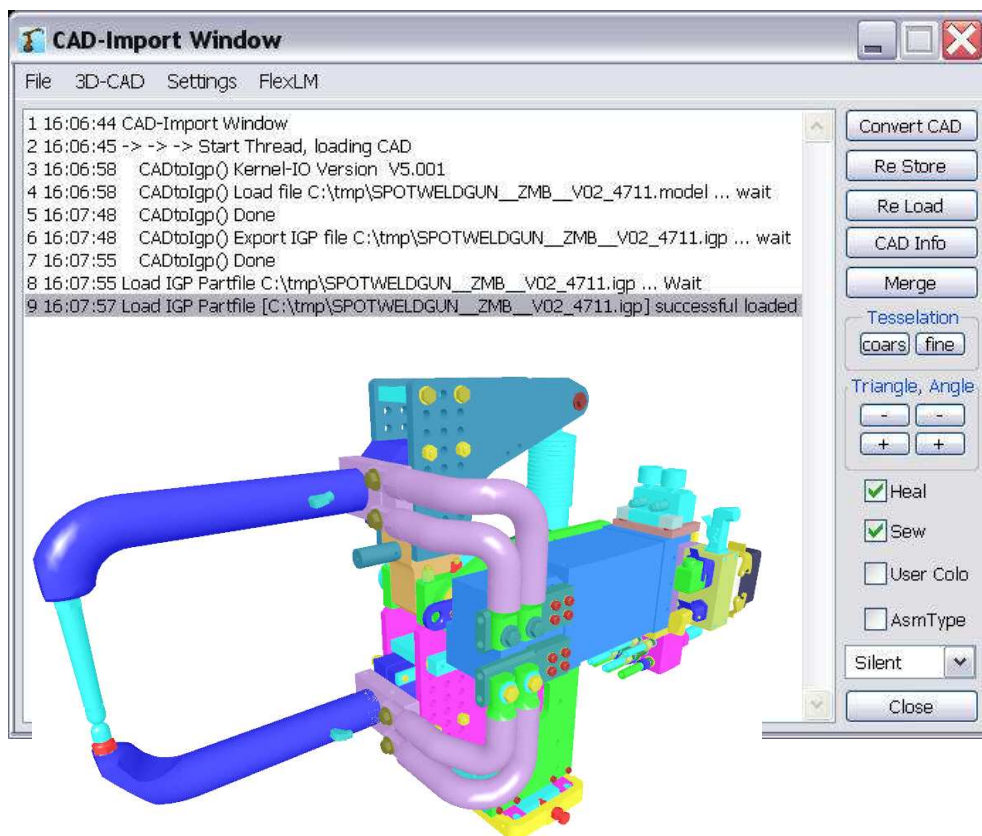


The new Version

EASY-ROB™ V5.0



October 2008

Version 1.0

EASY-ROB™

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EASY-ROB™ V5.0

The new version 5.0

The new EASY-ROB™ Version 5.0 contains dozens of improvements, mainly pushed - as usual - by our clients. This document should give a first overview about the most important changes. More details you will find as always in the Operation References.

EASY-ROB™ has been developed with the current version of Visual Studio 2008 and uses the latest RunTime-Libraries of version 9.0. Except for certain performance losing under Windows Vista, the ability to run is ensured. Nevertheless we still recommend Windows XP SP2 or SP3 for EASY-ROB™.

New in this version

- **Option RunTime,**
allows to simulate every workcell into the EASY-ROB™ DEMO, which is “free of charge”. It’s ideal to support the sales. The DEMO will run without any installation direct from CD or from USB Memory Stick.
- **History Diagram**
records for every robot the states like “in process”, “waiting for signal” or “error in travel ranges”, “collision” etc. during the simulation. For analyzes the results will be displayed graphically and can be stored as a picture.
- **CAD Import Window**
for the individual adaptation of imported CAD geometry (Step, IGES, JT, CATIA, UG, etc.)
Here its possible to change the tessellation, which helps in particular with detailed and „big“ geometries, to achieve adequate simulations speeds.

Robot / Devices got additional attributes. 12 Tools and 12 Home Positions can be set with user-defined names. The definition of travel range dependencies will deliver more realistic simulation results. All attributes can be clearly represented.

When creating Tags on a surface it is possible to set the tool approach direction (x, y, z). Particularly in measurement engineering its not always the z-axis. New Tags on a polygon will consider the orientation of the predecessor. Single paths can be blanked out to keep the 3D scene clear.

The Visual File Interface (more preferred paths) and the Project Manager has been revised, as all country codes by ISO-3166 are available. Beside other small changes, the version provides new ERCL- and ERPL- commands and API-functions to control the new functionality from external.

The new EASY-ROB™ V5.0 will be licensed automatically for clients with a valid service contract. We would like to thank our customers and users, who send suggestions and requirements for further development.

Thank you



Stefan Anton

EASY-ROB
3D Robot Simulation Tool

The option “RunTime”

The option **RunTime** enables the user to create protected workcells which can be loaded simulated in the EASY-ROB™ DEMO version.

Screenshots, AVI videos and animated VRML files can be created from the DEMO version.

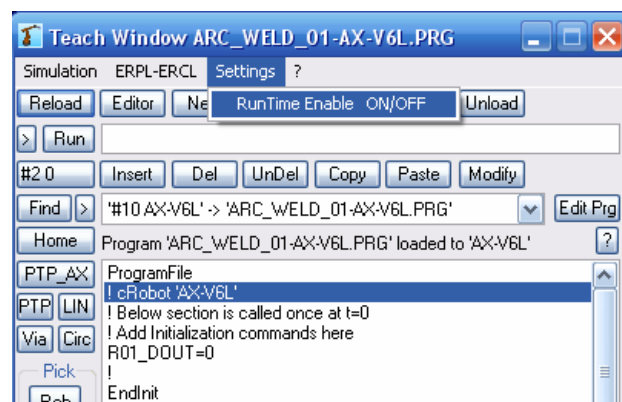
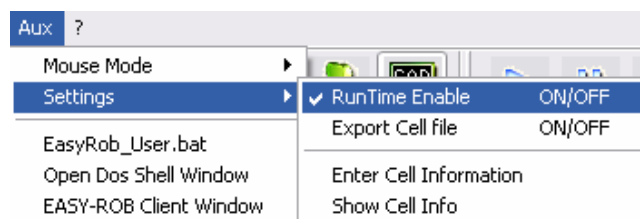
The RunTime option is ideal to support the sales department and to use it in presentations for the clients. If required the simulation and the results can be forwarded the client or can be added to an offer.

How does it work ?

After activating the option into the menu by mouse click the user has to save the robot program again to create a checksum at the end of the program.

The option can be activated through the main menu „Aux | Settings“ or through the menu „Settings“ in the TeachWindow.

That means that every workcell can be loaded. To simulate the workcell, the program needs a check sum which will be added while saving with the RunTime option.

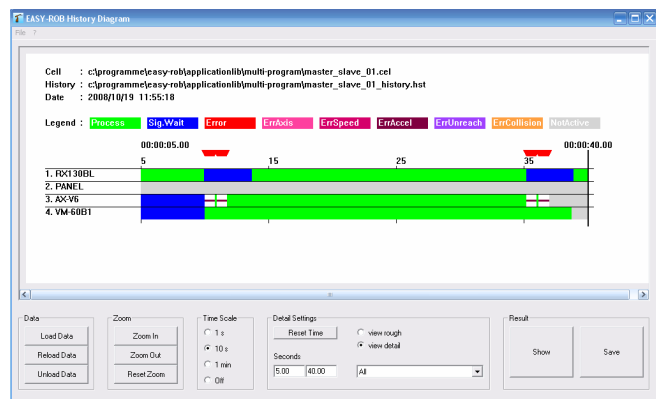


History Diagram

The new version EASY-ROB™ V5.0 provides the new functionality „*History-Diagram*“, which enables the user to analyze the simulation visual by a graphic.

History Diagram can record the state of every device into the workcell. The state like e.g. „waiting for signal“ or an „axis limit exceeding“ will be stored while every simulation step and will be displayed and analyzed in a diagram.

Because all possible states will be shown in different colors, an occurring error can be identified immediately.



Beside the clear colors every error will be displayed by a red triangle marker above the diagram, to make sure that even a short occurring error will be recognized.

The following states will be recorded:

- Process
- Signal wait
- Error
 - o Axis limit exceeding
 - o Speed limit exceeding
 - o Acceleration limit exceeding
 - o Unreachable position
 - o Collision
- Not active

By using the zoom and setting a time frame the user is able to analyze a specific area of the simulation result. The results can be displayed all together or device by device.

For the documentation the results can be stored as a picture in JPG or BMP format.

The recording for the history diagram can be switched on and of for each device by new ERC commands. (see chapter ERCL-commands in this document)

Starting a recording by one mouse click for all data of all devices can done through the EASY-ROB™ menu „Simulation | Run Settings | Automatic History Diagram Output“.

New CAD-Import Window

The CAD-Import Window has been revised complete to provide new functions.

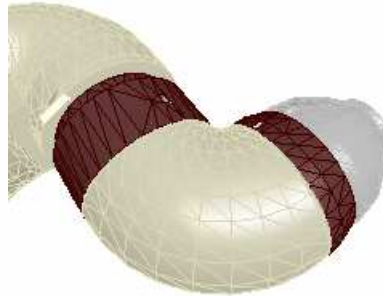
Today's common detailed and "big" CAD geometries are able to slow down a simulation tremendous.

To adapt the simulation to the needs - e.g. reduce data to increase the simulation speed - the new CAD-Import Window provides functions the change the tessellation of the workpiece.

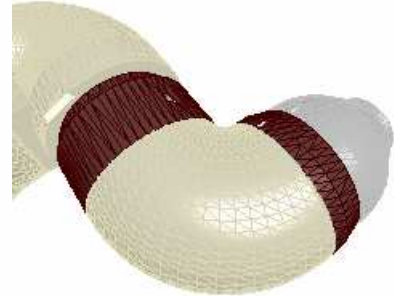
According to the requirements the workpiece can be stored with different tessellations.



rough (coarse, triangle 4.0, angle 60°)
polygons 23.337



averagel (triangle 1.0, angle 45°)
polygons 35.692



fine (fine, triangle 0.25, angle 30°)
polygons 67.470

As well the new „Heal“ and „Sew“ function will support the user to get the best possible result during the import of data from an external CAD-system.

„Healing“ will close (heal) geometries and „Sewing“ will combine edges which are within a tolerance. This helps in data reduction.

The user can manipulate the color of the geometry. When using the option „User Color“ it is possible to change the color of the converted geometry afterwards in EASY-ROB™.

Supported import formats are: STL, VRML II, Step, IGES, VDA, JTOpen, CATIA V4, CATIA V5, Pro/E, UG II, SolidWorks and Robface.

Open the „CAD-Import Window“ through the menu „3D-CAD | Open CAD-Import Window“.

To import CAD data it is required the start the FlexLM-service first from the menu of the CAD-Import Window: „FlexLM | Start FlexLM CAD-Import“.

The service can be stopped and the logfile „ctlmd.log“ can be edit through the same menu.

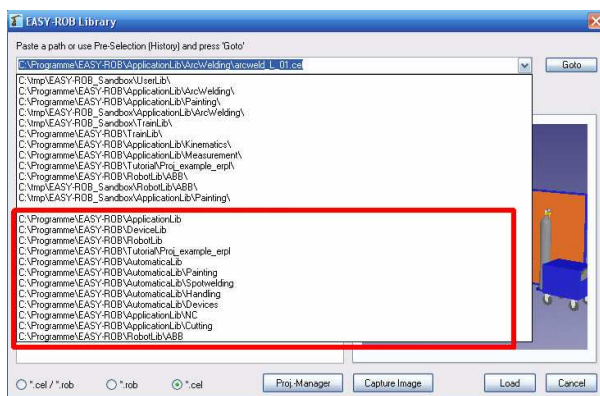
Important:

If a firewall is in use, ensure that the communication of the CTLMD License Managers is not blocked !

New functionality in the Visual File Interface

12 preferred paths

In addition to the automatically generated path history the new version provides in the same Pull-down-Menu „preferred paths“. The list of „preferred paths“ paths has to be created by the user and will be stored in the file **„er_LoadFromLibPb_prefered.ini“**. The basic file will be created automatically if it doesn't exist. The difference to the path history is that the preferred paths won't change and that enables the user to have a quick access to 12 important paths.



The list of preferred paths has to be created by the user and will be stored in the file **„er_LoadFromLibPb_prefered.ini“** in the EASY-ROB™-target directory.

To edit the file open it through the menu:
File | EASY-ROB System Files | Er_LoadFromLibPB_prefered.ini file

Country code by ISO-3166

Project data can be added from the Visual File Interface to direct to the Project Manager. One of the items is the country code where the project is related to.

The complete list of all country codes by ISO-3166 is implemented now.

Simulation and Planning

Workcell Export

The EASY-ROB™ function “Export Workcell” supports the user to collect all related items of the workcell. It will copy the current workcell and all related files such as IGP-files and programs to a new folder

The export can be started through the menu „File | Save | Cell File Export“

ESC – View to Start condition

By using the ESC-key the EASY-ROB™ world can be set back at any time to the view in which the workcell has been loaded.

Menu: View | Set 3D Views | Reset View Ctrl+Shift+R

Initialize View

By the command „Initialize View“ the world can be set back to the “zero state”. The world coordinate system will be in the center of the world.

Menu: View | Set 3D Views | Initialize View

Views in SIM-Mode and the CAD Preview

While working on a simulation the user is able to toggle at any time between the “world mode SIM” and the “world mode CAD Preview“, to check e.g. a CAD geometry.

Each mode does have its own View and these Views are separated. That means that when the user toggles the mode that the View will toggle as well.

The world coordinate system will help with its color:

The mode SIM has got a green coordinate system and the mode CAD Preview has got a red coordinate system.

Workcell Information

In every workcell the user can store information as a text, which will be displayed in bottom left corner of the world.

The length of the displayed information is one line, whereupon the number characters are depending on the width of the screen and the used resolution.

In the full version the user is able to decide whether the text is visible or not.

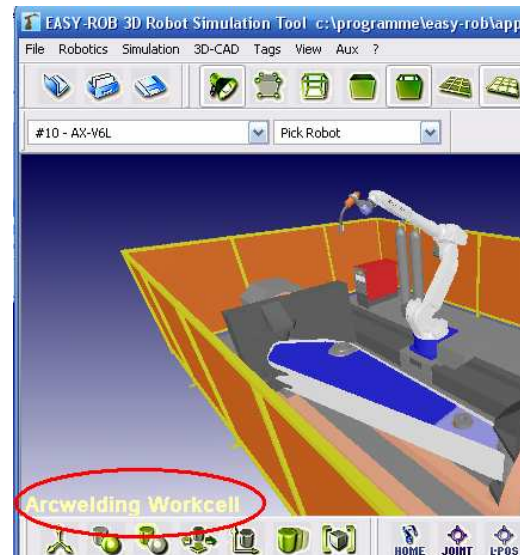
The Demo Version will show the workcell information permanent.

To enter information just call up the input dialog by menu:

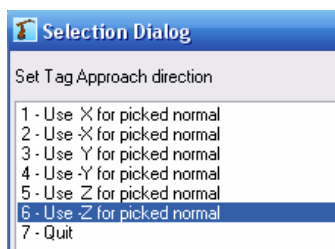
„Aux | Settings | Enter Cell Information“

To switch the information on or off use the menu:

„Aux | Settings | Show Cell Info“



Tag Approach Direction



When creating a Tagpoint at the surface normal the Approach Direction (X, Y, or Z) can be determined.

The dialog to set the Approach Direction can be called through the menu: „Tags | Tag Approach Direction“

When starting EASY-ROB™ the Approach Direction will be taken from the environment file. The default value is „-Z“.

Display of the „Collision Line“

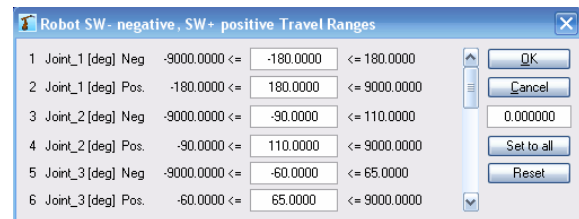
While active collision checks the collision line shows the shortest distance of two nearly colliding bodies. Because the „Collision Line“ can bother the user, it's possible to switch it off now.

Menu: „View | Show/Hide | Show Collision Line“

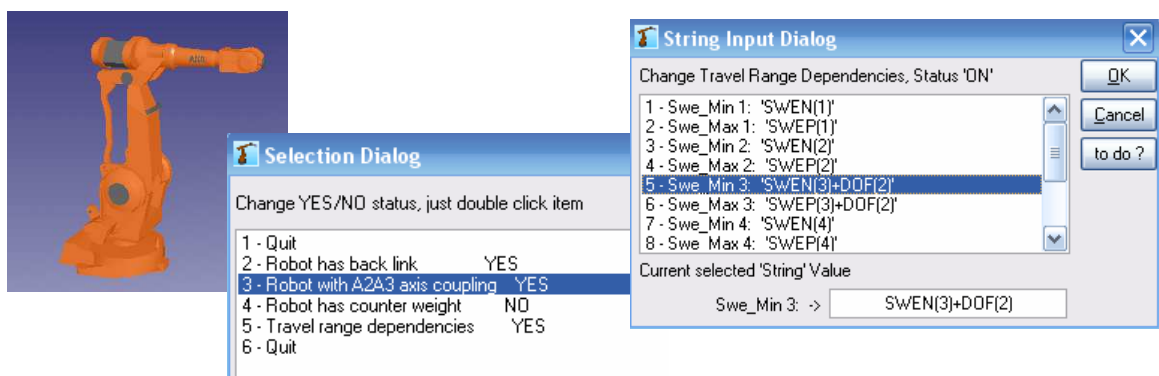
Robot Attributes

Travel Range, Travel Range Dependencies and Extended Attributes

To simplify the definition of the travel ranges of a robot, the masks for positive und negative travel ranges are combined in one mask now.



When using a robot with a back link where axis 2 and axis 3 are coupled and dependent on each other, the dependency can be defined in the attributes as Travel Range Dependencies.



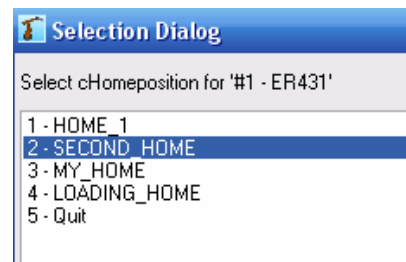
When using a back link and axis coupling (Extended Attributes) the travel ranges will change depending on the axis position of the robot. (example ABB IRB24-10)

12 Homepositionen

With this version the user is able to define up to 12 Homepositions for each device.

The Homepositions can have “meaningful names” and can be called by the ERPL-command „HOME *HomePositionName*“ or „HOME n“ with an corresponding number.

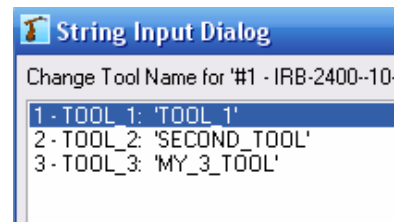
To let the robot move to the Homeposition just use the button „Home“ of the “Move to Target Toolbar” or use the menu „Simulation | Move to | Homeposition “



12 Tools

With this version the user is able to define up to 12 Tools for each device.

The Tools can have “meaningful names” and can be called by the ERPL-command „TOOL *ToolName*“.



Attributes Information

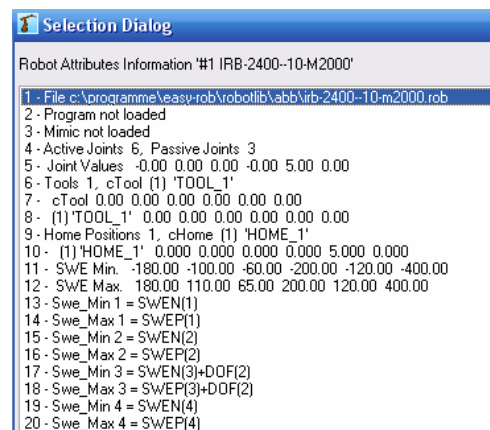
All attributes of a device can be displayed together in the „Attribute Information“.

The information can be called by the function „Attribute“ in the Kinematics Window of the robot.

The Attribute Information will send direct into the system file „moni_msg.txt“.

To open this file use

Menu „File | Edit | EASY-ROB System Files | Moni_msg file“
or the shortcut „Alt+Shift+M“



Remark:

To enable the writing into the file, the variable MONI_MSG_OUTPUT has to be set to „1“.

ERPL-Commands

TOOL *ToolName*

Call and set the tool with the name „*ToolName*“

TOOL DEVICE *tool_dev_name tool_name*

Call and set the tool „*tool_name*“ of the device „*tool_dev_name*“

TOOL \$NAME_n

Call the tool which has been defined by the command „ERC SET_PARAMETER“ in „\$NAME_n“, with n=1...100 e.g. : ERC SET_PARAMETER \$NAME_1 *ToolName*

HOME n

Call the home position with number „n“, with n=1 ... 12

HOME „*HomePositionName*“

Call and set the home position with the name „*HomePositionName*“

HOME \$NAME_n

Call the home position which has been defined by the command „ERC SET_PARAMETER“ in „\$NAME_n“, with n = 1...100. e.g.: ERC SET_PARAMETER \$NAME_1 *HomePositionName*

ERC SET_PARAMETER \$NAME_n Prefix [idx]

Use the string parameter \$Name_n with Prefix and Index „idx“.

Example: Running along tagpoints PTP T_1 T_4 . by Prefix =”T_”, Index „idx“

```
idx =1
WHILE le(idx,4)
  ERC SET_PARAMETER $NAME_2 T_ idx
  PTP $NAME_1
  idx = idx +1
ENDWHILE
```

ERCL-Commands

ERC WORLD_COORSYS ON/OFF

Enables / Disables the world coordinate system.

ERC ALL_COORSYS ON/OFF

Enables / Disables all coordinate system in the workcell

ERC HISTORY_DEVICE ON / ALL_ON

Enables the recording of data (one device / all devices) for the History-Diagram

ERC HISTORY_DEVICE OFF / ALL_OFF

Disables the recording of data (one device / all devices) for the History-Diagram

ERC HISTORY_OUTPUT ON / ALL_ON [filename]

Start of the History Diagram recording. By using the command „ALL_ON“ the recording for all devices will be switched on automatically. (ERC HISTORY_DEVICE ALL_ON)

(When leaving out a filename, the system will use by default the name "Cellname_history.hst")

ERC HISTORY_OUTPUT OFF

Stop the History Diagram recording. By using the command „ALL_OFF“ the recording for all devices will be switched off automatically. (ERC HISTORY_DEVICE ALL_OFF)

API-Functions

See header files „er_dvlp.h“ and „er_dvlp_ext.h“

API-UserDLL

```
const int AUX_UPDATE_IDX_SET_NEXT_TARGET = 36 // prepare next motion
const int AUX_UPDATE_IDX_NEED_MORE_DATA  = 38 // motion planner, need more data
const int AUX_UPDATE_IDX_TARGET_REACHED  = 39 // motion planner, target reached
const int AUX_UPDATE_IDX_IPO_ERROR       = 40 // motion planner, detects error
```

Dialog I/O

- `int dialog_open (int dialog_idx,int dlg_mode)`
New dialog idx “CAD_IMPORT_DLG” to open or close CAD Import Window

Simulation

- `float *inq_sim_time (void)`
Return global simulation time [s]
- `char *inq_cell_info (void)`
Returns a pointer to cell information string
- `int *inq_cell_info_show (void)`
Show or hide the cell information

Robot Attributes

- `int *inq_num_tool (void)`
Number of defines tools [1...KIN_TOOLS] for cRobot
- `int *inq_ctool_idx (void)`
Get current tool idx for cRobot, zero based
- `frame *inq_tTw_strt (void)`
Start condition, Tool frame for cRobot Tip to TCP
- `frame *inq_tTw_data_idx (int ctool_idx)`
Return Tool data for ctool_idx, zero based
- `frame *inq_tTw_data_strt_idx (int ctool_idx)`
Return Tool data start condition for ctool_idx, zero based
- `char *inq_tool_name_idx (int ctool_idx)`
Return Tool name for ctool_idx, zero based
- `int *inq_num_home (void)`
Number of defines Home positions [1... KIN_HOMEPOSITIONS] for cRobot
- `int *inq_chome_idx (void)`
Get current Home position idx for cRobot, zero based
- `float *inq_homepos (void)`
Get current Home position joint values cRobot
- `float *inq_homepos_idx (int chome_idx)`
Get Home position joint values for chome_idx, zero based
- `char *inq_homepos_name (void)`
Return current Home position name
- `char *inq_homepos_name_idx (int chome_idx)`
Return Home position name for chome_idx, zero based

Paths and Tags

- `int *inq_rob_tag_path_visible (void)`
Set visibility for cPath to ON or OFF
- `void menu_PathClone (void)`
Clones complete Path
- `void menu_TagClone (void)`
Clones current Tag 'cTag'
- `void menu_NewTagOnTcp (void)`
Creates a new Tag in current path at Tcp of cRobot
- `int menu_cTagOnTcp (void)`
Shifts cTag to the Tcp of cRobot
- `int menu_NewTagOnFrame (frame *T)`
Creates a new Tag in current path at location of frame 'T'
- `int menu_cTagOnFrame (frame *T)`
Shifts cTag to location of frame 'T'
- `int menu_NewTagOnPickPoint (int vertices=0)`
Creates a new Tag at current picked location,
vertices=1: keep cOrientation, =0 use normal for approach direction
- `int menu_cTagOnPickPoint (int vertices=0)`
Shifts cTag to the current picked location,
vertices=1: keep cOrientation, =0 use normal for approach direction

CAD Import and Conversion

- **int * Convert_CAD** (char *cad_file, char *igp_file=0, int confirm=1)
 Converts a CAD file "cad_file" (format: step, iges,...) into IGP file "igp_file"
 confirm: 1 User confirmation required if IGP file already exists
 0 No user confirmation required

- | | | | |
|------------------------|----------------------------------------------|-----------------------|---------------------------------------|
| <code>const int</code> | <code>CONVERT_CAD_DEFAULT</code> | <code>= 0x0;</code> | <code>// _WARNING, _HEAL, _SEW</code> |
| <code>const int</code> | <code>CONVERT_CAD_MSG_VERBOSE</code> | <code>= 0x1;</code> | |
| <code>const int</code> | <code>CONVERT_CAD_MSG_WARNING</code> | <code>= 0x2;</code> | <code>// default</code> |
| <code>const int</code> | <code>CONVERT_CAD_MSG_SILENT</code> | <code>= 0x4;</code> | |
| <code>const int</code> | <code>CONVERT_CAD_TESSELLATION_RESET</code> | <code>= 0x10;</code> | |
| <code>const int</code> | <code>CONVERT_CAD_TESSELLATION_COARSE</code> | <code>= 0x20;</code> | |
| <code>const int</code> | <code>CONVERT_CAD_TESSELLATION_FINE</code> | <code>= 0x40;</code> | |
| <code>const int</code> | <code>CONVERT_CAD_HEAL</code> | <code>= 0x100;</code> | <code>// default</code> |
| <code>const int</code> | <code>CONVERT_CAD_SEW</code> | <code>= 0x200;</code> | <code>// default</code> |
| <code>const int</code> | <code>CONVERT_CAD_USR_COLOR</code> | <code>= 0x400;</code> | |

- **int Convert_CAD_Setting** (int Setting = CONVERT_CAD_DEFAULT)
 Set converter settings

- **float Convert_CAD_SetTessellation** (int Tessellation =
 CONVERT_CAD_TESSELLATION_RESET)
 Setting for tessellation

- **int Convert_CAD_ReStore** (void)
 Restore and load converted CAD file into CAD Preview

- **int Convert_CAD_Unload** (void)
 Unload Kernel

Contact

EASY-ROB

3D Robot Simulation Tool
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Web: <http://www.easy-rob.com>

EASY-ROB Customer area

Online available: Program Updates and Robot libraries

Web: <http://www.easy-rob.com/en/special/customer-area>

Data:

User:	customer
Password:	*****

Notes