Operating manual
Palletizing PowerPac
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Overview of the manual

About this manual

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

Usage

This manual should be used during installation and configuration of Palletizing PowerPac. It describes Palletizing PowerPac and includes step-by-step instructions on how to perform the tasks from there.

Who should read this manual?

This manual is mainly intended for:

- System integrators
- ABB engineers
- End customers

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

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| A        | Released with RobotStudio 5.14.03
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  • Updated the section Import PMS on page 117. |
| B        | Released with RobotStudio 5.15
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  • Added pmSystem_doMotorOnState and updated pmSystem_doMotorOn, see System outputs on page 269.
  • Updated new Operator interface on page 94 dialog box
  • Updated Flow recovery on page 244
  • Updated instruction PmSetRecoverAction - Set flow recover action on page 306
  • Updated timing diagrams in Timing diagrams for PLC communication on page 279.
  • Updated Approach/Depart, see Group operation set on page 180. |
| C        | Released with RobotStudio 5.15.01
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  • Updated the section PmUtility module on page 212.
  • Updated the section Public system module pmrcSys on page 228.
  • Added the section Delete projects on page 116.
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| D        | Released with RobotStudio 5.60
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| G        | Released with RobotStudio 6.01
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Updated the section *Pallet pattern on page 72.* |
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  * Updated the section *Operation editor on page 196* |
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  * Updated the section *Pattern/Stack operation set on page 183.* |
| P        | Released with RobotStudio 2019.1.  
Updated the references. |
1 Safety

Safety of personnel

When working inside the robot controller it is necessary to be aware of voltage-related risks.

A danger of high voltage is associated with the following parts:

- Units inside the controller, for example I/O units, can be supplied with power from an external source.
- The mains supply/mains switch.
- The power unit.
- The power supply unit for the computer system (230 VAC).
- The rectifier unit (400-480 VAC and 700 VDC). Capacitors!
- The drive unit (700 VDC).
- The service outlets (115/230 VAC).
- The power supply unit for tools, or special power supply units for the machining process.
- The external voltage connected to the controller remains live even when the robot is disconnected from the mains.
- Additional connections.

Therefore, it is important that all safety regulations are followed when doing mechanical and electrical installation work.

Safety regulations

Before beginning mechanical and/or electrical installations, ensure you are familiar with the safety regulations described in Product manual - IRC5.
2 Introduction

2.1 Overview

This chapter gives an overview of the Palletizing PowerPac software, and includes the following:

- The Palletizing cell concept.
- A description of the palletizing process.
- A list of terms relating to PickMaster and terms which are specific to palletizing.
2 Introduction

2.2 About Palletizing PowerPac

Overview

The Palletizing PowerPac (PzPP) is a RobotStudio solution for offline programming and simulation of Palletizing application. The PowerPac replaces the ABB's PickMaster 5 application.

PickMaster is designed to handle one or more cells in the production. It is a modular product, which can be customized to your needs:

- PickMaster RC is a stand-alone robot kernel, running the process in production. It communicates through the RAPID program, I/O interface, and FlexPendant interface.
- PzPP allows you to make the configuration and simulation for a palletizing application and process.

Prerequisites

The Palletizing PowerPac can be installed on a computer running Windows XP, Windows Vista, or Windows 7. RobotStudio should also be installed.

To work with real controllers, the computer must be connected to a controller over an Ethernet network.

For minimum system requirements, see Product specification - Palletizing PowerPac. The Prepared for PickMaster option, together with the Palletizing PowerPac sub-option, are the required RobotWare software options to use PickMaster on the IRC5 controller.

Palletizing PowerPac functionality

The PowerPac contains:

- The Build Tool Function and Tool Events Configuration for configuring a robot tool model. See Create Tool on page 120.
- The Tool I/O Configuration for configuring the I/O connection between robot tool and controller. See Edit Tool Signals on page 168.
- The Build Feeder Configuration for configuring the feeder model properties, including hotspots. See Create Feeder on page 139.
- The Feeder Configuration for configuring the feeder properties, including signals, work objects, feeder CAD models, and so on. See Feeder on page 170.
- The Product/Pallet/Sheet Configuration for configuring the product/pallet/sheet that will be picked and placed by the robot. See Product/Pallet/Sheet on page 59.
- The Pallet Pattern Configuration for configuring the stack of products organized in different layouts. See Pallet pattern on page 72.
- The Layout Editor for creating new or modifying existing layouts. See Layout Editor on page 75.
- The Pick Setting Configuration for configuring the products and tool orientation, as well as the tool functions to activate when gripping the products. See Pick setting on page 79.
- The Operation Set Configuration for configuring the format operation set and pattern operation set. See Operation set on page 179.
- The Job Wizard Configuration for configuring a new job including pattern operation sets and/or format operation sets. See Add job on page 83.
- The Flow configuration for defining accessible feeders in runtime. See Flow on page 201.
- The Tuning for changing parameter values online from the FlexPendant. See Tuning on page 253.
- The Project Settings for defining project name, descriptions, restart options and tune limitations. See Project Settings on page 154.
- The Feeder Order Settings for defining feeder order in the cell layout. See the Feeder Order Settings page in Controller Settings on page 158.
- The Event Settings for defining signals that can report events from external devices. See The Event Settings page in Controller Settings on page 158.
- The Message Settings for defining messages that can be reported from external devices. See The Message Settings page in Controller Settings on page 158.
- The Robot Settings for modifying motion limits and RAPID programs for each robot. See Robot Settings on page 165.
- The I/O Interface editor for assigning I/O values to products, product groups, pattern operation sets, feeders, flows, and projects. See I/O interface on page 107.
- The Pack Data for storing the Project in controller. See Pack data on page 111.
- The UnPack Data for retrieving the stored project. See UnPack data on page 114.
- The Palletizing Library for saving products, layouts, I/O connections and messages. See Library on page 119.
- The Preview Palletizing function to go through each palletizing robot targets for user validation. See Preview Palletizing on page 90.
- The Simulation function to simulate the palletizing application. See Simulation on page 93.
- The Download and Upload function to synchronize programs between RobotStudio and robot controllers. See Download on page 102 and Upload on page 104.
2.3 The palletizing process

Overview

The palletizing application aims at picking larger size objects from a fixed position and stacking them tightly together in another fixed position. An important parameter in the palletizing process is the speed of the process, that is, the throughput of products in time and the efficiency in stacking the products in a stable configuration without taking up too much space.

After the palletizing process, the stacks are loaded into containers or trucks. The lesser the space products require, lesser will be the transportation cost.

The palletizing cell

The following figure illustrates an example of a palletizing cell.

In a palletizing cell, the robot is used for the following tasks:

- Picking and placing one or more products.
- Picking and placing slip sheets from a slip sheet stack station to pallet stations. This task is optional.
- Picking and placing pallets from a pallet stack station to pallet stations. This task is optional.

When working with the optional tasks described above, the robot has to be able to pick the objects off a varying and initially unknown stack size. This is solved by automatically searching the height of the stack, usually with a sensing device in the robot gripper for the first approach and then keeping track of the stack height. For more information, see Stack search on page 191.

If the robot is not handling the pallets, they are moved into position by a feeder working in two directions, by AGVs or manually by fork lifts.

All the goods produced in a factory pass through the palletizing cells before shipping to the customers. This means that there is a large number of different products, which have to be guided to the right destination for accumulation. The most common shapes of products are a variety of carton boxes followed by bag types, but increasing numbers of open recycling crates are shaped for tight stacking.

Continues on next page
Packing the products

The way the products are packed is solved by using optimal layer layouts, and a variety of layouts to build stability in the complete stack. The various layouts can be achieved by using different layouts every second layer or by simply rotating or mirroring the same layout for every second layer.

Further common practice to stabilize the stack and protect the products is to use slip sheets between the layers. The slip sheets are thin cardboard sheets and they can be placed anywhere between the layers, but mostly they are evenly distributed. Slip sheets can also be placed at the bottom and on the top.

Speeding up the process

Introduction

For the fast palletizing process, the robot itself has to be fast and it has to be able to take more than one product at a time. The simplest way is to take boxes in groups and to place them in the same configuration in one drop. However, this reduces the universal flexibility of the robot. It is usually used for half and full layer palletizing, where the layouts are simple and very high throughput is required, often also in retrofits of older hard automated palletizers.

To plan each layout

A more flexible and efficient way is to plan each layout to be processed as efficiently as possible, which usually means as few operations as possible with a limited number of boxes at a time. If a specific format requested by the pallet stack is not possible to place in one target, the placing operation has to be split into a number of separate placing targets, releasing one box at a time, with the possibility to rotate each box separately if needed. This is referred to as single pick, multiple placing.

Infeeders, outfeeders, and logical devices

To handle many products and pallet loads simultaneously, the installations use multiple infeeders and outfeeders gathered around the robot and logical devices to order the correct products to the robots. Different products have different production cycle durations and any order can be stopped and switched to another at any time, while other orders continue to operate without being affected.

The robot can move between different stacks

During the palletizing process the robot has to be informed about the next format to pick and where to get it. When an operation is completed, another station can request the robot. In this way the robot has to move constantly and dynamically between different combinations of stacks.

The flow concept

Introduction

PickMaster introduces the unique concept of Flow which is a built-in and automated intelligent order sequence distribution for the robot to act upon. Thereby, no advanced PLC program is required to control the logics of the application.

Continues on next page
Execution of a palletizing job

A palletizing job with the flow concept can be described in the following steps:

1. A PLC requests a palletizing job to be done by a robot on a palletizing station. For example build a pallet consisting of seven layers of boxes on outfeeder 1.

2. While executing the job, the robot will step by step request the PLC to feed pallets, products, and slipsheets. For example, the robot requests a box to be fed on infeeder 1, or a new stack of slipsheets to be placed at the slip sheet station.

3. When a palletizing job is ready, the robot communicates to the PLC that the job has been completed. For example a full pallet is ready on outfeeder 1.

4. The palletizing station is prepared for a new job to be started. For example the PLC sends the pallet away. A new palletizing job can now be requested by the PLC to be started on the palletizing station.

Sequence of palletizing jobs

Palletizing jobs are configured using the graphical user interface in the Palletizing PowerPac PC application. Many different jobs can be executed by the robot in a sequence that does not have to be decided in advance. A palletizing job can be modified while executing, for example finishing a job before it has been completed.

Parallel palletizing jobs

The flow concept allows a robot running multiple palletizing jobs in parallel, using one palletizing station for each job. The jobs run independently of each other but can share common resources, for example one infeeder can feed products to several parallel jobs.

The robot can switch between different jobs after each pick-place cycle. If a job not is ready to run after a pick-place cycle (for example, the next box to be picked cannot be fed since an error has occurred on the infeeder) the robot continues to work with the other jobs until the error has been resolved. In this way, the productivity of the robot can be maximized.

Running parallel jobs does not add any complexity to programming or operator interaction.
Product flow sequence

Following are the product flow sequence chart and the signal chart which are helpful while simulation.

Product flow sequence chart, 1 in -1 out

Signal chart

Related information

Terms and concepts on page 22
2.4 Terms and concepts

About these terms

Some words have a specific meaning when used in this manual. This manual’s definitions of these words are listed below. Some of the terms are put in their context when describing a palletizing process. See The palletizing process on page 18

Words that have italic font style in the definition column are included in the term list and have their own definitions.

Term list

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Action</td>
<td>Description of one robot movement to get to/on/from a target. Every action can have a number of events. For more information, see Relationship between RAPID execution and PickMaster project on page 204.</td>
</tr>
<tr>
<td>Activator</td>
<td>An I/O controlled part of a robot tool, normally a vacuum cup. For more information, see Create Tool on page 120</td>
</tr>
<tr>
<td>Event</td>
<td>A description of an event on the robot path, for example setting an I/O signal. For more information, see Relationship between RAPID execution and PickMaster project on page 204.</td>
</tr>
<tr>
<td>Facing</td>
<td>Possibility to select one or more sides of an item that should be facing outwards in a pallet pattern.</td>
</tr>
<tr>
<td>Feeder</td>
<td>A PickMaster’s representation of pick and place areas. Often referred to as station, infeeder, or outfeeder. It defines the signals needed to control the in- and outfeeding of groups and pallet patterns on the feeder. Palletizing jobs can only be started on master feeders, see Flow on page 201. The feeding on a slave feeder is dictated by one or more master feeders. A feeder also holds all group operation sets and all pallet pattern operation sets. It also contains general robot movement data for the feeder, for example, safe positions. For more information, see the Feeder on page 170 Configuration.</td>
</tr>
<tr>
<td>Flow</td>
<td>Logical directions of items being moved between pick and place stations when performing a palletizing/depalletizing job. A flow: • Contains one master station on which palletizing/depalletizing jobs can be started. The master station dictates the operation sequence for itself and its slave stations. • Contains one or more slave stations. The slave stations execute operations requested by the master station. For more information, see Flow on page 201.</td>
</tr>
<tr>
<td>Group</td>
<td>Describes a group of products that can be picked/placed by a robot tool in one operation.</td>
</tr>
<tr>
<td>Group operation set</td>
<td>One operation that describes how to pick/place a group on a specific feeder. For more information, see the Operation set on page 179 Configuration.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Hotspot</td>
<td>A special frame on feeder model that can be used to attach a work object. It also describes the position relationship between an item and the work object.</td>
</tr>
<tr>
<td>Item</td>
<td>The generic term for a specific object to be picked or placed. An item can be a product (i.e. box or bag), pallet, or slip sheet. An item is based on the geometric definition of a shape. For more information, see the Product/Pallet/Sheet on page 59 Configuration. Box: A rigid box with rectangle shape Bag: Same as box, but the bag has margins on length and width sides, specifying how much distance the bags can be overlapped with each other in a layout. Sheet: A thin sheet that is placed on a pallet before palletizing of products and between two layers to increase stability in the stack. Pallet: The actual wooden or plastic structure that the products are placed on.</td>
</tr>
<tr>
<td>Job</td>
<td>A job is a supported program (i.e. Operation Set) on a flow's master feeder.</td>
</tr>
<tr>
<td>Layout</td>
<td>Defines the arranged two dimensional pattern of the shapes in a layer.</td>
</tr>
<tr>
<td>Master Feeder</td>
<td>The master station of a flow</td>
</tr>
<tr>
<td>Operation</td>
<td>An operation describes what a robot shall do when entering a work area for a new pick or place. What to do is described as a list of targets. For more information, see Relationship between RAPID execution and PickMaster project on page 204.</td>
</tr>
<tr>
<td>Pallet pattern</td>
<td>Defines a stack of shapes organized in different layouts. A layer in the stack can either be of pallet, slip sheet, or product type.</td>
</tr>
<tr>
<td>Pallet pattern operation set</td>
<td>A sequence of operations that describe how to pick/place a pallet pattern on a specific feeder.</td>
</tr>
<tr>
<td>Pick Setting, i.e. Format</td>
<td>Defines one item or a group of items that can be picked/placed by a robot tool in one operation.</td>
</tr>
<tr>
<td>Project</td>
<td>Description of a PickMaster palletizing process applied on a specific line. Several projects can be defined for each line. For more information, see Project overview on page 106.</td>
</tr>
<tr>
<td>Robot Target</td>
<td>A single robot target that robot goes to during picking and placing. An action contains one robot target.</td>
</tr>
<tr>
<td>Safe Target</td>
<td>A position that the robot always has to pass through when going to or leaving a feeder</td>
</tr>
<tr>
<td>Slave Feeder</td>
<td>A slave station of a flow</td>
</tr>
<tr>
<td>Stack</td>
<td>An arranged pile of items consisting of a number of layers.</td>
</tr>
<tr>
<td>Target</td>
<td>A target describes a robot position used when performing an operation on a feeder. A target has a list of products carried by the robot tool and a list of actions that shall be executed. Note the difference with robot target: a target can have a list of actions, and each action has one robot target.</td>
</tr>
</tbody>
</table>
## 2.4 Terms and concepts

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tool Function</td>
<td>A single function of a tool that requires input signals to control and will generate results as output signals.</td>
</tr>
<tr>
<td>Tool Scenario</td>
<td>One grouping of tool functions to use in all actions of a target during picking or placing.</td>
</tr>
<tr>
<td>Work area</td>
<td>The original term used in PickMaster 5 PC to describe feeders, now it is only used in RAPID functions and variables.</td>
</tr>
<tr>
<td>Zone</td>
<td>A vacuum tool function is divided into a number of zones. Each zone has one or more activators.</td>
</tr>
</tbody>
</table>
2.5 Using a robot with 6 axes

Overview

Even though running Palletizing PowerPac applications on a robot with 6 axes is possible, some manual modifications might be required depending on the robot configuration that is used.

The configuration of SingArea determines if you have to do manual modifications before running Palletizing PowerPac on a robot with six axes. This section describes the required modifications depending on the robot configuration.

The following scenarios are described for a bending backwards robot with 6 axes:

• Axis 6 is pointing down. See Axis 6 points down on page 26.
• The wrist is tilted. See Wrist is tilted on page 27.
• The robot is bending backwards. See Robot is bending backwards on page 28.

For using a parallel rod robot with 6 axes together with Palletizing PowerPac, see Parallel rod robot on page 29.

Configuration of SingArea

Linear movements are by default configured to use SingArea \ Wrist path interpolation mode. This setting is configured in the Operation Set dialog boxes. See Group operation set on page 180 and Pattern/Stack operation set on page 183.
### Bending backwards robot

This section illustrates the different scenarios for a bending backwards robot, and describes the required manual modifications.

#### Axis 6 points down

The figure illustrates axis 6 pointing down. In this position the robot works in a similar way as a floor mounted palletizer robot with 4 axes, always having the mounting interface (and the tool) directed downwards in a horizontal orientation. No bending backward positions are used.

<table>
<thead>
<tr>
<th>Configuration</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Using SingArea \Wrist</td>
<td>Long linear movements causes varying tool orientation. Tool orientation deviates between targets when using SingArea /Wrist interpolation. The deviation is small for short movements but increases with longer distance between robot targets.</td>
</tr>
<tr>
<td>Using SingArea \LockAx4</td>
<td>While using a 6 axis robot, using this instruction locks the fourth axis during the motion between the targets.</td>
</tr>
<tr>
<td>Using SingArea \Off</td>
<td>See Manual modifications on page 28.</td>
</tr>
</tbody>
</table>

*Continues on next page*
Wrist is tilted

The figure illustrates the tilted wrist. In this position the robot uses other tool orientations than a robot with 4 axes for some work areas, for example wall mounted work areas. No bending backward positions are used.

<table>
<thead>
<tr>
<th>Configuration</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Using SingArea \Wrist</td>
<td>Not recommended.</td>
</tr>
<tr>
<td>Using SingArea \LockAx4</td>
<td>Not recommended.</td>
</tr>
<tr>
<td>Using SingArea \Off</td>
<td>See <em>Manual modifications on page 28</em>.</td>
</tr>
</tbody>
</table>
Robot is bending backwards

The figure illustrates the robot bending backwards. In this case the robot uses bending backward movements to reach some work areas. The tool can have various orientations.

<table>
<thead>
<tr>
<th>Configuration</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Using SingArea \Wrist</td>
<td>Not recommended.</td>
</tr>
<tr>
<td>Using SingArea \LockAx4</td>
<td>Not recommended.</td>
</tr>
<tr>
<td>Using SingArea \Off</td>
<td>See <em>Manual modifications on page 28</em>.</td>
</tr>
</tbody>
</table>

Manual modifications

When the robot configuration is set to SingArea \Off, the following modifications are required for robot to run properly:

1. Use ConfL \Off. Update the system module pmrcUser, with the procedure PmDoAction from system module pmrcSys and rename the procedure to DoAction. Modify DoAction according to description in section *System module pmrcUser on page 29*. Linear motion supervision must be turned off to allow movements with large axis reorientations (> 90°).

2. Use a robot position for each work area with MoveJ. In PzPP browser, record a safe position for each feeder, and use MoveJ for each position. See Safe Targets *Set WorkObject position on page 177*. First ensure the angles of axis 4 and 6 do not reach the physical limitation. Then ensure the robot has the correct arm configuration when operating on the work area.
First ensure the angles of axis 4 and 6 do not reach the physical limitation. Then ensure the robot has the correct arm configuration when operating on the work area.

**System module pmrcUser**

Modify the system module *pmrcUser*, with the procedure *DoAction* copied from procedure *PmDoAction* in system module *pmrcSys*.

```plaintext
... 
IF Act.ArmConfMon = TRUE THEN
  ConfL\Off;
  ConfJ\On;
ELSE
  ConfL\Off;
  ConfJ\On;
ENDIF 
... 
```

You find the complete program code for the system modules *pmrcUser* and *pmrcSys* in section *Program code on page 229*.

**Note**

The following modifications must be done in the program code:

- ConfL\Off
- ConfJ\On

**Note**

The procedure *Operate* in program module *PmMain* must be updated with a call to *DoAction* instead of *PmDoAction*.

**Parallel rod robot**

**RAPID calls to PMCalcArmConf**

When using a parallel rod robot, the same modifications need to be done as described for the bending backwards robot. For a parallel robot only the scenarios *Axis 6 points down on page 26* and *Wrist is tilted on page 27* are possible.

Following modification needs to be done in addition to what is described for bending backwards robots:

All RAPID calls to the routine *PmCalcArmConf* must use the optional argument \TypeB1 instead of \cf6.
2 Introduction

2.5 Using a robot with 6 axes

Continued

pmMain.mod

Modify the program module pmMain.mod, procedure Operate:

... PmCalcArmConf
    Act.RobTgt, Tgt.TargetTool, Tgt.TargetWobj\TypeB1\MaxAngle:=
    MaxToolAngle\MinAngle:=MinToolAngle\SingAreaType:=Act.SingAreaType;
...

Related information

Group operation set on page 180.
Pattern/Stack operation set on page 183.
Public system module pmrcUser on page 227.
3 Installation

3.1 System requirements

Hardware and software requirements

The following are the prerequisites for installing Palletizing PowerPac:

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

<table>
<thead>
<tr>
<th>Hardware requirements</th>
<th>Software requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPU: 2.0 GHz or faster processor, recommended is multicore</td>
<td>Microsoft Windows 7 (32 Bit or 64 bit)</td>
</tr>
<tr>
<td>processor</td>
<td>Microsoft Windows 10 (64 bit)</td>
</tr>
<tr>
<td>Memory: 1 GB RAM or more (More is recommended).</td>
<td>RobotStudio 5.60 or above</td>
</tr>
<tr>
<td>Available disk space: 5+ GB on the system disk, 250+ MB</td>
<td>RobotWare 5.60 or above</td>
</tr>
<tr>
<td>on the installation disk</td>
<td>.NET 4.7.2 Framework</td>
</tr>
<tr>
<td>Graphics card: High performance OpenGL-compatible</td>
<td>.NET 4.7.2 Framework</td>
</tr>
<tr>
<td>graphics card with the corresponding up-to-date drivers</td>
<td></td>
</tr>
<tr>
<td>installed</td>
<td></td>
</tr>
<tr>
<td>Screen resolution: 1280 x 1024 pixels (Recommended)</td>
<td></td>
</tr>
<tr>
<td>Colors: 256 or higher</td>
<td></td>
</tr>
<tr>
<td>DPI: Normal size (96 dpi)</td>
<td></td>
</tr>
<tr>
<td>Mouse: Three-button mouse</td>
<td></td>
</tr>
</tbody>
</table>

Installing Palletizing PowerPac

Use this procedure to install the Palletizing PowerPac:

1. Browse to Palletizing PowerPac installation package and double-click Setup.exe.
   The installation starts.

2. Read the License Agreement and accept the terms.

3. Click Install.

4. When the installation is finished, complete the installation wizard by clicking Finish.

Note

Ensure that you have RobotStudio installed on your computer before installing Palletizing PowerPac.

Installing a license

To install a license of RobotStudio and PowerPac, see Operating manual - RobotStudio.
Versions of Palletizing PowerPac

The Palletizing PowerPac is available in the following two versions:

- **Basic**: The Basic version has limited features and is available free of cost.
- **Premium**: The Premium version has advanced features and is available on paying a subscription fee.

**Note**

The Basic version requires a Station or Pack&Go file.

Following are the details of the features available in the two versions of Palletizing PowerPac.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Basic</th>
<th>Premium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Build Cell</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>- Add Tool</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Build Cell</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>- Add Feeder</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Product Data</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>- Product/Pallet/Sheet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Pallet Patterns</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Programming</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>- Pick Setting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Add Job</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Validation</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>- Check Reachability</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Preview Palletizing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Simulation</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>- Start</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Pause/Stop</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Reset</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transfer</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>- Add Controller</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Download</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Upload</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project Properties</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>- Overview</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- IO Interface</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Unpack data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Report</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project Properties</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>- Pack Data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Delete Projects</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Import PM5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Advanced</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>- Library</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Models</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3 Installation

3.1 System requirements

Continued

<table>
<thead>
<tr>
<th>Feature</th>
<th>Basic</th>
<th>Premium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced - IOPanel</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>3D Tools and Help</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

The support for the different versions of Palletizing PowerPac depends on the RobotStudio version installed on your system as displayed in the following table:

<table>
<thead>
<tr>
<th>RobotStudio version</th>
<th>Palletizing PowerPac Basic</th>
<th>Palletizing PowerPac Premium</th>
</tr>
</thead>
<tbody>
<tr>
<td>RobotStudio Basic</td>
<td>Limited features</td>
<td>Not available</td>
</tr>
<tr>
<td>RobotStudio Premium</td>
<td>Limited features</td>
<td>Full features</td>
</tr>
</tbody>
</table>

**Note**

Graphics is disabled in the Basic version of RobotStudio and Palletizing PowerPac.
4 Workflow

4.1 Introduction

The following is the recommended working procedure for Palletizing PowerPac with PickMaster.
4 Workflow

4.2 Preparing your controller for PickMaster

Prerequisites
To run a PickMaster application you must prepare your robot controller for PickMaster. You create and install a system for the robot controller using RobotStudio.

The option Prepared for PickMaster, with the sub-option Palletizing PowerPac, is needed to run PickMaster on an IRC5 robot controller.

Preparing your controller for PickMaster
Use this procedure to prepare the controller for PickMaster:

<table>
<thead>
<tr>
<th>Action</th>
<th>Note/See</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Create and install a system for the robot controller using RobotStudio.</td>
</tr>
<tr>
<td>2</td>
<td>Setup RAPID tool data for the robot tool. Use RobotStudio or the FlexPendant.</td>
</tr>
<tr>
<td>3</td>
<td>Calibrate the work object for each feeder. Use the FlexPendant.</td>
</tr>
<tr>
<td>5</td>
<td>Add feeder related signals. Use RobotStudio or the FlexPendant.</td>
</tr>
<tr>
<td>6</td>
<td>Add event related signals if you want an external equipment to report errors and/or messages to the PickMaster application. Use RobotStudio or the FlexPendant.</td>
</tr>
</tbody>
</table>
4.3 How to add tool

On the Palletizing tab, click Add Tool to import a tool for the palletizing process. See Add tool on page 55 for detailed description.
On the Palletizing tab, click Add Feeder to import a feeder and add to a robot for the palletizing process. Continue to add other feeders. At least two feeders are required for each robot. See Add feeder on page 57 for detailed description.
4.5 How to create or modify product data

On the Palletizing ribbon tab, click Product/Pallet/Sheet to create or modify items for the palletizing process.
See Product/Pallet/Sheet on page 59 for detailed description.

On the Palletizing ribbon-tab, click Pallet Patterns to create or modify patterns for the palletizing process.
See Pallet pattern on page 72 for detailed description.
4.6 How to set pick setting

On the Palletizing tab, click Pick Setting to define how products from a group or a stack are picked by a robot tool.

See Pick setting on page 79 for detailed description.

Note

This function is only available when at least one item is created, and one tool is attached to at least one robot.
4.7 How to add job

On the Palletizing tab, click Add a Job to create a job for palletizing process. See Add job on page 83 for detailed description.
4.8 How to do simulation

On the Palletizing tab, click Start button to start simulation, Stop button to stop simulation and Reset button to clean the temporary objects generated in the previous simulation.

See Simulation on page 93 for detailed description.
4.9 How to adjust cell layout to achieve reachability

If Check Reach or Simulation has reported unreachable targets, you usually have following ways to adjust the cell:

- **Move feeders:** You can enable the Freehand Move, click on the feeder model in the station, and drag it to an appropriate position. You can also use the Set WorkObject Position to change the feeder location.
- **Move robot:** You can also move the robot by Freehand Move or by Set Position of the corresponding robot model.

After you have changed robot position, a message box will show up to ask you whether to update the Task Frame:

![Image of message box asking if you want to move the Task Frame]

Choose Yes to update Task Frame, otherwise, the controller needs to be restarted. Then a further message box will ask you to keep the positioning of all stationary RAPID variables (for example, work object):

![Image of message box asking if you want to keep the positioning of all stationary RAPID objects]

Choose Yes to keep all work object values unchanged, otherwise the work objects will move together with the robot.
4 Workflow

4.10 How to transfer the project

4.10 How to transfer the project

On the Palletizing ribbon-tab, click Add Controller to connect to online controllers, and Download to check the destinations and transfer the project onto the online controllers.

See Add controller on page 101 and Download on page 102 for detailed description.
4.11 How to start production

Introduction

To run a PickMaster project in production you can use the PickMaster FlexPendant interface.

Starting production

Use this procedure to start a PickMaster project.

<table>
<thead>
<tr>
<th>Action</th>
<th>See</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Start the PickMaster FlexPendant interface.</td>
<td></td>
</tr>
<tr>
<td>2 Select the project you want to run.</td>
<td>Opening a project on page 236.</td>
</tr>
<tr>
<td>3 Start the project.</td>
<td>Starting a project on page 237.</td>
</tr>
<tr>
<td>4 Start flows.</td>
<td>Starting a specific flow on page 238 and Starting and stopping all flows on page 240.</td>
</tr>
</tbody>
</table>

Related information

* FlexPendant interface on page 234.
* Opening a project on page 236.
* Starting and stopping production on page 237.
4.12 How to Pack Palletizing Project Data to Controller

On the Palletizing tab, in the Project group, click Add Controller to connect to online controllers. Click on Pack Data in Project group to transfer the palletizing project configured in RobotStudio Station to online or offline controllers.

For more information, see Add controller on page 101 and Pack data on page 111.
4.13 How to UnPack Palletizing Project Data from Controller

On the Palletizing tab, in the Project group, click Add Controller to connect to online controllers. Click on UnPack Data in Project group to transfer the palletizing project configured in RobotStudio Station from online or offline controller.

For more information, see Add controller on page 101 and UnPack data on page 114.
4.14 How to Import PickMaster5 Projects into Palletizing PowerPac

Palletizing tab, in the Project group, click on Import PM5 to convert PickMaster5 project to palletizing project.

For more information, see Import PM5 on page 117.
5 User interface

5.1 Introduction

This chapter describes how to navigate in Palletizing PowerPac. Windows and other parts of the user interface are described in respect of their content and how they are accessed. The description of the main layout provides an overview of the menus, ribbon commands, and windows in Palletizing PowerPac.
5.2 General

Overview

Before starting Palletizing PowerPac, you must load a RobotStudio station. In a station without system and robot, you are able to edit products, pallet patterns, create custom grippers and feeders, and edit libraries. In a station with a system and at least one robot, you can continue to add tools and feeders to the robots, to configure flows and pick/place operation sets on feeders. The virtual controller (VC) associated with the robot must be loaded with Prepare for PickMaster option and Palletizing PowerPac sub-option.

Loading a Station

You can go through following steps to create a station and a system, and start using Palletizing PowerPac:

1. Open RobotStudio and create an empty station.
2. Select a palletizing robot and create a system from layout.
3. In the Systems option list, check Prepare for PickMaster – Palletizing PowerPac. Finish system building and wait until system is ready.
4. On the Add-Ins tab in the ribbon, select Palletizing from the PowerPacs group.
5. A dedicated tab for Palletizing is added to the ribbon.
6. The Palletizing ribbon and tree structure browser opens.
7. Start from ribbon left to right: add tool, add feeder, add products, add patterns, add job, simulate, add real controllers and download.

Note

For other ways to create a station and a system, refer to Operating manual - RobotStudio.
The User Interface

The panes and windows of the user interface, described in the following figure, help you create a well-structured palletizing program.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Palletizing ribbon tab</td>
<td>Contains the general functions for palletizing application. When creating a new project, the work flow is usually from left to right. See Ribbon on page 52 for detailed description.</td>
</tr>
<tr>
<td>2 Palletizing browser</td>
<td>Organizes the components of the station and project in a tree structure. See Layout browser on page 146 for detailed description.</td>
</tr>
<tr>
<td>3 Tool window</td>
<td>Dialog boxes to edit certain project elements in browser and ribbon.</td>
</tr>
<tr>
<td>4 Graphics window</td>
<td>The graphics window is coordinated with the selection in browser elements and edited object in the tool window, showing context related temporary graphic objects.</td>
</tr>
</tbody>
</table>
5 User interface

5.3 Ribbon

5.3.1 Overview

The Palletizing PowerPac ribbon contains the following controls

- Building cell
- Creating pick and place programs
- Operating virtual controller
- Modifying Palletizing PowerPac data
- Modeling tools and feeders
- Help information

Elements on the Palletizing ribbon-tab

<table>
<thead>
<tr>
<th>Group</th>
<th>Button</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Build Cell</td>
<td>Add Tool</td>
<td>Add a tool to robot for palletizing/depalletizing. See Add tool on page 55 for detailed description.</td>
</tr>
<tr>
<td></td>
<td>Add Feeder</td>
<td>Add feeders to the cell for palletizing/depalletizing. At least two feeders are needed for a robot. See Add feeder on page 57 for detailed description.</td>
</tr>
<tr>
<td>Product Data</td>
<td>Product/Pallet/Sheet</td>
<td>Create products, pallets or sheets to be palletized/depalletized. See Product/Pallet/Sheet on page 59 for detailed description.</td>
</tr>
<tr>
<td></td>
<td>Pallet Patterns</td>
<td>Create pattern related to the products to be palletized/depalletized. See Pallet pattern on page 72 for detailed description.</td>
</tr>
<tr>
<td>Programming</td>
<td>Pick Setting</td>
<td>Define how robot tool picks the products, pallets or sheets. See Pick setting on page 79 for detailed description.</td>
</tr>
<tr>
<td></td>
<td>Add Job</td>
<td>Open Job Wizard to build a new palletizing/de-palletizing job. See Add job on page 83 for detailed description.</td>
</tr>
<tr>
<td>Validate</td>
<td>Check Reach</td>
<td>Check whether all of the picking robot targets and placing robot targets are reachable.</td>
</tr>
<tr>
<td></td>
<td>Settings on Check</td>
<td>Check whether the specified picking robot targets and placing robot targets are reachable. See Check reach on page 88 for detailed description.</td>
</tr>
<tr>
<td></td>
<td>Reachability</td>
<td>Preview all pick and place targets for all operation sets on feeders, by jumping tool or robot to the robot targets accordingly. See Preview Palletizing on page 90 for detailed description.</td>
</tr>
</tbody>
</table>

Continues on next page
<table>
<thead>
<tr>
<th>Group</th>
<th>Button</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Simulation</strong></td>
<td><strong>Quick Start</strong></td>
<td>Transfer program to virtual controller, open operator interface and start the simulation with the default jobs in one click. See Operator interface on page 94 for detailed description.</td>
</tr>
<tr>
<td></td>
<td><strong>Operator Interface</strong></td>
<td>Transfer program to virtual controller, open operator interface. Then start the simulation for the specified jobs manually. See Operator interface on page 94 for detailed description.</td>
</tr>
<tr>
<td></td>
<td><strong>Record Simulation as Viewer</strong></td>
<td>Select this option to save the simulation as viewer file after the simulation is stopped. See Record as viewer File on page 99 for detailed description.</td>
</tr>
<tr>
<td></td>
<td><strong>Speed Mode</strong></td>
<td>Set simulation speed and there are three modes for it, such as Full, Customized and Low. See Speed mode on page 100 for detailed description.</td>
</tr>
<tr>
<td><strong>Transfer</strong></td>
<td><strong>Add Controller</strong></td>
<td>Connect a controller with this station using RobotStudio Online functionality.</td>
</tr>
<tr>
<td></td>
<td><strong>Download</strong></td>
<td>Download the program to connected controllers. See Download on page 102 to Controllers for detailed description.</td>
</tr>
<tr>
<td></td>
<td><strong>Upload</strong></td>
<td>Upload the program from the connected controller. See Upload on page 104 from Controllers for detailed description.</td>
</tr>
<tr>
<td><strong>Project</strong></td>
<td><strong>Overview</strong></td>
<td>Displays the overview information for all operation sets in the project. See Project overview on page 106 for detailed description.</td>
</tr>
<tr>
<td></td>
<td><strong>I/O Interface</strong></td>
<td>Displays the I/O information for this project. See I/O interface on page 107 for detailed description.</td>
</tr>
<tr>
<td></td>
<td><strong>Report</strong></td>
<td>Generate a report for this project. See Project report on page 110 for detailed description.</td>
</tr>
<tr>
<td></td>
<td><strong>Pack Data</strong></td>
<td>Stores the Palletizing PowerPac project in the controller (Virutal or Real controller). See Pack data on page 111 for detailed description.</td>
</tr>
<tr>
<td></td>
<td><strong>UnPack Data</strong></td>
<td>Unpacks the stored Palletizing PowerPac project to the controller (Virutal or Real controller). See UnPack data on page 114 for detailed description.</td>
</tr>
<tr>
<td></td>
<td><strong>Delete Projects</strong></td>
<td>Deletes the saved projects from the Virtual or Online Controller. See Delete projects on page 116 for more details.</td>
</tr>
<tr>
<td><strong>Advanced</strong></td>
<td><strong>Library</strong></td>
<td>Edit the default libraries for reuse. See Library on page 119 for detailed description.</td>
</tr>
<tr>
<td></td>
<td><strong>Models</strong></td>
<td>Guide user to design customized tool and feeder. See Create Tool on page 120 and Create Feeder on page 139 for detailed description.</td>
</tr>
</tbody>
</table>

*Continues on next page*
## 5 User interface

### 5.3.1 Overview

<table>
<thead>
<tr>
<th>Group</th>
<th>Button</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IOPanel</td>
<td>Monitors and sets the signals used during palletizing process. See IOPanel on page 142.</td>
</tr>
<tr>
<td>3D Tools</td>
<td>View angles</td>
<td>Adjust the view point for the station from top, left, and front.</td>
</tr>
<tr>
<td></td>
<td>Freehand move</td>
<td>Enable to adjust the position/orientation for the selected objects by manual dragging in 3D view.</td>
</tr>
<tr>
<td>Help</td>
<td>Help</td>
<td>Provides the user manual of Palletizing PowerPac.</td>
</tr>
<tr>
<td></td>
<td>About</td>
<td>Provides the general information about Palletizing PowerPac.</td>
</tr>
</tbody>
</table>
5.3.2 Add tool

1. On the Palletizing ribbon Tab, in the Build Cell group, click Add Tool.

2. Under Add Tool select the tool from ABB Grippers, User Grippers, or Browse Library to select a gripper. The Add Tool dialog appears.

   **Note**

   One robot can only hold one tool for palletizing/depalletizing.

3. Do one of the following:
   - Click OK to add the selected tool to the robot. The robot will hold the tool and the signals will be connected between the tool and the virtual controller automatically.
• Click **Add to Station Only** to only add the selected tool into the station only. The robot will not hold the tool and there is no signal connection between the tool and the virtual controller.

4 After the tool is added to the robot, a new **Tool** node will be added under the robot node in the programming browser, and also a tool node will be added in the layout browser.

<table>
<thead>
<tr>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>When a custom tool is added the signals are mapped automatically to the free available signals based on their type.</td>
</tr>
</tbody>
</table>
5.3.3 Add feeder

1 On the Palletizing ribbon tab, in the Build Cell group, click Add Feeder.

2 Under Add Feeder select the Feeder from ABB Feeders, User Feeders, or Browse Library to select a feeder.

Note
There should be at least two feeders for a robot for palletizing/depalletizing.

3 After a feeder library is selected, the following dialog box pops up.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controller</td>
<td>Select a controller in which the robot to work with the feeder belongs to.</td>
</tr>
<tr>
<td>Robot</td>
<td>Select a robot in which the feeder is added.</td>
</tr>
<tr>
<td>Signal Configuration</td>
<td>Provide the match information about signals connection between the feeder and the virtual controller. If the signal connection is not valid, the status light is red, and you can check and modify with button Edit Signals. See Edit detailed signals for feeder on page 173 for detailed description.</td>
</tr>
</tbody>
</table>
5 User interface

5.3.3 Add feeder

Continued

4 Do one of the following:
   - Click OK to add the selected feeder to the robot. The signals are connected between the feeder and the virtual controller automatically.
   - Click Add to Station Only to add the selected feeder into the station only. There is no signal connection between the feeder and the virtual controller.

5 After the feeder is added, a new feeder node is added under the Feeders node of the robot in the programming browser, and also a new feed node is added in the layout browser.
5.3.4 Product/Pallet/Sheet

1. On the Palletizing ribbon tab, in the Product Data group, click Product/Pallet/Sheet.

2. In the Product/Pallet/Sheet dialog box, click on any of the four item types: Box, Bag, Pallet, or Sheet.

   **Note**
   In a project, at least one box or one bag should be created.

   **Note**
   After an object is selected from the item list, its properties will be shown on the right of the UI.

For each type of item, there are two types for its collection:

- **Group**: a row by column grouping of several items, to describe how many items are handled by the robot at one pick. Usually for boxes and bags that comes with several rows.

   Palletizing PowerPac supports the handling of multiple columns of items in the group. This allows the user to create a group with multiple columns in the Products dialog. The creation of a multi column item group also means that the Layouts in the Operation sets have to be handled according to the number and arrangement of items in the group. This has been handled for a few groups.

*Continues on next page*
To use multiple columns, mention the number of columns to be picked by the gripper in the **Product/Pallet/Sheet** dialog box. Also, ensure that the pattern layout has a count that is divisible by the number of items in the format.

**Note**

Multi column support is handled only for the start corner X-Y-, the user is free to use other combinations but the layouts may require manual corrections.

Currently the Operation set generation is handled only for “Back” orientation for the BoxGroup (Item group).

It is recommended to manually check for collisions in the Operation set while the boxes are being placed as it is currently not possible to check for collisions.

- **Stack**: stacking of items by several layers. Usually for pallets and sheets, which are stacked together with several layers.

<table>
<thead>
<tr>
<th>Click</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>Box</td>
<td>Create a new box as item with default values, and a default box group will be created simultaneously.</td>
</tr>
<tr>
<td>Bag</td>
<td>Create a new bag as item with default values, and a default bag group will be created simultaneously.</td>
</tr>
<tr>
<td>Pallet</td>
<td>Create a new pallet as item with default values, and a default pallet stack will be created simultaneously.</td>
</tr>
<tr>
<td>Sheet</td>
<td>Create a new sheet as item with default values, and a default sheet stack will be created simultaneously.</td>
</tr>
<tr>
<td>Group</td>
<td>Create a new group for the selected item.</td>
</tr>
<tr>
<td>Stack</td>
<td>Create a new stack for the selected item.</td>
</tr>
<tr>
<td>Delete</td>
<td>Delete the selected object (product, group or stack) in the item list.</td>
</tr>
<tr>
<td>Export</td>
<td>Export the existing items to an XML file for reusing.</td>
</tr>
<tr>
<td>Import</td>
<td>Import and create items from an XML file.</td>
</tr>
</tbody>
</table>
Box Properties

This section describes how to edit the box properties.

<table>
<thead>
<tr>
<th>To...</th>
<th>Do this</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rename a Box</td>
<td>In the Name text box, type a new name for the box. In default, a unique name can be generated automatically when a new box is created.</td>
</tr>
<tr>
<td>Set I/O value</td>
<td>In the I/O value number box, type a value to identify different products. Or click the button besides it, a new I/O value can be found automatically.</td>
</tr>
<tr>
<td>Select Box from Library</td>
<td>In the Library drop-down combo box, select an existing box to read in its values.</td>
</tr>
<tr>
<td>View the Item Type</td>
<td>In the Type combo box, the item type is shown. Its type cannot be changed after the item is created.</td>
</tr>
<tr>
<td>Set Box Size</td>
<td>In the Size boxes, type the dimensions for x, y and z.</td>
</tr>
<tr>
<td>Set Box Weight</td>
<td>In the Weight number box, type the weight (in kg).</td>
</tr>
<tr>
<td>Set Box Facing</td>
<td>Select the check boxes in Facing group to define which sides of the box to attach a label. See below ‘Note’ for detailed description.</td>
</tr>
<tr>
<td>Save the Box</td>
<td>Click Save As Library button, current box will be saved into the library for reusing.</td>
</tr>
<tr>
<td>Edit Advanced Settings for Box</td>
<td>Click Show Advanced Settings button, the advanced settings of the box will be shown in the right window and can be modified manually. See Advanced setting for Item on page 66.</td>
</tr>
<tr>
<td>Show a Box</td>
<td>With the specified size and facing setting, the box can be shown in the 3D View.</td>
</tr>
</tbody>
</table>
### 5 User interface

5.3.4 Product/Pallet/Sheet

Continued

---

**Note**

The facing defines the sides of a product that are of specific importance. A facing side could be a label or a carton opening (See *Advanced setting for Item on page 66* to know how to change the label picture). If the product is to be used in a pallet pattern, the products can be placed in a way that will maximize labels on the outside or openings in a specific direction.

---

**Bag Properties**

This section describes how to edit the bag properties.

**Properties**

<table>
<thead>
<tr>
<th>Name</th>
<th>Bag</th>
</tr>
</thead>
<tbody>
<tr>
<td>Library</td>
<td>Custom</td>
</tr>
<tr>
<td>Setting</td>
<td></td>
</tr>
<tr>
<td>Size (mm)</td>
<td>400.00</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>1.00</td>
</tr>
<tr>
<td>Margin</td>
<td>0</td>
</tr>
<tr>
<td>Facing</td>
<td>X (mm)</td>
</tr>
<tr>
<td></td>
<td>Y (mm)</td>
</tr>
</tbody>
</table>

**3D View**

---

```
xx110000011
```

---

<table>
<thead>
<tr>
<th>To...</th>
<th>Do this</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rename a Bag</td>
<td>Same as Box</td>
</tr>
<tr>
<td>Set I/O value</td>
<td>Same as Box</td>
</tr>
<tr>
<td>Select Bag from Library</td>
<td>Same as Box</td>
</tr>
<tr>
<td>View the Item Type</td>
<td>Same as Box</td>
</tr>
<tr>
<td>Set Bag Size</td>
<td>Same as Box</td>
</tr>
<tr>
<td>Set Bag Weight</td>
<td>Same as Box</td>
</tr>
<tr>
<td>Set Bag Margin</td>
<td>In the Margin number boxes, type the margin distance which is allowed for overlapping between multiple bags in a pallet pattern.</td>
</tr>
<tr>
<td>Set Bag Facing</td>
<td>Same as Box</td>
</tr>
<tr>
<td>Save the Bag</td>
<td>Same as Box</td>
</tr>
<tr>
<td>Edit Advanced Settings for Bag</td>
<td>Same as Box</td>
</tr>
<tr>
<td>Show a Bag</td>
<td>Same as Box</td>
</tr>
</tbody>
</table>

Continues on next page
This section describes how to edit the pallet properties.

<table>
<thead>
<tr>
<th>To...</th>
<th>Do this</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rename a Pallet</td>
<td>Same as Box</td>
</tr>
<tr>
<td>Set I/O value</td>
<td>Same as Box</td>
</tr>
<tr>
<td>Select Pallet from Library</td>
<td>Same as Box</td>
</tr>
<tr>
<td>View the Item Type</td>
<td>Same as Box</td>
</tr>
<tr>
<td>Set Pallet Size</td>
<td>Same as Box</td>
</tr>
<tr>
<td>Set Pallet Weight</td>
<td>Same as Box</td>
</tr>
<tr>
<td>Set Pallet Facing</td>
<td>Same as Box</td>
</tr>
<tr>
<td>Save the Pallet</td>
<td>Same as Box</td>
</tr>
<tr>
<td>Edit Advanced Settings for Pallet</td>
<td>Same as Box</td>
</tr>
<tr>
<td>Show a Pallet</td>
<td>Same as Box</td>
</tr>
</tbody>
</table>
Sheet Properties

This section describes how to edit the Sheet properties.

<table>
<thead>
<tr>
<th>Property</th>
<th>Do this</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rename a Sheet</td>
<td>Same as Box</td>
</tr>
<tr>
<td>Set I/O value</td>
<td>Same as Box</td>
</tr>
<tr>
<td>Select Sheet from Library</td>
<td>Same as Box</td>
</tr>
<tr>
<td>View the Item Type</td>
<td>Same as Box</td>
</tr>
<tr>
<td>Set Sheet Size</td>
<td>Same as Box</td>
</tr>
<tr>
<td>Set Sheet Weight</td>
<td>Same as Box</td>
</tr>
<tr>
<td>Set Sheet Facing</td>
<td>Same as Box</td>
</tr>
<tr>
<td>Save the Sheet</td>
<td>Same as Box</td>
</tr>
<tr>
<td>Edit Advanced Settings for Sheet</td>
<td>Same as Box</td>
</tr>
<tr>
<td>Show a Sheet</td>
<td>Same as Box</td>
</tr>
</tbody>
</table>
This section describes how to edit the Group properties.

<table>
<thead>
<tr>
<th>Property</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group Name</td>
<td>In the Group Name text box, type a new name for the group. In default, a unique name can be generated automatically when a new group is created.</td>
</tr>
<tr>
<td>Used Item</td>
<td>In the Used Item combo box, this used item name will be shown. Its value cannot be changed after the group is created.</td>
</tr>
<tr>
<td>Orientation</td>
<td>In the Orientation combo box, select the group orientation to use. The selection defines the side of the group to place in negative y direction. A green marker shows the origin of each item.</td>
</tr>
<tr>
<td>Row Count</td>
<td>In the Row Count number box, type a value to define the rows of the group.</td>
</tr>
<tr>
<td>Column Count</td>
<td>In the Column Count number box, type a value to define the columns of the group.</td>
</tr>
<tr>
<td>I/O Value</td>
<td>The I/O value is a combined value and is calculated from the orientation of the group and the number of rows and columns of occurrences of the item in the group. The I/O value represents the different ways a group can arrive on a conveyor. Also it is possible to type a value to identify different products in the I/O value number box. Click the button on the right, a new valid I/O value will be assigned.</td>
</tr>
<tr>
<td>Weight</td>
<td>With the specified row and column, the group can be shown in the 3D View.</td>
</tr>
</tbody>
</table>

Continues on next page
Stack Properties

This section describes how to edit the stack properties.

In the Stack Name text box, type a new name for the stack. In default, a unique name can be generated automatically when a new stack is created.

- **Rename a Stack**
  - In the Stack Name text box, type a new name for the stack. In default, a unique name can be generated automatically when a new stack is created.

- **View Used Item**
  - In the Used Item combo box, this used item name will be shown. Its value cannot be changed after the stack is created.

- **Set Stack Orientation**
  - In the Orientation combo box, select the stack orientation to use. The selection defines the side of the stack to place in negative y direction. A green marker shows the origin of each item.

- **Set Stack Height**
  - In the Height Count number box, type a value to define the layers of the stack.

- **Show a Stack**
  - With the specified row and column, the group can be shown in the 3D View.

Advanced setting for Item

After one item is created, its advanced settings can be edited as well. There are 3 pages for its settings: General, Pick/Place and Motion Limits.

Continues on next page
In this section the general settings about the CAD of the item can be adjusted.

![CAD Settings](image)

<table>
<thead>
<tr>
<th>To...</th>
<th>Do this</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set Label Picture</td>
<td>Click the <strong>Browse</strong> button to select a custom picture as the product label.</td>
</tr>
<tr>
<td>Set Texture</td>
<td>Select the <strong>Use Texture</strong> check box to use the selected picture as texture.</td>
</tr>
<tr>
<td>Set Customized Model</td>
<td>Select the <strong>Use Customized Model</strong> check box, and then click the <strong>Browse</strong> button to select a customized CAD model for the item. If customized model is used changing the size of the item will not affect the model itself.</td>
</tr>
<tr>
<td>Show Outline</td>
<td>Select the <strong>Show Outline in CAD model</strong> check box to display the outline of the CAD item as thin lines along the product edges.</td>
</tr>
<tr>
<td>Show Origin</td>
<td>Select the <strong>Show Origin in CAD model</strong> check box to display the origin of the CAD item as green markers on the top and bottom surfaces.</td>
</tr>
</tbody>
</table>
5 User interface

5.3.4 Product/Pallet/Sheet

Continued

<table>
<thead>
<tr>
<th>To...</th>
<th>Do this</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set Color</td>
<td>Click Color to select the color of the CAD item.</td>
</tr>
<tr>
<td></td>
<td>Note</td>
</tr>
<tr>
<td></td>
<td>The color is hidden if texture is used.</td>
</tr>
<tr>
<td>Apply Tune Values</td>
<td>Click Apply Tune Values to set the tuned values as the default values for individual products.</td>
</tr>
</tbody>
</table>

Pick/Place

In this section the timing of tool events can be set, in order to pick and place the item as efficient as possible. You can define the pick time, that is, the time the robot is standing still in the pick position when picking up the item. Similarly the place time can also be defined, that is, the time the robot is standing still in the place position when placing the item.

The drop offset for the item in a pattern operation set can be set as well. This is usually used for bag when being released with an offset above the already finished stack. If a pattern operation set is created using this item, the value will be used as each layer’s drop offset. See Offsets for each layer on page 186 for detailed information.
### 5 User interface

#### 5.3.4 Product/Pallet/Sheet

Continued

<table>
<thead>
<tr>
<th>To...</th>
<th>Do this</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set Time Values for Vacuum Activation and Deactivation.</td>
<td>In the Vacuum Activation Time and Vacuum Deactivation Time number boxes, type the values.</td>
</tr>
<tr>
<td>Adjust Time that Robot Stays at the Robot Target Position When Picking or Placing an Item.</td>
<td>In the Pick Time and Place Time number boxes, type the time in seconds.</td>
</tr>
<tr>
<td>Set Drop Offset</td>
<td>In the Drop Offset number box, type the offset (in mm). It is useful for releasing bag from a certain height.</td>
</tr>
</tbody>
</table>

You can adjust the location, where the tool zone gets activated when picking the item. The time when the zone should activate, Vacuum Activation Time, is specified in seconds before reaching the pick position. If a negative time is specified, activation will take place after reaching the pick position. If the time is set to zero, activation will occur after half the pick time has passed.

![Diagram showing robot speed, time, tool activation, and pick time.](image)

You can also adjust the location, where the tool zone gets deactivated when placing the item. The time when the zone should deactivate, Vacuum deactivation time, is specified in seconds before reaching the place position. If a negative time is
specified, deactivation will take place after reaching the place position. If the time is set to zero, deactivation will occur after half the place time has passed.
**Motion Limits**

In this section the default speed and acceleration limits for the item can be defined. Also the tuned speed and acceleration of the item can be viewed. To edit separate motion configurations for the actions (Pick Approach, Pick Depart, Place Approach and Place Depart), select the Use * check box of the action to edit. If the Use * check box is cleared, the default settings will be used for this action.

<table>
<thead>
<tr>
<th>Advanced</th>
<th>Name: Box1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>General</td>
</tr>
<tr>
<td>General Motion Limits</td>
<td>Tuned</td>
</tr>
<tr>
<td>Speed 5000.0</td>
<td>5000.0 m/s</td>
</tr>
<tr>
<td>Acc/Dec 10.0</td>
<td>10.0 mm/s</td>
</tr>
<tr>
<td>Rot Speed 500.0</td>
<td>500.0 deg/s</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>To...</th>
<th>Do this</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set Maximum Speed</td>
<td>In the Speed number box, type the maximum allowed speed.</td>
</tr>
<tr>
<td>Set Acceleration/Deceleration</td>
<td>In the Acc/Dec number box, type the acceleration value (in mm/s). The same value will be used for both acceleration and deceleration.</td>
</tr>
<tr>
<td>Set Maximum Rotation Speed</td>
<td>In the Rot Speed number box, type the maximum allowed rotation speed (in deg/s).</td>
</tr>
</tbody>
</table>

**Note**

There is NO need to set approach or depart speed because these will be limited by the acceleration and deceleration limits.
5 User interface

5.3.5 Pallet pattern

5.3.5 Pallet pattern

Introduction

1 On the Palletizing ribbon tab, in the Product Data group, click Pallet Patterns.

The Pallet Patterns dialog box opens and you can create or import pallet pattern to be used in the station.

Note

The items that are defined before using Product/Pallet/Sheet are listed in the pattern. In a project, at least one pallet pattern should be created. After one pallet pattern is selected in the Pallet Patterns list, its corresponding properties are displayed on the right side.

The following table describes the details of the Pallet Pattern list section:

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add Pattern button</td>
<td>Creates a new pallet pattern with the selected items. For more information, see Pallet Pattern Layout on page 73.</td>
</tr>
<tr>
<td>button</td>
<td>Deletes the selected pallet pattern from the pattern list.</td>
</tr>
<tr>
<td>Import button</td>
<td>Imports and creates pallet patterns from an XML file. The used items in the XML file will also be created in station.</td>
</tr>
<tr>
<td>Export button</td>
<td>Exports the existing pallet patterns into an XML file.</td>
</tr>
</tbody>
</table>

Continues on next page
The following table describes the details of the Properties dialog box:

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>General properties</td>
<td><strong>Name</strong>: Displays the name of the selected pallet pattern. You can also edit the name of the selected pallet pattern. <strong>Check Max Height</strong>: Verifies the selected maximum height. <strong>Clamp Thickness</strong>: Allows you to specify the thickness of the clamp static board. This thickness is used to create gaps to accommodate the static board of the clamp between the boxes inside the pattern. Each pattern is updated according to the location of the static board when the clamp gripper places the items. <strong>Select Format</strong>: Allows you to select the format that is used when a clamp gripper is configured. The format selection specifies the relative orientation of the items with the clamp gripper. This relative orientation is used to find the location of the static board while re-calculating the pallet patterns to accommodate the gaps.</td>
</tr>
</tbody>
</table>

1. **Generate and select layouts section**

   - Based on the selected pallet, product, sheet and inputted pallet margin, the possible layout is calculated. You can also select the layouts saved in the library. You can choose a layout and click the right arrow button to select into the 2. **Selected Layouts section**.

2. **Selected Layouts section**

   - The selected layouts can be modified, and/or used directly to create layers. The specified layout can also be saved to reuse. You can choose a selected layout and click the right arrow button to add into pattern layers.

3. **Pattern Layers section**

   - Displays the whole layers in a pallet pattern. For each layer you can also see the layout name, and adjust the mirror type.

**Layout View section**

- Displays the 2D view of any selected layout in the above 3 lists of layouts.

---

**Pallet Pattern Layout**

This section describes defining the pallet pattern layout. A pallet pattern is built as a stack of item layouts. Layout contains only one type of item.

<table>
<thead>
<tr>
<th>To...</th>
<th>Do this</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select Pallet Area</td>
<td>In the selection box Pallet Area, select the pallet to use. If there are no pallets defined before, a default pallet area (1200 mm* 800mm) will be used for calculating the layout, which can be modified. The layout will be generated based on the selected pallet or input pallet size, and the margin.</td>
</tr>
<tr>
<td>Set Pallet Margin</td>
<td>In the Pallet Margin text box, type the minimum allowed margin (in mm). This will limit the maximum layout size by including a safety margin to the size of the palletizing area.</td>
</tr>
<tr>
<td>Select Product</td>
<td>Select the Product to be used, that is, a box or a bag.</td>
</tr>
<tr>
<td>Select Sheet</td>
<td>Select the Sheet to use. That is optional for the pallet pattern.</td>
</tr>
</tbody>
</table>
Note

You must always select a pallet, even if it will not be included in the pallet pattern. The pallet defines the maximum size of each layout. The pallet can NOT be changed once a layout based on the pallet is selected but sheet and product can be changed to build a pallet pattern with different items.

When the appropriate items are selected, the Layout Source list will be populated with the generated layouts. The layouts are generated for the selected product using different algorithms. Information, such as Item, Count, and Coverage, is shown for each layout.

The layouts that are saved in the library are selected by choosing From Library in Layout Source. After you have selected a new sheet, product, or given a new margin, new layouts are generated based on the new information. The new layouts are listed in the Layout Source list. All layouts in the Selected Layouts list are not affected and still use the old product and margin.

<table>
<thead>
<tr>
<th>To...</th>
<th>Do this</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access Library Layouts</td>
<td>In the Layout Source drop-down list, select From Library. This will show all layouts from the library converted to use the selected items.</td>
</tr>
<tr>
<td>Select Layouts to Use in the Pallet Pattern</td>
<td>In the Layout Source list, select the layouts of interest and click right arrow button to bring it to the Selected Layouts list.</td>
</tr>
<tr>
<td>Edit Layout</td>
<td>In the Selected Layouts list, select the layout and click Edit Layout button. This opens up the Layout Editor. See Layout Editor on page 75 for detailed description.</td>
</tr>
<tr>
<td>Export to Library</td>
<td>In the Selected Layouts list, select the layout and click Export to Library.</td>
</tr>
<tr>
<td>Show a Layout</td>
<td>In either the Layout Source or the Selected Layouts list, select the layout and it is displayed in the Layout View.</td>
</tr>
<tr>
<td>Remove Layout from Selected List</td>
<td>In the Selected Layouts list, select the layout to remove and click the Delete button.</td>
</tr>
</tbody>
</table>
Pallet Pattern Layers

This section describes how to proceed with the pallet pattern layer. When the layouts to use in the pallet pattern are defined, continue with setting the order and number of layers. The resulting pallet pattern is always shown in the Pattern Layers together with the stack details.

<table>
<thead>
<tr>
<th>To...</th>
<th>Do this</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add Layers</td>
<td>In the Selected Layouts list, select the layout you want to use and click the right arrow button to add to the Pattern Layers list.</td>
</tr>
<tr>
<td>Remove Layers</td>
<td>In the Pattern Layers list, select the layer and click [x] to remove every layer in the Pattern Layers list.</td>
</tr>
<tr>
<td>Reorder Layers</td>
<td>In the Pattern Layers list, select the layer and click [&gt;] [&lt;] to reorder the layers in the list.</td>
</tr>
<tr>
<td>Show a Layer</td>
<td>In the Pattern Layers list, select the layer and it will be shown in the Layout View.</td>
</tr>
<tr>
<td>Show Pallet Pattern</td>
<td>All of the layers in the Pattern Layers list will be shown in the Pattern Layers View.</td>
</tr>
</tbody>
</table>

Layout Editor

Introduction

Layout Editor is to create new or modify existing layouts. The purpose of modifying layouts is to make them fit the operator’s specific requirements. A layout can be saved to the Library and/or to a pallet pattern configuration for a project.

Depending on which layout to edit, you can start the Layout Editor in two ways:

1. From the Library, if you want to edit a layout that is included in the library.
   - In the library tree view, select a layout item to edit. For more information, see Library on page 119.
   - Click Edit.
   - The Layout Editor window appears and you can edit the layout.

2. From a Pallet Pattern dialog box, if you want to edit a layout that is included in a Pallet Pattern.
   - Select the pallet pattern that includes the layout to edit.
   - In the Selected Layouts list, select the layout to edit.
5 User interface

5.3.5 Pallet pattern

Continued

- Click Edit Layout
- The Layout Editor window appears and you can edit the layout.

Illustration, Layout Editor

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Layout</td>
<td>Shows the name of the layout and the size of the area where to palletize. The Layout area is mostly the area of a pallet. The Layout margin is the free distance from the edge of the palletizing area to the actual layout. The values for Layout area and Layout margin are only editable when there are no items in the layout.</td>
</tr>
<tr>
<td>Item</td>
<td>The drop-down combo box shows the selected item. If you add a new item, it will be added to the layout. If there are no items in the layout, you select which item to add. When you edit a library layout you can change the selected item to any of the available items in the library. When you edit a layout in a pallet pattern, you cannot change the item.</td>
</tr>
<tr>
<td>Display</td>
<td>Shows the layout of a layer. Here you modify the layout by using a drag-and-drop operation or the buttons on the right side. The Show Overlap check box provides an option to show the overlapping boxes in red.</td>
</tr>
<tr>
<td>Selection</td>
<td>Shows the position and orientation of the selected item. You can adjust the position by editing the values in the text boxes, or by using CTRL + arrow keys.</td>
</tr>
</tbody>
</table>

Continues on next page
### 5.3.5 Pallet pattern

**Re-orientation**

This feature is supported only in grippers with clamp. The **Start Corner** combo box contains all the four possible start corner options. On click of **Re-orient** button, the items are re-oriented to avoid moving clamp collision and the re-orientation is based on start corner, current orientation and the pick format selected from the pallet patterns window. When re-orientation is applied, the layout buttons, and context menu options are disabled. On click of **Reset** button, re-orientation functionality is reverted.

**Note**

If a layout is re-oriented in a pallet pattern, then new targets need to be generated for all the operation sets that uses the same pallet pattern.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Re-orientation</td>
<td>This feature is supported only in grippers with clamp. The <strong>Start Corner</strong> combo box contains all the four possible start corner options. On click of <strong>Re-orient</strong> button, the items are re-oriented to avoid moving clamp collision and the re-orientation is based on start corner, current orientation and the pick format selected from the pallet patterns window. When re-orientation is applied, the layout buttons, and context menu options are disabled. On click of <strong>Reset</strong> button, re-orientation functionality is reverted.</td>
</tr>
<tr>
<td>Layout information</td>
<td>Shows the number of items in the layout and its coverage ratio. If there are any overlapping shapes, this will be noted here as well.</td>
</tr>
</tbody>
</table>

**Proceed with the item**

<table>
<thead>
<tr>
<th>To...</th>
<th>Do this</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select multiple items</td>
<td>Press and hold the CTRL key while you click the items to select. Or use Press Left mouse key + Drag to multi select items</td>
</tr>
<tr>
<td>Select all items</td>
<td>Click Select All, or perform a select all operation (CTRL+A).</td>
</tr>
<tr>
<td>Add a new item</td>
<td>Click Add.</td>
</tr>
<tr>
<td>Copy an item</td>
<td>Click the item to copy and perform a copy-and-paste operation (CTRL+C for copy, CTRL+V for paste).</td>
</tr>
<tr>
<td>Delete the selected item/items</td>
<td>Click Delete, or press the Delete button on the keyboard.</td>
</tr>
<tr>
<td>Rotate the selected item/items</td>
<td>Click Rotate.</td>
</tr>
</tbody>
</table>

**Proceed with the layout**

<table>
<thead>
<tr>
<th>To...</th>
<th>Do this</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mirror the layout in x direction</td>
<td>Click Flip Horizontal.</td>
</tr>
<tr>
<td>Mirror the layout in y direction</td>
<td>Click Flip Vertical.</td>
</tr>
<tr>
<td>Rotate the entire layout 180°</td>
<td>Click Rotate.</td>
</tr>
<tr>
<td>Center the layout</td>
<td>Click Center.</td>
</tr>
</tbody>
</table>
5 User interface

5.3.5 Pallet pattern

Continued

Align and distribute

The selected items can be aligned relative to each other by their edges. When you
align items, the marked item always remains stationary. For example, clicking Align
Left aligns the left edges of all selected objects with the left edge of the marked
item. The selected items can also be distributed relative to the marked item. When
items are distributed, all selected items are moved adjacent to the marked item in
a horizontal or vertical direction. The marked item always remains stationary.
Distribution of items is normally followed by an alignment operation.

Tip

All the commands are also accessible from the menu that appears when you
select an item and right-click.

Related information

Library on page 119
Pallet pattern on page 72
Terms and concepts on page 22
5.3.6 Pick setting

Procedure

1. On the Palletizing ribbon tab, in the Programming group, click Pick Setting to define how the item group or a stack is held by a robot tool.

2. The item and tool orientations can be configured, along with the tool functions (and zones if vacuum function is used) to activate when gripping the items. Furthermore, tool I/O signal events can be defined to control specific tool functionality.

3. | Item               | Description                                                                 |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Add</td>
<td>Create a new pick setting for an item group or a stack.</td>
</tr>
<tr>
<td>Delete</td>
<td>Delete the selected pick setting.</td>
</tr>
<tr>
<td>Show Pick Setting</td>
<td>In the Pick Setting list, select the pick setting and the tool with the items will be shown in the 3D View. Weight information is shown, including product weight, and tool weight. If the product weight is more than the max payload of the tool’s used tool data, a warning icon will be shown. Additionally, format ID is shown.</td>
</tr>
</tbody>
</table>

After one object is selected in the pick setting list, its preview and corresponding properties will be shown in the right.

Note
It is possible to define more than one pick settings for a same item group or stack.

Continues on next page
5 User interface

5.3.6 Pick setting

Continued

Tool Location

This section describes how to adjust the tool location relative to the group or the stack.

To... | Do this
--- | ---
Align Position between tool functions (and/or zones) with products | Select the tool functions (and zones if the tool contains vacuum function) from the left selection list, and select the product in the right selection list. The tool will then be put to a location where the tool function position is at the center top of the product. Note that this is only used to change tool location, and does not necessarily mean that the selected tool function will be used to pick the product. To set which tool function to use for picking each product, see Item - Tool Function Match on page 81.

Tool Alignment | Tool alignment allows you to position the tool based on the selection relative to the object which is being picked. This is valid only in the case of clamp gripper. For the rest of the grippers the default position is center.

Adjust Offset and Rotation | Input the translation offset and rotation angles (or click the rotation buttons) to adjust detailed offsets. The offset is relative to the aligned tool function and the selected product.

View TCP location | The TCP name and location is shown. The location is relative to the item group or stack’s origin.
Item - Tool Function Match

This section describes how to adjust the match relationship between item and tool function, i.e., which tool function is used to pick or place each item.

**To...** | **Do this**
--- | ---
Select Tool Scenario | In the Tool Scenario list, select the tool scenario you want to use. The tool scenario defines a group of tool functions that will be used in the pick setting, and tool functions not included in a tool scenario will not be activated. See Tool events and scenarios on page 135 for detailed information.
Adjust Relationship between Tool Function and Items | For each item, select a tool function to match with this item. If vacuum is selected for one item, it should also be used for other items.
Adjust Relationship between Tool Zone and Items (if vacuum is used) | If vacuum is used, you need to check the match between zones and items, i.e., using which zones to pick/place which items. Select Auto Calculate to automatically calculate the default item-zone matches.

When simulation is running, robot is at a pick position, and tool open signals are activated, the picking sensor of the tool functions will also be activated and any items that intersect with the sensor area will be picked up. Thus to make simulation of picking work, the picking location of the tool, relative to the items, should make the picking sensor areas of the tool function intersect with the matched item.

Continues on next page
See Create Tool on page 120 for detailed information on picking sensor of different type of tool functions.

Note

The position of the tool, as well as the match between tool function and item, are important for simulation of picking to work.

Additional Events

This section describes how to edit the additional events for the tool.

For some pick settings, the items cannot be picked or placed by only using the defined tool functions and/or zones - for example, when picking a pallet using a specific I/O driven tool that cannot be modeled by standard tool functions. In such cases it is possible to set digital or group output signals and wait for digital input signals at various positions when picking or placing the products. These I/O events can be set for each pick or place operation at first approach action, last approach action, target action and first depart action, and last depart action. You must also define the value to set for output signals and the value to check for digital input signals. See an example in the following illustration.

<table>
<thead>
<tr>
<th>Type</th>
<th>Signal Name</th>
<th>Value</th>
<th>Preset Time</th>
<th>Movement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set</td>
<td>G0_Gripper</td>
<td>2</td>
<td>0</td>
<td>PickFirstApproach</td>
</tr>
<tr>
<td>Wait</td>
<td>G1_GripperOpen</td>
<td>1</td>
<td>0</td>
<td>PickFirstApproach</td>
</tr>
<tr>
<td>Set</td>
<td>G0_Gripper</td>
<td>1</td>
<td>0</td>
<td>Pick</td>
</tr>
<tr>
<td>Wait</td>
<td>G1_GripperClosed</td>
<td>1</td>
<td>0</td>
<td>PickLastDepart</td>
</tr>
<tr>
<td>Set</td>
<td>G0_Gripper</td>
<td>1</td>
<td>0</td>
<td>PickLastDepart</td>
</tr>
<tr>
<td>Wait</td>
<td>G1_GripperClosed</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

xx110000028

Type of the event:
- Set: set an output signal to a value at a specific movement.
- Wait: check the value of an input signal that indicates the actual status of the tool. In this example used for checking that the desired action indicated by the group output signal has been achieved.

Signal Name: The signal that is used in the event

Preset Time: The time in advance for the out signal to set to a value (only used for Set output type)

Movement: Describes when event occurs, i.e., first approach action, last approach action, target action and first depart action, or last depart action.
After the cell is built, the product data is created and the pick setting is ready, a new job for palletizing/depalletizing can be created with a wizard.

1. On the Palletizing ribbon tab, in the Programming group, click Add Job to open a wizard to create a new job for palletizing/depalletizing in three steps.

<table>
<thead>
<tr>
<th>Page</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Match Feeders with Products/Pattern for Picking/Placing</td>
</tr>
<tr>
<td>2</td>
<td>Configure Operation Set for Group or Stack</td>
</tr>
<tr>
<td>3</td>
<td>Configure Operation Set for Pallet Pattern</td>
</tr>
</tbody>
</table>

2. Distribute the roles of each feeders as described in the following table:

<table>
<thead>
<tr>
<th>To...</th>
<th>Do this</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set Job Type</td>
<td>There are two types for the job, Palletizing and Depalletizing. It should be defined for the job at first. In the Job Type group, select the radio box to define the job type.</td>
</tr>
<tr>
<td>Select Controller and Robot</td>
<td>In the Robot group, select a controller and a robot in which the job is added.</td>
</tr>
</tbody>
</table>

Continues on next page
## 5 User interface

### 5.3.7 Add job

*Continued*

<table>
<thead>
<tr>
<th>To...</th>
<th>Do this</th>
</tr>
</thead>
</table>
| **Select Feeder as Master** | Master feeder is usually the feeder where the palletizing/de-palletizing jobs will be started. See *Flow on page 201* for detailed information.  
  In the Feeder selection box, select one feeder as the master. Note that feeders that are not valid to be a master (for example, those being slave feeders for existing flows) are not listed in the selection box.  
  Once the master feeder is selected, the other feeders of the robot valid as slave will be listed in the tree view.  
  If this feeder is not used as master by any existing flow, when the job creation is finished, a new flow will be created as well, including the newly generated job.  
  If this feeder is a master of an existing flow, when the job is created, the existing flow will include the newly created job. |
| **Select Pallet Pattern for the Job** | In the Pattern selection box, select one pallet pattern. This pattern will be implemented in this job. In the main 3D view, the selected pallet pattern will be shown on the master feeder. Once the pallet pattern is selected, the necessary groups or stacks to build the pallet pattern will be listed in the list view (i.e. Groups and Stacks list). |
| **Adjust Orientation for Selected Pallet Pattern** | Click Flip button, the orientation of selected pallet pattern will be flipped 90 degrees on the master feeder. |
| **Select Feeder to Feed in Products** | Select one candidate feeder in the right list, select one group or stack in the left list, click Right Arrow button, the selected group or stack will be added under the selected candidate feeder. It means that this feeder will feed in (or out) products in this palletizing (or de-palletizing) job. Groups or stacks provided by existing operation sets on the feeder will also be listed. |
| **Remove Feeder from Feeding in Products** | In the right list, select one group or stack under a candidate feeder, click Delete button, the selected group or stack will be removed from the candidate feeder. It means that this selected group on this feeder will not play a role in this job. |
| **Adjust Orientation for Selected Group or Stack** | In the right list, select one group or stack under a candidate feeder, click Flip button, the orientation of selected group or stack will be flipped 90 degrees on this feeder. |

3 **Click Next button** to continue to the next step.

**Tip**

In the main 3D View, the products can be moved directly to adjust their position and orientation.

4 **Configure Operation Set for Group or Stack** and then **Configure Operation Set for Pallet Pattern** is described in the following sections.
Configure operation set for group or stack

After the group or stack is selected, the operation set is configured. In general, if this job type is palletizing, the action for the operation set in this page is Picking, otherwise the action is Placing.

Each group or stack on each feeder will have its own operation set. The operation set will define how to pick or place the group or stack based on the pick setting related to the corresponding group or stack.

<table>
<thead>
<tr>
<th>To...</th>
<th>Do this</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rename the Operation Set</td>
<td>In the Name text box, type a new name for the operation set. In default, a unique name can be generated automatically when a new operation set is created.</td>
</tr>
<tr>
<td>Select Pick Setting</td>
<td>Each group or stack should have at least one pick setting defined before. Based on the selected group or stack, one appropriate pick setting can be selected in the Pick Setting selection box for this operation set.</td>
</tr>
<tr>
<td>Set Stack Search</td>
<td>In some cases before picking the items (usually for pallet or sheet), the position of the items should be searched. Select Stack Search check box, the robot will search the height of pallet or sheet before picking it.</td>
</tr>
</tbody>
</table>
| Check Reach                | Click Check Reach button to validate the reachability of all robot targets related to picking/placing the group/stack. The color of the icon next to the Check Reach button will show the check result:  
  - Green: all robot targets can be reached  
  - Red: some of robot targets cannot be reached.  
  If it is red, then move mouse cursor over the icon and a tooltip will be shown, indicating which operation sets are not reachable. Select the corresponding operation set, and the unreachable items will turn red in main 3D view. For more information, see Check reach on page 88.  
  You can adjust feeder position, flip group.Stack position, or move robot to make all targets reachable. |
Configure operation set for pallet pattern

After the pallet pattern and corresponding group or stack are selected, and pick settings are selected for slave feeders, the operation set for the master feeder is configured. In general, if this job type is palletizing, the action for the operation set is Placing, otherwise the action is Picking.

A new pallet pattern operation set will be created, that defines the sequence and positions of picking/placing operations, using the pick settings selected for the related groups/stacks.

### To... | Do this
--- | ---
Preview Palletizing | Click Preview Palletizing button, a preview dialog will pop out to visualize all the robot targets in the main 3D view, which you can go through step-by-step.
For more information, see Preview Palletizing on page 90.

Click **Next** button to continue to the next page.

---

Configure operation set for pallet pattern

After the pallet pattern and corresponding group or stack are selected, and pick settings are selected for slave feeders, the operation set for the master feeder is configured. In general, if this job type is palletizing, the action for the operation set is Placing, otherwise the action is Picking.

A new pallet pattern operation set will be created, that defines the sequence and positions of picking/placing operations, using the pick settings selected for the related groups/stacks.

### To... | Do this
--- | ---
Rename the Operation Set | In the Name text box, type a new name for the operation set. In default, a unique name is generated automatically when a new operation set is created.

Edit the Pallet Pattern | Select one layer in the Pattern Layers list, this layer layout will be shown in Layer Properties view. Click Edit button, a dialog box will be shown to edit the selected layer. See Layout Editor on page 75 for detailed description. Select Start Corner combo box, this layer will change its start corner according to the selection.

---

5 User interface

5.3.7 Add job

Continued
### To... | Do this
--- | ---
Check Reach | Click **Check Reach** button, to validate the reachability of all robot targets related to picking/placing the pattern. The color of the icon next to the **Check Reach** button will show the check result:
- Green: all robot targets can be reached
- Red: some of robot targets cannot be reached.
If is is red, the unreachable items in the selected pattern will turn red in main 3D view. For more information, see *Check reach on page 88*. You can adjust feeder position, flip group/stack position, or move robot to make all targets reachable.

Preview Palletizing | Click **Preview Palletizing** button, a preview dialog will pop out to visualize all the robot targets in the main 3D view, which you can go through step-by-step. See *Preview Palletizing on page 90* for detailed description.

Show Selected Layer in 3D View | Select **Show Selected Layer in 3D View** check box and select one layer in the Pattern Layers list, the selected layer will be shown in 3D View and layers above it will be invisible.

Click **Finish button** to complete the wizard.

After a job is created, the corresponding program nodes will be added into the browser, including new operation sets, flow and new jobs under the flow.
5.3.8 Check reach

When any robot targets are generated in the station, it is possible to validate whether they are reachable.

1. On the Palletizing ribbon tab, in the Validate group, click Check Reach button, to validate the reachability of all robot targets related to picking/placing the pattern. If all robot targets are reachable, the icon displays green. Otherwise it turns red.

2. If there are unreachable targets, a warning dialog box pops up with the message 'Do you want to see details'. If you click Yes, a list appears on the right side with the reach status of all the items.

**Note**

It is recommended that before downloading program and running simulation, all targets should be checked to be reachable.

<table>
<thead>
<tr>
<th>Do this</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check Selected Object</td>
</tr>
<tr>
<td>Select an object in the check list and click Check button, or double</td>
</tr>
<tr>
<td>click the object, the robot targets contained by the object will be</td>
</tr>
<tr>
<td>checked. The light status will change its color according to the check</td>
</tr>
<tr>
<td>result. Green means that the robot targets can be reached while red</td>
</tr>
<tr>
<td>means that some of robot targets cannot be reached.</td>
</tr>
</tbody>
</table>

Continues on next page
### 5 User interface

#### 5.3.8 Check reach

Continued

<table>
<thead>
<tr>
<th>To...</th>
<th>Do this</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check All Robot Targets</td>
<td>Click Check All button, all objects in the list will be checked.</td>
</tr>
<tr>
<td>Show Unreachable Products</td>
<td>If some objects contain unreachable targets after checking, click on the object and the unreachable items in the selected object will turn red in main 3D view. Information of unreachable targets will also be shown in RobotStudio output window.</td>
</tr>
</tbody>
</table>
5.3.9 Preview Palletizing

**Previewing the Palletizing operation**

For any operation set, the operation process can be previewed. That is, each pick or place robot target can be checked. The preview helps you to check the sequence of picking and placing, and check on the possible collisions.

To preview the Palletizing operation:

1. On the Palletizing ribbon tab, in the Validate group, click *Preview Palletizing*.

   The preview interface is displayed in the right window. All existing operation sets are listed in the Palletizing Programs group.

   ![Preview Palletizing interface](image)

2. Select an operation set in the list, and select preview preview palletizing options according to your requirement.
The following figure and table provides information regarding the preview palletizing options.

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Play Control - Speed</td>
<td>You can drag the button in the speed track bar and adjust the preview play speed from the slowest to the fastest.</td>
</tr>
<tr>
<td>Play Control - Step</td>
<td>Type a step number in the box and press ENTER. The preview goes to the specified step.</td>
</tr>
<tr>
<td>Play controls</td>
<td>Click to play all preview steps one by one from the current step.</td>
</tr>
<tr>
<td></td>
<td>Click to pause the preview step at the current step.</td>
</tr>
<tr>
<td></td>
<td>Click to stop the preview step the first step.</td>
</tr>
<tr>
<td></td>
<td>Click or the up arrow in Steps number box to navigate the previous step.</td>
</tr>
<tr>
<td></td>
<td>Click or the down arrow in Steps number box to navigate to the next step.</td>
</tr>
<tr>
<td>Show with Tool</td>
<td>Select the Tool check box to display the tool during the preview process.</td>
</tr>
<tr>
<td>Show with Robot</td>
<td>Select Robot check box, the robot holding the tool jumps to each robot target during the preview process. If the robot target is not reachable, the robot will not move to this robot target.</td>
</tr>
</tbody>
</table>
The Arm Configuration list displays all the possible arm configurations for a selected target in the operation set. You can define Safe targets and Search targets with their respective configuration. Click Apply Config to apply the selected configuration to the current target.

Following are the known limitations of Arm Configuration option:

- Arm configurations for General Offset targets, Horizontal Approach/Depart targets, and Extra Z targets have by default the same configuration as the item placement target and cannot be edited.
- If a Pallet pattern has the same layout pattern in all the layers, then the Arm configurations are same through all the layers. The arm configurations within a layer can be changed but cannot be changed layer to layer.

**Note**

When defining search targets you can select the reachable Arm configurations for Search targets and subsequent Box pick targets.

**Note**

The configurations are retained for small displacements in Feeder positions and Operation set displacements. For larger displacements Arm configurations may have to be redefined.

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arm Configuration</td>
<td>The Arm Configuration list displays all the possible arm configurations for a selected target in the operation set. You can define Safe targets and Search targets with their respective configuration. Click Apply Config to apply the selected configuration to the current target. Following are the known limitations of Arm Configuration option:</td>
</tr>
<tr>
<td></td>
<td>- Arm configurations for General Offset targets, Horizontal Approach/Depart targets, and Extra Z targets have by default the same configuration as the item placement target and cannot be edited.</td>
</tr>
<tr>
<td></td>
<td>- If a Pallet pattern has the same layout pattern in all the layers, then the Arm configurations are same through all the layers. The arm configurations within a layer can be changed but cannot be changed layer to layer.</td>
</tr>
<tr>
<td></td>
<td><strong>Note</strong></td>
</tr>
<tr>
<td></td>
<td>When defining search targets you can select the reachable Arm configurations for Search targets and subsequent Box pick targets.</td>
</tr>
<tr>
<td></td>
<td><strong>Note</strong></td>
</tr>
<tr>
<td></td>
<td>The configurations are retained for small displacements in Feeder positions and Operation set displacements. For larger displacements Arm configurations may have to be redefined.</td>
</tr>
<tr>
<td>Reset Configuration</td>
<td>The Rest Configuration list allows you to reset the configurations. Configurations could be reset for each target as well as for the entire operation set by selecting Reset All Layers.</td>
</tr>
<tr>
<td></td>
<td><strong>Note</strong></td>
</tr>
<tr>
<td></td>
<td>To reset the configuration of an individual operation, first select the operation set in the browser tree.</td>
</tr>
<tr>
<td></td>
<td><strong>Note</strong></td>
</tr>
<tr>
<td></td>
<td>When a target is reset, the configurations for all the offset targets surrounding the target are reset.</td>
</tr>
<tr>
<td>Show Robot Targets</td>
<td>Select Show Robot Targets check box, the robot targets related to the operation set will be shown in main 3D view.</td>
</tr>
<tr>
<td>Show Target Description</td>
<td>Select Show Target Description check box, the description about the robot targets will be shown in main 3D view.</td>
</tr>
</tbody>
</table>
5.3.10 Simulation

Click Start button, the following three simulation steps will be executed automatically and the operator interface will be displayed in the right window.

1. Download the project file to virtual controller.
2. Load project file into PickWare and start project.
3. Start flows and jobs.

The Pause is to Pause the simulation. On Pausing the button changes to Step. The step allows you to advance the simulation step by step.

If the simulation is started, the Stop button will be enabled. Click Stop button, the simulation will be stopped.

The Reset button is enabled when simulation is not started. Click Reset button, the simulation environment will be reset, the products created during the simulation will be cleaned, and the station is ready for next simulation.
Click **Operator Interface**, the first two simulation steps will be executed. You can then start the flows and jobs with the buttons in this interface.

The project status is shown on top of the interface:

<table>
<thead>
<tr>
<th>Project status</th>
<th>Description</th>
<th>Status Light</th>
</tr>
</thead>
<tbody>
<tr>
<td>Started</td>
<td>The project has been started successfully.</td>
<td>xx110000044</td>
</tr>
<tr>
<td>Starting</td>
<td>The project is in the starting process.</td>
<td>xx110000045</td>
</tr>
<tr>
<td>Stopped</td>
<td>The project has been stopped.</td>
<td>xx110000046</td>
</tr>
<tr>
<td>Error</td>
<td>Error occurs during the project execution.</td>
<td>xx110000047</td>
</tr>
</tbody>
</table>

Below the project status, there are two pages in the operator interface:
Control page

Control the starting and stopping of flows, and the job sequences for each flow.

All available flows are listed in the Controllers and Flows group. After the project is started, the status light will show different color to indicate flow status.

<table>
<thead>
<tr>
<th>Project status</th>
<th>Description</th>
<th>Status Light</th>
</tr>
</thead>
<tbody>
<tr>
<td>Running</td>
<td>The flow is running.</td>
<td>xx110000044</td>
</tr>
<tr>
<td>Stopping</td>
<td>The flow is in the stopping process.</td>
<td>xx110000045</td>
</tr>
<tr>
<td>Stopped</td>
<td>The flow has been stopped.</td>
<td>xx110000046</td>
</tr>
</tbody>
</table>
## 5 User interface

### 5.3.11 Operator interface

**Continued**

<table>
<thead>
<tr>
<th>Project status</th>
<th>Description</th>
<th>Status Light</th>
</tr>
</thead>
<tbody>
<tr>
<td>Error</td>
<td>Error occurs during the flow execution.</td>
<td>xx110000047</td>
</tr>
</tbody>
</table>

**Flow control**

For the flows in the Controller and Flows group, their execution status can be controlled by the right buttons.

<table>
<thead>
<tr>
<th>To...</th>
<th>Do this</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start a Flow</td>
<td>Select one flow in the Controllers and Flows group whose status is Stopped, click to start the selected flow. If the selected flow is to be restarted, a flow recover option can be selected to specify how and when the flow must be restarted. If the status of the selected flow is not Stopped, this button will be disabled.</td>
</tr>
<tr>
<td>Stop a Flow</td>
<td>Select one flow in the Controllers and Flows group whose status is Running, click to stop the selected flow. A flow stop option can be selected to specify how and when the flow must be stopped. If the status of the selected flow is not Running, this button will be disabled.</td>
</tr>
<tr>
<td>Start All Flow(s)</td>
<td>Click to start all flows. If some of flows are to be restarted, a flow recover option can be selected to specify how and when these flows must be restarted. This button is enabled when the status of some of the flows are Stopped.</td>
</tr>
<tr>
<td>Stop All Flow(s)</td>
<td>Click to stop all flows. A flow stop option can be selected to specify how and when the flow must be stopped. This button is enabled when the status of some of the flows are Running.</td>
</tr>
</tbody>
</table>

**Scheduled Jobs**

When one flow is selected, the scheduled jobs belonging to this flow will be refreshed in Scheduled Jobs group as well.

<table>
<thead>
<tr>
<th>To...</th>
<th>Do this</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add Job</td>
<td>In the Scheduled Jobs group, click button and a dialog will pop up. The dialog shows all supported jobs of the flow. Select one job and click OK button, the selected job will be added into the list.</td>
</tr>
<tr>
<td>Delete a Job</td>
<td>In the Scheduled Jobs group, select one job and click to delete the selected job from the list.</td>
</tr>
<tr>
<td>Reorder Jobs</td>
<td>In the Scheduled Jobs group, select one job and click the Up or Down button to reorder the job in the list.</td>
</tr>
</tbody>
</table>

**Continues on next page**
To... | Do this
---|---
Repeat the Jobs | Select Run Continuously check box, the jobs in the list will be executed repeatedly.

**Statistics Tab**

**Statistics Tab** displays the statistics information for the palletizing process, including cycle time, throughputs, and certain event logs.

When the simulation is started, the statistics information is continuously updated to display the palletizing process data.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
</table>
| Simulation Time | Display the simulation time in second.
5 User interface

5.3.11 Operator interface

Continued

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product Data</td>
<td>Display how many products are inputted and outputted and the calculated data of throughput (based on outputted products and cycle time).</td>
</tr>
<tr>
<td>Simulation Event Log</td>
<td>Display the main event log for palletizing process.</td>
</tr>
</tbody>
</table>
5.3.12 Record as viewer File

Check this option, to save the whole simulation as RobotStudio Viewer file after the simulation is stopped.
5 User interface

5.3.13 Speed mode

5.3.13 Speed mode

There are three speed modes for the simulation process: Full, Customized and Low.
You can check and change the speed mode, before the simulation is started. Default mode is Low.
Note that the specified speed is effective when robot is moving without products. If robot is moving with products, the speed is limited by the motion limits of the product itself.
5.3.14 Add controller

On the Palletizing ribbon tab, in the Transfer group, under Add Controller click one of the following:

- Add Controller - For adding available controllers to the network
- One Click Connect - For connecting to the service port of the controller

For more information on Online functionality, See Operating manual - RobotStudio.
On the Palletizing ribbon tab, in the Transfer group, click Download, the download interface will be displayed. The available virtual controllers and online controllers will be listed in the table.

The download includes:

- Synchronizing work object and tool data values, if downloading to virtual controller(s)
- Checking the completeness of project setups
- Generating and transferring the configuration files
- Generating and transferring the tune file to Pickware
To... | Do this
---|---
Download Program to Online Controller | Clear the Download to Virtual Controller check box. After the online controller(s) is added as described above, the available online controller(s) will be available to select in the table’s Online Controller column. Match each virtual controller with an online controller, and click Download button to download the program to the available online controller(s).

Note

The download to online controllers is task based. You can select any particular task in the online controller to download from the station.

Download Program to Virtual Controller | Select Download to Virtual Controller check box, and click Download button to download the program to virtual controller(s).

Before transferring the project, it is checked for errors to ensure that the configuration is valid.

Note

The project verification when transferred to the controller does not include verification of the RAPID program.

Note

It is not possible to transfer a project to a controller that is running the very same project. To update a project on a controller, the project must first be stopped.

Note

If the same project already exists on the controller, the tuning will be overwritten. To preserve the tuning use function before the downloading.
On the Palletizing ribbon tab, in the Transfer group, click Upload button in ribbon, the upload interface gets displayed. The available virtual controllers and online controllers will be listed in the table.

The upload includes:

- Reading the work object and tool data values from controller: feeder positions and tool function positions in the project will be updated accordingly.
- Reading the tune value from Pickware: the product sizes (the graphical model), feeder tune offsets (thus operation set positions on the feeders) will be updated accordingly.
### 5 User interface

#### 5.3.16 Upload

**Continued**

<table>
<thead>
<tr>
<th>To...</th>
<th>Do this</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upload Program from Online Controller</td>
<td>Unselect <strong>Upload from Virtual Controller</strong> check box. After the online controller(s) is added as described above, the available online controller(s) will be available to select in the table’s <strong>Online Controller</strong> column. Match each virtual controller with an online controller, and click Upload button to upload data from the available online controller(s).</td>
</tr>
<tr>
<td>Upload Program from Virtual Controller</td>
<td>Select <strong>Upload from Virtual Controller</strong> check box, and click Upload button to upload the program from virtual controller(s).</td>
</tr>
</tbody>
</table>
5 User interface

5.3.17 Project overview

On the Palletizing ribbon tab, in the Project group, click Overview button in ribbon to display the overview information for the project.

The dialog shows each configured operation set and its corresponding product and format I/O values. You can also save this information into .txt file by clicking the “Save As Report” button.
5.3.18 I/O interface

On the Palletizing ribbon tab, in the Project group, click I/O Interface button in ribbon to display the I/O information for the project. The interface is a one-stop place to view all information related with PLC for synchronizing with robot for palletizing process. This includes all I/O values used in the projects (items and item groups, pattern operation sets, feeders, flows and projects), and all I/O signal names used in controllers, feeders, tools, and flows.

To save all the information into .txt file, click “Save As Report” button, input file name and click Save.

I/O values

To view and edit all I/O values used in the project.

For Products, Pattern operation sets, and Flows, you can also view and edit their I/O values in their editing interface respectively.

You can click “Generate Default” to generate default values for interested objects.

Continues on next page
If you want to start the projects using a PLC instead of the FlexPendant, then you must assign unique I/O value to each project.

The project I/O values are stored on the controller in the folder HOME:/Pickmaster/RC-Mode/ProjectMapping. A dedicated GI signal, pmProject_giSelection, specifies which project to start.

The projects exist in the controller will be listed on the list view. And their I/O values will be also read from the project mapping file and shown together.

Projects with I/O value of -1 means these projects are not assigned in the mapping file and cannot be remotely started by PLC.

To change an I/O value for a project, you can click on the I/O value number and input a different value.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generate Default</td>
<td>Generate default I/O values for project with unassigned values.</td>
</tr>
<tr>
<td>Export…</td>
<td>Export the project I/O value setup to an xml file.</td>
</tr>
<tr>
<td>Import</td>
<td>Import a project I/O value setup from an xml file. The current setup will be replaced.</td>
</tr>
<tr>
<td>Remove</td>
<td>Remove the project from the list. The removed project I/O value can now be used by another project.</td>
</tr>
</tbody>
</table>
Signals

You can view all the signals used in the project, including the signal name, related object and its type, and the signal’s usage/purpose.
On the Palletizing ribbon tab, in the Project group, click Report button in ribbon to display the process report for the project.

The report function generates a report for all project objects, including item properties, pattern designs, operation sets, and flows.

You can save the report as a PDF or Excel file.
5.3.20 Pack data

1 In the Project group, click Pack Data, the Pack Data interface is displayed in the right window.

![Pack Data]

The available virtual controllers and online controllers are listed in the drop down menu.

2 Click Pack Data To.
The **Pack Data** creates a Pack and Go file of the RobotStudio Station in `.rspag` format and transfers it to the online/virtual controllers.

<table>
<thead>
<tr>
<th>To</th>
<th>Do this</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pack Data to Online Controller</td>
<td>After the online controller(s) is added, the available online controller(s) is available for selection in the drop down menu <strong>Online Controller</strong>. Click <strong>Pack Data To</strong> in tool window and select Online Controller(s).</td>
</tr>
<tr>
<td>Pack Data to Virtual Controller</td>
<td>Click <strong>Pack Data To</strong> in tool window and select Virtual Controller(s).</td>
</tr>
<tr>
<td>To</td>
<td>Do this</td>
</tr>
<tr>
<td>---------------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Include Libraries</td>
<td>Select Include Libraries present in the dialog to include them while packing data.</td>
</tr>
</tbody>
</table>

**Note**

If a similar palletizing project data exists in the controller, the data would be overwritten.
5.3.21 UnPack data

1. In the Project group, click UnPack Data.

The UnPack Data interface is displayed in the right window.

**Controller Name:** Corresponds to the selected controller

**Project Name:** Corresponds to the Palletizing Project name
Pack and Go file: Corresponds to the Pack and Go file created

2 Select either Virtual or Online as the controller type.

**Note**

Based on the selection the Virtual or Online controllers would be populated along with the available pack and go files.

3 Click and select the Pack and Go file.

4 Click UnPack Data.

**Note**

1 The Pack and Go file can also be accessed from the controller system folder.
2 The system that is unpacked will not have the project information in the form of Pack and Go (.rspag). Pack data needs to be done inorder to have the same.
The controller (Virtual or Online Controller) contains reference of projects. The Delete Projects option allows you to delete the saved projects from the selected Controller.

To delete a project:

1. Click the Delete Projects button.
   
   The Delete project from controller window is displayed.

2. Select the controller type from the Select Controller Type section.
   
   The saved projects in the selected controller are displayed.

3. Select the project(s) that you want to delete.

4. Click the Delete button.
   
   The selected projects are removed from the selected controller.
5.3.23 Import PM5

1 In the Project group, click Import PM5.

![Import PM5 interface](image1.png)

The Import PM5 interface is displayed in the right window.

2 Browse and select the PickMaster5 project to be imported (.pmproj).

3 Map the controllers in RobotStudio with the controllers in PickMaster5 project.

4 Map the tasks in RobotStudio with the tasks in PickMaster5 project.

5 Click Import.

Continues on next page
6 The PickMaster5 project is converted to Palletizing PowerPac project structure.

**Note**

1 The Import function will check for `.pmline` file before reading the PickMaster project.
2 Default feeders are used which are provided as part of Palletizing PowerPac.
3 Supports addition of Vacuum gripper tool only
4 The values of Format offset, Format rotation and operation sets are read from the `.pmproj` file, the values are updated during to Palletizing PowerPac AutoCorrect.
5 User needs to update the workobject and tooldata values from the controller.
6 If ItemZoneMap is not manual, the zone mapping is re-calculated automatically and overwritten.
5.3.24 Library

In the Advanced group, click Library to display the libraries used in the project. Library contains template products, pattern layouts, controller messages and tool I/O connections.

In Palletizing PowerPac, there are two places where library files are saved:

- Installation directory: C:\Program Files (x86)\ABB\Palletizing PowerPac 2019\Library
- User directory: “…\My Documents\RobotStudio\Palletizing\Library\”

Library files from each location are retrieved and shown in the UI. New libraries added are stored in the user library and only the library files from the user directory can be edited and saved.

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add an library item</td>
<td>Right click on a group node (i.e., Items, Layouts, Messages, Connections), and click Add context menu</td>
</tr>
<tr>
<td>Edit</td>
<td>Click on the node and edit on the right UI. Note only library items from user directory can be edited and saved. Otherwise, a message will be shown to user for warning.</td>
</tr>
<tr>
<td>Delete</td>
<td>Right click on a library item node, and click Delete context menu.</td>
</tr>
<tr>
<td>Copy an existing item</td>
<td>Right click on a library item node, and click Copy context menu.</td>
</tr>
</tbody>
</table>
5 User interface
5.3.25 Models

Create Tool

The Create Tool interface is used to create a Palletizing PowerPac compatible tool SmartComponent model. The SmartComponent model can then be attached to the robot, or saved as RobotStudio library (.rslib) file, and be imported and reused in other palletizing projects.

Tool Functions

Introduction

A Palletizing PowerPac compatible tool includes properties of:

- Tool weight, center of gravity, and inertia.
- I/O connection template name: the I/O template that can be used as default for the tool. This information is used when the tool is attached to a robot. See Edit Tool Signals on page 168 for detailed information.
- Tool function: A tool should contain at least one tool function. A tool function is a modular function of the tool that is controlled by certain I/O and optionally containing certain behaviors.

For example, the ABB Vacuum Tool in Palletizing PowerPac contains the following three tool functions:

1. Pallet pick function: a type of claw that is controlled by 2 DI signals for opening and closing, and and contains 2 DO signals to tell the opened and closed status. It is usually used to pick up a pallet.

2. Vacuum function: the vacuum is usually controlled by a GI signal to open certain groups of suction cups and close other groups of suction cups. It is usually used to pick boxes.

3. Searcher: the searcher is usually controlled by 2 DI signals for opening and closing, and and contains 2 DO signals to tell the opened and closed status. It is usually used to detect the actual height of a pallet stack. When the searcher is totally opened, and during the downward movement touches the...
pallet, one of the DO signal value is changed so robot will know the actually height of the pallet.

- Tool data: each tool function usually uses one tool data. Thus a tool may contain one or more tool data. These tool data, when the tool is attached to a robot, will be created in station.

The following sections describe:

- How to edit tool weight, I/O template, tool data
- How to add/edit/remove different types of tool functions, and the related tool data

**General tab**

![General tab interface](image)
Choose a default I/O template for this tool. The chosen template will be used as default when the tool is attached to a robot. The available templates are read from library.

Use Tool Height

The height of the tool. This value is considered as the default tool height. If this option is not selected, default height of the tool based on the tool functions is considered as the tool height.

Tool Weight

The weight of the tool. This value is applied to the related tool data in station when this tool is attached to a robot.

Center of Gravity (mm) Center of gravity of the tool. This value is applied to the related tool data in station when this tool is attached to a robot.

Inertia Ix,ly,lz (kgm²) Inertia of the tool. This value is applied to the related tool data in station when this tool is attached to a robot.

Tool data List

A list of tool data that are contained by this tool. Some tool functions of this tool may use one of the tool data. The tool data will be created or overridden accordingly in station when this tool is attached to a robot.

Name Name of the tool data.

Max Payload (Kg) Maximum payload for this tool data. In Pick Setting dialog, if the tool function using this tool data is specified to pick products more than this payload, a warning appears.

TCP (Relative to Tool Origin) The position and orientation of the tool data.

To add/edit/remove tool functions

There are currently 6 types of tool functions defined in Palletizing PowerPac. Click the button, and the following window is displayed:

Following sections describe each tool function, and their related UI interfaces.
A Vacuum function contains one or more Activators, and several activators can be grouped into one zone and opened and closed together. It also contains one or more zone configurations that specify different way of grouping activators into zones.

The editing UI for Vacuum is as following:

<table>
<thead>
<tr>
<th>Properties</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>You can change the tool function name, choose the tool data, and input a control signal name for tool SmartComponent.</td>
</tr>
</tbody>
</table>

**Vacuum1**  
**Tooldata**: Vacuum

**Control Signal**: aSCToolActivators

xx110000080

**Note**

The control signal is for the tool SmartComponent, and is not a robot controller signal.
An activator is a physical correspondent to the control signal, and controls one part of the tool, for example a vacuum cup. The figure shows a configuration example.

### Activators

<table>
<thead>
<tr>
<th>Name</th>
<th>Start Bit</th>
<th>Bit Length</th>
<th>A/D/1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ac1</td>
<td>0</td>
<td>1</td>
<td>0/1</td>
</tr>
<tr>
<td>Ac2</td>
<td>1</td>
<td>1</td>
<td>0/1</td>
</tr>
<tr>
<td>Ac3</td>
<td>2</td>
<td>1</td>
<td>0/1</td>
</tr>
<tr>
<td>Ac4</td>
<td>3</td>
<td>1</td>
<td>0/1</td>
</tr>
<tr>
<td>Ac5</td>
<td>4</td>
<td>1</td>
<td>0/1</td>
</tr>
<tr>
<td>Ac6</td>
<td>5</td>
<td>1</td>
<td>0/1</td>
</tr>
<tr>
<td>Ac7</td>
<td>6</td>
<td>1</td>
<td>0/1</td>
</tr>
<tr>
<td>Ac8</td>
<td>7</td>
<td>1</td>
<td>0/1</td>
</tr>
<tr>
<td>Ac9</td>
<td>8</td>
<td>1</td>
<td>0/1</td>
</tr>
<tr>
<td>Ac10</td>
<td>9</td>
<td>1</td>
<td>0/1</td>
</tr>
</tbody>
</table>

To add a new activator, click [+] . To remove an activator, click [−] . To edit an activator setting, select the activator from the list and edit the value in the lower UI.

For descriptions of the activator settings, see [Activators properties on page 125](#).
Here you define the configurations of the zones. A zone is a collection of activators with the same state, while a configuration is a setup of zones that a tool can have. A tool can have several configurations but only one at a time can be active. The figure shows a configuration example.

To add or remove a configuration, click or . In the Configurations group; To set a configuration as default, right click on a configuration and select Set as Default Configuration; To add or remove a zone, click “Add Zone” and “Delete Zone” button. To include an activator into a zone, select the check box at the activator row and the zone column. The activators are defined at the Vacuum Activators page.

Activators properties

The following table describes the settings of the activators:

<table>
<thead>
<tr>
<th>Setting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>The activator’s name</td>
</tr>
<tr>
<td>Position</td>
<td>The center position of the activator related to the TCP. It is recommended to set the same z-value to all activators within one zone.</td>
</tr>
<tr>
<td>Orientation</td>
<td>The center orientation of the activator related to the TCP.</td>
</tr>
<tr>
<td>Size</td>
<td>The size of the activator.</td>
</tr>
<tr>
<td>Start bit</td>
<td>Defines the first bit field where the activator is connected to the Activators control signal.</td>
</tr>
<tr>
<td>Bit Length</td>
<td>The number of bit fields used for the activator.</td>
</tr>
</tbody>
</table>
### Setting

<table>
<thead>
<tr>
<th>Setting</th>
<th>Description</th>
</tr>
</thead>
</table>
| A/D/I   | Defines the Active (A), Deactivated (D), and Idle (I) states for the activator. The state for the activator is set by the values of the bits defined by the fields of the Start Bit and No. Bits. The different states:  
  - Active state, which is set for an activator when it holds an item.  
  - Deactivated state, which is set for an activator when it releases an item.  
  - Idle state, which is set when no item is held by the activator.  
  The values for the different states are given in the format A/D/I, that is Active/Deactivated/Idle. To set a value, click the value of an activator and select the desired value from the drop-down combo box.  
  If Bit Length is set to the value 1, the Idle state is not used since only two states can be given with one bit. |

### Clamp

A Clamp function contains a clamp and a hook. They are usually independently controlled by different DI/GI signals.
The editing UI of Clamp is as following:

<table>
<thead>
<tr>
<th>Properties</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open/Close Clamp</td>
<td>Opening and closing of clamp can be controlled by DI or GI signals, and when the open or close state is reached, it can set DO or GO signals to certain values. Also, a mechanical movement in 3D view may be included to visualize the opening and closing.</td>
</tr>
<tr>
<td></td>
<td><img src="image" alt="Control Signals (Input)" /></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Take the above setting for Open Clamp as example: To add/edit/remove a signal to trigger the open movement, click +, −, or × in the Control Signals (Input) group. You can specify the signal type (DI/DO/GI/GO), the signal set value, the pulse value and length. See Edit signal control on page 134 for detailed information.

To add/edit/remove a signal to be triggered when open movement is finished, click add/edit/remove in the Status Signals (Output) group. See Edit signal control on page 134 for detailed information of setting signal and value.

To add a joint movement for opening of clamp, select the corresponding joint and move the slider bar to the opened position. You can also click the slider bar and input the joint position directly.

To edit the time that the joint takes to move to the open position, input a time value (s) in Move Duration number box.

The above example specifies that:

- When the input tool signal “giOpenClamp” goes to 1, the clamp will start to open. The open movement will take 0.2 seconds to move joint J2 to position 0. When the open movement is finished and the joint is at position 0, the output tool signal “goClampOpened” will be set to 1.

Open/Close Hook Same as Clamp

Continues on next page
### Picking Sensor (Simulation)

The picking sensor is mainly for simulation use. It defines an area (usually within the clamp tool) that will intersect with the products when robot moves to the picking position.

In simulation, the products that intersect with this area during the closing of the clamp will be picked up by the clamp.

Thus users need to set the position and size of this area with appropriate values so that this area will intersect with the products that are “intended” to be picked when the tool is at picking positions.

During editing, the picking sensor area will also be shown in 3D view as a gray box:

<table>
<thead>
<tr>
<th>Property</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Picking Sensor</td>
<td>The gripper will pick the products from product center bottom as default (e.g. claw clamp type).</td>
</tr>
<tr>
<td>Position (TCP)</td>
<td>0.000 0.000 210.000</td>
</tr>
<tr>
<td>Orientation</td>
<td>0.000 0.000 0.000</td>
</tr>
<tr>
<td>Size [x,y,z]</td>
<td>300.000 50.000 400.000</td>
</tr>
<tr>
<td>Pick Mode</td>
<td>Center/Bottom</td>
</tr>
</tbody>
</table>

Continues on next page
Pick Mode: Pick mode defines whether the tool function should pick the products from top or bottom. This affects the default position of the tool relative to the products, defined in Pick Setting.

Currently only Center Top and Center Bottom are supported:
- Center top: in default position, the center of the picking sensor area will be aligned with the center top of the product
- Center bottom: in default position, the center bottom of the picking sensor area will be aligned with the center bottom of the product

Claw

Simpler than clamp, a Claw function contains only a claw.

The editing UI of Claw is as following:

<table>
<thead>
<tr>
<th>Properties</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open/Close Claw</td>
<td>Opening and closing of claw is similar to that of clamp. See Open/Close Clamp to see how to edit control signals and status signals, and joint movements.</td>
</tr>
</tbody>
</table>

![Image of Claw editing UI]

Continues on next page
### 5 User interface

5.3.25 Models

**Continued**

<table>
<thead>
<tr>
<th>Properties</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Picking Sensor (Simulation)</td>
<td>The picking sensor for claw is the same as that of Clamp. See Picking Sensor (Simulation) for clamp for detailed information.</td>
</tr>
</tbody>
</table>

The picking sensor for claw is the same as that of Clamp. See Picking Sensor (Simulation) for clamp for detailed information.

<table>
<thead>
<tr>
<th>Properties</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>The search stop trigger describes which tool signal to trigger when a product is detected by search sensor, and the flank type of the signal that is triggered.</td>
</tr>
</tbody>
</table>

The search stop trigger describes which tool signal to trigger when a product is detected by search sensor, and the flank type of the signal that is triggered.

<table>
<thead>
<tr>
<th>Properties</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Search</td>
<td>An example contains a searcher movement, and search sensor. The movement contains the opening, the loosening, and the closing of searcher. And the search sensor describes in simulation where on the tool to detect product's height (such as pallet stack).</td>
</tr>
</tbody>
</table>

The editing UI of Search is as following:

<table>
<thead>
<tr>
<th>Properties</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>The trigger flank type describes what kind of signal value change indicates a search stop:</td>
</tr>
<tr>
<td></td>
<td>• Both Flanks: Trigger for any signal change</td>
</tr>
<tr>
<td></td>
<td>• Negative Flank: Trigger when signal changes from high to low</td>
</tr>
<tr>
<td></td>
<td>• Positive Flank: Trigger when signal change from low to high</td>
</tr>
</tbody>
</table>

A search function contains a searcher movement, and search sensor. The movement contains the opening, the loosening, and the closing of searcher. And the search sensor describes in simulation where on the tool to detect product's height (such as pallet stack).
A typical sequence of search process includes: open searcher, loosen search, wait until search sensor touches product and stop signal triggers, close searcher.

The steps related to joint movements are described as Open Searcher, Loosen Searcher, and Close Searcher.

The editing each movement is same as Open/Close Clamp. See Open/Close Clamp for detailed information.
The editing of search sensor is the same as that of Clamp, except that for search, Pick Mode information is not needed, since search is not used for picking.

Note that the position of the sensor should be set carefully so that the height of the lowest position of the sensor area is the same as the height of the search TCP position. Otherwise, during simulation, the sensor SmartComponent may touch the pallet/sheet stack earlier than the TCP, and robot can not calculate the height value correctly, thus missing the product picking afterwards.

During editing, the search sensor area will also be shown in 3D view as a gray box:

---

Sensor
A sensor function is a simple function to add a product sensor and triggers certain DO when a product is detected.

The editing UI of Sensor is as following:

<table>
<thead>
<tr>
<th>Properties</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>A DI signal can be specified to activate the sensor, and a DO signal should be specified to be triggered when product is detected.</td>
</tr>
</tbody>
</table>

- **Activate Sensor (DI)**
  - Signal: `dStartPartCheck`

- **Sensor Out (DO)**
  - Signal: `dPartChecked`

- **Sensor (Simulation)**
  - **Position (Relative to TCP) [mm]**
    - X: 0.000
    - Y: 0.000
    - Z: 0.000
  - **Orientation (deg)**
    - X: 0.000
    - Y: 0.000
    - Z: 0.000
  - **Size [x,y,z] [mm]**
    - X: 10.000
    - Y: 10.000
    - Z: 20.000

---

Unit mover

> A unit mover function is a function to move some part of the tool which is not picking related. For example, a bag flatter/fixer in a claw tool is typical unit mover:

---

Continues on next page
The editing UI of unit mover is as following:

<table>
<thead>
<tr>
<th>Properties</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open/Close Setting</td>
<td>Opening and closing of a Unit Mover is similar to that of clamp. See Open/Close Clamp to see how to edit control signals and status signals, and joint movements.</td>
</tr>
</tbody>
</table>

Edit signal control

A signal control describes a signal configuration that can be used to trigger certain behavior (e.g. opening a clamp) or to show certain status (e.g. clamp is totally opened). It includes the information of the signal and the value for this signal to set to.

In Signal Control interface, you can specify such a value control for a signal.
5 User interface

5.3.25 Models

To add a signal control on a new SmartComponent signal, click on the “Signal” list box to change it to input mode, and type the name for the new signal. Then choose the signal type at “Type” list box. The new signal can then be used other signal controls. To add a signal control on an already created signal, click on the arrow besides the “Signal” list box, and choose one. In this case you will not be able to change the signal type by the “Type” list box.

<table>
<thead>
<tr>
<th>Properties</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signal</td>
<td>To add a signal control on a new SmartComponent signal, click on the “Signal” list box to change it to input mode, and type the name for the new signal. Then choose the signal type at “Type” list box. The new signal can then be used other signal controls. To add a signal control on an already created signal, click on the arrow besides the “Signal” list box, and choose one. In this case you will not be able to change the signal type by the “Type” list box.</td>
</tr>
<tr>
<td>Type</td>
<td>Choose the type of the new signal. This is disabled if an already existing signal is selected.</td>
</tr>
<tr>
<td>Set or Pulse</td>
<td>This group specifies the value change property of the signal for set or pulse. If the Set option button is selected, the set value is sent at Preset Time before the robot reaches a certain target. If the Pulse option button is selected, the Reset Value is sent after Pulse Length.</td>
</tr>
</tbody>
</table>

Tool events and scenarios

The tool events describe how the tool functions are controlled during picking and placing. It includes a list of events to control certain tool functions to open and close during different movement of picking and placing.

The tool scenarios describe which group of tool functions to use to pick different type of products. For example, the ABB Vacuum tool contains two picking tool functions: vacuum and pallet picker. When the tool is picking boxes, only vacuum is used; and when it is picking pallets, only pallet picker is used. Thus two scenarios can be created, each only including the vacuum function and the pallet picker function respectively. See Pick setting on page 79 on how tool scenarios are used.

When the tool is attached to the robot, a controller I/O signal will be specified to connect to each tool I/O signal (see Edit Tool Signals on page 168). Thus during picking/places of group and pattern operation sets, the controller signal and its value will be set or waited, according to what is specified for its connected tool I/O and value, in the tool event settings.
You can open the Edit Tool Events interface by right clicking on the tool node from browser's Layout tab or Programming tab.
5 User interface

5.3.25 Models

Continued

<table>
<thead>
<tr>
<th>Properties</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contained Tool Functions</td>
<td>List of contained tool functions. Each contained tool function should have a sequence of control events.</td>
</tr>
<tr>
<td>Event Sequence</td>
<td>The list of events for the selected tool function, in picking and placing</td>
</tr>
<tr>
<td>Type</td>
<td>Set or Wait. Set means the event is to set a signal to a certain value; Wait means the event is to start waiting until a signal value equals to a specified value.</td>
</tr>
<tr>
<td>Signal Name</td>
<td>The signal to be used in the event</td>
</tr>
<tr>
<td>Value</td>
<td>The set or wait value for the signal</td>
</tr>
<tr>
<td>Preset Time</td>
<td>The time to preset a signal to a certain value. Only valid for Set type of event.</td>
</tr>
</tbody>
</table>
### Properties

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>The movement phase (i.e. action) of a pick/place target where this event is used.</td>
</tr>
<tr>
<td>Each pick/place target contains at least 1 Approach point, 1 pick/place point, and 1 Depart point. Depending on the approach/depart setting in operation sets, one pick/place target may contain more than 1 Approach points and 1 Depart points. (See Operation set on page 179 for detailed information on operation, target, and actions)</td>
</tr>
<tr>
<td>Accordingly, in picking and placing, there are 6 movements defined respectively:</td>
</tr>
<tr>
<td>Pick First Approach -&gt; Pick Last Approach -&gt; Pick -&gt; Pick First Depart -&gt; Pick Last Depart</td>
</tr>
<tr>
<td>Place First Approach -&gt; Place Last Approach -&gt; Place -&gt; Place First Depart -&gt; Place Last Depart</td>
</tr>
<tr>
<td>First Approach means the first approach point of a pick (or place) operation.</td>
</tr>
<tr>
<td>Last Approach means the last approach point of a pick (or place) operation. If only 1 approach point was specified originally, an extra point will be added at the same location as the last approach.</td>
</tr>
<tr>
<td>Pick (or Place) means the actual point where pick (or place) happens.</td>
</tr>
<tr>
<td>First Depart means the first depart point of a pick (or place) operation. If only 1 depart point was specified originally, an extra point will be added at the same location as the first depart.</td>
</tr>
<tr>
<td>Last Depart means the last depart point of a pick (or place) operation.</td>
</tr>
</tbody>
</table>

### Add, edit, or delete an event

To add/edit/remove an event, click under the event list.
List of contained tool scenarios.

Scenario List

A tool should at least have one tool scenario.

Pick/Place Scenario

For each scenario, two tree views will be shown for Picking and Placing, including all the movements. The tool functions that contain events for the movement will be listed under the movement node.

To include a tool function into a scenario at a specific movement, select the check box before the tool function node under the movement node.

Pick/Place Scenario

- Pick First Approach
- Pin
- Claw1
- Pick Last Approach
- Place
- Place Last Approach
- Place First Depart
- Place Last Depart
- Place
- Claw1
- Pic First Depart
- Pin
- Claw1
- Pick Last Depart
- Pick Last Depart

Create Feeder
The Create Feeder interface is used to create a Palletizing PowerPac compatible feeder SmartComponent model. The SmartComponent model can then be added to the robot, or saved as RobotStudio library (.rslib) file, and be imported and reused in other palletizing projects.

A Palletizing PowerPac compatible feeder includes properties of:

- Default feeder type: the default type that this feeder will be used.
- Hotspots of this feeder: a hotspot is a special frame attached with the feeder model that can be directly used to position a work object. A hotspot also describes how does the product will be shown up at this position.

<table>
<thead>
<tr>
<th>Properties</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default Type</td>
<td>The default type is used when this SmartComponent model is added for a robot, and a feeder is to be created. The default feeder type (i.e., InFeeder, OutFeeder, PalletFeeder, or SheetFeeder) will use the type defined here, but user can still choose to use another type. See Add feeder on page 57 for detailed information.</td>
</tr>
<tr>
<td>Hotspots</td>
<td>The list of hotspots contained by this feeder.</td>
</tr>
<tr>
<td>General</td>
<td>General information: name, position, and orientation of the hotspot frame.</td>
</tr>
<tr>
<td>Properties</td>
<td>Description</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| WorkObject/Product alignment| The group specifies the location of the work object and which quadrant the items are picked from or placed to. Adjust the Alignment and Rotation parameters to select a location suitable for calibration of the work object.  
Alignment: Specifies if the work object origin is located to the right or to the left of the items.  
Rotation: Specifies the orientation of the work object coordinate system.  
When you change the values for Alignment and Rotation, a dummy box and three coordinate arrows will be shown at the hotpot in 3D view, visualizing the relationship between item and work object. Note that the item’s front is attached with label. |

**Note**

The work object should be calibrated with its origin where items are fixed, that is along any guide and stop rails. For an infeeder or other feeders used for picking, the work object calibration is especially important. If the picking location of the tool must be adjusted, then update the tool location in Pick Setting. Avoid adjusting the displacement frame or tuning the location of the feeder, since this might reduce the accuracy when items are placed. For a palletizing feeder or other feeders where products are placed, the work object calibration can be adjusted with the displacement frame or by tuning the location of the feeder to modify the place location of items.
5 User interface

5.3.26 IOPanel

Overview

IOPanel helps to monitor and set the signals used during a palletizing process. This can be used both for VC and RC. It helps to understand the problems during commission and it works as a tool for training classes. It also helps to understand the handshake between the PLC and the controller and also how to control the system using the flow and job signals.

User interface

In the Advanced group, click IOPanel. The IOPanel window is displayed.

The IOPanel window has the following four tabs:

- The Common tab allows you to monitor the project signals, gripper signals, event message signals, default height signals, flow signals, and system signals.
- The Infeeder tab allows you to monitor the infeeder signals.
- The Outfeeder tab allows you to monitor the outfeeder signals.
- The Stack Sheets tab allows you to monitor the pallet and stack sheet signals.

By default, the appropriate signals are selected for each each types. If required, the signal can be changed and monitored. Set the signal by clicking on the LED. The LED color changes to red. If it is a group signal then type the numeric value corresponding to the signal.
5.3.27 Change viewpoint

A viewpoint stores the location and direction of a virtual camera in the 3D environment. It stores points of interest in a station and to create camera movements during simulation.

<table>
<thead>
<tr>
<th>Icon</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="xx110000112" alt="Icon" /></td>
<td>To view the objects in the Top orientation.</td>
</tr>
<tr>
<td><img src="xx110000113" alt="Icon" /></td>
<td>To view the objects in the Front orientation.</td>
</tr>
<tr>
<td><img src="xx110000114" alt="Icon" /></td>
<td>To view the objects in the Right orientation.</td>
</tr>
</tbody>
</table>
5 User interface

5.3.28 Adjust position of object

5.3.28 Adjust position of object

The selected object in main 3D view can be adjusted with freehand.

<table>
<thead>
<tr>
<th>Icon</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="xx110000111" alt="Icon" /></td>
<td>To adjust the position of selected object in main 3D view.</td>
</tr>
<tr>
<td><img src="xx1100000116" alt="Icon" /></td>
<td>To adjust the orientation of selected object in main 3D view.</td>
</tr>
</tbody>
</table>
5.3.29 Help

This group is related to displaying help documentation and the basic software information.

<table>
<thead>
<tr>
<th>To...</th>
<th>Do this</th>
</tr>
</thead>
<tbody>
<tr>
<td>Show Help File</td>
<td>Click Help button, a help file with chm format will display to give detailed information about this PowerPac.</td>
</tr>
<tr>
<td>Show Basic Information</td>
<td>Click About button, a dialog will display to show basic information about this PowerPac, such as version number, status of license, etc.</td>
</tr>
</tbody>
</table>
5 User interface

5.4 Layout browser

5.4.1 Introduction

The layout browser is a hierarchical display of physical items, such as robots and tools.

<table>
<thead>
<tr>
<th>Icon</th>
<th>Node</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Station</td>
<td>The station node</td>
</tr>
<tr>
<td></td>
<td>Robot</td>
<td>The robot in the station.</td>
</tr>
<tr>
<td></td>
<td>Tool</td>
<td>A tool SmartComponent in the station. This may or may not be attached to a robot</td>
</tr>
<tr>
<td></td>
<td>Feeder</td>
<td>A feeder SmartComponent in the station. This may or may not be added into a robot</td>
</tr>
<tr>
<td></td>
<td>Part</td>
<td>A physical object in RobotStudio. Parts with geometric information are made up of one or more 2D or 3D entities. Parts without geometric information are empty.</td>
</tr>
</tbody>
</table>
5.4.2 Station

You can access the context menus for the station node in the layout browser by right-clicking the station node.

**Context Menus from the Station Node**

<table>
<thead>
<tr>
<th>Context Menu</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Import Model…</td>
<td>Import one model into this station, which should be a library component file for RobotStudio.</td>
</tr>
</tbody>
</table>
5 User interface

5.4.3 Robot

You can access the context menus for the robot node in the layout browser by right-clicking the robot node.

<table>
<thead>
<tr>
<th>Context Menu</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jump Home</td>
<td>Jump the robot to the home position.</td>
</tr>
<tr>
<td>Mechanism Joint Jog</td>
<td>Jog the robot's joint.</td>
</tr>
<tr>
<td>Set Position…</td>
<td>Set robot's position.</td>
</tr>
<tr>
<td>Examine</td>
<td>Adjust an appropriate viewpoint for the robot.</td>
</tr>
<tr>
<td>Rename</td>
<td>Change the robot's name.</td>
</tr>
<tr>
<td>Visible</td>
<td>Show or hide the robot.</td>
</tr>
</tbody>
</table>
5.4.4 Tool SmartComponent

You can access the context menus for the tool node in the layout browser by right-clicking the tool node.

Context Menus from the Tool Node

<table>
<thead>
<tr>
<th>Context Menu</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Edit Tool Functions…</td>
<td>Edit tool functions for this tool. See Tool Functions on page 120 for detailed description</td>
</tr>
<tr>
<td>Edit Tool Events…</td>
<td>Edit tool events for this tool. See Tool events and scenarios on page 135 for detailed description</td>
</tr>
<tr>
<td>Joint Jog</td>
<td>Jog the tool’s joint. Only available when a mechanism is used.</td>
</tr>
<tr>
<td>Disconnect Library</td>
<td>Disconnect the library</td>
</tr>
<tr>
<td>Save As Library</td>
<td>Save the library as rslib file</td>
</tr>
<tr>
<td>Attach to / Detach from</td>
<td>If the tool has not been attached to the robot, click Attach to menu and select the right robot, this tool will attach to the selected robot. If the tool has been attached to a robot, click Detach from menu, this tool will detach from the robot.</td>
</tr>
<tr>
<td>Examine</td>
<td>Adjust an appropriate viewpoint for the tool.</td>
</tr>
<tr>
<td>Rename</td>
<td>Change the tool’s name.</td>
</tr>
<tr>
<td>Visible</td>
<td>Show or hide the tool.</td>
</tr>
<tr>
<td>Delete</td>
<td>Delete the tool from station.</td>
</tr>
</tbody>
</table>
5 User interface

5.4.5 Feeder SmartComponent

You can access the context menus for the feeder node in the layout browser by right-clicking the feeder node.

### Context Menus from the Feeder Node

<table>
<thead>
<tr>
<th>Context Menu</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Edit Feeder Hotspots…</td>
<td>Edit hotspots for this feeder. See Create Feeder on page 139 for detailed description</td>
</tr>
<tr>
<td>Disconnect Library</td>
<td>Disconnect the library</td>
</tr>
<tr>
<td>Save As Library</td>
<td></td>
</tr>
<tr>
<td>Attach to / Attached Status</td>
<td>If the feeder has not been attached to the robot, click Attach to menu and select the right robot, this feeder will attach to the selected robot. If the tool has been attached to a robot, which robot is attached to will display in this context menu.</td>
</tr>
<tr>
<td>Set Position…</td>
<td>Set feeder’s position.</td>
</tr>
<tr>
<td>Examine</td>
<td>Adjust an appropriate viewpoint for the feeder.</td>
</tr>
<tr>
<td>Rename</td>
<td>Change the feeder’s name.</td>
</tr>
<tr>
<td>Visible</td>
<td>Show or hide the feeder.</td>
</tr>
<tr>
<td>Delete</td>
<td>Delete the feeder from station.</td>
</tr>
</tbody>
</table>
5.4.6 Part

You can access the context menus for the part node in the layout browser by right-clicking the part node.

### Context Menus from the Part Node

<table>
<thead>
<tr>
<th>Context Menu</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Build into a Tool…</td>
<td>Build this part as a tool Smart Component, which can be used by the robot. See Create Tool on page 120 for detailed description.</td>
</tr>
<tr>
<td>Build into a Feeder…</td>
<td>Build this part as a feeder Smart Component, which can be used by the robot. See Create Feeder on page 139 for detailed description.</td>
</tr>
<tr>
<td>Set Position…</td>
<td>Set part’s position.</td>
</tr>
<tr>
<td>Examine</td>
<td>Adjust an appropriate viewpoint for the part.</td>
</tr>
<tr>
<td>Rename</td>
<td>Change the part’s name.</td>
</tr>
<tr>
<td>Visible</td>
<td>Show or hide the part.</td>
</tr>
<tr>
<td>Delete</td>
<td>Delete the part from station.</td>
</tr>
</tbody>
</table>
5.5 Programming browser

5.5.1 Introduction

The programming browser is a hierarchical display of program elements for each controller and robot.

Each virtual controller can subsequently run up to four robot nodes, here named T_ROB1.

<table>
<thead>
<tr>
<th>Icon</th>
<th>Node</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="xx110000122" alt="Project Icon" /></td>
<td>Project</td>
<td>The project node</td>
</tr>
<tr>
<td><img src="xx110000123" alt="Controller Icon" /></td>
<td>Controller</td>
<td>A controller that exists in the station</td>
</tr>
<tr>
<td><img src="xx110000124" alt="Robot Icon" /></td>
<td>Robot</td>
<td>A robot (motion task) that exists in the parent controller</td>
</tr>
<tr>
<td><img src="xx110000125" alt="Tool Icon" /></td>
<td>Tool</td>
<td>The tool used by the parent robot. It references a tool SmartComponent.</td>
</tr>
<tr>
<td><img src="xx110000126" alt="Feeders Icon" /></td>
<td>Feeders</td>
<td>The collection of feeders for the parent robot</td>
</tr>
<tr>
<td><img src="xx110000127" alt="Feeder Icon" /></td>
<td>Feeder</td>
<td>A feeder that is used by the robot. It references a feeder SmartComponent.</td>
</tr>
<tr>
<td>Icon</td>
<td>Node</td>
<td>Description</td>
</tr>
<tr>
<td>------</td>
<td>------</td>
<td>-------------</td>
</tr>
<tr>
<td><img src="xx110000128" alt="Operation Set" /></td>
<td>Operation Set</td>
<td>An Operation Set program that picks/places from/to the parent feeder. Depending on the type of item it handles (box, bag, pallet, or sheet), and whether it is picking or placing, the icon is different.</td>
</tr>
<tr>
<td><img src="xx110000129" alt="Flows" /></td>
<td>Flows</td>
<td>The collection of flows for the parent robot</td>
</tr>
<tr>
<td><img src="xx110000130" alt="Flow" /></td>
<td>Flow</td>
<td>A flow that exists for the parent robot</td>
</tr>
<tr>
<td><img src="xx110000131" alt="Job (Master Operation Set)" /></td>
<td>Job (Master Operation Set)</td>
<td>A supported job for the parent flow. It actually references to an Operation Set of the flow’s master feeder.</td>
</tr>
<tr>
<td><img src="xx110000132" alt="Slave Operation Set" /></td>
<td>Slave Operation Set</td>
<td>Reference to an Operation Set on the slave feeders that are related to the master job.</td>
</tr>
</tbody>
</table>
5 User interface

5.5.2 Project

Context Menus from the Project Node

You can access the context menus for the project node in the programming browser by right-clicking the project node.

<table>
<thead>
<tr>
<th>Context Menu</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Settings</td>
<td>Edit settings for the project. The following section gives you a more detailed description on Project Settings.</td>
</tr>
<tr>
<td>Rename</td>
<td>Change the Project’s name.</td>
</tr>
</tbody>
</table>

Project Settings

Introduction

This dialog is shared with project, controller and robot settings. The left tree view is a hierarchical display of project elements for each controller and robot. Select the project node and its settings will display in the right three pages.

General

The project name and description can be edited in this page.
Restart Options

Select which restart options should be visible on the FlexPendant when recovering after an error. All options are selected as default. To hide a restart option on the FlexPendant, clear the option's check box. See Flow on page 201.

Continue Pick-Place is always available.
Tune Limitation

It is used to set the minimum and maximum limits for how much each parameter can be tuned online. For more information about how to tune the parameters online, see Runtime operation on page 233.

**Feeder WorkObject Group**

Click **Reset Tune Value** to reset all the tuned values.

Click **Apply Tune Value** to assign the tuned values as the default values.

In the Feeder WorkObject group the limits are specified using the same unit as the parameter. The x, y, z, and z angle defines the displacement of the feeder relative to the default value. The Lower tune limits define the maximum displacement from the default values in the negative direction. The Upper tune limits define the maximum displacement from the default values in the positive direction.

**Example**

- Assume the default value of Z angle in the Group Operation Set Configuration window is 25 degrees. See Group operation set on page 180.
- The Lower tune limit in the Tune Limitations window is set to 6 degrees. This means you can tune the z-angle to maximum 6 degrees less than the default value, that is, you can tune the Angle (z) to a minimum of 19 degrees.
- The Upper tune limit in the Tune Limitations window is set to 6 degrees. This means you can tune the z-angle to maximum 6 degrees more than the default value, that is, you can tune the Angle (z) to a maximum of 31 degrees.
The following table describes the parameters of the Feeder WorkObject group:

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>Displacement of the feeder in x-direction relative the work object.</td>
</tr>
<tr>
<td>Y</td>
<td>Displacement of the feeder in y-direction relative the work object.</td>
</tr>
<tr>
<td>Z</td>
<td>Displacement of the feeder in z-direction relative the work object.</td>
</tr>
<tr>
<td>Angle(Z)</td>
<td>Displacement angle of the feeder in the z-direction.</td>
</tr>
</tbody>
</table>

**Item Group**

In the Item group all limits are specified in percent (%) relative the default value, which is referred to as 100%.

**Example**

- Assume the default speed in the Motion Limits window is 1000 mm/s. This is referred to as 100%. See *Advanced setting for Item on page 66*.
- The Lower tune limit in the Tune Limitations window is 10% of the default speed. Hence, you can tune the speed to a minimum of 100 mm/s.
- The Upper tune limit in the Tune Limitations window is 110% of the default speed. Hence, you can tune the speed to a maximum of 1100 mm/s.

The following table describes the parameters of the Item group:

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed</td>
<td>Specifies maximum speed for an item.</td>
</tr>
<tr>
<td>Rot Speed</td>
<td>Specifies maximum orientation speed for an item.</td>
</tr>
<tr>
<td>Acc/Dec</td>
<td>Specifies maximum acceleration/deceleration for an item.</td>
</tr>
<tr>
<td>Pick Time</td>
<td>Specifies the time that the robot stays at the target position when picking an item.</td>
</tr>
<tr>
<td>Place Time</td>
<td>Specifies the time that the robot stays at the target position when placing an item.</td>
</tr>
<tr>
<td>Vacuum Activation Time</td>
<td>Specifies the time for vacuum activation.</td>
</tr>
<tr>
<td>Vacuum Deactivation Time</td>
<td>Specifies the time for vacuum deactivation.</td>
</tr>
<tr>
<td>Size (z)</td>
<td>Specifies the height of an item.</td>
</tr>
</tbody>
</table>
5 User interface

5.5.3 Controller

5.5.3.1 Controller

Context Menus from the Controller Node

You can access the context menus for the controller node in the programming browser by right-clicking the controller node.

<table>
<thead>
<tr>
<th>Context Menu</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Settings</td>
<td>Edit settings for the controller. The following section gives you a more detailed description on Controller Settings.</td>
</tr>
</tbody>
</table>

Controller Settings

Introduction

This dialog is shared with project, controller and robot settings. The left tree view is a hierarchical display of project elements for each controller and robot.

Select the controller node and its settings will display in the right four pages.

General
If selected, the Position request trigger signals and the Operation set complete signals will be pulsed instead of set by the controller. It is not recommended to use “Pulse Feeder DO Signals” since a pulse may be missed out to be detected by the PLC.

Pulse Length
Here you specify the general pulse length that will be used, if the controller pulses an output signal. The pulse length can be set in the range of 50 ms to 2000 ms.

### Events

**Event Signals**

This group contains the signals that are used by an external equipment to report a message or error to the PickMaster process.

**Source Settings**

This group contains the information on which source (feeder, robot and/or robot controller) is affected by a reported error.

### Event Signals Group

**Item**

**Trigger (DI)**

Specifies which digital input signal will be used to trigger an event. When this signal goes high, the event will be reported to the PickMaster process. This signal must be used together with the Error Source (GI) and/or Messages (GI) signal.

---

Continues on next page
5 User interface

5.5.3.1 Controller

Continued

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Error Source (GI)</td>
<td>A group input signal representing the source of an error. If the signal is defined it indicates where the error has occurred (feeder, robot and/or controller) when the Trigger (DI) signal is set, and thus where a flow recovery action should be performed to handle the error. For information about the source setting, see below Source Settings Group.</td>
</tr>
<tr>
<td>Messages (GI)</td>
<td>A group input signal representing an event message. If the signal is defined it specifies which message will appear on the FlexPendant when the Trigger (DI) signal is set. You define the messages in the line view of PickMaster, see Messages on page 162.</td>
</tr>
</tbody>
</table>

Source Settings Group

The Source Settings group needs to be configured if the Error Source (GI) signal in the Signals group is used. See Flow recovery on page 244.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source</td>
<td>Specifies the feeder, robot and/or controller that can be affected by the reported error.</td>
</tr>
<tr>
<td>Bit</td>
<td>Specifies which bit of the Error Source (GI) signal to use for the specific source. One or several bits can be set when triggering an event. Value 0 indicates no action.</td>
</tr>
</tbody>
</table>

If the source points out a feeder, then the feeder will be set in error state when the Trigger (DI) peaks. The current state of a feeder is indicated by the FlexPendant interface, see Viewing flow status on page 240. It is also indicated by the feeder I/O signal Execution state (GO), see Feeder on page 170.

A feeder in error state cannot be used in any pick or place operations.

A flow can continue to operate if there are alternative feeders to operate on. If there is no alternative feeder the flow will continue to operate until the feeder in error state is needed. The RAPID execution stops if there is only one flow.

If one feeder is shared between several flows all flows will stop when the feeder goes to error state. Setting one feeder in error state can result in error state on other feeders as well. The PickMaster process automatically sets affected feeders in error state.

If you plan to use Redo last pick then we recommend that you set the place feeder in error state rather than the pick feeder. Setting the pick feeder in error state after the pick operation is completed will not stop the robot movement. In this case the robot will continue to deliver the faulty products.

Flow recovery can be used from the FlexPendant interface or the I/O interface to recover from errors.

For examples, see Event and error reporting on page 276.
The feeder order settings define the physical order of the feeders, that is, in which order the robot will pass the feeders when making long movements through its working range.

The feeder order settings are used to define which feeders that will be considered when planning the path height of an intermediate movement between two feeders. Also, when moving to or from the home position, the feeder order settings will affect the path height. Each feeder and the home position are given an order number. When planning an intermediate movement, the order number of the start feeder and the end feeder (where none, one or both of them may be the home position) will set the upper and lower order limits of order numbers for other feeders to be considered when planning the path height. The order numbers can be freely chosen and two feeders can have the same order.

PM_HOME is a default installed feeder with work object pm_homeWObj. The order number for this feeder should be where the home position is located.
5 User interface

5.5.3.1 Controller

Continued

Messages

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max Title Length</td>
<td>Displays the title length. There can be maximum 60 characters in the message title.</td>
</tr>
<tr>
<td>Max Message Length</td>
<td>Displays the total message length. Each message can contain maximum 195 characters, including the title.</td>
</tr>
<tr>
<td>Import</td>
<td>Click Import to import messages from PickMaster library.</td>
</tr>
<tr>
<td>Export Selected</td>
<td>Click Export Selected to export a message to PickMaster library.</td>
</tr>
<tr>
<td>Export All</td>
<td>Click Export All to export all messages to PickMaster library.</td>
</tr>
<tr>
<td>Add</td>
<td>Click <img src="image" alt="add" /> to add a new message. If the controller is connected, the first available value will be given to the new message.</td>
</tr>
<tr>
<td>Delete</td>
<td>Click <img src="image" alt="delete" /> to delete a message.</td>
</tr>
<tr>
<td>Category</td>
<td>Click the Category column and select a category in the drop-down list. The category controls how the message is presented on the FlexPendant.</td>
</tr>
<tr>
<td>Value</td>
<td>Click the Value column and select a value or type a value in the drop-down list. The value is mandatory.</td>
</tr>
<tr>
<td>Title</td>
<td>Click the Title column and type the title.</td>
</tr>
</tbody>
</table>
Click the Message text group and type the description for the selected message.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>Click the Message text group and type the description for the selected message.</td>
</tr>
</tbody>
</table>
5 User interface

5.5.3.2 Robot

Context Menus from the Robot Node

You can access the context menus for the robot node in the programming browser by right-clicking the robot node.

<table>
<thead>
<tr>
<th>Context Menu</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attach Tool…</td>
<td>If there is no tool attached to the robot, this context menu will display. It is to add a tool to the robot. See Add tool on page 55 for detailed description.</td>
</tr>
<tr>
<td>Settings</td>
<td>Edit settings for the robot. The following section gives you a more detailed description on Robot Settings.</td>
</tr>
<tr>
<td>Jump Home</td>
<td>Jump the robot to the home position.</td>
</tr>
<tr>
<td>Set Position…</td>
<td>Set robot’s position.</td>
</tr>
<tr>
<td>Examine</td>
<td>Adjust an appropriate viewpoint for the robot.</td>
</tr>
<tr>
<td>Visible</td>
<td>Show or hide the robot.</td>
</tr>
</tbody>
</table>
Robot Settings

This dialog is shared with project, controller, and robot settings. The left tree view is a hierarchical display of project elements for each controller and robot. Select the robot node and its settings will display in the right page.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controller</td>
<td>The name of the controller which the robot belong to.</td>
</tr>
<tr>
<td>Robot</td>
<td>The name of the robot.</td>
</tr>
<tr>
<td>Speed</td>
<td>The speed of the robot.</td>
</tr>
<tr>
<td>Acceleration/Deceleration</td>
<td>The speed can be set to full or low with the right button.</td>
</tr>
<tr>
<td></td>
<td>The acceleration/deceleration speed of the robot.</td>
</tr>
<tr>
<td>Rotation Speed</td>
<td>The rotation speed of the robot.</td>
</tr>
<tr>
<td>Load and Start RAPID</td>
<td>If you select this check box, you can press the start button on the FlexPendant and the RAPID module will be loaded to the robot controller. The check box is selected by default.</td>
</tr>
<tr>
<td>Activate PickWare Log</td>
<td>If you select this check box, the log files for system debug purpose are generated in the Home folder of the robot system.</td>
</tr>
</tbody>
</table>
To add a RAPID module to the project:
1. Click Add.
2. The Load RAPID dialog box appears, and you can select which RAPID module to add.
3. In the Load RAPID dialog box, click OK.

To remove a RAPID module from the project, select a module and click Delete.
To edit a RAPID module, select a module and click Edit.
To save a module with a new name, select a module and click Export.

Select software to edit the RAPID. In default, the software is notepad.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
</table>
| Add      | To add a RAPID module to the project:  
1. Click Add.  
2. The Load RAPID dialog box appears, and you can select which RAPID module to add.  
3. In the Load RAPID dialog box, click OK. |
| Delete   | To remove a RAPID module from the project, select a module and click Delete. |
| Edit     | To edit a RAPID module, select a module and click Edit. |
| Export   | To save a module with a new name, select a module and click Export. |
| Browse   | Select software to edit the RAPID. In default, the software is notepad. |
5.5.4 Tool

**Context Menus from the Tool Node**

You can access the context menus for the tool node in the programming browser by right-clicking the tool node.

<table>
<thead>
<tr>
<th>Context Menu</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Edit Tool Signals</td>
<td>Edit signals for this tool.</td>
</tr>
<tr>
<td></td>
<td>See <a href="#">Edit Tool Signals on page 168</a> Error! Reference source not found. for detailed description</td>
</tr>
<tr>
<td>Edit Tool Functions…</td>
<td>Edit tool functions for this tool.</td>
</tr>
<tr>
<td></td>
<td>See <a href="#">Tool Functions on page 120</a> for detailed description</td>
</tr>
<tr>
<td>Edit Tool Events…</td>
<td>Edit tool events for this tool.</td>
</tr>
<tr>
<td></td>
<td>See <a href="#">Tool events and scenarios on page 135</a> for detailed description</td>
</tr>
<tr>
<td>Joint Jog</td>
<td>Jog the tool’s joint.</td>
</tr>
<tr>
<td>Detach from</td>
<td>If the tool has been attached to a robot, click Detach from menu, this tool will detach from the robot. And this node will be deleted either.</td>
</tr>
<tr>
<td>Examine</td>
<td>Adjust an appropriate viewpoint for the tool.</td>
</tr>
<tr>
<td>Rename</td>
<td>Change the tool’s name.</td>
</tr>
<tr>
<td>Visible</td>
<td>Show or hide the tool.</td>
</tr>
</tbody>
</table>
Edit Tool Signals

In Edit Tool Signals interface, you can view and edit the I/O connection between tool and controller.

A tool SmartComponent contains a set of input and output signals. In order for simulation to run, they should be connected with certain virtual controller I/O.

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I/O Template List</td>
</tr>
<tr>
<td>Tool I/O</td>
</tr>
<tr>
<td>Controller I/O</td>
</tr>
<tr>
<td>Save as Library</td>
</tr>
</tbody>
</table>
5.5.5 Feeders

5.5.5.1 Context Menus from the Feeders Node

You can access the context menus for the feeders node in the programming browser by right-clicking the feeders node.

<table>
<thead>
<tr>
<th>Context Menu</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add Feeder…</td>
<td>It is to add a feeder into the station. See Add feeder on page 57 for detailed description.</td>
</tr>
</tbody>
</table>
5 User interface

5.5.5.2 Feeder

5.5.5.2 Feeder

Context Menus from the Feeder Node

You can access the context menus for the feeder node in the programming browser by right-clicking the feeder node.

<table>
<thead>
<tr>
<th>Context Menu</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Edit…</td>
<td>Edit general settings for this feeder. See Edit feeder on page 171 for detailed description</td>
</tr>
<tr>
<td>Edit Feeder Hotspots…</td>
<td>Edit hotspots for this feeder. See Create Feeder on page 139 for detailed description</td>
</tr>
<tr>
<td>Add Operation Set - Group</td>
<td>Add a group operation set. See Operation set on page 179 for detailed description. Available when the feeder does not have any operation set or already has group operation sets.</td>
</tr>
<tr>
<td>Add Operation Set – Pattern/Stack</td>
<td>Add a pattern or stack operation set. See Operation set on page 179 for detailed description Available when the feeder does not have any operation set or already has pattern/stack operation sets.</td>
</tr>
<tr>
<td>Safe Targets…</td>
<td>Define the safe positions that the robot will pass before entering and after leaving the selected feeder. You can define several safe positions to let the robot follow a path when entering and leaving the feeder. Please note the order of the selected safe positions! The last safe position in the list is the last that the robot will pass before reaching the feeder and the first that the robot will pass when leaving the feeder. The last safe position in the list will also define the reference arm and wrist configuration of the robot when operating the feeder. See Safe targets on page 175 for detailed description</td>
</tr>
<tr>
<td>Robot Path Height…</td>
<td>Define some height attributes that are considered when the robot is moving to, from or over the feeder. The Robot path height settings affect the height of intermediate movements, which means the settings affect the output of the RAPID instruction PmGetPathHeight that is used by MoveInterMid in the PmUtility module. See Robot path height on page 176 for detailed description</td>
</tr>
<tr>
<td>Set WorkObject Position…</td>
<td>Set WorkObject position for the feeder. See Set WorkObject position on page 177 for detailed description</td>
</tr>
<tr>
<td>Examine</td>
<td>Adjust an appropriate viewpoint for the feeder.</td>
</tr>
<tr>
<td>Rename</td>
<td>Change the feeder’s name.</td>
</tr>
<tr>
<td>Visible</td>
<td>Show or hide the feeder.</td>
</tr>
<tr>
<td>Delete</td>
<td>Delete the feeder from station.</td>
</tr>
</tbody>
</table>

Continues on next page
Edit feeder

There are two pages to edit general settings for feeder.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>The name of the feeder.</td>
</tr>
<tr>
<td>Type</td>
<td>The feeder type and the following types are available:</td>
</tr>
<tr>
<td></td>
<td>• Infeeder</td>
</tr>
<tr>
<td></td>
<td>• Outfeeder</td>
</tr>
<tr>
<td></td>
<td>• PalletFeeder</td>
</tr>
<tr>
<td></td>
<td>• SheetFeeder</td>
</tr>
<tr>
<td>Work Object to Attach</td>
<td>Specify to which work object this feeder is connected. To change work object, select a work object from the drop-down box. Ten predefined work objects are listed in the work object drop-down box. The work object can be selected also in offline mode.</td>
</tr>
<tr>
<td>Signal Index</td>
<td>Specify which default signals that shall be suggested for the feeder when selecting Use Default I/O checkbox. It is combined with the feeder type.</td>
</tr>
<tr>
<td>Stop Job Timeout</td>
<td>Define the maximum time a pending position request will be active after a stop job has been started. It is used only by the slave feeders. Should be set to a time that is longer than the time it takes to generate new targets on the feeder. For example, longer than the maximum product infeed time.</td>
</tr>
</tbody>
</table>
5 User interface

5.5.5.2 Feeder

Continued

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model (SmartComponent)</td>
<td>Select which model (SmartComponent) is the source of the feeder.</td>
</tr>
<tr>
<td>Hotspot to Attach Workobject</td>
<td>Select which hotspot is attached with the work object.</td>
</tr>
</tbody>
</table>

![Edit Feeder: OutFeeder1](xx110000143)

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use Default I/O</td>
<td>See <em>Edit detailed signals for feeder on page 173</em> for detailed description.</td>
</tr>
<tr>
<td>Edit Signals…</td>
<td>Edit detailed signals for the feeder. Click this button, a dialog will popup. In this dialog, the signal configuration can be adjusted. See <em>Edit detailed signals for feeder on page 173</em> for detailed description.</td>
</tr>
<tr>
<td>Simulated</td>
<td>See <em>Edit detailed signals for feeder on page 173</em> for a detailed description.</td>
</tr>
<tr>
<td>Feeder Used as Master</td>
<td>See <em>Edit detailed signals for feeder on page 173</em> for a detailed description.</td>
</tr>
<tr>
<td>Feeder Used as Slave</td>
<td>See <em>Edit detailed signals for feeder on page 173</em> for a detailed description.</td>
</tr>
</tbody>
</table>
When the feeder is not used in any job this check box is selected by default.

Provides the match information about signals connection between the feeder and the virtual controller. If the signal connection is not valid, the status light is red, otherwise it is green.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feeder Used neither as Master nor as Slave</td>
<td>When selected, PickMaster will, depending on the selection of Master or Slave, suggest default signals in Position request, Target generation, and Status. The names of the default signals will be based on the selection in feeder type and default signal index. Clear the checkbox if you want to edit the signal selection manually. See Default signals.</td>
</tr>
<tr>
<td>Use Default I/O</td>
<td>When selected, PickMaster will, depending on the selection of Master or Slave, suggest default signals in Position request, Target generation, and Status. The names of the default signals will be based on the selection in feeder type and default signal index. Clear the checkbox if you want to edit the signal selection manually. See Default signals.</td>
</tr>
<tr>
<td>Feeder Used as Master</td>
<td>Specify this feeder is used as master. Filter that simplifies setting up a master feeder. When selected, only signals and parameters that can be used by a master feeder are enabled for updates.</td>
</tr>
<tr>
<td>Feeder Used as Slave</td>
<td>Specify this feeder is used as slave. Filter that simplifies setting up a slave feeder. When selected, only signals and parameters that can be used by a slave feeder are enabled for updates.</td>
</tr>
<tr>
<td>Feeder Used neither as Master nor as Slave</td>
<td>Specify this feeder is used neither as master nor as slave. When selected, signals and parameters are not enabled.</td>
</tr>
</tbody>
</table>
5 User interface

5.5.5.2 Feeder

Continued

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position Request Group</td>
<td>Define the signals used by the PickMaster process when requesting new operation sets. For a detailed description of the signals, see Basic I/O interface on page 260.</td>
</tr>
<tr>
<td>Target Generation Group</td>
<td>Define the signals used by a PLC to indicate that new targets are available for picking or placing. For a detailed description of the signals, see Basic I/O interface on page 260.</td>
</tr>
<tr>
<td>Simulated</td>
<td>When the check box is selected, the configured target generation signals are not used on the robot controller. Instead, Target generation will be directly cross connected to the output of the Position request signals. Use simulation on all slave feeders to test run a palletizing project without having implemented the communication with a PLC. Palletizing jobs can be started from the FlexPendant or the I/O interface. If only one job, that is, operation set, has been defined for a master feeder, simulation can be used to auto start the job in a continuous mode when the flow has been started.</td>
</tr>
<tr>
<td>Status Group</td>
<td>Define different signals to monitor the status of the PickMaster process. For a detailed description of the signals, see Basic I/O interface on page 260.</td>
</tr>
<tr>
<td>Robot Control Group</td>
<td>Define different signals to affect the PickMaster process. For a detailed description of the signals, see Basic I/O interface on page 260.</td>
</tr>
</tbody>
</table>

Note

All the above-mentioned signals and their corresponding values are available in the Process signal view on the FlexPendant interface for PickMaster.

Note

When the Target Generation Selection signal is not set on the selected feeder, there can only be one operation set in the feeder. See the Operation set on page 179 Configuration for more information.
**Safe targets**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add a Safe Target</td>
<td>Click [+] to add a new safe target in the list.</td>
</tr>
<tr>
<td>Delete a Safe Target</td>
<td>Select the safe target and click [x] to delete it from the list.</td>
</tr>
<tr>
<td>Reorder Safe Targets</td>
<td>Select the safe target and click [↑] or [↓] to reorder the target in the list.</td>
</tr>
<tr>
<td>Change Move Type for a Safe Target</td>
<td>Select the safe position in the list and click the move type value. Select move type in the drop-down list.</td>
</tr>
<tr>
<td>Rename a Safe Target</td>
<td>In the Name text box, type a new name for the safe target. In default, a unique name can be generated automatically when a new safe target is created.</td>
</tr>
<tr>
<td>Select Axis Configuration</td>
<td>Select one axis configuration for the selected safe target in the combo box. Also click the right button, the available configurations for the safe target can be calculated automatically.</td>
</tr>
<tr>
<td>Show the Reference WorkObject</td>
<td>The referenced workobject of the safe target is shown in the Location page.</td>
</tr>
</tbody>
</table>

Continues on next page
### 5 User interface

#### 5.5.5.2 Feeder

**Continued**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Edit Safe Target Position</strong></td>
<td>Click in one of Position boxes, and then click the position in the graphics window to transfer the values to the Position boxes. Or type a new value in the Position boxes to specify the position of the safe target.</td>
</tr>
<tr>
<td><strong>Edit Safe Target Orientation</strong></td>
<td>Type a new value in the Orientation boxes to specify the orientation of the safe target.</td>
</tr>
<tr>
<td><strong>Modify Safe Target Position and Orientation based on Current Robot Pose and Selected TCP</strong></td>
<td>Select one available TCP in the combo box and click Read Robot Pos button, the selected safe target will be updated based on current robot pose.</td>
</tr>
<tr>
<td><strong>Check Reach for the Safe Target</strong></td>
<td>Select one safe target in the list and click to check the robot can reach the safe target based on the selected TCP.</td>
</tr>
<tr>
<td><strong>Edit External Axis for the Safe Target</strong></td>
<td>If the robot system has external axis, in the External Axis page, the external axis value can be edited for the selected safe target.</td>
</tr>
</tbody>
</table>

### Robot path height

The default robot path height is the expected height of the feeder after an operation set has been completed. For an outfeeder the default height is normally set to **Full height** or **Height of latest finished operation set**. For an infeeder, the default height is normally set to **Full height**, **Empty height**, or **Height of latest finished operation set** depending on how the products are fed into the working range of the robot.

![Edit Path Height: InFeeder1](image-url)
Height of latest finished operation set

Height of latest finished operation set is the final height of the latest run operation set. The default height can be temporarily updated in runtime, for example, set to Empty after unloading a completed stack from the working range of the robot, by using predefined signals in the extended I/O interface or the RAPID function PmSetDefaultHeight.

Note

It is possible to update the default height in runtime to save cycle time without decreasing the margins for collisions, especially if the project consists of many feeders and flows.

Empty height

Define the empty height of the feeder in the work object frame (mm).

Full height

Defines the full height of the feeder in the work object frame (mm). Select the Auto generate full height check box to generate the value as the maximum value between height of the configured operation sets and the safe targets defined (if any).

Safety Offset

An offset that is always added to the expected height of the feeder.

Set WorkObject position

<table>
<thead>
<tr>
<th>To...</th>
<th>Do this</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change the Reference Coordinate System</td>
<td>Select the Reference coordinate system you want to use to position the WorkObject used for the feeder.</td>
</tr>
<tr>
<td>Edit WorkObject Position</td>
<td>Click in one of Position boxes, and then click the position in the graphics window to transfer the values to the Position boxes. Or type a new value in the Position boxes to specify the position of the WorkObject.</td>
</tr>
</tbody>
</table>
### 5 User interface

#### 5.5.5.2 Feeder

*Continued*

<table>
<thead>
<tr>
<th>To...</th>
<th>Do this</th>
</tr>
</thead>
<tbody>
<tr>
<td>Edit WorkObject Orientation</td>
<td>Type a new value in the Orientation boxes to specify the orientation of the WorkObject. Or click and to adjust the orientation for the WorkObject.</td>
</tr>
<tr>
<td>Check Reach for the WorkObject</td>
<td>Click check whether the robot can reach the WorkObject based on the active TCP. If it is reachable, the status light will be red, otherwise its color is green.</td>
</tr>
</tbody>
</table>
5.5.5.3 Operation set

Overview

An operation set defines how positions are generated for a specific feeder. There are two types of operation sets, the Group Operation Set defining how to pick or place a item group and the Pallet Pattern/Stack Operation Set defining how to pick or place a complete pallet pattern.

Operation sets are created from a feeder and consequently locked to the feeder and the robot with its tool.

Operation sets defined for master feeders are equivalent with palletizing jobs that can be started from a PLC or the FlexPendant interface.

Operation sets defined for slave feeders specify how product groups are to be picked or placed.

Start the operation set configuration

Operation sets are owned by feeders and are accessed from there. For more information about how to add operation sets, see the Feeder on page 170 Configuration.

You can access the context menus for the operation set node in the programming browser by right-clicking the operation set node.

Context Menus from the operation Set

<table>
<thead>
<tr>
<th>Context Menu</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Edit…</td>
<td>Open the editing dialog for the operation set. See Group operation set on page 180 and Pattern/Stack operation set on page 183 for detailed information.</td>
</tr>
<tr>
<td>Locate Pick Setting</td>
<td>Locate the referenced Pick Setting. The Pick Setting interface will be opened and the referenced pick setting will be selected. Available for group and stack operation set.</td>
</tr>
<tr>
<td>Locate Pallet Pattern</td>
<td>Locate the referenced pattern. The pallet pattern interface will be opened and the referenced pallet pattern will be selected. Available for pattern operation set.</td>
</tr>
<tr>
<td>Locate Stack</td>
<td>Locate the referenced item stack. The Product/Pallet/Sheet interface will be opened and the referenced item stack will be selected. Available for stack operation set.</td>
</tr>
<tr>
<td>Preview Palletizing…</td>
<td>Preview each pick (place) target in the operation set. See Preview Palletizing on page 90 for detailed description.</td>
</tr>
<tr>
<td>Rename</td>
<td>Change the operation set’s name.</td>
</tr>
<tr>
<td>Delete</td>
<td>Delete the Operation Set from the parent feeder.</td>
</tr>
</tbody>
</table>
5 User interface

5.5.5.3 Operation set

Continued

**Group operation set**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pick Setting Selection</td>
<td>Select the item, item group and the pick setting for that item group to use. Click to see item count, weight, Pick setting ID, and related input signals from the online PLC when the targets have been generated.</td>
</tr>
<tr>
<td>Validation</td>
<td>Use Preview Palletizing function to view each target of the operation set. See <em>Preview Palletizing on page 90</em> for detailed information. Use Check Reach to quickly check reach-ability of all the targets, which will be indicated by the status light.</td>
</tr>
<tr>
<td>General</td>
<td>Pick or Place: indicates how does the robot access the item group. Preparation Time (Simulation): if picking, it describes the time it takes for the item group to show up on the in-feeder before robot goes to pick; if placing, it describes the time it takes for the item group to be moved away on the out-feeder after robot has placed it. A robot can only continue to work on the feeder after the previous items are moved away. Displacement: describes the displacement between the item group and the feeder’s work object. To rotate the frame 90 degrees, click the Flip button, and offsets and angle will be updated to keep chosen alignment. Or you can also click “Drag in 3D View” and use Freehand Move to move the item CAD models directly.</td>
</tr>
</tbody>
</table>

Continues on next page
Define the robot path to follow when picking or placing the item group. It enables configuration of Approach and Depart movements which are necessary for specific grippers like Jaw Gripper. It will be useful where the gripper has to make horizontal movements to avoid collisions to neighboring equipment/components inside the cell. It is basically an improvement to the movement of robots as well as the pick and place directions. You can pick and place the items (Bag, Box, Pallet, Sheet and so on) based on the selection of Approach and Depart.

1. Select the Add Horizontal Approach and Add Horizontal Depart, then add the approach and depart value.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approach/Depart</td>
<td>Define the robot path to follow when picking or placing the item group. It enables configuration of Approach and Depart movements which are necessary for specific grippers like Jaw Gripper. It will be useful where the gripper has to make horizontal movements to avoid collisions to neighboring equipment/components inside the cell. It is basically an improvement to the movement of robots as well as the pick and place directions. You can pick and place the items (Bag, Box, Pallet, Sheet and so on) based on the selection of Approach and Depart.</td>
</tr>
</tbody>
</table>
You can enable stack search only if the operation set is Pick. To enable the stack search, select the Activate Stack Search check box.

For more information, see Stack search on page 191.

The following table describes the configuration parameters for the group operation set's stack search:

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Search</td>
<td>You can enable stack search only if the operation set is Pick. To enable the stack search, select the Activate Stack Search check box.</td>
</tr>
<tr>
<td>Speed</td>
<td>Defines the TCP speed of the robot when it searches for the format.</td>
</tr>
<tr>
<td>Offset</td>
<td>Defines an offset of the distance between the expected position of the format, and the starting position of the robot's search movement. The total search offset will also include the product height of the format.</td>
</tr>
<tr>
<td>Stop height</td>
<td>Defines the TCP height above the work object where the robot will stop the search movement (if search stop never occurs).</td>
</tr>
<tr>
<td>Search Tool Function</td>
<td>Defines which search tool function to use for searching. See Tool Functions on page 120 on description on search tool function</td>
</tr>
</tbody>
</table>
**Pattern/Stack operation set**

**Introduction**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pattern/Stack</td>
<td>Set the name of the Operation Set. Select the pallet pattern or item stack to use. Click ![image] to see item count, weight, total height, and the related product selection signal from the online PLC when the targets have been generated.</td>
</tr>
<tr>
<td>Validation</td>
<td>Use Preview Palletizing function to view each target of the operation set. See <em>Preview Palletizing on page 90</em> for detailed information. Use Check Reach to quickly check reach-ability of all the targets, which will be indicated by the status light beside the check button and before each layer. Also see <em>Check reach on page 88</em> for detailed information.</td>
</tr>
</tbody>
</table>

![Diagram](image)
### 5 User interface

#### 5.5.5.3 Operation set

*Continued*

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pattern tab</td>
<td>This section lists and shows information about all layers in the pallet pattern and the pick settings to be used for this pallet pattern.</td>
</tr>
<tr>
<td></td>
<td>In the Pick Settings to use list box, check the ones that you want to include in the operation set. It is important to select them in such a way that it is possible to complete each layer.</td>
</tr>
<tr>
<td></td>
<td><strong>Note</strong></td>
</tr>
<tr>
<td></td>
<td>When a pick setting for an item group with more than one column is used, the algorithm to calculate the operations and target positions may be wrong. Warning information will be shown in 2D layout view and user should manually check the sequence and use Preview Palletizing to validate.</td>
</tr>
<tr>
<td></td>
<td>To edit layer offsets, select the layer and edit the values. To edit the operations for a layer, double-click on the layer, or click on the layer and then click Edit. Manually edited layers operations will be specifically marked as “Manual”, otherwise, they will be marked as “Auto”. See <em>Operation editor on page 196</em> for more information. The display shows how the items are grouped together in different operations. For more information, see Display information.</td>
</tr>
<tr>
<td>General tab</td>
<td><img src="272x424" alt="Image" /></td>
</tr>
<tr>
<td></td>
<td><strong>I/O Value</strong>: Set the I/O value of the Operation Set. Also see <em>I/O interface on page 107</em> for detailed information.</td>
</tr>
<tr>
<td></td>
<td><strong>Pick or Place</strong>: Indicates how does the robot access the item group.</td>
</tr>
<tr>
<td></td>
<td><strong>Preparation Time (Simulation)</strong>: If picking, it describes the time it takes for the pattern/stack group to show up on the in-feeder before robot goes to pick; if placing, it describes the time it takes for the pattern/stack to be moved away on the out-feeder after robot has placed it. A robot can only continue to work on the feeder after the previous pattern/stack is moved away.</td>
</tr>
<tr>
<td></td>
<td><strong>Start Corner</strong>: Defines the corner of the pallet pattern where the robot should start.</td>
</tr>
<tr>
<td></td>
<td><strong>Displacement</strong>: Describes the displacement between the item group and the feeder’s work object. To rotate the frame 90 degrees, click the Flip button, and offsets and angle will be updated to keep chosen alignment. Or you can also click “Drag in 3D View” and use Freehand Move to move the item CAD models directly.</td>
</tr>
</tbody>
</table>

*Continues on next page*
### 5 User interface

#### 5.5.3 Operation set

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approach/Depart tab</td>
<td>Define the robot path to follow when picking or placing the item group. It enables configuration of Approach and Depart movements.</td>
</tr>
<tr>
<td>Search</td>
<td>To enable the stack search, select the Activate Stack Search check box. For information about the configuration parameters for the stack search, see Stack search on page 191. To configure the Place Search operation select the Place option in the General tab. Once you select the place option, the Place Search configuration options are enabled on the Search tab. For information about the configuration parameters for the place search, see Place search on page 192.</td>
</tr>
</tbody>
</table>

**Note**

Place search is used only for Boxes and Bags.

---

**Display information**

The two-dimensional display shows how the items are grouped together in different operations. Each operation for a layer is given a number and every target within an operation is given a letter. As an example, 2A identifies the first target in the second operation and 4B identifies the second target in the fourth operation. Every item is marked with a tag notifying the operation and target number. Every target is also marked with an arrow showing the direction the robot will move in when picking or placing that target. For format operation sets there will only be one operation with one target, but for pallet patterns the items will be automatically grouped into several operations.

In 3D view, it also show an overview of the resulting operation set, including the facing of all the items.

Continues on next page
5 User interface

5.5.5.3 Operation set

Continued

Offsets for each layer

You can configure adjustments of the general offsets, drop offset and the search offset for individual layers in the Layers Properties section.

<table>
<thead>
<tr>
<th>Layer offset</th>
<th>Used when</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item offset</td>
<td>Items are attached to the tool.</td>
</tr>
<tr>
<td>Tool offset</td>
<td>No items are attached to the tool.</td>
</tr>
</tbody>
</table>

Use positive values to approach/depart to/from the layer with increased height than defined by the general offset. Use negative values to approach/depart the layer with decreased height. There are no limitations on offsets but the product layer height defines a lower limit in runtime.

Note

This functionality is enabled in RobotWare 5.11. When using older RobotWare releases, then the configured layer offset values will have no effect.

If the Item offset is set to a lower negative value than the general offset, there is a risk that carried items will collide with other items already situated in the top layer. Such an offset may however be useful if space or robot reach is limited in specific layers. To avoid collisions, the layout operations may be modified to achieve an optimal pick/place order and item orientations.

Drop offset describes the offset in Z direction above original targets. Usually used for bag palletizing where bags are dropped off from a certain height above the unfinished pallet pattern.
Approach and depart

In this section you define how the robot should move when accessing formats in the operation set. The movement will consist of 3 to 7 positions, depending on the selected settings. The position in which the robot actually picks or places the format is known as the target. Positions preceding the target are called approach and positions following the target are called depart.

**Item** | **Description**
--- | ---
General offset | Defines the general pick and place approach/depart height. It also defines the movement safety distance to keep between robot held items and their nearby items in a pallet pattern. See the robot movement tables on the following pages for a detailed approach and depart movement description when picking and placing items.
End approach in z only | Select this check box when you want the robot to move straight down just before it reaches the target. In the Offset box, type the extra approach distance.
Start depart in z only | Select this check box when you want the robot to move straight up when it leaves the target. In the Offset box, type the extra depart distance.
### Item | Description
--- | ---
Add Horizontal Approach | Select this check box when you want to add an additional approach point before the pick target, so that the tool will move to the pick target from side instead of above. In Direction selection box, select the horizontal direction; and in the Offset box, type the horizontal offset.

Add Horizontal Depart | To move the gripper horizontally away from the object of interest with the specified horizontal depart value. Directions of movements can also be configured.

Use Concurrency | When the check box is selected, the Conc instruction is added to the RAPID move instruction. It allows the subsequent instructions to be executed while the robot is moving to avoid unwanted stop.

Use Arm Config Monitoring | Select this check box to enable the Act.ArmConfMon Boolean variable.

Use SingArea | You can select one of the following 3 options for SingArea.
- SingArea Off - The tool orientation is not allowed to differ.
- Sing Area Wrist - The tool orientation is allowed to differ somewhat to avoid wrist singularity.
- SingArea LockAx4 - The orientation is such that the 4th axis is locked, that is, 6 axis robot behaves like a 4 axis robot. By default the SingArea is set to SingArea Off.

Note

The orientation of the tool will deviate between target positions during linear movements when approaching or departing from a work area. The orientation of the tool will never deviate during movements where products are picked or placed.

---

#### Note

For more information about the concurrency and SingArea settings, see *Technical reference manual - RAPID Instructions, Functions and Data types*.

The following table illustrates the resulting robot movement for group operation sets using various settings. Use the following assumptions:

- General offset is offs.
- End approach in z is appr.
- Start depart in z is dept.

<table>
<thead>
<tr>
<th>Type</th>
<th>Direction</th>
<th>End approach</th>
<th>Start depart in Z only</th>
<th>Position count in Z only</th>
<th>Movement</th>
</tr>
</thead>
<tbody>
<tr>
<td>any</td>
<td>none</td>
<td>no</td>
<td>no</td>
<td>3</td>
<td>offs</td>
</tr>
</tbody>
</table>

Continues on next page
For pallet pattern operation sets the movements are generated a little bit differently. Since multiple picking or placing is supported, the height of the current item must be taken into account. The special cases, when the last item is placed as well as when the first item is picked, are handled separately. The table below illustrates the resulting movement for a pallet pattern operation set with different settings.

Use the following assumptions:
- General offset is offs.
- End approach in z is appr.
- Start depart in z is dept.
- Layer item offset is item offs.

<table>
<thead>
<tr>
<th>Type</th>
<th>Direction</th>
<th>End approach</th>
<th>Start depart in Z only</th>
<th>Position count in Z only</th>
<th>Movement</th>
</tr>
</thead>
<tbody>
<tr>
<td>pick</td>
<td>any</td>
<td>no</td>
<td>no</td>
<td>3</td>
<td><img src="xx110000162" alt="Diagram" /></td>
</tr>
<tr>
<td>place</td>
<td>any</td>
<td>no</td>
<td>no</td>
<td>3</td>
<td><img src="xx110000163" alt="Diagram" /></td>
</tr>
<tr>
<td>pick</td>
<td>any</td>
<td>no</td>
<td>yes</td>
<td>4</td>
<td><img src="xx110000164" alt="Diagram" /></td>
</tr>
<tr>
<td>place</td>
<td>any</td>
<td>yes</td>
<td>no</td>
<td>4</td>
<td><img src="xx110000165" alt="Diagram" /></td>
</tr>
<tr>
<td>pick</td>
<td>any</td>
<td>yes</td>
<td>yes</td>
<td>5</td>
<td><img src="xx110000166" alt="Diagram" /></td>
</tr>
</tbody>
</table>
5 User interface

5.5.5.3 Operation set

Continued

- Layer tool offset is tool offs.
- Item height is h.

<table>
<thead>
<tr>
<th>End approach in Z only</th>
<th>Start depart in Z only</th>
<th>Special case</th>
<th>Position count</th>
<th>Movement</th>
</tr>
</thead>
<tbody>
<tr>
<td>no</td>
<td>no</td>
<td>no</td>
<td>5</td>
<td><img src="xx110000167" alt="Image" /></td>
</tr>
<tr>
<td>no</td>
<td>no</td>
<td>last place</td>
<td>4</td>
<td><img src="xx110000168" alt="Image" /></td>
</tr>
<tr>
<td>no</td>
<td>no</td>
<td>first pick</td>
<td>4</td>
<td><img src="xx110000169" alt="Image" /></td>
</tr>
<tr>
<td>yes</td>
<td>no</td>
<td>no</td>
<td>6</td>
<td><img src="xx110000170" alt="Image" /></td>
</tr>
<tr>
<td>no</td>
<td>yes</td>
<td>no</td>
<td>6</td>
<td><img src="xx110000171" alt="Image" /></td>
</tr>
<tr>
<td>yes</td>
<td>yes</td>
<td>no</td>
<td>7</td>
<td><img src="xx110000172" alt="Image" /></td>
</tr>
</tbody>
</table>

Continues on next page
Any pick or place except the first pick or the last place in the operation.

**Note**

If using Vacuum tool function to pick the items, the statuses of the tool zones are changed during each operation. When picking items, the zones that are configured for those items are set to activate at the target position. When placing items, the corresponding tool zones are set to deactivate at the target position and then to idle at its last depart position.

For more information about tool events, see *Tool events and scenarios on page 135, Advanced setting for Item on page 66*, and the *Pick setting on page 79 Advanced Events*.

**I/O interface**

Whenever the target generation signal is set for a feeder, the positions in an operation set are sent to that feeder. If different operation sets are required in a feeder, the target generation selection signal must be set for corresponding feeder and all operation sets must be given unique I/O values. To select a specific operation set, you first set the correct I/O value for the target generation selection and then set the target generation trigger.

If the target generation selection signal is not configured for the corresponding feeder, only one operation set is allowed for the feeder. When using several operation sets in the same feeder, all operation sets must have unique I/O values. For more information about the target generation signals, see the *Edit detailed signals for feeder on page 173*.

**Stack search**

The following table describes the configuration parameters for the pattern/stack operation set’s stack search.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activate stack search</td>
<td>Select the Activate check box. When stack search is activated, you can enter values in the text boxes.</td>
</tr>
<tr>
<td>Speed</td>
<td>Defines the TCP speed of the robot when it searches for the next layer.</td>
</tr>
<tr>
<td></td>
<td>To set speed, in the Speed text box, type the value the robot should use when searching.</td>
</tr>
<tr>
<td>Offset</td>
<td>Defines an offset of the distance between the next layer and the starting position of the robot's search movement. The total search offset will also include the product height of the next layer and the current layer’s layer search offset (defined in the Layers section). Total search offset = offset + product height + layer search offset.</td>
</tr>
<tr>
<td></td>
<td>To set offset, in the Offset text box, type the offset value from the assumed to most layer where the robot should start the search procedure.</td>
</tr>
<tr>
<td>Stop height</td>
<td>Defines the TCP height above the work object where the robot will stop the search movement (if search stop never occurs).</td>
</tr>
<tr>
<td></td>
<td>To set stop height, in the Stop height text box, type the offset value from the work area where the robot should stop searching.</td>
</tr>
</tbody>
</table>
### Place search

The following table describes the configuration parameters for Place Search.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post Place</td>
<td>Executes the search operation after making a placement.</td>
</tr>
<tr>
<td>Pre-Place</td>
<td>Executes the search operation before making a placement.</td>
</tr>
<tr>
<td>Search start layer</td>
<td>Allows you to select from which layer the Place Search operation should start. The frequency of search applies from the selected of search start layer.</td>
</tr>
<tr>
<td>Search on item (within layer)</td>
<td>Allows you to select whether First item/placement from the layout or the last item/placement from the layout should be used for the search operation.</td>
</tr>
</tbody>
</table>

Following are the different scenarios arise during Place search:

<table>
<thead>
<tr>
<th>Search on item/when to search</th>
<th>Post-Place</th>
<th>Pre-Place</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Item/placement</td>
<td>Post-place search is performed on the first item and the result is used for the remaining items of the current layer.</td>
<td>Pre-place search is performed before the first item is placed and the result is used for the entire current layer.</td>
</tr>
<tr>
<td>Last item/placement</td>
<td>Post-place search is performed on the last item of the current layer and the result is used in the next layer.</td>
<td>Pre-place search is performed on the last item of the current layer and this result is not useful since the layer is already completed.</td>
</tr>
</tbody>
</table>
Search tool

With stack search activated, a special search tool is activated and a search movement is started before the first item in the first layer is picked. The search movement starts an offset from the expected height of the pallet pattern/format and continues until a sensor input indicates that the top layer is reached. If there is no indication from the sensor input, the search movement continues until a stop height is reached. At search stop, the height of the pallet pattern (or format) is updated with the current height of the search tool. Then, movement is started to the approach position of the next pick position. The search tool is deactivated before the movement to the pick position is started.

Pallet pattern

If a pallet pattern is used, picking will continue with lower layers until the pallet is empty. It is also possible to configure new searches for lower layers to improve the picking accuracy. Further it is possible to order a new search from the top of the pallet pattern at any time before the next layer is picked by using an input signal. See Redo search signal in the illustration, in section Edit detailed signals for feeder on page 173.

Configuration of stack search

You do the configuration of the stack search in the Pallet Pattern Operation Set Configuration and Group Operation Set configuration dialog boxes.

Configuration of search tool

You do the configuration of the search tool function in the Search tool on page 193 window.
Stack search target sequence, example

The following illustration shows an example of a stack search target sequence.

<table>
<thead>
<tr>
<th>Sequence step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Position of search tool at start of search movement. The search tool tcp will be placed above the center point of the stack. Activation of the search tool.</td>
</tr>
<tr>
<td>2</td>
<td>Target position for search movement with search tool. In this example never reached. To properly detect an empty stack, stop height should be set lower than half the height of the bottom layer (where the height of the bottom layer is defined as described in PmGetWaHeight).</td>
</tr>
<tr>
<td>3</td>
<td>Resulting search target. Top layer is reached with the search tool and search stop occurs. Height of the pallet pattern is updated.</td>
</tr>
<tr>
<td>4</td>
<td>Approach target of the next pick position with the normal tool configuration. Deactivation of the search tool.</td>
</tr>
<tr>
<td>5</td>
<td>Next pick position with the normal tool configuration.</td>
</tr>
</tbody>
</table>

Check reach

Click **Check Reach** to verify if all positions can be reached by the robot. All robot positions are checked for each layer and each operation, including safe positions, approach positions, pick/place positions, and stack search specific positions. Imported tune data can affect the result.

The check reachability function is implemented for Pallet pattern operation set and Format operation set.

In current version, intermediate positions are NOT checked.
The result of the reachability check function is displayed in different ways

<table>
<thead>
<tr>
<th>Result</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status light</td>
<td>The status light will be Gray, Green, and Red, indicating reach status of unknown, all reachable, and containing unreachable targets.</td>
</tr>
<tr>
<td></td>
<td>Each layer also has a status light indicating its containing targets.</td>
</tr>
<tr>
<td>3D graphical display</td>
<td>In 3D view, if a layer contains unreachable positions, the related items with these positions are drawn with red color.</td>
</tr>
<tr>
<td>Graphic display in Layer, layout display</td>
<td>When selecting a layer containing unreachable positions from the layers list, all items containing unreachable positions will be drawn in red</td>
</tr>
</tbody>
</table>
When configuring a pattern operation set, it is automatically given operations, which means that which formats to use and how to access them is defined for each layer. In some situations there might be requirements not fulfilled by the generated operations. In such cases you can adjust the operations using the Operation Editor.

A layer normally requires several operations, each using a specific format. The order of the operations is important since this is the order the robot will use to access the formats.

<table>
<thead>
<tr>
<th>To...</th>
<th>Do this</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remove an operation</td>
<td>Click Remove to remove the last existing operation.</td>
</tr>
<tr>
<td></td>
<td><strong>Note</strong></td>
</tr>
<tr>
<td></td>
<td>You can remove only the last operation, and new operations can only be added last. This means that to change operations, you may have to remove existing operations first.</td>
</tr>
<tr>
<td>Remove all operations</td>
<td>Click Remove All to remove all existing operations.</td>
</tr>
<tr>
<td>Add an operation</td>
<td>Click New to add a new operation. The selected format to use for the operation is shown in the Display area.</td>
</tr>
<tr>
<td>Select format</td>
<td>Select the format to use for the new operation in the Format list.</td>
</tr>
</tbody>
</table>

Continues on next page
<table>
<thead>
<tr>
<th>To...</th>
<th>Do this</th>
</tr>
</thead>
<tbody>
<tr>
<td>Define format location</td>
<td>Move and rotate the format using the mouse. To define that an item in the format should be placed at a specific location in the layer, make the areas overlap and double-click on the intersection. To define if an item should be placed separately or together with its neighbor, right-click and select Group item or Separate item.</td>
</tr>
<tr>
<td>Auto generate operations</td>
<td>Click Fill to auto generate the operations for the rest of the layer.</td>
</tr>
<tr>
<td>Show the tool</td>
<td>Select this check box to display the location of the tool while dragging a format in the display area.</td>
</tr>
<tr>
<td>Approach direction</td>
<td>To change the general approach direction of a placed target, right-click and select Approach or select the target and use the mouse wheel to change the direction. The horizontal depart direction is indicated by grey arrows.</td>
</tr>
<tr>
<td>Horizontal Approach direction</td>
<td>This is enabled only when the Add Horizontal Approach check box is selected in the Approach/Depart tab, and the direction is set to User Defined. If the check box is selected and the appropriate direction is chosen in this tab, then all the targets follow this direction. If the check box is not selected, the option is disabled. To change the horizontal approach direction of an individual target, right-click on the target and select Horizontal Approach direction and choose the appropriate direction. The horizontal approach direction is indicated by red arrows.</td>
</tr>
<tr>
<td>Horizontal Depart direction</td>
<td>This is enabled only when the Add Horizontal Depart check box is selected in the Approach/Depart tab, and the direction is set to User Defined. If the check box is selected and the appropriate direction is chosen in this tab, then all the targets follow this direction. If the check box is not selected, the option is disabled. To change the horizontal depart direction of an individual target, right-click on the target and select Horizontal Depart direction and choose the appropriate direction. The horizontal depart direction is indicated by green arrows.</td>
</tr>
<tr>
<td>Tool Events</td>
<td>To set Tool Events for each item, right-click on the item and select Tool Events. The events are stored for each item. If there is no change to the Tool Events at the item level, then the Tool Events defined at the Tool level shall be used for the corresponding item.</td>
</tr>
<tr>
<td>Retain Manual Changes</td>
<td>Select this check box to retain the manual changes made to the pallet pattern even if you change the layout from the pallet pattern editor.</td>
</tr>
</tbody>
</table>

**Note**

It is recommended that you use a mouse with a wheel when working with the Operation Editor. The mouse wheel can be used to rotate the format and change the access directions.

Continues on next page
Layers with edited operations is not updated in the operation set configuration when input such as start corner is changed. Remove all operations and click Fill to make the layer un-edited.
5.5.6 Flows

5.5.6.1 Flows

Context Menus from the Flows

You can access the context menus for the flows node in the programming browser by right-clicking the flows node.

<table>
<thead>
<tr>
<th>Context Menu</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add Flow…</td>
<td>It is to add a new flow into the robot. See Add Flow on page 199 for detailed description.</td>
</tr>
</tbody>
</table>

Add Flow

![Add Flow Dialog](image)

Continues on next page
### 5 User interface

#### 5.5.6.1 Flows

*Continued*

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>The name of the flow as it will be shown.</td>
</tr>
<tr>
<td><strong>Note</strong></td>
<td>The name of the flow will also appear on the PickMaster FlexPendant interface.</td>
</tr>
<tr>
<td>I/O Value</td>
<td>A unique I/O value for each flow. The I/O value is used when starting, stopping, or performing recovery of a flow from a PLC instead of using the FlexPendant. The I/O value of the GI signal, pmFlow_giSelection, specifies which flow to be started/stopped/recovered.</td>
</tr>
<tr>
<td>Description</td>
<td>A brief description of the flow.</td>
</tr>
<tr>
<td>Priority</td>
<td>Set individual priority between different flows, used to decide which flow to execute if several are ready to be executed. Valid values are between 0 and 32767 (0 is the highest priority).</td>
</tr>
<tr>
<td>Auto Start</td>
<td>Select Auto Start check box if the flow should start when the project starts.</td>
</tr>
<tr>
<td>Early Request</td>
<td>Select Early request check box if the next request for new products to the slave feeder (used as a slave) is made before the operation is executed on the master feeder (used as a master). If this option is not selected, the next request for new products to the slave feeders is made after the operation is executed on the master feeder.</td>
</tr>
<tr>
<td><strong>Note</strong></td>
<td>In practice, when palletizing and the outfeeder feeder is the master, the next operation is requested on the infeeder right after the last products are picked up from it. The consequence can be that if something fails on the way to the feeder in which to place the products, it might not be possible to redo the interrupted operation since the next product is already requested in the infeeder, which may not be the same as the interrupted one.</td>
</tr>
<tr>
<td>Status Signal</td>
<td>A unique GO status signal for each flow. The status signal is used to monitor the runtime status of the flow.</td>
</tr>
<tr>
<td>Master Feeder</td>
<td>Select the feeder on which palletizing jobs are started. Often the feeder where the pallet pattern is built is used as a master. A feeder used as a master in a flow cannot be involved in any other flows.</td>
</tr>
<tr>
<td>Slave Feeders</td>
<td>Select the feeder(s) used as slaves (slave feeders). These are the feeder(s) that will serve the master feeder with products. The slave feeder(s) are often pallet stacks, slipsheet stacks, and conveyor feeders. Slave feeders can be shared by multiple flows.</td>
</tr>
</tbody>
</table>
5.5.6.2 Flow

Context Menus from the Flow

You can access the context menus for the flow node in the programming browser by right-clicking the flow node.

<table>
<thead>
<tr>
<th>Context Menu</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Edit…</td>
<td>Edit the selected flow configuration. See Add Flow on page 199 for detailed description.</td>
</tr>
<tr>
<td>Add Job…</td>
<td>Starts the Add Job wizard. See Add job on page 83 for detailed description.</td>
</tr>
<tr>
<td>Locate Master Feeder</td>
<td>Locate the master feeder of this flow. The feeder node will be selected in the Programming browser.</td>
</tr>
<tr>
<td>Rename</td>
<td>Change the flow’s name.</td>
</tr>
<tr>
<td>Delete</td>
<td>Delete the flow from the robot.</td>
</tr>
</tbody>
</table>
## Context Menus from the Job

You can access the context menus for the job node in the programming browser by right-clicking the job node.

<table>
<thead>
<tr>
<th>Context Menu</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Locate Original Operation set</td>
<td>Locate the referenced operation set node in Programming browser.</td>
</tr>
<tr>
<td>Simulate Job</td>
<td>Starts simulation but only running the selected job.</td>
</tr>
<tr>
<td>Delete</td>
<td>Delete the referenced operation set of the master feeder.</td>
</tr>
</tbody>
</table>
6 RAPID program

6.1 Introduction

Structure of this chapter

This chapter describes the RAPID program module templates and system modules. Program examples with detailed descriptions are also included. Windows and other parts of the user interface are described with regard to their content and how they are accessed.
6 RAPID program

6.2 Overview

6.2.1 Relationship between RAPID execution and PickMaster project

Overview

The RAPID program templates for a robot executes a pick-and-place cycle for one of the configured flows in every loop. The selection of flow is made in priority order among the flows which currently are ready to execute, that is, having targets generated for the next operation on both the infeeder and the outfeeder. The robot movements and the I/O events on the infeeder and outfeeder are performed according to the configured operation sets and formats.

Intermediate positions

The RAPID program templates include functionality to generate safe intermediate positions for the movements between infeeders, outfeeders and the home position.

Operation, target, action, event and product

Introduction

To describe all movements in an Operation Set, their properties are divided into Operations, Targets and Actions, which are retrieved by the instructions PmGetOperation, PmGetTarget and PmGetTgtAction.

Operation

Everything that is done by the robot in one visit to work area. This includes multi-pick or multi-place of several products.

One Operation contains one or more Targets.

For details, see pm_operationdata - PickMaster operation data on page 352.

Target

The final position of every pick or place of one or more products. Also contains the work object and tool used for the whole path to and from the target positions.

One Target contains one or more Actions and product data.

For details, see pm_targetdata - PickMaster target data on page 366.

Action

One path segment on the way to and from a target. Every action is realized as a move instruction (TriggL/MoveL) in RAPID.

One Action contains one or more Events.

For details, see pm_actiondata - PickMaster action data on page 337.

Event

An event that occurs on the path. It can be a change of a signal value or an acknowledgement that a certain task has been performed and is realized through trigg data using TriggL in RAPID.

Continues on next page
Product

One or more Product(s) that is/are handled (picked/placed) by the robot at each Target.

Illustration

A typical place operation of two products at two different angles will be realized as:

A Operation
B Targets
C Actions
D Event (in this case *Turn off the vacuum*)
E Products
F To next InterMid position
6 RAPID program

6.2.2 RAPID modules overview

Overview
To run a PickMaster project you need RAPID program modules and system modules, which are described in this section.

RAPID template modules
The PickMaster installation includes the following two RAPID template modules:

- PmMain, which is a program module that contains basic code to execute the operations in different work areas.
- PmUtility, which is a program module that contains home positions and intermediate positions.

The RobotWare option Prepared for PickMaster, together with the sub-option Palletizing PowerPac, includes the following two RAPID template modules:

- PmProjMgr, which is a program module that contains basic code to execute the commands from PickMaster I/O interface.
- PmProjServer, which is a program module that contains basic code to execute the commands from PickMaster I/O interface, executed in a semi-static RAPID task.

System modules
The RobotWare option Prepared for PickMaster, together with the sub-option Palletizing PowerPac, includes the following three installed system modules:

- pmrcUser, which is a system module that contains tool and work object declarations and traps for checking I/O values.
- pmrcSys, which is a system module that contains open non-view procedures mainly used to set all modal data used in the moves.
- pmrcBase, which is a system module that contains encrypted non-view procedures and variables used in the process.
6.3 Program module templates

6.3.1 PmMain module

Overview
This section describes the routines and variables in the PmMain module. The module contains the main procedure for the PickMaster RAPID execution, and it is where the program starts the execution.

This section describes the following procedures:
- Main
- OperateSequence
- Operate

Procedure Main

Usage
This is the main procedure of the template and where the execution starts.

Description
The routine is re-executed for every new pick and place cycle. The error handler is used to recover an error when running a pick and place cycle including a stack search on the master work area.

To recover PM_ERR_JOB_EMPTY, follow these directions:
1. Move back the robot in the negative search direction.
2. Eliminate the cause of the error, for example, fill up with new pallets.
3. The position request DO signal is set on the master work area after an empty stack is detected.
   Generate a new job on the master work area.
4. Recover the error in the error handler using RETRY. As a result the robot will start the new job and a new pick and place cycle is started.

Program code

```rapid
PROC Main()
  IF FirstMainLoop THEN
    MoveHomePos;
    FirstMainLoop:=FALSE;
  ENDIF
  PmWaitProjStart;
  OperateSequence;
  ERROR
  IF ERRNO = PM_ERR_JOB_EMPTY THEN
    RETRY;
  ENDIF
ENDPROC
```

Related information
Procedure OperateSequence on page 208.
PmWaitProjStart - Wait for any active project on page 316.
PmGetWaByWobj - Get a reference to a work area using a work object data on page 300.

Procedure OperateSequence

Usage

This routine performs one cycle sequence.

Description

OperateSequence executes one cycle beginning with fetching a flow that is ready to be executed. Then the robot operates first on the infeeder and then on the outfeeder.

The error handler is used to handle some errors when running an operation including a stack search.

<table>
<thead>
<tr>
<th>Error code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM_ERR_PALLET_REduced</td>
<td>The detected stack height was lower than expected. The error is recovered by fetching next operation using RETRY.</td>
</tr>
<tr>
<td>PM_ERR_PALLET_EMPTY</td>
<td>The detected stack height was zero on a slave work area.</td>
</tr>
<tr>
<td>PM_ERR_JOB_EMPTY</td>
<td>The detected stack height was zero on a master work area. The error is raised and recovered in the Main routine.</td>
</tr>
</tbody>
</table>

To recover PM_ERR_PALLET_EMPTY:

1. Move back the robot in the negative search direction.
2. Eliminate the cause of the error, for example, fill up with new pallets.
3. Set the position request DO signal if an empty stack is detected. Generate a new stack by setting the target generation signals according to the position request.
4. Set variable MultiOperation to TRUE to avoid an intermediate movement before starting a new search.
5. Recover the error in the error handler using RETRY. As a result, the robot will search the new stack from the top.

Program code

```rpid
PROC OperateSequence()
PmGetFlow waInFeeder, waOutFeeder;
Operate waInFeeder;
Operate waOutFeeder;
ERROR
TEST ERRNO
CASE PM_ERR_PALLET_REduced:
! Number of remaining layers on pallet was updated after stack search.
! Operate the same work area again to access the new current layer.
MultiOperation:=TRUE;
RETRY;
CASE PM_ERR_PALLET_EMPTY:
```

Continues on next page
The pallet stack was found empty during stack search.
MultiOperation:=TRUE;
RETRY;
CASE PM_ERR_JOB_EMPTY:
! The pallet stack was found empty during stack search on master.
MultiOperation:=FALSE;
RAISE;
ENDTEST
ENDPROC

Related information

Procedure Operate on page 209.

Procedure Operate

Usage

This procedure is used to execute an operation.

Description

The procedure loops through all targets in an operation and through all actions in every target. It calls the PmCalcArmConf, which helps setting the arm configuration on every target. Before the very first target in the operation is executed, the robot will move to an intermediate position.

The default error handler handles raise errors from PmSearchAdjust when running stack search. The errors are raised to the calling routine, OperateSequence.

Arguments

WorkArea

Datatype: pm_wadescr

Contains a reference to a work area.

Program code

PROC Operate(VAR pm_wadescr WorkArea)
VAR pm_operationdata Op;
VAR pm_targetdata Tgt;
VAR pm_actiondata Act;
VAR bool FirstTgtInOp:=TRUE;
PmGetOperation WorkArea, Op;
WHILE PmGetTarget(WorkArea \OpHandle:=Op.OpHandle, Tgt) DO
  WHILE PmGetTgtAction(WorkArea, Tgt.TargetHandle, Act) DO
    PmCalcArmConf Act.RobTgt, Tgt.TargetTool, Tgt.TargetWobj \cf6\MaxAngle:=MaxToolAngle\MinAngle:=MinToolAngle\SingAreaType:=Act.SingAreaType;
    IF FirstTgtInOp AND (NOT MultiOperation) THEN
      MoveInterMid WorkArea, Tgt, Act, PmSafetyOffsetZ \MaxAngle:=MaxToolAngle\MinAngle:=MinToolAngle;
    ENDIF
    DoAction WorkArea, Tgt, Act;
    SetLastPos WorkArea, Tgt, Act;
  ENDWHILE
ENDPROC

Continues on next page
ENDWHILE
MultiOperation:=FALSE;

ERROR
TEST ERRNO
  CASE PM_ERR_PALLET_REduced:
    RAISE;
  CASE PM_ERR_PALLET_EMPTY:
    RAISE;
ENDTEST
ENDPROC

Related information

Procedure PmDoAction on page 228
Procedure SetLastPos on page 213.
Procedure MoveInterMid on page 214.

pm_wadescr - PickMaster work area reference on page 370.
pm_operationdata - PickMaster operation data on page 352.
pm_targetdata - PickMaster target data on page 366.
pm_actiondata - PickMaster action data on page 337.
PmGetOperation - Get operation from a work area on page 296.
PmCalcArmConf - Calculates the arm configuration on page 288.
PmGetTarget - Get target on page 328.
PmGetTgtAction - Get target action on page 330.
PmSearchAdjust - Adjust number of remaining layers on page 303

Variables waInFeeder1 and waOutFeeder1

Usage

The variables are used as work area descriptors for one infeeder and one outfeeder.

Description

The descriptors are handled to access the work areas when retrieving operations, targets and actions.

Program code

VAR pm_wadescr waInFeeder1;
VAR pm_wadescr waOutFeeder1;
PmGetFlow waInFeeder, waOutFeeder;
Operate waInFeeder1;
Operate waOutFeeder1;

Related information

pm_wadescr - PickMaster work area reference on page 370.

Constants MaxToolAngle and MinToolAngle

Usage

The constants are used to set the maximum and minimum allowed angles for the tool.

Continues on next page
Description

The angle limitation is used to set the maximum and minimum angle on the tool axis 6. This may be changed because of the limitations in hoses and wires.

Program code

PmCalcArmConf Tgt.RobTgtPoint, Tgt.TargetTool, Tgt.TargetWobj cf6
\MaxAngle:=MaxToolAngle \MinAngle:=MinToolAngle
\SingAreaType:=Act.SingAreaType;

Related information

pm_wadescr - PickMaster work area reference on page 370.
PmCalcArmConf - Calculates the arm configuration on page 288.
6 RAPID program

6.3.2 PmUtility module

Overview

This section describes the routines and variables in the PmUtility module. The module contains support for the home and intermediate position.

Procedure MoveHomePos

Usage

This procedure is used to move the robot to the home position.

Description

This routine uses MoveInterMid to move the robot to a well-defined home position with a safe path height when passing intermediate work areas on the way. The routine will wait for the project to be started before the movement is executed. The default installed work area PM_HOME is used as the work area to go to. Finally, the home position is set as the last work area, thus making it the starting point for the next intermediate movement which also will get a safe path height.

Program code

PROC MoveHomePos()
    CONST num RetractDist:=50;
    VAR pm_targetdata Tgt;
    VAR pm_actiondata Act;
    VAR pm_wadescr HomeWorkArea;
    ! Get the weight from current tool and frame from tool0
    PmLastTool:=CTool();
    PmLastTool.tframe:=tool0.tframe;
    PmLastWobj:=CWObj();
    PmLastRobTgt:=CRobT(Tool:=PmLastTool,Wobj:=PmLastWobj);
    Act.Speed:=v500;
    Act.Accel.AccLim:=FALSE;
    Act.Accel.AccMax:=100;
    Act.Accel.DecelLim:=FALSE;
    Act.Accel.DecelMax:=100;
    Act.Accel.Acc:=100;
    Act.Accel.Ramp:=100;
    Act.RobTgt:=CalcRobT(HomePos,tool0);
    Tgt.TargetTool:=PmLastTool;
    Tgt.TargetWobj:=pm_home_WObj;
    PmLastRobTgt.trans.z:=PmLastRobTgt.trans.z+RetractDist;
    MoveLPmLastRobTgt,Act.Speed,fine,PmLastTool\Wobj:=PmLastWobj;
    PmWaitProjStart;
    PmGetWaByWobj pm_home_WObj,HomeWorkArea;
    MoveInterMid HomeWorkArea,Tgt,Act, PmSafetyHeight\MoveToEndPoint;
    PmLastRobTgt:=Act.RobTgt;
    PmLastWobj:=Tgt.TargetWobj;
    PmLastTool:=Tgt.TargetTool;
    PmSetLastWa HomeWorkArea;

Continues on next page
Related information

- *PmWaitProjStart* - Wait for any active project on page 316.
- *PmGetWaByWobj* - Get a reference to a work area using a work object data on page 300.
- *PmSetLastWa* - Set last used work area on page 305.

**Procedure SetLastPos**

**Usage**

This procedure is used to store the last position, tool, work object, and work area.

**Description**

The stored position, tool, work object, and work area are used when calculating the intermediate position.

**Arguments**

- **WorkArea**
  - Datatype: `pm_wadescr`
  - Last work area that was used.
- **Tgt**
  - Datatype: `pm_targetdata`
  - Last target data that was used.
- **Act**
  - Datatype: `pm_actiondata`
  - Last action data that was used.

**Program code**

```rapid
PROC SetLastPos(VAR pm_wadescr WorkArea, VAR pm_targetdata Tgt, VAR pm_actiondata Act)
VAR robtarget temp;
temp:=LastRobTgt;
LastRobTgt:=Act.RobTgt;
LastWobj:=Tgt.TargetWobj;
LastTool:=Tgt.TargetTool;
PmSetLastWa WorkArea;
IF Act.ArmConfMon = FALSE THEN
  LastRobTgt.robconf:=temp.robconf;
ENDIF
ENDPROC
```

**Related information**

- `pm_actiondata` - PickMaster action data on page 337.
- `pm_targetdata` - PickMaster target data on page 366.
- `pm_wadescr` - PickMaster work area reference on page 370.
- *PmSetLastWa* - Set last used work area on page 305.
6 RAPID program

6.3.2 PmUtility module
Continued

Procedure MoveInterMid

Usage
This procedure is used to move the robot from a starting point (for example another work area or the home position) towards a new operation on the next work area with a safe path height when passing intermediate work areas on the way from the starting point.

Description
This procedure uses the last stored position (from the SetLastPos procedure) and a new operation on the next work area to calculate three consecutive intermediate positions by using the PmCalcIntermid routine. PmGetPathHeight is used to find the minimum height for a safe travel towards the work area.

Arguments

WorkArea
Datatype: pm_wadescr
Work area to go to.

Tgt
Datatype: pm_targetdata
The next target to go to.

Act
Datatype: pm_actiondata
The next action to perform.

SafetyOffsetZ
Datatype: num
An additional safety offset that is added to the minimum path height.

MaxAngle
Datatype: num
The maximum allowed tool angle.

MinAngle
Datatype: num
The minimum allowed tool angle.

MoveToEndPoint
Datatype: switch
Finish with zone or fine point.

Program code

PROC MoveInterMid(VAR pm_wadescr WorkArea, VAR pm_targetdata Tgt, VAR pm_actiondata Act, num SafetyOffsetZ, num MaxAngle, num MinAngle, switch MoveToEndPoint)
CONST num IntermidPart1:=0.1;
CONST num IntermidPart2:=0.5;
CONST num IntermidPart3:=0.9;
VAR robtarget InterMid;

Continues on next page
VAR robtarget InterMid2;
VAR robtarget InterMid3;
VAR jointtarget FromJointTgt;
VAR jointtarget ToJointTgt;
VAR robtarget FromRobTgt;
VAR robtarget ToRobTgt;
VAR num MinZ;
VAR pm_wadescr LastWorkArea;

PmGetLastWa LastWorkArea;

! Calculate MinZ. The z value of the tool and product is not considered in the calculation of min z in PmCalcIntermid.
IF Tgt.NumOfAppProds=0 THEN
  ! MinZ without product in tool
  MinZ:=PmGetPathHeight(LastWorkArea, WorkArea\UseSafePosition) + Tgt.GripLenEmptyZ + SafetyOffsetZ;
ELSE
  ! MinZ with product in tool
  MinZ:=PmGetPathHeight(LastWorkArea, WorkArea\UseSafePosition) + Tgt.GripLenLoadedZ + SafetyOffsetZ;
ENDIF

! Check z value also for the start and end target.
! Use tool and workobject from target tool.
TempTool:=Tgt.TargetTool;
TempWobj:=Tgt.TargetWobj;

! Set start and end target values.
FromJointTgt:=CalcJointT(PmLastRobTgt, PmLastTool\Wobj:=PmLastWobj);
ToJointTgt:=CalcJointT(Act.RobTgt, TempTool\Wobj:=TempWobj);
FromRobTgt:=CalcRobT(FromJointTgt, tool0);
ToRobTgt:=CalcRobT(ToJointTgt, tool0);

! Compare z value for start and end targets, set a new higher value for z if needed.
IF (FromRobTgt.trans.z<ToRobTgt.trans.z) AND (MinZ<ToRobTgt.trans.z) THEN
  MinZ:=ToRobTgt.trans.z;
ELSEIF (ToRobTgt.trans.z<FromRobTgt.trans.z) AND (MinZ<FromRobTgt.trans.z) THEN
  MinZ:=FromRobTgt.trans.z;
ENDIF
ConfJ\On;

! Use the frame from tool0 and the load from target tool
TempTool:=Tgt.TargetTool;
TempTool.tframe:=tool0.tframe;

! Set Acceleration
PathAccLim Act.Accel.AccLim\AccMax:=Act.Accel.AccMax,
! Using PmDoMove3 instead of MoveJ.
! PmDoMove3 will automatically avoid using too many consecutive concurrent (\Conc) movements.
! Travel distance: 10%
InterMid1:=PmCalcIntermid(PmLastRobTgt,PmLastTool,PmLastWobj, Act.RobTgt,Tgt.TargetTool,Tgt.TargetWobj,IntermidPart1\ MaxAngle?MaxAngle\MinAngle?MinAngle\AngleLimAx6\ MinZ:=MinZ\FromWa:=LastWorkArea\ToWa:=WorkArea);
PmDoMove3
   PM_MOVE_JOINT\Conc,InterMid1,Act.Speed,z200,TempTool,wobj0;

! Calculate intermediate targets two and three
InterMid2:=PmCalcIntermid(PmLastRobTgt,PmLastTool,
   PmLastWobj,Act.RobTgt,Tgt.TargetTool,Tgt.TargetWobj,
   IntermidPart2\MaxAngle?MaxAngle\MinAngle?MinAngle\ AngleLimAx6\MinZ:=MinZ\FromWa:=LastWorkArea\ToWa:=WorkArea);
InterMid3:=PmCalcIntermid(PmLastRobTgt,PmLastTool,
   PmLastWobj,Act.RobTgt,Tgt.TargetTool,Tgt.TargetWobj,
   IntermidPart3\MaxAngle?MaxAngle\MinAngle?MinAngle\ AngleLimAx6\MinZ:=MinZ\FromWa:=LastWorkArea\ToWa:=WorkArea);

! Travel distance: 50%
PmDoMove3
   PM_MOVE_JOINT\Conc,InterMid2,Act.Speed,z200,TempTool,wobj0;

! Travel distance: 90%
IF Present(MoveToEndPoint) THEN
   PmDoMove3
   PM_MOVE_JOINT\Conc,Act.RobTgt,Act.Speed,fine,TempTool,wobj0;
ELSE
   PmDoMove3
   PM_MOVE_JOINT\Conc,InterMid3,Act.Speed,z200,TempTool,wobj0;
ENDIF
ENDPROC

Related information
pm_actiondata - PickMaster action data on page 337.
pm_targetdata - PickMaster target data on page 366.
pm_wadescr - PickMaster work area reference on page 370.
PmGetLastWa - Get last used work area on page 295.
PmGetPathHeight - Get a safe path height for an intermediate movement on page 323.
PmCalcArmConf - Calculates the arm configuration on page 288.

Variable HomePos

Usage

The variable is used to set the home position of the robot.

Continues on next page
Description

The home position must be modified for custom purposes.

Program code

```plaintext
LOCAL PERS jointtarget
   HomePos:=[[0,0,0,0,90,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]]; //
   ...
   MoveAbsJ HomePos,HomeSpeed,fine,TempTool;
```

Related information

*Technical reference manual - RAPID Instructions, Functions and Data types, section robtarget - Position data.*
6 RAPID program

6.3.3 PmProjMgr module

6.3.3 PmProjMgr module

Overview

The PmProjMgr module can be used if needed. It is prepared to be used in PickMaster I/O interface for starting a project and loading the modules needed for the main palletizing loop. The I/O signals used in this module are the same as in the configuration that comes with the installation of PickMaster. This module is compatible with the modules PmMain and PmUtility.

This section describes:

• Procedure Main
• Trap TrapProjectStopped

Procedure Main

This section describes the main routine in the PmProjMgr module.

Usage

This is where the program starts the execution if the PickMaster I/O interface is used.

The error handler is simple but it is prepared so it can easily be complemented with more sophisticated error handling depending on your needs.

Description

PmProjMgr executes the following:

• Setting up a TRAP that supervises the stop project signal. The RAPID execution is interrupted and continues from Main.
• Waiting for project start signal.
• Reading project selection signal. The mapping between project and its signal value must have been transferred.
• Starting selected project.
• Setting current project signal to the value of the selected project.
• Loading the modules in the project. The modules are only loaded if it is specified in the configuration and if they are not already loaded.
• Executing the main loop until the project is stopped. The main routine that is called is the same as if the project is started without the I/O interface.

Program code

PROC main()
VAR pm_projectinfo ProjInfo;
IF FirstProjMgrLoop THEN
FirstProjMgrLoop:=FALSE;
! Project is stopping
IDelete pmIntProjectStopping;
CONNECT pmIntProjectStopping WITH TrapProjectStopped;
ISignalDI\SingleSafe,pmProject_diStop,1, pmIntProjectStopping;
ENDIF
! Activate the main loop
StartLoadRun:=TRUE;

Continues on next page
IF PM_PROJECT_STATUS=PM_PROJECT_STOPPED OR
  PM_PROJECT_STATUS=PM_PROJECT_STOPPING OR
  PM_PROJECT_STATUS=PM_PROJECT_ERROR THEN
  IF PM_PROJECT_STATUS=PM_PROJECT_STOPPING THEN
    WaitUntil PM_PROJECT_STATUS=PM_PROJECT_STOPPED OR
    PM_PROJECT_STATUS=PM_PROJECT_ERROR;
  ENDIF
!
  ! Wait for start project order from PLC
  WaitDI pmProject_diStart,1;
  ! Check which project to be started
  ProjectSelection:=pmProject_giSelection;
  ! Get info from select project
  PmGetProjectInfo ProjectSelection,ProjInfo;
  ProjectInfo:=ProjInfo;
  ! Start the selected project
  IF StartLoadRun THEN
    WaitTestAndSet ProjectStart;
    IF PM_PROJECT_STATUS<>PM_PROJECT_RUNNING THEN
      PmStartProj ProjectInfo.Name\Signal:=pmProject_goStatus;
    ENDIF
    ProjectStart:=FALSE;
  SETGO pmProject_goCurrent, ProjectSelection;
  ENDIF
ELSE ! STARTING OR RUNNING
  ! Wait for project to be running
  PmWaitProjStart;
ENDIF
!
  ! Load all program modules for the task
  IF StartLoadRun THEN
    LoadAllModulesInTask ProjectInfo;
  ENDIF
ENDIF
WHILE StartLoadRun DO
  ! Execute the main routine in the selected project
  "%mMain\Main"%;
  IF PM_PROJECT_STATUS=PM_PROJECT_STOPPED OR
    PM_PROJECT_STATUS=PM_PROJECT_STOPPING OR
    PM_PROJECT_STATUS=PM_PROJECT_ERROR THEN
    StartLoadRun:=FALSE;
  ENDIF
ENDWHILE
ERROR
IF ERRNO=PM_ERR_NO_TASK THEN
  ! ProjectInfo has no task configured for current task
  StartLoadRun:=FALSE;
ELSEIF ERRNO=PM_ERR_PROJ_NOT_FOUND THEN
  ! There is no project mapped to the selection value
  StartLoadRun:=FALSE;
  WaitDI pmProject_diStart,0;
  TRYNEXT;
ELSEIF ERRNO=ERR_REFUNKPRC THEN
  ! There is no main routine in the loaded modules
Continues on next page
Trap TrapProjectStopped

This section describes the trap that is called when the project stopped signal is pulsed.

Usage

The trap will prevent that RAPID execution continues after an ordered stop of project. The execution continues at main but the loaded modules are not unloaded. Starting a new project will fail to load the new modules. This trap is not executed if the recommended stop sequence is followed.

Description

TrapProjectStopped executes the following:

- Stopping robot movement.
- Clearing the robot path.
- Resetting stop move state.
- Continuing execution from main.

Program code

```
TRAP TrapProjectStopped
  StopMove\Quick;
  ClearPath;
  StartMove;
  FirstProjMgrLoop:=TRUE;
  WaitTime 2;
  ExitCycle;
ENDTRAP
```

Related information

6.3.4 PmProjServer module

Overview
The PmProjServer module is used in the semi-static RAPID task PM_PROJ_SUPERV. It is prepared to be used in PickMaster I/O interface for starting and stopping flows. The I/O signals used in this module are the same as in the configuration that comes with the installation of PickMaster. The I/O signals are mapped to alias signals to prevent errors if the signals are not configured in the controller. A warning is generated in the error log at each restart of the controller if the signals are not found.

Procedure Main
This section describes the main routine in the PmProjServer module.

Usage
This is where the program starts the execution.

Description
Main routine executes the following:
- Connecting all alias signals with the configured signals.
- Waiting for a project to start.
- Connecting traps to project stop, flow start, and flow stop traps.
- Waiting for the project to stop.
- Disconnecting all traps.

Program code

```
PROC main()
VAR bool SignalsExist:=TRUE;
! Connect all alias signals with the configured signals
SignalsExist:=ConnectAliasSignals();
WHILE SignalsExist=FALSE DO
  ! Loop forever
  WaitTime 1000;
ENDWHILE
WHILE TRUE DO
  ! Wait for project to be running.
  PmWaitProjStart;
  ! Connect all traps with its interrupts
  ConnectTraps;
  ! Wait for stop project order
  Until PM_PROJECT_STATUS=PM_PROJECT_STOPPED;
  SetGO alias_goCurrentProject, 0;
  ! Disconnect all traps from its interrupts
  DeleteTraps;
ENDWHILE
ENDPROC
```

Continues on next page
6 RAPID program

6.3.4 PmProjServer module

Continued

**Trap TrapSetRecoverAction**

This section describes the trap that executes when the set recover action signal has been pulsed.

**Description**

Before a flow that is in error state can be started a recover action has to be set. If using the I/O interface a flow, work area, and a recover action must have been set before the set recover action is pulsed. An event log messages is generated with information about conditions for a successful flow restart.

**Program code**

```rapid
TRAP TrapSetRecoverAction
VAR pm_flowinfo FlowInfo;
VAR num FlowSelection;
VAR pm_wainfo WaInfo;
VAR num RecoverAction;
VAR num WaSelection;
VAR num EvtId;
VAR errstr Arg1;
VAR errstr Arg2;
VAR errstr Arg3;
VAR errstr Arg4;
VAR bool UseMasterWa:=FALSE;
FlowSelection:=alias_giSelectionFlow;
RecoverAction:=alias_giRecoverAction;
WaSelection:=alias_giWaRecoverSelection;
! Get info from selected flow
PmGetFlowInfo FlowSelection,FlowInfo;
IF RecoverAction=PM_RECOVER_REDO_LAST_PICK THEN
  ! Set recover action
  PmSetRecoverAction FlowInfo.Name,RecoverAction\EventId:=EvtId
  \Argument1:=Arg1\Argument2:=Arg2\Argument3:=Arg3
  \Argument4:=Arg4;
ELSE
  ! Get info from selected Work Area
  PmGetWaInfo WaSelection,WaInfo;
  IF UseMasterWa = TRUE THEN
    ! Set recover action - If no workarea, use the master workarea for the flow
    PmSetRecoverAction FlowInfo.Name\Workarea:=FlowInfo.MasterWa,
    RecoverAction\EventId:=EvtId
    \Argument1:=Arg1\Argument2:=Arg2\Argument3:=Arg3\Argument4:=Arg4;
    UseMasterWa:=FALSE;
  ELSE
    ! Set recover action
    PmSetRecoverAction
    FlowInfo.Name\Workarea:=WaInfo.Workarea,RecoverAction
    \EventId:=EvtId\Argument1:=Arg1\Argument2:=Arg2
    \Argument3:=Arg3\Argument4:=Arg4;
  ENDIF
ENDIF
```

Continues on next page
IF (EvtId<2398) AND (EvtId>2392) THEN
    PmErrorLog EvtId,FlowInfo.Name,Arg1,Arg2,Arg3,Arg4
    \EventType:=TYPE_WARN;
ENDIF

ERROR
! Continue supervision on recoverable errors
IF ERRNO=PM_ERR_FLOW_NOT_FOUND THEN
    IF RecoverAction = PM_RECOVER_CONTINUE_OPERATION THEN
        UseMasterWa:=TRUE;
        TRYNEXT;
    ELSE
        RETURN;
    ENDIF
ELSEIF ERRNO=PM_ERR_WA_NOT_FOUND THEN
    RETURN;
ELSEIF ERRNO=PM_ERR_NO_RUNNING_PROJECT THEN
    RETURN;
ELSEIF ERRNO=PM_ERR_REDO_LAST_PICK_REJECTED THEN
    RETURN;
ELSEIF ERRNO=PM_ERR_WORKAREA_EXPECTED THEN
    RETURN;
ELSEIF ERRNO=PM_ERR_NOT_VALID_RECOVER_ACTION THEN
    RETURN;
ELSE
    RETURN;
ENDIF
ENDTRAP

Trap TrapStartFlow
This section describes the trap that executes when the start flow signal has been pulsed.

Description
A GI signal defines which flow should be started. The flow name received from PmGetFlowInfo is used to start the flow.

Program code
TRAP TrapStartFlow
    VAR pm_flowinfo FlowInfo;
    VAR num FlowSelection;
    FlowSelection:=alias_giSelectionFlow;
    ! Get info from selected flow
    PmGetFlowInfo FlowSelection,FlowInfo;
    ! Start the selected flow
    PmStartFlow FlowInfo.Name;
ERROR
    ! Continue supervision on recoverable errors
    IF ERRNO=PM_ERR_FLOW_NOT_FOUND THEN
        RETURN;
    ELSEIF ERRNO=PM_ERR_NO_RUNNING_PROJECT THEN
        RETURN;
   Continues on next page
ELSEIF ERRNO=PM_ERR_WRONG_FLOW_STATE THEN
    RETURN;
ELSE
    RETURN;
ENDIF
ENDTRAP

**Trap TrapStopFlow**

This section describes the trap that executes when the stop flow signal has been pulsed.

**Description**

A GI signal defines which flow should be stopped and another GI signal defines the stop behavior. The flow name received from `PmGetFlowInfo` is used to stop the flow.

**Program code**

```rapid
TRAP TrapStopFlow
    VAR pm_flowinfo FlowInfo;
    VAR num FlowSelection;
    VAR num StopOption;
    FlowSelection:=alias_giSelectionFlow;
    StopOption:=alias_giStopOptionFlow;
    ! Get info from selected flow
    PmGetFlowInfo FlowSelection,FlowInfo;
    ! Stop the selected flow
    PmStopFlow FlowInfo.Name,StopOption;
    ERROR
    ! Continue supervision on recoverable errors
    IF ERRNO=PM_ERR_FLOW_NOT_FOUND THEN
        RETURN;
    ELSEIF ERRNO=PM_ERR_NO_RUNNING_PROJECT THEN
        RETURN;
    ELSE
        RETURN;
    ENDIF
ENDTRAP
```

**Trap TrapProjectStopped**

This section describes the trap that executes if the stop project signal has been pulsed.

**Description**

`PmStopProj` is called to stop the current project. This trap will normally not be executed since the traps are disconnected at the same time as the stop project signal has been pulsed.

**Program code**

```rapid
TRAP TrapProjectStopped
    PmStopProj;
ENDTRAP
```

*Continues on next page*
Related information

PmGetFlowInfo - Get information about a specific flow on page 293.
PmStartFlow - Starts a specific flow on page 310.
PmStopFlow - Stop a specific flow on page 313.
PmStopProj - Stop current project on page 315.
An ABB IRC5 robot controller installed with the RobotWare option Prepared for PickMaster, together with the sub-option Palletizing PowerPac, will always contain the following loaded system modules:

- pmrcUser (open)
- pmrcSys (open)
- pmrcBase (encrypted).
6.4.2 Public system module pmrcUser

Description

The pmrcUser module contains declarations of work object data and tool data that can be used when setting up the line. Additional work objects and tools can be added here.

Trap TrapDIToolEvents

Usage

This trap is called if one DI signal is not set to the desired value at a specific robot position. The RAPID execution and robot movement is interrupted until all the specified DI and GI signal values for the robot position are set to their desired values.

WarningTime defines how long time the robot will wait for the signals to be set before a warning is logged.

PollTime defines how often the signals will be checked while waiting.

Program code

```rapid
TRAP TrapDIToolEvents
    VAR num warningTime := 5; VAR num pollRate := 0.1;
    PmCheckToolEventInputSignals warningTime, pollRate;
ENDTRAP
```

Trap TrapGIToolEvents

Usage

This trap works in the same way as TrapDIToolEvents but is executed for GI signals.
6.4.3 Public system module pmrcSys

Description
The pmrcSys module contains instructions and data that are a part of the PickMaster base functionality. This module is declared as NOSTEPIN, which means that the code is open and editable but it is not possible to step into the routines. The NOSTEPIN statement can be removed for debug purposes.

This module is not saved in a backup. If modifications are needed in this module, then rename the instructions and move them to pmrcUser.

Procedure PmDoAction

Usage
Execute an action, that is, a single robot movement having preconfigured path events and motion settings.

Basic examples
A basic example of the procedure PmDoAction is seen in the program code for the Procedure Operate on page 209, in the PmMain module.

Arguments

WorkArea
Datatype: pm_wadescr
Contains a reference to the work area to use.

Tgt
Datatype: pm_targetdata
The target data used for the move.

Act
Datatype: pm_actiondata
The action data used for the move.

Error handling
The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO will be set to:

<table>
<thead>
<tr>
<th>Error code</th>
<th>Des</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM_ERR_PALLET_REduced</td>
<td>The detected stack height was lower than expected.</td>
</tr>
<tr>
<td>PM_ERR_PALLET_EMPTY</td>
<td>The detected stack height was zero on a slave work area.</td>
</tr>
<tr>
<td>PM_ERR_JOB_EMPTY</td>
<td>The detected height was zero on a master work area.</td>
</tr>
</tbody>
</table>

Syntax

PmDoAction
[ Wa ':= ' ] < expression (IN) of pm_wadescr > ','
[ Tgt ':= ' ] < expression (IN) of pm_targetdata > ','
[ Act ':= ' ] < expression (IN) of pm_actiondata > ';'
See the program code by browsing the `pmrcSys` module on the robot.

### Procedure `PmDoMove3`

**Usage**

This procedure calls the selected move Instruction (`MoveL`, `MoveJ`, `TriggL` or `TriggJ`) using the selected parameters.

**Basic examples**

A basic example of the procedure `PmDoMove3` is seen in the program code for the `Procedure MoveInterMid` on page 214, in the `PmUtility` module.

**Arguments**

- **Move**
  
  **Datatype:** `pm_movetype`
  
  The type of movement that is used. Supported types are `MoveJ`, `MoveL`, `TriggL` and `TriggJ`.

- **Conc**
  
  **Datatype:** `bool`
  
  Tells if a concurrent move instruction is used.

- **ToPoint**
  
  **Datatype:** `robtarget`
  
  The destination point of the movement.

- **Speed**
  
  **Datatype:** `speeddata`
  
  The speed data that applies to movements. Speed data defines the velocity of the tool center point, the external axes and of the tool reorientation.

- **T1**
  
  **Datatype:** `triggdata`
  
  Variable that refers to trigger conditions and trigger activity.

- **T2**
  
  **Datatype:** `triggdata`
  
  Variable that refers to trigger conditions and trigger activity.

- **T3**
  
  **Datatype:** `triggdata`
  
  Variable that refers to trigger conditions and trigger activity.

- **T4**
  
  **Datatype:** `triggdata`
  
  Variable that refers to trigger conditions and trigger activity.

- **T5**
  
  **Datatype:** `triggdata`
  
  Variable that refers to trigger conditions and trigger activity.

Continues on next page
6 RAPID program

6.4.3 Public system module pmrcSys

Continued

T6
Datatype: triggdata
Variable that refers to trigger conditions and trigger activity.

T7
Datatype: triggdata
Variable that refers to trigger conditions and trigger activity.

T8
Datatype: triggdata
Variable that refers to trigger conditions and trigger activity.

Zone
Datatype: zonedata
Zone data for the movement. Zone data describes the size of the generated corner path.

Inpos
Datatype: stoppointdata
The setting of the dwell in the motion.

Tool
Datatype: tooldata
The tool in use when the robot moves. The tool center point is the point that is moved to the specified destination position.

WObj
Datatype: wobjdata
The work object (coordinate system) to which the robot position in the instruction is related.

Program code

See the program code by browsing the pmrcSys module on the robot.

Variable pm_home_Wobj

Usage

This variable is used for the default installed work area PM_HOME to connect to an always existing work object.

Description

The variable is only used to get PM_HOME work area. It is a copy of the installed work object wobj0.

Variables LastRobTgt, LastWobj and LastTool

Usage

These variables are used to store the last position, work object, and tool.

Description

The variables are used to store the last position’s properties, to be able to calculate an intermediate position.

Continues on next page
See usage of the variables in the program code by browsing the `pmUtility` module.
7 Runtime operation

7.1 Introduction

Structure of this chapter

This chapter describes the runtime operating interface to PickMaster.

The runtime operating interface consists of three parts:

- PickMaster FlexPendant interface. A graphic operator's interface.
- PickMaster I/O interface. Used by a PLC.
- PickMaster RAPID interface. The RAPID interface can be customized to receive and handle requests not covered by the FlexPendant or the I/O interface. For a complete description of program modules, functions, procedures, and data specific for palletizing see RAPID program on page 203, and RAPID reference information on page 285.

Prerequisites

The runtime operating interface is only available with the option Prepared for PickMaster, with the sub-option Palletizing PowerPac.
7 Runtime operation

7.2 FlexPendant interface

7.2.1 Introduction to PickMaster FlexPendant interface

PickMaster FlexPendant interface

The PickMaster FlexPendant interface is available from the ABB menu on the FlexPendant. It is a graphical user interface designed to control and/or supervise the palletizing process.

The PickMaster FlexPendant interface covers the following four areas:

- Open Project
- Production
- Process Signals
- Tune

Illustration

The illustration shows the PickMaster main menu.

Open Project

Open Project displays a list of all the PickMaster projects that have been downloaded to the robot controller. A project must be opened before it can be started from the production window. The status bar always contains information about the loaded project as well as the current location within the window hierarchy.

See Opening a project on page 236.

Production

Production is used by the operator to start and stop and monitor the palletizing process.

Continues on next page
7.2.1 Introduction to PickMaster FlexPendant interface

Continued

See Starting and stopping production on page 237.

Process Signals

Process Signals presents a list of all the work areas, items, events, and the I/O signals that are connected to each work area. It is possible not only to view but also to set new signal values. This window also presents all the tool configurations that build up the tool together with the zones and the activators. For a detailed description of the tool configuration, see Zone frame on page 383, and Activators properties on page 125.

See also Process Signals on page 250.

Tune

Tune is used to change the parameter values online while running the PickMaster application.

See Tuning on page 253.
7.2.2 Opening a project

This section describes how to open a PickMaster project from the Open Project window. A list of all the available projects on the controller appears together with a description, if provided. For more information, see Project on page 154.

<table>
<thead>
<tr>
<th>Action</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. On the PickMaster main menu, tap Open Project.</td>
<td>The Open Project button is only accessible if the current PickMaster project is stopped.</td>
</tr>
<tr>
<td>2. Tap a project.</td>
<td>When a project is selected, the OK button appears. To update the list of projects, tap Refresh.</td>
</tr>
<tr>
<td>3. To open the project and return to the main menu, tap OK.</td>
<td></td>
</tr>
<tr>
<td>4. To view information about the project, tap View project info.</td>
<td>The window shows information about line path, transfer data, PickMaster version, user, computer, and a description of the project.</td>
</tr>
<tr>
<td>5. To close the window, tap Cancel.</td>
<td></td>
</tr>
</tbody>
</table>

The following figure shows the Open Project window.

![Open Project window](image)

Related information

Starting and stopping production on page 237.
Process Signals on page 250.
7.2.3 Starting and stopping production

Overview

This section describes how to start and stop the palletizing process from the Production window.

Illustration, Production window

The illustration shows an example of the Production window when three flows are defined in the PickMaster project.

<table>
<thead>
<tr>
<th>Flow</th>
<th>Flow status</th>
<th>Active job</th>
<th>Job status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow1</td>
<td>Running</td>
<td>Idle</td>
<td></td>
</tr>
<tr>
<td>Flow2</td>
<td>Running</td>
<td>Large boxes</td>
<td>Running</td>
</tr>
</tbody>
</table>

Flow control

- Start
- Stop
- Start All
- Stop All

Job control

- Start
- Stop

Flow

The name of the flow as specified in the PickMaster project.

Status

The status of the flow, which can be Stopped, Running, or Error. The status can also indicate type of stop in progress, for example, Stopping after cycle, Stopping after layer, and Stopping after pallet.

Active job

The currently running job on the flow, that is, the name of the active master operation set.

Job status

The current job status of the flow, which can be Idle (no job is running), Running or Stopping (a job has been ordered to stop).

Starting a project

<table>
<thead>
<tr>
<th>Action</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. On the Production menu, tap Project.</td>
<td></td>
</tr>
<tr>
<td>2. Tap Start.</td>
<td>A warning appears if the system is in motors off state.</td>
</tr>
</tbody>
</table>

Continues on next page
7 Runtime operation

7.2.3 Starting and stopping production

Continued

Stopping a project

<table>
<thead>
<tr>
<th>Action</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. On the Production menu, tap Project.</td>
<td></td>
</tr>
<tr>
<td>2. Tap Stop. To cancel, tap No.</td>
<td>A warning appears.</td>
</tr>
</tbody>
</table>

Restarting RAPID

The following procedure describes how to restart the program execution. This is the same function as pushing the hardware button Start on the IRC5 FlexPendant.

<table>
<thead>
<tr>
<th>Action</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. On the Production menu, tap Project.</td>
<td></td>
</tr>
<tr>
<td>2. Tap Restart RAPID.</td>
<td>The Restart RAPID button is only available when program is paused.</td>
</tr>
</tbody>
</table>

Starting a specific flow

Starting the flow will enable the starting and execution of a palletizing job.

**Note**

The PickMaster project must be started before a flow can be started.

<table>
<thead>
<tr>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. In the list of defined flows, tap on the flow to start. The Start Flow button becomes available.</td>
</tr>
<tr>
<td>2. Tap Start Flow.</td>
</tr>
</tbody>
</table>

Stopping a specific flow

Stopping the flow pause the execution of a running palletizing job. When the flow is restarted, the execution of the job will continue. A flow stop option can be selected to specify how and when the flow shall be stopped.

<table>
<thead>
<tr>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. In the list of defined flows, tap on the flow to stop. The Stop Flow button becomes available.</td>
</tr>
<tr>
<td>2. Tap Stop Flow.</td>
</tr>
</tbody>
</table>

Starting a specific job

**Note**

The flow must be running before a job can be started.

<table>
<thead>
<tr>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. In the list of defined flows, tap on the flow to start a job on. The Start Job button appears.</td>
</tr>
<tr>
<td>2. Tap Start Job. The Start Job window appears.</td>
</tr>
</tbody>
</table>
The following illustration shows an example of the Start job window.

Job selection
A list of palletizing jobs defined for the master work area to select from.

Restart conditions
A list of parameters that needs to be specified when an unfinished job shall be restarted, for example, a half finished pallet pattern. When starting a new job, do not update these parameters. NOTE: A restart is not possible if the last operation was a partially completed multi drop operation. In that case, some products has to be manually removed from the stack before starting, for example, a removal of the top layer.

Layer count
Specifies number of available full layers, including defined pallet and slip sheets.

Product count
Specifies number of available products in the top layer. If the top layer is full, product count shall be set to zero.

Editing restart conditions

<table>
<thead>
<tr>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Select restart condition.</td>
</tr>
<tr>
<td>2. Press Edit restart condition menu.</td>
</tr>
<tr>
<td>3. Enter appropriate value on the displayed numerical pad and press OK.</td>
</tr>
</tbody>
</table>

Stopping a specific job
If stopping a job, it will be finished without being completed. The job will stop as soon as any currently ongoing or pending pick-places cycle has been completed or cancelled. Pending position requests on slaves will be cancelled if no targets are generated before the slave’s stop job timeout has passed.

Continues on next page
If the job is waiting on a slave that has been running out of products, stop job can be used to finish the job without running any further pick-place cycles. The job will become stopped after the stop job timeout has passed.

**Note**

The flow must be running before a job can be stopped.

<table>
<thead>
<tr>
<th>Action</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. In the list of defined flows, tap on the flow to stop the job on. The Stop Job button becomes available.</td>
<td></td>
</tr>
<tr>
<td>2. Tap Stop Job. A pop-up window appears.</td>
<td></td>
</tr>
<tr>
<td>3. In the pop-up window, confirm that the job shall be stopped.</td>
<td></td>
</tr>
</tbody>
</table>

### Starting and stopping all flows

<table>
<thead>
<tr>
<th><strong>To...</strong></th>
<th><strong>Do this</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Start all flows</td>
<td>Tap Start All Flows.</td>
</tr>
<tr>
<td>Stop all flows</td>
<td>Stop All Flows.</td>
</tr>
</tbody>
</table>

### Viewing flow status

<table>
<thead>
<tr>
<th>Action</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. In the list of flows, tap on a specific flow. In the Production window, the Status command on the View menu becomes available.</td>
<td></td>
</tr>
<tr>
<td>2. On the View menu, tap Status and select a work area.</td>
<td></td>
</tr>
<tr>
<td>3. To close the Status Information window, tap Status on the View menu.</td>
<td></td>
</tr>
</tbody>
</table>
The following illustration shows an example of the Production window when the flow status information appears. In this example the project Medium Coffee includes the work areas Medium Outfeed and Medium Infeed.

<table>
<thead>
<tr>
<th>Work Area</th>
<th>The name of the work area as specified in the PickMaster software.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status</td>
<td>Provides status information about the work area, which can be Running or Error.</td>
</tr>
<tr>
<td>Operation Set</td>
<td>Specifies the last accessed operation set on the work area.</td>
</tr>
<tr>
<td>Item Count</td>
<td>A counter for the accumulated number of items that has been picked or placed on the work area since the project start.</td>
</tr>
</tbody>
</table>

Viewing messages

<table>
<thead>
<tr>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. On the View menu, tap Messages.</td>
</tr>
<tr>
<td>2. In the list of messages, tap a specific message. A message window appears.</td>
</tr>
</tbody>
</table>
The following illustration shows an example of the message window where only messages concerning flow recovery are shown.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Date &amp; Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>2398</td>
<td>Message</td>
<td>2007-8-30 6:44:21</td>
</tr>
<tr>
<td>2399</td>
<td>PickMaster Flow Stopped Immediately</td>
<td>2007-8-30 6:2:57</td>
</tr>
</tbody>
</table>

**Code**  The code of the message.

**Title**  The title of the message.

**Date**  The date and time of the generated message.

**Clear**  Clears the list of messages. Note that the messages are not deleted. If the production window is closed and then reopened, the cleared messages appear again.

**OK**  Closes the window.

For details about message configuration, see *Messages on page 162.*

### Changing or viewing flow stop options

1. In the list of flows, tap on the flow to change the stop option for. The Flow Stop Options button on the Production menu becomes available.

2. Tap Flow Stop Options and select a stop option. The currently selected stop option is checked.

There are four different ways to stop each product flow from the FlexPendant. Each stop option is described according to what will happen when a flow is stopped with the specific stop option and after tapping `StopFlow`.

<table>
<thead>
<tr>
<th>Flow stop option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finish cycle</td>
<td>The robot will continue palletizing until the current pick/place cycle of the job is finished.</td>
</tr>
<tr>
<td>Finish layer</td>
<td>The robot will continue palletizing until the current layer of the job is finished.</td>
</tr>
<tr>
<td>Finish job</td>
<td>The robot will continue palletizing until the current job is finished.</td>
</tr>
</tbody>
</table>

Continues on next page
The flow is stopped and a flow recovery action must be selected when restarting. If the flow is the current active flow, the robot will stop immediately, without finishing a started cycle. A warning symbol appears next to the flow, indicating that a flow recovery action must be selected, and the status changes to Error. If another flow shares one of the slave work areas, a warning symbol will appear also next to that flow when this slave is requested, but the flow status does not change. If the stopped flow is not the current active flow, the robot will continue palletizing using the remaining running flows.

A StopFlow command can be cancelled using Undo. However, this is not possible with flow stop option "Stop Immediately". To cancel a requested stop action:

- On the Stop Options menu, tap Undo.

### Related information

* Opening a project on page 236.*
* Process Signals on page 250.*
* Feeder on page 170.*
* Events on page 159.*
* Robot Settings on page 165.*
7 Runtime operation

7.2.4 Flow recovery

Overview

If a work area is in error state, (for example, as a result of using event signals Error Source and Trigger), a warning symbol appears next to the flows that are affected. If a flow is stopped in the error state, a warning symbol appears on the Start Flow button. For example, this occurs if the flow is stopped immediately or if the flow needs to access a work area in the error state. The warning symbol indicates that the flow must be recovered when started. The following section describes how to recover the flow in such a case.

Recovering a specific flow

Overview

<table>
<thead>
<tr>
<th>Action</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 In the Production window, tap Start Flow.</td>
<td>See Illustration, Production window with a flow to recover on page 245.</td>
</tr>
<tr>
<td>2 The Restart options window appears. Select one of the displayed recovery options and tap OK.</td>
<td>You get three options to continue. See Illustration, Restart options window on page 246.</td>
</tr>
<tr>
<td>3 The Production window appears and there is a note symbol on the Start Flow button. Tap Start Flow.</td>
<td>See Illustration, Production window after selecting a recovery option on page 247.</td>
</tr>
<tr>
<td>4 A dialog box containing information about the selected option appears. Verify the status as specified in the message, and then tap OK.</td>
<td>After tapping OK, the flow is in production again. If the RAPID program has stopped, it will restart. See Illustration, Confirm restart information on page 248.</td>
</tr>
</tbody>
</table>
Illustration, Production window with a flow to recover

The following figure illustrates the **Production** window when a flow has been forced to stop due to an error.

![Production window](image)

*Start Flow*

The warning symbol indicates that a flow has been forced to stop by an error in a work area or with the stop option **Stop immediately**. When the **Start Flow** button is pressed, the **Restart options** window appears.
Illustration, Restart options window

The work areas in error state are marked with a warning symbol. Select a suitable recover action and press OK to confirm.

<table>
<thead>
<tr>
<th>Recover action</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continue Pick-Place</td>
<td>The flow continues from where it was stopped.</td>
</tr>
<tr>
<td>Redo last pick</td>
<td>The flow repeats the last pick operation. Redo last pick is enabled in the gap only after the first product is picked and before the first product is placed.</td>
</tr>
<tr>
<td>Restart layer</td>
<td>The flow restarts the job from the beginning of the current layer, starting with the picking.</td>
</tr>
<tr>
<td>Terminate job</td>
<td>The flow terminates the current job, cancel the remaining operations, and enable the starting of the next job.</td>
</tr>
</tbody>
</table>

**Note**

The robot moves directly to the pick work area after a restart with flow recovery when using Redo last pick, Restart layer, or Terminate job. Any passed safe position is not considered in the planned path. Ensure that the robot is jogged to a secured position.
Illustration, Production window after selecting a recovery option

The following figure illustrates the Production window after selecting a recovery option for a flow.

Start Flow

The info symbol indicates that a flow recovery action has been selected for the flow. Tap Start to display more information about the selected action, expected number of products in robot tool and on work areas, and so on.
Illustration, Confirm restart information

The following figure illustrates the information window to confirm while starting the flow after selecting a flow recovery action. Tap OK to immediately run the flow start. The error state for the flow and the work areas are reset. Tap Cancel to open the Restart options window from where you can select a new restart action.

Restarting other flows after error event

If a flow is stopped by an error event (or “Stop immediately”) while the robot is executing the flow, the RAPID program will also stop.

In order to restart execution of the other flows without first resolving the error:

1. Verify that the robot tool is prepared for the next pick/place cycle, for example, empty
2. Jog the robot to a safe position from where execution of the next pick/place cycle can be started
3. Move PP to Main
4. Restart RAPID
5. Confirm a warning message on the flex pendant

WARNING

If the PP is not moved to Main in step 3, the robot may start moving to an already fetched but not yet executed target. Execution will then stop on the next of the following functions: PmGetEvent, PmGetTarget, or PmGetTgtAction.
Illustration, Restart other flows after error event

The following figure illustrates the warning message which must be confirmed if RAPID is restarted after an error event of the executing flow.

![Warning message for restarting after error event]

**Task: T ROB1**
The RAPID program has been stopped by a superior system. Verify that the cause of the stop is removed before starting. The program execution will continue after tapping OK.

---

**Related information**

*Starting and stopping production on page 237*
7 Runtime operation

7.2.5 Process Signals

Introduction

This section describes how to use the Process Signals window to manually control and view:

- The I/O signals that are connected to a work area.
- The zones and the activators that build up the tool configuration.
- The event signals.

Viewing the work area signals

<table>
<thead>
<tr>
<th>Action</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Tap View and select Work Areas.</td>
<td>See Feeder on page 170.</td>
</tr>
<tr>
<td>3. From the Work Areas list, tap one work area.</td>
<td></td>
</tr>
</tbody>
</table>

The following illustration shows an example of the Process Signals window when one work area is selected.

Viewing the tool configuration

<table>
<thead>
<tr>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Tap View and select Tool.</td>
</tr>
<tr>
<td>3. From the Tool list, tap one tool configuration.</td>
</tr>
</tbody>
</table>
The following illustration shows an example of the Process Signals window when one tool configuration is selected.

### Viewing events

<table>
<thead>
<tr>
<th>Action</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Tap View and select Events.</td>
<td>See Events on page 159.</td>
</tr>
<tr>
<td>3. From the Events list, tap one controller.</td>
<td></td>
</tr>
</tbody>
</table>
The following illustration shows an example of the Process Signals window when one controller is selected.

Related information

- Opening a project on page 236.
- Starting and stopping production on page 237.
7.2.6 Tuning

Introduction

This section describes how to tune the parameter values online in the Tune window. A parameter can be tuned at any time for a selected project, for example while the project is running. Parameter tune updates affects the received data of the next calls to Pickmaster RAPID instructions (for example PmGetTarget).

Illustrations, Tune window

Below the FlexPendant interface illustrating tuning of an item and a work area.

Item

The illustration shows an example of the Tune window when five products are defined, and the properties that can be tuned for each product.

The following table describes the Property parameters:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed</td>
<td>Specifies the maximum speed for an item.</td>
</tr>
<tr>
<td>Ori speed</td>
<td>Specifies the maximum orientation speed for an item.</td>
</tr>
</tbody>
</table>
7 Runtime operation

7.2.6 Tuning

Continued

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acceleration</td>
<td>Specifies the maximum acceleration/deceleration for an item.</td>
</tr>
<tr>
<td>Pick time</td>
<td>Specifies the time the robot stays at the target position when picking an item.</td>
</tr>
<tr>
<td>Place time</td>
<td>Specifies the time the robot stays at the target position when placing an item.</td>
</tr>
<tr>
<td>Size Z</td>
<td>Specifies the height of the item. When updating the item height, the height of pick and place positions for next items to be handled will be affected accordingly. Always when updating the item height, the operator is asked if the new value shall be applied also to previously placed layers. If the answer is yes, product place positions will be affected by height updates of all previously placed items in lower layers. If the answer is no, place positions will only be affected by the height updates of new items to be placed. Pick positions will never be affected.</td>
</tr>
<tr>
<td>Pick Activation</td>
<td>Specifies the time for pick activation.</td>
</tr>
<tr>
<td>Place Activation</td>
<td>Specifies the time for place activation.</td>
</tr>
</tbody>
</table>

Work Area

The illustration shows an example of the Tune window when six work areas are defined, and the properties that can be tuned for each work area.

<table>
<thead>
<tr>
<th>Work Area</th>
<th>Property</th>
<th>Value</th>
<th>Default</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infeed</td>
<td>Disp offs x</td>
<td>10</td>
<td>0</td>
<td>mm</td>
</tr>
<tr>
<td>Outfeed</td>
<td>Disp offs y</td>
<td>0</td>
<td>0</td>
<td>mm</td>
</tr>
<tr>
<td>Slip feed</td>
<td>Disp offs z</td>
<td>0,8</td>
<td>0</td>
<td>mm</td>
</tr>
<tr>
<td>Infeed 2</td>
<td>Disprotz</td>
<td>0</td>
<td>0</td>
<td>degrees</td>
</tr>
<tr>
<td>Outfeed 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outfeed 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Work area

The name of a work area specified in the PickMaster project. See Feeder on page 170.

Property

The property of a work area. For description of the parameters, see table below.

Value

Specifies the actual current value of the property.

Default

Specifies the default value of the property as it was in the PickMaster project when it was downloaded to the controller.

Continues on next page
The following table describes the Property parameters:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disp offs x</td>
<td>Displacement of the work area in x-direction relative the work object.</td>
</tr>
<tr>
<td>Disp offs y</td>
<td>Displacement of the work area in y-direction relative the work object.</td>
</tr>
<tr>
<td>Disp offs z</td>
<td>Displacement of the work area in z-direction relative the work object.</td>
</tr>
<tr>
<td>Disprotz</td>
<td>Displacement angle of the work area in the z-direction.</td>
</tr>
</tbody>
</table>

How to proceed

This section describes how to proceed with tuning of an item and a work area.

Tuning an item

<table>
<thead>
<tr>
<th>Action</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>On the Tune menu, tap View.</td>
<td></td>
</tr>
<tr>
<td>Tap Item.</td>
<td></td>
</tr>
<tr>
<td>In the Item list, tap the item to tune.</td>
<td></td>
</tr>
<tr>
<td>In the Property list, tap the item property to tune.</td>
<td></td>
</tr>
<tr>
<td>On the Tune menu, tap Tune Value.</td>
<td>The Item Tune Value window appears. See illustration below this procedure.</td>
</tr>
<tr>
<td>In the Increment drop-down combo box, select the size of increment.</td>
<td>The increment specifies the value that will be added to/subtracted from the item property for each time you tap the + or - button.</td>
</tr>
<tr>
<td>Tap Apply.</td>
<td></td>
</tr>
</tbody>
</table>

The following figure illustrates tuning of an item.
Tuning a work area

<table>
<thead>
<tr>
<th>Action</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. On the Tune menu, tap View.</td>
<td></td>
</tr>
<tr>
<td>2. Tap Work Area.</td>
<td></td>
</tr>
<tr>
<td>3. In the Work Area list, tap the work area to tune.</td>
<td></td>
</tr>
<tr>
<td>4. In the Property list, tap the work area property to tune.</td>
<td></td>
</tr>
<tr>
<td>5. On the Tune menu, tap Tune Value.</td>
<td>The Work Area Value window appears. See illustration below this procedure.</td>
</tr>
<tr>
<td>6. In the Increment drop-down combo box, select the size of increment.</td>
<td>The increment specifies the value that will be added to/subtracted from the item property for each time you tap the plus or minus button.</td>
</tr>
<tr>
<td>7. Tap Apply.</td>
<td></td>
</tr>
</tbody>
</table>

The following figure illustrates tuning of a work area.

![Slip & Pallet](image)
7.3 I/O interface

7.3.1 Overview

**PickMaster I/O interface**

The PickMaster I/O interface is used by external equipment, such as a PLC, to control and supervise the palletizing process. It consists of two parts:

- The basic I/O interface defines work area specific signals. It covers the minimum I/O configuration needed to run a PickMaster project.
- The extended I/O interface adds optional functionality, for example reporting error events, starting projects and flows, and so on. You can use the extended I/O interface if needed.
7.3.2 Default signals

Introduction to default signals
More than one hundred (100) default signals are installed on every controller with the option Prepared for PickMaster. The signals can be used when setting up PickMaster lines and projects.

Configuration and setup
The signals can be selected in the configuration dialogs. As default, the signals are mapped to simulated I/O units, Pickmaster_Sim1, Pickmaster_Sim2, and Pickmaster_Sim3. During commissioning, the signals can be mapped to physical I/O units.

Additional signals are required if you use more than:
- 8 work areas
- 1 robots
- 1 controllers
- 4 flows

Use RobotStudio for:
- Renaming, reconfiguring, or removing default signals.
- Adding additional signals.

Description of default signals
The following default signals are installed.

Work areas
Default signals are defined for eight work areas. Signal name prefixes:
- pmInfeeder1
- pmInfeeder2
- pmInfeeder3
- pmInfeeder4
- pmOutfeeder1
- pmOutfeeder2
- pmOutfeeder3
- pmOutfeeder4
- pmSlipsheet1
- pmPallet1

Controller system actions
Default signals are defined for controller system actions. Signal name prefix:
- pmSystem

Project handling
Default signals are defined for project handling. Signal name prefix:
- pmProject

Continues on next page
Flows

Default signals are defined for flows. Signal name prefixes:

- pmFlow
- pmFlow1
- pmFlow2
- pmFlow3
- pmFlow4

Grippers

Default signals are defined for a gripper. Signal name prefix:

- pmGripper1

Event reporting

Default signals are defined for event reporting. Signal name prefix:

- pmEvent
The I/O signals are used by a PLC to:

- Start and stop jobs on master work areas.
- Control and supervise the flow of products on work areas.
- Control and supervise the robot execution on work areas.
- Control and supervise the status and height of work areas.

I/O signals must be setup for each work area. Some of the signals must be used and others can be used if needed.

How to use the work area signals depends on if the work area will be used as a master or slave.

### Master work areas

#### Overview

The following signals must be configured:

- Target generation trigger signal (DI)
- Target generation product selection (GI)
- Position request trigger signal (DO)

The following signals must be setup if simulated target generation is selected for the work area. See *Feeder on page 170*.

- Position request trigger signal (DO)

#### Target generation trigger signal (DI)

The signal is mandatory unless simulated target generation is used.

The signal can also be skipped if palletizing jobs always are to be started using the FlexPendant interface.

A trigger pulse generates the start of a new palletizing/depalletizing job on that work area. A palletizing/depalletizing job is equivalent to one of the operation sets configured for the feeder. Before the signal is pulsed, the flow must be running, the position request trigger signal must be set and the work area must be prepared for the job to be started. For example:

- Work area is empty and ready to receive products to build a new pallet.
- Work area is loaded with a pallet to be depalletized.

Default signal, example: *pmOutfeeder1_diTgtGenTrig*.

#### Target generation product selection (GI)

The signal is mandatory if there is more than one operation set for the work area.
7 Runtime operation

7.3.3 Basic I/O interface

Continued

It is used to select among all palletizing jobs (that is, operation sets) configured for the work area. The signal is set to the product I/O value for the selected operation set. It must be set before the target generation trigger signal is pulsed.

Default signal, example: `pmOutfeeder1_giProdSel`.

**Target generation format selection (GI)**

The signal has no function and is not required.

**Target generation start layer count (GI)**

The signal is optional. It is used when restarting an unfinished job. The signal is set to the number of full layers on the stack, including the pallet (if defined in the pallet pattern) and slip sheets. It must be set before the target generation trigger signal is pulsed.

Default signal, example: `pmOutfeeder1_giStartLayerCount`.

**Target generation start product count (GI)**

The signal is optional. It is used when restarting an unfinished job. The signal is set to the number of products on the top layer off the stack. If the top layer is full, the signal is set to zero. It must be set before the target generation trigger signal is pulsed.

Default signal, example: `pmOutfeeder1_giStartProdCount`.

**Position request trigger signal (DO)**

The signal is mandatory if simulated target generation is used and highly recommended otherwise.

The signal is set by the controller when it is ready to start a new palletizing job (that is, operation set) on that work area. This will happen:

- When the corresponding flow is started.
- When a job is completed.
- When a job is stopped before completing.
- When an operation set is finished using the robot execution signal.
- As a result of a flow recovery action.

A new job/operation set cannot be started until the signal is set and the work area is prepared for palletizing (the work area is empty and ready to receive new products from the slave infeeders) or depalletizing (the work area is loaded with a new pallet of products). The signal is reset when the target generation trigger signal is pulsed or if the flow is stopped.

Default signal, example: `pmOutfeeder1_doPosReqTrig`.

**Position request product selection (GO)**

The signal has no function and is not required.

**Position request format selection (GO)**

The signal has no function and is not required.

**Position request requesting master (GO)**

The signal has no function and is not required.

Continues on next page
Position available (DO)
The signal is optional.
The signal indicates if target positions can be received in RAPID to be executed by the robot. Using the Robot execution signal affects the output of the Position available signal.

If the robot execution signal is not defined, Position available is set after:

- A new operation set is generated by the PLC.
- Any operation, except the last one of an operation set, is performed by the robot.

If the robot execution signal is not defined, the Position available signal is reset after any operation is received in RAPID.

If the robot execution signal is defined, the Position available signal is set after:

- A new operation set is generated and the robot execution signal is set by the PLC.
- Any operation, except the last one of an operation set, is performed by the robot, the robot execution signal is reset and then set again by the PLC.

If the robot execution signal is defined, the Position available signal is reset after:

- Any operation is received in RAPID.
- The robot execution signal is reset to finish an uncompleted operation set.

Default signal, example: pmOutfeeder1_doPosAvail.

Queue empty (DO)
The signal is optional.
The signal indicates if there are targets generated that yet has not been received in RAPID.

After the last target is received for an operation set, the signal goes to one. Note, the signal will go high before the movements is finished, that is the last products might not have been placed/picked.

Default signal, example: pmOutfeeder1_doQueueEmpty.

Operation set complete (DO)
The signal is optional.
The signal is set:

- After all products in an operation set have been placed/picked and the robot has departed from the work area after the last place/pick operation.
- If the job is stopped (e.g. before being completed)
- If the current job is finished before being completed by resetting the robot execution signal.

The signal is reset when the target generation trigger signal is pulsed. If the target generation signal is set very early, that is, just before or just after operation set is complete, the signal will be reset after a time corresponding to the configured pulse length. For more information on pulse length configuration, see Controller Settings on page 158.

Default signal, example: pmOutfeeder1_doOpSetCompl.
Execution state (GO)

The signal is optional.

The signal indicates the runtime state of the work area.

<table>
<thead>
<tr>
<th>I/O value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>A project using this work area is not running.</td>
</tr>
<tr>
<td>1</td>
<td>Work area is running.</td>
</tr>
<tr>
<td>2</td>
<td>Work area has an error. Flow recovery is required to recover from the error.</td>
</tr>
<tr>
<td>3</td>
<td>Work area has a response error, that is, the PLC has generated wrong targets. A generation of correct targets is required to recover from the error.</td>
</tr>
</tbody>
</table>

Default signal, example: `pmOutfeeder1_goExecState`.

Height state (GO)

The signal is optional.

The signal indicates the current height of the work area. The signal must have a bit length of at least three to represent the five possible states.

<table>
<thead>
<tr>
<th>I/O value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Full height. The height is equal to the setting of Full height, see Robot path height on page 176.</td>
</tr>
<tr>
<td>1</td>
<td>Active height. An operation set is executed and the height is updated after each pick or place until the operation set is completed.</td>
</tr>
<tr>
<td>2</td>
<td>Latest height. The height is equal to the final height of the latest run operation set.</td>
</tr>
<tr>
<td>3</td>
<td>Empty height. The height is equal to the setting of Empty height, see Robot path height on page 176.</td>
</tr>
<tr>
<td>4</td>
<td>Value. The height is set to a value with the RAPID function <code>PmSetDefaultHeight</code>.</td>
</tr>
</tbody>
</table>

Default signal, example: `pmOutfeeder1_goHeightState`.

Layer count (GO)

The signal is optional.

The signal value indicates the number of full layers on the work area.

Default signal, example: `pmOutfeeder1_goLayerCount`.

Product count (GO)

The signal is optional.

The signal value indicates the number of products in the top layer. If the top layer is full, the signal is set to zero.

Default signal, example: `pmOutfeeder1_goProductCount`.

Stop job (DI)

The signal is optional.
The signal is used to stop the currently ongoing job before it is completed. The flow must be running before a job can be stopped. The job is stopped by pulsing the signal.

The job will stop as soon as any currently ongoing or pending pick-places cycle is completed or cancelled. Pending position requests on slaves will be cancelled if no targets are generated before the slave’s stop job timeout has passed. For more information on stop job timeout, see Feeder on page 170.

If the job is waiting on a slave that is running out of products, stop job can be used to finish the job without running any further pick-place cycles. The job will become stopped after the stop job timeout has passed.

Default signal, example: pmOutfeeder1_diStopJob.

Robot execution (DI)

The signal is optional.

The signal is used to control whether the robot is allowed to approach the work area or not. If the signal is reset, the RAPID execution will not pass the instruction PmGetTarget until the signal is set. After an operation is performed by the robot, the signal must be reset and then set again to allow the robot to approach the work area the next time.

The signal can also be used to finish the current operation set before all operations have been completed. If the signal is reset, the remaining targets will be removed.

Default signal, example: pmOutfeeder1_diRobotExec.

Redo search (DI)

The signal is optional.

The signal is used with operation sets having stack search activated.

Stack search is normally not used for a master work area.

If the signal is pulsed, the next operation will start with a search movement from the top of the stack. The signal can be used after adding new items on a stack. To affect the next approach to the work area, the signal must be pulsed before the robot receives the operation in RAPID.

Default signal, example: pmOutfeeder1_diRedoSearch.

Slave work areas

The following signals must be setup:

- Target generation trigger signal (DI)
- Target generation product selection (GI)^2
- Target generation format selection (GI)^3
- Position request trigger signal (DO)
- Position request product selection (GO)^2
- Position request format selection (GO)^3

The following signals must be setup if simulated target generation is selected for the work area. See Feeder on page 170.

- Position request trigger signal (DO)
Position request product selection (GO) ²
Position request format selection (GO) ³

2) Only mandatory if there is more than one item.
3) Only mandatory if there is more than one format for the same item.

Position request trigger signal (DO)
The signal is mandatory.
The signal is set by the controller when one of the corresponding master work areas requests a format on this slave work area from the PLC. The requested format must be defined as an operation set in the feeder. The request occurs after the previous pick and place cycle for that flow has finished.
If the flow uses early request, then the request will occur in advance, before the robot has finished the previous cycle. Early request will decrease cycle times if the same flow is run in consecutive pick place cycles. The signal is reset when the target generation trigger signal is pulsed.
Default signal, example: \textit{pmInfeeder1\_doPosReqTrig}.

Position request product selection (GO)
The signal is mandatory if there is more than one item.
The signal I/O value specifies the requested product when the position request trigger signal is set.
Default signal, example: \textit{pmInfeeder1\_goProdSel}.

Position request format selection (GO)
The signal is mandatory if there is more than one format for the same item.
The signal I/O value specifies the requested format when the position request trigger signal is set.
Default signal, example: \textit{pmInfeeder1\_goFormSel}.

Position request requesting master (GO)
The signal is optional.
The signal value indicates the requesting master work area. The I/O value of the work area is configured in the Work Area I/O Settings editor. For more information on the Work Area I/O Settings, see \textit{Edit detailed signals for feeder on page 173}.
Default signal, example: \textit{pmInfeeder1\_goReqMaster}.

Target generation trigger signal (DI)
The signal is mandatory unless simulated target generation is used.
A trigger pulse indicates that a previously requested format is now available for the work area to be handled by the robot.
Default signal, example: \textit{pmInfeeder1\_diTgtGenTrig}.

Target generation product selection (GI)
The signal is mandatory if there is more than one item.
The signal specifies the product I/O value of the available format when the target generation trigger signal is pulsed.
Default signal, example: \textit{pmInfeeder1\_giProdSel}.

Continues on next page
Target generation format selection (GI)
  The signal is mandatory if there is more than one format for the same item.
  The signal specifies the format I/O value of the available format when the target
  generation trigger signal is pulsed.
  Default signal, example: pmInfeeder1_giFormSel.

Target generation start layer count (GI)
  The signal has no function and is not required.

Target generation start product count (GI)
  The signal has no function and is not required.

Position available (DO)
  The signal is optional.
  The signal indicates if target positions can be received in RAPID to be executed
  by the robot. Using the Robot execution signal affects the output of the Position
  available signal.
  If the Robot execution signal not is defined, Position available is set after:
  • A new operation set is generated by the PLC.
  • Any operation, except the last one of an operation set, is performed by the
    robot.
  If the Robot execution signal is not defined, Position available is reset after any
  operation is received in RAPID.
  If the Robot execution signal is defined, Position available is set after:
  • A new operation set is generated and the Robot execution signal is set by
    the PLC.
  • Any operation, except the last one of an operation set, is performed by the
    robot, the Robot execution signal is reset and then set again by the PLC.
  If the Robot execution signal is defined, Position available is reset after:
  • Any operation is received in RAPID.
  • The Robot execution signal is reset to finish an uncompleted operation set.
  Default signal, example: pmInfeeder1_doPosAvail.

Queue empty (DO)
  The signal is optional.
  The signal indicates if there are targets generated that yet has not been received
  in RAPID.
  After the last target is received for an operation set, the signal goes to one. Note,
  the signal will go high before the movements have finished, that is the last products
  might not yet have been picked/placed.
  Default signal, example: pmInfeeder1_doQueueEmpty.

Operation set complete (DO)
  The signal is optional.
The signal is set:

- After all products in an operation set have been placed/picked and the robot has departed from the work area after the last place/pick operation.
- If the current operation set is finished before being completed by resetting the robot execution signal.

The signal is reset when the target generation trigger signal is pulsed. If the target generation signal is set very early, that is, just before or just after operation set is complete, the signal will be reset after a time corresponding to the configured pulse length. For more information on pulse length configuration, see Controller Settings on page 158.

Default signal, example: pmlfeeder1_doOpSetCompl.

Execution state (GO)

The signal is optional.

The signal indicates the runtime state of the work area.

<table>
<thead>
<tr>
<th>I/O value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>A project using this work area is not running.</td>
</tr>
<tr>
<td>1</td>
<td>Work area is running.</td>
</tr>
<tr>
<td>2</td>
<td>Work area has an error. Flow recovery is required to recover from the error.</td>
</tr>
<tr>
<td>3</td>
<td>Work area has a response error, that is, the PLC has generated wrong targets. A generation of correct targets is required to recover from the error.</td>
</tr>
</tbody>
</table>

Default signal, example: pmlfeeder1_goExecState.

Height state (GO)

The signal is optional.

The signal indicates the current height of the work area. The signal must have a bit length of at least three to represent the five possible states.

<table>
<thead>
<tr>
<th>I/O value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Full height. The height is equal to the setting of Full height, see Robot path height on page 176.</td>
</tr>
<tr>
<td>1</td>
<td>Active height. An operation set is being executed and the height is updated after each pick or place until the operation set is completed.</td>
</tr>
<tr>
<td>2</td>
<td>Latest height. The height is equal to the final height of the latest run operation set.</td>
</tr>
<tr>
<td>3</td>
<td>Empty height. The height is equal to the setting of Empty height, see Robot path height on page 176.</td>
</tr>
<tr>
<td>4</td>
<td>Value. The height is set to a value with the RAPID function PmSetDefaultHeight.</td>
</tr>
</tbody>
</table>

Default signal, example: pmlfeeder1_goHeightState.

Layer count (GO)

The signal is optional.

Continues on next page
7 Runtime operation

7.3.3 Basic I/O interface

Continued

The signal value indicates the number of full layers on the work area. For example, for a pallet stack or a slip sheet stack.

Default signal, example: `pmIntfeeder1_goLayerCount`.

Product count (GO)

The signal is optional.

The signal value indicates the number of products in the top layer. If the top layer is full, the signal is set to zero.

Default signal, example: `pmInfeeder1_goProductCount`.

Stop job (DI)

The signal has no function and is not required.

Robot execution (DI)

The signal is optional.

The signal is used to control whether the robot is allowed to approach the work area or not. If the signal is reset, the RAPID execution will not pass the instruction `PmGetTarget` until the signal is set. After an operation is performed by the robot, the signal must be reset and then set again to allow the robot to approach the work area next time.

The signal can also be used to finish the current operation set before all operations have been completed. If the signal is reset, the remaining targets will be removed.

Default signal, example: `pmInfeeder1_diRobotExec`.

Redo search (DI)

The signal is optional.

The signal is used with operation sets having stack search activated. If the signal is pulsed, next operation will start with a search movement from the top of the stack. The signal can be used after adding new items on a stack. To affect the next approach to the work area, the signal must be pulsed before the robot receives the operation in RAPID.

Default signal, example: `pmInfeeder1_diRedoSearch`. 
7.3.4 Extended I/O interface

Controller system handling

Introduction

A number of default system signals are installed to handle the controller system, for example to set the controller in motors on state.

See Technical reference manual - System parameters, the topic I/O, for descriptions of system inputs and outputs.

System inputs

<table>
<thead>
<tr>
<th>System input</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>pmSystem_diLoadStart1</code></td>
<td>Load and start the PmProjMgr module for motion task T_ROB1.</td>
</tr>
<tr>
<td><code>pmSystem_diLoadX</code></td>
<td>Load the PmProjMgr module for motion task T_ROBX.</td>
</tr>
<tr>
<td><code>pmSystem_diStart</code></td>
<td>Start RAPID execution.</td>
</tr>
<tr>
<td><code>pmSystem_diStop</code></td>
<td>Stop RAPID execution.</td>
</tr>
<tr>
<td><code>pmSystem_diStartMain</code></td>
<td>Start RAPID execution from Main.</td>
</tr>
<tr>
<td><code>pmSystem_diMotorsOn</code></td>
<td>Set motors on.</td>
</tr>
<tr>
<td><code>pmSystem_diResetEstop</code></td>
<td>Confirm reset of emergency stop.</td>
</tr>
</tbody>
</table>

System outputs

<table>
<thead>
<tr>
<th>System output</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>pmSystem_doLoadReadyX</code></td>
<td>A robot program (for example, PmProjMgr) is loaded for T_ROBX.</td>
</tr>
<tr>
<td><code>pmSystem_doCycleOn</code></td>
<td>Robot program is executing.</td>
</tr>
<tr>
<td><code>pmSystem_doMotorOnState</code></td>
<td>Set while in Motors on State. Otherwise, its reset.</td>
</tr>
<tr>
<td><code>pmSystem_doMotorOn</code></td>
<td>Set while in Motors on State. If the controller is in guard stop, the output starts pulsing with a frequency of 1 sec. If the controller is not calibrated or the revolution counter is not updated, the output will pulsate even faster in manual mode.</td>
</tr>
<tr>
<td><code>pmSystem_doRunchOk</code></td>
<td>Run chain is closed.</td>
</tr>
<tr>
<td><code>pmSystem_doEmStop</code></td>
<td>Emergency stop state.</td>
</tr>
<tr>
<td><code>pmSystem_doAutoOn</code></td>
<td>Automatic mode is used.</td>
</tr>
</tbody>
</table>

Project handling

Overview

It is possible to start, halt, restart, stop, and supervise projects.

Default signals

The following default signals must be used for project handling:

<table>
<thead>
<tr>
<th>Project signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>pmProject_goCurrent</code></td>
<td>The current project.</td>
</tr>
<tr>
<td><code>pmProject_goStatus</code></td>
<td>The status of current project.</td>
</tr>
</tbody>
</table>
## 7 Runtime operation

### 7.3.4 Extended I/O interface

Continued

<table>
<thead>
<tr>
<th>Project signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>pmProject_diStop</td>
<td>Stop current project.</td>
</tr>
<tr>
<td>pmProject_diStart</td>
<td>Start selected project.</td>
</tr>
<tr>
<td>pmProject_giSelection</td>
<td>Project selector.</td>
</tr>
<tr>
<td>pmProject_diSetDefaultHeight</td>
<td>Set default height for a work area.</td>
</tr>
<tr>
<td>pmProject_giDefaultHeight</td>
<td>Default height selector.</td>
</tr>
<tr>
<td>pmProject_giDefHeightWaSel</td>
<td>Work area selector for setting the default height.</td>
</tr>
<tr>
<td>pmProject_diNoWait</td>
<td>PickWare internal use.</td>
</tr>
<tr>
<td>pmProject_diNoWait</td>
<td>PickWare internal use.</td>
</tr>
</tbody>
</table>

### Project status values

The current status of the project is reflected by the signal `pmProject_goStatus`.

<table>
<thead>
<tr>
<th>I/O value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Project is stopped.</td>
</tr>
<tr>
<td>1</td>
<td>Project is stopping.</td>
</tr>
<tr>
<td>2</td>
<td>Project is starting.</td>
</tr>
<tr>
<td>3</td>
<td>Project is running.</td>
</tr>
<tr>
<td>5</td>
<td>Project in error state.</td>
</tr>
</tbody>
</table>

### Default height values

The following selections are supported when setting the default height.

<table>
<thead>
<tr>
<th>I/O value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Full</td>
</tr>
<tr>
<td>1</td>
<td>Latest</td>
</tr>
<tr>
<td>2</td>
<td>Empty</td>
</tr>
<tr>
<td>3</td>
<td>Value</td>
</tr>
<tr>
<td>4</td>
<td>Standard, that is, as configured in the Robot Path Height. See Robot path height on page 176.</td>
</tr>
</tbody>
</table>

### Starting a project for a single robot system

<table>
<thead>
<tr>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Ensure that the previous project is stopped, that is the signal <code>pmProject_goStatus</code> is 0.</td>
</tr>
<tr>
<td>2 Switch to motors on state using the controller system signals.</td>
</tr>
<tr>
<td>See Technical reference manual - System parameters, the topic I/O.</td>
</tr>
<tr>
<td>3 Pulse the system input <code>pmSystem_diLoadStart1</code> to load and start the PmProjMgr module.</td>
</tr>
<tr>
<td>4 Wait until the robot program is started, that is when <code>pmSystem_doCycleOn</code> is set.</td>
</tr>
<tr>
<td>5 Set <code>pmProject_giSelection</code> to select the project to run. The I/O value for the project is set in the Project I/O value editor. See Project Manager on page 108.</td>
</tr>
<tr>
<td>6 Pulse <code>pmProject_diStart</code> to start the project.</td>
</tr>
</tbody>
</table>

Continues on next page
Starting a project for a multimove system

If the used RobotWare version is older than 6.02, a few manual preparations are needed. A system input must be defined for all the motion tasks, having the following arguments:

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signal name</td>
<td>pmSystem_diLoadX</td>
</tr>
<tr>
<td>Action</td>
<td>Load</td>
</tr>
<tr>
<td>Argument1</td>
<td>PmProjMgr.mod</td>
</tr>
<tr>
<td>Argument2</td>
<td>T_ROBX</td>
</tr>
<tr>
<td>Argument3</td>
<td>N/A</td>
</tr>
<tr>
<td>Argument4</td>
<td>N/A</td>
</tr>
</tbody>
</table>

1 A system input is preconfigured for T_ROB1. This instance can be copied and modified to create system inputs for T_ROB2, T_ROB3 and so on.

Stopping robot program - halting project

<table>
<thead>
<tr>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Pulse pmSystem_diStop to stop the robot program.</td>
</tr>
<tr>
<td>2 Wait until the robot program is stopped, which occurs when pmSystem_doCycleOn is reset.</td>
</tr>
</tbody>
</table>
7 Runtime operation

7.3.4 Extended I/O interface

Continued

Restarting robot program - restarting project

<table>
<thead>
<tr>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Switch to motors on state using the controller system signals. See Technical reference manual - System parameters, the topic I/O.</td>
</tr>
<tr>
<td>2 Pulse pmSystem_diStart to start the robot program.</td>
</tr>
<tr>
<td>3 Wait until the robot program is started, which occurs when pmSystem_doCycleOn is set.</td>
</tr>
</tbody>
</table>

Stopping current project

<table>
<thead>
<tr>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Pulse pmSystem_diStop to stop the robot program.</td>
</tr>
<tr>
<td>2 Wait until the robot program is stopped, which occurs when pmSystem_doCycleOn is reset.</td>
</tr>
<tr>
<td>3 Pulse pmProject_diStop to stop the project.</td>
</tr>
<tr>
<td>4 Wait until project is stopped, which occurs when pmProject_goStatus goes to 0.</td>
</tr>
</tbody>
</table>

Set a new default height for a work area

Setting a new default height is a possibility to save cycle time without decreasing the margins for collisions, especially if the project consists of many work areas and flows.

For an outfeeder the default height can be set to Empty after a finished stack has been unloaded. This may allow the robot to make lower intermediate movements when passing over the outfeeder next time and thus saving cycle time.

For an infeeder the default height can be set to Full before a new stack is loaded. This will force the robot to make intermediate movements with enough height when passing over the work area.

The new default height is active until new targets have been generated (or after a new default height is set).

<table>
<thead>
<tr>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Set pmProject_giDefaultHeight to select the new default height.</td>
</tr>
<tr>
<td>2 Set pmProject_gDefHeightWaSel to select the work area. The I/O value of the work area is configured in the Work Area I/O Settings editor. See Edit detailed signals for feeder on page 173.</td>
</tr>
<tr>
<td>3 Pulse pmProject_diSetDefaultHeight.</td>
</tr>
<tr>
<td>4 Wait until the default height is updated, that is, the work area height state GO signal is updated to reflect the change. Note! If the current height state is 1, which means active height, the height state will not be updated until the last target of the current operation set is picked/placed.</td>
</tr>
</tbody>
</table>

Continues on next page
Flow handling

It is possible to start, stop, and supervise, and recover flows.

Default signals

The following default signals must be used for flow handling:

<table>
<thead>
<tr>
<th>Flow signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>pmFlow_diStart</td>
<td>Start selected flow.</td>
</tr>
<tr>
<td>pmFlow_diStop</td>
<td>Stop selected flow.</td>
</tr>
<tr>
<td>pmFlow_diRecover</td>
<td>Recover the selected flow with the selected recover action on the selected work area.</td>
</tr>
<tr>
<td>pmFlow_giSelection</td>
<td>Flow selector.</td>
</tr>
<tr>
<td>pmFlow_giStopOption</td>
<td>Set stop option.</td>
</tr>
<tr>
<td>pmFlow_giRecoverAction</td>
<td>Set recover action.</td>
</tr>
<tr>
<td>pmFlow_giWaRecoverSelection</td>
<td>Select work area for recover action.</td>
</tr>
<tr>
<td>pmFlowX_goStatus</td>
<td>Status of flow X (X=1,2,3,…).</td>
</tr>
</tbody>
</table>

Flow status values

The statuses of the flows are reflected by the pmFlowX_goStatus signals.

The status signal for the flow is setup in the Flow editor. See Flow on page 201.

If a flow goes to error state, you can do flow recovery from the I/O Interface or the PickMaster FlexPendant interface.

<table>
<thead>
<tr>
<th>I/O value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Flow is stopped.</td>
</tr>
<tr>
<td>1</td>
<td>Flow is running.</td>
</tr>
<tr>
<td>2</td>
<td>Flow is stopping after current pick place cycle.</td>
</tr>
<tr>
<td>3</td>
<td>Flow is stopping after current layer.</td>
</tr>
<tr>
<td>4</td>
<td>Flow is stopping after current pallet/operation set.</td>
</tr>
<tr>
<td>5</td>
<td>Flow in error state.</td>
</tr>
</tbody>
</table>

Flow stop options

Stop option is specified with the signal pmFlow_giStopOption.

<table>
<thead>
<tr>
<th>I/O value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Stop immediately.</td>
</tr>
<tr>
<td>1</td>
<td>Finish cycle.</td>
</tr>
<tr>
<td>2</td>
<td>Finish layer.</td>
</tr>
<tr>
<td>3</td>
<td>Finish pallet/operation set.</td>
</tr>
</tbody>
</table>

Flow recover actions

A flow recover action is specified with the signal pmFlow_giRecoverAction.

<table>
<thead>
<tr>
<th>I/O value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Continue</td>
</tr>
<tr>
<td>2</td>
<td>Restart layer</td>
</tr>
</tbody>
</table>
7 Runtime operation

7.3.4 Extended I/O interface

Continued

<table>
<thead>
<tr>
<th>I/O value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Terminate job/Next pallet</td>
</tr>
<tr>
<td>4</td>
<td>Redo last pick</td>
</tr>
</tbody>
</table>

Starting or restarting a flow

<table>
<thead>
<tr>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
</tbody>
</table>

Stopping a flow

Stopping the flow pause the execution of a running palletizing job. When the flow is restarted, the execution of the job will continue. A flow stop option can be selected to specify how and when the flow shall be stopped.

<table>
<thead>
<tr>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
</tbody>
</table>

Stopping a flow immediately

When stopping a flow with stop option 0, it stops immediately, a flow recover action, for example \textit{Continue}, must be specified before restarting the flow.

If this is the only running flow or if the robot is currently working on this flow, then the robot will also stop immediately. However, if multiple flows are running, the robot can continue working on the other flows.

To force a stop of the robot, this sequence can be preceded by a \textit{Stopping robot program - halting project} action. This will require a \textit{Restarting robot program - restarting project} action after selecting recover action and restarting the flow.

Recovering a flow

If a flow has entered error state, the \textit{pmFlowX\_goStatus} signal is set to 5. Use this procedure to recover the flow.

<table>
<thead>
<tr>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
</tbody>
</table>
Action 3 Set \texttt{pmFlow\_giWaRecoverSelection} to select which work area the recover action shall be applied for.

The signal must not be set for the recover actions \texttt{Continue} and \texttt{Redo last pick}. The selected work area must be included in the selected flow, normally the master work area is selected.

The I/O value of the work area is configured in the Settings editor. For more details, see Events on page 159.

Action 4 Pulse \texttt{pmFlow\_diRecover} to recover the flow.

Action 5 An elog message is logged from the PickMaster RAPID application. The message contains information on the expected state of the robot tool and work areas before restarting the flow (see \texttt{PmSetRecoverAction - Set flow recover action on page 306}).

The flow is now prepared for being restarted.

Note

The error state of the flow indicated by \texttt{pmFlowX\_goStatus} will not change until the flow is restarted.

Stopping an infeeder

Stopping the robot from moving to an infeeder, that is a slave work area. The robot program will stop if the robot just has started a movement to the infeeder. In all other situations, the robot will continue to run all possible pick and place cycles that does not include the infeeder. If a flow comes to a point where it needs the infeeder in order to continue palletizing, the flow will stop in error state. But the robot may still continue to run pick and place cycles for other running flows. If the infeeder is redundant within a flow, that is there exists another infeeder that can supply the same units, the flow never stops (unless all redundant infeeders have been stopped).

Action 1 Set \texttt{pmEvent\_giErrorSource} to select the infeeder to be stopped. For more information to setup event signals for the robot controller, see Events on page 159.

Action 2 Pulse \texttt{pmEvent\_diTrigger} to generate an error on the infeeder.

Action 3 Wait until the infeeder is in error state, which occurs when the execution state signal, \texttt{pmInfeeder1\_goExecState} goes to 2.

Note

A multiple selection of infeeders is possible as in the preceding sequence.

Restarting an infeeder

Restarting an infeeder that is stopped. The infeeder can be restarted when the flow is executing or from a state where flows have been forced to stop. Afterwards, the robot will be able to pick from the infeeder again.

Action 1 Select a flow that has reached error state, that is \texttt{pmFlowX\_goStatus} = 5, that needs a stopped infeeder. If there are no such flows, select any flow that uses the infeeder. Set \texttt{pmFlow\_giSelection} to the selected flow. The I/O value for the flow is configured in the Flow editor. For more information, see Flow on page 201.

Continues on next page
### 7.3.4 Extended I/O interface

Continued

<table>
<thead>
<tr>
<th>Action</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Set <code>pmFlow_giRecoverAction</code> to 1 (= Continue).</td>
</tr>
<tr>
<td>3</td>
<td>Set <code>pmFlow_giWaRecoverSelection</code> to select the infeeder. The I/O value of the work area is configured in the Work Area I/O Settings editor. For more details, see <strong>Events on page 159</strong>.</td>
</tr>
<tr>
<td>4</td>
<td>Pulse <code>pmFlow_diRecover</code> to set recover action for the flow.</td>
</tr>
<tr>
<td>5</td>
<td>Pulse <code>pmFlow_diStart</code> to apply the recover action and start the selected flow.</td>
</tr>
<tr>
<td>6</td>
<td>Wait until the flow is running, <code>pmFlowX_goStatus = 1</code>, and the infeeder is running, <code>pmInfeeder1_goExecState = 1</code>.</td>
</tr>
<tr>
<td>7</td>
<td>If there is another flow that has an error state that needs the previously stopped infeeder, continue from Action 1 to restart the flow.</td>
</tr>
</tbody>
</table>

#### Note

The flow may stay in error state, if it uses another infeeder that has been stopped. To get the flow running, a restart will be needed for that infeeder too.

#### Event and error reporting

**Default signals**

It is possible to report events and errors for work areas, robots, and controllers that affect the runtime operation. See **Events on page 159**.

The following default signals can be used for event and error reporting.

<table>
<thead>
<tr>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>pmEvent_diTrigger</code></td>
<td>Generate an event.</td>
</tr>
<tr>
<td><code>pmEvent_giErrorSource</code></td>
<td>Select error source(s).</td>
</tr>
<tr>
<td><code>pmEvent_giMessage</code></td>
<td>Select log message.</td>
</tr>
</tbody>
</table>

#### Example, Report an error for a work area and log an elog message

<table>
<thead>
<tr>
<th>Action</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Set the proper bit for <code>pmEvent_giErrorSource</code> to select a work area. The bit representing the work area is set in the Event settings tab of the Controller Properties. See <strong>Events on page 159</strong>.</td>
</tr>
<tr>
<td>2</td>
<td>Set <code>pmEvent_giMessage</code> to select a message. Values that represent different messages are set in the Message Settings, see section <strong>Messages on page 162</strong>.</td>
</tr>
<tr>
<td>3</td>
<td>Pulse <code>pmEvent_diTrigger</code> to generate the error and the elog message.</td>
</tr>
<tr>
<td>4</td>
<td>Wait until the work area enters error state, which occurs when the execution state signal of the work area, <code>pmFlowX_goExecState</code>, gets the value 2.</td>
</tr>
</tbody>
</table>
Example, Log an elog message

<table>
<thead>
<tr>
<th>Action</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Set the proper bit for <code>pmEvent_giErrorSource</code> to select a controller. The bit that represents the controller is set in the <code>Event settings</code> tab of the Controller Properties. See <a href="#">Events on page 159</a>.</td>
</tr>
<tr>
<td>2</td>
<td>Set <code>pmEvent_giMessage</code> to select a message. Values that represent different messages are set in the <code>Message Settings</code>, see section <a href="#">Messages on page 162</a>.</td>
</tr>
<tr>
<td>3</td>
<td>Pulse <code>pmEvent_diTrigger</code> to generate the elog message.</td>
</tr>
</tbody>
</table>

Robot tool

The control of the robot tool in runtime operation is integrated in the PickMaster RAPID interface and defined by the project configuration.

Available default signals for tools:

<table>
<thead>
<tr>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>pmGripper1_goActivators</code></td>
<td>Activators control</td>
</tr>
<tr>
<td><code>pmGripper1_doActivator1Open</code></td>
<td>Activator control</td>
</tr>
<tr>
<td><code>pmGripper1_doActivator1Close</code></td>
<td>Activator control</td>
</tr>
<tr>
<td><code>pmGripper1_doActivator2Open</code></td>
<td>Activator control</td>
</tr>
<tr>
<td><code>pmGripper1_doActivator2Close</code></td>
<td>Activator control</td>
</tr>
<tr>
<td><code>pmGripper1_doActivator3Open</code></td>
<td>Activator control</td>
</tr>
<tr>
<td><code>pmGripper1_doActivator3Close</code></td>
<td>Activator control</td>
</tr>
<tr>
<td><code>pmGripper1_doActivator4Open</code></td>
<td>Activator control</td>
</tr>
<tr>
<td><code>pmGripper1_doActivator4Close</code></td>
<td>Activator control</td>
</tr>
<tr>
<td><code>pmGripper1_diActivator1Opened</code></td>
<td>Activator status</td>
</tr>
<tr>
<td><code>pmGripper1_diActivator1Closed</code></td>
<td>Activator status</td>
</tr>
<tr>
<td><code>pmGripper1_diActivator2Opened</code></td>
<td>Activator status</td>
</tr>
<tr>
<td><code>pmGripper1_diActivator2Closed</code></td>
<td>Activator status</td>
</tr>
<tr>
<td><code>pmGripper1_diActivator3Opened</code></td>
<td>Activator status</td>
</tr>
<tr>
<td><code>pmGripper1_diActivator3Closed</code></td>
<td>Activator status</td>
</tr>
<tr>
<td><code>pmGripper1_diActivator4Opened</code></td>
<td>Activator status</td>
</tr>
<tr>
<td><code>pmGripper1_diActivator4Closed</code></td>
<td>Activator status</td>
</tr>
<tr>
<td><code>pmGripper1_diPartCheck1</code></td>
<td>Part check status</td>
</tr>
<tr>
<td><code>pmGripper1_diPartCheck2</code></td>
<td>Part check status</td>
</tr>
<tr>
<td><code>pmGripper1_diPartCheck3</code></td>
<td>Part check status</td>
</tr>
<tr>
<td><code>pmGripper1_diPartCheck4</code></td>
<td>Part check status</td>
</tr>
<tr>
<td><code>pmGripper1_diPartCheck5</code></td>
<td>Part check status</td>
</tr>
<tr>
<td><code>pmGripper1_giPartCheck1</code></td>
<td>Part check status</td>
</tr>
<tr>
<td><code>pmGripper1_goSearchActivate</code></td>
<td>Search tool activation.</td>
</tr>
<tr>
<td><code>pmGripper1_diSearchStop</code></td>
<td>Stack search stop trigger.</td>
</tr>
<tr>
<td><code>pmGripper1_goToolEvent1</code></td>
<td>GO tool event.</td>
</tr>
</tbody>
</table>

Continues on next page
## 7 Runtime operation

### 7.3.4 Extended I/O interface

Continued

<table>
<thead>
<tr>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>pmGripper1_goToolEvent2</td>
<td>GO tool event.</td>
</tr>
<tr>
<td>pmGripper1_goToolEvent3</td>
<td>GO tool event.</td>
</tr>
<tr>
<td>pmGripper1_goToolEvent4</td>
<td>GO tool event.</td>
</tr>
<tr>
<td>pmGripper1_goToolEvent5</td>
<td>GO tool event.</td>
</tr>
<tr>
<td>pmGripper1_doToolEvent1</td>
<td>DO tool event.</td>
</tr>
<tr>
<td>pmGripper1_diToolEvent1</td>
<td>DI tool event.</td>
</tr>
<tr>
<td>pmGripper1_giToolEvent1</td>
<td>GI tool event.</td>
</tr>
<tr>
<td>pmGripper1_giToolEvent2</td>
<td>GI tool event.</td>
</tr>
<tr>
<td>pmGripper1_giToolEvent3</td>
<td>GI tool event.</td>
</tr>
<tr>
<td>pmGripper1_giToolEvent4</td>
<td>GI tool event.</td>
</tr>
<tr>
<td>pmGripper1_giToolEvent5</td>
<td>GI tool event.</td>
</tr>
</tbody>
</table>
7.3.5 Timing diagrams for PLC communication

Introduction

Each timing diagram shows a basic example on the I/O communication between the robot controller and the PLC when running a PickMaster project. The individual updates of different I/O signals are shown related to important events of the palletizing process, for example when a pickup of a format has been completed.

The following events in the palletizing process can be found in the timing diagrams:

<table>
<thead>
<tr>
<th>Event</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operate infeeder</td>
<td>The RAPID execution has executed the RAPID procedure Operate for the infeeder.</td>
</tr>
<tr>
<td>Pick</td>
<td>The robot has reached the pick position and picked up a complete format in the tool.</td>
</tr>
<tr>
<td>Operate outfeeder</td>
<td>The RAPID execution has executed the RAPID procedure Operate for the outfeeder.</td>
</tr>
<tr>
<td>Place</td>
<td>The robot has reached the place position and placed a complete format on the work area.</td>
</tr>
<tr>
<td>Pallet pattern unloaded</td>
<td>A finished pallet pattern leaves the working range of the robot when being transferred from an outfeeder.</td>
</tr>
<tr>
<td>Operation set complete</td>
<td>An operation set is complete when the robot has picked/placed the last product in a job/operation set and then departed from the last pick/place position. The doOpSetCompl signal is set a short time after the precedent pick/place event when the robot reaches the last depart target action.</td>
</tr>
</tbody>
</table>

See examples:

- *Example minimum process control on a running flow on page 280.*
- *Example robot execution control on page 281.*
- *Example height control of a running flow on page 282.*
- *Example flow control on page 283.*

Continues on next page
7 Runtime operation

7.3.5 Timing diagrams for PLC communication

Continued

Example minimum process control on a running flow

Task: Pick single items from infeeder and place pallet pattern with two items on outfeeder.

Settings: Early request, Use concurrency, non-pulsed controller mode.

<table>
<thead>
<tr>
<th></th>
<th>A Master outfeeder, process control</th>
<th>B Master outfeeder, process status</th>
<th>C Operate outfeeder</th>
<th>D Place</th>
<th>E Slave infeeder, process control</th>
<th>F Slave infeeder, process status</th>
<th>G Operate infeeder</th>
<th>H Pick</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>doPosReqTrig</td>
<td>C</td>
<td>D</td>
<td>C</td>
<td>D</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>dTgtGenTrig</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>doPosAvail</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>deQueueEmpty</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>deOpSelCompl</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>goExecState</td>
<td>1 (running)</td>
<td>1 (active)</td>
<td>1 (active)</td>
<td>0 (full)</td>
<td>0 (full)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>goHeightState</td>
<td>0 (full)</td>
<td>0 (full)</td>
<td>0 (full)</td>
<td>0 (full)</td>
<td>0 (full)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>en1000000195</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Continues on next page
Example robot execution control

Task: Pick single items from infeeder and place pallet pattern with two items on outfeeder, control the robot access to work areas by using the robot execution signal.

Settings: Early request, Use concurrency, non-pulsed controller mode, default height Full on both infeeder and outfeeder.

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>doPoeReqTrig</td>
<td>doPosAvail</td>
<td>doQueueEmpty</td>
<td>doOpSelComp</td>
<td>doExecState</td>
</tr>
<tr>
<td>dTgtGenTrig</td>
<td>doPosAvail</td>
<td>doQueueEmpty</td>
<td>doOpSelComp</td>
<td>doExecState</td>
</tr>
<tr>
<td>dRobotExec</td>
<td>doPosAvail</td>
<td>doQueueEmpty</td>
<td>doOpSelComp</td>
<td>doExecState</td>
</tr>
</tbody>
</table>

A Master outfeeder, process control
B Master outfeeder, process status
C Operate outfeeder
D Place
E Slave infeeder, process control
F Slave infeeder, process status
G Operate infeeder
H Pick

Continues on next page
Example height control of a running flow

Flow task: Pick single items from infeeder and place pallet pattern with two items on outfeeder. Control the height change of the outfeeder caused by unloading the pallet pattern to minimize the cycle time for other flows.

Settings: Early request, Use concurrency, non-pulsed controller mode, default height *Full* on infeeder and *Latest* on outfeeder.

- A: Project control, process control
- B: Pallet pattern unloaded from outfeeder
- C: Master outfeeder, process control
- D: Master outfeeder, process status
- E: Operate outfeeder
- F: Place
- G: Slave infeeder, process control
- H: Slave infeeder, process status
- J: Operate infeeder
- K: Pick

Continues on next page
Example flow control

Task: Start a flow, pick single items from infeeder and place pallet pattern on outfeeder, control the robot access to work areas by using the robot execution signal, stop the flow with stop option finish cycle, cancel the rest of the job by resetting the robot execution signal from the outfeeder.

Settings: Early request, Use concurrency, non-pulsed controller mode, default height *Full* on both infeeder and outfeeder.

A Flow control, process control. In this example, the *giSelection* signal is constantly set to this flow.

B Master outfeeder, process control

C Master outfeeder, process status. In this example, the *goExecState* signal is constantly set to 1 (running).

D Operate outfeeder

E Place

F Slave infeeder, process control

G Slave infeeder, process status. In this example, the *goExecState* signal is constantly set to 1 (running).

H Operate infeeder

J Pick
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8 RAPID reference information

8.1 Introduction to RAPID reference information

Structure of this chapter

This chapter describes the RAPID instructions, functions, and data types that are specific for PickMaster.
8.2 Instructions

8.2.1 PmAckTarget - Acknowledge a target

Usage

PmAckTarget is used to acknowledge a target.

Basic examples

IF status = OK THEN
   PmAckTarget Wa, Target, PM_ACK;
ELSE
   PmAckTarget Wa, Target, PM_NACK;
ENDIF

Arguments

PmAckTarget Wa Target Status

Wa

Data type: pm_wadescr
Contains a reference to a work area.

Target

Data type: pm_targetdata
The target that is acknowledged.

Status

Data type: pm_acktype
The acknowledge status.

Predefined data

The acknowledge status, used in argument Status, can be one of the following:

<table>
<thead>
<tr>
<th>Constant</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM_ACK</td>
<td>The target is acknowledged as used.</td>
</tr>
<tr>
<td>PM_NACK</td>
<td>The target is acknowledged as not used.</td>
</tr>
<tr>
<td>PM_LOST</td>
<td>If the target is acknowledged as lost.</td>
</tr>
</tbody>
</table>

Syntax

PmAckTarget
   [ Wa '=' ] < expression (IN) of pm_wadescr > ','
   [ Target '=' ] < expression (IN) of pm_targetdata > ','
   [ Status '=' ] < expression (IN) of pm_acktype > ';'

Related information

For information about The data type pm_wadescr
See pm_wadescr - PickMaster work area reference on page 370.
### 8.2.1 PmAckTarget - Acknowledge a target

#### Continued

<table>
<thead>
<tr>
<th>For information about</th>
<th>See</th>
</tr>
</thead>
<tbody>
<tr>
<td>The data type pm_targetdata</td>
<td><em>pm_targetdata - PickMaster target data on page 366.</em></td>
</tr>
<tr>
<td>The data type pm_acktype</td>
<td><em>pm_acktype - PickMaster target acknowledge type on page 336.</em></td>
</tr>
</tbody>
</table>
8 RAPID reference information

8.2.2 PmCalcArmConf - Calculates the arm configuration

Usage

PmCalcArmConf is used to calculate a suitable arm configuration for a robtarget, that is the robconf component of the robtarget. Some switches can be selected to optimize the resulting arm configuration, for example for a robot of a certain type. A maximum and minimum angle can be set up for one axis. The resulting arm configuration will also depend on the initial settings of robconf.

Basic example

PmCalcArmConf RobTgtPoint, TargetTool, TargetWobj \cf6 MaxAngle:=180 \MinAngle:=-180 \SingAreaType:=Act.SingAreaType;

Arguments


RobTgt

Robot target
Data type: robtarget
The robot target whose arm configuration will be calculated.

Tool

Tool
Data type: tooldata
The tool used for calculation of the robot arm configuration.

Wobj

Work object
Data type: wobjdata
The work object (coordinate system) to which the robot position is related.

[\cf1]

Data type: switch
An arm configuration is calculated where the axis 1 angle is limited by the arguments MaxAngle and MinAngle. A solution closer to +45 degrees is preferred for axis 1. A solution close to the input arm configuration is preferred for the other axes.

[\cf4]

Data type: switch
An arm configuration is calculated where the axis 4 angle is limited by the arguments MaxAngle and MinAngle. A solution closer to +45 degrees is preferred for axis 4. A solution close to the input arm configuration is preferred for the other axes.

[\cf6]

Data type: switch
An arm configuration suitable for a 4 axes palletizer robot or a 6 axes bending backwards robot is calculated. The axis 6 angle is limited by the arguments

Continues on next page
MaxAngle and MinAngle. A solution closer to +45 degrees is preferred for axis 6. A solution close to the input arm configuration is preferred for the other axes.

[\TypeB1]

Data type: switch
An arm configuration suitable for a parallel rod robot is calculated. The axis 6 angle is limited by the arguments MaxAngle and MinAngle. A solution closer to +45 degrees is preferred for axis 6. A solution close to the input arm configuration is preferred for the other axes.

[\MaxAngle]

Maximum angle
Data type: num
Maximum angle allowed for one axis. Which axis is decided by the selection of cf1, cf4, cf6 or TypeB1.

[\MinAngle]

Minimum angle
Data type: num
Minimum angle allowed for one axis. Which axis is decided by the selection of cf1, cf4, cf6 or TypeB1.

[\SingAreaType]

Interpolation mode
Data type: pm_singareatype
Specifies the interpolation mode to be used with this robtarget. The argument is required to find a configuration with the LockAx4 interpolation mode.

Error handling
The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO is set to:

<table>
<thead>
<tr>
<th>Error code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM_ERR_CALCCONF</td>
<td>Failed to calculate arm configuration. A highly complex arm configuration may cause this error.</td>
</tr>
<tr>
<td>PM_ERR_AXLIM</td>
<td>Failed to calculate axis limit. The axis angle cannot be calculated due to angle limitations.</td>
</tr>
<tr>
<td>PM_ERR_LIM_VALUE</td>
<td>Wrong limitation value. The coordinate is not possible to calculate.</td>
</tr>
</tbody>
</table>

Syntax

Instruction

| [ RobTgt ':=' | < expression (INOUT) of robtarget > ',' |
| [ Tool ':=' | < expression (IN) of tooldata > ',' |
| [ Wobj ':=' | < expression (IN) of wobjdata > |
| [ '\ ' cf1 ] | [ '\ ' cf4 ] | [ '\ ' cf6 ] | [ '\ ' TypeB1 ] |
| [ '\ ' MaxAngle ':=' | < expression (IN) of num >) |
| [ '\ ' MinAngle ':=' | < expression (IN) of num >] |
8 RAPID reference information

8.2.2 PmCalcArmConf - Calculates the arm configuration

Continued

```c
[ '\' SingAreaType ':=' < expression (IN) of pm_singareatype >]

';'
```

Related information

<table>
<thead>
<tr>
<th>For information about</th>
<th>See</th>
</tr>
</thead>
<tbody>
<tr>
<td>The data type <code>confdata</code></td>
<td>Technical reference manual - RAPID Instructions, Functions and Data types, section Data types.</td>
</tr>
<tr>
<td>The data type <code>robtarget</code></td>
<td>Technical reference manual - RAPID Instructions, Functions and Data types, section Data types.</td>
</tr>
</tbody>
</table>
8.2.3 PmGetFlow - Get flow to execute

Usage

PmGetFlow is used to wait until any flow reports that it is ready to be executed. The instruction will return two work area references to the work areas that are ready to be executed within a flow. If several flows are ready to be executed, the process behind the instruction will return references of the highest prioritized flow. If the time-out time is not used, the instruction is blocking until any flow is ready to be executed.

Basic examples

A basic example of the instruction PmGetFlow is illustrated below.

PROC OperateSequence()
  PmGetFlow waInFeeder, waOutFeeder;
  Operate waInFeeder;
  Operate waOutFeeder;
ENDPROC

Arguments

PmGetFlow PickWa PlaceWa [\MaxTime] [\TimeFlag]

PickWa

Data type: pm_wadescr
Variable that is updated to refer to the pick work area of the flow that is ready to be executed.

PlaceWa

Data type: pm_wadescr
Variable that is updated to refer to the place work area of the flow that is ready to be executed.

[\MaxTime]

Maximum Time
Data type: num
The maximum period of permitted waiting time, expressed in seconds. If this time runs out before the condition is met, the error handler will be called if there is one, with the error code PM_ERR_TIMEOUT. If there is no error handler, the execution will be stopped.

[\TimeFlag]

Timeout Flag
Data type: bool
The output argument that contains the value TRUE if the maximum permitted waiting time runs out before the condition is met. If this argument is included in the instruction, it is not considered an error if the maximum time runs out. This argument is ignored if the MaxTime argument is not included in the instruction.

Continues on next page
8  RAPID reference information

8.2.3  PmGetFlow - Get flow to execute
Continued

Program execution

If the programmed condition is not met when executing a PmGetFlow instruction, the robot will wait and the time will be supervised. If it exceeds the maximum time value, the program will continue if a TimeFlag is specified, or generate an error if it is not specified. If a TimeFlag is specified, this will be set to TRUE if the time is exceeded, otherwise it will be set to FALSE.

More examples

More examples of how to use the instruction PmGetFlow are illustrated below.

PROC OperateSequence()
    PmGetFlow waInFeeder, waOutFeeder \
MaxTime:=6 \nTimeFlag:=bTimeout;
    IF NOT bTimeout THEN
        Operate waInFeeder;
        Operate waOutFeeder;
    ELSE
        p1 := CRobT\n\Tool:=tool0 \nWObj:=wobj0);
        MoveL RelTool(p1,100,0,0), v100, fine, tool0;
        MoveL p1, v100, fine, tool0;
    ENDIF
ENDPROC

Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO will be set to:

<table>
<thead>
<tr>
<th>Error code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM_ERR_TIMEOUT</td>
<td>No flow was ready to be executed within the time-out time.</td>
</tr>
</tbody>
</table>

Syntax

PmGetFlow

[ PickWa ':=' ] < expression (VAR) of pm_wadescr > ','
[ PlaceWa ':=' ] < expression (VAR) of pm_wadescr >
[ '"' MaxTime ':=' ] < expression (IN) of num > ','
[ '"' TimeFlag ':=' ] < variable (VAR) of bool >] '

Related information

<table>
<thead>
<tr>
<th>For information about</th>
<th>See</th>
</tr>
</thead>
<tbody>
<tr>
<td>The data type pm_wadescr</td>
<td>pm_wadescr - PickMaster work area reference on page 370</td>
</tr>
<tr>
<td>The Robot Flow Configuration</td>
<td>Flow on page 201</td>
</tr>
</tbody>
</table>
8.2.4 PmGetFlowInfo - Get information about a specific flow

Usage

PmGetFlowInfo gets information about a flow. The flow must be in the started project.

Basic examples

A basic example of the instruction PmGetFlowInfo is illustrated below.

```rapl
TRAP TrapStartFlow
    VAR pm_flowinfo FlowInfo;
    VAR num FlowSelection;
    ! Get info from selected flow
    PmGetFlowInfo FlowSelection,FlowInfo;
ENDTRAP
```

Arguments

PmGetFlowInfo SelectionNumber | Name FlowInfo

SelectionNumber

Data type: num

The number that maps a specific flow with its signal value.

Name

Data type: string

The name of the flow in a started project.

FlowInfo

Data type: pm_flowinfo

Variable that holds the information about the flow.

Program execution

The program fails with a recoverable error if the flow cannot be found. All other errors are considered to be fatal.

More examples

Another example of how to use the instruction PmGetFlowInfo is illustrated below.

```rapl
TRAP TrapStartFlow
    VAR pm_flowinfo FlowInfo;
    VAR num FlowSelection;
    FlowSelection:=1;
    ! Get info from selected flow
    PmGetFlowInfo FlowSelection,FlowInfo;
    ! Start the selected flow
    PmStartFlow FlowInfo.Name;
    TPWrite "Master work area = " + PmGetWaName (FlowInfo.MasterWa);
    ERROR
    ! Continue supervision on recoverable errors
    IF ERRNO=PM_ERR_FLOW_NOT_FOUND THEN
        RETURN;
    ENDTRAP
```

Continues on next page
Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO will be set to:

<table>
<thead>
<tr>
<th>Error code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM_ERR_FLOW_NOT_FOUND</td>
<td>No flow was found with this selection number or name.</td>
</tr>
<tr>
<td>PM_ERR_NO_RUNNING_PROJECT</td>
<td>No running project.</td>
</tr>
</tbody>
</table>

Syntax

```
PmGetFlowInfo
  [SelectionNumber ':=' ] < expression (IN) of num > ','
  | [Name ':=' ] < expression (IN) of string > ','
  | [FlowInfo ':=' ] < expression (VAR) of pm_flowinfo > ';
```

Related information

<table>
<thead>
<tr>
<th>For information about</th>
<th>See</th>
</tr>
</thead>
<tbody>
<tr>
<td>The data type pm_flowinfo</td>
<td>`pm_flowinfo - PickMaster flow information on page 345.</td>
</tr>
</tbody>
</table>
8.2.5 PmGetLastWa - Get last used work area

Usage

PmGetLastWa gets the last used work area. The work area must previous have been set by the instruction PmSetLastWa.

Basic examples

A basic example of the instruction PmGetLastWa is illustrated below.

VAR pm_wadescr WorkArea;
! Get last used work area
PmGetLastWa WorkArea;

Arguments

PmGetLastWa Workarea

Workarea

Data type: pm_wadescr
A descriptor to the last set work area.

Program execution

All errors are considered to be fatal.

Syntax

    PmGetLastWa
    [Workarea ':='] < expression (VAR) of pm_wadescr > ';' 

Related information

<table>
<thead>
<tr>
<th>For information about</th>
<th>See</th>
</tr>
</thead>
<tbody>
<tr>
<td>The data type pm_wadescr</td>
<td>pm_wadescr - PickMaster work area reference on page 370</td>
</tr>
<tr>
<td>The instruction PmSetLastWa</td>
<td>PmSetLastWa - Set last used work area on page 305</td>
</tr>
<tr>
<td>The instruction PmGetPathHeight</td>
<td>PmGetPathHeight - Get a safe path height for an intermediate movement on page 323</td>
</tr>
</tbody>
</table>
8.2.6 PmGetOperation - Get operation from a work area

Usage
PmGetOperation is used to get operation data from a work area.

Basic example
PERS wobjdata wInfeeder2 := [FALSE, TRUE, "", [[2180.65, 1430.22, -720.753], [0.00104, 0.00130, 0.00039, 1.00000]], [[0, 0, 0], [1, 0, 0, 0]]];
VAR pm_wadescr PickWa;
VAR pm_operationdata Op;
PmGetWaByWobj wInfeeder2, PickWa;
PmGetOperation PickWa, Op;

Get operation data for the work area using work object data wInfeeder2.

Arguments
PmGetOperation Wa Operation [\MaxTime] [\TimeFlag]
Wa
Data type: pm_wadescr
Contains a reference to a work area.

Operation
Data type: pm_operationdata
Operation data that is fetched from a work area.

[\MaxTime]
Maximum Time
Data type: num
The maximum period of waiting time permitted, expressed in seconds. If this time runs out before the condition is met, the error handler will be called, if there is one, with the error code PM_ERR_TIMEOUT. If there is no error handler, the execution will be stopped.

[\TimeFlag]
Timeout Flag
Data type: num
The output argument that contains the value TRUE if the maximum permitted waiting time runs out before the condition is met. If this argument is included in the instruction, it is not considered an error if the maximum time runs out. This argument is ignored if the MaxTime argument is not included in the instruction.

Error handling
The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO will be set to:

<table>
<thead>
<tr>
<th>Error code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM_ERR_TIMEOUT</td>
<td>No pm_operationdata could be fetched within the time out time.</td>
</tr>
</tbody>
</table>

Continues on next page
8.2.6 PmGetOperation - Get operation from a work area

Syntax

```plaintext
PmGetOperation
    [ Wa ':=' ] < expression (IN) of pm_wadescr > ','
    [ Operation ':=' ] < expression (INOUT) of pm_operationdata >
    [ '\ MaxTime ':=' ] < expression (IN) of num >]
    [ '\ TimeFlag ':=' ] < variable (VAR) of bool >] ';'
```

Related information

<table>
<thead>
<tr>
<th>For information about</th>
<th>See</th>
</tr>
</thead>
<tbody>
<tr>
<td>The data type pm_wadescr</td>
<td><code>pm_wadescr - PickMaster work area reference on page 370</code></td>
</tr>
<tr>
<td>The data type pm_operationdata</td>
<td><code>pm_operationdata - PickMaster operation data on page 352</code></td>
</tr>
</tbody>
</table>
8 RAPID reference information

8.2.7 PmGetProjectInfo - Get information about a specific project

Usage

PmGetProjectInfo gets information about a project. The project must be transferred to the controller.

Basic examples

A basic example of the instruction PmGetProjectInfo is illustrated below.

PROC main()
! Get info from select project
PmGetProjectInfo ProjectSelection,ProjInfo;
ENDPROC

Arguments

PmGetProjectInfo SelectionNumber | Name ProjectInfo

SelectionNumber

Data type: num
The number that maps a transferred project with its signal value. See Project Manager on page 108.

Name

Data type: string
The name of a transferred project.

ProjectInfo

Data type: pm_projectinfo
Variable that holds the information about the project.

Program execution

The program will fail with a recoverable error if the project cannot be found. All other errors are considered to be fatal.

More examples

Another example of how to use the instruction PMGetProjectInfo is illustrated below.

PROC main()
VAR pm_projectinfo ProjInfo;
VAR num ProjectSelection;
! Wait for start project order from PLC
WaitDI pmProject_diStart,1;
! Check which project to be started
ProjectSelection:=pmProject_giSelection;
! Get info from select project
PmGetProjectInfo ProjectSelection,ProjInfo;
! Start the selected project
PmStartProj ProjInfo.Name;

Continues on next page
WHILE TRUE DO
! Execute the main routine in the selected project.
"PmMain:Main";
ENDWHILE
ERROR
IF ERRNO=PM_ERR_PROJ_NOT_FOUND THEN
! There is no project mapped to the selection value
TRYNEXT;
ENDIF
ENDPROC

Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO will be set to:

<table>
<thead>
<tr>
<th>Error code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM_ERR_PROJ_NOT_FOUND</td>
<td>No project was found with this selection number or name.</td>
</tr>
</tbody>
</table>

Syntax

PmGetProjectInfo
  [SelectionNumber ':='] < expression (IN) of num> ','
  | [Name ':='] < expression (IN) of string> ','
  [ProjectInfo ':='] < expression (VAR) of pm_projectinfo> ';'
8 RAPID reference information

8.2.8 PmGetWaByWobj - Get a reference to a work area using a work object data

Usage

PmGetWaByWobj gets the reference for a specified work area.

The arguments to the instruction is the work object data, that is to be connected to the work area, and the pm_wadescr.

Basic example

PERS wobjdata wInfeeder1 := [FALSE,TRUE,"",[[2180.65,1430.22,-220.753], [0.00104,-0.00130,0.00039,1.00000]],[[0,0,0],[1,0,0]]];
VAR pm_wadescr PickWa;
PmGetWaByWobj wInfeeder1, PickWa;

Arguments

PmGetWaByWobj WObj Wa

WObj

Work Object

Data type: wobjdata

The work object data that should be searched for in all work areas.

Wa

Data type: pm_wadescr

Variable that is updated to refer to the work area that corresponds to the provided work object.

Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO will be set to:

<table>
<thead>
<tr>
<th>Error code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM_ERR_WOBJ</td>
<td>No work area has reference to the work object data used.</td>
</tr>
</tbody>
</table>

Syntax

PmGetWaByWobj
[ Wobj ':= ' ] < persistent (PERS) of wobjdata > ','
[ Wa ':= ' ] < expression (INOUT) of pm_wadescr > ';'

Related information

<table>
<thead>
<tr>
<th>For information about</th>
<th>See</th>
</tr>
</thead>
<tbody>
<tr>
<td>The data type pm_wadescr</td>
<td>pm_wadescr - PickMaster work area reference on page 370</td>
</tr>
<tr>
<td>The data type wobjdata</td>
<td>Technical reference manual - RAPID Instructions, Functions and Data types, section Data types</td>
</tr>
</tbody>
</table>
8.2.9 PmGetWaInfo - Get information about a specific work area

Usage

PmGetWaInfo gets information about a work area. The work area must be in the started project. This information can be used in an external user interface or as a way to get a work area descriptor from a selection number.

Basic examples

Basic examples of the instruction PmGetWaInfo are illustrated below.

VAR pm_wainfo WaInfo;
VAR num WaSelection:=1;
! Get info from selected Work Area
PmGetWaInfo WaSelection, WaInfo;

Arguments

PmGetWaInfo SelectionNumber | WorkArea FlowInfo

SelectionNumber

Data type: num
The number that maps a specific work area with its signal value.

WorkArea

Data type: pm_wadescr
A valid descriptor in a started project. The descriptor could be collected from PmGetFlow or PmGetWaByWobj.

FlowInfo

Data type: pm_wainfo
Variable that holds the information about the work area.

Program execution

The program will fail with a recoverable error if the work area cannot be found. All other errors are considered to be fatal.

Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO will be set to:

<table>
<thead>
<tr>
<th>Error code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM_ERR_WA_NOT_FOUND</td>
<td>No work area was found with this selection number or name.</td>
</tr>
<tr>
<td>PM_ERR_NO_RUNNING_PROJECT</td>
<td>No running project.</td>
</tr>
</tbody>
</table>

Syntax

PmGetWaInfo
[SelectionNumber ':='] < expression (IN) of num > ','
[(Workarea ':=') < expression (VAR) of pm_wadescr > ','
[WaInfo ':='] < expression (VAR) of pm_wainfo > ';'

Continues on next page
## Related information

<table>
<thead>
<tr>
<th>For information about</th>
<th>See</th>
</tr>
</thead>
<tbody>
<tr>
<td>The data type pm_wainfo</td>
<td>pm_wainfo - PickMaster Work Area information on page 371</td>
</tr>
<tr>
<td>The data type pm_wadescr</td>
<td>pm_wadescr - PickMaster work area reference on page 370</td>
</tr>
<tr>
<td>The instruction PmGetFlow</td>
<td>PmGetFlow - Get flow to execute on page 291</td>
</tr>
<tr>
<td>The instruction PmGetWaByWobj</td>
<td>PmGetWaByWobj - Get a reference to a work area using a work object data on page 300</td>
</tr>
</tbody>
</table>
8.2.10 PmSearchAdjust - Adjust number of remaining layers

Usage

PmSearchAdjust is used after a stack search to adjust the number of remaining layers in a pallet pattern. It also updates the search frame to improve the picking accuracy for a pallet pattern or format.

Basic examples

Basic examples of the instruction PmSearchAdjust are illustrated below.

Example 1

VAR pm_wadescr PickWa;
VAR num PalletPatternHeightZ:=1097;
PmSearchAdjust PickWa, PM_SEARCH_Z, PalletPatternHeightZ;

A pallet pattern available at the specified work area is updated in the z-direction of the work object. The detected height of the pallet pattern is 1097 mm.

Example 2

VAR pm_wadescr PickWa;
VAR num FormatHeightZ:=154;
PmSearchAdjust PickWa, PM_SEARCH_Z, FormatHeightZ;

A format available at the specified work area is updated in the z-direction of the work object. The detected height of the format is 154 mm.

Arguments

PmSearchAdjust Workarea SearchType SearchPos

WorkArea

Data type: pm_wadescr
Contains a reference to a work area.

SearchType

Data type: pm_searchtype
Represents an integer with a symbolic constant for different types of searches.

SearchPos

Search Position
Data type: num
The detected size in mm of the pallet pattern or format. The size is expressed relative the work object.

Error handling

The following recoverable error can be generated. The errors can be handled in an error handler. The system variable ERRNO will be set to:

<table>
<thead>
<tr>
<th>Error code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM_ERR_PALLET_REduced</td>
<td>A number of layers were removed since the detected stack height was lower (at least half the product height lower) than expected. The error is recovered through acknowledge of the search target and fetching next operation.</td>
</tr>
</tbody>
</table>

Continues on next page
The detected height of the pallet pattern or format indicates missing parts. The error is recovered through acknowledge of the search target, trigger the Redo Search signal for the work area and fetching next operation.

Limitations

The instruction may only be used after an action containing a SearchL movement has been fetched with PmGetTgtAction and before the corresponding target has been acknowledged.

Predefined data

The search type, used in argument SearchType can be one of the following:

<table>
<thead>
<tr>
<th>Constant</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM_SEARCH_X</td>
<td>0</td>
<td>Search was performed in the x direction of the work object.</td>
</tr>
<tr>
<td>PM_SEARCH_Y</td>
<td>1</td>
<td>Search was performed in the y direction of the work object.</td>
</tr>
<tr>
<td>PM_SEARCH_Z</td>
<td>2</td>
<td>Search was performed in the z direction of the work object.</td>
</tr>
</tbody>
</table>

Syntax

PmSearchAdjust
   [ WorkArea ':=' ] < expression (IN) of pm_wadescr > ','
   [ SearchType ':=' ] < expression (IN) of pm_searchtype > ','
   [ SearchPos ':=' ] < expression (IN) of num > ';'

Related information

<table>
<thead>
<tr>
<th>For information about</th>
<th>See</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stack search</td>
<td>Stack search on page 191.</td>
</tr>
<tr>
<td>Format frame versus work object in format operation set</td>
<td>Format frame versus work object in format operation set on page 386.</td>
</tr>
<tr>
<td>Pallet pattern versus work object in pallet pattern operation set</td>
<td>Pallet pattern frame versus work object in pallet pattern operation set on page 388.</td>
</tr>
<tr>
<td>The data type pm_wadescr</td>
<td>pm_wadescr - PickMaster work area reference on page 370.</td>
</tr>
<tr>
<td>The data type pm_searchtype</td>
<td>pm_searchtype - PickMaster stack search type on page 361.</td>
</tr>
</tbody>
</table>
8.2.11 PmSetLastWa - Set last used work area

Usage

PmSetLastWa sets the last used work area. Use the instruction PmGetLastWa to get the work area.

Basic examples

Basic examples of the instruction instruction are illustrated below.

VAR pm_wadescr WorkArea;
! Set last used work area
PmSetLastWa WorkArea;

Arguments

PmSetLastWa Workarea

Workarea

Data type: pm_wadescr
A descriptor to the last used work area.

Program execution

All errors are considered to be fatal.

Syntax

PmSetLastWa
[Workarea ':=' ] < expression (VAR) of pm_wadescr > ';'

Related information

<table>
<thead>
<tr>
<th>For information about</th>
<th>See</th>
</tr>
</thead>
<tbody>
<tr>
<td>The data type pm_wadescr</td>
<td>pm_wadescr - PickMaster work area reference on page 370</td>
</tr>
<tr>
<td>The instruction PmGetLastWa</td>
<td>PmGetLastWa - Get last used work area on page 295</td>
</tr>
<tr>
<td>The instruction PmGetPathHeight</td>
<td>PmGetPathHeight - Get a safe path height for an intermediate movement on page 323</td>
</tr>
</tbody>
</table>
8.2.12 PmSetRecoverAction - Set flow recover action

**Usage**

PmSetRecoverAction sets flow recover action before starting a flow in error state. This instruction must be used before starting a flow with use of the IO interface if the flow is in error state. The instruction also returns information that can be used in an event log message. This message describes circumstances for restarting with selected recover action.

**Basic examples**

Basic examples of the instruction PmSetRecoverAction are illustrated below.

```plaintext
VAR pm_flowinfo FlowInfo;
PmSetRecoverAction FlowInfo.Name, PM_RECOVER_REDO_LAST_PICK;
```

**Arguments**

PmSetRecoverAction Name \WorkArea RecoverAction \EventId \Argument1 \Argument2 \Argument3 \Argument4

**Name**

Data type: string

The name of the flow to set recover action on.

**WorkArea**

Data type: pm_wadescr

The work area to perform recover action on. This is mandatory if using recover action Restart layer or Terminate job/Next pallet, where it is recommended to select the master work area. This is not required for recover action Continue and Redo last pick.

**RecoverAction**

Data type: num

The recover action that is performed at next flow start.

**[\EventId]**

Data type: num

The event message number in process domain that creates a message for the chosen recover action.

**[\Argument1]**

Data type: errstr

The first argument to the event log message, one space if not used.

**[\Argument2]**

Data type: errstr

The second argument to the event log message, one space if not used.

**[\Argument3]**

Data type: errstr
The third argument to the event log message, one space if not used.

\[Argument4\]

Data type: errstr

The fourth argument to the event log message, one space if not used.

## Program execution

The program will fail with a recoverable error with recover action:

- `PM_RECOVER_REDO_LAYER` or `PM_RECOVER_NEXT_PALLET` without a valid work area.
- A recover action not in range.
- `PM_RECOVER_REDO_LAST_PICK` when nothing is picked.

All other errors are considered to be fatal.

## Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable `ERRNO` will be set to:

<table>
<thead>
<tr>
<th>Error code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>PM_ERR_WORKAREA_EXPECTED</code></td>
<td>This recover action demands a work area.</td>
</tr>
<tr>
<td><code>PM_ERR_NOT_VALID_RECOVER_ACTION</code></td>
<td>The recover action is not one of the supported.</td>
</tr>
<tr>
<td><code>PM_ERR_REDO_LAST_PICK_REJECTED</code></td>
<td>The redo last pick recover action is rejected, no products picked.</td>
</tr>
<tr>
<td><code>PM_ERR_NO_RUNNING_PROJECT</code></td>
<td>No running project.</td>
</tr>
</tbody>
</table>

## Predefined messages

There are predefined event messages in the process domain for describing what to do before the flow start with the chosen recover action.

```xml
<Message number="2393">
Flow recover with redo last pick
The Flow <Flow name> will redo last unfinished operation at next flow start.
Verify that:
The tool is empty
Products from last operation are restored on <WorkArea name>
The reason for the stop is solved.
</Message>
<Message number="2394">
Flow recover with continue pick-place
The Flow <Flow name> will restart from where it was stopped at next flow start. Verify that the fault causing the stop has been handled.
Verify expected number of products:
Tool: <Number of products>
WorkArea name/Number of products/Layer number
</Message>
```

Continues on next page
Continued

Flow recover with restart layer
The Flow <Flow name> will restart from beginning of layer <layer number> on WorkArea <WorkArea name> at next flow start.
Verify that:
The reason for the stop is solved
The tool is empty
Following WorkAreas are empty:
<WorkArea name>
<WorkArea name>
<WorkArea name>

Flow recover with next pallet
The Flow <Flow name> will restart from beginning of next pallet on WorkArea <WorkArea name> at next flow start.
Verify that:
The reason for the stop is solved.
The tool is empty
Following WorkAreas are empty:
<WorkArea name>
<WorkArea name>
<WorkArea name>

Flow recover with redo last pick
The Flow <Flow name> will redo last unfinished operation at next flow start.
Verify that:
The tool is empty
New products can be supplied on <WorkArea name>
The reason for the stop is solved.

Predefined data

<table>
<thead>
<tr>
<th>Constant</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM_RECOVER_CONTINUE_OPERATION</td>
<td>1</td>
<td>The pick-place operation will continue from where it was stopped.</td>
</tr>
<tr>
<td>PM_RECOVER_REDO_LAYER</td>
<td>2</td>
<td>The pick-place operation repeats last layer.</td>
</tr>
<tr>
<td>PM_RECOVER_NEXT_PALLET</td>
<td>3</td>
<td>The current job is terminated and the flow is prepared to continue with the next pallet.</td>
</tr>
<tr>
<td>PM_RECOVER_REDO_LAST_PICK</td>
<td>4</td>
<td>The pick-place operation repeats the last pick operation. This recover action is valid only when the robot has picked up items that has not been placed yet.</td>
</tr>
</tbody>
</table>
8.2.12 PmSetRecoverAction - Set flow recover action

Syntax

PmSetRecoverAction
[ Name ':=' ] < expression (IN) of string > ','
[ '\\' WorkArea ':=' ] < expression (VAR) of pm_wadescr > ','
[ RecoverAction ':=' ] < expression (IN) of num > ','
[ '\\' EventId ':=' ] < expression (IN) of num > ','
[ '\\' Argument1 ':=' ] < expression (VAR) of errstr > ','
[ '\\' Argument2 ':=' ] < expression (VAR) of errstr > ','
[ '\\' Argument3 ':=' ] < expression (VAR) of errstr > ','
[ '\\' Argument4 ':=' ] < expression (VAR) of errstr > ';'

Related information

<table>
<thead>
<tr>
<th>For information about</th>
<th>See</th>
</tr>
</thead>
<tbody>
<tr>
<td>The instruction PmStartFlow</td>
<td>PmStartFlow - Starts a specific flow on page 310</td>
</tr>
</tbody>
</table>
8 RAPID reference information

8.2.13 PmStartFlow - Starts a specific flow

8.2.13 PmStartFlow - Starts a specific flow

Usage

PmStartFlow starts a flow. The flow must be in the started project.

Basic examples

A basic example of the instruction PmStartFlow is illustrated below.

TRAP TrapStartFlow
  VAR pm_flowinfo FlowInfo;
  VAR num FlowSelection;
  ! Get info from selected flow
  PmGetFlowInfo FlowSelection,FlowInfo;
  ! Start the selected flow
  PmStartFlow FlowInfo.Name;
ENDTRAP

Arguments

PmStartFlow Name

Name

Data type: string
Variable that refers to a flow in a started project.

Program execution

The program will fail with a recoverable error if no project is running. All other errors are considered to be fatal, such as wrong flow name.

Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO will be set to:

<table>
<thead>
<tr>
<th>Error code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM_ERR_NO_RUNNING_PROJECT</td>
<td>No running project.</td>
</tr>
<tr>
<td>PM_ERR_WRONG_FLOW_STATE</td>
<td>Starting a flow in error state without setting a recover action.</td>
</tr>
</tbody>
</table>

Predefined data

There are predefined constants for the flow status. The constants are used for setting values on flow status signals, configured in flow editor. See Flow on page 201.

<table>
<thead>
<tr>
<th>Constant</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM_FLOW_STOPPED</td>
<td>0</td>
<td>The flow is stopped</td>
</tr>
<tr>
<td>PM_FLOW_RUNNING</td>
<td>1</td>
<td>The flow is running</td>
</tr>
<tr>
<td>PM_FLOW_STOPPING_AFTER_CYCLE</td>
<td>2</td>
<td>The flow is stopping after current cycle is finished</td>
</tr>
<tr>
<td>PM_FLOW_STOPPING_AFTER_LAYER</td>
<td>3</td>
<td>The flow is stopping after current layer is finished</td>
</tr>
</tbody>
</table>
### 8.2.13 PmStartFlow - Starts a specific flow

<table>
<thead>
<tr>
<th>Constant</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM_FLOW_STOPPING_AFTER_PALLET</td>
<td>4</td>
<td>The flow is stopping after current pallet is finished</td>
</tr>
<tr>
<td>PM_FLOW_ERROR</td>
<td>5</td>
<td>The flow is in error state</td>
</tr>
</tbody>
</table>

#### Syntax

```
PmStartFlow
  [FlowSelector ':='] < expression (IN) of string > ';
```

#### Related information

<table>
<thead>
<tr>
<th>For information about</th>
<th>See</th>
</tr>
</thead>
<tbody>
<tr>
<td>The instruction PmGetFlowInfo</td>
<td><strong>PmGetFlowInfo</strong> - Get information about a specific flow on page 293.</td>
</tr>
<tr>
<td>The instruction PmStopFlow</td>
<td><strong>PmStopFlow</strong> - Stop a specific flow on page 313.</td>
</tr>
<tr>
<td>The instruction PmSetRecoverAction</td>
<td><strong>PmSetRecoverAction</strong> - Set flow recover action on page 306</td>
</tr>
<tr>
<td>The data type pm_flowinfo</td>
<td><strong>pm_flowinfo</strong> - PickMaster flow information on page 345.</td>
</tr>
</tbody>
</table>
8 RAPID reference information

8.2.14 PmStartProj - Start a PickMaster project

8.2.14 PmStartProj - Start a PickMaster project

Usage

PmStartProj starts a PickMaster project. When this instruction is executed, the project setup is read and all PickMaster internal parts of the project are initialized. The time of execution depends on the size of the project.

Basic example

PmStartProj "MyPMProj";
IF PM_PROJECT_STATUS=PM_PROJECT_STARTING THEN
    WaitUntil PM_PROJECT_STATUS=PM_PROJECT_RUNNING;
ENDIF

Arguments

PmStartProj Name [\Signal]

Name

Data type: string
The name of the project to start.

[\Signal]

Data type: signalgo
The signal that shows the status of the project.

Predefined data

There are predefined constants for the status of the project. Those constants are used for setting values on Signal (project status signal) and the installed persistent variable PM_PROJECT_STATUS. PM_PROJECT_STATUS can be accessed from RAPID program.

<table>
<thead>
<tr>
<th>Constant</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM_PROJECT_STOPPED</td>
<td>0</td>
<td>The project is stopped.</td>
</tr>
<tr>
<td>PM_PROJECT_STOPPING</td>
<td>1</td>
<td>The project is about to stop.</td>
</tr>
<tr>
<td>PM_PROJECT_STARTING</td>
<td>2</td>
<td>The project is starting up.</td>
</tr>
<tr>
<td>PM_PROJECT_RUNNING</td>
<td>3</td>
<td>The project is running.</td>
</tr>
<tr>
<td>PM_PROJECT_ERROR</td>
<td>4</td>
<td>The project is in error state.</td>
</tr>
</tbody>
</table>

Syntax

PmStartProj
    [ Name ':=' ] < expression (IN) of string > ','
    [ '\Signal ':=' ] < expression (VAR) of signalgo > ';

Related information

<table>
<thead>
<tr>
<th>For information about</th>
<th>See</th>
</tr>
</thead>
<tbody>
<tr>
<td>The instruction PmStopProj.</td>
<td>PmStopProj - Stop current project on page 315.</td>
</tr>
</tbody>
</table>
8.2.15 PmStopFlow - Stop a specific flow

Usage

PmStopFlow stops a flow. The flow must be in the started project.

Basic examples

A basic example of the instruction PmStopFlow is illustrated below.

```rapid
TRAP TrapStopFlow
    VAR pm_flowinfo FlowInfo;
    VAR num FlowSelection;
    VAR num StopOption;
    ! Get info from selected flow
    PmGetFlowInfo FlowSelection,FlowInfo;
    ! Stop the selected flow
    PmStopFlow FlowInfo.Name, StopOption;
ENDTRAP
```

Arguments

**PmStopFlow Name StopOption**

Name

Data type: string
Variable that refers to a flow in a started project.

StopOption

Data type: num
Variable that specifies different stop behavior.

Program execution

The program will fail with a recoverable error if no project is running. All other errors are considered to be fatal, such as wrong flow name or wrong value on StopOption.

Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO will be set to:

<table>
<thead>
<tr>
<th>Error code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM_ERR_NO_RUNNING_PROJECT</td>
<td>No running project.</td>
</tr>
<tr>
<td>PM_ERR_INVALID_FLOW_STOP_OPTION</td>
<td>Invalid stop option.</td>
</tr>
</tbody>
</table>
8 RAPID reference information

8.2.15 PmStopFlow - Stop a specific flow

Continued

Predefined data

Flow status constants

There following constants are predefined for the status of the flow. Use the constants to set values on flow status signal, configured in flow I/O settings editor. See Flow on page 201.

<table>
<thead>
<tr>
<th>Constant</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM_FLOW_STOPPED</td>
<td>0</td>
<td>The flow is stopped</td>
</tr>
<tr>
<td>PM_FLOW_RUNNING</td>
<td>1</td>
<td>The flow is running</td>
</tr>
<tr>
<td>PM_FLOW_STOPPING_AFTER_CYCLE</td>
<td>2</td>
<td>The flow is stopping after current cycle is finished</td>
</tr>
<tr>
<td>PM_FLOW_STOPPING_AFTER_LAYER</td>
<td>3</td>
<td>The flow is stopping after current layer is finished</td>
</tr>
<tr>
<td>PM_FLOW_STOPPING_AFTER_PALLET</td>
<td>4</td>
<td>The flow is stopping after current pallet is finished</td>
</tr>
<tr>
<td>PM_FLOW_ERROR</td>
<td>5</td>
<td>The flow is in error state</td>
</tr>
</tbody>
</table>

StopOption constants

The following constants are predefined for StopOption.

<table>
<thead>
<tr>
<th>Constant</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM_FLOW_STOP_IMMEDIATELY</td>
<td>0</td>
<td>The flow will stop immediately and a flow recovery action must be selected before restarting</td>
</tr>
<tr>
<td>PM_FLOW_FINISH_CYCLE</td>
<td>1</td>
<td>The flow will finish current cycle before stopping</td>
</tr>
<tr>
<td>PM_FLOW_FINISH_LAYER</td>
<td>2</td>
<td>The flow will finish current layer before stopping</td>
</tr>
<tr>
<td>PM_FLOW_FINISH_PALLET</td>
<td>3</td>
<td>The flow will finish current pallet before stopping</td>
</tr>
</tbody>
</table>

Syntax

```
PmStopFlow
   [Name ':=' ] < expression (IN) of string > ','
   [StopOption ':=' ] < expression (IN) of num > ';'
```

Related information

<table>
<thead>
<tr>
<th>For information about</th>
<th>See</th>
</tr>
</thead>
<tbody>
<tr>
<td>The instruction PmGetFlowInfo</td>
<td>PmGetProjectInfo - Get information about a specific project on page 298.</td>
</tr>
<tr>
<td>The instruction PmStartFlow</td>
<td>PmStartFlow - Starts a specific flow on page 310.</td>
</tr>
<tr>
<td>The data type pm_flowinfo</td>
<td>pm_flowinfo - PickMaster flow information on page 345.</td>
</tr>
</tbody>
</table>
8.2.16 PmStopProj - Stop current project

Usage

PmStopProj stops the active PickMaster project.

Basic example

PmStopProj;

Syntax

PmStopProj;

Related information

<table>
<thead>
<tr>
<th>For information about</th>
<th>See</th>
</tr>
</thead>
<tbody>
<tr>
<td>The instruction PmStartProj</td>
<td>PmStartProj - Start a PickMaster project on page 312.</td>
</tr>
</tbody>
</table>
8.2.17 PmWaitProjStart - Wait for any active project

Usage

PmWaitProjStart is used to wait until any project is running. The instruction can be used with a timeout; the instruction then waits the timeout time before giving the answer. The instruction is blocking until any project is started from any client.

Basic example

PmWaitProjStart \MaxTime := 5;
Check if project is started. If not, wait 5 seconds to see if the project is started during that time.

Arguments

PmWaitProjStart [\MaxTime] [\TimeFlag]

[\MaxTime]

Maximum Time
Data type: num
The maximum period of waiting time permitted, expressed in seconds. If this time runs out before the condition is met, the error handler will be called, if there is one, with the error code PM_ERR_TIMEOUT. If there is no error handler, the execution will be stopped.

[\TimeFlag]

Timeout Flag
Data type: bool
The output argument that contains the value TRUE if the maximum permitted waiting time runs out before the condition is met. If this argument is included in the instruction, it is not considered an error if the maximum time runs out. This argument is ignored if the MaxTime argument is not included in the instruction.

Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO will be set to:

<table>
<thead>
<tr>
<th>Error code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM_ERR_TIMEOUT</td>
<td>The project was not started within the time out time</td>
</tr>
</tbody>
</table>

Syntax

PmWaitProjStart
[ '\' MaxTime ':=' < expression (IN) of num >]
[ '\' TimeFlag ':=' < variable (VAR) of bool >] '\'

Related information

<table>
<thead>
<tr>
<th>For information about</th>
<th>See</th>
</tr>
</thead>
<tbody>
<tr>
<td>The instruction PmStartProj</td>
<td><em>PmStartProj - Start a PickMaster project on page 312.</em></td>
</tr>
</tbody>
</table>
8.3 Functions

8.3.1 PmCalcIntermid - Calculate intermediate position

Usage

This function calculates an intermediate position between two targets. If no limitations are set, the calculated position is a part of all axis movements.

Basic example

```
InterMid:=PmCalcIntermid(p10, tool2, wobj2, p20, tool1, wobj1, 0.4
\MaxAngle:=180 \MinAngle:= -180 \AngleLimAx6 \MaxY:=2200
\MinY:= 2200 \MinMax:= 670 \FromWa:= LastWorkArea
\ToWa:= WorkArea);
MoveJ InterMid, v1000, z200, tool0\Wobj:= wobj0;
```

Return value

**Data type:** robtarget

The function will return a robtarget expressed in wobj0 and tool0.

Arguments

- **StartRobTgt**
  - **Data type:** robtarget
  - The robot target from where the robot starts the move.

- **StartTool**
  - **Data type:** tooldata
  - The tool that is used at the start point.

- **StartWobj**
  - **Data type:** wobjdata
  - The work object that is used at the start point.

- **EndRobTgt**
  - **Data type:** robtarget
  - The robot target where the move shall end.

- **EndTool**
  - **Data type:** tooldata
  - The tool that is used at the end point.

- **EndWobj**
  - **Data type:** wobjdata
  - The work object that is used at the end point.
8 RAPID reference information

8.3.1 PmCalcIntermid - Calculate intermediate position

Continued

InterMidPart

Data type: num
The part of all the axis moves that is used as an intermediate position. If the intermediate position is in the middle of the start and end positions, the value shall be set to 0.5. The value must be between 0 and 1.

[\MaxAngle]

Data type: num
Maximum allowed axis angle on selected axis.

[\MinAngle]

Data type: num
Minimum allowed axis angle on selected axis.

[\AngleLimAx1]

Data type: num
Limit angle on axis 1.

[\AngleLimAx4]

Data type: num
Limit angle on axis 4.

[\AngleLimAx6]

Data type: num
Limit angle on axis 6.

[\MaxX]

Data type: num
Maximum allowed X-value on intermediate position.

[\MinX]

Data type: num
Minimum allowed X-value on intermediate position.

[\MaxY]

Data type: num
Maximum allowed Y-value on intermediate position.

[\MinY]

Data type: num
Minimum allowed Y-value on intermediate position.

[\MaxZ]

Data type: num
Maximum allowed Z-value on intermediate position.

[\MinZ]

Data type: num
Minimum allowed Z-value on intermediate position.

Continues on next page
### [\MaxRadius]

**Data type:** num

Maximum allowed radius of the intermediate position in the XY plane.

**Note**

If `MaxRadius` is specified, limitations on X and Y will not be considered.

### [\MinRadius]

**Data type:** num

Minimum allowed radius of the intermediate position in the XY plane.

**Note**

If `MinRadius` is specified, limitations on X and Y will not be considered.

### [\LimitRobBase]

**Data type:** switch

Limitations on X, Y and Z are defined in the base frame of the robot.

### [\LimitWorld]

**Data type:** switch

Limitations on X, Y and Z are defined in the world frame, that is, wobj0. If this switch is not selected, the limitations will be made in the robot base frame as default.

### [\FromWa]

**Data type:** pm_wadescr

Reference to the work area the robot was operating before the intermediate movement. The presence of the reference will not affect the result of the function. The reference is only used to improve error handling of the function.

### [\ToWa]

**Data type:** pm_wadescr

Reference to the next work area the robot will operate. The presence of the reference will not affect the result of the function. The reference is only used to improve error handling of the function.

#### Error handling

The following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO will be set to:

<table>
<thead>
<tr>
<th>Error code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM_ERR_CALCCONF</td>
<td>Failed to calculate arm configuration. A highly complex arm configuration can cause this error.</td>
</tr>
<tr>
<td>PM_ERR_AXLIM</td>
<td>Failed to calculate axis limit. The axis angle cannot be calculated because of the angle limitations.</td>
</tr>
<tr>
<td>PM_ERR_LIM_VALUE</td>
<td>Wrong limitation value. The coordinate is not possible to calculate.</td>
</tr>
</tbody>
</table>

Continues on next page
## 8 RAPID reference information

### 8.3.1 PmCalcIntermid - Calculate intermediate position

<table>
<thead>
<tr>
<th>Error code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM_ERR_PART_VAL</td>
<td>The value of the InterMidPart is not valid.</td>
</tr>
</tbody>
</table>

**Syntax**

```
PmCalcIntermid '('
[ StartRobTgt ':=' ] < expression (IN) of robtarget > ','
[ StartTool ':=' ] < expression (IN) of tooldata > ','
[ StartWobj ':=' ] < expression (IN) of wobjdata > ','
[ EndRobTgt ':='] < expression (IN) of robtarget > ','
[ EndTool ':='] < expression (IN) of tooldata > ','
[ EndWobj ':='] < expression (IN) of wobjdata > ','
[ InterMidPart ':='] < expression (IN) of num >
[ '\' MaxAngle ':='] < expression (IN) of num >
[ '\' MinAngle ':='] < expression (IN) of num >]
[ ['\'AngleLimAx1 ] [ ['\'AngleLimAx4 ] [ ['\'AngleLimAx6 ]
]
[ ['\' MaxX := < expression (IN) of num >]
[ ['\' MinX := < expression (IN) of num >]
[ ['\' MaxY := < expression (IN) of num >]
[ ['\' MinY := < expression (IN) of num >]
[ ['\' MaxZ := < expression (IN) of num >]
[ ['\' MinZ := < expression (IN) of num >]
[ ['\' MaxRadius := < expression (IN) of num >]
[ ['\' MinRadius := < expression (IN) of num >]
[ ['\' FromWa := < expression (IN) of pm_wadescr >]
[ ['\' ToWa := < expression (IN) of pm_wadescr >']

A function with a return value of the data type robtarget.
8.3.2 PmGetEvent - Get events for an action

Usage

PmGetEvent is used to get an event for an action on a work area.

Basic examples

```plaintext
VAR pm_eventdata Event;
ArrSize := Dim(TriggArr,1);
WHILE PmGetEvent(Wa, Tgt.TargetHandle, Act.ActionHandle, Event)
    AND i <= ArrSize DO
    TEST Event.Type
    CASE PM_EVENT_PROC:
        TriggEquip TriggArr{i}, Event.Dist, Event.Time,
            \ProcID:=Event.ProcId, Event.Value;
    CASE PM_EVENT_DO:
        GetDataVal Event.SignalName,doSignal;
        TriggEquip TriggArr{i}, Event.Dist, Event.Time,
            \DOp:=doSignal, Event.Value;
    CASE PM_EVENT_GO:
        GetDataVal Event.SignalName,goSignal;
        TriggEquip TriggArr{i}, Event.Dist, Event.Time,
            \GOp:=goSignal, Event.Value;
    ENDTEST
    Incr i;
ENDWHILE

TEST Act.NumOfEvents
    CASE 0:
            \WObj:=curr_WObj;
    CASE 1:
        TriggL Tgt.RobTgtPoint, Act.Speed, TriggArr{1}, Act.Zone,
            curr_Tool \WObj:=curr_WObj;
ENDTEST
```

Return value

Data type: bool

The function will return TRUE as long as a new pm_eventdata can be delivered for the action handle.

Arguments

PmGetEvent (Wa TargetHandle ActionHandle Event)

Wa

Data type: pm_wadescr

Contains a reference to a work area.

TargetHandle

Data type: pm_targethandle

Contains a reference to a target.
8 RAPID reference information

8.3.2 PmGetEvent - Get events for an action

Continued

ActionHandle

Data type: pm_actionhandle
Contains a reference to an action.

Event

Data type: pm_eventdata
Event data that is fetched from a work area.

Syntax

PmGetEvent '('
    [ Wa ':=' ] < expression (IN) of pm_wadescr > ','
    [ TargetHandle ':=' ] < expression (IN) of pm_targethandle > ','
    [ ActionHandle ':=' ] < expression (IN) of pm_actionhandle > ','
    [ Event ':=' ] < expression (INOUT) of pm_eventdata >')'

A function with a return value of the data type bool.

Related information

<table>
<thead>
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<td>The data type pm_targethandle</td>
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<td>Technical reference manual - RAPID Instructions, Functions and Data types, section Instructions.</td>
</tr>
</tbody>
</table>
8.3.3 PmGetPathHeight - Get a safe path height for an intermediate movement

Usage

PmGetPathHeight returns a safe lowest path height for an intermediate movement between two work areas. None, one or both of the work areas may be defined as the home position of the robot.

The function returns the maximum height in wobj0 (mm) of the two work areas and their intermediate work areas. The height of a work area is either the active height of the products or the default height, depending on the height state of the work area, see section Height state (GO) on page 263. The home position does not have a height itself. The Safety offset is always added to the height of each work area.

The order of the work areas and the home position is defined in the Feeder Order tab, see section Feeder order on page 161 in the line configuration. Intermediate work areas are defined as those having an order value between the order values of the two work areas. The default height is used for inactive work areas, for example empty or full work areas waiting for new targets to be generated. The default height can be adjusted in runtime, for example to indicate that a finished stack has been unloaded. See PmSetDefaultHeight - Set the default height on page 326.

Basic examples

Basic examples of the function PmGetPathHeight are illustrated below.

```
VAR pm_wadescr waInFeeder;
VAR pm_wadescr waOutFeeder;
VAR num MinZ;
PmGetFlow waInFeeder,waOutFeeder;
! Calculate MinZ
MinZ:=PmGetPathHeight(waInFeeder,waOutFeeder);
```

Return value

Data type: num

The function returns the lowest safe path height expressed in wobj0.

Arguments

```
PmGetPathHeight (FromWa ToWa [\UseSafePosition] [\UseDefaultHeight])
```

FromWa

Data type: pm_wadescr

The work area from where the robot shall move. May also be selected as the home position, that is, a default installed work area connected to the predefined wobjdata pm_home_Wobj. See section Procedure MoveHomePos on page 212.

ToWa

Data type: pm_wadescr

The work area the robot will move to. May also be selected as the home position, that is a default installed work area connected to the predefined wobjdata pm_home_Wobj. See section Procedure MoveHomePos on page 212.
8 RAPID reference information

8.3.3 PmGetPathHeight - Get a safe path height for an intermediate movement

Continued

\[\text{UseSafePosition}\]

Data type: switch
Consider the heights of used safe positions for work areas having an active height. For more information on how to configure safe positions, see Safe targets on page 175.

\[\text{UseDefaultHeight}\]

Data type: switch
Consider the default heights for work areas having an active height. For more information on how to configure default height, see Robot path height on page 176.

Program execution

All errors are considered to be fatal.

More examples

Example 1

PROC MoveInterMid(VAR pm_wadescr WorkArea, VAR pm_targetdata Tgt,
VAR pm_actiondata Act,num SafetyHeight,num MaxAngle,num MinAngle,switch MoveToEndPoint)
CONST num IntermidPart1:=0.5;
VAR robtarget InterMid1;
VAR num MinZ;
PmGetLastWa LastWorkArea;
! Calculate MinZ
MinZ:=PmGetPathHeight(LastWorkArea,WorkArea\UseSafePosition) +Tgt.TargetTool.tframe.trans.z+SafetyHeight;
! Use the frame from tool0 and the load from target tool
TempTool:=Tgt.TargetTool;
TempTool.tframe:=tool0.tframe;! Travel distance: 50%
InterMid1:=PmCalcIntermid(LastRobTgt,LastTool,LastWobj,
Act.RobTgt,Tgt.TargetTool,Tgt.TargetWobj,
IntermidPart1\MaxAngle?MaxAngle\MinAngle?MinAngle 
\AngleLimAx6\MinZ:=MinZ);
MoveJConc,InterMid1,Act.Speed,z200,TempTool\Wobj:=wobj0;
ENDPROC

Syntax

PmGetPathHeight
[FromWa ':=' ] < expression (VAR) of pm_wadescr > ','
[ToWa ':=' ] < expression (VAR) of pm_wadescr > ','
['' UseSafePosition ] ','
['' UseDefaultHeight ] ';'

Related information

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<td>PmSetLastWa - Set last used work area on page 305</td>
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8.3.3 PmGetPathHeight - Get a safe path height for an intermediate movement

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<tr>
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</table>
8.3.4 PmSetDefaultHeight - Set the default height

Usage

PmSetDefaultHeight updates the default height for a work area. It returns the new default height (mm). The height state GO signal of the work area is updated to reflect the change, see Height state (GO) on page 263. The signal update occurs immediately if the work area does not have an active height.

Setting a new default height is a possibility to save cycle time without decreasing the margins for collisions, especially if the project consists of many work areas and flows.

For an outfeeder the default height can be set to Empty after a finished stack has been unloaded. This allows the robot to make lower intermediate movements when passing over the outfeeder next times and thus saving cycle time.

For an infeeder the default height can be set to Full before a new stack is loaded. This will force the robot to make intermediate movements with enough height when passing over the work area.

The new default height is active until new targets have been generated (or after new default height is set).

Basic examples

Basic examples of the function PmSetDefaultHeight are illustrated below.

Example 1

PERS wobjdata wobjOutfeeder :=
[FALSE, TRUE, "", [[2180.65, -1430.22, -220.753], [0.00104, -0.00130, 0.00039, 1.00000], [1, 0, 0, 0]]];
VAR pm_wadescr OutWa;
VAR num NewDefHeight;
PmGetWaByWobj wobjOutfeeder, OutWa;
NewDefHeight := PmSetDefaultHeight OutWa \Empty;

Example 2

PERS wobjdata wobjOutfeeder :=
[FALSE, TRUE, "", [[2180.65, -1430.22, -220.753], [0.00104, -0.00130, 0.00039, 1.00000], [1, 0, 0, 0]]];
VAR pm_wadescr OutWa;
VAR num NewDefHeight;
PmGetWaByWobj wobjOutfeeder, OutWa;
NewDefHeight := PmSetDefaultHeight OutWa \Value:=100;

Return value

Data type: num

The function returns the new default height.

Arguments

PmSetDefaultHeight (Workarea [\Standard] | [\Empty] | [\Full] | [\Latest] | [\Value])
Workarea

Data type: pm_wadescr
The work area.

[\Standard]

Data type: switch
Set the default height as configured in the Robot Path Height see Robot path height on page 176.

[\Empty]

Data type: switch
Set the default height to Empty.

[\Full]

Data type: switch
Set the default height to Full.

[\Latest]

Data type: switch
Set the default height to the height of the latest completed operation set.

[\Value]

Data type: num
Set the default height to a specified value (mm).

Note
The Safety offset defined in the Robot Path Height will always be added to the specified height.
8 RAPID reference information

8.3.5 PmGetTarget - Get target

8.3.5 PmGetTarget - Get target

Usage

PmGetTarget is used to get a target for an operation on a work area. If the optional argument OpHandle is left out, the function will return the next target without regard to the operation it belongs to.

Basic example

PmGetOperation Wa, Op;
WHILE PmGetTarget(Wa, \OpHandle:=Op.OpHandle, Tgt) DO
    WHILE PmGetTgtAction(Wa, Tgt.TargetHandle, Act) DO ...
    ENDWHILE
ENDWHILE

Return value

Data type: bool

The function will return TRUE as long as a new pm_targetdata can be delivered.

Arguments

PmGetTarget (Wa [\OpHandle] Targets [\MaxTime] [\TimeFlag])

Wa

Data type: pm_wadescr

Contains a reference to a work area.

[\OpHandle]

Data type: pm_ophandle

Contains a reference for an operation on a work area.

Target

Data type: pm_targetdata

Target data that is fetched from a work area.

[\MaxTime]

Maximum Time

Data type: num

The maximum period of waiting time permitted, expressed in seconds. If this time runs out before the condition is met, the error handler will be called, if there is one, with the error code PM_ERR_TIMEOUT. If there is no error handler, the execution will be stopped.

[\TimeFlag]

Timeout Flag

Data type: bool

The output argument that contains the value TRUE if the maximum permitted waiting time runs out before the condition is met. If this argument is included in

Continues on next page
the instruction, it is not considered an error if the maximum time runs out. This argument is ignored if the MaxTime argument is not included in the instruction.

### Error handling

Following recoverable errors can be generated. The errors can be handled in an ERROR handler. The system variable ERRNO will be set to:

<table>
<thead>
<tr>
<th>Error code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM_ERR_TIMEOUT</td>
<td>No pm_targetdata could be fetched within the time out time.</td>
</tr>
<tr>
<td>PM_ERR_OPERATION_LOST</td>
<td>The pm_operationdata is not valid, probably because of a pulse on the robot execution signal.</td>
</tr>
</tbody>
</table>

### Syntax

```
PmGetTarget (''
    [ Wa ':'= ' ] < expression (IN) of pm_wadescr >
    [ '"' OpHandle ':'= ' < expression (IN) of pm_ophandle >] ',
    [ Target ':'= ' ] < expression (INOUT) of pm_targetdata >
    [ '"' MaxTime ':'= ' < expression (IN) of num >]
    [ '"' TimeFlag ':'= ' < variable (VAR) of bool > ] ')'
```

A function with a return value of the data type bool name.

### Related information

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<tr>
<th>For information about</th>
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<tbody>
<tr>
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</tbody>
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8 RAPID reference information

8.3.6 PmGetTgtAction - Get target action

8.3.6 PmGetTgtAction - Get target action

Usage

PmGetTgtAction is used to get an action for a target on a work area.

Basic examples

PmGetOperation Wa, Op;
WHILE PmGetTarget(Wa \OpHandle:=Op.OpHandle, Tgt) DO
  WHILE PmGetTgtAction(Wa, Tgt.TargetHandle, Act) DO
    curr_WObj := Tgt.TargetWobj;
    curr_Tool := Tgt.TargetTool;
       \WObj:=curr_WObj;
  ENDWHILE
ENDWHILE

Return value

Data type: bool
The function will return TRUE as long as a new pm_actiondata can be delivered for the target handle.

Arguments

PmGetTgtAction ( Wa TargetHandle Action )

Wa

Data type: pm_wadescr
Contains a reference to a work area.

TargetHandle

Data type: pm_targethandle
Contains a reference to a target.

Action

Data type: pm_actiondata
Action data that is fetched from a work area.

Error handling

The following recoverable error can be generated. The error can be handled in an ERROR handler. The system variable ERRNO will be set to:

<table>
<thead>
<tr>
<th>Error code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM_ERR_OPERATION_LOST</td>
<td>The pm_operationdata is not valid, probably because of a pulse on the robot execution signal.</td>
</tr>
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</table>

Syntax

PmGetTgtAction '('
  [ Wa ':='] < expression (IN) of pm_wadescr > ','
  [ TargetHandle ':='] < expression (IN) of pm_targethandle > ','
  [ Action ':='] < expression (INOUT) of pm_actiondata > ')'
A function with a return value of the data type `bool name`.

### Related information

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8.3.7 PmGetWaHeight - Get the height of a work area

8.3.7 PmGetWaHeight - Get the height of a work area

Usage

PmGetWaHeight gets the current stack height of a specified work area.

Basic examples

height := PmGetWaHeight (PickWa);

Return value

Data type: num

The function returns the current height of the specified work area in mm. The height is equivalent to the z-coordinate of the current top layer expressed in the work object. If the stack is empty, zero is returned.

Arguments

PmGetWaHeight (Wa [\UseSafePosition])

Wa

Data type: pm_wadescr

Contains a reference to a work area.

[\UseSafePosition]

Data type: switch

If UseSafePosition is set, the height is equivalent to the maximum z-coordinate of used safe positions and the current top layer expressed in the work object.

Syntax

PmGetWaHeight '('
[ Wa '://' ] < expression (IN) of pm_wadescr >')'

A function with a return value of the data type num.

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</table>
8.3.8 PmGetWaName - Get the name of a work area

Usage

PmGetWaName gets the name of a specified work area.

Basic examples

A basic example of the function PmGetWaName is illustrated below.

```plaintext
VAR string waname;
waname:=PmGetWaName(WorkArea);
```

Return value

Data type: string
The function will return the name of the work area.

Arguments

PmGetWaName (WorkArea)

WorkArea

Work Area
Data type: pm_wadescr
Contains a reference to a work area.

Syntax

PmGetWaName '('
   [ WorkArea ':=' ] < expression (VAR) of pm_wadescr >')'

A function with a return value of the data type string.
8 RAPID reference information

8.4 Data types

8.4.1 pm_accdata - PickMaster acceleration/deceleration data

Usage

pm_accdata is used to describe and restrict accelerations and decelerations.

Description

pm_accdata is a part of pm_actiondata and is used as input arguments to the instructions PathAccLim and AccSet. It restricts the robots acceleration and deceleration.

Components

acc

acceleration
Data type: num
Acceleration and deceleration as a percentage of the normal values. 100% corresponds to maximum acceleration. Maximum value: 100%. Input value lower than 20% gives 20% of maximum acceleration.
Used as argument Acc in AccSet.

ramp

Data type: num
The rate at which acceleration and deceleration increases as a percentage of the normal values (see instruction AccSet for more information).
Used as argument Ramp in AccSet.

acclim

acceleration limit
Data type: bool
TRUE if there is to be a limitation of the acceleration, FALSE otherwise.
Used as argument AccLim in PathAccLim.

accmax

maximum acceleration
Data type: num
The absolute value of the acceleration limitation in m/s². Only used when acclim is TRUE.
Used as argument AccMax in PathAccLim.

decellim

deceleration limit
Data type: bool
TRUE if there is to be a limitation of the deceleration, FALSE otherwise.

Continues on next page
Used as argument `Decellim` in `PathAccLim`.

decelmax

maximum deceleration

Data type: num

The absolute value of the deceleration limitation in m/s².

Used only when `decellim` is TRUE.

Used as argument `DecelMax` in `PathAccLim`.

Examples

```rapid
VAR pm_actiondata Act;
VAR num my_accmax;
WHILE PmGetTgtAction(WorkArea, Tgt.TargetHandle, Act) DO
  my_accmax := Act.accel.accmax;
  ...
ENDWHILE
```

Limitations

The `pm_accdata` members can only be set by the instruction `PmGetTgtAction`.

Structure

```
< dataobject of pm_accdata >
< acc of num >
< ramp of num >
< acclim of bool >
< accmax of num >
< decellim of bool >
< decelmax of num >
```

Related information

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<td>The instruction <code>AccSet</code></td>
<td>Technical reference manual - RAPID Instructions, Functions and Data types, section Instructions.</td>
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</tbody>
</table>
8.4.2 pm_acktype - PickMaster target acknowledge type

**Usage**

`pm_acktype` is used to represent an integer with a symbolic constant for different types of acknowledgements.

**Description**

A `pm_acktype` is used to decide which type of acknowledgement should be used.

**Example**

```
PmAckTarget WorkArea, WorkArea, PM_ACK;
```

**Predefined data**

<table>
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<tr>
<th>Constant</th>
<th>Value</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM_ACK</td>
<td>301</td>
<td>The target is acknowledged as used</td>
</tr>
<tr>
<td>PM_NACK</td>
<td>302</td>
<td>The target is acknowledged as not used</td>
</tr>
<tr>
<td>PM_LOST</td>
<td>303</td>
<td>The target is acknowledged as lost</td>
</tr>
</tbody>
</table>

**Characteristics**

`pm_acktype` is an alias data type for `num` and consequently inherits its characteristics.

**Related information**

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</tbody>
</table>
8.4.3 pm_actiondata - PickMaster action data

Usage

`pm_actiondata` specifies an action for a target.

Description

Properties for one target action.

Components

RobTgt

Data type: `robtarget`

Specifies the position of the robot and external axes.

Type

Data type: `pm_actiontype`

Specifies type of action.

MoveType

Data type: `pm_movetype`

Specifies type of movement.

ArmConfMon

Data type: `bool`

Specifies if the robot’s configuration is monitored during the movement.

UseConc

Use concurrent

Data type: `bool`

Specifies if concurrent program execution is used or not. See Technical reference manual - RAPID Instructions, Functions and Data types.

SingAreaType

Data type: `pm_singareatype`

Specifies type of interpolation mode.

Accel

Acceleration and deceleration data

Data type: `pm_accdata`

Restrict the robot’s acceleration and deceleration.

Search

Data type: `pm_searchdata`

Defines search type, search stop type and search signal to be used with a search movement.

Speed

Data type: `speeddata`

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8 RAPID reference information

8.4.3 pm_actiondata - PickMaster action data

Continued

Specifies the movement speed. See Technical reference manual - RAPID Instructions, Functions and Data types.

Zone

Data type: zonedata

Specifies the corner path after the movement. See Technical reference manual - RAPID Instructions, Functions and Data types.

NumOfEvents

number of events

Data type: num

Specifies number of events.

ActionHandle

Data type: pm_actionhandle

A reference to the action where this pm_actiondata was retrieved.

Examples

| VAR pm_actiondata Act; |
| PmGetOperation WorkArea, Op; |
| WHILE PmGetTarget(WorkArea \OpHandle:=Op.OpHandle, Tgt) DO |
| WHILE PmGetTgtAction(WorkArea, Tgt.TargetHandle, Act) DO |
| ... |
| ENDWHILE |
| ENDWHILE |

Limitations

The action data members can only be set by the instruction PmGetTgtAction.

Structure

< dataobject of pm_actiondata >
< RobTgt of targetdata >
< Type of pm_actiontype >
< MoveType of pm_movetype >
< ArmConfMon of bool >
< UseConc of bool >
< SingAreaType of pm_singareatype >
< Accel of pm_accdata >
< Search of pm_searchdata >
< Speed of speeddata >
< Zone of zonedata >
< NumOfEvents of num >
< ActionHandle of pm_actionhandle >

Related information

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#### 8.4.3 pm_actiondata - PickMaster action data

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<td><strong>pm_searchdata</strong> - PickMaster search data on page 359</td>
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<tr>
<td>The function <strong>PmGetTgtAction</strong></td>
<td><strong>PmGetTgtAction</strong> - Get target action on page 330.</td>
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<tr>
<td>The data type <strong>zonedata</strong></td>
<td>Technical reference manual - RAPID Instructions, Functions and Data types, section Data types.</td>
</tr>
<tr>
<td>The data type <strong>speeddata</strong></td>
<td>Technical reference manual - RAPID Instructions, Functions and Data types, section Data types.</td>
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<tr>
<td>The instruction <strong>ConfL</strong></td>
<td>Technical reference manual - RAPID Instructions, Functions and Data types, section Instructions.</td>
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<td>Technical reference manual - RAPID overview, section Synchronisation with logical instructions.</td>
</tr>
</tbody>
</table>
8 RAPID reference information

8.4.4 pm_actionhandle - PickMaster action handle

Usage

pm_actionhandle is used to store data about a target action.

Description

Data of the type pm_actionhandle contains a reference to an action.

Examples

PmGetOperation WorkArea, Op;
WHILE PmGetTarget(WorkArea \OpHandle:=Op.OpHandle, Tgt) DO
  WHILE PmGetTgtAction(WorkArea, Tgt.TargetHandle, Act) DO
    WHILE PmGetEvent(WorkArea, Tgt.TargetHandle, Act.ActionHandle, Event) DO
      ...
    ENDWHILE
  ENDWHILE
ENDWHILE

Limitations

Describe the limitations for the data type. Names of data types are written in script-text.

Characteristics

pm_actionhandle is a non-value data type.

Related information

<table>
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<tbody>
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<td>PmGetEvent - Get events for an action on page 321.</td>
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</tbody>
</table>
8.4.5 pm_actiontype - PickMaster action type

Usage

`pm_actiontype` is used to represent an integer with a symbolic constant for different types of actions.

Description

A `pm_actiontype` is used to decide which payload should be used for the next movement.

Example

```
TEST Tgt.Type
  CASE PM_APPROACH_POS:
    curr_Load := Tgt.AppProdsLoad;
  CASE PM_TARGET_POS:
    curr_Load := Tgt.AppProdsLoad;
    curr_StopPoint:=Tgt.StopPointData;
  CASE PM_DEPART_POS:
    curr_Load := Tgt.DepProdsLoad;
  ENDTEST
  GripLoad curr_Load;
```

Predefined data

<table>
<thead>
<tr>
<th>Constant</th>
<th>Value</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM_APPROACH_POS</td>
<td>200</td>
<td>The action is a part of the approach movement</td>
</tr>
<tr>
<td>PM_TARGET_POS</td>
<td>201</td>
<td>The action moves to the target position</td>
</tr>
<tr>
<td>PM_DEPART_POS</td>
<td>202</td>
<td>The action is a part of the depart movement</td>
</tr>
</tbody>
</table>

Characteristics

`pm_actiontype` is an alias type for `num` and thus inherits its characteristics.

Related information

<table>
<thead>
<tr>
<th>For information about</th>
<th>See</th>
</tr>
</thead>
<tbody>
<tr>
<td>The data type <code>pm_actiondata</code></td>
<td><code>pm_actiondata - PickMaster action data on page 337.</code></td>
</tr>
<tr>
<td>The instruction GripLoad</td>
<td><code>Technical reference manual - RAPID Instructions, Functions and Data types, section Instructions.</code></td>
</tr>
</tbody>
</table>
8.4.6 pm_eventdata - PickMaster event data

Usage

`pm_eventdata` is used to specify an event.

Description

The components in `pm_eventdata` are used in the instruction `TriggEquip`. The different components decide what kind of trigger should be used for a specific action. For example, it describes when a Gripper should be closed or opened.

Components

type

**event type**

Data type: `pm_eventtype`

Type of event. Used to separate how to set up triggers with instruction `TriggEquip`. Types that are allowed are `PM_EVENT_PROC`, `PM_EVENT_DO`, and `PM_EVENT_GO`.

time

Data type: `num`

Input argument `EquipLag` in instruction `TriggEquip`.

dist

**distance**

Data type: `num`

Input argument `Distance` in instruction `TriggEquip`.

procid

**process id**

Data type: `num`

Input argument `ProcID` in instruction `TriggEquip`.

signalname

**Data type: string**

Input argument `DOp` or `GOp` in instruction `TriggEquip`.

Atime

Data type: `num`

Reserved for future use.

value

Data type: `num`

Input argument `SetValue` in instruction `TriggEquip`. Should not be used if a PickMaster project uses longer group signals than 23 bits.

Dvalue

Data type: `dnum`

Continues on next page
**Input argument** Set\(D\text{value}\) in instruction *TriggEquip*. Normally used instead of \(value\) since the numerical resolution is higher. Required for PickMaster projects using long group signals, that is longer than 23 bits and up to 32 bits.

**Examples**

```rapid
VAR pm_eventdata Event;
ArrSize := Dim(TriggArr,1);
WHILE PmGetEvent(WorkArea, Tgt.TargetHandle, Act.ActionHandle, Event) AND i <= ArrSize DO
  TEST Event.Type
    CASE PM_EVENT_PROC:
      TriggEquip TriggArr{i}, Event.Dist, Event.Time,
        \ProcID:=Event.ProcId, Event.Value;
    CASE PM_EVENT_DO:
      GetDataVal Event.SignalName,doSignal;
      TriggEquip TriggArr{i}, Event.Dist, Event.Time,
        \DOp:=doSignal, Event.Value;
    CASE PM_EVENT.GO:
      GetDataVal Event.SignalName,goSignal;
      TriggEquip TriggArr{i}, Event.Dist, Event.Time,
        \GOp:=goSignal, Event.Value;
  ENDTEST
  Incr i;
ENDWHILE
```

**Limitations**

The event data members can only be set by the instruction *PmGetEvent*.

**Structure**

- `<dataobject of pm_eventdata>`
- `<type of pm_eventtype>`
- `<time of num>`
- `<dist of num>`
- `<procid of num>`
- `<signalname of string>`
- `<value of num>`

**Related information**

<table>
<thead>
<tr>
<th>For information about</th>
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</thead>
<tbody>
<tr>
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</tr>
<tr>
<td>The function <em>PmGetEvent</em></td>
<td><em>PmGetEvent - Get events for an action on page 321.</em></td>
</tr>
<tr>
<td>The instruction <em>TriggEquip</em></td>
<td><em>Technical reference manual - RAPID Instructions, Functions and Data types, section Instructions.</em></td>
</tr>
<tr>
<td>The instruction <em>TriggL</em></td>
<td><em>Technical reference manual - RAPID Instructions, Functions and Data types, section Instructions.</em></td>
</tr>
</tbody>
</table>
8.4.7 pm_eventtype - PickMaster event type

Usage

*pm_eventtype* is used to represent an integer with a symbolic constant for different type of events.

Description

A *pm_eventtype* is used to decide which type of trigg event should be used.

Examples

```c
TEST Event.Type
    CASE PM_EVENT_PROC:
        TriggEquip TriggArr{i}, Event.Dist, Event.Time,
        \ProcID:=Event.ProcId, Event.Value;
    CASE PM_EVENT_DO:
        GetDataVal Event.SignalName,doSignal;
        TriggEquip TriggArr{i}, Event.Dist, Event.Time, \DOp:=doSignal,
        Event.Value;
    CASE PM_EVENT_GO:
        GetDataVal Event.SignalName,goSignal;
        TriggEquip TriggArr{i}, Event.Dist, Event.Time, \GOp:=goSignal,
        Event.Value;
ENDTEST
```

Predefined data

<table>
<thead>
<tr>
<th>Constant</th>
<th>Value</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM_EVENT_PROC</td>
<td>220</td>
<td>Process with identity ProcId should receive the event. (For internal use)</td>
</tr>
<tr>
<td>PM_EVENT_DO</td>
<td>221</td>
<td>Digital output signal is changed.</td>
</tr>
<tr>
<td>PM_EVENT_GO</td>
<td>222</td>
<td>Digital group output signal is changed.</td>
</tr>
</tbody>
</table>

Characteristics

*pm_eventtype* is an alias type for *num* and thus inherits its characteristics.

Related information

<table>
<thead>
<tr>
<th>For information about</th>
<th>See</th>
</tr>
</thead>
<tbody>
<tr>
<td>The data type <em>pm_eventdata</em></td>
<td><em>pm_eventdata - PickMaster event data on page 342.</em></td>
</tr>
<tr>
<td>The instruction <em>TriggEquip.</em></td>
<td><em>Technical reference manual - RAPID Instructions, Functions and Data types, section Instructions.</em></td>
</tr>
</tbody>
</table>
8.4.8 pm_flowinfo - PickMaster flow information

Usage

pm_flowinfo holds information about a flow.

Description

The flow information holds data and references to everything that is needed for starting a flow or viewing user information about a specific flow.

Components

Name

Data type: string
The name of the flow.

SelectionNumber

Data type: num
The number that connects a flow with its I/O signal value. See Flow on page 201.

SignalName

Data type: string
The name of the configured status signal.

MasterWa

Data type: pm_wadescr
A work area descriptor to the master work area in the flow.

SlaveWorkAreas

Data type: pm_slavewainfo
A collection of slave work areas.

NumberOfSlaveWA

Data type: num
Number of slave work areas in the flow.

Examples

VAR pm_flowinfo FlowInfo;
PmGetFlowInfo FlowSelection,FlowInfo;

Limitations

The flow information members can only be set by the instruction PmGetFlowInfo.

Structure

< dataobject of pm_flowinfo >
< Name of string >
< SelectionNumber of num >
< MasterWa of pm_wadescr >
< SlaveWorkAreas of pm_slavewainfo >
< NumberOfSlaveWA of num >

Continues on next page
### Related information

<table>
<thead>
<tr>
<th>For information about</th>
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</thead>
<tbody>
<tr>
<td>The instruction PmGetFlowInfo</td>
<td><em>PmGetFlowInfo - Get information about a specific flow on page 293.</em></td>
</tr>
<tr>
<td>The data type pm_wadescr</td>
<td><em>pm_wadescr - PickMaster work area reference on page 370.</em></td>
</tr>
<tr>
<td>The data type pm_slavewainfo</td>
<td><em>pm_slavewainfo - PickMaster slave work area information on page 363.</em></td>
</tr>
</tbody>
</table>
8.4.9 pm_moduleinfo - PickMaster module information

Usage

pm_moduleinfo holds information about the RAPID modules that can be loaded into a task.

Description

The module information contains names of the modules that can be loaded into a RAPID task after the project is started. The modules are selected in Robot settings and transferred with the project. See Robot Settings on page 165.

Components

There are 10 components, named in a number series, ModName1 to ModName10.

ModName1

Data type: string

The name of the file containing a RAPID module.

...

ModName10

Data type: string

The name of the file containing a RAPID module.

Examples

VAR pm_projectinfo ProjInfo;
PmGetProjectInfo ProjectSelection,ProjInfo;
Load \Dynamic,"HOME:\File:=ProjInfo.Robot1.ModuleNames.ModName1;

Limitations

The operation data members can only be set by the instruction PmGetProjectInfo.
There can be maximum ten modules.

Structure

< dataobject of pm_moduleinfo >
  < ModName1 of string >
  < ModName2 of string >
  < ModName3 of string >
  < ModName4 of string >
  < ModName5 of string >
  < ModName6 of string >
  < ModName7 of string >
  < ModName8 of string >
  < ModName9 of string >
  < ModName10 of string >
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### 8.4.9 pm_moduleinfo - PickMaster module information

*Continued*

### Related information

<table>
<thead>
<tr>
<th>For information about</th>
<th>See</th>
</tr>
</thead>
<tbody>
<tr>
<td>The instruction <em>PmGetProjectInfo</em></td>
<td><em>PmGetProjectInfo - Get information about a specific project on page 298.</em></td>
</tr>
<tr>
<td>The data type <em>pm_robotinfo</em></td>
<td><em>pm_robotinfo - PickMaster robot information on page 357.</em></td>
</tr>
</tbody>
</table>
8.4.10 pm_movetype - PickMaster movement type

Usage

`pm_movetype` is used to represent an integer with a symbolic constant for different type of movements.

Description

The `pm_movetype` is used to decide which type of movement instruction should be used.

Example

```
TEST Move
  CASE PM_MOVE_LIN:
    MoveL ToPoint, Speed, Zone, Tool\WObj:=WObj;
  CASE PM_MOVE_JOINT:
    MoveJ ToPoint, Speed, Zone, Tool\WObj:=WObj;
ENDTEST
```

Predefined data

<table>
<thead>
<tr>
<th>Constant</th>
<th>Value</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM_MOVE_JOINT</td>
<td>240</td>
<td>The action is a joint movement</td>
</tr>
<tr>
<td>PM_MOVE_LIN</td>
<td>241</td>
<td>The action is a linear movement</td>
</tr>
</tbody>
</table>

Characteristics

`pm_movetype` is an alias data type for `num` and consequently inherits its characteristics.

Related information

<table>
<thead>
<tr>
<th>For information about</th>
<th>See</th>
</tr>
</thead>
<tbody>
<tr>
<td>The data type <code>pm_actiondata</code></td>
<td><code>pm_actiondata - PickMaster action data on page 337.</code></td>
</tr>
<tr>
<td>The instruction <code>MoveJ</code></td>
<td><code>Technical reference manual - RAPID Instructions, Functions and Data types, section Instructions.</code></td>
</tr>
<tr>
<td>The instruction <code>MoveL</code></td>
<td><code>Technical reference manual - RAPID Instructions, Functions and Data types, section Instructions.</code></td>
</tr>
</tbody>
</table>
8.4.11 pm_offsetdata - Offset data

Usage

`pm_offsetdata` describes an offset position.

Description

The `pm_offsetdata` is used to displace a robot position in x, y, and z direction and rotation around the axis.

Components

- **x**
  - Data type: num
  - The displacement in the x-direction, in the object coordinate system.

- **y**
  - Data type: num
  - The displacement in the y-direction, in the object coordinate system.

- **z**
  - Data type: num
  - The displacement in the z-direction, in the object coordinate system.

- **rx**
  - Data type: num
  - The rotation in degrees around the x-axis of the tool coordinate system.

- **ry**
  - Data type: num
  - The rotation in degrees around the y-axis of the tool coordinate system.

- **rz**
  - Data type: num
  - The rotation in degrees around the z-axis of the tool coordinate system.

Examples

```rapid
VAR pm_actiondata Act;
VAR num x_offset;
WHILE PmGetTgtAction(WorkArea, Tgt.TargetHandle, Act) DO
  x_offset := Act.offset.x
  ...
ENDWHILE
```

Limitations

The offset data members can only be set by the instruction `PmGetTgtAction`.

Structure

```rapid
< dataobject of pm_offsetdata >
< x of num >
```
### Related information

<table>
<thead>
<tr>
<th>For information about</th>
<th>See</th>
</tr>
</thead>
<tbody>
<tr>
<td>The data type <strong>pm_actiondata</strong></td>
<td><em>pm_actiondata</em> - PickMaster action data on page 337.</td>
</tr>
<tr>
<td>The function <strong>PmGetTgtAction</strong></td>
<td><em>PmGetTgtAction</em> - Get target action on page 330.</td>
</tr>
<tr>
<td>The function <strong>Offs</strong></td>
<td>Technical reference manual - RAPID Instructions, Functions and Data types, section Functions.</td>
</tr>
</tbody>
</table>
8.4.12 pm_operationdata - PickMaster operation data

Usage

pm_operationdata is used to specify an operation on a work area.

Description

The operation data holds data and references to everything that is going to be done when the robot enters a work area.

Components

- **operationnumber**
  
  Data type: num
  
  The operation number is the ordinal number of the operation in the layer.

- **layernumber**
  
  Data type: num
  
  The layer number is the ordinal number of the layer in the operation set.

- **scenenumber**
  
  Data type: num
  
  The scene number is the ordinal number of the current operation set.

- **formatid**
  
  Data type: num
  
  The format id value is defined in the Pick Setting Configuration window.

- **numoftargets**
  
  number of targets
  
  Data type: num
  
  The number of targets that are handled by the operation.

- **ophandle**
  
  operation handle
  
  Data type: pm_ophandle
  
  The operation handle is a reference to the operation.

Examples

VAR pm_operationdata Op;
PmGetOperation WorkArea, Op;

Limitations

The operation data members can only be set by the instruction PmGetOperation.

Structure

- < dataobject of pm_operationdata >
- < operationnumber of num >
- < layernumber of num >

Continues on next page
### Related information

<table>
<thead>
<tr>
<th>For information about</th>
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</thead>
<tbody>
<tr>
<td>The instruction PmGetOperation</td>
<td><a href="#">PmGetOperation - Get operation from a work area on page 296.</a></td>
</tr>
<tr>
<td>The format id value</td>
<td>The <a href="#">Pick setting on page 79 Configuration.</a></td>
</tr>
</tbody>
</table>
8 RAPID reference information

8.4.13 pm_ophandle - PickMaster operation handle

Usage

`pm_ophandle` is used to store data about an operation.

Description

Data of the type `pm_ophandle` contains a reference to an operation.

Examples

```plaintext
PmGetOperation WorkArea, Op;
WHILE PmGetTarget(WorkArea \OpHandle:=Op.OpHandle, Tgt) DO
    ...
ENDWHILE
```

Characteristics

`pm_ophandle` is a non-value data type.

Related information

<table>
<thead>
<tr>
<th>For information about</th>
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</tr>
</thead>
<tbody>
<tr>
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<td><code>pm_operationdata - PickMaster operation data on page 352</code>.</td>
</tr>
<tr>
<td>The instruction PmGetOperation</td>
<td><code>PmGetOperation - Get operation from a work area on page 296</code>.</td>
</tr>
</tbody>
</table>
8.4.14 pm_projectinfo - PickMaster project information

Usage

pm_projectinfo holds information about a project.

Description

The project information holds data and references to everything that is needed for starting a project or viewing user information about a specific project.

Components

ProjectDescription

Data type: string
The description used in project properties.

Name

Data type: string
The name of the project.

SelectionNumber

Data type: num
The number that connects a project with its I/O signal value. See Project Manager on page 108.

Robot1

Data type: pm_robotinfo
The information related to the first robot RAPID task.

Robot2

Data type: pm_robotinfo
The information related to the second robot RAPID task, used in a MultiMove system.

Robot6

Data type: pm_robotinfo
The information related to the sixth robot RAPID task, used in a MultiMove system.

NumberOfFlows

Data type: num
The number of flows handled by the project.

Examples

VAR pm_projectinfo ProjInfo;
PmGetProjectInfo ProjectSelection,ProjInfo;

Limitations

The operation data members can only be set by the instruction PmGetProjectInfo.
8 RAPID reference information

8.4.14 pm_projectinfo - PickMaster project information

Continued

Structure

< dataobject of pm_projectinfo >
< ProjectDescription of string >
< Name of string >
< SelectionNumber of num >
< Robot1 of pm_robotinfo >
< Robot2 of pm_robotinfo >
< Robot3 of pm_robotinfo >
< Robot4 of pm_robotinfo >
< Robot5 of pm_robotinfo >
< Robot6 of pm_robotinfo >
< NumberOfFlows of num >

Related information

<table>
<thead>
<tr>
<th>For information about</th>
<th>See</th>
</tr>
</thead>
<tbody>
<tr>
<td>The instruction PmGetProjectInfo</td>
<td>PmGetProjectInfo - Get information about a specific project on page 298.</td>
</tr>
<tr>
<td>The data type pm_robotinfo</td>
<td>pm_robotinfo - PickMaster robot information on page 357.</td>
</tr>
</tbody>
</table>
8.4.15 pm_robotinfo - PickMaster robot information

Usage

*pm_robotinfo* holds information about a RAPID task connected to a robot.

Description

The robot information holds data and references to everything that is needed for setting up the environment for a RAPID task after starting the project.

Components

<table>
<thead>
<tr>
<th>Component</th>
<th>Data type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active</td>
<td>bool</td>
<td>Defines if valid data for this robot exists.</td>
</tr>
<tr>
<td>Name</td>
<td>string</td>
<td>The name of the robot.</td>
</tr>
<tr>
<td>TaskName</td>
<td>string</td>
<td>The name of the RAPID task connected to this robot.</td>
</tr>
<tr>
<td>LoadRapid</td>
<td>bool</td>
<td>Defines if the RAPID modules should be loaded or not after the project starts.</td>
</tr>
<tr>
<td>ModuleNames</td>
<td>pm_moduleinfo</td>
<td>The RAPID modules that should be loaded after the project starts.</td>
</tr>
</tbody>
</table>

Examples

```plaintext
VAR pm_projectinfo ProjInfo;
PmGetProjectInfo ProjectSelection,ProjInfo;
IF projInfo.Robot1.LoadRapid THEN
  LoadAllModules projInfo.Robot1.ModuleNames, projInfo.Name, projInfo.Robot1.TaskName;
ENDIF
```

Limitations

The robot information members can only be set by the instruction *PmGetProjectInfo*.

Structure

```plaintext
< dataobject of pm_robotinfo >
< Active of bool >
< Name of string >
< TaskName of string >
< ModuleNames of pm_moduleinfo >
```
8 RAPID reference information

8.4.15 pm_robotinfo - PickMaster robot information

Continued

Related information

<table>
<thead>
<tr>
<th>For information about</th>
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</thead>
<tbody>
<tr>
<td>The instruction PmGetProjectInfo</td>
<td>PmGetProjectInfo - Get information about a specific project on page 298.</td>
</tr>
<tr>
<td>The data type pm_projectinfo</td>
<td>pm_projectinfo - PickMaster project information on page 355.</td>
</tr>
<tr>
<td>The data type pm_moduleinfo</td>
<td>pm_moduleinfo - PickMaster module information on page 347.</td>
</tr>
</tbody>
</table>
8.4.16 pm_searchdata - PickMaster search data

Usage

pm_searchdata is used to store data used for search movements.

Description

pm_searchdata is a part of pm_actiondata and is used as input argument to procedure DoSearch. It defines search specific data.

Components

searchtype

Data type: pm_searchtype
Type of search (x, y or z). Is used as argument in PmSearchAdjust.

stoptype

Data type: pm_stoptype
Search stop type. Defines the robot stop method when performing a search movement.

signalname

Data type: string
Search signal name. The name of the signal to supervise during the search movement.

iotriggtype

Data type: pm_iotriggtype
I/O trigger type. Defines how the search signal is triggered, e.g. trigger on both flanks.

Example

VAR pm_actiondata Act;
VAR pm_stoptype my_stoptype;
WHILE PmGetTgtAction(WorkArea, Tgt.TargetHandle, Act) DO
  my_stoptype := Act.search.stoptype;
  ...
ENDWHILE

Limitations

The pm_searchdata members can only be set by the instruction PmGetTgtAction.

Structure

<dataobject of pm_searchdata>
  < searchtype of pm_searchtype >
  < stoptype of pm_stoptype >
  < signalname of string >
  < iotriggtype of pm_iotriggtype >

Continues on next page
## Related information

<table>
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</thead>
<tbody>
<tr>
<td>The data type <strong>pm_actiondata</strong></td>
<td><strong>pm_actiondata - PickMaster action data on page 337.</strong></td>
</tr>
<tr>
<td>The function <strong>PmGetTgtAction</strong></td>
<td><strong>PmGetTgtAction - Get target action on page 330.</strong></td>
</tr>
</tbody>
</table>
8.4.17 pm_searchtype - PickMaster stack search type

Usage

`pm_searchtype` is used to represent an integer with a symbolic constant for different types of stack search types.

Description

A `pm_searchtype` is used to specify which type of stack search type is used.

Example

```
PmSearchAdjust PickWA, PM_SEARCH_Z, 570;
```

Predefined data

<table>
<thead>
<tr>
<th>Constant</th>
<th>Value</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM_SEARCH_X</td>
<td>0</td>
<td>Stack search in the x direction</td>
</tr>
<tr>
<td>PM_SEARCH_Y</td>
<td>1</td>
<td>Stack search in the y direction</td>
</tr>
<tr>
<td>PM_SEARCH_Z</td>
<td>2</td>
<td>Stack search in the z direction</td>
</tr>
</tbody>
</table>

Characteristics

`pm_searchtype` is an alias data type for `num` and consequently inherits its characteristics.

Related information

<table>
<thead>
<tr>
<th>For information about</th>
<th>See</th>
</tr>
</thead>
<tbody>
<tr>
<td>The instruction PmSearchAdjust</td>
<td><code>PmSearchAdjust - Adjust number of remaining layers on page 303.</code></td>
</tr>
</tbody>
</table>
8.4.18 pm_singareatype - PickMaster interpolation type around singular points

Usage

pm_singareatype is used to represent an integer with a symbolic constant for different types of interpolation around singular points.

Description

The pm_singareatype is used to decide how the robot is to move in the proximity of singular points.

Examples

IF Act.SingAreaType = PM_SING_AREA_OFF THEN
  SingArea\Off;
ELSEIF Act.SingAreaType = PM_SING_AREA_WRI THEN
  SingArea\Wrist;
ELSE
  SingArea\LockAx4;
ENDIF

Predefined data

<table>
<thead>
<tr>
<th>Constant</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM_SING_AREA_OFF</td>
<td>260</td>
<td>The tool orientation is not allowed to differ.</td>
</tr>
<tr>
<td>PM_SING_AREA_WRI</td>
<td>261</td>
<td>The tool orientation is allowed to differ somewhat to avoid wrist singularity.</td>
</tr>
<tr>
<td>PM_SING_AREA_LOCKAX4</td>
<td>262</td>
<td>The orientation is such that the 4th axis is locked, that is, 6 axis robot behaves like a 4 axis robot.</td>
</tr>
</tbody>
</table>

Characteristics

pm_singareatype is an alias type for num and thus inherits its characteristics.

Related information

<table>
<thead>
<tr>
<th>For information about</th>
<th>See</th>
</tr>
</thead>
<tbody>
<tr>
<td>The data type pm_actiondata</td>
<td>pm_actiondata - PickMaster action data on page 337.</td>
</tr>
<tr>
<td>The instruction SingArea</td>
<td>Technical reference manual - RAPID Instructions, Functions and Data types, section Instructions.</td>
</tr>
</tbody>
</table>
8.4.19 pm_slavewainfo - PickMaster slave work area information

Usage

pm_slavewainfo holds information about the slave work areas in a flow.

Description

The slave work area information is a collection of work areas that can be used in any PickMaster function or instruction that demands pm_wadescr. The maximum number of slaves is 19. Current number of slaves is specified with NumberOfSlaveWA in pm_flowinfo.

Components

There are 19 components, named in a number series, SlaveWa1 to SlaveWa19.

SlaveWa1

Data type: pm_wadescr
The descriptor to a work area.

SlaveWa19

Data type: pm_wadescr
The descriptor to a work area.

Examples

VAR pm_flowinfo FlowInfo;
VAR num height;
VAR num FlowSelection;
PmGetFlowInfo FlowSelection,FlowInfo;
height:=PmGetWaHeight(FlowInfo.SlaveWorkAreas.SlaveWa1);

Limitations

The slave work area information members can only be set by the instruction PmGetFlowInfo.

Structure

< dataobject of pm_slavewainfo >
< SlaveWa1 of pm_wadescr >
< SlaveWa2 of pm_wadescr >
< SlaveWa3 of pm_wadescr >
< SlaveWa4 of pm_wadescr >
< SlaveWa5 of pm_wadescr >
< SlaveWa6 of pm_wadescr >
< SlaveWa7 of pm_wadescr >
< SlaveWa8 of pm_wadescr >
< SlaveWa9 of pm_wadescr >
< SlaveWa10 of pm_wadescr >
< SlaveWa11 of pm_wadescr >
< SlaveWa12 of pm_wadescr >
< SlaveWa13 of pm_wadescr >
< SlaveWa14 of pm_wadescr >

Continues on next page
### 8. RAPID reference information

#### 8.4.19 pm_slavewainfo - PickMaster slave work area information

*Continued*

< SlaveWa15 of pm_wadescr >
< SlaveWa16 of pm_wadescr >
< SlaveWa17 of pm_wadescr >
< SlaveWa18 of pm_wadescr >
< SlaveWa19 of pm_wadescr >

### Related information

<table>
<thead>
<tr>
<th>For information about</th>
<th>See</th>
</tr>
</thead>
<tbody>
<tr>
<td>The instruction PmGetProjectInfo</td>
<td>PmGetProjectInfo - Get information about a specific project on page 298.</td>
</tr>
<tr>
<td>The data type pm_flowinfo</td>
<td>pm_flowinfo - PickMaster flow information on page 345.</td>
</tr>
</tbody>
</table>
8.4.20 pm_stoptype - PickMaster stop type

**Usage**

pm_stoptype is used to represent an integer with a symbolic constant for different types of stop methods.

**Description**

A pm_stoptype is used to decide which type of robot stop method that shall be used.

pm_stoptype is a part of pm_searchdata.

**Example**

```rapid
VAR pm_searchdata SearchData;
VAR signaldi diSearchSignal;
VAR pm_stoptype StopType;
...
GetDataVal SearchData.SignalName,diSearchSignal;
StopType := SearchData.StopType;
TEST StopType
  CASE PM_STOP_NOT_USED:
    ...
  CASE PM_STOP:
    ...
  CASE PM_SSTOP:
    ...
  CASE PM_PSTOP:
    ...
```

**Predefined data**

<table>
<thead>
<tr>
<th>Constant</th>
<th>Value</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM_STOP_NOT_USED</td>
<td>0</td>
<td>No stop is being used</td>
</tr>
<tr>
<td>PM_STOP</td>
<td>1</td>
<td>Robot stiff stop</td>
</tr>
<tr>
<td>PM_PSTOP</td>
<td>2</td>
<td>Robot program stop</td>
</tr>
<tr>
<td>PM_SSTOP</td>
<td>3</td>
<td>Robot soft stop</td>
</tr>
</tbody>
</table>

**Characteristics**

pm_stoptype is an alias data type for num and consequently inherits its characteristics.

**Related information**

<table>
<thead>
<tr>
<th>For information about</th>
<th>See</th>
</tr>
</thead>
<tbody>
<tr>
<td>The data type pm_searchdata</td>
<td><a href="#">pm_searchdata - PickMaster search data on page 359</a></td>
</tr>
</tbody>
</table>
8.4.21 pm_targetdata - PickMaster target data

Usage

pm_targetdata specifies a target for a work area.

Description

The target data holds data and a reference to a target.

Components

TargetNumber
  Data type: num
  Defines the ordinal number of the target.

OperationNumber
  Data type: num
  Defines the ordinal number of the operation.

LayerNumber
  Data type: num
  Defines the ordinal number of the layer.

SceneNumber
  Data type: num
  Defines the ordinal number of the scene.

RobTgtPoint
  Data type: robtarget
  Defines the position of the robot and external axes.

TargetTool
  Data type: tooldata
  Defines the tool used with the target.

TargetWobj
  Data type: wobjdata
  Defines the work object used with the target.

StopPointData
  Data type: stoppointdata
  Defines the stoppointdata to be used when moving to the position of the target.

NumOfAppProds
  number of approach products
  Data type: num
  The number of products held by the robot tool when approaching the target position.

Continues on next page
AppProdsLoad

approach product load
Data type: loaddata
Defines the load attached to the robot tool when approaching the target position.

NumOfDepProds

number of depart products
Data type: num
The number of products held by the robot tool when departing from the target position.

DepProdsLoad

depart product load
Data type: loaddata
Defines the load attached to the robot when departing from the target position.

NumOfActions

number of actions
Data type: num
Specifies the number of target actions.

TargetHandle

Data type: pm_targethandle
A reference to the target from where this pm_targetdata was retrieved.

ProductHeight

Data type: num
The height of the product to place or pick. It is not necessary a product in the tool for this target.

Examples

    PmGetOperation WorkArea, Op;
    WHILE PmGetTarget(WorkArea \OpHandle:=Op.OpHandle, Tgt) DO
      ...
    ENDWHILE

Limitations

The operation data members can only be set by the instruction PmGetTarget.

Structure

< dataobject of pm_targetdata>
  < TargetNumber of num >
  < OperationNumber of num >
  < LayerNumber of num >
  < SceneNumber of num >
  < RobTgtPoint of robtarget >
  < TargetTool of tooldata >
  < TargetWobj of wobjdata >

Continues on next page
8 RAPID reference information

8.4.21 pm_targetdata - PickMaster target data
Continued

< StopPointData of stoppointdata >
< NumOfAppProds of num >
< AppProdsLoad of loaddata >
< NumOfDepProds of num >
< DepProdsLoad of loaddata >
< NumOfActions of num >
< TargetHandle of pm_targethandle >
< ProductHeight of num >

Related information

<table>
<thead>
<tr>
<th>For information about</th>
<th>See</th>
</tr>
</thead>
<tbody>
<tr>
<td>The instruction PmGetTarget</td>
<td>PmGetTarget - Get target on page 328.</td>
</tr>
<tr>
<td>The data type robtarget</td>
<td>Technical reference manual - RAPID Instructions, Functions and Data types, section Data types.</td>
</tr>
<tr>
<td>The data type tooldata</td>
<td>Technical reference manual - RAPID Instructions, Functions and Data types, section Data types.</td>
</tr>
<tr>
<td>The data type wobjdata</td>
<td>Technical reference manual - RAPID Instructions, Functions and Data types, section Data types.</td>
</tr>
<tr>
<td>The data type stoppointdata</td>
<td>Technical reference manual - RAPID Instructions, Functions and Data types, section Data types.</td>
</tr>
<tr>
<td>The data type loaddata</td>
<td>Technical reference manual - RAPID Instructions, Functions and Data types, section Data types.</td>
</tr>
</tbody>
</table>
8.4.22 pm_targethandle - PickMaster target handle

**Usage**

`pm_targethandle` is used to store data about a target.

**Description**

Data of the type `pm_targethandle` contains a reference to a target.

**Example**

```r
PmGetOperation WorkArea, Op;
   WHILE PmGetTarget(WorkArea \OpHandle:=Op.OpHandle, Tgt) DO
     WHILE PmGetTgtAction(WorkArea, Tgt.TargetHandle, Act) DO
       ...
     ENDBWILWHILE
   ENDBWILWHILE
```

**Characteristics**

`pm_targethandle` is a non-value data type.

**Related information**

<table>
<thead>
<tr>
<th>For information about</th>
<th>See</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>The data type <code>pm_targetdata</code></td>
<td><code>pm_targetdata - PickMaster target data on page 366.</code></td>
<td></td>
</tr>
<tr>
<td>The function <code>PmGetTarget</code></td>
<td><code>PmGetTarget - Get target on page 328.</code></td>
<td></td>
</tr>
<tr>
<td>The function <code>PmGetTgtAction</code></td>
<td><code>PmGetTgtAction - Get target action on page 330.</code></td>
<td></td>
</tr>
</tbody>
</table>
Usage

pm_wadescr is used to store data about a work area.

Description

Data of the type pm_wadescr contains a reference to a work area.

Examples

PERS wobjdata wInfeeder1 :=
[FALSE,TRUE,"",[[2180.65,-1430.22,-220.753],
[0.00104,-0.00130,0.00039,1.00000]],[[0,0,0], [1,0,0,0]]];
VAR pm_wadescr PickWa;
PmGetWaByWobj wInfeeder1, PickWa;

Characteristics

pm_wadescr is a non-value data type.

Related information

<table>
<thead>
<tr>
<th>For information about</th>
<th>See</th>
</tr>
</thead>
<tbody>
<tr>
<td>The function PmGetWaByWobj</td>
<td>PmGetWaByWobj - Get a reference to a work area using a work object data on page 300.</td>
</tr>
</tbody>
</table>
8.4.24 pm_wainfo - PickMaster Work Area information

Usage

`pm_wainfo` holds information about a work area.

Description

The work area information holds data and references that can be used for viewing user information about the specific work area.

Components

<table>
<thead>
<tr>
<th>Name</th>
<th>Data type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>string</td>
<td>The name of the work area.</td>
</tr>
<tr>
<td>SelectionNumber</td>
<td>num</td>
<td>The number that connects a work area with its I/O signal value. See I/O values on page 107.</td>
</tr>
<tr>
<td>Workarea</td>
<td><code>pm_wadescr</code></td>
<td>The work area descriptor.</td>
</tr>
<tr>
<td>TaskNo</td>
<td>num</td>
<td>The RAPID task number this work area is connected to. Only valid after the first call to <code>PmGetTarget</code> for this work area.</td>
</tr>
<tr>
<td>Order</td>
<td>num</td>
<td>The configured order for this work area. See Feeder order on page 161.</td>
</tr>
<tr>
<td>DefaultHeight</td>
<td>num</td>
<td>The configured default height. See Robot path height on page 176.</td>
</tr>
<tr>
<td>DiTgtGenTrig</td>
<td>string</td>
<td>The name of the configured target generation trigger signal.</td>
</tr>
<tr>
<td>DoPosRegTrig</td>
<td>string</td>
<td>The name of the configured position request trigger signal.</td>
</tr>
<tr>
<td>GoProdSel</td>
<td>string</td>
<td>The name of the configured target generation product selection signal.</td>
</tr>
</tbody>
</table>

Continues on next page
8.4.24 pm_wainfo - PickMaster Work Area information

Continued

GoFormSel
   Data type: string
   The name of the configured target generation format selection signal.

GiProdSel
   Data type: string
   The name of the configured position request product selection signal.

GiFormSel
   Data type: string
   The name of the configured position request format selection signal.

DiRobotExec
   Data type: string
   The name of the configured robot execution signal.

DiRedoSearch
   Data type: string
   The name of the configured redo search signal.

DoQueueEmpty
   Data type: string
   The name of the configured queue empty signal.

DoPosAvail
   Data type: string
   The name of the configured position available signal.

DoOpSetCompl
   Data type: string
   The name of the configured operation set complete signal.

DoExecState
   Data type: string
   The name of the configured execution state signal.

AccumulatedAckTarget
   Data type: num
   The number of accumulated acknowledged targets since project start for this work area.

AccumulatedNumOfProd
   Data type: num
   The number of accumulated picked or placed products since project start for this work area.

Examples

   VAR pm_wainfo WaInfo;
   VAR num WaSelection:=1;

Continues on next page
PmGetWaInfo WaSelection,WaInfo;

Limitations

The work area information members can only be set by the instruction PmGetWaInfo.

Structure

< dataobject of pm_wainfo >
  < Name of string >
  < SelectionNumber of num >
  < WorkArea of pm_wadescr >
  < TaskNo of num >
  < Order of num >
  < DefaultHeight of num >
  < DiTgtGenTrig of string >
  < DoPosReqTrig of string >
  < GoProdSel of string >
  < GoFormSel of string >
  < GiProdSel of string >
  < GiFormSel of string >
  < DiRobotExec of string >
  < DiRedoSearch of string >
  < DoQueueEmpty of string >
  < DoPosAvail of string >
  < DoOpSetCompl of string >
  < DoExecState of string >
  < AccumulatedAckTarget of num >
  < AccumulatedNumOfProd of num >

Related information

<table>
<thead>
<tr>
<th>For information about</th>
<th>See</th>
</tr>
</thead>
<tbody>
<tr>
<td>The instruction PmGetWaInfo</td>
<td>PmGetWaInfo - Get information about a specific work area on page 391</td>
</tr>
<tr>
<td>The data type pm_wadescr</td>
<td>pm_wadescr - PickMaster work area reference on page 370</td>
</tr>
</tbody>
</table>
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9 Relationships between PickMaster frames

9.1 Structure of this chapter

This chapter describes the different frames used by PickMaster and how they relate to each other. Each section describes the relationship between two (or several) frames.
9 Relationships between PickMaster frames

9.2 Shape frame

Shape size

The size of the shape is specified as X size, Y size and Z size in the Product/Pallet/SHEET Configuration window.

Visualization of the shape frame

The shape frame is shown in the Product/Pallet/SHEET Configuration window, but without reference to any other frame.

In the windows Pick Setting Configuration, Pallet Pattern Operation Set Configuration and Group Operation Set Configuration the origin of the shape frame is marked as a blue corner on the shape.
9 Relationships between PickMaster frames

9.3 Format frame versus shape frame

Format frame settings
The relationship between a format frame and shape frames are defined in the Pick Setting Configuration by the settings of Orientation, Row, and Column. See the Pick setting on page 79 configuration.

Orientation defines the orientation relationship between the format frame and the shape frames. Possible values are Front, Left, Back, and Right.
Row defines number of shapes in the y-direction of the format frame.
Column defines number of shapes in the x-direction of the format frame.
The relationship between the format frame and the shape frames will also depend on the X size, Y size, and Z size of the shape defined in the Product/Pallet/SHEET Configuration and the tuning of item size which is displayed in the same dialog.

Orientation explanation
Orientation defines which side of the item to place in the negative y-direction.
The following examples show some different orientations.

Orientation: Front

Coordinates for the format frame:
- $X_F$, $Y_F$, $Z_F$

Coordinates for the shape frame:
- $X_S$, $Y_S$, $Z_S$

F  Front side of the shape
R  Right side of the shape
L  Left side of the shape
B  Back side of the shape
U  Upper side of the shape
9 Relationships between PickMaster frames

9.3 Format frame versus shape frame

Continued
Row explanation

Row defines number of shapes in the y-direction of the format frame.
The following examples show the combination of row, column, and orientation.

Row: 3 ; Column: 1; Orientation: Front
9 Relationships between PickMaster frames

9.3 Format frame versus shape frame

Continued

Row: 3; Column: 1; Orientation: Left

xx0700000259

Column explanation

Column defines number of shapes in the x-direction of the format frame.

The following example shows the combination of row, column, and orientation.

Row: 3; Column: 2; Orientation: Front

xx0800000371

Visualization of the format frame

The format frame is shown in the Pick Setting Configuration window. For more information, see the Pick setting on page 79 configuration.
9 Relationships between PickMaster frames

9.4 Pallet pattern frame versus shape frame

**9.4 Pallet pattern frame versus shape frame**

**Use a palletizing area shape**

The pallet pattern frame coincides with the shape frame of the palletizing area shape, which is selected in the Layout Configuration (only shapes with Form set to Pallet can be selected).

The palletizing area shape can be used as pallet in the pallet pattern but this is not mandatory.

The palletizing area shape sets the x-y-size of the pallet pattern. Only box shapes and sheet shapes that are smaller than or have the same size as the palletizing area shape will be available for use within the pallet pattern.

**Where to see the shape frame and pallet pattern**

The location of the shape frame can be viewed in the Product/Pallet/Sheet Configuration window.

The location of the pallet pattern frame can be viewed in the Layout Configuration or the Pallet Pattern Configuration window.

**Illustration**

![Illustration of pallet pattern frame and shape frame]

- \( X_s, Z_s \) Coordinates for the shape frame of the palletizing area shape
- \( X_p, Z_p \) Coordinates for the pallet pattern frame
9 Relationships between PickMaster frames

9.5 Format frame versus tool frame

Illustration

Format frame

The format frame is defined in the Item Group Configuration window, under Product/Pallet/Sheet window, shown in the 3D view.

Item frame

The offset frame is selected by setting Aligned item in the Pick Setting Configuration window, under Tool location. The offset frame is positioned on the top of the selected item and has the same orientation as the format frame.

Offset frame

The offset frame has an offset relative to the item frame. This offset is selected by setting Offset in the Pick Setting Configuration window, under Tool location. The offset frame z-direction is always opposite to the item frame. The orientation of the offset frame’s xy-plane relative to the item frame can be selected in steps of 90 degrees in the Pick Setting Configuration window, under Tool location.

Tool frame

The zone frame cannot be directly viewed in the Pick Setting Configuration window. Instead, the location of the tool frame is displayed. The tool frame position is different from the zone frame but the orientation is the same.

Zone frame

The zone frame is selected by setting aligned tool configuration and zone in the Pick Setting Configuration window, under Tool location. The zone frame has an offset relative to the tool frame. The location of the zone frames and the corresponding offsets are displayed in the Tool Function(Vacuum) window, under the Zones tab. The offset can be changed by selecting Activator in Zones, or by setting the activator x, y, z in the Tool Function(Vacuum) window, under Activators tab.

Continues on next page
Zone frame and offset frame
When a format is being picked by a robot, a zone frame coincides with an offset frame.

Where to see the tool frame
The location of the tool frame relative to a format can be viewed in the Pick Setting Configuration window. See the Pick setting on page 79 configuration.
9.6 Pallet pattern item versus tool frame

Tool location

The location of the tool relative to a specific item when picking/placing it, is automatically solved by PickMaster. The location of the tool is highly dependent on the selected Formats to use in the Pallet Pattern Operation Set Configuration. Every used format creates a number of possible positions of the tool relative to the item. The solution must also consider that every layer must be completely finished before starting with the next layer in the pallet pattern.

The autogenerated solution can be modified in detail in the Operation Editor, which is accessible from the Pallet Pattern Operation Set Configuration. For each item in every layer is it possible to modify:

- The pick/place order within the layer.
- The format to be used.
- The item in the selected format to be used.
- The orientation of the item may be flipped 180 degrees.
- Single access or (if possible) grouped access with adjacent items.

Illustration

Where to see the tool frame

The location of the tool frame relative to an item in a pallet pattern can be viewed in the Pallet Pattern Operation Set Configuration window. See Pattern/Stack operation set on page 183.

Related information

The Operation editor on page 196.
9 Relationships between PickMaster frames

9.7 Format frame versus work object in format operation set

Overview

The expected location of a format relative to the work object while being picked or placed depends on a chain of frames, starting with the work object and ending with the format frame.

Illustration

Work object

The location of the work object is defined by the selection of Work object in the Feeder Configuration window.

The location of the work object is affected by all settings in the selected work object, including user frame and object frame settings. It is also affected by use of program displacement.

In Palletizing PowerPac, the position of the work object is aligned with the selected hotspot of the feeder model (Feeder hotpot configuration window).

Tune frame

The location of the tune frame relative to the work object is defined by the current online tuning of the work area. By default the tune frame coincides with the work object. The tune frame location may be changed from the PickMaster RC online tuning by updating the following work area properties: Disp offs x, Disp offs y, Disp offs z, and Disp angle z. The tune frame is first displaced from the work object with the Disp offs vector. Then the tune frame is rotated around the displaced origo in the z-direction with the Disp angle z.

Work area frame

The location of the work area frame relative to the tune frame is defined by the Alignment and Rotation settings of the selected hotspot used by the feeder.

Displacement frame

The location of the displacement frame relative to the work area frame is defined by the settings of Displacement frame: x, y, z and z angle in the Group Operation Set Configuration window.

Continues on next page
9 Relationships between PickMaster frames

9.7 Format frame versus work object in format operation set

Continued

Search frame
Search frame has an offset relative to the displacement frame. The offset is initially zero but is automatically updated after a stack search.

Format frame
At pick/place on a work area, the format frame coincides with the search frame.

Where to see the work object
The location of the work object relative to a general format can be viewed in the Feeder Hotspot window. However, the location is only valid if the following are zero: tune frame location, displacement frame offset, reorientation, and search frame.

The location of the work object relative to a specific format can be viewed in the Group Operation Set Configuration window. However, the location is only valid if the tune frame location is zero (=default) and if the search frame offset is zero.
9 Relationships between PickMaster frames

9.8 Pallet pattern frame versus work object in pallet pattern operation set

Overview
The expected location of a pallet pattern frame relative to the work object while being picked or placed depends on a chain of frames, starting with the work object and ending with the pallet pattern frame.

Illustration

Work object
The location of the work object is defined by the selection of Work object in the Feeder Configuration window.

The location of the work object is affected by all settings in the selected work object, including user frame and object frame settings. It is also affected by use of program displacement.

In Palletizing PowerPac, the position of the work object is aligned with the selected hotspot of the feeder model (Feeder hotpot configuration window).

Tune frame
The location of the tune frame relative the work object is defined by the current online tuning of the work area. By default the tune frame coincides with the work object. The tune frame location may be changed from the PickMaster RC online tuning by updating the following work area properties: Disp offs x, Disp offs y, Disp offs z, and Disp angle z. The tune frame is first displaced from the work object with the Disp offs vector. Then the tune frame is rotated around the displaced origo in the z-direction with the Disp angle z.

Work area frame
The location of the work area frame relative to the tune frame is defined by the Alignment and Orientation settings of the selected hotspot used by the feeder.
9 Relationships between PickMaster frames

9.8 Pallet pattern frame versus work object in pallet pattern operation set

Displacement frame
The location of the displacement frame relative to the work area frame is defined by the settings of Displacement frame: x, y, z and z angle in the Pallet Pattern Operation Set Configuration window.

Search frame
Search frame has an offset relative to the displacement frame. The offset is initially zero but is automatically updated after a stack search.

Format frame
At pick/place on a work area, the pallet pattern frame coincides with the search frame.

Where to see the work object
The location of the work object relative to a general pallet pattern can be viewed in the Feeder Hotspot window. However, the location is only valid if the following are zero: the tune frame location, displacement frame offset, reorientation, and the search frame offset.

The location of the work object relative to a specific pallet pattern can be viewed in the Pallet Pattern Operation Set Configuration window. However, the location is only valid if the tune frame location is zero (=default) and if the search frame offset is zero.
9 Relationships between PickMaster frames

9.9 Tune frame versus work area frame

Formats and pallet patterns
The relationship between tune frame and work area frame is valid for both formats and pallet patterns.

Alignment
Alignment defines which side of the work area frame the tune frame is found on, left or right.
The offset of the work area frame is zero with left alignment. With right alignment, the offset becomes equal to the x-size of the format expressed in the format frame.

Orientation
Orientation defines the orientation of the tune frame in the z-direction relative to the work area frame: 0, 90, 180 or 270 degrees.

Examples
The displayed positions of the format in these examples assumes no displacement frame offset/reorientation and zero search offset.

Alignment: Left; Orientation: 0

Coordinates for the tune frame

\[
X_T, Y_T, Z_T
\]

coordinates for the work area frame

\[
X_{WA}, Y_{WA}, Z_{WA}
\]
9 Relationships between PickMaster frames

9.9 Tune frame versus work area frame

Continued
9 Relationships between PickMaster frames

9.9 Tune frame versus work area frame

Continued
9.10 Tune frame versus work area frame versus displacement frame

Displacement frame settings

Displacement frame settings are made in the Group Operation Set Configuration window for formats and in the Pattern Operation Set Configuration window for pallet patterns.

\( x, y, \) and \( z \) defines an offset of the displacement frame relative to the work area frame but in the direction of the tune frame. \( z \) angle defines a z-rotation of the displacement frame relative the displaced origin.

Example

This example shows the coordinates for the tune frame, the work area frame and the displacement frame. It also shows how the items in the format are placed.

The following settings are made for the work area frame in the Group Operation Set Configuration window:

<table>
<thead>
<tr>
<th>Setting</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alignment</td>
<td>Right</td>
</tr>
<tr>
<td>Orientation</td>
<td>270</td>
</tr>
</tbody>
</table>

The following settings are made for the displacement frame in the Pattern Operation Set Configuration window:

<table>
<thead>
<tr>
<th>Setting</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>( x )</td>
<td>0</td>
</tr>
<tr>
<td>( y )</td>
<td>1500</td>
</tr>
<tr>
<td>( z )</td>
<td>0</td>
</tr>
<tr>
<td>( z ) angle</td>
<td>90°</td>
</tr>
</tbody>
</table>

The displayed position of the format in this example assumes zero search frame offset.

\( X, Y, Z \) Coordinates for the tune frame
\( X_{WA}, Y_{WA}, Z_{WA} \) Coordinates for the work area frame
\( X_D, Y_D, Z_D \) Coordinates for the displacement frame
This page is intentionally left blank
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