# Model-Based Design Toolbox for HCP

**Release Notes** 

Automatic Code Generation for the HCP Family Version 1.2.0

Target Based Automatic Code Generation Tools For MATLAB™/Simulink™/Stateflow™ Models working with Simulink Coder ™ and Embedded Coder®



# Summary

1	Ma	in Features	1-3
2	HC	CP MCU Support	2-3
		Packages & Derivatives Functions	
3	Mo	odel-Based Design Toolbox Features	
	3.1	HCP Simulation modes	
	3.2	HCP Example Library	
4	Pre	erequisites	4-9
	4.1	MATLAB Releases and OSes Supported	
		Build Toolchain Support	
5	Kn	own Limitations	5-11
6	Sup	pport Information	6-11

# 1 Main Features

The NXP's Model-Based Design Toolbox for HCP version 1.2.0 is designed to support S32S2xx, S32R4x and S32G2xx MCUs into MATLAB/Simulink environment, allowing users to:

- Design applications using Model-Based Design methodologies;
- **Simulate** and **Test** Simulink models for S32S, S32R and S32G MCUs before deploying the models to the hardware targets;
- Generate the application code automatically without any needs for hand coding C/ASM
- **Deployment** of the application directly from MATLAB/Simulink to the NXP evaluation boards

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The main features and functionalities supported in v1.2.0 RFP release are:

- Support for S32S247TV MCU and the GreenBox II Development Platform
- Support for S32G274A MCU and the GoldBox Development Platform (S32G-VNP-RDB2 Reference Design Board)
- Support for S32R41 MCU with Development Board (X-S32R41-EVB)
- Compatible with MATLAB releases R2020a R2022b
- Fully integrated with Simulink Toolchain
- Includes an Example library that covers:
  - Software-in-Loop, Processor-in-Loop
  - For more details about each of the topics highlighted above please refer to the following chapters.

# 2 HCP MCU Support

## 2.1 Packages & Derivatives

The Model-Based Design Toolbox for HCP version 1.2.0 supports:

Model-Based Design Toolbox for HCP Release Notes

- S32S2xx MCU Packages: o S32S247TV
- S32G2xx MCU Packages: o S32G274A
- S32R4x MCU Packages:
   S32R41

The configurations can be easily changed for each Simulink model from the **Configuration Parameters** menu:

Configuration Parameters: s32g2	2xx_pil_target/Configuration (Active) >	<
Q Search		
Solver Data Import/Export Math and Data Types Diagnostics Hardware Implementation Model Referencing	Hardware board:     NXP S32G2xx     ▼       Code Generation system target file:     ert tlc       Device vendor:     ARM Compatible     ▼       ▶ Device details	1
Simulation Target Code Generation	Hardware board settings	
	Clocking Hardware part: S32G274A  Hardware part: S32G274A	
	OK Cancel Help Apply	ř.

## 2.2 Functions

The Model-Based Design Toolbox for HCP version 1.2.0 supports the following functions:

- Memory read/write
- Register read/write
- Profiler

The default configuration supported by the toolbox is available inside the **Target Hardware Resources** panels:

Solver       Data Import/Export         Math and Data Types       Code Generation system target file: ert.tlc         Device vendor: ARM Compatible       Device type: ARM Cortex-A53 (64 bit)         Hardware Implementation       Nodel Referencing         Simulation Target       Device details         Hardware board settings       Operating system/scheduler         Target hardware resources       Groups         Clocking       Device Address: 5.12.240.91         Hardware part       User Name: root         Placer Parameters       Protecomputing         Download Dir: /home/root       Nome/root		bx_pil_target/Configuration (Active) -		×
Data Import/Export   Math and Data Types   Diagnostics   Hardware Implementation   Model Referencing   Simulation Target   Code Generation   Operating system/scheduler Target hardware resources   Groups   Clocking   Hardware part   User Name : root   Password : highperformancecomputing   Device data Dir: /home/root	Q Search			
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<ul> <li>Diagnostics</li> <li>Device vendor: ARM Compatible  <ul> <li>Device type: ARM Cortex-A53 (64 bit)</li> </ul> </li> <li>Device details</li> </ul> <li>Device details <ul> <li>Hardware board settings</li> </ul> </li> <li>Operating system/scheduler <ul> <li>Target hardware resources</li> <li>Clocking <ul> <li>Device Address: 5.12.240.91</li> <li>User Name : root</li> <li>Password : highperformancecomputing</li> <li>Device dot Dir : /home/root</li> </ul> </li> </ul></li>		Code Generation system target file: ert tic		
Model Referencing Simulation Target Code Generation Hardware board settings  • Operating system/scheduler  • Target hardware resources  Groups Clocking Hardware part Board Parameters PIL Device Address: 5.12.240.91 User Name : root Password : highperformancecomputing Download Dir : /home/root		Device vendor: ARM Compatible     Device type: ARM Cortex-A53 (64 bit)	5	
Target hardware resources   Groups   Clocking   Hardware part   Board Parameters   PIL   Device Address:   5.12.240.91   User Name :   root   Password :   highperformancecomputing   Download Dir :   [/home/root]	Model Referencing Simulation Target			
•		Target hardware resources      Groups     Clocking     Hardware part     Board Parameters     PIL     Device Address: 5.12.240.91     User Name : root     Password : nighperformancecomputing     Download Dir : /home/root		

From this panel, the user can update the model **Board Parameters** like device address, user name, password, and download folder.

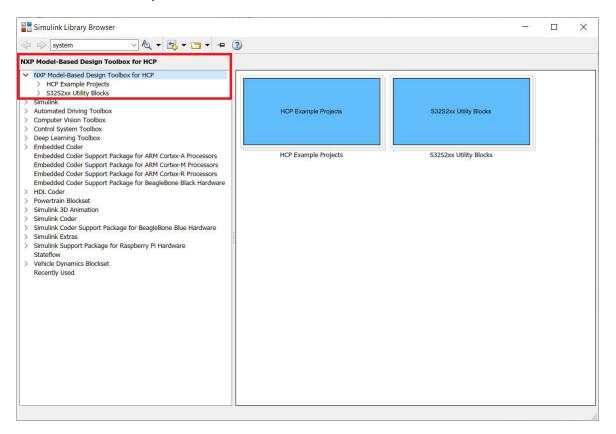
The Model-Based Design Toolbox for HCP version 1.2.0 has been tested using the official NXP GreenBox II Development Platform for S32S2xx, NXP GoldBox Development Platform for S32G2xx and X-S32R41-EVB Development Board for S32R41.

# 3 Model-Based Design Toolbox Features

The Model-Based Design Toolbox for HCP version 1.2.0 is delivered with complete HCP MCUs Simulink Block Library as shown below.

There are two main categories:

- HCP Example Projects
- S32S2xx Utility Blocks



## 3.1 HCP Simulation modes

The toolbox provides support for the following Simulation modes:

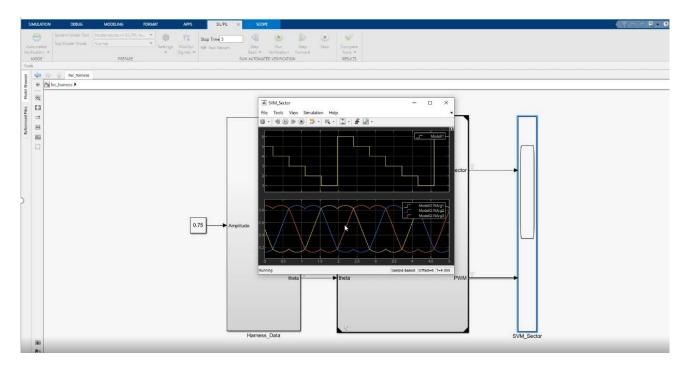
- Software-in-Loop (SIL)
- Processor-in-Loop (PIL)

#### Software-in-Loop

A SIL simulation compiles and runs the generated code on the user's development computer. One can use such a simulation to detect early defects and fix them.

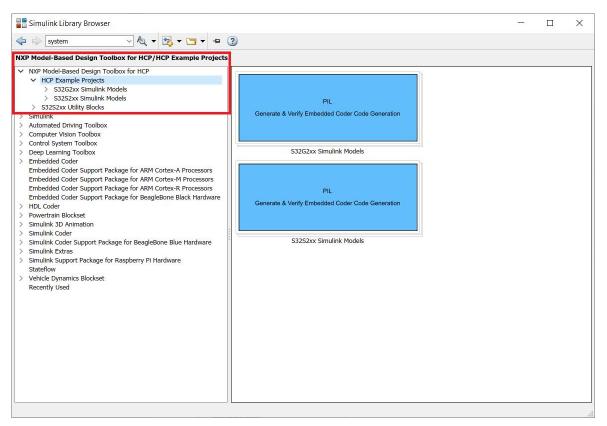
Processor-in-loop

In a PIL simulation, the generated code runs on the target hardware. The results of the PIL simulation are transferred to Simulink to verify the numerical equivalence of the simulation and the code generation results. The PIL verification process is a crucial part of the design cycle to ensure that the behavior of the deployment code matches the design.



## 3.2 HCP Example Library

The Examples Library represents a collection of Simulink models that let you test different MCU on-chip modules and run complex PIL applications.



The Simulink models shown as examples are enhanced with a comprehensive description to help users better understand the functionality that is exercised, hardware setup instructions whenever are necessary, and a result validation section.

The examples are also available from the MATLAB help page.

# 4 Prerequisites

## 4.1 MATLAB Releases and OSes Supported

This toolbox is developed and tested to supports the following MATLAB releases:

- R2020a;
- R2020b;
- R2021a;
- R2021b;
- R2022a;
- R2022b

For a flowless development experience the minimum recommended PC platform is:

- Windows® OS or Ubuntu OS: any x64 processor
- At least 4 GB of RAM
- At least 6 GB of free disk space.
- Internet connectivity for web downloads.

#### **Operating System Supported**

	SP Level	64-bit
Windows 7	SP1	Х
Windows 10		Х
Ubuntu 21.10		Х

### 4.2 Build Toolchain Support

The following compilers are supported:

MCU Family	Compiler Supported	<b>Release Version</b>
S32S2xx	GCC for ARM Embedded Processors	V9.2
S32G2xx	GCC for ARM Embedded Processors	V10.2
S32R4x	GCC for ARM Embedded Processors	V9.2

The target compiler for the Model-Based Design Toolbox needs to be configured.

The Model-Based Design Toolbox uses the Toolchain mechanism exposed by the Simulink to enable automatic code generation with Embedded and Simulink Coder toolbox. By default, the toolchain is configured for the MATLAB R2020a - R2022b releases. For any other MATLAB release, the user needs to execute a toolbox m-script to generate the appropriate settings for his/her installation environment.

This is done by changing the MATLAB Current Directory to the toolbox installation directory (e.g.: ..\MATLAB\Add-Ons\Toolboxes\NXP\_MBDToolbox\_HCP\) and running the "mbd\_hcp\_path.m" script.

```
>> mbd_hcp_path
Treating 'C[...]\\NXP_MBDToolbox_HCP as MBD Toolbox installation root.
MBD Toolbox path prepended.
Registering the toolchain ...
Successful.
```

Model-Based Design Toolbox for HCP Release Notes This mechanism requires users to install the <u>Embedded Coder Support Package for ARM</u> <u>Cortex-A Processor</u> and <u>Embedded Coder Support Package for ARM Cortex-R Processor</u> as a prerequisite.

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Installed	d Updates			10	Get Add-	Ons
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	Embedded Coder Support Package for BeagleBone Black Hardware version 20.1.3	📣 Hardware Support Package		6 July 2021	0	:
	Embedded Coder Support Package for ARM Cortex-A Processors version 20.1.3	📣 Hardware Support Package		1 July 2021		:
	Simulink Coder Support Package for BeagleBone Blue Hardware version 20.1.1	📣 Hardware Support Package		5 July 2021	0	:
THE	MATLAB Support Package for Raspberry Pi Hardware version 20.1.3	📣 Hardware Support Package		5 July 2021	0	:
	Embedded Coder Support Package for ARM Cortex-R Processors version 20.1.1	📣 Hardware Support Package		15 March 2021	0	:
0)	MATLAB Support Package for USB Webcams version 20.1.1	📣 Hardware Support Package		7 September 2021		:

The "mbd\_hcp\_path.m" script verifies the user setup dependencies and will issue instructions for a successful installation and configuration of the toolbox.

The toolchain can be further enhanced using the Simulink Model Configuration Parameters menu:

Configuration Parameters: s32g2x	x_pil_harness/Configuration (Act	ive) — 🗆	×
Q Search			1
Solver Data Import/Export Math and Data Types	Ocherate code only     Package code and a     Toolchain settings	tifacts Zip file name: <empty></empty>	
<ul> <li>Diagnostics</li> <li>Hardware Implementation</li> <li>Model Referencing</li> <li>Simulation Target</li> </ul>	Toolchain:	XP S32G2 (GCC)	
► Code Generation	Tool	Options	
	Assembler	-csysroot="\$(SDKTARGETSYSROOT)" \$(EXTRA_ASFLAGS) -O2 -pipe -g -feliminate-unused-d	
	C Compiler	-c -fstack-protector-strong -D_FORTIFY_SOURCE=2 -Wformat -Wformat-security -Werror=format	
	Linker	-WI,-O1 -WI,hash-style=gnu -WI,as-needed -WI,-z,relro,-z,nowsysroot="\$(SDKTARGETSYSF	
	Shared Library Linker	-WI,-O1 -WI,hash-style=gnu -WI,as-needed -WI,-z,relro,-z,nowsysroot="\$(SDKTARGETSYSF	
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# 5 Known Limitations

The list of know limitations can be found the readme.txt file that is delivered with the toolbox and can be consulted in the MATLAB Add-on installation folder of the Model-Based Design Toolbox for HCP.

# 6 Support Information

For technical support please sign on to the following NXP's Model-Based Design Toolbox Community: <u>https://community.nxp.com/t5/NXP-Model-Based-Design-Tools/bd-p/mbdt</u>

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