

# **JModelica.org-SDK User's Guide**

**Version 1.13**

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# **JModelica.org-SDK User's Guide: Version 1.13**

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# Acknowledgements

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# Chapter 1. Introduction

## 1.1. About JModelica.org-SDK

The JModelica.org Software Development Kit (SDK) is a bundle of tools used to build JModelica.org from source code on Windows. Thereby, using the SDK it is possible to keep up with the latest code changes or contribute to the development of the platform.

It is strongly recommended to read this documentation before installing or using the JModelica.org-SDK.

## 1.2. About JModelica.org

JModelica.org is an extensible Modelica-based open source platform for optimization, simulation and analysis of complex dynamic systems. The main objective of the project is to create an industrially viable open source platform for optimization of Modelica models, while offering a flexible platform serving as a virtual lab for algorithm development and research. JModelica.org is intended to provide a platform for technology transfer where industrially relevant problems can inspire new research and where state of the art algorithms can be propagated from academia into industrial use. JModelica.org is a result of research at the Department of Automatic Control, Lund University, [Jak2007] and is now maintained and developed by Modelon AB in collaboration with academia.

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# Chapter 2. Installation

## 2.1. Supported platforms

The JModelica.org-SDK can be installed on 32 and 64 bit Windows (7, 10).

## 2.2. Dependencies

All dependencies are bundled in the installer. They are listed below, each with version number and link to corresponding home page. Note that uninstalling the OPC server (when the SDK is uninstalled) affects other installations of the JModelica.org-SDK and JModelica.org binary installers on your computer.

- **Applications**

- Apache Ant 1.9.9
- CMake 3.8.2
- Java 1.7 (JDK and JRE)
- MinGW (tdm-gcc 5.1.0)
- Slik Subversion Client 1.9.7
- Python 2.7.13
- Swig 3.0.8

- **Libraries**

- Ipopt 3.12.4
- boost 1.54
- Graybox OPC Automation Wrapper 2.02
- OpenOPC for Python 1.3.1

- **Python packages**

- xlwings 0.11.4
- wxPython 4.0.0a1

- wxPython-common 3.0.2.0
- win-unicode-console 0.5
- widgetsnbextension 3.0.3
- webencodings 0.5.1
- wcwidth 0.1.7
- trollius 2.1
- traitlets 4.3.2
- tornado 4.5.2
- testpath 0.3.1
- six 1.11.0
- singledispatch 3.4.0.3
- simplegeneric 0.8.1
- setuptools 36.5.0
- scipy 0.19.0
- scandir 1.5
- SALib 1.0.3
- qtconsole 4.3.1
- pyzmq 16.0.2
- pytz 2017.2
- pythonnet 2.3.0
- python-dateutil 2.6.1
- Pyro 3.16
- pyreadline 2.1

- pypiwin32 219
- pyparsing 2.2.0
- Pygments 2.2.0
- prompt-toolkit 1.0.15
- pip 9.0.1
- pickleshare 0.7.4
- pbr 3.1.1
- pathlib2 2.3.0
- pandocfilters 1.4.2
- openpyxl 2.4.8
- numpy 1.13.1+mkl
- notebook 5.1.0
- nose 1.3.7
- nose-cov 1.6
- nbformat 4.4.0
- nbconvert 5.3.1
- natsort 5.1.0
- mock 2.0.0
- mistune 0.7.4
- matplotlib 2.0.2
- MarkupSafe 1.0
- lxml 4.0.0
- jupyter 1.0.0



- jupyter-core 4.3.0
- jupyter-console 5.2.0
- jupyter-client 5.1.0
- jsonschema 2.6.0
- JPype1 0.6.2
- Jinja2 2.9.6
- jdcalf 1.3
- JCC 2.23
- ipywidgets 7.0.1
- ipython 5.5.0
- ipython-genutils 0.2.0
- ipykernel 4.6.1
- html5lib 0.999999999
- futures 3.1.1
- functools32 3.2.3.post2
- funcsigns 1.0.2
- freeopcua 0.90.3
- et-xmlfile 1.0.1
- enum34 1.1.6
- entrypoints 0.2.3
- decorator 4.1.2
- Cython 0.25.2
- cyclerc 0.10.0

- coverage 4.4.1
- cov-core 1.15.0
- configparser 3.5.0
- comtypes 1.1.3
- colorama 0.3.9
- certifi 2017.7.27.1
- bleach 2.0.0
- backports.shutil-get-terminal-size 1.0.0
- backports-abc 0.5
- pydoe 0.3.8
- pyserial 3.4
- openopc 1.3.1

### 2.2.1. Bundled Python distributions

From JModelica.org-SDK version 1.12, a Python 32 bit distribution, and in JModelica.org-SDK version 1.13 a Python 64 bit distribution, containing all necessary Python packages are bundled in the installation. The Python command shells, available from the JModelica.org-SDK start menu, will by default use these Python installations.

The JModelica.org-SDK will look at the environment variable `PYTHONHOME` to locate the Python interpreter to use and this makes it easy to switch to another Python installation. Either set the environment variable `PYTHONHOME` before starting any of the start menu command shells or edit the file `setenv.bat` available in the JModelica.org-SDK root install folder.

## 2.3. Installation

The JModelica.org-SDK Windows installer sets up a complete pre-configured development environment with convenient start menu shortcuts. Follow the steps in the section below to install the SDK and build the sources.

However, to utilize the OPC capabilities of openOPC the script `INSTALL.bat` in `OpenOPC` must be run. See Section 2.3.5.

## 2.3.1. Install the SDK

1. Download the JModelica.org-SDK executable and save the file somewhere on your computer.
2. Run the file by double-clicking and selecting "Run" if prompted with a security warning. This will launch an installer which should be self-explanatory.
3. Select "Yes" at the end of the installation when asked if the source code should be checked out from JModelica.org as this is needed when building the sources.

## 2.3.2. Building the sources

1. Start the *msys* shell from the JModelica.org start menu.
2. Configure the sources for build and installation with:

```
./configure.sh
```

This will create the subdirectories `build` and `install`.

3. Compile the sources with `make` from the `build` folder:

```
cd build
make && make install && make casadi_interface
```

4. Test the installation by starting a Python shell from the JModelica.org-SDK start menu and run a few examples. Do this for both the 32 bit distribution and the 64 bit distribution of Python. Starting the Python session from the start menu will set all the environment variables required to run the JModelica.org Python interfaces.

```
# Run the VDP example and plot results
from pyjmi.examples import vdp
vdp.run_demo()

# Run the CSTR example and plot results
from pyjmi.examples import cstr
cstr.run_demo()

# Run the CSTR example using CasADi and plot results
from pyjmi.examples import cstr_casadi
cstr_casadi.run_demo()
```

### 2.3.2.1. Rebuilding sources

When rebuilding sources, first make sure to invoke `make clean` and then rebuild with `make install` and `make casadi_interface`. That is, open *msys* from the JModelica.org-SDK start menu and type:

```
cd build
make clean && make install && make casadi_interface
```

### 2.3.3. Getting started with JModelica.org

Please see the JModelica.org User's Guide for documentation of the JModelica.org platform.

### 2.3.4. Changing Ipopt solver

The solver bundled in JModelica.org is Ipopt-MUMPS. However, it is also possible to use other linear solvers with Ipopt. This requires a few changes in the setup and rebuilding the sources. The procedure is:

1. Open the script file `configure.sh`, which is located in the SDK root folder, in a text editor.
2. Search for the lines `--with-ipopt` and `--with-ipopt64` respectively, and exchange the default Ipopt solver path with the path to the solver that you want to use. Save and close.
3. Rebuild the sources, that is open `msys` and run `configure.sh`, `make`, `make install` and `make casadi_interface`.
4. Open the file `setenv.bat`, which is also found in the SDK root folder, in a text editor.
5. Look for the line which sets the `IPOPT_HOME` environment variables and exchange the default path with the path to your solvers.

### 2.3.5. Starting OPC server

During the installation of JModelica.org you will be asked whether to install Graybox OPC Automation Wrapper or not. If it is installed there will be a folder named `OpenOPC` in the SDK folder. To start the OPC server, the `INSTALL.bat` must be run with administration rights. It takes three optional arguments; ip adress, inactivity time, and max clients. For more information on the options, see `OpenOPC/README.txt`.

It is possible to test if the OPC server was setup properly by running the following in Python (32 and 64 bit):

```
from OpenOPC import open_client
opc = open_client()
```

If the server is not up-and-running an exception will be thrown.

### 2.3.6. Troubleshooting

- After a src update it may happen that the make command reports problem with finding automake, autoheader etc. This may be safely ignored.
- It can happen that the msys shell closes directly when started from the JModelica-SDK start menu. This is due to that msys requires that one DLL is loaded from a specific place in memory and if that place is occupied by some other DLL, msys can not start. This problem is fixed by starting msys before any other programs, i.e. restart computer and start msys first.

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# Chapter 3. Release notes

## 3.1. Release notes for JModelica.org SDK version 1.13

- JModelica.org-SDK now also includes a bundled Python 64 bit installation with all required Python packages pre-installed. Also a number of additional Python packages have been added for convenience.

The MinGW/msys environment has been updated to TDM64 MinGW-w64 edition. Especially, this entails an upgrade to gcc 5.1.0 with support for generating 64 bit programs.

With the this release it should be possible to build JModelica.org in both 32 and 64 bit modes. Note that CasADi has a performance penalty in the 32 bit mode that is not present in the 64 bit mode.

- Several Third Party updates have been made
  - Apache ANT 1.9.9
  - CMake 3.8.2
  - SVN client 1.9.9
  - tdm-gcc 5.1.0
- An OPC server has been added
  - Graybox OPC Automation Wrapper 2.02
- Updated Python interpreter and Python packages updated and added
  - Python 2.7.13
  - xlwings 0.11.4
  - wxPython 4.0.0a1
  - wxPython-common 3.0.2.0
  - win-unicode-console 0.5
  - widgetsnbextension 3.0.3
  - webencodings 0.5.1
  - wcwidth 0.1.7

- trollius 2.1
- traitlets 4.3.2
- tornado 4.5.2
- testpath 0.3.1
- six 1.11.0
- singledispatch 3.4.0.3
- simplegeneric 0.8.1
- setuptools 36.5.0
- scipy 0.19.0
- scandir 1.5
- SALib 1.0.3
- qtconsole 4.3.1
- pyzmq 16.0.2
- pytz 2017.2
- pythonnet 2.3.0
- python-dateutil 2.6.1
- Pyro 3.16
- pyreadline 2.1
- pypiwin32 219
- pyparsing 2.2.0
- Pygments 2.2.0
- prompt-toolkit 1.0.15
- pip 9.0.1

- pickleshare 0.7.4
- pbr 3.1.1
- pathlib2 2.3.0
- pandocfilters 1.4.2
- openpyxl 2.4.8
- numpy 1.13.1+mkl
- notebook 5.1.0
- nose 1.3.7
- nose-cov 1.6
- nbformat 4.4.0
- nbconvert 5.3.1
- natsort 5.1.0
- mock 2.0.0
- mistune 0.7.4
- matplotlib 2.0.2
- MarkupSafe 1.0
- lxml 4.0.0
- jupyter 1.0.0
- jupyter-core 4.3.0
- jupyter-console 5.2.0
- jupyter-client 5.1.0
- jsonschema 2.6.0
- JPype1 0.6.2

- Jinja2 2.9.6
- jdcals 1.3
- ipywidgets 7.0.1
- ipython 5.5.0
- ipython-genutils 0.2.0
- ipykernel 4.6.1
- html5lib 0.999999999
- futures 3.1.1
- functools32 3.2.3.post2
- funcsigns 1.0.2
- freeopcua 0.90.3
- et-xmlfile 1.0.1
- enum34 1.1.6
- entrypoints 0.2.3
- decorator 4.1.2
- Cython 0.25.2
- cyclerc 0.10.0
- coverage 4.4.1
- cov-core 1.15.0
- configparser 3.5.0
- comtypes 1.1.3
- colorama 0.3.9
- certifi 2017.7.27.1



- bleach 2.0.0
- backports.shutil-get-terminal-size 1.0.0
- backports-abc 0.5
- pydoe 0.3.8
- pyserial 3.4
- openopc 1.3.1

## **3.2. Release notes for JModelica.org SDK version 1.12**

- JModelica.org-SDK now includes a bundled Python installation with all required Python packages pre-installed
- Several Third Party updates have been made
  - Apache ANT 1.9.6
  - CMake 3.4.2
  - Iptopt 3.12.4
  - Java 7u80
  - Swig 3.0.8
  - SVN client 1.9
- Updated Python interpreter and Python packages
  - Python 2.7.11
  - Cython 0.2.3.4
  - IPython 4.1.1
  - JCC 2.21
  - lxml 3.5
  - matplotlib 1.5.1
  - nose 1.3.7

- NumPy 1.10.4
- PyReadline 2.1
- SciPy 0.17
- wxPython 3.0.2

### **3.3. Release notes for JModelica.org SDK version 1.11**

- The MinGW/msys environment has been reverted to vanilla MinGW edition. This includes a revert to GCC 4.7.2. This is due to problems with CasADi being very slow with TDM GCC.

### **3.4. Release notes for JModelica.org SDK version 1.10**

- The MinGW/msys environment has been updated to TDM64 MinGW-w64 edition. Especially, this entails an upgrade to gcc 4.8.1 with support for generating 64 bit programs.
- The svn client has been upgraded to support Subversion 1.8.

### **3.5. Release notes for JModelica.org SDK version 1.9**

Added support for building Modelica CasADi interface which introduced two new dependencies:

- boost 2.54
- JCC 2.18

### **3.6. Release notes for JModelica.org-SDK version 1.8.1**

This is a bug fix release.

- MinGW / msys installation has been updated. This fixes a problem with autotools (automake and autoconf) that was introduced in the previous release.

### **3.7. Release notes for JModelica.org-SDK version 1.8**

- Updated MinGW / msys, especially this entails an upgrade to gcc 4.7.2
- Upgraded to Java 7
- Upgraded to Ipopt 3.10.3
- Updated the following Python packages:

- Cython to 0.18
- distribute to 0.6.35
- lxml to 3.1.0

### **3.8. Release notes for JModelica.org-SDK version 1.7.1**

- Moved SDK installation instructions to a standalone document (JModelica.org-SDK User's Guide)
- User's Guide is available in the start menu

### **3.9. Release notes for JModelica.org-SDK version 1.7**

- Installer is now completely standalone, that is all dependencies are bundled in the installer. The new additions are:
  - Java 1.6 (JDK/JRE)
  - Python 2.7
  - Python packages:
    - IPython
    - PyReadline
    - Distribute
    - Numpy
    - Scipy
    - Matplotlib
- Upgraded to Subversion 1.7
- Upgraded to Apache Ant 1.8.4 and Python packages Nose 1.2.1, Cython 0.17.2 and lxml 3.0.1

### **3.10. Release notes for JModelica.org-SDK version 1.6.1**

- Updated a link to the plot GUI

### **3.11. Release notes for JModelica.org-SDK version 1.6**

- Removed CasADi
- Removed SUNDIALS
- Added SWIG
- Added CMake

### **3.12. Release notes for JModelica.org-SDK version 1.5.1**

- Upgraded CasADi

### **3.13. Release notes for JModelica.org-SDK version 1.5**

- Moved to Python 2.7
- Upgraded to Ipopt 3.10.0
- Added gdb to mingw
- Removed docbook support
- Added the wxPython package
- Added CasADi

### **3.14. Release notes for JModelica.org-SDK version 1.4**

- Added SuperLU

### **3.15. Release notes for JModelica.org-SDK version 1.3**

- Upgraded to Sundials 2.4.0 to be compatible with Assimulo
- Removed PySundials
- Added Cython Python Package
- Added the utilities dc and mktemp needed by the jm\_tests script

### **3.16. Release notes for JModelica.org-SDK version 1.2**

- Moved to Python 2.6
- Added pysundials (2.3.0-rc2 with minor bugfix) and rebuilt for 2.6 (note that the config file is installed for current user only in %PROFILE%\pysundials\config)
- Added convenience shell script for running configure
- Added mathml support for docbook toolchain (for pdf and xhtml targets)

### **3.17. Release notes for JModelica.org-SDK version 1.1**

- Added docbook with xsltproc + fop toolchain
- Added wget to msys
- Added SUNDIALS 2.3.0 and pysundials 2.3.0b6 (not yet stable, pysundials issue with dll lookup)
- Added autoconf, autogen, automake
- Added support for parallel SDK installations

### **3.18. Release notes for JModelica.org-SDK version 1.0**

- Changed to MSYS-1.0.11-rc-1 to fix random crashes on some computers
- Made Python a requirement
- Creates start menu shortcuts for all users
- Added \$PYTHON\_PATH/Scripts to msys path
- Added setenv.bat for environment setup
- Added startup bat file for msys with environment setup
- Added IPython menu shortcut for pylab mode

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# Bibliography

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