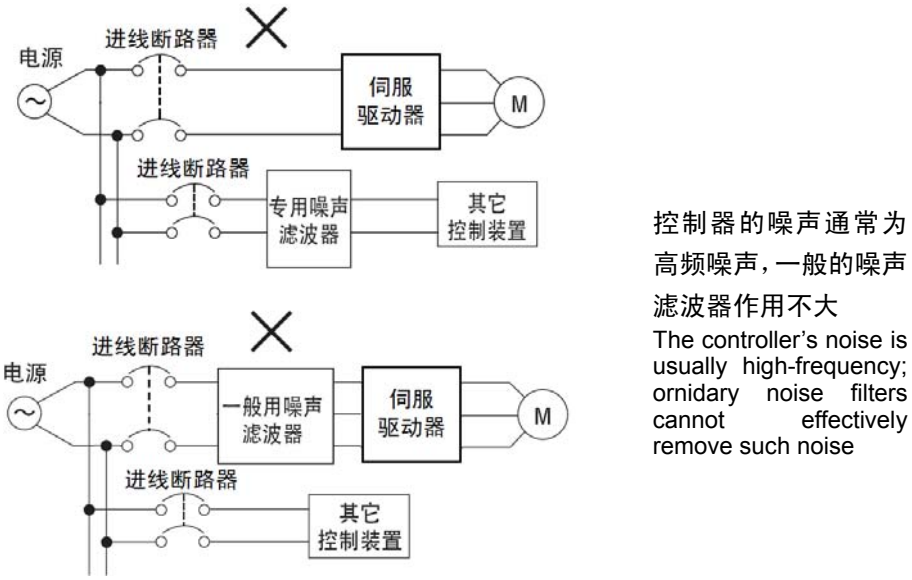
Use of an AC reactor on a servo driver's incoming line side can effectively inhibit power supply's surge, so that burn-out of the driver's rectifier bridge is prevented and the power supply side's power factor is improved. Figure 3-6 shows how to connect an AC reactor.

5) Noise Filter on the Power Supply Side



电源 Power supply 进线断路器 Incoming line breaker 专用噪声滤波器 Dedicated noise filter
伺服驱动器 Servo driver 其他控制装置 Other control devices 请使用变频器或交流伺服专用噪声滤波器 Please use a noise filter dedicated to the frequency converter or AC servo. 噪声滤波器要良好地接地 The noise filter shall be reliably earthed

Figure 3-4 Correct Connection of a Noise Filter on the Power Supply Side



电源 Power supply 进线断路器 Incoming line breaker 专用噪声滤波器 Dedicated noise filter
伺服驱动器 Servo driver 其他控制装置 Other control devices

Figure 3-5 Wrong Connection of a Noise Filter on the Power Supply Side

In order to lower the high-frequency interference noise coupled from the power supply side to the driver and inhibit the noise from the driver to the power supply at the same time, the user can use a noise filter of a matching model and specifications on the driver's power supply side as shown in shown in Figure 3-4 (correct connection), never connect it as shown in Figure 3-5 (wrong connection).

6) Connection of a Standard Incoming Circuit

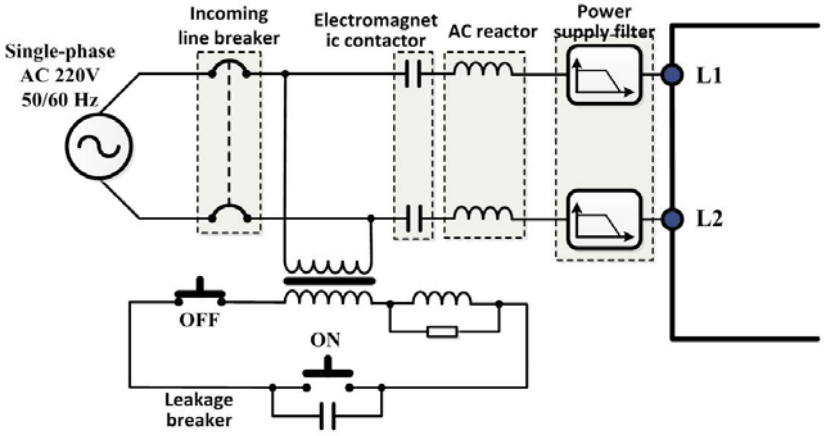


Figure 3-6 Connection of Working Power Supply's Incoming Circuit

Control power terminals L1C/L2C are only for supplying the system's control circuit; its current is limited (≤100mA), so no separate incoming circuit as used for working power supply is needed. The user can directly connect working power terminals L1/L2 to L1C/L2C. When noise in the working conditions is big, it's better to insulate the control power supply from the working power supply, and use a power supply noise filter between the insulation transformers and L1C/L2C, see Figure 3-7 below:

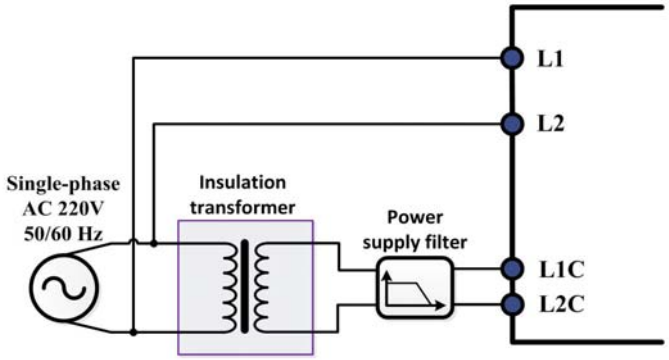


Figure 3-7 Connection of Control Power Supply's Incoming Circuit

7) Connection of Multiple Drivers

Connection of multiple servo drivers are as shown in Figure 3-8:

【Note】Multiple drivers can use a common incoming line breaker and a common noise filter, but their specifications must match total capacity of the power supply to the servo units, with load conditions considered.

Driver Model	Power （KW）	Air Circuit Breaker （A）	220V Electromagnetic Contactor （A）
HS0020A-xxxx	0.2	10	10
HS0040A-xxxx	0.4	10	10
HS0060A-xxxx	0.6	10	10
HS0075A-xxxx	0.75	15	15
HS0100A-xxxx	1.0	15	15
HS0120A-xxxx	1.2	15	15
HS0150A-xxxx	1.5	20	20
HS0200A-xxxx	2.0	40	40
HS0250A-xxxx	2.5	40	40
HS0300A-xxxx	3.0	40	40

Table 3-3 Selection of Models of Circuit Breakers, Contactors and Reactors

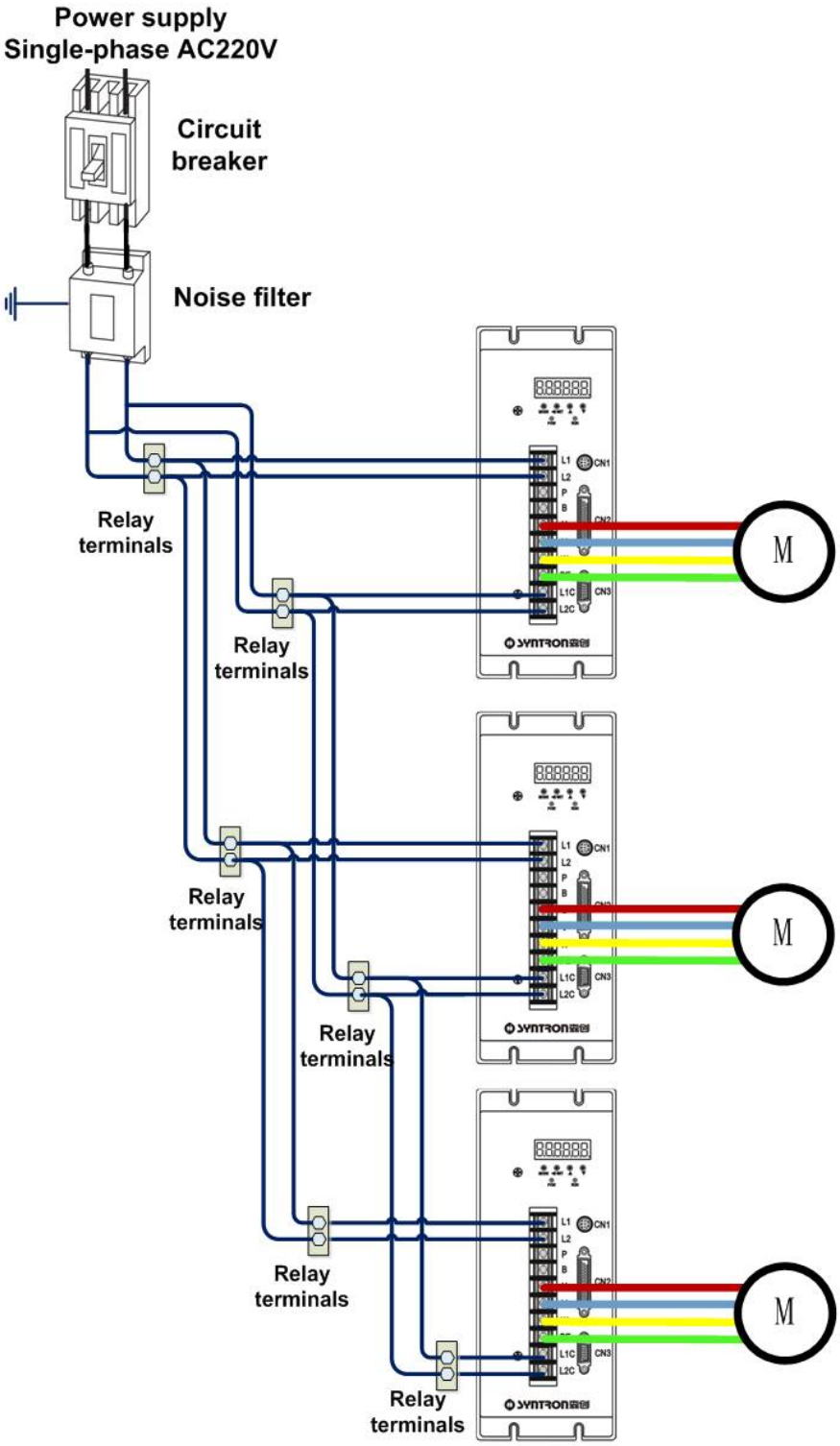


Figure 3-8 Connection of Multiple Servo Drivers

3.2.4 Connection on the Main Circuit's Output Side

The driver's output terminals U, V, W and PE shall be connected as per the correct phase sequence to the servo motor's connecting terminals U, V, W and PE.

【Note】Wires in our company's each servo motor's U/V/W/PE windings are correspondingly colored red/blue/yellow/green (yellow green).

Prohibited
● Never connect any incoming power line to any output terminal. ● Never connect any incoming power line to any output terminal, or the driver's internal parts will be damaged.
● Never short-circuit or ground any output terminal. ● Never directly touch any output terminal or let any output line touch the driver's case, or there will be danger of electric shock and short-circuiting. Besides, never short-circuit the output wires.
● Never use any phase-shift electrolytic capacitor or LC/LR noise filter. ● Never connect any phase-shift electrolytic capacitor or LC/LR noise filter to the output circuit. Connection with them will cause damage to the driver's internal parts and components.
● Never use any electromagnetic switch to connect or disconnect the load. ● Never connect any electromagnetic switch or electromagnetic contactor to the output circuit for the purpose of connecting or disconnecting the load. When the driver is working with a load, the surge currents will trigger action of the driver's protection circuit.

3.2.5 How to Tackle Interference

This manual provides three methods for inhibiting the space interference and inductive interference, namely use of magnetic filters, shielded cables and output filters.

1）Magnetic Filter

As shown in Figure 3-9, common-mode interference on the output side can be effectively inhibited by a magnetic filter installed near the driver's output side.

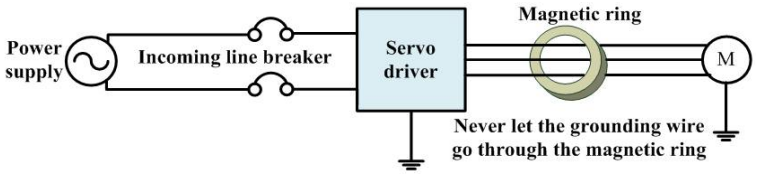


Figure 3-9 Diagram of Magnetic Filter's Installation

2） Shielded Output Cable

Radio interference and inductive interference can be effectively inhibited with use of a shielded cable as the servo driver's output cable. When the shielded cable is used, the

shielding layer's two ends shall be grounded as shown in Figure 3-9.

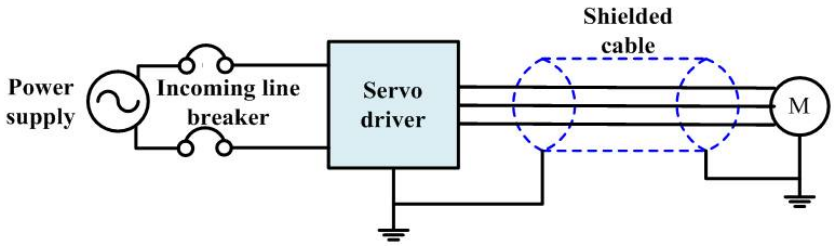


Figure 3-10 Diagram of Shielded Cable's Connection

3）Shielded Output Cable

In an environment with strong interference, an output filter can be used to inhibit interference; as the driver's input side and driver itself can also generate interface, use of both input and output filters can have a better effect. Figure 3-11 is the diagram of such method.

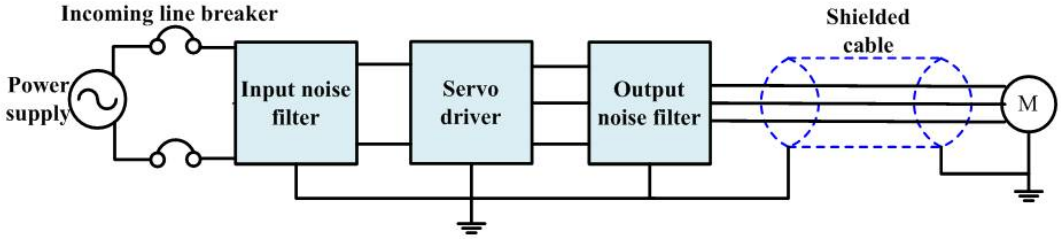


Figure 3-11 Diagram of Use of Filters for Inhibiting Radio Interference

3.2.6 Connection of the Grounding Wire

The grounding wire is marked with PE, please ensure it is reliably connected to the ground.

Grounding resistance: under 4Ω.

Grounding wire: Never let the driver and powered devices like welding machines use a common grounding wire.

Grounding wire: Please select the wire diameter as prescribed by the governing technical standards for electrical equipment, and the wire's length should be as short as possible. When two or more drivers are used, never let the grounding wires form a circuit. Figure 3-12 is the diagram of an example:

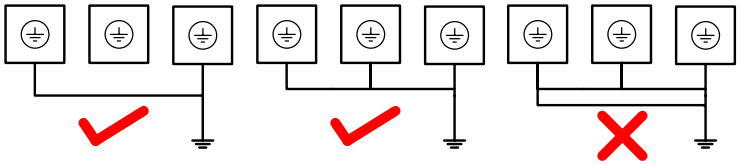


Figure 3-12 Connection of Grounding Wires

3.2.7 Connection of External Braking Resistors

1) Connecting Method

Any external braking resistor shall be connected between terminal P and terminal B, please never connect it to any other terminal, or the braking resistor will be burnt out by abnormal heat, or the driver will probably be damaged. Figure 3-13 shows how to connect the external braking resistor(s).

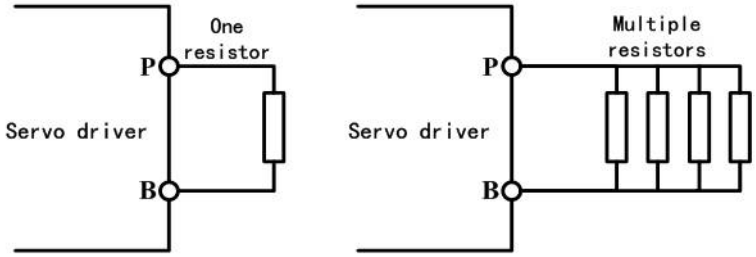


Figure 3-13 Connection of Braking Resistor(s)

2) Setting of the Braking Resistor(s)'s Capacity

HS-series servo drivers have no braking resistor connected inside them, so when energy-consuming braking is needed for their working condition, external resistors can be used. Table 3-4 shows the recommended resistor capacity.

【Note】Please select the braking resistors strictly as per Table 3-4 to ensure both adequate discharge of energy and safety of the braking circuit. For details of regenerative braking, please refer to "错误！未找到引用源。 Regenerative Braking".

Specifications of Servo Driver	Specifications of Built-in Braking Resistor	Allowed Current of External Braking Resistors	Recommended Specifications of External Braking Resistors
HS0020A-xxxx	200Ω/60W	≤5A	＞120Ω
HS0040A-xxxx	200Ω/60W	≤5A	＞120Ω
HS0060A-xxxx	200Ω/60W	≤5A	＞120Ω
HS0075A-xxxx	100Ω/60W	≤10A	＞60Ω
HS0100A-xxxx	100Ω/60W	≤10A	＞60Ω
HS0120A-xxxx	100Ω/60W	≤10A	＞60Ω

HS0150A-xxxx	100Ω/60W	≤12A	＞40Ω
HS0200A-xxxx	100Ω/60W	≤15A	＞40Ω
HS0250A-xxxx	100Ω/60W	≤15A	＞40Ω
HS0300A-xxxx	100Ω/60W	≤15A	＞40Ω

Table 3- 4 Selection of Models of External Braking Resistors

3.2.8 Precautions for Main Circuit's Connection

1) Pleasure do use a circuit breaker or a fuse protector between main power supply's and working power supply's input terminals (L1/L2).

2) Please do connect the grounding wire to the driver's grounding terminal PE, and the grounding wire should be a copper-core one with a section area of over 4mm², and the grounding resistance shall be lower than 4Ω.

3) Please do ensure reliable connection of all wires and terminals

4) When the circuit's connection is completed, please check the following items:

a. Is every connection correct?

b. Is there any wire's connection not completed?

c. Is there any short-circuiting between terminals and wires, or their being short-circuited to the ground?

3.3 Connection to the Encoder's Interface

Encoder interface CN3's pins are defined as in Figure 3-14.

Please do connect the wires as per the pin sequence of the motor-side's aviation plug (see 3.6.2), or the encoder will work incorrectly, or even be burnt out.

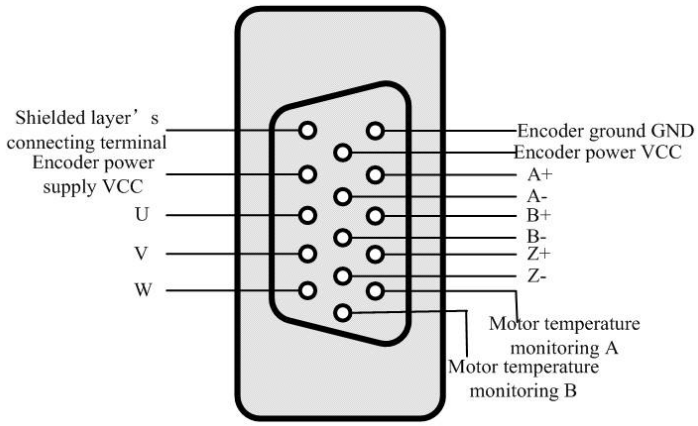


Figure 3-14 Sequence of Encoder Interface's Pins

3.4 Connection of Controlling Input and Output Ports

3.4.1 Positions and Definition of Input and Output Interface CN2's Pins

Positions of input and output interface's pins and their definition are as shown in Figure 3-15 below:

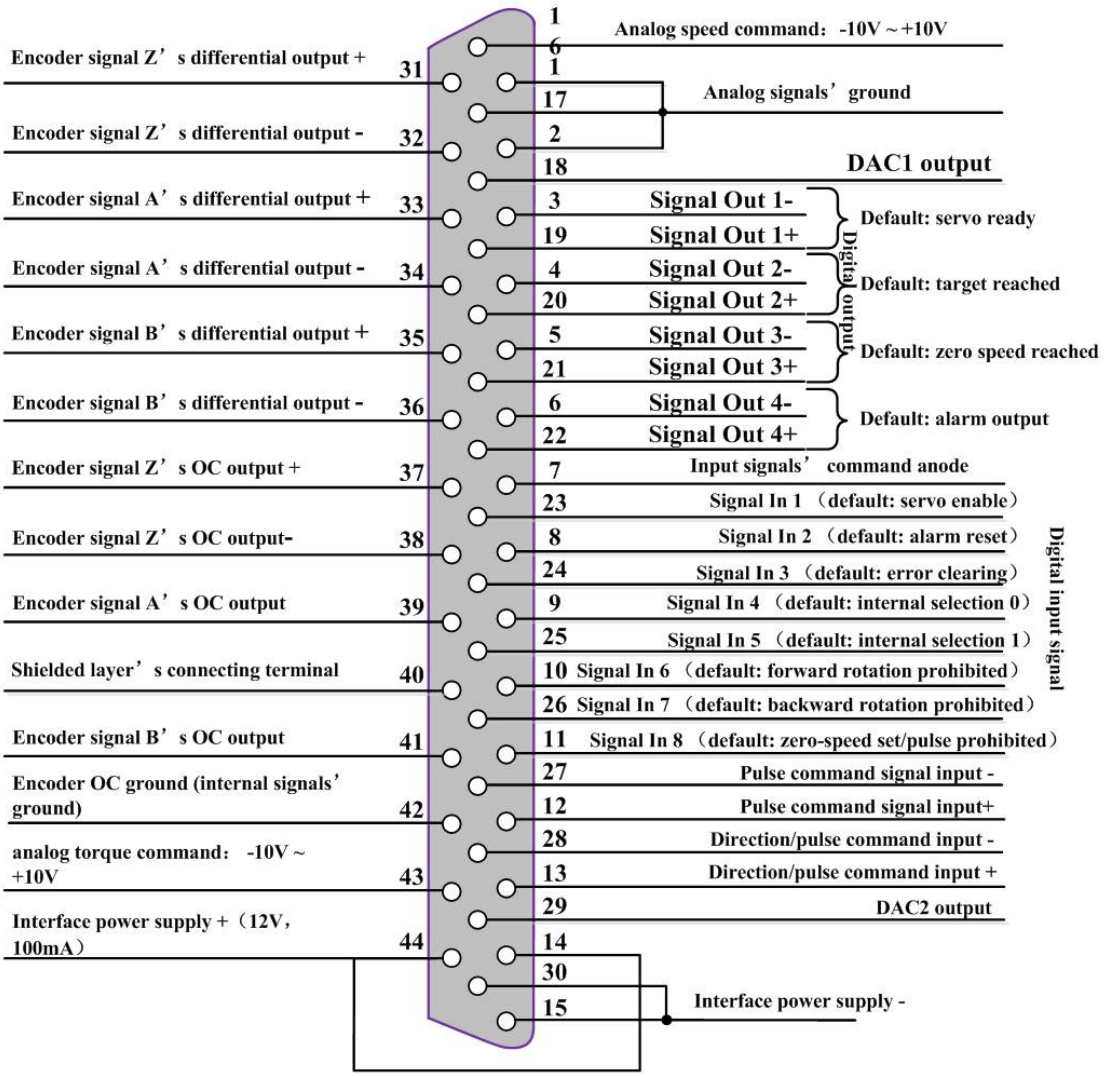


Figure 3-15 Positions of Pins of Input and Output Interface CN2

3.4.2 Names and Functions of Input and Output Interface CN2's Signals

Signal In 1~8 and SignalOut 1~4 are user's IO ports, and can be flexibly allocated according to the user's need.

1) Input Signals

Names and definition of input signals are shown in Table 3-5 below, in which ON means input optocoupler is on, OFF means it is off. When the input signals are connected to a common anode, low level brings ON status and high level brings OFF status; when the input signals are connected to a common cathode, the low level brings OFF status, and high level brings ON

status.

Control mode	Signal Name	Pin No.	Function Description		
Position mode External speed mode Internal speed mode External torque mode	Servo Enabling（SON）	SignalIn 1 ~ 8 They are allocated freely to the pins: Pin 23 Pin 8 Pin 24 Pin 9 Pin 25 Pin 10 Pin 26 Pin 11 corresponding to input signals SignalIn 1~8 according to the need	This signal controls motor windings' energization	ON	Effective
				OFF	Ineffective
	Alarm Reset（ARST）		This signal resets alarm (warning) code after the alarm (warning)'s reason is eliminated	ON	Effective
				OFF	Ineffective
	Forward Rotation Prohibited（CCWL）		This signal prohibits the motor from rotating in the forward direction (counterclockwise)	ON	Effective
				OFF	Ineffective
	Backward Rotation Prohibited（CWL）		This signal prohibits the motor from rotating in the backward direction (clockwise)	ON	Effective
				OFF	Ineffective
	Zero-speed Set/Pulse Prohibited（ZSPD / INH）		Speed mode: Motor speed command is forced at zero; Position mode: Motor pulse setting signal is shut off	ON	Effective
				OFF	Ineffective
	External Forward-rotation Torque Limit（TCCW）		When the motor is rotating in the forward direction (counterclockwise), this signal ensures the output torque is limited within the range defined by configuration parameter "Fn 0A3".	ON	Effective
				OFF	Ineffective
	External Backward-rotation Torque Limit（TCW）		When the motor is rotating in the backward direction (clockwise), this signal ensures the output torque is limited within the range defined by configuration parameter "Fn 0A4".	ON	Effective
				OFF	Ineffective
	Control Mode Shifting（CMODE）		When the driver is under a mixed control mode, this signal enables shifting between Mode One and Mode Two	ON	Effective
				OFF	Ineffective
	Emergency Stop（EMG）		This signal provides emergency stop and deenergization of the motor's windings; the way of stopping is determined by the dynamic brake and electromagnetic brake	ON	Ineffective
				OFF	Effective
	Command Reversion（COMINV）		This signal provides reversion of the commands for position, speed and torque	ON	Ineffective
				OFF	Effective
	Gain Shifting（GAIN）		This signal provides shifting between the speed loop gain and torque loop gain	ON	Ineffective
				OFF	Effective
	Reserved		It is a reserved port, don't use it	ON	Ineffective
				OFF	Effective
Position mode	（PULSE）	Pin 12/27	The servo motor's position is controlled with the "pulse+direction" commands; selection between commands is achieved through parameter "Fn 038"; for more details, please refer to "5.4.1 Selection of Pulse Command Mode"		
	Direction Command（SIGN）	Pin 13/28			

<table>
<tr><td rowspan="5">Position mode</td><td>Electronic Gear Selection 0 （GEAR0）</td><td rowspan="3">They are freely allocated to the pins corresponding to SignalIn 1~8</td><td colspan="4">These signals determine numerator of the 4 electronic gear ratios through value of the combination GEAR 0/1; the 4 electronic gear ratios have a common denominator “Fn 054”</td></tr>
<tr><td rowspan="2">Electronic Gear Selection 1 （GEAR1）</td><td colspan="2">Gear ratio numerator 1: “Fn 050”</td><td colspan="2">Gear ratio numerator 2: “Fn 051”</td></tr>
<tr><td colspan="2">Gear ratio numerator 3: “Fn 052”</td><td colspan="2">Gear ratio numerator 4: “Fn 053”</td></tr>
<tr><td>Error Clearing （CLR）</td><td>They are freely allocated to the pins corresponding to SignalIn 1~8</td><td colspan="2" rowspan="2">Position error clearing signal</td><td>ON</td><td>Ineffective</td></tr>
<tr><td>OFF</td><td>Effective</td></tr>
<tr><td rowspan="2">External speed mode</td><td>External Analog Speed Command （ASPD）</td><td>Pin 16</td><td colspan="4" rowspan="2">The signal uses external analog commands to control motor’s rotation speed
Analog input range: -10V ~ +10V
Slope coefficient and zero point of the analog speed command can be set through configuration parameters “Fn 060” and “Fn 061”.</td></tr>
<tr><td>Analog Ground （AGND）</td><td>Pin 1/2/17</td></tr>
<tr><td rowspan="3">Internal speed mode</td><td>Internal Speed Selection 0 （INSPD0）</td><td rowspan="3">They are freely allocated to pins corresponding to SignalIn 1 ~ 8</td><td colspan="4">These signals determine selection of speed from 8 internal speed values via the value of the INSPD 0/1/2 combination</td></tr>
<tr><td>Internal Speed Selection 1 （INSPD1）</td><td>Internal speed 1 “Fn 071”</td><td>Internal speed 2 “Fn 072”</td><td>Internal speed 3 “Fn 073”</td><td>Internal speed 4 “Fn 074”</td></tr>
<tr><td>Internal Speed Selection 2 （INSPD2）</td><td>Internal speed 5 “Fn 075”</td><td>Internal speed 6 “Fn 076”</td><td>Internal speed 7 “Fn 077”</td><td>Internal speed 8 “Fn 078”</td></tr>
<tr><td rowspan="2">External torque mode</td><td>External Analog Torque Command （ATRQ）</td><td>Pin 43</td><td colspan="4" rowspan="2">The signal uses external analog commands to control motor’s torque
Analog input range: -10V ~ +10V
Slope coefficient and zero point of the analog torque command can be set through configuration parameters “Fn 064” and “Fn 065”</td></tr>
<tr><td>Analog Ground （AGND）</td><td>Pin 1/2/17</td></tr>
</table>

Table 3- 5 Names and Definitions of Input Signals

2） Output Signals

Names and definitions of output signals are shown in Table 3-6 below, in which ON means output optocoupler is on, OFF means it is off.

<table>
<tr><th>Control Mode</th><th>Signal Name</th><th>Pin No.</th><th colspan="3">Function Description</th></tr>
<tr><td rowspan="2">Position mode</td><td rowspan="2">Position Reached （ATPOS）</td><td rowspan="2">They are allocated freely to pins</td><td rowspan="2">The signal is effective when number of tracking error pulses is ≤“Fn 040 - Fn 041”
The signal is ineffective when number of tracking error pulses is >“Fn 040 + Fn 041”
“Fn 040” sets the threshold value at</td><td>ON</td><td>Effective</td></tr>
<tr><td>OFF</td><td>Ineffective</td></tr>
</table>

		corresponding to output signals SignalOut 1~4 according to the need	which the position is deemed to be reached "Fn 041" sets the value of hysteresis of signal "Position Reached"		
	Near the Position (NTPOS)	They are allocated to Pin 3/4/5/6 corresponding to SignalOut 1+ ~ 4-	The signal is effective when number of tracking error pulses is ≤"Fn 042 - Fn 043"	ON	Effective
			The signal is ineffective when number of tracking error pulses is >"Fn 042 + Fn 043" "Fn 042" sets the value at which the threshold position is deemed to be near "Fn 043" gives the value of hysteresis of signal "Near the Position"	OFF	Ineffective
Position mode External speed mode 内部速 Internal speed mode Torque mode Position mode	Zero Speed Reached (AZSPD)	They are allocated to Pin 19/20/21/22 corresponding to SignalOut 1+ ~ 4+	The signal is effective when | feedback rotation speed | is ≤"Fn 044 - Fn 045"	ON	Effective
			The signal is ineffective when | feedback rotation speed | is >"Fn 044 + Fn 045" "Fn 044" sets the threshold value at which zero speed is deemed to be reached "Fn 045" gives the value of hysteresis of signal "Zero Speed Reached"	OFF	Ineffective
	Target Speed Reached (ATSPD)	They are allocated freely to pins corresponding to output signals SignalOut 1~4 according to the need	The signal is effective when | feedback rotation speed | is ≥"Fn 046 + Fn 047"	ON	Effective
			The signal is ineffective when | feedback rotation speed | is <"Fn 046 - Fn 047" "Fn 046"：目标速度到达门限值； "Fn 046" sets the threshold value at which target speed is deemed to be reached "Fn 047"：目标速度到达回差值 "Fn 047" gives the value of hysteresis of signal "Target Speed Reached"	OFF	Ineffective
	Speed Consistent (VCOIN)		The signal is effective when | feedback rotation speed – commanded rotation speed | is ≤ "Fn 048"	ON	Effective
			The signal is ineffective when | feedback rotation speed – commanded rotation speed | is > "Fn 048" "Fn 048" gives value of error in speed consistency	OFF	Ineffective
	Target Torque Reached (ATTRQ)		The signal is effective when | actual torque | is ≥"Fn 049 + Fn 04A"	ON	Effective
			The signal is ineffective when | actual torque | is < "Fn 049 - Fn 04A" "Fn 049" sets the threshold value at	OFF	Ineffective

External speed mode Internal speed mode Torque mode			which target torque is deemed to be reached; "Fn 04A" gives value of hysteresis of signal "Target Torque Reached"		
	Electromagnetic Brake Release (BRK-OFF)		This signal releases the motor's built-in mechanical brake (electromagnetic brake). As the current needed for driving the electromagnetic brake's control coil is big, when this signal is used for controlling brake coils' on-off operation,, an intermediate relay must be used.	ON	Effective
				OFF	Ineffective
	Torque under Limit (TRQL)		This signal is effective when torque limit occurs; the limit includes internal basic torque limit, internal+external torque limit, internal+external analog torque limit, and internal+external+external analog torque limit; for more details, please refer to configuration parameter "Fn 0A0" for torque limit mode; when torque limit mode is not used, this signal is ineffective	ON	Effective
				OFF	Ineffective
	Dynamic Brake Release (DBR-OFF)		This signal is effective when dynamic brake is released, or it is ineffective	ON	Effective
				OFF	Ineffective
	Rotation Speed under Limit (SPDL)		This signal is effective when rotation speed limit occurs under the torque mode; the limit includes basic speed limit alone, basic speed limit + internal multi-stage speed limit, basic speed limit +external analog speed limit, and basic limit speed +internal multi-stage speed limit + external analog speed limit. No matter what limit mode is used, when the speed exceeds the motor's maximum speed limit, the motor's maximum speed limit shall be used. For more details, please refer to configuration parameter "Fn 0AD" for methods of speed limit under torque mode; when no speed limit under torque mode is used, this signal is ineffective	ON	Effective
				OFF	Ineffective
	Regenerative Braking Circuit (ULB)		This signal is effective when the regenerative braking circuit works, or it is ineffective	ON	Effective
				OFF	Ineffective
	Motor Rotation Direction (MSP-SIGN)		This signal is effective only when the motor rotates in the forward direction, or it is ineffective	ON	Effective
				OFF	Ineffective
	Motor Winding		This signal is effective only when the	ON	Effective

	Power On（MPOW-ON）		windings are energized, or it is ineffective	OFF	Ineffective
	Alarm Signal Output（ALM）		This signal is effective only when an alarm of fault (FAULT) or warning (WARN) occurs, or it is ineffective	ON	Effective
				OFF	Ineffective
	Servo Ready（SRDY）	They are allocated freely to pins corresponding to output signals SignalOut 1~4 according to the need	This signal indicates that the system's power-on self-test has been passed, and the system is waiting for the "Servo Enabling" (SON) signal	ON	Effective
				OFF	Ineffective
	Servo Enabling Input Effective（ENA-SRV）		This signal indicates that servo is enabled	ON	Effective
				OFF	Ineffective
	Servo Enabling Ineffective（DIS-SRV）		This signal indicates that servo enabling is ineffective	ON	Effective
				OFF	Ineffective
	Servo Emergency Stop（EMGING）		This signal indicates that the servo motor is in the emergency stop status	ON	Effective
				OFF	Ineffective
	Severe Fault（FAULT）		This signal indicates that there is a severe fault, and only by deenergization can the operator clear the fault alarm status	ON	Effective
				OFF	Ineffective
	Ordinary Warning（WARN）		This signal gives an alarm of ordinary warning, which can be cleared away by the Alarm Reset (ARST) signal	ON	Effective
				OFF	Ineffective
	Target Reached（TR）		When the signal of Position Reached (under position mode), Speed Reached (under speed mode) or Torque Reached (under any mode) is effective, this signal is effective; when none of the three signals is effective, this signal is ineffective	ON	Effective
				OFF	Ineffective
	Internal Limit（INL）		This signal is effective when either the signal Forward Rotation Prohibited or signal Backward Rotation Prohibited is effective; when neither of the two signals is effective, this signal is ineffective	ON	Effective
				OFF	Ineffective

Position mode External speed mode Internal	Encoder Frequency-dividing Differential Output A+/A- (OA)	Pin 33/34	This signal indicates the encoder performs frequency-dividing output of differential signal A+ / A-	Encoder's frequency divider value can be set by using configuration parameter "Fn03E" (divider for frequency-dividing output of QEP
	Encoder Frequency-dividing Differential Output B+/B- (OB)	Pin 35/36	This signal indicates the encoder performs frequency-dividing output of differential signal B+ / B-	

speed mode Torque mode	Encoder Frequency-dividing Output OCA (OCA)	Pin 39	This signal indicates the encoder performs frequency-dividing output of OC signal A		encoder's pulse)
	Encoder Frequency-dividing Output OCB (OCB)	Pin 41	This signal indicates the encoder performs frequency-dividing output of OC signal B		
	Encoder Differential Output Z+/Z- (OZ)	Pin 31/32	This signal indicates the encoder outputs differential signal Z+ / Z-		Encoder's output signal Z can be stretched by using configuration parameter "Fn03F" (for stretching Pulse Z's output width)
	Encoder output OC Z+/Z- (OCZ)	Pin 37/38	This signal indicates the encoder performs frequency-dividing output of OC signal Z+/Z-		
	DAC 1	Pin 18	DAC channel 1's output signal	Signal source	"Fn 0CA"
				Amplitude	"Fn 0C8"
	DAC 2	Pin 29	DAC channel 2's output signal	Signal source	"Fn 0CB"
				Amplitude	"Fn 0C9"

Table 3- 6 Names and Definitions of Output Signals

3.4.3 Types of Input and Output Ports' Signals

1）Structure of the Position Pulse/Direction Command Input Interface

The position pulse input interface is based on optocoupler isolation with a built-in Schmidt trigger, the interface levels between Pulse+ and Pulse-, and between Sign+ and Sign- are "standard TTL level", and are never allowed to exceed this level range; if necessary, the user should connect a current-limiting resistor by himself. The maximum allowable input pulse frequency: 500KHz in case of line drive, and 200KHz in case of open collector drive. In order to ensure correctness of position input, line drive is recommended. Under line drive mode, the pulse's effective pulse width (optocoupler's on-time) should be longer than 0.8us; under the open collector drive mode, the shorter the connecting wire the better (not longer than 1m), and effective pulse width should be bigger than 2us. Pulse/direction interface's structure is as shown in Figure 3-16:

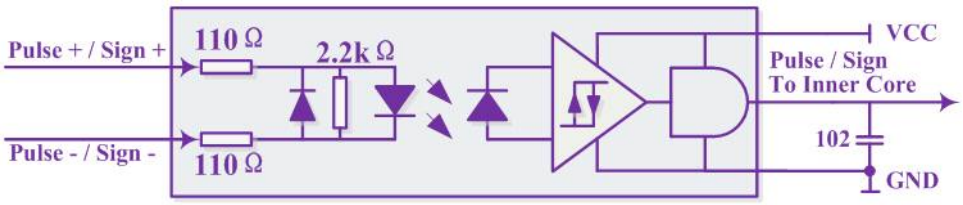


Figure 3-16 Structure of the Pulse Input Interface

2） Structure of User IO Interface

The signal input interface is based on optocoupler isolation with a common anode (common-anode connection is for standard models, and common-cathode connection is an alternative) and a 2.4 kΩ current-limiting built-in resistor connected in series; it can meet the needs of a signal interface with a voltage range of 12V~24V between COM+ and SignalIn1~8; it is never allowed to use signal levels out of the allowable range. Signal output is based on optocoupler isolation, and its maximum driving capacity is DC30V/DC50mA. Figure 3-17 shows the structure of the user IO interface.

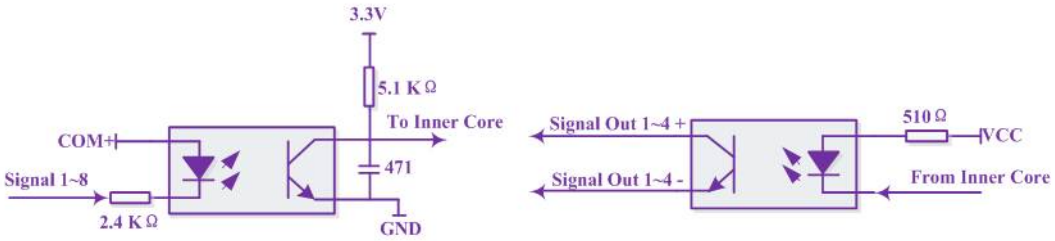


Figure 3-17 Structure of the IO Interface

Prohibited
Never connect a signal beyond the allowable voltage magnitude directly to the pulse input interface or user IO interface, or the interface will be damaged.

3.4.4 Connection of Input and Output Terminals

1） Wiring of the Analog Command Input Interface

When a LS series servo driver works under external analog speed mode or external analog torque mode, it's necessary to use an analog command input interface to receive the analog commands sent from the upper machine ('s rheostat or DAC). The allowable level range of the analog input interface is -10V~+10V. The user can adjust the gain, zero point and direction of analog input commands, and filter parameters through configuration parameters. For details of configuration, please refer to "5.5 Running under Speed Mode" and "5.6 Running under External Analog Torque Mode". Structure and wiring of analog command input interface are as shown in Figure 3-18:

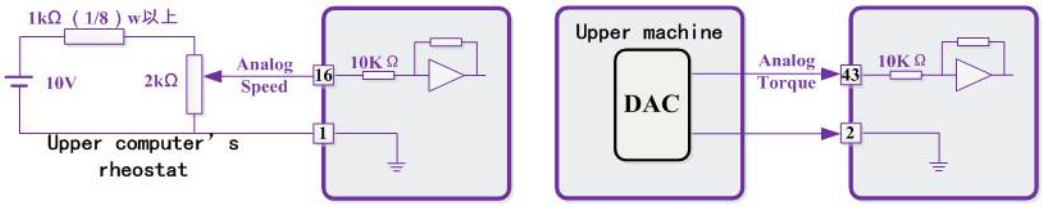


Figure 3-18 Structure of Analog Command Input Interface

Prohibited
Never connect a signal beyond the allowable voltage magnitude directly to the analog input interface, or the interface will be damaged.

2） Wiring of the DAC Output Interface

HS series servo drivers support 2 channels of DAC output that can be used for observing the internal status parameters, but it is recommended not to use them as feedback signals. The user can use configuration parameters to set signal sources and amplitude of the 2 DAC channels by referring to the detailed description in Table 3-7 below. The maximum output range of the 2 DAC channels is -10V~+10V. Structure of DAC output interface is shown in Figure 3-19:

Parameter No.	Parameter Description
Fn 0CA	Selection of DAC Channel 1's signal source: 0-127: status value of "Dn 00"~"Dn 7F"
Fn 0CB	Selection of DAC Channel 2's signal source: 0-127: status value of "Dn 00"~"Dn 7F"
Fn 0C8	Setting of DAC Channel 1's maximum value: corresponding Dn xx's value when DAC 1's output is +10V
Fn 0C9	Setting of DAC Channel 1's maximum value: corresponding Dn xx's value when DAC 2's output is +10V

Table 3- 7 Configuration Parameters of DAC Output Channels

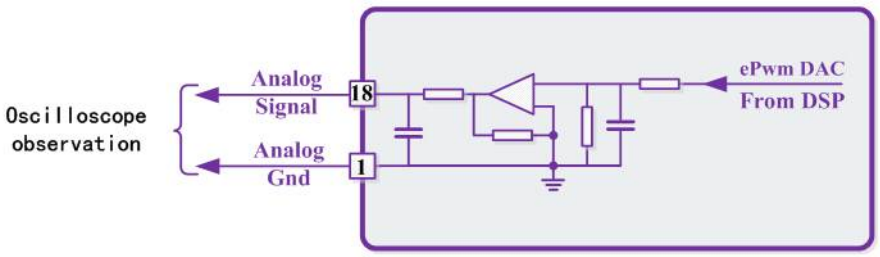
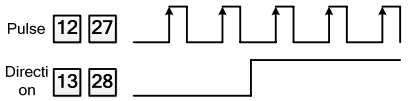
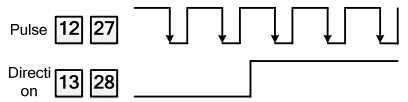
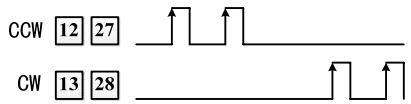
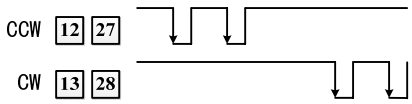
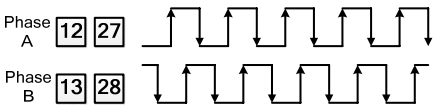


Figure 3-19 Structure of DAC Output Interface

3） Wiring of the Pulse Direction Command Interface

Based on the difference in the upper machine's form of output and output level, the HS-series servo drivers support 6 different pulse input modes as shown in Table 3-8 below. The user can, based on his actual needs, change parameter "Fn038"'s value to select an input mode.

Fn 038	Input Mode	Description	Waveform Description (An arrow means an effective position command)
1	Single-pulse positive logic	At the pulse end (12,27), the process from optocoupler's being off to on is interpreted as receiving a command, at the direction end (13, 28), the level controls direction of running	
2	Single-pulse negative logic	At the pulse end (12,27), the process from optocoupler's being on to off is interpreted as receiving a command, at the direction end (13, 28), the level controls direction of running	
3	Double-pulse positive logic	At the pulse end (12,27), the process from optocoupler's being off to on is interpreted as receiving a command for forward rotation, at the direction end (13, 28), the process from optocoupler's being off to on is interpreted as receiving a command for backward rotation	
4	Double-pulse negative logic	At the pulse end (12,27), the process from optocoupler's being on to off is interpreted as receiving a command for forward rotation, at the direction end (13,28), the process from optocoupler's being on to off is interpreted as receiving a command for backward rotation	
5	Orthogonal-pulse positive logic	The pulse end (12,27) is used as Phase-A orthogonal signal, the direction end (13,28) is used as Phase-B orthogonal signal, when Phase A is ahead of Phase B, the direction is interpreted as being forward	

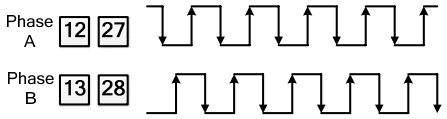
6	Orthogonal-pulse negative logic	The pulse end (12,27) is used as Phase-A orthogonal signal, the direction end (13,28) is used as Phase-B orthogonal signal, when Phase B is ahead of Phase A, the direction is interpreted as being forward	

Table 3-8 Description of Pulse Command Input Modes

Based on the difference in the upper machine's form of output and output level, and in order to inhibit noise and ensure reliable transmission of signals, we recommend the wiring pattern as shown in Figures 3-20 ~ 3-24 for HS-series servo drivers.

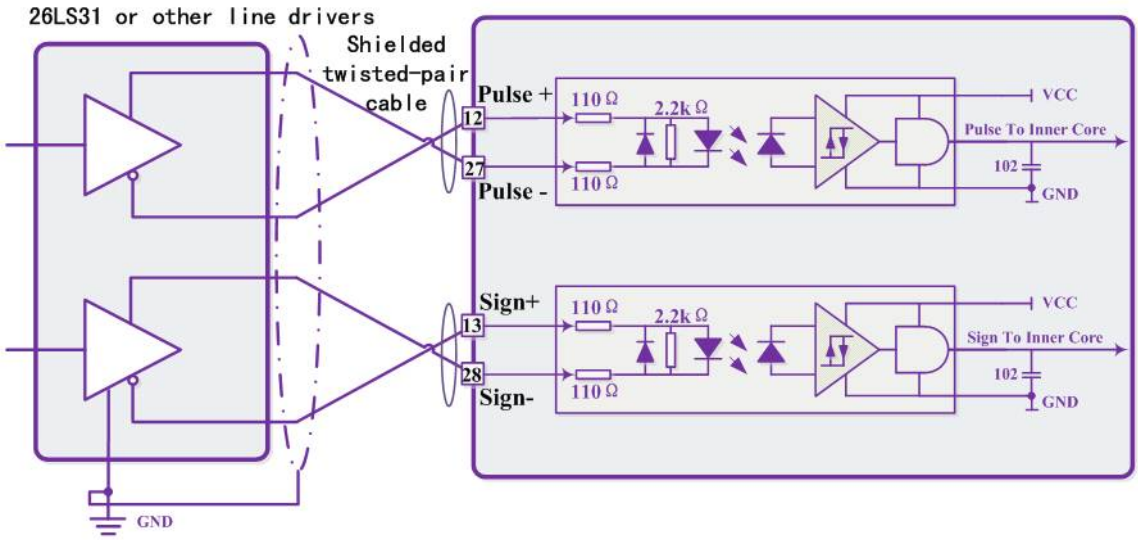


Figure 3-20 Diagram of Wiring between an Upper Machine Employing Line Drive Output and the Driver

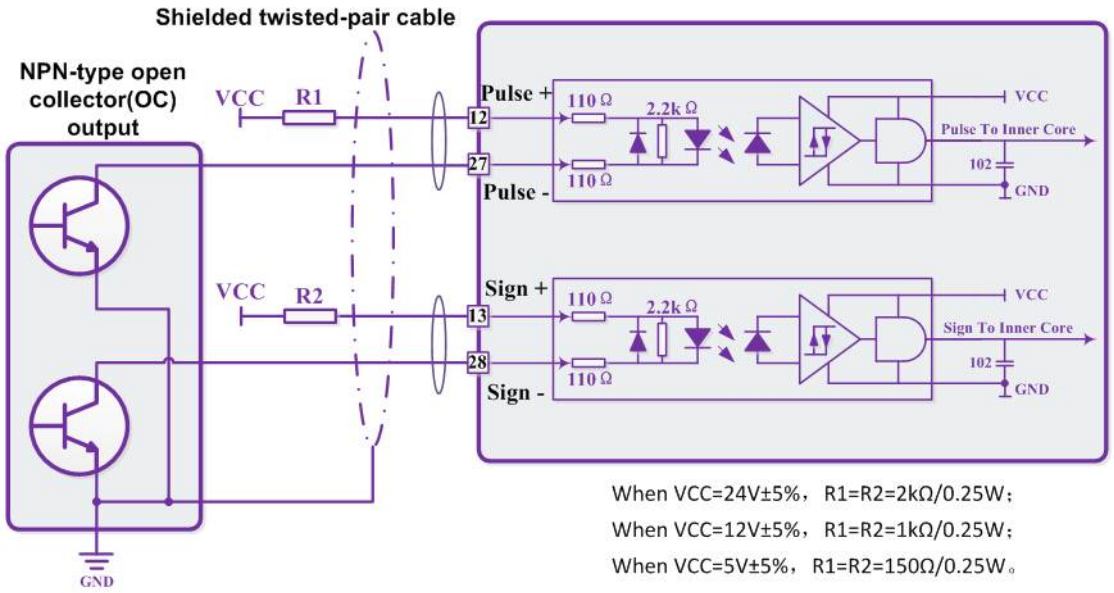


Figure 3-21 Diagram 1 of Wiring between an Upper Machine Employing NPN-type OC Output and the Driver

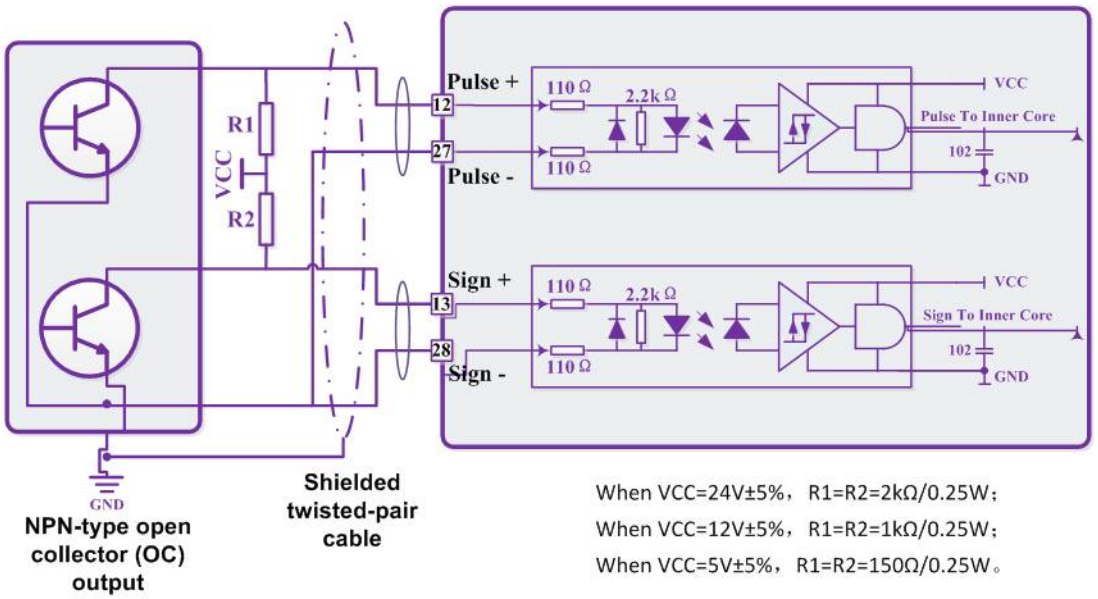


Figure 3-22 Diagram 2 of Wiring between an Upper Machine Employing NPN-type OC Output and the Driver

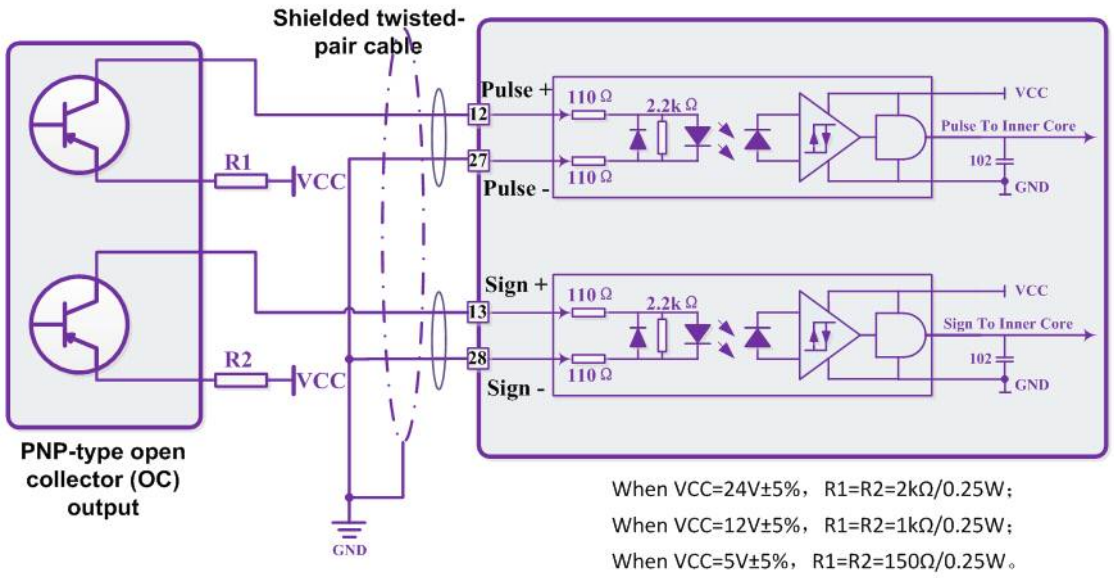


Figure 3-23 Diagram 1 of Wiring between an Upper Machine Employing PNP-type OC Output and the Driver

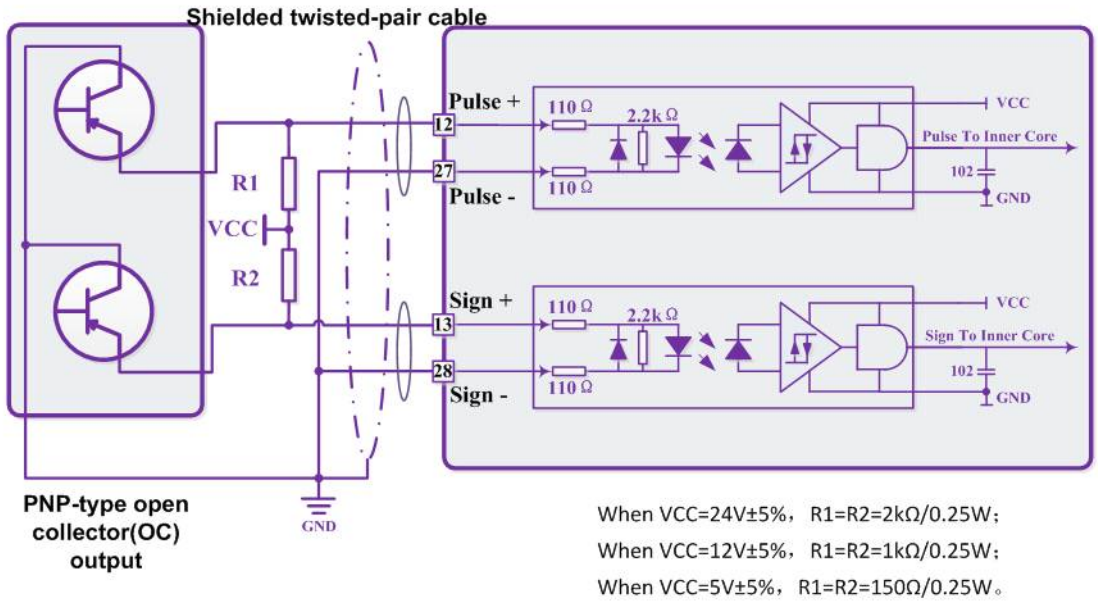


Figure 3-24 Diagram 2 of Wiring between an Upper Machine Employing PNP-type OC Output and the Driver

【Note】An HS-series servo driver's input interface level is standard TTL level, the current-limiting resistors in Figures 3-21 ~3-24 (R1=R2=R) must have appropriate ohm values, or the pulse/direction ports will be damaged. When VCC=24V±5%, R=2kΩ/0.25W; when VCC=12V±5%, R=1kΩ/0.25W; when VCC=5V±5%, R=150Ω/0.25W.

For a pulse input port, a shielded twisted-pair cable must be selected for use, and two ends of such a cable are connected respectively to the shielding layer's connecting terminal and standard earth.

4） Wiring of an Encoder's Differential Output Ports

An encoder's Phase-Z differential pulse output signal can be used as the upper machine's positioning counting signal; the user can use configuration parameter "Fn 03F" to stretch Phase Z's pulse output width and set Phase Z's output polarity. The encoder's Phase-A and Phase-B output frequency-dividing differential signals; their frequency divider is set by using configuration parameter "Fn 03E"; they can be used as upper machine's positioning counting and speed measuring signals. The system's wiring method should preferably suit the need of differential output signals, and the cable for differential output shall not be longer than 20m. Figure 3-25 is a diagram of wiring:

【Note】An encoder's output cable must be a shielded multi-strand twisted-pair cable, and each core's section area shall not be smaller than 0.2mm²; the cable's shielding layer is required to be reliably connected to its connecting terminal or standard earth.

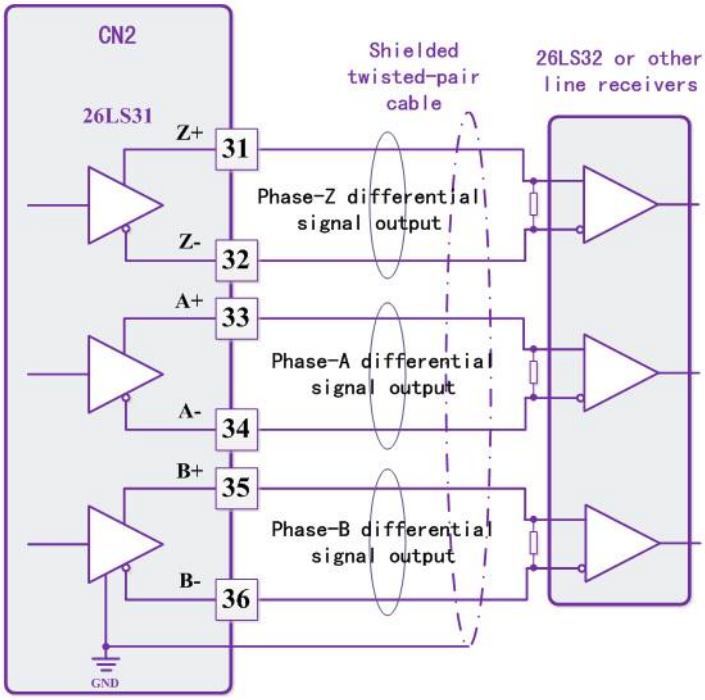


Figure 3-25 Diagram of Wiring for an Encoder's Differential Output

5） Wiring of Encoder's OC Output Ports

In addition to differential output ports, a channel of OC output ports are available for encoder's output signal A/B/Z. Form of Phase-Z's open collector is an OC gate with optoelectronic isolation, form of Phase A/B's open collector is an OC gate without isolation. Figures 3-26 and 3-27 are diagrams of wiring for OC output ports:

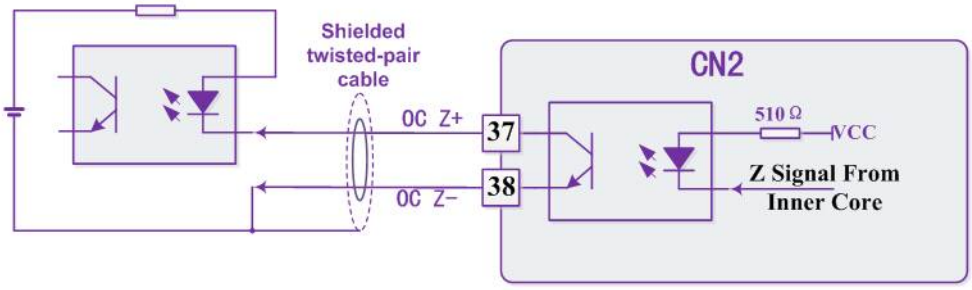


Figure 3-26 Diagram of Wiring for an Encoder's OCZ Signal

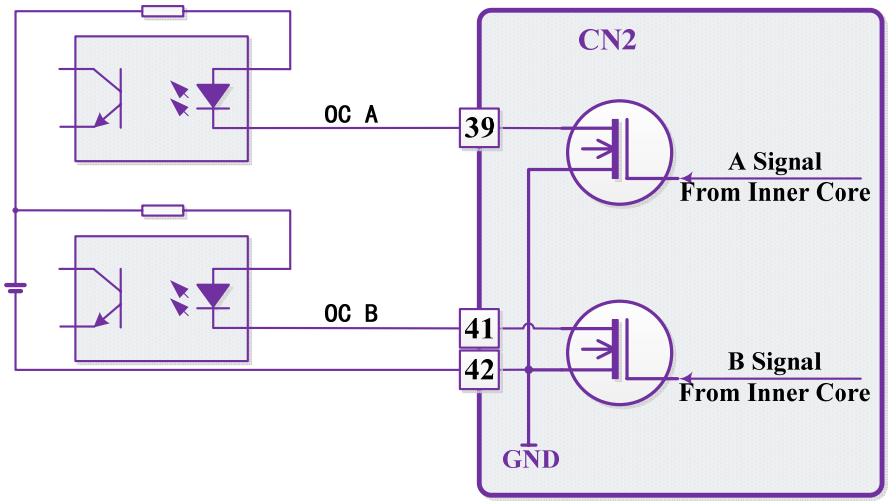


Figure 3-27 Diagram of Wiring for an Encoder's OCA/B Signals

Parameter No.	Parameter Description	Setting Range	Setting Unit	Ex-works Setting
Fn 03E	Divider for frequency-dividing output of encoder's pulse	1 ~ 128	—	1
Fn 03F	Output width of encoder's Pulse Z, when it is negative, it means reversion operation of Pulse Z's output polarity	-15 ~ +15	Quadruple of A/B orthogonal width	2

【Note】In case of OC output, each signal wire should be shorter than 1m, and to prevent

high-requency interference's influence, its route should be as far from power supply cables and motor cables as possible (300mm away at least).

3.5 Wiring of the Communication Interface

Positions and definitions of communication interface CN1's pins are as shown in Figure 3-28 and Table 3-9:

Figure 3-28 Positions of Pins of the Communication Interface CN1

Pin No.	**1 (Black)**	**2 (Brown)**	**3 (Red)**	**4 (Orange)**
Signal definition	CAN_L	RS232_TXD	shielding layer connecting terminal	RS485_B
Pin No.	**5 (Yellow)**	**6 (Green)**	**7 (Blue)**	**8 (Purple)**
Signal definition	GND	CAN_H	RS485_A	RS232_RXD

Table 3-9 Definition of the Communication Interface CN1's Signals

With the help of a CN1 communication interface, an HS-series servo driver can write and read the parameters through RS232/RS485 and CAN bus.

HS-series servo drivers are equipped with industrial-standard Modbus communication, and are capable of conveniently building a network of multiple drivers and controlling their communication with the upper machine. The Modbus is based on RS232 or RS485's hardware circuits. The user can shift between them by using configuration parameter "Fn 0F0". Plus, HS-series servo drivers' CAN bus configuration supports the communication protocols/methods with HollySys' independent intellectual property rights, and are applicable to industrial bus control.

Parameter No.	**Parameter Description**			
Fn 0F0	Modbus Communication Mode			
	0	RS232 (Ex-works setting)	1	RS485

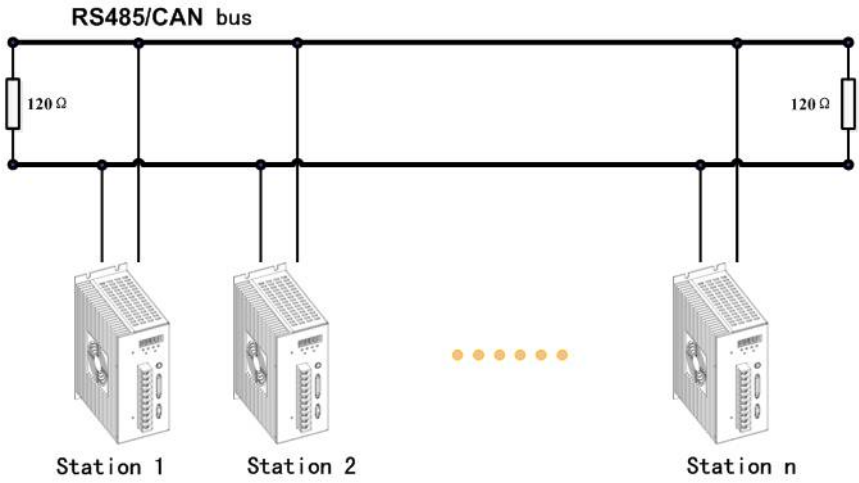


Figure 3-29 120Ω Balancing Resistors to be Connected by the User Himself

HS-series servo drivers' RS485 bus and CAN bus nodes don't provide system-level 120Ω balancing resistors, the users need to connect such resistors by themselves as shown in Figure 3-29 above when building their networks.

3.6 Wiring of Aviation Plugs Applicable to the Motors

3.6.1 Definition of Motor Windings and Allocation of Pins

Coloring rule of each HollySys Electric-made servo motor's winding wires is as such: U/V/W/PE respectively correspond to red/blue/yellow/green (yellow green); for information about windings' definition and allocation of pins, please consult the manufacturer.

3.6.2 Definition of an Encoder's Signals and Allocation of Pins

Manufacturer-provided default type of encoders installed in the servo motors for HS-series servo drivers is 2500-wire photoelectric incremental encoders. For information about signals of the aviation plugs connected to such encoders and definition of their pins, please consult the manufacturer.

Prohibited
Please never confuse connection of the encoder's power supply and ground, or the encoder will be burnt out.

3.6.3 Precautions for Wiring and Use of Motors Equipped with Brakes

1) Controlling voltage of the braking control coil of a servo motor's electromagnetic brake is 24VDC, and its current is got by 24V/R, which should be 500mA ~ 2A. R is resistance value of the electromagnetic brake's control coil, and can be measured with a

multimeter.

2) A servo motor with a built-in electromagnetic brake is allowed to run only after the electromagnetic brake is released; never forcibly run the motor before releasing the electromagnetic brake.

3) The user can control on-off action of the electromagnetic brake by himself according to his needs, or configure any one of the 4 signal output ports as the signal Electromagnetic Brake Release (BRK-OFF) , and use external circuits and configuration parameters “Fn 0C0” ~ “Fn 0C4” to control on-off action of the electromagnetic brake. For detailed configuration, please refer to “5.11.3 Electromagnetic Braking”.

Attention
Optocoupler isolation is used for user’s output signals; the optocoupler allows only a limited amount of current to pass, and cannot be used to directly control energization and deenergization of the electromagnetic brake’s control coil, which must be achieved through an external relay and a DC power supplier.

3.7 Diagram of Typical Wiring

3.7.1 Diagram of Position-mode Wiring

Wiring under the position mode is as shown in Figure 3-20 below.

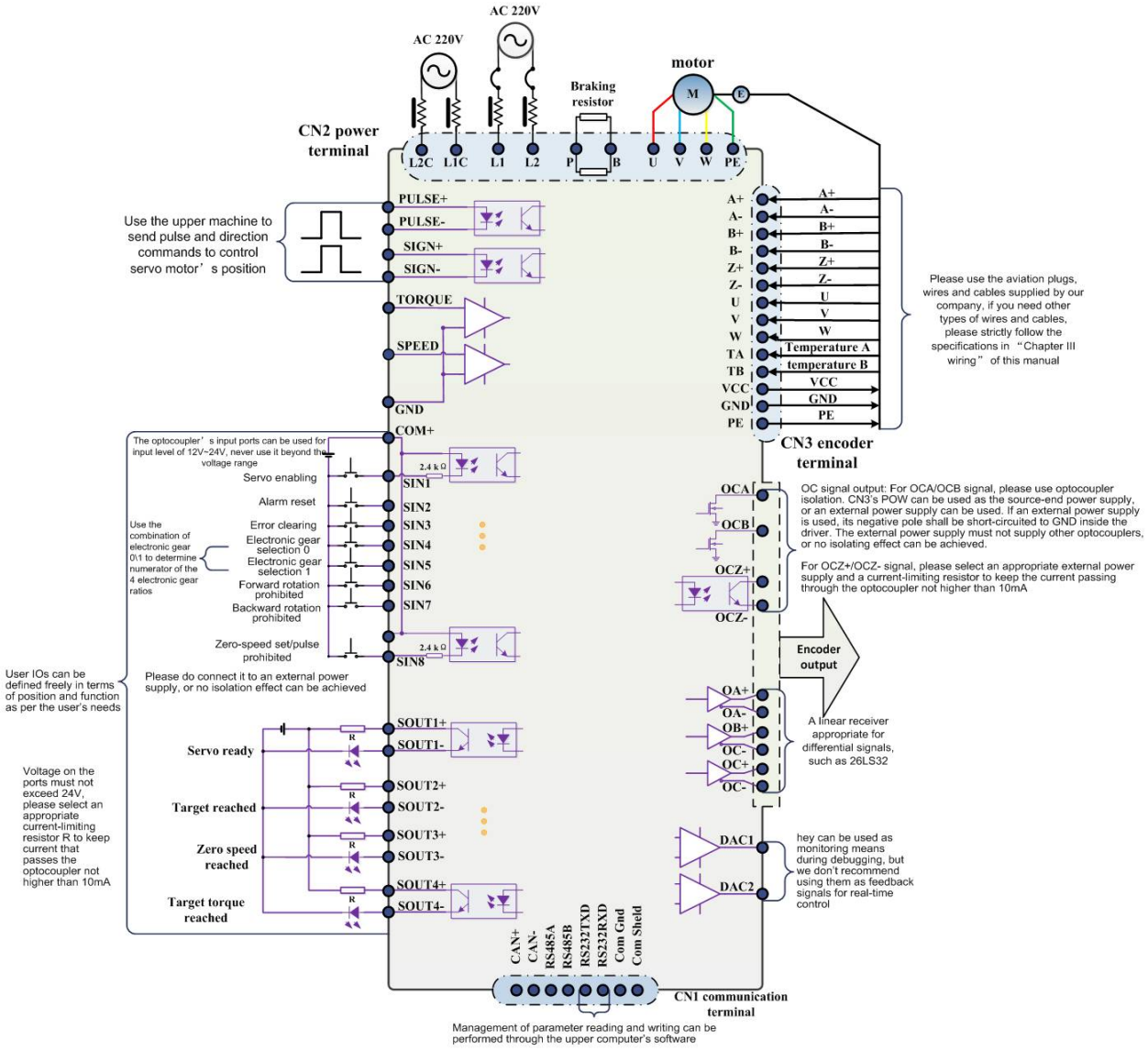


Figure 3-30 Diagram of Wiring under Position Mode

3.7.2 Diagram of Wiring under External Analog Speed Mode

Figure 3-22 is the diagram of wiring under external analog speed mode.

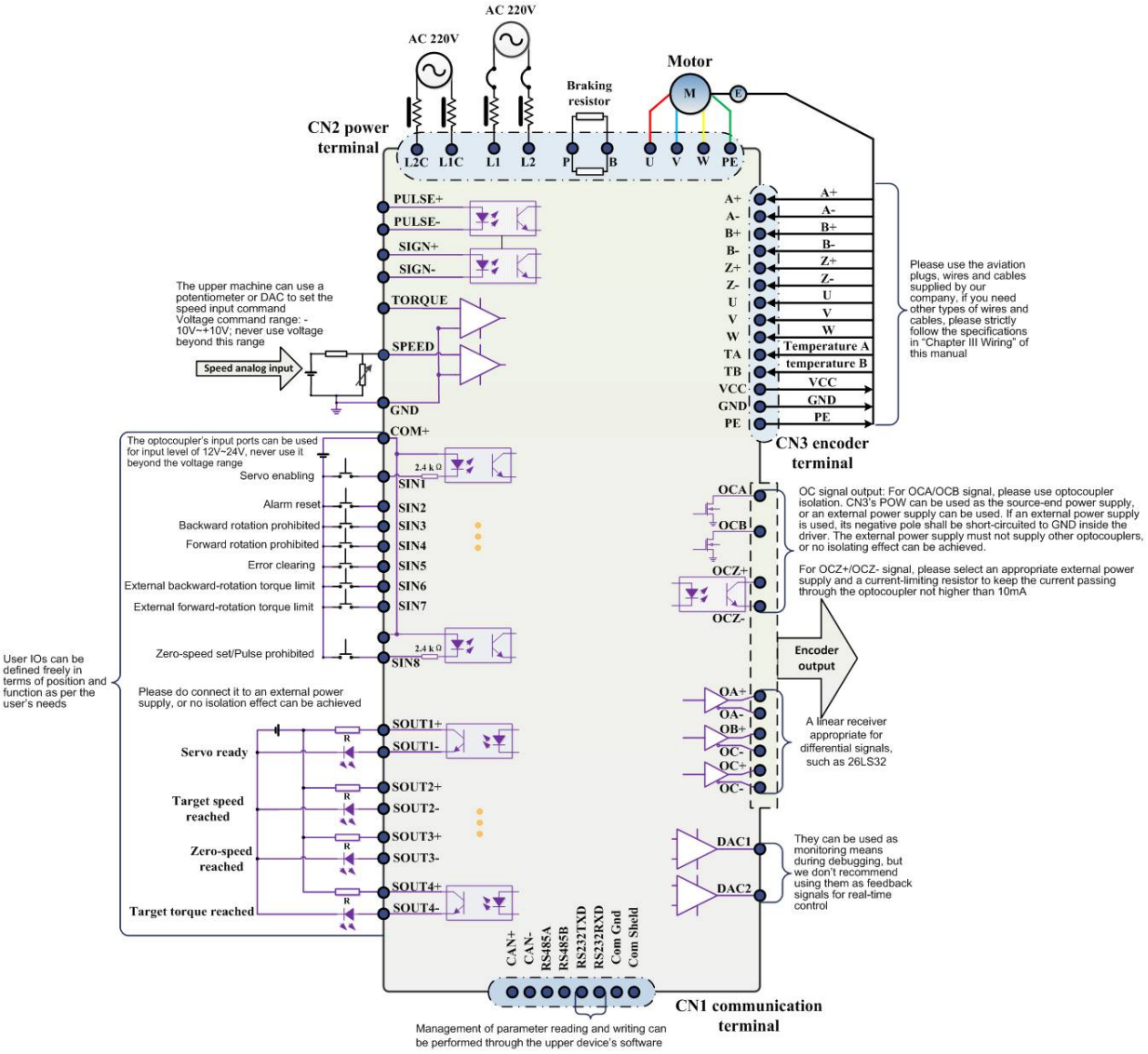


Figure 3-31 Diagram of Wiring under External Analog Speed Mode

3.7.3 Diagram of Wiring under Internal Speed Mode

Figure 3-32 is the diagram of wiring under internal speed mode.

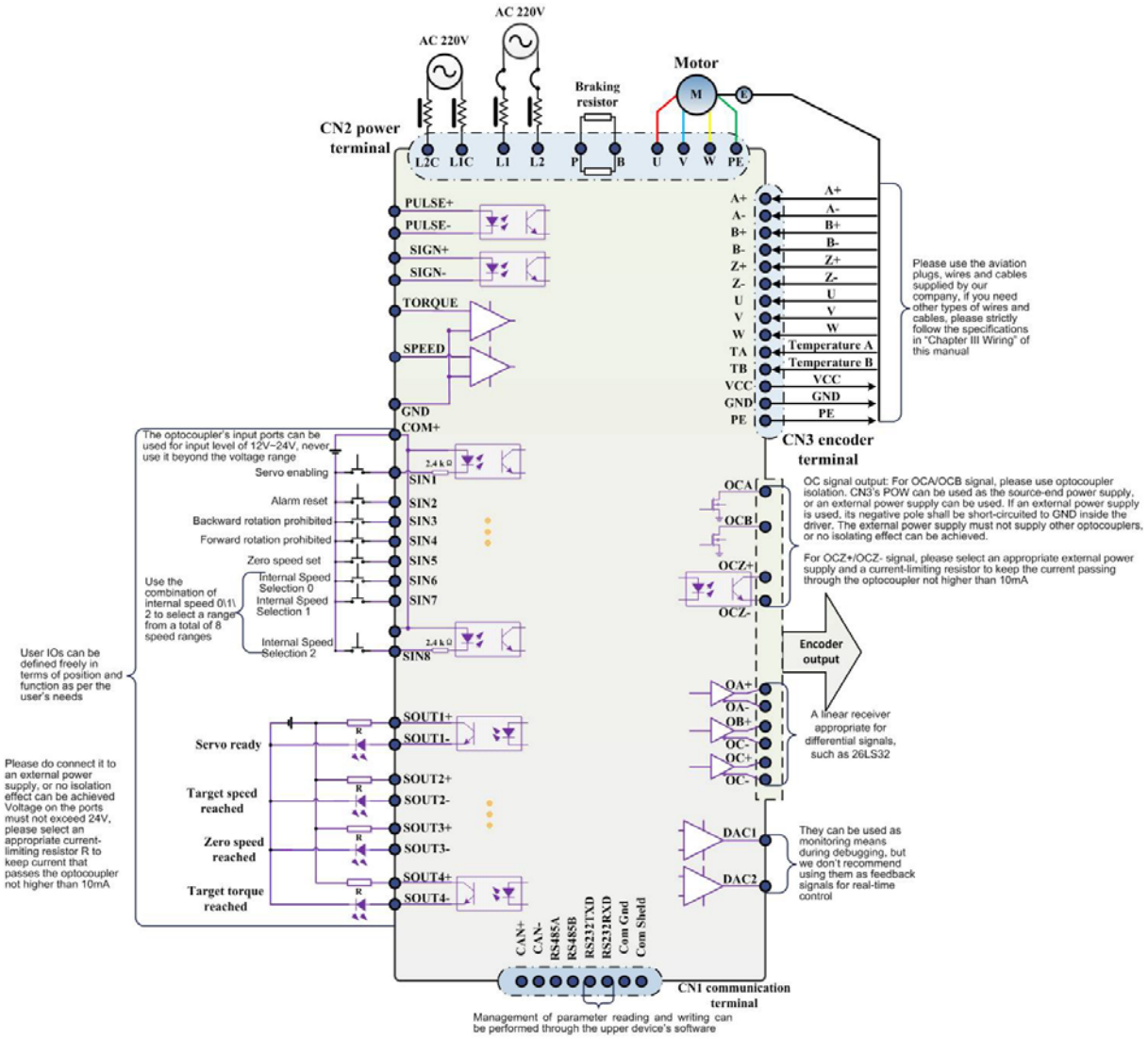


Figure 3-32 Diagram of Wiring under Internal Speed Mode

3.7.4 Diagram of Wiring under External Analog Torque Mode

Figure 3-33 is the diagram of wiring under external analog torque mode.

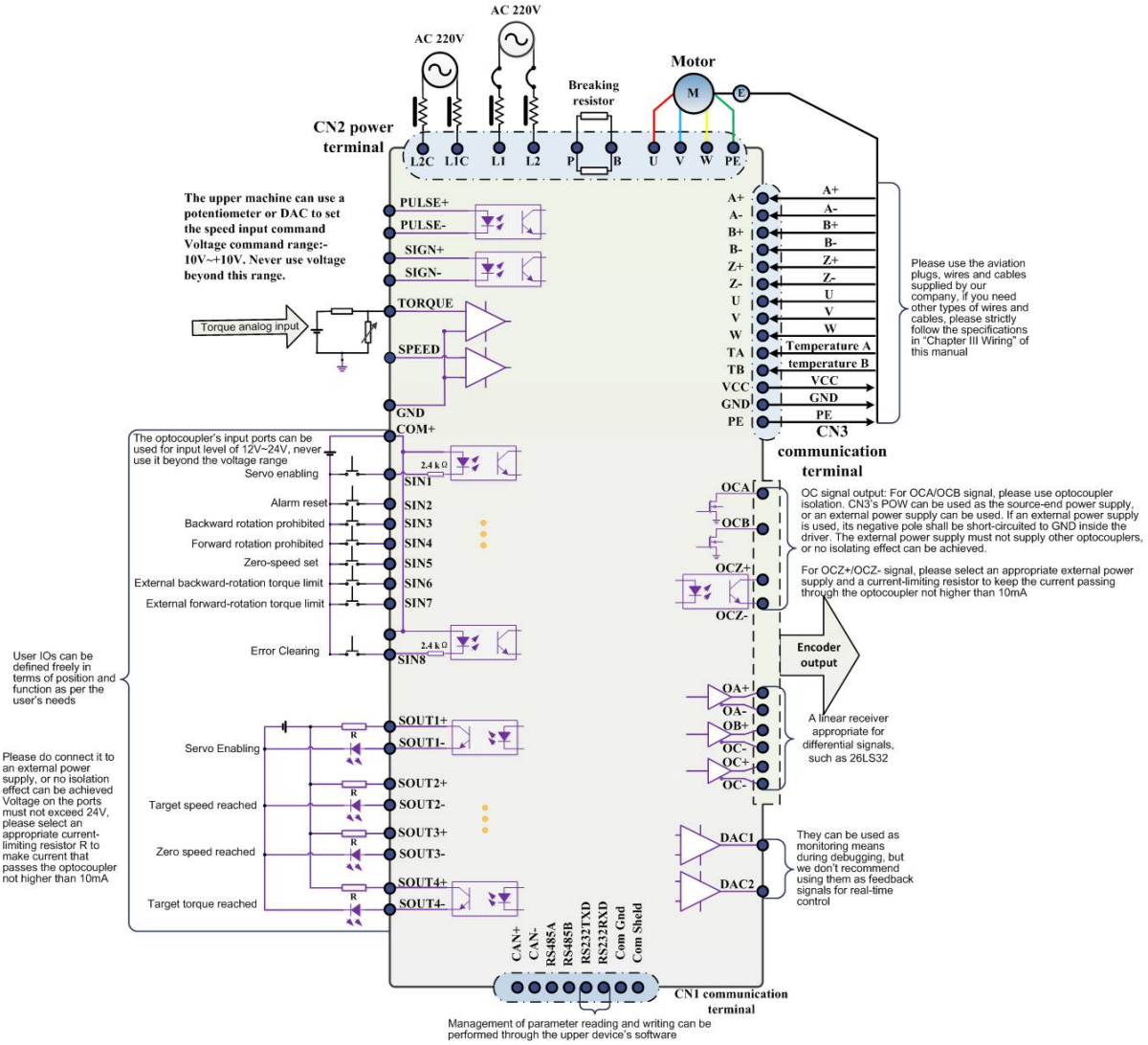


Figure 3-33 Diagram of Wiring under External Analog Torque Mode

3.7.5 Diagram of Wiring under Bus Mode

Figure 3-34 is the diagram of wiring under bus mode.

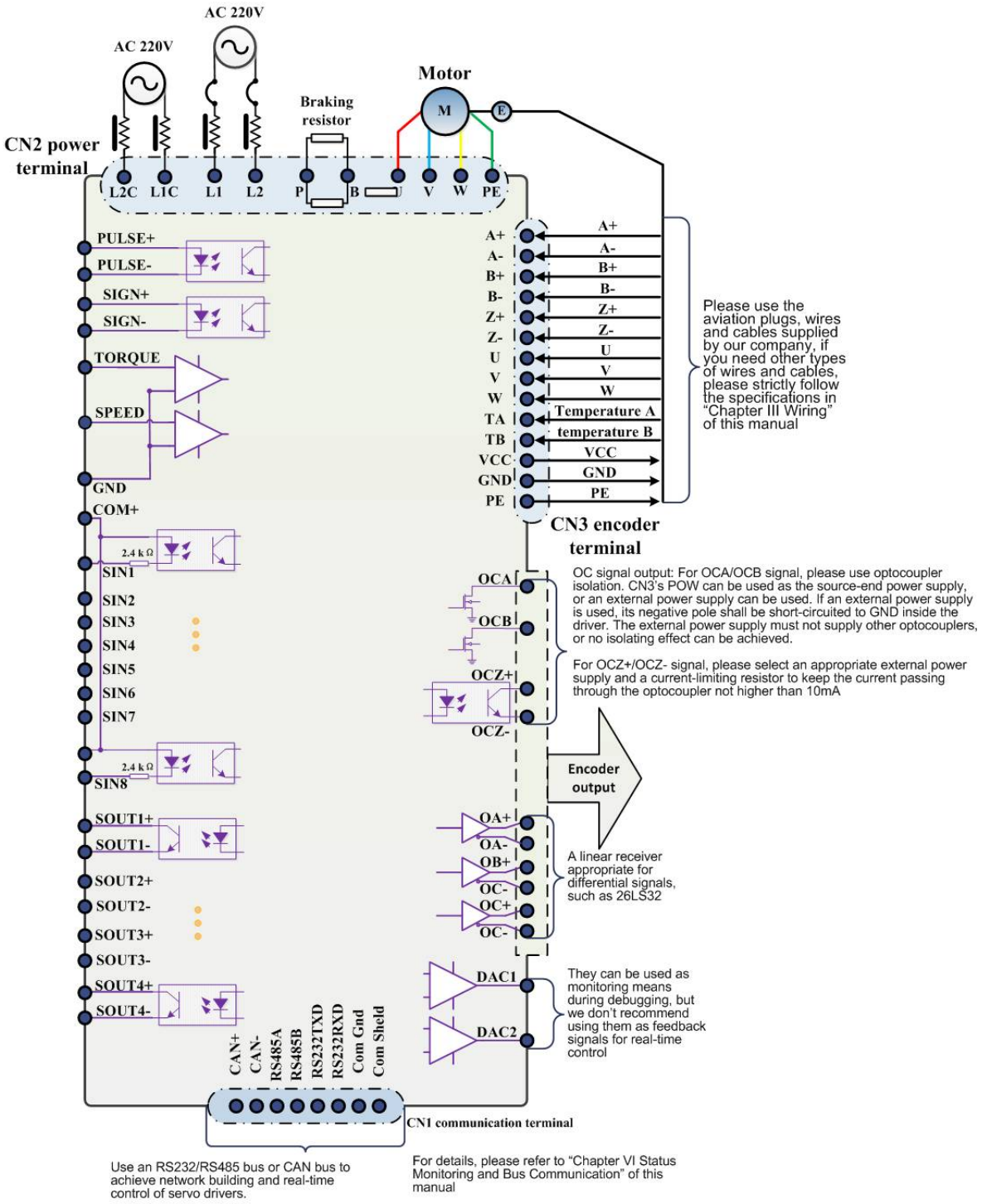
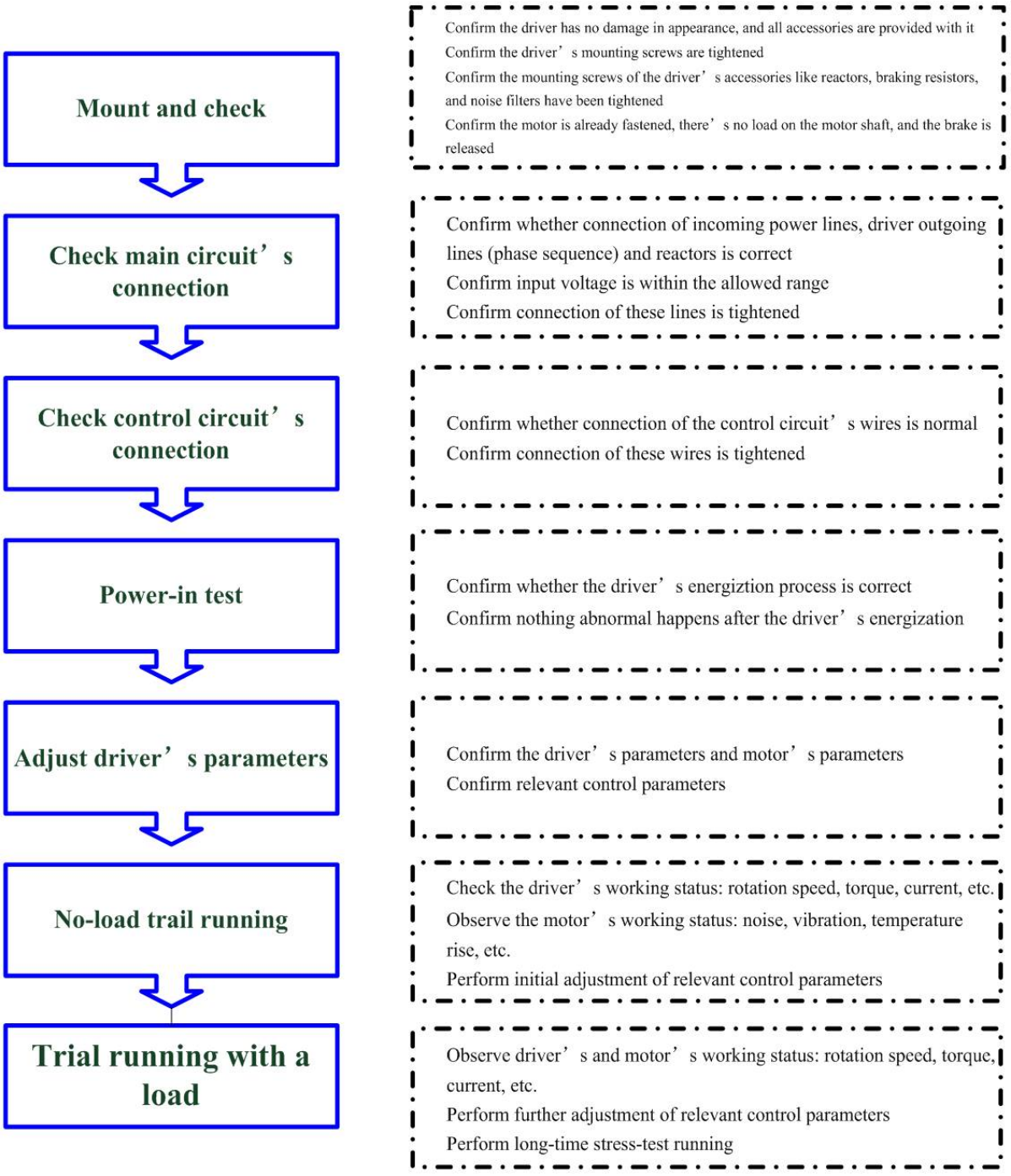


Figure 3-34 Diagram of Wiring under Communication Mode

Chapter IV Trial Running

4.1 Basic Procedure of Trial Running

When a driver is energized and begins trial running for the first time, the following procedure must be followed, or accidents are very likely to happen, which would damage the driver and motor, or cause other kinds of danger.



4.2 Confirm Connection of Wires of Main Circuit

For connection of main circuit's wires, please confirm the following requirements are met:

1） Driver's L1 and L2 terminals are connected to a power-frequency 220V (50Hz/60Hz) single-phase power supply with an allowed range voltage fluctuation of -15% ~ +10%;

2） If an external braking resistor is needed, it should be connected between P and B;

3） When connecting the driver's output terminals to the motor, their phase sequence must be identical, or the motor cannot work normally, and there will be possibility of burning out the driver and motor. Two ends of the grounding wire shall be respectively connected to the motor's case and driver's case, and then connected to the electrical cabinet's grounding wire.

4） When an output wire is equipped with a magnetic filter, the filter should be as near to the side of driver as possible, the grounding wire must not go through the ring-shape magnetic filter, and the magnetic filter must not touch U/V/W terminal;

5） Driver and motor must be reliably grounded;

6） Driver output cables of different power levels are different in allowed peak current. For details of how to select cables, please refer to 3.1 Selection of Peripheral Devices and Connection with Them;

7） Confirm all connections are tightened.

4.3 Confirm Connection of Wires of Control Circuit

For connection of control circuit's wires, please confirm the following items:

1) Driver's L1C and L2C terminals are connected to a power-frequency 220V (50Hz/60Hz) single-phase power supply with an allowed range voltage fluctuation of -15% ~ +10%;

2) For better electromagnetic compatibility, control power supply terminals L1C and L2C should preferably be insulated from working power supply terminals L1 and L2

3) DC voltage between user digital input signals and their common port COM+ is +12V ~ +24V, it is never allowed to exceed this range, otherwise the signals will be ineffective or the driver will be damaged;

4) Maximum driving capacity of the user digital output signals is 30V/50mA; it is never allowed to exceed this range, or the driver's digital output ports will be damaged;

5) The encoder's cable is recommended to be a shielded twisted-pair cable, and shielding layer's two ends should be connected to CN3's "shielding layer connecting

terminal". The cable should be as short as possible, for selection of cable models, please refer to 3.1 Selection of Peripheral Devices and Connection with Them;

6) The communication cable is recommended to be a shielded twisted-pair cable, and shielding layer's two ends should be connected to CN1's "shielding layer connecting terminal". The cable should be as short as possible, for selection of cable models, please refer to 3.1 Selection of Peripheral Devices and Connection with Them;

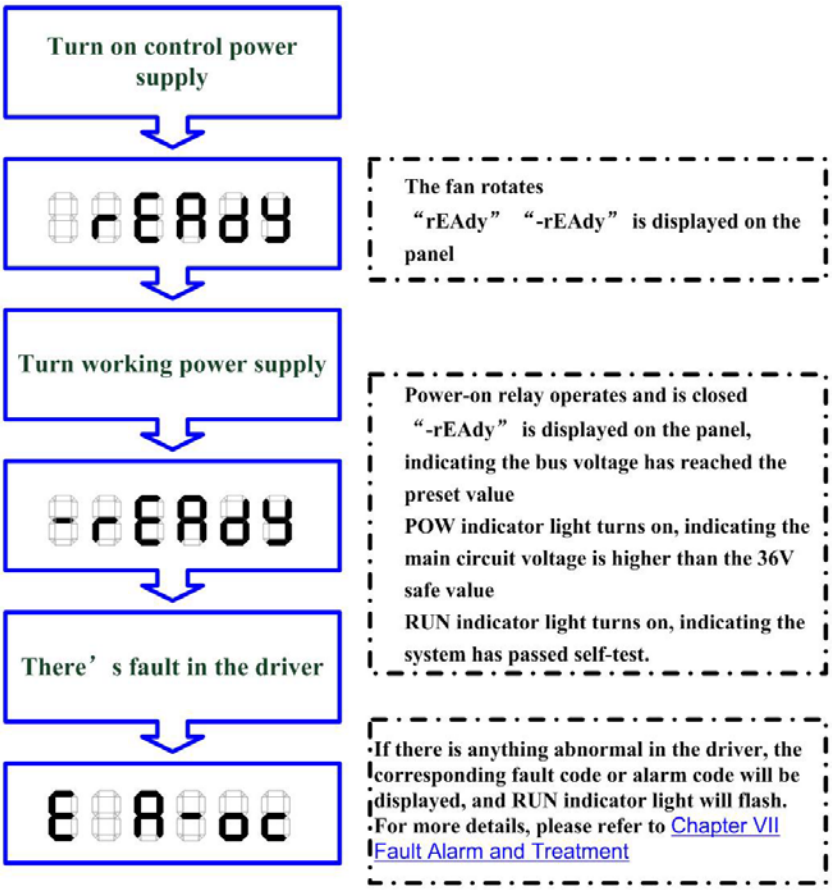
7) All input and output ports must work with the matching plugs provided by our company, or the driver is likely to be damaged;

8) Confirm all the wire connections and plugs are tightened and firm.

4.4 Driver's First-time Energization

Due to vibration or other reasons, the driver's internal parts and components may be damaged during transport and mounting; when a driver is energized for the first time, its process of energization should be observed carefully, any problems found should be treated in a timely manner.

The driver's energization process and items to be observed:



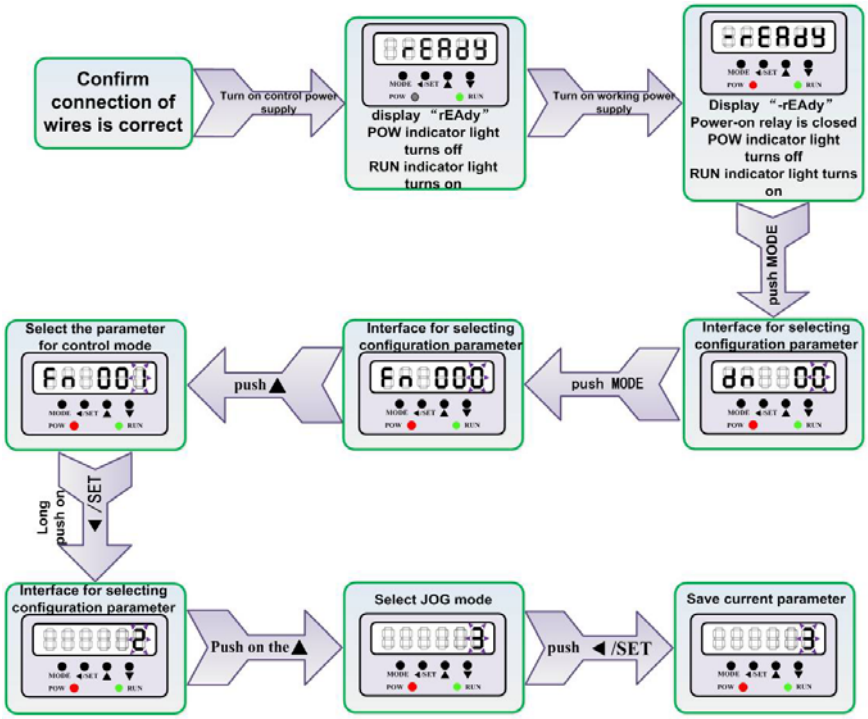
4.5 Confirm Motor and Configuration Parameters

Each HS-series servo driver already has appropriate motor parameter setting as per the motor to work with it before it goes out of the factory, and most of the set parameters need not be changed. When change to any parameter is needed, please refer to "Annex—Configuration Parameters of HS-series Servo Drivers"; for more details, please consult the manufacturer.

4.6 No-load Trial Running under JOG Mode

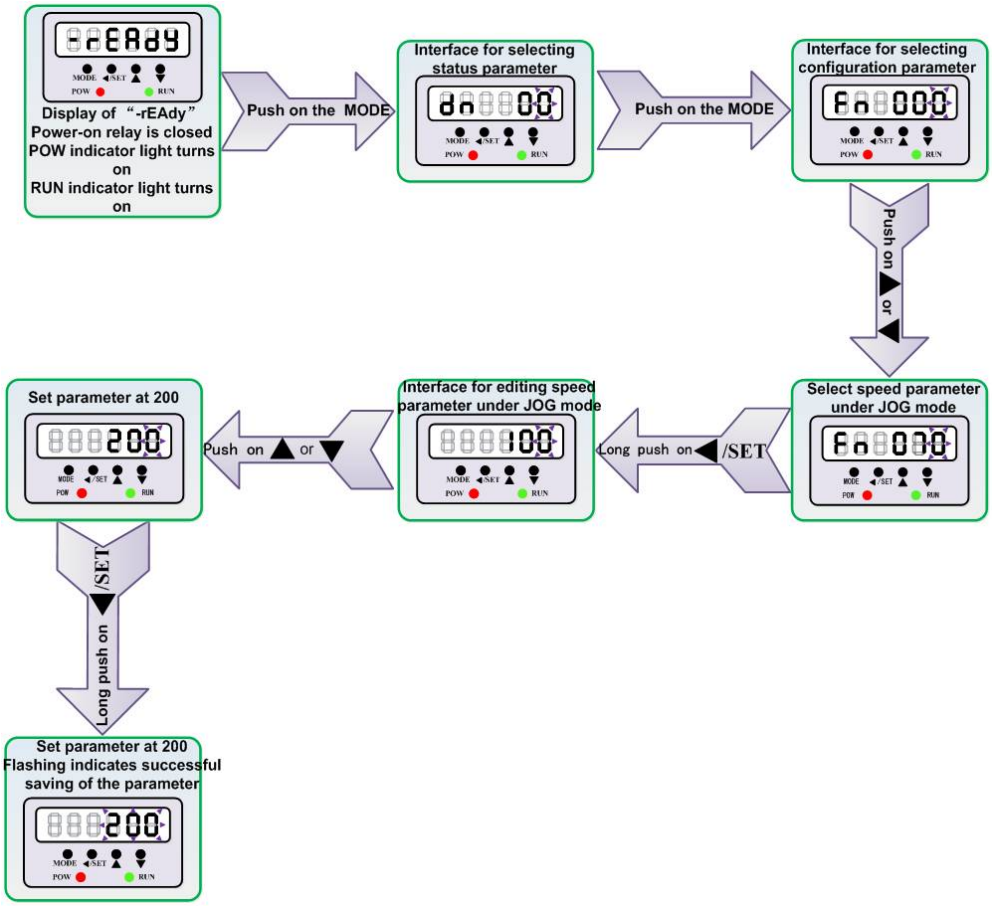
Through running under the JOG mode, the user can check whether connections of motor windings and encoder's feedback cable are correct, and confirm whether the motor is working normally. Please refer to the following steps of operation.

1) Set the driver's running mode as JOG Trial Running Mode; corresponding parameter configuration is "Fn 001"= 3":

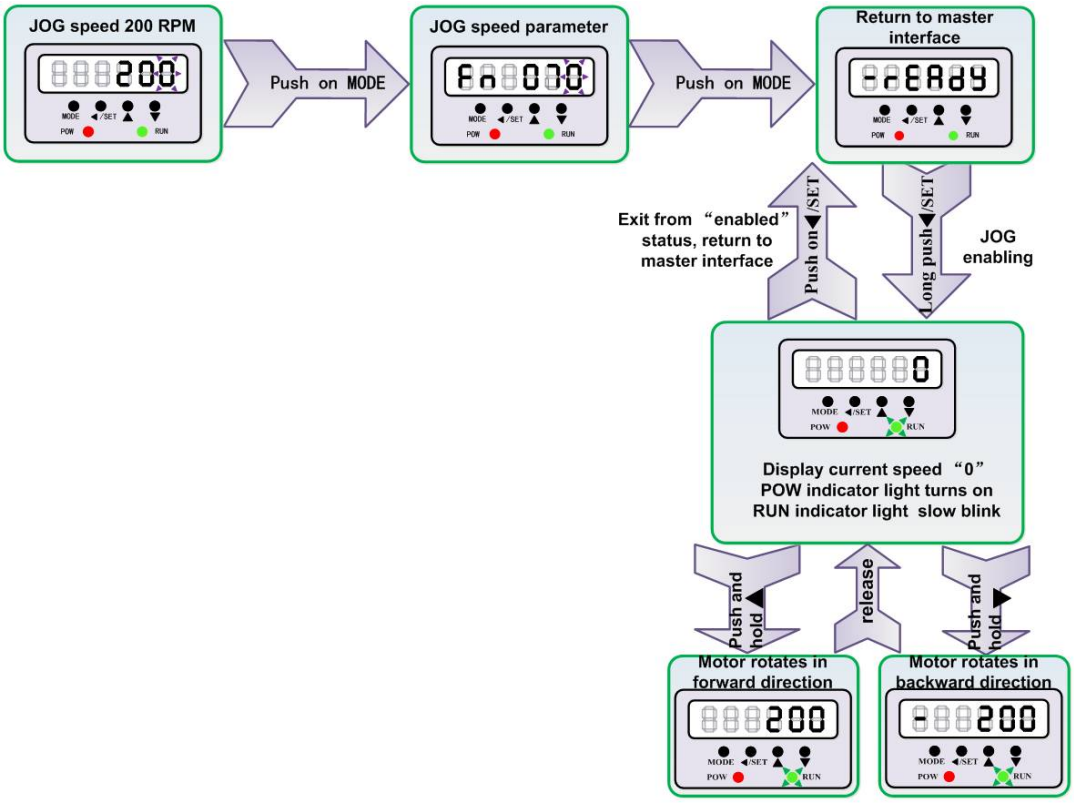


Turn on the power supply after confirming connection is correct, if no alarm of fault (FAULT) or warning (WARN) happens, "-rEAdy" is displayed on the panel, and power-on relay is closed. When RUN indicator light turns on, it indicates the system has passed self-test, and POW indicator light also turns on to indicate the DC bus voltage has exceeded the 36V DC safe voltage value. Set the driver in the JOG mode, which means setting "Fn 001"= 3, then make a long push on ◄/SET key until the value flashes, which indicates setting of the parameter is successfully saved.

2) After power is on again, set the motor's running speed under JOG mode: set "Fn 070" = 200 RPM (the user may set it differently as per his needs; don't set an overly high speed value for the first-time running, so as to avoid danger)



3) Use the push keys on the operation panel to make the motor run at ±200 RPM in an inching manner



After returning to the master interface, make a long push on the "◄/SET" key, "Servo Enabling" (SON) will be effective; the motor at this moment is in the status of zero speed and locked shaft, the operation panel shows current speed is "0". Push ▲ or ▼key, the motor will rotate in the forward or backward direction at the set speed. If the driver or motor is abnormal, strange screeches, vibration, unstable running and other abnormal phenomena will occur, and the operation panel will show corresponding fault (FAULT) or warning (WARN) code. By pushing on "◄/SET" key the user can return to the master interface, and "Servo Enabling" (SON) at this moment will become ineffective.

Observe the following phenomena:

1) Is the driver's fan rotating stably?

2) Is the motor running stably?

3) Is there any abnormal noise when the motor is running?

4) Is the motor's surface temperature rise normal?

5) Is the reactor obviously heated?

6) Is the external braking resistor obviously heated?

After it is confirmed that nothing abnormal happens, the user may increase the rotation speed gradually, and repeat the steps above.

4.7 Trial Running with a Load

When performing the driver's trial running with a load, take care to observe the following:

1) Increase the load step by step, once overloading is found, immediately turn off the driver and eliminate the fault's reasons;

2) During the process of load increase, continuously monitor the driver's feedback speed, output current, output torque, abnormal noise and temperature rise; once anything abnormal is found, immediately turn off the driver;

3) When adjusting the motor's parameters, exit from the "enabled" status first, then change the parameter values after the motor has stopped; and the motor's speed and load should be lowered appropriately to avoid accidents, the magnitude of parameter adjustment should not be too big;

4) Don't make overload or destructive tests, so as to avoid damage to the driver and motor and to avoid danger as well.

Chapter V Running

5.1 Select the Control Mode

HS-series servo drivers support the hard-wired control port work mode, Modbus communication control mode, and CAN communication control mode. The user can select a working mode through configuring the parameter “Fn 000”.

Parameter No.	Parameter Description	Setting Range of Parameter	Ex-works Setting
Fn 000	Selection of application work mode: 1: ordinary hard-wired control port work mode; 2: Modbus bus mode; 3: CAN bus mode	0~3	1

Ordinary hard-wired control port work mode has 10 different control modes (configuration parameter: “Fn 001”) as shown in Table 5-1 below. The user can select one from them to control working of the servo motor according to his needs.

<table>
<tr><th>Fn 001</th><th colspan="2">Control Mode</th></tr>
<tr><td>0: External analog speed mode</td><td colspan="2">It uses analog voltage commands to control the servo motor’s speed, please use it if you
✧ want to control the motor’s speed
✧ use the frequency-dividing output feedback signal from the servo driver’s encoder and configure the position loop at the command controller to perform position control</td></tr>
<tr><td>1: Internal speed mode</td><td colspan="2">By using different combinations of output interface CN2’s INSPD0/1/2 signals, the user can select a speed value already set in the configuration parameters “Fn 071”～“Fn 078”</td></tr>
<tr><td>2: External pulse position mode</td><td colspan="2">When you need to perform positioning operation, please use
✧ pulse train position commands to control the servo motor’s position
✧ number of input pulses to control position, and use frequency of input pulse to control speed</td></tr>
<tr><td>3: JOG mode</td><td colspan="2">It is used for the driver’s first-time energization and trial running, for more details, please refer to “Chapter IV Trial Running”</td></tr>
<tr><td>4: External analog torque mode</td><td colspan="2">It uses analog voltage torque commands to control the servo motor’s output torque, please use it when you need to output pushing or pulling force via control of the torque.</td></tr>
<tr><td rowspan="2">5-10: Mixed control mode</td><td>Control Mode Shifting (CMODE): OFF</td><td>Control Mode Shifting (CMODE): ON</td></tr>
<tr><td>No. 1 Mode</td><td>No. 2 Mode</td></tr>
<tr><td>5</td><td>External pulse position mode</td><td>External analog speed mode</td></tr>
<tr><td>6</td><td>External pulse position mode</td><td>Internal speed mode</td></tr>
<tr><td>7</td><td>External pulse position mode</td><td>External analog torque mode</td></tr>
<tr><td>8</td><td>Internal speed mode</td><td>External analog speed mode</td></tr>
<tr><td>9</td><td>Internal speed mode</td><td>External analog torque mode</td></tr>
<tr><td>10</td><td>External analog speed mode</td><td>External analog torque mode</td></tr>
</table>

Table 5- 1 Control Modes of HS-series Servo Drivers

When mixed control mode is selected (by configuring parameter Fn 001), in some circumstances, the user can shift between servo motor's work modes in a dynamic way via status of the input signal Control Mode Shifting (CMODE); when Control Mode Shifting (CMODE) is ineffective (OFF), No. 1 mode is selected, when CMODE is effective (ON), No. 2 mode is selected:

Parameter No.	Parameter Description	Setting Range of Parameter	Ex-works Setting
Fn 01A	Control Mode Shifting (CMODE) configuration 1: Internally enabled at all times; 0: internally disabled -1 ~ -8: to be determined by digital input signal ports (SignalIn 1~8)	-8~1	0

5.2 User IO Signal Configuration

An HS-series servo driver supports 8 channels of input and 4 channels of output; these 12 IO channels can be flexibly allocated based on the user's needs.

5.2.1 Allocate User Input Signal Ports (SignalIn 1~8)

For every input signal that concerns the user, there is a corresponding configuration parameter "Fn **xxx**" as shown in Table 5-2. By configuring parameter "Fn **xxx**", the user can select between control by input signal ports (SignalIn 1~8) and forcible internal execution.

Parameter No.	Parameter Description	Setting Range	Ex-works Setting	Parameter No.	Parameter Description	Setting Range	Ex-works Setting
Fn 010	Servo Enabling（SON）	- 8～+1	-1	Fn 018	External Backward-rotation Torque Limit（TCW）	- 8～+1	0
Fn 011	Alarm Reset（ARST）	- 8～+1	-2	Fn 019	Gain Shifting（GAIN）	- 8～+2	0
Fn 012	Emergency Stop（EMG）	- 8～+1	1	Fn 01A	Control Mode Shifting（CMODE）	- 8～+1	0
Fn 013	Reserved	- 8～+1	—	Fn 01B	Zero-speed Set/Pulse Prohibited（ZSPD/INH）	- 8～+1	-8
Fn 014	Internal Speed 0（INSPD0） Electronic Gear 0	- 8～+1	-4	Fn 01C	Error Clearing（CLR）	- 8～+1	-3

	（GEAR0）						
Fn 015	Internal Speed 1 （INSPD1） （GEAR1）	- 8～+1	-5	Fn 01D	Command Reversion （COM-INV）	- 8～+1	0
Fn 016	Internal Speed 2 （INSPD2）	- 8～+1	0	Fn 01E	Forward Rotation Prohibited （CCWL）	- 8～+1	-6
Fn 017	External Forward-rotation Torque Limit （TCCW）	- 8～+1	0	Fn 01F	Backward Rotation Prohibited （CWL）	- 8～+1	-7

Table 5-2 Index of Input Signal Configuration Parameters

【Example】The configuration parameter corresponding to input signal “Servo Enabling” (SON) is “Fn 010”. When “Fn 010”=1, “Servo Enabling” (SON) signal is always effective; when “Fn 010” = 0, “Servo Enabling” (SON) signal is ineffective; when “Fn 010” = one value from -1~-8, “Servo Enabling” (SON) signal is controlled by one in the input signal ports of SignalIn 1~8, and the default value is -1, in other words, the input signal port (SignalIn1) determines whether “Servo Enabling” (SON) signal is effective. When SignalIn 1 turns input optocoupler on, “Servo Enabling” (SON) signal is effective; when SignalIn 1 turns optocoupler off, “Servo Enabling” (SON) signal is ineffective. Details of wire connection is described in “3.4 Connection of Controlling Input and Output Ports”. If input signals’ logic needs to be changed, the user can achieve it by changing values of configuration parameters “Fn 00E” and “Fn 00F”as shown in Table 5-3 below.

Parameter No.	Parameter Description	Setting Range	Ex-works Setting
Fn 00E	Bit 1 of digital input exclusive OR or reversion operation controlling bits (input signal ports SignalIn 1~4) Thousands digit: to be input through SignalIn 4 Hundreds digit: to be input through SignalIn 3 Tens digit: to be input through SignalIn 2 Ones digit: to be input through SignalIn1	0000~1111	0000
Fn 00F	Bit 2 of digital input exclusive OR or reversion operation controlling bits (input signal ports SignalIn 5~8) Thousands digit: to be input through SignalIn 8 Hundreds digit: to be input through SignalIn 7 Tens digit: to be input through SignalIn 6 Ones digit: to be input through SignalIn5		
【Example】when Fn 00E =0011 and Fn 00F=0000, SignalIn 1’s and SignalIn 2’s input signals are reversed, and input signals of SignalI 3~8 remain unchanged			

Table 5- 3 Digits for Control of Input Signals’ Reversion

When an HS-series servo driver goes out of the factory, default allocation of input signal ports (SignalIn 1~8) is as shown in Table 5-4 below:

Input Signal Port	Meaning of Input Signal		Input Signal Port	Meaning of Input Signal	
SignalIn 1	SON	Servo Enabling	SignalIn 5	INSEL1	Internal Selection 1
				INSPD1 /GEAR1	
SignalIn 2	ARST	Alarm Reset	SignalIn 6	CCWL	Forward Rotation Prohibited
SignalIn 3	CLR	Error Clearing	SignalIn 7	CWL	Backward Rotation Prohibited
SignalIn 4	INSEL0	Internal Selection 0	SignalIn 8	Zero-speed Set/Pulse Prohibited	
	INSPD0 /GEAR0			ZSPD/ INH	

Table 5-4 Ex-works Setting of Input Signal Ports

5.2.2 Digital Filtering of Input Signals

In an environment with industrial noise, in order to avoid misoperation, filtering must be performed for input signals. The user may adjust width of window filtering by adjusting value of configuration parameter “Fn 00C”.

Parameter No.	Parameter Description	Setting Range	Setting Unit	Ex-works Setting
Fn 00C	Coefficient of digital input port filtering cycle	0 ~ 255	—	100

5.2.3 Allocation of User Output Signal Ports (SignalOut 1~4)

For each one of the output signal ports (SignalOut 1~4), there is also a corresponding configuration parameter “Fn **xxx**” which determines the signal’s meaning, see Table 5-5 for explanation:

Parameter No.	Parameter Description	Setting Range	Ex-works Setting	
Fn 030	Setting of Digital Output 1 (SignalOut 1)	+1 ~ -32	-17	Servo Ready (SRDY)
Fn 031	Setting of Digital Output 2 (SignalOut 2)	+1 ~ -32	-27	Target Reached (TR)
Fn 032	Setting of Digital Output 3 (SignalOut 3)	+1 ~ -32	-1	零速到达（AZSPD） Zero Speed Reached (AZSPD)
Fn 033	Setting of Digital Output 4 (SignalOut 4)	+1 ~ -32	-5	Alarm Signal Output (ALM)

Table 5- 5 Configuration Parameters of Output Signal Ports

【Example】The configuration parameter corresponding to output signal port (SignalOut 1) is “Fn 030”, when “Fn 030”=1, it means the output signal port (SignalOut 1) has forcibly turned output optocoupler on; when “Fn 030”= 0, it means output signal port (SignalOut 1) has forcibly turned output optocoupler off; when “Fn 030”= one of the values from -1 ~ -32, it means output signal port (SignalOut 1) corresponds to internal output signal 0 ~ 31. If the user needs to change output signal’s logic, he can achieve it through changing value of configuration parameter “Fn 034” as per Table 5-6 below. No.s of internal output signals are shown in Table 5-7.

Parameter No.	Parameter Description	Setting Range	Ex-works Setting
Fn 034	Bits for controlling exclusive OR or reversion operation of output signals Thousand’s digit: to be input through SignalIn 4 Hundred’s digit: to be input through SignalIn 3 Ten’s digit: to be output through SignalOut 2; one’s digit: to be output through SignalOut 1	0000~1111	0000
【Example】when Fn 034 =1100, SignalOut 4’s and SignalOut 3’s output signals are reversed, but SignalOut 1’s and SignalOut 2’s output signals remain unchanged			

Table 5- 6 Digits for Control of Output Signals’ Reversion

Output Signal	Signal No.	Signal Description
Zero Speed Reached （AZSPD）	-1	The signal is effective when ｜feedback rotation speed｜is ≤“Fn 044 - Fn 045” The signal is ineffective when ｜feedback rotation speed｜is >“Fn 044 + Fn 045” “Fn 044” sets the threshold value at which zero speed is deemed to be reached; “Fn 045” sets the value of hysteresis of signal “Zero Speed Reached”
Target Speed Reached （ATSPD）	-2	The signal is effective when ｜feedback rotation speed｜is ≥“Fn 046 + Fn 047” The signal is ineffective when ｜feedback rotation speed｜is <“Fn 046 - Fn 047” “Fn 046” sets the threshold value at which target speed is deemed to be reached; “Fn 047” sets the value of hysteresis of signal “Target Speed Reached”
Position Reached （ATPOS）	-3	The signal is effective when number of tracking error pulses is ≤“Fn 040 - Fn 041” The signal is ineffective when number of tracking error pulses is >“Fn 040 + Fn 041”

		“Fn 040” sets the threshold value at which position is deemed to be reached; “Fn 041” sets the value of hysteresis of signal “Position Reached”
Speed Consistent （VCOIN）	-4	The signal is effective when ｜feedback rotation speed – commanded rotation speed｜is ≤ “Fn 048” The signal is ineffective when ｜feedback rotation speed – commanded rotation speed｜is > “Fn 048” “Fn 048” sets value of error in speed consistency
Alarm Signal Output （ALM）	-5	This signal is effective only when a fault (FAULT) or warning (WARN) occurs, or it is ineffective
Target Torque Reached （ATTRQ）	-6	The signal is effective when ｜actual torque｜is ≥“Fn 049 + Fn 04A” The signal is ineffective when ｜actual torque｜is < “Fn 049 - Fn 04A” “Fn 049” sets the threshold value at which target torque is deemed to be reached; “Fn 04A” sets value of hysteresis of signal “Target Torque Reached”
Electromagnetic Brake Release （BRK-OFF）	-7	This signal is effective when band-type brake is in released status, and ineffective when band-type brake is in locked status; as the current needed for driving the electromagnetic brake’s control coil is big, when this signal is used for controlling brake coil’s on-off operation, an intermediate relay must be used.
Near the Position （NTPOS）	-8	The signal is effective when number of tracking error pulses is ≤“Fn 042 - Fn 043” The signal is ineffective when number of tracking error pulses is >“Fn 042 + Fn 043” “Fn 042” sets the threshold value at which the position is deemed to be near; “Fn 043” sets the value of hysteresis of signal “Near the Position”
Torque under Limit （TRQL）	-9	This signal is effective when torque limit occurs; the limit includes internal basic torque limit, internal+external torque limit, internal+external analog torque limit, and internal+external+external analog torque limit; for more details, please refer to torque limit modes set by configuration parameter “Fn 0A0”; when no torque limit occurs, this signal is ineffective
Speed under Limit （SPDL）	-10	This signal is effective when rotation speed limit occurs under the torque mode; the limit includes basic speed limit alone, basic +internal multi-stage speed limit, basic +external analog speed limit, and basic +internal +external analog speed limit. No matter which limit mode is effective, when the speed exceeds the motor’s maximum speed limit, the motor’s maximum speed limit shall govern. For more details, please refer to speed limit modes set by configuration parameter “Fn 0AD”; when no speed limit occurs, this signal is ineffective

Dynamic Brake Released （DBR-OFF）	-11	This signal is effective when the dynamic brake is released, otherwise it is ineffective
Regenerative Braking Working （ULB）	-12	This signal is effective when the regenerative braking circuit is working, or it is ineffective
Reserved	-13	Its function is not defined
Winding Power On （MPOW-ON）	-14	This signal is effective when the motor windings are energized, or it is ineffective

Motor Rotation Direction （MSP-SIGN）	-15	This signal is effective only when the motor rotates in the forward direction, or it is ineffective
Reserved	-16	Its function is not defined
Servo Ready （SRDY）	-17	This signal indicates that the system’s power-on self-test has been passed, and the system is waiting for the “Servo Enabling” (SON) signal
Servo Enabling Input Effective （ENA-SRV）	-18	This signal indicates that servo is enabled
Reserved	-19	Its function is not defined
Severe Fault （FAULT）	-20	This signal indicates that there is a severe fault, and only by deenergization can the operator clear the fault alarm status
Reserved	-21	Its function is not defined
Servo Emergency Stop （EMGING）	-22	This signal indicates that the servo motor is in the emergency stop status
Servo Enabling Ineffective （DIS-SRV）	-23	This signal indicates that the internal servo enabling is ineffective. The signal is effective when the driver gives an alarm of abnormality
Ordinary Warning （WARN）	-24	This signal gives an alarm of ordinary warning, which can be cleared away by the Alarm Reset (ARST) signal
Reserved	-25	Its function is not defined
Reserved	-26	Its function is not defined
Target Reached （TR）	-27	When the signal Position Reached (under position mode), or Speed Reached (under speed mode) or Torque Reached (under torque mode) is effective, this signal is effective; when none of the three signals is effective, this signal is ineffective

Internal Limit （INL）	-28	This signal is effective when either forward rotation or backward rotation is prohibited; when neither of them is prohibited, this signal is ineffective
Reserved	-29	Its function is not defined
Reserved	-30	Its function is not defined
Reserved	-31	Its function is not defined
Reserved	-32	Its function is not defined

Table 5-7 Definition and No.s of Internal Output Signals

Default allocation of output signal ports SignalOut1~4 of each HS-series servo driver going out of the factory is as shown in Table 5-8:

Output Signal Port	**Definition of Output Signal**		**Output Signal Port**	**Definition of Output Signal**	
SignalOut 1	ENA-SRV	Servo Enabling	SignalOut 3	AZSPD	Zero Speed Reached
SignalOut 2	TR	Target Reached	SignalOut 4	ALM	Alarm Output

Table 5- 8 Ex-works Setting of Output Signal Ports

5.3 Setting of Basic Operating Functions

5.3.1 Servo Enabling

Servo Enabling (SON) signal is used to control energization of the servo motor's windings, it has two values: ON (winding power is on) and OFF (winding power is off).

By configuring parameter "Fn 010", the user can allocate the Servo Enabling (SON) signal to any one of the input signal ports (SignalIn 1~8). "Fn 010"= 0 means Servo Enabling (SON) signal is ineffective, and "Fn 010"= 1 means Servo Enabling (SON) signal is effective all the time.

Servo Enabling (SON) signal's triggering mode can be selected through "Fn 02B", when "Fn 02B"=0, Servo Enabling signal is under high-level-effective mode, under which only if Servo Enabling (SON) signal is effective, when the driver's main circuit is switched on, the driver will immediately enter the SON status; when "Fn 02B"=1, the Servo Enabling signal is under rising-edge-trigger-effective mode, under which if Servo Enabling (SON) signal is effective, when driver's main circuit is switched on, the driver cannot immediately enter the SON status, the user must first turn off enabling, and wait until power-on relay is closed, only then, can he turn on enabling again and enter the corresponding control mode.

Attention
Please do turn on Servo Enabling (SON) signal first and then enter the position, speed and torque commands to start or stop the servo motor.

If you enter the commands first and then start or stop the motor by turning on or off Servo Enabling (SON) signal and the AC power supply, the driver's internal parts and components may be aged and possibility of fault will then become higher.

5.3.2 Emergency Stop

When Emergency Stop (EMG) signal is effective, the servo driver quickly enters the emergency stop status, in which the motor windings' power is off and motor is stopped (the way of stopping the motor depends on configuration of the dynamic brake and electromagnetic brake (an applicable motor is equipped with an electromagnetic band brake)); the internal output signal Servo Emergency Stop (EMGING) is effective.

Attention
In high-power mechanical equipment, usually one or more emergency stop switches are set in one or more places easily accessible to the operator. In case a fault suddenly occurs when the equipment is working, the user can immediately turn off the motor, so as to avoid bodily injury or the machine's damage.

5.3.3 Alarm Reset

When an alarm of warning (WARN) occurs to the servo driver, the motor windings' power is turned off and the motor is stopped; (the way of stopping the motor depends on configuration of the dynamic brake (an applicable motor is equipped with an electromagnetic band brake)); the internal output signal Alarm Signal Output (ALM) is effective; at this moment the driver enters warning (WARN) status, and the operation panel shows the warning code

Warning (WARN) indicates that there's something abnormal inside the driver or the main part of the motor, after cause of the warning (WARN) is removed, enable the Alarm Reset (ARST) signal; when enabling of Alarm Reset (ARST) signal has become ineffective, the driver reenters the normal working status. For meaning of warning codes and methods for solving the problem of warning, please refer to "Chapter VII Fault Alarm and Treatment".

5.3.4 Fault

There are two levels of alarm (ALM) of HS-series servo drivers: 1 warning (WARN), and 2 fault (FAULT).

When a servo driver has a sever fault and enters the fault (FAULT) status, power of the motor's windings is turned off, and the motor is stopped (the way of stopping the motor depends on configuration of the dynamic brake and electromagnetic brake (an applicable motor is equipped with an electromagnetic band brake)); the internal output signal Alarm Signal Output (ALM) is effective, and the operation panel shows the fault code.

The fault (FAULT) status cannot be reset by the Alarm Reset (ARST) signal, and the user must reenergize the servo driver after removing cause of the fault, only then can the servo driver work normally. For meaning of fault codes and methods for solving the problem of fault, please refer to “Chapter VII Fault Alarm and Treatment”.

5.3.5 Reversion of Commands

No matter what mode the motor is running under, when Command Reversion (COM-INV) signal is enabled, reversion operation will be performed for the driver’s all position, speed, and torque commands.

Attention
If the Command Reversion (COM-INV) signal is enabled while the motor is running, please see to it that the motor’s speed and load are not too high, or the motor’s rotation direction will be changed suddenly ,which is likely to damage mechanical parts.

5.3.6 Zero Speed Reached

Zero Speed Reached (AZSPD) signal output is effective when ｜feedback rotation speed｜is ≤“Fn 044 - Fn 045”;

Zero Speed Reached (AZSPD) signal output is ineffective when ｜feedback rotation speed｜is > “Fn 044 + Fn 045”.

Parameter No.	Parameter Description	Setting Range	Setting Unit	Ex-works Setting
Fn 044	Value set as threshold at which zero speed is deemed to be reached	0~1000	rpm	30
Fn 045	Value set as hysteresis of signal “Zero Speed Reached”	0~1000	rpm	5

5.3.7 Target Speed Reached

Target Speed Reached (ATSPD) signal output is effective when ｜feedback rotation speed｜is ≥“Fn 046 + Fn 047”;

Target Speed Reached (ATSPD) signal output is ineffective when ｜feedback rotation speed｜is <“Fn 046 - Fn 047”.

Parameter No.	Parameter Description	Setting Range	Setting Unit	Ex-works Setting
Fn 046	Value set as threshold at which target speed is deemed to be reached	0~30000	rpm	—
Fn 047	Value set as hysteresis of signal “Target Speed Reached”	0~1000	rpm	10

5.3.8 Speed Consistent

Speed Consistent (VCOIN) signal output is effective when ｜feedback rotation speed － commanded rotation speed｜is ≤ “Fn 048”; or VCOIN signal output is ineffective.

When ｜feedback rotation speed － commanded rotation speed｜is ≤ “Fn 048”, Speed Consistent (VCOIN) signal output is effective;

When ｜feedback rotation speed － commanded rotation speed｜is ＞“Fn 048”, Speed Consistent (VCOIN) signal output is ineffective.

Parameter No.	Parameter Description	Setting Range	Setting Unit	Ex-works Setting
Fn 048	Value set as error in speed consistency	0~100	rpm	5

5.3.9 Target Torque Reached

Target Torque Reached (ATTRQ) signal is effective when ｜actual torque｜is ≥ “Fn 049 + Fn 04A”;

Target Torque Reached (ATTRQ) signal is ineffective when ｜actual torque｜is < “Fn 049 - Fn 04A”.

Parameter No.	Parameter Description	Setting Range	Setting Unit	Ex-works Setting
Fn 049	Value set as threshold at which target torque is deemed to be reached	0~3000	1‰ of rated torque	—
Fn 04A	Value set as hysteresis of signal “Target Torque Reached”	0~3000	1‰ of rated torque	10

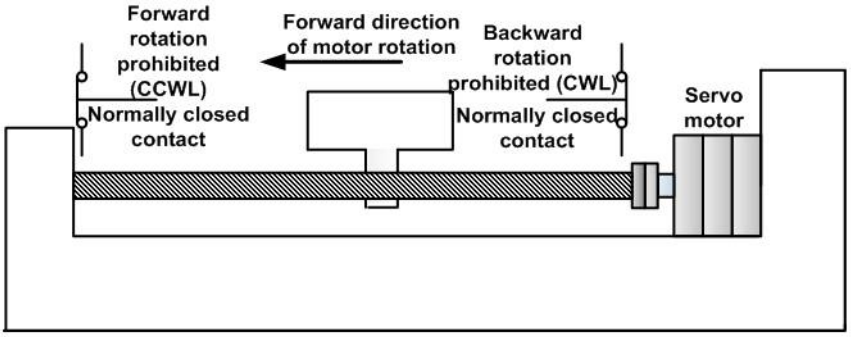
5.3.10 Over-travel

Over-travel prevention is a kind of safety function capable of forcibly stopping the servo motor through (Forward Rotation Prohibited and Backward Rotation Prohibited) signals input into the position-limit switches when any of the machine’s moving parts has gone beyond the safe travel range designed for it.

Attention
Installation of the position-limit switches In case of straight-line drive, please ensure position-limit switches are installed, so as to prevent damage to the machine. When any of the position-limit switches has poor contacting or disconnection, please use the “normally closed contact” to move the motor to the safe side.

"Forward Rotation Prohibited" and "Backward Rotation Prohibited" can be set as "always effective", "always ineffective" or "to be determined by external input signals" through configuration of relevant parameters. Only when the user has enabled function of forward-rotation and backward-rotation position limit check through configuration of parameter "Fn 02F", can the user perform control of position limit.

Parameter No.	Parameter Description	Setting Unit	Ex-works Setting
Fn 01E	Setting of Forward Rotation Prohibited (CCWL) 1: internally enabled; 0: internally disabled; -1~-8: to be determined by digital input signal ports (SignalIn 1~8)	-8~+1	-6
Fn 01F	Setting of Backward Rotation Prohibited (CWL) 1: internally enabled; 0: internally disabled; -1~-8: to be determined by digital input signal ports (SignalIn 1~8)	-8~+1	-7



- Position pulse error clearing

  Under position control mode, if the user wants the servo motor to stop when it has overtravelled, he can determine the way of stopping the servo motor by setting the value of "Fn 02E".

Parameter No.	Parameter Description	Setting Range	Ex-works Setting
Fn 02E	Way of stopping the motor when the driver forbids motor's rotation 0: soft stop (all tracking error pulses are sent); 1: emergency stop (number of tracking error pulses is reset) 【Note】In case of big inertia of the load, an emergency stop may cause mechanical devices' vibration	0~1	0
Fn 02F	Function of forward-rotation and backward-rotation position limit check 0: over-travel (forward rotation prohibited/backward rotation prohibited) check is not performed; 1: over-travel check is performed	0~1	0

In the rotary applications like round-platforms or conveyors, no over-travel preventing function is needed, and no wiring for signals to prevent over-travel is needed.

5.3.11 Parameter for Restoring Default Ex-works Setting

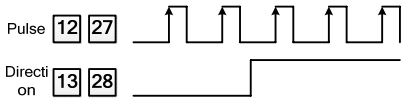
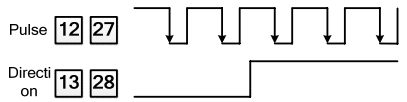
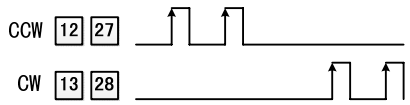
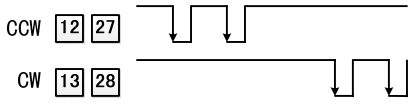
By configuring the parameter “Fn 007”, the user can restore the default ex-works setting. When the user has set “Fn 007”=1, and turned on the driver again, all the system’s parameters, except “Fn 001”, “Fn 006” and “Fn 008, will be restored to their preset default ex-works values.

Parameter No.	Parameter Description	Setting Range	Setting Unit	Ex-works Setting
Fn 007	Loading of ex-works setting value	0~1	—	0

5.4 Running under External Pulse Position Mode

5.4.1 Selection of Pulse Command Mode

By configuring the parameter “Fn 038”, the user can select one from the 6 pulse command modes below:

Fn 038	Input Mode	Description	Description of Waveform (arrows stand for effective positions for commands)
1	Single pulse Positive logic	At the pulse end (12,27), the process from optocoupler’s being off to on is interpreted as receiving a command, at the direction end (13, 28), the level controls direction of running	
2	Single pulse Negative logic	At the pulse end (12,27), the process from optocoupler’s being on to off is interpreted as receiving a command, at the direction end (13, 28), the level controls direction of running	
3	Double pulse Positive logic	At the pulse end (12,27), the process from optocoupler’s being off to on is interpreted as receiving a command for forward rotation, at the direction end (13, 28), the process from optocoupler’s being off to on is interpreted as receiving a command for backward rotation	
4	Double pulse Negative logic	At the pulse end (12,27), the process from optocoupler’s being on to off is interpreted as receiving a command for forward rotation, at the direction end (13, 28), the process from optocoupler’s being on to off is interpreted as receiving a command for backward rotation	

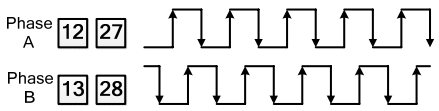
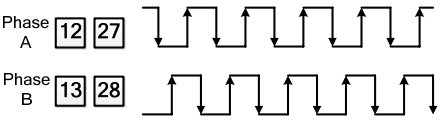
5	Orthogonal pulse Positive logic	The pulse end (12,27) is used as Phase-A orthogonal signal, the direction end (13,28) is used as Phase-B orthogonal signal, when Phase A is ahead of Phase B, the direction is interpreted as being forward	
6	Orthogonal pulse Negative logic	The pulse ends (12,27) are used as Phase-A orthogonal pulse, the direction ends (13,28) are used as Phase-B orthogonal pulse, when Phase B is ahead of Phase A, the direction is interpreted as being forward	

Table 5-9 escription of 6 Types of Pulse Command Modes

5.4.2 Pulse Command Window Filter

In some environments where working noise is big, the user can perform window filtering of the input pulse commands by configuring parameter “Fn 039”, so as to inhibit noise interference.

Parameter No.	Parameter Description	Setting Range	Ex-works Setting
Fn 039	Width of pulse input command’s window filtering	0~127	0

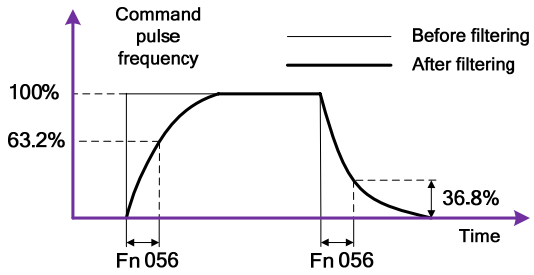
【Note】The bigger the set value of the parameter, the better interference-inhibiting filtering effect and the lower passing frequency of the pulses to pass. Table 5-10 below shows the matching between commonly used set values for Fn 039 and the pulses’ passing frequency

Parameter	Set Value	Pulse Passing Frequency
Fn 039	0	2.5M
	1	1.5M
	4	400K
	6	250K

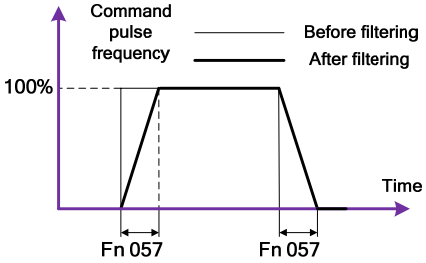
Table 5-10 Table of Matching between Fn 039’s Commonly Used Values and Pulses’ Passing Frequency

5.4.3 Pulse Command Smoothing Filter

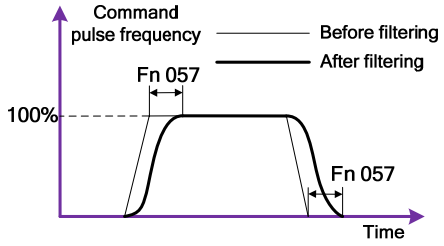
Parameter No.	Parameter Description	Setting Range	Ex-works Setting
Fn 056	Coefficient of proportionality of pulse input command exponent filtering: 0 (cancellation of exponent filtering)	0～30000	0
Fn 057	Coefficient of pulse input command moving smoothing filtering	1～128	32
Exponent Filtering		Moving Smoothing Filtering	



Waveform responding to step input



Waveform responding to step input



Waveform responding to input of ladder-diagram commands

This function is fairly effective on such occasions: 1. The upper device that sends the commands doesn't perform acceleration or deceleration, 2. The command's pulse frequency is very low.

【Note】This setting doesn't influence length of movement (number of command pulses). The bigger the value of filtering coefficient is set, the better filtering smoothness is, but hysteresis is also bigger.

5.4.4 Function of Command Pulse Prohibition

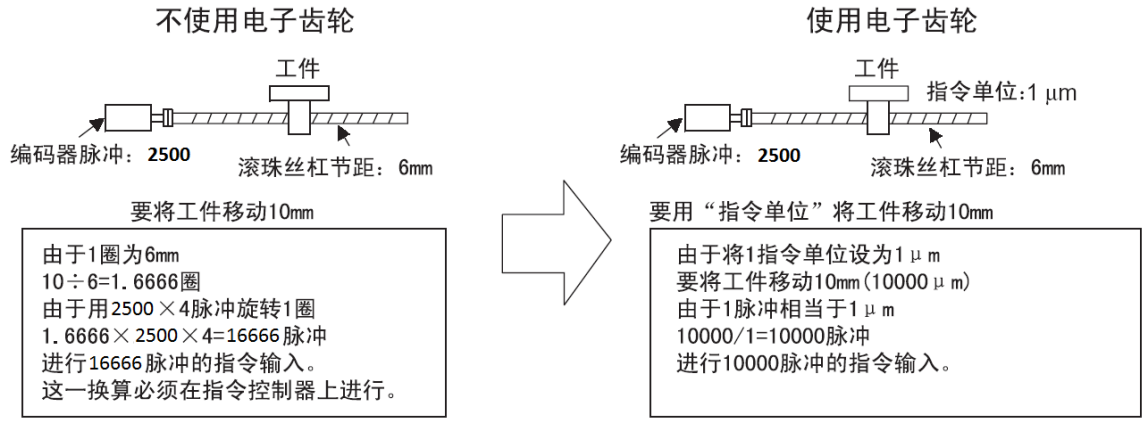
This is the function of stopping (prohibiting) command pulse input counting under the position control mode, and sharing the same digital input signal source and configuration parameter with Zero-speed Set (ZSPD) signal; in such case, the motor's shaft is locked.

Parameter No.	Parameter Description	Setting Range	Ex-works Setting
Fn 01B	Setting of Pulse Prohibited (INH): 1: internally enabled; 0:internally disabled -1 ~ -8: to be determined by digital input signal ports (SignalIn 1~8)	-8 ~ +1	-8

5.4.5 Setting of Electronic Gear

1） Meaning of Electronic Gear Function

"Electronic gear function" is a kind of function capable of setting at any value the workpiece's movement corresponding to 1 pulse of command signal input by the command controller. Such 1 pulse of command from the command controller is named "1 command unit". Figure 5-1 is an example of its application.



不使用电子齿轮 Electronic gear isn't used 工件 Workpiece 编码器脉冲 Encoder pulse 滚珠丝杠节距 Ball screw pitch
要将工件移动 10mm Workpiece needs to be moved 10mm
由于 1 圈为 6mm
As one turn brings a movement length of 6mm,
10/6=1.6666 圈，
10/6=1.6666 turns
1.6666X2500X4＝16666 脉冲
1.6666X2500X4＝16666 pulses
进行 16666 脉冲的指令输入
perform 16666 pulses of command input.
这一换算必须在指令控制器上进行 This conversion must be performed on the command controller
使用电子齿轮 Electronic gear is used
指令单位 command unit
由于将 1 指令单位设为 1μm
As 1 command unit is set as 1μm
要将工件移动 10mm (10000μm)
the workpiece needs to be moved 10mm (10000μm)
由于 1 脉冲相当于 1μm，
and 1 pulse is equivalent to 1μm
10000/1＝10000 脉冲
10000/1＝10000 pulses
进行 10000 脉冲的指令输入
perform 10000 pulses of command input

Figure 5-1 Meaning of the Function of Electronic Gear

2） Setting of Electronic Gear Ratio

Motor shaft and load side's mechanical reduction ratio is n/m (for every m turns of motor's rotation, the load shaft rotates n turns), set value of electronic gear ratio is to be obtained from the following formula:

electronic gear ratio A/B = electronic gear ratio's numerator / electronic gear ratio's denominator = Encoder's resolution / Movement corresponding to load shaft's 1 turn of rotation (command unit) *m/n

Parameter No.	Parameter Description	Setting Range	Ex-works Setting
Fn 050	Electronic gear ratio's numerator 1	1～32767	1
Fn 051	Electronic gear ratio's numerator 2	1～32767	1
Fn 052	Electronic gear ratio's numerator 3	1～32767	1
Fn 053	Electronic gear ratio's numerator 4	1～32767	1
Fn 054	Electronic gear ratio's denominator	1～32767	1

Attention
When the setting range is exceeded, please round off the numerator and denominator to integers within the prescribed range. Setting range of electronic gear ratio is 0.01～100, if this range is exceeded, the servo driver cannot work normally.

3） Steps of Setting the Electronic Gear Ratio

The set value of electronic gear ratio varies with composition of the machine; please set it following the steps shown in Table 5-11 below:

Step	Item of Setting
1	Confirm the machine's reduction ratio, ball screw's lead, belt pulley's diameter, etc.
2	Confirm the resolution of the encoder used for the servo motor
3	Confirm upper device's command unit, which should be based on mechanical specifications, positioning accuracy and other factors
4	On the basis of the confirmed command unit, calculate the number of command units needed for one turn of the load shaft's rotation
5	In accordance wtith the formula for calculating electronic gear ratio, calculate the electronic gear ratio
6	Apply the calculated electronic gear ratio to the corresponding parameters
7	Based on actual needs, shift in a dynamic way the electronic gear ratio while the motor is already stopped (4-stage shift)

Table 5-11 Steps for Setting the Electronic Gear Ratio

4） Formula for Calculating Electronic Gear Ratio

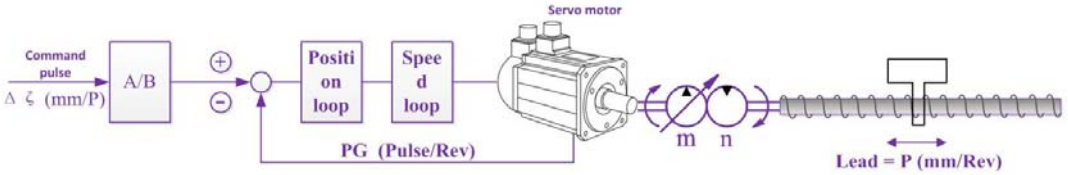


Figure 5-2 Formula for Calculating Electronic Gear Ratio

Δζ (mm/P): command unit PG (Pulse/Rev): encoder resolution (quadruple QEP encoder's line numbers)

P (mm/Rev): ball screw lead n/m: reduction ratio (for every m turns of motor's rotation, the load shaft rotates n turns)

Formula for calculating electronic gear ratio is as shown in Figure 5-2:

As $\frac{n*P}{\Delta\zeta}*\frac{A}{B}=PG*m$, it can be deduced that $\frac{A}{B}=\frac{PG*m*\Delta\zeta}{n*P}=\frac{PG}{\frac{P}{\Delta\zeta}}*\frac{m}{n}$

Please use the parameters to set the electronic gear ratio's numerator A and denominator B.

5） Shifting between Electronic Gear Ratio Values

HS-series servo drivers support dynamic shifting between 4 electronic gear ratio values. By setting values of configuration parameters "Fn 050 ~ Fn 054", the user can give 4 values to the electronic gear ratio, and by inputting the signals of Electronic Gear Selection 0 (GEAR0) and Electronic Gear Selection 1 (GEAR1), the user can shift in a dynamic way between 4 electronic gear ratio values.

Selection of Electronic Gear Ratio		Numerator of Electronic Gear Ratio	Denominator of Electronic Gear Ratio
GEAR0	GEAR1		
0	0	First numerator (Fn 050)	Denominator (Fn 054)
0	1	Second numerator (Fn 051)	
1	0	Third numerator (Fn 052)	
1	1	Fourth numerator (Fn 053)	

6） An Example of Setting the Electronic Gear Ratio

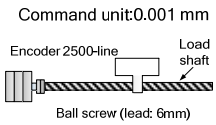
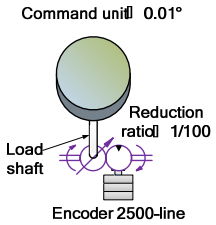
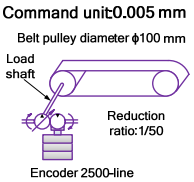
Step	Item	Machine Composition					
		Ball Screw		Round Table		Belt + Belt Pulley	
							
1	Machine specifications	Ball screw lead:6mm Reduction ratio: 1:1		Rotation angle/turn: 360° Reduction ratio: 1:100		Pulley diameter: 100mm Reduction ratio: 1:50	
2	Encoder resolution	2500*4=10000		2500*4=10000		2500*4=10000	
3	Command unit	0.001 mm (1 μm)		0.01°		0.005 mm (5 μm)	
4	Movement/turn of load shaft	6 mm/0.001 mm = 6000		360°/0.01°= 36000		π*100 mm/0.005 mm = 62800	
5	Electronic gear ratio	$\frac{A}{B}=\frac{10000}{6000}*\frac{1}{1}$		$\frac{A}{B}=\frac{10000}{36000}*\frac{100}{1}$		$\frac{A}{B}=\frac{10000}{62800}*\frac{50}{1}$	
6	Parameter	Fn 050 / Fn 051 / Fn 052 / Fn 053	5	Fn050 / Fn 051 Fn052 / Fn 053	250	Fn 050 / Fn 051 Fn 052 / Fn 053	1250
		Fn 054	3	Fn 054	9	Fn 054	157

Table 5-12 An Example of Setting the Electronic Gear Ratio

5.4.6 Signal of Position Reached

Number of tracking error pulses “Dn 03” is the absolute error between the number of command pulses sent by the command controller and number of pulses corresponding to the motor’s actual rotation, when number of tracking error pulses is ≤“Fn 040 - Fn 041”, Position Reached (ATPOS) signal output is effective; when number of tracking error pulses is ＞“Fn 040 + Fn 041”, Position Reached (ATPOS) signal output is ineffective.

Parameter No.	Parameter Description	Setting Range	Setting Unit	Ex-works Setting
Fn 040	Threshold value at which position is deemed to be reached	1 ~ 1024	Pulse	50
Fn 041	Value of hysteresis of signal “Position Reached”	-30000 ~ 30000	Pulse	0

5.4.7 Near the Position Signal

When the number of tracking error pulses “Dn 03” is ≤“Fn 042 - Fn 043”, Near the Position (NTPOS) signal output is effective; when number of tracking error pulses “Dn 03” is ＞“Fn 042 + Fn 043”, Near the Position (NTPOS) signal output is ineffective.

Parameter No.	Parameter Description	Setting Range	Setting Unit	Ex-works Setting
Fn 042	Value set as threshold at which position is deemed to be near	0～30000	Pulse	500
Fn 043	Value set as hysteresis of signal “Near the Position”	0～30000	Pulse	50

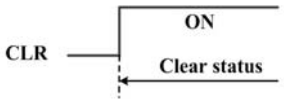
5.4.8 Alarm of Over-travel

When the number of tracking error pulses “Dn 03” is ＞“Fn 0DA”, an alarm of over-travel occurs

Parameter No.	Parameter Description		Setting Range	Setting Unit	Ex-works Setting
Fn 0DA	= 0	Cancellation of over-travel alarm	0 ~ 32767	Pulse	30000
	!= 0	Value of deviation set for over-travel			

5.4.9 Position Pulse Error Clearing

Error Clearing (CLR) signal is set through digital input port “Fn 01C”, and is used to reset the counter of pulse command errors. The way of resetting is configured by “Fn 02C” and “Fn 02D”, details of the parameters’ setting is shown in Table 5-13 below.

Parameter No.	Parameter Description		Setting Unit	Ex-works Setting
Fn 02C	Clearing of position tracking error pulse		0~1	0
	0: clear (default value)	1: don’t clear		
Fn 02D	Way of clearing position error through the input port		0~1	0
	0			
	Clear at High level (default)			
	【Note】If it is set as Maintaining Clear Status, the servo’s locking function is ineffective; so the motor will rotate at a very low speed due to drift of the speed loop. In order to ensure the Error Clearing signal is reliably executed, please ensure ON status is kept for >250us.			
	1			

	Clear on rising edge			
	【Note】in order to ensure Error Clearing signal is reliably executed, please ensure ON status is kept for >25us			

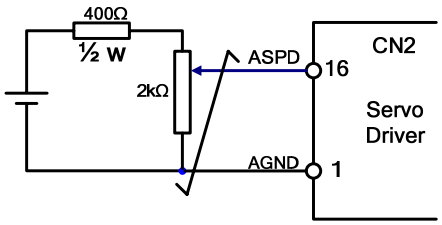
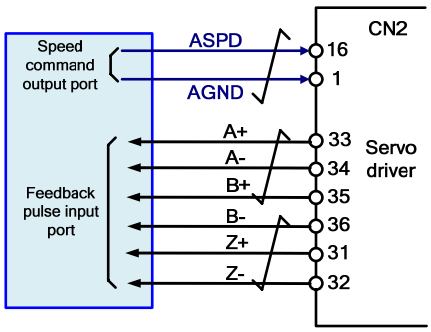
Table 5-13 Description of Configuration Parameters for Clearing Position Error

【Note】When an alarm of fault (FAULT) or warning (WARN) occurs, the position error is temporarily retained for convenience of observation; when the alarm of warning (WARN) is reset by the Alarm Reset (ARST) signal, or the driver is reenergized, the system automatically clears away the error to enable rerunning.

5.5 Running under Speed Mode

5.5.1 Running under External Analog Command Mode

1）Setting of Input Signals

Signal Name	Port Position	Signal Meaning
Analog Speed (ASPD)	CN2-16	Analog command input
Analog Ground (AGND)	CN2 -1/2/17	Analog signal ground
Input specifications: maximum allowable iput voltage: DC±10V		
An example of input circuit In order to be able to adopt effective measures against interference, please do use shielded multi-strand twisted-pair cables 		When the command controller is performing position control, use a programmable controller or similar tool to receive information of the servo motor's current rotor position and current speed through the encoder's feedback. 

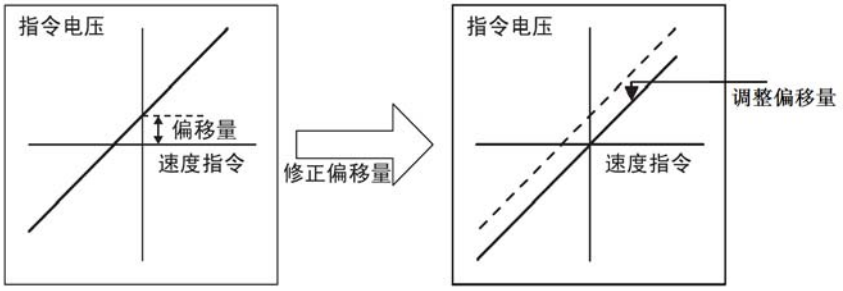
2）Adjustment of Speed Command Gain

Gain of the speed command can be configured with the configuration parameter "Fn 060":

Parameter No.	Parameter Description	Setting Unit	Setting Unit	Ex-works Setting
Fn 060	Analog speed command gain	1~1000	rpm/V	300

3）Adjustment of Speed Command Bias

When the external analog speed mode is used, even the command, which is an analog voltage value, is 0V, the motor still may rotate at a very low speed. This phenomenon will happen when the upper control device's or the external circuit's command voltage has a slight bias (mV level). In such condition, the user may adjust the command's bias by configuring parameter "Fn 061". Figure 5-3 below is an example:



指令电压 Command voltage 偏移量 Bias 速度指令 Speed Command 修正偏移量 Correct the bias 调整偏移量 Adjust the bias

Figure 5-3 Adjustment of Speed Command Bias

Parameter No.	Parameter Description	Setting Range	Ex-works Setting
Fn 061	Analog speed command ADC zero drift	-1000~+1000	0

4）Setting of Speed Command's Direction

The user can shift direction of the input speed command by configuring parameter "Fn 062":

Parameter No.	Parameter Description	Setting Range	Ex-works Setting
Fn 062	Setting of reversion of analog speed command's direction 0: analog speed command's direction isn't reversed; 1: analog speed command's direction is reversed	0~1	0

5）Low-pass Filter

By letting analog speed commands go through a low-pass filter, the user can remove interference generated by high-frequency noise. If the set value is too big, the driver's responsiveness will be lowered.

Parameter No.	Parameter Description	Setting Range	Setting Unit	Ex-works Setting
Fn 063	Time constant of analog speed command low-pass filter	0~30000	0.1ms	0

6）Analog Speed Command Zero-value Clamping

When inputting an analog command, it's not easy for the user to achieve a command of absolute zero speed. With zero-value clamping, the motor will not have position change due to rotation caused by any external force.

Function of zero-value clamping is set by configuring the parameter "Fn 068".

When zero-value clamping function is effective, and motor speed is not higher than the speed value set by analog speed command zero-value clamping, the motor's speed is lowered to zero and its shaft is locked.

Parameter No.	Parameter Description	Setting Range	Setting Unit	Ex-works Setting
Fn 068	Setting of analog command value clamping 0: no zero-value clamping function for analog commands is available 1: zero-value clamping function is available for analog units -1 ~ -8: to be determined by digital input signal ports SignalIn 1~8	-8~1	—	1
Fn 069	Value set for analog speed command zero-value clamping	0~30000	rpm	30

5.5.2 Running under Internal Speed Mode

1）Meaning of Internal Speed Mode

Under the internal speed mode, through the combination of digital input signals (INSPD0/1/2), by configuring parameters "Fn 071"~"Fn 078", the user can select from 8 internal speed values preset, so as to control servo motor's rotation speed. Figure 5-4 describes selection of internal speeds.

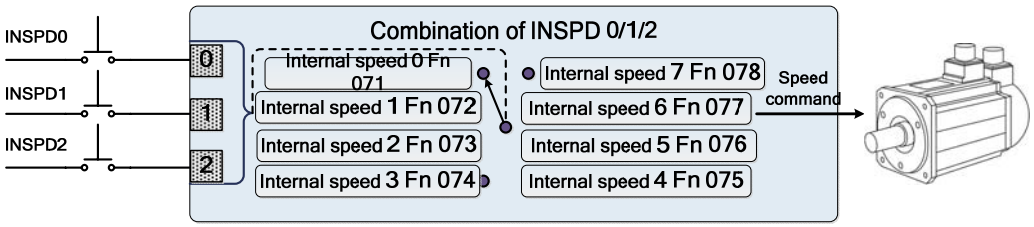


Figure 5-4 Selection of an Internal Speed

2）Setting of User Parameters

Parameter No.	Parameter Description	Setting Range	Setting Unit	Ex-works Setting
Fn 071	Internal speed 1's set value	-30000～+30000	rpm	500
Fn 072	Internal speed 2's set value	-30000～+30000	rpm	1000
Fn 073	Internal speed 3's set value	-30000～+30000	rpm	1500
Fn 074	Internal speed 4's set value	-30000～+30000	rpm	2000
Fn 075	Internal speed 5's set value	-30000～+30000	rpm	-2000
Fn 076	Internal speed 6's set value	-30000～+30000	rpm	-1500
Fn 077	Internal speed 7's set value	-30000～+30000	rpm	-1000
Fn 078	Internal speed 8's set value	-30000～+30000	rpm	-500

Attention
The internal speed values above will be limited into the prescribed speed range even though they are higher than the applicable motor's highest speed. Don't let speed fluctuation be too big when shifting the speed, or add a smoothing filter for the speed command, so as to avoid vibration due to abrupt change of speed.

Table 5-13 Configuration Parameters for 8 Ranges of Internal Speed

3）Shifting of Internal Speed

ON means INSPD 0/1/2 turns the input optocoupler on, OFF means INSPD 0/1/2 turns the input optocoupler OFF.

INSPD 2's Status	INSPD 1's Status	INSPD 0's Status	Selected Speed
OFF	OFF	OFF	Internal Speed 1
OFF	OFF	ON	Internal Speed 2
OFF	ON	OFF	Internal Speed 3
OFF	ON	ON	Internal Speed 4
ON	OFF	OFF	Internal Speed 5
ON	OFF	ON	Internal Speed 6
ON	ON	OFF	Internal Speed 7
ON	ON	ON	Internal Speed 8

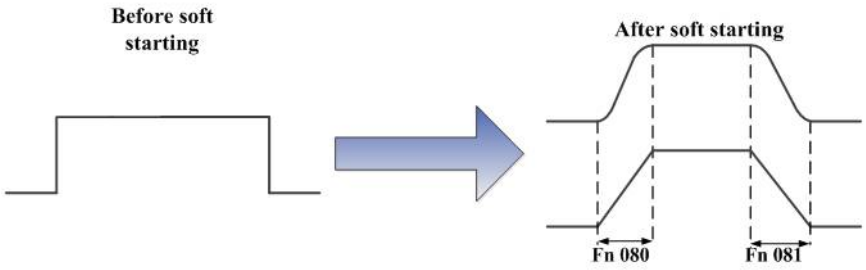
Table 5-15 Select From 8 Ranges of Internal Speed

5.5.3 Time for Acceleration and Deceleration

When inputting a selected step velocity command, by configuring the time of acceleration and deceleration, the user can turn it into a command for smooth speed change, so that the motor can be started smoothly.

Parameter No.	Parameter Description	Setting Unit	Setting Range	Ex-works Setting
Fn 0B8	Setting of time for motor acceleration	ms	0~30000	0
Fn 0B9	Setting of time for motor deceleration	ms	0~30000	0
Fn 0BA	Time constant of S-curve acceleration (or deceleration) under speed mode	ms	0~500	0

When inputting the step speed command or selecting an internally set speed, the user can perform smooth speed control, the time for acceleration (or deceleration) is set as the time needed for the motor to change its speed from 0 (1000) rpm to 1000 (0).



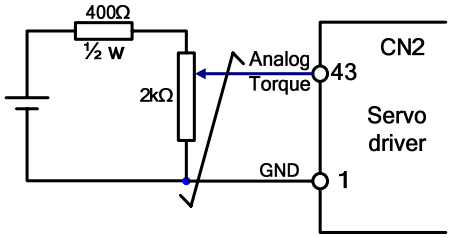
5.5.4 Zero-speed Set

If Zero-speed Set (ZSPD) signal is set as ON, the input value of speed command will be ignored, emergency stop of the servo motor will be performed, and its shaft will be locked.

Parameter No.	Parameter Description	Setting Range	Ex-works Setting
Fn 01B	Configuration of Zero-speed Set (ZSPD): 1: internally enabled; 0: internally disabled -1 ~ -8: to be determined by digital input signal ports (SignalIn 1~8)	-8～+1	-8

5.6 Running under External Analog Torque Mode

5.6.1 Setting of Input Signals

Signal Name	Port Position	Meaning of Signal
Analog Torque (ATRQ)	CN2 - 43	Analog command input
Analog Ground (AGND)	CN2 - 1/2/17	Analog ground signal
Input specifications: maximum allowable input voltage: DC ± 10V		
An example of input circuit In order to be able to adopt effective measures against interference, please do use shielded multi-strand twisted-pair cables 		

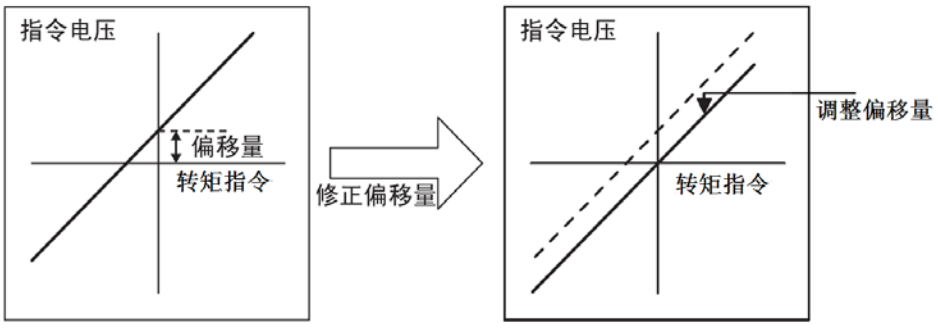
5.6.2 Adjustment of Torque Command Gain

Gain of the torque command can be configured with configuration parameter “Fn 064”.

Parameter No.	Parameter Description	Setting Range	Setting Unit	Ex-works Setting
Fn 064	Analog torque command gain	1～300	1%*Tr / V	30

5.6.3 Adjustment of Torque Command Bias

When the external analog torque mode is used, even the command, which is an analog voltage value, is 0V, the motor’s output torque is not necessarily 0. This phenomenon will happen when the upper control device’s or external circuit’s command voltage has a slight bias (mV level). In such condition, the user may adjust the command’s bias by changing value of configuration parameter “Fn 065”. Figure 5-5 below is an example:



指令电压 Command voltage 偏移量 Bias 转矩指令 Torque Command 修正偏移量 Correct the bias 调整偏移量 Adjust the bias

Figure 5-5 Adjustment of Torque Command Bias

Parameter No.	Parameter Description	Setting Range	Ex-works Setting
Fn 065	Analog torque command ADC zero drift	-1000～+1000	0

5.6.4 Setting of Torque Command's Direction

The user can shift direction of input torque command by configuring parameter "Fn 066":

Parameter No.	Parameter Description	Setting Range	Ex-works Setting
Fn 066	Setting of reversion of the analog torque command's direction 0: the torque command's direction isn't reversed; 1: the torque command's direction is reversed	0～1	0

5.6.5 Torque Command Low-pass Filter

By letting the analog torque commands go through a low-pass filter, the user can remove interference generated by high-frequency noise. If the set value is too big, the driver's responsiveness will be lowered.

Parameter No.	Parameter Description	Setting Range	Setting Unit
Fn 067	Time constant of analog torque command low-pass filter	0~30000	0.1ms

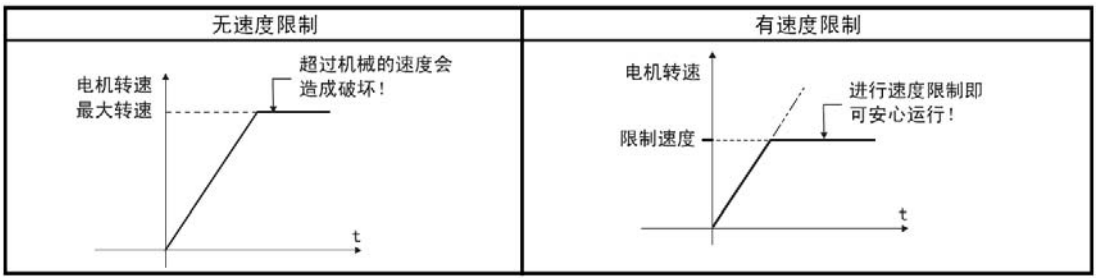
5.6.6 Zero-value Clamping of Analog Torque Command

Zero drift is unavoidable to analog inputs; when the analog torque command is very small and the user hopes to set it as zero, he can achieve zero-value clamping with parameter "Fn 068" (analog command zero-value clamping mode) and "Fn 06A" (value set for analog torque command zero-value clamping).

Parameter No.	Parameter Description	Setting Range	Setting Unit	Ex-works Setting
Fn 068	Setting of analog command clamping 0: no zero-value clamping function is available for analog commands 1: zero-value clamping function is available for analog commands -1 ~ -8: to be determined by digital input signal ports SignalIn 1~8	-8~1	—	1
Fn 06A	Value set for analog torque command zero-value clamping	0~30000	(Rated current/torque) ‰	30

5.6.7 Speed Limit when Torque is under Control

As when torque is under control, the servo motor needs to receive torque commands, motor speed is not processed. If a torque command's value is set too big for the load torque on the mechanical side, the mechanical load torque will be exceeded and motor speed will be significantly raised. As a measure for protecting the mechanical side, torque control is supplemented with the function of limiting servo motor's speed. Figure 5-6 below is an example.



无速度限制 No speed limit 电机转速 motor speed 最大转速 Maximum speed
超过机械的速度会造成破坏 If machine maximum speed limit is exceeded, damage will be caused
有速度限制 With speed limit 限制速度 Limited speed
进行速度限制即可安心运作 When speed is limited, the user can operate in a reassuring way

Figure 5-6 Speed Limit under Torque Mode

The function of speed limit under torque mode is classified into 4 modes, and can be configured through configuration parameter "Fn 0AD".

Parameter	Setting Value	Speed Limit Mode
Fn 0AD	0	Basic speed limit
	1	Basic speed limit + internal speed limit (the smaller is taken as speed limit)
	2	Basic speed limit + external analog speed limit (the smaller is taken as speed limit)
	3	Basic speed limit + internal multi-stage speed limit + external analog speed limit (the smallest is taken as speed limit)

Basic speed limit is divided into basic forward speed limit to be set with configuration parameter "Fn 0AE" and basic backward speed limit to be set with configuration parameter "Fn 0AF".

Parameter No.	Parameter Description	Setting Range	Setting Unit
Fn 0AE	Basic forward speed limit under torque mode	60~30000	rpm
Fn 0AF	Basic backward speed limit under torque mode	60~30000	rpm

External analog speed limit controls the Speed Limit Value through an external analog command, in such case, the channel of external analog speed is used as source of external analog speed limit commands, and its configuration of gain, zero point, direction and filtering features is the same as under "5.5.1 Running under External Analog Command Mode".

With combination of digital input signals (INSPD 0/1/2), internal multi-stage speed limit enables the user to select from 8 preset values of internal speed by configuring parameters “Fn 071”~“Fn 078” (the same configuration parameters also used for internal multi-stage speed) as shown in the Table 5-17 below, so that the user can limit the servo motor’s speed.

【Note】Under any of the 4 modes of speed limit above, if the Speed Limit Value is higher than value of the highest speed limit configuration parameter “Fn 0AC”, the motor’s speed will be kept under the highest speed; if the minimum Speed Limit Value is smaller than 60 RPM, the minimum speed will be limited at 60RPM. If you want to set the servo motor speed command at 0, please use the function of “Zero-speed Set”.

INSPD 2 Status	INSPD 1 Status	INSPD 0 Status	Selected Speed Limit Value
OFF	OFF	OFF	Speed Limit Value 1
OFF	OFF	ON	Speed Limit Value 2
OFF	ON	OFF	Speed Limit Value 3
OFF	ON	ON	Speed Limit Value 4
ON	OFF	OFF	Speed Limit Value 5
ON	OFF	ON	Speed Limit Value 6
ON	ON	OFF	Speed Limit Value 7
ON	ON	ON	Speed Limit Value 8

Table 5-16 Selection from 8 Values of Speed Limit

5.7 Resonance Inhibition

1）Meaning of Resonance Inhibition

When resonance occurs to the machine system, probably it is because the servo system’s rigidity is too high and response is too quick; by lowering the gain, such problem can probably be alleviated. Each HS series driver is equipped with two low-pass filters and two trappers (band-stop filters), so that resonance can be inhibited without having to lowering the gain. The principle of resonance inhibition is to use filters to inhibit resonance humps of mechanical response (see Figure 5-7):

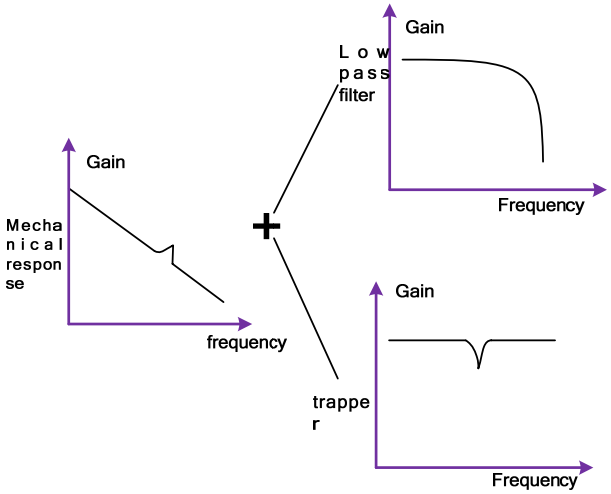


Figure 5-7 Use of Filters for Inhibiting Mechanical Response's Resonance Humps

Type of Filter	Applicable Condition	Advantages	Disadvantages
Low-pass filter	High-frequency resonance	It's unnecessary to know the exact resonance point	Phase lag and lower system bandwidth will be caused, making it inappropriate for conditions with medium and low-frequency resonance
Trapper	Low- and medium-frequency resonance	It doesn't affect the system's overall bandwidth	It's necessary to know the exact resonance frequency, wrong setting of frequency will affect system's performance, so it is not applicable to conditions where resonance frequency often drifts.

Parameter No.	Parameter Description	Setting Range	Setting Unit
Fn 092	Time constant of No.1 torque command's low-pass filter	10us	0~30000
Fn 093	Time constant of No.2 torque command's low-pass filter	10us	0~30000
Fn 094	Center frequency of No.1 torque command's band-stop filter	Hz	100~30000
Fn 095	Bandwidth frequency of No.1 torque command's band-stop filter	0.1Hz	0~30000
Fn 096	Rate of attenuation of No.1 torque command's band-stop filter	1%	0～100
Fn 097	Center frequency of No.2 torque command's band-stop filter	0.1Hz	100~30000
Fn 098	Bandwidth frequency of No.2 torque command's band-stop filter	0.1Hz	0~30000
Fn 099	Rate of attenuation of No.2 torque command's band-stop filter	1%	0～100

2）Low-pass Filters

Parameters “Fn 092” and “Fn 093” are used to configure two low-pass filters’ time constants. The user can select one of them through shifting of gain, but cannot use them two simultaneously (except they’re connected in series). A low-pass filter is effective by default, and can have very good attenuation effect on high-frequency signals, so it can achieve fairly good inhibition of high-frequency resonance and noise. For example, if ball screws are used in the machine, when the driver’s gain is raised, sometimes high-frequency resonance will happen, in which condition use of low-pass filters can have good effect, but the system’s response bandwidth and phase margin are also lowered, so the system is likely to become unstable. If the system’s resonance is at a low- and medium-frequency, the low-pass filters cannot have the effect of resonance inhibition.

When the machine has high-frequency vibration due to the servo driver, the user can adjust time constant of the torque low-pass filter to eliminate vibration. The smaller the time constant is, the easier it is to perform control with good response; but due to restraint of mechanical conditions, though the bigger the time constant is, the easier it is to inhibit high-frequency vibration, the phase margin would be smaller, making it very likely to cause oscillation.

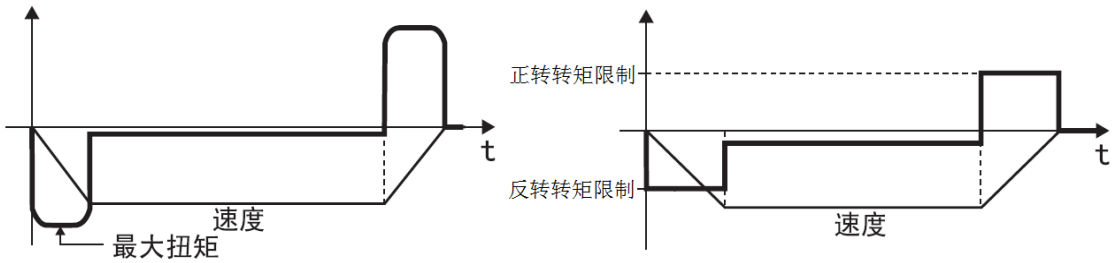
3）Trappers

Parameters “Fn 094”~“Fn 099” are used to set the two trappers’ relevant parameters. When the two trappers are connected in series, they can be used at the same time and can inhibit resonance at two different frequencies. The two trappers are shut off by default. If the resonance frequency (center frequency) can be known, the trappers can directly eliminate resonance. Generally if the resonance frequency is confirmed, use of trappers can have better effect than use of low-pass filters. When resonance frequency is not known, the user can change the inhibiting frequency following the from-higher-to-lower order, the inhibiting frequency corresponding to the smallest vibration is the optimal value for setting. But if resonance frequency drifts with time or any other factor, and the drift is too big, it is not appropriate to use trappers.

In addition to the center frequency, the user can adjust the trappers’ bandwidth and rate of attenuation. But the user must take care to ensure his setting is appropriate. The bigger the bandwidth and rate of attenuation, probably the better the effect of mechanical resonance inhibition, but phase change will also be bigger, which sometimes can enhance vibration.

5.8 Torque Limit

For the purpose of protecting the machine, the user can limit the output torque. By selecting one from of the 4 modes of torque limit, the user can give different values of limit respectively on forward and backward rotation (see Figure 5-8 below).



最大扭矩 Maximum torque　速度 Speed

正转转矩限制 Limit on forward-rotation torque

反转转矩限制 Limit on backward-rotation torque

Figure 5-8 Torque Limit

HS-series servo drivers' function of torque limit is divided into 4 modes, and can be set with configuration parameter "Fn 0A0".

Parameter No.	Setting Value	Parameter Description	Setting Range	Ex-works Setting
Fn 0A0	0	Internal torque limit	0～3	0
	1	Internal + external torque limit		
	2	Internal + analog torque limit		
	3	Internal + external + analog torque limit		

1) Internal torque limit: the output torque is limited within the range defined by internal forward-rotation torque limit configuration parameter "Fn 0A1" and internal backward-rotation torque limit configuration parameter "Fn 0A2".

Parameter No.	Parameter Description	Setting Range	Setting Unit	Ex-works Setting
Fn 0A1	Internal forward-rotation torque limit	1~500	1% of rated torque	500
Fn 0A2	Internal backward-rotation torque limit	1~500	1% of rated torque	500

2) Internal torque limit + external torque limit: the lesser of the two is taken as the torque limit value.

Whether external torque limit is effective is controlled by digital input signals External Forward-rotation Torque Limit (TCCW) and External Backward-rotation Torque Limit (TCW). External Forward-rotation Torque Limit (TCCW) signal corresponds to external forward-rotation torque limit configuration parameter "Fn 0A3", External Backward-rotation Torque Limit (TCW) signal corresponds to external backward-rotation torque limit configuration parameter "Fn 0A4".

Parameter No.	Parameter Description	Setting Range	Setting Unit	Ex-works Setting
Fn 0A3	External forward-rotation torque limit	0~500	1% of rated torque	100
Fn 0A4	External backward-rotation torque limit	0~500	1% of rated torque	100

3) Internal torque limit + analog torque limit: the lesser of the two is taken as torque limit value.

Analog torque limit controls torque limit value by use of external analog signals, in which case the channel of external analog torque is used as source of external analog torque limit commands, and configuration of its gain, zero point, direction and filtering features is the same as under "5.6 Running under External Analog Torque Mode".

4) Internal torque limit + external torque limit + analog torque limit: the least of the three is taken as torque limit value.

【Note】Analog torque limit: analog voltage commands' input voltage has no polarity, no matter the voltage is positive or negative, only its absolute value is used; the torque limit value corresponding to the input voltage's absolute value acts on both the forward rotation and backward rotation.

In addition, no matter which torque limit is used, an overall absolute value will be used to finally limit the torque. No matter the limit is on forward-direction torque or backward-direction torque, its maximum absolute value is defined by Fn 0A5.

Parameter No.	Parameter Description	Setting Range	Setting Unit	Ex-works Setting
Fn 0A5	Torque limit by absolute value	0~5000	1‰ of rated torque	5000

5.9 Shifting of Gain

1) Meaning of Shifting of Gain

By shifting of gain based on change of motor speed or input signals, the following purposes can be achieved:

a. shifting to a lower gain value when the motor has stopped (servo shaft is locked), so as to inhibit vibration and harsh noise;

b. shifting to a higher gain value when the motor is stopped, so as to raise the servo's rigidity;

c. shifting to a higher gain value when the motor is running can achieve better tracing of commands and a shorter positioning time;

d. shifting between different gain values based on condition of the load device to achieve optimal control.

2) Parameters Related to Shifting of Gain

Both No.1 gain and No.2 gain appear in the form of a parameter group. Each group has four parameters, and all four are shifted at the same time. Combination of gain values are as shown in Table 5-17. Based on his needs, the user can set the value of configuration parameter “Fn 019”, and shift between No. 1 Gain and No.2 Gain based on different parameter values and the motor’s current feedback speed (see Table 5-18 below):

No. 1 Gain			
Parameter No.	**Parameter Description**	**Setting Unit**	**Setting Range**
Fn 087	Speed loop’s No.1 proportional gain Kv1	0.01	10~5000
Fn 088	Speed loop’s No. 1 integral time constant Ti	0.1ms	1~10000
Fn 05C	Position loop’s No. 1 proportional gain Kp1	0.01	1~10000
Fn 092	No. 1 torque command low-pass filter’s time constant	10us	0~30000
No. 2 Gain			
Parameter No.	**Parameter Description**	**Setting Unit**	**Setting Range**
Fn 089	Speed loop’s No.2 proportional gain Kv2	0.01	10~5000
Fn 08A	Speed loop’s No. 2 integral time constant Ti	0.1ms	1~10000
Fn 05D	Position loop’s No. 2 proportional gain Kp2	0.01	1~10000
Fn 093	No. 2 torque command low-pass filter’s time constant	10us	0~30000

Table 5-17 Configuration Parameters for Shifting of Gain

Parameter No.	**Parameter Description**				**Setting Unit**	**Setting Range**	**Ex-works Setting**
Fn 019	Setting of shifting of gain (GAIN)	2	|speed feedback value| ≤ “Fn0B2 - Fn 0B3”	No. 1 gain	—	-8 ~ +2	0
			|speed feedback value|＞ “Fn0B2+ Fn 0B3”	No. 2 gain			
		1	No. 2 gain is used at all times				
		0	No. 1 gain is used at all times				
		-1 ~ -8	OFF	No. 1 gain			
			ON	No. 2 gain			
			The user selects one from SignalIn 1~8 ports as per his needs				
Fn 0B0	Delay of shifting of gain				ms	-30000~30000	4

Fn 0B1	Time for shifting of gain	ms	-30000~30000	4
Fn 0B2	Critical point of speed for shifting of gain	rpm	0~30000	10
Fn 0B3	Set value of the hysteresis of speed for shifting of gain	rpm	0~1000	2

Table 5-18 Configuration Parameters in Conditions for Shifting of Gain

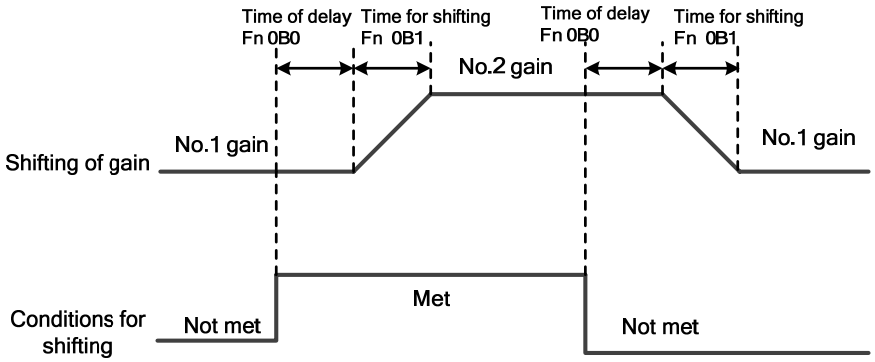


Figure 5-9 Shifting of Gain

As shown in Figure 5-9, when the conditions for shifting are met, the shifting is made from No. 1 gain to No.2 gain; when conditions for shifting are not met, the shifting is made from No.2 gain to No. 1 gain. Shifting can happen only when the status of changing the conditions for the shifting is maintained for longer than the time of delay “Fn 0B0”, so as to avoid misshifting due to interference. During shifting, the current combination of gain smoothly, linearly and gradually changes over the time for shifting “Fn 0B1” to reach the target combination of gain; all the parameters within the combination change at the same time, so as to avoid mechanical shock due to sudden change of parameters. In order to avoid frequent shifting, the comparator has a hysteresis value “Fn 0B3”.

5.10 Adjustment of Gain

5.10.1 Adjustment of Speed Loop’s Gain

Parameter No.	Parameter Description	Setting Range	Setting Unit
Fn 084	Rotational inertia coefficient of the load	100～1000	1%
Fn 087	Speed loop’s No.1 proportional gain Kv1	10～5000	0.01
Fn 088	Speed loop’s No. 1 integral time constant Ti: 0 means suspension of integral control	1～10000	0.1ms
Fn 089	Speed loop’s No.2 proportional gain Kv2	10～5000	0.01
Fn 08A	Speed loop’s No. 2 integral time constant Ti: 0 means suspension of integral control	1～10000	0.1ms

Step 1: input the load information: Rotational inertia coefficient of the load = (load inertia+ motor inertia)/motor inertia;

Step 2: select internal speed mode (“Fn 001”=1) to adjust speed gain.

Step 3: increase as much as possible the speed loop’s proportional gain “Fn 087”, until the load (i.e. the motor) has no abnormal vibration and noise and its speed is stable.

Step 4: increase as much as possible the speed loop’s integral gain “Fn 088”, until the load (i.e. the motor) has no abnormal vibration and noise, its speed overregulating and underregulating status meet the conditions for the load’s work, and its speed is stable.

5.10.2 Adjustment of Position Loop’s Gain

Parameter No.	Parameter Description	Setting Range	Setting Unit
Fn 05A	Speed loop’s speed feedforward coefficient	0～100	1%
Fn 05B	Position-loop speed feedforward low-pass filter’s time constant	0～6400	10 us
Fn 05C	Position loop’s No. 1 proportional gain Kp1	1～10000	0.01
Fn 05D	Position loop’s No. 2 proportional gain Kp2	1～10000	0.01

Step 1: if allowed by the condition of load, internal speed mode (“Fn 001”=1) and the method of “adjustment of gain under speed running mode” can be selected for completing adjustment of speed gain.

Step 2: based on the needs of the actual application, set the electronic gear ratios “Fn 050”~“Fn 054” and command smooth filtering coefficient “Fn 039” at appropriate values.

Step 3: appropriately increase the proportional gain parameter “Fn 05C”, to ensure while the system is stable, the load has good position command tracing features, and the system is not very likely to oscillate when the motor is stopping and running.

Step 4: if higher position response performance is required, the user can appropriately increase speed feedforward coefficient “Fn 05A” and adjust feedforward filter’s time constant “Fn 05B”. But it should be kept in mind that a too big feedforward coefficient will cause overregulation.

5.10.3 Precautions for Adjustment of Gain

1) Setting of gain’s value is determined based on the specific condition of load, if the load varies significantly, the gain has to be readjusted;

2) during adjustment of parameters, if oscillation occurs, the user should immediately disable enabling of servo (i.e. to make “Servo Enabling” (SON) ineffective), or turn off the power,

then turn on the power again and decrease the gain parameter;

3) when load inertia is big, by adjusting No.2 speed loop's gain parameters "Fn 089" and "Fn 08A", and parameters for conditions for shifting of gain "Fn 0B2" and "Fn 0B3", the user can separately adjust servo motor's low-speed control features, so as to enhance servo system's adaptability to load inertia in both high and low speed ranges.

5.11 Working Characteristics of the Braking Circuit

HS-series servo drivers have three kinds of braking circuit: 1. generative braking circuit, 2. dynamic braking circuit and 3. electromagnetic braking circuit. The following is introduction to working principles of these three kinds of braking circuit and the process of configuring them.

5.11.1 Generative Braking

1) Definition of Generative Braking

Energy-consuming braking is used for HS-series servo drivers; when the bus voltage is higher than the set value, discharge of energy starts. For details of connection and model selection of external braking resistors, please refer to "3.2.7 Connection of External Braking Resistors".

A unique energy-consuming braking technique (for which technical patent has been applied for) is used for HS-series servo drivers, which ensures braking circuit's safety while the largest possible amount of energy is discharged at the highest rate, and effectively enhances the drivers' reliability.

Note】HS-series servo drivers have already be equipped by the manufacturer with built-in braking resistors, which in the most circumstances can meet the need of energy-consuming braking. In case of special needs (e.g. the regenerative energy that has exceeded servo unit's discharging ability, the desire to lower the servo's internal temperature, high frequency of energy-consuming braking), external resistors can be connected; for details of resistor model selection, please refer to "Table 3-4 Selection of Models of External Braking Resistor ".

2）Relevant Parameters and Setting

Attention
Parameters of the regenerative braking circuits have been set before drivers leave the factory. In order to ensure normal working of the drivers, the user may not change the parameters above by himself. If parameter adjustment is necessary, the user should consult the manufacturer.

Each driver's regenerative braking status can be known by observing the internal output signal Regenerative Braking Circuit (ULB) or POW indicator light on the operation panel (details of which are in "2.2.3 Description of Display of Indicator Lights").

5.11.2 Dynamic Braking

1) Definition of Dynamic Braking

Dynamic braking is a commonly used way for the servo motor's emergency stop. By short-circuiting the servo motor's 3-phase windings, the user can achieve emergency stop of the motor (See Figure 5-10). The servo driver has a built-in current-limiting resistor dedicated to dynamic braking.

Prohibited
Never artificially short-circuit the motor's power wiring terminals in the hope of the effect of dynamic braking

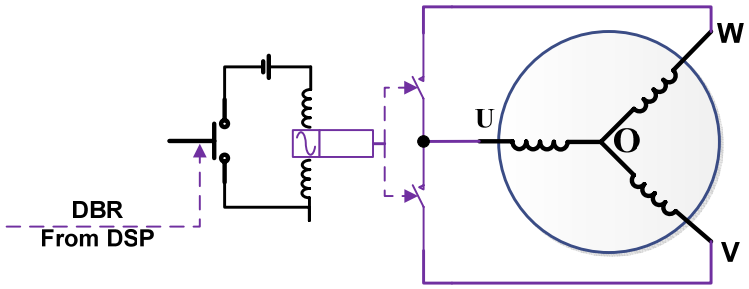


Figure 5-10 Working Principle of Dynamic Brake

2) Relevant Parameters and Setting

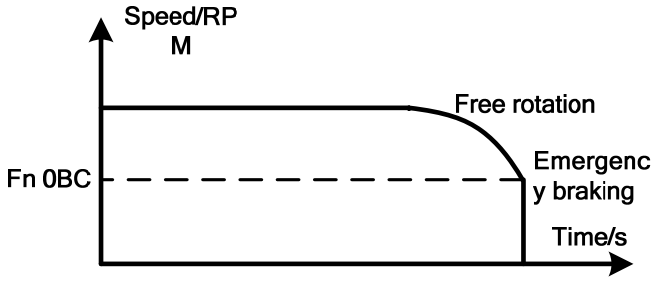


Figure 5-11 The Motor Speed Allowed for Starting the Dynamic Brake

Parameter No.	Parameter Description	Setting Range	Setting Unit	Ex-works Setting
Fn 0BC	Motor speed allowed for the dynamic brake: When motor speed is higher than it, no braking is allowed, and the motor is rotating under the free mode; When motor speed is lower than it, braking starts (See Figure 5-11)	0～10000	rpm	1/2 rated speed
Fn 0BD	Dynamic braking modes: 0: During deceleration, the motor freely decelerates until it stops; the stopped shaft is left free; 1: During deceleration, the motor freely	0～3	—	0

	decelerates until it stops; the stopped shaft is under the control of dynamic braking; 2: During deceleration, the motor is stopped by dynamic braking; the stopped shaft is left free; 3: During deceleration, the motor is stopped by dynamic braking; the stopped shaft is under dynamic braking			

Working status of the driver's dynamic brake can be observed via the internal output signal Dynamic Brake Release (DBR-OFF).

5.11.3 Electromagnetic Braking

1) Applications of an Electromagnetic Brake

In case of vertical shaft (or a shaft under an external force) as shown in Figure 5-12 below, in order to prevent gravity (or any other external force) from causing the servo motor to rotate without turning on the servo motor, an electromagnetic brake (band-type brake) should be used for the servo motor.

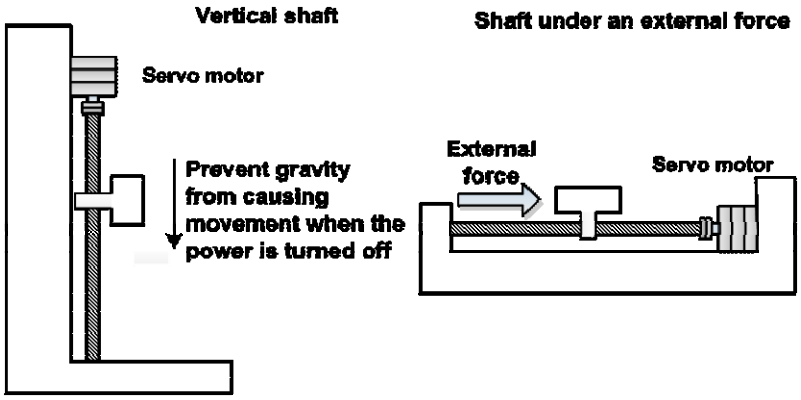


Figure 5-12 Application of a Servo Motor with an Electromagnetic Brake

2) Connection of the Electromagnetic Brake

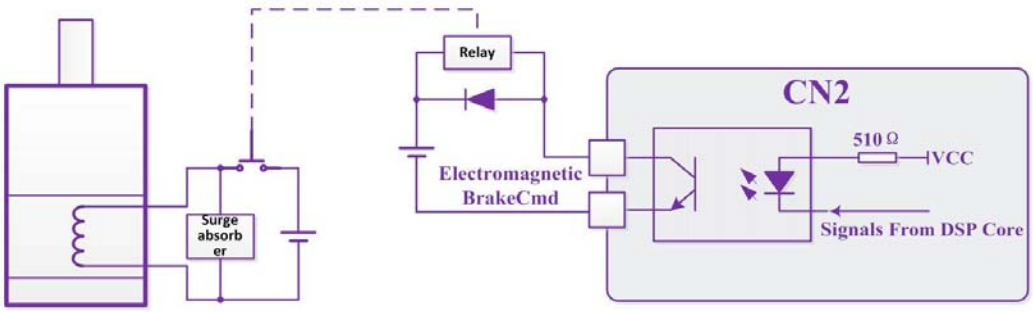


Figure 5-13 Wiring of the Electromagnetic Brake

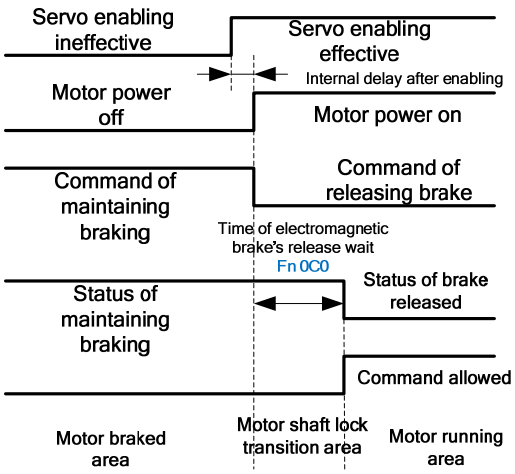
Configure any of the digital output signal ports SignalOut 1~4 with electromagnetic brake control (BRK-OFF) signal (see 5.2.3 for details), and use an external relay and power supply (prepared by the user himself) to control on-off operation of the motor brake's coil (as shown in Figure 5-13), so as to achieve the purpose of controlling the electromagnetic brake.

3) Relevant Parameters and Setting

Parameter No.	Parameter Description	Setting Range	Setting Unit	Ex-works Setting
Fn 0C0	Duration of releasing electromagnetic brake: time from the driver's sending of release command to the brake's complete release, which is to be determined by the brake coil's electrical parameters	0～3000	ms	50
Fn 0C1	Speed during electromagnetic brake's braking wait: value of such speed must be bigger than Fn 0C3's value, or the system will use Fn 0C3's value by default	0～500	rpm	300
Fn 0C2	Time of electromagnetic brake's braking wait	0～10000	ms	3000
Fn 0C3	Braking action triggering speed of electromagnetic brake	0～300	rpm	100
Fn 0C4	Duration of electromagnetic brake's braking action: time from the driver's sending of the lock command to the brake's complete lock, which is to be determined by the brake coil's electrical parameters	0～3000	ms	50

a. Process of Electromagnetic Brake's Release

When status of the Servo Enabling (SON) signal changes from ineffective to effective, after a period of internal delay (to be determined by the driver), the motor's windings are energized and the driver has sent the command for releasing the brake, but the electromagnetic brake will not be released immediately, and will wait for a period of release wait "Fn 0C0"; during such time of wait, the motor shaft is at zero speed and locked, the driver doesn't allow action on any command it has received; when time of release wait has elapsed, the electromagnetic brake is released, and the driver makes the action required by the command sent from the upper device. Detailed sequence of actions is as shown in Figure 5-14 below:



igure 5-14 Sequence of Release Actions of the Electromagnetic Brake

b. Braking Process of the Electromagnetic Brake

Braking process of the electromagnetic brake is divided into two circumstances: 1. When the motor is running at a low speed (motor speed is lower than braking action triggering speed “Fn 0C3”), the electromagnetic brake directly acts; 2. When the motor is running at a high speed, the electromagnetic brake’s direct action is very likely to cause wear of the braking mechanism, so braking action may be started after a delay or a period of the motor’s low-speed running.

When the motor is running at a low speed, and status of Servo Enabling (SON) signal turns from effective to ineffective, the driver doesn’t allow action on any command received, the shaft is forcibly locked at zero speed, and the command of maintaining braking is sent. After a period, i.e. when time of electromagnetic brake’s braking action “Fn 0C4” has elapsed, the electromagnetic brake starts braking action, the motor’s windings are deenergized, and the motor enters the motionless state. Detailed sequence of actions is as shown in Figure 5-15.

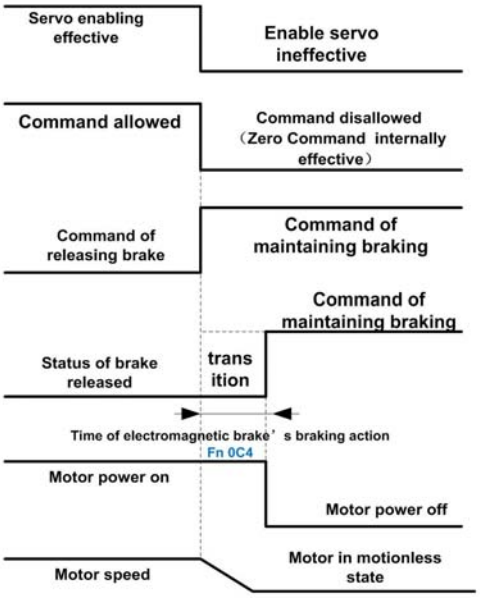


Figure 5-15 Electromagnetic Brake's Sequence of Actions (low-speed running)

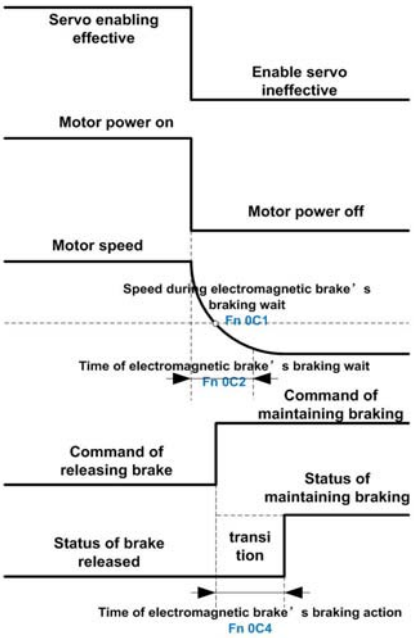


Figure 5-16 Electromagnetic Brake's Sequence of Actions (high-speed running)

When the motor is running at a high speed, and the driver has a fault or its enabling becomes ineffective, the motor's windings are deenergized immediately, the motor rotates under the effect of inertia, when any of the two conditions (namely motor speed has lowered to speed ("Fn 0C1") during electromagnetic brake's braking wait, or the elapse of time after motor windings' deenergization has exceeded the time of electromagnetic brake's braking wait "Fn 0C2") is met, the driver sends the command of maintaining braking, after a period of time,

namely after the time of electromagnetic brake's braking action "Fn 0C4", the electromagnetic brake starts braking action. Detailed sequence of actions are as shown in Figure 5-16.

5.12 Output Setting of Encoder

5.12.1 Frequency-dividing Output of Encoder's Phase-A/B Signals

Encoder's Phase A and Phase B pulse output signals can be used as upper computer's positioning counting and speed measuring signals; their divider for frequency dividing can be determined through configuration parameter "**Fn 03E**". Figure 5-17 shows details of frequency dividing.

Parameter No.	Parameter Description	Setting Range	Ex-works Setting
Fn 03E	Divider for frequency-dividing output of encoder's pulse	1~128	1

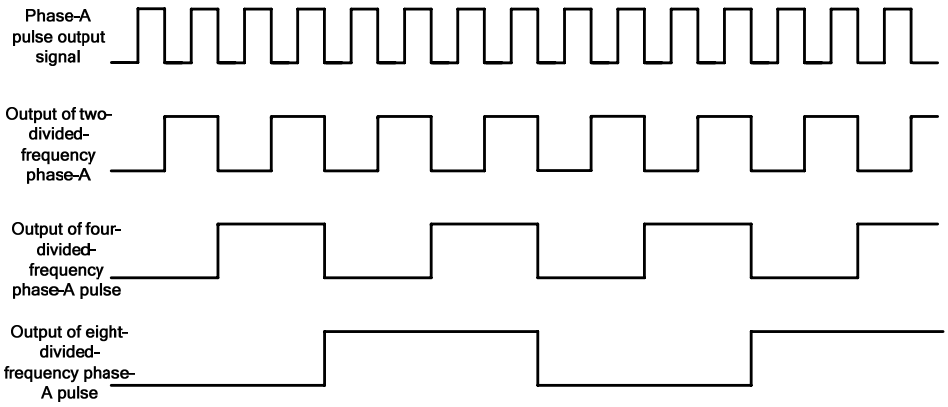


Figure 5-17 Output of 2/4/8-divided-frequency Phase-A Pulse Signal

5.12.2 Setting of Encoder's Phase-Z Output Pulse Stretching

Encoder's Phase-Z pulse output signal can be used as upper device's positioning counting signal. Based on difference in upper device's capture velocity, Phase-Z pulse output signal can be stretched appropriately though configuration parameter "**Fn 03F**". Figure 5-18 shows details of Phase-Z output pulse stretching.

Parameter No.	Parameter Description	Setting Range	Setting Unit	Ex-works Setting
Fn 03F	Encoder Phase-Z pulse output width When this parameter is set as a negative value, Pulse-Z's output polarity is reversed	-15～+15	Quadruple A/B Orthogonal width	2

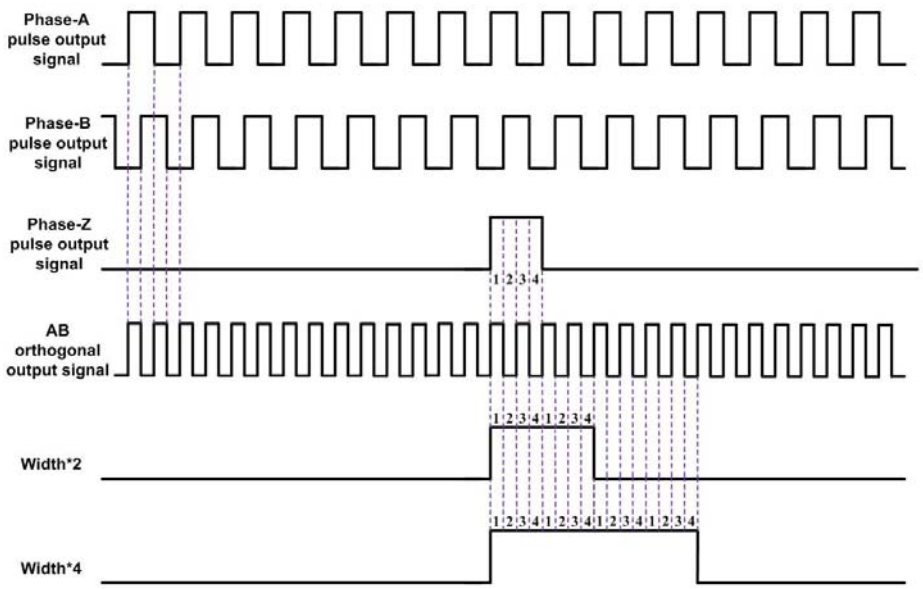


Figure 5-18 Phase-Z Pulse Output Stretching

5.13 Functional Block Diagram of Control Principles

HS-series servo drivers' functional block diagram of control principles is as shown in Figure 5-19

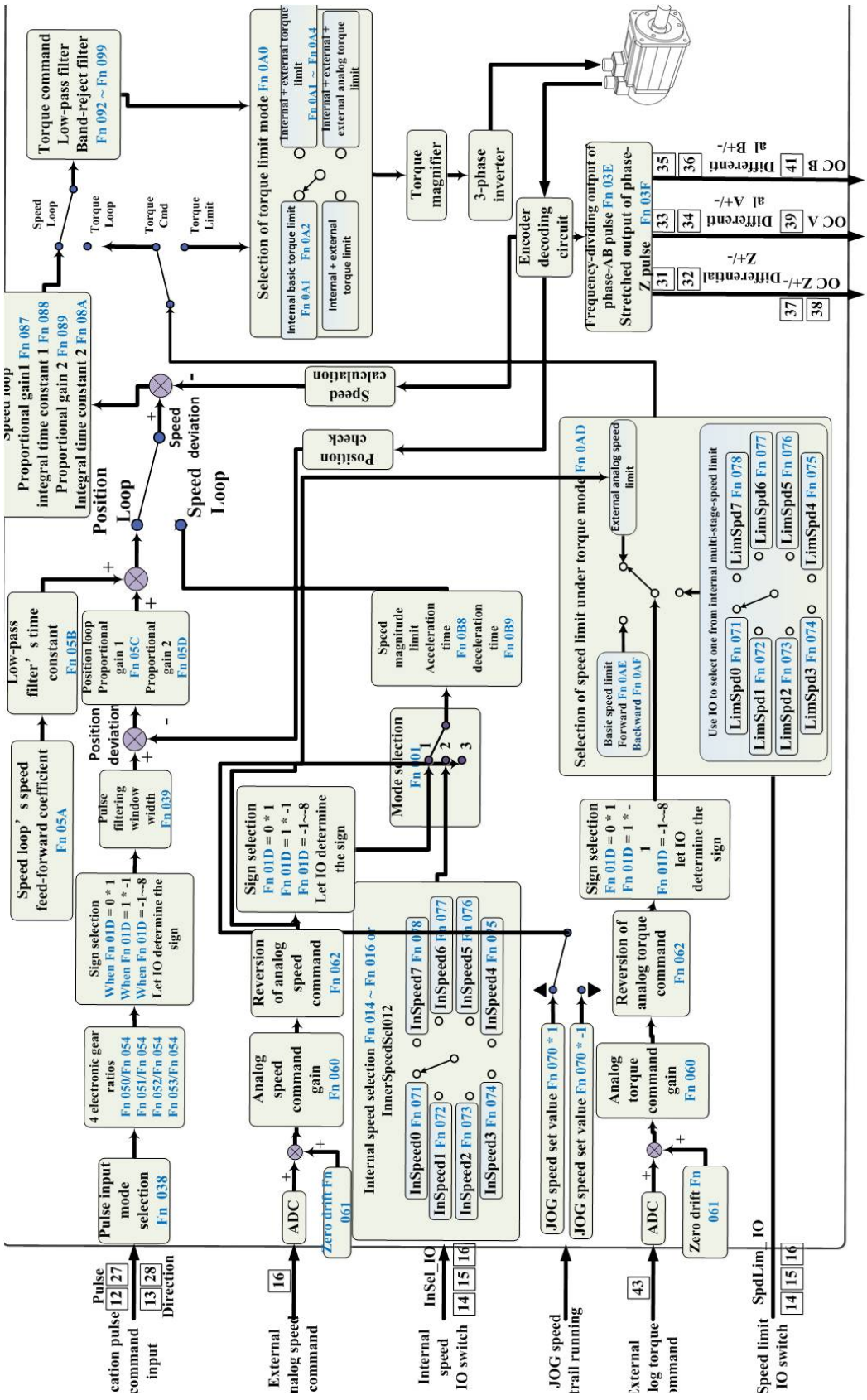


figure 5-19 the principle chart of controlling

Chapter VI Status Monitoring and Bus Communication

6.1 Dn Status Parameters Dn

Servo driver status parameter “Dn xx” records some current working status information of the motor. The user can, according to his needs, configure Fn 005 to display the motor’s working status information on the operation panel.

Dn Parameter No.	Description of Status Parameter
0	Motor’s current working speed (unit: rpm)
1	Frequency of position pulse command (unit: KHz)
2	Rate of motor’s effective torque (unit: 1‰)
3	Number of tracking error pulses in case of running under position control mode (unit: pulse)
4	Display of rotor position within motor’s single turn (unit: pulse)
5	Analog speed command voltage value in case of speed mode (unit: 1mV)
6	Torque command voltage value in case of torque control mode (unit: 1mV)
7	Motor speed command value (unit: rpm)

Table 6-1 Description of Commonly-used Status Parameter “Dn xx”

6.2 DAC Monitoring

An HS-series servo driver provides 2 channels of DAC output monitoring signals for observing the internal status parameters, but we don’t recommend use of them as feedback signals. The user may use corresponding configuration parameters to set the signal sources and amplitude values of the 2 DAC channels. The 2 channels of DAC’s maximum output range is -10V ~ +10V.

Configuration Parameter	Description of Configuration Parameter	Setting Range
Fn 0C8	Setting of DAC 1’s maximum value: It sets the value of “Dn xx” corresponding to DAC1’s output of +10V	1~32767
Fn 0C9	Setting of DAC 2’s maximum value: It sets the value of “Dn xx” corresponding to DAC2’s output of +10V	1~32767
Fn 0CA	Selection of DAC 1’s signal source: Its value is the serial No. “xx” in status parameter “Dn xx”	-1~256

Fn 0CB	Selection of DAC 2's signal source: Its value is the serial No. "xx" in status parameter "Dn xx"	-1~256

【Example】Use an Oscilloscope, the user can, via DAC 1, observe the oscillograph of the motor's current running speed. When Fn 0CA=00, it means Dn 00 (status parameter to indicate motor's speed) is selected as DAC 1's signal source. When Fn 0C8=3000, it means when DAC 1's output voltage is +10V, the motor's running speed is 3000rpm, namely a relationship of 300rpm:1V between the running speed and DAC 1's output voltage. By hooking the oscilloscope's probe to I/O port CN2-18 and using oscilloscope probe's clamps to connect CN2-2, the user can observe the oscillograph he wants to see.

【Note】When Fn 0CA/ Fn 0CB=-1, the corresponding DAC outputs a sawtooth wave, which is used for DAC output channel's self-test.

6.3 Setting of MODBUS Bus

By setting configuration parameter "Fn 000"=2, the user enables the HS-series servo driver to work under Modbus bus application mode.

Modbus bus' control mode is configured by the parameter "Fn 003".

Parameter No.	Description of Parameter	Setting Range	Ex-works Setting
Fn 003	Modbus bus control mode: 0: standby mode 1: torque running mode; 2: speed running mode; 3: incremental position running mode; 4: absolute position running mode	0～4	0

Modbus bus is built on hardware circuits of RS232 or RS485; the user can use configuration parameter "Fn 0F0" to shift between them. The default mode is RS232 communication.

Modbus bus' baud rate setting is determined by configuration parameter "Fn 0F1".

Range of Modbus bus node No.s is 1~255, and is set by configuration parameter "Fn 0F2".

Parameter No.	Description of Parameter	Setting Range	Setting Unit	Ex-works Setting
Fn 0F0	Modbus communication mode 0 (RS232), 1 (RS485)	0～1	—	0
Fn 0F1	Modbus bus baud rate	12~1152	100bps	96
Fn 0F2	Modbus bus node No.	1~255	—	1

【Note】HS-series drivers' default Modbus configuration employs RS 232 communication, if any user needs to use RS485 communication, he must explain it when placing the order.

When any user uses RS485 when he is building his network, he needs to connect the system-level 120Ω matching resistor himself.

For detailed instructions of Modbus communication control, please refer to User Manual for HS Servo Drivers' Communication.

6.4 CAN Bus Setting

By setting configuration parameter "Fn 000"=3, the user enables the HS-series servo driver to work under CAN bus application mode.

CAN bus' control mode is configured by the parameter "Fn 003".

Parameter No.	Description of Parameter	Setting Range	Setting Unit
Fn 003	CAN bus baud rate: 0: standby mode 1: torque running mode; 2: speed running mode; 3: incremental position running mode; 4: absolute position running mode	0～4	0

CAN bus' baud rate setting is determined by configuration parameter "Fn 0F3".

Range of CAN bus node No.s is 0~255, and is set by configuration parameter "Fn 0F4".

HS-series servo drivers' CAN bus configuration supports the CanRegVist bus with HollySys' independent intellectual property rights. CanReg protocol's group No. allocating number is determined by the configuration parameter "Fn 0F5".

Parameter No.	Description of Parameter	Setting Range	Setting Unit	Ex-works Setting
Fn 0F3	CAN bus baud rate	0～1000	KHz	50
Fn 0F4	CAN bus node No.	0~255	—	1
Fn 0F5	CanReg protocol's group No. allocating number	1~255	—	1

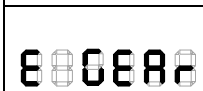
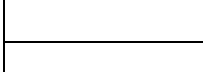
For detailed description of CAN communication control, please refer to *User Manual for HS Servo Drivers' Communication*.

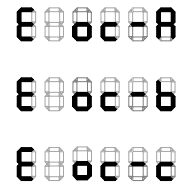
Chapter VII Fault Alarm and Treatment

7.1 Alarm Codes and Troubleshooting

Alarm (ALM) codes include codes for fault (FAULT) and codes for warning (WARN); the “E xxxx” shown on the operation panel indicates the cause of the driver’s current fault (FAULT) or warning (WARN).

Alarm Code	Meaning	Fault Level	Cause of Alarm	Troubleshooting
E.oHEcc	Abnormal panel communication	Fault (FAULT)	Communication between the driver’s operation panel and DSP is abnormal a. Communication cable has poor contacting or is damaged; b. Noise interference; c. Panel module or DSP’s communication interface is damaged	* Disconnect other power-consuming devices , turn on again, if the alarm still occurs, it can be judged that the driver is damaged, and need be replaced with a good one with the same specifications * After turning on again, if display is normal, but when other power-consuming devices are also working, the alarm occurs, it shows that the working environment is severely interfered by noise
E.brSt	Braking resistor’s resistance value is too small	Fault (FAULT)	Regenerative braking resistor’s resistance value is too small	* Return it to the manufacturer for repair
E.dnrE	The driver has no corresponding alarm	Warning (WARN)	Servo motor doesn’t respond to the driver’s commands a. Motor rotor is locked; b. Motor cable is disconnected; c. Servo motor has a fault	* Check machine’s installation to see if torque limit value is too small; * Check motor cables; * Return it to the manufacturer for repair
E.EnAb	Encoder AB alarm	Warning (WARN)	a. Encoder wiring fault; b. Encoder is damaged; c. Noise interference is severe	* Confirm encoder wiring is reliable and correct; * Shorten encoder’s feedback wires, perform wiring strictly as per wiring requirements (see Table 3-1 Specifications of Wires and Cables for Different Power Terminals and Signal Ports); * Increase the value of QEP encoder’s sampling filtering
E.EncU	Encoder UVW alarm			

				cycle parameter “Fn 135”【only professionals may perform it】; * Return it to the manufacturer for repair
	Abnormal fram reading and writing	Fault (FAULT)	Fram data writing operation check error	* Return it to the manufacturer for repair
	Abnormal electronic gear parameters	Warning (WARN)	Wrong configuration of electronic gear parameters	* Refer to “5.4.5 Setting of Electronic Gear” to reconfigure electronic gear parameters
	Undervoltage of working power supply	Warning (WARN)	a. Voltage of the working power supply is too low; b. Voltage threshold for undervoltage check is too high; c. Any fault in the driver voltage measuring circuit	* Check voltage of the power supply; * Reconfigure undervoltage check threshold parameter “Fn 0D1”; * Ignore undervoltage alarm by use of “Fn 0D2” * Return it to the manufacturer for repair;

Alarm Code	Meaning	Fault Level	Cause of Alarm	Troubleshooting
	Overcurrent	Warning (WARN)	Current of servo driver’s working power circuit is higher than prescribed value: a. Motor’s start and stop are too abrupt; b. Driver is damaged; c. Motor connections U, V and W are short-circuited, or any of its windings is short-circuited to its enclosure; d. Any fault of the motor; e. Self-protection of the power module f. Strong oscillation of the servo motor	* Disconnect the motor’s connection, if any alarm occurs immediately after turning on and entering enabling status, the driver is damaged, and need be replaced with a good one with the same specifications; * Turn off the power supply, check motor’s U, V and W connections, and check whether their insulation resistance with the enclosure is correct; measure resistance of the motor’s 3 phases, if they are not balanced, the motor is damaged and need be replaced; * Readjust servo gain parameter to let servo motor run stably; * Raise current check threshold “Fn 0D5” and window filtering width “Fn 0D6”.

	Overload	Fault (FAULT)	The motor runs with its torque higher than rated torque for a long time; a. Load is too big; b. Motor oscillation; c. Electromagnetic brake is locked; d. Motor and its encoder's wiring is wrong; e. Connection between encoder feedback wire and motor is loose; f. The motor's fault	* Increase the driver's and motor's capacity, increase the time for acceleration and deceleration on the speed curve, decrease the motor's load; * Readjust the gain; * Confirm the electromagnetic brake is released when the motor is running; * Check to confirm the motor and encoder are wired correctly; * Check to confirm the encoder and motor shaft are coupled firmly; * Return it to the manufacturer for repair
	Overspeed	Warning (WARN)	The motor's galloping: a. The set speed command's value is too big; b. Encoder's feedback signal is wrong; c. The load's fluctuation is too big; d. Any fault of the motor	* Confirm the commanded speed is not higher than maximum speed; * Confirm the encoder's wiring is correct; * Check the machine's installation; * Return it to the manufacturer for repair
	Overvoltage of the working power supply	Fault (FAULT)	a. Working power supply's voltage is too high; b. Driver's voltage measuring circuit has a fault	* Check voltage of power supply; * Return it to the manufacturer for repair
	Abnormal parameter configuration	Fault (FAULT)	Value of the configuration parameter is out of allowed range	* Use the default parameter; * Reconfigure the parameter
	Overflow of the position deviation counter	Warning (WARN)	Overflow of the position deviation counter: a. Position command's inputting frequency is too high; b. Position loop's gain is too small; c. Motor or encoder wiring is wrong; d. Motor torque is not enough, or the load is too big	* Correctly adjust the command pulse's inputting frequency; * Readjust the relevant gain; * Rectify the motor and encoder's wire and cable connection; * Replace the motor with another one with a bigger power, or lower the load

Alarm Code	Meaning	Fault Level	Cause of Alarm	Troubleshooting
	Alarm of power module's overheating	Fault (FAULT)	Power module is overheated because: a. Ambient temperature is too high; b. Driver fan has a fault; c. Servo motor has a fault; d. Motor load is too high; e. Energy-consuming braking circuit has a fault	* Improve driver's cooling conditions; * Lower driver's load, or used a driver with a higher power level; * External resistor's resistance value is too small; * Increase the value of overheating alarm threshold parameter "Fn 0D7" 【only professionals may perform it】 * Return it to the manufacturer for repair
	Alarm of power module	Fault (FAULT)	Hardware alarm of power module's overcurrent: a. Load fluctuation is too big; b. Gain is too big; c. Motor's start and stop are too abrupt; d. Three phases' windings are short-circuited; e. Power module is damaged	* Replace with a servo driver and servo motor that have a higher power level; * Readjust the relevant gain; * Increase the time for acceleration and deceleration; * Confirm motor wiring is correct; * Return it to the manufacturer for repair
	Power failure of working power supply	Fault (FAULT)	Voltage on the working power supply's incoming terminals are lost	* Confirm working power supply's incoming terminals are connected correctly; * If the terminal connection is correct but alarm still occurs, return the power supply to the manufacturer for repair
	Over-travel	Warning (WARN)	Number of tracking error pulses is > "Fn 0DA": a. Position command's inputting frequency is too high; b. Position loop's gain is too small; c. Over-travel parameter Fn 0DA's set value is too small; d. Motor or encoder wiring is wrong; e. Motor torque is not enough or the load is too big	* Correctly adjust command pulse's inputting frequency; * Readjust relevant gain; * Readjust set value of "Fn 0DA"; * Rectify the motor and encoder's wire and cable connection; * Replace the motor with another one with a bigger power, or lower the load

E.P518	Alarm of abnormal zero point of 1 phase's ADC	(FAULT)	Zero point fault of 1 phase's current monitoring ADC	* Return it to the manufacturer for repair
E.P528	Alarm of abnormal zero point of 2 phases' ADCs	Fault (FAULT)	Zero point fault of 2 phases' current monitoring ADCs	* Return it to the manufacturer for repair

Alarm Code	Meaning	Fault Level	Cause of Alarm	Troubleshooting
E.5PEE	Lock of rotor or stall	Warning (WARN)	Motor speed is too low (rotor is locked) or is too high, namely, speed error is too big: a. The encoder has errors or encoder's wiring is wrong b. Position command's inputting frequency is too high; c. Time for acceleration or deceleration is too short; d. Speed loop's overregulation is too big; e. The load's inertia is too big; f. Motor fault	* Replace the motor or encoder, correct encoder's cable connection; * Correctly adjust command pulse's inputting frequency; * Increase the time for acceleration or deceleration; * * Readjust the relevant gain, or decrease the parameter of load inertia ratio; * Decrease the load inertia, or replace the motor with another one with a bigger power; * Return it to the manufacturer for repair
E.USPn	Driver and motor are not matching	Fault (FAULT)	The driver doesn't match the motor's model	* Refer to "1.1.5 Description of Matching between the Driver and Motor" and reselect a suitable motor
E.2L65	Alarm of Pulse-Z loss of the encoder	Warning (WARN)	d. Encoder wiring fault; e. Damage to the encoder; f. Severe noise interference	* Confirm encoder wiring is reliable and correct; * Shorten the encoder's feedback wires, perform wiring strictly as per wiring requirements (see Table 3-1 Specifications of Wires and Cables for Different Power Terminals and Signal Ports); * Increase the value of QEP
E.2EtE	Alarm of too many Pulse-Z errors of			

	the encoder			encoder ’ s sampling filtering cycle parameter “Fn 135”【only professionals may perform it】; * Return it to the manufacturer for repair

7.2 Abnormal Performance and Troubleshooting

Abnormality	Cause of Abnormality	Troubleshooting
Under position mode, positioning is inaccurate	* The wire for position pulse setting or encoder’s feedback wire is too long, the shielded wire is not grounded; * When electrical noise is strong or motor driver power is big, position pulse output is not standard differential output, single-side setting or OC gate setting is selected; * Driver control wires and encoder feedback wires are arranged in a mixed wiring way with working power lines; * Upper device’s chips are weak in resistance to interference in a large-current environment	* The wire for position pulse setting or encoder’s feedback wire should be as short as possible, the shielded wire should be grounded strictly as required by “**错误！未找到引用源。** Connection of Input and Output Terminals”, control wires’ diameter should be increased (seeTable 3-1 Specifications of Wires and Cables for Different Power Terminals and Signal Ports); * Use a power supply isolating transformer and power supply filter to inhibit power supply noise, use differential output for pulse output, convert OC gate or single-side setting into differential setting on the output end; * Separate layout of power lines and control wires, control wires should be shielded ones, and strictly connected to the standard ground
Under speed mode, speed fluctuates	* Speed setting wire is interfered by noise: * Load fluctuation is too big; * Gain is too big	* The setting wire should be as short as possible, signal wire diameter should be increased, and shielded wires must be strictly grounded; * Driver’s and motor’s enclosure should be connected to the standard ground; * Provide the ability to perform zero-speed clamping when the motor is motionless; * Upper device’s power supply shall be an isolated power supply

Chapter VIII Maintenance

8.1 Check of Servo Motor

As the AC servo motor has not brushes, only simple daily check is enough. Table 8-1 gives the rough schedule of check. Please determine a suitable schedule according to your application conditions and environment.

Item of Check	Frequency of Check	Key Points of Check and Maintenance	Remarks
Confirmation of vibration and sound	Every day	Judge with feeling and hearing	Not stronger than in other days
Check of appearance	To be determined by status of oil contamination	Use cloth to wipe or a pneumatic tool to clean	
Measurement of insulation resistance (Measure between U/V/W output terminals and PE)	At least once a year	Cut off connection with the servo driver, use a 500V megohmmeter to measure insulation resistance, it is normal if the measured resistance value is over 10MΩ	When the measured resistance value is below 10MΩ, please contact the manufacturer in a timely manner
Replacement of oil seals	At least once every 5000 hours	Detach the servo motor from the machine, then replace the oil seals	Only applicable to servo motors with oil seals
Comprehensive check	At least once every 20000 hours, or once every 5 years	Please contact the manufacturer	The user should not detach or clean the servo motor himself
Prohibited			
Please don’t detach the servo motor for the purpose of maintenance or check.			

Table 8-1 Schedule of Servo Motor’s Check

8.2 Check of the Servo Driver

No servo driver need be checked every day, but at least one check each year is needed. Table 8-2 below shows frequency of check of the servo driver.

Danger			
When checking and maintaining a driver, don't directly touch or use any metal tool to touch any main-circuit terminal or any other part inside the driver before the four items of precaution below have been confirmed, or there will be danger of electric shock: ● Reliably shut off the driver's power supply, and wait for at least 15 minutes; ● All LED numerating tubes and indicator lights on the operation panel have turned out; ● POW indicator light on the operation panel has turned out; ● Use a voltage meter to measure the voltage between main-circuit terminals P and N, and the measured voltage value is lower than DC36V			
Item of Check	**Frequency of Check**	**Key Points of Check**	**Treatment of Abnormality**
Cleaning of main body and circuit board	At least once every year	No dust, filth, oil contamination, etc. exists	Use cloth to wipe or a pneumatic tool to clean
Loosening of bolts		Mounting bolts of the terminal plate and connectors may not be loose	Please tighten
Abnormality of parts on the main body and circuit board		No discoloration, damage or broken wire caused by heating may exist	Please contact the manufacturer

Table 8-2 Schedule of Servo Driver's Check

8.3 Rough Criteria for Change of Driver's Internal Parts

Electrical and electronic parts will have mechanical wear or aging, in order to ensure safety, please check them regularly as per the schedule in Table 8-3 below.

Name of Part	Standard Years for Change	Method of Change, etc.	Conditions of Use
Cooling fan	4～5	Please replace with a new one	Environment temperature: average annual temperature at 30℃ Load factor: under 80% Service factor: under 20 hours/day
Smoothing capacitor	7～8	Please replace with a new one (make such decision after investigation)	
Relay	—	Make a decision after investigation	
Fuse	10	Please replace with a new one	
Aluminum electrolytic capacitor	5	Please replace with a new circuit board (make such decision after investigation)	

Table 8-3 Rough Criteria for Change of Servo Driver's Internal Parts

As parameters of each servo driver overhauled by our company has been restored to their ex-works setting, please do restore them to your user setting before using the driver.

8.4 Storage of Drivers

1. Requirements of the environment for storing drivers

Environment Features	Requirement	Remarks
Environment temperature	0～+70℃	Temperature of the environment for long-time storage should be under 30℃, to avoid deterioration of capacitors' characteristics, the environment shall not have the conditions for condensation and freezing due to change of temperature
Environment humidity	5～95%RH	Measures like sealing with plastic film and protection with desiccants may be used
Other conditions	No direct radiation of the sun, dirt, erosive gases, flammable gases, oil mist, vapour, water dripping and vibration may exist, and saline matters should be kept at the lowest level	

2. If any driver is not used for a long time, it is recommended that the driver be energized once every 6 months, for over 30 minutes every time of energization, so as to avoid failure of any component inside it, or the driver should run with no load.

8.5 Warranty of Drivers

1. Any driver that has a fault or is damaged under normal conditions of use is entitled to warranty within 12 months starting from the date of shipping, after which, an appropriate charge is required for the repair service requested;

2. Even within the 12-month period of warranty, a certain amount of repair charge will be required in case of any of the following conditions:

(1) The machine is damaged due to failure to connect or operate as instructed by the user's manual;

(2) Damage caused by fire, flood, and abnormal voltage;

(3) Damage caused by application of the driver beyond its normal function.

8.6 Scrapping

When scrapping a driver, please take care to

Avoid explosion of electrolytic capacitors: when incinerating the electrolytic capacitors of the main circuit and on the printed circuit board, they will probably explode.

Avoid generation of waste gases: when incinerating socket connectors, printed circuit boards and other plastic parts, toxic gases will probably be generated.

Use correct treatment methods: please treat the scrapped drivers as industrial waste.

Appendix – Configuration Parameters of HS-series Servo Driver

The configuration parameters in the form of "**Fn xxx**" of each servo driver, are the system information set up for the corresponding motor, which is the basis for the system's ability to work normally. All such parameters have been configured when drivers are delivered out of the factory. Most of these parameters do not need to be modified, and users can change some parameters according to their own needs for use of the drivers, so as to realize different purposes of their application.

[Note] Other parameters not indicated are internal parameters, which have been set when drivers are delivered out the factory and do not need to be modified in normal cases; In case that modification is needed in special circumstances, please contact the factory.

A.1 Work Control Modes

Fn 000	Parameter Name	**Application work mode**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	1~3	**—**	**1**	**When power is on again**	错误！未找到引用源。/错误！未找到引用源。/错误！未找到引用源。
	1: control port's ordinary hard-wired work mode; 2. Modbus bus mode; 3. CAN bus mode				

Fn 001	Parameter Name	**Motor control mode**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	-1~10	**—**	**2**	**Upon re-enabling**	错误！未找到引用源。
	-1: Manufacturer test mode: 0: External speed running mode Speed control is achieved by receiving the analog speed commands sent by the upper device 1: Internal speed mode: Speed control is achieved by selecting from 8 internal speed values via the value of the combination of digital input signals InnerSpeedSelect 0/1/2 2: External pulse position mode: Position control is achieved by receiving "pulse+direction" commands sent by the upper device 3: JOG inching running mode:				

	It is trial running mode, conducting trial inching running of the servo motor via the operation panel 4: Torque running control mode: Torque control is achieved by receiving the analog torque commands sent by the upper device 5~10: Mixed control mode: It achieves switching between the first mode and the second mode via the status of Control Mode Switch;

	OFF (the first mode)	ON (the second mode)
5	External pulse position mode	External analog speed mode
6	External pulse position mode	Internal speed mode
7	External pulse position mode	External analog torque mode
8	Internal speed mode	External analog speed mode
9	Internal speed mode	External analog torque mode
10	External analog speed mode	External analog torque mode

Fn 003	Parameter Name	**Modbus/CAN bus control mode**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0~4	**—**	**0**	**When power is on again**	错误！未找到引用源。/错误！未找到引用源。
	0: standby mode; 1:torque running mode; 2: speed running mode; 3: incremental position operation mode; 4: absolute position running mode;				

A.1 System Basic Parameters' Control

Fn 004	Parameter Name	**Definition of motor rotation direction**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0~1	**—**	**0**	**When power is on again**	错误！未找到引用源。
	Viewed from the side of the motor shaft,0: counter-clockwise direction is defined as forward rotation of the motor; 1: clockwise direction is defined as forward rotation of the motor;				

Fn 005	Parameter Name	**Default displayed value of the operation panel**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0~255	**—**	**0**	**Immediately**	**6.1**
	By default, the operation panel displays the "Dn xx" status value, and the ex-works setting displays "Dn 00" , which is the motor feedback speed value				

Fn 006	Parameter Name	**Loaded motor model**		关联模式 Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	1-30000	**—**	**—**	**When power is on again**	**Remarks**
	For the existing servo motor model code, please refer to the Remarks.				

Fn 007	Parameter Name	**Loading of ex-works setting value**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0~1	**—**	**0**	**When power is on again**	错误！未找到引用源。
	When -1 is written in and power is turned on again, the current operating parameters will be saved into the user backup area. When 1 is written in and power is turned on again, the ex-works setting values for the motor model corresponding to "**Fn 006**" will be reset. When 2 is written in and power is turned on again, parameters in the user backup area willl be read out as current parameters and the current parameters will be saved.				

Fn 008	Parameter Name	**System password setting**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	-32768~32767	**—**	**1688**	**When power is on again**	**—**
	User password: 1688; when user password is not 1688, changing parameters by mistake can be prevented.				

A.2 Digital Input Ports

Fn 00C	Parameter Name	**Coefficient of digital input port's filtering cycle**		Related Mode	**Position, speed and torque**
	Setting Range	Setting unit	Ex-works Setting	Effective Time	Reference
	0~255	**—**	**100**	**When power is on again**	错误!未找到引用源。
	The bigger the numerical value, the better the filtering effect.				

Fn 00E	Parameter Name	**Bit 1 of the controlling bits for digital input's exclusive OR or reversion operation**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0000~1111	**—**	**0000**	**Immediately**	错误！未找到引用源。
	Thousands digit: Signalln 4; hundreds digit: Signalln 3; tens digit: Sinalln 2; ones digit: Signalln 1; When the corresponding digit's value is 1, it means the input signal is reversed; when the corresponding digit's value is 0, it means the input signal is not reversed.				

Fn 00F	Parameter Name	**Bit 2 of the controlling bits for digital input's exclusive OR or reversion operation**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0000~1111	**—**	**0000**	**Immediately**	错误！未找到引用源。
	Thousands digit: Signalln 8; hundreds bit: Signalln 7; tens bit: Sinalln 6; ones bit: Signalln 5; When the corresponding digit's is 1, it means the input signal is reversed; when the corresponding digit's value is 0, it means the input signal is not reversed.				

A.3 Internal Control Signals

Fn 010	Parameter Name	**Servo Enabling (SON) setting**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	-8 ~ 1	**—**	**-1**	**Immediately**	错误！未找到引用源。/错误！未找到引用源。/错误！未找到引用源。
	1:internally valid; 0: internally invalid; -1~-8: to be determined by digital input signal ports (SignalIn 1~8). Used to control whether the servo motor winding is energized;				

Fn 011	Parameter Name	**Alarm Reset (ALM setting**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	-8 ~ 1	**—**	**-2**	**Immediately**	错误！未找到引用源。/错误！未找到引用源。/错误！未找到引用源。
	1:internally effective; 0: internally ineffective; -1~-8: to be determined by digital input signal ports (SignalIn 1~8). Only used to reset alarm of warning (WARN); for reset of alarm of fault (FAULT), reenergization is needed.				

Fn 012	Parameter Name	**Emergency Stop setting**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	-8 ~ 1	**—**	**1**	**Immediately**	错误！未找到引用源。/错误！未找到引用源。/错误！未找到引用源。
	1:internally ineffective; 0: internally effective; -1~-8: to be determined by digital input signal ports (SignalIn 1~8). Emergency stop signal is low-level-effective, used for emergency stop, and the motor winding is rapidly deenergized at this moment				

Fn 014	Parameter Name	**Internal Selection 0 (INSEL0) setting**		Related Mode	**Position, internal speed**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	-8 ~ 1	**—**	**-4**	**Immediately**	错误!未找到引用源。/错误！未找到引用源。/错误！未找到引用源。 (错误！未找到

					引用源。)
	1: internally effective: 0; internally ineffective: -1~-8; to be determined by digital input signal ports (SignalIn 1~8). Under the internal speed mode, switch to the internal speed INSPD0; under position mode, switch to electronic gear ratio GEAR0.				

Fn 015	Parameter Name	**Internal Selection 1(INSEL 1) setting**		Related Mode	**Position, internal speed**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	-8 ~ 1	**—**	**-5**	**Immediately**	错误！未找到引用源。/错误！未找到引用源。/错误！未找到引用源。(错误！未找到引用源。)
	1: internally effective: 0; internally ineffective: -1~-8; to be determined by digital input signal ports (SignalIn 1~8). Under the internal speed mode, switch to the internal speed INSPD1; under position mode, switch to electronic gear ratio GEAR1.				

Fn 016	Parameter Name	**Internal Selection 2(INSEL 2) setting**		Related Mode	**Internal speed**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	-8 ~ 1	**—**	**0**	**Immediately**	错误！未找到引用源。/错误！未找到引用源。/错误！未找到引用源。
	1: internally effective: 0; internally ineffective: -1~-8; to be determined by digital input signal ports (SignalIn 1~8). Under the internal speed mode, switch to the internal speed INSPD2.				

Fn 017	Parameter Name	**External Forward-rotation Torque Limit (TCCW) setting**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	-8 ~ 1	**—**	**0**	**Immediately**	错误！未找到引用源。/错误！未找到引用源。/错误！未找到引用源。
	1: internally effective: 0; internally ineffective: -1~-8; to be determined by digital input signal ports (SignalIn 1~8).				

Fn 018	Parameter Name	TCW setting		Related Mode	Position, speed and torque
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	-8 ~ 1	—	0	Immediately	错误！未找到引用源。/错误！未找到引用源。/错误！未找到引用源。
	1: internally effective: 0; internally ineffective: -1~-8; to be determined by digital input signal ports (SignalIn 1~8).				

Fn 019	Parameter Name	Gain Shifting (GAIN) setting		Related Mode	Position, speed and torque
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	-8 ~ 2	—	0	Immediately	错误！未找到引用源。/错误！未找到引用源。/错误！未找到引用源。
	When setting different values for Fn019, refer to the following explanation:				
	2	When |speed feedback value| < "**Fn 0B2 – Fn 0B3**"		No. 1 gain	
		When |speed feedback value| > "**Fn 0B2 + Fn 0B3**"		No. 2 gain	
	1	No.2 gain is used invariably			
	0	No.1 gain is used invariably			
	-1~-8	OFF: Ineffective		No. 1 gain	
		On: Effective		No. 2 gain	

Fn 01A	Parameter Name	Control Mode Shifting (CMODE) setting		Related Mode	Position, speed and torque
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	-8 ~ 1	—	0	Immediately	错误！未找到引用源。/错误！未找到引用源。/错误！未找到引用源。
	1: internally effective: 0; internally ineffective: -1~-8; to be determined by digital input signal ports (SignalIn 1~8). This parameter is used for mixed control mode; by using Control Mode Shifting (CMODE) signal, it enables shifting between No.1 and o.2 modes; please refer to 5.1 for details.				

Fn 01B	Parameter Name	Zero-speed Set/Pulse Prohibited (ZSPD/INH) setting	Related Mode	Position, speed and torque

	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	-8 ~ 1	**—**	**-8**	**Immediately**	错误！未找到引用源。**/** 错误！未找到引用源。**/** 错误！未找到引用源。**(**错误！未找到引用源。**)**
	1: internally effective: 0; internally ineffective: -1~-8: to be determined by digital input signal ports (SignalIn 1~8). Under position mode,Pulse forbiddening(INH) signal shuts the pulse input counter, the servo motor enters shaft-locked status; under other modes, Zero-speed Set (ZSPD) signal will ignore speed command's value, and the motor will enter shaft-locked status.				

Fn 01C	Parameter Name	**Error resetting (CLR) setting**		Related Mode	**Position**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	-8 ~ 1	**—**	**-3**	**Immediately**	错误！未找到引用源。**/**错误！未找到引用源。**/5.4.1**
	1: internally effective: 0; internally ineffective: -1~-8: to be determined by digital input signal ports (SignalIn 1~8). This signal resets the driver's pulse command error counter				

Fn 01D	Parameter Name	**Command Reversion(COM-INV) setting**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	-8 ~ 1	**—**	**0**	**Immediately**	错误！未找到引用源。**/**错误！未找到引用源。**/**错误！未找到引用源。
	1: internally effective; 0: internally ineffective; -1~-8: to be determined by digital input signal ports (SignalIn 1~8). This signal determines whether the position, speed and torque commands of the driver are reversed.				

Fn 01E	Parameter Name	**Forward Rotation Prohibited (CCWL) setting**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	-8 ~ 1	**—**	**-6**	**Immediately**	错误！未找到引用源。**/**错误！未找到引用源。**/**错误！未找到引用源。
	1: internally effective; 0:; internally ineffective; -1~-8: to be determined by digital input signal ports (SignalIn 1~8). This signal enables the motor to stop forward-direction rotation				

Fn 01F	Parameter	**Backward Rotation Prohibited**	Related	**Position, speed**

	Name	**(CWL) setting**		Mode	**and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	-8 ~ 1	**—**	**-7**	**Immediately**	错误！未找到引用源。/错误！未找到引用源。/错误！未找到引用源。
	1: internally effective: 0: internally ineffective; -1~-8: to be determined by digital input signal ports (SignalIn 1~8). This signal enables the motor to stop reverse-direction rotation				

Fn 02B	Parameter Name	**Servo Enabling (SON) signal's triggering mode**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0 ~ 1	**—**	**0**	**Immediately**	错误！未找到引用源。
	0: SON high-level-effective mode; 1: "Servo Enabling" (SON) rising-edge-trigger-effective mode; 【Note】Before turning power on, you need to check to confirm "Servo Enabling" (SON) signal is in the ineffective status, to ensure work safety after the fault is eliminated, and to avoid the danger of galloping which will be caused if the "Servo Enabling" (SON) is not disabled when the power is turned on.				

Fn 02C	Parameter Name	**Clearing of Position Tracking Error Pulse**		Related Mode	**Position**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0 ~ 1	**—**	**0**	**Immediately**	**5.4.1**
	When digital input signal SON is ineffective, whether deviation of the position tracking error pulses should be reset: 0: eliminate; 1: do not eliminate it, the upper device can read the count of the position tracking error pulses.				

Fn 02D	Parameter Name	**Way of clearing position error through the input port**		Related Mode	**Position**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0 ~ 1	**—**	**0**	**Immediately**	**5.4.1**
	0: clear at the high level; 1: clear on the rising edge;				

Fn 02E	Parameter Name	**Way of stopping the motor when the driver forbids**	Related Mode	**Position**

		motor's rotation			
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0 ~ 1	**—**	**0**	**Immediately**	错误！未找到引用源。
	0: The motor stops after the all the position tracking error pulses have been sent; 1: when count of position tracking error pulses is reset, the motor is immediately stopped				

Fn 02F	Parameter Name	**Function of forward-rotation and backward-rotation position limit check**	Related Mode	**Position**	
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0 ~ 1	**—**	**0**	**Immediately**	错误！未找到引用源。
	0：0: over-travel (forward rotation prohibited/backward rotation prohibited) check is not performed; 1: over-travel(forward rotation prohibited/backward rotation prohibited) check is performed				

A.4 Digital output ports

Fn 030	Parameter Name	**Digital Output 1 (SIgnalOut1) setting**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	-32~ 1	**—**	**-17**	**Immediately**	错误！未找到引用源。/错误！未找到引用源。
	1: output always effective; 0: output always ineffective; -1~-32: to be determined by the corresponding digit of the internal status word				

Fn 031	Parameter Name	**Digital Output 2(SignalOut2) setting**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	-32 ~ 1	**—**	**-27**	**Immediately**	错误！未找到引用源。/错误！未找到引用源。
	1: output always effective; 0: output always ineffective; -1~-32: to be determined by the corresponding digit of the internal status word				

Fn 032	Parameter Name	**Digital Output 3(SignalOut3) setting**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	-32 ~ 1	**—**	**-1**	**Immediately**	错误！未找到引用源。/错误！未找到引用源。错误！未找到引用源。
	1: output always effective; 0: output always ineffective; -1~-32: to be determined by the corresponding digit of the internal status word				

Fn 033	Parameter Name	**Digital Output 4(SignalOut4) setting**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	-32 ~ 1	**—**	**-5**	**Immediately**	错误!未找到引用源。/错误！未找到引用源。
	1: output always effective; 0: output always ineffective; -1~-32: to be determined by the corresponding digit of the internal status word				

Fn 034	Parameter Name	**Bits for controlling exclusive OR or reversion operation of output signals**	Related Mode	**Position, speed and torque**

	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0000 ~ 1111	**—**	**1000**	**Immediately**	错误！未找到引用源。
	Ones digit: SignalOut1 reversion controlling digit; tens digit: SignalOut 2 reversion controlling digit; Hundreds digit: SignalOut3 reversion controlling digit; thousands digit: SignalOut4 reversion controlling digit; 1: the output signal corresponding to the digit is reversed; 0: the output signal corresponding to the digit isn't reversed;				

A.5 Pulse port Input and Output

Fn 038	Parameter Name	**Pulse Input Mode Selection**		Related Mode	**Position**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	1 ~ 6	**—**	**1**	**When power is on again**	错误！未找到引用源。
	1: single pulse train positive logic; 2. single pulse train negative logic; 3. double pulse train positive logic; 4: double pulse train negative logic; 5. orthogonal pulse positive logic; 6. orthogonal pulse negative logic.				

Fn 039	Parameter Name	**Width of Pulse Input Command's Window Filtering**		Related Mode	**Position**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0~ 127	**—**	**0**	**When power is on again**	错误！未找到引用源。
	The bigger, the better effect of the filtering, but the passing frequency of the input pulse will be lowered				

Fn 03E	Parameter Name	**Divider for Frequency-dividing output of Encoder's Pulse**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	1 ~ 128	**—**	**1**	**When power is on again**	错误！未找到引用源。
	Divider for frequency-dividing output of encoder's A/B signal;				

Fn 03F	Parameter Name	**Encoder's Phase-Z Pulse Output Width**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	-15 ~ 15	**Quadruple A/B orthogonal**	**2**	**When power is on again**	错误！未找到引用源。/错误！未找到引用源。

		width			
	To adapt to the different capturing capabilities of different upper devices, Phase-Z signal's output can be stretched. When a negative value is used for this parameter, Phase-Z pulse output signal's polarity shall be reversed.				

A.6 Judgment on Target-reaching Status

Fn 040	Parameter Name	**Threshold value at which position is deemed to be reached**		Related Mode	**Position**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	1 ~ 1024	**Pulse**	**50**	**Immediately**	错误！未找到引用源。
	When | number of tracking error pulses| is ≤ "**Fn 040** – **Fn 041**", the Position Reached (ATPOS）signal output is effective; When | number of tracking error pulses|＞ "**Fn 040** + **Fn 041**", the Position Reached (ATPOS）signal output is ineffective.				

Fn 041	Parameter Name	**Value of hysteresis of signal "Position Reached"**		Related Mode	**Position**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	-30000 ~ 30000	**Pulse**	**0**	**Immediately**	错误！未找到引用源。
	When |number of tracking error pulses| is ≤ "**Fn 040** – **Fn 041**", the Position Reached (ATPOS）signal output is effective； When |number of tracking error pulses| is ＞ "**Fn 040** + **Fn 041**", the Position Reached (ATPOS）signal output is ineffective.				

Fn 042	Parameter Name	**Value set as threshold at which position is deemed to be near**		Related Mode	**Position**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0 ~ 30000	**Pulse**	**500**	**Immediately**	错误！未找到引用源。
	When |number of tracking error pulses| is ≤ "**Fn 042** – **Fn 043**", the Near the Position (NTPOS）signal output is effective; When |number of tracking error pulses| is ＞ "**Fn 042** + **Fn 043**", the Near the Position (NTPOS）signal output is ineffective;				

Fn 043	Parameter Name	**The position gets close to return-difference set value**		Related Mode	**Position**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0 ~ 30000	**Pulse**	**50**	**Immediately**	错误！未找到引用源。
	When |number of tracking error pulses| is ≤ "**Fn 042** – **Fn 043**", the Near the Position (NTPOS）signal output is effective; When |number of tracking error pulses| is ＞ "**Fn 042** + **Fn 043**", the Near the Position (NTPOS）signal output is ineffective;				

Fn 044	Parameter Name	**Value set as threshold at which zero speed is deemed to be reached**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0 ~ 1000	**rpm**	**30**	**Immediately**	错误！未找到引用源。
	When |motor feedback speed| is ≤ "**Fn 044** – **Fn 045**", the Zero Speed Reached (AZSPD) signal output is effective; When |motor feedback speed| is ＞ "**Fn 044**+ **Fn 045**", the the Zero Speed Reached (AZSPD) signal output is ineffective;				

Fn 045	Parameter Name	**Value set as hysteresis of signal "Zero Speed Reached"**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0 ~ 1000	**rpm**	**5**	**Immediately**	错误！未找到引用源。
	When |motor feedback speed| is ≤ "**Fn 044** – **Fn 045**", the Zero Speed Reached (AZSPD) signal output is effective; When |motor feedback speed| is ＞ "**Fn 044**+ **Fn 045**", the Zero Speed Reached (AZSPD) signal output is ineffective;				

Fn 046	Parameter Name	**Value set as threshold at which target speed is deemed to be reached**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0 ~ 30000	**rpm**	**—**	**Immediately**	错误！未找到引用源。
	When |motor feedback speed| is ≥ "**Fn 046** + **Fn 047**", the Target Speed Reached (ATSPD) signal is effective; When |motor feedback speed| is ＜ "**Fn 046** - **Fn 047**", the Target Speed Reached (ATSPD) signal is ineffective;				

Fn 047	Parameter Name	**Value set as hysteresis of signal "Target Speed Reached"**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0 ~ 1000	**rpm**	**10**	**Immediately**	错误！未找到引用源。
	When |motor feedback speed| is ≥ "**Fn 046** + **Fn 047**"， the Target Speed Reached (ATSPD) signal is effective;				

	When |motor feedback speed| is ＜ "**Fn 046** - **Fn 047**"， the Target Speed Reached (ATSPD) signal is ineffective;

Fn 048	Parameter Name	**Value set as error in speed consistency**		Related Mode	**Speed**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0 ~ 100	**rpm**	**5**	**Immediately**	错误！未找到引用源。
	When ｜feedback speed – commanded speed｜is ≤ "**Fn 048**", Speed Consistent (VCOIN) signal output is effective; When ｜feedback speed – commanded speed｜is ＞ "**Fn 048**", Speed Consistent (VCOIN) signal output is ineffective;				

Fn 049	Parameter Name	**Value set as threshold at which target torque is deemed to be reached**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0 ~ 3000	**1‰ of rated torque**	**—**	**Immediately**	错误！未找到引用源。
	When |motor feedback torque| is ≥ "**Fn 049** + **Fn 04A**", the signal Target Torque Reached (ATTRQ) is effective; When |motor feedback torque| ＜ "**Fn 049** - **Fn 04A**", the signal l Target Torque Reached (ATTRQ) is ineffective;				

Fn 04A	Parameter Name	**Value set as hysteresis of signal "Target Torque Reached"**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0 ~ 3000	**1‰ of rated torque**	**10**	**Immediately**	错误！未找到引用源。
	When |motor feedback torque| is ≥ "**Fn 049** + **Fn 04A**", the Target Torque Reached (ATTRQ) signal is effective; When |motor feedback torque| is ＜ "**Fn 049** -**Fn 04A**", the Target Torque Reached (ATTRQ) signal is ineffective;				

A.7 Position Loop Control Parameters

Fn 050	Parameter Name	**Electronic gear ratio's numerator 1**		Related Mode	**Position**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	1~ 32767	**—**	**1**	**Immediately**	错误！未找到引用源。
	Electronic Gear Ratio 1= "**Fn 050 / Fn 054**"				

Fn 051	Parameter Name	**Electronic gear ratio's numerator 2**		Related Mode	**Position**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	1~ 32767	**—**	**1**	**Immediately**	错误！未找到引用源。
	Electronic Gear Ratio 1= "**Fn 051 / Fn 054**"				

Fn 052	Parameter Name	**Electronic gear ratio's numerator 3**		Related Mode	**Position**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	1~ 32767	**—**	**1**	**Immediately**	错误！未找到引用源。
	Electronic Gear Ratio 1= "**Fn 052 / Fn 054**"				

Fn 053	Parameter Name	**Electronic gear ratio's numerator 4**		Related Mode	**Position**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	1~ 32767	**—**	**1**	**即时生效 Immediately**	错误！未找到引用源。
	Electronic Gear Ratio 1 = "**Fn 053 / Fn 054**"				

Fn 054	Parameter Name	**Electronic gear ratio's denominator**		Related Mode	**Position**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	1~ 32767	**—**	**1**	**When power is on again**	错误！未找到引用源。
	The 4 gear ratios share a common denominator, and are required to be within 1 ~ 100, exceeding which will cause an alarm of parameter error; Shifting between the 4 electronic gear ratios can be achieved by Electronic Gear Selection 1 (ElectricGear1) and Gear Selection 2 (ElectricGear2).				

Fn 056	Parameter Name	**Coefficient of proportionality of pulse input command exponent filtering**		Related Mode	**Position**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0~ 30000	**—**	**0**	**Immediately**	错误！未找到引用源。
	Pulse command exponent filtering can transfer the step speed commands into exponential-type speed commands, and the number of position pulses remains unchanged. The higher the value, the longer the time for acceleration and deceleration, and the poorer dynamic response.				

Fn 057	Parameter Name	**Pulse input command moving smoothing filtering**		Related Mode	**Position**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	1~ 128	**—**	**32**	**When power is on again**	错误！未找到引用源。
	Pulse command smoothing filtering can transfer the step speed commands into gradual-change-type speed commands, the number of position pulses remains unchanged. The higher the value,the smoother the speed command.				

Fn 05A	Parameter Name	**Position loop speed feed-forward coefficient**		Related Mode	**Position**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0~100	**1%**	**0**	**Immediately**	错误！未找到引用源。
	Position loop's speed feed-forward gain coefficient				

Fn 05B	Parameter Name	**Time constant of position loop speed feed-forward low-pass filter**		Related Mode	**Position**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0~6400	**0.01ms**	**—**	**Immediately**	错误！未找到引用源。
	Position loop speed feed-forward gain coefficient				

Fn 05C	Parameter Name	**Position loop's No. 1 proportional gain Kp1**		Related Mode	**Position**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference

	1~10000	**0.01**	**—**	**Immediately**	错误！未找到引用源。/错误！未找到引用源。
	The position loop's No. 1 proportional gain. The higher the value, the quicker the response of the position loop, but overregulation or oscillation might occur.				

Fn 05D	Parameter Name	**Position loop's No. 2 proportional gain Kp2**		Related Mode	**Position**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	1~10000	**0.01**	**—**	**Immediately**	错误！未找到引用源。/错误！未找到引用源。
	The position loop's No. 2 proportional gain. The higher the value, the quicker the response of the position loop, but overregulation or oscillation might occur.				

A.8 Analog Input Parameters

Fn 060	Parameter Name	**Analog speed command gain**		Related Mode	**External speed**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	1~1000	**rpm/V**	**300**	**Immediately**	错误！未找到引用源。
	The set value of the external analog speed command gain means: the motor rotation speed represented by every 1V of voltage				

Fn 061	Parameter Name	**Analog speed command ADC's zero drift**		Related Mode	**External speed**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	-1000~1000	**—**	**0**	**Immediately**	错误！未找到引用源。
	Used to adjust analog speed command's zero point				

Fn 062	Parameter Name	**Setting of reversion of analog speed command's direction**		Related Mode	**External speed**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0~1	**—**	**0**	**Immediately**	错误！未找到引用源。
	0：The analog speed command's direction is not reversed; 1: The analog speed command's direction is reversed				

Fn 063	Parameter Name	**Time constant of analog speed command low-pass filter**	Related Mode	**External speed**

	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0~30000	**0.1ms**	**0**	**Immediately**	错误！未找到引用源。
	The higher the value, the better the filtering effect, but speed value traceability will be weakened.				

Fn 064	Parameter Name	**Analog torque command gain**		Related Mode	**Torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	1~300	**0.01×rated torque/V**	**30**	**Immediately**	错误！未找到引用源。
	Set value of the gain of the external analog torque command is: the percentage of rated torque represented by every 1V of voltage				

Fn 065	Parameter Name	**Analog torque command ADC zero drift**		Related Mode	**Torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	-1000~1000	**—**	**0**	**Immediately**	错误！未找到引用源。
	It's used to adjust analog torque command's zero point				

Fn 066	Parameter Name	**Setting of reversion of the analog torque command's direction**		Related Mode	**Torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0~1	**—**	**0**	**Immediately**	错误！未找到引用源。
	0:analog torque command's direction is not reversed; 1: analog torque command's direction is reversed				

Fn 067	Parameter Name	**Time constant of analog torque command low-pass filter**		Related Mode	**Torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0~30000	**0. 1ms**	**10**	**Immediately**	错误！未找到引用源。
	The higher the value, the better the filtering effect, but the torque value traceability				

	will be weakened.

Fn 068	Parameter Name	**Setting of analog command zero-value clamping**		Related Mode	**External speed, torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	-8~1	**—**	**1**	**Immediately**	错误！未找到引用源。/错误！未找到引用源。
	0: no zero-value clamping function is available for analog commands; 1: zero-value clamping function is available for analog units; -1 ~ -8: to be determined by digital input signals SignalIn 1~8				

Fn 069	Parameter Name	**Value set for analog speed command zero-value clamping**		Related Mode	**External speed**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0~30000	**rpm**	**30**	**Immediately**	错误！未找到引用源。
	When the analog speed command is lower than the set value of “**Fn 069**”, it is deemed to be zero speed.				

Fn 06A	Parameter Name	**Value set for analog torque command zero-value clamping**		Related Mode	**External speed**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0~30000	(**Rated current/torque**) ‰	**30**	**Immediately**	错误！未找到引用源。
	When analog torque command value is lower than the set value of “**Fn 06A**”, it is deemed that the torque is zero.				

A.9 Internal Speed Parameters

Fn 070	Parameter Name	**Set value of JOG speed**		Related Mode	**JOG mode**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	-500~500	**rpm**	**100**	**Immediately**	错误!未找到引用源。
	In case of trial running, do not set an overly high speed value, so as to avoid danger.				

Fn 071	Parameter Name	**Set value of Internal speed 1**		Related Mode	**Internal speed**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	-30000~30000	**rpm**	**500**	**Immediately**	错误!未找到引用源。
	Use the combination of Internal Speed Selection 1/2/3 to set a command value to determine which one of the 8 internal speed values is to be used				

Fn 072	Parameter Name	**Set value of internal speed 2**		Related Mode	**Internal speed**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	-30000~30000	**rpm**	**1000**	**Immediately**	错误!未找到引用源。
	Use the combination of Internal Speed Selection 1/2/3 to set a command value to determine which one of the 8 internal speed values is to be used				

Fn 073	Parameter Name	**Set value of internal speed 3**		Related Mode	**Internal speed**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	-30000~30000	**rpm**	**1500**	**Immediately effective**	错误!未找到引用源。
	Use the combination of Internal Speed Selection 1/2/3 to set a command value to determine which one of the 8 internal speed values is to be used				

Fn 074	Parameter Name	**Set value of internal speed 4**		Related Mode	**Internal speed**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	-30000~30000	**rpm**	**2000**	**Immediately**	错误!未找到引用源。
	Use the combination of Internal Speed Selection 1/2/3 to set a command value to determine which one of the 8 internal speed values is to be used				

Fn 075	Parameter Name	**Set value of Internal speed 5**		Related Mode	**Internal speed**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	-30000~30000	**rpm**	**-2000**	**Immediately**	错误！未找到引用源。
	Use the combination of Internal Speed Selection 1/2/3 to set a command value to determine which one of the 8 internal speed values is to be used				

Fn 076	Parameter Name	**Set value of Internal speed 6**		Related Mode	**Internal speed**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	-30000~30000	**rpm**	**-1500**	**Immediately**	错误!未找到引用源。
	Use the combination of Internal Speed Selection 1/2/3 to set a command value to determine which one of the 8 internal speed values is to be used				

Fn 077	Parameter Name	**Set value of internal speed 7**		Related Mode	**Internal speed**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	-30000~30000	**rpm**	**-1000**	**Immediately**	错误!未找到引用源。
	Use the combination of Internal Speed Selection 1/2/3 to set a command value to determine which one of the 8 internal speed values is to be used				

Fn 078	Parameter Name	**Set value of internal speed 8**		Related Mode	**Internal speed**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	-30000~30000	**rpm**	**-500**	**Immediately**	错误!未找到引用源。
	Use the combination of Internal Speed Selection 1/2/3 to set a command value to determine which one of the 8 internal speed values is to be used				

A.10 Speed Loop Adjustment Parameters

Fn 084	Parameter Name	**Rotational inertia coefficient of the load**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	100~1000	**1%**	**—**	**Immediately**	错误!未找到引用源。
	Rotational inertia coefficient of the load :(load inertia+ motor inertia)/motor inertia				

Fn 087	Parameter Name	**Speed loop's No.1 proportional gain Kv1**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	10~5000	**0.01**	**—**	**Immediately**	错误!未找到引用源。/错误!未找到引用源。
	The bigger the proportional gain, the quicker the speed response, but an overly big proportional gain value might lead to speed overregulation.				

Fn 088	Parameter Name	**Speed loop's No. 1 integral time constant Ti**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	1~10000	**0.1ms**	**—**	**Immediately**	错误！未找到引用源。/错误！未找到引用源。
	The smaller the integral time constant, the lower the speed steady-state error, but an overly low time constant is very likely to cause oscillation				

Fn 089	Parameter Name	**Speed loop's No.2 proportional gain Kv2**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	10~5000	**0.01**	**—**	**Immediately**	错误！未找到引用源。/错误！未找到引用源。
	The bigger the proportional gain, the quicker the speed response, but an overly big proportional gain value might lead to speed overregulation.				

Fn 08A	Parameter Name	**Speed loop's No. 2 integral time constant Ti**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works	Effective Time	Reference

			Setting		
	1~10000	**0.1ms**	**—**	**Immediately**	错误！未找到引用源。/ 错误！未找到引用源。
	The smaller the integral time constant, the lower the speed steady-state error, but an overly low value is very likely to cause oscillation.				

A.11 Torque Current Command Filtering Parameters

Fn 092	Parameter Name	**Time constant of No.1 torque command's low-pass filter**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0~30000	**10us**	**—**	**Immediately**	错误！未找到引用源。/错误！未找到引用源。
	The bigger the time constant, the better the filtering effect, but an overly big time constant will cause overly big phase shift of the torque command, and worsen the dynamic response				

Fn 093	Parameter Name	**Time constant of No.2 torque command's low-pass filter**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0~30000	**10us**	**—**	**Immediately**	错误！未找到引用源。/错误！未找到引用源。
	The bigger the time constant, the better the filtering effect, but an overly big time constant will cause overly big phase shift of the torque command, and worsen the dynamic response				

Fn 094	Parameter Name	**Center frequency of No.1 torque command's band-stop filter**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	100~30000	**HZ**	**—**	**When power is on again**	错误！未找到引用源。
	It is suggested that the set value not be less than 100Hz, and it is generally used in middle frequency band.				

Fn 095	Parameter Name	**Bandwidth frequency of No.1 torque command's band-stop filter**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0~30000	**0.1HZ**	**—**	**When power is on again**	错误！未找到引用源。
	It is suggested that the set value not exceed 15Hz, and 0Hz means that band-stop filtering is canceled.				

Fn 096	Parameter Name	**Rate of attenuation of No.1 torque command's band-stop filter**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0~100	**1%**	**—**	**When power is on again**	错误！未找到引用源。
	The bigger the value, the better the filtering effect, but an overly big value might cause the torque command oscillation				

Fn 097	Parameter Name	**Center frequency of No.2 torque command's band-stop filter**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	100~30000	**HZ**	**—**	**When power is on again**	错误!未找到引用源。
	It is suggested that the set value not be less than 100Hz, and it is generally used in middle frequency band.				

Fn 098	Parameter Name	**Bandwidth frequency of No.2 torque command's band-stop filter**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0~30000	**0.1HZ**	**—**	**When power is on again**	错误!未找到引用源。
	It is suggested that the set value not exceed 15Hz, and 0Hz means that the band-stop filtering is canceled.				

Fn 099	Parameter Name	**Rate of attenuation of No.2 torque command's band-stop filter**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0~100	**1%**	**—**	**When power is on again**	错误!未找到引用源。
	The bigger the value, the better the filtering effect, but an overly big value might cause torque command's oscillation				

A.12 Parameters for Control and Limit

Fn 0A0	Parameter Name	**Torque limit mode**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0~3	**—**	**0**	**Instantly effective at a low rate**	错误！未找到引用源。
	0: internal torque limit; 1: internal+ external torque limit; 2: internal+ analog torque limit; 3: internal+external+ analog torque limit				

Fn 0A1	Parameter Name	**Internal forward-direction torque limitation**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	1~500	**1% of rated torque**	**500**	**Instantly taking effect at a low rate**	错误！未找到引用源。
	It sets value of internal forward-direction torque limit				

Fn 0A2	Parameter Name	**Internal backward-direction torque limitation**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	1~500	**1% of rated torque**	**500**	**Instantly taking effect at a low rate**	错误！未找到引用源。
	Its sets value of internal backward-direction torque limit				

Fn 0A3	Parameter Name	**External forward-direction torque limitation**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0~500	**1% of Rated torque**	**100**	**Instantly taking effect at a low rate**	错误！未找到引用源。
	It limits the value of the forward-direction torque limit via external forward-direction torque limit (ExtCcwTorqueLimit)				

Fn 0A4	Parameter Name	**External backward-direction torque limit**	Related Mode	**Position, speed and torque**	
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0~500	**1% of rated torque**	**100**	**Instantly taking effect at a low rate**	错误！未找到引用源。
	It limits the value of the backward-direction torque limit via external backward-direction torque limit (ExtCcwTorqueLimit)				

Fn 0A5	Parameter Name	**Torque limit by absolute value**	Related Mode	**Position, speed and torque**	
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0~5000	**1% of rated torque**	**500**	**Real-time effect at a high rate**	错误！未找到引用源。
	It uses the absolute value to limit the torque value (unit: 1‰ of rated torque)				

Fn 0AC	Parameter Name	**Setting of motor maximum operation speed limit (absolute value)**	Related Mode	**Position, speed and torque**	
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	1~30000	**rpm**	**—**	**When power is on again**	错误！未找到引用源。
	It is the maximum allowable speed command under the position and speed modes, and the maximum rotation speed limit value under torque mode				

Fn 0AD	Parameter Name	**Way of speed limit under torque mode**	Related Mode	**Torque**	
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0~3	**—**	**0**	**Upon re-enabling**	错误！未找到引用源。
	0: basic speed limit alone; 1: basic speed limit+ internal speed limit 2: basic speed limit+ external analog speed limit 3: basic speed limit+ internal multi-stage speed limit+ external analog speed limit When it exceeds the motor maximum operation speed limit of “**Fn 0AC**”, the motor’s maximum operation speed limit shall govern				

Fn 0AE	Parameter Name	**Basic forward speed limit under torque mode**		Related Mode	**Torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	60~30000	**rpm**	**—**	**Immediately**	错误！未找到引用源。
	It sets value of basic forward rotation speed limit				
Fn 0AF	Parameter Name	**Basic backward speed limit under torque mode**		Related Mode	**Torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	60~30000	**rpm**	**—**	**Immediately**	错误！未找到引用源。
	It sets value of basic backward rotation speed limit				

A.13 Gain Shifting

Fn 0B0	Parameter Name	**Delay of shifting of gain**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	-30000~30000	**ms**	**4**	**Immediately**	错误！未找到引用源。
	When triggering conditions for shifting are met, it performs a delay for a period of time, and then shifts the gain				

Fn 0B1	Parameter Name	**Time for shifting of gain**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	-30000~30000	**ms**	**4**	**Immediately**	错误！未找到引用源。
	When the gain is being shifted, it is changed at an even rate over the time set by "**Fn 0B1**"				

Fn 0B2	Parameter Name	**Critical point of speed for shifting of gain**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0~30000	**rpm**	**10**	**Immediately**	错误！未找到引用源。
	When |feedback rotation speed| ≤ "**Fn 0B2 - Fn 0B3**", No.1 gain is effective; When |feedback rotation speed| ＞"**Fn 0B2 + Fn 0B3**", No.2 gain is effective;				

Fn 0B3	Parameter Name	**Set value of speed hysteresis for shifting of gain**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0~1000	**rpm**	**2**	**Immediately**	错误！未找到引用源。
	When |feedback rotation speed| ≤ "**Fn 0B2 - Fn 0B3**", No.1 gain is effective; When |feedback rotation speed| ＞"**Fn 0B2 + Fn 0B3**", No.2 gain is effective;				

A.14 Time for Acceleration and Deceleration

Fn 0B8	Parameter Name	**Setting of time for motor deceleration**		Related Mode	**Speed**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0~30000	**ms**	**0**	**Immediately**	错误！未找到引用源。
	It sets the time needed by feedback speed for following the command speed when the speed command's change magnitude is +1000 RPM.				

Fn 0B9	Parameter Name	**Setting of time for motor deceleration**		Related Mode	**Speed**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0~30000	**ms**	**0**	**Immediately**	错误！未找到引用源。
	It sets the time needed by feedback speed for following the command speed when the speed command's change magnitude is -1000 RPM.				

Fn 0BA	Parameter Name	**Time constant of S-curve acceleration and deceleration**		Related Mode	**Speed**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0~500	**ms**	**0**	**When power is on again**	错误！未找到引用源。

A.15 Dynamic Brake

Fn 0BC	Parameter Name	**Motor speed allowed for the dynamic brake**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0~10000	**rpm**	**1/2 rated rotation speed**	**Immediately**	错误！未找到引用源。
	Dynamic braking is not allowed and the motor is under free mode when rotation speed is higher than Fn 0BC; dynamic braking starts when rotation speed is lower than Fn 0BC.				

Fn 0BD	Parameter Name	**Braking mode of dynamic brake**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0~3	**—**	**0**	**Immediately effective**	错误！未找到引用源。
	0: the motor freely slows down during deceleration, and keeps in a free state after stopping; 1: the motor freely slows down during deceleration, and is under the control of dynamic brake after stopping; 2: the motor is under dynamic braking during deceleration, and keeps in a free state after stopping; 3:the motor is under dynamic braking during deceleration, and is still under the control of dynamic brake after stopping.				

A.16 Electromagnetic Brake

Fn 0C0	Parameter Name	**Duration of releasing electromagnetic brake**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0~3000	**ms**	**50**	**When power is on again**	错误！未找到引用源。
	It is the time from when the driver sends the release command to when the brake is fully released, and is determined by the electrical parameters of the brake coils.				

Fn 0C1	Parameter description	**Brake waiting speed for electromagnetic brake**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0~500	**rpm**	**300**	**Immediately**	错误！未找到引用源。
	The electromagnetic brake can be started only when the speed is lower than this set rotation speed, otherwise the motor will rotate freely during deceleration until it finally stops; The brake will start braking when either "**Fn 0C1**" or "**Fn 0C2**" conditions are met				

Fn 0C2	Parameter Name	**Time of electromagnetic brake's braking wait**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0~10000	**ms**	**3000**	**When power is on again**	错误！未找到引用源。
	Electromagnetic braking action can only be performed when the brake's waiting time has exceeded the set value, otherwise the motor will rotate freely to decelerate until it finally stops; The electromagnetic brake will start braking when either "**Fn 0C1**" or "**Fn 0C2**" conditions are met				

Fn 0C3	Parameter Name	**Braking action triggering speed of electromagnetic brake**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0~300	**rpm**	**100**	**Immediately effective**	错误！未找到引用源。
	When the motor speed's absolute value is less than "**Fn 0C3**", it will be deemed that the motor is in low-speed operation, and the electromagnetic brake in this case does not need to wait and the may start braking directly.				

Fn 0C4	Parameter Name	**Duration of electromagnetic brake's braking action**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0~3000	**ms**	**50**	**When power is on again**	错误！未找到引用源。
	It is the time from when the braking command is sent to when braking process is completed, and is determined by the electrical parameters of the brake coils.				

A.17 DAC Status Monitoring

Fn 0C8	Parameter Name	**Setting of DAC1's maximum value**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	1~32767	**—**	**—**	**Immediately**	错误！未找到引用源。/错误！未找到引用源。
	It sets the amplitude of DAC channel 1, specifically sets the corresponding **Dn xx**'s value when DAC 1's output is +10V.				

Fn 0C9	Parameter Name	**Setting of DAC2's maximum value**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	1~32767	**—**	**—**	**Immediately**	错误！未找到引用源。/错误！未找到引用源。
	It sets the amplitude of DAC channel 2, specifically sets the corresponding **Dn xx**'s value when DAC 2's output is +10V.				

Fn 0CA	Parameter Name	**Selection of DAC 1's signal source**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	-1~256	**—**	**—**	**Immediately**	错误！未找到引用源。/错误！未找到引用源。
	It selects DAC channel 1's signal source, which corresponds to the serial number of status parameter "**Dn xx**"				

Fn 0CB	Parameter Name	**Selection of DAC 2's signal source**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	-1~256	**—**	**—**	**Immediately**	错误！未找到引用源。/错

					误！未找到引用源。
	It selects DAC channel 2's signal source, which corresponds to the serial number of status parameter "**Dn xx**"				

A.18 Alarm Protection Configuration

Fn 0D0	Parameter Name	**Set voltage value of overvoltage alarm**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0~10000	**0.1V**	**4050**	**Immediately**	错误！未找到引用源。
	When the DC bus voltage value exceeds the set value of "**Fn 0D0**", "**E oUdc**" overvoltage alarm will happen.				

Fn 0D2	Parameter Name	**Undervoltage alarm mode**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0~2	**—**	**2**	**Immediately**	错误！未找到引用源。
	0: alarm is not allowed, and running continues; 1: alarm is allowed; 2: alarm is not allowed, but motor will be stopped and wait for the working power to re-meet the requirements.				

Fn 0DA	Parameter Name	**Value of deviation set for over-travel**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0~32767	**Pulse**	**30000**	**Immediately**	错误！未找到引用源。/错误！未找到引用源。
	When |number of tracking error pulses| is ≥ "**Fn 0DA**", an "**E PoSE**" position over-travel alarm occurs; When "**Fn 0DA**" is ＞0, the over-travel alarm function is effective; when "**Fn 0DA**"=0, the over-travel alarm function is ineffective.				

Fn 0DF	Parameter Name	**Threshold value set for motor overspeed alarm**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	1~32767	**rpm**	**—**	**When power is on again**	错误！未找到引用源。
	It sets the motor's maximum alarm rotation speed; if this speed is exceeded, the overspeed alarm will be sent				

A.19 Communication Bus Configuration

Fn 0F0	Parameter Name	**Modbus communication mode**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0~1	**—**	**0**	**When power is on again**	错误！未找到引用源。/错误！未找到引用源。
	0：RS232；1：RS485				

Fn 0F1	Parameter Name	**Modbus bus Baud rate setting**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	12~1536	**100bps**	**96**	**When power is on again**	错误！未找到引用源。/错误！未找到引用源。

Fn 0F2	Parameter Name	**Modbus bus node No.**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	1~255	**—**	**1**	**When power is on again**	错误！未找到引用源。/错误！未找到引用源。

Fn 0F3	Parameter Name	**CAN bus Baud rate**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0~1000	**KHZ**	**500**	**When power is on again**	错误！未找到引用源。/错误！未找到引用源。

Fn 0F4	Parameter Name	**CAN bus node address**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	0~255	**—**	**1**	**When power is on again**	错误！未找到引用源。/错误！未找到引用源。

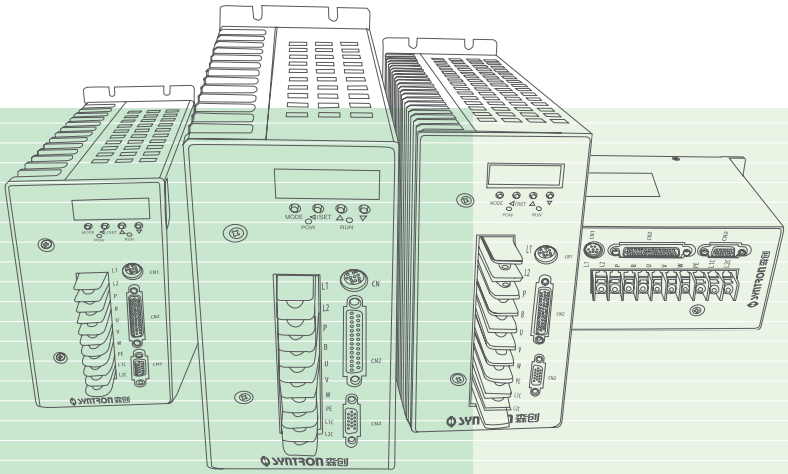
Fn 0F5	Parameter Name	**CanReg protocol's group No. allocating number**		Related Mode	**Position, speed and torque**
	Setting Range	Setting Unit	Ex-works Setting	Effective Time	Reference
	1~255	**—**	**1**	**When power is on again**	错误！未找到引用源。/错误！未找到引用源。

Remarks: Definition of servo motor code “xx”

1. The two digits on the left represent No. of the motor’s pedestal: 00--40CB, 01--60CB, 02--80CB, 03--86CB, 04--90CB, 05--110MB, 06--120MB, 07--130MB, 50—130HMB, 51—150HMB, 52—180HMB.

2. The two digits on the right stand for motor specifications; see the existing product models and codes for servo motors in the table below:

Servo Motor Code	Servo Motor Model	Servo Motor Code	Servo Motor Model
00 01	40CB003C	06 00	120MB040A
00 05	40CB005C	06 05	120MB055A
00 10	40CB010C	06 10	120MB075A
		06 15	120MB100A
01 00	60CB020C	06 20	120MB150A
01 05	60CB030C-00****	06 30	120MB075B
01 10	60CB040C	06 35	120MB100B
01 11	60CB040C-30xxxx	06 40	120MB150B
01 12	60CB040C-50xxxx	06 45	120MB200B
01 15	60CB060C	06 50	120MB300B
01 20	60CB075C	06 55	120MB110C
		06 60	120MB150C
02 00	80CB050C	06 65	120MB220C
02 05	80CB075C	06 70	120MB300C
02 06	80CB075C-50xxxx		
02 07	80CB075C/80ST-M2430	06 98	130MB055A
02 10	80CB100C	07 00	130MB100A
		07 02	130MB150A
03 00	86CB060C-00****	07 05	130MB100B
		07 10	130MB130B
04 00	90CB050C	07 15	130MB150B/130ST-M7520
04 05	90CB075C	07 20	130MB200B
04 10	90CB100C	07 21	130MB300B
04 15	90CB120C	07 22	130MB100C
		07 23	130MB150C
05 00	110MB040A	07 25	130MB200C
05 05	110MB060D	07 26	130MB300C
05 10	110MB075D	07 30	130MB100D
05 15	110MB075B		
05 20	110MB100B		
05 25	110MB120B		
05 30	110MB120C		



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