

Accelerate. Innovate. Differentiate.

# CANOPER

for



# **Quick Start Guide**











Caution: Make sure that the EVAL board you are using is safely installed according to the instructions!



**Caution: The follow described software is for** 

use for evaluation and test only!





# **Table of Contents**

1	Project	Project overview4							
2	Softwa	Software structure							
3	CANoj	CANopen examples							
4	Notes .		5						
5	5 Initial quick starting								
5	5.1 Cr	eate a new User project with CANopen in Synergy Framework:	6						
	5.1.1	Basic steps	6						
	5.1.2	CANopen integration	9						
	5.1.3	Prepare the Synergy configuration for CANopen							
	5.1.4	First CANopen Application							
6	Service	e and Support	14						
7	helpful Tools								
8	License	e Terms for the Evaluation Version of the Binary (demo)							
9	Space	for your own notes							





#### **Project overview** 1

The port CANopen implementation on the Renesas Synergy platform. Based on the Synergy Software Package (SSP Version 1.1.1).

**Environment:** 

- Evaluation-Board: Renesas SK-S7G2
- ➤ Compiler: GNU for ARM gcc v4.9
- ➢ IDE: e2-studio Version: 5.0.0.43

#### 2 Software structure



From port generated folders (e.g. unfolded CANopenSlave1 project):

- → CANopenSlave1 Synergy Project structure, with included Synergy configuration file (configuration.xml), module descriptions and e2-Studio project files.
  - ➢ synergy/CANopen/canopen CANopen stack from port
  - > synergy/CANopen/drivers CANopen drivers (CAN, CPU and CANopen timer)
  - ➢ src sources from port example code (for a simple CANopen device).

→ Documentation - user manual, reference manual from port CANopen stack

Note: All other developed example projects have the same structure.

RENESAS Synergy Dert PROFESSIONAL



#### 3 **CANopen examples**

In this framework implemented CANopen example projects:

Name	Тур	CANopen Services	Notes
CANopen -	Slave	NMT-Slave, SDO-	The node ID is 32 and all commu-
Slave SI		PDO	COB-IDs.
CANopen -	Slave	NMT-Slave, SDO-	The node ID is 32 and all commu-
Slave s2		Server, NodeGuarding,	COB IDs
		PDO	COD-IDS.
CANopen -	Slave	NMT-Slave, SDO-	The node ID is 32 and all commu-
Slave s3		Server, Sync-Consumer,	nication objects have the default
		NodeGuarding, PDO	COB-IDs.
CANopen -	Master	NMT-Master, SDO-	Implementation of a CANopen
Master ml		Server/Client, Node- Guarding, Emergency	application functionality
		Guarding, Emergency	The node ID is 5 and all communi-
			cation objects have the default
			COB-IDs.
CANopen -	Master	NMT-Master, SDO-	Implementation of a CANopen
Master m2		Server/Client, Heartbeat	master device with a minimum
			application functionality.
			The node ID is 5 and all communi-
			cation objects have the default
			COB-IDs.

CAN-Bitrates is set in the main file from the examples default on 125Kb.

#### 4 Notes

The example projects are supported by ThreadX RTOS and be based on the "BlinkyThreadX" template. The ThreadX components, the BSP and the peripheral driver interfaces (HAL) was created and generated with the Synergy configurator.

For further notes please read the CANopen driver Readme. (../synergy/CANopen/drivers/synergy/Readme)





#### **Initial quick starting** 5

# 5.1 Create a new user project with CANopen in Synergy framework:

Prerequisite:

The example project CANopenSlave1 from port is already loaded in the e2studion IDE.

### 5.1.1 Basic steps

- → Create a new project over the menu "File New SynergyProject "
- → assign a name for the new project (e.g. UserCANopenSlave1) and set a location for the project

	🗖 🗖 🚼 Outline 🕄 🐵 Make Ta	get
e2 studio - Project Configuration (Synergy Project)	available.	
e2 studio - Project Configuration (Synergy Project) Specify the new project details.		
Project	Toolchains	
Project name UserCANopenSlave1	GCC ARM Embedded	
V Use default location	IAR ARM Toolchain	
Location: C:\jsc\Renesas_Synergy_with_CANopen\CANopen\UserCANopenSlave1	Browse	
UserName: Renesas Synergy Evaluation User Email: noreply@renesas.com		
LICENSE INFORMATION: Issued: 06/02/2016		
LICENSE INFORMATION: Issued: 06/02/2016 SUPPORTED COMPONENTS: Component: Synergy BSP Permissions: Source=yes,Edit=yes,Save=yes,View=yes,Compile=yes		
LICENSE INFORMATION: Issued: 06/02/2016 SUPPORTED COMPONENTS: Component: Synergy BSP Permissions: Source=yes,Edit=yes,Save=yes,View=yes,Compile=yes		-
LICENSE INFORMATION: Issued: 06/02/2016 SUPPORTED COMPONENTS: Component: Synergy BSP Permissions: Source=yes,Edit=yes,Save=yes,View=yes,Compile=yes	₫ 🛛 •	<u></u>

In the next step select the used toolchain and board support:

- Synergy software package (ssp version 1.1.1)
- ➢ Board S7G2-SK (S1, S5)
- ➢ Compiler ARM GCC v4.9





Debugger J-Link ARM

This environment is current supported and tested from port.

C/C++ - e2 studio File Edit: Source Refactor Navigate Search Project Renesas Views Run Window Help								
Project Explorer 🛛 🖳	🗖 🗖 📴 Outline 🛛 🛞 Make Target 🖓 🗖							
b C e z studio - Project Configuration (Synergy Project)	le.							
e2 studio - Project Configuration (Synergy Project) Select the board support that you require.								
Device Selection SSP version: 1.1.1 Board: S762 SK Device: R7FS7627H3A01CFC								
Select Tools Toolchain: GCC ARM Embedded Toolchain version: 4.9.3.20150529 Debugger: J-Link ARM •	Available Tools GCC ARM Embedded 4.3.3.20150529 4.8.4.20140725 Debuggers J-Link ARM RTOS Express Logic ThreadX Smart Manual I/O Registers Supported Software Manual Supported Software Manual Supported							
② <back :<="" next="" td=""><td>Finish Cancel</td></back>	Finish Cancel							
CANopenSlave1								

→ next step you select a project template. Please select the "S7G2-SK Blinky with ThreadX" The CANopen implementation from port based on this template.





C/C++-+2 studio	
	🖋 ▼   🗉 📊 🤰 ▼ 🔁 ▼ 😓 マ 🗢 マ 🔍 Quick Access 📔 🔡   📴 C/C++ 🎋 Debug
Project Explorer 🛛 🗖	" 🗖 📴 Outline 😫 🛞 Make Target " 🗖
e2 studio - Project Configuration (Synergy Project)	
e2 studio - Project Configuration (Synergy Project)	
Select the type of project you wish to create.	
Project Template Selection	
BSP Base Board Support Package for the chosen Synergy family. No RTOS included.	
• S7G2-SK BSP Board Support Package for the S7G2-SK. No RTOS included.	
• STG2-SK Blinky Blinky for the STG2-SK.	
STG2-SK Blinky with ThreadX Threaded version of Blinky for the STG2-SK.	
Code Generation Settings I Use Synergy Code Formatter	
0	<back next=""> Finish Cancel</back>
<	
CANopenSlave1	<u></u>

→ after you pressed the Finish-Button you can see your new created project in the "Project Explorer" from e2studio with the typical folder structure for a Synergy project, beside the CANopenSlave1 example project from port.





🖻 Synergy Configuration - UserCANopenSlave1/configuration.xml - e2 studio									
File Edit Navigate Search Project Renesas Views Run Window Help									
	©   ☆ • O • 4 •   Ø •   2 • 2 • 2 • ○ •	Quick Access	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	The Debug in Synergy Configuration					
Project Explorer 🛛 📄 🔄 💆 🖓 🖻	🌼 [UserCANopenSlave1] Synergy Configuration 🛛	- 1	🗆 🧧 Package 🖂	🔍 ④ ▼ 🔛 ▼ 🗠 ▼ 🗆					
CANopenSlave1  CANopenSlave1  CANopenSlave1	Summary	Generate Project Conter	t						
<ul> <li>▶ III includes</li> <li>▶ G src</li> <li>▶ G src</li> <li>&gt; Script</li> <li>▶ prergy_cfg</li> <li>♥ configuration.xml</li> <li>▶ Stript</li> <li>▶ UserCANopenSlave1 Debug.launch</li> </ul>	This editor allows you to modify the Synergy project setting BSP Allows board and device selection The board type is optional Board properties can be modified in the Properties view Clock Allows configuration of the clock generation circuit Pins Allows configuration of the clock generation circuit Pins Allows configuration of the reads within a Synergy project Synergy modules and objects can be added to individue Properties of each thread, module and object can be model Messaging Allows configuration of the messaging framework ECU Allows configuration of interrupts Components Synergy components can be selected on this page Only those components suited to your selected board and Board: STG2 SK Device: RYFSTG27HAD0LCPC SSP Version 1.1.1	ss stored in the configuration file (configuration.xml). up I threads diffed in the Properties view nd device will be displayed							
	Summary Cocky Find Threads incodinging red		•	•					
Problems		Pin Conflicts 🔀		~					
		Description	Module Pin	Location Resource					
Properces are not available.									
		•	m	•					
0 items selected			82						

## 5.1.2 CANopen integration

→ next step you should copy and paste the CANopen Stack and drivers from port example project CANopenSlave1 to your user project. This software packages you can find under the synergy folder. You can copy and paste inside the e2studio IDE.





💽 Synergy Configuration - UserCANopenSlave1/configuratio	n.xml - e2 studio			- • • ×
File Edit Navigate Search Project Renesas Views R	un Window Help			
🎦 Project Explorer 🐹 📄 🔄 🔽 🗖	🌐 [UserCANopenSlave1] Synergy Configuration 😒		👩 Package 😒	
CANopenSlave1 [Debug]  Similaries	Summary	Generate Project Content		
<ul> <li>Sincludes</li> <li>Sincludes</li> <li>Sincludes</li> <li>Sincludes</li> <li>Sincludes</li> <li>Concern</li> <li>Concern</li> <li>Concern</li> <li>Concern</li> <li>Concern</li> <li>Concern</li> <li>Sincludes</li> &lt;</ul>	This editor allows you to modify the Synergy project setting BSP Allows board and device selection The board type is optional Board properties can be modified in the Properties view Clocks Allows configuration of the clock generation circuit Pins Allows editing of the projects pin configuration and set Threads Allows configuration of threads within a Synergy project Synergy modules and objects can be added to individue Properties of each threads module and object can be mod Messaging Allows configuration of the messaging framework ECU Allows configuration of interrupts Components Synergy components can be selected on this page Only those components suited to your selected board a Board: STG2 SK Device: RTF5TG27H3A01CFC SSP Version: 1.1.1	as stored in the configuration file (configuration.xml).	¥40         191           ¥41         191           ¥42         191           ¥42         191           ¥42         191           ¥42         191           ¥42         191           ¥42         191           ¥43         191           ¥44         191           ¥45         191           ¥45         191           ¥45         191           ¥45         191           ¥45         191           ¥45         191           ¥46         191           ¥47         191           ¥48         191           ¥44         191           ¥44         191           ¥44         191           ¥44         191           ¥44         191           ¥44         191           ¥44         191           ¥44         191           ¥44         191           ¥44         191           ¥44         191           ¥44         191           ¥44         191           ¥44         191           ¥44	Debug Synergy Configuration
	Summary 🙆 BSP Clocks Pins Threads Messaging ICU	Components	dSBHS_RRF □ 0	• • •
	Board: STG2 SK Device: R7FSTG27H3A01CFC SSP Version: 1.1.1 Summary	Components	845_24830_22V	
🔲 Properties 🔀 🖹 Problems		Di tems		
Properties are not available.		Desenntion Mi ∢ II	ndule Pin	Location Resource

# 5.1.3 Prepare the Synergy configuration for CANopen

Additional to the blinky template with ThreadX we need some Synergy components and objects for a CANopen project.

These are:

- $\rightarrow$  HAL-driver CAN driver (r\_can), Timer driver (g\_agt), optionally Uart driver (r\_sci\_uart)
- → CANopen Thread with 2 semaphores, 1 event flag, 1 mailbox queue

For a quick start it's recommended you copy and paste the files configuration.xml and S7G2-SK\_CANopenThreadX.pincfg from the port example. This overwrites the template setting in the new project. This configuration files have made all necessary settings for use the CANopen functionality with Synergy.

Alternatively, you must add all components and objects in the new project like the example project.





官 Synergy C	onfiguration - CANopenSlave1/configur	ation.xml - e2	studio						
File Edit I	Vavigate Search Project Renesas V	iews Run	Window Help						
1 🖬 👻 🖽 🛛	) 🗞 • 🎸 • 🛠 🗟 (O ( 🖬 )	<b>1</b>   <i>1</i>   C	☆ ▼ 💽 ▼ 隆 ▼   🖋 ▼   🖢 ▼ 🖗 ▼ '	÷ 🔶 •	• ⇒ •	Quick Access	🛛 🔂 C/C++ 🔻	🌣 Debug	Synergy Configuration
Project E	oplorer 🛛 📄 🕏 🔻 🖻	- 🗆 🏟	[UserCANopenSlave1] Synergy Configuration	@ [C	:ANopenSlave1] Synergy Configuration 🖂				👼 Pa 🛛 🗖 🗖
⊿ 🧭 CANe ⊳ 👯 B	ppenSlave1 [Debug] inaries	Su	Immary				Generate Projec	t Content	
<ul> <li></li></ul>			is editor allows you to modify the Synergy proj P Allows board and device selection The board type is optional Board properties can be modified in the Prope ocks Allows configuration of the clock generation of selection of the projects pin configuration reads Allows configuring of threads within a Synergy Synergy modules and objects can be added to Properties of each thread, module and object cessaging Allows configuration of the messaging framew U Allows configuration of interrupts imponents Only those components can be selected on this p Only those components wited to your selecter	ect settin; rties view ircuit n and set ronject vork vork vork vork	gs stored in the configuration file (configura , up al threads adified in the Properties view nd device will be displayed	ion.xml).			No.         221           No.
		Sur	* ssp. common V1.11 [Pack V1.1.1] [Renesas## nmary 🙆 BSP Clocks Pins Threads Messag	¥Commo ging ICU	n##all##ssp_common####1.1.1] Components			Ŧ	USBHS_DP
Propertie	s 🔀 🔝 Problems		<b>1</b>		Pin Conflicts 🔀 0 items				~ - 8
- items s					Description	Module	Pin	Locat	tion Resource
Resource	Property	Value							
					4	III			
	🌼 4 items selected					8			

After this step you see the created Objects in the Threads view from project Synergy Configuration (configuration.xml).





🛃 Synergy Configuration - UserCANopenSlave1/configuration.xml - e2 studio									
File Edit Navigate Search Project Renesas Views Run Window Help									
🎦 Project Explorer 🔀 🛛 📄 😫 🤊		🌐 [UserCANopenSlave1] Synergy Configuration 🔀							P 🛛 🗖 🗖
CANopenSlave1		Threads					0		🔍 ⊕, ▾ 📲
Binaries							Generate Proje	ect Content	*
▷ Mincludes		Thereit		10					
> 🗁 src		Threads 🧌 🛍	HAL	/Common Stacks				1 H	
Synergy		HAL/Common				1			
Script		g_cgc CGC Driver on r_cgc		g_can CAN Driver on	g_timer0 Timer	g_uart3 UART Driver o	n r_sci_uart		
b b synergy_cfg		g_etc ELC Driver on r_etc		i_can	briver of fillage				
📄 CANopenSlave1.elf.jlink		Blinky Thread							
CANopenSlave1.elf.launch									
🔅 configuration.xml						SCI Common	g_transferU I ran: Driver on r. dtc F	ster <u>g</u>	E
S/G2-SK_CANopenThreadX.pinctg		@ CANopenThread					SCI3 TXI	SC	
UserCANopenSlave1		g_canopen_semaphore0 Semaphore							
A CA STC		g_canopen_semaphore1 Semaphore							
Synergy gen		g_canopen_event_flagsu Event Flags +							P400 [ P401 [
blinky_thread_entry.c		HAL/Common Objects 🔊 🔊							P402 [
b le hal_entry.c		- to to							P404 [
b 🐸 synergy									P405 [
b 🗁 script									P700 (
b b synergy_cfg									P702 (
Configuration.xml Configuration.xml Configuration.xml									P703 ( P704 (
STG2-SK_DIRKyTHEauX.pincty									P7Q5 (
UserCANopenSlave1 Debug.launch									P707 (
									PB00 ( PB01 (
									VBATT [
			<					•	XCIN
		Summany A BSD Clocks Ding Threads Massaging		Components					+ ] 22V
			9 100	components					• • •
UserCANopenSlave1 Debug.launch									AVCC_USBHS [
									AVSS_USBHS [
									VSS2_US8HS [ VSS2_US8HS [
			•						USBHS_DM ( USBHS_DP r
		Summary 🕭 BSP Clocks Pins Threads Messaging	g ICU	Components					
🔲 Properties 🔀 🎅 Problems		📑 🖬 🔻 🖘 🗠		🎦 Pin Conflicts 😒					~ - 8
Property	Value			0 items	^				
				Description		Module	Pin	Location	Resource
				1					
				•				1	,

Just press the button "Generate Project Content". This step will generate all Synergy sources in order to the configuration setting.

# 5.1.4 First CANopen Application

- → For a CANopen application you need additionally a basically set of source files.
- → For a quick start it's recommended you copy and paste the highlighted application files from the port example src folder into the src folder from new project. This files included all necessary sources for a simple CANopen slave functionality.







### They are:

Main\_canopen.c - CANopen Thread call initializations from stack and drivers further include the main loop with the cyclic functionality from CANopen

- → appl.c a simple application thread
- → usr\_301.c, nmt\_slave.c user indication functions called from CANopen stack
- → s1.can DesignTool project file
- ➔ application\_thread\_entry.c, canopen\_thread\_entry.c entry point and joining layer between Synergy generated Thread objects and own sources with Thread functions

From port DesignTool generated sources:

- → cal\_conf.h configuration file for the CANopen stack and drivers
- $\rightarrow$  co\_init.c customized initialization functions for the stack
- → object.c, object.h object dictionary from example

You can adapt this sources on your requirements or alternatively you have the possibility to included your own sources.

In the next step you must add the following include paths in the compiler settings from new project

- → "\${workspace\_loc:/\${ProjName}/synergy/CANopen/canopen/include}"
- → "\${workspace\_loc:/\${ProjName}/synergy/CANopen/drivers/shar\_inc}"





→ "\${workspace\_loc:/\${ProjName}/synergy/CANopen/drivers/synergy}"

This paths are including for the CANopen stack and drivers.



Just should make the project successful build.

Import the project into your *e2-studio workspace* by *opening ''File -> Import''* and *selecting ''Existing-Projects''*.

The project files can be found in the folder (../CANopen/CANopenSlave1/). (e. g. project CANopenSlave1)

In order to generate the prepared Synergy components from the Synergy Configurator. Open the file "configuration.xml" and press the button "Generate Project Content". Once all necessary files were created, the project can be built and loaded into the Synergy S7G2 target.

# 6 Service and Support

If you have questions or problem's please contact our service team:





# Life Chat: http://synergyxplorer.renesas.com/support/feature/chat

#### helpful Tools 7

For a quick success and better results, we recommend the use of our CANopen Design Tool (CDT)

The free trial version (WIN and LINUX) you can download here.

http://www.port.de/en/products/canopen/tools/canopen-design-tool.html#tab-9

#### 8 License Terms for the Evaluation Version of the Binary (demo)

License Terms for the Evaluation Version of the Binary (demo)

Licensor: port GmbH, www.port.de Licensee: You - the user of the demo

This demo is intended to be used in a disconnected laboratory environment (stand-alone network) to verify fit and basis functions. Please back-up all data before employing the demo. It comes AS-IS, no warranty of any kind - not expressed, not implied. Use at your own risk. The demo is functionally and timely limted and must not be used in any real-life network.

The demo has the status of a Proof-of-Concept; to show the capabilities of the software in a specific environment.

You are granted the non-exclusive License to run the demo for evaluation for testing as long as you are in legal possession of the corresponding original CD (carrying this demo) and only as long as you use the License for the intended use for non-commercial evaluation.

You are not permitted to reverse engineer, dis-assemble or modify the binary software. You have no rights to re-distribute or otherwise publish the demo. All rights reserved. All and any not expressively granted rights remain intellectual property of the Licensor.

www.port.de - June 2016

#### 9 **Space for your own notes**