USER MANUAL

WIREPAS COMMANDER

PC TOOL FOR THETIS-I

VERSION 1.3

MAY 22, 2023

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Revision history

Manual version	SW version	Notes	Date
1.0	1.0.0.0	First release	December 2020
1.1	1.0.1.0	• New software version 1.0.1.0 • Updated `References` to Wirepas documentation	February 2021
1.2	1.1.0.0	• New software version 1.1.0.0 – Support of the sensor data of the Thetis-I evaluation kit	March 2021
1.3	1.1.0.0	• Added information about remote node configuration • Updated links to Wirepas documentation • New corporate design	May 2023

⋆ For details on the software version, please refer to the chapter `Software history`.

Abbreviations

Abbreviation	Name	Description
CSAP	Configuration Service Access Point	UART control command for module configuration
DSAP	Data Service Access Point	UART control command for radio data transmission and reception
0xhh [HEX]	Hexadecimal	All numbers beginning with 0x are stated as hexadecimal numbers. All other numbers are decimal.
FTDI	Future Technology Devices Interglobal	USB-to-Serial converter chip
FW	Firmware	
MCU	Micro Controller Unit	
MSAP	Management Service Access Point	UART control command for module management
PER	Packet Error Rate	
RF	Radio frequency	Describes everything relating to the wireless transmission
SWD	Serial Wire Debug	
UART	Universal Asynchronous Receiver Transmitter	The UART allows communicating with the module of a specific interface
USB	Universal Serial Bus	

Contents

1 Overview

The Wirepas Commander is an easy-to-use PC software that enables complete control of the Thetis-I via its command interface. This tool offers an intuitive graphical user interface that enables the user to interact with the wireless module and understand the communication protocol between the module and the connected host.

The Wirepas Commander along with the Thetis-I allows quick prototyping and testing of various features of the Wirepas mesh network.

> **!** In order to communicate with the Wirepas module using this commander, an evaluation hardware has to be prepared. This shall include minimal pin connection (please refer to the product user manual) and adequate hardware to convert USB/Com port signals to UART interface (e.g. FTDI FT232R converter chip).

> **!** Wirepas Commander is an evaluation tool that is intended for development purposes only. It is recommended to check regularly for available updates.

1.1 System requirements

This tool is intended to run on a PC with the following requirements:

- Supported operating systems:
    - Windows 10, 32/64 bit
    - Windows 8, 32/64 bit
    - Windows 7, 32/64 bit

- Version 4.6.1 or later of the Microsoft .NET framework is required to use Wirepas Commander. Install this package if you receive a corresponding error message when starting the program.

- A screen resolution of 1920 x 1080 pixels or more is recommended.

The tool works completely offline without the need for any sort of internet connection.

1.2 Connecting the module to the computer

The wireless module evaluation hardware has to be connected to the PC. On successful installation of the PC drivers (see Section `1.3` for FTDI driver installation), the evaluation board appears as an USB serial port with a numbered COM port in the device manager as shown in the Figure `1`.

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Figure 1: Virtual COM port

1.3 Installation

The Wirepas Commander itself is an executable and does not require an installation. It will create folders and files on the hard drive e.g. for log file storing.

However, in case the serial-to-USB FTDI converter chip (i.e. **FT232R**) is used on the evaluation platform, it requires Virtual COM Port (VCP) drivers to be installed for proper operation. To install these drivers please follow the "Installation Guides" of FTDI found under:

https://www.ftdichip.com/Drivers/VCP.htm

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

2 Operation

2.1 Starting the program

Double-click the executable to start the program. The GUI shown in Figure 2 will appear.
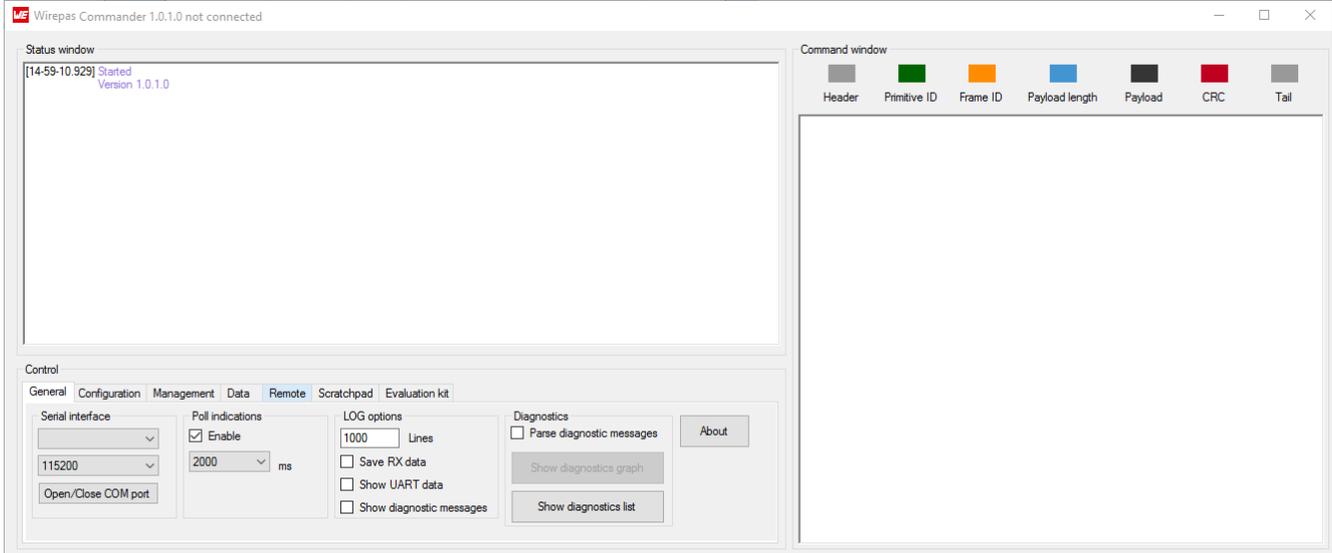
Figure 2: Start-up

2.2 COM Interface

Once connecting the Thetis-I evaluation board to the PC, the device appears as a USB serial COM port. All the COM ports on the PC are made available for connection under the "Serial interface" drop-down menu at the "General" tab of the "Control" section. The COM ports can be updated by clicking on the drop-down menu. Select the COM port corresponding to the connected radio device by scrolling through the menu. Click on the "Open/Close COM port" button to connect to the device. Messages in the status window appear indicating connect/disconnect event or errors.
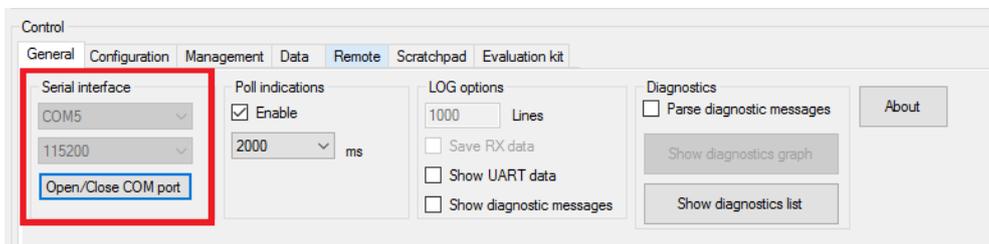

Figure 3: Open COM port

> Before connecting a module or device via USB for the first time, the correct driver must be installed and a (virtual) COM port must be available (see chapter 1.3).

2.3 Log windows

The Wirepas Commander configures and controls the Thetis-I by sending commands over the serial interface. These command packets and the corresponding response from the module are displayed in the command window. The packet structure used for communication with the module is color coded for better readability. The packets sent to the module are left oriented and the ones sent from the module are right oriented. Each command packet is appended with a short packet description.
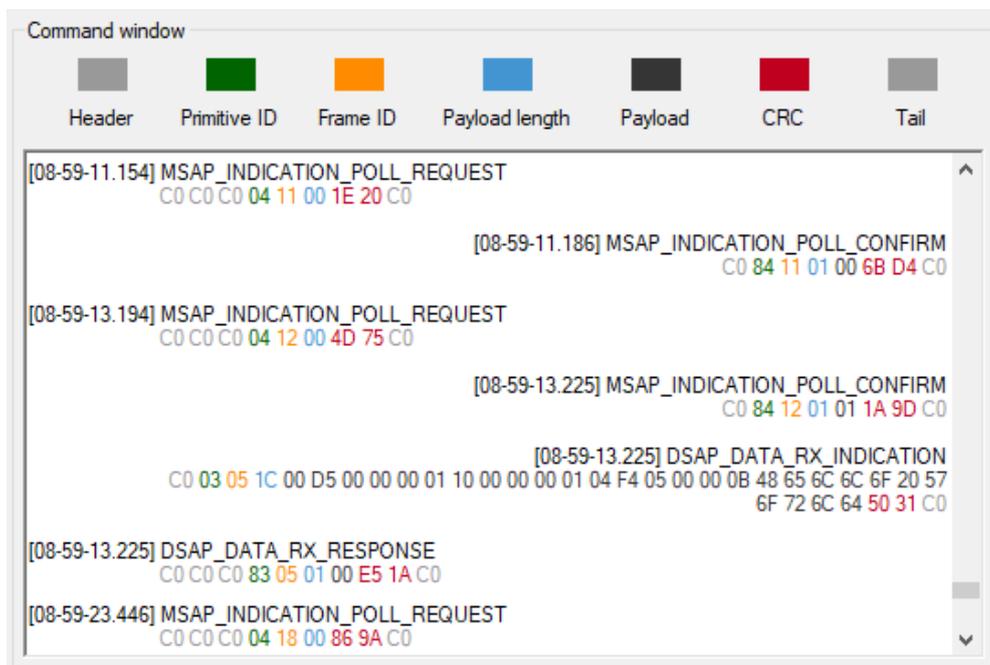

Figure 4: Command window

Besides of that, all status messages from the Wirepas Commander software tool itself are printed in the status window. The messages are color coded to easily distinguish warnings and errors from information messages.

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Figure 5: Status window

Click with the right mouse button into any log window to get more options like

- copy the window content to clipboard.

- clear the window content.

The "Log options" menu in the "General" tab of the "Control" section allows to

- restrict the maximum number of lines in the status and command window.

- save received radio frames in an XML file.

- show diagnostic messages of the Wirepas mesh network, in case such a message has been received.

- show UART data in the command window.
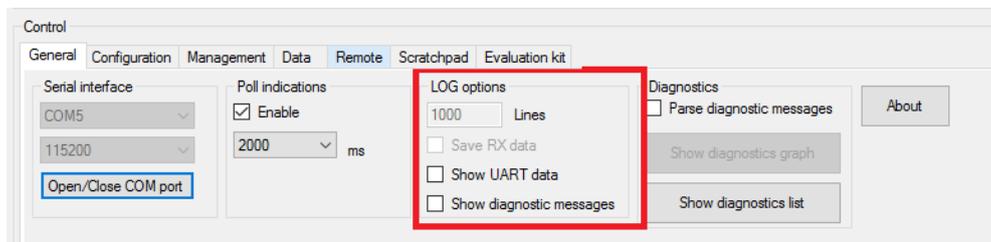
Figure 6: Log options

2.4 Diagnostics

The "Diagnostics" menu in the "General" tab of the "Control" section allows to

- parse the received diagnostic data.

- display the interpreted diagnostic data in a list.
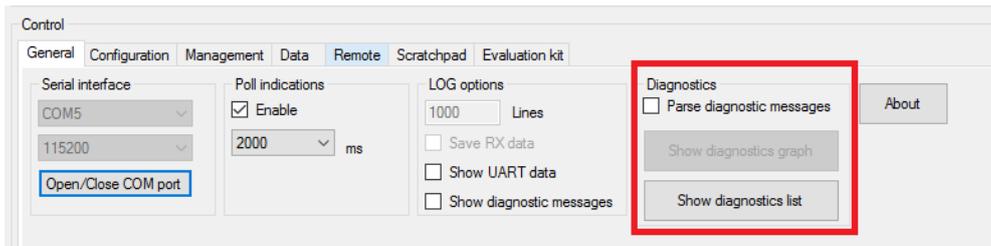
Figure 7: Diagnostics

In case no radio module is connected to the Wirepas Commander, a previously saved XML file containing the received radio frames, can be loaded and displayed.

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2.5 Control section

The control section allows to configure and control the Thetis-I. It creates and sends command frames to the radio module and checks the command message responses that are returned by the radio module.

As described in the Wirepas Mesh Dual-MCU API Reference Manual [1], the Thetis-I returns a confirmation message if a request message has been sent to the radio module. Besides of that, the Thetis-I does not send any indication message (i.e. received radio data) to the host without an invitation to send. This means that the host must send repeatedly so called "MSAP-INDICATION_POLL" requests to signalize that it is ready to fetch indication messages from the radio module.

To enable the periodic transmission of "MSAP-INDICATION_POLL" requests by the Wirepas Commander the check box "Poll indications enable" in the "General" tab of the "Control" section must be set. Besides of that, the dropdown box nearby allows to define the polling interval.
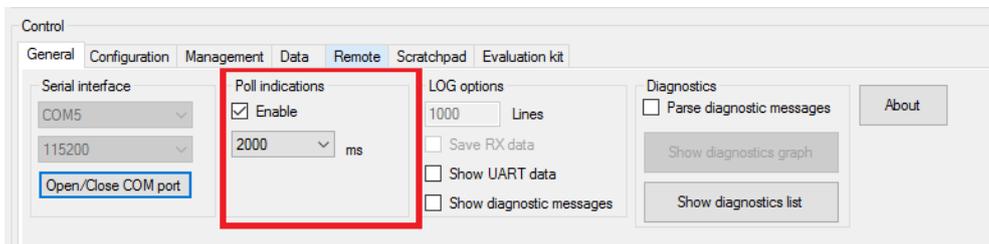

Figure 8: Enable polling to receive indication messages

> In case the Thetis-I has sent an indication message to the host, the host must return a response message to signalize that the host has received the indication message. The Wirepas Commander implements this function to automatically reply with a response message.

The valid commands to control the Thetis-I can be divided into three groups. Each group of commands has its own tab in the Wirepas Commander:

Configuration CSAP messages are used to configure the radio module, if the radio stack is stopped. These commands can be found in the "CSAP" tab of the "Control" section.

Management MSAP messages are used to control the radio module and the Wirepas mesh network, if the radio stack is running. These commands can be found in the "MSAP" tab of the "Control" section.

Data DSAP messages are used to transmit and receive radio data, if the radio stack is running. These commands can be found in the "DSAP" tab of the "Control" section.

> Most of the text boxes can be used to insert new values as well as to display values that have been read from the Thetis-I. If not restricted by the text box, numeric values can be entered as decimal values or as hexadecimal values, starting with a "0x" prefix.

> Please note, that values that are read from the module will be displayed in the text box as decimal and hexadecimal at the same time. When writing values to the module, only one, either decimal or hexadecimal notation, has to be used.

Besides of that, there are additional tabs with special features:

Remote This tab allows to send remote commands for configuration and control of remote devices that are part of the network. It uses the DSAP functions with special format and end points.
After sending a "Begin" request, MSAP and CSAP attributes can be updated using "Write" requests. To deploy the new settings, an "End" request must be placed, followed by an "Update" request. Before placing each request, the previous request must be acknowledged by the corresponding "Response" message sent by the remote node.
See the Wirepas Mesh Remote API Reference Manual [2] for detailed information.
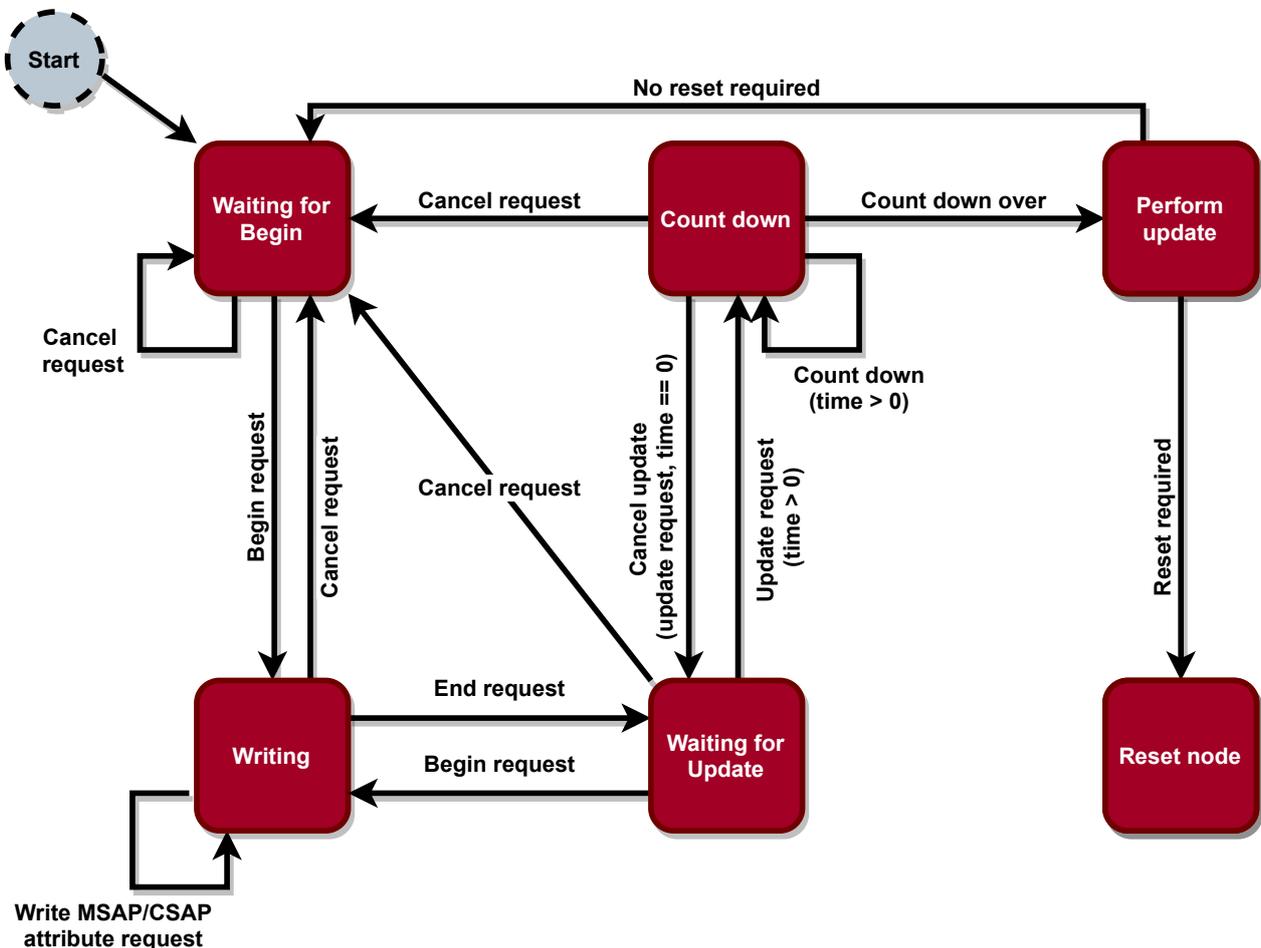

Figure 9: Flow chart: Remote writing CSAP and MSAP attributes

Scratchpad This tab allows to use the OTAP functionality for wireless firmware update of the Wirepas mesh nodes.

Evaluation kit This tab allows to visualize the sensor data that is distributed in the Wirepas mesh network built by the sensor nodes that are part of the Thetis-I evaluation kit. In addition to that, this tab allows to configure the sensor nodes (data format and update interval) by using DSAP functions with special format and end points. Please refer to the Thetis-I evaluation kit manual to get more information about the data format and the update interval, and how to configure it.
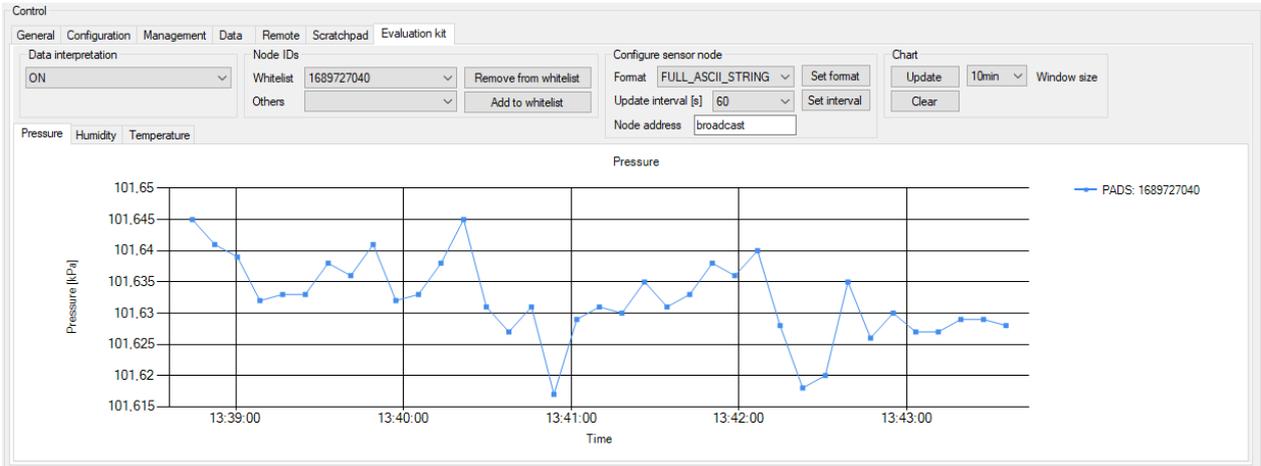

Figure 10: Evaluation kit sensor node data

3 Taking a new node into operation

In factory state, the Thetis-I must be configured first to allow participation on an existing Wirepas mesh network. To do so, please perform the following steps:

1. Connect the Wirepas test board to the PC and start the Wirepas Commander.

2. Select the right COM port and press the "Open/Close COM port" button. By default, the check box "Poll indications enable" in the "General" tab of the "Control" section is checked. Thus, the Wirepas Commander starts sending "MSAP-INDICATION_POLL" requests to the radio module and in case the radio module has an indication message pending, it will send it to the Wirepas Commander.
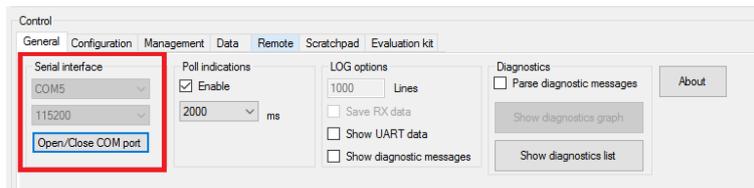

Figure 11: Open COM port

3. Configure the connected radio module to match the needs of your Wirepas mesh network. Thus go to the "CSAP" tab and set

   a) The node address to a unique address.

   b) The network address of the network you want to join.

   c) The network channel of the network you want to join.

   d) The node role. Please note that there must be at least one sink in the network.
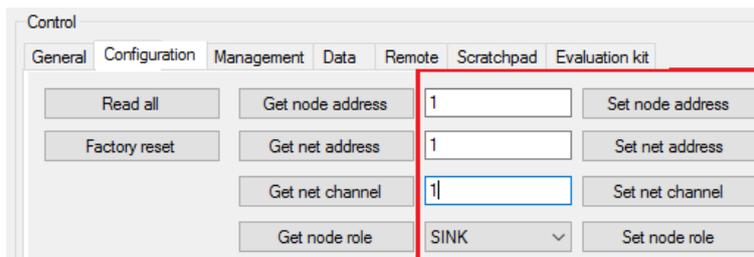

Figure 12: Configure the node

   e) (optional) The cypher key and authentication key, in case the network requires it. Please choose own keys for your network.
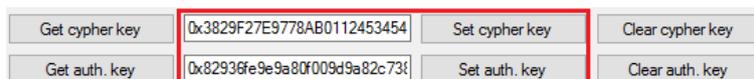

Figure 13: (Optional) Configure the cypher and authentication key

4. Start the radio stack on the "MSAP" tab. A "MSAP-STACK_STATE.indication" message will be received by the Wirepas Commander as soon as the stack runs.
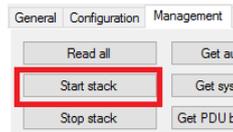
Figure 14: Start the stack

5. (Optional) In case, the node is a sink node and diagnostics messages shall be enabled, write the "App config data" with a diagnostics interval of larger than 0. Please refer to the **Wirepas dual mcu manual** [1].
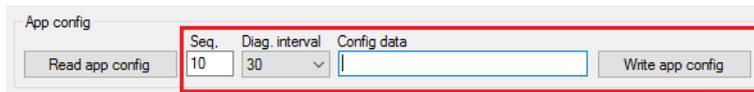
Figure 15: (Optional) Write app config data

6. (Optional) In case data shall be transmitted through the Wirepas mesh network, fill the fields in the "DSAP" tab and press "TX request". Please refer to the **Wirepas dual mcu manual** [1].
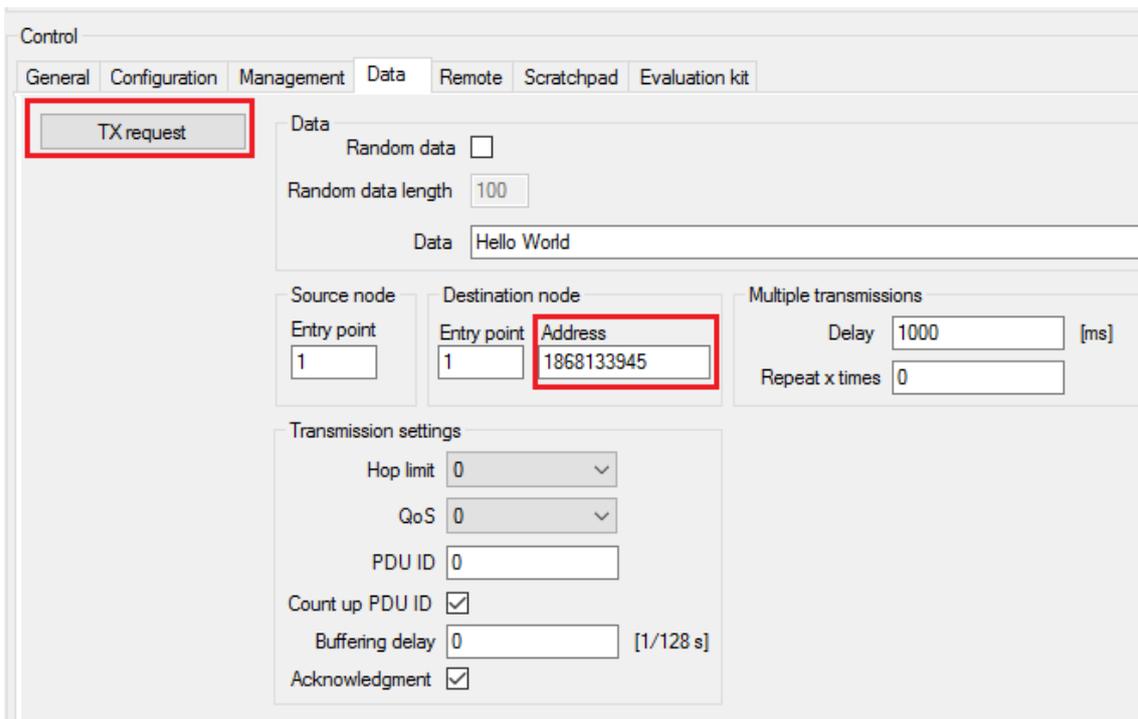
Figure 16: (Optional) Transmit "Hello world"

4 Software history

Version 1.0.0.0   "Release"

- Initial version of the tool

Version 1.0.1.0   "Release"

- Collect and display diagnostic data
- Improved data format for saving and loading of received radio frames

Version 1.1.0.0   "Release"

- Added tab "evaluation kit" that displays the data of the evaluation kit's sensor nodes

5 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] Wirepas. Wirepas Mesh Remote API Reference Manual, WP-RM-117, version 5.0A. `https://www.we-online.com/man-wirepas-2`.

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8.9 Miscellaneous

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