

Integration Guide

for metraTec TUC 2.x

TCP/IP to UART Converter



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Version: 2.4 for TUC2 Hardware Revision 02.05

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1 General Information

1.1 Symbols Used

This integration guide uses different symbols to point out potentially dangerous situations. The following symbols are used throughout the document.



ATTENTION

Indicates a potentially hazardous situation. If this is not avoided, the product or something in its surrounding could be damaged.



NOTES

Declares notes for the user as well as other useful information, where no harmful or dangerous situations can be expected.

1.2 Security Advice

The TUC 2 module was not designed to work in dangerous surroundings. Using the module in applications where a technical failure would directly lead to death or serious injuries is not intended ("High Risk Activities" e.g. nuclear facilities, flight control, medical life support machines, or weapons systems). The producer disclaims any warranty for suitability of the module in such applications.

1.3 Export Restriction

The TUC 2 module contains components that underlie US export restrictions. It is therefore forbidden to export the product to countries that are on the US trade embargo list. This is also valid for countries that are on the EU trade embargo list.

1.4 Further Documentation

While this documentation explains the electrical and mechanical characteristics of the TUC 2 module, it might be useful to also read the TUC 2 User Guide, which explains in detail the configuration of the module using the freely available Config-Manager software as well as the serial interface.

Source: <http://www.metratec.com> → Support → Downloads → Documents

2 Product Description

2.1 Applications

With the metraTec TCP/IP to UART Converter (TUC 2), devices with one or two 3.3V UART connections can be equipped with the communication possibilities of the Ethernet.

For this, the data stream gets converted from UART to a TCP socket stream and can be accessed via LAN. The transparent conversion and correct Ethernet communication is realized by the TUC 2 module.

For the configuration of the communication parameters of the TUC 2 module, there are three easy options available: Using an integrated web site or using a separate tool that finds the device without knowing its IP address.

Alternatively, some pins can be configured as GPIOs to enable sampling of sensors etc. via the web. The module contains the required bridge rectifier circuits and pins to be able to connect a Power over Ethernet controller (with the according power supply unit) that enables supplying the device with electrical power via Ethernet.

2.2 Intended Use

The TUC 2 module generates a connection between up to two 3.3V UART interfaces and appropriate TCP sockets for communication via the internet. This enables communication of UART interface devices (e.g. micro controllers, sensor modules, etc.) by Ethernet using a server over long distances, even world wide if required, using the internet.

2.3 Scope of Delivery

The TUC 2 module comes with the following parts:

- TUC 2 module
- Documentation and software tools are available via download from metraTec's website.

3 Migrating from TUC 1 to TUC 2

3.1 Mechanical

The board dimensions and the RJ-45 Ethernet Jack are identical. No mechanical changes are required on the transition from TUC 1 to TUC 2.

3.2 Electrical

The general functional behavior is widely unchanged. Please refer to the specifications section for details on the TUC 2.

The power requirements and reset behavior are more stringent to guarantee safe device startup.

<i>Parameter</i>	<i>TUC 1</i>	<i>TUC 2</i>
reset threshold voltage / V	2,9	3,08
Supply voltage min. / V	3,0	3,15

Tab. 1: Power requirements and reset behavior

The TUC2 IOs are 5V tolerant only after a valid power supply voltage $V_{DD} > 2.2V$ is applied. Otherwise a 3.6V limit applies for all pins.

3.3 Functional

The reset to defaults function activation has been changed to low active. The communication parameters (UART Port settings, IP addresses, IP settings...) can be reset to defaults by pulling Pin 8 low for during power up of the device. The pin is sampled for approximately 500ms after the TUC 2 power supply has reached 3,08V.

After power up the pin can be used for communication or as a GPIO. The pin has an internal 10k pullup resistor and should be left floating if the pin is not used as in most UART applications.

4 Specifications

4.1 General Specifications

<i>Parameter</i>	<i>TUC 1</i>
Functional Principle	TCP to UART Converter Module
Power Supply	3.3V DC
Current Supply	200mA typ. for 3.3V DC
Serial Communication	2x UART
Digital Inputs/Outputs	Up to 8 x 3.3V IOs, configurable by firmware, 5V tolerant (at VDD > 2.2V)
Ethernet Connection	RJ45 Socket
Protocols	TCP
Temperature Range	0°C up to +70°C (32°F to 158°F)
Dimensions	40 x 25 x 16mm

4.2 Mechanical Specifications

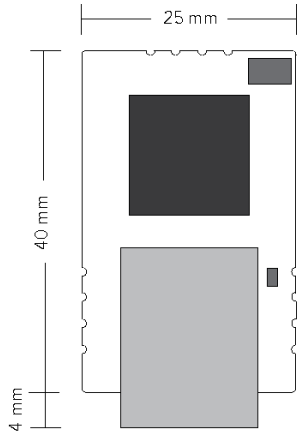


Fig. 1: Overview TUC 2 module

4.3 Pinout

Pin	Pin Direction	Signal name	Pin Function
1	Power Input	3.3V	positive supply pin
2	Power Input	GND	negative supply pin
3	Power Output	PoE -	negative rectified PoE voltage
4	Power Output	PoE +	positive rectified PoE voltage
5	Digital In	RxD 0	UART 0 receive data
6	Digital Out	TxD 0	UART 0 transmit data
7	Digital Out	CTS 0	UART 0 clear to send
8	Digital In	RTS 0	UART 0 ready to send Factory Reset (at power up)
9	Digital In	RxD 1	UART 1 receive data
10	Digital Out	TxD 1	UART 1 transmit data
11	Digital Out	CTS 1	UART 1 clear to send
12	Digital In	RTS 1	UART 1 ready to send

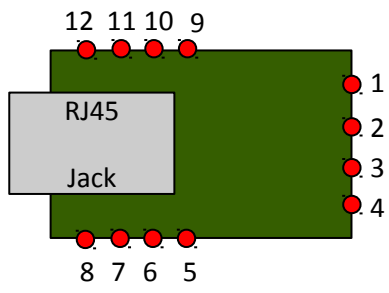


Fig. 2: TUC 2 pin assignment

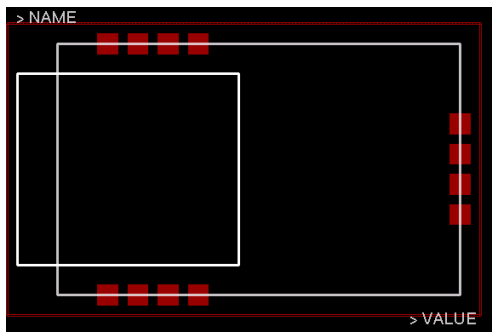


Fig. 3: TUC 2 footprint (Eagle library available from metraTec)

4.4 Absolute Maximum Ratings

Parameter	Min.	Max.	Unit
Supply Voltage VDD	-0.5	3.6	V
Input Voltage IO pins	-0.3	3.6	V
		5.25 (VDD>2.2V)	V
PoE Current	-	720	mA

4.5 Electrical Characteristics

Parameter	Min.	Typ.	Max.	Unit
Supply Voltage	3.15	3.3	3.6	V
Supply Current	150	200	300	mA
Input Voltage High	2.4	-	5.25 (VDD>2.2V) 3.6	V V
Input Voltage Low	0	-	1	V
Output Voltage High	2.9	-	-	V
Output Voltage Low	-	-	0.4	V
Output Current High	-4	-	-	mA
Output Current Low	4	-	-	mA

5 Detailed Description

5.1 Power Supply

The module does not have an integrated power supply unit, thus a constant 3.3V DC power supply has to be provided. A power supply monitor releases the TUC from reset when the power supply stabilizes for 200 ms above 3.08 V.

5.2 PoE

For the use of Power over Ethernet (PoE) the two contacts needed are made available by two vias. Therefore, a device with PoE functionality can be constructed based on the TUC 2. The required bridge rectifier circuits are already included into the module. The bridge rectifier can handle loads up to 720mA enabling a total power of 35W at a nominal voltage of 48V which meets PoE+ specifications.

Additional heat-sinking might be required when using PoE at high loads. It is the responsibility of the designer to check thermal behavior in the desired application.

The TUC may be used in isolated and non-isolated PoE designs.

A PoE powered device requires an external power supply converting the power delivered by the power sourcing equipment (PoE switch) to the desired voltage level. Power supply design support is available as a service from metraTec.

5.3 Serial Communication

The TUC 2 module is equipped with two UART connections for communicating with micro controllers or other devices. Data from these connections can be sent and received directly by the appropriate Ethernet sockets on the two available TCP ports (default ports are 10 001 and 10 002). Default UART setup is 115200, 8, N, 1. For further details on configuration and usage as well as advanced features please refer to the TUC 2 user guide.

5.4 EMC

The TUC incorporates a 1n/3kV decoupling capacitor from Ethernet jack shield to TUC power ground enabling to pass EN55011 class A emission limits without shielded enclosure. A connection from the Ethernet jack shield to chassis ground as well as additional decoupling or filters at the TUC interfaces might be advisable depending on the application.

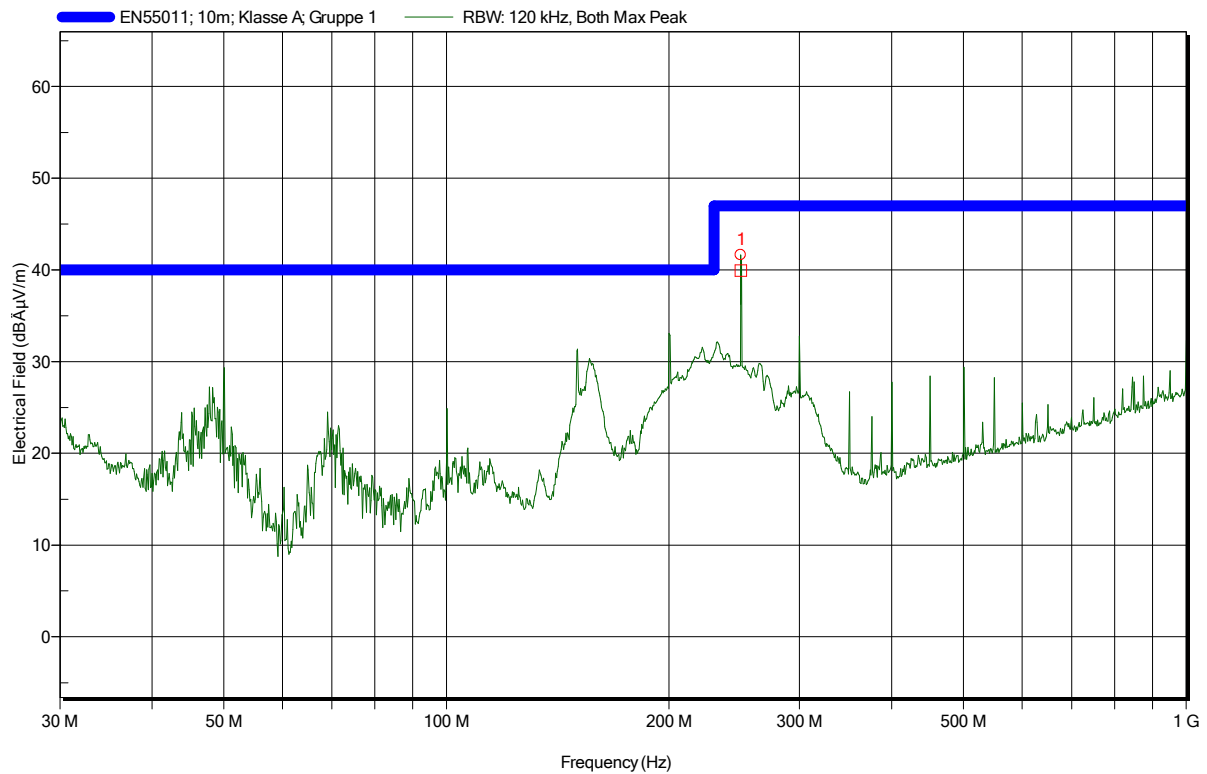


Abbildung 1: Radiated Emissions EN55011 without enclosure

5.5 Hardware Flow Control

The UARTs are operated without flow control by default. The flow control pins may be left floating when hardware flow control is disabled. Hardware flow control can be enabled by the user. The TUC2 supports bidirectional symmetric flow control using RTS and CTS pins. The pin naming on the TUC 2 follows the DCE (Data Communication Equipment) naming convention. The host controller connected to the TUC can pause communication by writing a high level to the TUCs RTS input causing the TUC 2 to stop transmitting data via its TX output. The TUC 2 will write a high level to its CTS output before the internal data buffers are filled to a critical level. The wiring diagram is shown in Figure 4.

As the TUC will send the content of the internal transmit buffer on its UART Tx line until it is empty, a maximum of 16 bytes might be transmitted after assertion of the RTS line. The RTS line should be asserted at a time the hosts Rx buffer can still accommodate those 16 bytes.

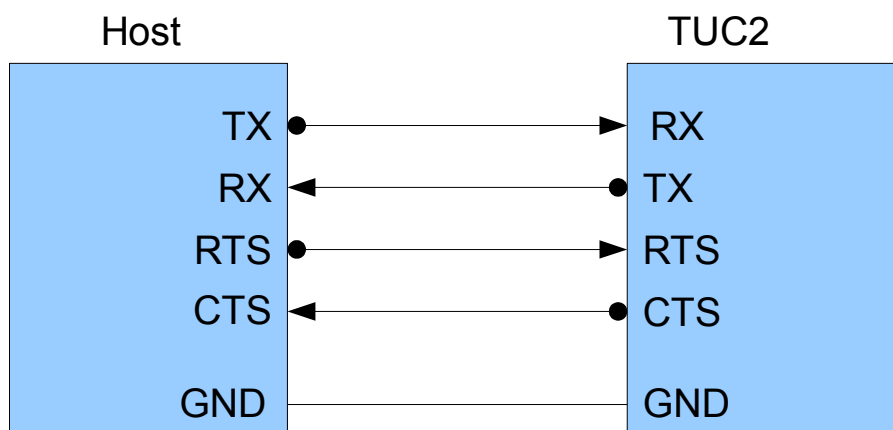


Fig. 4: UART wiring with bidirectional symmetric hardware flow control



Care must be taken not to initialize the UART of the host controller and writing a low level to the TUC2 RTS 0 pin directly at power up. This pin is a dual use pin and acts as Factory Reset during power up. Allow for a 500ms delay after finish of the power up sequence before enabling the TUC2 UART output by writing a low level to RTS 0.

An optional boot loader without Factory Reset function for the TUC2 is available on demand. This is useful if the application has no control over the timing behavior of the TUC2s host UART while using flow control.

5.6 Recovery after Misconfigurations

In case the settings of the TUC2 were misconfigured or lost, the TUC Config Manger available as a free download can be used to find the TUC on the Network and to correct settings. In case this is not possible or successful the TUC can be reset using hardware functionality.

The TUC2 offers two options for recovering from misconfiguration:

Both options require hardware access for security reasons.

5.6.1 Factory Reset

All settings are set back to the factory defaults (see TUC user guide for values). This is useful in case the TUC was misconfigured or settings are lost. The Factory Reset is triggered by holding Pin8 (RTS 0) low during power up of the TUC2.

An optional Bootloader (BTL_TUC_FLOWCTRL) disabling this function is available in case there are problems with unintentionally triggered Factory Resets during system start up in applications using flow control.

5.6.2 Firmware Reset

Upon triggering the firmware reset the TUC2 loads the firmware it was originally delivered with from the on-board flash. This is used when a firmware update failed or the active firmware is not running. The Firmware Reset always includes a Factory Reset as well. The Firmware Reset is triggered by connecting the Testpads TP5 and TP6 on the TUC2 PCB during power up. The testpads are encircled in Fig. 5. The connection may be established by qualified personnel using testpins or a temporary solder bridge.

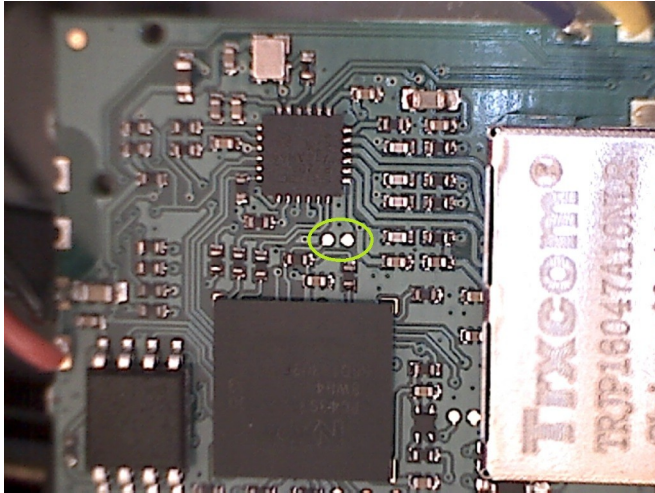


Fig. 5: Testpads for triggering the firmware reset

5.7 Digital I/O (planned for future versions)

The UART interface pins of the TUC 2 module can be configured as normal 3.3V GPIOs (please refer to the user guide). The pins can be set and read via Ethernet, e.g. for setting status pins of devices.

Pin	Pin Direction	Signal name	Pin Function
9	Digital I/O	GPIO_0	General purpose IO
10	Digital I/O	GPIO_1	General purpose IO
11	Digital I/O	GPIO_2	General purpose IO
12	Digital I/O	GPIO_3	General purpose IO
5	Digital I/O	GPIO_4	General purpose IO
6	Digital I/O	GPIO_5	General purpose IO
7	Digital I/O	GPIO_6	General purpose IO
8	Digital I/O	GPIO_7	General purpose IO Factory Reset (at power up)

5.8 SPI

SPI and other interfaces may be added on request. Please contact metraTec.

6 Further Notes

6.1 Environmental

Our Electronic devices are covered by the (German) ElektroG (electronic waste law) as well as the European WEEE directive and as such may not be disposed of by way of the normal household trash. Instead they have to be recycled properly. For you as our customer this is no additional burden, however, as you can send the device back to us for proper recycling. We assure you that the devices received back will be recycled properly and in an environmentally friendly way. Our WEEE Registration ID is DE 56060482.

When selecting electronic components we additionally made sure that all components are free of heavy metals and other harmful substances as required by the RoHS Directive for many industries. Hence, our products are produced in the most environmentally friendly way possible.



7 Version History

<i>Version</i>	<i>Changes</i>	<i>Changed by</i>	<i>Date</i>
2.0	Initial version for TUC 2	TM / RH	19.03.19
2.1	Hardware Flow Control added	TM	28.03.19
2.2	Hardware Flow Control description revised	TM	21.06.19
2.3	IO maximum ratings dependence on Vdd clarified, recovery section added, flow control buffer behaviour added	TM	12.11.19

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Changes in function, form, features can happen without prior notice.