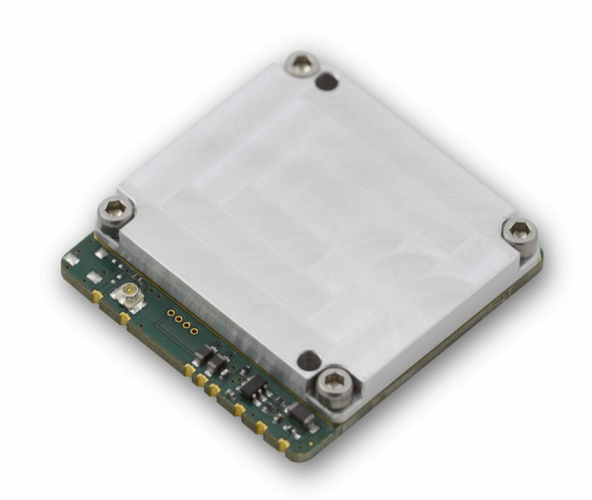


Technical Documentation

for metraTec DwarfG2 XR UHF Mid Range RFID Module



Date: November 2016

Version: 1.4

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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 DwarfG2 XR UHF RFID Module 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 DwarfG2 XR UHF RFID 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. 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 DwarfG2 XR module, it might be useful to also read the metraTec UHF Protocol Guide, which explains the ASCII protocols used to control the module in full detail.

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

2 Product Description

The DwarfG2 XR UHF RFID Module is an easy to use RFID Mid Range module which can be integrated into your electronics without big effort. This allows you to equip your product with RFID functionality without designing your own RF board. Thanks to the tested and extremely flexible firmware you can read and write data to any tag that follows the EPC Class 1 Gen 2 standard in no time. Even special features, e.g. sensor tags, can be used without firmware modifications. With the right external antenna a read range of up to 2 m is possible.

Thanks to the quick firmware, the module is perfect for applications in printers and similar devices where high reading and writing speed is needed.

2.1 Intended Use

The DwarfG2 UHF RFID Mid Range Module reads RFID tags that comply to the EPC Class 1 Gen 2 standard on a range of up to 2 m. For HF transponders that use the ISO 15693/14443 standards, please refer to our HF modules.

2.2 Technical Specification

Power Supply	5 V DC, 850 mA max.
Communication	5 V UART
Antenna Connector	U.FL
Transmit frequency	868 MHz (UHF RFID, ETSI)
RF output power	Up to 500 mW (configurable via Firmware)
Supported RFID Protocol	EPC Class 1 Gen 2
Temperature Range	-20 °C to +70 °C
Dimensions	40 x 42 x 6 mm

2.3 Module Overview

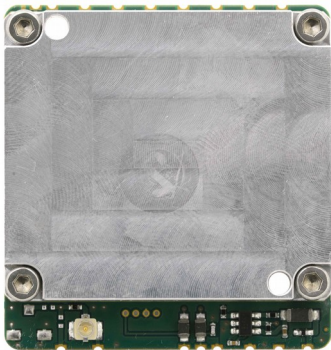


Fig. 1: Top View DwarfG2 XR Module

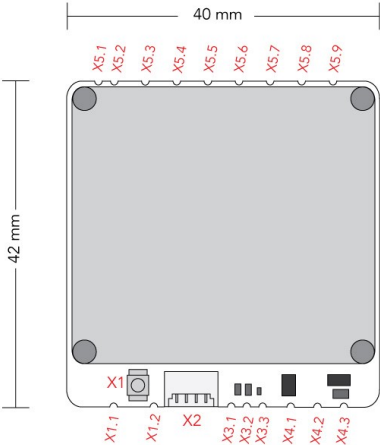


Fig. 2: Connector Overview of DwarfG2 XR

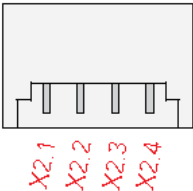


Fig. 3: Details of X2 connector

2.4 Scope of Delivery

The DwarfG2 XR UHF RFID Module comes with the following parts:

- DwarfG2 XR UHF RFID Module
- Documentation, Drivers and Demo Software are available via download from metraTec's website

2.5 Accessories

The following accessories and modules are available to extend and evaluate the functionality of the DwarfG2 XR UHF RFID Module:

- different external UHF OEM antennas
- different RFID tags suitable for almost every application

3 Power Supply and Power Consumption

The module does not feature a power supply nor reverse polarity protection. It is the task of the host board to supply a well filtered 5 V DC supply in order to achieve an optimum RFID performance. You either use the SMD vias X4.1 and X4.3 at the side to supply the module with power or two of the pins on connector X2.

With the enable pin (which default state is "ON") you can shut down the module to save additional power. Just pull the pin to ground for shut down. This will bring down power consumption to nearly zero, but will also reset the module so all settings are lost.

Pin	Pin Function
X4.1 / X2.3	GND
X4.2	Enable Pin
X4.3 / X2.4	5 V DC

Tab. 1: Power Supply Pins

Supply voltage	5 V DC (4.8 V – 5.5 V)
Power consumption RF on	850 mA max
Power consumption RF off	90 mA
Power consumption Stand-By	30 mA
Power consumption Shut-Down	50 μ A
GPIO voltage level	5 V

Tab. 2: DC characteristics

RFID systems require a very high level supply quality. Use linear regulators with high precision and high control speed whenever possible. When using switching power supplies make sure the switching speed is above 500 kHz and use an EMC optimized layout as well as shielded inductors.



NOTES

Tests have shown that the overall performance of the module can be slightly increased when the module gets 5.3 V DC voltage instead of 5.0 V DC which is the nominal voltage. Keep in mind that at the same time the heat development is increased as well.

4 Host Communication

The DwarfG2 XR UHF RFID Module communicates with its host using a 5 V UART connection. This enables direct connection to a host micro-controller. There is a range of circuits available to convert the 5 V UART Signal to RS232, RS422 / 485 or to USB or Ethernet. Please contact metraTec if you need advice on such converter circuits.

There are two ways to connect the module with a host:

1. Using the SMD vias X3.1 to X3.3 at the side of the module
2. Using the pins of connector X2

Pin	Pin Function
X3.1 / X2.1	Tx
X3.2 / X2.2	Rx
X3.3 / X2.3	GND

Tab. 3: UART connections

The UART commands used to control the DwarfG2 XR Module are described in the metraTec Protocol Guide. This guide comprises a detailed description of all commands, response formats and examples. As this protocol is shared among several metraTec products the guide is available in a separate document.

Please see: www.metratec.com --> Support --> Downloads --> Documentation

In the standard version the DwarfG2 XR UART works at 115.200 Baud, 8 databits, No parity, 1 Stopbit and no flow control.

5 RF Communication

The DwarfG2 XR Module uses an external antenna to send out RF power and data to the UHF transponder. Any 50 Ohm antenna which radiates at 868 MHz will work. There are several products available from metraTec which give you lots of options regarding form factor of the antenna as well as maximum read range.

You connect the external antenna to the module via the U.FL connector (X1) at the lower side of the module.

The second possibility is to connect an SMD antenna and use vias X1.1 and X1.2 for an RF connection.

Via	Via Function
X1.1	RF
X1.2	GND

Tab. 4: Antenna vias



ATTENTION

Please make sure to connect an antenna before turning on RF power. Although the module can detect a missing antenna, using the reader in this configuration is not advisable.

6 Digital Inputs/Outputs

The DwarfG2 XR Module has 8 digital Inputs/Outputs (X5) that can be set via the right firmware commands. These IOs are TTL level (5 V DC).

Via	Via Function
X5.1	GND
X5.2	Input/Output 1
X5.3	Input/Output 2
X5.4	Input/Output 3
X5.5	Input/Output 4
X5.6	Input/Output 5
X5.7	Input/Output 6
X5.8	Input/Output 7
X5.9	Input/Output 8

Tab. 5: GPIO vias



ATTENTION

Please make sure to only connect 5 V level to the GPIO vias. Many industrial devices use 24 V DC IOs which will destroy the module if connected without proper protection.

7 Integration Hints

7.1 Power Supply

The DwarfG2 XR consumes up to 850 mA at full RF output. Make sure the power supply can handle this load without output voltage drop. Use a 5.3 V supply for more tolerance for voltage drops. Use wide PCB traces or large diameter wires for the DC connections.

The low power operation modes of the DwarfG2 XR will introduce additional inrush currents at the time of the power up ramp of the RF. Use a large bypass capacitor (100 μ F or larger) close to the power input of the DwarfG2 XR if the power supply cannot handle these peak loads. Increase the capacitance value if the reader sends BOD (Brown Out Detected) messages, as these are indicating a voltage drop down to a critical level.

7.2 Heat Management

The DwarfG2 XR will heat up quickly due to high power and small package. Use the low power mode (SPM ON) whenever possible. The application host may also lower the duty cycle using SRI ON/OFF commands as far as possible to reduce power consumption.

The cover of the DwarfG2 XR is a solid aluminum part thermally connected to the heat sources on the module. Connect this cover to an external heat sink if the application does not allow for sufficient duty cycle reduction. This may be a dedicated heat sink or the application housing. The host PCB may also be used as additional heat sink.

7.3 EMC

Use good electromagnetic compatibility practices when developing the host system. This is important in order not to degrade RF performance of the module due to increased noise and to limit spurious radiations of spurs generated by the module.

Please contact metraTec in case further integration support is required.

8 Certification



ATTENTION

Changes or modifications to the module not expressly approved by metraTec could void the user's authority to operate the equipment.

The DwarfG2 UHF XR RFID Module complies with ETSI Rule EN 302 208. Nonetheless, the integrator of the module has to make sure that all requirements are met by the final product. It is his obligation to declare product conformity. We recommend to assign this task to a qualified third-party test lab specialized on EMC measurements.

Product versions for regulations other than ETSI, e.g. FCC (USA) or CI (Canada) on request.

9 Further Notes

Electronic devices like the DwarfG2 XR UHF RFID Module 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

<i>Version</i>	<i>Change</i>	<i>Changed by</i>	<i>Date</i>
1.0	created	KD	05.09.2012
1.1	Pin description corrected	KD	05.11.2012
1.2	Application hints added	TM	10.12.2013
1.3	Chapters Certification and Further Notes added, minor changes	CS	18.06.2015
1.4	update address and images	KS	29.11.2016

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