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FSCUT4000E Installation Manual

System: FSCUT4000E

Document version: V1.3.0

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Foreword

Thank you for using BOCHU FSCUT4000E System.

BOCHU FSCUT4000E Laser Cutting Control System (hereinafter referred to as FSCUT4000E) is primarily designed for medium-power bus-based cutting systems. It combines motion control, laser operation, and gas flow management into one reliable package. Using EtherCAT communication technology, it delivers precise performance while keeping costs competitive.

This manual is only an instruction for the installation and wiring of the FSCUT4000E system. For software operation or details required advanced permissions, please refer to other manuals or contact our technical support.

Due to the continuous update of system functions, the actual situation may differ in some aspects from the statements in this manual. We've tried our best to ensure that the content of the manual is applicable, but reserves the right of final interpretation. Changes in the content of this manual will not be explicitly notified.

Any questions or suggestions during use, please contact us through the information provided.

Convention Symbol Explanation

Notice: Supplementary or explanatory information for the use of this product.

Caution: If not operated as specified, it may result in minor physical injury or equipment damage.

Warning: If not operated as specified, it may lead to death or serious physical injury.

Danger: If not operated as specified, it will cause death or serious physical injury.

Declaration

Operation of the machine tool and the laser cutting effect may directly relate to the material being cut, the laser used, the gas used, the gas pressure, and the various parameters you set. Please set various parameters carefully according to your cutting process requirements!

Improper parameter settings and operations may lead to poor cutting effect, damage to the laser head, or other machine tool components, and even personal injury. FSCUT4000E Laser Cutting Control System has tried its best to provide various protection measures. Laser equipment manufacturers and end users should try to follow operating procedures to avoid the occurrence of injury accidents.

BOCHU does not bear any direct, indirect, incidental and/or consequential losses and liabilities resulting from improper use of this manual or this product!

Revision History

Version No.	Date	Description
V1.3.0	2025/03/19	Format and content revision.

Contents

Chapter 1 Overview

1.1 Introduction

FSCUT4000E is a cost-effective CNC system designed for laser cutting. Developed based on EtherCAT bus technology, it integrates motion control, laser control, and cutting gas control. It is widely adopted in industries such as sheet metal fabrication, kitchenware, and lighting fixtures. This manual is intended solely for installation guidance. For software operation and additional information, please refer to the CypCutE User Manual.

1.2 System Diagram

FSCUT4000E mainly includes the bus BMC228B Master Control Card and the bus terminal boards. BMC228B integrates the EtherCAT Master protocol stack. The Ethernet cable is routed from the BMC228B's Ethernet port. The system wiring is shown below.

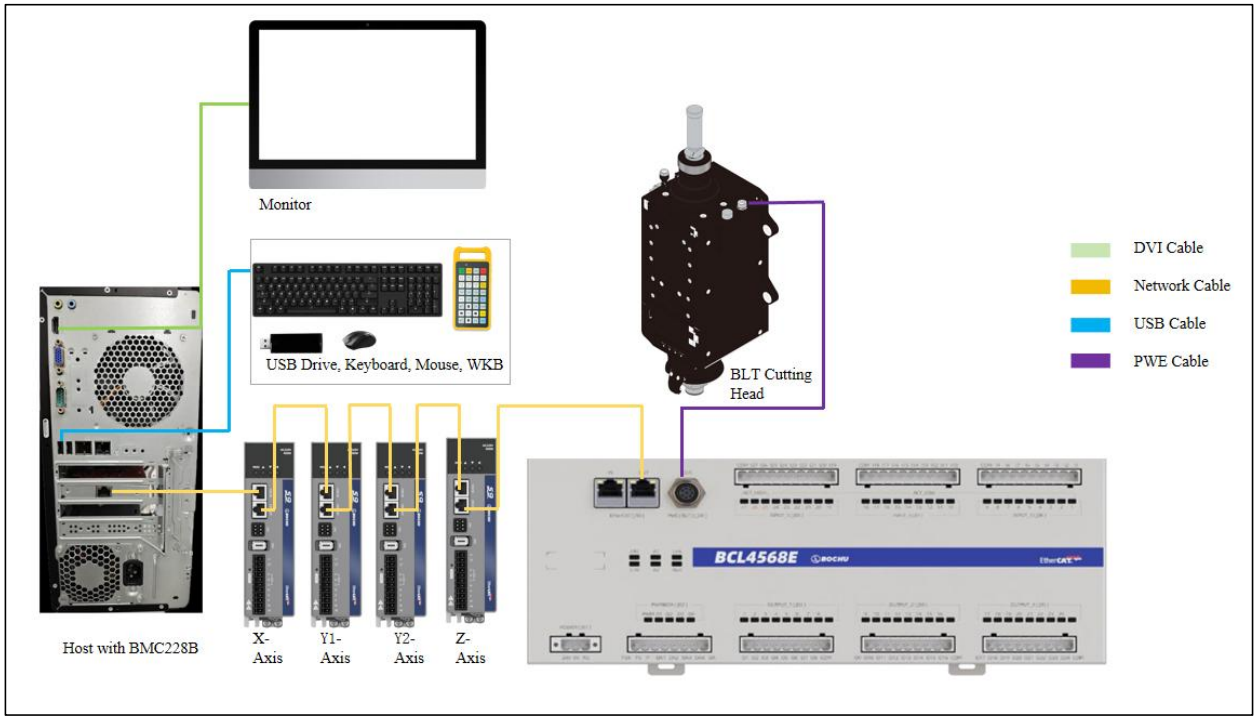


Figure 1-1 System wiring for BLT cutting head

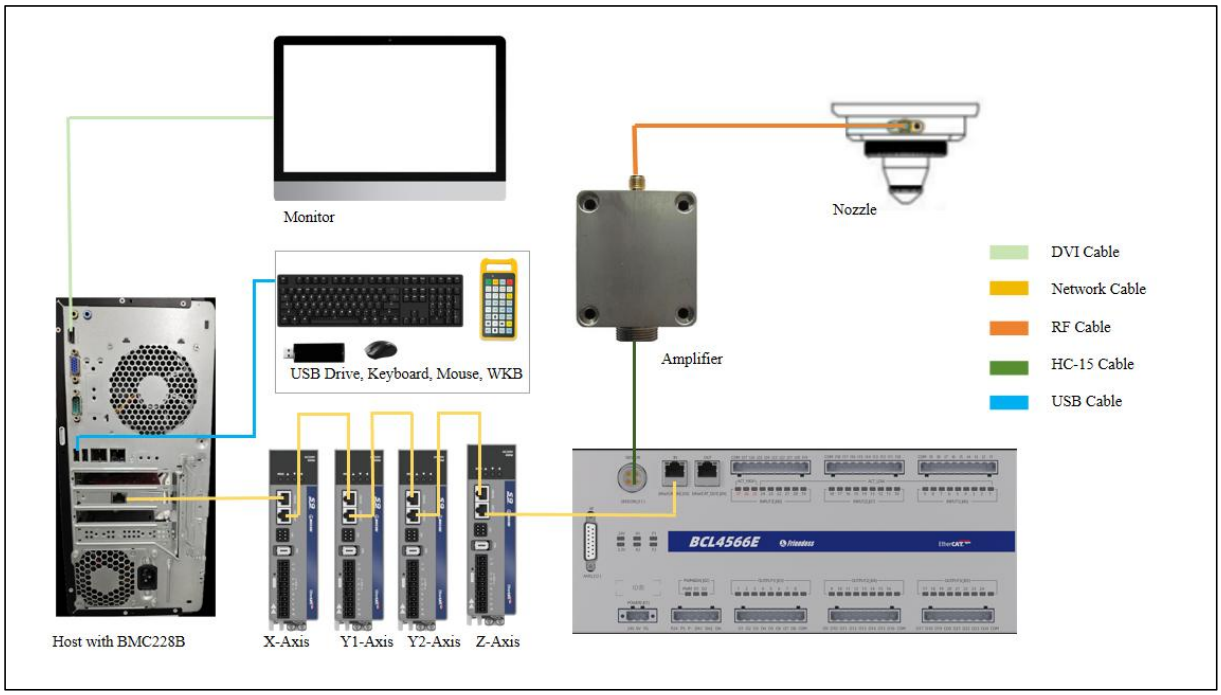
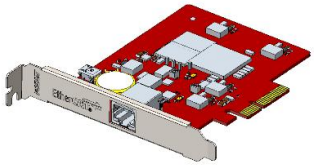


Figure 1-2 System wiring for Non-BLT cutting head

1.3 Product Specifications

The specific components of FSCUT4000E (adapted for BLT Cutting Head) include the BMC228B Master Control Card, BCL4568E Terminal Board, WKB V6 Wireless Controller, and related cables.

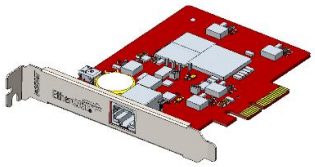
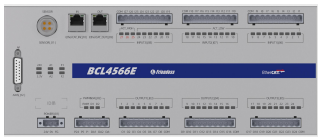
Table 1-1 Product Specifications (for BLT Cutting Head)

BMC228B Master Control Card*1	BCL4568E Terminal Board*1	LAN-20X-PWE Cable*1
		
WKB V6 Wireless Controller*1	**Network Cables (LAN-0.3X*3, LAN-1X*1, LAN-3X*1)**	
		

⚠ Notice: The hardware components and quantities may vary slightly across different FSCUT4000E configuration packages. For clarification or detailed specifications, please contact BOCHU technical support.

The specific components of FSCUT4000E (adapted for Non-BLT Cutting Head) include BMC228B Master Control Card, BCL4566E Terminal Board, WKB V6 Wireless Controller, BCL Amplifier, and related cables.

Table 1-2 Product Specifications (for Non-BLT Cutting Head)

BMC228B Master Control Card*1	BCL4566E Terminal Board*1	HC-15 Cable*1
		
BCL Amplifier*1	**WKB V6 Wireless Controller*1**	**SPC-140 RF Cables*2**
		
Network Cables (LAN-0.3X*3, LAN-1X*1, LAN-3X*1)		
		

Chapter 2 BMC228B Wiring

BMC228B Master Control Card is an EtherCAT bus-based motion control card. Equipped with a main chip operating at 1.0 GHz clock speed, it delivers outstanding overall performance.

Table 2-1 BMC228B Technical Data

Parameter	Description
Bus Protocol	EtherCAT Master Protocol
PCI Express	PCI Express2.0 (Gen2)
Power Supply	● Source: Powered by PCIe motherboard ● Input: Max. 12 V/1 A ● Hot-plugging: Not supported
Anti-interference Level	● ESD: GB/T Level 3 (Contact: 6 kV; Air: 8 kV) ● EFT: GB/T Level 4 (Power supply: 4 kV; Signal: 2 kV) ● Surge: IEC Level 2 (AC Line-to-Ground: 2 kV; DC Line-to-Ground: 1 kV)
Dimension	127.6 x 121.0 x 21.45 mm (L x W x H)
Weight	About 80 g
Cooling	Nature Cooling
Operating temperature	0 ~ +60℃
Storage temperature	-20 ~ +70℃
Humidity	0% to 90% (non-condensing)
Certification	CE
Environment Requirement	The waterproof and dustproof grade of the Master Control Card is IP00, unprotected. Please place the host PC in a clean, dust-free environment.

2.1 **Dimension Diagram**

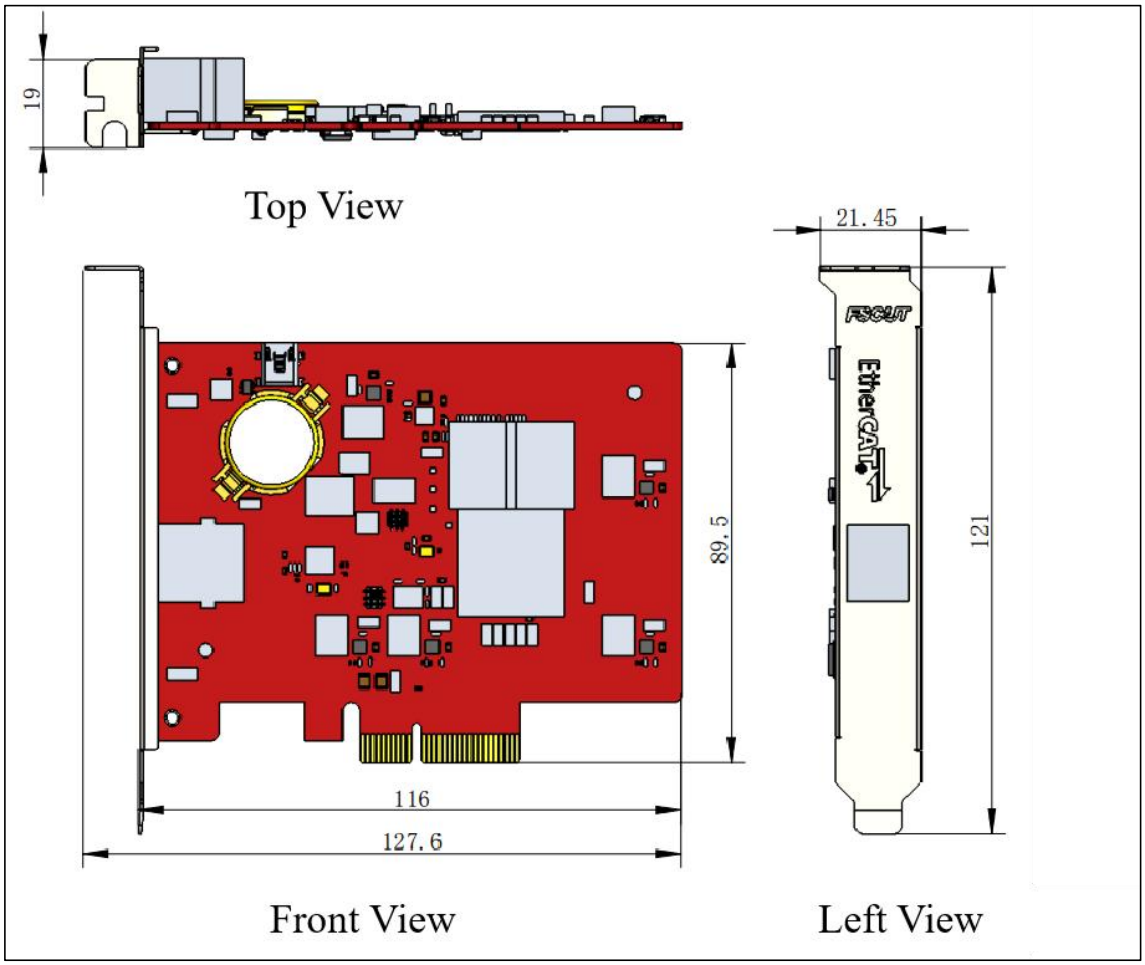


Figure 2-2 BMC228B dimension

2.2 Installation Diagram

Step 1 Install the BMC228B Master Control Card into the PCIe X4 slot.

Step 2 Apply uniform pressure across the card during insertion or removal (refer to callout ②), and secure its blank screw (refer to callout ①).

Step 3 For heat dissipation of the card, keep it away from other cards as far as possible.

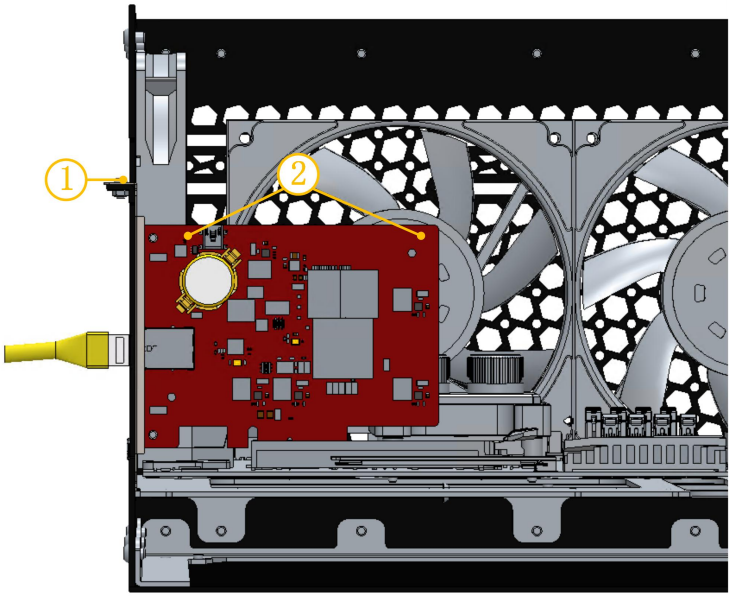


Figure 2-3 BMC228B control card installation

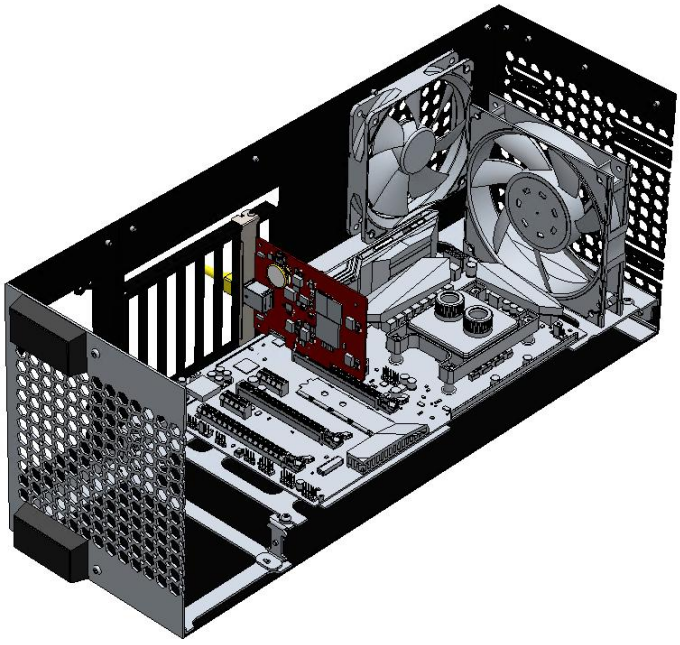


Figure 2-4 BMC228B control card after installation

2.3 Ethernet Terminal

BMC228B features a standard RJ45 port, designed to connect EtherCAT slave devices such as servo drives, BCS100E, BCL4566E, etc.

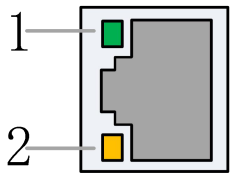


Figure 2-5 Ethernet terminal

The description of Ethernet terminal is as follows.

Table 2-1 Ethernet Terminal Description

Label	Description	LED Color	Status	Description
1：Speed	Ethernet communication connection speed	Green	Off	10 Mbps connection
			On	100 Mbps connection
2：Link	Ethernet communication link status	Yellow	Off	No connection
			Blinking	Communicating
			On	Connected

2.4 PCIe Interface

BMC228B features a PCIe X4 physical interface (refer to callout ①), which is compatible with X8/X16 slots. It complies with the PCI Express V2.0 (Gen2) standard.

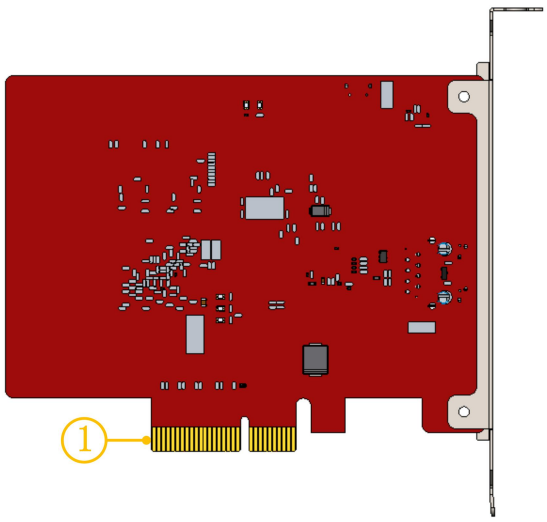


Figure 2-6 Gold fingers interface

Motherboard compatibility requirements are detailed in the following table.

Table 2-2 Motherboard Requirements

Parameter	Description
System	64-Bit Win7/10
CPU	Intel i3 8100 or higher
Memory	4 GB or higher
PCIe Physical	X4 or higher
PCI Express	PCI Express 2.0 (Gen2) or higher
Motherboard PCIe Power Supply	12 V/1 A or higher

Chapter 3 BCL4568E Wiring

BCL4568E is an IO expansion board based on an EtherCAT bus, which can be connected with the peripheral resources required by the FSCUT4000E laser cutting system.

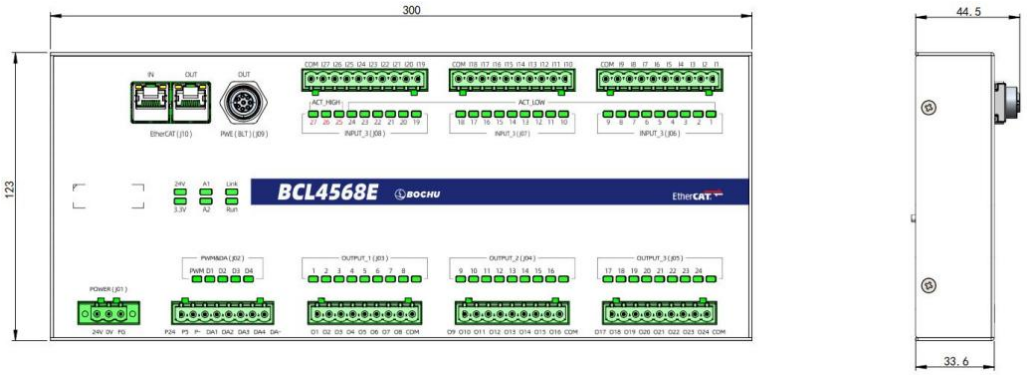


Figure 3-1 BCL4568E dimension (mm)

Figure 3-2 BCL4568E product appearance

The table below shows the technical data of BCL4568E.

Table 3-1 BCL4568E Technical Data

Module	Qty.	Description
Power	/	Input: 24 VDC/6 A
DA	4	• Range: 0 ~ 10V • Resolution: 12 bit • Accuracy: 50 mV
PWM	2	• Voltage Levels: 5 V and 24 V • Accuracy: 5 kHz, 0.3% (Top to 50 kHz, 3%)

Module	Qty.	Description
General Output	24	● Logic Level: 24 V high level ● Current Limits: ≤ 0.7 A per channel; ≤ 2.5 A for all channels
Dedicated Input	27	● IN1 ~ IN24: active-low (valid range: 0 ~ 15 V; invalid range: 19 V ~ 24 V) ● IN25 ~ IN27: active-high (valid range: 8 ~ 24V; invalid range: 0 V ~ 4 V)
Working Temperature	/	0℃ ~ 60℃
Humidity	/	10% ~ 90% RH (non-condensing)
Dimension	/	300 × 123 × 34 mm (L × W × H)
Weight	/	913 g

3.1 Interface Layout

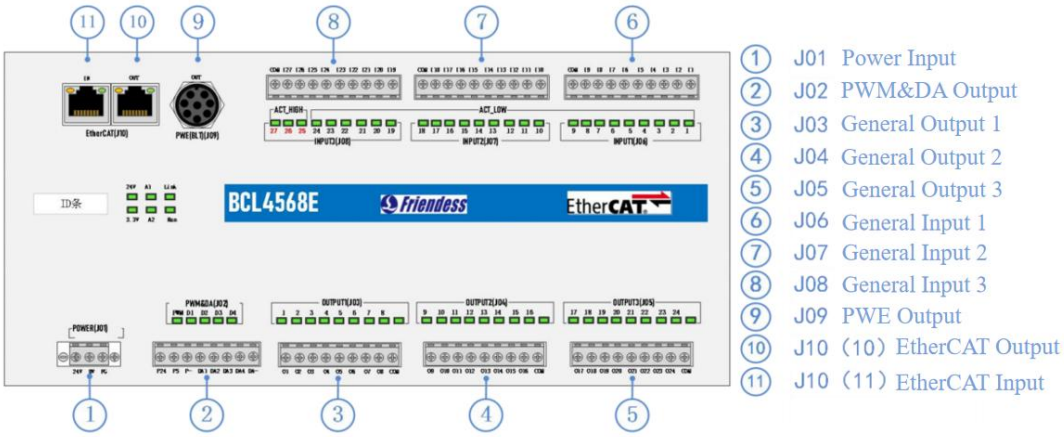


Figure 3-3 Detailed interface layout of BCL4568E terminal

3.1.1 J01 Power Terminal

The machine's shell is the negative terminal of the capacitor measured. To ensure stable operation of the measuring circuit, the ***FG*** pin of the power supply interface must conduct well with the machine shell, and the preamplifier shell of the BCL4568E must also conduct well with the machine shell. The specific indicator is that DC resistance should always be less than 10 Ω, otherwise it might not be effective for electromagnetic compatibility.

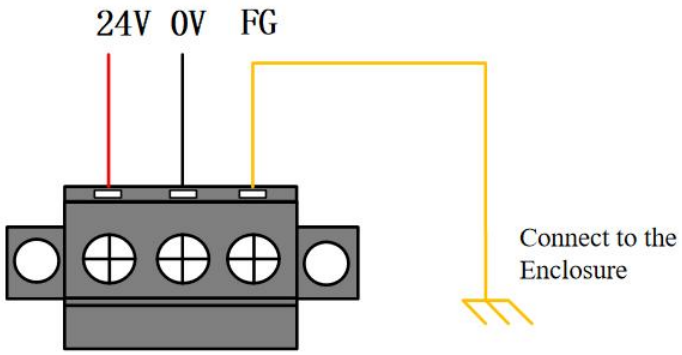


Figure 3-4 Power wiring terminals

3.1.2 J02 PWM/DA Wiring Terminal

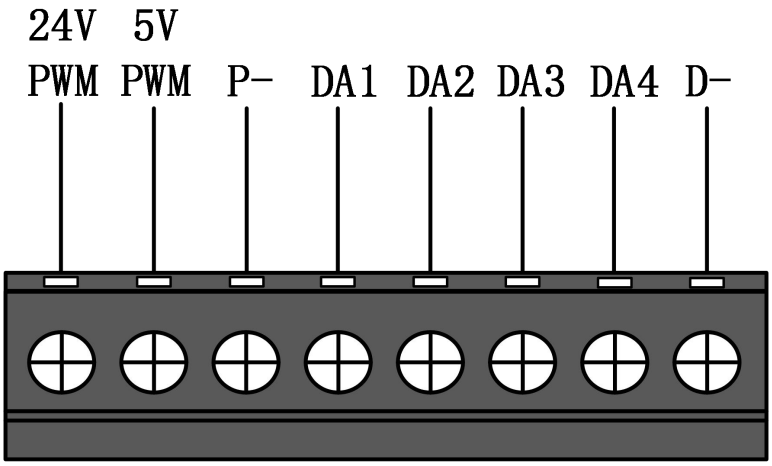


Figure 3-5 PWM/DA wiring terminal

BCL4568E has 2 pulse width modulation (PWM) signals. The left channel is 24 V level PWM, the right channel is 5 V level PWM, and P- is the negative terminal of the PWM signal. The duty cycle is adjustable from 0% to 100% with a maximum carrier frequency of 50 kHz. The signal output is shown in the figure below.

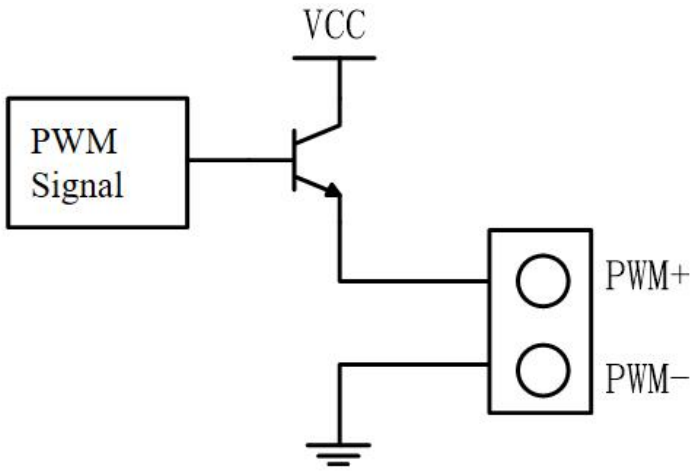


Figure 3-6 PWM output circuit

⚠ Caution：

1. There are dedicated enabling relays for PWM+ and PWM- signals, and there is no need for external relay for isolation.

2. Wrong connection of the 5 V/24 V PWM signals may cause damage to the laser.

BCL4568E has 4 analog outputs from 0 ~ 10 V. DA1/DA2/DA3/DA4 are positive terminals of analog, and D- is the negative terminal of analog. It is advised to configure DA1/DA2/DA3/DA4 as control signals for laser peak power and gas proportional valves through the Machine Config Tool of CypCutE.

Table 3-2 BCL4568E Signals

Parameter	Value
Output Signal Range	0 V ~ +10 V
Maximum Output Load Capacity	50 mA
Maximum Tolerance	+/-10 mV
Resolution	2.7 mV
Conversion Speed	400 us

3.1.3 J03/J04/J05 Output Terminal

Taking J03 as an example, the terminals are shown in the figure below:

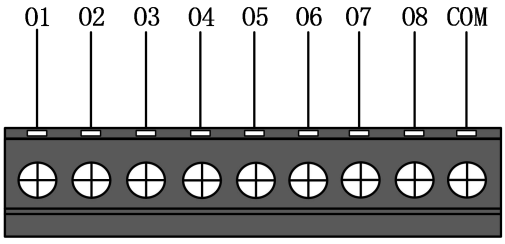


Figure 3-7 Output Wiring terminals

There are 24 high-level (24 V level) outputs for J03-J05, the figure above shows the wiring of J03. 01-08 are positive ends of the output terminal, and COM is the negative end of the output terminal. Through Machine Config tool, the 24 outputs can be configured to work as the output port of ***Height Controller***, ***Laser***, ***Cutting Head***, ***Auxiliary Gas***, ***Alarm***, and ***Dual-Motor Pallet Changer***.

⚠ Caution：

1. The maximum current of one output port is 0.7 A, and the short circuit protection will be triggered once exceeded.

2. The maximum current of total output port is 2.5 A, and the short circuit protection will be triggered once exceeded.

3.1.4 J06/J07/J08 Input Terminal

Taking J06 as an example, the terminals are shown in the figure below:

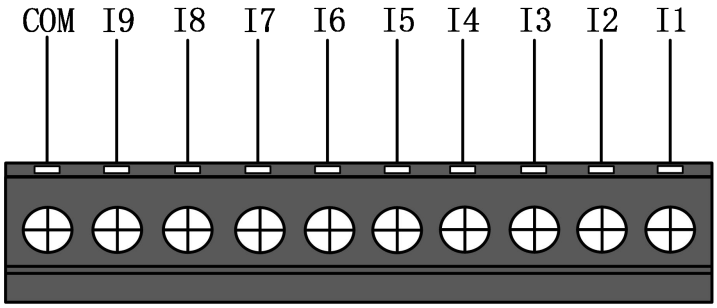


Figure 3-8 Input wiring terminals

There are a total of 27 input channels in J06, J07 and J08.

- IN1 ~ IN24: active (conducting) at low level (0 ~ 15V); inactive (non-conducting) at high level (19 ~ 24 V);
- IN25 ~ IN27: active (conducting) for high level (8 ~ 24V); inactive (non-conducting) at low level (0 ~ 4 V).

Taking J06 as an example, I1 ~ I9 are the positive ends of input terminals, and COM is the negative end of the input terminal.The typical wiring of a photoelectric switch is shown below, and NPN type 24 V photoelectric switch must be used.

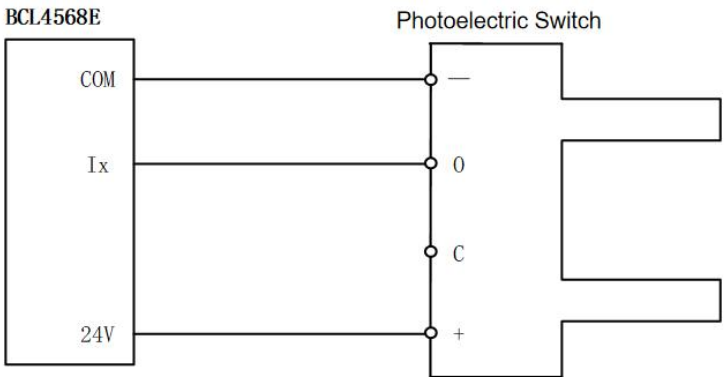


Figure 3-9 Photoelectric Switch wiring

The typical wiring of the contact switch is shown below.

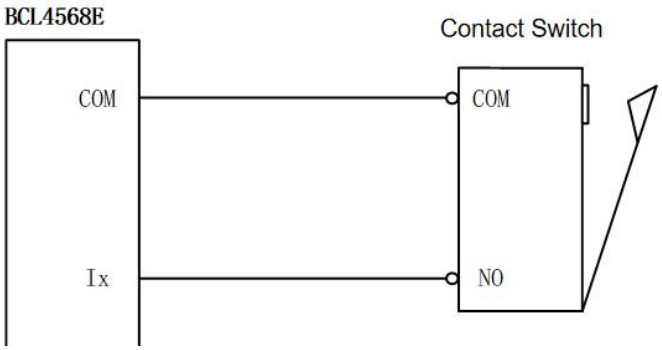


Figure 3-10 Contact Switch wiring

The typical wiring of magnetic switch is shown below, NPN type 24 V magnetic switch shall be used.

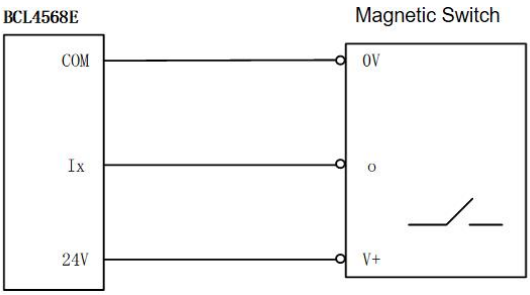


Figure 3-11 Magnetic Switch wiring

3.1.5 J09 PWE Network Interface

J09 is an output interface that connects the Ethernet power. It supports 100 Mbps network communication, and provides power and communication to the BLT cutting heads via PWE cables.

Figure 3-12 PWE Interfaces

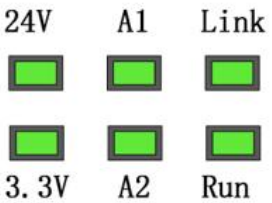


Figure 3-13 PWE indicator

The table below shows the distinct connection status indicated by the PWE LEDs.

Table 3-3 PWE Network and Power Connection Status Sheet

Label	Description	LED Color	Status	Description
1：Link	Hardware Connection and Communication Status	Green	Off	PWE No Connection
			On	PWE Connected
			Blinking	Connected, with Communication
2：Run	EtherCAT Bus Link Status	Green	Off or Blinking	Not in the OP State
			On	In the OP State

3.1.6 J10 Network Interface

J10 is the output and input interface for EtherCAT network. It supports 100 Mbps network communication, and is recommended to use CAT5E (or above) standard RJ45 network cable for bus communication.

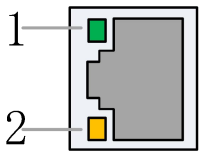


Figure 3-14 Network terminal

Description of the connection status of the network interface is shown in the table below.

Table 3-4 RJ45 Connection Status

Label	Description	LED Color	Status	Description
1：Link	EtherCAT Bus Connection and Communication Status	Green	Off	No Connection
			On	Connected, No Communication
			Blinking	Connected, with Communication
2：Status	EtherCAT Bus Link Status	Yellow	Off or Blinking	Not in the OP State
			On	In the OP State

3.2 Wiring Diagram

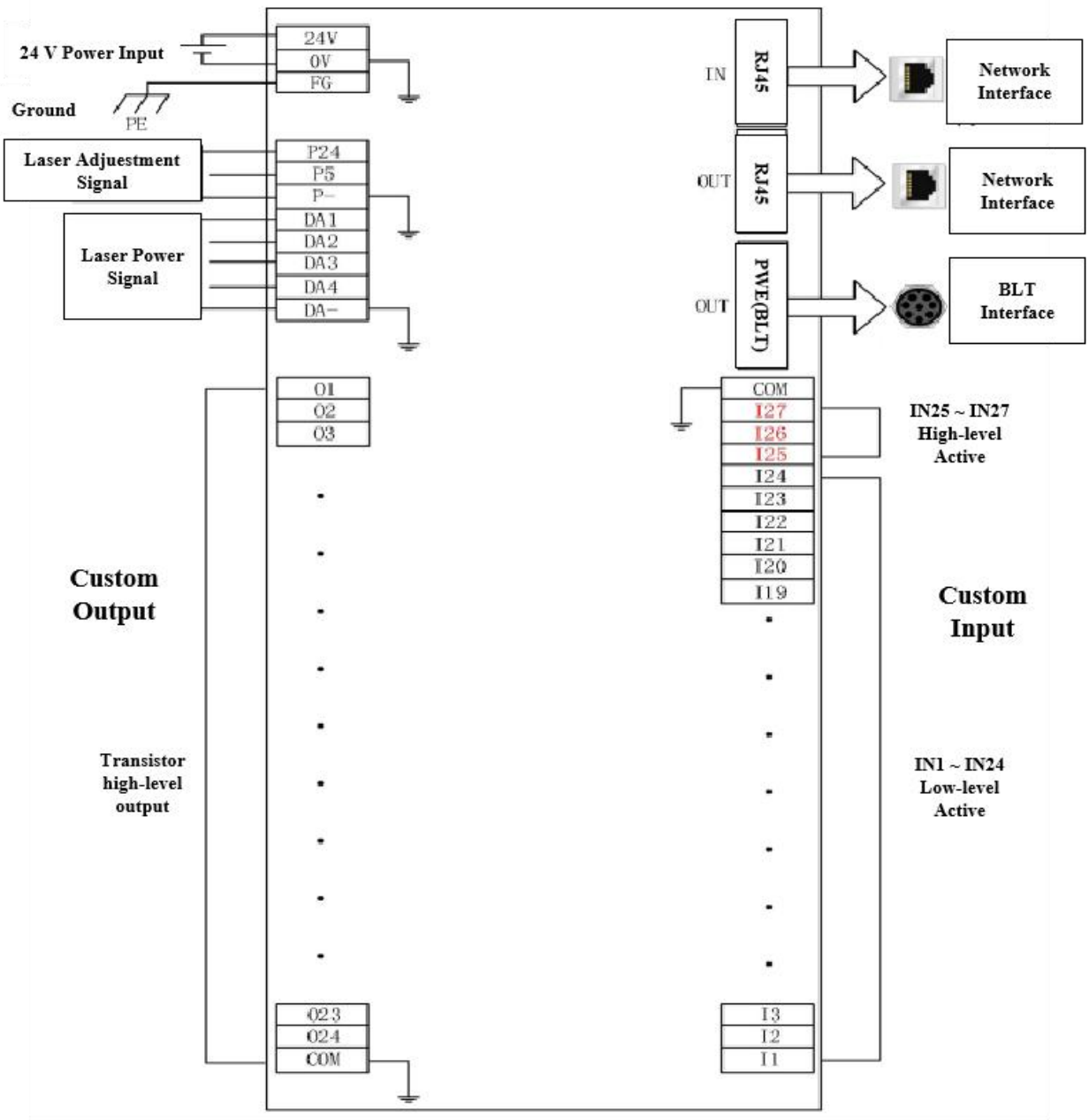


Figure 3-15 BCL4568E wiring

Chapter 4 BCL4566E Wiring

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

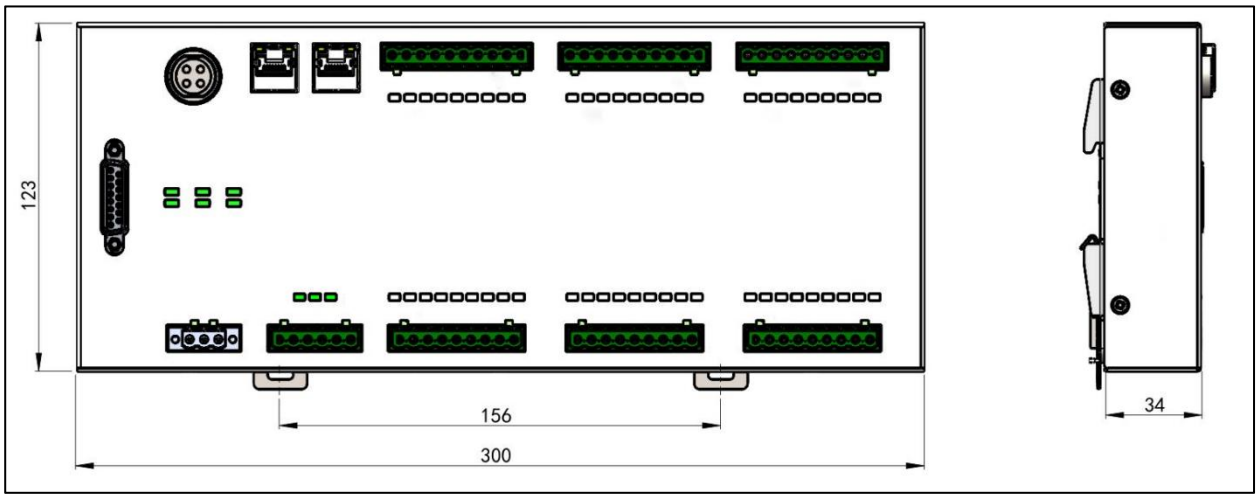


Figure 4-1 BCL4566E dimension (mm)

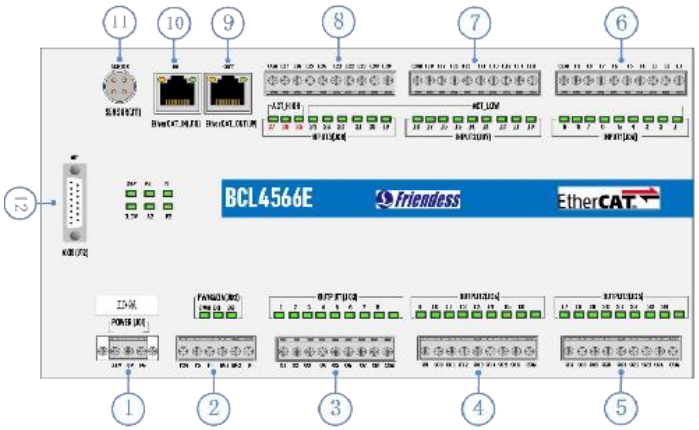
The table below shows the hardware resources of BCL4566E.

Table 4-1 BCL4566E Technical Data

Module	Qty.	Description
Power	/	Input: 24 VDC/3.5 A
DA	4	● Range: 0 ~ 10V ● Resolution: 12 bit ● Accuracy: 50 mV
PWM	2	● Voltage Levels: 5 V and 24 V ● Accuracy: 5 kHz, 0.3% (Top to 50 kHz, 3%)
General Output	24	● Logic Level: 24 V high level ● Current Limits: ≤ 0.7 A per channel; ≤ 2.5 A for all channels
Axis Quantity	1	● Signal Type: Digital pulse (PUL ± / DIR ± differential outputs) ● Max. Pulse Frequency: 600 kHz
Dedicated Input	27	● IN1 ~ IN24: active-low (valid range: 0 ~ 15 V) ● IN25 ~ IN27: active-high (valid range: 8 ~ 24V)
Capacitive Sensor	1	Frequency range: 2 MHz to 4 MHz.

Module	Qty.	Description
Working Temperature	/	0℃ ~ 60℃
Humidity	/	10% ~ 90% RH (non-condensing)
Dimension	/	300 × 123 × 34 mm (L × W × H)
Weight	/	640 g

4.1 Interface Layout



J01 Power Input
J02 PWM & DA Output
J03 General Output 1
J04 General Output 2
J05 General Output 3
J06 General Input 1
J07 General Input 2
J08 General Input 3
J09 Ether CAT Output
J10 Ether CAT Input
J11 Capacitive Sampling Input
J12 Pulse axis

Figure 4-2 Detailed interface layout of BCL4566E terminal

4.1.1 J01 Power Terminal

The machine's shell is the negative terminal of the capacitor measured. To ensure stable operation of the measuring circuit, the ***FG*** pin of the power supply interface must conduct well with the machine shell, and the preamplifier shell of the BCL4566E must also conduct well with the machine shell. Specific indicators are: DC resistance should always be less than 10 Ω, otherwise it might not be effective for EMC.

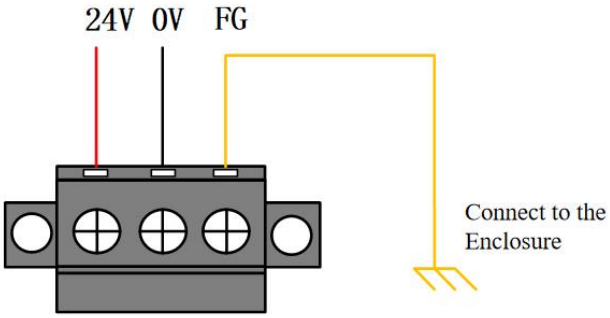


Figure 4-3 Power wiring terminals

4.1.2 J02 PWM/DA Wiring Terminal

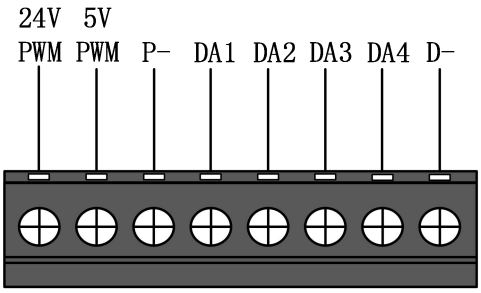


Figure 4-4 PWM/DA wiring terminal

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

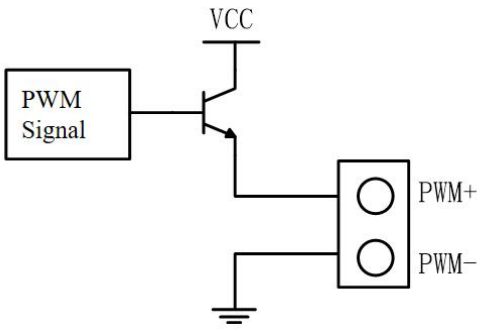


Figure 4-5 PWM output circuit

Caution：

1. There are dedicated enabling relays for PWM+ and PWM- signals, and there is no need for external relay for isolation.

2. Wrong connection of the 5V/24V PWM signal may cause damage to the laser.

BCL4566E has 2 analog outputs from 0 ~ 10 V. DA1/DA2 are positive terminals of analog, and D- is the negative terminal of analog. It is advised to configure DA1/DA2 as control signals for laser peak power and gas proportional valves through the Machine Config Tool of CypCutE

Below are the signals of BCL4566E.

Table 4-2 BCL4566E Signals

Parameter	Value
Output Signal Range	0 V ~ + 10 V
Maximum Output Load Capacity	50 mA
Maximum Tolerance	+/- 10 mV
Resolution	2.7 mV
Conversion Speed	400 us

4.1.3 J03/J04/J05 Output Terminal

Taking J03 as an example, the terminals are shown in the figure below:

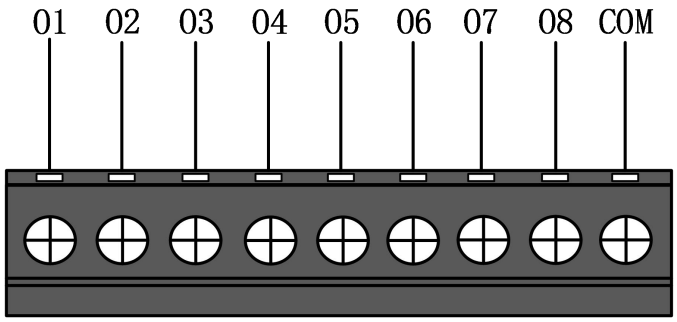


Figure 4-6 Output wiring terminals

There are 24 high-level (24 V level) outputs for J03 ~ J05. The figure above shows the wiring of J03. 01 ~ 08 are positive ends of the output terminal, and COM is the negative end of the output terminal. Through TubePro Machine Config tool, the 24 outputs can be configured to work as the output port of ***Height Controller***, ***Laser***, ***Cutting Head***, ***Auxiliary Gas***, ***Alarm***, and ***Dual-Motor Pallet Changer***.

⚠ Caution：

3. The maximum current of one output port is 0.7 A, or the short circuit protection will be triggered.
4. The maximum current of total output port is 2.5A, or the short circuit protection will be triggered.

4.1.4 J06/J07/J08 Input Terminal

Taking J06 as an example, the terminals are shown in the figure below:

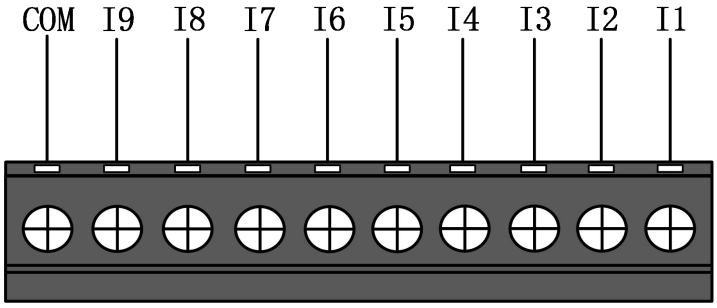


Figure 4-7 Input wiring terminals

There are a total of 27 input channels in J06, J07 and J08.

- IN1 ~ IN24: active (conducting) at low level (0 ~ 15V), inactive(non-conducting) at high level (19 ~ 24 V);
- IN25 ~ IN27: active (conducting) for high level (8 ~ 24V), inactive(non-conducting) at low level (0 ~ 4 V).

Taking J06 as an example, I1 ~ I9 are the positive ends of input terminals, and COM is the negative end of the input terminal.The typical wiring of a photoelectric switch is shown below, and NPN type 24 V photoelectric switch must be used.

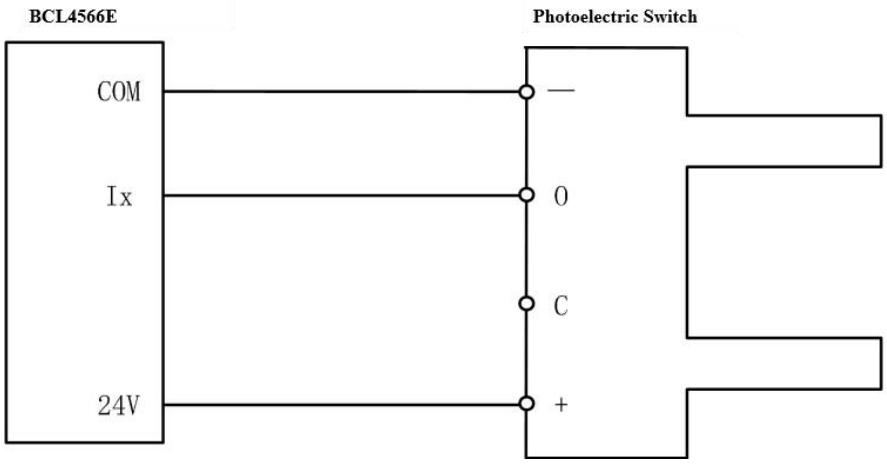


Figure 4-8 Photoelectric switch wiring

The typical wiring of the contact switch is shown below.

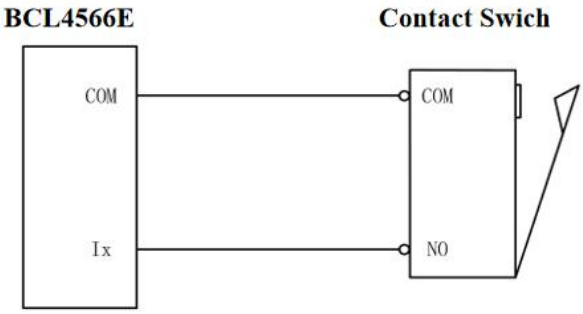


Figure 4-9 Contact switch wiring

The typical wiring of magnetic switch is shown below, NPN type 24V magnetic switch shall be used.

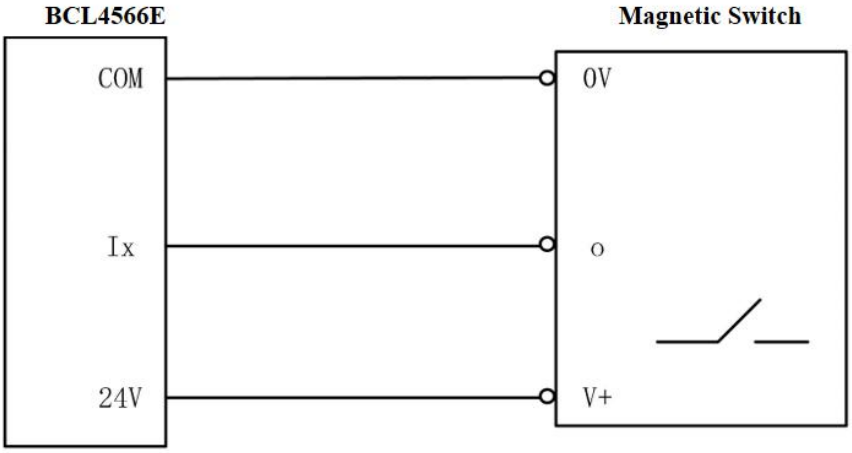


Figure 4-10 Magnetic switch wiring

4.1.5 J09/J10 Network Interface

J09 is an output interface, while J10 is the input interface. It supports 100Mbps network communication, and is recommended to use CAT5E (or above) standard RJ45 network cable for bus communication.

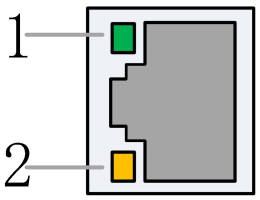


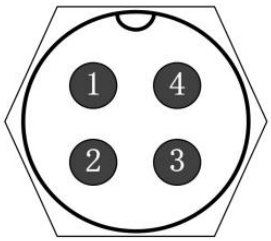
Figure 4-11 Network terminal for RJ45 connection

Description of the connection status of network interface is shown in the table below.

Table 4-3 RJ45 Connection Status

Label	Description	LED Color	Status	Description
1：Link	Ether CAT Bus Connection and Communication Status	Green	Off	No Connection
			On	Connected, No Communication
			Blinking	Connected, with Communication
2：Status	EtherCAT Bus Link Status	Yellow	Off or Blinking	Not in the OP State
			On	In the OP State

4.1.6 J11 Sensor Interface



1: Connect to 1 of the other end;
2: Connect to 2 of the other end;
3: Connect to 3 of the other end;
4: Connect to 4 of the other end.

Figure 4-12 Sensor interface

The 4-core signal transmission cable for the sensor can be self-made using a 3-core shielded cable and 2 four-core aviation plugs. In the case of manufacturing the cable, connect cores 1, 2, and 3 to their corresponding counterparts. For the 4th core, it must be connected to the shielding layer. To ensure stability, using the original cable is recommended.

4.1.7 J12 DB15 Interface for Server

The focusing servo driver control interface of BCL4566E is a DB15F double-row hole interface, and the pin definitions of the corresponding wire are shown in the following figure:

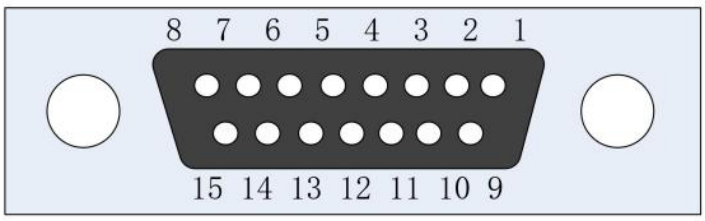


Figure 4-13 Servo driver interfaces

The axes definition is shown below:

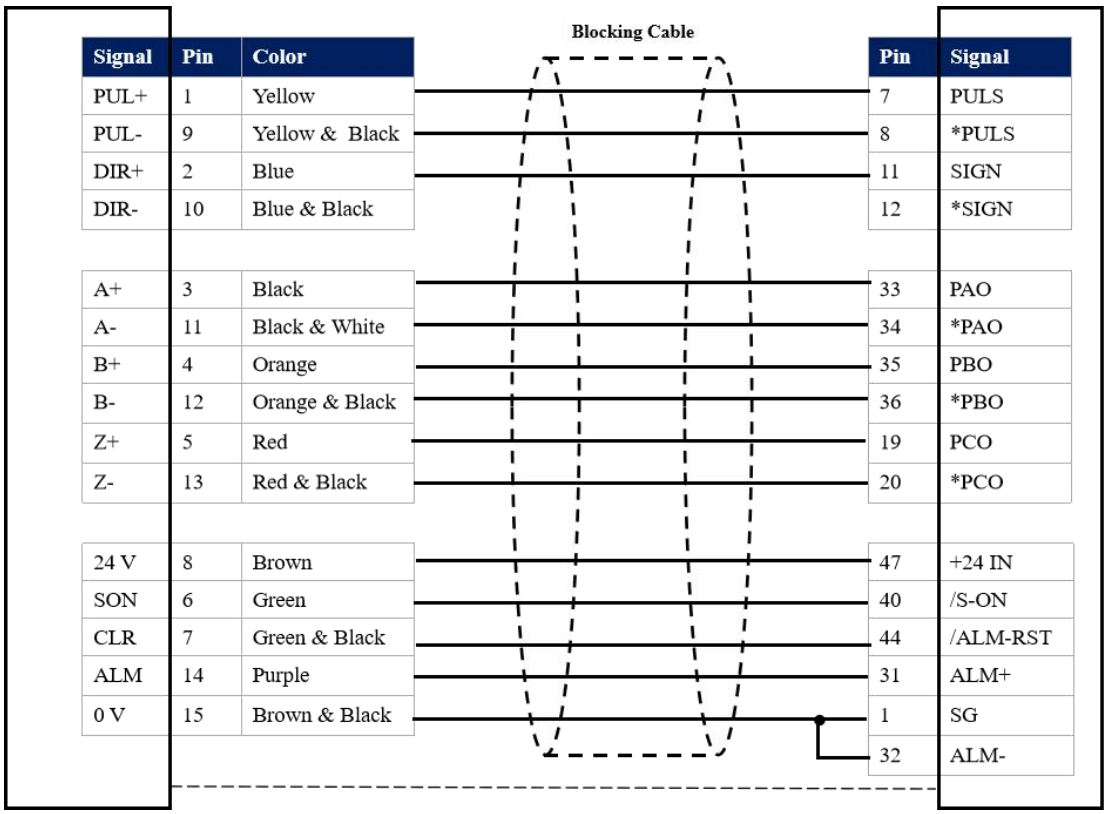
Table 4-4 J12 DB15 Interface Signals

Pin	Signal Name		Pin	Signal Name
1 Yellow	PUL+ (Positive Pulse)		9 Yellow & Black	PUL- (Negative Pulse)
2 Blue	DIR+ (Positive Direction)		10 Blue & Black	DIR- (Negative Pulse)
3 Black	A+ (Encoder A Phase Positive)		11 Black & White	A- (Encoder A Phase Negative)
4 Orange	B+ (Encoder B Phase Positive)		12 Orange & Black	B- (Encoder B Phase Negative)
5 Red	Z+ (Encoder C Phase Positive)		13 Red & Black	Z- (Encoder Z Phase Negative)
6 Green	SON (Servo Enable)		14 Purple	ALM (Alarm Signal)
7 Green & Black	—		15 Brown & Black	0V(Power Ground)
8 Brown	24V (Power Output)			

⚠ Caution:

1. +24 V, 0 V: Supply 24 VDC power to the servo driver.
2. PUL: Digital signal, which provides pulse signals to the driver.
3. DIR: Digital signal, which provides direction signals to the driver.
4. SON: Output the servo drive enable signal.
5. ALM: Receive the alarm signal from the servo driver.
6. A+, A-, B+, B-, Z+, Z-: Three-phase signals of the encoder, input signals.

4.1.8 Axis Wiring Diagram for Yaskawa Servo



Signal	Pin	Color	Pin	Signal
PUL+	1	Yellow	7	PULS
PUL-	9	Yellow & Black	8	*PULS
DIR+	2	Blue	11	SIGN
DIR-	10	Blue & Black	12	*SIGN
A+	3	Black	33	PAO
A-	11	Black & White	34	*PAO
B+	4	Orange	35	PBO
B-	12	Orange & Black	36	*PBO
Z+	5	Red	19	PCO
Z-	13	Red & Black	20	*PCO
24 V	8	Brown	47	+24 IN
SON	6	Green	40	/S-ON
CLR	7	Green & Black	44	/ALM-RST
ALM	14	Purple	31	ALM+
0 V	15	Brown & Black	1	SG
			32	ALM-

Figure 4-14 Axis wiring diagram for Yaskawa servo

⚠ Caution:

When connecting drives of other brands, pay attention to the following:

1. Check the type of the SON signal, and check whether it is active at a low level (that is, it is ***ON*** when it is connected to the GND of the 24 V power supply).

2. Confirm the parameter setting of the servo drive, and that the received pulse signal type is ***pulse + direction***.

3. Check whether there is an external emergency stop signal input in the input terminals of the servo drive, and the logic of this signal.

4. Before the trial operation of the drive, the terminal block must be supplied with a 24V power source first, because the 24V power source required by the servo is supplied through the terminal block.

5. If the drive still cannot operate, confirm that the drive parameter setting ***forward and reverse rotation input prohibition*** is not used.

4.2 Wiring Diagram

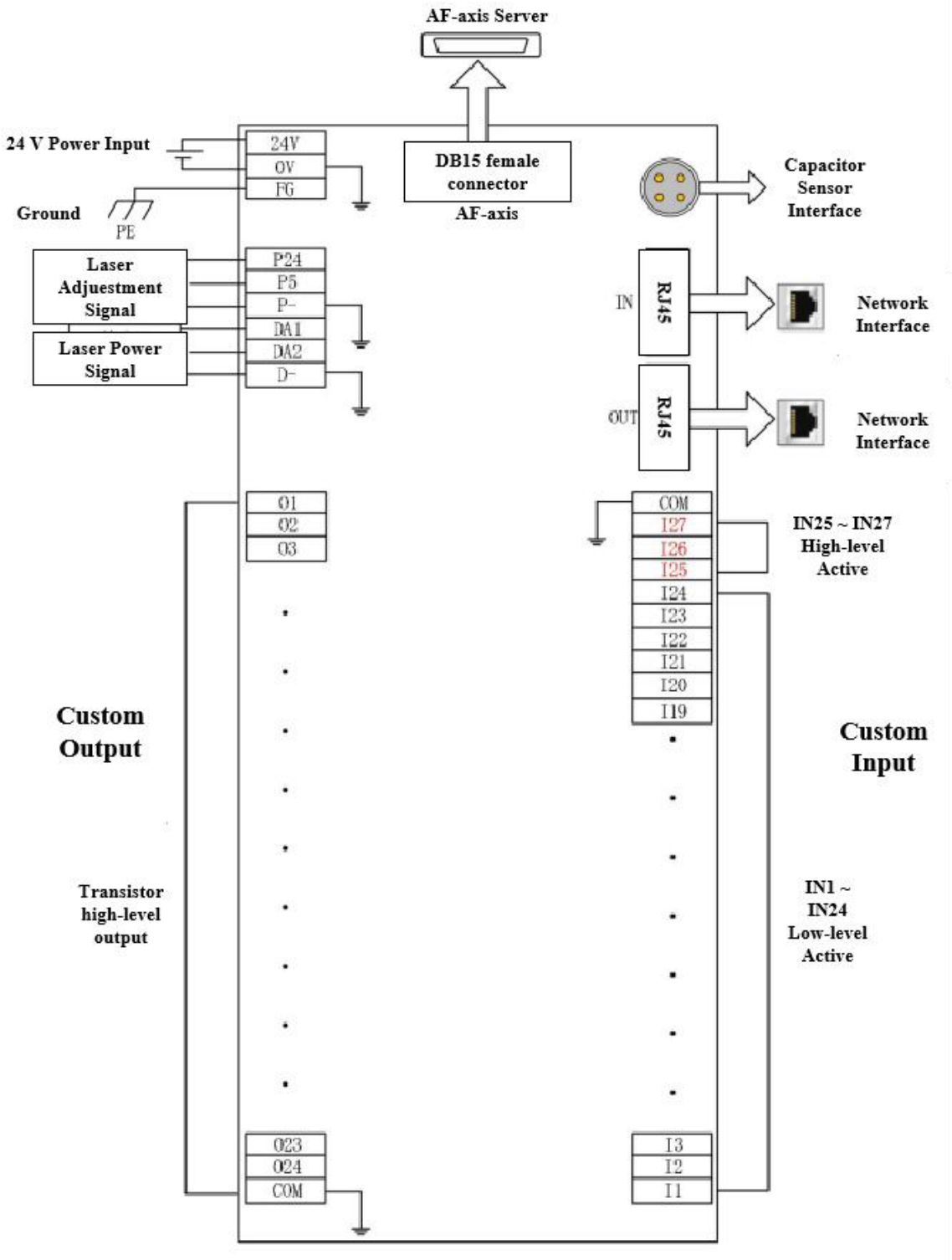


Figure 4-15 BCL4566E wiring

Chapter 5 Cutter Wiring

5.1.1 ProCutter Wiring

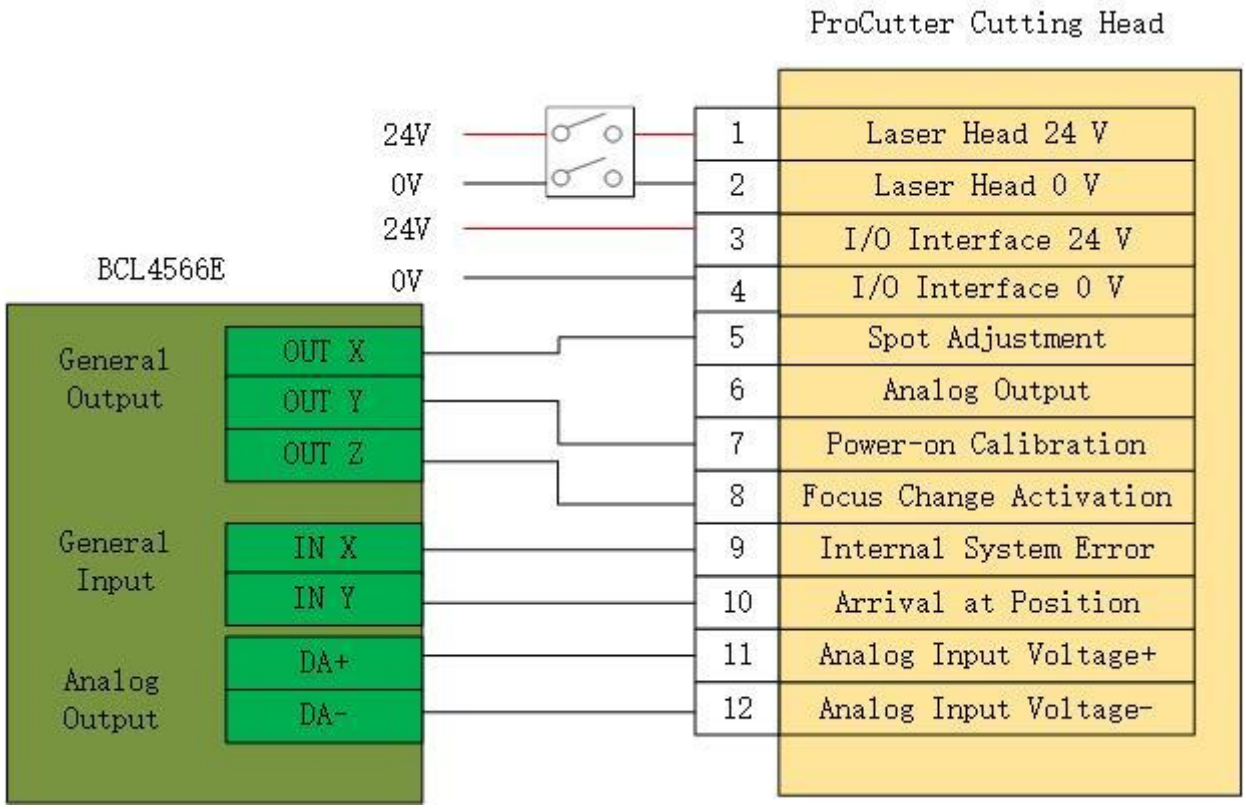


Figure 5-1 ProCutter wiring

Chapter 6 Laser Wiring

6.1 IPG-German Non-Network Communication Wiring

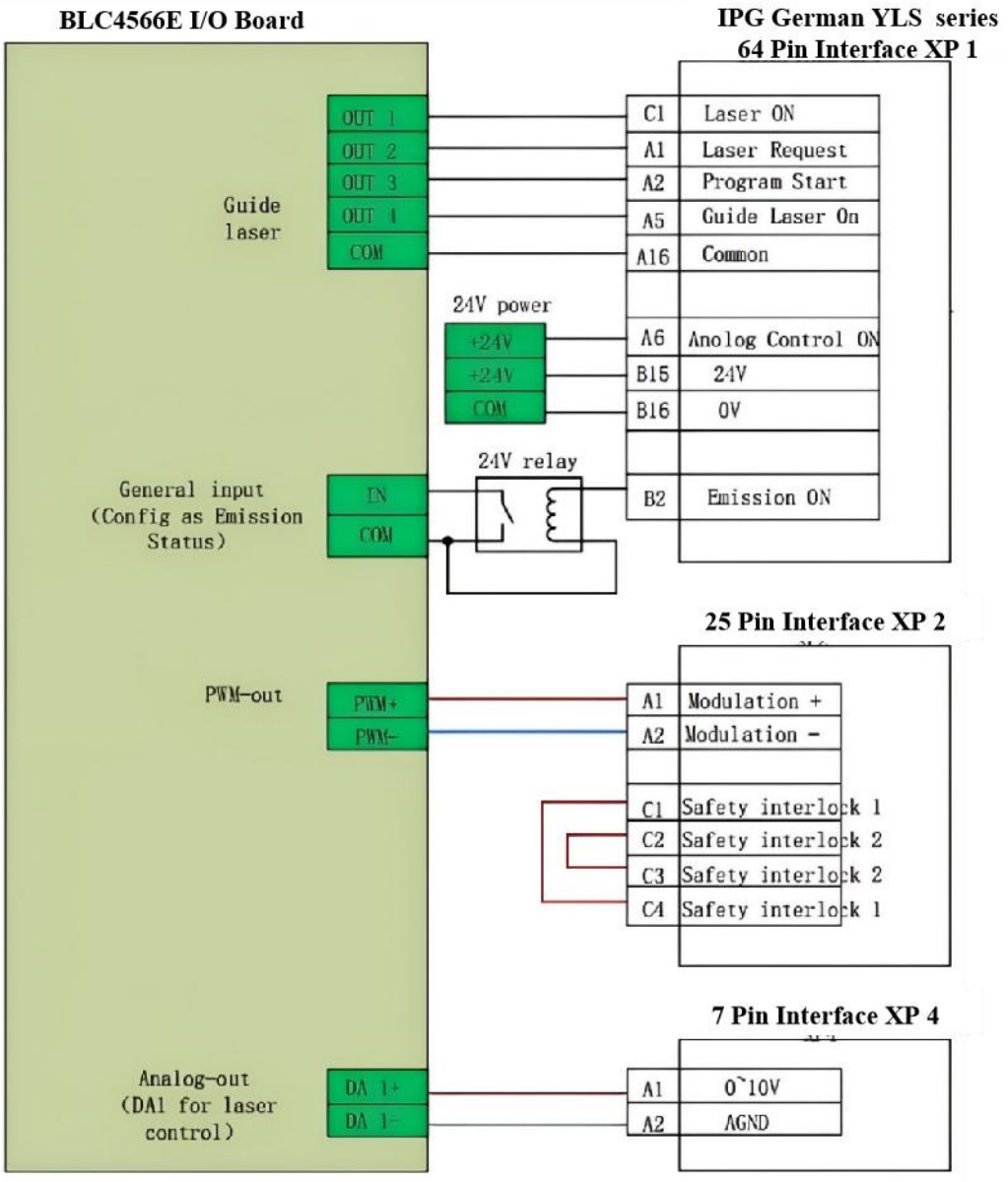


Figure 6-1 IPG-German laser wiring

6.2 IPG-American Non-Network Communication Wiring

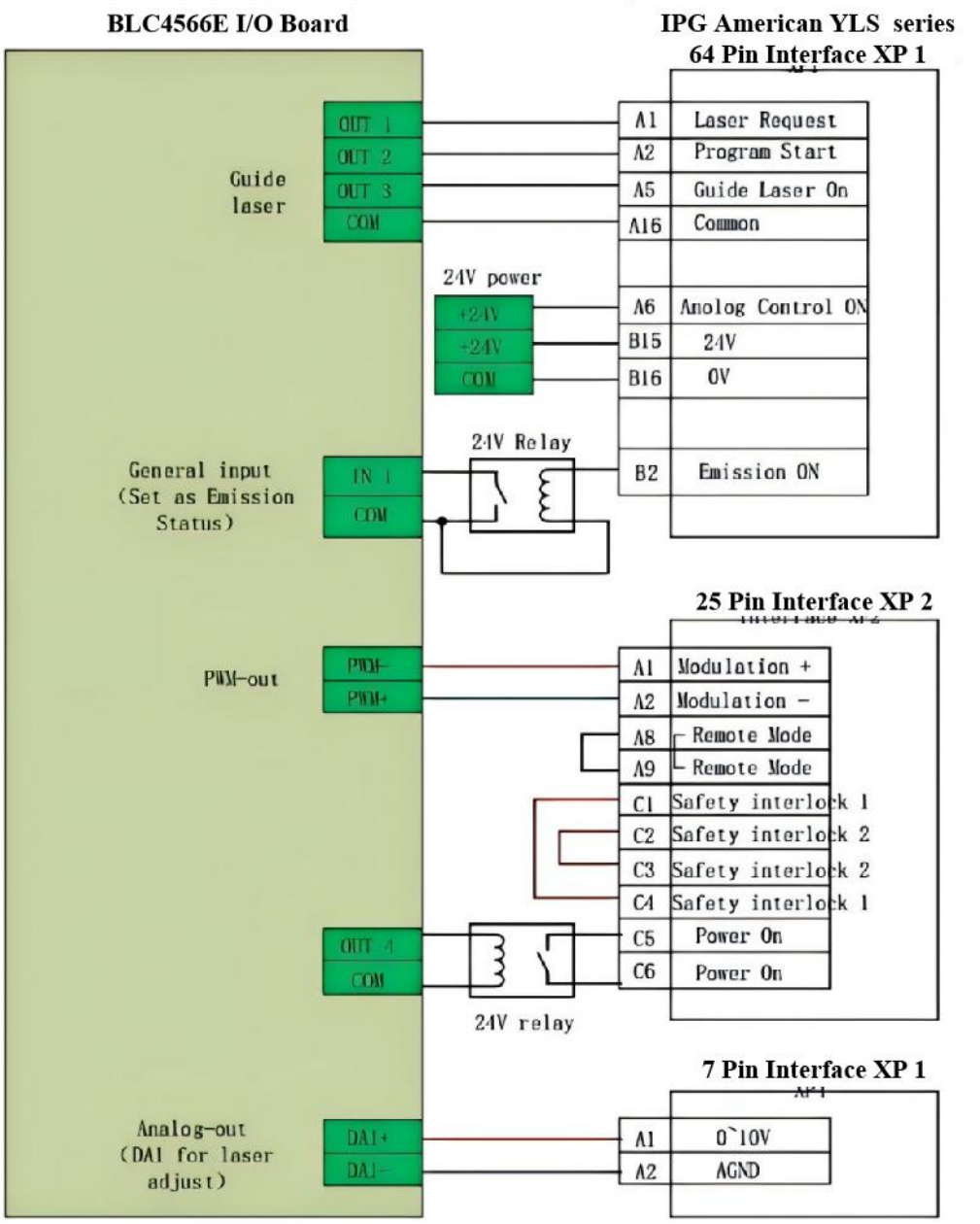


Figure 6-2 IPG-American laser wiring

6.3 RayCus Serial Communication Wiring

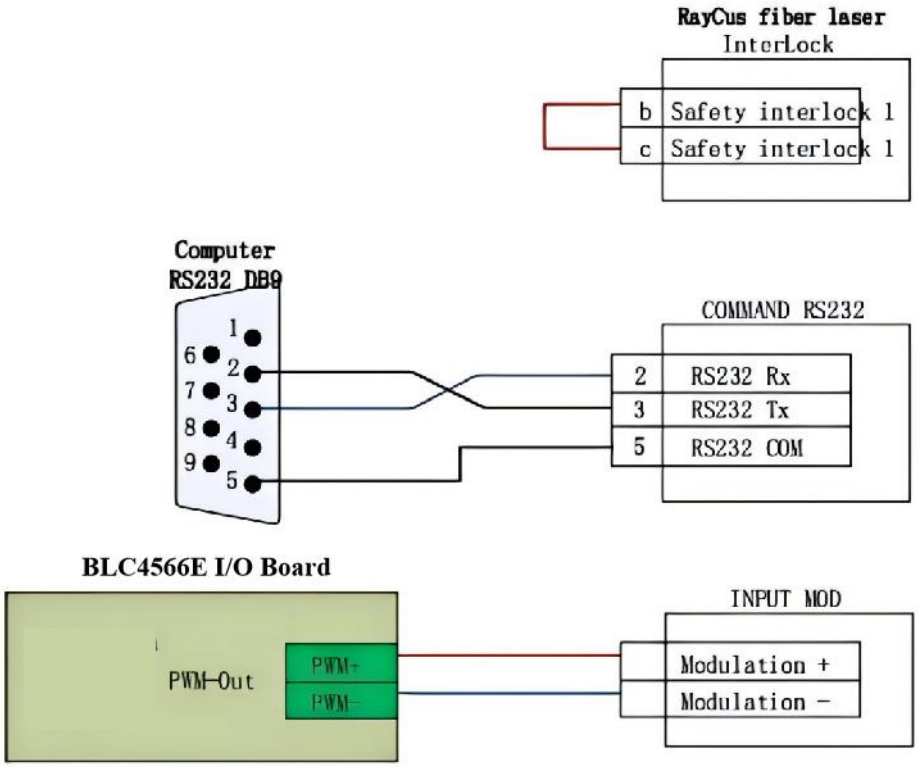


Figure 6-3 RayCus laser wiring

6.4 Trumpf Serial Communication Wiring

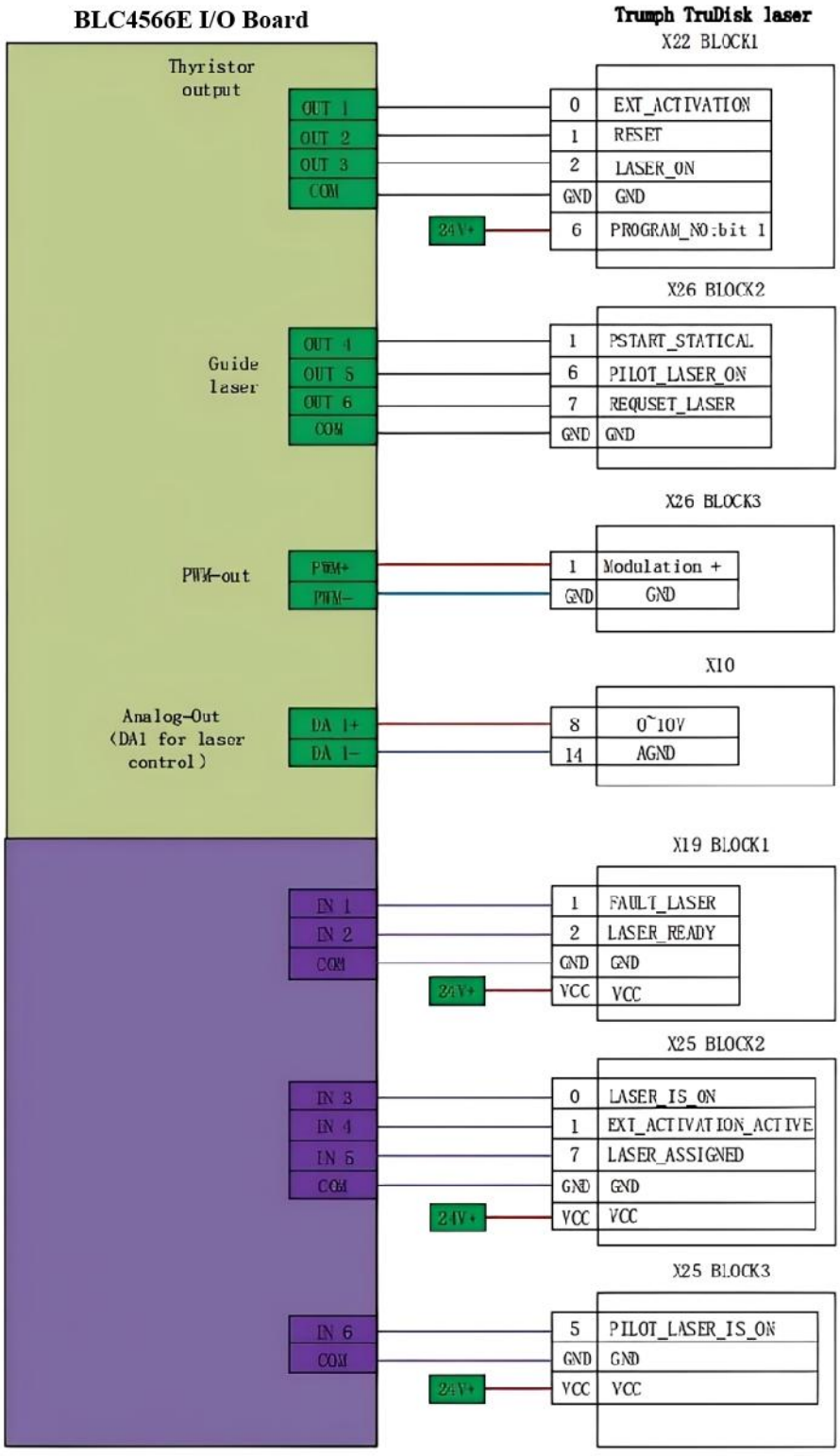


Figure 6-4 Trumpf laser wiring

Chapter 7 Installation Instructions

7.1 Install BMC228B Master Control Card

Step 1 Power off the host.

Step 2 Open the host chassis, select a free PCIe slot, and use a screwdriver to remove its slot cover.

Step 3 Insert BMC228B into the slot (see Installation Diagram).

Step 4 Tighten the screws of the BMC228B retention bracket with a screwdriver.

Step 5 Cover the chassis cover, and power on the host PC.

7.2 Install BMC228B Driver

Two ways to install BMC228B driver.

- Check ***Drivers*** when installing CypCutE. The BMC228B driver will be automatically installed.

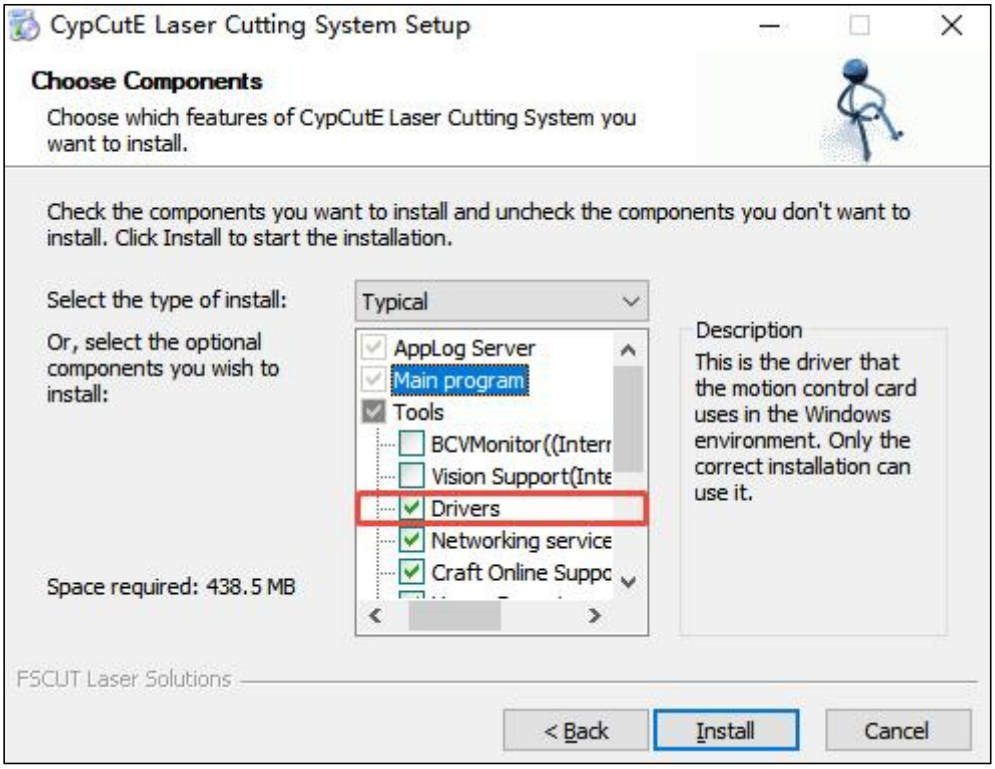


Figure 7-1 Install drivers during CypCutE installation

- Install BMC228B driver through ***Device Manager***.

1. Open the ***Device Manager***. If the driver is not installed, ***Other Devices*** will be accessible.

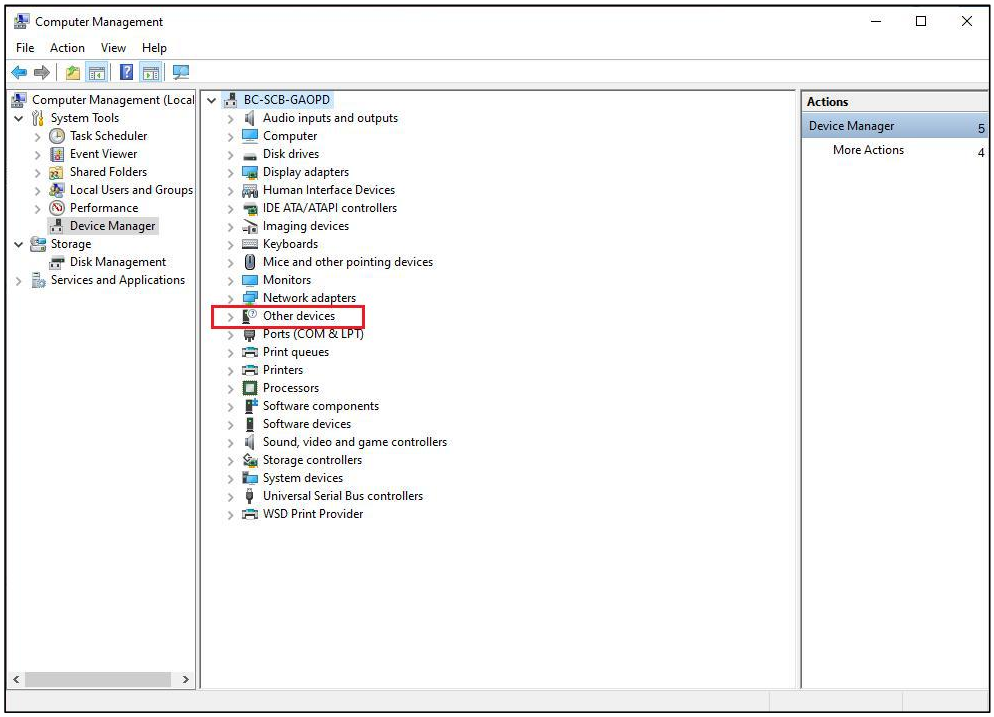


Figure 7-2 Device manager interface

2. Under ***Other Devices***, right-click on ***PCI FLASH Memory***, and select ***Update Driver Software***.

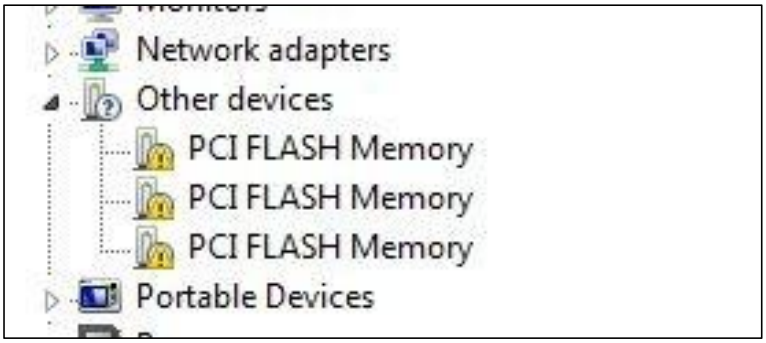


Figure 7-3 Right-click ***PCI FLASH Memory*** to select ***Update Driver Software***

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

4. ***BMC228 DMA*** will be shown as the figure below.

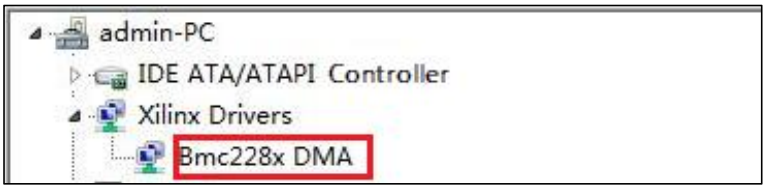


Figure 7-4

7.3 Connect Slave

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

7.4 Scan in Machine Config Tool

Open **Machine Config Tool**, and enter the password (61259023).

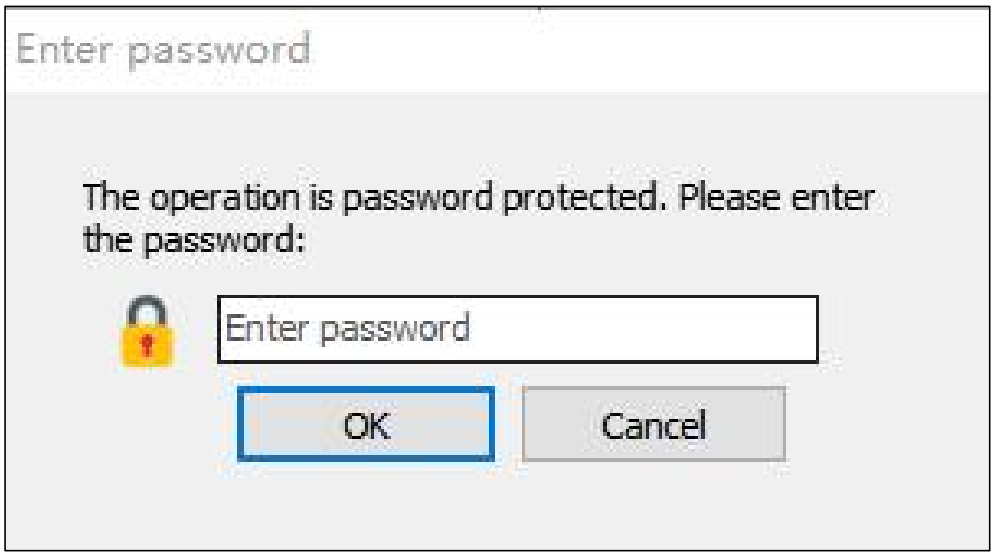


Figure 7-5 Enter the password to access machine config tool

In the ***BUS Scan*** interface, click ***Start scan***, and the system will scan the connected slave information.

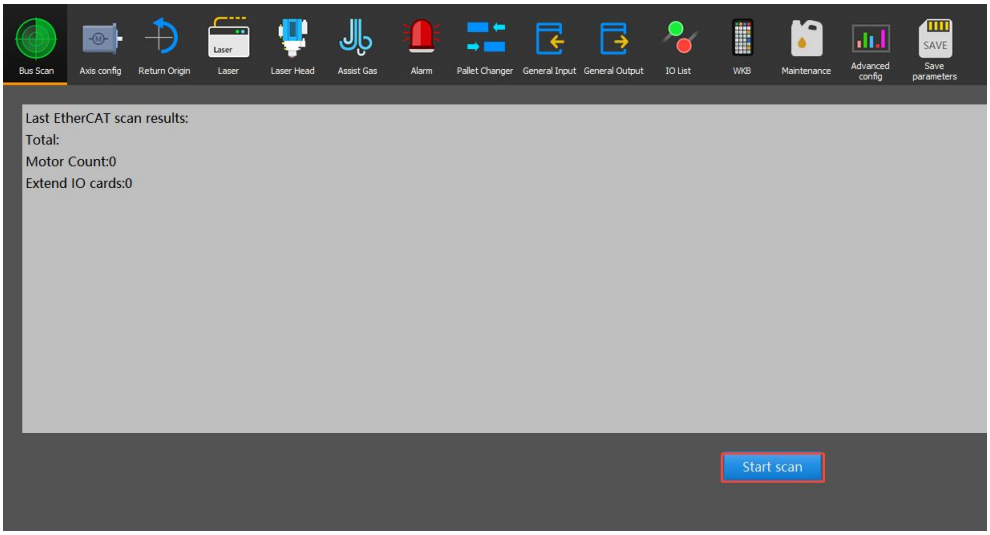


Figure 7-6 Scan the connected slave

7.5 Operate CypCutE

After setting the parameters in ***Machine Config Tool***, return to the user interface of CypCutE. Import the drawings, set the process parameters, and finally click ***Start*** to cut. For software functions, refer to CypCutE User Manual.

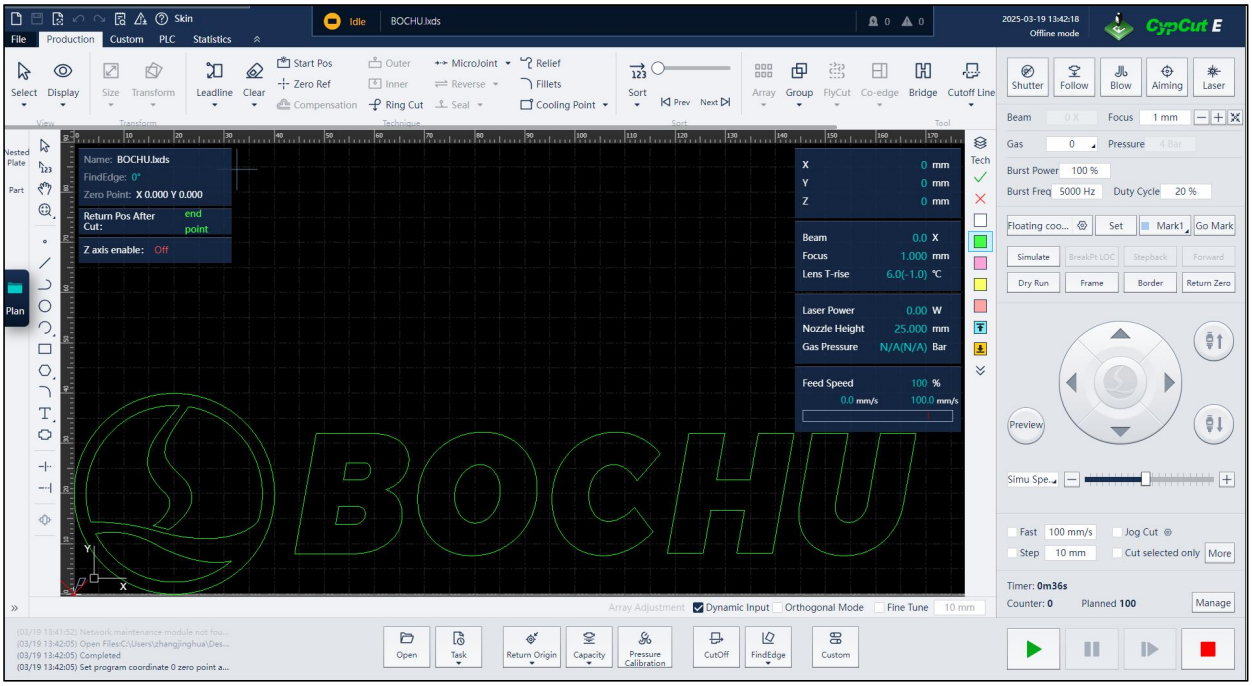


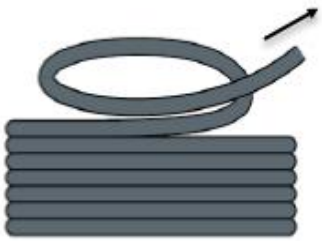
Figure 7-7 CypCutE user interface

Chapter 8 Wiring Precautions

8.1 **Drag Chain Wiring**

- 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 should be done before laying the cables, to give the cables time for 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.

Table 8-1 Cable Releasing

Correct	Incorrect
	

- 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.

- 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. A minimum clearance of 10% of the cable diameter must be maintained between cables and adjacent spacer, separators, or neighboring cables.

Table 8-2 Cable Laying

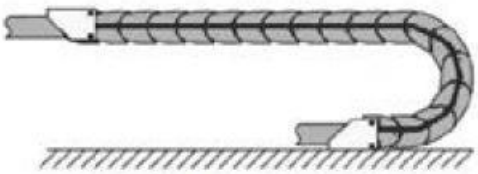
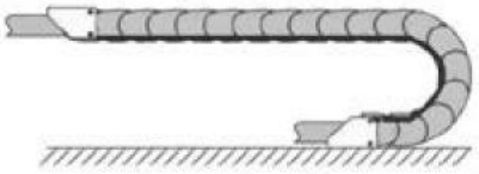
Correct	Incorrect
	

- The cables should be installed according to the weight and size of the cables. The larger and heavier cables should be placed outside; the smaller and lighter cables should be placed inside. The cables can also be placed from the inside out in descending order of size. Do not place one cable on top of another without using a spacer.
- 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.
- For a 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.

Figure 8-2 Self-Supporting and sliding

- 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).
- 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.

Table 8-3 Cable runs Along the Center Area of the Drag Chain

Correct	Incorrect
	

- 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.
- 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.

8.2 Machine Tool Wiring

- Power Supply (Power) Wiring
  - Strong Electricity
    - Strict separation of strong and weak electricity

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

Table 8-4 Cable Diameter and Corresponding Power

Cable Spec (mm^2)	Cross Section (mm^2)	25℃ Copper Wire Ampacity (A)	Single-Phase 220 V Load Power (W)	Three-Phase 380 V 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.

- Weak Electricity (24 VDC 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.

➢ Grounding

- The ground wiring adopts the standard two-color wires, yellow and green.

- 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 ≤ 0.1Ω。

➢ Signal (Control)

- Signal wire color, e.g., black.

- Choose the signal wire according to the power.

- 24 VDC 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:

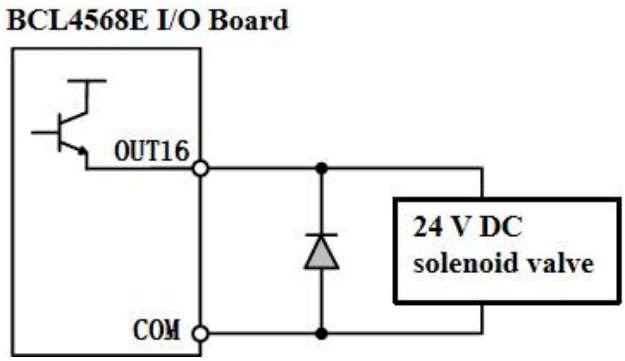


Figure 8-3 Connect a freewheeling diode in parallel at both ends of the Solenoid Valve

- 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 ≤ 1Ω and the resistance to the grounding point of the electrical cabinet is ≤ 6Ω.

➢ Notes

- Each cable is marked clearly and accurately.

- Cables are parallel and not crossed, and the harnesses should be straight and leveled.

- If using the cables from BOCHU, 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.

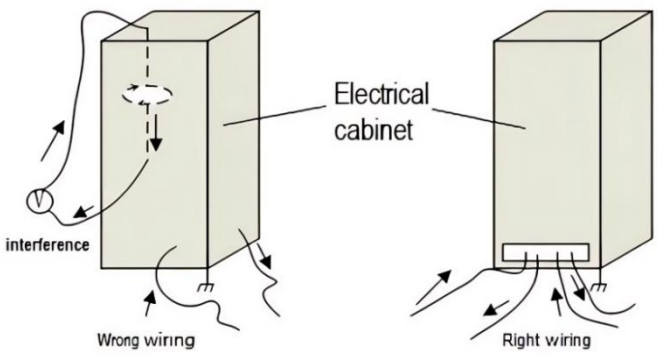


Figure 8-4 Cabinet wiring

8.3 Assembly Requirements

- Handle control cards with extreme care. Before touching circuit components or inserting/removing control cards, wear anti-static gloves or discharge static electricity by contacting a properly grounded metal object. Failure to comply may cause electrostatic discharge (ESD) damage to the BMC 228B master control card.
- Except for the USB interface, all other interfaces must be connected/disconnected ONLY when the system is powered off. Live plugging/unplugging (while powered on) may result in permanent damage to internal components due to electrical surges.
- Handle with care. Avoid applying physical pressure or placing heavy objects on the control card. Mechanical stress (e.g., bending) may deform the card, leading to circuit failure or functional impairment.

Chapter 9 Troubleshooting

9.1 Device Manager Cannot Find PCIe Devices

If the device manager cannot find any PCIe devices:

Step 1 Check the status of the indicators on BMC228B. The positions of the power indicator and system status indicator are shown below.

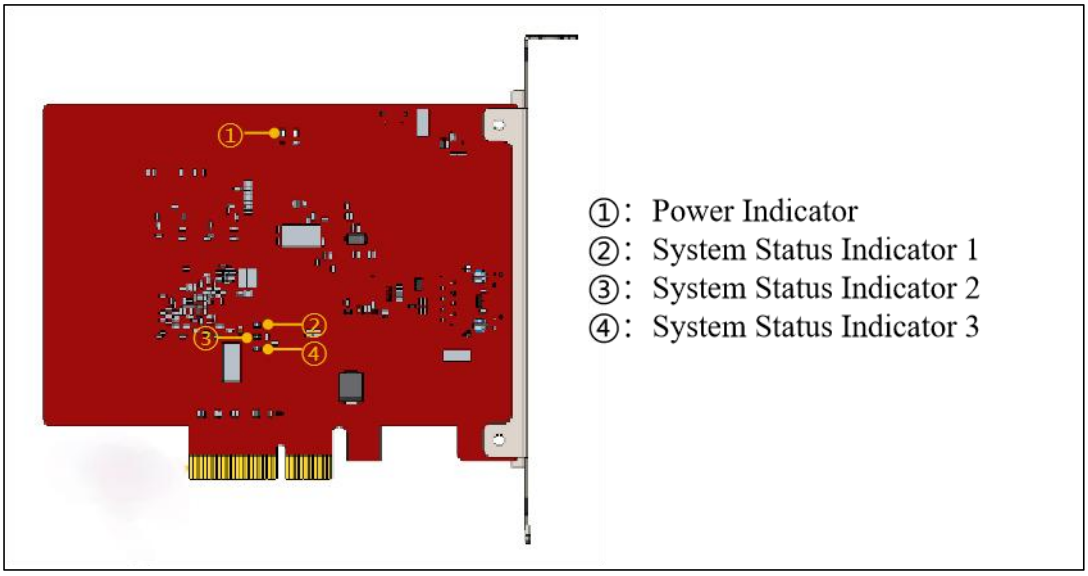


Figure 9-1 BMC228B indicators

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

Step 2 If the BMC228B status indicator is abnormal, change a card slot or host computer to scan again.

Step 3 If the PCIe device still cannot be found, contact the technical support for help.

9.2 Device Manager Cannot Install Driver

If PCIe devices are in the device manager, but the BMC228B driver is not recognized:

Step 1 Please manually install the driver again according to Install BMC228B Driver.

Step 2 If the driver is still not installed, change a card slot or install the driver on the host again.

Step 3 If the driver is still not installed, contact the technical support for help.

9.3 Bus Scan failed

If the ConfigTool failed to scan the slaves:

Step 1 Check whether the EtherCAT bus servo and slaves are powered on.

Step 2 Check whether the network cable is installed securely.

Step 3 Check whether the slave device is supported. If it is, change the slave device and scan again. If not, contact BOCHU technical support.

Step 4 If still failed, contact the technical support for help.

9.4 Bus Network Alarm

9.4.1 Bus network alarm, the network cable is not connected 0x9811002D

Cause

The slave device is not powered on or the network port is connected incorrectly.

Solution

Check the power supply of the slave device and the wiring of the network port.

9.4.2 Watchdog timeout alarm

Cause

Communication between CypCutPro and BMC228B timed out.

Solution

If it is automatically released, it can be ignored; if it occurs during processing, record the operation steps and give feedback to BOCHU technical support.

9.4.3 Bus network alarm, network mismatch 0x9811001E

Cause

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.

Solution

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.

9.4.4 Bus network alarm frame lost 0x98110025

Cause

EtherCAT network communication data frame loss.

Solution

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.

9.4.5 Bus network alarm, the slave is not in OP state

Cause

The Nth slave is abnormal, the network cable between the N-1 slave and the Nth slave is loose or interfered.

Solution

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.

9.4.6 Bus network alarm, network timeout 0x98110010

Cause

EtherCAT network communication data frames are lost continuously.

Solution

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.

BOCHU

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