



*The professional software suite
for automatic control design and forecasting*



EICASLAB DEMO in 6 steps

Version 1.0

www.eicaslab.com

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EICASLAB DEMO 1.0 in 6 Steps

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EicasLab DEMO in 6 steps

The purpose of this short guide is to lead you to quickly run and use the main features of the DEMO version of the EICASLAB software suite.

A more detailed description about the advanced available features and the tools composing EICASLAB DEMO is presented in the EICASLAB DEMO User Manual.

Overview

EICASLAB is a powerful software suite supporting designers of automatic control system architectures.

EICASLAB allows the automation of processes related to modelling plants, designing and testing embedded control systems for industrial automation equipment (e.g. robots, machine tools, special purpose machines etc.).

EICASLAB assists all phases of the design process of the control strategy: from system concept to finalised control structure. EICASLAB also provides utilities and features to support the phases of hardware in the loop and rapid prototyping (Automated Code Generation).

EICASLAB enables to develop, optimise and test all the algorithms and software related to the “plant controller”. The tool offers sophisticated control techniques (Automated Algorithm Generation) without requiring a deep mathematical knowledge for their applications.

EICASLAB DEMO is a demonstration version of the EICASLAB software suite. It has been designed to provide you with all the basic features of the commercial version, together with a predefined set of examples (DEMO projects) regarding standard professional applications.

Main steps

Even though EICASLAB DEMO provides a large variety of features and tools, it is very easy to use and is composed of friendly interfaces able to let you start up working quickly.

In the following paragraphs a short description on how to open, implement and simulate projects is presented.

1 – Installing and launching EICASLAB DEMO

EICASLAB DEMO can be downloaded for free from the EICASLAB web site www.eicaslab.com.

Note

EICASLAB DEMO was **compiled for 32-bit Operating System**. Running it on 64-bit architectures might require the installation of 32bit libraries. In case of problems in finding the correct libraries please contact EICASLAB Support (support@eicaslab.com).

Linux installation procedure

For Linux OS the installation file is called `EICASLABDEMO1.0.tar.gz`.

For using EICASLAB DEMO in Linux, please verify that the following packages are installed in your system:

- imageMagick
- bash or tcsh
- ddd
- gdb
- gcc
- make

The first installation step is to extract the content of `EICASLABDEMO1.0.tar.gz`: you can use a browser or open a Terminal Console in the directory where you have downloaded the installation file and digit the command:

```
tar xzf EICASLABDEMO1.0.tar.gz
```

The result is a directory called `EICASLABDEMO1.0` containing an `Install` script; in order to start the EICASLAB DEMO Installer you have to type:

```
./EICASLABDEMO1.0/Install
```

In order to complete the installation process you can follow the instructions reported in the EICASLAB DEMO User Manual.

Windows installation procedure

For Windows OS the installation file is called `EICASLABDEMO1.0.zip`.

For installing EICASLAB in your PC, please download it from the login.eicaslab.com website and extract the downloaded package `EICASLABDEMO1.0.zip` in a working directory.

The result is a folder called `EICASLABDEMO1.0` containing the `Install.exe` file. Run it to start the EICASLAB DEMO Installer.

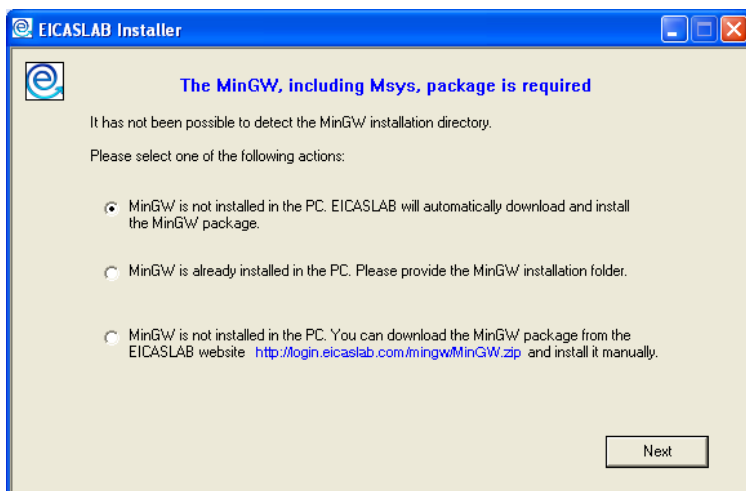
EicasLab DEMO for Windows requires the MinGW and Xming packages. During the installation phase EicasLab will automatically check if these packages are installed in your system and, if they are not present, it will ask you to automatically download and install them.

The MinGW and Xming packages can also be manually installed. All the instructions for manually installing them are described in the “[MinGW and Xming Installation's Guide](#)”, downloadable from the EicasLab DEMO web site.

In the following it will be described the automatic procedure that EICASLAB runs for installing the required packages if they are not found in your system.

Once the `Install.exe` file is launched, if the MinGW package, including Msys, is not found EICASLAB will show you the following window in which you can choose among the following items:

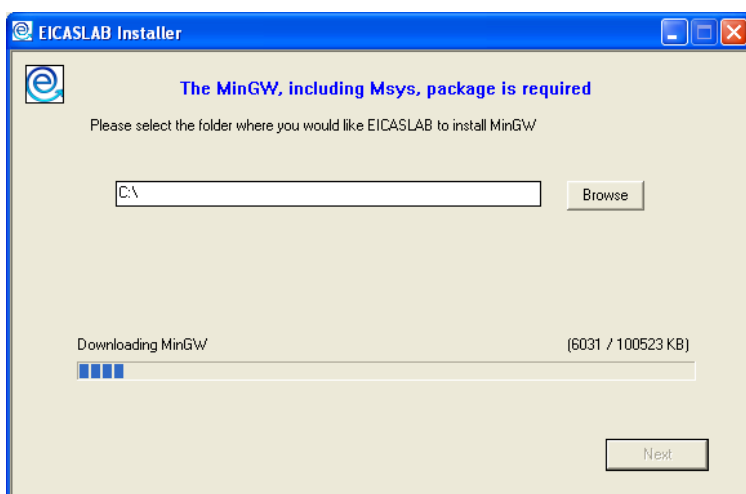
- **MinGW is not installed in the PC. EICASLAB will automatically download and install the MinGW package.** You can choose this item if you want EICASLAB to automatically install the MinGW package.
- **MinGW is already installed in the PC. Please provide the MinGW installation folder.** You can choose this item if the MinGW package is installed in your PC but EICASLAB is not able to detect the installation folder.
- **MinGW is not installed in the PC. You can download the MinGW package from the EICASLAB website <http://login.eicaslab.com/mingw/MinGW.zip> and install it manually.** You can choose this item if you want to install manually the MinGW package.



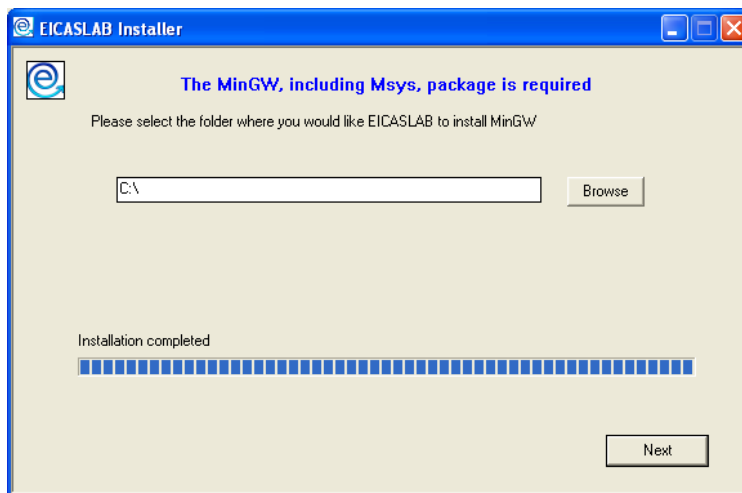
If you choose the first item the following window gets opened where you can provide the folder where you want EICASLAB to install the MinGW package.



By clicking the **Next** button the installation procedure starts and the following window gets opened.

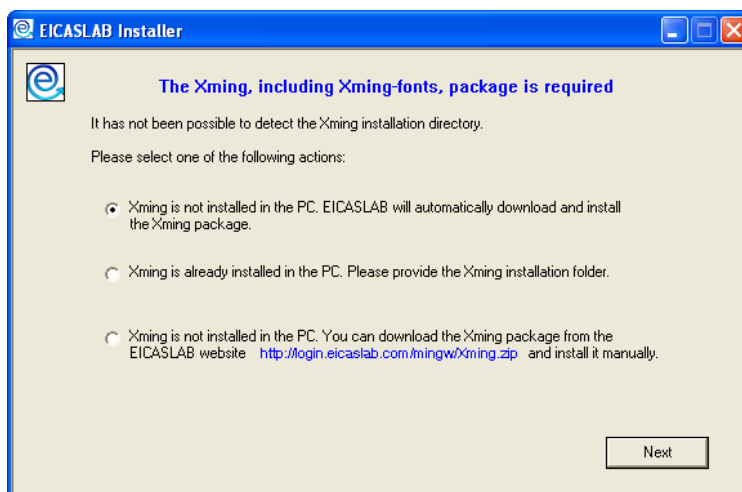


When the installation of the MinGW package is completed you can click the **Next** button.

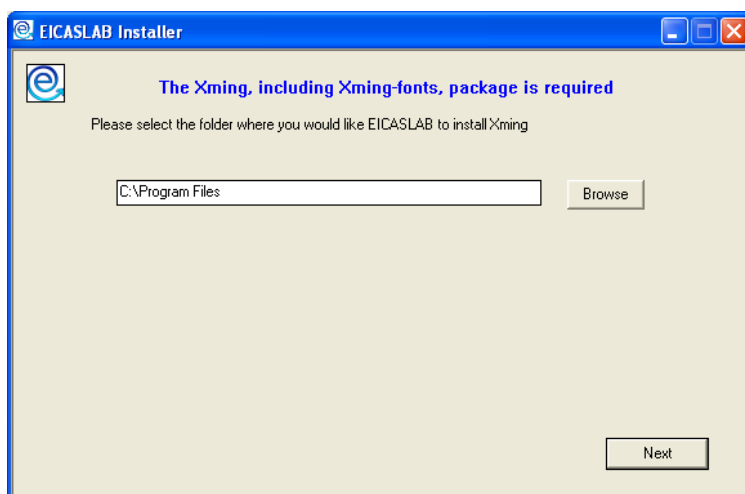


If the Xming package is not found in your system the EICASLAB installer shows you the following window where you can choose among the following items:

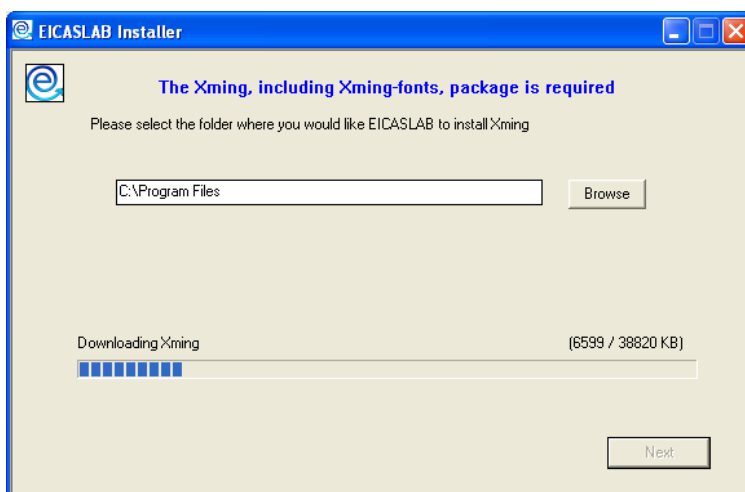
- **Xming is not installed in the PC. EICASLAB will automatically download and install the Xming package.** You can choose this item if you want EICASLAB to automatically install the Xming package.
- **Xming is already installed in the PC. Please provide the path of the Xming executable file.** You can choose this item if the Xming package is installed in your PC but EICASLAB is not able to detect the installation folder.
- **Xming is not installed in the PC. You can download the Xming package from the EICASLAB website <http://login.eicaslab.com/mingw/Xming.zip> and install it manually.** You can choose this item if you want to install manually the Xming package.



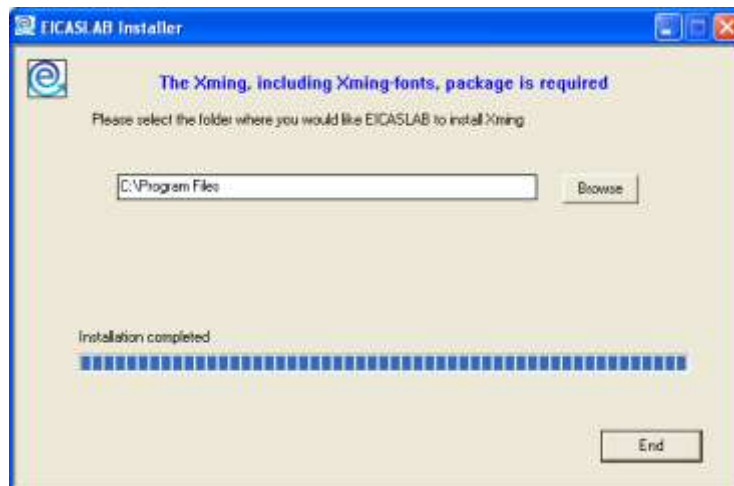
If you choose the first item the following window gets opened, where you can provide the folder where you want EICASLAB to install the Xming package.



By clicking the **Next** button the installation procedure starts and the following window gets opened.



When the installation of the MinGW package is completed you can click the **End** button in order to start the EICASLAB installation.



Note

When running Xming for the first time Windows firewall, if activated, could block the program. Please unblock it as shown in the following figure.



In order to complete the installation process you can follow the instructions reported in the EICASLAB DEMO User Manual.

Launching EicasLab DEMO

Once you have successfully installed EICASLAB DEMO on your computer, you will be able to launch it by using all the quick links¹ selected during the installation process, as:

- icons on the desktop;
- shortcuts on the operative system application menu;
- symbolic links;
- alias.



EICASLAB is composed by several tools devoted to special tasks. The first one you run when you launch EICASLAB is the MASTER tool, devoted to the management of all the phases of the design process.

2 – Opening projects

EICASLAB DEMO is supplied together with a set of test cases implementing the most common control algorithm techniques, applied to a “rotating table” single axis control application.

More information about the technical characteristics of each example is given in the document: `EICASLABDEMOtestcases.pdf`.

DEMO projects are subdivided into four main families according to the implemented control algorithms:

- *PID*: with a PID control algorithm;

¹ You can also run the executable file `run.` from a terminal you have to type the command: `<Installation path>/EICASLAB1.0/MASTER/bin/product/{linux or windows}/run.`

- *Classical Model based*: with a control algorithm based on state observer and state control;
- *EICAS Model based*: developed by following the EICAS control design methodology (www.eicas.it);
- *User*: without any predefined control algorithm. Here you can develop your own control architecture.

The projects belonging to the first three families are locked: you can analyse the structure of the system, run the simulation and analyse the results, but you cannot make any modification.

On the contrary the *User* project has been developed in order to allow you to build your own control algorithm and, as a consequence, to perform comparisons with the other predefined test cases.

For each control algorithm implemented, different control architectures have been considered:

- the control loop is closed by using the measurements taken on the motors, that is before the mechanical gear;
- the control loop is closed by using the measurements taken on the rotating load, that is after the mechanical gear.

Moreover for the *EICAS Model Based* family also a hierarchical architecture has been implemented: the low level control loop is closed by using the measurements taken on the motors, the upper level control loop is closed by using the measurements taken on the rotating load.

The *User* project does not contain any predefined control algorithm; in order to make you able to build the control architecture you prefer, both measurements taken on the motors and on the rotating load are available.

EICASLAB DEMO provides one project for every control architecture considered for each DEMO family.

Family	Control architecture – projects
PID	Motor measurement
	Table measurement
Classical Model Based	Motor measurement
	Table measurement
EICAS Model Based	Motor measurement
	Table measurement
	Hierarchical
User	Not predefined

You can open DEMO projects by using the **DEMO** menu available in the MASTER window.



3 – Implementing projects

The EICASLAB tool devoted to the implementation of projects is SIMBUILDER. It can be opened from the MASTER tool by using:

- *SIMBUILDER* -> *Run SIMBUILDER* item,
- *Run SIMBUILDER* button.

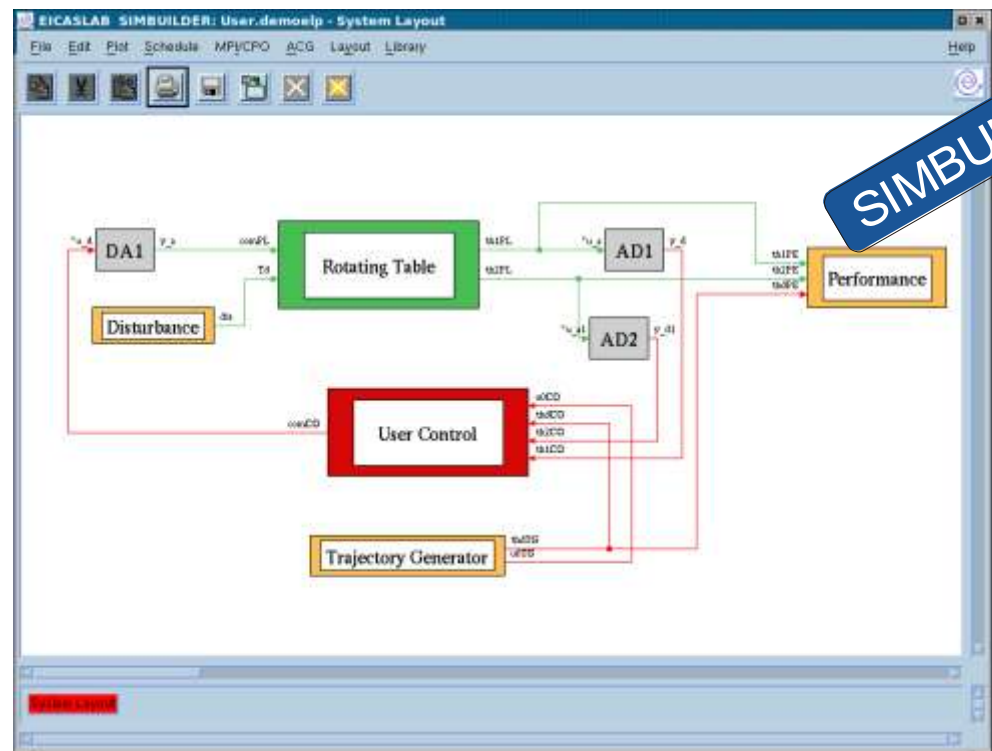
SIMBUILDER supports the plant modelling description and the control algorithm design. The tool is conceived as a hierarchical structure of graphical layouts (layout concept), each one with its own block library (oriented library).

SIMBUILDER is organised in three main work areas related to the actual controlled system: Plant, Control and Mission areas.

The Plant Area is devoted to the plant modelling, allowing the use of continuous time model, discrete time model or experimental data.

The Control Area implements the control algorithm by considering the actual structure of the final controller (Single/Multi processors, with one or more control functions for each processor).

The Mission Area defines the host commands (for the control algorithm) and the disturbances (acting on the plant).



The structure of DEMO projects is predefined and not changeable. *PID*, *Classical Model Based* and *EICAS Model Based* projects are locked, you can only analyse the structure of the system (by doubling clicking on system blocks), but you cannot make any modification. If you are interested in locked projects, you can go directly to paragraph 5.

Only in the *User* project you can develop your own Control. In this case you can choose to program the Control Area by using different *programming modes* (option available by means of the **Programming Mode** item in the popup menu of the block):

- **Graphical mode** allows you to build your block by using a block diagram representation (default). The scheme will be composed of elementary blocks, available in the library window, connected by means of wired links;
- **C mode**, on the contrary, gives you the possibility to build a block by inserting your C code in a complete structure of .c and .h files whose templates are supplied and generated by EICASLAB.

Before simulating and post-processing projects you have to define the variables to be displayed and stored (steps necessary only for the *User* project).

- Variables for simulations can be set using **SIM Plot Block** item of the popup menu of the block you are interested in.
SIM appears as a window with six plotting areas where in each one up to four variables can be displayed during the simulation. For this reason you have to define the plotting area (from 1 to 6) where the variable will be displayed and its progressive number in the area (from 1 to 4).

- Variables for post-processing can be set using *POST Plot Block* item of the popup menu of the block you are interested in. You have only to enable the variables you need.

4 – Compiling projects

Before simulating the *User* project you need to compile it. Compilation process can be enabled from the MASTER tool by using:

- *SIM -> Compile* item,
- *Compiler* button.

The *Warning* section lists all the possible problems related to the project implementation.

PID, *Classical Model Based* and *EICAS Model Based* projects are locked, you do not need to compile them.

5 – Simulating and debugging projects

Projects simulation is performed by the SIM tool.

You can run SIM from the MASTER tool by using:

- *SIM -> Run SIM* item,
- *Run SIM* button.

The *User* project can be debugged by using the Debug SIM modality available in the MASTER tool:

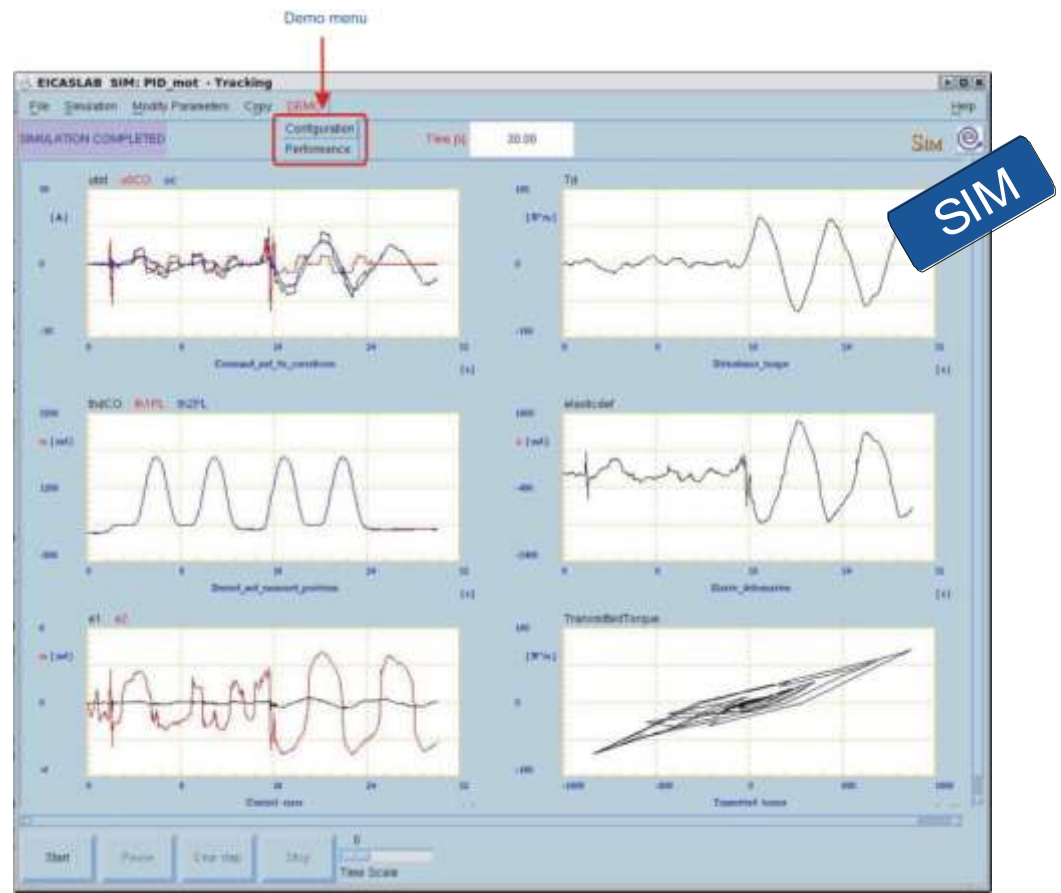
- *SIM -> Debug SIM* item.

The debugger is defined in your settings.

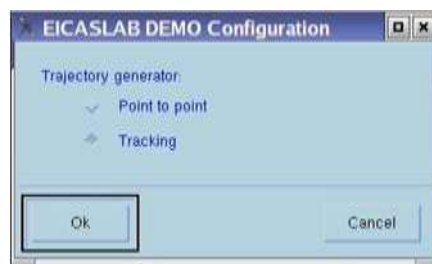
The simulation can be managed by *Start*, *Pause*, *One step*, *Stop* and *Reset* buttons.

During the simulation the SIM window displays the variables you set in SIMBUILDER by means of *SIM Plot Block* feature (see paragraph 3).

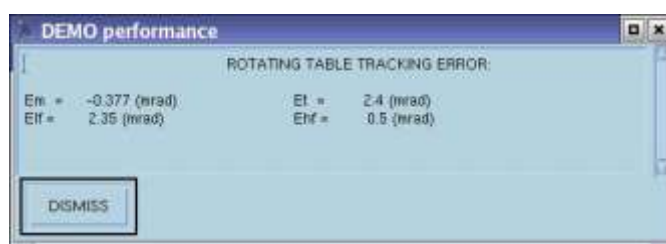
The *DEMO* menu provides some useful features able to let you easily configure and analyse demo simulations.



The *Configuration* item allows to choose the operating mode of the trial: point to point or tracking.



The *Performance* item, available only for locked projects (belonging to *PID*, *Classical Model Based* and *EICAS Model Based* families) summarises the performance indexes of the trial according to what reported in the technical note *EICASLABDEMOtestcases.pdf*.



6 – Post-processing projects

Off-line analysis of data stored during simulation is performed by the post-processing POST tool.

It can be opened from the MASTER tool by using:

- **POST** -> **Run POST** item ,
- **Run POST** button.

Beyond the classical post-processing functions (e.g. sum, product etc.) POST provides also statistical and complex mathematical elaborations such as standard deviation, mean value etc...

POST is also a useful tool for preparing technical reports. It allows to capture images in the desired format for printing or being included in word processors.

The Processing window lists the variables set in SIMBUILDER by means of **POST Plot Block** feature (see paragraph 3). Here you can:

- perform mathematical elaborations among variables;
- set diagrams graphs to be displayed. You can choose between time and phase diagrams:
 - time diagram is built considering as an ordinate the variable you select, and as an abscissa always the variable time (**TIME DIAGRAM** button);
 - phase diagram is built by a couple of variables, the first one is considered as an abscissa, the second one as an ordinate (**PHASE DIAGRAM** button).

Six areas are available, in each one up to ten diagrams can be displayed (**AREA #** button).

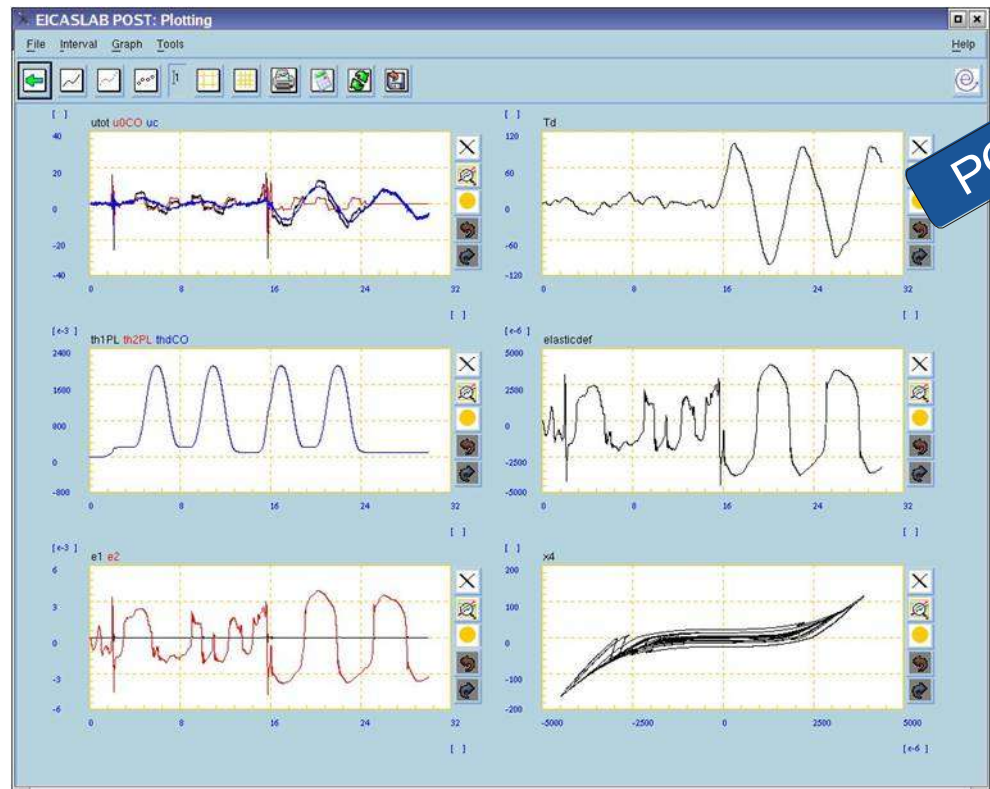
START PLOT button applies your preferences and displays the Plotting window.

For locked projects (belonging to *PID*, *Classical Model Based* and *EICAS Model Based* families) EICASLAB DEMO provides a configuration file able to set all the plotting areas according to what displayed during the simulation. You has to use:

- **File** -> **Load Configuration** item,

and select the `performance.save` file.





From the Plotting window you can:

- analyse graphs displayed on each area. Buttons all around the areas allow to make zoom and manage the graphs (*Interval* and *Graph* menu);
- perform further mathematical and statistical analysis (*Tools* menu);
- prepare graphs for technical reports (*File -> Prepare for printing* item)

Note

A more detailed description about the advanced available features and the tools composing EICASLAB DEMO is presented in the EICASLAB DEMO User Manual.

Create your control algorithm and try it now!
Enjoy your work with EICASLAB DEMO!

