imperix

BOOMBOX
QUICK START GUIDE
FOR C/C++ DEVELOPMENT

Note

While every effort has been made to ensure accuracy in this publication, no responsibility can be accepted for errors or omissions. Data may change, as well as legislation, and the reader is strongly advised to obtain copies of the most recently issued regulations, standards, and guidelines.

INSTALLING THE SOFTWARE

Abstract — This section describes how to retrieve and install the software that is necessary to get started with the BoomBox. This includes Texas Instrument's C/C++ integrated development environment, the necessary libraries, as well as imperix's monitoring and debugging software : BoomBox Control.

Keywords — *Code Composer Studio, BoomBox SDK, BoomBox Control, Install.*

1.1 INSTALLING THE COMPUTER SOFTWARE

Before using the BoomBox, the necessary software development environment must be installed on a personal computer. The minimum software includes :

- *Code Composer Studio :* It is the Integrated Development Environment (IDE) that is provided by Texas Instrument (TI) for the control code development. Code Composer Studio (CCS) is based on Eclipse. It is made freely available directly by TI.
- *BoomBox C/C++ SDK :* This Software Development Kit (SDK) is provided by imperix. It contains all the necessary software libraries, drivers and compiling tools to work with the BoomBox from Code composer Studio.
- *BoomBox Control :* This utility software from imperix provides a graphical user interface to monitor and control the BoomBox during run time. It is mostly useful for debugging and validating control code at the system level.

1.1.1 CODE COMPOSER STUDIO

The first step consists in downloading and installing Code Composer Studio Version 7. To do so, follow the corresponding steps:

- Go to *http://processors.wiki.ti.com/index.php/Download_CCS* and click on "Code Composer Studio Version 7 Downloads."
- Download the off-line installer for Windows (CCS7.4.0.00015.zip).

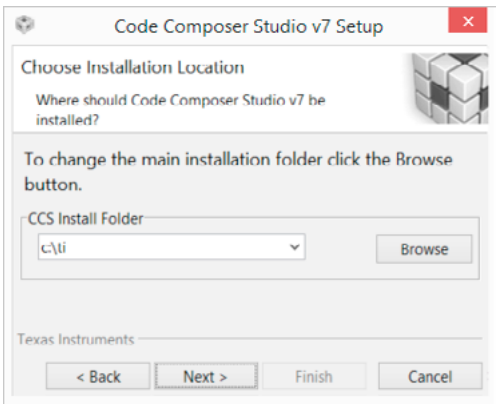
Release	Build #	Date	Download
7.4.0	7.4.0.00015	Dec 13, 2017	**Web Installers:** Windows Linux MacOS **Off-line Installers:** Windows MD5 Linux MD5 - 64-bit only MacOS MD5

» Start the install process and accept the terms of the license agreement.

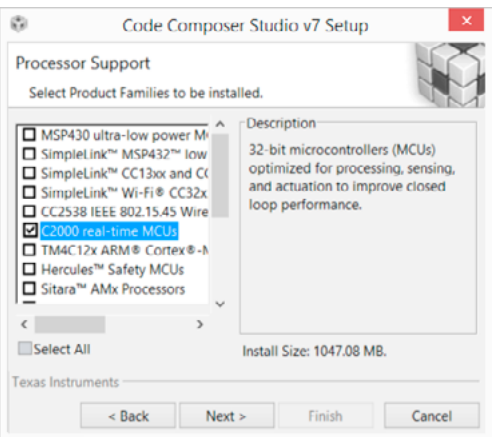
» Keep the default installation folder.

Note :

In some early versions of CCS, spaces were not allowed in the path name of the workspace. It is therefore advised not to place the workspace in the "Documents and settings" folder.



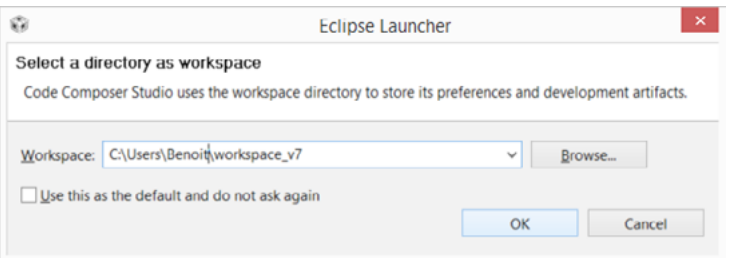
» In the "Processor support" page, check only "C2000 real-time MCUs".



» Check only "TI XDS Debug Probe Support" and click "Finish". At the end of the file copy process, the installer will notify that everything has been successfully installed.

» Launch Code Composer Studio.

» At the first launch, the folder where the project files will be saved – the workspace – can be freely chosen. This also allows to keep projects clearly separated when working on multiple applications simultaneously.



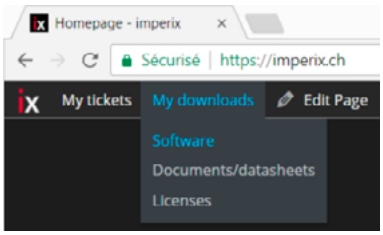
» Code Composer Studio is now ready!

1.1.2 BOOMBOX SDK

The imperix SDK for C/C++ coding enables the user to develop and debug run-time code for the BoomBox. The installer can be found on imperix's website. Registration is needed to access it.

» In order to download the installer from imperix's website go to *https://www.imperix.ch/customer-area/* and log into your account.

» Click on the tab "My downloads" and select "software."



» Click on "BoomBox C/C++ SDK x.x.x" and the download button to get the latest version of "BoomBoxCppSDK_setup.exe."

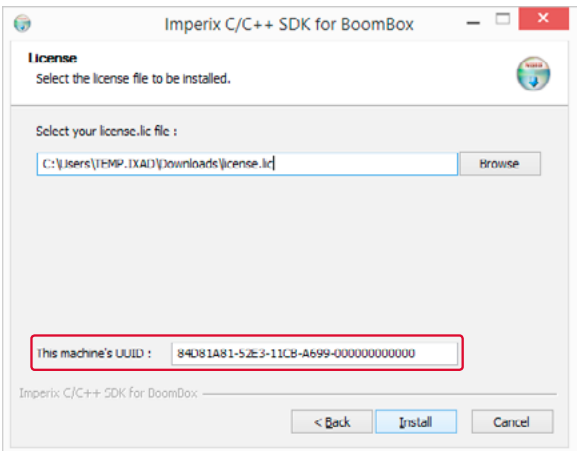
» Once the download is finished, execute the installer.

» Select where the SDK will be installed. Keep the default path.

Note:

Here again, keeping the default destination folder and no spaces or special characters in the path is highly recommended.

» On the License page, select your licence file. This will allow the installer to select the appropriate files for copy.



» If you already requested a license, it should by available in the license section on imperix's website. Then:

- Go to *https://www.imperix.ch/customer-area/* on log into your account.
- Click on the tab "My downloads" and click "License."
- Download the license file that is meant for your computer.
- Use the downloaded license file for the ongoing install process.

» If you do not have a license file, you must request one using the following process :

- Go to *https://www.imperix.ch/support/request-license*.
- Fill in the requested information. The UUID of your computer is required. Provide the code display by the installer.
- Your request will be validated and the license will be generated by a support engineer. You will receive the file at the e-mail address indicated in the request form. The process usually takes less than one day if the request is sent during office opening times (CET).
- Use the provided license file in the install process.

» Once the licence file is selected, click on "Install." The install finishes shortly.

1.1.3 BOOMBOX CONTROL

BoomBox Control is a graphical software that enables the user to monitor, control and display data from the BoomBox control platform.

» You will find the installer on the software download section of imperix's website:

- Go to *https://www.imperix.ch/customer-area/* on log into your account.
- On the website click on the tab "My downloads" and then "software."
- Download the latest version of "BoomBox Control Utility"

» Extract and execute "BoomBoxControl_setup.exe"

» Select an installation destination folder and click "Install."

» BoomBox Control has been installed on your computer !

1.2 IMPORT THE USER TEMPLATE

Once Code Composer Studio is installed and the workspace is set up, the user must retrieve the base source code (User_template_x.x.x.zip) from imperix's website.

» Similarly to all other files, the user template can be found in the download section of imperix's website :

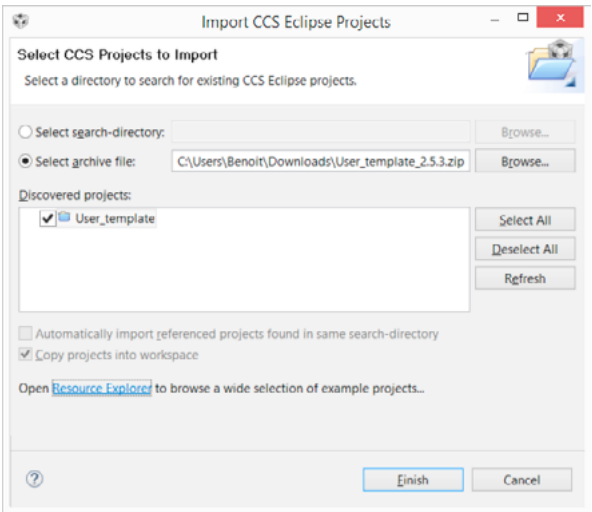
- Go to *https://www.imperix.ch/customer-area/* and reach the "My downloads" and then "software" section.
- Click on "User template for C/C++ coding."
- Download "User_template_x.x.x.zip." Save the file in a temporary folder.

» Launch Code Composer and select "Project" -> "Import CCS Project..."

» Check the box "Select archive file" and browse your computer to find the freshly downloaded zip file (User_template_x.x.x.zip), click "Finish."

Note :

It is also possible to manually unzip the archive and check the box "Select search-directory" instead. If you do this make sure to also check the box "Copy projects into workspace."



» Once this is done, the user benefits from a ready-to-use code project appearing in the Project Explorer window (the left-hand column of Code Composer).

1.3 EDITING THE PROJECT TEMPLATE

The project template contains several folders, which are organized as follows :

» 'API' contains ready-to-use routines that are popular in power electronic applications (controllers, coordinate transformations, PLLs, data structures, etc. . .). Users are recommended to use these predefined routines. If necessary, these routines can be modified.

» 'Lib' contains the BoomBox's pre-compiled operating system as well as a sub-directory 'Includes' that contains the headers of the corresponding user-accessible routines.

Note :

By browsing the Includes, the use can get a quick overview of the available peripheral driver routines, as well as all the necessary information regarding their use.

» 'Linker_scripts' are files dedicated to memory management. Users should not modify or add extra files in this sub-folder.

» 'My_functions' is the folder *where all user files should be stored*. By default, it contains only three files that the user can freely modify :

  » *user.h*, which typically contains the prototypes of the user-defined routines as well as the some data types definitions.

  » *user.cpp*, which serves as the code root and contains the initialization and main interrupt service routines used to control the application.

  » *cli_commands.h*, which contains the routines related to the management of the command line interface.

Note :

imperix recommends to refer to the tutorials and application examples in order to get quickly started with the programming of the BoomBox. The corresponding documents and code examples are available at : *https://www.imperix.ch/code-examples*.

6

PROGRAMMING THE BOOMBOX

Abstract — This section describes how to connect the BoomBox to the computer and how to program the BoomBox once the code has been compiled. Two approaches are described, either using a suitable emulator from Texas Instruments in computer-connected mode, or directly using BoomBox Control

Keywords — *XDS100v2, Emulator, Download code, Flash the BoomBox, USB.*

2.1 CONNECTING TO THE BOOMBOX

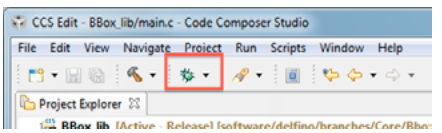
For most applications, two physical links should be established between the BoomBox and the computer :

» *Emulator :* Connect TI's XDS100v2 emulator (provided with the BoomBox) to the JTAG port on the rear side of the BoomBox and to the PC using a USB-mini cable. This link is required to interact with the BoomBox from Code Composer Studio.

» *Virtual serial port :* Place another USB (type B) cable between the console port of the BoomBox (back panel) and the PC. This link provides the virtual COM port that is used by BoomBox Control.

2.2 FLASHING FROM CODE COMPOSER STUDIO

With this approach, the program is directly loaded into the DSP's volatile memory and its execution is controlled using the emulator. The debug mode can be started from the dedicated Code Composer Studio icon :



Code Composer Studio then enters its standard debug environment. Three main control actions are available :

» *Pause :* This action is meant to pause the DSP's execution. This may be useful in non-real time applications, but is also generally pointless when control tasks must be executed regularly and continuously. Therefore, it is recommended *not to use* this feature.

> *Warning :*
> **Pausing the program execution is strictly identical to completely freezing the DSP. Therefore, using this action when the PWM outputs are enabled is assimilated as a severe software fault and will require to restart the BoomBox before enabling outputs again.**

» *Play :* This action *resumes* the DSP's execution. This will reset the BoomBox, because of loss of real-time (see above warning).

» *Stop :* This action breaks the link between the emulator and the BoomBox. It does neither stop the DSP, nor shut down the application.

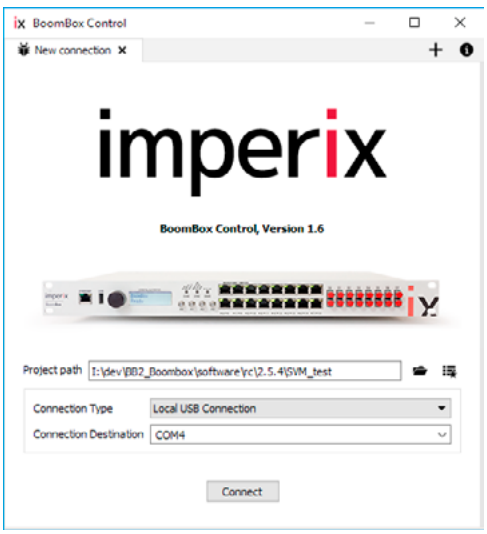
Warning :

Clicking on the 'Stop' icon doesn't shut down the application ! It only stopps the emulator, i.e. breaks the communication with the BoomBox. Therefore, the user should pay attention to properly de-energize the application before breaking the link to the BoomBox.

2.3 FLASHING FROM BOOMBOX CONTROL

With this approach, the program is flashed into the BoomBox startup EEPROM using the BoomBox Control software. The BoomBox will therefore automaticall boot up on this code after every power cycle. This approach is useful when the BoomBox should later operate without a direct connection to a computer.

BoomBox Control can be launched through the Windows's start menu or by opening a configuration file. The splash screen opens immediately.



Next, a connection to a BoomBox must to be established.

» Select your working folder for code development (most likely somewhere inside your Code Composer Studio Workspace). This tells BoomBox Control where to look for code variables and other configuration files.

» Select 'Local USB Connection' and the COM port which corresponds to the BoomBox, usually the last one.

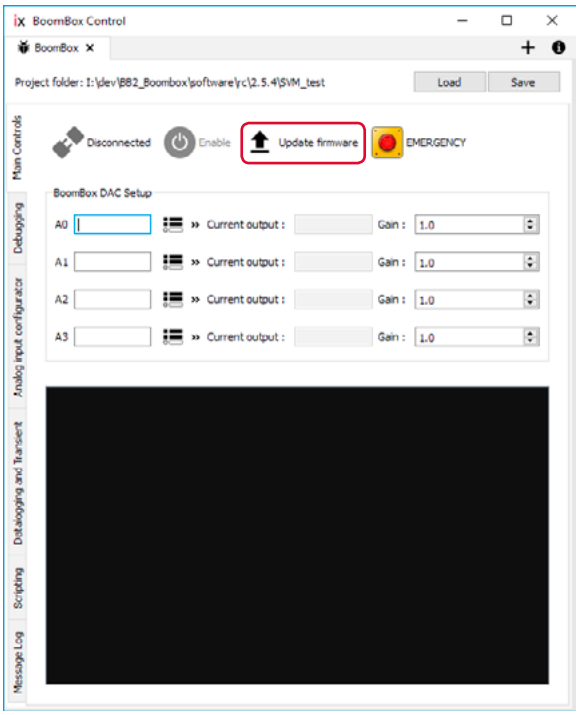
» Click connect to establish connection with the BoomBox.

Notes :

BoomBox Control communicates directly with the DSP. As such, a working code must have been downloaded and started inside the BoomBox. When the communication cannot be established, the most probable cause is that no code is running inside the BoomBox.

For a code to be running inside the BoomBox, it must have been previously flashed in debug mode using Code Composer Studio, or be present inside the EEPROM.

» Click the 'Update firmware' button on the 'Main Controls' tab.



» Find in the CCS workspace folder the compiled output file. It should be stored at the address : [CCS Workspace folder]/[YourProjectName]/Debug_BoomBox/

» Select the '*.a00' file, and open it.

Note :

The '*.a00' file is generated by Code Composer Studio after a successful build. In consequence, this file is not produced until the compilation and linking processes succeed.

» A set of messages are displayed in the BoomBox Control console, confirming that the BoomBox has been programmed (its EEPROM is written) and rebooted.

Note :

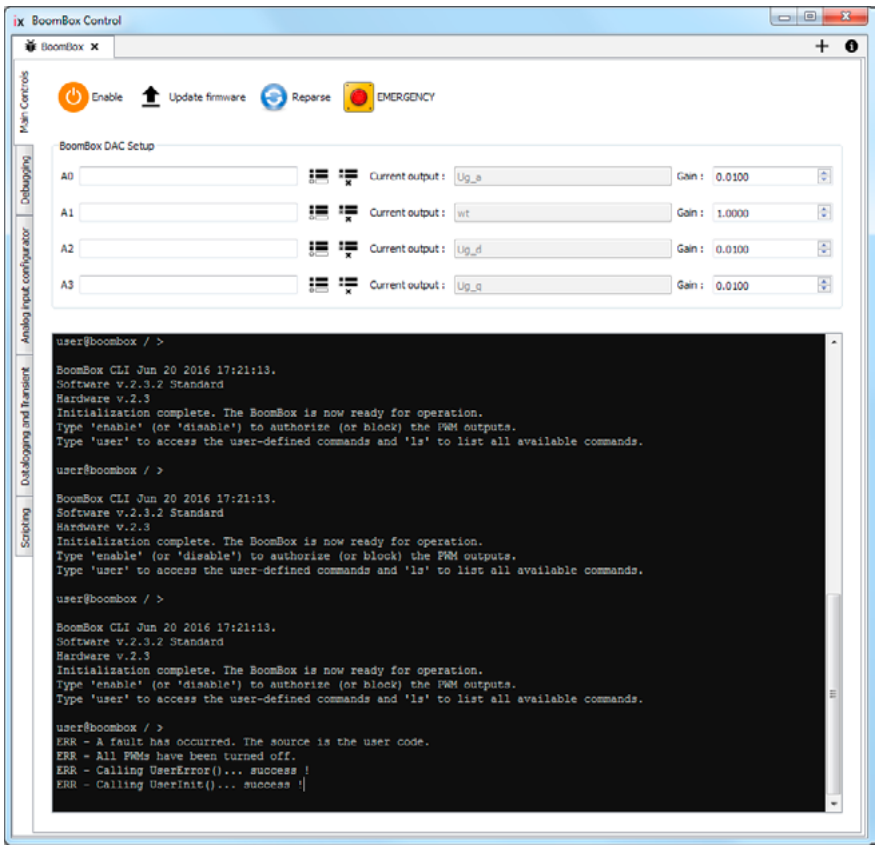
If the emulator is active during the flashing process (e.g. because the running code was previously flashed from CCS), it may prevent the DSP to reboot automatically. Manually clicking on the *play* button or disconnecting the emulator may be needed.

MONITORING THE BOOMBOX

Abstract — This section describes how to instruct the BoomBox to start producing PWM gating signals and basic monitoring of the DSP code.

Keywords — *enable, disable, gating, PWM, debug, monitor, variables.*

3.1 ENABLING AND DISABLING GATING SIGNALS



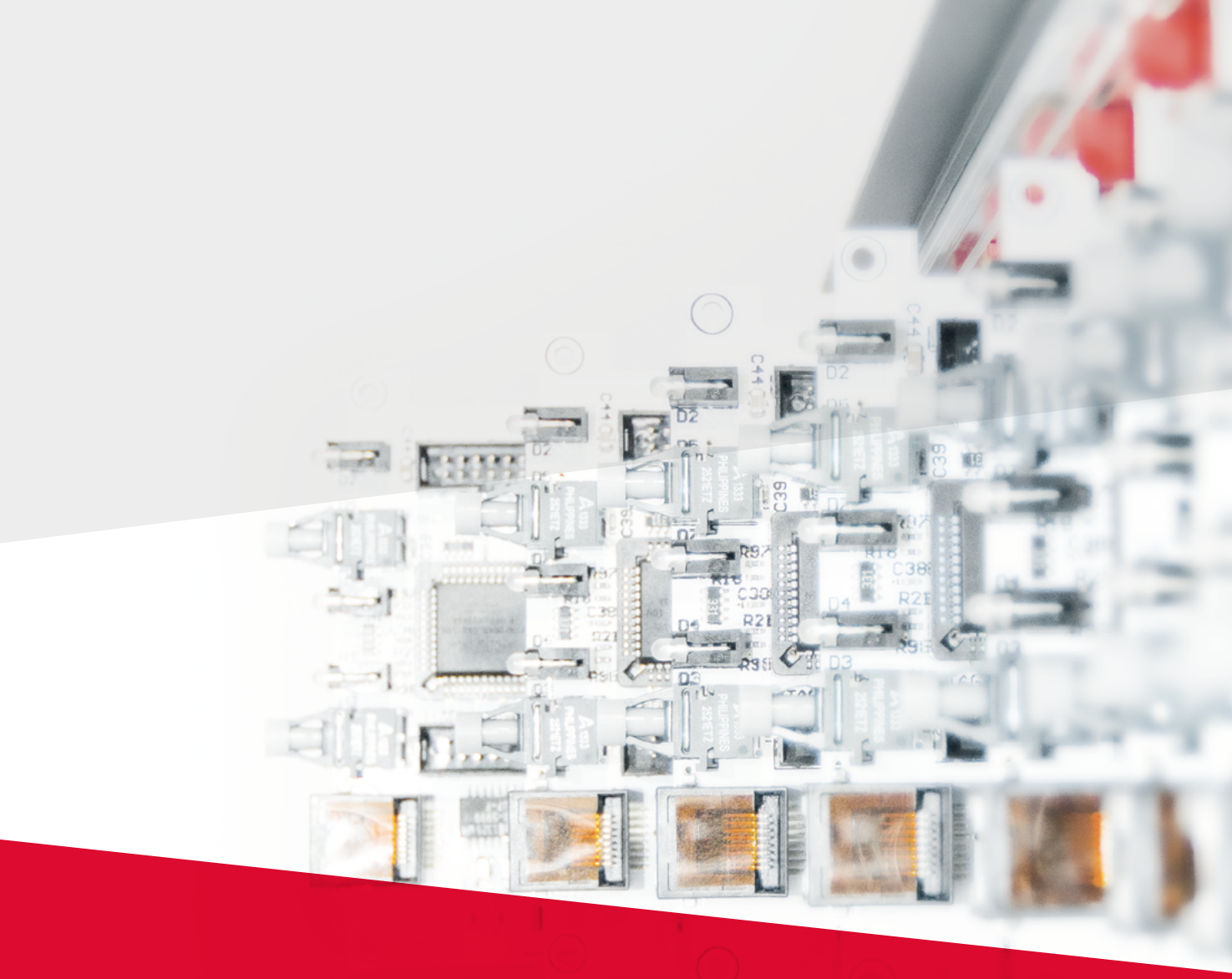
Enabling and disabling the BoomBox's gating signals is as simple as clicking the **'Enable/Disable'** button on the **'Main Controls'** tab of BoomBox Control.

3.2 WATCHING AND ALTERING VARIABLES

In the **'Debugging'** tab, variables can be added to the watch list by typing their name in the top field and pressing Enter. Their current values can then be monitored in real-time in the list below. The user can also alter a variable's value by double-clicking on it (see figure above).

Additionally, by dragging a variable from the watch list and dropping it over the plot below, the variable's evolution in time can be viewed.

The maximum update rate of this plot is 10 Hz so it is only suited to slow variables. For fast phenomena, please use the datalogging feature described in section 6.2.5, page 39 of the **BoomBox User Manual**.



imperix Ltd.

Rue de la Dixence 10
CH-1950 Sion
Switzerland

Phone +41 (0)27 552 06 60
Fax +41 (0)27 552 06 69

www.imperix.ch
support@imperix.ch

Find your closest distributor on imperix.ch/resellers