



## USER MANUAL

THETIS-I USB RADIO STICK

2611086021011

VERSION 1.1

APRIL 24, 2023

**WÜRTH ELEKTRONIK** MORE THAN YOU EXPECT

\*\*\*\*\*

## **MUST READ**

### **Check for firmware updates**

Before using the product make sure you use the most recent firmware version, data sheet and user manual. This is especially important for Wireless Connectivity products that were not purchased directly from Würth Elektronik eiSos. A firmware update on these respective products may be required.

We strongly recommend to include in the customer system design, the possibility for a firmware update of the product.

## Revision history

Manual version	HW version	Notes	Date
1.0	1.0	<ul style="list-style-type: none"><li>• Initial version of the manual</li></ul>	March 2021
1.1	1.0	<ul style="list-style-type: none"><li>• Updated document style</li></ul>	April 2023

## Abbreviations

Abbreviation	Name	Description
API	Application Programming Interface	
FSE	Field Sales Engineer	Support and sales contact person responsible for limited sales area
COM Port	Communication Port	
FCC	Federal Communications Commission	
FTDI	Future Technology Devices International	USB-to-Serial converter chip
GPIO	General Purpose Input/Output	
HIGH	High signal level	
LOW	Low signal level	
MCU	Micro Controller Unit	
PC	Personal Computer	
RED	Radio Equipment Directive	
RF	Radio frequency	Describes everything relating to the wireless transmission.
UART		Universal Asynchronous Receiver Transmitter allows communicating with the module of a specific interface.
USB	Universal Serial Bus	
VCP	Virtual COM Port	
VDD	Supply voltage	
WE	Würth Elektronik	

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# 1 Introduction

The Thetis-I is a radio module that provides wireless connectivity capabilities in the 2.4 GHz frequency band. The Thetis-I USB Radio Stick incorporates the Thetis-I in a USB stick form factor enabling easy interfacing with any USB enabled device like personal computer or laptop. The Thetis-I USB Radio Stick allows quick set-up of a radio link between PC and any system with integrated Thetis-I radio module.

## 1.1 Ordering information

WE order code	Description
2611086021011	Thetis-I USB Radio Stick

Table 1: Ordering information

## 1.2 Wirepas™ technology

As an official partner of Wirepas™, Würth Elektronik eiSos is authorized to make commercial use of Wirepas firmware for the purposes of normal business.

## 2 Functional description

The Thetis-I USB Radio Stick consists of Thetis-I radio module along with a serial-to-USB adapter that enables direct connection to any USB compatible device. An FTDI serial-to-USB converter chip **FT231X** connects the USB interface to the UART pins of the integrated radio module. Besides UART, additional digital GPIO pins (CBUS) are connected to the radio module to provide special functions like reset. Figure 1 illustrates all the functional components of Thetis-I USB Radio Stick.

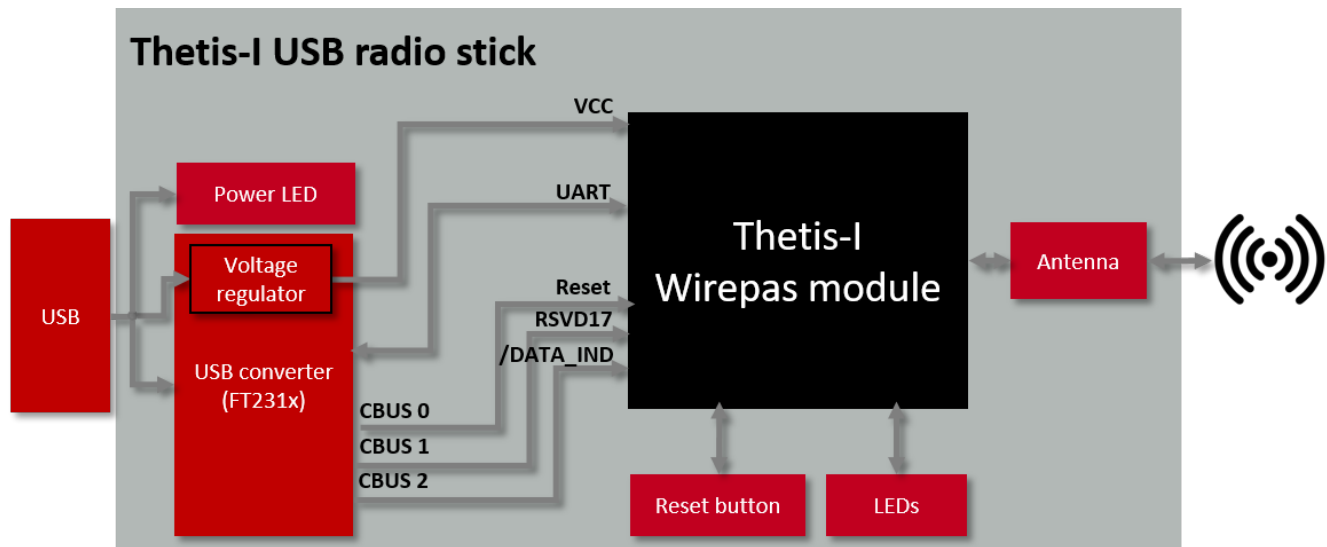


Figure 1: Block diagram of the Thetis-I USB Radio Stick

### 2.1 Typical Setup

The Thetis-I USB Radio Stick offers the Wirepas Mesh API on its UART interface. Please refer to the Wirepas dual MCU manual [1] for the full documentation.

Two or more modules or USB radio sticks can communicate with each other if they share the same Wirepas network ID, channel and encryption as well as authentication keys. Based on the network configuration, data can be:

- broadcast;
- multicast to a group;
- unicast to a specific module.

The role of the Thetis-I USB Radio Stick can be:

- sink;
- routing node;
- non-routing node.

In the frame of the Wirepas EV-Kit and together with the PC tool Wirepas Commander [4], the USB radio stick can be used in a prototype Wirepas network consisting of the USB radio stick itself, a mini evaluation board, and three sensor nodes. Please refer to the Wirepas Evaluation Kit user manual [2].



## 2.2 Taking into operation

The serial-to-USB FTDI converter chip **FT231X** requires special drivers to be installed for proper operation. The Virtual COM Port (VCP) drivers have to be installed by following the "Installation Guides" found under: <https://www.ftdichip.com/Drivers/VCP.htm>



It is recommended to restart the PC after installation of drivers.

On proper installation of the drivers, the module appears as a virtual COM port on the PC (ttyUSBx on Linux, COMx on Windows) in case of the VCP driver use. This COM port can be opened in any serial emulator program or user written software to communicate with the radio module.

The radio module responds to commands in a specific format. Please refer to the corresponding Thetis-I user manual [3] for the complete description of the command set.



When connecting the USB radio stick to the PC, it is recommended to reset the USB radio stick once. This can be done using the USB stick reset button or using the CBUS0 pin (see chapter 2.2.1.1). This reset procedure is also recommended after each reboot of the PC.

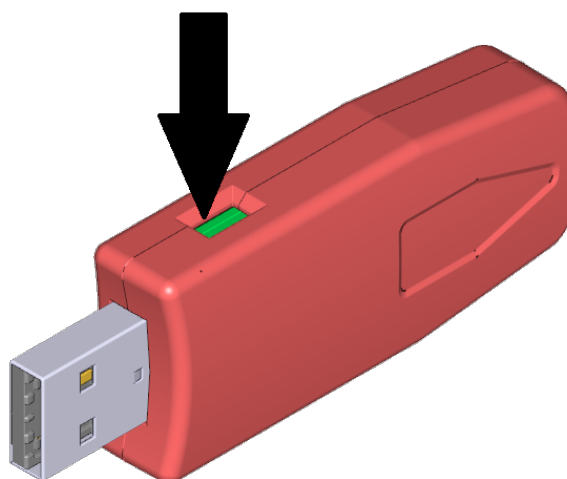


Figure 2: Reset button on the Thetis-I USB Radio Stick

### 2.2.1 Usage of CBUS pins

To switch the CBUS pins static HIGH or LOW and thus to use the provided pins functions of the Thetis-I radio module, the D2XX driver of FTDI has to be used. This driver is part of the

previous mentioned VCP driver installation in case of Windows OS. In case of Linux, a manual installation is required.

Please follow FTDI's "Installation Guides" for proper D2XX install:

<https://www.ftdichip.com/Drivers/D2XX.htm>

Example codes and tutorials for "how to use the D2XX driver within your own software tool" can be found in the software example section of:

<https://www.ftdichip.com/Support/SoftwareExamples/CodeExamples.htm>

### 2.2.1.1 Resetting the Thetis-I USB Radio Stick using the CBUS pin

The */RESET* pin of the Thetis-I can be used to reset the integrated radio module. As the */RESET* pin is connected to the CBUS0 pin of the integrated FTDI chip, the radio module can be reset by pulling the CBUS0 pin low for at least 100 ms and releasing it to high level again.

By default, the CBUS0 pin of the FT231X is configured as FT\_CBUS\_GPIO (bit bang), such that the FTDI D2XX driver function `SetBitMode` can be used.

```
/* prep: create and connect an FTDI device instance */  
  
/* set CBUS0 to output level LOW */  
SetBitMode(0x10, FTDI.FT_BIT_MODES.FT_BIT_MODE_CBUS_BITBANG);  
  
/* hold CBUS0 for at least 100ms on LOW level */  
wait_ms(100);  
  
/* clear FTDI receive and send buffers */  
Purge(FTDI.FT_PURGE.FT_PURGE_RX | FTDI.FT_PURGE.FT_PURGE_TX);  
  
/* set CBUS0 to output level HIGH */  
SetBitMode(0x00, FTDI.FT_BIT_MODES.FT_BIT_MODE_RESET);  
  
/* a delay according to the reset timing parameter will occur (see manual) */  
  
/* disconnect and close the FTDI device instance */
```

Code 1: Pin reset via CBUS0 using the D2XX driver

## **3 Regulatory compliance information**

### **3.1 Important notice EU**

The use of RF frequencies is limited by national regulations. The Thetis-I USB Radio Stick has been designed to comply with the RED directive 2014/53/EU of the European Union (EU).

The Thetis-I USB Radio Stick can be operated without notification and free of charge in the area of the European Union. However, according to the RED directive, restrictions (e.g. in terms of duty cycle or maximum allowed RF power) may apply.

### **3.2 Important notice FCC**

The use of RF frequencies is limited by national regulations. The Thetis-I USB Radio Stick has been designed to comply with the FCC Part 15.

The Thetis-I USB Radio Stick can be operated without notification and free of charge in the area of the United States of America. However, according to the FCC Part 15, restrictions (e.g. in terms of maximum allowed RF power and antenna) may apply.

### 3.3 EU Declaration of conformity



#### EU DECLARATION OF CONFORMITY

**Radio equipment:** 2611086021011

**The manufacturer:** Würth Elektronik eiSos GmbH & Co. KG  
Max-Eyth-Straße 1  
74638 Waldenburg

This declaration of conformity is issued under the sole responsibility of the manufacturer.

#### **Object of the declaration: 2611086021011**

The object of the declaration described above is in conformity with the relevant Union harmonisation legislation Directive 2014/53/EU and 2011/65/EU with its amending Annex II EU 2015/863 . Following harmonised norms or technical specifications have been applied:

EN 300 328 V2.2.2 (2019-07)  
EN 301 489-1 V2.2.3  
EN 301 489-17 V3.2.4 (2020-09)  
EN 62479 : 2010  
EN 62368-1:2014 + AC:2015

*i.A. G. Exlerdt*

Trier, 8th of February 2021

Place and date of issue

### **3.4 FCC - Federal Communications Commission**

The device has been FCC Part 15 B tested.

Contains FCC ID: R7T1101102

The enclosed device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:

- (i.) this device may not cause harmful interference and
- (ii.) this device must accept any interference received, including interference that may cause undesired operation.

### **3.5 IC - Industry Canada**

This device contains ISED: 5136A-1101102

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

## 4 References

- [1] Wirepas. Wirepas Mesh Dual-MCU API Reference Manual, WP-RM-100, version 5.1A. <https://www.we-online.com/man-wirepas-1>.
- [2] Würth Elektronik. Thetis-I Evaluation Kit user manual. <https://www.we-online.de/katalog/de/manual/2611019021011>.
- [3] Würth Elektronik. Thetis-I user manual. <https://www.we-online.de/katalog/de/manual/2611011021010>.
- [4] Würth Elektronik. Wirepas Commander PC tool. <https://www.we-online.com/Wirepas-Commander>.

## 5 Important notes

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

### 5.1 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.

### 5.2 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.

### 5.3 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.

### 5.4 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.

## 5.5 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 5.1 and 5.2 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.

## 5.6 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.

## 5.7 Property rights

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## 5.8 General terms and conditions

Unless otherwise agreed in individual contracts, all orders are subject to the current version of the "General Terms and Conditions of Würth Elektronik eiSos Group", last version available at [www.we-online.com](http://www.we-online.com).



## **6 Legal notice**

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The responsibility for the applicability and use of the Würth Elektronik eiSos wireless connectivity product with the incorporated Firmware in a particular customer design is always solely within the authority of the customer. Due to this fact, it is up to you to evaluate and investigate, where appropriate, and to decide whether the device with the specific product characteristics described in the product specification is valid and suitable for your respective application or not.

You are responsible for using the Würth Elektronik eiSos wireless connectivity product with the incorporated Firmware in compliance with all applicable product liability and product safety laws. You acknowledge to minimize the risk of loss and harm to individuals and bear the risk for failure leading to personal injury or death due to your usage of the product.

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shall inform Würth Elektronik eiSos about the intent of such usage before design-in stage. In certain customer applications requiring a very high level of safety and in which the malfunction or failure of an electronic component could endanger human life or health, you must ensure to have all necessary expertise in the safety and regulatory ramifications of your applications. You acknowledge and agree that you are solely responsible for all legal, regulatory and safety-related requirements concerning your products and any use of Würth Elektronik eiSos' products with the incorporated Firmware in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by Würth Elektronik eiSos. YOU SHALL INDEMNIFY WÜRTH ELEKTRONIK EISOS AGAINST ANY DAMAGES ARISING OUT OF THE USE OF WÜRTH ELEKTRONIK EISOS' PRODUCTS WITH THE INCORPORATED FIRMWARE IN SUCH SAFETY-CRITICAL APPLICATIONS.

### **7.3 Ownership**

The incorporated Firmware created by Würth Elektronik eiSos is and will remain the exclusive property of Würth Elektronik eiSos.

### **7.4 Firmware update(s)**

You have the opportunity to request the current and actual Firmware for a bought wireless connectivity Product within the time of warranty. However, Würth Elektronik eiSos has no obligation to update a modules firmware in their production facilities, but can offer this as a service on request. The upload of firmware updates falls within your responsibility, e.g. via ACC or another software for firmware updates. Firmware updates will not be communicated automatically. It is within your responsibility to check the current version of a firmware in the latest version of the product manual on our website. The revision table in the product manual provides all necessary information about firmware updates. There is no right to be provided with binary files, so called "Firmware images", those could be flashed through JTAG, SWD, Spi-Bi-Wire, SPI or similar interfaces.

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## **7.7 Applicable law and jurisdiction**

Applicable law to this license terms shall be the laws of the Federal Republic of Germany. Any dispute, claim or controversy arising out of or relating to this license terms shall be resolved and finally settled by the court competent for the location of Würth Elektronik eiSos' registered office.

## **7.8 Severability clause**

If a provision of this license terms is or becomes invalid, unenforceable or null and void, this shall not affect the remaining provisions of the terms. The parties shall replace any such provisions with new valid provisions that most closely approximate the purpose of the terms.

## **7.9 Miscellaneous**

Würth Elektronik eiSos reserves the right at any time to change this terms at its own discretion. It is your responsibility to check at Würth Elektronik eiSos homepage for any updates. Your continued usage of the products will be deemed as the acceptance of the change.

We recommend you to be updated about the status of new firmware and software, which is available on our website or in our data sheet and manual, and to implement new software in your device where appropriate.

By ordering a wireless connectivity product, you accept this license terms in all terms.

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**Contact**

Würth Elektronik eiSos GmbH & Co. KG  
Division Wireless Connectivity & Sensors

Max-Eyth-Straße 1  
74638 Waldenburg  
Germany

Tel.: +49 651 99355-0  
Fax.: +49 651 99355-69  
[www.we-online.com/wireless-connectivity](http://www.we-online.com/wireless-connectivity)

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