

# Modelica Simulation in XC05ix

## How simple it is!



- ✓ **Dynamic simulation with Modelica**
- ✓ **Simple graphical programming**
- ✓ **Realistic and safe control design**
- ✓ **Robust adaptive control**
- ✓ **Reduced engineering time**
- ✓ **Full size industrial control system**
- ✓ **Flexible use with industrial standard**

## Using Modelica in XC05ix

Running the process model in real-time environment directly in the control system is a much more realistic approach than using off-line simulation and will also save you a lot of engineering time. Since the simulation is continuous you can do all the changes in the control functions you want during running and observe the outcome, just as you do when you control a physical process.

Any process model created with the Modelica language can be loaded into the XC05 unit for real-time simulation. The model may run at the same time as the XC05 unit is controlling a physical process.. Running the model inside the PLC unit gives the user many new opportunities:

- ✓ Developing embedded control systems without the need of extensive tests of C-code.
- ✓ Developing the control strategy in a realistic environment on-line
- ✓ Optimizing the control performance with built-in self-tuning regulators
- ✓ Verifying the control functions before applying them to the physical process
- ✓ Detecting changes in the process by identifying deviations from a designed model
- ✓ Training unit for students in control engineering

The simulation capacity is very large, e.g. a Boiler model with about 100 internal states could be run down to about 3 msec cycling. The model can be generated off-line with any simulation tool that describes the model in the Modelica language. With the normal XC05 programming tool for XC05 you load and integrate the model with all the other control functions you have created in the XC05. How this is done is briefly described below, for more details we refer to the First Graph Manual which you can find on our web site.

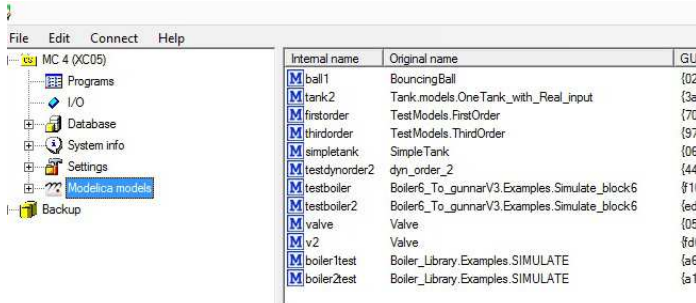
### The XC05 control system

The XC05 control system is a new intelligent IoT unit developed by First Control where several disciplines used by engineers and researchers are integrated into a small compact box. In addition to the normal automation functions, the unit contains built-in process simulation, self-tuning regulators, statistics according to the SPC standard and all the normal mathematic functions you may need. The basic purpose is to achieve better control with less engineering effort.

You can find more information about the XC05 on our WEB site [www.firstcontrol.se](http://www.firstcontrol.se)

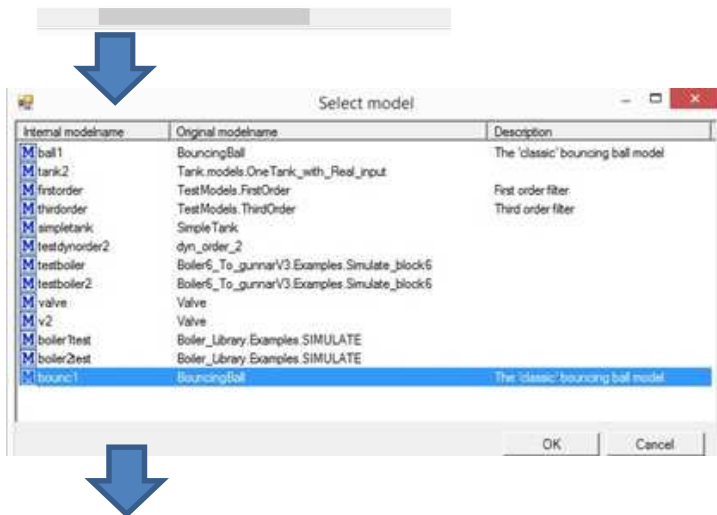
## This is how you do process simulation in XC05ix

### Step 1: Create a local model library



If you select the node “Modelica” in the project tree in FirstGraph, the total local model library is displayed. You can select any Modelica model on your PC and load it down to the XC05. During loading, the local resolver will compile the model and integrate it into the local control library. Up to 50 unique models can be downloaded to the XC05 unit and used in an arbitrarily number of instances.

### Step 2: Insert a model into your program

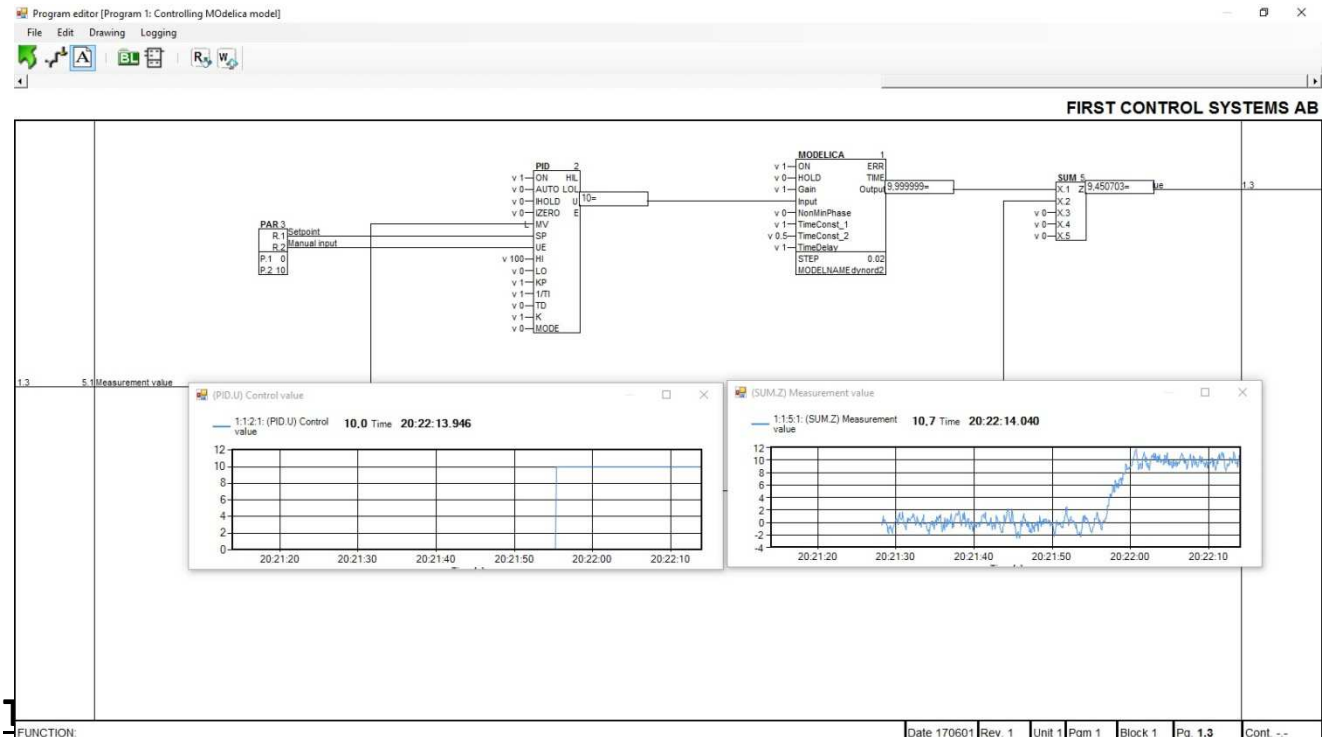


Select the “Modelica” item in the object table and a pop-up window will appear with all the available models in the library. Then select the model you want to use and the model will immediately be displayed in your program. Note that you may have several versions of the same model running independently.

The Modelica model will act as any other object in the library. The inputs and output names are taken from the definitions in the Modelica file. The model object can be started/restarted in real time (ON input) or be brought to a temporary stop (HOLD input) if you need to do some changes before you proceed.

MODELICA		3
v C	ON	ERR
v C	HOLD	TIME
	inp.1	outp.1
	inp.2	outp.2
	...	...
	inp.N	outp.N
	STEP	0.02
	MODELNAME	ball1

## Step 3: Connect the model to your control functions



You connect your model to the control objects using a simple drag-and-drop procedure. The application will start running as soon as you make a "LOAD" of the program. Note that the code behind the graphical drawing is generated on-line by the local resolver.

In this simple example we are using a second order dynamical model with a time delay which is controlled by a simple PID regulator. To make it more realistic, we have added some filtered noise on the measured output. In the clip we have just made a step response which is shown in the curves.

Remark.

Above we have just used the local display functions by clicking on the signal values we want to display. Of course the signals can also be sent to an operator platform for display and storage. Even if you are connected via Internet, you can still do the same thing provided you have some VPN connection.