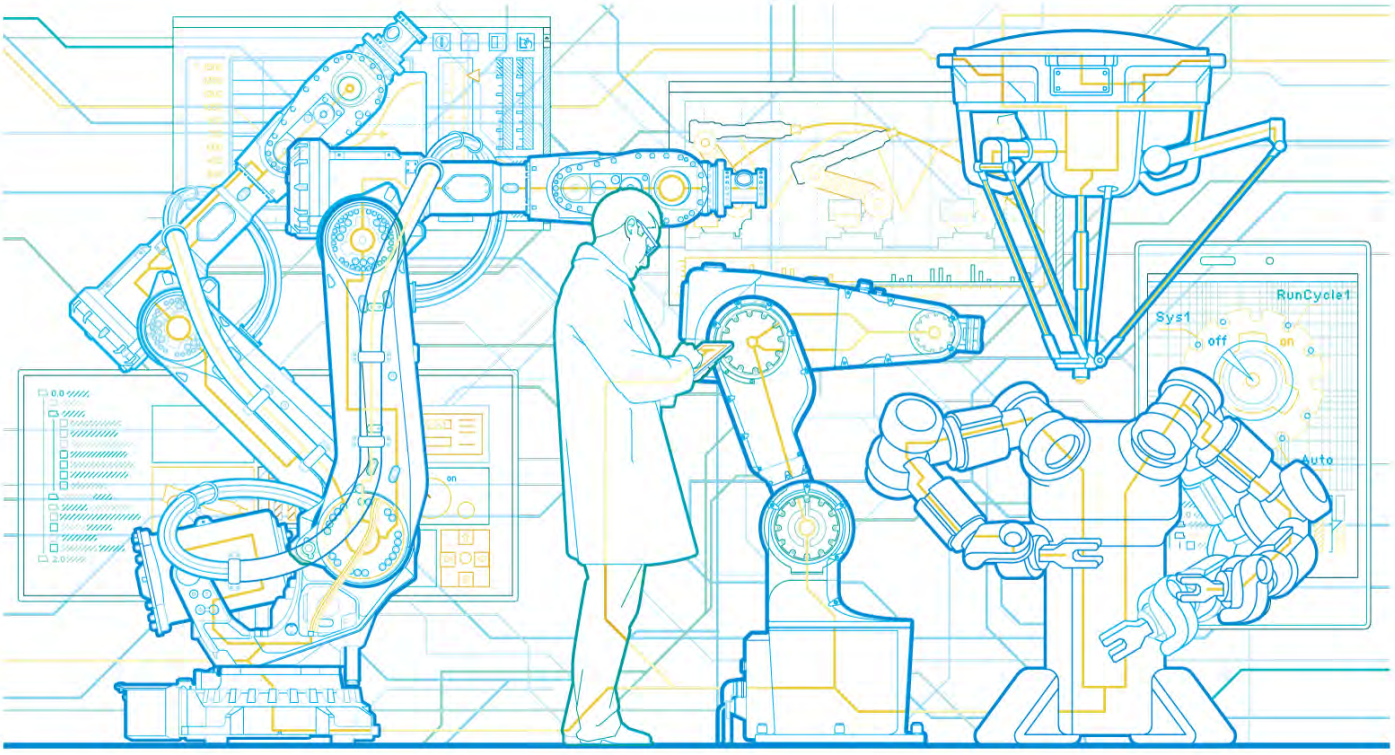


# Operating manual
# Cutting PowerPac

Trace back information:
Workspace Main version a205
Checked in 2017-02-27
Skribenta version 4.6.334

# Operating manual

# Cutting PowerPac

RobotStudio 6.04

Document ID: 3HAC043509-001

Revision: G

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Additional copies of this manual may be obtained from ABB.

Original instructions.



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Sweden

# Table of contents

# Overview of this manual

## About this manual

This manual is designed as a step-by-step guide to learn the sequence of work when you work with Cutting PowerPac.

General steps are:

- Create a cutting station. See *Setting up a cutting station on page 31*
- Create paths. See *Manage paths on page 49*
- Verify and optimize paths. See *Path optimization on page 143*
- Load program to the controller. See *Virtual controller settings on page 157*

## Usage

This reference manual contains general and specific information about the Cutting PowerPac tools and workflow.

## Who should read this manual?

This manual should be used by anyone working with Cutting PowerPac.

## Prerequisites

You should have a basic knowledge of:

- RobotStudio
- RAPID
- Cutting process

## References

| Reference | Document ID |
|---|---|
| *Operating manual - RobotStudio* | *3HAC032104-001* |
| *Operating manual - IRC5 with FlexPendant* | *3HAC050941-001* |
| *Technical reference manual - RAPID overview* | *3HAC050947-001* |
| *Technical reference manual - RAPID Instructions, Functions and Data types* | *3HAC050917-001* |

## Revisions

| Revision | Description |
|---|---|
| - | First edition |
| A | Released with RobotStudio 5.15<br>The following updates are made:<br>• 3D free form cutting function has been improved.<br>• Cutting parameter tables are added.<br>• New calibration method is added. |

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*Continued*

| Revision | Description |
|---|---|
| B | Released with RobotStudio 5.61<br>The following updates are made:<br>• Few sections are rearranged.<br>• Few images are updated.<br>• Minor editorial corrections are done. |
| C | Released with RobotStudio 6.0<br>Following are the updates:<br>• Updated various sections in the chapter *User interface on page 23*.<br>• Updated the chapter *Path simulation on page 155*. |
| D | Released with RobotStudio 6.0<br>Following are the updates:<br>• Updated the section *Creating a Part program on page 63*.<br>• Updated the section *Modify multiple instructions on page 116*. |
| E | Released with RobotStudio 6.01<br>Following is the update:<br>• Updated the section Work flow of importing station components. |
| F | Released with RobotStudio 6.02<br>Following are the updates:<br>• Updated the section *Synchronize on page 153*.<br>• Removed the section Work flow of importing station components. |
| G | Released with RobotStudio 6.04<br>Following is the update:<br>• Updated the section *Create calibration points on page 55*. |

# 1 Introduction and installation

## 1.1 Introduction to Cutting PowerPac

**About Cutting PowerPac**

Cutting PowerPac is a tool for generating cutting programs in RobotStudio. Utilizing the CAD geometry as the basis for all robotics programming, you can generate 2D and 3D shape cutting instructions based on geometry features, and also generate free form cutting path base on the edges. This method, known as geometry-based offline programming, gives you control over the cutting paths, resulting in improved quality.

**About this chapter**

This chapter will guide you through the installation process.

**Prerequisites**

To complete the installation process, you must have the following items:

- RobotStudio and RobotWare Cutting installed on your computer.
- Cutting PowerPac installation package.
- A license certificate.
- A logon account with administrator rights.

## 1.2 Robotics terminology

### 1.2.1 Robot positions

**About positions**

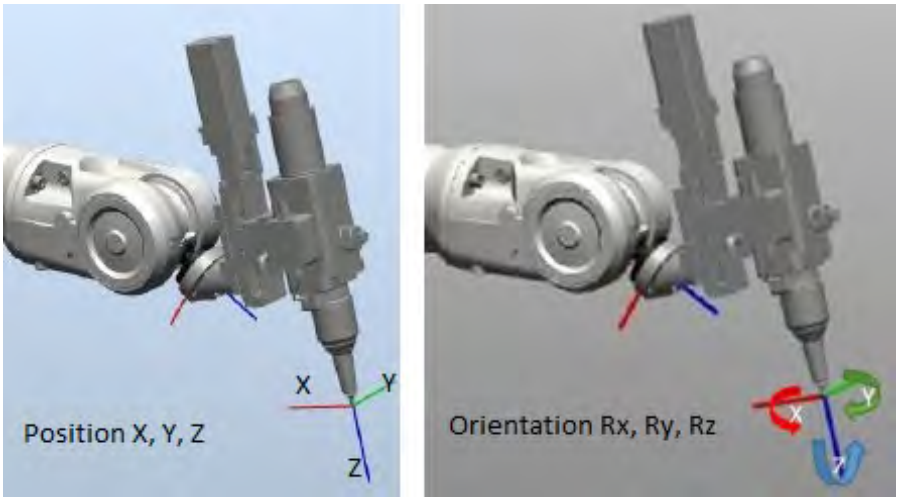
The exact position of the robot is determined using the position of the resolvers and counters that count the number of resolver revolutions. These are called revolution counters. If the robot is correctly calibrated then the current position is automatically calculated at start.

**How robot positions are displayed**

Positions are always displayed as:

- The point in space expressed in the x, y, and z tool center point coordinates.
- The angular rotation of the tool center point expressed in Euler angles or as a quaternion.

Typical positioning information required by robots:

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**Position format**

The position can be displayed in different formats.

The position can be displayed relative to the following frames:

- World
- Base
- Work object

The Orientation format can be set to:

- Quaternion
- Euler angles

The Position angle format can be set to:

- Angles

*Continues on next page*

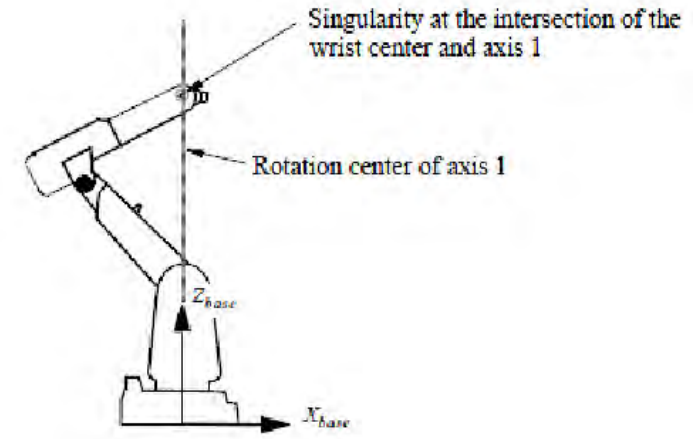
The Presentation angle unit can be set to:

- Degrees
- Radians

## 1.2.2 Singularity

### Description

Arm singularities are all configurations where the wrist center (the intersection of axes 4,5 and 6) ends up directly above axis 1.

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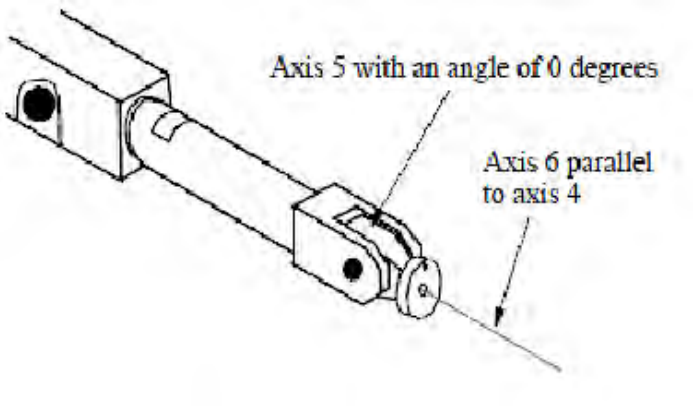
Wrist singularities are configurations where axis 4 and axis 6 are on the same line, that is axis 5 has an angle equal to 0.

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## 1.2.3 Typical frames/coordination systems

**Overview**

This section provides an introduction to the coordinate systems used mostly for offline programming. In RobotStudio, you can either use the coordinate systems (that are explained below) or the user-defined coordinated systems for co-relating elements and objects.

**Coordinate systems**

A frame/coordinate system defines a plane or space by axes from a fixed point called the origin. Robot targets and positions are located by measurements along the axes of coordinate systems.

A robot uses several coordinate systems, each suitable for specific types of jogging or programming.

- The base coordinate system is located at the base of the robot. It is the easiest one for just moving the robot from one position to another.
- The work object coordinate system is related to the work piece and is often the best one for programming the robot.
- The tool coordinate system defines the position of the tool the robot uses when reaching the programmed targets.
- The world coordinate system that defines the robot cell, all other coordinate systems are related to the world coordinate system, either directly or indirectly. It is useful for jogging, general movements and for handling stations and cells with several robots or robots moved by external axes.
- Reference Coordinate System (RCS) is used to create and manipulate targets in RobotStudio. Like workobject coordinate system or User Cordinate system, Reference Coordinate System can also be used to set the target location and angle.
- The user coordinate system is useful for representing equipment that holds other coordinate systems, like work objects.

The coordinate systems are co-related hierarchically. The origin of each coordinate system is defined as a position in one of its ancestries. The following are the descriptions of the commonly used coordinate systems.

**Base coordinate system (BCS)**

The base coordinate system is called the Base Frame (BF). Each robot in the station, both in RobotStudio and the real world has a base coordinate system which is always located at the base of the robot.

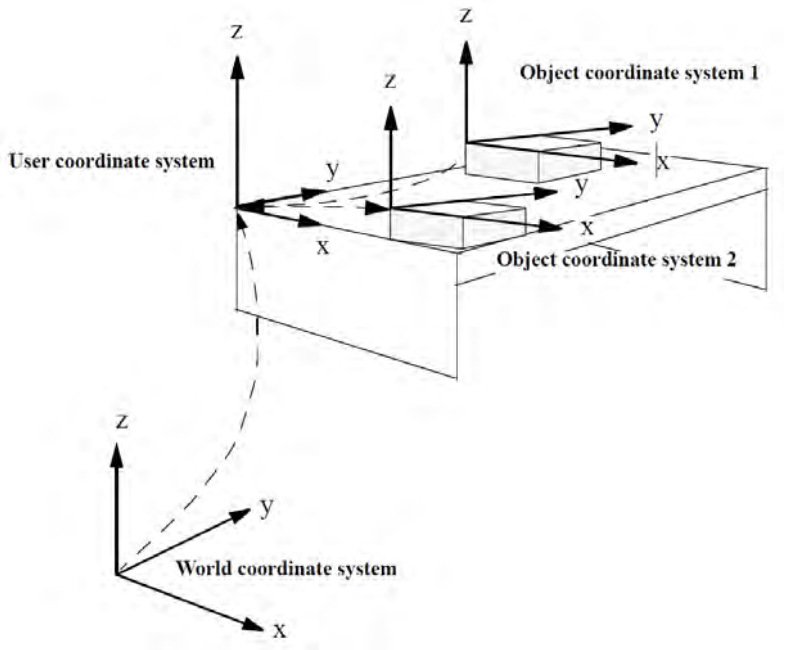
*Continues on next page*

1.2.3 Typical frames/coordination systems
*Continued*

**Work object coordinate system**

A coordinate system referenced to an work object is called an work object coordinate system. This coordinate system is also very suited to off-line programming since the positions specified can usually be taken directly from a drawing of the work object. The work object coordinate system can also be used when jogging the robot.

The work object coordinate system is defined based on the user coordinate system. That means it must be defined in two frames, the user frame (related to the world frame) and the object frame (related to the user frame).

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The programmed positions are always defined relative to a work object coordinate system.

If a fixture is moved/turned, this can be compensated for by moving/turning the user coordinate system. Neither the programmed positions nor the defined work object coordinate systems need to be changed. If the work object is moved/turned, this can be compensated for by moving/turning the work object coordinate system.

If the user coordinate system is movable, that is, coordinated additional axes are used, then the object coordinate system moves with the user coordinate system. This makes it possible to move the robot in relation to the object even when the workbench is being manipulated.

**Tool center point (TCP) coordinate system**

TCP is the tool center point coordinate system. Different TCPs can be defined for one robot, but only one may be active at a time. All robots have one predefined TCP at the robot's tool mounting point, called tool0.

The position of the robot and its movements are always related to the tool center point. This point is normally defined as being the center point of the tool or

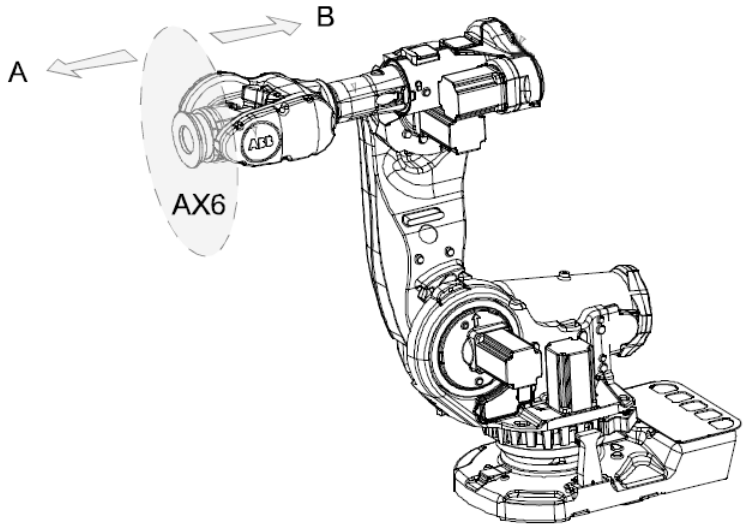
*Continues on next page*

somewhere on the tool, for example, at the cutting head tip of a laser cutting gun, at the center of a gripper or at the end of a grading tool.

When a program runs, the robot moves the TCP to the programmed position. When a position is recorded, it is the position of the TCP that is recorded. This is also the point that moves along a given path at a given velocity.

A tool is an object that can be mounted directly or indirectly on the robot turning disk or fitted in a fixed position within the robot working range. A fixture or a cutting gun is not a tool.

All tools must be defined with a TCP. Each tool that can be used by the robot must be measured and its data stored in order to achieve accurate positioning of the tool center point.

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| | |
|---|---|
| A | Tool side |
| B | Robot side |

**World Coordinate system (WCS)**

The RobotStudio world coordinate system represents the entire station or robot cell. This is the top of the hierarchy to which all other coordinate systems are related (when using RobotStudio).

**User Coordinate System (UCS)**

The user coordinate system is used to get different coordinate systems for different fixtures or working surfaces. A fixture, however, may include several work objects that are to be processed or handled by the robot. Thus, it often helps to define a coordinate system for each object in order to make it easier to adjust the program if the object is moved or if a new object, the same as the previous one, is to be programmed at a different location.

*Continues on next page*

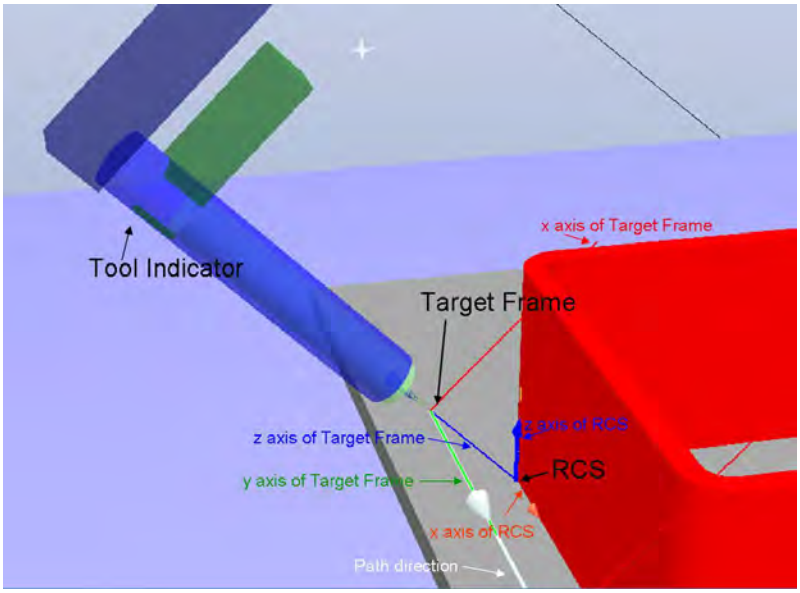
1.2.3 Typical frames/coordination systems
*Continued*

**Reference Coordinate System (RCS)**

In Cutting PowerPac, every robtarget is associated with a local reference coordinate system called Reference Coordinate System (RCS).

RCS is primarily used to help create and manipulate targets in RobotStudio. As workobject/UCS, RCS can be used to set the target location and angle.

Usually a target's RCS accommodates the shape of the part geometry. For example, for cutting targets along a cut path, the RCS positions are along the cut path, the x axis directions are along the path direction, and the z axis directions are along the normal vector of the cut surface. Thus, instead of entering target values in relation to a world coordinate or a work object, you can specify offsets and angles relative to the RCS, which have a more direct space relationship between robot targets and the cut.

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**Task Frame (TF)**

The Task Frame represents the origin of the robot controller world coordinate system in RobotStudio.

The following picture illustrates the difference between the base frame and the task frame.

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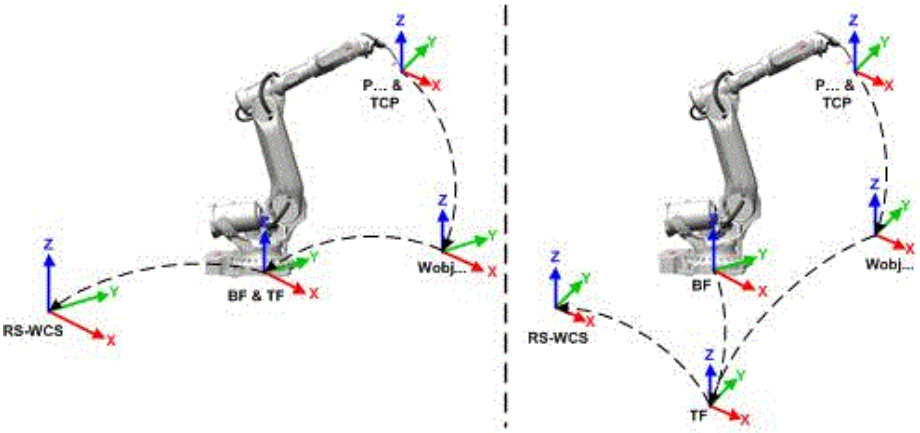
In the picture to the left, the task frame is located at the same position as the robot base frame. In the picture to the right, the taskframe has been moved to another position.

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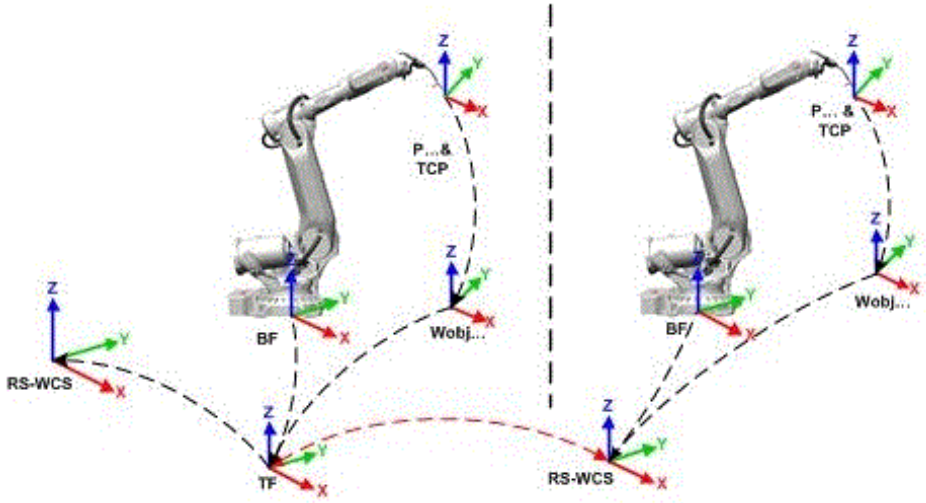
The task frame in RobotStudio is mapped to the robot controller coordinate system in the real world, for example, on the work shop floor.

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## Object Frame

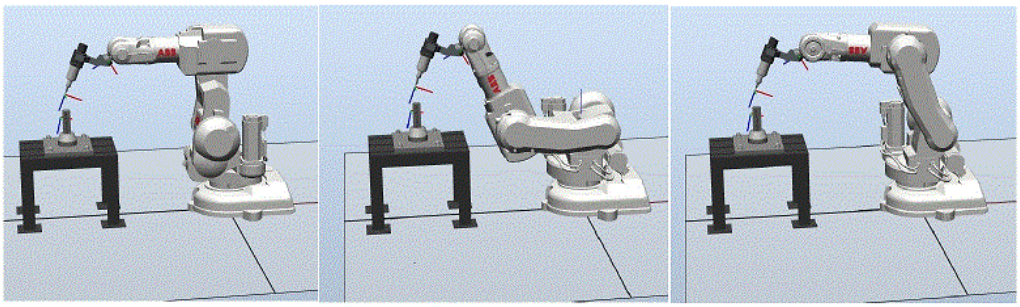
The object frame is based on the user frame. Users can define the object frame by two means:

- Position. Assign the origin of the object frame, a point on X axis, a point on XY platform to define the frame.
- Three-point. Assign the first point on X axis, the second point on X axis and a point on Y axis to define the frame.

## 1.2.4 Robot configuration

### Axis configurations

Targets are defined and stored as coordinates in a Workobject coordinate system. When the controller calculates the position of the robot axes for reaching the target, it will often find more than one possible solution to configuring the robot axes.



configur

### Storing axis configurations in targets

For targets that are taught after jogging the robot to the position, the used configuration will be stored in the target.

Targets created by specifying or calculating positions and orientations get a default configuration value (0,0,0,0), which might not be valid for reaching the target.

### Common problems and solutions related to robot axis configurations

It is most likely that targets created by other ways than jogging cannot be reached at their default configuration.

Even if all targets in a path have validated configurations, you might encounter problems when running the path if the robot cannot move from one configuration to the other. This is likely to occur where an axis shifts greater than 90 degrees during linear movements.

Repositioned targets keep their configuration, but the configurations are no longer validated. As a result, the problems described above might occur when moving targets.

Common solutions for configuration problems are:

- To resolve the problems described above, you can assign a valid configuration to each target and verify that the robot can move along each path.
- You can also turn configuration monitoring off, which means that you ignore the stored configurations and let the robot find working configurations at runtime. If this is not done the proper way, you might get unexpected results.
- In some cases there might not be any working configurations. Possible solutions might then be to reposition the work piece, reorient targets (if acceptable for the process) or add an external axis that either moves the work piece or the robot for increasing reachability.

*Continues on next page*

**How configurations are denoted**

The robot's axis configurations are denoted by a series of four integers, specifying in which quadrant of a full revolution significant axes are located. The quadrants are numbered from zero for positive (counterclockwise) rotation and from -1 for negative (clockwise) rotation.

For a linear axis, the integer specifies the range (in meters) from the neutral position in which the axis is located.

A configuration for a six-axis industrial robot (like IRB 140) may look like: [0 -1 2 1]

The first integer (0) specifies the position of axis 1: somewhere in the first positive quadrant (between 0 and 90 degrees rotation). The second integer (-1) specifies the position of axis 4: somewhere in the first negative quadrant (between 0 and -90 degrees rotation). The third integer (2) specifies the position of axis 6: somewhere in the third positive quadrant (between 180 and 270 degrees rotation). The fourth integer (1) specifies the position of axis x, a virtual axis used for specifying the wrist center in relation to other axes.

## 1.2.5 Other

**Generic data**

Besides default RAPID data types, such as robtarget and tooldata, PowerPacs also uses other data types. These are called generic data. In Cutting PowerPac, some process related data, such as `cutdata`, `leaddata`, and `fricdata` are supported.

## 1.3 Installing Cutting PowerPac

### Overview

To install Cutting PowerPac, RobotStudio and RobotWare Cutting must be installed on your computer.

### Installing Cutting PowerPac

To install the Cutting PowerPac, follow these steps:

1. Browse to Cutting PowerPac installation package and double-click **Setup.exe**.
   The installation opens.
2. Click **Install Cutting PowerPac**.
   The installation starts.
3. Read the License Agreement and accept the terms.
4. Click **Install**.
5. When the installation is finished, complete the installation wizard by clicking **Finish**.

### Installing a license

RobotStudio works without activation for a trial period of 30 days. By default, the Cutting PowerPac is also activated after installation . After 30 days, the RobotStudio activation key is required to activate Cutting PowerPac Add-on.

To activate Cutting PowerPac, use the Activation Wizard of RobotStudio. RobotStudio activation automatically activates the Cutting PowerPac Add-on also.

To verify the activation status of Cutting PowerPac:

1. Click **File** > **Options** > **Licensing**.
2. Click **View Installed License Keys** to view the status of your current license.

## 1.4 Programing workflow

**Overview**

This chapter is designed as a step-by-step guide to learn the sequence of work when you work with Cutting PowerPac. To work with Cutting PowerPac follow the procedure.

- *Setting up a cutting station on page 31*
- *Manage paths on page 49*
- *Path optimization on page 143*
- *Path view on page 91*
- *Data management on page 147*

# 2 User interface

## 2.1 Start and close Cutting PowerPac

**Overview**

Before you can start using Cutting PowerPac, you must load a RobotStudio station that includes at least one cutting robot. The virtual controller (VC) associated with the cutting robot must be loaded.

**Start Cutting PowerPac**

To start Cutting PowerPac:

1. Open a RobotStudio cutting station.
2. On the **Add-Ins** tab in the ribbon, select **Cutting** from the **PowerPacs** group.
   A dedicated tab for **Cutting** is added to the ribbon.
3. Click the **Cutting** tab.
   The Cutting PowerPac user interface is displayed.

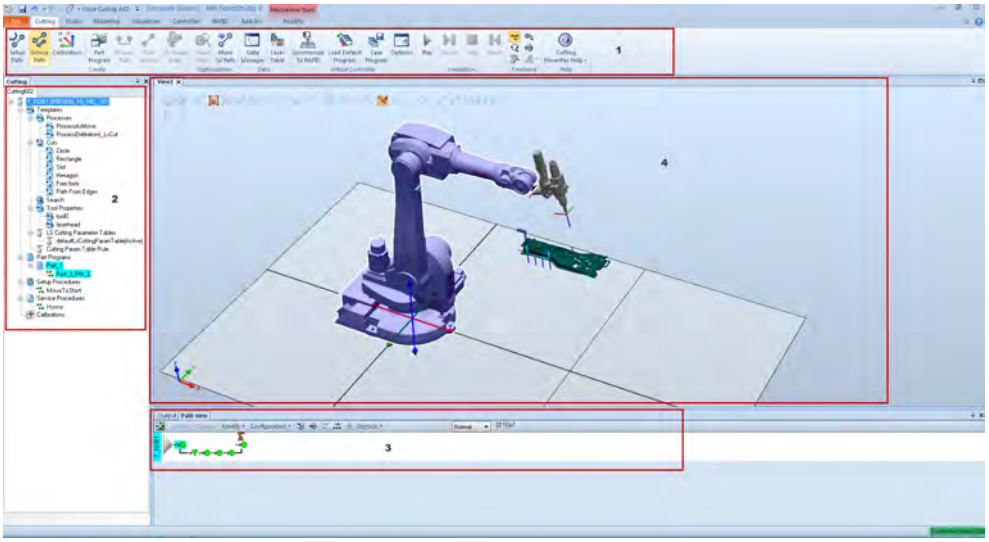
**Close Cutting PowerPac**

To close Cutting PowerPac, click the **Close Cutting** button above the Cutting ribbon tab. The Cutting PowerPac is closed.

## 2.2 User interface

### The user interface

The following figure and table provide details about the Cutting PowerPac user interface.



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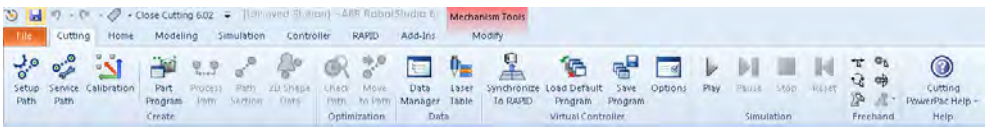
| Label | Item | Description |
|---|---|---|
| 1 | Cutting ribbon | Contains the general functions for Cutting process. |
| 2 | Cutting browser | Displays the components of the station in a tree structure. |
| 3 | Path view window | Categorizes and linearly maps the targets. |
| 4 | 3D Graphics window | The graphics window is coordinated with these panes: a path highlighted in the browser, is highlighted with the same color in the graphics window. A simulation appearing in the graphics window is represented in the path view by a robot cursor stepping through the path in the path view.<br>The graphics window is an important source to input geometry targets. By clicking on the part models in the window, you can create or modify a target in the geometry space. |

### The Cutting ribbon

The Cutting ribbon contains the controls for creating paths, virtual controller operations, modifying Cutting PowerPac data, and help information.

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Elements on the cutting ribbon-tab:

| Group | Button | Description |
|---|---|---|
| Create | Setup Path   | Opens a dialog box to create a new setup path and inserts a new path node into the tree structure. For more details, see *Create/edit setup and service procedures on page 50*.<br>**Note**<br>You can access this function also from the Cutting browser by right-clicking the **Setup Procedures** node. |
| | Service Path   | Opens a dialog box to create a new service path and inserts a new path node into the tree structure. For more details, see *Create/edit setup and service procedures on page 50*.<br>**Note**<br>You can access this function also from the Cutting browser by right-clicking the **Service Procedures** node. |
| | Calibration   | Creates 3 to 10 calibration points to get the transition relationship of the offline calibration points on the CAD model and the calibration points on the work object in the real laser cutting work. |
| | Part Program  | Opens a dialog box to create a new part program, insert a new part node into the tree structure, and creates an empty path. For more details, see *Create or edit Part programs on page 62*.<br>**Note**<br>You can access this function also from the Cutting browser by right-clicking the **Part Programs** node.<br>See *Create or edit Part programs on page 62* for the definition for part program. |
| | Process Path   | Inserts a new empty path node into the tree structure.<br>**Note**<br>This button is available only when a part node or a path node under the part node is selected in the Cutting browser. You can access this function also from the Cutting browser by right-clicking the **Process Path** node.<br>See *Create/edit Process paths on page 72*for the definition for process path. |
| | Path Section   | Creates a free form cutting. For more details, see*Create Free Form Cutting on page 99*.<br>This button is available after a path or the last instruction of a free form cutting path is selected. |
| | 2D Shape Data | |

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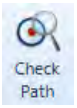
| Group | Button | Description |
|---|---|---|
| |  | Opens a dialog box to select a face from the CAD model, and saves the corresponding 2D shape data into a .cad file which is used to create a 2D shape cut instruction. For more information, see *Create Shape Data From Edges Dialog Box on page 114*. |
| Optimization | Check path<br>  | Verifies whether the robot can reach all the targets on the path, and if collision exists in the cutting procedure. Available only when a free form cutting path is selected. See *Check path on page 144* |
| | Move to path<br>  | Verifies whether the robot can move to the laser cutting points in the created cutting path. |
| Data | Data Manager<br>  | Opens the Data Manager dialog box, which lists all the related data in the current station.<br>See *Overview on page 147* for the detailed description of data manager. |
| | Laser Table<br>  | Click to create and edit laser cutting parameter tables. See *LS Cutting parameter tables on page 39* for detailed information regarding to Laser Table. |
| Virtual controller | Synchronize To RAPID<br>  | Synchronizes the program to the virtual controller. |
| | Load Default Program<br>  | Loads the default program into VC for the active task. Usually the default program is null. |
| | Save Program<br>  | Saves the current program in the virtual controller.<br>The program is saved to a predefined directory. The folder name is: `Station name"_"Task name`. For example, for the task `T_ROB1` in station `Irb140_250A_RW_5_11`, its storing directory is `HOME\Irb140_250A_RW_5_11_T_ROB1`. |
| | Options<br>  | Opens the synchronization settings dialog box. |

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| Group | Button | Description |
|---|---|---|
| Simulation | Play   | Simulates the cutting procedure in the 3D graphical window. |
| | Pause   | Pauses the simulation. |
| | Stop   | Stops the simulation of the laser cutting procedure in the 3D graphic window. |
| | Reset   | Restores the path to the status at the beginning of the simulation. |
| Freehand | Free hand   | Move/rotate frames in the station or adjust joints of the robot. |
| Help | Cutting PowerPac Help   | Provides the following information:<br>• Help file<br>• Cutting PowerPac version information |

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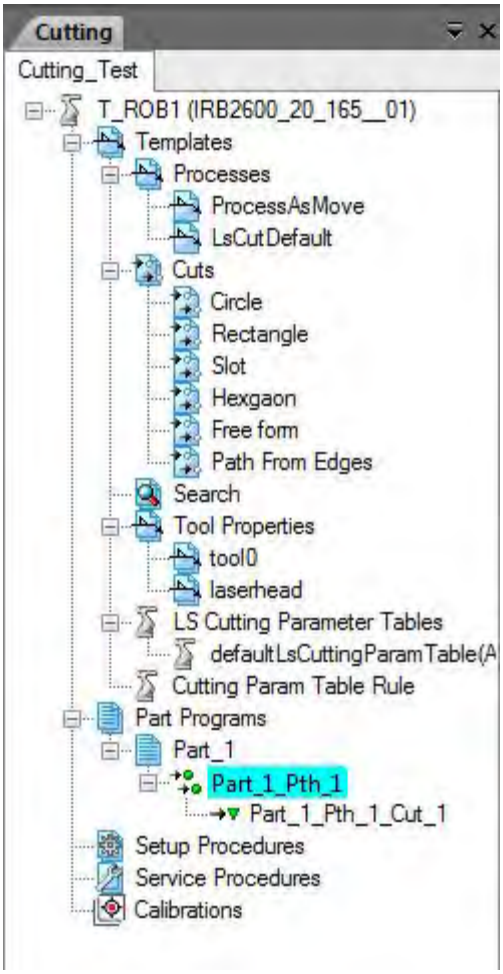
### Cutting browser

The tree structure of the Cutting browser provides an overview of the controllers, robots, templates, programs, and calibrations.

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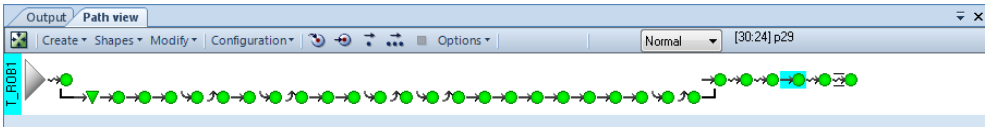
For more details, see *Manage paths on page 49*.

### Output/Path view

There are two tabs in the Output/Path view.

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| Item | Description |
|---|---|
| Output | Displays the messages including general system messages, RAPID messages, controller messages, simulation messages, event log, and application messages. |
| Path view | Displays a window where you can create, modify, view paths, change configuration, and the virtual commissioning of the paths. For more details, see *Path view on page 91*. |

*Continues on next page*

**3D Graphic window**

It is a 3D view interface where you can choose view settings, control graphics view, create new views, view/hide the selected targets, frames, paths, parts and mechanisms. For more details, see *Operating manual - RobotStudio*.

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# 3 Setting up a cutting station

## 3.1 Create a station with a robot system

### Overview

This section describes how to create a system and build a cutting station.

The system points out the robot models and options to use, and it also stores configurations and programs for the robots. You can create a station with a template system or with an existing system. In most cases, a virtual controller is automatically started when you create a new station. Library files for the robot used by the system are then imported to the station.

### Building a new system

The following procedure shows the workflow for building a new system.

> **Note**
>
> This procedure is applicable only if you are using RobotWare versions prior to RobotWare 6.0. From RobotWare 6.0 onwards **Installation Manager** is used for building a system. For more information about building a system using **Installation Manager**, see *Operating manual - RobotStudio*.

1. Click **System Builder** on the **Controller** ribbon-tab.

   The System Builder window is displayed.
2. Click **Create New**.

   The **New Controller System** window is displayed.
3. Click **Next**.
4. Type a name for the system in Name field and select a path in the Path field.
5. Click Next.
6. Select the **Virtual Key** option.

   The controller key is displayed in the **Controller Key** field.

   > **Note**
   >
   > The RobotWare keys determine which RobotWare versions and parts to use in the system. Creating a system to run on either IRC5 controller or virtual controllers requires at least two keys: one for the controller module and one for each drive module in the cabinet.
7. Click **Next**.
8. Click the arrow button to add the drive key to the **Added Drive Keys** field.
9. Click **Next**.
10. In the **Enter Key** field browse to the location **...\ABB Industrial IT\Robotics IT\Mediapool\CUTTING** and select the key.

*Continues on next page*

11 Click on the arrow button to move the selected key to the **Added options** list.
12 Click **Next**.
13 Select the required options from the **Modify Options** window.
14 Click **Finish**.
   The system is created in the specified location.
15 Click **Close**.

### Create a station

The station can be created in three ways:

| Activity | Description |
|---|---|
| Click **File**-> **New** -> **Station with Robot Controller** to create a station with a template system | This is the simplest way to create a new station containing a robot and a link to a rudimentary system. Available robot models are listed. After selection, RobotStudio will automatically create a matching virtual controller. |
| Click **File**-> **New** -> **Station with existing Robot Controller** to create a station with an existing system | Create a new station containing one or more robots, and add an existing built system to it. |
| Click **File**-> **New** -> **Empty Station** to create a station with no system | An advanced users can build a station from scratch and then add a new or an existing system to it. |

# 4 Manage templates

## 4.1 Creating templates

**Overview**

Before the first cut path is created, you should create your own process template, modify the properties related with cutting parameters and motion instructions. When instructions are created, the instructions automatically use the created templates. When the template is modified, all the related instructions automatically use the modified template.

For detailed information, see *Manage templates on page 33*.

## 4.2 Process templates

### Overview

A process template in Cutting PowerPac is a collection of templates for process parameters, cutting targets, instruction arguments, and so on. It specifies the information needed to create a complete cutting on the part. Cutting PowerPac is installed with default process templates, such as *ProcessAsMove* and *CutDefault*.

### Shortcut menus from the Process Templates node

| Node | Menu | Description |
|---|---|---|
| **Process** | **Import** | Imports predefined process templates. |
| | **Properties** | Allows you to view and modify the properties of a process template. |
| | **Create Copy** | Creates a copy of a selected process template. |
| | **Save** | Saves the selected process template to disk. |
| | **Delete** | Deletes the selected process template. |

### Importing a process template

The process templates are based on several instructions. For example, the *ProcessAsMove* template includes instructions for MoveL, MoveJ and MoveC. These default move instructions are always available in the virtual controller. The *Cut Default* template (included in the Cutting PowerPac installation) uses instructions such as CutL and CutC. These are available in a virtual controller installed with the option *Cutting*.

1. Right-click the process node and click **Import**. In the **Import Process Template** dialog box, select the corresponding template and click **Open**.
2. An error message appears if the underlying instructions for the template are not found in the controller. In this case, RobotStudio must be told how these instructions should be handled. This should be done manually in the **Instruction Template Manager** in RobotStudio or by importing a predefined description file.

   If the template is successfully imported, the related process definitions will be automatically added into RobotStudio. Do not manually modify or delete any of these process definitions in the **Instruction Template Manager**.

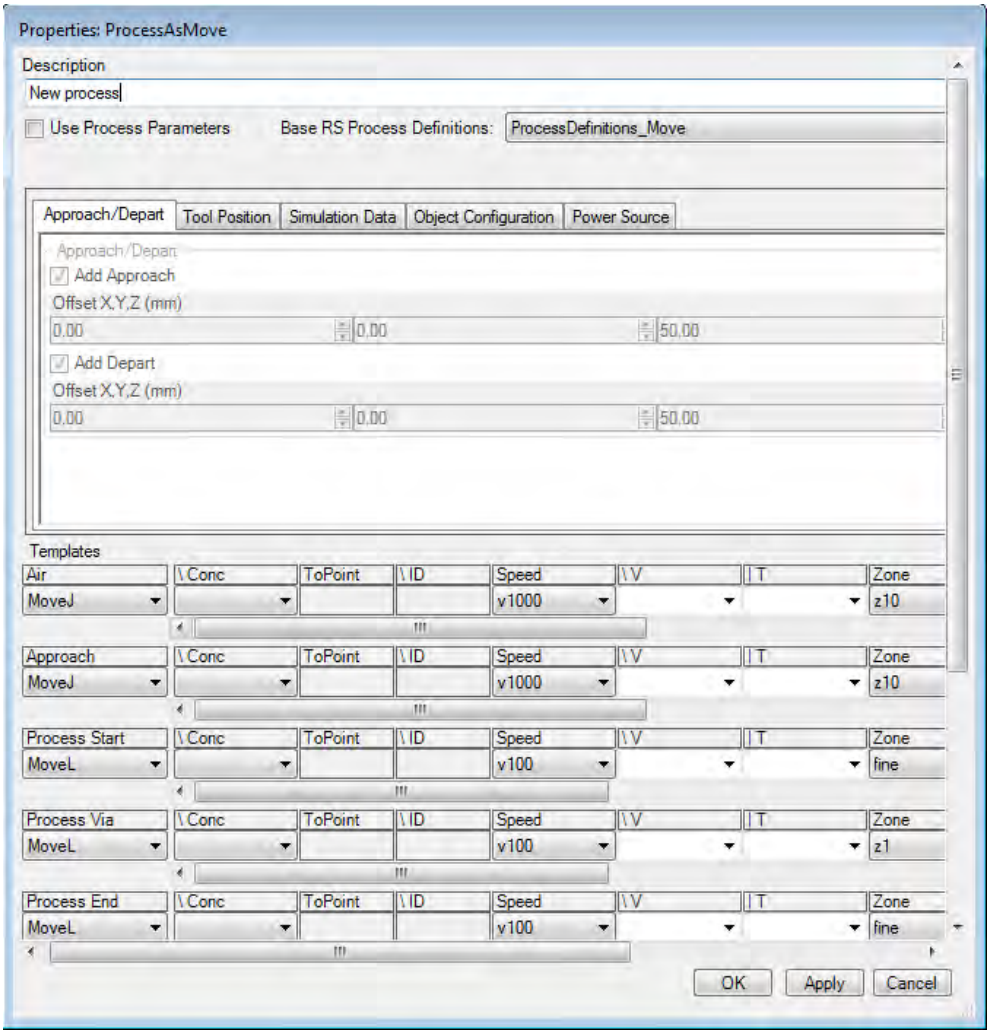
### Modifying process templates

1. In the Cutting browser, right-click a template and click **Properties** to open a dialog box.
2. Modify any values. To store your changes without closing the dialog box, click **Apply**. To store your changes and close the dialog box, click **OK**. To close the dialog box without storing any changes, click **Cancel**.

*Continues on next page*

### Process template properties

In the Cutting browser, right-click a template and click **Properties** to open a dialog box.

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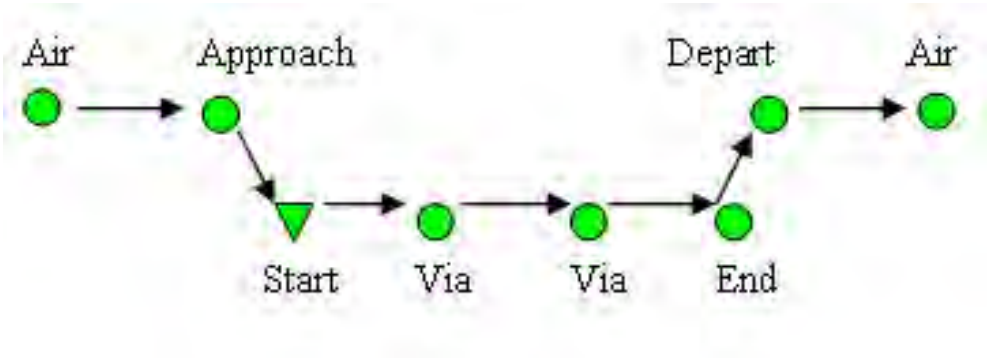
| Section | Description |
|---|---|
| **Description** | A data field for entering a text description of the process template. This information is not transferred to the RAPID code. |
| **Process Parameters** | Optional.<br>The values can be obtained from a Cutting case, or manually modified. If selected, the property values will be used as target settings in Create Free Form Cutting. |
| **Base RS Process Definitions** | A process template is associated with a RobotStudio base process definition file. The definition file contains all the instruction templates used by the process template, and is imported into RobotStudio by Cutting PowerPac.<br>Usually you do not need to change the association between a process template and a definition file. However if such a case occurs, you can select a different definition here, export the process template and import into Cutting PowerPac again. |

*Continues on next page*

| Section | Description |
|---|---|
| **Templates** | Templates section.<br>Settings for RAPID instructions. Instruction parameters (for example, motion type, speed, zone) will be set for all targets depending on the target classification.<br>If an argument is generic data, a **Create new...** appears in the drop-down list. If selected, a dialog box opens to create a new data of this type. Input the name of the new argument, then click the **...** button after the argument button and edit the data.<br>Clicking the button can start the Data Editor, where sync properties and data values can be modified. See *Data Manager on page 148* for more information. |

### Targets in a cutting process

The following figure illustrates a typical sequence of targets in a cutting process.

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Cutting targets will be assigned with process parameters in accordance with one of the following classifications:

| Target | Description |
|---|---|
| **Air Move** | Intermediate target between cutting paths. Generates a MoveJ or MoveL instruction, depending on the motion type. |
| **Approach Move** | The first target before a cutting path. Generates a MoveJ or MoveL instruction, depending on the motion type. Is connected to the following Process Start target, so that the orientation always follows the process start point with a variable approach distance. |
| **Process Start** | The first target in a cutting path. Generates a `CutLStart` instruction, activating the cutting process. |
| **Process Via** | The intermediate target in a cutting path. Generates a `CutL` or `CutC` instruction, depending on the motion type. |
| **Process End** | The last target in a cutting path. Generates a `CutLEnd` or `CutCEnd` instruction depending on the motion type. Deactivate the cutting process. |
| **Depart Move** | The first target after a cutting path. Generates a `MoveL` instruction. It is connected to the preceding Process End Target, so that the orientation always follows the process end point with a variable depart distance. |

## 4.3 Cut templates

**Overview**

A cut template is a collection of cutting creation methods. See *Create Free Form Cutting on page 99* for detail.

## 4.4 Tool properties template

**Overview**

Since the tool model in RobotStudio differs from the tool in reality, Cutting PowerPac must know the geometry of the activated tool to be able to calculate correct cutting head angles based on the search parameters.

## 4.5 LS Cutting parameter tables

**Overview**

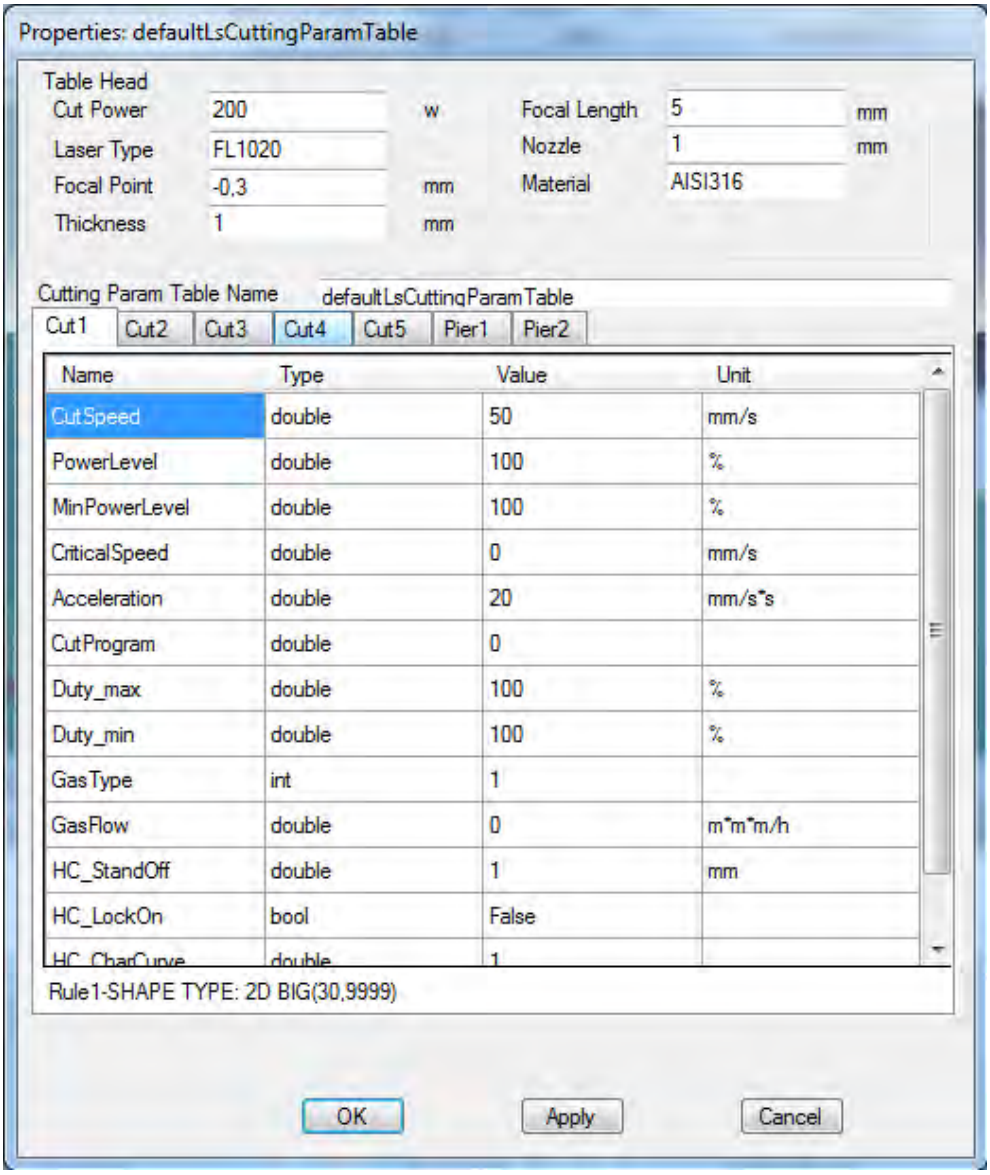
LS cutting parameter tables contain two kinds of cutting process parameters: cutting parameters and piercing parameters. It can help cutting experts to save and maintain good cutting parameters in the PC and let the users select cut data group configurations according to rules during offline programming. Users can create, edit LS cutting parameter tables and view existing parameter tables in the cutting browser.

In each parameter table, there can be up to 5 cutting groups and 5 pierce groups for users to choose.

*Continues on next page*

### View and edit LS cutting parameter tables

Click **LS Cutting Parameter Tables**, right click on the **defaultLsCuttingParamTable**, and select **Properties**. The **Properties:defaultLsCuttingParamTable** table is displayed. This table displays all the existing cutting parameter groups and piercing parameter groups. You can edit the entries in the Value column by double clicking it.

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| Section | Description |
|---|---|
| **Table Head** | General attributes of a cutting parameter table containing general cutting information such as cutting power, laser type, focal length, and so on. |
| **Cutting Param Table Name** | The name of the cutting parameter table. |
| **Cut** tabs | Displays the cut parameters. There can be a maximum of 5 cutting parameter groups in the **Cutting Param Table Name**. |

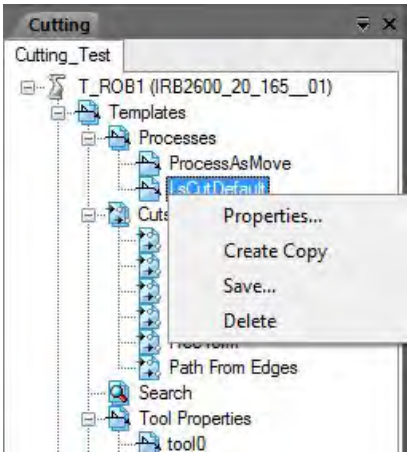
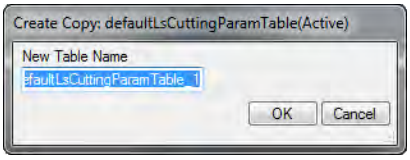
*Continues on next page*

| Section | Description |
|---|---|
| **Pier** tabs | Displays the pierce parameters. There can be a maximum of 2 pierce parameter groups in the **Cutting Param Table Name**. |

### Save LS Cutting Parameter Table

Click **LS Cutting Parameter Table**, right click on the cutting parameter table to be saved, and select **Save**. The **Save Cutting Param Table** window is displayed. Type a name in the **File name** field and click **Save**. The LS cutting parameter tables must be saved as mod files in the `RobotStudio/Systems/[System Name]/HOME/LsCuttingParamTables` path. The mod file can be opened using a text editor.

### Create a LS Cutting Parameter Table

| | Description | Illustration/Note |
|---|---|---|
| 1 | Right click a process template based on which the new template should be created and select **Create Copy**. |  <br>xx1300001184 |
| 2 | The **Create Copy** window is displayed. Type a name in the **New Table Name** field and click **OK**. |  <br>xx1300001185 |
| 3 | Edit the properties of the newly created process according to *View and edit LS cutting parameter tables on page 40*. | |

### Add parameter groups in the LS Cutting Parameter Table

| | Description | Illustration/Note |
|---|---|---|
| 1 | Open the LS Cutting Parameter table saved as a mod file. For detailed information for how to save the table, please refer to *Save LS Cutting Parameter Table on page 41*. | |

*Continues on next page*

| | Description | Illustration/Note |
|---|---|---|
| 2 | Add the codes for the new group in the section it belongs. For example, add a cutting parameter group under the section CuttingParamTableHead by copying an existed cutting parameter table, pasting it in the existed cutting parameter groups and change the index number and parameter values of the newly created group. | The CuttingParamTableHead section<br>`!for CuttingParamTableHead^M`<br>`CuttingParamTableHead.CutPower := 2000;`<br>`CuttingParamTableHead.FocalLength := 5;`<br>`CuttingParamTableHead.FocalPoint := -0.3;`<br>`CuttingParamTableHead.LaserType := "FL1020";`<br>`CuttingParamTableHead.Material := "AISI316";`<br>`CuttingParamTableHead.Nozzle := 1;`<br>`CuttingParamTableHead.Thickness := 1;`<br><br>The cutting parameter group<br>`!for CuttingParamGroups{3}^M`<br>`CuttingParamGroups{3}.Acceleration := 3;` (index number)<br>`CuttingParamGroups{3}.CriticalSpeed := 25;`<br>`CuttingParamGroups{3}.CutSpeed := 25;`<br>`CuttingParamGroups{3}.Delay := 0;`<br>`CuttingParamGroups{3}.Duty_max := 50;` (parameter value)<br>`CuttingParamGroups{3}.Duty_min := 50;`<br>`CuttingParamGroups{3}.GasFlow := 6;`<br>`CuttingParamGroups{3}.GasType := 0;`<br>`CuttingParamGroups{3}.StandOff := 0.7;`<br>`CuttingParamGroups{3}.IsPulse := FALSE;`<br>`CuttingParamGroups{3}.MinCutPower := 70;`<br>`CuttingParamGroups{3}.PowerLevel := 70;`<br>`CuttingParamGroups{3}.CutProgram := 0;`<br>`CuttingParamGroups{3}.HC_CharCurve := 0;`<br>`CuttingParamGroups{3}.HC_LockOn := FALSE;`<br>`CuttingParamGroups{3}.Kerf := 0.15;^M` |
| 3 | Update the parameter of numCuttingGroups which indicates the total number of cutting groups or numberPiercingGroups which indicates the total number of piercing groups. | `tableName := "defaultLsCuttingParamTable";^M`<br>`numCuttingGroups := 3;^M`<br>`numPiercingGroups := 2;^M`<br>total number of cutting groups |
| 4 | Save the modified mod file. | |
| 5 | Right click the **LS Cutting Parameter Tables** button and select **Import...**, browse to the modified table in the **Import LS Cutting Param Table** shows up afterwards and click **Open**. | |

**Note**

The LS Cutting Parameter Table in the cutting browser is saved in the station. Modification to the LS Cutting Parameter Table after the station has been opened would be made in the system and would not be synchronized to the station automatically. So importing the modified parameter table in the cutting browser must be implemented after the modification of the parameter table.

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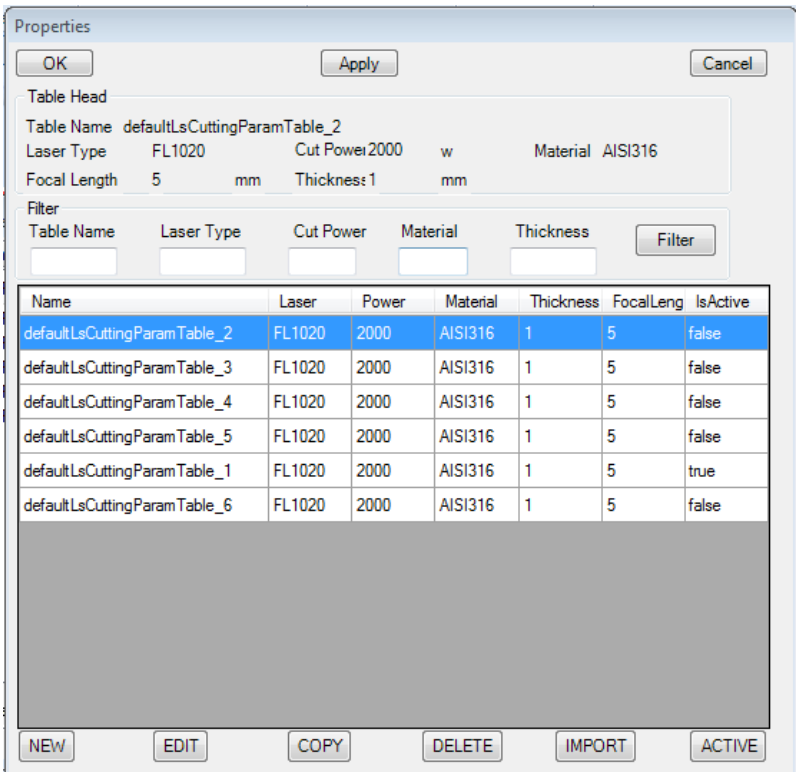
### Edit LS Cutting parameter tables

Click **Laser Table** button in the **Data** group on the Ribbon. The **Cutting Table Checking** window is displayed. Select a task and click the **LS Cutting Parameter Tables** button. The **Properties** is displayed.

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You can select the current active (the value in the **IsActive** column is true) LS cutting parameter table and click **Edit** to check the reason of the invalid TableConf or select a laser table and execute the following operations:

| Action | Description |
|---|---|
| **NEW** | Click to create a new LS cutting parameter table with the parameter values same as that of the default parameter table. |

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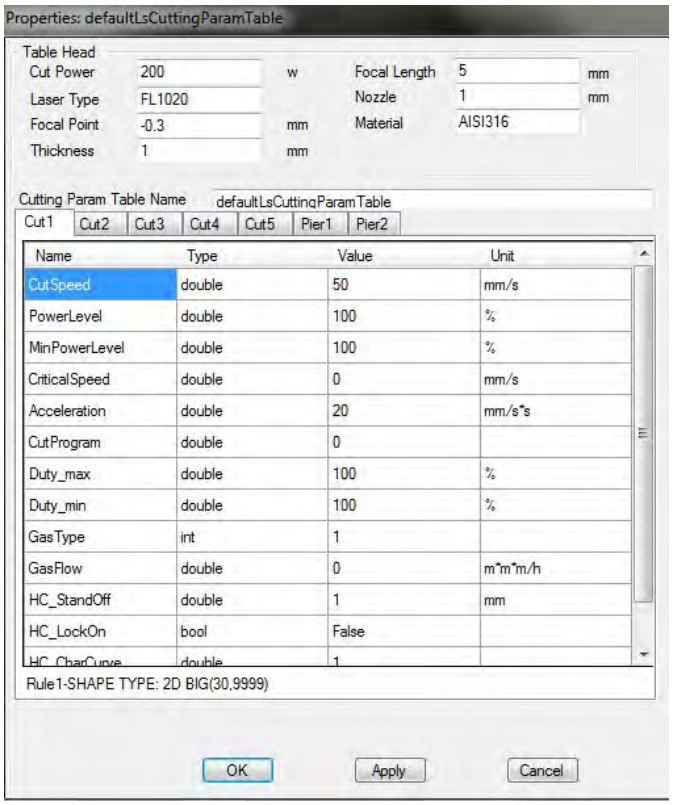
| Action | Description |
|---|---|
| **EDIT** | Click and open the property interface of a LS cutting parameter table to edit it.<br>  <br><br>xx1300001170 |
| **COPY** | Click to copy the selected LS cutting parameter table. |
| **DELETE** | Click to delete the selected LS cutting parameter table.<br>**Note**<br>There has to be atleast one laser cutting parameter table. |
| **IMPORT** | Click to import an existing LS cutting parameter table and save as a `*.mod` file. |
| **ACTIVE** | Click to set the selected LS cutting parameter table as the active laser table and apply it to all the cutting instructions. The **IsActive** column of the active LS cutting parameter table would be **true**. |

### Edit the LS TableConf

You can edit the LS tableconf from the Pathview by double clicking on a target.

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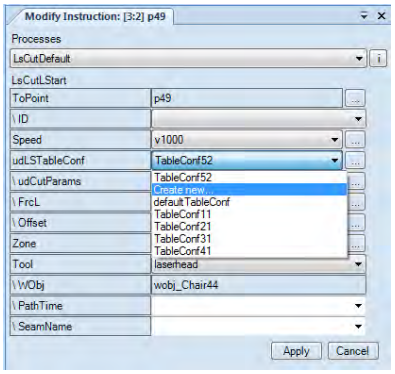
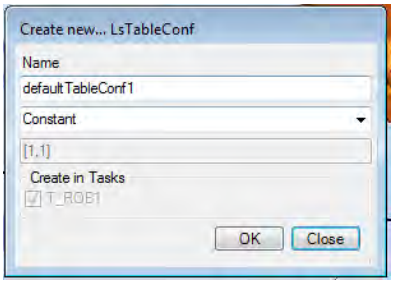
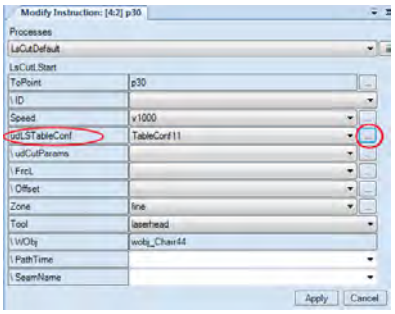
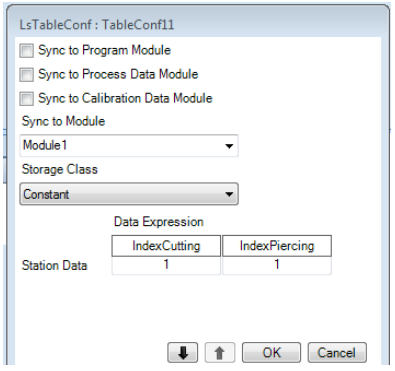
To create a new **TableConf**:

| | Description | Illustration |
|---|---|---|
| 1 | Click the **...** button after the drop down list to view/edit the data of the LS TableConfig.<br>**Note**<br>The **\udCutParams** is used to control the laser cutting process and includes parameters for controlling the laser head, laser, and also the cutting gas including pierce and cut phase. This parameter when used overrides the **udLSTableConf** parameter. |  <br>xx1300001171 |
| 2 | The **Create New...** interface would show up displaying a default value of the group and the task it belongs to.<br>Name the TableConfig with a name that can show the combination of the cutting group and the piercing group.<br>Select the storage type of the TableConf from the storage class dropdown list.<br>Click **OK** to confirm. |  <br>xx1300001172 |
| 3 | Click the **...** button after the TableConf dropdown list. |  <br>xx1300001173 |
| 4 | An **LsTableConf** edit/view interface displaying the detailed information of the TableConf would show up.<br>Select the Module that it would be saved to from the **Sync to Module** dropdown list or directly input a new module name in the Sync to Module column.<br>Select the storage class.<br>Modify **IndexCutting** and **IndexPiercing** in the **Station Data** block to modify the TableConf just created.<br>Click **OK** to confirm. |  <br>xx1300001174 |

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**Note**

If select a TableConf saved in the LSDefaultData module from the TableConf dropdown list and click the ... button, the IndexCutting and IndexPiercing data can not be modified in the LsTableConf edit/view interface displayed.

## 4.6 Cutting Param Table rule

### Overview

Cutting Param Table Rule sets the following range of five types of cutting groups:

| Rule | Description |
|---|---|
| Gen2D | Usually for bigger size of 2D shape cutting. Default size would be 30 to 9999 mm of the maximum diagonal line. |
| Special2D | Usually for smaller size of 2D shape cutting. Default size would be 0 to 30 mm of the maximum diagonal line. |
| Gen3D | Usually for bigger size of 3D shape cutting. Default size would be 30 to 9999 mm. For linear shape, the minimum length is 30 mm. For circular shape, the minimum diameter is 30 mm. |
| Special3D | Usually for smaller size of 3D shape cutting. Default size would be 0 to 30 mm. For linear shape, the maximum length is 30mm. For circular shape, the maximum diameter is 30mm. |
| SpecialPiercing | Parameters for piercing. |

You can manually set the range of Gen2D and Special2D in the Table Rule interface. Rules for Gen3D, Special3D and SpecialPiercing are not suggested to be modified.

**Note**

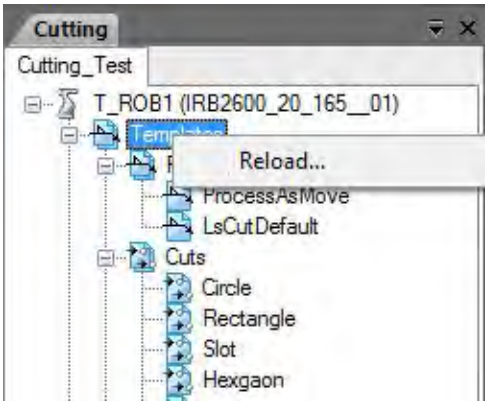
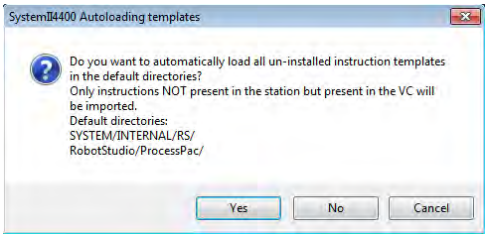
After a parameter group is created, a table rule would be automatically assigned to the group. You can modify the properties of the groups according to the their shape type.

## 4.7 Reload templates

### Reloading a templates

The template reload function is used to reload instruction template files saved in the default directory to the station.

To reload a template:

| | Description | Illustration |
|---|---|---|
| 1 | Right click the **Templates** node, and click **Reload**. |  <br>xx1300001189 |
| 2 | A message would prompt to make users confirm reload templates in the default directory or not. |  <br>xx1300001190 |
| 3 | Click **Yes** to confirm reloading, **No** or **Cancel** to quit without reloading. | |

# 5 Manage paths

## 5.1 Overview

### Overview

Programming with Cutting PowerPac is an iterative process, which typically begins with creating paths in the Cutting browser. After opening the Path View, targets, and instructions are added to the path using process and cut templates, combined with input from clicking at geometry objects in graphics window.

### Creating process paths

The following table shows the workflow:

| | Activity | Description |
|---|---|---|
| 1 | Create a program part node in the Cutting Browser, which is the holder of process paths. | See *Create or edit Part programs on page 62* for the detailed procedure. |
| 2 | Create a Process path. | See *Create/edit Process paths on page 72* for the detailed procedure. |
| 3 | Verify and optimize the created path by the cutting ribbon tab and the cutting browser or by the path view window. | See*Path optimization on page 143* for the detailed procedure to verify and optimize by the cutting ribbon tab and the cutting browser.<br>See *Path view on page 91* for the detailed procedure to verify and optimize by the path view window. |

## 5.2 Create/edit setup and service procedures

### Overview

The setup and service procedure nodes provide holders for motion paths that neither fit into a part program nor include cutting paths. For example, most stations require a path for moving the robot to its home position.

Further examples of setup and service procedures for an cutting system include motion paths for the following:

- To and from the home position and the Bulls eye TCP device (service procedure)
- To and from the home position (service procedure)
- To and from the home position and the service station (service procedure)
- Including targets for frame definition of the IRBP positioner (setup procedure)
- Including targets for TCP definition with the Bulls eye TCP calibration device (setup procedure)

### Shortcut menus from the Setup Procedures node

| Node | Menu | Description |
|---|---|---|
| **Setup Procedure** | **Create Setup Path** | Inserts a new setup path node in the tree structure.<br>  **Note**<br>You can also access this function from the Cutting ribbon-tab. |
| **Import Path** | Import a path XML file into station as a setup path. | |

*Continues on next page*

| Node | Menu | Description |
|---|---|---|
| **Setup Path** | **Properties** | Modifies the properties of setup path with a dialog box. The contents of the dialog box are the same as in **Create Setup Path** dialog box. |
| | **Open/Close** | Opens the path in the path view. Not available on an open path.<br>Closes an open path, removing it from the path view. Only available on an open path. |
| | **Create Setup Path** | Inserts a new setup path node into the tree structure.<br>**Note**<br>You can also access this function from the Cutting ribbon-tab. |
| | **Synchronize to RAPID** | Synchronizes the selected path to the virtual controller. |
| | **Export Path** | Export path into a XML file. The default name of the file consists of task name and path name. An dialog box will appear for users to specify the exporting reference frame.<br>See *Exporting a path on page 73*for detailed description. |
| | **Import Path** | Import XML path file into the station as a setup path. A dialog box opens for specifying import reference, tool, workobject, path name and module name.<br>Please see *Importing a path on page 74*for detailed description. |
| | **Visible** | A check mark indicates that the selected path is visible.<br>Not available on an open path. |
| | **Delete** | Closes an open path, removing it from the path view. Only available on an open path. |

## Shortcut menus from the Service Procedures node

| Node | Menu | Description |
|---|---|---|
| **Service Procedure** | **Create Service Path** | Inserts a new service path node in the tree structure.<br>**Note**<br>You can also access this function from the Cutting ribbon-tab. |
| **Import Path** | Import a path XML file into station as a service path. | |

*Continues on next page*

| Node | Menu | Description |
|---|---|---|
| **Service Path** | **Properties** | Modifies the properties of service path with a dialog box. The contents of the dialog box are the same as in the **Create Service Path** dialog box. |
| | **Open/Close** | Opens the path in the path view. Not available on an open path.<br>Closes an open path, removing it from the path view. Only available on an open path. |
| | **Create Service Path** | Inserts a new service path node into the tree structure.<br>**Note**<br>You can also access this function from the Cutting ribbon-tab. |
| | **RAPID** | Synchronizes the selected path to the virtual controller. |
| | **Export Path** | Export path into a XML file. The default name of the file consists of task name and path name. A dialog box opens for specifying the exporting reference frame.<br>See *Exporting a path on page 73* for detailed description. |
| | **Import Path** | Import XML path file into station, as a service path. A dialog box opens for specifying import reference, tool, workobject, path name, and module name.<br>See *Importing a path on page 74*for detailed description. |
| | **Visible** | A check mark indicates that the selected path is visible.<br>Not available on an open path. |
| | **Delete** | Closes an open path, removing it from the path view. Only available on an open path. |

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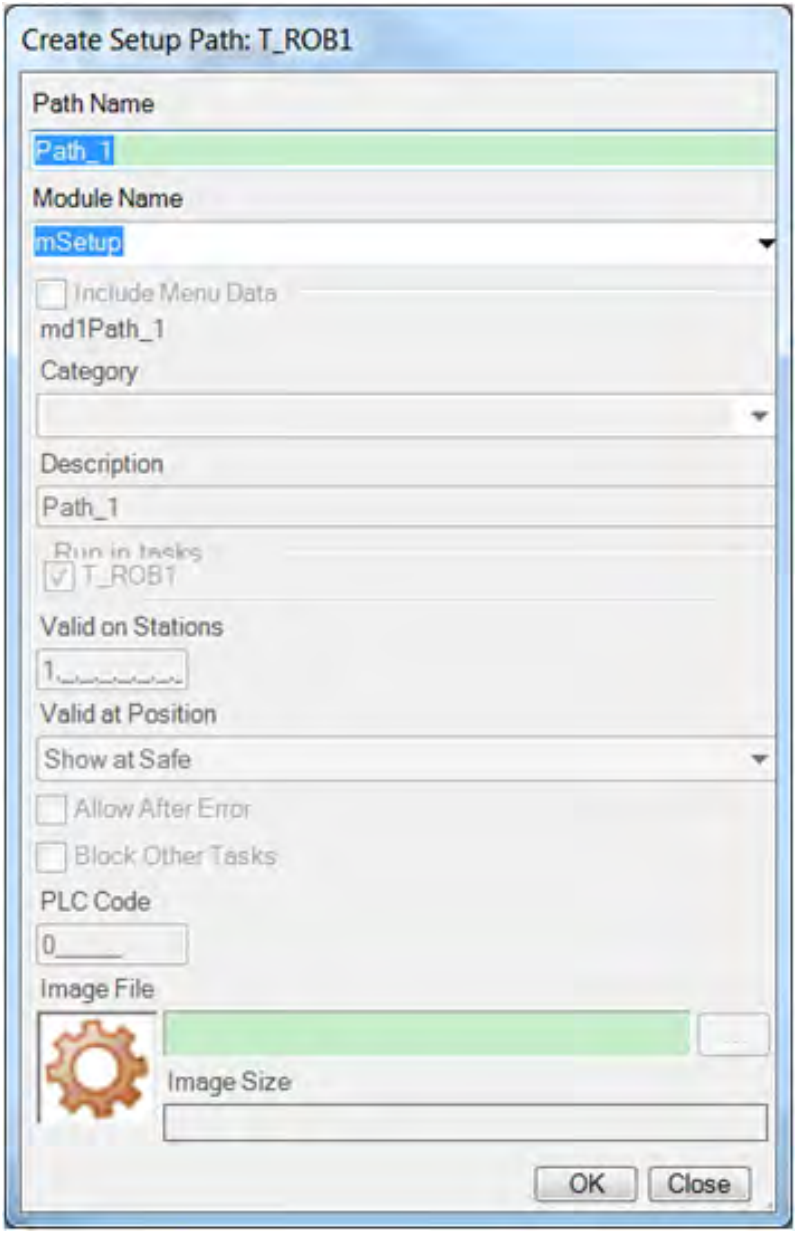
### Creating a setup/service path

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| Object | Description |
|---|---|
| **Path Name** | Enter a name for the created path. |
| **Module Name** | Synchronize RAPID module. Default module is `mSetup`. |
| **Include Menu Data** | If selected, the menu data will also be created. The information in the menu data is as the following inputs from the dialog box. |
| **Category** | Input a category string for the setup/service path. |
| **Description** | Get automatic update when entering a new setup/service path. |
| **Run in tasks** | Select tasks in which the new create path runs. Useful when used in a MultiMove program. |

*Continues on next page*

| Object | Description |
|---|---|
| **Valid on Stations** | Select stations for which this part data will be valid. The value should be a number from 1 to 8. |
| **Valid at Position** | Select stations for which this part data will be valid. The value should be a number from 1 to 8. |
| **Allow After Error** | If selected, this menu item will be shown after an error occurs. |
| **Block Other Tasks** | If selected, all other tasks will be blocked during the execution of this path. |
| **PLC Code** | A unique integer number, to indicate the ID for PLC interface. |
| **Image File** | Select an image for the new created setup/service path. This image can be shown on Production Manager of the FlexPendant. |

To create a Setup/Service path, follow these steps:

1. In the Cutting browser, right-click the setup/service procedures node or a setup/service path node and click **Create Setup Path Service** or **Create Service Path**, or click **Setup Path** or **Service Path** in the Cutting ribbon-tab to open the dialog box.
2. Complete the dialog box and click **OK**. If any RAPID name is invalid, then clicking **OK** will not close the dialog box.

**Note**

After completing the dialog box, you can view the created setup/service path in the tree structure of the Cutting browser. If the path is selected to be run in multi-tasks, a new setup/service node with the same name will be created under each task. This is very useful in a MultiMove station.

## 5.3 Create/edit calibrations

### Overview

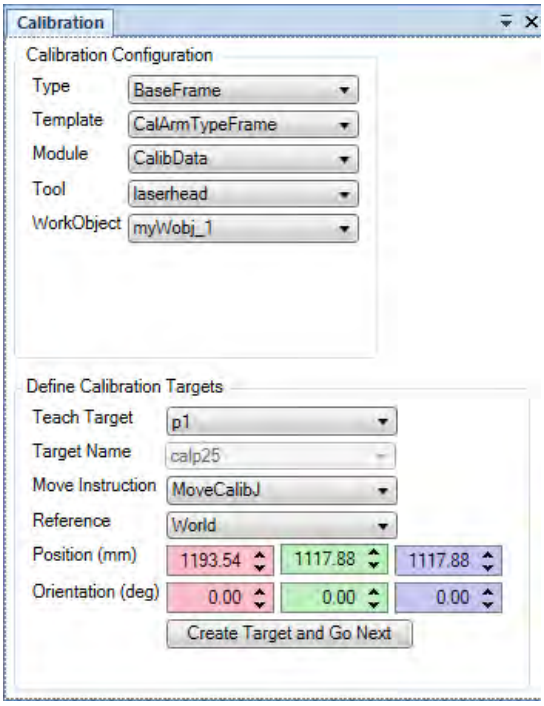
When you simulate the cutting path and process in the RS station on PC, calibration is needed to transfer the simulated positions in RobotStudio station in PC to real process positions in the real cutting workshop. RS Cutting PowerPac provides a standard calibration method with higher accuracy.

You can generate 3 to 10 calibration points based on the 3D CAD model. The first 3 calibration points would be used to get the transition relation, the other calibration points are used to improve the accuracy. There are two types of calibration points: general point and circle center point. General point is a point on a regular solid workpiece. Circle center point is the center of a circular hole which is found using geometry calculation.

### Create calibration points

Creating calibration points

Following is the description of the Calibration window:

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| Object | Description |
|---|---|
| **Type** | Allows you to select a calibration type. It can be calibration of BaseFrame for robot or positioner, calibration of Tool, or calibration of WorkObject. |
| **Template** | Allows you to select an available instruction templates for the selected calibration type. |
| **Module** | Allows you to select a RAPID module where the calibration instructions and targets are created. |

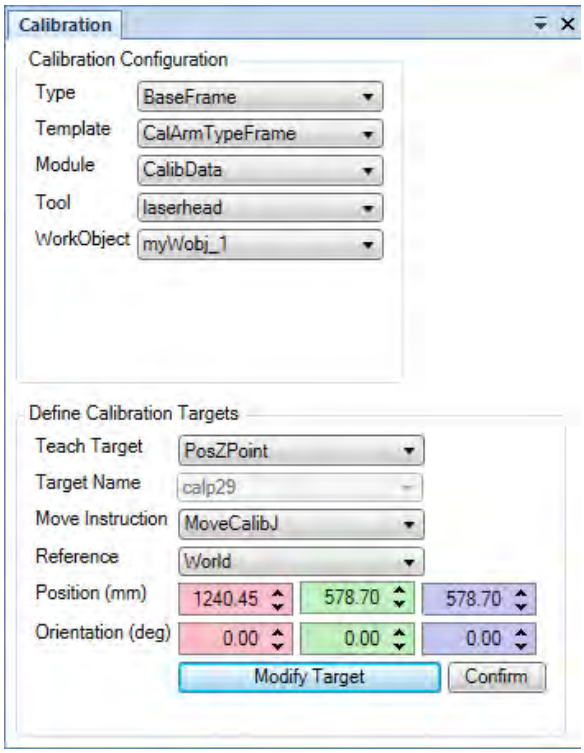
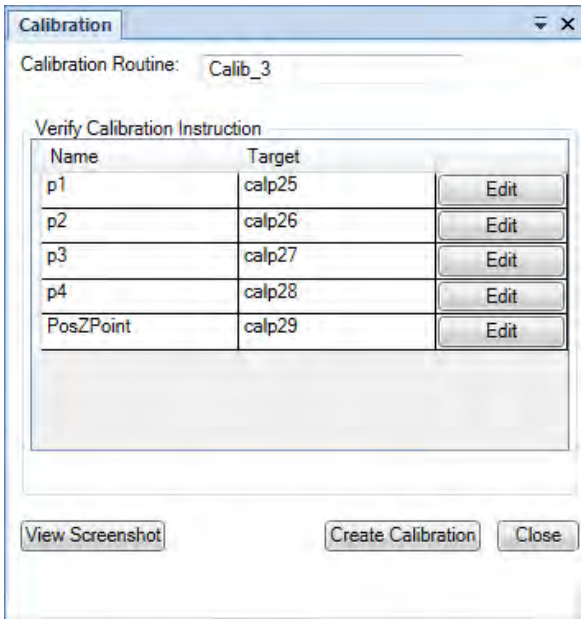
*Continues on next page*

| Object | Description |
|---|---|
| **Tool** | Allows you to select an RobotStudio tool to be used for calibration. |
| **Workobject** | Allows you to select a workobject (coordinate system) to which the calibration targets are related. |
| **Teach Target** | Allows you to select a number of calibration target. It varies based on the selected template. |
| **Target Name** | Displays the name of the calibration target. |
| **Move Instruction** | Allows you to select the type of move instruction. |
| **Reference** | Allows you to select the reference frame used for positioning of calibration targets. It is in sync with the RobotStudio reference frames. |
| **Position (mm)** | Allows you to select the matrix to locate the created targets. |
| **Orientation (deg)** | Allows you to select configure the orientation of the target. |
| **Create Target and Go Next** | Creates a target and the **Calibration** window is refreshed. |
| **Modify Target** | Allows you to modify a target. |
| **Confirm** | Allows you to save the changes in a selected target. |

Use the following procedure to create a calibration.

| | Step | Figure/Description |
|---|---|---|
| 1 | Click the **Calibration** icon in the cutting ribbon tab.<br>The **Calibration** window is displayed. | |
| 2 | Select a target on the part in the graphical window.<br>The position of the target is updated in the **Calibration** window. | |

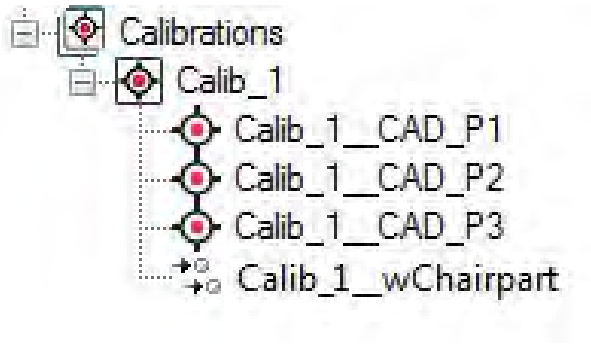
*Continues on next page*

| | Step | Figure/Description |
|---|---|---|
| 3 | Click the **Create Target and Go Next** button.<br>The **Calibration** window is refreshed. |  <br>xx1600001663 |
| 4 | Repeat the same steps for all the targets of the selected template. | **Note**<br>The **Modify target** button is used to modify the position of a selected target. |
| 5 | Click **Confirm**.<br>The **Calibration** window is refreshed. |  <br>xx1600001664 |

*Continues on next page*

| | Step | Figure/Description |
|---|---|---|
| 6 | Type a name for the calibration in the **Calibration Routine** field. | Click **Edit** to go back to previous screen and edit the position of a selected target.<br>Click **View Screenshot** to preview the targets. A 3D view window displaying the corresponding calibration points on the part is displayed |
| 7 | Click **Create Calibration**.<br>The calibration is created and the browser window displays the new calibrations. Also the Path View is created with the instructions. | |

After the creation procedure, the newly created calibration is displayed under the **Calibrations** node of the browser tree.

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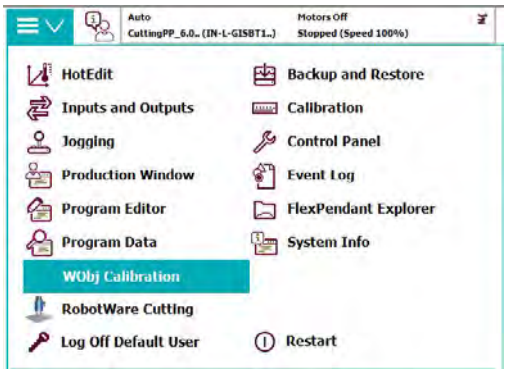
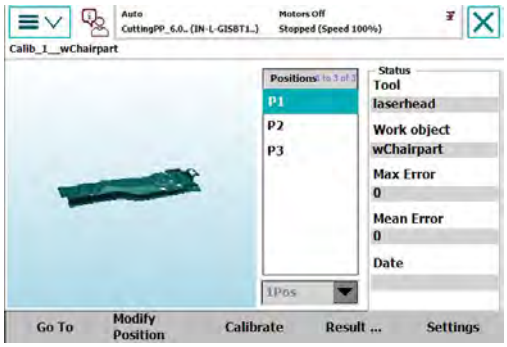
Procedure to calibrate on FlexPendant

| | Description | Illustration |
|---|---|---|
| 1 | Setup the fixture by mounting the master workpiece on the fixture. | |
| 2 | Replace the cut nozzle with the teaching tip on the cutting head. | |
| 3 | In the ABB main menu, tap the **Calibration** function. |  <br>xx1300001128 |

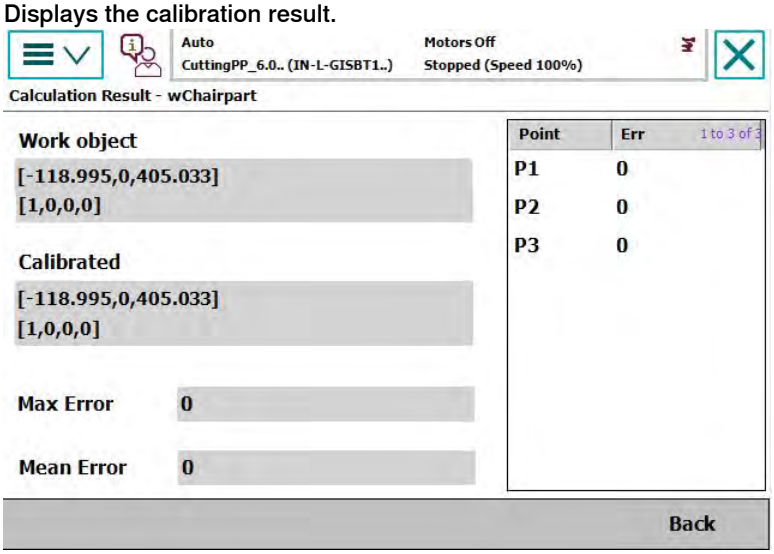
*Continues on next page*

| | Description | Illustration |
|---|---|---|
| 4 | The calibration interface is displayed. |  <br>xx1300001129 |
| 5 | Select the point used in calibration. And click **Go To**. The robot would go to that position which also can be marked in the picture. | |
| 6 | Jog the robot to the exact position on the real work piece, and tap **Modify Position**. | |
| 7 | Modify the other calibration points' positions using the same steps from step 5 to step 6. | |
| 8 | After all positions of calibration points have been modified, click **Calibrate**. The calibration would be done. | |

Description for items on the calibration interface:

| Item | Description |
|---|---|
| **Status** | This block can show the detailed information about the current calibration. |
| **Tool** | Displays the currently active tool. |
| **Work object** | Display the currently active work object. |
| **Max Error** | For all calibration points, the max difference between the offline calibration point and the corresponding position on real work piece. |
| **Mean Error** | For all calibration points, the mean variance of the difference between the offline calibration point and the corresponding position on real work piece. |
| **Date** | The date to do the calibration. |

*Continues on next page*

| Item | Description |
|---|---|
| **Result** | Displays the calibration result.<br>  <br>xx1300001130 |
| **Settings** | Display the calibration list. After select a calibration and click **OK**. The selected calibration is displayed. |

## Edit calibrations

Double click the newly created calibration, calibration points and the calibrated work object would be displayed under the node.

Operation about the newly created calibration.

| Item | Description |
|---|---|
| Rename | Give the calibration another name by right click the calibration to be re-named and select **Rename**. |
| Delete | Delete the calibration by right click the calibration to be deleted and select **Delete**. |
| ScreenShot | Used to show a picture on which the calibration points are marked and displayed on the work object for users' convenience to recognize the calibration points in the calibration process. |
| Property | Modify the position of the calibration point by right click a calibration point and select **Property**, then click on the work object in the 3D graphical view window to select a new position for the calibration point. |

View the screenshot of calibration points

Use the following procedure to view the screen shot of calibration points:

| | Description |
|---|---|
| 1 | Right click the calibration whose screenshot to be viewed and select **ScreenShot**. |
| 2 | View the calibration according to step 6 of *Create calibration points on page 55*. |

## 5.4 Create/edit process paths

### 5.4.1 Overview

**Overview**

Programming with Cutting PowerPac is an iterative process. The general process typically is:

1. Add parts in the cutting browser. A part is a container of process paths. When a part is created, a process path would be automatically created in the part. For detailed information of create a part, please see *Create or edit Part programs on page 62*.
2. Select path section for the process path. For detailed information of create a cutting, please see *Create/edit Process paths on page 72*.

## 5.4.2 Create or edit Part programs

### Overview

The **Part Programs** node is an owner of a part program. A part program is equivalent to a program module in RAPID (.mod). In the RAPID module, the part program is translated into a general RAPID procedure, which includes calls to other RAPID procedures in a sequence, where each procedure equals to a process path in the part program.

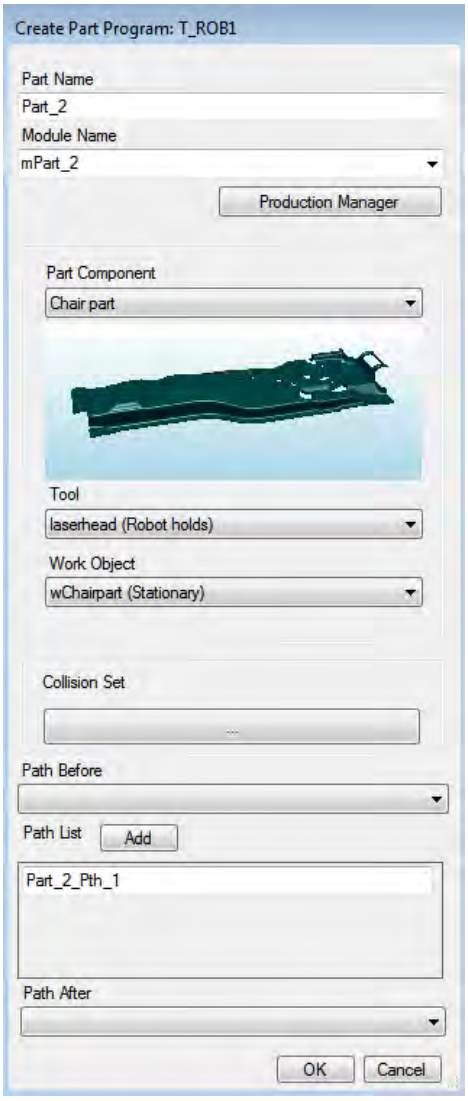
### Shortcut menus from the Part Programs node

| Node | Menu | Description |
|---|---|---|
| **Part Programs** | **Create Part Program** | Inserts a new part node into the tree structure and creates an empty path.<br>**Note**<br>You can access this function also from the Cutting ribbon-tab. |
| | **Import Part Program** | Imports XML part files. A dialog box opens for specifying import reference, tool, workobject, part name, path name, module name, and so on.<br>See *Importing a Part program on page 68* for detailed description. |
| **Part** | **Properties** | Modifies the properties of part program with a dialog box. The content is the same as in the **Create Part Program** dialog box. |
| | **Open** | Opens the Path view window, and shows the selected node's path items in that window. |
| | **Create Part Program** | Inserts a new part program node into the tree structure and creates an empty path.<br>**Note**<br>You can access this function also from the Cutting ribbon-tab. |
| | **Create Process Path** | Inserts a new path node into the tree structure.<br>**Note**<br>You can access this function also from the Cutting ribbon-tab. |
| | **Synchronize to RAPID** | Synchronizes the selected part (and all included paths) to the virtual controller. Not available if any path in the part program is open. |
| | **Export Part Program** | Export part program into an XML file. The default name of the file consists of the task name and the part name. A dialog box opens for specifying the exporting reference frame.<br>See *Exporting a Part program on page 67* for detailed description. |

*Continues on next page*

| Node | Menu | Description |
|---|---|---|
| | **Import Part Program** | Import an XML part file into station, as a part program. A dialog box opens for specifying import reference, tool, workobject, part name, path name, module name, and so on.<br>See *Importing a Part program on page 68* for more description. |
| | **Import Path** | Import XML path file into this part, as a process path. A dialog box opens for specifying import reference, tool, workobject, path name and module name.<br>See *Importing a path on page 74*for more description. |
| | **Delete** | Deletes the selected node. |

## Creating a Part program

| | Description | Illustration/Remark |
|---|---|---|
| 1 | In the Cutting browser, select the **Part Programs** node or a part program node, right click it and click **Create Part Program...**, or click **Part Program** in the Cutting ribbon tab to open the **Create Part Program** window. |  <br>xx1300001196 |

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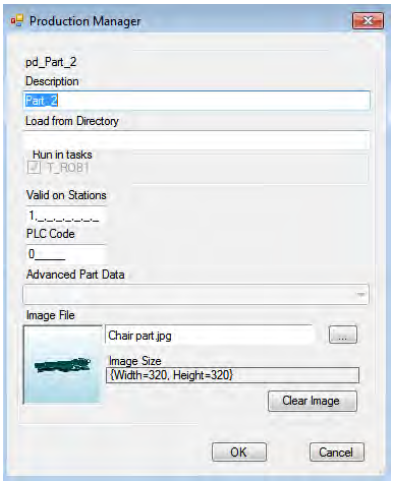
5.4.2 Create or edit Part programs
*Continued*

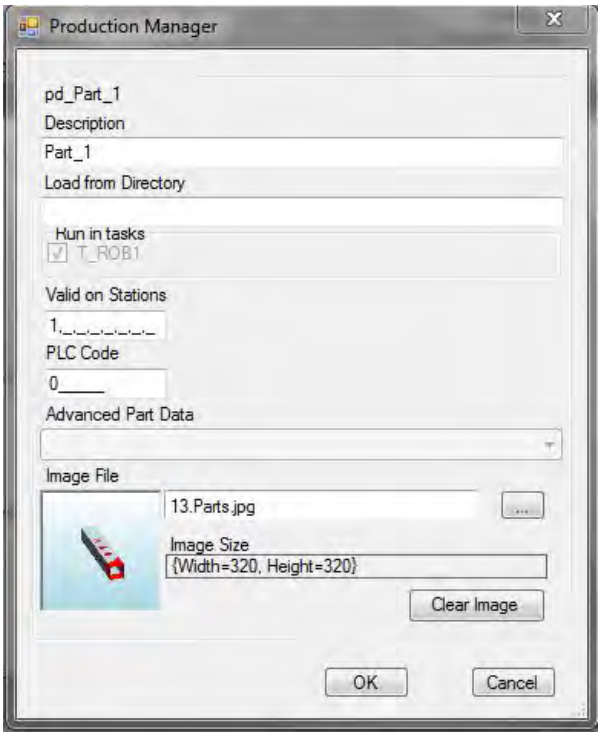
| | Description | Illustration/Remark |
|---|---|---|
| 2 | Select the required options. | **Note**<br>When the Cutting PowerPac is activated, the active Tool and WorkObject in RobotStudio Settings becomes dthe efault selection in the **Tool** list and **Work Object** list. After creating a Part program, the saved WorkObject, Tool, and Part Component are remembered and selected automatically while creating subsequent Part programs. |
| 3 | Click **Production Manager**.<br>The **Production Manager** window is displayed. |  <br>xx1400002784<br>**Note**<br>The **Production Manager** window automatically displays the image of the selected Part Component in the **Create Part Program** window. The image automatically gets saved under system/HOME directory. |
| 4 | Enter all the needed information and click **OK**. If any RAPID names are invalid, clicking **OK** will not close the dialog box. | |

| Object | Description |
|---|---|
| Part Name | Enter a name for the new part program. |
| Module Name | Get automatic update when entering a new part name. |
| Production Manager | The management interface to show the additional information of the part program. |
| Part Component | Select the component for which the cutting part program would be created. After the selection, the component is displayed in the 3D graphic view window below. |
| Tool | Select the tool to be used to cut from the tool list. |
| Work Object | Select the work object coordination system that would be used for cutting. |
| Collision set | Set up collision sets to detect if collision exists during the simulation of the cutting process. |

*Continues on next page*

| Object | Description |
|---|---|
| Path Before | Select a path that runs before the created part program. The path usually is a service path |
| Path List | Click **Add** to add new empty paths for the part program. You can also rename the new paths here. |
| Path After | Select a path that runs after the created part program. |

The Production Manager interface

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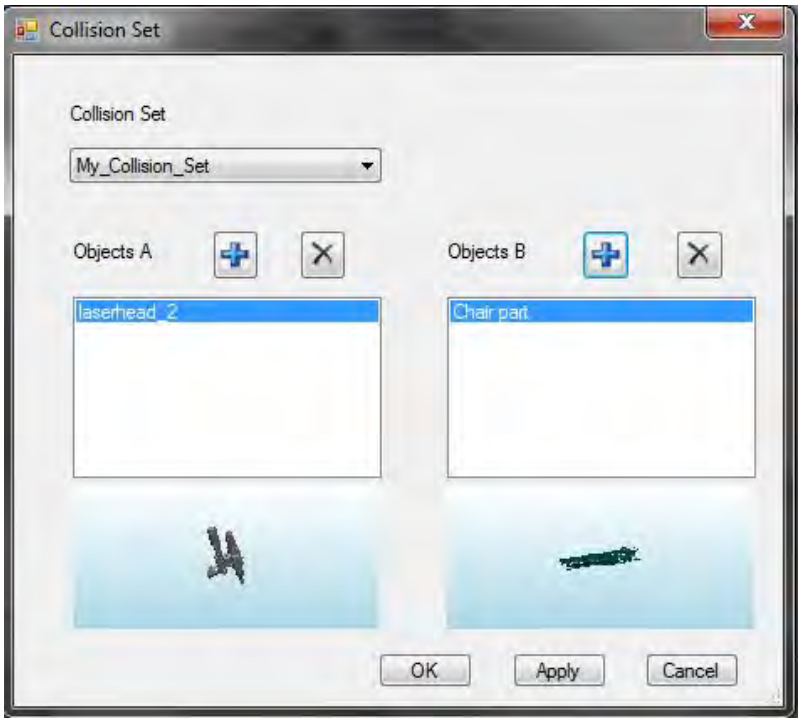
| Object | Description |
|---|---|
| **Description** | Get automatic update when entering a new part name. |
| **Load from Directory** | If the module is loaded from the file system, this text specifies the directory. |
| **Run in tasks** | Select tasks in which the created part program runs. This is useful when used in a MultiMove program. |
| **Valid on Stations** | Select the stations for which this part data will be valid. The values should be numbers from 1 to 8. |
| **PLC Code** | A unique integer number to indicate the part program ID in PLC code. |
| **Advanced Part Data** | The partdata can be bound to an advanced path data. |
| **Image File** | Select an image for the created part program. This image can be shown on Production Manager of the FlexPendant. |
| **Image Size** | When the image is selected, the size of the image would be automatically displayed in this field. |

*Continues on next page*

5.4.2 Create or edit Part programs
*Continued*

Collision Set

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| Object | Description |
|---|---|
| Collision Set | The dropdown list to select a existed collision set or select to create a new collision set. |
| Objects A, B | The collision set component A and B. |
| 3D graphic view window (marked with 1) | The selected parts in collision set can be displayed with its 3D model. |

Procedures to create a collision set:

| | Description | Illustration |
|---|---|---|
| 1 | To create a collision set, click the drop down list of Collision Set and select **Create new....** | |
| 2 | A **Create CollisionSet** interface would show up. Name the new collision set in the interface and click **OK**. | |
| 3 | Click the add button to separately add components in **Object** set A and B. Click the delete button to delete component from the object set. |  |
| 4 | Click **Apply** to confirm the collision set. Click **OK** to confirm and quite the collision set interface. | |

To edit a collision set, click the collision set to be edit in the collision set drop down list and follow steps 3 and 4 of creating a collision set.

After entering all the needed information, you can view the new part program in the tree structure of Cutting browser. If the part program is selected to be run in multi-tasks, a new part program node with the same name will be created under each task.

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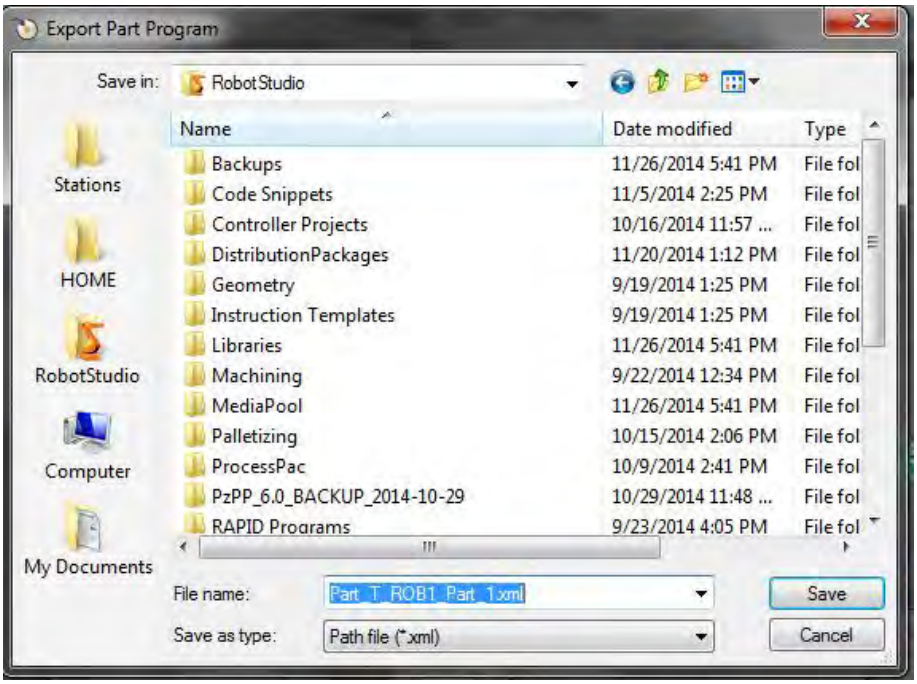
### Exporting a Part program

To export a part program into an XML file, follow these steps:

1 In the Cutting browser, select the **Part Programs** node or a part program node, right-click it and click **Export Part Program** to open a dialog box.

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2 Specify a name of the file and a directory to store.

The default name of the file is *"Part_"+Task name+ "_" + Part name*.

The default directory is under *"/My Documents/RobotStudio/Stations"*.

3 Click **Save** and a dialog box opens.

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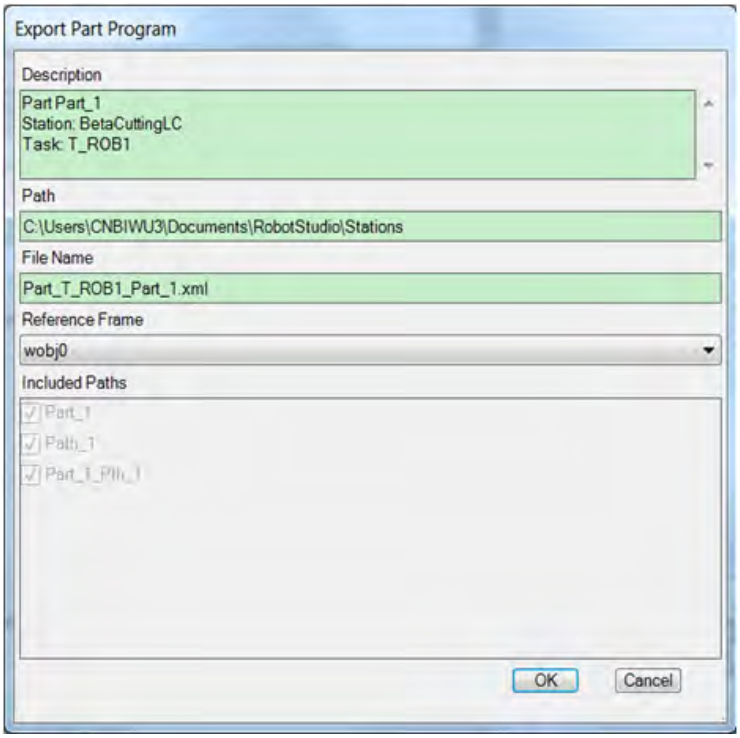
5.4.2 Create or edit Part programs
*Continued*

4 Check the data and click **OK**. The XML file will be saved.

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| Object | Description |
|---|---|
| **Description** | Describes the name of the part, the station, and the task. Read-only. |
| **Path** | The directory where the file is stored. Read-only. |
| **File Name** | The name of the saved file. |
| **Reference Frame** | A reference where the path targets in the part program are related to. This affects the position and rotation values of the targets. The references can be World Coordinate, User Coordinate System, robot base coordinate, or work object coordinate. |
| **Included Path** | The included paths to be exported are listed here. Besides paths in the selected part, service paths are also listed, in case you want to export service procedures together with the part program. Check the service procedures that you want to export together. |

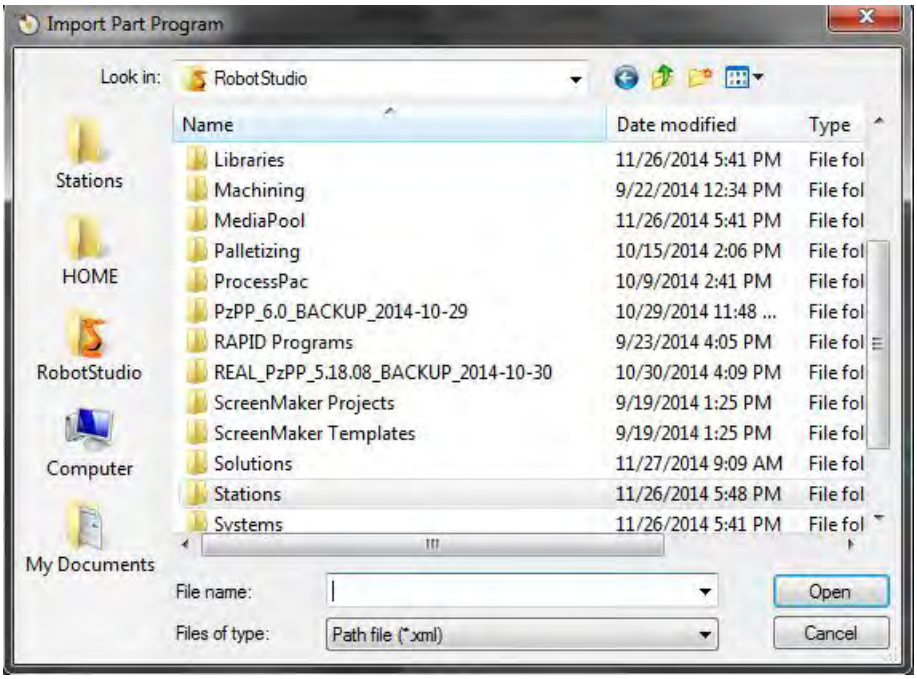
### Importing a Part program

A file can only be imported as the same object as it was exported. A part can only be imported as a part.

*Continues on next page*

To import a part XML file into the station, please follow the steps:

1 In the Cutting browser, select the **Part Programs** node or a part program node, right-click it and click **Import Part Program** to open a dialog box.

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2 Select a part program file to import and click **Open**. A message box opens telling if a wrong type of XML file is selected.

If a wrong type of XML file is selected, a message is shown.

If a right type is selected, a dialog box opens.

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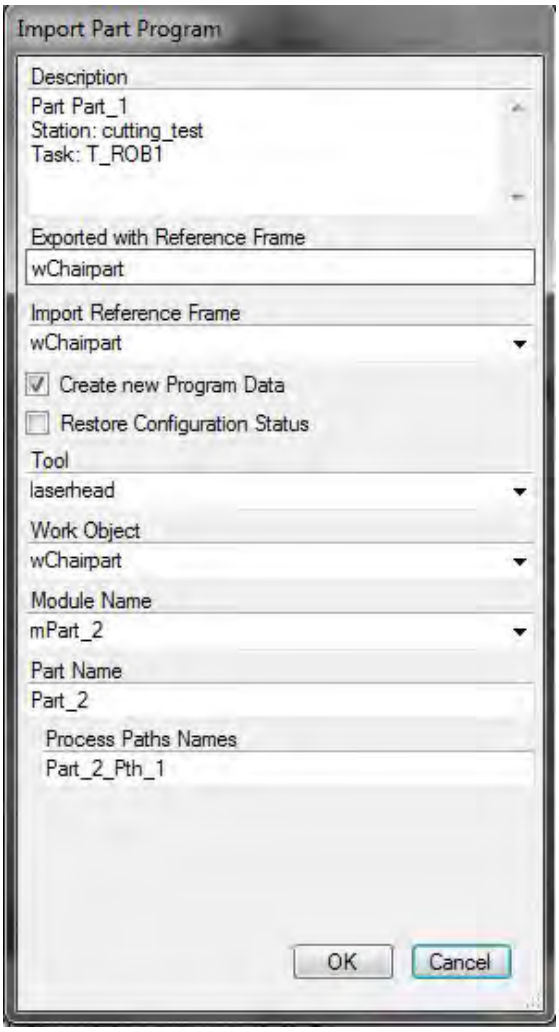
5.4.2 Create or edit Part programs
*Continued*

3 Check the data and click **OK**. The XML file will be imported.




xx1300001203

| Object | Description |
|---|---|
| Description | Describes the name of the part, the station, and the task. Read-only. |
| Exported With Reference Frame | Used when the part program is exported. Read-only. |
| Import Reference Frame | A reference to import part program. This affects the position and rotation values of the targets. The references can be World Coordinate, User Coordinate System, robot base coordinate, or work object coordinate. |
| Create New Program Data | Select the check box to create a new copy of the included Program Module data; otherwise, old data will be referenced. |
| Restore Configuration Status | Select the check box to restore configuration status of the included targets to when they were exported. Otherwise, the configuration status is re-set to undefined.<br>**Note**<br>This is a lazy function. Make sure that the targets are indeed of the same configuration status. |

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| Object | Description |
|---|---|
| Tool | The tool for the part program. If left blank, the tool from the file will be used. |
| Work Object | Select workobjects for targets in the part program. If left blank, the workobject from the file will be used. |
| Module Name | The synchronized RAPID module of the part program. |
| Path Name | The name of the imported part. |
| Process Paths Names | The name of the process paths in the part. |

**Note**

The following rules apply when creating new data and importing XML files:

- If the data is of program data type **Sync to Program Module**, new names will be created automatically, unless the **Create New Program Data** is unchecked.
- If the data is of another type, such as **Sync to Process Data Module**, new data will only be created if it is not present in the station. For example, a cutdata cd1 that is synchronized to the process data module will not be created again when importing. The old data cd1 will be used instead.

## 5.4.3 Create/edit Process paths

### Overview

Process Paths are listed in the Cutting browser under the part programs. As a component of a part program, a path is a holder of cut in a sequence. Each cut includes a list of targets that constitute a continuous path. Paths can be dragged from one part to another; similarly, the order of paths in a part can be rearranged.

**Note**

A process path created in the Cutting browser is also visible in the **Path&Targets** browser in the **Home** ribbon tab. During synchronization with the virtual controller, the path is translated into a RAPID procedure.

### Shortcut menu from the Process Path node

| Node | Menu | Description |
|---|---|---|
| **Path** | **Open** | Opens the path in the path view. Not available on an open path. |
| | **Create Process Path** | Inserts a new path node into the tree structure. Not available on an open path.<br>**Note**<br>You can access this function also from the Cutting ribbon-tab. |
| | **Synchronize to RAPID** | Synchronizes the selected path to the virtual controller. Not available on an open path. |
| | **Export Path** | Export a path into a XML file. The default name of the file consists of task name and path name. A dialog box opens for specifying the exporting reference frame.<br>See *Exporting a path on page 73* for detailed description. |
| | **Import Path** | Import a path XML file into the current station as a process path. A dialog box opens for specifying the importing reference frame, tool, workobject, module, and path name.<br>See *Importing a path on page 74* for detailed description. |
| | **Visible** | With a check mark to indicate that the selected path is visible.<br>Not available on an open path. |
| | **Delete** | Delete the selected path. Not avail-able on an open path. |
| | **Rename** | Rename the selected path. Not available on an open path. |
| | **Close** | Closes an open path, removing it from the path view. Only available on an open path. |

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When a 3D path is created, a path with the path name would be displayed under the path node. Menu of the 3D path is:

| Menu | Description |
|---|---|
| **Edit** | Edit the Path section. For detailed description of the Path Section, please see *Create Path Section on page 78*. |
| **Delete** | Delete the path. |
| **Setting** | Setting of the path. |

### Creating process paths

There are three ways to create process paths:

- Right-click a part program node and click **Create Process Path**.
- Click a part program node or a process path node, and click **Process Path** in the **Create** group of the **Cutting** ribbon-tab.
- Add paths to the path list from the **Create Part Program** dialog box.

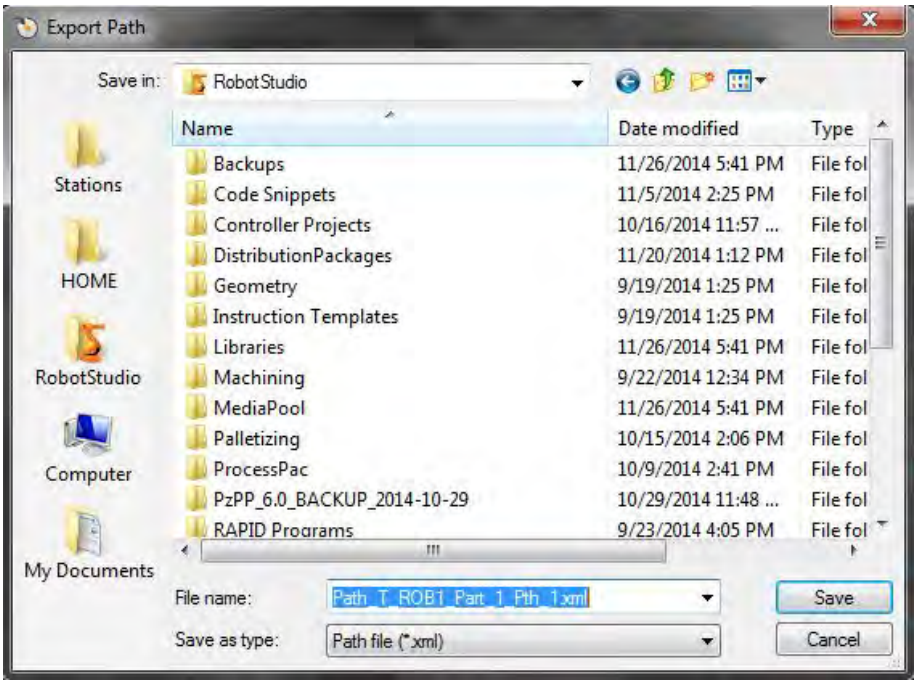
### Exporting a path

To export a path into an XML file, follow these steps:

1 In the Cutting browser, right-click a path, and click **Export Path**. A dialog box opens. Specify the name of the file and the directory to store.

The default name of the file is *"Path_"+task name+"_"+path name*.

The default directory is under *"/My Documents/RobotStudio/Stations"*.

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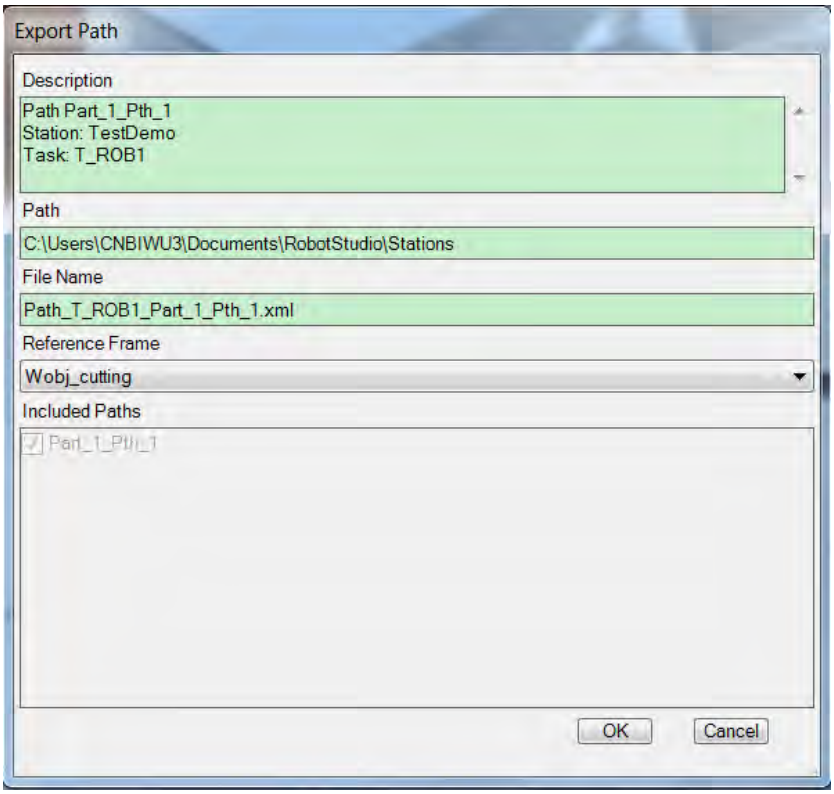
2 Click **Save** and the **Export Path** dialog box opens.

*Continues on next page*

3 Complete the dialog box and click **OK**. The XML file will be saved.




xx1300001207

| Object | Description |
|---|---|
| **Description** | Describes the name of the path, the station, and the task. Read-only. |
| **Path** | The directory where the file is stored. Read-only. |
| **File Name** | The name of the saved file. |
| **Reference Frame** | Select a reference that the path targets in the path are related to. This affects the position and rotation values of these targets. The references can be World Coordinate, User Coordinate System, robot base coordinate, or work object coordinate. |
| **Included Path** | The included paths to be exported are listed here. Besides the selected path, service paths are also listed, in case you want to export service procedures together with the selected path. Check the service procedures that you want to export together. |

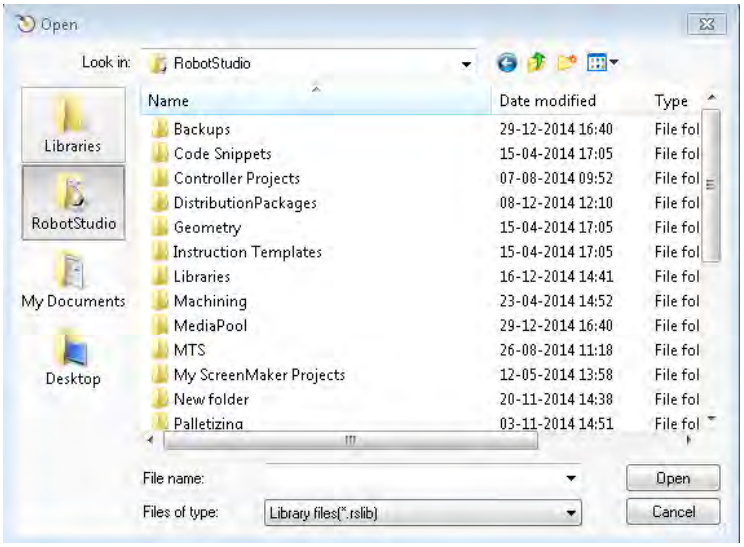
## Importing a path

To import a path XML file into the station, follow these steps:

1 In Cutting browser, right-click a path, and select **Import Path**. A dialog box opens.

*Continues on next page*

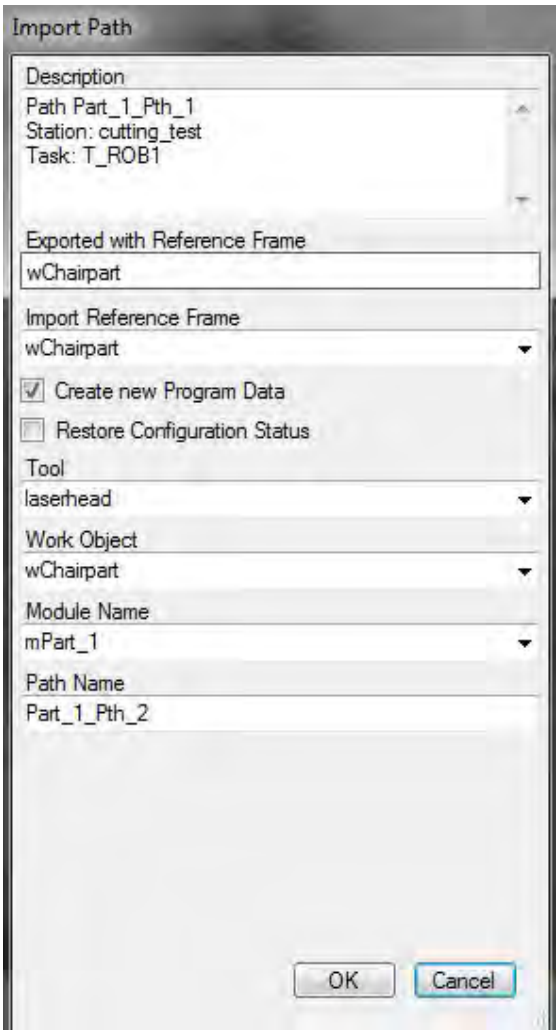
**Specify a path file to import and click OK. A message box opens telling if a wrong type of XML file is selected.**




xx1500000722

*Continues on next page*

2 Click **Open**. The **Import Path** dialog box opens.




xx1300001209

| Object | Description |
|---|---|
| Description | Describes the name of the part, the station, and the task. Read-only. |
| Exported With Reference Frame | Reference used when the part program is exported. Read-only. |
| Import Reference Frame | A reference to import part program. This affects the position and rotation values of these targets. The references can be World Coordinate, User Coordinate System, robot base coordinate, or work object coordinate. |
| Tool | Select the tool for the part program. If left blank, the tool from the file will be used. |
| Work Object | Select workobjects for targets in the part program. If left blank, the workobject from the file will be used. |
| Module Name | The synchronized RAPID module of the part program |
| Path Name | The name of the imported part. |

*Continues on next page*

3 Complete the dialog box and click **OK**. A new path will be imported.

> **Note**
>
> The rules about creating new data are the same as described in *Importing a Part program on page 68*.

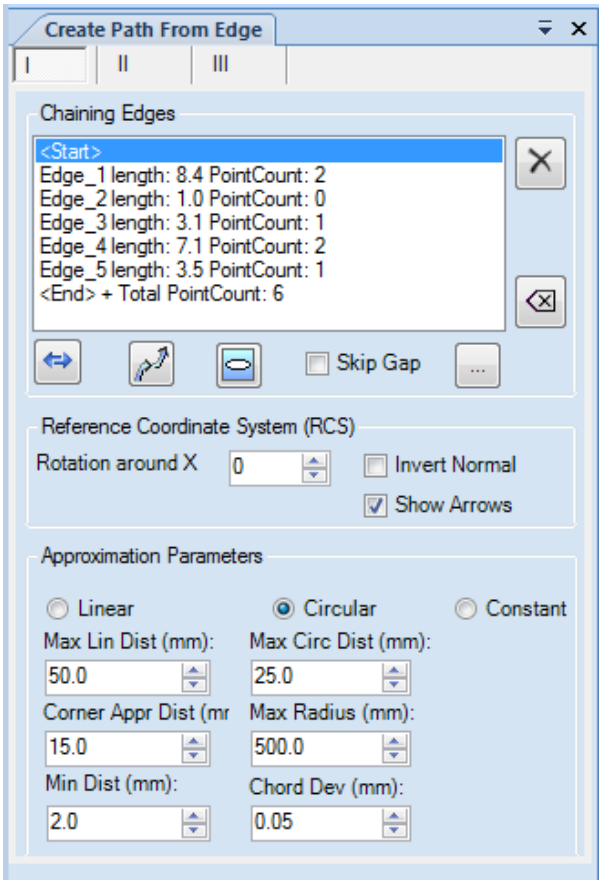
## 5.4.4 Create Path Section

### Overview

To add 3D free form cuts to a path, click **Path Section** on the **Create** ribbon tab. The Create Path From Edge interface would show up.

### Create Path From Edge interface (the first page)

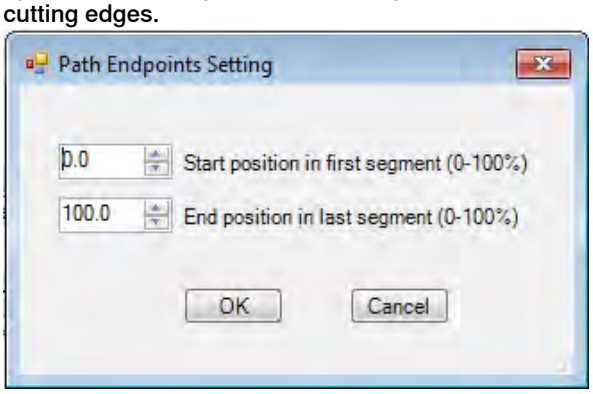
Following is the first page of the **Create Path From Edge** interface:




xx1300001247

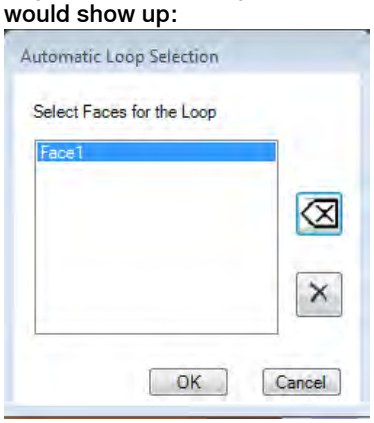
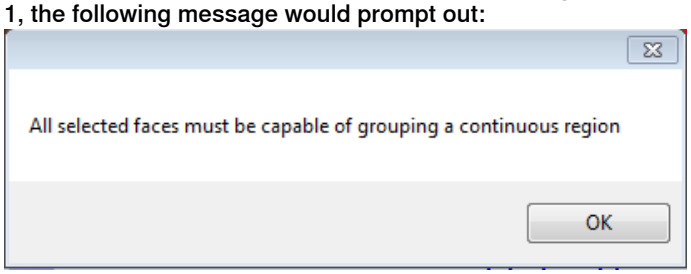
| Object | Description |
|---|---|
| **Chaining Edges** | Show the selected continuous adjacent edges selected from the CAD model.<br>The default edge selection method is manual selection.<br>After some edges are manually selected, If there are tangent edges after the selected edges, the Tangent selection method can be active. Tangent edges afterward would be automatically selected if the **Tangent** button is clicked. Users can use the Loop selection method by click the **Loop** button and select a continuous face group containing the former selected edges. |
|  | Delete the last selected cutting edge. |

*Continues on next page*

| Object | Description |
|---|---|
|  | Delete all the selected cutting edges. |
|  | Click this button, the **Path Endpoints Setting** interface would show up to set the start position and end position on the first and last cutting edges.<br>  <br>xx1300001252 |
|  | Reverse the edges items in the chaining edges. |
|  | Automatic tangent edge selection method. If users click this button after at least one cutting edge has been selected, RS Cutting PowerPac would automatically calculate followed tangent edges in the cutting direction until a non-tangent edge is met. This function is available only when there are tangent edges following the first manually selected edges in the cutting direction. |

*Continues on next page*

5.4.4 Create Path Section
*Continued*

| Object | Description |
|---|---|
|  | Automatic loop selection method. This method is used to select edges that form a loop. Click this button, the following interface would show up:<br>  <br><br>xx1300001256<br>Select faces that constitute a continuous region with **Face 1** which contains the first manually selected edges and click **OK**. Loop edges would be automatically selected.<br>If faces selected can no constitute a continuous region with Face 1, the following message would prompt out:<br>  <br><br>xx1300001257 |
| **Skip Gap** | When this item is checked, gaps shorter than the minimum linear distance in manually selected edges are acceptable. Only applicable for manually edge selection method. |
| **Reference Coordinate System (RCS)** | For detailed description, please see *Reference Coordinate System (RCS) on page 16*. |
| **Rotation around X** | Specify the rotation angle around X axis. |
| **Invert Normal** | Indicate whether inverting the current normal of the cutting surface. |
| **Approximation Parameters** | Parameters as minimum and maximum distances, maximum radius etc. for different approximation types. |
| **Linear** | Apply the linear approximation parameters on current selected edges. |
| **Circular** | Apply the circular approximation parameters on current selected edges.<br>If one edge failed to apply the circular approximation, it would automatically change to apply the linear approximation. |
| **Constant** | Apply the constant length approximation on current selected edges. |
| **Max Lin Dist (mm)** | Specify the maximum length for linear approximation. |

*Continues on next page*

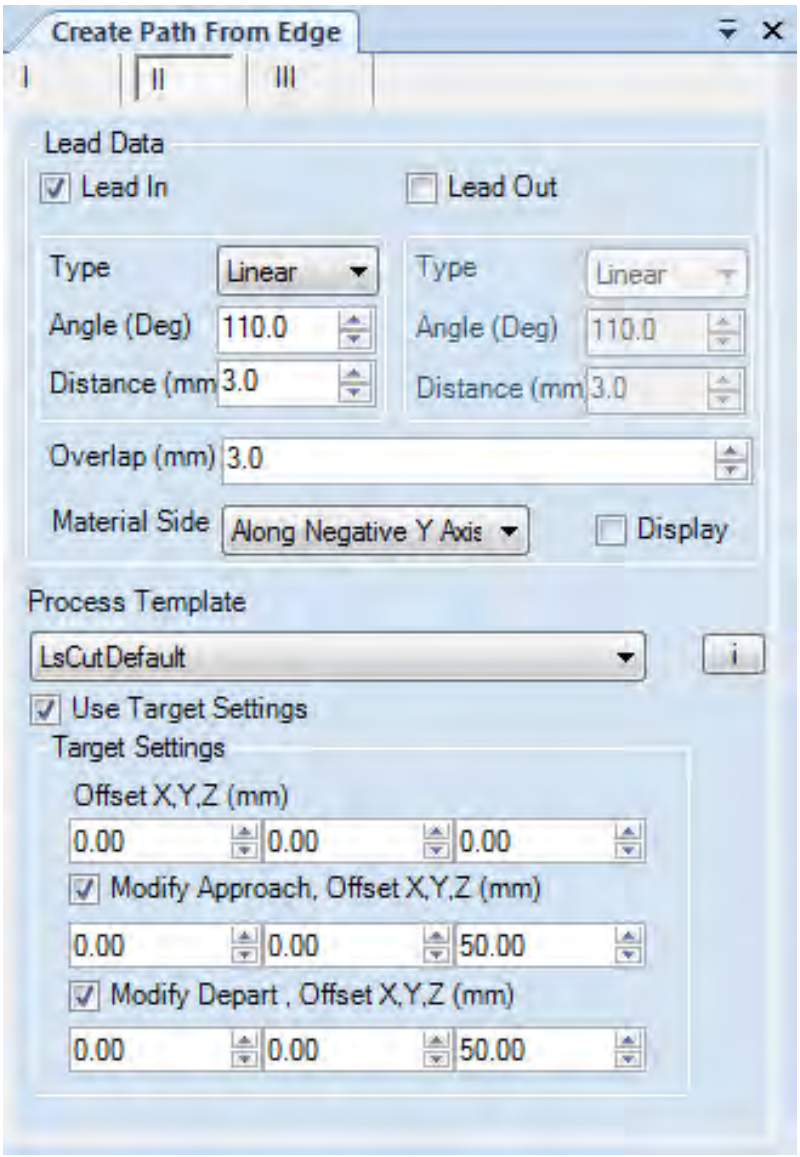
| Object | Description |
|---|---|
| **Corner Appr Dist (mm)** | Specify the edge length of the corner for linear approximation.<br>This value should be greater than the value of "Min Dist", otherwise it has no effect on approximation.<br>Therefore if the user don't want insert any corner into the linear paths, this value can be set with 0. |
| **Min Dist (mm)** | Specify the minimum length for linear approximation.<br>If one linear path's length is shorter than this specified value, this linear path would be eliminated in the resultant paths.<br>Instead, a new linear path, which starts from the end position of the previous valid path and ends to the start position of the next valid path, will be inserted into the path list. |
| **Max Circ Dist (mm)** | Specify the maximum length for circular approximation. |
| **Max Radius (mm)** | Specify the maximum radius for circular approximation. |
| **Chord Dev (mm)** | Specify the maximum chord value for circular approximation. |

*Continues on next page*

### Create Path From Edge interface (the second page)

#### Introduction

The second page of free form cutting selection interface:




xx1300001248

| Object | Description |
|---|---|
| **Lead Data** | Lead parameters about the lead in and lead out path of the cutting head before and after the cutting. |
| **Lead In** | If selected, the new cutting will include an approach target before Process Start point. |
| **Lead Out** | If selected, the new cutting will include a depart target after Process End point. |
| **Type** | There are two types of leaddata: Linear and circular. |
| **Overlap (mm)** | In the leadout phase of cutting, the overlap distance between the start point of leadout (that is, the exit point) and the entry point. Only applicable in closed loop shape cutting. |

*Continues on next page*

| Object | Description |
|---|---|
| **Material Side** | Select the direction of the material side. When you select **Display**, an arrow indicating the direction of the material side is displayed. It is useful for creating or editing the path. |
| **Process Template** | Select the process template from the drop down list and click the **i** button, an interface displaying some manually input process parameters of the process template, such as voltage, current etc. would show up. |
| **Use Target Settings** | Used to offset the position of targets, approach point and depart point. If **Use Target Settings** is ticked, the offset settings would be used. |
| **Offset X,Y,Z (mm)** | The offset distance of the process targets with their RCS. |
| **Modify Approach, Offset X,Y,Z (mm)** | The offset distance of the approach points with their RCS. |
| **Modify Depart.Offset X,Y,Z(mm)** | The offset distance of the departure points with their RCS. |

## Lead Data Linear


xx1300001297

| Object | Description |
|---|---|
| **Angle (Deg)** | The angle of the linear lead in/out path relative to the tangent line of the cutting path at the entry/exit point. |
| **Distance (mm)** | The vertical distance from the start/end point of the linear lead in/out path to the tangent line of the cutting path at the entry/exit point. |

## Lead Data Circular


xx1300001298

| Object | Description |
|---|---|
| **Radius (mm)** | The radius of the circular between the start/end point and the entry/exit point and which is also tangent to the tangent line of the cutting path at the entry/exit point. |
| **Distance (mm)** | The distance of the start/end point on the leadin/leadout path to the tangent line of the cutting path at the entry/exit point. |

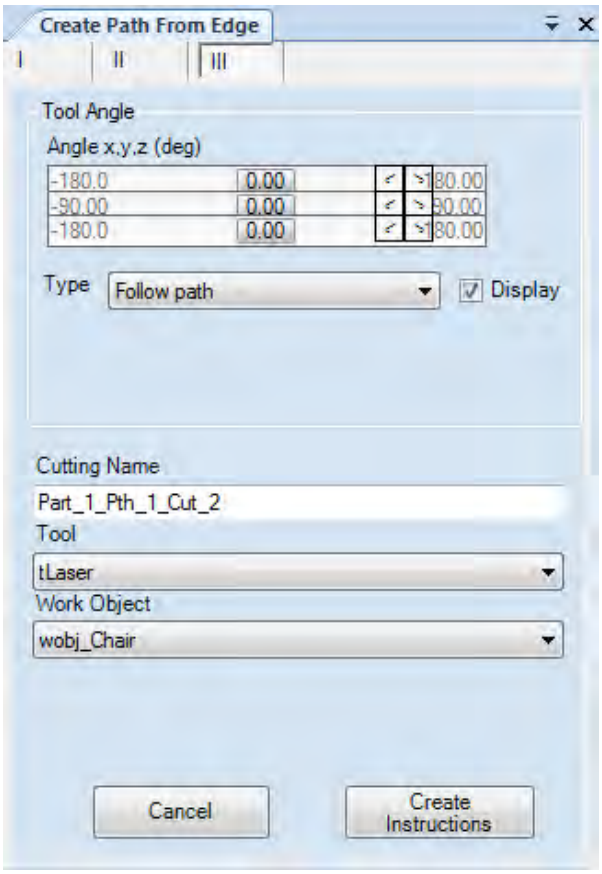
*Continues on next page*

5.4.4 Create Path Section
*Continued*

### Create Path From Edge interface (the third page)

Introduction

The third page of free form cutting selection interface:




xx1300001258

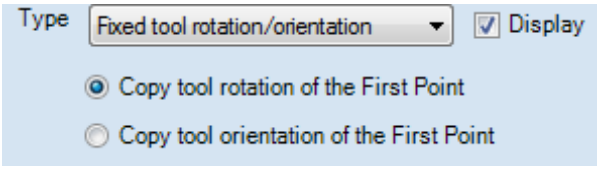
| Object | Description |
|---|---|
| **Tool Angle (deg)** | The tool status of angle. |
| **Angle x,y,z (deg)** | The work angle, push/drag angle, and tool spin angle of the tool, in relation to its RCS. |
| **Type** | The item to choose the tool angle type along the cutting path. Here three methods to calculate the tool angle are listed:<br>• **Follow path**.When this type is selected, direction of the X axis of TCP is the same with the RCS's X axis of the edge. Direction of the Y and Z axes are contrary to the RCS's of Y and Z axes.<br>• **Fixed tool rotation/orientation**. When this type is selected, tool rotation/orientation is fixed as the first target in the path. For detailed description, see *Fixed tool rotation/orientation on page 85*.<br>• **Spherical interpolation of tool rotation**. For detailed description, see *Spherical interpolation of tool rotation on page 85*. |
| **Display** | When selected, a simulated TCP would be displayed to indicate the modified tool angle. |
| **Cutting name** | The name of the new cutting. |
| **Tool** | Select tool of the cutting. |
| **Work Object** | Select work object for the targets of the new cutting. |

*Continues on next page*

| Object | Description |
|---|---|
| **Use Target Settings** | Indicate whether using target settings. |

Fixed tool rotation/orientation

When the tool angel type is Fix tool orientation, the following interface can be seen:

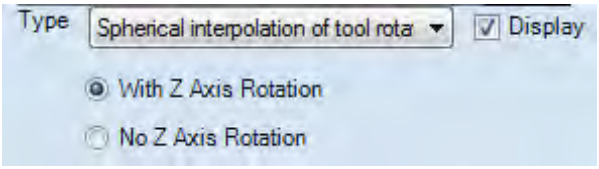



xx1300001259

| Object | Description/Illustration |
|---|---|
| Copy tool rotation of the first point | When this option is selected, the X axis direction of the TCP along the cutting path would be fixed as the same with the first point while the Z axis direction of the TCP keeping unchanged. |
| Copy tool orientation of the first point | When this option is selected, the direction of the TCP along the cutting path would be fixed as the same with the TCP of the first point on the cutting path. |

Spherical interpolation of tool rotation

Spherical interpolation of Z is an another method to calculate the angle of TCP. When **Spherical interpolation of tool rotation** is selected, the following interface can be seen:




xx1300001260

| Object | Description/Illustration |
|---|---|
| **With Z Axis Rotation** | When this option is selected, the Z axis of the tool orientation would rotate during the tool's moving along the cutting path. |
| **No Z Axis Rotation** | .When this option is selected, the Z axis of the tool orientation would not rotate during the tool's moving along the cutting path |

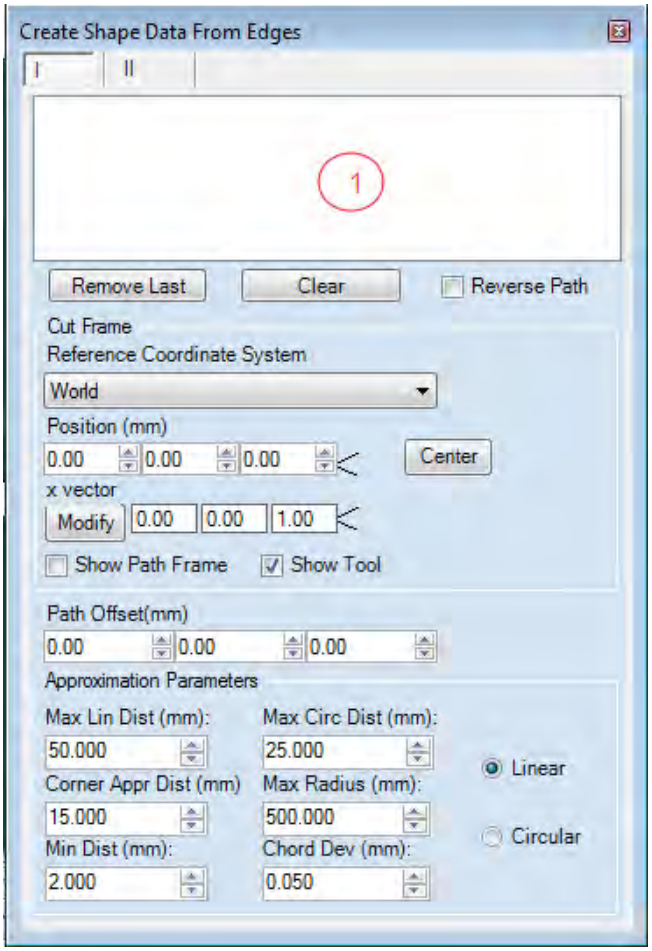
## 5.4.5 Create 2D Shape

### Creating Cuts

To add 2D shape cuts to a path, click **2D Shape Data**.

The **Create Shape Data From Edges** window is displayed.

Following is the first page:




xx1300001204

| Object | Description |
|---|---|
| **List Box (Marked with 1)** | Show the selected continuous adjacent edges from the CAD model. |
| **Remove Last** | Remove the last edge in the list box. |
| **Clear** | Clear all the selected edges. |
| **Reverse Path** | Reverse the edges items in the list box. |
| **Reference Coordination System** | The reference coordination system based on which the cutting frame would be created. |
| **Position** | Position of the TCP. Click the < sign after the position fields would active the **Center** button. Click the **Center** button, TCP would automatically go to the center of the 2D shape. |

*Continues on next page*

| Object | Description |
|---|---|
| **x vector** | X vector of the path frame.<br>Click the < sign after the x vector fields to active the x vector modification function, then click in the 3D graphic view window to select another x vector. Click the **Modify** button to modify the position of the TCP. Click **Invert** button in the interface can invert the direction of the x vector. |
| **Show Path Frame** | Displays the path frame. |
| **Show Tool** | Displays the TCP. |
| **Path Offset (mm)** | Offset the cutting path in X, Y, Z directions. |
| **Approximation Parameters** | Parameters as minimum and maximum distances, maximum radius etc. for different approximation types. |
| **Max Lin Dist (mm)** | Specify the maximum length for linear approximation. |
| **Max Circ Dist (mm)** | Specify the maximum length for circular approximation. |
| **Corner Appr Dist (mm)** | Specify the edge length of the corner for linear approximation.<br>This value should be greater than the value of "Min Dist", otherwise it has no effect on approximation.<br>Therefore if the user don't want insert any corner into the linear paths, this value can be set with 0. |
| **Max Radius (mm)** | Specify the maximum radius for circular approximation. |
| **Min Dist (mm)** | Specify the minimum length for linear approximation.<br>If one linear path's length is shorter than this specified value, this linear path would be eliminated in the resultant paths.<br>Instead, a new linear path, which starts from the end position of the previous valid path and ends to the start position of the next valid path, will be inserted into the path list. |
| **Chord Dev (mm)** | Specify the maximum chord value for circular approximation. |
| **Linear** | Apply the linear approximation on current selected edges. |
| **Circular** | Apply the circular approximation on current selected edges.<br>If one edge failed to apply the circular approximation, it would automatically change to apply the linear approximation. |
| **Constant** | Apply the constant length approximation on current selected edges. |

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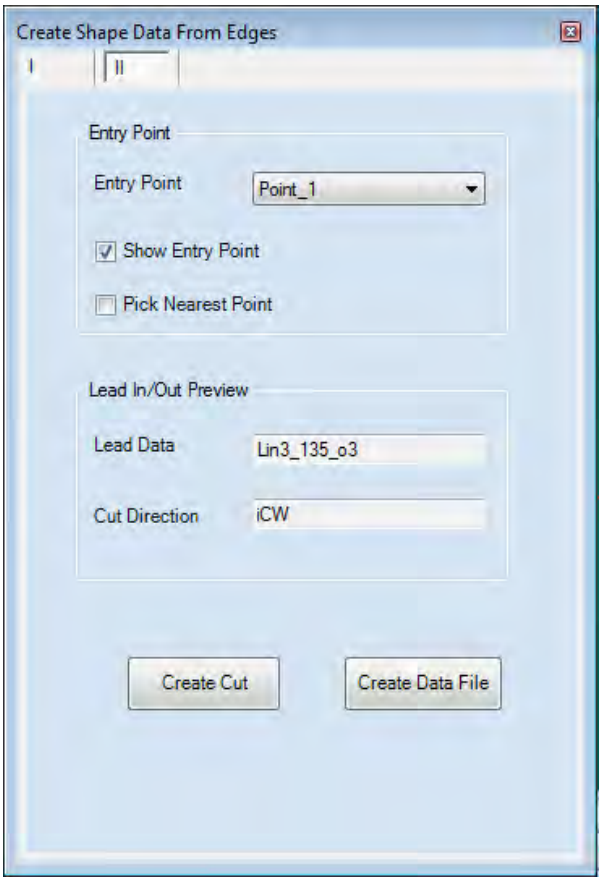
5.4.5 Create 2D Shape
*Continued*

Following is the second page:




xx1300001205

| Object | Description |
|---|---|
| **Entry Point** | The drop down list to select the start point of the cutting. |
| **Show Entry-Point** | When selected, the entry point would be displayed in the cutting path. |
| **Pick Nearest Point** | When selected, the nearest point to the TCP would be picked as the entry point of the cutting. |
| **Lead Data** | Lead parameters about the lead in and lead out path of the cutting head before and after the cutting. |
| **Lead In** | If selected, the new cutting will include an approach target before Process Start point. |
| **Cut Direction** | CW or iCW. Indicate the cutting direction is clockwise or anticlockwise. |
| **Create Cut** | When click Create Cut, a cutting data file would be prompt to be saved and a cutting instruction would be added in the path view window. |
| **Create Data File** | When click Create Data File, only a cutting data file would be prompt to be saved. |

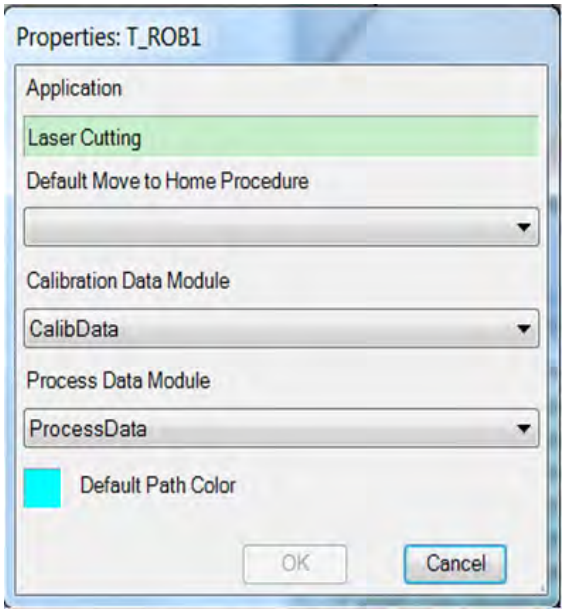
The 2D shape cuts also can be added in the **Path view** window. See *2D shape instructions on page 108* for the detailed description of how to add cuts to process paths in the **Path view** window.

## 5.5 Other edit for task

### Overview

You can access the shortcut menus for the task node (top node) in the Cutting browser by right-clicking the task node.

### Shortcut menus from the task node

| Menu | Dialog Box Elements | Description |
|---|---|---|
| **Properties** | | Allows you to specify the following properties for the selected task:<br>  <br>xx1300001179 |
| | **Application** | From the options selected in the virtual controller, the system determines the application suitable to the robot type. If the robot is for laser cutting, an appropriate move and action instruction set will be imported to the station. |
| | **Default Move to Home Procedure** | This optional property adds a procedure before the first cutting of every part program. This is usually the starting point for the first cutting, ensuring that the robot can actually move to the first instruction in the first cutting. |
| | **Calibration Data Module** | This optional property puts all workobjects and tooldata in the specified module when synchronizing with the virtual controller. You can map it to a specific RAPID module in the virtual controller. |
| | **Process Data Module** | This mandatory property puts all process data in the specified module when synchronizing with the virtual controller. You can map it to a specific RAPID module in the virtual controller. |
| | **Default Path Color** | This optional property sets the color used to highlight open paths in the Cutting browser and the path view. |
| **Refresh** | | Refreshes the browser to reflect changes in the path view. |

*Continues on next page*

| Menu | Dialog Box Elements | Description |
|---|---|---|
| **Import Action Instruction** | | Imports predefined action instructions. |
| **Import Move Instruction Description** | | Imports predefined move instruction descriptions. |
| **Import Move Instruction** | | Imports predefined move instructions. |
| **Synchronize to Virtual Controller** | | Synchronizes the entire task to the virtual controller.<br>**Note**<br>Since the **Synchronize to Virtual Controller** is available from the shortcut menu in Cutting PowerPac, the Synchronize to virtual controller function in RobotStudio's **Offline** tab will be disabled. |

### Import Action Instruction/Move Instruction/Move Instruction Description

Some default move instructions are always available in the controller after the RobotStudio and Cutting PowerPac are installed.

To be able to use instructions other than default, it is necessary to tell RobotStudio how these instructions should be handled.

Follow these steps to import instructions:

1. Right-click a task node and click **Import Action Instruction** or **Import Move Instruction Description**, or **Import Move Instruction**. A dialog box opens.
2. In **Look in**, browse to the location where you stored the instruction files (`*.xml`).
3. Select the desired file and click **Open** to import the selected file to the current task.

A default set of action instructions and move instruction can be automatically imported when you open a system for the first time:


xx1300001180

Click **Yes** to automatically load the templates files. Click **No** to deny automatic loading. Click **Cancel** to skip automatic loading this time.

Default directories are:

- /HOME/RS of the system folder. This will be ignored if not present.
- /MyDocument/RobotStudio/ProcessPac/

See *Operating manual - RobotStudio* for the definition of Action Instruction, Move Instruction, and Move Instruction Description.

# 6 Path view

## 6.1 Overview

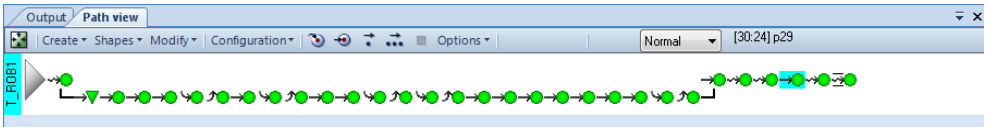
### Path view window

The **Path view** window displays the targets in a path by representing them with *Instruction icons on page 92*. Path creation, modification, configuration and simulation functions also are included in this window.

The large arrow head indicates the start of a path. When a program contains several paths, the first instruction in the path view is the last instruction of the preceding path. This enables you to verify that the robot can bridge the paths.

The path view holds *Path View toolbar general introduction on page 96*, which has menus and buttons for the most frequently used commands. You can use the **Create** menu to add or insert instructions and the **Modify** menu to manipulate targets and axes. Users can modify individual targets or the entire path.

The path view also contains a *Shortcut menu on page 95* and a number of *Multi-Selection Operations on page 121* to modify multiple targets.




xx1300001176

- Check reachability and modify robot configuration. For detailed information, see *Configuration Menu on page 133*.
- Create 2D and 3D cutting paths. For detailed information, see *Create instructions on page 98* and *2D shape instructions on page 108*.
- Modify an individual cutting instruction/target or grouped instructions/targets in a path. For detailed information, see *Modify instructions on page 115*.
- Cutting process simulation and its setting. For detailed information, see *Path View toolbar on page 96*.

All the functions are set to create cuttings and help the robot can reach efficiently all cutting targets in the cutting path.

### Improve the reachability of cutting

Following are general methods to improve the reachability of the cutting:

- Set ConfL or ConfJ to Off for enabling the robot to use new configurations for reaching the target.
- Change the orientation of the target.
- Change the position of either the robot or the work piece.
- Use a system with a track external axis for increasing the robot's range.
- Use a system with a positioner external axis for enabling different work piece positions for different targets.

## 6.2 Instruction icons in the path

### Overview

Instruction icons displays the type (shape), motion (arrow) and status (color) of each target. The lower level targets represents process sections, such as cutting paths and search sequences, while the upper level targets represents air move sections, which typically connect process sections.

### Instruction icons

The following table describes the icon shapes:

| Icon | Description |
|---|---|
|  | Target |
|  | Target with collision error |
|  | Process start target |

The following table describes the arrows:

| Icon | Description |
|---|---|
|  | Linear move |
|  | Joint move |
|  | Absolute joint move |
|  | Circular move |

The following table describes the color coding. The goal is to turn all the status fields green before synchronizing the paths to the virtual controller.

| Icon | Description |
|---|---|
| | White = unknown status |
|  | Green = target verified |
|  | Yellow = solution found, but not verified |
|  | Red = no solution, or target out of reach |
|  | Blue = non-motion instruction |

*Continues on next page*

The following table describes examples of the above:

| Icon | Description |
|---|---|
|  | Linear move, process start target, solution found but not verified |
|  | Joint move, target verified |
|  | Circular move, target verified, with collision error |
|  | Circular move, target verified, with collision error |
|  | Joint move, target verified, with collision error |
|  | Linear move, target verified, with collision error |
|  | Linear move, process start target, solution verified, with collision error |
|  | Circular move, no solution or out of reach |
|  | Linear move, unknown status |

The following table describes the instruction levels:

| Level | Instruction type | Instruction |
|---|---|---|
| Upper | Air | MoveL, MoveJ |
| Lower | Process | CutLStart, CutL, CutC, CutLEnd, CutCEnd, Search_1D, |

The following table describes the non-motion instructions:

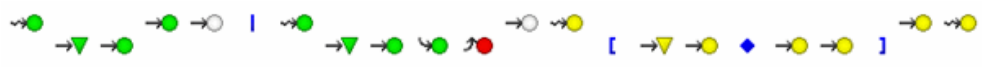
| Icon | Description |
|---|---|
|  | WaitSyncTask |
|  | SyncMoveOn |
|  | SyncMoveOff |

*Continues on next page*

6.2 Instruction icons in the path
*Continued*

| Icon | Description |
|---|---|
|  | Miscellaneous RAPID |

**Example**



| PROC My Path |
|---|
| MoveJ |
| SearchL |
| SearchL |
| MoveL |
| MoveL |
| WaitSyncTask |
| MoveJ |
| CutLStart |
| CutL |
| CutC |
| CutCEnd |
| MoveL |
| MoveJ |
| SyncMoveOn |
| CutLStart |
| CutL |
| SetDO |
| CutL |
| CutLEnd |
| SyncMoveOff |
| MoveL |
| MoveJ |
| ENDPROC |

## 6.3 View and edit in the path view toolbar

### 6.3.1 Shortcut menu

**Overview**

The table describes the commands of the path view shortcut menu.

| Object | Description |
|---|---|
| **Create** | See *Create instructions on page 98*. |
| **Shapes** | See *2D shape instructions on page 108*. |
| **Modify** | See *Modify instructions on page 115*. |
| **Check Reach** | See *Check Reach on page 133*. |
| **Jump To** | See *Path View toolbar general introduction on page 96*. |
| **Move To** | See *Path View toolbar general introduction on page 96*. |
| **Show Item Info** | Displays instruction, the path angle and tool angle for the selected item. |
| **Set Target Reference as UCS** | Sets the target referenced in the instruction as User Coordinate System. |
| **Delete** | Deletes the selected item. |
| **Modify/Convert to Linear Move** | Converts a MoveJ instruction to a MoveL instruction. |
| **Modify/Convert to Joint Move** | Converts a MoveL instruction to a MoveJ instruction. |
| **Modify/Convert to Air** | Converts an approach or depart instruction to an air instruction, and disconnects it from the first or last target, respectively, in a cutting path. |
| **Modify/Convert to Approach** | Converts an air instruction to an approach or depart instruction, and connects it to the first or last target, respectively, in a seam. |
| **Export Process Section(s)** | Export one or more process sections into XML path file. Only available on Process Start target, or range selections with even pairs of Process Start and Process End targets. |
| **Import Process Section(s)** | Import path XML path into station, as one or more new cutting in the path. Only available on non-process targets. |
| **Select Instructions** | Switch to select the corresponding instructions in RobotStudio environment when you select a range of icons in path view. You may see the effect by checking the **Modify** ribbon-tab of RobotStudio. |

## 6.3.2 Path View toolbar general introduction

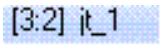
### Overview

The path view toolbar has buttons for the most frequently used commands.

### Path View toolbar

| Icon | Description |
|---|---|
|  | The **Set View Center** button sets the view center automatically to the selected target in the path view or the active TCP (if no target is selected). |
| The **Create** menu | This menu contains the following commands:<br>• *Create Free Form Cutting on page 99*<br>• *Create CutL/C instruction on page 101*<br>• *Create Air instruction on page 103*<br>• *Create ABS joint target on page 105*<br>• *Create an Action instruction on page 106*<br>• *Create Procedure Call on page 107* |
| The **Shapes** menu | This menu contains the following commands:<br>• *Cut Circle instruction on page 109*<br>• *Cut Wrist Circle instruction on page 110*<br>• *Cut Rectangle instruction on page 111*<br>• *Cut Slot instruction on page 112*<br>• *Cut Hexagon instruction on page 113*<br>• *Cut 2D shape instruction on page 114*. |
| The **Modify** menu | This menu contains the following commands:<br>• *Modify instruction on page 115*.<br>• *Modify target on page 117*<br>• *Modify Jointtarget/External Axes on page 119*<br>• *Modify Reference Vector on page 120*<br>• *Modify Selected Targets on page 121* |
| The **Configuration** menu | This menu contains the following commands:<br>• *Check Reach on page 133*.<br>• *Set Configuration on page 134*. |
|  | • The **Jump to Target** button jumps the robot with active TCP to the selected target. It gives you a chance to view cutting head angles and detect possible collisions with the robot.<br>• A successful result turns the target yellow and moves the robot one discrete step towards the target.<br>• An unsuccessful result turns the target red and leaves the robot in its current position. |

*Continues on next page*

| Icon | Description |
|---|---|
|  | • The **Move to Target** button moves the robot to the selected target from the previous target in the target list, checks for reach and sets the robot configuration. You can also select a range of targets and move the robot in sequential order down the target list.<br>• A successful result turns the target green and moves the robot continuously towards the target.<br>• An unsuccessful result turns the target red and leaves the robot in its current position.<br>  **Note**<br>The virtual controller is not running when executing this command. |
|  | The **Execute Move Instruction** button executes the path associated with the selected target. It is only effective on the target generated by commands in the **Shapes** menu. |
|  | The **Simulate** button synchronizes the opened paths to the virtual controller and executes the paths in the virtual controller. |
| The **Options** menu | The menu contains the following options related with **Simulate**:<br>• Enable Log<br>• Save As View<br>• Auto View-Center On<br>Check or clear the check boxes to enable or disable the options.<br>See *The Options Menu on page 138* for more information. |
|  | The **Speed Control** list applies only to **Jump to** and **Move to**. Simulation speed is determined by the RAPID program. |
|  | The index and name of the active object. |

## 6.3.3 Create instructions

### 6.3.3.1 Overview

**Overview**

This menu contains the following commands:

- *Create Free Form Cutting on page 99*.
- *Create CutL/C instruction on page 101*.
- *Create Air instruction on page 103*.
- *Create ABS joint target on page 105*.
- *Create an Action instruction on page 106*.
- *Create Procedure Call on page 107*

**Note**

The contents of the Create menu will change depending on selected target. The Create dialog boxes can not exist together with other dialog boxes brought from the path view. They will close other dialog boxes automatically, and vice versa. Thus, make sure that changes in dialog boxes have been applied before a create dialog is opened.

## 6.3.3.2 Create Free Form Cutting

### Overview

This command creates a continuous path that includes the following targets:

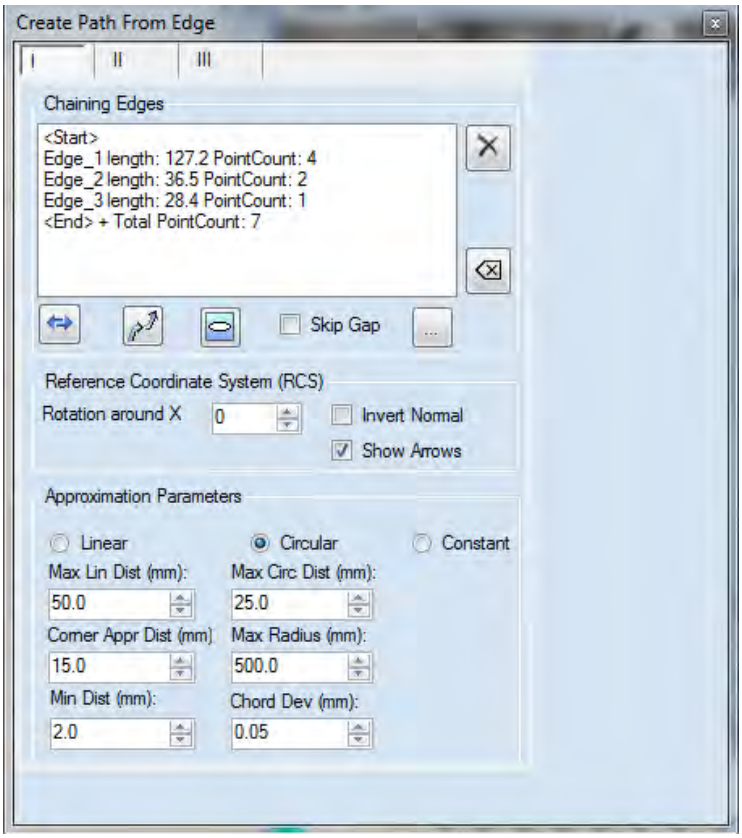
- Approach Move (optional)
- Process start
- Process Via
- Process End
- Depart Move (optional)

This command is available after a path or the last instruction in a free from cutting path has been selected.

### Creating a Free Form Cutting path procedure

To create a free form cutting path, follow these steps:

1 Click **Path Section** in the **Create** cutting ribbon tab or click **Create** -> **Free Form Cutting** in the path view window. The **Create Path From Edge** window is displayed.

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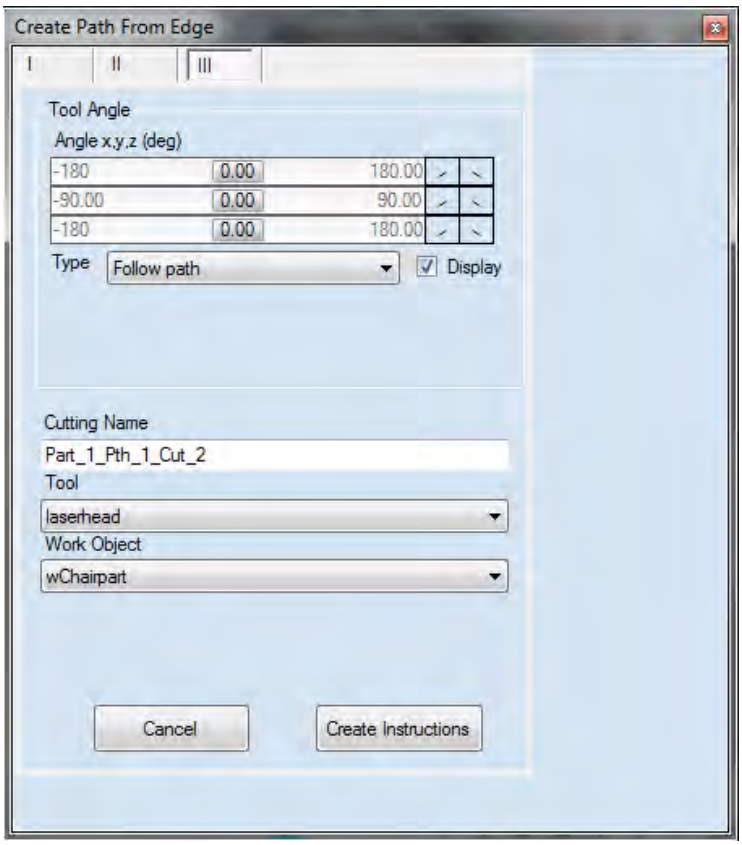
6.3.3.2 Create Free Form Cutting
*Continued*

2 In the **Create Path From Edge** window, select the required fields in the **I**, **II**, and **III** tabs and click the **Create Instructions** button.

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The free form cutting path is created. For more details, see *Create Path Section on page 78*.

**Related Information**

*Path View toolbar general introduction on page 96*.

## 6.3.3.3 Create CutL/C instruction

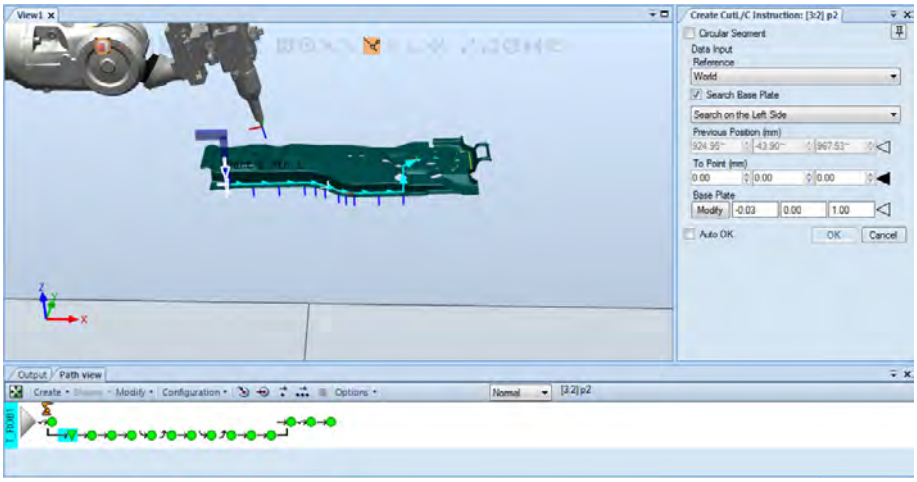
### Overview

This command, which is available only when a process instruction is selected, adds cut instructions to a free form path.

### Creating a CutL/C instruction

To create a CutL/C instruction, follow these steps:

1. In the Path View, select the process start target and then in the **Create** menu, click **CutL/C Instruction**.
2. In the graphics window, click in the middle of the free form path to add a new cut.

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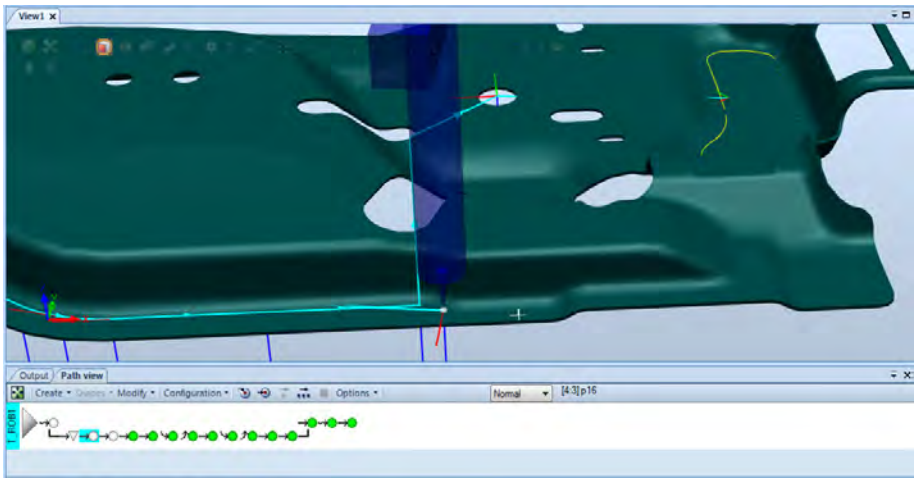
3. Optionally, select the **Auto OK** check box to automatically create the cut instruction when valid input has been entered, and then click **OK**.

   A new target is displayed in the graphics window, and an instruction icon is added to the path view.

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6.3.3.3 Create CutL/C instruction
*Continued*

**Note**

To make a smooth movement from the previous target to the new target, the default angle of the target is the same as the previous one.

**Related Information**

*Path View toolbar general introduction on page 96*.

## 6.3.3.4 Create Air instruction

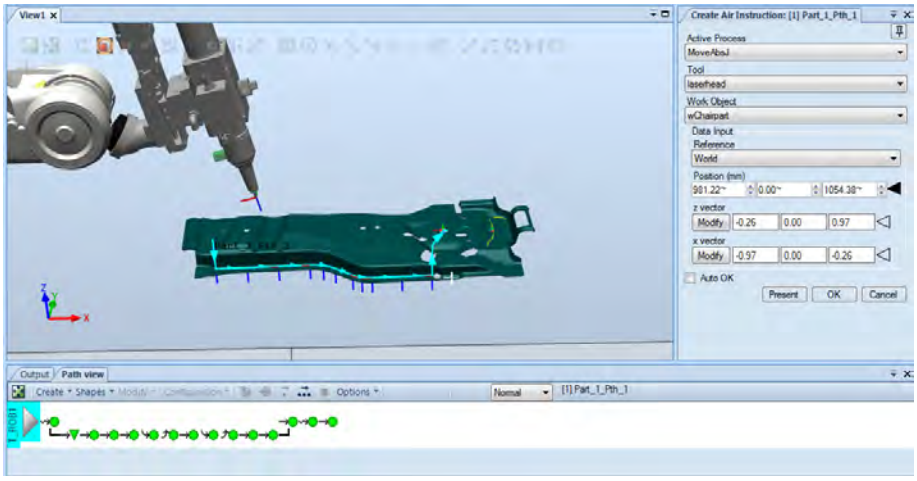
### Overview

Air instructions can be added to a path.

### Creating an Air instruction

To create an air instruction, follow these steps:

1. In the Path View, select the last target.
2. In the **Create** menu, click **Create Air Instruction**.
3. In the graphics window, move the robot's TCP to the desired position. In the dialog box, click **Present**. This will read the current position of the active tool into the **Data Input** area.

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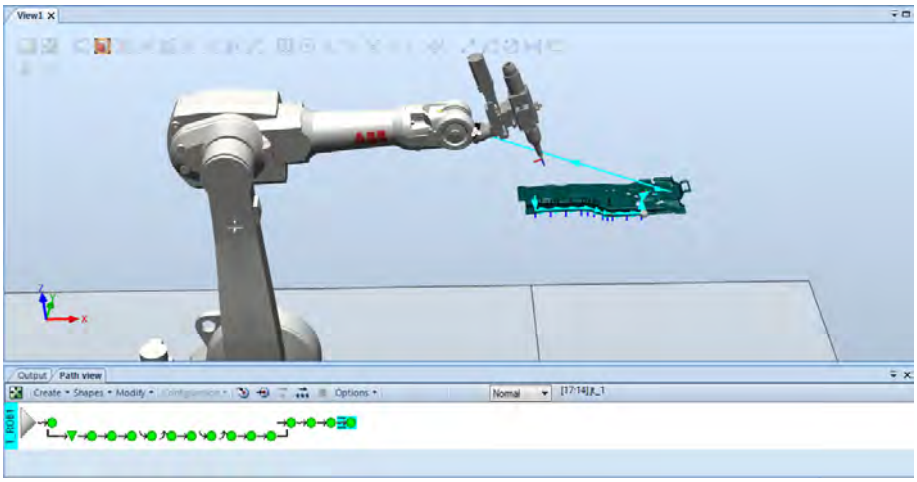
4. In the dialog box, click **OK**. A new target is displayed in the graphics window, and an instruction icon is added to the path view.

   If the **Auto OK** check box is selected, the air instruction is automatically created when a valid input has been entered.

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6.3.3.4 Create Air instruction
*Continued*

**Related Information**

*Path View toolbar general introduction on page 96*.

## 6.3.3.5 Create ABS joint target

### Overview

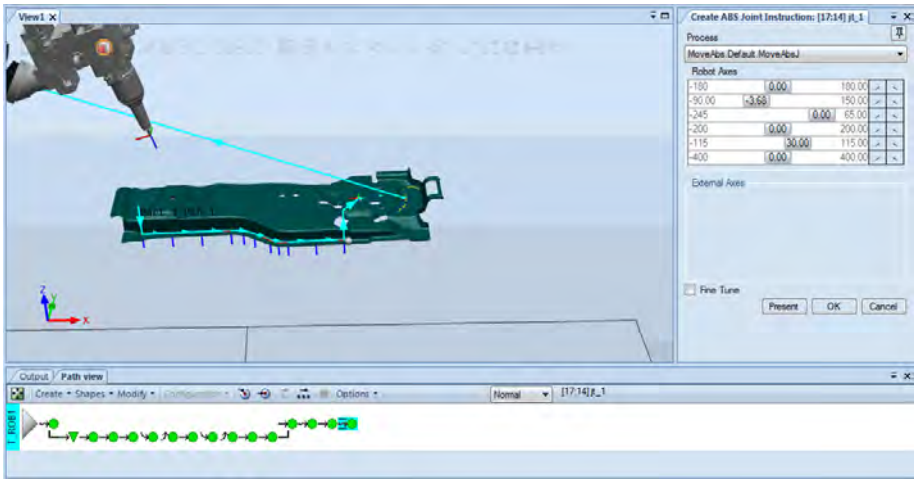
Absolute joint instructions can be added to a path.

### Creating a Jointtarget

To create a jointtarget, follow these steps:

1 In the path view, select the last target.

2 In the **Create** menu, click **Absolute Joint Instruction**.



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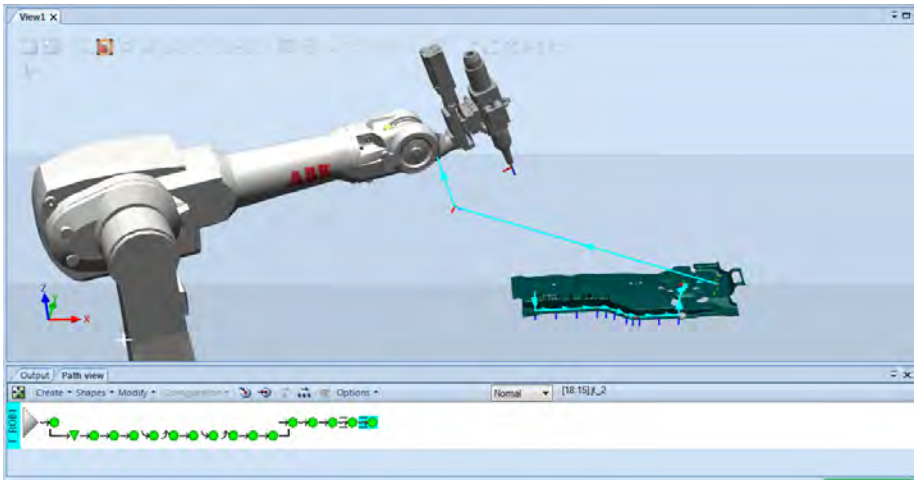
3 Jog the robot to an arbitrary position and click **OK**.

A new jointtarget is displayed in the graphics window, and an instruction icon is added to the path view.



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### Related Information

*Path View toolbar general introduction on page 96*.

## 6.3.3.6 Create an Action instruction

### Overview

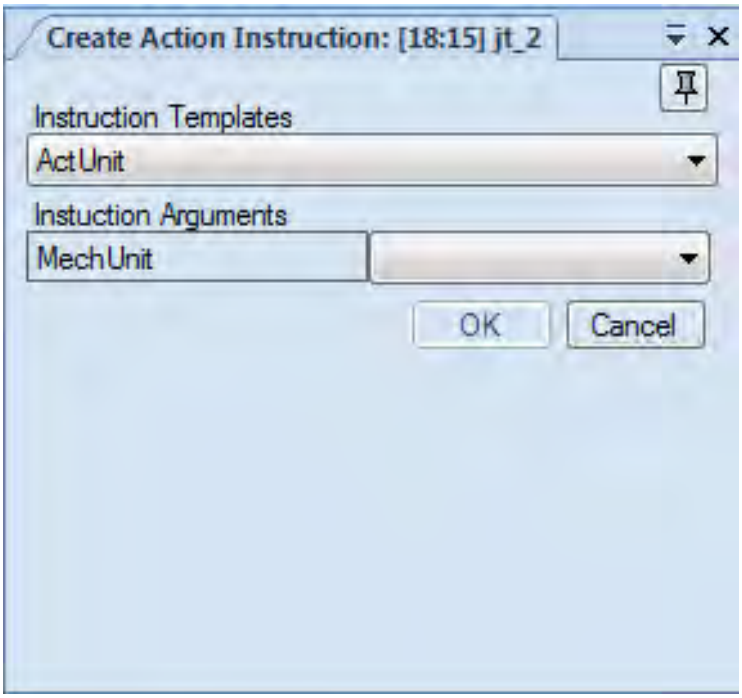
Absolute joint instructions can be added to a path.

### Creating an Action Instruction

To create an action instruction, follow these steps:

1. In the path view, select the last target.
2. In the **Create** menu, click **Action Instruction**.

   The **Create Action Instruction** window is displayed.

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3. Select an instruction from the **Instruction Templates** list.

   For more information on the various instructions, refer *Technical reference manual - RAPID Instructions, Functions and Data types*.
4. Select a mechanical unit from the **Instruction Arguments** list.
5. Click **OK**.

   A blue instruction icon is added to the path view.

### Related Information

*Path View toolbar general introduction on page 96*.

## 6.3.3.7 Create Procedure Call

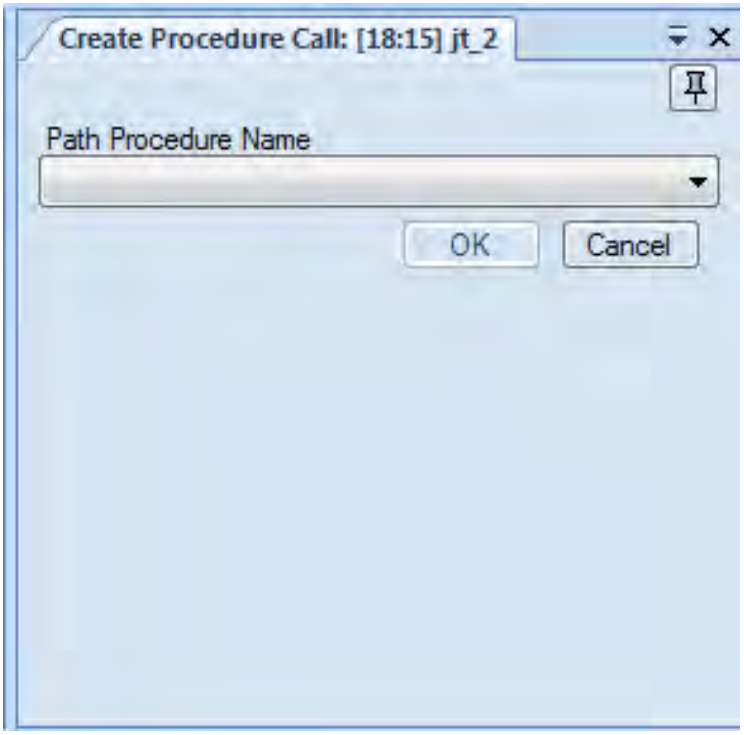
### Overview

Procedure calls can be added to a path.

### Creating Procedure Call

To create a Procedure Call, follow these steps:

1. In **Path View**, select the last target.
2. In the **Create** menu, click **Procedure Call**.
   The **Create Procedure Call** window is displayed.

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3. Select a path procedure from the **Path Procedure Name** list.
4. Click **OK**.
   A blue instruction icon is added to the path view.

### Related Information

*Path View toolbar general introduction on page 96*.

## 6.3.4 2D shape instructions

### 6.3.4.1 Common items used in Shape menu

**Overview**

The commands in the **Shapes** menu are used to create cutting instructions based on specified geometry shapes. The geometry shapes can be defined by actions on the CAD model in the geometry window. All the instructions created by this menu are applied on the 2D cutting path.

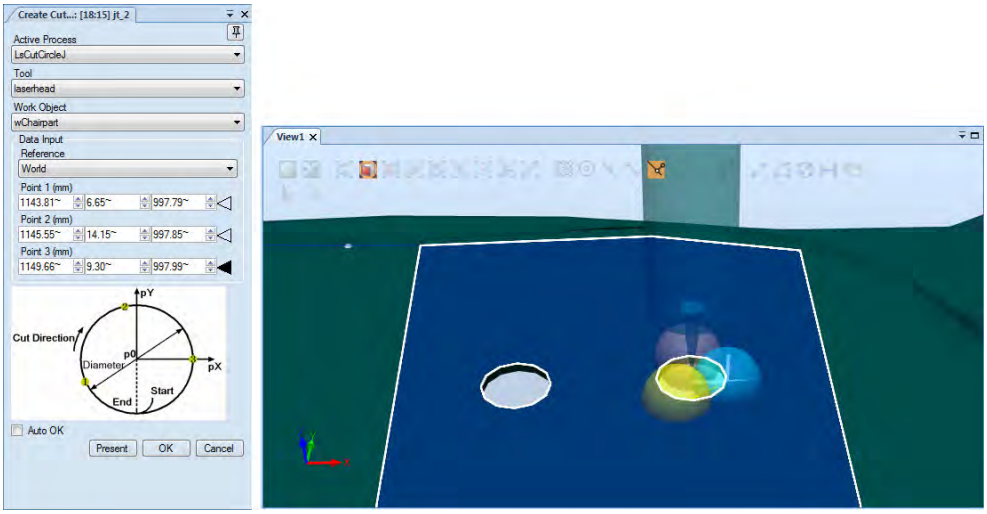
Following are the common items used in the windows corresponding to each command in the **Shapes** menu.

| Object | Description |
|---|---|
| **Active Process** | Specifies the process template for the new cutting instruction. |
| **Tool** | Specifies the tool object for the new cutting instruction. |
| **Work Object** | Specifies the work object for the new cutting instruction. |
| **Reference** | Specifies the reference frame for the new cutting instruction. |
| **Auto OK** | If selected this option automatically accomplish the creation after the geometry feature is specified. |
| **Present** | Specifies the current position as the selected input point. |

## 6.3.4.2 Cut Circle instruction

The `Cut Circle` instruction is used for cutting a circle on the desired postion by defining the points along the circumference.

The three points, Point 1, Point 2 and Point 3, define the circle feature in the dialog box.

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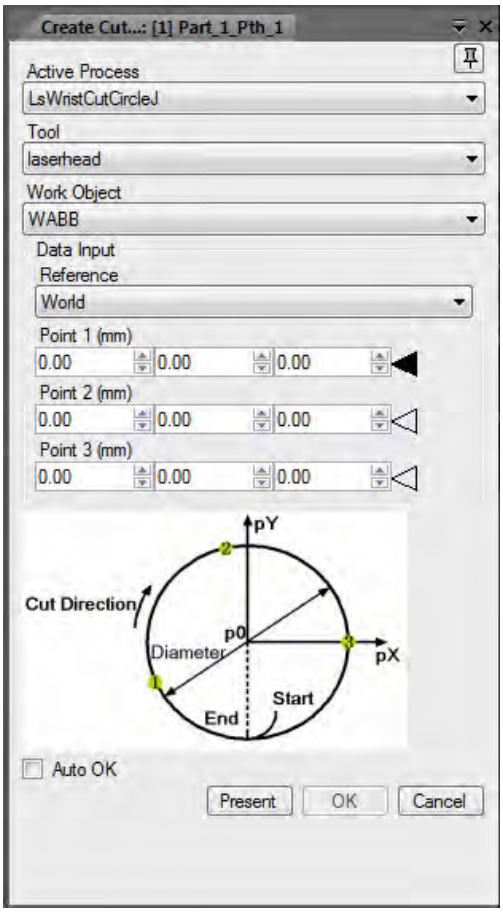
## 6.3.4.3 Cut Wrist Circle instruction

The `Cut Wrist Circle` instruction is used for cutting a circle on the desired postion by defining the circumference.

The **Cut Wrist Circle Instruction** window is very similar to the **Cut Circle Instruction** window. The only difference is the presence of the **Active Process** list in the window.

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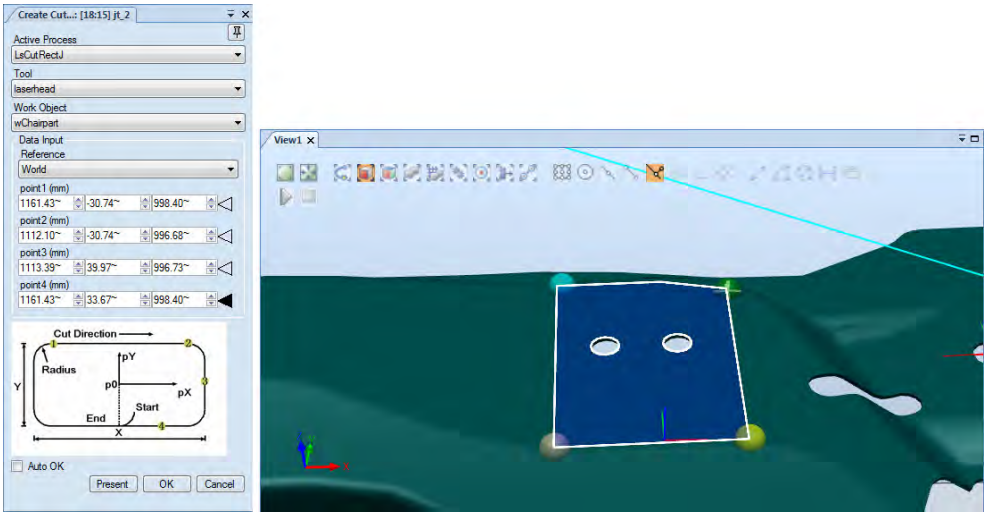
## 6.3.4.4 Cut Rectangle instruction

The `Cut Rectangle` instruction is used for cutting a rectangle on the desired postion by defining the vertices.

The four vertices, point1, point2, point3 and point4, define the dimensions of the rectangle in the window.

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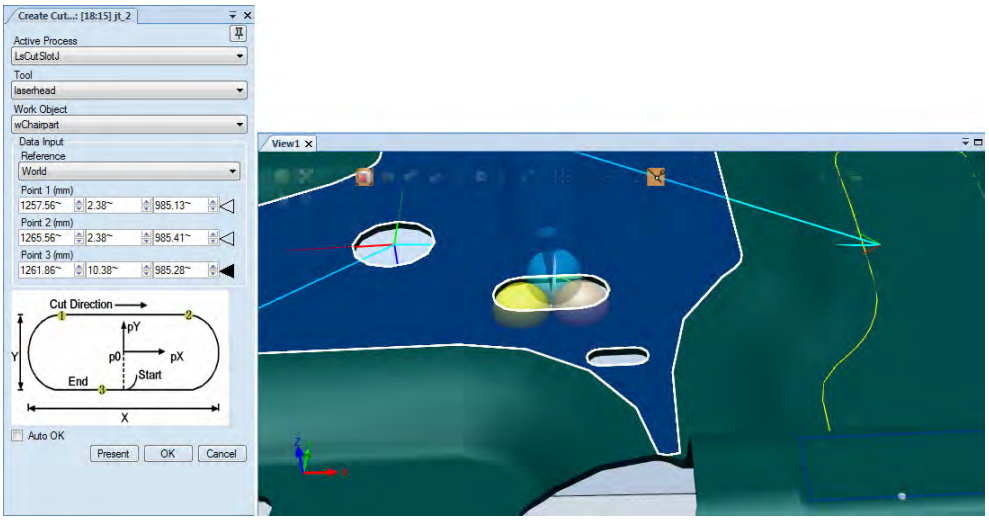
## 6.3.4.5 Cut Slot instruction

The `Cut Slot` instruction is used for cutting a slot on the desired postion by defining the boundaries.

The three points, Point 1, Point 2 and Point 3, define the slot feature in the window.

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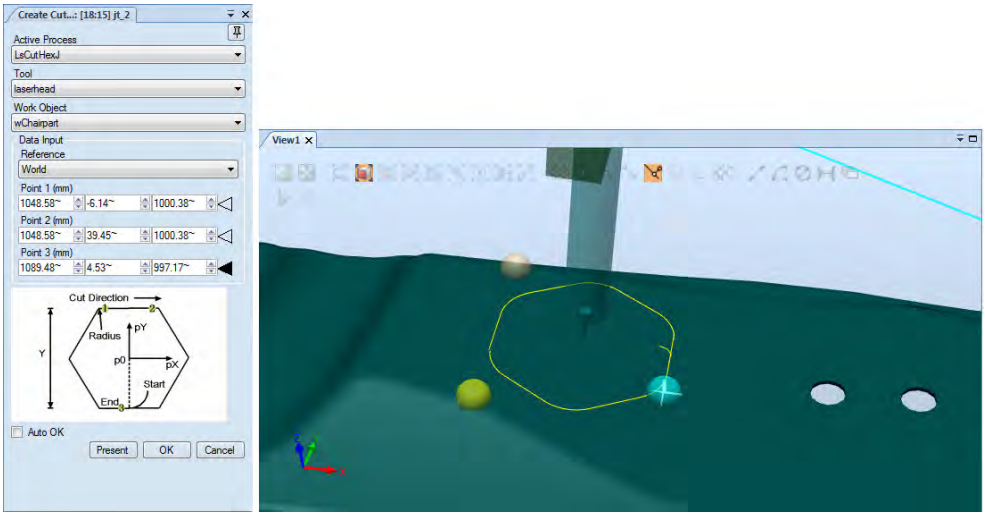
## 6.3.4.6 Cut Hexagon instruction

The `Cut Hexagon` instruction is used for cutting a Hexagon on the desired postion by defining the vertices.

The three points, Point 1, Point 2 and Point 3, define the hexagon feature in the window.

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## 6.3.4.7 Cut 2D shape instruction

### Create Shape Data From Edges Dialog Box

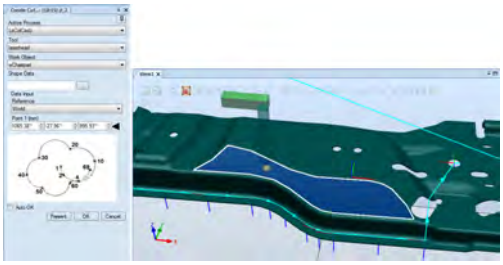
To create a 2D shape instruction from the Path view toolbar, you must first specify a corresponding shape data file which is created by clicking the **2D Shape Data** button in the **Create** group in the **Cutting** tab.

For more details about create 2D shape data, see *Create 2D Shape on page 86*.

### Create Cut… Dialog Box

The `Cut Hexagon` instruction is used for cutting complex shapes on the surface by defining the boundaries.

Click the **Shapes** list and select **Cut 2D shape Instruction...**. The **Create Cut...** window is displayed.



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| Object | Description |
|---|---|
| **Shape Data** | Specify the shape data file (.cad file) created by the **Create Shape Data From Edges** dialog box.<br><br>**Note**<br><br>The shape data must be located in the default folder "Controller System Path"\\HOME\\CwCadShapes. |
| **Point 1** | Specify the reference point for the shape data. This point is corresponding to the **Location** in the first page of the **Create Shape Data From Edges** dialog box. |

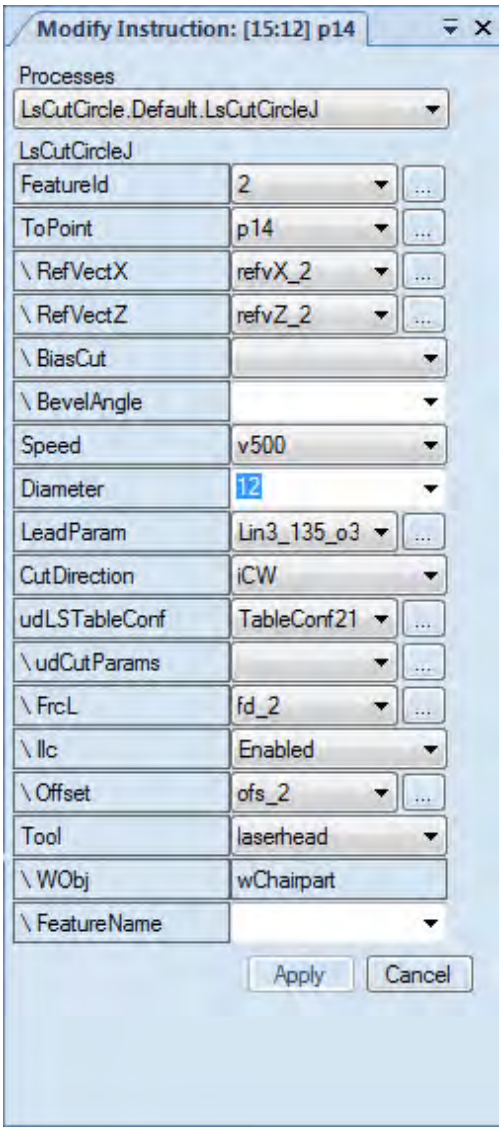
## 6.3.5 Modify instructions

### 6.3.5.1 Modify instruction

**Overview**

Most instructions have arguments that specify how the instruction must be performed. For example, the arguments of the `LsCutCricleJ` instruction specify the circle geometry feature with which the robot moves along the circle path. In the Modify Instruction dialog box, you can display and change these arguments.

**The Modify Instruction Dialog Box**

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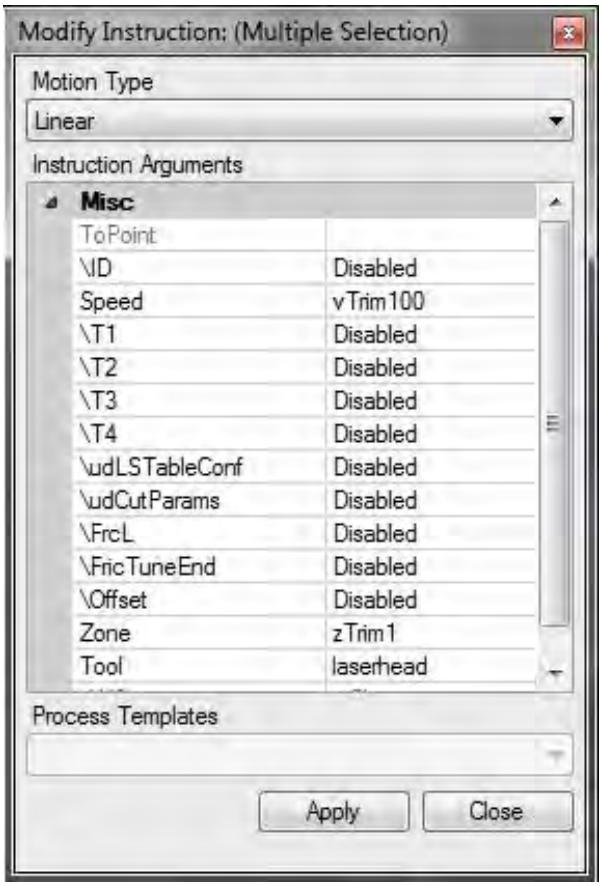
**Related Information**

*Path View toolbar general introduction on page 96*.

## 6.3.5.2 Modify multiple instructions

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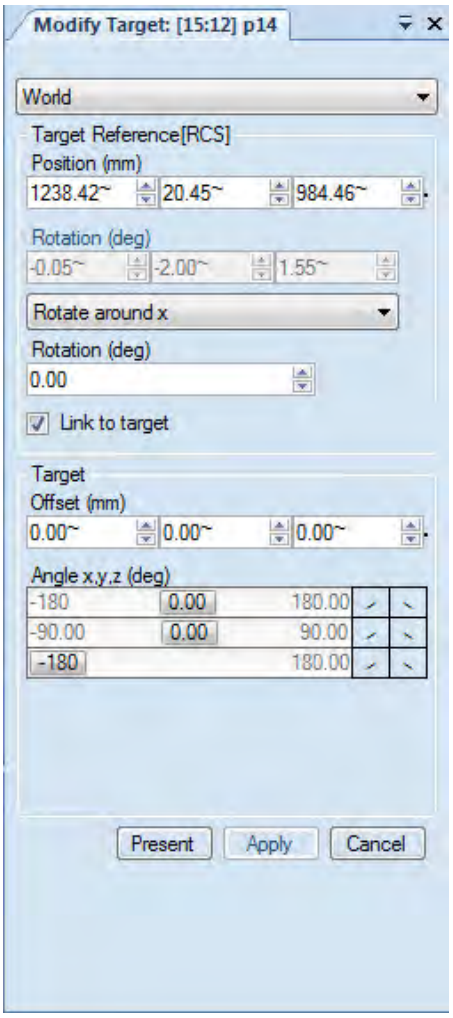
The **Modify Instruction (Multiple Selection)** window allows you to change the instructions and the corresponding common parameter values when multiple targets are selected from path view.

Only similar instructions are allowed to be edited together since they have the same arguments which can be set to one value.

## 6.3.5.3 Modify target

### The Modify Target Dialog Box

The **Modify Target** dialog box is used to edit target positions and orientations.

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| Object | Description |
|---|---|
| **Reference** | The coordinate system of the target reference. All available frames in the station are listed. It affects the values shown for RCS's position and rotation. |
| **Target Reference (RCS)** | The position and rotation of the RCS.<br>Highlight the arrow head on the right to select a new position in graphic interface, or manually enter values to modify.<br>**Note**<br>Since Approach/Depart targets' RCS align with Start/End target, their RCS are not directly modifiable.<br>For rotation of process targets, such as Start, Via, and End targets, only rotating around X axis is allowed. For other targets, rotation around x, y, and z axis are all available. |

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6.3.5.3 Modify target
*Continued*

| Object | Description |
|---|---|
| **Link to target** | If selected, modifications made on RCS will also affect the target in world frame, and the offset and angle of the target in its RCS keeps unchanged.<br>Normally the target is set to be linked with it's RCS. |
| **Target** | The offset and angle values are relative to the target reference. For information on tool angles. |

**Related Information**

*Path View toolbar general introduction on page 96*.

## 6.3.5.4 Modify Jointtarget/External Axes

### Overview

This dialog box is used to modify the jointtarget or external axis values of a selected target. Jointtargets are used in instructions such as MoveAbsJ and MoveExtJ.

### Modifying a Jointtarget or External Axes

To modify a jointtarget or external axis, follow these steps:

1. In the **Modify** menu, click **Jointtarget** / **External Axes**.
2. Click **Present** to obtain the external axis values of the active robot, and then move the slide bars to jog the robot.
3. Click **Apply**.

### Related Information

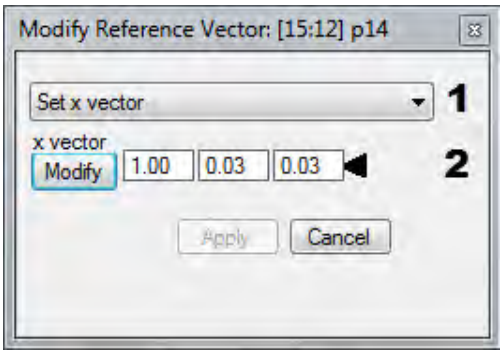
*Path View toolbar general introduction on page 96*.

## 6.3.5.5 Modify Reference Vector

### Overview

This dialog box is used to modify the reference vector of a selected cutting instructions based on the geometry feature.

### The Modify Reference Vector Dialog Box

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| Label | Description |
|---|---|
| 1 | Select a vector for editing (X vector or Z vector). |
| 2 | Set or modify the value of the selected vector. |

## 6.3.5.6 Multi-Selection Operations

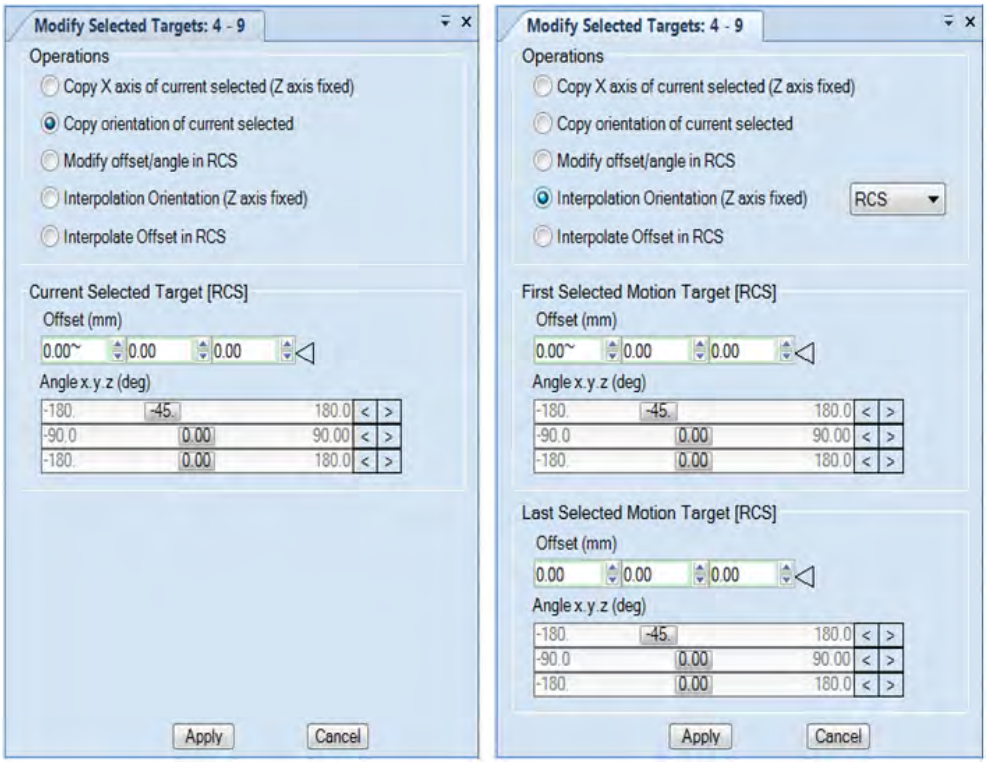
### Overview

Multiple targets may be selected in the path view by clicking one target, pressing SHIFT and then clicking another target. All targets in between will also be highlighted grey.

Depending on the targets selected, the following additional operations may be available from the shortcut menu.

### Modify Selected Targets

This command shows a dialog box containing several useful function options which can be respectively performed on multi-selected free form path targets.

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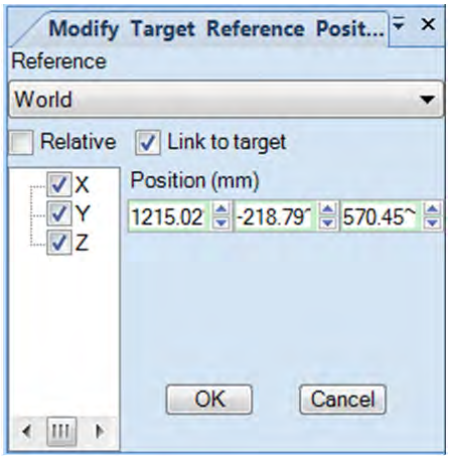
6.3.5.6 Multi-Selection Operations
*Continued*

| Group | Object | Description |
|---|---|---|
| Operations | Copy X axis of current selected (Z axis fixed) | If this option is enabled, the group Current Selected Target, representing the first clicking target in the selected target list, is shown up.<br>For the detail description of this option, see the option Spin X to Selected in *Optimize selected target on page 126*. |
| | Copy orientation of current selected | If this option is enabled, the group Current Selected Target is shown up.<br>For the detail description of this option, see the option Copy Rotation from Selected in *Optimize selected target on page 126*. |
| | Modify offset/angle in RCS | If this option is enabled, the group Current Selected Target is shown up.<br>For the detail description of this option, see *Target Offset/Angle on Selection on page 124*. |
| | Interpolation Orientation (Z axis fixed) | If this option is enabled, two groups First Selected Motion Target and Last Selected Motions Target, representing respectively the first and last motion target in the selected target list, are shown up.<br>For the detail description of this option, see the option Interpolate Orientation of *Optimize selected target on page 126*. |
| | Interpolate Offset in RCS | If this option is enabled, two groups First Selected Motion Target and Last Selected Motions Target are shown up.<br>For the detail description of this option, see the option Interpolate Targets Offset of *Optimize selected target on page 126*. |
| Current Selected Target /First Selected Motion Target /Last Selected Motion Target | Offset | Specify the offset of the target in RCS. |
| | Angle x.y.z | Specify the angle of axis X, Y and Z respectively in RCS. |

## Target Reference Position on Selection

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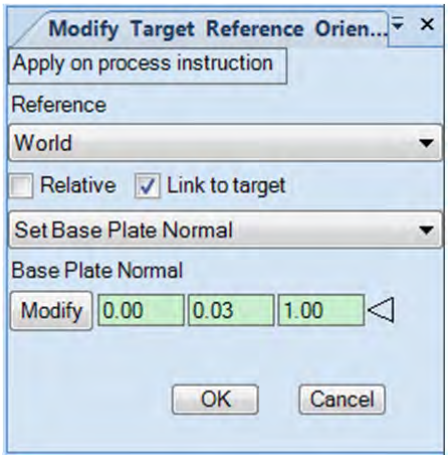
The following table describes the elements of the dialog box.

| Object | Description |
|---|---|
| **Reference** | The coordinate system of the target reference. All available frames in the system are listed. |
| **Relative** | Select to perform a relative move of the target reference. |
| **Link to target** | Select to move the selected targets together with RCS. |
| **Position** | Enter the absolute position or relative move of the target reference. If you want to move the target reference in just one direction, clear the check boxes of the other axes. |

## Target Reference Orientation on Selection

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This command applies only to process instructions.

The following table describes the elements of the dialog box.

| Object | Description |
|---|---|
| **Reference** | The coordinate system of the target reference. All available frames in the system are listed. |
| **Relative** | Select to perform a relative reorientation of the approach vector. |
| **Link to target** | Select to rotate the selected targets. |
| **Modify Base Plate Normal** | The arrowhead points to the current values of the base plate normal. Click **Modify** to enter a new vector or invert the current one. Alternatively, click the arrowhead to turn it black, and then click in the graphics window on the surface that will constitute the new base plate. |

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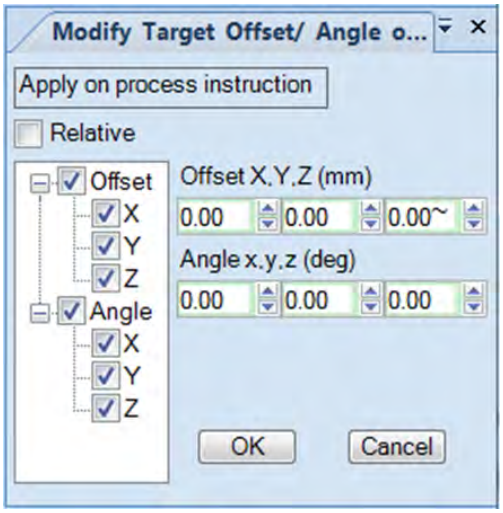
6.3.5.6 Multi-Selection Operations
*Continued*

### Target Offset/Angle on Selection

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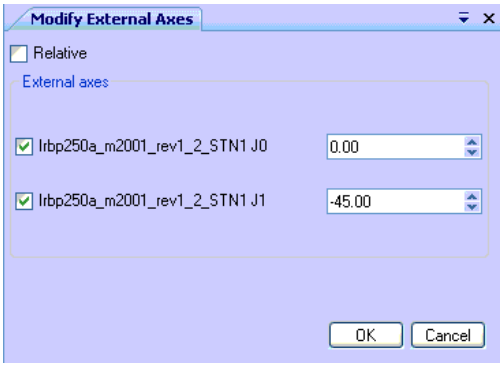
This command offsets or rotates selected targets of process instructions a given distance or angle. This offset or angle is in relation to the target references coordinate system. If **Relative** is selected, the offset or angle will be in relation to the target itself. Clear the offset or angle directions in the tree nodes on the left side that have no bearing on the operation.

### External Axes Values on Selection

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This command sets the external axis values on all selected targets. If **Relative** is selected, the given value will be in relation to the current external axis values defined for each target.

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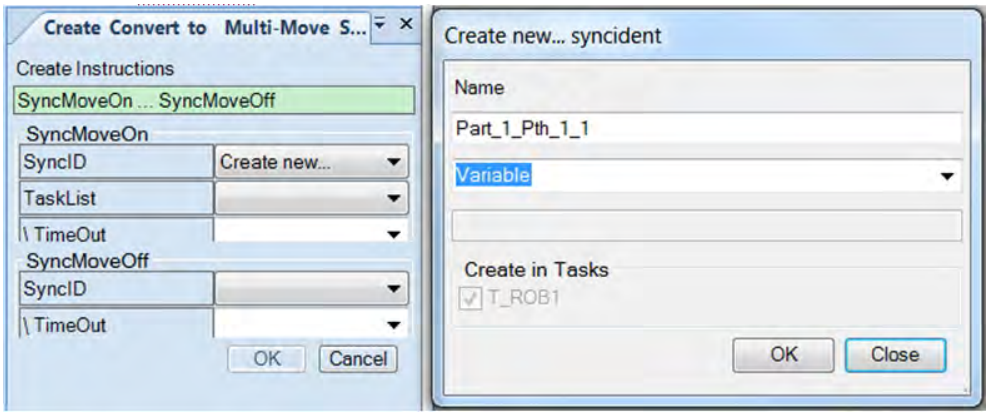
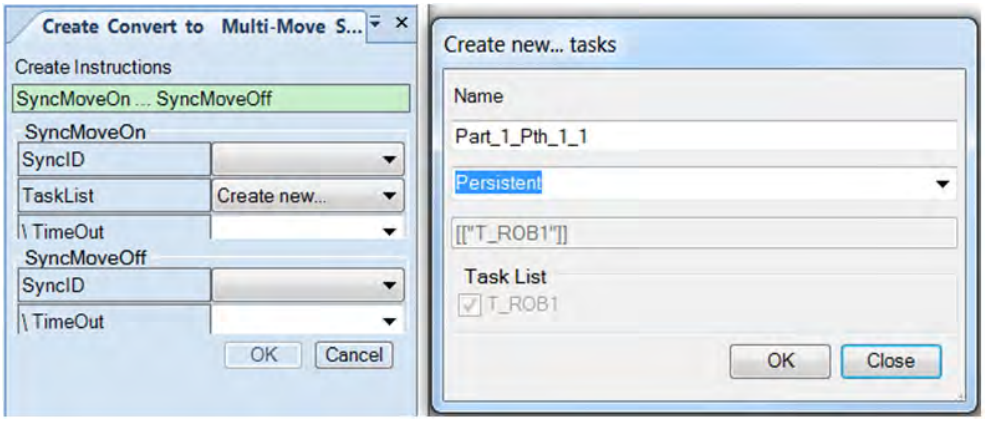
### Convert to MultiMove Section




xx1300001281

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It is possible to enter special commands for motion synchronization in the path view. These commands are represented by blue instruction icons and letter flags. Each letter represents a Sync ID, and two identical letters form a pair marking a synchronized MultiMove section.

Select all instructions to be included in the MultiMove section. From the context menu, select Modify/Convert to MultiMove Section. A dialog appears asking the user to define a Sync ID and a Task List. If there are no Sync IDs or Task Lists present in the station, you can create new by selecting **Create new** from the list. The necessary data will then be created automatically. When creating a new Task List, you will also be prompted to select the tasks to be included in the list.

For more information, see *Application manual - MultiMove*.

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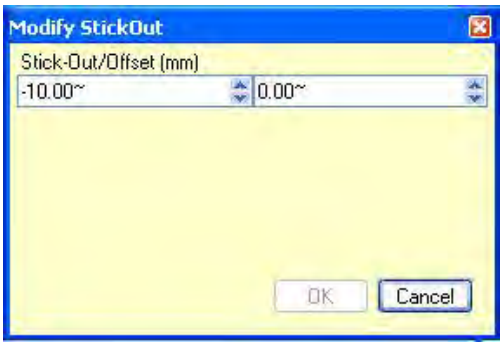
6.3.5.6 Multi-Selection Operations
*Continued*

### Stick-Out

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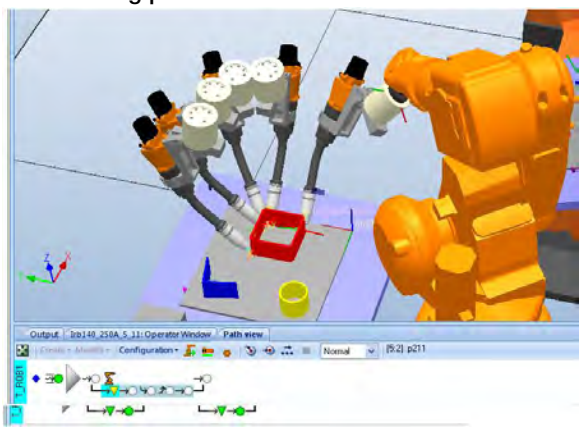
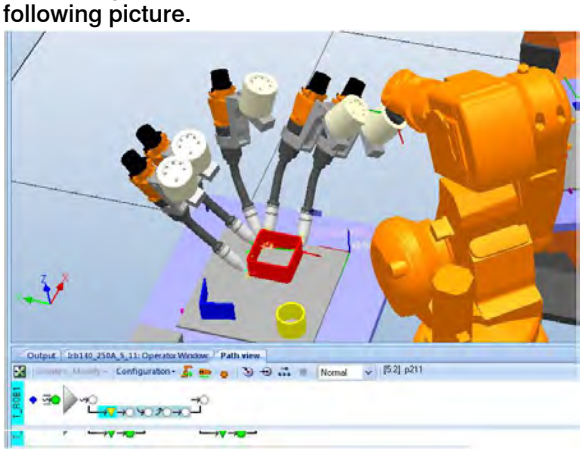
| Object | Description |
|---|---|
| Stick-Out | This command modifies the position of the target offset as a function of stick-out. The value of the stick-out is based on the defined tool properties. It affects the tool position along its z axis. |
| Offset | This value modifies the position of the target offset along its y axis. |

### Optimize selected target


xx1300001284

| Option | Description |
|---|---|
| Spin X Towards Robot Base | Spin the X axis of the targets towards the robot base. |

*Continues on next page*

| Option | Description |
|---|---|
| Spin X to Selected | This function can be used to orient a row of targets so the target x axes point in the same direction. The function will spin all marked targets around the z axes until the target x axes match the selected target x axis as close as possible.<br>Before using this function, the status is illustrated in the following picture.<br>  <br>xx1300001285<br>After using this function, the status is illustrated in the following picture.<br>  <br>xx1300001286 |

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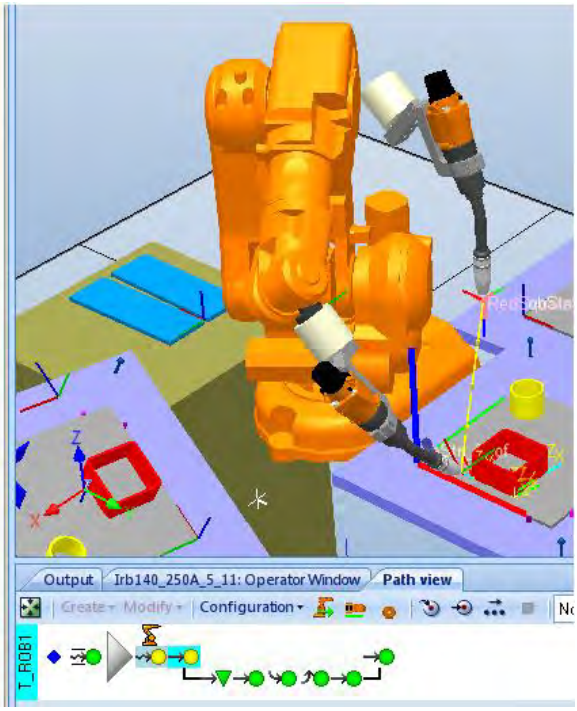
6.3.5.6 Multi-Selection Operations
*Continued*

| Option | Description |
|---|---|
| Copy Rotation from Selected | This function copies the orientation of the selected target to all other marked targets. Depending on the type of target, only the appropriate part of the orientation is copied. For an air target, it is a complete copy. For a process target, only the orientation of the tool-x axis is copied. For a search target, the reference frame is aligned with the selected target z axis and the search target x axis is aligned with the selected x axis.<br>Before using this function, the status is illustrated in the following picture.<br>  <br>xx1300001287<br>After using this function, the status is illustrated in the following picture. |

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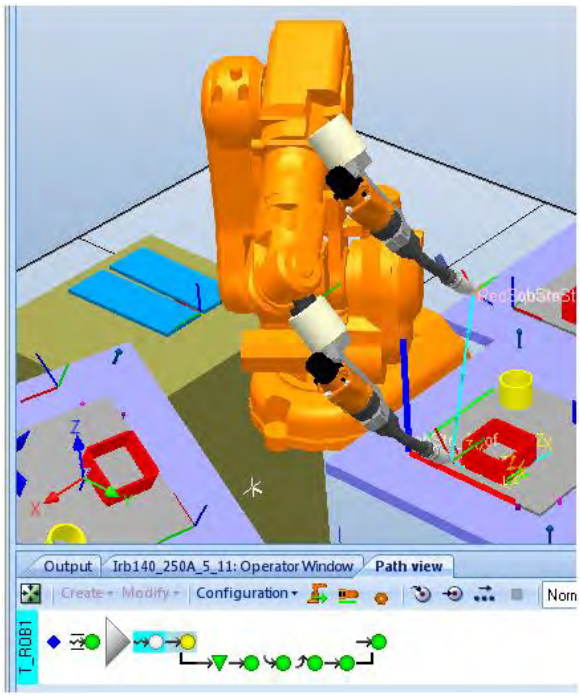
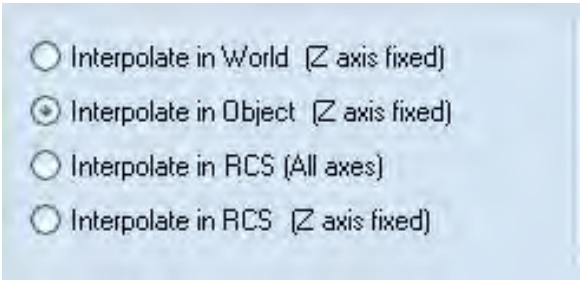
| Option | Description |
|---|---|
| |  <br>xx1300001288 |
| Interpolate Orientation | Interpolate orientations of targets based on the selected coordinates.<br>• **Interpolate in World (Z axis fixed)**: Set to interpolate the Z axis value of the Euler angles of the targets, in relative to world frame (that is, external axes, if exist, are moved to calculate interpolation values).<br>• **Interpolate in Object (Z axis fixed)**: Set to interpolate the Z axis of the Euler angles of the targets in object frame (work object), with Z axis fixed.<br>• **Interpolate in RCS (Al axes)**: Set to interpolate the travel, work and spin angle of the targets in each RCS.<br>• **Interpolate in RCS (Z axis fixed)**: Set to interpolate the spin angle of the targets in each RCS, with Z axis fixed.<br>  <br>xx1300001289 |
| Interpolate Targets Offset | Interpolate offsets of targets based on the selected coordinates. |

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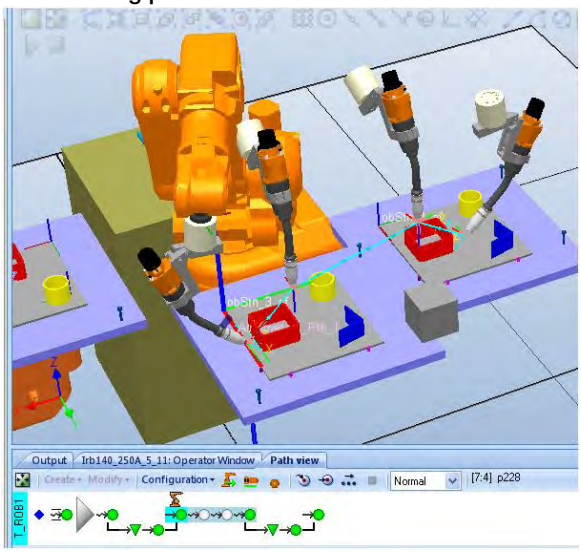
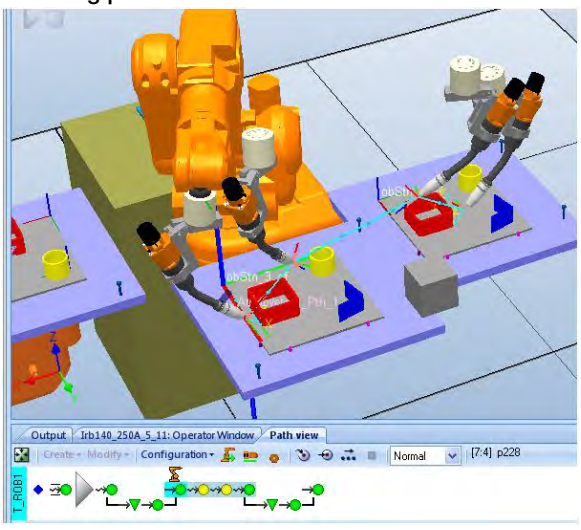
6.3.5.6 Multi-Selection Operations
*Continued*

| Option | Description |
|---|---|
| Interpolate External Axes | This command interpolates the external axes for a select range based on the move distance between the tool robot points. The points can be either in the same path or in different open paths. |
| Interpolate Robot Wrist Axes | This command can be used to optimize air moves. The function tries to interpolate the robot wrist axes from the selected start target to the selected end target. The interpolation of the joint values is based on the move distance of the robot targets. All selected targets must have a solution before the operation is executed.<br>Before using this function, the status is illustrated in the following picture.<br>  <br><br>xx1300001290<br>After using this function, the status is illustrated in the following picture.<br>  <br><br>xx1300001291 |

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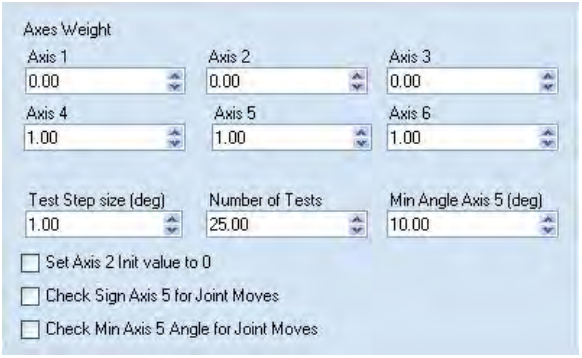
| Option | Description |
|---|---|
| Minimize Axes Movement | Optimizes the spin angles of the selected motion items by minimizing the value change of robot joint moves.<br>It searches for a best target orientation by evaluating multiple orientation values in the close range, based step angle.<br>The weight value for each joint shows the importance of each joint in the minimization.<br>Several checkings on joint moves can be enabled to filter out invalid targets.<br>• **Axes Weight**: Weight for this axis during searching axis.<br>• **Test Step size**: The step value of the angle to search for best orientations of the target.<br>• **Number of Tests**: The maximum number of steps to search for best orientations.<br>• **Min Angle Axis 5**: The minimum angle of axis 5 to keep during searching. Set to a value large enough so that an orientation close to singularity is not selected.<br>• **Set Axis 2 Init value to 0**: Set axis 2 to zero during searching.<br>• **Check Sign Axis 5 for Joint Move**: Keep the sign of axis 5 value during searching.<br>• **Check Min Axis 5 Angle for Joint Move**: Make axis 5 minimum angle effective during searching.<br>  <br>xx1300001292 |

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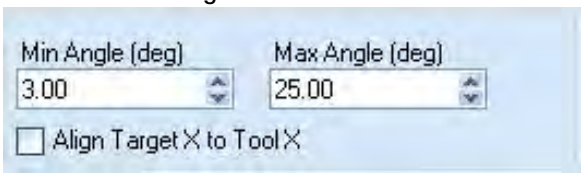
6.3.5.6 Multi-Selection Operations
*Continued*

| Option | Description |
|---|---|
| Pivot Target From TCP to RCS | Set the Z axis of the targets towards the tool. This is usually used in laser cutting.<br>• **Min Angle (deg)**: Enter the minimum angle between z axis of the target and the RCS during pivoting. You may need this to keep the laser tool from cutting perpendicularly onto the work piece surface.<br>• **Max Angle (deg)**: Enter the maximum angle between z axis of the target and the RCS during pivoting. You may need this to make the cutting direction not too inclined towards work piece surface.<br>• **Align Target X to Tool X**: Check to also set the x axis of target to current x axis of the tool.<br>  <br>xx1300001293 |
| The **Apply** button | Click this button to apply your settings on the selected targets. |
| The **Cancel** button | Click this button to cancel your settings in this editor. |

## 6.3.6 Configuration Menu

### 6.3.6.1 Check Reach

**Overview**

The Check Reach command verifies whether the robot can reach a target. A successful result turns the color of the target as white or yellow. The white color donotes there is no configuration assigned to the target and yellow color denotes there is a configuration assigned to the target. An unsucessful result turns the color to red.

**Related information**

*Path View toolbar general introduction on page 96*.

## 6.3.6.2 Set Configuration

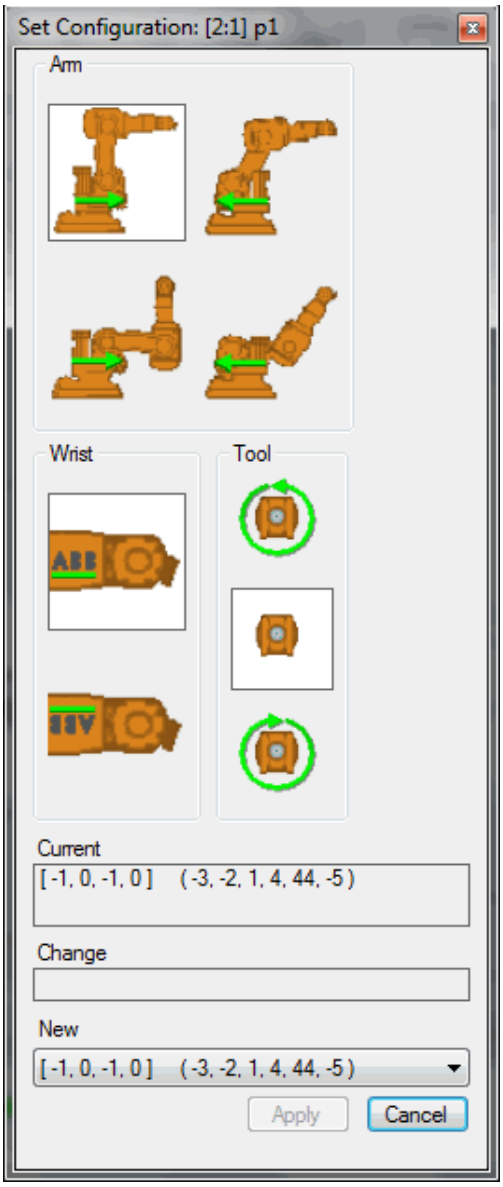
### Overview

It is possible to attain the same target position and orientation in several different ways, using different sets of axis angles. We call this the settings of different robot configurations.

In Cutting PowerPac, robot configuration can be set for individual targets. The system calculates a configuration based on your selections, after which values are displayed.

### The Set Configuration Dialog Box

This dialog box requires that you select three positions, one each for the robot arm, wrist and tool, before clicking **Apply**.

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The following table describes the elements of the dialog box:

| Object | Description |
|---|---|
| **Arm** | The group is used to specify whether the robot wrist is in front of or behind axis 1, and whether the elbow is up or down. |
| **Wrist** | This group is used to specify whether axis 4 will be turned positive or negative. |
| **Tool** | This group is used to specify whether axis 6 will be turned positive or negative. If neutral is selected, the configuration of axis 6 will be determined by the arm and wrist selections. |
| **New** | This list displays the configuration and joint values for a selected configuration, as well as alternatives. |
| **Current** | This box displays the configuration currently stored in the selected target. |
| **Change** | This box calculates the difference in joint values between the currently selected target and the preceding target in the path. |

**Tip**

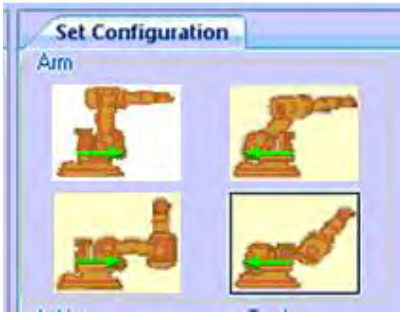
Have this dialog box and the **Modify Target** dialog box open at the same time. The configuration will then be automatically recalculated when the target is modified, which will help you determine how much you can adjust the target while keeping it within reach.

## How to Set Configuration

Cutting PowerPac provides two ways to set a configuration for a target.

- Specify a configuration setting by selecting a combination of arm, wrist and tool configuration among the symbols on the control. The settings will be used to find the robot configuration that fits the selection best.
- Manually select a robot configuration among all the possibilities given. This is done by selecting one of the robot configurations in the drop-down **New**. The configuration setting controls will then be updated accordingly.

When selecting a configuration, the selected symbol gets a frame around it, and the selection process will make the background white for the valid configuration that was selected. If the two (the frame and the white background) does not coincide, the selection could not be fulfilled.

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6.3.6.2 Set Configuration
*Continued*

**Tip**

To set the configuration for a cutting path:

1. Create a cutting path with the approach point as a joint move. Make all other moves linear
2. Set the configuration for the first target (the joint move).
3. Run through all the targets using the **Move To** function.
4. If there is a problem, modify the configuration of the first target and repeat the step 3.

**Related Information**

*Path View toolbar general introduction on page 96*.

## 6.3.7 Simulation

**Overview**

The simulation buttons in Path view window are: Jump to, Move to, Execute Move Instruction, Simulate. For detailed information, see *Path View toolbar on page 96*.

## 6.3.8 The Options Menu

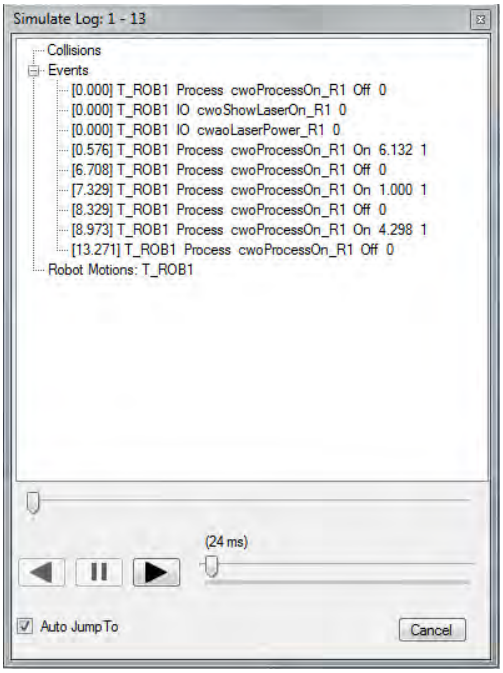
### Overview

Select simulation options for the executed paths.

### Enable Log

Use this procedure to enable log:

1. On the path view toolbar, select the check box of **Enable Log** from the **Options** menu.
2. Click the **Simulate** button.
3. When the execution finishes, the **Simulate Log** window is displayed. View the simulate logs in this window.

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| Item | Description |
|---|---|
| Collisions | Collision events happened during simulation in RobotStudio 3D environment are listed here.<br>You need to first create collision set including interesting objects by using RobotStudio functions. |
| Events | RobotStudio and Virtual Controller events, for example, motor on/off, I/O changes, program start/stop, raised during simulation are listed here. |
| Robot Motions | Data about TCP robots' motion details during simulation are listed here.<br>Each data item represents the running robot motion information on a simulation step, including time stamp, TCP position, joint angles and joint value percentage relative to the respective joint limits. |

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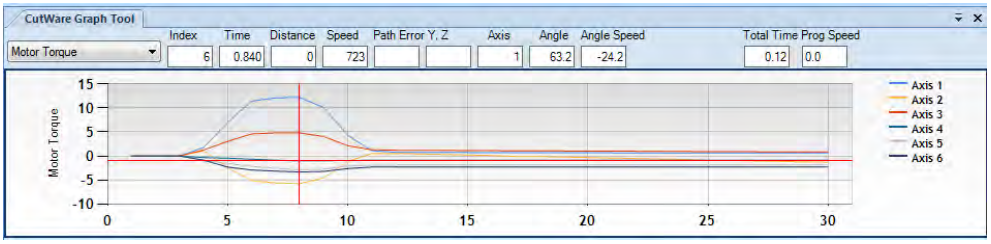
| Item | Description |
|---|---|
| External Axes Motions | Data about external axes' motion details during simulation are listed here.<br>Each data item represents the running external axes' motion information on a simulation step, including time stamp, and joint angles. |
| Play Controls | Controls to play, pause and reverse play the log. |
| Auto JumpTo | Check to enable robots' automatic *JumpTo* when an data item is selected by keyboard or mouse clicking. |

There also would be a CutWare Graph Tool window displaying to show parameters as motor speed, motor torque, TCP speed etc.. See the picture below.

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The x axis of the coordinate is time, items for y axis can be selected from the top left drop down list. After the selection and click on the diagram displayed, the corresponding information would be displayed in the graph and the text field on the top of the interface.

### Save As Viewer

This function can save the simulation process as an .exe file used for replaying the simulated cutting process. Use this procedure to save the simulation of the executed paths as a RobotStudio viewer file:

1. On the path view toolbar, select the check box of **Save As Viewer** from the **Options** menu.
2. Click the **Simulate** button.

   When the execution finishes, the **Save As** dialog box opens.
3. In the dialog box, specify the name and location for the viewer file.
4. Click **Save**.

### Auto View-Center On

When this function is checked, the simulation view interface would automatically be put as the view center in the simulation process.

## 6.3.9 Export Process Section

### Overview

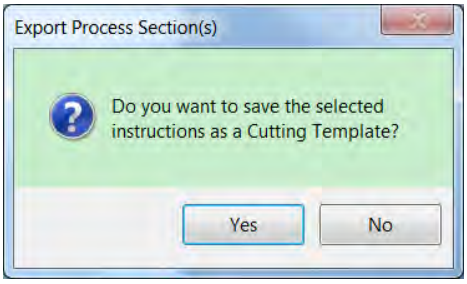
One or more cutting paths can be exported as a XML file, and then imported into other part programs in the same or different station. This feature greatly reduces duplicate work when paths between parts or stations are similar.

### How to Export a Process Section

To export process sections, follow these steps:

1. To export a single cutting path, right click on the Process Start target, or select a complete process section. To export multiple cutting paths, select a complete range with equal numbers of Start and End targets. Right click, and select **Export Process Section(s)**.

   If a single process section is selected, a user message will appear for you to select if the path should be saved as a template.

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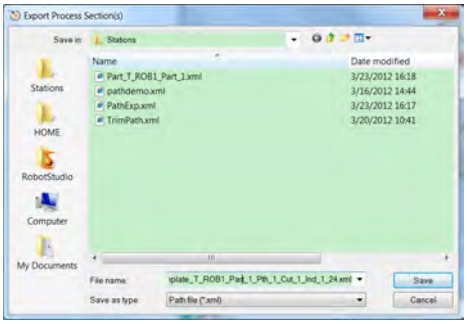
   If a process section is saved as template, you will be able to modify the approach or depart offset, path angle/offset when importing the saved file. Otherwise, you will only be able to import and create new path targets as they were exported.

   A dialog box appears.

2. Specify the XML file name and directory. If a path is saved as template, the default name should be *"Template_" + Task name + Path name + "Ind_" + index of first target + "_" + index of last target;* otherwise, the name is *"Section_" + Task name + Path name + "Ind_" + index of first target + "_" + index of last target*. The default directory is under the *"/My Documents/RobotStudio/Stations"*.

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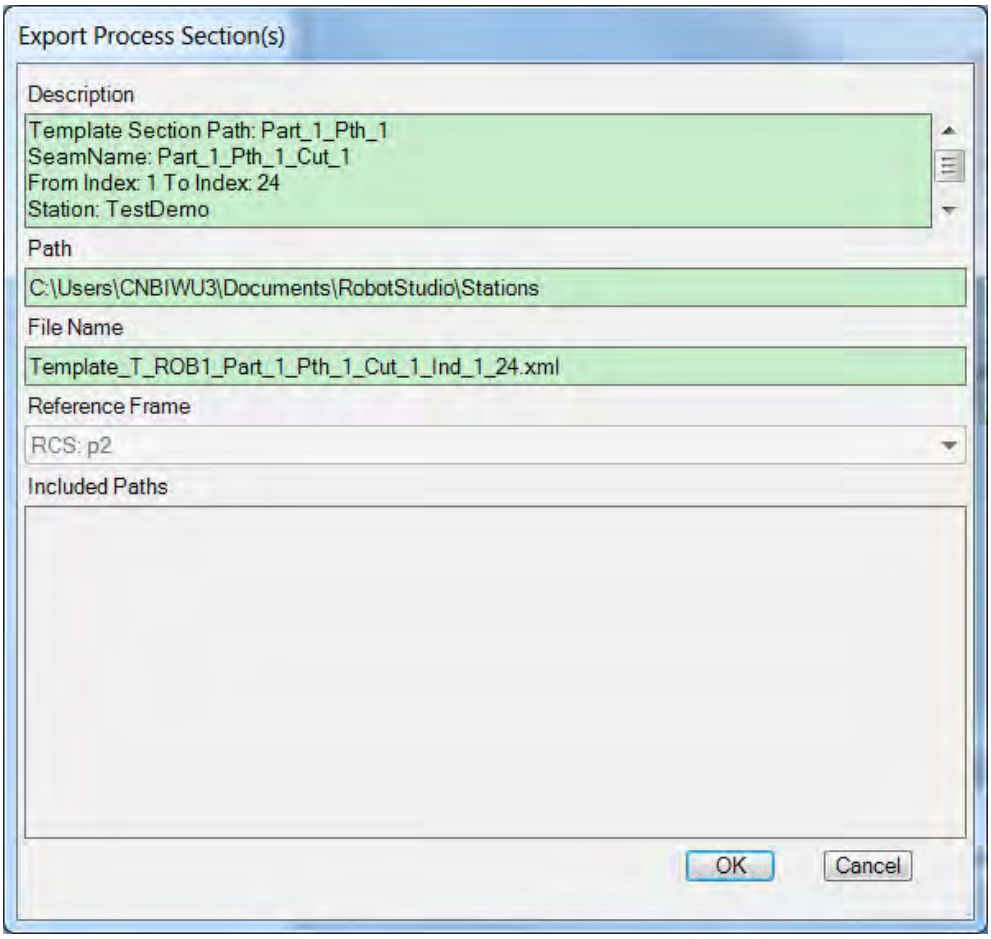
3 Click **Save** and an exporting dialog box opens.

4 Complete the dialog box, click **OK**, and an XML file will be created.

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| Object | Description |
|---|---|
| Description | Describes the name of the station, the task, and the start index and end index of the targets in the exported process sections. Read-only. |
| Path | The directory in which the file is stored. Read-only. |
| File Name | The name of the saved file. Read-only. |
| Reference Frame | Select a reference that the path targets in the process sections are related to. This affects the position and rotation values of these targets. The references can be World Coordinate, User Coordinate System, robot base coordinate, or work object co-ordinate, and also the RCS of the first target. |
| Included Paths | The included paths to be exported are listed here. |

## 6.4 Verify and modify

### 6.4.1 Overview

**Overview**

Verify and modify procedure is done together with the path view and simulation in the **Path view** window.


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Instruction icons in the Path View notify you if a target is out of reach by changing the target color to red. If the target is within the reach of the robot, the target color changes to yellow.

The path is tested and verified by pushing the buttons in the toolbar of the path view. A successfully executed path displays all the targets in green color.

If an execution is failed, it is possible to tune the individual target position, orientation, and other instruction attributes. Changes are checked by executing the path again. This procedure is repeated until all the targets are tested and verified, that is, all the targets in the **Path View** are green.

**Verifying**

| | Activity | Description |
|---|---|---|
| 1 | Open the selected path in the Path View to show targets and instructions. | |
| 2 | Click the Jump to Target. Move to Target or Simulation button in the Path View toolbar to test the selected targets. | See *Path View toolbar general introduction on page 96*for the detailed description. |

**Modifying**

When the robot can not reach all targets in the path or users want to optimize the path, modification can to be done.

See *Modify instructions on page 115* for a detailed description.

# 7 Path optimization

## 7.1 Overview

**Overview**

After cutting paths are created, Optimization can be done to make the robot can reach all cutting targets and implement cutting process.

You can use following procedure to optimize paths using the cutting browser and the **Optimization** group on the Cutting ribbon tab.

1. Right click the path in the cutting browser and select **Check Path** to test the reachability and collision status of the cutting path. Detailed information, please see *Check path on page 144*. The collision check function is included in Check Path function. For how to create a collision set, see *Collision Set on page 66*.
2. Click the **Move To Path** button in the **Optimization** tab of the ribbon to check if the robot can move to all the cutting targets.
3. If the robot can not successfully move to all targets, right click the path and select **Edit** to edit the path section in the **Edit PathSection** window until the robot can move to all the targets.

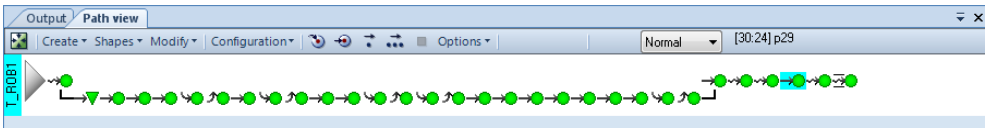
**Tip**

If the robot still can not move to all targets on the path, users can use view the path with robot simulation using the **Path view** window. For detailed information, please see *Path view on page 91*.

## 7.2 Check path

### Overview

Click the **Check Path** button of the **Optimization** group in the cutting ribbon tab, the **Path View** interface would show instruction icons presenting cutting targets. Users can know what type of error the target is by its icon.

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For detailed description for items on the **Path View** ribbon tab, please refer to *Path View toolbar general introduction on page 96*.

For detailed information about instruction icons, please refer to *Instruction icons in the path on page 92*

## 7.3 Collision check

**Overview**

Users can check if collision exists during the cutting process. For how to setup collision set, please see *Collision Set on page 66*.

If collision exists during the simulation of cutting process, the components that have collision would turn to red in simulation. You can also know collision error existing by the instruction icons. Targets with collision error would have an exclamation mark in the icon. For description for instruction icons in cutting path, please see *Instruction icons in the path on page 92*.

**Note**

To view the collision status of cutting paths, the collision set must be created.

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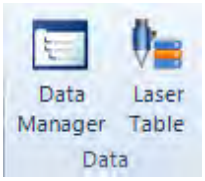
# 8 Data management

## 8.1 Overview

**Task group**

The functions in this group are related to the active task.

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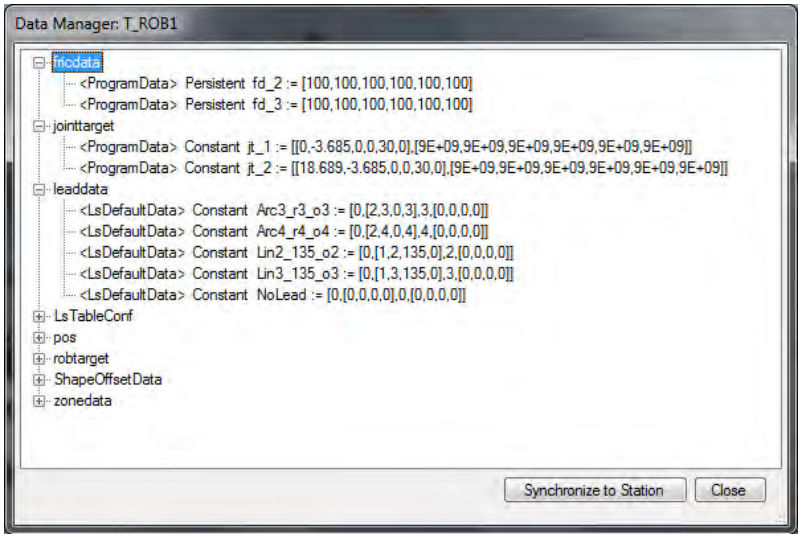
## 8.2 Data manager

### Data Manager

Click **Data Manager** to open the data edit interface. You can:

- Compare the data in the station with the date in the virtual controller.
- Synchronize data from the virtual controller to the station.
- Synchronize data from the station to the virtual controller.
- Modify data other than default, such as fricdata, leaddata, and LsCutData.

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### Synchronize data between virtual controller and station

Synchronizing ensures that the RAPID program in the system, running on the virtual controller, corresponds to the programs in Cutting PowerPac. You can synchronize data both from the station to the virtual controller and from the virtual controller to the station.

To synchronize the entire program stored in a robot system from the virtual controller to the station, follow these steps:

1. Select a task node from the Cutting browser, and click **Data Manager** to open the Data Manager interface.
2. Click **Synchronize to Station**.

To synchronize specific data between the virtual controller and the station, follow these steps:

1. Select a task node from the Cutting browser, and click **Data Manager** on the ribbon to open the data edit interface.
2. Click the "+" signs to expand the modules.
3. Click the data that you want to synchronize. An editor opens where you can view the data expression.
4. Click the **up arrow** to synchronize the data from the virtual controller to the station.

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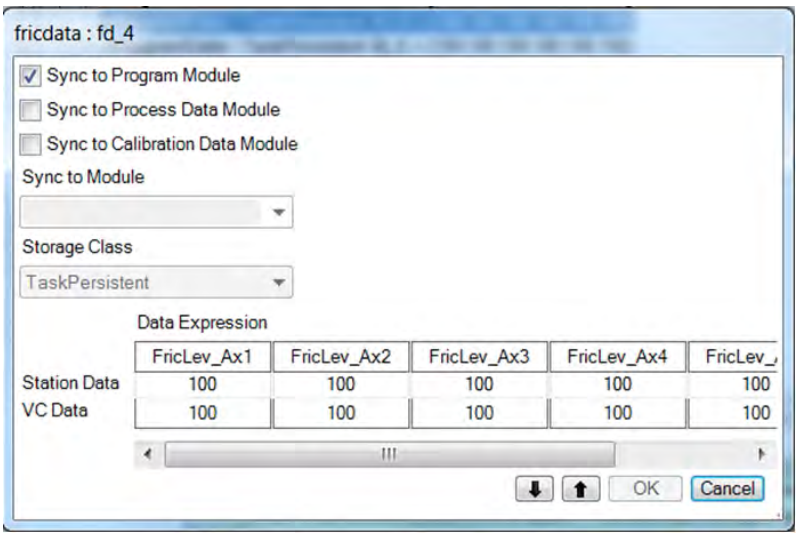
5 Click the **down arrow** to synchronize the data from the station to the virtual controller.

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**Note**

- For data that is just created but not shown in the virtual controller, you can specify the type in virtual controller when synchronizing. The type can be `Persistent`, `TaskPersistent`, `Constant`, or `Variable`. For the data that is already shown in the virtual controller, this function is disabled.
- Only data of type other than `robtarget` and `jointtarget` can be synchronized from the virtual controller to the station.

**Note**

One of the features in Cutting PowerPac is the multilevel synchronization. You can choose to synchronize an entire task, a part program, or a path to the virtual controller.

### Modify data

To modify data in the data edit interface of **Data Manager**, follow these steps:

1 Select a task node from the Cutting browser and click **Data Manager** to open the Data Editor.
2 Click the “+” signs to expand the modules.
3 Double click the data that you want to modify. A Data Editor opens where you can view the data expression. In Data Editor, you can modify the synchronize reference, the storage class in RAPID programs, and the values of the data itself.
4 Modify the data.
5 Click **OK** to make the changes take effect.

*Continues on next page*

Each data item has a classification that is used to define in which modules data should end up in the virtual controller. The data classification will be used to set the module name property when the data is synchronized to the virtual controller.

- **Sync as Inline Data**: This selection is only available for jointtargets and robtargets. The data will not be declared but included in the instruction.
- **Sync to Program Module**: The default setting for most data. The data will be synchronized to the same module as the procedure where it was used.
- **Sync to Process Data Module**: Default setting for data such as leaddata. The data will be synchronized to the module defined as Process Data Module, See task properties.
- **Sync to Calibration Data Module**: Default setting for data such as tooldata. The data will be synced to the module defined as Calibration Data Module, See task properties.
- **Sync to Module**: Name of the procedure to where the data will be synced. No update will be done during synchronization.

**Note**

The **Storage Class** selection is enabled only if data does not exist in the virtual controller; otherwise it will simply use the storage class of the data in the virtual controller.

## 8.3 Laser table

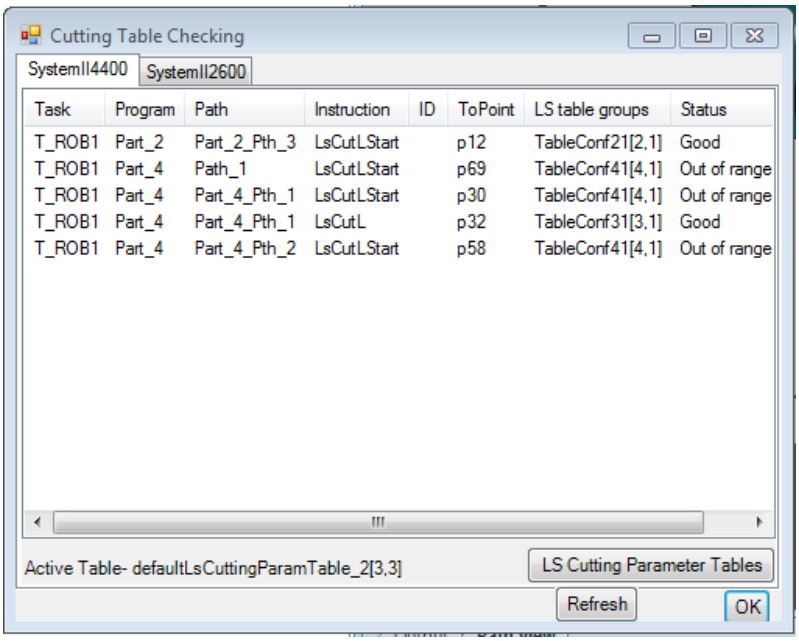
### Overview

You can manage the laser table with the **Laser Table** function in **Data**.

Click the **Laser Table** button in the **Task** group of Cutting ribbon tab, the **Cutting Table Checking** window is displayed.

By this interface, users can:

- Check if the LS TableConf are valid or not.
- Create and Edit LS cutting parameter tables.
- Create and edit LS TableConf.

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| Object | Description |
|---|---|
| **Task** | The task which contains the instruction that using a **LS TableConf**. |
| **Program** | The part that contains the instruction that using a **LS TableConfTableConf**. |
| **Path** | The path that contains the instruction that using a **LS TableConf**. |
| **Instruction** | The instruction that using a **LS TableConf**. |
| **ID** | ID of the instruction in a multimove system. |
| **ToPoint** | Targets in the cutting path. |
| **LS Table-Confs** | List of TableConfs. For more information, see *LS Cutting parameter tables on page 39*. |
| **Status** | Displays if the LS TableConf is valid or not. There are three types of status: **Good**, **Out of range** and **Invalid table**. |
| **Active Table** | Displays the LS Cutting parameter table that currently is active and the quantities of laser and piercing groups inside the table. |

*Continues on next page*

| Object | Description |
|---|---|
| **LS Cutting Parameter Tables** | Displays the list of LS cutting parameter tables. You can execute CREATE, EDIT, COPY, DELETE, IMPORT operation to the LS cutting parameter tables and set the active table. For more details, see *LS Cutting parameter tables on page 39*. |

**Check the valid status of LS TableConf**

Check the **Status** column in the **Cutting Table Checking** interface, the valid status of the **LsTableConf** is displayed.

If the TableConf is valid, **Good** is displayed.

If the TableConf is valid but the table configuration is out of range, that is, exceed the maximum number of cutting or piercing groups in the table, **Out of range** is displayed.

If currently there is no active LS cutting parameter table, then **Invalid table** is displayed.

When the status of the **TableConf** is **Out of range**, users need to change the TableConf according to the following procedures:

1. View the LS cutting parameter table and check the quantity of its cutting groups and piercing groups. For detailed information about viewing the LS cutting parameter table, see *Edit LS Cutting parameter tables on page 43*.
2. Open the instruction that using this Ls TableConf and edit the TableConf or use another TableConf or create a new one. For detailed information, see *Edit LS Cutting parameter tables on page 43*.

When the status of the LS TableConf is **Invalid table**, users need to set the active LS cutting parameter table. For more details, see *Edit LS Cutting parameter tables on page 43*.

# 9 Synchronize

## Overview

It is important to keep the virtual controller and the Cutting PowerPac in synchronization, which requires exact mapping between the graphical objects and the RAPID language. For example, a target in the graphical environment generates a robtarget definition and a move instruction in the virtual controller; a path including targets in the graphical environment generates a routine with move instructions in the virtual controller.

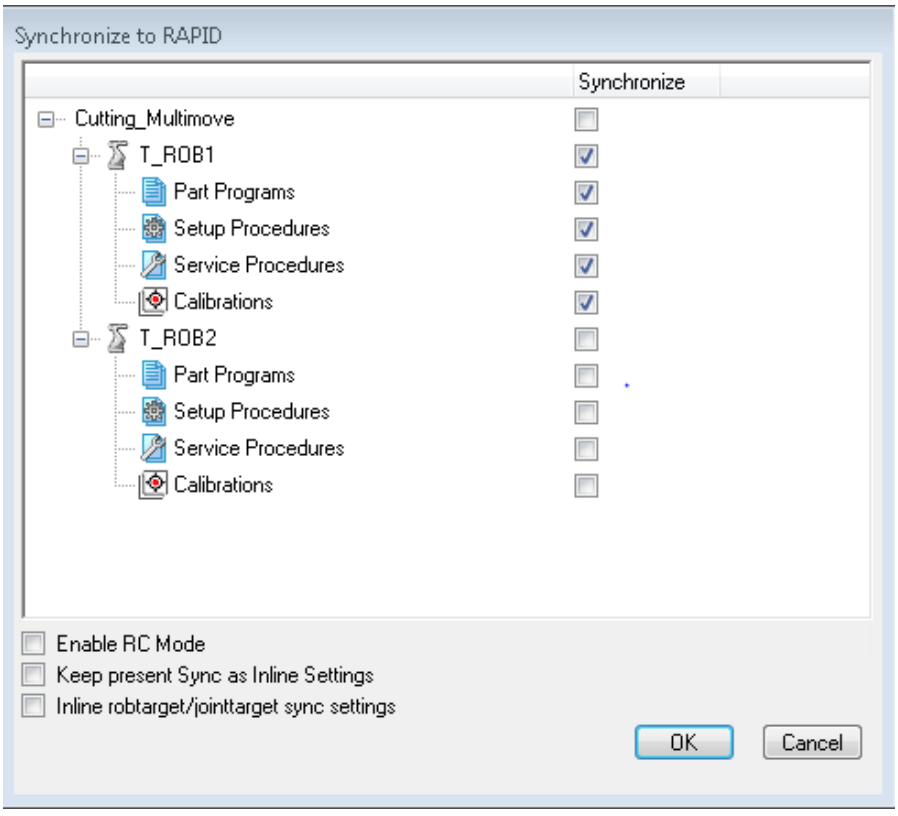
## Workflow

Following is the basic workflow:

1. Create and modify targets and paths in the graphics environment.
2. Synchronize selected item to the virtual controller.
3. The resulting RAPID programs reside in the virtual controller and is ready for download to the real controller.

One of the feature in Cutting PowerPac is the multilevel synchronization. You can choose to synchronize an entire task, a part program, or a path to the virtual controller.

In the case of MultiMove system the child levels to be synchronized depend on the task that is being selected. For example, if task 1 (T_ROB1) is selected the **Synchronize to RAPID** window pre-selects only T_ROB1 and its child levels. But you can select other child levels of another task according to your requirement.

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# 10 Path simulation

## 10.1 Path simulation using the cutting ribbon tab

**Path simulation using the cutting ribbon tab**


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The **Simulation** group on the **Cutting** ribbon tab has the following functions:

- Play, pause, stop, and reset the simulation of the cutting process.

For more details, see *The Cutting ribbon on page 24*.

To simulate a cutting process using the **Cutting** ribbon tab, use the following procedure:

1. In the **Simulation** group, click the **Synchronize to RAPID** icon and synchronize the cutting program to the virtual controller.
2. Click the **Simulation** ribbon tab and setup the simulation.
3. On the **Cutting** ribbon tab, in the **Simulation** group, click the **Play** button to start the simulation.

**Note**

You can directly simulate all the open paths using the **Path view** window. For more details, see *Path View toolbar on page 96* and *Verifying on page 142*.

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# 11 Virtual controller settings

## 11.1 Save Program

### Saving a program

After synchronization, RAPID programs are stored in virtual controller. You can access these programs from the **Offline** tab of RobotStudio. For more information, see *Operating manual - RobotStudio*. You can also save the programs as files on your PC, which makes it possible to load them to other controllers, or real IRC5 controllers.

Click **Save Program** to save the programs in virtual controller as files. The RAPID programs are saved under "HOME" directory of the system folder.

**Note**

When saving a program to files, the RAPID program stored in the virtual controller is saved. To save modifications in the station, first synchronize them to the virtual controller, and then click **Save Program**.

### Load program to real controller

After synchronization, the fully functional RAPID program is generated in the virtual controller and can be saved to files and later downloaded to a real controller using the **Online** ribbon-tab. For more details about synchronization and downloading, consult the *Operating manual - RobotStudio*.

This is the basic workflow:

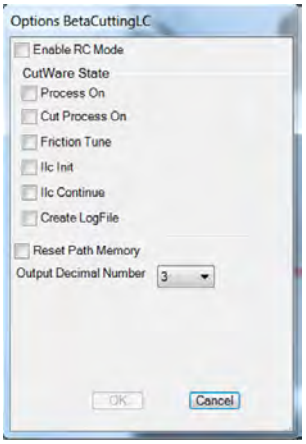
1. Synchronize the tasks to the virtual controller to generate RAPID program.
2. Save the programs to files by clicking **Save Program** on the Cutting ribbon-tab.
3. Copy the files to the real controller or download to real controller by using the **Online** ribbon-tab. See *Operating Manual - RobotStudio* for detailed procedure.

There are some files needing to be manually copied from My Documents/RobotStudio/Systems/[folder with the name of the user system]/Home to the corresponding locations in the real controller:

- The folder of LsCuttingParamTables.
- The .pfg file in the folder named by the name of the station.
- The screenshot picture for calibration.
- TpsView_Calibration.dll and TpsView_Calibration.gtpu.dll used for calibration.

## 11.2 Options

### Options

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Click **Options** to open a dialog box, which contains the following options:

| Group | Item | Description |
|---|---|---|
| | **Enable RC Mode** | Synchronization option.<br>If selected, this option is enabled for all the tasks in the current station. It means that for variables that already exist in the virtual controller, synchronization will not override them. Only new variables are created. |
| **CutWare State** | **Process On** | Allows you to enable or disable the process option. Used for offline simulation. |
| | **Cut Process On** | Allows you to enable or disable the cut process option. Used for offline simulation. |
| | **Friction Tune** | Allows you to enable or disable the friction tuning option. Used for offline simulation. |
| | **Ilc Init** | Allows you to enable or disable the Ilc option which will replace the previous Ilc setting. Used for offline simulation. |
| | **Ilc Continue** | Allows you to enable or disable the Ilc option which will calculate the new Ilc data based on the previous Ilc settings. Used for offline simulation. |
| | **Create LogFile** | Allows you to enable or disable the log file option. Used for offline simulation. |
| | **Reset Path Memory** | Allows you to clear the path memory. |
| | **Output Decimal Number** | Specify the fraction number of output data in cutting instructions |

# Index

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