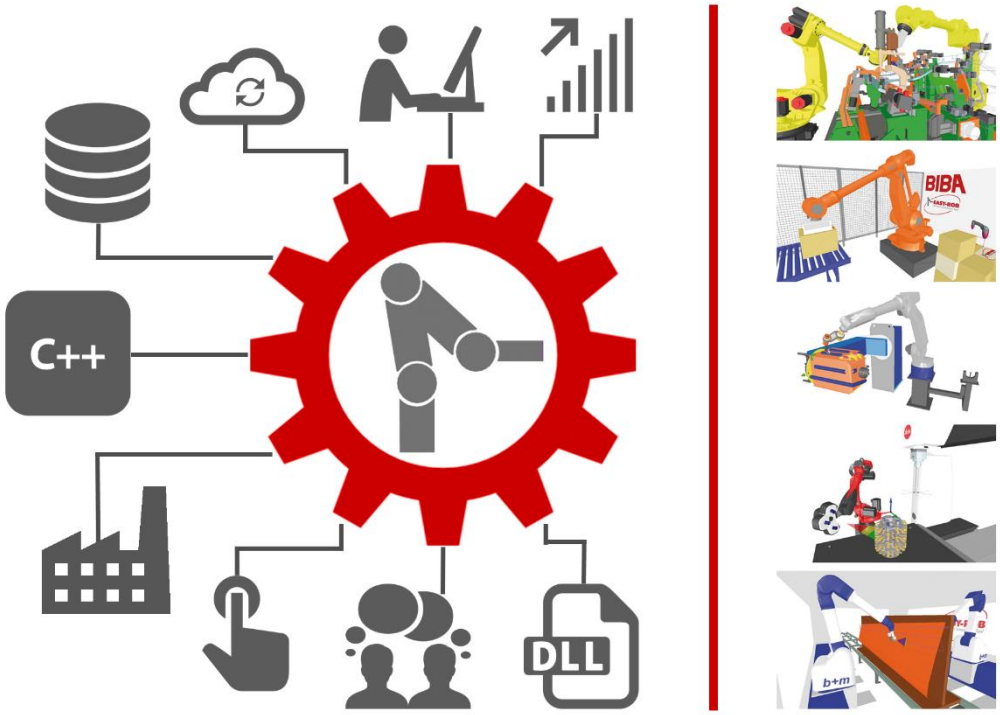
Product Description

EASY-ROB™



November 2021

Version 3.3

EASY-ROB Software GmbH Hauptstr.42 65719 Hofheim am Taunus Germany Phone: +49 6192 921 70-77 FAX: +49 6192 921 70-66 info.er@easy-rob.com www.easy-rob.com

EASY-ROB Software GmbH Hauptstr.42 65719 Hofheim am Taunus Germany Phone: +49 6192 921 70-77 FAX: +49 6192 921 70-66 info.er@easy-rob.com www.easy-rob.com

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EASY-ROB Software GmbH Hauptstr.42 65719 Hofheim am Taunus Germany Phone: +49 6192 921 70-77 FAX: +49 6192 921 70-66 info.er@easy-rob.com www.easy-rob.com

The Product EASY-ROB™

EASY-ROB™ is a planning and simulation software for robots and other kinematics based on 3D CAD files. All applications for example assembly, coating or handling can be programmed and the robot motions as well as the virtual production plant will be immediately visualized in a 3D scene.

It does not matter if you have only one kinematic or several robots- with EASY-ROB ™ you plan your work cells, check the reachability, collisions, travel ranges, estimate cycle times and thus increase the predictability and reduce startup times considerably.

Finally you can translate the created simulations by post processors in machine code and apply it to real systems.

Your advantages

- Quick checking and visualizing of automation ideas

- Feasibility studies at a reasonable price
- Increasing planning and investment security

- Efficient programming of processes
- Reduction of startup times
- Recording of simulation results for clients

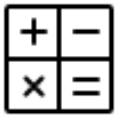
Applications

- Layout planning e.g. of robot work cells

- Checking of reachability, collisions and travel ranges
- Cycle time analysis and estimations

- Offline programming
- Sales assistance
- Training and education

- Feasibility studies for the development of new machine concepts
- Individual product customization by APIs (Application Programming Interface)
- Integration of own mathematic procedures and solutions (API)



You can use the Product Suite with common PCs. EASY-ROB™ is available as a 64-bit application for Microsoft® Windows®.

For the user-friendly experience a graphics adapter with dedicated memory and NVIDIA GeForce/ATI chip set is recommend. EASY-ROB™ uses the OpenGL™ graphic library (version 2.0 and higher).

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All Features at a Glace

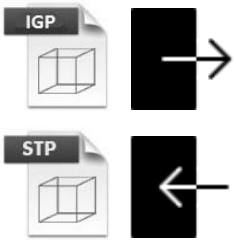
Robot libraries

- Brands
  - ABB / FANUC / KUKA / Yaskawa / PKM DELTA / STAUBLI / TRICEPT/ Universal Robots
  - adept / b+m / Comau / Denso / Eisenmann VarioRobots / Güdel / igm / Kawasaki / Mitsubishi / OTC-Daihen / Unimation

At the moment we have more than 1000 kinematic- models for EASY-ROB™.
Libraries will be delivered including positioners, conveyors etc. (if available).

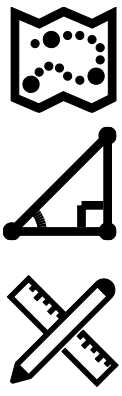
- Modeling of individual devices and robots
  - Positioners, grippers, turn tables as well as special kinematics
  - Attributes e.g. travel ranges, max. speeds and accelerations
  - Formula Parser with mathematical functions
  - Numerical Solver for inverse kinematics of individual robots in Denavit-Hartenberg (DH) Notation and universal coordinates

CAD files- import and export



- Modeling of simple parameterized 3D geometries such as
  - Cubes, spheres, cones and cylinders
- Standard CAD file import
  - IGP / STL ASCII and binary (colored) / 3DS / VRML I + II,97
- Standard CAD files export
  - STL binary (colored), VRML II,97 und IGP part file
- 3D-Tool *)
  - Neutral import interface for: STEP and IGES

Layout planning



- Creation of several paths, containing unlimited number of target locations (TAG Points)
- Paths can be linked to any geometry and/or kinematic
  Thus the process will be defined. Afterwards kinematics and devices will be optimally placed
- Quick exchange of robots and kinematics
- Monitoring of accessibility, travel ranges, speeds and accelerations
- Hierarchical collision detection including tolerances
- Individual measurement functions such as distance- and circle-measurement

***) optional**

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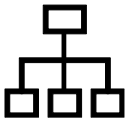
Simulation of work cells

- Window for the current executed robot program
- Realtime displaying of robot status data such as joint data, TCP position, cycle time
- Interpolation types (synchro point to point – PTP, continuous path – LIN, CIRC)
- Smooth and jolt-free speed profiles
- TCP trace is displayed as points or lines with approach vectors in different colors
- During program execution you can change the view using the full shaded mode
- Grap and release of bodies and devices through the robot
- Hierarchical collision detection (bounded boxes, convex and concave hull) including tolerances
- Camera functions
    - Not limited positioning of the camera in the work cell for an individual process view

Programming of robots

- ERPL: EASY-ROB™ Program Language
    - Powerful programming language to create sequence programs including robot motion commands
    - Digital signals and variables for program synchronization
    - Formula Parser with mathematical functions
- ERCL: EASY-ROB™ Command Language
    - Integrated programming language with simulation commands e.g. to enable collisions, TCP trace etc.
- Creating Tag points and paths at the geometry
- Numerical solution for inverse kinematics (redundant robots)
- History Diagram
    - Detailed protocol with graphical display for evaluation and documentation of simulation results
    - Export as jpg or bmp file

Project administration



- Device Manager
    - Management of kinematics components, devices and tools which are stored as an image with short textual description
- Project Manager
    - Database with visualization for customer- or project-specific archiving of work cells

***) optional**

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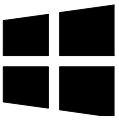
Presentation

- Production of video files (AVI)
- Animated STL- and VRML (I + II, 97)- sequences of the complete work cell layout
- RunTime *)
    - To create protected work cells. These can be loaded and simulated with the free EASY-ROB™ Viewer, see Product Suite.
- 3D-PDF-Export *) Animated 3D PDF of the simulation

User interface – licensing

- Intuitive user interface
- ERC Searcher
    - Easy search function of EASY-ROB™ program commands in existing projects
- You can start EASY-ROB™ on the same PC as often as needed
- Hardware-related licensing (PC linked)
- WibuKey USB-Dongle*)
    - PC- independent licensing procedure
- License-Manager *)
    - To manage and share the existing licenses in the network (LAN)

System requirements



EASY-ROB ™ runs on standard, Windows®-based x64 PCs. A graphics adapter with dedicated memory and OpenGL 2.0 support (or higher) is recommended.

Minimum requirement

- 4 GB RAM for Microsoft® Windows® 7
- Onboard graphics adapter with min. 512 MB RAM

Recommendation

- 8-16 GB RAM for Microsoft® Windows® 10
- Dedicated graphics adapter with 4 GB RAM or higher

Program adjustment with powerful APIs

- Application Programming Interface (API) to integrate your own C code algorithms for:
    - inverse kinematics,
    - trajectory planning and interpolation,
    - position control and
    - dynamic robot model
- Development of own dialogs, sensor interfaces and post processors
- Simulation of the robot dynamic (PPI cascade controller with pseudo analog PI velocity control)
- Several options to customize and extend the basic functionality

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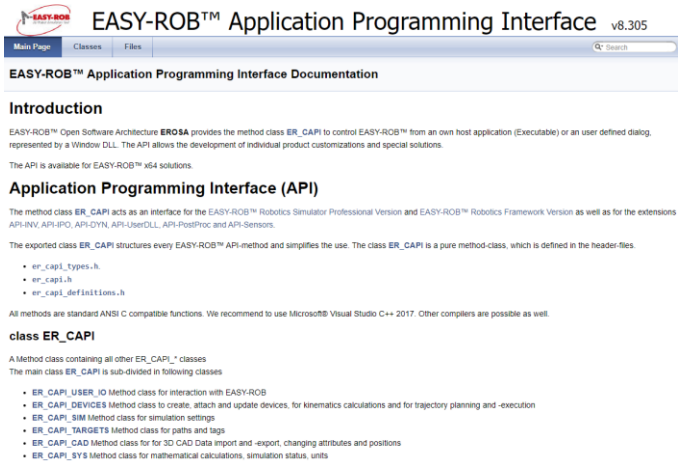
ER_CAPI: API-methods class to program the App (ERA) and Framework (ERF)

C#

C++

- This method class is implemented in App Professional and Framework and is realized via C/C ++ and C#
- Documentation (doxygen) of the methods class ER_CAPI is available for the Internet Explorer https://easy-rob.com/fileadmin/Userfiles/doc/er_capi/index.html



EASY-ROB™ Application Programming Interface v8.305

Main Page | Classes | Files

EASY-ROB™ Application Programming Interface Documentation

Introduction

EASY-ROB™ Open Software Architecture **EROSA** provides the method class **ER_CAPI** to control EASY-ROB™ from an own host application (Executable) or an user defined dialog, represented by a Window DLL. The API allows the development of individual product customizations and special solutions.

The API is available for EASY-ROB™ x64 solutions.

Application Programming Interface (API)

The method class **ER_CAPI** acts as an interface for the EASY-ROB™ Robotics Simulator Professional Version and EASY-ROB™ Robotics Framework Version as well as for the extensions API-INV, API-IPO, API-DYN, API-UserDLL, API-PostProc and API-Sensors.

The exported class **ER_CAPI** structures every EASY-ROB™ API-method and simplifies the use. The class **ER_CAPI** is a pure method-class, which is defined in the header-files.

- er_capi_types.h
- er_capi.h
- er_capi_definitions.h

All methods are standard ANSI C compatible functions. We recommend to use Microsoft® Visual Studio C++ 2017. Other compilers are possible as well.

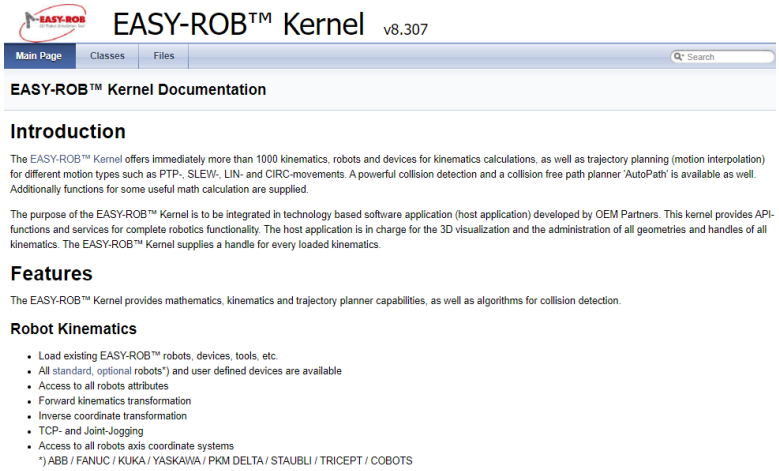
class ER_CAPI

A Method class containing all other ER_CAPI_* classes
The main class **ER_CAPI** is sub-divided in following classes

- **ER_CAPI_USER_IO** Method class for interaction with EASY-ROB
- **ER_CAPI_DEVICES** Method class to create, attach and update devices, for kinematics calculations and for trajectory planning and -execution
- **ER_CAPI_SIM** Method class for simulation settings
- **ER_CAPI_TARGETS** Method class for paths and tags
- **ER_CAPI_CAD** Method class for for 3D CAD Data import and -export, changing attributes and positions
- **ER_CAPI_SYS** Method class for mathematical calculations, simulation status, units

ERK_CAPI: API-methods class to program the EASY-ROB™ Kernel

- Serves as a programming interface for the EASY-ROB™ Kernels and is controlled via C/C ++
- The API-functions, -methods and -services are based on the RRS 1 Interface Description (Realistic Robot Simulation - http://www.realistic-robot-simulation.org)
- Documentation (doxygen) of the methods class ERK_CAPI is available for the Internet Explorer https://easy-rob.com/fileadmin/Userfiles/doc/erk_capi/index.html



EASY-ROB™ Kernel v8.307

Main Page | Classes | Files

EASY-ROB™ Kernel Documentation

Introduction

The EASY-ROB™ Kernel offers immediately more than 1000 kinematics, robots and devices for kinematics calculations, as well as trajectory planning (motion interpolation) for different motion types such as PTP-, SLEW-, LIN- and CIRC-movements. A powerful collision detection and a collision free path planner 'AutoPath' is available as well. Additionally functions for some useful math calculation are supplied.

The purpose of the EASY-ROB™ Kernel is to be integrated in technology based software application (host application) developed by OEM Partners. This kernel provides API-functions and services for complete robotics functionality. The host application is in charge for the 3D visualization and the administration of all geometries and handles of all kinematics. The EASY-ROB™ Kernel supplies a handle for every loaded kinematics.

Features

The EASY-ROB™ Kernel provides mathematics, kinematics and trajectory planner capabilities, as well as algorithms for collision detection.

Robot Kinematics

- Load existing EASY-ROB™ robots, devices, tools, etc.
- All standard, optional robots*) and user defined devices are available
- Access to all robots attributes
- Forward kinematics transformation
- Inverse coordinate transformation
- TCP- and Joint-Jogging
- Access to all robots axis coordinate systems

*) ABB / FANUC / KUKA / YASKAWA / PKM DELTA / STAUBLI / TRICEPT / COBOTS

Both APIs are available in two versions:

1. The first original version exports only ANSI C functions
2. The second version wraps those functions and exports the method class (wrapper class) ER_CAPI or ERK_CAPI, which leads to a better structure and ease the usage

***) optional**

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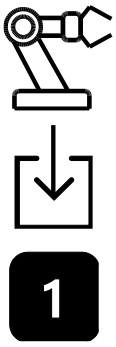
EASY-ROB™ Product Suite

The EASY-ROB™ Product Suite provides for each application the right solution. It does not matter whether as App Professional or as a Framework in your own software family.

The Product Suite serves all your virtual process steps and supports you throughout. From planning the robot work cell, to the testing reachability, collisions and travel ranges, up to the cycle time analysis and program generation.

For more details please see "All Features at a Glace".

EASY-ROB™ App Professional (ERA)

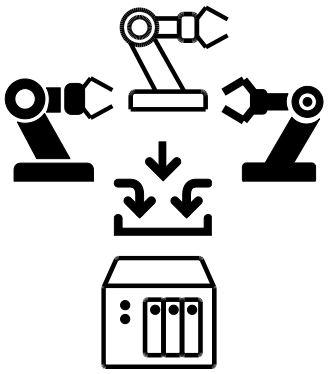


As Single-Robot variant, the entry-level version also enables you to gain professional access to the virtual programming world!

- For robot work cells with only one (1) robot. Robots are defined by minimum 4 axis and can move to Cartesian targets (TAGs). The number of kinematics like grippers, turntables and/ or conveyors is not limited in loading, linking and simulating.
- For each work cell and all kinematics only one program is loaded. All kinematics are controlled by this program sequentially, but will not move simultaneous.
- With the Robot-Plus option you can upgrade the Single- to a Multi-Robot variant.

Item No.: er_sw01

EASY-ROB™ App Professional (ERA)



- The number of robots and programs for each work cell is not limited.
- Kinematics such as grippers, turntables and/or conveyors can be loaded, linked and simulated as often as required.
- With App Professional you can move several robots and kinematics synchronized and simultaneous. The different programs communicate by I/O-signals.

Item No.: er_sw07

EASY-ROB™ Viewer

With the cost-neutral EASY-ROB™ Viewer you can simulate existing work cells.

Program specific functions are available such as different views, start, stop or creating video files. This version is especially developed for marketing and sales employees to improve e.g. presentations.

The user can load and simulate existing and prepared robots and protected work cells. All functions of App Professional are available including capturing movies (AVI) and the animated VRML export.

You can get the EASY-ROB™ Viewer for free at https://easy-rob.com/en/easy-rob_app/.

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EASY-ROB™ App Professional (Educational)

EASY-ROB offers for universities and colleges for practical training the Educational versions. These are not released for production use (noncommercial).

For more details please see "All Features at a Glace".

Item No.: er_sw07e

Single-Robot Variant

Item No.: er_sw01e

EASY-ROB™ Framework (ERF)

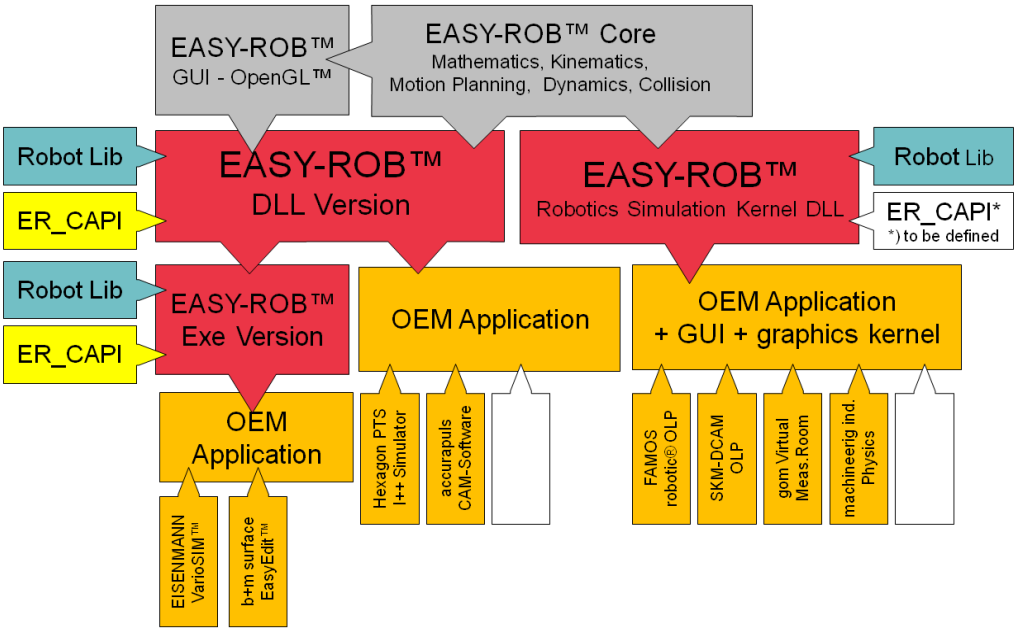
The EASY-ROB™ Framework is a robotics SDK (Plugin) and allows the integration of the EASY-ROB™ functionality into technology based software application (host application) developed by OEM Partners. Using available API-Functions and the exported method class ER_CAPI, the EASY-ROB™ Framework can be controlled completely form the host application.

The EASY-ROB ™ Framework starts as an OpenGL ™ window without title, menu, toolbars and status bar and can be placed anywhere by using Windows®-handles within your own application.

Existing work cells, robots, devices, robot assemblies, tools etc. can be loaded, connected and controlled by using the API. The complete robotics functionality is available. In case of collisions or exceeding of travel ranges while simulation, EASY-ROB™ will report the events to the host application.

EASY-ROB™ Framework includes the range of EASY-ROB™ App Professional plus the API-UserDLL functionality (Item No.: er_api04).

EROSA - **E**ASY-**R**OB™ **O**pen **S**oftware **A**rchitecture



Item No.: er_sw05

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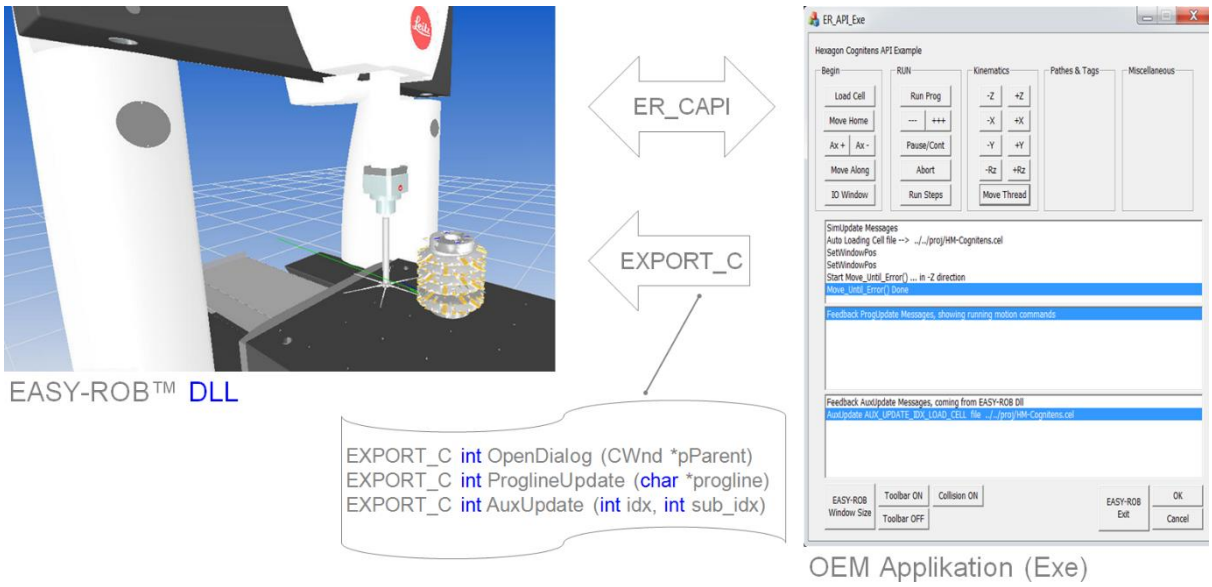
Your advantages

- Integration into your own technology-based applications
- Bidirectional control of EASY-ROB™ by more than 1000 API- functions (ER_CAPI)
- Placement of the OpenGL™ window into your own application
- Benefit from the available robotics Know-How und robot libraries
- Collision detection with tolerances
- AutoPath™ collision free path planning
- C# Wrapper for .NET Framework, available for Windows® as a 64-bit library

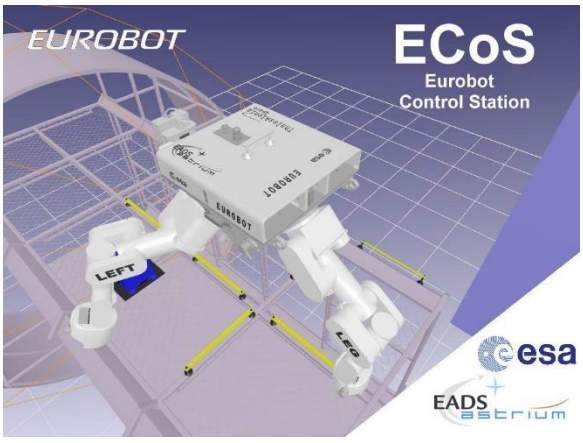
The usage of the EASY-ROB™ Framework is very versatile:

Schematic representation

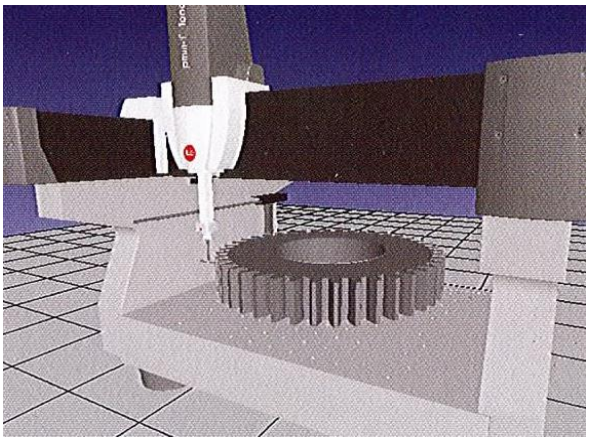


API – methods class ER_CAPI

Integration examples



Eurobot Control Station **ECoS**, EADS astrium



Quindos with I++ Simulator,
Hexagon Manufacturing Intelligence

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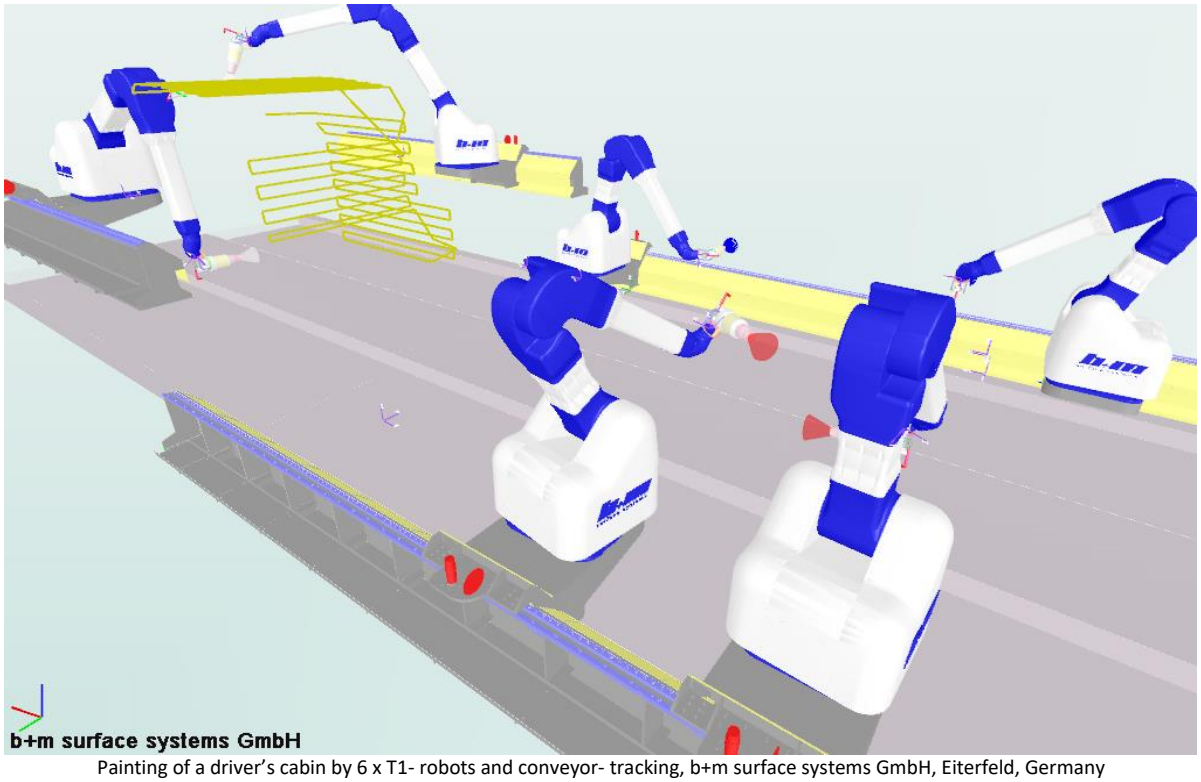
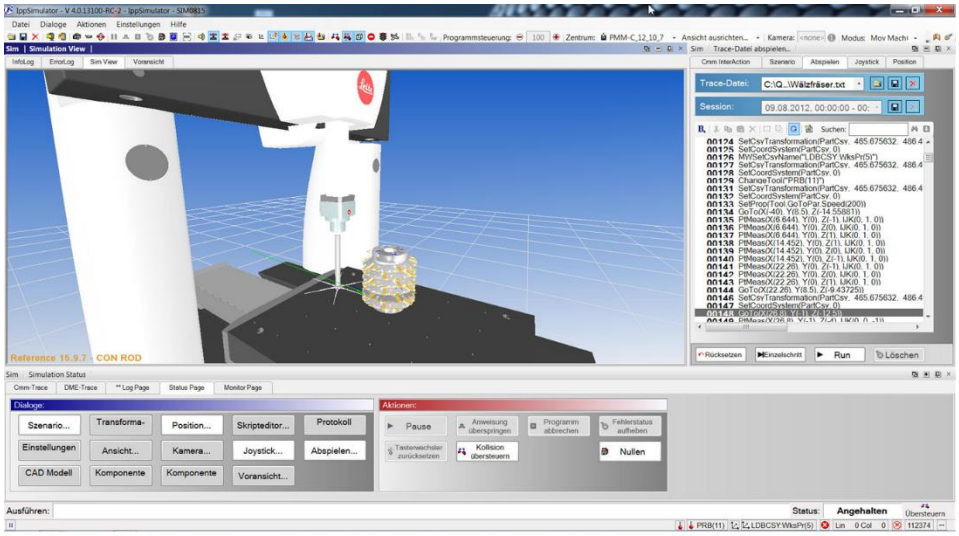
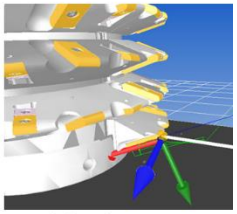
Integration examples

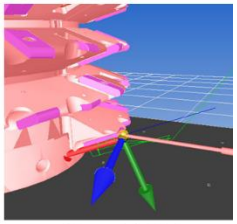


Painting of a driver's cabin by 6 x T1- robots and conveyor- tracking, b+m surface systems GmbH, Eiterfeld, Germany





taktile Antastung



positive Kollision

Hexagon Metrology PTS GmbH, I++ Simulator, Quindos

We recommend the Microsoft® Visual C++ compiler for the usage of the EASY-ROB™ Framework.
(Usage of C++/C# under reserve)

For the individual implementation, we are pleased to offer our services!

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EASY-ROB™ Kernel (ERK)

Boost your application!

If you need professional robotics functionality, the EASY-ROB ™ Kernel is exactly the right solution!

The Kernel offers immediately more than 1000 robots, turn tables, tools etc. for kinematics calculations as well as a trajectory planner (PTP-, LIN-, CIRC- und SLEW-movements).

The EASY-ROB ™ Kernel is a plug-in and is ready to be integrated in technology-based software applications (host application) from OEM partners. Only API-functions and services (method class ERK_CAPI) for robotics functionality are provided. The host application handles 3D visualization as well as the administration of all geometries and handles of all kinematics.

Advantages

- Integration in own applications
- Bidirectional control of the kernel
- Robotics know-how
- Kinematic calculations
- Trajectory planning: path planning and execution (Path interpolation, IPO)
- Robot libraries
- Collision detection with tolerances
- 3D visualization by host application
- Available for Windows® as a 64-bit library

Kinematic of robots and devices

- Load more than 1000 robots, devices, tools etc. from all available robot libraries
- Forward transformation
- Inverse coordinate transformation
- Access to all positions of robot axis coordinate systems

Item No.: er_sw06

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Trajectory planning and execution

- Motion types: fully synchronized PTP, LIN, CIRC und SLEW
- Smooth and phase synchronous velocity profile
- Tool-guided movement
- Workpiece-guided movement (external TCP)
- Track motion (LVA)
- Conveyor tracking
- Tracking windows (boundary up and down)
- Synchronization with external positioner (turn tables)
- Wait time
- Automatic reduction of velocity e.g. due to a singularity
- Cycle time analysis and estimation

Schematic presentation

More than 1000 robots, positioners and other devices available

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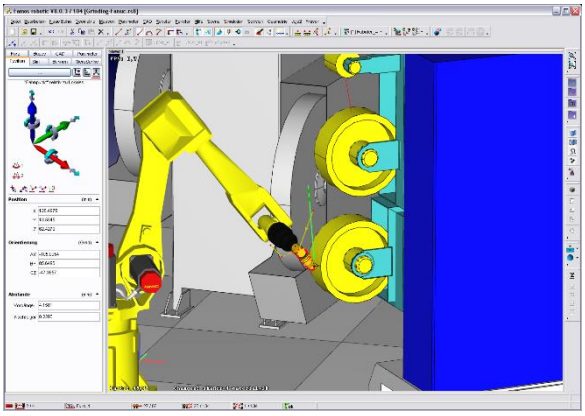
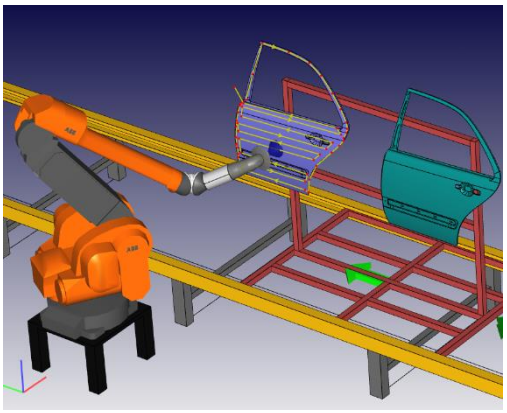
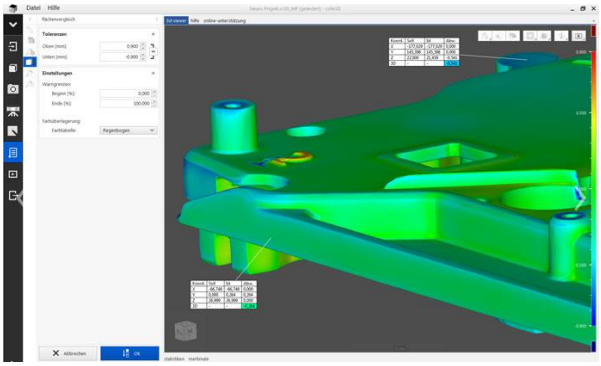
Integration examples



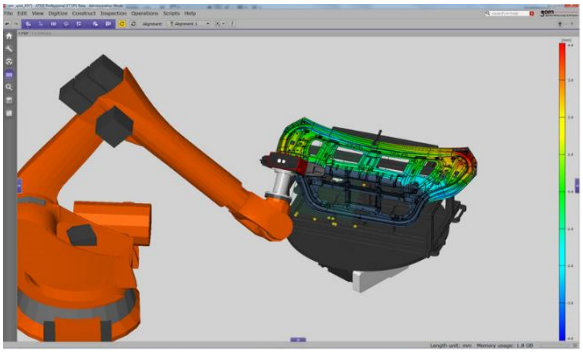
Offline programming system FAMOS robotic®,
carat robotic innovation GmbH, Dortmund, Germany



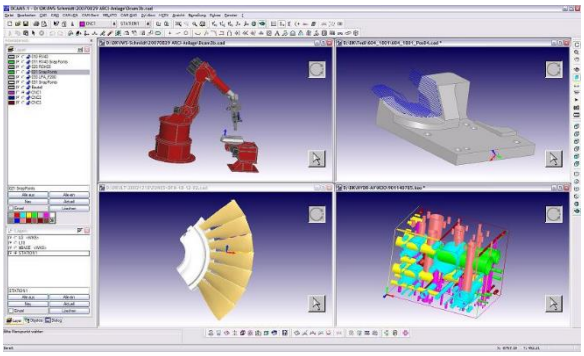
FAMOS robotic®, painting using conveyor tracking
carat robotic innovation GmbH



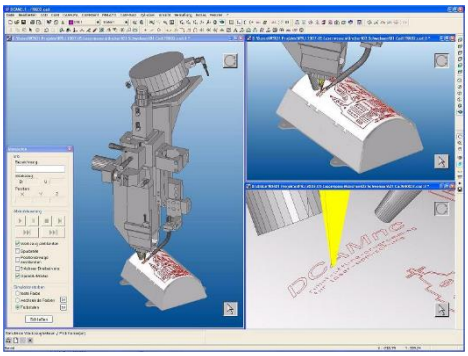
VISIO 7 - Automatisierungssoftware,
Carl Zeiss Optotechnik GmbH



ATOS Professional, GOM GmbH



SKM-DCAM, S.K.M, Informatik GmbH, Schwerin, Germany



Laser- cladding, S.K.M, Informatik GmbH

We recommend the Microsoft® Visual C++ compiler, other may be possible, too.
(Usage of C++/C# under reserve).

For the individual implementation, we are pleased to offer our services!

Item No.: er_sw06

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VISU

3D Visualization for Industry

The powerful EASY-ROB™ VISU is designed for integration into technology-based software applications. Finally, visualize processes, display problems, or just let your customers and colleagues see the new project-

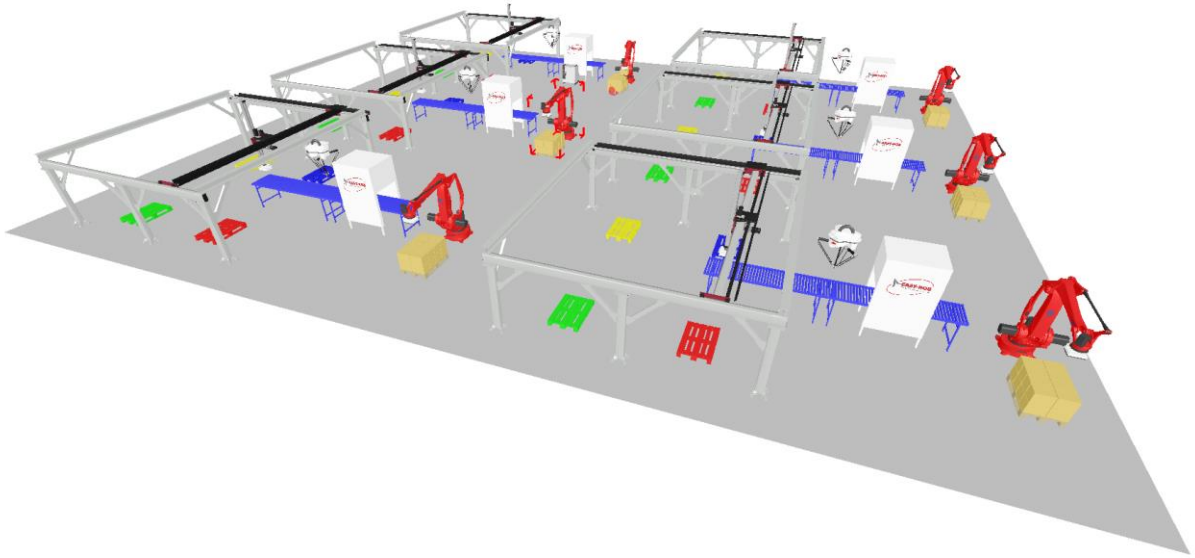
With EASY-ROB™ VISU, Industry 4.0 starts in your own software solution!

Advantages

- Price performance advantage by self-development
- High performance with low hardware requirements
- Technology-based software solutions
- No dedicated memory required
- Free placement of the OpenGL™ window
- Available for Windows® 32- and 64-Bit

Application possibilities

- Animation and simulation
- Advertising and sales
- Displaying of sensor data
- Real-time connection
- Positioning of geometries
- Industry-independent



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Features

More than 1000 times in use-

Now finally free available! Thanks to the open software architecture EROSA, EASY-ROB™ VISU is now available

OpenGL™ Engine

- Robust graphics engine based on the OpenGL™ graphics library

AVI Recorder

- Integrated creation of video files in many resolutions

Integration

- Detailed doxygen documentation
- Programming examples for MS Visual Studio® C/C++ und C#

Mathematics

- Method class for math. calculations, e.g. of homogeneous matrices
- Conversion of angles, triangle calculation and formula parser etc.

Measuring tools

- Position, distance, diameter etc.

Camera function

- Static / movable and freely positionable as often as required

API

- C/C++ und C# Method class ERVisu_CAPI

CAD Import

- CAD files – import and export
- Modeling of simple parameterizable 3D geometries

Art. Nr.: er_sw05v

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Collision

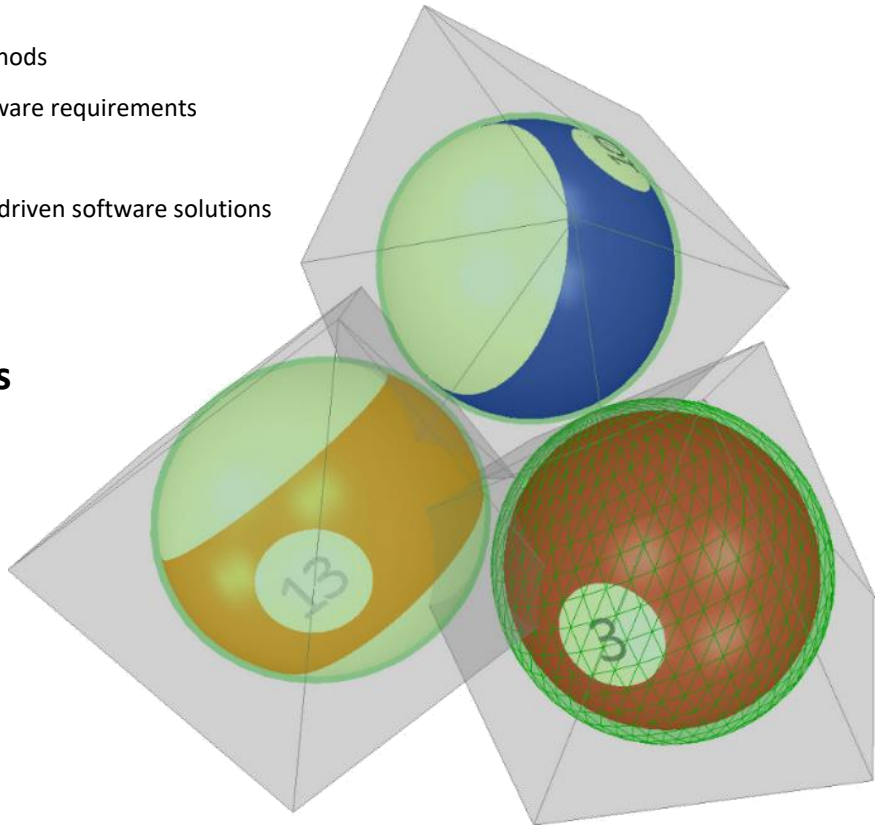
Collision Detection of 3D Objects

The high-performance EASY-ROB™ Collision is used for integration into technology-based software applications. Quickly and accurately check your 3D application for collisions-

It doesn‘t matter how big your models are, you can rely on EASY-ROB™ Collision!

Advantages

- Including various calculation methods
- High performance with low hardware requirements
- Thread safe
- Easy integration into technology-driven software solutions
- Available for
  Windows® 64-Bit



Application possibilities

- Animation and simulation
- Motion planning
- Assembly tests
- Offline programming
- Measurement protocols
- Virtual Prototyping
- Surgical simulation
- Haptic rendering
- Molecular design
- Industry-independent

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Features

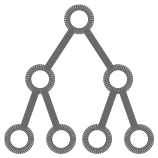
More than 1000 times in use–

Now finally free available! Thanks to the open software architecture EROSA, EASY-ROB™ Collision is now available

Various Calculation Methods

- Collision Detection
- Toleranz
- Distanz Berechnung

Hierarchical representation



- Intelligent and fast with OBBTree-Tight-Fitting

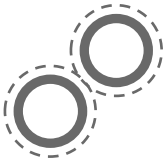
Collision Detection

- Method of whether two triangulated models collide
- Collision detection according to the first colliding triangle pair
- Calculation of all colliding triangle pairs

Threadsafe

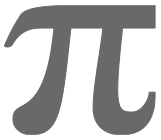
- Parallel collision test safe on multi-core CPU

Clearance



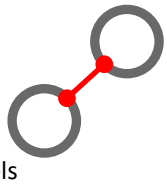
- Checks if two models are closer or further than a defined tolerance distance

Mathematics



- Method class for math. calculations, e.g. of homogeneous matrices

Distance



- Calculates the smallest Euclidean distance between two non-colliding models and
- The 2 closest points on the models

Integration

- Detailed doxygen documentation
- Programming examples for MS Visual Studio® C/C++ und C#

API

- C/C++ and C# Method class ERColl_CAPI

Art. Nr.: er_sw04c

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Product Description

EASY-ROB™ Robot Libraries

EASY-ROB™ has libraries ready of all common robot types of the market- overall more than 1000 items! Not yet implemented robots, machines, tools and handling systems you can easily and quickly “virtual recreate” in EASY-ROB™. Either you do it on your own or with us.

For your individual kinematic, we are pleased to offer our services!

Attributes of all models:

- Axis velocities and accelerations,
- Axis offsets and turn directions,
- Axis travel ranges with kinematic dependencies,
- Cartesian boundaries and
- Management of several tools and home positions.

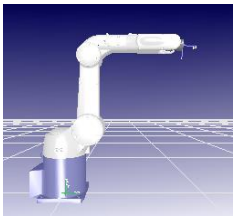
Attributes as far as possible conform to manufacturer’s details e.g. from data sheets.
In order to achieve realistic simulation results, the attributes can be changed according to the requirements and saved as a new robot model.

Brands

adept

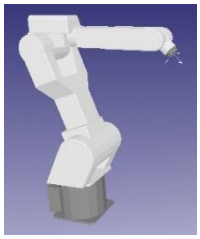
b+m

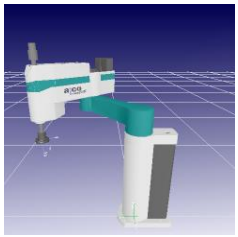
COMAU


DENSO

GUEDEL

IGM


KAWASAKI


Manz-Automation

MITSUBISHI

OTC-Daihen

Reis

UNIMATION

EISENMANN

Schunk

Universal Robots

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KUKA

Art. Nr.: er_ir01

Stäubli

Art. Nr.: er_ir02

Tricept®

Art. Nr.: er_ir04

ABB

Art. Nr.: er_ir05

Yaskawa

Art. Nr.: er_ir06

FANUC

Art. Nr.: er_ir07

Universal Robots

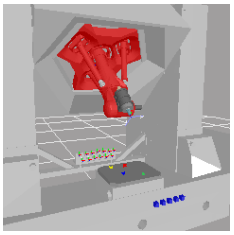
Art. Nr.: er_ir08

PKM-Delta

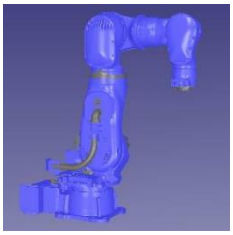
Art. Nr.: er_ir09

KUKA

Stäubli


Tricept®

ABB


Yaskawa

FANUC

PKM-Delta

Fanuc

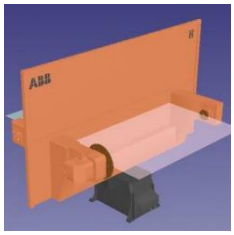
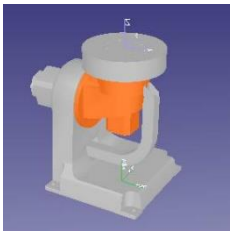
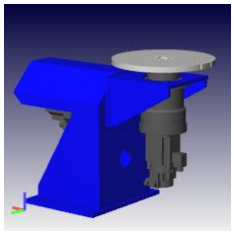


ABB Positioner


KUKA Positioner


Yaskawa Positioner

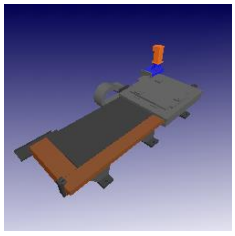
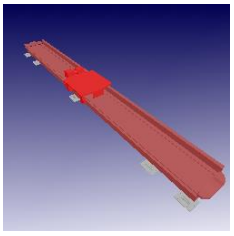


ABB Track


KUKA Track

KUKA

ABB

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Product Description

EASY-ROB™ Options and APIs

Overview

Additional to the basic functions of the EASY-ROB™ App Professional-, -Framework- and -Kernel version, there are other options and APIs (Application Programming Interface).

EASY-ROB™ is designed fully modular and allows through its open system architecture (EROSA) complete freedom in configuring of your version. Each and every option and API can be booked individually, allowing an easy customization of EASY-ROB ™.

Benefit from the assortment of powerful APIs!

EASY-ROB™	App/Framework		KERNEL	Item No
Products	Single-Robot	Multi-Robot	ERK	
OpenGL™ VISU	Included	Included	×	sw05v
Collision	Included	Included	✓	sw04c,erk04
ER_CAPI	✓	✓	×	api**
ERK_CAPI	×	×	Included	-
Robot Libraries	✓	✓	✓	ir**,opk**
Modules				
3D-PDF Export	✓	✓	✓	op11
RunTime	✓	✓	×	op09
Robot-Plus	✓	Included	✓	op10,erk03
AutoPath™	✓	✓	✓	op07,erk05
Remote Control	✓	✓	×	op01
ToolBox	×	×	✓	opm08
NC Simulation	✓	✓	×	op02
APIs				
API-KIN	✓	✓	✓	api01,opa01
API-IPO	✓	✓	×	api02
API-DYN	✓	✓	×	api03
API-UserDLL	✓	✓	×	api04
API-Post Process	✓	✓	✓	api05,opa05
API-Sensor	Included	Included	×	free of charge
3D-Tool	✓	✓	×	ca1
License-Manager	✓	✓	✓	op03

✓ = available; × = not available; Included = already contained

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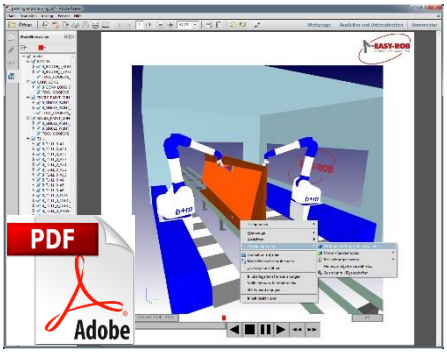
3D-PDF Export



With the EASY-ROB™ 3D-PDF Export option the entire simulation run of a work cell can be saved as an animated 3D-PDF file, opened with the free Adobe Reader XI and then started as a simulation.
Visualize conveniently and easily your project and share it with customers, partners and colleagues.

To ensure a proper operation, at least the use of Adobe Reader Version XI (11.0.10) is recommended.

Item No.: er_op11

RunTime

By the use of the RunTime option protected work cells can produced and then be loaded and simulated in the free EASY-ROB™ Viewer. Screenshots, AVI videos and animated VRML files can then be generated from the Viewer.

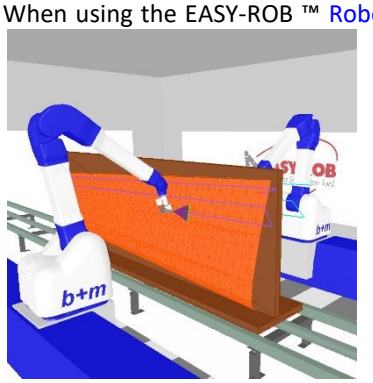
The RunTime option is ideal for supporting sales and in customer presentations. Simulations and results can be forwarded as needed to customers or added to an offer.

Item No.: er_op09

Robot-Plus

Useful extension for the App Professional– in combination with the Robot-Plus option the Single-Robot version becomes a Multi-Robot variant.

When using the EASY-ROB ™ Robot-Plus option any number of robot kinematics (* .rob files) with inverse kinematic solution and more than three axes can be loaded and moved in a work cell. Next this option allows for each kinematic and robot loading a separate program and to simulate all of them synchronized.



The programs can interact by I/O-signals. Functions like "Wait_Until_Signal_Set" and "Wait_Until_Signal_Unset" simplify synchronization.

The maximum number of loaded programs is limited by the loaded kinematics of a cell, but these are arbitrary.

Robots or kinematics with up to three axes, as conveyors, positioner or XYZ-gantries do not need the Robot-Plus option and can be loaded as many times as needed.

Item No.: er_op10

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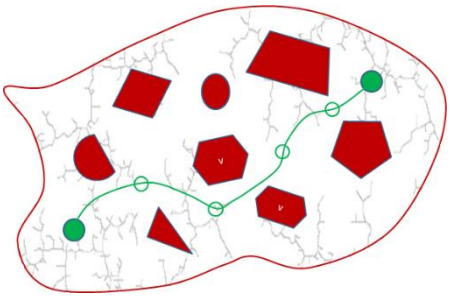
AutoPath™



The EASY-ROB™ option AutoPath™ generates collision-free paths. The calculation simplifies the operator's job significant.

In the first step, the user selects a collision free start and end location, in which the travel ranges of the robot are in a valid position. Then the "Find path" function determines a collision-free path. As a result several intermediate joint values are generated and shown in the AutoPath™ dialog. These can be pasted into the robot program teach window. An optimum result is achieved if the process know-how of the operator is combined with AutoPath™.

Note: Only for users with at least one EASY-ROB ™ license.

Item No.: er_op07

Remote Control

The EASY-ROB™ Remote Control interface supports data exchange with other software programs and external systems such as NC or robot controls, measurement systems and various input devices. The interface is based on a standardized TCP/IP socket connection, so the data exchange can take place in the LAN and over the Internet.

The aim of the Remote Control interface is the 3-dimensional visualization of the real process. To establish a connection between EASY-ROB™ and an external system, an Application Program Interface (API) is provided with the Dynamic Link Library (DLL) "er_remote.dll" and an example program in the programming language C/C++ is available. The communication is based on so-called OpCodes followed by the actual information.

Item No.: er_op01

MATLAB® Remote Control

With the MATLAB® Remote Control EASY-ROB™ can be used as a 3D visualization system for calculations in MATLAB®. The interface is based on a standardized TCP/IP socket connection (Internet/LAN). In addition to the transfer of axis values from MATLAB® to EASY-ROB™ all ERPL and ERCL commands can be sent.

The option MATLAB® Remote includes the option EASY-ROB™ Remote Control.

Item No.: er_op04

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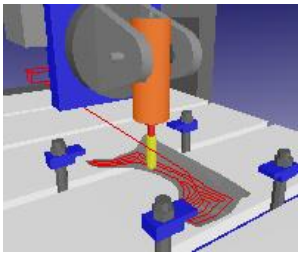
NC-Simulation



The NC-Simulation option allows to model your NC machine using 3D data from a CAD or CAD/CAM Systems. The ROBMOD modelling feature enables you to create 3-, 4- or even 5-axis machines. In addition to the internal programming language ERPL (EASY-ROB Program Language), also NC code in accordance to DIN 66025 can be interpreted and executed.

N00001 G90
N00002 G00 X323.0Y-11.5 Z649.0 A39.9860 B114.0308
N00003 G01 X-100.0Y0.0 Z260.0 A0.0000 B90.0000
N00004 G02 X423.0Y0.1244 I161.5 J0.0
….

The NC code is executed and the machine and tool motions are visualized immediately. The "Program Window" shows the current executed block number. Several output windows display the machine status data, such as the TCP location, machine axis-values, -speeds and -accelerations, motion time of current executed block and the total cycle time. The collision feature “COLL” detects collisions during the NC program simulation. Critical machine data are monitored, and the simulation can stop on collisions, exceeded travel ranges and/or maximum axis speeds or accelerations. The "Teach Window" allows to execute every block in single step mode and also backwards. During the simulation run you can pan, tilt and zoom the 3D-scene. Further information you’ll get in the document „EASY-ROB-NC-Import-Description“.

In conjunction with the API-Post-Process option NC code can also be translated into robot programs.

Item No.: er_op02

EASY-ROB Software GmbH Hauptstr.42 65719 Hofheim am Taunus Germany Phone: +49 6192 921 70-77 FAX: +49 6192 921 70-66 info.er@easy-rob.com www.easy-rob.com

API-KIN Kinematics

The API-KIN enables you to fully integrate user-defined kinematics.

The API is used to develop user-defined functions to solve the forward as well as inverse kinematic problem (IKP). Solutions for parallel kinematic machines (PKM) can also be developed with this interface as well as numerical solution concepts.

By means of exported functions the user has direct access to the robot information such as kinematic lengths, direction of rotation, axis offsets, travel ranges or the TCP position. Mathematical routines to handle homogeneous transformation matrices are available as well as trigonometric functions for angle, triangle and trapezoid calculations.

An example project for the Microsoft® Visual C++ compiler is available and will generate the Dynamic Link Library (DLL) er_kin.dll; the DLL can have arbitrary solutions.

Item No.: er_api01

API-IPO Trajektroy Planner

The API-IPO allows to develop and program your own trajectory planning and execution.

With this API you can develop user defined functions for the trajectory planning (interpolation) of the motions types PTP (synchronized point-to-point interpolation), LIN (linear interpolation) und CIRC (circular interpolation).

An example project for the Microsoft® Visual C++ compiler is available and will generate the Dynamic Link Library (DLL) er_ipo.dll; the DLL can have 12 solution each motion type.

Item No.: er_api02

API-DYN Dynamic

By means of the API-DYN option you can develop and program the dynamic behavior as well as the position control of the robot.

With this API you can develop user defined functions for the position control of the dynamic model of the robot. The dynamic option allows to monitor the position control and the robot model during the simulation.

An example project for the Microsoft® Visual C++ compiler is available and will generate the Dynamic Link Library (DLL) er_dyn.dll; the DLL can have 12 solution.

Item No.: er_api03

EASY-ROB Software GmbH Hauptstr.42 65719 Hofheim am Taunus Germany Phone: +49 6192 921 70-77 FAX: +49 6192 921 70-66 info.er@easy-rob.com www.easy-rob.com

API-UserDll

The API-UserDll option will customize EASY-ROB™ individual to your needs. Application-specific (own) dialogs can be developed, which will be automatically loaded with every program start of EASY-ROB and can then be operated.

Frequently used functions like load / save of work cells and robots, jogging of axis or the TCPs, simulation -start, -stop or -abort, TCP- trace and collision On/Off etc. can be combined clearly in one dialog for the end user. The user benefits from the whole robotics functionality, own implemented calculations or even communication with external processes or controllers (via TCP/IP).

Finally, the results are visualized in EASY-ROB™, where the axis position of the kinematics or updated geometries are manipulated or positioned accordingly. For example, if a collision or exceeding the travel ranges is detected during simulation, EASY-ROB™ announces these events to the user application (API-UserDLL) that can accordingly react.

By using the API-UserDll the whole range of functionalities of the Microsoft® Visual C++ compiler is available to create dialogs, buttons, lists, edit arrays, check boxes, pictures etc. More than 700 API-functions (ER_CAPI) exported by EASY-ROB™ are available.

Item No.: er_api04

API-Post-Process

The API-Post-Process option is an API for customizing and extending post processors, which convert an ERPL program in a robot program. The existing post processors are written in C code and can be customized and extended individually.

Following robot manufactures or programming languages are already implemented:

- ABB Rapid (S4, IRC5),
- KUKA KRL (KRC1, 2),
- b+m (S3 und X5),
- OTC,
- FANUC TP (RJ3iB, RJ3iC),
- COMAU PDL (C5G),
- Universal Robots UR-Script (UR-Control).

Languages of additional robot manufacturers can be created by modification of the examples. The number of post processors is not limited.

Item No.: er_api05

API-Sensors

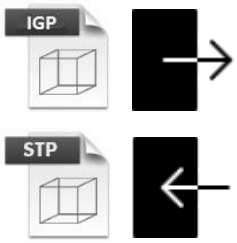
With the aid of the API-Sensors interface you can connect external devices e.g. as a SpaceMouse or digitizers directly to EASY-ROB™ for recording joint values and Cartesian positions for visualization. The interface is open and can be adjusted and programmed freely by the provided API.

Item No.: foc

EASY-ROB Software GmbH Hauptstr.42 65719 Hofheim am Taunus Germany Phone: +49 6192 921 70-77 FAX: +49 6192 921 70-66 info.er@easy-rob.com www.easy-rob.com

Produktbeschreibung

EASY-ROB™ CAD and License Management



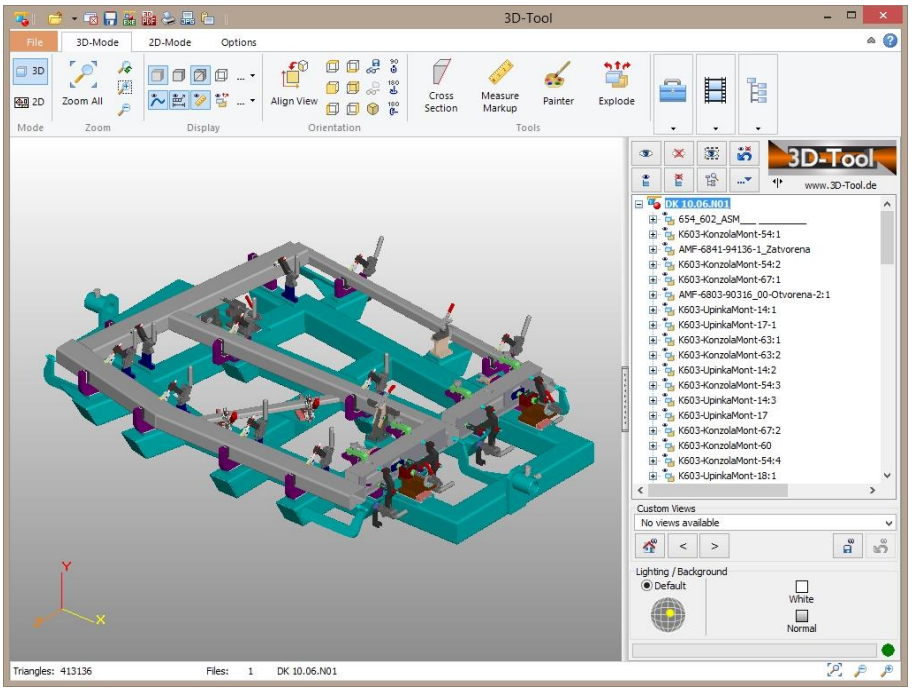
EASY-ROB™ uses powerful interfaces for importing a lot of 3D CAD formats from different CAD systems. EASY-ROB™ App Professional und Framework allow by default to work with following data:

- STL (ASCII, binary, binary with colors)
- 3DS
- VRML II,97

3D-Tool

Due to 3D-Tool *) you can import or convert on your own the file exchange formats STEP and IGES. The 3D-Tool interface is offered as 64-Bit version. The CAD-Converter allows to convert native data formats (CATIA, ProE, NX, etc.) into STL and to modify the tessellation.

- STEP
- IGES



https://www.3d-tool.de/

Item No.: er_ca1

***) optional**

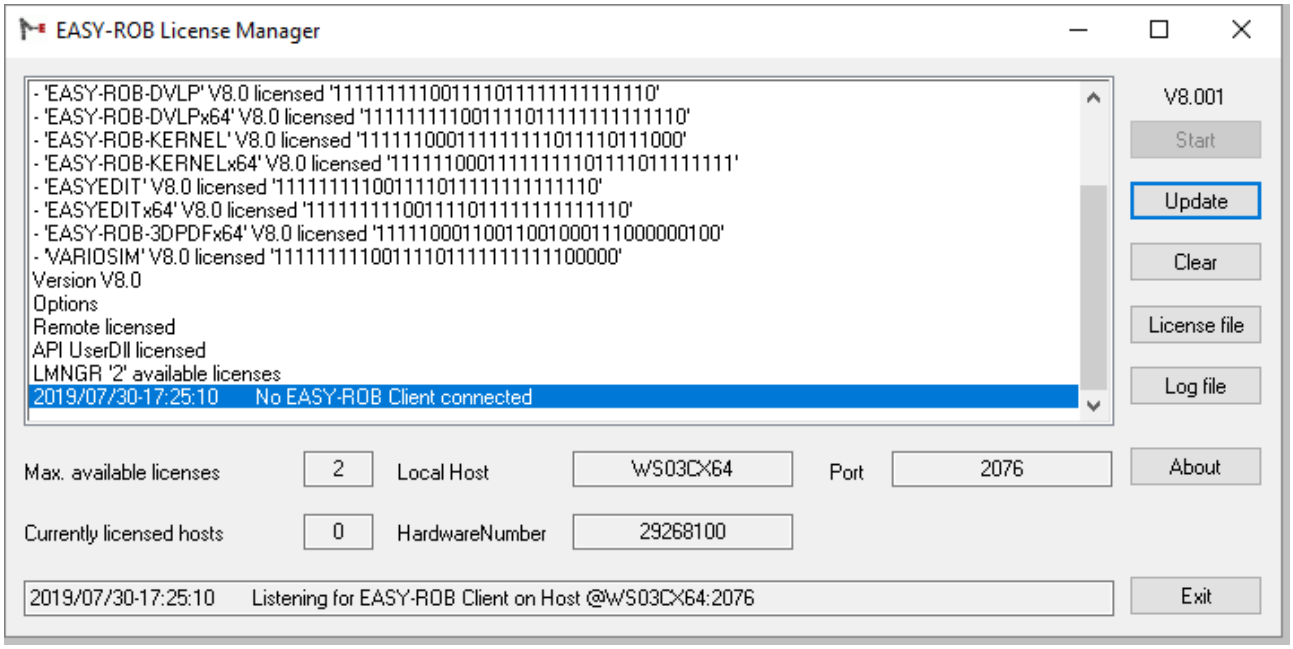
EASY-ROB Software GmbH Hauptstr.42 65719 Hofheim am Taunus Germany Phone: +49 6192 921 70-77 FAX: +49 6192 921 70-66 info.er@easy-rob.com www.easy-rob.com

License-Manager

The License-Manager *) is a floating license program for a centralized administration of several EASY-ROB™ licenses. As started as a license server under Windows® the License-Manager allows to start EASY-ROB™ on each PC in the local area network (LAN).

The number of simultaneously used EASY-ROB™ licenses is limited by the maximum number of purchased licenses. The License-Manager counts repeated executed EASY-ROB™ instances on the same PC only one time.

The licensing with the License-Manager takes places via HardwareNumber or WibuKey dongle, see under *License key for EASY-ROB™.*



Item No.: er_op03

***) optional verfügbar**

EASY-ROB Software GmbH Hauptstr.42 65719 Hofheim am Taunus Germany Phone: +49 6192 921 70-77 FAX: +49 6192 921 70-66 info.er@easy-rob.com www.easy-rob.com

Product Description

EASY-ROB™ License / Hardware

License key for EASY-ROB™

You can choose for the different options for the license key:

- **HardwareNumber**
  Every PC will be identified by its own unique hardware number. The license file "*license.dat*" will license EASY-ROB™ exactly for this PC.

- **WibuKey USB Dongle**

The WibuKey dongle has its own unique identification number. The license file "license.dat" will license EASY-ROB™ for exactly this dongle. If you will use a different PC you just have to replug the dongle*.
*) The WIBU Runtime (dongle driver) has to be installed once on each PC.

Item No.: er_hw03

License agreements

- EASY-ROB™ software products are copyrighted.
- EASY-ROB™ can be used for educational and commercial purposes.
- It is prohibited to use an EASY-ROB™ education or classroom license for commercial or industrial purposes e.g. programming of an assembly line.
- EASY-ROB Software GmbH makes no warranty for the simulation results and any damage that may consequently occur.
- Reselling of any EASY-ROB™ product to third parties is prohibited without written permission on the part of EASY-ROB Software GmbH.
- EASY-ROB™ Viewer version can be used for presentation purposes without written permission.
- The disclosure of the license key to third parties is prohibited without written permission on the part of EASY-ROB Software GmbH.
- The software maintenance is not transferable.

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System requirements / Hardware

The Product Suite is designed for purpose on commercial PCs. The program is available as a 64-bit application for Microsoft® Windows®.

For the user-friendly experience a graphics adapter with dedicated memory and NVIDIA GeForce/ATI chip set is required. EASY-ROB™ uses the OpenGL™ graphics library (version 2.0 and higher).

For large CAD models, we recommend using the EASY-ROB™ 64-bit version and Windows® 7, 8.1 and 10 with at least 8-16 GB RAM.

System requirements

EASY-ROB™ runs on standard, Windows®-based x64 PCs.

Minimum requirement

- 4 GB RAM for Microsoft® Windows® 7
- Onboard graphics adapter with min. 512 MB RAM

Recommendation

- 8-16 GB RAM for Microsoft® Windows® 10
- Dedicated graphics adapter with 4 GB RAM or higher

Navigation

We recommend a three button mouse for a better navigation.

EASY-ROB™ supports the 3D Mouse (Space Mouse) of 3DConnexion. You'll experience an intuitive and more precise three-dimensional navigation through your simulation.

Picture: 3DConnexion, http://www.3dconnexion.com

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EASY-ROB™ Service

Individual services

Our range of services covers different areas. Whether consulting, training or individual customization of EASY-ROB™ – we are happy to help.

To meet increasing demands and individual applications needs, we are pleased to offer our expert consulting.

1. Trainings

Basic training for the safe use of EASY-ROB ™ or individual training for advanced users can take place at the customer site or in the company's headquarters of EASY-ROB.

2. Simulation services and consulting

Service in simulation e.g. layout planning/feasibility checks takes place with EASY-ROB™.

The client will get the results in the EASY-ROB™ format. With the EASY-ROB™ Viewer (free of charge) the client can load and simulate the provided data.

In addition, AVI files or 3D PDF files with animation can be created for the customer.

3. Individual customization

We offer support for an individual customization or extending of EASY-ROB™ by means of the available API options.

4. Development and design of new concepts

Support for development and design of new machine concepts or special kinematics by developing the inverse kinematic solution.

Please feel free to contact us- we are here for you!

EASY-ROB Software GmbH Hauptstr.42 65719 Hofheim am Taunus Germany Phone: +49 6192 921 70-77 FAX: +49 6192 921 70-66 info.er@easy-rob.com www.easy-rob.com

EASY-ROB™ Contact

EASY-ROB Software GmbH

Address: Hauptstrasse 42
65719 Hofheim am Taunus
Germany

Contact: Mr. Stefan Anton

Phone: +49 6192 921 70 -77 / -79
FAX: +49 6192 921 70 66

Email: contact@easy-rob.com
sales@easy-rob.com

Url: www.easy-rob.com

EASY-ROB customer area

Content: Program updates and robot libraries

Web: www.easy-rob.com/en/downloads-2/client-area/

Log in data:

User name: customer
Password: **********

Space for your notes

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