HYUNDAI ROBOTICS

WARNING

INSTALLATION SHOULD ONLY BE PERFORMED BY QUALIFIED INSTALLATION PERSONNEL AND MUST CONFORM TO ALL NATIONAL AND LOCAL CODES

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Hyundai Robot

Hi5aSJ230425FMEN3

Hi5a Controller Function Manual

SoftJoint

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1 Overview of Functions

1.1. Introduction

The SoftJoint function is used for making the individual axes of the robot move like a virtual spring against external forces. As the function is operated using software, there is no need for additional hardware, such as force or torque sensors, when using the function.

1.2. Summary of functions

- The function is for making individual axes of the robot move like a virtual spring against external forces.
  (When the softness is set as being small enough, relevant axes will recover at original angles when the external force is removed.)
- The softness of each axis can be adjusted by the AXIS.Softness command.
- It can be used for the robot axis and additional axes.
- Version of the supported software: Main, V40.03-00 or higher; DSP SV6.08or higher

1.3. Precautions for use

- For the same softness, the spring strength of each axis will grow as the robot size gets larger. This is because the link weight will get larger and the friction force will grow as the robot size gets larger.
  Increase in the spring strength means that more force is needed to push at the same angle.
- Before using this function, it is necessary to input the tool information through load estimation. [AXIS.Softness = 0] equals the function being off and [AXIS.Softness = 100] means showing the highest sensitivity to the external force.
- Depending on the level of softness and whether external force exists, individual axes may not move to the instructed position while the SoftJoint function is turned on. While there is a position error between the final command and the current position, if the function is turned off, control will be initiated for the relevant axis revert to the final instructed position. In this case, be careful about the possibility of the robot hitting an external area. To prevent such problems, it is necessary to use P* (current value) and the Move command to update the current angle that resulted from being pushed because of external force or gravity.
- In the following cases, be careful about the possibility of the axis dropping when the SoftJoint is turned on.
  - When the tool information has been inputted incorrectly: While the actual tool is 100 kg, it is inputted as 0 kg.
  - When AXIS.Softness has been inputted as too large:
    Example: When AXIS.Softness=80 is inputted, AXIS.Softness=70 or a lower value is required to prevent the axis from dropping.

2 How to Use

2.1. SoftJoint program structure

To use the SoftJoint function, softness should be set for each axis first. When all the work related to being pushed has ended, the SoftJoint function needs to be deactivated.

Classification	Description	Program Example
Condition settings	Sets the softness of each axis Setting the softness as 0 for an axis means that the SoftJoint for it is turned off.	AXIS5.Softness=10 AXIS8.Softness=100
Function starting	Turns on the SoftJoint function	SoftJoint ON
Function ending	Turns off the SoftJoint function When it is turned off, the softness for all axes will be reset to 0.	SoftJoint OFF

2.2. SoftJoint command statement

The command statements used in the SoftJoint function include “AXIS.Softness,” which is a command statement for setting the softness, and “SoftJoint,” which is a command statement for activating or deactivating the SoftJoint function.

2.2.1. AXIS.Softness statement

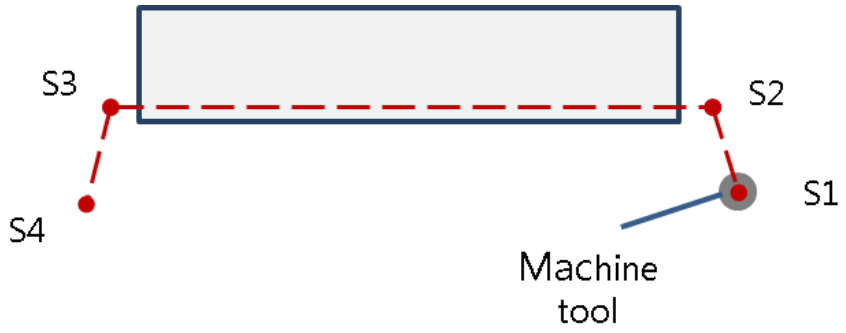
Description	A command statement for setting the softness of each axis to be used for the SoftJoint function.	
Input method	『[F6]: Command input』 → 『[F7]: Assign』 → 『PREV/NEXT』 → 『[F7]: AXIS』 → 『Axis number』 → 『.』 → 『[F2]: Softness』 → 『ENTER』 → 『Softness value』 → 『ENTER』 → 『ENTER』	
Grammar	AXIS<Axis number>.Softness=<Softness value>	
Parameter	Axis number	Number of the axis for which the SoftJoint function is to be used
	Softness value	Input 0–100
Example	AXIS5.Softness=90 AXIS10.Softness=80	Sets the softness of the B axis as 90 Sets the softness of the additional axis 10 as 80
Information	▪ Before executing SoftJoint ON, users must use the AXIS.Softness command statement for setting the softness for the axis that is designed to be pushed. ▪ AXIS.Softness=0 is equal to turning off the function. ▪ The higher the AXIS.Softness value gets, the less power is required to push at the same angle.	

2.2.2. SoftJoint statement

Description	A command statement for activating (ON) or deactivating (OFF) the SoftJoint function	
Input method	『[F6]: Command input』→『[F1]: Motion, I/O』→『PREV/NEXT』→『PREV/NEXT』→『PREV/NEXT』→『[F6]: SoftJoint』→『ON or OFF』→『ENTER』	
Grammar	SoftJoint <ON/OFF>	
Parameter	ON	Activates the SoftJoint function
	OFF	Deactivates the SoftJoint function
Example	When turning off the function while the final instructed angle and the current angle are the same	
	AXIS5.Softness=90 SoftJoint ON MOVE P,S=50 mm/s,A=0 SoftJoint OFF	Sets the softness of the B axis as 90 Function on External force applied while moving Function off
	When turning off the function while the final instructed angle and the current angle are different	
	AXIS5.Softness=90 SoftJoint ON MOVE P,S=50 mm/s,A=0 P1=P* MOVE P,P1,S=100%,A=7 SoftJoint OFF	Sets the softness of the B axis as 90 Function on External force applied while moving Saves the current angle in P1 right before the function is turned off Use MOVE command, update the final command to P1 Function off
Information	▪ When turning off the function while the final instructed angle and the current angle are different, a collision could occur while the relevant axis recovers at the final instructed angle. ▪ To prevent such problems, users need to update the final instruction by using P* and the Move command before turning off the SoftJoint. ▪ For this, P* should be set as the current value. (『[F1]: System』→『1: User environment』→『9: P* selection=Current value』)	

3 Example Program

Chamfering by using the SoftJoint function



S1	MOVE L,S=100mm/s,A=0,T=0	
S2	MOVE L,S=100mm/s,A=0,T=0	
	AXIS4.Softness=80	Sets the softness of the R2 axis as 80
	AXIS5.Softness=90	Sets the softness of the R2 axis as 90
	SoftJoint ON	SoftJoint function on
S3	MOVE L,S=50mm/s,A=0,T=0	Moves to S3 and carries out chamfering
	SoftJoint OFF	SoftJoint function off
S4	MOVE L,S=100mm/s,A=0,T=0	
	END	

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