ABB Robotics

Operating manual
Painting PowerPac

Power and productivity
for a better world™

Trace back information:
Workspace RW 5-15-01 version a4 (not checked in)
Published 2013-04-01 at 11:06:15
Skribenta version 1184

Operating manual
Painting PowerPac

Document ID: 3HNA019758-001
Revision: G

ABB AS, Robotics
Discrete Automation and Motion
N-4349 BRYNE
Norway

Table of contents

Overview

About this manual

This manual contains information and instructions for installing, configuring, programming, and running Painting PowerPac.

Usage

This manual should be used during installation and configuration of Painting PowerPac. It describes Painting PowerPac and includes step-by-step instructions to perform the tasks.

Who should read this manual?

This manual is intended for:

- System integrators
- End Customers
- Offline Programmers
- Robot Paint and service technicians
- ABB engineers

Prerequisites

The reader should:

- Have experience with RobotStudio
- Have experience of installation and configuration work
- Good skills in the IRC5 robot controller and RAPID programming

Organization of chapters

The manual is organized in the following chapters:

Chapter	Contents
1 Introduction	Introduces Painting PowerPac, and painting process and terms that are used in following chapters.
2 Installtion and Licensing	How to install the software and pre-requisites for installation.
3 Workflow for Painting PowerPac	Describes Step-by-step procedure to use Painting PowerPac.
4 Painting Tab	Describes in detail creating of Paint Cell, Paint Program and how to synchronize with Virtual Controller and station.
5 Paint Path Tab	Describes how to create PaintStrokes, Inserting Events, and Modifying Targets.
6 Paint Panel Tab	Describes how to create and shape Panels.

References

References	Document ID
Operating manual - RobotStudio	3HAC032104-001
Operating manual - Trouble shooting	3HAC020738-001

Continues on next page

Continued

References	Document ID
Technical reference manual - RAPID Instructions, Functions and Data types	3HAC16581-1
Technical reference manual - RAPID overview	3HAC16580-1
Technical reference manual - RAPID kernel	3HAC16585-1
Technical reference manual - System parameters	3HAC17076-1
Operator's Manual - IRC5P	3HNA008861-001

Other references

References	Description
http://www.robotstudio.com/forum/	RobotStudio Support Forum

Revisions

Revision	Description
-	New Operating Manual.
A	Released with RW 5.12.03 Added *Importing Workpieces on page 129*, *Auto PaintStroke on page 102*, and *Brush Tables and Virtual Applicator on page 74*.
B	Released with RW 5.13.01 Added *Stay-On Painting on page 110*, and *Specifying a Painting Sequence on page 51*.
C	Released with RW 5.13.02 Added *Generating Cycle Time Reports on page 89*
D	Released with RW 5.14 Updated the Graphical User Interface
E	Released with RW 5.14.02 Painting functionalities were divided in various Tabs namely *Painting Tab on page 35*, *Paint Panel Tab on page 129*, and *Paint Path Tab on page 97* Added *Envelope on page 135* and *Mapping Tables on page 55*.
F	Released with RW 5.14.03 Turn Offset and Edge Offset parameters added. Updated the Graphical User Interface
G	Released with RW 5.15 • Included the section *Conveyor Tracking on page 32*. • Updated the Create New Station screenshot in *Creating a Paint Station on page 35*. • Included the section *Conveyor Tracking Option on page 36*. • Updated the screenshot in *Creating Brush Specification on page 39*. • Included the section *Creating Conveyor Mechanism on page 47*. • Included the section *Conveyor Setup on page 58*. • Included the section *Part Control on page 64*. • Included the section *Conveyor Parameters on page 65*. • Included the section *Conveyor Simulation on page 88*.

Product documentation, M2004

Categories for manipulator documentation

The manipulator documentation is divided into a number of categories. This listing is based on the type of information in the documents, regardless of whether the products are standard or optional.

All documents listed can be ordered from ABB on a DVD. The documents listed are valid for M2004 manipulator systems.

Product manuals

Manipulators, controllers, DressPack/SpotPack, and most other hardware will be delivered with a **Product manual** that generally contains:

- Safety information.
- Installation and commissioning (descriptions of mechanical installation or electrical connections).
- Maintenance (descriptions of all required preventive maintenance procedures including intervals and expected life time of parts).
- Repair (descriptions of all recommended repair procedures including spare parts).
- Calibration.
- Decommissioning.
- Reference information (safety standards, unit conversions, screw joints, lists of tools).
- Spare parts list with exploded views (or references to separate spare parts lists).
- Circuit diagrams (or references to circuit diagrams).

Technical reference manuals

The technical reference manuals describe reference information for robotics products.

- *Technical reference manual - Lubrication in gearboxes*: Description of types and volumes of lubrication for the manipulator gearboxes.
- *Technical reference manual - RAPID overview*: An overview of the RAPID programming language.
- *Technical reference manual - RAPID Instructions, Functions and Data types*: Description and syntax for all RAPID instructions, functions, and data types.
- *Technical reference manual - RAPID kernel*: A formal description of the RAPID programming language.
- *Technical reference manual - System parameters*: Description of system parameters and configuration workflows.

Application manuals

Specific applications (for example software or hardware options) are described in **Application manuals**. An application manual can describe one or several applications.

Continues on next page

Continued

An application manual generally contains information about:

- The purpose of the application (what it does and when it is useful).
- What is included (for example cables, I/O boards, RAPID instructions, system parameters, DVD with PC software).
- How to install included or required hardware.
- How to use the application.
- Examples of how to use the application.

Operating manuals

The operating manuals describe hands-on handling of the products. The manuals are aimed at those having first-hand operational contact with the product, that is production cell operators, programmers, and trouble shooters.

The group of manuals includes (among others):

- *Operating manual - Emergency safety information*
- *Operating manual - General safety information*
- *Operating manual - Getting started, IRC5 and RobotStudio*
- *Operating manual - Introduction to RAPID*
- *Operating manual - IRC5 with FlexPendant*
- *Operating manual - RobotStudio*
- *Operating manual - Trouble shooting IRC5*, for the controller and manipulator.

Safety

Safety of personnel

A robot is heavy and extremely powerful regardless of its speed. A pause or long stop in movement can be followed by a fast hazardous movement. Even if a pattern of movement is predicted, a change in operation can be triggered by an external signal resulting in an unexpected movement.

Therefore, it is important that all safety regulations are followed when entering safeguarded space.

Safety regulations

Before beginning work with the robot, make sure you are familiar with the safety regulations described in the manual *Operating manual - General safety information*.

This page is intentionally left blank

1 Introduction

1.1 About Painting PowerPac

Overview

The Painting PowerPac is a RobotStudio solution for offline programming and simulation of Paint application. It allows the programming and installation of new robots offline. This reduces installation and programming time, while not disturbing ongoing production..

Painting PowerPac is used to verify the paint line layout and painting programs. Possible program weaknesses, such as singularity, speed deviations and so on, are discovered before production start. Cycle time and robot positioning challenges are discovered at an early stage instead of after installation. It is possible to simulate the Production sequence and visualize bottlenecks and get an estimate on paint parameters.

Use the Painting PowerPac for controlling a range of features of the paint process, such as:

- Setting up the Paint cell
- Creating and editing of brush specifications
- Creating Paint Strokes
- Setting and editing Events
- Setting up the Production sequence using Job Queue
- Estimating volume of Paint material consumed for a program
- Connecting to the *Virtual Applicator* to get Brush tables using the Service

Note

Painting PowerPac works with Paint systems only

1.2 Terms and Concepts

Painting PowerPac concepts

The following table lists the terminologies and concepts used in Painting PowerPac

Concept	Description
Brush Specification	Brush Specification is a table of brush properties used by Painting PowerPac for displaying purposes, as a supplement to the “standard” Brush Tables. It contains information about the Brush Width, Length, Color, Pitch, Spray Distance and TCP Velocity associated with a Brush number. These brush properties are not used by the robot controller directly, but is used by Painting PowerPac to generate paint programs.
PaintStroke	PaintStroke is the term used to identify a group of *PaintL* and *SetBrush* instructions between the Start and End of a Paint sequence.
Paint Specification	Paint Specification contains information about the characteristics of the paint material such as the Nominal Thickness, its Density and Solid Content information. These parameters are used when user wants to access the Virtual Applicator services
Panel	Unique segments of a workpiece can be grouped together and saved as a Panel. For example, Door, Hood and so on. Panels are used while generating path using the Auto PaintStroke feature.
Virtual Fluid Device	Virtual Fluid Device is the utility option under Reports group in the ribbon tab. It shows the Material Consumption and the Gun-On time for executed programs and material (Brush Table) combination.
Workpiece	The CAD models on which the paint programs are created are referred to as Workpieces. In a RobotStudio station, there can be several CAD models, some represent the part being worked upon and others the environment.
Support Instruction	Support Instruction is a term used to identify a group of instructions like `WaitWobj`, `DropWobj`, `MoveL`, `MoveAbsJ` which will help during paint programming.

1.3 Painting support in RobotStudio

Paint Manipulator libraries are integrated into RobotStudio and are available as template systems from RobotStudio 5.15. The available system are shown in the following table.

Robot Type	Manipulator Variant	RS Model Name
IRB 52	standard vertical arm (Right and Left)	IRB52_12_700_1005__01.rslib
IRB 52	short vertical arm (Right and Left)	IRB52_12_475_1005__01.rslib
IRB 540 -12	standard arm (Right and Left)	IRB540_12_1000_1620__01.rslib
IRB 580-12	short arm (Right and Left) and standard arm w/MTB (Right and Left)	IRB580_12_1000_1220__01.rslib
IRB 580-12	standard arm (Right and Left) and standard arm w/MTB (Right and Left)	IRB580_12_1000_1620__01.rslib
IRB 5400-12	standard arm (Right and Left)	IRB5400_12_1200_1620__01.rslib
IRB 5400-12	standard arm (Right and Left)	IRB5400_12_1200_1620__01.rslib
IRB 5400-13	standard arm (Right and Left)	IRB5400_13_1200_1620__01.rslib
IRB 5400-13	standard arm axis 2 + 60 deg	IRB5400_13_1200_1620_60P_01.rslib
IRB 5400-14	standard arm (Right and Left)	IRB5400_14_1200_1620__01.rslib
IRB 5400-14	standard arm axis 2 + 60 deg	IRB5400_14_1200_1620_60P_01.rslib
IRB 5400-22	process arm (Right and Left)	IRB5400_22_1200_1620__01.rslib
IRB 5400-23	process arm (Right and Left)	IRB5400_23_1200_1620__01.rslib
IRB 5400-24	process arm (Right and Left)	IRB5400_24_1200_1620__01.rslib
IRB 5500	AType_b80 and BType_b80	IRB5500_35A_1300_1720__01.rslib IRB5500_35B_1300_1720__01.rslib
IRB 5500 ProArm	AType_b80 and BType_b80	IRB5500_ProArm_A_1300_1720__01.rslib IRB5500_ProArm_B_1300_1720__01.rslib

Motion Instructions

Process templates functionality provides support (including synchronization) for arbitrary motion instructions. The templates for *PaintL* and *SetBrush* are added and set as default when the user activates the Painting PowerPac from the addins tab.

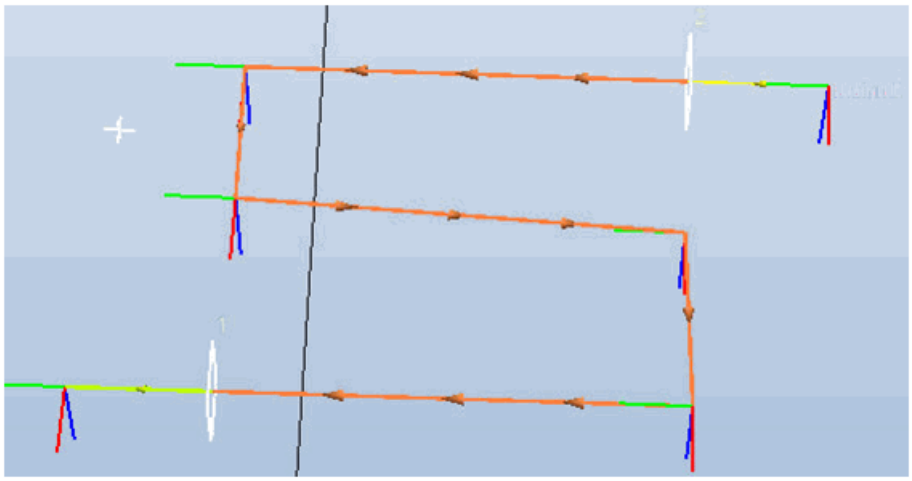
Action Instructions

The process template functionality of RobotStudio provides support for including Action instructions *SetBrush*, *UseBrushTab*, *WaitWobj*, *DropWobj* and so on. The parameters for the action instructions can also be specified from RobotStudio.

In Painting PowerPac, *SetBrush* instruction is automatically loaded once the PowerPac is activated.

1.4 Event Visualization

SetBrush events are represented graphically with a white square crossing the path, as shown in the following figure.



xx1100000808

The color of the path between events are also set based on the Brush Specification. It is also possible to modify the event positions by graphically selecting and moving the event marker.

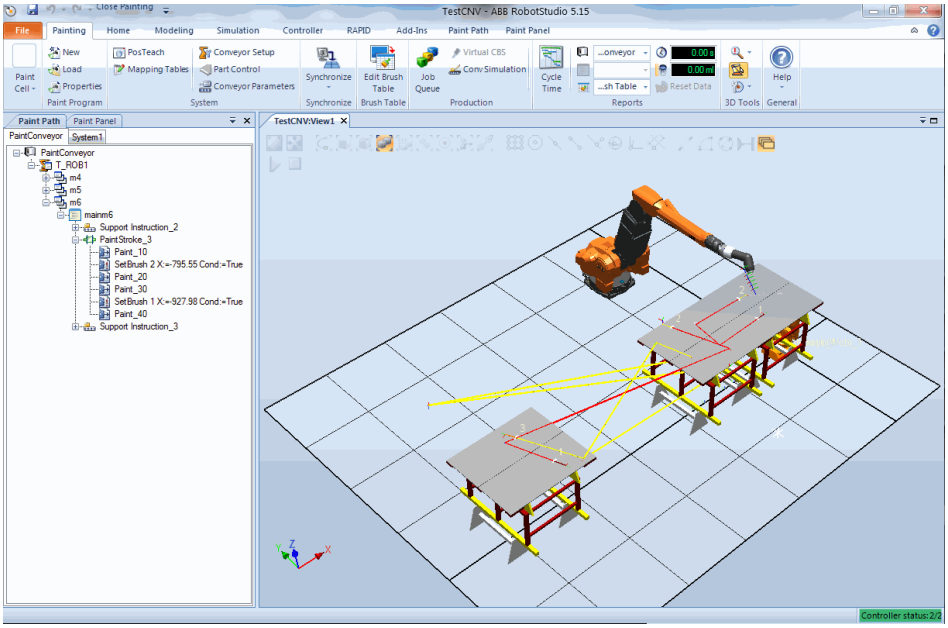
For more information about Brush Specifications, see *Creating Brush Specification on page 39*.

1.5 Graphical User Interface

1.5.1 Overview

The graphical user interface of Painting PowerPac has the following tabs:

- Painting tab
- Paint Path Tab
- Paint Panel Tab
- Browser window



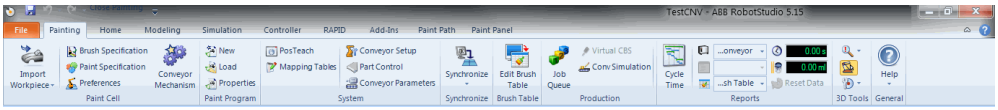
xx1200001393

Note

The '*Paint Specification*' is displayed in the **Paint Cell** group only if there is a valid '*Virtual Applicator*' license present in the system.

1.5.2 Painting Tab

The Painting tab allows you to setup a paint cell, specify parameters and functions to simulate the cell, and generate reports. It enables you to perform most Painting related operations.



xx1100000810

The Painting Tab consists of the following nine groups listed in the same sequence as when creating a paint program.

1. **Paint Cell**
2. **Paint Program**
3. **System**
4. **Synchronize**
5. **Brush Table**
6. **Production**
7. **Reports**
8. **3D Tools**
9. **General**

Group	Button	Functionality
Paint Cell	Import Workpiece	Choosing the CAD model which is then imported into the station and placed below the TCP of the robot.
	Brush Specification	Creating Brush specifications to be used in a program.
	Paint Specification	Creating Paint specifications to be used in a program.
	Preferences	Creating templates which are used when creating PaintStrokes.
	Conveyor Mechanism	Creating a conveyor mechanism for the selected part by defining the conveyor length and attachment points.
Paint Program	New	Creating a new paint program and select the Workpiece and the Brush Specification for that program.
	Load	Loading an existing Paint program.
	Properties	Changing the properties such as Name of the paint program, Brush specification and workpiece.

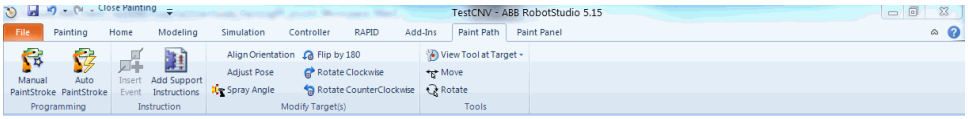
Continues on next page

Continued

Group	Button	Functionality
System	PosTeach	Updating any fixed utility positions in the controller.
	Mapping Tables	Allows you to define the Mapping and Index files, which are used to call Paint routines from external clients such as FlexPendant.
	Conveyor Setup	Mapping a conveyor mechanism to a system.
	Part Control	Helps in setting up the conveyor by defining the Part Sequence and the way parts should be tracked by the conveyor.
	Conveyor Parameters	Defining the parameters of a conveyor and a robot.
Synchronize	Synchronize to VC	Selecting the procedures to be synchronized to VC.
	Synchronize to Station	Selecting the procedures to be synchronized to the Station.
Brush Table	Edit Brush Table	Creating Brush tables or connecting to the Virtual Applicator service and geting Brush tables. Visualizing the Spray pattern for a given brush number.
Production	Job Queue	Appending jobs and visualizing the production as it happens in the real paint system.
	Virtual CBS	Modifying the parameters that are associated with the CBS system.
	Conveyor Simulation	Controlling the simulation by selecting which conveyor mechanisms to run and adjusting the speed of the conveyor mechanism. It also helps to pause, restart, and reset the conveyor.
Reports		
	Cycle Time	Viewing the cycle time information of the executed paint programs as a Gantt chart.
	System	Displays a list of systems in Robot Studio station.
	Procedure	Displays list of already executed programs.
	Material	Displays list of materials defined under the selected system.
	Reset data	Resets all the virtual fluid device data.
3D Tools	Show/Hide, Jog Joint, View Tool at Target	Operating the 3D utility tools.
General	Manual	Viewing the Online Help Operationg manual.
	About	Viewing information about the product version and support contact information.

1.5.3 Paint Path Tab

Paint Path provides functions for creating paint strokes either manually or automatically, inserting events on the path and quick access functions to edit the path/targets.



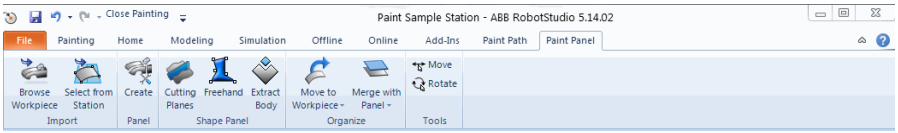
xx1100000952

The Paint Path Tab consists of the following four groups:

- **Programming**
- **Instruction**
- **Modify Target(s)**
- **Tools**

1.5.4 Paint Panel Tab

Paint Panel tab provides functions for processing and shaping workpieces (CAD models) to identify appropriate panels which are to be painted.



xx1100000953

The Paint Panel Tab consists of the following five groups:

- **Import**
- **Panel**
- **Shape Panels**
- **Organize**
- **Tools**

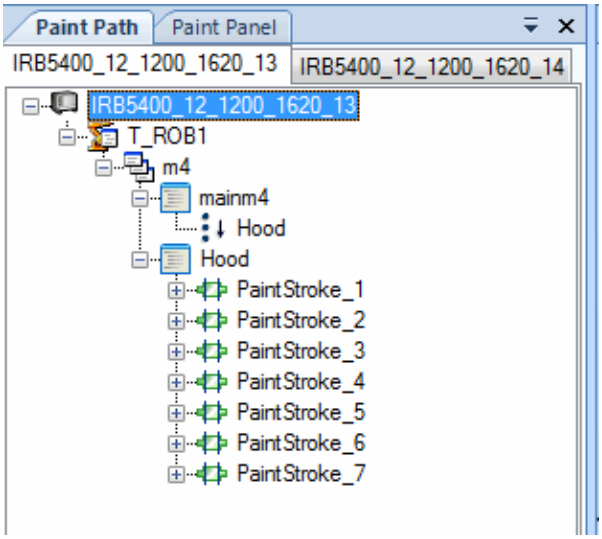
1.5.5 Browser Window

The Browser window in the Painting PowerPac provides a tree view of the System and the Paint programs that are created using the Painting PowerPac.

The workpieces are listed separately in another Browser window called *Panel*.

Paint Path

All the controllers in the station are listed in the Painting browser as separate tabs.



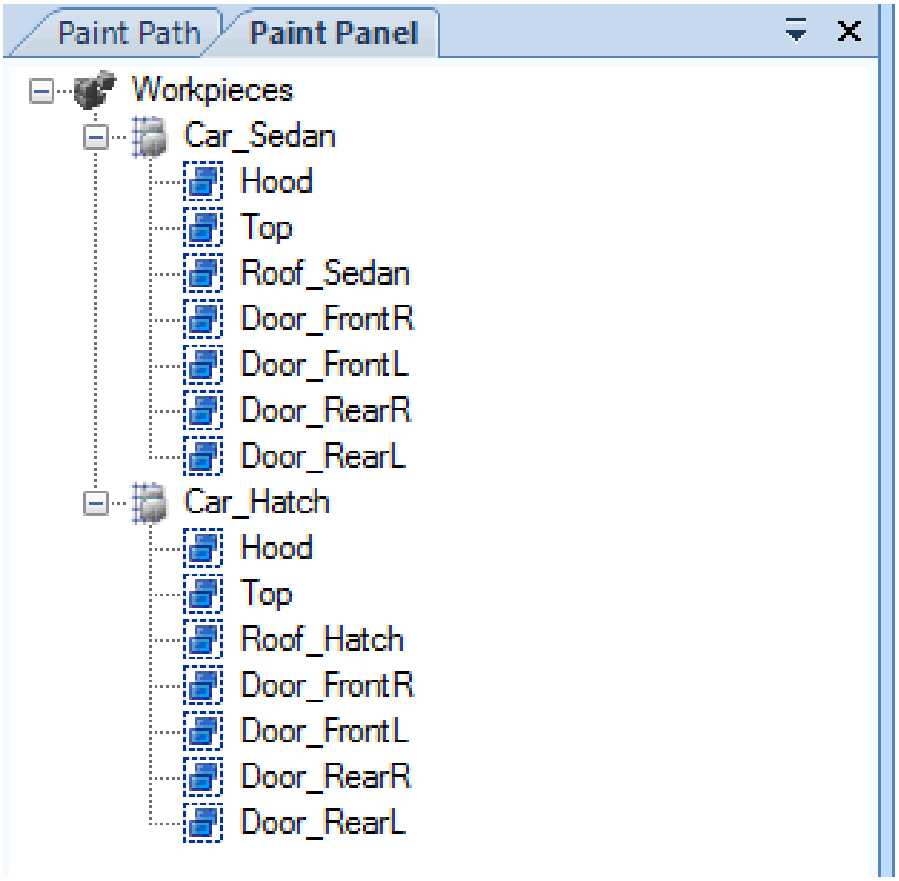
xx1100000811

Continues on next page

Continued

Paint Panel

Panel browser window lists all the workpieces on which the paintstrokes are created. Panel represents a unique region on the workpiece on which the paint path has to be generated. Panels are identified and listed for each workpiece as shown in the following figure.



xx1100000812

This page is intentionally left blank

2 Installing and Licensing Painting PowerPac

2.1 System Requirements

The following are the prerequisites for installing:

- A computer that meets or exceeds the system requirements as specified by RobotStudio.
- A log on account with administrator rights on the computer.
- RobotStudio 5.15

Hardware Requirements	Software Requirements
CPU: 2.0 GHz or faster processor, recommended is multicore processor	Microsoft Windows XP Professional with Service Pack 3 or Windows 7
Memory: 1 GB RAM or more (More is recommended).	RobotStudio 5.15 or above
2 GB RAM is running Windows Vista, 7, Stations with several robot systems or large CAD models	RobotWare 5.15 or above
Available disk space: 5+ GB on the system disk, 250+ MB on the installation disk	.NET 4.0 Framework SP1
Graphics card: High performance OpenGL-compatible graphics card with the corresponding up-to-date drivers installed	
Screen resolution: 1280 x 1024 pixels (Recommended)	
Colors: 256 or higher	
DPI: Normal size (96 dpi)	
Mouse: Three-button mouse	

2.2 License Key

The license certificate document contains ABB contact information, an activation key, a list of licensed products and an expiration date.

For more information about licensing, see the RobotStudio-OM manual.

Prerequisites

You need a license key to use Painting PowerPac. The license key is valid only on the computer on which RobotStudio and the Painting PowerPac are installed.

The license key is invalidated if you change your file system (for example, from FAT32 to NTFS).

Requesting a License Key

To request your license key:

1. Log on to your computer.
2. Launch RobotStudio and then navigate to **Information : Manage Licences**
3. Click on **Activation Wizard** and select **I want to request a licence file**
4. Enter the Activation key received along with RobotStudio.
5. Save the report and upload the file to the SOFA server.
6. On receiving the Licence key, install manually or activate over the Internet

Trial and Conversion

You can use Painting PowerPac for a trial period of 30 days. The trial period license file 'PaintingPowerPac_5.15_KEY.bin' is found in the installation folder of Painting PowerPac folder, usually in *C:\Program Files\ABB Industrial IT\RoboticsIT\Painting PowerPac 5.15*. Activate this license file to use Painting PowerPac for a trial period.

Once the trial period is over, procure and activate a licence to continue to use Painting PowerPac. The Virtual Applicator functionality is not available during the trial period.

2.3 Getting Started with Painting PowerPac

Starting Painting PowerPac

To start the Painting PowerPac:

1. Create a new paint station, or open an existing paint station by using RobotStudio.
2. Click **Painting** in the PowerPacs group of the **Add-ins** tab on the Ribbon.

> **Note**
>
> Painting PowerPac cannot be activated without a station having an active paint controller running.

Stopping PowerPac

To stop Painting PowerPac, click **Painting** on the **Add-ins** tab or click **Close Painting PowerPac** in the Quick Access Toolbar.

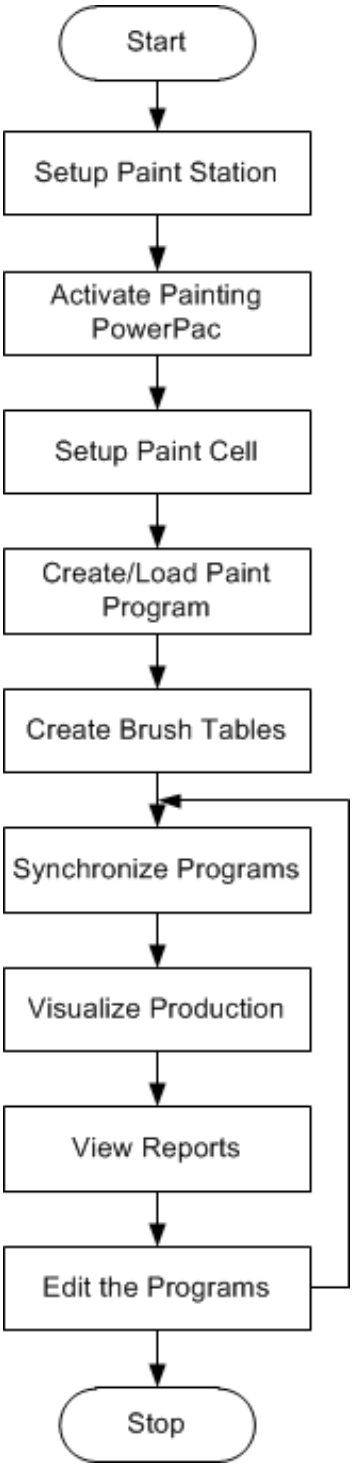
This page is intentionally left blank

3 Workflow

3.1 Painting PowerPac

Operation Flow

The following flowchart shows the recommended flow for working with Painting PowerPac. For more information, see the table following the flowchart.



Continues on next page

Continued

xx1200000065

Note

The Painting station must be setup in RobotStudio before activating Painting PowerPac. The Painting PowerPac provides a method for creating paths and events. Use the regular RobotStudio functions for building a paint station.

	Task	Description
1	Setup Paint Station	Create a new station from RobotStudio which has Paint systems. Import and attach paint tool libraries to the robot.
2	Activate Painting PowerPac	Click **Add-Ins** Tab and click **Painting** that enables the Painting PowerPac tabs. For more information see *Graphical User Interface on page 17*.
3	Setup Paint Cell	Setup the Paint Cell as follows: • Identify Panels on the Workpieces (For example: CAD models). There are a numerous features to identify a suitable Panel which is essential while programming. For more information, see *Importing Workpieces on page 129*, *Creating Panels on page 133*, and *Shape Panels on page 136* • Define Paint and Brush Specifications, and Paint Path settings. For more information, see *Creating Paint Specification on page 42*, *Creating Brush Specification on page 39*, and *Creating User Preferences on page 44*. • Create a *Creating Conveyor Mechanism on page 47*.
4	Create New Paint Program or Load an existing program	Create a new program after selecting the workpiece to the painted and the Brush Specification to be used in the program For more information, see *Creating New Paint Program on page 50* and *Loading a Paint Programs on page 53*.
5	Configure a number of spatial functions in the controller. Configure a conveyor encoder unit.	See *Conveyor Setup on page 58* and *Conveyor Parameters on page 65*.
6	Create Brush Tables	Brush Tables are required to calculate the parameters from Virtual Fluid Device. For more information, see *Brush Tables and Virtual Applicator on page 74*.
7	Synchronize programs	After creating PaintStrokes, Sync to VC from Painting tab.
8	Visualize Production	Use Job Queue feature to setup production sequence by appending jobs or use RobotStudio Simulation setup and Start the simulation. For more information, see *Job Queue on page 81*, Virtual CBS. Control the simulation by selecting which conveyor mechanisms to run, adjusting the speed of the conveyor mechanism. For more information, see *Conveyor Simulation on page 88*.
9	View Reports	After executing the simulation, check the reports for information about the cycle time of individual tasks and the overall process time. For more information, see *Generating Cycle Time Reports on page 89* Check on the Material consumption and Gun-On time. For more information, see *Brush Tables and Virtual Applicator on page 74*

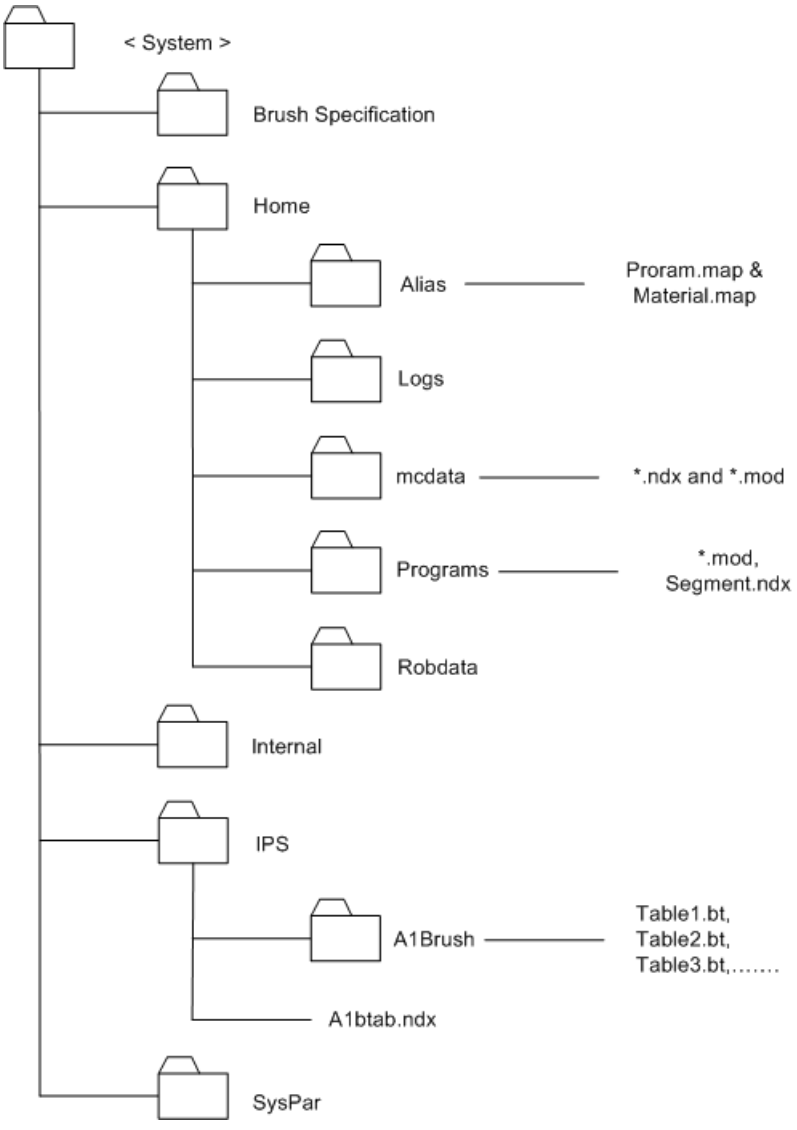
Continues on next page

Continued

	Task	Description
10	Edit the program	You can adjust the generated programs using a number of features such as Insert Event, and so on which are available from the context menu of the Paint Path. For more information, see *Insert Events on page 113*, and *Context Menu on page 120*.

Folder configuration

The following diagram gives an overview of the files and folder structure in Painting PowerPac.

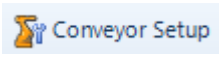
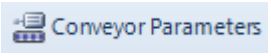
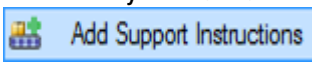
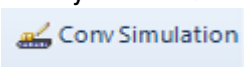


xx1200000064

3.2 Conveyor Tracking

Operation Flow

The following table shows an overview of the conveyor tracking features in Painting PowerPac and their usage during different activities.

	Task	Conveyor Function	Description
1	System/Layout setup	Conveyor Setup 	To configure the system for enabling conveyor tracking, see *Conveyor Setup on page 58*.
		Create Conveyor Mecahnism 	For creating a conveyor mechanism, see *Creating Conveyor Mechanism on page 47*.
2	Programming	Part Control 	For defining the objects on the conveyor. For more information about *Part Control*, see *Setting up a conveyor*, in *Operating manual - RobotStudio*.
		Conveyor Parameters 	For defining the parameters of a conveyor and a robot, see *Conveyor Parameters on page 65*.
		Add Conveyor Instructions 	For adding relevant instructions like `WaitWobj` and `DropWobj`
3	Simulation	Conveyor Simulation 	Controlling the simulation by selecting which conveyor mechanisms to run and adjusting the speed of the conveyor mechanism. It also helps to pause, restart, and reset the conveyor.

Overview

To work with a system in RobotStudio with conveyor tracking, the following steps are suggested:

1 System and conveyor configuration

- **System with Conveyor Tracking option selected**

  Create/modify a system with conveyor tracking option enabled.

- **Conveyor mechanism library**

  The conveyor mechanism can be created that defines from where to where it travels, its limits, and the attachment points. This library must be saved on the PC.

Continues on next page

Tip

In Painting PowerPac, refer *Conveyor Setup on page 58* and *Creating Conveyor Mechanism on page 47*.

2 When the system is included in the RobotStudio station, it requests to include the conveyor library. Choose the saved conveyor library.

Tip

If there can be several controllers in the station and to map all the controllers to the same conveyor, refer *Conveyor Setup on page 58*.

3 The workpieces that are to be tracked are specified in the Part Control.

Tip

For more information, see *Part Control on page 64*.

4 Program the path on the workpieces.

Create programs using PowerPac and add conveyor instructions across the program.

Tip

The PowerPac comes with additional support for easily adding conveyor instructions to the paint strokes. Add instructions like `WaitWobj`, `DropWobj`, etc. See *Context Menu on page 120* for more information.

5 Setup the conveyor parameters.

The conveyor parameters includes Start Window Width, Minimum Distance, Sync Offset, and Maximum Distance, these parameters might need to be modified depending on the programs.

Tip

The conveyor parameters can be visualized graphically.

For more information, see *Conveyor Parameters on page 65*.

6 Synchronize the program to virtual controller.

Tip

In Painting PowerPac, see *Synchronizing to Virtual Controller and Station on page 70* for more information.

Continues on next page

Continued

7 Start Simulation.

Tip

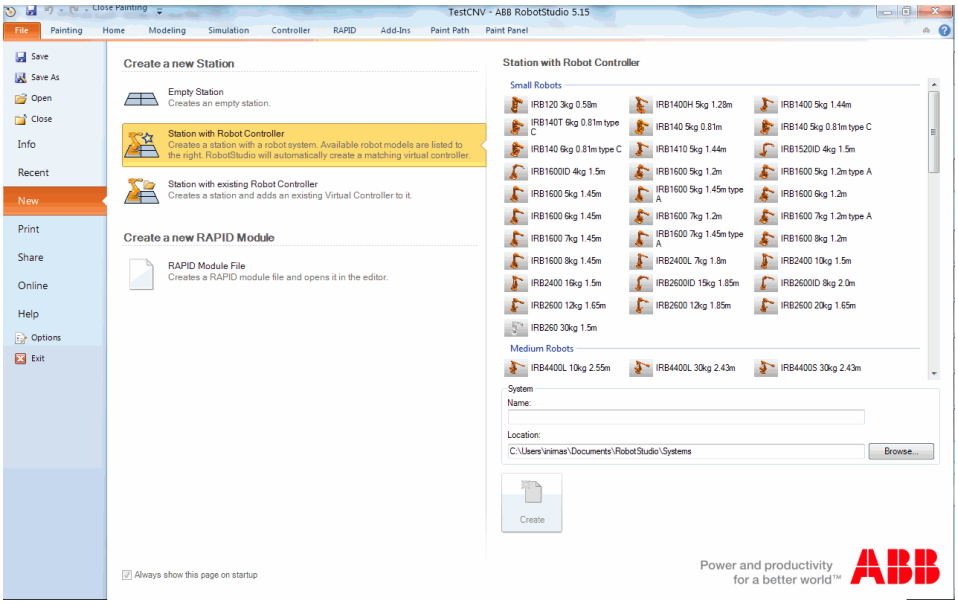
From Painting PowerPac, the conveyor simulation operations can be controlled. See *Conveyor Simulation on page 88* for more information.

4 Painting Tab

4.1 Paint Cell

4.1.1 Creating a Paint Station

1. On **File** Tab, Click **New**.
2. Select **Station with Robot Controller** to create a station from the existing Templates. You can also create an **Empty station** or **Station with existing Robot Controller**.
3. Select a paint robot and click **Create**.



xx1100000813

Note

The base frame of the Robot is rotated by 90 degrees as the Paint systems in RobotStudio are configured as right-sided.

Color Change and CBS Options

The options *Color Change* or *CBS* options are not selected by default. You need to select these options to simulate Material change and CBS operations. One method to select these options for the system is described below.

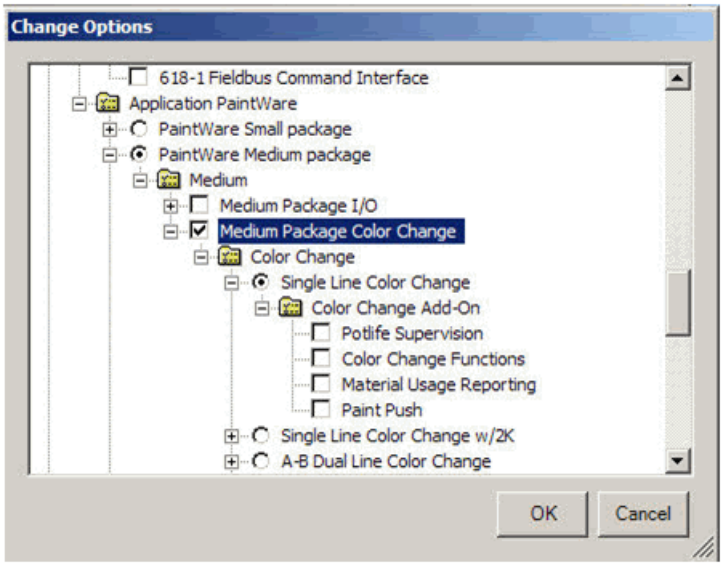
1. Shut down the controller if the System is in use and select **Modify** from *System Builder*.
2. Navigate to **Options** tab.

Continues on next page

4.1.1 Creating a Paint Station

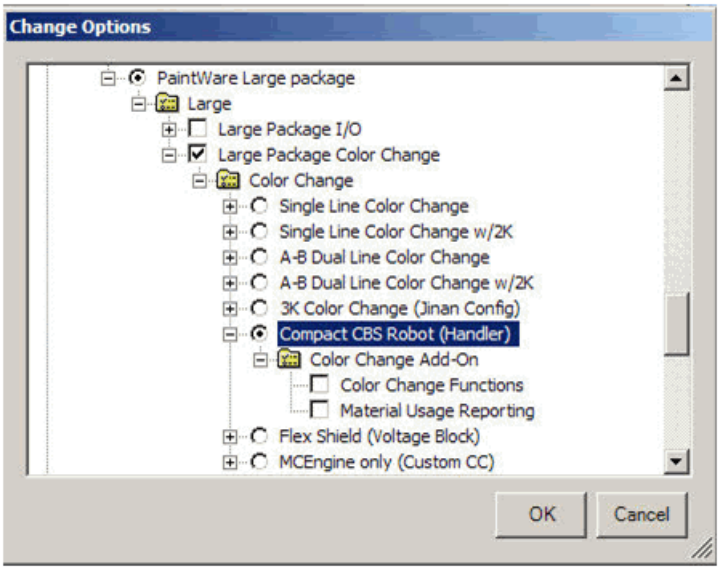
Continued

3 Select **Color change** from either Paintware *Small* or *Medium* or *Large* package.



xx1100000814

4 To create a system with CBS support, select **Compact CBS Robot (Handler)** from *Paintware Large* package.



xx1100000815

For more information, see *Virtual CBS on page 85* and *Job Queue on page 81*

Conveyor Tracking Option

The *Conveyor Tracking* option is not selected by default. You need to select this option to simulate the Conveyor operations. One method to select this option for the system is described below.

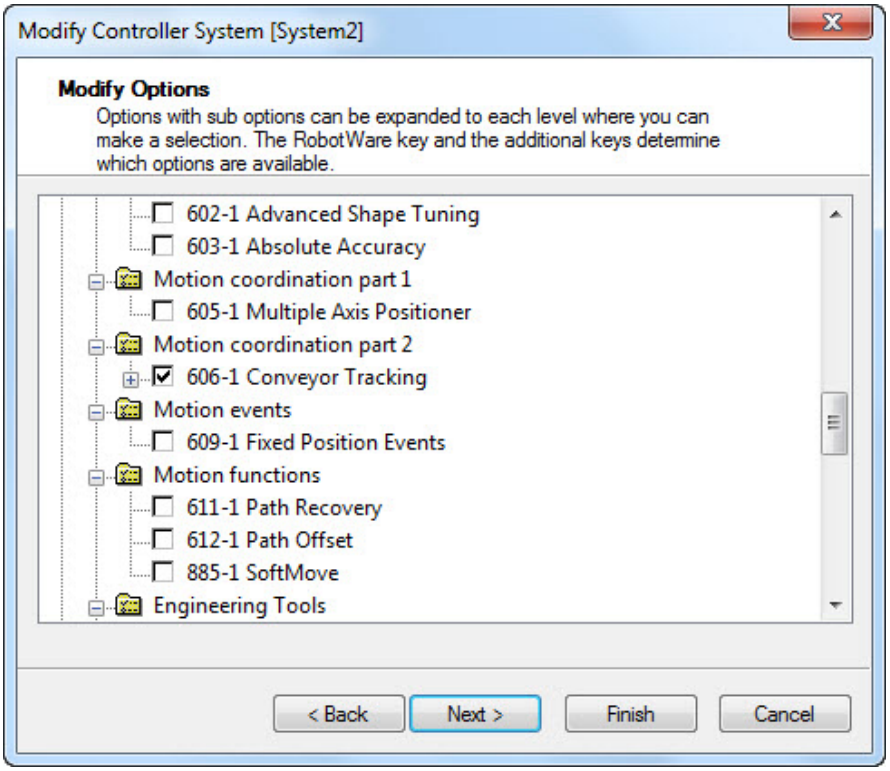
1 Shut down the controller if the System is in use and select **Modify** from *System Builder*.

Continues on next page

Continued

2 Navigate to **Options** tab.

3 Select **606-1 Conveyor Tracking** option from **Motion coordination part 2**.



en1200001079

4.1.2 Importing Workpiece

Refer *Importing Workpieces on page 129* for more details.

4.1.3 Creating Brush Specification

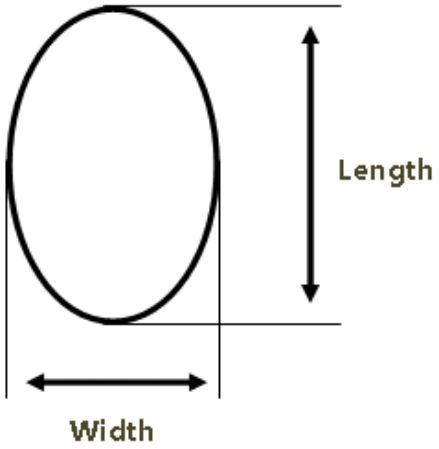
Overview

Brush Specification allows you to set various brush properties used by Painting PowerPac. These Brush properties are not used by the robot controller directly, instead it is used by Painting PowerPac to identify PaintStrokes and while accessing the Virtual Applicator service which supplies the appropriate Brush Table parameters.

Creating a Paint program requires a Brush Specification to be defined in the station. For each brush number, the Brush Specification has the following information:

- **Width** *in mm*
- **Length** *in mm*
- **Color**
- **TCP Speed** *in mm/s*
- **Pitch** *in mm*
- **Spray Distance** *in mm*

The **Width** and **Length** information is used while creating/identifying paint strokes. The **Color** information in a Brush number is shown on the path. The **Width** and **Length** represent the pattern of the spray for the corresponding Brush number. For example, a value of 0 for **Width** and **Lenght** indicates that the corresponding brush number is used to Turn-Off the paint. This information is used when Loading existing Paint programs. It is important to create the appropriate Brush specification such that the PaintStrokes are identified correctly.



xx1100000842

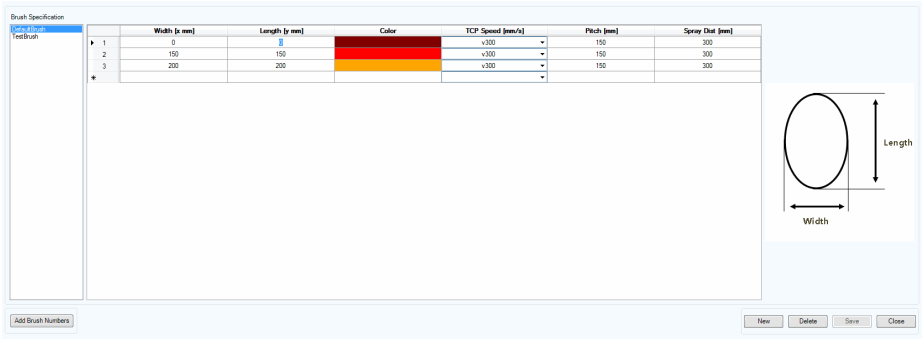
Continues on next page

4.1.3 Creating Brush Specification

Continued

Usage

1 On the **Painting** Tab, in the **Paint Cell** group, click **Brush Specification**.



xx1100000843

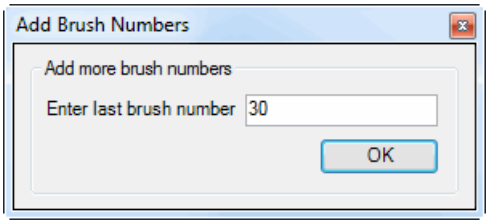
2 In the **Brush Specification** dialog, follow the procedure below to create a **Brush Specification**.

	Action	Info
1	Click **New**	
2	Enter the name of the Specification (for example *Brush1*and so on) and click **Apply**.	The name is appended in the list on the left side of the dialog. Multiple Brush Specifications can be created by following steps 1 and 2.
3	Specify the following parameters: • **Width** *in mm* • **Length** *in mm* • **Color** • **TCP Speed** *in mm/s* • **Pitch** *in mm* • **Spray Distance** *in mm*	For **Width** and **Length** specify the X and Y (in mm) of the spray pattern. Some default values for Brush numbers 1 and 2 are appended automatically. You can change the default values. The Pitch, Spray Distance, TCP Speed are used in the Virtual Applicator service which calculates the Brush Tables for the given values along with the information from the Paint Specification. For any given program, ensure that the above values are used when making a Paint program by specifying them in the *Preferences*. Each Brush number has an associated Color. The color can be changed in the dialog as shown in the following figure.
4	Click **Save** to save the Brush Specification.	When a new Brush Specification is created, it is automatically saved. If any changes are made to the Brush number parameters, then it must be manually saved. To delete a Brush Specification, select it from the tree view and then click **Delete**.

Continues on next page

Continued

3 To add the brush numbers, click **Add Brush Numbers** in the **Brush Specification**.



xx1200001371

4.1.4 Creating Paint Specification

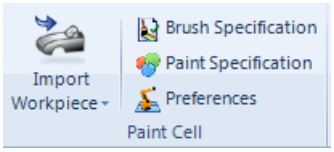
Procedure

Note

This feature is available only if a valid license of Virtual Applicator is installed.

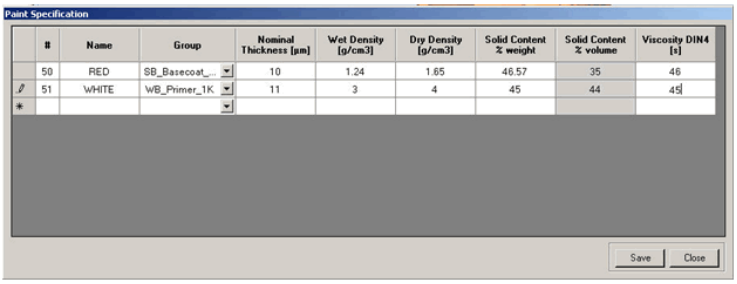
The Paint Specification contains details of the paint material used during the painting sequence. The following procedure describes creating Paint Specification:

1 On the **Painting** Tab, in the **Paint Cell** group, click the **Paint Specification**.



xx1100000844

2 The **Paint Specification** allows you to set the Paint material parameters and characteristics. The Virtual Applicator uses these information while calculating the Brush Tables.



xx1100000845

3 The table describes the parameters in the **Paint Specification**

Parameter	Description
Number	The Paint Number used to identify the paint type
Name	The name of the paint/material. Ensure that the name of the material and the number are unique.
Group	You can select from the drop down menu a list of paint groups which identify the nature of the paint, such as: • Water based (WB) or Solvent based (SB) • Primer coat or Base coat or Clear coat If Virtual Applicator license is not installed, then the option *None* is listed.
Nominal Thickness	
Wet and Dry Density	Density of paint in wet and dry mass conditions measured against the total volume of the paint sample. Unit - gm / cm3
Solid Content % Weight	It is the ratio between the total amount by weight of all Solid ingredients and the total amoount by weight of paint. It is specified as a percentage.

Continues on next page

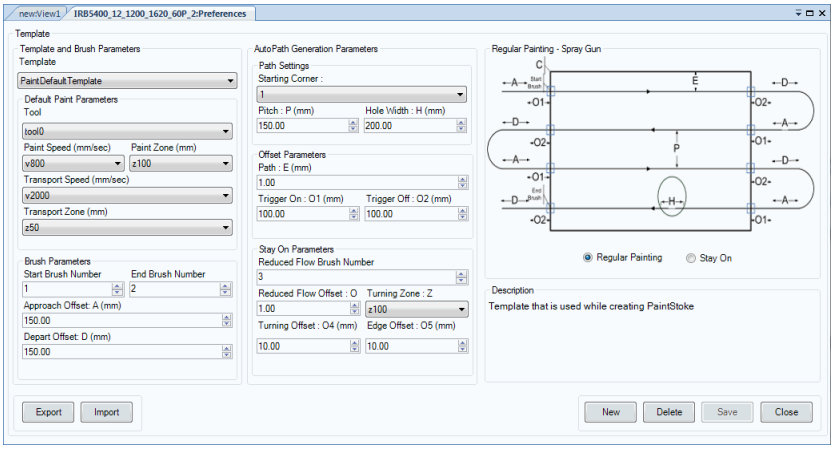
Continued

Parameter	Description
Solid Content % Volume	It is the ratio between the total sum by volume of all Solid ingredients in paint and the total sum by volume of paint. It is specified as a percentage. This value is calculated when the values for Solid content % weight and the Wet and Dry density are entered.
Viscosity	Specify the viscosity of the Paint. Unit – CentiPoise

4.1.5 Creating User Preferences

You can use the **Preferences** to find the settings done while creating Paintstrokes. **Preferences** are stored in a station in the form of Templates. You can define the parameters that are associated with Paint and Brush instructions and those required while **Auto PaintStroke** generation.

1 On the **Painting** Tab, in the **Paint Cell** group, click the **Preferences** to open the dialog. The dialog is as shown in the following figure:



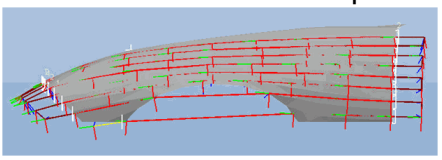
xx1100000846

2 The following table describes the options available in the **Preferences** dialog.

Option	Description
Template	All templates that are created are listed. Choose any template and the corresponding values are selected for all the remaining options. Every new station has a default template named *PaintDefaultTemplate*.
Default Paint Parameters	The default Paint Parameters are used in the *PaintL* instruction. • Choose the tool to be used in the instruction in the **Tool** list. This list is referred from the Home tab. • **Paint Speed** is the velocity of the TCP when painting. • **Paint Zone** is the Zone value while painting. • **Transport Speed** is the speed of the PaintL instruction when the robot is not painting, that is, when it is moving between PaintStrokes. • **Transport Zone** is the zone value to be used for the PaintL instruction when the robot is not painting, that is, when it is moving between paint strokes.

Continues on next page

Continued

Option	Description
Brush Parameters	• **Start Brush Number** is the Brush number to be used for Turning On the paint flow. • **End Brush Number** is the Brush number used to Turn Off the paint flow. • **Approach Offset:A** is the value in millimeter which specifies the distance that the robot has to travel before turning on the paint flow. This is the distance in which the robot needs to reach programmed TCP speed. • **Depart Offset:D** is the distance the Robot has to travel after turning off the paint.
Auto Path Generation Parameters	These parameters along with the Paint and Brush parameters are used when using *Auto PaintStrokes* functionality. The radio buttons show the various parameters and the path pattern for *Regular* and *Stay-On* painting.
Starting Corner:C	To create a program on a Panel, you need to specify the starting point of the paint stroke. Select one of the four corners of the panel as the starting point.
Pitch:P	Pitch is the distance between two parallel paint strokes
Hole Width:H	Hole width is the minimum size of any hole that will be identified during path generation. For the identified holes, targets are created at the starting and ending point after path generation. A hole can be any gap on the divided model. If there are holes in the panel and along the path, and the size of the hole is larger than the specified value in the template, then targets are created at the starting and ending point of the hole along the path. You can add events at these positions. Holes that are smaller than the specified size are ignored.  xx1100000859
Offset Parameters	
Path:E	Distance from the starting corner edge to the first paint stroke. This is usually half the pitch size.
Trigger On : O1	Distance that the robot has to travel before turning on the paint. A brush event is created at this point.
Trigger Off : O2	Distance that the robot has to travel before turning off the Paint flow. A brush event is created at this point.
Stay On Parameters	
Reduced Flow Brush number	This is the Brush number used to reduce the paint flow when robot is making a turn when using Stay-On painting
Reduced Flow Offset: O3	This is the offset distance before which the reduced flow event must be inserted before starting the turning operation and the distance turning before which the normal brush event is inserted when using Stay-On painting.
Turning Zone: Z	This is the Zone information used for the PaintL instructions which are used to make a turn in Stay-On painting.
Turn Offset	This is the distance the target is offset from the path direction when making a turn.

Continues on next page

4.1.5 Creating User Preferences

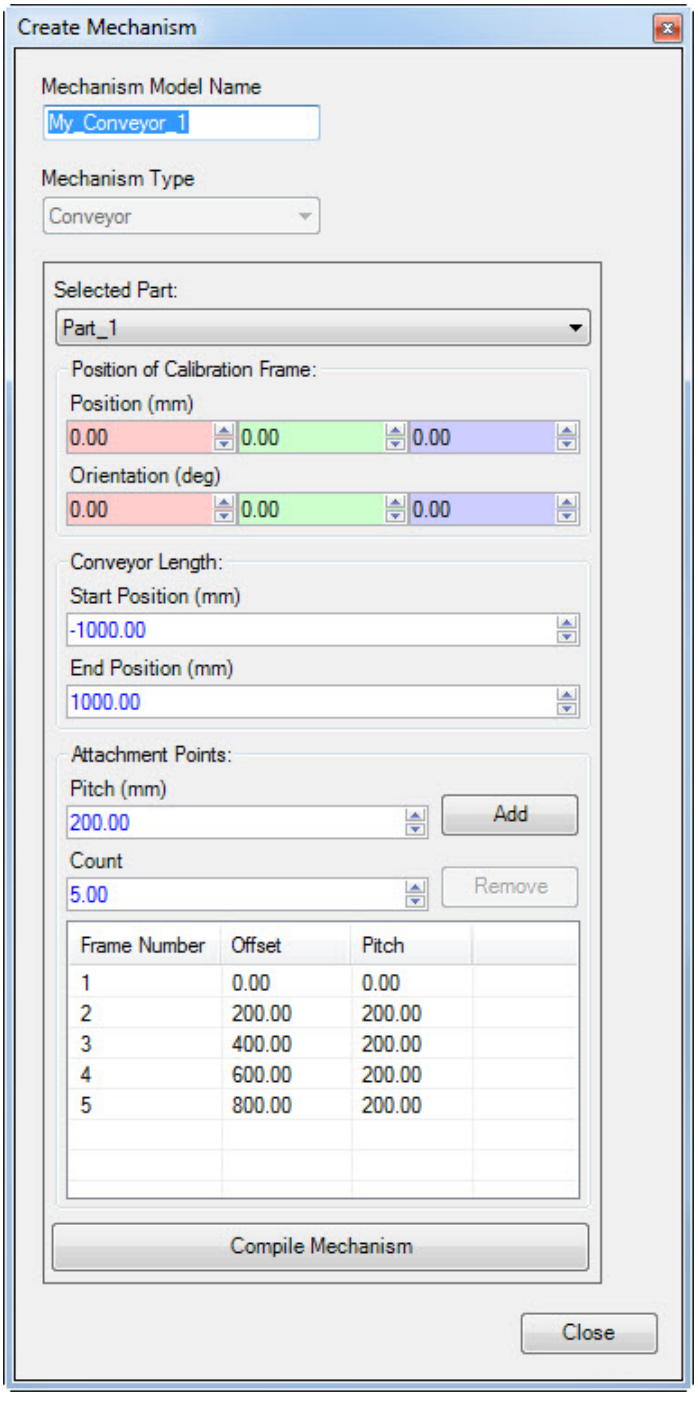
Continued

Option	Description
Edge Offset	This is the distance of the target from the edge of the Panel.
New	Click **New** to create a new template.
Save	Click **Save** to store the template as a part of the station internally.
Export and Import	Click **Export** to export the template. The templates are saved as **.tpl* files. You can import templates that have been created from other stations, by clicking **Import**. When a template is imported and saved, it is saved as a part of the station.

4.1.6 Creating Conveyor Mechanism

This topic describes how to create a conveyor mechanism for the selected part by defining the conveyor length and attachment points.

1 On the **Painting** tab, in the **Paint Cell** group, click **Conveyor Mechanism** to open the dialog. The dialog is as shown in the following figure:



en1200001001

Continues on next page

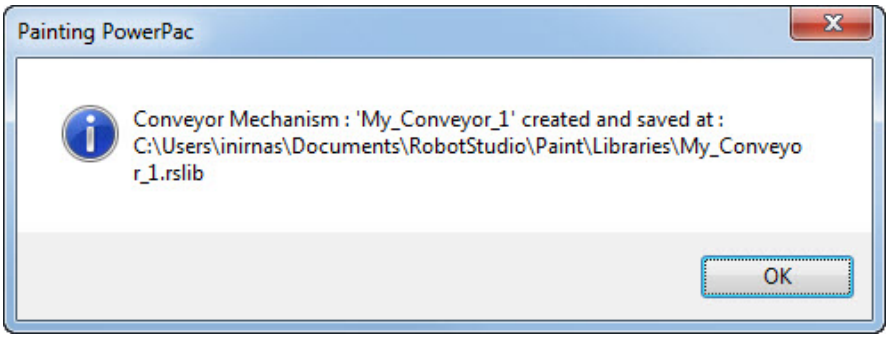
4.1.6 Creating Conveyor Mechanism

Continued

2 The following table describes the options available in the **Create Mechanism** dialog.

Option	Description
Mechanism Model Name	By default, the mechanism name is created as *My_Conveyor*. The mechanism name can be edited.
Mechanism Type	By default, the mechanism type *Conveyor* is selected and cannot be changed.
Selected Part	Displays the parts present in the station. A part should exist in RobotStudio station for it to be displayed in the list. For more information about creating Parts, see *Modeling tab*, in *Operating Manual - RobotStudio*.
Position of Calibration Frame	Enter the base frame values relative to the local origin of the selected graphic component. The default value of Position and Orientation is 0.
Conveyor Length	Enter the conveyor start and end positions in mm units. The start position should be a negative value, for example, -1000 mm. The end position should be a positive value, for example, 1000 mm. So the total length of the conveyor is 2000 mm.
Attachment Points	Define attachment points to track and sequence the part. Attachment points can be defined by specifying the pitch and the number of objects that should be created with respect to the pitch. Pitch defines the offset between each attachment frame. For example, 5 attachment frames can be created with a pitch size of 200 mm
Compile Mechanism	Click Compile Mechanism to compile the mechanism. For more information about Compile Mechanism, see *Modeling tab*, in *Operating Manual - RobotStudio*.

3 The following figure shows the path where the conveyor mechanism is saved:



xx1200001111

By default:

- For *Windows XP*, the RobotStudio conveyor mechanism library file path can be found at `C:\Documents and Settings\<user name>\My Documents\RobotStudio\Paint\Libraries\`.

Continues on next page

Continued

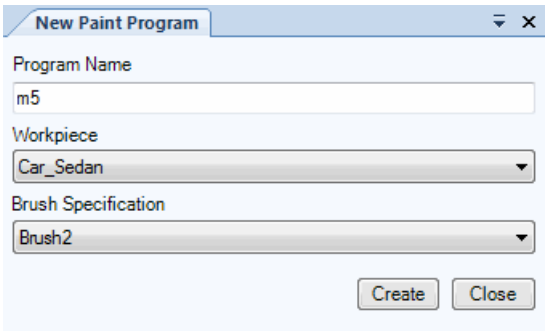
- For *Windows 7*, the RobotStudio conveyor mechanism library file path can be found at `C:\Users\<user name>\Documents\RobotStudio\Paint\Libraries\`.

4.2 Paint Program

4.2.1 Creating New Paint Program

Procedure

1 On the **Painting** Tab, in the **Paint Program** group, click **New** to create a **New Paint Program**.



xx1100000847

2 In the **New Paint Program** dialog, follow the procedure below to create a **New Paint Program**

Option	Description
Program Name	The **Program Name** is automatically suggested as a number pre-fixed with *m*. For example m5, m6, and so on. The number is incremented automatically every time a new program is created. Your can keep the name as it is or enter a new one.
Workpiece	Specify the CAD model to be associated with the program.
Brush Specification	Select the Brush specification to be associated with the program.

Note

Using Painting PowerPac RAPID modules can be created and procedures can be added to these modules. Painting programs have a naming convention that specifies that the program must have a prefix *m* followed by the name. For example *m4, m5*

The procedure also follows the same convention and is prefixed by *main*. For example *main*m4, *main*m5

To create a new paint program, you are required to have a **Brush Specification** created and have the workpiece located in the station

3 Click **Create** to create a **New Paint Program**.

4 The Painting PowerPac creates a program and a procedure and lists it in the browser window. The procedure name is *main* followed by the program name. For example, *mainm14*. The *program.map* is also updated with the information

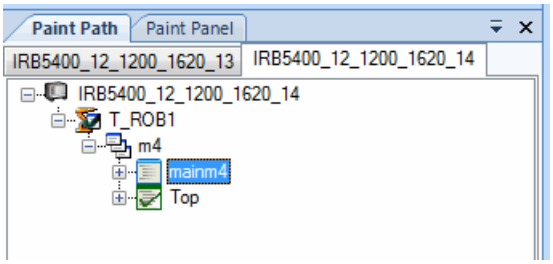
Continues on next page

Continued

of the program and a corresponding default name is specified in the mapping file.

<System>\HOME\alias\program.map

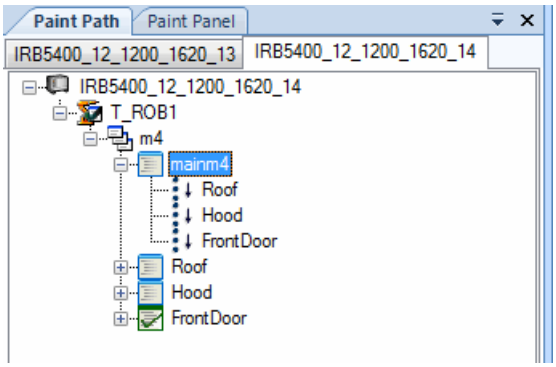
For example, if module *m14* is created, then the default mapping in *program.map* is *14, Program14*.



xx1100000848

Specifying a Painting Sequence

Painting Sequence is the sequence of execution of paint procedures. To specify the painting sequence, select a procedure and drag-and-drop it under another procedure in the same program. A sequence node is created which has the same name as that of the procedure. When you synchronize the program and procedure into the Virtual controller, the RAPID code will contain the procedure call.



xx1100000866

The procedure calls in RAPID procedure *mainm4* are as below.

```
PROC mainm4()
Roof_Car;
Hood;
FDoor_Left;
ENDPROC
```

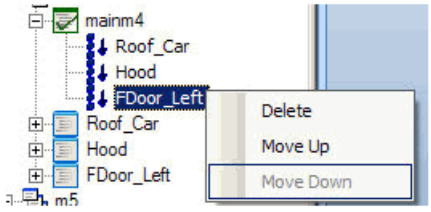
You can drag-and-drop a procedure in a program any number of times to any procedure in the same program. This way the corresponding node is created in

Continues on next page

4.2.1 Creating New Paint Program

Continued

the target procedure. You can also rearrange the sequence of the nodes by right-clicking the sequence node.



xx1100000867

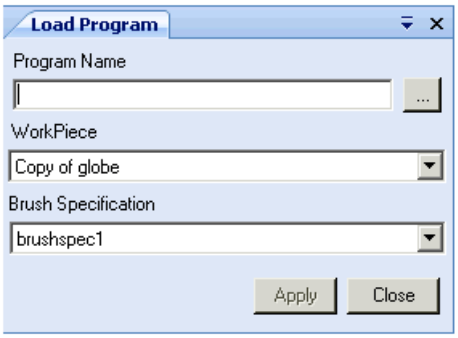
The painting sequence node is an action instruction node which is created in RobotStudio with the same name as that of the procedure. The operations allowed on the sequence node are described in the following table.

Operations	Description
Delete	Deletes the node
Move up	Moves node one level up. If the node above is a PaintStroke node, then the sequence node is inserted above it.
Move Down	Moves the node one level down.

4.2.2 Loading a Paint Programs

Procedure

1 On the **Painting** ribbon Tab, in the **Paint Program** group, click **Load**. The **Load Program** dialog appears as shown in the following figure.



xx1100000868

2 The following table describes the options you can specify in the **Load Program** dialog.

Option	Description
Program Name	Select the program name (*.mod) from the list available alongside.
Workpiece	Specify the CAD model to be associated with the program.
Brush Specification	Select the Brush specification to be associated with the program.

3 Click **Apply**. The program is validated and loaded into the station. The module and the procedures are appended to the browser window and paint instructions are added under **PaintStroke**.

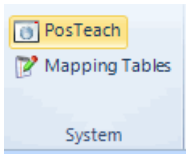
Note

In the Brush Specification if the value of *Width* and *Length* are 0 for a particular brush number, then the painting stops at that brush. The Paint program is segregated into paintstrokes based on the brush numbers with (0, 0) as values in the Brush Specification. For more information on Brush Specification, see *Creating Brush Specification on page 39*.

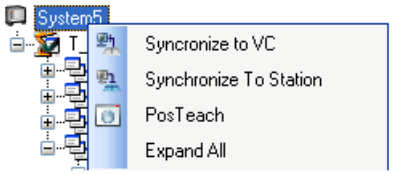
4.3 System

4.3.1 PosTeach

PosTeach allows you to update any fixed utility positions in the controller. On the **Painting** ribbon Tab, in the **System** group, click **PosTeach** or from the context menu option under the System.



xx1100000911



xx1100000910

You can update the positions for:

1 **Home**
2 **Material**
3 **Ready**
4 **User**

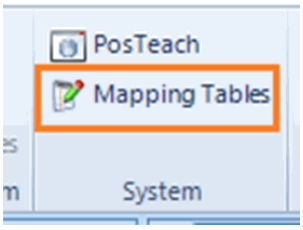
Use the following procedure to update the positions:

	Action	Information
1	Select one of **Home**, **Material**, **Ready**, or **User** positions	
2	Jog the robot to the corresponding position and click **Update**	The current robot position is recorded into the Global variable for the corresponding position in the system.
3	Click **Warm Start**	The variables are of the Persistent type and are updated only when the controller is warm-started.

HomePos and *CCPos* are pre-defined programs in the Paint Controller. You can append and check these programs from the Job Queue.

4.3.2 Mapping Tables

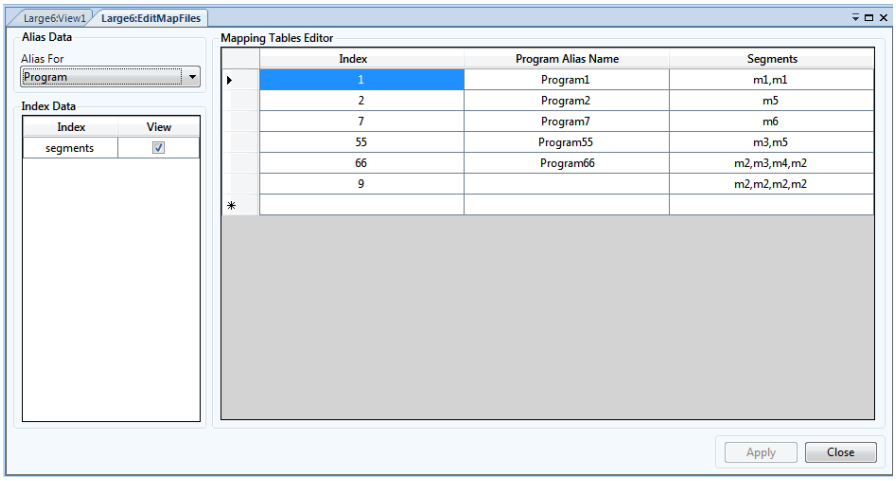
The **Mapping Tables** editor allows you to define the Mapping and Index files, which are used to call Paint routines from external clients such as FlexPendant.



xx1100000948

Mapping and Index files

The Mapping and Index files depends on the parameters selected in **Additional Options** while creating a System. For example: **Color Change** , **CBS**, and so on. For more information, see *Creating a Paint Station on page 35*.



xx1100000949

A System with **Color Change** option will allows you to use the *Material.map* and related Index files. For a System without the **Color Change** option, you can use only the *Program.map* and *Segments.ndx* files.

In Painting PowerPac, the Mapping and Index files to be used are created depending on the type of System.

The Index files are created depending on the System options and the map, and **.mod* files in the sytem folder. For example: If *c1g1cln.mod* file exists, the *C1Clean.ndx* file is created automatically

CBS related **.ndx* files will be shown only if system supports CBS option.

Paint programs are identified by the letter *m* followed by a unique number called the program index. For example m1, m2, m3, m4 and so on.

The *Program.map* file maps the program index to the program alias. The program alias helps to identify a material, as shown in the following examples:

1, Program1

Continues on next page

Continued

2, Program2

3, Program3

4, Roof

5, Door

The *Material.map* file maps the material index to the material alias. The material alias helps to identify a material, as shown in the following examples:

1, Material1

2, Material1

3, Material3

4, Red

5, Blue

A1BTab.ndx file present under *<System>/IPS* folder is used to specify the mapping between the material index and the corresponding Brush table number, such as:

1, 3

2, 4

3, 1

4, 5

5, 2

If there are no entries in the A1BTab.ndx file then the material index is mapped to the corresponding Brush table index files.

segments.ndx file present under *<System>/HOME/alias* folder is used to specify the sequence of programs that execute one after the other for a program index.

1, m1

2, m2

3, m3, m5

4, m4, m5

5, m5

When using the with Painting PowerPac, the *program.map* file is automatically filled.

The following table describes the options you can specify in the **Mapping Tables Editor**.

Options	Descriptions
Alias For: Program or Material	Program alias displays the entries for the *Program.map* file and lists the associated Index file that is *Segments.ndx*. The segment index details are displayed next to the **Program alias Name**. The Segments are displayed when you enable the view in the **Index Data** Panel. The entries are displayed corresponding to the Program index numbers. Material alias displays the entries for the *Material.map* file and depending on System option lists the associated Index files such as *c1Clean.ndx*. The entries are displayed corresponding to the Material index numbers.

Continues on next page

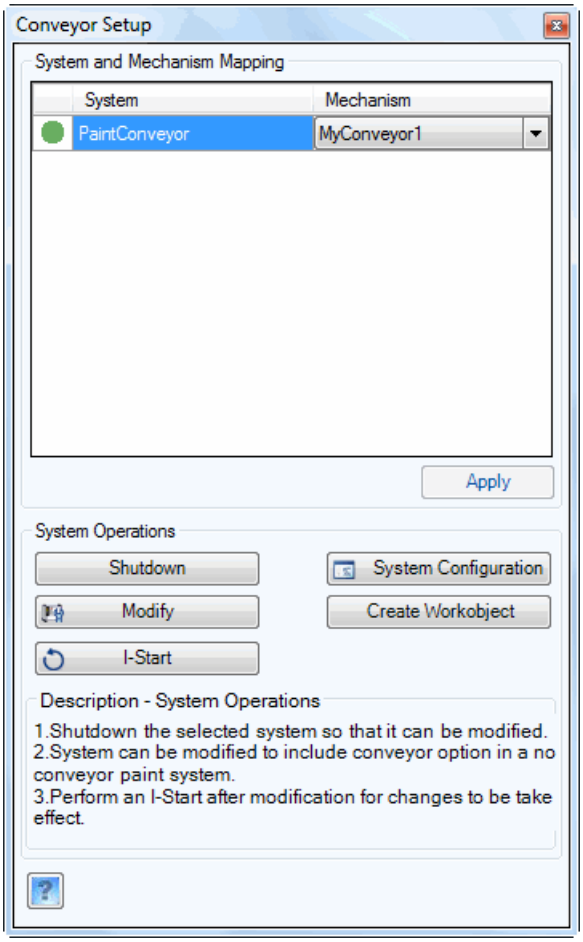
Continued

Options	Descriptions
Edit Segments	Double clicking the Segment cells in the editor opens a dialog which allows you to do the following operations: • select from the programs in the System folder, the set of programs • Re-order the sequence • Delete an entry The selected modules are shown once you press **OK**. You can select any cell and edit the entries. Only Segment index file cells cannot be edited directly. If a change is made in one file, then all related files are affected automatically.

4.3.3 Conveyor Setup

This topic describes how to map a conveyor mechanism to a system.

1 On the **Painting** tab, in the **System** group, click **Conveyor Setup** to open the dialog. The dialog is as shown in the following figure:



xx1200001210

2 The following table describes the options available in the **System and Mechanism Mapping** dialog.

Option	Description
Status	Indicates the status of the controller. • Red - Controller stopped • Yellow - Controller starting in progress • Green - Controller started
System	Displays paint systems with both conveyor and non-conveyor options
Mechanism	Displays the associated mechanism to the corresponding conveyor system. Also allows user to change the mechanism.

Continues on next page

Continued

3 The following table describes the options available in the **System Operations** dialog.

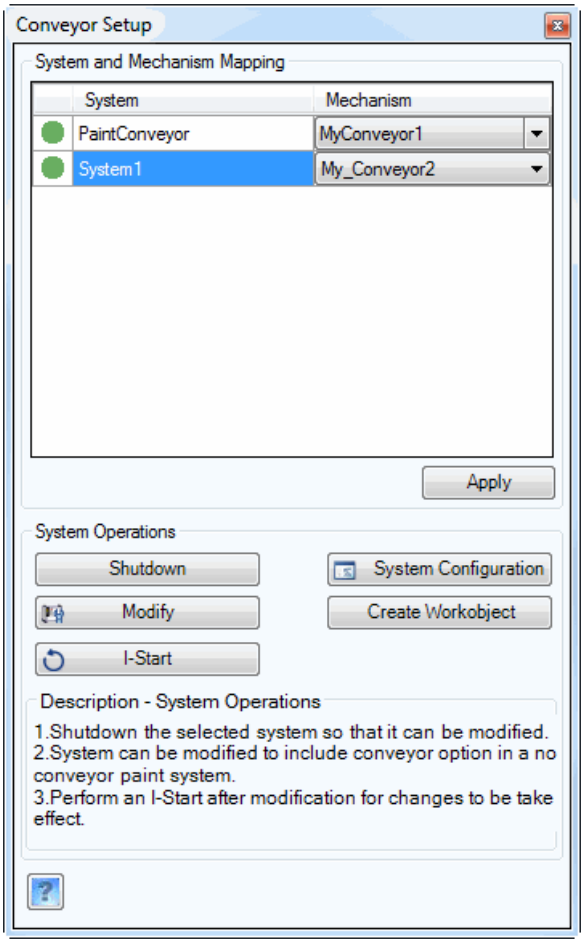
Option	Description
Shutdown	To stop/shutdown the selected system so that it can be modified.
Modify	To modify the options in the selected system.
I-Start	To restart the system after all the modifications.
System Configuration	To check system configuration.
Create Workobject	To create a new conveyor object for the selected system.

Use cases

Following use cases describe how to use the different options in the dialog:

Use case 1: Map different conveyor systems to a single conveyor mechanism

1 On the **Painting** tab, in the **System** group, click **Conveyor Setup** to open the dialog. The dialog is as shown in the following figure:



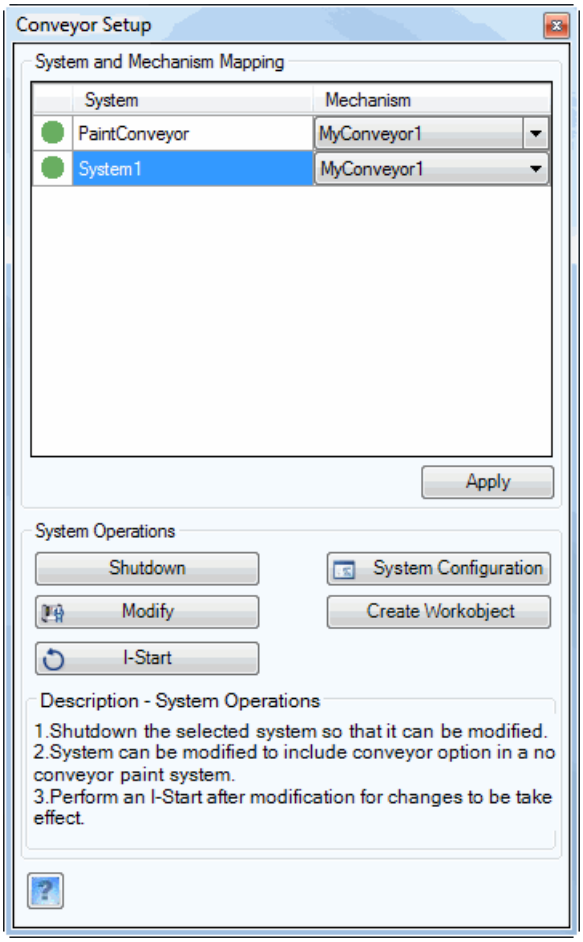
xx1200001229

Continues on next page

4.3.3 Conveyor Setup

Continued

2 Select the second conveyor mechanism for selected system *System1* same as first mechanism.



xx1200001230

3 Click **Apply**.

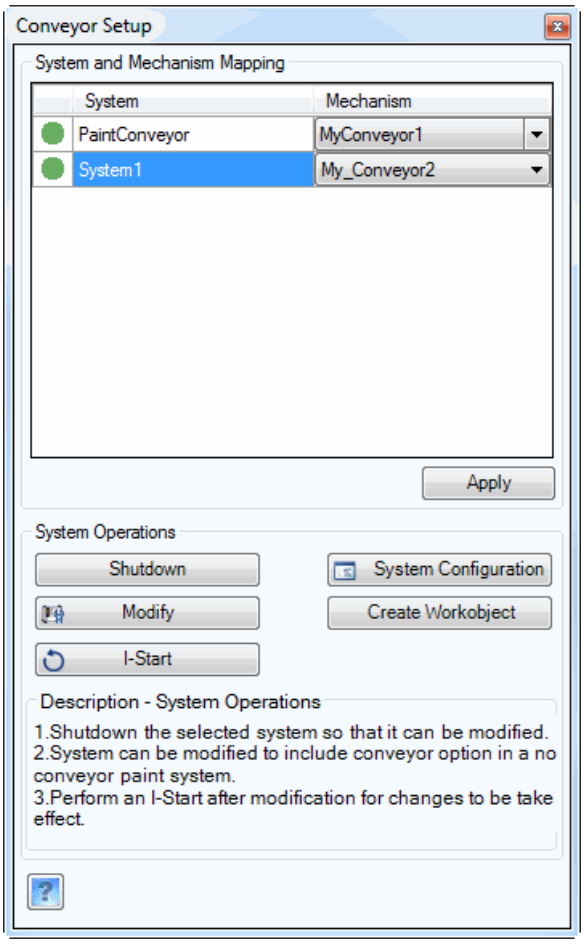
The different conveyor systems is mapped to a single conveyor mechanism.

Continues on next page

Continued

Use case 2: Change a non-conveyor system to a conveyor system and map the mechanism

1 On the **Painting** tab, in the **System** group, click **Conveyor Setup** to open the dialog. The dialog is as shown in the following figure:



xx1200001229

2 Select the non-conveyor system and Click **Shutdown** to stop the selected controller.

3 Click **Modify** and select the conveyor option. see *Conveyor Tracking Option on page 36*.

4 Click **Finish** to exit the modify window.

5 Click **I-Start** in the Conveyor Setup window to restart the controller.

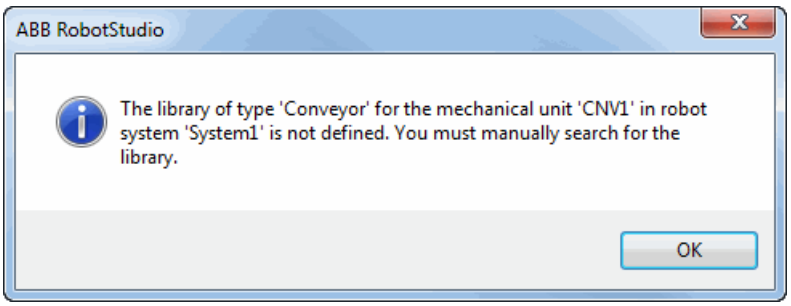
A non-conveyor system is modified as a conveyor system.

Continues on next page

4.3.3 Conveyor Setup

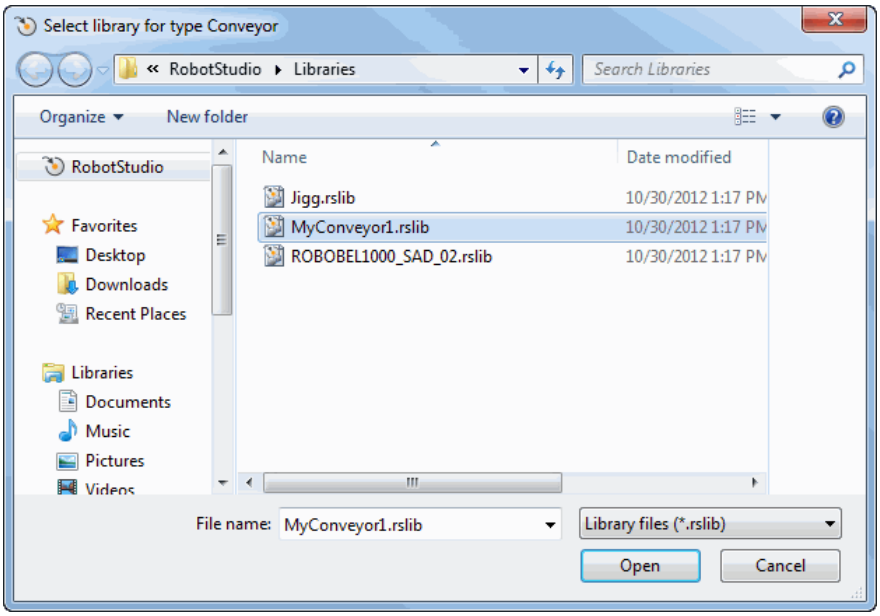
Continued

6 Manually search for the library of type *Conveyor* for the mechanical unit in the robot system *System1*.



xx1200001306

7 Select the library for type *Conveyor* and click **Open**.

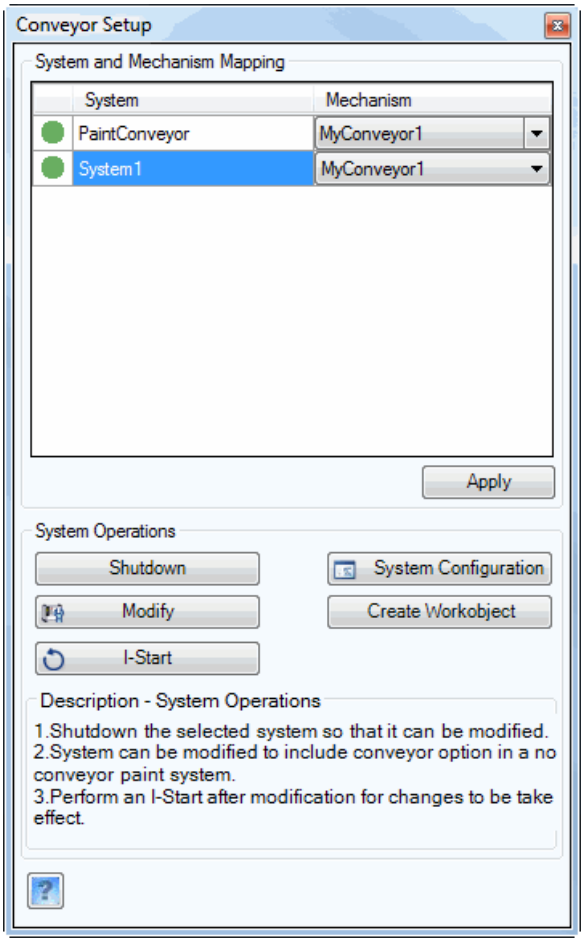


xx1200001307

Continues on next page

Continued

8 Select the second conveyor mechanism for selected system *System1* same as first mechanism.



xx1200001230

9 Click **Apply**.

The different conveyor systems is mapped to a single conveyor mechanism.

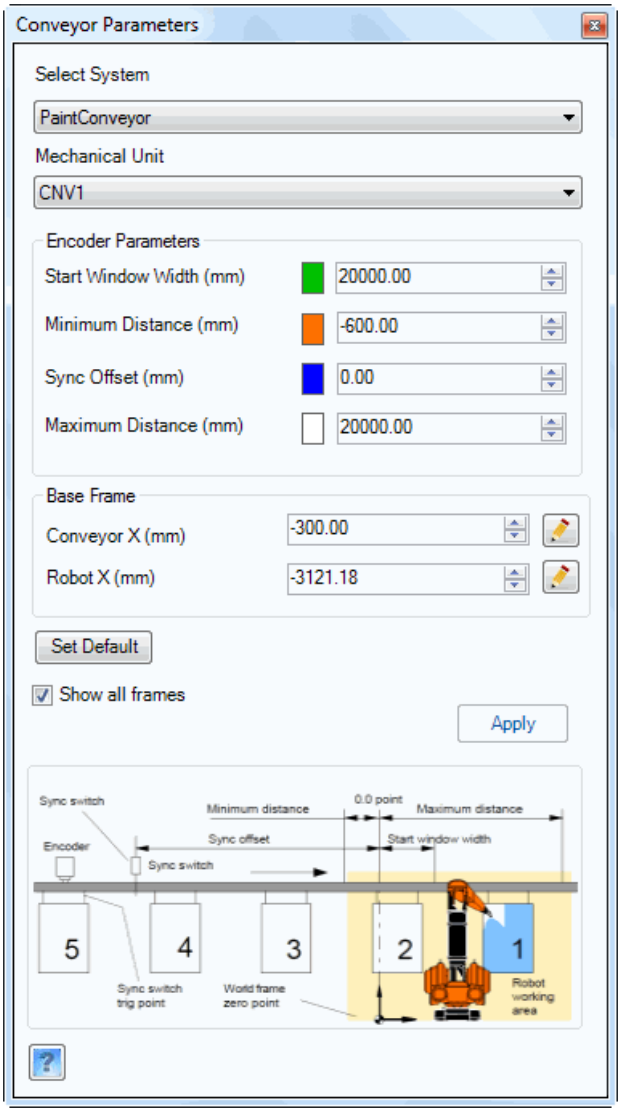
4.3.4 Part Control

For more information about *Part Control*, see *Setting up a conveyor*, in *Operating manual - RobotStudio*.

4.3.5 Conveyor Parameters

This topic describes how to define the parameters of a conveyor and a robot.

1 On the **Painting** tab, in the **System** group, click **Conveyor Parameters** to open the dialog. The dialog is as shown in the following figure:



xx1200001335

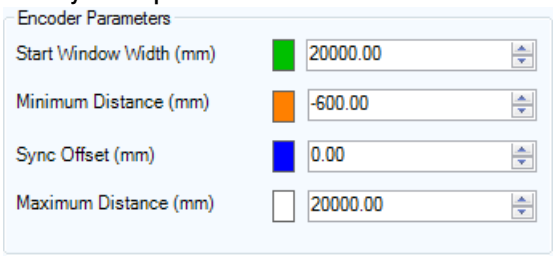
2 The following table describes the options available in the **Conveyor Parameters** dialog.

Option	Description
Select System	Lists all the avalaible systems in the station.
Mechanical Unit	Displays the Mechanical Unit associated with the selected system.

Continues on next page

4.3.5 Conveyor Parameters

Continued

Option	Description
Encoder Parameters	A list of conveyor parameters is displayed for the selected conveyor. All parameters can be edited.  xx1200001336 Some of the parameters need a restart of the controller to get activated. This is communicated by a message appearing when entering the new value. The purpose of each parameter is described in the following sections.
Base Frame	**Conveyor Base Frame** determines the location of the conveyor in relation to the position of World Frame. The origo of the Conveyor Base Frame is also called the conveyor 0.0 point which is used as reference point for some of the conveyor parameters. **Robot Base Frame** determines the location of the robot in relation to World Frame. This frame is a coordinate system where the zero point of the coordinate system is located on the floor plane of the robot base, in the center of the rotation of the first axis of the robot (except IRB 5500). When installing a robot, the location of this frame (and thereby the location of the robot) in relation to the World Frame must be determined.
Set default	Sets all the parameters to the system default values.
Show all frames	Displays and hides all the frames available in the system when checked and unchecked, respectively.
Apply	To save the changed parameters and restart the system.

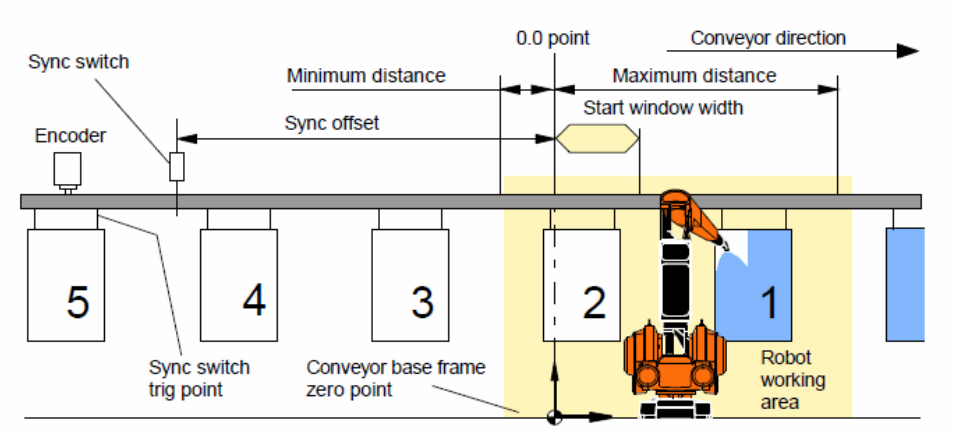
Continues on next page

Encoder Parameters

Start Window Width (mm)

Description

The **Start Window Width** defines the distance from the 0.0 point to the point where the robot no longer is supposed to connect to that object (e.g., when the robot does not have sufficient time to complete the object before it moves out of reach). More objects can be located in the Start Window simultaneously. A `WaitWObj` instruction will connect to the first object in the Start Window.



xx1200001337

Example

Object 2 is inside the Start Window and the robot will start processing it as soon as it has completed object 1. If object 2 should leave the start window before object 1 is completed, it will be dropped and pass the robot without being painted. If the robot has completed object 1 but object 2 has not yet entered the Start Window, the robot will wait in the `WaitWObj` instruction until object 2 enters the Start Window.

Note

If the 0.0 point is outside the robot's working area, a `WaitWObj \ RelDist:=pos` must be used in the robot program to compensate for the distance from the 0.0 point to the point where the robot can reach the object. (Another way to remove this problem is to move the position of the Conveyor Base Frame, and thereby the 0.0 point, to a location within the robot's reach.

Continues on next page

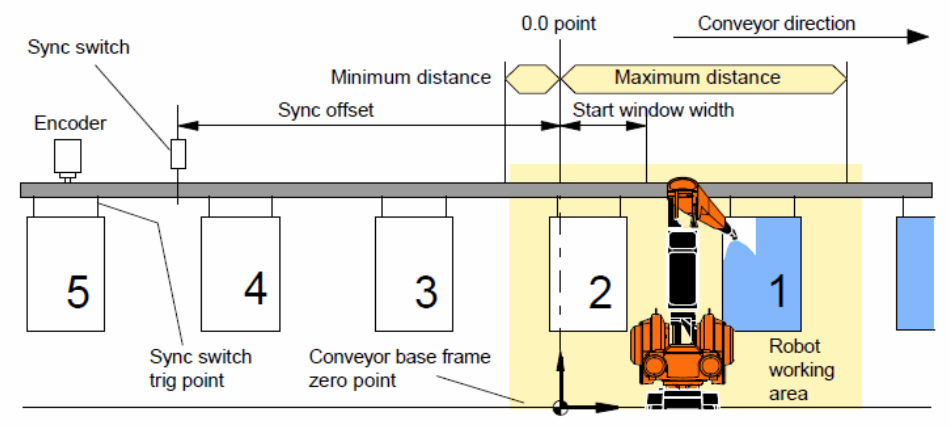
4.3.5 Conveyor Parameters

Continued

Minimum / Maximum Distance (mm)

Description

It is possible to monitor the position of the conveyor and automatically drop any connected objects which move outside the maximum or minimum specified distance. The purpose is to prevent coordination of motion beyond the work area of the robot for both forward and backward operation of the conveyor. If an object is dropped, the robot motion is stopped and an error message is issued.



xx1200001339

Maximum Distance

Defines the maximum limit of the tracking envelop, and is usually determined by the working area of the robot. A typical value for Maximum Distance is in the area of 3 meters, but this depends on the size of the robot's work area.

Minimum Distance

Defines the minimum limit of the tracking envelop. If the robot has started on an object (the object has been *connected*) and the conveyor stops and for some reason moves backwards so much that the object passes the minimum distance limit, the object will be dropped. In a practical installation, this value must always be negative. This is because there is a need to define a clearance for negative conveyor movement for objects that are connected at the 0.0 point.

Example

If Object 1 should pass the maximum distance before the painting operation has been completed, the object will be dropped as it can no longer be reached by the robot. If the conveyor stops after the robot has started processing Object 2, and for some reason runs so much backwards that Object 2 passes the minimum distance in backwards direction, the object will be dropped and can not be retrieved.

Continues on next page

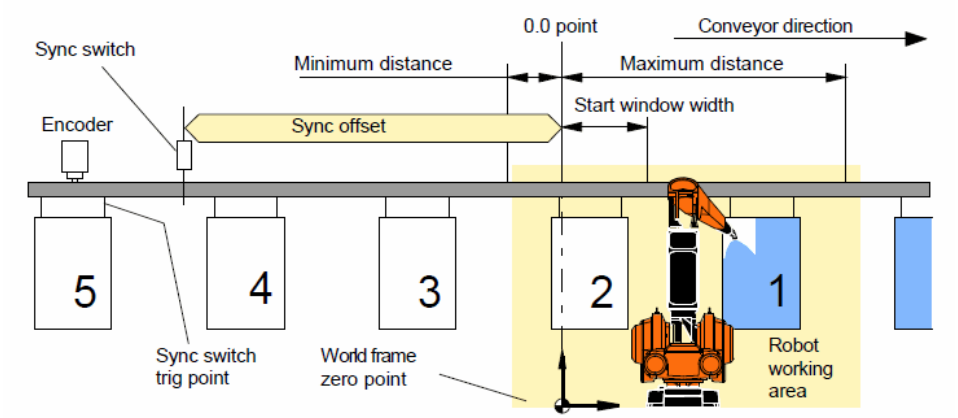
Sync Offset (mm)

Description

The **Sync Offset** (Called **Queue tracking distance** in earlier systems) defines the location of the sync switch in relation to the 0.0 point on the conveyor. (Origo of the Conveyor Base Frame)

Note

In many installations, Sync Offset is set to 0, i.e., the sync switch is placed in the same position as the origo of the Conveyor Base Frame. This means that the object on the conveyor will enter the Start window immediately when the Sync switch is triggered.



xx1200001338

Example

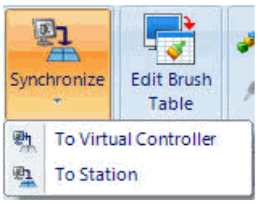
Object 2, 3 and 4 have been registered by the sync switch and are present in the object queue in the control system. (The position returned from the encoder for the objects located between the sync switch and the 0.0 point is negative). If object 2 is not present, a `WaitWObj` instruction will make program execution wait until object 3 has entered the start window. Object 5 has not yet passed the sync switch and has therefore not yet been registered by the control system.

Note

It is not possible to move the World frame by changing the value for the Sync Offset (This is a common misinterpretation of this parameter). The system will simply believe that the sync switch was moved, and behave accordingly.

4.4 Synchronizing to Virtual Controller and Station

You can synchronize procedures to the Virtual Controller (VC) and to the RobotStudio station.

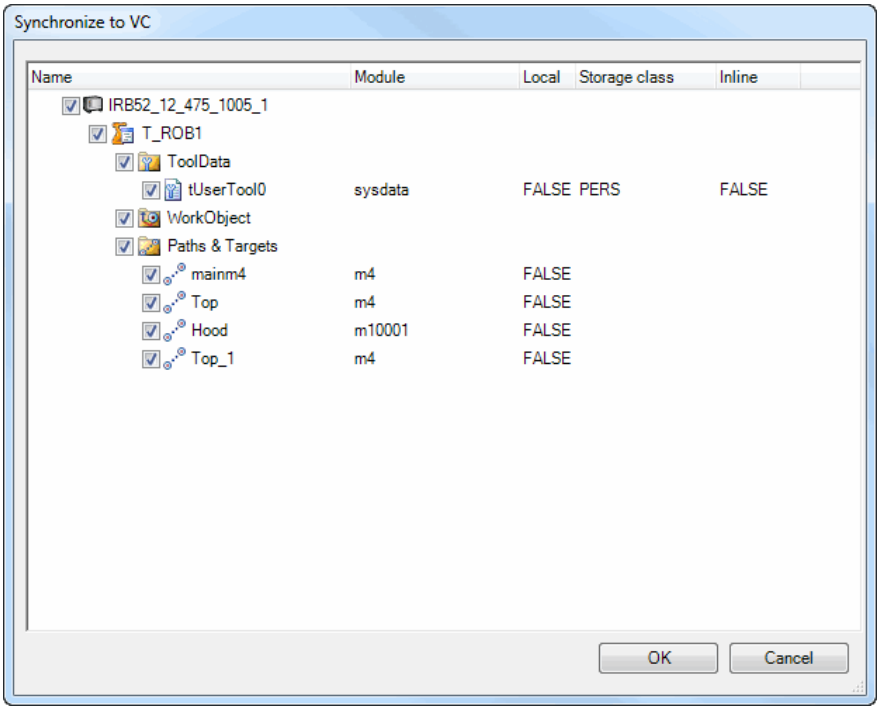


xx1100000912

Synchronizing to Virtual Controller

1 On the **Painting** ribbon Tab, click **Synchronize**, and then click **To Virtual Controller**, the **Synchronization to Virtual Controller** dialog box appears.

2 Choose the procedures to be synchronized to the Virtual Controller from all the systems in the station. All the selected procedures are synchronized to the virtual controller (VC). For more information about **Synchronization to Virtual Controller**, see *Synchronization to VC*, in *Operating manual - RobotStudio*.



xx1100000913

Continues on next page

Continued

Info

In Painting systems, the RobTargets are usually declared as LOCAL. Hence there could be several targets by the same name in different modules. This feature is also available in Painting PowerPac where the RobTargets created are declared as LOCAL. RobotStudio supports unique naming of RobTargets. In case of LOCAL targets, the name of the RobTarget is prefixed with the corresponding module name to distinguish them.

Example:

For modules m4 and m5 the corresponding targets are displayed as:

m4/Paint_10 m5/Paint_10

m4/Paint_20 and m5/Paint_20

3 After **Synchronization to Virtual Controller**, the target is created as *LOCAL const Paint_10*. Similarly when a paint module is synchronized to Controller, the targets are associated with module names as specified above.

4 The generated RAPID code contains information about the
   - *Workpiece Name*
   - *Workpiece Position*
   - *Brush Specification*

   These are uploaded as Datatypes into the RAPID program. You can refer to this information when setting up the Paint cell.

5 While loading a Paint program from PowerPac with the above information, the Brush is automatically selected and the workpiece is positioned at the defined position in RobotStudio.

Example

```
MODULE m4
CONST string m4_WorkPiece:="Mazda MX5";
CONST string m4_WorkPiecePos:="[0,2.12,0],[0,0,0]";
CONST string m4_BrushSpecification:="Brush1";
LOCAL CONST robtarget Paint_10:=[[1749.98,2930,317.92],
[6.12303176911189E-17,6.12303176911189E-17,1,6.12303176911189E-17],
[0,0,0,0],[9E9,9E9,9E9,9E9,9E9,9E9]];
LOCAL CONST robtarget Paint_20:=[[1174.75,2925.72,333.54],
[6.12303176911189E-17,6.12303176911189E-17,1,6.12303176911189E-17],
[0,0,0,0],[9E9,9E9,9E9,9E9,9E9,9E9]];
LOCAL CONST robtarget Paint_30:=[[957.62,1640.81,853.48],
[6.12303176911189E-17,6.12303176911189E-17,1,6.12303176911189E-17],
[0,0,0,0],[9E9,9E9,9E9,9E9,9E9,9E9]];
LOCAL CONST robtarget Paint_40:=[[343.98,2386.23,594.17],
[6.12303176911189E-17,6.12303176911189E-17,1,6.12303176911189E-17],
[0,0,0,0],[9E9,9E9,9E9,9E9,9E9,9E9]];
LOCAL CONST robtarget Paint_50:=[[-41.91,2293.59,544.97],
[6.12303176911189E-17,6.12303176911189E-17,1,6.12303176911189E-17],
[0,0,0,0],[9E9,9E9,9E9,9E9,9E9,9E9]];
```

Continues on next page

Continued

```
LOCAL CONST robtarget Paint_60:=[[-402.05,2387.09,469.97],
[6.12303176911189E-17,6.12303176911189E-17,1,6.12303176911189E-17],
[0,0,0,0],[9E9,9E9,9E9,9E9,9E9,9E9]];
LOCAL CONST robtarget Paint_70:=[[-172.04,1980.45,524.26],
[6.12303176911189E-17,6.12303176911189E-17,1,6.12303176911189E-17],
[0,0,0,0],[9E9,9E9,9E9,9E9,9E9,9E9]];
LOCAL CONST robtarget Paint_80:=[[175.85,1897.09,573.16],
[6.12303176911189E-17,6.12303176911189E-17,1,6.12303176911189E-17],
[0,0,0,0],[9E9,9E9,9E9,9E9,9E9,9E9]];
LOCAL CONST robtarget Paint_90:=[[934.24,2912.63,228.14],
[6.12303176911189E-17,6.12303176911189E-17,1,6.12303176911189E-17],
[0,0,0,0],[9E9,9E9,9E9,9E9,9E9,9E9]];
LOCAL CONST robtarget Paint_100:=[[1607.1,2886.01,152.97],
[6.12303176911189E-17,6.12303176911189E-17,1,6.12303176911189E-17],
[0,0,0,0],[9E9,9E9,9E9,9E9,9E9,9E9]];
PROC mainm4()
PaintL Paint_10,v2000,z50,tool0\WObj:=wobj0;
SetBrush 2\X:=1650;
PaintL Paint_20,v800,z100,tool0\WObj:=wobj0;
PaintL Paint_30,v800,z100,tool0\WObj:=wobj0;
PaintL Paint_40,v800,z100,tool0\WObj:=wobj0;
PaintL Paint_50,v800,z100,tool0\WObj:=wobj0;
PaintL Paint_60,v800,z100,tool0\WObj:=wobj0;
PaintL Paint_70,v800,z100,tool0\WObj:=wobj0;
PaintL Paint_80,v800,z100,tool0\WObj:=wobj0;
PaintL Paint_90,v800,z100,tool0\WObj:=wobj0;
SetBrush 1\X:=1810;
PaintL Paint_100,v800,z100,tool0\WObj:=wobj0;
ENDPROC
ENDMODULE
```

Note

- RobTargets declared as LOCAL can only be created from Painting PowerPac.
- If a target created from Painting PowerPac is used in another procedure in the station, then the target is internally converted to an In-Line target when the procedures are Synchronized to Virtual Controller.
- For more information, see the Release Notes for known limitations with LOCAL RobTargets usage in RobotStudio.

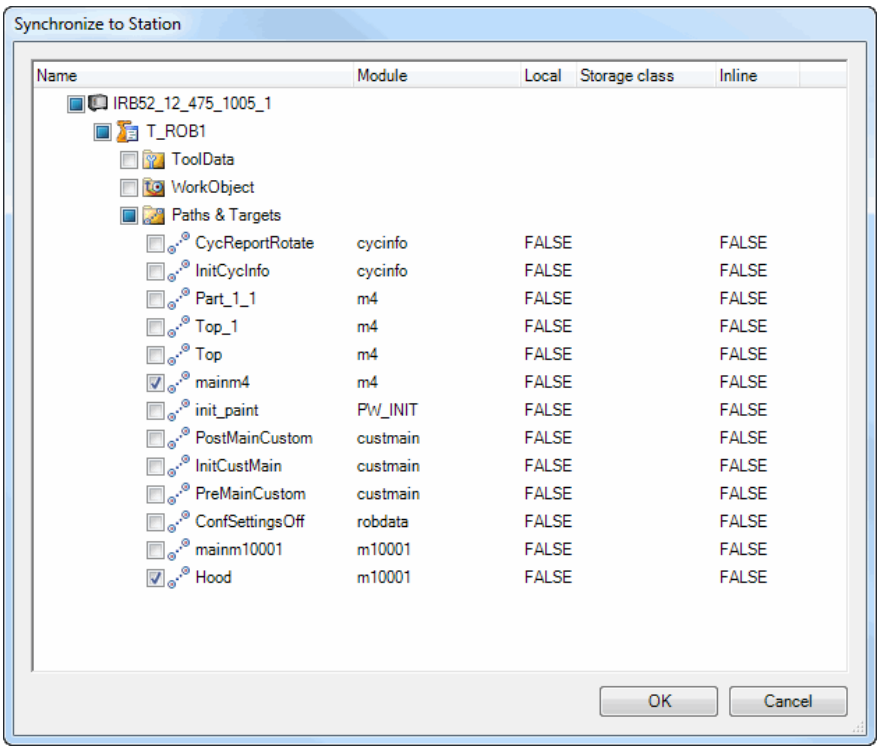
Synchronizing to Station

1 On the **Painting** ribbon Tab, click **Synchronize**, and then click **To Station**, the **Synchronization to Station** dialog box appears.

Continues on next page

Continued

2 Choose the procedures to be synchronized to RobotStudio station when offline.



xx1100000914

3 The selected procedures are synchronized to the station. While synchronizing procedures, all the RobTarget names are pre-fixed with the information of the corresponding module. This ensures that the target names are unique and are not overwritten when multiple modules having the same *LOCAL RobTarget* names are synchronized.

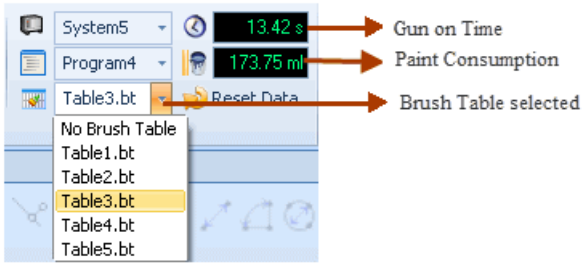
Note

- To synchronize new procedures, click **Load**, on the **Painting** ribbon Tab, in the **Paint Program** group.
- When a Program and its corresponding procedures are synchronized into the Virtual Controller, then the resulting RAPID file is saved in the corresponding system folder. This is because the RAPID modules in the system are loaded into RobotStudio during execution from the Paint main procedure.
- If a target created from Painting PowerPac is used in another procedure in the station, then the target is internally converted to an *In-Line target* when the procedures are synchronized to a Virtual Controller.

4.5 Brush Tables and Virtual Applicator

Brush Tables provides the Brush Parameters used by the Painting PowerPac while painting.

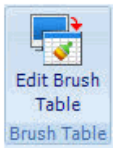
The Brush Parameters are used in Virtual Fluid Device, to calculate the Gun-On time and the Paint consumption. For more information on Gun-On time and Paint/Material consumption, see *Reports - Material Consumption and Gun-On time on page 94*



xx1200000069

The Painting PowerPac stores the Brush Tables in the *IPS folder* under *<System>* folder. For example: *<System>/IPS/A1Brush/Table1.bt*. For more information on folder structure, see *Folder configuration on page 31*.

To edit the Brush Table, click **Edit Brush Table** ,on the **Painting** ribbon Tab. A Brush Table editor appears.

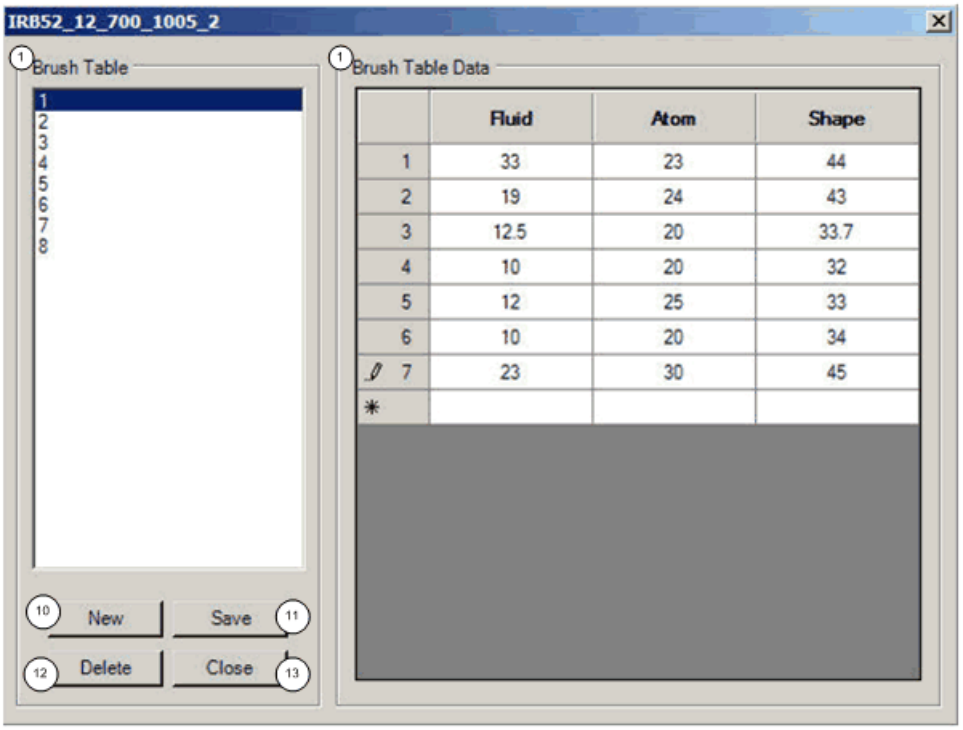


xx1100000869

Continues on next page

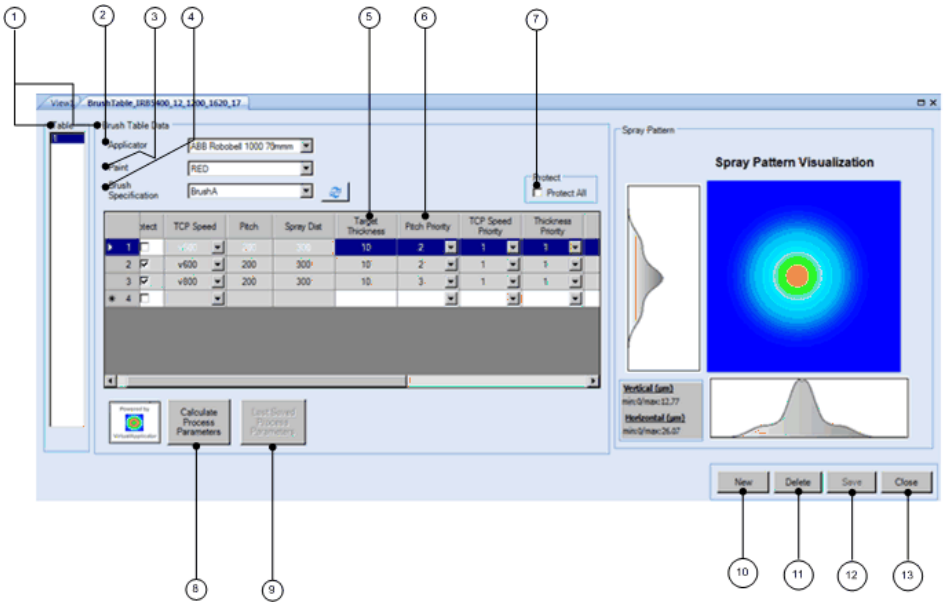
Continued

If the Virtual Applicator license is not installed, the user can key in the brush parameters directly on the table.



xx1100000870

If the Virtual Applicator license is installed, the Brush Table appears with additional columns.



xx1100000872

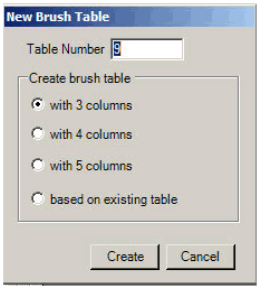
Continues on next page

Continued

Item	Option	Description
1	**Brush Table and Brush Table Data**	All the Brush tables associated with the system are listed. When you select a table, the associated values are shown in the right side under the respective columns.
2	**Applicator**	Select from a list of Applicators that are defined in the VA Service. If you are not connected to the network, then an option None is also listed. However it is a pre-requisite that an Applicator must be selected to get the Brush Table from the VA Service.
3	**Paint**	Select the paint defined in the Paint Specification
4	**Brush Specification**	Select a Brush Specification from the list. The table is populated with the Brush Table values for TCP Speed, Pitch, and Spray Distance. You cannot modify these values. To modify certain values in the dialog, select **None** in the Brush Specification.
5	**Target Thickness**	Specify the required thickness of paint (in micro meter) on the workpiece.
6	**Priority**	Specify priorities for Thickness, Pitch and TCP speed. The priorities are: 1 - High 2 – Medium 3 - Low The process parameters are optimized based on the priority.
7	**Protect All**	Select the **Protect All** check box to protect the Brush table from modification of the values in the Brush numbers, and from any changes in either the Applicator or Paint and Brush Specification.
8	**Calculate Process Parameters**	On clicking **Calculate Process Parameters**, the VA Service processes the inputs and returns the Brush table value for each row. The service always returns 5 columns irrespective of how many are present in the table currently.
9	**Last Saved Process Parameters / Generate Process Parameters**	On clicking **Generate process parameters**, the Brush table is updated with values from the Virtual Applicator. You can verify by toggling between the last saved values of the Brush table and the current values. The process parameters that are changed by the Virtual Applicator are highlighted.

Continues on next page

Continued

Item	Option	Description
10	**New**  xx1100000871	Click **New** to create a new table based on the following parameters: • **Table Number** - Suggests the first available table number in the current system. You can change it. • Specify the columns required: Click **3 columns** to have Fluid, Atom, and Shape columns Click **4 columns** to have Fluid, Atom, Shape1, and HV columns Click **5 columns** to have Fluid, Atom, Shape1, Shape2, and HV columns • Click **Based on existing table** if the new table must have the same values as the existing table.
11	**Delete**	To delete the selected Brush Table from the System folder.
12	**Save**	On clicking **Save** all the associated information present in the dialog and the table values of Fluid, Atom, Shape are stored. Subsequently when you close and open the dialog and select a table, then all these options are also selected along with the Brush table.
13	**Close**	To close the Brush Table

The Virtual applicator service calculates the brush parameters with the following inputs you provide to the Brush Table.

1 Paint Specification
   - Paint Groups
   - Nominal Thickness
   - Viscosity
   - Solid Content %Volume

2 Brush Specification
   - TCP Speed
   - Pitch
   - Spray Distance

3 Brush Table Editor
   - Applicator
   - Target Thickness
   - High Voltage (kV) - optional
   - Atom (krpm) – optional
   - Thickness priority
   - Pitch priority
   - TCP speed priority

The Virtual Applicator service calculates the following with the above input you provide.

1 Fluid

Continues on next page

Continued

2 Atom (krpm)
3 Shape1
4 Shape2
5 HV (kV)

Note

The values in the Brush table, such as the Applicator, Paint and Brush specifications and so on (other than the Process parameters) are saved only when the RobotStudio station is saved.

Applicators Supported

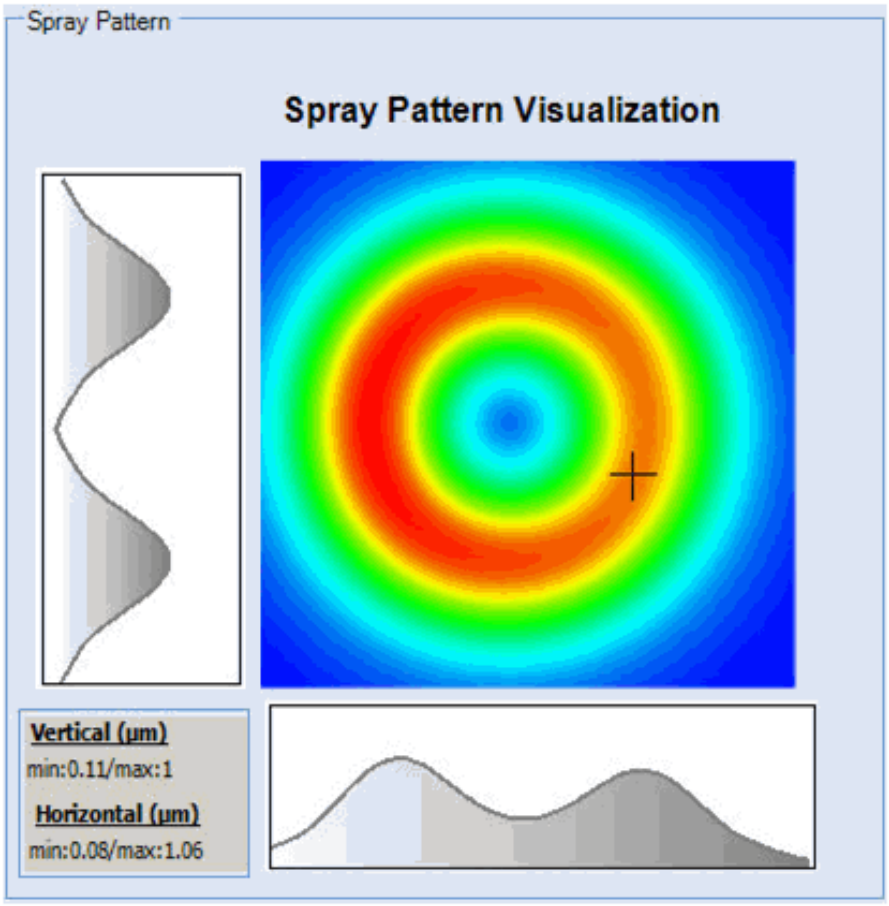
The following set of Applicators are currently supported in the Virtual Applicator for generating the Process parameters:

- ABB Flexbell G1 Copes
- ABB Robobell 625 50mm
- Pneumat 1 DeVi797 - 1.2 mm
- ABB Robobell 1000 70mm
- ABB Robobell 1000 40mm

Continues on next page

Spray Pattern Visualization

The spray pattern for a specified brush number in a brush table is the visualization in the form of an image of the paint deposition when the applicator is spraying paint for a period of 1 second on a flat area of size 1meter x 1meter.



xx1100000873

The spray pattern image is created using the Virtual Applicator service. Hence you need to be connected to network for visualizing the spray pattern. The service is invoked by selecting the Brush number row as shown in preceding figure.

The required inputs for generating the image are:

1 Paint Specification
   - Paint Groups
   - Nominal Thickness
   - Viscosity
   - Solid Content %Volume

2 Brush Values
   - TCP Speed
   - Pitch
   - Spray Distance
   - Target thickness
   - Process parameters - Fluid, Atom, Shape, Air1, Air2, HV

Continues on next page

Continued

The thickness profile on the spray pattern at any point can be visualized by selecting any location on the image. The corresponding horizontal and vertical thickness profile for the selected row and column of the location are displayed along with information of the minimum and maximum values of all the elements in the row and column.

The spray pattern for a given brush number in a Brush table is not changed unless any value that has been used to get the spray pattern has changed. You must select the Brush number again to get the spray pattern for the modified brush table.

4.6 Production

4.6.1 Job Queue

Use the Job Queue functionality to visualize production using controls similar to those on the Paint Teach Pendant Unit.

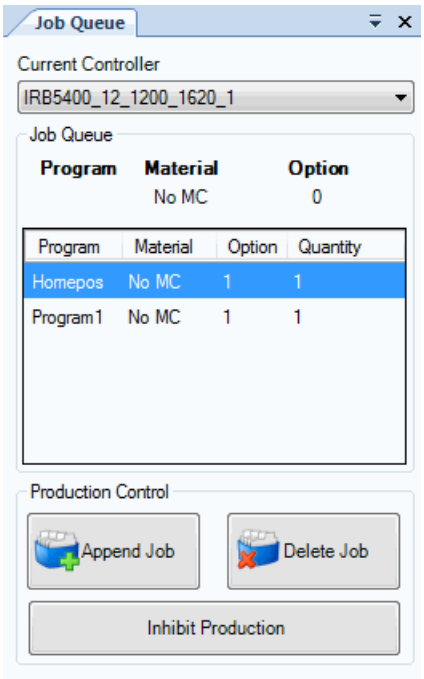
The following are the pre-requisites for using the Job Queue:

1. Programs must be saved in the *System/HOME/programs* folder.
2. The mapping files, *program.map* and *material.map* files must be filled with the corresponding entries. The files can be located under *System/HOME/alias* folder. For more information on mapping files, see *Mapping Tables on page 55*.

Usage

xx1100000874

On the **Painting** Tab, in the **Production** group, click **Job Queue** to open the **Job Queue** dialog box.



xx1200000252

The following table describes the options in the **Job Queue** dialog.

Option	Description
Append	To append a job to the controller/controllers.

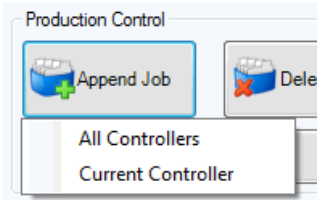
Continues on next page

4.6.1 Job Queue

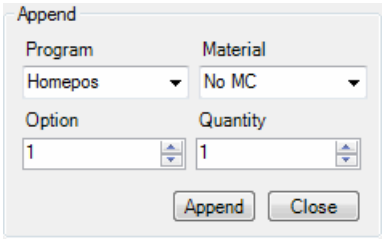
Continued

Option	Description
Delete	To delete job/jobs from controller/controllers
Inhibit/Resume	When running the job in Production mode, you can Inhibit (pause) and Resume the production.
Job Queue	To see the jobs in the Queue and the currently executing job.

Appending a Job



xx1100000875



xx1100000876

You can append a job to the job queue of the current controller or to all controllers in the station.

To append a job:

1. Click **Append** on the Job Queue dialog.
2. Select **Current Controller** or **All Controllers** as required.
3. In the *Append* dialog, enter the **Program**, **Material**, **Option** and **Quantity** (Number of times the program must be executed).
4. Click **Append** in the *Append* dialog.

When you append a job to the current controller, then the Program and Material information present for that controller is listed. When you append a job to all the controllers in the station, then all the information is combined and presented. You must ensure that the mapping information in the controllers correspond to each other. If there is any mismatch, then the information is shown in the output window.

Deleting a Job

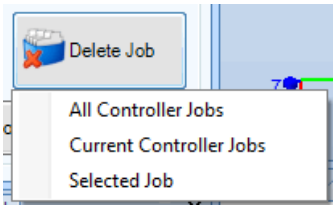
In the **Job Queue** dialog box, click **Delete**, and then select one of the following options:

- **All Controller jobs** - To delete all jobs, except the currently executing job
- **Current Controller jobs** - To delete the currently executing job

Continues on next page

Continued

- **Selected Job** - To delete the selected job. All the jobs below it are shifted upwards.



xx1100000877

Example: You append a job with quantity 10 and then delete the job during the 5th execution. In this case the current execution continues until completion and then stops because the subsequent jobs are deleted.

Simulating the Production

After appending jobs to the queue, you can view a simulation of the production by clicking the **Play**button from Graphics window or from the Simulation tab in RobotStudio. To start the production the Entry point for the simulation must be in the main module.

Note

If you open the Job Queue dialog when no simulation is running, then the entry point for each controller is set to their corresponding main procedures. If you start the simulation when jobs are in queue, then all the controllers are started simultaneously and start executing the programs as listed in the Job Queue.

Tip

Only the currently executing program from the programs folder are listed in the Offline tab. During production, the program to be executed is loaded into RobotStudio to the Offline tab from the *System/HOME/programs* folder. After execution the program is deleted from the Offline tab.

Inhibiting and Resuming Production

You can pause and resume the production at any point. To pause the production, click **Inhibit**. To resume the production, click **Resume**.

When a program is paused during execution, it completes the currently executing task and then pauses. However, the simulation status does not change to *Stop* and the controller remains in the *Start* state. When resumed, the production continues as normal.

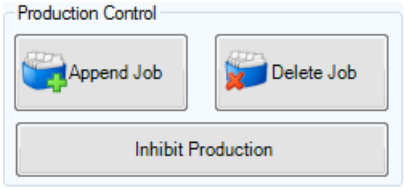
Note

Clicking **Inhibit** or **Resume** does not affect the execution of high priority jobs such as *HomePos*.

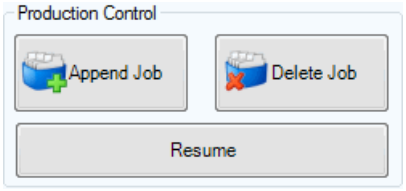
Continues on next page

4.6.1 Job Queue

Continued



xx1100000878



xx1100000879

Tip

- Sometimes jobs might not be appended to the controller because controller might give Socket error, Try to Close and Re-open the Job Queue dialog box and try again.
- If user is not able to append jobs to the controller because of any reason, restart the controller and then try again.

Note

When working with Job Queue, the Material supply will always be enabled if Color change option is selected in the System.

4.6.2 Virtual CBS

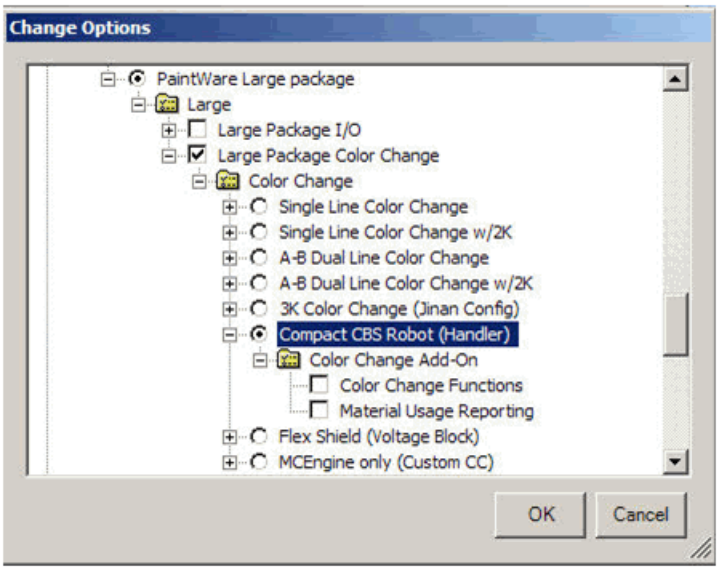
The Virtual CBS is used for visualizing the production in system which are configured with a CBS option. The time taken for color changing operations and so on can be checked by setting the values for the CBS parameters.

Note

The Virtual CBS is available only if the system has CBS option enabled.

Usage

The CBS option is not enabled by default. You can enable the CBS option while creating a Paint Station from the *Change Options* dialog, as shown in the following figure.



xx1100000880

To enable the CBS option for the Paint Station, click the **Compact CBS Robot (Handler)** option. Consequently the option is enabled in the Painting PowerPac ribbon tab also, as shown in the following figure.

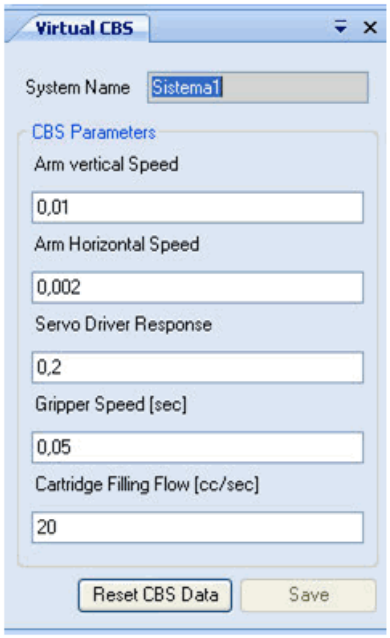
xx1100000881

Continues on next page

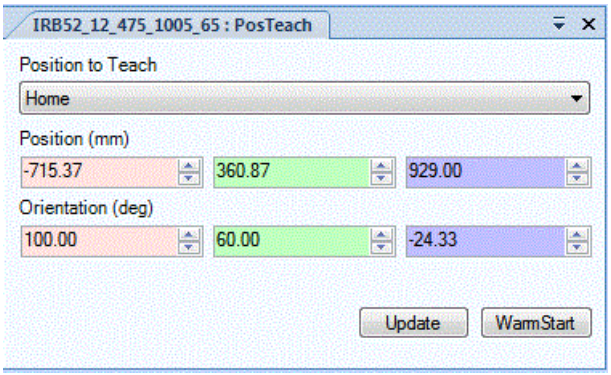
4.6.2 Virtual CBS

Continued

Click the **Virtual CBS** button on the ribbon tab to open the *Virtual CBS* dialog, as shown in the following figure.



xx1100000882



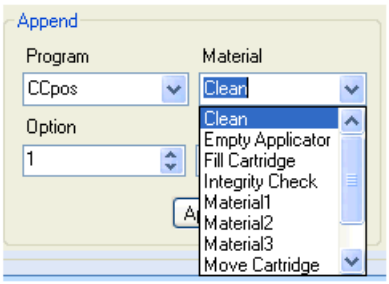
xx1100000883

	Action	Information
1	In the **System Name** box, of the *Virtual CBS* dialog, enter a system which CBS option selected, and then open the PowerPac	The Virtual CBS option is enabled.
2	Open the **Pos Teach** dialog and teach the Material Change position.	Jog the robot to the Material Change position. Update the position and restart the controller
3	Go back to the *Virtual CBS* dialog and specify the CBS Parameters. Then click **Reset CBS Data**.	The specified CBS parameters values are updated and used whenever the Reset CBS Data is specified and a material change is invoked.
4	Append Jobs from Job Queue with a different material.	When there is a material change from one job to another, the Robot moves to the Material Change / CBS position and waits for the time specified in the Virtual CBS dialog. It then proceeds to execute the job.

Continues on next page

Continued

In CBS systems, there are a number of instructions are listed in **Append:Material** as shown in following figure. These additional tasks, such as *Empty Applicator*, *Fill Cartridge* and so on, are maintenance operations used for the CBS.



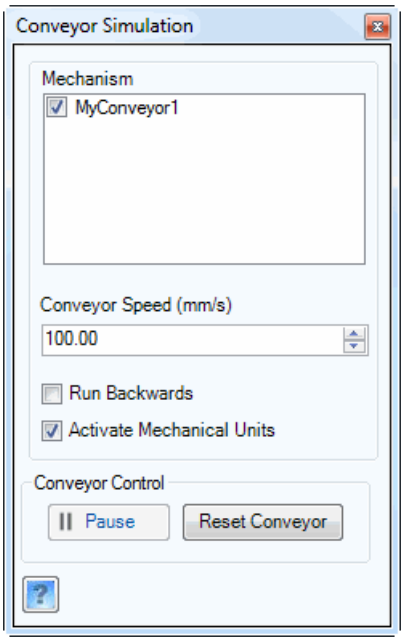
xx1100000884

When you append jobs from the queue and execute them, the robot moves to the color change position and waits there. The time for which the robot waits depends on the CBS parameters specified. During this time you can decide the new values for the CBS parameters.

4.6.3 Conveyor Simulation

The Conveyor Simulation is used to control the simulation by selecting which conveyor mechanisms to run, adjusting the speed of the conveyor mechanism. It also helps to pause, restart, and reset the conveyor.

1 On the **Painting** tab, in the **Production** group, click **Conv Simulation** to open the dialog. The dialog is as shown in the following figure:



xx1200001311

2 The following table describes the options available in the **Conveyor Simulation** dialog.

Option	Description
Mechanism	Lists all the available conveyor mechanisms in the station.
Conveyor Speed	Adjust the conveyor speed during simulation.
Run Backwards	To move the conveyor in the backward direction.
Active Mechanical Units	To activate mechanical units.
Conveyor Control	**Pause:** Options exists to pause and resume the simulation. **Reset Conveyor:** To bring the conveyor back to the start position.

Note

The conveyor speed and direction can be changed while running the simulation.

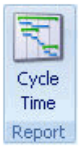
To bring the conveyor back to the start position, click **Reset Conveyor**.

4.7 Reports

4.7.1 Generating Cycle Time Reports

The cycle time of a painting cell can be considered as the time taken between the robot's HomePos to HomePos movement. The cycle time report is generated as a Gantt chart with operations from each Robot plotted on a time scale.

To launch the report window, click **Cycle Time** from the ribbon tab.



xx1100000915

In Painting PowerPac, the report is generated whenever the simulation is executed. Use the following procedure for generating the report.

	Action	Information
1	Teach Programs/Positions and Synchronize to VC	Synchronize the paint programs to the VC. It is also advised to teach the HomePos, Material Pos and so on, so that the complete paint process simulation can be as similar to the real world as possible.
2	Append jobs and start the simulation. Simulate the complete process.	Using the Job Queue feature, append jobs to the controller and then start the simulation. The complete process might include moving to HomePos, performing some Color change sequence and so on.
4	Stop simulation	Once the painting simulation is completed, click on Stop button.
5	Check Cycle time reports	Click **Cycle Time** to view the reports window or if already open, click **Update** in the report. The report shows the programs executed on a graph. The description of the graph is given in the following figure.

xx1100000916

Reports in the station are listed in the left side of the window in serial order with the nomenclature *Reportxx*, where xx indicates the number of the report. Reports

Continues on next page

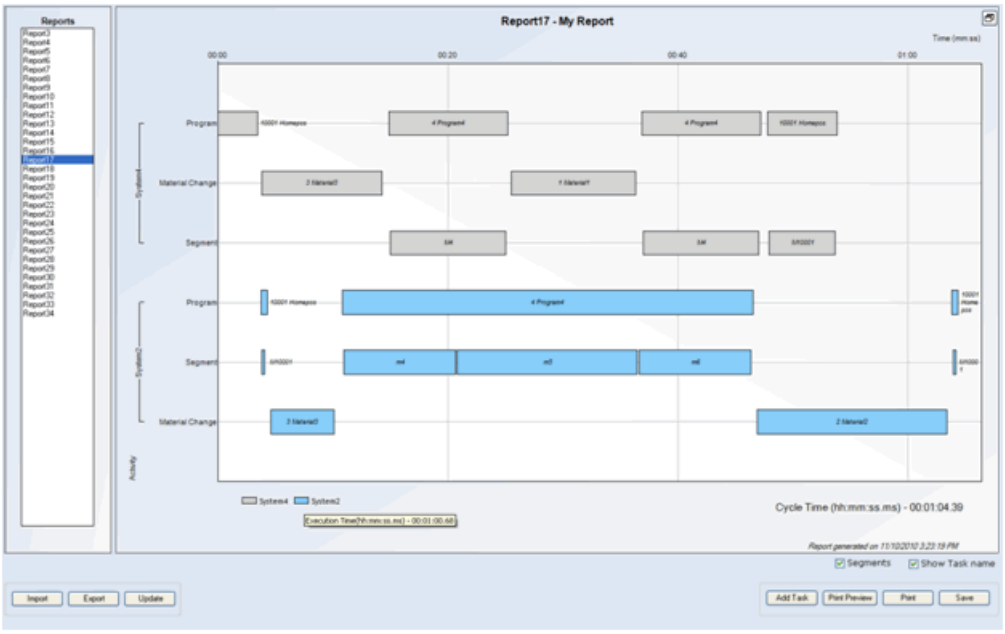
4.7.1 Generating Cycle Time Reports

Continued

are created if any paint program has been executed between simulation play and simulation stop.

xx1100000917

The report generated looks as shown in the following figure.



xx1100000918

The report shows the following information in the form of a Gantt chart:

- Task blocks representing each executed program
- Task information containing Name, Start time, and Duration
- Activity which represents a collection of similar tasks
  - There are three predefined activities - Program, Material Change and Segment.
  - Activities from each robot system (Source) are represented together as a set
  - Tasks from each set are represented using a similar color, the legend information shows the same
- The time taken by each robot
- The complete cycle time of all the activities in the cell
- The report details such as date and time when the simulation completed execution

The complete cycle time of the robot is measured based on the time difference between the last and first task in the report. You can infer about tasks that run in

Continues on next page

parallel, idle times and so on from the report. Some of the options in the report are as described in the following table.

Option	Description
Zoom In / **Zoom Out**	You can zoom into the report by right-clicking-and-dragging on the report region. The amount of zoom depends on the zoom selection area. Whenever the task extends beyond the visible region, a scroll bar in shown. You can zoom out by clicking the minus symbol next to the scroll bar.
Update	Whenever the report is open and a simulation has been executed, to view the latest report click **Update**. This fetches all the new reports that have been created. Closing and reopening the Cycle Time reports dialog also fetches the latest reports.
Add Task	You can add a new task by specifying the Name, Start time and Duration: • • under an existing Activity or a new Activity • under an existing Source (controller) or a new source
Edit Task	Right-click the task and open the *Edit Task* option. You can edit a task to modify the Name, Start time, and Duration. The changes are reflected in the report.
Add title	Enter an appropriate title for the report (maximum 32 characters). The title appears at the top of the report in the following format: Reportxx - *title* The Title information dialog can also be selected by using the right-click context options from the report list.
Delete task	Deletes the task, if there is no other task under the corresponding Activity. Then the whole row is removed including the Activity. If there is no other task under the source, then the complete information is also removed.
Delete report	Right-click on the report/reports select **Delete**.
Show / **Hide Task and Segment names**	You can select whether or not to show the Segments or Task names in the report.
Import / **Export report**	The selected report can be exported as a *.ctr* file. The default location to export these reports is *C:\Data\RobotStudio\Paint\Reports*. You can also import a report. The report might be renamed if there is already a report existing with the same name.
Print Preview and Print	You can view the print layout and print the report.
Save report	Any changes made to the report be applied on clicking **Save**.

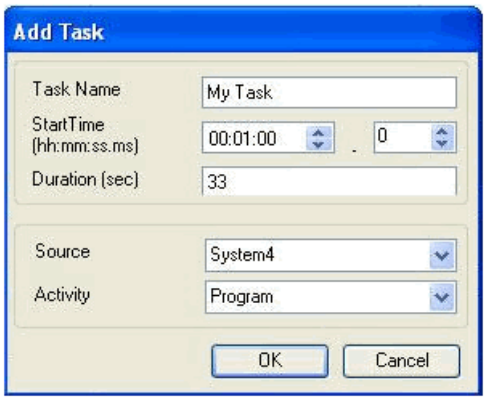
Continues on next page

4.7.1 Generating Cycle Time Reports

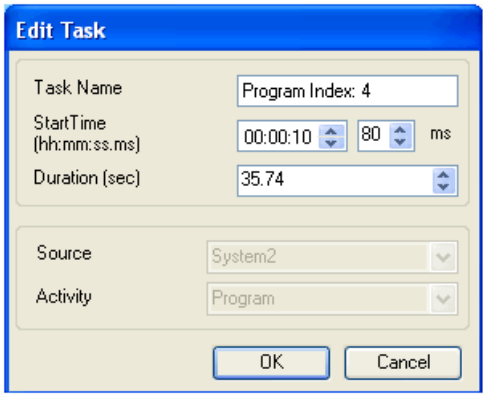
Continued

Add / Edit task

This feature enables you to add tasks under an existing Activity and Source or create a new Activity and/or Source and edit existing tasks.



xx1100000919



xx1100000920

In the report the names of the tasks are referred from the *Program.map*, *Segment.ndx* and *Material.map* files.

Example:

Consider that the *Program.map* file contains the following entry:

4, Roof

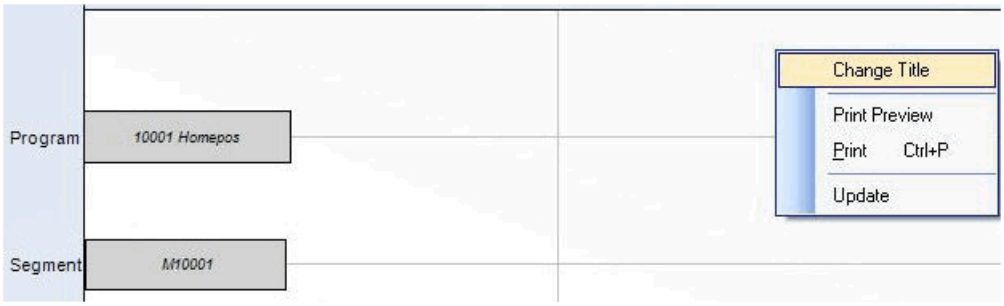
5, Bonnet

If you proceed to append the Roof from Job Queue, then the report will show *4 Roof* as the task name. In the *Edit task* dialog for the same task, the information will be shown as *Program Index: 4*. If you modify it as *Program Index: 5*, then the task name will show *5 Bonnet*. Similarly for Material and Segment tasks the task names are read from the corresponding files from the source.

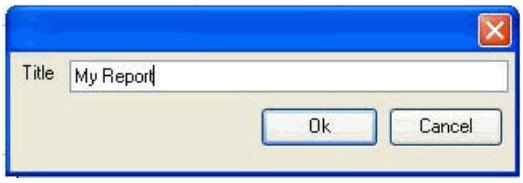
Continues on next page

Change title

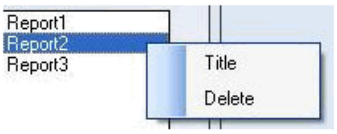
You can specify a title for the report. This option is available upon right-clicking on a blank area of the report or on the report itself.



xx1100000921



xx1100000922



xx1100000923

Note

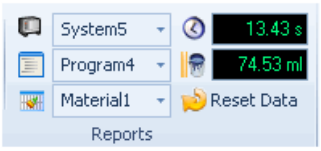
- **A cycle time report** is generated if paint program is executed between each Play and Stop operation. Therefore, several reports might be shown when user launches / updates the reports.
- Reports are saved as part of the RobotStudio station.

Tip

Use the short-cut option in the graphical window for Simulation Play and Stop

4.7.2 Reports - Material Consumption and Gun-On time

From the Reports group you can access the **Gun-On time** and the **Material Consumption** reports for a program.



xx1100000885

Material indicates the color of paint. Each material must be associated with a Brush Table which is used when painting with a particular material. The information regarding which Brush table is to be used with which material, is specified in the *material.map* file. This file is created in the following location.

<System>/HOME/alias/material.map

Material map file contains entries such as,

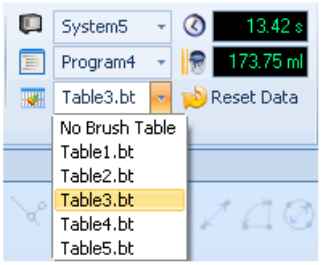
1, Material1

2, Material2

3, Material3

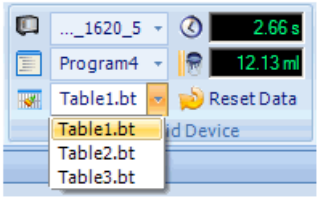
where *1* indicates the Brush table number used when *Material1* is specified. You can specify any Brush table which is used for a particular material. Ensure that the corresponding Brush table is present in the system.

The *Material.map* file is created only for systems where the Color Change option has been selected.



xx1100000886

If the Color Change option is not selected in a system, then the drop down option lists the Brush Tables present in the system as shown in the following figure.



xx1100000887

Brush tables are created using the Edit Brush Table option from the ribbon tab. The tables are stored in the following location in the system folder.

Continues on next page

For example:*<System>/IPS/A1Brush/Table1.bt*

The folders for *IPS*, *A1Brush* and the *A1BTab.ndx* are created when enabling Painting PowerPac. To use a new material and its associated Brush Table, it is necessary to update the *Material.map* and *A1BTab.ndx* files located in the current system.

For example:*<System>/IPS/A1BTab.ndx*

Usage

Gun-On time is the time duration, in seconds, during which there is paint flow from the applicator while executing a program. In a program this is decided by the Brush number used in the SetBrush instructions that are used to turn-off the paint flow. That is, the material parameter value in the Brush Table is 0 for that corresponding Brush number.

Material Consumption is the volume of paint, in milli litres (ml), consumed for a program. It is calculated based on the Material used and the Brush tables associated with the Material.

	Action	Information
1	Create a program and synchronize to the VC. Setup and execute the simulation.	Gun-On time and Material consumption are calculated for a program that is executing on the controller. The procedures that are required to execute can either be appended from the Job Queue or be specified from the Simulation Setup. If there are multiple controllers in a station, then all the controllers must be setup for the simulation. Start the simulation and execute the procedures
2	Select the Controller	From the Reports ribbon group, select the controller
3	Select Program and Material	All the programs and materials that have been executed/associated in the selected controller are listed. By default *No Material*/ *No BrushTable* is listed.
4	Gun-On time and Material consumption	For the selected program and material the corresponding Gun-On times are calculated and displayed. The values are calculated for the program executed last.
5	Reset	Reset clears all the values displayed and removes all programs in the list.

All the programs that are executed on each controller are listed when the controller is selected. For a selected Program, you can select and check the Gun-On time and consumption for different Program and Material combinations. This functionality can be used along with the Job Queue or from the RobotStudio Simulation Setup.

This page is intentionally left blank

5 Paint Path Tab

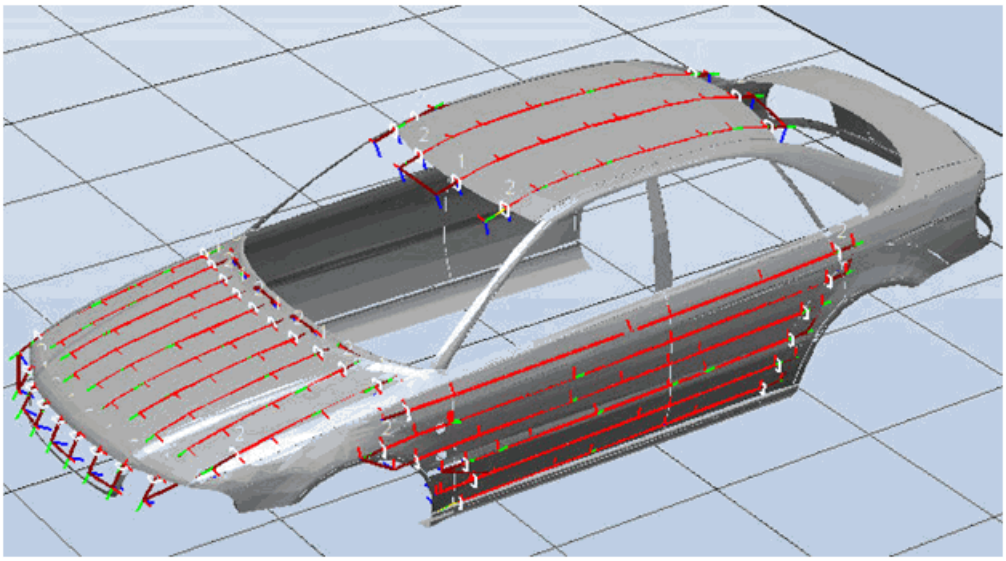
5.1 Programming

5.1.1 Overview

PaintStroke is the configuration given to paint contactless in a path defined by you. The path followed, to paint a desired Panel or workpiece, is either programmed manually (**Manual PaintStroke**) or automatically (**Auto PaintStroke**). The PaintStroke depends on the applicator used to paint. For more information, see *Painting Patterns on page 109*. The following figure shows the defined paths on a car body.

Note

Many of the functionalities described in this chapter is also available through context menus. For more information, see *Context Menu on page 120*.

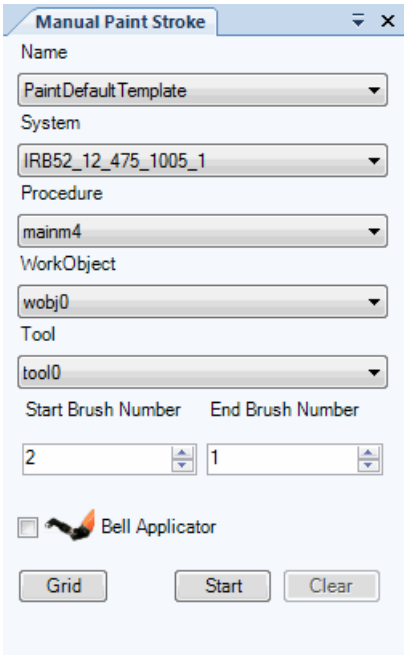


xx1100000854

5.1.2 Manual PaintStrokes

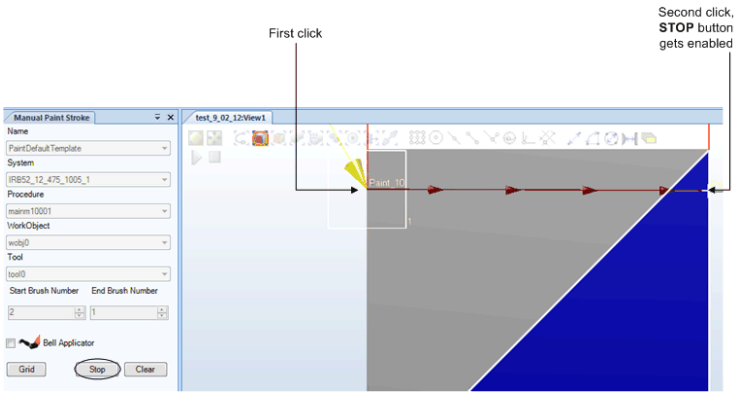
Creating Manual PaintStrokes

1 On the **Paint Path** Tab, in the **Programming** group, click **Manual PaintStroke**.
This Opens the **Manual PaintStroke** dialog box.



xx1100000850

2 Select a **Template** from the drop down menu list
3 Select the **System** for which you want to configure the PaintStrokes.
4 Select the reference **Workobject**
5 If your applicator is a Bell applicator, then select the **Bell Applicator**. For more information, see *Painting Patterns on page 109*.
6 Click **Start** and then click on the workpiece to teach the Paint program.
After clicking the second point, the **Start** button changes to **Stop**.



xx1200000090

Continues on next page

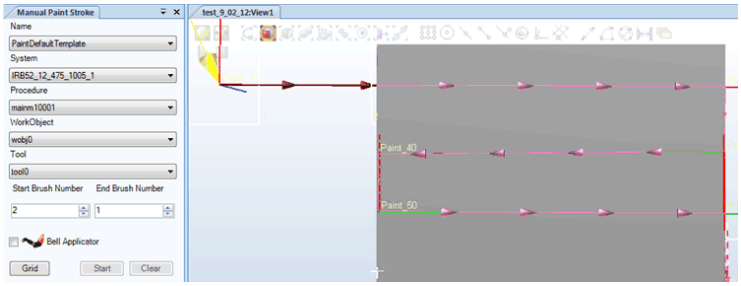
Continued

Note

If you are creating multiple PaintStrokes, you can directly proceed to select points on the surface without needing to click *Start* again.

7 Click **Stop**

After clicking **Stop**, the button changes to **Start** and is disabled.



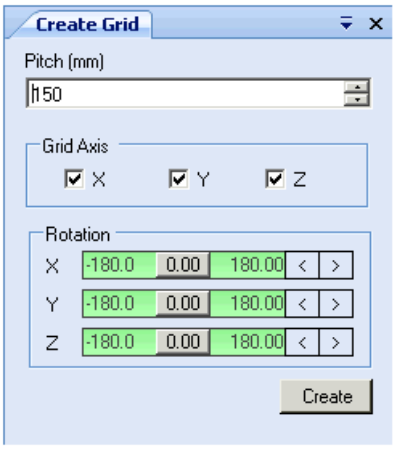
xx1200000090

Note

The paintstroke is not appended if the user has closed the dialog before clicking Stop.

8 You can create a grid view on the surface on which paint strokes are created. This functionality helps in creating parallel paths while creating Paint strokes for models with intricate surfaces, this feature helps in positioning the targets more accurately.

Click **Grid** to open the *Create Grid* dialog. Use the following procedure to create a grid.



xx1100000903

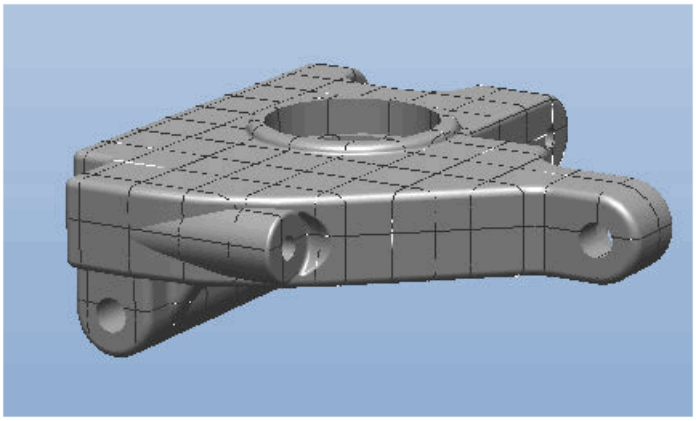
	Action	Information
1	Select the surfaces or parts from the graphical window.	You can select either surfaces or parts. For multiple selections, hold down the Shift key while selecting.
2	Specify the **Pitch**	The Pitch value which defines the distance between each path.

Continues on next page

5.1.2 Manual PaintStrokes

Continued

	Action	Information
3	Select the axes for the grid and rotate the grid, as required, along each axis.	By default all the three grid axes are selected. You can clear the check boxes of the axes which are not applicable. You can rotate the grid around the x, y and z axes.
4	Click **Create**.	The grid is created on the selected surfaces / parts. You can visualize the grid as a 3-D frame of the part. The grid of the model is created based on the world coordinates.



xx1100000904

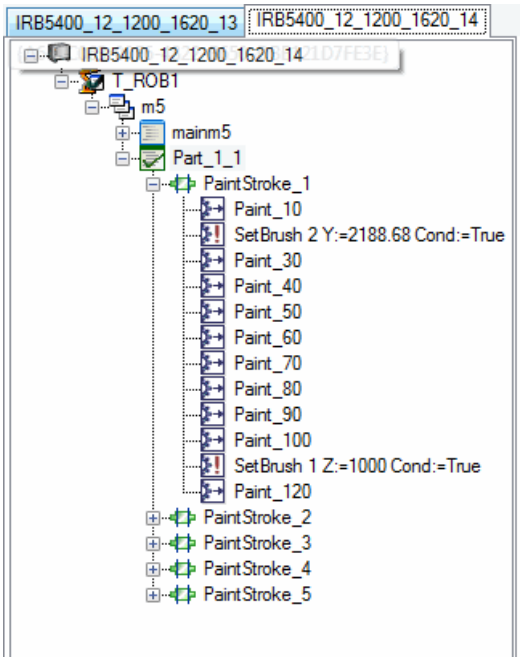
Please note that when you select another set of surfaces and create a grid, the previous grid is deleted. When the **Manual PaintStroke** dialog is closed, all the grids are deleted. You can also *Show* / *Hide* the grid using the option present on the ribbon tab.

9 The PaintStrokes are created and appended to the *Paint Path Browser tab*. *SetBrush* instructions are inserted at the beginning and the end position of the PaintStroke. The Position and the Offset distances are automatically calculated. The event position is indicated graphically. The first and the last

Continues on next page

Continued

Targets are offset by the Approach and Depart distance specified in the *Preferences Templates*.



xx1200000092

Tip

In the process of Creating a PaintStroke, if you do not wish to save the PaintStroke, then click **Clear**. This removes the current PaintStroke.

PaintStrokes are appended under the Painting Browser tab and are numbered PaintStroke_1, PaintStroke_2. The paintstrokes are appended to the procedure which is active. If you navigate to any other tab while creating PaintStrokes and then return to Painting, click **Continue** to proceed with creating the programs.

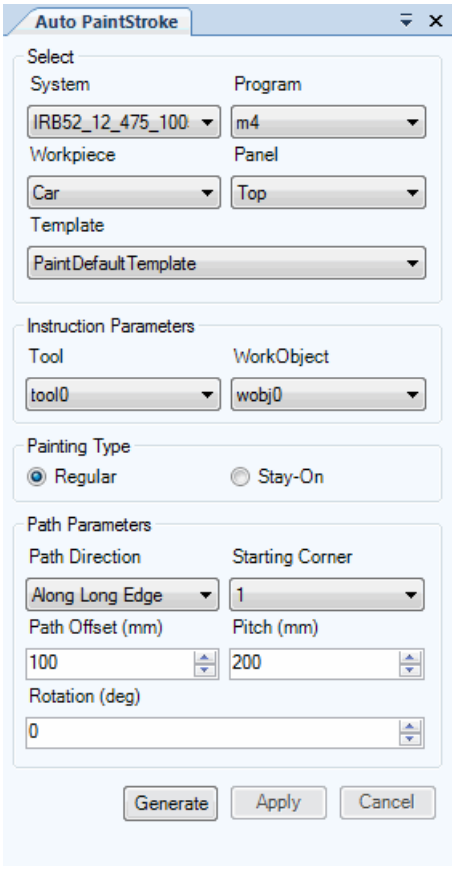
Tip

Press the keyboard key *S* instead of clicking the **Stop** button for every paintstroke.

5.1.3 Auto PaintStroke

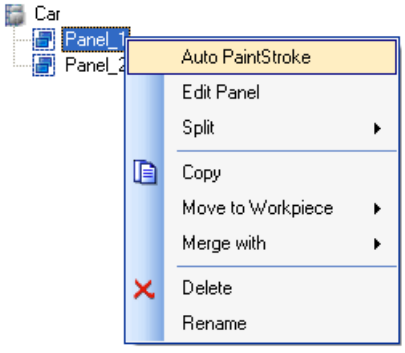
Creating Auto PaintStroke

1 On the **Paint Path** Tab, in the **Programming** group, click **Auto PaintStroke**.
This Opens the **Auto PaintStroke** dialog box.



xx1100000856

You can also access the **Auto PaintStroke** quickly by right clicking directly on the Panel listed in the **Paint Panel** Tab's context menu.



xx1100000855

Continues on next page

Continued

Note

Auto PaintStroke creates paths automatically on the Panels identified. Before using **Auto PaintStroke** make sure that

- A program is created and listed in the Painting PowerPac browser window
- The Workpiece is imported into Painting tab and Panels are identified on it.
- The parameters in the **Preferences** dialog are set.

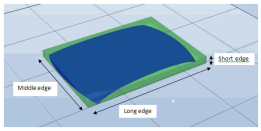
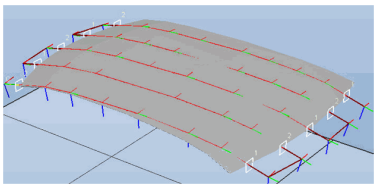
2 The following table gives you the procedure on how to select the value in the **Auto PaintStroke** dialog box

Option	Description
Workpiece, Panel and Template	Select the workpiece on which the paint strokes are to be created. Once the meshed workpieces are selected, all the panels associated with that workpiece are listed. Select a panel and ensure that it is highlighted in the graphical window. Select an available template from the station. The template provides default values to all the options in the dialog and the values required to generate the path. The default values are modified when needed.
Instruction Parameters	**Tool** and **WorkObject** are populated based on the template selected.
Painting Type	You can create the paint strokes depending on the type of applicator. Click **Regular** for a Spray Gun type applicator. Click **Stay-On** type for Bell type applicators. The paint path created is unique for each type of painting.

Continues on next page

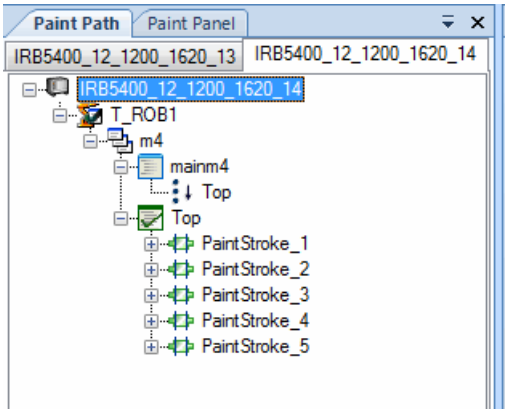
5.1.3 Auto PaintStroke

Continued

Option	Description
Path Parameters  xx1100000857	**Path Direction** Specify the path on the selected panel with **Path Direction**. You can choose the direction of the path as: • **Along Long Edge** - When the program is created along the longest side of the Panel (here the length of the box) • **Along Middle Edge** - When the program is created along with less longer side of the Panel (here the breadth of the box) • **Along Short Edge** - When the program is created along the shortest side of the Panel (in this case the vertical side of the box) **Starting Corner** Select the starting corner of the path as 1, 2, 3, or 4 as required. Then click **Generate** to create the path. The other points can be located by moving in the counter-clockwise direction from the current starting corner point.  xx1100000858 **Pitch** Pitch describes the distance between two parallel paths. You can change the Pitch value from the dialog.

3 Click **Generate** to creates a path on the panel using the selected template parameters. The Set Brush instructions at the starting and ending points of each paint stroke are also automatically generated.

4 Click **Apply** to store the path. Individual Paint strokes are identified and appended to a procedure with the name associated with the Panel. The name of the procedure is similar to the corresponding Panel name.



xx1100000865

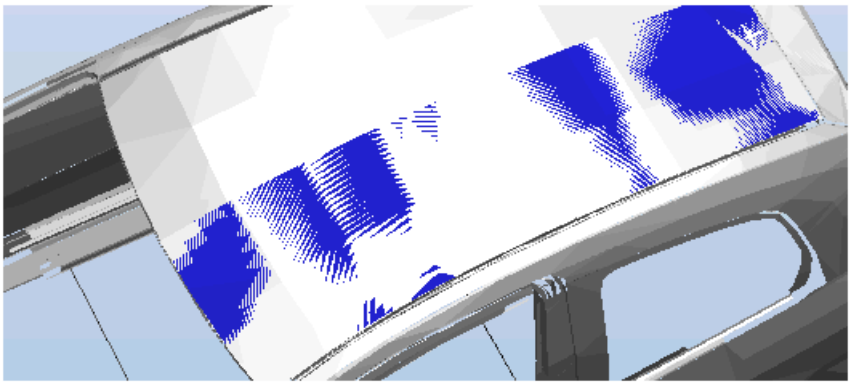
Continues on next page

5 Click **Cancel** to discard the created path. You can choose another combination of parameters and generate the path again.

Handling Errors - Scenarios

Multiple layers in CAD model

Some CAD models may have multiple layers. You may have selected only the top surface of the workpiece while creating the Panel. However the path generated may not be as expected. An example of multiple layers is shown in the following figure.



xx1100000864

In a case, as shown in the previous figure, delete all duplicate layers and leave only one layer which defines the surface to be painted.

RobTarget Z- axis is not pointing normal into the surface

In some CAD models the Z-axis may be pointing out of the surface. Here you can choose *Adjust Position and Orientation* feature from the context menu of the PaintStroke to rotate the RobTargets by 180 degrees.

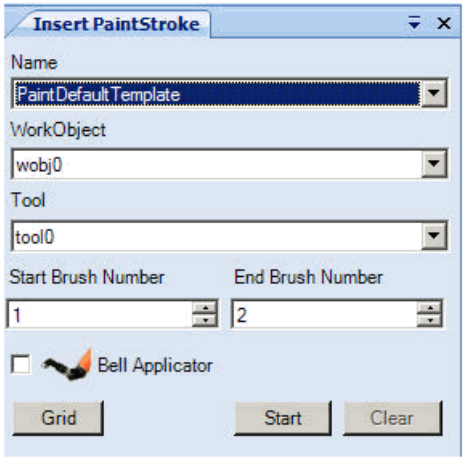
Stay-On painting is creating paint strokes which are not similar to the template

In such cases the Pitch and Edge values are not proportional to the edge length. Modify the same to be proportional with the size of the edge along the path direction.

5.1.4 Inserting PaintStroke

To insert a Paintstroke between two PaintStrokes, right click on any paint stroke and the select **Insert PaintStroke**. For more information, see *PaintStroke Node Options on page 123*

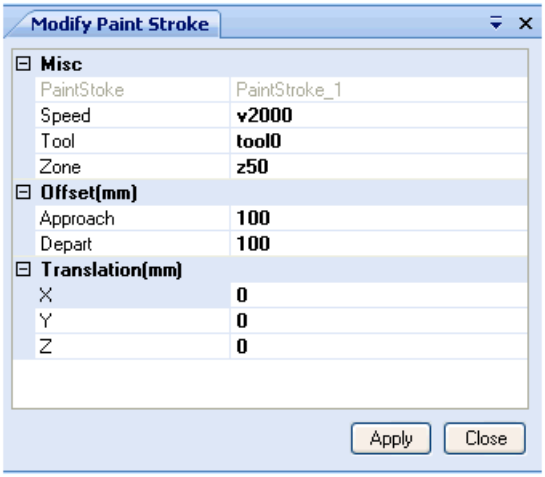
The following dialog appears.



xx1100000895

5.1.5 Modifying PaintStroke

To modify the Paintstroke for the parameters in the *PaintL* instruction, use the **Modify Paint Stroke** dialog. To modify a Paintstroke, right click on any paint stroke and the select **Modify Paint Stroke**. The following dialog appears. Change the displayed parameters and click **Apply** to modify the PaintStroke. The change is reflected in all the Paint instructions under the PaintStroke.



xx1100000896

Under **Offset**, you can change the **Approach** and **Depart** distances for the selected PaintStroke. When you translate the PaintStroke, then all the instructions in the PaintStroke are offset by the specified distance with respect to the Global frame. The *SetBrush* trigger positions are also updated.

5.1.6 Deleting PaintStroke

You can select a PaintStroke and delete it. All the *PaintL* and *SetBrush* instructions under the PaintStroke are also deleted.

Note

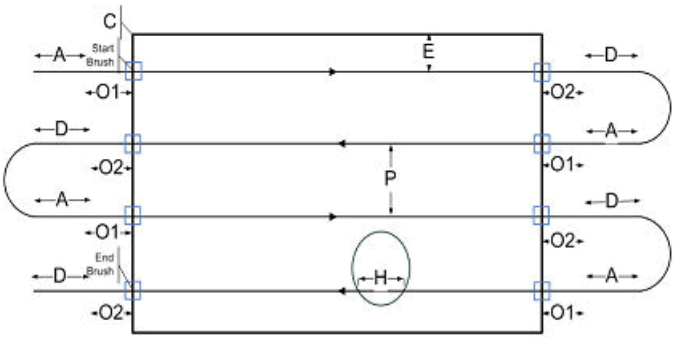
If there are no procedures in RobotStudio which are referring to the same Targets, then the Targets are also deleted.

5.1.7 Painting Patterns

In robotic painting the spray pattern is dependent on the type of applicator that is used. A Spray Gun type applicator gives an oval shaped pattern whereas a Bell Cup type applicator gives a circular pattern. In Painting PowerPac, the orientation of the targets in the paint stroke is decided based on the type of applicator used.

Regular Painting

In Regular Painting the paint strokes are created for the Spray-Gun type of applicator. The spray pattern is primarily oval, and the path generated has multiple parallel paint strokes. Hence the applicator tool orientation is same and the spraying pattern is uniform. The targets are aligned such that the Y axis of the target is pointing in the direction of the path and the Z axis is normal and pointing into the surface. Each stroke is identified by *Start Brush* and *End Brush* trigger events placed at the edge of the panel, as shown in the following figure.



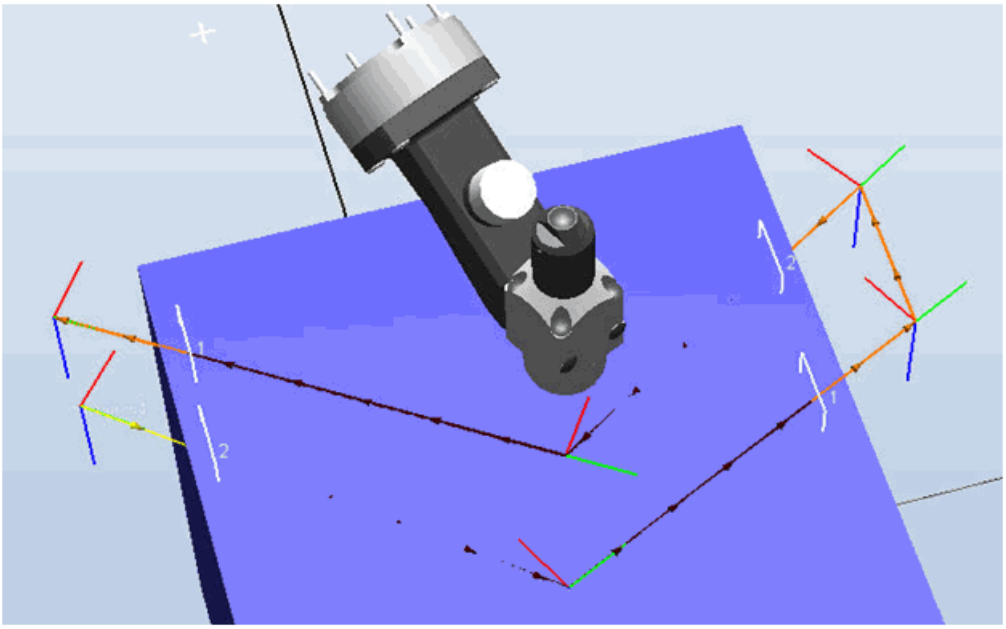
xx1100000860

When creating subsequent PaintStrokes, the orientation of the targets are automatically adjusted to minimize the tool re-orientation when moving from one PaintStroke to another. This means that if the tool has to rotate >100 deg in order to align with the target in the current paintstroke, then the orientation of the targets in the PaintStrokes are aligned in the direction of the path and then rotated by 180 deg about Z-axis. This minimizes the tool re-orientation and is helpful when creating

Continues on next page

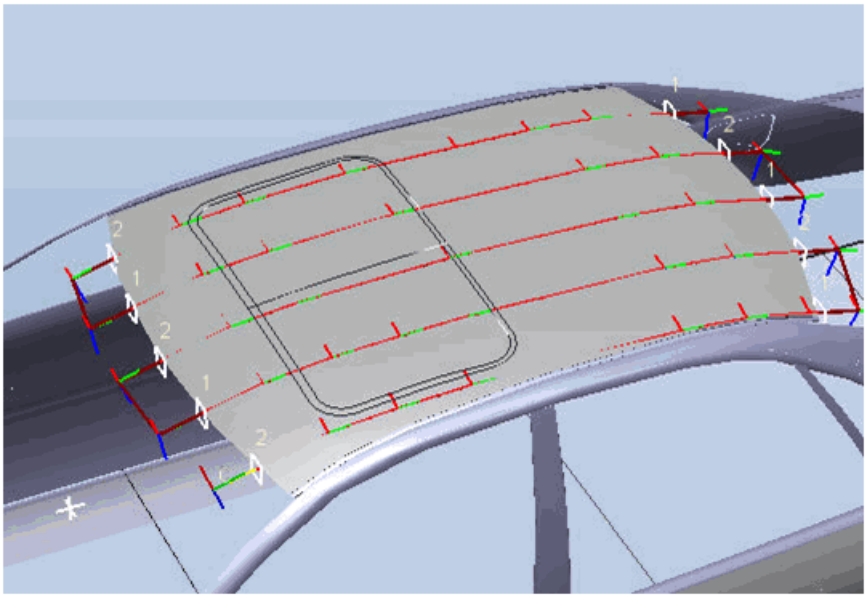
Continued

parallel PaintStrokes where the Tool orientation would not change. This is illustrated in the following figure.



xx1100000851

The Path generated on a simulated car's roof with Regular Painting is shown in the following figure.



xx1100000861

Stay-On Painting

In stay-On painting the paint strokes are created for the Bell type of applicator. The spray pattern is primarily circular, hence the spray pattern is uniform irrespective of the applicator orientation.

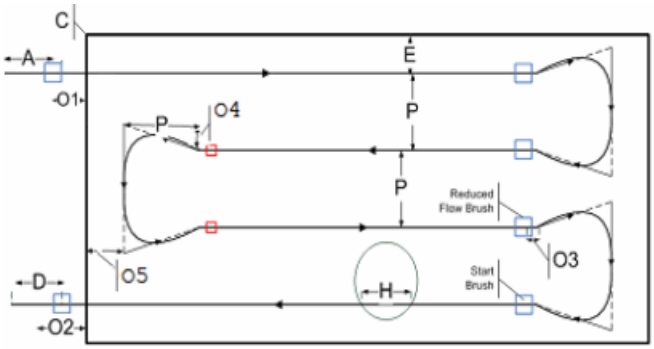
Continues on next page

Continued

The spray pattern is not affected by the tool orientation when moving along the path. When moving from one parallel segment of the path to the next, the robot has to make a smooth transition. Hence the two targets are placed with a little offset. The *Turning Zone (Z)* for these PaintL instructions can be specified in the *Preferences* dialog.

The **Turn Offset** parameter is used to specify the distance by which the turning point is offset from the path and is usually depends on the Pitch. The default value is 0. While making a turn, the paint flow is reduced. The *reduced flow* brush event is created and placed at an offset (O3) before the instruction which starts to take the turn. After the robot has made the turn, the Start brush event is placed with the same offset distance to resume normal painting and at the end of the paint stroke the End brush event is inserted to turn off the paint flow. The **Edge offset** parameter allows user to control the distance between the Panel edge and the Turning target.

You can specify the Brush numbers to be used for Start, End, and Reduced flow trigger points.



xx1100000863

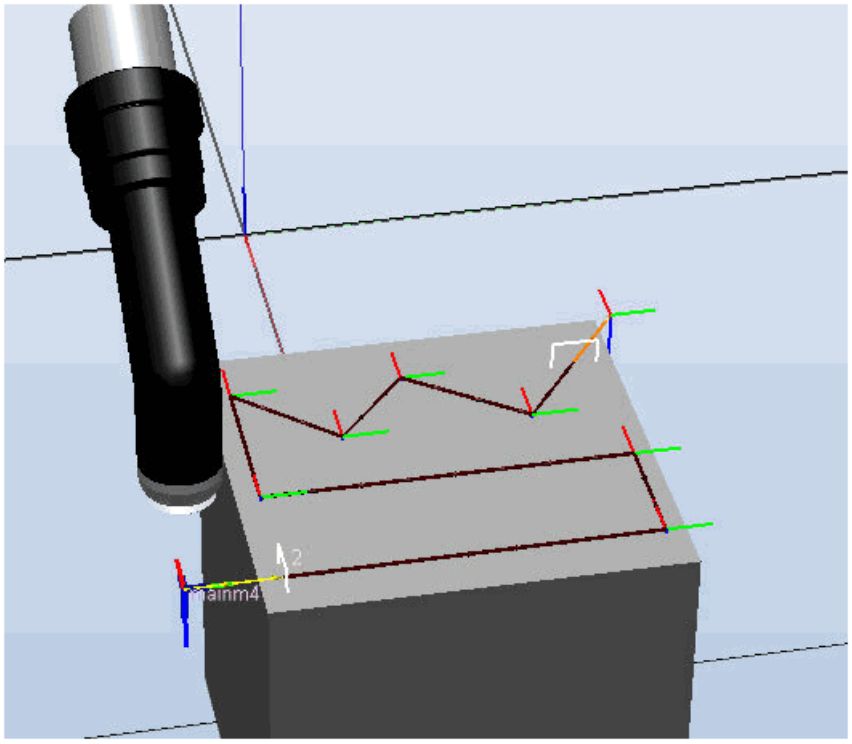
The first and the second targets are aligned so that Y-axis is pointing in the direction of the path. All the subsequent targets in the paintstroke have the same orientation as that of the previous target with the Z- axis points normal into the surface at all the selected points. As the orientations of targets are similar, for most cases the

Continues on next page

5.1.7 Painting Patterns

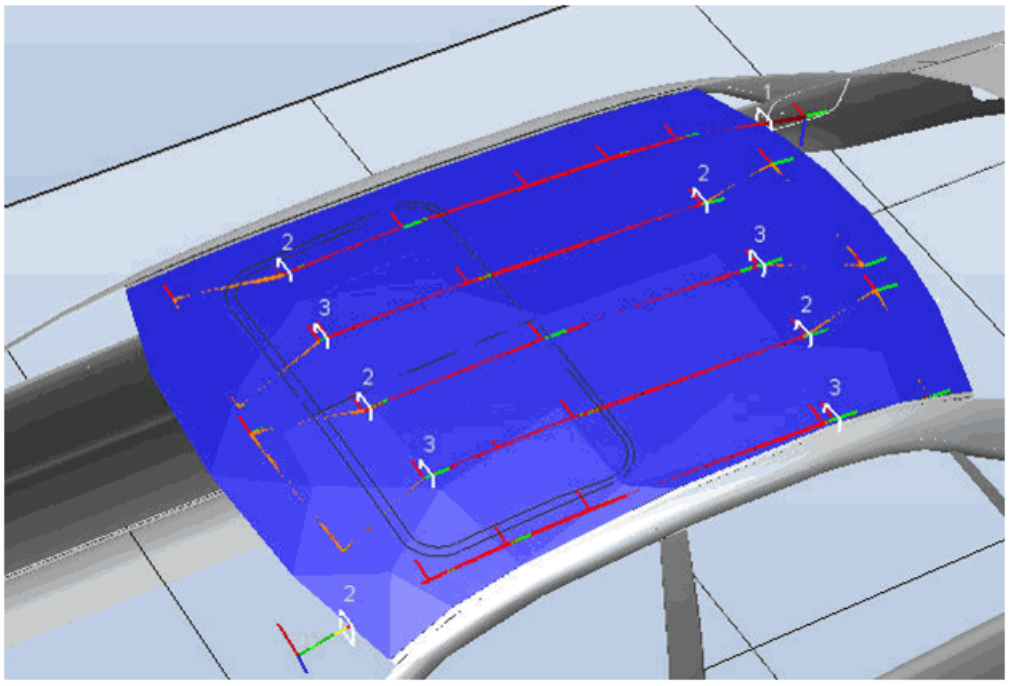
Continued

robot does not need to re-orient much when moving along the path. This is illustrated in the following figure.



xx1100000852

The Path generated on a simulated car's roof with Stay-On Painting is shown in the following figure.

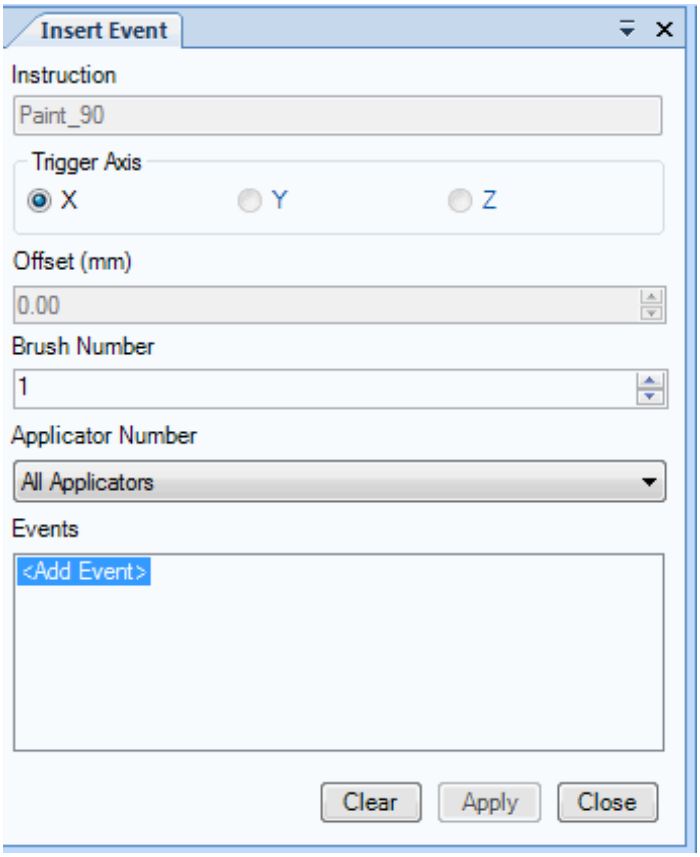


xx1100000862

5.2 Instruction

5.2.1 Insert Events

You can add an *Event* on a *PaintL* instruction, using the *Insert Event* dialog.



xx1100000898

To add an event:

1. Right-click the *PaintL* instruction and select **Insert Event**. The **Insert Event** dialog opens. The instruction is highlighted in the graphical window.
2. The Major axis is automatically calculated.
3. Select the Brush Number from the drop down menu
4. Select the Applicator.
5. Click **Add Event** from the Events menu option and then graphically select the event positions on the instruction. The event offset values are calculated and displayed in the menu.
6. Click **Apply**. The event is inserted above the PaintL instruction.

Note

A maximum of 10 events can be added in a Paint instruction and the instructions are automatically ordered based on the path direction when applied to the PaintStroke.

5.3 Modifying Targets

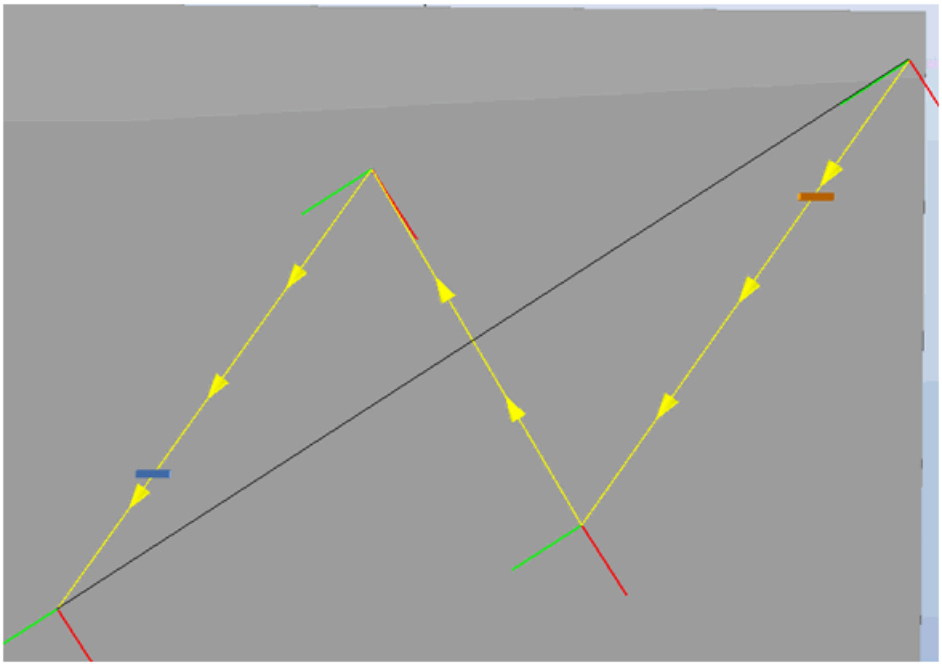
This functionalities allow you to modify the target positions in various context and enables to achieve the required targeted area to be painted. The following sections lists the available functionalities

Continues on next page

5.3.1 Align Orientation

Align Orientation option sets the same orientation to all the RobTargets in the PaintStroke. The orientation of the RobTargets is such that the Y-axis points in the direction from the Start Brush event to the Ending Brush event. This is illustrated in the following figure.

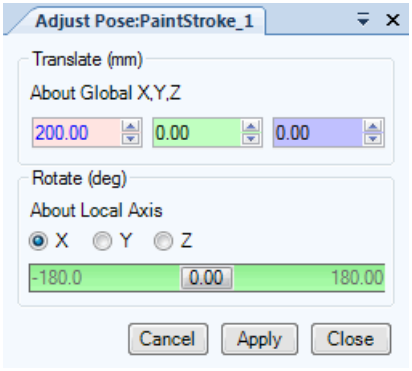
The *black* line shows the direction from the Start and the End Event. The Y–axis of all RobTargets are oriented in the direction of the line.



xx1100000892

5.3.2 Adjusting Position and Orientation

You can modify the position and orientation of either one or all the PaintStrokes in a Program, using the *Adjust Position and Orientation* dialog. The functionality is available under the PaintStroke and PaintL instruction levels.



xx1100000908

Usage

	Item	Description
1	Offset Position	You can offset paintstroke/paintstrokes or instructions. The paintstroke is offset by the specified values from the current with the Global reference frame. The global reference frame can be visualized in the graphical window of RobotStudio. When paintstroke is offset, then all the associated SetBrush instructions are also updated such that they reflect the current values with respect to the WorkObject.
2	Rotate	All the targets in the PaintStroke/PaintStrokes are rotated around the selected axis. The rotations are relative to the current local position. Both the Offset and Rotate changes are commited on clicking **Apply**. If you click **Cancel**, then rotations come back to the original values.

Note

When you enter any value in any of the dialogs, then the corresponding targets are modified graphically to indicate the new positions. The new values are applied only when you click **Apply**.

5.3.3 Setting Spray Angle

While painting, the applicator is slightly tilted in the direction of the path to blow away any dust particles on the workpiece. Spray Angle is the angle made by the applicator tool when moving in the direction of the path. A positive value orients the tool in the direction of the path, while a negative value orients it in the opposite direction.

The spray angel is set using the *Modify Spray Angle* dialog. You can open this dialog from the context menus of the Program, PaintStroke and PaintL instruction nodes.

xx1100000905

Usage

	Item	Description
1	Create Paintstrokes from Painting PowerPac	Create the paintstrokes using either Manual PaintStokes or Auto Create PaintStroke option. Ensure that the targets have their Z - axis pointing normally into the surface.
2	Select the **Modify Spray Angle** option from the PaintStroke node and specify a positive value in degrees. Then click on Apply	All the instructions associated with the corresponding PaintStroke are modified such that their Z - axis is pointing slightly in the direction of the path.
3	Modify the value again and click on Apply	The angle is always relative to the current target orientation

Irrespective of how the targets are oriented, a positive value always indicates that the Tool is pointing in the direction of the path. This is termed as *Push*.

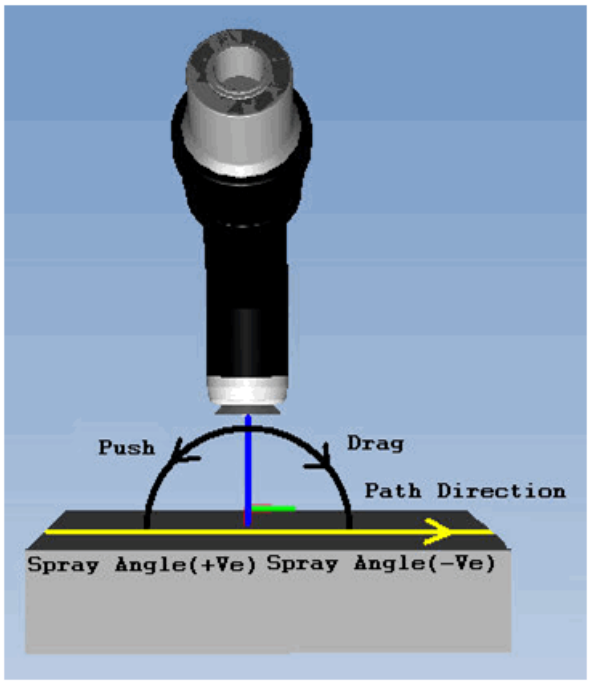
If the tool is pointing in the opposite direction of the path, then it is termed as *Drag*.

Continues on next page

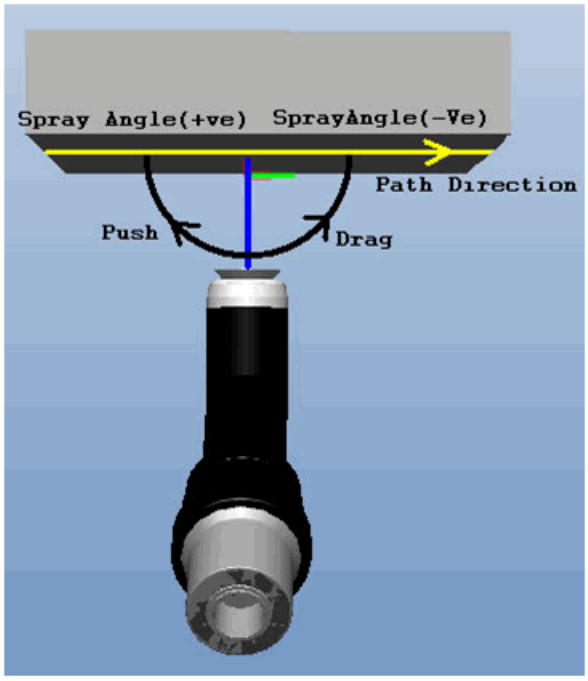
5.3.3 Setting Spray Angle

Continued

For example, if the targets are pointing normal to the surface, but in the opposite direction, then specifying a Positive value for the Spray angle aligns it in the direction of the path.



xx1100000906



xx1100000907

In the preceding figure, specifying a positive value would rotate the tool such that it is in Push.

Modifying the spray angle in cases where the orientation of targets after generating a path on a surface, is not uniform. For example, if some targets are pointing in

Continues on next page

the opposite direction, then specify a Spray Angle of 180 degrees to correct the orientation.

Note

When you apply a new Spray Angle, the targets continue to rotate in a specific direction such that the Z - axis of the target is pointing towards or away from the direction of the path. In this process when the Z- axis moves above the path, then the targets' properties change such that for the same Spray Angle, the movement shall be in the opposite direction as described in the above pictures. Hence in order to continue to rotate in the earlier direction, you must change the sign of the Spray Angle once it crosses the plane of the path.

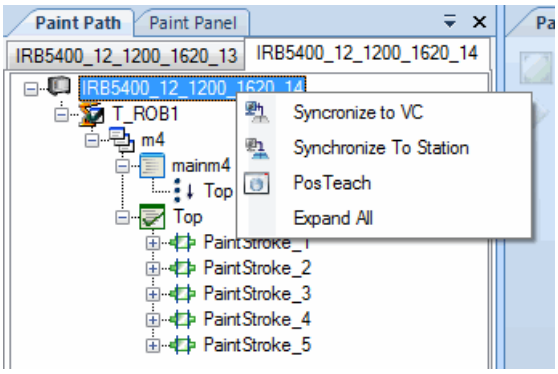
Note

For the rotate options like Flip by 180, Rotate Clockwise, and Rotate AntiClockwise, see *PaintStroke Node Options on page 123*.

5.4 Context Menu

The context menus of each node in the **Paint Path** browser provide options pertaining to that node.

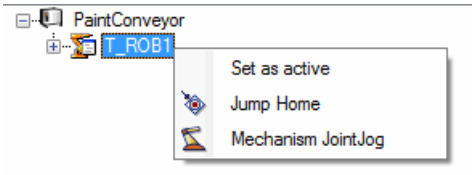
Controller Node Options



xx1100000888

Option	Description
Synchronize to VC	To synchronize the current program to the virtual controller.
Synchronize to Station	To open the dialog where user can select the programs and procedures to synchronize into Station. See Synchronization for more information.
Pos Teach	To update the Global positions for the Painting robot.
Expand all	To expand all the elements in the tree nodes.

Task Node Options



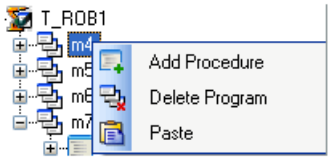
xx1200001372

Option	Description
Set as active	To set the Robot Task as active.
Jump Home	To move a robot to its home position.
Mechanism JointJog	For jogging the joints of the mechanism in the selected station.

Continues on next page

Continued

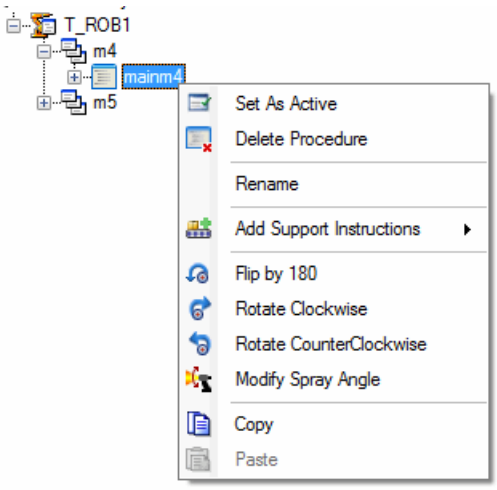
Program Node Options



xx1100000889

Option	Description
Add Procedure	To add a Procedure under a program. A dialog opens where you can enter name of the procedure. The procedure hence created is by default *Set as Active*.
Delete Program	To delete a program. In this case all the Procedures in the program are deleted.
Paste	To Paste Procedures from the Program node.

Procedure Node Options



xx1100000890

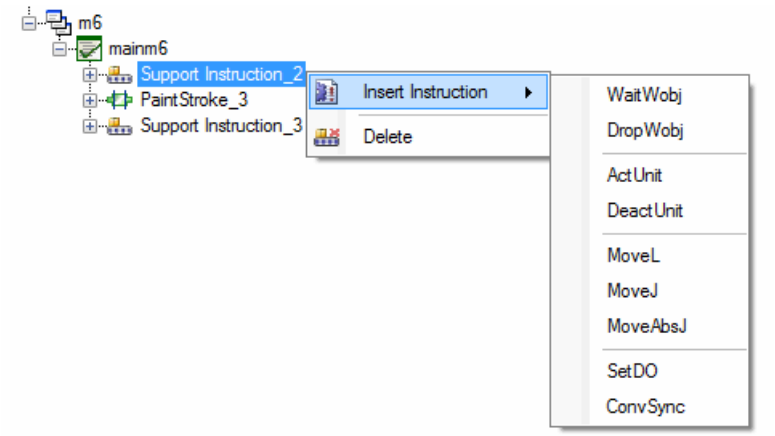
Option	Description
Set As Active	To select the procedures to which PaintStrokes have to be appended. This is applicable when there are multiple procedures in a program.
Delete Procedure	To delete a single procedure and all the PaintStokes under it.
Rename	To renames a procedure.
Add Support Instructions	Begin: To add the wobj instruction. End: To drop the wobj instruction.
Flip by 180	To rotate all the targets in the procedure by 180 degree about the Z-axis.
Rotate Clockwise	To rotate all the targets in the procedure by 90 degree in clockwise direction about the Z-axis.
Rotate CounterClockwise	To rotates all the targets in the procedure by 90 degree in counter-clockwise direction about the Z-axis.

Continues on next page

Continued

Option	Description
Modify Spray Angle	To open dialog for modifying the spray angle. For information on Spray Angle, see *Setting Spray Angle on page 117*
Copy-Paste	To copy and paste procedures / PaintStrokes from the Procedure node.

Support Instruction Node Options



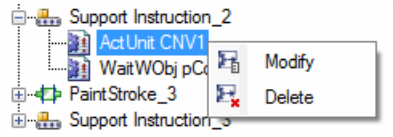
xx1200001383

Option	Description
WaitWobj	Wait Work Object connects to a work object in the start window on the conveyor mechanical unit.
DropWobj	Drop Work Object is used to disconnect from the current object and the program is ready for the next object on the conveyor.
ActUnit	Used for activation of a mechanical unit.
DeactUnit	Used for deactivation of a mechanical unit.
MoveL	Used to move the tool center point (TCP) linearly to a given destination.
MoveJ	Used to move the robot quickly from one point to another when that movement does not have to be in a straight line.
MoveAbsJ	Used to move the robot and external axes to an absolute position defined in axes positions.
SetDO	Used to change the value of a digital output signal, with or without a time delay or synchronization.
ConvSync	Used to turn on/off the retract function. Optional parameters are the Retract distance, and a switch to change retract axis.
Delete	To delete the selected Support Instruction.

Continues on next page

Continued

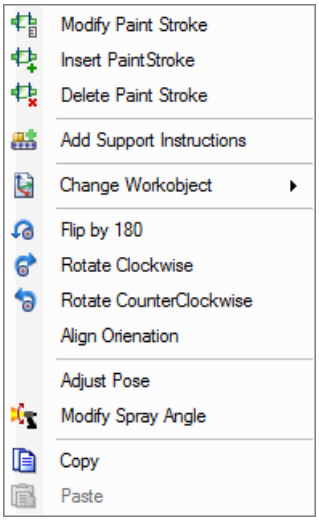
Example - ActUnit



xx1200001392

Option	Description
Modify	To modify the Instruction Arguments and Process Templates for the selected support instruction.
Delete	To delete the selected support instruction.

PaintStroke Node Options



xx1100000891

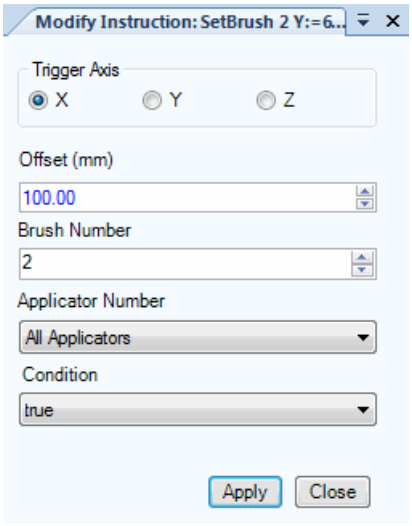
Option	Description
Modify PaintStroke	To add a procedure under a program. A dialog is provided where you can enter the name. Ensure that the name of the procedure is valid and has the prefix *main*.
Insert PaintStroke	To insert a PaintStroke. The procedure is similar to creating new PaintStrokes, but only one PaintStroke can be inserted.
Delete PaintStroke	To delete a PaintStroke. In this case all the instructions under the PaintStroke are deleted.
Add Support Instructions	Identifies a group of instructions like `WaitWobj`, `DropWobj`, `MoveL`, `MoveAbsJ` which will help during paint programming.
Change Workobject	To associate the target with respect to another workobject.
Flip by 180	To rotate all the targets in the PaintStroke by 180 degree about the Z-axis.
Rotate Clockwise	To rotate all the targets in the PaintStroke by 90 degree in clockwise direction about the Z-axis.

Continues on next page

Continued

Option	Description
Rotate CounterClockwise	To rotate all the targets in the PaintStroke by 90 degree in counter-clockwise direction about the Z-axis.
Align Orientation	To offset the Paintstroke or rotate the targets in the PaintStroke along the local axis.
Modify Spray Angle	To modify the spray angle for all the targets in the PaintStroke.
Copy-Paste	To copy-and-paste the PaintStrokes/Instructions from the PaintStroke node.

Modifying and Deleting Events



xx1100000900

Use this procedure to modify the SetBrush event attributes:

1. Right-click the event and select **Modify Event** to open the dialog shown previously. The event is also highlighted in the graphical window.
2. To reposition the event, enter the offset value for the major axis and click **Apply**. The event position is re-positioned. If the event position is not reachable, then the event does not re-position.

   You can modify the event position graphically also. Click on the SetBrush instruction in the browser window to activate the modification arrows in the graphics. Click and drag on the arrows to re-position the event. The values are automatically updated in the instruction.
3. Change the **Brush Number** and **Applicators**, if needed and click **Apply**.

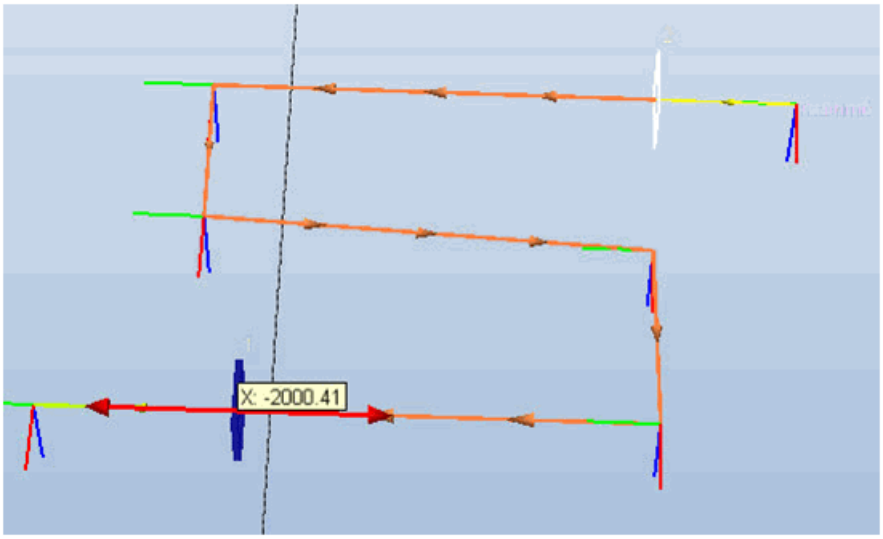
   When the brush number is changed, the path color changes corresponding to the information in the brush specification.

The Conditional argument value *True* for the SetBrush event indicates that the event is triggered.

Continues on next page

Continued

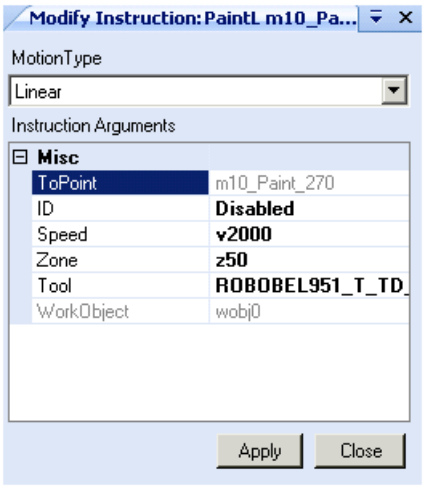
The argument *False* indicates that the event will not be triggered even if the robot path passes the trigger point.



xx1100000901

Modifying Instructions

You can modify a selected instruction using the *Modify Instruction* dialog.



xx1100000899

Make the changes and click **Apply**. The changes are reflected in the instruction and can be verified from the RobotStudio *Home* tab.

Deleting Instruction

You can select an instruction and delete it. If the instruction is a *PaintL* and has associated SetBrush events, the events are re-positioned.

Example:

PaintStroke_1

PaintL Target_20

SetBrush 2/Y:= 75;

Continues on next page

Continued

SetBrush 5/X:= -150;

PaintL Target_30

PaintL Target_40

SetBrush 2/Y:= 75;

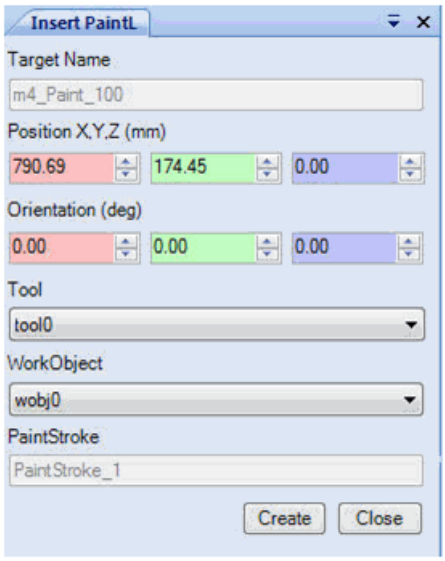
PaintL Target_50

Deleting PaintL Target_30 also deletes *SetBrush* 5/X: = -150 and *SetBrush* 2/Y:= 75

The events under it, *SetBrush* 2/Y:= 75, are re-positioned based on the new path.

Inserting PaintL

To insert a PaintL instruction in the PaintStroke, use the *Insert PaintL* dialog.



xx1100000897

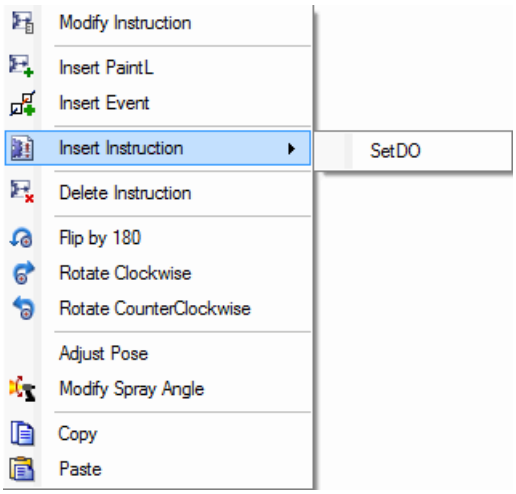
To add a new PaintL instruction:

1. Right-click the PaintL instruction after which the new instruction has to be inserted.
2. Click the place where the target is to be created. The position information is updated in the dialog box. The location is graphically indicated.
3. Enter the orientation value in the dialog box.
   - The default orientation of the target that is created from Insert PaintL option is such that they are rotated 180 degrees about the X – axis in comparison to the targets that are created from RobotStudio.
   - If there is a SetBrush instruction after a PaintL instruction after which the new instruction is to be inserted, then the SetBrush instruction is deleted after the new instruction is inserted. You need to create the deleted instruction afresh.
4. Select the corresponding Tool and WorkObject information for the Instruction. The PaintStroke which is to be associated and the target names are displayed for reference.
5. Click **Create**. The instruction is appended after the older PaintL instruction.

Continues on next page

Continued

PaintL Instruction Node Options



xx1100000893

Option	Description
Modify Instruction	To modify instruction parameters that are passed into the program.
Insert PaintL	To add an instruction after a PaintL instruction.
Insert Event	To add an event on a PaintL instruction. See Insert Event for more details
Insert Instruction	SetDO: Used to change the value of a digital output signal, with or without a time delay or synchronization.
Delete Instruction	To delete an instruction. Any *SetBrush* instructions associated with the *PaintL* instruction are also deleted.
Flip by 180	To rotates all the targets in the PaintStroke by 180 degree about the Z-axis.
Rotate Clockwise	To rotates all the targets in the PaintStroke by 90 degree in clockwise direction about the Z-axis.
Rotate CounterClockwise	To rotates all the targets in the PaintStroke by 90 degree in the counter-clockwise direction about the Z-axis.
Adjust Position and Orientation	To offset or rotate the corresponding target in the PaintStroke along the local axis.
Modify Spray Angle	To modify the spray angle for all the corresponding targets in the PaintStroke.
Copy-Paste	To copy-and-paste instructions.

SetBrush Instruction Node Options

xx1100000894

Continues on next page

Continued

Option	Description
Modify Event	To modify the event parameters such as the Brush number, Applicator number and change the trigger position. The event is also modified graphically.
Delete Event	To delete an event.

6 Paint Panel Tab

6.1 Importing Workpieces

Note

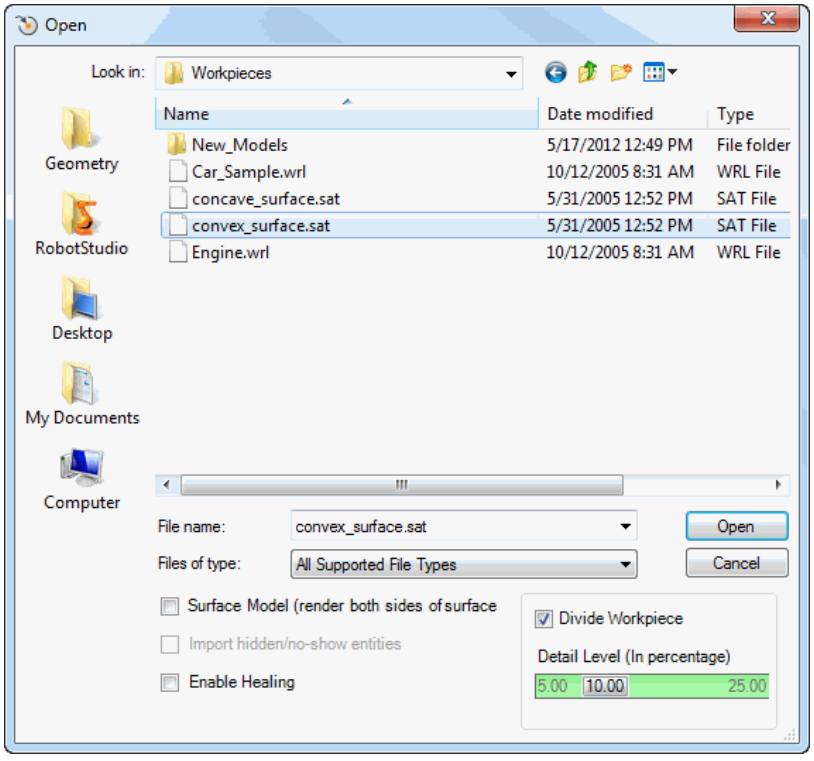
Many of the functionalities described in this chapter is also available through context menus. For more information, see *Context Menu on page 143*.

1 On the **Paint Panel** Tab, in the **Import** group, do one of the following.

- 

xx1200000095

click **Browse Workpiece** to browse for a CAD model from a folder. You can also divide the workpiece into smaller parts after selecting the level of detail by which the parts will be filtered.

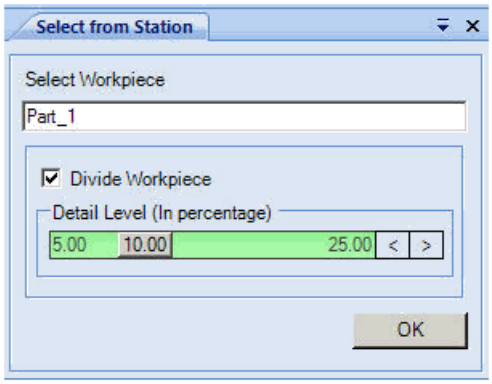


xx1100000818

Continues on next page

Continued

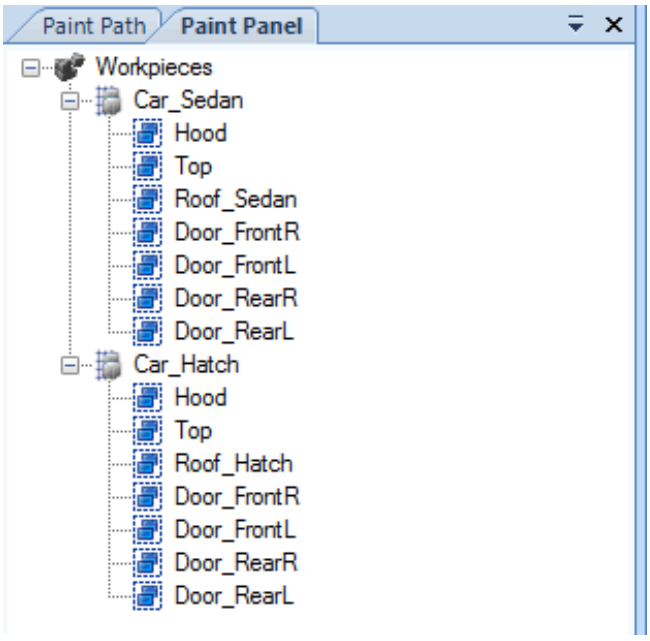
- click **Select from station** - With this option you can select an already existing CAD models in the station as Workpieces.



xx1100000819

2 After choosing the Workpiece, you can select the **Divide Workpiece** to sub-divide the CAD model based on the natural gaps in the surface. By selecting the **Detail Level** you can choose the level of filter you want to apply on the model. For more details, see *Dividing Workpiece on page 131*.

3 Once the workpiece is imported , it is listed in the **Paint Panel browser** as shown in the following figure.



xx1100000812

Note

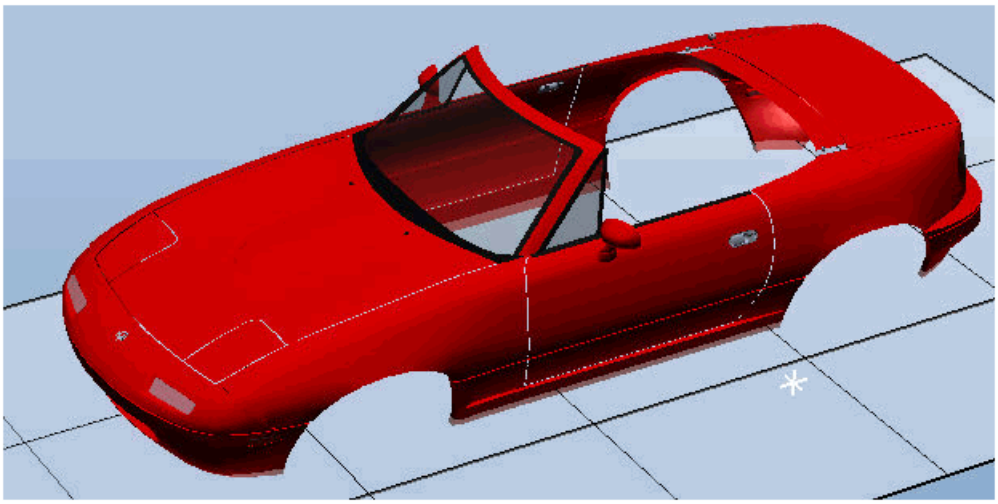
The workpieces imported into PowerPac are stored as a Graphical Component Group (GCG) in RobotStudio.

Continues on next page

Continued

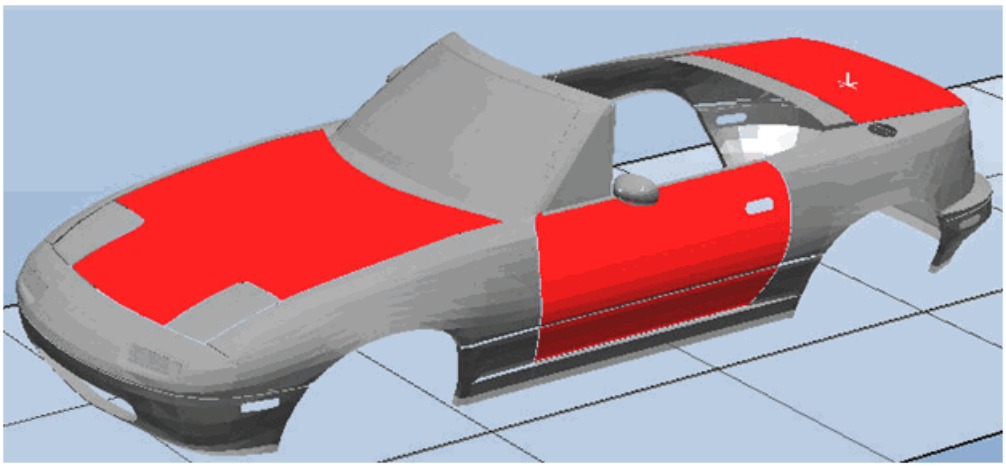
Dividing Workpiece

A model can be divided into smaller parts based on the natural gaps in the model. If the imported workpiece is a single part as shown below, then the process identifies natural gaps in the model such as the Door, Hood, Head lamp and so on, and sub-divides the model into smaller parts such that the natural gaps are clearly identified.



xx1100000830

The following image shows the workpiece after it has been sub-divided into smaller triangular parts. The individual parts corresponds to the Door, Bonnet and other parts that can be identified individually.



xx1100000831

Processing a workpiece to sub-divide it into a number of smaller parts depends on the format, size, complexity and the level of detailing in the model. If the model is highly detailed and large in size, then the process will take more time to complete. This functionality requires a minimum free main memory space of 500 MB.

The imported workpiece is listed in the Panel browser tab and the divided parts are all collected together as a Panel.

Continues on next page

Continued

While importing a workpiece, you can divide the workpiece into smaller parts, using the **Divide Workpiece** functionality. This functionality is available in both the *Browse* and *Select from Station* options.

For more information about the *Browser* and *Select from Station* options for importing a workpiece, see *Importing Workpieces on page 129*.

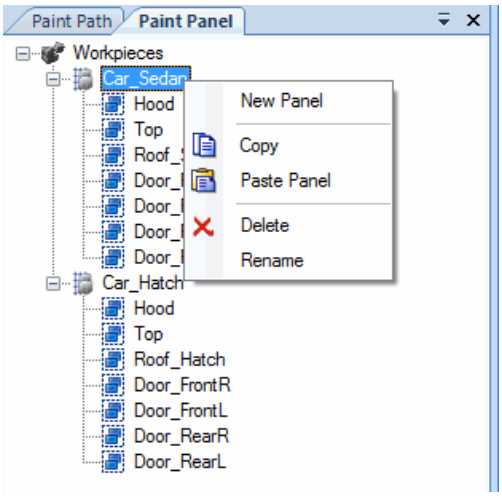
Use the following procedure for dividing the workpieces into smaller parts during import.

	Action	Info
1	Select the workpiece by either *Browse* or *Select from Station*.	Workpiece name is reflected in the dialog
2	Select the **Divide Workpiece** check box.	After enabling this option, you need to set the filter size, which is the smallest size of the divided parts. After division, any part which is smaller than the filter size is deleted.
3	Set the filter size in **Detail Level**. By default the value is 10% of the Workpiece size.	The filter size is set as a percentage value of the size of the workpiece.
4	Proceed to finish importing the workpiece.	The workpiece will be imported into RobotStudio and then subdivided into smaller triangular parts.

6.2 Creating Panels

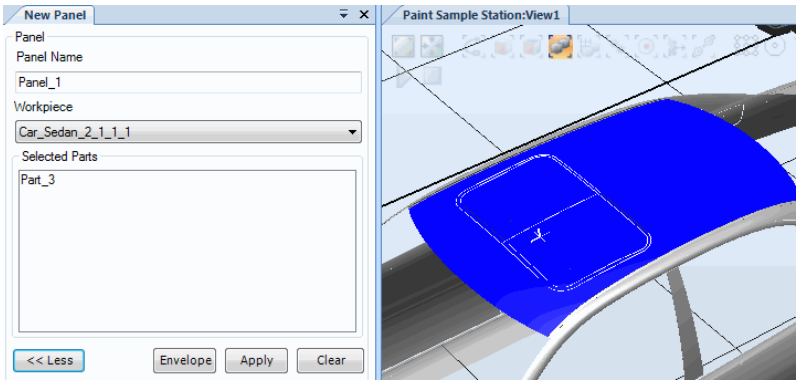
You can create and specify panels by either clicking the *Panels* option on the Paint Panel Tab or by right-clicking the Workpiece listed under the Panel browser window and selecting **New Panel**.

xx1100000821



xx1100000822

The *New Panel* dialog as shown in the following figure. Click on the parts on the workpiece and enter the details to specify them as panels.



xx1100000823

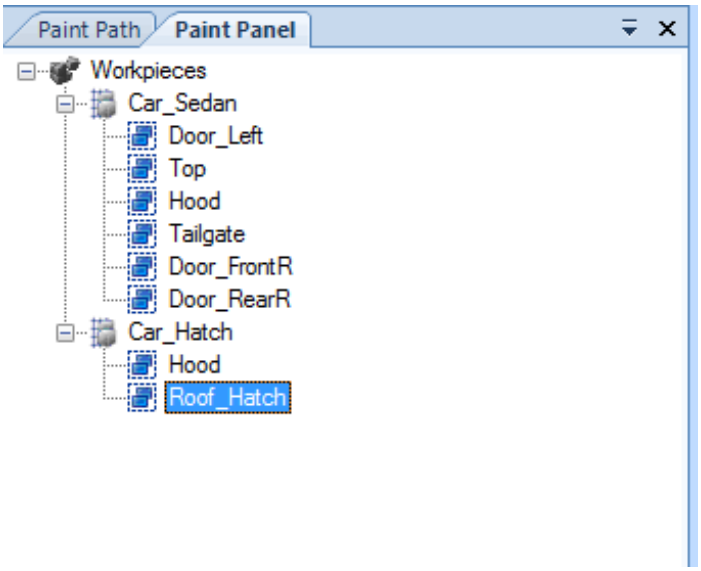
The usage of this functionality is as listed in the following table

	Action	Info
1	Verify the name of the Panel	By default a name will be suggested which will be Panel_1, Panel_2, and so on. You can also specify the name of the Panel as desired. For example Hood, Door, and so on.

Continues on next page

Continued

	Action	Info
2	Select the workpiece	Only workpieces which are listed under Panel browser window will be listed. You must choose the corresponding workpiece with which the Panel has to be identified.
3	Click on the surface of the workpiece to select the parts.	The selected parts will be listed in the dialog.
4	Envelope	This functionality is used to create Panels on complex structures. Click **More** on the **New Panel** dialog box to show **Envelope** button. For more information, see *Envelope on page 135*.
5	Click **Apply**	The panel is created and listed in the Panel Browser window below the corresponding workpiece selected in Step 2.



xx1100000824

You can perform the following operations on the Panel:

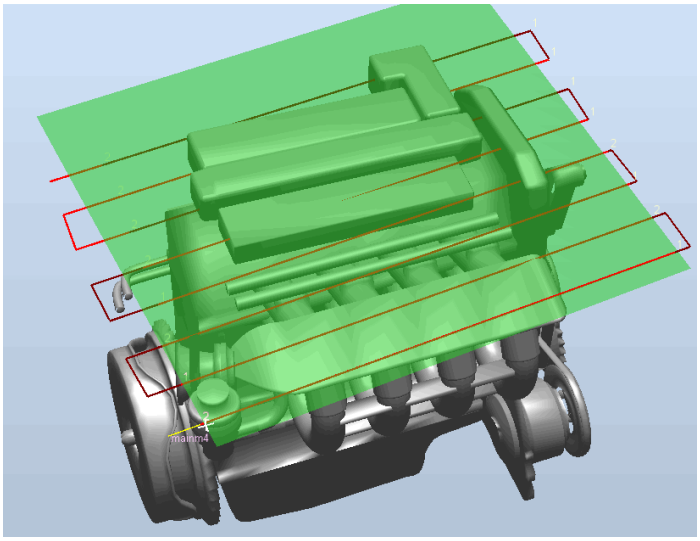
- **Auto PaintStroke** - Opens the AutoPaintstroke dialog
- **Edit Panel** - To add or remove parts
- **Shape Panel** - To Shape a Panel using *Cutting Planes, Freehand, Select Bodies* For more information about each of the preceding options, see *Shape Panels on page 136*.
- **Copy** / **Paste** a Panel
- **Rename** a Panel
- **Delete** a Panel

Continues on next page

Envelope

Envelope is used while working with complex structures. Identifying panels correctly is one of the key tasks to generate paint strokes automatically. For painting some workpieces which are complex, the paint strokes are sometimes similar to a flat surface and do not need to follow the contours of the workpiece. For example: Painting an Engine.

It generates an envelope box over the selected parts. You can then choose the panel parts from the envelope box. Paint strokes can be easily generated on these panels. The following figure shows a Envelope created on an Engine.



xx1100000950

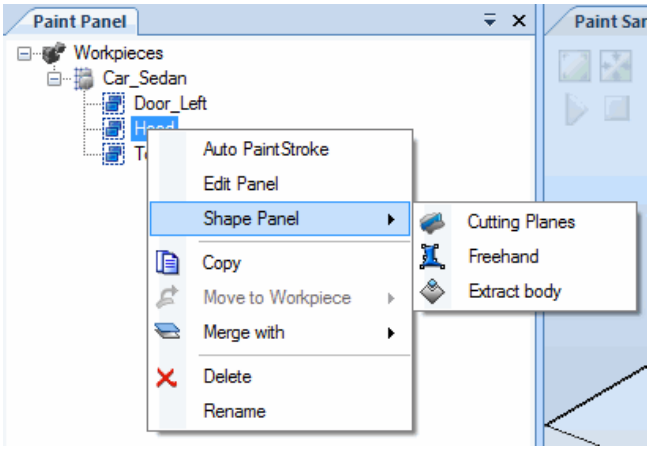
6.3 Shape Panels

A Panel is a collection of logically connected parts which represent a unique section of the workpiece. For example Hood, Door and so on of a car body.

In Painting PowerPac, it is possible to Shape a panel into two or more panels such that a program can be generated for each panel separately. Shape operation mostly divides / creates parts and identifies the collection of parts uniquely as Panels.

Some sample scenarios for Shaping panels are:

- While using multiple robots to Paint (for example: painting car panels), it is required to identify the painting region for each robot. You can Shape the panel into sub-panels and create programs for each robot separately.
- If a workpiece is well defined and during import you choose not to divide it. You can then Shape the workpiece panel based on the information in the workpiece.



xx1100000832

Shape operation can be done by:

- **Cutting Planes**
- **Freehand**
- **Extract body**

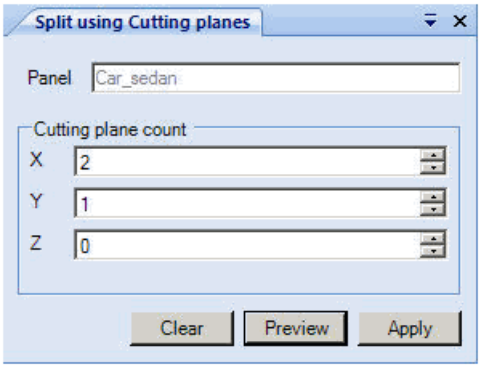
Continues on next page

Continued

Shape using cutting planes

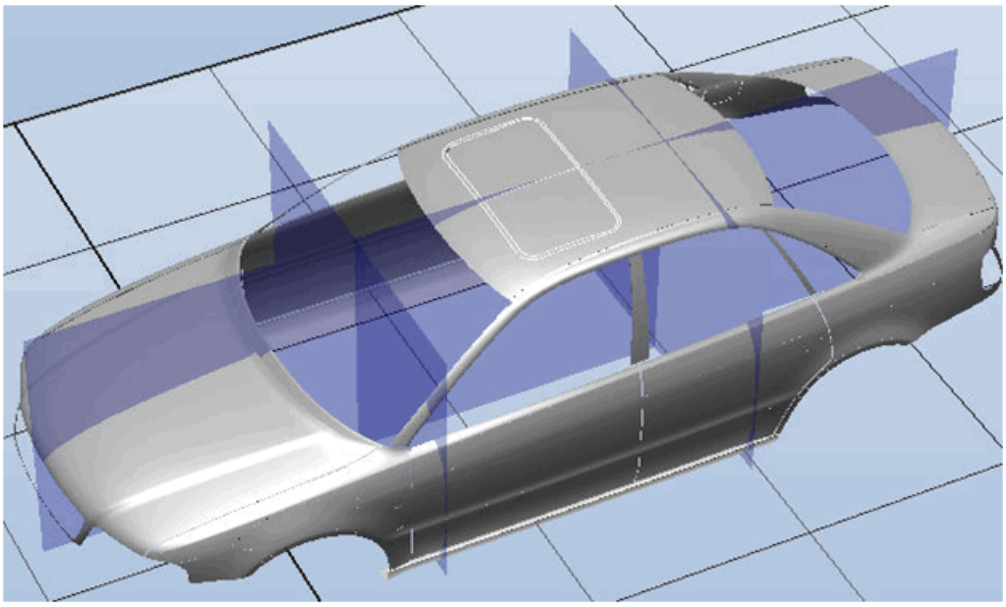
This functionality divides a Panel along a number of cutting planes which intersect the parts along each axis. The cutting planes are placed such that the workpiece is divided equally into the number of planes along each axis.

You can shape the panel by specifying the number of cutting planes along each of the X, Y and Z axes.



xx1100000833

Click **Preview** to view the cutting planes on the Panel, as shown in the following figure.

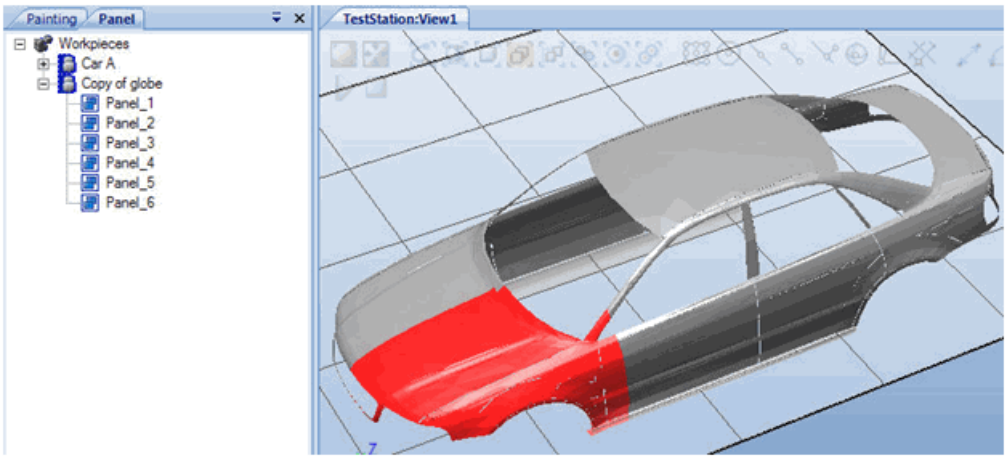


xx1100000834

Continues on next page

Continued

On clicking **Apply**, the parts in the panel are divided along the cutting planes and the parts within each plane are identified as a Panel. For example, according to the Cutting Plane count in the previous figure, there are six panels created.



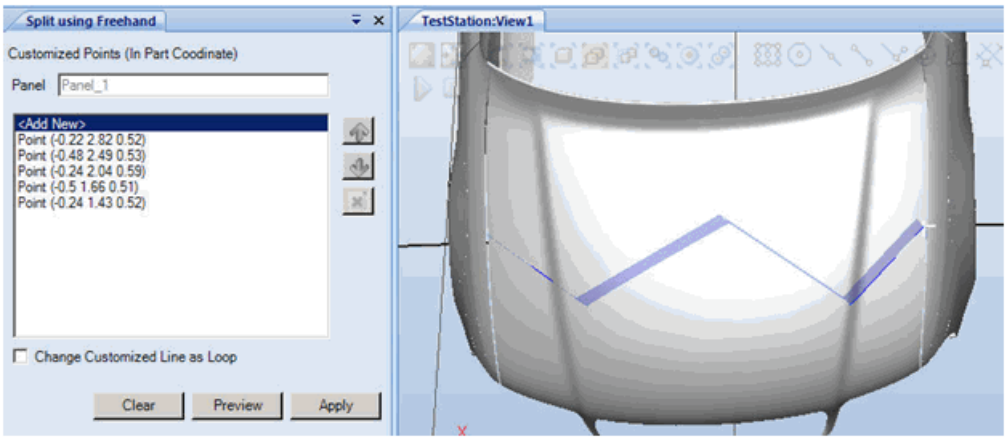
xx1100000835

Dividing a workpiece during importing breaks it into smaller parts along the natural gaps in the surface. Hence it may not always identify one half of the car body by selecting parts. In this scenario the functionality of being able to shape an existing panel helps in identifying different panels along different sections uniquely.

You can customize the cutting planes' position using RobotStudio options *Freehand Move* or *Rotate*.

Shape using freehand

Use this functionality provides to shape a panel along a defined direction.



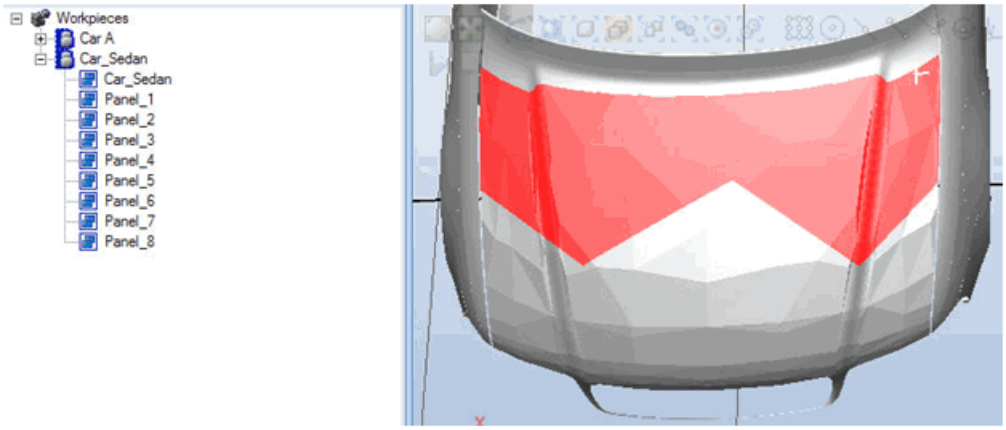
xx1100000836

For example, the preceding figure shows the panel of the hood of a car where the user has clicked to select five points on it. When the user chooses **Preview**, the cutting plane is generated along the line joining the points sequentially. When the

Continues on next page

Continued

user clicks **Apply**, the parts in the panel are divided and identified as panel(s) along the cutting plane.

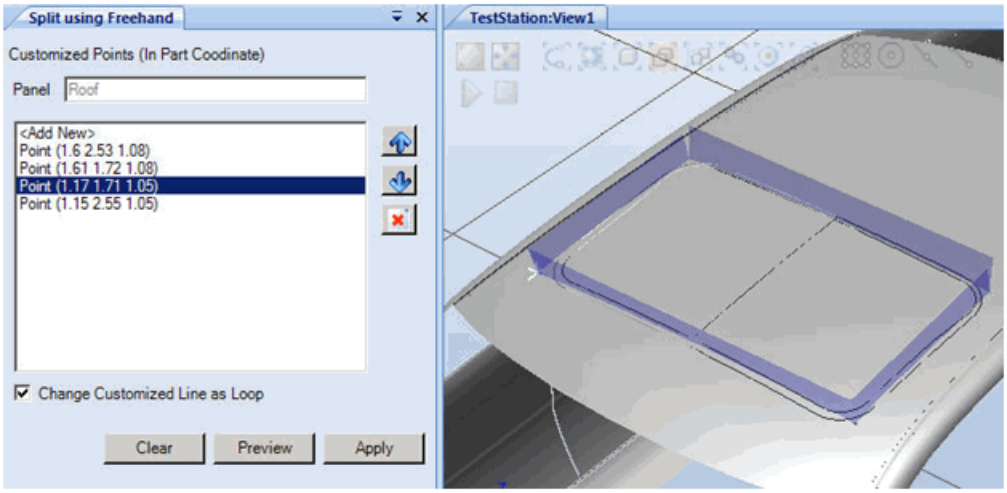


xx1100000836

Shaping a panel subdivides it into at least two panels. Depending on the panels, you can then merge the panels.

If you select the **Change customized line as Loop** check box, the cutting plane created will form a closed loop by joining the first and last point as shown below.

The cutting planes points in the following figure are created such that they represent the sun-roof of a car.



xx1100000837

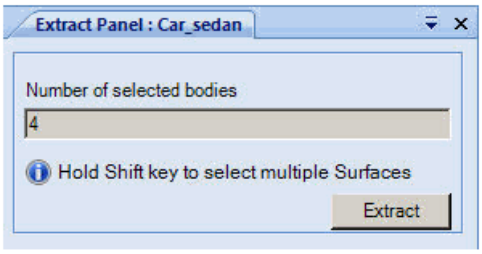
The arrows can be used to move the points up and down to change the sequence. Click **Preview** to regenerate the cutting planes.

Continues on next page

Continued

Extract body

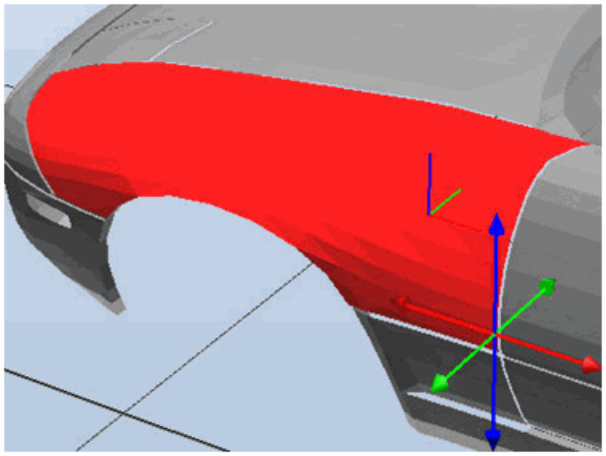
A Panel is a collection of parts. Using this functionality it is possible to Shape the panel so as to collect a number of bodies within the part and create a part from the collection. This part is then identified separately as a Panel.



xx1100000838

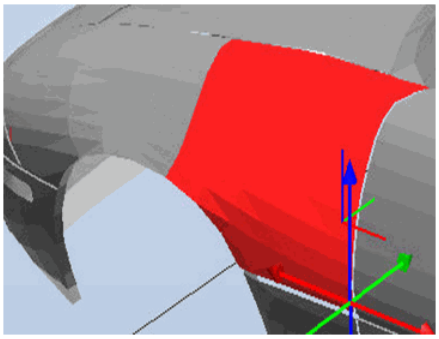
In the Extract Panel tab, click thetext box Number of selected bodies. The selection level then changes to body. User can click on individual bodies and then click **Extract**. All the selected bodies will be grouped together as a separate part and listed under the Meshed workpiece. The new part is subsequently identified as a Panel.

Before Extraction

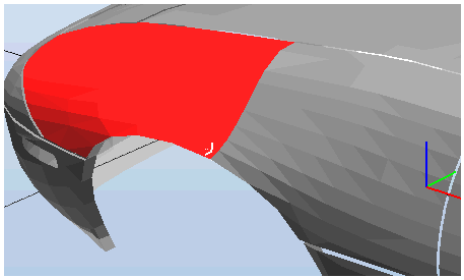


xx1100000839

After Extraction



xx1100000840



xx1100000841

Continues on next page

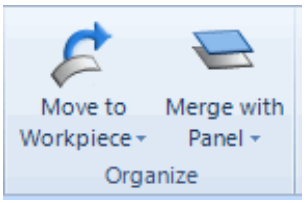
This functionality is useful when you have a panel which has:

- Parts which have multiple bodies (after dividing)
- Parts with well defined geometries which user need not divide to identify Panels.

Note

Shape operation using *Cutting Planes* and *Freehand* can be performed repeatedly. The time taken for each operation depends on the number of parts and bodies in the Panel. Hence it is important to note that the computer has sufficient free RAM memory (at least 500 MB) before proceeding with the operation.

6.4 Organize



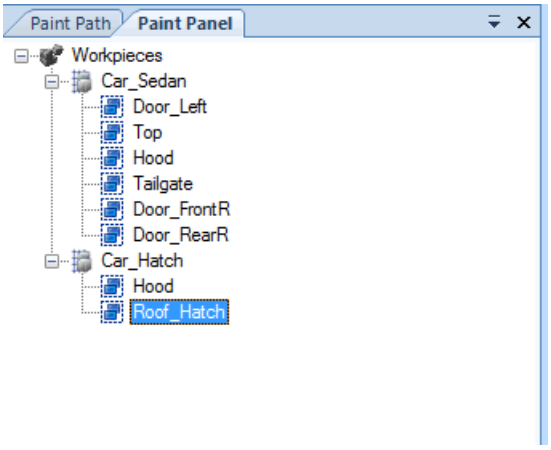
xx1100000951

Move to Workpiece: The functionality allows you to Move the parts in the Panel to a selected workpiece.

Merge with Panel: Merge the panel with another panel in the selected workpiece. This option list all the Panels in the selected workpiece. After the merge operation the source panel is removed.

6.5 Context Menu

Workpieces are displayed in a treeview list in the **Paint Panel** tab, as shown in the following figure.



xx1100000825

The Panel tab is organized into the following:

Workpieces

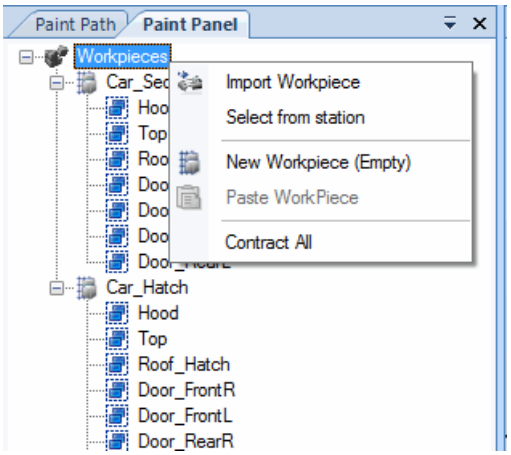
- Workpiece_1
  - Panel_1
  - Panel_2
  - Panel_3
  - Panel_4
- Workpiece_2
  - Panel_1
  - Panel_2
  - Panel_3
  - Panel_4
- Workpiece_2
  - Panel_1
  - Panel_2

The possible operations in the context menu of the **Paint Panel** tab tree nodes are described in the following sections.

Continues on next page

Continued

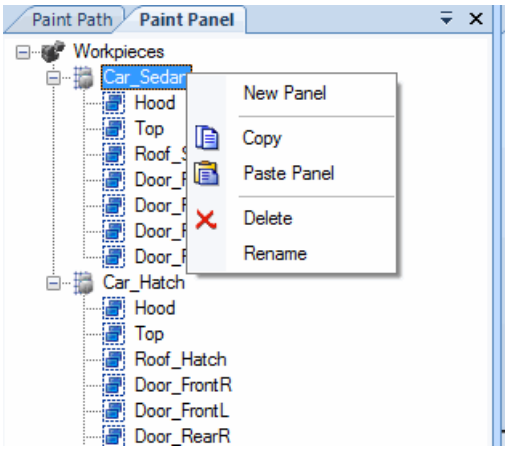
Workpieces node context menu



xx1100000826

Menu Option	Function
Expand all	View all the Panels listed under all the workpieces.
Import Workpiece	Open the dialog where you can import the workpiece by browsing the folder.
Select from station	Open the dialog where you can select graphically a CAD model to be imported.
New Workpiece (Empty)	Create a new blank workpiece and lists it in the tree view. You can drag-and-drop or copy-paste Panels from other workpieces into the new workpiece. The workpiece thus created is a Graphic Component Group in RobotStudio.
Paste Workpiece	Paste a copied workpiece. A new node will be created under Workpieces node. A copy of the corresponding parts of the Panels is created in the workpiece graphic component group.

Workpiece node context menu



xx1100000827

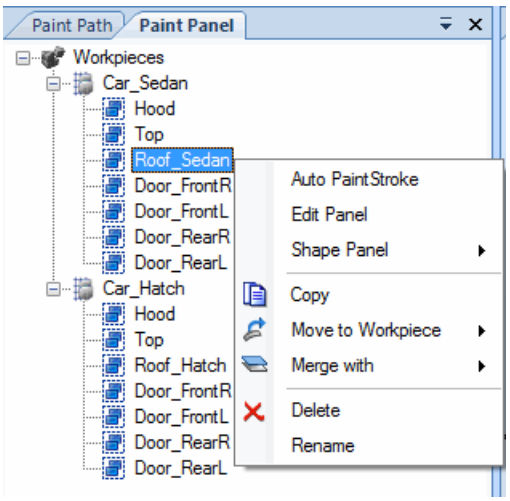
Menu Option	Function
New Panel	Open a dialog where you can select Parts to create Panel.

Continues on next page

Continued

Menu Option	Function
Copy	Copie the Workpiece and all the panels under it.
Paste Panel	Create a new Panel under the workpiece. No new parts are created under the workpiece.
Delete Panel	Delete the Panel.
Rename	Rename a workpiece. The corresponding Graphic component group is also renamed in RobotStudio.

Panel node context menu



xx1100000828

Menu Option	Function
Auto PaintStroke	Open the AutoPaintstroke dialog.
Edit Panel	Edit the panel by adding or removing parts
Shape	Shape a Panel using: 1 Cutting planes 2 Freehand 3 Select bodies For more information, see *Shape Panels on page 136*
Copy	Copy the parts in the Panel in the workpiece.
Move to Workpiece	Move the parts in the Panel to a selected workpiece.
Merge with	Merge the panel with another panel in the selected workpiece. This option list all the Panels in the selected workpiece. After the merge operation the source panel is removed.
Rename	Rename a Panel. Note that the Panel naming conventions follow the RAPID procedure naming conventions.

Continues on next page

Continued

Copy-Paste, **Move to Workpiece**, and **Merge with** operations can also be performed by using Drag and Drop operations on the Panels as described below:

Note

- **Copy-Paste**- Select Panel, Hold Shift-key and drag and drop onto another workpiece.
- **Move to Workpiece** - Select Panel and drag and drop onto another workpiece in the Panel tab.
- **Merge with** - Select Panel and drag and drop onto another Panel in the same workpiece.

Index

Contact us

ABB AB
Discrete Automation and Motion
Robotics
S-721 68 VÄSTERÅS, Sweden
Telephone +46 (0) 21 344 400

ABB AS, Robotics
Discrete Automation and Motion
Box 265
N-4349 BRYNE, Norway
Telephone: +47 51489000

ABB Engineering (Shanghai) Ltd.
5 Lane 369, ChuangYe Road
KangQiao Town, PuDong District
SHANGHAI 201319, China
Telephone: +86 21 6105 6666

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

www.abb.com/robotics

3HNA019758-001, Rev G, en