



ANR008 WIRELESS CONNECTIVITY SDK

APPLICATION NOTE

VERSION 1.6

AUGUST 9, 2021

Revision history

Manual version	SW version	Notes	Date
1.0	3.0.0	<ul style="list-style-type: none"> Initial version of this document 	April 2019
1.2	3.0.0	<ul style="list-style-type: none"> Updated file name to new AppNote name structure. Updated important notes, legal notice & license terms chapters. 	June 2019
1.3	3.1.0	<ul style="list-style-type: none"> Updated supported modules 	September 2019
1.4	3.2.0	<ul style="list-style-type: none"> Updated supported modules 	May 2020
1.5	3.3.0	<ul style="list-style-type: none"> Updated supported modules Updated supported libraries Updated installation instructions Added description for SPI interfaces 	February 2021
1.6	3.4.0	<ul style="list-style-type: none"> Fixed wrong links Updated installation description of FTDI drivers Renamed USB radio sticks variants 	August 2021

★ For SDK version history see chapter [Software history](#)

Abbreviations and abstract

Abbreviation	Name	Description
CS	Checksum	
DC	Duty cycle	Active transmission time per hour expressed as percentage. 1% means, channel is occupied for 36 seconds per hour.
FSE	Field Sales Engineer	Support and sales contact person responsible for limited sales area
0xhh [HEX]	Hexadecimal	The prefix 0x indicates hexadecimal values. All other numbers are decimal values.
HIGH	High signal level	
LOW	Low signal level	
LPM	Low power mode	Operation mode with reduced energy consumption.
LRM	Long range mode	Tx mode increasing the RX sensitivity by using spreading and forward error correction
LSB	Least significant bit	
MSB	Most significant bit	
PL	Payload	The real, non-redundant information in a frame/packet.
RF	Radio frequency	Describes everything relating to the wireless transmission.
SDK	Software development kit	Software code that implements the command interface of various Würth Elektronik eiSos products
UART		Universal Asynchronous Receiver Transmitter - a serial data transmission interface
VDD	Supply voltage	

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1 Introduction

The Würth Elektronik eiSos wireless modules provide an easy to use radio interface to any embedded application. The module's interface with the host processor of the embedded application via UART can be operated using a command interface.

The Wireless Connectivity SDK is a set of software tools that enable quick software integration of Würth Elektronik eiSos wireless modules into any of the most commonly used host processors. It consists of a collection of C-code developed on the Raspberry Pi 3 platform. It contains the drivers for radio modules as well as sample projects that use the UART, SPI and USB peripheral of Raspberry Pi 3 to communicate with the attached radio device.

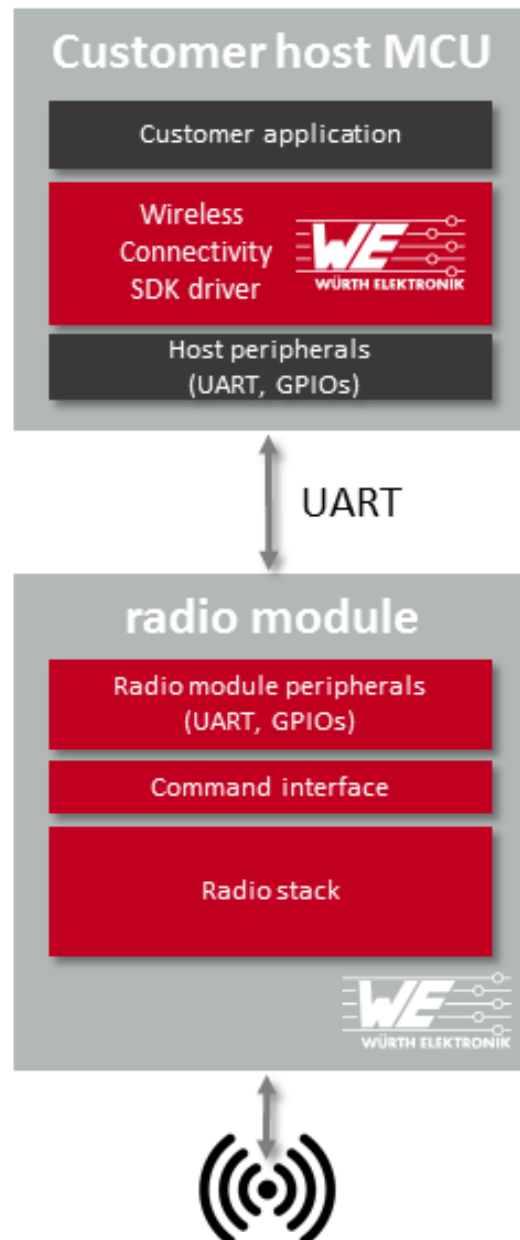


Figure 1: Wireless connectivity SDK driver as part of the end product

1.1 Motivation

The aim of the Wireless Connectivity SDK is to minimize the effort required on customer side to enable his host MCU to communicate with Würth Elektronik eiSos radio modules. It contains the implementation of all available commands in pure C-code. In order to integrate any Würth Elektronik eiSos wireless module, the user has to simply port the corresponding C-code to his host processor. This significantly reduces the time needed for developing the software interface to the radio module.

Würth Elektronik eiSos products, like the 868MHz proprietary radio module Tarvos-III, use a so called **command interface** for configuration and operation tasks. This interface provides up to 30 commands that accomplish tasks like updating various device settings, transmit/receive data and putting the module into one of various low power modes.



There are Würth Elektronik eiSos wireless modules that can operate in transparent mode in addition to the standard command mode. When using the transparent mode, the device does not interpret the commands sent via UART. Please make sure that the connected radio device runs in command mode to use the Wireless Connectivity SDK.

The commands of such an interface can be divided into 3 categories:

1. Requests: The host requests the module to trigger any action, e.g. in case of the request `CMD_RESET_REQ` the host asks the module to perform a reset.
2. Confirmations: On each request the module answers with a confirmation message as a feedback on the requested operation status. In case of a `CMD_RESET_REQ`, the module answers with a `CMD_RESET_CNF` to tell the host whether the reset will be performed or not.
3. Indications and Responses: In case of special events, the module indicates the same spontaneously to the host. The `CMD_DATAEX_IND` indicates for example that data was received via radio.

The commands itself have the following format:

Start byte	Command	Length	Payload	CS
0x02	1 Byte	1 Byte	Length Bytes	1 Byte

Example: `CMD_DATA_REQ` of the Tarvos-III

The `CMD_DATA_REQ` has the command number 0x00. It serves a simple data transfer. The length field indicates the number of bytes to be transmitted via radio.

Format:

Start byte	Command	Length	Payload	CS
0x02	0x00	1 Byte	Length Byte	1 Byte

Sending "Hello World!"

Start byte	Command	Length	Payload	CS
0x02	0x00	0x0C	0x48 0x65 0x6C 0x6C 0x6F 0x20 0x57 0x6F 0x72 0x6C 0x64 0x21	0x0F

Where we send 12 bytes (0x0C), which are "Hello World!" (0x48 0x65 0x6C 0x6C 0x6F 0x20 0x57 0x6F 0x72 0x6C 0x64 0x21) and the resulting checksum is 0x0F.

To use the complete feature set of such a radio device, all available commands of the corresponding command interface have to be implemented on the custom host processor. This involves considerable effort for the user and this is exactly the reason why Würth Elektronik eiSos offers the Wireless Connectivity SDK.

The steps for porting are explained in more detail in chapter 3.

2 Wireless Connectivity SDK overview

The Wireless Connectivity SDK is developed on the Raspberry Pi 3 platform. It contains the radio module drivers as well as example projects demonstrating simple applications.

The radio modules supported by the latest version of the Wireless Connectivity SDK are shown in table 1.

The Evaluation board for a specific radio module can also be used with this SDK. As the Evaluation boards also include the FTDI UART to USB converter IC the "USB radio stick" variant of the module driver package can also be used to interface the Evaluation boards.

SDK version	Radio standard	Radio module & usb dongle
3.4.0	Bluetooth® LE	Proteus-I, Proteus-II, Proteus-II USB radio stick, Proteus-III, Proteus-III USB radio stick, Proteus-III-SPI
	Proprietary 169 MHz	Titania
	Proprietary 434 MHz	Thadeus
	Proprietary 868 MHz	Tarvos-I, Tarvos-I USB radio stick, Tarvos-II, Tarvos-II USB radio stick, Tarvos-III, Tarvos-III USB radio stick, Thebe-I, Thebe-II
	Proprietary 915 MHz	Telesto-I, Telesto-II, Telesto-III, Telesto-III USB radio stick, Themisto-I
	Proprietary 2.4 GHz	Triton, Thalassa, Thalassa USB radio stick. Thyone-I, Thyone-I USB radio stick
	Wi-Fi / WLAN	Calypso
	Wireless M-BUS	Metis-II, Metis-II USB radio stick, Metis-I, Metis-I USB radio stick, Mimas-I, Mimas-I USB radio stick

Table 1: Radio module support in the Wireless Connectivity SDK

2.1 Content of the Wireless Connectivity SDK

Besides the various sample projects, there is a directory named **drivers**. Within the **driver** directory, each supported radio module has its own directory that contains the implementation of its command interface. Additionally to the definition of the commands, a thread is defined that checks for the confirmation and indication messages that are transmitted from the radio module to the host. Furthermore, functions that use specific radio module pins, like a pin reset or pin wake-up, are defined here.

Besides the module-specific directories, the subdirectory **global** contains all the shared functions as well as the definitions of the serial communication and GPIO interfaces of the underlying host.

```

/
├── drivers ..... Contains the code to be ported to custom hosts
│   ├── global
│   │   ├── global.h ..... Declares all functions to be defined on custom hosts
│   │   ├── global.c ..... Implements shared functions
│   │   ├── global_ftdi.c ..... UART and GPIO of the FTDI USB driver for RPi
│   │   ├── global_serial.c ..... UART of the RPi using termios
│   │   ├── global_serialWiringPi.c ..... UART of the RPi using wiringPi library
│   │   ├── global_spi.c ..... SPI interface of the RPi using ioctl
│   │   ├── global_pin.c ..... GPIO interface of the RPi using the libgpod library
│   │   └── global_pinWiringPi.c .... GPIO interface of the RPi using the wiringPi library
│   ├── ...
│   ├── Triton ..... Command interface of the Triton module
│   │   ├── Triton.h
│   │   └── Triton.c
│   ├── ...
│   ├── ThebeI ..... Command interface of the Thebe-I module
│   │   ├── ThebeI.h
│   │   └── ThebeI.c
│   └── ...
├── Example_Triton ..... Demo project using Triton module
│   ├── main.c
│   └── Example_Triton.cbp
├── ...
├── Example_ThebeI ..... Demo project using Thebe-I module
│   ├── main.c
│   └── Example_ThebeI.cbp
└── ...

```

The **global** directory contains various implementations of the serial and GPIO interface. Even though they are implemented with the Raspberry Pi platform in mind they can be used as a starting point for other platforms or even used on various Linux-based systems. Within the Code::Blocks projects the implementations can be selected by means of the build target.

Build target	Interface	API/Library	Comments
Debug	UART	termios	For modules using UART
Release	GPIO	libgpiod	For modules using UART
DebugWiringPi	UART	wiringPi	For modules using UART
ReleaseWiringPi	GPIO	wiringPi	For modules using UART
Debug	SPI	spi_dev	For modules using SPI
Release	GPIO	libgpiod	For modules using SPI
Debug_WiringPi	SPI	spi_dev	For modules using SPI
Release_WiringPi	GPIO	wiringPi	For modules using SPI
Debug	UART	FTDI	For USB radio stick
Release	GPIO	None	For USB radio stick. Uses FTDI CBUS pins instead of GPIOs of the Raspberry Pi.

Table 2: Implementations of serial and GPIO interfaces in Wireless Connectivity SDK



WiringPi is deprecated by the author and no longer under development. WiringPi shall not be used anymore.



The definition of the serial and USB interfaces of the Raspberry Pi is included.

3 Host integration

As described in chapter 2.1 the functions in the Wireless Connectivity SDK have been developed on the Raspberry Pi platform. To use all the features of the radio module, the module's drivers in the SDK have to be ported to the new custom platform.

In the following example, the steps involved in porting the drivers of the Bluetooth® LE 4.2 radio module, Proteus-I, to a custom platform is described.

- The directories **drivers/global** and **drivers/ProteusI** as well as the file **WE_common.h** have to be integrated to the custom project.
- In the function **InitDriver** of the file **ProteusI.c**, a thread is defined that listens to confirmation and indication messages that are transmitted from the attached radio module to the host processor.
Case 1: Threads are supported, the **rxthread** has to be ported to the host's thread system.
Case 2: Threads are not supported, a state machine has to be created that periodically checks for incoming UART bytes.

```
void *rx_thread()
{
    while(1)
    {
        /* wait for 1ms, then check if new RX data is available */
        delay (1);
        while (BytesAvailable())
        {
            /* interpret received byte */
            if (ReadByte(&readBuffer))
            {
                ...
            }
        }
    }
}
```

Code 1: Code snippet of the rxthread

- The file **global.h** declares the shared functions that deal with the serial interface as well as the usage of GPIOs for pin related functions.

```
/* Switch pin to input/output high/low with/without pullup/pulldown
 * input:
 * - pin_number: number of pin
 * - inout: input or output
 * - pull: pullup, pulldown or no pull
 * - out: output level high or low
 *
 * return: true, if success
 *        false, otherwise
 */
extern bool SetPin( int pin_number, SetPin_InputOutput_t inout, SetPin_Pull_t pull,
                  SetPin_Out_t out);

/*
 * Open the serial interface
 * input:
 * - baudrate: baudrate of the interface
 * return: true, if success
 *        false, otherwise
 */
```

```
*/  
extern bool OpenSerial(int baudrate);
```

Code 2: Code snippet of the file global.h

Here the definition of these functions, depending on the custom host peripherals, has to be created by the user. The existing files **global_serial.c**, **global_ftdi.c** and **global.c** can be removed from the project as it contains the corresponding implementation for the Raspberry Pi.

After dealing with the **rxthread** and the definition of the functions declared in **global.h**, the driver is functional. The corresponding demo project can be considered as a basis for application development on the custom platform.

4 Running Wireless Connectivity SDK sample applications on the Raspberry Pi

4.1 Hardware connections

For creating custom applications on the basis of the Raspberry Pi, connect the pins of the module to corresponding pins on the Raspberry Pi (power supply, ground, serial/SPI interface and other pins like reset). If the SPI version of a module is used, the driver assumes that *SPI0 CE0* is used as chip select pin. Please refer to figure 2 to get an overview of the pins of the Raspberry Pi used in the driver application examples.

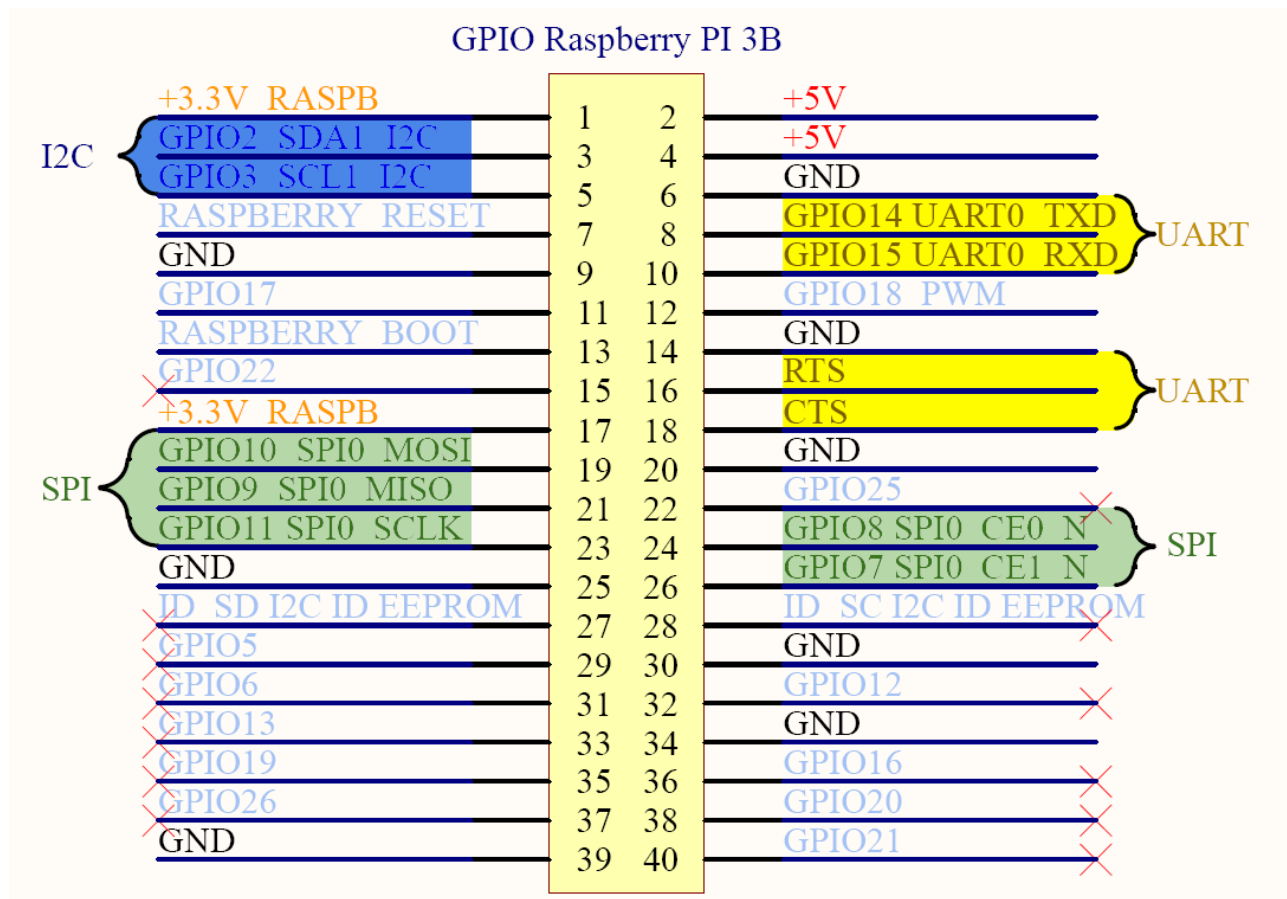


Figure 2: Extended connector from Raspberry Pi

Alternatively, Würth Elektronik eiSos USB dongles such as the Tarvos-II USB radio stick & Tarvos-III USB radio stick and evaluation boards can be directly connected to the USB-interface of the Raspberry Pi. If a USB port is to be used, the D2xx driver from FTDI has to be installed first (see section 4.4.2).



Some products, such as Tarvos-II USB radio stick, operate in transparent mode by default. In this case the device does not interpret the commands sent by the Wireless Connectivity SDK and thus communication fails. In this case first set the default operation mode to command mode, for example by using the Würth Elektronik eiSos software tool ACC.

4.2 Install the Raspberry Pi OS on the Raspberry Pi

1. Install the Raspberry Pi OS to a SD card according to official documentation at <https://www.raspberrypi.org/>. It is recommended to use the Raspberry Pi Imager.
2. After installing the image on the SD card, insert it into the Raspberry Pi's SD card slot, connect your monitor, mouse and keyboard. Now the Raspberry Pi is ready to boot up. Please start it by powering it up.
3. After booting the Raspberry Pi, switch off the Bluetooth® interface by clicking on the Bluetooth® button on the right upper corner of the screen (see figure 3). Otherwise it is not possible to use the UART interface of the Raspberry Pi.
4. Then turn on the WiFi for connecting to the internet by clicking on the WiFi button on the right upper corner of the screen and selecting the WiFi of your choice.

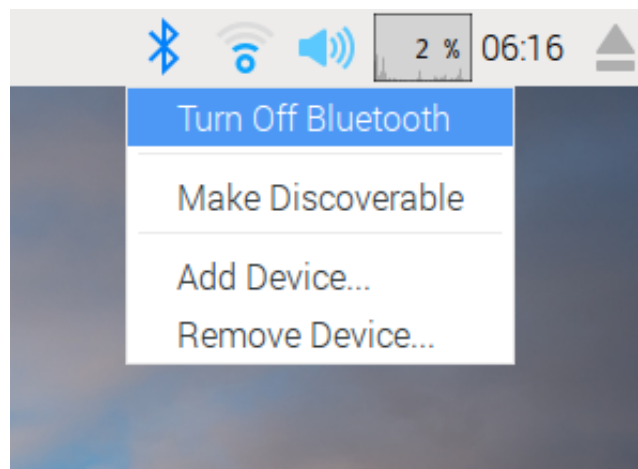


Figure 3: Switch off the Bluetooth® and connect to internet via WiFi

5. After connecting to the internet make sure your Raspberry Pi is up to date with the latest versions of Raspberry Pi OS. To update the system open a terminal by clicking on the terminal symbol in the left upper corner (see figure 4).



Figure 4: Terminal button

- Then upgrade the Raspberry Pi OS by typing in terminal:

```
sudo apt-get update
sudo apt-get upgrade
```

4.3 Configuring the peripherals

- Next, the peripherals have to be enabled. To do so open the menu by clicking on the Raspberry Pi symbol on the left upper corner of the screen and open the **Preferences** → **Raspberry Pi Configuration** window (see figure 5). Enable the SPI or serial depending on the required interface.

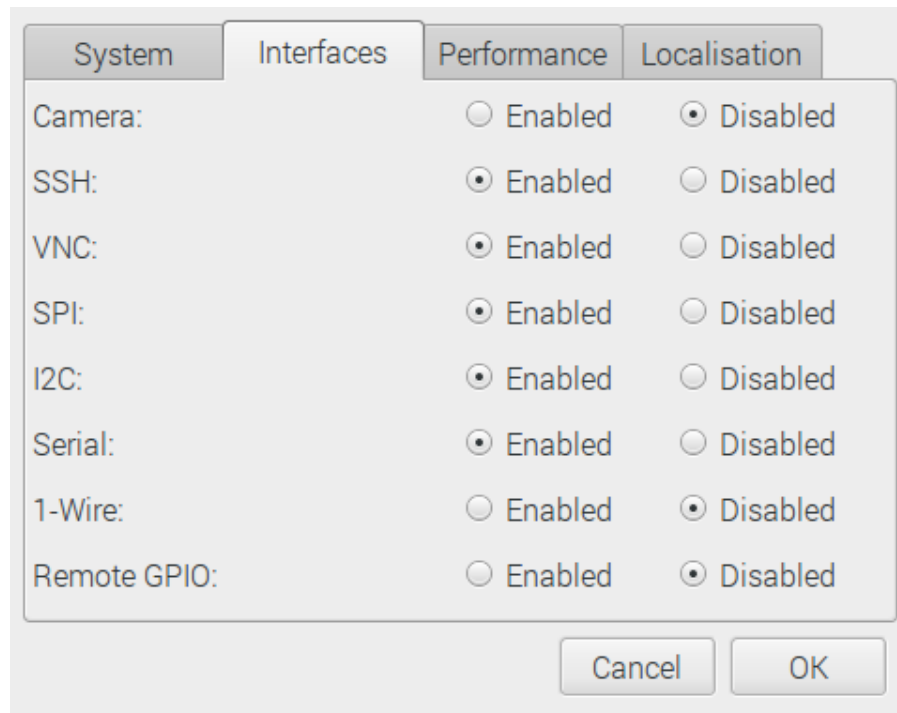


Figure 5: Raspberry Pi interface configuration

- After enabling the interfaces a dialog should appear asking for a reboot to apply the changes. If no dialog appears reboot by clicking on the Raspberry symbol on the left upper corner of the screen and select **Shutdown**.
- Now, after enabling the serial interface, the Raspbian OS claims it for console output. To disable this feature, please remove the string "console = serial0,115200" from the file **/boot/cmdline.txt** and save it. Root privilege is needed to change the file. To open the file accordingly type in terminal:

```
sudo leafpad /boot/cmdline.txt
```

- Please check whether the serial interface is still enabled by opening the file **/boot/config.txt** and check whether the string "enable_uart=1" is still included. If not, please add it and save the file. Root privilege is needed to change the file. To open the file accordingly type in terminal:


```
sudo leafpad /boot/config.txt
```

5. Please reboot as before and check whether the files **/boot/cmdline.txt** and **/boot/config.txt** are still as described in the previous two points. If not, adapt the two files again as described before and reboot. Otherwise the UART-interface to the module is not active and thus the module communication fails.
6. In order to use the peripherals as a non-root user, the local user has to be a member of the peripheral group. In order to check this, type in the following in the terminal,

```
groups
```

If the output contains GPIO and ,if required, SPI, then skip the next step.

7. Add the current user to the groups by typing in the following commands in the terminal,

```
sudo adduser pi gpio
sudo adduser pi spi
```

Logout and login to update the user group settings.

4.4 Install the required libraries

By default `termios` is used to communicate with the UART interface of the Raspberry Pi. This is installed by default and no further action is required. The same is true for the SPI interface and the usage of the `spidev` API.

The library to control the GPIO pins has to be installed however.

4.4.1 Install the `libgpod` library

To access the GPIO pins `libgpod` is used. It can be installed by typing the following in the terminal:

```
sudo apt-get update
sudo apt-get install libgpod2 libgpod-dev libgpod-doc
```

Note that as of now Raspberry Pi OS is based on Debian Buster and installs `libgpod` version 1.2. This version of `libgpod` does not support Pull-up and Pull-Down for GPIO pins yet. This feature was introduced with version 1.5. For the sample applications using modules with UART interface, `libgpod` version 1.2 is sufficient.

For modules using the SPI interface however, Pull-up and Pull-Down is required and `libgpod` has to be build and installed manually. See `libgpod` documentation:

<https://git.kernel.org/pub/scm/libs/libgpod/libgpod.git/about/>

4.4.2 Install the FTDI driver for USB (optional)

To run a Würth Elektronik eiSos USB dongle such as the Tarvos-II USB radio stick on the Raspberry Pi, the FTDI library is used and has to be installed.

To do so, first download the latest D2xx Linux driver for the ARM hard-float architecture from

<https://ftdichip.com/drivers/d2xx-drivers/>.

There are three versions available of the the FTDI D2xx driver which support the Raspberry Pi. To find out which architecture is used by your Raspberry Pi and Raspberry Pi OS, type the following in the terminal:

```
lscpu
```

The command will print information about the CPU. For output "Architecture: armv71" use the v7 version of the D2xx driver.

To install the FTDI driver the following commands have to be run in the terminal. It is assumed that the driver is version 1.4.22 for armv7 and saved to the **~/Downloads** directory.

1. Go to the directory where the driver is saved

```
cd ~/Downloads
```

2. Unpack the gzip file

```
tar -xvf libftd2xx-arm-v7-hf-1.4.22.tgz
```

3. Copy the needed header files to the system folder /usr/local/include

```
sudo cp release/ftd2xx.h /usr/local/include  
sudo cp release/WinTypes.h /usr/local/include
```

4. Copy the libraries to the system folder /usr/local/lib

```
sudo cp release/build/lib* /usr/local/lib
```

5. Create a symbolic link to the latest version

```
sudo ln -sf /usr/local/lib/libftd2xx.so.1.4.22 /usr/local/lib/libftd2xx.so
```

6. Update the shared libraries

```
sudo ldconfig
```

7. As the D2xx driver is incompatible with the FTDI VCP driver in the Linux kernel, the kernel modules "ftdi_sio" and "usbserial" have to be unloaded. To do so, please run:

```
sudo modprobe -r ftdi_sio  
sudo modprobe -r usbserial
```

8. Now all supported USB dongles can be used.

4.5 Install the Wireless Connectivity SDK

The Wireless Connectivity SDK was developed in the Code::Blocks development environment.

1. First download and install the software Code::Blocks. Open a terminal and type:

```
sudo apt-get install codeblocks
```

2. Now download the Wireless Connectivity SDK driver as zip file from <https://github.com/WurthElektronik/WirelessConnectivity-SDK/releases> to the location **~/Downloads**
3. The file is going to be extracted to the folder **~/Projects**. If the folder does not exist create it by typing in terminal:

```
mkdir ~/Projects
```

4. Now extract the Wireless Connectivity SDK to **~/Projects** by typing in terminal:

```
unzip ~/Downloads/WirelessConnectivity-SDK.zip -d ~/Projects
```

5. Then start the desired project via Code::Blocks by typing in terminal. For example,

```
codeblocks ~/Projects/WirelessConnectivity-SDK/Example_ProteusIII/  
ProteusIII.cbp &
```

6. Select the build target using the drop-down menu, e.g. Debug.

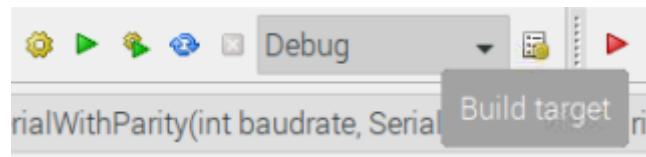


Figure 6: Select build target of the application

7. Then press **Build** → **Rebuild** to build the project (see figure 7).

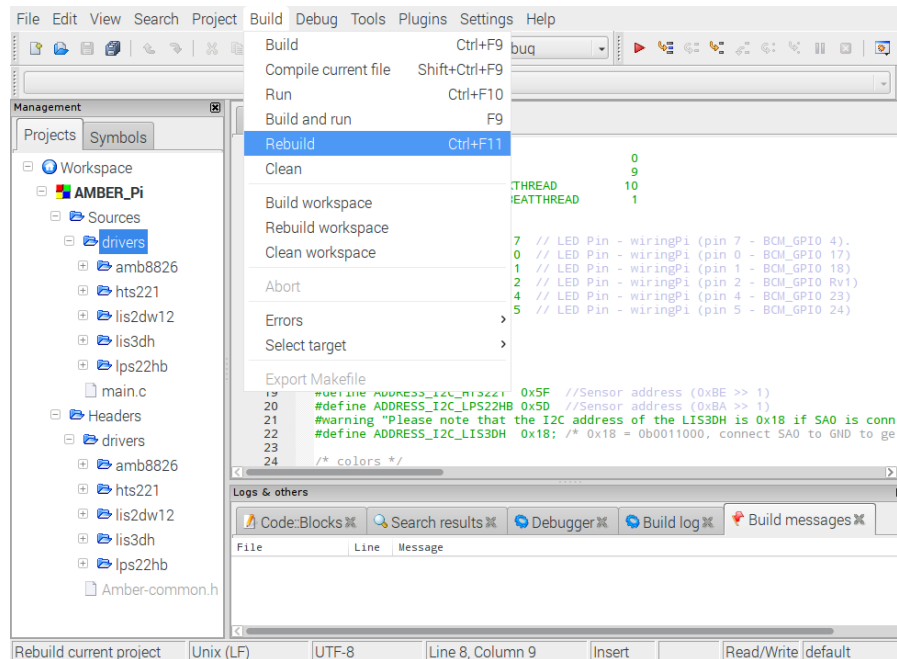


Figure 7: Rebuild the application

8. If it builds without errors the setup succeeded.
9. In case of further question, please contact our technical support at <https://we-online.com/wireless-connectivity/support>

4.6 FAQ - Frequently asked questions

4.6.1 The initialization function fails, what can I do?

The initialization function usually sets up the serial interface, performs a pin reset and waits for the module's response. In case this fails, there are several possibilities:

- The module is not powered up. Please check the *VCC* and *GND* connection.
- The *RESET* line is not connected, thus no pin reset was applied.
- The *UART RX* and *UART TX* lines are not connected, thus the module response was not transmitted.
- The UART interface does not run well. Please check the UART settings and initialization.
- The connected module or USB dongle does not run in command mode and thus does not respond to a pin reset and/or command request. In this case, set the device to command mode, for example by using the software tool ACC.
- The **rxthread** function, waiting for module response, does not work correctly.

4.6.2 ProteusIII-SPI: Pin Wakup leads to "GetPin: Could not read pin level"

When using the ProteusIII-SPI, the same pin is used to wake-up the module and to check for new messages. So there is a chance that the pin is accessed at the same time by different functions within the application. Mostly this will have no effect and the wake-up will succeed. If it leads to errors, the problem can be fixed by using a mutex.

5 Software history

Version 1.0.0 "Engineering"

- Initial version of the SDK

Version 1.2.0 "Release"

- Added new products
- Updated driver structure to easily switch between serial and USB interface on Raspberry

Version 1.6.3/2.0.0 "Release"

- Added new products

Version 3.0.0 "Release"

- Added driver for Wi-Fi module Calypso and proprietary high power radio module Thebe-I
- Replaced old module names by new module names

Version 3.1.0 "Release"

- Added driver for proprietary high power radio module Thebe-II and Themisto-I
- Bugfix in reset function of Proteus-* drivers
- Fixed typos in function names and resulting bug in Calypso driver

Version 3.2.0 "Release"

- Added driver for proprietary 2,4 GHz module Thyone-I and Thyone-I Plug
- Added driver for Bluetooth® LE module Proteus-III and Proteus-III Plug

Version 3.3.0 "Release"

- Added driver for Bluetooth® LE module Proteus-III-SPI
- Added implementation for SPI interfaces
- Added gpio implementation using libgpiod as wiringPi replacement

Version 3.4.0 "Release"

- Updated driver for proprietary 2,4 GHz module Thyone-I to add new features of latest module firmware
- Updated driver for Bluetooth® LE module Proteus-III add new features of latest module firmware

6 Important notes

The following conditions apply to all goods within the wireless connectivity product range of Würth Elektronik eiSos GmbH & Co. KG:

6.1 General customer responsibility

Some goods within the product range of Würth Elektronik eiSos GmbH & Co. KG contain statements regarding general suitability for certain application areas. These statements about suitability are based on our knowledge and experience of typical requirements concerning the areas, serve as general guidance and cannot be estimated as binding statements about the suitability for a customer application. The responsibility for the applicability and use in a particular customer design is always solely within the authority of the customer. Due to this fact, it is up to the customer to evaluate, where appropriate to investigate and to decide whether the device with the specific product characteristics described in the product specification is valid and suitable for the respective customer application or not. Accordingly, the customer is cautioned to verify that the documentation is current before placing orders.

6.2 Customer responsibility related to specific, in particular safety-relevant applications

It has to be clearly pointed out that the possibility of a malfunction of electronic components or failure before the end of the usual lifetime cannot be completely eliminated in the current state of the art, even if the products are operated within the range of the specifications. The same statement is valid for all software sourcecode and firmware parts contained in or used with or for products in the wireless connectivity and sensor product range of Würth Elektronik eiSos GmbH & Co. KG. In certain customer applications requiring a high level of safety and especially in customer applications in which the malfunction or failure of an electronic component could endanger human life or health, it must be ensured by most advanced technological aid of suitable design of the customer application that no injury or damage is caused to third parties in the event of malfunction or failure of an electronic component.

6.3 Best care and attention

Any product-specific data sheets, manuals, application notes, PCN's, warnings and cautions must be strictly observed in the most recent versions and matching to the products firmware revisions. This documents can be downloaded from the product specific sections on the wireless connectivity homepage.

6.4 Customer support for product specifications

Some products within the product range may contain substances, which are subject to restrictions in certain jurisdictions in order to serve specific technical requirements. Necessary information is available on request. In this case, the field sales engineer or the internal sales person in charge should be contacted who will be happy to support in this matter.

6.5 Product improvements

Due to constant product improvement, product specifications may change from time to time. As a standard reporting procedure of the Product Change Notification (PCN) according to the JEDEC-Standard, we inform about major changes. In case of further queries regarding the PCN, the field sales engineer, the internal sales person or the technical support team in charge should be contacted. The basic responsibility of the customer as per section 6.1 and 6.2 remains unaffected. All wireless connectivity module driver software "wireless connectivity SDK" and its source codes as well as all PC software tools are not subject to the Product Change Notification information process.

6.6 Product life cycle

Due to technical progress and economical evaluation we also reserve the right to discontinue production and delivery of products. As a standard reporting procedure of the Product Termination Notification (PTN) according to the JEDEC-Standard we will inform at an early stage about inevitable product discontinuance. According to this, we cannot ensure that all products within our product range will always be available. Therefore, it needs to be verified with the field sales engineer or the internal sales person in charge about the current product availability expectancy before or when the product for application design-in disposal is considered. The approach named above does not apply in the case of individual agreements deviating from the foregoing for customer-specific products.

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7 Legal notice

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