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SERVO DRIVE
INSTRUCTION MANUAL
V 2.11.05

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Servo Drive SYM
Version 2.11.05

By:

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CNC MACHINES & CNC EQUIPMENTS

Chapter 1 Brief Introduction

1．1 Product brief introduction

From the 1980's, AC Servo technology have been developed and performance improved, nowadays widely apply to automation area, such as numerical control machine, package printing machine, textile machinery, automatic production line etc.

SDXXX series is our newly researched and developed generation of AC Servo drive, which with core arithmetic element of IRMCK201, complicated programmable device of EPLD and Mitsubishi intelligent power mode, have advantages of high integration density, small size, fast response speed, perfect protection, high reliability etc. Applicable to automatic industry control area, like high-precision numerical control machine, automatic production line, machine manufacture etc.

Comparing to former drive system, SDXXX AC Servo System has such advantages below：

★ Servo drives provide electrical outputs to servo motors in Semi-Closed loop motion control systems which use positional feedbacks to servo drive.

★ Speed ratio is 1：5000, from low speed to high speed, all have steady torque characteristics.

★ Servo motor can reach to maximum speed 5000rpm, turning positioning accuracy 1/10000r （PS：Different model of motor have different maximum speed）。

★ By modifying parameters can adjust settings of operation mode and characteristics, to meet different requirements.

★ Improved space vector control algorithm can produce larger torque than normal SPWM, and less noise.

★ With triple overload capacity, strong load capacity.

★ Perfect functional protection of over current, over voltage, under voltage and coder faulty.

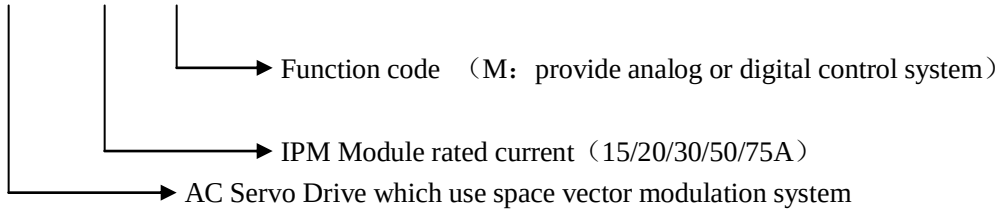
★ Monitoring function allow to display 18 parameter status, include position error, motor speed, pulse feedback, command pulse, motor current, warning recorder etc.

★ High applicability, can apply to high speed high-precise motor, and can fit up with different types of motors of 2~8 magnetic pole, 400-6000 coder.

1．2 Model Meaning

1． Servo drive model

S D 30 MT



Chapter 2 Installation

【Notice】

☆ Stock and installation must meet environmental condition requirements.

☆ Fire proof material is needed for installation, is not allowed to install on or near inflammable substance, to avoid fire.

☆ Servo drive must be installed inside the electrical control equipment, avoid of dust, aggressive gas, electric conduction subjects or fluids, inflammable and explosive substances.

☆ Servo drive and servo motor should prevent vibration, prohibit shock.

☆ Prohibit towing the wire, motor shaft and coder

2．1 Installation site

◎Install inside the electricity control system

Environmental temperature has great impacts on the Servo drive life span. Heat output condition inside the control system and internal electrical equipments heating would impact servo drive surrounding temperature, so drive heat-sink cooling and control system internal configuration should be considered while designing, to assure servo drive surrounding temperature is under 55℃, relative humanity below 95%, long time safe working temperature under 45℃.

◎Servo drive nearby heating equipments

If Servo drives working under high temperature, life span would shorten obviously and tempt to go out of order. So should make sure under the condition of heat convection and emission, relative

humanity surrounded the servo drive below 55℃

◎Servo drive nearby vibratory equipments

Take all kinds of shock proof measures, to assure servo drive do not affected by vibration, and keep vibration at 0.5g（4.9m/s^2）.

◎Servo drive works in severe environment

If the Servo drives working under severe environment, aggressive gas, moisture, metal dust, water and processing fluids, would lead to servo drive errors. So while installation, protection measures must be taken to guarantee the working environment.

◎Servo drive nearby jamming equipment

Jamming equipments nearby servo drive would disturbing servo drive power lead and control wire so as to lead to wrong operation, in order to assure servo drive normal working, noise filter and other interdiction countermeasures could apply to use. Please notice using noise filter would increase leakage current, in order to prevent such situation, isolation transformer is available. It is need to pay extra attention that command signal wire is easy to be disturbed; reasonable routing and shield measurements are needed.

2．2　Servo drive installation

Note：

☆ Servo drive must be installed inside well protected electrical control system.

☆ Servo drive must be installed according to regulated direction and inter space, meanwhile keep good heat output condition.

☆ Servo drive cannot be installed on inflammable substances or nearby to prevent fire.

1. Installation environment

（1）Protection

Servo drive has no protective structure, so installed into well protected electricity control system is a must, and avoid of contact with corrosive and flammability gas, prevent electric conduction substances, metal dust, oil mist and fluids inside.

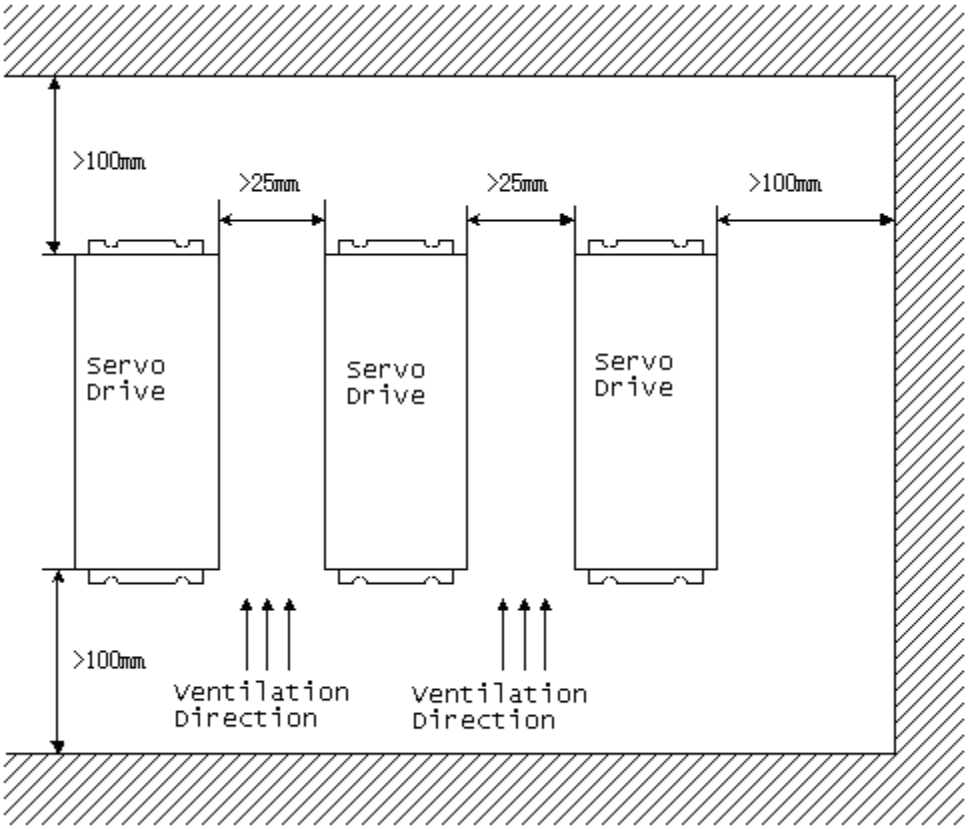
（2）Humiture

Environmental temperature 0－50℃, long time working temperature under 45℃, relative humidity below 90%, meanwhile to assure well heat output condition.

（3）Vibration and Shock

Servo drive installation should avoid vibration, taking vibration absorbing measure to keep it under 0.5g（4.9m/S^2）, servo drive installation cannot bear stress and shock.

2. Ventilation inter space



3. Method of Installation

（1）Method of installation

Motor installation adopted flange mounting, in any direction.

（2）Installation announcements

◎While dismounting belt wheel, don’t knock the motor or motor shaft, avoid to damage coder, should dismounting by screw type tools.

◎Motor cannot afford heavy thrust load and radial load. Suggest choosing resilient coupling to connect load.

◎Use Anti-loosing washer to motor fixed, prevent the motor getting loose.

4. Mounting dimensions

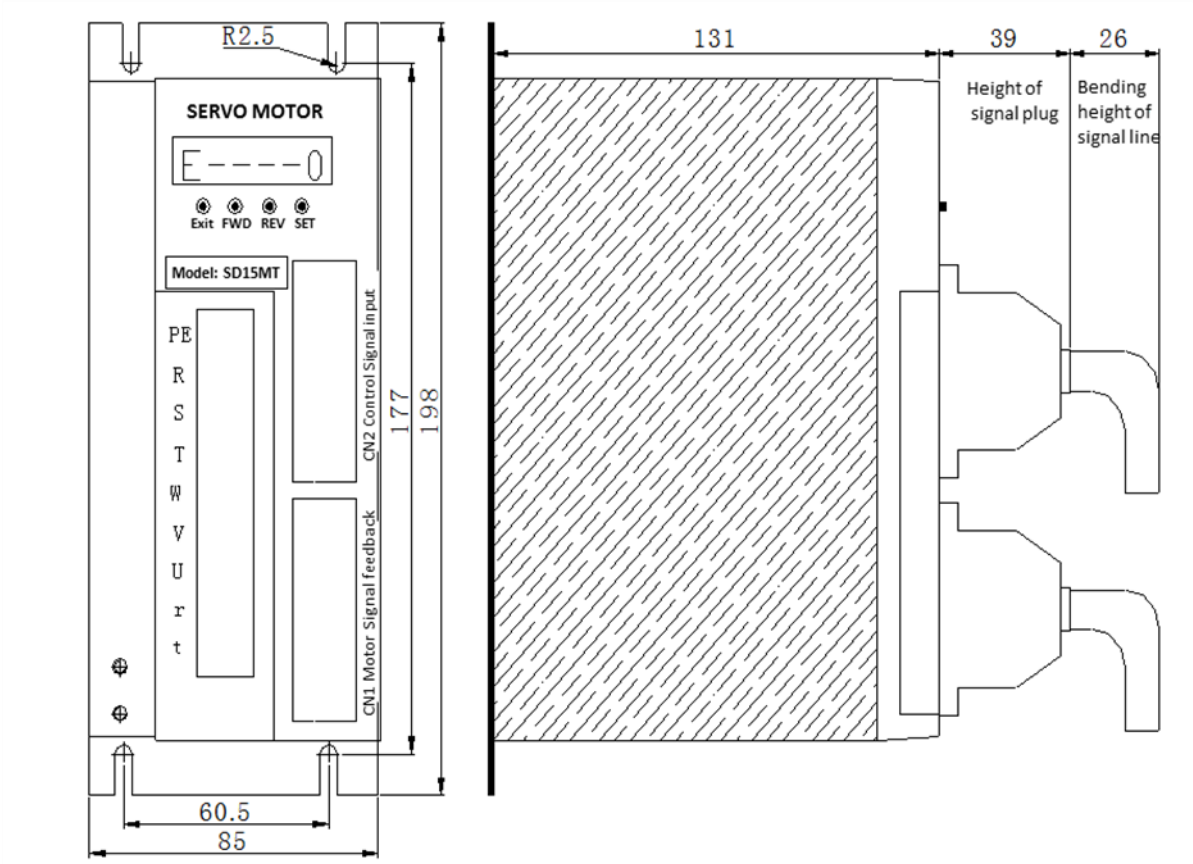


Diagram 2-1: **SD15MT Mounting Dimensions**

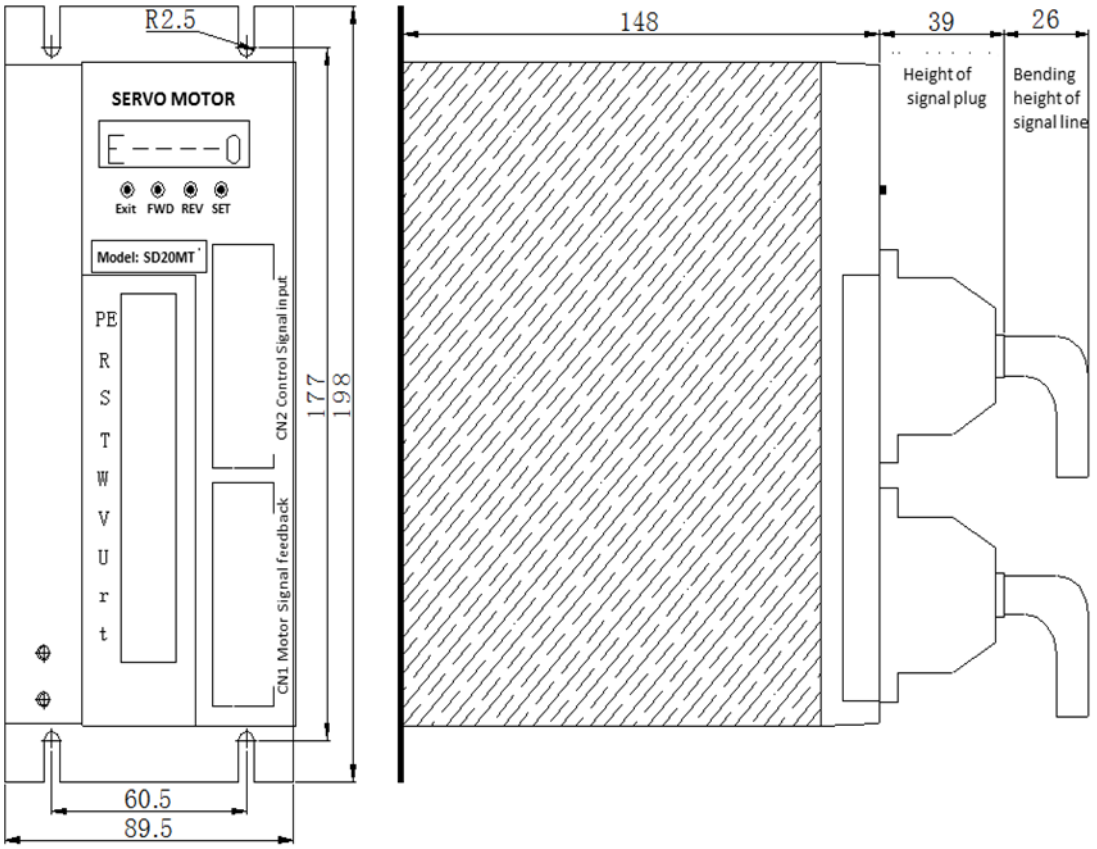


Fig. 2-2: SD20MT Installation Size

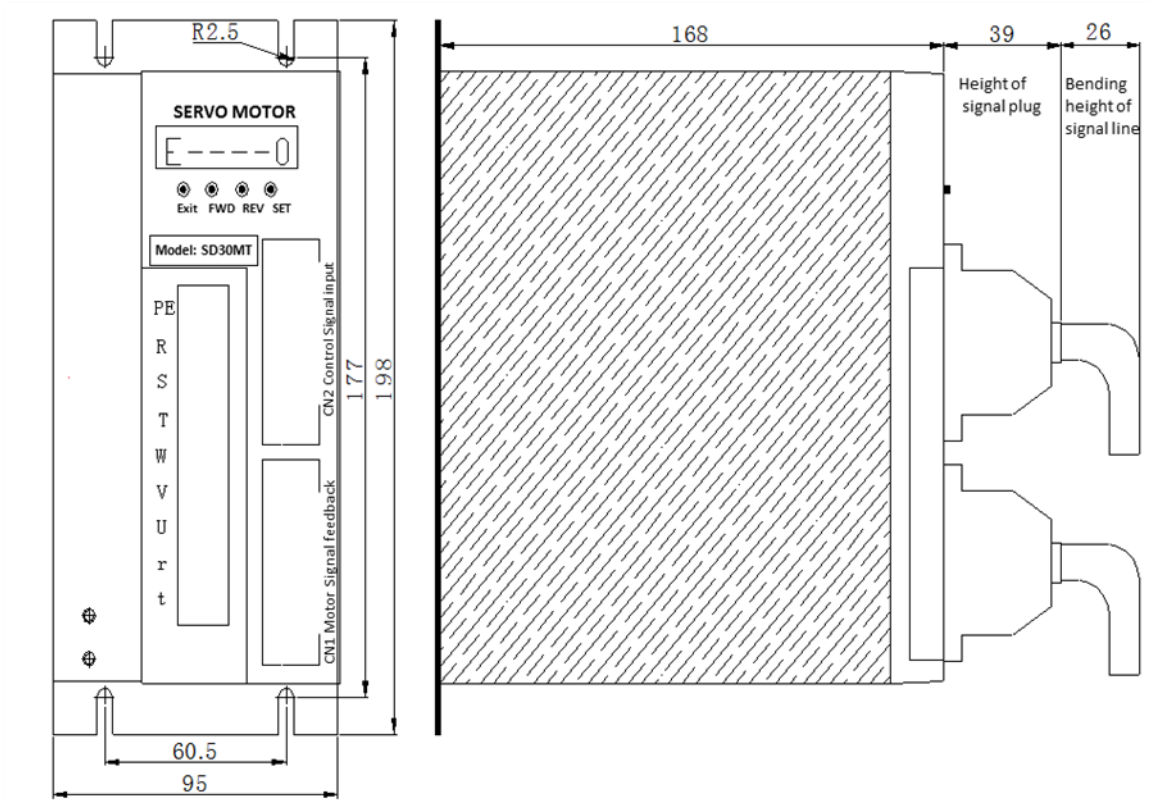


Fig. 2-3: SD30MT Installation Size

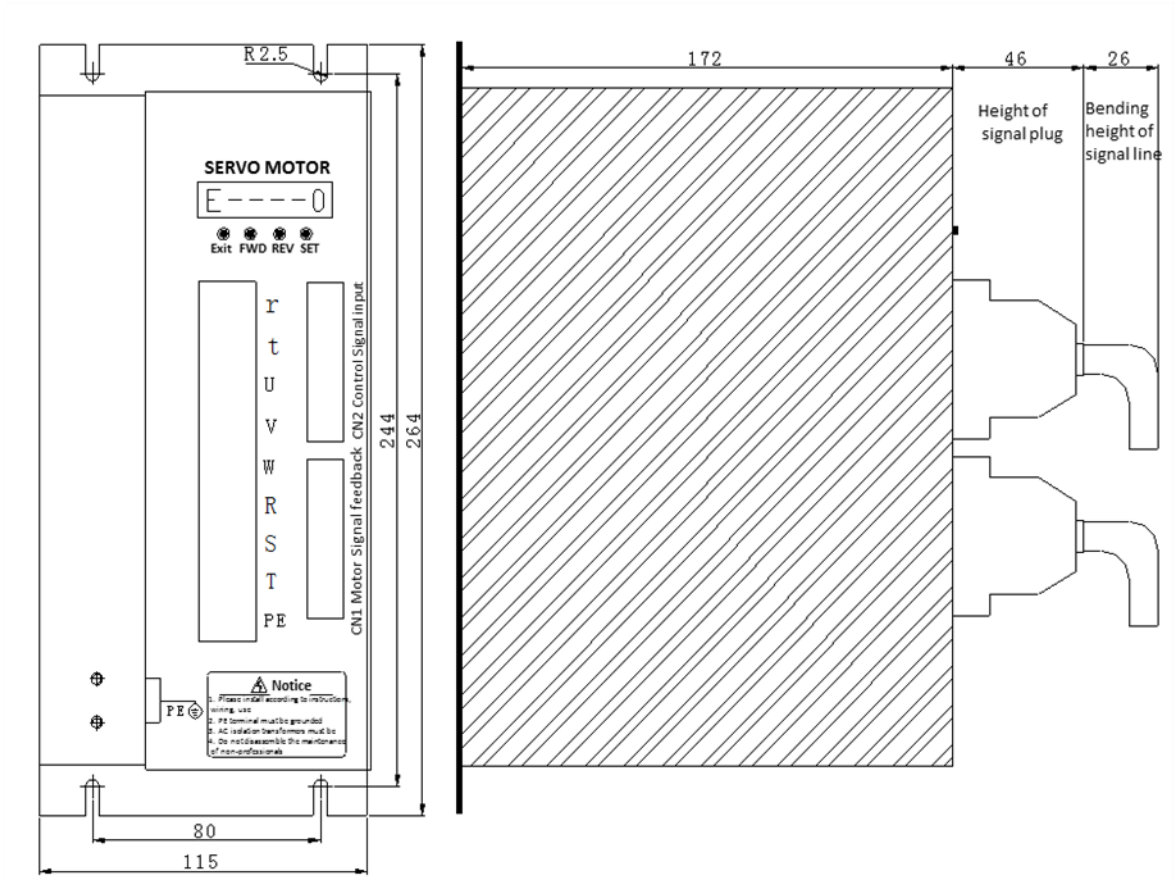


Fig. 2-3: SD50MN Installation Size

Chapter 3 Connection

【Attention】

☆External Alternating Current cannot directly connect to Servo drive, and must be connected through isolation transformer.

☆ Connection must be done strictly basing on terminal voltage and voltage polarity, to prevent equipment damage or injuries.

☆Servo drive and servo motor must be well connected to the earth.

☆U、V、W and Machine winding must be put into one-to-one relationship, otherwise motor or drive would be damaged.

☆ Cable and leading wire must be fixed well, and don't close to servo drive radiator and motor, otherwise the heat would reduce the level of insulating property.

☆Do not touch the terminal or leading wire within 5 minutes after power cuts,
Because there is large capacity high voltage electrolytic capacitor inside the servo drives.

3．1 Standard Connection

This Servo Drive connection is related to control mode etc.

1．In the position / analog control mode SD15MT/SD20MT/SD30MT/SD50MN please follow below：

Fig.3-1：SD15MT position / analog control mode standard wiring

Fig.3-2：SD20MT/SD30MT/SD50MN position / analog control mode standard wiring

2． Wiring

（1）Power supply Terminal

⊙ Terminal lead wire diameter: R、S、T、U、V、W≥1.5mm²（AWG14－16），r、t≥1.0mm²（AWG16－18）.

⊙ PE earth lead wire diameter＞2mm² . Servo drive and servo motor must be connecting to earth through the point on the PE terminal.

⊙ This connection terminal are JUT-1.5－3 cold molding/pressing isolated terminal, be sure to secure fixed.

⊙ SD15M power supply should use single-phase isolation transformer, SD20MN、SD30MN，SD50MN，SD75MN power supply should use three-phase isolation transformer, to reduce possibility of personnel harming by motor.

It is better to install noise filter between commercial power and the isolation transformer, to increase the system capacity of resisting disturbance.

⊙ Please install non-burn out (NFB) circuit breaker, so that to cut off external power suppler if drive error happens.

（2）Signal Control Terminal CN2、 Signal Feedback Terminal CN1

⊙ Wire diameter: use H-cable/Screened Cable (twisted H-cable/screened cable is better), wire

diameter≥0.12 mm² , shielding layer must connect to FG terminal.

⊙ Length of wire: cable length should as short as possible, which of Signal Control cable CN2 cannot in excess of 3 meters, Signal feedback cable CN1 cannot in excess of 20 meters.

⊙ Wiring: Keep away from power line while wiring, in order to prevent interference occurs.

⊙ Please install surge absorption element for sensitive element (windings) in related line: Direct circuit windings inverse parallel connected to fly-wheel diode, Alternating circuit windings install in parallel to resistor-capacitor loop up.

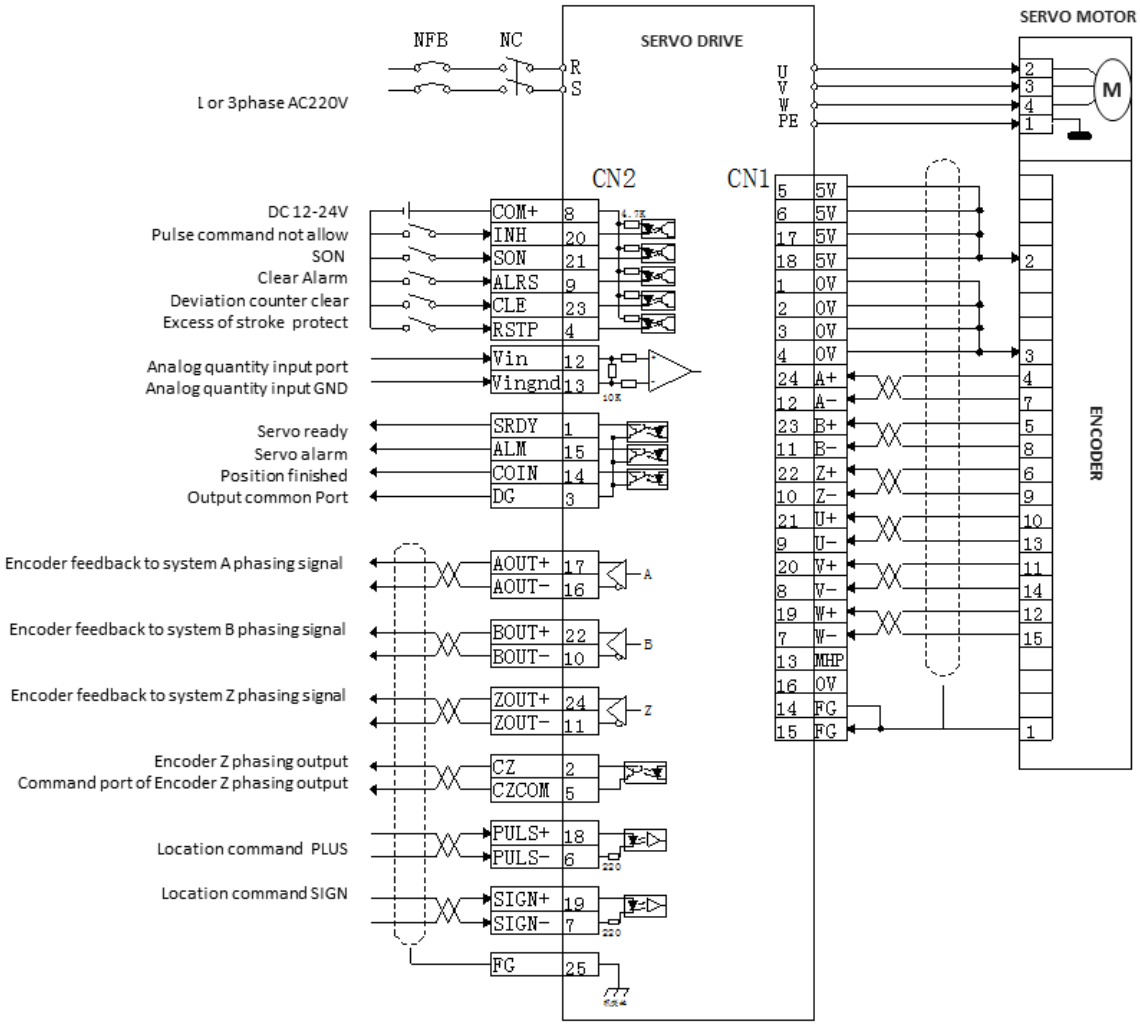


Fig.3-1：SD15MT position / analog control mode standard wiring

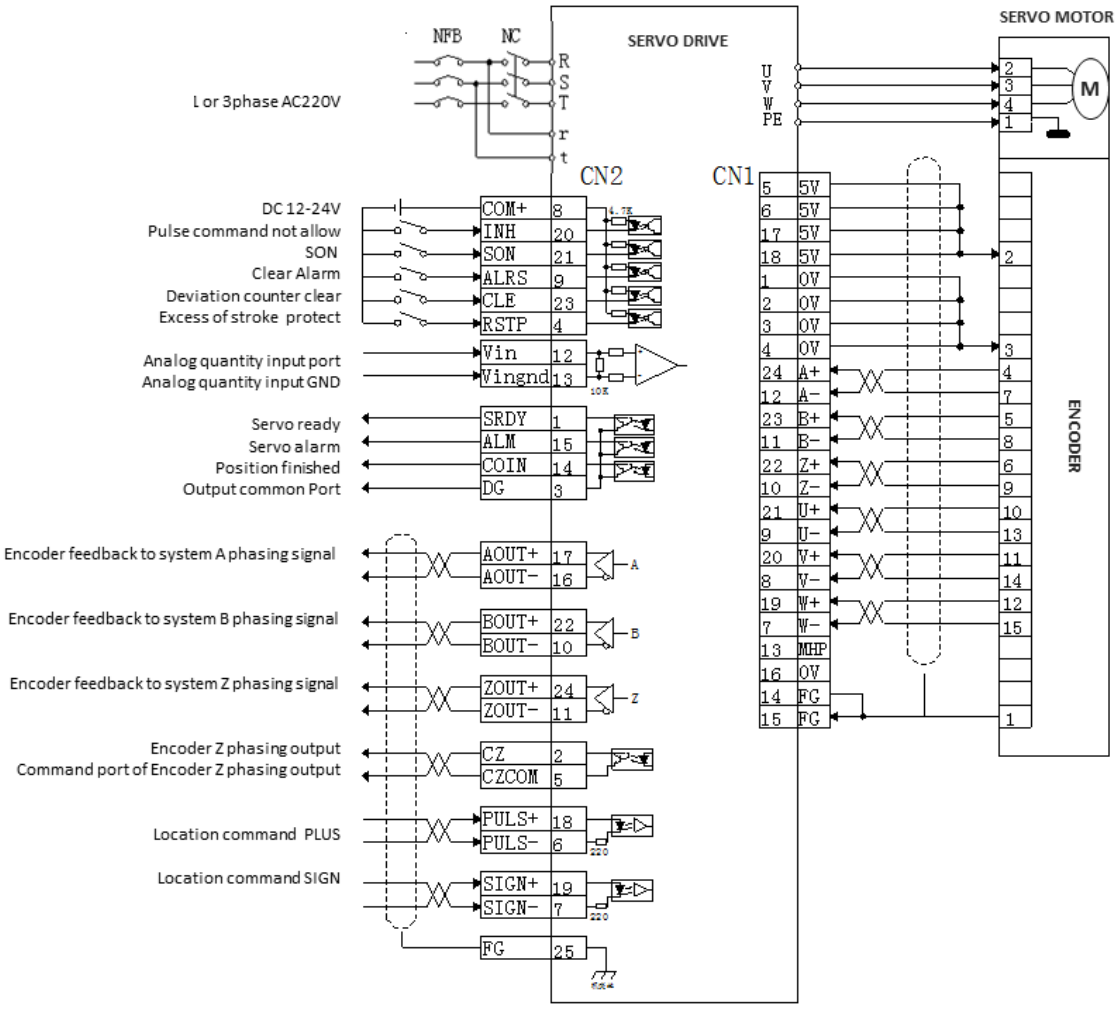


Fig.3-2：SD20MT/SD30MT/SD50MN position / analog control mode standard wiring

3．2 SD15MT/SD20MT/SD30MT/SD50MN **Terminal Function**

1．Terminal Configuration

Fig.3-7 is the interface terminal set up sheet of servo drive, in which, TB1 is SD15MT/ SD20MT/30MT terminal strip; TB2 is 50MN terminal strip; CN2 is DB25 socket connector with pin-on socket and hole type plug; CN1 is also DB25 socket connector, which with hole type socket and pin-on plug.

Explanation: while in analog quantity speed control model: Vin is the input terminal, Vingnd is the input port/address. AOUT+、AOUT-、BOUT+、BOUT-、ZOUT+、ZOUT- are system feedback signals from the coder.

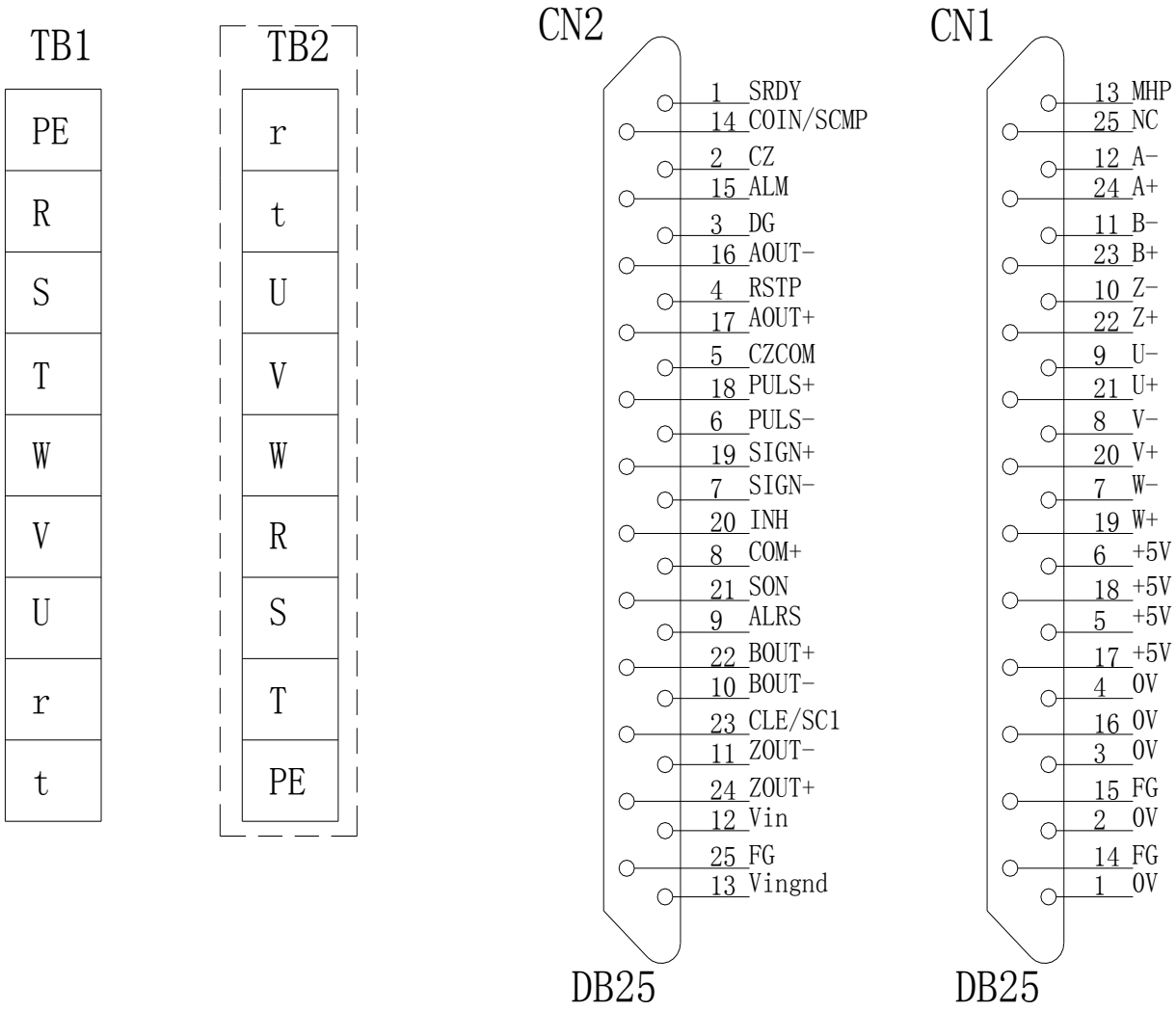


Fig. 3-7：SD15MT/SD20MT/SD30MT/SD50MN Servo drive interface terminal configuration

2. Power supply terminal TB2

Sheet 3.1 TB Power supply terminal

Terminal No	Terminal Marking	Signal Name	Function
TB－1	R	Primary Loop Power supply Single-phase or Three-phase	Primary loop power supply terminal ～220V 50HZ Notice: don't connect with motor outlet terminal U、V、W
TB－2	S		
TB－3	T		
TB－4	PE	system ground	ground terminal ground resistance < 100ohm; Servo motor output and power supply input connect to ground in on public point.
TB－5	U	Servo motor output	Servo motor outlet terminal Must be connected one-to-one corresponding to motor terminal U、V、W
TB－6	V		
TB－7	W		
TB－8	r	Control Power Single-phase	Control loop power supply input terminal～220V 50Hz PS: TB1 in the SD15MT don't need to connect with.
TB－9	t		

3. CN2 Control Terminal CN2

Control mode for short:

P represents position control mode

S represents analog speed control mode

Sheet 3.2 CN2 Control Signal input/output terminal

Terminal No.	Signal Name	Marking	I/O	Mode	Function
CN2－8	Power supply anode of the Input terminal	COM＋	Type1		Power supply anode of the input terminal is used to drive the photo isolator of input terminal DC12～24V，Current≥100mA
CN2－20	Command pulse inhibited	INH	Type1	P	position command pulse inhibited input terminal INH ON：command pulse input inhibited INH OFF：command pulse input valid

CN2－21	Servo Enable	SON	Type1	P,S	Servo enabling input terminal SON ON： enable to work SON OFF： drive close and stop working, motor in free state Note1: before switch SON OFF to SON ON, must keep the motor silent Note2: After switch to SON ON, please wait at least 5ms later to input command Note3: If using PA27 to open internal, SON signal will not detect.
CN2－9	Alarm clear	ALRS	Type1	P,S	alarm clear input terminal ALRS ON：clear system alarm ALRS OFF：keep system alarm
CN2－23	deviation counter 0 reset	CLE	Type1	P	position deviation counter 0 reset input terminal CLE ON： while in position control, position deviation counter 0 reset
CN2－12	analog input terminal	Vin	Type4	S	External analog velocity instruction input terminal, single-end mode, input impedance, 10Kilohm, input range－10V～＋10V.
CN2－13	analog input port/address	Vingnd			Analog input earth wire
CN2－1	Servo ready to output	SRDY	Type2	P,S	ready to output terminal SRDY ON： Control power and primary power are normal, drive do not warning, servo is ready to output ON SRDY OFF： Primary power not connected or drive warning, servo is ready to output OFF
CN2－15	Servo warning output	ALM	Type2	P,S	Servo warning output terminal. By changing Parameter PA27 to change the warning output level, to know which is effective, high level or low level
CN2－14	position complete output	COIN	Type2	P	position complete output terminal COIN ON：When numeral value of the position deviation counter in the set position range, the position complete output ON

CN2－4	over travel protection	RSTP	Type1	P,S	external link over travel protection signal, while signal is effective the Err—32 occur to alarm/warning
CN2－3	Common port of output terminal	DG			earth wire common port of the control signal output terminal (except CZ)
CN2－17	Coder phase-A signal	AOUT＋	Type5	P,S	1. Differential mode drive output of Coder A、B、Z (26LS31 output, is equivalent to RS422) 2. Non-isolated output (Uninsulated)
CN2－16		AOUT－			
CN2－22	Coder phase-B signal	BOUT＋	Type5	P,S	
CN2－10		BOUT－		P,S	
CN2－24	Coder phase-Z signal	ZOUT＋	Type5	P,S	
CN2－11		ZOUT－		P,S	
CN2－2	Coder phase-Z open-collector output	CZ	Type6	P,S	1. Coder phase-Z signal output through open-collector, when coder phase-Z signal appears, output ON (output conducted), if signal not appears, output OFF (output stop) 2. Non-isolated output (Uninsulated) 3. Normally the Phase-Z signal pulse is very narrow, so please use high speed photo coupler to receive.
CN2－5	Common terminal of Coder phase-Z	CZCOM			Common terminal of coder phase-Z output terminal
CN2－18	command pulse PLUS input	PULS＋	Type3	P	external command pulse input terminal Note 1: PA - 9 set the pulse input mode 1) Command pulse + sign means 2) CCW / CW pulse command mode
CN2－6		PULS－			
CN2－19	command pulse SIGN input	SIGN＋	Type3	P	
CN2－7		SIGN－			
CN2－25	screen earth wire	FG			earth wire screen terminal

4. Signal feedback terminal CN1

Sheet 3.3 **Signal feedback terminal CN1**

Terminal	Signal Name	Terminal Marking	Color	Function

No.		Marking	I/O	Mode		
CN1－5 CN1－6 CN1－17 CN1－18	5V Power supply	＋5V				Servo motor photoelectric encoder use＋5V power supply; if the cable is long, please use several centre yarn connection in parallel, in order to reduce the voltage drop
CN1－1 CN1－2 CN1－3 CN1－4 CN1－16	Power supply common address	0V				
CN1－24	Coder A＋Input	A＋	Type4			Connect with Servo motor photoelectric encoder A＋.
CN1－12	Coder A－Input	A－				Connect with Servo motor photoelectric encoder A－.
CN1－23	Coder B＋Input	B＋	Type4			Connect with Servo motor photoelectric encoder B＋.
CN2－11	Coder B－Input	B－				Connect with Servo motor photoelectric encoder B－.
CN2－22	Coder Z＋Input	Z＋	Type4			Connect with Servo motor photoelectric encoder Z＋.
CN2－10	Coder Z－Input	Z－				Connect with Servo motor photoelectric encoder Z－.
CN1－21	Coder U＋Input	U＋	Type4			Connect with Servo motor photoelectric encoder U＋.
CN1－9	Coder U－Input	U－				Connect with Servo motor photoelectric encoder U－.
CN1－20	Coder V＋Input	V＋	Type4			Connect with Servo motor photoelectric encoder V＋.
CN1－8	Coder V－Input	V－				Connect with Servo motor photoelectric encoder V－.
CN1－19	Coder W＋Input	W＋	Type4			Connect with Servo motor photoelectric encoder W＋.

CN1－7	Coder W－Input	W－	Type4			Connect with Servo motor photoelectric encoder W－.

3．3　I/O Connector Principle

1．Switched input value connector

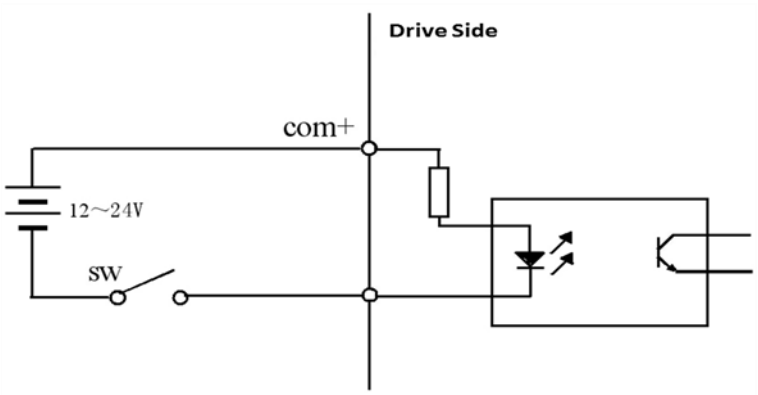


Fig.3-8　Type1 Switched input value connecter

（1）User supplied power, DC12～24V，Current≥100mA；

（2）Attention, if current polarity inverse connected, will lead to servo drive out of service.

2．Switched output value connector

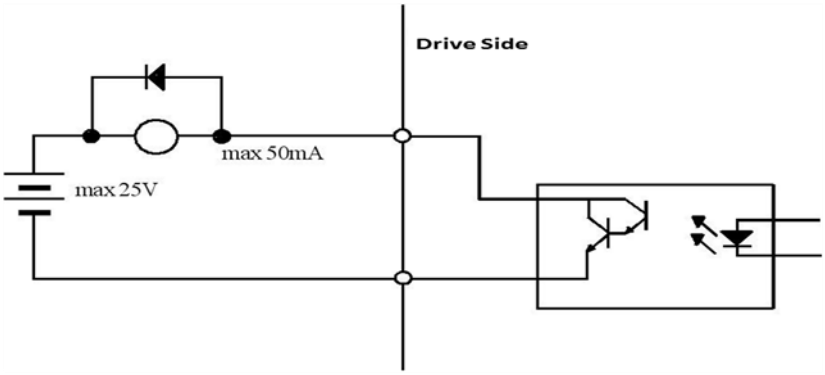


Fig.3-9　Type2 Switched output value connector

（1）User supplied external power, but must pay attention, if the power polarity inverse connected, will lead to damage of servo drive.

（2）Open-collector output, maximum current is 50mA, external power maximum voltage is 25V. Therefore, switched output value signal load must meet the requirement. If excess the requirement or output directly connect with power would lead to damage of servo drive.

（3）If it is lagging load such as a relay, two-terminal load must be reverse parallel connected with fly-wheel diode. Fly-wheel diode reverse connection will lead to damage of servo drive.

3. Pulse input value connector

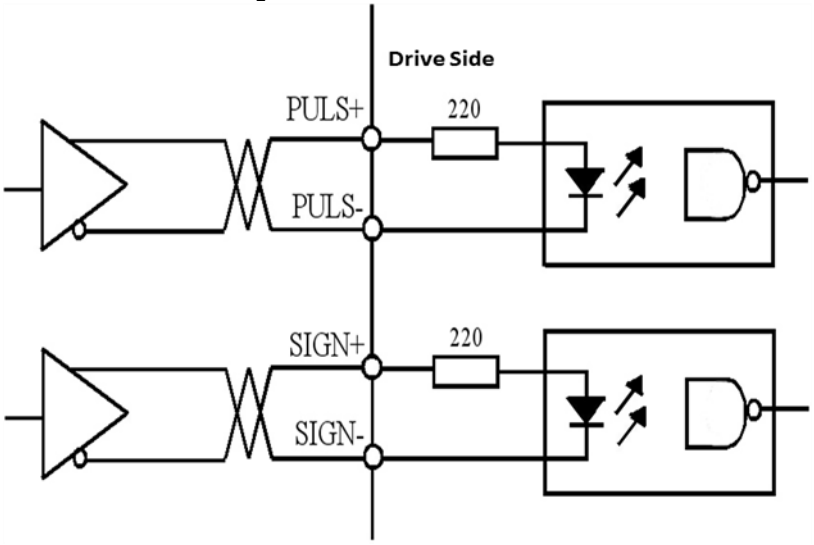


Fig. 3-10 Type3 Differential drive mode of pulse input value connector

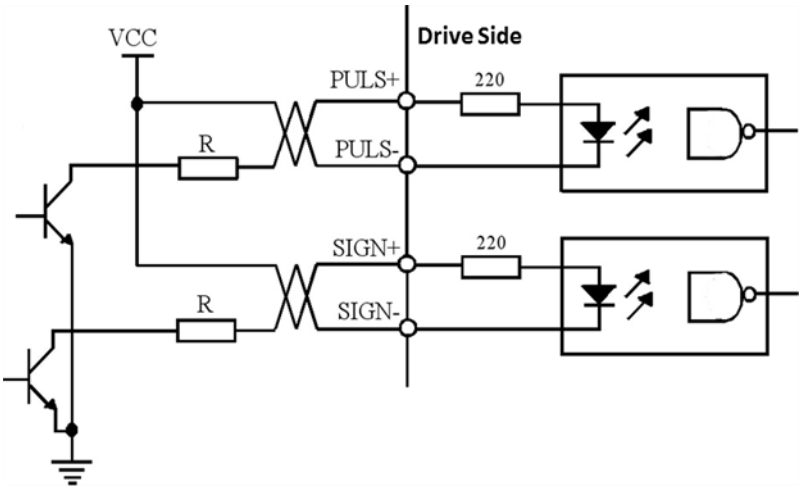


Fig. 3-11 Type3 Single ended drive mode of pulse input value connector

（1）In order to accurately transfer pulse values data, suggest to apply differential drive mode.

（2）In differential drive mode, please use AM26LS31、MC3487 driver or similar RS422 driver;

（3）Single ended drive mode would reduce action frequency. Input electric current according to pulse value, drive current 10～15mA，limit external power maximum voltage at 25V, evaluate resistance R value. Rule of thumb data: VCC＝24V，R＝1.3～2k；VCC＝12V，R＝510～820Ω；VCC＝5V，R＝82～120Ω。

（4）User supplied power while in single ended drive mode. But must pay attention that, power polarity inverse connection may lead to servo drive damage.

（5）Please check Sheet 3.4 for Pulse input mode, the arrows represent counting along, Sheet 3.5 is pulse input time sequence and parameters.

Sheet 3.4 Pulse input mode

Pulse instruction type	CCW CW	Parameter settings
Pulse train code	PULS SIGN	0 Command pulse + Code
CCW Pulse train CW pulse train	PULS SIGN	1 CCW Pulse/ CCW pulse

Sheet 3.5 Pulse input time sequence parameter

Parameters	Differential drive input	Single ended drive input
tck	>2uS	>5uS
th	>1uS	>2.5uS
tl	>1uS	>2.5uS
trh	<0.2uS	<0.3uS
trl	<0.2uS	<0.3uS
ts	>1uS	>2.5uS
tqck	>8uS	>10uS
tqh	>4uS	>5uS
tql	>4uS	>5uS
tqrh	<0.2uS	<0.3uS
tqrl	<0.2uS	<0.3uS
tqs	>1uS	>2.5uS

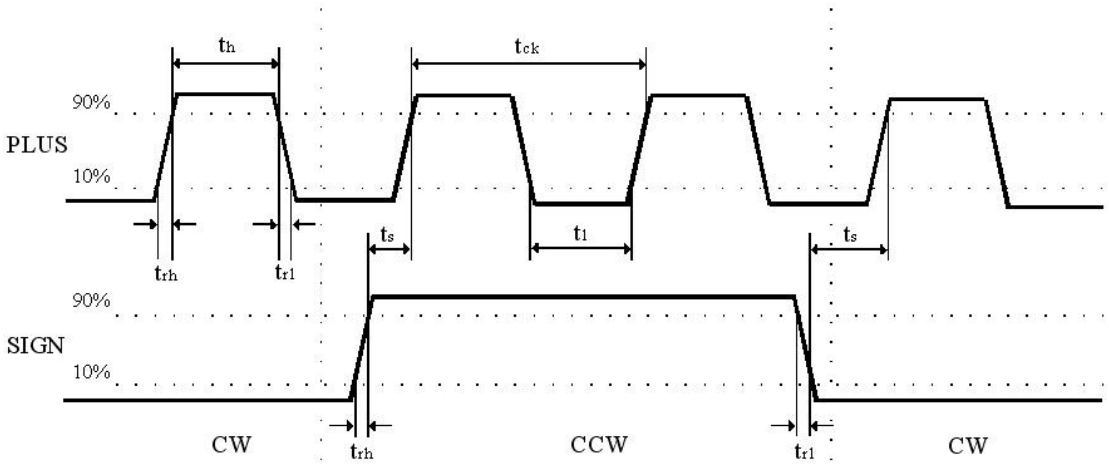


Fig.3-12 Sign input connector time sequence diagram（500kHz Maximum pulse frequency）

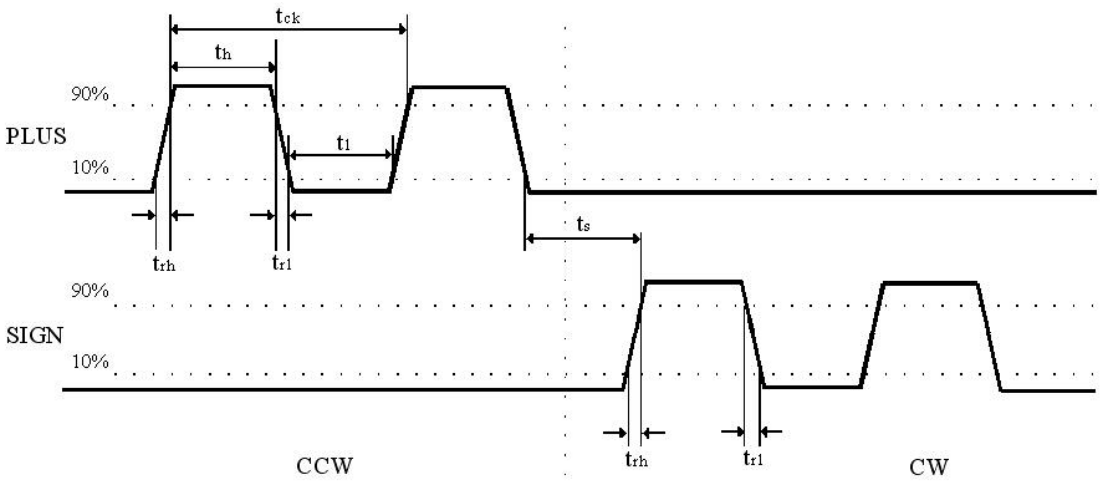


Fig.3-13 C Pulse/CW Pulse input connector time sequence diagram（500kHz Maximum pulse frequency）

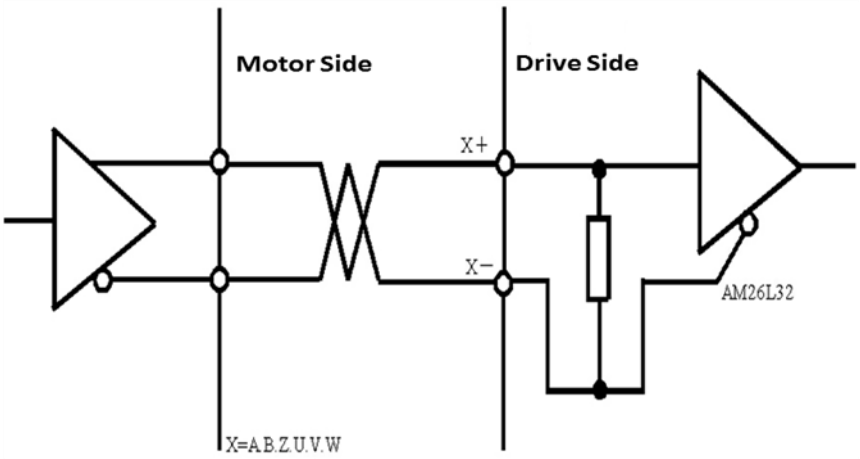


Fig.3-14 Servo motor photoelectric coder input connector

Chapter 4 Parameters

【Notice】

☆ A person involved in parameter adjustment must understand the meaning of the parameter; faulty settings may lead to equipment damage and personnel injuries.

☆ Suggest to adjust parameters in zero load of the servo motor.

4．1 Parameter Setting Data Sheet

This servo drive has display and modification function of working parameters.

Note: Different type of drive has different factory settings. Operate EE-df to find out the factory settings of the drive.

Sheet 4.1 Parameter Data Sheet

Parameter No.	Parameter Name	Applicable Mode	Parameter Range	Factory Settings	Units
PA－01	Control Method	P，S	1～3	1	
PA－02	Velocity loop Ratio Constant (In Mid velocity、high velocity)	P，S	10～1000	100	
PA－03	Velocity loop integral constant (In Mid velocity、high velocity)	P，S	10～1000	100	
PA－04	Acceleration Time Constant	P，S	6～1530	6	ms
PA－05	Deceleration Time Constant	P，S	6～1530	6	ms
PA－06	Position loop Plus	P	10～500	160	
PA－07	Position loop feed forward coefficient	P	0～100	10	
PA－08	Acquiescent display content	P， S	1～15	1	
PA－09	Positional command pulse mode choosing	P	1～2	1	
PA－10	Positional command pulse choose inverse direction	P	1～2	1	
PA－11	Positional out-of-tolerant detection range	P	1～3000	900	*10 Pulse
PA－12	Positional out-of-tolerant neglect option	P	1～2	1	
PA－13	Motor maximum speed	P，S	0～3000	2000	Rpm
PA－14	Speed feedback low-pass filter coefficient	S	1～30	12	
PA－15	Analog speed instruction zero-deviation building out value	S	3000～-3000		
PA－16	Analog speed instruction plus	S	1～100	24	
PA－17	Analog speed instruction choose inverse direction	S	1～2	2	
PA－18	Electronic gear numerator	P	1～32767	1	
PA－19	Electronic gear denominator	P	1～32767	1	
PA－20	Motor overload factor	P，S	1.0～3.0	2.5	
PA－21	Standby				
PA－22	Position control feedback low-pass filter coefficient	P	0～200	50	
PA－23	Coder warning option switch	P，S	1～2	1	

PA－24	Inside parameter	P，S			
PA－25	Inside parameter	P，S			
PA－26	Standby				
PA－27	Enable signal choosing and warning level choosing	P，S	0～3	0	
PA－28	Position complete range	P，S	0～3000	10	Pulse
PA－29	Electric current loop proportional constant	P，S	500～5000	2400	
PA—30	Electric current loop integral constant	P，S	300～2000	1000	
PA—31	Standby				
PA－32	Speed loop plus change rate	P，S	0～100	13	
PA－33	Motor rated current	P，S	0～9.0	6.5	Ampere
PA－34	Standby				
PA－35	Motor type choosing	P，S	1～18		
PA－36	Minimum value of speed loop proportional constant (Low speed)	P，S	1～500	100	
PA－37	Change rate of speed loop integral constant	P，S	0～100	10	
PA－38	Motor and IPM module system in correspondence	P，S	1～5000	15M：601 20MN:601 30MN:1202 50MN:1000	
PA－39	Electric current loop integral constant in low speed	P，S	1～5000	1	
PA－40	Minimum value of speed loop integral constant (in low speed)	P，S	1～1000	50	
PA－41	Clear historical warning records	P，S	1～2	1	
PA－42	Automatic zero-deviation compensation choose	S	1～2	1	
PA－43	Maximum current limitation parameter	P，S	1000～8190	8190	
PA－44	Standby	S	1～200	1	
PA－45	Standby	S	0～100	0	
PA－46	备用 Standby	S	1～100	1	
PA－47	Error dumping CLE signal option switch	P	1～2	2	
PA－48	Pulse inhibit INH signal option switch	P	1～2	2	
PA－49	Over travel protection switch option and level option	P，S	1～3	3	

PA－50	Servo ready level option	P，S	1～2	1	
PA－51	Standby				
PA－52	Standby				
PA－53	Standby				
PA－54	Standby				
PA－55	Standby				
PA－56	Standby				
PA－57	Standby				
PA－58	Standby				
PA－59	Standby				
PA－60	Standby				

4．2 Parameter Function

PA－1： Control mode choosing, by this parameter to supply methods of choosing right drive control mode.

PA－1 Parameter Value	Control Mode
1	Positional Control Mode
2	Analog speed control mode
3	Speed trial run control mode
4	JOG trial run control mode

For positional control mode, positional instruction/command input from the pulse input port; for analog speed control mode, speed instruction/command input from the pin of input port, which match with different speed according to positive、negative level (±10V); for speed trial run control mode, should carry out in SEEDTEST states; for JOG trial run control mode, should carry out in JOGTEST states.

PA－2： Speed loop proportional constant, by this parameter to set up proportional gain of speed loop adjustor.

The higher Setting value is, the larger the proportional gain will be, and more rigidity the system will be. Please set parameter value according to condition of loading and default reference value of drive, try to make this parameter as large as possible in the condition of system non-oscillating.

PA－3： Speed loop integral constant, by this parameter to set up integral time constant of the speed loop adjustor.

The higher setting value is, the more rigidity system will be. The higher inertia loading is, the higher setting value will be. Please set parameter value according to condition of loading and default reference value of drive, try to make this parameter as large as possible in the condition of system non-oscillating.

PA－4: Acceleration Time Constant, this value is for setting acceleration time of motor

from 0rpm to 1000rpm.

PA－5： Deceleration time constant, this value is for setting deceleration time of motor from 0rpm to 1000rpm.

PA－6： Position loop plus is used to set up proportional gain of the position adjustor.

The higher setting value is, the higher proportional gain will be, and more rigidity the system will be, and position lag value will be smaller in same frequency command pulse condition.

PA－7： Position loop feed forward parameter, used to adjusting feed forward gain of position loop.

The higher parameter setting is, the smaller position lag value will be; the lower parameter setting is, the response will be slower.

PA－8： Default display content, this parameter is used to setting default display content of the drive after electrifying.

PA－9： Pulse mode choosing, this parameter is used to setting drive default position loop pulse input mode.

PA－9 Parameter Value	Position control pulse input mode
1	Command pulse + direction
2	CCW pulse/CW pulse (double pulse mode)

PA－10： Position command pulse choose reverse direction, this parameter is used to choosing reverse direction of the motor.

1：motor co rotation，2：motor contra rotation。

PA－11： Positional out-of-tolerant detection range, this parameter is used to setting positional out-of-tolerant pulse range in mode of position control.

If the motor factual following error is greater than this parameter value, meanwhile PA12＝1, the drive will occur error warning of Err—9.

PA－12： Close position error neglect option, if set the parameter to 2, parameter 11 will be out of use and the position out-of-tolerant range will not lead to drive warning.

PA－13： Maximum speed, by which is used to set maximum running speed of this drive system. The speed and running direction are unrelated.

PA－14： While in analog control of （PA=2）, speed feedback low pass filter coefficient.

PA－15： Zero-deviation compensation rate for analog speed input.

Can use PA42=2 automatic compensation, or use manual compensation. (Please check Troubleshoot Method)

PA－16： Settings of proportional relations between analog speed input voltage and factual running speed of the motor.

PA－17： Motor which is analog speed controlled choose reverse control direction.

PA－18： Electronic gear numerator, together with PA－19 are used to set frequency dividing and frequency doubling ratio of the position command pulse.

In the position control mode, by setting PA－18、PA－19, to easily connected with all kinds of control systems, in order to reach to an ideal control resolution, that is all kinds of angular measures and pulse relationship.

PA－19： Electronic gear denominator, using coordinate with PA－18.

PA－20： Motor over load coefficient, by which is used to limit the maximum torque when motor running in positional、speed model. That is overload coefficient.

PA－21： Standby

PA－22： Speed feedback low pass filter coefficient while in positional control（PA1＝1）mode.

PA－23： Coder warning option switch. While in PA23=1, allow warning Err—3 and Err—25 happen; while in PA23=2, Err—30 and Err—25 warning do not happen.

PA－24： Internal parameter

PA－25： Internal parameter

PA－26： Standby

PA－27： Enable signal option and warning level option

PA－27 Parameter Value	Enable Signal	Warning signal output
0	External enable	low level
1	Internal enable	low level
2	External enable	high level
3	Internal enable	high level

PA－28： Position completed range.

This parameter gives basis to drive which is in positional control mode, to justify whether position is completed or not. When position deviation counter left pulse quantity is less than or equals to this set parameter, drive considers as position completed, and with signal COIN ON, otherwise with signal COIN OFF.

PA－29： Current loop proportional constant. Normally it is not allowed to amend by customer.

PA－30： Current loop integral constant. Normally it is not allowed to amend by customer.

PA－31： Standby

PA－32： Speed loop gain/plus change rate. By adjusting this value can change low speed stationarity, but this value can not be too small, otherwise motor will do line crawl.

PA－33： Motor rated current

PA－34： Standby

PA－35： Motor type choosing:

PA－36： Minimum value of speed loop proportional constant. By adjusting this to change low speed stationarity, but this value can not be too small, otherwise motor will do line crawl.

PA－37： Speed loop integral change rate. By adjusting this to change low speed stationarity, but this value can not be too small, otherwise motor will do line crawl.

PA－38： Coefficient of IPM module corresponding to the Motor. For debug method please check the last chapter.

PA－39： Minimum value of current loop proportional constant. Normally it is not allowed to amend by customer.

PA－40： Minimum value of speed loop integral constant. By adjusting this to change low speed stationarity, but this value can not be too small, otherwise motor will do line crawl.

PA－41： Warning of history clearing. Warning records parameter are dp－16、17、18，while PA41=2, history warning records clear to zero, so as to record new warning codes.

PA－42: Automatic zero-deviation compensation option. While PA42=1, automatic zero-deviation compensation option is invalid. While servo enable is invalid, just press “confirm” key once, the servo drive automatic zero-deviation compensation will be

accomplished, and automatic recording this zero-deviation (that is PA15)

PA－43： Maximum current limitation parameter.

PA－44： Standby

PA－45： Standby

PA－46： Standby

PA－47： Error clear CLE signal switch option

While PA47=2, CLE signal is invalid.

While PA47=1, CLE signal is valid.

PA－48： Pulse prohibited INH signal switch option.

While PA48=2, INH signal is invalid.

While PA48=1, INH signal is valid.

PA－49： Over travel protection Err—32 valid levels choose.

While PA49=3: Close the function of over travel protection.

While PA49=2: Low level warning

While PA49=1: High level warning

PA－50： Servo ready signal could choose by PA50 before states of servo enable SON is invalid. While PA50=2: ready signal is valid; while PA50=1: ready signal is invalid.

PA－51： Standby

PA－52： Standby

PA－53： Standby

PA－54： Standby

PA－55： Standby

PA－56： Standby

PA－57： Standby

PA－58： Standby

PA－59： Standby

PA－60： Standby

Chapter 5 Error Warning & Handling

【Notice】

☆Do not touch the servo drive and motor within 5 minutes after power cuts, to prevent electric shock and burns.

☆ When servo motor fault warning appears, servo drive can put into service only after clearing faults according to warning code.

☆Before reset the warning system, must be sure SON (Servo enable) signal is invalid, to prevent accidents resulting by sudden start of the motor.

When error warning happens, if no option to parameter, in the first level of software will display Err-xx and flashing meantime, xx is the warning code. If busy in option, the displayed contents will flash, at this moment, please press logout/quit key as soon as Err-xx appears.

When warning appears, please clear error first according to warning code, and then can continue to give drive into service.

5．1 Warning Data Sheet

Sheet 5.1 Warning Data Sheet

Warning Code	Warning Name	Contents
--	Normal	
3	Main circuit over voltage	The main circuit power voltage is too high
4	Main Circuit under voltage	The main circuit power voltage is too low
6	Motor over speed	Motor rotate speed is too high
8	Input pulse frequency is too high	Position loop given frequency exceeds the settings.
9	Position error	Position error exceeds the setting range.
11	Over current protection	load current is over large
14	Writing EEPROM error	Error appears while writing EEPROM
15	FPGA Configuration error	While to deploy FPGA internal parameter, error happens.
17	Overload protection	Servo drive and motor are over loads.
20	Reading EEPROM error	Error happens while reading EEPROM internal parameter.
25	Coder UVW errors	UVW signal have overall high level or overall low level
27	IPM warning	IPM under voltage or over current protection

30	Coder fault	Coder wire break or phase lacking
32	Over travel protection	Over travel protection warning

5．2 Warning Handling Method

Sheet 5.2 Warning handling method

Warning Code	Warning Name	Running States	Causes	Handling Method
3	Main circuit over voltage	Appears while control power connected	1) Circuit board fault	1) Change the servo drive
		Appears while main power connected	1) Supply voltage is too high 2) supply voltage wave form is abnormal	1) Check power supply source
		Appears in process of motor running	1) Braking resistor connection wire broken off	1) Rewiring the connection
			1) Braking transistor damaged 2) Internal braking resistor damaged	1) Change the servo drive
			1) braking loop capacity not enough	1) Reduce on-off frequency 2) Increase acceleration time/deceleration time constant 3) Reduce torque limitation 4) Reduce load inertia 5) Change higher power drive and motor
4	Main circuit under voltage	Appears while main power supply connected	1) Circuit board fault 2) Power supply fuse damaged 3) Flexible/soft start-up circuit errors 4) Rectifier damaged	1) change servo drive

			1) Supply voltage too low 2) Temporary power cut time above 20mS	1) Check power supply
		Appears in process of motor running	1) Power supply capacity not enough 2) Instantaneous power-fail	1) Check power supply
			1) Radiator overheating	1) Check condition of loading
6	Motor over speed		1) Coder connection error	1) Check the connection
			1) Coder damaged	1) Change motor
			1) Coder cable not well	1) Change cable
			1) Coder cable too long, to cause coder supply voltage too low	1) Shorten cable 2) Use multiple core joint supply
8	Input pulse frequency is too high	Appears while control power connected or during motor running	1) Electric circuit error	1) Change servo drive
			1) Frequency is too high	1) Educe relevant control frequency
9	Position deviation over-flowed		1) Motor got stuck by mechanism 2) Input command pulse abnormal	1) Check mechanical load part 2) Check command pulse 3) Check whether motor rotate follow the command pulse
11	Over current		1) Short circuit between drive U、V、W	1) Check connection
			1) Not well earthed	1) Ground/earth correctly
			1)Motor insulation damaged	1)Change motor
			1) Drive damaged	1) Change drive
			1) Input digital gear ratio too high	1) reset correctly
			1) Coder error	1) Change servo motor
			1) Coder cable not well	1) Change coder cable

			1) Servo system instability leads to overshoot.	1) Reset relative gain 2) If gain cannot reset to proper value, otherwise to reduce load rotary- to-inertia ratio.
14	Writing EEROM error		1) chip or circuit board damaged	1) Change servo drive
15	FPGA configuration error		1) chip or circuit board damaged	1) Change servo drive
17	Over load	Appears while control power connected	1) Circuit board error	1) Change servo drive
		Appears while motor running	1) Running over rated torque	1) Check the load 2) Reduce the start-up frequency 3) Reduce torque limitation value 4) Change higher power drive and motor
			1) Keep the brake unopened	1) Check operation brake
			1) Motor unsteady vibrating	1) Adjust gain 2) Increase acceleration time/deceleration time 3) Reduce load inertia
			1) One of the connection broken of U、V、W 2) Coder connection fault	1) Check connection
20	Reading EEPROM error		1) Chip or circuit board damaged	1) Change servo drive
25	Coder U V W error		1) Coder damaged 2) Coder connection fault 3) Not well earthed	1) Change motor 2) Check connection 3) Ground/earth correctly
27	IPM warning		1) Voltage too low 2) Motor current too high 3) Coder connection broken or poor contact	1) Check AC input 2)Reduce acceleration 3) Change motor 4) Check coder wire

			4) PE line didn't connect to earth	5) PE line of servo drive and motor must be earthed in same time
30	Coder error		1) Coder damaged 2) Coder connection error	1) Change motor 2) Check cable
32	over travel protection		1. Touch the over travel switch	1) Logout/quit over travel protection

Chapter 6 Display and Operation

【Notice】

☆ For narrative convenience, this instructions use signs to represent keys on the panel: ← means Logout; ⇓ means Reduce； ⇑ means Increase; Enter means Confirm.

6.1 Keyboard Operation

★Drive panel is consisted by 6 LED nixie tube monitors and 4 keys of ⇑、⇓、←、Enter, by which to display all kinds of system states, setting parameters etc. Key-press functions as follows:

⇑: Sequence number、numeral value increasing, or forward option

⇓: Sequence number、numeral value reduce, or stand back option.

←: Return to former operation menu, or cancel operation

Enter: Enter into former operation menu, or input confirm.

Notice: During the operation process, keep the button of ↑、↓ pressed, the operation will retry, and much longer time is, much faster the retry speed is.

★6 LED Nixie tube display all kinds of system states and data, if all of the Nixie tubes flash, warning that system error happened.

Notice In warning states, press ⇑、**Enter two keys in same time and keep it for one sec, so as to logout/quit warning states.**

★Operation conducted with layered operating menu, the first layer is warning display or default parameter watch over, the second layer is main menu which contain four operation ways, the third layer is the function menu in all kinds of operation ways. Fig. 6-1 is the

main menu operation block diagram.

★Each time, as soon as power connected, the systems will automatic detects current working states, will display waning messages if any abnormal occurs; if working normally, will automatic display user set default watch over value (please check PA-8 parameter instruction). Each time user must press Enter into the first layer of main menu operation mode.

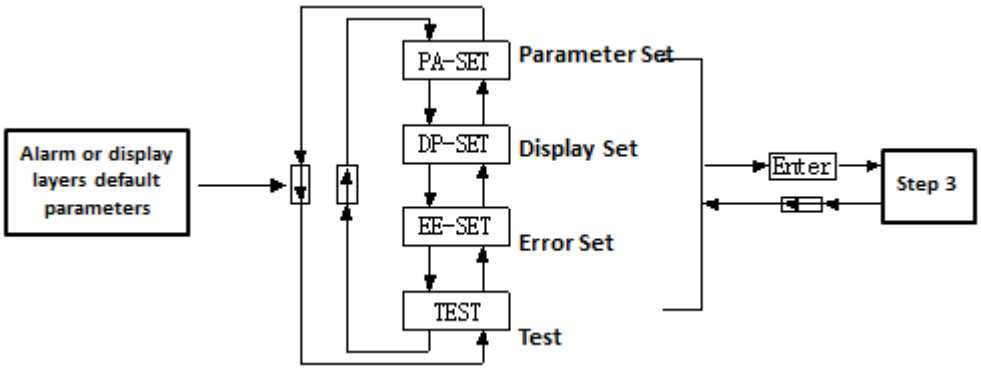
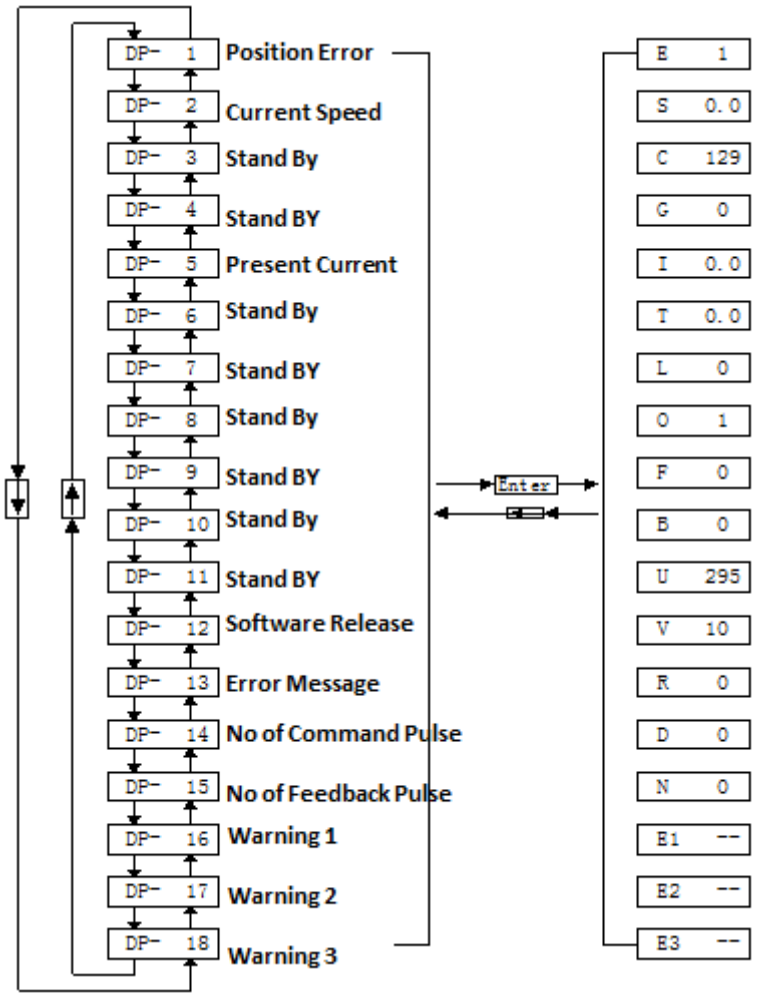


Fig. 6-1 Operation Mode Selection

6.2 Watch over Mode

Choose "DP-SET" in the first layer and press Enter into watch over mode, see the diagram 6-2, there are totally 18 kinds of display states, using ↑、↓ to choose needed display mode, and then press Enter into concrete display state.



6-2 Watch over mode operation diagram

【Note 1】Position Error (DP-1): it is the error/difference between given position and coder feedback position during running, which would affect the machining precision if it is too large difference/error. The servo motor response characteristic can be improved by adjusting parameter and reduce error/difference.

【Note 2】Current Speed （DP-2）: Current running speed of the servo motor

【Note 3】Present Current （DP-5）: Present motor current.

【Note 4】Software Release （DP-12）: Latest software version of the servo drives.

【Note 5】Command/Instruction pulse accumulation（DP-14）: Number of command pulse. While servo power connected, display 0; displayed number of impulse corresponding to the number of command (Maximum displaying 9999 impulse, if more than this, display the remainder).

【Note 6】Feedback pulse accumulation（DP-15）: The number of feedback pulse to coder. After servo power on it will display 0; and the maximum displaying impulse number is 9999, if more than this number, display remainder.

【Note 7】Warning 1（DP-16）: Servo records the historical warning for the first time.

【Note 8】Warning 2（DP-17）: Servo records the historical warning for the second time.
【Note 9】Warning 3（DP-18）: Servo records the historical warning for the last time.

6.3 Parameter Settings

Note 2 Parameter settings becomes effective immediately, wrong settings may makes the equipment running faulty and lead to accidents.

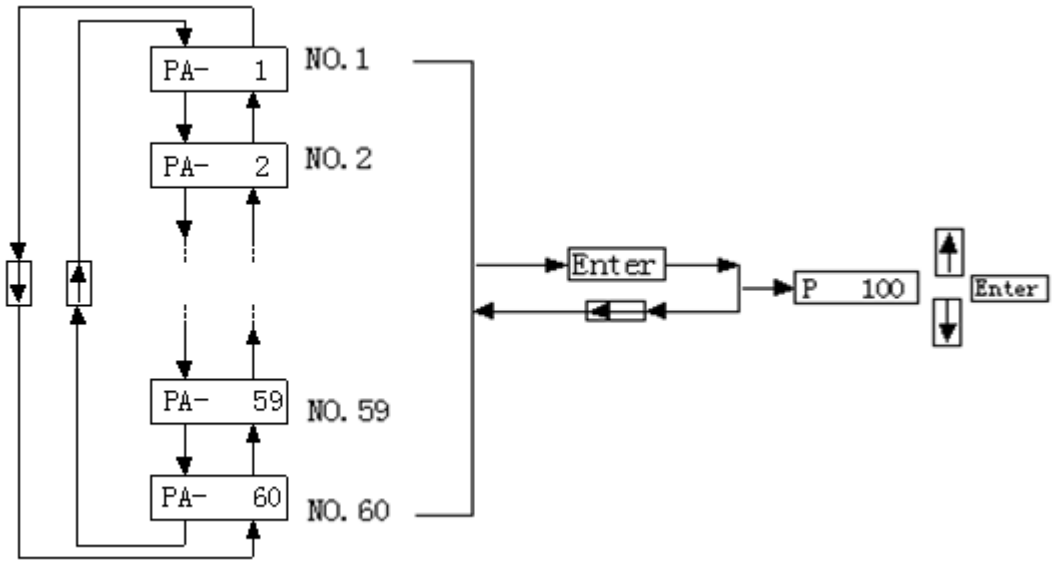
Choose "PA－SET" in the second layer, and press Enter into parameter setting mode, see diagram 6-3.

Press ↑、↓ to choose parameter code, and press Enter to display the parameter value, press ↑、↓ can modify the parameter value.

Press ↑ OR ↓ once, parameter value will increase or reduce 1, keep pressing ↑or ↓, parameter value will continuously increase or reduce.

If parameter been modified, the leftmost LED Nixie Tube"P"starts flashing, then press Enter to confirm modified value becomes effective, at this time"P"shows normal, modified value will response to the control immediately, and after this, press ↑ or ↓ can go on modifying parameter, after finished, press ← to back to parameter choosing states.

If not satisfied with the modifying value, please do not press Enter to confirm, and can press ← to cancel, so as to restore original parameter value, and back to parameter choosing states.



6

-3 Parameter setting operation diagram

6.3 Parameter Management

Note 1 If read-in not confirmed after modifying parameter, it will not be conserved/saved in case of power-fail, and modification is invalid.

Parameter management is an operation of processing between Memory and EEPROM, choose "EE－SET" in the first layer and press Enter into the parameter management mode, as seen in diagram 6-4. Firstly need to choose operation model, totally there are three models, press ↑、↓ to choose.

Set "parameter read-in" for example, choose "EE－rt"，then press Enter, monitor shows "EE－NO"and the leftmost "E"starts flashing. Then, press↑or ↓ to choose"EE－YES", at this time leftmost"E"display in normal states. Finally, press Enter, and the monitor will keep about 4 seconds which means parameter is now read-in EEPROM. After read-in finished, monitor will shows "FINISH"，at this time, press ← to back to operation choosing mode.

♀"EE－rT"parameter write-in：It means to write memory parameter into EEPROM parameter area. User modified parameter can only change the memory parameter value, next time after electrifying the parameter value will recover to original. If hope to permanently change the parameter, it is need to implement parameter write-in operation, to write memory parameter into EEPROM parameter area, next time after electrifying the modified parameter will be in use.

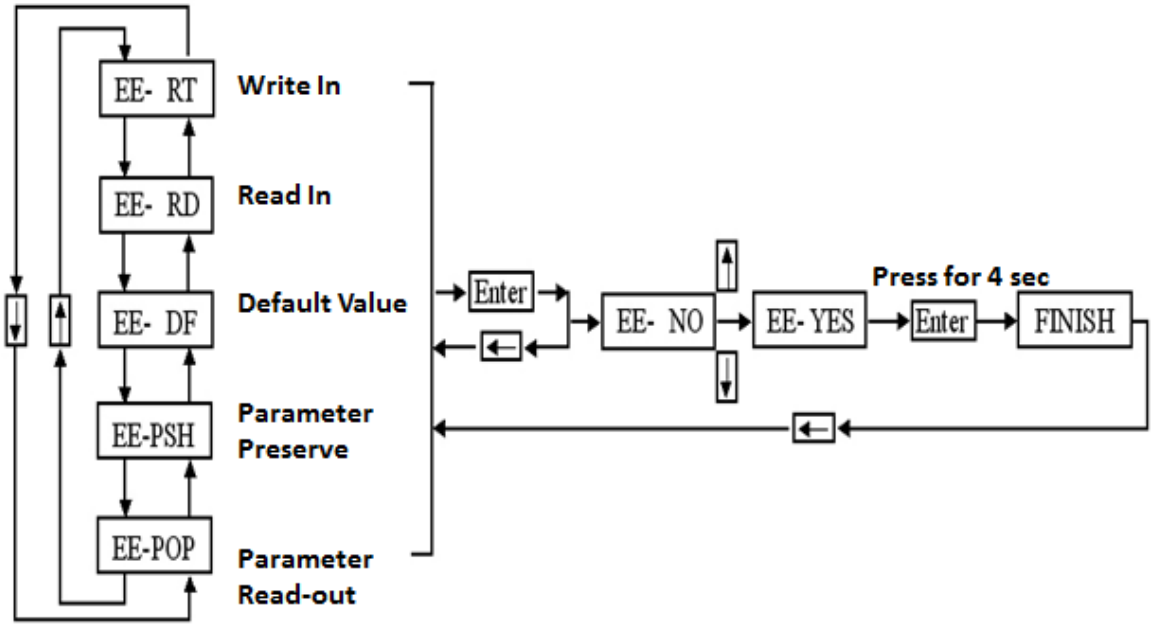
♀"EE－rd" parameter read-in：It means to read EEPROM parameter area's value into memory. This process will carry out automatic once electrifying, at the first time, memory parameter value is different from that in EEPROM parameter area. But if user modified parameter will change the memory parameter value, while user not satisfied with modified parameter or parameter been disordered, it is time to implement parameter read-in operation, to read EEPROM parameter area's value into memory again, and recover to newly electrifying parameter.

♀"EE－df" recover default value：It means to read all parameter default values （出厂值）into memory, and write-into EEPROM parameter area, so that next electrifying to use default parameter. When user disorder the parameter which leads to abnormally working, by carry out this operation, can recover all parameter back to default value. Because different drive mode have different default value, while using operation of recovering default value, firstly to assure drive mode（Parameter PA35） is correct.

♀"EE－psh" user parameter preserve：It is mainly used for user to preserve self motor parameter. For example, when user adjusting motor parameter, if quite satisfied with which set of the parameter

data, by this operation can permanently preserve this parameter into EEPROM （Note：Can only allow preserving a set of data, and after carrying out this operation the former preserved content will be covered automatically）.

♀"EE－pop" user parameter read-out：operate together with above "EE－PSH", used to recover user previous/ever adjusted parameter value（from EEPROM directly to lead in working area）. If user didn't preserve working parameter, after present operation, if restart, the parameter in working area will be vacant, and must to operate "EE－DF"to recover default value.



6-4 Parameter Management Operation Diagram

6.5 Trial run/Test run

Note 1 Suggest to conduct speed trial run in zero load states, to prevent equipment sudden accidents happen.

Note 2 While in trial run/test run, drive SON （servo enable） must be effective

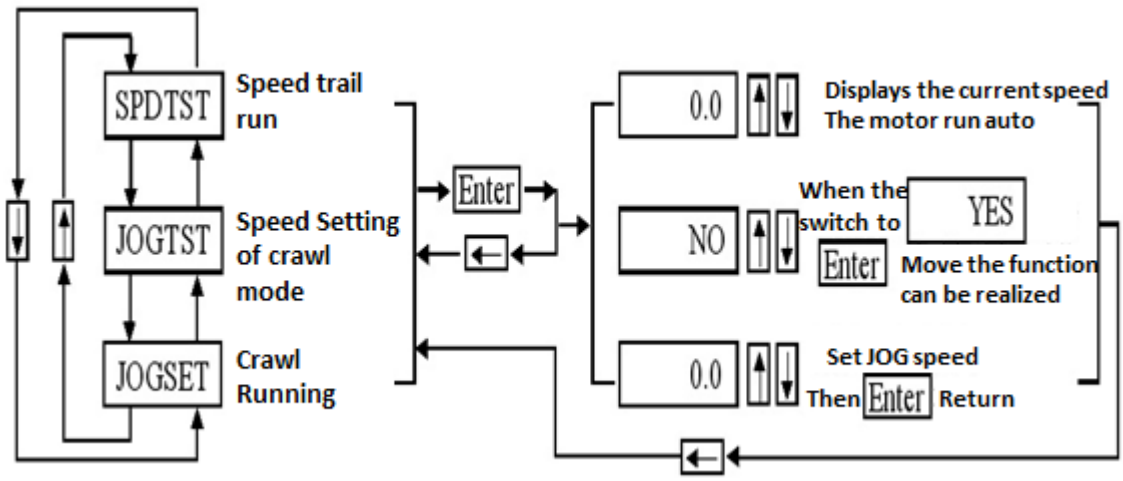
Note 3 While in the process of speed trial run, press ↑or ↓,（for motor protection）system key scroll will not be faster and faster, but continuously carrying out in fixed repeated speed.

Choose “TEST” in the first layer, and press Enter into trial run/test run operation mode. Trial run/test run contain：Speed trial run “SPDTST”、JOG（inching/crawl mode） value setting “JOGSET”、JOG operation“JOGTST”。User can press ⇑、⇓ to choose and press Enter into.

♀“SPDTST” speed trial run：value unit is r/min, system in speed control mode, speed command supply by ⇑（steadily increase）、⇓（descending）,motor running following by given showed speed. If the showed speed is positive value, motor co rotation; if the showed speed is negative value, motor reserve rotation.

♀“JOGSET” speed setting of crawl mode：Value unit is r/min, original value is“0.0”，user can set one speed value according to requirements by choose key ⇑（steadily increase）、⇓（descending）. Positive value means motor co rotation; negative value motor means reserve rotation.

♀“JOGTST” crawl running： User press Enter into crawl running mode, every initial display“NO”， can press ⇑、⇓ to switch into“YES”, and then every time pressing Enter, motor running following the set speed value in“JOGSET”, if keep pressing Enter, the motor will continuously running according to this speed, until Enter loosening.



6-5 Trial run operation diagram

Chapter 7 Electrifying Running

【Notice】

☆Drive and motor must be safely earthed; PE terminal must be connected safely with equipment earth terminal.

☆ Suggest drive power supply by isolation transformer and power filter, to assure security and anti-interference capability.

☆Power supply can be connected only after checking and confirm connection without a fault.

☆An emergency stop circuit must be connected, to immediately cut off power while error happens.

☆After drive error warning, before restart the drive, must make sure all errors have been handled、SON signal is invalid.

☆Do not touch the drive and motor with 5 minutes after power cut, prevent electric shock.

☆Drive and motor may rise high temperature after a period of running, prevent burning.

7.1 Electricity supply connection

See diagram 7-1 for reference of electricity supply connection, and connect the power supply according to the following steps.

1) Connect the main power into main circuit power input terminal through electromagnetic contactor（three-phase connect to R、S、T，single-phase connect to R、S）。

2) Control circuit power R、T should be connected simultaneously or ahead of the main circuit power. If only connect control circuit power, servo ready with signal （SRDY）OFF.

3) After main circuit power connected, around 1.5 seconds later, servo ready with signal（SRDY）ON，at this time servo enable signal（SON）can be accepted, and after detecting servo enable is effective, drive output is effective, the motor excitation and motor under running states. If detected servo enable is invalid or warning, base circuit closed and motor under free states.

4) When servo enables and power supply connected in same time, base circuit will be connected around 1.5 seconds later.

5) Frequently on-off power supply, is likely to damage soft start circuit and dynamic braking circuit, on-off frequency must be limited in 5 times every hour, below 30 times every day. If the drive or motor is overheating, after line up for error reasons, still need to wait for 30 minutes to cool off and then connect power supply again.

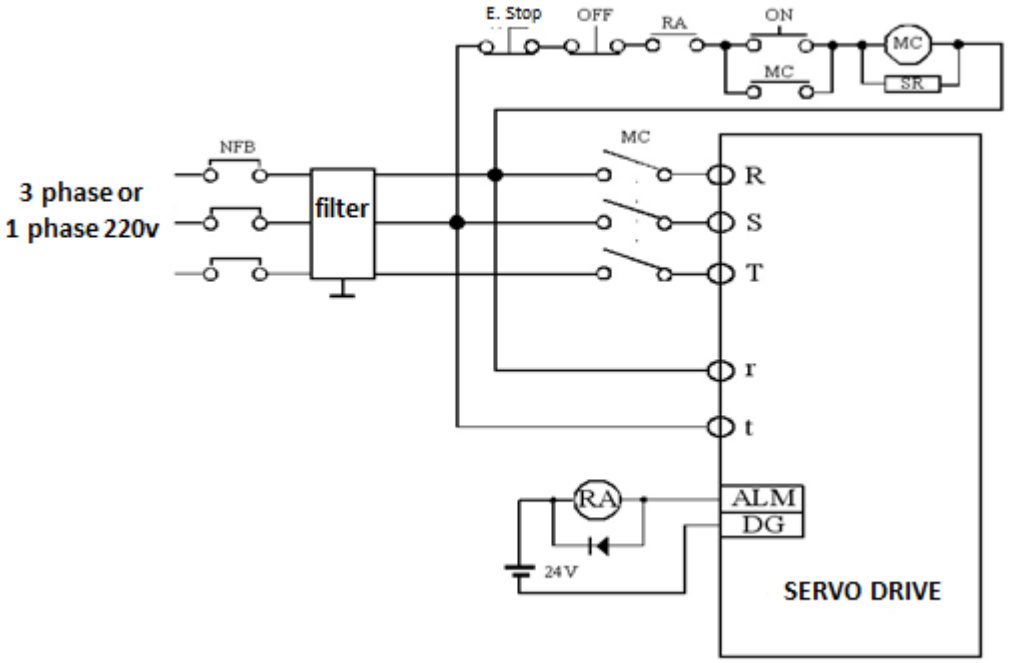


Fig. 7-1 Power connection diagram

7.2 Trial run

1. Checking before running

After finished installation and connection, please check the follows before power on：

△Whether the Power supply terminal TB connection is correct、reliable/safety? Whether the input voltage is correct?

△Whether the power supply wire、motor wire are earthed or any short circuit?

△Whether control signal terminal is connected correctly? If the Power supply polarity and size are correct?

△Whether drive and motor are fixed securely?

△Whether motor shaft connect with load?

2. Electrifying Trial Run

A: Trial run method

（1）Connect CN2 to input control signal：Servo enable （SON）OFF.

（2）Switch on control circuit power supply（do not switch on main circuit power supply temporarily），then the drive monitor been lighten, if warning appears please check the connection.

（3）Please set control mode (Parameter PA-1) into speed trial run mode(set into 3)。

（4）Switch on the main circuit power supply.

（5）Make sure there's no warning and abnormal situation, then make servo enable（SON）ON，at this time motor is in excitation, in zero speed state.

（6）By pressing key operation, go into speed trial run operation states, speed trial run command prompt

is “S”，value unit is R/MIN, system under speed control mode, and by pressing key ↑、↓ to change speed command, motor should running according to given speed.

B: JOG Crawl Run

（1）Connect CN2 to input control signal：Servo enable（SON）OFF。

（2）Switch on control circuit power supply （do not switch on main circuit power supply temporarily），then the drive monitor been lighten, if warning appears please check the connection.

（3）Please set control mode (Parameter PA-1) into JOG running mode(set into 4)。

（4）Switch on the main circuit power supply.

（5） Make sure there’s no warning and abnormal situation, then make servo enable（SON）ON，at this time motor is in excitation, in zero speed state.

（6）By pressing key operation into JOG running operation state, JOG running command prompt is “J”, value unit is R/MIN, system under speed control mode, speed and direction decided by JOGSET, by pressing Enter then motor will running according to JOGSET speed and direction.

C：Position Mode Running

（1）Connect CN2 to input control signal： servo enable（SON）OFF

（2）Switch on control circuit power supply （do not switch on main circuit power supply temporarily），then the drive monitor been lighten, if warning appears please check the connection.

（3）Set control mode （parameter PA-1）to position mode running （set to 1）， and set the parameter PA-9 according to drive output signal mode, and to set suitable digital gear ratio （PA-18、PA-19）

（4）Switch on the main circuit power supply

（5）Make sure there’s no warning and abnormal situation, then make servo enable（SON）ON，at this time motor is in excitation, in zero speed state.

（6）Operation position controller output signal to drive CN2-6、18、7、19, to make the motor running follow commands.

7.3 Adjustment

Note 1 Wrong parameter settings may lead to equipment damage and accidents, so please confirm the correctness before start.

Note 2 Suggest to adjust in zero loading, and then adjust in load.

1. Basic gain adjustment

※ Speed control

（1） [Speed proportional gain]（Parameter PA-2）setting value，keep it not in condition of oscillating motion, to set a large value as much as possible. Normally, the larger the load inertia is, the larger the set value [Speed proportional gain].

（2） [Speed integral time constant](Parameter PA-3) setting value, according to given conditions, to set a large value as much as possible. When [Speed integral time constant] set value is large, response speed will increase, but it is tend to go into oscillating motion. Assure not in condition of oscillating motion, try to set a large value as much as possible. If [Speed integral time constant] settings are too small, the speed will changes largely when loads changes. Normally, the larger load inertia, the smaller the [Speed integral time constant].

※ Position Control

（1）Set suitable [Speed proportional gain] and [Speed integral time constant] according to the above methods.

（2）[Position Feed forward Gain](Parameter PA-7) sets to 10%.

（3）[Position Proportional Gain] (Parameter PA-6) value setting. in the steady range, to set the value as large as possible. If the [Position Proportional Gain] setting value is large, position command tracking property will be better, and delay error will be smaller, but it is tend to oscillate when stop positioning.

（4）If required position tracking property is very high, can increase the [Position feed forward gain] set value. But if it is too large, will lead to overshoot.

Note 1 if set value of [position proportional gain] is small, system will be in steady states, but position tracking property will be lower, delay error become larger, in order to get a high [position proportional gain], it is useful to increase the set value of [acceleration and deceleration time constant](Parameter PA-4,PA-5), to prevent overshoot.

Note 2 When to increase set value of [position feed forward gain], while the system is unsteady, it is useful to increase set value of [acceleration and deceleration time constant], to prevent overshoot.

Note 3 [position proportional gain] setting reference sheets:

Stiffness	**[Position Proportional Gain]**
Low	10～60/S
Middle	60～100/S
High	100～220/S

2. Basic Paramerter Adjusting Diagram

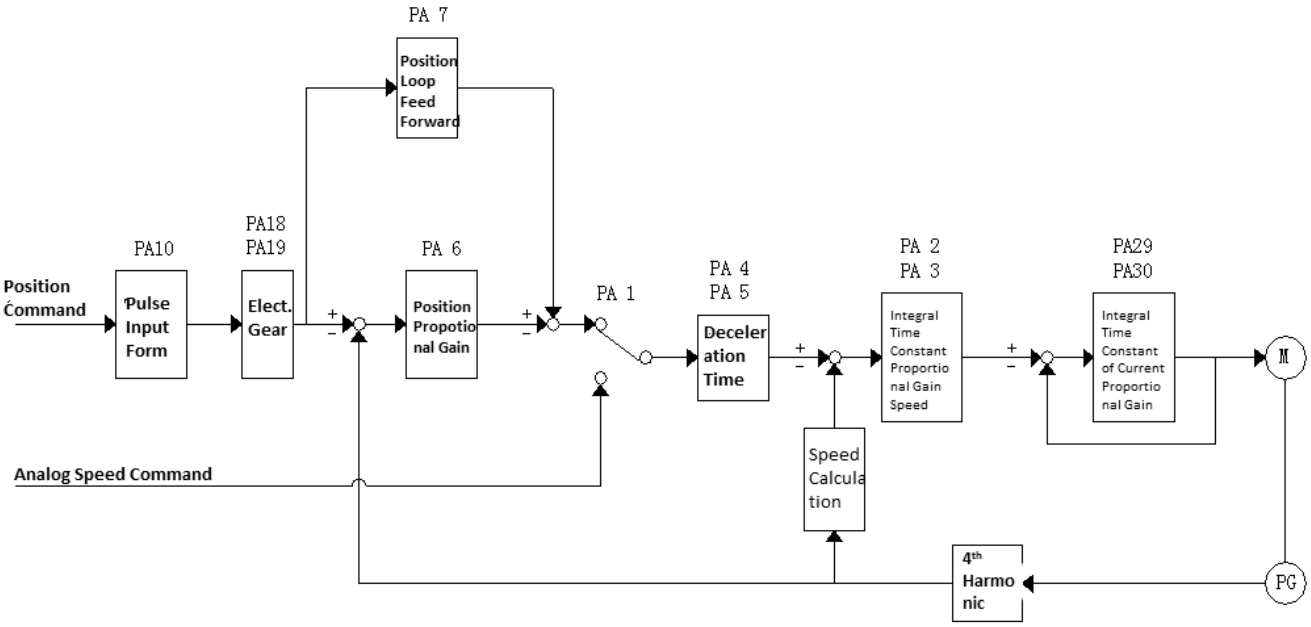


Diagram 7-2 Basic Parameter Adjusting Diagram

1. Settings of position resolution and electronic gear

Each turn running/stroke of servo motor and each feedback pulse Pt of coder, decided by the position resolution, see the following formulation:

$$\Delta l = \frac{\Delta S}{P_t}$$

In the formulation：

Δl：One impulse stroke (mm)

ΔS：Servo motor stroke of each turn(mm/turn)

P_t：Coder's each turn feedback impulse count (impulse/turn)

Because, there is quadruple circuit in the system, so $P_t = 4 \times C$， C means windings of each turn.

Command impulse multiply by electronic gear ratio G makes to the positional control impulse, so a command impulse stroke shows:

$$\Delta l^* = \frac{\Delta S}{Pt} \times G$$

$$\text{and } G = \frac{\text{Command impulse frequency dividing numerator}}{\text{Command impulse frequency dividing denominator}}$$

4. Start Stop Property Adjustment

Servo system start stop property is the time of acceleration and deceleration, decided by load inertia, start and stop frequency, meantime limited by performance/function of servo drive and motor. Frequent start and stop、too short time of acceleration and deceleration、too large load inertia, all of this will lead to warning result by drive and motor overheating、main circuit over voltage, must be adjusted according to practical situation.

（1）Load inertia and start stop frequency

If used in high start and stop frequency situation, must be confrim whether it is in allowrance frequency range. Allowance frequency range is different according to motor type、capacity、load inertia、motor rotation speed. If in the condition of load inertia m times motor inertia, servo motor allowance start stop frequency and recommend acceleration and deceleration time (Parameter PA-4, PA-5) as follows:

Load inertia	Allowance start stop frequency
m≤3	＞100times/min: acceleration and deceleration time 10mS or less
m≤5	60～100times/min：acceleration and deceleration time 20mS or less
m＞5	＜60times/min：acceleration and deceleration time above 50mS

（2）Servo motor impaction

Different type of servo motor have different allowance start stop frequency and acceleration and deceleration time, result by load condition、running time、load carry duty and environmental temperature as so on. Please take the motor instruction book for reference, and adjusting according to specific circumstances, preventing overheating lead to warning or impacting the life span.

（3）Adjusting Method

Normally load inertia should be within 5 times of motor rotor inertia, when under large load inertia, during speed down, often result in main circuit over voltage or brake abnormal, at this time it can use such handling methods:

⊙To increase acceleration and deceleration time, firstly can set in a larger value, and then reduce gradually to suitable value.

⊙Low down internal torque limitation value, reduce current limitation value.

⊙Reduce maximum motor rotating speed.

⊙Change into another larger power、inertia motor.

Chapter 8 Production Specification

8．1 Drive specification

		SD15MT	SD20MT	SD30MT	SD50MN
Output Power (KW)*		0.2~0.6	0.6~1.0	1.0~2.5	2.5~5.2
(Nm) Motor Rated Torque		1~3	3~5	5~15	15~27
Dimensions（mm）		198×85×131	198×89×148	198×95×168	264×115×172
Weight（Kg）		2	2.5	3	5
Input Power supply		Single-phase AC220V –15~+10% 50/60Hz	Three-phase AC220V –15~+10% 50/60Hz		
Using Environm-ent	Temperature	Working: 0~55°C Storing: -20°C ~80°C			
	Humidity	Less than 90% (Non condensation of moisture)			
	Oscillation	Less than 0.5g(4.9m/S^2)，10~60Hz(Non continuously-running)			
Control mode		① Position Control ②Analog speed control ③Speed trial run			
Regenerative braking		Internal installed			
Control characteristic		Speed frequency response: <400Hz			
		Speed fluctuation ratio: <±0.03(load 0~100%)；<±0.02(Power -15~+10%)(value corresponds to rated speed)			
		Speed governing ratio: 1:5000			
		Impulse frequency: ≤500kHz			
Control input		① Servo Enable ②Warning clearance ③Deviation counter zero clearing ④Command impulse inhabit ⑤Over-traveling protection			
Control output		① Servo ready to output ②Servo warning output ③Position finished output ④Coder signal			
Position Control		Input method	① Impulse + sign ② CCW impulse/CW impulse		
		Electronic gear ratio	1~32767		
		Feedback impulse	10000 impulse/turn		
Acceleration and Deceleration function		Parameter setting time of acceleration and deceleration 6~1530mS (0r/min←→1000r/min)			

Monitoring function	Rotate speed、command impulse accumulated、position deviation、feedback impulse accumulated、motor current、running states and so on
Protection Function	Over speeding、main power supply over voltage，under voltage、over current、over load、coder abnormal、position running out/difference and so on
Display、Operation	6 LED displaying states、4 keys setting parameter
Suitable load inertia	Less than 5 times of motor rotor inertia

Chapter 9 Ordering directions

9.1 Capacity Choosing

To determine a servo system capacity, should integrated considering load inertia、load torque、required position precision、required maximum speed, suggesting to choose follow the steps:

1）Calculate the load inertia and torque

Referring to related information/material to calculate out load inertia、load torque、acceleration and deceleration torque、effective torque, for the basis of next step of choosing.

2）A preliminary confirmation of register ratio

Calculate out the maximum register ratio according to required maximum speed and maximum motor rotating speed, by this register ratio and motor minimum turning unit to check whether can meet minimum position unit requirements, if the position precision requirement is very high, can enlarge the register ratio (factual speed limit reduced) or choose another motor with higher rotating speed.

3）Checking inertia and torque

To convert load inertia and load torque to motor shaft through mechanical reduction ratio, and the converted inertia shouldn't larger than 5 times of motor rotor inertia, converted load torque、effective torque shouldn't larger than motor rated torque. If cannot match the above requirements, to increase mechanical reduction ratio (factual speed limit reduced) or choose another motor with higher capacity.

9.2 Electronic Gear Ratio

Meanings of the electronic gear ratio、adjustment methods，please check Chapter 4 (Sheet 4.1 Parameter Function)、Chapter 6 (6.3 Parameter Settings)

In position control mode, load factual speed is:

Command impulse speed×G×mechanical reduction ratio

In position control mode, load factual minimum displacement is:

Minimum command impulse stroke×G×mechanical reduction ratio

Note when electronic gear ratio G is not 1, to do gear ratio division operation maybe produce a

remainder, at this time maybe have position deviation, and the maximum deviation is the minimum rotational number (Minimum resolution response).

Chapter 10 Adjusting Method

1： The first step must be under the condition of motor wire U, V, W unconnected, to set motor corresponding PA35 parameter.

2： Please modify PA 33 parameter according to rated current of mating motor. This parameter would affect over current protection value and overload protection value.

3： Calculation of PA38:

SD15MT:	PA38=3874/ Motor rated current;
SD20MT:	PA38=3874/ Motor rated current;
SD30MT:	PA38=7748/Motor rated current;
SD50MN:	PA38=10000/ Motor rated current;

According to the above formula and make out a rounded number, and then input to AC servo motor drive, at last it becomes effective after re-electrifying.

4： Set PA1 to 1:

Servo in position mode, at this time PA15,PA16,PA17,PA44, PA45, PA46, these analog speed control parameter are ineffectual.

Set PA1 to 2:

①: Servo is in analog speed mode, at this time PA6,PA7, PA9, PA10, PA11,PA12, PA18,PA19, PA22, such position control parameter are ineffectual.

②: For SIMENS 802C system: PA17=1;

For Nanjing Taikang close loop system: PA17=2;

For FAGOR close loop system: PA17=2

③: Manual drive zero adjusts PA15: firstly servo must be correctly connected with system, under condition of zero load, to adjust PA15 value to let the motor immovability when the system in zero speed, and meantime system following error is in range of several impulses.

Because manual zero adjustment is very troublesome, so later developed automatic zero deviation compensation function. When servo enable is ineffectual and PA42=2, just press “Confirm” key once, so as to let servo drive to complete automatic zero deviation compensation, and meantime automatically memorize this zero deviation value, that is value of PA15.

5： Rigidity Adjustment:

A: In position control mode:

Normally, user just need to adjust PA2、PA36、PA32 and PA29 these proportional constant. PA3、PA37、PA40 and PA30, these integral constant don't need to be adjust normally. Rigidity adjustment divides into following three steps:

①：The first step is to let motor working in several turns per minute, for example to choose feeding speed F2、F5、F10, to use clock gauge or dial indicator to testing whether working platform movement is uniform, and at this time it is mainly to adjust speed loop proportional gain PA36. The larger the motor、the heavy the load、the fasten the assembling, PA36 should be larger, otherwise motor will creep or Err-17 over load protection will happen. If PA36 is too large, rigidity is too strong, the control platform will have obvious high-frequency vibration, at this time should reduce the value of PA36.

②：After low speed adjusted well, to let motor working above 10 turns per minute, that is between F100~F6000, meantime should adjust PA2 value to make working platform works at a constant speed and without noise. If it is not useful, please reduce PA29 value! Normally:

PA2=PA36*(1.0~2)

③：After complete above two steps, let the motor working within 10 turns per minute, that is around F50, if vibration is heavy please reduce PA32 value, if motor creep please enlarge PA32 value to increase rigidity.

B: In analog speed control mode:

①elative parameter explanation:
PA39: current loop integral constant while in low speed，PA39=(1/10~1/3)PA30;（in position control mode，PA39=1）
②Increase PA36,PA39, PA40 can increase low speed rigidity. Mainly to increase value of PA36.
③Increase PA2,PA3,PA32,PA37 can improve middle speed、high speed rigidity. Mainly to increase value of PA2.。

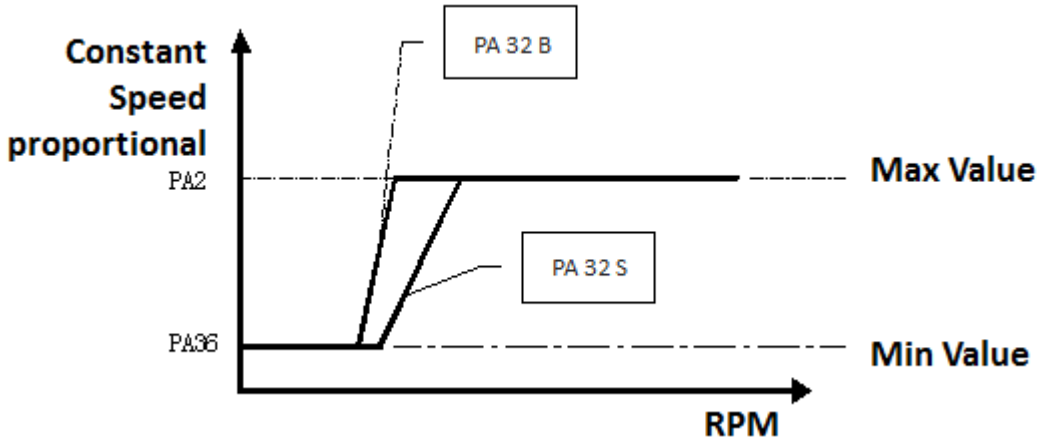
PA2=(1.2~1.5)*PA36

PA3>PA40;

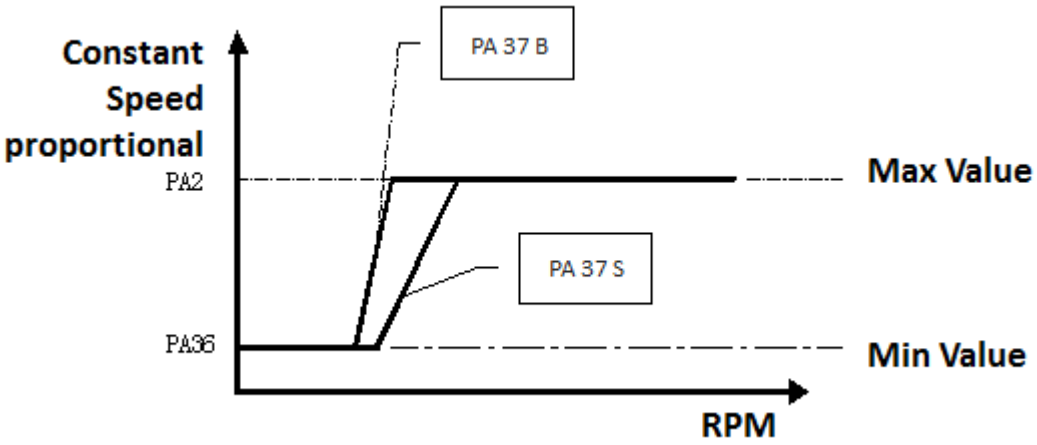
PA32=13~30;

PA37=10~20;

C: Speed loop proportional constant PA2 、PA36 and PA32 relationship as follows:



D: Speed loop integral constant PA3、PA37 and PA40 relationship as follow diagram：



6：If hope to make servo motor lockup as soon as power connected, or do not use external enable signal, please set PA27 into 1 or 3;

7：If the equipment doesn't earth well, or in the working circumstances of transducer, when the drive frequently happens warning Err--30, Err—25, suggest to set PA23 to 2, to screen coder warning happens.

8：Strong electric wire in the electric box such as 380V incoming line/inlet wire、transducer 's U、V、W output wire、AC servo U、V、W output wire, should keep away from signal wire of AC servo, or do not even binding together! Otherwise strong disturbance will impact normally working of AC servo.