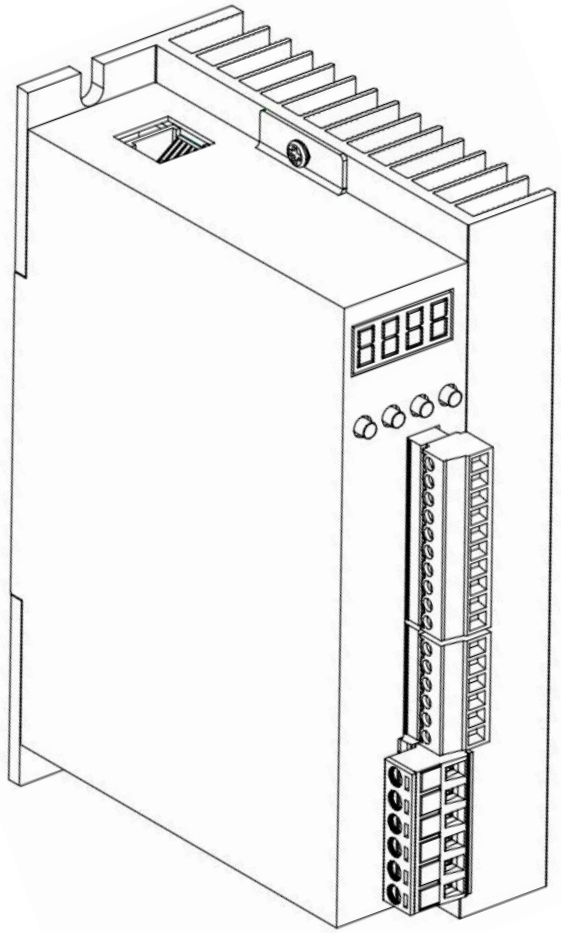
DL86H-V3.0 Manual



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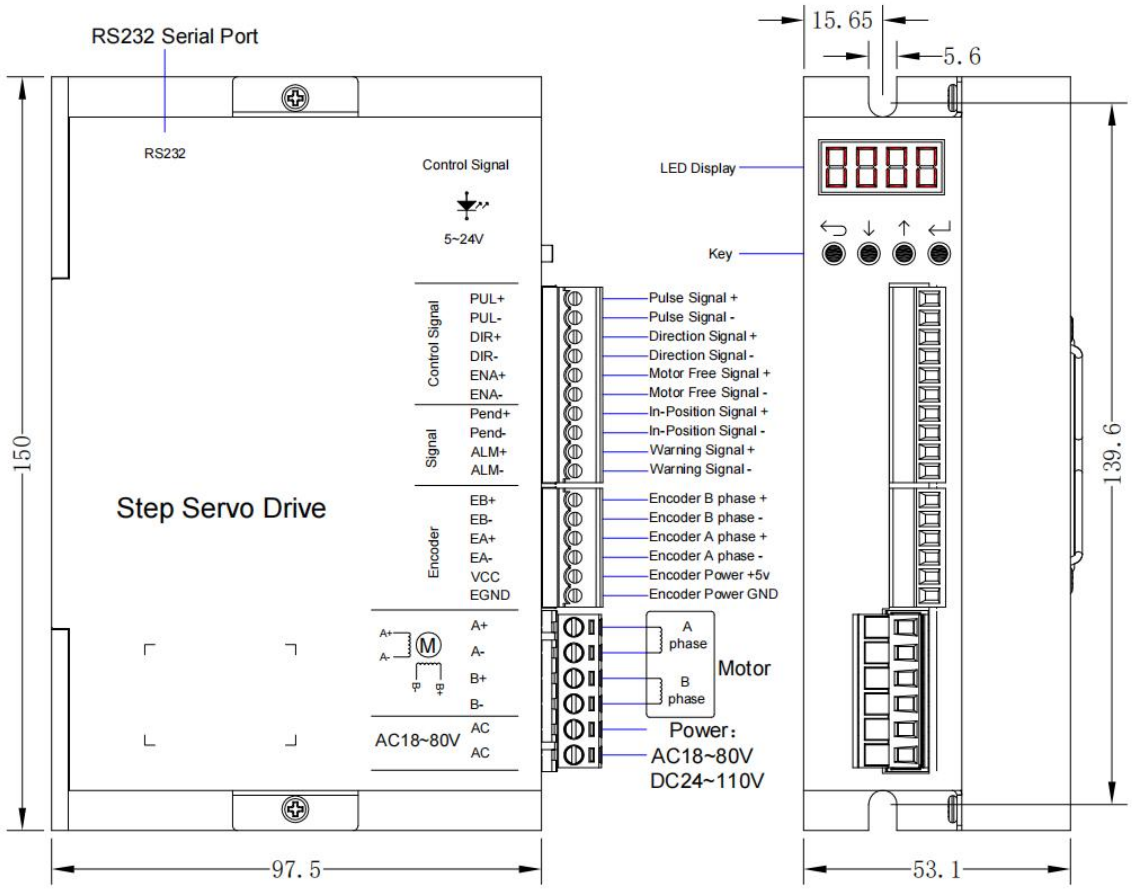
1、Introduction

DL86H is a new digital step-servo driver, using a vector controlling technology. It can drive 57/60 series and 86 series step-motors.

DL86H can fit various automation equipment and instruments with below technical features:

- Use of 32 bit motor control MCU of Freescale Semiconductor
- Use of vector servo control technology
- Easy Operation with four LED Segment Displays and keyX4
- Wide range of drive current drive current from 0.4 to 8.0A/phase
- Can drive 57 /60series and 86 series hybrid step-motors(Closed-Loop and Open-Loop)
- Opto-isolated signal input/output
- Highest response frequency: 200Kpps
- Provide 16 channels micro steps ,highest micro step: 51200 ppr
- Provide Electronic Gear Ratio
- Protection circuit：Over heat; Over current; Over voltage; Over-speed and position deviation
- Two control method:Position,Speed
- Net Weight:520g

2、Dimensions(unit:mm)



Picture 1

Caution:

When the Driver temperature exceeds 40°C,the fan will start to work. When the Driver temperature exceeds 70°C, the current will be cut off automatically and the Driver will not work till the temperature drops to 40°C. In case this happens, please install ventilation equipment.

3、Port definition and Drive connection

3.1 Port definition

3.1.1 Step-motor and Power Definition

Terminal Number	Mark	Function	Motor Wire Colour
1	**A+**	A phase +	White
2	**A-**	A phase -	Green
3	**B+**	B phase +	Blue
4	**B-**	B phase -	Black
5	**AC**	Power input	AC18~ 80V/DC24-110V
6	**AC**	Power input	

3.1.2 Encoder Definition

Terminal Assignment	Mark	Function	Wire Colour
1	**EB+**	Encoder B phase +	Yellow
2	**EB-**	Encoder B phase -	Green
3	**EA+**	Encoder A phase +	Black
4	**EA-**	Encoder A phase -	Blue
5	**VCC**	Encoder power +5V	Red
6	**EGND**	Encoder power GND	White

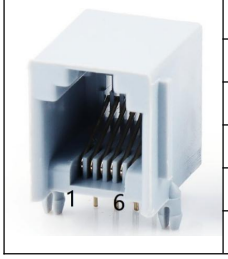
3.1.3 Control Signal

Terminal Assignment	Mark	Function	Instruction
1	**PUL+**	Pulse signal positive side	Pulse signal: In single pulse (pulse/direction) mode, this input represents pulse signal, each rising or falling edge active (software configurable); 5-24V when PUL-HIGH, 0-0.5V when PUL-LOW. In double pulse mode (pulse/pulse) ,this input represents clockwise (CW) pulse. For reliable response, pulse width should be longer than 2.5 μ s.
2	**PUL-**	Pulse signal negative side	
3	**DIR+**	Direction signal positive side	DIR signal: In single-pulse mode, this signal has low/high voltage levels,representing two directions of motor rotation; in double-pulse mode , this signal is counter-clock (CCW) pulse. For reliable motion response, DIR signal should be ahead of PUL signal by 5 μ s at least. 5-24V when DIR-HIGH,0-0.5V when DIR-LOW. Please note that rotation direction is also related to motor-Drive wiring match. Exchanging the connection of two wires for a coil to the Drive will reverse motion direction.
4	**DIR-**	Direction signal negative side	

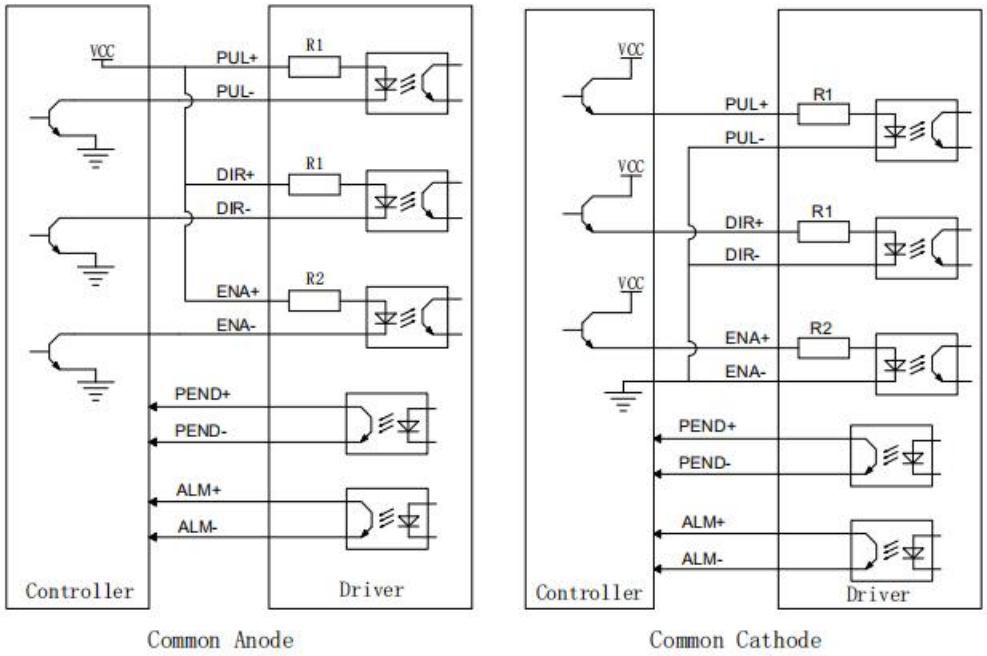
5	**ENA+**	Motor free signal positive side	When drive break down ,it will output ALM signal to the PC
6	**ENA-**	Motor free signal negative side	
7	**Pend+**	In-position signal positive side	When step motor is in-position, the drive will give a signal to the PC
8	**Pend-**	In-position signal negative side	
9	**ALM+**	Warning signal positive output	This signal is used for enabling/disabling the Driver.Usually left UNCONNECTED (ENABLED)
10	**ALM-**	Warning signal negative output	

3.1.4 RS232 Terminal

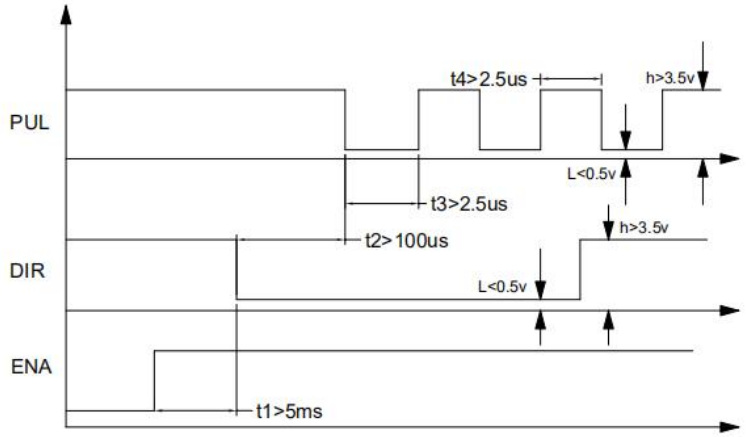
This terminal use TTL electrical level,when conmmunicate with PC,the Baud Rate is 115200.Just use Pin2,Pin3 and Pin5.

Picture	Pin	Name	Instruction
	1	+3.3V	Power positive pole
	2	GND	Signal Ground
	3	RxD	Received Data
	4	GND	Signal Ground
	5	TxD	Transmit Data
	6	+5V	Power positive pole

3.2 Control Signal Circuit



Picture 2(a) Control signal Interface Connection Diagram



Picture 2(b) Input Signal Oscillogram

4、Parameter Setting

DL86H have four LED Segment Displays and four keys :↩、↓、↑ and ↵.

Key	Instruction
↩	back，cancel；return to the previous menu, cancel the operation
↓	PgDn、adjust data when value is modified
↑	PgUp、shift data when value is modified
↵	Enter the parameter setting model(press the key for 3 seconds)

When the drive start to work, it displays the driver version first, then it displays the state of driver after 3 seconds. when the step-motor start to work, it displays the speed of step-motor(r/min).Once the step-motor reverses, the top byte of speed value flashes.

4.1 Parameter Function Instruction

4.1.1 Parameter Function Table

Parameter	Function	Value	Factory Setting	Instruction
P000	Control parameter	～	0000	Read 4.1.2 Function of P000
P001	Micro step setting	SEt, 2～256	10	17 channels
P002	Set direction of step-motor rotation	0、1	0	Set the motor rotate direction
P003	Select the motor type	57、86	86	57or86 motor type
P004	Setting Position Deviation	1～9999	4000	
P005	Standby Current Ratio	0～100%	50	
P006	Electronic Gear Ratio(Numerator)		1	
P007	Electronic Gear Ratio (Denominator)		1	
P020	Low 4 bit of pulse	～		Display the value of input pulse
P021	High 4bit of pulse	～		
P100	Running Current Ratio	10～120%	100	*

P101	Current Loop Gain	1～1000	115	Modify is forbidden
P102	Current Loop Integral Time Constant	1～1000	45	Modify is forbidden
P103	Current Loop Damping Factor	1～1000	830	Modify is forbidden
P104	Speed Loop Gain	1～1000	65	Modify is forbidden
P105	Speed Loop Integral Time Constant	1～1000	85	*
P106	Position Loop Gain	1～1000	50	*
P107	Speed Loop Feed-forward	1～100	95	*
P108	Enable	0、1	1	*
P109	Speed Loop Damping Factor	1～100	15	*
P110	Setting I/O Level signal	0000～1111	0000	Setting level signal of ENA, Pend and ALM.0 or 1 is valid
P111	positioning accuracy	1-50	1	±1 pulse.The bigger the value, the bigger the positioning error； When the load is too heavy, the resonance can be suppressed。
P112	resonance coefficient	1-12	6	Under the same inflexibility, the smaller the value, the shorter the positioning time, the more easily resonance occurs
P200	Control Mode	0、1、2、3	0	0: Position control mode (Mode A); 1: Speed control mode 2: Position control mode (Mode B) 3: Open-Loop drive mode (Mode C)
P201	Speed setting in speed mode	1～3000	60	Self-inspection pulse (unit: rev/min)
P202	acceleration time in speed mode		100	unit: ms
P203	The delay time of brake on(__ms)		0	Read 4.1.3 Function of P000
P204	Control mode after Alarm	0、1、2	0	Read 4.1.4 Function of P000
P300	Running Current Setting(Open-Loop)	2.0A~6.0A	4.8	Running Current(RMS) Unit: 0.1A
P305	Time of Over-Load		1600	Unit:0.1ms

NOTE 1:

◆ Default value of **P110** is 0000,

P110= $\frac{0}{A}\ \frac{0}{B}\ \frac{0}{C}\ \frac{0}{D}$

D=0, When malfunction occurs, **ALM** output is low impedance;

D=1, When malfunction occurs, **ALM** output is high impedance;

C=0, When step-motor is in-position, **Pend** output is low impedance;

C=1, When step-motor is in-position, **Pend** output is high impedance;

B=0 ,Pulse+Direction,the falling edge is effective;

B=1 ,Pulse+Direction,the rising edge is effective;

B=2,CCW pulse/CW pulse,the falling edge is effective;

B=3,CCW pulse/CW pulse,the rising edge is effective;

A=0,when **ENA** input signal is low – level, the drive cut off motor current and set the motor free.

A=1,when **ENA** input signal is high – level, the drive cut off motor current and set the motor free.

◆ **P200：Position Control Mode Instruction**

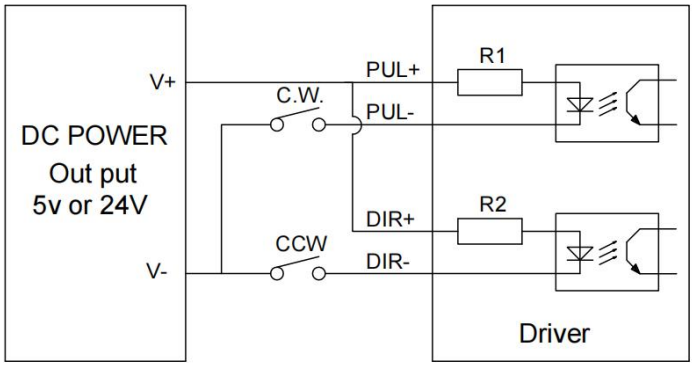
P200	Function
0	Mode A:Closed-loop(include position-loop,current-loop and speed-loop)
2	Mode B:Phasor control(include position-loop and current-loop)

P200=2 (Mode B)

Parameter	Function	Factory Setting	Instruction
P104	Speed Loop	10	The value is smaller, the gain is higher and its rigidity is stronger
P106	Position Loop	25	The value is smaller, the gain is higher and its rigidity is stronger

◆ **P200：Speed Mode Setting(Self-inspection pulse)**

PUL- point signal input level	DIR- point signal input level	Function
0	0	Motor stopped
0	1	Clockwise(Self-inspection pulse)
1	0	Counter clockwise(Self-inspection pulse)
1	1	Motor stopped



◆ **When P200's Value is 3 ,setting P300's value is as follow table ((Unit：0.1A)**

Current (RMS)	0020	0025	0032	0038	0042	0048	0053	0060

NOTE 2:When P000 is "0200", the internal drive will run at 60 rev / min. In this mode, pressing ↓ down the speed of motor, pressing ↑ raise the speed of motor, speed ranging from-300 to +300,pressing ⮌ cancel this mode.

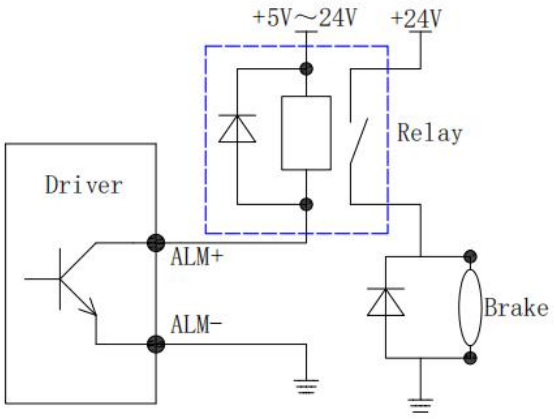
4.1.2 Function of P000

P000	Function
1111	Reset to Factory Defaults
0100	soft-start up the fan
0101	Display the speed of motor
0102	Display the value of DC bus voltage
0103	Display the temperature value of Drive
0104	Display position error
0105	Display ex-factory date
0106	History fault
0200	Self-inspection pulse

4.1.3 Function of P203

P203	Function
0	Define alarm signal output
200ms	This parameter defines the delay time from the motor energized until the action(alarm output) BRK is ON (for example 200ms)

◆When alm port is using for BRK,the lowest digit of P110 must set up 1.



4.1.4 Function of P204

P204	Alarm signal is on
0	PWM is closed immediately
1	PWM is closed slowly after 3 second
2	PWM keeping on 3 second,then Driver clear alarm signal,and restart.When clearing alarm signal twice,the alarm signal is keeping-on still,the Driver doesn't restart again.

4.1.5 Subdivision Table（P001）

Micro step	SEt, 2,4,5,8,10,16,20,25,32,40,50,64,100,128,200,256

◆Servo Response:

1.Higher the speed loop gain(**P104**) or smaller the speed loop integral time constant(**P105**), faster the speed control response will be. But due to machine feature, machine vibration may result due to excessive speed loop gain.

2.Higher the position loop gain(**P106**), faster the position control response will be with fewer errors. But due to machine feature, machine vibration may result due to excessive position loop gain. The position loop gain is enabled in the zero-position fixed mode.

3.Speed feed-forward(**P107**) reference is the function that reduces the positioning time by feed-forward compensation in position control. The max value is 100.

【***Terminology***】 Feed-forward Control: It indicates the necessary corrective action that is performed prior to external interference in the control system. Once it is activated, servo gain will rise and the response performance will be improved.

NOTE：

1、 Provides 16 kinds of micro step selection, upmost micro step can be set to 200x.

2、 When the step-motor rotation direction and the system direction given by the controller are opposite, please change the value of parameter **P002.**

3、 When you select SEt (the value of P001),the micro step of Servo Drive is Electronic Gear Ratio.

If the deceleration ratio of the servomotor and the load shaft is given as ***n/m*** where ***m*** is the rotation of the servomotor and ***n*** is the rotation of the load shaft, the electronic gear ratio is calculated as below：

$$\text{Electronic gear ratio} = \frac{P006}{P007}$$

$$= \frac{Encoder.resolution.ratio}{Displacement.per.load.shaft.revolution(reference.units)} \times \frac{m}{n}$$

Note that: $\frac{1}{20} \le$ Gear Ratio ≤ 20

Encoder resolution ratio indicates the count of pulses output by the encoder during one motor rotation.

Orthogonal incremental encoder resolution ratio = Number of wires * 4

For example:

Displacement per load shaft revolution =6000(pulse)

Number of wires=1000

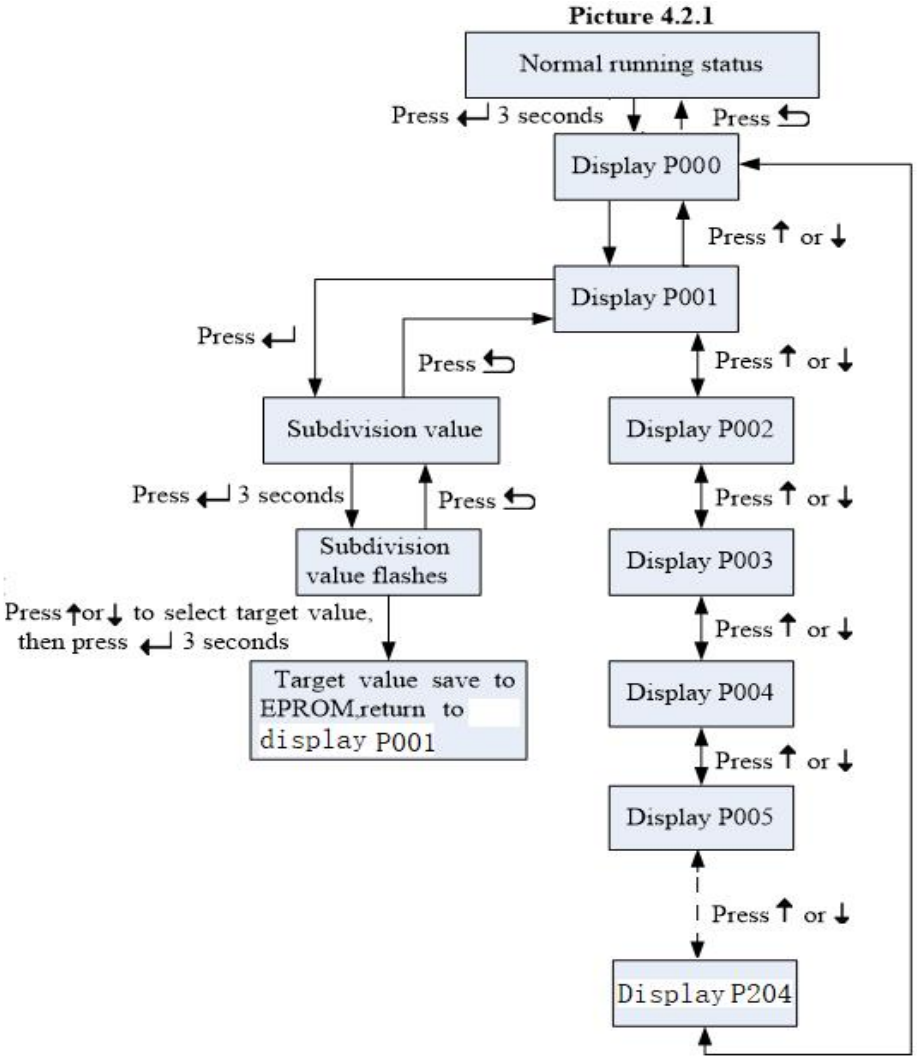
m=1,**n**=1

$$\text{Gear Ratio} = \frac{P006}{P007} = \frac{1000*4}{6000} \times \frac{1}{1} = \frac{2}{3}$$

Calculation as below: P006=2，P007=3

4.2 How to set parameter

Picture 4.2.1



Note:

1.P000 will return to factory setting when the Drive restart

2.When P000 is "1111",all parameters will reset to Factory defaults

4.3 Alarm code

When malfunction occurs, the driver will display corresponding alarm code, and more will be shown in turn if more alarm signals.

ALM Code	Function	Instruction
Er01	Over Current	When current exceeds rated value, the drive will stop running
Er02	Over-Speed	The max speed is 4500r/min
Er03	Position deviation	When position deviation value exceeds rated value, the driver will stop running
Er04	Over Heat	The max value is over 80℃
Er05	Over DC Voltage	When input voltage exceeds rated value, the driver will stop running, the voltage range from AC18~80V

Er06	EPROM happen fault	Reading or Writing EPROM is failure
Er07	Over Load	Check whether the load is too heavy
Er08	Motor fault	Motor lack phase

5、Warranty Terms

Our company will provide warranty of 2 years from the delivery date and free maintenance under warranty.