FROG-200S

Capacitive Height Controller User Manual
V3.0

Foreword

Thank you for choosing our product!

This manual provides a comprehensive guide on the use of the FROG-200S Capacitive Height Controller, including features of the system, operation, and installation instructions.

Please thoroughly read this manual before using this controller and any related equipment. This will help you use it more effectively.

Due to continuous updates of product features, there may be some discrepancies between the product you receive and the descriptions in this manual. We apologize for any inconvenience caused.

CONTACT US:

Shenzhen Ospri Intelligent Technology Co., Ltd.

TEL：0755-85225225

Address: Room 1001, Building A, No.4 Factory, Baolong Zhizaoyuan, New Energy 1st Road, Baolong Community, Longgang District, Shenzhen

Chapter I Product Introduction

1.1 Brief introduction

The FROG-200S is a capacitive distance sensor and controller (hereinafter referred to as FROG-200S). In the laser cutting process, factors such as unevenness of the workpiece and high-pressure gas jet cutting cause the distance between the nozzle and the surface of the workpiece to be inconsistent, negatively affecting the cutting effect, and may even damage the nozzle. The FROG-200S distance adjuster can maintain a constant distance between the nozzle and the surface of the workpiece during high-speed laser cutting, protect the nozzle from colliding with the workpiece, and significantly improve the cutting effect. The capacitive sensor on the cutting head can detect the distance from the nozzle to the surface of the workpiece, which is then sent to the adjustment box after being amplified by the preamplifier.

After processing, the output signal is sent to the servo controller to control the Z-axis.

The FROG-200S distance adjustment box can act as a controller outputting control voltage, or as a distance measurement system outputting distance signals, depending on the chosen mode, sensor control mode, and distance measurement system mode.

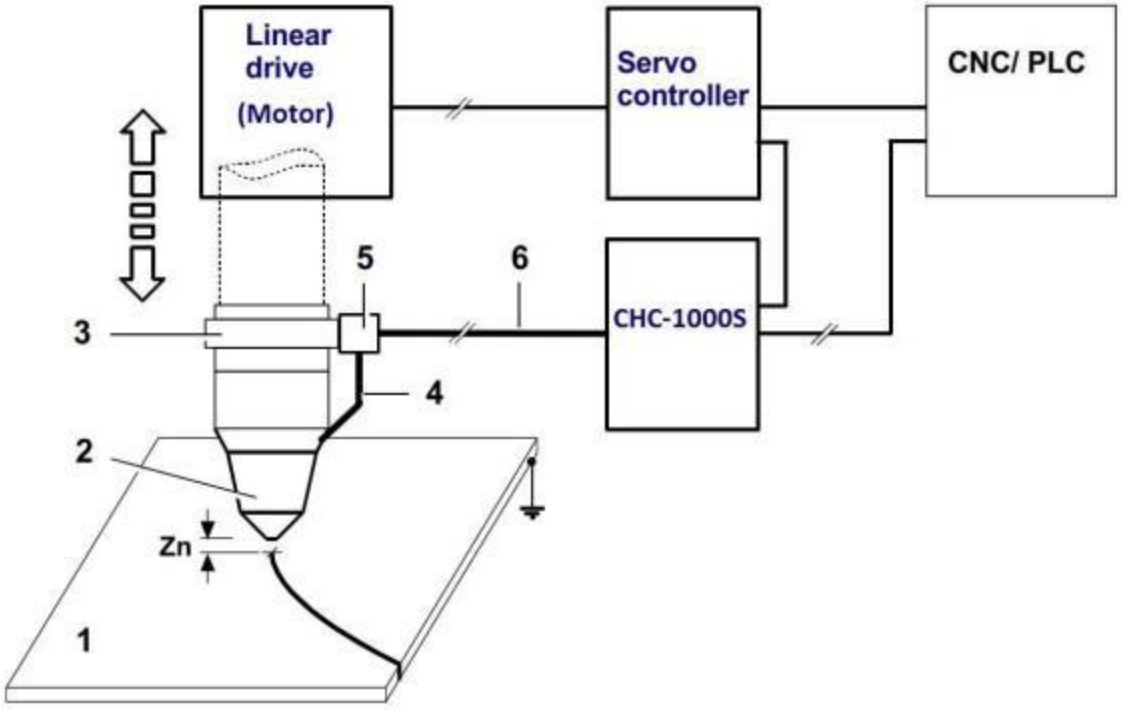


Figure 1-1 System Wiring Diagram

1. Workpiece,

2. Sensor

3. Cutting Head

4. Electrode Cable

5. Preamplifier

6. Sensor Cable

1.2 Performance Description

- Capacitance sampling rate of 1000 times per second.
- Static measurement accuracy of 0.001 millimeters.
- Height measurement range of 0-25 millimeters.
- The signal is undiminished and resistant to interference when the amplifier signal transmission cable reaches a length of 100 meters.
- With support of network communication, firmware upgrades via USB flash, and online upgrades.
- With support of jitter suppression functionality, effectively minimizing jitter caused by blowback and slag.
- With support of plasma interference filtering, effectively preventing abnormal interference and nozzle collision.
- Can adapt to any cutting head and nozzle with self-adapting capacitor parameters.
- With support of collision alarm, nozzle electrode loss detection alarm, and sensor disconnection alarm.
- With support of 16-point and 20-point capacitor calibration, and displays the calibration curve.
- With support of real-time capacitor calibration, effectively solving issues related to temperature and other factors impacting the capacitive sensor.
- With 16-bit DA output, it outputs voltage (±10V) signals in sensor control mode, or linear height signals with voltage (0-10V) in distance measurement mode at a refresh rate of 1000 times per second.
- 14-bit AD input, testing external analog voltage signals (0V-10V) for real-time adjustment of standstill distance.
- With support of oscilloscope function for real-time monitoring of capacitive sensor changes.
- With support of diagnostic tests to real-time detect changes in AD/DA and IO.
- With support of EtherCAT bus communication (optional).

Chapter 2 Wiring

2.1 System Composition

The capacitive height controller control system consists of the FROG-200S booster host, preamplifier, cables, etc.

Part name	Amount	Standard configuration	Optional
Height Controller Host	1	FROG-200S	Optionally supports EtherCAT
PREAMPLIFIER	1	FROG-AMP	
RF Cable	1	SPC-140(140mm)	SPC-180(180mm)
Sensor Cable	1	STC-10 (10m)	STC-15 (15m)
Male Plug	1	DB25 (M)	

2.2 Installation Dimensions

2.2.1 Main Controller

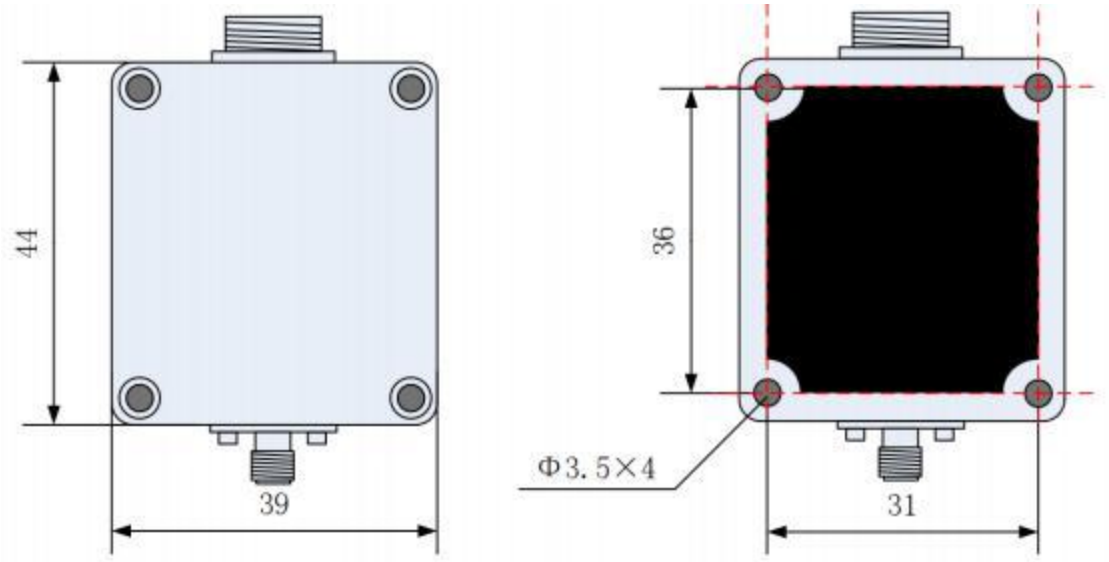
The external dimensions of the main controller of the height controller are as shown in the diagram below,

Front side

The thickness is 52.5mm.

2.2.2 Preamplifier

The appearance and dimensions of the preamplifier are as shown in the diagram below,



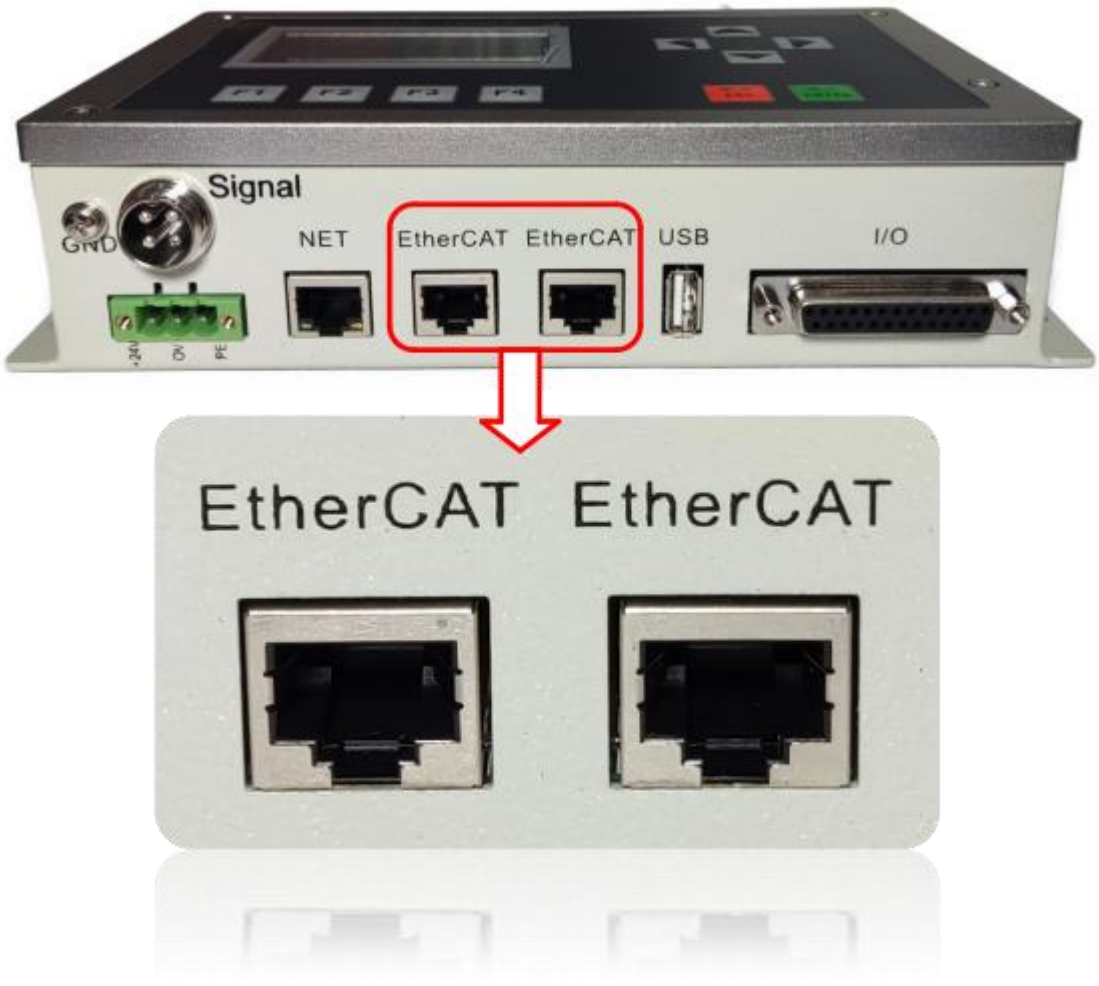
Sensor Installation Dimensions

2.3 Interface Description

2.3.1 Interface Layout (EtherCAT Version Description)

Note: The height controller can optionally support EtherCAT bus. The standard version and the EtherCAT bus version have the same external dimensions, but their interfaces and markings differ. Please refer to the instructions below.

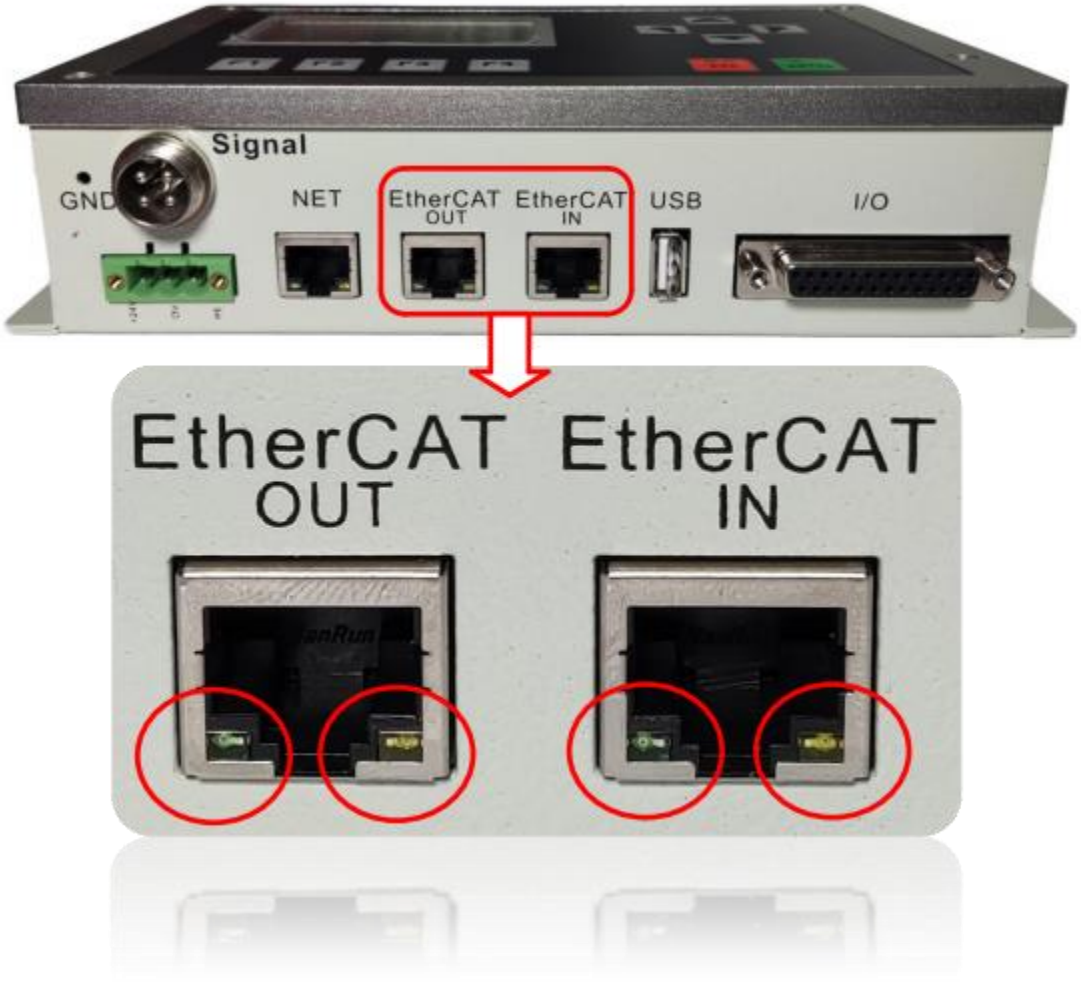
1. FROG-200S Standard Version (EtherCAT is not supported)



FROG-200S Standard Version (EtherCAT is not supported)

Note: The figure 1-1 shows the FROG-200S standard version. In the standard version, the EtherCAT interface does not have an LED indicator light, and the network port has no actual functionality. It only serves to plug the hole for product design compatibility.

2. FROG-200S Supports EtherCAT Bus Version, as shown in figure 2-1 below (Note: This feature is optional, please specify when ordering)

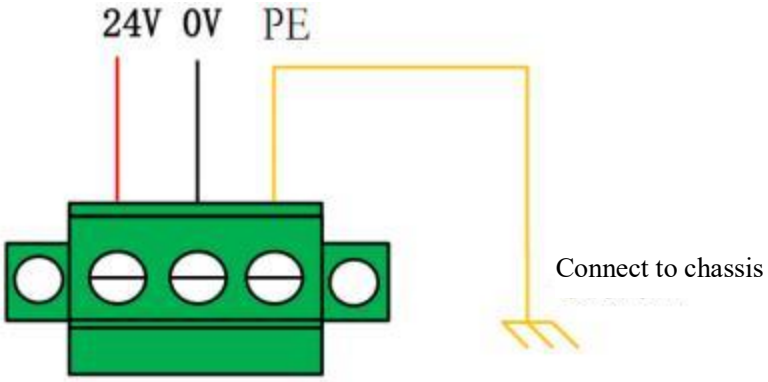


FROG-200S EtherCAT Bus Version

Note: The above image shows the FROG-200S with EtherCAT version.

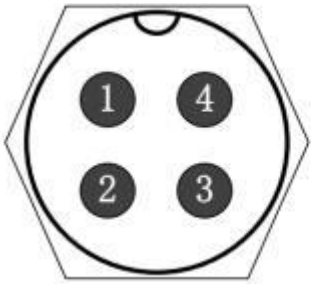
The EtherCAT interface has an LED indicator light and has IN and OUT markings. You can select EtherCAT mode in the height controller parameter setting interface when using.

2.3.2 Power Interface



The machine's case is the negative pole of the tested capacitor. To ensure the stable operation of the measurement circuit, the power interface of PE Foot must be reliably connected to the machine case (i.e., it must be well conducted with the machine case). The case of the preamplifier must also be well conducted with the machine case. The specific indicator is that the DC impedance is always less than 10 ohms, otherwise, the actual follow-up effect may not be good.

2.3.3 Sensor Interface

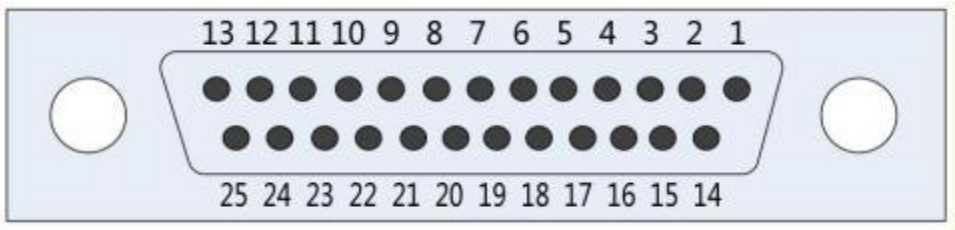


1: Connected to the other end 1
2: Connected to the other end 2
3: Connected to the other end 3
4: Connected to the shielding layer

The sensor interface uses a 3-core shielded cable to transmit signals. You can use a 3-core shielded cable and a standard aviation plug to make it yourself. When making, cores 1, 2, 3 are connected, and the 4th core must be connected with the shielding layer.

The standard cable length is 15 meters, and it can be customized according to needs.

2.3.4 Input/Output Interface



25 Core Female Head (Pin) Input/Output Interface

Pin	Signal definition	Pin	Signal definition
1	24V (Power Input)	14	0V (Power Ground)
2	OUT1 (Signal Output)	15	IN1 (Signal Input)
3	OUT2 (Signal Output)	16	IN2 (Signal Input)
4	OUT3 (Signal Output)	17	IN3 (Signal Input)
5	OUT4 (Signal Output)	18	IN4 (Signal Input)
6	OUT5 (Signal Output)	19	IN5 (Signal Input)
7	OUT6 (Signal Output)	20	IN6 (Signal Input)
8	(Reserved Interface)	21	IN7 (Signal Input)
9	(Reserved Interface)	22	IN8 (Signal Input)
10	CAN-H (CAN Bus Communication Interface)	23	CAN-L (CAN Bus Communication Interface)
11	AD+ (Positive Terminal Input Interface of 0-10V)	24	AD- (Negative Terminal Input Interface of 0-10V)
12	DA+ (Positive Terminal Output Interface of ±10V)	25	DA- (Negative Terminal Output Interface of ±10V)
13	0V (Power Ground)		

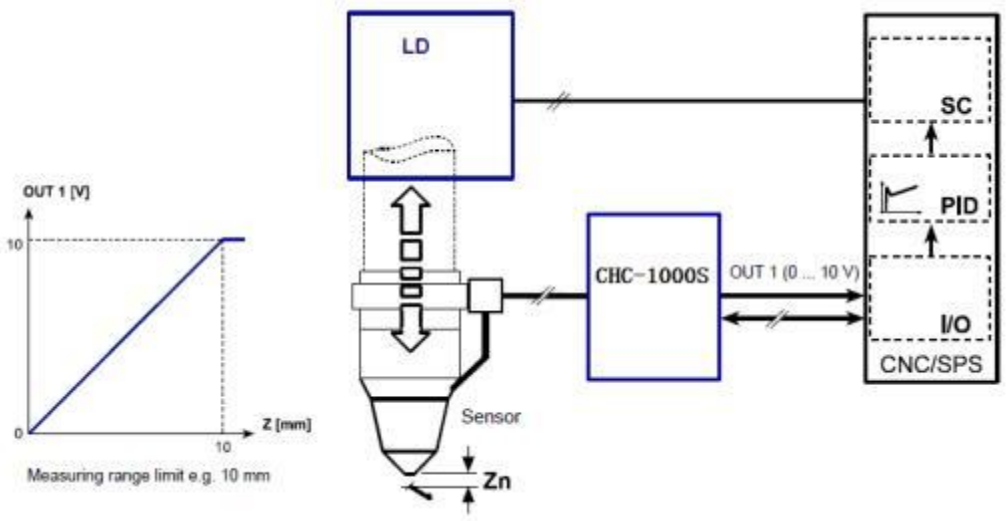
Explanation of Pin Definitions:

	Pin	Interfaces	Definition	I/O	Signal Name	Voltage	Remarks
Number amount	**15**	**IN1**	**A3**	I	CAL.REQUEST/ SET RANGE/ SET RANGE		Reference Point Calibration 16 Point Calibration, 100%MBEW Calibration Start Signal
	16	**IN2**	**A4**	I	SELECT CHAR.BIT0		Undefined Yet
	17	**IN3**	**A5**		SELECT CHAR.BIT1		
	18	**IN4**	**A6**		SELECT CHAR.BIT2		
	19	**IN5**	**A7**		STROBE		Calibration Signal (Teach Mode)
	20	**IN6**	**A8**	I	Zn1-4 BIT0		Undefined Yet
	21	**IN7**	**A9**		Zn1-4 BIT1		
	22	**IN8**	**B1**	I	CHECK		Real-time Calibration Signal
	2	**OUT1**	**A10**	O	FAR		Indicates Sensor is Outside the Measuring Range
	3	**OUT2**	**A11**	O	COLLISION (+NOZZLE LOST)		Meaning Depends on A14 and A15, See Below Table
	4	**OUT3**	**A12**	O	CABLE CUT		Indicates Sensor Wire Break
	5	**OUT4**	**A13**	O	READY		Cotroller Box Ready
	6	**OUT5**	**A14**	O	BODY TOUCH		Sensor and Workpiece Short Circuit
	7	**OUT6**	**A15**	O	POS.REACHED/ NOZZLE LOST		Reach Set Point or Calibration Completed; Nozzle Electrode Missing
Simulation amount	**11**	**AD+**	**A16**	A	EXT.NOZZLE(+)	0-10V	Nozzle and Workpiece Spacing 0.3V-9.7V, External Spacing (3%-97%MBEW)
	24	**AD-**	**A17**		EXT.NOZZLE(-)		
	25	**DA-**	**A18**	A	GND	± 10V 0-10V	Control Voltage
	12	**DA+**	**A19**		OUT		Linear Distance

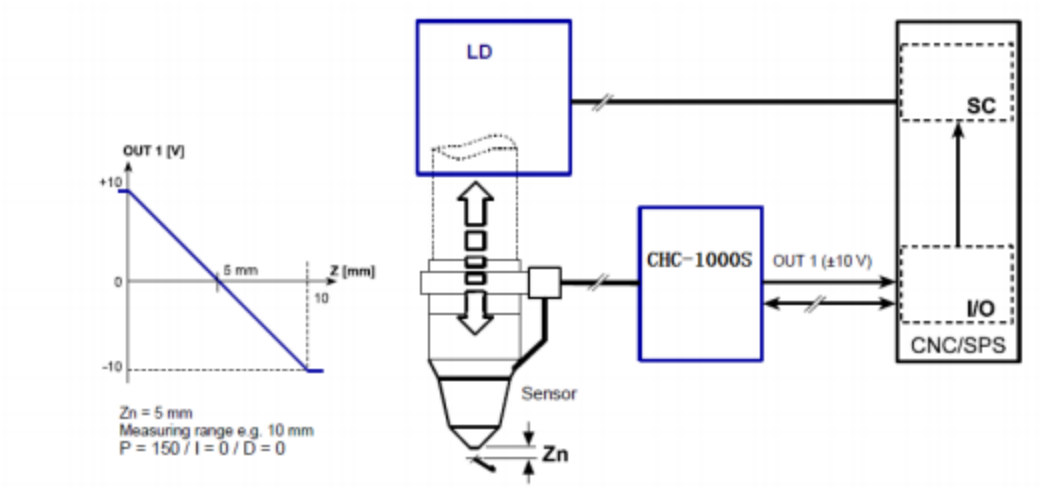
Alarm Output Definition:

Alarm Information	Output			Remarks
	A11	A14	A15	
TIP TOUCH	High	---	---	Sensor Short Circuits with Workpiece
BODY TOUCH	High	High	---	Sensor Body Short Circuits with Workpiece
NOZZLE LSOT	High	---	High	Nozzle Electrode Missing

2.3.5 Application Cases



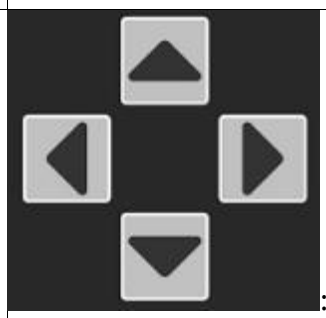
Controler box as a distance measuring system, measurement range 10mm, output voltage OUT = 0-10V.



Controller box as a controller, measurement range 10mm, Zn=5mm, proportion adjustment, P=150, I=0, D=0. Distance from -5mm to +5mm, corresponding output voltage -10V to +10V

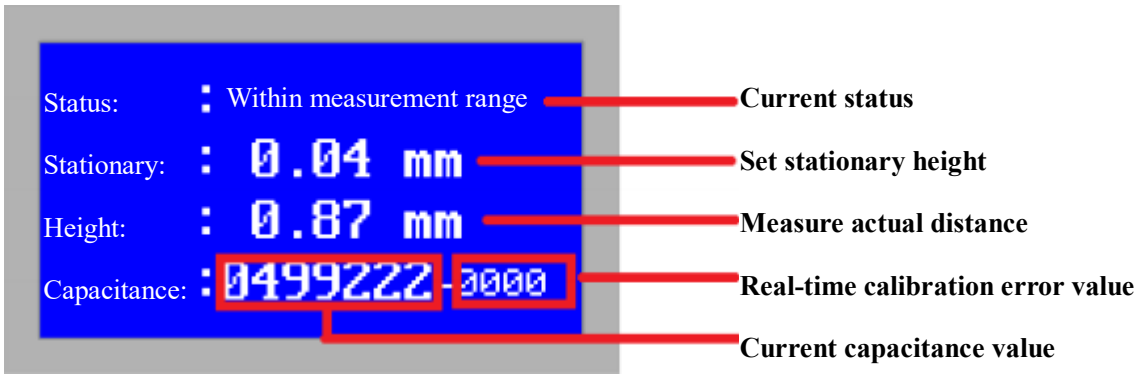
Chapter III Operating Instructions

3.1 Button Description

Shortcut key	 : Used for Main Menu Selection
Direction key	 : Adjust the Selected Project. As well as the Increase or Decrease of Data
Control Key	 : "OK" to Confirm Current Operation, "Cancel" to Exit Current Operation

3.2 Main Interface

After the system is powered on and initialized, it automatically enters the "Main Interface". As shown in the figure below



The display functions on the main interface include:

Status: Displays the current status of the Controller box. There are several types of status:

A. Nozzle Collision: Sensor short circuits with the workpiece.

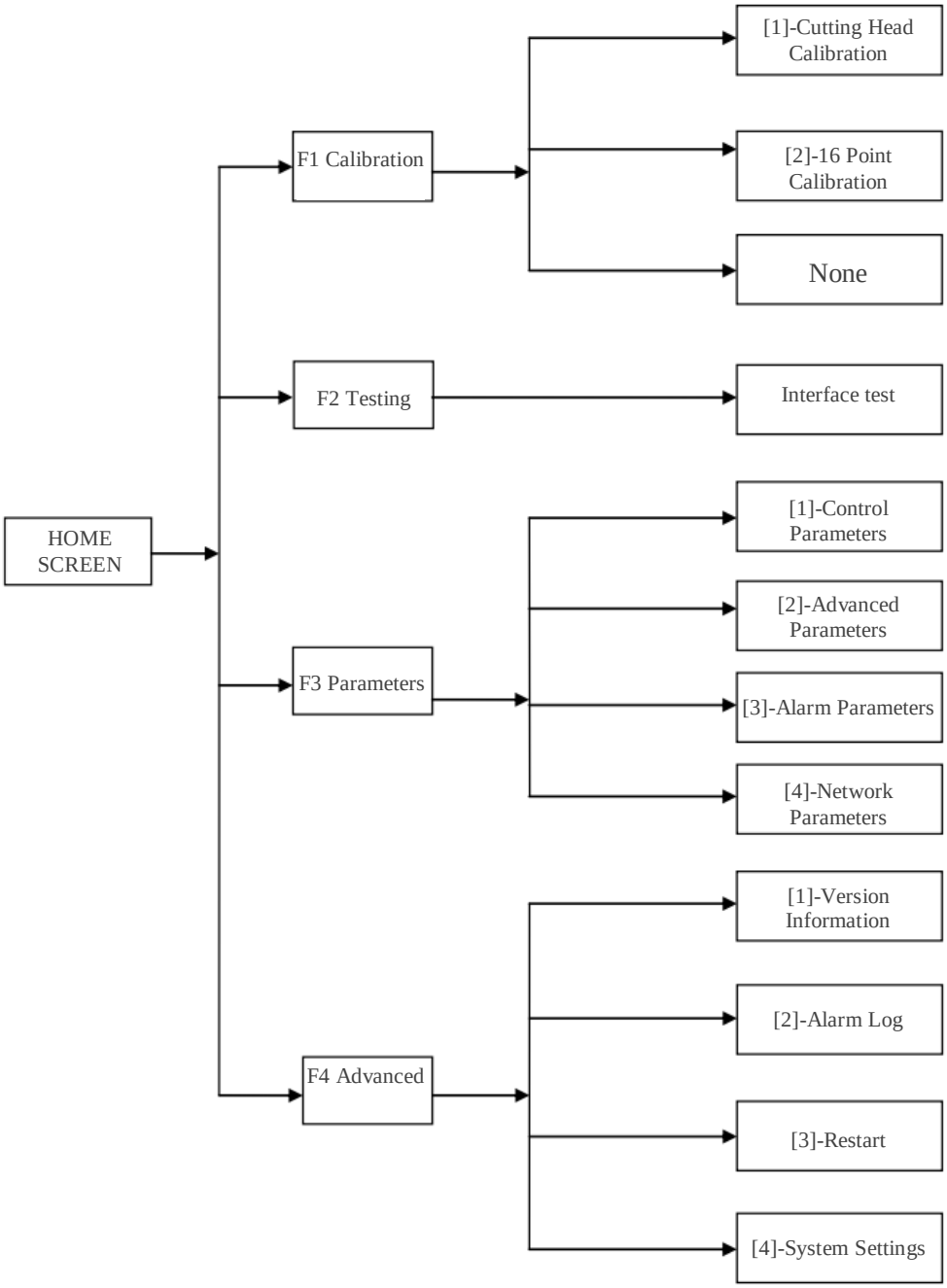
B. Within Measuring Range: Sensor measurement distance is within the valid range.

C. Within Measuring Range: Sensor measurement distance exceeds the valid range.

Standby: Displays the system's standby distance. The standby distance is obtained by the Controller box through measuring the signal input from A16-- A17. This data is only valid in sensor control mode.
Height: Displays the distance between the cutting head and the plate when within the capacitive measuring range.

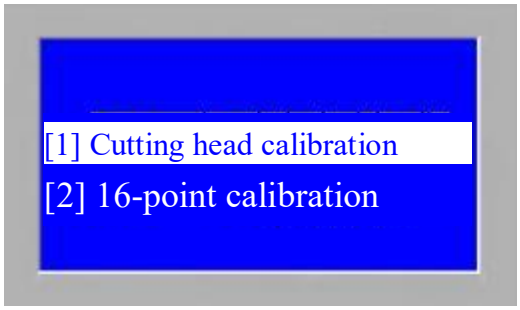
Capacitance: The system's sampling principle is to get the distance by measuring the capacitance between the cutting head and the plate. The closer the cutting head is to the plate, the greater the capacitance (but the displayed capacitance value will be smaller). When the floating head touches the plate, the capacitance will become 0.

3.3 Menu Structure



3.4 Calibration Interface

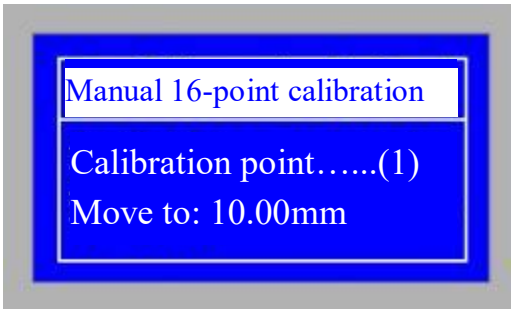
In the main interface, press the <F1> key to enter the "Manual Calibration Interface". as shown in the following figure:



When first using FROG-200S, you must first perform a capacitance calibration. During subsequent use, if the capacitance changes due to reasons such as temperature drift, you only need to redo the capacitance calibration.

【1】 Cutting Head Calibration Function: To avoid triggering the height controller alarm due to the change in body capacitance caused by replacing different shaped nozzles or cutting heads, and therefore preventing the system from performing 16-point capacitance calibration because of an alarm input signal.

【2】 Manual 16 Point Calibration:



During the manual calibration process, please follow the prompts on the interface to move the cutting head to the corresponding height away from the plate. During the calibration process, users can forcibly end calibration by pressing the "Cancel" button.

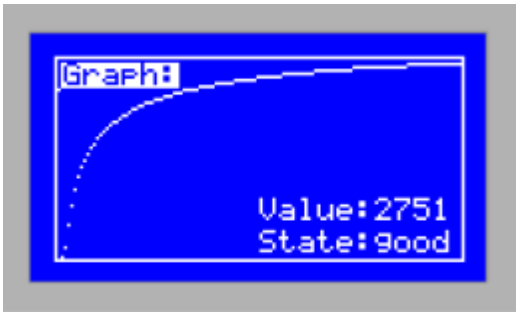
Floating Head Calibration Process:

In short, it consists of the following steps:

(1). Operate the floating head to move slowly downwards to detect contact with the plate.

(2). After contacting the plate, the height controller sends a collision signal to the system. The system takes the position of the plate contact as the starting point, controls the floating head to move upwards, operates according to the distance of the calibration point prompted on the screen, presses the "Confirm" button to proceed to the operation of the next point, or forcibly ends the calibration by pressing the "Cancel" button.

After the 16-point calibration is completed, there are 2 indicators, the first indicator displays the capacitance range after the calibration is completed, the second indicator has the status of this calibration: there are three levels: "Excellent", "Good", and "Poor". It can display the height-capacitance curve, the normal curve should be smooth as shown in the figure, press <Confirm> to save the calibration value.



Stability: Reflects the static characteristics of the capacitance. If the indicator is not ideal after calibration, it may be due to plate vibration or strong external interference. At the same time, it reflects the dynamic characteristics of the capacitance change during the calibration process. The ideal situation for this indicator is "Excellent" or "Good".

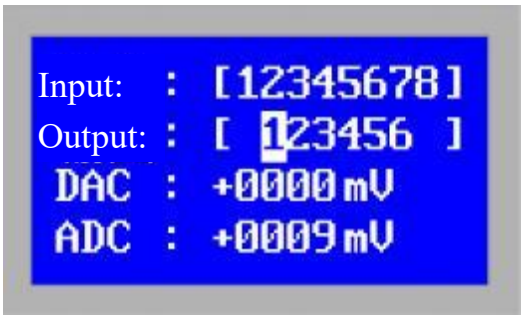
Effective Value: The capacitance change from 0.2mm away from the plate to away from the plate. It reflects the measurement range of the nozzle sensor. The larger the measurement range, the better the tracking accuracy and stability.

As the sensor is affected by external temperature and interference, it may cause a large deviation in the calibration distance and need to recalibrate. In order to reduce the number of calibrations, the real-time calibration function of the height controller can be used to improve the stability of the system.

For real-time calibration, please refer to section 3.5.2 for detailed introduction.

3.4 Test Interface

In the main interface, press the <F2> key to enter the "Test Interface". as shown in the following figure:



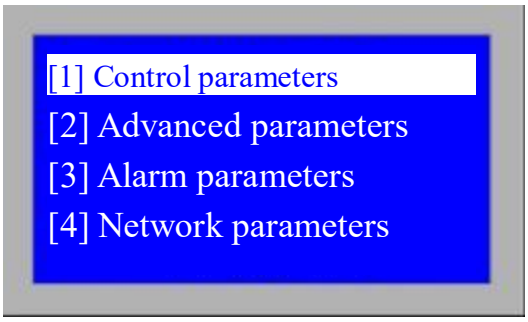
Input: Current status of all corresponding ports can be directly observed (IN1~IN8).

Output: Open and close outputs (Out1~Out6) can be tested. Left and right (← and →) arrows select the port to be tested. Up (↑) and down (↓) are used to change the status of the object of operation.

DAC: Left and right arrows select digits, up and down arrows change values, and you can immediately output corresponding voltage values. ADC: Displays current AD input port voltage.

3.5 Parameters Interface

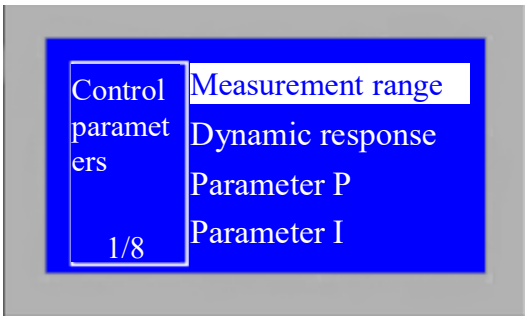
In the main interface, press the <F3> key to enter the "Parameters Interface". as shown in the following figure:



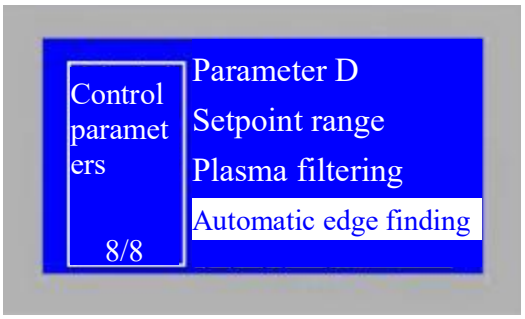
When first using the FROG-200S, users must correctly set the above parameters. Especially, it is essential to set the "Control Parameters" correctly, otherwise, the system will not function properly.

3.5.1 Control Parameters

Press the <up> or <down> to select the target menu item, press <Enter> to enter the "Control Parameters" interface, the first page is shown in the following figure:



The second page is shown in the following figure:

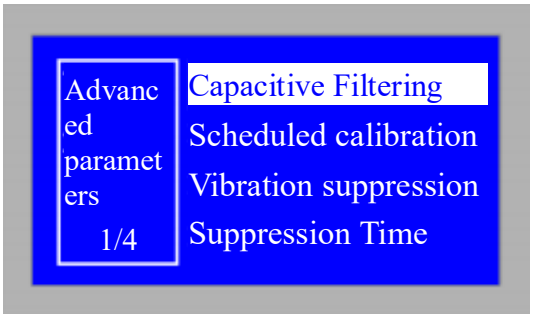


The meanings of each parameter are as shown in the following table:

Parameter name	Meaning
Measurement range	Set the maximum range that the system can measure, default 10mm, you can choose 10mm, 15mm, 20mm, 25mm range.
Dynamic response	Set the dynamic response of the system, in mV/ms, the larger the faster the system response. This parameter is only effective in sensor mode (control mode).
Parameter P	Set the PID parameters of the system, this parameter is only effective in sensor mode (control mode).
Parameter I	Set the PID parameters of the system, this parameter is only effective in sensor mode (control mode).
Parameter D	Set the PID parameters of the system, this parameter is only effective in sensor mode (control mode).
Fixed Point Range	Within this range, it is considered that the set point has been reached. Default 0.5mm. Only effective in sensor mode (control mode).
Plasma Filtering	Plasma cloud interference filtering time setting. Setting range: 0-50ms
Auto Edge Find	Enter this parameter can be set: 1. Edge Find Enable Switch 2. Edge Sensing Distance 3. Edge Detection Time Please set according to actual needs.

3.5.2 Advanced Parameters

Press the <up> or <down> to select the target menu item, press <Enter> to enter the "Advanced Parameters" interface,
as shown in the following figure:

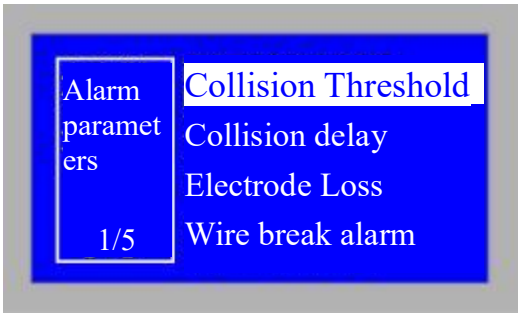


The meanings of the parameters are as shown in the following table:

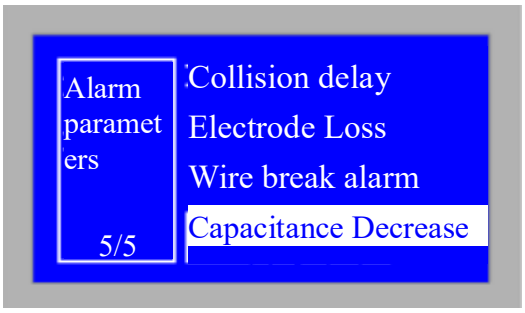
Parameter name	Meaning
Capacitive Filtering	Through software processing, real-time suppression of environmental interference on capacitive values is achieved.
Real-Time Calibration	Set when the real-time calibration function is turned on. The height controller can automatically calibrate the body capacitance of the cutting head after each processing, to reduce the number of manual calibrations of the height controller. When using this function, please make sure the cutting head is at the docking point, the floating head is more than 30mm from the panel surface, then trigger the IN8 input signal, and the signal needs to be maintained for more than 100ms.
Oscillation Suppression	Set when the vibration suppression function is turned on. This function can suppress vibrations caused by the disturbance of cutting airflow to structures with weak rigidity, thus reducing cross-sectional ripple.
Suppression Time	This parameter is the intensity of the vibration suppression function. The larger the value, the more obvious the effect of the vibration suppression function, but it will slow down the response of the height controller. The default value is 20ms, and the recommended range is 5~100ms.

3.5.3 Alarm Parameters

Press the <up> or <down> to select the target menu item, press <Enter> to enter the "Alarm Parameters" interface:



The second page is shown in the following figure:



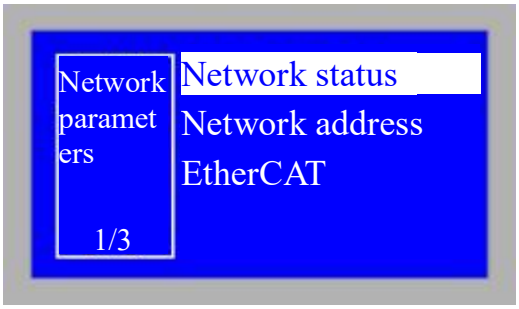
The meanings of the parameters are as shown in the following table:

Parameter name	Meaning
Collision Threshold	Set the threshold to prevent collision. If the position reaches this threshold range, the 'TIP TOUCH' signal will be set. Setting Range: 0.00 – 1.00mm

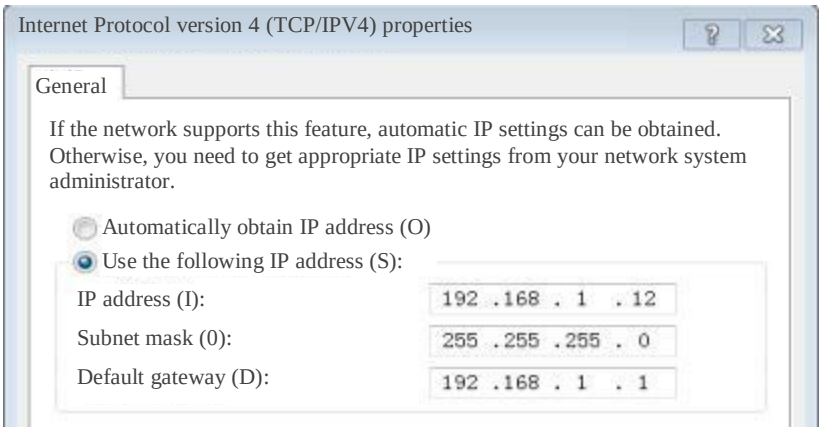
Collision Delay	The parameter can delay the output of the 'TIP TOUCH' or 'COLLISION' (A11 pin) signals, which can filter short pulse interference and improve system stability. Only when the time of disturbance or contact with the workpiece exceeds the delay time, the 'TIP TOUCH' signal will be sent to the CNC/PLC. If the evasive action of the driver is fast enough, or the disturbance pulse is short, the 'TIP TOUCH' signal will not be triggered, thereby improving the stability of the system. Setting Range: 0-1000ms
Electrode Loss	When the electrode loss function is enabled, the copper nozzle electrode is checked, when the copper nozzle is more than 30mm from the surface. The NOZZLE LOST (A15 pin) signal is output.
Capacitance Decrease	When the system detects that the body capacitance has decreased by a certain range, this alarm will be generated. Set the threshold for the decrease in capacitance that triggers the "body capacitance decreased alarm". When real-time calibration is enabled, this threshold will be added to the subsequent capacitance compensation value, which can reduce the frequency of triggering this alarm.

3.5.4 Network Parameters

Press the <up> or <down> to select the target menu item, press <Enter> to enter the "Network Settings" interface, as shown in the following figure:



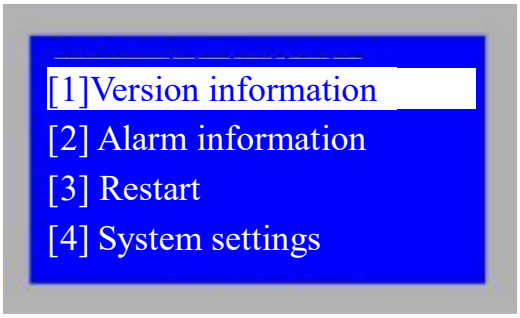
When connecting to the network, it is recommended to connect the PC and FROG-200S via an Ethernet cable. The IP address of the PC should be set in the same segment as the FROG-200S (192.168.1.xxx, cannot repeat with FROG-200S). The gateway also needs to be set in this segment, and the last number is 1, such as 192.168.1.1. As follows:



Note: After resetting the IP of the computer's network card, you must disable and re-enable the network card to make the IP settings effective.

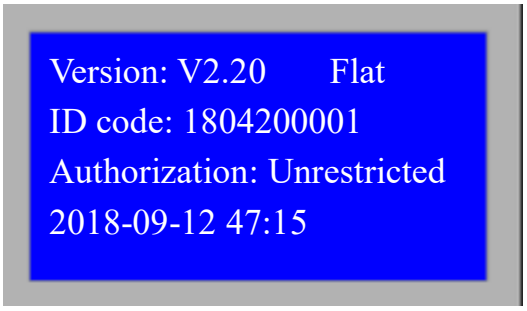
3.6 Advanced Parameters

In the main interface, press the <F4> key to enter the "Advanced Interface". as shown in the following figure:



3.6.1 Version Information

Press the <up> or <down> to select the target menu item, press <Enter> to enter the "Version Information" interface, as shown in the following figure:



In this interface, users can view:

Information	Meaning
Version	The program version number of FROG-200S, such as V2.20. "(Flat)" indicates that it is used for flat cutting scenarios. Combine (3D) means it is used for 3D cutting scenarios.
ID Code	The unique global serial number of FROG-200S, such as 1804200001.
Authorization	Date till which FROG-200S can be used.
Date	Current internal date of FROG-200S.

Attention:

When the FROG-200S service time expires, the main interface will display relevant alarm information (Authorization expired), and key functions will not be available. Users can press <F1> to register in this interface, enter the registration interface, and enter the correct registration code to restore normal use.

3.6.2 Alarm Information

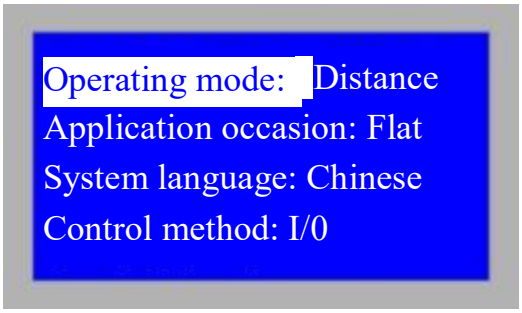
Press the <up> or <down> to select the target menu item, press <Enter> to enter the "Alarm Information" interface. In this interface, previous alarm events will be displayed in a list format. The system records up to the last 20 alarm events. Press <F1> to clear the alarm list. When multiple alarms occur at the same time, the main interface will display multiple alarms in a scrolling format. The specific meaning represented by the alarm can be referred to the alarm instructions.

3.6.3 Restart

Press the <up> or <down> to select the target menu item, press <Enter> to enter "Restart", which can restart the FROG-200S controller. This operation is equivalent to cutting off the system's power and then turning it on again.

3.6.4 System Settings

Press the direction key <↑> or <↓> to select the target menu item, press the direction key <←> or direction key <→> to modify the settings, as shown in the following figure:



In this interface, users can view:

Information	Meaning
Work Mode	Control: Sensor working mode, output 0 ~ ±10V. Distance: Distance measurement system, output 0V ~10V.
Application scenario	0: Flat cutting application. 1: Three-dimensional cutting application.
System Language	0: Chinese 1: English
Control mode	I/O: I/O control mode Network: EtherCAT bus control.

Chapter IV Alarm Description

4.1 Alarm Explanation and Possible Causes

Alarm name	Alarm Description	Potential causes
Capacitance changes to 0	When the system cannot measure capacitance accurately, the capacitance value will change to 0.	➢ The floating head touches the board surface. ➢ Cutting head is flooded. ➢ The body capacitance of the cutting head is too large, beyond the detection range. ➢ Amplifier is damaged. ➢ Poor contact between the amplifier/cutting head wiring. ➢ Inside the cutting head, a short circuit between the positive pole (nozzle) and negative pole (chassis) of the induced capacitance. .
Body Capacitance Becomes Smaller	When the system detects that the body capacitance has decreased by a certain range, this alarm will be generated.	➢ Changing parts, moving connections, or the random changes in the characteristics of the analog components themselves may cause this alarm. At this time, recalibration can be done. ➢ Laser scattering on the nozzle, causing the nozzle temperature to rise sharply, causing temperature drift. ➢ Blowing changes the gap between the positive pole (nozzle) and the negative pole (cutting head casing). ➢ Poor contact of the amplifier's wiring, nozzle, etc. ➢ If the calibration distance setting is too small (3D is less than 10mm, 2D is less than 15mm), it may also cause the alarm of body capacitance becoming smaller. ➢ Poor contact of the amplifier's wiring, nozzle, etc. ➢ Plasma cloud impacts the capacitance amplifier. Especially during the cutting process of stainless steel plates, particularly those with a film, the follow-up height should not be set below 0.5mm. Properly increasing the follow-up height will improve; properly increasing the blowing pressure is advised.
Capacitance Abnormally Large	When the system detects that the capacitance exceeds the maximum set during calibration, or the set plate-touching capacitance, this alarm will be triggered.	➢ The floating head touches the board surface. ➢ A small amount of water has entered the cutting head. ➢ Laser scattering on the nozzle causes the nozzle temperature to rise sharply. Temperature drift occurs.

	or set the plate capacitance, will generate the alarm.	➢ Blowing changes the gap between the positive pole (nozzle) and the negative pole (cutting head casing).
Authorization expired	The system set the use time is up.	Please contact the supplier for resolution.
Capacitance Calibration	When changes in capacitance occur, or system parameters have been modified,	the capacitance can be recalibrated.

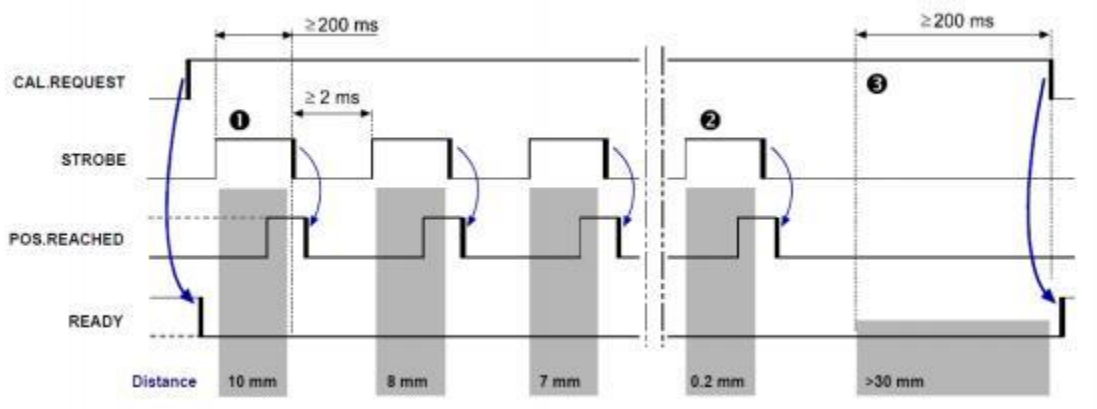
Chapter V Debugging Instructions

5.1 Manual Reference Point (16 points) Calibration

1. Change or confirm the measurement range limit (maximum 25mm)
2. In the main interface, press the <F1> key to enter the [Calibration] interface, and then enter the "16-point Calibration" menu.
3. Begin calibration, move the cutting head to the first point, and press [Enter] to confirm.
4. Move and confirm the remaining 15 points in sequence.
5. Confirm or cancel to exit, calibration ends.

5.2 Automatic Reference Point (16 points) Calibration

Automatic calibration control timing diagram is as follows:



1. Change or confirm the measurement range limit (maximum 25mm).
2. Set the CAL.REQUEST signal (PIN A3, High).
3. Move the sensor towards the workpiece until the COLLISION signal is set (PIN A11 is high), that is, it touches the workpiece and finds the zero point required for calibration.
4. Move to the first reference point (measurement range limit value).
5. Set the STROBE signal (PIN A7, High) to confirm that the reference point has been reached.
6. The STROBE must be maintained for more than 200ms before reading the POS.REACHED signal. POS.REACHED (PIN A15, High) signal confirms that the measured value has been accepted by the CNC/PLC.
7. Handle the remaining 15 reference points respectively.

For Example :

REF.POINT	MeasurementRange 10mm	MeasurementRange 15mm	MeasurementRange 20mm	MeasurementRange 25mm
Reference point 1	10.00mm	15.00mm	20.00mm	25.00mm
Reference point 2	8.00mm	12.00mm	16.00mm	20.00mm
Reference point 3	7.00mm	10.50mm	14.00mm	17.50mm
Reference point 4	6.00mm	9.00mm	12.00mm	15.00mm
Reference point 5	5.00mm	7.50mm	10.00mm	12.50mm
Reference point 6	4.00mm	6.00mm	8.00mm	10.00mm
Reference point 7	3.00mm	4.50mm	6.00mm	7.50mm
Reference point 8	2.50mm	3.75mm	5.00mm	6.25mm
Reference point 9	2.00mm	3.00mm	4.00mm	5.00mm
Reference point 10	1.80mm	2.70mm	3.60mm	4.50mm
Reference point 11	1.50mm	2.25mm	3.00mm	3.75mm
Reference point 12	1.20mm	1.80mm	2.40mm	3.00mm
Reference point 13	1.00mm	1.50mm	2.00mm	2.50mm
Reference point 14	0.70mm	1.05mm	1.40mm	1.75mm
Reference point 15	0.50mm	0.75mm	1.00mm	1.25mm
Reference point 16	0.20mm	0.30mm	0.40mm	0.50mm
Nozzle Lost	>30.00mm	>30.00mm	>30.00mm	>30.00mm

Nozzle Loss Detection Function [NOZZLE LOST]

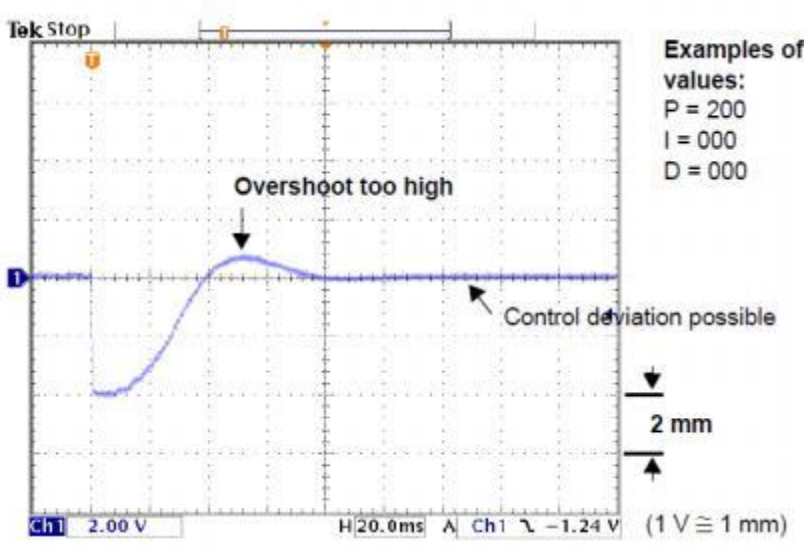
The following steps are mandatory; otherwise, the entire calibration process is invalid.

1. Set CAL.REQUEST signal (PIN A3, High).
2. Move the sensor away from the workpiece, the distance should be greater than 30mm.
3. Maintain this position for at least 200ms to calibrate NOZZLE LOST.
4. Reset the CAL.REQUEST signal (PIN A3, Low).

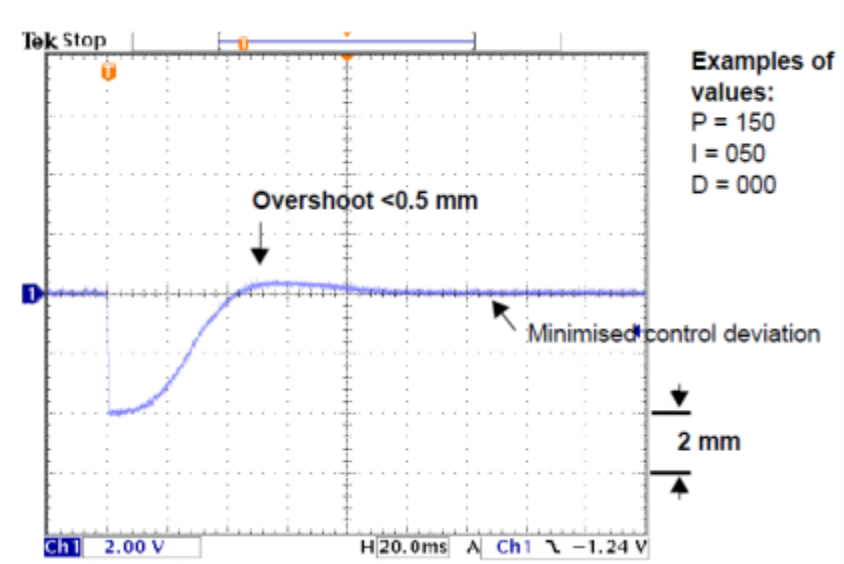
If an error occurs during the reference point calibration process, the COLLISION (PIN A11, High) signal will be set. If calibration fails, please repeat the above steps.

5.3 Adjust System and Control Parameters Optimize PID Parameters

1. Set the current stationary distance to (1mm).
2. Set the default PID parameters, P=20, I=0, D=0.
3. Switch the system to automatic.
4. Monitor the A19 signal on the oscilloscope.
5. Increase P until oscillation (P-Param). When changing P, steps two to five need to be repeated.
6. Set P to 75% of the oscillation value.
7. Set I to 30% of the P value.



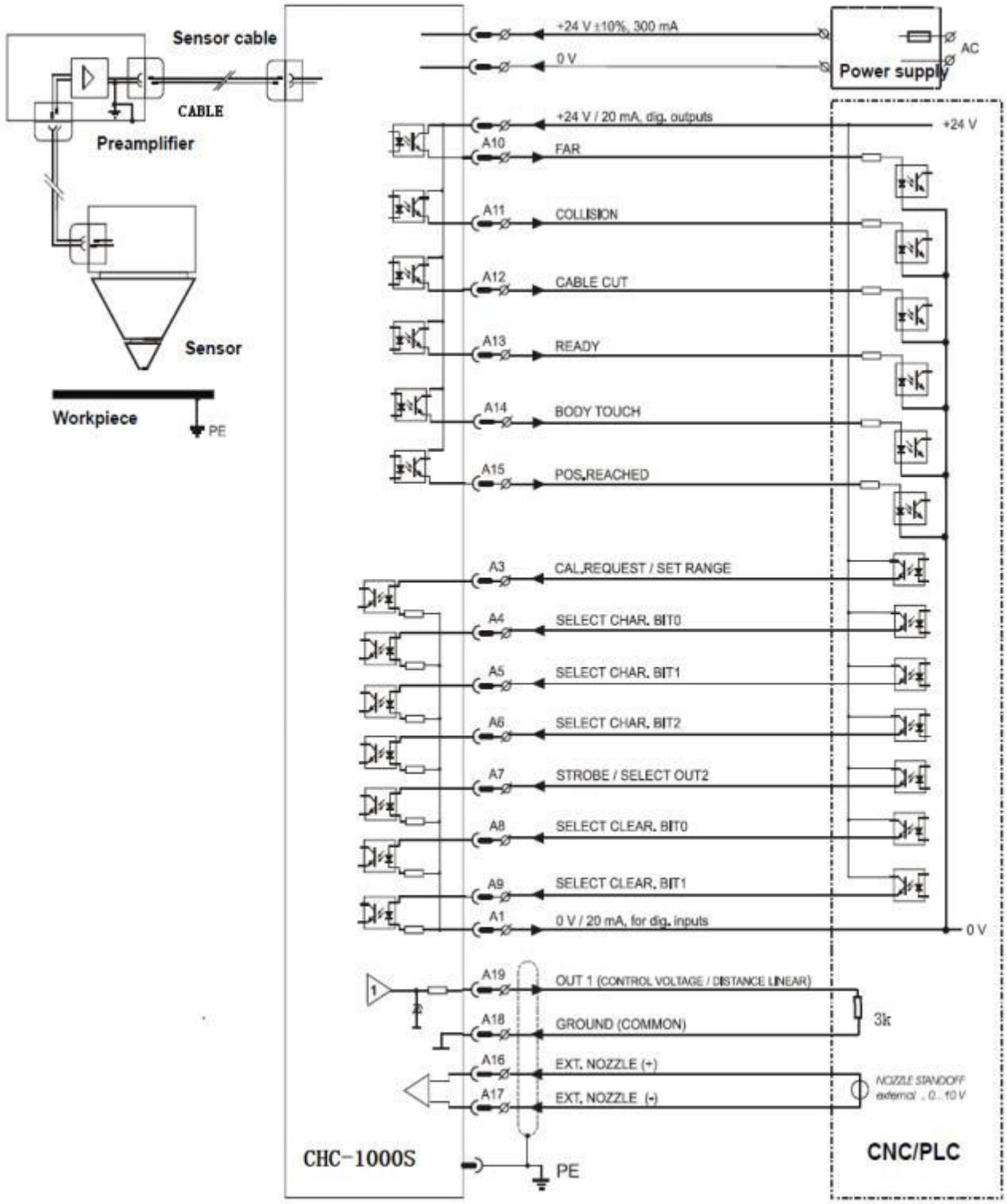
P-Param



I-Param

Chapter Six Wiring Diagram Reference

6.1 IO Wiring Example



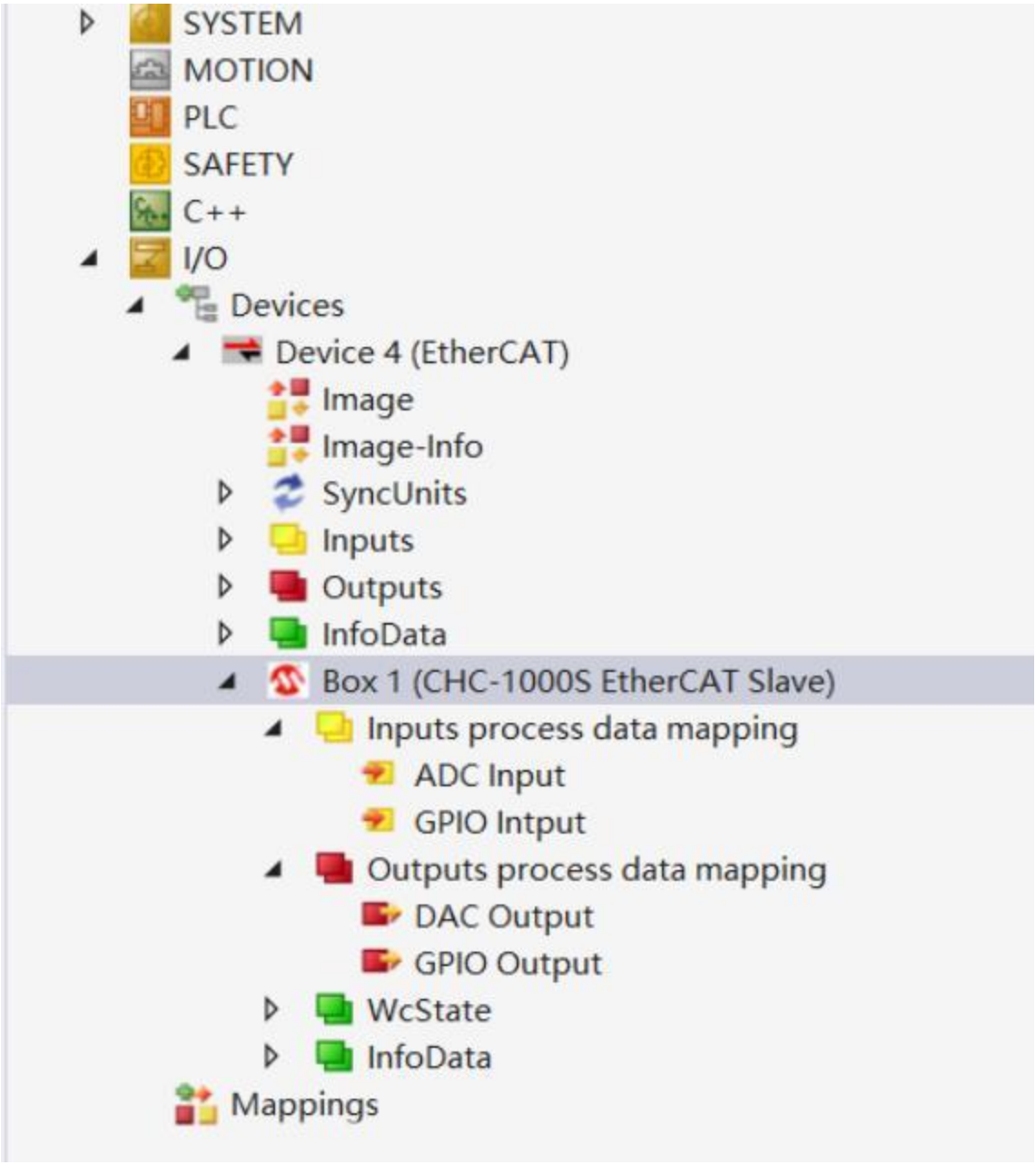
FROG-200S is connected to the system by IO.

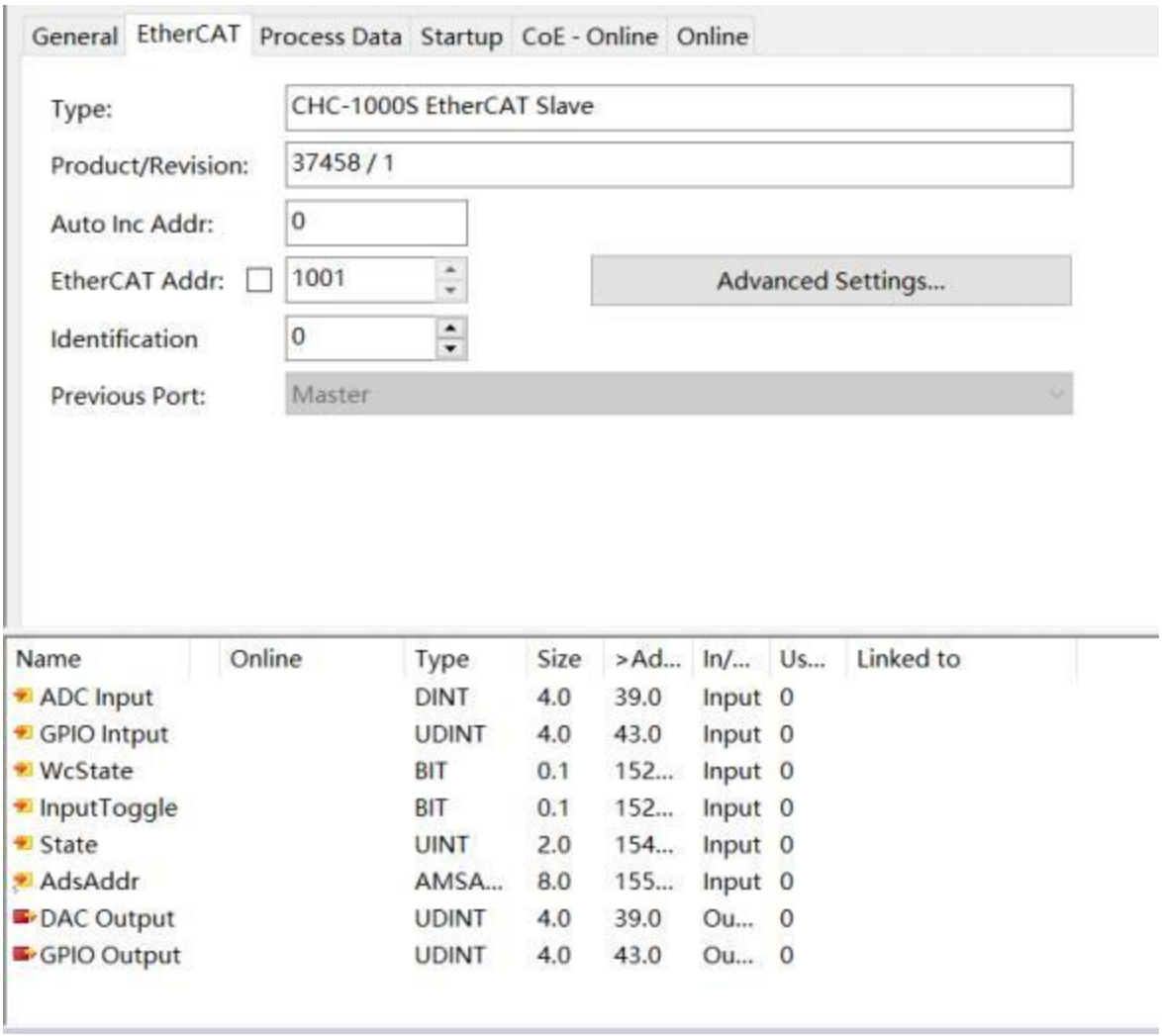
6.2 When using EtherCAT bus communication

1. Refer to Section 3.6.4 of the manual and change the control mode to EtherCAT.

2. Connect the height controller EtherCAT (IN) to the control system master station EtherCAT (OUT) with a network cable.

3. Import the XML file into the user's PC control system software (please contact us for the XML file), and then you can add the slave station FROG-200S (FROG-200SEtherCAT Slave) in the master control software, as shown in the following figure (taking Beckhoff software as an example).





4. Configuration Description

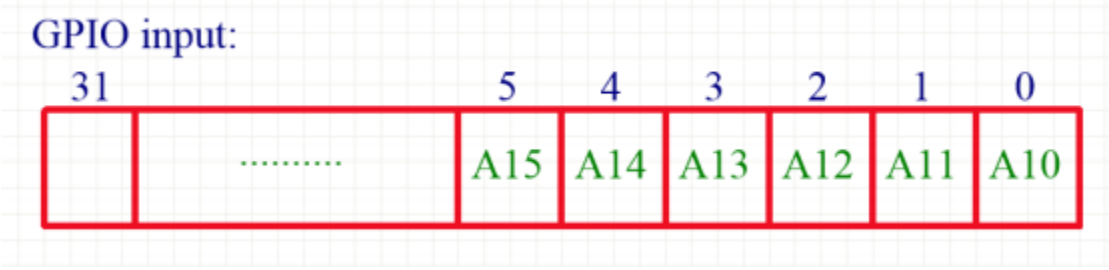
The following is the description and configuration guide of FROG-200S in EtherCAT mode.

GPIO Input: 32-bit general input register (input for the main control system), corresponding to the output port of FROG-200S (function definition: A10, A11, A12, A13, A14, A15).

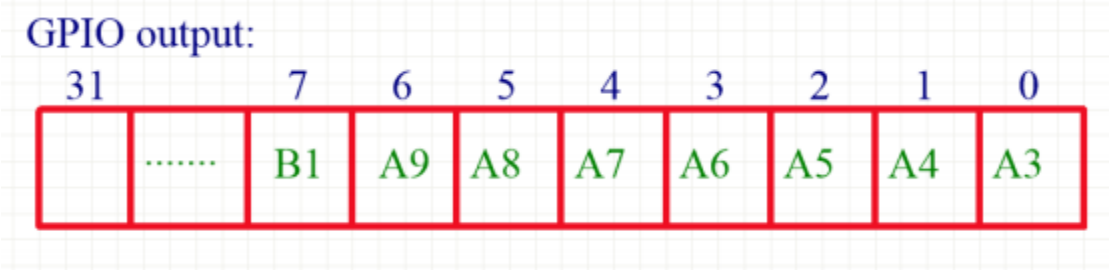
GPIO Output: 32-bit general output register (output for the main control system), corresponding to the input port of FROG-200S (function definition: A3, A4, A5, A6, A7, A8, A9, Fn).

ADC Input: Analog signal input (relative to the main control system), corresponding to the analog signal output of the height controller (data range -10000~10000 corresponds to -10V ~ +10V), function definition same as analog signal output interface (A18, A19).

DAC Output: Analog signal output (relative to the main control system), corresponding to the analog signal input of the height controller (data range 010000 corresponds to 010V), function definition same as analog signal input interface. (A16， A17) 。



General Input Register Address Definition Diagram (32-bit)



General Output Register Address Definition Diagram (32-bit)

Please refer to the following table for specific data address corresponding function explanation.

Function	Data Description (Relative to the Main Station)	Data Type .	Bit Address (BIT)/Data Range	Remark Function Explanation (Compatible with EG8030)
A3	GPIO Output	UDINT	Bit0	Reference Point Calibration (16-point calibration) (20-point calibration, supported in new version, for high-power laser cutting) Calibration Start Signal CAL.REQUEST
A4	GPIO Output	UDINT	Bit1	Undefined Yet
A5	GPIO Output	UDINT	Bit2	
A6	GPIO Output	UDINT	Bit3	
A7	GPIO Output	UDINT	Bit4	Calibration Signal STROBE
A8	GPIO Output	UDINT	Bit5	Undefined Yet
A9	GPIO Output	UDINT	Bit6	
Fn (B1)	GPIO Output	UDINT	Bit7	Real-time Calibration Signal
A10	GPIO Input	UDINT	Bit0	FAR Indicates away from the workpiece, indicating that the sensor is outside the measuring range

A11	GPIO Input	UDINT	Bit1	COLLISION (+NOZZLE LOST) Collision signal, the specific meaning depends on A14, A15
A12	GPIO Input	UDINT	Bit2	CABLE CUT Indicates Sensor Wire Break
A13	GPIO Input	UDINT	Bit3	READY Height Controller box Ready
A14	GPIO Input	UDINT	Bit4	BODY TOUCH Sensor body collision (effective when using built-in amplifier, no such function for external amplifier)
A15	GPIO Input	UDINT	Bit5	POS.REACHED Reach set point or calibration completed (during calibration); NOZZLE LOST Nozzle electrode lost (during work)
A16 & A17	DAC Output Analog signal output	UDINT	0-10000 (Data range)	0-10V is used to set: The interval distance between the nozzle and the workpiece is 0.3V-9.7V, External Spacing (3%-97%MBEW)
A18 & A19	ADC Input Analog signal input	DINT	-10000~ 10000 (Data range)	Measurement mode: 0-10000 corresponds to the height within the measuring range; Control mode: 0~±10000 corresponds to the difference between the set height value and the measured height value (after PID adjustment).

Note: The function definitions of other unexplained address positions are reserved and can be expanded according to user needs. Please contact us if necessary.