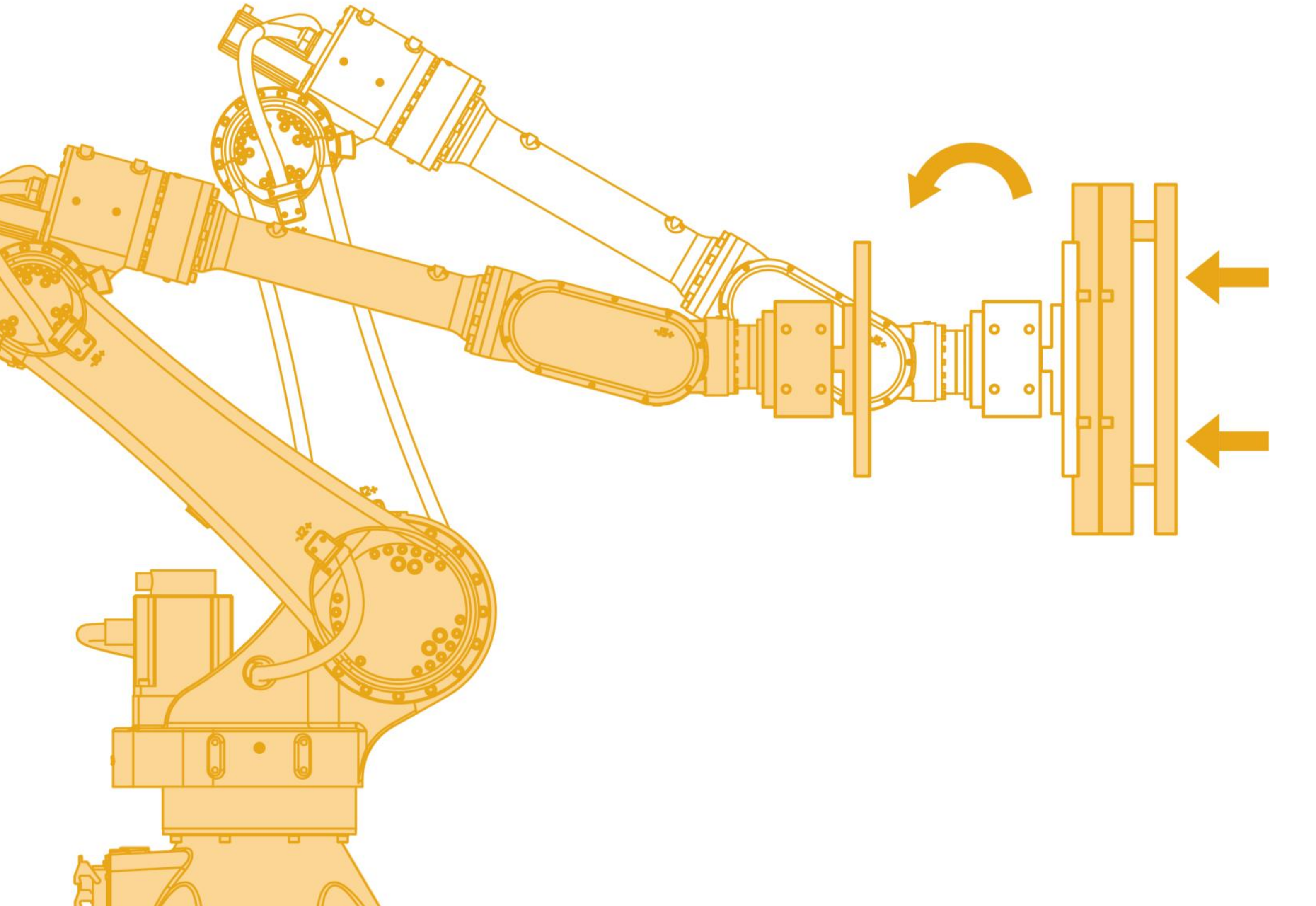
PEITIAN ROBOTICS

Soft Float User Manual

V1.1.0



Foreword

About This Manual

This manual introduces the application of robot soft float, and describes in detail the application background and software configuration process of soft float. Reading this document will help readers to master the working principle and use method of soft float.

Prerequisites

Before operating the robot, be sure to read the relevant safety instructions and operation instructions of the product carefully. Users must understand the safety knowledge and basic operation knowledge before using the robot's soft float.

Please read the following documents when necessary:

- "Operation Manual of AIR-TP Teach Pendant"
- "ARL Programming Manual"
- "Fault and Troubleshooting Manual of AIR Series Industrial Robot System"

Target Groups

- Operators
- Product technicians
- Technical service personnel
- Robot teachers

Meaning of Common Signs

The signs and their meanings in this manual are detailed in Table 1.

Table 1 Signs used in this manual

Sign	Meaning
⚠ Danger	Failure to follow the instructions may cause accidents, resulting in serious or fatal personal injury.
⚠ Warning	Failure to follow the instructions may cause accidents, resulting in moderate or minor personal injury, and may also cause damage to materials only.
⚠ Notice	You are prompted to keep in mind environmental conditions and important matters, or quick operation methods.

Sign	Meaning
Tip	You are prompted to refer to other literature and instructions for additional information or more details about operation instructions.

Manual Description

The contents of this manual are subject to supplementation and modification. Please visit "Download Center" on the website regularly to obtain the latest version of this manual in a timely manner.

Website URL: http://robot.peitian.com/

Revision History

The revision history contains the instructions for each document update. The latest version of the document contains updates to all previous versions of the document.

Table 2 Signs used in this manual

Version	Publication date	Modification description
V1.0.0	2020/10/10	1st official publication
V1.1.0	2021/12/10	2nd official release Upgrade the software version to v2 six point four

Document Number and Version

The document-related information is shown in Table 3.

Table 3 Document-related information

Document name	"Soft float User Manual"
Document number	UM-P05070000006-001
Document version	V1.1.0
Software version	2.6.4

Symbol convention

Refer to Table 4 for document related symbol conventions.

Table 4 Symbol convention

Format	Significance
<>	The angle bracket "< >" indicates the button name, such as "click the <YES> button".

Format	Significance
[]	"[]" with square brackets indicates the window name, menu name and data table, such as "pop up [New User] window".
/	Multi-level menus are separated by "/". Such as [File/New/Folder], the multi-level menu represents the [Folder] menu item under the [New] submenu under the [File] menu.

Contents

1 Overview of soft float

1.1 Definition of soft float

Soft float means that the robot has a certain degree of active compliance through force control, which reduces the stiffness of the robot in a predetermined direction, so as to produce a flexible response to the external force (or moment) in that direction. At the same time, in other directions, the initial operating mode is maintained. When using soft float, the robot may not follow the programmed path and some functions (for example: collision detection) are disabled. This function can be used alone or in combination with movement instructions.

1.2 Application scenarios of soft float

When this function is used alone, the typical application area is die-casting machine, and the robot will follow the movement of the push rod machine. When this function is used in combination with movement instructions, the robot will mainly follow an orderly path in the non-soft float direction, while allowing a larger position deviation in the soft float direction. If the position of the workpiece changes in the specified direction, set the soft float to make the robot follow the position change and avoid hard collisions.

When soft float is used in combination with movement instructions, common applications include die casting picking, workpiece picking, flexible assembly, etc.

1.3 Function description

The following functions of soft float can be configured through the teach pendant:

- ARL instruction used to enable/disable the soft float mode.
- The system parameters are used to set the soft float movement.
- The system parameters are used to set the soft float monitoring.

1.4 Restrictions on use

The restrictions on the use of the soft float function are as follows:

- When soft float is in effect, collision detection is not supported.
- The soft float does not support 4-axis robots.
- Soft float does not support the use of multimove.
- Soft float does not support the use of conveyor tracking.
- Soft float does not support simultaneous use with safe areas.

2 Principle of soft float

2.1 Basic parameters

Soft float is used to set the softness in the following two situations:

- The joints are soft float, that is, each axis is independently and flexibly controlled.
- Cartesian soft float, that is, flexible control of the robot TCP in a Cartesian direction.

Figure 2-1 shows the evasion direction of soft float in three modes: axis direction, basic coordinate system direction, and tool coordinate system direction. See Table 2-1 for the description of the pictures.

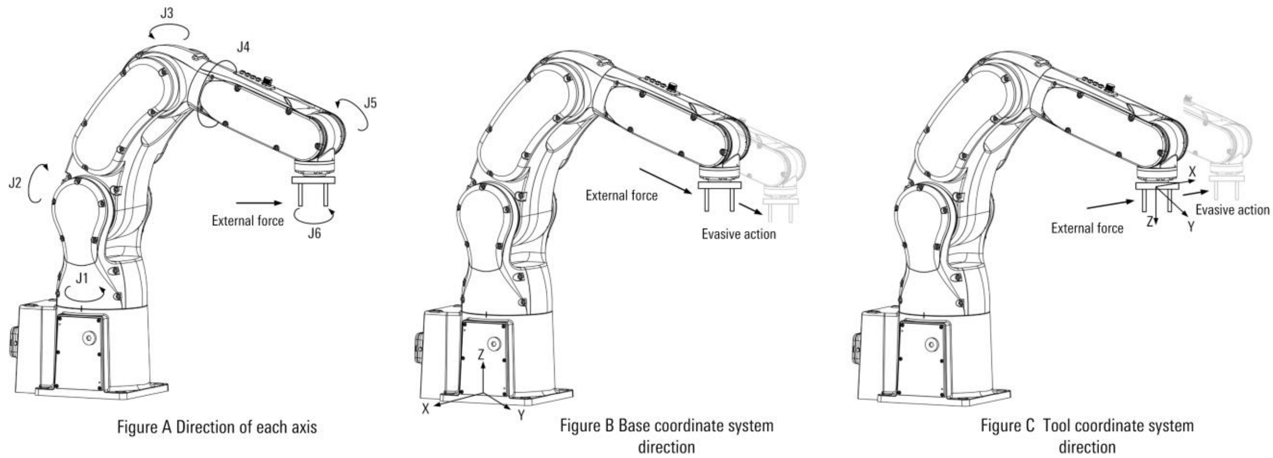


Figure 2-1 Software buffer setting method

Table 2-1Picture description

No.	Description
Figure A	When using the soft float of each axis, follow the external force and perform an evasive movement by the rotation of each axis.
Figure B	When soft float in the direction of the basic coordinate system, an evasive action is performed along the specified direction of the basic coordinate system according to the external force. For example, when the basic coordinate Y-axis direction is specified, an evasive action is performed in the basic Y-axis direction.
Figure C	When soft float in the direction of the tool coordinate system, the evasive action is performed along the specified direction of the tool coordinate system according to the external force. For example, when the X direction of the tool coordinate system is specified, an evasive action is performed in the X axis direction of the tool.

Softness is controlled by two parameters: stiffness and damping. The parameter description is shown in Table 2-2.

Table 2-2 The behavior of softness is explained by two parameters

Parameter	Description
Stiffness	Describe the force with which the robot attempts to return to the reference point. The value set in the ARL program is a percentage of the configured value. The higher the value, the stronger the spring effect. Setting this value to zero will not produce a spring effect, and the robot will float in the selected direction. As shown in Figure 2-2 and Table 2-1. The calculation formula of the actual stiffness value is as follows: Actual stiffness value = Stiffness factor*2* Initial value of damping
Damping	Describe how much resistance there is to push the robot. The resistance does not increase with the distance between the robot and the reference point, but usually increases with the speed of the robot. As shown in

Parameter	Description
	Figure 2-1and Table 2-1. The calculation formula of the actual damping value is as follows: Actual damping value = Initial value of damping + Damping coefficient * Initial value of damping

Tip

- Refer to section 5.1 and section 5.2 for stiffness coefficient setting.
- For the setting of initial damping value, please refer to Section 4.2.
- Refer to section 5.1 and 5.2 for damping coefficient setting.

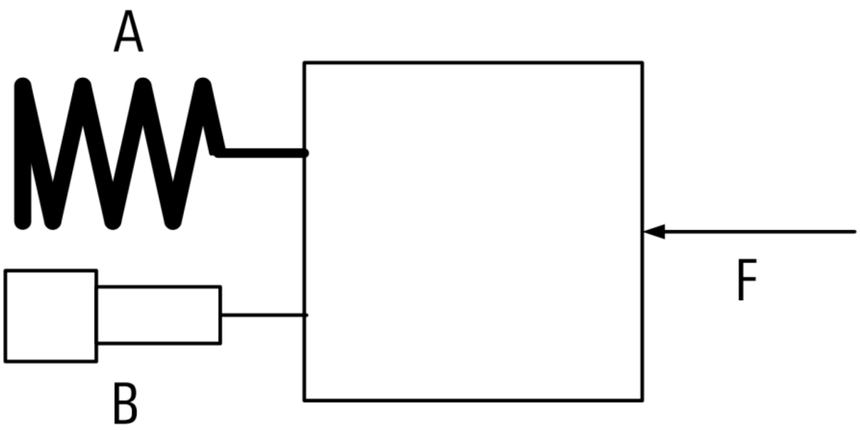


Figure 2-2 Diagram of stiffness/damping

Table 2-3 Picture description

No.	Description
A	The stiffness can be compared to a spring.
B	Damping is equivalent to hydraulic shock absorbers.

2.2 Reference position

If soft float is turned on but no movement instruction is used, the robot position when it is turned on will be used as the reference position. If an external force pushes the robot away from the position, the robot will bounce and apply a force that pushes to the reference position. As shown in Figure 2-3 and Table 2-3.

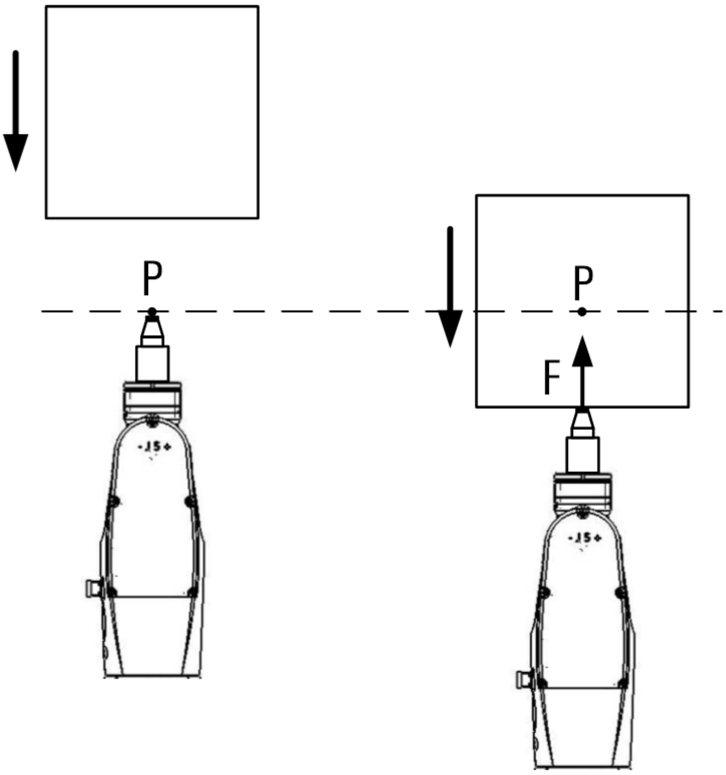


Figure 2-3 Diagram of the reference position

Table 2-4 Picture description

No.	Description
P	Reference position
F	Force (proportional to the distance between the robot TCP and the reference position)

If a move instruction is used, the robot will try to move to its programmed position. If there is an obstacle in the soft direction, the robot will apply force to the reference position. The reference position of each moment is the position that the robot TCP should reach without obstacles. In the non-soft direction, the robot will closely follow the reference path, but in the soft direction, there may be a distance to the reference position. This distance generates a force to push to the reference position. After the movement, the programmed target is the new reference position. As shown in Figure 2-4 and Table 2-4.

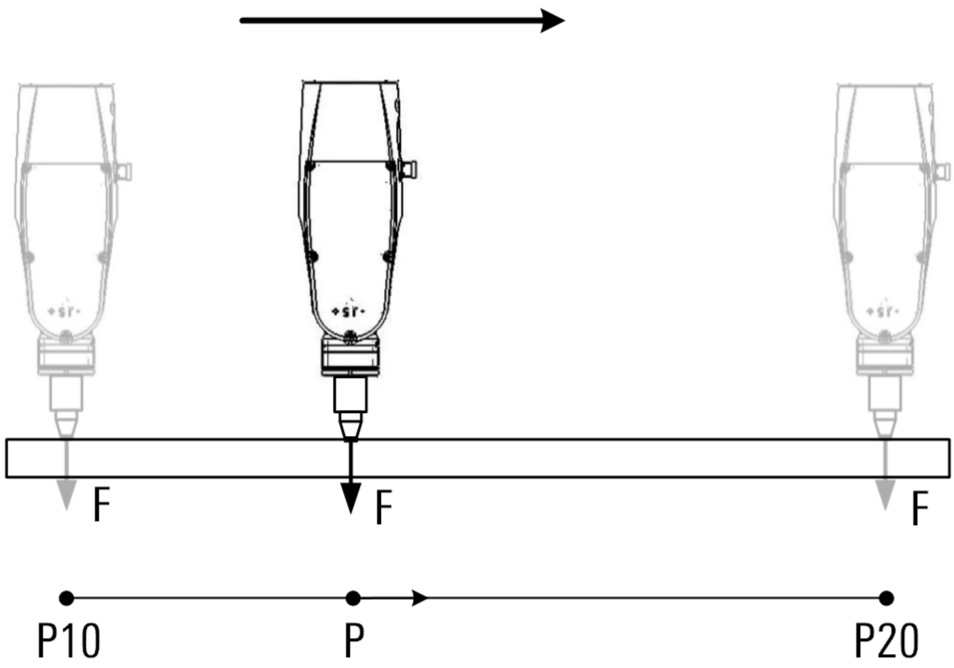


Figure 2-4 Reference pose when using movement instructions

Table 2-5 Picture description

No.	Description
P10	The programmed position before the move instruction.
P20	The programming target of the move instruction.
P	The reference position of the current robot position, located on the reference path between p10 and p20.
F	Force

3 Permission level

When using the AIR-TP teach pendant for the first time, it will prompt the user interface when logging in for the first time, and the user can choose:

- Teacher: Permission 4

It can perform operations such as writing the robot working program, and has the authority to modify some parameters. The initial login password is: PEACE.

- Operator: Permission 5

The robot's position parameter operation status can be simply checked, and there is no program modification or parameter modification authority. The initial login password is: LOVE.

Tip	Ordinary users can only log in to the teach pendant with the authority of teacher and operator.

4 Configuration of torque obtained by internal estimation

4.1 Channel parameter configuration

The configuration steps are as follows.

Step1. As shown in Figure 4-1, select [System/Parameter Configuration] in the upper right corner of the main interface to enter the [Parameter Configuration] interface shown in Figure 4-2.

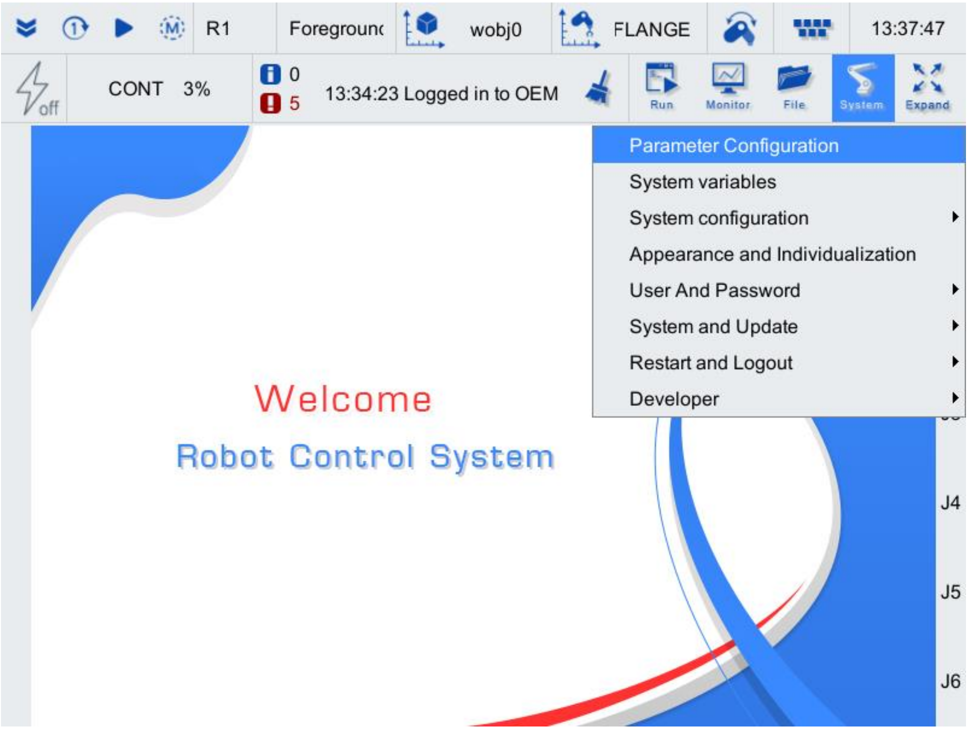


Figure 4-1 [Parameter configuration] selection list

Figure 4-2 [Parameter configuration] tab display area

Step2. In the [Channel 1] interface, click to select the [SF_ENABLE (Enable soft float in Cartesian or axis space)] parameter.

Step3. Click <Edit>, and the dialog box shown in Figure 4-3 will pop up. Select [Value] as true, and click <Yes>. The parameter description is shown in Table 4-1.

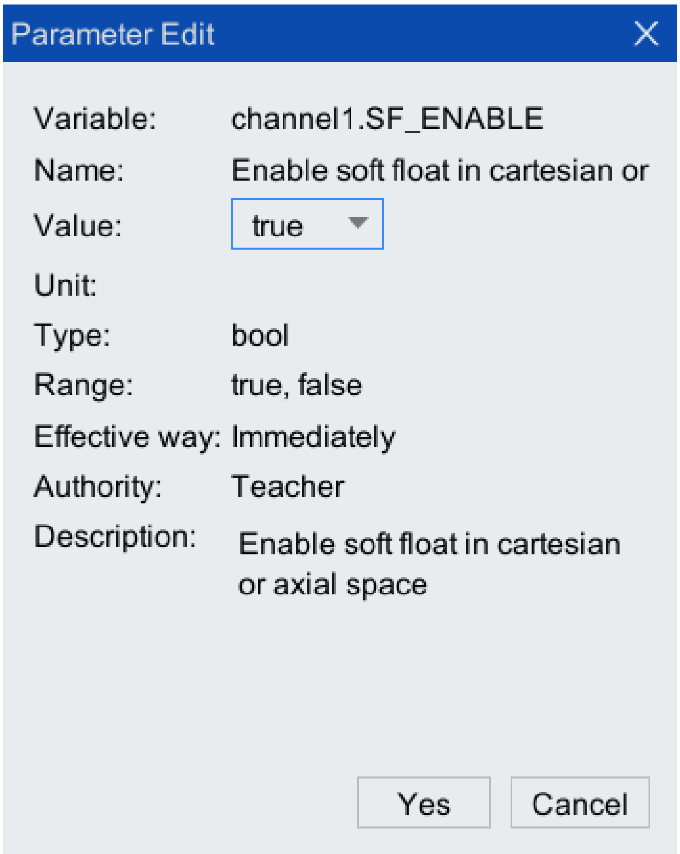


Figure 4-3 Enable Cartesian or axis space soft float interface

Table 4-1 Parameter Description

Parameter	Description
Value	Enable Cartesian or axis space soft float. The values are as follows: ■ ture: Enable Cartesian or axis space soft float. ■ false: Disable Cartesian or axis space soft float.

Step4. In the [Channel] interface, click to select the [SF_TYPE (Acquisition method of soft float getting external force)] parameter.

Step5. Click <Edit>, and the dialog box shown in Figure 4-4 will pop up. Configure the parameter in [Value] to "estimate" and click <Yes>. The parameter description is shown in Table 4-2.

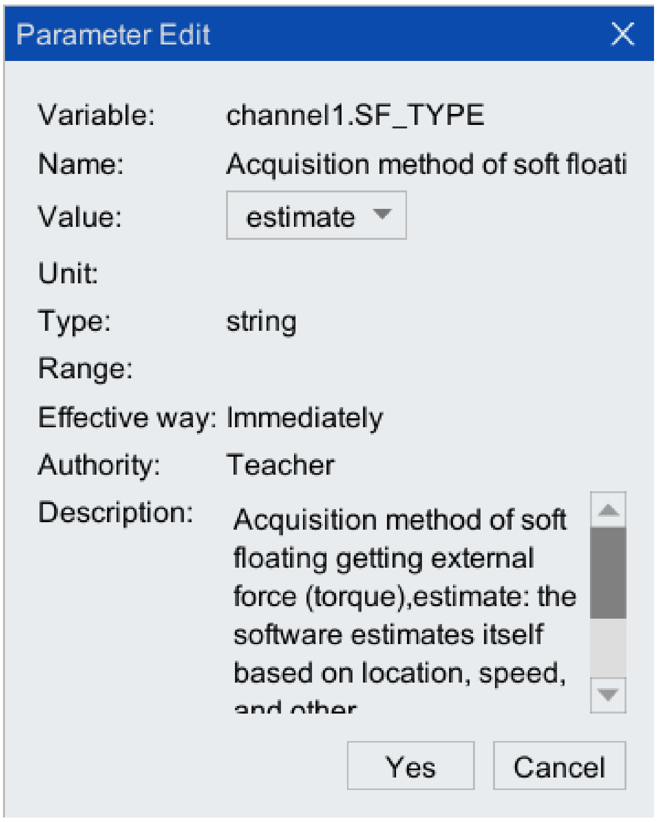


Figure 4-4 Soft float external force acquisition method configuration interface

Table 4-2 Parameter Description

Parameter	Description
Value	There are two ways to obtain the soft float external force (torque), and the values are as follows: ■ estimate: Internal estimation method. Means that the software estimates itself based on information such as position and speed. ■ sensor: Sensor method. Means obtained from the torque sensor.

Step6. Select the [Global] tab, as shown in Figure 4-5, and click [+] before each sub-item of [TOOL_INERTIA (tool inertia parameter)] to display the parameters that need to be configured. There are 32 groups of optional sub-items for tool inertia parameters, and the items are from [0] to [31].

Step7. Configure the inertia parameters of the tool according to the actual use of the tool. The parameter description is shown in Table 4-3.

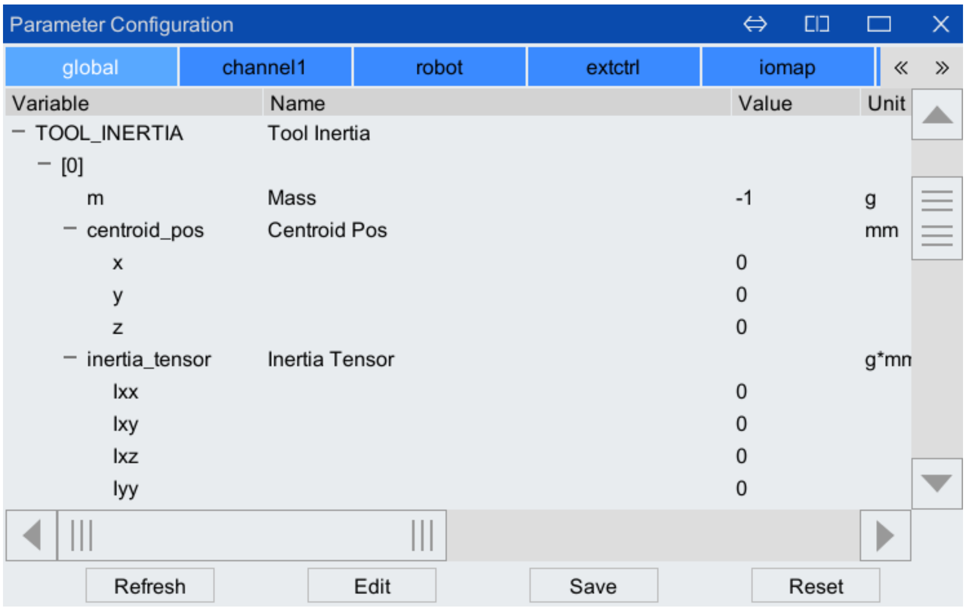


Figure 4-5 Tool inertia parameter setting interface

Table 4-3 Tool inertia parameters

Variable		Unit	Meaning	Remark
m		g	Quality	Tool quality
centroid_pos	x	mm	Centroid coordinates	The centroid reference coordinate system is the flange coordinate system
	y	mm		
	z	mm		
Inertia_tensor	Ixx	$g*mm^2$	Inertia tensor	For the inertial principal axis, Ixy, Iyz, Izx are all 0
	Ixy	$g*mm^2$		
	Ixz	$g*mm^2$		
	Iyy	$g*mm^2$		
	Iyz	g*mm2		
	Izz	g*mm2		

Step8. Click to select the row of the parameter that needs to be configured, and click <Edit>.

Step9. In the pop-up [Parameter Edit] interface, configure [Value].

Step10. The setting of tool inertia parameters is divided into the following situations:

- If no tool is installed on the operating machine, the values of the parameters m, x, y, z, Ixx, Ixy, Ixz, Iyy, Iyz, and Izz under the corresponding tool item are all set to 0.
- If the operating machine is equipped with tools, the corresponding tool inertia parameters can be determined according to the following two methods:

Determined according to modeling calculation: Use software to draw the three-dimensional model of the tool and correctly configure the material properties, and solve the inertial parameters of the tool model in a reasonable coordinate system, which can be equivalent to the inertial parameters of the actual tool.

Provided by the tool supplier: If the tool is obtained through procurement channels, the inertia parameter value corresponding to the tool can be provided by the supplier.

Step11. After the parameter configuration is completed, click <Save>, and the dialog box shown in Figure 4-6 will pop up. Select "Save all" in [Please select save type], and click <Yes>.

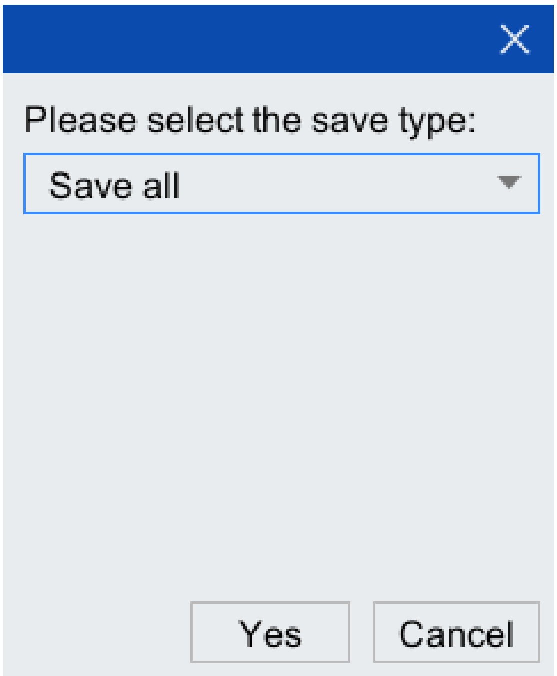


Figure 4-6 Save as type dialog

Step12. Click <Yes> in the prompt dialog box that pops up. As shown in Figure 4-7.

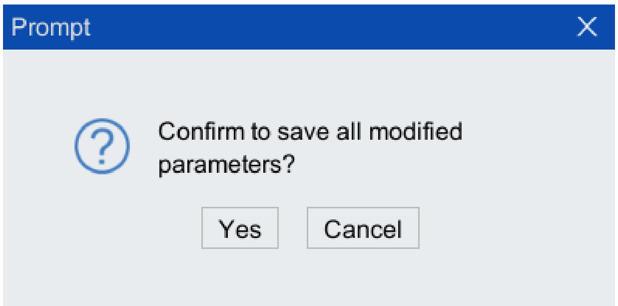


Figure 4-7 Confirm to save the modification prompt box

Step13. Click <Yes> in the dialog box that pops up successfully to save the parameters. As shown in Figure 4-8.

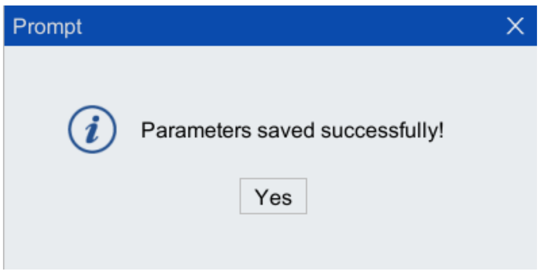


Figure 4-8 Save successful prompt box

4.2 Configuration of mechanical unit parameters

Danger	Adjusting the stiffness and damping parameters may cause speeding. Users do not adjust the stiffness and damping parameters by themselves. If you need to adjust, please contact our after-sales personnel.

The configuration steps are as follows:

Step1. In the [Robot] interface, click to select [SF_JNT_DAM (Axis impedance control damping parameter)].

Step2. Click <Edit>, and the dialog box shown in Figure 4-9 will pop up. Configure the parameter value in [Value], and click <YES> after completing the configuration. See Table 4-4 for parameter description.

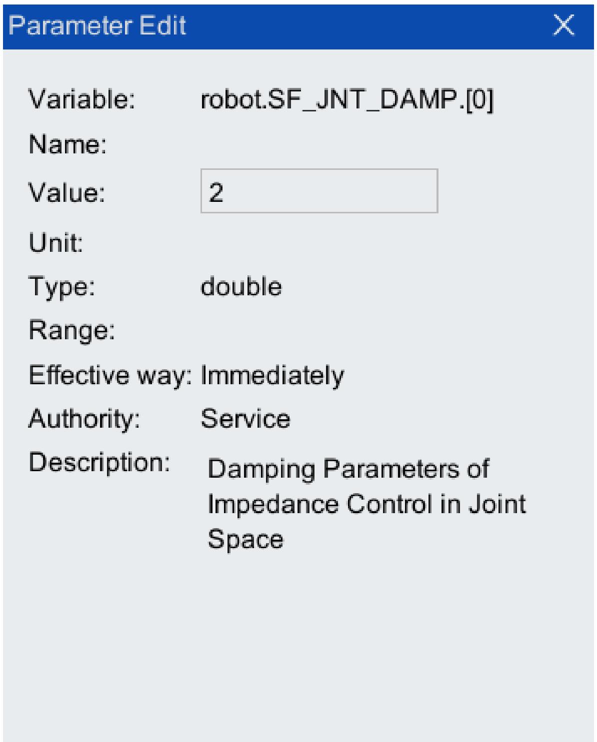


Figure 4-9 Configuration interface of shaft impedance control damping parameters

Table 4-4 Parameter Description

Parameter	Description
Value	The damping parameter of shaft impedance control is the initial value of shaft damping. Danger: Users should not configure this parameter by themselves. For configuration and adjustment, please contact our after-sales personnel.

Step3. In the [Robot] interface, click to select [SF_CAS_DAMP (Cartesian impedance control damping parameter)].

Step4. Click <Edit>, and the dialog box shown in Figure 4-10 will pop up. Configure the parameter value in [Value], and click <YES> after completing the configuration. See Table 4-5 for parameter description.

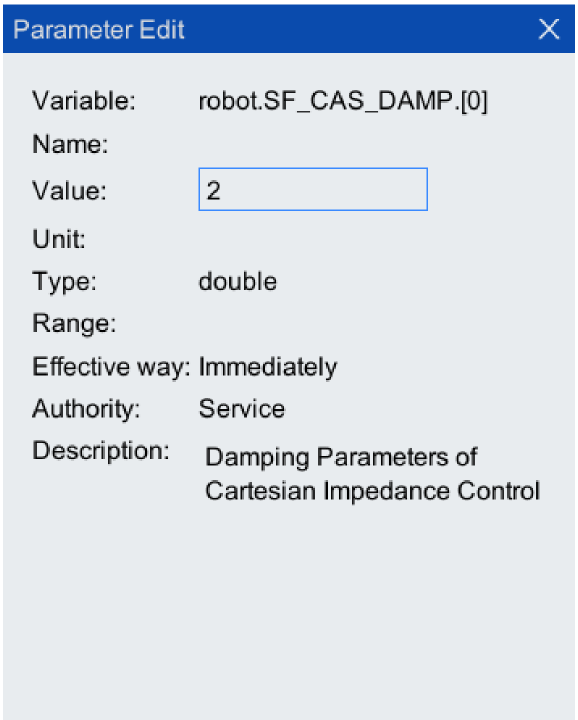


Figure 4-10 Cartesian impedance control damping parameter configuration interface

Table 4-5 Parameter Description

Parameter	Parameter
Value	The damping parameter of Cartesian impedance control is the initial value of Cartesian damping. Danger: Users should not configure this parameter by themselves. For configuration and adjustment, please contact our after-sales personnel.

Step5. In the [Robot] interface, click to select [SF_STATIC_THRES (static friction threshold coefficient)].

Step6. Click <Edit>, and the dialog box shown in Figure 4-11 will pop up. Configure the parameter value in [Value], and click <Yes> after completing the configuration. See Table 4-6 for parameter description.

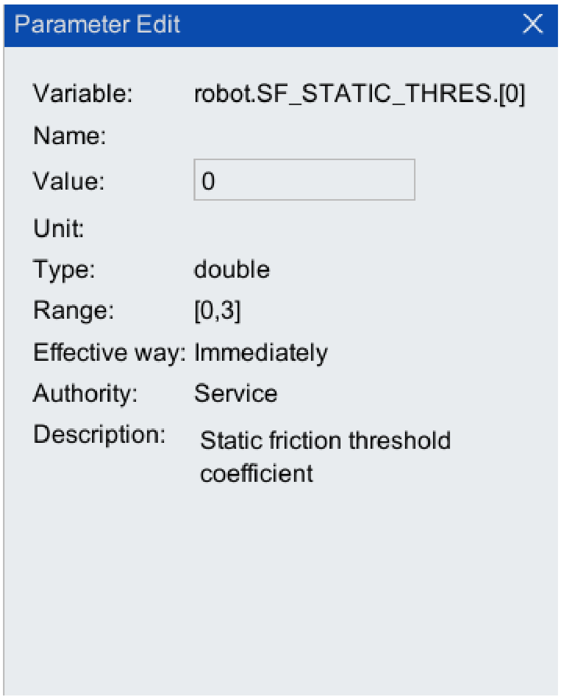


Figure 4-11 Configuration interface of static friction threshold coefficient

Table 4-6 Parameter Description

Parameter	Description
Value	Static friction threshold coefficient  Users should not configure this parameter by themselves. For configuration and adjustment, please contact our after-sales personnel.

Step7. After the parameter configuration is completed, click <Save>, and the dialog box shown in Figure 4-12 will pop up. Select "Save all" in [Please select save type], and click <Yes>.

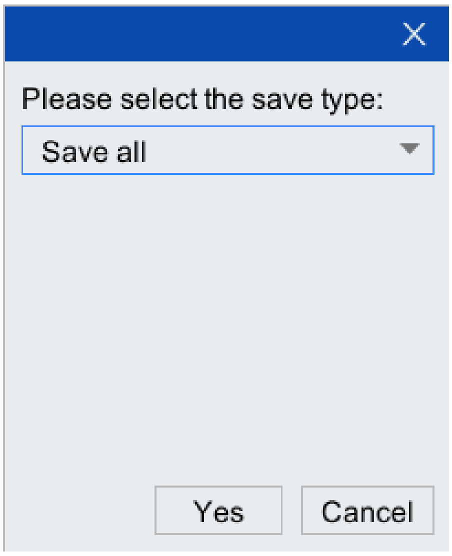


Figure 4-12 Save as type dialog

Step8. Click <Yes> in the prompt dialog box that pops up. As shown in Figure 4-13.

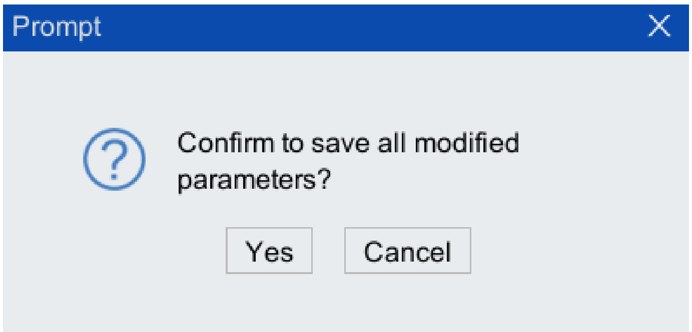


Figure 4-13 Confirm to save the modification prompt box

Step9. Click <Yes> in the dialog box that pops up successfully to save the parameters. As shown in Figure 4-14.

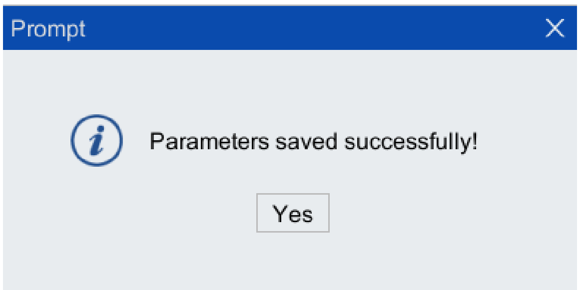


Figure 4-14 Save successful prompt box

4.3 Soft float monitoring

The configuration steps are as follows.

Step1. In the [Robot] interface, click the [+] before [SF_CAS_MONITOR (Cartesian space soft float monitoring parameter)] to display the parameters that need to be configured. As shown in Figure 4-15, the parameter description is shown in Table 4-7.

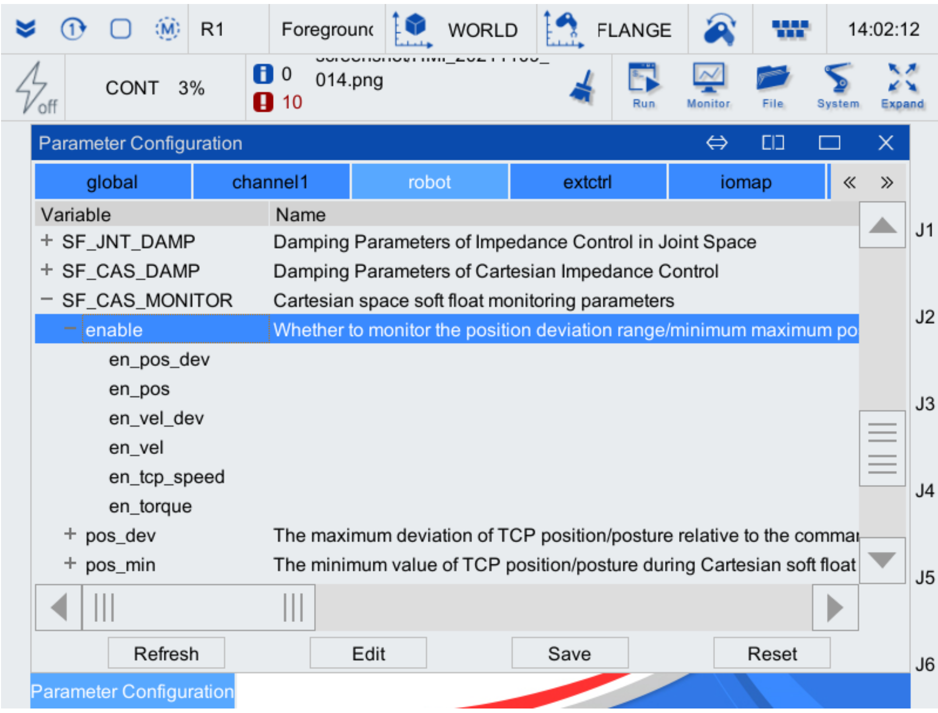


Figure 4-15 Cartesian space soft float monitoring parameter configuration interface

Table 4-7 Parameter Description

Variable		Unit	Meaning
Enable (Whether to enable monitoring)	en_pos_dev	-	Whether the range of pose deviation is monitored The range of values is: ■ ture ■ false
	en_pos	-	Whether to monitor the pose The range of values is: ■ ture ■ false
	en_vel_dev	-	Whether the speed deviation is monitored The range of values is: ■ ture ■ false
	en_vel	-	Whether TCP speed is monitored The range of values is: ■ ture ■ false
	en_tcp_speed	-	Whether the maximum TCP speed is monitored The range of values is: ■ ture ■ false
	en_torque	-	Whether the torque is monitored The range of values is: ■ ture ■ false
pos_dev (Position deviation range)	x	mm	The maximum deviation between the actual position and the instruction position in the X-axis direction.
	y	mm	The maximum deviation between the actual position and the instruction position in the Y-axis direction.
	z	mm	The maximum value of the deviation between the actual position and the instruction position in the Z-axis direction.
	rx	degree	The maximum value that can be deviated from the instruction position when rotating around the X axis.
	ry	degree	The maximum value that can be deviated from the instruction position when rotating around the Y axis.
	rz	degree	The maximum value that can be deviated from the instruction position when rotating around the Z axis.
pos_min (Minimum position)	x	mm	The minimum value of the X component of TCP in Cartesian space.
	y	mm	The minimum value of the Y component of TCP in Cartesian space.
	z	mm	The minimum value of the Z component of TCP in Cartesian space.

Variable		Unit	Meaning
	rx	degree	The minimum value of the TCP component rotating around the X axis in Cartesian space.
	ry	degree	The minimum value of the TCP component rotating around the Y axis in Cartesian space.
	rz	degree	The minimum value of the TCP component rotating around the Z axis in Cartesian space.
pos_max (Maximum position)	x	mm	The maximum value of the X component of TCP in Cartesian space.
	y	mm	The maximum value of the Y component of TCP in Cartesian space.
	z	mm	The maximum value of the Z component of TCP in Cartesian space.
	rx	degree	The maximum value of the TCP rotation component around the X axis in Cartesian space.
	ry	degree	The maximum value of the TCP rotation component around the Y axis in Cartesian space.
	rz	degree	The maximum value of the TCP rotation component around the Z axis in Cartesian space.
vel-dev (Speed deviation range)	x	mm	The maximum deviation between the actual speed and the instruction speed in the X-axis direction.
	y	mm	The maximum deviation between the actual speed and the instruction speed in the Y-axis direction.
	z	mm	The maximum deviation between the actual speed and the instruction speed in the Z-axis direction.
	rx	degree	The maximum deviation between the actual speed and the instruction speed around the X axis.
	ry	degree	The maximum deviation between the actual speed and the instruction speed around the Y axis.
	rz	degree	The maximum deviation between the actual speed and the instruction speed around the Z axis.
vel (Speed range)	x	mm	The maximum value of the X component of TCP velocity in Cartesian space.
	y	mm	The maximum value of the Y component of TCP velocity in Cartesian space.
	z	mm	The maximum value of the Z component of TCP velocity in Cartesian space.
	rx	degree	The maximum value of the rotation component of the TCP velocity around the X axis in Cartesian space.
	ry	degree	The maximum value of the rotation component of the TCP velocity around the Y axis in Cartesian space.
	rz	degree	The maximum value of the rotation component of the TCP velocity around the Z axis in Cartesian space.
tcp_speed (Maximum TCP		Mm/s	The maximum line speed of TCP.

Variable		Unit	Meaning
speed)			
torque (Torque range)	Force_x		The TCP receives the maximum torque in the X direction.
	Force_y		The TCP receives the maximum torque in the Y direction.
	Force_z		The TCP receives the maximum torque in the Z direction.
	torque_x		The TCP is subjected to the maximum torque in the X direction.
	torque_y		The TCP is subjected to the maximum torque in the Y direction.
	torque_z		The TCP is subjected to the maximum torque in the Z direction.

Step2. In the [Robot] interface, click the [+] before [SF_CAS_MONITOR (Axis space soft float monitoring parameter)] to display the parameters that need to be configured. As shown in Figure 4-16, the parameter description is shown in Table 4-8.

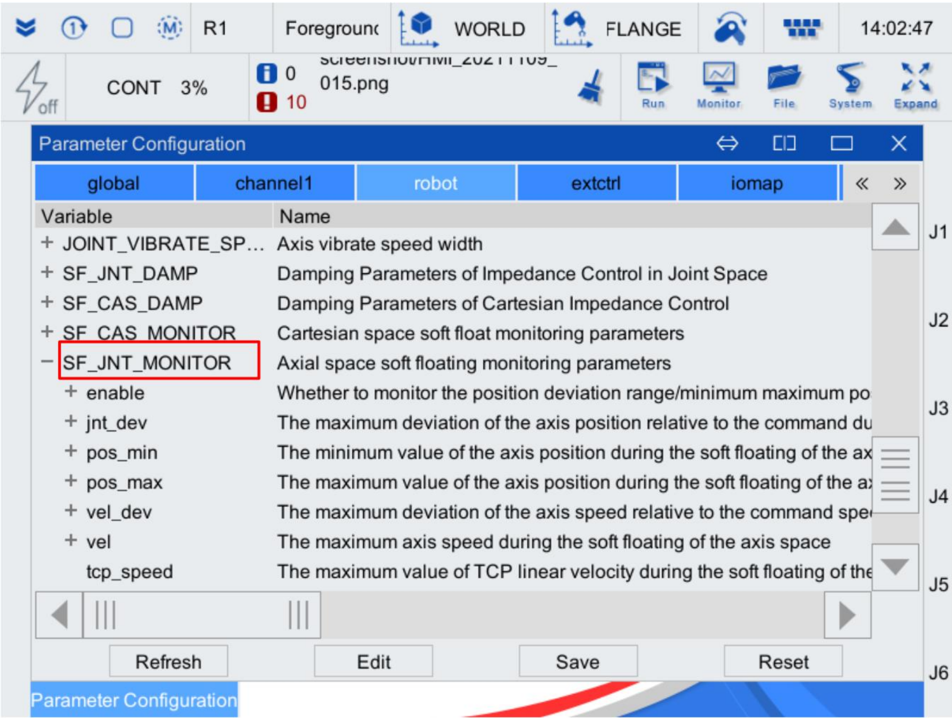


Figure 4-16 Axis space soft float monitoring parameter configuration interface

Table 4-8 Parameter Description

Parameter		Unit	Description
enable (Whether to enable monitoring)	en_jnt_dev	-	Whether the range of pose deviation is monitored The range of values is: ■ ture ■ false
	en_jnt	-	Whether to monitor the pose The range of values is: ■ ture ■ false

Parameter		Unit	Description
	en_vel_dev	-	Whether the speed deviation is monitored The range of values is: ■ ture ■ false
	en_vel	-	Whether TCP speed is monitored The range of values is: ■ ture ■ false
	en_tcp_speed	-	Whether the maximum TCP speed is monitored The range of values is: ■ ture ■ false
	en_torque	-	Whether the torque is monitored The range of values is: ■ ture ■ false
jnt_dev (Position deviation range)	j1	degree	The maximum deviation angle between the actual position of axis 1 and the instruction position.
	j2	degree	The maximum deviation angle between the actual position of axis 2 and the instruction position.
	j3	degree	The maximum deviation angle between the actual position of axis 3 and the instruction position.
	j4	degree	The maximum deviation angle between the actual position of axis 4 and the instruction position.
	j5	degree	The maximum deviation angle between the actual position of axis 5 and the instruction position.
	j6	degree	The maximum deviation angle between the actual position of axis 6 and the instruction position.
jnt_min (Minimum position)	j1	degree	The minimum value of 1 axis angle.
	j2	degree	The minimum value of 2 axis angle.
	j3	degree	The minimum value of 3 axis angle.
	j4	degree	The minimum value of 4 axis angle.
	j5	degree	The minimum value of 5 axis angle.
	j6	degree	The minimum value of 6 axis angle.
jnt_max (Maximum position)	j1	degree	The maximum value of 1 axis angle.
	j2	degree	The maximum value of 2 axis angle.
	j3	degree	The maximum value of 3 axis angle.
	j4	degree	The maximum value of 4 axis angle.

Parameter		Unit	Description
	j5	degree	The maximum value of 5 axis angle.
	j6	degree	The maximum value of 6 axis angle.
vel-dev (Speed deviation range)	j1	degree	The maximum deviation between the actual speed of axis 1 and the instruction speed.
	j2	degree	The maximum deviation between the actual speed of axis 2 and the instruction speed.
	j3	degree	The maximum deviation between the actual speed of axis 3 and the instruction speed.
	j4	degree	The maximum deviation between the actual speed of axis 4 and the instruction speed.
	j5	degree	The maximum deviation between the actual speed of axis 5 and the instruction speed.
	j6	degree	The maximum deviation between the actual speed of axis 6 and the instruction speed.
vel (Speed range)	j1	degree	Maximum speed of 1 axis.
	j2	degree	Maximum speed of 2 axis.
	j3	degree	Maximum speed of 3 axis.
	j4	degree	Maximum speed of 4 axis.
	j5	degree	Maximum speed of 5 axis.
	j6	degree	Maximum speed of 6 axis.
tcp_speed (Maximum TCP speed)		mm/s	The maximum line speed of TCP.
torque (Torque range)	j1	degree	The maximum value of external torque on axis 1.
	j2	degree	The maximum value of external torque on axis 2.
	j3	degree	The maximum value of external torque on axis 3.
	j4	degree	The maximum value of external torque on axis 4.
	j5	degree	The maximum value of external torque on axis 5.
	j6	degree	The maximum value of external torque on axis 6.

Step3. After the parameter configuration is completed, click <Save>, and the dialog box shown in Figure 4-17 will pop up. Select "Save all" in [Please select save type], and click <Yes>.

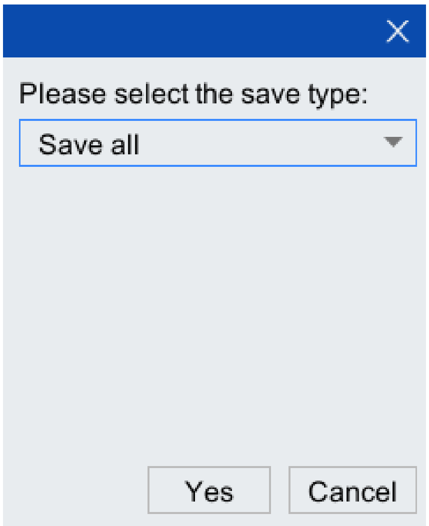


Figure 4-17 Save as type dialog

Step4. Click <Yes> in the prompt dialog box that pops up. As shown in Figure 4-18.

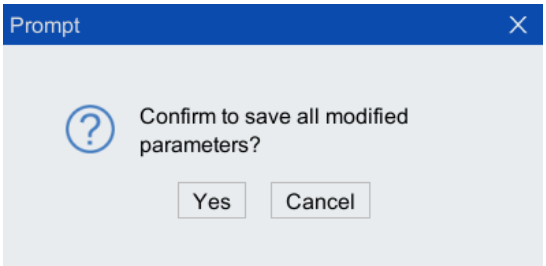


Figure 4-18 Confirm to save the modification prompt box

Step5. Click <Yes> in the pop-up dialog box of successful parameter saving. As shown in Figure 4-19.

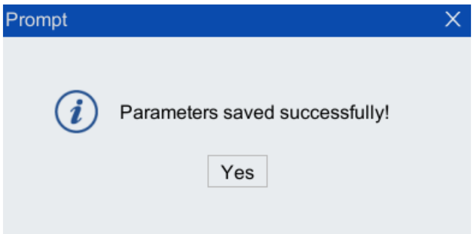


Figure 4-19 Save successful prompt box

5 Soft float instruction

See Table 5-1 for soft float instructions and descriptions.

Table 5-1 Soft float instructions and descriptions

Instruction	Name
startcasfloat	Open Cartesian space soft float
startjointfloat	Open axis space soft float
endfloat	End soft float

Danger

Adjusting the stiffness and damping parameters may cause speeding. Users do not adjust the stiffness and damping parameters by themselves. If you need to adjust, please contact our after-sales personnel.

Tip

When the soft float instruction is running, click the <||> (pause) at the upper right of the teach pendant operation panel, and the robot will still be in the soft float state. To exit the soft float state of the robot, press <RESET> (emergency stop) on the operation panel of the teach pendant.

5.1 Start Cartesian space soft float instruction(startcasfloat)

Instruction description

Start the Cartesian space soft float command.

Insert instruction steps

Step1. Click [Insert Cmd/Motion Control/Soft float], and the selection menu as shown in Figure 5-1 will pop up.

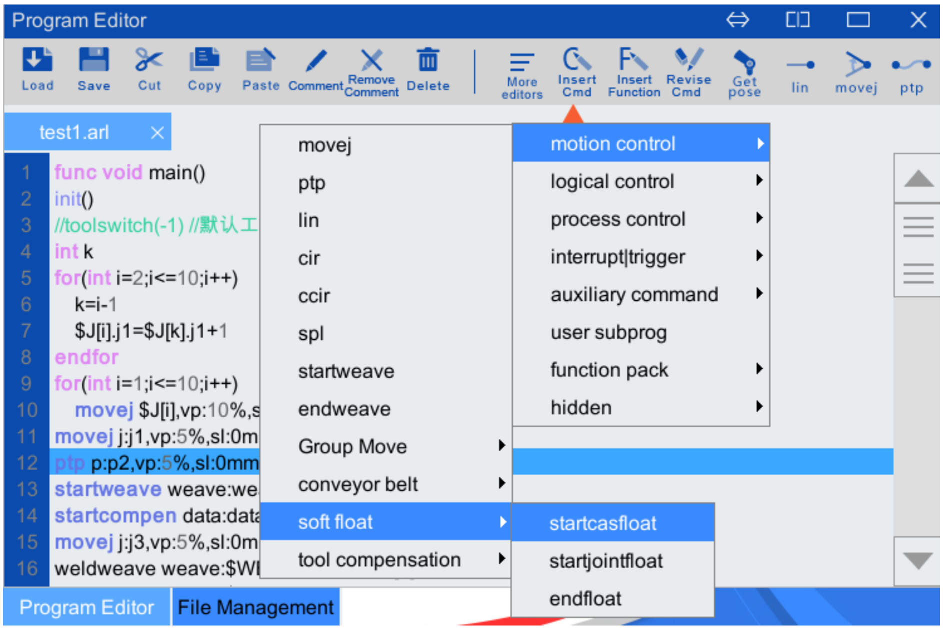


Figure 5-1 Soft float submenu instruction

Step2. Click [startcasfloat] in the selection menu, and the configuration interface shown in Figure 5-2 will pop up. Configure the parameter [rf], the parameter description is shown in Table 5-2.

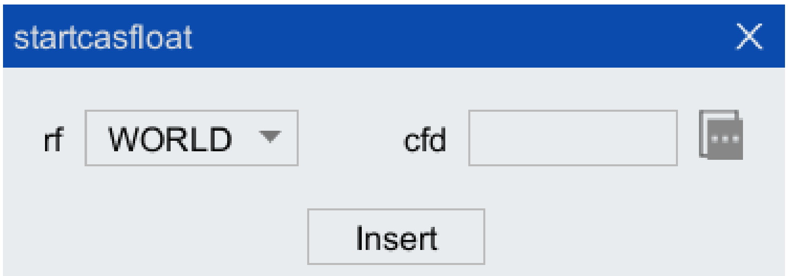


Figure 5-2 Parameter configuration interface

Table 5-2 Parameter Description

Parameter	Description
rf	The reference coordinate system of the floating direction. The optional coordinate systems are as follows: ■ WORLD: World coordinate system ■ BASE: Base coordinate system ■ wobj: Workpiece coordinate system ■ tool: Tool coordinate system
cfd	Cartesian space soft float parameters

Step3. Click the "" after the [cfd] parameter, and the configuration interface shown in Figure 5-3 will pop up. Configure the parameters. The parameter descriptions are shown in Table 5-3.

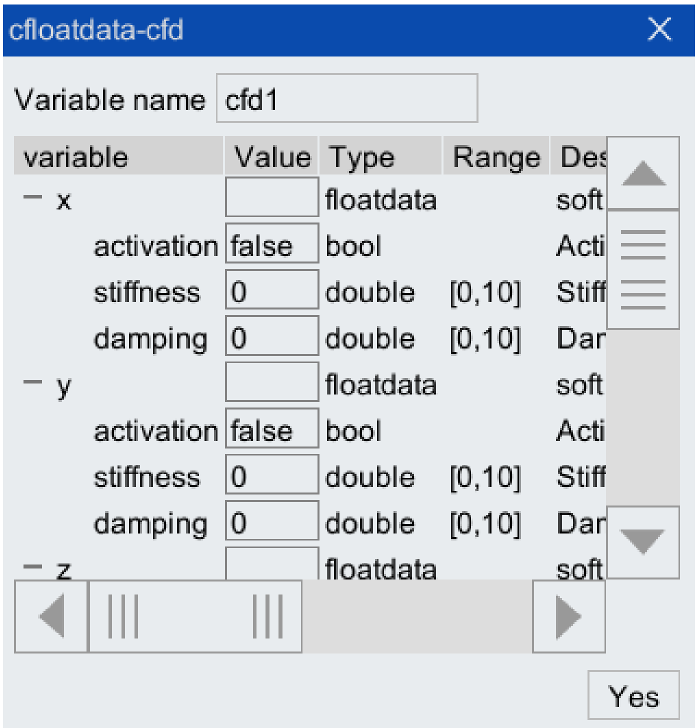


Figure 5-3 Parameter configuration interface

Table 5-3 Parameter Description

Parameter		Description
-x		X-direction soft float configuration parameters.
	activation	Activate now ■ ture: Activate now ■ false: Turn off activation
	stiffness	Stiffness factor. In integer form, the value range is 0~10.
	damping	Damping coefficient. In integer form, the value range is 0~10.
-y		Y direction soft float configuration parameters.
	activation	Whether to activate. ■ ture: Turn on activation ■ false: Turn off activation
	stiffness	Stiffness factor. In integer form, the value range is 0~10.
	damping	Damping coefficient. In integer form, the value range is 0~10.
-z		Z direction soft float configuration parameters.
	activation	Whether to activate. ■ ture: Turn on activation ■ false: Turn off activation
	stiffness	Stiffness factor. In integer form, the value range is 0~10.
	damping	Damping coefficient. In integer form, the value range is 0~10.
-rx		Soft float configuration parameters around the X axis.
	activation	Whether to activate. ■ ture: Turn on activation ■ false: Turn off activation
	stiffness	Stiffness factor. In integer form, the value range is 0~10.
	damping	Damping coefficient. In integer form, the value range is 0~10.
-ry		Soft float configuration parameters around Y axis.
	activation	Whether to activate. ■ ture: Turn on activation ■ false: Turn off activation
	stiffness	Stiffness factor. In integer form, the value range is 0~10.
	damping	Damping coefficient. In integer form, the value range is 0~10.
-rz		Soft float configuration parameters around the Z axis.
	activation	Whether to activate. ■ ture: Turn on activation ■ false: Turn off activation
	stiffness	Stiffness factor. In integer form, the value range is 0~10.

Parameter		Description
	damping	Damping coefficient. In integer form, the value range is 0~10.

Step4. After the configuration is complete, click <Yes>. Save [cfd] parameter configuration.

Step5. Click <Insert> to generate a soft float instruction to start Cartesian space.

Instruction format

startcasfloat rf: "WORLD",cfd:cfd1

5.2 Start axis space soft float instruction(startjointfloat)

Instruction description

Start the axis space soft float instruction.

Insert instruction step

Step1. Click [Insert Cmd/Motion Control/Soft float], and the selection menu shown in Figure 5-4 will pop up.

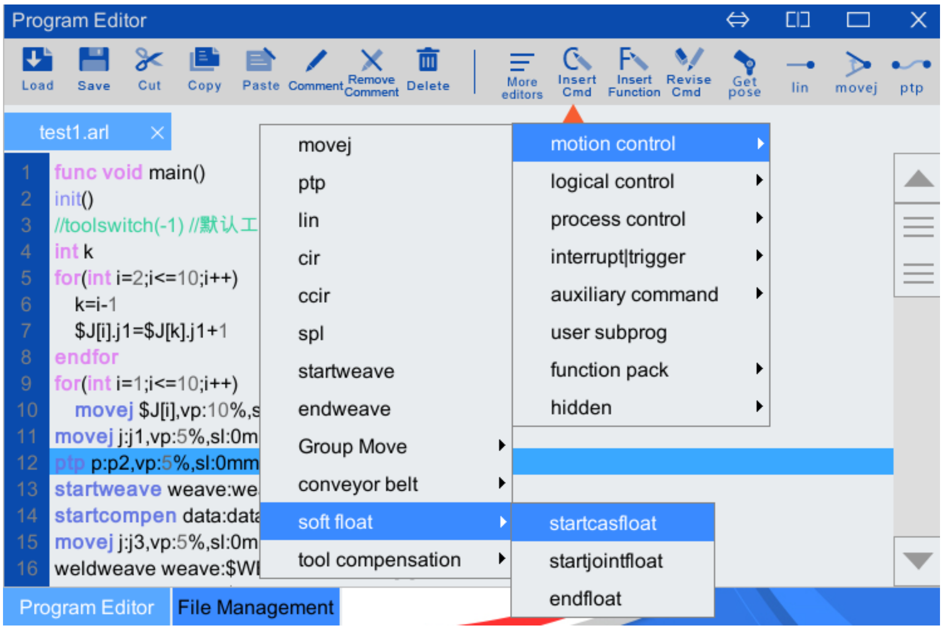


Figure 5-4 Soft float submenu command

Step2. Click [startjointfloat] in the selection menu, and the configuration interface shown in Figure 5-5 will pop up.

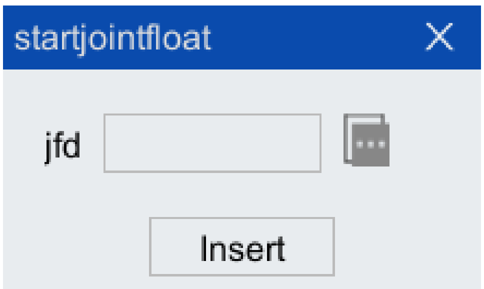


Figure 5-5 Parameter configuration interface

Step3. Click the " " after the [jfd] parameter, and the configuration interface shown in Figure 5-6 will pop up. Configure the parameters. The parameter descriptions are shown in Table 5-1.

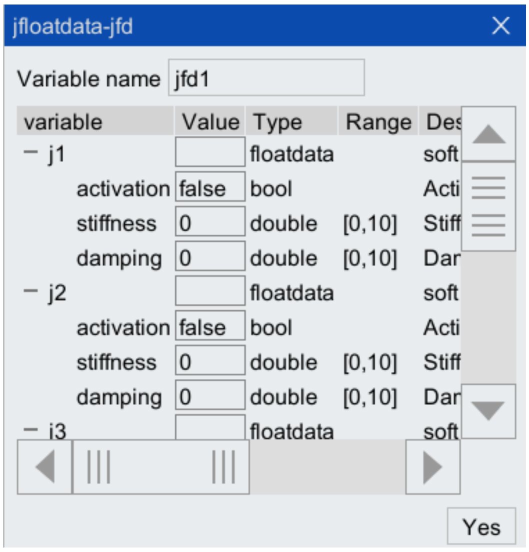


Figure 5-6 Parameter configuration interface

Table5-4 Parameter Description

Parameter		Description
-j1		1 axis soft float configuration parameters.
	activation	Whether to activate. ■ ture: Turn on activation ■ false: Turn off activation
	stiffness	Stiffness factor. In integer form, the value range is 0~10.
	damping	Damping coefficient. In integer form, the value range is 0~10.
-j2		2 axis soft float configuration parameters.
	activation	Whether to activate. ■ ture: Turn on activation ■ false: Turn off activation
	stiffness	Stiffness factor. In integer form, the value range is 0~10.
	damping	Damping coefficient. In integer form, the value range is 0~10.
-j3		3 axis soft float configuration parameters.
	activation	Whether to activate. ■ ture: Turn on activation ■ false: Turn off activation
	stiffness	Stiffness factor. In integer form, the value range is 0~10.
	damping	Damping coefficient. In integer form, the value range is 0~10.
-j4		4 axis soft float configuration parameters.
	activation	Whether to activate. ■ ture: Turn on activation

Parameter		Description
		■ false: Turn off activation
	stiffness	Stiffness factor. In integer form, the value range is 0~10.
	damping	Damping coefficient. In integer form, the value range is 0~10.
-j5		5 axis soft float configuration parameters.
	activation	Whether to activate. ■ ture: Turn on activation ■ false: Turn off activation
	stiffness	Stiffness factor. In integer form, the value range is 0~10.
	damping	Damping coefficient. In integer form, the value range is 0~10.
-j6		5 axis soft float configuration parameters.
	activation	Whether to activate. ■ ture: Turn on activation ■ false: Turn off activation
	stiffness	Stiffness factor. In integer form, the value range is 0~10.
	damping	Damping coefficient. In integer form, the value range is 0~10.

Step4. After the configuration is complete, click <Yes> to save the configuration of the [jfd] parameter.

Step5. Click <Insert> to generate start axis space soft float command.

Instruction format

startjointfloat jfd:jfd1

5.3 End soft float instruction(endfloat)

Instruction description

The endfloat instruction is used to end soft float.

Insert instruction step

Step1. Click [Insert Cmd/Motion Control/Soft float], and the selection menu shown in Figure 5-7 will pop up.

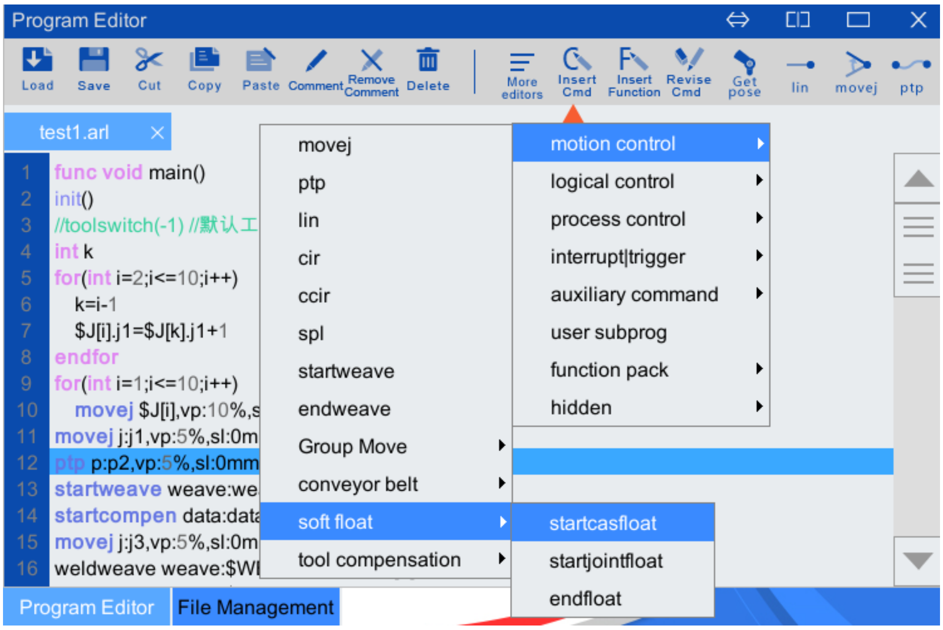


Figure 5-7 Soft float submenu command

Step2. Click [endfloat] in the selection menu, and the configuration interface shown in Figure 5-8 will pop up.

Figure 5-8 Insert command interface

Instruction format

endfloat

5.4 Program example

Application scenario

Figure 5-9 shows an example of the robot activating soft float (Z-axis direction) in the horizontal direction at position p1. By changing the stiffness and damping, the behavior of the robot can be controlled. A higher stiffness value will force the robot to return to position p1, while setting the stiffness to zero will make the robot float only when pushed externally. Damping control determines the degree to which the robot will resist the push of external machines.

This example shows a situation where the direction is known and the robot needs to be as soft as possible in that direction. The robot must cooperate with the machine to complete the extraction of parts.

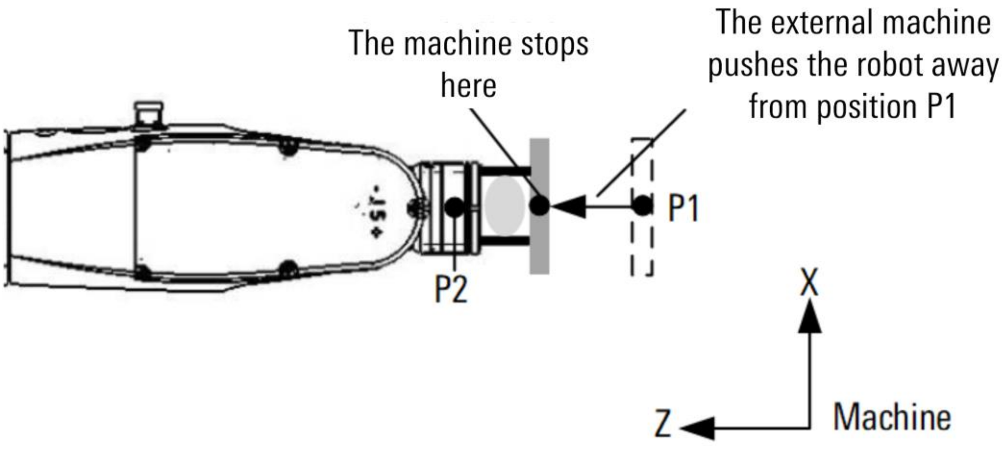


Figure 5-9 Diagram of application scenarios

Way of realization

The program example starts with the soft float on after the robot grabs the workpiece. After grasping the workpiece, the soft float will be turned on to make the robot soft in the Z direction of the machine. The stiffness is set to zero. At this point, the machine can start pushing the robot. After pressing is complete, move linearly to position p2 and disable soft float.

The configuration of turn on soft float instruction is as follows:

Step1. Click [Insert Cmd/Motion Control/Soft float], and select [startcasfloat] in the drop-down submenu. As shown in Figure 5-10.

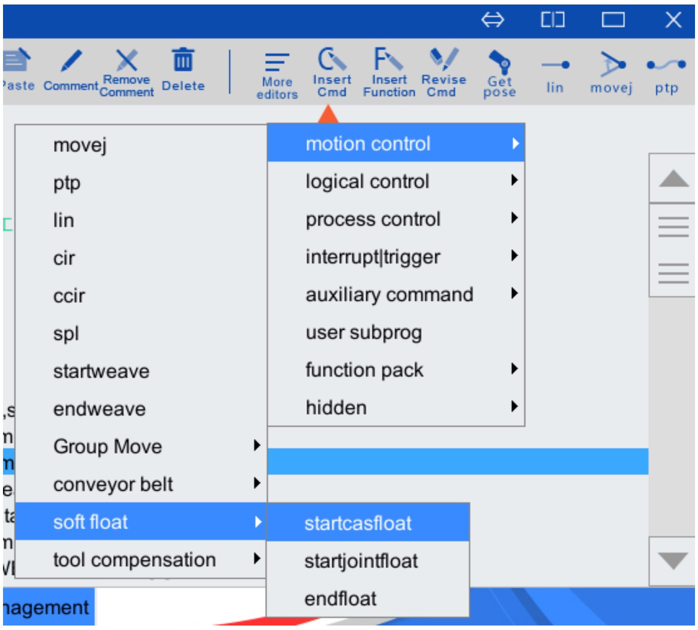


Figure 5-10 Instruction selection interface

Step2. The configuration interface shown in Figure 5-11 will pop up, and configure [rf] as "FLANGE".

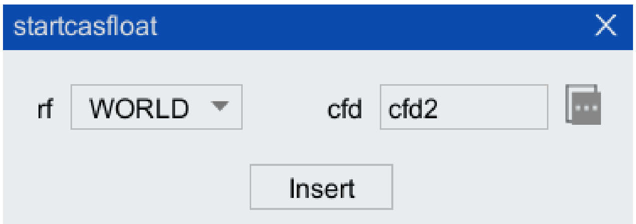


Figure 5-11 Parameter configuration interface

Step3. Click the " " after the [cfd] parameter, and the configuration interface shown in Figure 5-12 will pop up. The value of [activation] of the configuration variable Z is "true", and the value of the stiffness parameter [stiffness] is "0". Click <Yes> after the configuration is complete.

Figure 5-12 Parameter configuration interface

Step4. Click <Insert > to insert and start the Cartesian space soft float instruction. As shown in Figure 5-13.

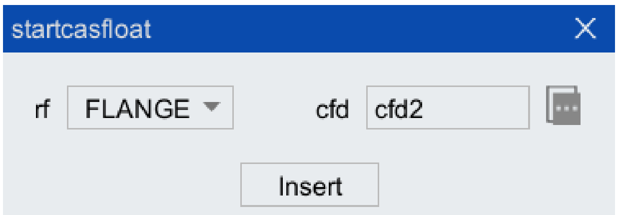


Figure 5-13 Parameter configuration interface

Code

The generated code is as follows:

```
func void main()

init()

//toolswitch(-1) // Default tool load

movej j:p1,vp:5%,sl:0mm,t:$FLANGE    // The robot moves to P1
```

```
setdo(1,1)    // Grab workpiece instruction

startcasfloat frame_id:36,cfd:cfd2    // Start Cartesian space float, turn on soft float in Z direction, and the stiffness is 0

waittime time:30    // Wait 30s for the external machine to push the robot

lin p:p2,vl:50mm/s,sl:0mm,t:$FLANGE,w:$WORLD    // The robot moves to P2

endfloat    // End soft float instruction

endfunc
```

PEITIAN ROBOTICS

WeChat Official Account

Official Website

Sevice Hotline : 400-990-0909
Official Website : http://robot.peitian.com

UM-P05070000006-001 / V1.1.0 / 2021.12.13