ROBOTICS

Operating manual

ArcWelding2 PowerPac

Trace back information:
Workspace Main version a590
Checked in 2024-05-29
Skribenta version 5.5.019

Operating manual

ArcWelding2 PowerPac

RobotStudio 2024.2

Document ID: 3HAC071361-001

Revision: L

The information in this manual is subject to change without notice and should not be construed as a commitment by ABB. ABB assumes no responsibility for any errors that may appear in this manual.

Except as may be expressly stated anywhere in this manual, nothing herein shall be construed as any kind of guarantee or warranty by ABB for losses, damage to persons or property, fitness for a specific purpose or the like.

In no event shall ABB be liable for incidental or consequential damages arising from use of this manual and products described herein.

This manual and parts thereof must not be reproduced or copied without ABB's written permission.

Keep for future reference.

Additional copies of this manual may be obtained from ABB.

Original instructions.

Table of contents

Overview of the manual 7

1 Introduction and Installation 9

1.1 Introduction to ArcWelding2 PowerPac 9
1.2 Installing ArcWelding2 PowerPac 10
1.3 Accessing the User Interface 11
1.4 Concepts 13

2 Arc Welding ribbon 15

3 Arc Welding browsers 17

3.1 Overview 17
3.2 Components 18
3.3 Programming 19

4 Arc Welding functions 21

4.1 Overview 21
4.2 Create Process Markups 22
4.3 Split Markup 33
4.4 Properties - Process Markups 36
4.5 Manage Programs 38
4.6 Adding the Process Path 40
4.7 Optimize weld targets 46
4.8 Modify Special 50
4.9 Insert Air Moves 52
4.10 Insert Process Instructions 55
4.11 Move To 57
4.12 Properties - Instruction 58
4.13 Properties - Target 60
4.14 Sync and play 64
4.15 Manage Templates 65
4.16 Generic Station Data 74
4.17 MultiMove action instructions 78

5 Motion Analyzer 83

6 Searching with SmarTac 89

6.1 Overview 89
6.2 Importing Search Templates 90
6.3 Create Search Instruction 91
6.4 Tool Properties 93
6.5 Workflow 97

7 Working with Arc Welding in VR 99

7.1 Overview 99
7.2 Arc Welding VR Window 100
7.3 Creating the Path in VR 110

Index 111

This page is intentionally left blank

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 • 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 33* • Updated the section *Adding the Process Path on page 40* • Updated the section *Select Path Mode on page 101* • Updated the section *Add Process on page 107*
D	Updated for RobotStudio 2020.1 release • Update the section *Split Markup on page 33* Added content on Modify Start Position. • Updated the section *Create Process Markups on page 22*. • Updated the section *Manage Templates on page 65*. • Updated the section *Create Search Instruction*.
E	Updated for RobotStudio 2020.2 release • Updated the section *Programming on page 19* • Updated the section *Move To on page 57*

Continues on next page

Continued

Revision	Description
F	Updated for RobotStudio 2020.3 release • Updated the section *Create Process Markups on page 22* • Updated the section *Split Markup on page 33* • Updated the section *Create Process Markups on page 22*, *Split Markup on page 33*, *Properties - Process Markups on page 36*, and *Manage Templates on page 65*.
G	Updated for RobotStudio 2021.2 release • Added the section *Generic Station Data on page 74*. • Updated the section *Components on page 18*. • Add the section *Insert Process Instructions on page 55*.
H	Updated for RobotStudio 2021.4 release • Added the section *Adding MultiMove action instructions*. • Updated information about **Template Editor** in the section *Manage Templates*. • Updated information about **PDispOff** and **PDispSet** in the section *Create Search Instruction*.
J	Updated for RobotStudio 2022.2 release. Following is the update: • Added the section *MultiPane function on page 80*.
K	Updated for RobotStudio 2023.2 release. Following are the changes: • Added the section *Function on page 52*. • Updated the section *Adding the Process Path on page 40*. • Updated the section *Manage Programs on page 38*.
L	Updated for RobotStudio 2024.2 release. • Added the section *Optimize weld targets on page 46*. • Updated the section *Arc Welding ribbon on page 15*.

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

1.2 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.

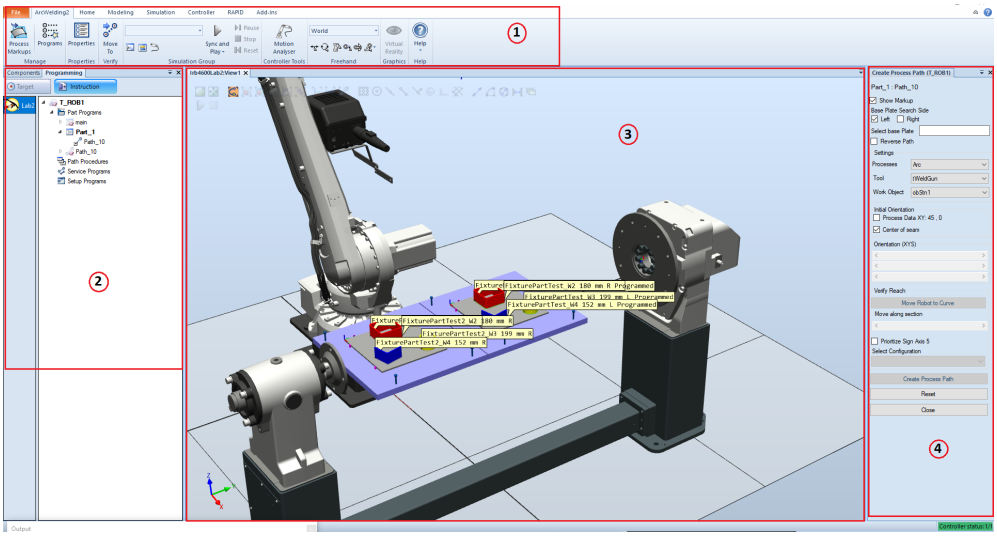
Loading a station

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.



xx1900000812

	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

	Item	Description
3	Graphics window	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. This coordination is especially useful when working with MultiMove systems. The graphics window is an important source to input geometry targets. By clicking on the part models in the window, you can create or modify a target in the geometry space.
4	Tool window	Enables you to create new instructions and modify existing instructions.

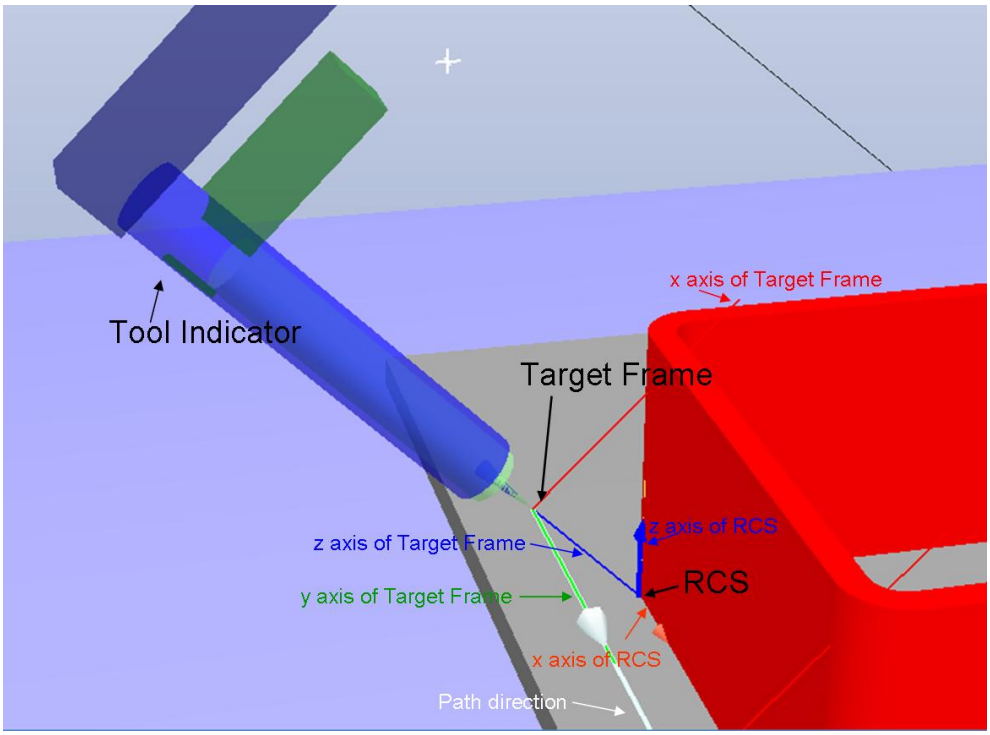
1.4 Concepts

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.



en1200000334

Process Markups

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

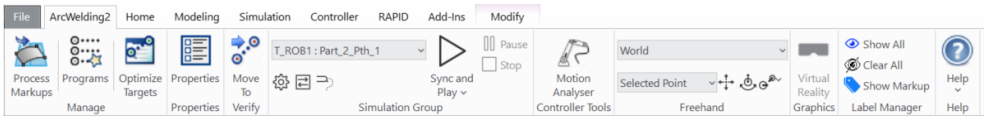
Welders can create or assign properties to the markups, which can be used by the programmers to set the weld speed, transport speed, process data, etc.

This page is intentionally left blank

2 Arc Welding ribbon

Overview

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



xx2400001201

Group	Button	Description
Manage	Process Markup	To create the markups by selecting the edges.
	Programs	To create programs for selected markups.
	Optimize Targets	Optimizes the orientation of the targets and creates smooth movements of the robot.
Properties	Properties	Displays properties of the selected objects.
Verify	Move To	Preview the Robot motion for the selected instructions
Simulation Group	Sync and Play	Sync to VC and execute the movement of the robots for the given instruction. 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. To sync and start the simulation, select a Part Program / Path procedure and choose Sync and play from the ribbon.
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	Provides the following information: • Contents, the help file • About ArcWelding2, version information

This page is intentionally left blank

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.

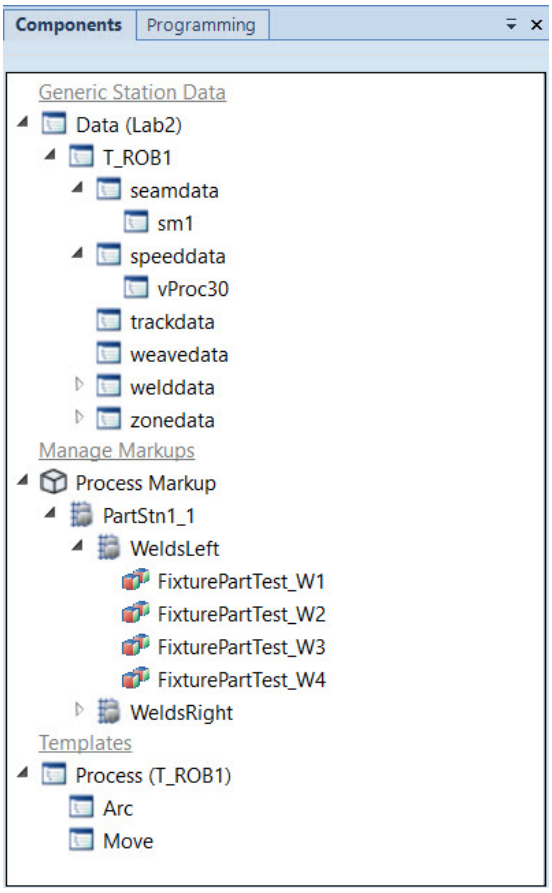
3.2 Components

Overview

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

The components browser lists the **Manage Markups**, **Templates**, and **Generic Station Data** in the station.

View	Description
Generic Station Data	Process templates data types can be viewed, configured, and instances of data types can be created/deleted.
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.



xx2100000069

3.3 Programming

Overview

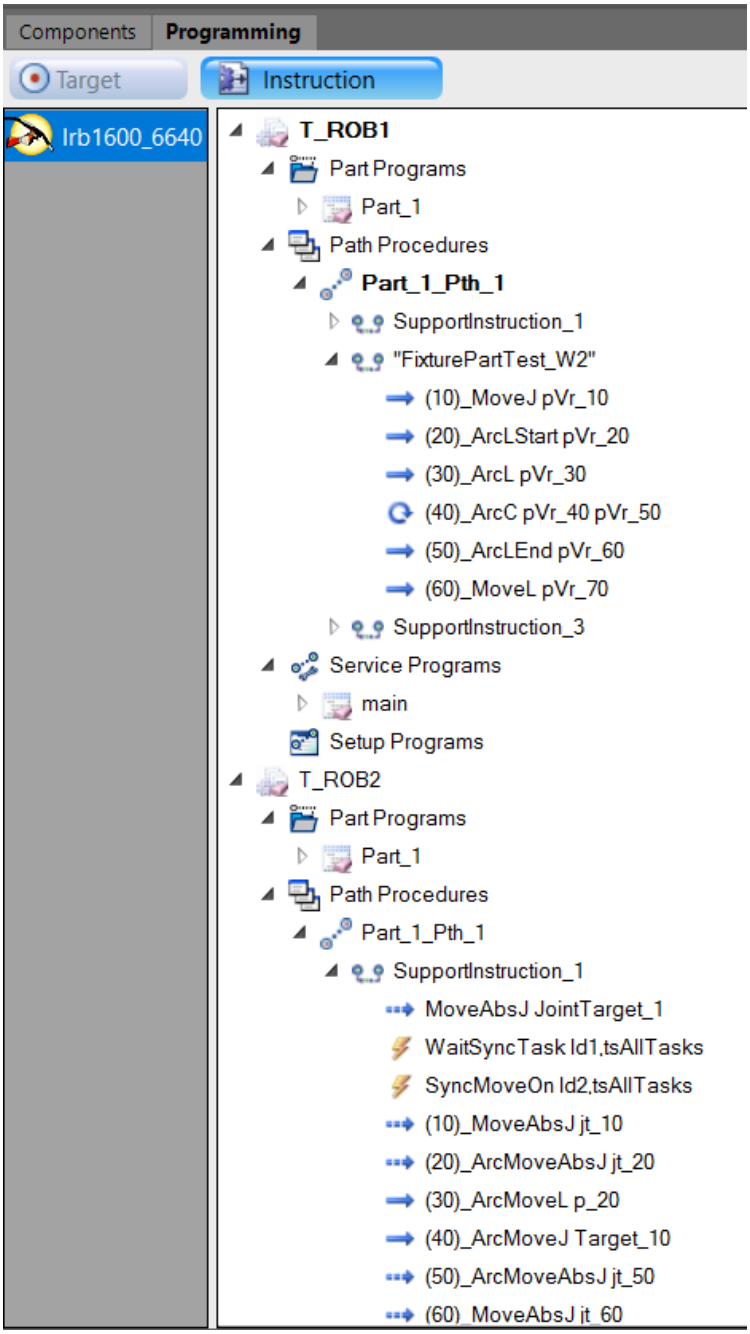
The programming browser tree organizes path procedures in the station under different groups and provides to change the view between Instruction and Target modes.

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. **Note** In case of MultiMove systems, IDs are displayed in the browser tree within (). This makes it easier to visualize which instructions are synchronized between tasks.
Services Programs	Procedures related to calibration, servicing etc.
Setup Programs	Procedures related to calibration, servicing etc.

Continues on next page

3.3 Programming
Continued



xx2000001767

4 Arc Welding functions

4.1 Overview

Introduction

This section describes the options within functions provided in AWPP.

- *Create Process Markups on page 22*
- *Split Markup on page 33*
- *Properties - Process Markups on page 36*
- *Manage Programs on page 38*
- *Adding the Process Path on page 40*
- *Modify Special on page 50*
- *Insert Air Moves on page 52*
- *Move To on page 57*
- *Properties - Instruction on page 58*
- *Properties - Target on page 60*
- *Sync and play on page 64*
- *Manage Templates on page 65*
- *Adding MultiMove Action Instructions*

4.2 Create Process Markups

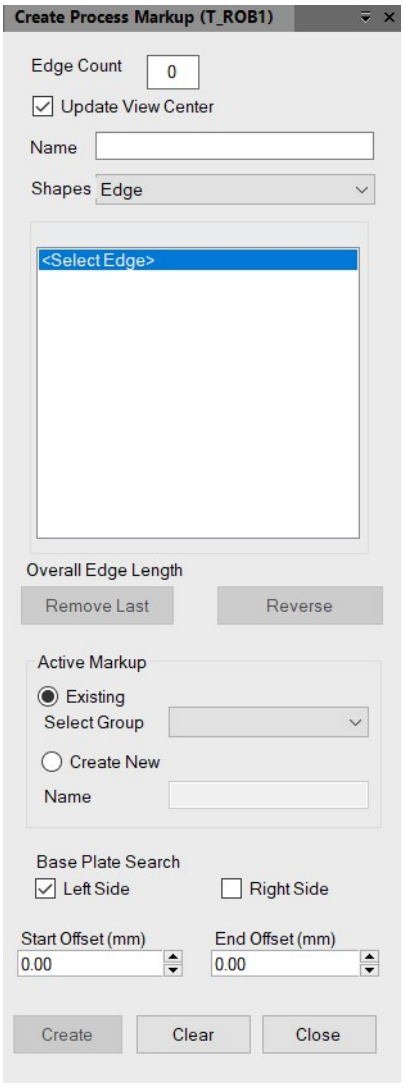
Overview

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.

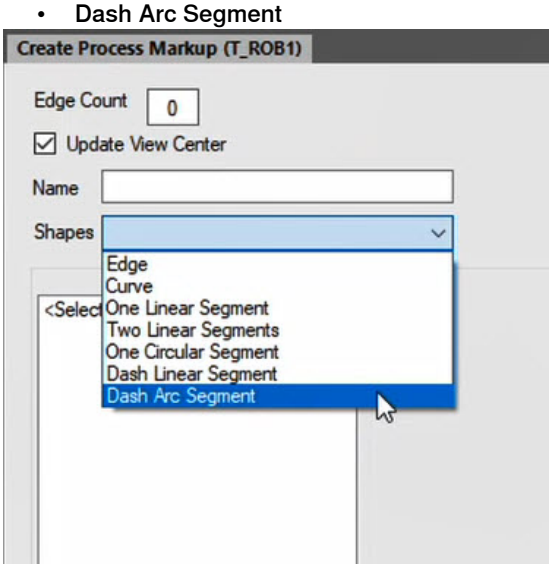
To view the window, select the **Process Markup** button from the ribbon, then the tool window option is displayed.

Function



xx1800002807

Continues on next page

Dialog Box Elements	Description
Edge Count	Displays the number of edges selected **Note** This function is available only for following shape options: • Edge • Curve
Update View Center	Brings selected edge to focus automatically, to help selecting the consecutive edge.
Name	Displays the name of the Markup
Shape	Displays the following shapes: • Edge • Curve • One Linear Segment • Two Linear Segment • Two Linear Segment (with radius corner) • One Circular Segment • Dash Linear Segment • Dash Arc Segment  xx2000001991
Overall Edge Length	Shows the total length of the selected edges. **Note** This function is available only for following shape options: • Edge • Curve
Remove Last button	Removes the last selected edge from the list. **Note** This function is available only for following shape options: • Edge • Curve

Continues on next page

Dialog Box Elements	Description
Reverse button	Reverses the sequence of the edges (changes the direction). **Note** This function is available only for following shape options: • Edge • Curve
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. **Note** This function is available only for following shape options: • Edge • Curve
End Offset	Distance from the End position of the Last edge where the markup shall end. **Note** This function is available only for following shape options: • Edge • Curve
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. Select the shape from the drop down. For more information see *Markup Template Shape on page 26*.

   If Edge/Curve is selected follow the below procedure:

   a For selecting Edge, click on **Select Edge** option.

   For selecting Curve, click on **Select Curve** option.

Continues on next page

b Select edges (curves) on the workpiece of the CAD model, where the process has 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.

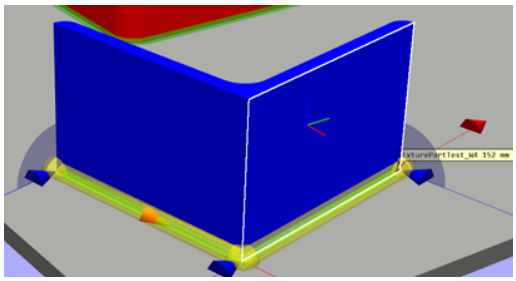
Following actions are carried:

- 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.



xx1800003145

4 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.

5 Select the relevant base plate from the **Base Plate Search** options.

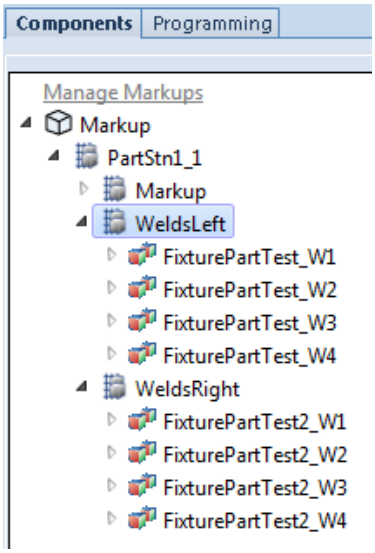
6 If required, markup curves start and end point can be changed from **Start Offset** and **End Offset** option.

7 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.

Continues on next page



xx1800003144

Markup Template Shape

Introduction

When the markup template shape is selected, the Data Input option list is displayed as per the template selected. Click the part where you want to start. Use the selection levels and the snap modes toolbars in RobotStudio to snap the cursor of chosen position. The XYZ coordinates of the chosen position will be entered in the Weld Start box. A spherical yellow marker indicates the chosen position in the graphics window.

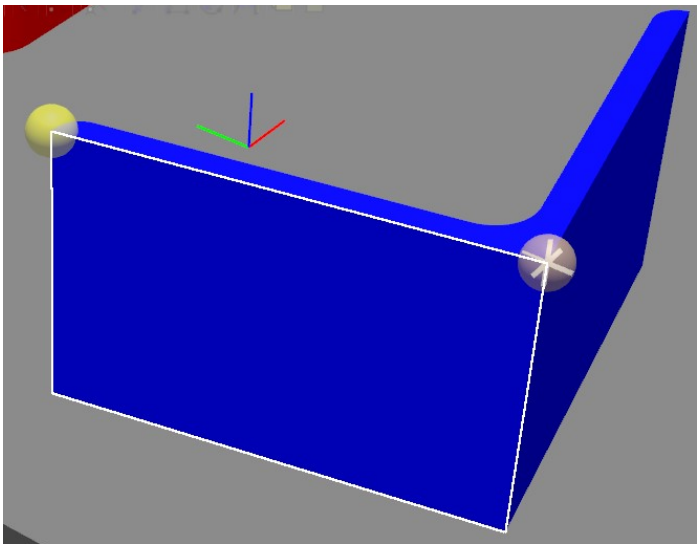
Note

The arrow head is highlighted in black to the right of the Data Input option, indicates which option is selected.

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

Continues on next page

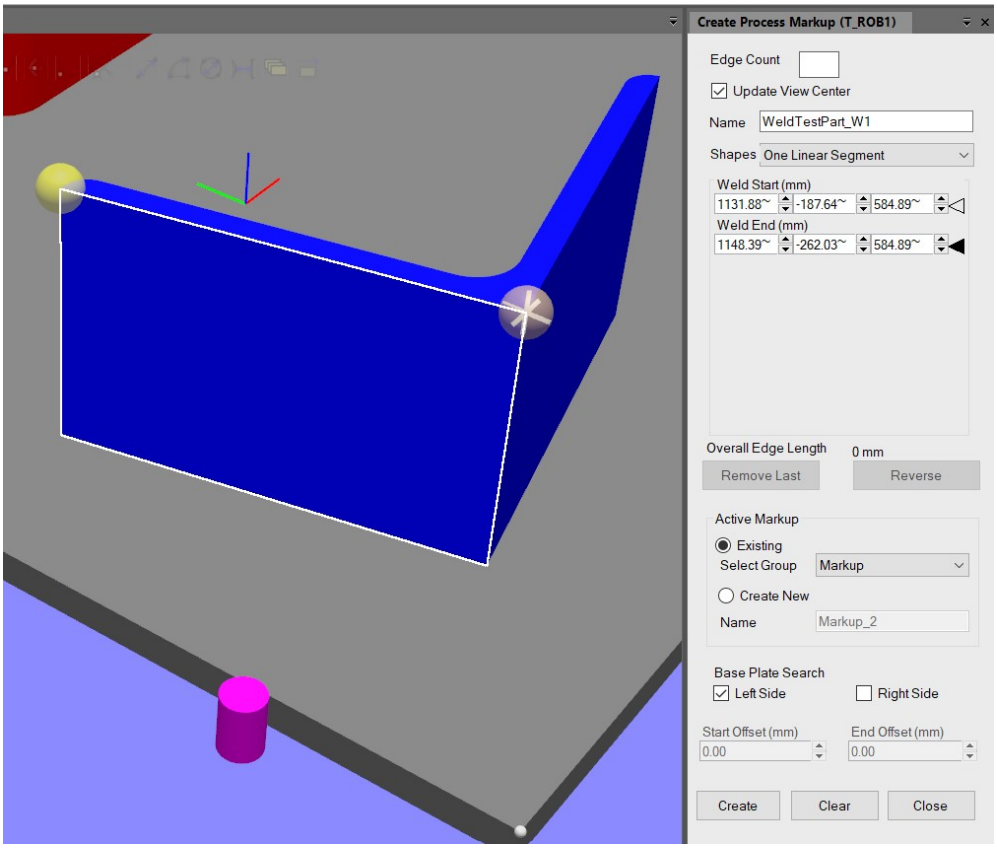
Click **Create** to generate the markup.



xx2000000527

One Linear Segment

The **One Linear Segment** template comprises of **Weld Start** and **Weld End**.



xx2000000524

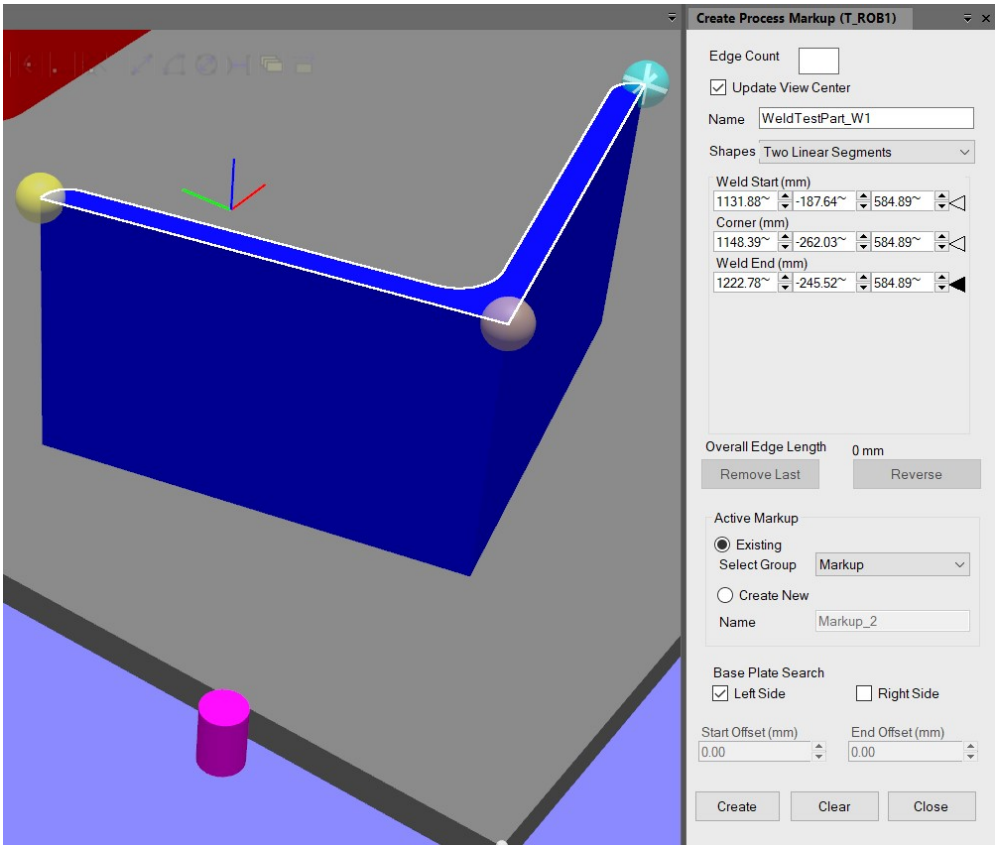
Continues on next page

4.2 Create Process Markups

Continued

Two Linear Segments

The **Two Linear Segments** template comprises of **Weld Start**, **Corner**, and **Weld End.**

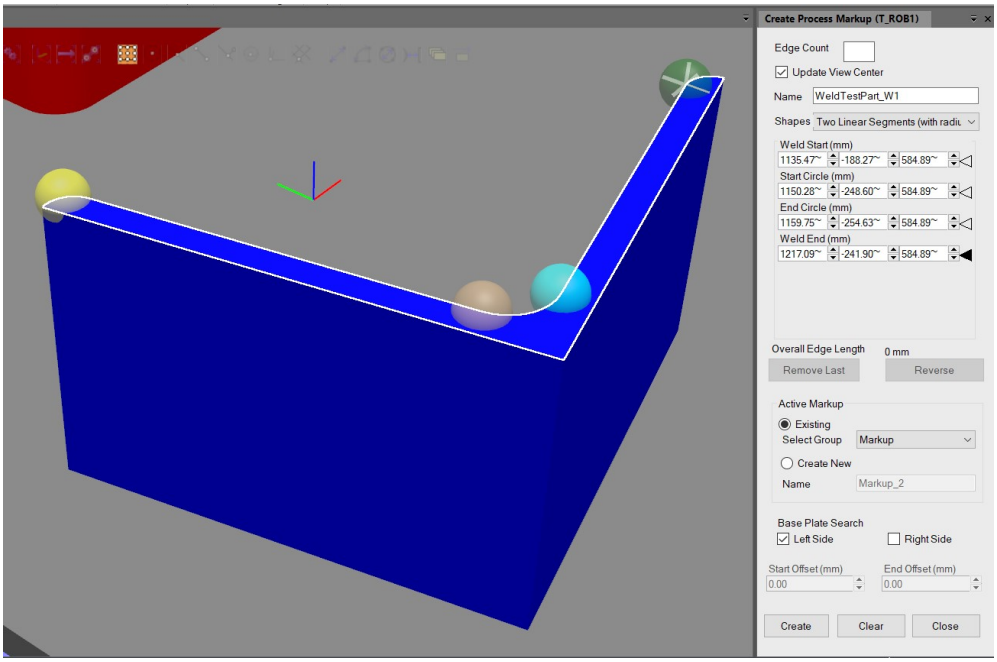


xx2000000526

Continues on next page

Two Linear Segments (with radius corner)

The **Two Linear Segments with a Corner** template comprises of **Weld Start**, **Start Circle**, **End Circle**, and **Weld End**.

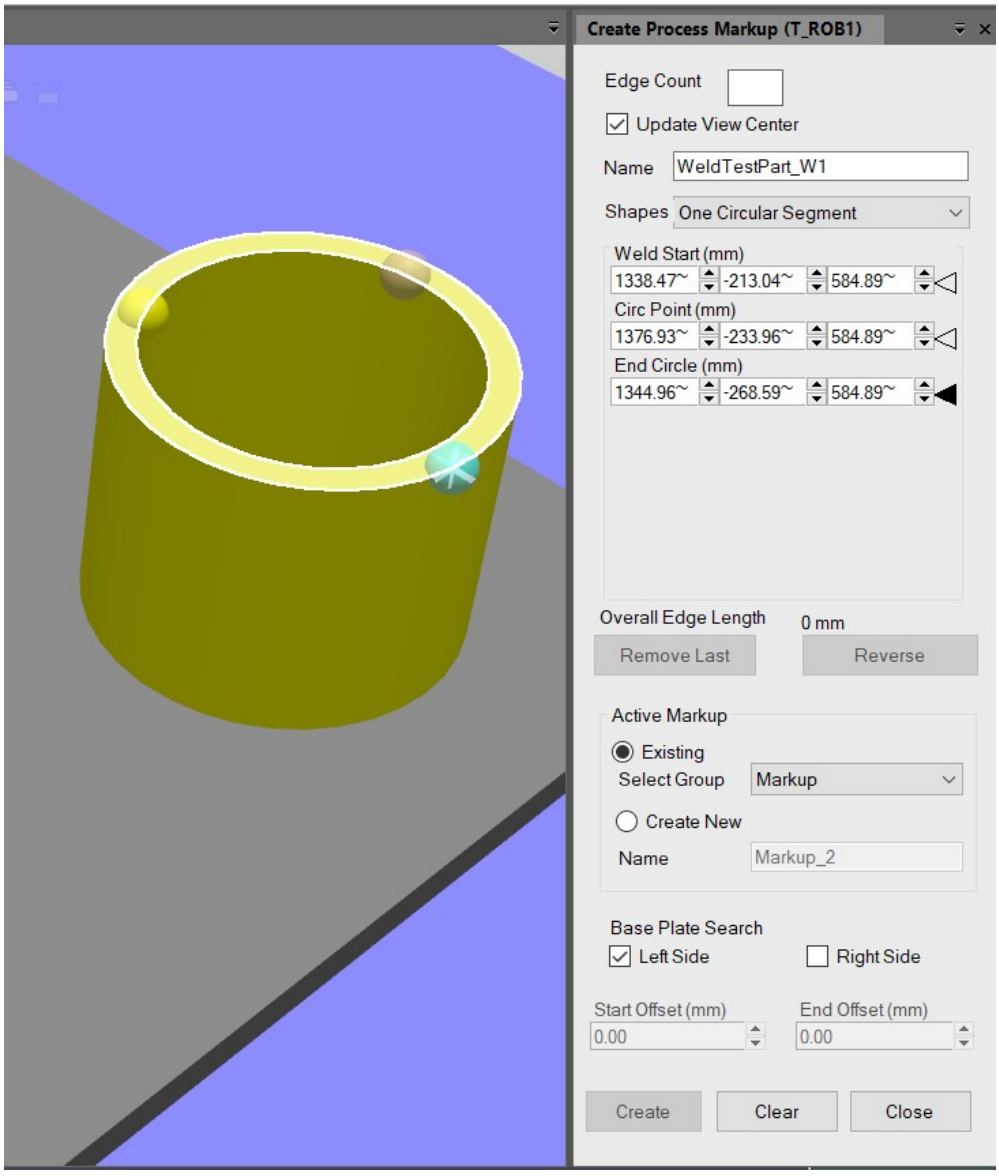


xx2000000525

Continues on next page

One Circular Segment

The **One Circular Segment** template comprises of **Weld Start, Circ Point,** and **End Circle.**



xx2000000523

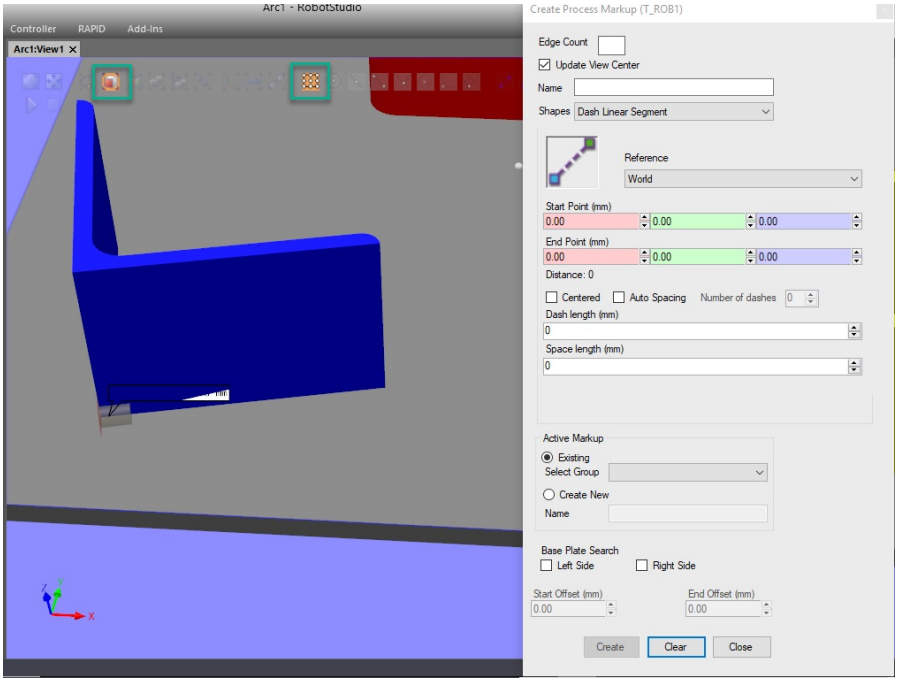
Dash Linear Segment

The **Dash Linear Segment** template comprises of the following :

- **Start Point**: Set the start point of Weld process
- **End Point**: Set the end point of Weld process
- **Centered**: Select **Centered** to align each dash/segment of Y and Z axis with respect to first and last point of dash/segment
- **Auto Spacing**: Select **Auto Spacing** and provide the values for **Number of dashes** and **Dash length**. The option **Centered** is selected by default.
- **Number of dashes**: Set the number of dashes/segments

Continues on next page

- **Dash length** : Set the length of each dash/segment
- **Space length**: Set the space between dash/segment



xx2000002073

Note

First select **Surface Selection** and **Snap Object** from the selection level bar.

Dash Arc Segment

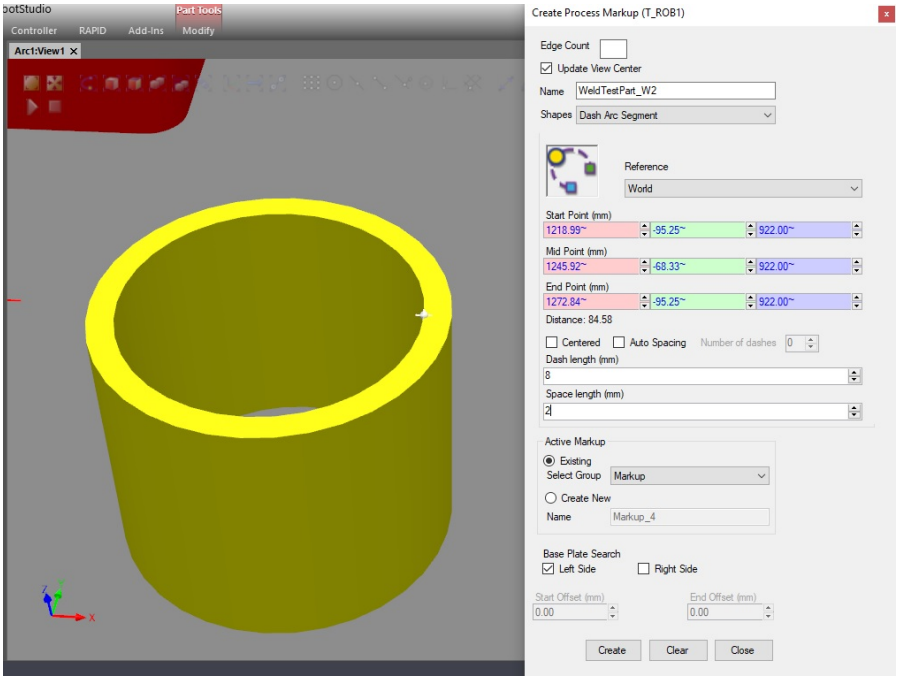
The **Dash Arc Segment** template comprises of the following :

- **Start Point**:Set the start point of Weld process
- **Mid Point** : Set the mid point of Weld process
- **End Point**: Set the end point of Weld process
- **Centered**: Select **Centered** to align each dash/segment of Y and Z axis with respect to first and last point of dash/segment
- **Auto Spacing**: Select **Auto Spacing** and provide the values for **Number of dashes** and **Dash length**. The option **Centered** is selected by default.
- **Number of dashes**: Set the number of dashes/segments
- **Dash length** : Set the length of each dash/segment
- **Space length** : Set the space between dash/segment

Continues on next page

4.2 Create Process Markups

Continued



xx2000002074

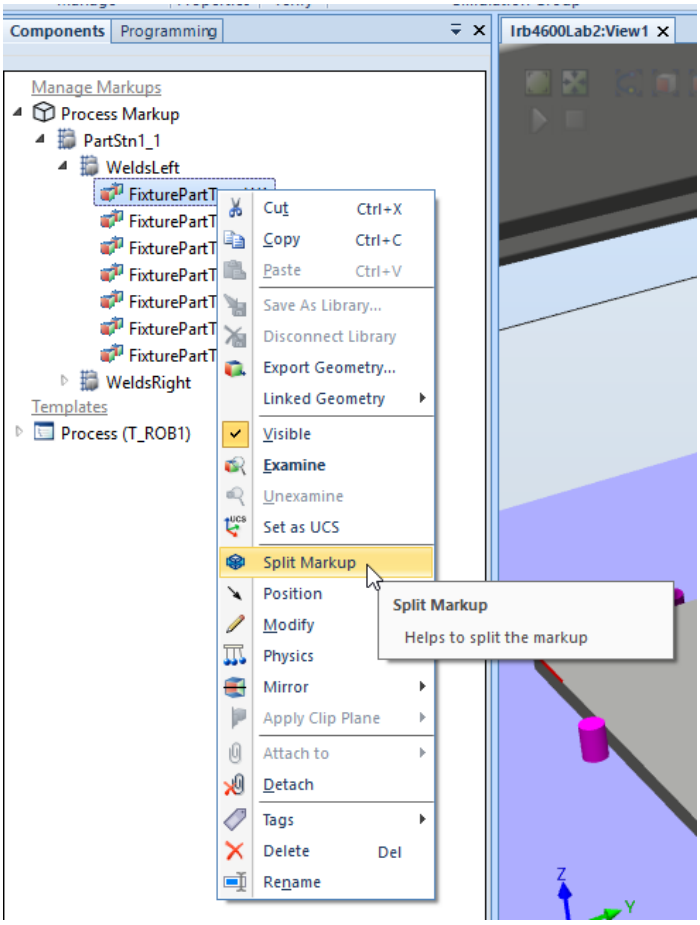
4.3 Split Markup

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.

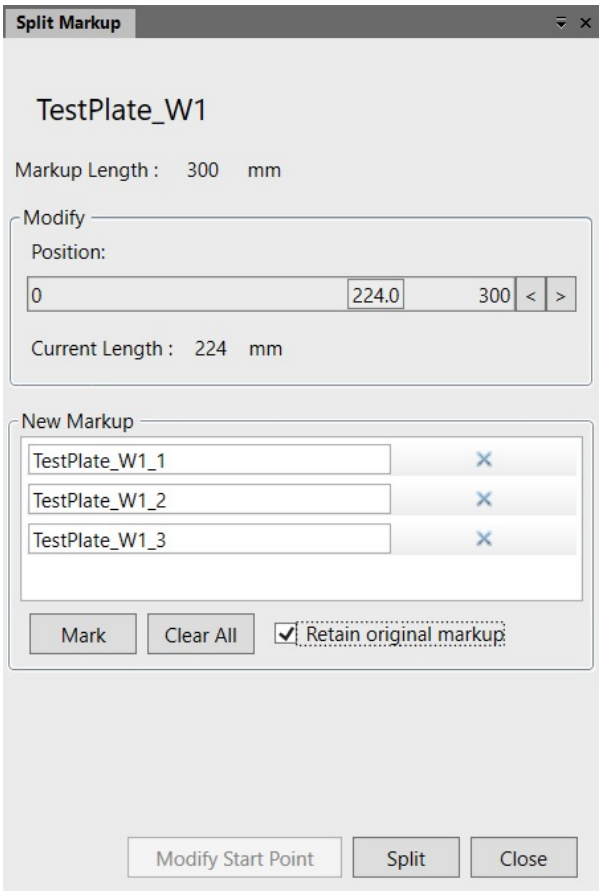
The **Split Markup** window is displayed.



xx1900001444

Continues on next page

Function



xx2000001866

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.
Retain original markup	Retains the original markup after the split operation.
Modify Start Point	You can modify the start point of the markup.
Split	Creates the new split markups for the selected process markup.
Close	Closes the **Split Markup** window.

Creating Split Markup

Use the following procedure to create the split markup:

1. Click **Components** tab.
2. Select and right click process markup.

Continues on next page

3 Select the **Split Markup** option.

The **Split Markup** window is displayed.

4 Click the **Modify Start Point** button and move the slider in **Position** option to modify the start point of the markup.

The start point is modified to the selected position in the markup.

> **Note**
>
> The modify start point is enabled only for closed markups.

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

Once the 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.

6 Click the **Mark** button to mark the split position.

A new pointer is created and list of all marked split markup are displayed in **New Markup** option.

> **Note**
>
> - If required, the marked split markup names can be edited.

> **Note**
>
> Select **Retain original markup** check box to retain the original markup. By doing so, you can go back and adjust the mark up split values, if required.

7 Click the **Split** button to create the split markup.

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

4.4 Properties - Process Markups

Overview

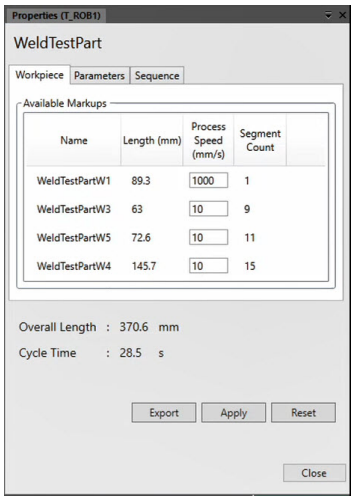
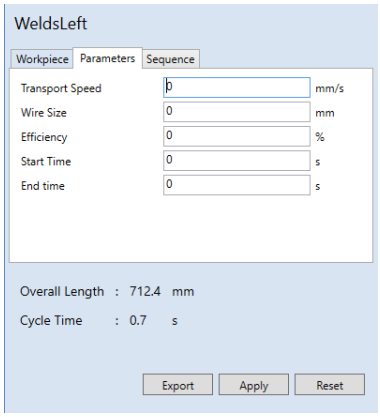
In Component markup properties, you can view all the parameters related to the markups created.

To view the component markup properties follow the below steps:

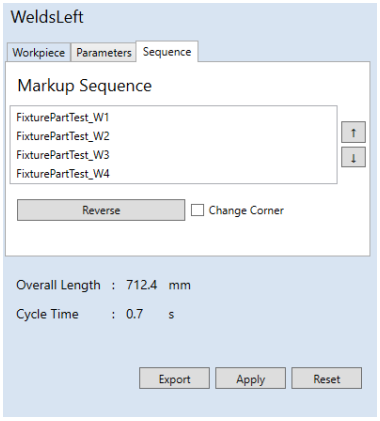
1. Select the **Component** tab in the browser window.
2. Under **Process Markup**, select the Process markup path.
3. Click on **Properties** button from the ribbon window.

   The tool window option is displayed in separate window.

The properties are displayed in three tabs.

Tabs	Description	Figures
Workpiece	Shows the Markup Length, their respective Process Speed and Segment count. These are used to compute the cycle time. **Note** Segment count cannot be edited, it shows the number of segments created for a WeldTestPart. Export: It exports all markup properties to a csv format.	 xx2000001992
Parameters	Used to set the welding parameters for a workpiece.	 xx1900000815

Continues on next page

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

4.5 Manage Programs

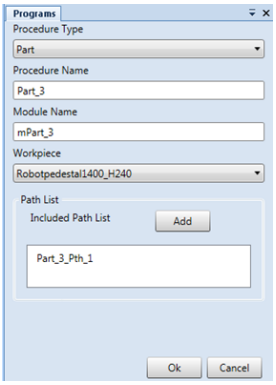
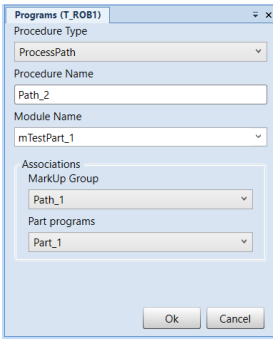
Overview

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.

> **Note**
>
> If process path is added to a part program, while synchronizing to RAPID make sure to include path procedure of the same part.

4.6 Adding the Process Path

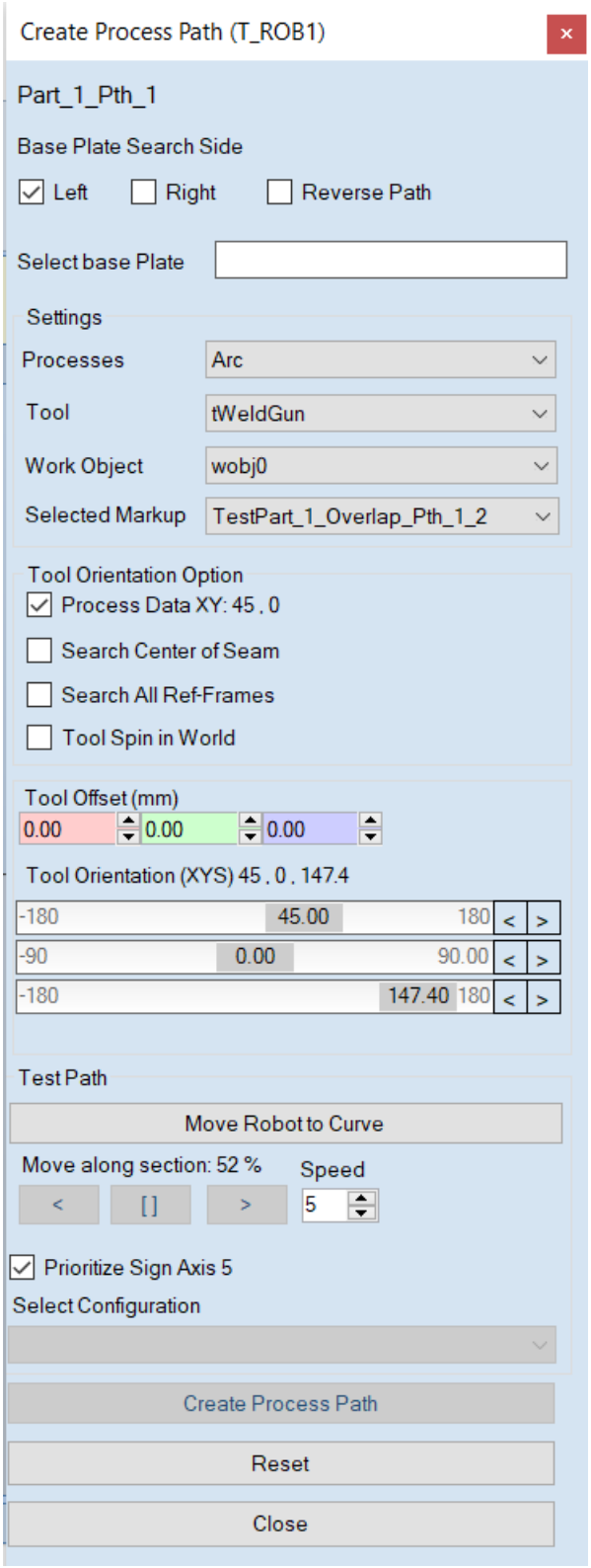
Overview

Add weld instructions under Process Path for Markups. In this process, robot is brought close to the markups and its 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

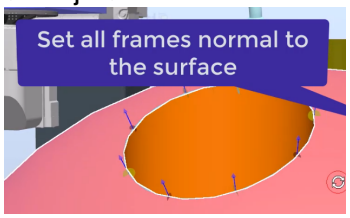
Function

The following table describes the information Create Process Path window:



xx1900000817

Continues on next page

Dialog Box Elements	Description
	The name of the markup group associated with the path procedure is displayed on the create process path window. The corresponding markup group label is highlighted in the graphical window.
Base Plate Search Side	Set the direction to search for the base plate for the selected markup in graphics.
Reverse Path	Reverses the path direction indicator.
Select base Plate	Used for selecting the Base plate manually.
Settings	**Processes**: Select the desired process template.
	Tool: Select the desired tool.
	Work Object: Select the desired workobject.
	Selected Markup: The Markup selected from a set of overlapped markups.
Tool Orientation Option	This section presents the options to quickly align the robot with the desired tool orientation on the markup. If no option is selected, the present tool orientation will be used.
	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.  xx1900001412
	Search All Ref-Frames: Align all targets along the path with the object.  xx1900001413 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	Adjusts the robot tool with reference to the seam.
Tool Orientation	Adjusts 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.

Continues on next page

Dialog Box Elements	Description
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

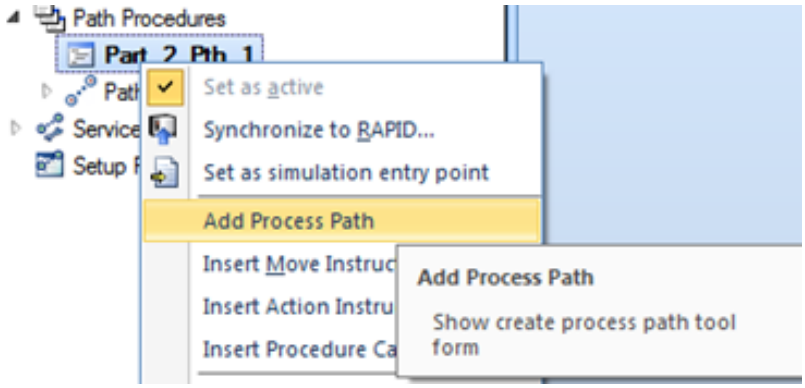
This function provides to create instructions for selected process markups from graphics window. This can be accessed from the Active Process Path procedure context menu.

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.



xx1800003141

Note

While adding a new Process Path, markups (that belongs to the associated MarkupGoups) associated with the path are highlighted.

Note

If a markup that does not belongs to the associated MarkupGroup is selected, notification bar is updated with the information for further process.

Continues on next page

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.

5 Select the markup in graphics (selection level Curve).

> **Note**
>
> Select the desired markup from the **Selected Markup** list and again make the selection in graphics for process path creation.

> **Note**
>
> A tool indicator is displayed a 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.

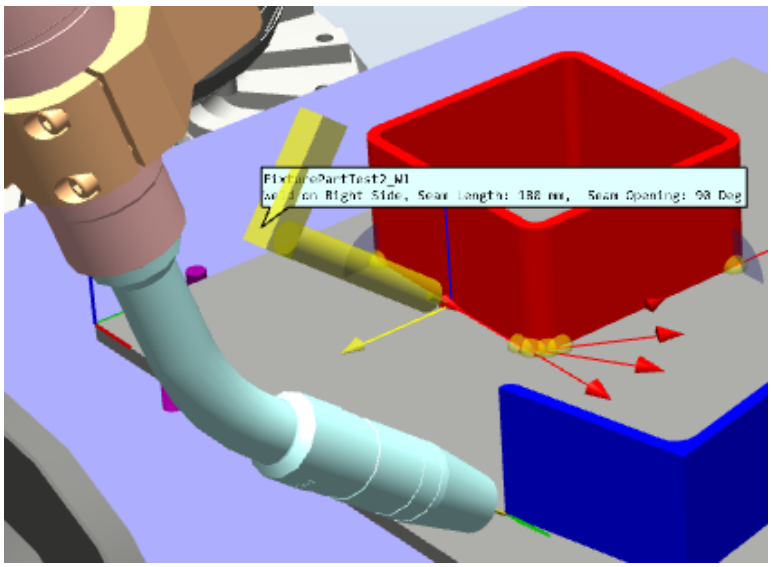
You can modify the tool indicator orientation as required using the sliders.

8 Verify the robot Reach.

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

Continues on next page

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.

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.

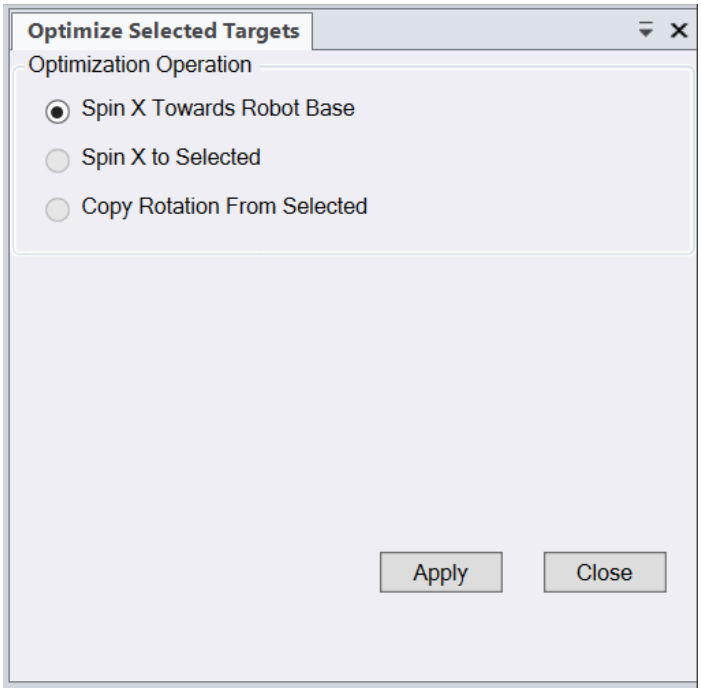
The graphics window highlights only remaining markups for which path has to be created.

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

4.7 Optimize weld targets

Overview

Optimize weld targets function allows you to optimize the orientation of the targets and create smooth movements of the robot. The following image displays the **Optimize Selected Targets** window.



xx2400001218

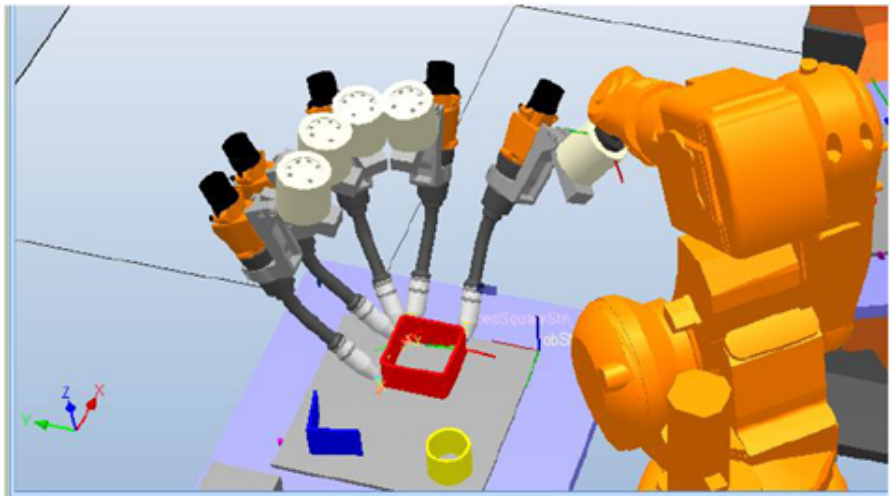
Spin X Towards Robot Base

The **Spin X Towards Robot Base** option allows you to spin the X axis of the targets towards the robot base.

Continues on next page

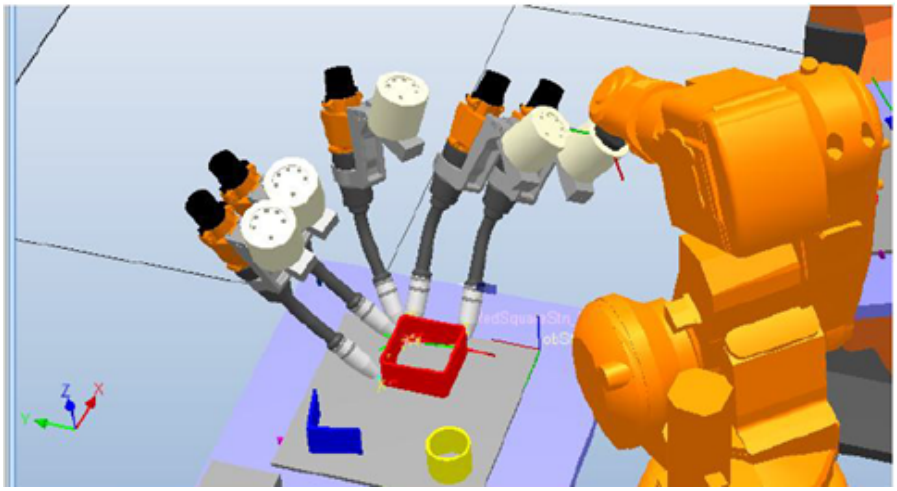
Spin X to Selected

The **Spin X to Selected** option allows you to orient a row of targets, so that the target's X axis points in the same direction. This option allows you to spin all the marked targets around the Z axis until the target X axis match the selected target X axis as close as possible. The following figure displays the status before using the **Spin X to Selected** option.



xx2400001219

The following figure displays the status after using the **Spin X to Selected** function.

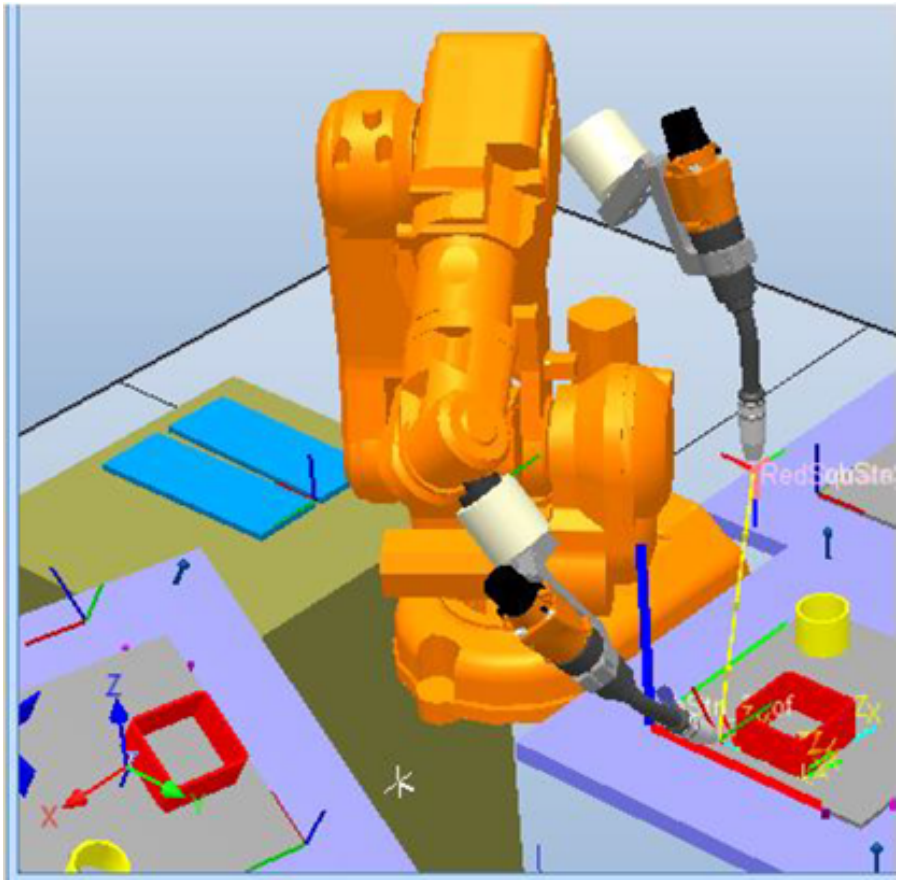


xx2400001220

Continues on next page

Copy Rotation from selected

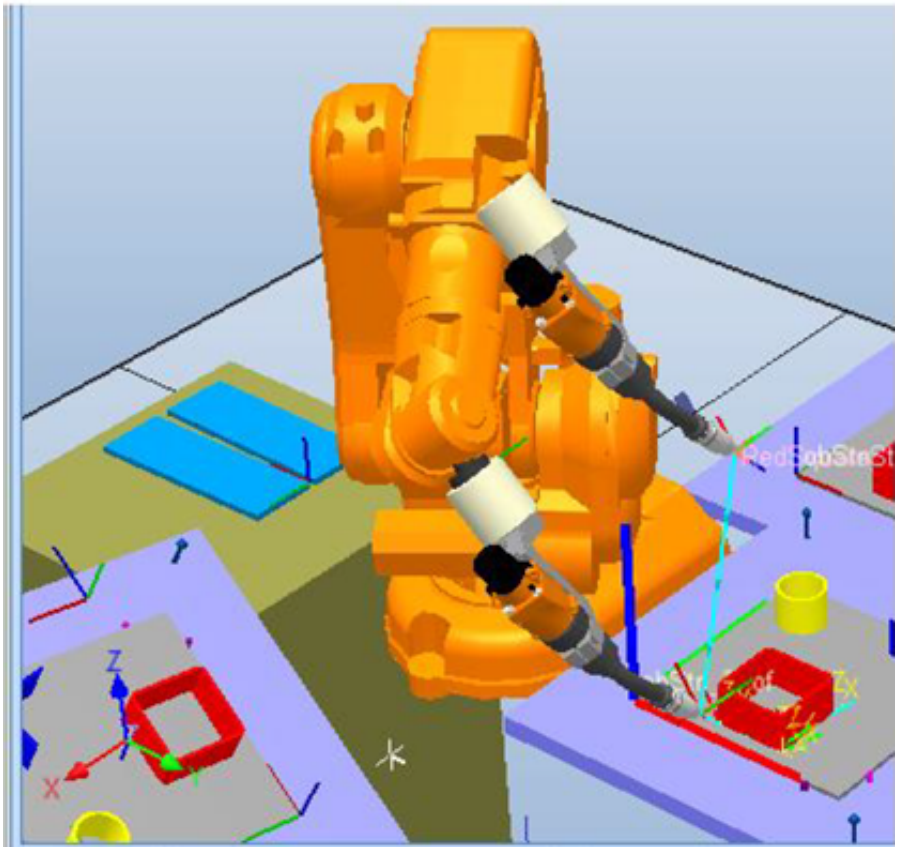
The **Copy Rotation From Selected** option allows you to copy the orientation of the selected target to all other marked targets. Depending on the type of target, only the appropriate part of the orientation is copied. For an air target, it is a complete copy. For a process target, only the orientation of the tool's X axis is copied. For a search target, the reference frame is aligned with the selected target's Z axis and the search target X axis is aligned with the selected X axis. The following figure displays the status before using the **Copy Rotation From Selected** option.



xx2400001221

Continues on next page

The following figure displays the status after using the **Copy Rotation From Selected** option.



xx2400001222

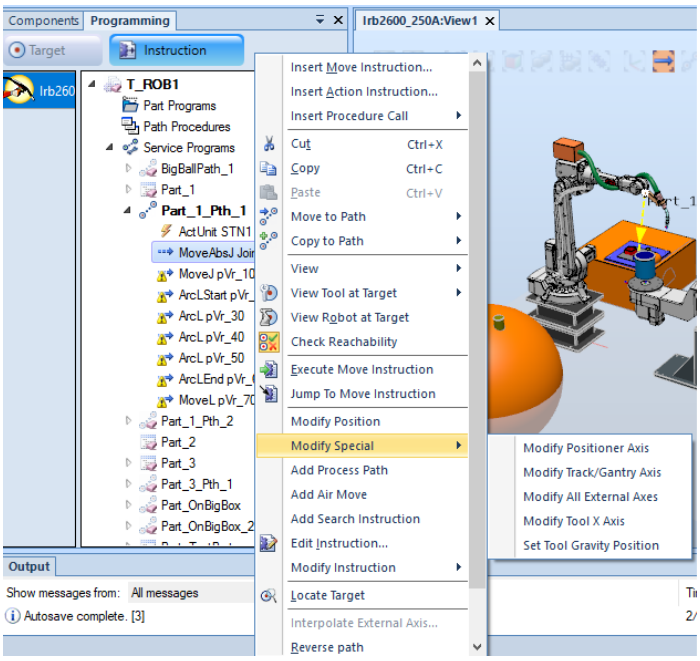
4.8 Modify Special

Overview

In this section you can modify the additional positions of the selected target.

In **Instruction** tab right click on the any path instruction and select **Modify Special** from the list. Following options are displayed:

- Modify Positioner Axis
- Modify Track/Gantry Axis
- Modify All External Axis
- Modify Tool X Axis
- Set Tool Gravity Position



xx1900002086

Modify Positioner Axis

In this option you can set the positioner values for the selected instruction same as joint values of the activated positioner.

Modify Track/Gantry Axis

In this option you can set Track/Gantry axis values for the selected instruction same as joint values of the activated track/gantry mechanical unit.

Modify All External Axis

In this option you can set all the external axis values for the selected instruction same as joint values of the activated mechanical unit.

Modify Tool X Axes

In this option you can spin the tool, so that all the X axes of the selected target points to the same direction.

Continues on next page

This function can be used to orient a row of targets so the target x axes point in the same direction. The function will spin all marked targets around the z axes until the target x axes match the selected target x axis as close as possible.

Set Tool Gravity Positions

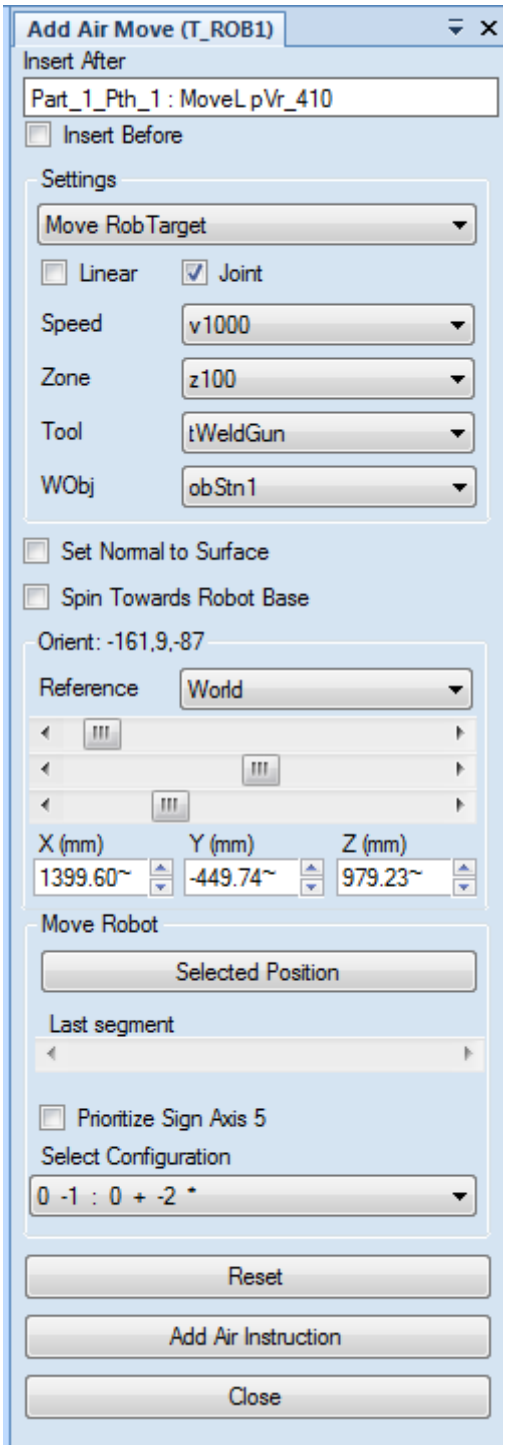
In this option you can modify all the selected targets, so that tool remains in the vertical position.

4.9 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



xx1900000819

Continues on next page

Dialog Box Elements	Description
Insert Before	To insert air instruction before the selected instruction
Settings	To define the type of air instruction (linear or joint). Also confirms 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 52*.
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

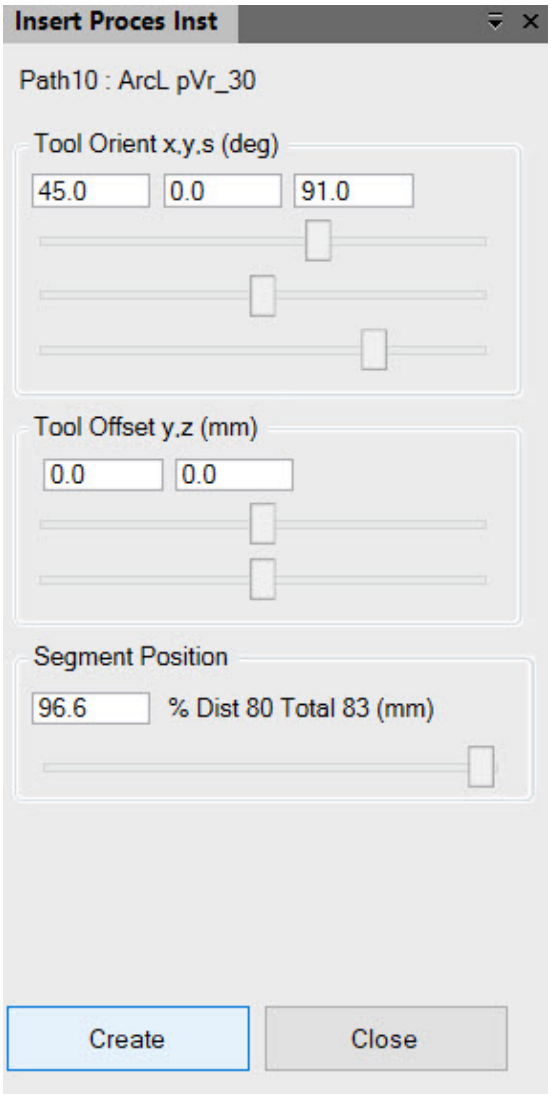
6 Change the orientation and position of the indicator in the graphical window and move robot to the selected position or move robot by the jogging using freehand move.
7 Select the desired configuration.
8 Click Add Air Instruction to insert a new instruction between the process sections.
9 The air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

4.10 Insert Process Instructions

Introduction

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

Function



xx2100000492

Dialog Box Elements	Description
Tool Orient	To set the orientation of the tool in x, y, s axis
Tool Offset	To offset the tool from the path in y, z axis
Segment Position	To set the segment position in %
Create	To create **Insert Proces Inst**
Close	To close the **Insert Proces Inst** window

Continues on next page

Procedure

Inserting a new instruction in a process path :

> **Note**
>
> Following scenarios should be met to insert an instruction in an already created process path :
> - Valid selections are process via or end instruction
> - Instruction will be inserted on the segment leading to the selected instruction
> - Instruction type will be based on the selected instruction

1. Click **Programming** browser.
2. Right-click the 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 Process instruction need to be added.
4. Right-click instruction list under the Path and select **Insert Proces Instr** from the context menu.

   The **Insert Proces Instr** window displayed.
5. Set the Process instruction as required. For information see *Function on page 55*.
6. Adjust the position along the path using **Segment Position**, where instruction need to be inserted.
7. Adjust the Tool orientation and offset at the position.
8. Click **Create** insert the process instruction.

4.11 Move To

Introduction

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

Procedure

Use this procedure to execute **Move To** function :

1. Select instructions from the browser tree.
2. Click **Move To** from the ribbon.

The robot executes motion for each instruction and the progress is indicated in the browser tree through a robot icon.

Note

You can see the instruction along with robot icon, to display the:

- instruction being executed.
- last instruction that was executed.

This is applicable for both MultiMove and Non-MultiMove stations.

4.12 Properties - Instruction

Overview

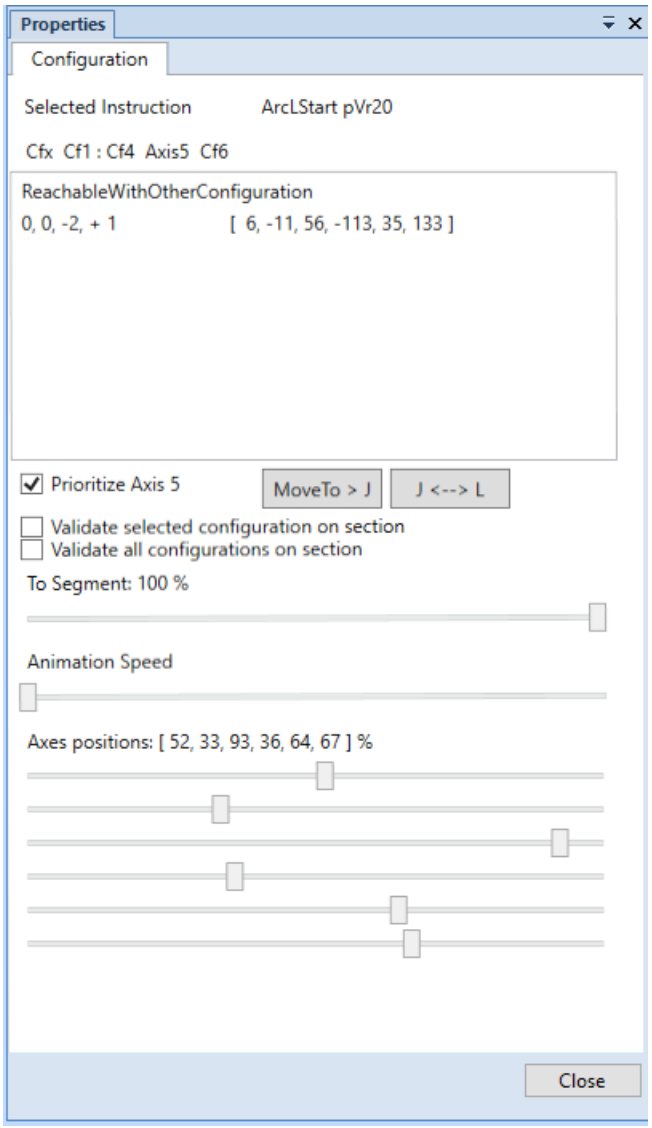
In Instruction properties, displays a tool window and moves the robot to the position, that is, animates the instruction execution from the preceding instruction, if available.

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 **Properties** button from the ribbon window.

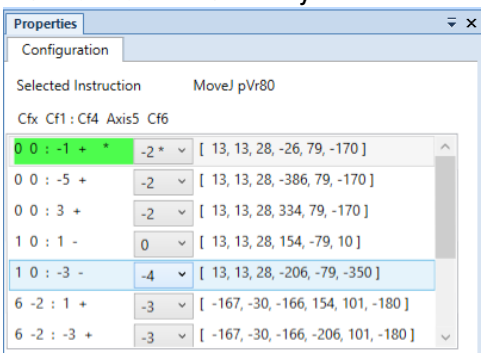
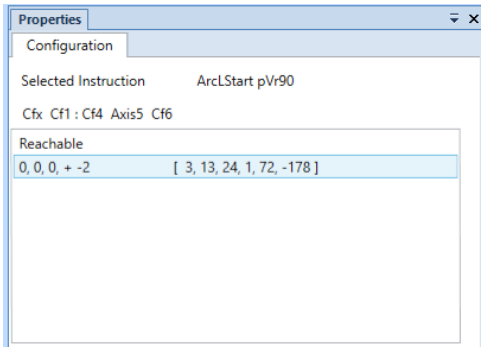
   The tool window option is displayed in separate window.



xx2000000095

Continues on next page

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

Properties	Description
Selected Instruction	Displays the selected instruction.
Cfx Cf1 : Cf4 Axis5 Cf6	If a Joint instruction is selected, the possible configurations are listed and allowed to modify.  xx1900000842 If a Linear instruction is selected, the reachability status is shown.  xx1900000841
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.
Axes Positions	Displays the position of axes in percentage. **Note** You can not change the slider position. It is disabled by default.

4.13 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 and select the target.
3. Click **Properties** button from the ribbon window.

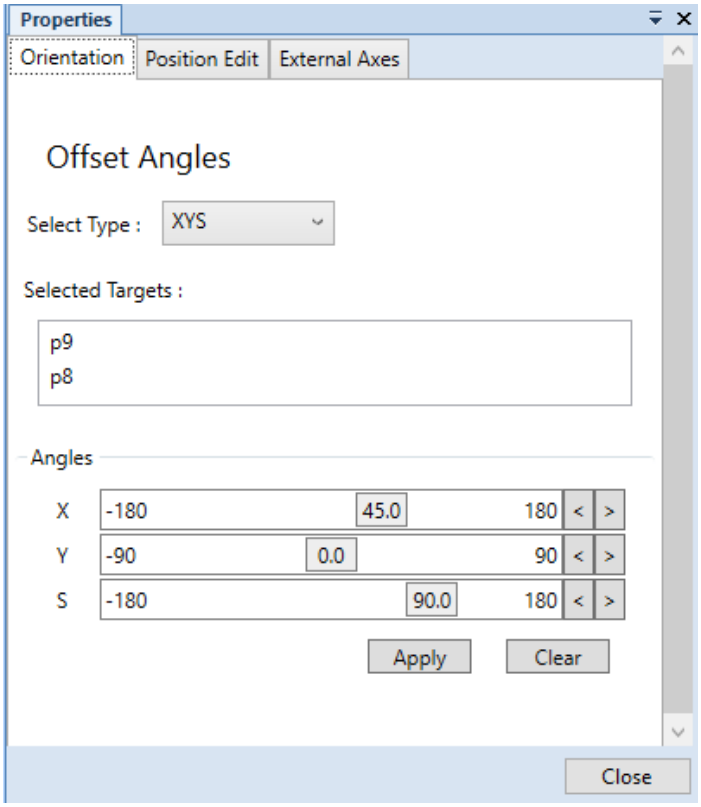
   The tool window option is displayed in separate window:

   The following properties are displayed under **Properties** option:

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

   Click **Apply** to apply the changes done.

   - Orientation
   - Position Edit
   - External Axes

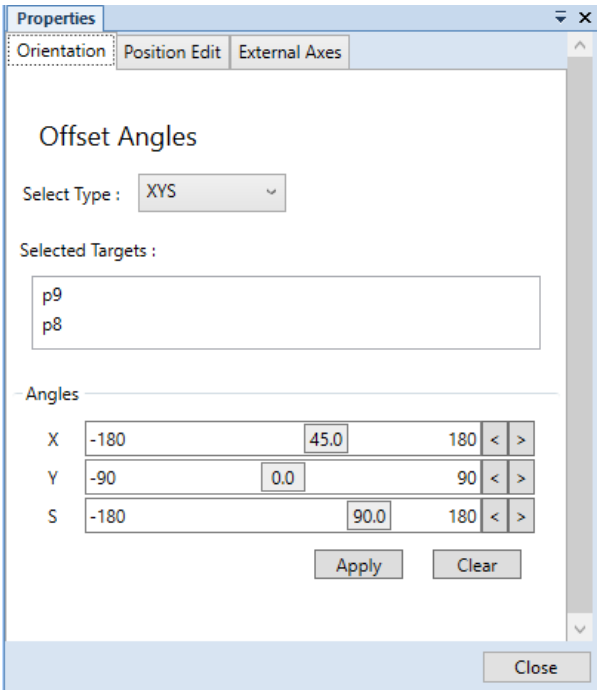


xx1900002144

Continues on next page

Orientation

The following properties are displayed under **Orientation** option:



xx1900002144

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

Click **Apply** to apply the changes done.

Position Edit

The following properties are displayed under **Position Edit** option:

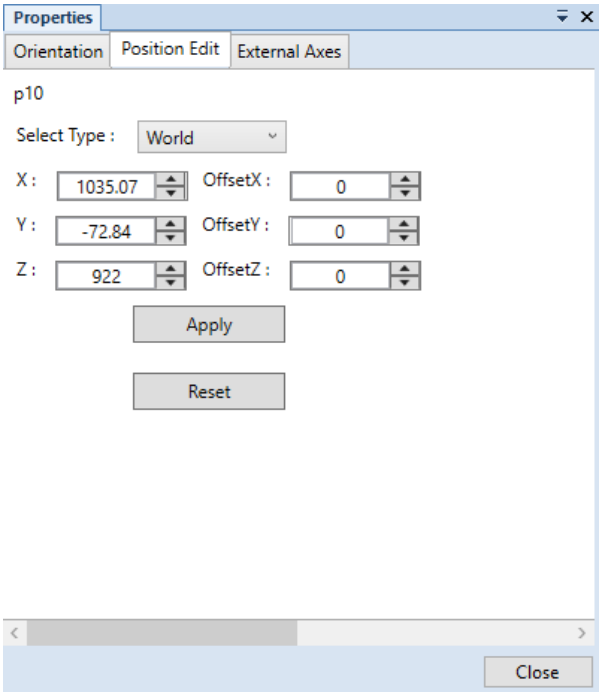
Note

When multiple targets are selected XYZ position option is disabled.

Continues on next page

4.13 Properties - Target

Continued



xx1900002143

Properties	Description
Select Type	Select the frame type from the drop down.
XYZ positions	You can change the XYZ position accordingly.
Offset positions	You can change the offset XYZ position accordingly.

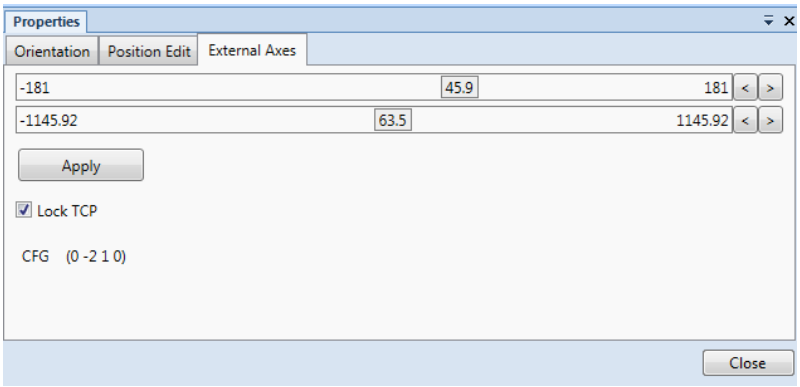
Click **Apply** to apply the changes done.

Click **Reset** to reverse the changes done.

External Axes

The following properties are displayed under **External Axes** option:

> **Note**
>
> Make sure **Activate Mechanical Unit** option is activated under **Simulation** tab.



xx2000000087

Continues on next page

Properties	Description
Slider	You can change/edit the external axes values by moving the slider.
Local TCP	Enable the TCP button to move robot along the external axes when you move the slider.
CFG	Displays the robot configuration.

4.14 Sync and play

Introduction

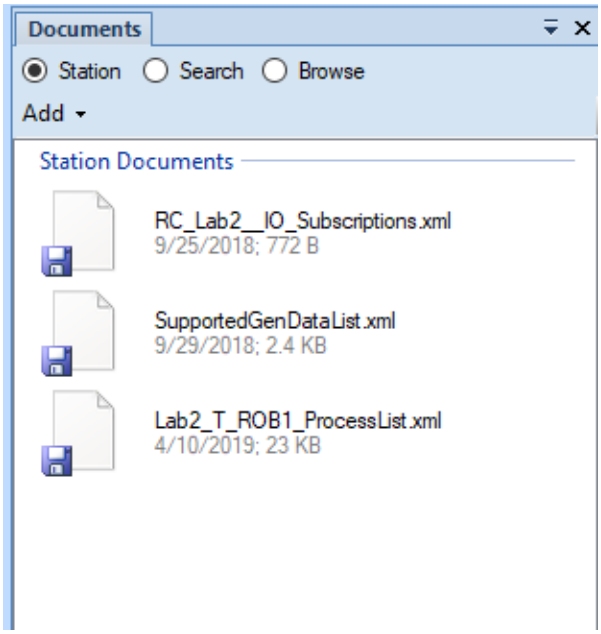
For the selected process path shall be synced to RAPID with updated references and start simulation automatically.

4.15 Manage Templates

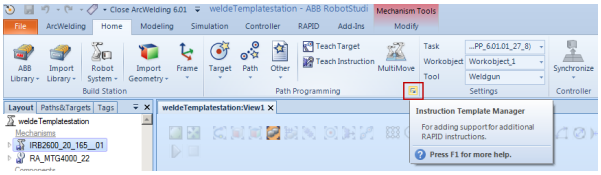
Overview

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.



xx1900000826



xx1500002107

Note

Depending upon the Arc options selected during system creation, corresponding templates are loaded to the station.

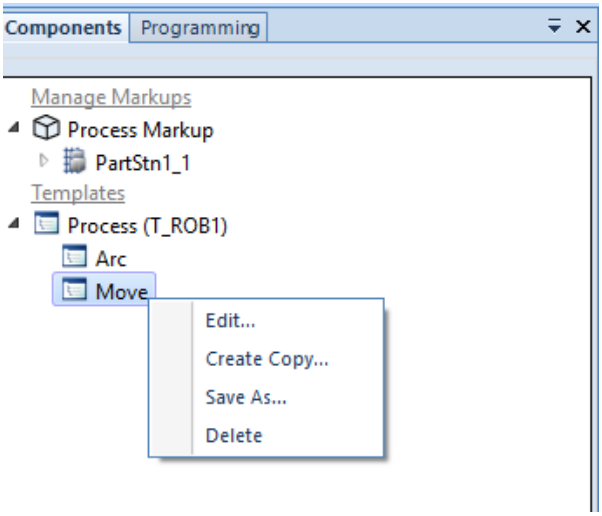
Continues on next page

Process templates

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

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

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



xx1900000827

Properties	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 the template and click **Edit**.

   The **Manage Arc Processes** window is displayed.
2. Modify the template according to your requirement.
3. Click **Apply** button.

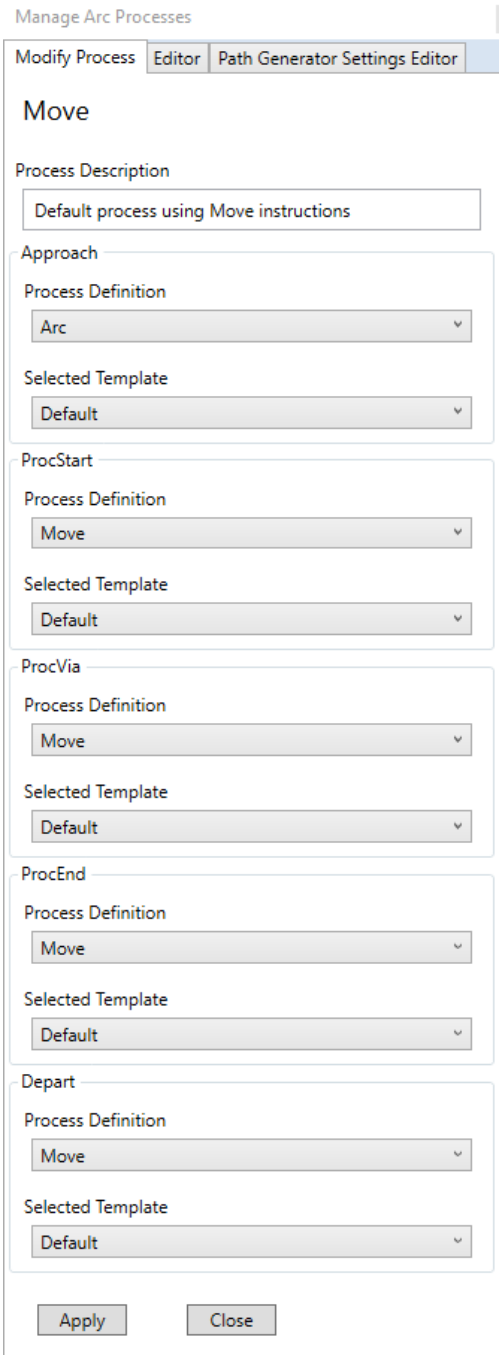
   The changes are saved.

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

- Modify Process
- Editor
- Path Generator Settings Editor

Continues on next page

Modify Process



xx2000000516

Section		Description
Process Description		You can modify the description about the template.
• **Approach** • **ProcStart** • **ProcVia** • **ProcEnd** • **Depart**	**Process Definition**	Select Process definition for all Instruction Types. Depending on the Selected Definition, Template List is displayed.

Continues on next page

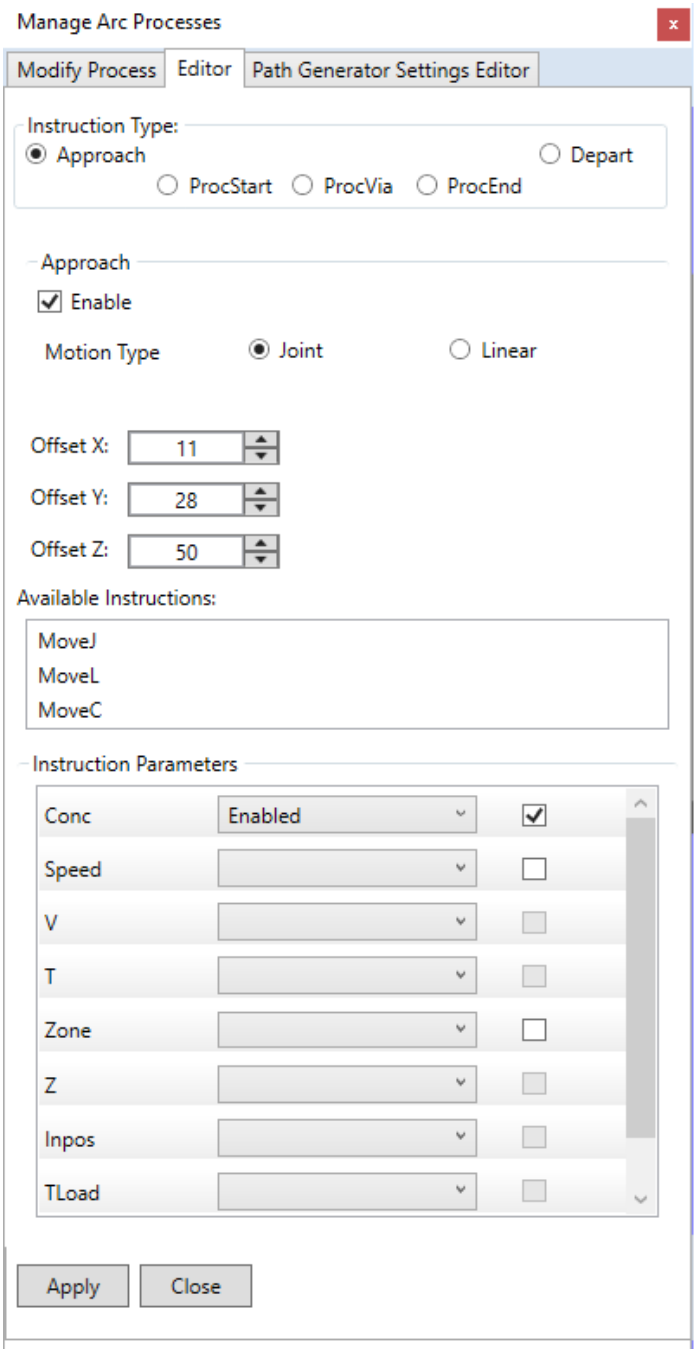
4.15 Manage Templates
Continued

Section		Description
• **Approach** • **ProcStart** • **ProcVia** • **ProcEnd** • **Depart**	**Selected Template**	Select the template in the selected Process Definition for all Instruction Types and Apply changes.
Apply		Click Apply button to apply the changes. **Note** ProcessList.xml is updated for the Active Task with the Selected Process Definition and Template for all Instruction Types.
Close		Click close button to close the tab.

Continues on next page

Editor

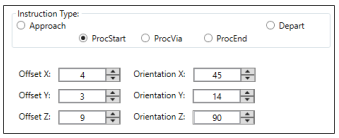
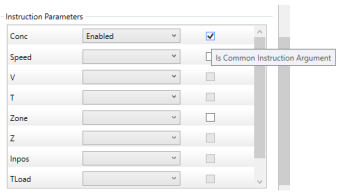
The **Instruction Parameters** and offsets can be edited by selecting the **Instruction Type** in the **Editor** tab.



xx2000000514

Section		Description
Instruction Type	• **Approach** • **ProcStart** • **ProcVia** • **ProcEnd** • **Depart**	Select to edit the instruction type as required.

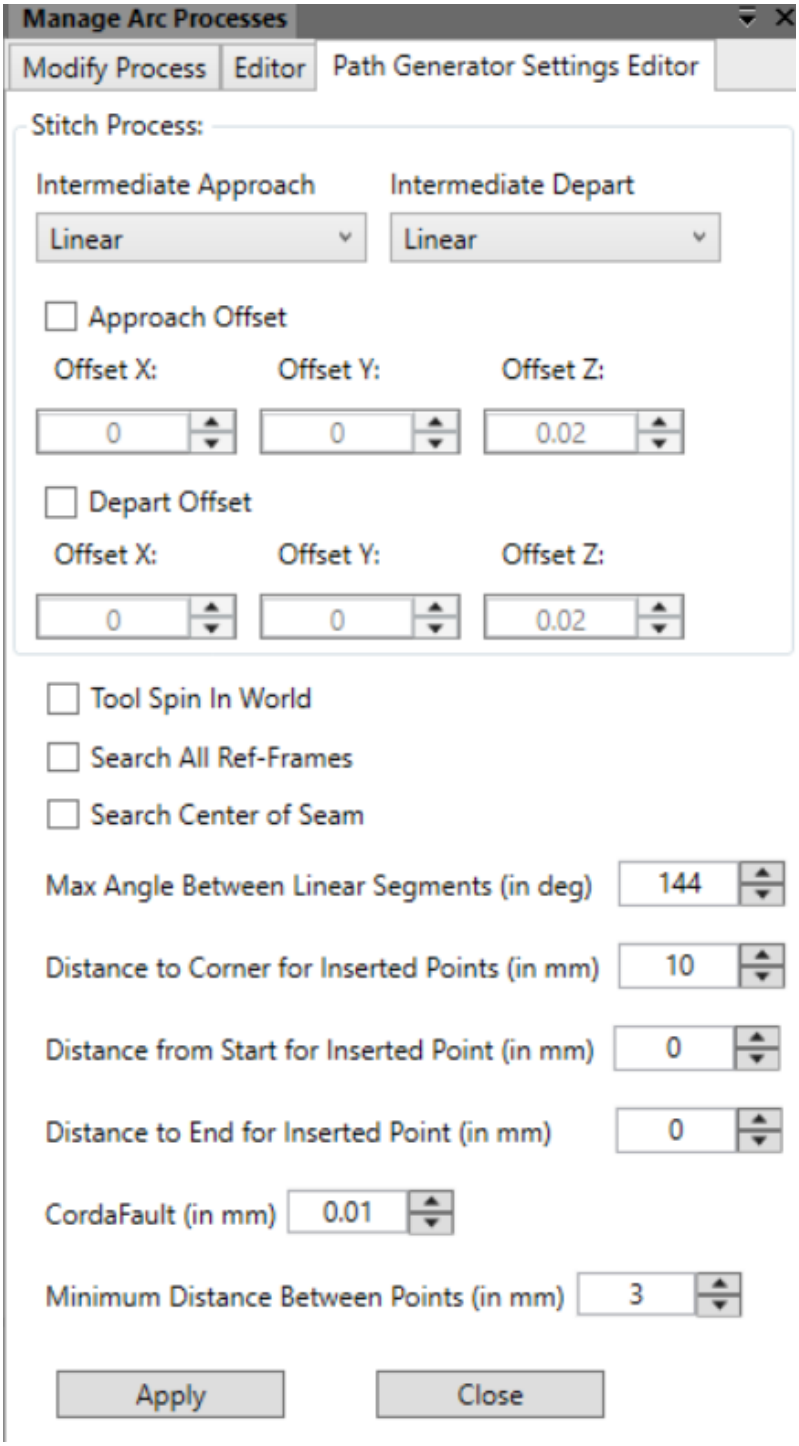
Continues on next page

Section		Description
Approach/Depart	**Enable**	Enable/Disable adding of approach/Depart Instruction to the Process section.
	Motion Type	Select the motion type: • Joint • Linear
	Offset value	Tool Offset value for instruction types can be edited. The values are edited in RCS frame.
• **ProcStart** • **ProcVia** • **ProcEnd**	Offset value	Tool Offset value for instruction types can be edited. The values are edited in RCS frame. The offset values for ProcStart/Via/End are same.
	Orientation	Tool Orientation for instruction types can be edited. The values are edited in RCS frame. The orientation for ProcStart/Via/End are same.  xx2000000691
Available Instruction		List all the available instruction for the Instruction type selected. The parameters can be edited from the drop down selection.
Instruction Parameters		List all the instruction parameters for the Instruction type selected. The parameters can be edited from the drop down selection. Common Instruction Argument: Check to add as a common argument. If the instruction type doesn't have any argument selected, then default common arguments is applied.  xx2000000541
Apply		Click Apply button to apply the changes.
Close		Click close button to close the tab.

Continues on next page

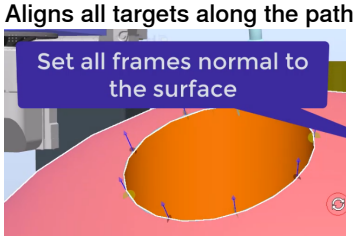
Path Generator Settings Editor

The Default Path Generator Settings can be edited for the selected template. These parameters are taken into account while creating Process Path.



xx2100002781

Continues on next page

Section	Description
Intermediate Approach	It is an offset that can be set when a robot is moving from one stitch process to another You can select the approach type: • Linear • Joint
Intermediate Depart	It is an offset that can be set when a robot is moving from one stitch process to another You can select the depart type: • Linear • Joint
Approach Offset	Set the Offset values (X,Y,Z) and select **Approach Offset**.
Depart Offset	Set the Offset values (X,Y,Z) and select **Depart Offset**.
Tool Spin In World	Keeps the tool spin reference to the world.
Search All Ref-Frames	Aligns all targets along the path with the object.  xx1900001413 **Note** For the above option the tool orientation is maintained with respect to RCS. This can be visualized together with Move Along Section option. Move Along Section Option is not present in this window, it is present in *Add Process Path* Window.
Search Center of Seam	Sets the tool to the center angle of the seam.  xx1900001412 **Note** For the above option the tool orientation is maintained with respect to RCS. This can be visualized together with Move Along Section option. Move Along Section Option is not present in this window, it is present in *Add Process Path* Window.
Max Angle Between Linear Segments (in deg)	If angle between linear segments is less than Max Angle Between Linear Segments, then a point before the corner and one after the corner is inserted, taking the Distance to Corner For Inserted Points into consideration.
Distance to Corner for Inserted Points (in mm)	The distance of the inserted points from the corner, in mm.

Continues on next page

Section	Description
Distance from Start for Inserted Point (in mm)	Distance of the inserted points from the start, in mm.
Distance to End for Inserted Point (in mm)	Distance of the inserted points to the end, in mm.
CordaFault (in mm)	To set the accuracy of the path.
Minimum Distance Between Points (in mm)	Displays the minimum distance between points in millimeter.
Apply	Click Apply button to apply the changes.
Close	Click Close button to close the tab.

4.16 Generic Station Data

Overview

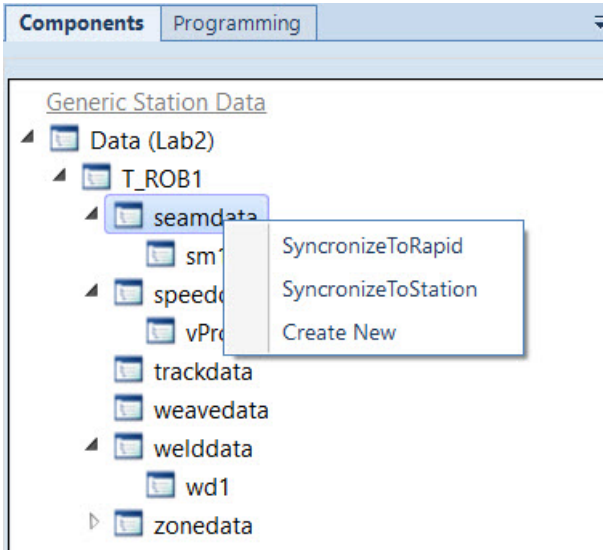
From **Generic Station Data** you can,

- view and configure Process template data types
- create or delete instances of data types

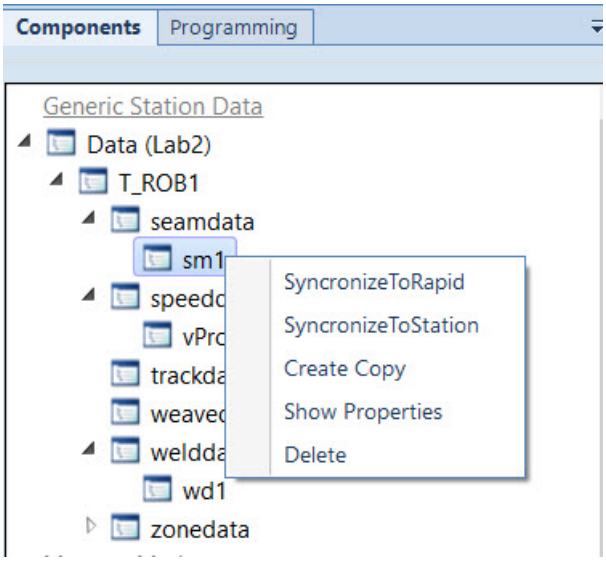
Process templates data types

Click **Components** tab and under **Generic Station Data** option, select the task.

Right-click the **data type** or **instance** to access the available options.



xx2100000070



xx2100000071

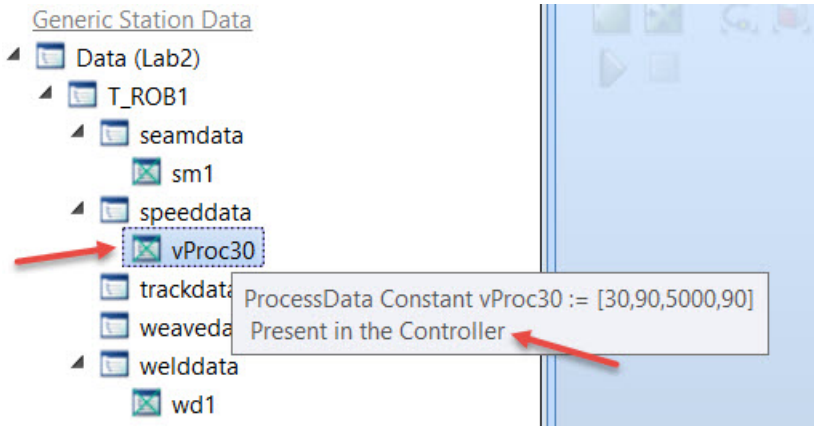
Properties	Description
SynchronizeToRapid	Synchronizes the selected data to Rapid.

Continues on next page

Properties	Description
SynchronizeToStation	Synchronizes the selected data to Station.
Create New	Creates a new instance of the selected type from default.
Create Copy	Creates a copy of the selected data.
Show Properties	Displays the properties of the selected object.
Delete	Deletes only unused data.

Note

Once the data synchronization to Rapid is complete, it is indicated in the status as **Present in the Controller**. Also, the color of the icon is changed.



xx2100000076

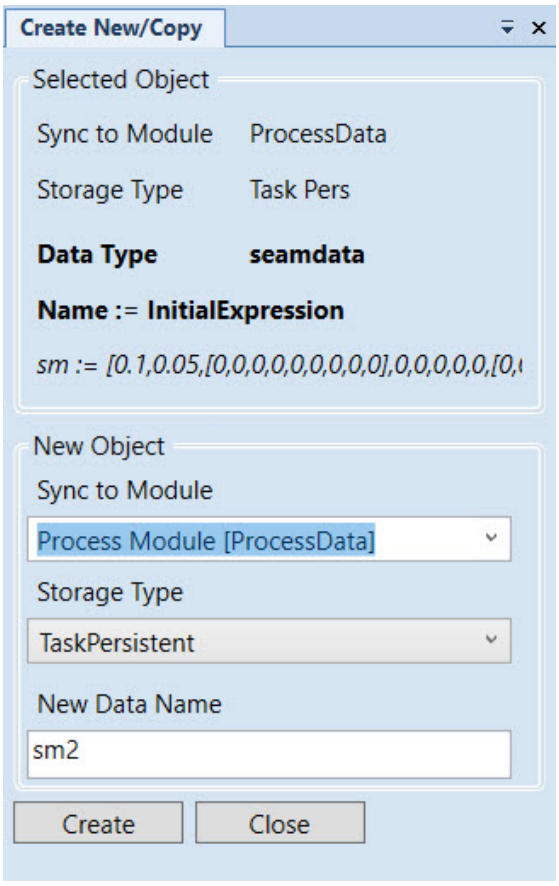
Creating new object / data type

Use the following procedure to create a new object or data type:

1 Right-click the **data type** and select **Create New**.

Continues on next page

The **Create New/Copy Object** window is displayed.



xx2100000073

2 Select the **Sync to Module** and **Storage Type** options as applicable.
3 Name the new data type in **New Data Name**.
4 Click **Create**.
The new data type is created.

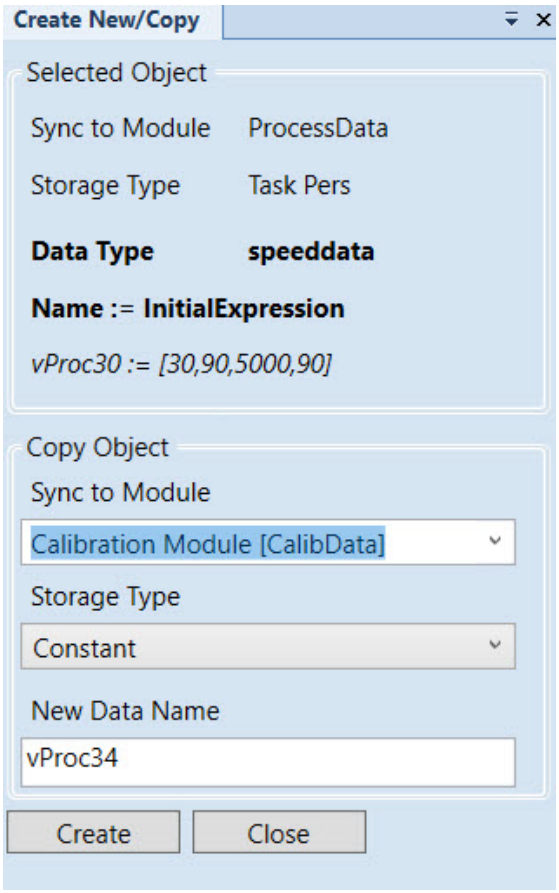
Creating a copy of object / instance

Use the following procedure to create a copy of the selected object or instance:

1 Right-click the **instance** and select **Create Copy**.

Continues on next page

The **Create New/Copy Object** window is displayed.



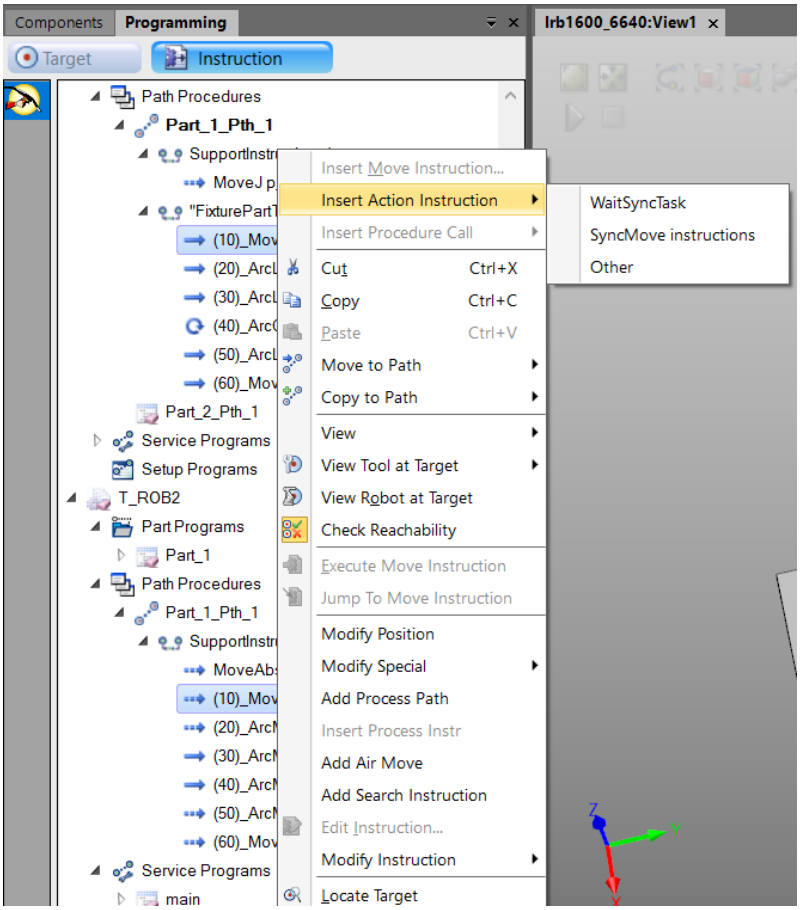
xx2100000075

2 Select the **Sync to Module** and **Storage Type** options as applicable.
3 Name the new instance in **New Data Name**.
4 Click **Create**.
The new instance is created.

4.17 MultiMove action instructions

Adding MultiMove action instructions

In case of a MultiMove system, users can insert Action instructions from the **Programming** browser tree.



xx2100002780

Select instructions and right-click to launch **Insert Action Instruction** context menu. The following options are available :

- **WaitSyncTask** : Inserts action instruction **WaitSyncTask** before the selected instruction in each task.

  > **Note**
  >
  > If the selected instruction is the first instruction, then **WaitSyncTask** is inserted after the selection.

- **SyncMove instructions** : Inserts the following two action instructions
  - **SyncMoveOn** - before the selected instruction
  - **SyncMoveOff** - after the selected instruction in each task

Continues on next page

- **Other** : Opens RobotStudio **Create Action Instruction** window for introducing an action instruction. It works only with single selected instruction, as in RobotStudio.

You can drag and drop the action instructions only within the **Programming** browser tree.

Note

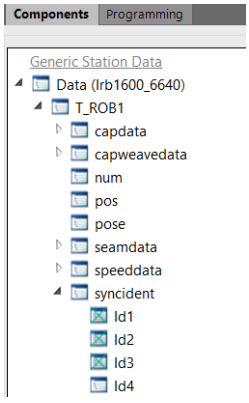
- For **WaitSyncTask**, **SyncMoveOn** and **SyncMoveOff** action instructions, SyncID is found and assigned automatically.
- SyncID is allocated to these action instructions, only when SyncID is available in all the selected tasks. This SyncID is not associated with any of the existing action instructions in the selected tasks.
- If SyncID is not found, a message is displayed in the Output log and action instruction will not be created. In such case, user need to create the SyncIDs and repeat the steps
- Multiple instruction selection in each task is not supported. Output log displays invalid selection message.

Note

- Drag and drop of action instruction to different process section or task will create a copy of the action instruction.
- The instruction IDs between Sync On and Off are updated whenever the Sync instruction is re-positioned. The numbering schemes follows similar sequence of related Sync instructions from other Tasks. If there are no other related instructions found, then the numbering starts with (1), (2) and so on.
- When a Sync On and Off instruction is drag and drop or copied onto other Task, it also copies the related Off and On instruction automatically and positioned based on the number of instructions from the source.

Note

By default, 50 Syncident RAPID datatype instances are created for each Task.



xx2100002812

Continues on next page

MultiPane function

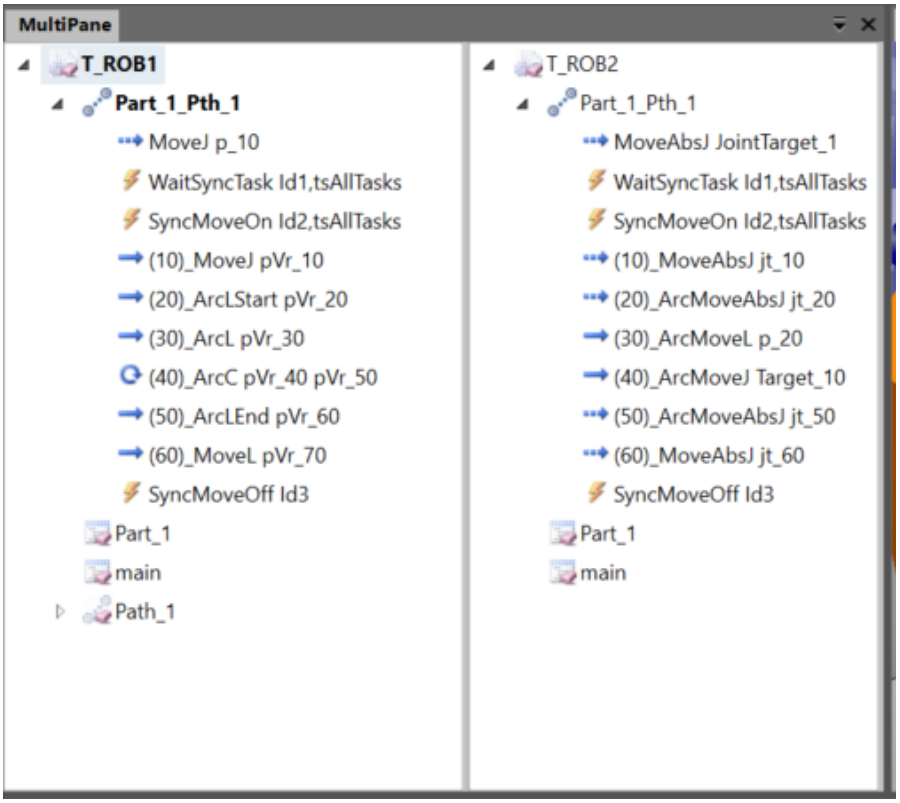
Introduction

While working with the MultiMove systems there are cases where you need to monitor the movement for multiple paths across the tasks. The MultiPane window displays the path instructions in tree format. Each task is displayed in a separate pane in the MultiPane window. The instructions within SyncMoveOn and SyncMoveOff in the path are highlighted during the MoveTo operation.

Accessing the MultiPane function

To access the MultiPane function, select the required tasks (use the CTRL key to select multiple tasks), right click, and select **MultiPane** from the context menu. The MultiPane window for the selected tasks is displayed. The tasks are arranged in the MultiPane window according to the order they are selected.

The task in multipane window currently displays all the available paths.



xx2200000592

Note

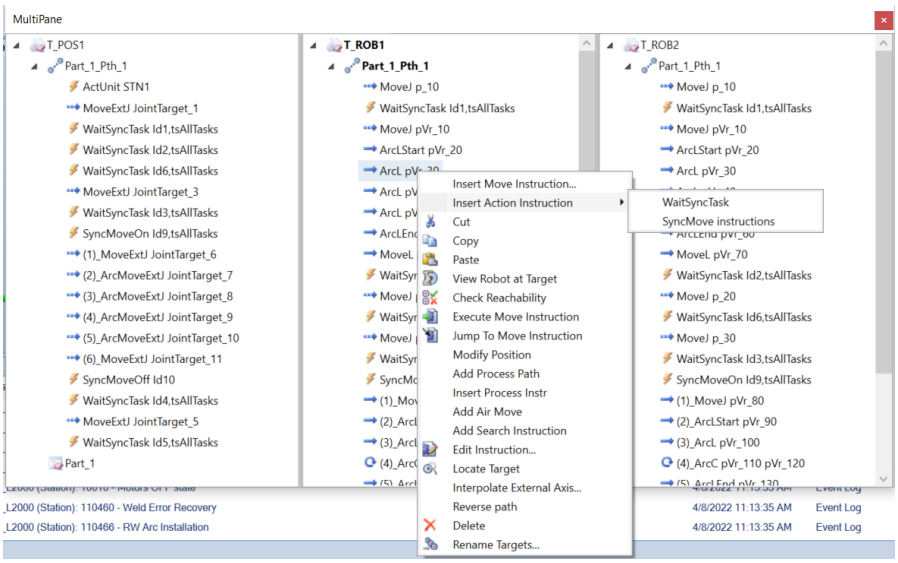
Once the MultiPane window is displayed, the Components/Programming browser tree is not available. The Components/Programming browser tree is displayed again, after the MultiPane window is closed.

Continues on next page

Programming in MultiPane window

Once the selected tasks are displayed in the MultiPane window it is easy to do MultiMove programming.

When you right-click on an instruction from the MultiPane window the context menu is displayed. You can use the options available in context menu to manage the program.



xx2200000594

When you insert **WaitSyncTask**, it is inserted above the selected instruction. But if the selected instruction is the first instruction in the task, then **WaitSyncTask** is inserted below it.

When you insert **SyncMove**, a **SyncMoveOn** instruction is inserted above the selected instruction and a **SyncMoveOff** instruction is inserted below the selected instruction. While inserting **SyncMove** you can either select a single instruction or a set of continuous multiple instructions.

For a selected set of continuous instructions, the **SyncMoveOn** instruction is inserted above the first instruction in the selection and the **SyncMoveOff** instruction is inserted below the last instruction in the selection.

Note

The selection can be made across tasks for inserting an action instruction. But continuous instructions selection support is available only for one task.

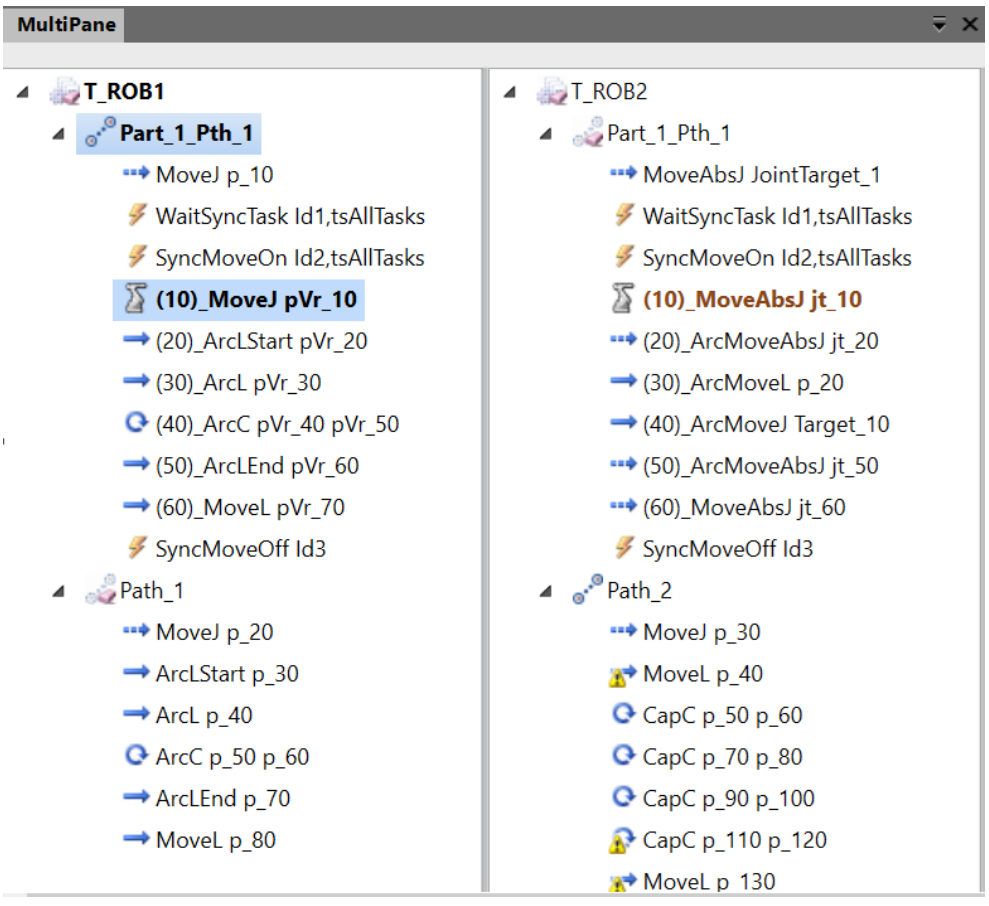
Continues on next page

Once you insert **SyncMove**, each instruction within SyncMove is assigned with a unique ID. When you drag and drop an instruction into or out of SyncMove, the IDs are automatically updated.

> **Note**
>
> It is possible to drag and drop an action instruction from one task (source task) to another task (target task) in the MultiPane window. When you do this, the instructions in the target task will get the same IDs as the instructions in the source task.

MoveTo operation

The MoveTo function is used to quickly verify the robot motion along a path, for identifying the reachability and configuration issues. From the MultiPane window when you select a path and click **MoveTo**, the current active instruction is highlighted (in bold) and the program pointer is displayed next to it. This way you can monitor the MulitiMove operation for the synchronized paths.



xx2200000599

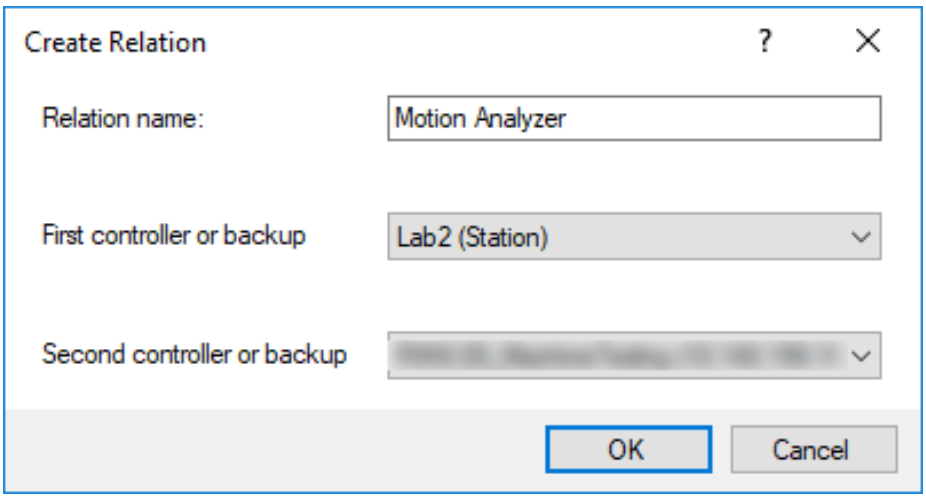
5 Motion Analyzer

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, eax, positioners, and workpieces.
- A relationship is created between the real and virtual robot controllers, when both are available.



xx1900001212

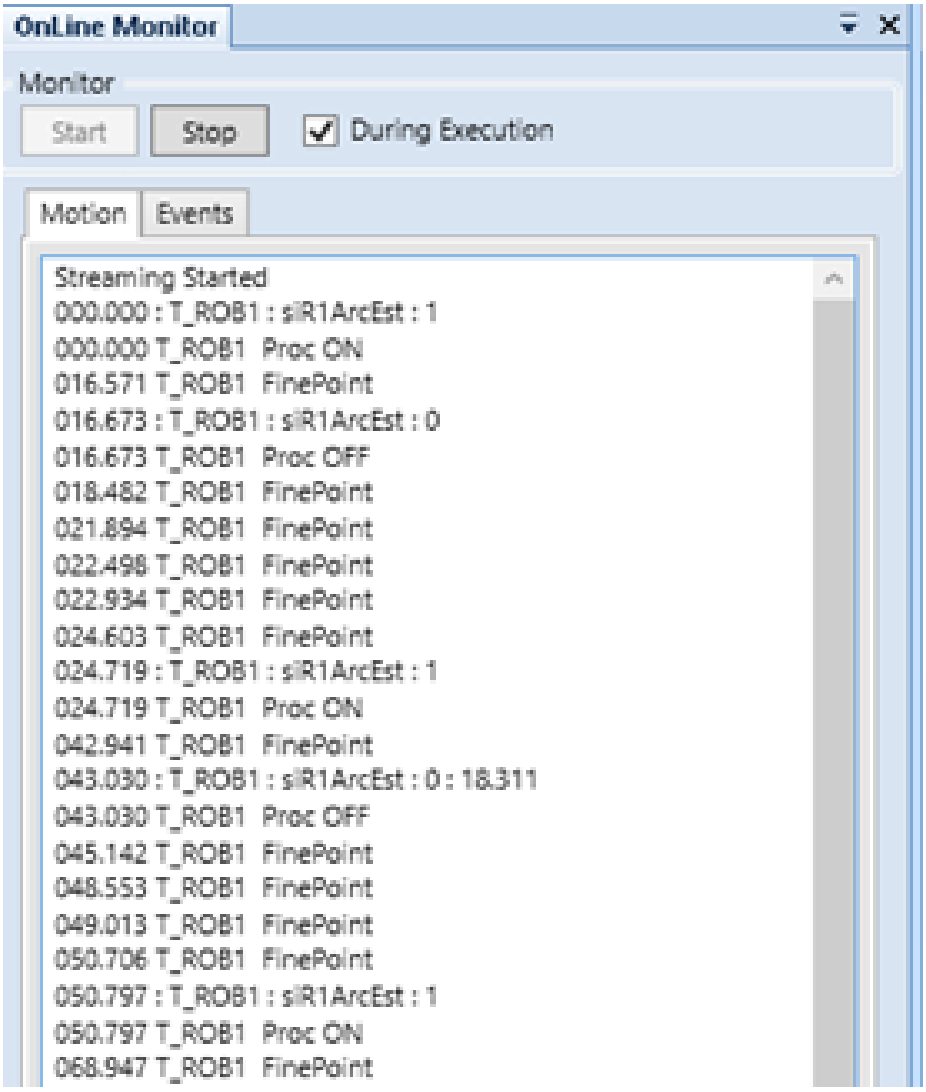
To mirror a real robot motion on to a virtual robot:

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 eax 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 eax and positioner.

Continues on next page

Continued



xx1800003146

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.

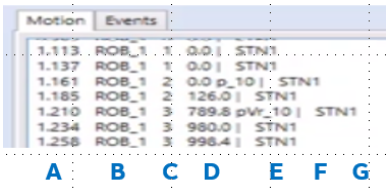
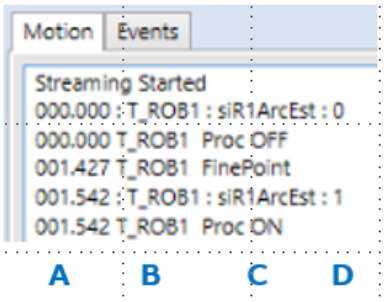
7 The RC Control gives options to Start the execution of the robot program on real robot.

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.

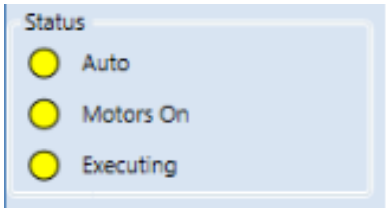
Online Monitor

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  xx1900001215	Computes and lists the motion positions are recorded in the information stream of the RC. 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  xx1900001216	Captures changes in subscribed IO Signals and Events. A Time stamp B Task C Signal / Event D Value

Continues on next page

Continued

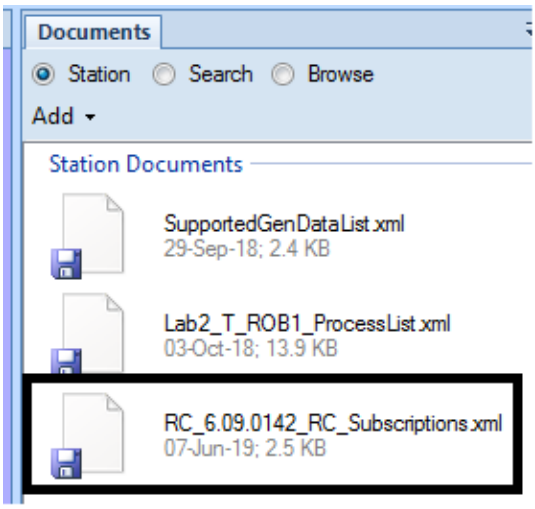
RC Control

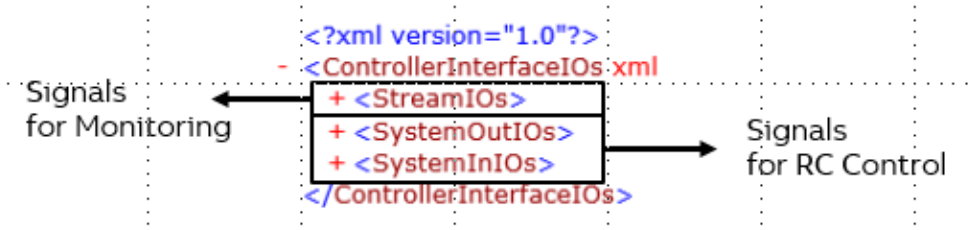
Options	Description
Status Indicators  xx1900001217	Shows status of Controller for: • Operating Mode • Motors state • Task state
Control  xx1900001218	**Start from Main** Starts program execution from "Main" for a single cycle.
	Start Main Cont Start Main Cont Starts program execution from the "Main" 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.

Continues on next page

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.



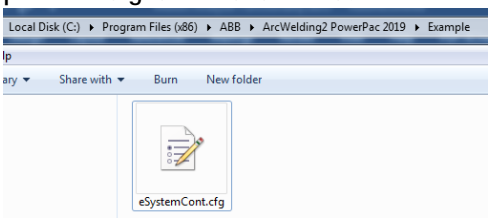


xx1900001219

Options	Description
Signals for monitoring - <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> xx1900001220	Configure the signals to be monitored.

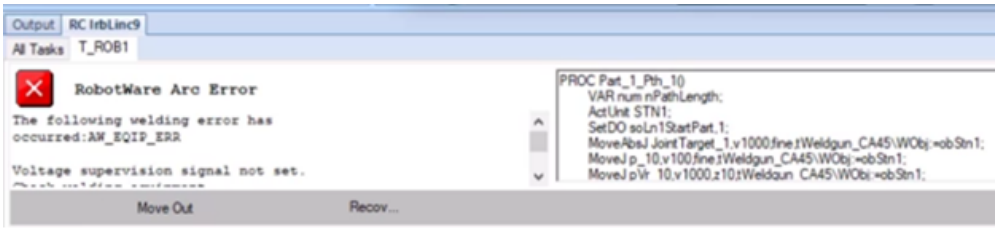
Continues on next page

Continued

Options	Description
Signals for RC Control - <SystemOutIOs> - <SystemOutIO> <Status>**MotOnState**</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> </SystemOutIOs> - <SystemInIOs> - <SystemInIO> <Action>**MotorOn**</Action> <Name>**soMotorsOn**</Name> <Type>**DO**</Type> </SystemInIO> - <SystemInIO> <Action>**StartMain**</Action> <Name>**soStartAtMain**</Name> <Type>**DO**</Type> </SystemInIO> - <SystemInIO> xx1900001222	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.  xx1900001221

TPU Messages

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



xx1900001223

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.

6.2 Importing Search Templates

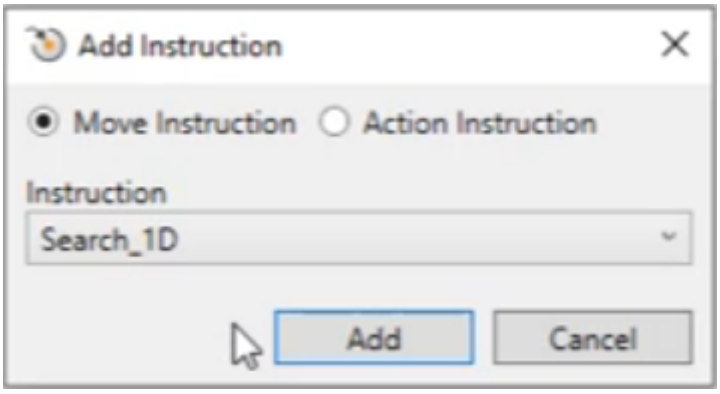
Overview

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.

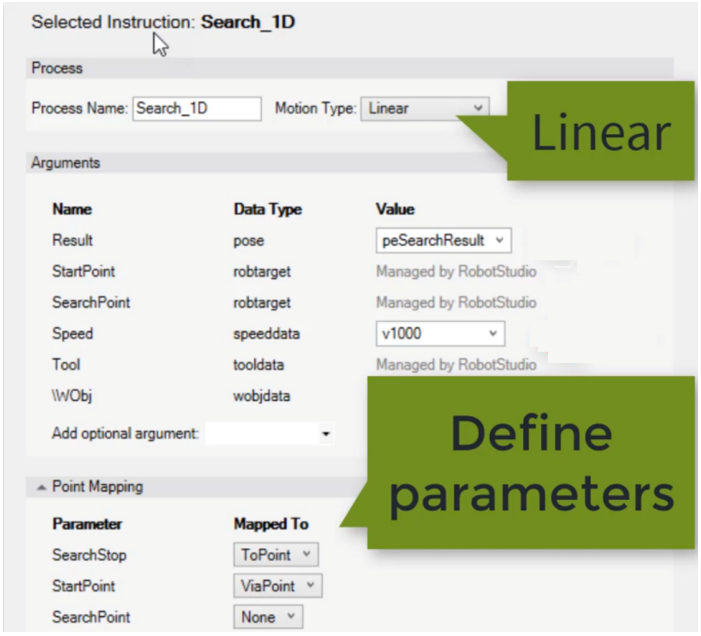
Import or Create Motion Instruction Descriptions

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.



xx1900000838

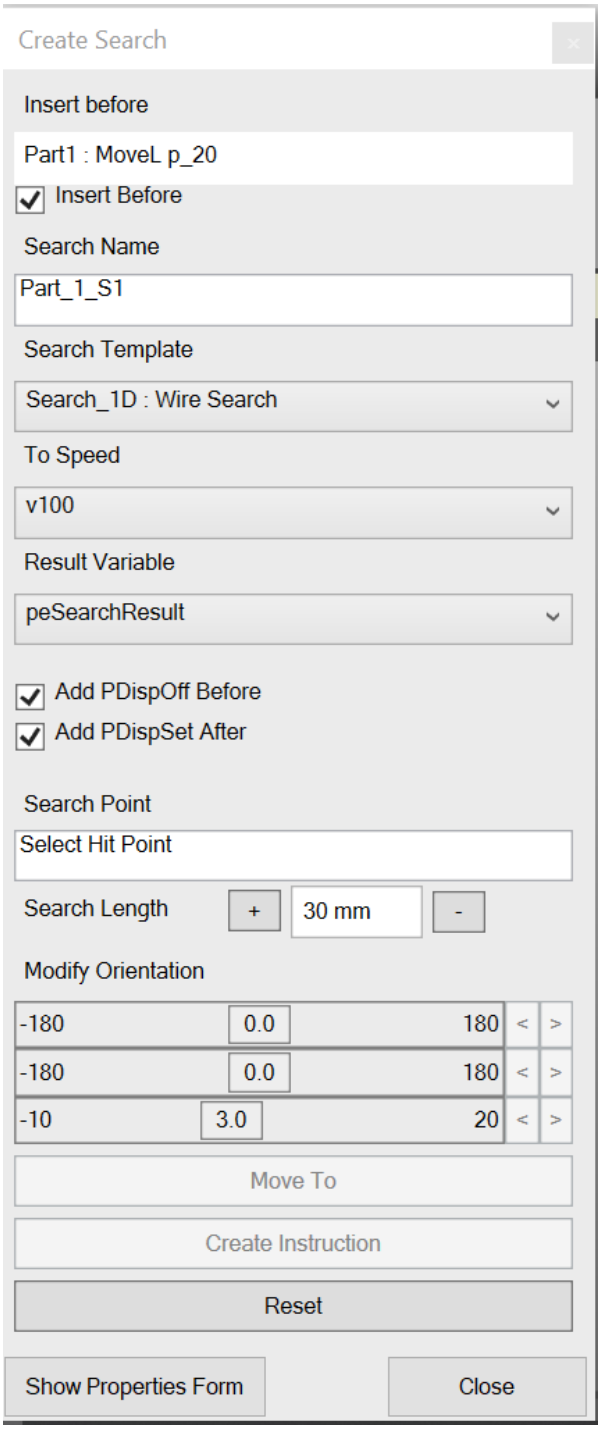


xx1900000839

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.



xx2100002790

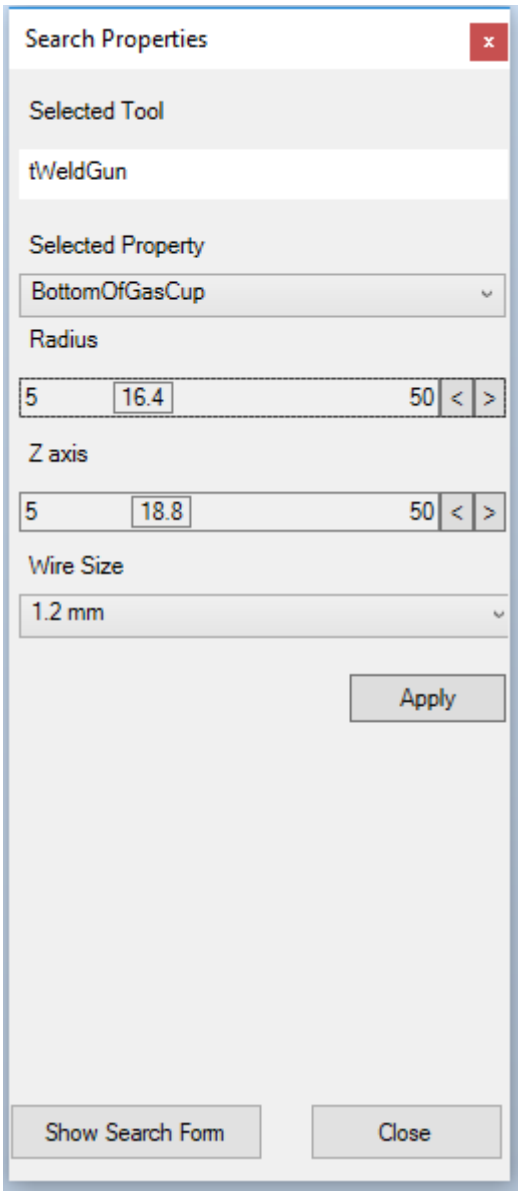
Continues on next page

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
To Speed	Defines the speed of the search target.
Result Variable	Stores the search result.
Add PDispOff Before	Adds the PDispOff RAPID instruction before the search instruction.
Add PDispSet After	Adds the PDispSet RAPID instruction after the search instruction.
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
Reset	Resets the search operation.
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.



xx1900000836

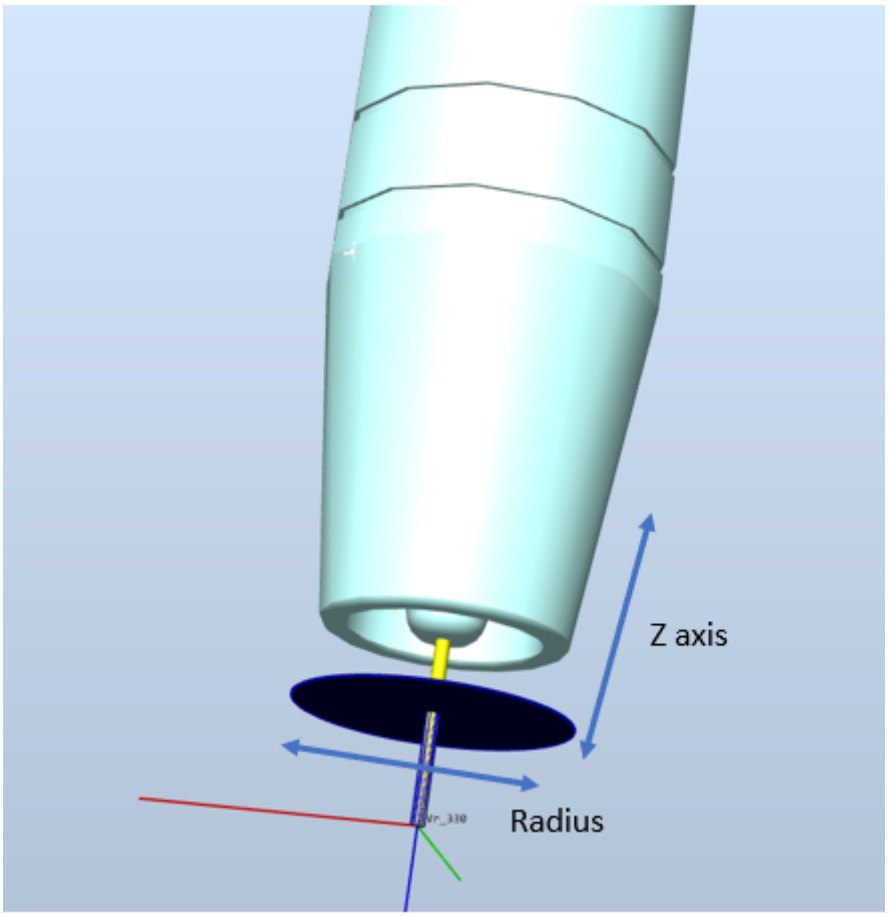
Section	Description
Select Tool	Displays the attached tool gun.

Continues on next page

Section	Description
Selected Property	Displays the search type option to use for the welding. • 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.

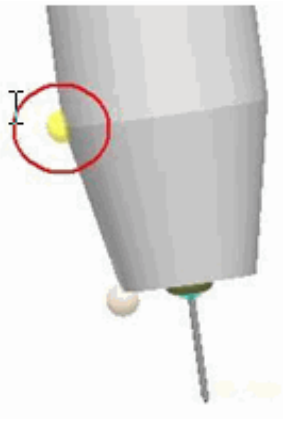
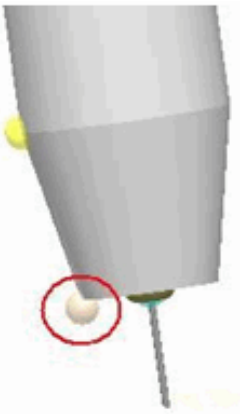
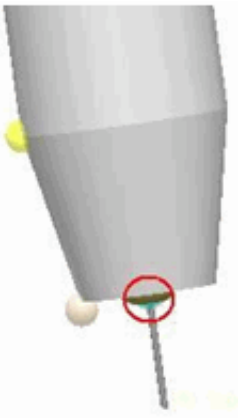
The following tool properties of the search.

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

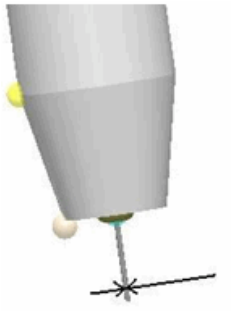


xx1900000840

Continues on next page

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.

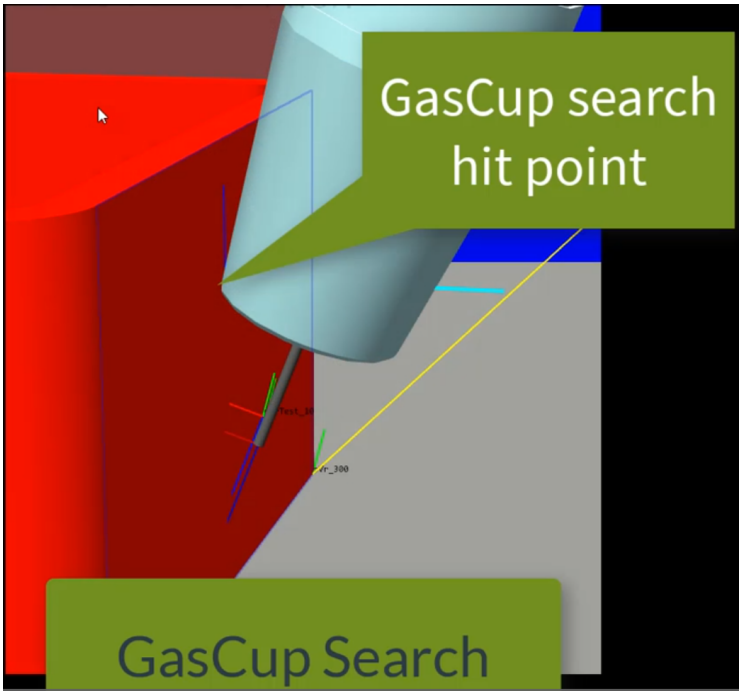
Continues on next page

Object	Description
Wire diameter  en1200000305	The diameter of the wire.

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.



xx1900000834

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..

This page is intentionally left blank

7 Working with Arc Welding in VR

7.1 Overview

Introduction

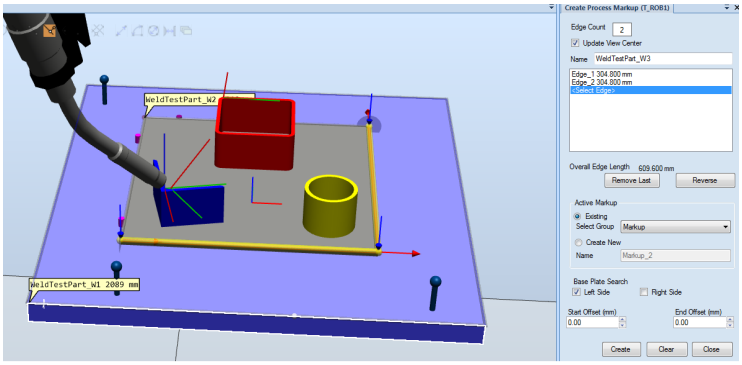
Refer to RobotStudio document for more information on Virtual Reality.

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.



xx1900000614

Use the following procedure to setup the VR:

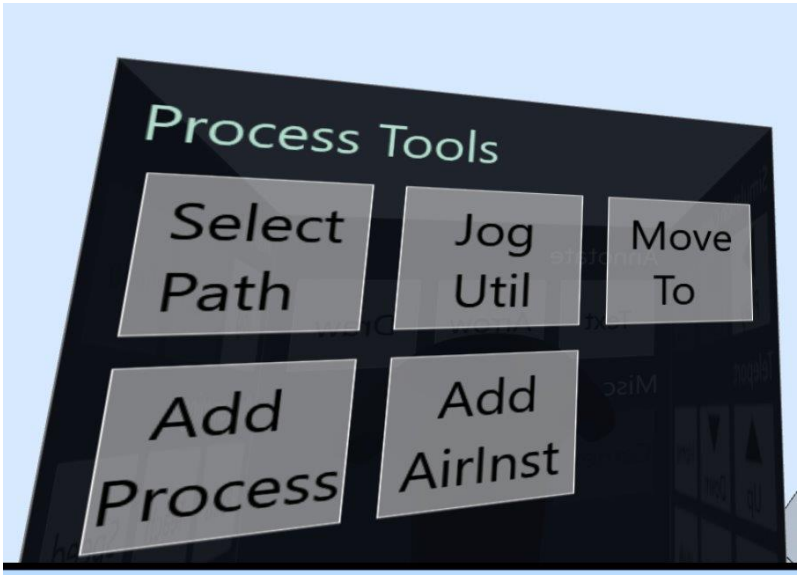
1. Open RobotStudio.
2. Click **Add In** tab and select **ArcWelding2** option, to activate the **ArcWelding2 PowerPac**.
3. From the ribbon tab, select the **Virtual Reality** option, to activate the **Virtual Reality**.

> **Note**
>
> The graphical window is made active for VR.

7.2 Arc Welding VR Window

Introduction

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



xx1900000601

The following modes are displayed in the window:

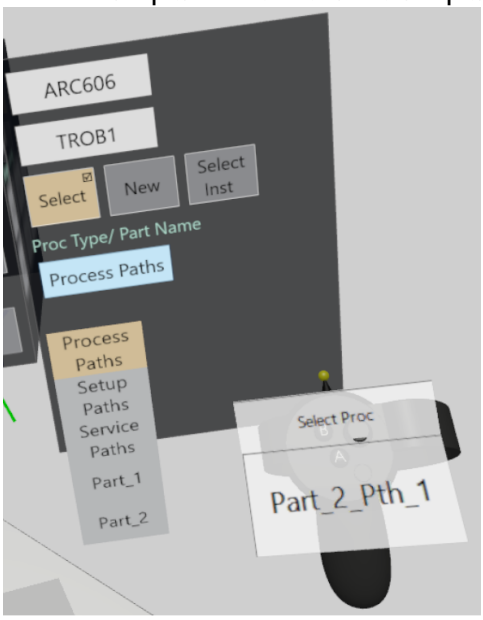
Mode	Description
Select Path	To create and test the path. Also sets the active controller, task, and path.
Move To	To move the robot along the different segments and to check the reachability of robot from the previous target position. Also, used to set the configuration.
Jog Util	To jog the mechanism 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.

Continues on next page

Select Path Mode

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

xx1900000602

Mode	Description
Controller Name	Set the active controller name.
Active Task	To set the active task.
Select	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.  xx1900001582
New	Sets the active workobject, tool and new empty path is displayed.

Continues on next page

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:

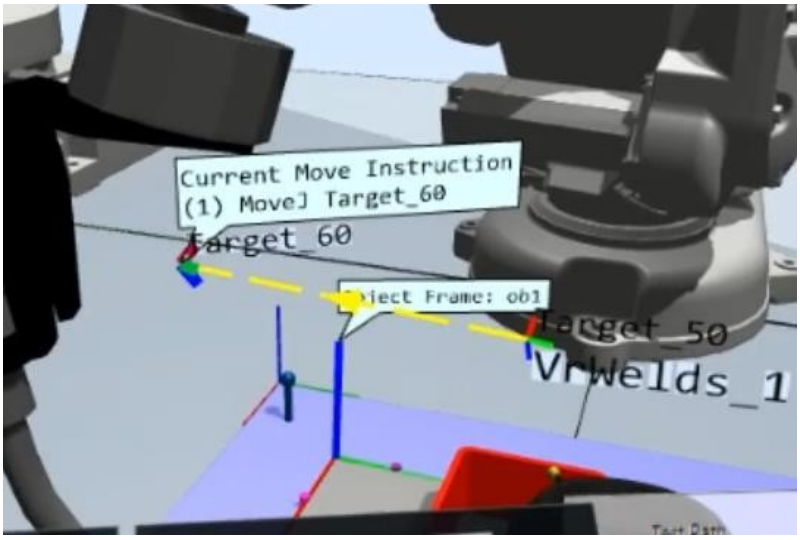
- Select **New** and click **Create Path** option, an empty path will be created.

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

> **Note**
>
> Click **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).

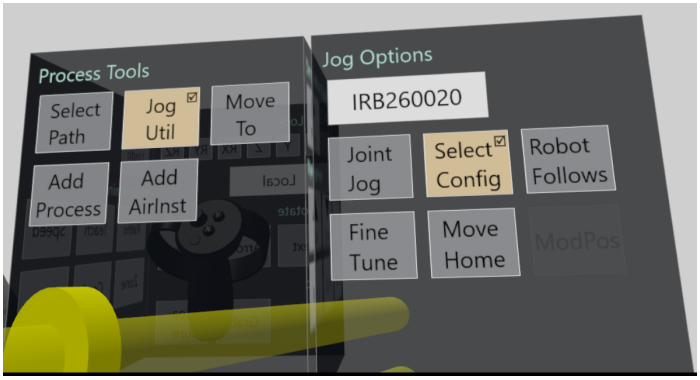


xx1900000612

Continues on next page

Jog Utility Mode

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



xx1900000610

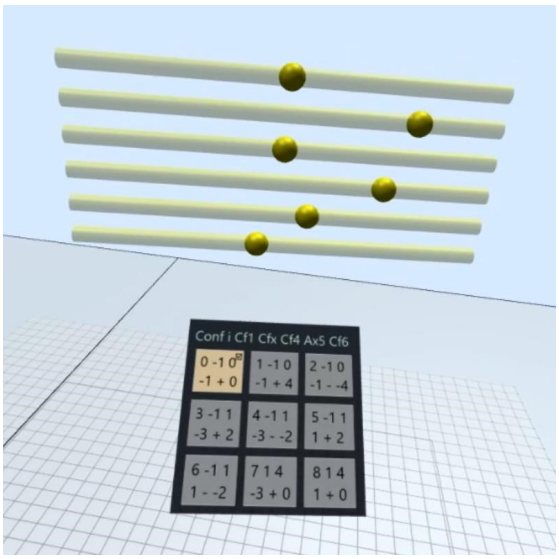
Mode	Description
Robot Name	To select the robot mechanism. The robot name is displayed.
Joint Jog	To move the Robot to an selected position by grabbing the axis and moving it or by the utility.
Select Config	To select the desired configuration. In select config, all possible configurations can be tested.
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.

Continues on next page

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



xx1900000611

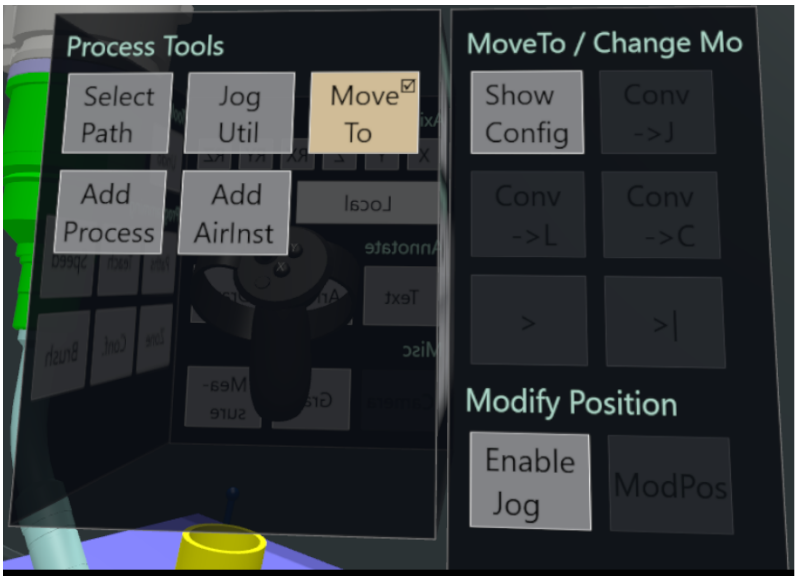
Move To Mode

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 **Move To** mode.

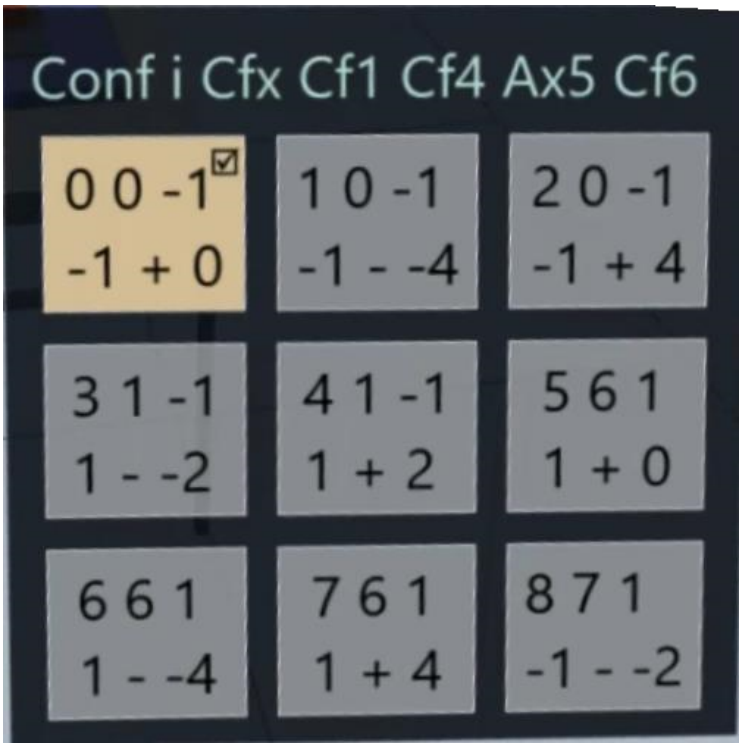
  The **MoveTo Options** window is displayed.
- Select the instruction by pressing the TRIGGER.

  Note

  The robot will move to the selected target position from the previous target position.
- Click **Show Config** mode, to change the configuration of robot.

Continues on next page

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.

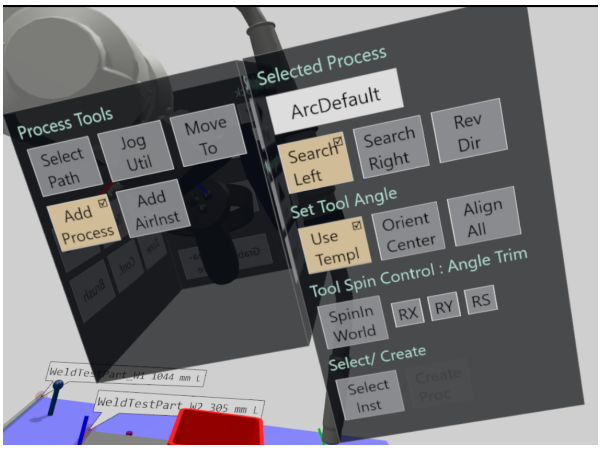
- To modify the position of the target of the selected instruction:
  1. Select an instruction and execute **Move To** for the selected instruction. Robot moves to the selected instruction.
  2. Click **Enable Jog**, and jog the robot to the new position by grabbing the robot.
  3. Click **ModPos**, 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 107*
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 108*
3. Click **Create Proc** option, to add the welds to the selected path.

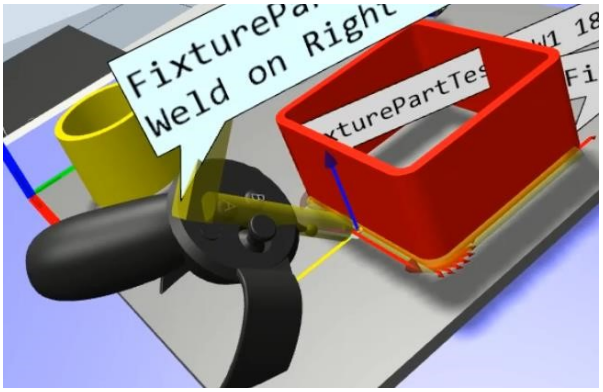
To select the process markup

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.

Continues on next page

- 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.

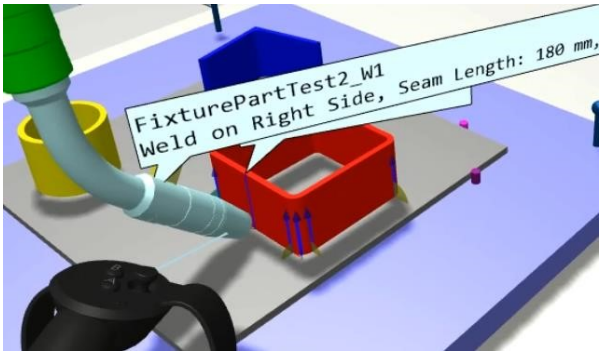


xx1900000608

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 **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.



xx1900000609

Add AirInst

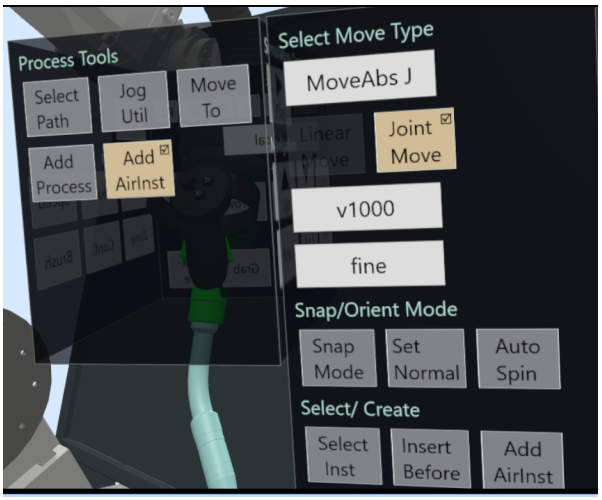
This is used to add air instruction before or after the selected instruction.

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 **Select Path** mode.

   Set the active task, workobject and tool.
2. Click **Create Path** option, to create an empty path.

   Select the created path.

   For more information, see *Select Path Mode on page 101*.
3. Click **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 **Add AirInst** mode to add the air instruction to the active path procedure.

   For more information, see *Add AirInst on page 108* mode.
5. Click **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 104* mode.

> **Note**
>
> If the targets are not reachable the robot will stop automatically.

Index

A
Air Instruction, 108
Air Move, 52
ArcWelding PowerPac
  User Interface, 11

G
Generic Data, 13

I
Instruction
  Search, 91
IO Configuration, 87

M
Motion Analyzer, 83
Move To, 57

O
Online Monitor, 85

P
Process Markup, 22

R
RC Control, 86
RCS, 13
Reference Coordinate System, 13

S
Search_1D, 89
Split Markup, 33

T
Template
  Searching Template, 89–90
  Tool Properties, 93

V
Virtual Reality, 100

ABB AB
Robotics & Discrete Automation
S-721 68 VÄSTERÅS, Sweden
Telephone +46 10-732 50 00

ABB AS
Robotics & Discrete Automation
Nordlysvegen 7, N-4340 BRYNE, Norway
Box 265, N-4349 BRYNE, Norway
Telephone: +47 22 87 2000

ABB Engineering (Shanghai) Ltd.
Robotics & Discrete Automation
No. 4528 Kangxin Highway
PuDong New District
SHANGHAI 201319, China
Telephone: +86 21 6105 6666

ABB Inc.
Robotics & Discrete Automation
1250 Brown Road
Auburn Hills, MI 48326
USA
Telephone: +1 248 391 9000

abb.com/robotics

3HAC071361-001, Rev L, en