



ROBOTICS

Operating manual

ArcWelding PowerPac 2



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Operating manual

ArcWelding PowerPac 2

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Overview of the manual

About this manual

This manual describes the key features in ArcWelding PowerPac 2 (AWPP 2).

Usage

This reference manual contains general and specific information about the AWPP 2.0 tools and workflow.

Who should read this manual?

This manual should be used by anyone working with AWPP 2.0.

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	Released with RobotStudio 6.08 First edition

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1 Introduction and installation

1.1 Introduction to ArcWelding PowerPac

About ArcWelding PowerPac

ArcWelding PowerPac 2 brings together experience of robot and weld processes into RobotStudio, to prepare offline programs more efficiently by utilizing the CAD geometry as basis for all robotics programming. This method is known as geometry-based off-line programming, it gives you unprecedented control over the robot configurations and weld angles, resulting in more accurate weld paths. It also extends the concept of digital robot twin by enabling the tracking the real robot motion together with a virtual station, for improved situational awareness and event handling, further bridging the gap between virtual and real robots.

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 Introduction and installation

1.2 Installing ArcWelding PowerPac

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 on **Setup.exe** setup file.
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 with atleast one arc-welding robot and/or the CAD model of the workpiece. The virtual controller (VC) associated with the arc-welding robot must be loaded with RobotWare Arc.

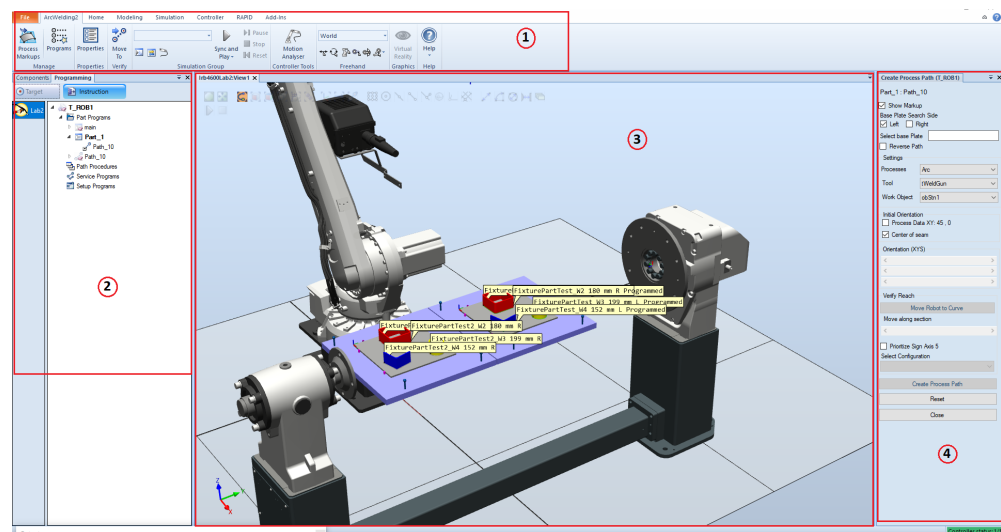
Loading a station

To initially open a station, follow these steps:

- 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.

The user interface

The panes and windows of the user interface are described in the following figure, which helps 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 Arc Welding ribbon on page 15 for detailed description.
2.	ArcWelding browser	Organizes the components of the station and robot programs in a tree structure. See Arc Welding browsers on page 17 for detailed description.

Continues on next page

1 Introduction and installation

1.3 Accessing the user interface

Continued

	Item	Description
3	Graphics window	<p>The graphics window is coordinated with these panes, a Paths and Process markups are highlighted in graphic. 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.</p> <p>This coordination is especially useful when working with MultiMove systems.</p> <p>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.</p>
4	Tool window	<p>Enables you to create new instructions and modify existing instructions.</p>

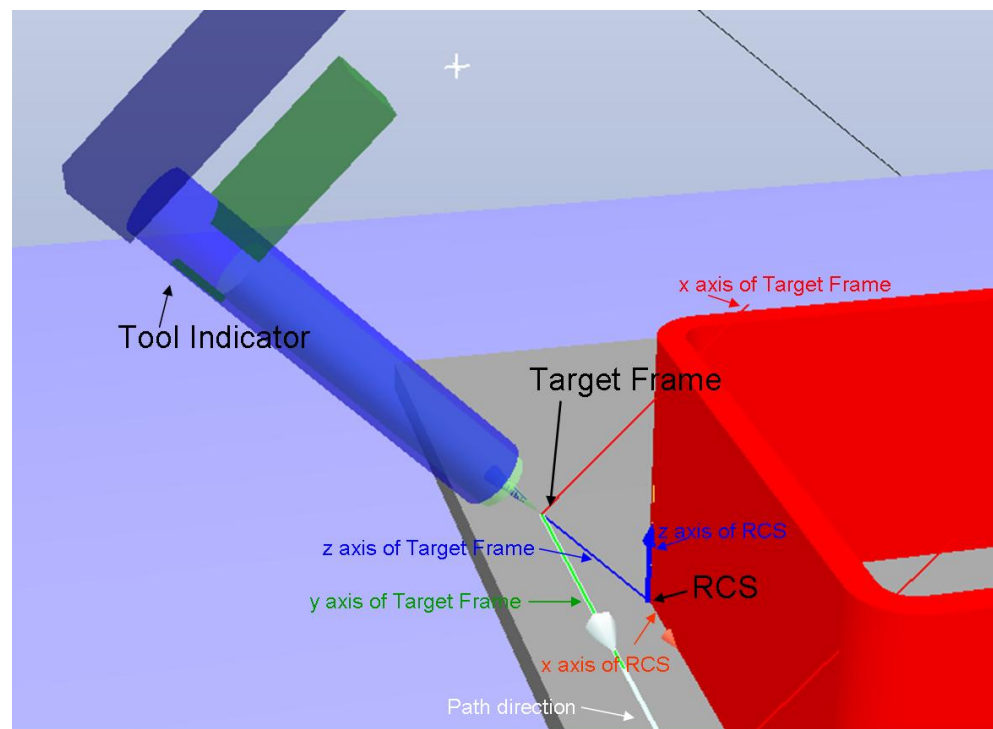
1.4 Concepts

Reference Coordinate System (RCS)

In ArcWelding PowerPac, every robtargt 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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Process Markups

Process markups are edges or joints on the CAD model which will be operated upon by the robot.

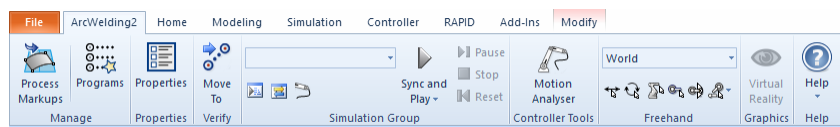
Welders can create or assign properties to the markups, which can be used by the programmers to set the weld speed, transport speed, process data, etc.

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2 Arc Welding ribbon

Overview

The Arc Welding ribbon contains all required options to create, manage and program the markups used during arc welding.



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Group	Button	Description
Manage	Process Markup	To create the markups by selecting the edges.
	Programs	To create programs for selected markups.
Properties	Properties	Displays properties of the selected objects.
Verify	Move To	Preview the Robot motion for the selected instructions
Simulation Group	Sync and Play	<p>Sync to VC and execute the movement of the robots for the given instruction.</p> <p>This option is used to sync a selected procedure to RAPID and start the simulation on the virtual robot controller. All related content (datatypes / procedures) are synced automatically.</p> <p>To sync and start the simulation, select a Part Program / Path procedure and choose Sync and play from the ribbon.</p>
Controller Tools	Motion Analyzer	It track the movement of robot through online.
Freehand	Freehand tools	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.
Help	About	<p>Provides the following information:</p> <ul style="list-style-type: none"> • Contents, the help file • About ArcWelding, version information

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3 Arc Welding browsers

3.1 Overview

Introduction

Arc Welding has two main browsers Components and Programming.

Browser	Description
Components	Managing Process Markups and Instruction Templates and provides to create and manage path programs efficiently.
Programming	It is used to program the markups using CAD models.

3 Arc Welding browsers

3.2 Components

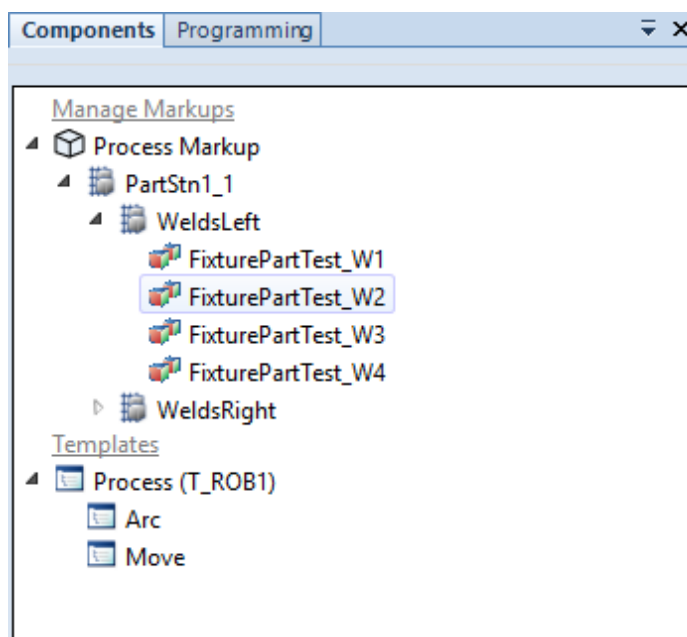
3.2 Components

Overview

In the components browser, user can select the markup and choose to view its properties.

The components browser lists the **Manage Markups** and **Templates** in the station.

View	Description
Manage Markups	Markups in a workpiece organized within groups are listed in the browser tree. User can select the markup / group to view its properties.
Templates	The process templates associated with the active Task is listed in the browser tree with provision to create / edit the templates.



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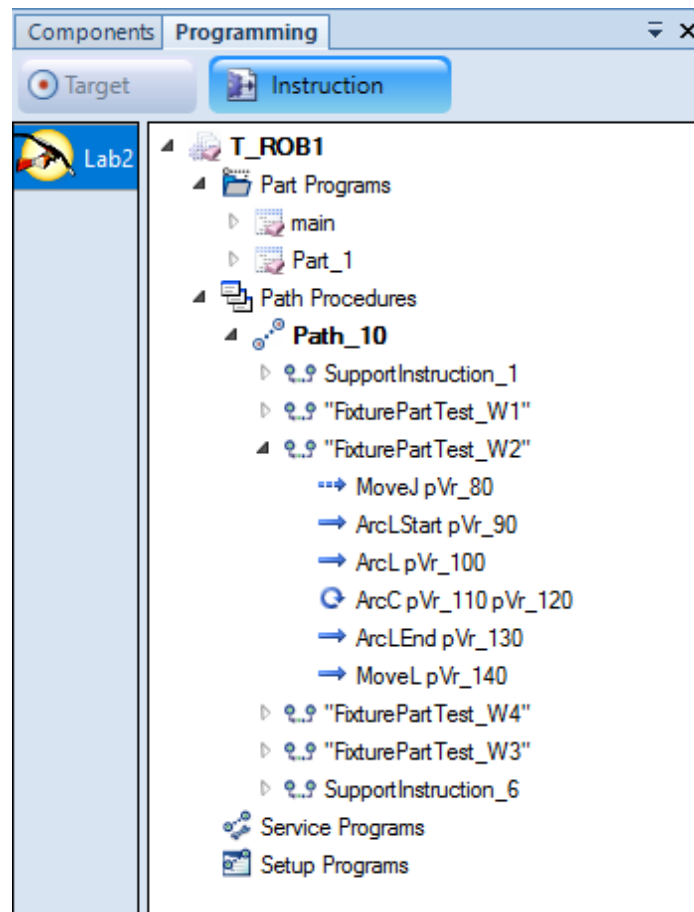
3.3 Programming

Overview

The programming browser tree organizes path procedures in the station under different groups and provides to change the view between Instruction and Target modes.

Markups link the robot program with CAD model. Can be defined by customer and passed on to programmer. Programmer uses that information to create a RAPID program. First step to automate programming.

View	Description
Part Programs	Procedures that contain procedure calls to different path procedures. Associated with workpiece / markup groups.
Path Procedures	Procedures that contain process instructions. Associated with process markups.
Services Programs	Procedures related to calibration, servicing etc.
Setup Programs	Procedures related to calibration, servicing etc.



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4 Arc Welding Functions

Introduction

This section describes the options within functions provided in AWPP.

- [*Create Process Markups on page 22*](#)
- [*Properties - Process Markups on page 26*](#)
- [*Manage Programs on page 28*](#)
- [*Adding the Process Path on page 30*](#)
- [*Insert Air Moves on page 35*](#)
- [*Move To on page 38*](#)
- [*Properties - Instruction on page 39*](#)
- [*Properties - Target on page 41*](#)
- [*Sync and Play on page 42*](#)
- [*Manage Templates on page 43*](#)

Continues on next page

4 Arc Welding Functions

4.1 Create Process Markups

4.1 Create Process Markups

Overview

Using this function, you can identify (create) a process markup by selecting the edges on the workpiece in the graphics window.

The markups are organized in the Components browser tree.

To view the window, select the Process Markup button from the ribbon, then the tool window option is displayed.

Function

Markup

Edge Count 2

☒ Update View Center

Name FixturePartTest_W2

Edge_1 76.200 mm
Edge_2 50.000 mm
<Select Edge>

Overall Edge Length 126.200 mm

Remove Last Reverse

Base Plate Search

☒ Left Side ☐ Right Side

Start Offset (mm) 0.00 End Offset (mm) 0.00

Create Clear Close

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Dialog Box Elements	Description
Edge Count	Displays the number of edges selected

Continues on next page

Dialog Box Elements	Description
Update View Center	Brings selected edge to focus automatically, to help selecting the consecutive edge.
Name	Displays the name of the Markup
Overall Edge Length	Shows the total length of the selected edges.
Remove Last button	Removes the last selected edge from the list.
Reverse button	Reverses the sequence of the edges (changes the direction).
Existing Select Markup	Select to add the new process markup under an existing markup group
Create New	Add markup under a new group.
Base Plate Search	Searches for the base plate in the selected side (left-side or right-side) with reference to the direction of the path.
Start Offset	Distance from the start position of the first edge where the markup shall start.
End Offset	Distance from the End position of the Last edge where the markup shall end.
Create button	Creates the process markup and lists the same in the components browser tree.
Clear button	To clear the selected edges in the current session
Close button	To close the current session

Creating the Process Markups

Use following procedure to create the process markup:

- 1 Click on **Components** tab.
- 2 Click on **Process Markups** option from the ribbon tab.
The **Create Process Markup** window is displayed.
- 3 Click on **Select Edge** option.
- 4 Select one or more edges on the workpiece of the CAD model, where the process is to be applied. Following action are carried:

- Curves are created on the edges.

Only consecutive edges can be grouped together, which shares a common vertex.



Note

The path is created according to the edge selection sequence.

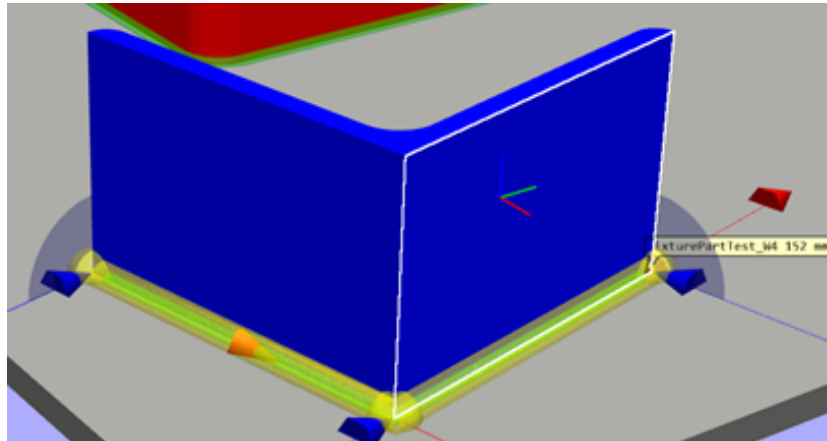
- As edges are selected the edge parameter are listed in the window.
- The name is generated for the process markup automatically in **Name** field.

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4 Arc Welding Functions

4.1 Create Process Markups

Continued



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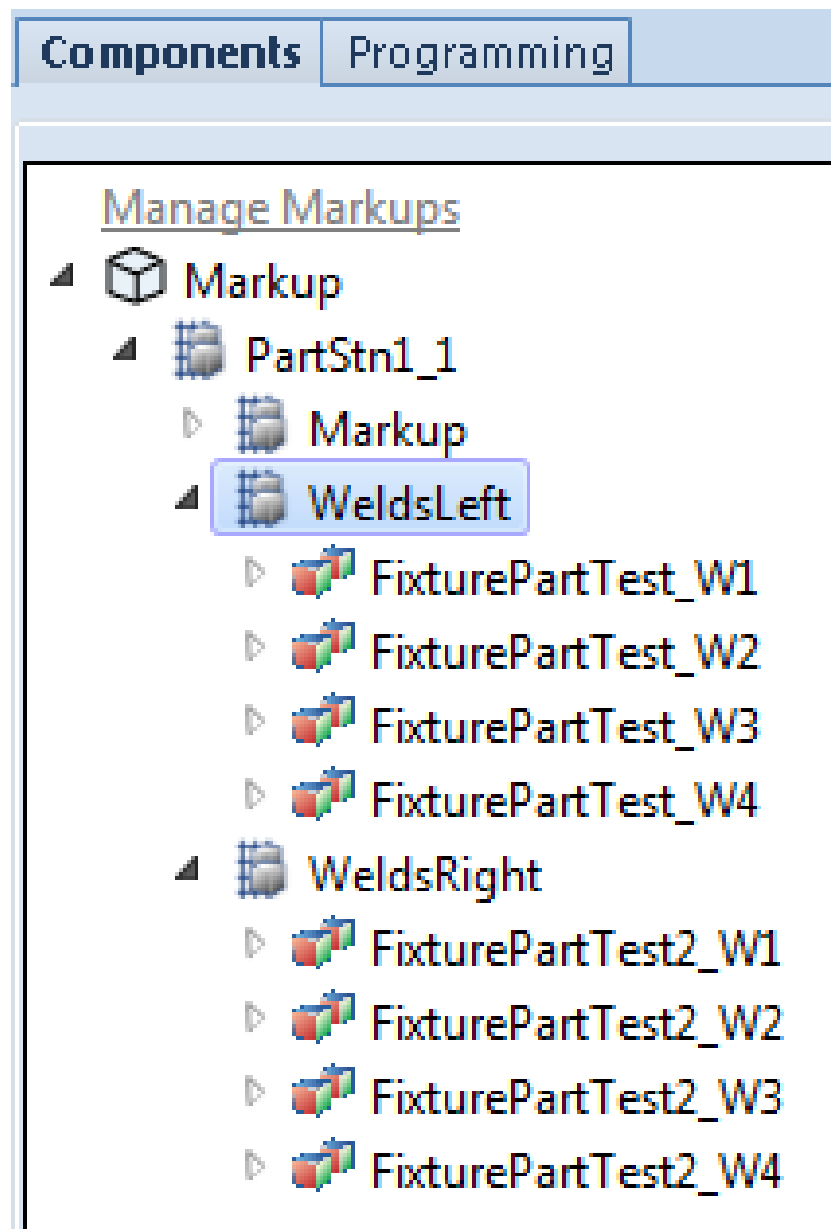
- 5 Select the relevant mark group from the **Active Markup** options.
The created process markups will be listed in this groups accordingly in component browser tree.
- 6 Select the relevant base plate from the **Base Plate Search** options.
- 7 If required, markup curves start and end point can be changed from **Start Offset** and **End Offset** option.
- 8 Click on **Create** button to create the process markup.
Created markups are grouped within a workpiece and are viewed from Components browser tree.



Note

These markups are stored as a Process Markup and is used for further planning and path generation.

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4 Arc Welding Functions

4.2 Properties - Process Markups

4.2 Properties - Process Markups

Overview

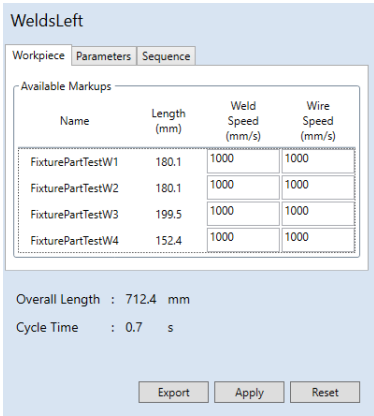
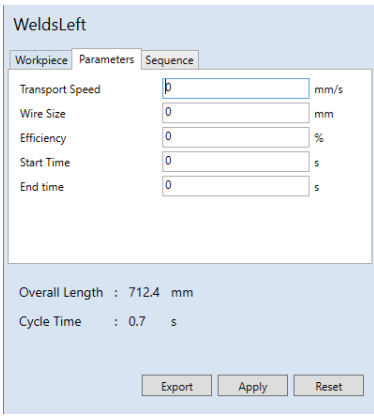
In Component markup properties, you can view all the parameters related to the markups created.

To view the component markup properties follow the below steps:

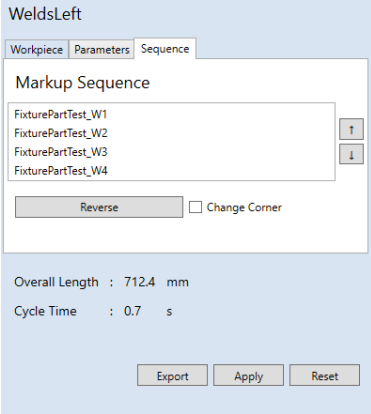
- 1 Select the **Component** tab in the browser window.
- 2 Under **Process Markup**, select the Process markup path.
- 3 Click on **Properties** button from the ribbon window.

The tool window option is displayed in separate window.

The properties are displayed in three tabs.

Tabs	Description	Figures
Workpiece tab	Shows the markup length there respective weld and wire speeds. These are used to compute the cycle time. Export: It exports all markup properties to a csv format.	 xx1900000814
Parameters tab	Used to set the welding parameters for a work-piece.	 xx1900000815

Continues on next page

Tabs	Description	Figures
Sequence	<p>This function is used to estimate the approximate cycle time by changing the markup sequence.</p> <p>Reverse: To reverse the markup sequence.</p> <p>Change Corner: To change the direction of each markup, but keeping the same sequence.</p> <p>Cycle Time: Is computed based on the markup length, weld speed, and transport speed defined in workpiece and parameters tab.</p>	 <p>xx1900000816</p>

4 Arc Welding Functions

4.3 Manage Programs

4.3 Manage Programs

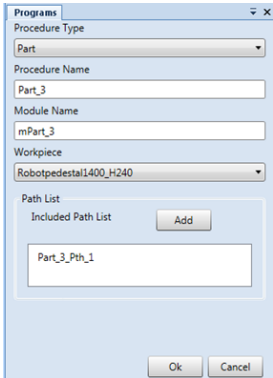
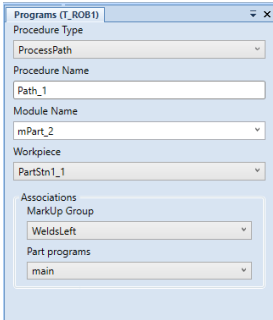
Overview

In the Manage programs function, you can create different types of procedures which are organized under corresponding sections in the **Programming** browser tree.

To view the window, select the **Program** button from the ribbon, then the tool window option is displayed.

The following procedure types are listed

- **Part** - Container for path procedures calls. Associated with a Workpiece
- **Process Path** - Container for weld path program. Each procedure is associated with a Markup group.
- **Setup** - Procedures with setup instructions
- **Service** - Procedures with Service/Calibration instructions

Dialog Box Elements	Description	Figure
Procedure Type - Part	Displays the procedure type	 xx1800003148
Workpiece	Select to associate a Part Program with a Workpiece	
MarkUp Group	Displays the markup group	
Included Path List	Allows to add of path list	
Procedure Type - ProcessPath	Displays the procedure type	 xx1900000813
MarkUp Group	Displays the markup group	
Part program	Displays the Part program	
Procedure name	Enter the name of the procedure	
Module Name	Select from existing modules or enter a new module name.	

Procedure

Use the following procedure to create a process path:

- 1 Click on **Programming** browser.

Continues on next page

- 2 Click on **Programs** option from the ribbon tab.
The **Program** window is displayed.
- 3 Select **Part** from the drop down under **Procedure Type** option.



Note

When **Part** is selected the Part procedure and Path program is created.
If Path is selected only the Path program is created.

- 4 Select process markup group from the drop down under **MarkUp Group** option.
Ensure that the Procedure type is **Part**.
- 5 Choose the workpiece to be associated with the part.
A process path is listed by default.
- 6 Choose the markup to be associated with the process path.
Multiple process paths can be added.
- 7 Click on **Ok** button to create the part procedure.
The newly created procedures are listed under the corresponding sections in the Programming browser tree.

4 Arc Welding Functions

4.4 Adding the Process Path

4.4 Adding the Process Path

Overview

Add weld instructions under Process Path for Markups. In this process, robot is brought close to the markups and it's reach and orientations are verified along the markup before creating a path. This approach of robot centric programming helps to identify and correct errors in early stages of programming.

Continues on next page

Function

The following table describes the information Create Process Path window:

xx1900000817

Dialog Box Elements	Description
Show Markup	Show / Hide Markups associated with the process path procedure.
Base Plate Search Side	Set the direction to search for the base plate for the selected markup in graphics.

Continues on next page

4 Arc Welding Functions

4.4 Adding the Process Path

Continued

Dialog Box Elements	Description
Select Base Plate	Used to select Base plate manually.
Reverse Path	Reverses the path direction indicator.
Settings	Choose the Instruction template and Tool and WorkObject to be used for the instructions that would be created.
Initial Orientation	Choose the initial tool orientation on the markup. This option is useful to quickly bring the robot to the desired position on the markup.
Process Data XY 45,0	Tool orients at 45 deg. on the seam with reference to the base plate.
Center of Seam	Tool orients perpendicular to the seam with reference to the base plate. Useful for V-grooves.
Orientation	Adjust the tool indicator orientation with reference to the seam.
Move Robot to Curve	: This option moves the robot to the selected position on the markup curve.
Move Along Section	Slider to move the robot along the markup, to verify reachability.
Select Configuration	Change the robot configuration.
Reset	Select markup again to restart the process.
Create Process Path	Creates instructions based on the selected template.

Procedure

This function provides to create instructions for selected process markups from graphics window. This can be accessed from the Active Process Path procedure context menu.

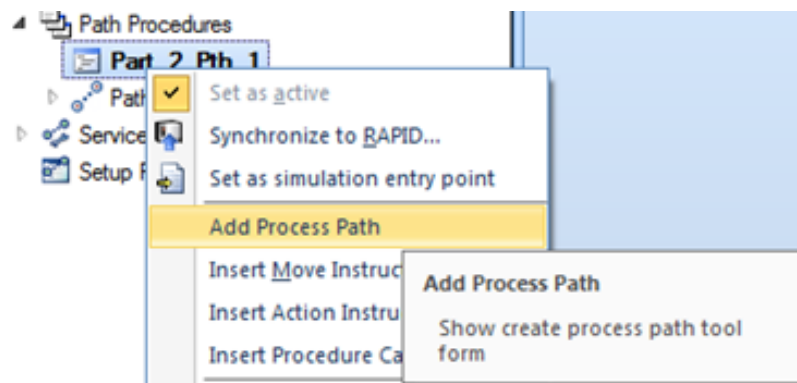
Use the following procedure to create a process path:

- 1 Click on **Programming** browser.
- 2 Right-click on a path list under the **Path procedures** and select **Set as active** from the context menu.

The path list gets highlighted.

- 3 Right-click on the highlighted path list and select **Add Process Path** from the context menu.

The Process Path window is displayed and highlights all the markups in graphics.



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- 4 Confirm the **Tool** and the **Work Object** from the drop-down under **Settings** option in the **Create Process Path** tab.
- 5 Select the markup in graphics (selection level Curve).



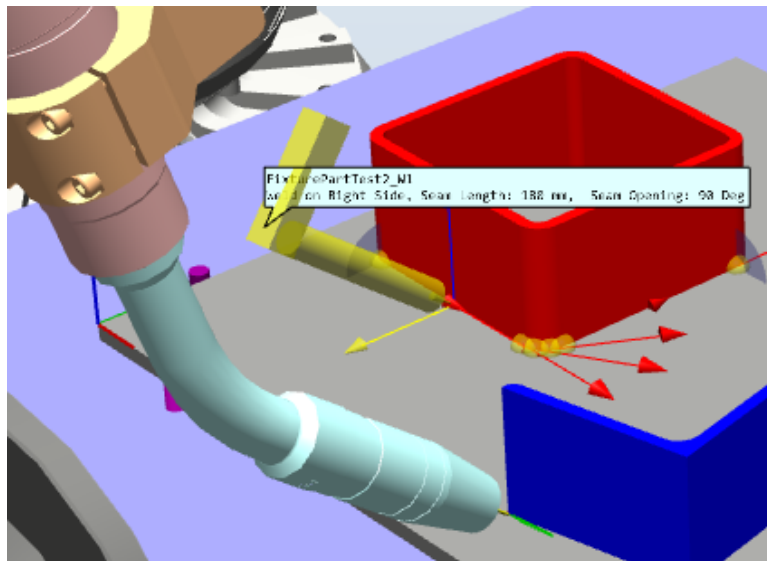
Note

A tool indicator is displayed on the curve based on the base plate information stored with the markup. The initial tool indicator orientation is based on the current tool attached to the robot. Hence, the robot will have to be physically moved close to the markup curve to bring the tool to an approximate required orientation before choosing the markup.

- 6 Set the Orientation.
You can modify the tool indicator orientation as required using the sliders.
- 7 Verify the robot Reach.

- Click on **Move Robot to Curve** option.

This brings the robot to the curve from current position and overlaps it with tool indicator.



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Note

The tool indicator will turn red, If the robot cannot reach the curve when clicking on **Move Robot to Curve** option.

- Using the slider, move the robot along the markup curve to confirm its reach. If not reachable, the robot will not move.
- 8 Select the required configuration from **Select Configuration** option.
Displays a list of configurations and animates the motion for a selection. This helps to verify cable twists and turns.
 - 9 Click on **Create Process Path** option.

Continues on next page

4 Arc Welding Functions

4.4 Adding the Process Path

Continued

This adds instructions under path procedure based on the selected process template. The instructions are organized as process sections in the **Programming** browser tree.

The graphics window highlights only remaining markups for which path has to be created.

The **Reset** button, clears all the markup selection and allows to start from beginning.

4.5 Insert Air Moves

Introduction

Air instructions are added to the active path before/after the selected instruction. This function can be accessed from the path/instructions' context menu.

Function

Add Air Move (T_ROB1)

Insert After
Part_1_Pth_1 : MoveL pVr_410

☐ Insert Before

Settings

Move RobTarget

☐ Linear ☒ Joint

Speed v1000

Zone z100

Tool tWeldGun

WObj obStn1

☐ Set Normal to Surface

☐ Spin Towards Robot Base

Orient: -161,9,-87

Reference World

X (mm) Y (mm) Z (mm)

1399.60~-449.74~979.23~

Move Robot

Selected Position

Last segment

☐ Prioritize Sign Axis 5

Select Configuration

0 -1 : 0 + -2 *

Reset

Add Air Instruction

Close

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Continues on next page

4 Arc Welding Functions

4.5 Insert Air Moves

Continued

Dialog Box Elements	Description
Insert Before	To insert air instruction before the selected instruction
Settings	To define the type of air instruction. Also confirm the speed, zone, tool and workobject.
Set Normal To Surface	Set the tool normal to the surface.
Spin Towards Robot Base	The tool is pointed towards the robot base.
Orient	To set the orientation of the tool in the defined frame.
Selected Position	Click to move the robot to the selected position.
Last segment	Move robot along the last segment. Applicable if robot move to is executed for the selected instruction.
Add Air Instruction	Click to add air instruction before/after the selected instruction.
Reset	To change back to the previous state.
Close	To close the Add Air Move window.

Procedure

To Create air instruction, follow the below procedure

- 1 Click on **Programming** browser.
- 2 Right-click on a path list under the Path procedures and select **Set as active** from the context menu.
The path list gets highlighted.
- 3 Select the Instruction from the path where the Air instruction to be add.
- 4 Right-click on a instruction list under the Path and select **Add Air Move** from the context menu.
The **Add Air Move** Window displayed.
- 5 Set the Air Instruction as required. For information see [Function on page 35](#).
- 6 Confirm the speed, zone, tool and workobject for the instruction.
- 7 Click on the Surface for a new position and click on **Selected Position** to move the Robot to the selected position on the surface.
- 8 Define the reference frame and change the indicator orientation and position in the graphical window.
- 9 Click **Add Air Instruction** to add air instruction.

To add Air instruction between two process section

- 1 Ensure that the path is active.
- 2 Select first instruction of the second process section and open Add Air Move window.
- 3 Check **Insert Before** so that instruction is inserted before this instruction.
- 4 Select the first instruction of the second process section and execute **Move To**.
The robot moves to the instruction and the Last segment slider in the add air move window is enabled
- 5 Change the position of robot using the slider.

Continues on next page

- 6 Change the orientation and position of the indicator in the graphical window and move robot to the selected position or move robot by the jogging using freehand move.
- 7 Select the desired configuration.
- 8 Click Add Air Instruction to insert a new instruction between the process sections.
- 9 The air instruction is inserted as support instruction in between the process sections.

4 Arc Welding Functions

4.6 Move To

4.6 Move To

Introduction

This function enables user to quickly verify the robot motion along the path, to identify reachability and configuration issues.

Procedure

To execute this function, follow the below steps:

- 1 Select instructions from the browser tree.
- 2 Invoke the **Move To** function from the ribbon.

The robot would execute the motion for each instruction and progress indicated in the browser tree via an icon.

4.7 Properties - Instruction

Overview

In Instruction properties, displays a tool window and moves the robot to the position, that is, animates the instruction execution from the preceding instruction, if available.

For a joint instruction, it displays a list of configurations and animates the motion for a selection. This helps to verify cable twists and turns.

Use the following procedure to view the instruction properties:

- 1 Select the **Programming** tab in the browser window.
- 2 Select the **Instruction** tab.
- 3 Click on **Properties** button from the ribbon window.

The tool window option is displayed in separate window.

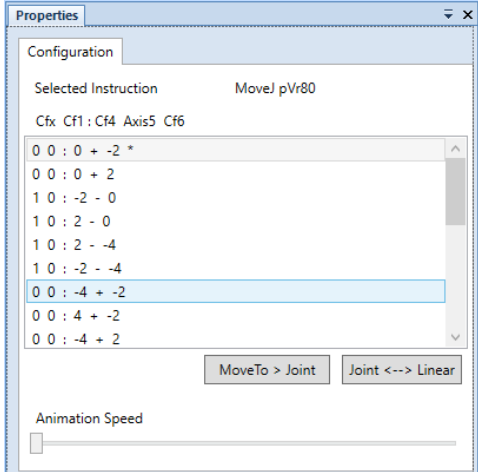
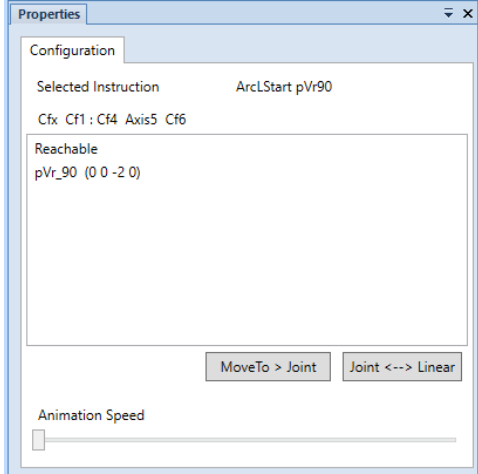
Continues on next page

4 Arc Welding Functions

4.7 Properties - Instruction

Continued

The following properties are displayed under **Configuration** tab:

Properties	Description
Cfx Cf1 : Cf4 Axis5 Cf6	<p>If a Joint instruction is selected, the possible configurations are listed and allowed to modify.</p>  <p>xx1900000842</p> <p>If a Linear instruction is selected, the reachability status is shown.</p>  <p>xx1900000841</p>
MoveTo->Joint	Moves the robot step-by-step until the next joint instruction in the path and in this process assigns the configurations for intermediate linear instructions.
Joint<--> Linear	Option to convert instruction from linear to joint and vice-versa.
Animation Speed	Select the animation speed.

4.8 Properties - Target

Introduction

In Target properties, you can view all the parameters related to the path created.

To view the target properties follow the below steps:

- 1 Select the Programming tab in the browser window.
- 2 Select the Target tab.
- 3 Click on Properties button from the ribbon window.

The tool window option is displayed in separate window.

The following properties are displayed under **Offset Angles** option:

Properties	Description
Select Type	Uses XYZ or World frame XYZ - Refers to RCS frames
Selected Targets	Lists the selected targets
Angles	Modify orientation with reference to XYZ or World frames.

Click on Apply button to apply the changes done.

4 Arc Welding Functions

4.9 Sync and Play

4.9 Sync and Play

Introduction

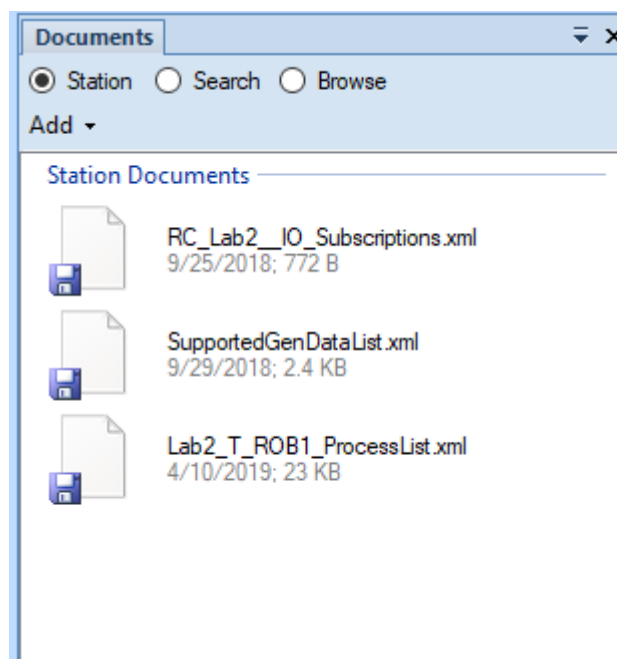
For the selected process path shall be synced to RAPID with updated references and start simulation automatically.

4.10 Manage Templates

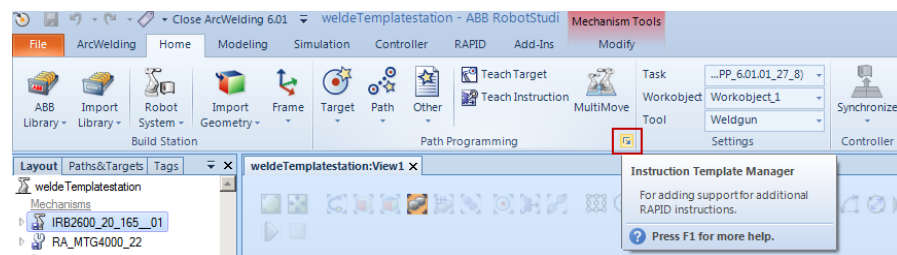
Overview

An process template is a collection of process parameters and instruction settings that define the properties of a weld.

The process templates are based on several instructions. For example, the **Move** template includes instructions for **MoveL**, **MoveJ**, and **MoveC**. These default move instructions are always available in RobotStudio. The process templates are created upon Activation of PowerPac, based on the available instructions in RobotStudio. they are saved in XML format within the RobotStudio station. Each motion task would have separate templates.



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Note

The Arc process template is not created automatically, when Arc Instruction template is imported after activating the PowerPac.

Continues on next page

4 Arc Welding Functions

4.10 Manage Templates

Continued

Process templates

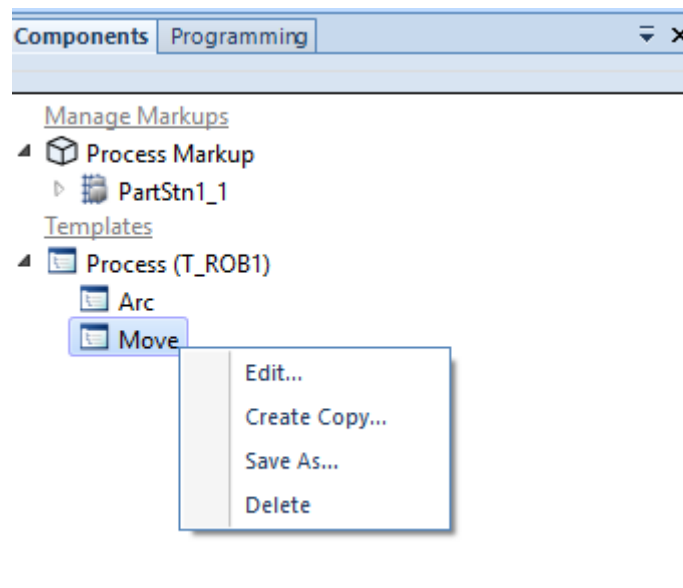


WARNING

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

Click on **Components** tab and under **Templates** option, select the templates.

Right-click on the selected templates to access the available options. The following figure and table provide more information about the available options.



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Menu	Description
Edit...	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.

Modifying an process template

To modify an application template:

- 1 Right-click on the template and click **Edit**.
The **Manage Arc Processes** window is displayed.
- 2 Modify the template according to your requirement.
- 3 Click **Apply** button.
The changes are saved.

Continues on next page

Manage Arc Processes

Arc

Process Description:
Default process using Arc instructions

Instructions Type:
Approach

Approach/Depart:
☒ Add Approach ☒ Add Depart

Offset Values (mm)
X: 0.00
Y: 0.00
Z: 50.00

Available Instructions:
MoveJ
MoveL
MoveC

Instruction Parameters

Conc	
Speed	v80
V	
T	
Zone	z10
Z	
Inpos	
TLoad	

Apply Close

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Continues on next page

4 Arc Welding Functions

4.10 Manage Templates

Continued

The following table provides the description of the Manage Arc Processes window:

Section	Description
Process Description	You can modify the description about the template.
Instruction Type	<p>Lists the types of instructions available with for the selected template.</p> <ul style="list-style-type: none">• Approach• ProcStart• ProcVia• ProcEnd• Depart <p>For the selected instruction type , the corresponding Available Instruction and Instruction Parameters are displayed. You can edit the parameters from this section.</p>
Approach/Depart	Select the Add Approach/Depart check box to enable the approach/depart parameters.
Offset Values	You can edit the approach/depart parameters from this section.
Available Instructions	Displays the available instructions for the selected instruction type.
Instruction Parameters	<p>Displays the instruction parameters for the selected instruction type.</p> <p>You can edit the parameters from this section.</p> <div> Note</div> <p>The check box ensures the same argument value is used as for other instruction types.</p>

5 Searching with SmarTac

5.1 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`.

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.

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.

5 Searching with SmarTac

5.2 Importing search templates

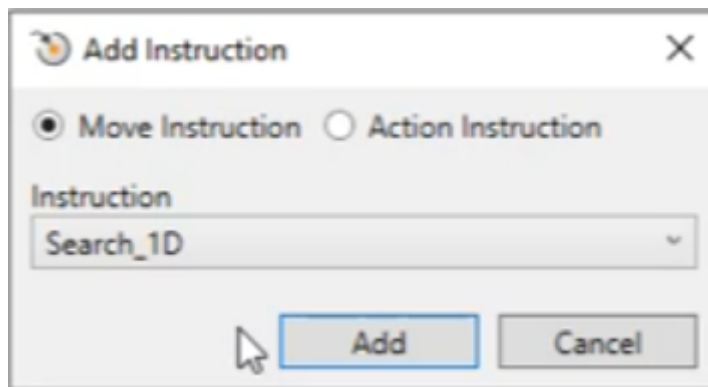
5.2 Importing search templates

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 instruction *Search_1D* is available in a controller with the option SmarTac installed. To be able to configure a Search_1D instruction in RobotStudio, 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 Adding the instruction definition.



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Continues on next page

Selected Instruction: **Search_1D**

Process

Process Name: Motion Type:

Arguments

Name	Data Type	Value
Result	pose	peSearchResult
StartPoint	robtarg	Managed by RobotStudio
SearchPoint	robtarg	Managed by RobotStudio
Speed	speeddata	v1000
Tool	tooldata	Managed by RobotStudio
WObj	wobjdata	Managed by RobotStudio
Add optional argument: <input type="text"/>		

Point Mapping

Parameter	Mapped To
SearchStop	ToPoint
StartPoint	ViaPoint
SearchPoint	None

Linear

Define parameters

xx1900000839

5 Searching with SmarTac

5.3 Create Search instruction

5.3 Create Search instruction

The Create Search Instruction Dialog Box

The Create Search windows form is accessible from the context menu of the instruction.

Create Search

☒ Insert Before

Path10 : MoveJ pVr_10

Search Name

No Name

Search Template

PaintDO : GasCup Search

Search Point

Select Search Point

Search Length + 30 mm -

Modify Orientation

-180	0.0	180	<	>
-180	0.0	180	<	>
0	3.0	20	<	>

Move To

Create Instruction

Show Properties Form

Close

xx1900000835

Object	Description
Search Object	Shows the instruction before / after which the Search instruction would be inserted
Search Name	The identifying name assigned to the search sequence
Search Template	Choose between: Gas cup search Search_1D

Continues on next page

Object	Description
Search Point	Enables and shows the graphically selected surface, together with the Tool indicator.
Search length	The distance in millimeters between the StartPoint and the Search Point of the search move, perpendicular to the surface.
Modify Orientation	Allows to modify the tool orientation along the XYS planes.
MoveTo	Brings the robot to the graphically selected position with either the Gas-cup or Wire.
Create Instruction	Creates the Search instruction at the selected position
Show Properties Form	Opens the Tool Properties form.

5 Searching with SmarTac

5.4 Tool properties

5.4 Tool properties

The Tool Properties Dialog Box

The **Tool Properties** dialog box is launched from the **Create Search** window form. The **Create Search** window form is launched from the instructions context menu of the active path procedure.

Search Properties

Selected Tool

tweldGun

Selected Property

BottomOfGasCup

Radius

5 16.4 50 < >

Z axis

5 18.8 50 < >

Wire Size

1.2 mm

Apply

Show Search Form Close

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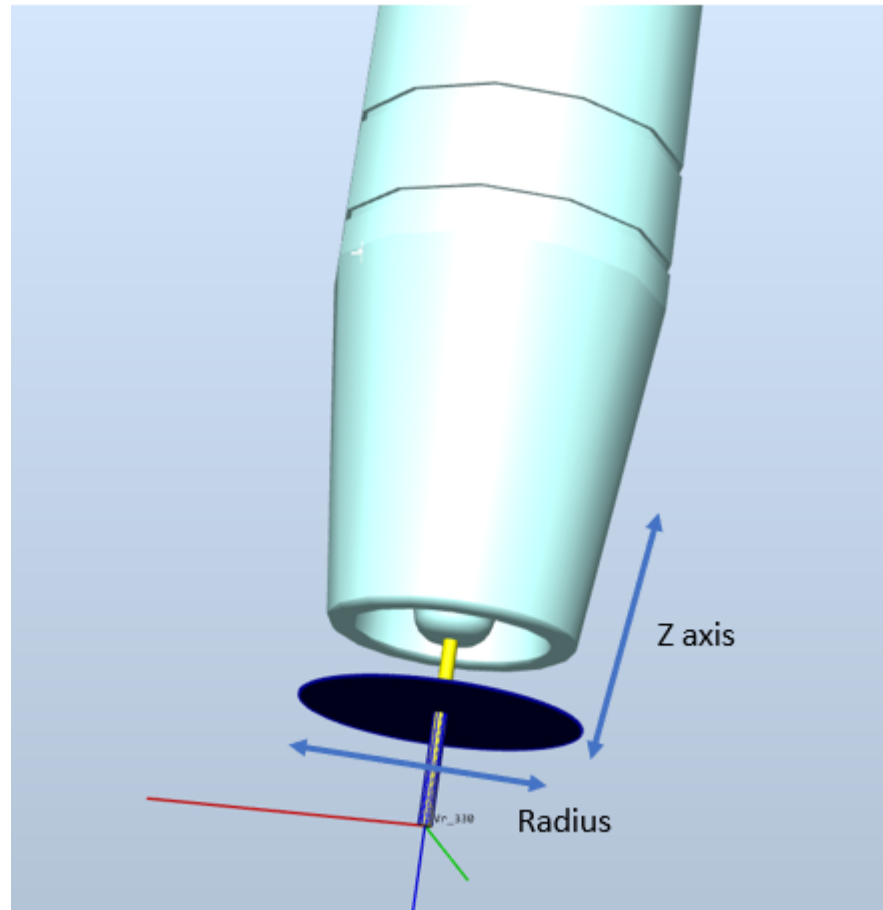
Section	Description
Select Tool	Displays the attached tool gun.

Continues on next page

Section	Description
Selected Property	Displays the search type option to use for the welding. <ul style="list-style-type: none"> BottomOfGasCup: Indicates the bottom of the gas cup. Associated with Search_1D template SearchHitPoint: The point on the gas cup that will hit the searched feature when performing a GasCup search. Associated with Gas Cup Search template
Radius	Adjust the radius parameter to suit the position on the gas cup.
Z axis	Adjust the position on the gas cup.
Wire Size	Use to change size of the wire.

The following tool properties of the search.

These properties are set by adjusting the Radius, Z-axis position interactively on the tool geometry



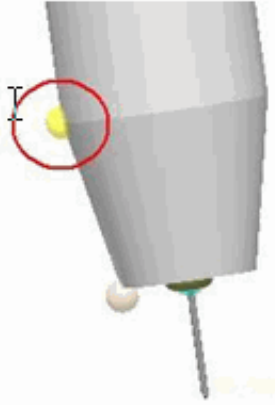
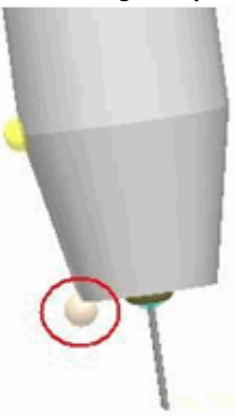

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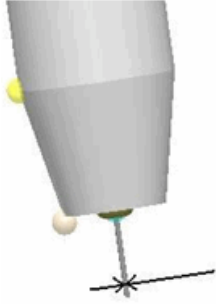
5 Searching with SmarTac

5.4 Tool properties

Continued

Object	Description
Gas cup hit pointl  en1200000300	The point on the gas cup that will hit the searched feature when performing a GasCup search.
Bottom of gas cup  en1200000302	Indicates the bottom of the gas cup.
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.

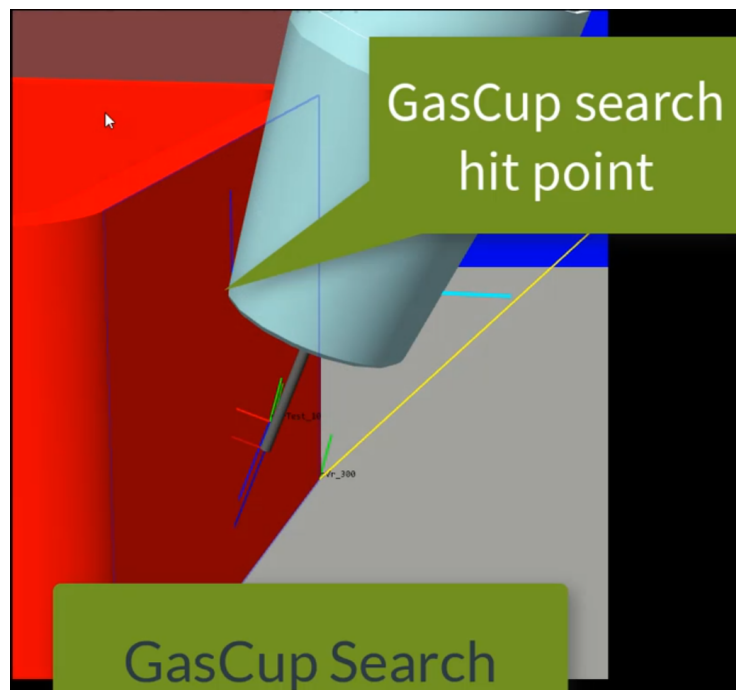
Continues on next page

Object	Description
<p>Wire diameter</p>  <p>en1200000305</p>	<p>The diameter of the wire.</p>

5.5 Workflow

Procedure

- 1 Ensure that the Search Templates are Instructions are available in RobotStudio.
- 2 Select the instruction and choose to launch the search window form.
- 3 Navigate to the Tool properties window and validate the position properties either Gas cup or Wire search type.
- 4 Return to the Search form.
- 5 Select the search template.
- 6 Click to select the search point on the graphics window, this shows a tool indicator for the selected surface.
- 7 Adjust the tool orientation in different planes.
- 8 Select to Move the Robot – Note that the Robot moves to the positions with the active Hit point, this may be either the Gas cup or the Wire.



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- 9 Iteratively adjust the Tool orientations about the selected point.
- 10 Select the Create instructions button and note the instruction is inserted in the browser tree..

6 Working with Arc Welding in VR

6.1 Overview

Introduction

Refer to RobotStudio document for more information on Virtual Reality.

Getting started

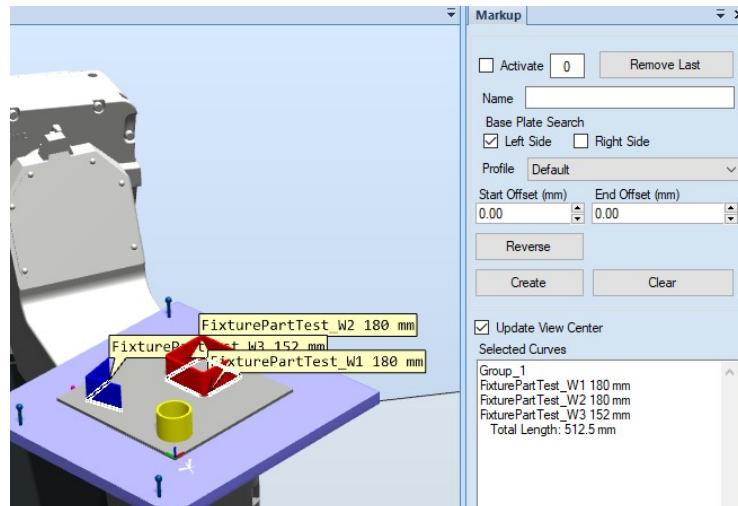
- Make sure that the complete hardware is connected and ready to use.



Note

Refer to RobotStudio document for more information on Virtual Reality.

- Make sure that the process markup is created, before you start the VR session.



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Use the following procedure to setup the VR:

- 1 Open the RobotStudio.
- 2 Click on the **Add In** tab and select the **ArcWelding2** option, to activate the **ArcWelding PowerPac 2**.
- 3 From the ribbon tab, select the **Virtual Reality** option, to activate the Virtual Reality.



Note

The graphical window is made active for VR.

6 Working with Arc Welding in VR

6.2 Arc Welding VR window

6.2 Arc Welding VR window

Introduction

Use the mechanism to select the **Process Tools** window using the PAD.



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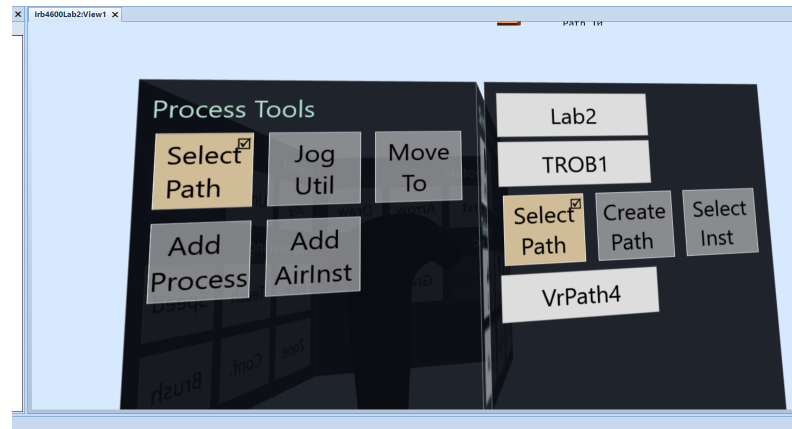
The following modes are displayed in the window:

Mode	Description
Select Path	Used to create and test the path. Also sets the active controller, tasks, and paths.
Move To	Used to move the robot along the selected instructions and to check the reachability of robot from the previous target position. Also, used to set the configuration.
Jog Util	Used to jog the mechanism by grabbing the robot axis or remotely.
Add Process	Used to add weld process sections to the active path procedure.
Add Airlnst	Used to add air instruction to the active path procedure.

Continues on next page

Select Path Mode

When the **Select** mode is selected, the following options are displayed:



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Mode	Description
Controller Name	Set the active controller name.
Active Task	Used to set the active task.
Select Path	Used to select a path from a list of path procedures. Only the selected path is visible. The selected path is made as the active path.
Create Path	Sets the active workobject and the tool. Used to create empty path with an ActUnit instruction.
Select Inst	Used to select an instruction for the path selected. The information for the selected instruction is displayed.
Test Path	Used to verify the selected path. The selected path is the active path.

Use the following procedure for selecting and creating a path:

- To create a new path click on the **Create Path** option, an empty path will be created.

**Note**

The ActUnit instruction will be inserted as the first instruction, when a new path is created.

- A path can be selected either by selecting it from the drop down or by pressing TRIGGER button when highlighted.
- Only the selected path is visible and the selected path is made active.
- The **Test Path** option is used to verify the active path.

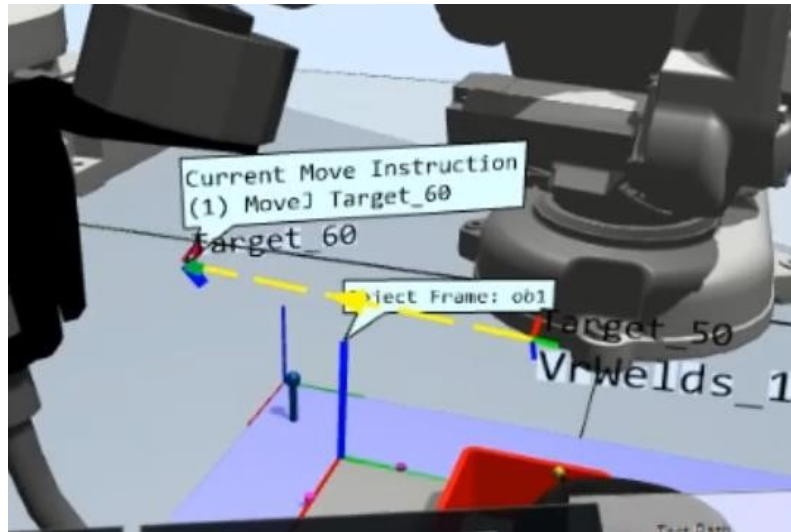
Continues on next page

6 Working with Arc Welding in VR

6.2 Arc Welding VR window

Continued

The information text will be shown for a few seconds in the current instruction and active work-object, when selected with the controller. Info text can be removed or brought up by pressing the PAD or A button (Oculus).



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Move To Mode

In **Move To** mode, you can move the robot to the selected instruction by pressing the TRIGGER.

When the **Move To** mode is selected, the **MoveTo Options** window is displayed with following modes.



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Mode	Description
Show Config	The robot configurations are shown. The configuration can be modified for the MoveJ instruction. The configured pane is shown only after the robot has reached the selected target.
Conv -> J	To convert the instructions from linear to joint.
Conv -> L	To convert the instructions from joint to linear.

Continues on next page

Mode	Description
Conv -> C	To convert the instructions from linear/joint to circular.

Use the following procedure to check the robot reachability from previous position and to change configuration:

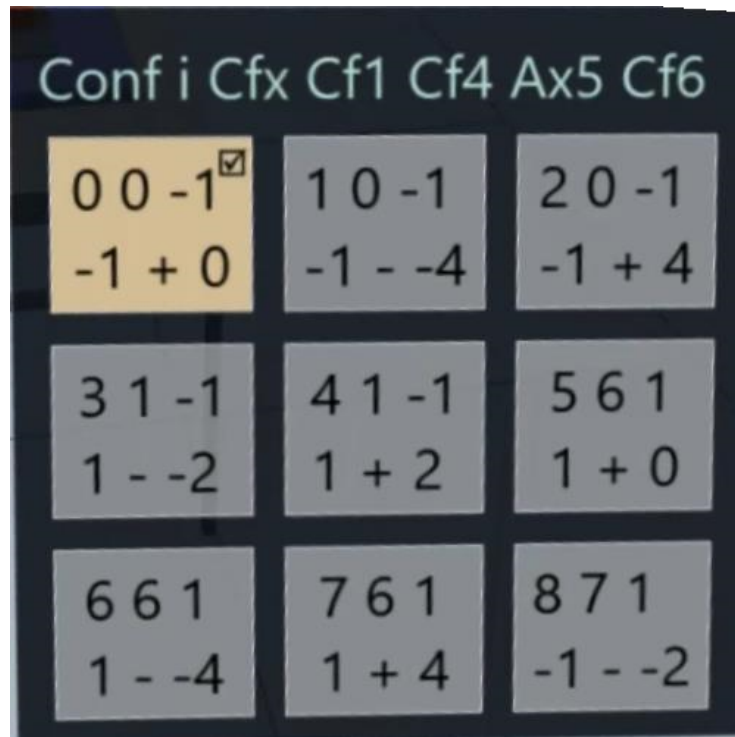
- Click on **Move To** mode.
The **MoveTo Options** window is displayed.
- Select the instruction by pressing the TRIGGER.



Note

The robot will move to the selected target position from the previous target position.

- Click on the **Show Config** mode, to change the configuration of robot.
The configuration pane window is displayed.



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- Check the movement of the robot by selecting the configuration for the selected instruction.
- The configuration can be modified for the selected instructions.



Note

The configuration pane is shown only after the robot has reached the selected target.

Continues on next page

6 Working with Arc Welding in VR

6.2 Arc Welding VR window

Continued

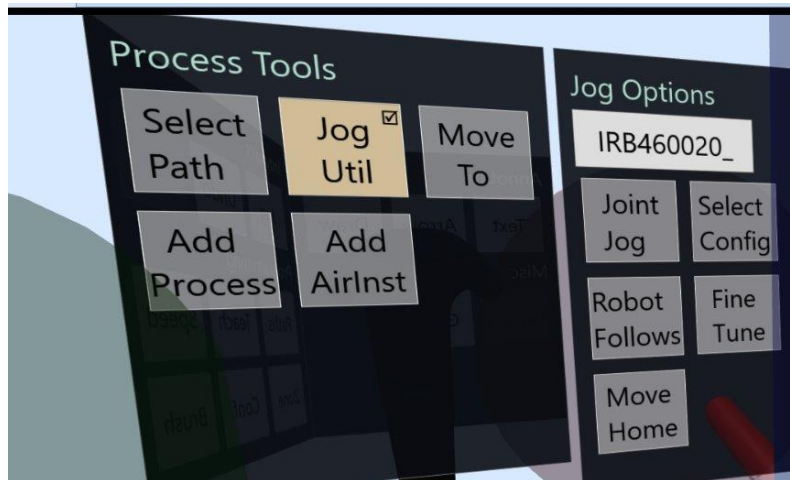


Note

Configuration pane. The most likely configuration is listed first.

Jog Utility Mode

When the **Jog Util** mode is selected, the **Jog Options** window is displayed with following modes.



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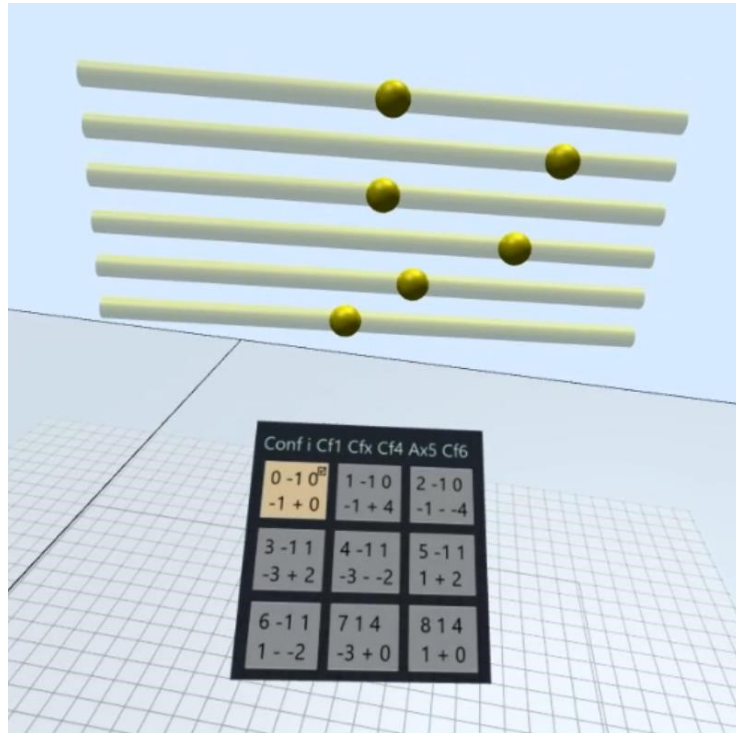
Mode	Description
Robot Name	To select the robot mechanism. The Robot name is displayed.
Joint Jog	To move the Robot to the selected position by grabbing the axis and moving it or by the utility.
Select Config	To select the desired configuration.
Move Home	The Robot moves to the home position.

Use the following procedure to jog the robot:

- The **Jog Util** mode is virtual tool that is used to jog a mechanism without grabbing it. It is useful for mechanism that are hard to reach.
- Mechanism is selected with a drop down.
- The absolute position of the axes are shown in joint jog mode.

Continues on next page

- Also, for the robot configurations are shown in a list.

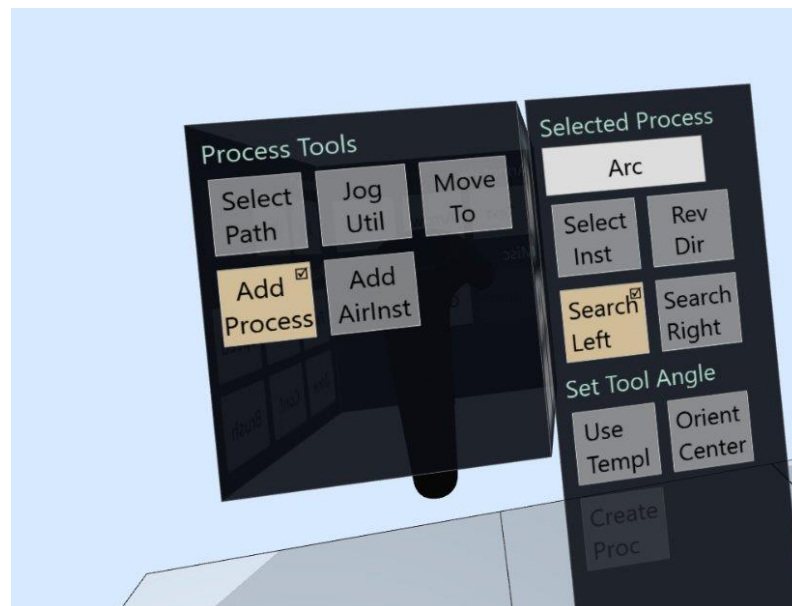


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Add Process

The **Add Process** mode is used to create welds.

When the **Add Process** mode is selected, the **Selected Process** window is displayed with following modes.



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Continues on next page

6 Working with Arc Welding in VR

6.2 Arc Welding VR window

Continued

Mode	Description
Select Inst	Used to select the instruction.
Rev Direction	Select this mode to reverse the wire direction
Search Left / Search Right	Select left or right side. The side defines the side of the wire to search for the base plate.
Use Templ	Used to select the process template.
Create Proc	Select this mode to create the weld (process section).

In the **Add Process** mode you can create the process section for the selected path procedure.

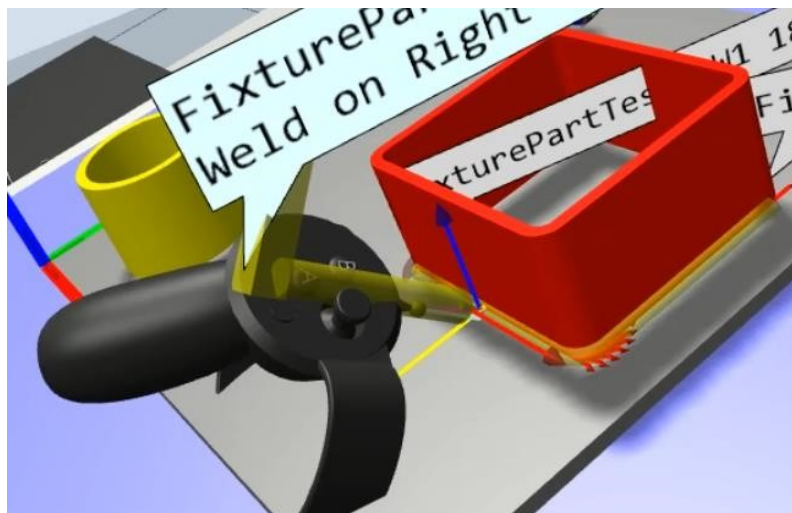
Use the following procedure for creation of the process section:

- 1 Select the process markup where the weld need to be created. For more information see [To select the process markup on page 64](#)
- 2 Move the robot to the selected markup to create the weld. For more information see [To move the robot to selected markup on page 65](#)
- 3 Click on **Create Proc** option, to add the welds to the selected path.

To select the process markup

Use the following procedure to select the process markup:

- Move the controller close to a wire. A coordinate system will be shown that indicates direction of the process and the base plate (blue arrow).
- Select left or right side. The side defines the side of the wire to search for the base plate (blue arrow). Example is a right side configuration shown in figure.
- When a wire is selected, the direction of the wire can be modified.
- Hold the thumb on the PAD to keep the position on the wire.



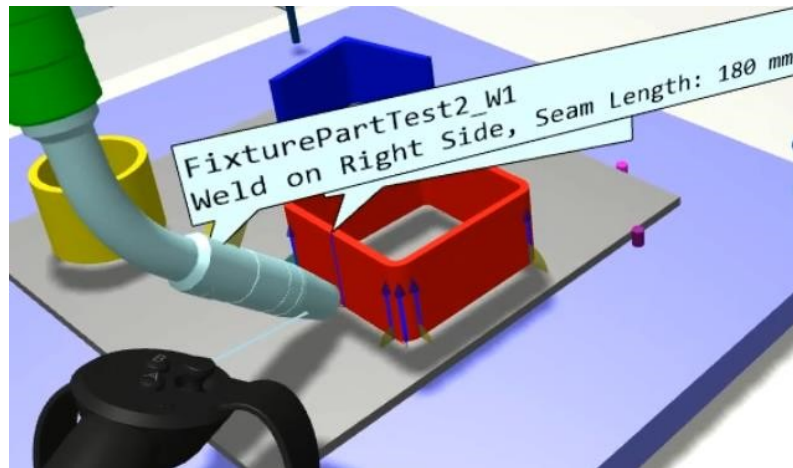
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To move the robot to selected markup

Use the following procedure to move the robot to selected markup:

- Robot can be moved along the selected section by pressing the TRIGGER button at the same time as the controller is moved along the section. The tool orientation will be kept in relation to the wire.
- Click on **Use Template** and select the desired template from the drop down.
- The orientation of the tool can be modified by pressing the LEFT TRIGGER button at the same time as the right controller angle is changed.
- A weld (process section) can be created by pressing **Create Proc** option.



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Continues on next page

6 Working with Arc Welding in VR

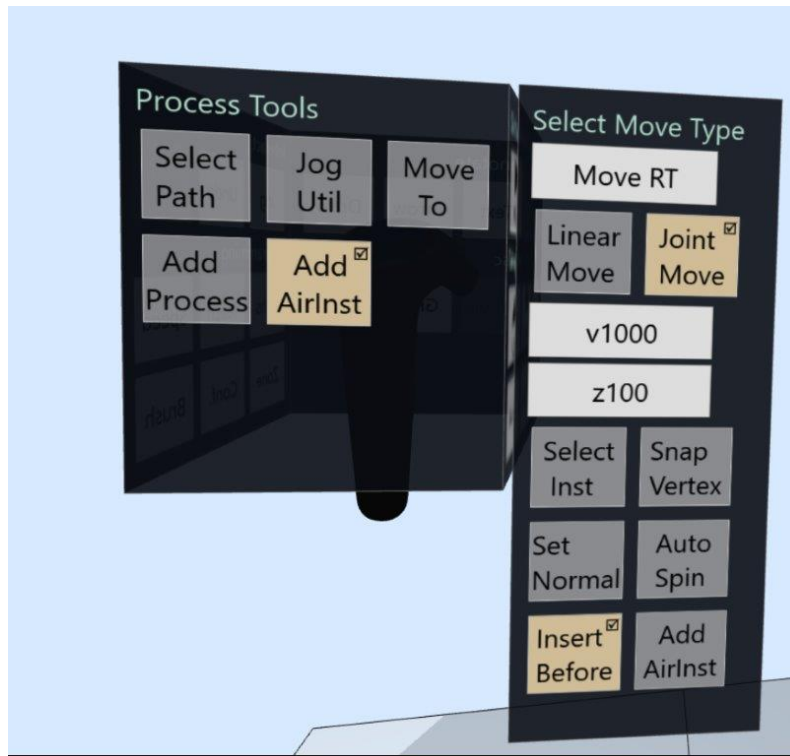
6.2 Arc Welding VR window

Continued

Add Airlnst

This is used to add air instruction before or after the selected instruction.

When the **Add Airlnst** mode is selected, the **Select Move Type** window is displayed with following modes:



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Mode	Description
Linear Move	Used to create linear air move instruction.
Joint Move	Used to create joint air move instruction.
Robot execution Speed	To select the speed of the robot while executing air instruction.
Select Inst	To select the instruction.
Snap Vertex	The closest vertex will be selected.
Set Normal	The tool will be normalized to the selected surface.
Auto Spin	The x axis of the tool will be pointing towards the robot base.
Insert Before	Used to insert the instruction before to the selected instruction.
Add Airlnst	To create air instruction before/after the selected instruction.

Use the following procedure to create an air instruction:

- Select the position where air instruction need to be created by pressing the TRIGGER. Robot moves to the selected position.
- By pressing the **Add Airlnst** button an air instruction will be added to the selected path.

6.3 Creating the Path in VR

Procedure

Use the following procedure to create the path in VR:

- 1 Click on **Select Path** mode.

Set the active task, workobject and tool.

For more information, see [Select Path Mode on page 59](#).

- 2 Click on **Create Path** option, to create an empty path.

- 3 Click on **Add Process** mode, to add weld process.

The **Selected Process** window is displayed.

For more information, see [Add Process](#) on how to add the process path.

- 4 Click on **Add AirInst** mode to add the air instruction to the active path procedure.

For more information, see [Add AirInst on page 66](#) mode.

- 5 Click on **Move To** mode to make sure all the target are reachable by robot from the previous position.

For more information, see [Move To Mode on page 60](#) mode.



Note

If the targets are not reachable the robot will stop automatically.

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ABB AB, Robotics

Robotics and Motion

S-721 68 VÄSTERÅS, Sweden

Telephone +46 (0) 21 344 400

ABB AS, Robotics

Robotics and Motion

Nordlysvegen 7, N-4340 BRYNE, Norway

Box 265, N-4349 BRYNE, Norway

Telephone: +47 22 87 2000

ABB Engineering (Shanghai) Ltd.

Robotics and Motion

No. 4528 Kangxin Highway

PuDong District

SHANGHAI 201319, China

Telephone: +86 21 6105 6666

ABB Inc.

Robotics and Motion

1250 Brown Road

Auburn Hills, MI 48326

USA

Telephone: +1 248 391 9000

abb.com/robotics