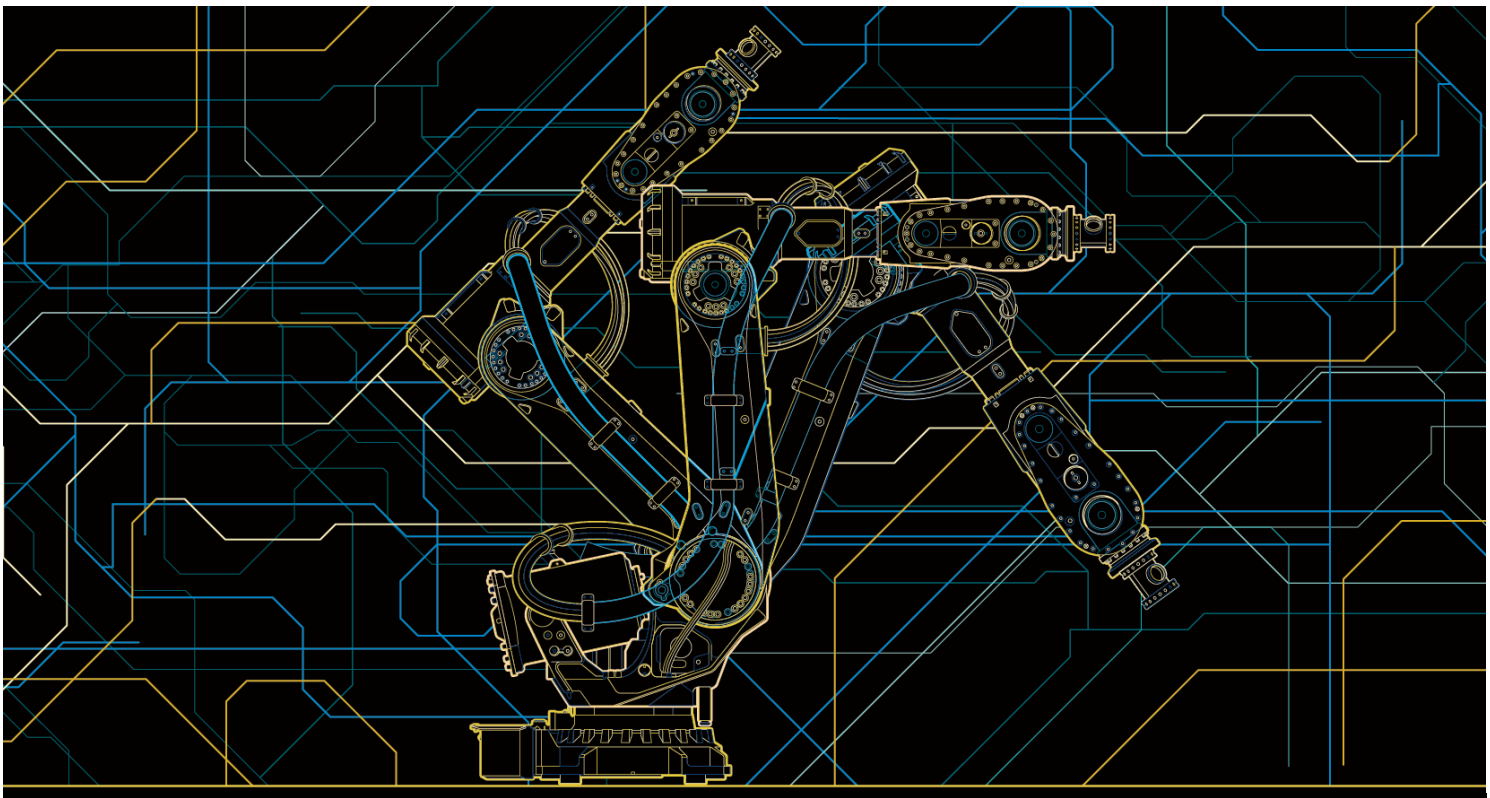

Operating Manual
ArcWelding PowerPac

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Operating Manual
ArcWelding PowerPac
RobotStudio 6.02

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Table of contents

Overview of the manual

About this manual

This manual describes how to use ArcWelding PowerPac to create arc welding programs offline. It also explains ArcWelding PowerPac terms and concepts.

Usage

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

Who should read this manual?

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

Prerequisites

The reader should have a basic knowledge of:

- RobotStudio
- RAPID
- Welding process

References

Reference	Document ID
3HAC032104-001	Operating manual - RobotStudio
3HAC021272-001	Application manual - MultiMove

Revisions

Revision	Description
A	First revision.
B	Editorial changes.
C	The graphical user interface is different from the old version. Added a section describing the new components of the user interface.
D	Added information about new functions, for example, multiple circular segments, path exporting and importing.
E	Minor corrections.
F	Updated the changes related to the path view toolbar and context menu: • Optimize Targets • Save As View • Enable Log
G	Editorial changes.

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Continued

Revision	Description
H	Released with RobotStudio 5.15 • Updated the information on **Save As** . See *Elements on the ArcWelding ribbon tab on page 18* and *Saving a program on page 22*. • Updated the screenshot of ArcWelding ribbon tab. See *ArcWelding ribbon tab on page 17*. • Added information on Virtual Arc. See *Elements on the ArcWelding ribbon tab on page 18* and *Task group on page 24*. • Updated the screenshot of the user interface. See *The user interface on page 11*.
J	Released with RobotStudio 5.15.01 • Added information about the Freehand tool group in the section *Elements on the ArcWelding ribbon tab on page 18*. • Added the new section *Freehand group on page 27*.
K	Released with RobotStudio 5.60 • Added information about the **MoveJ-MoveL** button in the section *Path View toolbar on page 67*. • Updated the section *Check Reach on page 105*.
L	Released with RobotStudio 5.61 • Updated the section *Task node on page 30*. • Updated the section *Creating a part on page 46*.
M	Released with RobotStudio 6.0 • Updated the section *Data Manager on page 24*.
N	Released with RobotStudio 6.01 • Updated the section *Creating a robot system on page 15*.
P	Released with RobotStudio 6.02 • Updated the section *Templates on page 33*. • Removed sections about Virtual Arc.

1 Introduction and installation

1.1 Introduction to ArcWelding PowerPac

About ArcWelding PowerPac

ArcWelding PowerPac is a dedicated tool for generating arc weld programs in RobotStudio. Utilizing the CAD geometry as the basis for all robotics programming, you can define weld locations and create robot positions. This method, known as geometry-based offline programming, gives you unprecedented control over the weld angles, resulting in improved quality.

About this chapter

This chapter will guide you through the installation process, which consists of these steps:

- *Installing ArcWelding PowerPac on page 10*.
- *Accessing the user interface on page 11*.

Prerequisites

The following are the prerequisites for installing:

- RobotStudio installed on your computer, which fulfils the system requirements
- ArcWelding PowerPac installation package
- A license certificate
- A log on account with administrator rights on the computer

1.2 Installing ArcWelding PowerPac

Overview

To be able to install ArcWelding PowerPac, RobotStudio must be installed on your computer.

Installing ArcWelding PowerPac

To install the ArcWelding PowerPac, follow these steps:

1. Browse to ArcWelding PowerPac installation package and double-click **Setup.exe**.

   The installation page opens.
2. Click **Install ArcWelding 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

Follow the procedure of installing a license as in RobotStudio.

1.3 Accessing the user interface

Overview

Before you can start using ArcWelding PowerPac, you must load a RobotStudio station that includes at least one arc-welding robot. The virtual controller (VC) associated with the arc-welding robot must be loaded with RobotWare Arc.

Loading a station

To initially open a station, follow these steps:

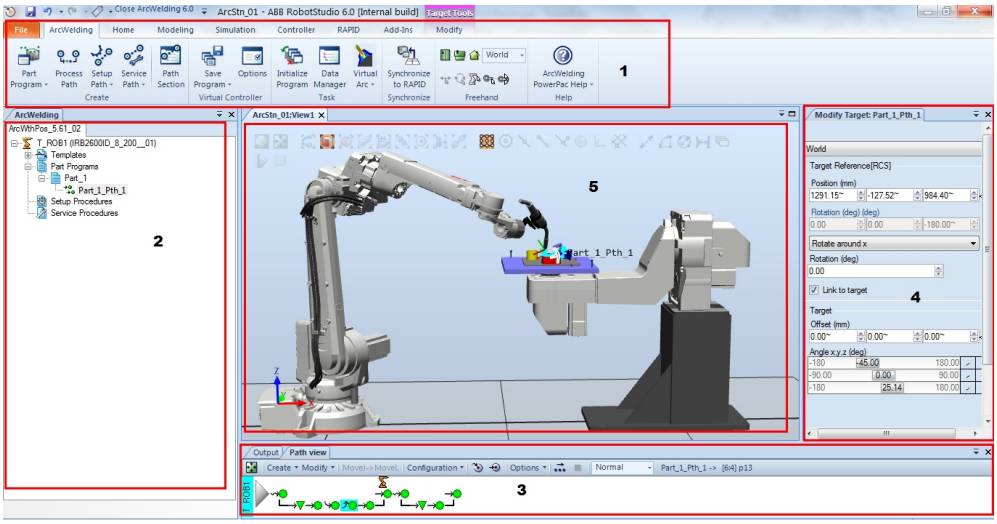
1. Open RobotStudio and create a new station with an existing system. In the **Systems Found** list, click **Arc**.
2. On the **Add-Ins** tab in the ribbon, select **ArcWelding** from the **PowerPacs** group.

   A dedicated tab for ArcWelding is added to the ribbon.

   The ArcWelding tree structure browser opens.
3. Expand the tree structure of the ArcWelding browser and right click **Part Programs**. Then click **Create part**. In the dialog box, click **OK**.
4. Right click the created path and click **Open** to open the path view.

The user interface

The panes and windows of the user interface, described in the following figure, help you to create a well-structured arc-welding program.



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	Item	Description
1.	ArcWelding ribbon-tab	Contains the general functions for arc-welding process. See *ArcWelding ribbon tab on page 17* for detailed description.
2.	ArcWelding browser	Organizes the components of the station in a tree structure. See *ArcWelding browser on page 29* for detailed description.

Continues on next page

	Item	Description
3.	Path view	Categorizes and linearly maps the targets. See *ArcWelding path view on page 63* for detailed description.
4.	Tool window	Dialog boxes created from the Path View. Enables you to create new instructions and modify existing instructions.
5.	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. This coordination is especially useful when working with MultiMove systems. 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.

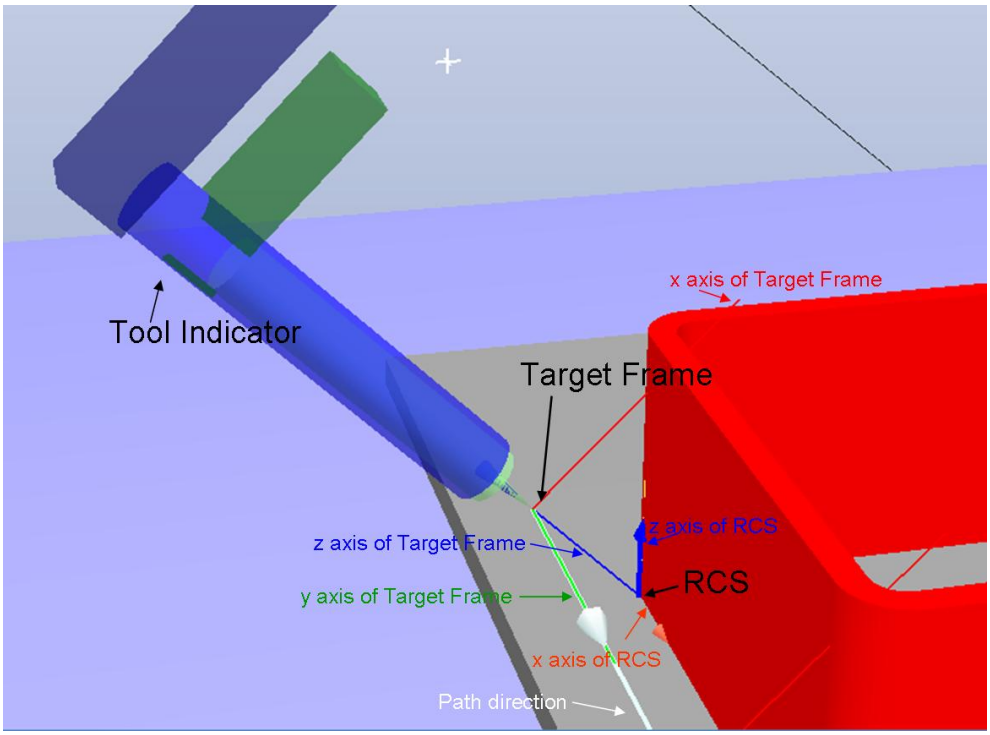
1.4 Concepts

Reference Coordinate System (RCS)

In ArcWelding 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 weld targets along a seam, the RCS positions are along the seam, the x axis directions are along the path direction, and the z axis directions are along the normal vector of the weld 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 welding seam.



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Application templates

An application template in ArcWelding PowerPac is a collection of templates for process parameters, weld targets, instruction arguments, and so on. It specifies the information needed to create a complete weld on the part. ArcWelding PowerPac is installed with default application templates, such as *ProcessAsMove* and *ArcDefault*.

Generic data

Besides default RAPID data types, such as robtarget and tooldata, PowerPacs also uses other data types. These are called generic data.

Continues on next page

In ArcWelding PowerPac, some process related data, such as welddata, seamdata, and weavedata are supported.

2 Creating a robot system

Building a new system

The following procedure describes 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 the **Name** field and select a path in the **Path** field.
5. Click **Next**.
6. For configuring a system with real controller, click browse button and select the key in the **Controller key** field.

   For configuring a system with virtual controller, 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. In the **RobotWare Version** list select the required RobotWare version.
8. Click **Next**.
9. For configuring a system with real controller, click the browse button, select the required drive key, and click the arrow button to add the drive key to the **Added Drive Keys** field.

   For configuring a system with virtual controller, click the arrow button to add the drive key to the **Added Drive Keys** field.

   > **Note**
   >
   > To configure a MultiMove system repeat this step to select and add the required number of drive keys.
10. Click **Next**.

Continues on next page

Continued

11 For adding additional options, click browse, select the key in the **EnterKey** field, and click the arrow button.

   The selected key is added to the **Added options** list.

12 Click **Next**.

13 Select the required options from the **Modify Options** window.

   Arc options can be selected from the **Application Arc** group.

> **Note**
>
> In the case of a MultiMove system, under the **Motion coordination part1** group, select the options from **Single Process** or **Multiprocess** for each manipulator according to your requirement.

14 Click **Finish**.

   The system is created in the specified location.

15 Click **Close**.

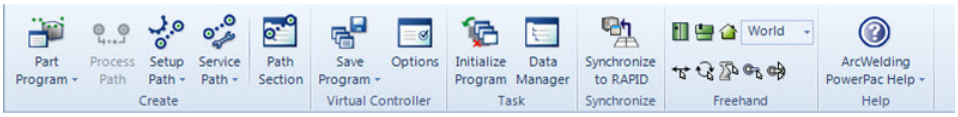
The new system is created.

3 ArcWelding ribbon tab

3.1 Overview

Overview

The ArcWelding ribbon tab contains the controls for creating paths, virtual controller operations, modifying ArcWelding PowerPac data, using freehand tools, changing the coordinate system, and help information.



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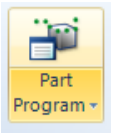
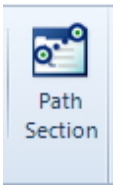
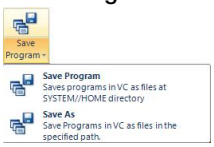
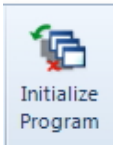
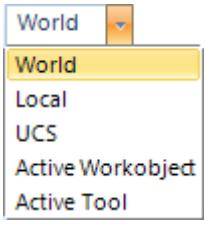
Elements on the ArcWelding ribbon tab

Group	Button	Description
Create	Part Program  en1200000365	Opens a dialog box to insert a new part node into the tree structure and creates an empty path. Only available when the Part Program node or a part node is selected in the ArcWelding browser. **Note** You can access this function also from the ArcWelding browser by right-clicking the Part Programs node. See *Part programs node on page 45* for the definition for part program.
	Process Path  en1200000366	Inserts a new path node into the tree structure. Not available on an open path. Only available when a part node or a path node under the part node is selected in the ArcWelding browser. **Note** You can access this function also from the ArcWelding browser by right-clicking the Process Path node. See *Process path on page 52* for the definition for process path.
	Setup Path  en1200000367	Inserts a new path node into the tree structure. Only available when the Setup Procedures node or a path node under the Setup Procedures node is selected from the ArcWelding browser. **Note** You can access this function also from the ArcWelding browser by right-clicking the Setup Procedures node. See *Setup and service procedures on page 57* for the definition for setup path.
	Service Path  en1200000368	Inserts a new path node into the tree structure. Only available when the Service Procedures node or a path node under the Service Procedures node is selected in the ArcWelding browser. **Note** You can access this function also from the ArcWelding browser by right-clicking the Service Procedures node. See *Setup and service procedures on page 57*.
	Path Section	Opens a dialog box to select sequential adjacentedges from the CAD model to represent a freeform path, and saves the path data into a XML filewhich will be used to create a free form cuttingpath in the future steps.Always available.

Continues on next page

Group	Button	Description
	 en1200000369	
Virtual controller	Save Program  en1200000370	• **Save Program**: Saves the current program in the virtual controller. The program is saved to a predefined directory. Under the system's home directory, a specific folder is created to store the RAPID programs for every task in the system. 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*. • **Save As**: To change the directory of the saved program, select **Save As** option. This will open a window asking for the new directory to save the current program.
	Options  en1200000372	Opens an dialog box to set the synchronization settings.
Task	Initialize Program  en1200000371	Overwrites the current program in the virtual controller with an empty one.
	Data Manager  en1200000373	Opens the Data Manager dialog box, which lists all the related data in the current station. Only available when the task node is selected in the ArcWelding browser. See *Task group on page 24* for the detailed description of data manager.
Synchronize	Synchronize to RAPID  en1200000374	Click Synchronize to RAPID to synchronize the selected program on the browser to the virtual controller

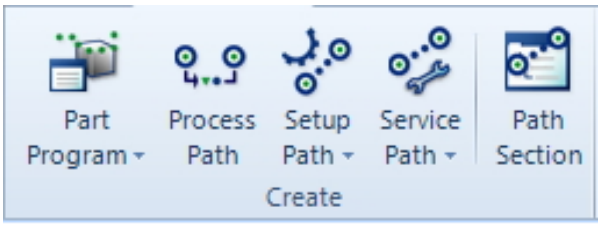
Continues on next page

Group	Button	Description
Freehand	Freehand tools  en1300000306	Tools in the **Freehand** group allows you to manage the movement of the robot, manage the view of the robot system, and to select the coordinate system. • - The **Top** tool displays the top view of the station with reference to the selected coordinate system. • - The **Front** tool displays the front view of the station with reference to the selected coordinate system. • - The **Right** tool displays the right view of the station with reference to the selected coordinate system. •  - The **Reference Coordinate System** drop-down listbox allows you to select the required coordinate system. • - The **Move** tool allows you to drag an item relative to the active reference coordinate system. • - The **Rotate** tool allows you to enable rotation around the various axes of an object determined by the reference coordinate system. • - The **Jog Joint** tool allows you to jog the different axes of a robot. • - The **Jog Linear** tool allows you to jog within the coordinate system defined by the active tool. • - The **Jog Reorient** tool allows you to enable the rotation of the TCP.
Help	ArcWelding Help  en1200000375	Provides the following information: • Contents, the help file • About ArcWelding, version information

3.2 Creating group

Overview

All the functions in the **Create** group are available in the ArcWelding browser.



en1200000378

Part Program

Click **Part Program** to open a dialog box to create a new part program. See *Creating a part on page 46* for the detailed description.

This button is available only when the Part Program node or a part node is selected in the tree structure.

Process Path

Click **Process Path** to insert a new empty path node into the tree structure.

This button is available only when a part node or a path node under the part node is selected.

Setup Path/Service Path

Click **Setup Path/Service Path** to open a dialog box to create a new setup path or service path. See *Creating Setup/Service Paths on page 134*.

This button is available only when the Setup/Service Procedures node or a path under the Setup/Service Procedure node is selected.

Path Section

Click **Path Section** to open a dialog box to select sequential adjacent edges from the CAD model to represent a free form path, and saves the path data into a XML file which will beused to create a free form cutting path in the future steps. This button is always available.

3.3 Virtual Controller group

Overview

The functions in this group are related to the virtual controller.

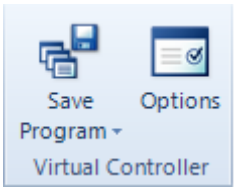
Saving a program

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**.



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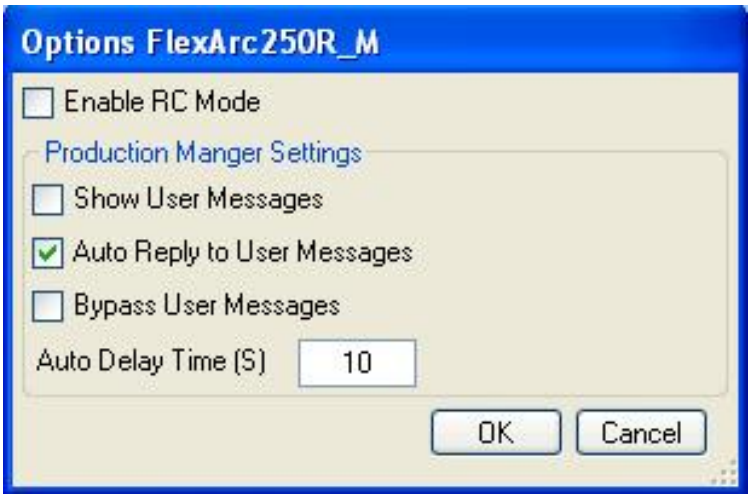
Options



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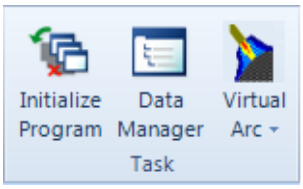
Click **Options** to open a dialog box, which contains the following options:

Group	Item	Description
	Enable RC Mode	Synchronization option. 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 will be created.
Production Manager Settings (FlexArc station needed)		Defines how the user message will be displayed on the FlexPendant. These options are available only when Production Manager is installed in the current system.
	Show User Messages	User messages on FlexPendant are shown. Press OK on the FlexPendant to hide the message and continue with running programmed procedures.
	Auto Reply to User Messages	User messages on FlexPendant are shown for a specified delay time. After that, the message automatically hides itself, and you can continue with running the programmed procedure. Specifies the delay time in the **Auto Delay Time** box.
	Bypass User Messages	User messages are not shown, and procedures keep on running.
Auto Delay Time	Only available when the **Auto Reply to User Messages** check box is selected. Specifies a time during which the user messages are displayed on the FlexPendant.	

3.4 Task group

Overview

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



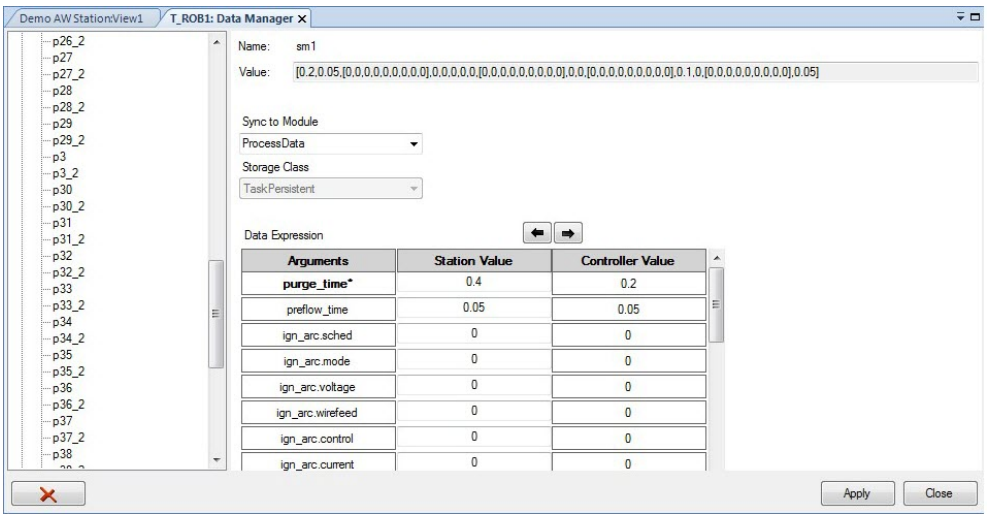
en1200000363

Initialize program

When you want to clean up the RAPID programs in the virtual controller, click **Initialize Program** to load an empty program to the virtual controller to overwrite the current one.

Data Manager

Click **Data Manager** to open the **Data Manager** window.



en1200000377

When you select a data from the data list, the corresponding attributes, for example, value, express, and so on, are displayed on the right side. In the**Data Manager** window you can:

- Compare the data in the station with the date in the virtual controller.
- Synchronize data from the virtual controller to the station.
- Modify data other than default, such as seamdata, trackdata, and weavedata.

> **Note**
>
> When a station value is modified the corresponding argument name becomes bold and an * symbol is added next to its name indicating that the highlighted argument is not saved. You have to click the **Apply** button to save the changes.

Continues on next page

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.

Note

Only data of the type other than `robtarget` and `jointtarget` can be synchronized from the data manager using the left and right arrow buttons.

Modify data

To modify data with **Data Manager** window, follow these steps:

1. Select a task node from the ArcWelding browser and click **Data Manager** to open the **Data Manager** window.
2. Click the **+** signs to expand the modules.
3. 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.

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.

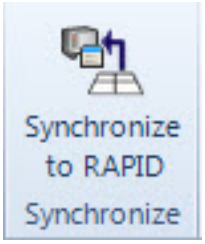
- **Sync as Inline Data**: This selection is only available for jointtargets and robtargets. The data will not be declared but included in the instruction.
- **Sync to Program Module**: The default setting for most data. The data will be synchronized to the same module as the procedure where it was used.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

Note

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

3.5 Synchronize group

Overview



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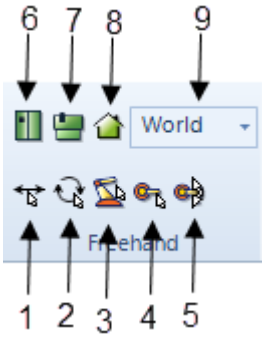
Synchronize ensures that the RAPID program in the system, running on the virtual controller, corresponds to the programs in ArcWelding PowerPac. You can synchronize data both from the station to the virtual controller and from the virtual controller to the station.

3.6 Freehand group

Overview

Freehand group allows the user to to manage the movement of the robot using freehand tools, manage the view of the robot system, and select the coordinate system from the ArcWelding tab.

The following figure and table provides you information regarding different elements in the Freehand group.



en1300000345

Label	Button name	Description
1	**Move**	Allows you to drag an item relative to the active reference coordinate system.
2	**Rotate**	Allows you to enable rotation around the various axes of an object determined by the reference coordinate system.
3	**Jog Joint**	Allows you to jog the different axes of a robot.
4	**Jog Linear**	Allows you to jog within the coordinate system defined by the active tool.
5	**Jog Reorient**	Allows you to enable the rotation of the TCP.
6	**Top**	Displays the top view of the station with reference to the selected coordinate system.
7	**Front**	Displays the front view of the station with reference to the selected coordinate system.
8	**Right**	Displays the right view of the station with reference to the selected coordinate system.
9	**Reference Coordinate System**	Allows you to select the required coordinate system.

Using the options in the Freehand group

Introduction

The following sections provide information regarding using the tools in the **Freehand** group.

Moving an item

1 In the **Layout** browser, select the item you want to move.
2 Click **Move**.

Continues on next page

3 In the graphics window, click one of the axes and drag the item into position.

Rotating an item

1 In the **Layout** browser, select the item you want to rotate.
2 Click **Rotate**.
3 In the graphics window, click one of the rotational rings and drag the item into position.

   If you press the **ALT** key while rotating, the item will snap 10 degrees at a time.

Jogging the joints of a robot

1 In the **Layout** browser, select the robot you want to move.
2 Click **Jog Joint**.
3 Click the joint you want to move and drag it to the preferred position.

   If you press the **ALT** key when jogging the joints of the robot, the robot will move 10 degrees at a time. If you press the **f** key, the robot will move 0.1 degree at a time.

Jogging the TCP of a robot

1 In the **Layout** browser, select the robot you want to move.
2 In the **Freehand** group, click **Jog Linear**. A coordinate system is displayed at the TCP of the robot.
3 Click the axis you want to move and drag the TCP to the preferred position.

   If you press the **f** key while jogging the robot linearly, the robot will move with a smaller step size.

Reorienting the TCP rotation

1 In the **Layout** browser, select the robot you want to reorient.
2 In the **Freehand** group, click **Jog Reorient**.

   An orientation ring appears around the TCP.
3 Click the orientation ring and drag the robot to rotate the TCP to the preferred position.

   The X, Y, and Z orientation appears with units.

Note

If you press the **ALT** key while reorienting, the robot moves by 10 units and if you press the **F** key, it moves by 0.1 unit.

Note

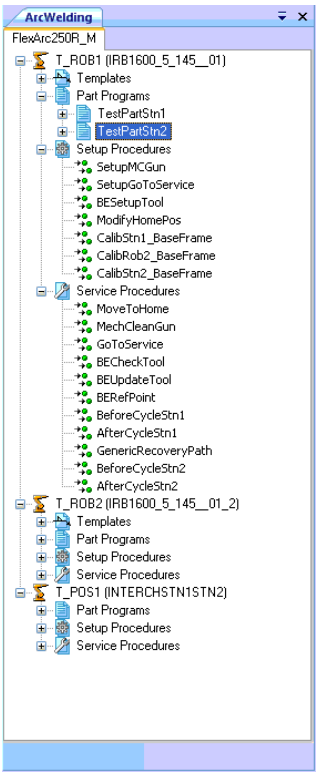
The behavior of orientation differs with the different reference coordinate system (World, Local, UCS, Active Workobject, Active Tool).

4 ArcWelding browser

4.1 Overview

Overview

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



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At the top you find several tabs, one for each virtual controller, here named *FlexArc250R_M*.

Each virtual controller can subsequently run up to four robot nodes, here named *T_ROB1, T_ROB2, and T_POS1*.

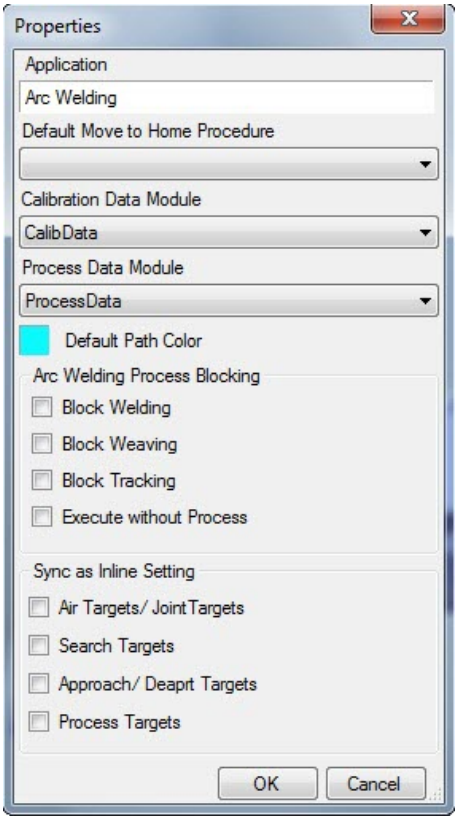
A predefined structure of templates, part programs, and setup and service procedures is found under each robot node.

4.2 Task node

Overview

You can access the shortcut menus for the task node (top node) in the ArcWelding 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:  en1200000376
	Application	From the options selected in the virtual controller, the system determines the application suitable to the robot type. If the robot is for arc welding, 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 seam of every part program. This is usually the starting point for the first seam, ensuring that the robot can actually move to the first instruction in the first seam.
	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.

Continues on next page

Menu	Dialog Box Elements	Description
	Process Data Module	This mandatory property puts all process data, such as weld, weave, and seam 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 ArcWelding browser and the path view.
	ArcWelding Process Blocking	The check boxes of this group have the same functions as blocking in the virtual controller RobotWare Arc application. This is useful during the testing phase. See *Application manual - Arc and Arc Sensor*.
	Sync as Inline Setting	Synchronizes with all the targets and instruction in the same line. It has the following options: • **Air Targets**/**Joint Targets**: Synchronizes all Air and Joint Targets present in the path procedure as inline. • **Search Targets**: Synchronizes all Search Targets present in the path procedure as inline. • **Approach and Depart Targets**: Synchronizes all Approach and Depart Targets present in the path procedure as inline. • **Process Targets**: Synchronizes all Process Targets (Weld Start, Via, Weld End, and so on) present in the path procedure as inline.
Refresh		Refreshes the browser to reflect changes in the path view.
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 RAPID		Synchronizes the entire task to the virtual controller. **Note** Since the **Synchronize to RAPID** is available from the shortcut menu in ArcWelding PowerPac, the Synchronize to virtual controller function in RobotStudio's **Home** tab is disabled.

Import action instruction/Move instruction description

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

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

Continues on next page

Follow these steps to import instructions:

1. Right-click a task node and click Import Action Instruction/Import Move Instruction Description/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.

4.3 Templates

4.3.1 Application templates

Overview

An application template is a collection of process parameters and instruction settings that define the properties of a weld, such as `seamdata`, `welddata`, `weavedata`, and `trackdata`.

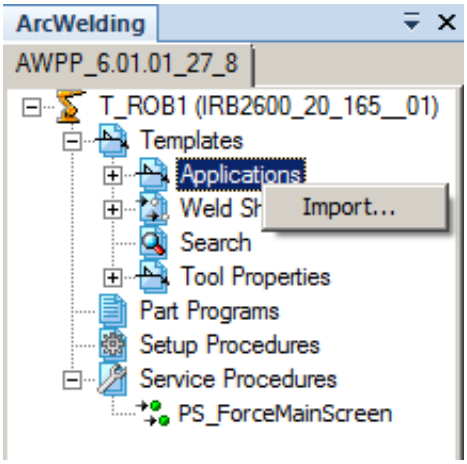
The application templates are based on several instructions. For example, the **ProcessAsMove** template includes instructions for `MoveL`, `MoveJ`, and `MoveC`. These default move instructions are always available in the virtual controller. The **Arc Default** template (included in the ArcWelding PowerPac installation) uses instructions such as `ArcLStart`, `ArcL`, `ArcLEnd`. These are available in virtual controller installed with the option `Arc`.

The application template is used to set process parameters on a weld, when the Create Weld function is executed. For more details, see *Create Weld on page 71*.

Importing an application template

To import a template:

1 Right-click on the Application node and click **Import**.



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The **Import Application Template** window is displayed.

2 Select the required template and click **Open**.

The selected template is added into the application browser tree and the related process definitions are automatically loaded into RobotStudio.

An error message is displayed 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 is done manually by clicking the **Instruction Template Manager** icon in **Path Programming** group in RobotStudio Home tab as

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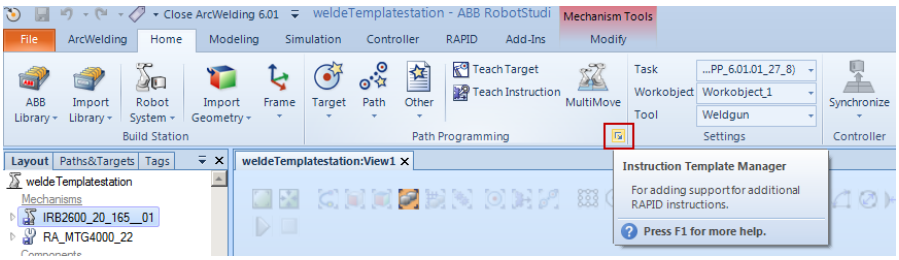
4.3.1 Application templates
Continued

shown in the following figure. For more details see Instruction Template manager section in the RobotStudio manual.



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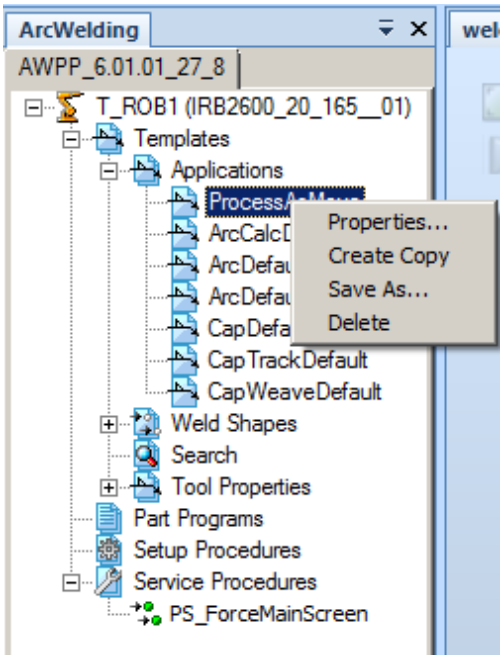
WARNING

Do not manually modify or delete any process definitions in **Instruction Template Manager**.

Right-click on the templates under Application node to access the available options. The following figure and table provide more infomration about the available options.



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Menu	Description
Properties...	View and modify the properties of the selected application template.
Create Copy	Creates a copy of the selected application template.
Save As	Saves the selected application template with a new name.
Delete	Deletes the selected application template.

Continues on next page

Modifying an application template

Modify application template

To modify an application template:

1. Right-click on the template and click **Properties**.

   The template properties window is displayed.
2. Modify the template according to your requirement.
3. Click **Save**.

   The changes are saved.

To save the changes without closing the properties window click **Save**. To save changes and close the properties window click **OK**. To save the template in another name click **Save As**. To cancel the modifications click **Cancel**.

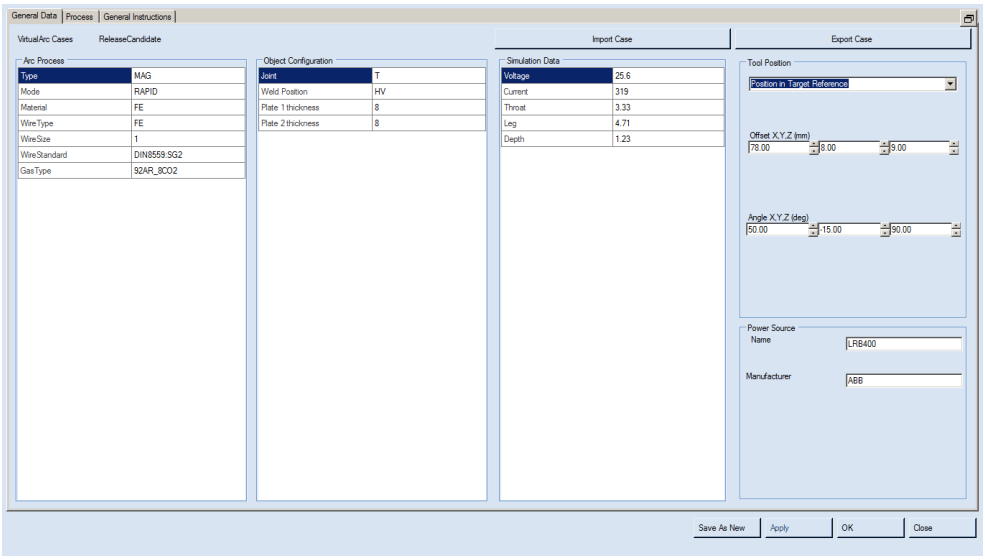
> **Note**
>
> The **Save As** option is enabled only if the changes to the current template are saved.

The template properties window has the following three tabs:

- **General Data**
- **Process**
- **General Instructions**

General Data tab

The General data tab allows you to to configure the Arc process parameter settings. These settings are saved with the template and can be used as a future reference there by reducing the fine-tuning efforts.



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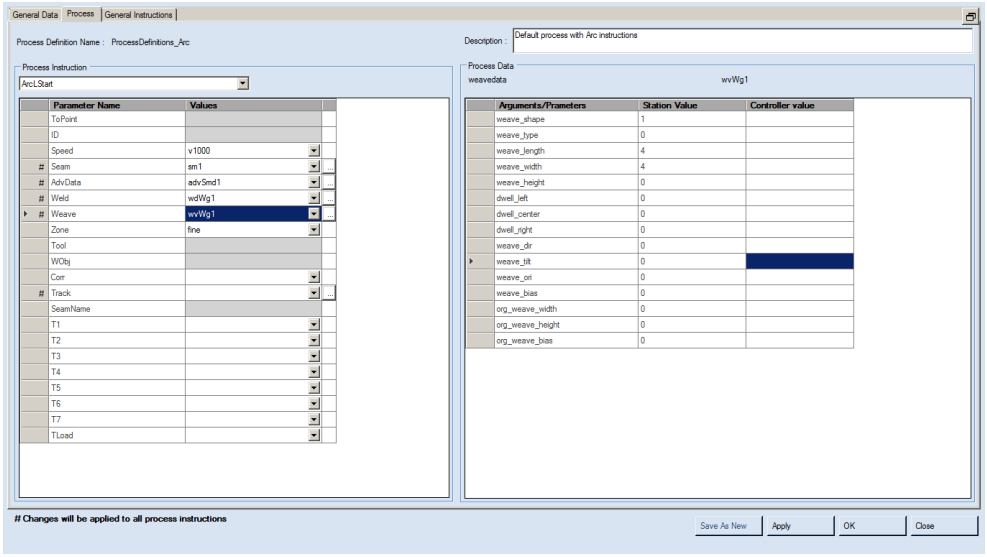
4.3.1 Application templates

Continued

Section	Description
Import Case	Imports an Arc Case. **Note** Virtual Arc has been removed from the application. However Virtual Arc cases continue to be available along with the installer. The cases can be found at ...User//MyDocuments/RobotStudio/VirtualArc and can be imported into the application.
Export Case	Exports a modified Arc Case.
Arc Process	Defines the type of arc process and properties of the feed wire.
Object Configuration	Defines the properties of the weld and weld part.
Simulation Data	Defines the properties of the welding arc.
Tool Position	Defines the default values for the tool position while creating a weld using this template.
Power Source	Displays information about the power source.

Process tab



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Section	Description
Process Instruction	Displays a list of process instructions available with the template. When you select an instruction, the corresponding parameters are displayed. You can edit the parameters from this section. **Note** When you switch between the rows in the table, the corresponding arguments and values are automatically updated in the **Process Data** section. **Note** If you edit process parameters, the modified values are automatically updated in the **Process Data** section.

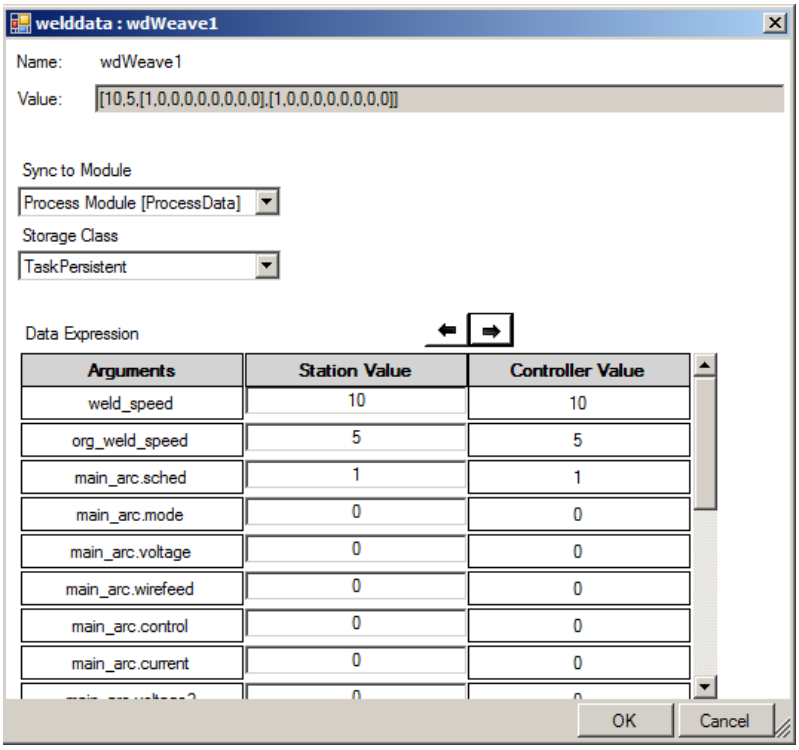
Continues on next page

Section	Description
Process Data	Displays the arguments and values of the selected process data value. **Note** You must select the value for a process data to display its corresponding arguments and values in the **Process Data** section.
Description	You can modify the description about the template.

Note

If you make any changes to a process data for a particular process instruction, the changes are also applied to the process data in other process instructions. These process instructions are marked by # symbol.

You can change the value of a process data by clicking on the corresponding list available in the **Values** column. Click the ... icon to edit the parameters of a selected process data. The following edit window is displayed.



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You can edit the station values for arguments from this window. You can also copy values between the **Station Value** and **Controller Value** columns by clicking on the left and right arrow button.

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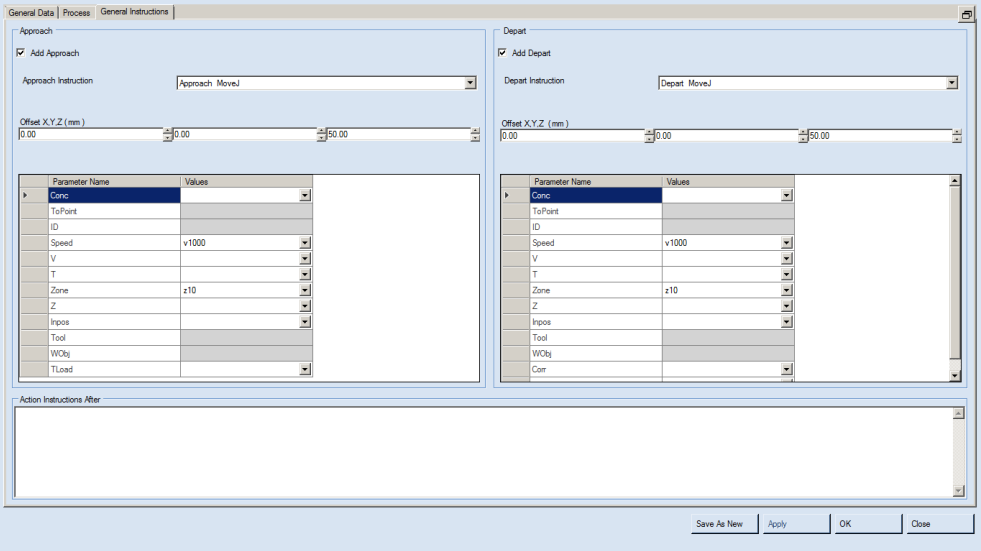
4.3.1 Application templates
Continued

General Instructions tab



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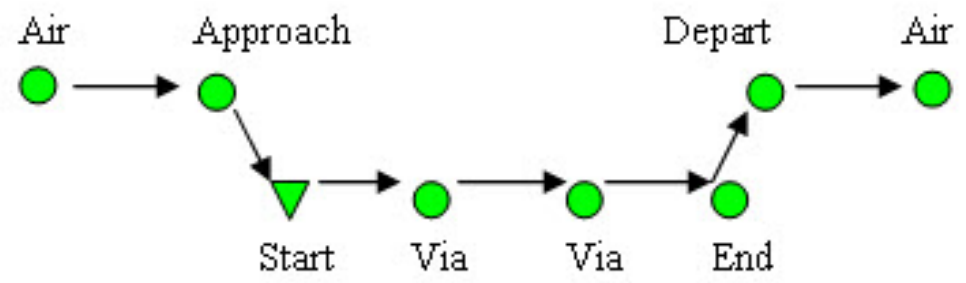
Section	Description
Approach	Select the **Add Approach** check box to enable the approach parameters. You can edit the approach parameters from this section.
Depart	Select the **Add Depart** check box to enable the depart parameters. You can edit the depart parameters from this section.
Action Instructions After	The RAPID instructions added in this section are saved with the template. Whenever a weld is created using this template these RAPID action instructions are automatically added after the last target in the weld path.

Note

The selected approach or depart instruction is used for creating an approach or depart instruction while creating a weld. For more details, see *Create Weld on page 71*.

Target classification

The following figure illustrates a typical sequence of targets.



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

Target	Description
Air Move	Intermediate target between welds. Generates a MoveJ or MoveL instruction, depending on the motion type.
Approach Move	The first target before a weld. 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 weld. Generates an ArcLStart instruction, activating the weld process.
Process Via	The intermediate target in a weld. Generates an ArcL or ArcC instruction, depending on the motion type.
Process End	The last target in a weld. Generates an ArcLEnd or ArcCEnd instruction, depending on the motion type, deactivating the weld process.
Depart Move	The first target after a weld. 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.

4.3.2 Weld shape templates

Overview

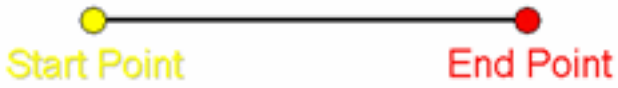
A weld shape template is a collection of weld parameters. The selected application template is used to set the weld parameters on a weld during creation. See *Create Weld on page 71* for using templates in weld creation.

Default weld shape templates

Object	Description
Start Point	Click the geometry where the weld should start.
End Point	If linear, click the geometry where the weld should end.
	If circular 3 point, click the geometry where the weld should end.
	If circular X segments, click the geometry along the circular edge after the Circ Point.
Circ Point	Click the geometry along the circular edge, between the Start Point and the End Point.
Corner Point	Click the geometry exactly on the corner, between the Start Point and the End Point.

Object	Description
Offset X, Y, Z	Offset distance of path in relation to RCS's three axes. Useful to avoid collision detection between the wire and part.
Angle X, Y, Z	Angle from Process Start target to Process End target. The three values correspond to Work Angle. Push/Drag (Travel Angle), and Spin Angles. See the illustration in *Create Weld on page 71*.
Approach Offset X, Y, Z	Offset distance of Approach target in relation to the RCS's three axes. Since Approach target's RCS is at the same position as Process Start target, the offset also specifies the distance between the two targets.
Depart Offset X, Y, Z	Offset distance of Depart target in relation to the RCS's three axes. Since Depart target's RCS is at the same position as Process End target, the offset also specifies the distance between the two targets.

One linear segment



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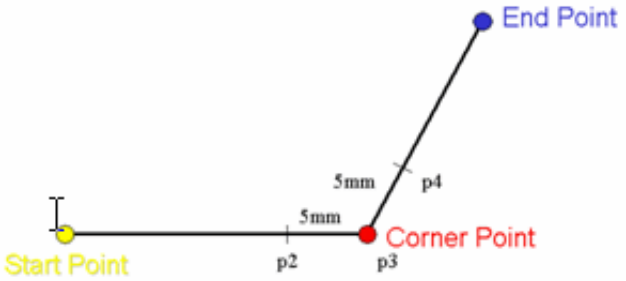
Index	Classification	Offset X, Y, Z	Work Angle	Push / Drag	Spin Angle
1	Start Point	(0,0,0)	45	0	90
2	End Point	(0,0,0)	45	0	90

Continues on next page

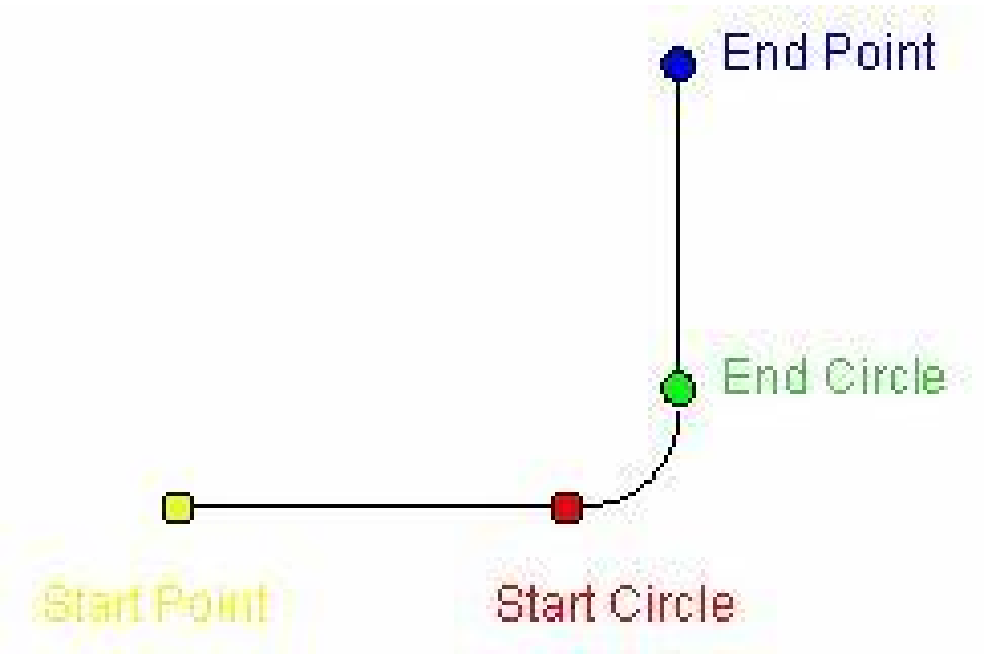
Two linear segments



en1200000310

Index	Classification	Offset X, Y, Z	Work Angle	Push / Drag	Spin Angle
1	Start Point	(0,0,0)	45	0	90
2	p2	(0,0,0)	45	0	90
3	p3	(0,0,0)	45	0	90
4	p4	(0,0,0)	45	0	90
5	End Point	(0,0,0)	45	0	90

Two linear segments (with radius corner)



en1200000350

Index	Classification	Offset X, Y, Z	Work Angle	Push / Drag	Spin Angle
1	Start Point	(0,0,0)	45	0	90
2	Start Circle	(0,0,0)	45	0	90
3	End Circle	(0,0,0)	45	0	90
4	End Point	(0,0,0)	45	0	90

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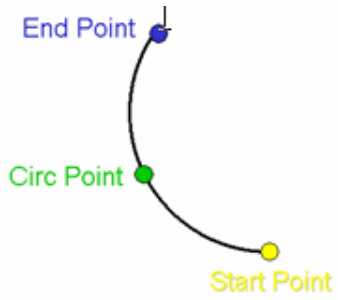
4.3.2 Weld shape templates
Continued

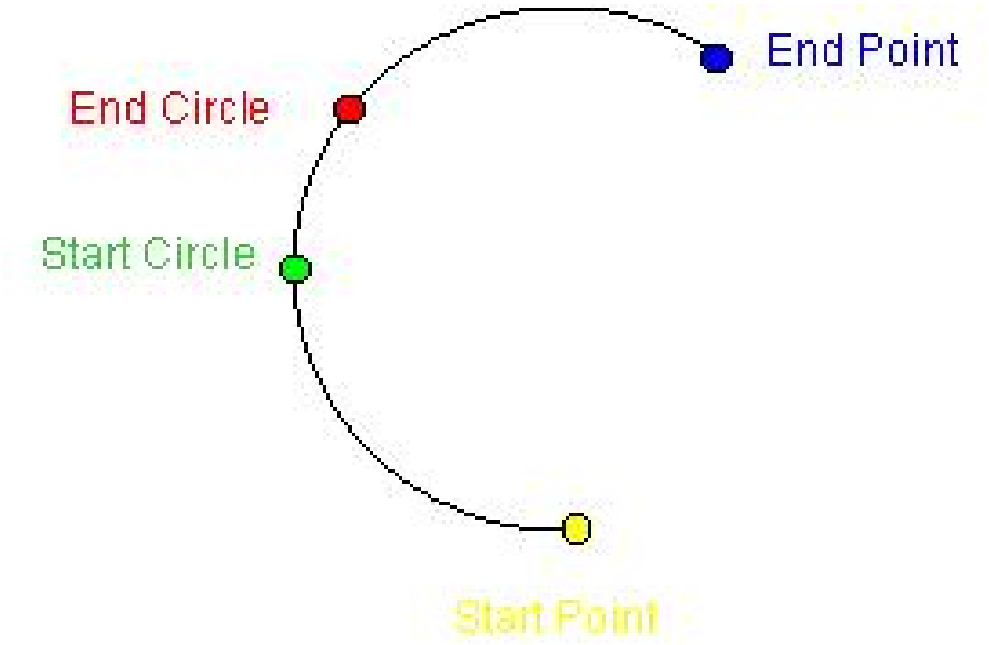
Circular segment



en1200000311

Index	Offset X, Y, Z	Classification	Work Angle	Push / Drag	Spin Angle
1	(0,0,0)	Start	45	0	90
2	(0,0,0)	End	45	0	90

Multiple circle segments



en1200000351

Index	Classification	Offset X, Y, Z	Work Angle	Push / Drag	Spin Angle
1	Start Point	(0,0,0)	45	0	90
2	Start Circle	(0,0,0)	45	0	90
3	End Circle	(0,0,0)	45	0	90
4	End Point	(0,0,0)	45	0	90

4.3.3 Search templates

Overview

A search template is a collection of search instructions.

When the needed instruction descriptions are available in the station, you can import and use the search template to create search instructions.

See *Searching with SmarTac on page 121* for detailed information.

4.3.4 Tool properties template

Overview

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

See *Searching with SmarTac on page 121* for detailed description.

4.4 Part programs

4.4.1 Part programs node

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. **NOTE!** You can access this function also from the ArcWelding 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. See *Importing a part program on page 49* 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.
	Create Part Program	Inserts a new part program node into the tree structure and creates an empty path. **NOTE!** You can access this function also from the ArcWelding ribbon-tab.
	Create Process Path	Inserts a new path node into the tree structure. **NOTE!** You can access this function also from the ArcWelding ribbon-tab.
	Synchronize to VC	Synchronizes the selected part (and all included paths) to the virtual controller. Not available if any path in the part program is open.
	Delete	Deletes the selected node.
	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. See *Exporting a part program on page 48* for detailed description.

Continues on next page

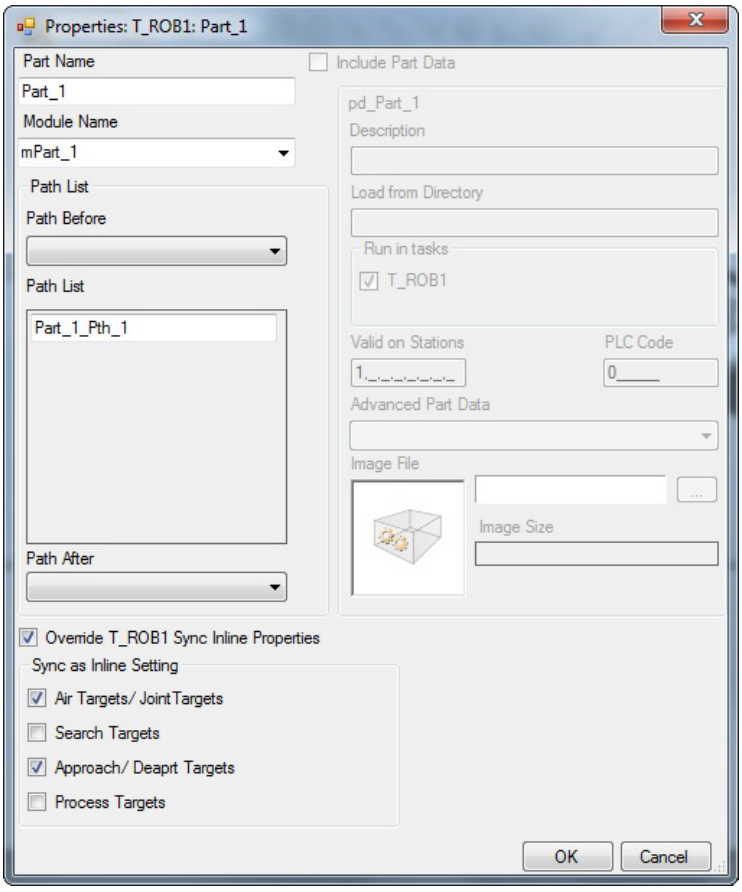
4.4.1 Part programs node
Continued

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. See *Importing a part program on page 49* 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. See *Importing a path on page 54* for more description.

Creating a part

To create a part in a part program, follow these steps:

1 In the ArcWelding 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 ArcWelding ribbon-tab to open a dialog box.



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2 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.
Include Part Data	If selected, the created part program will also include a partdata. The information in the partdata is a collection of inputs in the following two fields.
Part Data - Description	Get automatic update when entering a new part name.
Part Data - 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.
Path Before	Select a path that runs before the created part program.
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.
Override Parent Sync Inline Properties	Overrides the task sync inline properties. When this option is selected **Sync as Inline Setting** is enabled for the selected part procedure.

After entering all the needed information, you can view the new part program in the tree structure of ArcWelding 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. This is very useful when used in a MultiMove station.

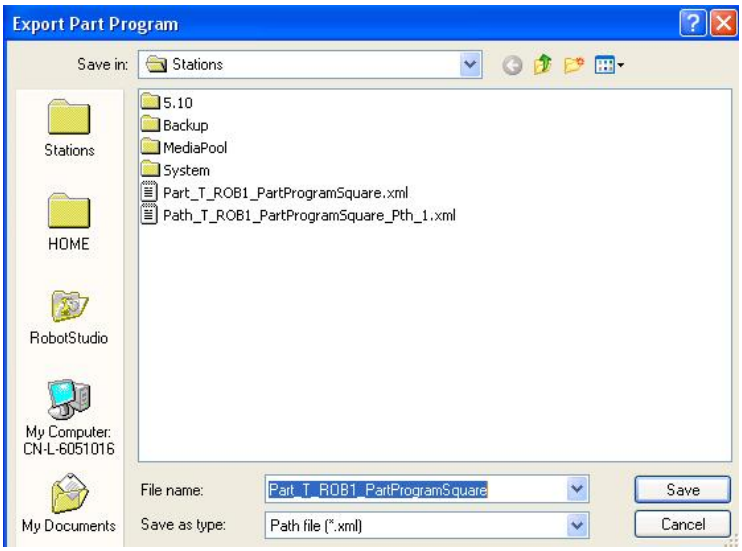
Continues on next page

4.4.1 Part programs node
Continued

Exporting a part program

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

1. In the ArcWelding 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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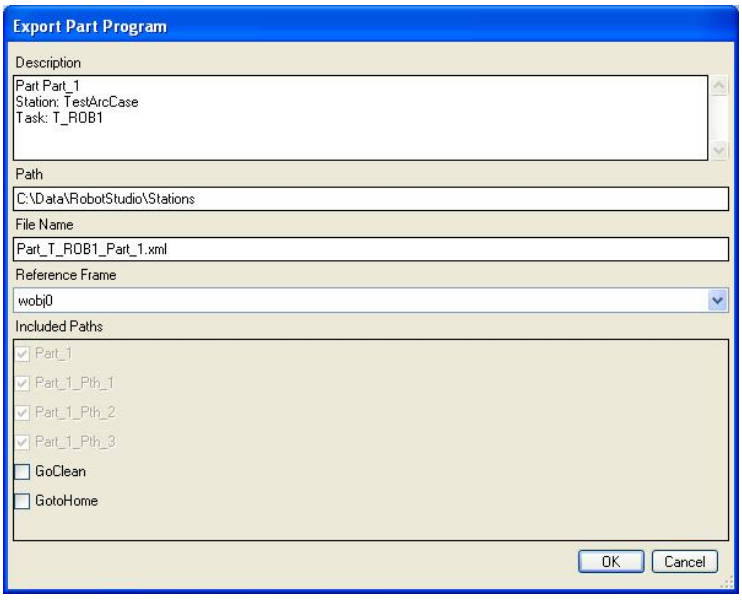
2. Specify a name of the file and a directory to store.
   The default name of the file is *"Part_"+Task name+ "_" + Part name*.
   The default directory is under *"/My Documents/RobotStudio/Stations"*.
3. Click **Save** and a dialog box opens.
4. Check the data and click **OK**. The XML file will be saved.



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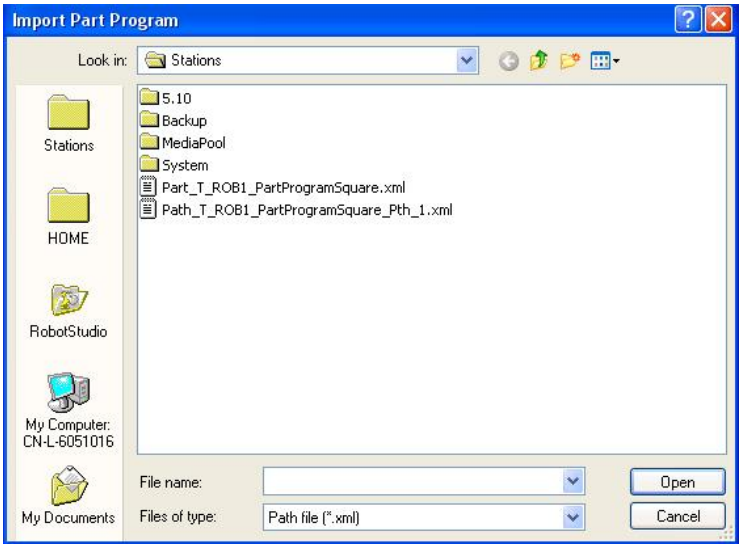
Object	Description
Description	Describes the name of the part, the station, and the task. Read-only.
Path	The directory where the file is stored. Read-only.
File Name	The name of the saved file.
Reference Frame	A reference where the path targets in the part program are related to. This affects the position 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.

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

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



en1200000337

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.

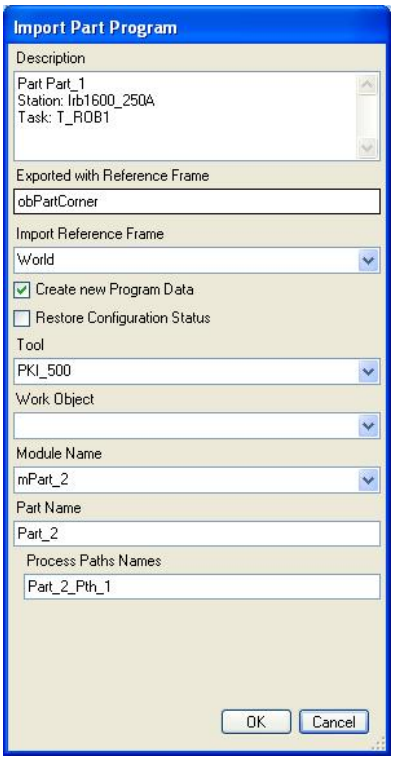
If a right type is selected, a dialog box opens.

Continues on next page

4.4.1 Part programs node

Continued

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



en1200000338

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. **NOTE!** This is a lazy function. Make sure that the targets are indeed of the same configuration status.
Tool	The tool for the part program. If left blank, the tool from the file will be used.
WorkObject	Select workobject 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.

Continues on next page

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 welddata wd1 that is synchronized to the process data module will not be created again when importing. The old data wd1 will be used instead.

4.4.2 Process path

Overview

Process Paths are listed in the ArcWelding browser under the part programs. As a component of a part program, a path is a holder of welds in a sequence. Each weld 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 ArcWelding browser is also visible in the Elements browser. 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. **NOTE!** You can access this function also from the ArcWelding ribbon-tab.
	Synchronize to VC	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. See *Exporting a path on page 53* 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. See *Importing a path on page 54* for detailed description.
	Visible	With a check mark to indicate that the selected path is visible. Not available on an open path.
	Close	Closes an open path, removing it from the path view. Only available on an open path.

Continues on next page

Creating process paths

There are three ways to create process paths:

- Add paths to the path list from the Create Part Program dialog box.
- 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 ArcWelding ribbon-tab.

Creating welds

To add welds to a path, first open the Path View by right-clicking a process path node and clicking **Open**.

See *Create Weld on page 71* for the detailed description of how to add welds to the Process Path.

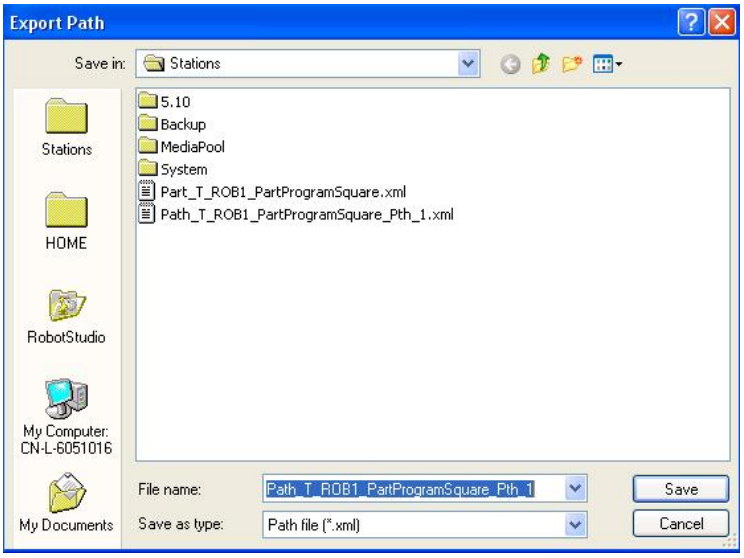
Exporting a path

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

1. In the ArcWelding 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"*.



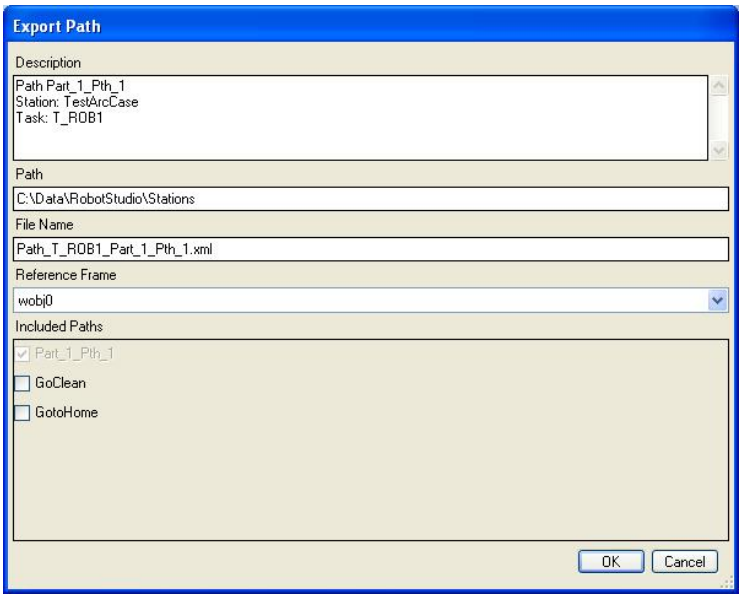
en1200000348

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

Continues on next page

4.4.2 Process path
Continued

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



en1200000339

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.

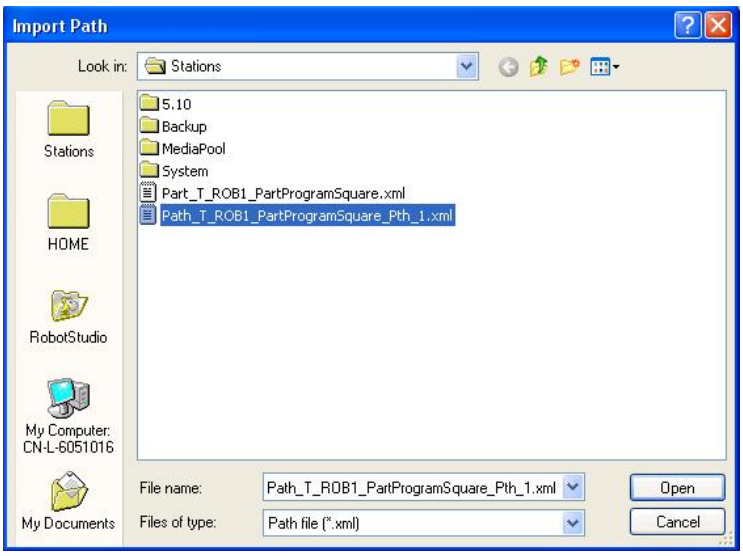
Importing a path

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

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

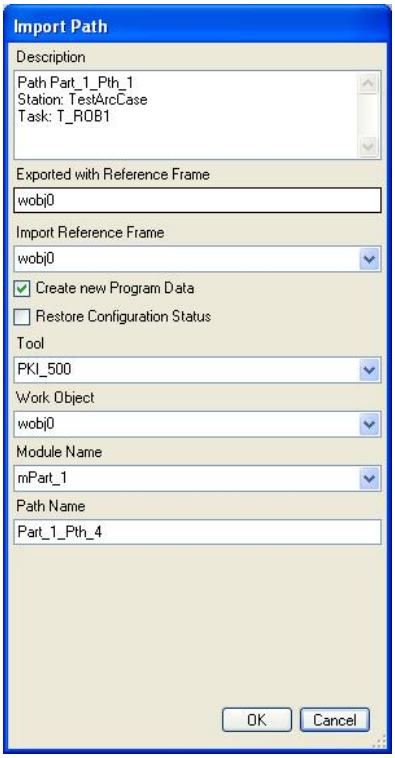
Continues on next page

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



en1200000349

2 Click **Open** and the **Import Path** dialog box opens.



en1200000340

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.

Continues on next page

4.4.2 Process path
Continued

Object	Description
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.
WorkObject	Select workobject 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.

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 49*.

4.5 Setup and service procedures

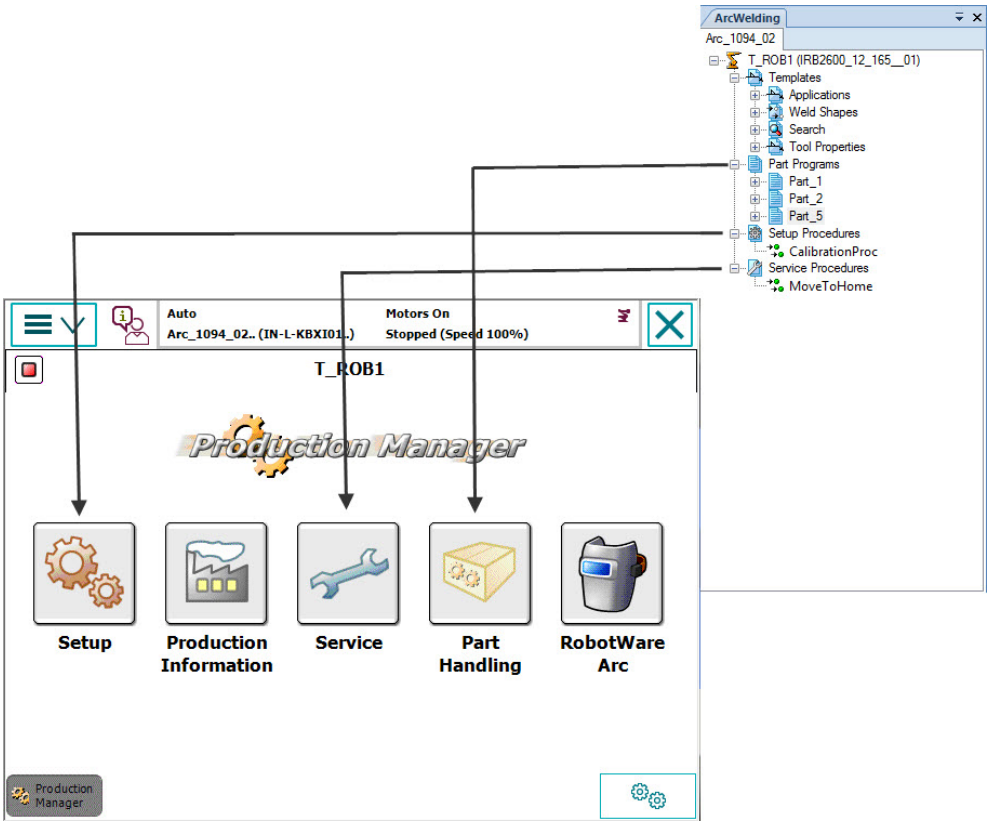
Overview

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

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

- To and from the home position and the BullEyes TCP calibration device (service procedure)
- To and from the home position and the torch cleaner device (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 BullEyes TCP calibration device (setup procedure)

After downloading these procedures to the robot controller, each procedure is visible in the production manager menu system on the FlexPendant.



en1200000312

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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. **NOTE!** You can also access this function from the ArcWelding ribbon-tab.
Import Path	Import a path XML file into station as a setup path.	
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. 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. **NOTE!** You can also access this function from the ArcWelding ribbon-tab.
	Synchronize to VC	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. See *Exporting a path on page 53* 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. Please see *Importing a path on page 54* for detailed description.
	Visible	A check mark indicates that the selected path is visible. 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. **NOTE!** You can also access this function from the ArcWelding 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. 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. **NOTE!** You can also access this function from the ArcWelding ribbon-tab.
	Synchronize to VC	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. See *Exporting a path on page 53* 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. See *Importing a path on page 54* for detailed description.
	Visible	A check mark indicates that the selected path is visible. 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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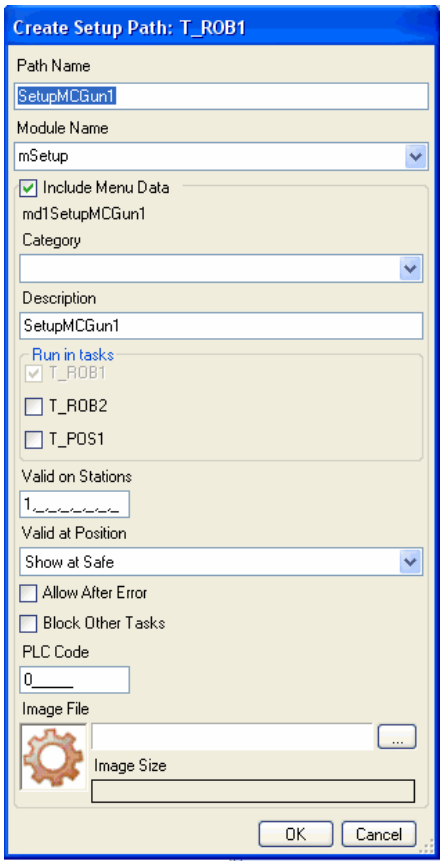
Creating a setup/service path



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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 menudata will also be created. The information in the menudata 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.
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.

Continues on next page

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

1. In the ArcWelding 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 ArcWelding 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 ArcWelding 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.

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5 ArcWelding path view

5.1 Overview

Overview

The path view displays the targets in a path by representing them with *Instruction icons on page 64*. The large arrow head indicates the start of a path.

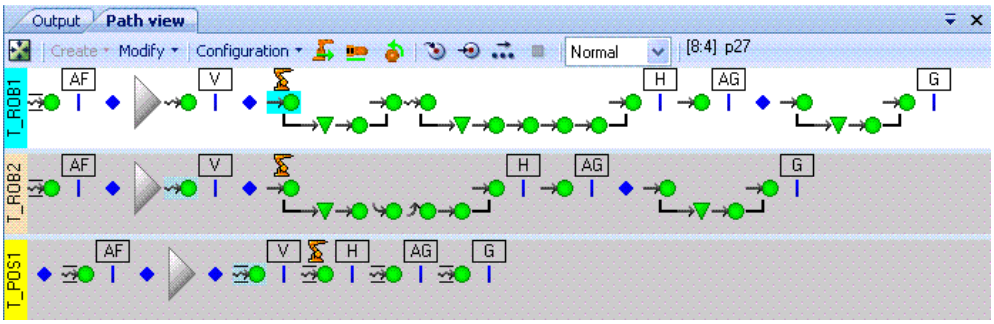
When a program contains several paths, the first instruction in the path view is the last instruction of the preceding path. This enables you to verify that the robot can bridge the paths.

The path view holds *The Path View toolbar on page 67*, which has menus and buttons for the most frequently used commands. You can use the **Create** menu to add welds or insert instructions and the **Modify** menu to manipulate targets and axes. The Path Player can execute individual targets or entire paths.

The path view also contains a *Shortcut menu on page 69* and a number of *Multi-Selection Operations on page 93* to modify multiple targets.

Multiple paths may also be displayed. Since each robot can display one path, up to four paths may then be stacked in the path view. When editing a path, however, the others are highlighted grey.

A robot icon, the Robot Cursor, sits on top of the targets to indicate the position of the robot in the target sequence. Note how the cursor advances step-by-step when the path is executed. This is particularly useful in MultiMove systems, where execution of multiple robots can be displayed in a single view.



en1200000282

5.2 Instruction icons

Overview

An instruction icon shows the type (shape), motion (arrow) and status (color) of each target. Targets are sequenced from left to right in two levels: the lower level represents process sections, such as welds and search sequences, while the upper level represents air move sections, which typically connect process sections.

Instruction icons

The following table describes the icon shapes:

Icon	Description
 en1200000253	Target
 en1200000254	Process start target

The following table describes the arrows:

Icon	Description
 en1200000255	Linear move
 en1200000256	Joint move
 en1200000257	Absolute joint move
 en1200000258	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
en1200000259	White = unknown status
 en1200000260	Green = target verified
 en1200000261	Yellow = solution found, but not verified
 en1200000262	Red = no solution, or target out of reach

Continues on next page

Icon	Description
 en1200000263	Blue = non-motion instruction

The following table describes examples of the above:

Icon	Description
 en1200000265	Linear move, process start target, solution found but not verified
 en1200000266	Joint move, target verified
 en1200000267	Circular move, no solution or out of reach
 en1200000268	Linear move, unknown status

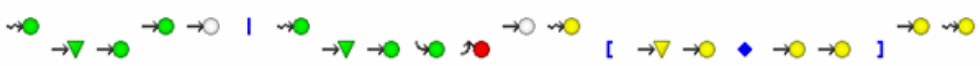
The following table describes the instruction levels:

Level	Instruction type	Instruction
Upper	Air	MoveL, MoveJ
Lower	Process	ArcLStart, ArcL, ArcC, ArcLEnd, ArcCEnd, Search_1D, Search_Groove

The following table describes the non-motion instructions:

Icon	Description
en1200000269	WaitSyncTask
en1200000270	SyncMoveOn
 en1200000271	SyncMoveOff
 en1200000272	Miscellaneous RAPID

Example


en1200000308

PROC My Path
MoveJ

Continues on next page

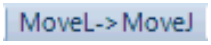
SearchL
SearchL
MoveL
MoveL
WaitSyncTask
MoveJ
ArcLStart
ArcL
ArcC
ArcCEnd
MoveL
MoveJ
SyncMoveOn
ArcLStart
ArcL
SetDO
ArcL
ArcLEnd
SyncMoveOff
MoveL
MoveJ
ENDPROC

5.3 The Path View toolbar

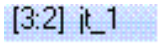
Overview

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: • *Create Weld on page 71*. • *Create Weld instruction on page 82*. • *Create Air instruction on page 84*. • *Create ABS joint target on page 86*. • *Create Search instruction on page 128*. • *Create an Action instruction on page 88*.
The **Modify** button	This menu contains the following commands: • *Modify instruction on page 89*. • *Modify target on page 90*. • *Modify Jointtarget / External Axes on page 92*.
The **MoveL-MoveJ** button 	The **MoveL->MoveJ** button converts the Air, Approach, and Depart targets to **MoveJ** or **MoveL**. This is a dynamic button and the button name is updated with reference to the selected target. For example, if you select an air target with the current Move configuration as **MoveJ** then the button text is updated to **MoveJ->MoveL**. Then by clicking the button, the target is converted to **MoveL** and the text on the button is updated to **MoveL->MoveJ**. Therefore by clicking the target, you can see the current Move configuration by looking at the text of the button and update accordingly.
The **Configuration** menu	This menu contains the following commands: • *Check Reach on page 105*. • *Set Configuration on page 106*.
	The **Arm** button opens a dialog box similar to the one opened by clicking *Set Configuration on page 106*. The image on the **Arm** button also indicates the active Arm configuration of the target.
	The **Wrist** button opens a dialog box similar to the one opened by clicking *Set Configuration on page 106*. The image on the **Wrist** button also indicates the active Wrist configuration of the target.
	The **Tool** button opens a dialog box similar to the one opened by clicking *Set Configuration on page 106*. The image on the **Tool** button also indicates the active Tool configuration of the target.

Continues on next page

Icon	Description
	The **Jump to Target** button jumps the robot with active TCP to the selected target. It gives you a chance to view torch angles and detect possible collisions with the robot. • A successful result turns the target yellow and moves the robot one discrete step towards the target. • An unsuccessful result turns the target red and leaves the robot in its current position.
	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. • A successful result turns the target green and moves the robot continuously towards the target. • An unsuccessful result turns the target red and leaves the robot in its current position. **NOTE!** The virtual controller is not running when executing this command.
	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**: • Save As View (Default value: Cleared). • Enable Log (Default value: Checked) Check or clear the check boxes to enable or disable the options. See *The Options Menu on page 109* 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.

5.4 Shortcut menu

Overview

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

Object	Description
Create	See *The Create menu on page 70*.
Modify	See *The Modify menu on page 89*.
Check Reach	See *Check Reach on page 105*.
Jump To	See *The Path View toolbar on page 67*.
Move To	See *The Path View toolbar on page 67*.
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 seam.
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 welds 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.
Remove Process	Convert a weld section into air points. Only available on Process Start targets.

5.5 The Create menu

5.5.1 Overview

This menu contains the following commands:

- *Create Weld on page 71*.
- *Create Weld instruction on page 82*.
- *Create Air instruction on page 84*.
- *Create ABS joint target on page 86*
- *Create Search instruction on page 128*.
- *Create an Action instruction on page 88*.

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.

5.5.2 Create Weld

Overview

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

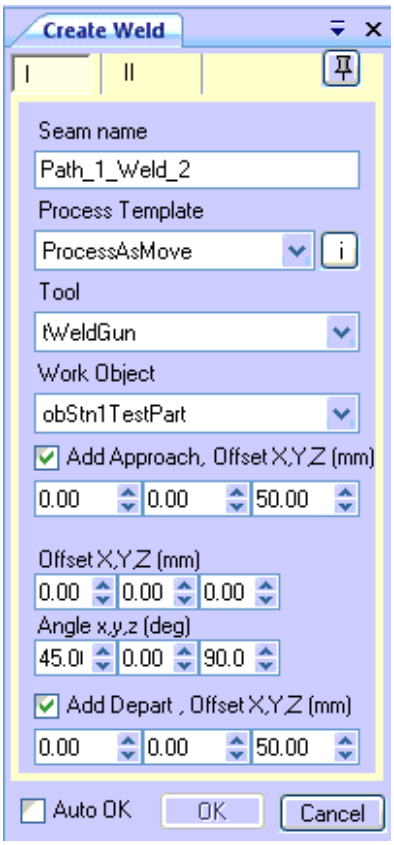
- Approach Move (optional)
- Process start
- Process Via
- Process End
- Depart Move (optional)

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

The Create Weld dialog box

The dialog box is composed with two tab-pages.

The first page contains parameters that are static among different welds, and users don't usually change.



en1200000284

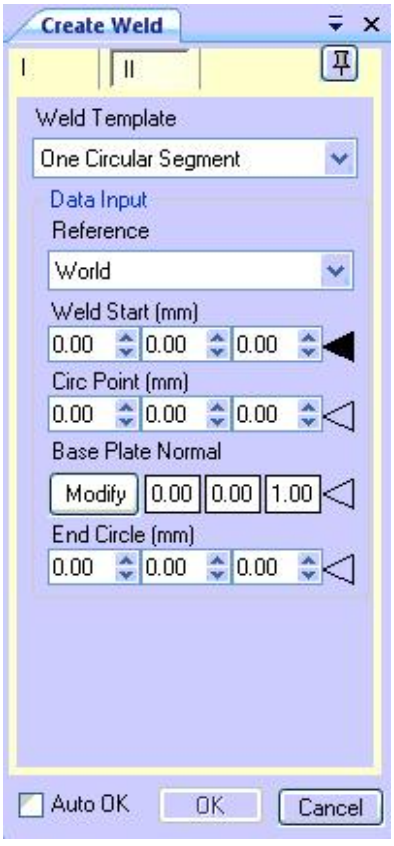
Object	Description
Seam name	The name of the new weld.

Continues on next page

5.5.2 Create Weld
Continued

Object	Description
Application template	Select the application template of the new weld. Click on i on the right side of the template, and a message box will display the process parameters of the template, such as weld speed, wire feed speed, voltage, and so on.
Tool	Select tool of the weld.
Work Object	Select work object for the targets of the new weld.
Add Approach	If selected, the new weld will include an approach target before Process Start point.
Offset X, Y, Z	The offset distance of the process targets with their RCS.
Angle X, Y, Z	The work angle, travel angle, and spin angle of the process targets, in relation to their RCS.
Add Depart	If selected, the new weld will include a depart target after Process End point.
Auto OK	If selected, the weld will be automatically added if all values in the dialog box are inserted.

The second page contains parameters that are usually variable among different welds:



en1200000326

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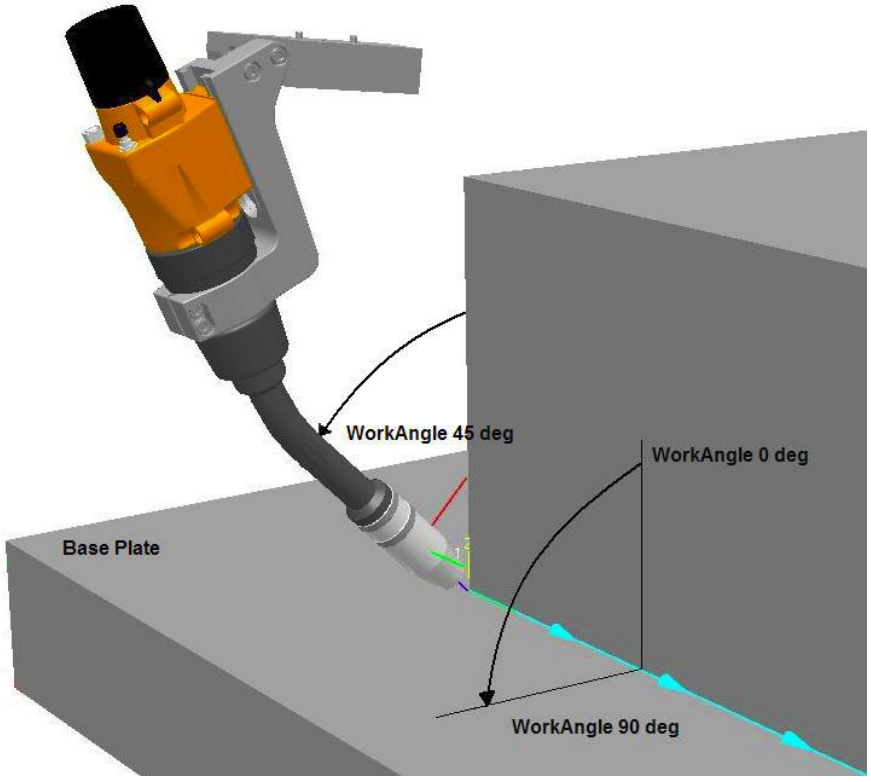
Object	Description
Weld Shape Templates	The weld shape template defines the shape of the new weld. Besides the list under the Weld Shape Templates tree node in the Browser, there is also another option of creating path from edge. See *Path From Edges on page 80*. The contents in the Data Input group will change as the selection of weld shape template changes.
Reference	Select a reference to show the geometry values of the controls below.
Data Input controls	Click the arrow on the right. The arrow is turned black. It means that the application expects you to click somewhere in the graphics window. You can click in the graphical user interface and the control will then read the value from the clicked point. You can also manually edit the values. After all the values of the controls are entered, the **OK** button will be enabled.

Creating a weld

To create a weld, follow these steps:

1. In the **Seam name** box, enter the name for the seam or use the default name.
2. In the **Process** list, select the application template for the seam.
3. In the **Template** list, select the weld shape template for the seam.
4. In the **Offset** boxes, specify, if necessary, an offset to shift the path.
5. In the **Angle** boxes, specify the tool angles.



en1200000285

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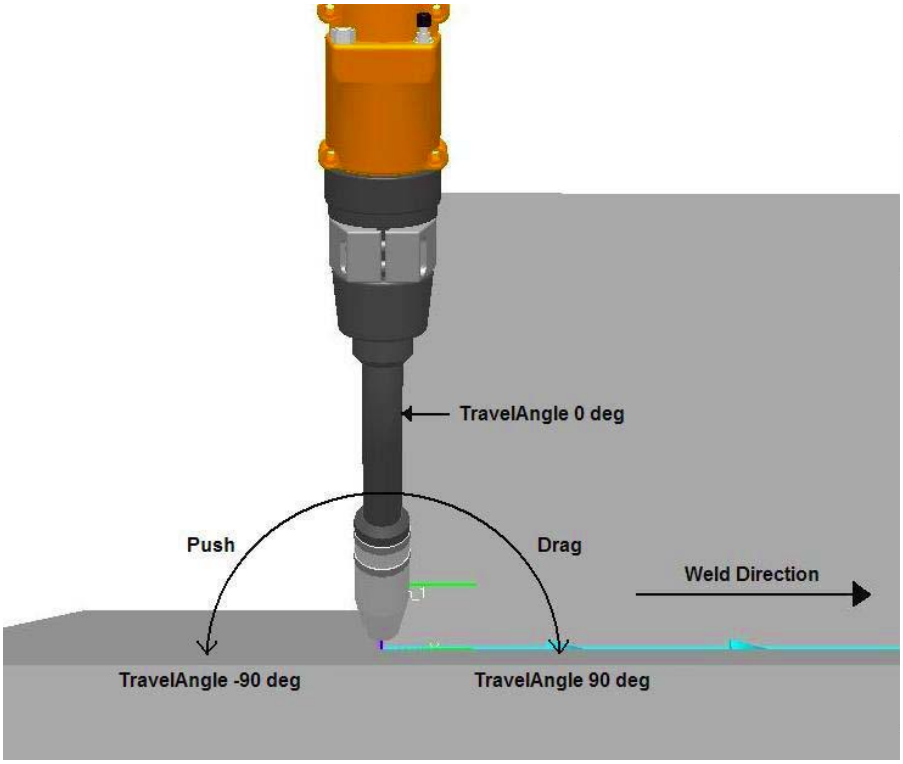
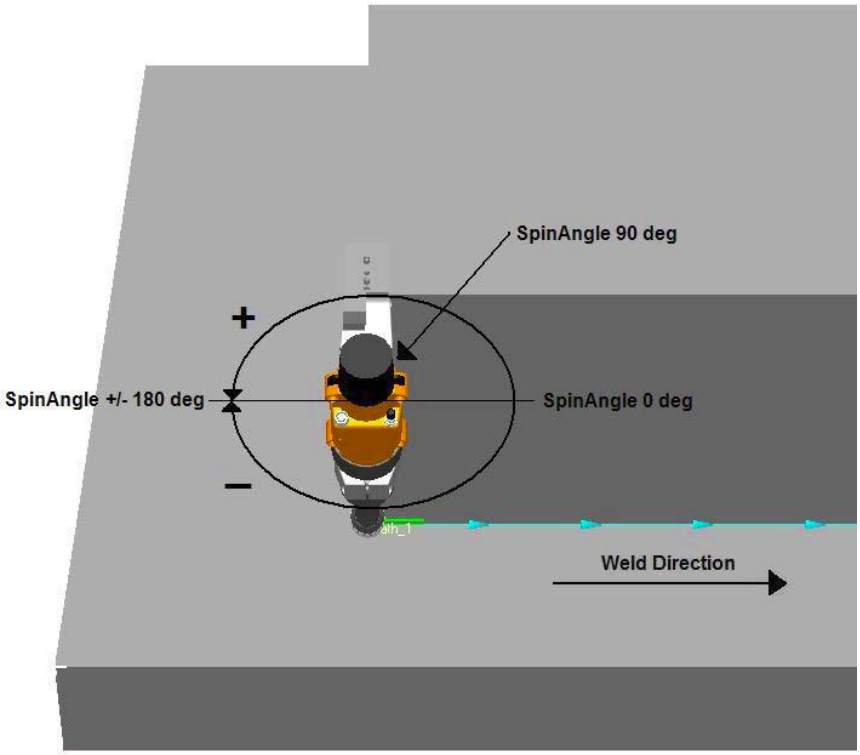
5.5.2 Create Weld
Continued



en1200000286



en1200000287

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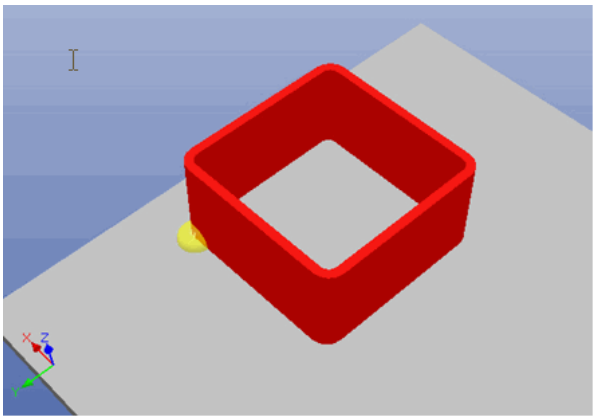
6 To optionally create approach and depart targets in the first and last process instructions, select the **Add approach** and **Add depart** check boxes, and specify the offset distances.

7 In the **Data Input** group, specify the geometric data for building the seam. Input the data by clicking in the graphical user interface, or manually enter the values in the input control.

Examples

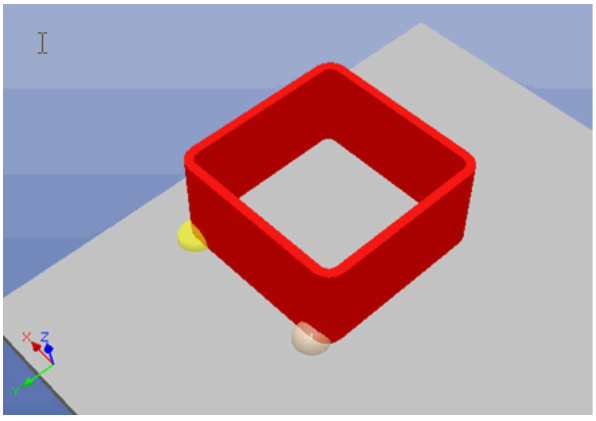
One Linear Segment

When the default weld shape template **One Linear Segment** is selected, the **Insert Weld Data Input** box list includes three items: Weld Start, Weld End and Base Plate. Click the part where you want the weld to start. Use the selection levels and the snap modes toolbars in RobotStudio to snap the cursor to a corner. The XYZ coordinates of the chosen position will be entered in the Weld Start boxes. A spherical yellow marker indicates the chosen position in the graphics window.



en1200000319

The arrow head is highlighted in black to the right of the Weld End boxes. Click the part where you want the weld to end. The XYZ coordinates of the chosen position will be entered in the weld End boxes. A second spherical marker indicates the chosen position in the graphics window.



en1200000320

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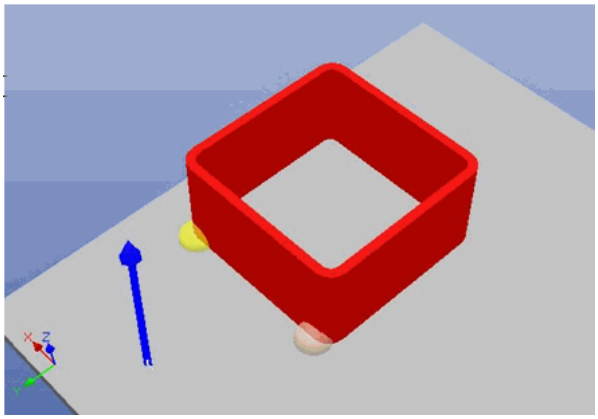
5.5.2 Create Weld
Continued

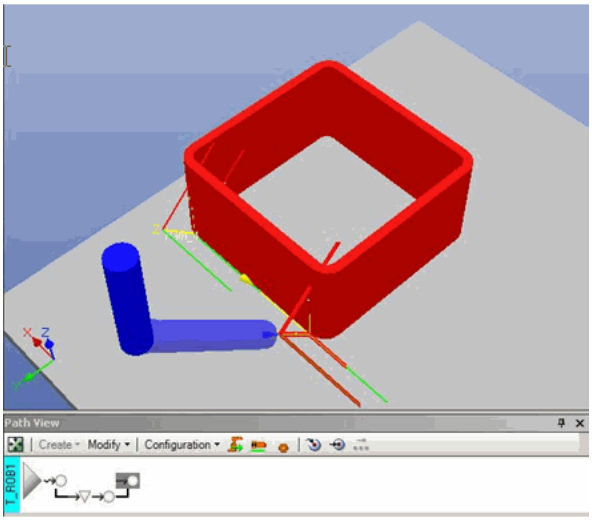
Finally the Base Plate arrow is highlighted. Pick a base plate to set the Z-orientation of the reference coordinate system. The XYZ coordinates of the chosen position will be entered in the Base Plate boxes. The Z-orientation will be indicated by a blue arrow in the graphics window.

Note: Clicking one of the arrows to the right of the input boxes will automatically set the view center to that position, enabling you to examine clicked positions before proceeding.



en1200000321

Click **OK** to generate the weld. Four targets will be created: Approach, Weld Start, Weld End and Depart. Each target is represented by a small coordinate system in the graphics window and instruction icons are added to the Path View.



en1200000322

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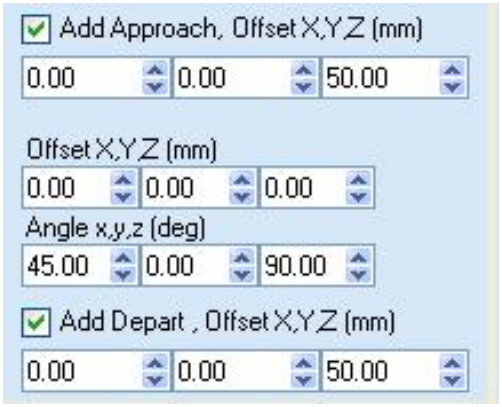
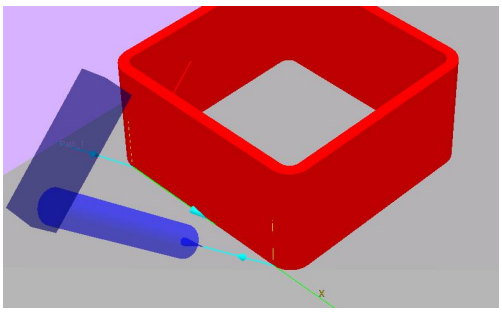
NOTE! The pick position of the base plate normal decides the sloping side of the work angle.



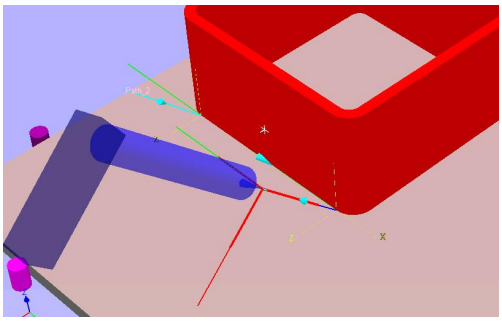
en1200000327

A positive value of the work angle and a base normal clicked on the right, will make the tool tilt to the right:



en1200000328

A positive value of the work angle and a base normal clicked on the left, will make the tool tilt to the left:



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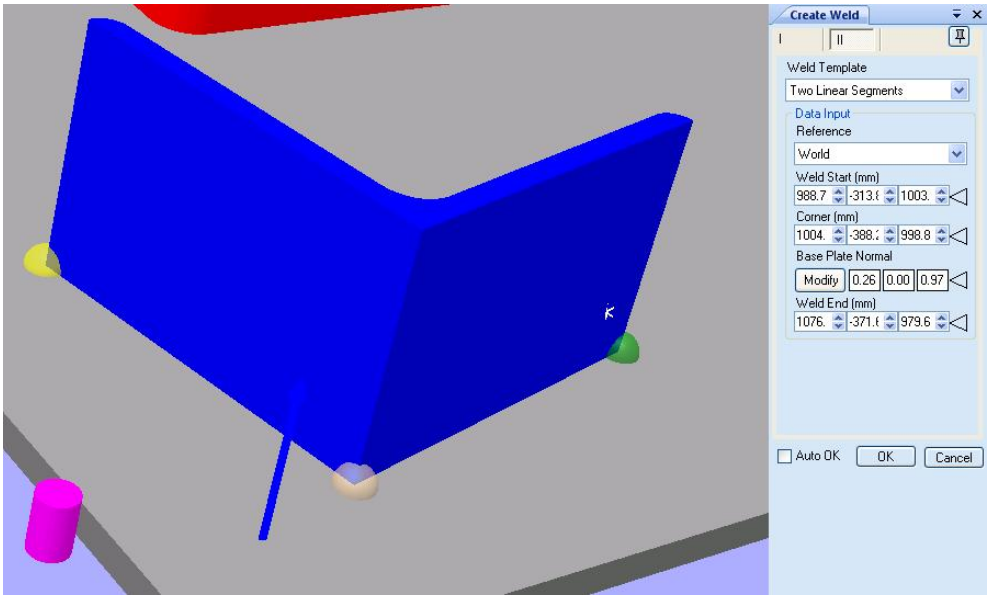
5.5.2 Create Weld
Continued

Two Linear Segments

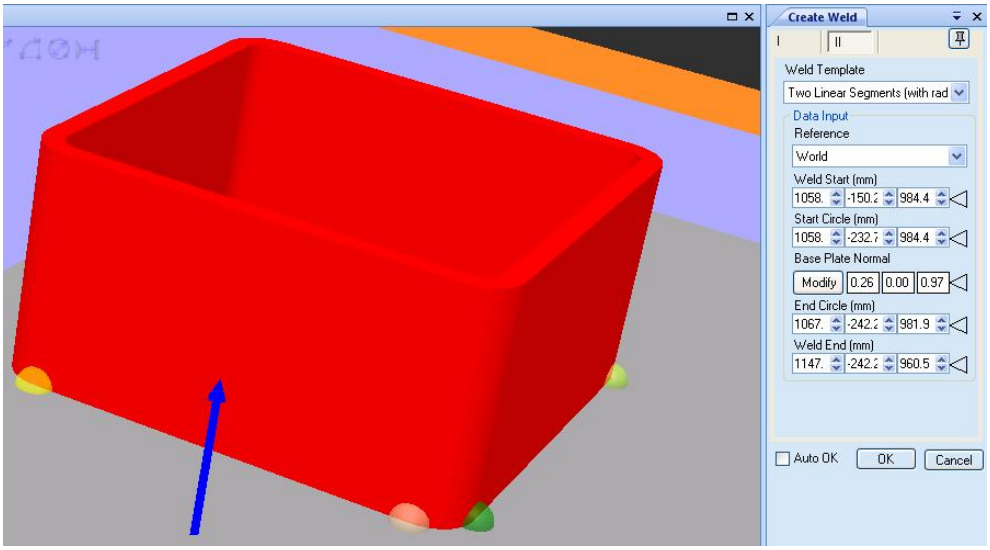
The **Two Linear Segments** template is composed with start target, corner target, end target, and the base plate normal vector. To keep a stable travel angle along the edge, and make a smooth turn around the corner, two additional targets will automatically be added besides the corner when the weld is created.



en1200000330

Two Linear Segments (with radius corner)

The **Two Linear Segments with a Corner** template is composed with start target, corner start, corner end, end target, and the base plate normal vector.



en1200000331

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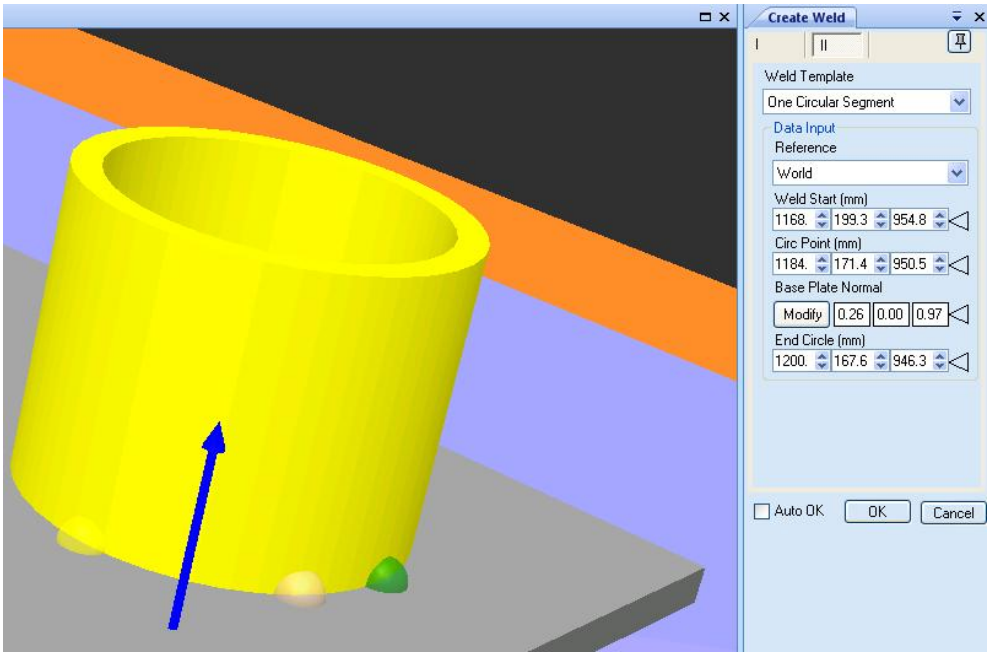
One Circular Segment

The **One Circular Segment** template is composed with start target, circle point, end target, and base plate normal vector.



en1200000332

Multiple Circle Segments

The **Multiple Circle Segments** template is composed with start target, circle point, end circle, end target, and base plate normal vector.

The **Weld Start**, **Circ Point**, **Base Plate** and **End Circle** are used to define the circle. Select points that are not more than 180 degrees apart. The last point defines the end point of the circle. If the end point is in between the **Start Point** and the **End Circle** point, a circle that is larger than 360 degrees will be created. The over-lap can be up to 45 degrees.The parameter **Max segment angle** defines the largest segment that can be created. A segment is the same as one circle instruction.The

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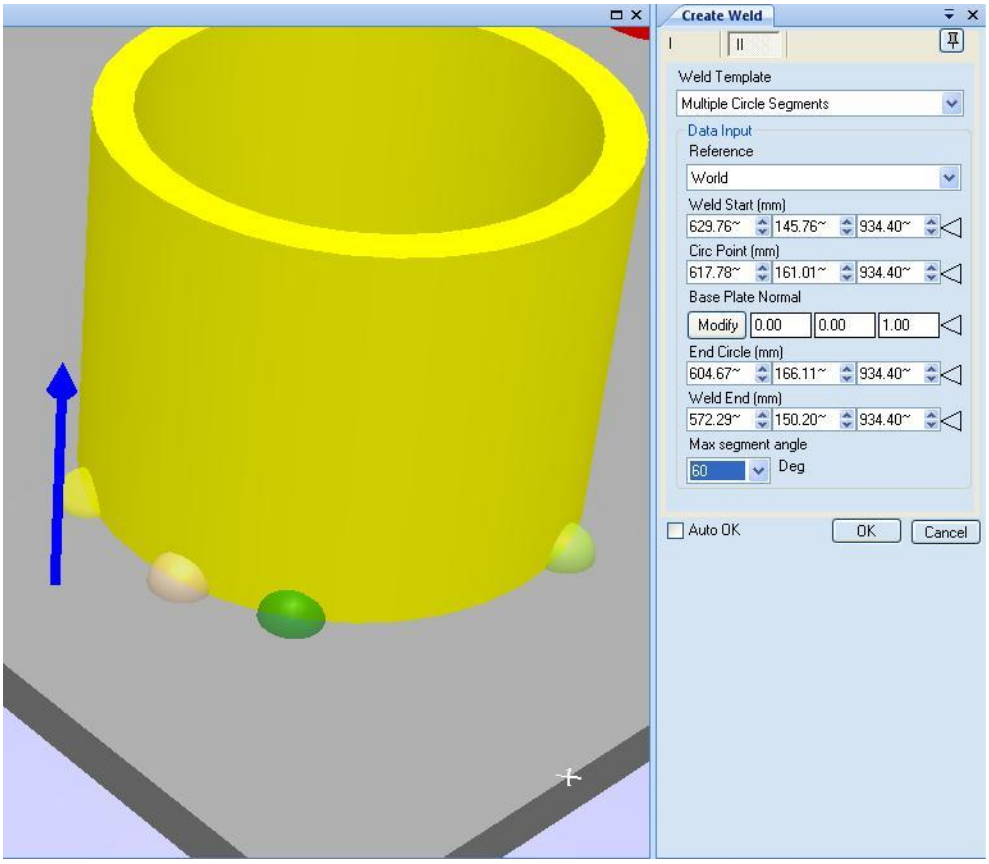
function will create evenly spaced targets over the selected range with a segment angle no larger than the Max segment angle.



en1200000352

Path From Edges

The **Path From Edges** template enables users to select edges and create path along them. It is composed of the edge list and the base normal. The indicator in the graphical interface shows the direction of the linked path. The sequence and the directions of the edges can also be adjusted.

This method uses a facet approach to interpolate through the selected edges. The maximum facet length, length tolerance, and angle tolerance can be specified.

Select **<Add New>** in the edge list, and click in the graphical user interface, the nearest edge to your clicked position will be selected and added in the edge list (if not already added).

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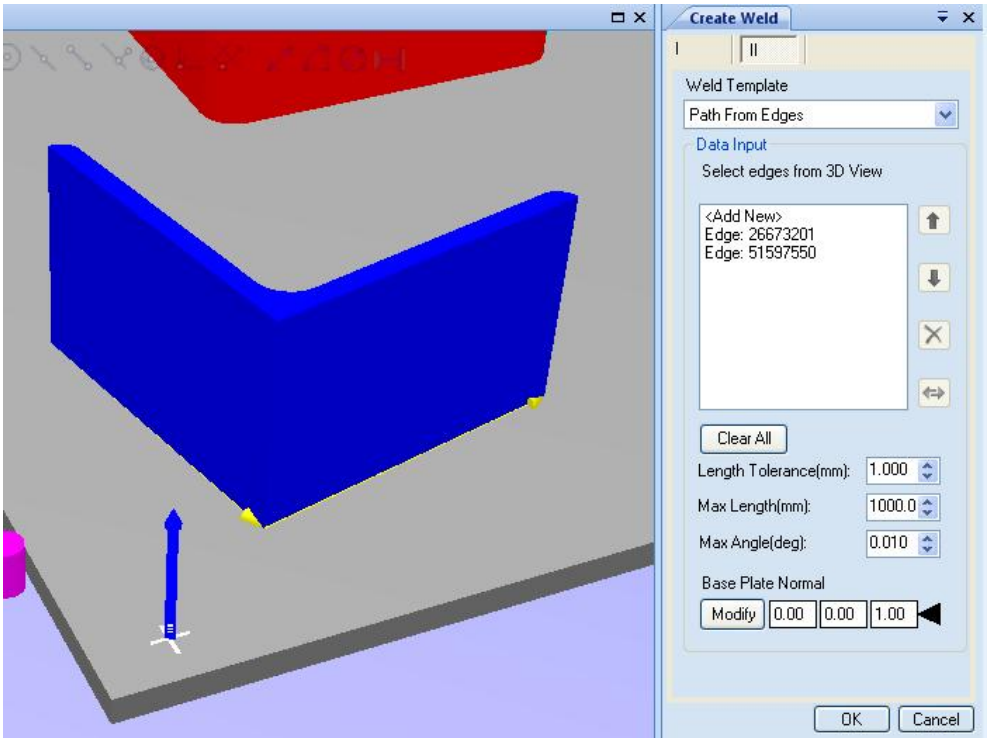
NOTE! Circular edges are interpolated as linear segments, and linear move targets are created along them.



en1200000333

Related information

The Path View toolbar on page 67.

5.5.3 Create Weld instruction

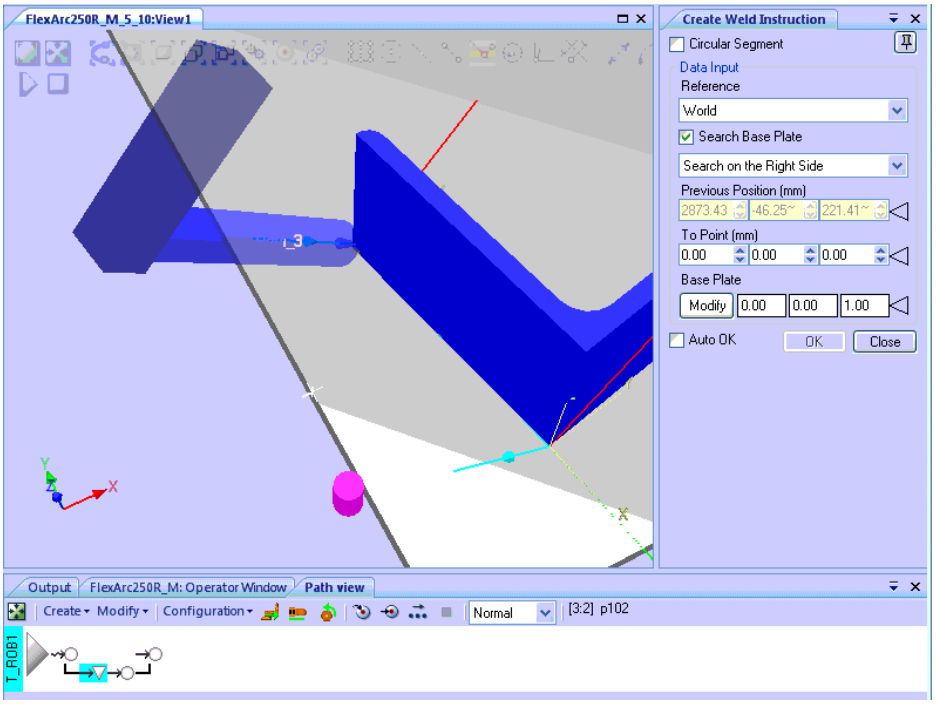
Overview

This command, which is available only when a process instruction is selected, adds weld instructions to a weld.

Creating a weld instruction

To create a weld instruction, follow these steps:

1. In the Path View, select the process start target and then in the **Create** menu, click **Weld Instruction**.
2. In the graphics window, click in the middle of the existing weld to add a new target.



en1200000288

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

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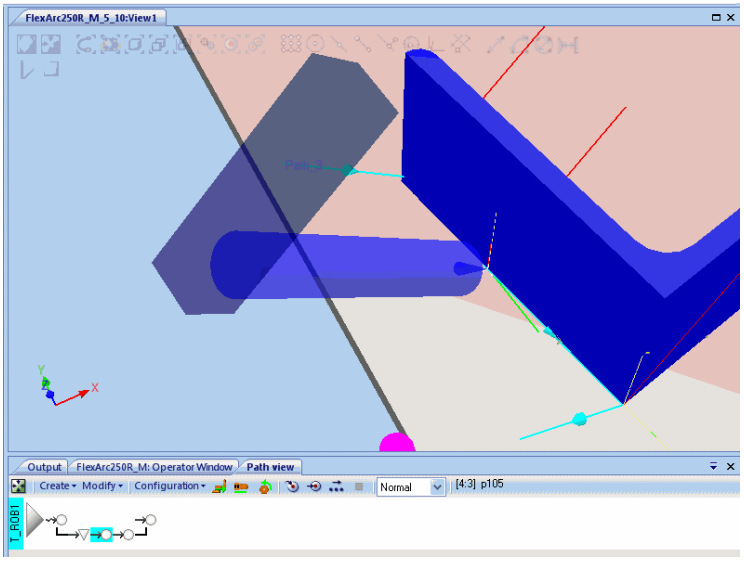
A new target is displayed in the graphics window, and an instruction icon is added to the path view.



en1200000313

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

The Path View toolbar on page 67.

5.5.4 Create Air instruction

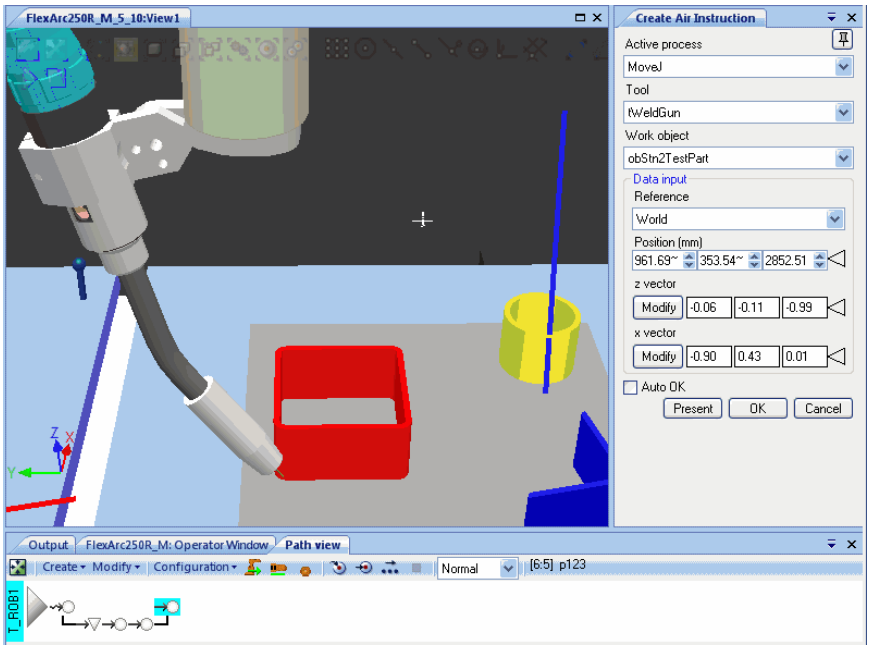
Overview

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. In the **Create** menu, click **Create Air Instruction**.
2. 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.



en1200000314

3. 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.

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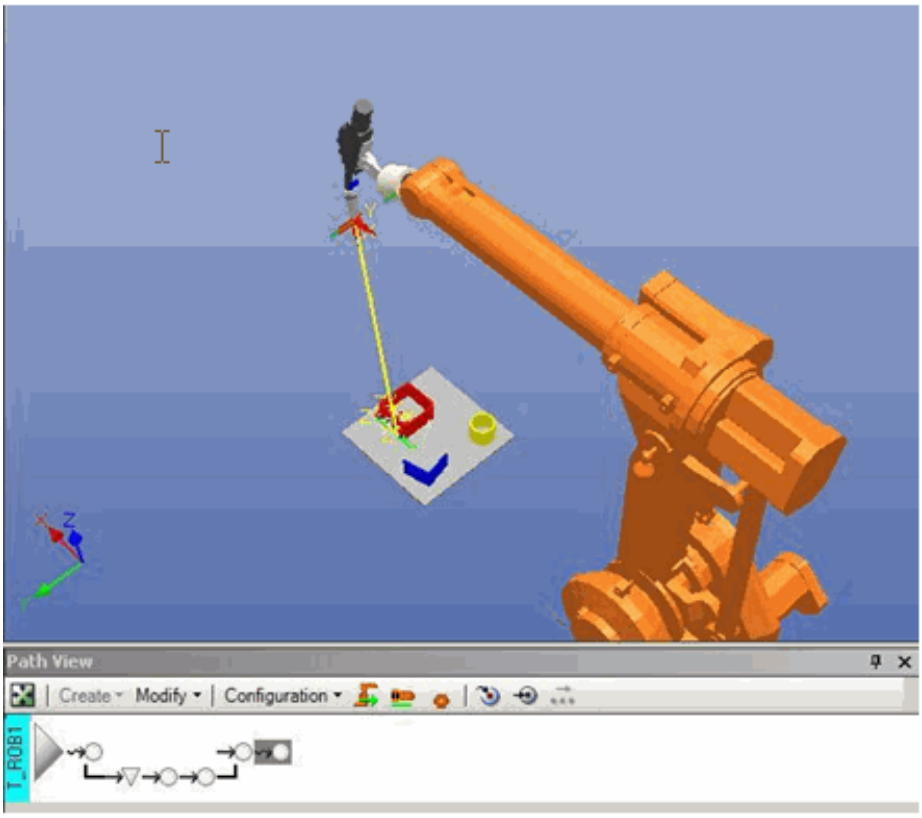
If the **Auto OK** check box is selected, the air instruction is automatically created when a valid input has been entered.



en1200000315

Related information

The Path View toolbar on page 67.

5.5.5 Create ABS joint target

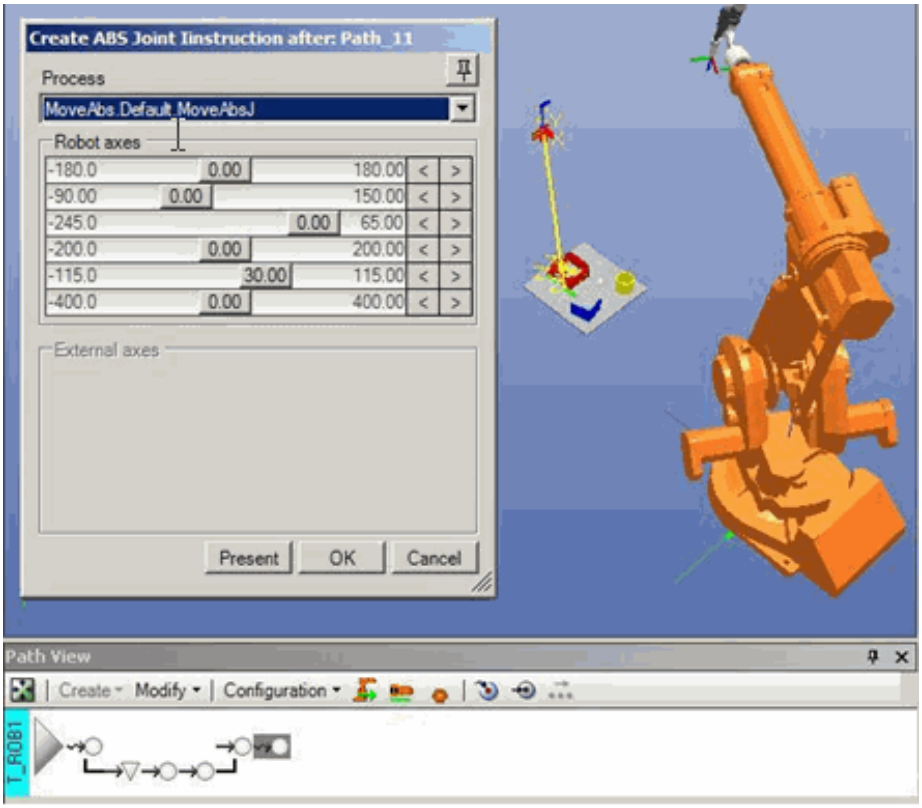
Overview

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



en1200000316

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

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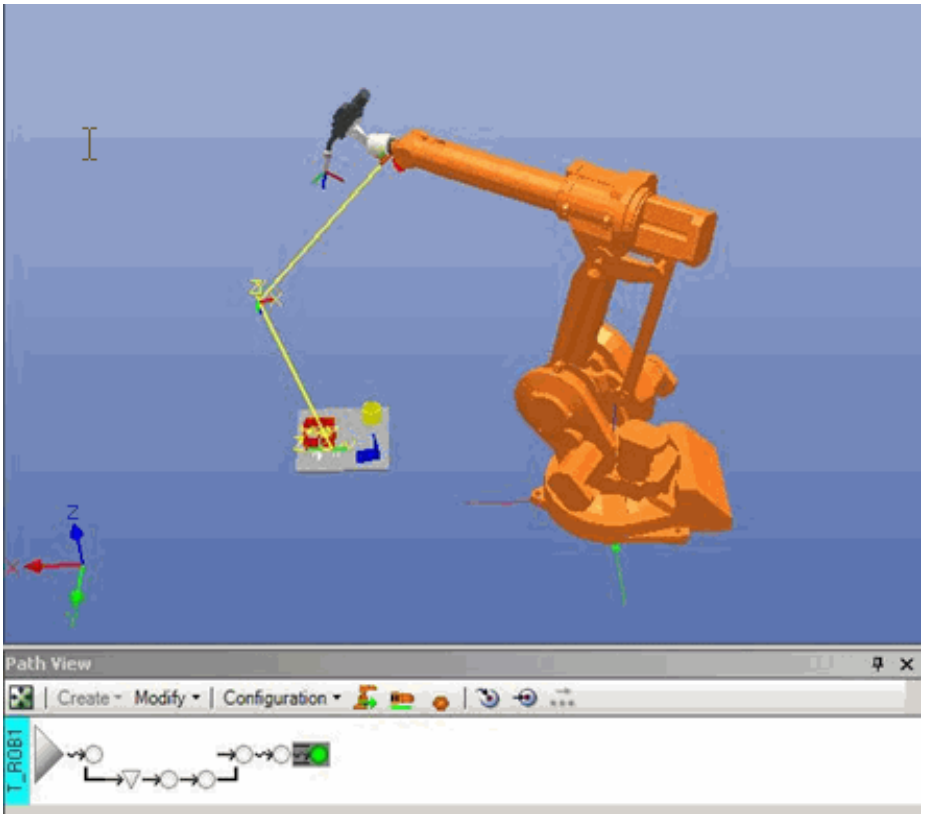
A new jointtarget is displayed in the graphics window, and an instruction icon is added to the path view.



en1200000317

Related Information

The Path View toolbar on page 67.

5.5.6 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. In the **Create** menu, click **Action Instruction**.
2. In the **Create Action Instruction** dialog box, select an instruction from the list, and then click **OK**.

   A blue instruction icon is added to the path view.

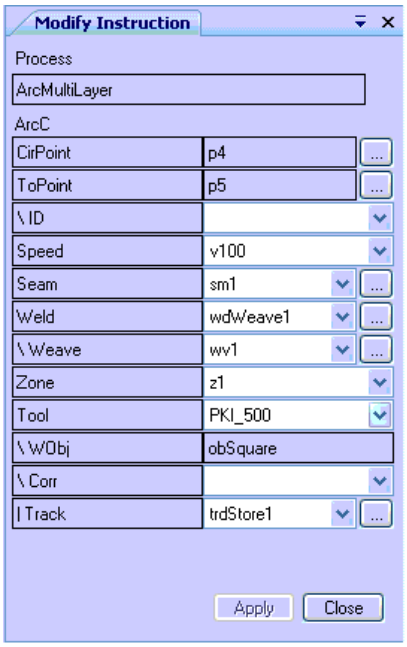
Related Information

The Path View toolbar on page 67.

5.6 The Modify menu

5.6.1 Modify instruction

Most instructions have arguments that specify how the instruction must be performed. For example, the arguments of the `MoveL` instruction specify the speed and accuracy with which the robot moves to the target. In the **Modify Instruction** dialog box, you can display and change these arguments, as well as seam weld and weave data.



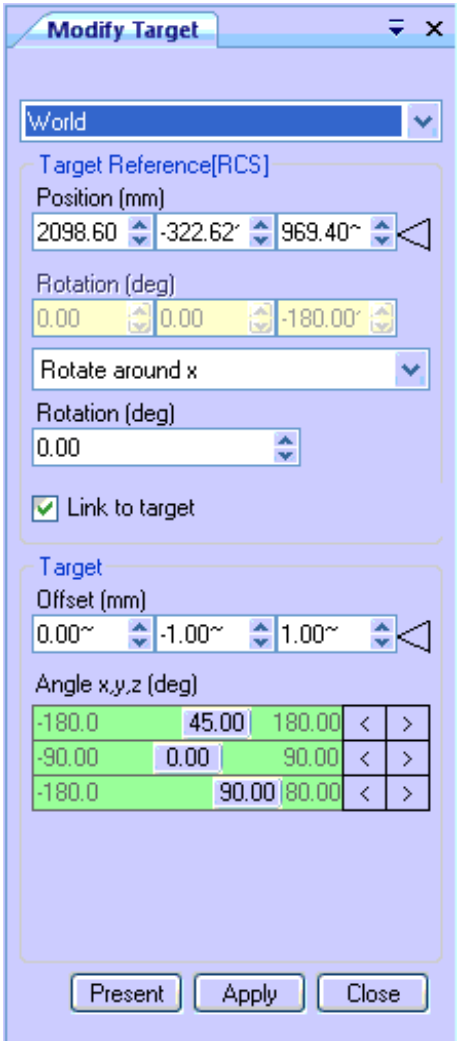
en1200000298

Related Information

The Path View toolbar on page 67.

5.6.2 Modify target

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



en1200000289

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. Highlight the arrow head on the right to select a new position in graphic interface, or manually enter values to modify. **Note** Since Approach/Depart targets' RCS align with Start/End target, their RCS are not directly modifiable. 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.

Continues on next page

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. 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, see *Create Weld on page 71*.

Related Information

The Path View toolbar on page 67.

5.6.3 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

The Path View toolbar on page 67.

5.6.4 Multi-Selection Operations

Overview

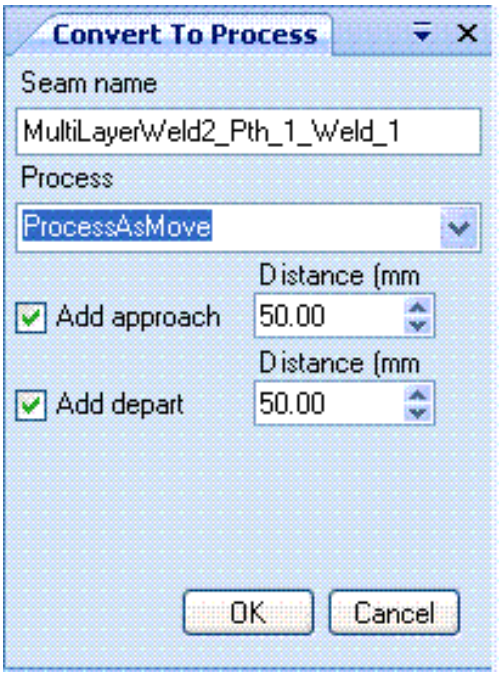
Multiple targets may be selected in the path view by clicking one target, pressing SHIFT and then clicking another target. All targets in between will also be highlighted grey.

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

Convert to Circular Move

This command converts two selected linear targets to the circular motion type. Neither target may be the process start target.

Convert to Process Selection



en1200000290

This command is available when regular MoveJ or MoveL instructions have been selected. Type a seam name in the **Seam Name** box, and select a process from the **Process** list. Select this check boxes to add approach and depart instructions and specify the distance of these targets from the seam start and end targets, respectively.

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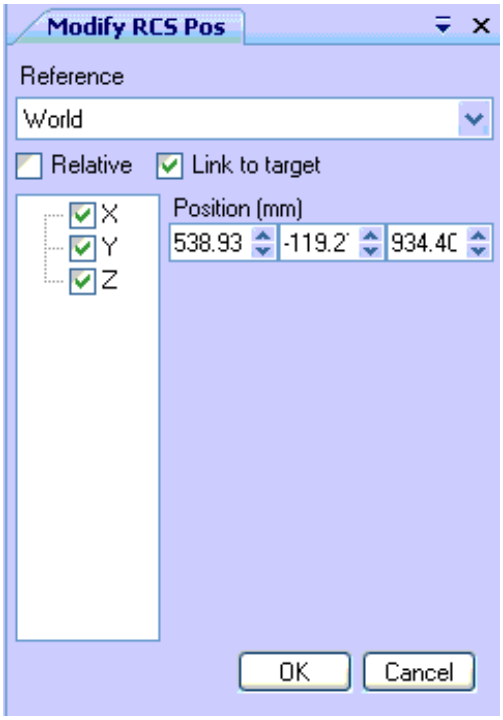
Target Reference Position on Selection



en1200000291

This command is created when a weld is generated.

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.

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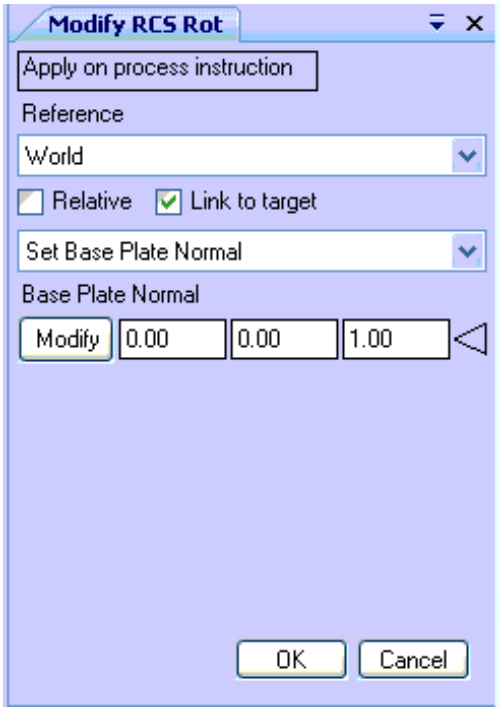
Target Reference Orientation on Selection



en1200000292

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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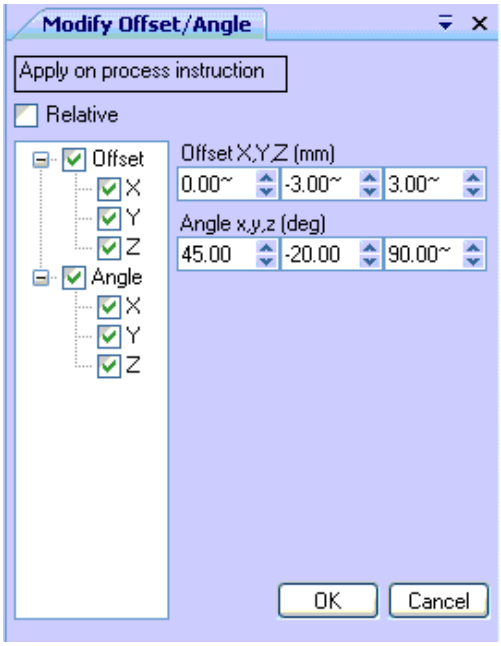
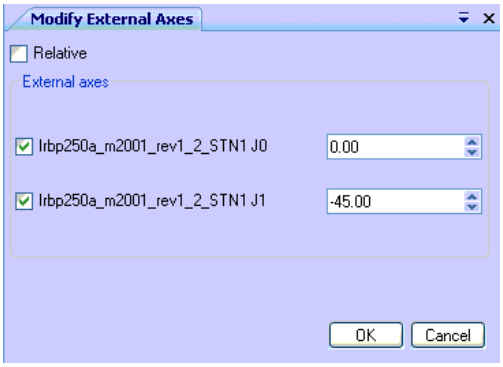
Target Offset/Angle on Selection



en1200000293

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



en1200000294

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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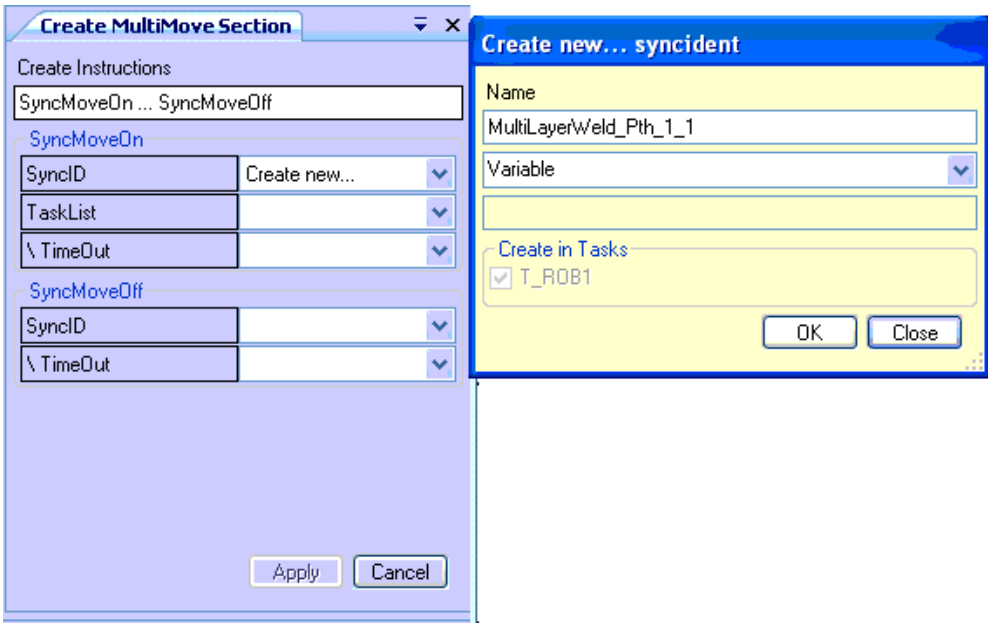
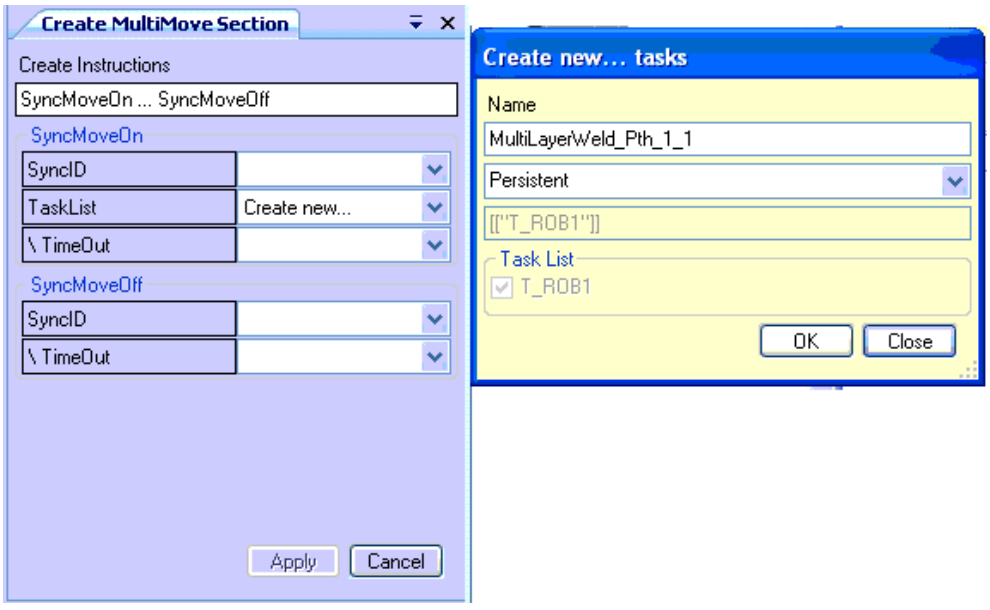
Convert to MultiMove Section



en1200000295



en1200000296

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.

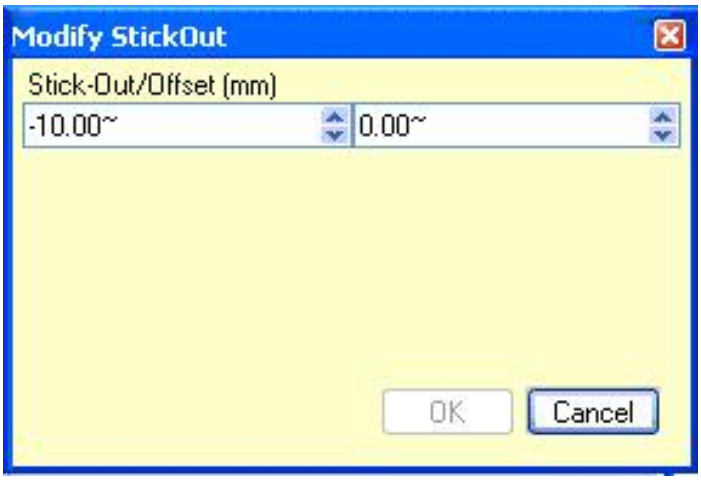
Continues on next page

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

NOTE! Programming RW Arc in synchronized mode with instruction IDs requires some special considerations for the error handling to work correctly. In the none-welding robot or external axis, some new instructions must be used when there are corresponding weld instructions in the welding robots. The instructions should be used to ensure that the automatic retry functionality works correctly and that the error levels are the same in all motion tasks.

	Move Instruction	Arc Instruction
For none welding robot	MoveJ	ArcMoveJ
	MoveL	ArcMoveL
	MoveC	ArcMoveC
	MoveAbsJ	ArcMoveAbsJ
For external axes	MoveExtJ	ArcMoveExtJ

Stick-Out



en1200000353

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.

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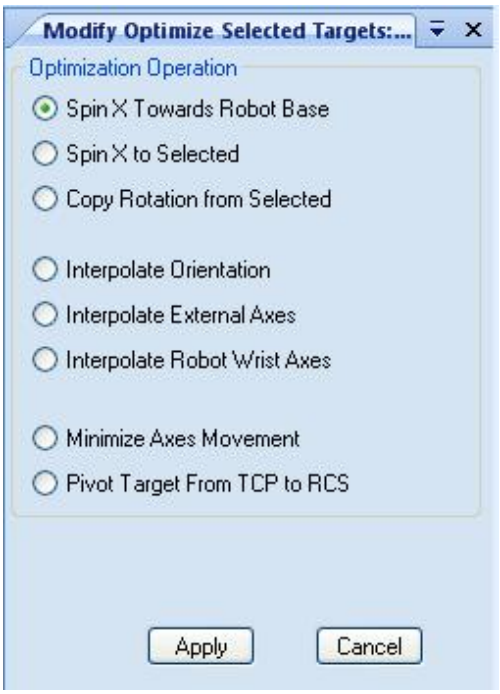
Optimize Selected Target



en1200000383

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

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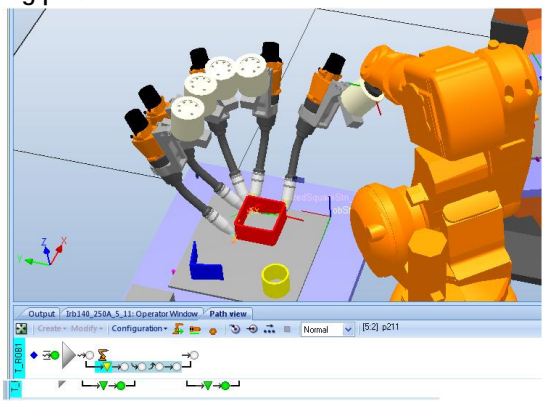
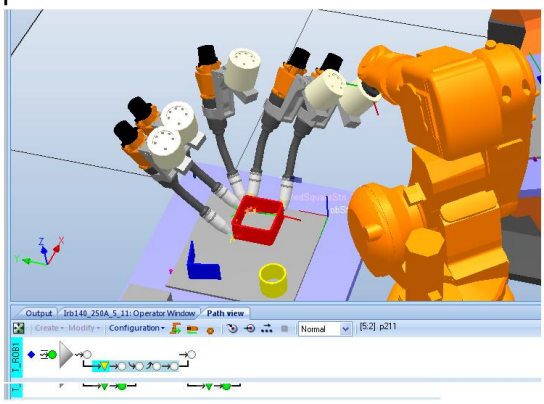
5.6.4 Multi-Selection Operations
Continued

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. Before using this function, the status is illustrated in the following picture.  en1200000357 After using this function, the status is illustrated in the following picture.  en1200000358

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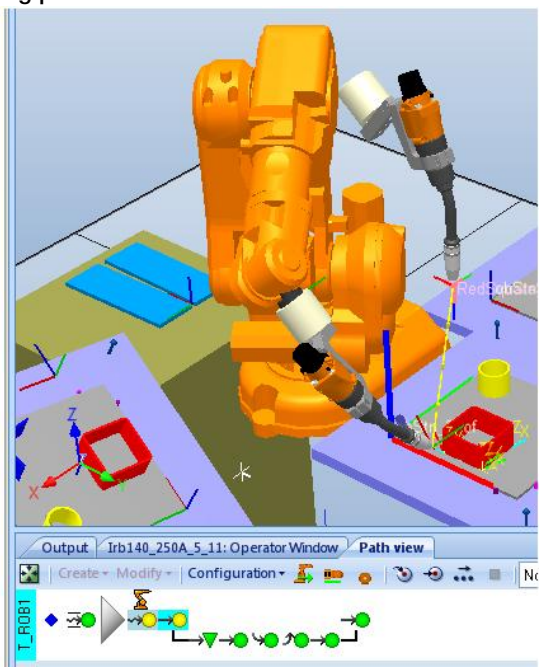
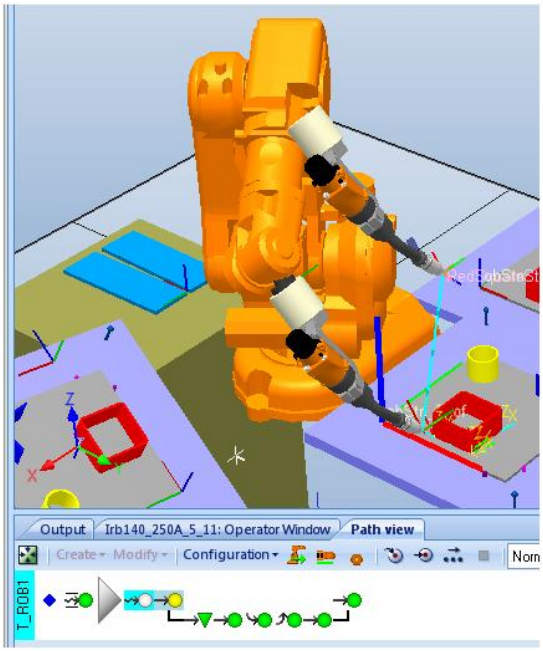
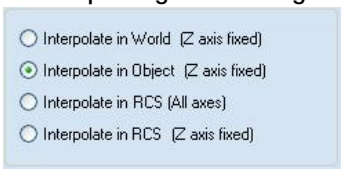
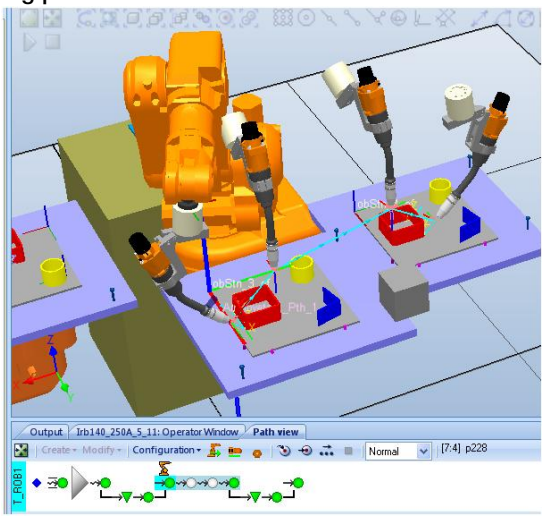
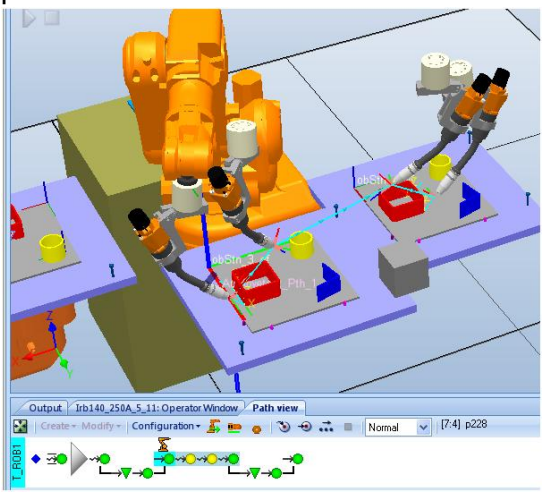
Option	Description
Copy Rotation from Selected	This function copies the orientation of the selected target to all other marked targets. Depending on the type of target, only the appropriate part of the orientation is copied. For an air target, it is a complete copy. For a process target, only the orientation 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. Before using this function, the status is illustrated in the following picture.  en1200000359 After using this function, the status is illustrated in the following picture.  en1200000360

Continues on next page

5.6.4 Multi-Selection Operations
Continued

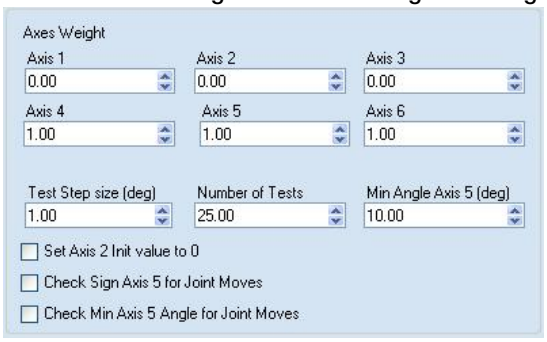
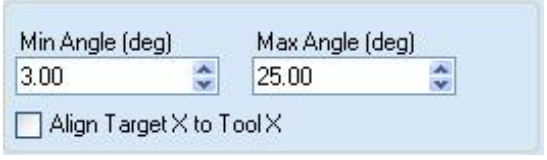
Option	Description
Interpolate Orientation	Interpolate orientations of targets based on the selected co-ordinates. • **Interpolate in World (Z axis fixed)**: Set to interpolate the Z axis value of the Euler angles of the targets, in relative to world frame (i.e., external axes, if exist, are moved to calculate interpolation values). • **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. • **Interpolate in RCS (Al axes)**: Set to interpolate the travel, work and spin angle of the targets in each RCS. • **Interpolate in RCS (Z axis fixed)**: Set to interpolate the spin angle of the targets in each RCS, with Z axis fixed.  en1200000384
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.

Continues on next page

Option	Description
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. Before using this function, the status is illustrated in the following picture.  en1200000355 After using this function, the status is illustrated in the following picture.  en1200000356

Continues on next page

5.6.4 Multi-Selection Operations
Continued

Option	Description
Minimize Axes Movement	Optimizes the spin angles of the selected motion items by minimizing the value change of robot joint moves. It searches for a best target orientation by evaluating multiple orientation values in the close range, based step angle. The weight value for each joint shows the importance of each joint in the minimization. Several checkings on joint moves can be enabled to filter out invalid targets. • **Axes Weight**: Weight for this axis during searching axis. • **Test Step size**: The step value of the angle to search for best orientations of the target. • **Number of Tests**: The maximum number of steps to search for best orientations. • **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 sigularity is not selected. • **Set Axis 2 Init value to 0**: Set axis 2 to zero during searching. • **Check Sign Axis 5 for Joint Move**: Keep the sign of axis 5 value during searching. • **Check Min Axis 5 Angle for Joint Move**: Make axis 5 minimum angle effective during searching.  en1200000385
Pivot Target From TCP to RCS	Set the Z axis of the targets towards the tool. This is usually used in laser cutting/welding. • **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. • **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. • **Align Target X to Tool X**: Check to also set the x axis of target to current x axis of the tool.  en1200000386
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.

5.7 The Configuration menu

5.7.1 Check Reach

Overview

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

Related information

The Path View toolbar on page 67.

5.7.2 Set Configuration

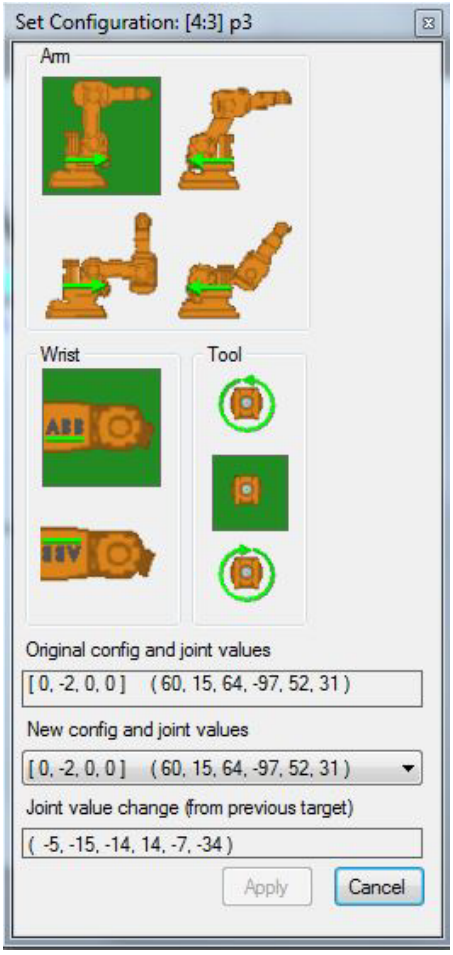
Overview

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 ArcWelding 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**.



en1200000281

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.

Continues on next page

Object	Description
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 config and joint values	This list displays the configuration and joint values for a selected configuration, as well as alternatives.
Original config and joint values	This box displays the configuration currently stored in the selected target.
Joint value change	This box calculates the difference in joint values between the currently selected target and the preceding target in the path.

Tip

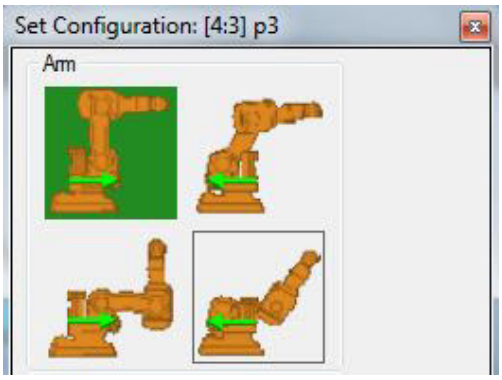
Have this dialog box and the **Modify Target** dialog box open at the same time. The configuration will then be automatically recalculated when the target is modified, which will help you determine how much you can adjust the target while keeping it within reach.

How to Set Configuration

ArcWelding 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 makes the background green for the selected valid configuration. If the two (the frame and the green background) does not coincide, the selection could not be fulfilled.



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5.7.2 Set Configuration
Continued

Tip

An easy way to set the configuration for a weld:

1. Create a weld 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

The Path View toolbar on page 67.

5.8 The Options Menu

Overview

Select simulation options for the executed paths.

Save As Viewer

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**.

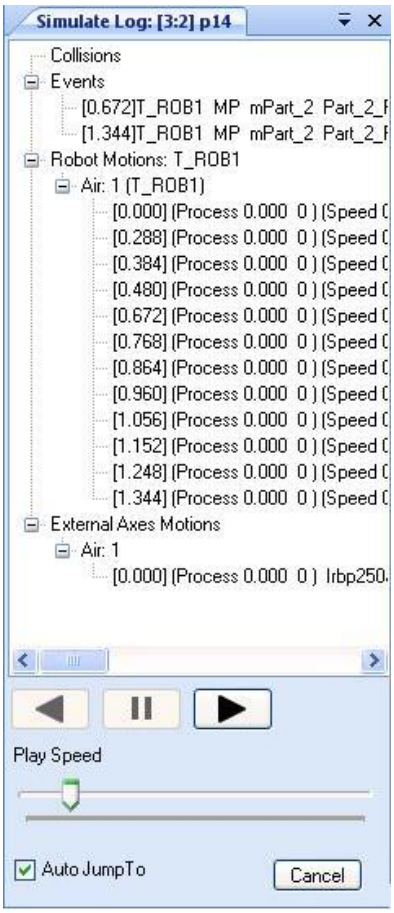
Enable Log

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.

Continues on next page

When the execution finishes, the **Simulate Log** window opens.



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3 View the simulate logs in this window.

Item	Description
Collisions	Collision events happened during simulation in RobotStudio 3D environment are listed here. 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. 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.
External Axes Motions	Data about external axes' motion details during simulation are listed here. 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.

Continues on next page

Item	Description
Auto JumpTo	Check to enable robots' automatic *JumpTo* when an data item is selected by keyboard or mouse clicking.

5.9 Export/Import Process Section

5.9.1 Overview

Overview

One or more welds in a path 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.

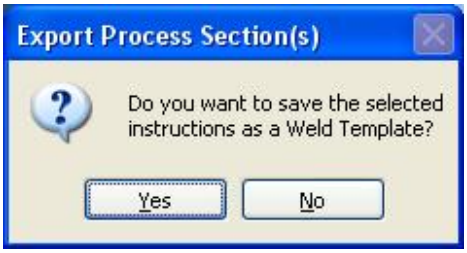
5.9.2 Export process section

How to Export a Process Section

To export process sections, follow these steps:

1. To export a single weld, right click on the Process Start target, or select a complete process section. To export multiple welds, 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/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. See *Import process sections on page 116* for more information.

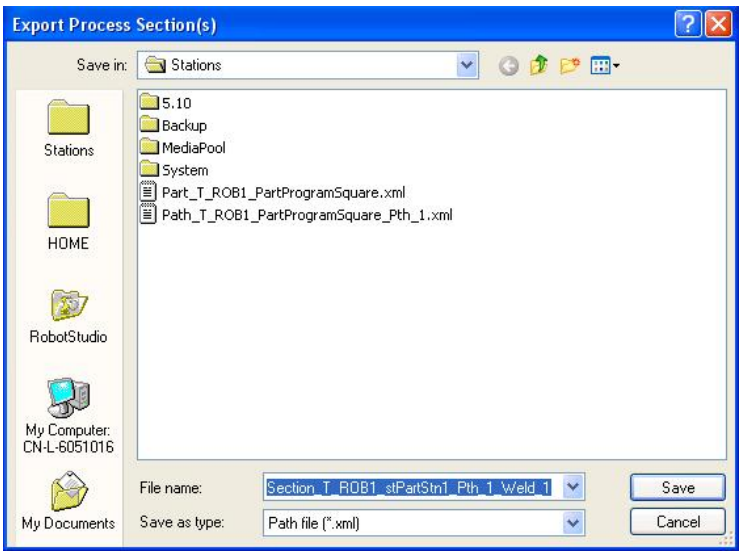
   A dialog box appears.

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 + Weld name + "Ind_" + index of first target + "_" + index of last target*; otherwise, the name is *"Section_" + Task name + Path name + "Ind_" + index of first target + "_"*

Continues on next page

5.9.2 Export process section
Continued

+ index of last target. The default directory is under the *"/My Documents/RobotStudio/Stations"*.



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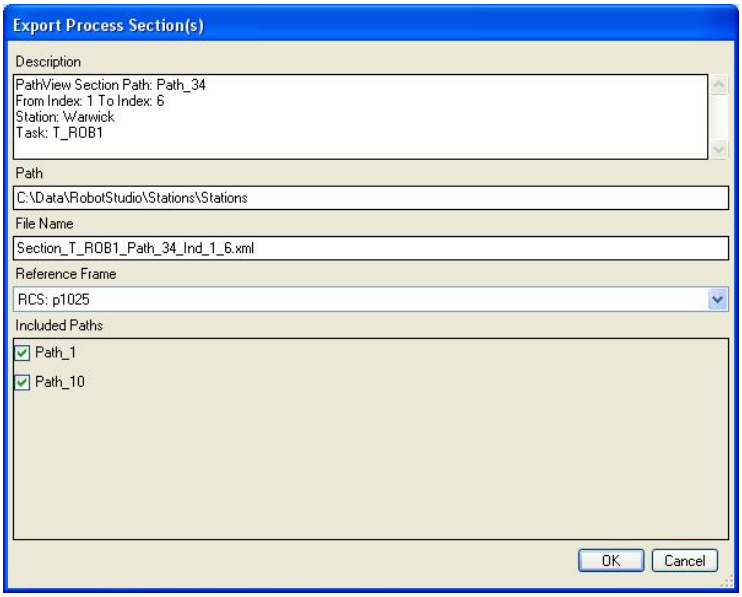
3 Click **Save** and an exporting dialog box opens.

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 section(s). Read-only.
Path	The directory in which the file is stored. Read-only.
File Name	The name of the saved file. Read-only.

Continues on next page

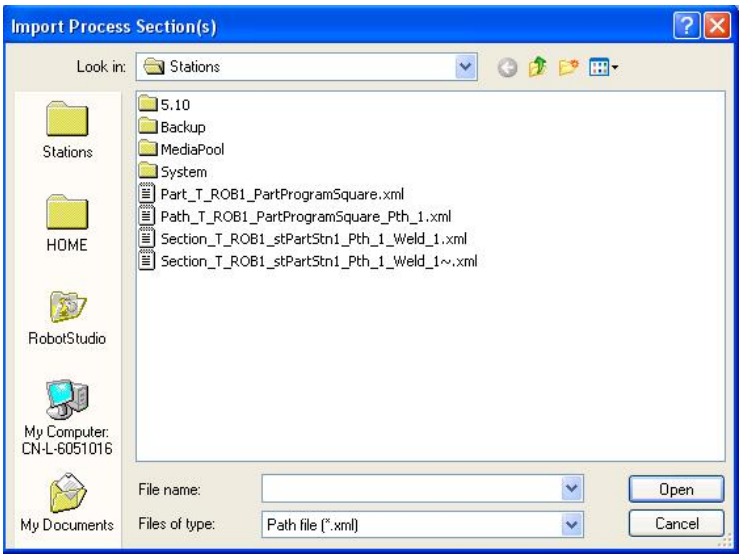
Object	Description
Reference Frame	Select a reference that the path targets in the process section(s) are related to. This affects the position and rotation values of these targets. The references can be World Coordinate, User Coordinate System, robot base coordinate, or work object coordinate, and also the RCS of the first target.
Included Paths	The included paths to be exported are listed here.

5.9.3 Import process sections

How to Import a Process Section

To import process sections, follow these steps:

1 To export process sections, right click a non-process target, and select **Import Process Section**. A dialog box opens from which you can select an XML file.



en1200000343

2 Click **Open**.

If a wrong type of path file is selected, a message box opens.

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Otherwise, an importing dialog box opens in which you can specify importing reference, tool, workobject, application template and set other parameters for importing.

3 Complete the dialog box, click **OK** and new process section will be created in the active path procedure.

The dialog box is composed of two tab pages.

Page one:

Continues on next page

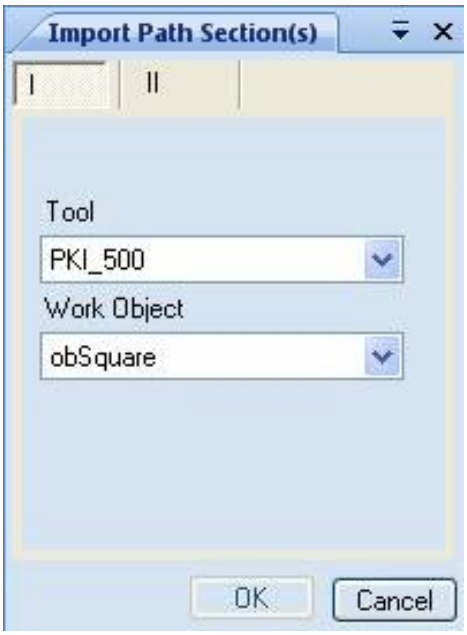
If the imported file is a template, the page one contains more properties for user to set, including seam name, application template, tool, workobject, approach/depart offset, target offset, and angles.

en1200000345

Continues on next page

5.9.3 Import process sections
Continued

Otherwise, page one only allows you to modify Tool and WorkObject.

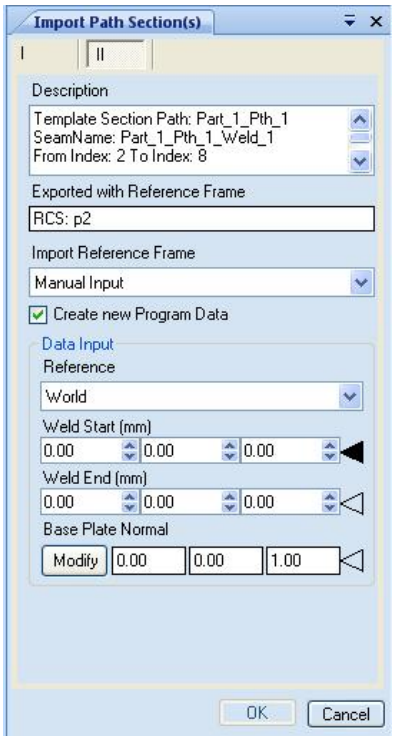


en1200000346

Object	Description
Seam name	Only available if the path file was exported as a weld shape template. Describes the name of the newly imported process section.
Application Template	Only available if the path file was exported as a weld shape template. Users can modify the application template of the imported weld. Read-only.
Tool	The tool of the newly imported process section(s).
Work Object	Select the work object of the newly created targets.
Use Target Settings	Only available if the path file was exported as a weld shape template. If this check box is selected, the Target Setting group will be enabled and parameters in the group will be effective on the newly imported weld. For detailed info of the values in the group, see *Create Weld on page 71*.

Continues on next page

Page two:



en1200000347

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 section(s). Read-only.
Exported With Reference Frame	The reference used when this section is exported. Read-only.
Import Reference Frame	Select a reference to import path. This affects the position and rotation values of these targets. The references could be World Coordinate, User Coordinate System, robot base coordinate, work object coordinate, and a coordinate system manually created by users. For path file that was exported as a weld shape template, only manual input is valid.
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.
Data Input	Group of controls for manual input. If the first target of the exported path was linear move, then the controls consist of Weld Start, Weld End, and Base Plate Normal; If the first target is a circular move, then the controls are Weld Start, Circular Point, Circle End Point, and Base Plate Normal. The dialog box will use the information in the input group to create a temporary coordinate system and apply the target values in the path file to create new targets in the station.

NOTE! The rules to create new data are the same as in Import Part.

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6 Searching with SmarTac

6.1 Overview

Search templates

A search template is a search instruction and the selected template will be used to create a search instruction when the Create search function is executed. There are seven predefined search templates available in ArcWelding PowerPac. All these templates require that the controller have the SmarTac option installed.

ArcWelding PowerPac supports both the `Search_1D` and the `Search_Groove` RAPID instructions.

Before you can start creating searches based on the imported search templates, you must define the tool geometry. ArcWelding PowerPac needs to know the gas cup diameter and wire stick-out when calculating torch angles based on the search parameters.

Search_1D

`Search_1D` is a RAPID instruction used for tactile searching of a feature with SmarTac. The search path is described by two required robtargets. The search result is stored as a pose data in the required argument *Result*. All SmarTac board activation and deactivation is automatically handled.

Example:

Search_1D peOffset,p1,p2,v200.tWeldGun;

When executed, the robot makes an L move to the start point p1. The SmarTac board is activated and motion starts towards the search point, p2. The robot moves on a linear path from p1 to p2. The robot will continue past the search point for a total search distance described by twice the distance between start point and search point. When contact is made with the part feature, the difference between the contact location and p2 is later stored in peOffset. The program displacement can be later used to shift programmed points using the RAPID instruction PDispSet.

Search_Groove

`Search_Groove` is a RAPID instruction used for tactilely searching a groove type feature with SmarTac. Searching occurs with the wire. A series of searches is performed to find the groove and determine its width. The StartPoint is programmed outside the groove at a point touching the part. The CenterPoint is programmed level with the StartPoint, but in the center of the groove. The search result is stored as pose data in the required argument *Result*. All SmarTac board activation and deactivation is automatically handled.

Example

Search_Groove peOffset,nWidth,p1,p2,10,v200, Weldgun;

The groove search is used to find the location and width of the groove to be welded. The groove has a 10-mm nominal width. The program displacement is stored in prOffset. The actual width of the groove is stored in nWidth. The StartPoint is p1

Continues on next page

and the CenterPoint is p2. The Initial Start Point is 15 mm above the StartPoint by default.

When executed, the robot makes an L move to a point above the start point, the Initial Start Point. The height of the Initial Start point above the StartPoint can be changed by the optional parameter, InitSchL. The SmarTac board is activated and motion starts towards the StatePoint. The robot will continue past the StartPoint for a total search distance described by twice the distance between the Initial Start Point and the StartPoint. When the surface of the plate is found, more searches occur, each one closer to the edge of the groove. When the groove is found, two searches are made inside the groove to determine the location and width. The start of both searches is beneath the CenterPoint. The optional parameter, NomDepth, will control how far into the groove the width and location surfaces will reach. The displacement data is stored in *Result*. This program displacement can later be used to shift programmed points using the RAPID instruction PDispSet.

Wire Searching vs. Gas Cup Searching

Sometimes it is necessary to search with the welding wire, rather than the gas cup. This is possible in some systems with the necessary optional hardware installed. The SmarTac instructions are designed to handle this. `Search_1D` has an optional argument, \Wire, that will switch the signal to the wire. The instruction `Search_Groove` assumes that wire searching capabilities are present.

Multidimensional Search

As seen in the `Search_1D` example above, a one-dimensional search will determine where a weld seam is if it is constrained to move in only one direction. In some cases this is adequate. More likely, though, a two- or three-dimensional search is required. The former would provide information about where a plate is located on a table. The latter would also determine the height of the table surface. To search a part in more than one direction, a combination of one-dimensional searches is used and the result of each search is added together.

The ArcWelding PowerPac comes with predefined templates that handle two- and three-dimensional searches.

6.2 Importing search templates

Overview

Importing search templates is a two-step procedure: first, motion instruction descriptions must be imported or created, then the search templates can be imported or created.

Import or Create Motion Instruction Descriptions

The search templates are based on one or several instructions. For example, the *Search_Wire_1D* template includes the instruction *Search_1D*. This instruction is available in a controller with the option SmarTac installed.

To be able to use a template that is using instructions other than default (MoveL, MoveJ and MoveC), it is necessary to tell RobotStudio how these instructions should be handled. This can be done manually in the **Instruction Template Manager** in RobotStudio or by importing a predefined description file. The ArcWelding PowerPac installation comes with the necessary instruction description files which easily can be imported into the station. Right-click the top node and click **Import Motion Instruction**. In this case you should import the **Search_1D** motion instruction description.

The motion instruction descriptions that are available in the station can be viewed in the **Instruction Template Manager**.

Import or Create Search Templates

After the required instruction descriptions are available in the station, it is possible to import or create and use the search templates. The ArcWelding PowerPac installation comes with the necessary search templates which easily can be imported into the station. Import an existing template by right-clicking the search node and then clicking **Import**.

The following search templates are available:

- Search_Wire_1D
- Search_Wire_2D
- Search_Wire_3D
- Search_GasCup_1D
- Search_GasCup_2D
- Search_GasCup_3D
- Search_Groove_1D

Before you can start creating searches based on the imported search templates you must define the tool geometry. ArcWelding PowerPac needs to know the gas cup diameter and wire stick-out to be able to calculate torch angles based on the search parameters. For more information, see *Tool properties on page 125*.

Continues on next page

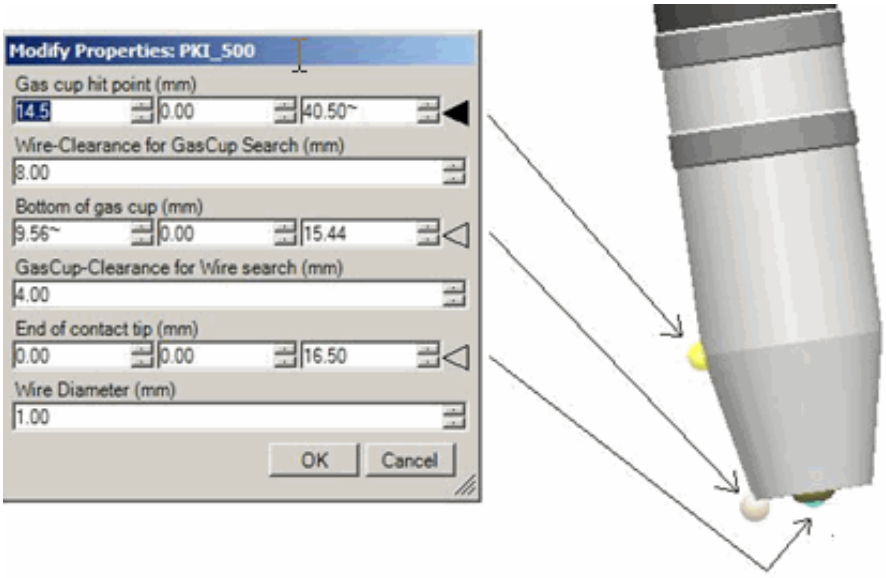
Shortcut Menu from Search and Tool Properties nodes

Node	Menu	Description
Search	**Import**	Imports predefined search templates, see *Importing search templates on page 123*.
Tool Properties	**Properties**	Allows you to define search properties for the selected tool, see *Tool properties on page 125*.

6.3 Tool properties

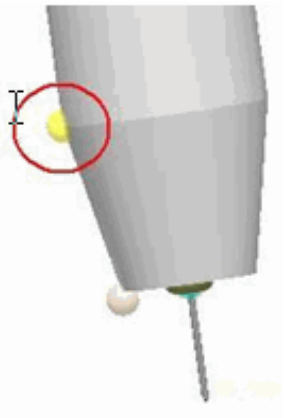
The Modify Properties Dialog Box

The **Modify Properties** dialog box is launched from the context menu of a selected tool. The View Center is automatically set to the tool, and the current properties are represented in the graphics window as colored spheres.

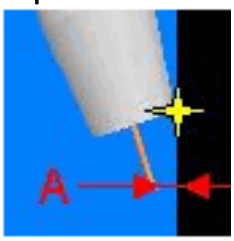
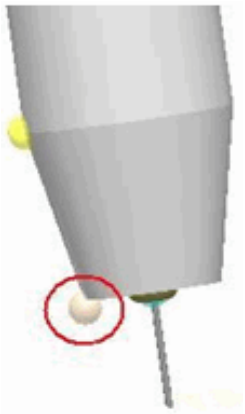
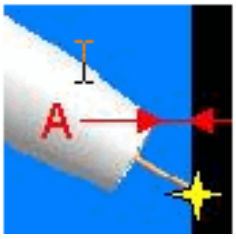
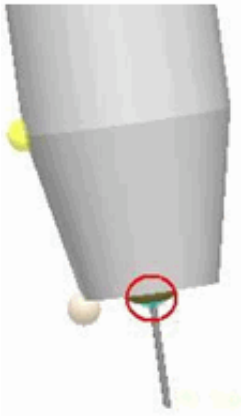


en1200000299

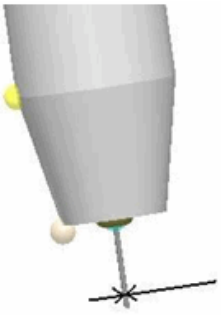
The properties of the tool are defined by clicking directly in the graphics window. ArcWelding PowerPac provides default values, but you may need to redefine these.

Object	Description
Gas cup hit point  en1200000300	The point on the gas cup that will hit the searched feature when performing a GasCup search.

Continues on next page

Object	Description
Wire Clearance for Gas Cup Search  en1200000301	The perpendicular distance (A) from the surface that the wire clears.
Bottom of gas cup  en1200000302	Indicates the bottom of the gas cup.
Gas cup clearance for wire search  en1200000303	The perpendicular distance (A) from the surface that the gas cup clears.
End of contact tip  en1200000304	Indicates the end of the contact tip. This information, along with the TCP information, is used to calculate the wire stick-out.

Continues on next page

Object	Description
Wire diameter  en1200000305	The diameter of the wire.

6.4 Create Search instruction

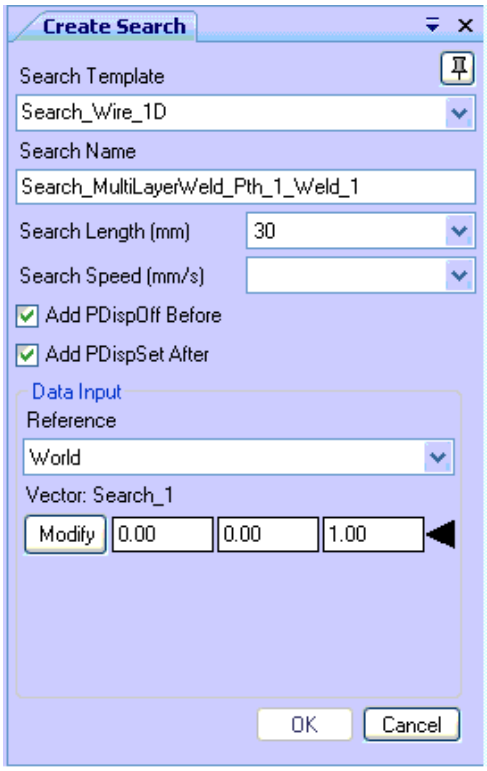
Overview

This command, which is available only if the selected instruction in the path view is a non-process point, adds a search sequence to a path.

Before a search instruction can be created, the following items must be imported:

- The required search and action instructions
- The required search template

The Create Search Instruction Dialog Box



en1200000306

Object	Description
Search Template	Here you select the search template that should be used for creating the search sequence.
Search Name	The identifying name assigned to the search sequence
Search Length	The distance in millimeters between the StartPoint and the Search Point of the search move, perpendicular to the surface.
Search Speed	The speed used during searching. (Optional)
Add PDispOff Before	Adds the PDispOff RAPID instruction before the search instruction. The displacement frame is turned off.
Add PDispSet After	Adds the PDispSet RAPID instruction after the search instruction. The displacement frame is turned on.
Data Input	Used to enter geometric data to build up the search. It will ask you to select points in the graphics. The number of points that you have to select depends on the search template.

Continues on next page

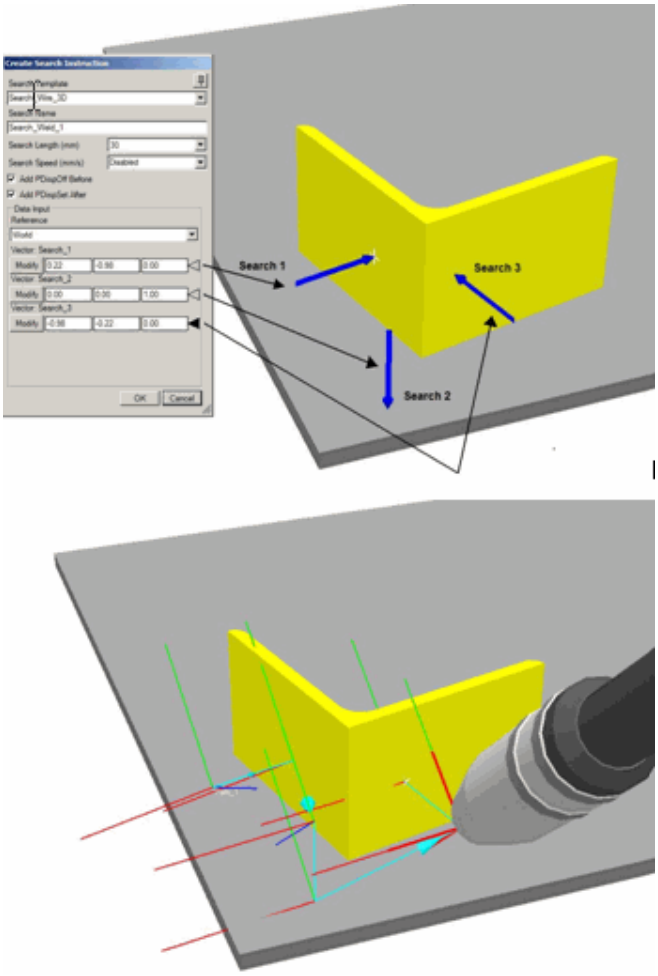
Example

This example shows you how to create a search based on the **Search_Wire_3D** template.

After the template is selected, the Data Input group lists three search vectors. Notice that an arrow head is highlighted in black to the right of the first search vector boxes. Therefore, you must click in the graphics window.

Click the part where you want the first search point. The snap mode is automatically set to a mode that allows you to click anywhere on the surface. The XYZ coordinates appear in the dialog box. Notice that a blue arrow in the graphics window indicates the selected search position and direction. The black arrow head now appears for the second search point. Define this in the graphics window, as well as the third. Click **OK** to create a complete search sequence.

It is recommended to select the search points in an order where the risk of the robot colliding with objects in minimized. You may have to add targets to the search paths afterwards.



en1200000307

Related information

The Path View toolbar on page 67.

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7 ArcWelding PowerPac workflow

7.1 Overview

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

Follow these steps:

7.2 Building an ArcWelding station

7.2.1 Creating an ArcWelding station

Overview

This section describes how to build a station by including the equipment necessary to create and simulate arc welding programs.

The operation described in this section should be done before starting ArcWelding PowerPac. The detailed description can be available from *Operating Manual - RobotStudio*.

Creating a station with a robot system

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.

Importing station components

The following table shows the workflow for importing station components. Perform only those steps applicable to your station.

Activity	Description
Import a tool	Click the lower split of the **Import Library** button from the **Home**ribbon-tab to display galleries of tools, and select the desired one.
Create tool data	For achieving correct motions in robot programs, the parameters of the tool have to be specified in the tool data. Click **Tooldata** on the **Home** ribbon-tab to open the **Create Tooldata** dialog box.
Import a work piece	If you have CAD models of the work piece, you can import them by using **Import Geometry** on the **Home** ribbon-tab.
Create workobject	For achieving correct motions in robot programs, the parameters of the work piece have to be specified in the workobject. Click **Workobject** on the **Home** ribbon-tab to open the **Create Workobject** dialog box.
Import other equipment	If you have CAD models of the work piece, you can import them by using **Import Geometry** on the **Home** ribbon-tab.

Placing objects

The following table shows the workflow for placing the objects in the station.

Activity	Description
Place objects	If you are building a model of a real station, placing all objects with known position, find suitable placement.
Attach tools	Attach the tools to the robot.
Attach work pieces to positioners	If positioner external axes are used, attach the work pieces to the positioners.
Test reachability	Test if the robot can reach critical positions on the work piece.

7.2.2 Creating an ArcWelding system

Overview

This section describes how you create and build systems to run on virtual and real controllers. These systems may even be downloaded to a real controller.

The system points out the robot models and options to use, and it also stores configurations and programs for the robots.

Building a new system using RobotStudio basic function

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

Note

This workflow 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*.

Activity	Description
Start new controller system wizard	Click **System Builder** on the **Controller** ribbon tab and click **Create New** in the dialog box to start the wizard.
Specify the name and location of the new system	To determine where on your computer to store the system you are creating.
Enter the RobotWare key and drive keys	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.
Add additional options	You can add options here. Additional options require a license key and must be first imported to the mediapool. The following options must be selected for an arc welding system: • Arc • MultiMove • SmarTac

7.3 Creating paths

Overview

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

Creating Application Templates

Before the first weld path is created, you should create your own application template, modify the properties related with weld parameters and motion instructions.

See *Application templates on page 33*for detailed information,

Creating Process Paths

The following table shows the workflow:

	Activity	Description
1	Create a program part node in the ArcWelding Browser, which is the holder of process paths.	See *Part programs node on page 45* for the detailed procedure.
2	Create a Process path.	See *Process path on page 52* for the detailed procedure.
3	Open the new created path in the Pact View and create targets and instructions.	The difference between a process path and a regular path is that it includes weld instructions. See *The Create menu on page 70* for the detailed procedure.

Creating Setup/Service Paths

The following table shows the workflow:

	Activity	Description
1	Create a setup/service path in the ArcWelding browser.	See *Setup and service procedures on page 57* for the detailed procedure.
2	Create a Process path. Open the new created path in the Pact View and create targets and instructions.	See *The Create menu on page 70* for the detailed procedure.

7.4 Verify and modify

Overview

The instruction icons in the Path View will immediately alarm 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 will change to yellow.

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

If the execution failed, it is possible to tune individual target position, orientation and other instruction attributes. Changes are checked by executing the path again. This procedure is repeated until all targets are tested and verified, that is all 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 Pact View toolbar to test the selected targets.	For more details, see *The Path View toolbar on page 67*.

Modifying

See *The Modify menu on page 89* for a detailed description.

7.5 Synchronize

Overview

It is important to keep the virtual controller and the ArcWelding PowerPac in perfect synchronization, which requires exact mapping between 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

This 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.

Note

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

7.6 Load program to real controller

Overview

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, see *Operating manual - RobotStudio*.

Workflow

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 ArcWelding 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.

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