



## ***Getting Started with X2C***

September 10, 2016

© Linz Center of Mechatronics GmbH

# Contents

<b>I</b>	<b>Installation</b>	<b>2</b>
<b>1</b>	<b>Software versions</b>	<b>2</b>
<b>2</b>	<b>Setup with <i>Scilab/Xcos</i> support</b>	<b>2</b>
2.1	Installation . . . . .	2
2.2	Deinstallation . . . . .	2
<b>II</b>	<b>How-To</b>	<b>3</b>
<b>3</b>	<b>X2C code generation with <i>Scilab/Xcos</i></b>	<b>3</b>
<b>4</b>	<b>Loading and building the demo application Blinky in <i>Code Composer Studio</i></b>	<b>5</b>
<b>5</b>	<b>Loading and building the demo application Blinky in <i>MPLAB X</i></b>	<b>6</b>
<b>6</b>	<b>Loading and building the demo application Blinky in <i>Keil <math>\mu</math>Vision</i></b>	<b>8</b>

# Part I

## Installation

### 1 Software versions

Following software versions were tested for full X2C functionality:

Software	Version
<i>Required:</i>	
Scilab ( <a href="http://www.scilab.org">www.scilab.org</a> )	5.5.x
Java Runtime Environment	6
<i>Optional (for documentation):</i>	
MiKTeX ( <a href="http://www.miktex.org">www.miktex.org</a> )	2.9
Doxygen ( <a href="http://www.doxygen.org">www.doxygen.org</a> )	1.8.10
Graphviz ( <a href="http://www.graphviz.org">www.graphviz.org</a> )	2.38
<i>Optional (for programming):</i>	
Texas Instruments Code Composer Studio	5.5.x
Texas Instruments Code Generation Tools	6.1.6
Keil $\mu$ Vision	4.x
Microchip MPLAB X IDE	3.x
Microchip Compiler XC16	1.25

Different versions of these programs may work but without warranty.

### 2 Setup with *Scilab/Xcos* support

#### 2.1 Installation

1. Open *Scilab/Xcos* and with the *File Browser* navigate to `<X2C_ROOT>\System\Scilab\Scripts`. Right click on **setup.sce** and click *Execute in Scilab*.
2. Restart *Scilab/Xcos*
3. The setup command creates a X2C configuration file which will automatically load X2C libraries and palettes at startup of *Scilab/Xcos*.

#### 2.2 Deinstallation

1. Open *Scilab/Xcos* and execute the command `initX2C(%f)` in the *Scilab/Xcos* console.
2. Restart *Scilab/Xcos*
3. Once above command was executed, the X2C configuration file is deleted and *Scilab/Xcos* will not load any X2C libraries or palettes anymore.

For the unlikely event that Scilab freezes at startup and remains in a deadlock state, the deinstallation can be done manually by deleting the file **scilab.ini** located in the Scilab home directory (for Windows typically `C:\Users\<your user name>\AppData\Roaming\Scilab\scilab-5.x.x`).

## Part II

# How-To

### 3 X2C code generation with *Scilab/Xcos*

The following section describes X2C code generation of a *Scilab/Xcos* model based on the *Blinky* demo application.

1. Open *Scilab/Xcos* and in the file browser navigate to your project directory (e.g. <X2C\_ROOT>\DemoApplication\Blinky\_TI\_TMS320F28069\_controlSTICK\X2CCode).
2. Double click on **DemoApplication.zcos**. The example project contains a few blocks used to demonstrate the basic function of X2C (see figure 1). The *Inport* and *Outport* blocks define the interface between the generated X2C code and the peripheral functions (e.g. ADC or GPIO Pins) on the target. For details about each block function read *X2Copen.Doc.pdf* in the documentation folder of the X2C directory.

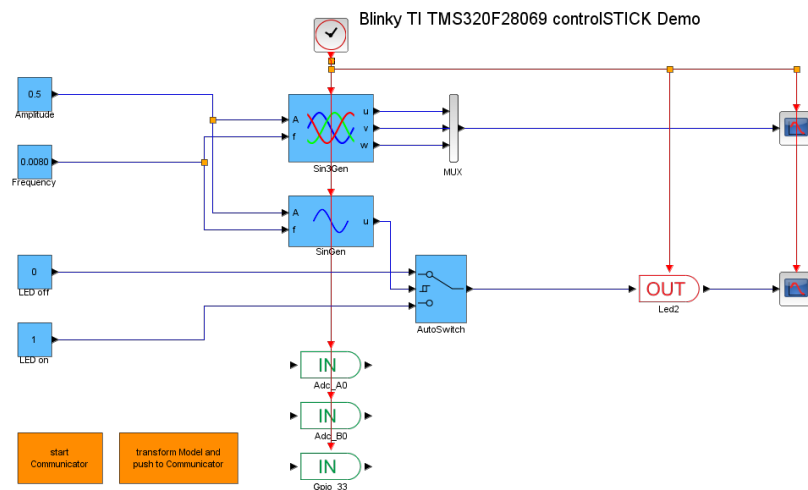


Figure 1: *Blinky* demo application in *Scilab/Xcos*

3. Double click on **start Communicator**. Some details of the current actions of the *Communicator* are shown in the *Log* area of the *Communicator* window and the *Scilab/Xcos* command line:

```
Starting Communicator
done
Successfully connected to Communicator
```

4. Double click on **Transform model and push to Communicator** and check the pop-up window for the end of the transformation process.
5. Click **Create Code** in the *Communicator*. Now the files *X2C.h* and *X2C.c* are generated in the <PROJECT\_ROOT>\X2CCode directory and the Log screen should contain the lines:

```
[...]
Model updated
Model XML file write: OK
Create code successful.
```

6. The *C* code for the *X2C* application has been created. Depending on the used target start the programming tool (e.g. *Code Composer Studio* or *MPLAB X*) and import the *Blinky* demo application project as described in section [4](#), or [5](#) respectively. Follow the instructions on how to configure and flash the project on the target.

## 4 Loading and building the demo application Blinky in Code Composer Studio

The demo application *Blinky* is intended to be used with *TI F28069 Piccolo controlSTICK*.

1. Connect the *TI F28069 Piccolo controlSTICK* with the computer.
2. Open *Code Composer Studio* (choose workspace directory as you like). Now click **Project** → **Import Existing CCS Eclipse Project**. Browse to the location of the *Blinky* project (<X2C\_ROOT>\DemoApplication\Blinky\_TI\_TMS320F28069\_controlSTICK). Click **Finish** to import the project.
3. In the *Code Composer Studio* file structure of the *Blinky* demo project there are two virtual folders *Blocks* and *Core*, which should be linked directly to the *X2C* directory. To ensure this go to **Project** → **Properties** drop down **Resource** and click **Linked Resources**. Double click on folder **X2C\_ROOT** and set the correct link to your *X2C* installation directory (<X2C\_ROOT>). After hitting **OK** two times there should not be any warning signs (like shown in figure 2) at the icons for the linked files in the *Blocks* and *Core* folders.

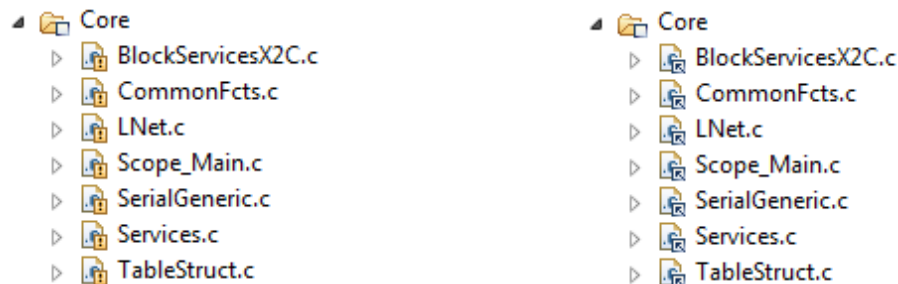


Figure 2: *Code Composer Studio* invalid (left) and valid (right) *X2C* root directory

4. The generated code from *X2C* is located in the folder <X2C\_ROOT>\DemoApplication\Blinky\_TI\_TMS320F28069\_controlSTICK\X2CCode. To check if code generation went fine go to the *X2CCode* folder and open *X2C.c*. Make sure time and date of code generation is plausible.
5. Build the project in *Code Composer Studio* by clicking **Project** → **Build all** or by clicking on the **Hammer** symbol as seen in figure 3 at the top of the screen. Check for errors while building in the console at the bottom of the screen.



Figure 3: *Code Composer Studio* build and debug buttons

6. If your target is connected to the computer click **Run** → **Debug** or click on the *Bug* symbol as seen in figure 3 at the top. The program is now transferred to the target and can be started with the **green arrow** button at the top.
7. After starting the program the on-board LED of the *TI F28069 Piccolo controlSTICK* should be blinking!

## 5 Loading and building the demo application Blinky in MPLAB X

The demo application *Blinky* is build for the combination of the *Microstick II* with the *dsPIC33FJ128MC802* processor and the *MicrostickPlus* developer board (for details see [www.microstick.com](http://www.microstick.com)).

**Info:** While flashing new code only the *Microstick II* needs to be connected with the computer.

1. Connect the *Microstick II* with the computer.
2. Open *MPLAB X* and click **File** → **Open Project**. Browse to the location of the *Blinky* demo application in the *X2C* directory <X2C\_ROOT>\DemoApplication\...\Blinky\_Microchip\_dsPIC33Fxxx\_MicrostickPlus. Click **Open Project**.
3. In the case the demo application is copied/moved to a different location, the include paths have to be adapted. To ensure the compiler uses the correct path variables right click on the **Projectname** → **Properties** → **XC16 Global Options** → **xc16-gcc**. In the drop down menu **Option categories** choose **Preprocessing and messages**. Click on the dots beside *C include dirs*. There are relative paths to the needed include files listed as seen in figure 4. Correct the links by double clicking on the path variables.  
**Info:** Only the links to the *Library* and *Controller* path need to be updated.

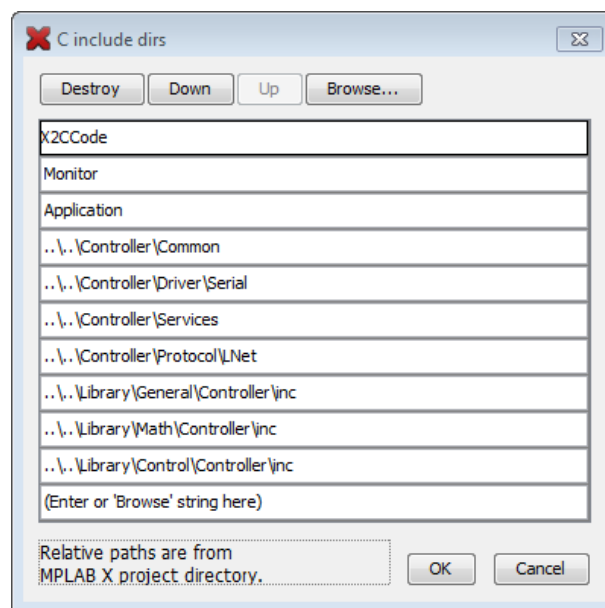


Figure 4: Default path variables for the include files

4. Go to **Run** → **Clean and Build Main Project** or click the *hammer with brush* button as seen in figure 5. After building there should be a message BUILD SUCCESSFUL in the message area at the bottom of the screen.



Figure 5: MPLAB X Clean and Build Main Project button

5. If the build process was successful go to **Run** → **Run Main Project** or click the *Green Arrow* button as seen in figure 5. If there is a message similar to *MICROSTICK not Found* try to select the *Starter Kits (PKOB)* item which represents your board.

6. After starting the program the LED (RB12) on the *MicrostickPlus Board* should be blinking!



## 6 Loading and building the demo application Blinky in *Keil $\mu$ Vision*

The demo application *Blinky* is intended to be used with the *ST STM32F051R8 Discovery kit*.

1. Connect the *ST STM32F051R8 Discovery kit* with the computer. You may have to install the ST-Link USB driver (available on [www.stm.com](http://www.stm.com)) to get the board recognized by your operating system.
2. Open *Keil  $\mu$  Vision* and click **Project** → **Open Project**. Browse to the location of the *Blinky* project (<X2C\_ROOT>\DemoApplication\Blinky\_ST\_STM32F051R8\_Discovery). Click **Open** to import the project.
3. In the *Keil  $\mu$  Vision* file structure of the *Blinky* demo project there are two virtual folders *Blocks* and *Core*, which are linked relatively to the *X2C* directory. If the *Blinky* demo project is copied/moved to a different location, the include paths as seen in figure 6 have to be adapted.

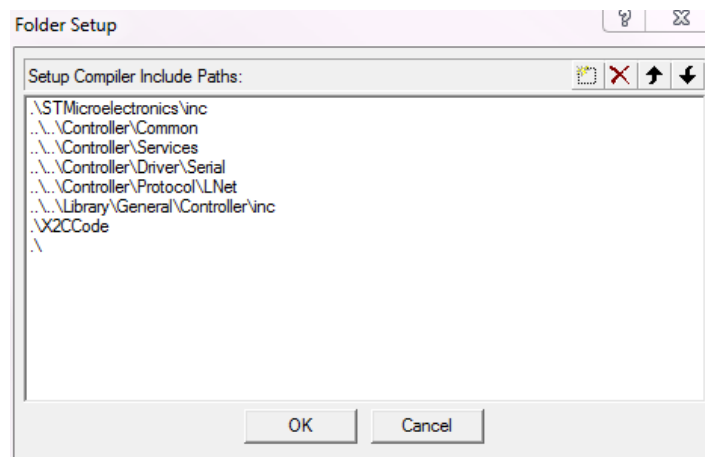


Figure 6: *Keil  $\mu$  Vision* include paths setting

To open shown window go to **Project** → **Options for target 'Blinky Demo'** change to tab **C/C++** and click ... next to the include paths text field.

4. The generated code from *X2C* is located in the folder <X2C\_ROOT>\DemoApplication\Blinky\_ST\_STM32F051R8\_Discovery\X2CCode. To check if code generation went fine go to the *X2CCode* folder and open *X2C.c*. Make sure time and date of code generation is plausible.
5. Build the project in *Code Composer Studio* by clicking **Project** → **Build target** or by clicking on the *Build* symbol as seen in figure 7 at the top left of the *Keil  $\mu$  Vision* screen. Check for errors while building in the console at the bottom of the screen.



Figure 7: *Keil  $\mu$  Vision* build and load buttons

6. If your target is connected to the computer click **Flash** → **Download** or click on the *Download* symbol as seen in figure 7 at the top left of the *Keil  $\mu$  Vision* screen. The program is now transferred to the target and is automatically started.

7. After starting the program the green on-board LED of the *ST STM32F051R8 Discovery kit* should be blinking!
8. To use *X2C Communicator* and *Scope* the computer has to be connected via serial interface to *ST STM32F051R8 Discovery kit*. For this reason a TTL-level compatible RS-232 adapter should be connected to pin PA9 - TxD, PA10 - RxD and GND.