

EDC Setting Guidance

Chapter 1: General Precaution

Notice before using:

1. Make sure input power is connected right. (supply power is single phase AC 220V)
2. Any circuit or short wiring between P and N is forbidden.
3. Phase sequence U/V/W of the motor must be in accordance with that of drive.
4. EDC is operated only to be connected to the panel or communication cable.
5. Positioning the machine safe to avoid accidents.
6. Noise from signal wire causes mechanical vibration and malfunctions easily. So noise rejection and grounding are necessary. Please route high-voltage power cables separately from low-voltage power cables and make cable route as short as possible.
7. Don't plug in or unplug the connectors when power is ON. Always turn the power OFF first before plugging in or unplugging the connectors.
8. Continuous operation with negative load is prohibited. Motor shouldn't keep continuous operating with load when it brakes by regenerative resistor or brake.

Process to set "Suitable motor model parameter"

- a. Check the purchased motor model;
- b. Check the purchased drive model;
- c. To confirm whether motor model is suitable with drive model according to following table. If not, please contact with the manufacturer or distributor.
- d. Power on drive control circuit after confirming motor model is suitable with drive model. Then reset "suitable motor model parameter Pn042" according to following table. And then power OFF, motor model setting is completed. (Note: "drive model parameter Pn223" is already set)

Servo Drive Model	Servo Motor Model	Pn223	Pn042
EDC-02A□A	EMJ-02APA□□	0	0
EDC-04A□A	EMJ-04APA□□	1	0
EDC-08A□A	EMJ-08APA□□	2	0
EDC-10A□A	EMJ-10APA□□	3	0
EDC-10A□A	EMG-10APA□□	3	1

Chapter 2

Introduction of EDC parameters and major control mode

I .Parameters for basic function

- 1.Pn000 Use servo ON input signal (/S-ON) or not (0-1)
[0] Use servo ON input (/S-ON).
[1] Don't use servo ON input (/SON)

- 2.Pn001 Use forward rotation prohibited input (P-OT) or not (0-1)
When 1CN pin is set as P-OT signal input,limit direction and enable are selected according to the parameter.
[0] Use forward rotation prohibited input (P-OT).
[1] Don't use forward rotation prohibited input (POT).

- 3.Pn002 Use reverse rotation prohibited input signal (N-OT) or not.(0-1)
When 1CN pin is set as N-OT signal input,limit direction and enable are selected according to the parameter.
[0] Use reverse rotation prohibited input (N-OT)
[1] Don't use reverse rotation prohibited input (N-OT).

- 4.Pn003 Operation performed at recovery from power loss (0~1)
[0] Servo alarm output is not available. (ALM)
[1] Servo alarm output is available. (ALM)

- 5.Pn004 How to stop when Servo OFF or overtravel occurs (0~3)
[0] Stops the motor by applying dynamic brake (DB).
[1] Coast to a stop.
[2] Stop the motor by applying DB when servo OFF,then the motor coast to a stop.
[3] Motor coasts to stop when S-off, then the motor stops by applying dynamic brake(DB).

- 6.Pn005 whether the error counter is cleared when S-OFF (0~3)
[0] clear the error counter when S-OFF
[1]: don't clear the error counter when S-OFF

7. Pn006 Rotation Direction Selection (0~1)
[0] Forward rotation is defined as counterclockwise rotation when viewed from the drive end.
[1] Forward rotation is defined as clockwise rotation when viewed from the drive end.

8. Pn008 Reference pulse Selection (0~2)

[0]signal+pulse

[1]CW+CCW

[2]A+B(orthogonal 4 times frequency)

9.Pn041 control mode selection (0-2)

[0] position control mode (pulse train reference)

[1] Position contact control mode(internal position reference)

[2]Speed control(parameter reference)

II Position Control Mode

Position Control

Position control is widely applied in various positioning occasions,which could replace various step transfer systems.Usually position control is operated by receiving pulse.Position is decided by pulse number and rotation speed is decided by pulse frequency.Position equivalent of one pulse depends on mechanical structure and electronic gear ratio.

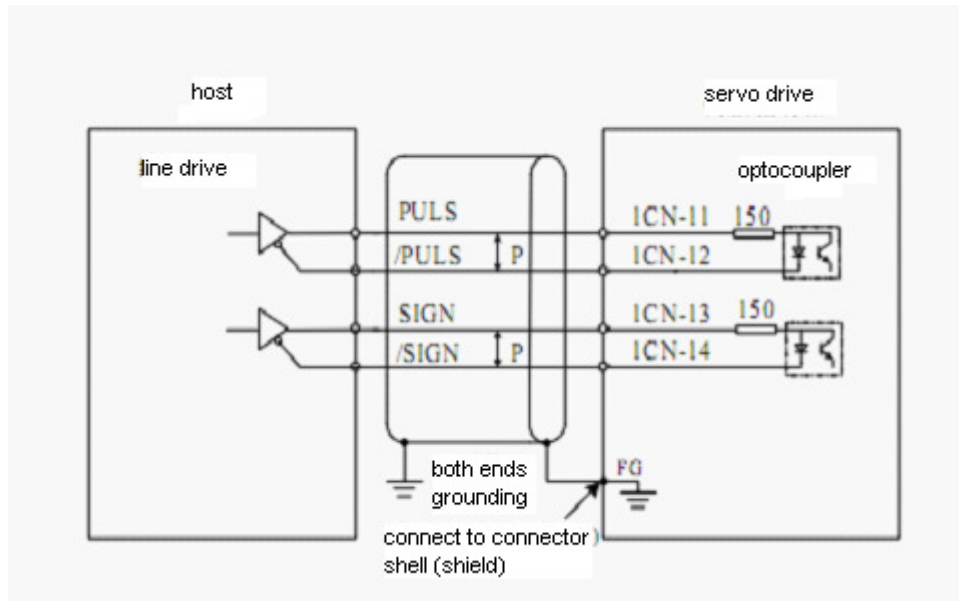
Possible parameters of position control

- 1.Pn008 Reference pulse form
- 2.Pn013 Speed loop gain
- 3.Pn014 Speed loop integration time constant
- 4.Pn015 Position loop gain
- 5.Pn017 Position feed forward
- 6.Pn022 Electronic gear A
- 7.Pn023 Electronic gear B
- 8.Pn024 First position reference filter
- 9.Pn056 Second electronic gear numerator
- 10.Pn057 Dynamic electronic gear enable
- 11.Pn102 First and second filter time

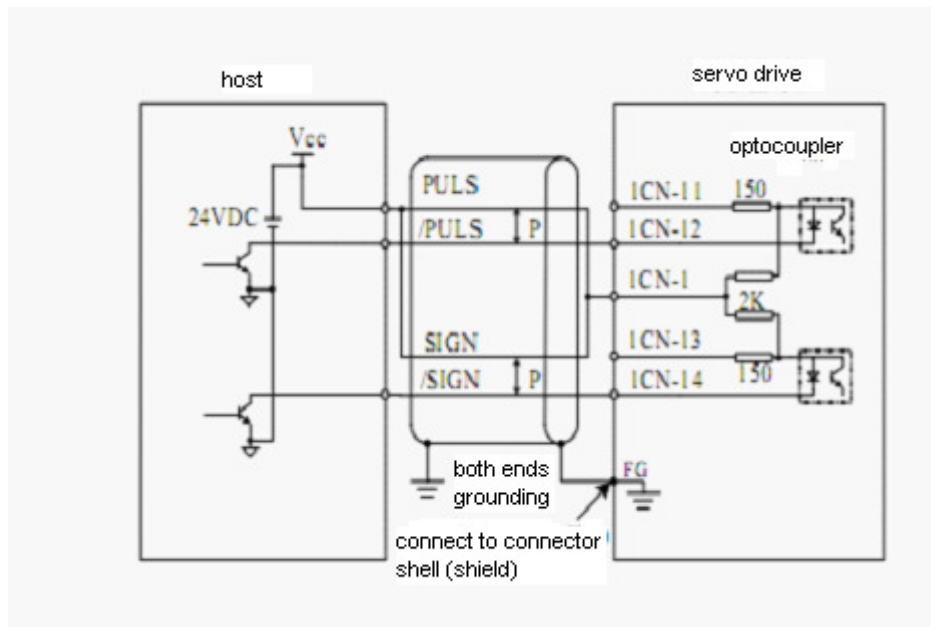
Connection of pulse inputting

Example 1 (host is that line drive outputs)

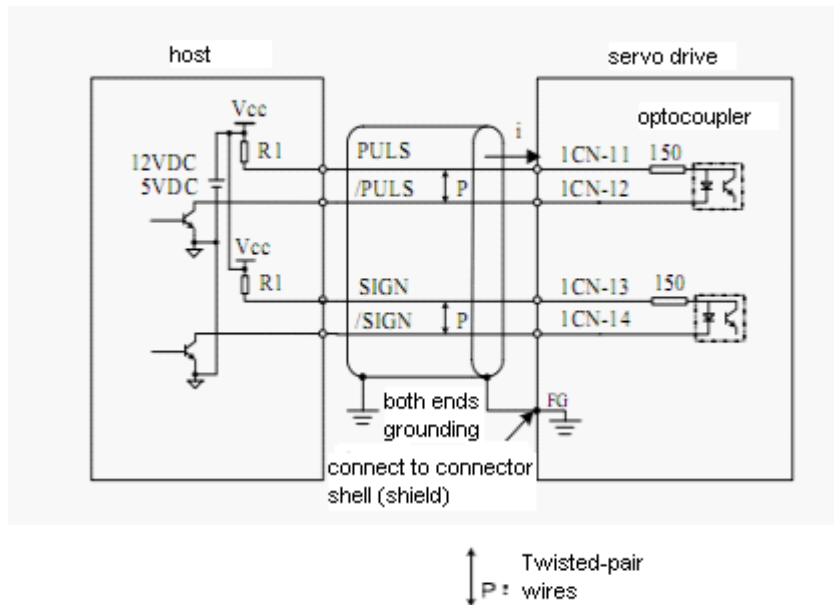
Suitable line driver(AM26LS31、SN75174 or replacement of MC3487 from TI firm)



Example 2 (host is open collector outputting and provide 24VDC signal power)



Example 3(host is open collector outputting,and provide 12VDC or 5VDC signal power)



Please set resistor R1 according to following current range.

Input current $i=10\sim 15\text{mA}$

$V_{cc}=12\text{V}, R1=560\sim 820\ \Omega$

$V_{cc}=5\text{V}, R1=82\sim 200\ \Omega$

Introduction for electronic gear

1. One pulse is corresponded to a position equivalent (reference unit) by electronic gear. User could set electronic gear easily according to mechanical speed reduce ratio, such as reference unit should correspond with mechanical displacement.

2. Electronic Gear is a ratio of pulse number from controller (denominator Pn023) and encoder resolution (numerator Pn022). EDB encoder is 2500P/R, whose resolution ratio is 10000P/N. For example, PLC demands 1000 pulse a revolution, electronic gear ratio is $Pn022/Pn023=10000/1000$, reduction of a fraction is 10/1.

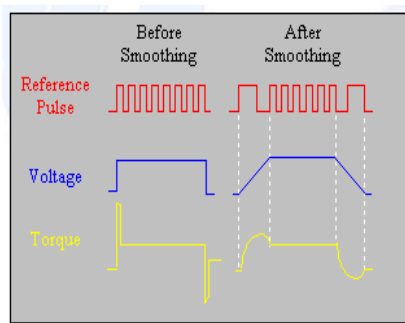
3. Feedback pulse number of reference unit of travel distance is fed back from motor encoder.

Introduction of second electronic gear:

There are two electronic gear ratios of EDC drive internal to adapt to some special occasions. The two electronic gear ratios could be dynamic switched during operation. Operation steps are as followings:

Dynamic electronic gear is effective, when $Pn041=1$ and $Pn057=1$, which is switched by P-CON signal (input signal selection parameter is set as 2). Numerator of electronic gear is $B=Pn022$ without P-CON signal inputting; Numerator of electronic gear is $B=Pn056$ with P-CON signal inputting. When $Pn057=0$, P/PI is still switched by P-CON.

Smooth operation of position loop



The smoothing function does not change the travel distance (number of pulses).

1. When host device is without accelerating /deceleration function.
2. When electronic gear is set too much.
3. When reference puls frequency is low.
4. When reference puls frequency is not stable.

Parameters, position reference first filter and feed forward, need to be set with above situations. When feed forward is set higher, it's better to set feed forward filter.

Notice for position control

1. It may cause position offset if position gain Pn015 is set too small (<16).
2. If two axes are of interpolation, position gain, position feed forward and speed offset of the two axes need to be set alike or the same.
3. High gain is helpful to increase positioning speed and reduce following offset. Position gain should match with speed gain.
4. When host reference puls frequency is instable or reference puls frequency is low, position reference first filter (Pn024) should be set.
5. Un010 and Un011 display position pulse. Motor current position (Un008 and Un009) is calculated by electronic gear.

III. Point control mode

1. The 8-node control function is built inside the EDC servo drives. Speed and smooth filter time of each node are available to set.
2. Delay step change and inputting external step change signal are available.
3. Absolute programming and relative programming are both available.
4. Loop and single operation and looking for reference point are all available.

Possible Parameters of node positioning control mode

1. Pn041 Control mode selection

- 2.Pn068 Single run and cycle run selection
- 3.Pn069 Step changing mode
- 4.Pn070 Program method
- 5.Pn071 Origin searching method
- 6.Pn072 Start point for program
- 7.Pn073 End point for program
- 8.Pn074 Speed of looking for reference point(bump the limit switch)
- 9.Pn075 Speed of looking for reference point(move away from the limit switch)
- 10.Pn077 Origin searching offset reverse
- 11.Pn078 Origin searching offset pulse number
- 12.Pn080-Pn095,Pn096-Pn103,Pn104-Pn111,Pn112-Pn119
node position;speed;smooth filter time;stop time for specific settings

Program steps for node positioning control mode:

- 1.Node positioning control mode is selected.That is Pn041=1
- 2.To confirm whether the system needs to connect limit switch.If not.Pn001 and Pn002 should be set and cancel forward and reverse rotation prohibit.
- 3.Whether to look for reference point,search speed and return time are all available to set.
- 4.To confirm how many position sections in total and set start and stop position.
- 5.Set displacement,speed and smooth filter time constant of each position section.
- 6.To confirm which inputting is start/stop switch and which one is looking for reference point switch.
- 7.To confirm step changing mode
- 8.To confirm program mode:absolute or relative.
- 9.To confirm whether it is internal S-ON or external switch control S-ON signal.

Notice for node positioning control mode:

- 1.Each node positioning displacement is combined by two parameters.Actual program displacement is combined by algebraic sum of two parameters.Note the unit of the two parameters.
- 2.Pay attention to the speed of looking for reference node.If the speed is too fast,soft start accelerate/decelerate should be set to reduce the machinery impact.
- 3.1CN is available without any inputting or outputting in node positioning control mode.
- 4.Sequence step changing is only supported at present.

Chapter 3 monitor and auxiliary function

I Monitor Function Mode

Monitor mode displays are as followings

Monitor No. Content

- Un000 Actual motor speed (Units: r/min)
- Un001 Input speed reference value (Units: r/min)
- Un002 Feedback torque reference(Units:%) (relative rated torque)
- Un003 Input torque reference (Units:%) (relative rated torque)
- Un004 Number of pulses of Encoder angles
- Un005 Input and output signal monitor
- Un006 Encoder signal monitor
- Un007 Speed given by pulse (electronic gear ratio is 1:1)
- Un008 Current motor position with 5 digits lower (*1 reference pulse)
- Un009 Current motor position with 5 digits higher(*10000 reference pulse)
- Un010 Position reference is 5 digits lower(*1 pulse)
- Un011 Position reference is 5 digits higher(*10000 pulse)
- Un012 Position offset is 5 digits lower(*1 pulse)
- Un013 Position offset is 5 digits higher(*10000 pulse)



internal status bit display

Monitor NO.	Digital NO.	Input & Output	Display	Related input&output signal
Un005	0	Input Signal	Servo Enable	1CN-15 (/S-ON)
	1		Alarm Clear	1CN-6(/ALM_RST)
	2		Clear Offset Counter	1CN-7(/CLR)
	3		Zero Position Signal	1CN-17(/ZPS)
	4、5、6		No Displaying	No Signal
	7	Output Signal	Servo Alarm	1CN-4 (/ALM)
	8		Positioning Complete (reach the speed)	1CN-3 (/COIN etc.)
9	Machinery brake release		1CN-2 (/BRK etc.)	
Un006	0	Input Signal	Encoder W Signal	2CN-12\13(PG-W)
	1		Encoder V Signal	2CN-5\6(PG-V)
	2		Encoder U Signal	2CN-10\11 (PG-U)

II auxiliary function mode

If it is in the auxiliary function mode, some operations could be selected by a panel. The detailed functions are shown as below:

Function NO.	Content	Other
Fn000	Display alarm history	Open operation
Fn001	Restore to factory settings	
Fn002	JOG operation	
Fn003	Automatic offset-signal adjustment of motor current detection	
Fn004	Software version of servo	
Fn005	System runtime	Hidden operation
Fn006	Software version of panel operator	
Fn007	Factory test	
Fn008	Inertia inspection	

Notes:

1. Open operation: auxiliary functions for general users
2. Hidden operation: When the panel operator is in simple code menu, press "× × × ×" and start to use the auxiliary functions

1. Operations for alarm history displaying

The last ten(10) alarms are displayed in the alarm history library. Take following steps to check the latest alarm.

1. Press MODE key to select auxiliary function mode
2. Press INC or DEC to select function number of alarm history display.

The LED display shows the text "Fn000" in red characters.

3. Press ENTER key, the latest alarm code is displayed.

Alarm No. Alarm code

The LED display shows "0-A01" in red characters. A bracket above the "A01" part indicates the alarm code, and an arrow points from the "0" to the label "Alarm No.".

4. Press INC or DEC key to display other alarm codes occurred recently

A diagram illustrating the navigation process. On the left, two buttons labeled "INC" and "DEC" are shown with curved arrows indicating they can be used to move between entries. In the center, a horizontal LED display shows "3-A05". Above the display, the number "4" is shown, and below it, the number "2" is shown, representing the next and previous entries in the alarm history.

5. Press ENTER to return to function number display.



If an alarm occurs right now, the alarm codes will be updated immediately. The alarm with a serial number of 0 is the current alarm, and the alarm with a serial number of 9 is the last alarm.

If the user wants to clear all alarm history data, press ENTER key and hold on for one second while alarm codes are being displayed , then all alarm history is deleted.



2.Restore to Defaults

Steps of Restoring to defaults are as followings:

1. Press MODE key to select auxiliary function mode.
2. Press INC or DEC key to select function number for restoring to Defaults.



3. Press ENTER to enter parameter restoring mode.



4. Press ENTER key and hold on for one second to restore all the parameters to default values.



5. Release ENTER key to return to function number display.



6. In Step 3, the parameter restoring operation can be canceled and quit current operation by a short press on the ENTER key.

3.JOG operation

Note:

This mode is not available when servo is on or some alarm occurs.

Take following operation steps to make JOG operation.

1. Press MODE key to select auxiliary function mode.
2. Press INC or DEC key to select JOG Function number.



Press ENTER key to enter JOG mode, meanwhile, servo is OFF(motor power is OFF).



Press MODE key to enable Servo ON /S-ON.

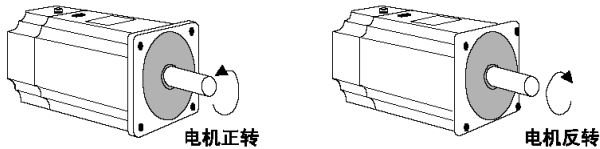


5. Press MODE key to turn servo ON and OFF.

If user wants to run motor, Servo On has to be used.

Press INC or DEC key, motor runs when pressing the keys.

The servomotor will rotate at the present setting speed as below.



During motor' s FWD or REV direction, LED display is as below:

Forward direction A red LED display showing the number 0.8000.

Reverse direction A red LED display showing the number 0.8000.

Press ENTER to return to function number display. At this moment, servo motor is turned OFF.



4 Offset signals adjustment of motor current detection

The servo drive will check motor current detection signals every time the servo is initializing upon power on and will adjust automatically if required, therefore, user needn' t do any manual adjustment in normal situations. If the user thinks the torque is a bit too large by judging from motor current offset, user may manually adjust motor current to lower down the torque further or to get higher running accuracy.

This section gives a know-how instruction on the operation steps to make offset signal automatic and manual adjustment.

Note:

The offset signal adjustment of motor current detection is only available when servo is OFF.

■ Adjust motor current detection offset signal automatically

Take following steps to make automatic offset adjustment.

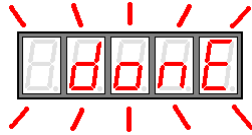
1. Press Mode key to select auxiliary function mode.
2. Press INC or DEC key to select function number.



3. Press ENTER key and enter automatic adjusting mode.



4. Press MODE and hold on for one second, donE is displayed and glimmers, the offset signal is then adjusted automatically.



Release the key



5. Press ENTER key to return to function number display.



5 Servo software version display

Take following steps to display software version of the servo drive.

1. Press MODE key and select Auxiliary Function Mode;
2. Press INC key or DEC key to select function number of software version display.



3. Press ENTER key, current software version is displayed.



4. Press ENTER key again to return to function number display



6 System runtime

Take following steps to display system runtime.

1. Press MODE key and select Auxiliary Function Mode.
2. Press INC key or DEC key to select function number.



3. Press ENTER key to display system runtime.

Following picture shows system runtime is 1 hour and 28 minutes.



4. Press ENTER key again to return to function number display.



The displayed time is the runtime after system is started up, the date is not refreshed in real time. If user wants to refresh the data, please repeat the operations in Step 3 and Step 4.

Chapter 4 inertial detection demonstration

1. Input background code with following display and then press “INC、DEC、DEC、INC、Enter” to return to the display.



2. Press MODE key and select Auxiliary Function Mode;
3. Press INC key or DEC key to select function number.



4. Press ENTER key and go into inertia inspection page as shown below:



5. Press Mode key again to start inertia detection. Following page is displayed:

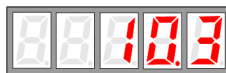


If servo alarm occurs or servo is ON, inertia inspection will not be executed, instead, a message “abort” is displayed on the panel operator as below.



If the user wants to cancel the function during inertia inspection or after entering the function menu, just press ENTER key.

When inertia inspection completes, inertia value of load and motor are displayed in the unit of $0.1 \text{ Kg} \cdot \text{m}^2 \times 10^{-4}$



6. Press ENTER key again to return to function number display page.



Step One:To judge whether inertial detection is available according to load .

Step Two:To operate inertial detection function Fn008.For example,detection value is 123,the unit is $0.1 \text{ Kg} \cdot \text{cm}^4$;(After this operation,inertial detected value is recorded into Pn124 automatically)

Step Three:Set Pn012 as 1

Step Four:Increase Pn120(feedback forward compensates of current)

appropriately

Step Five:Modify Pn013,Pn014,Pn018,Pn120,etc,according to operation status(rigidity and noise requirement of system).

Note:

- 1.Load moving distance must be in the mechanical allowed range to avoid device damage,since motor will rotate forward and reverse four circles each without external signal controlling during inertial detection operation.
 - 2.This operation is prohibited,when servo system is S-ON or alarming.
-

II 、 Setting Steps

Step One:To judge whether it is available to operate inertial detection according to load status.

Step Two:To operate inertial detection with auxiliary function Fn008 and set Pn012=1

Step Three:Modify Pn013/Pn014/Pn015/Pn018/Pn024,etc.according to operation status(rigidity and noise requirement of system)

Chapter 5

Gain Parameter Setting(Pn013/Pn014/Pn015)

Pn013 speed loop gain;Pn014 speed loop integral gain;Pn015 position loop gain

First of all,mechanical structure has a great influence on gain setting.If machine is in good rigidity(grinder screw transmission),relative servo gain could be set higher.If machine is in soft rigidity (package timing belt),relative servo gain shouldn't be set too high.

General setting thought for servo speed and position gain parameter :

There are three feedback loops inside of servo drive,including position loop,speed loop and current loop.The innermost loop(current loop)reacts fastest.The middle loop(speed loop)reacts faster than outmost loop(position loop) .Otherwise,it will cause vibration or bad reaction for motor rotation.User could just set position loop and speed loop,since current loop could keep a good performance of servo design.

Reaction of position loop shouldn't be faster than that of speed loop.So,if position loop gain would be increased,speed loop gain should be increased first.Motor may be caused vibration so that speed reference and positioning time will be increased,if increase position loop gain only.

Speed loop gain(Pn013)

Increasing speed loop percent gain is helpful to decrease variation of rotation speed pulsation, increase rigidity of servo drive and guarantee system stability and performance of transient operation. However, speed loop percent gain couldn't be too high in actual system. Otherwise, it will cause vibration of servo system.

Relationship between speed loop setting and load inertial.

When load rotary inertia is larger than motor rotary inertial and load friction torque is large, it should increase speed loop percent gain and speed loop integral time constant to guarantee operation stable requirement.

When load rotary inertia is smaller than motor rotary inertial and load friction torque is small, it should decrease speed loop percent gain and speed loop integral time constant to guarantee speed control precision with low speed.

Position loop gain(Pn015)

Position loop gain is related to servo motor and machine load.

Usually if position loop gain is high, motor speed delay time of position reference response will be decreased as well as position tracking error and positioning time. But relative mechanical rigidity and natural frequency must be high. When inputting position value changes suddenly, outputting position value changes and mechanical load impacts very much. So it is necessary to buffer this change by accelerating/decelerating speed or programming by host.

When position loop gain is small, setting is more easy. Since servo system is steady with small position loop gain and it's easy to set for large load.

Meanwhile, frequency range of servo system with low position loop gain is narrow and servo system isn't sensitive to noise. Position changes little as motor feeds, while offset of servo system position tracking with low position loop gain is large and it will cause offset of machining path during contour operation.

Chapter 6 Common alarm and remove method

I A04 overload

1. Wiring error and wiring leak

(1) wiring of U, V, W error between motor and drive

(2) Bad contact for side connector of servo motor

2. The model of servo drive doesn't match with that of servo motor

To check drive model and motor model and select proper drive or motor

3. Mechanical load exceeds motor rated rotation torque largely. The displayed value seems high by Un003(internal rotation percentage%)

(1) Decrease load torque and inertial momentum, If it still unavailable, please change a motor with higher capacity

(2)If the machine is abraded seriously or is stuck,please remove these mechanical problems.

4.The break doesn't release for motor with break.

(1)Please check break control circuit,since break is without power supplying.

(2)Break is burnt out.

II Encoder alarm A10 and A17

1.Encoder connector is badly connected or isn't plugged in.

Please check the connector and plug it again.

2.Encoder cable is damaged.

Please check it to confirm whether it is damaged.

3.The encoder is damaged.

The encoder needs repair.Avoid:No forced striking on motor shaft and encoder parts .

III.Over current alarm A12

1.Encoder cable between servo drive and motor wires error or is short wiring.

Please check encoder cable wiring and wire it correctly.

2.Power cable between servo drive and motor wires error or is short wiring.

Please check power cable wiring and wire it correctly.

IV.The light CHARGE and POWER&ALARM aren't bright.

1.Single phase power AC220V isn't supplied between R and T.

Wiring error.Drive board (R&T)is without power supplying.

2.R&T is short wiring that the drive is burnt out.

V.parameter setting is unavailable

The plug of panel cable is not plugged into the COM socked or connected badly.

Panel communication cable is damaged.

P.S.The setting guide manual is a general index of EDC servo modifying for reference.Please refer to EDC user manual or consult technique engineers of distributers for detailed parameter,etc.