

Installation

FSCUT4000E User Manual

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Ver 1.0



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Chapter 1 Overview

1.1 Introduction

FSCUT4000E is a cost-effective CNC system dedicated to laser cutting. It is based on EtherCAT bus technology and capable of motion control, laser control, and cutting gas control. It is common used in sheet metal, kitchen ware, lamps and such industries. This user manual is only for installation guidance.

1.2 System Diagram

FSCUT4000E includes the bus BMC228X Control Card, the bus IO board, and the bus height controller, among which the BMC228X control card integrates the EtherCAT master protocol stack.

The network cable is led out from the network port of BMC228X and connected to the BLT cutting head. The wiring diagram is shown in Figure 1.

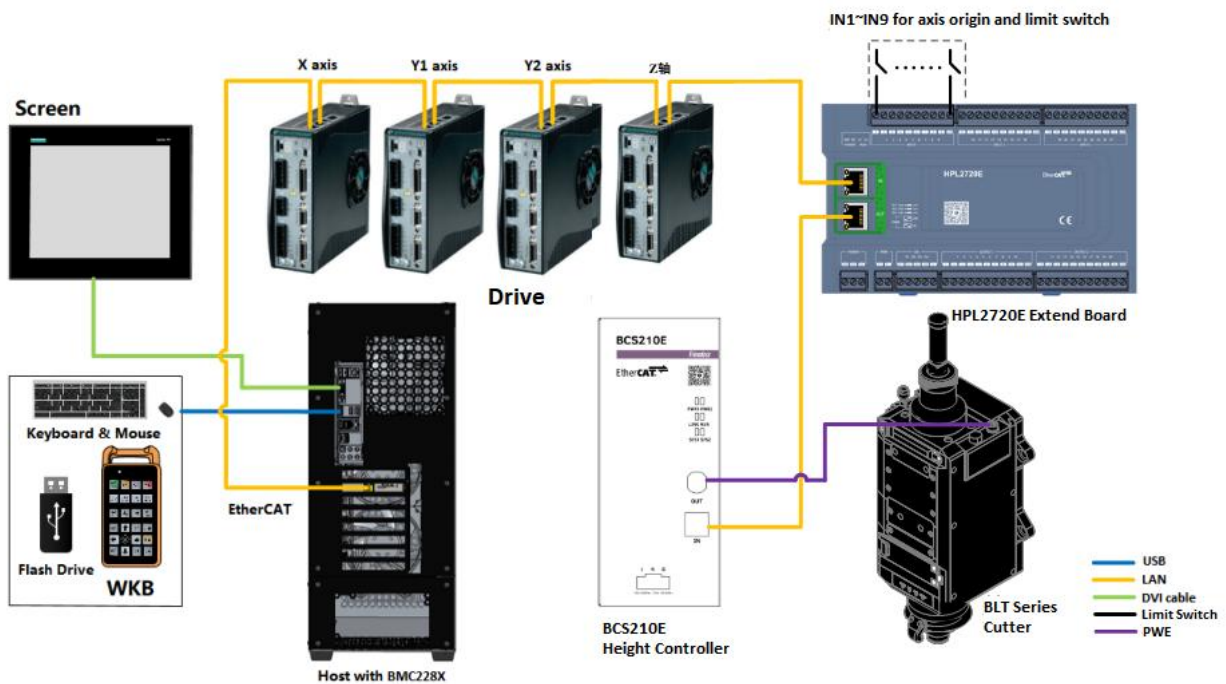


Figure 1 Wiring diagram of FSCUT4000E - BLT cutter

The wiring diagram of other cutting head is shown in Figure 2.

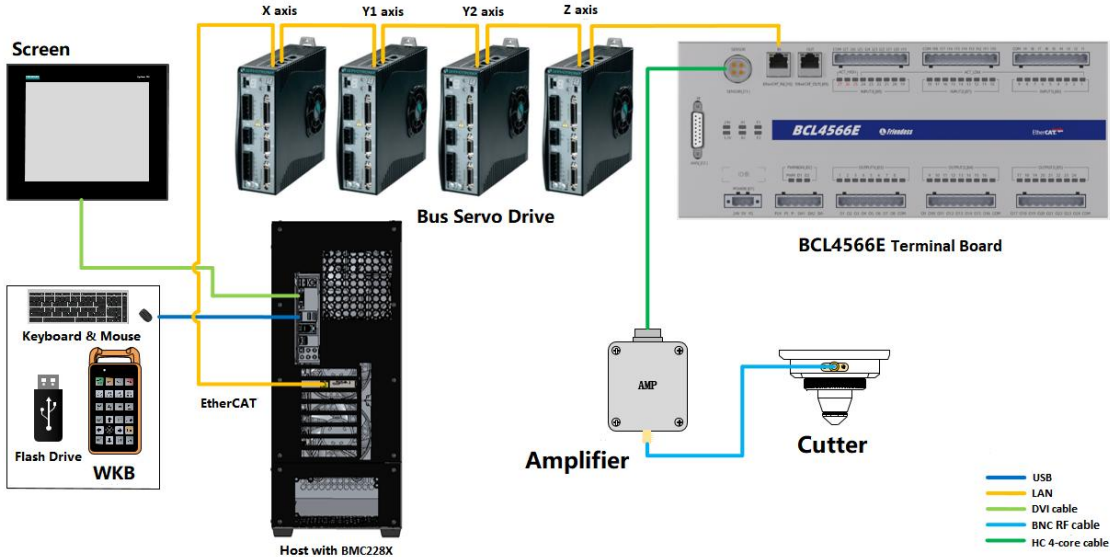


Figure 1 Wiring diagram of FSCUT4000E - other cutter



1.3 Product Details

FSCUT4000E bus CNC system includes BMC228X Control Card, BCL4566E terminal board or BCS210E height controller, HPL2720E, WKB V6 and related cables, etc.



| BMC228X Control Card (1) | BCS210E Motion Control (1) | HPL2720E EtherCAT Terminal Board (1) |
|---|---|---|
|  |  |  |
| WKB V6 (1) | LAN-20X-PWE Wire (1) | LAN Cables LAN-0.5X (4) LAN-1X (2) LAN-3X (1) |
|  |  |  |

Table 1-1 FSCUT4000E - BLT cutter details



| | | |
|--|--|---|
| <p>BMC228X Control Card (1)</p> | <p>WKB V6 (1)</p> | <p>BCL4566E Terminal Board (1)</p> |
|  |  |  |
| <p>BNC RF cables (2)</p> | <p>Amplifier (1)</p> | <p>HC 4-core cable (1)</p> |
|  |  |  |
| <p>LAN Cables LAN-0.5X (4) LAN-1X (1) LAN-3X (1)</p> | | |
|  | | |

Table 1-2 FSCUT4000E - other cutter details



Chapter 2 Wiring Instruction

2.1 BMC228X Installation

BMC228X Control Card is a motion control card based on the EtherCAT bus. Its 1.0Ghz main chip provides excellent overall performance and has passed Friendless stringent testing standards.

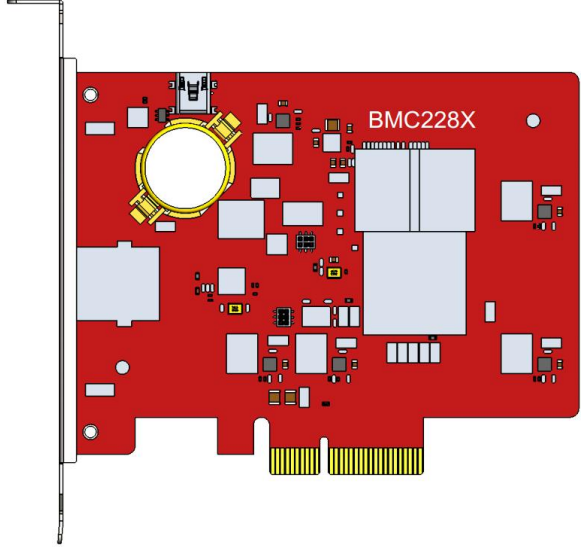
| | |
|---|--|
| BMC228X EtherCAT Control Card |  |
| Bus Protocol | EtherCAT Master Protocol |
| PCI Express | PCI Express2.0 (Gen2) |
| Power Supply | Powered by PCIe motherboard, max 12V/1A, no hot plug |
| Anti-interference Level | ESD 3 (6kV contact, 8kV air), EFT 4 (4kV power supply, 2kV signal), Surge international 2 (2kV AC line, 1kV DC line) |
| Dimension and Weight | |
| Dimension | (L x W x H) 127.6mm x121.0mm x21.45mm |
| Weight | 80g |
| Features | |
| Cooling | Nature Cooling |
| Operating temperature | 0~+60℃ |
| Storage temperature | -20~+70℃ |
| Humidity | 0% to 90% (non-condensation) |
| Certification | CE |
| Environment Requirements | |
| The waterproof and dustproof grade of the Control Card is IP00, unprotected. Please place the computer in a clean, dust-free environment. | |

Table 2-1 BMX228X Technical Data



2.1.1 Dimension Diagram

BMC228X Control Card dimension (mm) is shown in Figure 3.

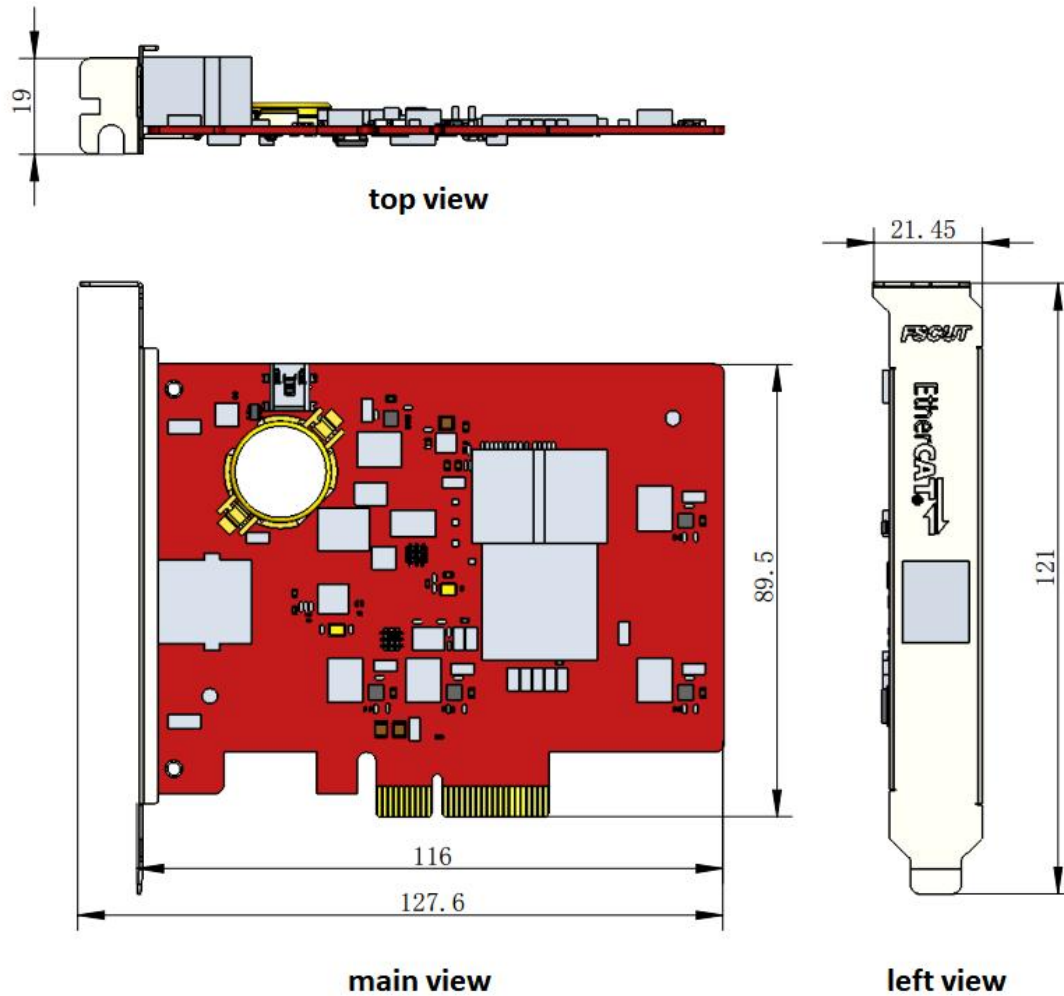


Figure 3 BMC228X Dimension

2.1.2 Installation Diagram

Install BMC228X in the socket of PCIE X4 and up with even force (refer to ②), and secure its blank screw (refer to ①). Be aware of the heat dissipation for BMC228X and keep it away from other cards as far away as possible. Refer to the diagram below.

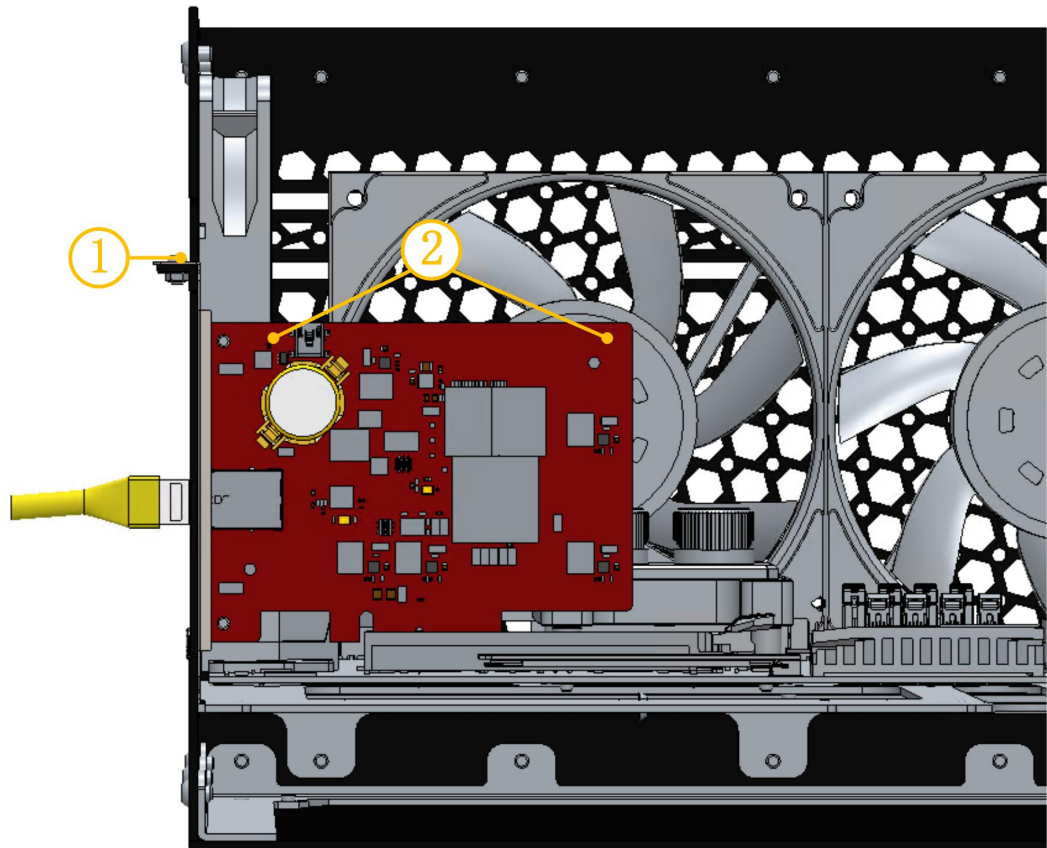


Figure 4 BMC228X Control Card Installation

BMC228X installed is shown below.

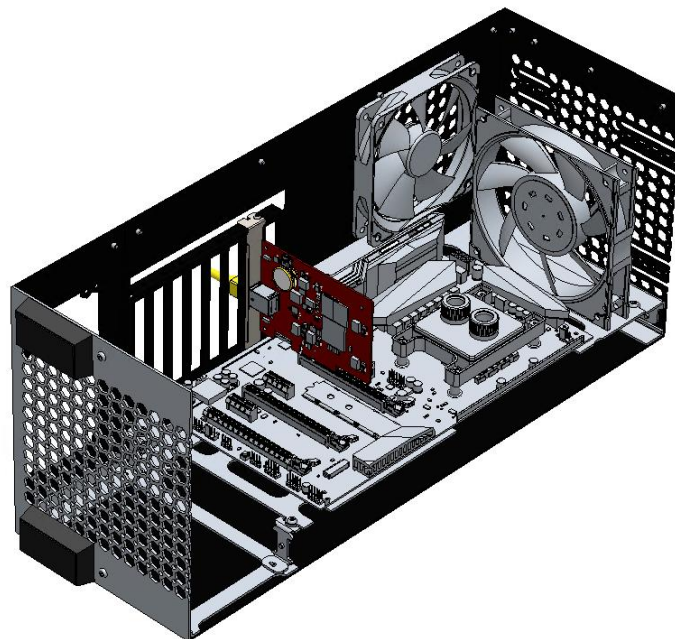
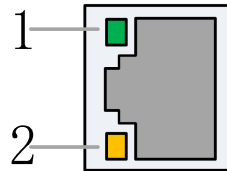


Figure 5 BMC228X Control Card After Installation



2.1.3 Ethernet Terminal

The standard socket of BMC228X is RJ45 that can be used to connect EtherCAT slave devices(servo drives, BCS100E, HPL2720E, etc.)



| Label | Description | LED color | Status | Description |
|----------|---|-----------|---------|---------------------|
| 1: Speed | Ethernet communication connection speed | Green | Off | 10 Mbps connection |
| | | | Solid | 100 Mbps connection |
| 2: Link | Ethernet communication link status | Yellow | Off | No connection |
| | | | Flashes | Communicating |
| | | | Solid | Connected |

Table 2-2 Description of RJ45 connection status



2.1.4 PCIE Socket

BMC228X PCIE socket is X4 (Figure 6①)and can be used for X4, X8, X16. Its PCI Express Protocol standard is V2.0 (Gen2) and the motherboard requirements are as shown in Table 2-3.

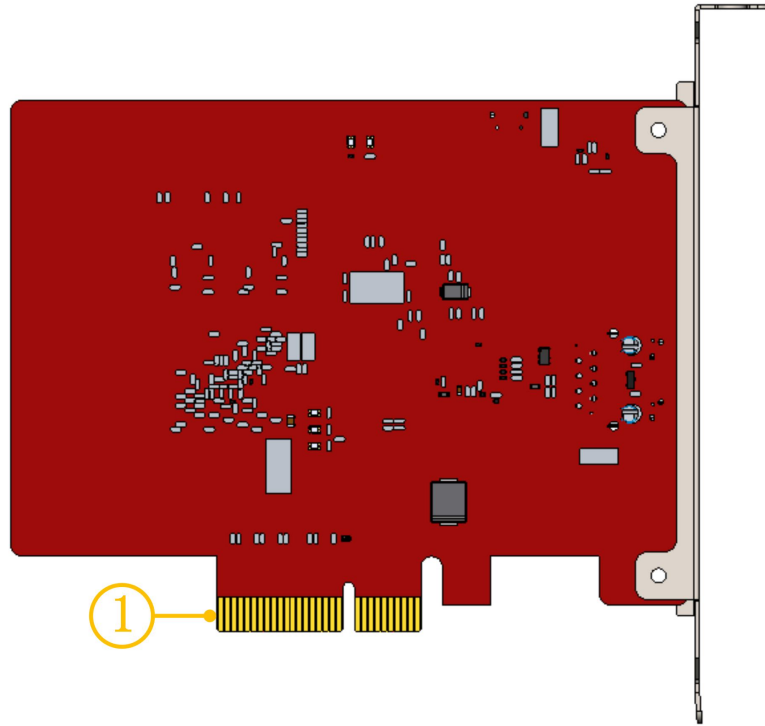


Figure 6 Gold Fingers

| | |
|-------------------------------|------------------------------|
| System | 64-Bit Win7/10 |
| CPU | Intel i3 8100 and up |
| Memory | 4GB and up |
| PCIE Socket | X4 and up |
| PCI Express | PCI Express2.0 (Gen2) and up |
| Motherboard PCIE power supply | 12V/1A and up |

Table 2-3 Motherboard Requirements



2.2 HPL2720E Wiring

HPL2720E is an IO extend board based on the EtherCAT bus, which supports the peripheral resources required by the FSCUT6000 high-power cutting system, as shown in Table 2-4.

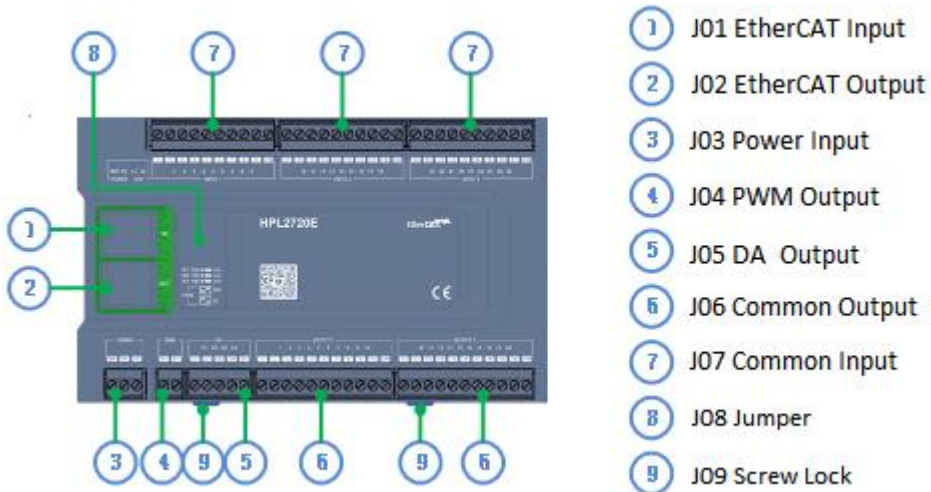
| HPL2720E | | | |
|---------------------|---|--|----------------------------|
| Module | Qty | Description | Note |
| Power Supply | / | 24V DC/5A | |
| PWM | 1 | 24V, $\pm 50\text{kHz}$ 0.3% | Max 50kHz,3% |
| DA | 4 | 0-10V, 12bit, $\pm 20\text{mV}$ | |
| Common Output | 20 | High level 24V output, $\leq 0.7\text{A}$ per channel The total current output $\leq 2.5\text{A}$ | External relay recommended |
| Common Input | 27 | 24V level, active low ($<15.6\text{V}$); IN1~IN3 can be switched to active high ($>5.8\text{V}$) | |
| Working Environment | Temperature: $0\sim 60^{\circ}\text{C}$ | | |
| | Humidity: 10%~90% (no condensation) | | |
| Dimension | 195×118×45.2mm | | |
| Weight | 480g | | |

Table 2-4 HPL2720E Hardware Resources



2.2.1 Interface Layout

The interface layout of the HPL2720E terminals is shown in the figure below.



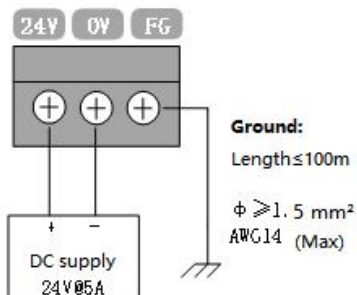
2.2.2 J01 EtherCAT Input Terminal

EtherCAT network cable input interface, standard RJ45 network cable;

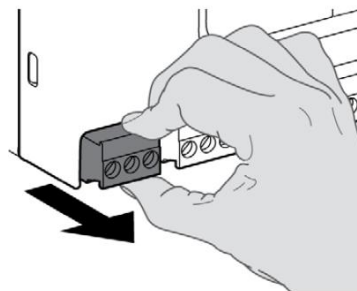
2.2.3 J02 EtherCAT Output Terminal

EtherCAT network cable output interface, standard RJ45 network cable;

2.2.4 J03 Power Input Terminal



How to remove power terminal block:



Notice

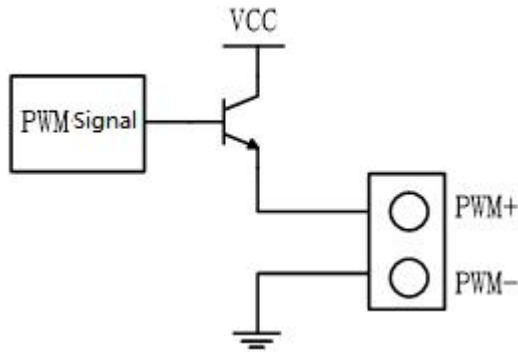
- 24V and 0V are respectively connected to the positive and negative poles of the DC 24V switching power supply; FG needs to be reliably connected to the ground, and the ground wire should be as short and thick as possible.
- All terminals are pluggable only, and disassembly is shown in the right figure above. There is no need to unplug the terminals for wiring.



2.2.5 J04 PWM Output Terminal

HPL2720E has a PWM pulse width modulation signal, which can be used to control the laser power. The PWM signal level is 24V. The duty cycle is continuously adjustable from 0% to 100%, and the max carrier frequency is 50KHz.

The signal output mode is shown in the figure below.



Note: The P+ and P- signals have enabled solid-state relays inside, and no external relays are needed for isolation!



2.2.6 J05 DA Output Terminal

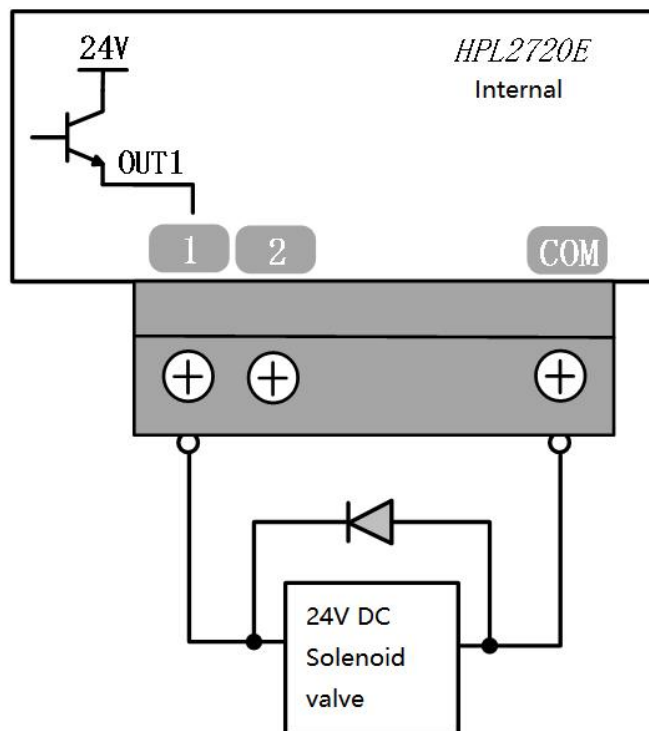
HPL2720E has 4 analog outputs of 0~10V. The four-way DA can be configured as the control signal of the laser peak power and the gas proportional valve through the "Cypfig" that comes with the CypCutE software.

| | |
|----------------|---------|
| Output Signal | 0~10V |
| Maximum Output | 50mA |
| Maximum Error | +/-20mV |
| Resolution | 2.7mV |
| Conversion | 400us |

Table 2-5 DA Output

2.2.7 J06 Common Output Interface

OUT1~OUT20, total 20 high-level 24V outputs In the "Cypfig" that comes with CypCutE, the output port can be configured as "height controller", "laser", "cutting head", "auxiliary gas", "alarm", "pallet changer" and other related controls interface.



Note: Only DC loads can be connected, the output current of each channel must be $\leq 0.7A$, and the total current of the output port must be $\leq 2.5A$, otherwise the short circuit protection will be triggered.

If you need to connect to an AC load, please connect an external relay;



2.2.8 J07 Common Input Interface

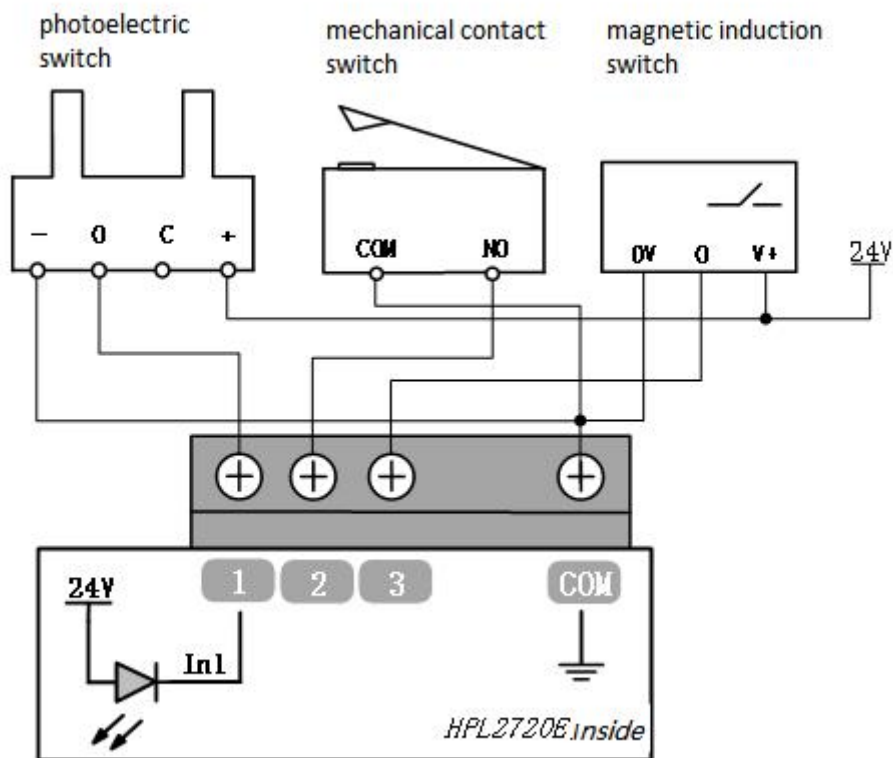
HPL2720E does not set a dedicated input, and each input port can be set as limit/origin signals

The Normally Open and Normally Closed modes of the limit and origin signals can be set in the "Cypfig" that comes with CypCutE. When it is set to NO, the input is valid when the input port is connected to 0V; when it is set to NC, the input is valid when it is disconnected from 0V.

The typical connection of the photoelectric switch is shown in the figure below, and an NPN type 24V photoelectric switch must be used;

The typical connection of mechanical contact switch is shown in the figure below;

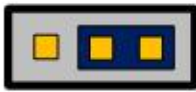
The typical connection of the magnetic induction switch is shown in the figure below, and the NPN type 24V magnetic induction switch must be used;



Among them, IN1~IN3 can adjust the polarity of the effective level through hardware jumpers:



IN1



ACT_LOW

Jumper cap under ACT_LOW:

Input signal, active low (0V valid);



ACT_HIGH

Jumper cap under ACT_HIGH:

Input signal, active high (24V valid)

Default ACT_LOW



2.3 BCL4566E Wiring

The BCL4566E bus height controller uses the EtherCAT bus to control the laser cutting capacitive follower. It is a high-performance capacitive height controller.

| BCL4566E Terminal Board | | |
|-----------------------------------|-----|---|
| Module | Qty | Description |
| Power Supply | / | 24V DC /3.5A |
| DA | 2 | 0-10V, 12bit, ±50mV |
| PWM | 2 | 5V and24V, ±50KHz 0.3% |
| Common Output | 24 | 24V active high 1) The current of single output ≤ 0.7A 2) The current of all outputs ≤ 2.5A |
| Axis | 1 | Pulse digital quantity, PUL±/DIR± output, up to 600KHz |
| Dedicated Input | 27 | IN1-IN24, active low, 0~ 15V IN25-IN27, active high, 24~ 8V |
| Capacitance Sensor | 1 | Capacitance frequency 2Mhz~4Mhz |
| Working Environment | / | Temperature: 0°C~60°C |
| | | Humidity: 10%~90%Rh(no(no condensation)) |
| Dimension | / | 300mm×123×34mm |
| Weight | / | 640g |

Table 2-6 BCL4566E Technical Data



2.3.1 Interface Layout

BCL4566E interface layout of terminals

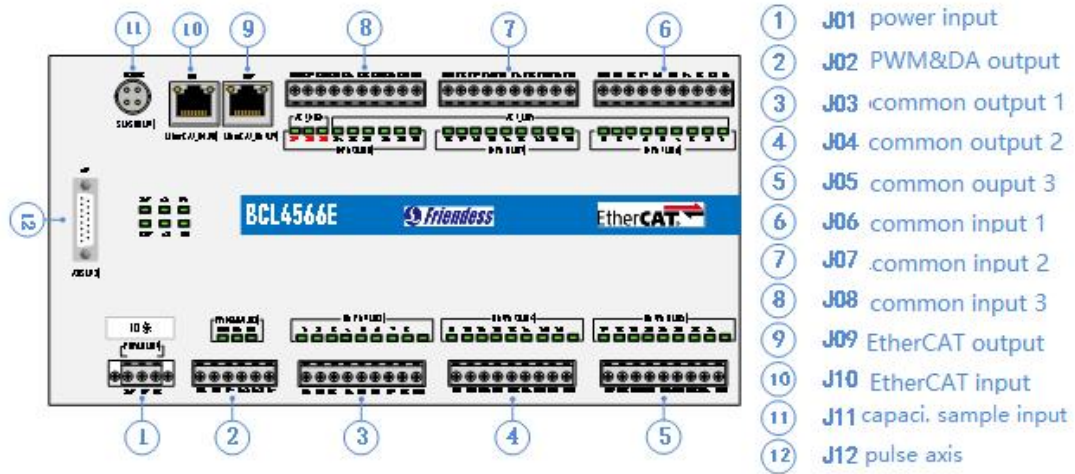


Figure 2.3.1 BCL4566E interface terminals

2.3.2 J01 Power Supply

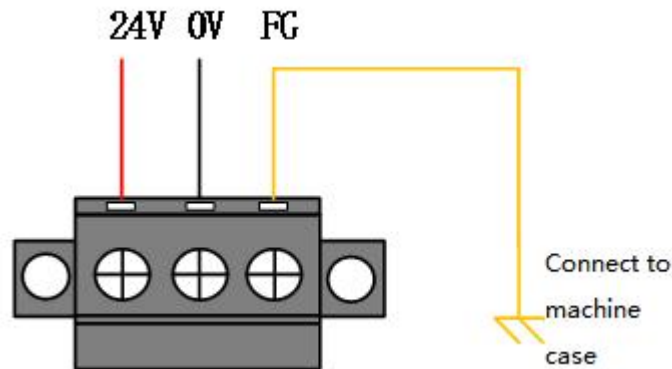


Figure 2.3.2 Power Supply Terminal

The machine case is the negative pole of the measured capacitance. In order to ensure the stable operation of the measurement circuit, the "FG pin" of the power interface must be reliably connected to the machine case (that is, it is in good conduction with the machine case). The case of the preamplifier of BCL4566E must also be connected with the machine case well. The specific index is that the DC impedance is always less than 10 ohms, otherwise the EMC effect may not be good.



2.3.3 J02PWM/DA Terminals

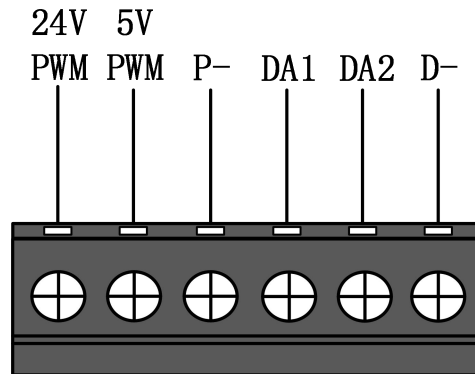


Figure 4 PWM/DA Terminals

BCL4566E has 2 channels of PWM pulse width modulation signal, the left channel is 24V level PWM. The right channel is 5V level PWM, and P- is the negative terminal of the PWM signal. The duty cycle is adjustable from 0% to 100%, and the highest carrier frequency is 50KHz. The signal output mode is shown in the figure below.

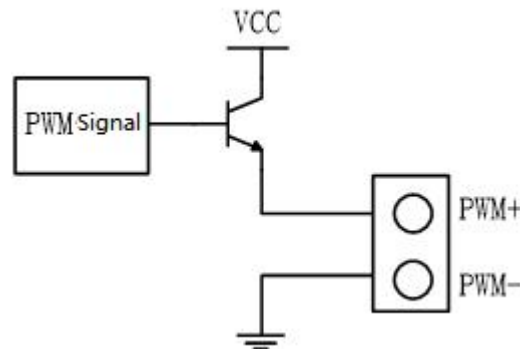


Figure 5 PWM Output Circuit

- Note: 1) There are dedicated enabling relays for PWM+ and PWM- signals, and there is no need for external relay isolation.
 2) Wrong connection of 5V/24V PWM signal may cause damage to the laser.

BCL4566E has 2 channels of 0~10V analog output. DA1/DA2 is the positive terminal of analog quantity, and D- is the negative terminal of analog quantity. DA1/DA2 can be configured as the control signal of laser peak power and gas proportional valve in the "Cypfig" that comes with CypcutE software.

| | |
|----------------------|---------|
| Output signal | 0V~+10V |
| Max Output | 50mA |
| Max Error | +/-10mV |
| Resolution | 2.7mV |
| Conversion | 400us |



2.3.4 J03/J04/J05 Output Terminal

Take J03 as an example, the interface diagram is as follows.

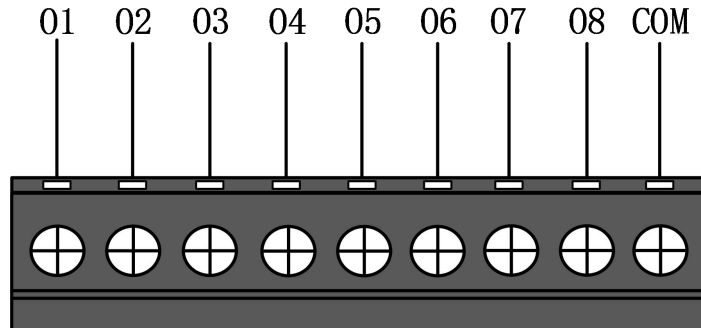


Figure 6 Output Terminal

J03-J05 has a total of 24 high-level (24V level) outputs. The above figure is the wiring diagram of J03. O1-O8 are the positive terminals of the output port, and COM is the negative terminal of the output port. The 24 output ports can be configured as control interfaces, e.g. "laser", "cutting head", "auxiliary gas", "alarm" and "pallet changer" etc. in the "Cypfig" that comes with CypcutE software.

Note: 1) The maximum current of one output port is 0.7A, otherwise the short circuit protection will be triggered.

2) The total current of the output ports cannot exceed 2.5A, otherwise the short circuit protection will be triggered.

2.3.5 J06/J07/J08 Input Terminal

Take J06 as an example, the interface diagram is as follows.

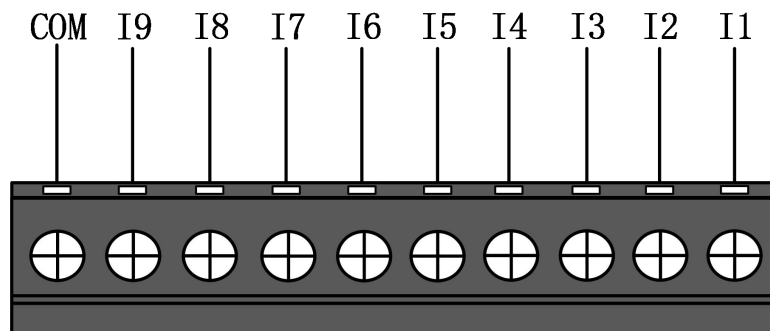
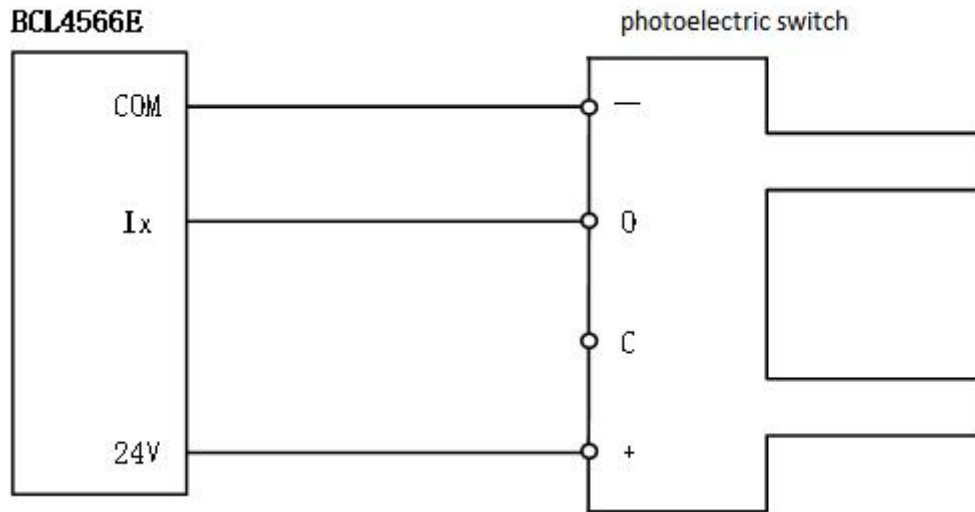


Figure 7 Input Terminal

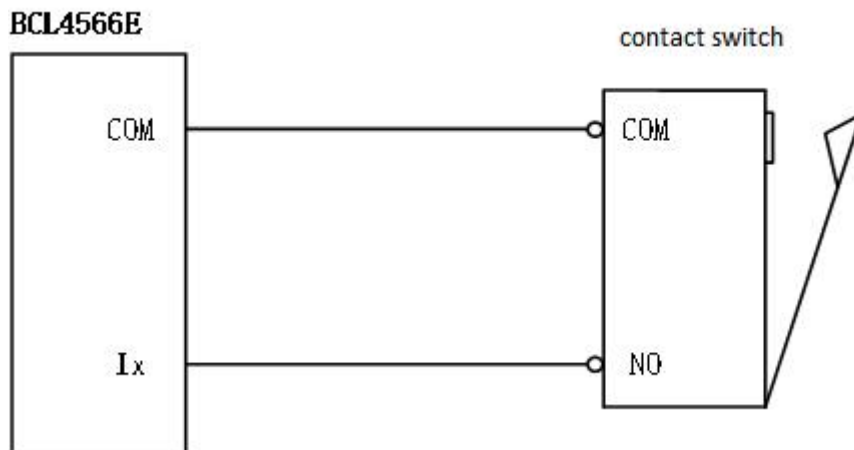
J06-J08 has a total of 27 input ports. IN1-IN24: active low (0~15V), high level (19-24V) has no conduction; IN25-IN27: active high(24~8V conduction), low level (0~4V) has no conduction. Take J06 as an example, I1-I9 are the positive terminals of the input port signal, and COM is the negative terminal of the input port.



The typical connection of the photoelectric switch is as shown in the figure below. An NPN 24V photoelectric switch should be used.



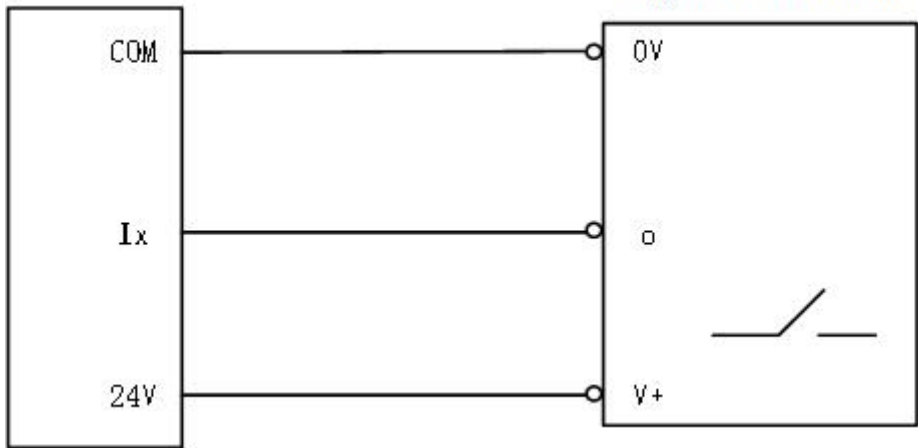
The typical connection of the contact switch is shown in the figure below.



The typical connection of the magnetic induction input switch is shown in the figure below. An NPN 24V magnetic induction switch should be used.

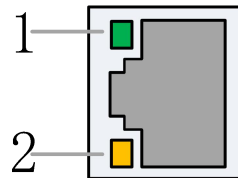


BCL4566E



2.3.6 J09/J10 Network

J09 is the EtherCAT network output interface, and J10 is the EtherCAT network input interface, supporting 100Mbps network communication. It is recommended to use standard RJ45 network cables in CAT5E or up for bus communication

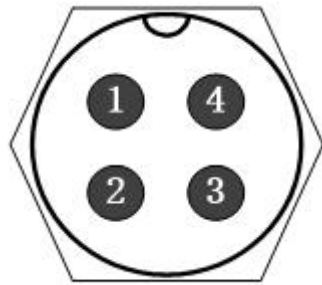


Description of RJ45 connection status of network terminal

| Label | Description | LED color | Status | Description |
|-----------|--|-----------|-------------|----------------------------------|
| 1: Link | EtherCAT Bus Connection and Communication Status | Green | Off | No connection |
| | | | Solid | Connected, without communication |
| | | | Flashes | Connected, with communication |
| 2: Status | EtherCAT Bus Link Status | Yellow | Off/Flashes | Not in the OP state |
| | | | Solid | in the OP state |



2.3.7 J11 Sensor



1. Connect to the other terminal 1
2. Connect to the other terminal 2
3. Connect to the other terminal 3
4. Connect to shielding layer

Figure 8 Sensor interface

The 4-core signal transmission cable of the sensor can be made by yourself with a 3-core shielded cable and two 4-pin plugs. 1, 2, and 3 cores are connected in pairs, and the 4th core must be connected with a shielding layer. It is recommended to use the original cable to ensure stability.

2.3.8 J12DB15 Servo Axis Interface

The control interface of BCL4566E focusing servo driver is double-row female DB15F, and the pin definition of the corresponding wire is shown in the figure below:

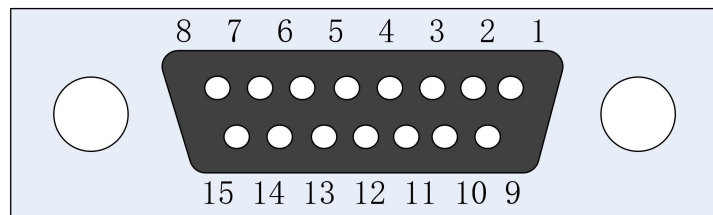


Figure 9 Servo drive interface

Axes are defined in the table below.

Servo Axis Interface Definition

| 15-pin Female Servo Control Interface | | | |
|---------------------------------------|-------------------|--------------------|-------------|
| Pin | Signal name | Pin | Signal name |
| 1 yellow | PUL+ | 9 yellow black | PUL- |
| 2 blue | DIR+ | 10 blue black | DIR- |
| 3 black | A+(encoder) | 11 black white | A-(encoder) |
| 4 orange | B+(Encoder) | 12 orange black | B-(encoder) |
| 5 red | Z+(encoder) | 13 red black | Z-(encoder) |
| 6 green | SON(servo enable) | 14 purple | ALM(alarm) |



| | | | |
|------------------|-------------------|-------------------|------------------|
| 7 green black | - | 15 brown black | 0V(power ground) |
| 8 brown | 24V(power output) | | |

+24V, 0V: 24VDC power for the servo driver.

PUL: digital signal, pulse signal for the driver.

DIR: digital signal, direction signal for the driver.

SON: output servo drive enable signal.

ALM: Receive the alarm signal of the servo drive.

A+, A-, B+, B-, Z+, Z-: three phases of the encoder, input signal.

Please refer to the figure below for the wiring with the Yaskawa servo drive.

Yaskawa Servo Wiring

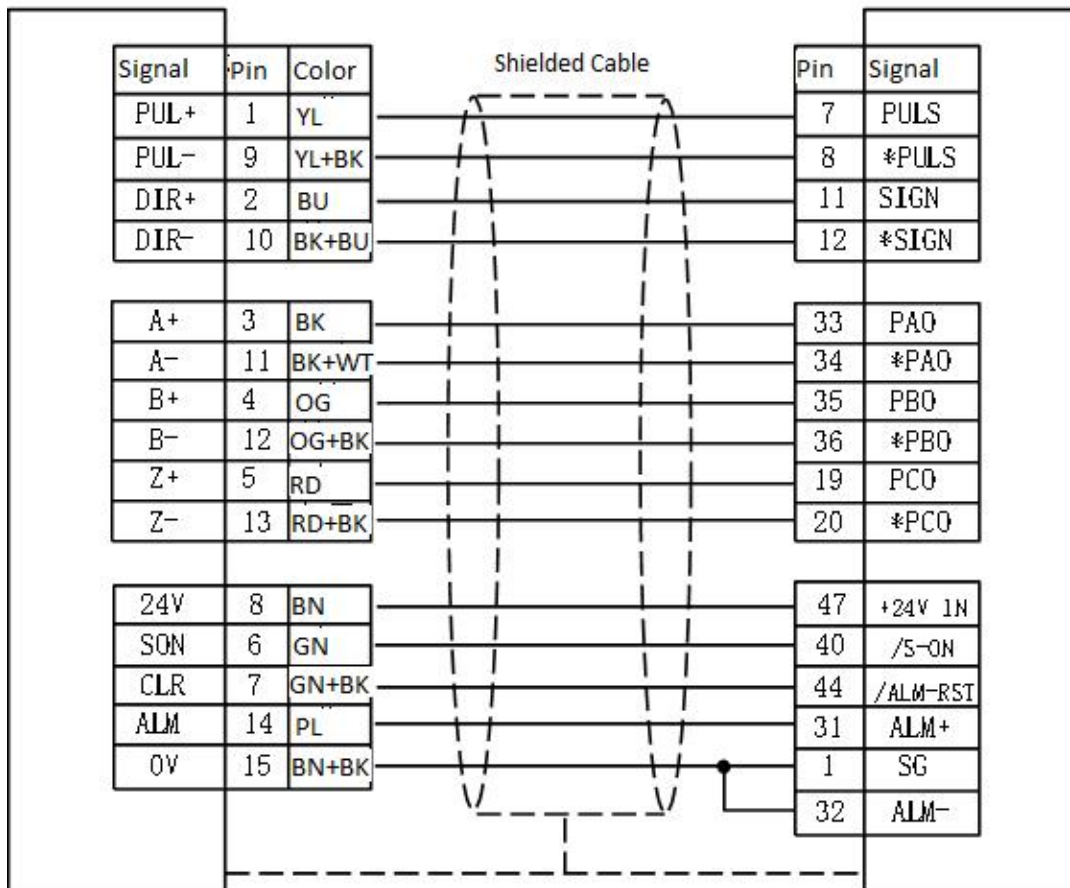


Figure 10 Yaskawa Servo Wiring Diagram

Pay attention to the following when connecting drives in other brands:

1. Please first confirm the type of SON signal of the servo drive you choose and whether it is active low (that is, it is ON when it is connected to the GND of the 24V power supply).
2. Make sure the parameter of the servo drive: the pulse signal received is "pulse + direction".
3. Confirm whether there is an external emergency stop signal input in the input terminal of the servo drive, and its logic.



-
4. Before the test run of the driver, 24V power must be supplied to the terminal board first, because the 24V power required by the servo is transferred through the terminal board.
 5. If the drive still cannot run, make sure that the parameter is set to not use "POT/NOT".

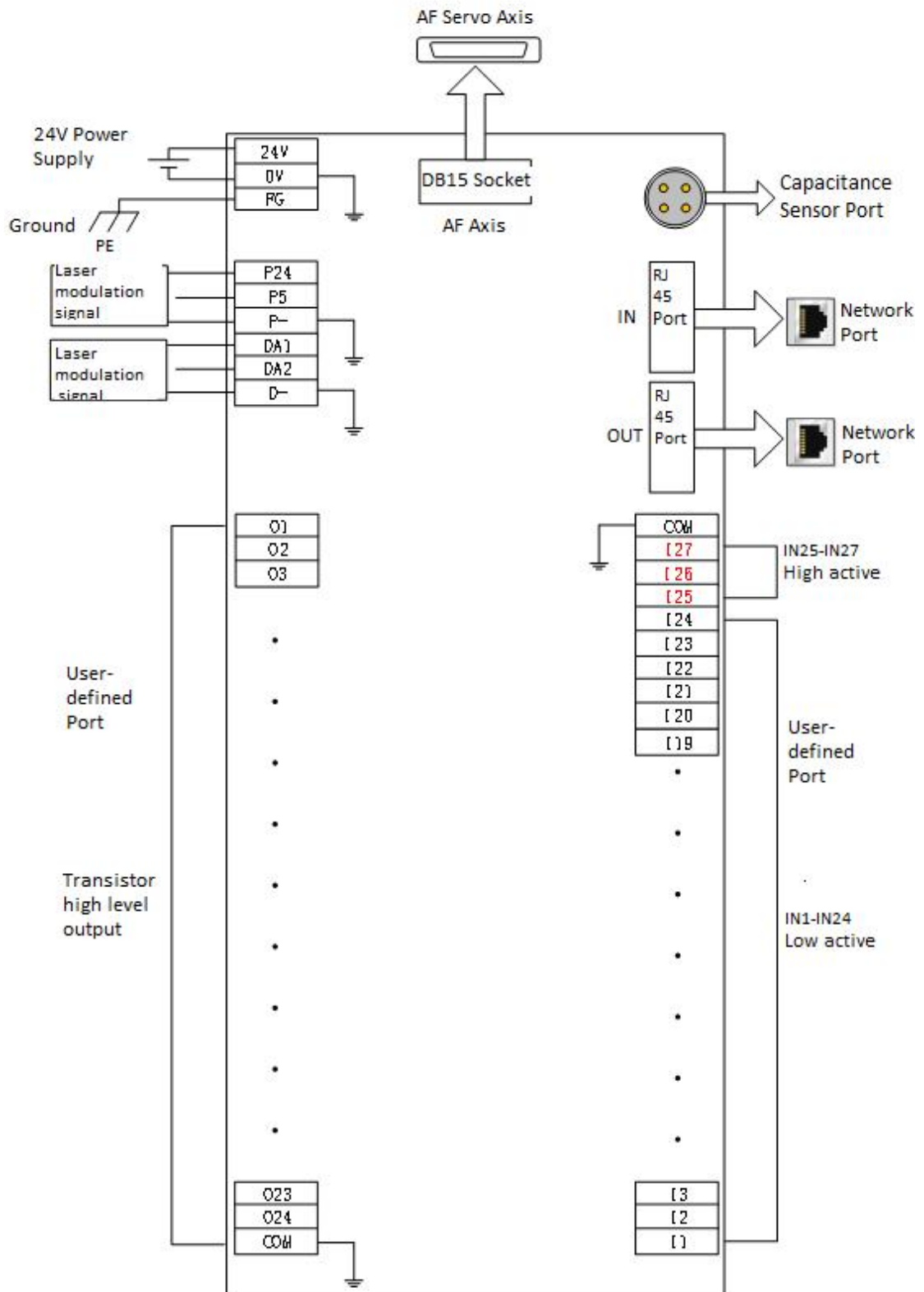


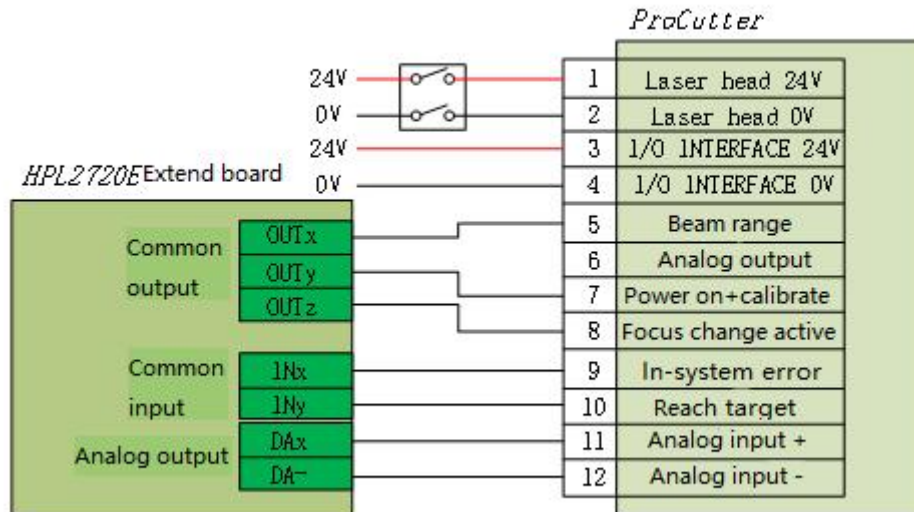
Figure 11 BCL4566E Wiring Diagram



2.4 Cutter Wiring

2.4.1 ProCutter Wiring

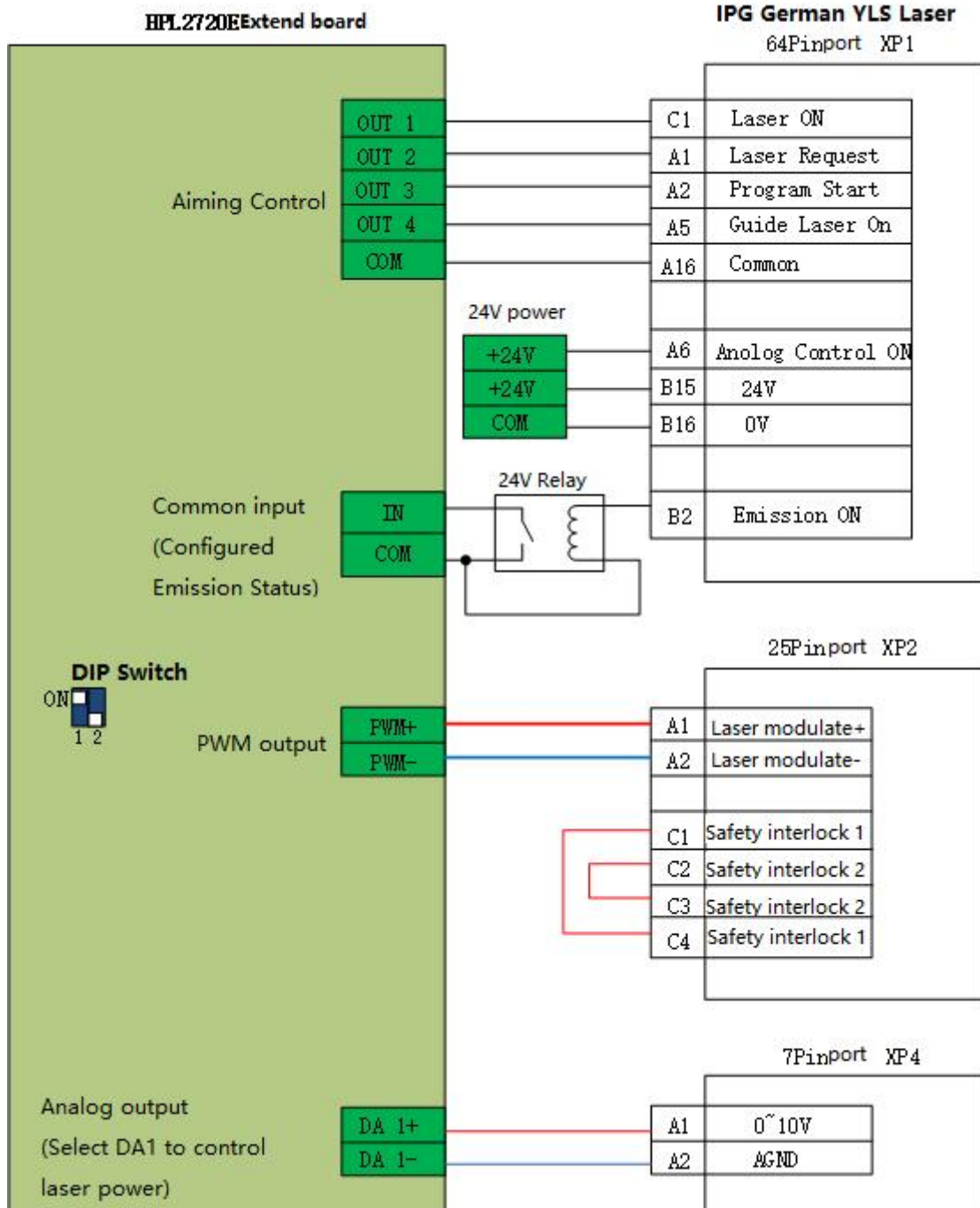
The connection of ProCutter cutting head is shown in the figure below.





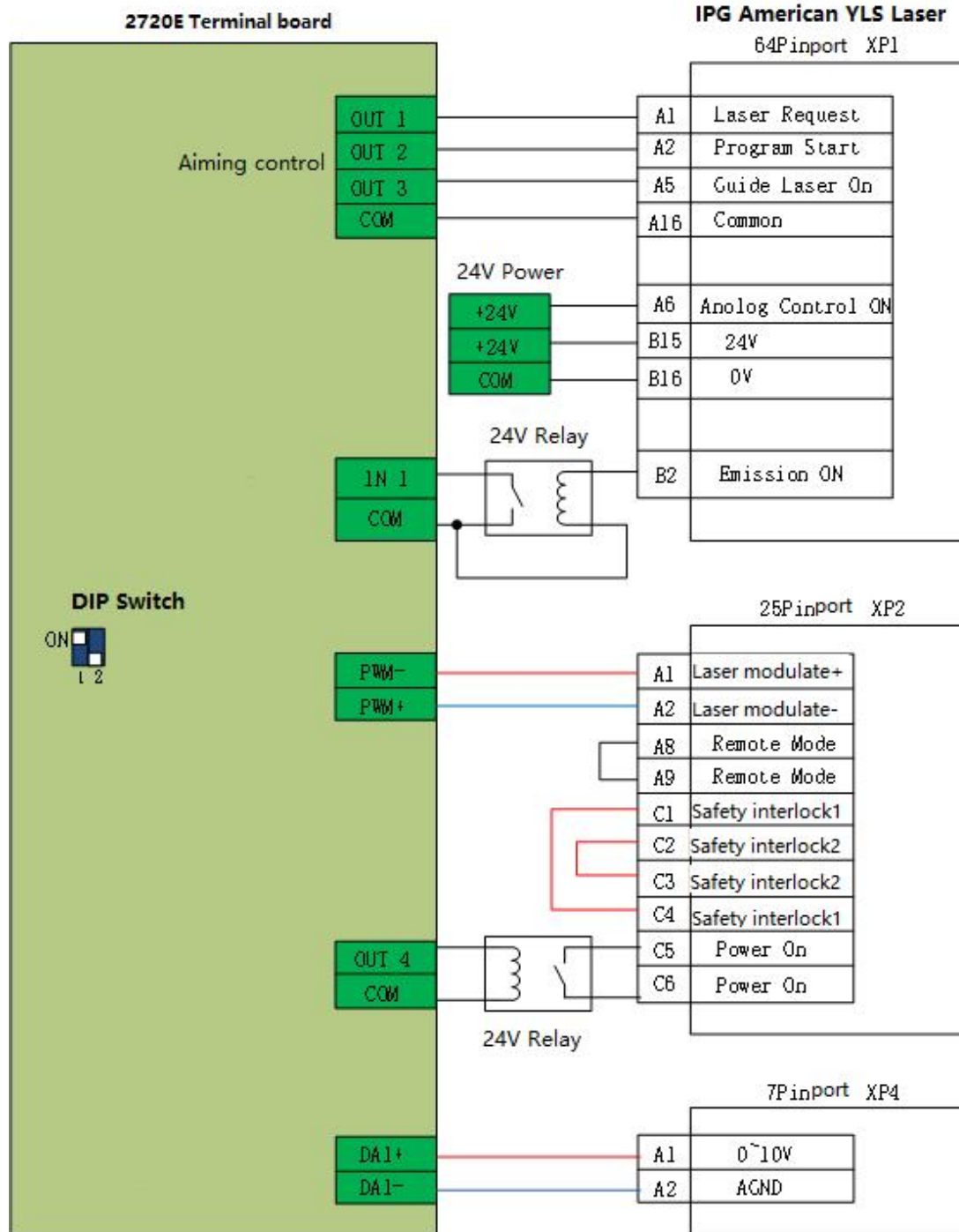
2.5 Laser Wiring

2.5.1 IPG_YLS Germany



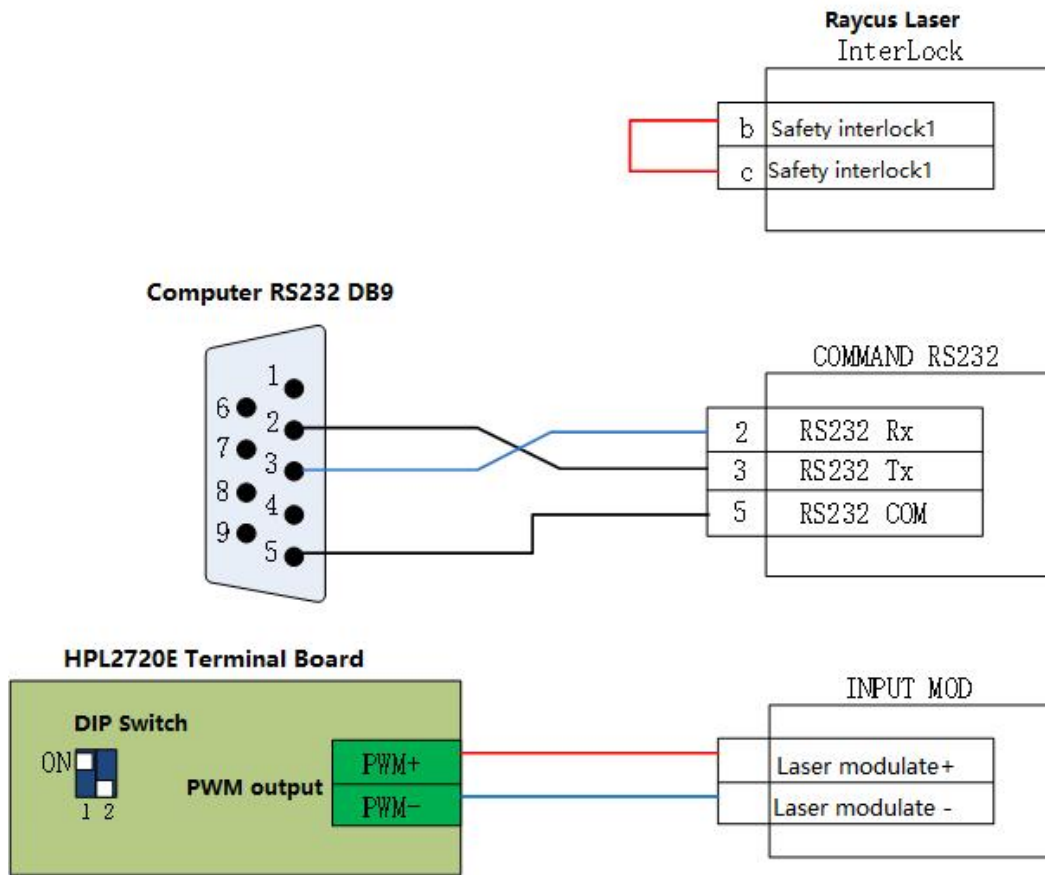


2.5.2 IPG_YLS American



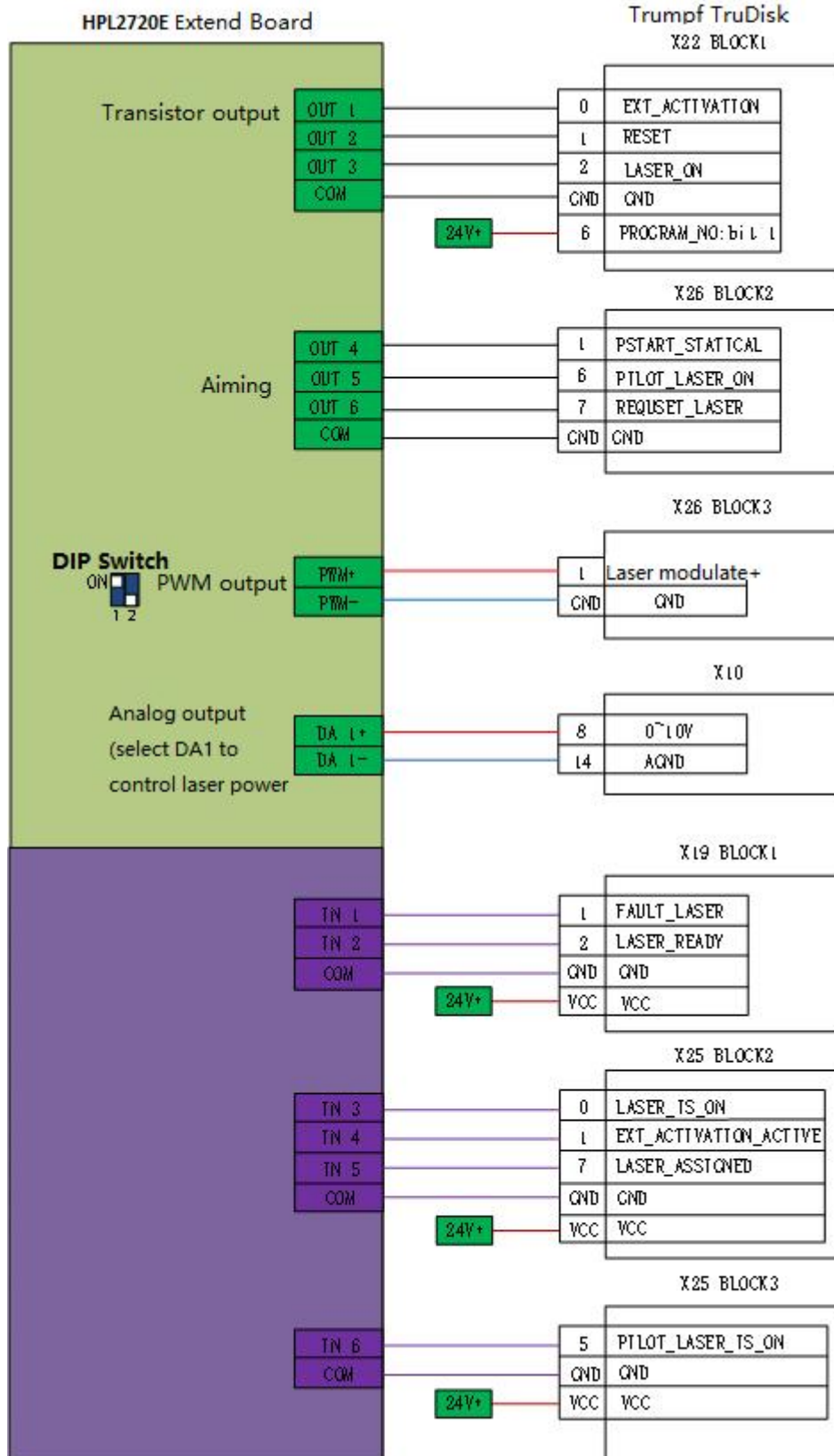


2.5.3 Raycus





2.5.4 Trumpf





Chapter 3 Installation

3.1 Installation Steps

3.1.1 Step 1 Install BMC228X Control Card

- 1) Power off the host.
- 2) Open the host case, select a free PCIE slot, and use a screwdriver to remove its slat.
- 3) Insert BMC228X into the slot. The installation is shown in 2.1.2.
- 4) Tighten the screws of the BMC228X block with a screwdriver.
- 5) Cover the case, turn on the power of the host PC, and start the host.

3.1.2 Step 2 Install MC228X Driver

Two ways to install BMC228X driver.

1. Use CypCutE to install the driver, check the driver when installing CypCutE, as shown in Figure 7. The BMC228X driver will be automatically installed.

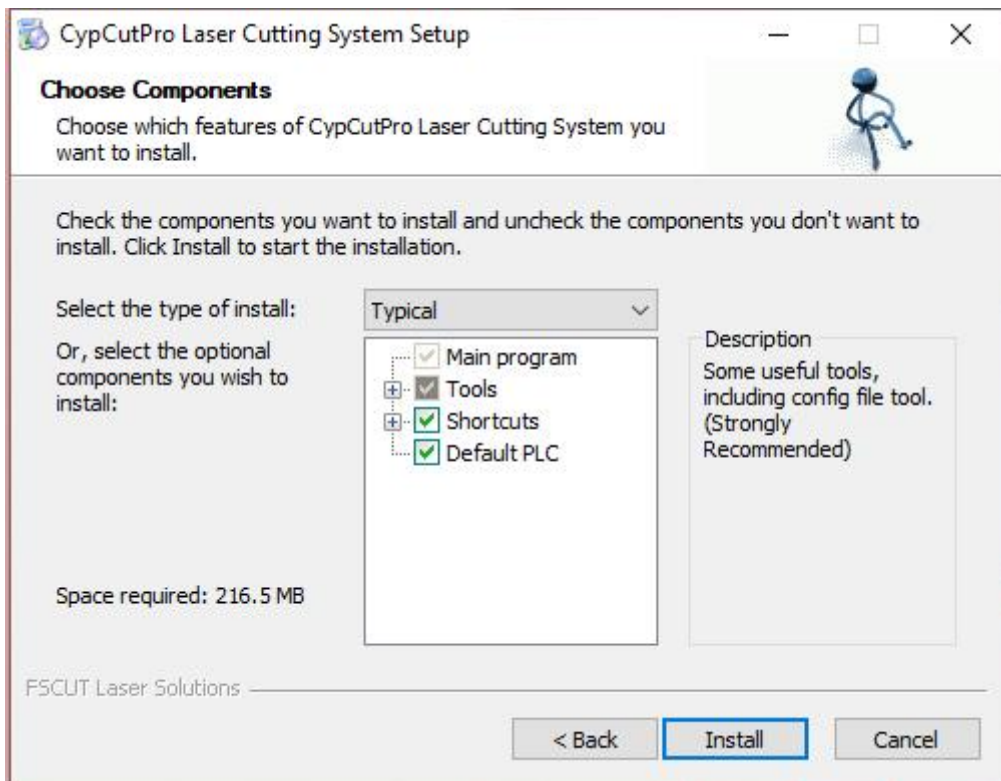


Figure 7 Check Driver Program

2. Open the "Device Manager", it will display "Other Devices" as shown in Figure 8, if its driver is not installed.

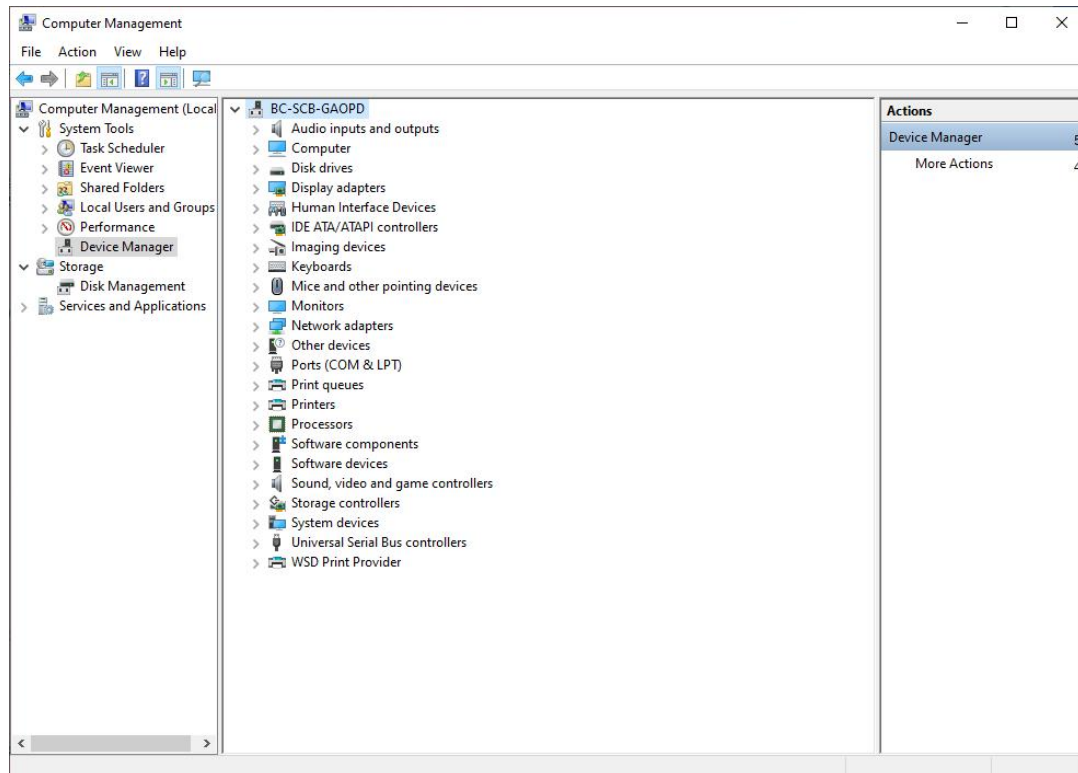


Figure 8 Unknown Device

Right click on "PCI FLASH Memory" and select "Update Driver Software".

Select CypCutE and find the default location of driver files: C:\Program Files (x86)\Friendess\CypCutE\Drivers, then click Next.

The driver installation is complete, if "BMC228X DMA" is displayed as shown.

3.1.3 Step 3 Connect the slave

Use CAT5E or above standard network cable (Friendess network cable recommended) to connect the slave. The wiring diagrams of BLT series cutting head and other cutting heads are shown in section 1.2.

3.1.4 Step 4 Scan in Cypfig

Open "Cypfig" and click "BUS Scan"->"Start". The system will scan the connected slave information.

1.3.1 Step 5. Use CypCutE

After setting the parameters in the "Cypfig", open CypCutE, import the graphics, and set the process parameters, then it can be processed See the software manual for details.

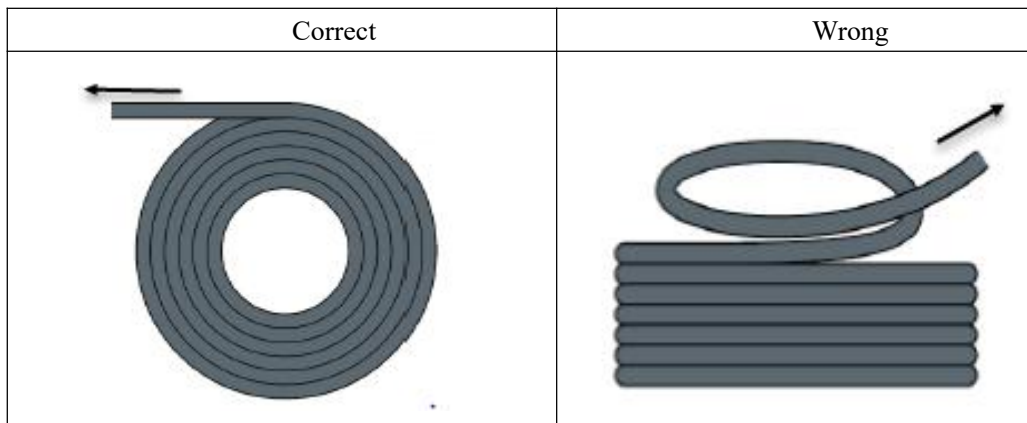


Chapter 4 Precautions

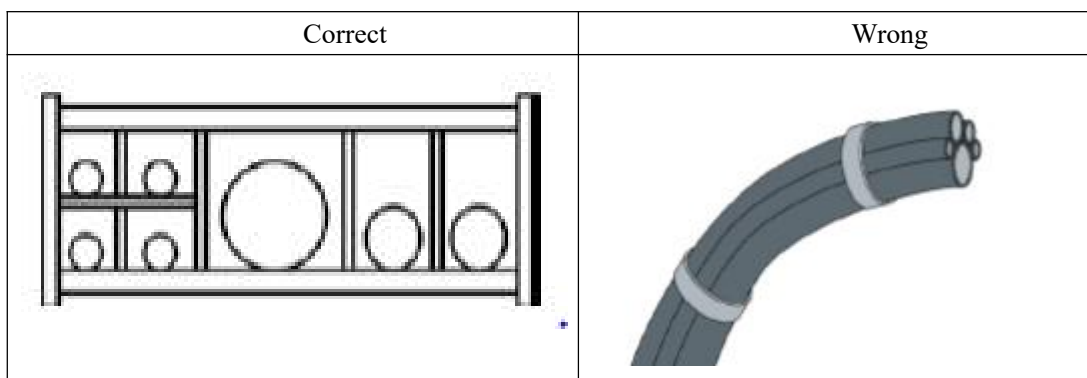
4.1 Wiring Precautions

4.1.1 Drag Chain Wiring

- 1) When releasing the 4-pin cable from the coil, it is necessary to prevent the cable from twisting (the cable must be released along the tangential direction) and the cable must be laid straight. This work should be done before laying the cables, to give the cables a period of stress relief. Because the manufacturing process cannot completely guarantee that the cable is straight and free of distortion, the printed logo on the surface of the cable rotates in a tiny spiral.



- 2) Cables are not allowed to be twisted when installed in a closed space, and twisting during installation may cause damage to the core wire stranding. This effect is gradually strengthened during the operation of the cable, resulting in back-twisting, which eventually leads to the breakage of the core wire and failure.
- 3) The cables must be laid loosely next to each other in the drag chain support. Spacers should be used to separate the cables as much as possible. The space between the cable and the spacer, separator and the cable adjacent to it, shall be at least 10% of the diameter.





- 4) The cables should be installed according to the weight and size of the cables. The larger diameter and heavier cables should be placed outside; the smaller diameter and lighter cables should be placed inside. The cables can also be placed from the inside to the outside descendingly by size. Do not place one cable on top of another without using a spacer.
- 5) For vertically suspended drag chains, keep more free space for the vertical support, because the cables will be stretched during operation. After a short run, it is necessary to check that the cables run along the center area and adjust them if necessary.
- 6) For self-supporting drag chain, cables are fastened to moving and fixed points. Suitable cable supports from the supplier are required. Cable ties have very limited applicability when operating at high accelerations. So you should not bundle multiple cables together. Cables should not be fixed or tied to any moving parts of the drag chain. The gap between the fixed point and the bending area should be wide enough.

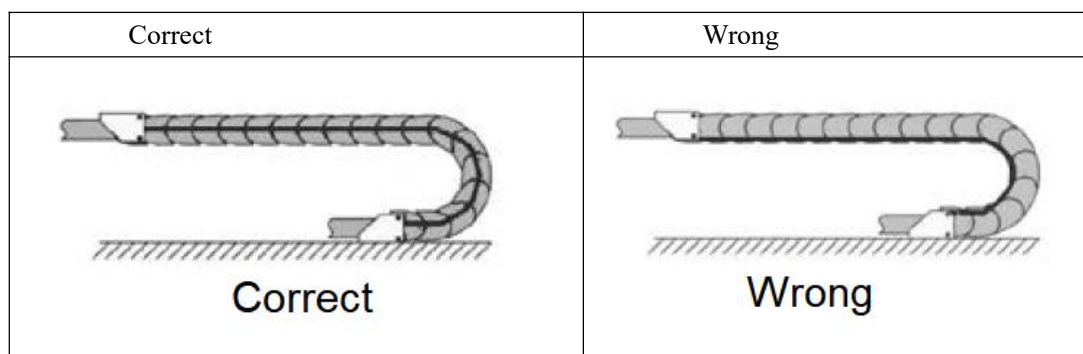


self-supporting



sliding

- 7) It is recommended to fix the cable on the moving point for sliding drag chains. A small cable protection zone is required at the fixing point. (Refer to the instructions from the drag chain supplier)
- 8) Please ensure that the cable runs along the center area with the desired bending radius. Do not apply tension to the cable (do not pull it too tightly), otherwise the friction inside the drag chain will cause the cable sheath to wear; do not let the cable be too loose in the drag chain, otherwise it will easily cause abrasion of the cable and the inner wall of the drag chain, or tangled with other cables.





- 9) If the cable does not run smoothly, check whether it is twisted along the longitudinal axis during operation. The cable should slowly rotate at a certain fixed point until it runs freely.
- 10) Given the size of cables and drag chains, their length characteristics vary considerably. During the first few hours, the cable naturally elongated. For drag chains, it takes more hours for this to happen. Such a large discrepancy can be remedied by regularly checking the cable installation locations. It is recommended to do regular inspections, every three months for the first year and at every maintenance thereafter. This includes checking that the cables are completely free to move within the intended bending radius and making adjustments if necessary.

4.1.2 Machine Tool Wiring

1. Power Supply (Power) Wiring

1) Strong Electricity

- Strict separation of strong and weak electricity

Select the appropriate diameter for the power cable according to the power. The table below is the cable diameter and its corresponding power.

| Cable Spec(mm ²) | Cross Section(mm ²) | 25°C Copper Wire Ampacity (A) | Single-phase 220v load power (W) | Three-phase 380v load power (W) |
|------------------------------|---------------------------------|-------------------------------|----------------------------------|---------------------------------|
| 1.5 | 1.38 | 15 | 3300 | 9476.8 |
| 2.5 | 1.78 | 25 | 5500 | 13163.2 |
| 4 | 2.25 | 32 | 7040 | 16848.8 |
| 6 | 2.85 | 45 | 9900 | 23693.6 |
| 10 | 7*1.35 | 60 | 13200 | 31591.2 |
| 16 | 7*1.7 | 80 | 17600 | 42121.6 |
| 25 | 7*2.14 | 110 | 24200 | 57917.6 |

- Add auxiliary devices such as short-circuit protectors and filters for strong electricity.

2) Weak Electricity (DC24V for example)

- Distinguish the positive and negative wires of the power supply in color, e.g., the red wire is connected to the positive pole, and the blue wire is connected to the negative pole
- Loads with relatively large interference (e.g. servos and solenoid valves) are powered separately from the controller.

2. Grounding

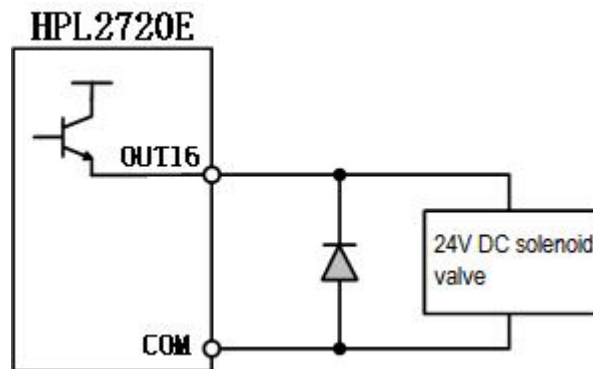
- **The ground wiring adopts the standard two-color, yellow and green, wires.**
- It is recommended to use multi-point grounding, for some high-frequency signals (PWM, pulse, encoder, capacitance, etc.) in the laser cutting machines.
- The machine tool uses galvanized grounding screws and a special grounding wire for



grounding. The resistance between the grounded metal body and the main grounding point should be $\leq 0.1\Omega$.

3. Signal (Control)

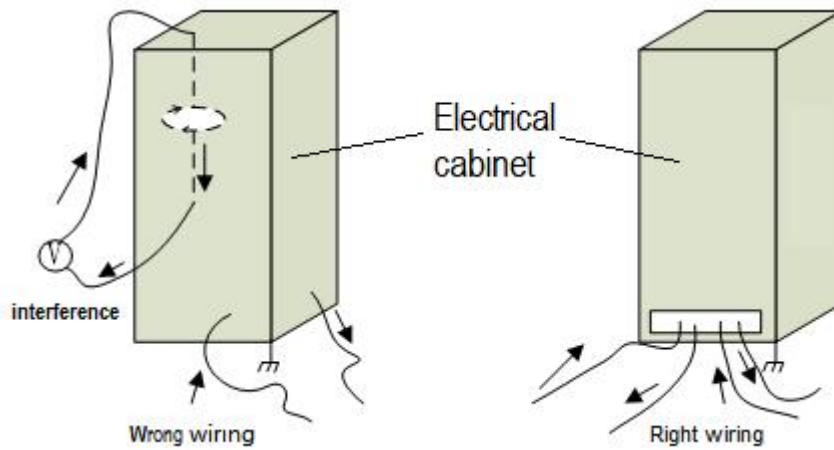
- Signal wire color, e.g. black.
- Choose the signal wire according to the power.
- DC 24V solenoid valve is recommended. Add absorption circuits at both ends of the solenoid valve, that is, connect a freewheeling diode in parallel at both ends of the solenoid valve (pay attention to the direction, withstand current, and withstand voltage), as shown in the figure below.



- It is recommended that the digital signal (PWM) shielding layer be grounded at both ends, and the analog signal (DA) shielding layer be grounded at one end. Single-ended grounding can avoid low-frequency current noise on the shielding layer; double-ended grounding can effectively eliminate high-frequency interference. If the transmission cable is very long, it is recommended to ground at multiple points to ensure that the shielding layer is at the same potential.
- The resistance from the cutting head connected to the amplifier to the shell of the machine tool is $\leq 1\Omega$, and the resistance to the grounding point of the electrical cabinet is $\leq 6\Omega$.

4. Notes

- Each cable is marked clearly and accurately.
- Cables are in parallel and not crossed, and the harnesses should be straight and leveled.
- If using the cables from Friendess, choose the appropriate cable according to the layout space, and do not pile up and circle it.
- All wiring must be firm to prevent sparking.
- Wiring should avoid loops and antenna effects. The current loop composed of signal source---transmission line---load is equivalent to a magnetic field antenna. As shown in the figure below, the wrong connection is on the left, and the correct connection is on the right.



4.1.3 Assembly Requirements

| | |
|--|--|
| | Handle with care. Please wear anti-static gloves or touch a grounded metal object to prevent static electricity from damaging the motion control card before touching the control card circuit or inserting/pulling the control card. |
| | Except for the USB interface, plugging and unplugging with power is prohibited for other interfaces, which may cause internal components damaged. |
| | Handle with care. Do not press the card. Pressing might cause the card to bend and its function damaged. |

4.2 Troubleshooting

4.2.1 Device Manager cannot find PCIe devices

If the device manager cannot find any PCIe devices:

1. Check the status of the indicators on BMC228X. The positions of the power indicator and system status indicator are shown in Figure 14

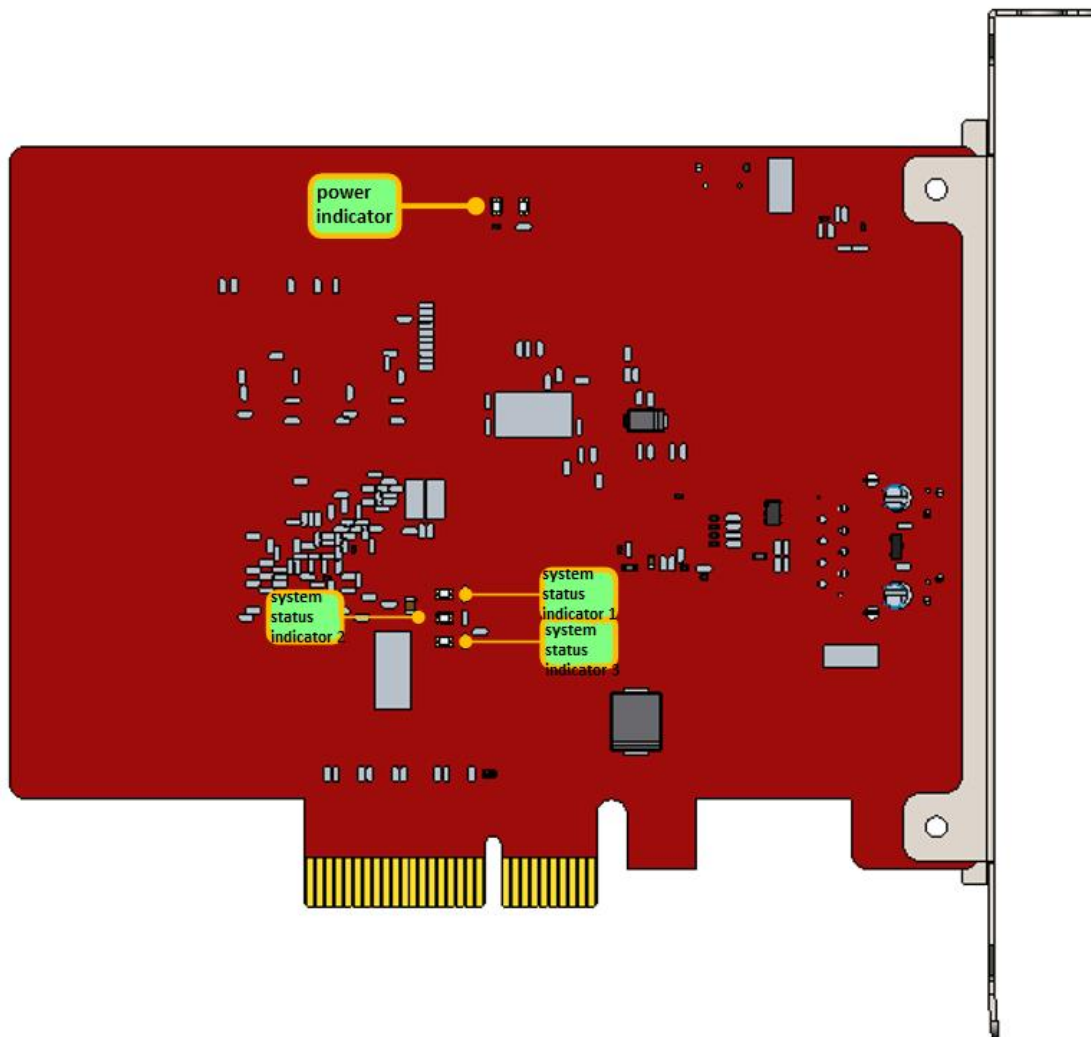


Figure 14 BMC228X Indicators

If it is not in the OP state, the power indicator is always on, both the system status indicator 1 and the system status indicator 2 flash at 1 Hz at the same time, and the system status indicator 3 is always on.

If it is in the OP state, the power indicator is always on, the system status indicator 1 and system status indicator 2 flash alternately at 1 Hz, and the system status indicator 3 is always on.

If the BMC228X status indicator is abnormal, change the card and try again.

2. If the BMC228X status indicator is normal, change a card slot or host computer to scan again
3. If the PCIe device still cannot be found, contact our customer service.

4.2.2 Device Manager cannot install driver

If PCIe devices are in the device manager, but the BMC228X driver is not recognized:

- 1) Please manually install the driver again according to section 3.1.2.
- 2) If the driver is still not installed, change a card slot or install the driver on the host.
- 3) If the driver is still not installed, contact our customer service.

4.2.3 Bus Scan failed

If the Cypfig failed to scan the slaves:



1. Check whether the EtherCAT bus servo and slaves are powered on.
2. Check whether the network cable installed securely.
3. Check whether the slave device is supported. If not, contact customer service. If yes, change the slave device and scan again.
4. If still failed, contact customer service

4.2.4 Bus network alarm

Common Bus Network Alarms and Solutions

| Alarm | Reason | Solution |
|---|---|---|
| Bus network alarm, the network cable is not connected 0x9811002D | The slave device is not powered on or the network port is connected incorrectly | Check the power supply of the slave device and the wiring of the network port |
| Watchdog timeout alarm | Communication between CypCutPro and BMC228X timed out | If it is automatically released, it can be ignored; if it occurs during processing, record the operation steps and give feedback to our customer service. |
| Bus network alarm, network mismatch 0x9811001E | The network cable between the EtherCAT network port of the computer and the slave is loose or the power supply of the slave is disconnected | <ol style="list-style-type: none"> 1. Check the wiring of the EtherCAT network port 2. Sort out the wiring and check for interference 3. Check the power supply of the slave |
| Bus network alarm frame lost 0x98110025 | EtherCAT network communication data frame loss | <ol style="list-style-type: none"> 1. Check the wiring of the EtherCAT network port 2. Sort out the wiring and check for interference 3. Check the power supply of the slave |
| Bus network alarm, the slave is not in OP state | The Nth slave is abnormal, the network cable between the N-1 slave and the Nth slave is loose or interfered | <ol style="list-style-type: none"> 1. Check the wiring of the EtherCAT network port 2. Sort out the wiring and check for interference 3. Check the power supply of the slave |
| Bus network alarm, network timeout 0x98110010 | EtherCAT network communication data frames are lost continuously | <ol style="list-style-type: none"> 1. Check the wiring of the EtherCAT network port 2. Sort out the wiring and check for interference 3. Check the power supply of the slave |

Table 2-1 Master card bus alarm and solution