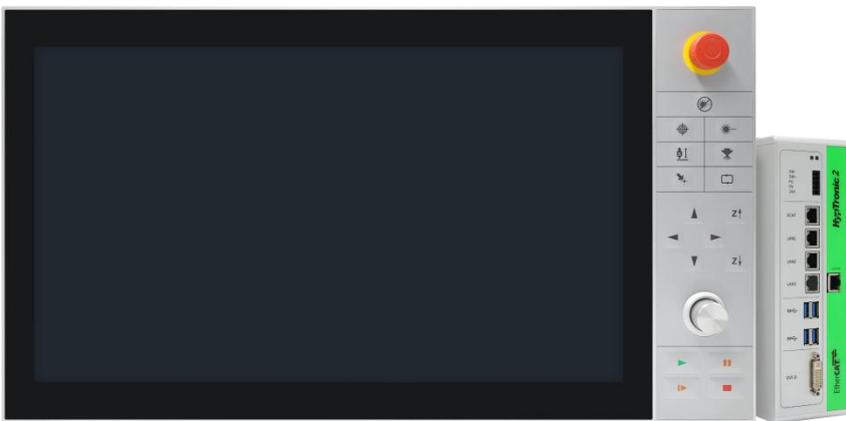


# Installation

## FSCUT8000 User Manual



Shanghai Friendess Co., Ltd

[www.fscut.com](http://www.fscut.com)

Ver 1.6

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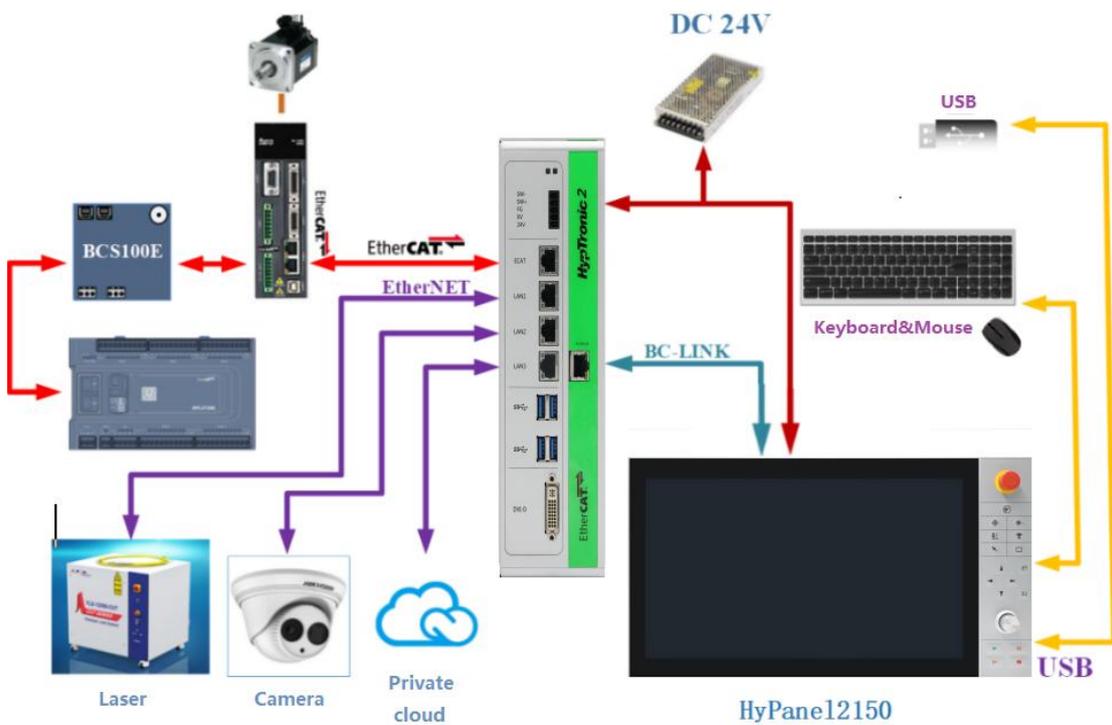
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# 1. Overview

## 1.1 Introduction

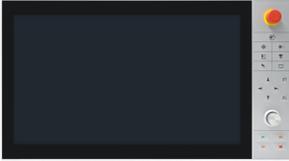
The FSCUT8000 system is a dedicated bus CNC control system for high power laser processing. It is based on EtherCAT bus technology and integrates BLink single network cable display transmission technology. It is a perfect solution for high-end laser cutting CNC machine tools. This manual is only for installation guidance. Please refer to the HypCut User Manual for software instructions and other information.

## 1.2 System Diagram



### 1.3 Product Details

FSCUT8000 EtherCAT CNC system includes HypTronic2 industrial computer, HyPanel2150 touch screen, HPL2720E expansion board, BCS100E or BCS210E height controller and related wires, etc.

HypTronic2 industrial computer	HyPanel2150 touch screen (1)	HPL2720E Terminal Board (1)
		
<p>LAN Cables LAN-0 3X(4) LAN-1X (2) LAN-7X (1)</p>		
		

If BCS100E or BCS100E\_PRO height controller is used, preamplifier, SPC-140 RF short cable and HC-15 4-pin cable are required:

BCS100E/E_PRO Height Controller (1)	Amplifier (1)	SPC-140 RF short cable (1)	HC-15 4-pin cable (1)
			

If BCS210E height controller is used, it should be equipped with PWE cables:

BCS210E height controller (1)	PWE Cables (1)
	

## 2. Wiring Instruction

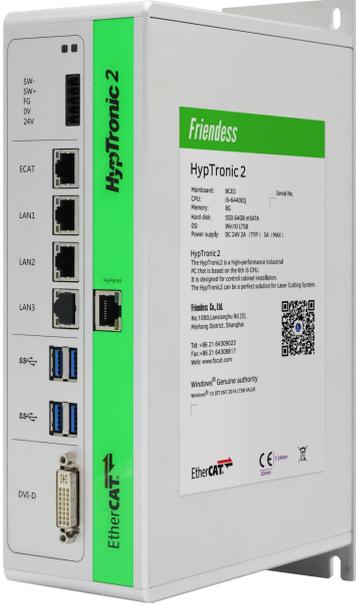
### Notice

The above wiring can only be done by personnel appropriately trained and must be powered off

### 2.1 HypTronic2 Wiring

HypTronic2 is an industrial computer based on EtherCAT and BCLink technology. The solid and delicate metal shell design provides good grounding effect and anti-interference ability.

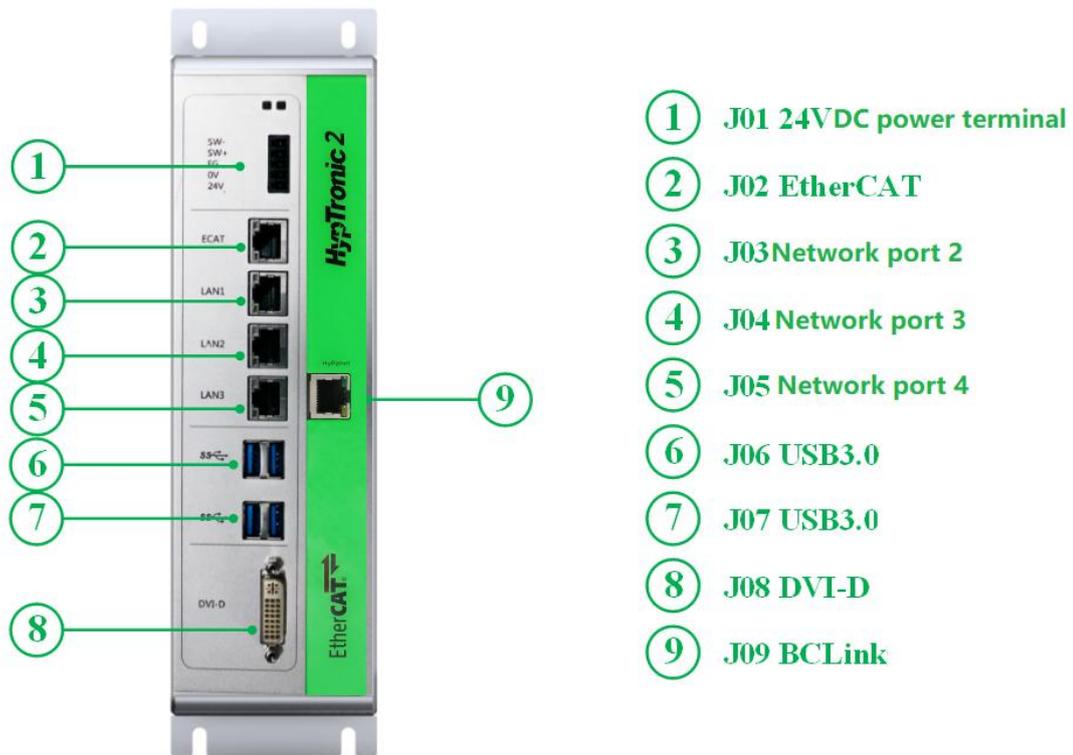
Table 1 HypTronic2 Technical Data

<p style="text-align: center;"><b>HypTronic2 Industrial Computer</b></p>	
<b>Processor</b>	Intel i5 processor ( 4 core 4 threading )
<b>Graphics Card</b>	Intel HD Graphics 530
<b>Memory</b>	RAM 8GB DDR4
<b>Hard Disk</b>	Onboard SSD solid state drive 64GB
<b>Real Time Ethernet Protocol</b>	J02 integrates EtherCAT master protocol
<b>Network</b>	J03, J04, and J05 are 3 Gigabit Ethernet interfaces
<b>USB</b>	4x USB3.0
<b>Power Supply</b>	DC24V 2A (typical), maximum 5A; hot swap OK
<b>Display</b>	BCLink bus, DVI-D for multi-screen display, up to 2 monitors
<b>Operating System</b>	Pre-installed Microsoft Windows 10 IOT Enterprise 2016 LTSP (64-bit)
<b>Power Consumption</b>	Up to 120W

Dimension and Weight	
Dimension	(L x W x H) 274x164x75mm
Weight	2.90kg
Feature	
Protection	IP20
Cooling	Air
Temperature	0~60°C
Certification	CE

### 2.1.1 Interface Layout

The interface layout of HypTronic2 is shown in the figure below.



### 2.1.2 J01 Power Terminal

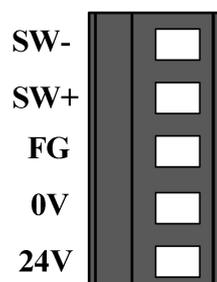


Table 2 J01 Power Input Terminal

Pin	Description
-----	-------------

---

SW-	Power button, negative (short circuit with 0V)
SW+	Power button, positive
FG	Shield (short circuit with 0V)
0V	Power ground
24V	24V power positive

### 2.1.3 J02 EtherCAT Communication Terminal

J02 terminal is defined as EtherCAT interface.

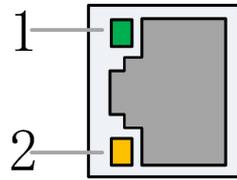


Table 3 RJ45 connection status

Label	Description	LED color	Status	Description
1: Speed	EtherCAT Bus Connection speed	Green	Off	10 Mbps connection
			Solid	100 Mbps connection
		Orange	Solid	1000 Mbps connection
2: Link	EtherCAT Bus Link Status	Yellow	Off	No connection
			Flashes	Communicating
			Solid	Connected

### 2.1.4 J03/04/05 Ethernet Terminal

J03/04/05 is a standard RJ45 interface. It can be used to connect network devices (such as network cameras, lasers with network communication, etc.), switches, etc.

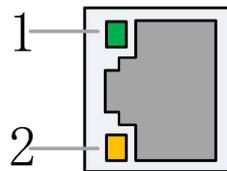


Table 4 RJ45 connection status

Label	Description	LED Color	Status	Description
1: Speed	Ethernet communication connection speed	Green	Off	10 Mbps connection
			Solid	100 Mbps connection
		Orange	Solid	1000 Mbps connection
2: Link	Ethernet communication link status	Yellow	Off	No connection
			Flashes	Communicating
			Solid	Connected

### 2.1.5 J06/07 USB Terminal

J06/07 is a standard USB3.0 interface, which can be used to connect USB devices.

### 2.1.6 J08 DVI Terminal

J08 is a standard DVI-D terminal, which can be used to connect monitors with DVI interface to realize dual monitor monitoring. Not used by default.

Note: The DVI is not used by default, and the DVI only supports DVI-D mode, and the DVI-VGA adapter cannot be used to connect the monitor with the VGA interface.

### 2.1.7 J09 BCLink Terminal

The BCLink interface uses a standard RJ45 connector, which can transmit the display signal and USB signal to the HyPanel2150 display through a network cable. Its advantages are simple wiring and strong anti-interference ability.

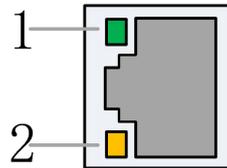


Table 5 BCLink terminal RJ45 connection status

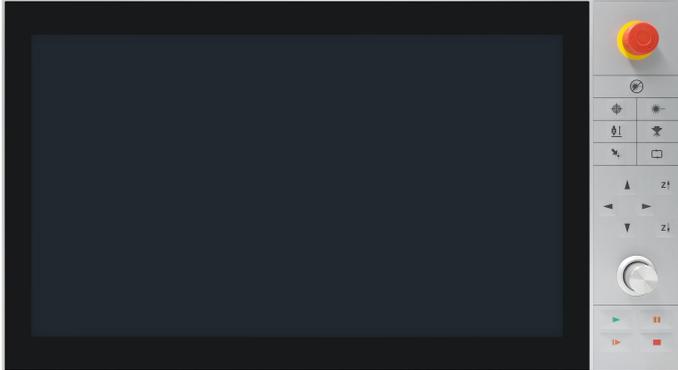
Label	Description	LED Color	Status	Description
1: ACT	BCLink Active	Green	Off	Inactive
			1Hz flickering	Active
2: LINK	BCLink link	Yellow	Off/Flashes	No connection
			Solid	Connect

## 2.2 HyPanel2150 Wiring

HyPanel2150 is an industrial LCD panel integrated with BLink technology and a USB key board.

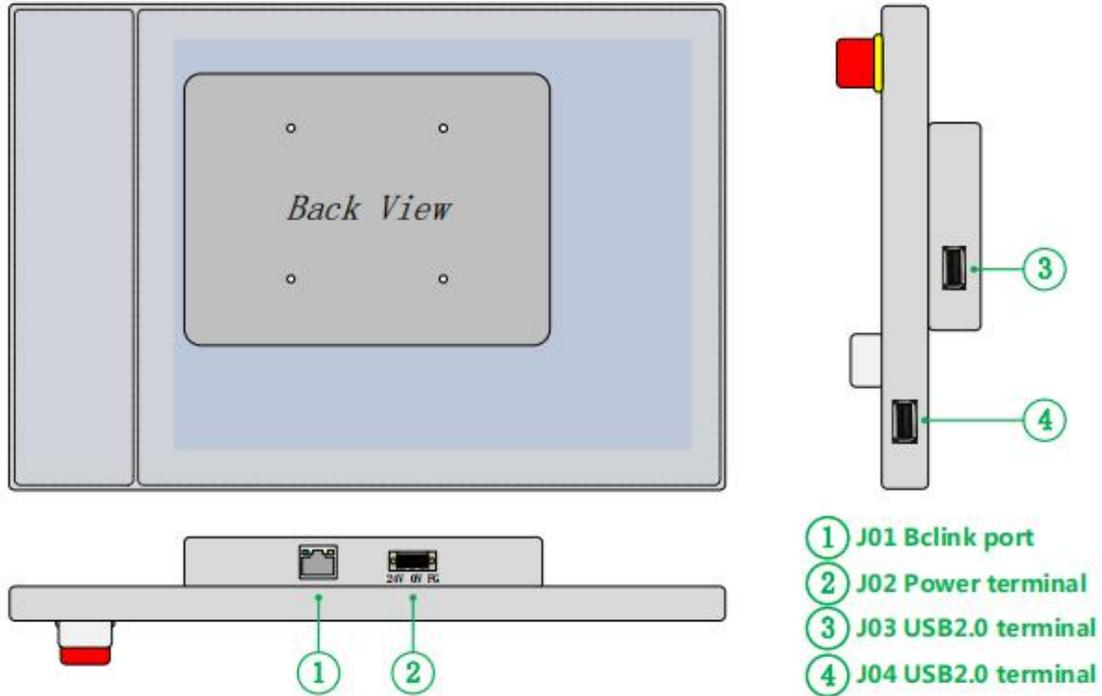
- Intuitive and can be fast operated with multi-touch glass front panel
- Sophisticated product design with industry standard widescreen
- Capacitive touch screens dedicated for industry

Table 6 HyPanel2150 Technical Data

<b>HyPanel2150 Industrial touch screen</b>	
<b>Size</b>	21.5" (16:9)
<b>Resolution</b>	1920x1080
<b>Operation Panel</b>	Multi-touch screen (glass front panel)
<b>Connection Distance</b>	Connect via BLink, up to 100m
<b>Installation</b>	Robotic Arm or Vertical Stand
<b>Dimension and Weight</b>	
<b>Dimension</b>	(L x W x H) 611.4x334.4x57.8mm
<b>Weight</b>	6.0kg
<b>Feature</b>	
<b>Protection</b>	Front panel IP65 (non-button area), rear panel IP20
<b>Cooling</b>	Air
<b>Temperature</b>	0~60°C
<b>Certification</b>	CE

### 2.2.1 Interface Layout

The interface layout of HyPanel2150 is shown in the figure below.



### 2.2.2 J01 BCLink Terminal

The BCLink interface uses a standard RJ45 connector, which can transmit the display signal and USB signal to the HyPanel2150 through a network cable.

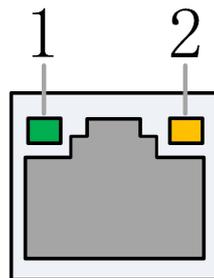
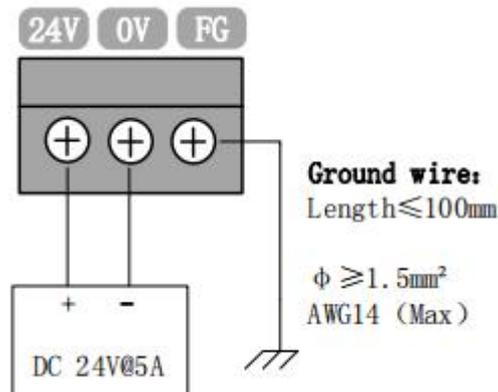


Table 7 BCLink terminal RJ45 connection status

Label	Description	LED Color	Status	Description
1: ACT	BCLink Active	Green	Off	Inactive
			1Hz flickering	Active
2: LINK	BCLink link	Yellow	Off/Flashes	No connection
			Solid	Connect

### 2.2.3 J02 Power Terminal

The power terminal is connected to the positive and negative poles of the DC 24V switch power supply to supply power to the HyPanel2150. FG needs to be reliably connected to the ground, and the ground wire should be as short and thick as possible. The reliable grounding of the screen shell can not only improve the stability of the system, but also prevent the screen or interface from being damaged due to external static electricity or surge.



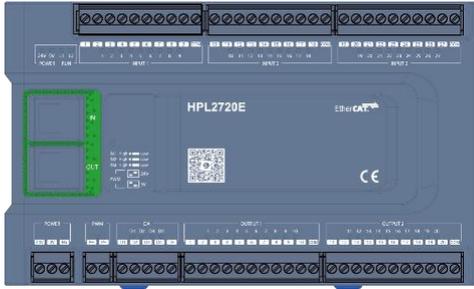
### 2.2.4 J03/04 USB Terminal

HyPanel2150 provides 2 USB2.0 ports (J03 and J04). J03 is for connecting the wireless keyboard and mouse receiver. J04 is for importing and exporting files via USB flash drive.

## 2.3 HPL2720E Wiring

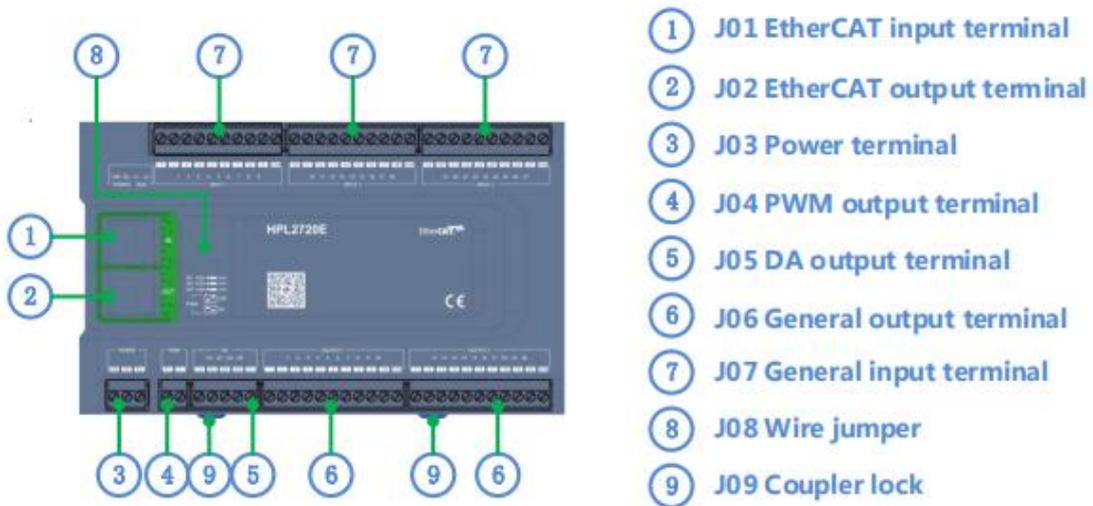
HPL2720E is an IO extend board based on the EtherCAT, which supports the peripheral resources required by the FSCUT8000 high-power cutting system.

Table 8 HPL2720E Hardware Resources

HPL2720E		HPL2720E	
HPL2720E			
Module	Qty	Description	Note
Power Supply	/	24V DC/5A	
PWM	1	24VPWM, $\pm 50\text{kHz}$ 0.3%	Max 50kHz, 3%
DA	4	0-10V, 12bit, $\pm 20\text{mV}$	
Common Output	20	High level 24V output, $\leq 125\text{mA}$ per channel	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: 0~60°C		
	Humidity: 10%~90% (no condensation)		
Dimension	195×118×45.2mm		
Weight	480g		

### 2.3.1 Interface Layout

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



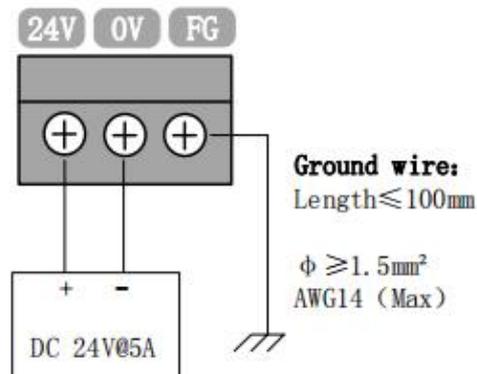
### 2.3.2 J01 EtherCAT Input Terminal

EtherCAT network cable input interface, standard RJ45 network cable;

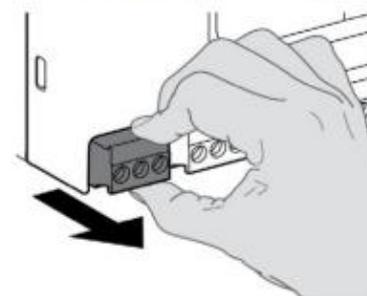
### 2.3.3 J02 EtherCAT Output Terminal

EtherCAT network cable output interface, standard RJ45 network cable;

### 2.3.4 J03 Power Input Terminal



How to unload terminal block



#### Notice

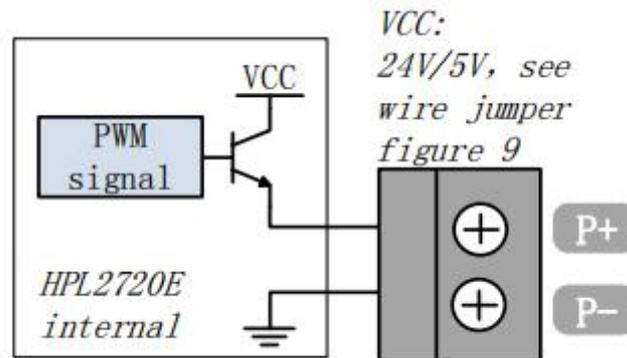
- 24V and 0V are respectively connected to the positive and negative poles of the DC 24V switching power supply; FG needs to be reliably connected to the ground, and the ground wire should be as short and thick as possible.
- All terminals are pluggable only, and disassembly is shown in the right figure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

### 2.3.5 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!**

**If you need 5V PWM signal, use BCL4516E which supports 24V/5V PWM switching.**

### 2.3.6 J05 DA Output Terminal

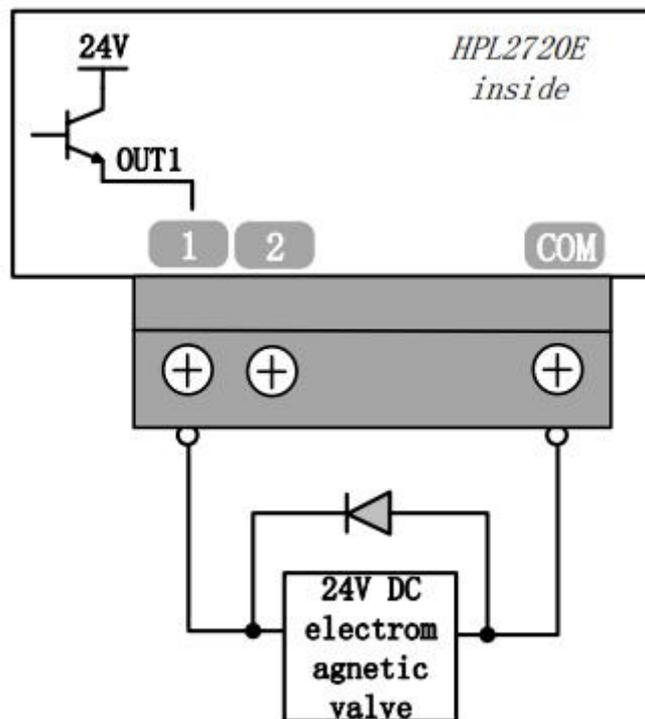
HPL2720E has 4 analog outputs of 0~10V. The four-way DA can be configured as the control signal of the laser peak power and the gas proportional valve through the "HypConfig" that comes with HypCut.

Table 9 DA Output Parameter

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

### 2.3.7 J06 Common Output Interface

OUT1~OUT20, total 20 high-level 24V outputs In the "HypConfig" that comes with HypCut, 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  $\leq 125\text{mA}$ .

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

### 2.3.8 J07 Common Input Interface

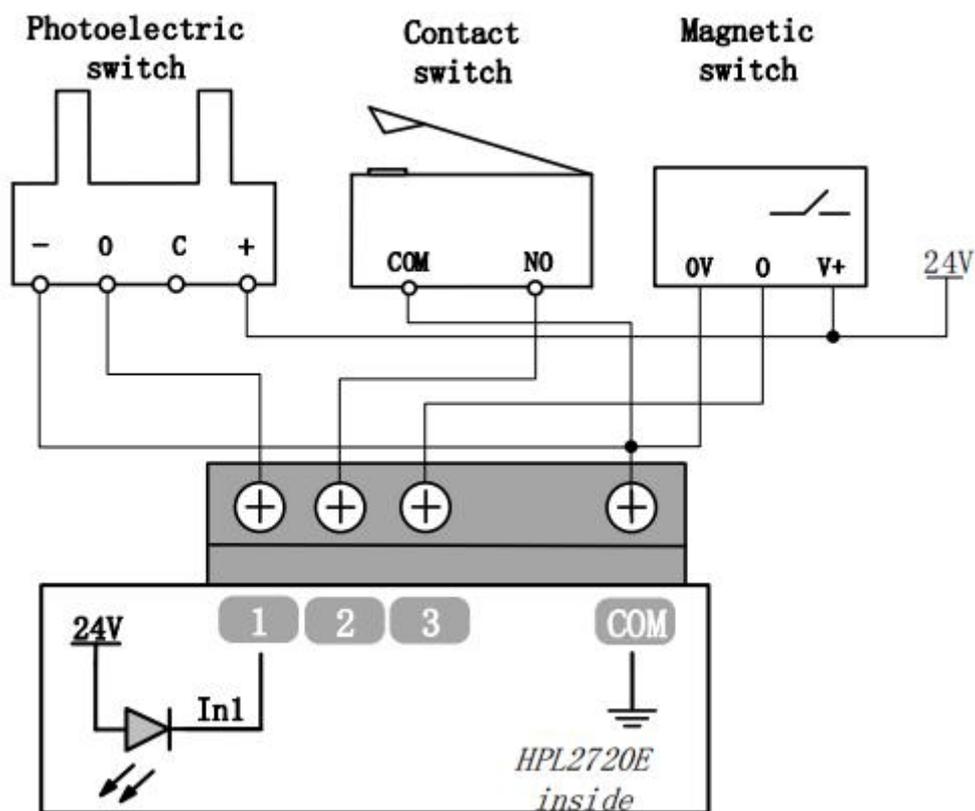
HPL2720E does not set a dedicated input, and each input port can be set as limit/origin signals

The Normally Open and Normally Closed of the limit and origin signals can be set in the "HypConfig" that comes with HypCut. 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.

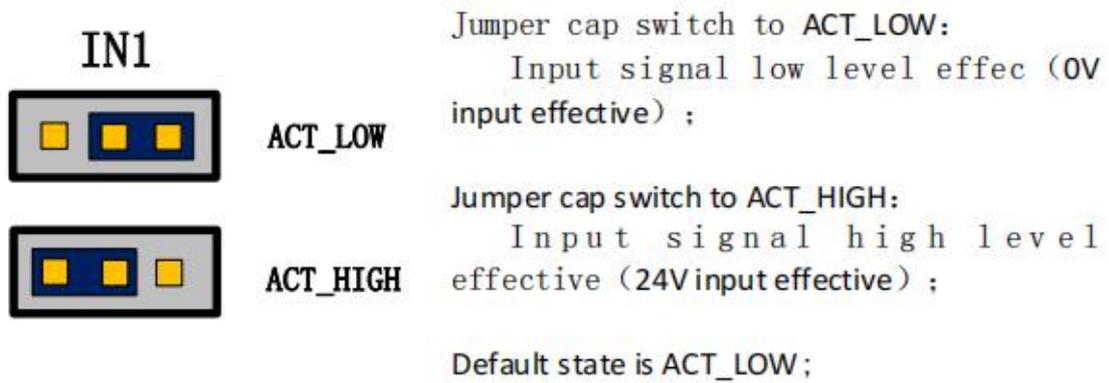
The typical connection of the photoelectric switch is shown in the figure below, and an NPN type 24V photoelectric switch must be used;

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:



## 2.4 BCS100E Wiring

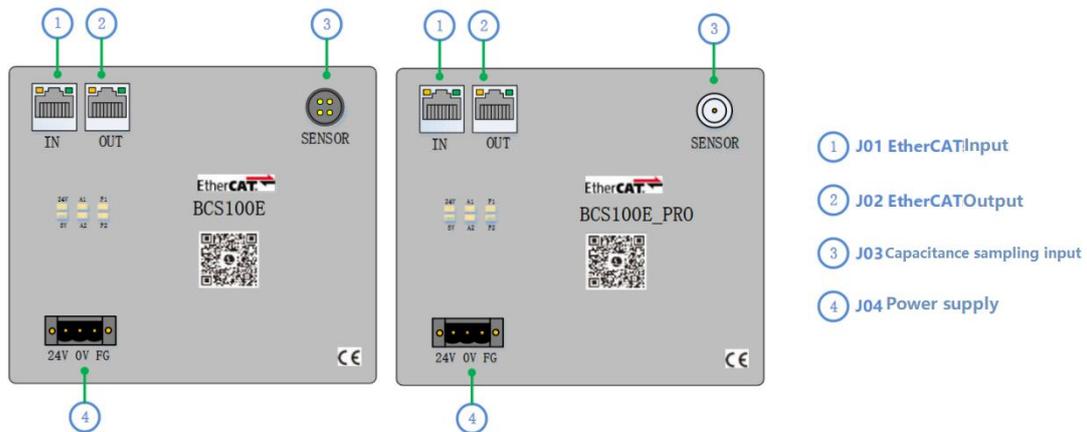
BCS100E is a height controller based on EtherCAT. BCS100E\_PRO is a model that specifically supports Precitec cutting heads, and perfectly supports all Precitec cutting heads.

Table 11 BCS100E/Pro parameters

Project	Description	
Power Supply	24V DC/1A	
Capacitance Sampling	BCS100E	Four-core cable, like BCS100
	BCS100E_PRO	Single-core BNC cable
Operating Environment	0~60°C	
Humidity	10% to 90% (non-condensation)	
Dimension	110.5×127.8×52.45mm	

### 2.4.1 Interface Layout

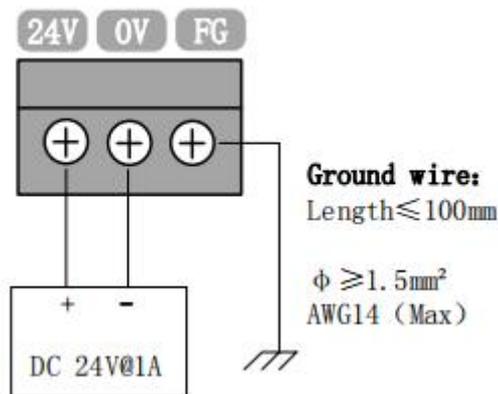
The interface layout of BCS100E/PRO is shown below.



### 2.4.2 Power Interface

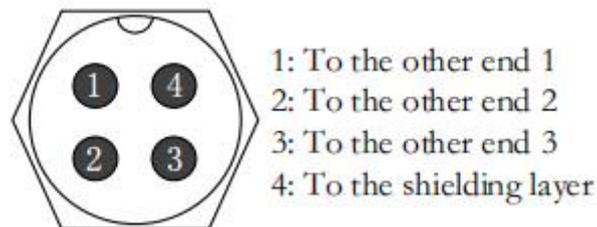
The machine case is the negative pole of the measured capacitance. In order to ensure the stable operation of the measurement circuit, the "FG pin" of the power interface must be reliably connected to the machine case (that is, it is in good conduction with the machine case). The case of the preamplifier must also be connected with the machine case well. The specific index is that the DC impedance should be less than 4 ohms, otherwise the follow may not be good.

Figure 5 Power Supply Wiring

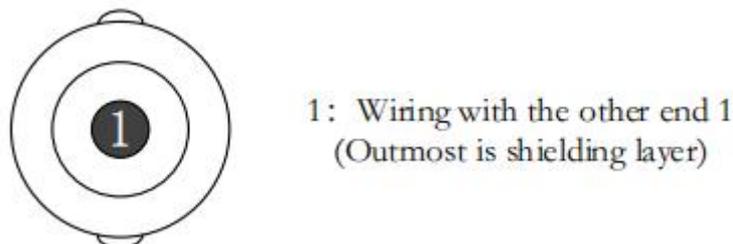


### 2.4.3 Sensor Interface

BCS100E sensor interface is shown below.



BCS100E\_PRO sensor interface is shown below.



## 2.5 BCS210E Wiring

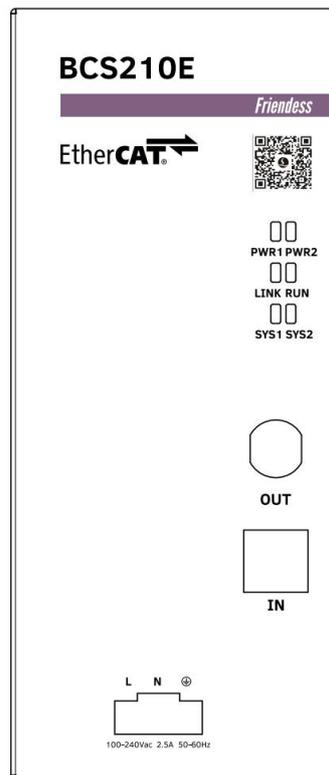
BCS210E capacitive height controller is a height controller tailored for BLT cutting head. It adopts the latest generation of Friendess follow and control algorithm and is a high-performance capacitive height controller.

Table 10 BCS210E Parameters

Project	Description
Power Supply	100-240Vac/2.5A
Operating Environment	0~60°C
Humidity	10% to 90% (non-condensation)
Dimension	87×225×120.6mm

### 2.5.1 Interface Layout

The interface layout of BCS210E is shown in the figure below.

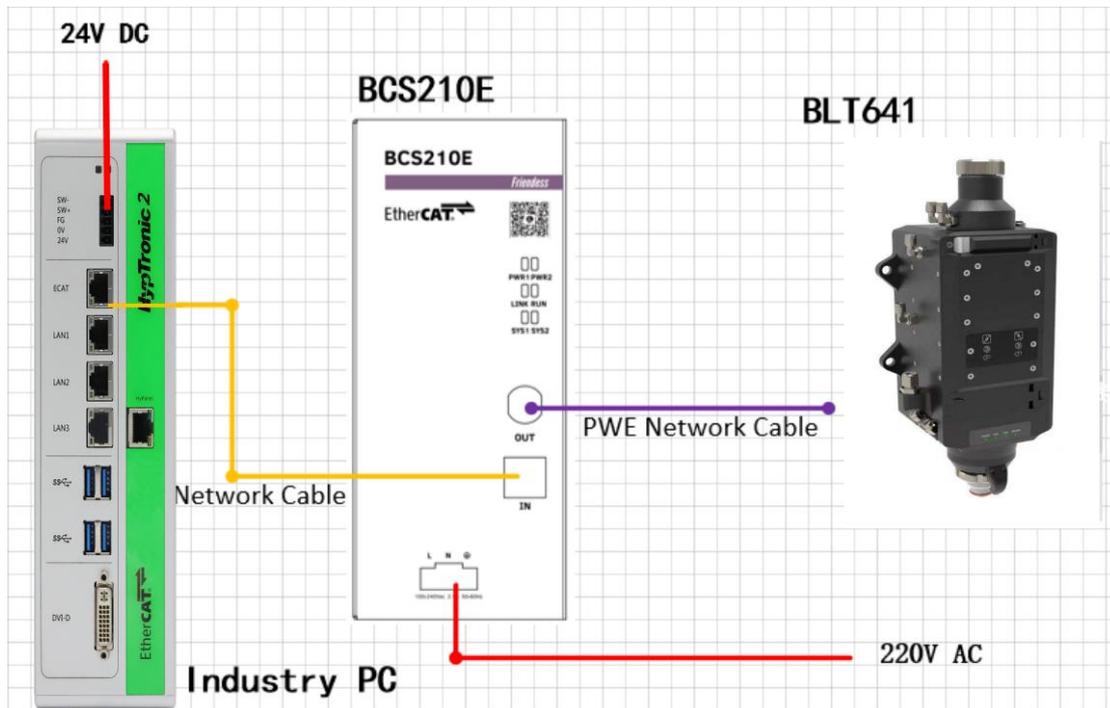


### 2.5.2 Silk Screen Description

Function	Silk Screen	Description	Powered-on State
Power Interface	L N	220V(power inlet)	/
Bus IN	IN	Bus IN Ethernet port, Connect standard cable(Yellow)	/
Bus OUT	OUT	Bus OUT Ethernet port, Connect PWE Cable(Purple)	/
Power LED1	PWR1	Internal Power LED1	Solid if powered on
Power LED2	PWR2	Internal Power LED2	Solid if powered on
COMM LED1	LINK	Communication LINK LED	Solid after the power stabilizes; After the bus is connected, it flashes rapidly.
COMM LED2	RUN	Communication RUN LED	Off if powered on; Solid after the bus is connected.
System LED1	SYS1	System running state LED1	After the power stabilizes, it flashed slowly.
System LED2	SYS2	System running state LED2	Solid after the power stabilizes;

### 2.5.3 Wiring Instruction

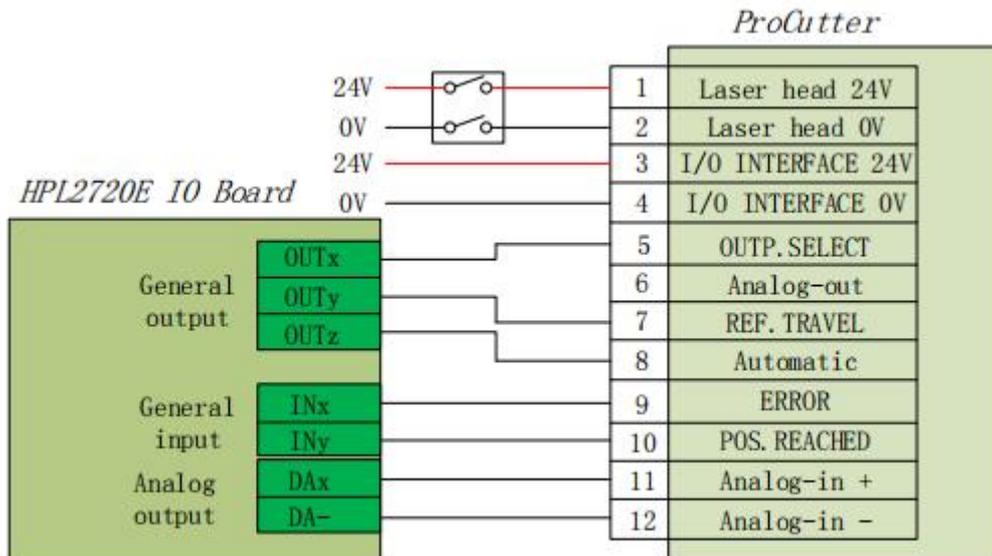
BCS210E is powered by 220V AC power and is connected to the previous level bus device using a standard Ethernet cable (yellow) into the BCS210E IN port. The BCS210E's OUT port is connected to the BLT series cutting head device using a PWE cable (purple).



## 2.6 Cutter Wiring

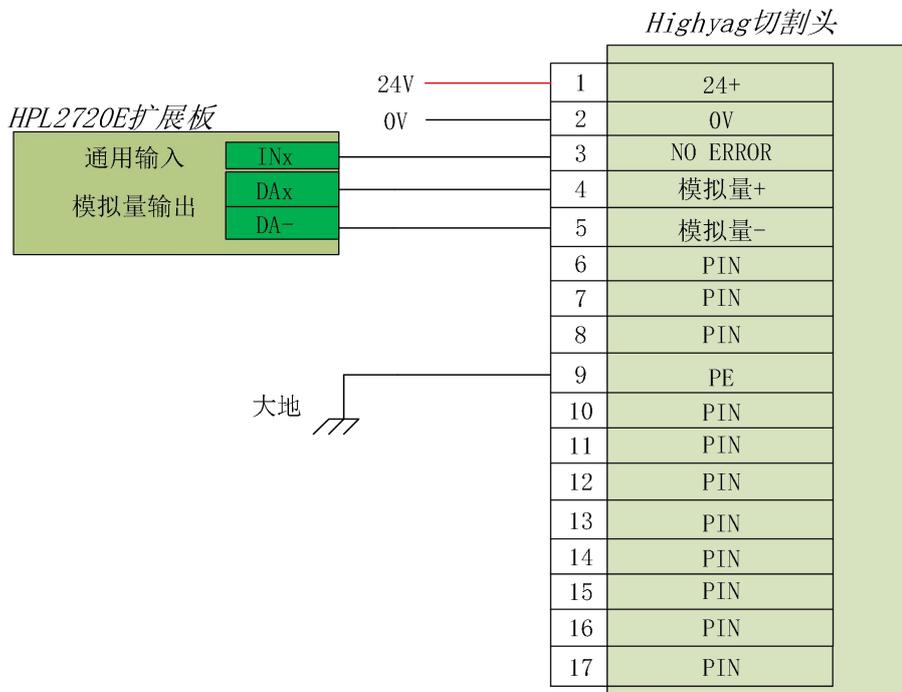
### 2.6.1 ProCutter Wiring

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



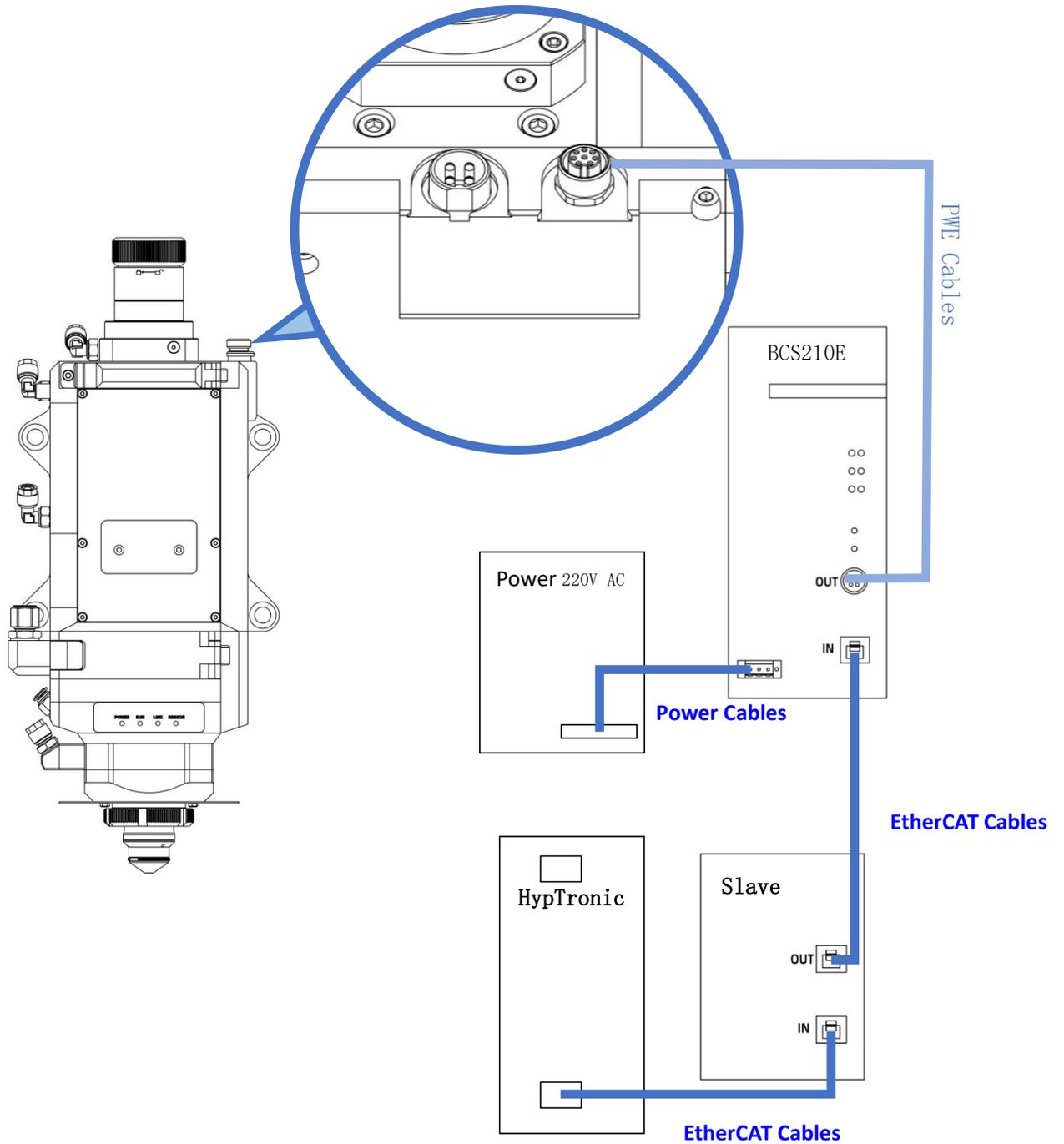
### 2.6.2 Highyag Wiring

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



### 2.6.3 BLT Cutting Head Wiring

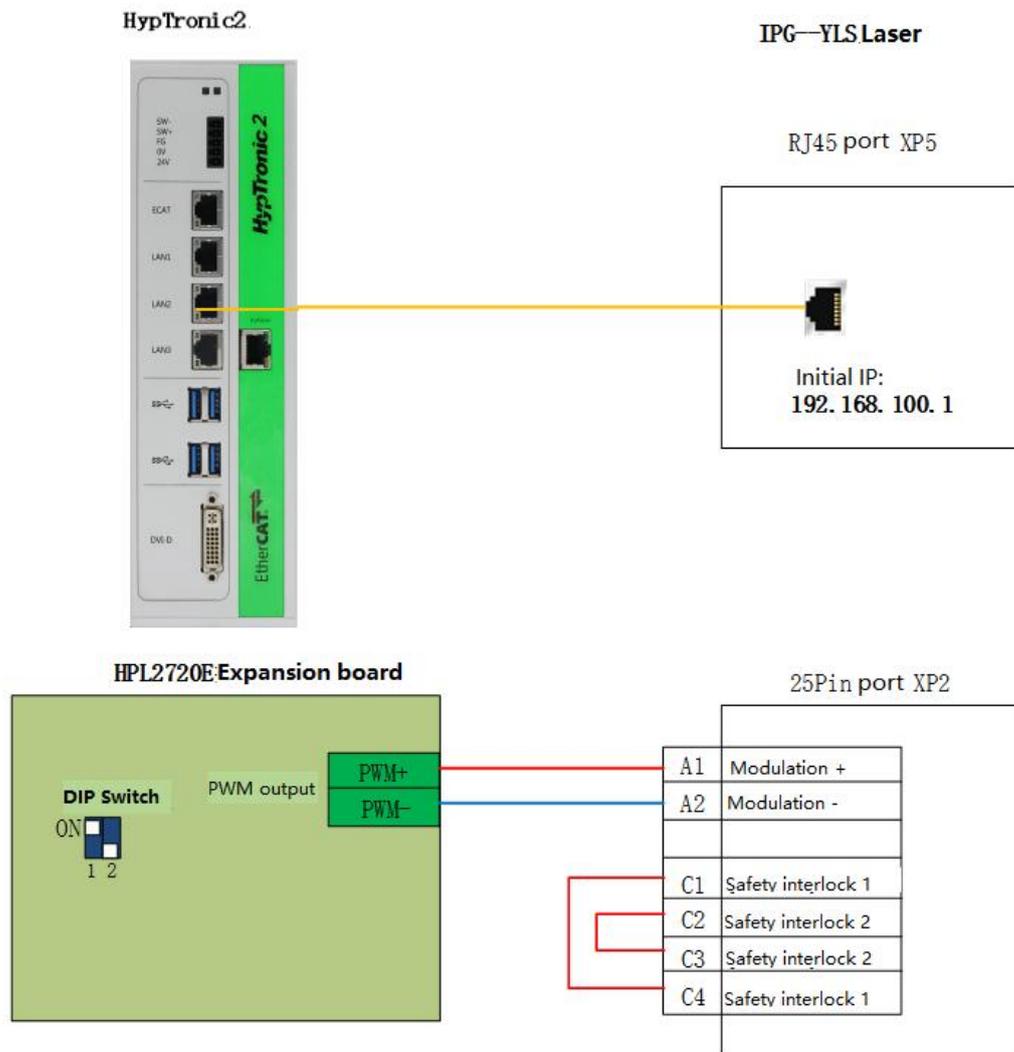
The connection of BLT cutting head for BCS210E is shown in the figure below.



## 2.7 Laser Wiring

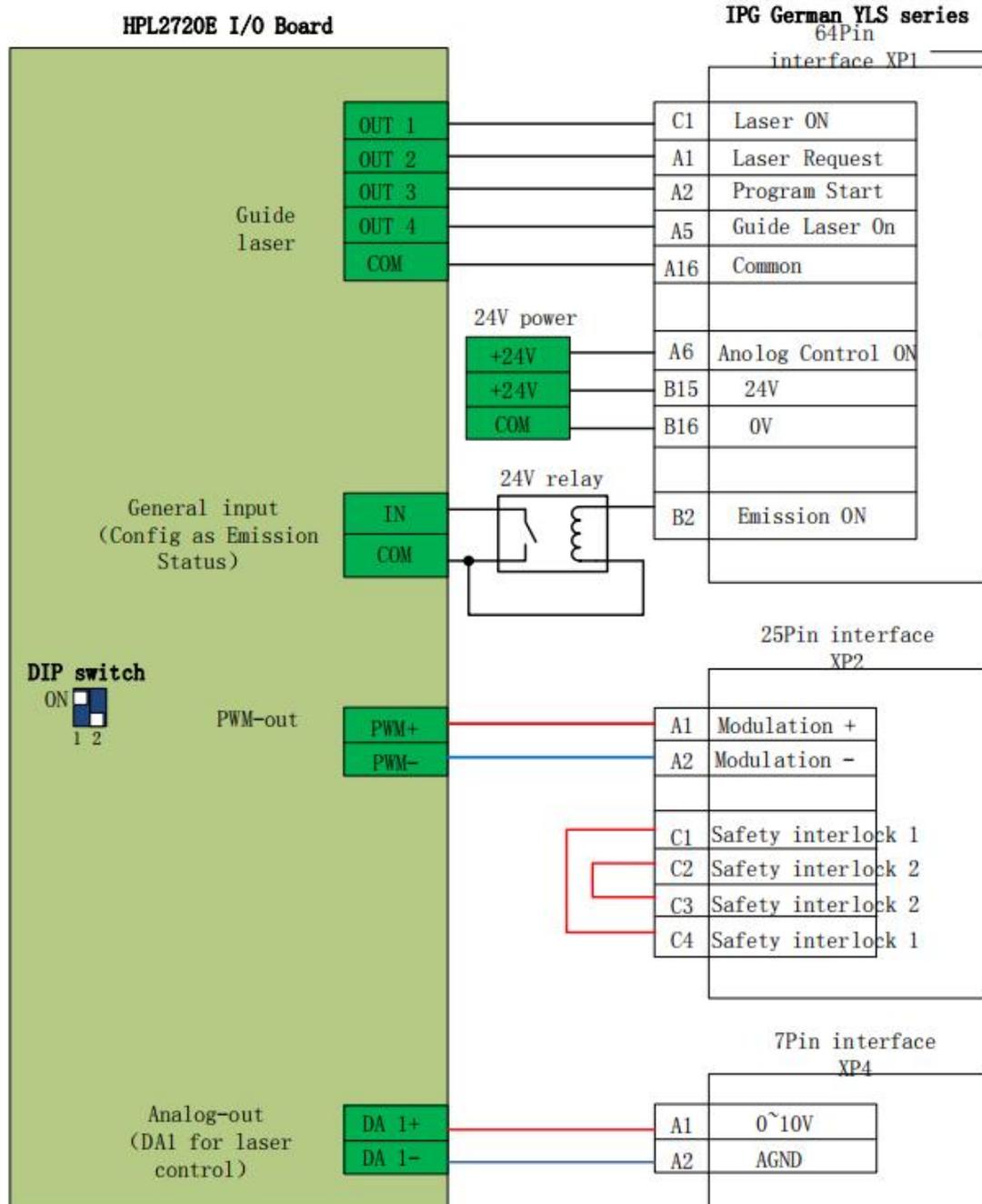
### 2.7.1 IPG\_YLS Network Communication Wiring

All IPG-YLS series lasers can be connected as shown in the figure below.

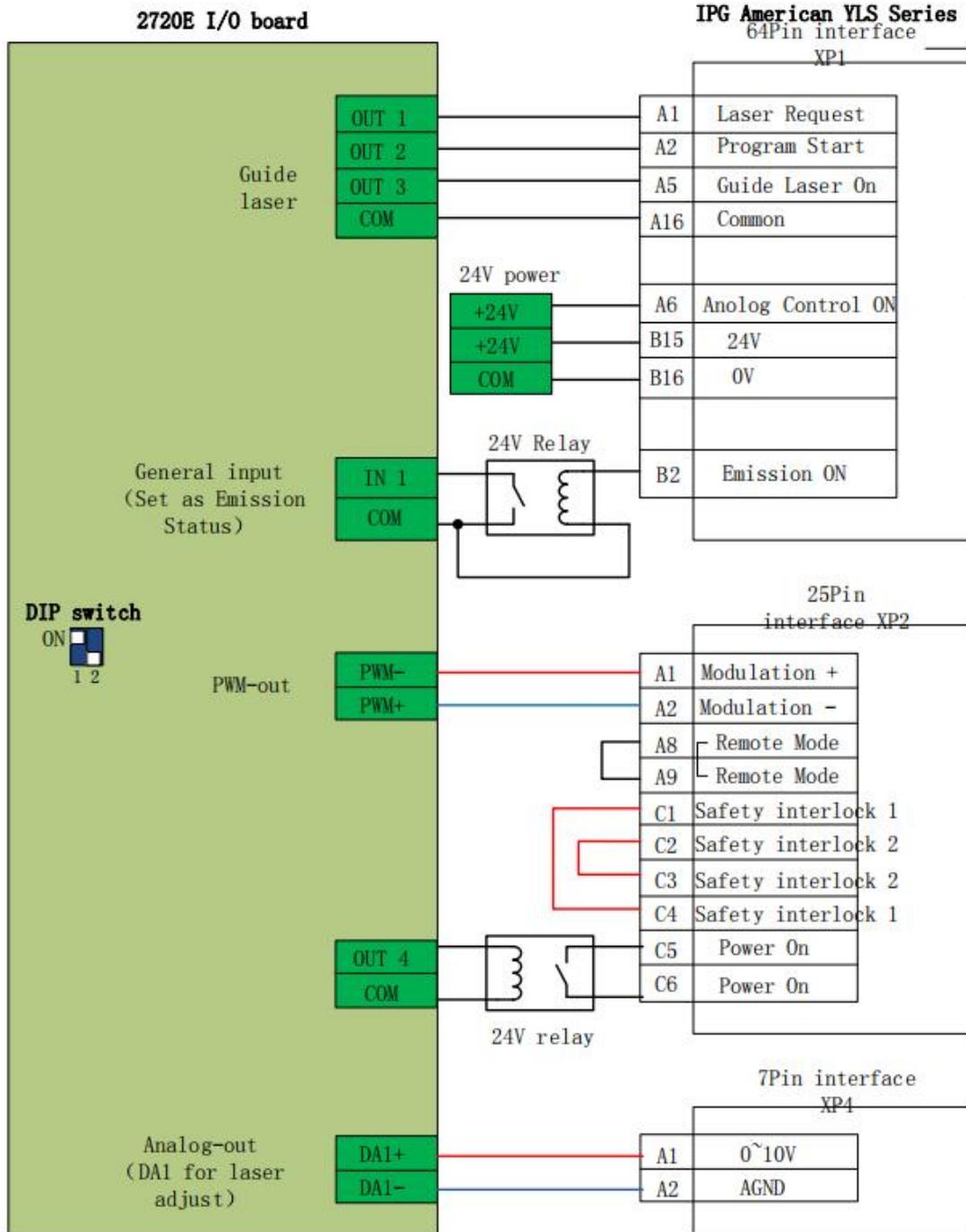


## 2.7.2 IPG\_YLS Germany

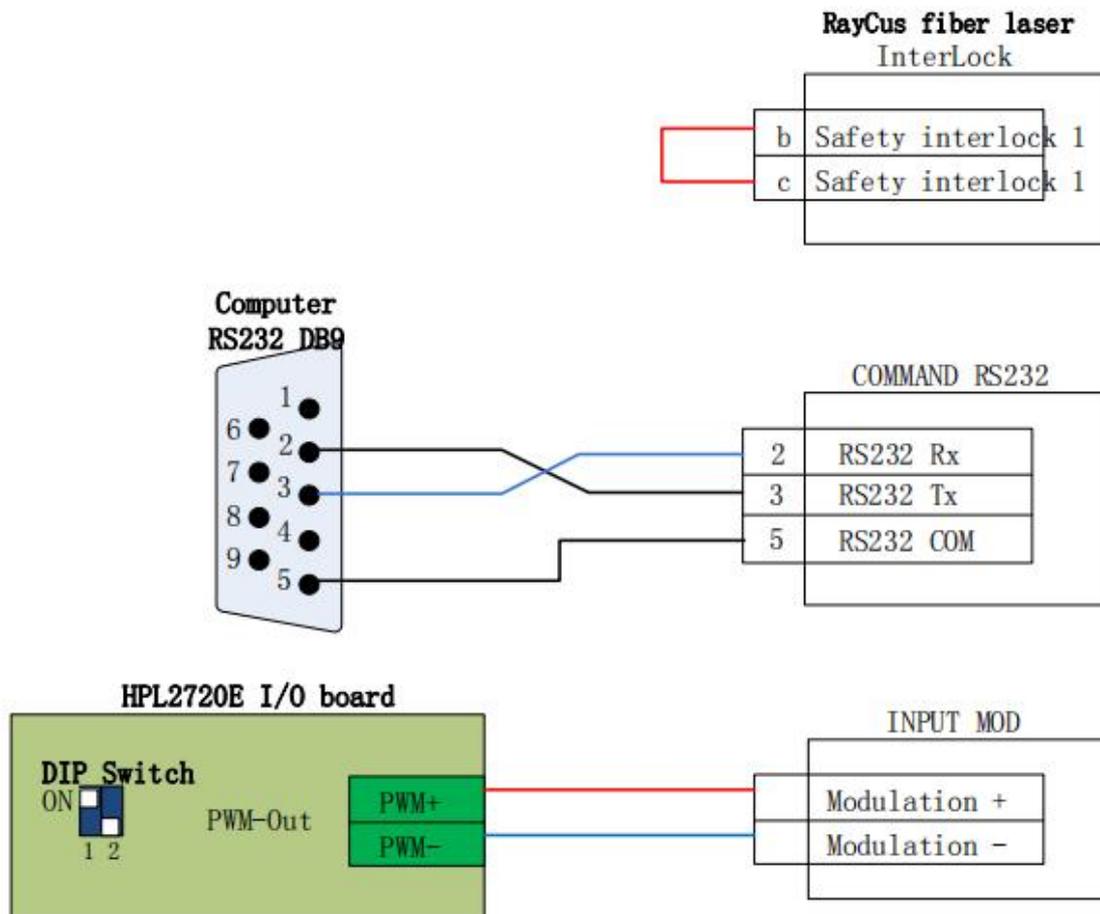
The connection of Highyag cutting head is shown in the figure below.



### 2.7.3 IPG-American Network Communication Wiring

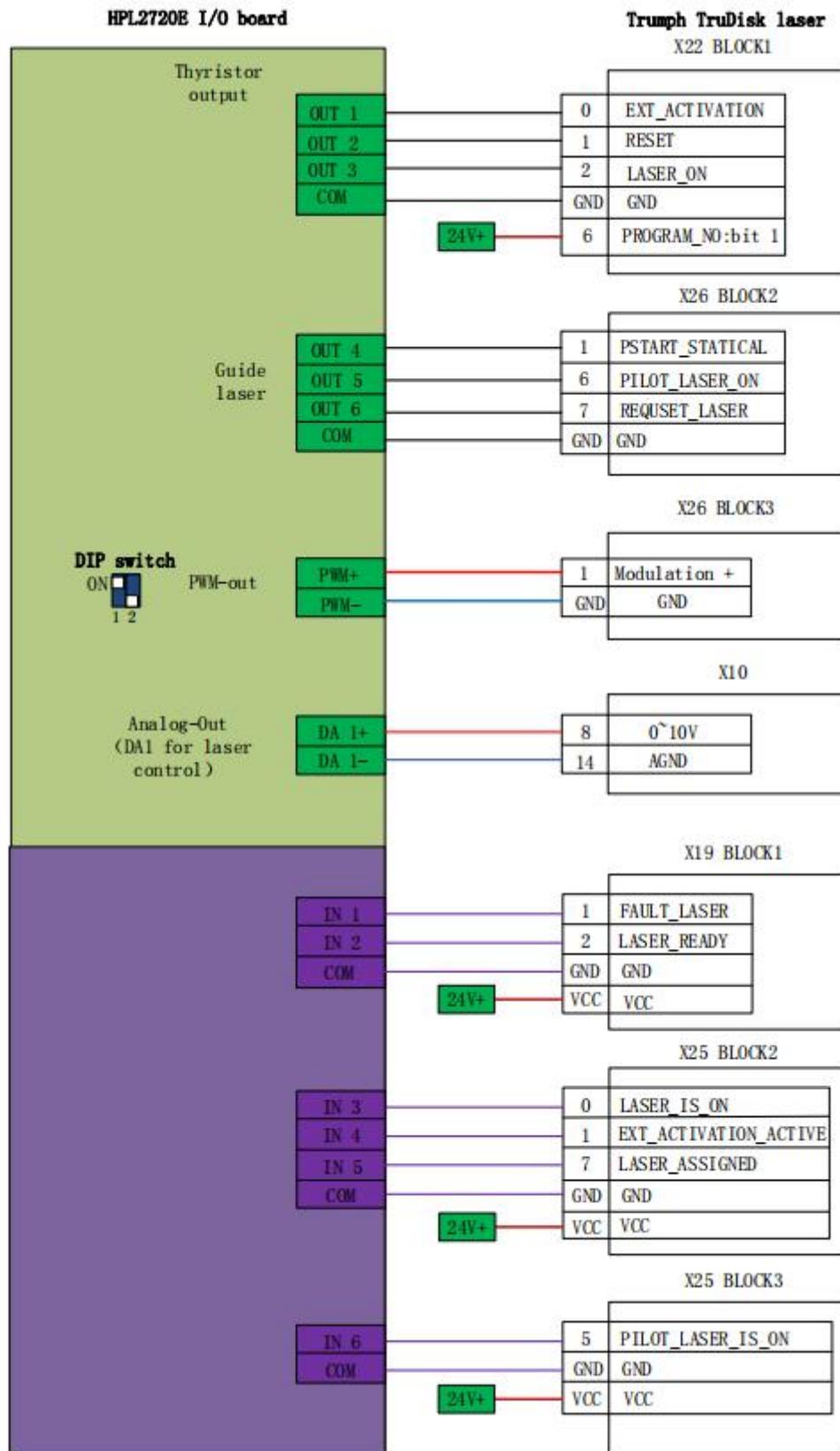


## 2.7.4 RayCus Serial Communication Wiring

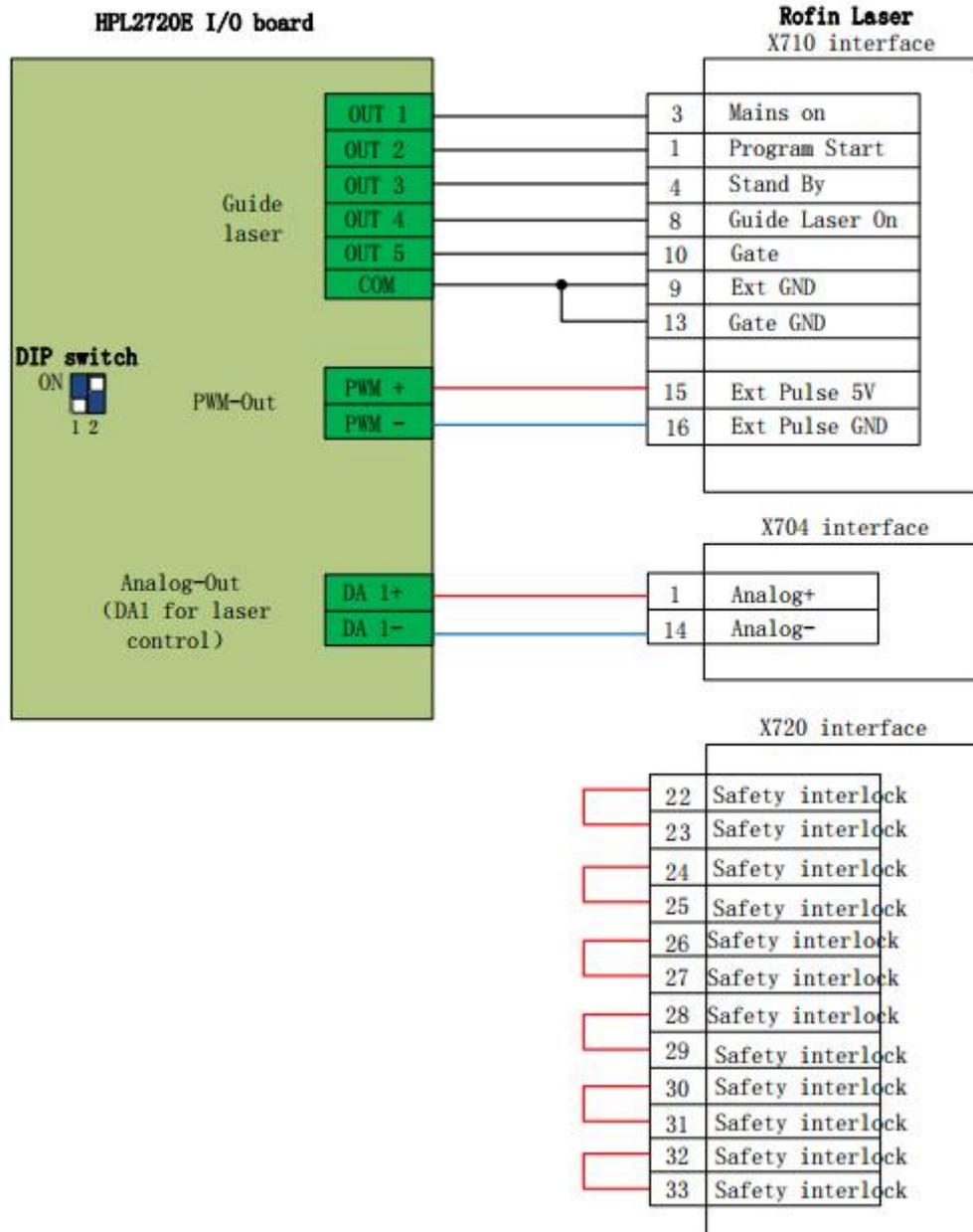


Note: HypTronic2 has canceled RS232, so you need to purchase a USB-to-RS232 module to control Raycus laser via serial port.

### 2.7.5 Trumpf Serial Communication Wiring



### 2.7.6 Rofin Serial Communication Wiring

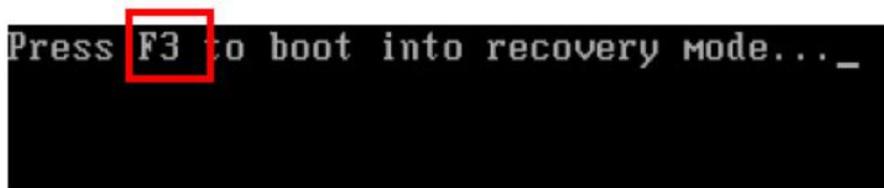


## 3. Quick Start

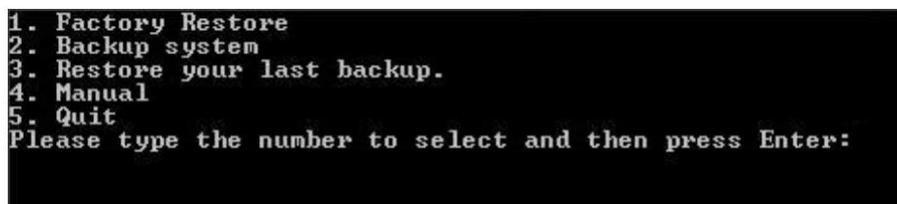
### 3.1 System Restore

If the system is infected with a virus or is running slowly due to the installation of too many software programs, please follow the steps below to perform a system restore to the factory settings.

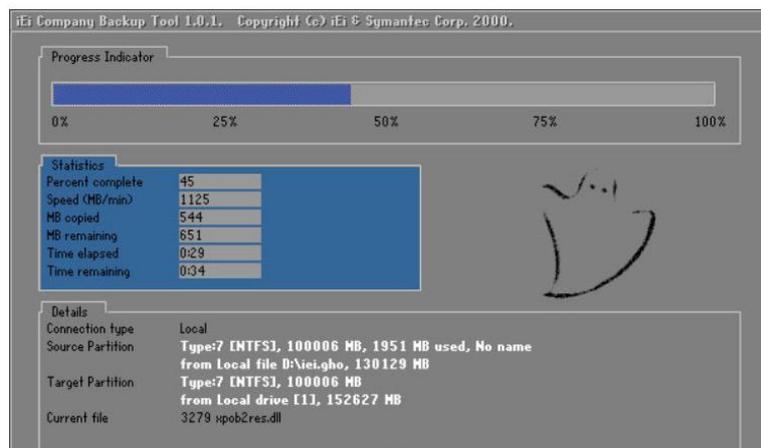
1. Restart HypTronic2
2. Press 'F3' on the following interface



3. Press '1' on the following interface, then press 'Enter'



4. It automatically enters the restore interface.



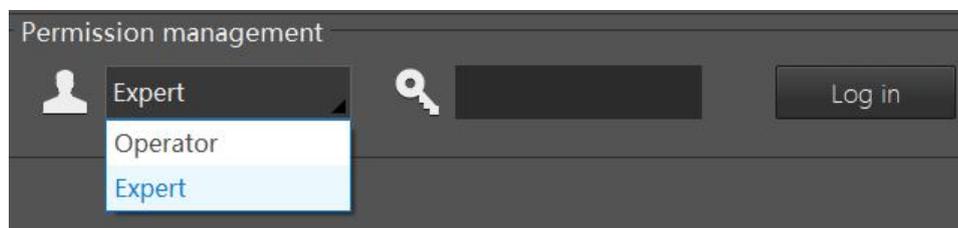
5. After the restoration is complete, restart it to finish the system restore.

## 4. HypConfig

### 4.1 Start HypConfig.



1. Double click“HypCut1.0” to start HypCut laser cutting control system. Once in the system, click Settings - Machine Information - Permission Management. Select Expert from the drop-down and enter the login password to access to Expert Privileges.



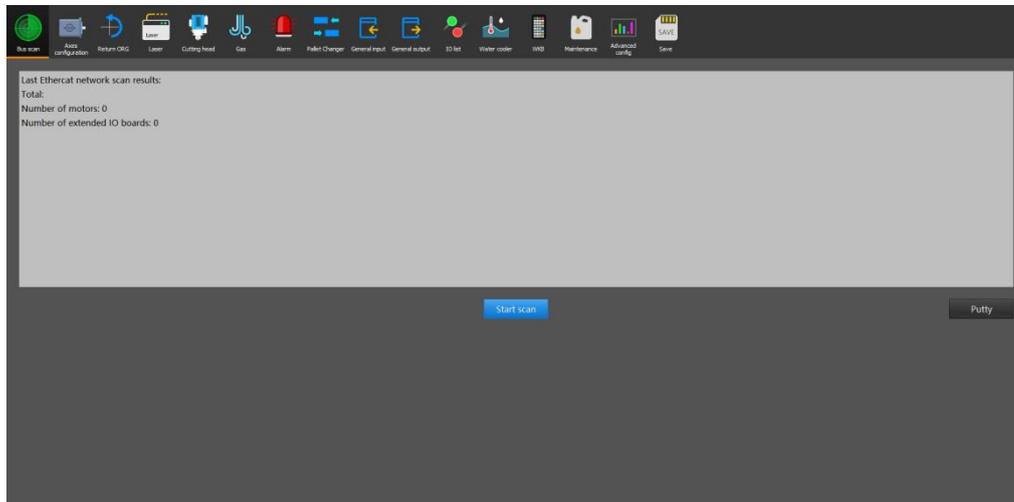
Default expert login password: 64309023

2. Then click the "Global Parameters - ConfigTool" button  to enter the system configuration interface.

**Note:**

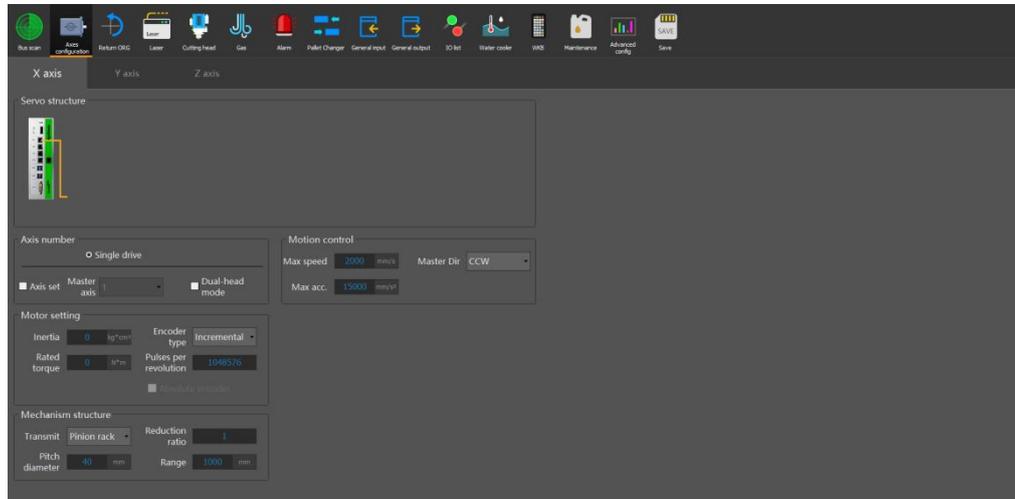
1. Please set the parameters according to the actual configuration of the cutting machine. Incorrect settings can lead to unpredictable serious consequences!
2. In the ConfigTool, the orange background represents the configuration of the input port and the green background represents the configuration of the output port.

## 4.2 Bus Scan



1. Before a bus scan, verify that each slave station communicates in series with the host via the network cable and that power-up is successful without alarms;
2. It is recommended to connect each EtherCAT slave in series as follows: Host → X → Y → Z → Other axis → BCS → I/O expansion → ...;
3. After clicking on the scan results, verify that the number of slaves displayed matches the actual number of the connected. If the number of scan results is less than the actual connected, check that the slave connections and status of the missing ones;
4. Scan OK: After correctly identifying all slave stations, you can proceed to the next specific parameter configuration for each axis;
5. Scan Failed: Check its corresponding resolution in the appendix according to the error code.

### 4.3 Axis Config



1. Select the X, Y axis drive mode according to the actual mechanical structure (single drive or dual drive);
2. According to the motor selection manual, fill in the four basic parameters of the drive motor corresponding to the model of each axis: Motor inertia, encoder type, rated torque, and pulses per revolution;

Drive	Pulses per revolution
Yaskawa $\Sigma 7$	1048576
Rexroth	3600000
Servotronix	360000
Motor Power	360000
Panasonic A5	1048576
Panasonic A6	8388608
Jiaqiang, WSX	10000

3. Select the correct drive structure (pinion and rack, leadscrew or other). The drive structure of XY axes is the pinion and rack and that of the Z axis is the leadscrew.
4. **PCD / leadscrew pitch / transmission lead:** Fill in the correct pitch circle diameter or lead of the gear rack according to the selected transmission mechanism design

Type	Formula
Helical Gear	$D = z * n / \cos(\beta)$
Spur Gear	$D = z * n$
Leadscrew	Leadscrew Pitch
Other	Transmission lead = Length S traveled by the transmission mechanism in one revolution

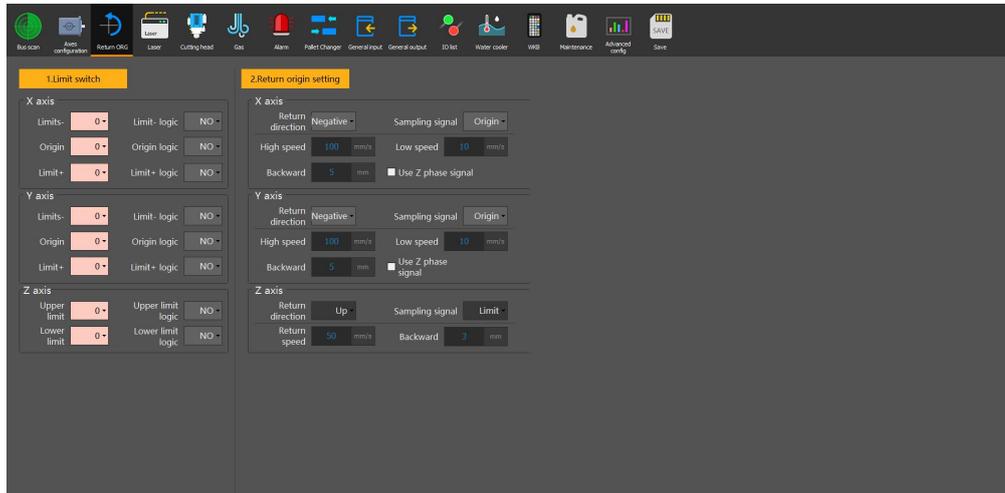
The common helix angle coefficient of the helical teeth in the laser processing industry:

$$\cos(\beta) = 0.9437$$

5. **Reduction ratio:**Set the correct reduction ratio which can be confirmed in the catalog or on the information plate of the speed reducer;
6. **Travel range:**Sets the approximate size of the machine to confirm the size of the soft limit range. The correct size of the machine's effective motion can then be measured using the stroke measurement function. It is not recommended to exceed hard limits.
7. **Maximum speed/maximum acceleration:**Fill in the preset machine maximum acceleration and speed, which cannot be exceeded in the software.
8. **Motor CW/CCW:**Modifies the actual direction of the axis motion when the machine tool moves along the positive and negative directions of the XY axis. Modify this parameter when the actual direction of movement is found to be opposite to that displayed in the system.
9. **Synchronous axis alarm setting:** Set the allowable deviation range and maximum deviation range between the dual-drive axis when the dual-drive axis are in the enabled state, to prevent excessive deviation between the dual-drive axis from causing damage to the shaft."
10. **Y-axis detection:**Automatic measure the direction and status of the dual-drive axis **to eliminate the torsion**. Follow the recommended steps in the box to detect.  
  
The dual-drive axis must always verify that the motor is moving in the "same" or "opposite" direction to prevent twisted shaft. The default movement direction of the dual-drive motor is 'opposite'.
11. **Brake signal:**A unique Z-axis function that controls the brake signal of the Z-axis motor

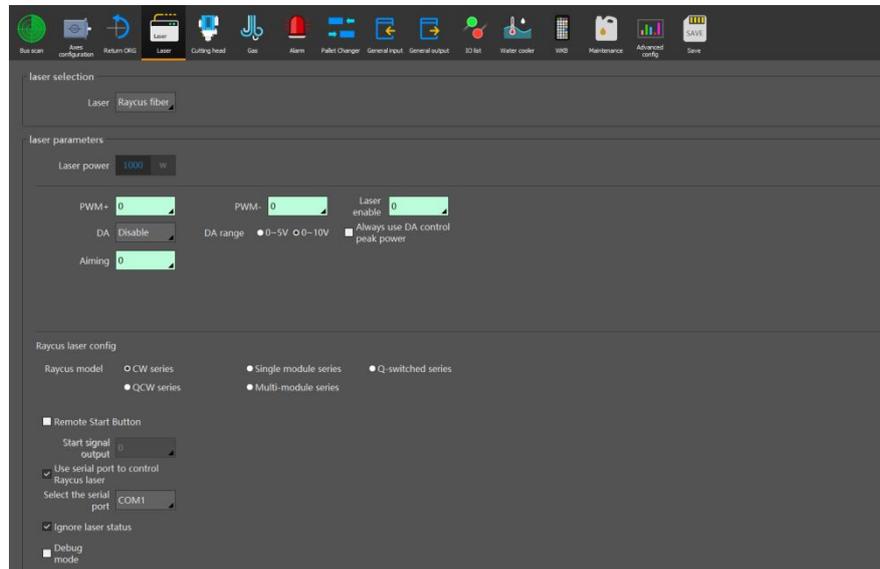
with a brake to prevent the Z-axis from sliding down and hitting the endstop if loss of enable signal or power

## 4.4 Return Origin



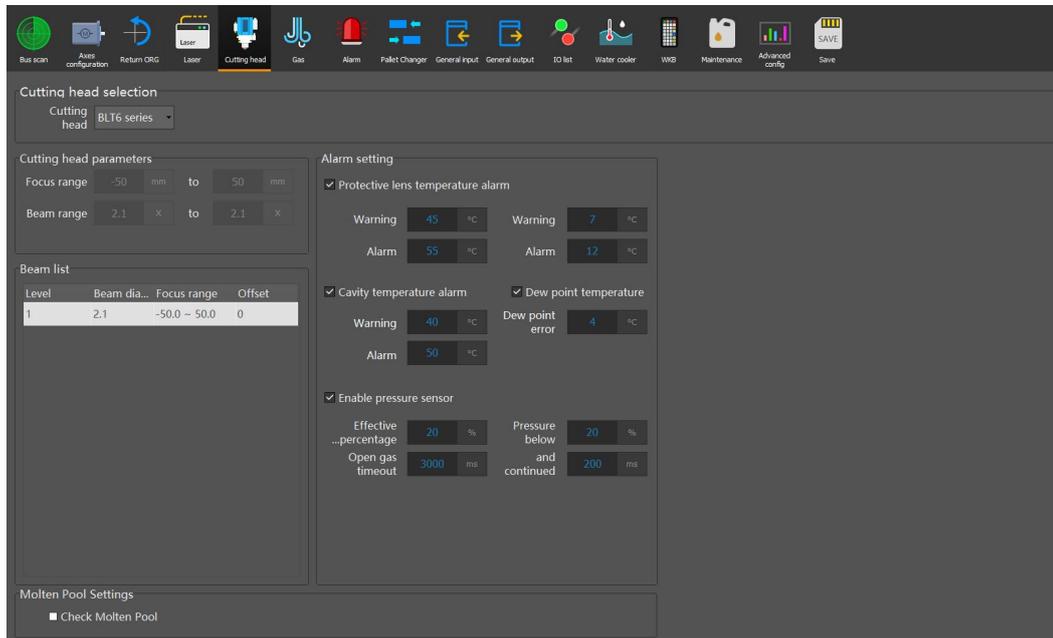
1. **Limit switch:** Configures hard limit switch and origin signal for X, Y and Z axes. NPN type (low-effective) normally-closed signal sensors are recommended for limit switches; NPN type normally-open signal sensors are recommended for origin.
2. **Return origin parameters:** Set the correct return origin direction, speed, stepback distance and other parameters, according to the actual configured origin position of the machine.

## 4.5 Laser



1. **Laser:** IPG, Raycus, Rofin, TRUMPF, Nlight and other types of lasers. Select the correct laser type depending on the laser that the device is paired with.
2. **Laser power:** Always set the correct laser power value. The laser energy control ratio within the system refers to this value.
3. **PWM enable +\ -:** The default PWM signal of the system comes with an isolated relay to prevent light leakage, in most cases there is no need for an external PWM enable signal. If additional PWM enable signal is required, the corresponding output control port can be configured.
4. **DA port:** The laser peak power can be controlled by adjusting the DA port voltage.
5. **Laser control:** Serial control, network control and hard wire control.
6. **Remote start button:** Configure it to remotely start the laser directly in the cutting system after remote start-up.

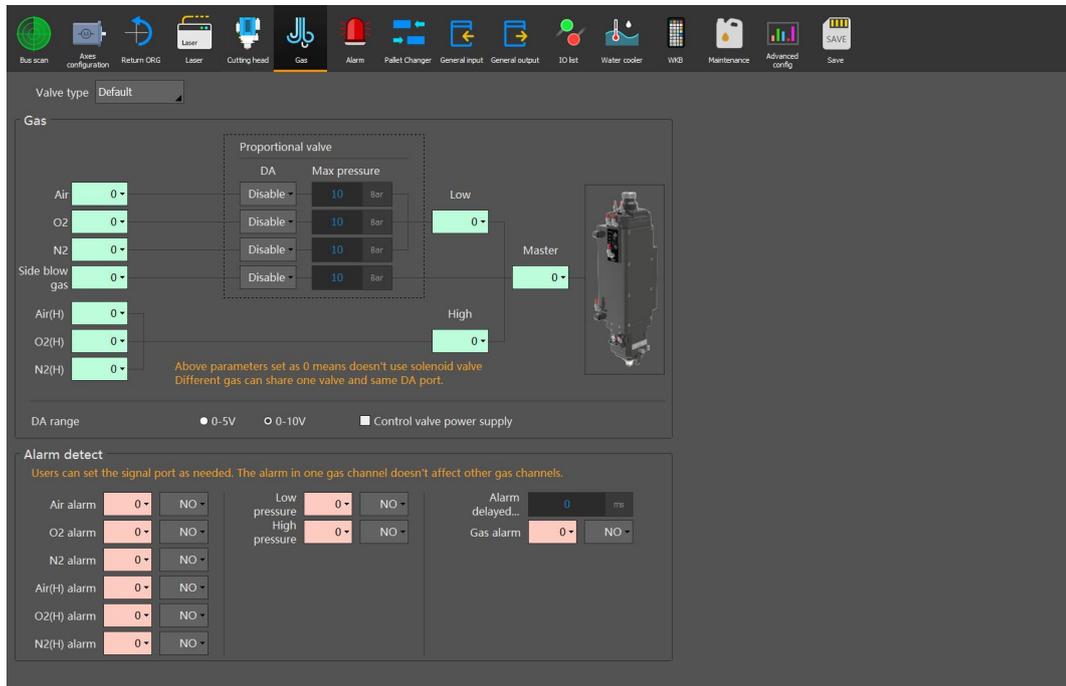
## 4.6 Cutting Head



**Cutting head** :Supports BLT series, ProCutter series, ProCutter Zoom, HighYAG and other focusing cutting heads that support bus servo control.

1. **Cutting head parameters:**The system preset range of focal point change and the adjustable range of spot size without manual setup.
2. **Spot list:**The system preset the spot to the corresponding focus range, without manual setup.
3. **Protective window temperature alarm:** The system presets protective window temperature alarm and temperature rise alarm.
4. **Air pressure sensor:** The system preset the deviation allowed in opening air pressure and the air pressure during machining.
5. **Lower protective window contamination detection:**The system preset threshold alarm for the lower protective window contamination.
6. **Smart monitoring:**When enabled, the system will provide intelligent monitoring such as Smart Piercing, process monitoring and so on.

## 4.7 Assist Gas



**Proportional valve:** Supports conventional analog + I/O mode of air valve control and Herbigier bus proportional valve.

**Bus proportional valve:** When configured as Bus Proportional Valve, there is no need to configure the air circuit structure, the system automatically recognizes the air, oxygen, and nitrogen control method in the Bus Proportional Valve.

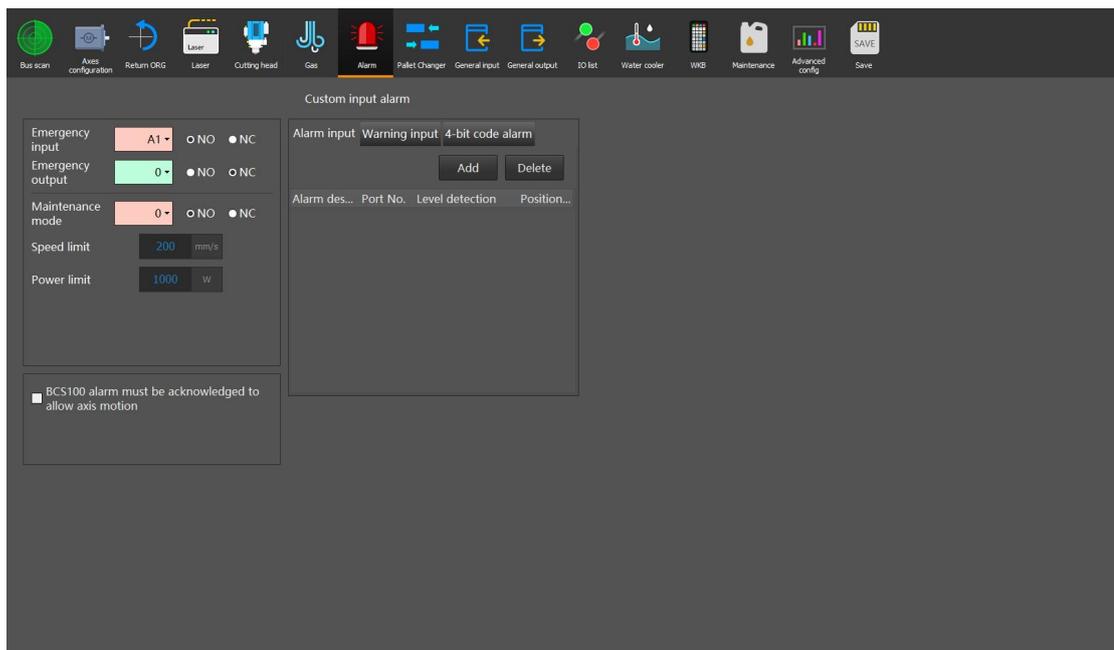
**Default proportional valve:** The system preset the corresponding air circuit structure, according to the electrical diagram and the actual interface to select the corresponding port.

1. **Main valve:** Set the total outlet for switching the auxiliary gas.
2. **High and low pressure main valves:** Set the switch to the outlet for the high and low pressure gas.
3. **Air switch:** Set the outlet to be used for air.
4. **Oxygen switch:** Set the outlet to be used for oxygen.
5. **Nitrogen switch:** Set the outlet to be used for nitrogen.
6. **Side blow switch:** Set the outlet to be used for side blown cooling air.
7. **DA pressure control:** Select the analog volumes of any channel on the HPL2720E to

regulate the gas pressure.

8. Alarm check: Select the alarm input corresponding to the gas.
9. **Alarm delay check:** Switch on the gas delay for a period of time before detecting an alarm input.

## 4.8 Alarm



**External emergency stop input:** Separate emergency stop control button signals from external devices are routed to the system configuration, e.g., separate emergency stop signal for pallet changer.

**Internal emergency stop output:** Output for HyPanel2150 emergency stop in the software.

**Maintenance switch:** CE certification of the European Union requires the control switch configuration port for maintenance. After the port is activated, the device will be restricted to a certain range of speed and power .

**Custom alarm:** Configure the custom alarm display information, level detection, signal anti-touch filter time, and limits for alarms triggered by the corresponding input.

**Custom warning:** Configure the custom warning display information, level detection, and signal anti-touch filter time triggered by the corresponding output. If this signal is

triggered, only a yellow warning will be shown and the machine's operation will not be limited.

**Four-digit code alarm:**A total of 16 alarms ranging from 0000 to 1111 can be set through a level signal group composed of four input ports, which provides some special external device alarm signal with access and saves input port resources.

**The height controller alarm must be acknowledged before the axis motion is allowed:**If any height controller alarm, the X and Y axis motion is inhibited. You need to click to confirm the axis motion is allowed., then the X, Y axis is can move.

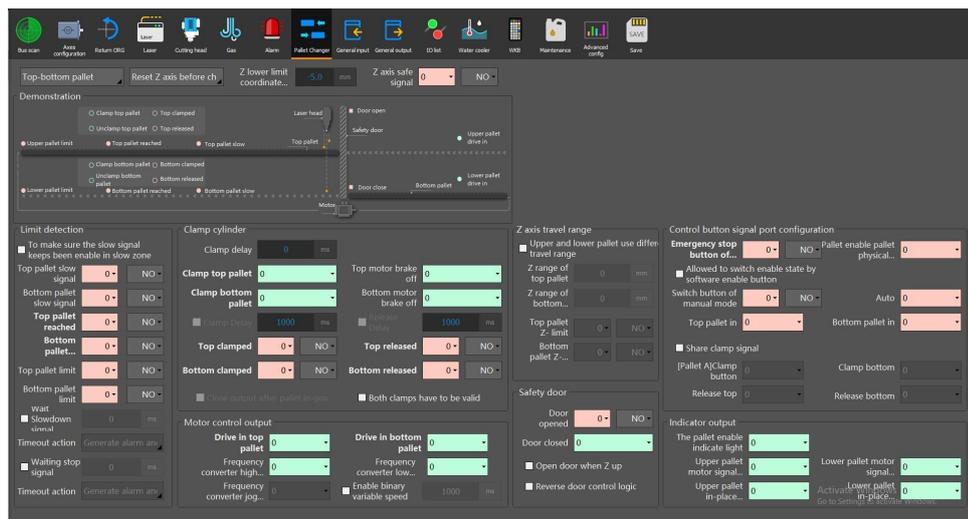
**Grating alarm input:**Configure the grating alarm input. When the input is valid, the machine will alarm and stop.

**Check the front grating only if laser off and machine in motion:** If enabled, check the front grating alarm only when the laser is off and the machine is in moving.

## 4.9 Pallet Changer

Type: Lift pallet, Hydraulic table, external I/O controlled table, etc.

### Key Configurations of Lift Pallet



**PalletA in-place signal:**An induction signal of the top table(PalletA) that is pushed in place. If detected, the pallet stops moving.

**PalletB in-place signal:**An induction signal of the bottom table(PalletB) that is pushed into place. If detected, the pallet stops moving.

**PalletA DriveIn signal:**Control the rotation direction of of the changer motor to push in the top pallet.

**PalletB DriveIn signal:**Control the rotation direction of the changer motor to push in the bottom pallet.

**E-STOP button:**HypCut will alerts "Pallet Emergency Stop" when this signal is active, and no changing is allowed.

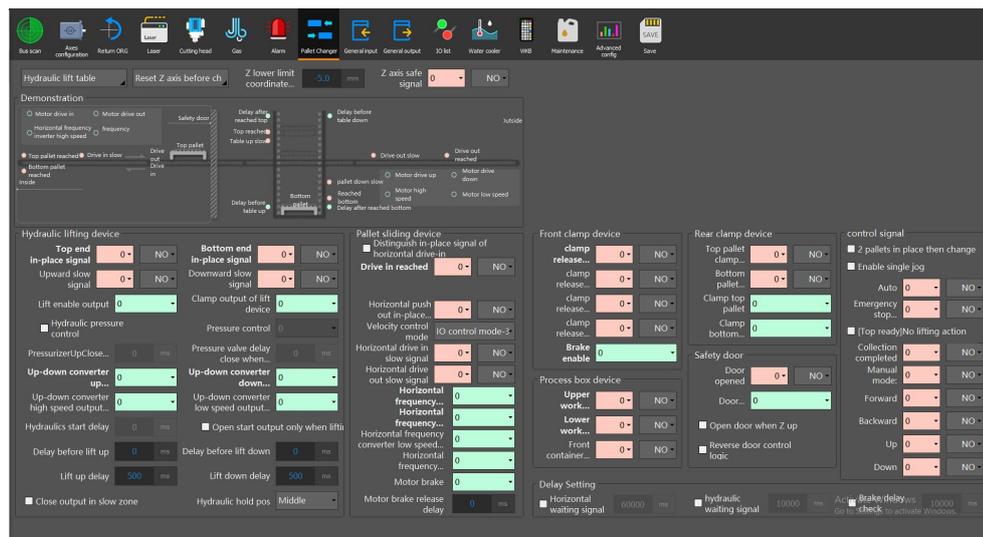
**PalletA clamped:**Output when the top table cylinder is clamped.

**PalletA unclamped:**Output when the top table cylinder released.

**PalletB clamped:**Output when the bottom table cylinder is clamped.

**PalletB unclamped:**Output when the bottom table cylinder is released.

## Key Configurations of Hydraulic Table



**Horizontal DroveIn signal:**An inductive signal of the table that is pushed in place. If detected, the table stops moving.

**Horizontal converter DriveIn output:**Control motor rotation to push in tables.

**Horizontal converter DriveOut output:**Control motor rotation to push out tables.

**Top reached signal:**An induction signal of the upward motion in place

**Bottom reached signal:**An induction signal of the downward motion in place

**Vertical converter up output:**Control hydraulic lifting up.

**Vertical converter down output:**Control hydraulic lifting down.

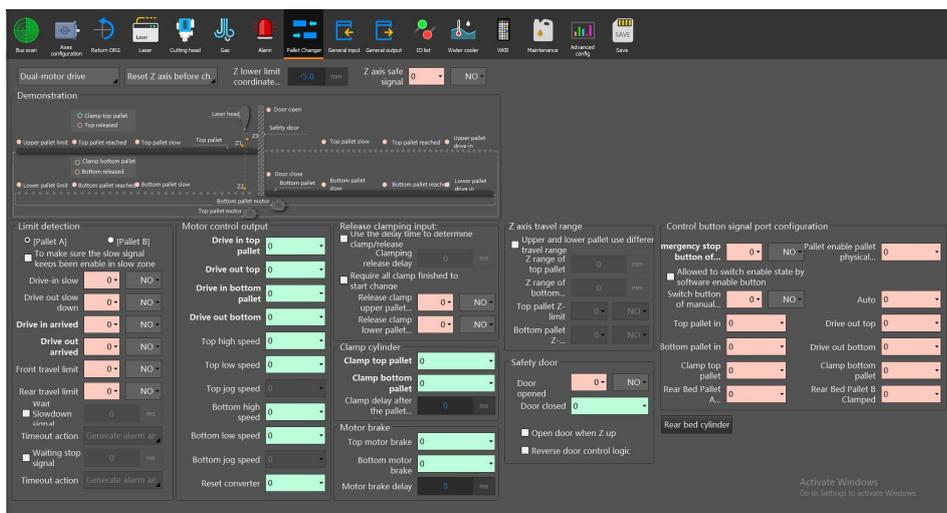
**Front bed unclamp signal:**Check whether the front bed is released.

**Front bed clamp signal:**Clamp output of the front bed. If it is active/valid, it is clamped.

**Upper container check:**Detect whether there is a worktable in the container check of the rear bed.

**Lower container check:**Detect whether there is a worktable in the lower container of the rear bed.

## Key Configurations of Dual-Motor Pallet Changer



**PalletA DriveIn/Out in-place signal:**An induction signal of the top table driven in/out into position. If it is detected, the pallet stops moving.

**PalletB DriveIn/Out in-place signal:** An induction signal of the bottom table driven in/out into position. If it is detected, the pallet stops moving.

**DriveIn/Out PalletA motor signal:**Control the rotation direction of the top table motor and drive the top table in/out.

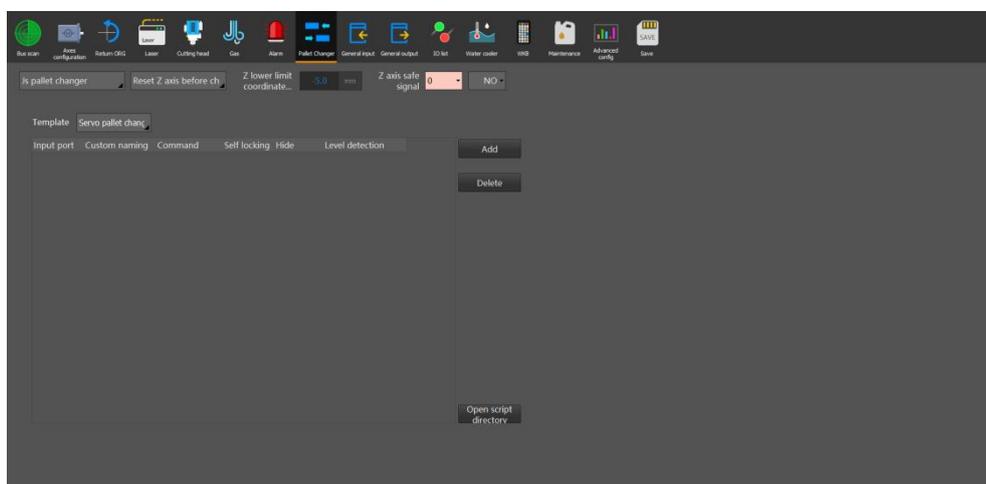
**DriveIn/Out PalletB motor signal:**Control the rotation direction of the bottom table motor and drive the top table in/out.

**Use the delay time to determine clamp state:**If selected, from closing the Lift Pallet brake clamp, waiting for the unclamping delay means the brake is released, operations can be continued; if not selected, use the Lift Pallet unclamping input as the signal for released.

**Lift Pallet unclamp input:**PalletA/B cylinder released detection signal. If it is active, it indicates PalletA/B is released and allowed to move.

## JS Pallet Changer Description

In HypConfig, you can add the buttons for the changer interface or input buttons.

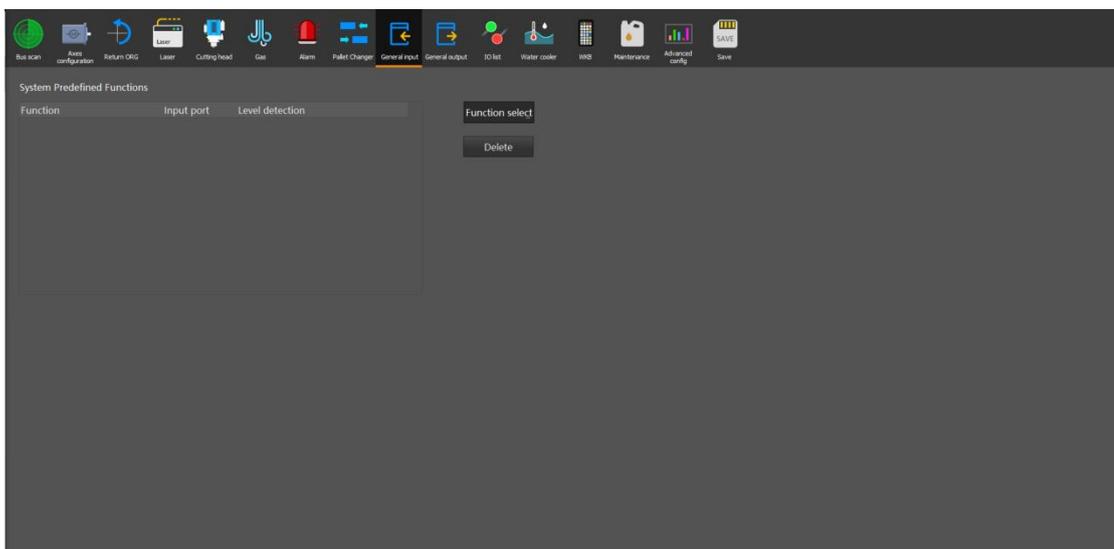


**Custom Name:** The button display name on the HypCut interface.

**Command:** Function name in JS code.

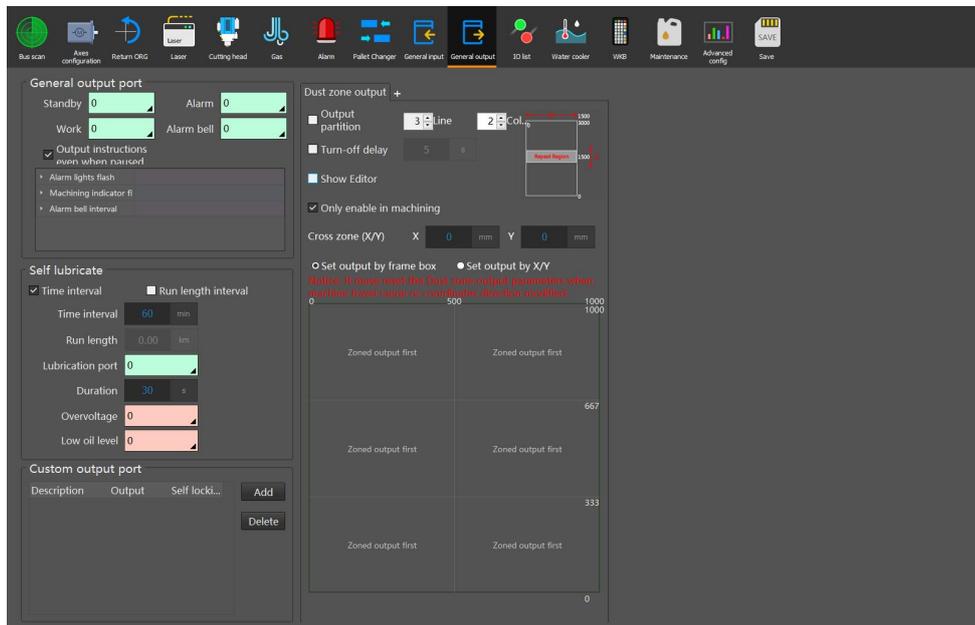
**Hide:** Hide the buttons from the interface.

## 4.10 Common Input



**Function:**By clicking the Function button, the user can select the function name of the input from the drop-down list and then configure the corresponding input and level detection.

## 4.11 Common Output



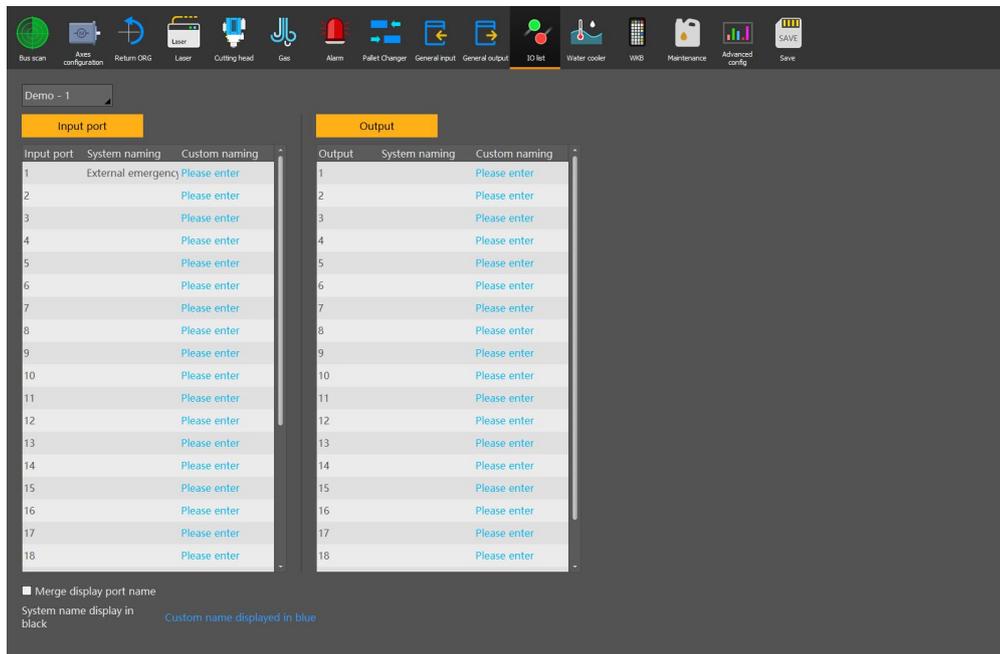
**Common output:** Port for machine 3-color control and alarm ring configuration. The recommended processing indicator is yellow, the standby indicator is green and the alarm is red.

**Self-Lubricate:** When this port is configured, the corresponding output port will be opened and kept for the set output time within each interval cycle, starting from the moment when the HypCut software is opened or when the motion mileage is started, and then closed. It can be connected to input signals for pump overpressure and oil level too low.

**Custom output:** Configure a custom output to display the control buttons for that custom port in Production - Custom tab in HypCut. The custom port can be controlled by either self-locking or contact mode.

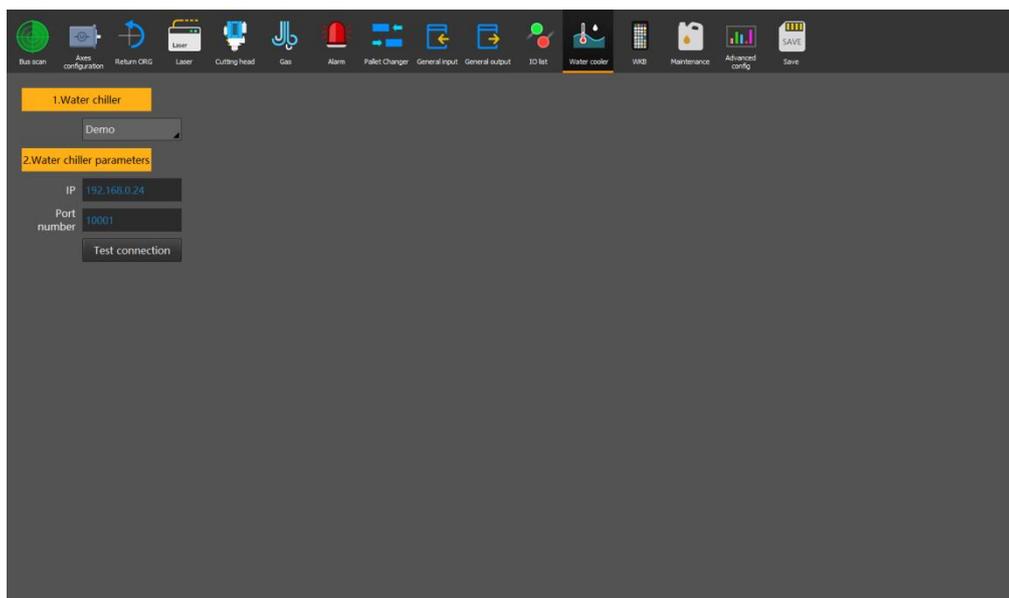
**Partition output:** Configure the corresponding control port and functional attributes for partitioned dust removal.

## 4.12 I/O List



An overview of all the I/O configurations of the machine, in which I/O custom designations can be checked and revised.

## 4.13 Water Chiller

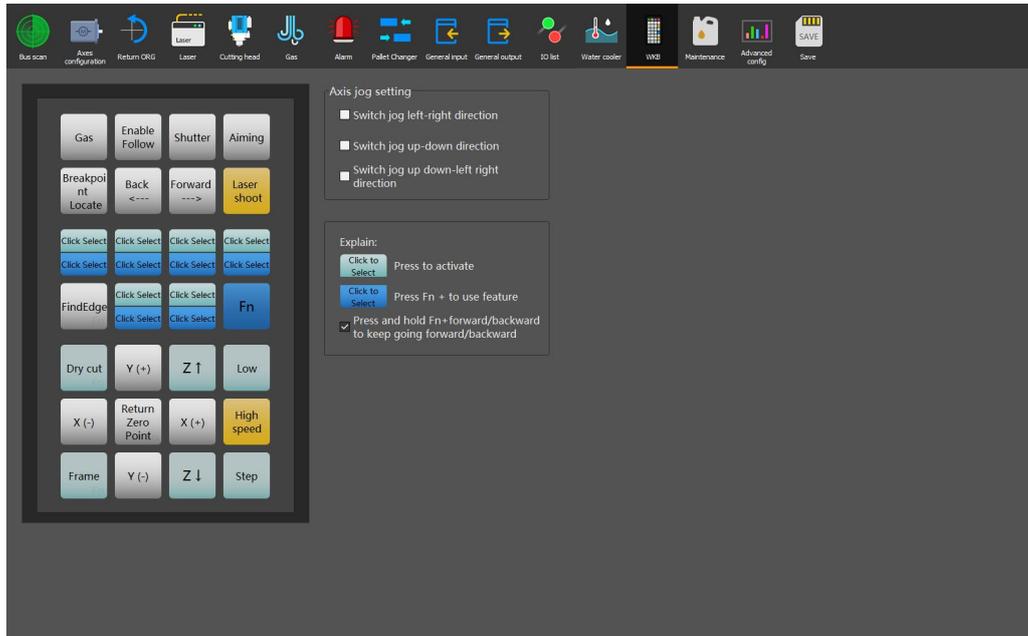


**Water chiller:** Currently supports S&A, Hanli.

**Water chiller parameters:** Configure the IP address to communicate with the water

chiller. After successful test connection, the water chiller monitoring and temperature setting can be implemented in the Diagnosis window.

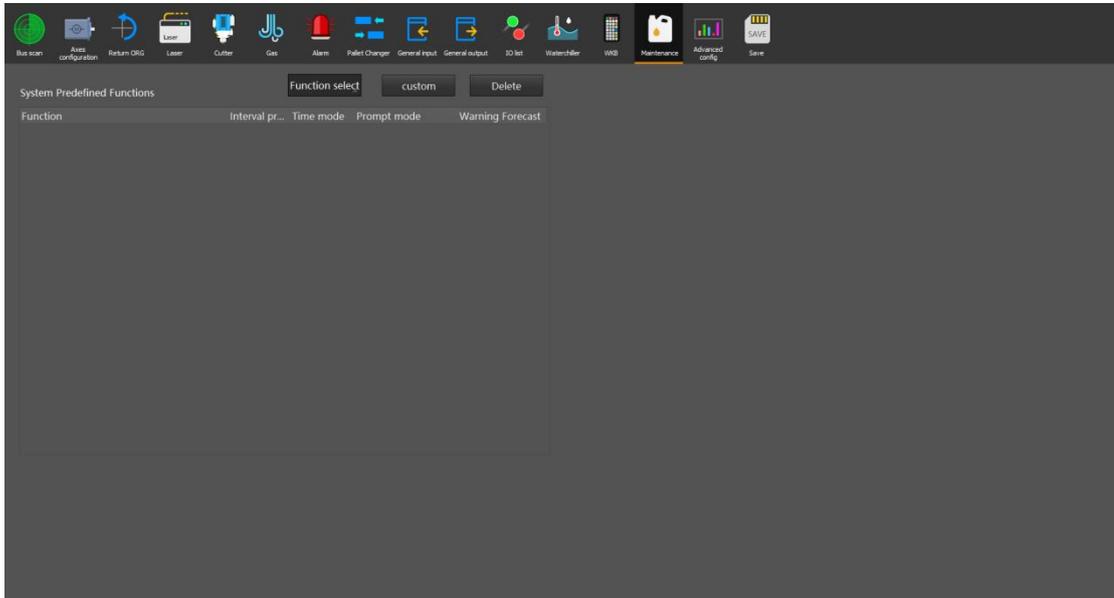
#### 4.14 WKB



**WKB Custom Button:**Configures the function of the six custom buttons on the handheld box.

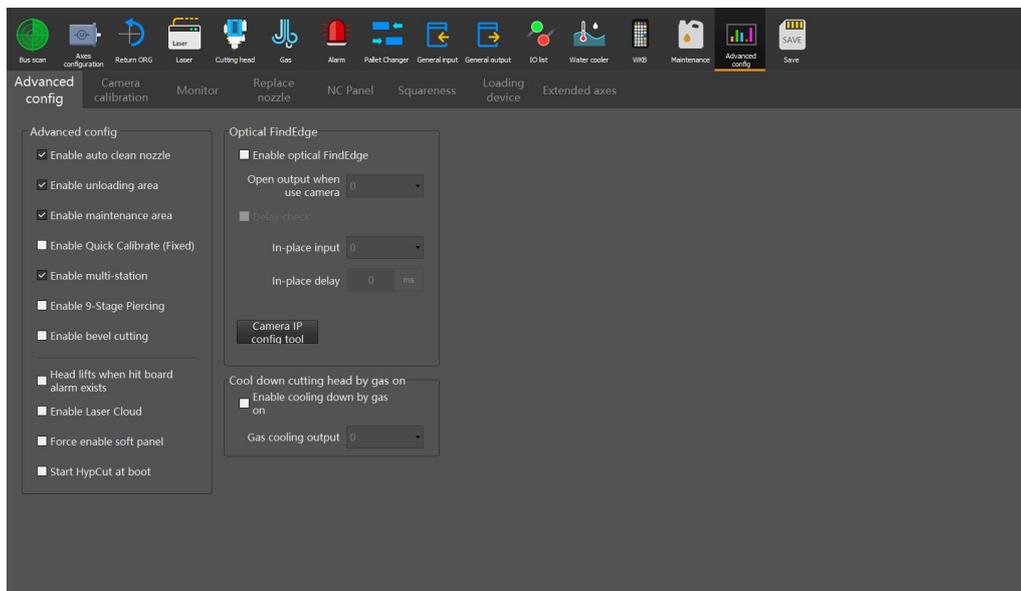
**Axis jog:**Configure the axis motion button of WKB and HyPanel2150.

## 4.15 Maintenance



The system preset items for maintenance. The reminder cycle and mode of the maintenance items can be set.

## 4.16 Advanced Config



**Auto clean nozzle:** Start-stop cleaning nozzle, which requires the device to install the cleaning brush in a fixed position.

**Unloading position:** Start and stop unloading position to meet the special unloading

position required for automation or the pallet changer.

**Maintenance area:** Start-stop maintenance position function, fixed a position in front of the device, so that the device can quickly return to the specified position during use with one click.

**Enable gas calibration position:** Start-Stop gas calibration position, which allows quick positioning to a fixed position for gas calibration.

**Quick calibration:** Start-Stop quick calibration requires the equipment to have a stainless steel calibration block installed in a fixed location.

**Enable 9-stage piercing:** If enabled, the piercing process supports up to 9-stage piercing.

**Enable bevel cutting:** If enabled, settings such as the swing axis parameters are provided in the Diagnosis - Machine Tool for simple bevel processing.

**Cutter lifts if hit-board alarm:** If enabled, the cutting head will automatically raise when a hit-board alarm occurs.

**Enable laser cloud:** If enabled, it can be used with the RayBox.

**Safety alert for booting the plate and tube integrated machine:** If enabled and the control card is used by other software, a safety prompt will be displayed and Y-axis motion will be limited. It will be cleared after the cutting head position is secure.

**FindEdge config:** Configure input and output for optical and photoelectric FindEdge.

**Camera calibration:** Configure communication for the remnant reproduction camera.

**Monitor:** Configure camera information, set the camera's prompt when detecting a person and limit the machine's motion or laser emission.

**Replace nozzle:** If enabled, the relevant IO and motor axis can be configured.

**NC Panel:** The CNC panel can be configured for standalone environment or local area network (LAN) environment.

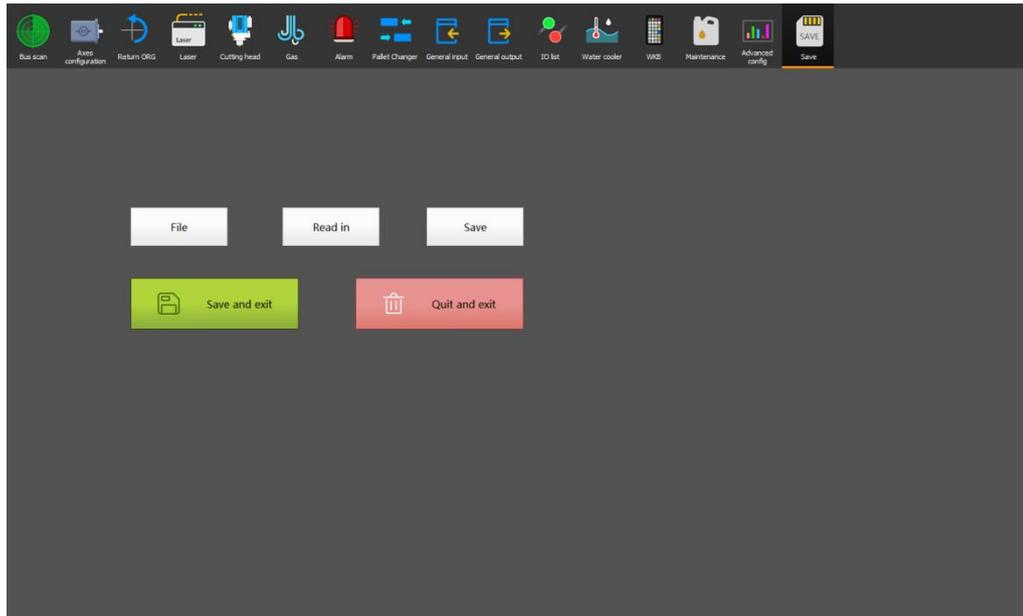
**Squareness:** Vertical correction can be made to improve the situation of poor vertical cuts.

**Coiling config:** Motor, mechanical, motion parameters and IO signals for feeding axis, flattening axis, and collecting axis.

**Feeding device:**Enable PLC feeder to configure communication parameters and register address.

**Extend Axis:**Enable the extension axis and configure the axis-related parameters.

## 4.17 Save



**Open config file path:**Navigate to the folder where the system background configuration is stored and proceed. Please proceed with caution.

**Read Param:**Read and import config files from backup files for quick recovery and batch installation.

**Save Param:**Saves the parameters that are modified this time in the platform configuration.

**Save and Exit:**Save the parameters that were modified in HypConfig and exit automatically to launch HypCut.

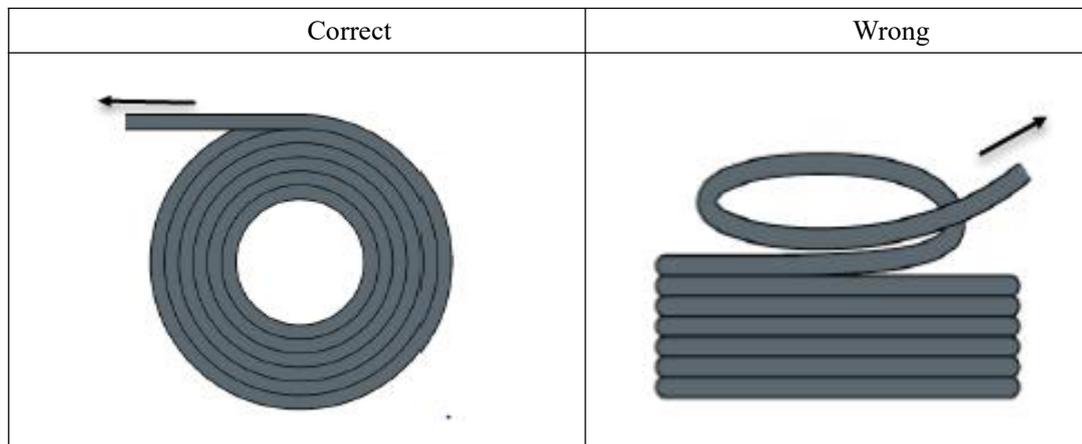
**Discard Changes and Exit:**Discard the parameters that were modified in HypConfig and automatically exit to launch HypCut.

## 5. Precautions

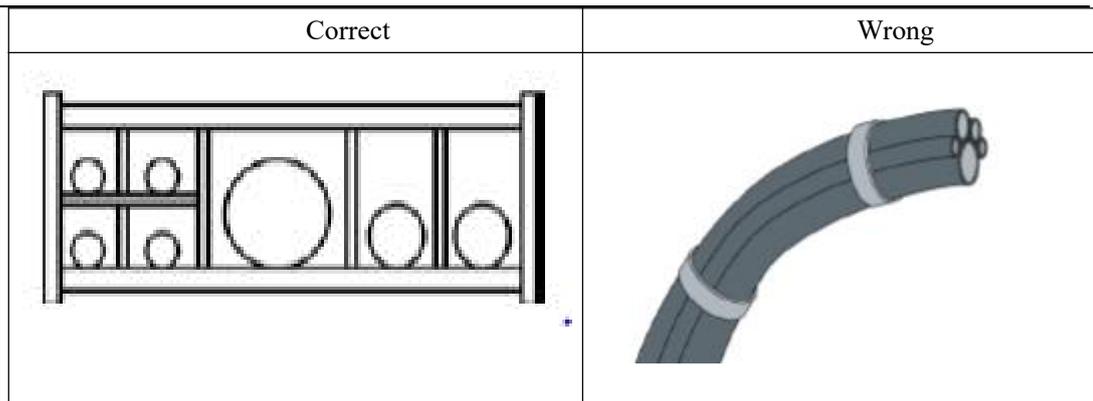
### 5.1 Wiring Precautions

#### 5.1.1 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 work 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.



- 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. The space between the cable and the spacer, separator and the cable adjacent to it, shall be at least 10% of the diameter.



- 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.
- 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 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.



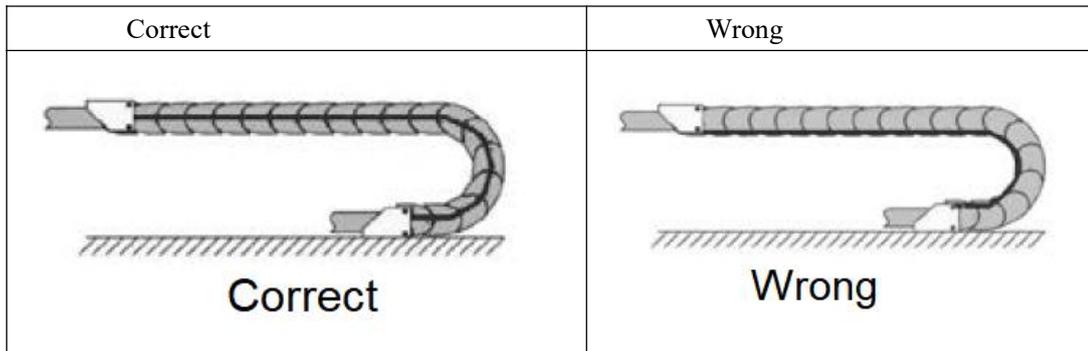
self-supporting



sliding

- 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.



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.

### 5.1.2 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 <sup>2</sup> )	Cross Section(mm <sup>2</sup> )	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)

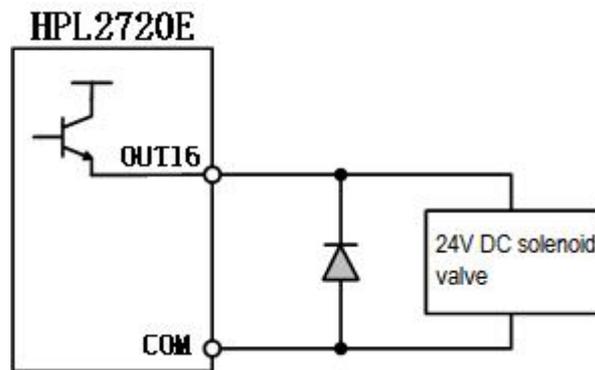
- Distinguish the positive and negative wires of the power supply in color, e.g., the red wire is connected to the positive pole, and the blue wire is connected to the negative pole
- Loads with relatively large interference (e.g. servos and solenoid valves) are powered separately from the controller.

## 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)

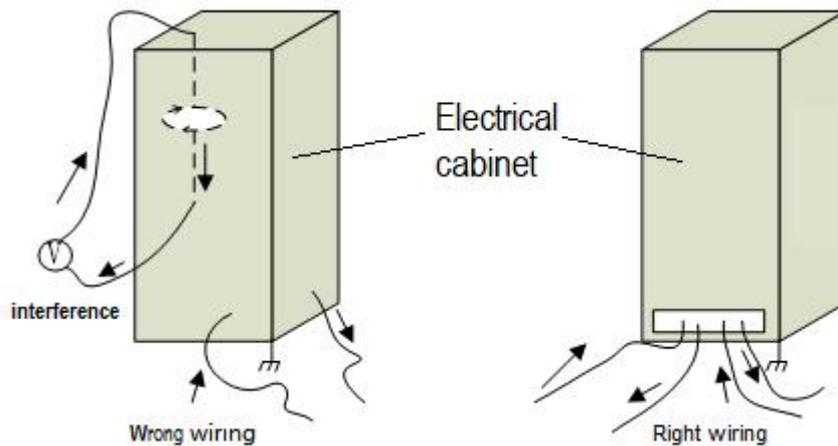
- Signal wire color, e.g. black.
- Choose the signal wire according to the power.
- DC 24V solenoid valve is recommended. Add absorption circuits at both ends of the solenoid valve, that is, connect a freewheeling diode in parallel at both ends of the solenoid valve (pay attention to the direction, withstand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



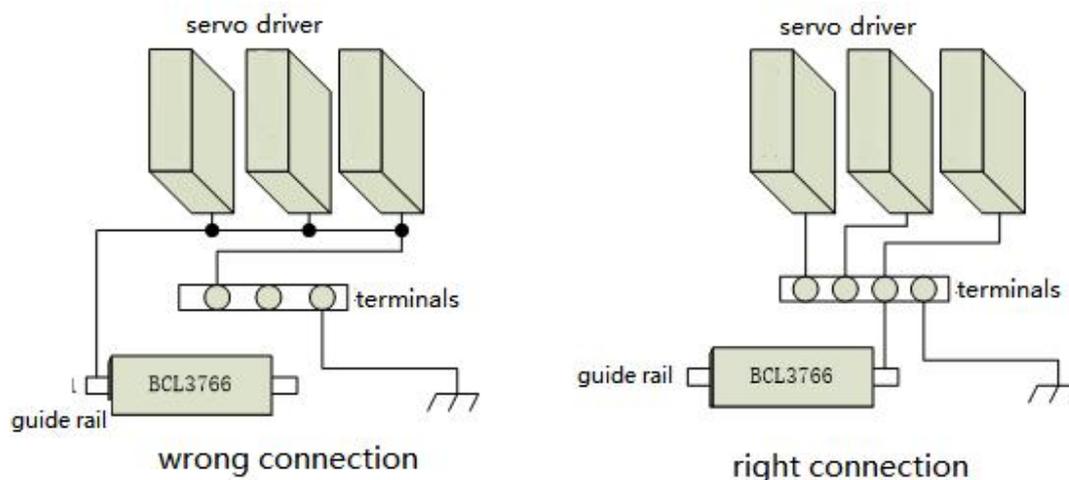
- It is recommended that the digital signal (PWM) shielding layer be grounded at both ends, and the analog signal (DA) shielding layer be grounded at one end. Single-ended grounding can avoid low-frequency current noise on the shielding layer; double-ended grounding can effectively eliminate high-frequency 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 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.



- It is recommended to use a star connection for wiring, not to use a serial connection, as shown in the following figure:



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### 5.1.3 Assembly Requirements

 A yellow triangular warning icon with a black border and a black exclamation mark inside.	<p>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.</p>
 A yellow triangular warning icon with a black border and a black exclamation mark inside.	<p>Except for the USB interface, plugging and unplugging with power is prohibited for other interfaces, which may cause internal components damaged.</p>
 A yellow triangular warning icon with a black border and a black exclamation mark inside.	<p>Handle with care. Do not press the card. Pressing might cause the card to bend and its function damaged.</p>

## 6. FAQ

### 6.1 Computer Cannot Enter the Operating System

1. Check the power connectors of the host and the monitor and see if it is loose and if the 24V voltage is OK.
2. If the host can be powered on, check if the monitor power is loose and if the voltage is OK.
3. If the monitor is OK, the system cannot be accessed, then the system may be infected with a virus. Try the following steps:
  - Press Win+R and manually boot explorer.exe to load.
  - Reboot the host to see if it enters the interface.
  - If it enters the host interface, use the antivirus software to remove the virus; If it still cannot enter it, do system restore.

### 6.2 The Touch Screen Does Not Display.

1. Check if the monitor power connector is loose, and if the 24V voltage is OK.
2. Check if the BCLink interface is plugged in.

### 6.3 System Virus-Infected

1. Follow the standard procedure for system restore.

### 6.4 System Boots Without Encryption Card

1. Check for any abnormal USB devices and unplug them if found.

### 6.5 Host Stuck on F3 Interface at Startup

When the computer getting stuck on the F3 screen during startup and cannot enter the operating system, try:

- 1) System Restore can be accessed via F3 (Restart the computer if it cannot be continued).
- 2) You can also enter the PE system and restart the computer to enter the operating system.
- 3) If there is a problem with the system, it can also be repaired using F3 system repair.

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NOTE: If any startup exception, unplug all USB peripherals first before troubleshooting.

## 6.6 Troubleshooting the HyPanel Black Screen

### 6.6.1 Screen Power Troubleshooting

Tools required: Multimeter

1. Confirm the power supply power of the screen, the maximum power consumption of the screen is 24V, 2A. Please ensure that the power supply meets the power consumption requirements (considering the total power consumption of all loads connected to the power supply). If it does not meet the requirements, replace it with a switch power supply that meets the requirements and ensure that the single current is greater than 2A (Mean Well switch power supply is recommended).
2. Adjust the multimeter gear to the DC voltage position, insert the red test lead into the voltage measurement hole of the multimeter, and insert the black test lead into the COM hole.
3. Measure the voltage of the power supply terminals under the screen, ensure the voltage range is between 23-25V, otherwise replace the power supply
4. Plug the power terminal into the screen and measure the 24V to 0V at this time:
  - 1). If the voltage measurement is 0V, unplug the power supply terminal immediately. The screen power is shorted, contact Friendess(Bochu) customer service for repair.
  - 2). If the voltage measurement is around -24V, unplug the power supply terminal immediately. The power supply is connected in reverse, reconnect it.

### 6.6.2 Network Port Indicator Troubleshooting

Check the BClink LED status when plugged in:

1. Observe the yellow one. If it is on, contact Friendess(Bochu) customer service for assistance.
2. If the yellow is off, observe the status of the green one on the BClink terminal at the screen and the host. If any one does not flash, then contact Friendess(Bochu) customer service to return the non-flashing device for repair; replace the network cable if both are flashing.

## 6.7 Troubleshooting False Emergency Stop

1. If it can quick self-recover after an emergency stop, the issue is USB HUB, wireless network cards, or other USB devices are used on the HyPanel. The USB port at the back of the HyPanel is theoretically used for the wireless keyboard and mouse receiver, and the front USB port is used for the USB flash drive. Plugging other devices may cause USB usage issues.

2. If the recovery is slow after the emergency stop or it cannot even be resumed: it is possible that some parts were not welded at the beginning after the peripheral issue has been ruled out. In this case, contact Friendess (Bochu) customer service to repair the screen.

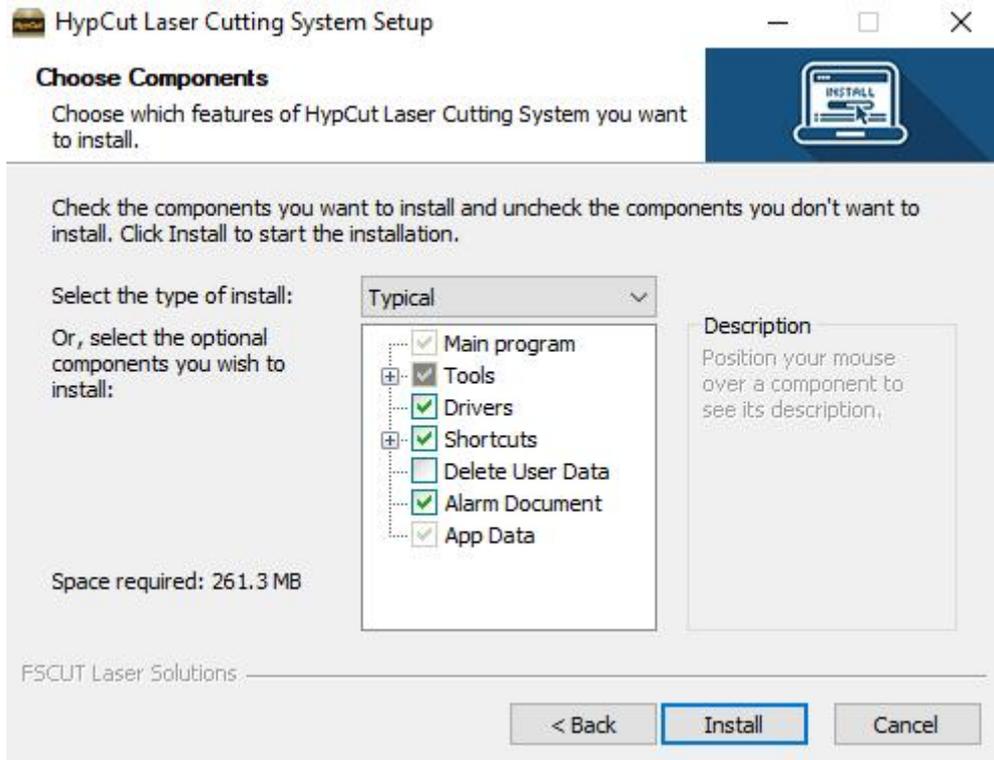
## 6.8 Hard Panel Connection Timeout Troubleshooting

1. If this alarm occurs when the network cable at the host or screen is shaky, insert the gold finger or network cable again, or replace the network cable.
2. While the alarm remains, the touch screen and USB peripherals do not work, insert the gold finger again.
3. If the software prints an alarm message accompanied by a [HKB USB Device Removed] message, try replacing the powered USB HUB with a powered one or using a USB to network port converter.
4. When the software prints an alarm message and indicates that the thread wait time is not 0, upgrade the HypCut to 2022B, August 31 and later version.

## 6.9 Master Card Upgrading

### 6.9.1 Auto Upgrading

1. Install software on master computer, check Drivers, as shown below:

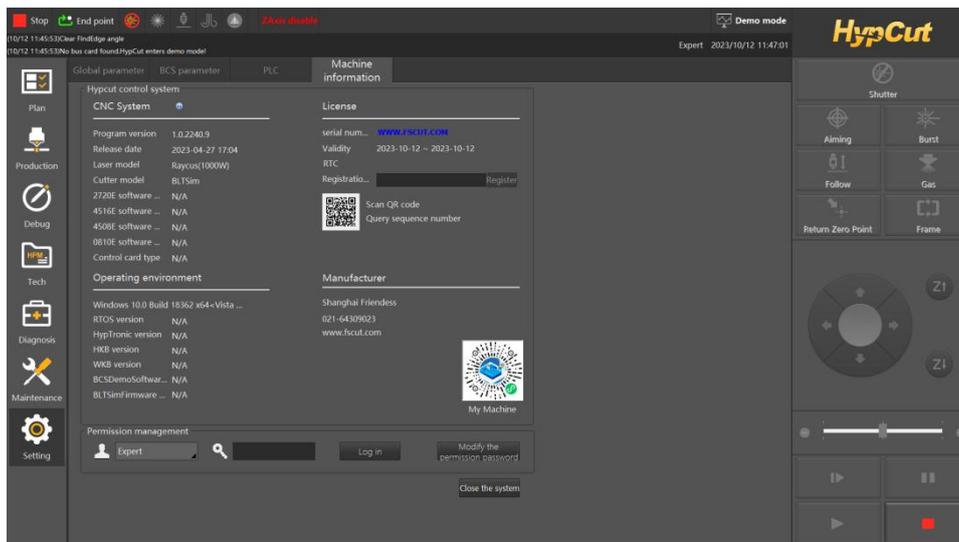


2. Auto check master card firmware version when install HypCut. Auto upgrade if the version was old. The version number and progress bar can be seen in the window, as shown below:

```

正在安装并驱动。 不要关闭此窗口(Installing Drivers, DO NOT Close)
BMC Driver Path: C:\Program Files (x86)\Friendess\HypCutPro\Drivers\win10\
Installing Dongle Driver...
Installing Motion Card Driver...
DEVICE ID: PCI\VEN_6125&DEV_228x
Installed Driver Count: 1
Installed Driver Time: 2022/3/31 8:00:00
Installing Driver Time: 2022/3/31
Driver already installed!
Update 64 Bit Drivers...
PID: 1708
Scanning for new hardware.
Scanning completed.
RetCode = 0
PID: 1712
PCI\VEN_6125&DEV_228A&SUBSYS_00076125&REV_00\4&382692A7&0&0000: Removed
1 device(s) removed.
RetCode = 0
PID: 1708
Scanning for new hardware.
Scanning completed.
RetCode = 0
Card Type: 228A
Current Firm Version: 100
AFM File Version: 110
Update ARM from 100 To 110
PID: 1732
PCI\VEN_6125&DEV_228A&SUBSYS_00076125&REV_00\4&382692A7&0&0000: Disabled
1 device(s) disabled.
RetCode = 0
Wait for BMC2280 rebooting...04%
  
```

3. The master card firmware will auto load and restart after upgrading. If there is no hint, check and confirm the upgraded firmware in software-Setting-Machine information after installation, then it will work.



4. Certain types of the master computer may ask for a restart after upgrading, as shown below. For it does not support hot swap, restart the computer can get it identified. Please contact us if it still not works.



## 6.9.2 Manual Upgrading

1. Open HypCut installation directory C:\Program Files (x86)\Friendess\HypCut\drivers, copy the firmware to be upgraded to this file.

- 
2. Close HypCut and open installation directory:  
C:\Program Files (x86)\Friendess\HypCut\drivers, double click InstallDrv.exe procedure.
  3. The following steps are the same with the step 2, 3, and 4 of 6.9.1.

## 7. Product Dimensions

Figure 1 Hypronic2 Dimension

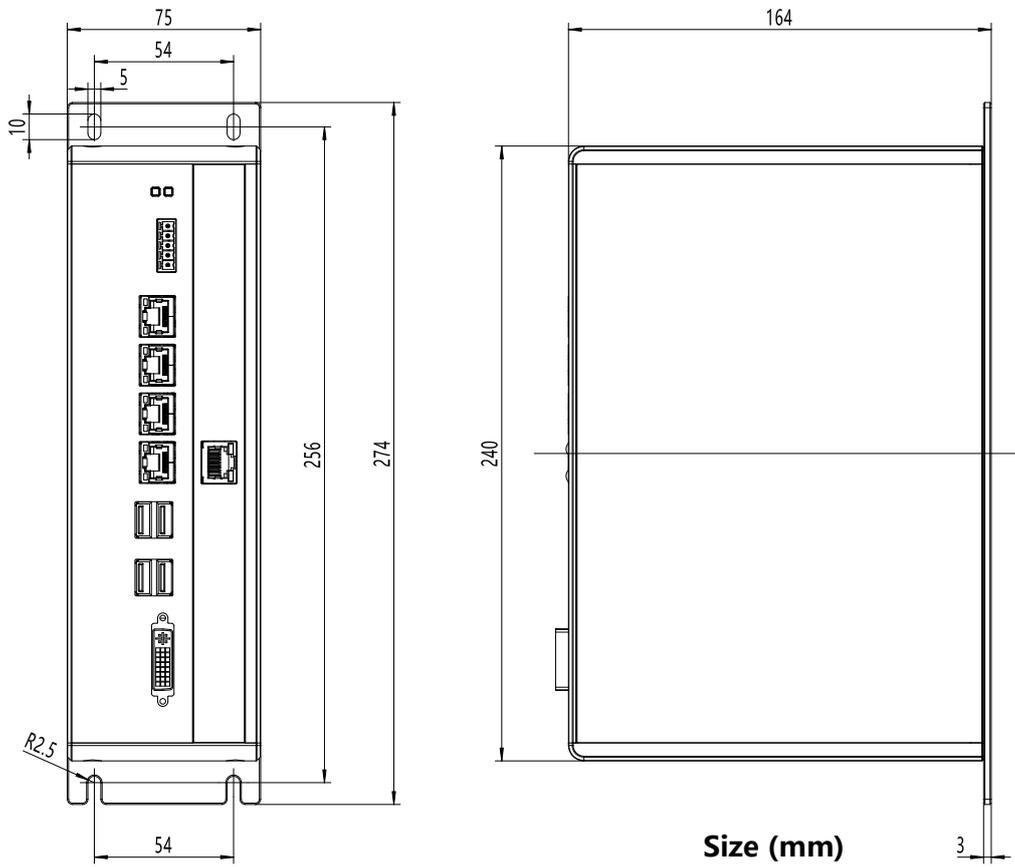
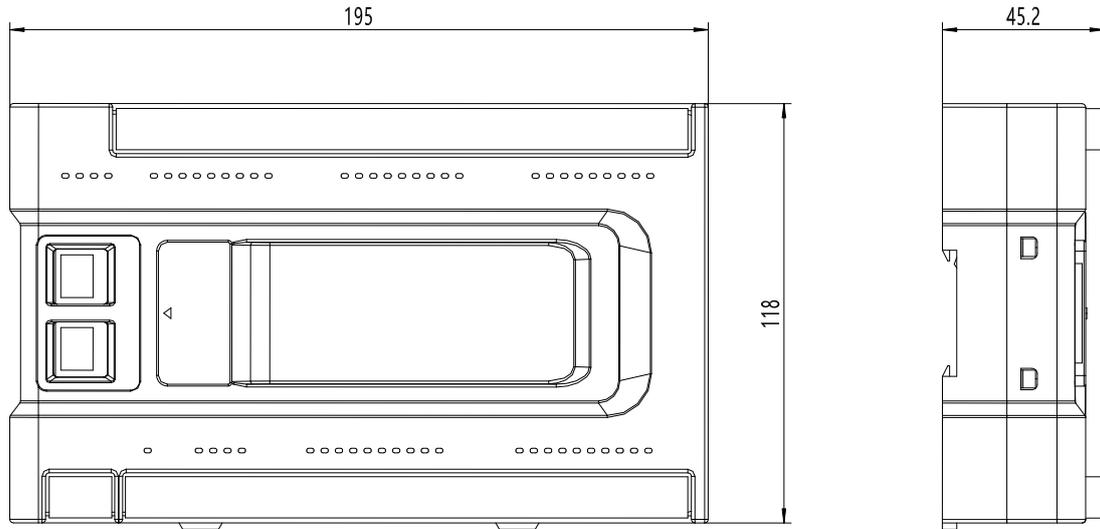
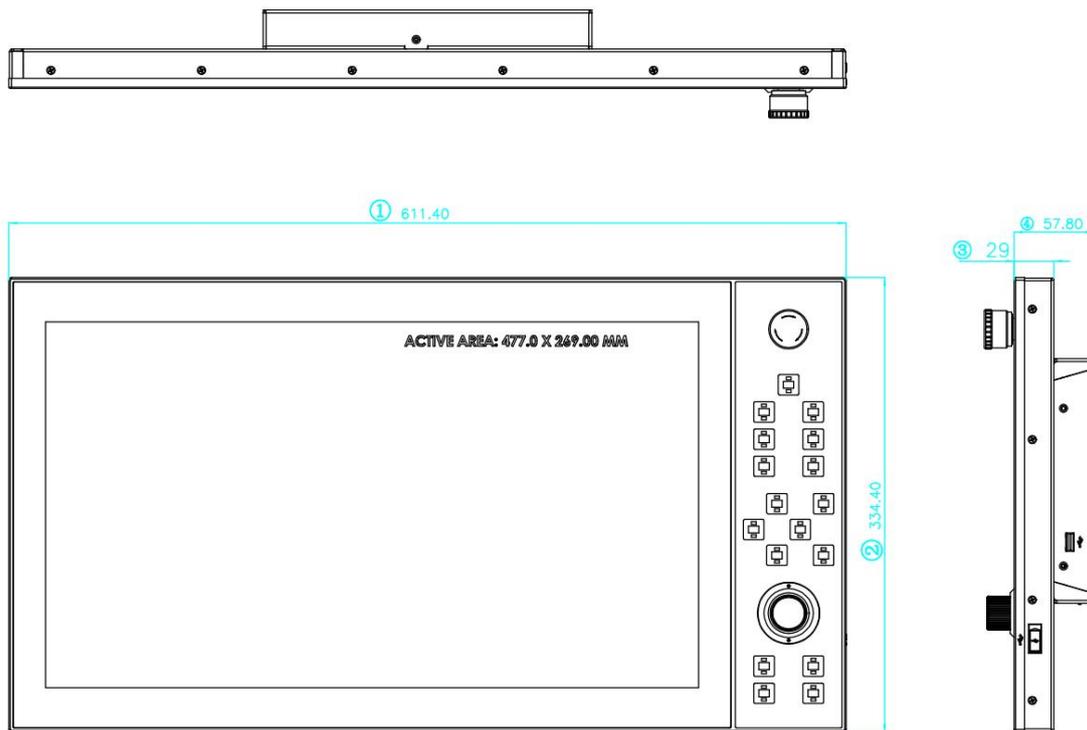


Figure 2 HPL2720E Dimension



Size (mm)

Figure 3 - HyPanel2150 Dimension



Size (mm)

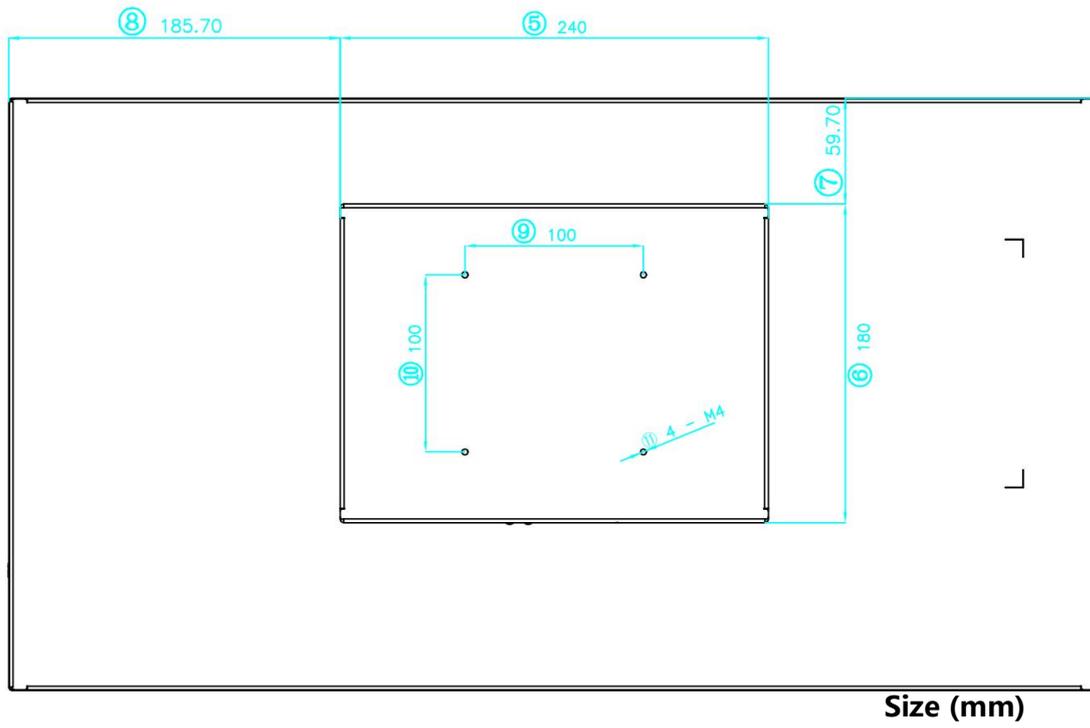


Figure 4 - BCS100E/PRO Dimension

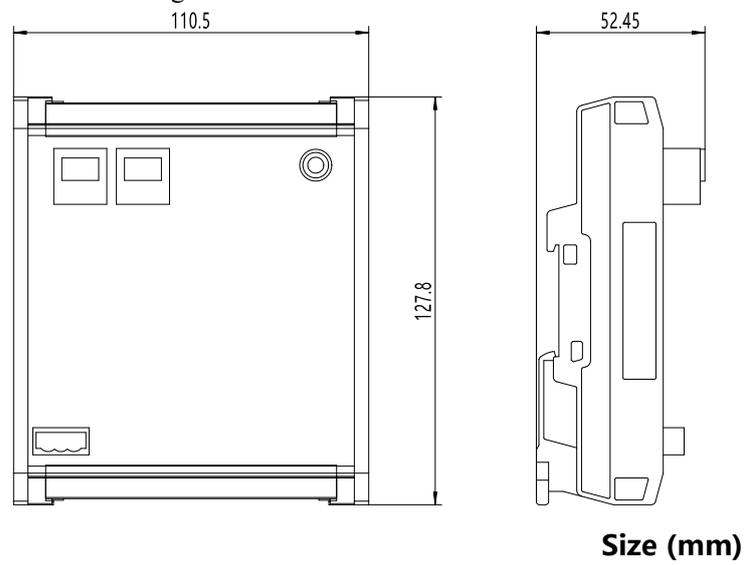
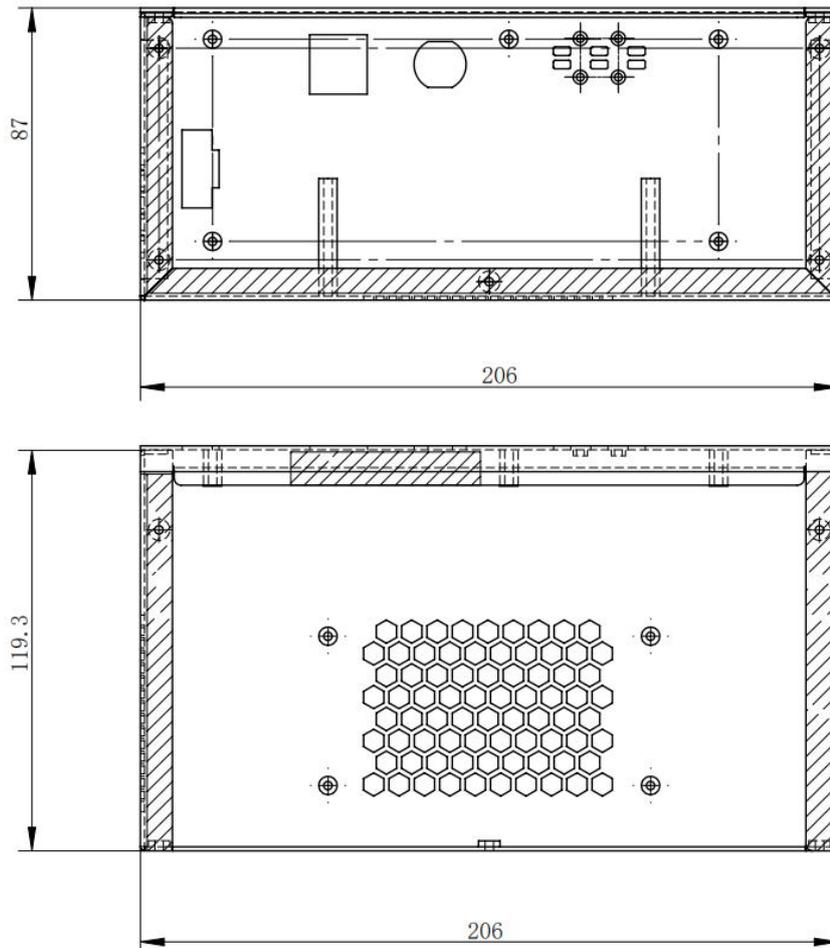


Figure 5 - BCS210E Dimension



Size (mm)