

Datasheet RFID HaT for RaspberryPi

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1. General Information / Security Advice

1.1. Notes on the Use of this Documentation

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



ATTENTION

Declares 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 Metratec RFID HaT for RaspberryPi was not designed for use in dangerous environments. Using this product in applications where a failure could directly result in severe injuries or death ("high risk activities") is not permitted. This includes but is not limited to applications in nuclear facilities, flight control systems, life support systems or weapon systems. The manufacturer denies the suitability of this device for such scenarios.

1.3. Export Restriction

The Metratec RFID HaT 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. The same applies to any countries that are on the EU embargo list.



1.4. Further Documentation

While this documentation explains the electrical and mechanical characteristics of the Metratec RFID HaT, it might be useful to also have a look at the Raspberry Pi side, especially the 40-pin connector. Source: https://www.raspberrypi.com/documentation/computers/raspberry-pi.html



2. Product Description

The Metratec RFID HaT for RaspberryPi is a multi-functional adapter board that allows you to connect various Metratec RFID modules to a Rasberry Pi Embedded PC via the 40-pin header. That way you can test out RFID modules without designing your own PCB. You can program the RFID functionality in a high-level language like Java or Python directly on the Linux of the Raspberry Pi. The board uses the serial connection as well as some outputs of the RPi to control the functionality. The Pi HaT can be combined with one of the Metratec DwarfG2 Modules. The DwarfG2 v2 module family consists of the DwarfG2_v2_Mini with 9 dBm maximum RF output power, the standard DwarfG2_v2 with 21 dBm maximum RF Output power and the DwarfG2_v2 XR with 27 dBm maximum output power. The RFID HaT features an integrated 4x multiplexer to connect up to 4 antennas to the MMCX or U.FI ports (eg. the Metratec Echo-4). You may also connect an additional external RFID module to the white X3 connector like the PLRM, QR-NFC or RR15.



Figure 1. RFID HaT for RaspberryPi (with DwarfG2 Module)

2.1. Technical Specification

The following table shows the technical specification of the RFID HaT with minimum, typical and maximum values for each parameter (where applicable).



	Min.	Тур.	Max.
Supply Voltage USB	4.7 V	5.0 V	5.3 V
ext. Supply Voltage X1	10 V	24 V	30 V



	Min.	Тур.	Max.
Supply Current Standby		depending on module	
Operating Temperature	-20°C	20°C	+70°C
Dimensions		39 x 36 x 5 mm	
Antenna Connector		4 x MMCX & U.Fl	
Antenna Impedance		50 Ohm	
Humidity		Non- condensing	
Communication Interface		3V3 UART	
V_In_low UART	-0.3V	0V	0.9V
V_In_high UART	2.3V	3.3V	3.45V
V_out_low UART	0V	0.1V	0.4V
V_out_high UART	2.9V	3.3V	3.45V

2.2. Pin assignments and description

The RFID HaT for Raspberry Pi is not only connected to the Raspberry Pi Linux Board via the 40-pin header but also has a number of external connectors X1 - X3 as well as four antenna ports from the internal multiplexer.





Figure 2. RFID HaT Pin Positions and Naming (top view)

2.3. Mechanical Specification

A STEP model is available for download for easy integration into your mechanical design.



3. Power Supply and Power Consumption

The module features a wide input range power supply connected to Input X1. This input features reverse polarity protection, overcurrent protection and surge protection. A DC voltage of 9V - 30V may be used to power the HaT via connector X1. This external power connector will also power the Raspberry Pi Main Board - do not connect a second power supply to the Pi via USB! You can also power the board from the Raspberry Pi side if the Pi USB power supply is strong enough. The required power rating depends on the RFID module you connect to the board. A DwarfG2-Mini will only require 200mA, a PLRM will require up to 2A (!) in addition to the 2-3A the Raspberry Pi requires (also depending on the version of the Pi).



Figure 3. RFID HaT Pin Power Connector

Pin Name	Pin Nr.	Direction	Marking	Function
V+	X1.1	PWR	"+"	10-30V main supply, connect low noise regulated supply
GND	X1.2	PWR	-	Ground

Table 2. Pins Power Connector



4. Communication

The RFID HaT communicates with the Raspberry Pi main board using the 3V3 serial connection on pins 8, TXD (GPIO 14) and 10, RXD (GPIO 15). The typical communication details for our RFID modules are given in the table below.

Table 3.	Communication	Interface	Specification
	••••••••		

	Min.	Тур.	Max.
Baudrate	114 000	115 200	116 500
Databits		8	
Parity		None	
Stopbits	1	1	1.5

To use the Serial on the Raspberry Pi, you need to activate the interface via "raspi-config".



5. External UART Connector

RFID HaT features the option to connect an external device via UART on connector X3. This connector is used in various Metratec products, incl. the QR NFC, RR15 and PLRM. Besides a 3.3V UART you also find 5V and GND on this connector to power the external modules. Connector Type is a JST S4B-EH 2.50mm single row 4 pos. header.



Figure 4. External UART Connector

Table 4. Ext UART Connector

Pin Name	Direction	Marking	Function
X3.1	in	RXD	Incoming UART/serial data
X3.2	out	TXD	Outgoing UART/serial data
X3.3	Pass.	GND	Ground
X3.4	PWR	5V0	5V supply to external module



6. General Purpose Inputs/Outputs

The RFID HaT also has a 2 optically isolated inputs and 4 outputs on connector X2. These can be used to interface with photo cells, movement sensors and light stacks. This enables a RFID HaT based system to react to outside events and signal its own internal state. Connector X2 is situated on the antenna port side of the product. The input pins are optically isolated 24 V DC inputs as common in automation technology in general Up to 25 mA are needed to set the input to "high". The output pins are high side switch DC outputs with a maximum current of 500 mA per pin. The external input voltage is used from the external power supply connector X1 is used to drive these pins. The output voltage is whatever is connected to input X1, and may therefor vary between 10V and 30V. The outputs can be used to directly power e.g. signal towers. Outputs are equipped with internal overcurrent and overtemperature shutdown.

The pins X2.1, X2.2, X2.15 and X2.16 are connected directly to the power supply input X1. They are meant as outputs diestributing the power applied to X1 and can be used to power external components like sensors, etc. The power on these pins is only limited by the power of the power supply used.

The pin description is the following:

Pin	Description
X2.1	GND
X2.2	DC Out
X2.3	Out 1 -
X2.4	Out 1
X2.5	Out 2 -
X2.6	Out 2
X2.7	Out 3 -
X2.8	Out 3

Table 5. GPIO Pin Description



Pin	Description
X2.9	Out 4 -
X2.10	Out 4
X2.11	In 1 -
X2.12	In 1
X2.13	In 2 -
X2.14	In 2
X2.15	GND
X2.16	DC Out



Figure 5. GPIO Interface



7. User RGP LED

The RFID HaT has one RGB LED to indicate the operational status. This is controlled by the Raspberry Pi base board via pins on the 40-pin header.

Table 6. LED Pin Description

RPi Pin	RPi GPIO	LED colour
16	GPIO23	green
18	GPIO24	red
22	GPIO25	blue



8. Certification

The Metratec RFID HaT for is an electronic component and cannot be used as a standalone product. As such it is not covered by CE or FCC regulation. When using the HaT to build your own product the integrator has to make sure the product meets local regulations. In case you need assistance regarding compliance of your RFID system please contact Metratec. If you are interested in a custom carrier board for our DwarfG2 modules or adapters for PLRM and QR-NFC modules, please send an enquiry to sales@metratec.com.



9. Further Notes

Electronic devices like the RFID HaT for Raspberry Pi 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.







10. Version History

The following table shows the different version of this file.

Table 7. Version History

Version	Change	by	Date
1.0	Initial version	KD	3.12.2024

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