INSTRUCTION

iManifold Robot Control System

Drag Process User Manual

Copyright Notice

Notice

Shenzhen iManifold Robot Technology Ltd. reserves the right to modify the product or its features without prior notice.。

Shenzhen iManifold Robot Technology Ltd. does not assume any responsibility for direct or indirect injury or damage caused by improper use of the product.

Contact us

Shenzhen iManifold Robot Technology Ltd.

Address：410, Building B, Huafeng International Robot Industrial Park, Bao'an District, Shenzhen

iManifold Technology (Jiangyin) Ltd

Address: Building 60, Tian'an Digital City, No. 55 Changshan Avenue, Jiangyin City, Wuxi City, Jiangsu Province

Catalogue

1. Function Introduction

The dynamic function calculates the external force/torque acting on each joint by controlling the current of the servo motor and combining it with the robot's dynamic model. Use accurate robot dynamics models to calculate in real-time and subtract these gravitational moments from sensor readings, leaving the operator's command force for drag teaching.

Chapters 1-6 of this manual introduce the Drag process parameters, while Chapter 7 provides operational instructions.

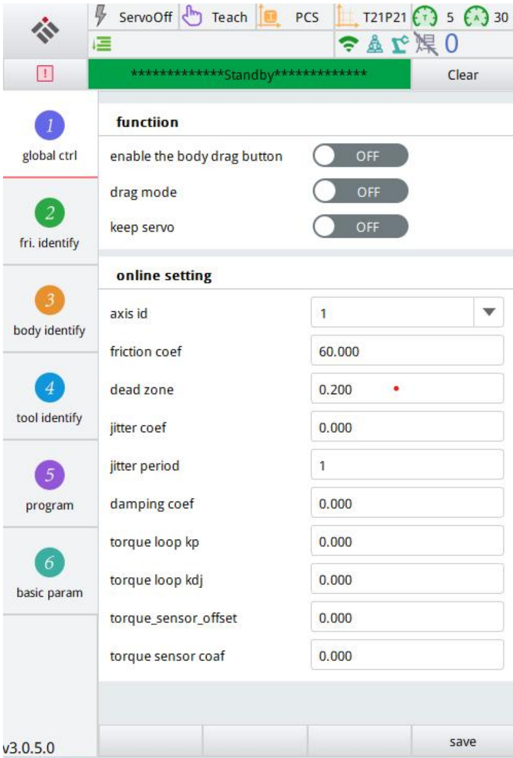
⚠Warning

1.Inaccurate models can lead to insufficient or excessive gravity compensation (feeling unstable and drifting).

2.After the load changes (tool/workpiece replacement), it is necessary to update the model parameters or recalibrate.

2. Global Control

The global control page is used to set parameters related to robot dynamics. Online parameter settings are related to robot drag teaching, virtual damping, and other functions. Please ensure that the dynamic parameters of the robot are set reasonably, otherwise the above functions may not function properly or the robot may shake abnormally.



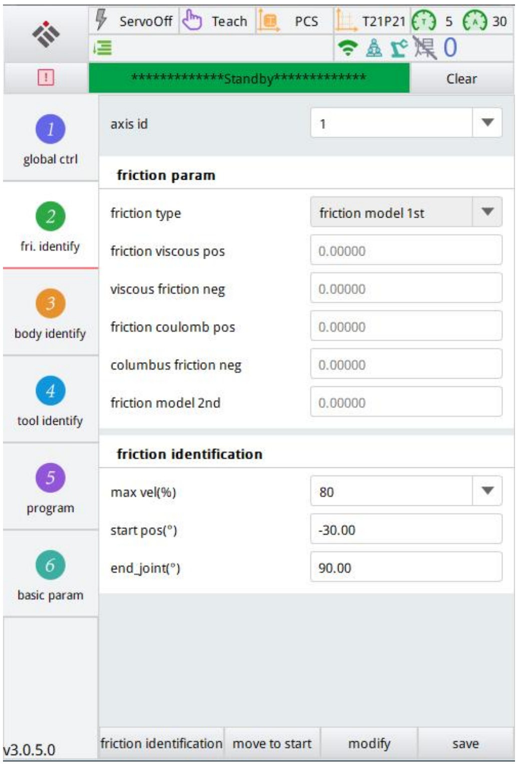
Serial Number	Function	Parameter Description
1	Enable the body drag button	IO button at the end of the robot, can enter the robot drag mode.
2	Drag mode	Enter drag mode through current interface.
3	Keep servo	The robot is servo holding state.

Serial Number	Presence	Parameter Description
1	Friction coef (%)	The percentage compensation value of friction compensation=coefficient x theoretical value (this parameter may need to be adjusted when the drag effect is poor)
2	Dead zone (deg/s)	Friction compensation does not take effect within the dead zone range
3	Jitter coef	Compensation value for jitter control within the dead zone=coefficient x theoretical value
4	Jitter period	The period of jitter control=flipping period x planning period x2
5	Damping coef	Virtual damping function
6	Torque loop kp	Activate the proportional term of the torque ring after activating the force control
7	Torque loop kdj	Enable force control and torque ring damping
8	Torque sensor offset	Offset correction of torque sensor
9	Torque sensor coaf	Amplitude correction of torque sensor

3. Identification of dynamic parameters

3.1. Friction Identification

Friction identification is the process of collecting information during the one to six axis motion of a robot by executing a series of preset trajectories in an unloaded state, and finally calculating various friction parameters. If you need to manually modify this parameter, please click the "Save" button after modification to save it. It is not recommended for users to make modifications on their own, as unauthorized modifications may cause abnormal dynamics related functions.



Serial Number	Parameter	Parameter Description
1	Friction type	The actual effective friction model is not recommended to be modified
2	Positive viscous friction force	Coefficient of frictional force in the direction of forward motion
3	Negative viscous	Coefficient of dynamic friction in the

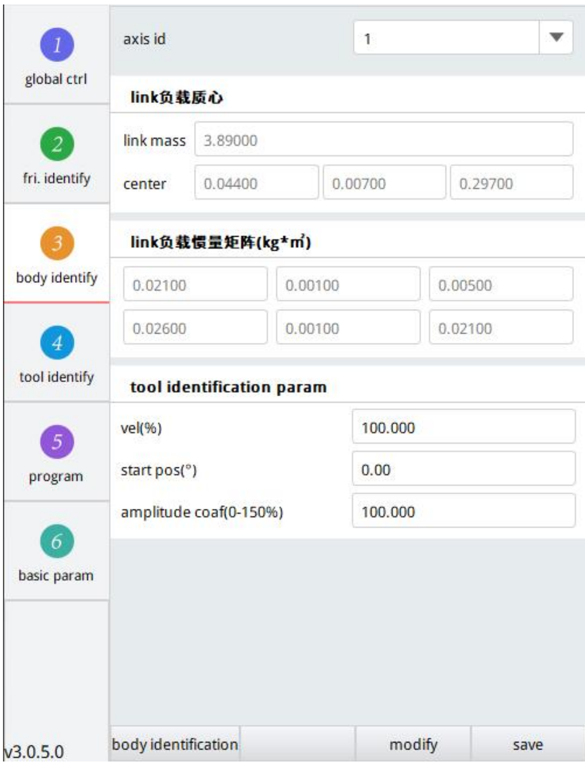
	friction force	negative direction of motion
4	Forward Columbus frictional force	Coefficient of static friction force in the direction of forward motion
5	Negative Columbus Friction Force	Coefficient of static friction force in the negative direction of motion
6	Second-order viscous friction force	Acceleration coefficient of friction force

<table>
<tr><th>Serial Number</th><th>Step</th><th>Instruction</th></tr>
<tr><td>1</td><td>Set maximum speed(%)</td><td>Control the maximum motion speed during the identification process
Value range: 60% (low-speed mode) to 100% (high-speed mode)
It is recommended to use 60% speed to verify the trajectory for the first time to avoid interference with the motion n '| · trajectory, and then use 80% -100% speed for friction identification</td></tr>
<tr><td>2</td><td>Set position(°)</td><td>It is necessary to simultaneously set the starting and ending positions for friction identification. The starting and ending positions can be adjusted according to the actual situation on site to avoid interference space. Please note that the trajectory length of the starting and ending positions should be greater than 100 ° (pay attention to the positive and negative directions)
Collaborative robot recommends location
<table>
<tr><th>Collaborate robot</th><th>initial position</th><th>Final Position</th></tr>
<tr><td>Joint 1</td><td>-60°</td><td>60°</td></tr>
<tr><td>Joint 2</td><td>-90°</td><td>30°</td></tr>
<tr><td>Joint 3</td><td>120°</td><td>0°</td></tr>
<tr><td>Joint 4</td><td>60°</td><td>-60°</td></tr>
<tr><td>Joint 5</td><td>60°</td><td>-60°</td></tr>
<tr><td>Joint 6</td><td>-180°</td><td>-60°</td></tr>
</table>
Recommended positions for 6-axis industrial robots
<table>
<tr><th>6-axis robots</th><th>initial position</th><th>Final Position</th></tr>
<tr><td>Joint 1</td><td>-30°</td><td>90°</td></tr>
<tr><td>Joint 2</td><td>-60°</td><td>60°</td></tr>
<tr><td>Joint 3</td><td>30°</td><td>-90°</td></tr>
</table></td></tr>
</table>

<table>
<tr><td></td><td></td><td><table><tr><td>Joint 4</td><td>60°</td><td>-60°</td></tr><tr><td>Joint 5</td><td>60°</td><td>-60°</td></tr><tr><td>Joint 6</td><td>-60°</td><td>60°</td></tr></table></td></tr>
<tr><td>3</td><td>Friction identification</td><td>Click on friction recognition to start running the preset trajectory and obtain friction parameters (you can click on hold servo on the global control interface or click Fn2 to select the drag shortcut function to hold servo)</td></tr>
<tr><td>4</td><td>Save results</td><td>After completing the identification, a pop-up window will appear displaying the identification results. Click confirm and save.</td></tr>
</table>

3.2. Body Identification

The body recognition operation is to collect information during the motion process by having the robot execute a series of preset trajectories. It is necessary to carry the current tool for identification, and if the tool is changed, it needs to be re identified. Support obtaining robot dynamic parameters from zero, including end load of each joint, inertia parameters of each joint load, and first-order friction model parameters of each joint.

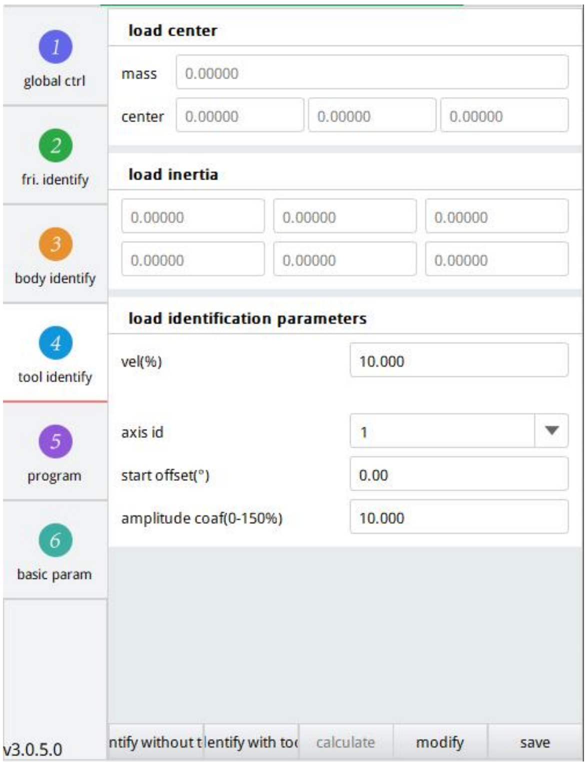


Serial Number	Step	Instruction
1	Set speed(%)	Control the motion speed of the identification process Value range: 60% (low-speed mode) to 100% (high-speed mode) It is recommended to use 60% speed verification trajectory for the first time to avoid interference space in the motion trajectory, and then use 80% -100% speed for friction identification
2	Set initial bias (°)	Safe obstacle avoidance starting position can be set for each axis

		When there is interference space, joint starting bias can be set to avoid interference space (pay attention to positive and negative directions)
3	Set amplitude coefficient (0%-150%)	Define the range of joint motion during the identification process Value range: 0.1% (conservative mode) to 150% (maximum travel) It is recommended to use a 100 amplitude coefficient to verify the trajectory for the first time, ensuring that there is no interference in the workspace
4	Full parameter identification	Click on full parameter recognition to start automatically running the preset trajectory and obtain the body parameters (you can click on hold servo on the global control interface or click Fn2 to select the drag shortcut function to hold servo)
5	Save results	After completing the identification, a pop-up window will appear displaying the identification results. Click confirm and save.

3.3. Load Identification

The load identification function can conveniently calculate the dynamic parameters of the tool. If you need to manually modify this parameter, please click the "Save" button after modification to save it. It is not recommended for users to make modifications on their own, as unauthorized modifications may cause abnormal dynamics related functions.



Serial Number	Step	Instruction
1	Set speed(%)	Control the motion speed of the identification process Value range: 60% (low-speed mode) to 100% (high-speed mode) It is recommended to use 60% speed verification trajectory for the first time to avoid interference space in the motion trajectory, and then use 80% -100% speed for friction identification
2	Axis number	You can set the starting bias and amplitude coefficient for each joint

3	Set starting bias(°)	Set the starting position for safe obstacle avoidance When there is interference space, joint starting bias can be set to avoid interference space (pay attention to positive and negative directions)
4	Set amplitude coefficient (0%-150%)	Define the range of joint motion during the identification process Value range: 0.1% (conservative mode) to 150% (maximum travel) It is recommended to use a 100 amplitude coefficient to verify the trajectory for the first time, ensuring that there is no interference in the workspace
5	Identification without load	Run the identification program without tools in an unloaded state and wait for the identification program to complete (you can click on hold servo on the global control interface or click Fn2 to select the drag shortcut function to hold servo)
6	Identification with load	Install the tool load, run the identification program with the tool, and wait for the identification program to complete (you can click on hold servo on the global control interface or click Fn2 to select the drag shortcut function to hold servo)
7	Calculate and save the results	After completing the calculation, a recognition result pop-up window appears. Click confirm and save.

⚠Warning

- Please be sure to accurately define the dynamic parameters of the new tool, otherwise it will affect the motion performance of the robot, and in severe cases, it may even cause overload and damage to the robot.
- Support load identification for robots in both upright and inverted positions (inverted position requires adjusting the direction of gravity).
- If the following situations occur during the identification process, the identification process will be terminated, and all obtained identification data will be lost, requiring re identification:

1. When the identification operation is in the middle, selecting other tools or switching to other interfaces;
2. Identify the triggering of emergency stop or external safety stop during program operation;
3. During the operation of the recognition program, switching from automatic mode to manual mode will result in recognition failure.

⚠ Danger

- The identification program needs to be executed in automatic mode, so all protective measures should be in an effective state. External control signals may start the robot at any time, so please switch to automatic mode after installation is completed and all personnel have retreated to a safe area.

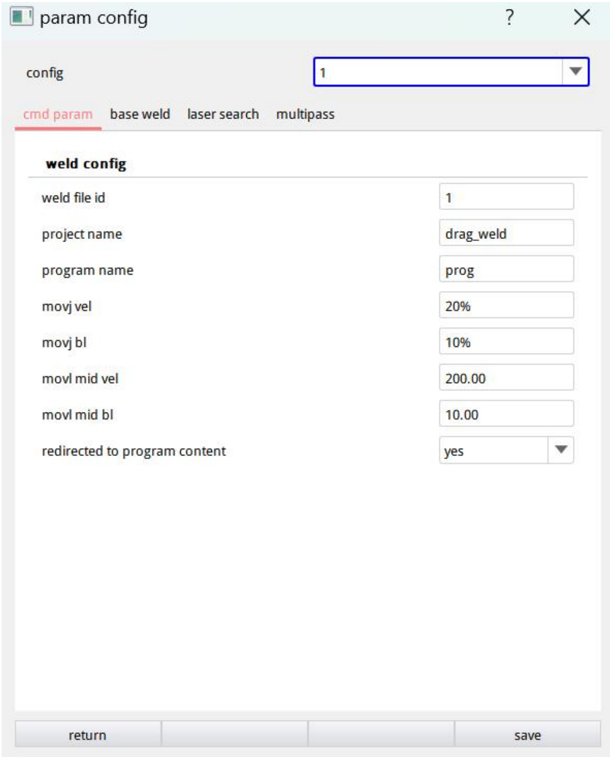
4. Program Generation

To generate programs using drag-and-drop mode for recording points, you must first configure the "instruction parameters". The "Basic Welding Parameters" section (including "Laser Positioning" and "Multi-layer Multi-track", which can be selected based on actual requirements)

Should be completed before starting the Drag teaching process. Instructions are inserted via IO signals during drag mode. After recording is complete, click [Generation] to enter the program interface for execution.

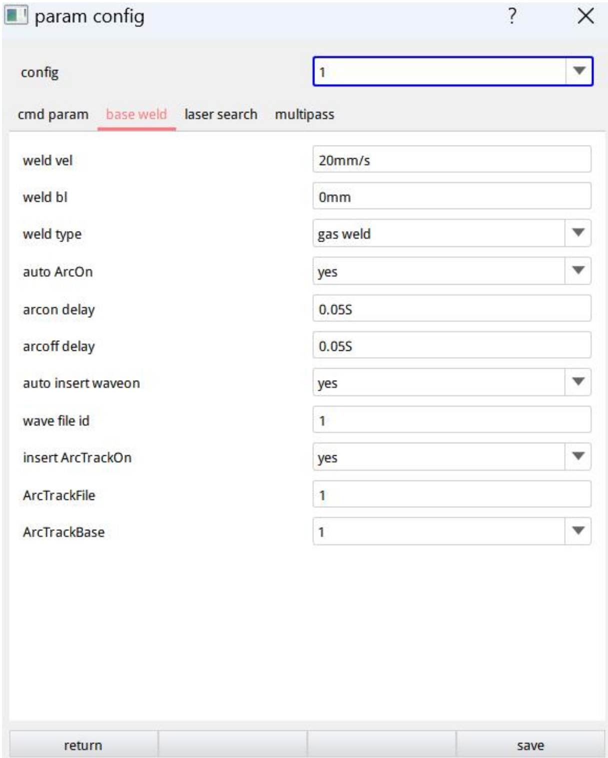
4.1. Configuration parameter Settings

The [Program] -[config] page supports the configuration and storage of 10 sets of independent welding parameters, which can be selected and called as needed when using drag welding. For details of welding instructions, please refer to the welding operation manual.



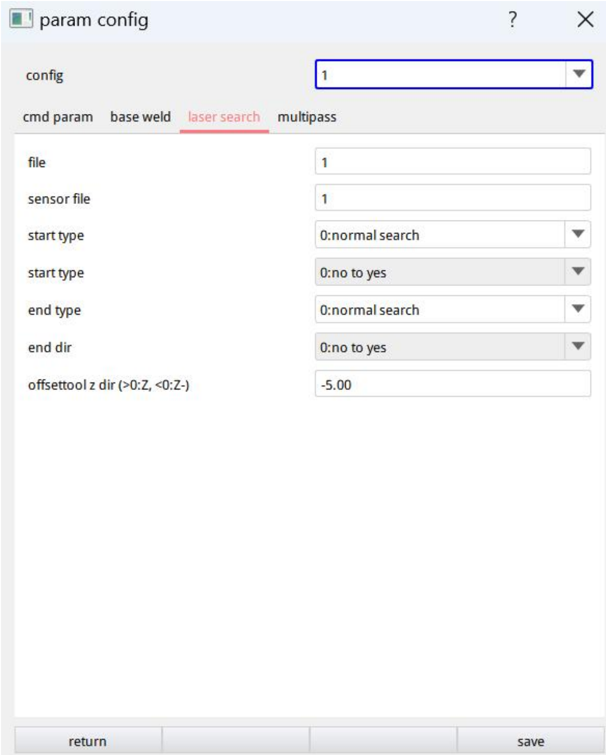
Cmd param：

Serial Number	Parameter Name	Parameter Description
1	Weld file id	Copy the welding files already configured in the welding process
2	Project name	Modify the name of the automatically generated project. The default is "drag_weld"
3	Program name	Modify the name of the automatic generation program. By default, it is "prog"
4	Movj vel	The speed at which the joint moves
5	Movj bl	The BL transition segment of joint motion
6	Movl mid vel	The command speed of Descartes' motion
7	Movl mid bl	The command speed of Descartes' motion
8	Redirected to program	The BL transition of the Dirac motion
9	Content	By default



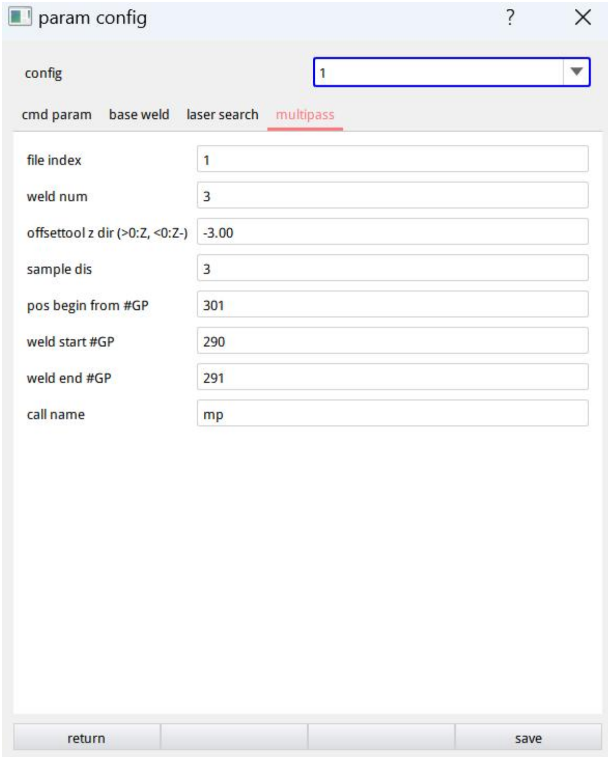
Base weld:

Serial Number	Parameter Name	Parameter Description
1	Weld vel	Start arc and Movl welding speed
2	Weld bl	The Movl transition section begins with a arc
3	Weld type	Support the selection of "gas weld" and "laser weld"
4	Auto ArcOn	The automatic insertion arc command is enabled by default
5	Arcon delay	Delay arc on time
6	Arcoff delay	Delay arc off time
7	Auto insert wave on	The automatic insertion arc command is set to yes by default
8	Wave file id	Copy the arc swing file configured in the welding process
9	Insert ArcTrackOn	Automatically insert arc tracking instructions
10	ArcTrackFile	Copy the arc tracking file already configured in the welding process
11	ArcTrackBase	Arc tracking type: 0: Sampling is required, 1: Custom baseline, 2: Special style1, 3: Dry elongation adaptive



Laser search：

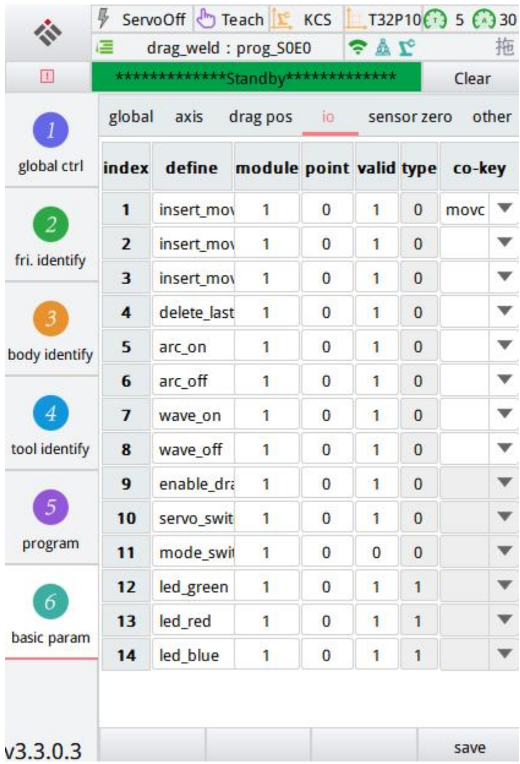
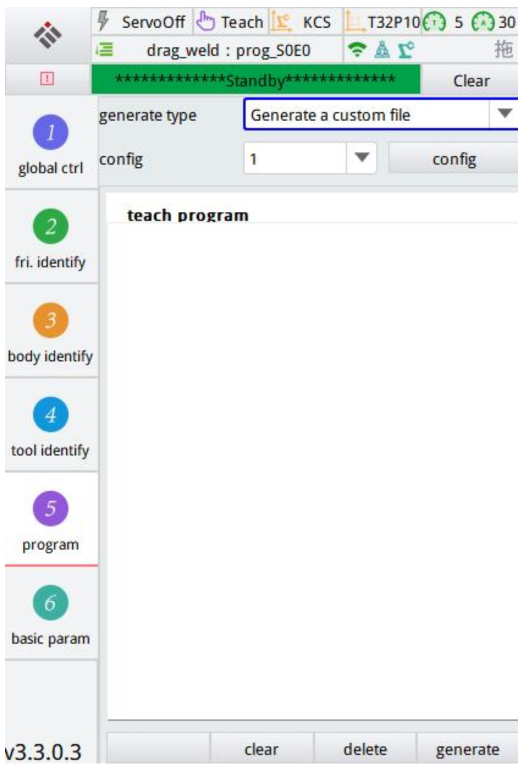
Serial Number	Parameter Name	Parameter Description
1	File	Copy the hand-eye calibration file configured in the welding process
2	Sensor file	Copy the sensor file configured in the welding process
3	Start type	Starting point location type: 0:normal search,1:move search
4	Start dir	Starting point identification mode: 0: from nothing to something, 1: from something to nothing. Follow the starting point to find the type automatically and cannot be modified manually
5	End type	End point location type: 0:normal search,1:move search
6	End dir	End point identification mode: 0: from no to yes, 1: from yes to no. Follow the end point to find the position type automatically, and cannot be manually modified
7	Offsettool z dir (>0:2, <0:2-)	The laser position along the tool z direction compensation distance is greater than 0, Z+ , less than 0: Z-



Multipass

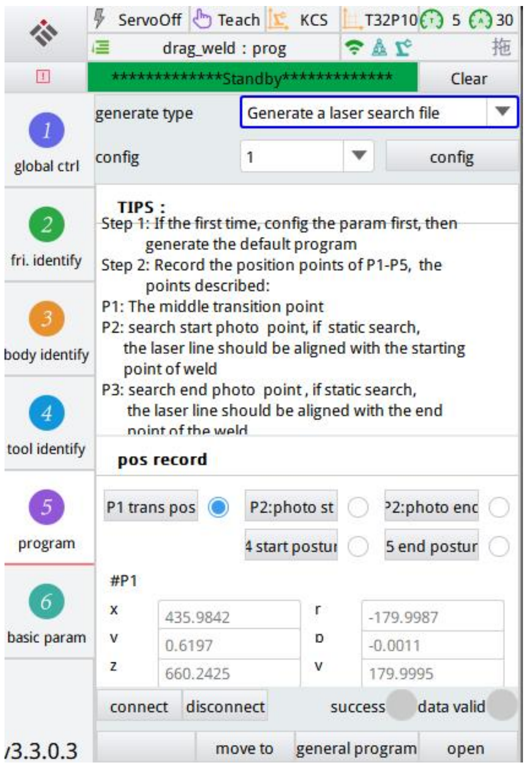
Serial Number	Parameter Name	Parameter Description
1	File index	Retrieves parameter files already configured in the multi-layer, multi-track process
2	Weld num	Number of Multipass generation layers
3	Offsettoolz dir (>0:2,<0:2-)	Multi-layer and Multipass sampling weld position compensation, default-3, greater than 0, Z+ , less than 0: Z-
4	Sample dis	The interval between adjacent sampling points
5	Pos begin from #GP	The generation of a multi-level, Multipass file requires the use of the starting sequence number of the location variable. By default, #GP301 is used
6	Weld start #GP	Multipass file generates the starting point of the weld track. The default is #GP290
7	Weld end #GP	Multipass file generates the end number of the weld track, default #GP291
8	Call name	Generate a Multipass weld program name

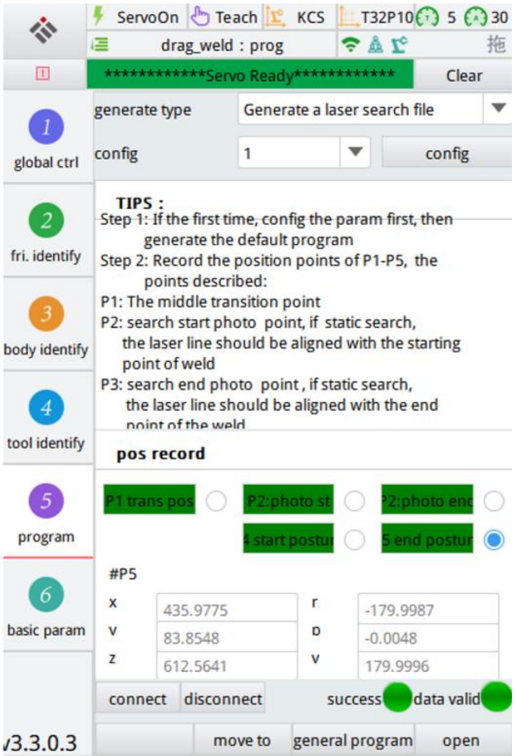
4.2. Create a custom file

Serial Number	Operation	Instances
1	Click [Drag]> [Parameter Setting]> [IO Configuration]. The IO configuration is configured according to the actual location of the IO module. The IO signal insertion instruction is used to configure the IO. (For details, see Chapter 5.4)	
2	Click [Drag]> [Program]>[Generate a Custom File], select the preset configuration parameters, and through the IO signal input instruction, the teaching trajectory will be displayed in the current interface	

3	After the demonstration trajectory program is completed, click [Program], the welding program will be automatically generated, switch back to playback mode to execute the program (the program template can be set in "configuration" according to actual needs)	

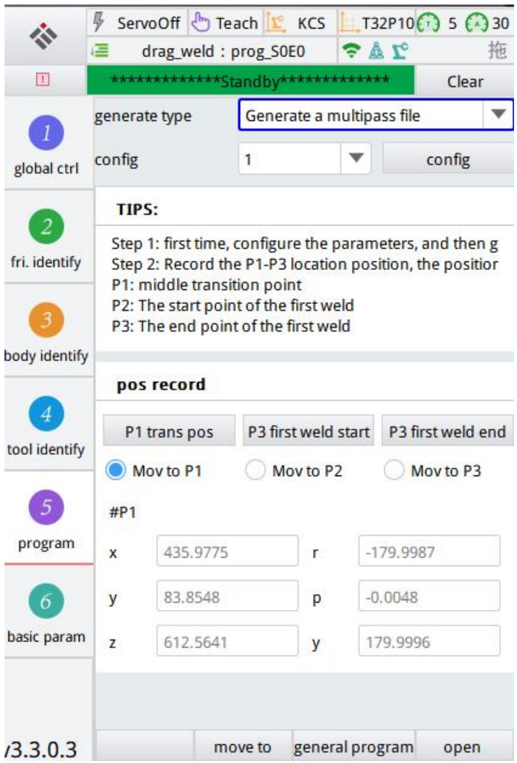
4.3. Create a laser location file

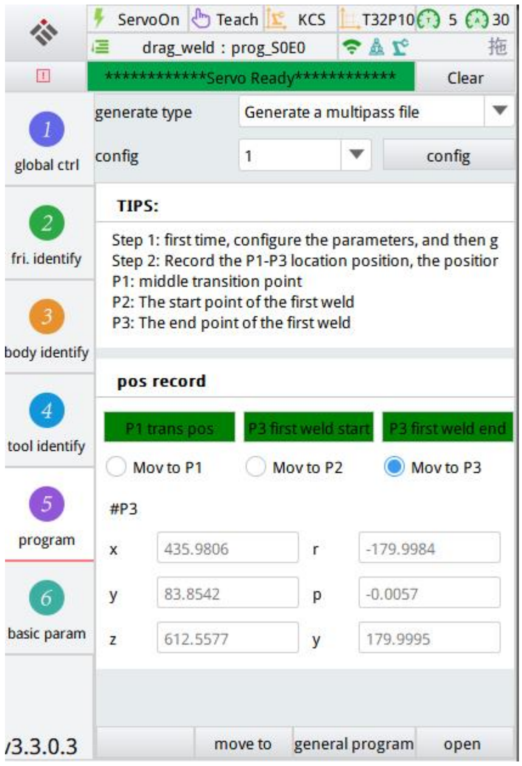
Serial Number	Operation	Instances
1	Click [Drag]>[Program]>[Generate a laser search file]. For the first time, you must configure parameters and click "Generate program" once	

<table>
<tr>
<td>2</td>
<td>Connect the laser sensor (the sensor file number needs to be set in advance). After successful connection, the indicator light will turn green</td>
<td>
</td>
</tr>
<tr>
<td>3</td>
<td>Record P1, P2, P3, P4, P5, and the point ("Data valid" indicator light turns green, indicating that the photo location is valid)</td>
<td>
</td>
</tr>
</table>

4	After the location point recording is completed, click [Open], switch back to playback mode to execute the program	

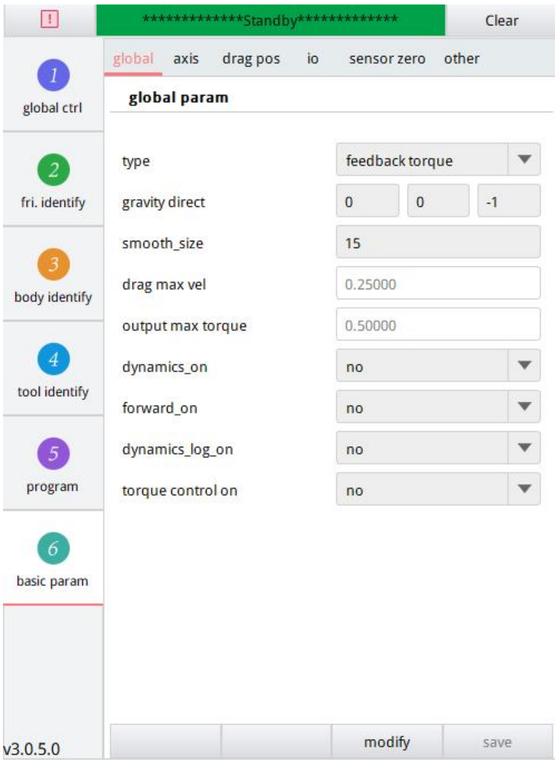
4.4. Generates a multipass file

Serial Number	Operation	Instances
1	Click [Drag]>[Program]>[Generate multipass file]. For the first time, you must configure the parameters and click "Generate program" once	

<table>
<tr>
<td>2</td>
<td>Record the intermediate transition point P1, the starting point of weld P2 and the end point of weld P3</td>
<td>
</td>
</tr>
<tr>
<td>3</td>
<td>After the location point recording is completed, click [Open], switch back to playback mode to execute the program</td>
<td>
</td>
</tr>
</table>

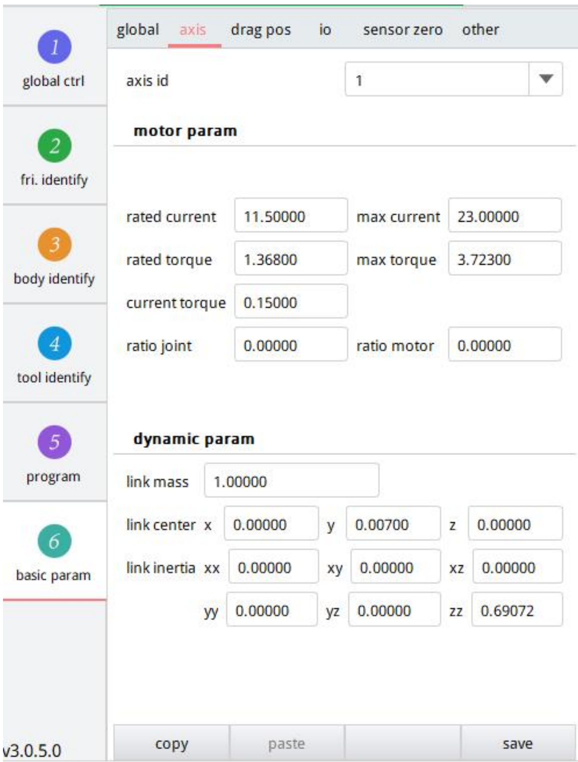
5. Parameter Settings

5.1. Global Parameter



Serial Number	Parameter Name	Parameter Description
1	Type	Different types of input feedback parameters in dynamics
2	Gravity direction (XYZ)	It determines the force situation during the robot's movement, such as inclined installation or inverted installation, and requires the correct setting of gravity parameters. Incorrect settings can lead to abnormal movement and alarms
3	Smoothing_size	output mean filter length
4	Drag max vel	Maximum speed of movement in drag mode
5	Output max torque	Maximum torque for movement in drag mode
6	Dynamics_on	Activate the dynamic function
7	Forward_on	Activate the dynamic feedforward function
8	Dynamics_log_on	Activate dynamic log
9	Torque control on	Activate the force control sensor function

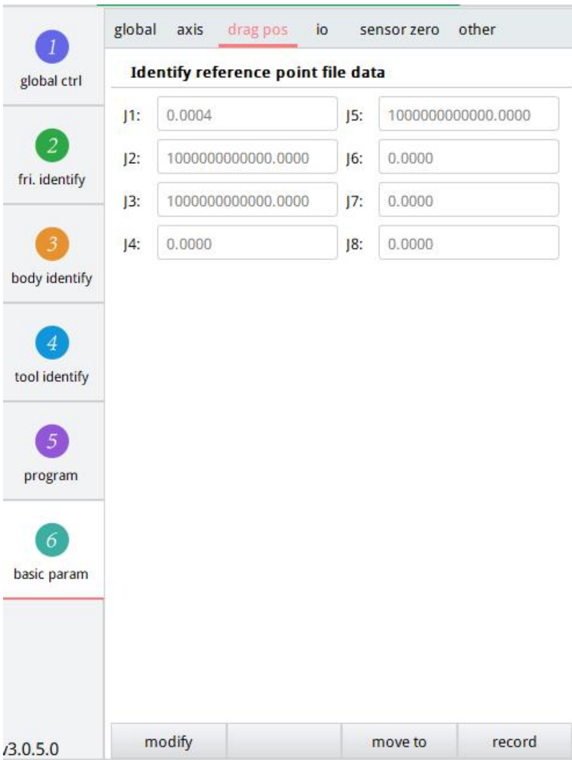
5.2. Joint Parameter



Joint parameters include robot body related data such as rated current, maximum current, rated torque, maximum torque, torque constant, reduction ratio, etc. The parameters on this page directly affect the accuracy of the motion. Please ensure that the robot motor parameters are set reasonably, otherwise there may be issues with the function not functioning properly or the robot parameter recognition failing. Do not modify without the permission and assistance of the robot manufacturer.

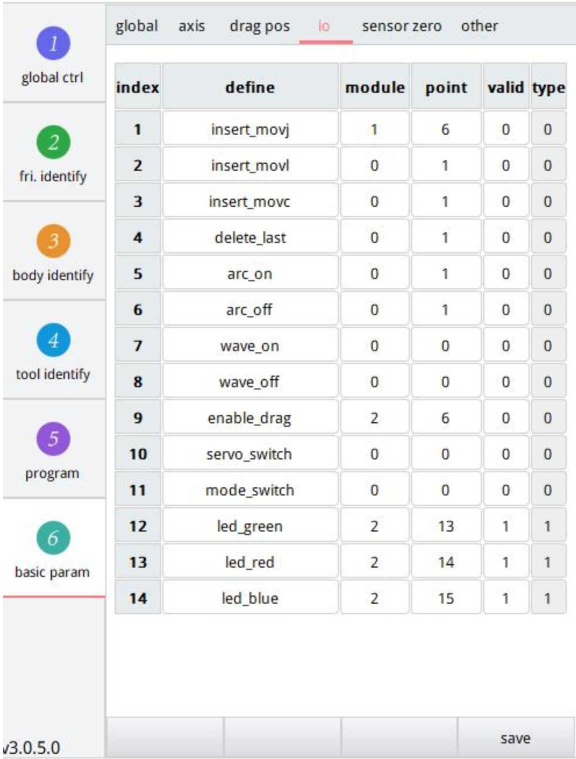
The dynamic parameters represent the mass, center of mass, and inertia of each joint, and can be automatically obtained through body identification.

5.3. Drag Position



The starting position of dragging supports user customization, which can be set on the "Parameter Settings" - "Drag Position" page. If not set, use the default origin position.

5.4. IO Configuration



index	define	module	point	valid	type
1	insert_movj	1	6	0	0
2	insert_movl	0	1	0	0
3	insert_movc	0	1	0	0
4	delete_last	0	1	0	0
5	arc_on	0	1	0	0
6	arc_off	0	1	0	0
7	wave_on	0	0	0	0
8	wave_off	0	0	0	0
9	enable_drag	2	6	0	0
10	servo_switch	0	0	0	0
11	mode_switch	0	0	0	0
12	led_green	2	13	1	1
13	led_red	2	14	1	1
14	led_blue	2	15	1	1

Module: Represents the address ID of the IO module, and the value of the extended IO slave address ID starts from 1.

Point: indicates the position of the module to be used, 0 indicates not to be used, and point values start from 1.

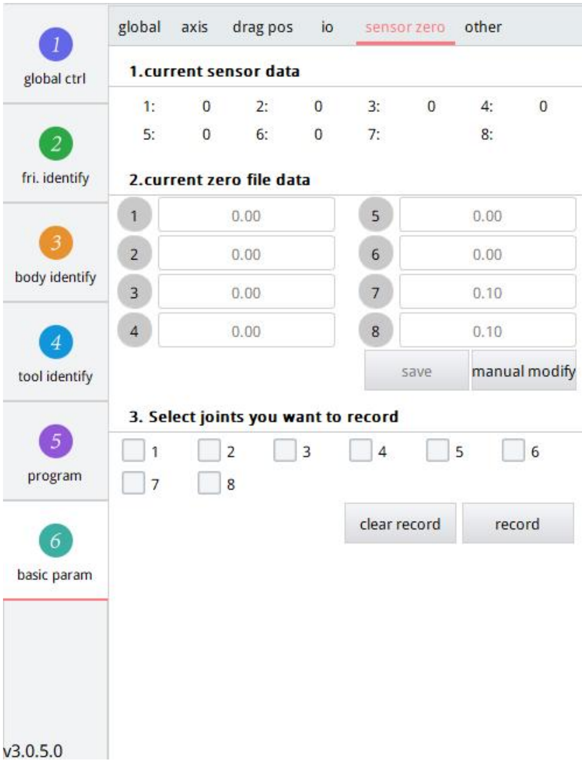
Valid value: Normal 1 is valid and can be reversed.

Serial Number	Parameter Name	Value	Instruction
1	Insert_movj	0-Input	Insert movj instruction
2	Insert_movl	0-Input	Insert movl instruction
3	Insert_movc	0-Input	Insert movc instruction
4	delete_last	0-Input	Delete the last instruction
5	arc_on	0-Input	Insert welding start instruction
6	arc_off	0-Input	Insert welding closure command
7	wave_on	0-Input	Insert the instruction to start the swing arc

8	wave_off	0-Input	Insert the instruction to close the swing arc
9	enable_drag	0-Input	Drag the button using the main body
10	led_green	1-Output	Turn on the green LED indicator light
11	led_red	1-Output	Turn on the red LED indicator light
12	led_blue	1-Output	Turn on the blue LED indicator light

5.5. Zero Calibration

Zero calibration of force sensor



When the force sensor data is abnormal or needs to be re recorded as zero position, it is necessary to calibrate the force sensor data and software recording calibration for each axis of the robot.

Mechanical zero calibration: By moving along a single axis, each axis runs to the mechanical reference zero point.

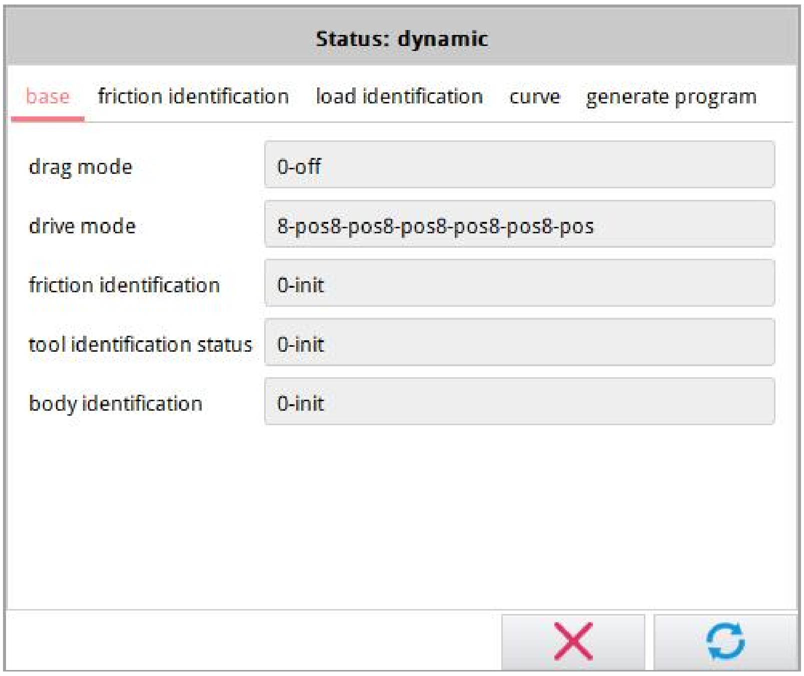
Software record calibration: After all six axes have returned to the mechanical reference zero point through single axis motion, it is necessary to enter the software's factory settings and re record the zero point position. Ensure that the zero positions of software and hardware correspond. Afterwards, every time the robot returns to zero, it will return to that position.

6. Status monitoring panel

Click the handheld box  button to open the floating status monitoring panel. Click  to select the dynamic status monitoring panel, which can monitor various parameters and status of the dynamic process, making it convenient for users to quickly understand the robot status.

6.1. Foundation

This interface can view the current status of the robot, display whether the robot is currently in drag mode, and also view the current recognition status.



Serial Number	Functional Monitoring	Parameter Description
1	Drag mode	Drag mode flag, set to 1-on when entering drag mode
2	Drive mode	Drive mode flag, set to 10 torque when entering drag mode

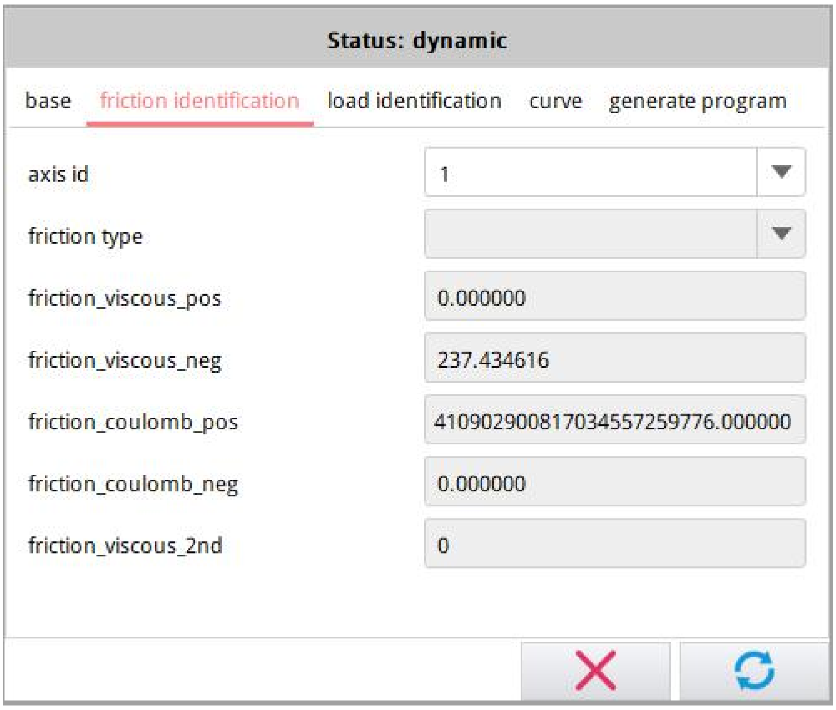
3	Friction identification	Friction identification flag, enter friction identification set as 4-identification in progress
4	Tool identification status	Tool identification flag, enter the tool identification position
5	BodyIdentification	The identification flag for the main body is set to 4-identification when entering the main body identification

Warning

1. In the upper servo state, the mode cannot be switched and a lower servo operation is required.
2. In the simulation state, the drive operation mode will remain in the current state, and the non simulated axis will not be affected.

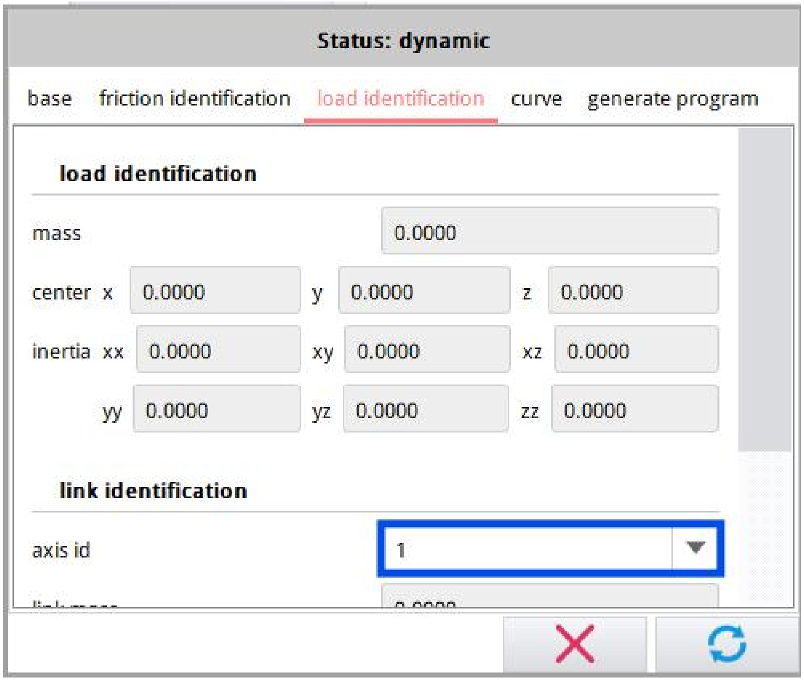
6.2. Friction Identification

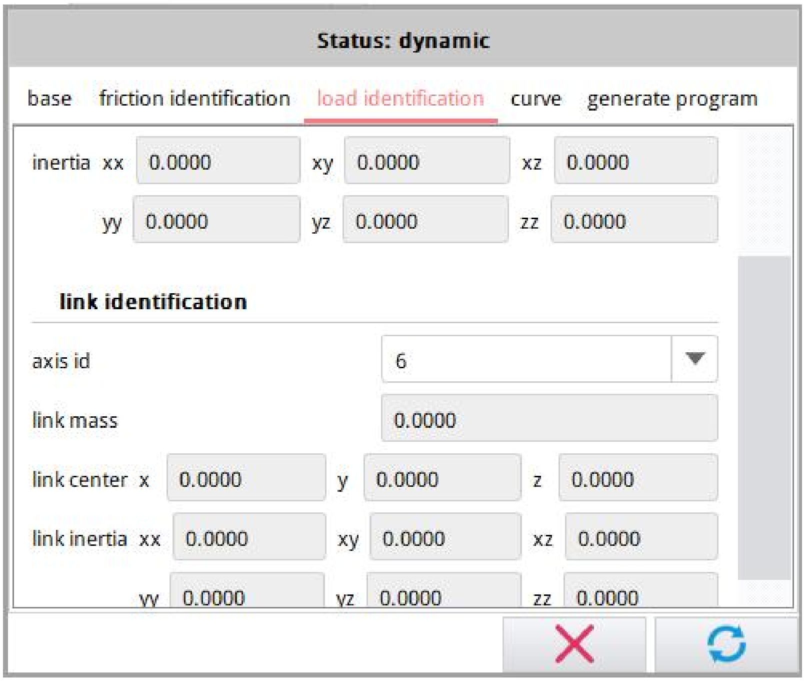
This interface displays the friction identification results of each axis. For detailed parameters, please refer to Chapter 3.



6.3. Load Identification

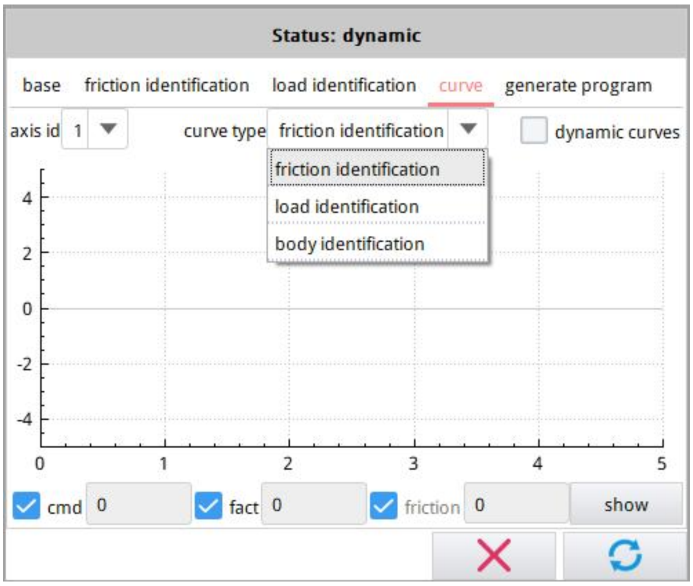
This interface displays the load results of each axis. For detailed parameters, please refer to Chapter 3.





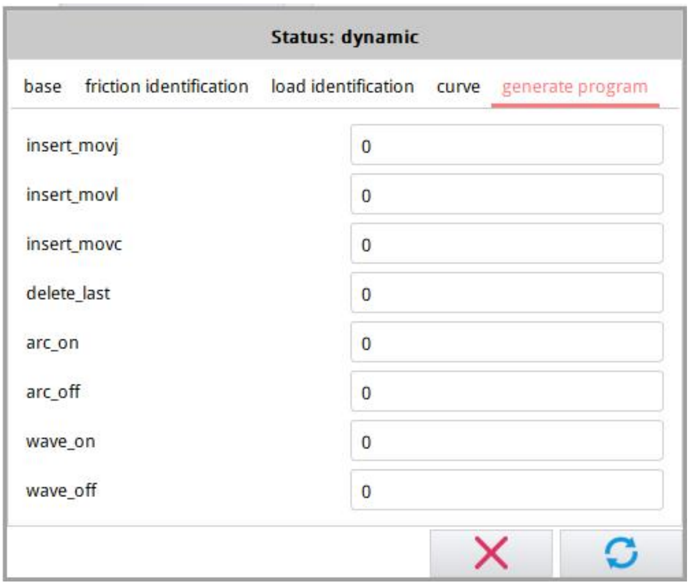
6.4. Curve

This interface displays the driver curve during the identification process, including friction identification, load identification, and body identification. Clicking on the display curve will allow you to view the current curve status and actual value.

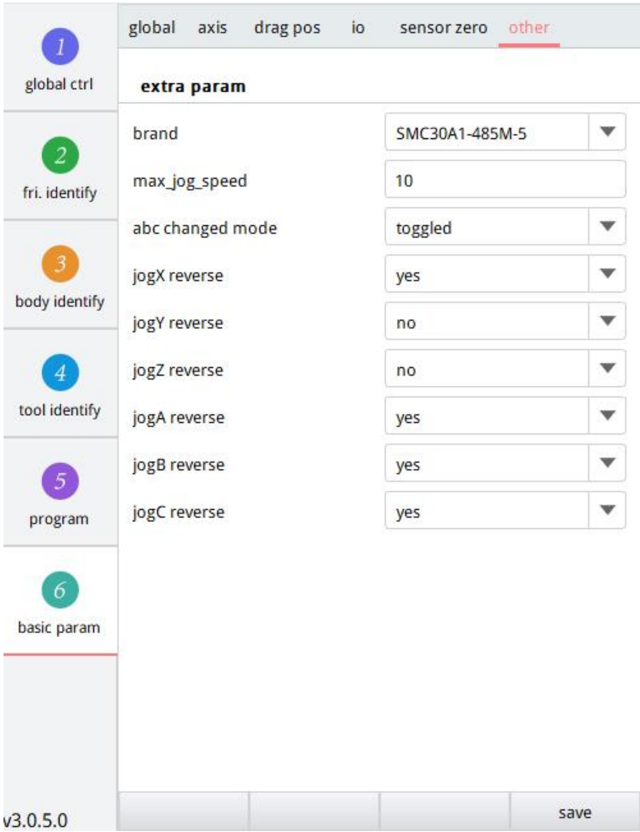


6.5. Program Generation

This interface displays the IO trigger status after configuring the dynamic process IO



7. Remote sensing function



Remote sensing module can be added to control the robot for fine adjustment after dragging. The remote control signal is transmitted through the 485 port to control the motor for direction adjustment.

The remote sensing module needs to be connected to a 24V power supply and plugged into the 485 port of the controller. Select the parameter type SMC30A1-485M-5 and save it. Wait for the encoder initialization to complete before using the remote sensing function.

Serial Number	Parameter	Instruction
1	Type	Remote sensing module, currently only supports SMC30A1-485M-5
2	Max_jog_speed	Maximum motion speed when remotely controlling a robot
3	ABC changed mode	Press and hold to switch tool coordinate system/press and hold

		to switch tool coordinate system
4	JogX Reverse	Switch remote sensing X motion direction
5	JogY Reverse	Switch remote sensing Y motion direction
6	JogZ Reverse	Switch remote sensing Z motion direction
7	JogA Reverse	Switch remote sensing A motion direction
8	JogB Reverse	Switch remote sensing B motion direction
9	JogC Reverse	Switch remote sensing C motion direction

8. Steps to implement dragging

The dynamic process can be adapted to different bodies, as the parameters of each body are different. Before using the dynamic process, the key parameters of the robot body need to be filled in the attached table.

Before using the dynamic process, it is necessary to fill in the key parameters in the robot information table in the "System Parameters" and "Dynamics Parameter Settings" sections.

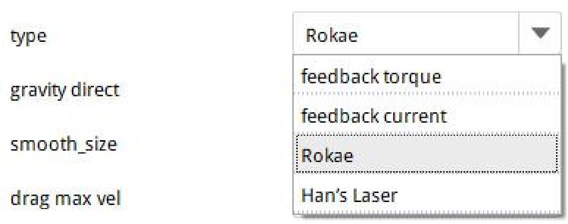
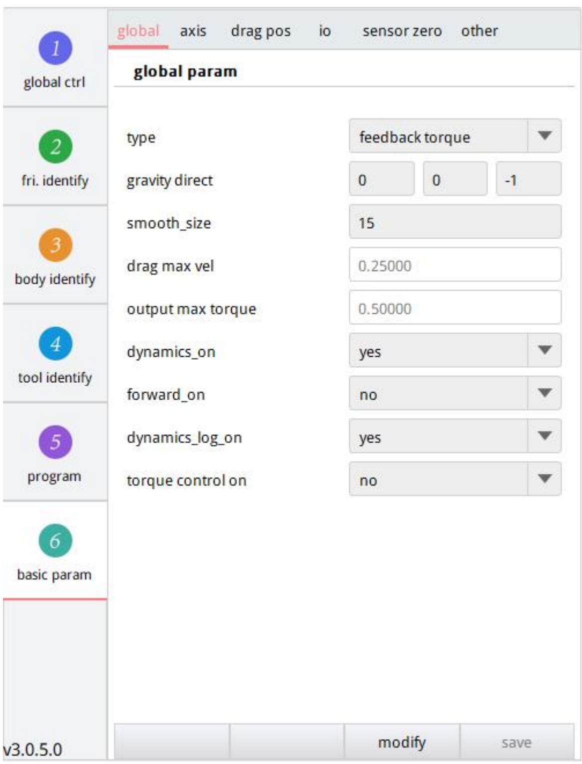
The complete use of dynamic process operation steps can be carried out step by step according to the following titles.

⚠Warning

Attention should be paid to the current model of the robot, as model errors can lead to identification anomalies.

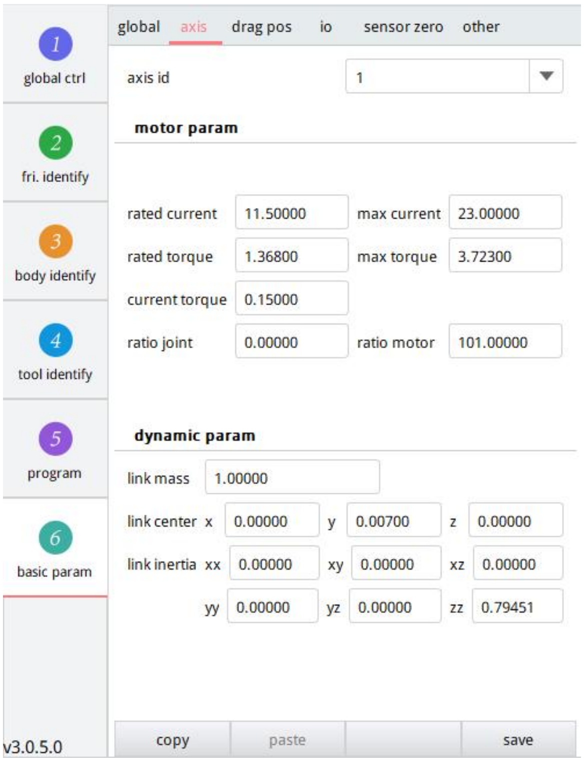
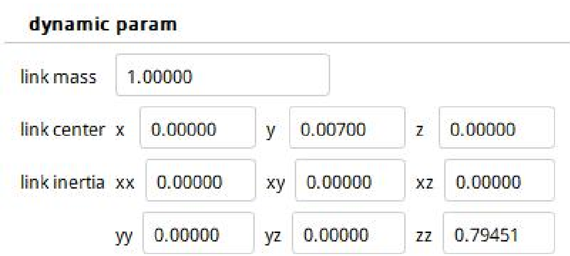
8.1. Global Parameter Import

This chapter requires setting dynamic global parameters. In the adaptation process of most systems or devices, global parameter settings usually only need to be enabled and adjusted during the first adaptation.

Serial Number	Operation	Instances
1	Click on [Menu]>[Drag]>[Parameter >Settings]>[Globa lParameters]	
2	Select "Rokae" for "Type". At present, the dynamic function of Rokae robots is supported. Non Rokae robots can contact Imanifold technicians for technical support	
3	Gravity direct", default set, Z direction is -1. Drag maximum speed, default is 0.85. Output maximum torque, default is 0.5. Dynamic senable ",default" Yes ". Forward enabled ", default" No ". Dynamics log enabled ", default" Yes ". Torque control enabled , default is' No '.	

8.2. Joint parameter import

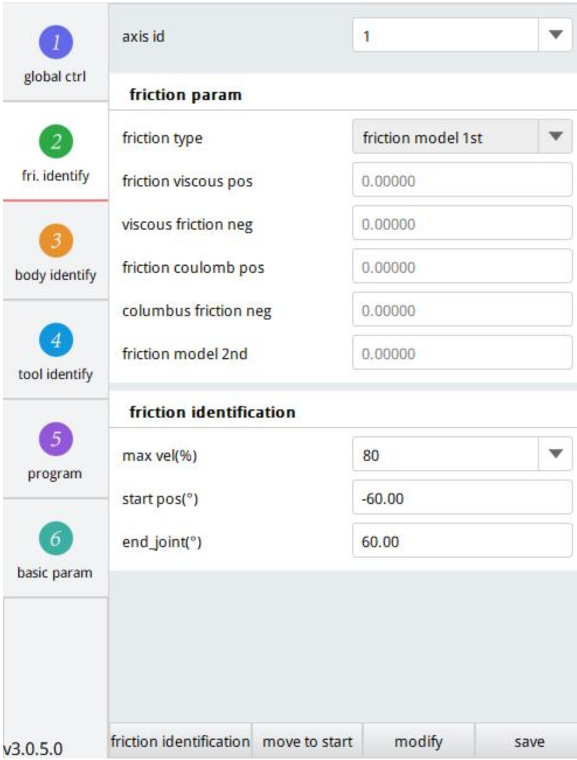
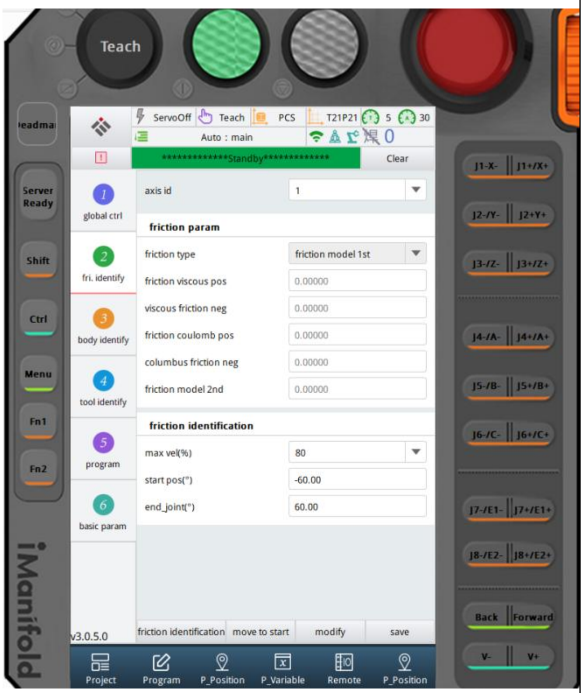
This chapter requires setting joint motor parameters. In the adaptation process of most systems or devices, joint motor parameter settings usually only need to be turned on and adjusted during the first adaptation.

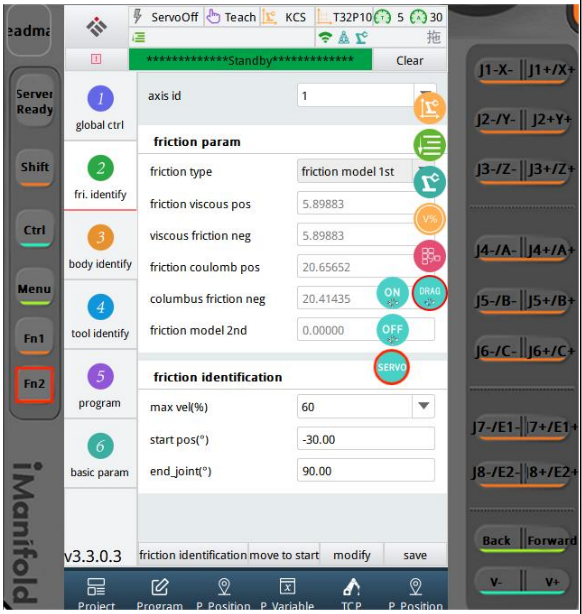
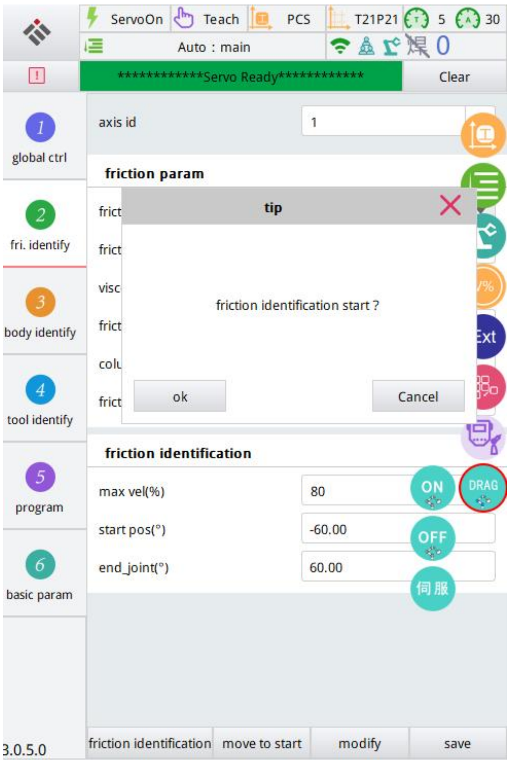
Serial Number	Operation	Instances
1	Click on [Menu]>[Drag]>[Parameter Settings]>[Joint Parameters]	
2	According to the parameters in the robot information table, it is necessary to fill in the 1-6 axis motor parameters in sequence. “Rated current”, “Rated torque”, “constanttorque” , “max current”, “max torque”, “ratio joint”, “ratio motor”	
3	Dynamics parameters do not need to be manually filled in, they can be obtained through identification	

8.3. Friction identification

After completing the basic parameter settings, friction identification can begin. Obtain the friction parameters of the robot body through friction identification, reduce the impact of friction on the control system, and actively compensate for friction in the control circuit.

Serial Number	Operation	Instances
1	Click on [Menu]>[Drag]>[FrictionIdentification]	
2	Friction identification needs to be carried out in an unloaded state, with the "max_vel"set to 80 to achieve the best identification effect (using 60% vel verification trajectory for the first time)	

3	Set the starting and ending positions of the joints during the identification process 1 axis (-60 °~60 °) 2-axis(-90 °~30 °) 3-axis (120 °~0 °) 4-axis(60 °~-60 °) 5-axis(60 °~-60 °) 6-axis(-180 °~-60 °)	
4	Click on [Drag]>[Friction Identification]>[Motion to Star] >[Forward], check the interference space when moving to start point	

5	Click on [Fn2]>[Drag]>[Servo] to enter the servo hold state	
6	Click on [Drag]>[Friction Identification]>[Friction Identification] to start single axis identification	
7	After the identification is completed, save the data and switch the axis number to start identifying the next axis	

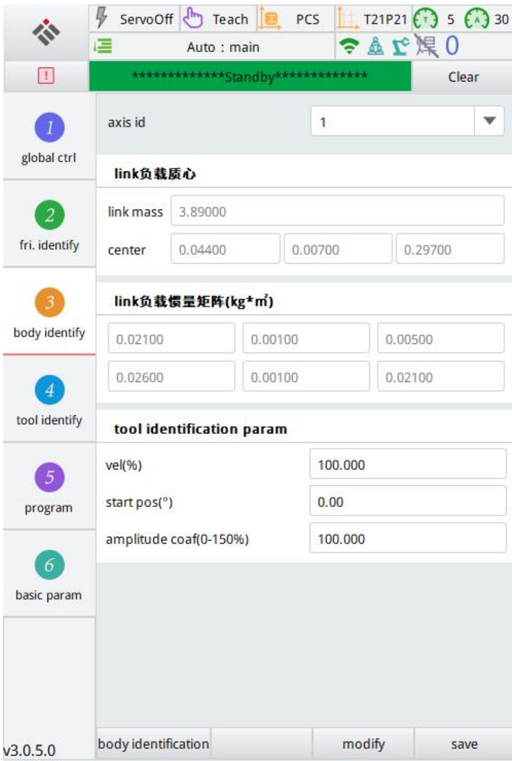
⚠Warning

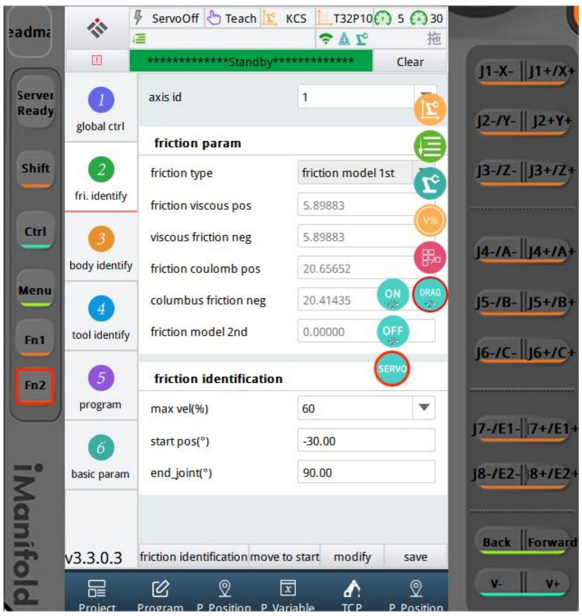
3. Set the friction force identification starting and ending positions for axes one to six on the interface (notice that the trajectory length of the starting and ending positions needs to be greater than 100 °, and also pay attention to the positive and negative directions).
4. Before identifying the body, friction force must be identified first. It is recommended to use 60% speed to verify the trajectory for the first time to avoid interference space in the movement trajectory. Afterwards, friction force identification can be carried out using 80% -100% speed.
5. Due to the influence of the robot body model, workpiece, and workspace, it is necessary to flexibly adjust the starting and ending positions according to the on-site situation when using friction identification.

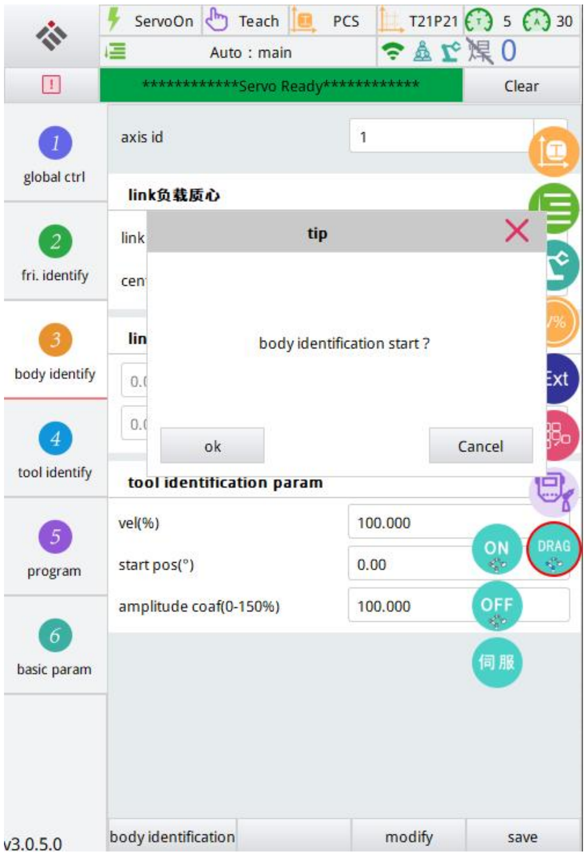
8.4. Body Identification

The body identification will collect information during the movement process, obtain the robot's dynamic parameters, and the collected dynamic parameters will be automatically filled into [Parameter Settings] - [Joint Parameters] - [Dynamic Parameters].

Serial Number	Operation	Instances
1	Click on [Menu] >[Drag] > [Body Identification]	
2	Carry the current tool for body identification. If the tool needs to be replaced, it is necessary to perform body identification again. Set the "max_vel" to 100 for the best recognition effect (use 60% speed to verify the trajectory for the first time)	

<table>
<tr>
<td>3</td>
<td>Set the initial bias and amplitude coefficient during the identification process
1 axis initial bias (0) amplitude coefficient (80)
2-axis initial bias (0) amplitude coefficient (60)
3-axis initial bias (90) amplitude coefficient (30)
4-axis initial bias (0) amplitude coefficient (70)
5-axis initial offset (60) amplitude coefficient (30)
6-axis initial bias (-90) amplitude coefficient (80)</td>
<td>

(Currently, only the Luoshi robot has added an initial bias. If it is for other robots, please contact Imanifold technicians for technical support.)</td>
</tr>
<tr>
<td>4</td>
<td>Click on [Fn2]>[Drag] >[Servo] to enter the servo hold state</td>
<td>
</td>
</tr>
</table>

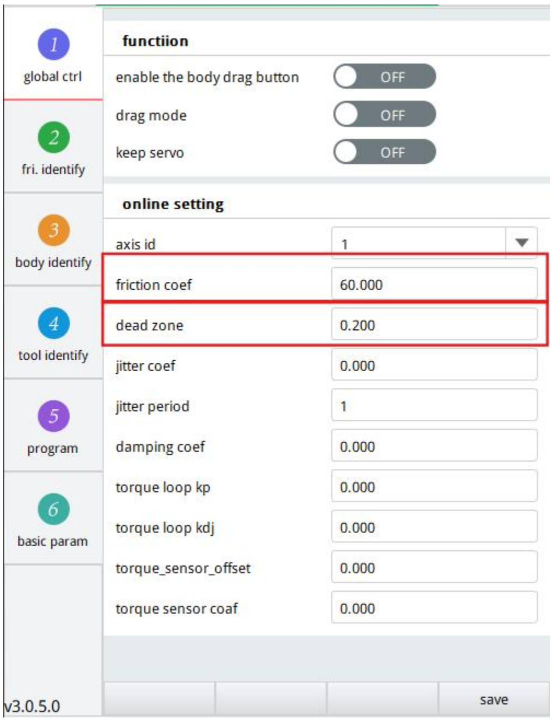
5	Click on [Drag]>[Body Identification]>[Global Parameter Identification] and wait for the identification to be completed and saved	

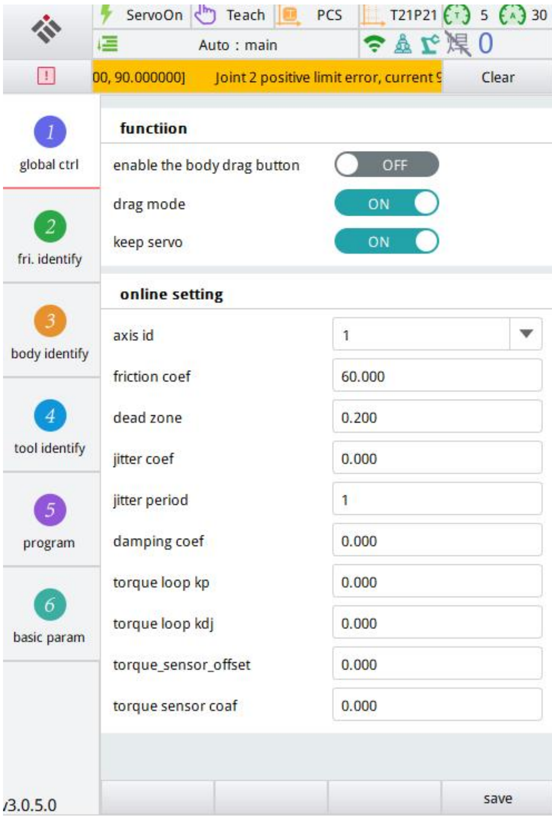
⚠Warning

1. Before identifying the body, it is necessary to first identify the friction force. It is recommended to use 60% speed to verify the trajectory for the first time to avoid interference space in the motion trajectory. Afterwards, 80% -100% speed can be used for body identification.
2. Body identification will execute the default motion trajectory, which is affected by the robot's body model, workpiece, and workspace. When using body recognition, it is necessary to flexibly adjust the initial bias and amplitude coefficient according to the on-site situation
3. Attention should be paid to the positive and negative directions when starting the bias.
4. The amplitude coefficient cannot be too small, as a small joint motion angle can lead to poor identification results.
5. After completing the body identification, the first drag effect needs to be carefully operated. If the drag effect is poor, the amplitude coefficient of that axis needs to be adjusted first and then re identified.

8.5. Friction coefficient adjustment

After the identification is completed, you can start entering the drag mode in Global Control. The DH parameters of different robot bodies are different, so when the single axis drag effect is poor, it is necessary to adjust the friction coefficient (the smaller the coefficient, the better the friction compensation effect, and the heavier the drag effect) until the effect is good.

Serial Number	Operation	Instances
1	Click on [Menu]> [Drag]> [Global Ctrl]	
2	The default friction coefficient is 60 Friction dead zone defaults to 0.02 The actual parameters are related to the robot body and load, and need to be fine tuned	

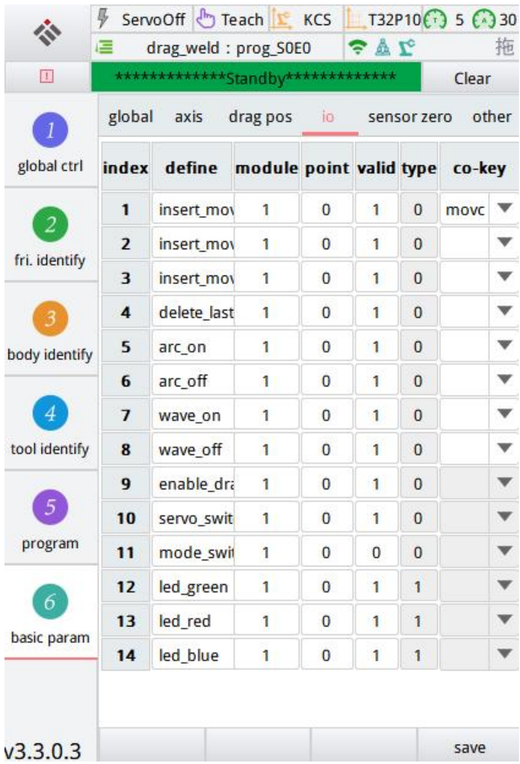
3	Enter drag mode to experience the drag effect, which is adjusted by the friction coefficient When the drag effect is heavy, increase the uniaxial friction coefficient When the drag effect is light, reduce the uniaxial friction coefficient	
4	Feel the drag effect on different axes and adjust the friction coefficient separately until the drag effect is normal	

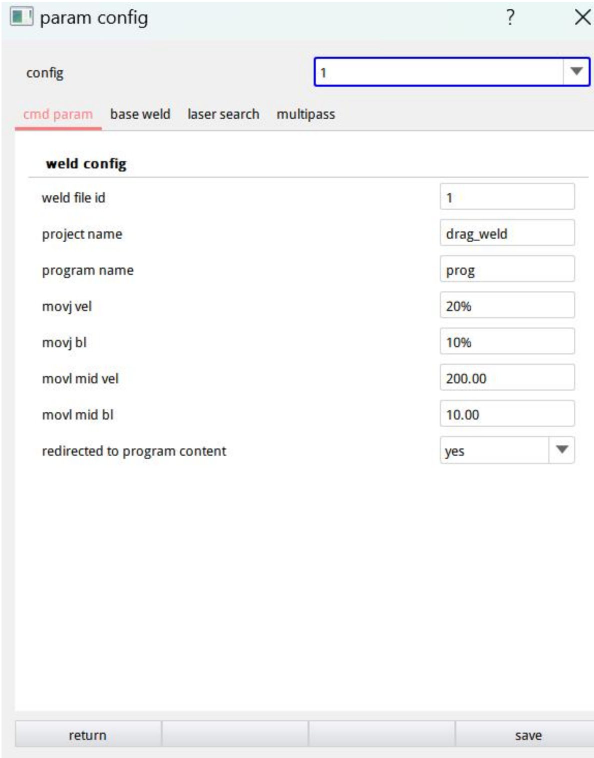
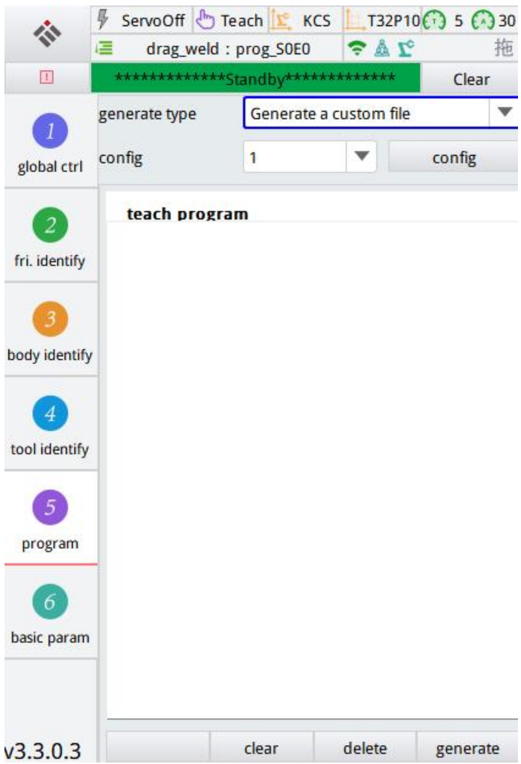
⚠Warning

1.Choose whether to use load identification according to the requirements (friction identification+body identification can be used without load identification if the drag effect is good after completion).

8.6. Program Generation

After the dynamic process debugging is completed, you can start recording point positions and generating programs by dragging joint positions.

<table>
<tr><th>Serial Number</th><th>Operation</th><th>Instances</th></tr>
<tr><td>1</td><td>Click [Drag]> [Parameter Setting]> [IO Configuration]. The IO configuration is configured according to the actual location of the IO module. The IO signal insertion instruction is used to configure the IO. (For details, see Chapter 5.4)</td><td>
</td></tr>
</table>

2	Click [Drag]>[Program]>[Configuration], which contains the configurable welding parameters with serial numbers 1-10. Different welding parameters can be set for different serial numbers	
3	Click [Drag]>[Program]>[Generate a Custom File], select the preset configuration parameters, and through the IO signal input instruction, the teaching trajectory will be displayed in the current interface	

<table>
<tr>
<td>4</td>
<td>After the demonstration trajectory program is completed, click [Program], the welding program will be automatically generated, switch back to playback mode to execute the program (the program template can be set in "configuration" according to actual needs)</td>
<td>
</td>
</tr>
</table>