Operating manual

Machine Tending PowerPac

RobotStudio 5.10

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Overview

About this manual

This manual is to be used when working with Machine Tending PowerPac.

Who should read this manual?

Machine Tending PowerPac can be set up with different user levels:

- Sales engineers can use this tool for demonstrating robot cell to customers.
- Project engineers can use this tool to minimize project risks by being able to select the optimum equipment and layout for an installation.
- RobotStudio experts can use both the Machine Tending PowerPac and RobotStudio base function for detailed engineering solutions.

Organization of chapters

Chapter	Contents
1.	Describes the key features and installation of Machine Tending PowerPac.
2.	Describes how to work with Machine Tending PowerPac.

References

Reference	Document Id
Operating manual - RobotStudio	3HAC028932-001

Revisions

Revision	Description
E	New section *Exporting and Importing Templates* added.

1 Introduction

1.1. Overview of Machine Tending PowerPac

Machine Tending PowerPac

Machine Tending PowerPac is simulation software that demonstrates the ability of ABB robots in machine tending applications. The Machine Tending PowerPac:

- Provides a five step wizard to create a work cell.
- Gives an estimation of the cycle time (both robot cycle and machine cycle) through the statistics function.
- Provides the cell layout and footprint after the first simulation.
- Identifies any post-processes that a robot can conduct while the machine is moulding a part.

RobotStudio

RobotStudio is the programming and simulation software, which enables the users to perform tasks such as training programming and configuration offline - without disturbing production. Machine Tending PowerPac is an add-in to RobotStudio. It is fully integrated with RobotStudio. A user can use RobotStudio base functions together with Machine Tending PowerPac.

Refer to *Operating manual - RobotStudio*.

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Key features

Machine Tending PowerPac provides the following key features:

Key Features	Description	Described in section
Cell Wizard	To create a three dimensional (3D) robot cell for simulation.	*Cell Wizard on page 23*.
Scenario based programming	To edit robot program in the process level rather than in the instruction level. • Each station has one or more scenarios that represent how a robot can tend a station in different ways. • Each scenario has several actions that can be edited.	*Editing stations on page 35*.
Cell simulation	To simulate states and behaviors of stations, including the robot in the cell: • Simulate different actions of a station within a cycle, • Simulate a machine cycle, • Simulate interactive logic between robot and other stations.	*Editing tools on page 42*. *Editing stations on page 35*. *Defining a cycle on page 47*.
Parametric station, tool and part	To modify the size of a station, tool, part, or auxiliary devices. It provides a convenient method to switch the tool to be used, and the part to be tended in the current station/cycle.	*Customizing Cell Components on page 58*. *Editing tools on page 42*. *Defining a cycle on page 47*.
Statistics information	To get information on: • Detailed statistics in the station/path level. • Both machine cycle and robot cycle and how they are synchronized. • Identifying the bottlenecks that influence the cycle time.	*Statistics Information on page 53*.

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Key Features	Description	Described in section
Auto-place cell components	To automatically place the cell components for reachability and to prevent collision: • Auto-placing all cell components while creating a 3D cell using the wizard, • Auto-placing a single station, • Changing robot - machine tending position to auto-place the complete cell.	*Auto-placing Cell Components on page 49*.
Customization library for stations, tools and parts	To create a station, tool, or part as the library template for Machine Tending PowerPac: • Station: to define a station with a SAT model, several paths and one or more tool methods. • Tool: to define a tool with a SAT model, customized TCP, or even the full set of the tool data. • Part: to define a part with a SAT model.	*Customizing Cell Components on page 58*.

1.2. Installing Machine Tending PowerPac

Overview

This section describes the installation process.

Prerequisites

To start the installation process, the following must be available:

- A computer that fulfils or exceeds the system requirements.
- A log in account with administrator rights on the computer.
- RobotStudio installed on the computer.
- Machine Tending PowerPac installation package.

System requirements

To work with Machine Tending PowerPac, the following are required:

Recommended hardware

- CPU: 2.0 GHz Intel Pentium 4 or faster processor
- Memory: 1 GB RAM or more
- Available disk space: 5+ GB on the system disk, 250+ MB on the installation disk
- 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

Software requirements

- Microsoft Windows XP Professional with Service Pack 2, or
- Microsoft Windows Vista - Business or higher

NOTE!

Firewall for Windows XP SP2 may block a few features necessary to run RobotStudio and RobotStudio Online properly. Make sure to unblock these features when required (Industrial Robot Discovery Server, RobotStudio StudioAppFramework module, Virtual Robot

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Controller (all published by ABB)). The block status of some programs can be viewed and changed through **Start** > **Settings** > **Control Panel** > **Windows Security Center** > **Windows Firewall** in the PC. For details, refer to www.microsoft.com.

NOTE!

Windows service-packs can be downloaded from www.microsoft.com.

Installing the Machine Tending PowerPac

	Action
1.	Browse to the Machine Tending PowerPac installation package and double-click the setup.exe file. Installation wizard is displayed.
2.	Click **Next** to continue installation.  pic0001

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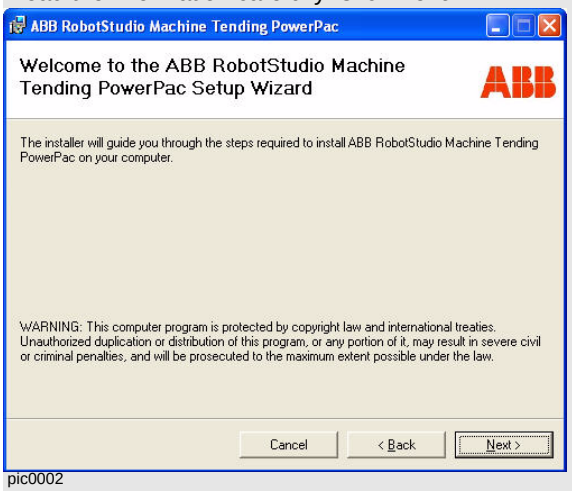
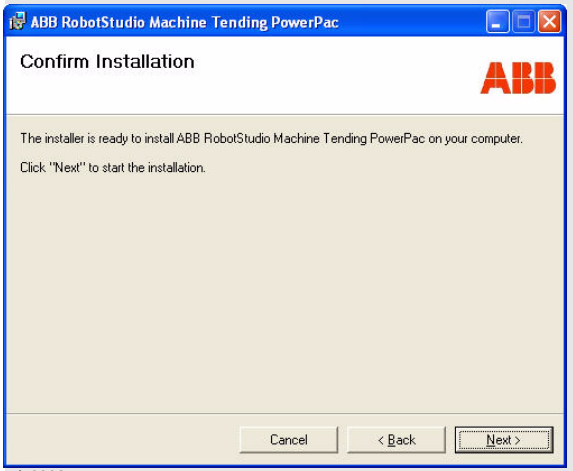
	Action
3.	Read the information carefully. Click **Next**.  pic0002
4.	Click **Next** to confirm installation.  pic0003

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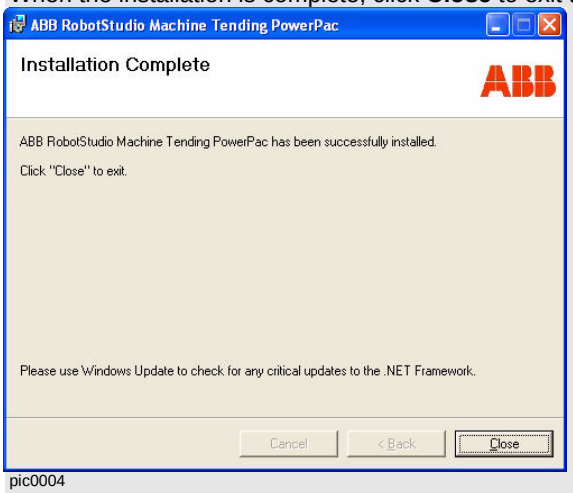
	Action
5.	When the installation is complete, click **Close** to exit the wizard.  pic0004

2 Working with the Machine Tending PowerPac

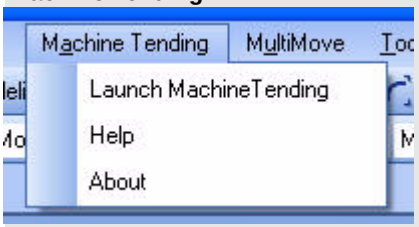
2.1. Getting started

Launching Machine Tending PowerPac

In RobotStudio there are two ways to launch the Machine Tending PowerPac:

- Create a new station then launch the Machine Tending PowerPac by choosing **Machine Tending** -> **Launch Machine Tending** from the RobotStudio menu bar.
- Open a saved station to automatically launch the Machine Tending PowerPac.

Creating a new station

	Action	Information
1.	In the welcome page of RobotStudio, click **Create a New Station**.	The **New Station** dialog box opens.
2.	There are two options to create a new station: • With **Template system**: select a system template from the library and then specify the name of the new system and the location where the new system need to be stored. • With **Existing System**: click the Existing System icon -> select a system pool -> select a system from the System Found list box -> select the **Cold Start** check box.	Creating a new station is the basic function of RobotStudio. For details, refer to *Operating manual - RobotStudio.* **Note!** Machine Tending PowerPac can not be launched with an empty station.
3.	Click **OK**.	The selected robot system will be launched.
4.	In the menu bar, select **Machine Tending** > **Launch Machine Tending**.  pic21-01	Machine Tending PowerPac will be launched. The toolbar collection and the tab page collection will be displayed after Machine Tending PowerPac is launched. For details, refer to *User interface on page 19*.

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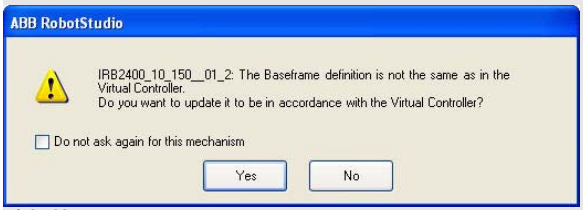
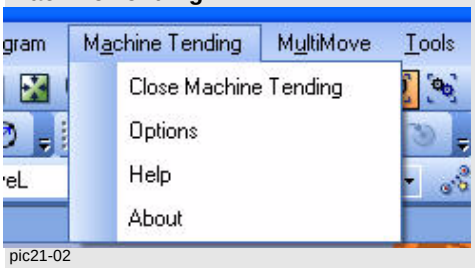
Opening a saved station

	Action	Information
1.	In the welcome page of RobotStudio, click **Browse Your Stations to Open**.	
2.	Browse and select a *.rsstn station file created from the Machine Tending PowerPac.	
3.	Click **Open**.	While loading a saved station, a dialog box appears. It provides an option to update the baseframe definition if a base was added to the used robot system.
4.	Click **No**. Otherwise the robot in the cell will be placed in the origin of worldframe.  pic21-03	The selected station is loaded. Machine Tending PowerPac will automatically launch if the station was saved from Machine Tending PowerPac.

Closing Machine Tending PowerPac

	Action	Information
1.	Click the menu bar **Machine Tending** > **Close Machine Tending**.  pic21-02	Machine Tending PowerPac will be closed. **Note!** The changes that are made after closing Machine Tending PowerPac can not be recognized in the Machine Tending PowerPac environment.

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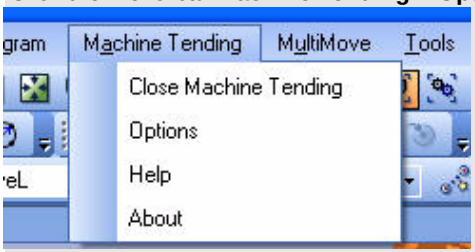
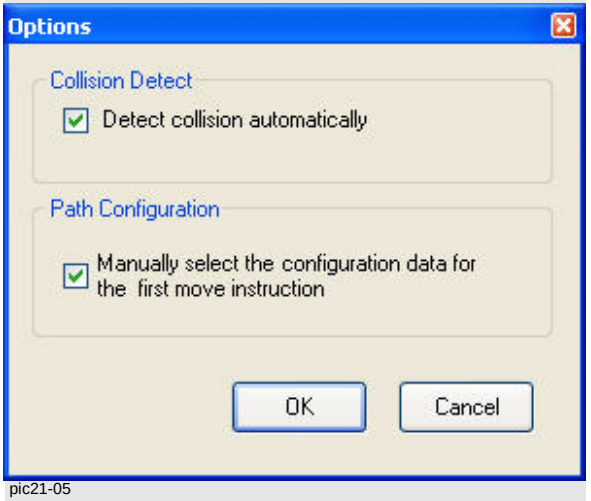
Selecting Options

	Action	Information
1.	Click the menu bar **Machine Tending** > **Options.**  pic21-02	The **Options** dialog box is displayed.
2.	Select or clear the check boxes to enable or disable the options.  pic21-05	There are two options: • Collision Detect: if this option is enabled, Machine Tending PowerPac will check the positions of all cell components in the current cell, and indicate any collision between them according to the current color settings. • Path Configuration: if this option is enabled, Machine Tending PowerPac will provide a dialog box during path configuration, from which the configuration data for the first move instruction can be defined.
3.	Click **OK** to make the changes take effect, or click **Cancel** to close this dialog box without any change.	The default setting is that both of the two options are enabled.

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NOTE!

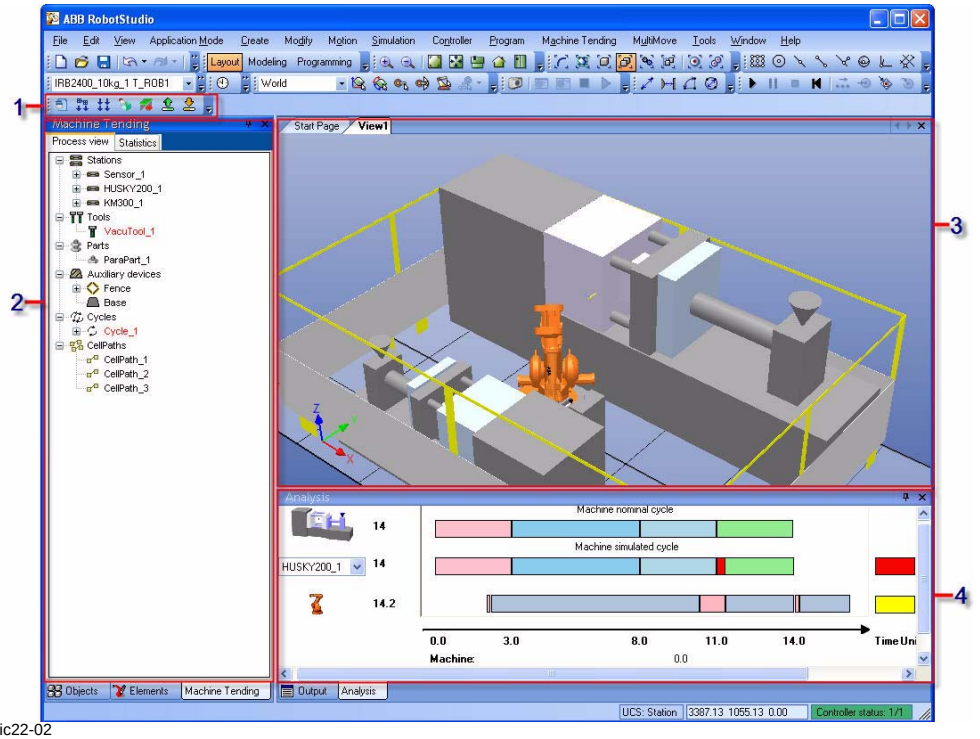
In RobotStudio, the station means the entire work cell including all required equipment. But in Machine Tending PowerPac, the concept of station is defined according to the application. A station includes:

- A geometrical model,
- A work object attached to the geometrical model,
- Two or more robot targets based on the station work object,
- Two or more paths defines the robot motion when robot tends the station,
- One or more tool actions defines the tool method - optional,
- One or more I/O signal actions defines the station logic - optional.

2.2. User interface

Overview

The Machine Tending PowerPac contains four different parts.



pic22-02

	Part	Description
1	Machine Tending PowerPac toolbar	Provides shortcut to wizard, path auto-configuration, synchronization, automatic cell placement, customization, and templates importing and exporting. *Toolbar of Machine Tending PowerPac on page 20*.

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	Part	Description
2.	Machine Tending tab collection	There are two tabs: • Process view: used to access most of the functions of Machine Tending PowerPac. Refer to *Process view on page 29*. • Statistics: used to view statistics, and launch run time information analysis during simulation. Refer to *Statistics Information on page 53*.
3.	3D graphical view	To view 3D robot cell and simulation.
4.	Analysis window	To display the runtime information for both machine cycles and robot cycles, and identify the bottlenecks of the production cycle. Refer to *Viewing the information in the analysis window on page 54*.

Toolbar of Machine Tending PowerPac

When launching the Machine Tending PowerPac, an exclusive toolbar for the Machine Tending PowerPac appears.

Button	Description
Launch Wizard  pic2204	Launches the work cell setup wizard.
Configure the Path and Synchronize with Virtual Controller  pic2205	Performs an automatic path configuration for all move instructions according to the active cycle settings, and synchronize the current cell settings to the virtual controller to generate RAPID program for simulation. Furthermore performs simulation set up automatically.
Synchronize with Virtual Controller  pic2209	Synchronizes the current cell setting to the virtual controller to generate RAPID program for simulation, and performs simulation set up automatically.

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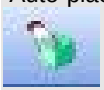
Button	Description
Auto-place Cell Component  pic2207	Auto-place cell components so that there is no collision between cell components and all targets are reachable: • Auto-placing all cell components while creating a 3D cell using the wizard. • Auto-placing a single station. • Changing the robot position with respect to the machine position type and hence auto placing whole cell.
Customize Cell Components  pic2208	Launches the customize object wizard to create a station, tool or part as the library item for Machine Tending PowerPac.
Export Template  pic2210	Exports templates to cab files to: • backup the customized templates. • share the customized templates with other Machine Tending PowerPac users. For details, refer to *Exporting and Importing Templates on page 65*.
Import Template  pic2211	Imports cab files that were exported using Machine Tending PowerPac before. For details, refer to *Exporting and Importing Templates on page 65*.

Operating the Graphics view with the mouse

The Graphics window is RobotStudio base environment. For details, refer to *Operating manual - RobotStudio*.

Select

Place the mouse pointer above the *Graphics* window and click to select objects.


pic2011

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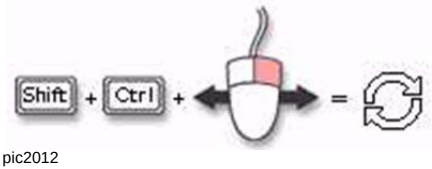
Rotate

Use these buttons to rotate the station around the current view center.

Using a 3-button mouse: Click and hold down the middle and the right mouse button.

Using a 2-button mouse: Click and hold down the right mouse button and the CTRL and SHIFT keys.



pic2012

Pan

Drag to pan the view. Hold down left mouse button and the CTRL key.

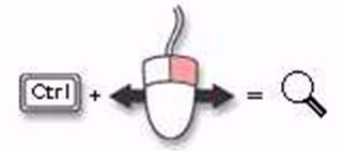
pic2013

Zoom

Drag to the left to zoom out, drag to the right to zoom in.

Using a 3-button mouse: Click and hold down the middle mouse button.

Using a 2-button mouse: Click and hold down the right mouse button and the CTRL key.



pic2014

2.3 Cell Wizard

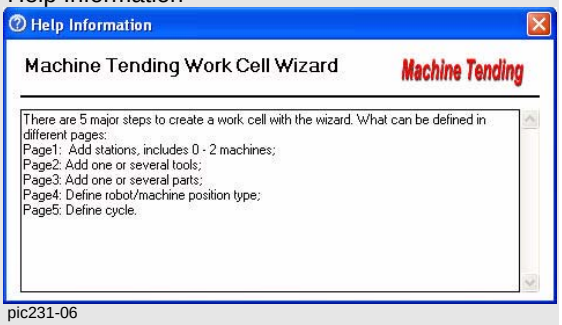
2.3.1. The Cell Wizard interface

Overview

The Cell Wizard guides the user to create a machine tending robot cell.

Cell Wizard items

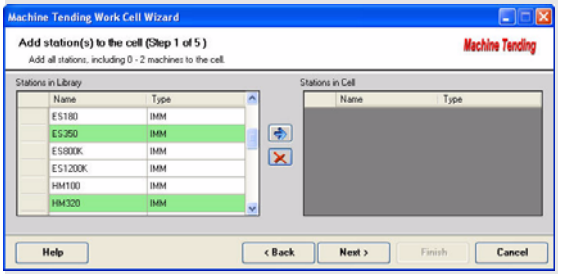
The following buttons are used in the cell wizard and referred to in the procedures.

Item	Description
Delete  pic231-01	Delete a selection.
Transfer  pic231-02	Transfer a selection.
Move up  pic231-03	Move a selection up.
Move down  pic231-04	Move a selection down.
Help Information  pic231-06	Click the **Help** button on each wizard page to display the help window. It contains the detailed information about how to operate in the current wizard page.

2.3.2. Creating a cell with the Cell Wizard

Creating a cell

The Cell Wizard has five steps. The table below describes the wizard.

	Action	Information
1.	**Start** Click **Launch Wizard** on the **Machine Tending PowerPac** toolbar collection.  pic232-01 Click **Next**.	The welcome page of the wizard is displayed.
2.	**Add station(s) to the cell**. • Select a station from the library, click **Transfer** to add the station to the cell. • Double click the station in **Stations in Cell** list box, and enter a valid name to rename the station if necessary. • Repeat the previous steps to add more stations.  pic232-02 Click **Next**.	There are recommended IMMs for different robot systems, which are marked with green in the list. This wizard page is used to add both machines and other types of stations to a cell. It is possible to add more than one station of the same type. If the list of predefined stations does not contain the required station, it is possible to add a new station type as a library item by using **Customize Cell Components**. Refer to *Customizing Cell Components on page 58* for more information. **Note!** The maximum number of machines that can be added to a cell is two. There is no limitation to add stations other than machines.

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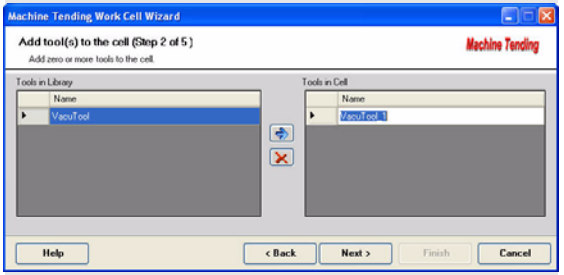
	Action	Information
3.	**Add tool(s) to the cell**. • Select a tool from the library, click **Transfer** to add the selection to the cell. • Double click the tool in **Tools in Cell** list box, and enter a valid name to rename the tool if necessary. • Repeat the previous steps to add more tools to the cell.  pic232-03 Click **Next**.	It is possible to add more than one tool of the same type. If the predefined tool does not meet the requirements, it is possible to add a new type of tool as a library item by using **Customize Cell Components**. Refer to *Customizing Cell Components on page 58* for more information. **Note!** The first tool added to the cell will be set as the active tool by default.
4.	**Add part(s) to the cell**. • Select a part from the library, click **Transfer** to add the selection to the cell. • Double click the part in **Parts in Cell** list box, and enter a valid name to rename the part if necessary. • Repeat the previous steps to add more parts to the cell.  pic232-04 Click **Next**.	There is a part library that includes customized parts and predefined parts. It is possible to add more than one part of the same type. If the list of predefined parts does not contain the desired part, it is possible to add a new part as a library item by using **Customize Cell Components**. Refer to *Customizing Cell Components on page 58* for more information.

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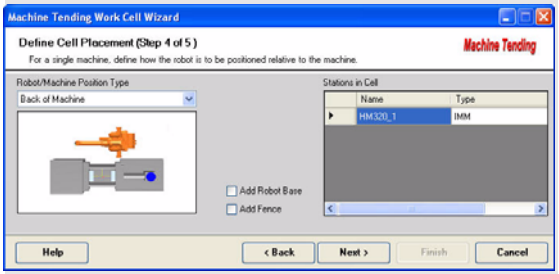
	Action	Information
5.	**Define Cell Placement**. • Click **Robot/Machine Position Type** list to choose a robot position type relative to the machine. • All the stations in cell are listed in the **Stations in Cell** table. • Select the **Add fence** and/or **Add Robot base** check box (s) to add a fence and/or a robot base to the cell.  pic232-05 Click **Next**.	There can be different situations. If there is: • no machine in the cell, there is no need to consider robot position relative to IMM, • one machine in the cell, there are three different ways to position the robot, Front of Machine, Back of Machine (default), On top of Machine, • two machines in the cell, only one robot position type is available. An image will show what the robot position type looks like. Other stations will automatically be placed relative to the robot so that they are reachable and there will not be any collisions.

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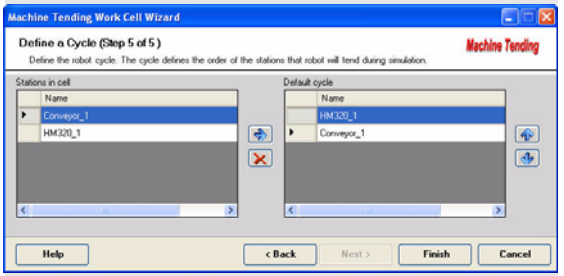
	Action	Information
6.	**Define a Cycle** A cycle defines the sequence of stations that the robot will tend. • Click a station or select several stations at a time in the **Stations in cell** field, and then click **Transfer** to add them to the cycle. • Sort the sequence of stations in the cycle by first selecting a station from **Default Cycle** list box and then clicking **Move up** / **down** to adjust the sequence.  pic232-06	Only one cycle can be set in Cell Wizard and the cycle is set as active by default. Refer to *Defining a cycle on page 47*.

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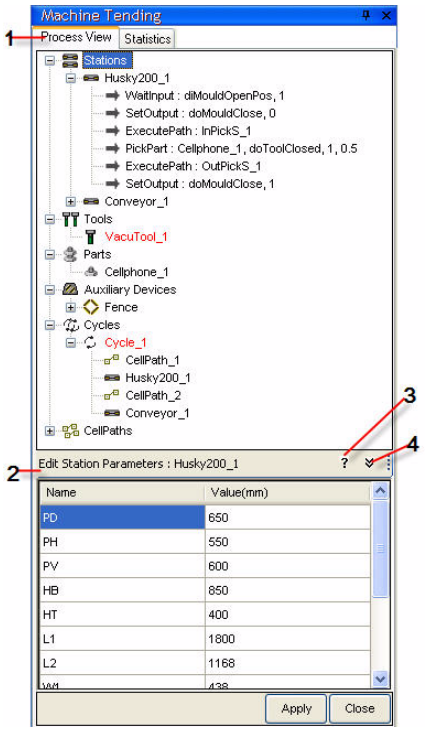
	Action	Information
7.	Click **Finish**, the Machine Tending PowerPac will: • add stations with default geometrical parameters, targets and paths to the 3D cell, • add tools to the 3D cell. If there are more than one tool in the cell, the active tool will be attached to the robot, the others will be placed next to the cell, • add parts to the 3D cell, • position all the stations including the machine(s) in the cell for reachability and to prevent collision. After that, a message box appears asking "Do you want to do automatic path configuration and then synchronize with Virtual Controller?". Click **Yes**, the Machine Tending PowerPac will: • Configure paths. • Synchronize all the settings to virtual controller. Click **No**, it will take a few seconds to build the 3D cell. The path configuration and synchronization can be executed with the Machine Tending PowerPac toolbar collection.	It is possible to edit the cell from the Process View, refer to section *Process view on page 29*. After the cell is created, simulation can be ran after necessary operations, refer to *Running a Simulation on page 51*.

2.4 Process view

2.4.1. Overview

Overview

When Machine Tending PowerPac is launched, the **Machine Tending** window displays two different tabs for Process View and Statistics.



pic241-01

Item	Description
1.	Tabs in Machine Tending: • Process view: to edit stations, tools, parts, cell paths, auxiliary devices and cycles. • Statistics: to view statistics information during simulation. Refer to *Statistics Information on page 53*.

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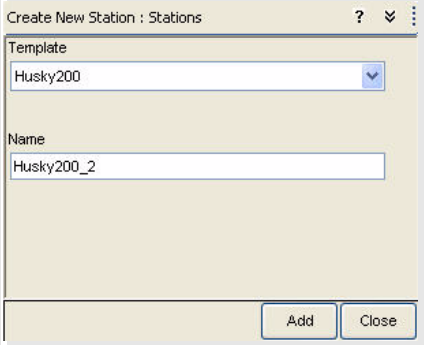
Item	Description
2.	Editing window: to modify the cell components based on the selection from the browser.
3.	Information: click this button to show help information.
4.	Hide editor: click this button to close the editing window.

2.4.2. Editing cell components

Procedures

This section describes the general operations available in the **Process view** tab page.

How to add a new station to the 3D cell

	Action	Information
1.	In **Process View** page, right-click the **Stations** node and select **Add station to Cell** from the context menu.  pic242-01	The **Create new station** dialog box is displayed at the bottom of the **Process view**.
2.	In the **Create new station** dialog box, select a station template from the drop-down list under **Template**. If necessary, change the automatically generated name in the text box under **Name**. Click the **Add** button to add the new station to the 3D cell.  pic242-02	Machine Tending PowerPac will place the new station at the origin of the Worldframe. Machine Tending PowerPac will place the new tools and parts next to the cell. For details on positioning new cell components, refer to *Auto-placing Cell Components on page 49*.
3.	Click the **Close** button or **Hide editor** to close the **Create New Station** dialog box.	

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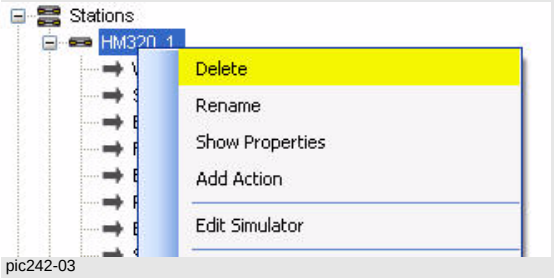
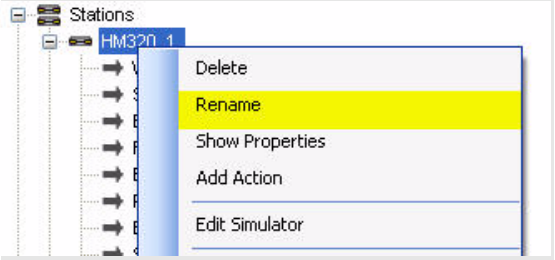
How to delete a station

	Action	Information
1.	Right-click a station from the **Stations** collection in the **Process View** tab page. Then select **Delete** from the context menu.  pic242-03	The selected station will be deleted from the 3D cell.

How to rename a station

	Action	Information
1.	Right-click a station from the **Stations** collection in the **Process View** tab page, then select **Rename** from the context menu.  pic242-04	The name must meet the RAPID naming rules for a variable. In addition to the rules for RAPID variable naming, the station name must be less than or equal to 12 characters. Refer to *Technical reference manual - RAPID overview* for the naming rules of a RAPID variable
2.	Enter a new name.	

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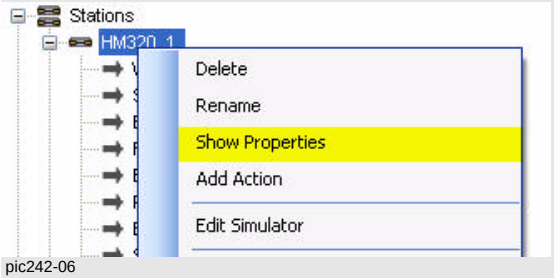
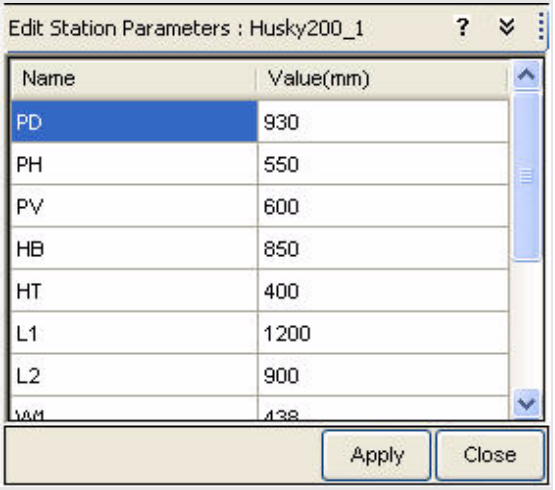
Continued

How to edit parameters

	Action	Information
1.	Right-click a station from the **Stations** collection in the **Process View** tab page, then select **Show Properties** from the context menu.  pic242-06	
2.	The **Edit Station Parameters** editing window is displayed at the bottom of the **Process view** tab page.  pic242-07	A station of different types has different sets of geometrical parameters. Changing the values of the parameters can change the size of the station.

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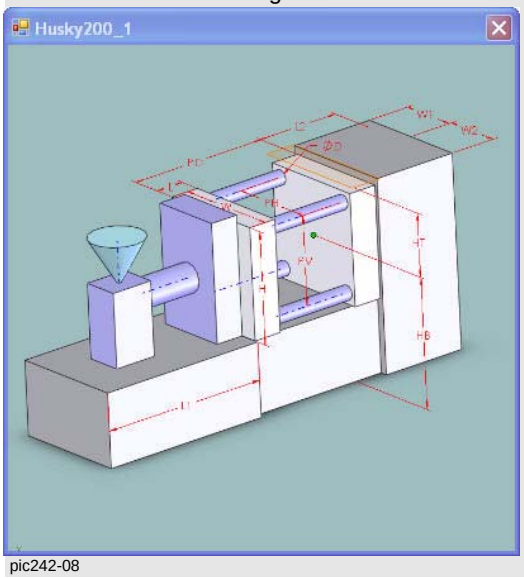
Continued

	Action	Information
3.	Click the "?" in the upper right corner of the **Edit station Parameter** dialog box.  pic242-08	An image is displayed in a pop-up window to illustrate the meanings of different parameters. If there is no description for the selected item, no information available message is displayed. Click **OK** to close this box.
4.	Click the **Value (mm)** text box to change one or more parameters, click the **Apply** button.	An invalid input is not accepted.
5.	Click the **Close** button or **Hide Editor** button to close the editor.	When the editor is closed, the pop-up window will automatically be closed.

2.4.3. Editing stations

Procedures

This section describes the procedures of editing stations.

How to add, delete, rename, and show properties of a station

For details, refer to *Editing cell components on page 31*.

Continues on next page

Continued

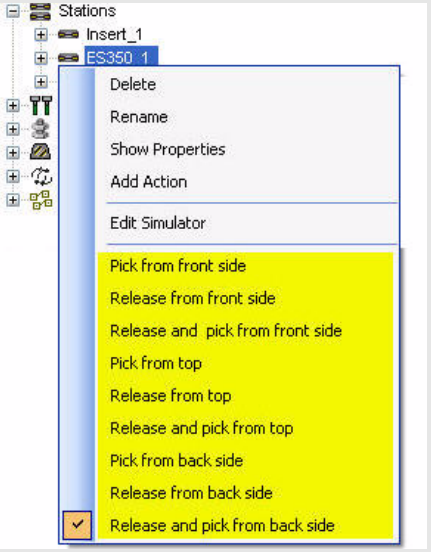
How to switch scenarios (Only for machine types)

A scenario represents how a robot tends a station. Several scenarios can be defined for a machine station to show how a robot can tend a station in different ways.

A scenario consists of several actions that are used to define the robot motion, tool method and I/O logics.

When a station has more than one scenario, it is possible to switch from one scenario to another. But only one scenario can be used for a station at a time. The chosen scenario can be customized by editing the variables of the associated actions.

Note! In this version, only a machines have several scenarios. A station of other types only has one scenario.

	Action	Information
1.	Right-click a machine name from the **Stations** collection in the **Process View** tab page. All the available scenarios are listed on the context menu. A check mark indicates the current scenario. Choose a new scenario make it the current one.  pic243-01	**Note!** A scenario and the robot position type must be in accordance with each other. Otherwise no solution can be found when using the **Auto-place Cell Components**. For example: If **Pick from back side** is needed for the coming simulation, place the robot at the back of machine first. Refer to *Auto-placing Cell Components on page 49* for more information. **Note!** In the cycle sequence if an insert is defined before the IMMs in the Cell Wizard, the default scenario for the IMM will be **Release and pick from top/front side/back side**. If an insert is added to the cell from the **Process View,** the scenario should be changed to **Release and pick from top/front side/ back side** manually.

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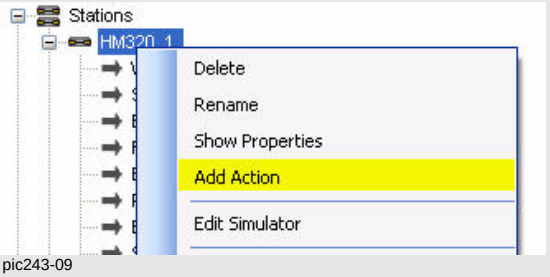
Continued

	Action	Information
2.	After selecting a scenario, the action collection that corresponds to the selected scenario will be displayed.  pic243-02	

How to edit an action

The action collection defines how a robot will tend a station with respect to robot motion, tool method and I/O logics.

The following table describes how to add a new action to the current scenario:

	Action	Information
1.	Right-click a station from the **Stations** collection in the **Process View** tab page, then select **Add Action** from the context menu.  pic243-09	
2.	Enter the required value in the **CreateNewAction** window.	Machine Tending PowerPac provides different action types, which require defining various values. The details are described in the following section.
3.	Click the **Add** button.	

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Continued

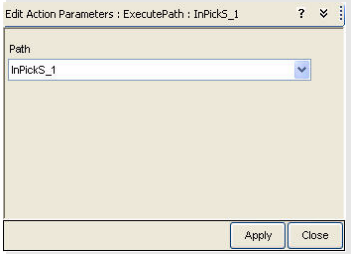
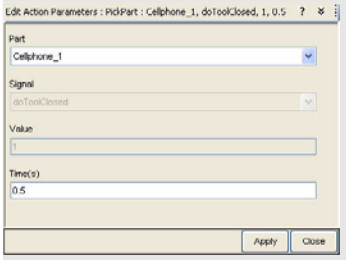
The following table describes how to edit an existing action in the current scenario:

	Action	Information
1.	Right-click an action item, select the **Show Properties**.	The action editor is displayed at the bottom of **Process view** tab page.
2.	Enter the required value, click the **Apply** button.	

Continues on next page

Continued

Machine Tending PowerPac provides the following action types:

Action Type	Description	Note/illustration
Robot motion	Defines how a robot travels inside/ outside a station. It is always connects with a path. Choose a path from the drop-down list.	 pic243-05
Tool method	Defines how a robot uses a tool in a work cell. • Choose a part that should be processed from the drop-down list, • Enter a value in the **Time(s)** text box. The value means how long time a tool method will take.	 pic243-06 **Note!** If there are two IMMs and two parts in the cell, by default both of the IMMs will process the first added part. If the two IMMs need to handle two different parts, right-click the tool method action (PickPart / ReleaseP-art) from the expanded IMM node, and then choose **Show Properties** to open the **Edit Action Parameters** editing window, select the part to be processed from the **Part** drop down list, modify the process time for a part in the **Time** text box if necessary and click **Apply**. If such a part needs to be processed or dropped down to other stations, do similar actions to the tool methods of such stations as for IMM stations.

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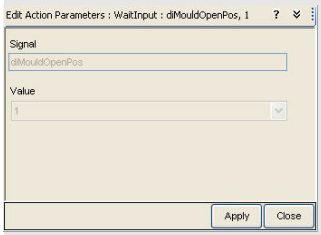
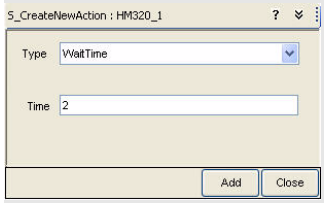
Continued

Action Type	Description	Note/illustration
Logics for station tending	Defines the application related logical conditions between a robot and a workstation.	 pic243-07
Wait time	Defines how long time the robot will wait for before tending the station. • Enter the time in the **Time** text box.	 pic243-08

Note! In this version it is not possible to edit signals in the Machine Tending PowerPac.

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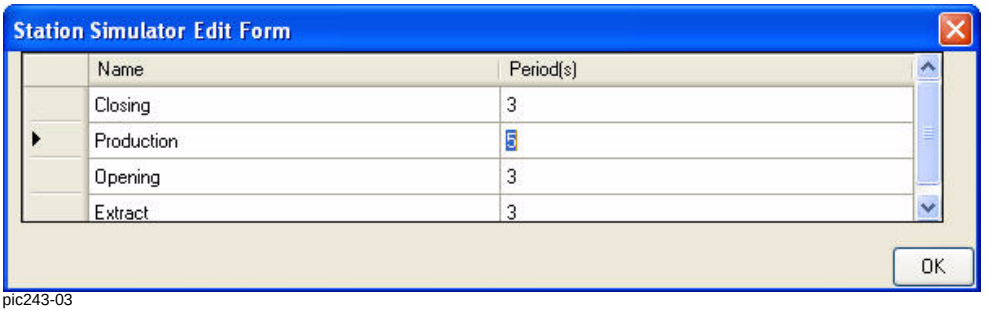
How to edit the simulator (Only for machine types)



pic243-03

	Action	Information
1.	Right-click a machine from the **Station** collection and select **Edit Simulator** from the context menu.	The **Station Simulator Edit Form** is displayed.
2.	Double-click the value in the **Period** text box and enter a new value. Click **OK**.	**Closing** is the time required by the mould to close completely. **Production** is the time used for moulding the parts. **Opening** is the time required by the mould to open after completing the production process. **Extract** is the time from when the robot starts going into the machine, until the robot comes out of the machine.

2.4.4. Editing tools

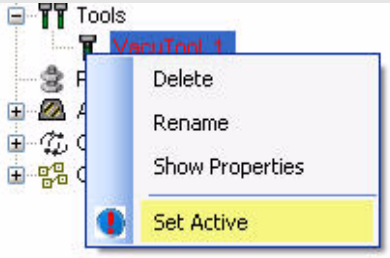
Procedure

This section describes how to edit tools.

How to add, delete, rename, and show properties of a tool

For details, refer to *Editing cell components on page 31*.

How to set an active tool

	Action	Information
1.	Right-click a tool from the **Tool** collection and select S**et Active** from the context menu.  pic244-01	The active tool will be used during simulation. Once a tool is set as active, the existing active tool will be demounted from the robot, and the new tool will be mounted. The TCP of the new tool will be used for all move instructions. **Note!** There should be only one active tool in one cycle.
2.	The tool name will be displayed in red color and the tool is set to active state.	**Note!** Only the tool that is set as active can be used in the simulation.

2.4.5. Editing parts

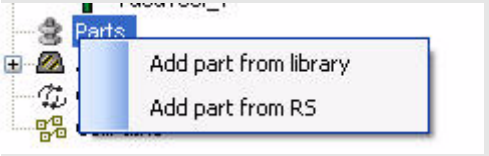
Procedure

This section describes how to edit parts.

How to delete, rename, and show properties of a part

For details, refer to *Editing cell components on page 31*.

How to add a part

	Action	Information
1.	Right-click the **Parts** collection.  pic245-03	
2.	Select **Add part from library** to launch the **Create new part** dialog box. • Select a part from the drop-down list under **Template** in the dialog box. • If necessary, change the automatically generated name in the text box under **Name**. • Click the **Add** button to add the new part to the 3D cell. Or select **Add part from RS**, a part that is imported using RobotStudio basic function will be added to the current cell.	**Note!** Only when using **Add part from RS**, the part that is imported using RobotStudio basic function can be used in Machine Tending PowerPac. Refer to *Operating manual - RobotStudio* for how to import parts with RobotStudio. Machine Tending PowerPac will place the new parts next to the cell.

2.4.6. Editing auxiliary devices

Procedure

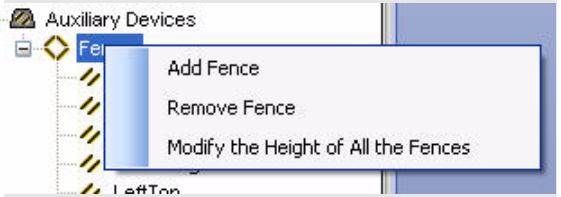
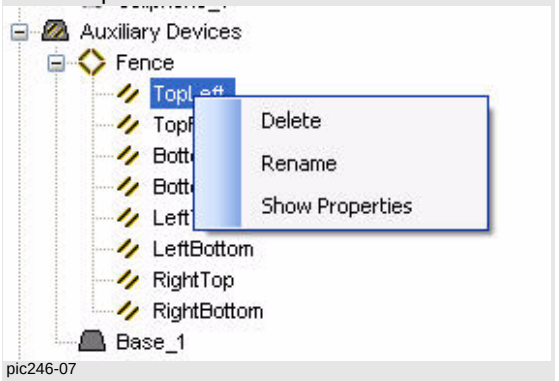
This section describes how to edit auxiliary devices.

How to edit fences

	Action	Information
1.	Right-click the **Auxiliary Devices** from the **Process View**: • select **Add a Fence or Robot Base** to add a fence element, • from the **Create new Auxiliary Station** editing window select **Fence**.  pic246-04	

Continues on next page

Continued

	Action	Information
2.	Right-click the **Fence**: • select **Add Fence** to add an entire fence which fits the size of the robot cell, • select **Remove Fence** to delete all the fences, • select **Modify the Height of All the Fences** and change the value from a pop-up window.  pic246-05  pic246-06	
3.	It is also possible to edit individual fence element.  pic246-07	See *Editing cell components on page 31* for detailed description.

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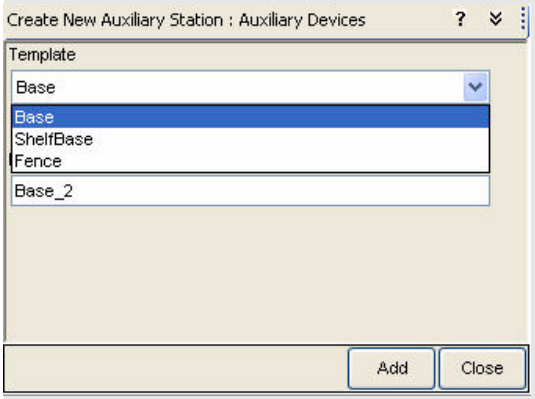
Continued

How to edit robot base

	Action	Information
1.	From the **Process View** tab page right-click the **Auxiliary Devices** node and select **Add a Fence or Robot Base**.  pic246-04	
2.	From the **Create new Auxiliary Station** editing window: • select a robot base, • if necessary, change the automatically generated name in the text box.  pic246-08	**Note!** After a base is added to the cell, the robot will be automatically placed on the base. The shelfbase can be used only when the robot is on top of the machine. If the robot/ machine position type is changed, the base type will also be changed to be in accordance with the position type.
3.	Right-click the base to delete, rename and show properties of a base.	See *Editing cell components on page 31* for detailed description. **Note!** When the height of the base is changed, there is no need to reposition the robot manually, the robot will automatically be placed on the base.

2.4.7. Defining a cycle

Procedure

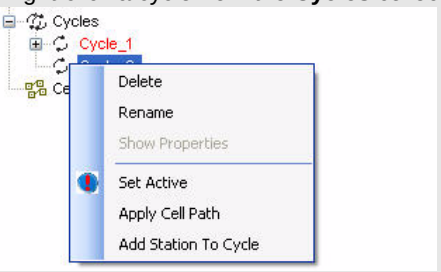
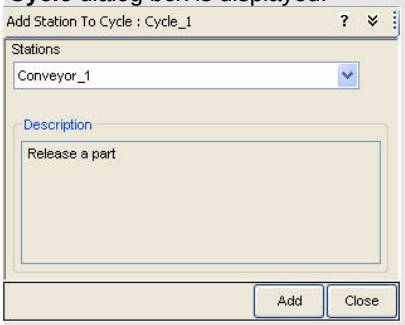
A cycle includes a list of stations which defines how a robot sequentially visits these stations. Several cycles can be defined, but only one cycle can be executed during simulation. This one is called the active cycle. Refer to *Creating a cell with the Cell Wizard on page 24*.

It is possible to edit the current cycle, or add a new cycle from the **Process View**. The sections below describe how to define cycles from the **Process View**.

How to add, delete, and rename a cycle

For details, refer to *Editing cell components on page 31*.

How to define a cycle

Action	Description
Open the context menu	Right-click a cycle from the **Cycles** collection to see the context menu.  pic-245-01
Add a station to the cycle	Select **Add Station to Cycle** from the context menu. The **Add Station to Cycle** dialog box is displayed.  pic245-02 Select a station from the drop-down list, click **Add** to add the station to the current cycle.

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Action	Description
Remove a station from the cycle	Right-click a station name from the current cycle collection, click **Delete** from the context menu.
Sort sequence	Drag the station up/down to sort the sequence of stations in the cycle.
Add cell path	A cell path is the path from one station to the next station according to the cycle. Right-click the cycle and select **Apply Cell Path** to create cell paths between every two stations according to the station sequence in the cycle settings. The cell paths will be displayed both in the cycle and the cell path collections. **Note!** Once a cycle is changed, the cell path previously created can not work properly. In such cases, it is necessary to apply the cell path for the second time to ensure correct robot motions.
Delete a cell path from a cycle	Right-click a cell path from the cycle and select **Delete**. The cell path still exists in the cell path collection, but will not be executed in this cycle.
Delete a cell path from cell path collection	Right-click a cell path from the cell path collection and select **Delete**. The cell path will automatically be removed from the cycle that uses this cell path.

How to set a cycle as active

Active cycle is the cycle to be executed during simulation. Only one cycle can be active at a time.

Right-click a cycle from the **Cycle** collection and select **Set Active**. The selected cycle is set as the active cycle and the cycle name is displayed in red color.

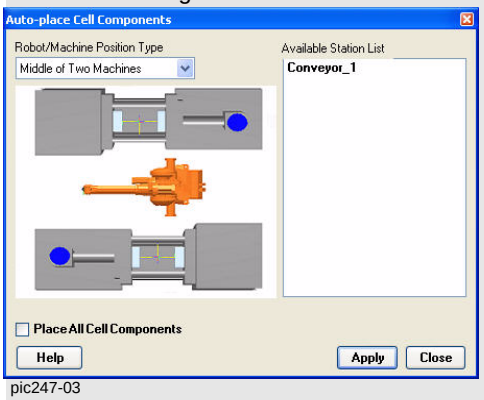
Note! By default, the cycle defined from the cell wizard is set as the active cycle.

2.4.8. Auto-placing Cell Components

Auto-place cell components

The Machine Tending PowerPac provides a function called auto-place cell components, which can either position a station, or place all stations, including the machine used in the cell considering collision free environment in the cell and reachability for the robot. This function is available from the Machine Tending PowerPac toolbar collection.

Auto-place one station

	Action	Information
1.	Click **Auto-place Cell Components** on the Machine Tending PowerPac toolbar.  pic247-03	The **Auto-place Cell Components** window is displayed.
2.	Select a station from the available station list box then click **Apply**.	If there is a solution, a position for the selected station will be found that can ensure: • all the targets within the station is reachable for the used robot. • does not collide other cell components including the robot. If there is no solution, the station will be placed in a default position that is not in collision with others.

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Auto-place all cell components

Action	Description
Manually select the **Place all Cell Components** check box	1. Click the **Auto-place Cell Components** on the Machine Tending PowerPac toolbar. The **Auto-place Cell Components** window is displayed. 2. Select the **Place all Cell Components** check box. 3. Click the **Apply** button to place all stations in the cell. A progress bar will indicate the progress.
Automatically select **Place all Cell Components** check box	The check box will be selected automatically while: • changing the robot position type from the **Robot/ Machine Position Type** drop down list, • changing the number of the machine used in the cell. Click **Apply** to place all the stations in the cell.

Note! When choosing **Place all Cell Components**, an individual station can not be placed separately.

2.5. Running a Simulation

Running a simulation

Simulates how a robot tends a cell, including states and behaviors of stations. It will:

- Simulates robot motions for the active cycle.
- Simulates different actions of stations within a cycle.
- Simulates interactive logics between the robot and other stations.

For details on editing simulation, refer to *Editing stations on page 35*.

How to start a simulation

Click **Play** from the simulation toolbar collection to run the simulation.

The graphics window will display how the robot tends the cell.

Note! The **Play** button will be enabled only after a successful synchronization to the virtual controller.

Refer to *Toolbar of Machine Tending PowerPac on page 20* for how to configure the path and synchronize with virtual controller.

How to stop a simulation

Click **Stop** any time the simulation should be stopped.

Note! When the simulation ends, click **Jump home** to get the robot its original position from current position.

Viewing run time information

During simulation, view statistics information from the **Statistics** tab page. Refer to *Statistics Information on page 53*.

How to change part handling behavior

It is possible to customize a tool method action when the simulation is stopped. For example, to set which part will be picked/released for a station, or how long time for a pick/release action. For details, refer to *Editing stations on page 35*.

How to edit machine simulator

For a machine, the time for different stages, i.e., time for machine closing, production, opening and allowed time for extraction, can be changed. For details on changing time for machine simulator, refer to *Editing stations on page 35*.

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NOTE!

When RobotStudio reports "Safety guard stop state" in the **Output** window, all the tasks related to the virtual controller can’t be implemented. It is recommended that use **System Control Panel** to solve the "Safety guard stop state" problems. For details, refer to *Operating manual - RobotStudio* in *Dialog boxes on the Controller menu/ The System Control Panel: My System dialog box*.

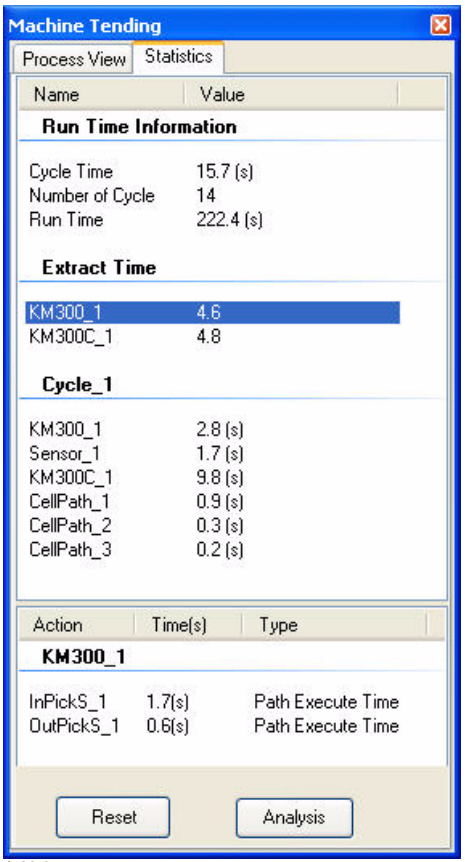
2.6. Statistics Information

Viewing run time information from Statistics tab page

While running a simulation, click the **Statistics** tab in the **Machine Tending** tab page collection to view the runtime statistics information:

Note!

- During simulation, statistics information is updated at the end of each cycle.
- Statistics information will be reset when a new cell is created or the simulation is restarted.



pic26-01

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Item	Description
Run Time Information	Provides statistics information for: • Cycle time: time for the last cycle. • Number of cycles: how many cycles runs from the simulation start. • Run time: total simulation time from the simulation start.
Extract Time	Provides statistics information for: • Extract Time of each IMM in the cell. Extract Time is the time from the robot starts going into IMM, until the robot comes out of IMM after necessary processing inside a machine.
Cycle Information	Provides statistics information for: • Cycle name: name of the active cycle. • Station list: station name and the execute time for each station in the active cycle.
Path information	Click a station name in station list to show the execute time of each path in the selected station. Meaning of each column: • Path name. • Execute time for the path in the selected station. • Description.
Reset and Analysis	• Click **Reset** to reset all the statistics information. This can be done only when no simulation is running. • Click **Analysis** to display the Analysis window. Refer to *Viewing the information in the analysis window on page 54* for more information.

Viewing the information in the analysis window

The analysis window graphically displays:

- Both machine cycles and robot cycles.
- Nominal machine cycles and simulated machine cycles.
- How a robot cycle fits with the simulated machine cycle,
- The bottlenecks in terms of synchronization of machine and robot.

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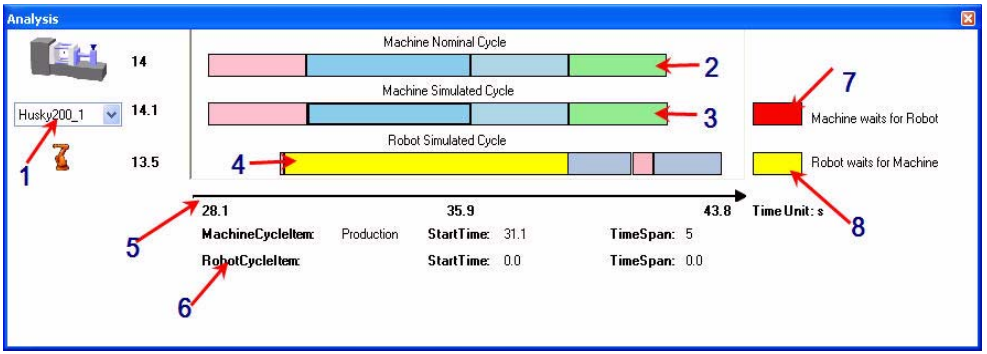
Click **Analysis** from Statistics tab page to show the analysis window.

Illustration



pic26-02

The table below describes all the items in the analysis window:

Item	Description	Action
1.	Drop down list All the used machines in the active cycle.	For the active cycle: • if no machine is used, there is nothing to be selected here, • if only one machine is used, only this machine can be chosen, • if two machines are used, select one from the drop down list, both the machine cycle and robot cycle will be updated to show how the selected machine synchronized with the robot along the time line.
2	Machine Nominal Cycle The time for different stages of a machine cycle specified by the user. Refer to *Editing stations on page 35*. Different portions of time are marked in different colors.	

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Item	Description	Action
3	Machine Simulated Cycle The actual machine cycle time during simulation.	Click any item in this line, the detailed information about the selected stage will be displayed in the first line in the **Description** area.
4	Robot Simulated Cycle The actual robot cycle time during simulation. Time for a robot tending different stations, as well as the cell path time between two stations, are marked with different colors. The sequence of stations and cell paths in this line is in accordance with those in the active cycle.	Click any item in this line, the detailed information will be displayed in the second line in the **Description** area.
5	Time axis Indicates the time of the active cycle, which is updated after each cycle.	
6	Description Detailed information for different portions of a cycle. The first line shows different portions of the simulated machine cycle. The second line shows different portions of the robot cycle. For each portion, it reports the starting time and the duration of the portion.	
7	Machine waits for the Robot (in red) Indicates the time from when the machine is fully opened until the robot is ready to tend the machine.	If there is a red block in **Machine Simulated Cycle**, it means that the machine waits for the robot. Click the block to show the exact waiting time.
8	Robot waits for the Machine (in yellow) Indicates the time from when the robot is ready to tending the machine until the machine is ready for tending.	If there is a yellow block in **Robot Simulated Cycle**, it means that the robot waits for the machine. Click the block to show the exact waiting time.

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NOTE!

During simulation, analysis information are updated at the end of each cycle.

NOTE!

All the items on the **Process view** page are unavailable during simulation. To improve the cycle time for machines and robots, stop the simulation first, then do necessary modifications from the **Process view**. The changes will take effect in the next simulation. Refer to *Editing stations on page 35*.

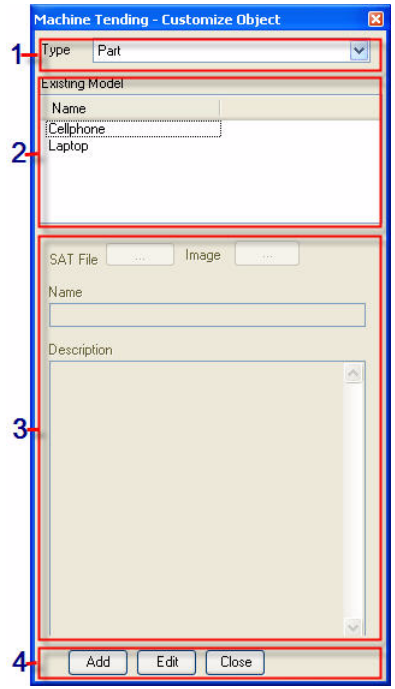
2.7. Customizing Cell Components

Overview

The Machine Tending PowerPac provides a library containing several types of stations, one vacuum tool and several kinds of parts that can be used directly.

In case the library does not contain the required station types, tools or parts, it is possible to create new types of station, tool or part by using **Customize Cell Components** in the Machine Tending PowerPac toolbar collection. The customized items can be saved as a library that a user can use in the coming work.

Note! Once the **Customize Cell Components** window is launched, the current Machine Tending cell must be cleaned up besides the robot system. It is recommended to save the work before starting to use this function.



pic27-01

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Item	Description
1.	**Type** drop down list. Click the drop down arrow to show the list, select a type for customization. The Machine Tending PowerPac provides the following types of objects for customization: • Station: includes a CAD model, a workobject, paths includes several targets, and scenarios defining how a robot will tend this station. • Tool: includes a CAD model and tool data. • Part: only includes a CAD model.
2.	Existing Model list box. After selecting an object type, the existing models of the selected type will be listed here.
3.	Customization working area. Available only after the **Add** or **Edit** button is clicked. It will appear differently depending upon the object type.
4.	Buttons. • Click **Add** to create a new model. • Select an existing model, from the **Existing Model** list box and click **Edit**. • Click **Close** to close the editor without any changes.

Procedures

Follow the procedure below to create a new model:

	Action	Information
1.	Click the **Customize Cell Components** in the **Machine Tending PowerPac** toolbar collection to launch the **Customize Object** window.	
2.	Select a type from the **Type** drop down list.	
3.	• Click **Add** to create a new object model. • Select an existing model from the **Existing Model** list box. The corresponding model will be loaded to the 3D view. Then click **Edit**.	
4.	The customization working area will be activated after the **Add** or **Edit** button is clicked.	How to customize different types of models is described below.

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How to create a customized part

The following procedure details how to create a part model.

	Action	Information
1.	Enter a name in the **Name** text box.	
2.	Click the **SAT file** button and a file browser will open for selecting a CAD model of SAT format. The CAD model is displayed in the graphics window.	In order to create a customized object, there should be a model in the format of *.sat.
3.	Click the **Image** button and an file browser will open for selecting an image as the representation of the selected part model.	Adding an image for a model is optional. The supported image formats are displayed in the file selection browser.
4.	Enter description for the new part (optional).	
5.	Click **Save** to save the part to the library. Click **Cancel** to ignore all the changes.	

How to create a customized tool

The following procedure details how to create a tool model.

	Action	Information
1.	Select **tool** from the **Type** drop down list.	
2.	Add sat file, picture and description for the new tool; provide a name for the new tool	Refer to *How to create a customized part on page 60*.

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	Action	Information
3.	Edit tool data. If the **Only TCP** check box is selected, only the TCP data will be displayed in the tool data list box. If this is unchecked, the full set of the tool data can be defined. But there is no validation check for the user input. Specify the values by clicking the text box and entering a new value, or Drag or rotate the indicator ball (the small green ball) in the 3D view to change the TCP value. Repositioning the indicator ball will only influence the TCP value.	The indicator ball (the small green ball) is only for facilitating the define of TCP. It is not a portion of the tool that will be created. When rotating the indicator ball to change the orientation of a TCP, make sure the rotation is based on the Local coordinate system, otherwise the results can be unpredictable.
4.	Click **Save** to save the customized tool to the library. Click **Cancel** to ignore all the changes.	

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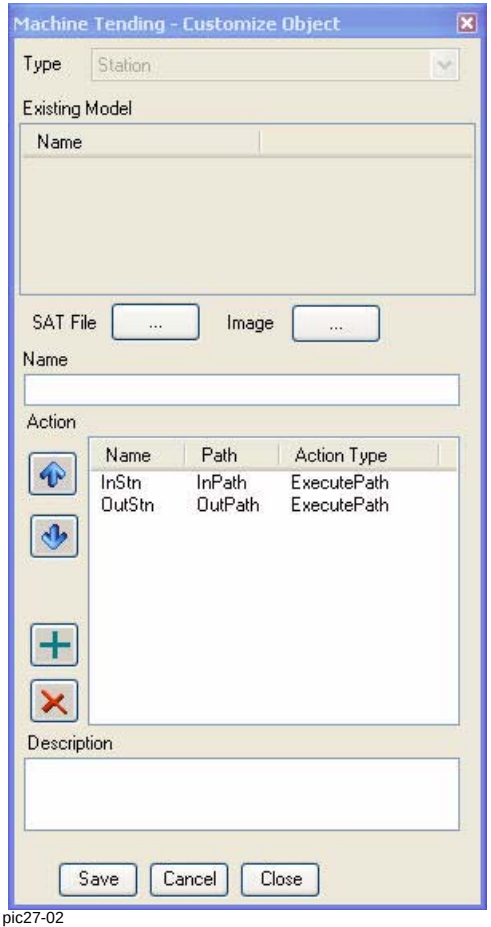
How to create a customized station

The following procedure explains how to create a customized station.



pic27-02

	Action	Information
1.	Select **Station** from the **Type** drop down list.	
2.	Enter a name for the new station. Add SAT file, picture, and provide description for the new station.	Refer to *How to create a customized part on page 60*.

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	Action	Information
3.	After adding the SAT file, a station model with an indicator ball (a small green ball) is displayed in the 3D view.	The indicator ball is only for facilitating manual operation in the 3D view. It is not a portion of the station that will be created. Refer to *Operating manual - RobotStudio*.
4.	Edit the path and the targets in the station: • Drag the indicator ball to reposition all targets in the station. • Use RobotStudio base functions to add new targets. See *Operating manual - RobotStudio*. • Use RobotStudio base functions to add new paths. See *Operating manual - RobotStudio*.	The targets added must be based on the work object of the customized station, which is called as "TempWorkObj", and the new paths must be formed only by such targets, otherwise the targets and paths will not be recognized.
5.	After importing a model, the default action for this station will be displayed in the **Action** list box. This includes two ExecutePath actions that describe how a robot goes in and comes out of the station.	

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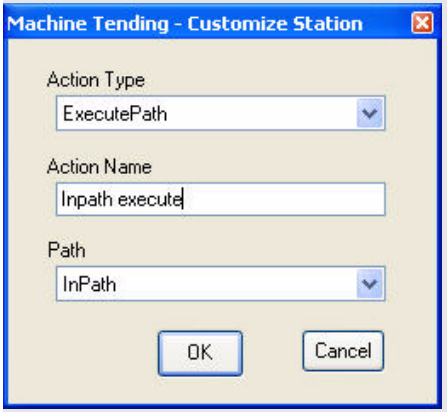
	Action	Information
6.	Edit an action. Double-click an action to show the **Customize action** editor. • Select an action type from the drop down menu. • Change the name for the selected action if necessary. • Select a path that the robot will perform for this action (Only when the **ExecutePath** is selected). Click **OK**.  pic27-03	The available robot action types are: **PickPart**: Pick a part. **ReleasePart**: release a part. **ExecutePath**: Let robot move along a path.
7.	Add a new action to a station. Click the **Add** button to show the customize action editor. Edit the new action. Click **OK** to add the new action to the list.	
8.	Adjust the sequence of the action in the station by selecting the action and then clicking the move up and move down buttons.	The robot will execute the actions in sequence.
9.	Click **Delete** to remove the action from the action box.	
10.	Click **Save** to save the model to the library. Click **Cancel** to ignore all the changes.	After **Save** or **Cancel** is performed, the modified component will be removed from the cell.

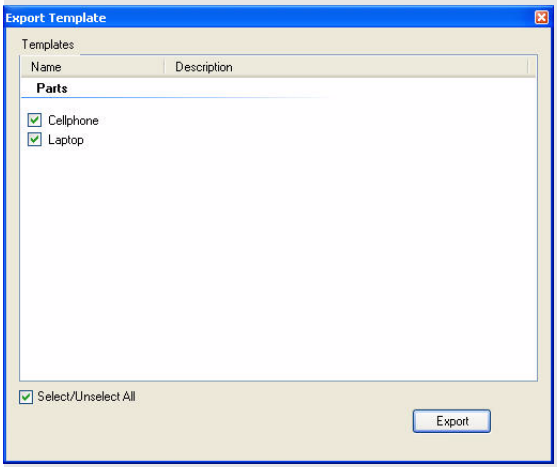
2.8. Exporting and Importing Templates

Overview

The Machine Tending PowerPac provides a library containing several types of templates that can be used directly. And it is also possible to share customized stations, tools and parts between different users by exporting and importing templates.

Exporting templates

The following procedure details how to export templates.

	Action	Information
1.	Click **Export template** in the **Machine Tending PowerPac** toolbar collection to launch the **Export Template** dialog box.	
2.	Select templates. • In the **Templates** list, select or clear the check boxes of the templates to decide which templates should be exported. • Click **Export**.  pic28-03	The **Export Template** window is displayed.

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	Action	Information
3.	Save the templates as a cab file. • Specify the location in **Save in**. • Enter a name for the cab file in the **File name** text box. • Click **Save**. All the selected templates will be saved in a cab file at the specified location.	

Importing templates to Machine Tending PowerPac

The following procedure details how to import templates.

	Action	Information
1.	Click **Import template** in the **Machine Tending PowerPac** toolbar collection to launch the **Import Template** window.	
2.	Select a cab file. • In **Look in**, browse to the location where the cab have been stored. • Select a desired cab file. • Click the **Open** button. The **Import Template** window is displayed.	**Note!** Only the cab files that are exported by Machine Tending PowerPac can be imported.

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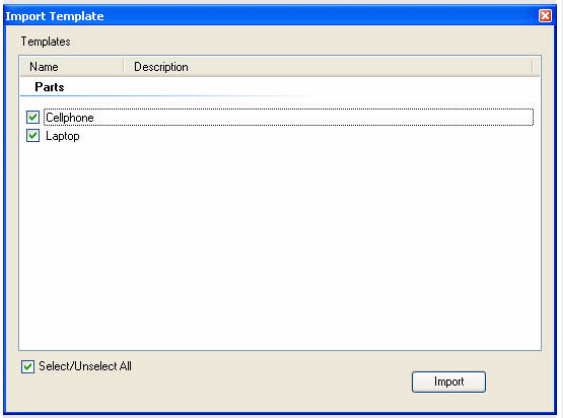
	Action	Information
3.	Select templates. • Select or clear the check boxes of the templates to decide which templates should be imported to the Machine Tending PowerPac. • Click the **Import** button.  pic28-01	All the templates in the cab file will be list in the **Import Template** window.

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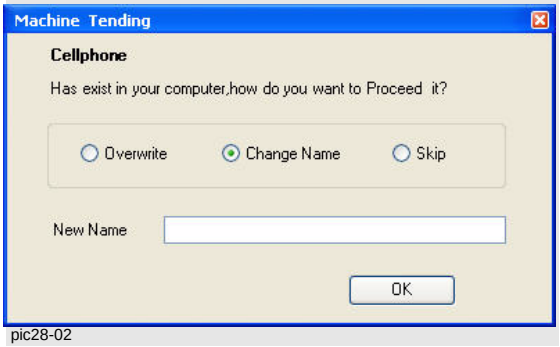
	Action	Information
4.	If a selected template has existed in Machine Tending PowerPac, there are three options: • Overwrite: the existed template will be replaced by the new imported one. • Change Name: enter a name in the **New Name** text box for the template. The template will be import with the new name. • Skip: the template will not be imported. Click **OK**.  pic28-02	
5.	A message box appears to inform that all the templates have been imported successfully. Click **OK**.	Next time launching the work cell wizard, the imported templates will be display in the library and can be used directly.

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