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ROBOTICS

Product specification
PickMaster® Twin
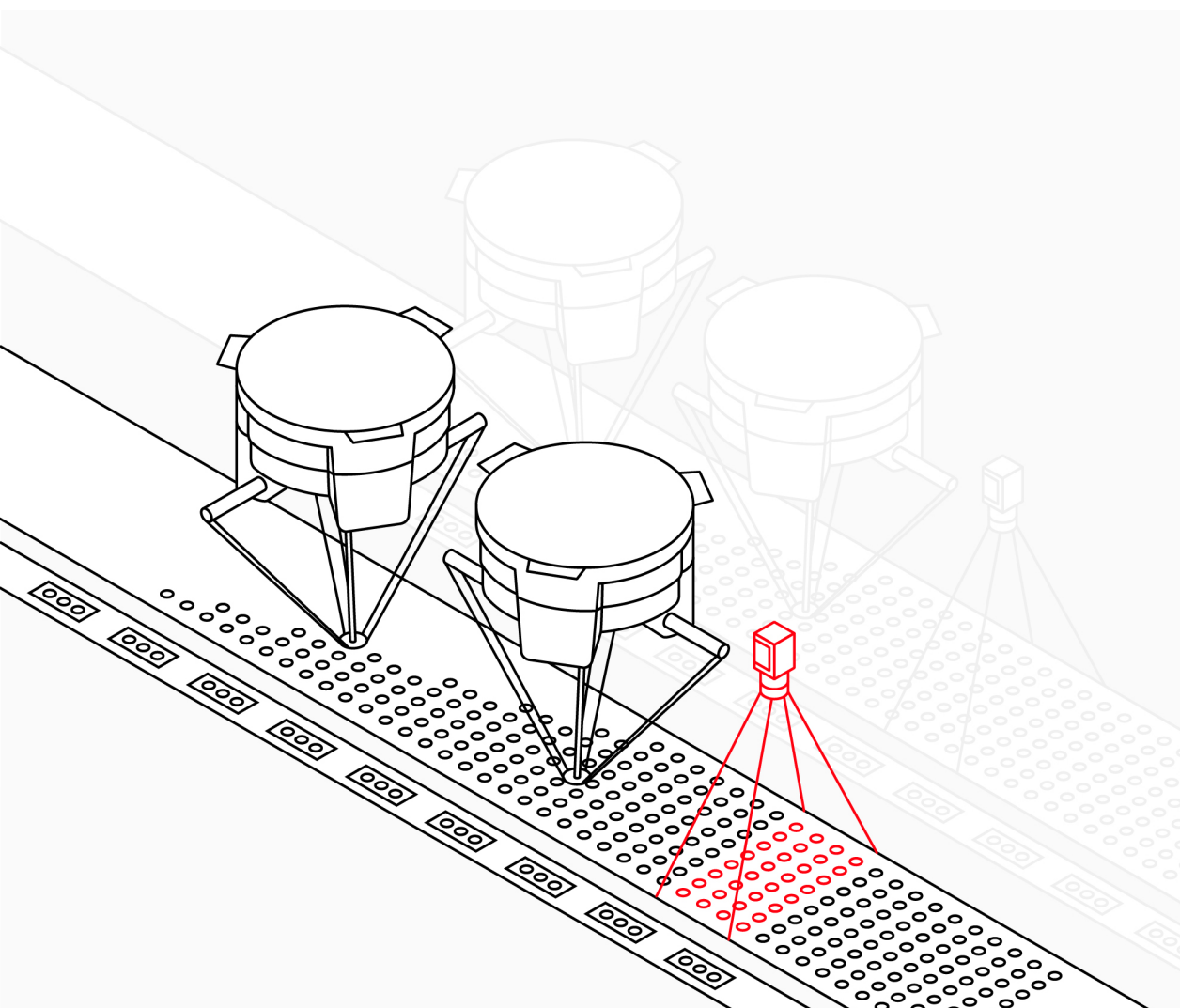
Product specification

PickMaster® Twin
Release 2.3

IRC5 and OmniCore

Document ID: 3HAC073650-001

Revision: G

Table of contents

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Overview of this specification

About this product specification

It describes the functionality, performance and options available for PickMaster$^{®}$ Twin in terms of:

- Application environment setting
- Basic concepts
- Configuration and commissioning
- Interactions with robots, cameras, sensors, conveyors, and other peripheral equipment
- Operation and controls
- Software and hardware options and licenses

Usage

Product specifications are used to find data and performance about the product, for example to decide which product to buy. How to handle the product is described in the product manual.

Users

It is intended for:

- Product managers and product personnel
- Sales and marketing personnel
- Order and customer service personnel

Cybersecurity

This product is designed to be connected to and to communicate information and data via a network interface. It is your sole responsibility to provide, and continuously ensure, a secure connection between the product and to your network or any other network (as the case may be).

You shall establish and maintain any appropriate measures (such as, but not limited to, the installation of firewalls, application of authentication measures, encryption of data, installation of anti-virus programs, etc) to protect the product, the network, its system and the interface against any kind of security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information. ABB Ltd and its entities are not liable for damage and/or loss related to such security breaches, any unauthorized access, interference, intrusion, leakage and/or theft of data or information.

References

Reference	Document ID
Product specification - Controller IRC5 with FlexPendant	*3HAC041344-001*
Product specification - Robot user documentation, IRC5 with RobotWare 6	*3HAC052355-001*
Technical reference manual - System parameters, IRC5	*3HAC050948-001*

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Reference	Document ID
Product specification - OmniCore C line	*3HAC065034-001*
Technical reference manual - System parameters, OmniCore	3HAC065041-001
Application manual - PickMaster Twin - PowerPac	3HAC064218-001
Application manual - PickMaster Twin - Operator	3HAC069977-001
Circuit diagram - PickMaster Twin	3HAC024480-020
Product specification - Controller software IRC5	3HAC050945-001
Product specification - RobotStudio	3HAC026932-001
Application manual - Conveyor tracking IRC5/RW 6	3HAC050991-001
Application manual - Conveyor tracking RW 7	3HAC066561-001

Revisions

Revision	Description
A	First edition
B	Published in release 21A. The following updates are made in this revision: • Updated information on supporting OmniCore controllers.
C	Published in release 22A. The following updates are made in PickMaster® Twin 2.0 revision: • Updated information for PickMaster® Twin 2.0 revision.
D	Published in release 22D. The following updates are made in PickMaster® Twin 2.1 revision: • Updated information for PickMaster® Twin 2.1 revision. • Updated supported languages.
E	Published in release 23A. The following updates are made in PickMaster® Twin 2.1.1 revision: • Updated information for PickMaster® Twin 2.1.1 revision. • Minor corrections.
F	Published in release 23B. The following updates are made in PickMaster® Twin 2.2 revision: • Updated information for PickMaster® Twin 2.2 revision. • Minor corrections.
G	Published in release 23D. The following updates are made in PickMaster® Twin 2.3 revision: • Updated information for PickMaster® Twin 2.3 revision.

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1 Introduction

Overview

Thank you for your interest in PickMaster® Twin. This document gives you an overview of the product characteristics and how it can be used.

PickMaster® Twin is a software suite designed for vision based high speed picking of random flow products on the fly. PickMaster® Twin supports ease-of use configuration, simulation and operation of a big variation of smaller or larger line layouts composed of a multitude of robots, cameras, conveyors and fixed work areas. It is a production system that comprises all steps in the life cycle of a picking installation from proposal, engineering, commissioning, operation to maintenance and support.

PickMaster® Twin is an ease-of-use concept to configure and operate a wide variety of layouts and recipes by comprehensive configuration settings and it also offers open program and script interfaces for dynamic customization in runtime.

PickMaster® PowerPac

Ease of Use software for offline and online configuration and commissioning in a visual 3D environment, powered by RobotStudio™. Uses Digital Twin technology for configuring and simulating picking applications offline. When the station has been built, the very same solution can be directly connected as a client to PickMaster® Runtime on the host computer in the real installation and running production through the same 3D visualization allowing simultaneous optimization of the picking process in the virtual world in real time while the real process acts accordingly.

With PickMaster® PowerPac, conveyors and cameras are easily calibrated and it comprises a powerful set of fully integrated vision functions for object identification and inspection.

PickMaster® Operator

State-of-the art user interface for operating PickMaster on the shop floor, built on ABB's Ability™ Zenon data management software. PickMaster® Operator offers intuitive pages for selecting, running and tuning production recipes as well as informative production data visualization, vision result display and recording. It comprises full user authentication support for selective page access. PickMaster® Operator is compliant with the OMAC PackML standard, making PickMaster an integrated part of modern packaging machineries and factory planning.

PickMaster® Runtime

Efficient runtime operation software for orchestrating the coordination of the packaging process for a multitude of robots and conveyors including integrated vision software for precise robot guidance and quality inspection. Alternatively, PickMaster® Runtime can synchronize any kind of sensors with the real time coordination of up to ten robots in a PickMaster installation.

Product content

PickMaster® PowerPac

Continued

PickMaster® Operator

PickMaster® RunTime

Vision Hardware

Hardware

Gigabit Ethernet Vision:

- Cognex CVL dongle, color vision enabled for max 2/10 cameras
- Basler acA1440-73gc color camera with 1440 x 1080 resolution, including cables
- 4 port GigE network interface card, Cognex CFG-8724
- Vision demo dongle

Licenses

PickMaster® Runtime (permanent)

PickMaster® PowerPac (subscription)

Robot controller:

- PickMaster Cell Ready
- PickMaster Robot Ready
- PickMaster Vision Ready

2 PickMaster features

2.1 Hardware topology

Overview

A PickMaster Twin runtime system contains a PickMaster Host PC with a robot controller network and a separate GigE vision camera network. Engineering and commissioning are done with PickMaster® PowerPac on a separate PC that connects over Ethernet to the host PC.
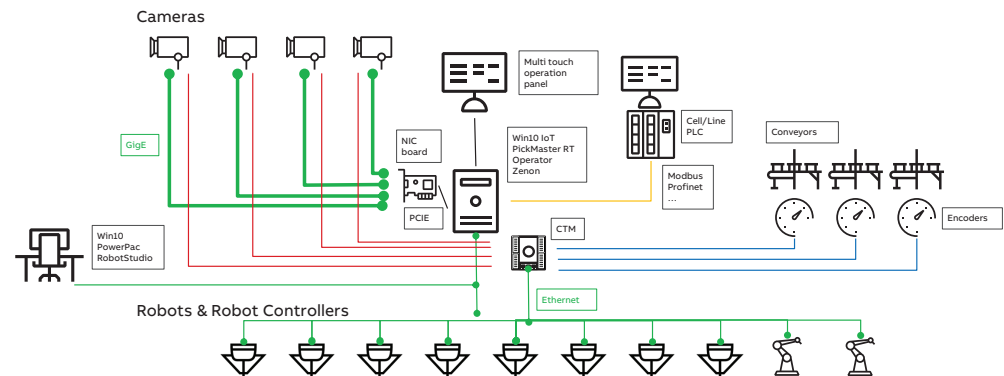

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Connection overview for a solution with 10 robots, 4 cameras and 3 conveyors.

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2.2 Characteristics and concepts

Concept description

A PickMaster Twin application is configured in a file and folder format called PickMaster solution, which contains one PickMaster station with one or more recipes. A PickMaster station defines the physical line layout and a recipe defines the products, containers and processes that will be executed on the station.

The local computer with the PowerPac solution can then be connected to the host computer in the installation and the solution is switched to real runtime mode. With the real equipment, the vision system is calibrated and configured and then the conveyors are calibrated to the robot base frames. The virtual system should then be adapted to correspond to the real placements of the components.

The solution can now be started with the real installation. The products will be recognized by the sensors and cameras and the robots will pick and place. Simultaneously, the same process will be animated in the virtual 3D environment. The solution is now running in emulation mode on the connected PowerPac computer.

The flow of real products and containers can be recorded and saved to a file, which can be used as virtual flow input without real products. The virtual products will then be recognized and appear in the 3D visualization, the real robots will move accordingly and the 3D emulation will show the robots picking and placing in a so called ghost picking mode. This technique is useful for testing different concepts and scenarios without the need to run real products through the production system.

When the solution with the recipes are accepted for production, it is then copied to the host computer, where it can be selected and executed from PickMaster Operator.

> **ℹ Note**
>
> PickMaster PowerPac is the engineering tool on a separate computer that can be attached and detached from the production host PC. PickMaster PowerPac is not validated for running on the production host PC or 24/7 production.

> **ℹ Note**
>
> PickMaster PowerPac and PickMaster Operator cannot be connected to the host computer at the same time.

2.3 Features of PickMaster PowerPac

Maximum configuration

- PickMaster Runtime per host PC: 1
- Robots per PickMaster: 10
- Cameras per PickMaster: 10
- Work areas per robot: 25
- Conveyors per robot: 6

Robots

PickMaster Twin supports all IRC5 and OmniCore robot types with the following exceptions:

- IRB 14000 (YuMi)
- MultiMove
- All paint robots

Digital twin technology

Digital Twin technology allows users to design, configure and simulate PickMaster applications offline and to connect the very same application with maintained 3D visualization and data integrity to the target factory floor system running the real PickMaster runtime and the real robots.

3D graphical station and recipe designer

Intuitive 3D environment showing a digital copy of the real installation. The installation configuration is described by its components that can be sized, moved and rotated to their correct positions. The comprehensive recipe designer lets users describe the products, containers and patterns as well as the pick and place processes aimed at running in a PickMaster station.
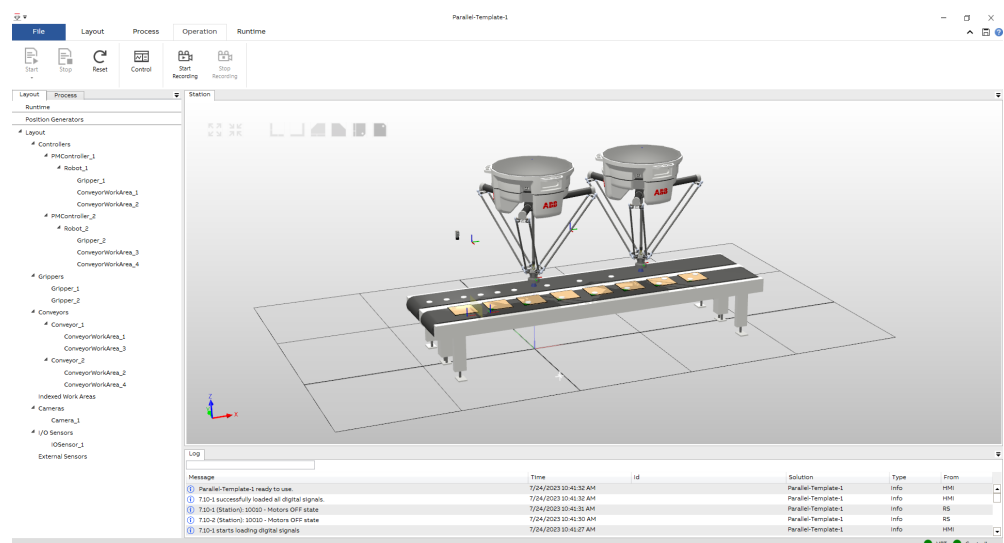
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The 3D visualization is showing the installation and the products running on the installation based on RobotStudio technology in offline simulation as well as in online emulation and ghost picking.

Full offline picking process simulation

Accurate simulation of the picking process showing items being picked and placed from and to conveyors or indexed work areas with simulated cameras or sensors.

The flow of items and containers can be specified in defined or random patterns. Flows can also be imported from real recorded production runs.

Online 3D graphics picking process emulation

Easy mode switch from offline simulation to the online runtime host connection over Ethernet and back to simulation.

In online mode, the robots are running the real process, while the 3D visualization is showing the very same process in emulation mode allowing users to further optimizing the result with the same online tuning capability as in offline simulation.

Ghost picking

Ghost picking is a variant of online production and emulation without the need to feed real products and containers. A virtual flow of items and containers produced on conveyors and indexed work areas and the real robots act accordingly, while the emulation is showing the virtual robots picking and placing the items into containers.

Ghost picking can be done with either predefined flows or recorded flows from the real production.

Flow optimization through visual operating windows tuning

Visual tuning windows are showing the process operation range for a robot on a conveyor for each pick and place operation. The window can be preset in the recipe and it can be modified in all four directions through the runtime tuning capability. Sizing of the tuning windows enables intuitive and fast optimization of the flow balance between multiple robots.

Runtime process tuning

The production process can be optimized by modifying critical parameters in runtime. The runtime tuning can be applied in offline simulation, online emulation and ghost picking.

The tuning parameters are saved with a recipe and they will be applied when the recipe is started the next time.

Solution format and Pack&Go for easy sharing

A PickMaster application configuration is stored in a PickMaster solution folder and a `PickMaster *.pmsln` file. It contains all parameters for both offline and online operation. The solution folder can be transferred to the host computer for production controlled from the Operator. When saved in a Pack&Go compressed file, all folders, files and also the virtual controllers are included and can be opened on any alternative PC with the same result.

Client and server toplogy

All process and vision execution is processed in the Runtime software on a PC, which is permanently installed at the production site. PickMaster PowerPac and Operator are client softwares that connect to Runtime. PickMaster PowerPac is running on a separate client PC. PickMaster Operator is running on the Runtime host computer. In offline simulation mode, the Runtime process runs as PickMaster Virtual Runtime.

Indexed and conveyor work areas

Robots in a PickMaster system can operate with fixed indexed work areas or coordinated with moving conveyors. The conveyors can be either linear or circular.

Random and predefined flow

Products and containers on indexed and conveyor work areas can be pre-defined with known positions or random, identified by vision cameras.

Robot controller and I/O signals

The robot controller must be equipped with at least one digital I/O board, e.g. DSQC 652, local I/O DSQC1030 Base unit or similar.

The detailed use of required I/O signals is as follows:

- Gripper vacuum and blow: two signals per vacuum tool
- Position generator trigger, e.g. camera: one signal per work area, e.g. pick and place area
- Conveyor start and stop command: one signal per conveyor if this function is used

Detailed hardware connection diagrams are shown in *Circuit diagram - PickMaster Twin*.

User Script

UserScripts lets users customize the dynamic pick and place process in PickMaster by modifying or creating item target positions in runtime using Python script language. There are four Python interfaces : Initialize, Adjuster, Vision and Distribution. Each interface represents an entry to influence the item target positions and their distribution to the robots.

External sensor

An external sensor is a software component that gives the user full control of how item positions are generated. An external sensor can use any type of item detection such as barcode readers, cameras, or a combination of photo sensors to generate item positions. If cameras are used, any vision hardware or image searching algorithms can be used. PMTW supports to use Python to implement external sensors programs.

Solution transfer

With solution transfer, PickMaster Powerpac and PickMaster Operator are able to pack and send solutions to each other via Ethernet.

2 PickMaster features

Time synchronization service

PickMaster Twin uses a time synchronization service to synchronize the time between the robot controllers and the Host PC running PickMaster. The synchronization is performed over the same network used for communication between PickMaster Runtime and the robot controllers.

It is compatible with both PTPv1 and PTPv2 protocols. The priority level can be adjusted through the visual interface, which can be used together with other time synchronization services in the market.

Controller side process flexibility

General

Optimized real-time control of positions and conveyors are provided by the RobotWare option *PickMaster Cell Ready or PickMaster Robot Ready.* PickMaster Cell Ready includes the ability to receive targets from vision, regardless of the number of cameras. If the controller was already configured with PickMaster Robot Ready, PickMaster Vision Ready can be added to enable the same vision capability as included in PickMaster Cell Ready.

With *PickMaster Ready* the robot is configured to work together with PickMaster Runtime. *PickMaster Ready* enables conveyor tracking process for up to six conveyors per controller.

PickMaster Ready contains a set of RAPID instructions, functions, variables, and data types. There are also predefined system and program modules as well as RAPID routines included in *PickMaster Ready*. The RAPID modules are part of the project definition and downloaded to the robot controller at project start. The RAPID modules may be adapted to fit specific application needs, but in most cases, very little or nothing needs to be changed.

PickMaster Ready takes care of the communication, initialization of enhanced conveyor tracking and makes it possible to perform advanced mixing, sorting and collating as well as exception handling as timeout or error handling.

Service variables and routines is a requirement but has not been implemented in PickMaster® Twin yet.

For more information, see *Application manual - PickMaster Twin* for the full set of instructions.

Product specification - PickMaster® Twin

2.4 Features of PickMaster Operator

PickMaster Operator

PickMaster Operator is the client software with the operator interface to control a PickMaster line on the host computer on the shopfloor. It is built on the ABB Ability ^{TM} Zenon platform and it can be integrated into higher level Zenon solutions or any PLC, line and factory operations systems.
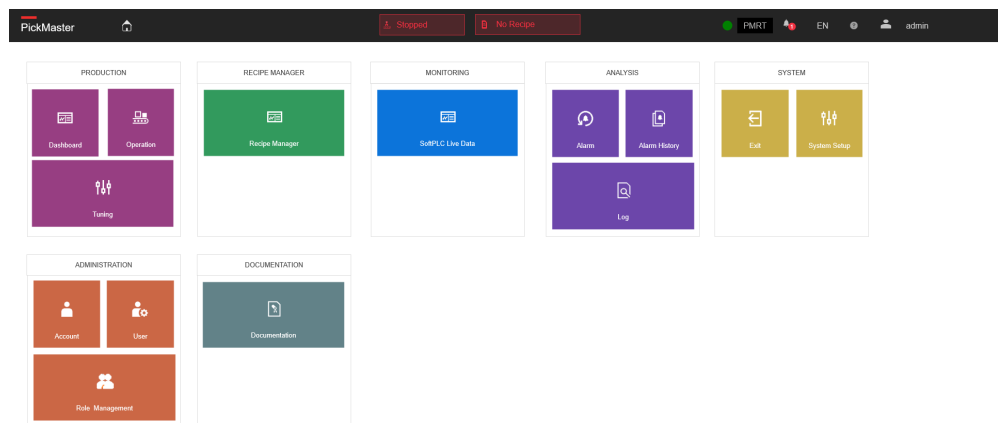
> **Note**
>
> Read the PickMaster Twin Operator application manual before installing/uninstalling ABB Ability ^{TM} Zenon.
>
> ABB Ability ^{TM} Zenon has specific installation/uninstalling procedures. Or it cannot work normally.

Graphical tile page selection

Instant access to all pages from a colorful comprehensive tile style selection page.

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Main top bar

Persistent on all pages with selection and information for direct access to the most vital features.

- Home: back to tile menu page
- Recipe information of active loaded and running recipes
- Current PackML state
- Active alarms
- Language selection
- User authentication and logon

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2 PickMaster features

2.4 Features of PickMaster Operator
Continued

### Full user authentication management and login control

Integrated maintenance of multiple users assigned to different access levels for selective access to specific pages.

Compliance with OMAC PackML standard and additional transparency control and status of individual robots in a PickMaster line

PickMaster can be remotely controlled through PackTags and the robots can be accessed through start/stop/reset and recovery from e-stop.

Integrated soft PLC with PackML operation logics

Integrated Soft PLC logics controlling the operational stages according to PackML standard.
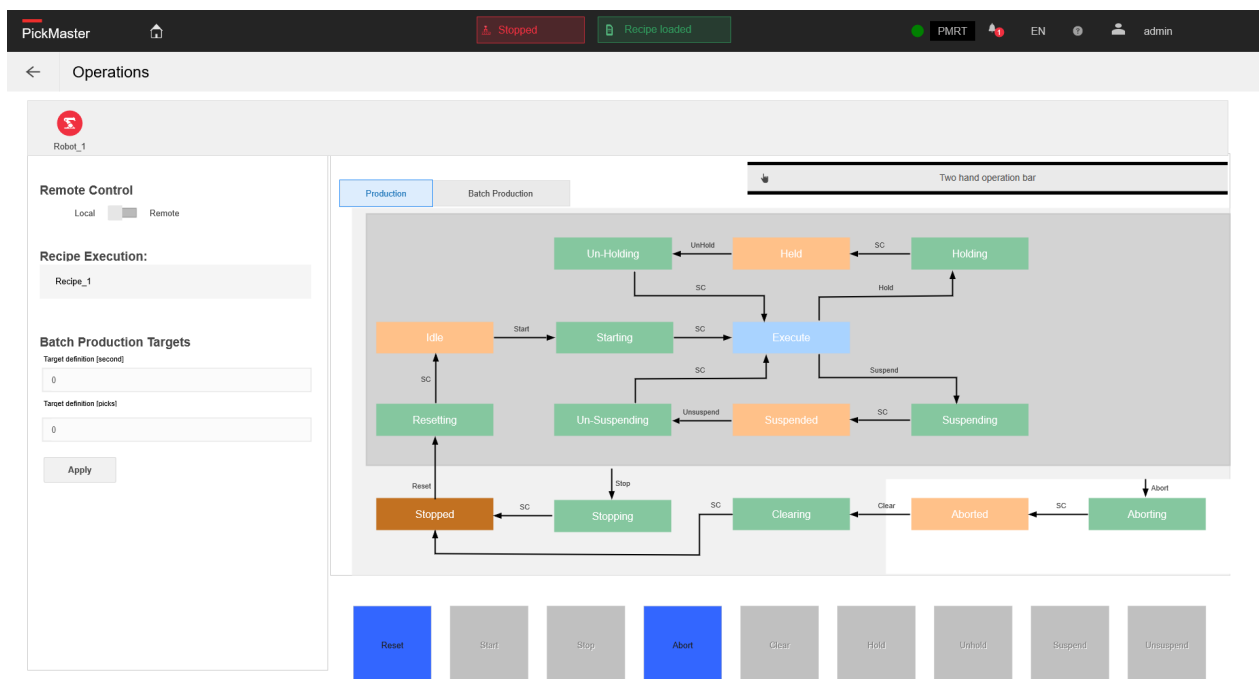
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Production page

Operation execution and process state information according to PackML standard states and modes. A recipe can run until stopped or in batch control mode for a certain time or number of products processed.

Alternatively, PickMaster can be operated by simpler start and stop buttons and the PackML states will not be visible.

Two hand operation safety

The operation page can be protected from unintended touch a requirement to push a release button with a second finger simultaneously.

Recipe management system

Selection of recipe to run and configuration of recipe specific parameters.

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Production dashboard

Visual overview of the ongoing production showing current numbers of picks and place per minute, historiv trend. The warning and error limits can be configures in the recipe setup.

Online parameter tuning

Tuning of process parameters during production. Same tuning capability as from PickMaster PowerPac for robots, work areas and camera display.

Customized graphical line layout

Drag and drop placing of robots, cameras, work areas and conveyors symbols on a canvas to reflect the locations in the actual line.

PackML support for PLC

Remote PLC access and control over EthernetIP, Modbus and Profinet.

Vision results

Runtime display of camera image acquisitions with vision results. A series of images can be stored to file for offline examination in PickMaster Vision Analyzer.

Alarms and logs

Active alarms and reset. List of historic alarms can be displayed and saved to file.

Logs can be filtered by topic and date/time and exported to file.

Auto start

When the auto-start is enabled, PickMaster Operator will start and login automatically with the predefined user account for auto-start when the PC is restarted.

2.5 Vision

General

The vision system in PickMaster is configured in PickMaster PowerPac when it is connected to PickMaster Runtime on the host PC where the vision software is installed and executed. The vision hardware license dongle has to be inserted on the host PC, but there is no hardware license required on the PickMaster PowerPac client PC.

Leading Cognex vision technology using cameras with high speed communication over Gigabit Ethernet and built-in algorithms, provides the integral vision technology in PickMaster.

The vision system is capable of recognizing regular as well as irregular forms for efficient search and concurrent inspection for categorization and quality checking. This includes unwrapped food like chicken, meat, etc or more geometrical accurate products or wrapped and packaged forms.

The vision system provides fast and reliable robot guidance as well as concurrent inspection capability. PickMaster can run a maximum of 10 cameras. In order to avoid messages from colliding on the camera network, it is recommended to use a separate port on the GigabitEthernet card for each camera. Thus 10 cameras require three GigE cards in the host PC. If a network switch is used, the camera image messages from simultaneously triggered cameras may collide, leading to loss of the camera result and missed products.

With PatMax^{TM}, many vision recognition tasks are easily solved. PatMax^{TM} is a patented method by Cognex, which is top of the line in vision technology. PatMax^{TM} returns reliable, accurate and repeatable 2-dimensional positions and orientations.

Features of vision

List of vision features:

- Concurrent camera acquisitions and vision processing on multiple cameras.
- Fast image updates.
- Fast and accurate calibration, linear or higher order algorithms for short focal lenses. Without the need to mount the camera accurately perpendicular to the surface.
- Import/export of calibrations.
- Multiple calibrations stored in a solution, e.g. for different object heights and calibration surface levels.

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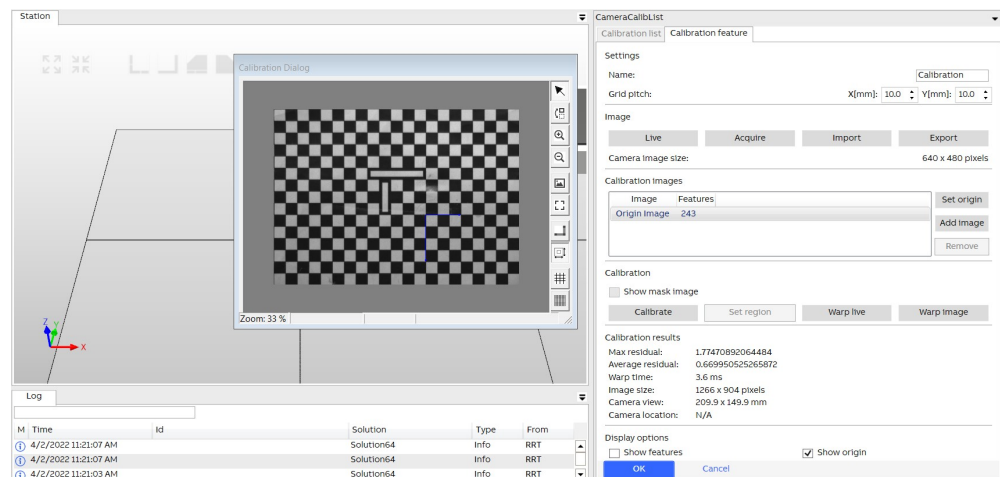
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- For geometric model search, enhanced use of PatMax^{TM} solves many difficult search tasks. Well suited for geometric search of both regular and irregular shapes.
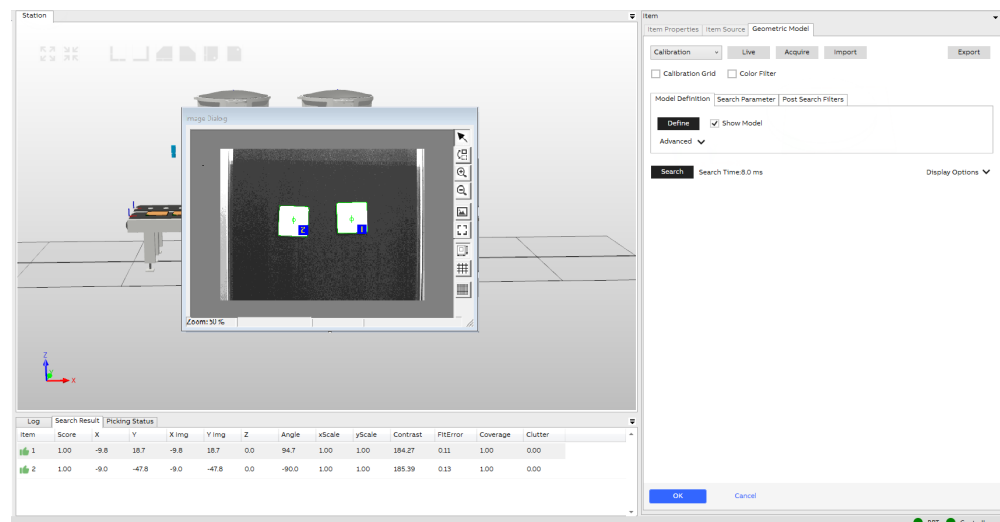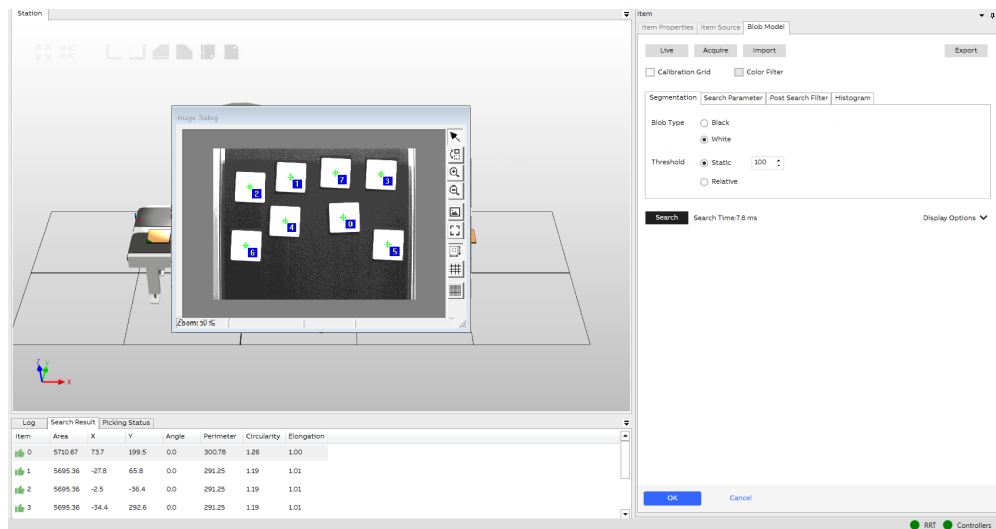

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- Sub score filter parameters enable adequate fine tuning, e.g. items to find, score limit, contrast limit, area overlap, clutter, scale, angle, granularity.
- Enhanced Blob modeling for fast and simple search operations without the need for taught models can find many different types of objects based on pixel features like area, perimeter, etc.

2.5 Vision
Continued

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- Multiple models per object possible.

  The import/export feature allows the use of vision models between different solutions of PickMaster Twin.

- Color vision for enhancing contrast and inspecting colors combined with interactive filter controls.
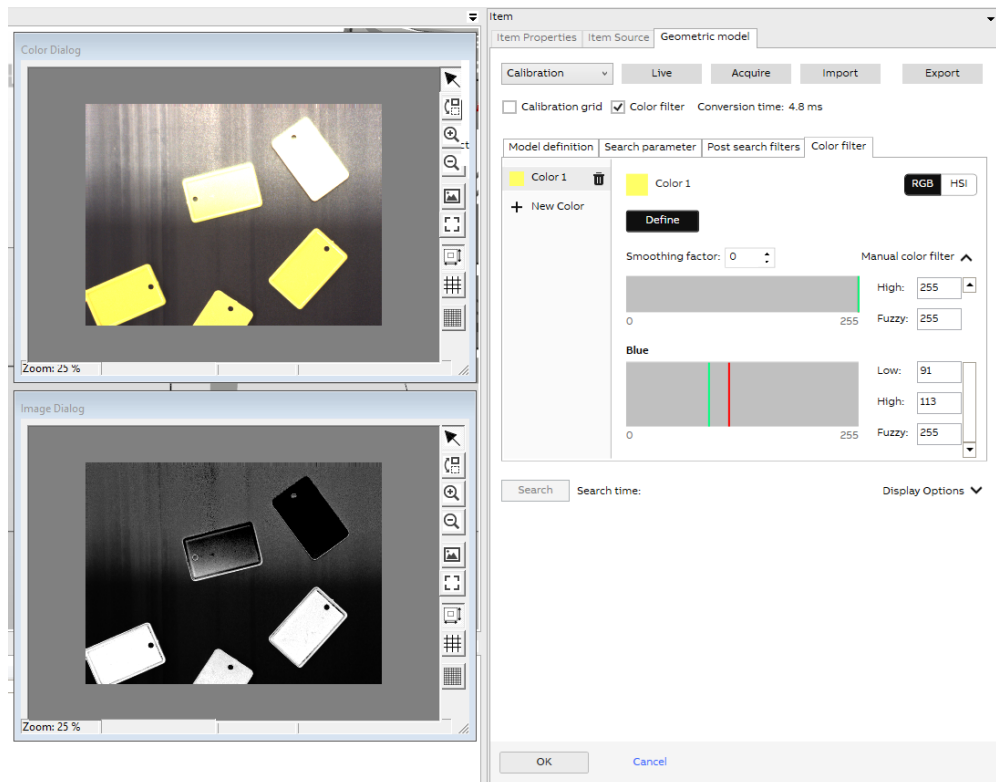
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- Image import/export can be used to edit camera images with external image editing tools in order to optimize the vision model. The export/import function

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can also be used for offline vision modeling by the use of the Vision simulation dongle.

- Zoom, pan, etc of the camera view simplifies accurate modeling.
- Auto camera trigger.
- Quality inspection with reject and type categorization.
- Quality inspection by combination of alignment model with multiple sub-inspection models.
- The alignment models can be geometric or blob. The sub-inspection models may be geometric and blob.
- Detail vision: Vision result window showing the search results in runtime. The images including all results can be saved in a file (*.pmv) for later analysis.

Vision equipment features

- PickMaster can be delivered with two variants of starter packages (Cell and Line) - smalll or large. Each package contains one Cognex color enabled vision hardware license (USB stick), one GigE color camera kit including cables, one 4-port GigE communication card. The vision license in the cell package allows max 2 cameras. The Line variant allows up to 10 cameras to be connected.

  Additional camera kits and communication boards can be ordered with the PickMaster order.
- Search tools PatMax^{TM} /Blob.
- Vision quality inspection tools Level I and Level II.
- Linear and non-linear calibration.
- Camera acquisition time and transfer rates: typically 50-200 ms on a high performance PC. Complex models can affect performance.
- Up to ten simultaneous camera acquisitions.

2.5 Vision
Continued

Detailed vision information and runtime Vision Analyzer

The vision and inspection results can be checked in detail in runtime for each individual camera, both in PickMaster PowerPac and in PickMaster Operator. The images and results are saved in a buffer. The results can be saved to a file (.pmv) and analyzed online or offline in a separate executable Vision Analyzer, which is also provided with the PickMaster software. Camera information and time stamps for each camera acquisition are also saved with this file.
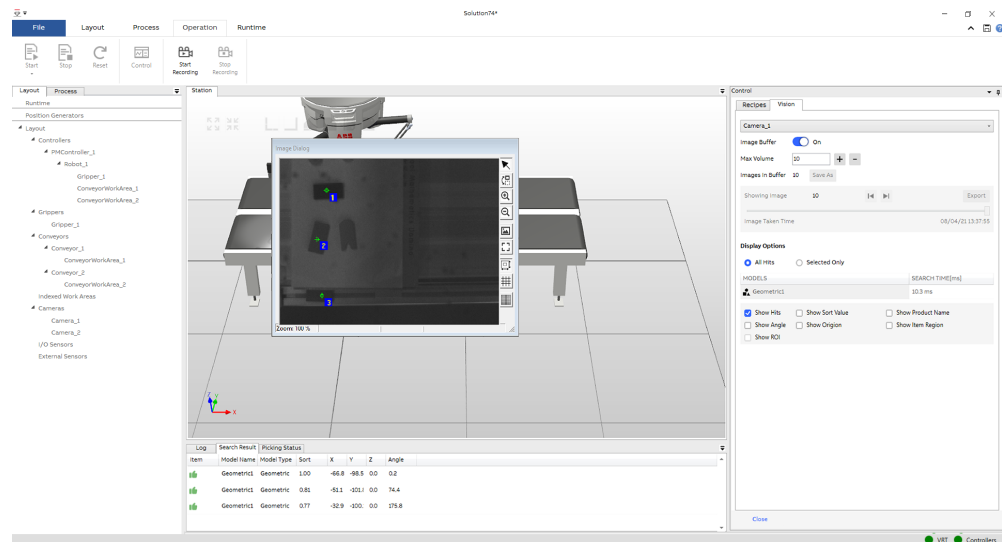
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2.6 Conveyor Tracking

Introduction

Continuously moving conveyor belts are the preferred way to feed items and packages. It gives a high flexibility since the robot can operate on the items on the fly for the full time they are within the working area of the robot.

PickMaster Twin can operate with a multitude of linear and circular conveyors in any configuration carrying random or predefined products and containers.

Speed

The system has been tested with a maximum conveyor speed at 100 m/min with an IRB 360 without vision recognition. The capability to follow conveyors at high speeds is dependent on the acceleration and speed limitations of the actual robot. When changing the speed of the conveyors, that is, when using them for stop and go, the accuracy is decreased dependent on the acceleration and deceleration slopes. The conveyor configuration parameters may need special attention to be adjusted to different robot types and load conditions. Indexing feeders can be used for regular conveyor tracking. If the acceleration and deceleration are within specified limits, see conveyor tracking manuals in the reference.

On conveyors with vision recognition the speed is limited by the following factors:

- Camera trigger frequency. The vision model search time and position transfer time limits the trigger frequency. For an average time of 250 ms the maximum frequency is 4 Hz.
- Motion blurs. On high-speed conveyors the camera shutter time needs to be very short which again requires very good light.

Drive Unit

External drive units connected to I/O controls operate the conveyors. Drive units like the ABB AC300 has a 24V I/O interface allowing forward, backwards, and stop operations, speed preset, and increment and decrement.

Encoder

One or more encoders measure the position of a conveyor. Usually an encoder is placed close to an identification and operation area in order to minimize errors caused by the elasticity and inaccurate guidance. The encoder measurement sample rate is configured in the robot controller and by default set to 20 ms.

The Conveyor Tracking Module DSQC2000 (CTM) handles multiple encoders and robots. PickMaster and conveyor tracking is also compatible with the older DSQC377/B encoder boards. For more details, see conveyor tracking manuals in the reference.

	Option	Requires
IRC5	DSQC 2000	1552-1 Tracking Unit interface option
	DSQC 377	709-1 DeviceNet master slave
OmniCore	DSQC 2000	616-1 PC interface

2.6 Conveyor Tracking
Continued

The encoder should be of type Open collector PNP output, two phases with 90 degrees phase shift, voltage 10-30V and current 50 - 100 mA

1   Normally supplied by 24 VDC from DSQC377/DSQC2000

The pulse ratio from the encoder should be in the range of 5000 - 10000 pulses per meter of conveyor motion (see wiring diagrams in *Application manual - PickMaster Twin*). The pulses from channels A and B are used in quadratures to multiply the pulse ratio by four to get the counts. This means that the control software will measure 20000 - 40000 counts per meter for an encoder with the pulse ratio given above. Reducing the number of measured counts below 20000 will reduce the accuracy of the robot tracking.

Increasing the number of measured counts beyond 40000 will have no significant effect as inaccuracies in robot and cell calibration will be the dominating factors for accuracy. The encoder board (DSQC377/DSQC2000) is able to handle min 500 and max 50000 counts per meter.

The maximum frequency is 50 kHz (may occur with high conveyor speed and many pulses per meter).

The encoder should be connected to the robot by a screened cable to reduce noise.

> **ℹ Note**
>
> If this cable is long, the inductance in the cable will produce spike pulses on the encoder signal, which may, over a period of time, damage the opto-couplers in the encoder board. The spike pulses can be removed by installing a capacitor between the signal wire and ground for each of the 2 phases. The capacitors should be connected to the terminal board where the encoder is connected and not on the encoder interface.

The number and speed of the conveyors are CPU consuming factors on the robot controller. Maximum six conveyors may be connected per robot controller.

2.7 Flow management/process

General

PickMaster can handle a wide variety of applications in packaging as it has integrated support for mixing, sorting, collating, blister patterns, etc.

The way the robot shall pick and place from different work areas is easily enhanced by PickMaster RAPID instructions. The order and priority including exception handling is possible to program with the RAPID instruction set provided with PickMaster.

However, in most cases, no programming adoptions are needed at all. The PickMaster software package contains predefined RAPID modules which are ready to use for 4, 5 and 6 axes robots.

Random flow

Random flow is the most flexible way of feeding products. There is no need for fixtures and many different products or packages can be transported on the same feeders without mechanical adoptions.

Predefined flow

The products and place trays may be placed in predefined positions. With PickMaster many robots and products with various patterns are easily configured and the process is executed with highest performance and efficiency with included work area limit supervision.

Indexing conveyors and fixed work areas

In many cases the products are presented to the robots on indexed tables or indexing conveyors. In this case conveyor tracking is not used, but the products may be randomly placed and vision recognition is then needed.

Double/multiple pick, single/double/multiple place

If higher performance is required, multiple picking is easily configured. However, heavier special grippers and a less flexible configuration are the disadvantages of this solution.

Configurable Pick and place sorting order

The items are normally picked and placed in direction of the production flow on the conveyors, i.e. first in, first out. It is also possible to extract the items from the flow in any three dimensional direction.

Mixing and sorting

Single product types, generated by PickMaster can be selected and extracted from the inflow and diverted to different positions.

Alternative operations can be executed if products or specific product types are missing from the inflow. A so called queue level signal can be used for evaluating if a position queue is empty and thus requires new input.

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Sorting directions makes it possible to optimize the capacity of the robot, i.e. to make sure the robot runs the shortest distance, etc.

Clearance areas can be declared to reject touching objects.

Camera distribution

Multiple robots can be connected to the same camera. This is useful to save the hardware and installation costs. It is essential that the objects are well separated and the neighbouring objects are not overlapping while picking or placing. If the robots are far away from the trigger point the elasticity of the conveyors may decrease the accuracy.

Load balancing and bypassing

With simple drag and drop, when defining the recipe in PickMaster PowerPac, the load of a production flow can be balanced among multiple robots. The position information is acquired at one initial point on the line either through a position trigger of predefined positions or through a camera using the camera distribution option. The production can easily be balanced with equal or biased loads on all robots involved. The function can be used to avoid upstream robots to consume most of the products on the conveyors and thereby leaving too little to the other robots.
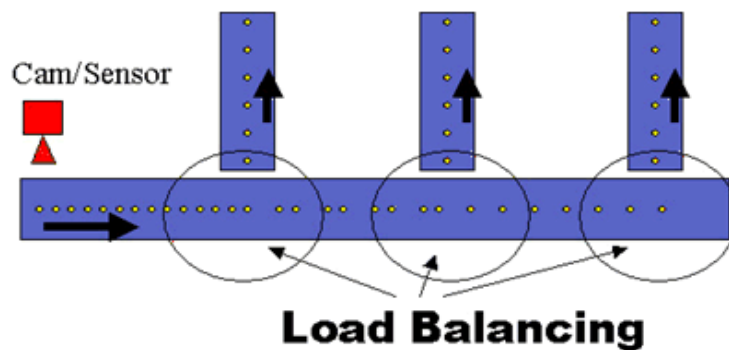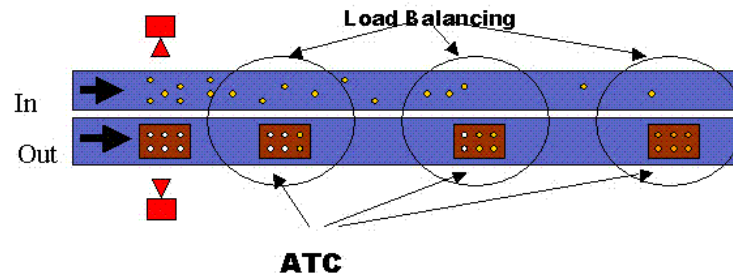

en0900000792

The Load Balancing function can also be applied on robots with individual trigger points (separate camera or sensor per robot). Simply decide, how much of the passing production shall be used and bypass the rest.

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Product specification - PickMaster® Twin
3HAC073650-001 Revision: G

Adaptive Task Completion

PickMaster® can be configured to ensure that every reachable object is picked and every reachable position is filled as a joint operation of multiple robots, this is called Adaptive Task Completion (ATC). Without the need to assign objects to specific robots, the ATC function makes sure that one, but only one, robot consumes the position. This option can be used for progressively filling cases, which pass multiple robots.

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Visual Operation windows

The operational work area of a robot on a conveyor is limited by entry and exit lines and side limitations forming a rectangular window where items can be accessed. By setting the size and location of the windows together with the ATC function, the load distribution can be efficiently modified. A smaller upstream window leaves less opportunity for the upstream robot to pick or place, leaving more items to the downstream robots. The windows are highlighted in the 3D environment of PickMaster PowerPac for intuitive configuration and the size can be tuned during runtime operation.

Robot stops and exceptions

A single robot can be paused, stopped or even powered down during production. The way the remaining robots are reacting is configurable. If load balancing is used, the workload designated to a paused robot can be redistributed automatically among the running robots. If ATC is used, the specific positions are redistributed to the next robot.

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3 Variants and options

PickMaster Powerpac

> The license for PickMaster Powerpac is listed in the Robot Studio production specification.
>
> For more information, refer to *Product specification - RobotStudio 3HAC026932-001*.

Software options

Runtime License [3600-1]

> Basic Runtime license
>
> This option *Runtime License* includes the license for Runtime and PickMaster operator.
>
> No physical items are delivered with this option.

Hardware options

Gigabit Ethernet Ready

Introduction

> PickMaster$^®$ is available with a Gigabit Ethernet vision system. This means that the PC communicates with the camera using a standard Gigabit Ethernet network interface card. The network card is mounted on the PCIE bus of the PickMaster Host PC.

GigE Vision Ready Cell [3601-1]

> The physical items delivered with this option:
>
> - One Basler acA1440-73gc GigE color camera including communication industrial Ethernet cable 20 m, power and signal cable 10 m
> - One 4-port GigE card, Cognex CFG-8724
> - One dongle license for up to two color cameras on USB Stick
>
> Requires:
>
> - Option *Runtime License* [3600-1]

GigE Vision Ready Line [3601-2]

> The physical items delivered with this option:
>
> - One Basler acA1440-73gc GigE color camera including communication industrial Ethernet cable 20 m, power and signal cable 10 m
> - One 4-port GigE card, Cognex CFG-8724
> - One dongle license for up to ten color cameras on USB Stick
>
> Requires:
>
> - Option *Runtime License* [3600-1]

Additional GigE card [3602-1]

> The option *Additional GigE* card is a 4-port network interface card. The quantity is (**1-2**) cards.

The physical items delivered with this option:

- One 4-port GigE card, Cognex CFG-8724

Requires:

- Option *GigE Vision Ready Line* [3601-2]

Additional color camera [3603-1]

xx1900001574

The option *Additional color camera* is Basler acA1440-73gc GigE color camera.

The quantity is (1-9) cameras.

The physical items delivered with this option:

- One Basler acA1440-73gc GigE color camera with ABB specified firmware
- Industrial Ethernet cable 20 m
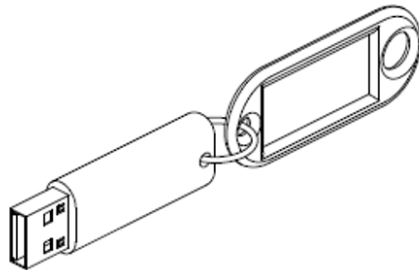- Power and signal cable 10 m

Requires:

- Option *Gigabit Ethernet Ready* [3601-X]

Accessories options

PickMaster Vision Sim. [3604-1]

One dongle license on USB Stick enabling all PickMaster vision functions using imported bitmap images but without the ability to connect cameras.

The quantity is (1-5).

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The physical items delivered with this option:

- One dongle license for up to eight color cameras on USB Stick

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Related Robotware options for IRC5

PickMaster Cell Ready [1580-1]

      Enables PickMaster runtime process with vision.

PickMaster Robot Ready [1580-2]

      Enables PickMaster runtime process for one robot without vision.

PickMaster Vision Ready [1581-1]

      Adds vision process capability if PickMaster Robot Ready was already selected.

      Robot Ready + Vision Ready = Cell Ready

      For more information, refer to *Product specification - Controller software IRC5 3HAC050945-001*.

Related Robotware options for OmniCore

PickMaster Cell Ready [3152-1]

      Enables PickMaster runtime process with vision.

PickMaster Robot Ready [3152-2]

      Enables PickMaster runtime process without vision.

PickMaster Vision Ready [3153-1]

      Adds vision process capability if PickMaster Robot Ready was already selected.

      Robot Ready + Vision Ready = Cell Ready

      For more information, refer to *Product specification OmniCore C line 3HAC065034-001*.

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4 Licensing

Licensing

PickMaster® Twin is licensed to customers for use on a particular PC for a particular time period and connected robot controllers. It is protected from unauthorized use though its Activation procedure.

PickMaster PowerPac

The activation key unlocks the premium functionality of PickMaster PowerPac on one PC for the duration of the subscription period. The PickMaster PowerPac premium functionality is required for building new PickMaster solutions. It also requires a RobotStudio premium license.

PickMaster Runtime

The activation key unlocks the runtime operator for PickMaster Twin runtime Operator built on ABB Ability Zenon 8.0 for one PC on the runtime target system. The license is permanent.

RobotWare PickWare

Three licenses are available: PickMaster Cell Ready, PickMaster Robot Ready, PickMaster Vision Ready. The licenses on the connected robot controllers are checked by PickMaster Runtime on the host PC in the installation. The licenses are permanent.

For more information, refer to *Product specification - Controller software IRC5 3HAC050945-001* and *Product specification OmniCore C line 3HAC065034-001*.

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5 System Requirements

Engineering: PickMaster PowerPac

- Windows 10 (64 bit) PC, recommended 1920x1080, performance according to RobotStudio recommendation. Higher performance is recommended for solutions with high number of robots in a solution.

- Software installations:
    - RobotStudio 2022.3.2
    - PickMaster Twin Client, which includes PickMaster PowerPac, Virtual Runtime and Real Runtime.

- For creating a new solution, license requirements:
    - An activated RobotStudio license
    - An activated PickMaster PowerPac license.

For more information, refer to *Product specification - RobotStudio 3HAC026932-001*.

Host system: PickMaster Runtime and Operator

- Windows 10 (64 bit) IPC, 2GHz, 500 GBit SSD, 8 GBit RAM, with recommended 17'' 1920x1080 multi-touch screen. Minimum two USB slots, one Ethernet port and one free PCI Express slot for a 168 mm x 110 mm size PCIE card. Unmanaged Ethernet switch (robot network)

- Robot controller:
    - IRC5 with RobotWare 6.15.03
    - Omnicore with RobotWare 7.10.

- Software installations:
    - ABB Zenon 8.0
    - PickMaster Twin Host, which includes PickMaster Operator and Real Runtime.

- License requirements:
    - On host PC: PickMaster Runtime license.
    - On robot controller: PickMaster Cell ready or PickMaster Robot Ready or PickMaster Vision Ready

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6 Supported Languages

PickMaster PowerPac and PickMaster Operator supports the following languages:

- English
- Simplified Chinese
- German
- Italian
- Spanish
- Japanese
- French
- Korean

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