PM63A/PM62A CNC System

Manufacturers' Manual

2nd Edition

Weihong Electronic Technology Co., Ltd.

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Preface

About this manual

This manual is intended for manufacturers. If you use the CNC system for the first time, you need to read through the manual. If you are experienced with the system, you can search for the desired info via the contents.

With 6 chapters, this manual can be divided into 4 parts, as follows:

1) Part 1: preface, introducing the precautions about transportation and storage, installation, wiring, debugging, usage, and so on. You need to read them carefully beforehand to ensure safe operations.
2) Part 2: product, including Chapter 1. Chapter 1 is product overview, including system configuration, mechanical dimension and introduction to each part.
3) Part 3: application, including Chapter 2~4. Chapter 2 is wiring instruction, Chapter 3 installation, Chapter 4 machine debugging.
4) Part 4: appendix, including Chapter 5 and 6. Chapter 5 lists parameter settings and wiring diagrams of various drivers and Chapter 6 states the software license agreement.

Applicable Product Models

This manual is applicable to PM63A/62A control card. Refer to the table below for details:

Product Model	Remarks
PM63A/62A control card	Self-developed high-performance motion control card, it is used together with NcStudio motion control software and can be widely used in milling and engraving, waterjet cutting industries. .

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Revision History

You can refer to the following table for the revision records of each edition.

Date	Edition	Revision Contents
2016.02	R2	Contact information updated.
2015.07	R1	Released for the first time.

Precautions

Precautions can be divided into caution and warning according to the degree of possible loss or injury in case of negligence or omission of precautions stipulated in this manual.

: general info, mainly for informing, such as supplementary instructions and conditions to enable a function. In case of negligence or omission of this kind of precautions, you may not activate a function. Note that in some circumstances, negligence or omission of even this kind of precautions could cause physical injury or machine damage.

: warning info requiring special attention. In case of negligence or omission of this kind of precautions, you may suffer physical injury, or even death, machine damage or other losses.

1) Precautions Related to Storage and Transportation

- The products should be transported properly in terms of the weight;
- An excess of specified quantity of stacking products is prohibited;
- Climbing, standing or placing heavy loads on the products is prohibited;
- Dragging or carrying the products via cables or devices connected to them is prohibited;

2) **Precautions Related to Installation**

- Only when this equipment installed in the qualified electricity cabinet can it be used. The construction of the cabinet must reach IP54 grade of protection;
- Paste sealing strips on the joint of the cabinet to seal all the cracks;
- Cable entry should be sealed while easy-to-open on the spot;
- A fan or heat exchanger should be adopted for the heat dissipation and air convection of the

WARNING

cabinet;

- If a fan is adopted, air strainer is a must in air inlet or air outlet;
- Dust or cutting fluids may have access to the CNC device via the tiny cracks and tuyere. Therefore it is necessary to pay attention to the surroundings and air flow direction of the air vent to make sure that the outflow gas is towards pollution source;
- 100 mm space should be preserved between the back of the CNC device and the cabinet wall for plugging cable connected with the device and the ventilation & heat dissipation in the cabinet;
- Space between this device and other equipments should also be preserved according to the requirements;
- The product should be installed firmly and without vibration. During installing, casting, knocking, striking, or loading on the product is forbidden;
- To reduce electromagnetic interference, power-supply components used should be above AC or DC 50V and the space between cable and CNC device should be preserved above 100mm;
- It will be better if CNC device is installed at a position facilitating debugging and maintenance.

3) **Precautions Related to Wiring**

- Only qualified people are allowed to participate in the wiring and checking;
- The CNC device should be grounded reliably and grounding resistance should be less than 4 ohm. Neutral line is absolutely not allowed to replace earth wire. Otherwise, it may result in malfunction of the device due to the interference;
- Wiring should be firm and steady, or misoperation may occur;
- Voltage values and positive & negative polarity of any connection plug should be in accordance with specifications set forth in the manual, or it may result in breakdowns such as short circuit and permanent damage to the device;
- To guard against electric shock or CNC device damage, fingers should keep dry before plugging or touching switch;
- The connecting wire should not be damaged and squeezed, or the leakage or short circuit may occur;
- It is prohibited to plug or open the chassis of CNC device when power on.

4) **Precautions Related to Running & Debugging**

- Parameters setting should be checked before running, since wrong setting may lead to

WARNING

accidental movements;

- Modification to parameters should be within the allowable range, or such breakdowns as unsteady running and machine damage will occur.

5) **Precautions in Use**

- Before power-on, please make sure that the switch is on blackout to avoid occasional start-up;
- Please check the electromagnetic compatibility during electrical design in order to avoid or reduce electromagnetic interference to the CNC device. A low pass filter should be employed to reduce electromagnetic interference if there are other electrical devices nearby;
- It is not allowed to frequently power on and power off. It is recommended to power up the machine again at least one (1) minute later after power failure or blackout.

CAUTION

1) **Precautions Related to Product and Manual**

- Matters related to restrictions and functions available stipulated in the manuals issued by the machine manufacturer are prior to those in this manual;
- This manual assumes all the optional functions are available, which you must confirm through manuals issued by the machine manufacturer;
- Please refer to manuals issued by the machine manufacturer for the instructions of machine tools;
- Functions, and software interfaces vary with the system and the version of software. Before using the system, you must confirm the specifications.

2) **Precautions When Opening the Package**

- Please make sure that the products are what you have ordered;
- Check if the products are damaged in transit;
- Check if the components and accessories are damaged or missing in terms of the detailed list;
- Please contact us promptly if product discrepancy, accessory missing or transit damage occurs.

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1. System Introduction

1.1. Introduction to PM63A/62A Control Card

Independently developed by Weihong Electronic Technology Co., Ltd., PM63A/62A control card, is mainly used together with NcStudio motion control software and can be applied to motion control of routers, engraving and milling machines, drilling machines and cutting machines.

1.2. PM63A/62A System Configuration

- One PM63A/62A servo control card
- A CD of NcStudio motion control software (unnecessary if the manufacturer has already customized one)
- One terminal board of EX25A2 or of other types
- One DB37M/F cable (1.5m)
- One DB50-CONNECT card
- One FC50-FC50 cable (25cm)
- One HD50F-CN50 Cable (1.5m)

1.3. Structure Description of PM63A/62A Control Card

PM63A/62A control cards adopt PCI interfaces. Taking PM63A as an example, the structural drawing is as shown in Fig. 1-1. For PM63A, the dimension is190mm × 127mm, for PM62A, 190mm × 121mm. There is a red LED D1 on the motion control card which indicates its work status: when NcStudio software runs normally, D1 is off; when NcStudio control software doesn't run, D1 is on.

The motion control card has 3 sockets. JP1 is the DB37M socket connected to the terminal board via a matched DB37M/F cable. JP2 is the extended socket for manual pulse generator (MPG, also known as handwheel). If handwheel function is ordered at purchase, connect JP2 to the back of PC chassis via a FC16-DB15F handwheel flat cable (with rail block). JP3 is the external extension socket, connected to the back of PC chassis through the cable FC50-FC50 and pin board DB50-CONNECT successively, the other end of pin board DB50-CONNECT connected to the terminal board through the cable HD50F-CN50.

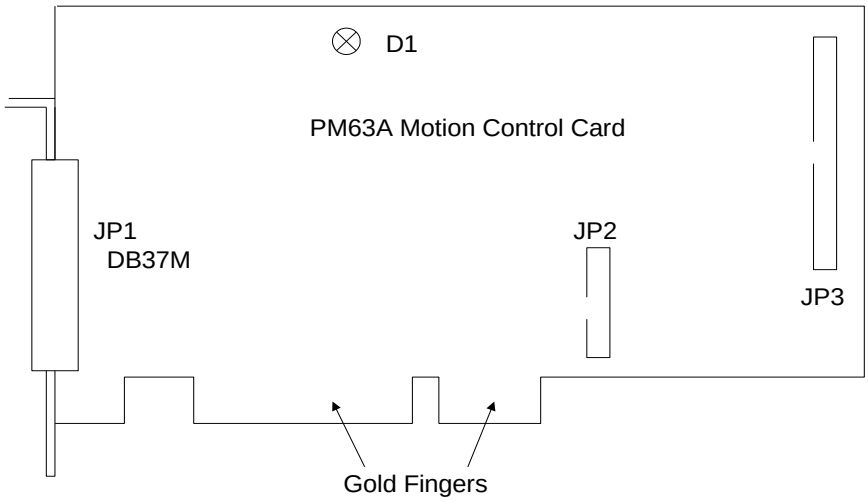


Fig. 1-1 Structural drawing of PM63Acontrol card

1.4. Structure Specification of Terminal Board

Four types of terminal board are available for PM63A/62A control card. They are EX25A2, EX2A4, EX1A3 and EX22A3, whose structure will be introduced separately.

◆ **Terminal Board EX25A2**

When PM63A/62A control card is used in routers or laser cutting machines, EX25A2, taking rail installation with contour dimension as 330mm × 107mm, is the equipped terminal board as standard. At its two ends, there are DB37-hole (on the left side) and DB50-pin (on the right side) which are corresponding to JP1 and JP3 of PM63A/62A control card respectively. Connect the terminal board with the port JP1 at the back of the control card with a DB37M/F cable. Connect the DB50-CONNECT card with the port JP3, then fix it to the back of computer by screw, and then join it to DB50 (pins) socket on the terminal board with a HD50F-CN50 cable.

JP2 socket is used for connecting a handwheel. Draw forth DB15 joint for the connecting of a handwheel (optional) through connection of FC16-DB15F. See Chapter 2.3 for pins definition of DB15F plug of handwheel.

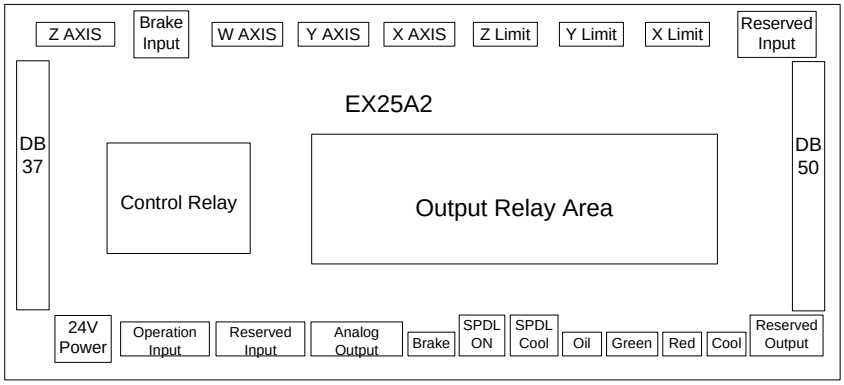


Fig. 1-2 Structure drawing of terminal board EX25A2

◆ **Terminal Board EX2A4**

PM63A/62A control card, together with EX2A4 terminal board, can be used as single-Y-axis waterjet cutting system. Terminal board EX2A4 adopts rail installation, with contour dimension 280mm × 72mm. there are DB37 holes on its left end and DB50 pins on the right end, which are corresponding to JP1 and JP3 of PM63A/62A control card respectively.

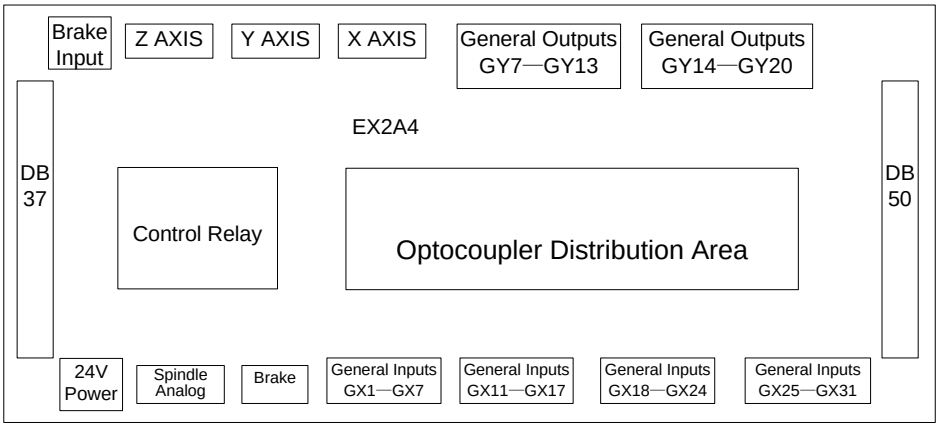


Fig. 1-3 Structure drawing of terminal board EX2A4

◆ **Terminal Board EX1A3**

PM63A/62A control card, together with terminal board EX1A3, can be used as dual Z axes engraving and milling CNC system. Terminal board EX1A3 adopts rail installation with contour dimension 330mm × 107mm. there are DB37 holes on its left end and DB50 pins on the right end, which are corresponding to JP1 and JP3 of PM63A/62A control card respectively.

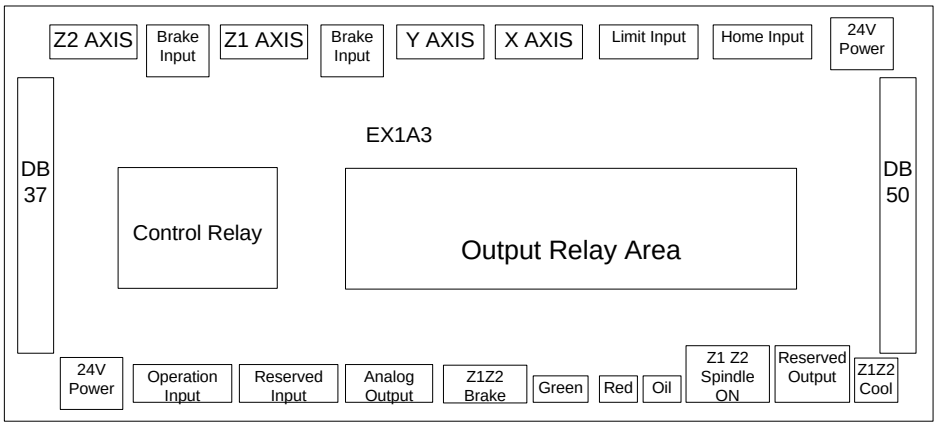


Fig. 1-4 Structure drawing of terminal board EX1A3

◆ **Terminal Board EX22A3**

PM63A/62A control card, together with EX22A3 terminal board, can be used as double Y axes waterjet cutting system as well as laser cutting system (including standard, double Y axes and turntable configurations), with contour dimension is 330mm × 107mm. there are DB37 holes on its left end and DB50 pins on the right end, which are corresponding to JP1 and JP3 of PM63A/62A

control card respectively.

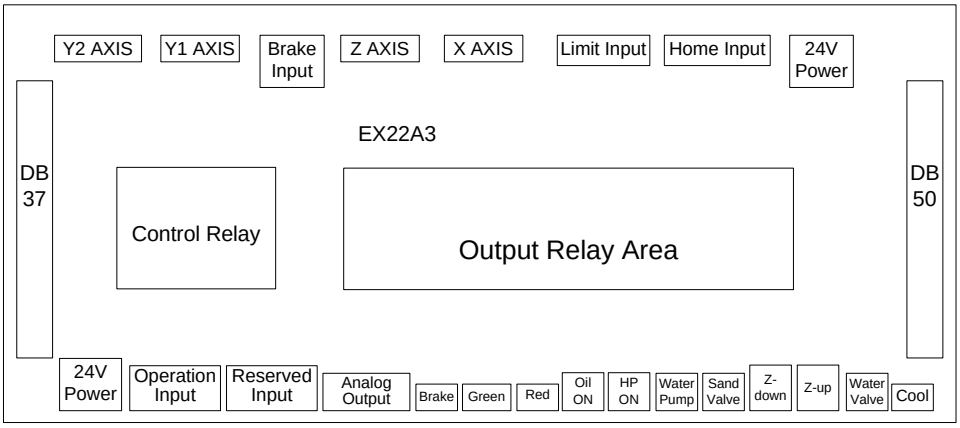


Fig. 1-5 Structure drawing of terminal board EX22A3

2. Wiring

2.1. Wiring Diagram of Terminal Board

2.1.1. Wiring Diagram of Terminal Board EX25A2

◆ **Applied for Engraving and Milling System**

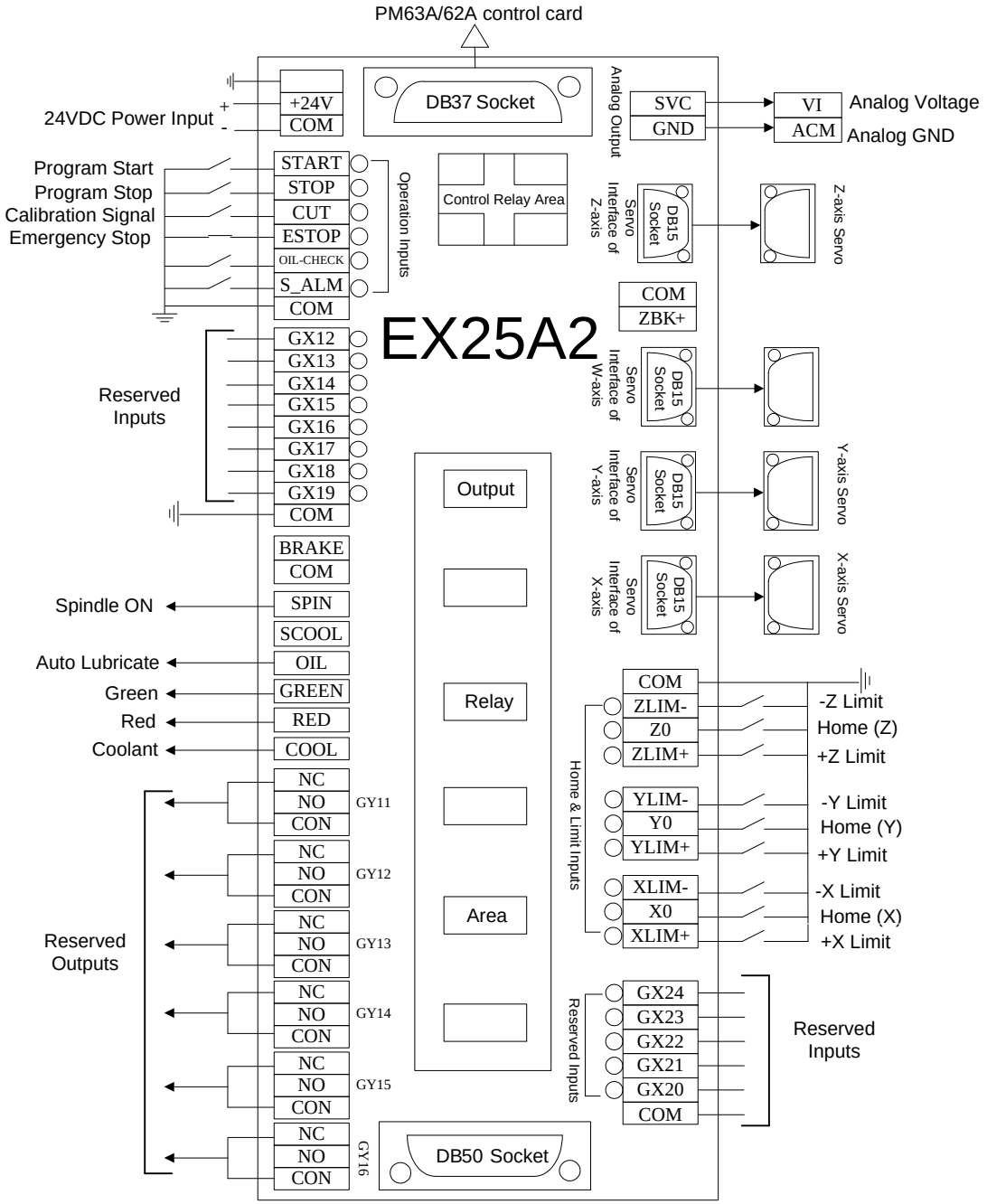


Fig. 2-1 Wiring diagram of terminal board EX25A2---for engraving and milling system

◆ Applied for Laser Cutting System

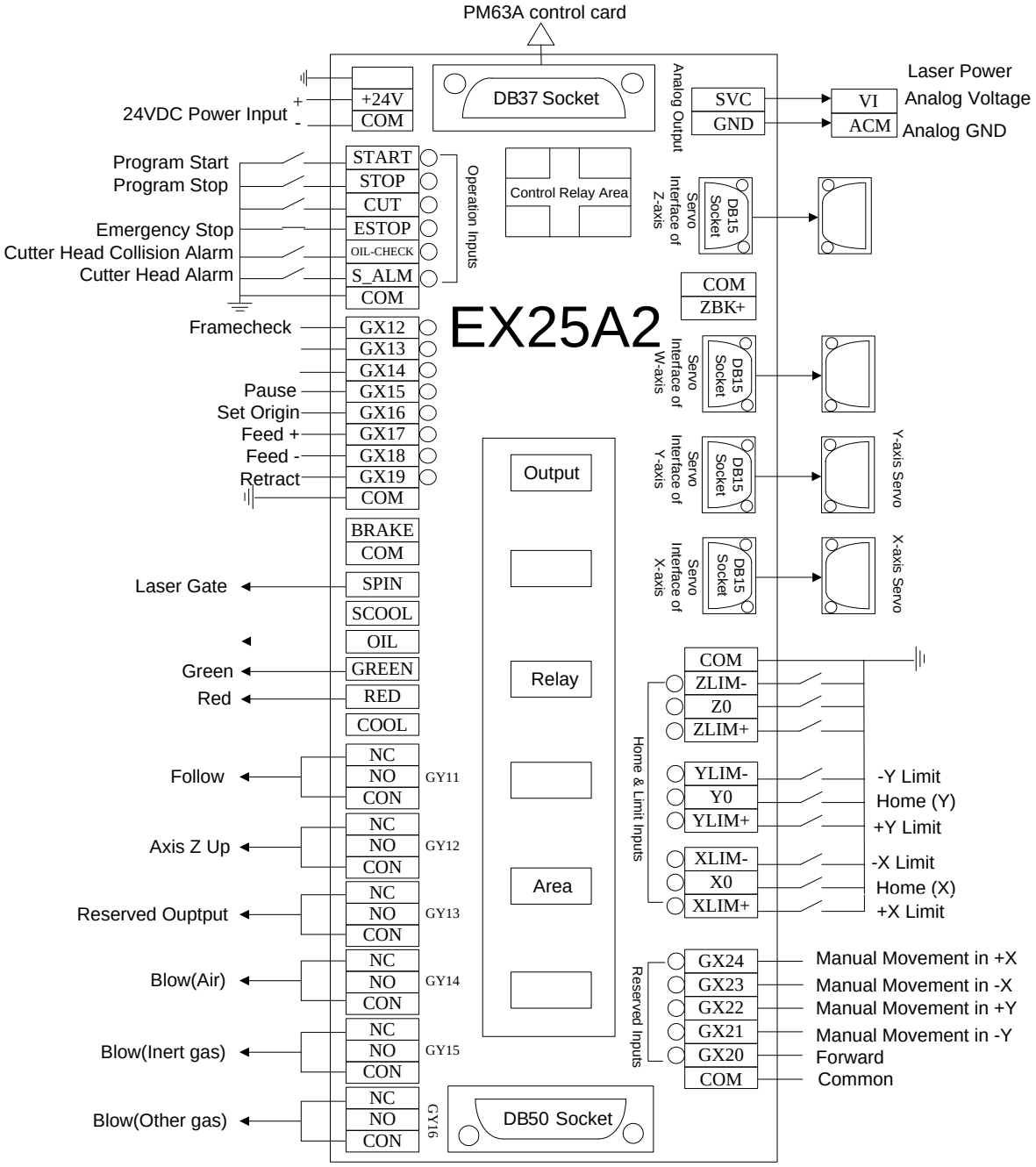


Fig. 2-2 Wiring diagram of terminal board EX25A2---for laser cutting system

2.1.2. Wiring Diagram of Terminal Board EX2A4

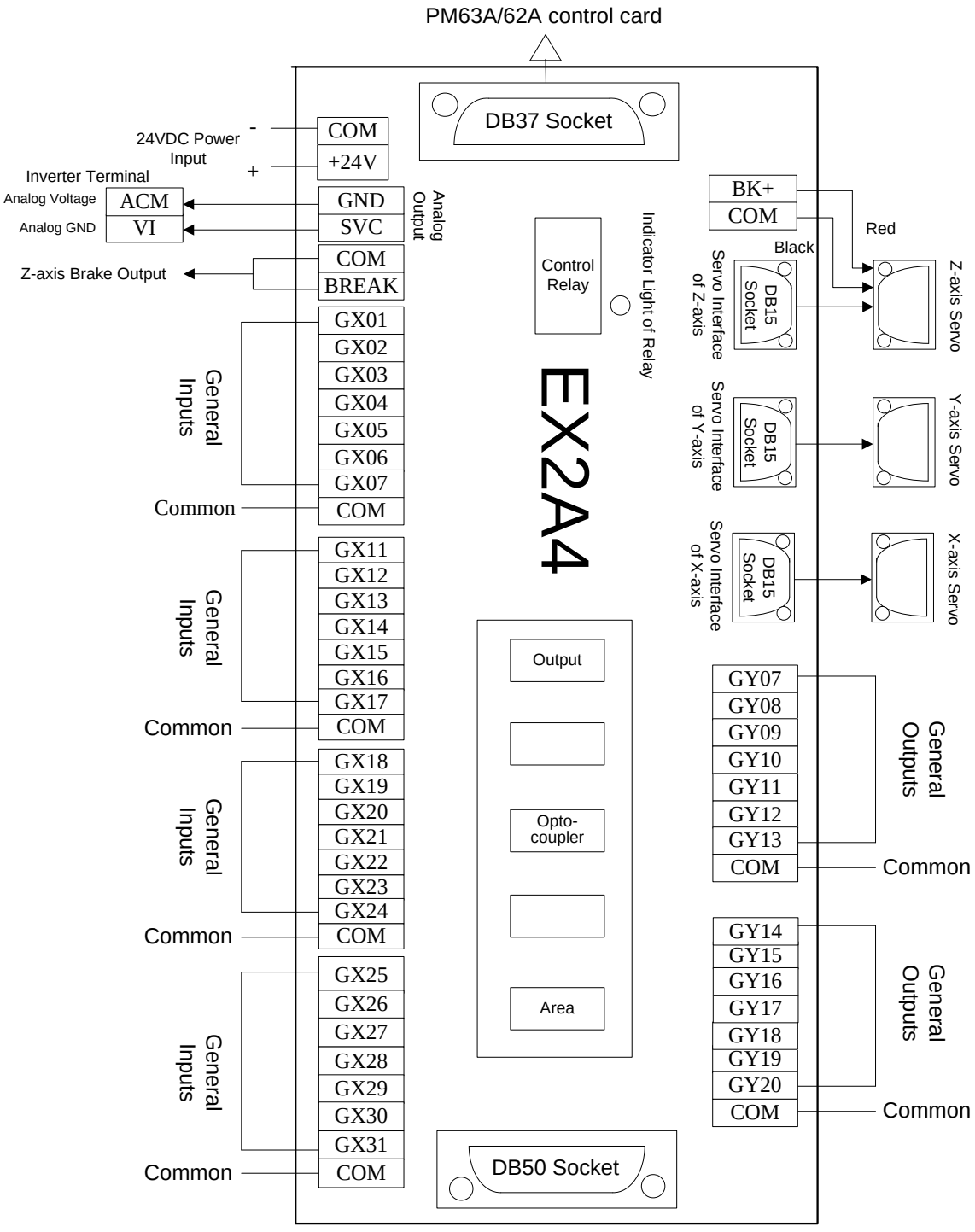


Fig. 2-3 Wiring diagram of terminal board EX2A4

2.1.3. Wiring Diagram of Terminal Board EX1A3

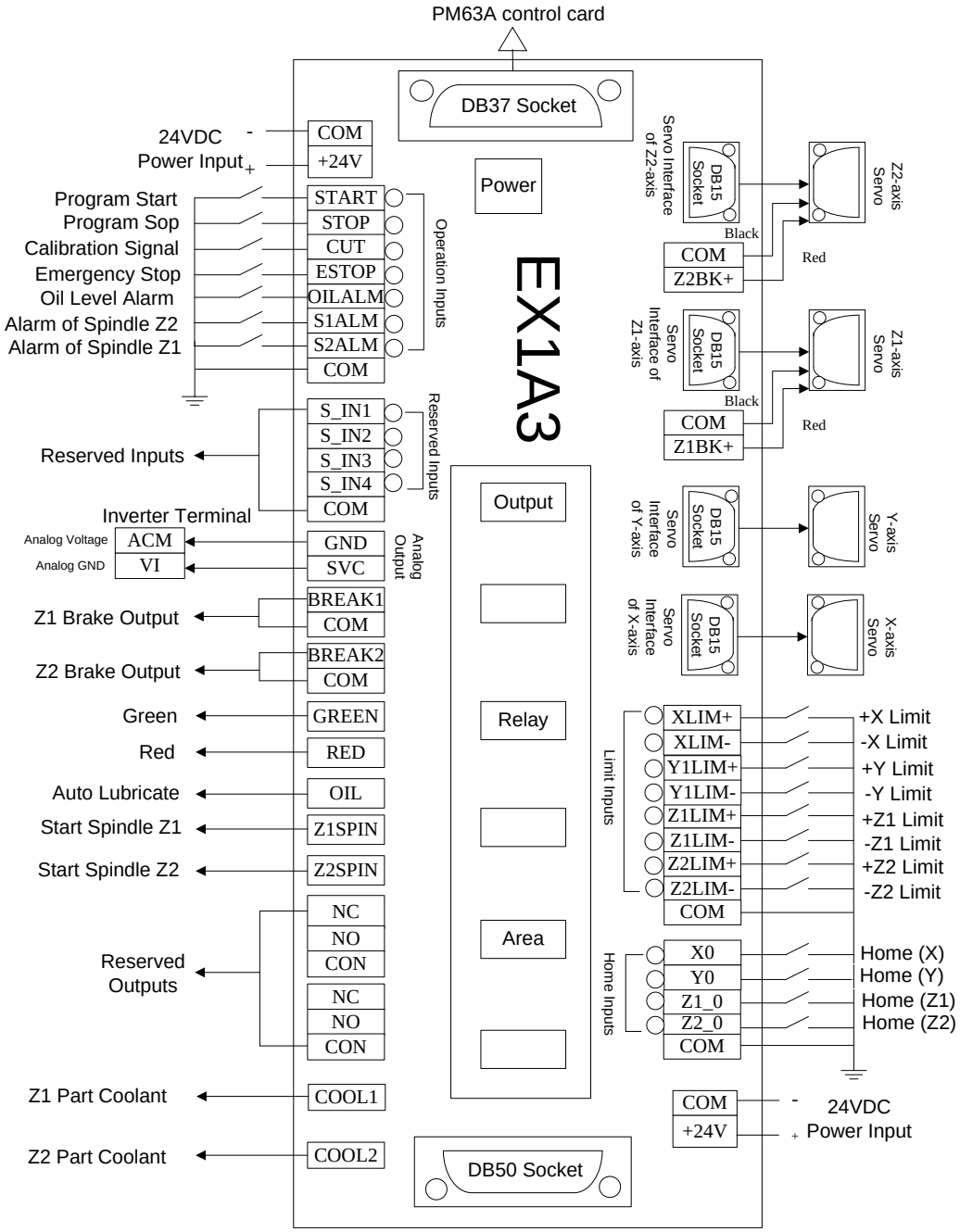


Fig. 2-4 Wiring diagram of terminal board EX1A3

2.1.4. Wiring Diagram of Terminal Board EX22A3

◆ **Applied for Double Y axes Configuration of Waterjet Cutting System**

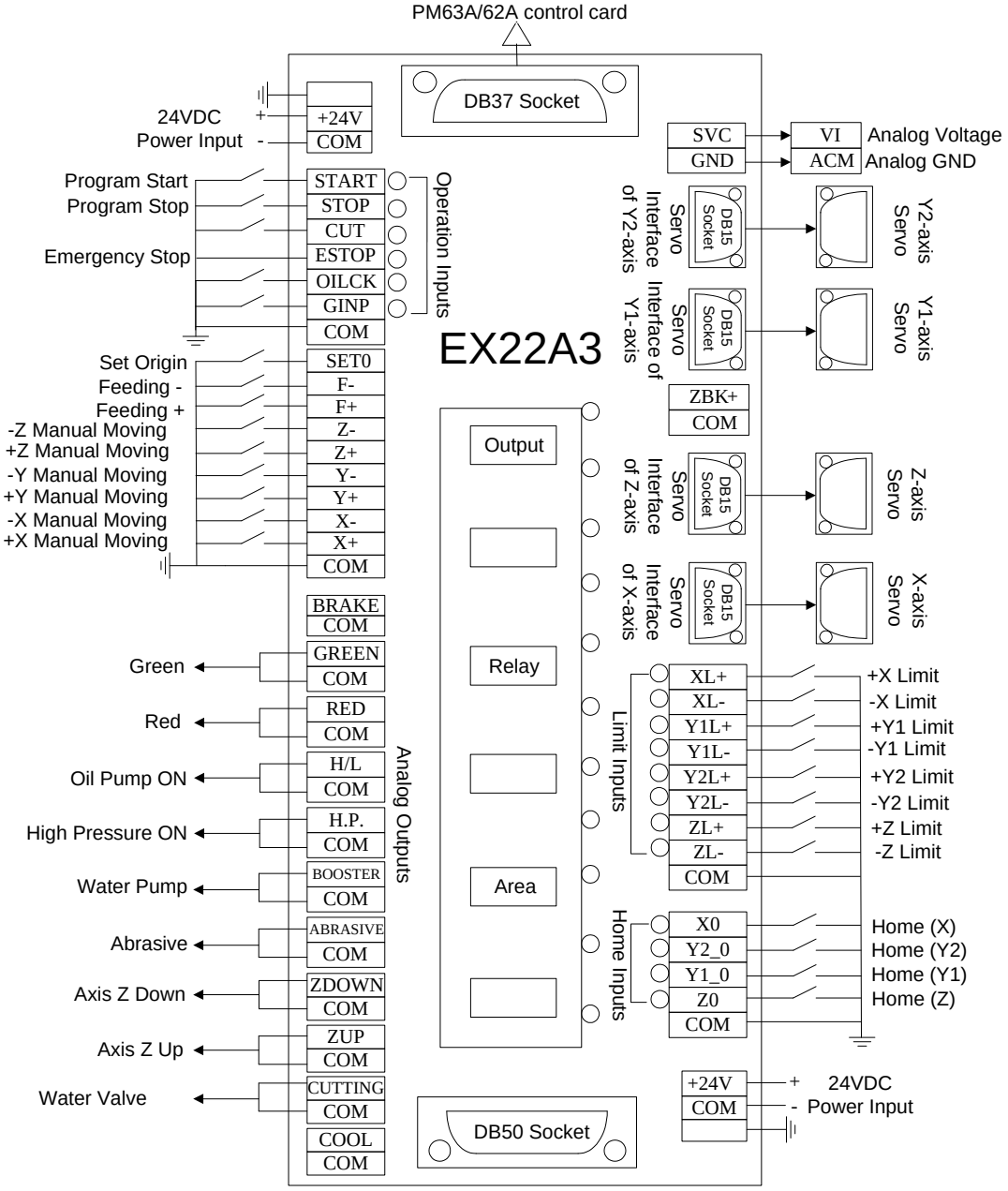


Fig. 2-5 Wiring diagram of terminal board EX22A3---for double Y axes waterjet cutting system

◆ Applied for Standard Configuration of Laser Cutting System

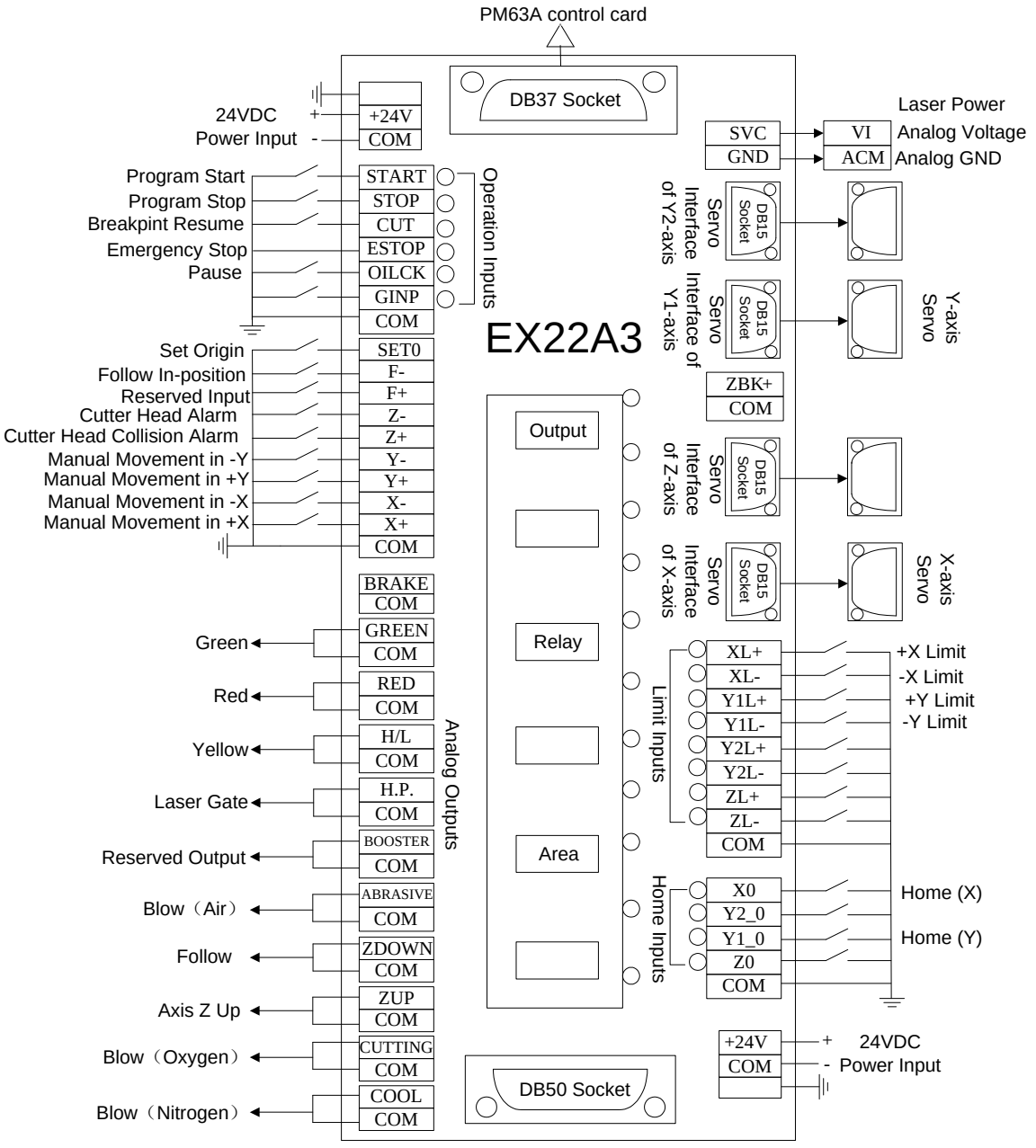


Fig. 2-6 Wiring diagram of terminal board EX22A3---for standard configuration of laser cutting system

◆ Applied for Double Y axes Configuration of Laser Cutting System

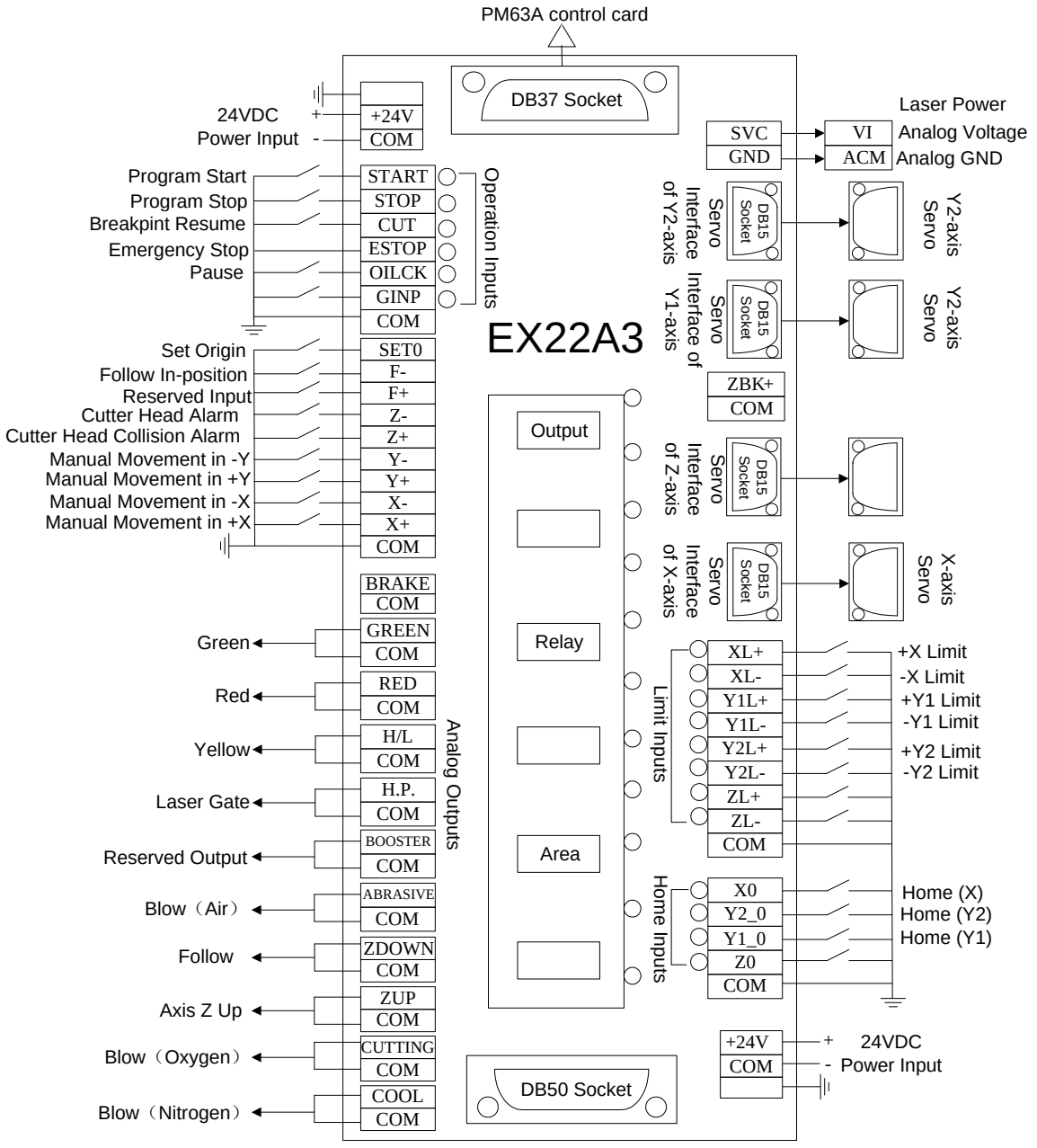


Fig. 2-7 Wiring diagram of terminal board EX22A3---for double Y axes configuration of laser cutting system

◆ Applied for Turntable Configuration of Laser Cutting System

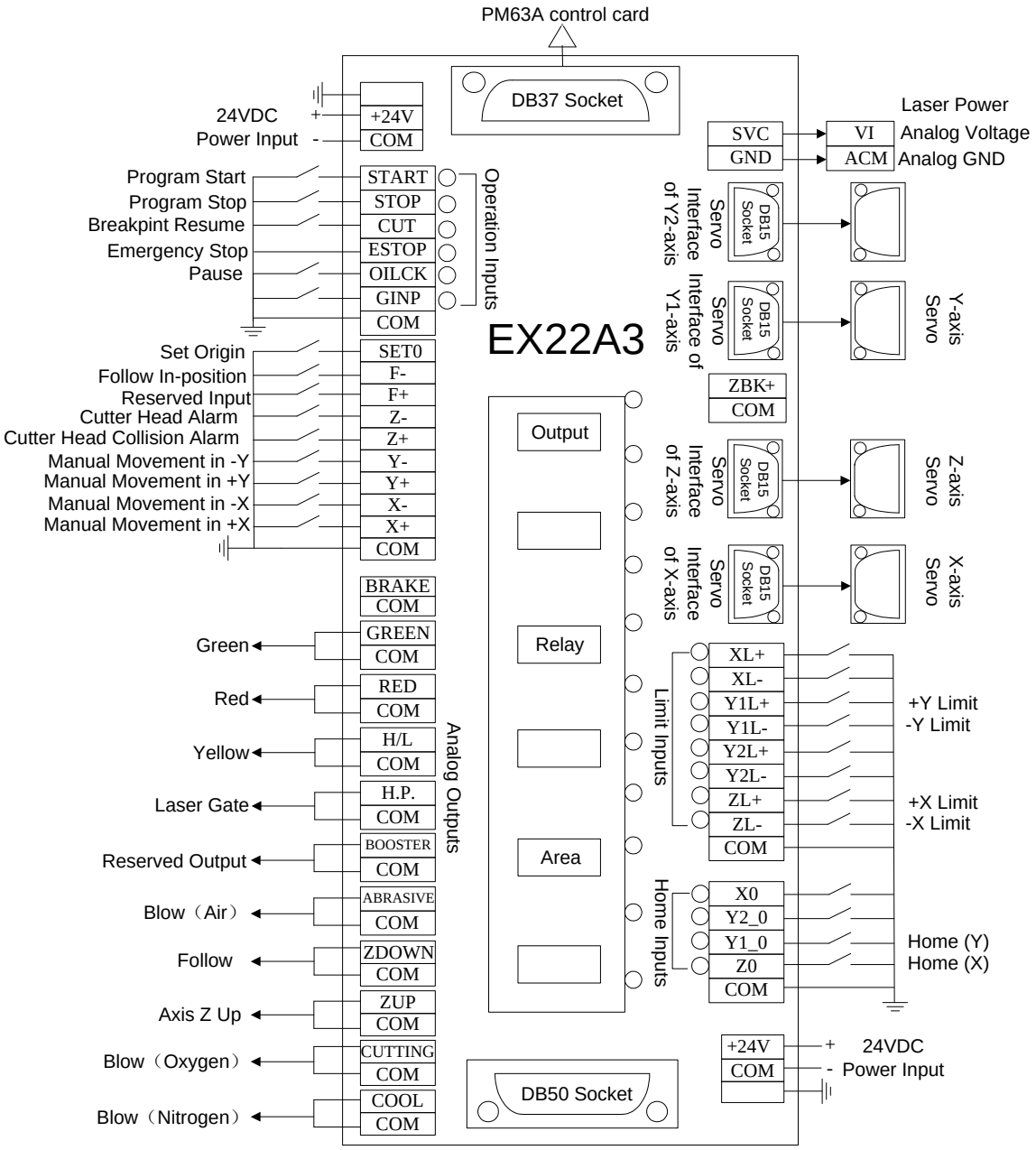


Fig. 2-8 Wiring diagram of terminal board EX22A3---for turntable configuration of laser cutting system

CAUTION

Please note that the above wiring diagram is for the situation where X axis serves as the turning axis. When Y axis serves as the turning axis of turntable, port Z0 is for the home signal of Y axis, and port X0 for the home signal of X axis.

2.2. Signal Types

2.2.1. Binary Input Signal

Active-low binary input signal supports NO and NC input signals which can be modified through modifying input port polarity in the software. Conducting to GND in NO connection means signal detected, while disconnecting with GND in NC connection means signal detected.

When binary input signal is connected with a mechanical switch, one end of which needs joining to binary input port and the other end to ground. Its joining method is as below:

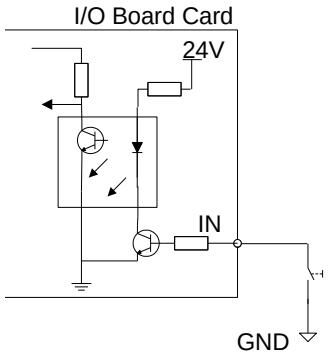


Fig. 2-9 Binary input connecting with a mechanical switch

Binary input signal can also be connected with a photoelectric switch or a proximity switch of NPN (NO or NC) type. Its joining method is as below:

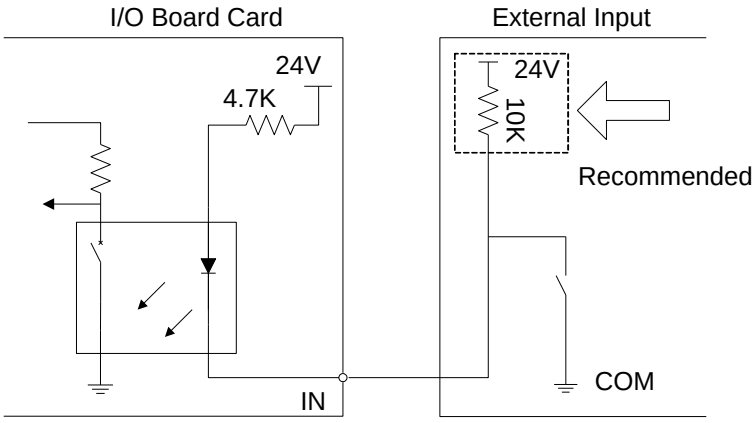


Fig. 2-10 Binary input connecting with a photoelectric switch or a proximity switch

2.2.2. Relay Output Signal

The relay output contact points on the terminal board have load capacity: 10A/250VAC and 10A/30VDC, which can control 220V AC load of low power. If high power load is needed, a contactor can be used.

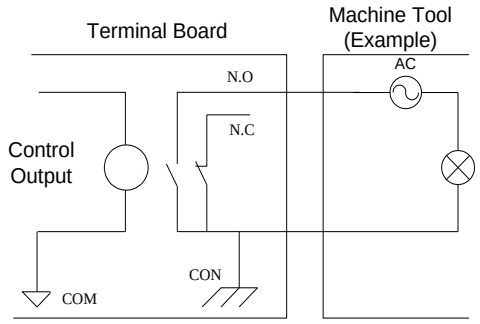


Fig. 2-11 Connection of relay output with a contactor

2.2.3. Differential Output Signal

Pulse command format to control the driver motion is “pulse + direction, negative logic”. The maximum pulse frequency is 160KHZ and the pulse direction is shown in Fig. 2-12.

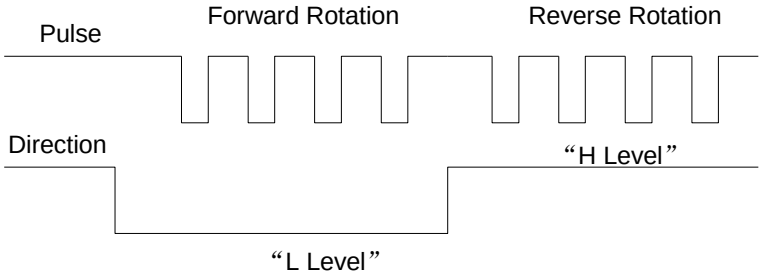


Fig. 2-12 Output type of pulse command

The output form of differential signal is shown in Fig. 2-13.

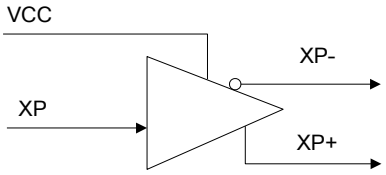


Fig. 2-13 Output type of pulse command

2.3. MPG interface

The JP2 interface on PM63A/62A control card is the MPG (or called handwheel) interface for connecting with a handwheel up to 6 axes with the help of connector FC16-DB15F. You can buy MPGs from WEIHONG or other companies, in other words, MPG is an optional component.

Our MPG interface is composed of dual-in line DB15 holes, and its pins definition is as shown in Fig. 2-14.

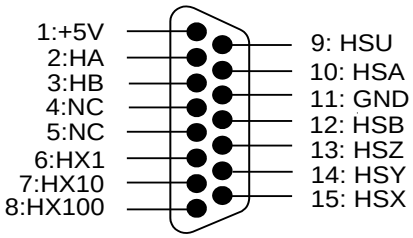


Fig. 2-14 Pins definition of MPG interface

See table 1 for details.

Table 1 Definition of MPG interface

Pins No.	Function	Description
1	+5V	Power on handwheel
2	HA	Encoder phase A signal
3	HB	Encoder phase B signal
4	NC	-
5	NC	-
6	HX1	X1 override
7	HX10	X10 override
8	HX100	X100 override
9	HSU	Selection of the fourth axis
10	HSA	Selection of the fifth axis
11	GND	Digital ground
12	HSB	Selection of the sixth axis
13	HSZ	Selection of Z axis
14	HSY	Selection of Y axis
15	HSX	Selection of X axis

2.4. Terminal Description

2.4.1. External Power Supply

- Terminal board needs external DC 24V power source.
- +24V, GND: they should be jointed to the corresponding ends of switch power supply on the machine tool.

2.4.2. Servo Driver Interface

The socket of servo driver joint is three-row DB15 holes. Its pins definition is shown in Fig. 2-15.

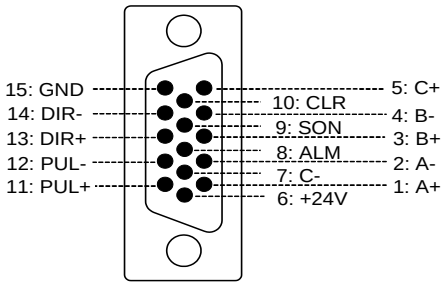


Fig. 2-15 Definition of driver interface

- +24V, GND: supplying 24V DC power to the servo driver;
- SON: servo ON, outputting servo drive enable signals;
- ALM: alarm, accepting alarm signals of servo driver;
- P+, P-: pulse (PULS), differential output signals;
- D+, D-: direction (DIR), differential output signals;
- A+, A-, B+, B-, C+, C-: three-phase input signals of encoder for detecting encoder zero.

Regarding the wiring diagram of our system with such servo drivers as YASKAWA, Panasonic, Mitsubishi, Delta, Fuji, Hitachi, Sanyo and KT, please refer to the appendix. If servo driver interface is connected with other brand drivers, please pay attention to the following items:

1) Firstly confirm the SON signal type of servo driver selected to see whether it is active low (i.e. servo is ON when SON and GND of 24V power is conducted);
2) Then make clear the level of servo driver alarm output port when there is no alarm. If it is normally low-level, the input port polarity of servo driver alarm should be “P” in “I/O Ports” window of software; if it is low-level when alarm occurs, the port polarity should be “N”;
3) Make sure the type of pulse signal received in parameters setting of servo driver is “pulse + direction”;
4) Make clear whether there is external emergency stop signal input in the input terminal of servo driver, and the logic of this signal;
5) Before the trial run of the driver, 24V power supply must be provided for the terminal board, because the 24V power for the driver is indirectly provided through the terminal board;
6) If the driver can’t rotate, make sure the driver parameter “forward and reverse rotation input prohibited” is set invalid.

2.4.3. Operation Interface

- ESTOP: emergency stop; binary input signal. It usually connects with a NC button. E-stop occurs when it is disconnected with GND;
- CUT: tool presetting; binary input signal;

- START: program start; for external connection with an operating button. Auto processing starts when it is conducted with GND;
- STOP: program stop; for external connection with an operating button. Processing stops when it is conducted with GND;
- COM: grounding; common port of digital signals.

2.4.4. Home Signal

- X0: home of X-axis, binary input, active low;
- Y0: home of Y-axis, binary input, active low;
- Z0: home of Z-axis, binary input, active low;
- COM: grounding; common port of the above three signals.

2.4.5. Limit Signal

- XLM+: positive limit of X-axis, binary input, active low;
- XLM-: negative limit of X-axis, binary input, active low;
- YLM+: positive limit of Y-axis, binary input, active low;
- YLM-: negative limit of Y-axis, binary input, active low;
- ZLM+: positive limit of Z-axis, binary input, active low;
- ZLM-: negative limit of Z-axis, binary input, active low;
- COM: grounding, common port of digital signals.

2.4.6. Spindle Control

- SVC: analog voltage (0~10V) signal output to control the rotary speed of spindle motor. It externally connects with the analog voltage frequency instruction input end of transducer (generally known as AVI/VI) and controls the spindle speed through voltage change causing frequency change of transducer.
- GND: analog voltage grounding, connecting with analog grounding of transducer (generally known as ACM).
- SPIN: spindle on/off, relay output, two terminals, one connecting with the digital grounding (DCM) of transducer and the other with forward rotation input end (FOR) of transducer.

2.4.7. Z-axis Brake

- BRAKE: brake control. Output form of brake varies with the type of terminal board. For terminal board EX2A4\EX1A3\EX22A3 and EX25A2, the two ends of BRAKE have DC 24V voltage output, and brake extension cords of Z-axis can be directly connected.

- BKJ+, BKJ-: two ends of the coil of brake relay. They have no corresponding relation with BK+ and BK- in the wiring diagram. When the coil is under work, current inflows from terminal BKJ+ and outflows from BKJ-. If the cable used is provided by our company, the cable of Z-axis has two extension wires: the red one is servo braking signals output (OC output) wire and the black one is ground wire. Join the red one to BKJ- and the black one to GND on the terminal board and provide BKJ+ with 24V power supply. (If you make the cable by yourself or utilize the cable of other brands, refer to the braking circuit in servo driver instruction book for wiring.)

2.4.8. Signal Lamp

- RED: red alarm lamp; it is on when the emergency stop occurs. It is also on as a reminder that the processing finishes.
- GREEN: green working lamp; when the machine tool runs normally, the lamp turns on.

2.4.9. Other Signals

- OIL: lubrication on, controlling auto oiling; relay contact output; the LED lamp turns on in oiling and turns off when oiling stops.
- COOL: cooling, relay contact output; two terminals equals one switch.

3. Installation

3.1. Installation of PM63A/62A Control Card

1) Insert the software CD into the CD driver of computer, find NcStudio icon and then double click it for installation of the software;

2) Power off the computer, then open the computer chassis, and then insert the control card into a PCI slot and fasten the screw of rail block (if there is an extended flat cable, its rail block screw should also be fastened), and then lid the computer case;

3) Power on the computer. The computer will find the new hardware-device. Users need to manual install the new driver according to the wizard. Refer to following part for detailed steps.

4) Double click the shortcut icon of Ncstudio on the desktop; if it runs normally, installation is over (if the control system runs abnormally, please check whether the control card is well inserted and the gold finger is clean).

3.1.1. Manually Update Hardware Driver

1) Right click “My Computer”, select “Properties”, and then click “Device Manager”. Choose the “CNC Adaptor” item, right click on it and select “Update Driver Software…” Users can begin updating process according to the wizard.

2) A dialog box as Fig. 3-1 will pop up. Select “Install form a list of specific location (Advanced)”, click [Next] to continue.

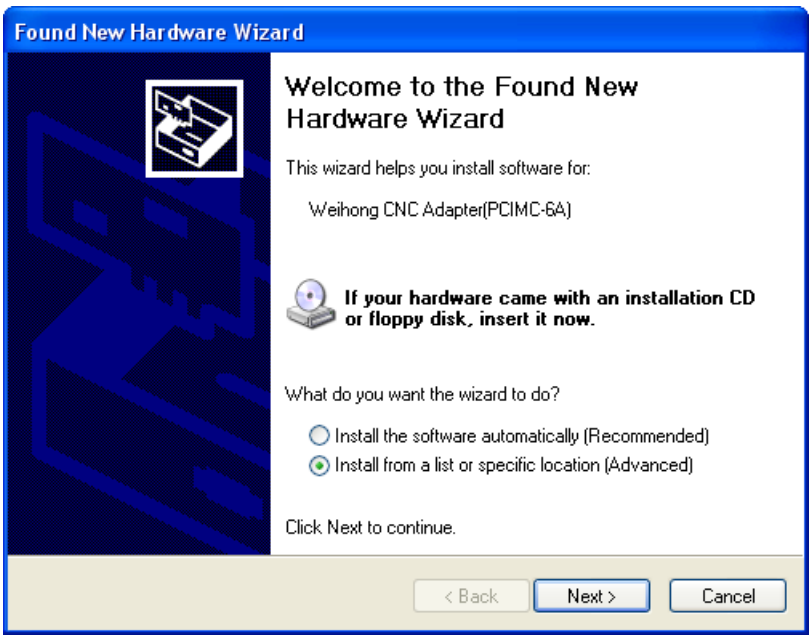


Fig. 3-1 Hardware update wizard

3) A dialog box as Fig. 3-2 will pop up. Select “Don’t search, I will choose the driver to install”, click [Next] to continue.

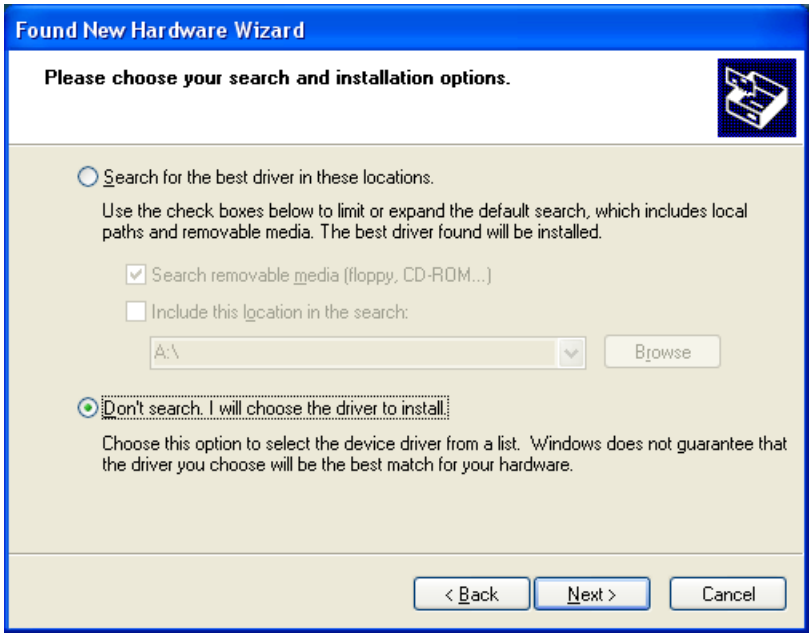


Fig. 3-2 Choose search and installation option

4) A dialog box containing compatible hardware will pop up, as shown in Fig. 3-3, click [Have Disk...] button to open the next dialog box.

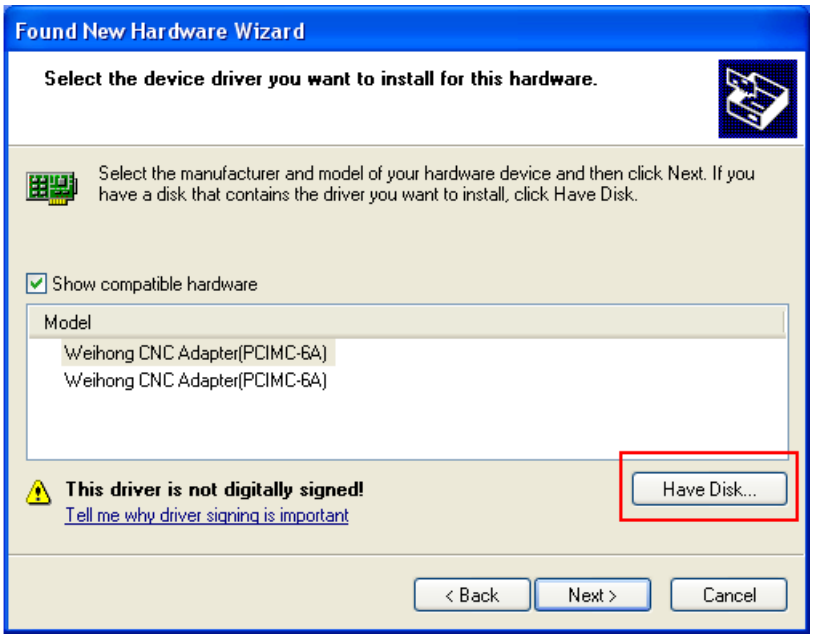


Fig. 3-3 Select the driver manually

5) A dialog box named “Install From Disk” will pop up, see Fig. 3-4. Click [Browse…] button to open the target file of driver.

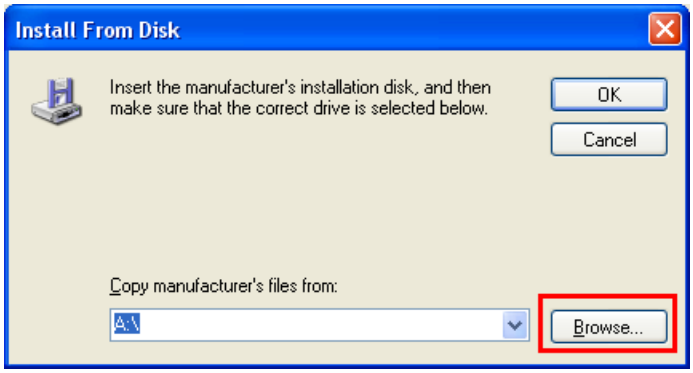


Fig. 3-4 Select the target file of driver

6) Click “Browse” to open a dialog box named “Locate File”, as shown in Fig. 3-5, select the target hardware driver in the list. Choose the target file “NcadptPci(PCIMC-6A).inf” under the directory of *C:\ProgramFiles\Naiky\PCIMC-6A.*

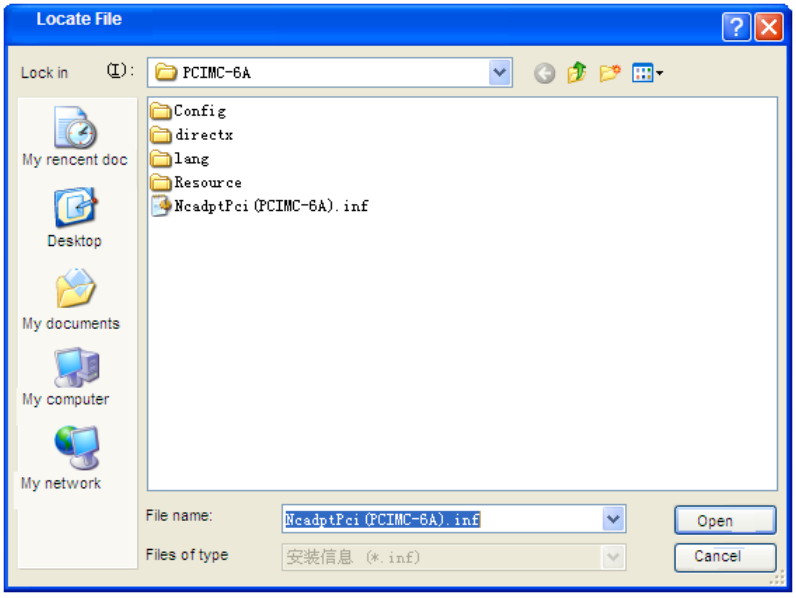


Fig. 3-5 Select the hardware driver

7) After hardware driver being correctly chosen, the interface jumps to the previous dialog box where the target file directory will be displayed under item “Copy manufacturer’s file from:”, as shown in Fig. 3-6.

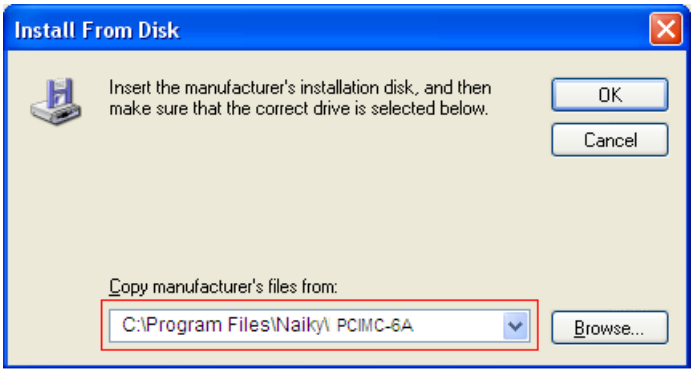


Fig. 3-6 Target file directory confirmation

8) Click [OK] to go back, and then click [Next] to start updating the driver software. The progressing picture is shown as Fig. 3-7.

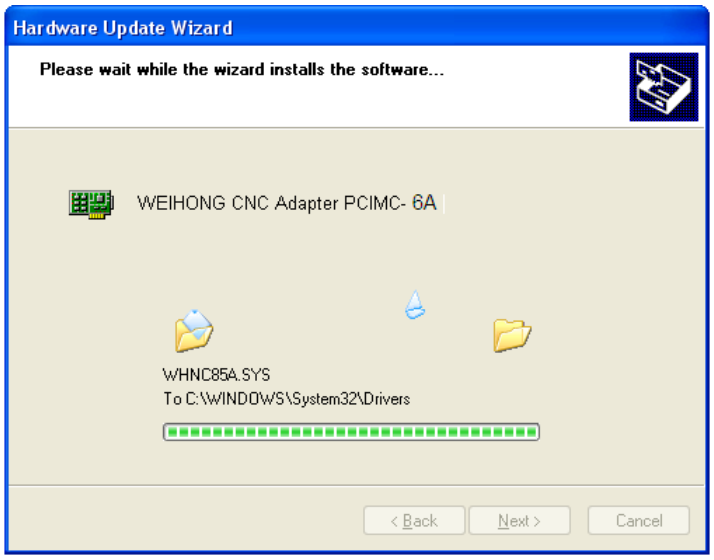


Fig. 3-7 Updating the driver

9) When the updating is finished, a dialog as shown in Fig. 3-8 will pop up. Click [Finish] to complete the update of the hardware driver. Double click the icon on the desktop or click the icon on the menu “Start-All Programs” can launch the software successfully.

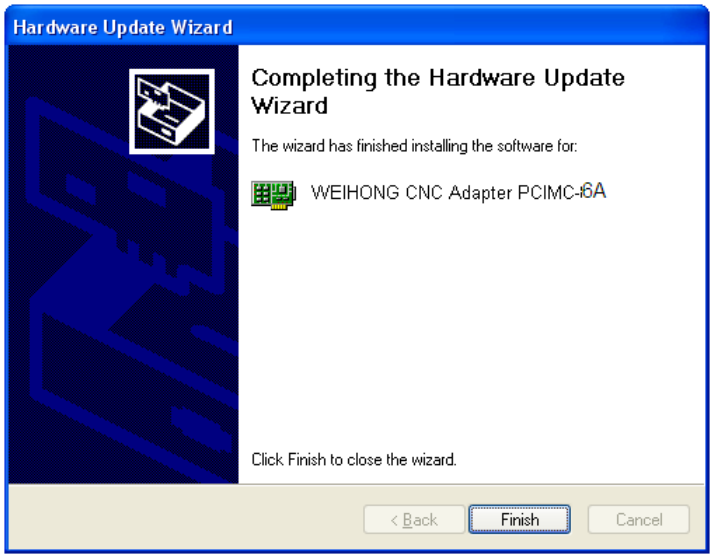


Fig. 3-8 Driver update completed

3.2. Customization of Setup Installation Package

A tool, named NHelper.exe under the installation directory, helps customize setup installation package. For example, when you want to change the settings of some parameters and set them to default value in the process of using Ncstudio, to achieve the best performance of a machine tool, yo can change the settings, find this tool, double click it, select a default configuration, and generate a

new software package with the parameter settings changed.

4. Machine Tool Debugging

4.1. Debugging Steps

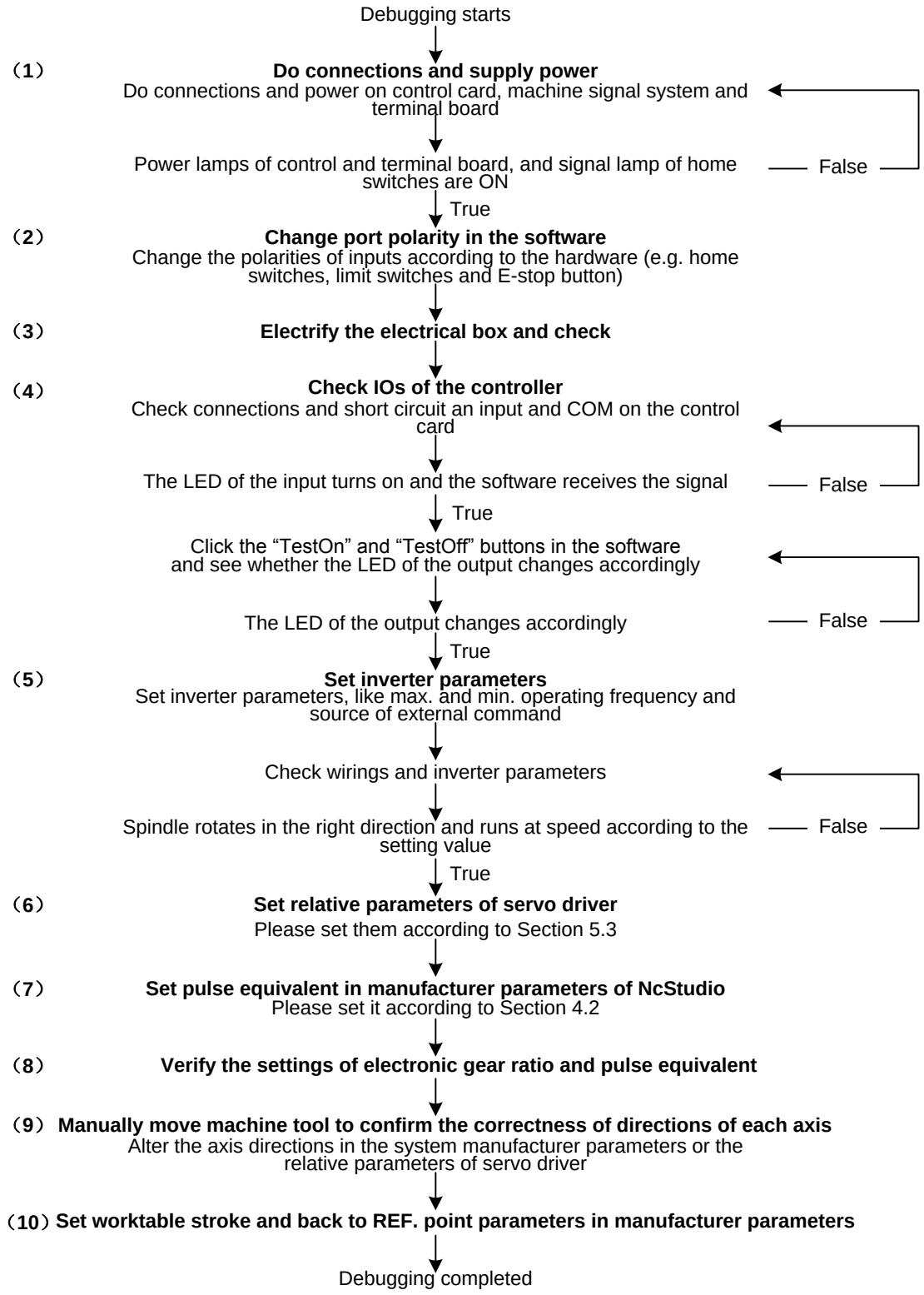


Fig. 4-1 Process of machine tool debugging

The above process if for preliminary debugging, see below for detailed steps:

1) Join the terminal board to port JP1 on the control card with a DB37M/F cable, to DB50 interface on the control card with a HD50F-CN50 cable, provide 24V power supply for the terminal board, and power on the machine signal system (proximity switch, etc). Examine the input signal LEDs of the terminal board: for example, if the home switch connected is normally closed, at this time, three LEDs of X0, Y0 and Z0 are on, trigger the home switch through artificial imitation. (For travel switch, artificial press can be used to observe whether the signals can be received. For photoelectrical switch, artificially obstruct the light to see if the signals can be gotten. For metal proximity switch, artificially approach it with a metal block to see if the signals can be gotten.) If the corresponding LED is out, it indicates the origin signals have been sent to the terminal board. If the home switch connected is normally open, LEDs should be usually out, and by artificially touching the switch, LEDs should become light, which shows the origin signals have been sent to the terminal board. The same method can be taken to test other input ports to ensure the correctness of the wiring between the terminal board and the machine tool, greatly shortening the debugging time.

2) Power on the computer, run NcStudio software, and then switch to “IOPort” window, displaying many input and output signals. Solid dots represent input signals, while hollow dots represent output signals; dots in red indicate the signals are invalid at the time (with no input or output), while dots in green indicate the signals are valid at the time. The “IOPort” window is as shown in Fig. 4-2 and Fig. 4-3. (They are for reference only. Ports displayed in “IOPort” window will vary with different software versions and hardware board card types. The actual situation is in line with shipment).

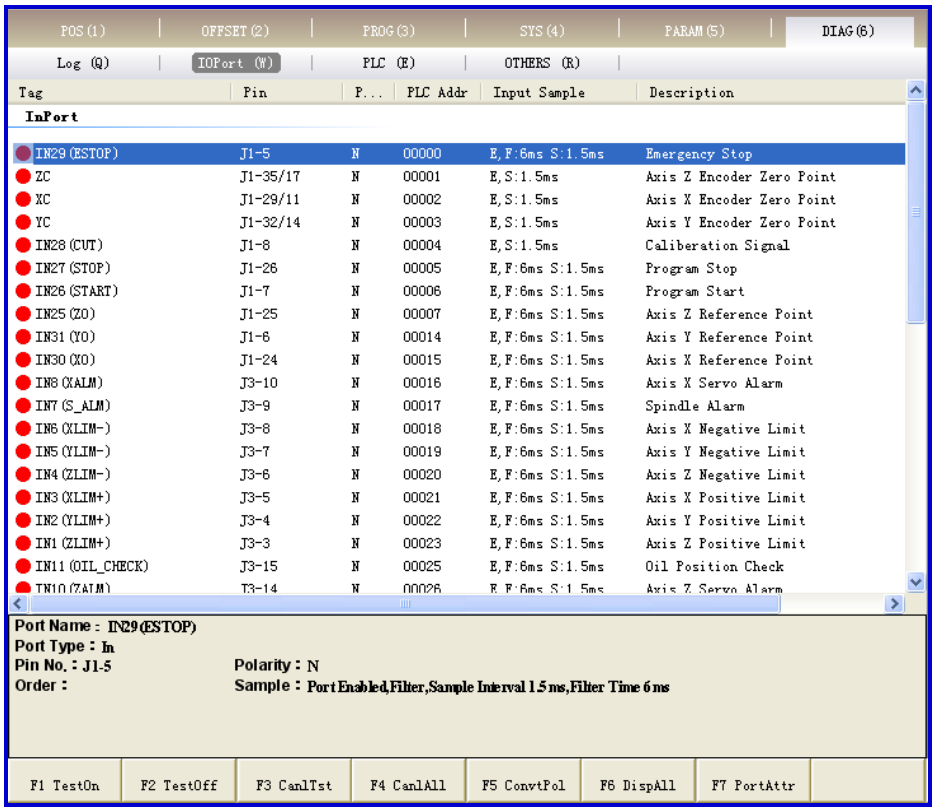


Fig. 4-2 I/O ports window of NcStudio (V9)

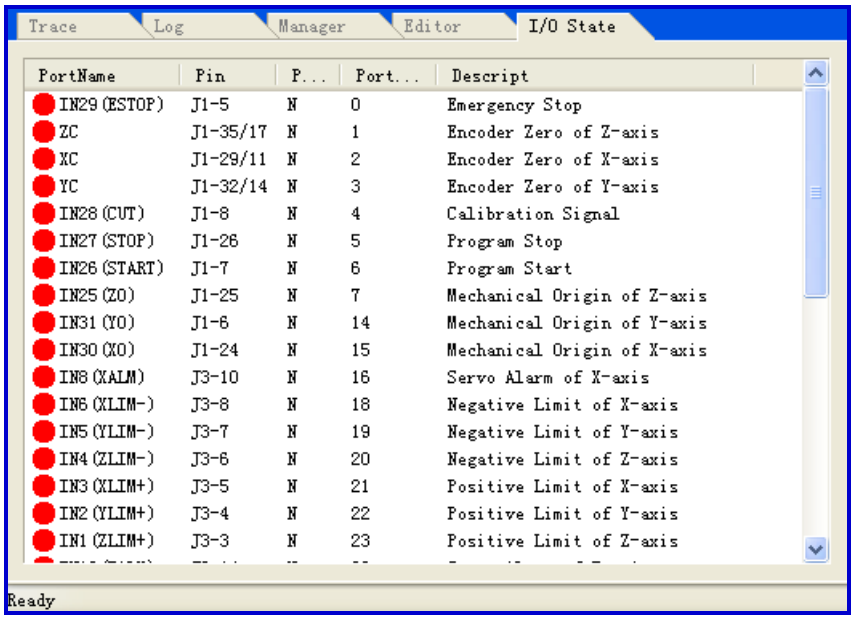


Fig. 4-3 I/O ports window of NcStudio (V8)

3) Alter the input port polarity in the software in terms of such buttons selected as home switch and E-STOP button: the polarity of NO input ports is N, while that of NC input ports is P. The way to alter the polarity is as follows:

In V8 version: press keys Ctrl, Alt and Shift simultaneously, while right clicking the signal to be modified its polarity, a menu to appear, and then choose “Toggle Polarity”. After changing the polarity of all desired ports, close and restart NcStudio, polarity modification to become valid instantly.

In V9 version: after selecting the signal to be modified its polarity, directly click the manipulation button [ConvtPol] under [IO Ports] screen of [Diagnosis] function section. After changing the polarity of all desired ports, close and restart NcStudio, polarity modification to become valid instantly.

4) Electrify the electrical box. At this time, the dots in front of such input signals as REF. point signals of the three axes, E-STOP signal, cycle start/stop signals and tool sensor signal should be in red, indicating all these signals are invalid. Otherwise, it is necessary to check the correctness of electrical circuitry and signals polarity. If electrical circuitry is correct, alter the corresponding signal polarity to ensure the dots in front of the above-mentioned signals red.

5) Test whether the inputs and outputs on the terminal board work normally.

For an input, the method is as following: short circuit an input and COM on the terminal board: if the corresponding LED on the terminal board turns on, but the corresponding input in the software does not have the signal, you need to check the connection of the cable DB37M/F between the control card PM63A/62A and the terminal board. If the LED does not turn on, you need to check whether the terminal board meets a fault (like power supply issue).

For an output, the method for V8 NcStudio is as following: change the value of the parameter “MoveToMechanicalPointBeforeMachining” to “false” (i.e. “0”), and then click on the menu item

“Advanced MDI…” under the “Operation” menu. Click the “MDI” tab in the pop-up “Advanced Functions” dialog, input the program into the input box using M901 code (for instance, to test whether the No.2 port works normally, enter the program “M901 H2 P1/ M901 H2 P0”), and then execute it, observing whether the corresponding LED turns on or off accordingly. If so, the output works normally; if not, check the connection of the cable DB37M/F between the NC63A host/ the control card (PM63A/62A) and the terminal board. The method for V9 NcStudio is as following: click the “TestOn” and “TestOff” buttons in the software, and observe whether the corresponding LED on the terminal board turns on or off accordingly. If so, the output works normally; if not, check the connection of the cable DB37M/F between the control card PM63A/62A and the terminal board.

CAUTION

Internally processed to pulse signal, the tool sensor signal turns to green instantaneously and then restores to red when the signal is gotten in debugging.

6) Set inverter parameters to make the inverter work under 0~10V analog voltage control mode. Spindle ON/OFF adopts forward rotation terminal control mode. Press down the [Spindle Start] button in the software, and observe in I/O window whether the color of signal dot in front of “Start Spindle” turns green, on the terminal board whether the green output indicator LED beside the corresponding relay becomes brightening, and whether the spindle starts to rotate. If the spindle does not rotate, please examine the connection of the inverter. Adjust the spindle speed in the software and the actual spindle speed should be changed correspondingly; otherwise, examine the connection and the parameters setting of the inverter. If the spindle rotates in a wrong direction, you can change the settings of the relative inverter parameters, or change the connection between the spindle and inverter: usually, there are three wires connected with the spindle. Exchanging any two of them will alter the spindle rotation direction.

7) Set the relative parameters of servo driver. For instance, see Appendix 5.3.2 and 5.3.3 for the setting of YASKAWA servo, and Appendix 5.3.4 and 5.3.5 for the setting of PANASONIC servo.

8) Set pulse equivalent in the “manufacturer parameters” of Ncstudio. The password of manufacturer parameters is “ncstudio”. The smaller the pulse equivalent is, the higher the resolution will be. The value of pulse equivalent will affect the maximum feed speed. Generally speaking, regarding the pulse equivalent of a mold machine, 0.001mm/p (the corresponding maximum feed rate is 9600mm/min) or 0.0005mm/p (the corresponding maximum feed rate is 4800mm/min) can be taken into consideration; for users who are not very critical of the accuracy, the pulse equivalent can be set a litter larger, such as 0.002mm/p (the corresponding maximum feed rate is 19200mm/min) or 0.005mm/p (the corresponding max. feed rate is 48000mm/min). When pulse equivalent is confirmed, calculate the electronic gear ratio of servo driver in terms of value of pulse equivalent. Refer to chapter 5.2 for the calculation of electronic gear ratio.

9) Move the machine tool manually to make sure the correctness of moving direction of each axis. Note that NcStudio adopts “right hand” coordinate system. For X-axis, right movement is the

positive direction; for Z-axis, upward movement the positive direction; while the positive direction of Y-axis is to move away from the operator (if the movement of Y-axis is the movement of worktable, its positive direction is the worktable moving towards the operator). If the direction is not correct, alter the axis direction in the system parameters or the relative parameters of servo driver. If Z-axis has brake, check the relative wiring of brake and the relative parameters of servo driver before Z-axis starts to move for the first time. After confirmation, move Z-axis in jog mode at a slow speed, and observe the response of Z-axis, making sure the brake can be opened normally.

10) Examine whether the value of electronic gear matches with that of pulse equivalent. Make a mark on any axis of the machine tool and set this marked point as the workpiece zero. Drive this marked axis to move a fixed distance by direct command input, jog or handwheel, and so on. Measure the actual moving distance with a vernier caliper and check whether the result is equal to the distance showed in the software.

11) Set the worktable stroke in the manufacturer parameters according to the actual size of the machine tool to enable software limit function.

12) Set “Back to Machine Zero” parameter in manufacturer parameters according to the installation position of home switches of the three axes. After correct setting, perform the “Back to Mechanical Origin” function under menu “Operation”. At first, home a single axis. Home the other two axes on condition that the moving direction of the first axis is correct; otherwise, stop homing and revise “The Direction of Backing to Machine Zero” parameter in the manufacturer parameters until all axes can return to the machine zero.

13) Axial acceleration: it is used to describe the acceleration / deceleration ability of a single axis, in mm/s^2. The value is determined by the physical characteristic of the machine tool, such as quality of movement part, torque, resistance, cutting load of feed-motor, and so on. The larger the value is, the less time spent in the process of acceleration / deceleration will be, and the higher the efficiency will be. Generally, for a servo motor system, the value is between 400 and 1200. Set the value smaller at the beginning; make the machine tool perform various typical movements for a period of time, and carefully observe it; when there is no abnormal situation, increase the value gradually; otherwise, decrease the value and reserve 50% ~ 100% insurance allowance.

14) Turning acceleration: it is used to describe the acceleration/deceleration ability in synchronized motion of multi-axis, in mm/s^2. The value limits the maximum speed of the machine tool in circular movement. The larger this value is, the higher the maximum allowable speed on circular movement of the machine tool will be. Generally, for a servo motor system, the value is between 1000 and 5000; for a heavy machine tool, the value should be smaller. Set the value smaller at the beginning; make the machine tool perform various typical movements for a period of time, and carefully observe it; when there is no abnormal situation, increase the value gradually; otherwise, decrease the value and reserve 50% ~ 100% insurance allowance.

Usually, given the drive ability of servo motor, frication of machine assembly, and endurance capacity of mechanical components, limit the maximum speed of the three axes in actual using by modifying the max. speed of each axis in the manufacturer parameters.

15) Set the parameter of auto lubrication (set a value smaller, such as once every 5 seconds). Observe if auto lubrication is executed correctly. If so, set it according to the actual need.

In case of any problem in the running of the machine tool, check every part carefully according to the steps above.

4.2. Pulse Test

If you suspect there is pulse loss, you can confirm it by either of the two following methods.

4.2.1. Stepping driver

Mark a little dot on the surface of a workpiece blank with a dagger; set this point as the workpiece zero; lift up Z-axis; set the coordinate of Z-axis as 0; repeatedly move the machine tool, for example, run a typical procedure with no tools (including synchronized movement of the three axes is much better), and pause or stop during machining is permitted; and then back to the workpiece zero; descend Z-axis slowly; observe whether the knifepoint matches with the marked dot.

4.2.2. Servo driver

For servo system, there is a more precise method: set servo driver mode as “ input pulse count mode “ in the “surveillance mode“ (for example, the parameter of YASKAWA servo is UN00C); regulate it to display the lower 4 bits (with “L ” before the count value) in count value (hexadecimal system); set workpiece zero and then write down the pulse count value at this time, then repeatedly run the procedure with no tools on the machine tool, then back to the workpiece zero and see whether the pulse count value at this time is the same with the original value.

For YASKAWA servo, as long as the value difference of pulse count value is no more than 4 (the frequency of host controller is 1/4 times the frequency of pulse sent by servo drive), indicating that the main controller sends the pulse within the tolerance of 1 pulse, the control system runs normally; otherwise, please check the pulse signal type of servo driver, and make the pulse type received by servo in accord with the pulse type sent by the system.

5. Appendix

5.1. Back to Machine Origin (Back to Reference Point)

Machine Origin (home) is the datum mark of MCS (machine coordinate system). The procedure of returning to reference point (home), varying with different machine structures & control software versions, is achieved via the execution of a block of G codes.

“Back to Reference Point” is a process to synchronize local coordinate system with actual external coordinate system via control system. In other words, since the concrete position of each axis is not detected in the system, after system start-up, it will control the motion of each axis and detect the switch signal pre-installed on each axis during the motion (the control system has already known the installation position of these switches). Thus, once these switch signals are found, the system will acquire the machine tool has reached the pre-specified position and then set the coordinate of this position as current coordinate, namely, the local coordinate system is synchronous with the actual one.

Generally, these switches are installed on the machine origin, i.e. “Back to Machine Origin” equals to the term “Back to Reference Point” in our system, and they are identical. Absolutely, the switch of reference point is allowed to be on other location rather than machine origin.

The principle of returning to REF. point can be divided into two types---with encoder feedback and without encoder feedback.

5.1.1. Principle of Returning to Machine Origin (Without Encoder Feedback)

The sketch map of returning to machine origin with servo motor is shown as below (without encoder feedback).

◆ **Coarse Positioning Stage**

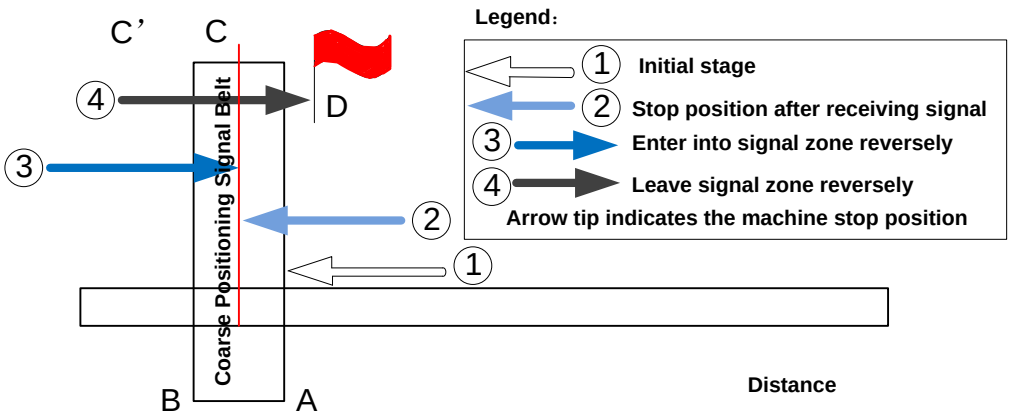


Fig. 5-1 Sketch map of coarse positioning (stopping within the signal belt after receiving REF. point signal)

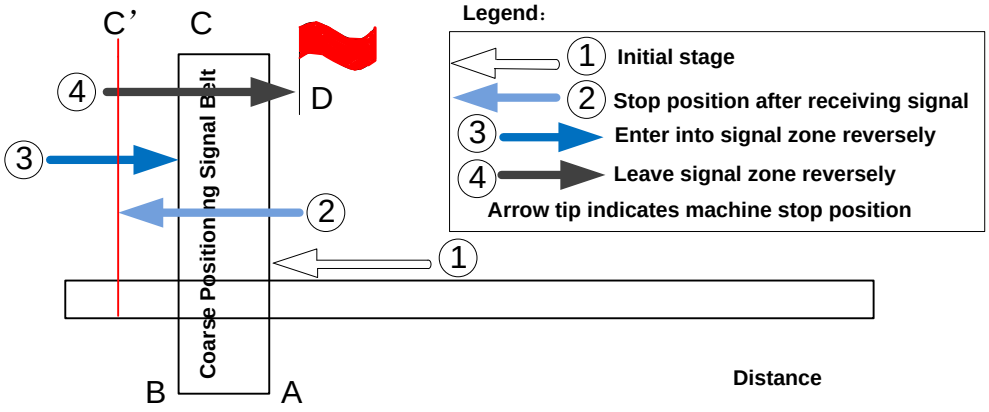


Fig. 5-2 Sketch mao of coarse positioning (stopping out of the signal belt after receiving REF. point signal)

1) When the machine keeps moving until receiving REF. point signal at place A, it should stop immediately, but it may stop at place C or C' due to time lag and inertia.

2) The machine keeps moving reversely at one third of "Home Search Velocity" until receiving REF. point signal (if the machine has stayed in the signal belt in the above step 1, it will make no motion in this step).

3) The machine keeps moving reversely at one-tenth of "Home Search Velocity" until the REF. point signal disappears (across the signal belt).

4) The machine halts at the red flag place D at the end of this stage.

◆ **Fine Positioning Stage**

Fine positioning, with various methods, is used to make each axis return to machine zero exactly by regarding encoder zero as fine positioning switch in our system, i.e. the axis is locating for machine zero in the motion via detecting encoder zero. Due to one zero signal sent per revolution of encoder, the fine positioning signal is periodic.

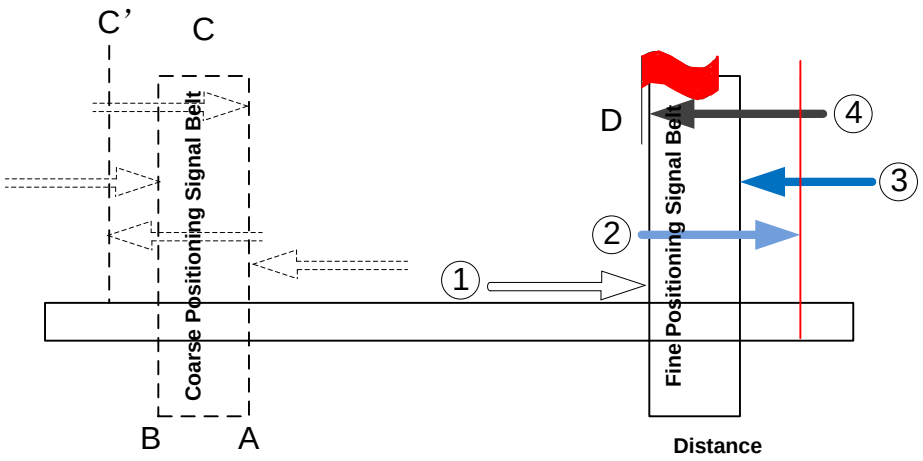


Fig. 5-3 The process of fine positioning

◆ **Retracing Stage**

After finishing the fine positioning stage, the system will execute retracting motion once with recommended retracting distance as half of the screw pitch. The sketch map is shown in Fig. 5-4.

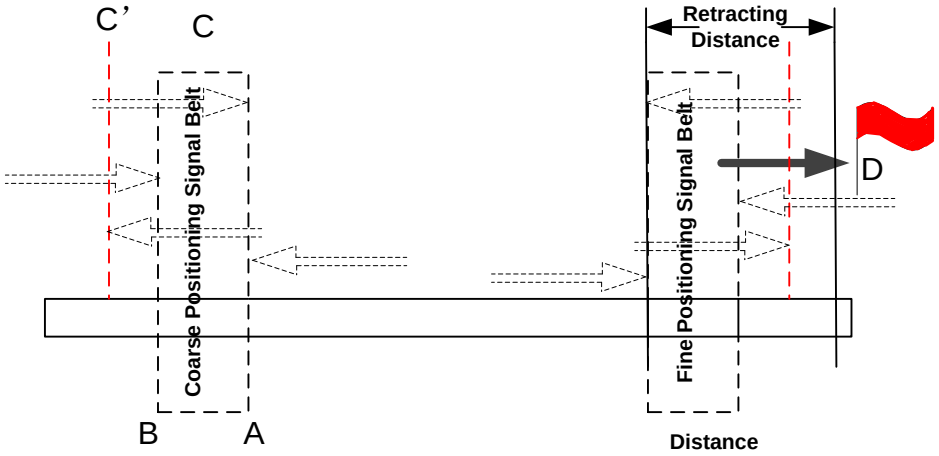


Fig. 5-4 Retracting stage

5.1.2. Principle of Returning to Machine Origin (with Encoder Feedback)

With encoder feedback function, the system will execute coarse positioning and fine positioning only once in returning to machine origin. The retracting distance after fine positioning is the actual retracting distance adjusted in terms of actual situation. And the concrete process is as below:

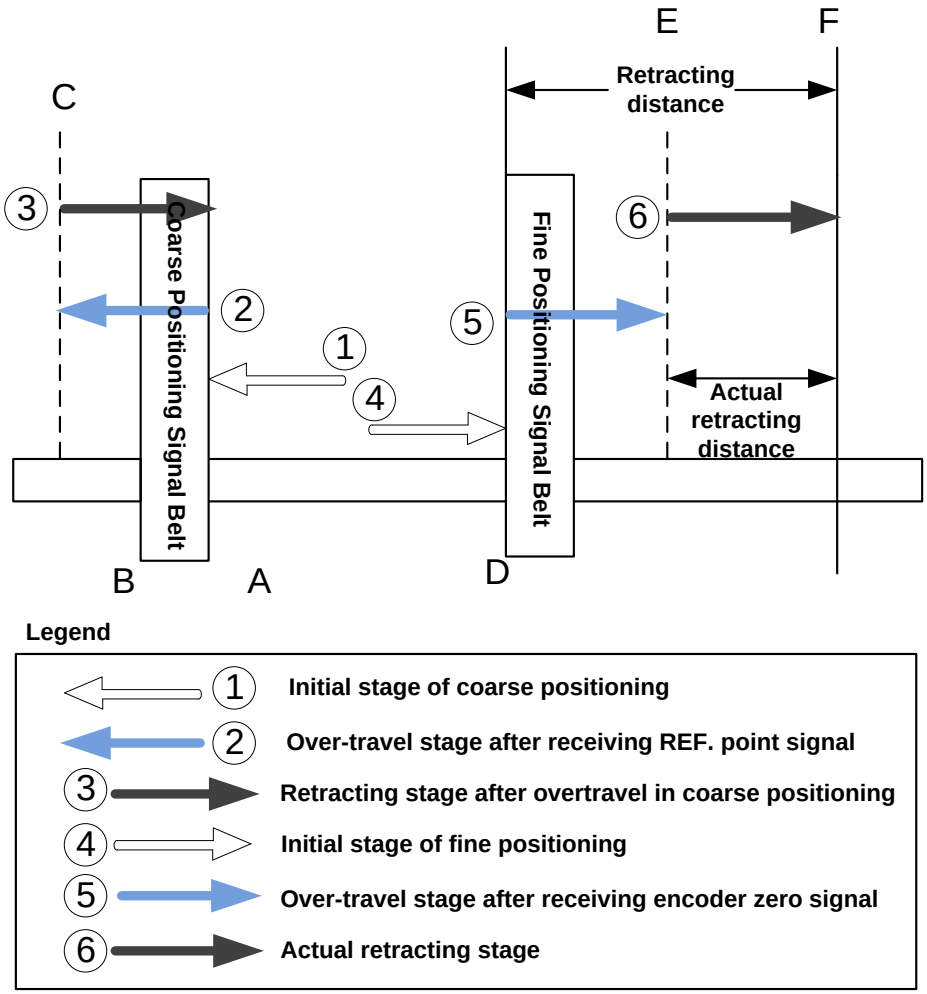


Fig. 5-5 The process of returning to machine origin

1) In coarse positioning stage, the machine tool should stop immediately at place “A” when receiving REF. point signal, but it may stop at place “C” due to over-travel caused by inertia and time-lag.
2) The machine executes retracting stage of coarse positioning.
3) In fine positioning stage, the machine tool moves reversely and should stop at place “D” immediately when receiving encoder zero signal; at the mean time, the feedback data of encoder will be latched, but the machine will generate over-travel and stop at place E due to inertia and time-lag. And the displacement between encoder zero signal and stop position (i.e. DE) is the across distance of signal deceleration.
4) In terms of the retracting distance and across distance calculated, calculate the actual retracting distance, and use this actual distance to make the machine move and stop at place F, keeping it free from the signal source.

5.2. Electronic Gear Ratio

5.2.1. Electronic Gear

Electronic Gear: assume that the host controller sends 5000 pulses per revolution of servo motor. When doubling revolutions of servo motor driven by the same amount of pulses is needed, there are two methods available, “set servo parameters” and “addition of mechanical gear between motor spindle and load-spindle”. Using circuit to realize the functions of mechanical gear is called electronic gear, viz. pulse frequency multiplication function.

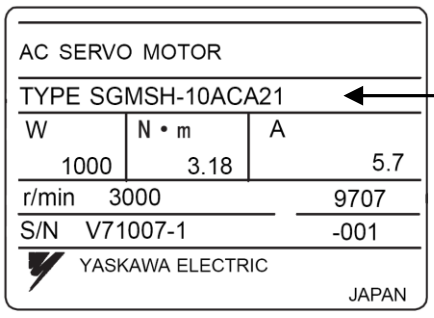
5.2.2. Electronic Gear Functions

Regarding “Electronic Gear”, it refers to a proportional control factor of output displacement to motor when a certain amount of pulses is input. For the “senior device” issuing pulses, it can be regardless of encoder pulse No. and mechanical deceleration ratio in controlling.

Functions of electronic gear: it can set the command unit freely (the displacement of screw corresponding to one pulse sent by host controller). Frequency reduplication can be used to amplify the frequency of pulse issued by the mater controller.

Electronic gear ratio= encoder resolution × command unit × mechanical deceleration ratio / pitch

Please see the servo motor label plate and then refer to the corresponding driver manual to confirm its encoder resolution. Fig. 5-6 is a label plate of YASKAWA SGMSH motor, and the 4th character in motor type is the serial encoder specification, so the resolution of this motor is 2^{17}, i.e. 131072.



Motor Type：

TYPE SGMSH-1 0 A C A 2 1

(The 4th character)

The 4th character: serial encoder spec.		
Sign	**Spec.**	**Remark**
2	17-bit absolute	Standard
C	17-bit incremental	Standard

Fig. 5-6 Name plate of servo motor-encoder resolution

For instance: (an example of YASKAWA servo) screw pitch of a certain type of machine is 5mm, with 17 bit encoder resolution, “0.0001mm/p” pulse equivalent and “1:1” deceleration ratio.

Electronic gear ratio $\frac{PN202}{PN203}=\frac{2^{17}}{5/0.0001}\times 1=\frac{131072}{5/0.0001}\times 1=\frac{8192}{3125}$

The conversion of electronic gear ratio is as shown below.

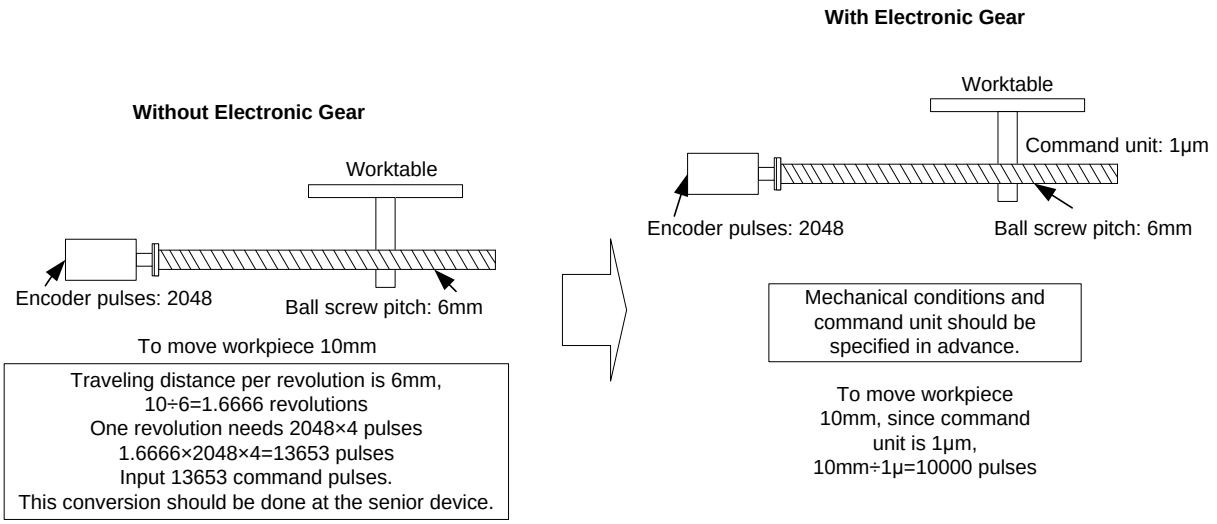


Fig. 5-7 Schematic conversion of electric gear ratio

5.2.3. Computing Method of Electronic Gear Ratio

The setting of electronic gear ratio should be in accordance with the specification of equipment.

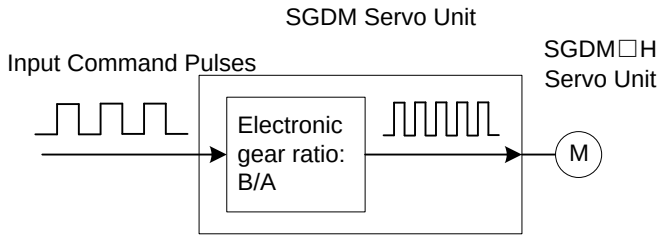


Fig. 5-8 Schematic function of "Electronic Gear Ratio"

$$\text{Electronic Gear Ratio}\ \frac{B}{A}=\frac{Pn202}{Pn203}=\frac{\text{Encoder Pulses}\times 4}{\text{Amount of movement per revolution of bearing axle}}\times\frac{m}{n}$$

$\frac{m}{n}$ is mechanical deceleration ratio.

5.2.4. Samples of Electronic Gear Ratio Setting

◆ **Sample One**

As screw pitch= 6mm (screw travels 6mm per revolution of bearing axle), "2048" ($2^{13}/2^2$) pulses will be generated per revolution of servo motor with 13-bit incremental encoder.

Command unit= 0.001mm (screw moves 0.001mm per pulse generated by host controller)

Amount of movement per revolution of bearing axle= 6mm/0.001mm=6000

Ball Screw

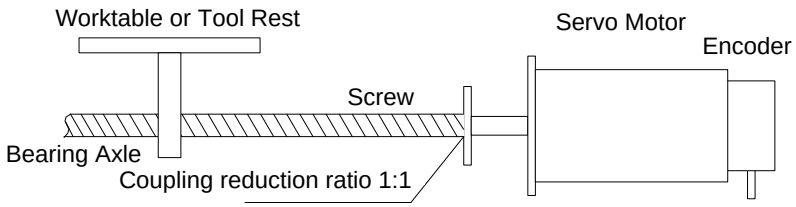


Fig. 5-9 Servo motor and screw sharing same axle (without reduction gearbox)

Servo motor and screw are sharing the same axle (without reduction gearbox), and one revolution of motor will lead to one rotation of screw.

$$\text{Electronic Gear Ratio}\frac{B}{A}=\frac{2048\times 4}{6000}\times\frac{1}{1}=\frac{8192}{6000}=\frac{Pn202}{Pn203}$$

(Note: for YASKAWA servo, “4” should be multiplied by the numerator.)

Table 2 Parameters setting value

Parameters	PN202	PN203
Setting Value	512	375

◆ **Sample Two**

Round Table

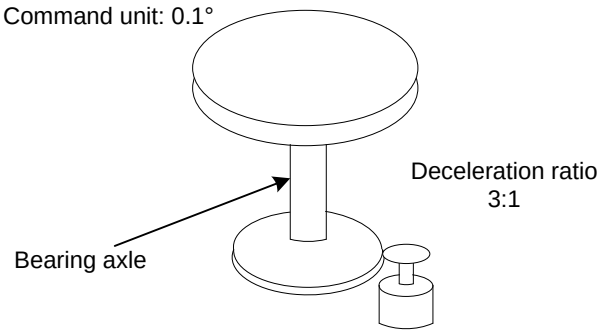


Fig. 5-10 Sample of round table

Pulses generated per revolution of motor=$2^{13}/2^2$=2048

Angle of rotation per revolution=360°

Command unit=0.1°

Amount of movement per revolution of bearing axle= 360°/ 0.1°=3600

$$\text{Electronic Gear Ratio}\frac{B}{A}=\frac{2048\times 4}{3600}\times\frac{3}{1}=\frac{Pn202}{Pn203}$$

Table 3 Parameters setting value

Parameters	PN202	PN203
Setting Value	512	75

◆ **Sample Three**

Belt + Pulley

Command unit: 0.02mm

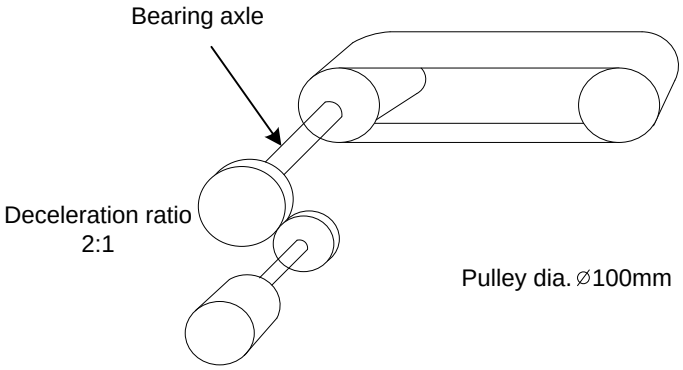


Fig. 5-11 Sample of “belt + pulley”

Pulses generated per revolution of motor=$2^{16}/2^{2}$=16384

Pulley diameter=100mm

Command unit=0.02mm

Amount of movement per revolution of bearing axle= 3.14×100mm/ 0.02mm=15700

$$\text{Electronic Gear Ratio}\frac{B}{A}=\frac{16384\times 4}{15700}\times\frac{2}{1}=\frac{Pn202}{Pn203}$$

CAUTION

If the calculation result is out of setting range, both the numerator and denominator should be divided by their common divisor.

Table 4 Parameters setting value

Parameters	PN202	PN203
Setting Value	32768	3925

5.3. Driver Parameters

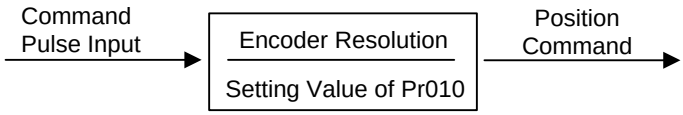
Specification for driver parameters listed in this chapter can only make a machine tool work normally without ensuring machining effects. To ensure better machining results, it is necessary to adjust relative parameters according to the specific machine tool

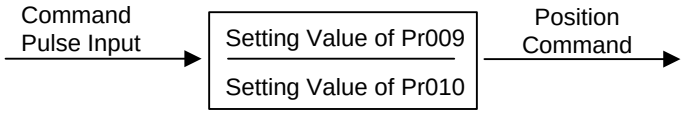
5.3.1. Parameter Setting of WISE Servo Driver

Para. No.	Function	Value	Description
Pr528	LED initial status	6	Monitor if the number of sent and received pulses is correct by setting this parameter. In Weihong control system, the correct quantity of pulses sent by control card is detected by pulse inspection in order to determine whether there is electrical interference.
Pr008	Command pulse No. per motor circle	0	When it is set to “0”, parameters Pr009 and Pr010 are valid.
Pr009	1st numerator of command pulse frequency division/ multiplication	Need calculation	Range: 0~2^{30} Typical value: pitch 5 mm, encoder resolution 10000, deceleration ratio 1:1, pulse equivalent 0.001 mm: Pr009＝10000 Pr010＝pitch 5mm/ pulse equivalent 0.001mm＝5000 Pr009/Pr010=10000/5000=2/1
Pr010	Denominator of command pulse frequency division/multiplication	Need calculation	
Pr100	1st position loop gain	480 (default)	Unit: 0.1/s. Set it according to the actual situation.
Pr101	1st velocity loop gain	270 (default)	Unit: 0.1Hz. Set it according to the actual situation.
Pr102	1st velocity loop integrated time constant	210 (default)	Unit: 0.1ms. Set it according to the actual situation.
When the value of Pr008 is not “0”, it can be calculated in terms of the following formula: $\text{Command pulse No. per motor circle} = \frac{\text{Screw pitch}}{\text{Pulse equivalent} \times \text{Mechanical deceleration ratio}} = \frac{5\text{mm}}{0.001\text{mm}/p} = 5000$ When screw pitch is 5mm and pulse equivalent 0.001, the value of Pr008 is “5000”.			

◆ **Attached list: relationship among parameters Pr008, Pr009 and Pr010**

Pr008	Pr009	Pr010	Description
0~2^{20}	– (no influence)	– (no influence)	Command Pulse Input → Encoder Resolution / Setting Value of Pr008 → Position Command As shown above, the process is undergone in terms of the setting value of Pr008, not affected by the settings of Pr009 and Pr010.

<table>
<tr><th>Pr008</th><th>Pr009</th><th>Pr010</th><th>Description</th></tr>
<tr><td rowspan="2">0</td><td>0</td><td>0~2^{30}</td><td> 

When the values of Pr008 and Pr009 are both set to “0”, as shown above, the process is undergone in terms of the setting value of Pr010.</td></tr>
<tr><td>0~2^{30}</td><td>0~2^{30}</td><td> 

When the value of Pr008 is “0”, but the value of Pr009 is not “0”, as shown above, the process is undergone in terms of the setting values of Pr009 and Pr010.</td></tr>
</table>

5.3.2. Parameter Setting of YASKAWA Σ–Ⅱ Servo Driver

Para. No.	Function	Value	Description
Fn010	Set password (to prevent arbitrary modification to parameters)	0000	Set [0000]: modification to user parameters [PnXXX] and part of auxiliary function parameters [FnXXX] permitted; Set [0001]: modification to user parameters [PnXXX] and part of auxiliary function parameters [FnXXX] prohibited.
Un00C	Surveillance mode	LXXXX (Hexadecimal system)	Monitor if the number of sent and received pulse is correct by setting this parameter. In Weihong control system, the correct quantity of pulse sent by control card is detected by pulse inspection in order to determine whether there is electrical interference.
Pn000	Direction selection Control mode selection	0010	Bit 0: Set 0, “CCW” rotation is forward rotation (viewed from the load end of screw ball); Set 1, the rotation direction of the motor is reversed. Bit 1: Set 1, position control mode (calculate pulse instruction all the time).
Pn200	Select pulse instruction mode	0005	Bit 0: Set 5, select the instruction input mode as “pulse + direction”, negative logic. Bit 3: Set 0, input differential signal into filter.
Pn50A	Selection function	8100	Bit 1: Set 0, Servo ON /S-ON, input from the 40th pin; Set 7, Servo ON all the time. Bit 3: Set 8, forward rotation not used and signal input (P-OT) prohibited.
Pn50B	Selection function	6548	Bit 0: Set 8, reverse rotation not used and signal input (N-OT) prohibited.

Para. No.	Function	Value	Description		
Pn50F	Selection function	0300	Set it when servo motor with brakes. Bit 2: Set 3, brake interlock signal “/BK” is output from CN1-29, CN1-30 to control 24V relay for brake.		
Pn50E	Selection function	0211	Set it when servo motor with brakes. To avoid of CN1-29 and CN1-30 being used for other function and leading to brake ineffective, “3” is not allowed to appear in the 4 digits.		
Pn506	Servo off, time delay of brake when motor stops	Depended	Set it when motor with brakes. Default setting is “0”, setting unit is 10ms.		
Pn201	Encoder cycle-divided ratio (Pulse output No. per motor cycle after cycle-divided)	See right-side	Gain Encoder	Type	Pulse No. per Motor Circle (PPR)
				A	13bit 2048
				B	16bit 16384
				C	17bit 32768
Pn202	Electronic gear ratio (numerator)	Need Calculation	Pn202 = pulse No. of each encoder circle × 4 × mechanical deceleration ratio. Pn203 = (screw pitch/ pulse equivalent). Typical value: pitch 5mm, encoder 17-bit, deceleration ratio 1:1, pulse equivalent 0.001mm, Pn202＝16384; Pn203＝625. Pitch 5mm, encoder 17-bit, deceleration ratio 1:1, pulse equivalent 0.0005mm, Pn202＝8192; Pn203＝625.		
Pn203	Electronic gear ratio (denominator)	Need Calculation			

5.3.3. Parameter Setting of YASKAWA Σ–Ⅴ Servo Driver

Para. No.	Function	Value	Description
Fn010	Parameter input prohibition setting	0000	Set [0000]: modification to user parameters [PnXXX] and part of auxiliary function parameters [FnXXX] permitted; Set [0001]: modification to user parameters [PnXXX] and part of auxiliary function parameters [FnXXX] prohibited.
Pn000	Function selection basic switch 0	0010	Bit 0: Set 0, positive rotation at positive rotation command; Bit 1: Set 1, position control mode (pulse sequence command)
Pn200	Format selection switch of position control command	0005	Bit 0: Set 5, select the instruction mode as “pulse + direction”, negative logic.
Pn50A	Input signal selection 1	8100	Bit 1: Set 0, Servo ON /S-ON, input from the 40th pin; Set 7, Servo ON all the time. Bit 3: Set 8, positive rotation not used and signal input (P-OT) prohibited.
Pn50B	Input signal selection 2	6548	Bit 0: Set 8, negative rotation not used and signal input (N-OT) prohibited.
Pn50F	Output signal selection 2	0300	Set it when servo motor with brakes. Bit 2: Set 3, brake interlock signal “/BK” is output from CN1-29, CN1-30 to control 24V relay for brake.
Pn50E	Output signal selection 1	0211	Set it when servo motor with brakes To avoid of CN1-29 and CN1-30 being used for other function and leading to brake ineffective, 3 is not allowed to appear in the 4 digits.
Pn506	Brake instruction-servo OFF time delay	Depended	Set it when motor with brakes Default setting is “0”, setting unit is ms.
Pn20E	Electronic gear ratio (numerator)	Need Calculation	$\frac{\text{Pn20E}}{\text{Pn210}}=\frac{\text{Encoder resolution}\times\text{Pulse equivalent}\times\text{Deceleration ratio}}{\text{Screw pitch}}$ For example, screw pitch 5mm, 20-bit encoder, deceleration ratio 1:1, pulse equivalent 0.001mm, $\frac{Pn20E}{Pn210}=\frac{2^{20}\times 0.001}{5}=\frac{1048576}{5000}=\frac{131072}{625}$ When screw pitch is 10mm, $\frac{Pn20E}{Pn210}=\frac{1048576}{10000}=\frac{65536}{625}$ For a rotary axis with 13-bit encoder and deceleration ratio as 60, $\frac{Pn20E}{Pn210}=\frac{2^{13}\times 0.001\times 60}{360}=\frac{8192}{6000}=\frac{512}{375}$
Pn210	Electronic gear ratio (denominator)	Need Calculation	

5.3.4. Parameter Setting of PANASONIC MINAS A4 Servo Driver

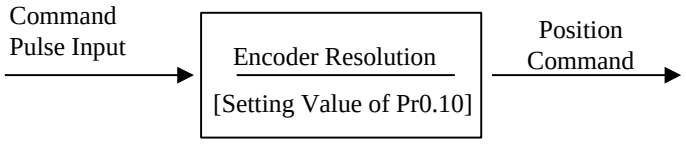
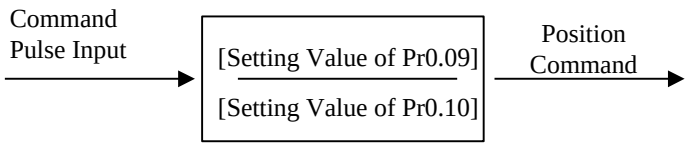
Para. No.	Function	Value	Description
Pr01	LED initial status	12	Monitor if the number of sent and received pulse is correct by setting this parameter. In Weihong control system, the correct quantity of pulse sent by control card is detected by pulse inspection in order to determine whether there is electrical interference.
Pr02	Select control mode	0	0: position mode 1: velocity mode 2: torque mode
Pr40	Selection of command pulse input	1	1: input by differential exclusive circuit
Pr42	Select command pulse input mode	3	Set command pulse input mode: pulse + direction, negative logic
Pr48	1st numerator of command pulse frequency multiplication	Need calculation Range: 1~10000	Typical value: pitch 5 mm, encoder resolution 10000, deceleration ratio 1:1, pulse equivalent 0.001 mm: Pr48＝10000 Pr4B ＝ pitch 5mm / pulse equivalent 0.001mm＝5000 Pr48/Pr4B=10000/5000=2/1
Pr4B	Denominator of command pulse frequency multiplication	Need calculation Range: 1~10000	

5.3.5. Parameter Setting of PANASONIC MINAS A5 Servo Driver

Para. No.	Function	Value	Description
Pr5.28	LED initial status	6	Monitor if the number of sent and received pulse is correct by setting this parameter. In Weihong control system, the correct quantity of pulse sent by control card is detected by pulse inspection in order to determine whether there is electrical interference.
Pr0.01	Select control mode	0	0: position mode 1: velocity mode 2: torque mode
Pr0.05	Selection of command pulse input	XX	0: Photo-coupler input (PULS1, PULS2, SIGN1, SIGN2) 1: Exclusive input for line driver (PULSH1, PULSH2, SIGNH1,SIGNH2) Note: generally, “1” is selected for this parameter.
Pr0.07	Command pulse input mode setup	3	Set command pulse input mode: pulse + direction, negative logic.
Pr0.08	Command pulse counts per one motor revolution	0	When it is set as “0”, parameters Pr0.09 and Pr0.10 are valid.
Pr0.09	1st numerator of command pulse frequency multiplication	Need calculation Range: $0\sim2^{30}$	Typical value: pitch 5 mm, encoder resolution 10000, deceleration ratio 1:1, pulse equivalent 0.001 mm: Pr0.09＝10000 Pr0.10＝pitch 5mm/ pulse equivalent 0.001mm＝5000 Pr0.09/Pr0.10=10000/5000=2/1
Pr0.10	Denominator of command pulse frequency multiplication	Need calculation Range: $0\sim2^{30}$	
When the value of Pr0.08 is not “0”, it can be calculated in terms of the following formula: $\text{Command pulse No. per motor circle} = \frac{\text{Screw pitch}}{\text{Pulse equivalent} \times \text{Mechanical deceleration ratio}} = \frac{5\text{mm}}{0.001\text{mm/p}} = 5000$ When screw pitch is 5mm and pulse equivalent 0.001, the value of Pr0.08 is “5000”.			

◆ **Attached List: the relationship among parameters Pr0.08, Pr0.09 and Pr0.10.**

Pr0.08	Pr0.09	Pr0.10	Description
$0\sim2^{20}$	— (no influence)	— (no influence)	Command Pulse Input → [Encoder Resolution / [Setting Value of Pr0.08]] → Position Command As shown above, the process is undergone in terms of the setting value of Pr0.08, not affected by the settings of Pr0.09 and Pr0.10.

Pr0.08	Pr0.09	Pr0.10	Description
0	0	0~2^{30}	 When the values of Pr0.08 and Pr0.09 are both set as “0”, as shown above, the process is undergone in terms of the setting value of Pr0.10.
	0~2^{30}	0~2^{30}	 When the value of Pr0.08 is “0”, but the value of Pr0.09 is not “0”, as shown above, the process is underdone in terms of the setting values of Pr0.09 and Pr0.10.

5.3.6. Parameter Setting of MITSUBISHI MR-E Servo Driver

Para. No.	Code	Function	Value	Description
0	*STY	Control mode selection and regenerative fittings	X0X0	Bit 0: set 0: select position control mode. Bit 1, select motor series: 0: HC-KFE; 1:HC-SFE; Bit 3, select regenerative apparatus, set 0: not use. Bit 4, select motor power.
1	MBR	Function selection 1	001X	Bit 0: input signal filter. If external input signal causes chattering due to noises, etc., input filter is used to suppress it. Bit 1: CN1-12 function selection, set “1”: electromagnetic brake interlock (MBR); set “0”: zero speed detection signal.
3	CMX	Electronic gear numerator	Need calculation	CMX/CDV=command unit × servo motor resolution × mechanical deceleration ratio / screw pitch. E.G., pitch 5 mm, encoder resolution 10000, deceleration ratio 1:1, pulse equivalent 0.001 mm, CMX/CDV=10000×0.001/5 = 2/1; When pulse equivalent = 0.0005mm, CMX/CDV = 1/1. Electronic gear ratio range: 1/50 ~ 500
4	CDV	Electronic gear denominator	Need calculation	
18	*DMD	Status display selection	00XX	3: cumulative command pulses E: load inertia When the parameter is set [3], monitor if the number of sent and received pulse is correct by setting this parameter. In Weihong control system, the correct quantity of pulse sent by control card is detected by pulse inspection to determine if there is electrical interference.
21	*OP3	Function selection 3 (command pulse format selection)	0001	Set pulse command input form: pulse train+ sign, negative logic
41	*DIA	Signal input SON-ON, LSP-ON and LSN-ON automatically selection	0110	Bit 0: Servo-ON selection. [0]: servo on by external input; [1]: servo on all the time inside. Bit 1: last signal of positive rotation range (LSP): [1]: auto servo on inside, without external wiring. Bit 3: last signal of negative rotation range (LSN): [1]: auto servo on inside and no need of external wiring.

5.3.7. Parameter Setting of DELTA ASDA-A Servo Driver

Para. No.	Function	Format & Range	Value	Description
P0-02	Driver status display		02	Monitor if the number of sent and received pulse is correct by setting this parameter. In Weihong control system, the correct quantity of pulse sent by control card is detected by pulse inspection to determine if there is electrical interference.
P1-00	External pulse input type	ZYX	102	X=2: pulse + direction; Z=1: negative logic
P1-01	Control mode setup	ZYX1X0	0000	Z=0: during control mode switching, DIO is maintaining the set value. Since switching control mode is not used, Z=0 Y=0: forward rotation (CCW) (in terms of load); Y=1: the rotation direction is reversed. X1X0=00: position control mode
P1-32	Motor stop mode selection	YX	00	Y=0: when there is no servo enabled, motor dynamic brake occurs; Y=1: motor is free. X=0: motor stops instantly, X=1: motor stops with deceleration.
P1-44	Electronic Gear Ratio (Numerator)(N1)	1~32767	Need calculation	N1/M= encoder pulses× 4× pulse equivalent× mechanical deceleration ratio/ pitch Representative value: encoder pulses=2500, pitch=5mm, pulse equivalent=0.001, deceleration ratio=1, calculation as below: N1/M= 2500×4×0.001/5 = 2 / 1, N1=2, M=1; When the multi-electronic gear ratio is not used, P2-60~ P2-62 are not required.
P1-45	Electronic Gear Ratio (Denominator) (M)	1~32767	Need calculation	
P2-10	Digital Input Pin DI1	X2X1X0	101	X1X0=01: digital input (DI1=SON) corresponds to 9th pin of CN1. X2 = 1: set DI1 input as NO (normally open) a-contact point.
P2-15	Digital Input pin DI6	X2X1X0	100	Default factory setting of DI6 and DI7 are NC (normally closed) limit signal input pins; driver can't run without being connected to pin 32 and pin 31 of CN1. X2=1: set DI6 and DI7 inputs as NO (normally open) a-contact points; X1X0=00, limit signal input of the driver is not used.
P2-16	Digital Input Pin DI7	X2X1X0	100	

Para. No.	Function	Format & Range	Value	Description
P2-17	Function setting for digital input pin DI8	X2X1X0	100	External EMG stop input is not used.
P2-21	Function setting for digital output pin DO4	X2X1X0	108	DO4 corresponds to pin 1 & pin 26, used as clamping-position brake signal of Z-axis; X2=1: set DO4 output as NO (normally open) a-contact point; X2=0: set DO4 output as NC (normally closed) b-contact point; X1X0=08: set pin 1 and pin 26 as BK+ and BK- respectively.
P2-22	Function setting for digital output pin DO5	X2X1X0	007	DO5 corresponds to pin 28 & pin 27, used as servo alarm signal. X2=0: set DO5 output as NC (normally closed) b-contact point. X1X0=07: set pin 28 and pin 27 as ALRM+ and ALRM- respectively.
P2-51	Servo ON (SON) setup		0	0: Servo ON must be triggered by numerical input signal. 1: when servo is powered, if there is no alarm signal, servo will be automatically on. Set 1 when there is no SON signal wire.

5.3.8. Parameter Setting of DELTA ASDA-A2 Servo Driver

Para. No.	Function	Format & Range	Value	Description
P0-02	Driver status display		02	Monitor if the number of sent and received pulse is correct by setting this parameter. In Weihong control system, the correct quantity of pulse sent by control card is detected by pulse inspection in order to determine whether there is electrical interference.
P1-00	External pulse train input type	ZYX	102	X=2: pulse + direction; Z=1: negative logic
P1-01	Set control mode	ZYX1X0	0000	Z=0: during control mode switching, DIO is maintaining the set value. Since switching control mode is not used, Z=0; Y=0: forward rotation (CCW) (from the view of load); Y=1: the rotation direction is reversed. X1X0=00: position control mode
P1-44	Electronic Gear Ratio (Numerator)(N1)	1~32767	Need calculation	$\frac{P1-44}{p1-45}=\frac{Encoderresolution\times Pulseequivalent\times Decelerationratio}{Screwpitch}$ When encoder resolution is 1280000, screw pitch 5mm, pulse equivalent 0.001, and deceleration ratio 1:1, $\frac{P1-44}{P1-45}=\frac{1280000\times 0.001}{5}=\frac{256}{1}$ When the multi-electronic gear ratio is not used, P2-60 ~P2-62 are not required.
P1-45	Electronic Gear Ratio (Denominator)(M)	1~32767	Need calculation	
P2-10	Function setting for digital input pin DI1	X2X1X0	101	X1X0=01: digital input (DI1 = SON) corresponds to 9th pin of CN1. X2=1: set DI1 input as NO (normally open) a-contact point.
P2-15	Function setting for digital input pin DI6	X2X1X0	100	Default factory setting of DI6 and DI7 is NC (normally closed) limit signal input; driver can't run without being connected to pin 32 and pin 31 of CN1. X2=1: set DI6 and DI7 inputs as NO a-contact point. X1X0=00, limit input of driver is not used.

Para. No.	Function	Format & Range	Value	Description
P2-16	Function setting for digital input pin DI7	X2X1X0	100	
P2-17	Function setting for digital input pin DI8	X2X1X0	100	External EMG stop input is not used.
P2-21	Function setting for digital output pin DO4	X2X1X0	108	DO4 corresponds to pin 1 & pin 26, used as clamping-position brake signal of Z-axis; X2=1: set DO4 output as NO (normally open) a-contact point; X2=0: set DO4 output as NC (normally closed) b-contact point; X1X0=08: set pin 1 and pin 26 as BK+ and BK- respectively.
P2-22	Function setting for digital output pin DO5	X2X1X0	007	DO5 corresponds to pin 28 & pin 27, used as servo alarm signal. X2=0: set DO5 output as NC b-contact point. X1X0=07: set pin 28 and pin 27 as ALRM+ and ALRM- respectively.

5.3.9. Parameter Setting of DELTA ASDA-B Servo Driver

Para. No.	Function	Format & Range	Value	Description
P0-02	Driver status display		02	Monitor if the number of sent and received pulse is correct by setting this parameter. In Weihong control system, the correct quantity of pulse sent by control card is detected by pulse inspection in order to determine whether there is electrical interference.
P1-00	External pulse train input type	ZYX	102	X=2: pulse + direction; Z=1: negative logic
P1-01	Set control mode	YX1X0	000	Y=0: forward rotation (CCW) (from the view of load); Y=1: the rotation direction is reversed. X1X0=00: position control mode
P1-32	Motor stop mode	YX	00	Y=0: when there is no servo enabled, motor dynamic brake occurs; Y=1: motor is free. X=0: motor stops instantly; X=1: motor stops with deceleration.
P1-44	Electronic Gear Ratio (Numerator)(N1)	1~32767	Need calculation	N1/M= mechanical deceleration ratio × 4 × encoder pulses× pulse equivalent / pitch. Representative value: encoder pulses=2500, pitch =5mm, pulse equivalent=0.001 mm/p, deceleration ratio = 1, calculation as below: N1 / M = 2500×4×0.001/5 = 2/1, N1=2, M=1; When the multi-electronic gear ratio is not used, P2-60 ~P2-62 are not required.
P1-45	Electronic Gear Ratio (Denominator)(M)	1~32767	Need calculation	
P2-10	Digital Input Pin 1 (DI1)	X2X1X0	101	X1X0=01: digital input (DI1 = SON) corresponds to 17th pin of CN1. X2=1: set DI1 input as NO (normally open) a-contact point.
P2-15	Function setting for digital input pin DI6	X2X1X0	100	Default factory setting of DI6 is NC (normally closed) limit signal input; driver can't run without being connected to pin 32 and pin 31 of CN1. X2=1: set DI6 input as NO a-contact point. X1X0=00, limit input of driver is not used.

Para. No.	Function	Format & Range	Value	Description
P2-18	Function setting for digital output pin DO1	X2X1X0	108	DO1 corresponds to the 16th pin, as clamping-position brake signal of Z-axis; X2=1: set DO1 output as NO a-contact point; X2=0: set DO1 output as NC b-contact point; X1X0=08: set the 16th pin as BK+.
P2-20	Function setting for digital output pin DO3	X2X1X0	007	DO3 corresponds to pin 1, used as servo alarm signal. X2=0: set DO3 output as NC b-contact point. X1X0=07: set pin 1 as ALRM+.

5.3.10. Parameter Setting of DELTA ASDA-B2 Servo Driver

Para. No.	Function	Format & Range	Value	Description
P0-02	Driver status display		02	Monitor if the number of sent and received pulse is correct by setting this parameter. In Weihong control system, the correct quantity of pulse sent by control card is detected by pulse inspection in order to determine whether there is electrical interference.
P1-00	External pulse train input type	ZYX	102	X=2: pulse + direction; Z=1: negative logic
P1-01	Set control mode	ZYX1X0	0000	Z=0: during control mode switching, DIO is maintaining the set value. Since switching control mode is not used, Z=0; Y=0: forward rotation (CCW) (from the view of load); Y=1: the rotation direction is reversed. X1X0=00: position control mode
P1-44	Electronic Gear Ratio (Numerator)(N1)	1~32767	Need calculation	N1/M= mechanical deceleration ratio × 4 × encoder pulses× pulse equivalent / pitch. Representative value: encoder pulses=40000, pitch =5mm, pulse equivalent=0.001, deceleration ratio = 1, calculation as below: N1 / M = 40000×4×0.001/5 = 32/1, N1=32, M=1; When the multi-electronic gear ratio is not used, P2-60 ~P2-62 are not required.
P1-45	Electronic Gear Ratio (Denominator) (M)	1~32767	Need calculation	
P2-10	Digital Input Pin DI1	X2X1X0	101	X1X0=01: digital input (DI1 = SON) corresponds to 9th pin of CN1. X2=1: set DI1 input as NO (normally open) a-contact point.
P2-15	Function setting for digital input pin DI6	X2X1X0	100	Default factory setting of DI6 and DI7 is NC (normally closed) limit signal input; driver can't run without being connected to pin 32 and pin 31 of CN1. X2=1: set DI6 and DI7 inputs as NO a-contact point. X1X0=00, limit input of driver is not used.

Para. No.	Function	Format & Range	Value	Description
P2-16	Function setting for digital input pin DI7	X2X1X0	100	
P2-17	Function setting for digital input pin DI8	X2X1X0	100	External EMG stop input is not used.
P2-18	Function setting for digital output pin DO1	X2X1X0	108	DO1 corresponds to pin 6 & pin 7, used as clamping-position brake signal of Z-axis; X2=1: set DO1 output as NO (normally open) a-contact point; X2=0: set DO1 output as NC (normally closed) b-contact point; X1X0=08: set pin 6 and pin 7 as BK- and BK+ respectively.
P2-22	Function setting for digital output pin DO5	X2X1X0	007	DO5 corresponds to pin 28 & pin 27, used as servo alarm signal. X2=0: set DO5 output as NC b-contact point. X1X0=07: set pin 28 and pin 27 as ALRM+ and ALRM- respectively.

5.3.11. Parameter Setting of SANYO PY Servo Driver

Para. No.	Abbr.	Name	Standard Value	Setting Range	Unit	Remark
1-2	EGER	Electronic gear ratio	4/1	1/32767 to 32767/1		Depends on specific encoder resolution. The formula of electronic gear ratio of servo driver is as below: Electronic gear ratio numerator =mechanical deceleration ratio × 4× pulse No. per encoder circle; Electronic gear ratio denominator = (screw pitch / pulse equivalent) E.G. In Weihong system, the default pulse equivalent is 0.001mm/p, screw pitch is 5mm, pulse number per encoder circle is 2000 and deceleration ratio is 1:1, currently the numerator of the electronic gear ratio is 8, and the denominator is 5. (Select incremental type encoder)
1-16	MENP	Pulse amount of the motor encoder 1. Set the pulse amount of the motor encoder; 2. Standard configuration of the encoder pulse No. is as below. Incremental encoder omitting wiring: --2000P/R Absolute encoder:--2048P/R		500 to 65535	P/R	
2-0	PMOD	Pulse format of position command: Our system uses: direction + pulse format, the parameters are shown as following:				

<table>
<tr><th>Para. No.</th><th>Abbr.</th><th>Name</th><th>Standard Value</th><th>Setting Range</th><th>Unit</th><th>Remark</th></tr>
<tr><td></td><td></td><td colspan="5">
PMOD
<table>
<tr><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
</table>
When bit 7=0
<table>
<tr><th>Bit 1</th><th>Bit 0</th><th>Command Pulse Input Digital Filter
Min. Pulse Width</th></tr>
<tr><td>0</td><td>0</td><td>0.8μs</td></tr>
<tr><td>0</td><td>1</td><td>0.2μs</td></tr>
<tr><td>1</td><td>0</td><td>0.4μs</td></tr>
<tr><td>1</td><td>1</td><td>1.6μs</td></tr>
</table>
When bit 7=1
<table>
<tr><th>Bit 1</th><th>Bit 0</th><th>Command Pulse Input Digital Filter
Min. Pulse Width</th></tr>
<tr><td>0</td><td>0</td><td>3.2μs</td></tr>
<tr><td>0</td><td>1</td><td>0.8μs</td></tr>
<tr><td>1</td><td>0</td><td>1.6μs</td></tr>
<tr><td>1</td><td>1</td><td>6.4μs</td></tr>
</table>
<table>
<tr><th>Bit6</th><th>Bit5</th><th>Command Pulse Format</th></tr>
<tr><td>1</td><td>0</td><td>Direction + Pulse</td></tr>
</table>
Switch of Digital Filter
<table>
<tr><td>0</td><td>High Speed</td></tr>
<tr><td>1</td><td>Low Speed (1/4)</td></tr>
</table>
</td></tr>
<tr><td>4-3</td><td>TYPE</td><td colspan="3">Control mode:
*Select one control mode from position, velocity, and torque modes.
<table>
<tr><th>Selection Item</th><th>Content</th></tr>
<tr><td>Position</td><td>Position control mode</td></tr>
<tr><td>Velocity</td><td>Velocity control mode</td></tr>
<tr><td>Torque</td><td>Torque control mode</td></tr>
<tr><td>Velo ↔Torq</td><td>Velocity ↔ Torque switch mode</td></tr>
<tr><td>Posi ↔Torq</td><td>Position ↔Torque switch mode</td></tr>
<tr><td>Posi ↔Velo</td><td>Position ↔Velocity switch mode</td></tr>
</table>
Referring to the switch type, the requisite control mode can be selected from pin 36 or 35 of the CN1. Func3, set Bit7 as 0: pin 36 is enabled.
set Bit7 as 1:pin 35 is enabled.
$ $ $: standard value varies with the reset setup (leave factory setting).</td><td>6 types</td><td>Our system selects position control mode.</td></tr>
</table>

5.3.12. Parameter Setting of SANYO R Servo Driver

Para. No.	Parameter Name	Set Value	Remarks
Group 0, parameter setting of tuning mode			
00	Setting of the tuning mode	00	Set as auto tuning mode
Group 8, setting of the control parameters			
00	Polarity of position input	00	Position command mode: forward rotation effective
11	Input command mode	02	Pulse + negative logic
15	Setting of electronic gear	8/5	It depends on the resolution of specific encoder. E.G.: incremental encoder 2000, the motor needs 2000 ×4=8000 pulses per circle. When pulse equivalent of Weihong control card is 0.001mm/p, it needs 1000 pulses to move 1mm along line, in other words, if the screw pitch is 5, so, to move 5mm along line needs 5000 pulses, so F=8000/5000=8/5.
Group 9, setting of function effective			
05	Servo ON selection	02	Select servo ON state.
02	Servo alarm elimination	10	Make the function of servo alarm effective
Setting of the system parameters			
02	Encoder selection	00	Standard incremental encoder. The parameter depends on specific situation, what we list is only a representative one.
03	Encoder resolution	2000	500－65535, set the encoder resolution manually.
08	Control mode selection	02	Select position control mode.

5.3.13. Parameter Setting of SANYO Q Servo Driver

Para. No.	Parameter Name	Set Value	Remarks
Group 1			
GER1	Electronic gear ratio 1	1/1	It sets electronic gear ratio for position command pulse. E.G., incremental encoder 2000, the motor needs 2000 ×4=8000 pulses per circle. When pulse equivalent of Weihong control card is 0.001mm/p, it needs 1000 pulses to move 1mm along line, in other words, if the screw pitch is 5, so, to move 5mm along line needs 5000 pulses, so F=8000/5000=8/5.
GER2	Electronic gear ratio 2	1/1	This setting is the same as that of electronic gear ratio 1 and activated during electronic gear switching.
Group 4			
PA400	Command pulse selection	00H	Set position command pulse as “pulse + direction”.
Group 8			
S-ON	Servo ON	02H	Select servo ON state.
AL-RST	Alarm reset	10H	Make the function of servo alarm effective
Setting of the system parameters			
01	Encoder selection	00	Standard incremental encoder. The parameter depends on specific situation, what we list is only a representative one.
03	Incremental encoder resolution	2000	500－65535, set the encoder resolution manually.
08	Control mode selection	02	Select position control mode

5.3.14. Parameter Setting of KT270 Servo Driver

Para. No.	Parameter Name	Value	Description
PA4	Control mode selection	0	The control mode of the driver can be set through this parameter: 0: position control mode; 1: speed control mode; 2: trial run control mode; 3: JOG control mode.
PA12	Numerator of position command pulse ratio	2	Set the ratio of position command pulse (electronic gear). Under position control mode, with the setting of the PA12 and PA13, it is convenient to match with pulse source of each type, which can reach users' perfect control resolution (that is angle/pulse) Expression: $P \times G = N \times C \times 4$ P: pulse amount of the input command; G: electronic gear ratio, G=ratio numerator / ratio denominator. N: circle number that the motor rotates; C: each circle line number of photoelectric encoder, C of our system =2500. E.G.: input command pulse with number of 6000 to make the servo motor rotate one circle, $G = \frac{N \times C \times 4}{P} = \frac{1 \times 2500 \times 4}{6000} = \frac{5}{3}$ So set PA12 as 5 and PA13 as 3. The recommended range of electronic gear ratio is: $\frac{1}{50} \le G \le 50$
PA13	Denominator of position command pulse ratio	1	Refer to parameter PA12.
PA14	Input mode of the position command pulse	0	Set the input mode of the position command pulse; there are three following modes which can be selected by setting the parameter: 0: pulse + symbol; 1: forward rotation pulse/reverse rotation pulse; 2: two orthogonal pulses inputs The setting of our system is "0": pulse + sign, negative logic.
PA20	Invalid input on the end of the stroke	1	0: Valid stroke end of LSP, LSN forward rotation, reverse rotation. When switch LSP is connected, driving of the forward rotation is allowed; When switch LSP is disconnected, driving of the forward rotation is prohibited (torque of the forward direction is 0). LSN is the same as LSP. If LSP and

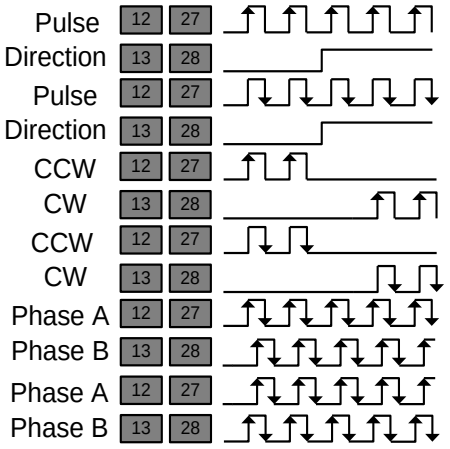
Para. No.	Parameter Name	Value	Description
			LSN are both disconnected, the abnormal alarming of driving prohibited will occur (NO.7). 1: Invalid stroke end of LSP, LSN forward rotation, reverse rotation. No matter which state of the switch LSP and LSN is in, driving of forward rotation and reverse rotation are both allowed. Simultaneously, even if LSP and LSN are both disconnected, abnormal alarming of driving prohibited will not occur (NO.7). 2: Invalid stroke end of LSP, LSN forward rotation, reverse rotation, and SON is forced to be effective. (Note: SON forcedly effective is only used for motor debugging. In normal use, we suggest controlling the state of SON by input port.) 3: Valid stroke end of LSP, LSN forward rotation, reverse rotation. When switch LSP is connected, driving of the forward rotation is allowed; When switch LSP is disconnected, driving of the forward rotation is prohibited (the speed of forward direction is 0, but the torque is not 0). LSN is the same as LSP. When LSP and LSN are both disconnected, abnormal alarming of driving prohibited will not occur (NO.7).

5.3.15. Parameter Setting of FUJI FALDIC-β Servo Driver

Para. No.	Name	Value	Description
01	Command pulse numerator α	Need calculation 1~32767	Command pulse numerator and denominator are equal to those of the electronic gear ratio. α/ β=encoder resolution× pulse equivalent× mechanical deceleration ratio / screw pitch. Typical value: encoder resolution 65536, pitch 5mm, pulse equivalent 0.001, mechanical deceleration ratio 1, α / β=65536×0.001 / 5=8192 / 625, So α=8192, β=625.
02	Command pulse denominator β	Need calculation 1~32767	
03	Pulse string input form	0	Set the input mode of pulse string as: instruction + symbol, that is 'pulse + direction'.
04	Direction of rotation switch	0 or 1	Set 0: Positive direction: Forward rotation (CCW) Set1: Positive direction: Reverse rotation (CW)
10	CONT1 signal distribution	1	CONT1 is distributed as RUN (i.e. SON); if not distributed, CONT1 will be auto ON if there is no alarming when powered.
11	CONT2 signal distribution	2	CONT2 is distributed as RST (i.e. servo alarming clearance CLR). When 12, 13, 14 are 0, that is CONT3, CONT4 and CONT5 can't be distributed as OT over-travel or EMG (external emergency stop).
15	OUT1 signal distribution	1	Set 1, OUT1 is distributed as a-contact point of alarming output; Set 2, OUT1 is distributed as b-contact point of alarming detection.
27	Parameter write-protection	0 or 1	Set 0, write-enable. Set 1, write-protected.
74	CONT always ON 1	1	Initial value: 0. when set "1", servo is activated (RUN).

5.3.16. Parameter Setting of STONE GS Servo Driver

<table>
<tr><th>Para. No.</th><th>Para. Name</th><th>Value</th><th>Description</th></tr>
<tr><td>F0f</td><td>Electronic gear ratio numerator</td><td>2</td><td rowspan="2">Electronic gear ratio of position mode: 4× pulse frequency fed back by servo encoder = command pulse frequency× F0f / F10; value of F0f / F10 must be within 1/100~100. (calculation with pitch 10mm)</td></tr>
<tr><td>F10</td><td>Electronic gear ratio denominator</td><td>1</td></tr>
<tr><td>F00</td><td>Control mode selection</td><td>2</td><td>0: External speed running mode; make sure the value and direction of motor speed according to the external analog -10V ~ +10V signal of CN2-16, 17;
1: Internal speed running mode; make sure the value and direction of motor speed according to the setting of parameter F33, F35, F37, F39 and the port status of CN2-9, CN2-25;
2: Position pulse running mode; accept the input of external position pulse and direction level signal;
3: Jog mode; make sure the motor speed in terms of parameter setting of F3b, and control the rotation direction by the direction keystroke ▼ and ▲;
4: Torque mode; make sure the value and direction of motor torque according to the external analog -10V ~ +10V signal of CN2-43, 1;
5~10: Mixed mode; select mode according to the port input status of CN2-24:
<table>
<tr><th rowspan="2">F00 Value</th><th colspan="2">CN2-24 Interface Status</th></tr>
<tr><th>OFF (Mode One)</th><th>ON (Mode Two)</th></tr>
<tr><td>5</td><td>Position Pulse Mode</td><td>External Speed Running Mode</td></tr>
<tr><td>6</td><td>Position Pulse Mode</td><td>Internal Speed Running Mode</td></tr>
<tr><td>7</td><td>Position Pulse Mode</td><td>Torque Mode</td></tr>
<tr><td>8</td><td>Internal Speed Running Mode</td><td>External Speed Running Mode</td></tr>
<tr><td>9</td><td>Internal Speed Running Mode</td><td>Torque Mode</td></tr>
<tr><td>10</td><td>External Speed Running Mode</td><td>Torque Mode</td></tr>
</table>
</td></tr>
</table>

Para. No.	Para. Name	Value	Description
F2e	Pulse input mode selection	2	Command pulse string mode selection of position mode: 1 – Single pulse train positive logic 2 – Single pulse train negative logic 3 – Double pulse train positive logic 4 – Double pulse train negative logic 5 – Orthogonal pulse positive logic 6 – Orthogonal pulse negative logic 

5.3.17. Parameter Setting of TECO TSDA Servo Driver

<table>
<tr><th>Para. No.</th><th>Function</th><th>Value</th><th colspan="3">Description</th></tr>
<tr><td rowspan="8">Pn010-1</td><td rowspan="8">Set control mode</td><td rowspan="8">1</td><td rowspan="2">Value</td><td colspan="2">Control mode</td></tr>
<tr><td>CN1 Pin12 open circuit</td><td>CN1 Pin12 closed circuit</td></tr>
<tr><td>0</td><td>Speed control</td><td>Speed control</td></tr>
<tr><td>1</td><td>Position control</td><td>Position control</td></tr>
<tr><td>2</td><td>Torque control</td><td>Torque control</td></tr>
<tr><td>3</td><td>Speed control</td><td>Speed control</td></tr>
<tr><td>4</td><td>Position control</td><td>Position control</td></tr>
<tr><td>5</td><td>Torque control</td><td>Torque control</td></tr>
<tr><td rowspan="4">Pn010-2</td><td rowspan="4">Set the pulse input format under position control mode</td><td rowspan="4">0</td><td>Value</td><td colspan="2">The format of pulse input</td></tr>
<tr><td>0</td><td colspan="2">Pulse + direction</td></tr>
<tr><td>1</td><td colspan="2">Dipulse</td></tr>
<tr><td>2</td><td colspan="2">A/B phase difference</td></tr>
<tr><td rowspan="3">Pn010-3</td><td rowspan="3">Set rotation direction of motor</td><td rowspan="3">1</td><td>Value</td><td colspan="2">Function</td></tr>
<tr><td>0</td><td colspan="2">Motor rotates anti-clockwise with the input of positive command.</td></tr>
<tr><td>1</td><td colspan="2">Motor rotates clockwise with the input of positive command.</td></tr>
<tr><td>Pn021</td><td>Electronic gear ratio numerator</td><td>5</td><td colspan="3">The input pulse amount will be multiplied with this number before output. Ratio range of parameter 21 to 22:
1/127＜parameter 21/ parameter 22＜127</td></tr>
<tr><td>Pn022</td><td>Electronic gear ratio denominator</td><td>1</td><td colspan="3">The input pulse amount will be multiplied with this number before output. Ratio range of parameter 21 to 22:
1/127＜parameter 21/ parameter 22＜127</td></tr>
<tr><td rowspan="3">Pn011-4</td><td rowspan="3">Set the value of Pin20 of CN1</td><td rowspan="3">1</td><td>Value</td><td colspan="2">Function</td></tr>
<tr><td>0</td><td colspan="2">Output of “0” speed signal</td></tr>
<tr><td>1</td><td colspan="2">Output of brake signal</td></tr>
<tr><td>Pn013-1</td><td>Set the maximum pulse frequency received by the driver under position control mode</td><td>7</td><td colspan="3">It can correct the phenomenon of unauthorized over-travel. 7 means frequency received is 200Kpps.</td></tr>
</table>

CAUTION

For parameter setting of driver of various brands, refer to the specific driver manual.

5.4. Wiring Diagram of Driver and Terminal Board

Wiring diagrams in the following chapters are the wiring diagrams of control system-axes control-driver motion. When users want to use one axis to control the motion of two drivers, the wiring diagram is as shown in Figure 2 in Chapter 5.4.1 and Figure 4 in Chapter 5.4.6 (take YASKAWA driver and DELTA driver as an example; for YASKAWA server, its alarm signal wiring is NC type, while for DELTA server, its alarm signal wiring is NO type).

5.4.1. Wiring with WISE Servo Driver

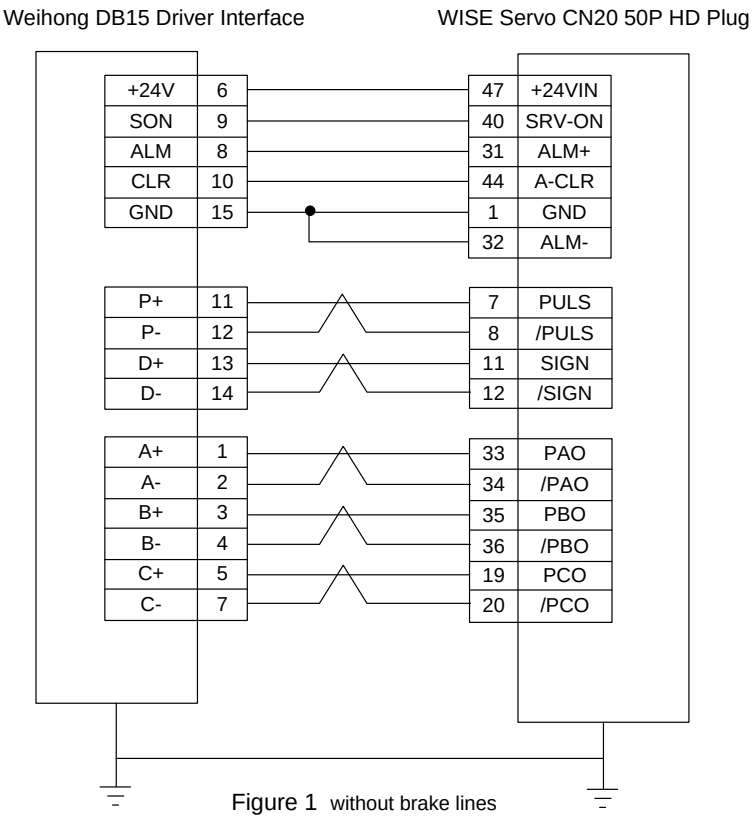


Figure 1 without brake lines

Note: twisted pair for differential signals

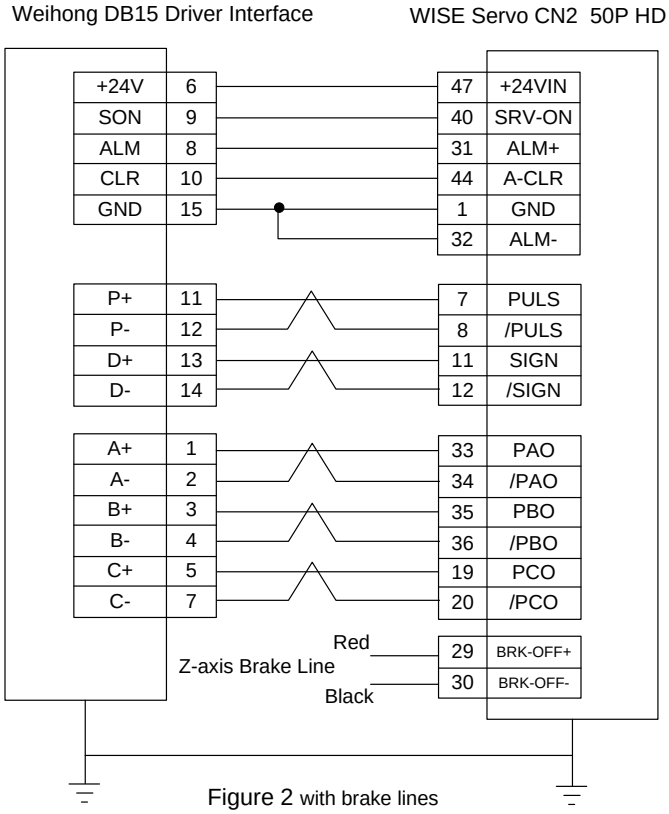


Figure 2 with brake lines

Note: twisted pair for differential signals.

5.4.2. Wiring with YASKAWA AC Servo Driver

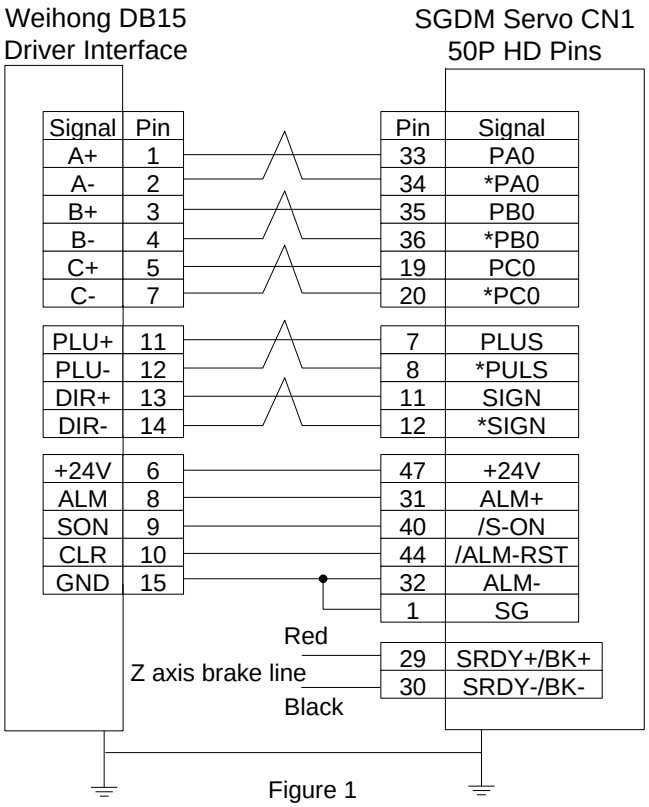


Figure 1

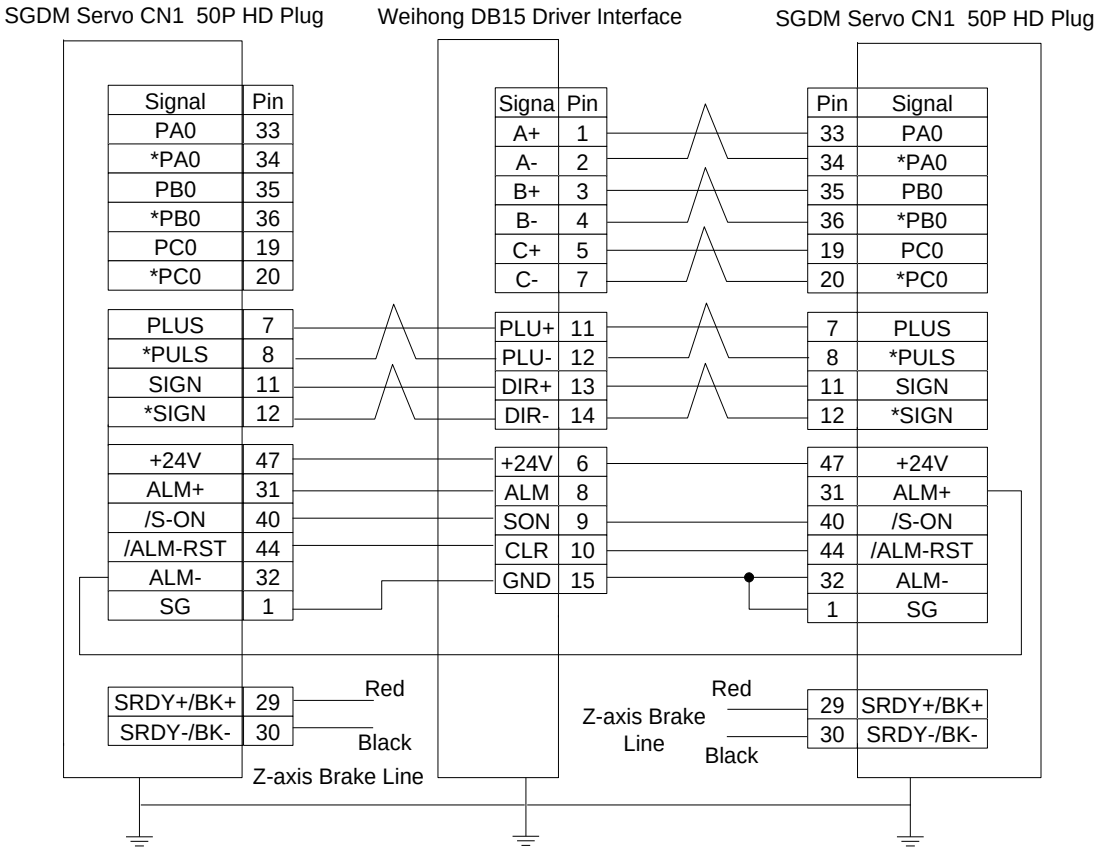
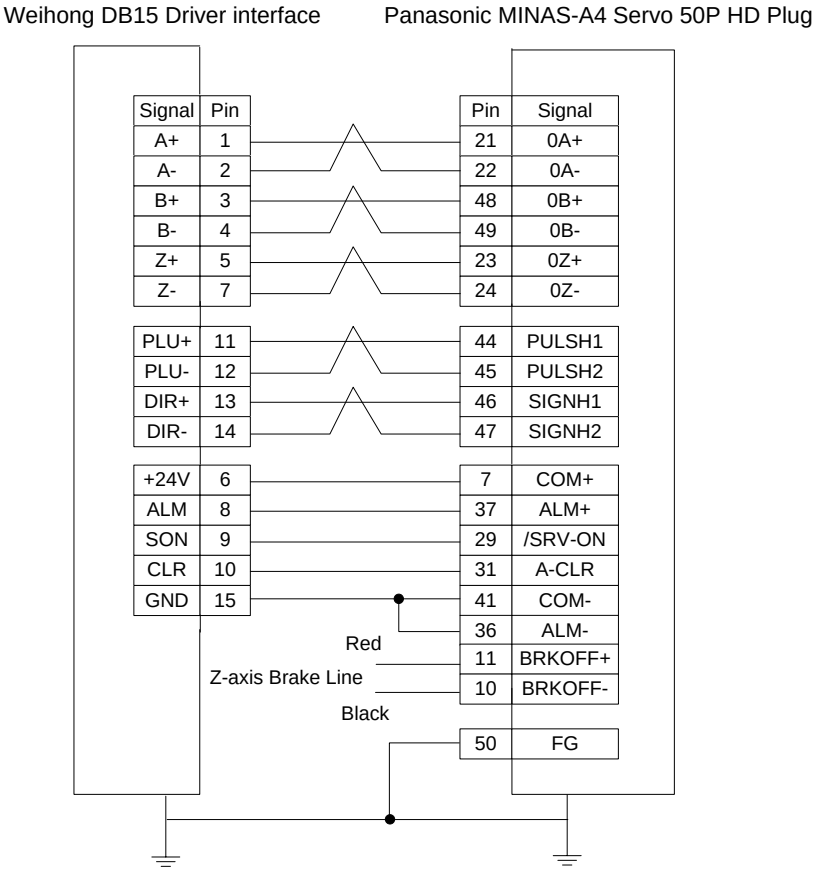

SGDM Servo CN1 50P HD Plug
Weihong DB15 Driver Interface
SGDM Servo CN1 50P HD Plug
Signal
Pin
PA0 33
*PA0 34
PB0 35
*PB0 36
PC0 19
*PC0 20
PLUS 7
*PULS 8
SIGN 11
*SIGN 12
+24V 47
ALM+ 31
/S-ON 40
/ALM-RST 44
ALM- 32
SG 1
SRDY+/BK+ 29
SRDY-/BK- 30
Red
Black
Z-axis Brake Line
Signa
Pin
A+ 1
A- 2
B+ 3
B- 4
C+ 5
C- 7
PLU+ 11
PLU- 12
DIR+ 13
DIR- 14
+24V 6
ALM 8
SON 9
CLR 10
GND 15
Pin
Signal
33 PA0
34 *PA0
35 PB0
36 *PB0
19 PC0
20 *PC0
7 PLUS
8 *PULS
11 SIGN
12 *SIGN
47 +24V
31 ALM+
40 /S-ON
44 /ALM-RST
32 ALM-
1 SG
29 SRDY+/BK+
30 SRDY-/BK-
Red
Z-axis Brake Line
Black

Figure 2

5.4.3. Wiring with PANASONIC AC Servo Driver



5.4.4. Wring with MITSUBISHI MR-JE Servo Driver

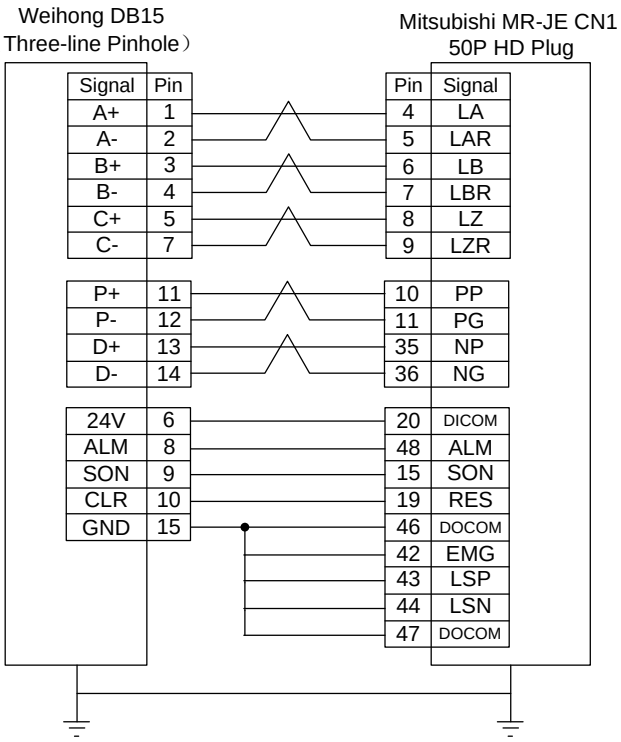


Figure 1 without brake lines

Note: twisted pair for differential signals.

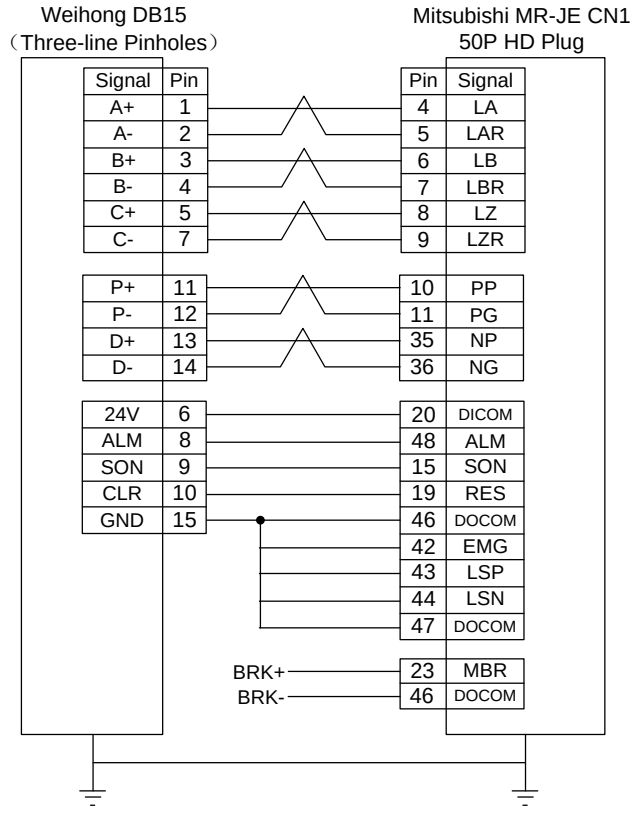
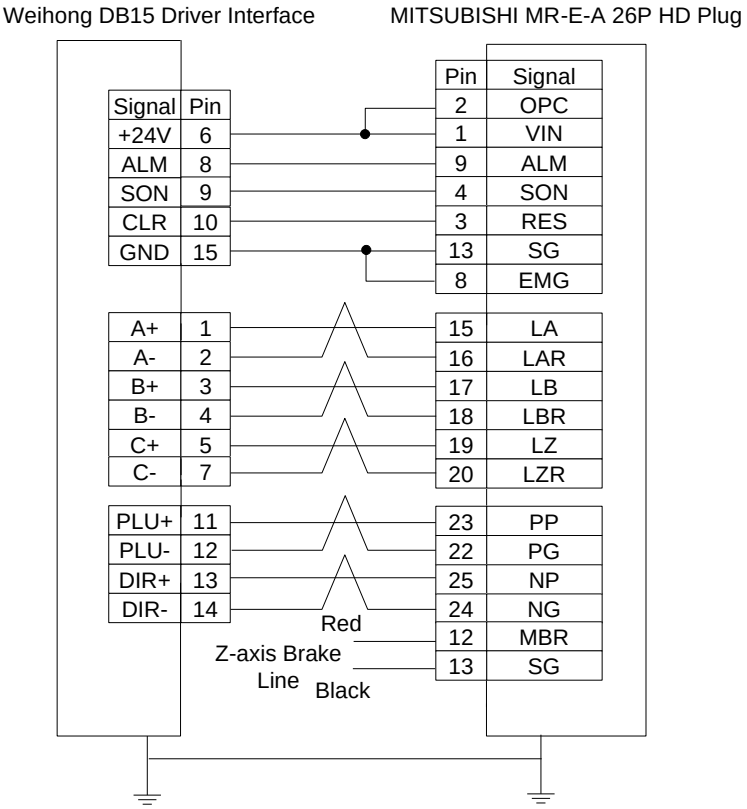


Figure 2 with brake lines

Note: twisted pair for differential signals.

5.4.5. Wiring with MITSUBISHI MR-E Servo Driver



5.4.6. Wiring with DELTA Servo Driver

DELTA ASDA-A, ASDA-A2 and ASDA-AB use the same cable. Among them, the wiring pins of ASDA-A2 and ASDA-AB are totally the same. As for ASDA-A, with PULSE as 41 and /PULSE as 43, its position command pulse signal pins are opposite to those of ASDA-A2 and ASDA-AB, but the other wiring pins are totally the same. For the detailed parameters settings, see Chapter 5.3.7 and Chapter 5.3.9.

Weihong DB15 Driver Interface　　DELTA ASDA-A Servo 50P

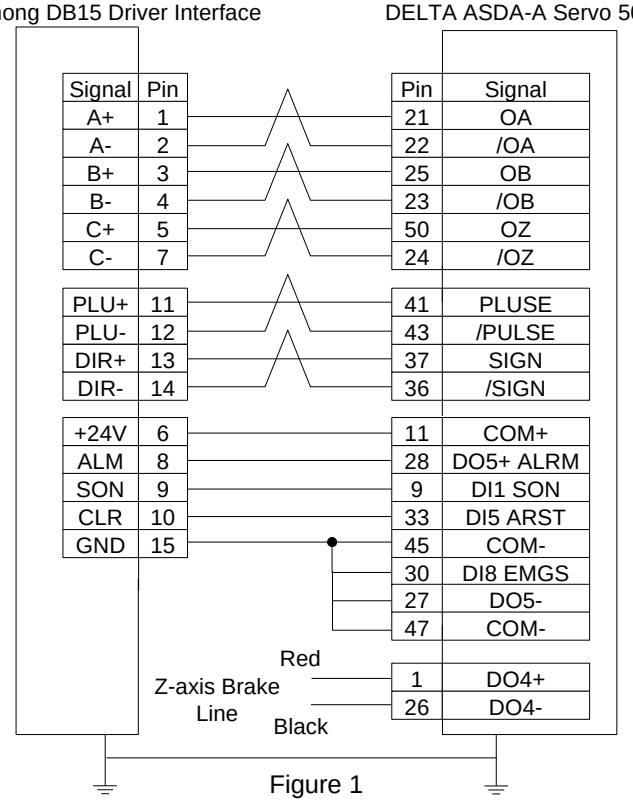


Figure 1

Weihong DB15 Driver Interface　　DELTA ASDA-B DB25 (Two-line Pinholes)

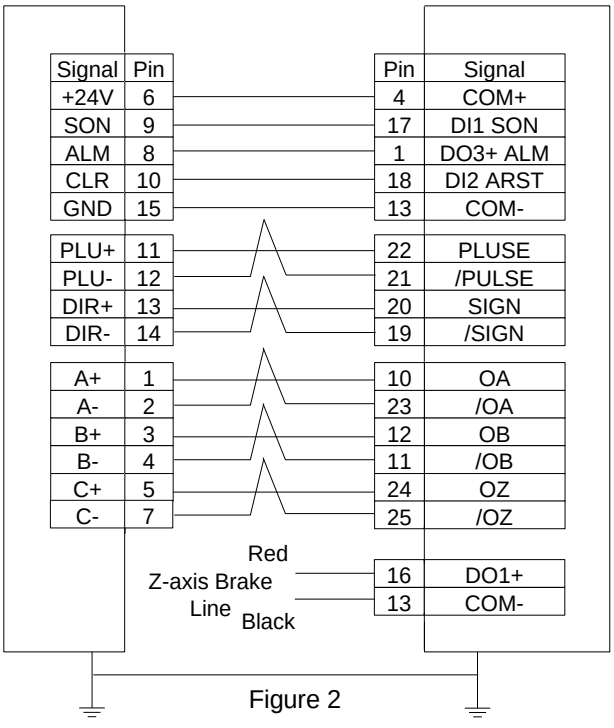


Figure 2

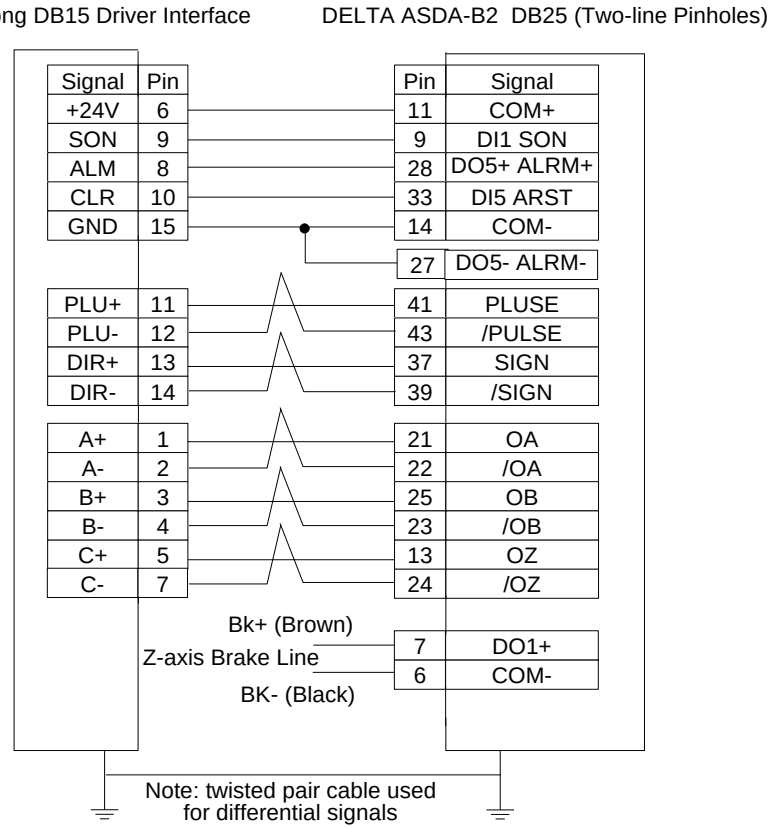


Figure 3

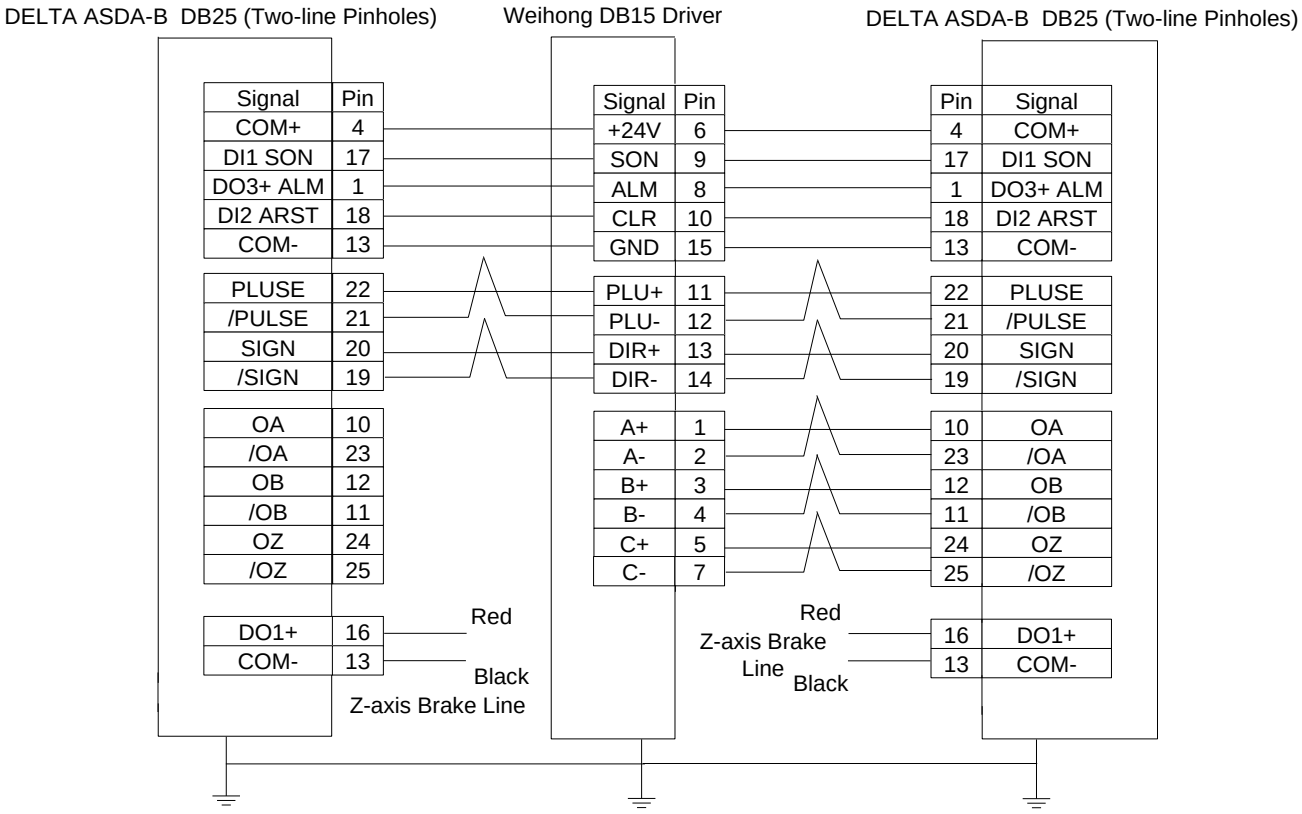
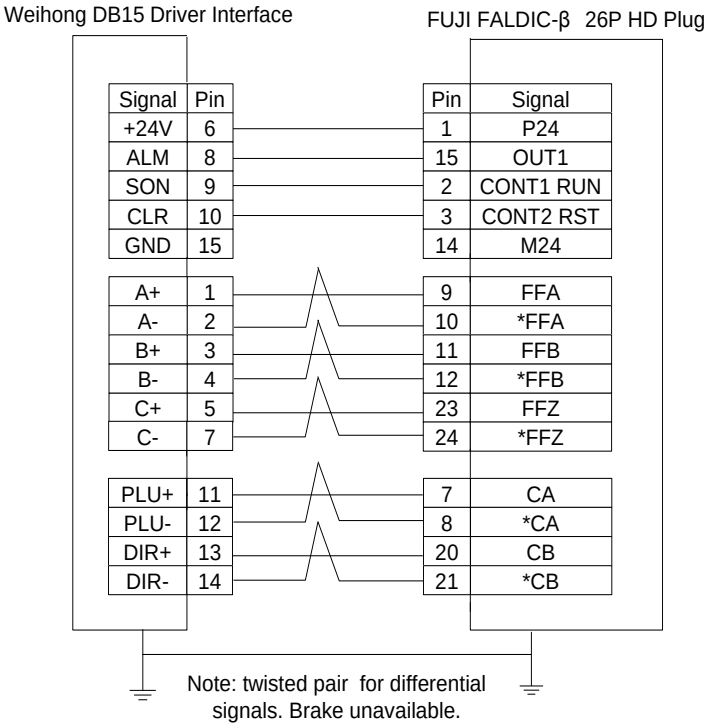
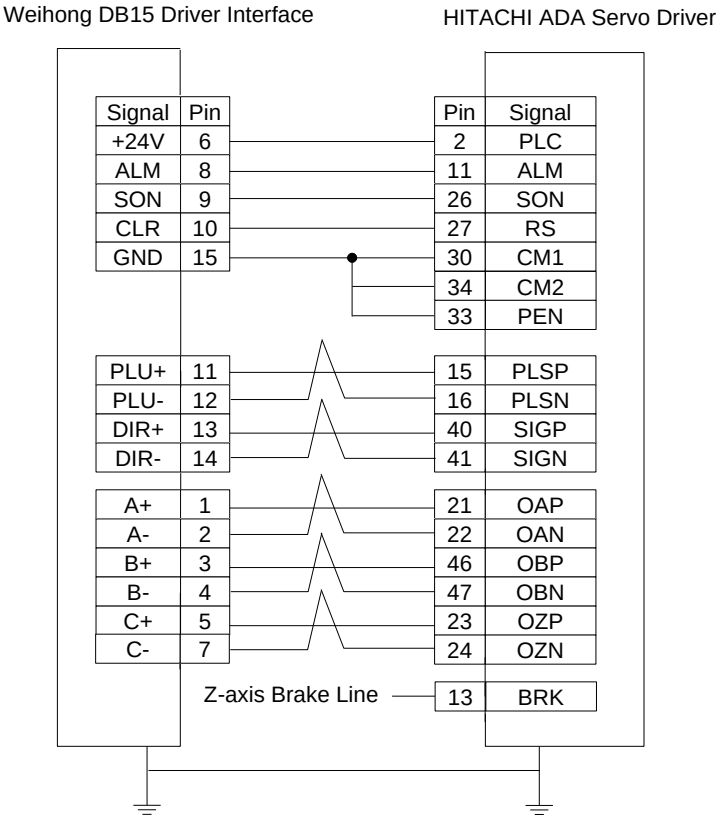


Figure 4

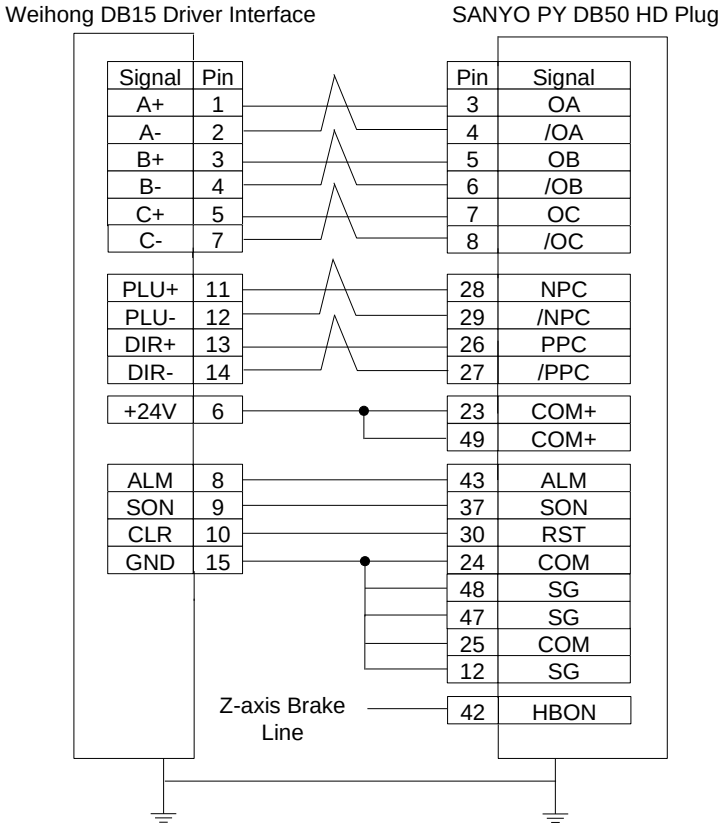
5.4.7. Wiring with FUJI Servo Driver



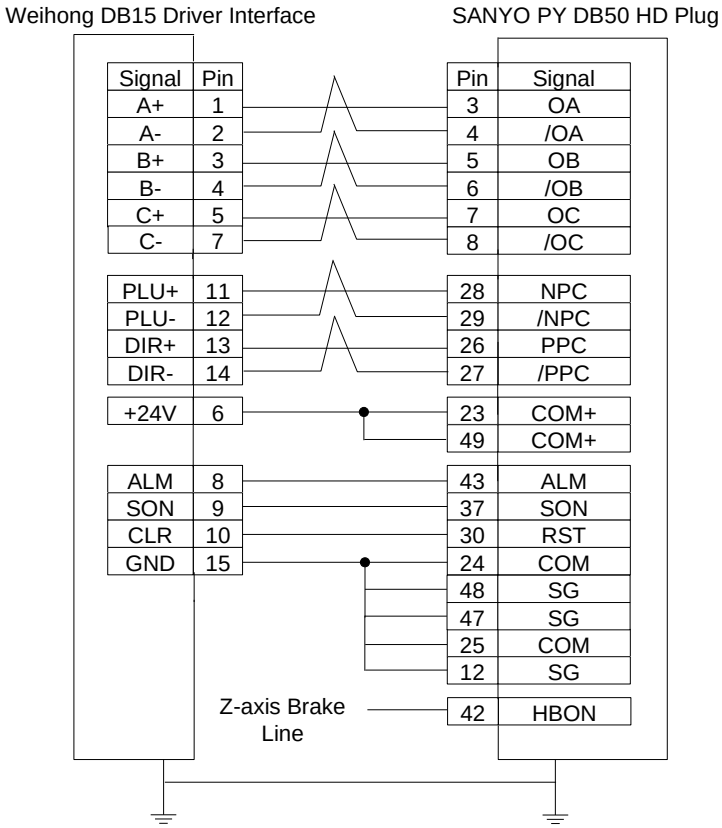
5.4.8. Wiring with HITACHI Servo Driver



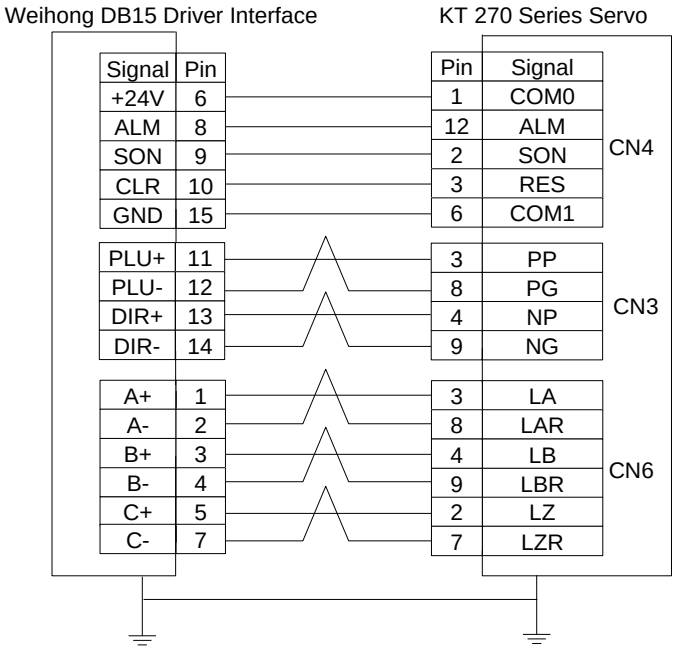
5.4.9. Wiring with SANYO PY Servo Driver



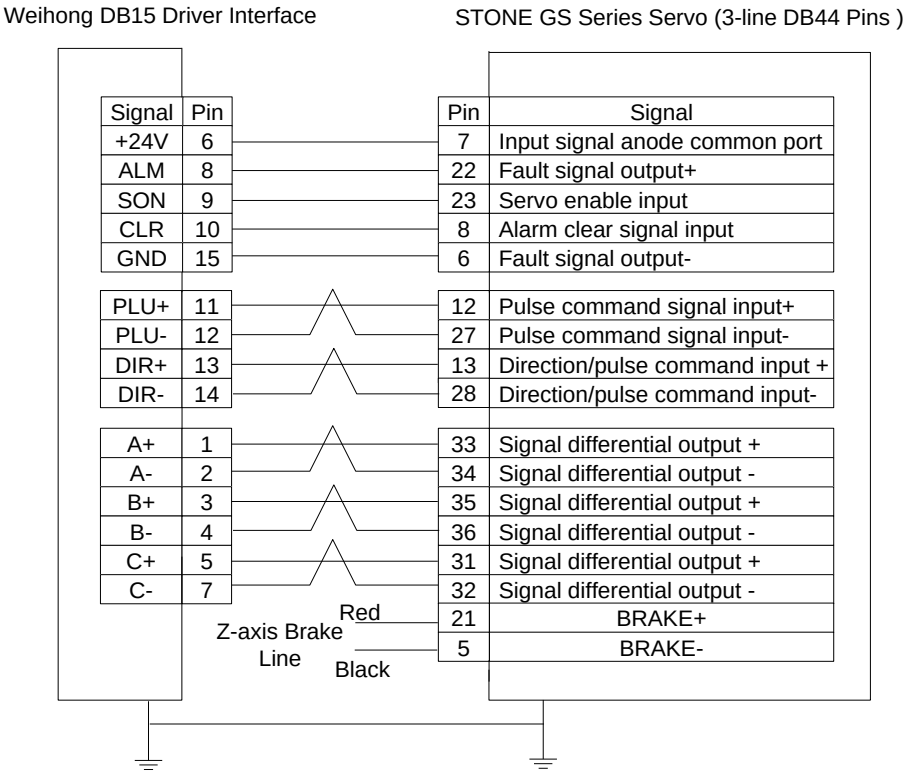
5.4.10. Wiring with SANYO R Servo Driver



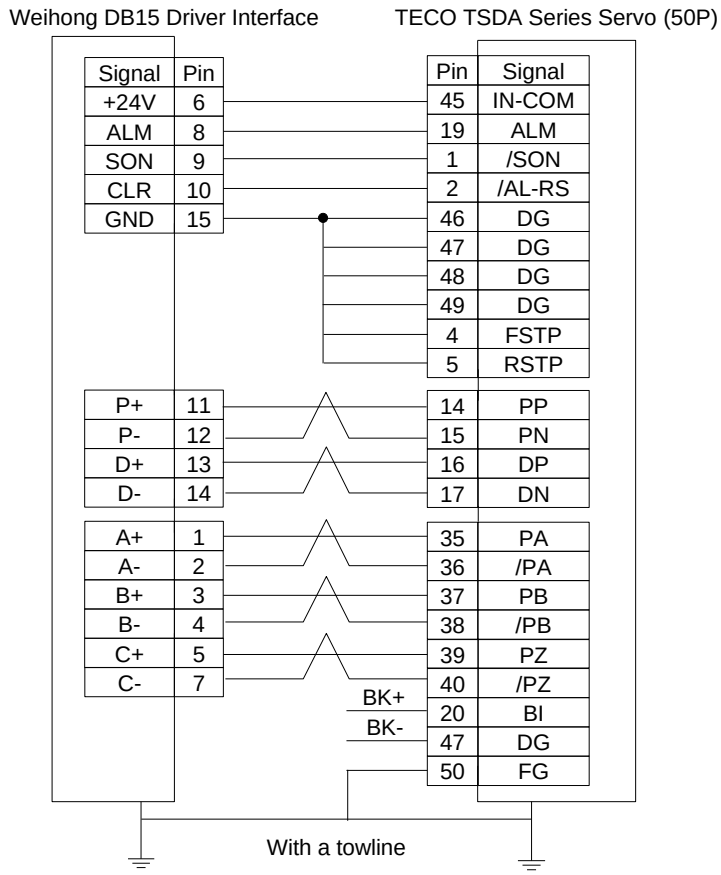
5.4.11. Wiring with KT270 Servo Driver



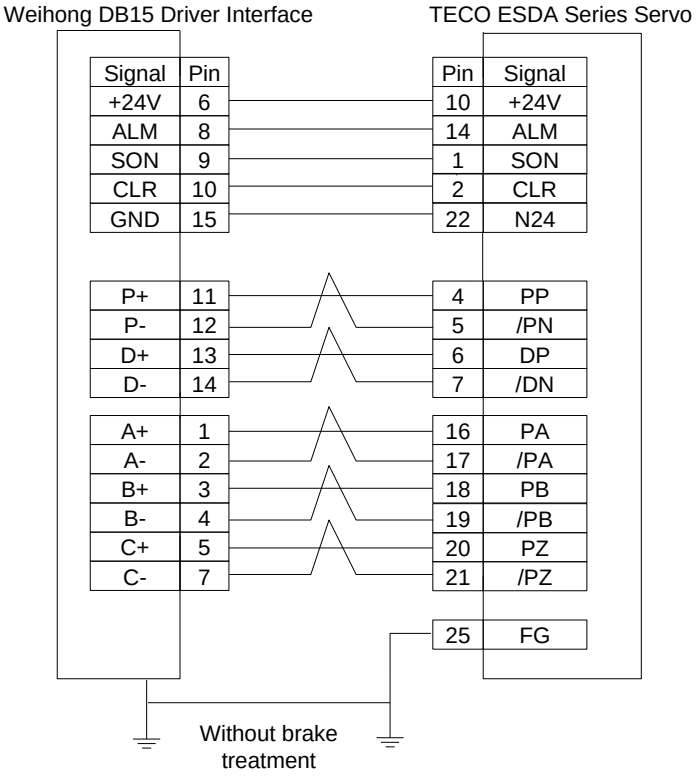
5.4.12. Wiring with STONE GS Servo Driver



5.4.13. Wiring with TECO TSDA Servo Driver



5.4.14. Wiring with TECO ESDA Servo Driver



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