3HSS2208H-110

8A 250VAC

Closed Loop Stepping System

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1 Brief Introduction

1.1 Overview

The $3HSS2208H-110$ stepper servo drive system integrates the servo control technology into the digital stepper drive perfectly, and fit the company 110 three-phase stepper motor. This stepper servo driver uses the latest 32-bit DSP and combines the advanced servo algorithm to control. Compared to the traditional step drive, this step servo driver can completely avoid the stepper motor lost step problem, and effectively restrain the temperature rise of the motor, reduce the motor vibration, greatly enhance the performance of high-speed motor. The driver is half price of the AC servo system. At the same time, the size of the adapter is compatible with the traditional step motor, which is convenient for customers to upgrade and replace. In short, the stepper servo driver set the advantages of no lost step, low temperature rise, high speed, high torque, low cost and so on in one, is a cost-effective high motion control products.

1.2 Features

- Without losing step, High accuracy in position
- 100% rated output torque
- Variable current control technology, High current efficiency
- Little vibration, Smooth and reliable moving at low speed
- Accelerate and decelerate control inside, Great improvement in smoothness of starting or stopping the motor
- User-defined micro steps
- Compatible with 1000 and 2500 lines encoder
- No adjustment in general application
- Lack of phase, over current, over voltage and over position protection
- Six digital tube display, easy to set parameters and monitor the motor

1.3 Applications

It is suitable for the automation equipment and instrumentation which require large torque, such as: engraving machine, wire-stripping machine, marking machine, cutting machine, laser photocomposing machine, plotting instrument, numerical control machine tool, automatic assembly equipment and so on. The application results are especially good in the devices with little noise and high speed.

2 Technical Index

2.1 Electrical and Environment Specifications

Input Voltage	$180-250VAC$
Continuous Current Output	$4.0A$
Maximum Input Frequency	$200KHz$
Signal Input Current	7 $20mA$ ($10mA$ Typical)
Default Communication Rate	$57.6Kbps$
Protections	• Over current peak value 12A±10% • Over voltage value 400VDC • The range of over position error can be set by the front panel or HISU
Overall Dimensions(mm)	$140 \times 70 \times 56$
Weight	Approximate $1500g$
Environment	Avoid dust, oil fog and corrosive gasses
Operating Temperature	0 $70°C$
Storage Temperature	$-20°C$ $+65°C$
Humidity	40~90%RH
Cooling method	Natural cooling or forced air cooling

2.2 Mechanical Specifications

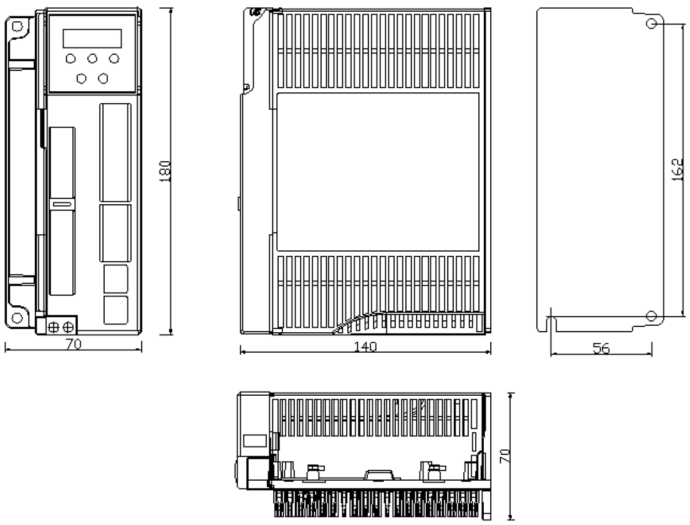


Fig. 1 Mechanical installation size (unit: mm)

Notice: Please take the terminal size and ventilation cooling while design the installation size.

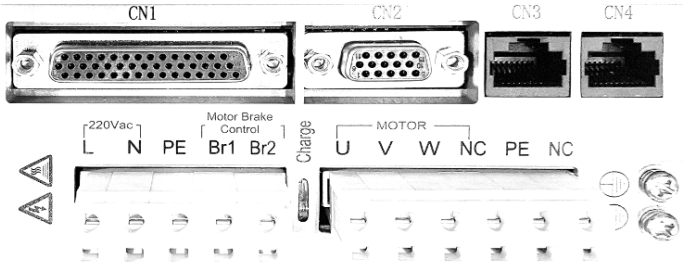
2.3 Elimination of Heat

- Driver's reliable working temperature should be <60°C, and motor working temperature should be <90°C;
- It is recommended to mount the drive vertically to maximize heat sink area. Use forced cooling method to cool the system if necessary.

3 Fault Data Display

Data display	Fault cause
	Over current in the motor
	Current sensor alarm
	Parameters upload alarm
	Over voltage in power supply
	Over position error alarm
	Missing phase alarm
	Drive off -line

4 Ports and Connections Introduction



4.1 Ports Definition

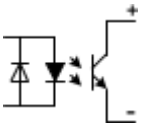
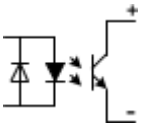
4.1.1 Power Interface Ports1

Port	Symbol	Definition	Remark
1	L	power L	180-250VAC between L and N
2	N	power N	
3	PE	Ground	protection earth
4	Br1	brake 1	motor brake control
5	Br2	brake 2	

4.1.2 Power Interface Ports2

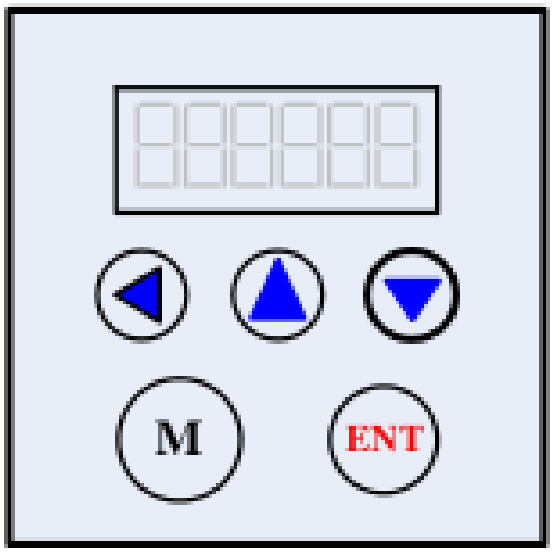
Port	Symbol	Definition	Remark
1	U	Motor connection U	
2	V	Motor connection V	
3	W	Motor connection W	
4	NC	Not connected	
5	PE	Ground port	
6	NC	Not connected	

4.1.3 Control Signal Interface Ports (44 Pins DB)

Port	Symbol	Definition	Remark
3	PUL+	Pulse in +	Compatible with 5V & 24V
4	PUL-	Pulse in -	
5	DIR+	Direction in +	Compatible with 5V & 24V
6	DIR-	Direction in -	
7	ALM+	Alarm out +	
8	ALM-	Alarm out -	
9	Pend+	Position out +	
10	Pend-	Position out -	
11	ENA+	Enable in +	Compatible with 5V & 24V
12	ENA-	Enable in -	

4.1.4 Status Indicator

Control panel (including 5 buttons and 6 LED digital tube displays)



◀	Left shift Digit
▲	Decrease or Next
▼	Increase or Previous
ENT	Enter or Confirm
M	Exit or Mode switching

Users can configure the drive via the on-board front panel. This panel includes six 7-segment digits and five keys for users operation as the picture show above.

Functions are as follows:

LED Display	Definition
d00SPF	**Reference Speed**
d01SPF	**Speed Feedback**
d02PLE	**Position Error**
d03PLR	**Position Reference**
d04PLF	**Position Feedback**
xx_Err	**Drive Failure**
En_OFF	**Drive offline**

Remark: Switch to Parameter display function via 'M'; Check the parameter via 'ENT' (The power on display data is the final parameter you want to check), Switch functions via '▼' or '▲' (While '◀' is valid); Exit or switch to the next function via 'M'.

5 Connections to Control Signal

The connections to the input and output control signals are as follows:

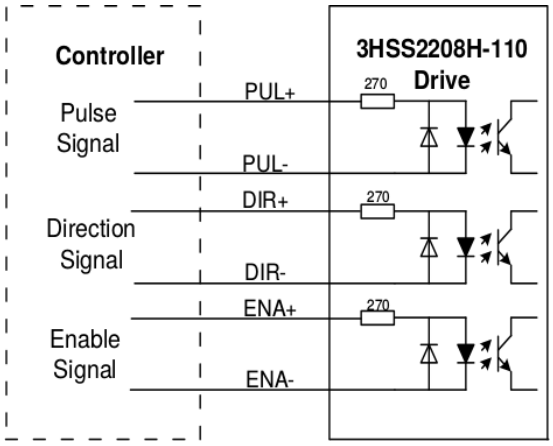


Fig. 2 Connections to differential signals

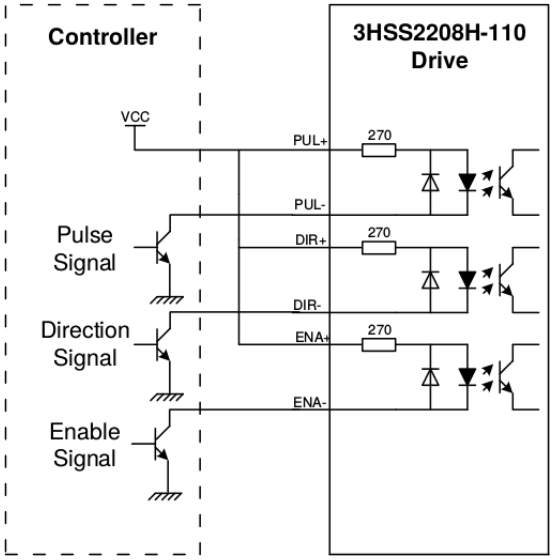


Fig. 3 Connections to common anode

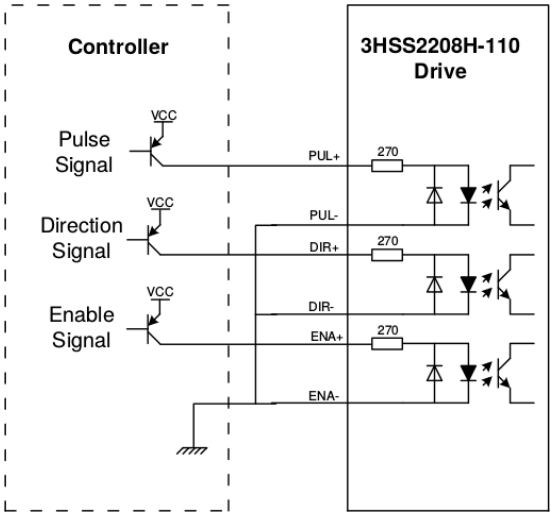


Fig. 4 Connections to common cathode

Attention: The control signal can be compatible with 5V and 24V.

6 Sequence Chart of Control Signal

In order to avoid some fault operations and deviations, PUL, DIR and ENA should abide by some rules, shown as following diagram:

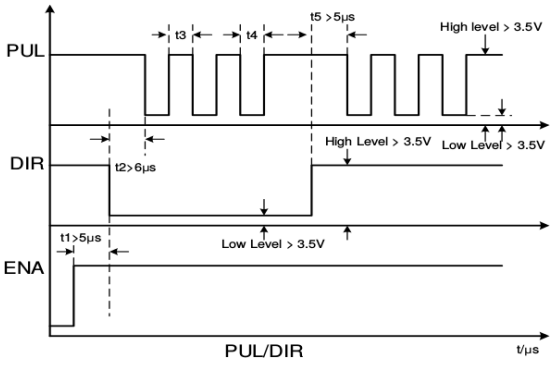


Fig. 5 Timing diagram of Control signal

Remark:

t1: ENA must be ahead of DIR by at least $6\mu s$. Usually, ENA+ and ENA- are NC (not connected). See "Connector P1 Configurations" for more information.

t2: DIR must be ahead of PUL active edge by at least $5\mu s$ to ensure correct direction;

t3: Pulse width not less than $2.5\mu s$;

t4: Low level width not less than $2.5\mu s$.

Control signal mode setting

The trigger pulse selection: drive through the front panel or HISU key board to set the pulse rising edge or falling edge triggered effectively.

7 Connections to Encoder

The connection wires of the encoder are designed with the extension wires of 15 pins and the motor encoder wires, and these special wires are provided by our company, users no need to connect them. The definitions of the 3HSS2208H-110 encoder interface ports are as follows:

DB x	Signal	Description
1	EA+	Encoder Chanel A output +
2	EB+	Encoder Chanel B output +
3	GND	Encoder GND Input
11	EA-	Encoder Chanel A output -
12	EB-	Encoder Chanel B output -
13	VCC	Encoder Voltage Input +5V

8 Parameters Configure

Setting 3HSS2208H-110 parameters is possible through the front panel. A set of the best default configure parameters has already set in the drive, user only need to configure the parameter Pulses/revolution, the detail functions are as follows:

Actual value = Set value × the corresponding dimension

Mode	*Definition*	*Range*	*Dimension*	*Drive Restart*	*Default Value*
P0	Reset	$0-100$	11	*N*	0
P1	Current loop K_p	$0-4000$	1	*N*	1000
P2	Current loop integral K_i	$0-1000$	1	*N*	100
P3	Damping coefficient	$0-500$	1	*N*	100
P4	Position loop K_p	$0-3000$	1	*N*	2000
P5	Position loop integral K_i	$0-1000$	1	*N*	150
P6	Speed loop K_p	$0-3000$	1	*N*	1250
P7	Speed loop integral K_i	$0-1000$	1	*N*	250
P8	Open loop current $[0.1 * A]$	$0-60$	0.1	*N*	40
P9	Close loop current $[0.1 * A]$	$0-40$	0.1	*N*	20
P10	Alarm level	$0-1$	1	*N*	0
P11	Direction level	$0-1$	1	*Y*	0
P12	Pulse edge	$0-1$	1	*Y*	0
P13	Enable level	$0-1$	1	*N*	0
P14	Arrival level	$0-1$	1	*N*	1
P15	Encoder line number	$0-1$	1	*Y*	0
P16	Position error limit	$0-3000$	10	*N*	1000
P17	Subdivision	$0-15$	1	*Y*	10
P18	reservation	-	-	-	-
P19	Speed smoothness	$0-10$	1	*N*	6
P20	User-defined p/r	$4-1000$	50	*Y*	8
P21	Close motor to detect the lack of phase	$0-1$Power on display	1	*N*	0
P22	Power on display	$0-4$	1	*Y*	0
P23	Drive enable lock	$0-1$	1	*N*	0
P24	Factory parameter	*reserved*	–	–	–
P25	Open and closed loop superposition ratio	$0-40$	1	*N*	20
P26	In-position output threshold	$0-20$	1	*N*	10
P27	Drive low-speed damping	$0-500$	1	*N*	1
P28	Factory parameter	*reserved*	–	–	–
P29	Factory parameter	*reserved*	–	–	–
P30	Drive phase loss detection	$0-1$	1	*Y*	1
P31	Drive self-test position	$0-9000$	1	*Y*	4000
P32	Drive self-test time	$0-1000$	1	*Y*	10
P33	Drive self-test switch	$0-1$	1	*N*	0
P34	Drive self-test acceleration	$0-10$	1	*N*	9
P35	Drive self-test speed	$0-1500$	1	*N*	1
P36	Factory parameter	*reserved*	–	–	–
P37	Factory parameter	*reserved*	–	–	–
P38	Bleeder resistor fault alarm	$0-1$	1	*Y*	1
P39	Drive overheat alarm enable	$0-1$	1	*Y*	0

There are total 23 parameter configurations, use the front panel to download the configured parameters to the drive, the detail descriptions to every parameter configuration are as follows:

P0 Reset Writing '11' will reset the drive.

P1 Current loop K_p Proportional Gain K_p is adjusted to make current rise fast or not. Proportional Gain determines the response of the drive to setting command. Low Proportional Gain

provides a stable system (doesn't oscillate), has low stiffness, and the current error, causing poor performances in tracking current setting command in each step. But too large proportional gain values may cause oscillations and unstable system.

P2 Current loop K_i Integral Gain The K_i is adjusted to reduce the steady error. Gain Integral helps to overcome the static current error of the drive. A low or zero value for Integral Gain may have current errors at rest. Increasing the integral gain can reduce the error. But if the Integral Gain is too large, the system may 'hunt' (oscillate) around the desired position.

P3 Damping coefficient This parameter is used to change the damping coefficient in case of the desired operating state is under resonance frequency.

P4 Position loop K_p & P5 K_i The PI parameters of the position loop. The default values are suitable for most of the application, you don't need to change them. Contact us if you have any question.

P6 Speed loop Kp & P7 Ki The P_I parameters of the speed loop. The default values are suitable for most of the application, you don't need to change them. Contact us if you have any question.

P8 Open loop current This parameter affects the static torque of the motor.

P9 Close loop This parameter affects the dynamic torque of the motor. (The actual current = open loop current + close loop current)

P10 Alarm Control This parameter is set to control the Alarm optocoupler output transistor. 0 means the transistor is cut off when the system is in normal working, but when it comes to fault of the drive, the transistor becomes conductive. 1 means opposite to 0.

P11 Direction level

P12 Stop lock enable This parameter is set to enable the stop clock of the drive. 1 means enable this function while 0 means disable it.

P13 Enable Control Enable level This parameter is set to control the Enable input signal level, 0 means low, while 1 means high.

P14 Arrival Control This parameter is set to control the Arrival optocoupler output transistor. 0 means the transistor is cut off when the drive satisfies the arrival command, but when it comes to not, the transistor becomes conductive. 1 means opposite to 0.

P15 Encoder resolution This drive provides two choices of the number of lines of the encoder. 0 means 1000 lines, while 1 means 2500 lines.

P16 Position error limit The limit of the position following error. When the actual position error exceeds this value, the drive will go into error mode and the fault output will be activated. (The actual value = the set value× 10)

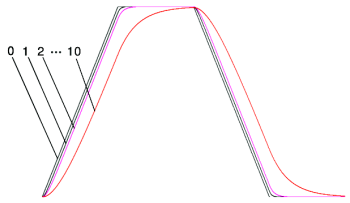
P17 Pulses/Revolution Subdivision

Para.	0	1	2	3	4	5	6	7
Puls/Rev	user	800	1600	3200	6400	12800	25600	51200

Para.	8	9	10	11	12	13	14	15
Puls/Rev	1000	2000	4000	5000	8000	10000	20000	40000

Tip: In addition, the driver also provides users with arbitrary subdivisions that can be set freely. The number is set via mode P20.

P19 Speed smoothness This parameter is set to control the smoothness of the speed of the motor while acceleration or deceleration, the larger the value, the smoother the speed in acceleration or deceleration.



P20 User-defined Micro Steps User can set the micro steps according the specific situation, the actual micro steps = the set value × 50.

P21 Close motor to detect the lack of Phase 1 is closed, and 0 is not closed. The use of manufacturer factory maintenance.

P22 Power on display

parameter	0	1	2	3	4
data display	speed reference	*speed feedback*	position tracking error	position reference	position feedback

P21 Close motor to detect the lack of Phase 1 is closed, and 0 is not closed. The use of manufacturer factory maintenance.

P22 Drive pulse filter Set to $0-20$, As the value increases, the passing frequency of drive pulses is gradually reduced. Used to suppress electronic interference generated in the environment.

P23 Drive enable lock $P23=0$ does not lock the shaft. $P23=1$ the shaft of the motor is locked, and the drive does not count external pulses.

P26 in-position output threshold The parameter is used to set the position deviation.

P30 Drive phases loss detection $P30=1$ means open, $P30=0$ means close. It is limited to the manufacturer's maintenance use.

P38 bleeder resistor fault detection $P38=1$ means on, $P38=0$ means off.

P39 drive overheat detection $P39=1$ means on, $P39=0$ means off.

9 Parameter adjustment method

Remark:

◀	Left shift Digit
▲	Decrease or Next
▼	Increase or Previous
ENT	Enter or Confirm
M	Exit or Mode switching

1. Switch to parameter configuration Mode via "M"

2. Switch to parameter you want to configure via " ◀ "

   You can also know the number which is configuring according to the left 7-segment display, for example: the display "1" indicates you are configuring the first number on the right; Then change the parameter via "▼"or "▲", Change the value from big to small circularly via "▼", for example: "9, 8... 1, 9"; Adjust the opposite value via "▲"

3. Save the set parameter via "ENT" when it is set correctly according to your adjustment; repeal the parameter to the original value via "M", then return.

Attention: The button "▲" may come to invalid when the set value comes to the maximum; Press the button " ◀ " to select the most significant digit when there is only this digit, decrease this value via "▼", and in this way can change the most significant value, for example the maximum value is 100, so when it comes to 100, you have to choose the most significant digit and then to decrease it into 0, this is the only way to reconfigure this value .)

9.1 Button Panel Operation

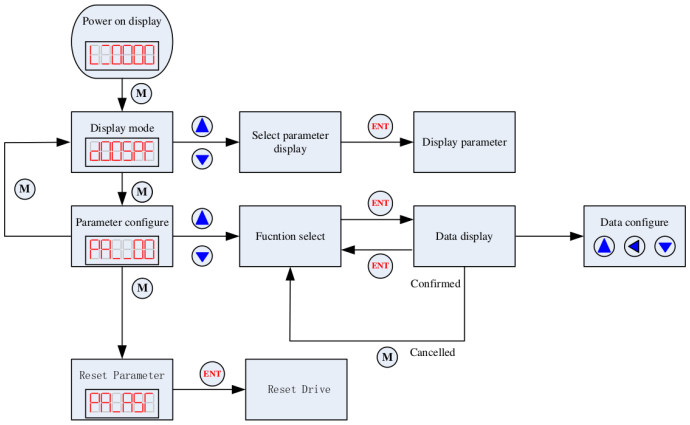


Fig. 7 Button operation flow diagram

9.2 Mode Configure Operation Example

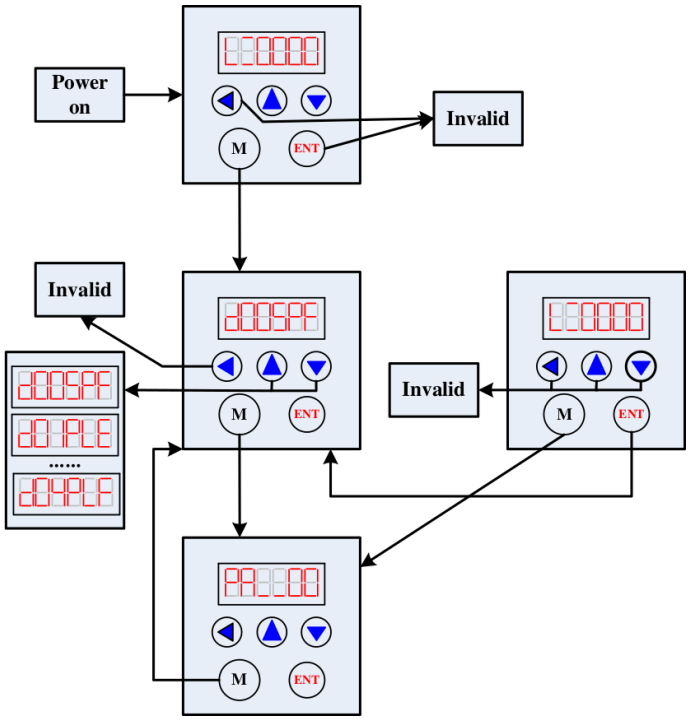


Fig. 8 Display operation flow diagram

9.3 Parameter Configure Operation Example

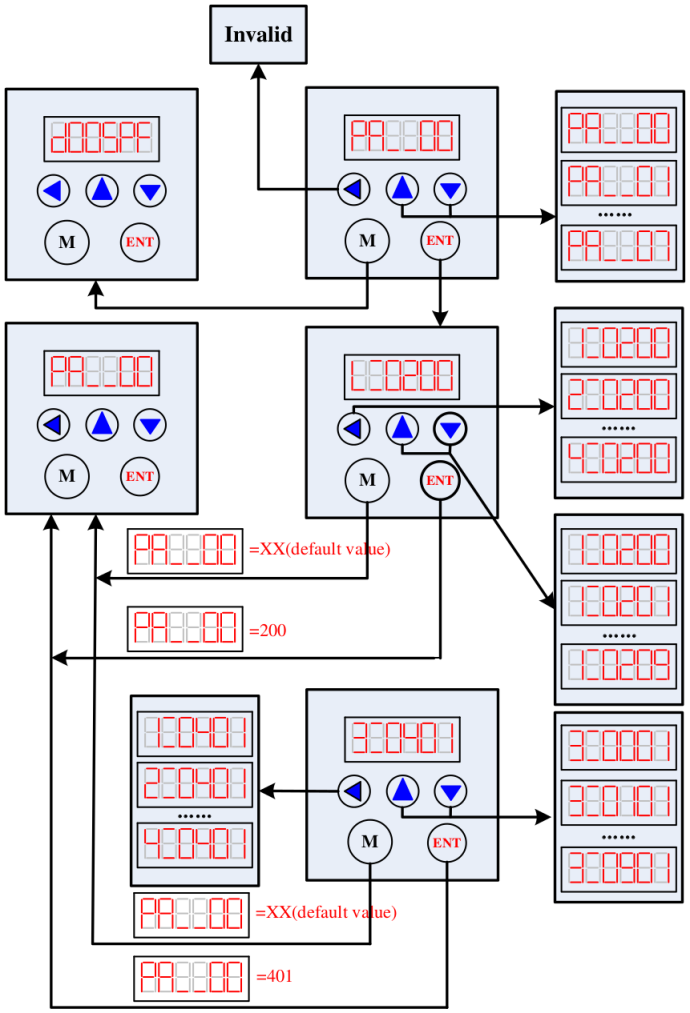


Fig. 9 Parameter configure flow diagram

Attention: The default parameters of current loop, position loop and speed loop are almost the best, user no need to change them, but to configure the parameter Pulses/revolution according to the necessity of the control system.

9.4 Processing Methods to Common Problems and Faults

Power on power light off

- No power input, please check the power supply circuit. The voltage is too low.

Power on red alarm light on

- Please check the motor feedback signal and if the motor is connected with the drive.
- The stepper servo drive is over voltage or under voltage. Please lower or increase the input voltage.

Red alarm light on after the motor running a small angle

- Please check the motor phase wires if they are connected correctly.