

## The new Version

# EASY-ROB™ V6.3



February 2014

Version 1.2



# EASY-ROB™

## Table of contents

EASY-ROB™ V6.3.....	4
CAD2ER 64-Bit with IGES Import.....	5
Additional robot post-processors .....	6
Complete Robot Libraries .....	7
New kinematic types .....	7
API - Doxygen documentation of class ER_CAPI .....	8
API - Doxygen documentation of class ERK_CAPI .....	9
Robotics Simulation Kernel with new programming examples .....	10
Robotics Simulation Kernel with collision-algorithms.....	10
Robotics Simulation Kernel with new functions .....	11
eLearning Platform at HBZ .....	12
Glossary EASY-ROB™ eLearning.....	13
Index.....	14
Device Manager .....	15
Removing Geometries from the Collision Chain .....	16
Colored STL export from Autodesk Inventor©.....	16
OnScreen world coordinate system for better orientation.....	16
Auto Tag Rename .....	16
3D Animation ON/OFF .....	17
NC-Import and conversion into a robot program .....	17
Contact .....	19
Notes .....	20

## EASY-ROB™ V6.3

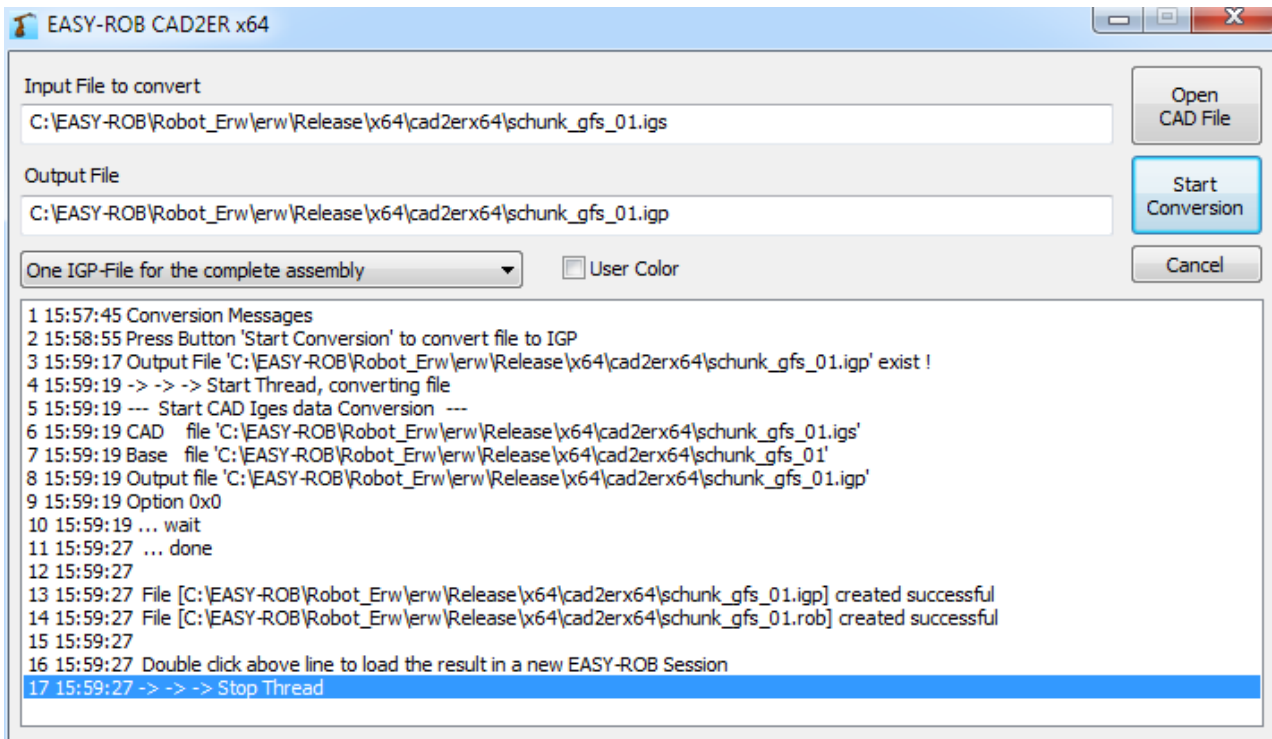
The new version is available free of charge for all customers with a valid license key for EASY-ROB™ V6.3. For customers using older versions, it will be possible to purchase an update.

We would like to thank you for your suggestions and ideas in advance.

Thank you

Stefan Anton  
EASY-ROB  
3D Robot Simulation Tool

## CAD2ER 64-Bit with IGES Import



The new CAD2ER converter is available as 64-Bit-Version, which is advantageous for large files. In addition to Step- and VRML-files, Iges-files can be converted into Igp as well, hereby a device-file (\*.rob) is simultaneously generated.

## Additional robot post-processors

The number of post-processors, which serve as the basis for the extension and the individual customization via API, has increased. Currently, post-processors for ABB, KUKA, Staubli, Comau C5G, Fanuc, Motoman and Universal Robots are available.

The API [Post-Process](#)\*) allows to produce program code for other controllers as well. The manufacturers listed below are examples only.



EASY-ROB™ is a manufacturer-independent robot simulation program

\*) the option API [Post-Process](#) is required

## Complete Robot Libraries

EASY-ROB™ provides libraries for the integration of all major types of robots in the market - ABB, b+m, Comau, Denso, Dürr, Eisenmann, Fanuc, Guedel, igm, Kawasaki, Kuka, Mitsubishi, Motoman, OTC-Daihen, Reis, Staubli, Tricept, Unimation, Universal Robots.

Additional robots, machines, tools and handling systems can easily and quickly be reconstructed virtually inside the EASY-ROB™ application

The robot libraries of ABB, Kuka, Staubli, Fanuc and Motoman are almost completely and permanently maintained. These also include positioners and external axes.

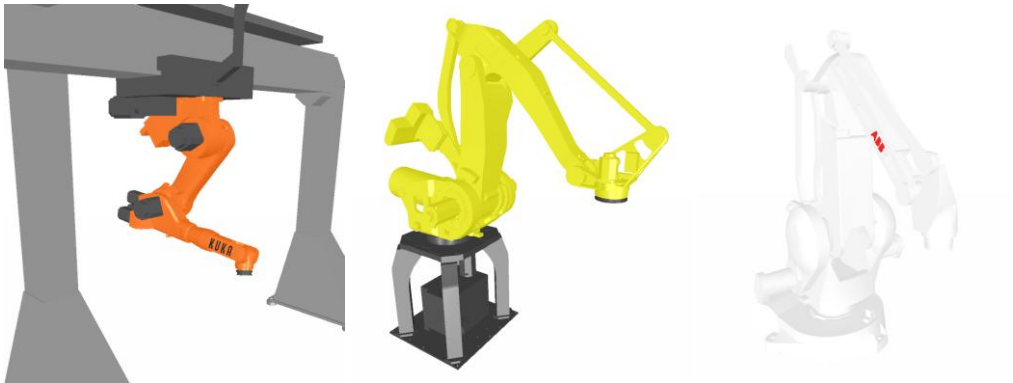
Actually more than 800 robots of different manufacturers are available.

For further informations see:

<http://www.easy-rob.com/en/product/extensions/robot-libraries.html>


## New kinematic types

Jet- and palletizing-robots have been added to existing robot-types.



## API - Doxygen documentation of class ER\_CAPI

For the control of EASY-ROB™ and for individual product customization the methods class [ER\\_CAPI](#) provides a variety of functions, which is documented with doxygen \*).



# EASY-ROB™ Application Programming Interface

v6.304

[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™ x86 and x64 solutions.

### Application Programming Interface (API)

The method class [ER\\_CAPI](#) acts as an interface for the EASY-ROB™ Multi-Program Version and EASY-ROB™ DLL 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-function 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](#)

All methods are standard ANSI C compatible functions. We recommend to use Microsoft® Visual Studio C++ 2008, 2010, 2012 or 2013. 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, update devices, for kinematics calculations and for motion 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

### class [ER\\_CAPI\\_USER\\_IO](#)

Method class for interaction with EASY-ROB

- [ER\\_CAPI\\_USER\\_IO\\_FILE](#) Method class to load and save work cells-, robots-, tool-files, etc.
- [ER\\_CAPI\\_USER\\_IO\\_DIALOG](#) Method class, supplies dialogs, i.e. to enter and show values
- [ER\\_CAPI\\_USER\\_IO\\_PICK](#) Method class to "pick" objects such as devices, tags, polygon, vertices, measure distances, ...
- [ER\\_CAPI\\_USER\\_IO\\_CRUISE](#) Method class to manipulate the 3D Scene

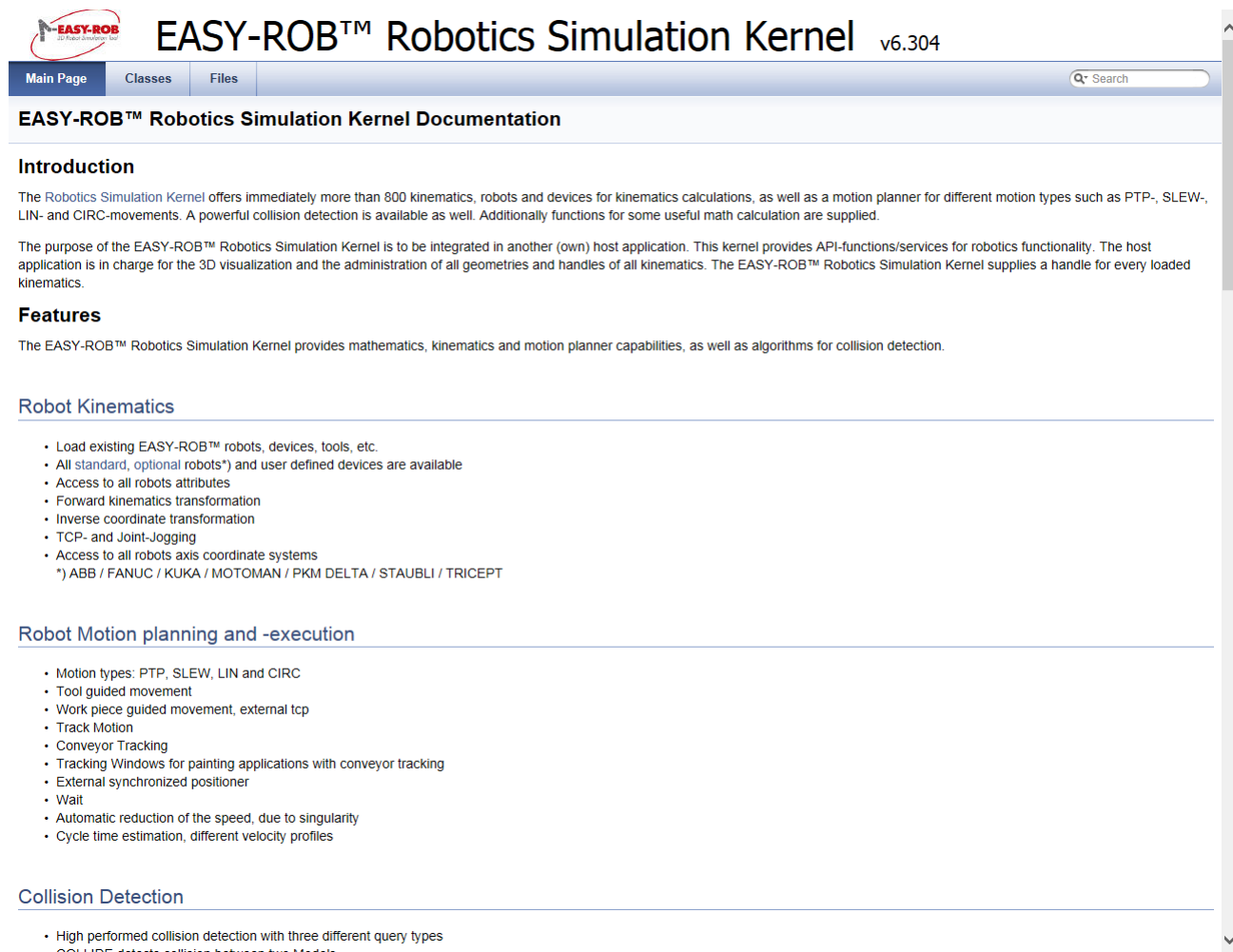
### class [ER\\_CAPI\\_DEVICES](#)

[ER\\_CAPI](#) documentation in Internet Explorer and as compiled HTML file available

\*) doxygen is a software documentation tool developed by Dimitri van Heesch.

## API - Doxygen documentation of class ERK\_CAPI

For the integration of the EASY-ROB™ Robotics simulation kernel in technology-based software solutions the methods class [ERK\\_CAPI](#) provides a variety of functions, which is documented with doxygen \*).



**EASY-ROB™ Robotics Simulation Kernel v6.304**

**EASY-ROB™ Robotics Simulation Kernel Documentation**

### Introduction

The Robotics Simulation Kernel offers immediately more than 800 kinematics, robots and devices for kinematics calculations, as well as a motion planner for different motion types such as PTP-, SLEW-, LIN- and CIRC-movements. A powerful collision detection is available as well. Additionally functions for some useful math calculation are supplied.

The purpose of the EASY-ROB™ Robotics Simulation Kernel is to be integrated in another (own) host application. This kernel provides API-functions/services for 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™ Robotics Simulation Kernel supplies a handle for every loaded kinematics.

### Features

The EASY-ROB™ Robotics Simulation Kernel provides mathematics, kinematics and motion 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 / MOTOMAN / PKM DELTA / STAUBLI / TRICEPT

### Robot Motion planning and -execution

- Motion types: PTP, SLEW, LIN and CIRC
- Tool guided movement
- Work piece guided movement, external tcp
- Track Motion
- Conveyor Tracking
- Tracking Windows for painting applications with conveyor tracking
- External synchronized positioner
- Wait
- Automatic reduction of the speed, due to singularity
- Cycle time estimation, different velocity profiles

### Collision Detection

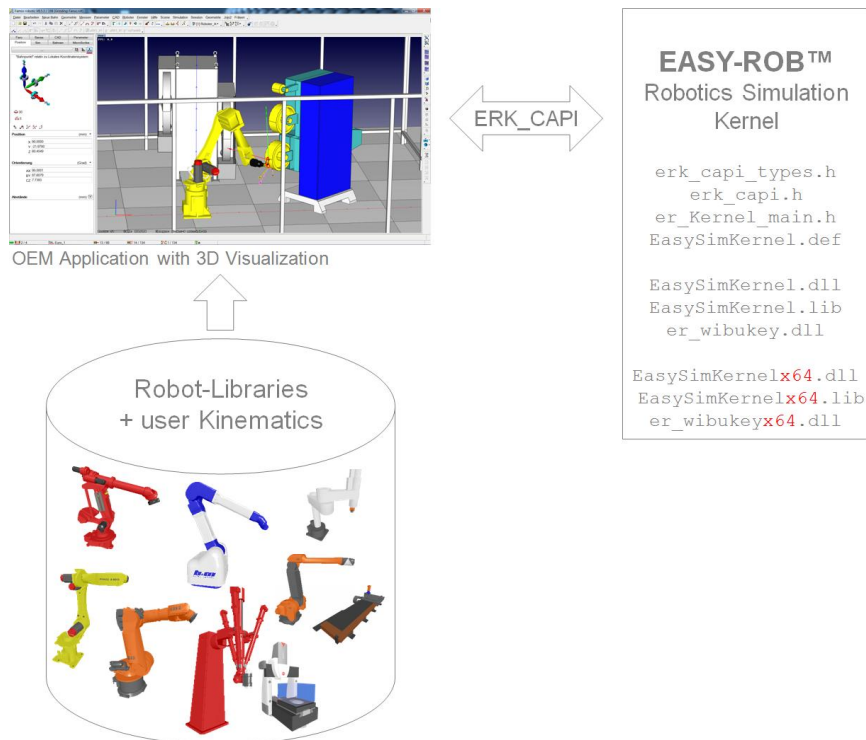
- High performed collision detection with three different query types
- COLLIDE detects collision between two Models

[ERK\\_CAPI](#) documentation in Internet Explorer and as compiled HTML file available

\*) doxygen is a software documentation tool developed by Dimitri van Heesch.

## Robotics Simulation Kernel with new programming examples

For the integration of the EASY-ROB™ Robotics simulation kernel in technology-based software solutions numerous examples are available that facilitate the application of the methods class ERK\_CAPI.



The examples are available as Visual Studio 2010 project.

For further information see

<http://www.easy-rob.com/fileadmin/Userfiles/doc/erk-example-documentation.pdf>

## Robotics Simulation Kernel with collision-algorithms

Powerful collision algorithms are integrated in the EASY-ROB™ Robotics Simulation Kernel. In the hierarchical collision detection, tolerances are also considered (near miss collision). It is based on triangulated geometries that are pre-loaded, so that high performance is achieved during the simulation.

## Robotics Simulation Kernel with new functions

- Method: `erGetJointSolutions (...)`

`int ERK_CAPI_ROB_KIN::erGetJointSolution(ER_HND er_hnd, double *q_solutions, long *warnings)`  
delivers all calculated angles after the call of an inverse kinematic transformation e.g. `erInvKinRobotBaseTcp()`. The host-application can decide which solution respectively robot-configuration should be selected (shortest angle movement).

- Method: `erGetCurrentStepData (...)`

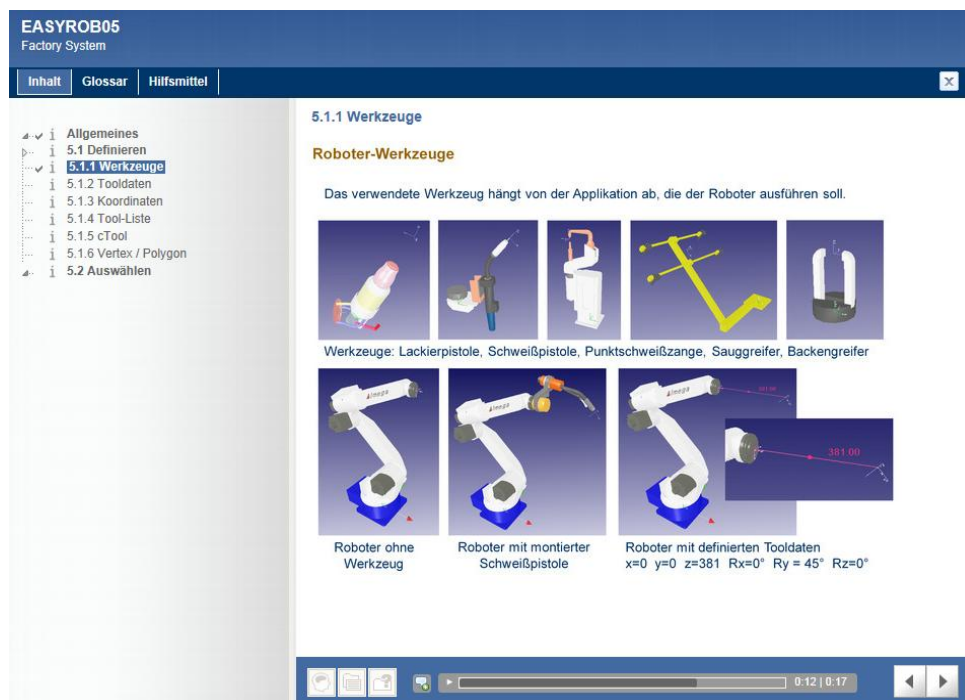
`int ERK_CAPI_MOP_EXEC::erGetCurrentStepData (ER_HND er_hnd, CURRENT_STEP_DATA *p_current_step_data)`

can be called after each `erGet_Next_Step()`. The Struct `CURRENT_STEP_DATA` contains information about the status, number of paths, the current calculated target with corresponding axis values, speeds and accelerations, turns, calculated values of external axes, length of path, distance to path, distance on path to target position (important for setting events) etc.

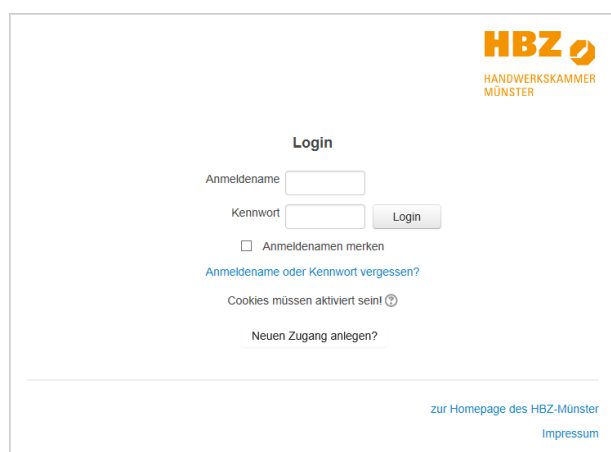
Further information can be removed from the Struct `CURRENT_STEP_DATA`.

## eLearning Platform at HBZ

In cooperation with the Chamber of Crafts in Münster, Germany (HBZ-craft training center) an eLearning platform with a total number of 25 modules for EASY-ROB™ and around the topic of robot arc welding has been developed.



Example: "Module 5 - Robot Tool data"



**HBZ**  
HANDWERKSKAMMER  
MÜNSTER

**Login**

Anmeldename:

Kennwort:

☐ Anmeldenamen merken

[Anmeldename oder Kennwort vergessen?](#)

Cookies müssen aktiviert sein! ⓘ

[zur Homepage des HBZ-Münster](#)

[Impressum](#)

<https://www.hbz-online.de/login/index.php>

Customer with a valid EASY-ROB™ software maintenance and support contract, you can use this platform free of charge.

## Glossary EASY-ROB™ eLearning

All keywords and terms that are used in EASY-ROB™ are explained in the glossary. They are also provided with a reference to the corresponding e-learning module.

### Glossar: EASY-ROB e-Learning



Abkürzung/ Name	Beschreibung	Description	Modul
<b>(Re)attachen</b>	Allgemein: Anbinden von Devices, Pfaden oder Tagpunkten	In general: Attaching devices, paths	8.3
<b>3D CAD Window</b>	Dialog, um 3D-Geometrien und deren Positionen (z.B. Referenz- und Offset-Position) zu manipulieren bzw. Attribute (z.B. Farbe) zu ändern	Dialog to manipulate 3D-geometries and their positions (e.g. reference- and offset-position) respectively to change attributes (e.g. colours).	0.2
<b>3DS</b>	3Ds MAX (Dateiendung *.3ds); Neutrales CAD-Format, das in EASY-ROB™ übernommen werden kann	3Ds Max (file-extension: *.3ds); neutral CAD-format, which can be overtaken into EASY-ROB™	19.1
<b>3D-Szene</b>	Gehört zur Bedienoberfläche von EASY-ROB™ siehe auch: "Arbeitswelt"	Belongs to the user interface of EASY-ROB™ see also: "Arbeitswelt"	0.1
<b>Accessory Robot</b>	Zubehör-Gerät mit nur einer Rotationsachse	Accessory unit with one rotational axis	15.1
<b>Achswert</b> <b>Joint value</b>	Jede Achse eines Roboters besitzt bei bestimmter Stellung des TCPs einen fest definierten Achswert. Mit einem Klick auf den "Joint-Button", können die Achswerte im "Robot Joint Values-Dialog" für jede Achse des Roboters geändert werden	Each robot-axis has a defined axis-value at a certain position of the TCP. The Joint values can be changed in the "Robot Joint Values-dialogue" for each axis of the robot, by clicking on the "Joint-Button"	11.1
<b>Actual Joint Speed and Acceleration</b>	Istwert-Geschwindigkeit (linear: [mm/s]; rotatorisch: [deg/s]) bzw. Istwert-Beschleunigung (linear: [mm/s²] rotatorisch: [deg/s²]) der Roboterachsen	Actual joint speed (linearly: [mm/s]; rotatory: [deg/s]) respectively actual joint acceleration (linearly: [mm/s²]; rotatory: [deg/s²])	12.4
<b>Approach Direction</b>	Die Approach Direction wird durch die "Approach Achse" eines Tags bzw. Roboters definiert und bezeichnet sozusagen die "Annäherungsrichtung"	The Approach direction is defined by the "approach axis" of a tag respectively robot. It describes so to say the "direction of approach".	14.3
<b>Arbeitswelt</b>	3D-Szene. Gesamte grafische Umgebung der EASY-ROB™-Software, in der z.B. Arbeitszellen zur Simulation erstellt werden	3D-scene. Complete graphical environment of the EASY-ROB™-Software, in which for example work cells for simulation can be created.	0.1
<b>Arbeitszelle</b> <b>Work cell</b>	Eine Arbeitszelle beinhaltet den gesamten Zellaufbau, bestehend aus Roboter, Werkzeug, Zuführeinheiten, Positionierer, Umgebung (Zaun, Wand)	A work cell contains the whole cell-structure, consisting robots, tools, feeders, positioner and environment (fence, wall)	7.0
<b>Asynchrones PTP</b> <b>Asynchronous PTP</b>	Asynchrones Point-To-Point, siehe auch "SLEW". Bewegungsart: Alle Achsen beginnen zur gleichen Zeit mit der Bewegung und erreichen die Zielposition zu unterschiedlichen Zeiten. Es erfolgt keine Synchronisation mit den anderen Achsen, es ist also keine Leitachse vorhanden (keine zeitliche Synchronisation)	Asynchronous Point-To-Point, see also "SLEW". Motion Type: All axes start their movement at the same time and reach their target position at different times. There is no synchronisation with the other axes. There is no master axis (no time-based synchronisation)	16.9

Screenshot: Glossary with additional indication of the eLearning Modules

## Index

The index makes it easy to search for terms and to seek the corresponding detailed explanations in the operation references, update descriptions of older versions and eLearning modules.

### EASY-ROB™ Index



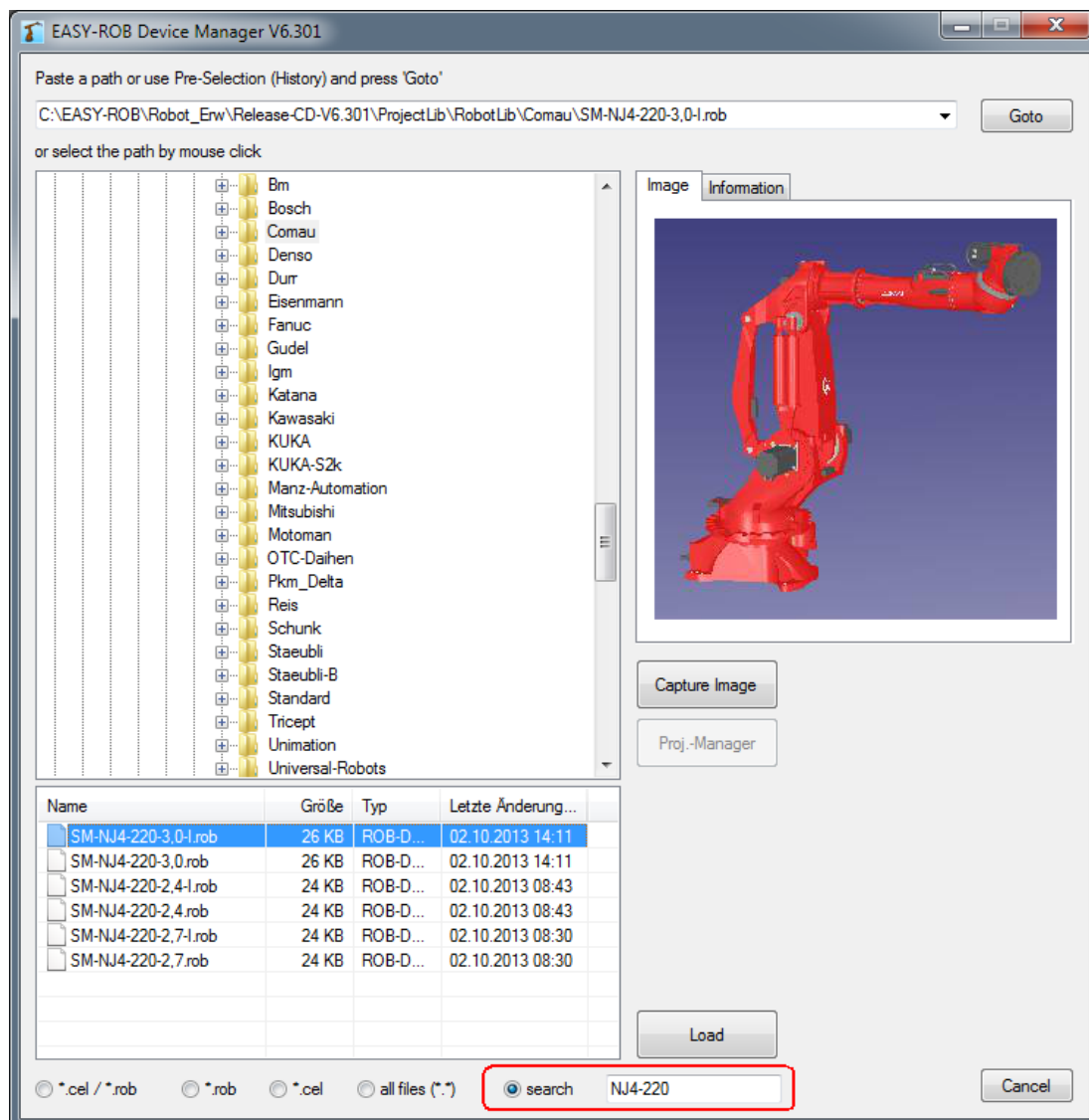
	E-Learning	Tutorial	Operat. Ref.	Spec. Fct.	Update EASY-ROB™								
					v6.0	v5.6	v5.3	v5.006	v5.0	v4.606	v4.603	v4.305	v4.007
Message Window	4.3												
Microsoft Foundation Class (MFC)											7		
Mimic file		6											
Mirror (paths)					23								
Mirror (tags)					26								
Mirror plane					26								
Mirror Tags					26								
Modify World View	2.1	7											
Module (EASY-ROB™ Simulation Kernel)					21								
Monitoring Message Datei (Moni_msg)	22.4		19						14				
MOP (API)					39								
MOP_PATH (API)					39			22					
MOP_PATH_DATA (API)							24						
Motion Commands (Teach Window)										17			
Motion Planner			88		20								
					21								
Motion Planner example (PTP, LIN, CIRC)					20								
Motion Planner example (sync. Positionierer)					20								
...													
O													
Offline programming					33								
Online Output Window		53					9				16		
OpenGL™											7		
Operation						8							
Orientation (Floor)												4	
Origin (TCP Trace)												5	
OTC-Daihen robots						17							
Override-commands										20			
P													
Pan Mode		7											
Parser functions								19					
Parser Vars (Online Output Window)											16		
Partial copy (tags)					23								
Passive Joint											12		

Screenshot: Index with page numbers in the proper document

## Device Manager

The huge number of devices or robots in a directory can impede the careful selection of the desired robot.

A new filter function allows entering a search word (e.g. "NJ4-220"), so only devices with this keyword are listed.



A click on the "search" button lists only desired devices and simplifies the selection.

## Removing Geometries from the Collision Chain

Not all geometries which are visualized in the 3D scene must be available in the collision list. For each geometry, an individual decision can be made in 3D CAD window.

This reduces the loading time for work cells and kinematics and saves valuable memory.

## Colored STL export from Autodesk Inventor©

Autodesk Inventor © is a widely used CAD program.

Colors for STL files are not defined but agreed. If a colored STL file is saved out of Autodesk Inventor ©, the coloring will be taken over into EASY-ROB™.

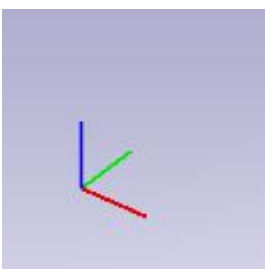
For further information see:

[http://en.wikipedia.org/wiki/STL\\_\(file\\_format\)#Color\\_in\\_binary\\_STL](http://en.wikipedia.org/wiki/STL_(file_format)#Color_in_binary_STL)

## OnScreen world coordinate system for better orientation

Probably many customers have been waiting for it. Now it's available for a better orientation. However, there are also opponents: "Who needs it anyway!"

An "OnScreen World Coorsys" is now also available in EASY-ROB™.



## Auto Tag Rename

Tags are permanently added, deleted or moved in order within the Tag Window. The numbering has changed. With "Auto Tag Rename" selected, all the tags of a path will be renumbered and order is restored again.

## 3D Animation ON/OFF

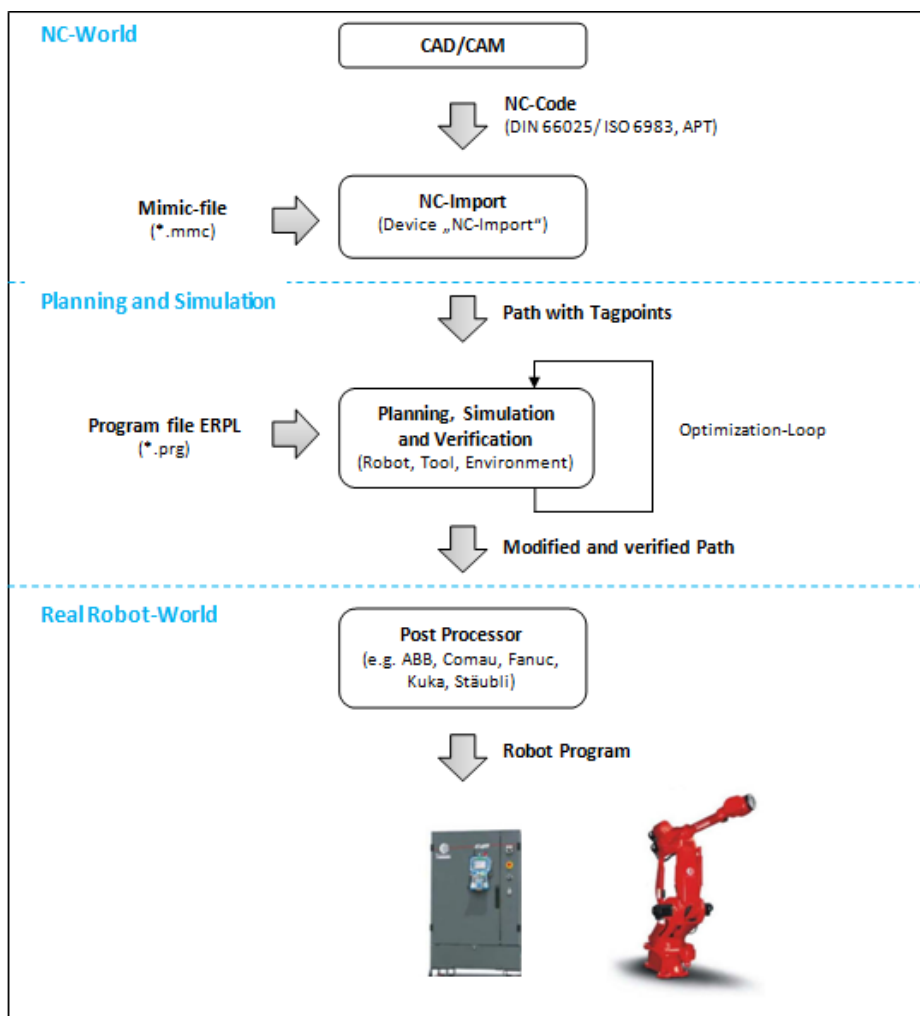
During the simulation, the graphical update can be disabled.



The simulation stops when STOP\_SWE, STOP\_COLLISION or similar functions are activated or at the end of simulation. Thus, the cycle time can be determined quickly.

## NC-Import and conversion into a robot program

That's new: NC programs can be imported. After that you can plan, simulate and verify until the robot moves along the generated NC path without any error. Last but not least a robot program can be created using a post-processor.



General work flow



## Contact

### EASY-ROB 3D Robot Simulation Tool

Stefan Anton

Hans - Thoma - Str. 26a, 60596 Frankfurt/Main, Germany

Tel. +49 (0) 69 677 24 287

Fax. +49 (0) 69 677 24 320

Email: [contact@easy-rob.com](mailto:contact@easy-rob.com)  
[sales@easy-rob.com](mailto:sales@easy-rob.com)

Web: [www.easy-rob.com](http://www.easy-rob.com)

### EASY-ROB Customer area

Online available: Program Updates and Robot libraries

Web: [www.easy-rob.com/en/special/customer-area](http://www.easy-rob.com/en/special/customer-area)

Access data:

User:	customer
Password:	*****

## Notes