



ROBOTICS

Operating manual

ArcWelding2 PowerPac



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Operating manual

ArcWelding2 PowerPac

RobotStudio 2019.3

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Original instructions.

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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
B	Released with RobotStudio 2019.1
C	Updated for RobotStudio 2019.3 release Following is the update: <ul style="list-style-type: none">• Updated the section Arc Welding Ribbon on page 15• Updated the section Create Process Markups on page 22• Added new section Split Markup on page 25• Updated the section Adding the Process Path on page 33• Updated the section Select Path Mode on page 69• Updated the section Add Process on page 75

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1 Introduction and Installation

1.1 Introduction to ArcWelding2 PowerPac

About ArcWelding2 PowerPac

ArcWelding2 PowerPac 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 ArcWelding2 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
- ArcWelding2 PowerPac installation package
- A license certificate
- A log on account with administrator rights on the computer

1 Introduction and Installation

1.2 Installing ArcWelding2 PowerPac

1.2 Installing ArcWelding2 PowerPac

Overview

To be able to install ArcWelding2 PowerPac, RobotStudio must be installed on your computer.

Installing ArcWelding2 PowerPac

To install the ArcWelding2 PowerPac, follow these steps:

- 1 Browse to ArcWelding2 PowerPac installation package and double-click on **Setup.exe** setup file.
The installation page opens.
- 2 Click **Install ArcWelding2 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 ArcWelding2 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.

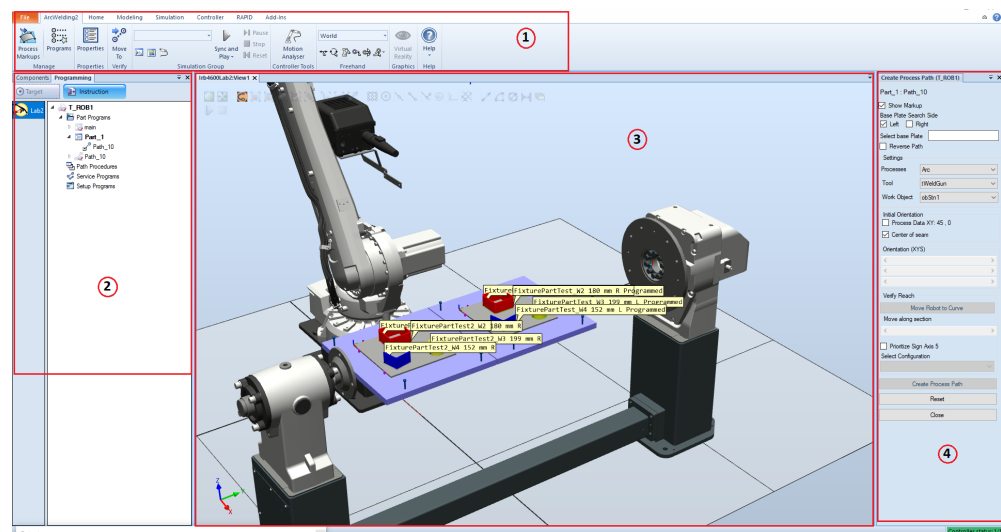
Loading a station

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 ArcWelding2 is added to the ribbon.
- The ArcWelding2 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.	ArcWelding2 ribbon-tab	Contains the general functions for arc-welding process. See Arc Welding Ribbon on page 15 for detailed description.
2.	ArcWelding2 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>

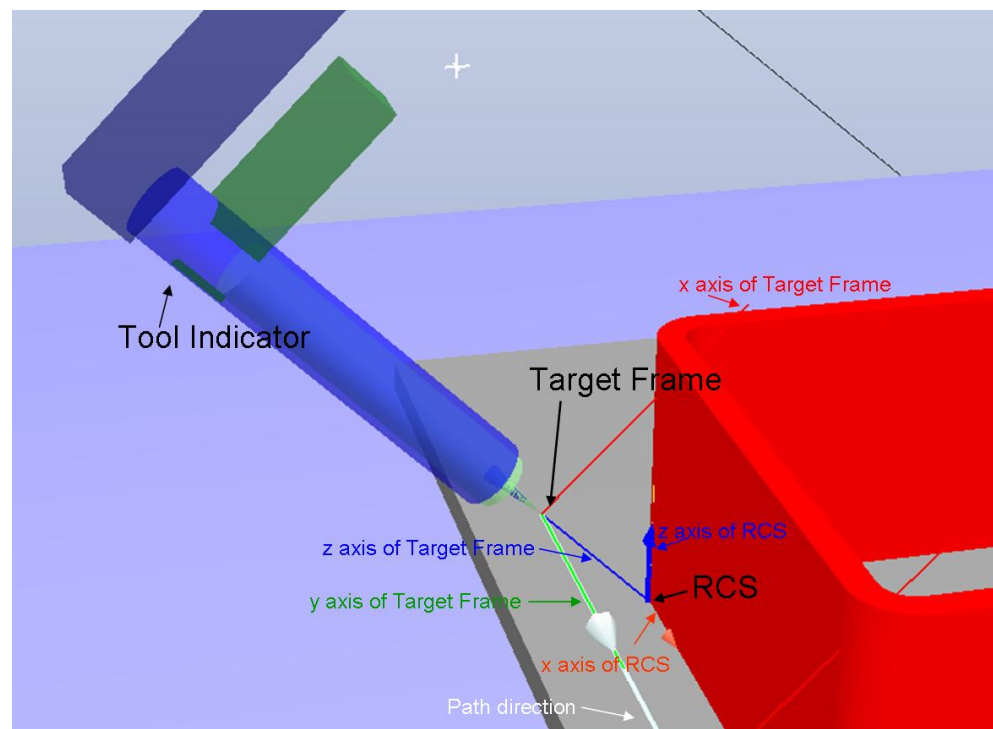
1.4 Concepts

Reference Coordinate System (RCS)

In ArcWelding2 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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Process Markups

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

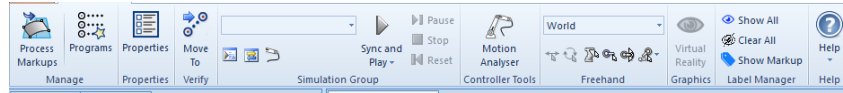
Welders can create or assign properties to the markups, which can be used by the programmers to set the weld speed, transport speed, process data, etc.

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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.
Label Manager	Show All	Displays all the available markup labels in station.
	Clear All	Clears all the available markup labels in station.
	Show Markup	Displays the label of the selected markup.
Help	About	<p>Provides the following information:</p> <ul style="list-style-type: none"> Contents, the help file About ArcWelding2, 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

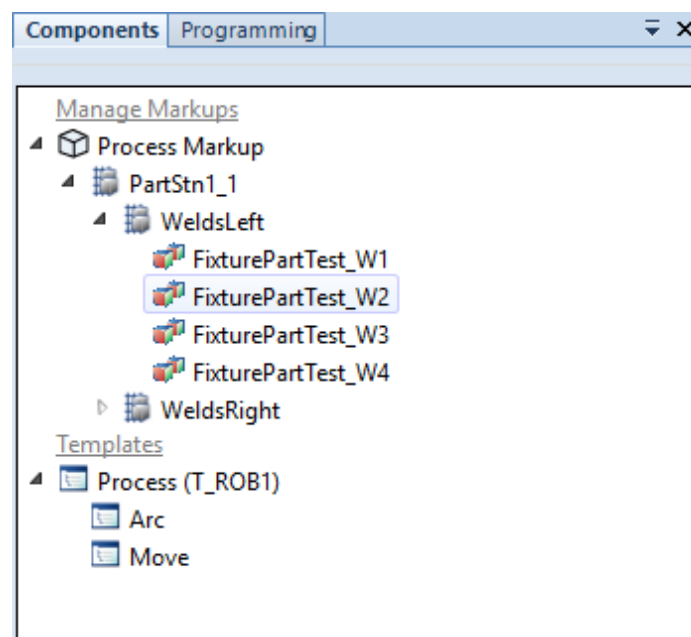
3.2 Components

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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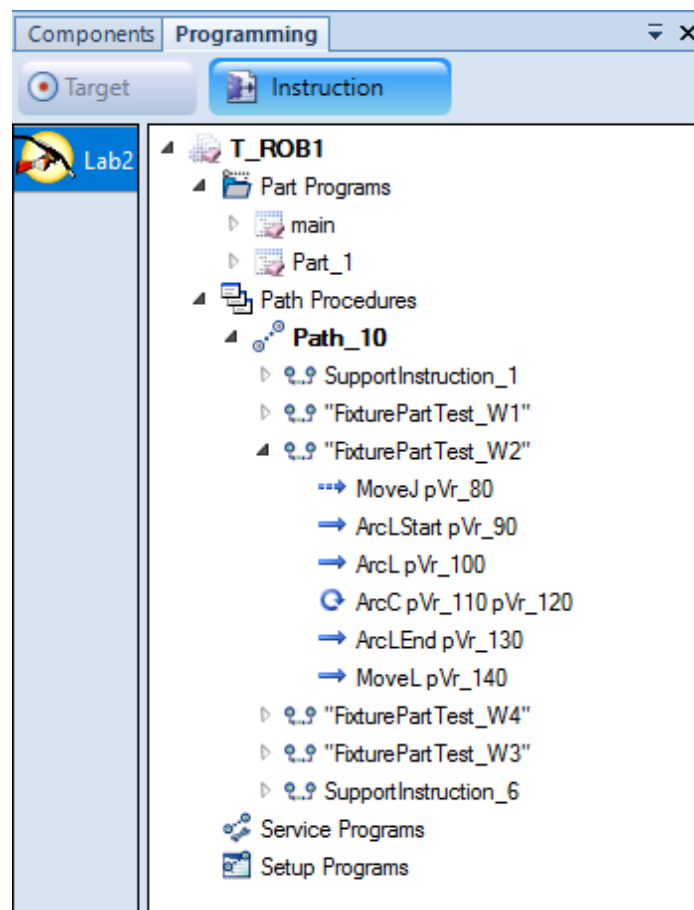
3.3 Programming

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*](#)
- [*Split Markup on page 25*](#)
- [*Properties - Process Markups on page 29*](#)
- [*Manage Programs on page 31*](#)
- [*Adding the Process Path on page 33*](#)
- [*Insert Air Moves on page 39*](#)
- [*Move To on page 42*](#)
- [*Properties - Instruction on page 43*](#)
- [*Properties - Target on page 45*](#)
- [*Sync and Play on page 46*](#)
- [*Manage Templates on page 47*](#)

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/curves 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

Create Process Markup (T_ROB1)

Edge Count

☒ Update View Center

Name

Edge_5 (From Curve)
Edge_6 (From Curve)
<Select Edge/Curve>

Overall Edge Length 152.400 mm

Active Markup

☒ Existing
Select Group

☐ Create New
Name

Base Plate Search

☒ Left Side ☐ Right Side

Start Offset (mm) End Offset (mm)

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

Continues on next page

Dialog Box Elements	Description
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/Curves** option.
- 4 Select edges (curves) on the workpiece of the CAD model, where the process is to be applied.



Note

By default **Surface Selection** icon is selected in selection level bar.
To select the curve edges, select the **Curve Selection** icon in the selection level bar.

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.

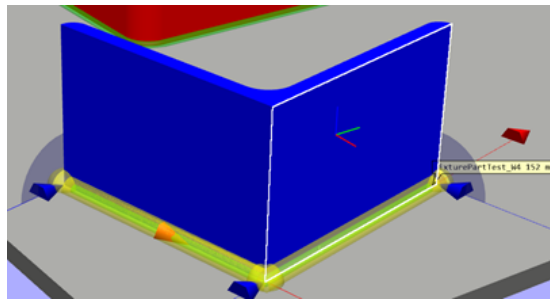
- As edges are selected the edge parameter are listed in the window.
- The name is generated for the process markup automatically in **Name** field.

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4 Arc Welding Functions

4.1 Create Process Markups

Continued



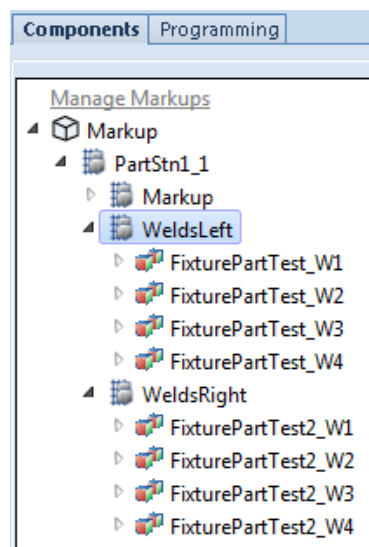
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- 5 Select the relevant mark group from the **Active Markup** options.
The created process markups will be listed in this groups accordingly in component browser tree.
- 6 Select the relevant base plate from the **Base Plate Search** options.
- 7 If 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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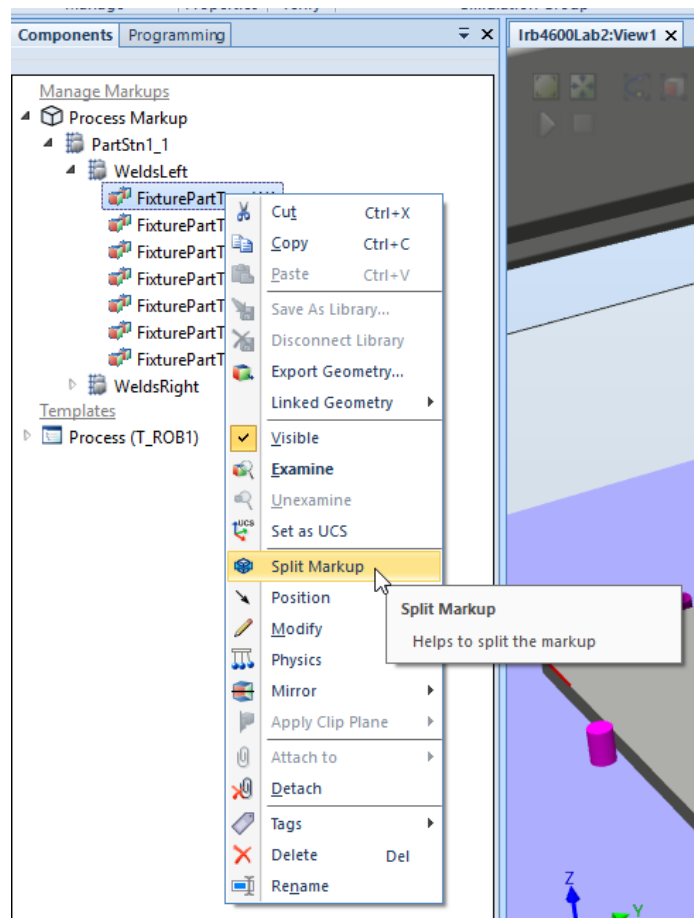
4.2 Split Markup

Overview

Using this function, you can split a process markup by selecting **Split Markup** option.

To view the option, select and right click on the **Process Markup** from the **Components** tab, and select the **Split Markup** option.

The **Split Markup** window is displayed.



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4 Arc Welding Functions

4.2 Split Markup

Continued

Function

Split Markup

FixturePartTest_W3

Markup Length : 199 mm

Split

Position:

0 147.0 199 < >

Current Length : 147 mm

New Markup

FixturePartTest_W3_1 X

FixturePartTest_W3_2 X

FixturePartTest_W3_3 X

Mark Clear All

Split Close

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Dialog Box Elements	Description
Markup Length	Displays the length of the selected process markup.
Position	Move the slider to select the position where the markup to be splitted.
Current Length	Displays the length of the selected markup from the start position to the current position of the slider.
New Markup	Lists all the split markup positions.
Mark	Marks the position of the split markup.
Clear All	Clears all listed split markups.
Split	Creates the new split markups for the selected process markup.
Close	Closes the Split Markup window.

Continues on next page

Creating Split Markup

Use the following procedure to create the split markup:

- 1 Click on **Components** tab.
- 2 Select and right click on the process markup.
- 3 Select the **Split Markup** option.

The **Split Markup** window is displayed.

- 4 Move the slider in **Position** option, to select the split position.

Once split position is selected, the length of the split markup is displayed in **Current Length** option.



Note

As you move the slider the pointer on the process markup moves in the graphic window.

- 5 Click on the **Mark** button, to mark the split position.



Note

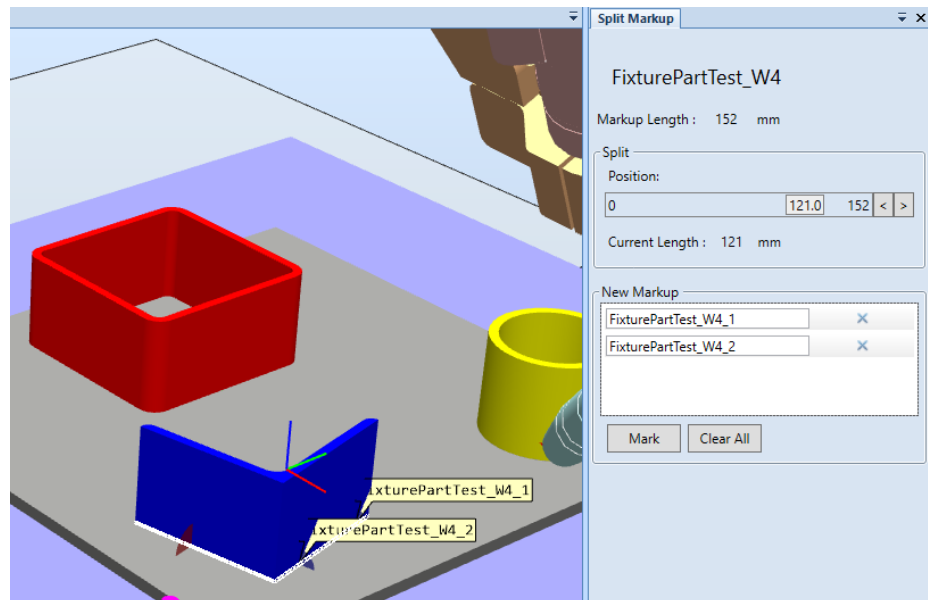
New pointer is created on split position.

The list of all marked split markup are displayed in **New Markup** option.



Note

If required, the marked split markup names can be edited.



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- 6 Click on the **Split** button, to create the split markup.

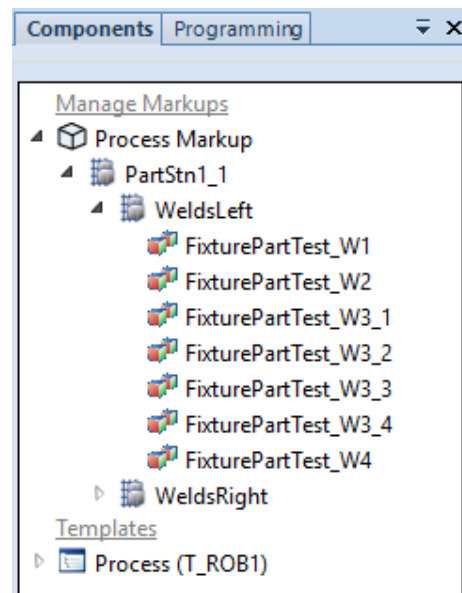
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4 Arc Welding Functions

4.2 Split Markup

Continued

The newly created split markups are listed in **Components** tab.



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4.3 Properties - Process Markups

Overview

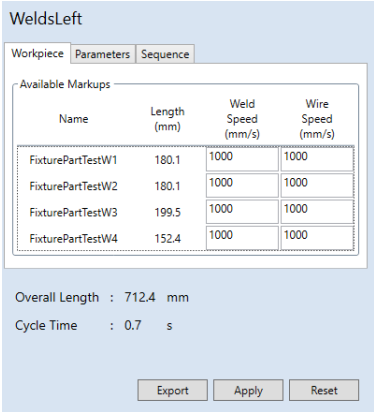
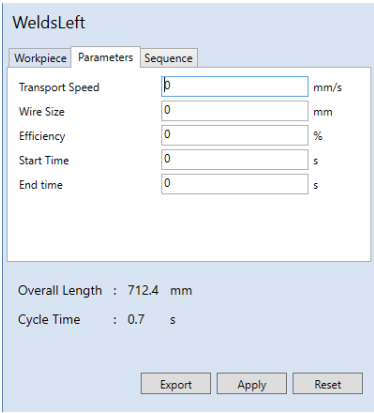
In Component markup properties, you can view all the parameters related to the markups created.

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.

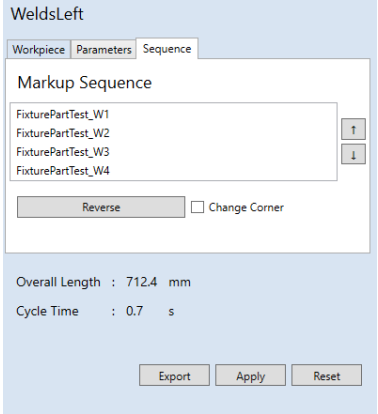
Tabs	Description	Figures
Workpiece tab	Shows the markup length there respective weld and wire speeds. These are used to compute the cycle time. Export: It exports all markup properties to a csv format.	 <p>xx1900000814</p>
Parameters tab	Used to set the welding parameters for a work-piece.	 <p>xx1900000815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

Continues on next page

4 Arc Welding Functions

4.3 Properties - Process Markups

Continued

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>

4.4 Manage Programs

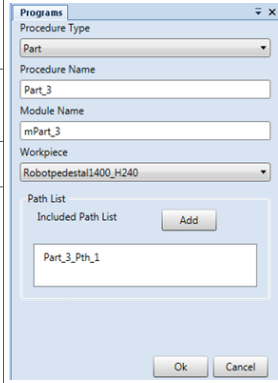
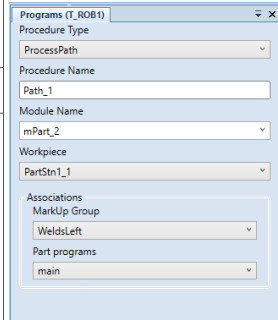
Overview

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

4 Arc Welding Functions

4.4 Manage Programs

Continued

- 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.

4.5 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

4 Arc Welding Functions

4.5 Adding the Process Path

Continued

Function

The following table describes the information Create Process Path window:

Create Process Path (T_ROB1)

Part_1 : Path_10

☒ Show Markup

Base Plate Search Side

☒ Left ☐ Right ☐ Reverse Path

Select base Plate

Settings

Processes Arc

Tool tWeldGun

Work Object obStn1

Tool Orientation Option

☒ Process Data XY: 45 , 0

☐ Search Center of Seam

☐ Search All Ref-Frames

☐ Tool Spin in World

Tool Offset (mm)

7.00 2.00 5.00

Tool Orientation (XYS) -45 , 0 , -52

Test Path

Move Robot to Curve

Move along section: 38 % Speed

< [] > 5

☒ Prioritize Sign Axis 5

Cfx Cf1 Cf4 Axis5 Cf6

0 -1 : 0 + -1 *


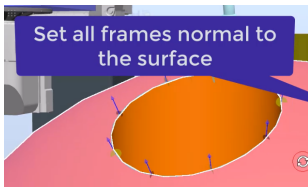
Create Process Path

Reset

Close

xx1900000817

Continues on next page

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.
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.
Tool Orientation	<p>This presents options to quickly align the robot with the desired tool orientation on the markup.</p> <p>If no option is selected, the present tool orientation will be used.</p> <ul style="list-style-type: none"> Process Data XY 45:0: Tool orients at 45 deg. on the seam with reference to the base plate. Uses the angle in the selected process. Search Center of Seam: Set tool to the center angle of the seam.  <p>xx1900001412</p> <ul style="list-style-type: none"> Search All Ref-Frames: Align all targets along the path with the object.  <p>xx1900001413</p> <ul style="list-style-type: none"> For the above options the tool orientation is maintained with respect to RCS. This can be visualized together with Move Along Section option. Tool Spin in World: Keeps the tool spin reference to the world.
Tool Offset	Adjust the robot tool with reference to the seam.
Tool Orientation	Adjust the tool orientation with reference to the seam.
Test Path	Move Robot to Curve: This option moves the robot to the selected position on the markup curve.
Move Along Section	In this option you can move the robot along the markup, using forward, backward and pause button. You can also adjust the speed of the robot movement.
Select Configuration	Change the robot configuration.
Reset	Select markup again to restart the process.
Create Process Path	Creates instructions based on the selected template.

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4 Arc Welding Functions

4.5 Adding the Process Path

Continued

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.

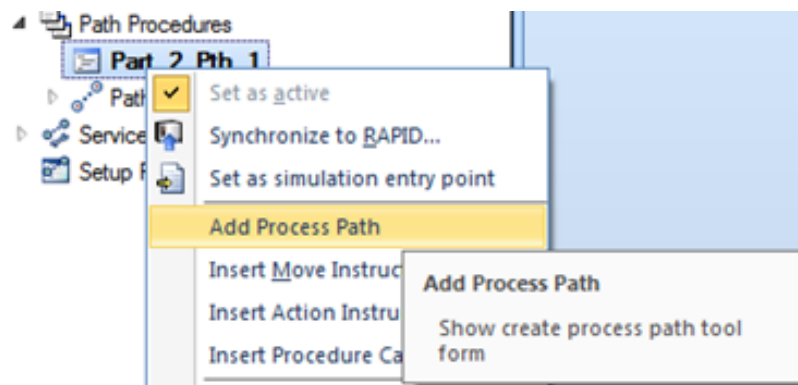
Use the following procedure to create a process path:

- 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.



Note

Make sure that the **Show markup** in **Label Manager** in ribbon is checked in.

The **Show markup** displays the label of the selected markup.

The labels indicates the process section creation on the selected markup by two colors:

- No color: No process section been created from the selected markup.
- Green: Process section been created from the selected markup.

Continues on next page

- 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 Use **Tool Offset** option to set the robot tool position.

- 7 Set the Tool Orientation.

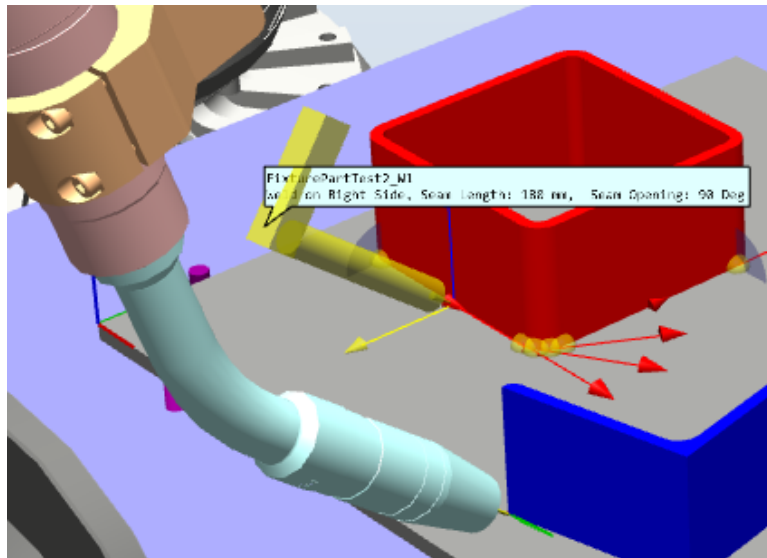
Choose from the **Tool Orientation** options and the sliders together with the **Move Along Section** option, to find the suitable combination.

You can modify the tool indicator orientation as required using the sliders.

- 8 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.



xx1800003149



Note

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

- Use forward or backward button to move the robot along the markup curve to confirm its reach. If not reachable, the robot will not move.

- 9 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.

Continues on next page

4 Arc Welding Functions

4.5 Adding the Process Path

Continued

10 Click on **Create Process Path** option.



Note

The label of the markup turns green color, once the markup and process section are mapped.

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 a all the markup selection and allows to start from beginning.

4.6 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

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Continues on next page

4 Arc Welding Functions

4.6 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 39](#).
- 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

4.7 Move To

4.7 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.

4.8 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.

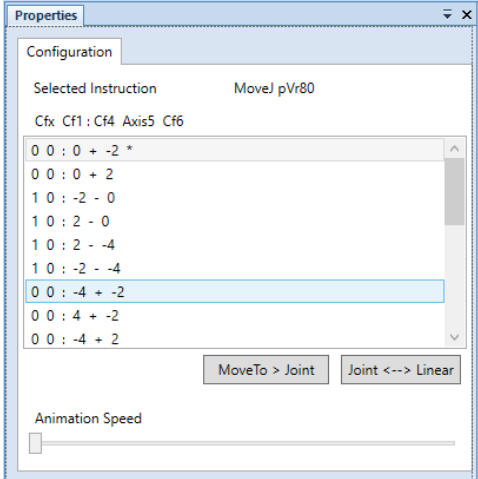
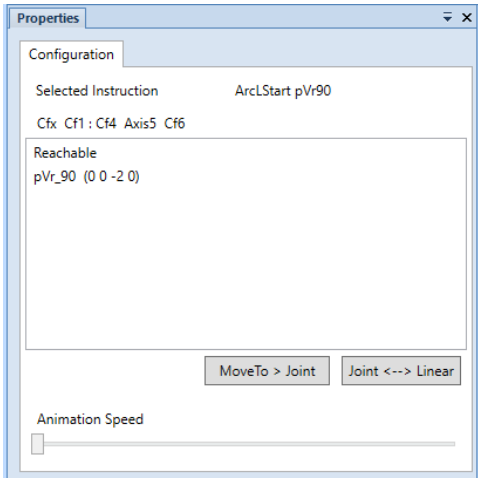
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4 Arc Welding Functions

4.8 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.

4.9 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

4.10 Sync and Play

4.10 Sync and Play

Introduction

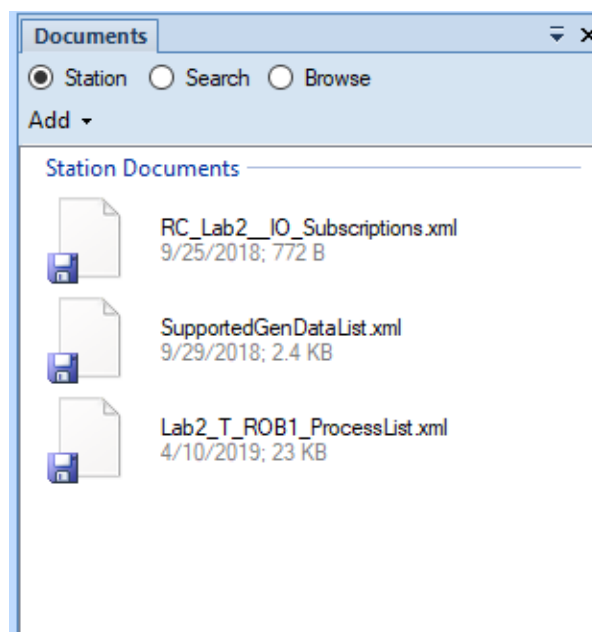
For the selected process path shall be synced to RAPID with updated references and start simulation automatically.

4.11 Manage Templates

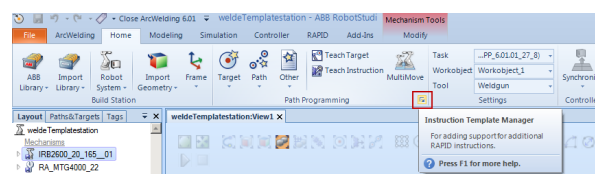
Overview

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

4.11 Manage Templates

Continued

Process templates

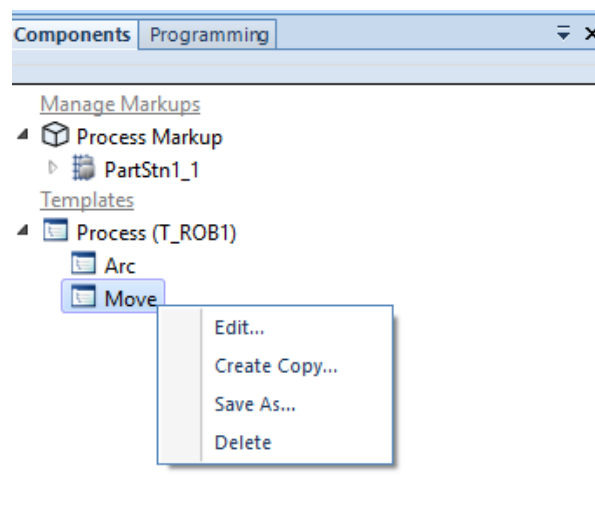


WARNING

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.

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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>

Continues on next page

4 Arc Welding Functions

4.11 Manage Templates

Continued

Section	Description
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>

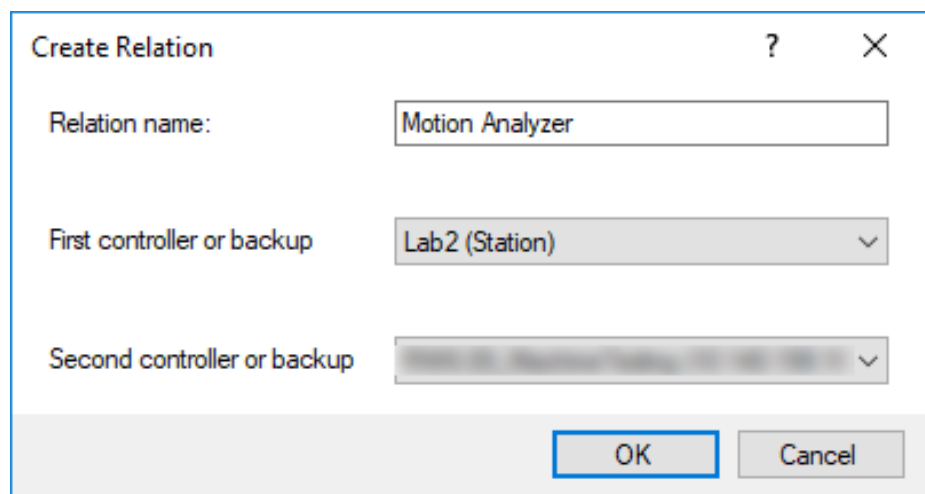
5 Motion Analyzer

Overview

This option is used to mirror a real robot motion on to a virtual robot in a RobotStudio station for online monitoring with support for analyzing events and robot control.

Prerequisites:

- The RobotStudio station matches the real robot cell with robots, eaz, positioners, and workpieces.
- A relationship is created between the real and virtual robot controllers, when both are available.



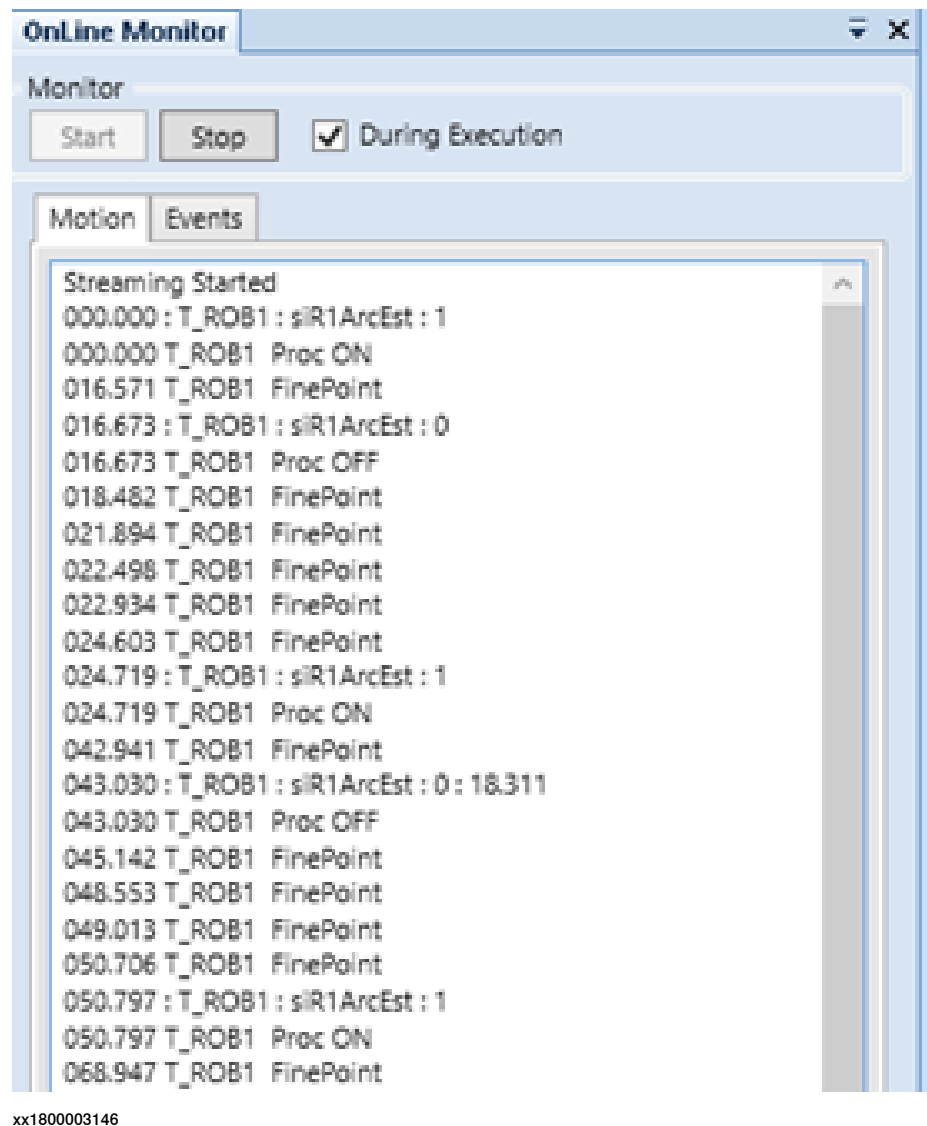
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To mirror a real robot motion on to a virtual robot:

- 1 Select **Motion Analyzer** from the ribbon, The **Online Monitor** and **RC Control** windows are displayed.
- 2 The **Online Monitor** window as following options:

Option	Description
Start tracking	This reflects the real robot motion together with external axis and positioners. All the motion information is recorded for analysis purpose. The recording happens only when the robot is moving and only if the option During Execution is selected.
Stop tracking	This stops the online robot tracking activity and all the recorded information is analyzed and organized in the Motion and Events tab.
Motion tab	This displays a list of all recorded robot positions together with the target details. Navigating through this list will move the virtual robot along the recorded positions together with eaz and positioner.
Events tab	This displays a list of events which occurred along a recorded path (Ex: Signals). Selecting an event brings the robot to the position when the event occurred, together with eaz and positioner.

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3 RC Control:

Select an option to control the real robot with provision to view and take action on the real robot via TPU messages.

Workflow

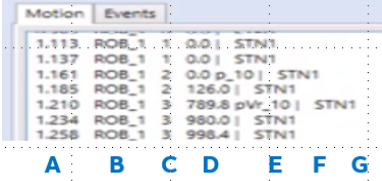
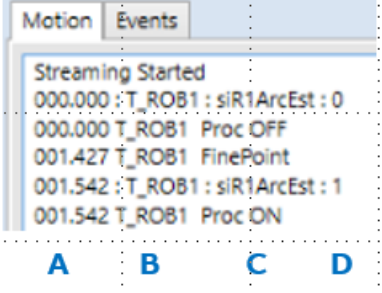
This function enables monitoring an On-line robot together with its matching digital twin as a RobotStudio station:

- 1 Create a RobotStudio Station with a **Layout** and **System** which matches the real cell.
- 2 Connect to the corresponding RC.
- 3 Define / Add signals to the RC which enable remote Robot operations. Sample configuration file is provided together with installer.
- 4 Confirm the signals that need to be monitored on the RC. The list of signals is maintained as a RobotStudio Station document (XML)
- 5 Map VC and RC using Create Relationship function.

Continues on next page

- 6 From AWPP ribbon tab, select **Motion Analyzer** option. This option prepares for monitoring the real robot via the virtual station.
- 7 The RC Control gives options to Start the execution of the robot program on real robot.
- 8 View and Respond to TPU messages
- 9 Monitoring
 - Start: The real robot movements are tracked and reflected in 3D view together with the IO events as they occur in the **Motion** tab.
 - Stop:
 - The motion positions are computed from the information buffer stream and listed in the **Motion** tab.
 - The IO events are grouped in the **Events** tab.
 - Investigate by stepping through the selected positions / events together with the virtual robot.

Online Monitor

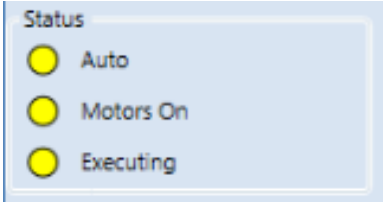

Options	Description
Start / Stop	Start / Stop recording the real robot motion and events. The information is recorded only when the real robot is moving
During Execution	When this option is selected, recording will automatically start together with the real robot program execution. No need to manually start for recording in this case. Click Stop to stop the program execution in between.
Motion  <p>xx1900001215</p>	Computes and lists the motion positions are recorded in the information stream of the RC. <ul style="list-style-type: none"> A Time Stamp B Task, Mech C Segment Number, Index One for each Instruction. D TCP Speed and Target Name for each New Segment. E Mechanism F Mechanism G Mechanism
Events  <p>xx1900001216</p>	Captures changes in subscribed IO Signals and Events. <ul style="list-style-type: none"> A Time stamp B Task C Signal / Event D Value

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5 Motion Analyzer

Continued

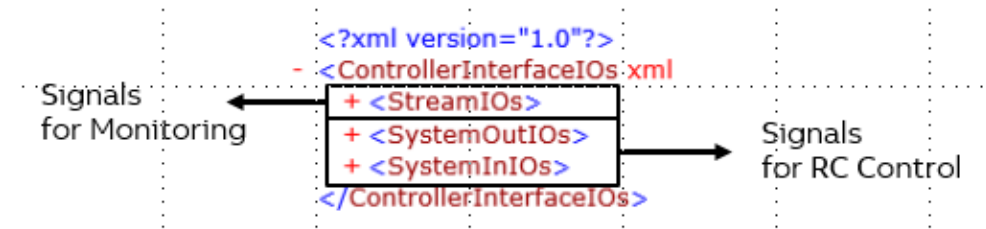
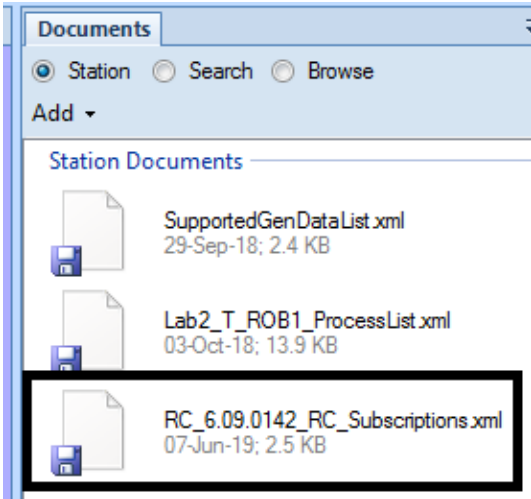
RC Control

Options	Description
Status Indicators  xx1900001217	Shows status of Controller for: <ul style="list-style-type: none">• Operating Mode• Motors state• Task state
Control  xx1900001218	Start from Main Starts program execution from "Main" for a single cycle. Start Main Cont Start Main Cont Starts program execution from the "Main" and runs the program continuously. Start Starts executing program from the position where the program pointer is set. Stop Stop the execution. Motors On / Off Used to turn on / off the Motors.

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IO Configuration

The signals to be monitored and enabling remote RC Control are defined in an XML which is created as a RobotStudio station document when Motion Analyzer option is activated.



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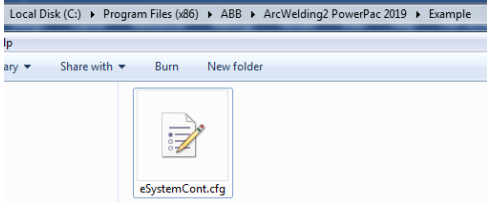
Options	Description
<p>Signals for monitoring</p> <pre>- <StreamIOs> - <StreamIO> <TaskName>T_ROB1</TaskName> <Name>soR1GasOn</Name> <Type>DO</Type> <ProcessOnSignal>>false</ProcessOnSignal> </StreamIO> - <StreamIO> <TaskName>T_ROB1</TaskName> <Name>soR1WeldOn</Name> <Type>DO</Type> <ProcessOnSignal>>false</ProcessOnSignal> </StreamIO> - <StreamIO> <TaskName>T_ROB1</TaskName> <Name>siR1ArcEst</Name> <Type>DI</Type> <ProcessOnSignal>>true</ProcessOnSignal> </StreamIO> </StreamIOs></pre>	<p>Configure the signals to be monitored.</p>

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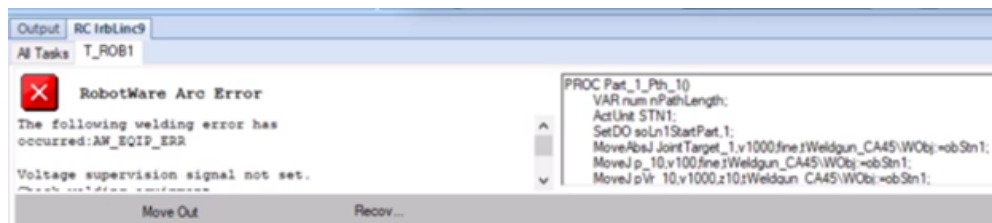
5 Motion Analyzer

Continued

Options	Description
<p>Signals for RC Control</p> <pre> - <SystemOutIO> - <SystemOutIO> <Status>MotorOn</Status> <Name>soMotorOnState</Name> <Type>DO</Type> </SystemOutIO> - <SystemOutIO> <Status>AutoOn</Status> <Name>soAutoOn</Name> <Type>DO</Type> </SystemOutIO> - <SystemOutIO> <Status>CycleOn</Status> <Name>soCycleOn</Name> <Type>DO</Type> </SystemOutIO> </SystemOutIO> - <SystemInIO> - <SystemInIO> <Action>MotorOn</Action> <Name>soMotorsOn</Name> <Type>DO</Type> </SystemInIO> - <SystemInIO> <Action>StartMain</Action> <Name>soStartAtMain</Name> <Type>DO</Type> </SystemInIO> </SystemInIO> </pre> <p>xx1900001222</p>	<p>Signals to be used for remote RC control. These signals need to be available on the Robot Controller. A sample configuration is provided together with the installer.</p>  <p>xx1900001221</p>

TPU Messages

It is possible for user to view and respond to TPU messages within AWPP 2 application in RobotStudio.



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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`.

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.

6 Searching with SmarTac

6.2 Importing Search Templates

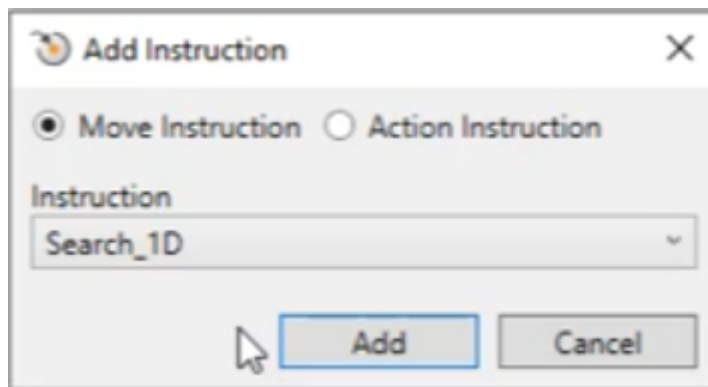
6.2 Importing Search Templates

Overview

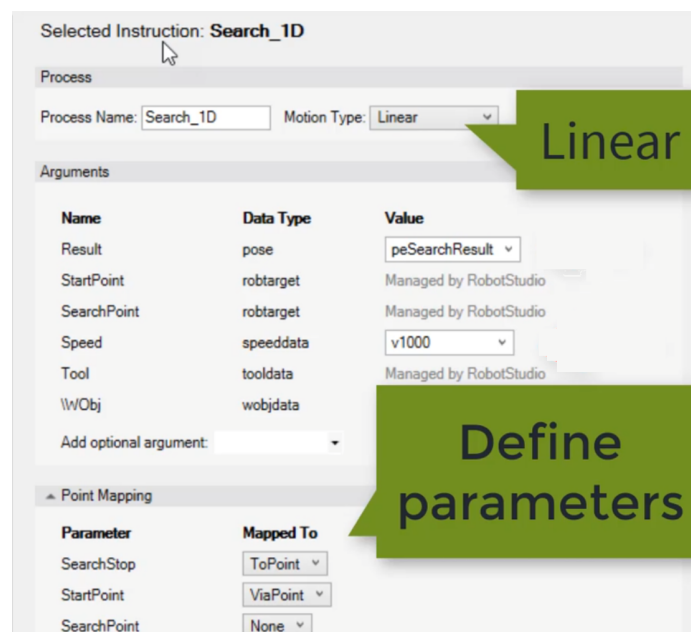
Importing search templates is a two-step procedure: first, motion instruction descriptions must be imported or created, then the search templates can be imported or created.

Import or Create Motion Instruction Descriptions

The search templates are based on one or several instructions. For example, the 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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6.3 Create Search Instruction

The Create Search Instruction Dialog Box

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

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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

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6 Searching with SmarTac

6.3 Create Search Instruction

Continued

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.

6.4 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.

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Section	Description
Select Tool	Displays the attached tool gun.

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6 Searching with SmarTac

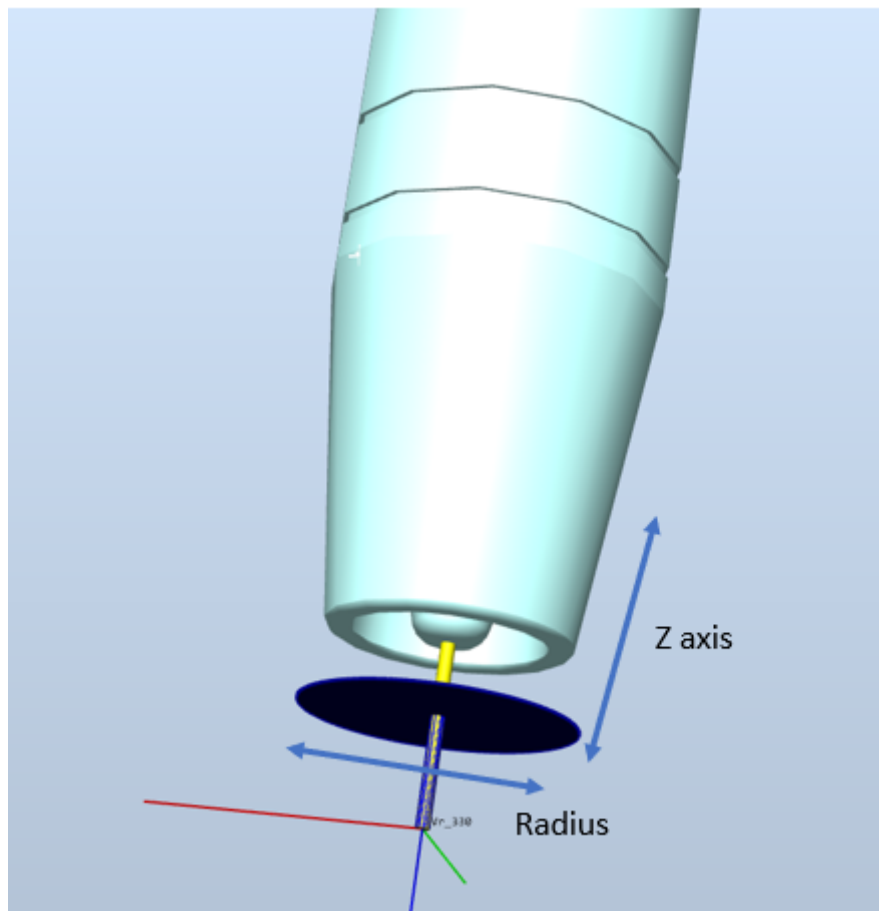
6.4 Tool Properties

Continued

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.

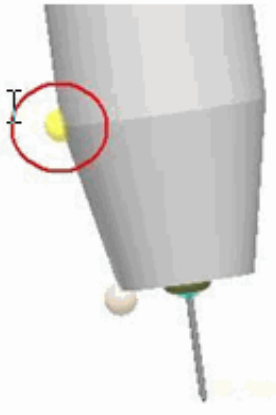
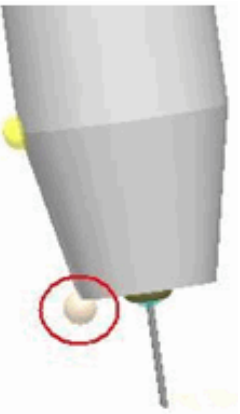
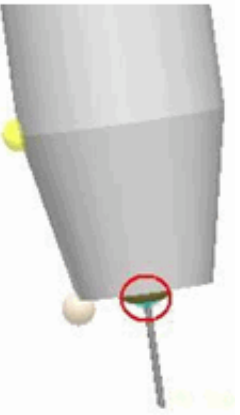
The following tool properties of the search.

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



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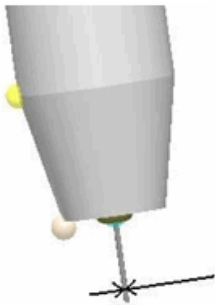
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Object	Description
Gas cup hit point  en1200000300	The point on the gas cup that will hit the searched feature when performing a GasCup search.
Bottom of gas cup  en1200000302	Indicates the bottom of the gas cup.
End of contact tip  en1200000304	Indicates the end of the contact tip. This information, along with the TCP information, is used to calculate the wire stick-out.

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6 Searching with SmarTac

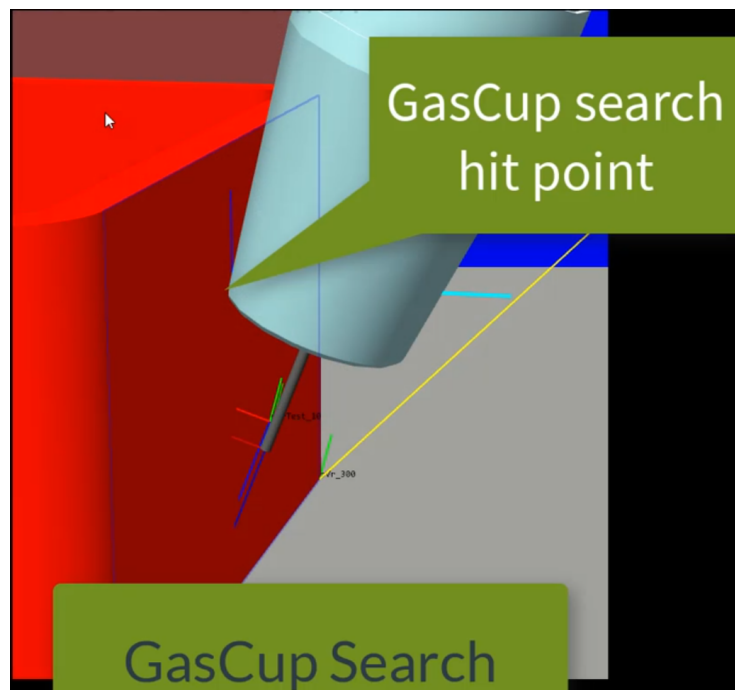
6.4 Tool Properties
Continued

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

6.5 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..

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7 Working with Arc Welding in VR

7.1 Overview

Introduction

Refer to RobotStudio document for more information on Virtual Reality.

Getting Started

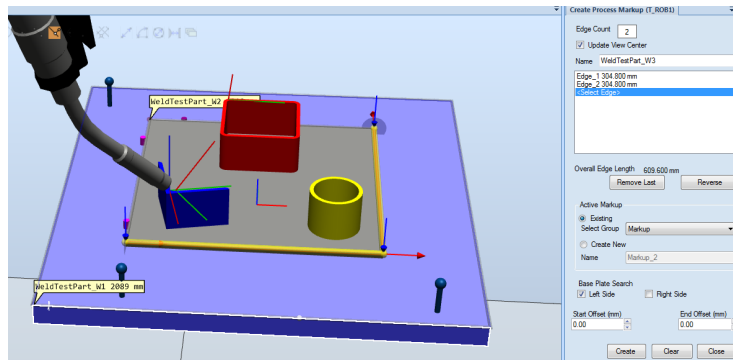
- Make sure that the complete hardware is connected and ready to use.



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



Note

The graphical window is made active for VR.

7 Working with Arc Welding in VR

7.2 Arc Welding VR Window

7.2 Arc Welding VR Window

Introduction

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



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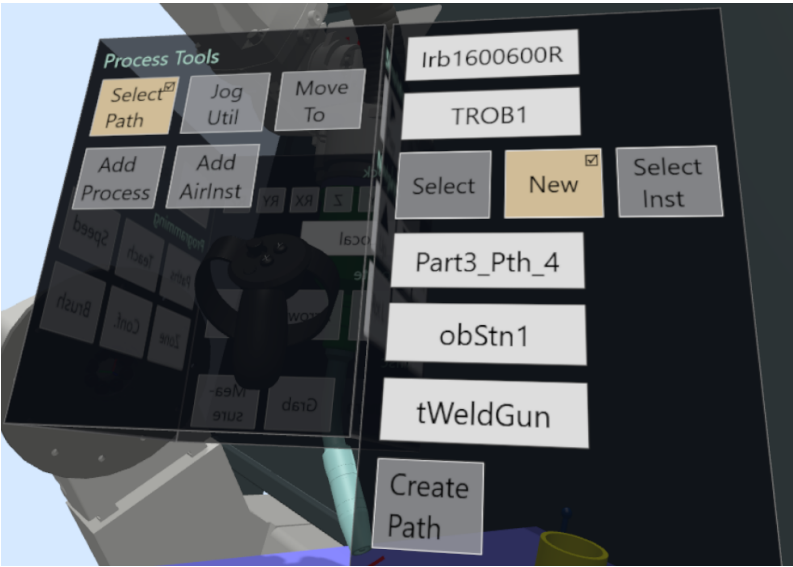
The following modes are displayed in the window:

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

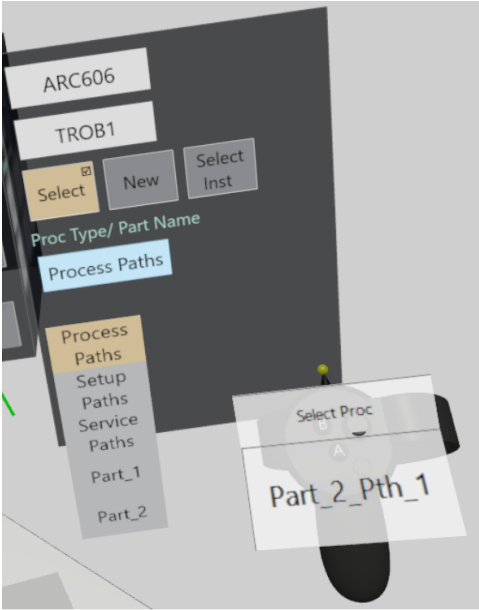
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Select Path Mode

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	To set the active task.
Select	<p>To select procedure type or part name in the selected task. The path procedures are listed in hand tool for the selected procedure type. Only the selected path is visible. The selected path is made as the active path.</p> 
New	Sets the active workobject, tool and new empty path is displayed.

xx1900001582

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7 Working with Arc Welding in VR

7.2 Arc Welding VR Window

Continued

Mode	Description
Select Inst	To select an instruction in the selected task for the path selected. The information for the selected instruction is displayed.
Create Path	To create an empty path with an ActUnit instruction.
Test Path	To verify the selected path. The selected path is the active path.

Use the following procedure for selecting and creating a path:

- Select **New** and click on **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.

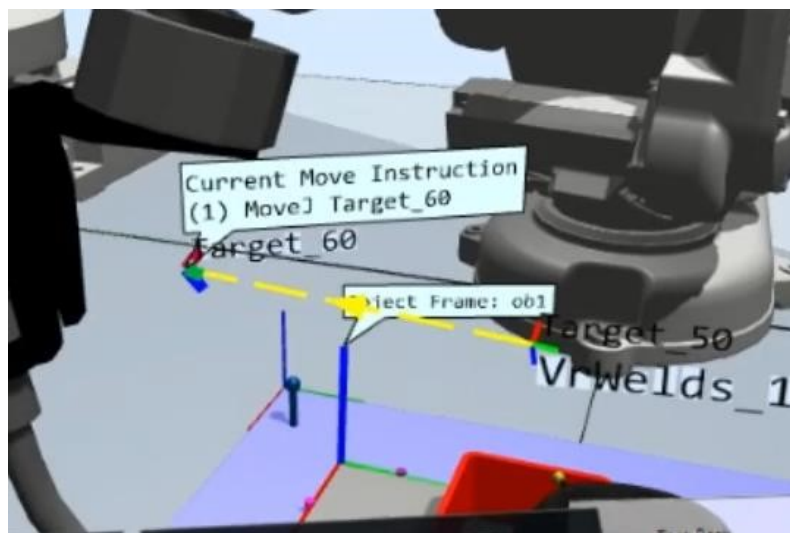


Note

Click on **Select** option, and select the path from the drop down.

- 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 made active.
- The **Test Path** option is used to verify the active path.

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).



xx1900000612

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Jog Utility Mode

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



xx1900000610

Mode	Description
Robot Name	To select the robot mechanism. The robot name is displayed.
Joint Jog	To move the Robot to an selected position by grabbing the axis and moving it or by the utility.
Select Config	To select the desired configuration. In select config, all possible configurations can be tested.
Robot Follows	The robot follows and aligns with the positioner movements for the coordinated systems.
Fine Tune	The robot performs fine movements while following the positioner.
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.
- Enable **Joint Jog** to modify each axis of the robot at a time.
- Mechanism is selected with a drop down.
- The absolute position of the axes are shown in joint jog mode.

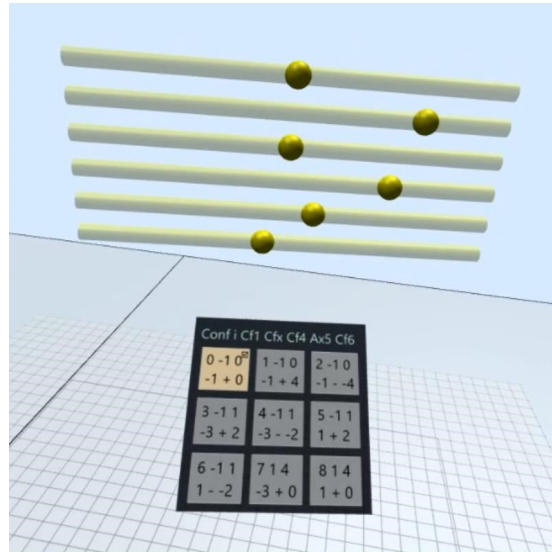
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7 Working with Arc Welding in VR

7.2 Arc Welding VR Window

Continued

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



xx1900000611

Move To Mode

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

Move To mode is used to move the robot along different segments.



Note

In **Move To** mode, robot can only be jogged when **Enable Jog** option is selected.

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



xx1900000603

Continues on next page

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.
Conv -> C	To convert the instructions from linear/joint to circular.
(>) Next button	The robot executes the next instruction.
(>I) Forward button	The robot moves to the next joint move instruction.
Enable Jog	When Enable Jog mode is enabled, robot can be jogged and instruction can be modified. Note: When this option is selected, robot cannot execute Move To operation.
ModPos	To modify the position of target of the selected instruction to the current TCP when Enable Jog is enabled.

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 **Show Config** mode, to change the configuration of robot.

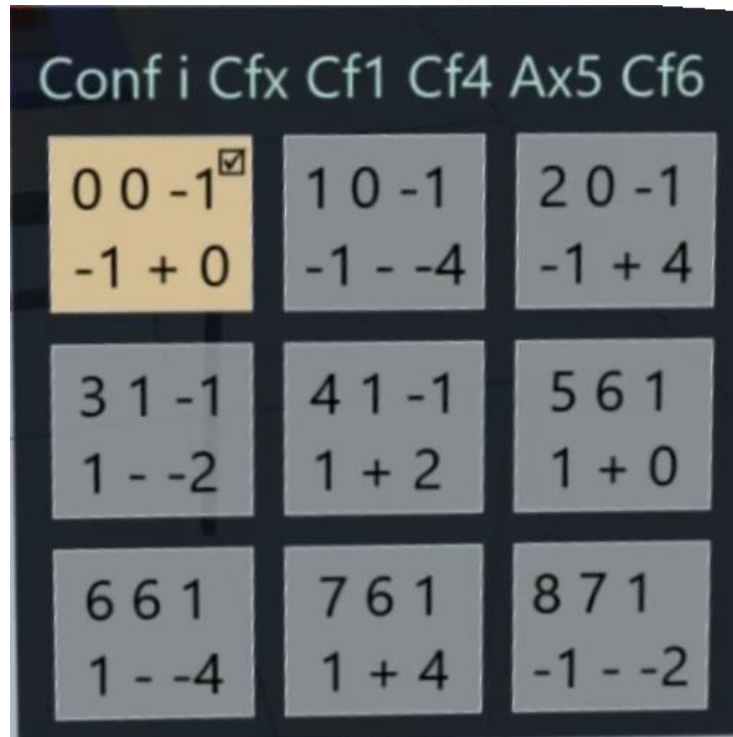
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7 Working with Arc Welding in VR

7.2 Arc Welding VR Window

Continued

The configuration pane window is displayed.



xx1900000604

- Check the movement of the robot by selecting the configuration for the selected instruction.



Note

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

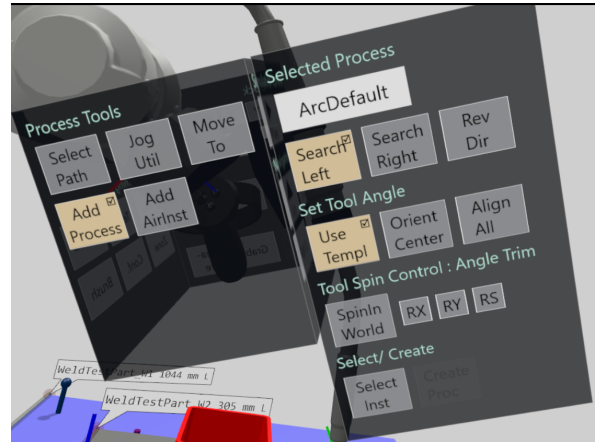
- To modify the position of the target of the selected instruction:
 - 1 Select an instruction and execute **Move To** for the selected instruction. Robot moves to the selected instruction.
 - 2 Click on **Enable Jog**, and jog the robot to the new position by grabbing the robot.
 - 3 Click on **ModPos**, the target is updated to the new position.

Continues on next page

Add Process

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

When the **Add Process** mode is selected, following window is displayed:



xx1900000605

Mode	Description
Search Left / Search Right	The side defines the side of an wire to search for the base plate.
Rev Direction	To reverse the wire direction
Use Templ	To select the process template.
Orient Center	Orient tool at center of path.
Align All	Align all RCS frames with object.
SpinIn World	Keep tool spin (tool x axis) relative to the World Coordinates.
Tool Angle Trim	Gives provision to modify the tool angle along XYS planes.
Select Inst	To select the instruction.
Create Proc	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 needs to be created. For more information see [To select the process markup on page 75](#)
- 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 76](#)
- 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, which indicates the 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.

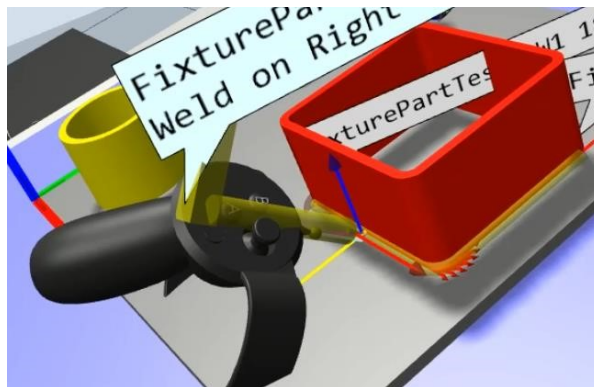
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7 Working with Arc Welding in VR

7.2 Arc Welding VR Window

Continued

- 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.

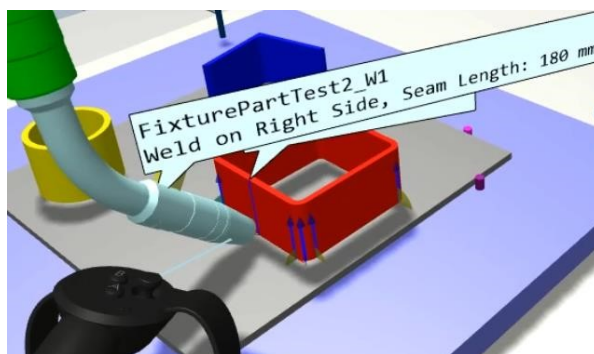


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To move the robot to selected markup

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

- Robot moves along the selected section by pressing the TRIGGER button 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 as the right controller angle is changed.
- A weld (process section) can be created by pressing the **Create Proc** option.



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Add AirInst

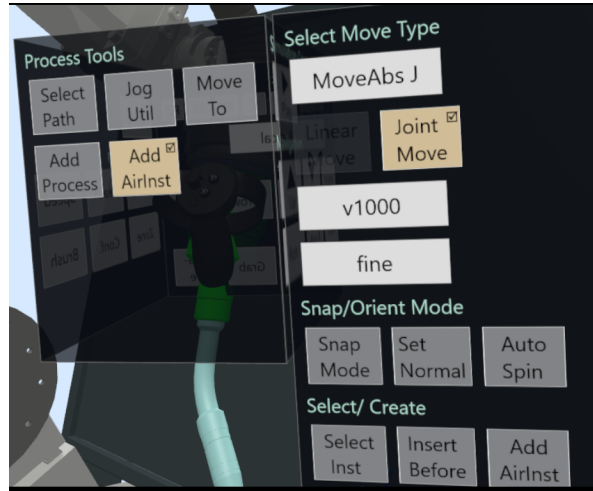
This is used to add air instruction before or after the selected instruction.

The instructions can be added by moving the robot to the desired location.

Location of new instruction can also be defined by selecting a surface on any object.

Continues on next page

When the **Add AirInst** mode is selected, following window is displayed:



xx1900000606

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 Mode	To snap to specific positions on the part.
Set Normal	The tool will be normal 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 AirInst	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 AirInst** button an air instruction will be added to the selected path.

7.3 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.
- 2 Click on **Create Path** option, to create an empty path.
Select the created path.
For more information, see [Select Path Mode on page 69](#).
- 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 Airlnst** mode to add the air instruction to the active path procedure.
For more information, see [Add Airlnst on page 76](#) 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 72](#) mode.



Note

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

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