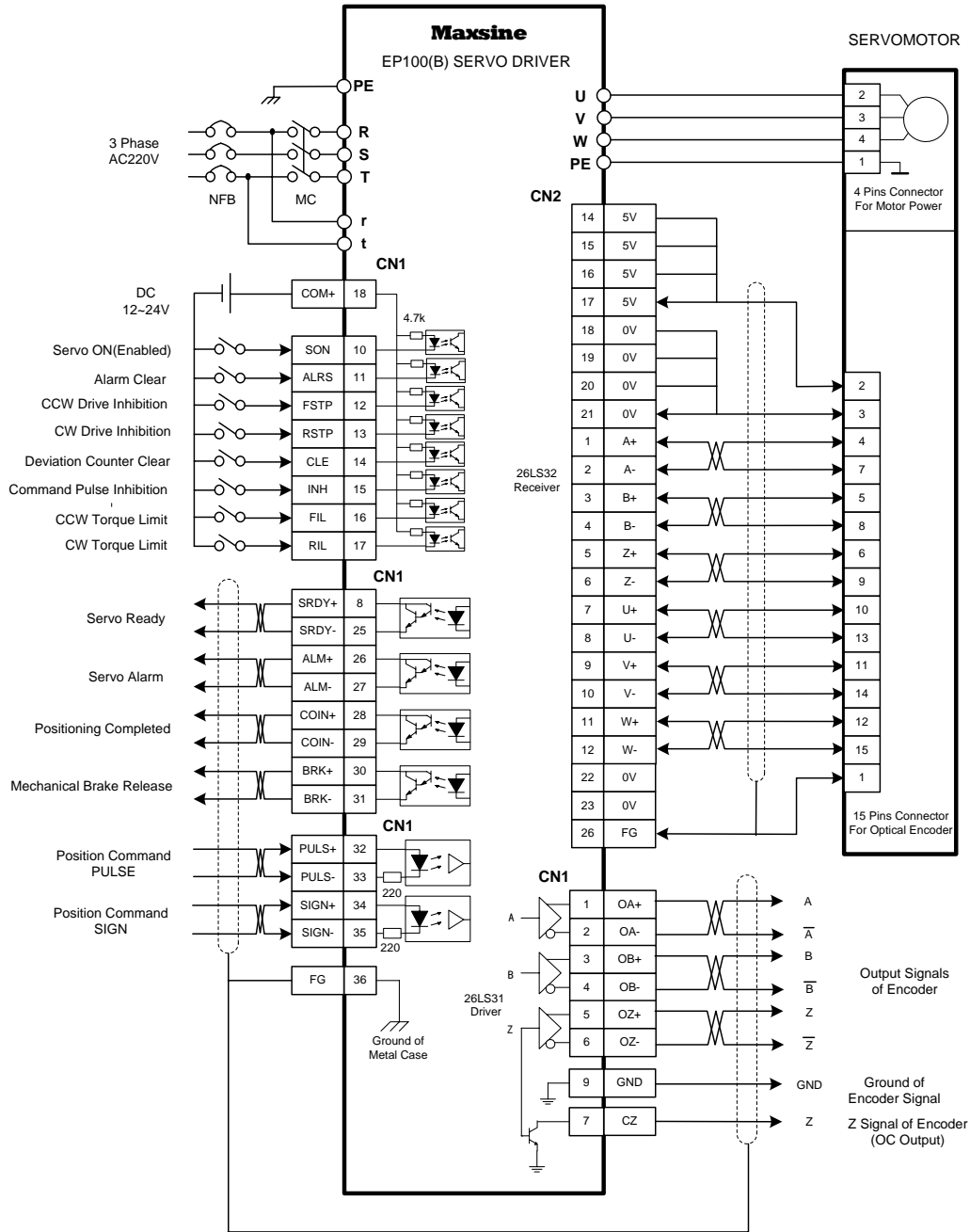# Maxsine

## EP*100*　AC SERVO

## QuickGuide

Maxsine Electric Co.,Ltd

# 1.1 Standard wiring

## Position control



Picture 1.1 Standard wiring for position control

# 1.2 Terminal disposition for interface

Figure 3.1 is the disposition chart of terminal connector CN1 for the servo driver. CN1 is the connector with 36 cores. Figure 3.2 is the disposition chart of terminal connector CN2 for the servo driver. CN2 is the connector with 26 cores.
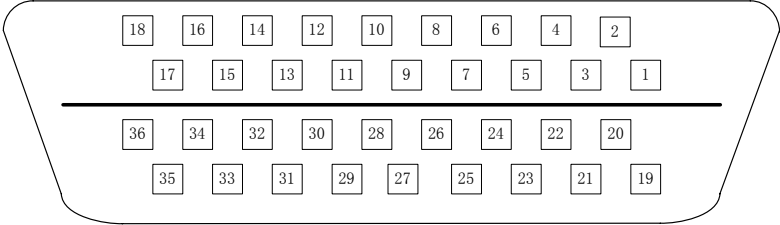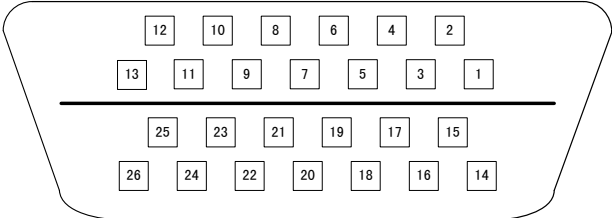


Figure 2.1 the soldering lug of the CN1 plug（face to lug）
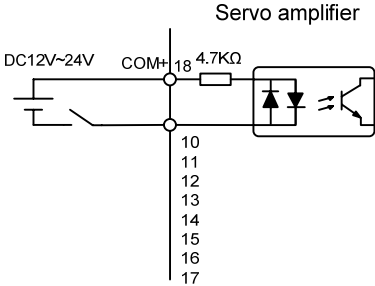


Figure 2.2 the soldering lug of the CN2 plug（face to lug）
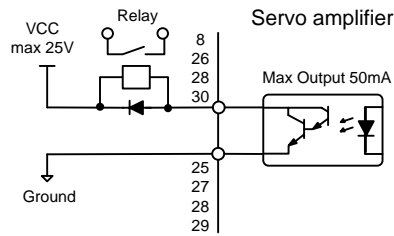
# 1.3 Input/output interface type

## 1.3.1 Switch value input interfaces



- The range of external DC power supply is 12~24V, and the minimum input current is 100mA .
- Inverting the polarity of DC power source, which is provided by the user, can cause the servo driver damage.

## 1.3.2 Switch value output interfaces
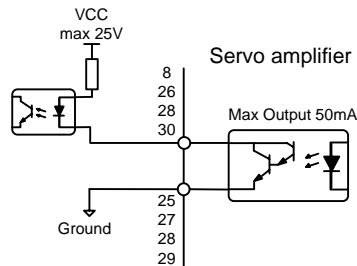


Relay connection



Photo-coupler connection

- The outputs use Darlington photo-coupler. It can be connected with relay, photo-coupler.
- Inverting the polarity of DC power source, which is provided by the user, can cause the servo driver damage.
- Open-collector circuit is used to transfer the outputs signal. the maximum current is 50mA, the maximum voltage of external DC power supply is 25V. loads of the output signal should be limited in that range, if not or directly connect to the power, can cause the servo driver damage.
- When using relay like inductive loads, a free-wheel diode must be connected with the inductive load in parallel. If the diode connects in wrong direction can cause damage to the output circuit.
- Owing to the low level of output is approximately 1V and cannot satisfy the TTL low-level request, therefore cannot directly connect with the TTL circuit.

# 1.3.3 Pulse interfaces
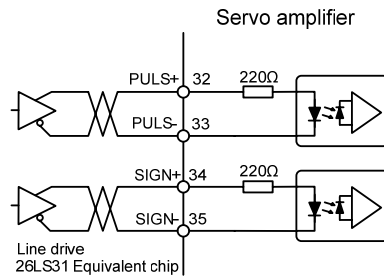
The differential input connection
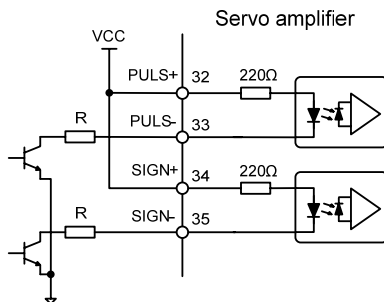
The single input connection

- The differential input connection is recommended for a correct transfer.
- The RS422 driver(e.g AM26LS31、MC3487) is used to make the differential connection.
- The action frequency will be fall down under a single connection. Base on the input circuit, the driver current is in the range of 10~15mA , the maximum voltage of external DC power supply is 25V, the R value will be got, Experience data:VCC=24V, R=1.3~2k; VCC=12V, R=510~820Ω; VCC=5V, R=82~120Ω.
- Under the single connection, inverting the polarity of DC power source, which is provided by the user, can cause the servo driver damage.
- The input mode、timing and parameters of the pulse are shown below, the arrow indicates the counting edge. When use the mode of A、B phase, the maximum of the four times the frequency is 500kHz.

| Command pulse type | CCW | CW | Parameter P035 |
|---|---|---|---|
| Pulse+ DIR | PULS  SIGN | PULS  SIGN | 0 |
| CCW pulse/ CW pulse | PULS  SIGN | PULS  SIGN | 1 |
| A phase+ B phase | PULS  SIGN | PULS  SIGN | 2 |

Input pulse mode

| Pulse waveform of position command | Parameter demand | |
|---|---|---|
| | Differential | Single end |
|  Pulse+DIR<br>The maximum frequency is 500kHz | $t_{ck}>2\mu s$<br>$t_h>1\mu s$<br>$t_l>1\mu s$<br>$t_{rh}<0.2\mu s$<br>$t_{rl}<0.2\mu s$<br>$t_s>1\mu s$<br>$t_{qck}>8\mu s$<br>$t_{qh}>4\mu s$ | $t_{ck}>5\mu s$<br>$t_h>>2.5\mu s$<br>$t_l>>2.5\mu s$<br>$t_{rh}<0.3\mu s$<br>$t_{rl}<0.3\mu s$<br>$t_s>2.5\mu s$<br>$t_{qck}>10\mu s$<br>$t_{qh}>5\mu s$ |
|  CCW pulse/CW pulse<br>The maximum frequency is 500kHz | $t_{ql}>4\mu s$<br>$t_{qrh}<0.2\mu s$<br>$t_{qrl}<0.2\mu s$<br>$t_{qs}>1\mu s$ | $t_{ql}>5\mu s$<br>$t_{qrh}<0.3\mu s$<br>$t_{qrl}<0.3\mu s$<br>$t_{qs}>2.5\mu s$ |
|  A phase+B phase<br>The maximum frequency is 125kHz | | |

Input pulse timing and parameters

6

# 1.3.4 Encoder signals output interfaces
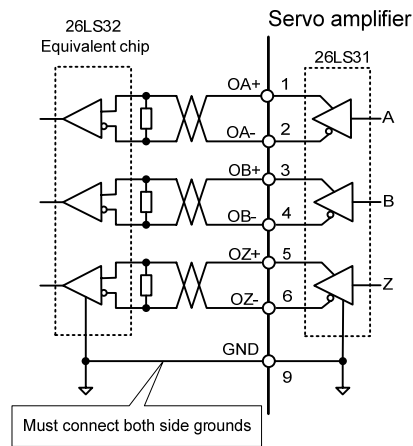


- The encoder signals is transferred through the differential driver (e.g AM26LS31).
- On the host controller uses AM26LS32(or equivalent) to make the receiver, must connect the terminal resistance, the value is about 330Ω;
- Encoder signal (GND) of servo driver must connect with the ground terminal on host controller.
- No isolation output.
- The high-speed photo coupler (e.g. 6N137) can also be used on the host controller to make the receiver.
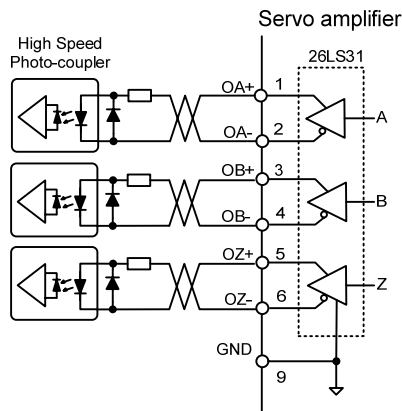
## 1.3.5 Open-collector output of encoder Z signal
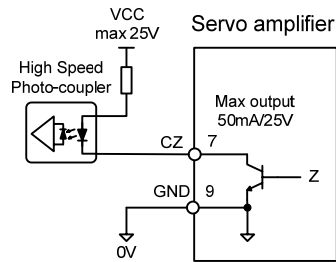


- The Z signal of encoder is transferred through the open-collector circuit, it output ON(Turn on) when the Z signal appears or OFF(Turn off) when there is no Z signal appears.
- No isolation output.
- Because the width of the Z pulse is narrow, please use a high-speed photo-coupler to receive it on the host controller.

## 1.3.6 Photoelectric encoder input interfaces of servomotor
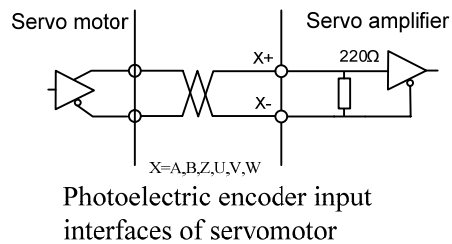


Photoelectric encoder input
interfaces of servomotor

# 1.4 Parameter table

The default value in the next table take 110ST-M02030 (matches the EP100-2A drivers the example. the parameter "*" symbol is possibly dissimilar in other models.

Table 4.1 User parameter table

| Ordinal | Name | Usage | Range | Default | Unit |
|---------|------|-------|-------|---------|------|
| 0 | Password | P，S，T | 0~9999 | 315 | |
| 1 | Identity code of servo driver | P，S，T | 0~51 | 30* | |
| 2 | Software version (read only) | P，S，T | * | * | |
| 3 | Status of initial display | P，S，T | 0~21 | 0 | |
| 4 | Control mode selection | P，S，T | 0~6 | 0 | |
| 5 | Proportional gain of speed loop | P，S | 5~2000 | 150* | Hz |
| 6 | Integral time constant of speed loop | P，S | 1~1000 | 20* | ms |
| 7 | Filter of torque | P，S，T | 20~500 | 100 | % |
| 8 | Filter for speed detection | P，S | 20~500 | 100 | % |

| Ordinal | Name | Usage | Range | Default | Unit |
|---|---|---|---|---|---|
| 9 | Proportional gain of position loop | P | 1~1000 | 40 | 1/s |
| 10 | Feed forward gain of position loop | P | 0~100 | 0 | % |
| 11 | Cut-off frequency of feed forward filter for position loop | P | 1~1200 | 300 | Hz |
| 12 | Numerator of frequency divider for position command pulse | P | 1~32767 | 1 | |
| 13 | Denominator of frequency divider for position command pulse | P | 1~32767 | 1 | |
| 14 | Input mode of position command pulse | P | 0~2 | 0 | |
| 15 | Reversing direction of position command pulse | P | 0~1 | 0 | |
| 16 | Positioning completed range | P | 0~30000 | 20 | pulse |
| 17 | Position deviation limit for error detection | P | 0~30000 | 400 | ×100 pulse |
| 18 | Neglect excessive position deviation | P | 0~1 | 0 | |
| 19 | Smooth filter for position command | P | 0~30000 | 0 | 0.1ms |
| 20 | Neglect drive inhibition inputs | P，S，T | 0~1 | 0 | |
| 21 | JOG running speed | S | -3000~3000 | 120 | r/min |
| 22 | Internal/external speed command selection | S | 0~2 | 1 | |
| 23 | Maximum speed limit | P，S，T | 0~4000 | 3600 | r/min |
| 24 | Internal speed 1 | S | -3000~3000 | 0 | r/min |
| 25 | Internal speed 2 | S | -3000~3000 | 100 | r/min |
| 26 | Internal speed 3 | S | -3000~3000 | 300 | r/min |
| 27 | Internal speed 4 | S | -3000~3000 | -100 | r/min |
| 28 | Arrival speed | S | 0~3000 | 500 | r/min |
| 29 | Input gain of analog torque command | T | 10~100 | 30 | 0.1V/100 % |
| 30 | Alarm level of torque overload | P，S，T | 1~300 | 300 | % |
| 31 | Detection time for torque overload alarm | P，S，T | 0~32767 | 0 | ms |
| 32 | Permission of control mode exchange | P，S，T | 0~1 | 0 | |
| 33 | Inversing direction of analog torque command | T | 0~1 | 0 | |

| Ordinal | Name | Usage | Range | Default | Unit |
|---|---|---|---|---|---|
| 34 | Internal torque limit in CCW direction | P，S，T | 0~300 | 300* | % |
| 35 | Internal torque limit in CW direction | P，S，T | -300~0 | -300* | % |
| 36 | External torque limit in CCW direction | P，S，T | 0~300 | 100 | % |
| 37 | External torque limit in CW direction | P，S，T | -300~0 | -100 | % |
| 38 | Trial running in speed mode; Torque limit in JOG operation | S | 0~300 | 100 | % |
| 39 | Zero offset compensation of analog torque command | T | -2000~2000 | 0 | |
| 40 | Acceleration time constant | S | 1~10000 | 0 | ms |
| 41 | Deceleration time constant | S | 1~10000 | 0 | ms |
| 42 | S-curve acceleration/deceleration time constant | S | 1~1000 | 0 | ms |
| 43 | Gain of analog speed command | S | 10~3000 | 300 | (r/min) / V |
| 44 | Reversing direction of analog speed command | S | 0~1 | 0 | |
| 45 | Zero offset compensation of analog speed command | S | -5000~5000 | 0 | |
| 46 | Time constant of filter for analog speed command | S | 0~1000 | 300 | Hz |
| 47 | Action setting for electromagnetic brake when servomotor is in standstill | P，S，T | 0~200 | 0 | ×10ms |
| 48 | Action setting for electromagnetic brake when servomotor is in motion | P，S，T | 0~200 | 50 | ×10ms |
| 49 | Action speed for electromagnetic brake when servomotor is in motion | P，S，T | 0~3000 | 100 | r/min |
| 50 | Speed limit in torque control | T | 0~5000 | 3600* | r/min |
| 51 | Electronic gear is available in dynamic | P | 0~1 | 0 | |
| 52 | Second numerator of frequency divider for position command pulse | P | 1~32767 | 1 | |
| 53 | Bottom four bits control word for forcing the input terminal to be ON | P，S，T | 0000~1111 | 0000 | Binary |

| Ordinal | Name | Usage | Range | Default | Unit |
|---------|------|-------|-------|---------|------|
| 54 | Top four bits control word for forcing the input terminal to be ON | P，S，T | 0000~1111 | 0000 | Binary |
| 55 | Bottom four bits control word for inversing the terminal input signal | P，S，T | 0000~1111 | 0000 | Binary |
| 56 | Top four bits control word for inversing the terminal input signal | P，S，T | 0000~1111 | 0000 | Binary |
| 57 | Control word for inversing the terminal output signal | P，S，T | 0000~1111 | 0000 | Binary |
| 58 | Time constant of input terminal for removing the effect of vibrating contact | P，S，T | 1~1000 | 16 | 0.1ms |
| 59 | Demonstration operation | P，S | 0~1 | 0 | |

# 1.5 Alarm table

Table 5.1 Alarm table

| Alarm code | Alarm name | Alarm content |
|---|---|---|
| -- | Normal | |
| 1 | Over speed | Servomotor speed exceeds the speed limit. |
| 2 | Over voltage of the main power supply | The voltage of the main power supply exceeds the specified value. |
| 3 | Under voltage of the main power supply | The voltage of the main power supply exceeds the specified value. |
| 4 | Position deviation exceeds the limit value | The counter of position deviation exceeds the setting limit value. |
| 5 | Servomotor over heat | The temperature of servomotor is too high |
| 6 | Saturation fault of the speed amplifier | The speed regulator is in saturation status for a long time |
| 7 | Drive inhibition is abnormal | CCWL、CWL the inputs of drive inhibition are OFF. |
| 8 | Overflow of position deviation counter | The absolute value of position deviation counter exceeds $2^{30}$ |
| 9 | Encoder signal fault | Lack of the signals of encoder |
| 10 | Under voltage of control power supply | The voltage of control power supply is too low. |
| 11 | IPM model fault | IPM intelligent model fault |
| 12 | Over current | Over-current of servomotor |
| 13 | Overload | Overload of servomotor and servo driver (instantaneous over heat) |
| 14 | Brake fault | Fault occurs in brake circuit |
| 15 | Encoder counter error | Encoder counter is abnormal. |
| 16 | Over-heat of servomotor | The heat load of servomotor exceeds the setting value ($I^2t$ detection) |
| 17 | Speed response fault | Speed deviation is too big for a long time |
| 19 | Over heat reset | System was reset by over heat fault |
| 20 | EEPROM error | EEPROM is in error |
| 21 | U4 error | U4 is in error |
| 22 | Reserved | |
| 23 | U6 chip error | U6 chip or current sensor is in error |
| 29 | Over torque alarm | The torque of servomotor exceeds the setting value and sustained time |

| 30 | Lost Z signal of encoder | Z signal of encoder is loss. |
|----|--------------------------|------------------------------|
| 31 | UVW signals error of encoder | The UVW Signals error or pole number does not match with the servomotor |
| 32 | Illegal code of encoder UVW signals | UVW signals are all high level or low level |

# 1.6 Display and button operation

The front panel consists of the display (6-digit, 7-segment LED) and four switching buttons ( $\uparrow$ , $\downarrow$ , $\leftarrow$ , Enter ). It is used for display the system status, parameter setting and so on. Operation is executed in layer. $\leftarrow$ and Enter button expresses the layer going backward and forward respectively; The Enter button has the meaning of enter, confirm. The $\leftarrow$ button has the meaning of exit, cancel. The $\uparrow$ and $\downarrow$ button expresses increase and decrease of serial number or value size respectively; if press down and hold the $\uparrow$ or $\downarrow$ button，then has the effect of repeat for doing so; And the longer of holding the higher of repeat rate.

If 6 LED digit or decimal point of the most right side LED digit is twinkling, shows that any alarm occurs. If the POWER lamp lit indicates that the main power supply is on. If the RUN lamp has lit, indicates that the servomotor is in motion.
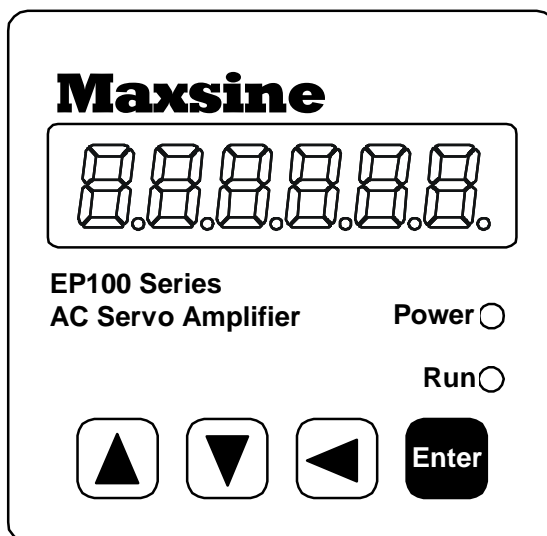
Picture 6.0 Front panel

# 1.7 First layer

Use the first layer to select the operation mode, There are seven operation mode can be selected by using ↑ or ↓ button，Then press down the Enter button for entering the second layer that has selected. After that if press down the ← button, then return to the first layer again.

| | |
|---|---|
| dP- | Monitor Mode |
| PA- | Parameter Setting |
| EE- | Parameter Management |
| Sr- | Trial Running of Speed |
| Jr- | JOG Running |
| AU- | Automatic Gain Adjustment |
| CO- | Encoder Zero Adjustment |
| oL- | Open Loop Operation |

**First Layer**
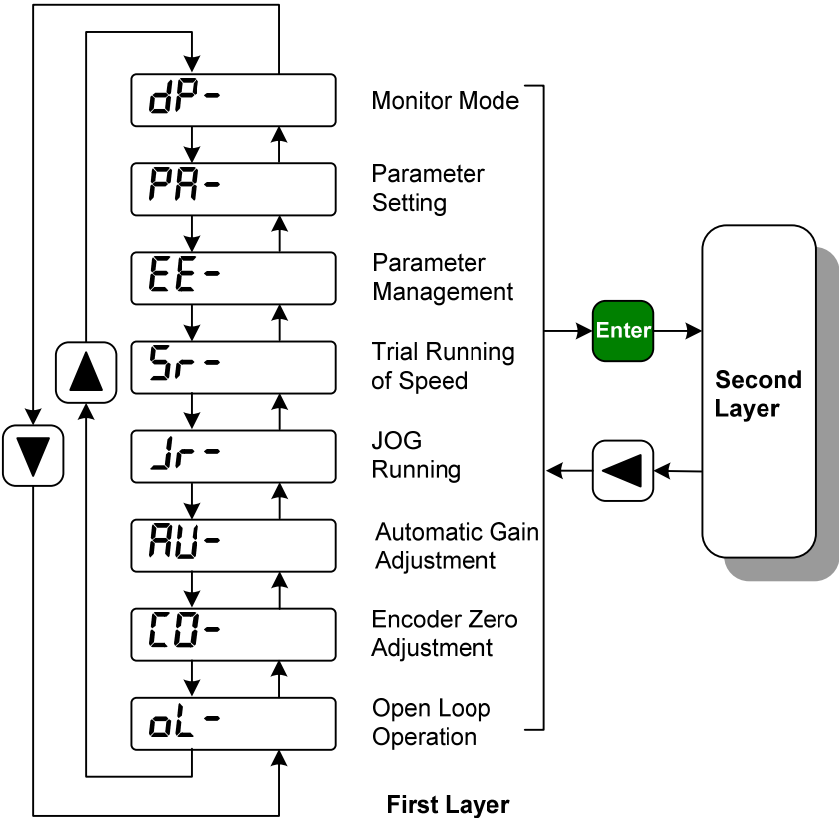
**Enter**

**Second Layer**

Picture 7.0 Diagram of operation mode selection

# 1.8 Second layer

## 1.8.1 Monitor mode

If has chosen the monitor mode "**dP-**    " in the first layer, Press the Enter button to enter the monitor mode. There is twenty one monitor's status. Use ↑ and or ↓ button to select the needing monitor's status; Press the Enter button again to enter the concrete display condition.

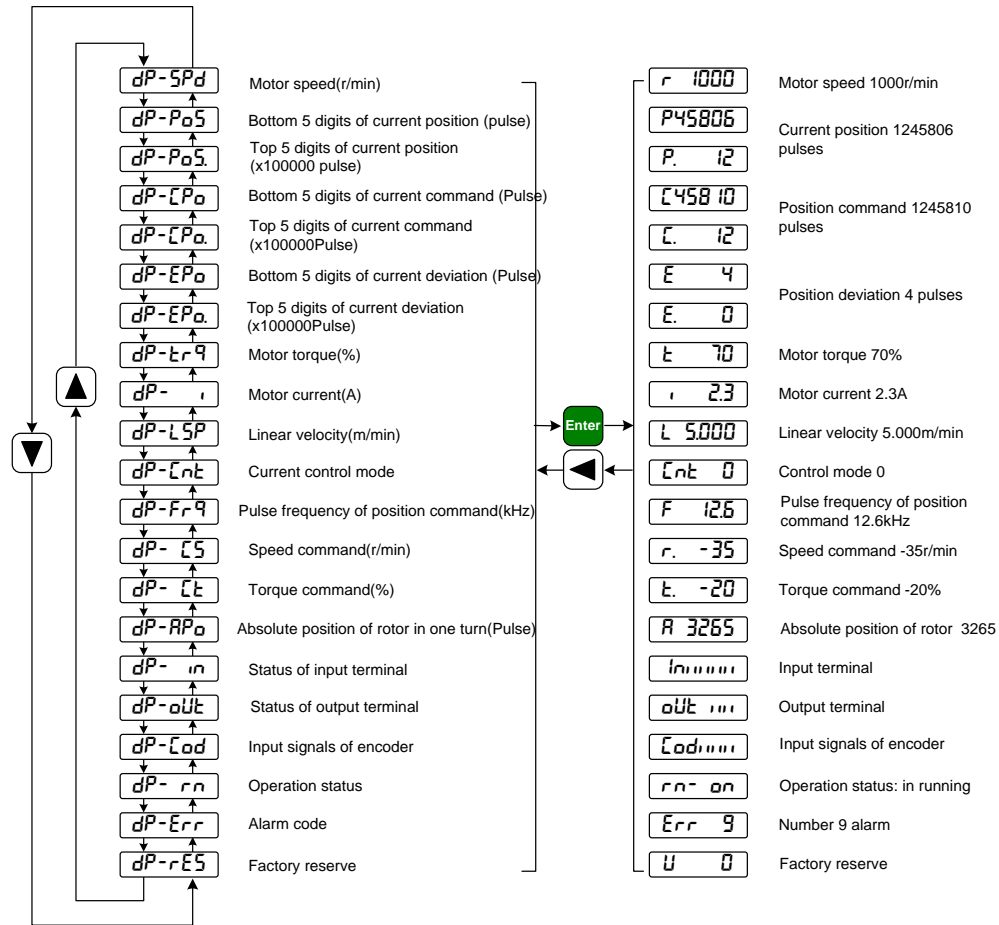| Monitor | Description | | Display | Value |
|---------|-------------|---|---------|-------|
| dP-SPd | Motor speed(r/min) | | r 1000 | Motor speed 1000r/min |
| dP-PoS | Bottom 5 digits of current position (pulse) | | P45806 | Current position 1245806 pulses |
| dP-PoS. | Top 5 digits of current position (x100000 pulse) | | P. 12 | |
| dP-CPo | Bottom 5 digits of current command (Pulse) | | C45810 | Position command 1245810 pulses |
| dP-CPo. | Top 5 digits of current command (x100000Pulse) | | C. 12 | |
| dP-EPo | Bottom 5 digits of current deviation (Pulse) | | E 4 | Position deviation 4 pulses |
| dP-EPo. | Top 5 digits of current deviation (x100000Pulse) | | E. 0 | |
| dP-tr9 | Motor torque(%) | | t 70 | Motor torque 70% |
| dP- ι | Motor current(A) | | ι 2.3 | Motor current 2.3A |
| dP-LSP | Linear velocity(m/min) | | L 5.000 | Linear velocity 5.000m/min |
| dP-Cnt | Current control mode | | Cnt 0 | Control mode 0 |
| dP-Fr9 | Pulse frequency of position command(kHz) | | F 12.6 | Pulse frequency of position command 12.6kHz |
| dP- CS | Speed command(r/min) | | r. -35 | Speed command -35r/min |
| dP- Ct | Torque command(%) | | t. -20 | Torque command -20% |
| dP-APo | Absolute position of rotor in one turn(Pulse) | | A 3265 | Absolute position of rotor 3265 |
| dP- ιn | Status of input terminal | | Inιιιιιι | Input terminal |
| dP-oUt | Status of output terminal | | oUt ιιιι | Output terminal |
| dP-Cod | Input signals of encoder | | Codιιιιι | Input signals of encoder |
| dP- rn | Operation status | | rn- on | Operation status: in running |
| dP-Err | Alarm code | | Err 9 | Number 9 alarm |
| dP-rES | Factory reserve | | U 0 | Factory reserve |

Picture 8.0 Diagram of monitor mode operation

## 1.8.2 Parameter setting

If has chosen the parameter setting mode "$PA-$ " in the first layer, Press the Enter button to enter the parameter setting mode. Use ↑ and or ↓ button to select the number of parameter. Press the Enter button to display the value of selected parameter. Use ↑ and ↓ button to be able to modify the parameter value. Press ↑ (or ↓ ) button once to increase ( or decrease) the parameter value by one. Pressing down and hold the ↑ ( or ↓ ) button, the parameter can increase ( or decrease) continuously. When the parameter value is modified, the decimal point on the most right sides LED is lit. Press Enter to confirm the parameter value to be effective, meanwhile the decimal point is turned off. The modified parameter value is immediately active to influence on the control. Hereafter pressing ↑ or ↓ button can continue to modify the parameter. After finishing modification of parameter, press the ← button to return to the parameter number selection. If the value of the parameter is not satisfied, do not press the Enter button and can press ← button to cancel and to resume the original parameter value and to return to the parameter number selection.
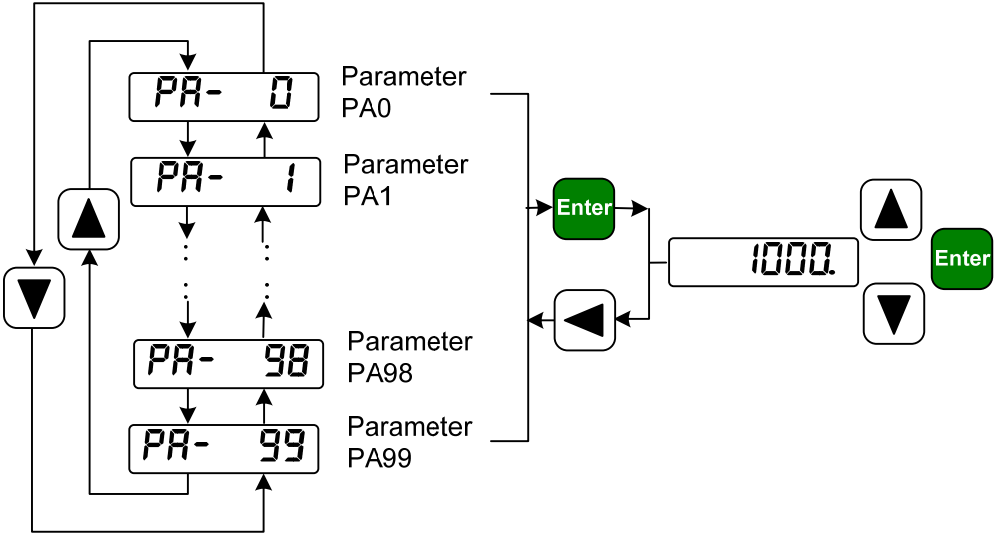


Picture 8.1 Diagram of parameter setting operation

## 1.8.3 Parameter management

Choose the parameter management mode "**EE-**    " in the first layer. Press the Enter button for entering the parameter management mode in which operation is performed between the parameter list and the EEPROM.

There are five operation modes. First use ↑ and or ↓ button to select an operation mode. Take "parameter write in" as the example, select "**EE-SEt**" and then pressing down and hold the Enter button at least three seconds to active the writing operation mode. The "**StArt**  " is displayed in the front panel indicating that the parameter is writing into EEPROM. Waiting for about 1 to two second, if the writing operation is successful, then the "**F in iSH**" will display, if it is fail the "**Error**   " will display. After finished the operation and then press the ← button for returning to the operation mode selection.

**EE-SEt**    **Parameter write**

This operation indicates that the parameter in parameter list will write to EEPROM. The user has made change to a parameter. This only change the value of the parameter in parameter list, but in the next time when the power supply is on the parameter will restore its original value. Making permanent change to a parameter value, it is the need to carry out the parameter write operation and write the parameter to EEPROM, in later when the power supply is on and will be able to use the parameter.

**EE-dEF**   **Resume default value**

This operation indicates that each default value of all the parameters will read and write to the parameter list and EEPROM. For the next time when power supply is on the default parameters will be used by now. When many parameters become confusion and cause abnormal operation, it is necessary to carry out this operation for resuming the default parameters. There are different default parameters for different servo driver model and the servomotor model. Therefore, before doing this operation the servo driver code (Parameter P001) and the servomotor code (Parameter P002) must be selected correctly.
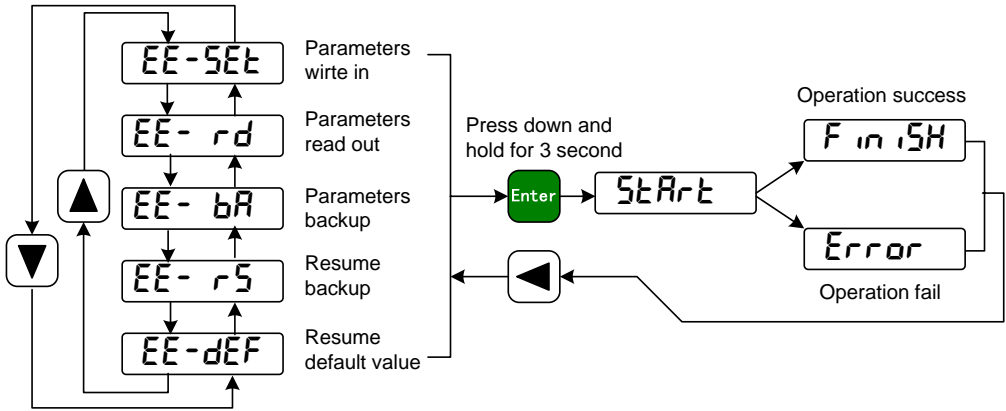


Picture 8.2 Diagram of parameter management operation

# 1.9 Operation of position control mode with simple wiring

## Wiring

According to the picture 7.8 make the wiring carefully.

- The main circuit terminal R、S and T connect with three phase AC 220V power supply.
- The terminal 'r' and 't' of control power supply connect with single phase AC 220V power supply.
- The output terminals(U,V,W) must be connected with the servo motor connections(U,V,W) correspondingly, otherwise the servo motor will stop or over speed.
- Using the encoder connector CN2 connect the servo driver with the servomotor.
- Using the control signal connector CN1 connect other wiring according to the drawing.
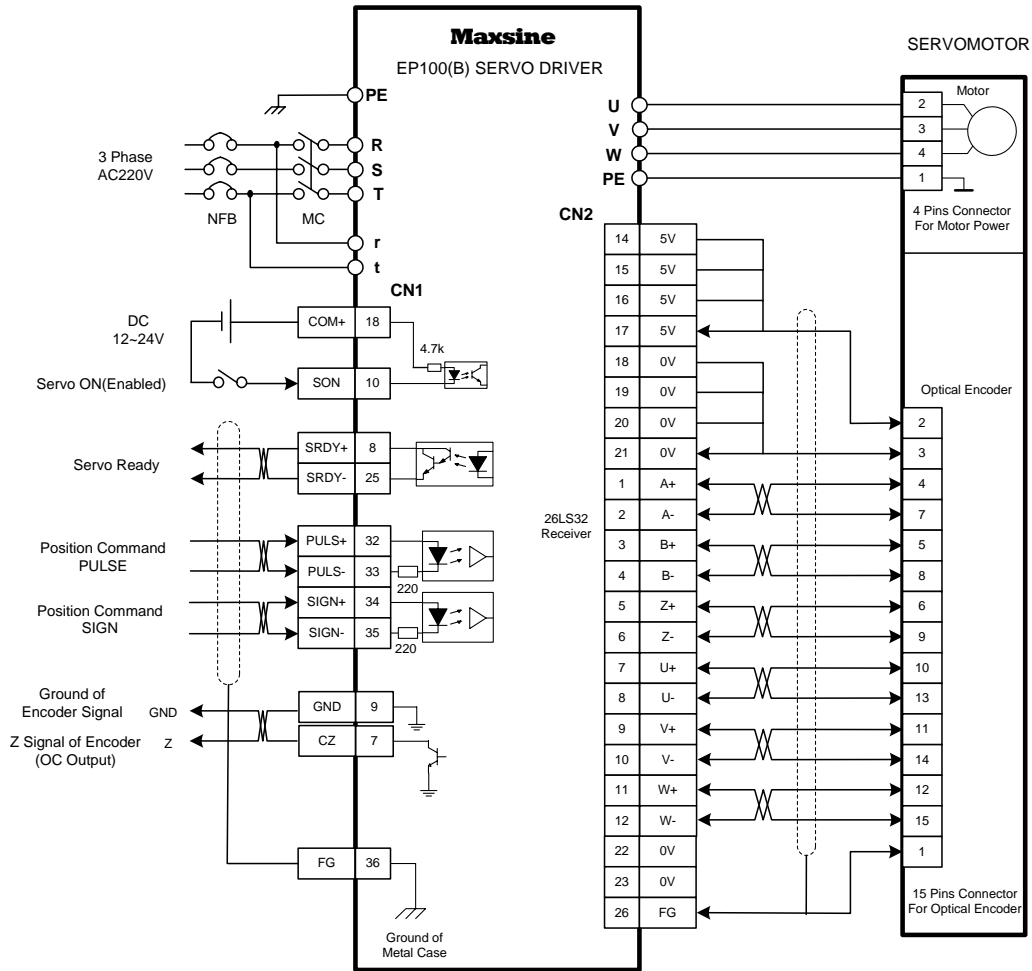


Picture 9.0 Simple wiring diagram of position control mode

# Operation

- Turn on the control power supply and then the main power supply. The display of the front panel is lit. The POWER indicating LED is lit.
- Set parameters according to the table below:

| Number of parameter | explanation | Setting value | Default value |
|---|---|---|---|
| PA4 | Control mode selection | 0 | 0 |
| PA12 | Numerator of electronic gear | By user setting | 1 |
| PA13 | Denominator of electronic gear | By user setting | 1 |
| PA19 | Smooth filter for position command | 0 | 0 |
| PA20 | Neglect drive inhibition inputs | 1 | 0 |

- Confirming that there is neither any alarm nor any unusual situation, the servo enable (SON) signal is given, then the RUN indicating LED lit and the servomotor is active at zero speed state by now. Send low frequency command pulse from the host controller to the servo driver and make the servomotor running under low speed.