

# RRUI4

# RFID UHF READER

This document applies to the following products:

- RFID UHF Reader      520100xx



# Foreword and General Information

**The information in this manual was correct at the time of going to press.  
We reserve the right, however, to make changes at any time and without prior notice.**

This document was prepared for specialist personnel who install, configure and place in operation the reader.

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## Scope

The information in this manual is intended to support the development process and development guidelines at the customer. In addition, this manual provides supporting information on the applicable standards for the related installation location, as well as the relevant safety standards related to the installation and configuration of the Kathrein reader.

## General information

This manual includes information on the installation, configuration, operation and maintenance of the reader. In addition, detailed technical data is provided with the intention of better informing users about the reader's features.

Therefore, in the interests of long service life and trouble-free operation, read this manual carefully and follow all the instructions and information it contains.

## Warranty

Switching on the AC or DC power supply prior to connecting the antenna cable is considered incorrect installation. Any malfunctions that then occur subsequently are therefore also not covered by the warranty. The manual should be read and understood in its entirety prior to setup or maintenance of the reader. We accept no liability if the customer fails to take the precautionary measures given here. The warranty is void in such cases.

## Disposal Instructions



Electronic equipment is not domestic waste - in accordance with directive 2002/96/EC OF THE EUROPEAN PARLIAMENT AND THE COUNCIL dated 27<sup>th</sup> January 2003 on used electrical and electronic appliances, it must be disposed of properly.

At the end of its service life, take this unit for disposal to an appropriate official collection point.



### **Spent batteries are special waste.**

Do not throw spent batteries into your domestic waste; take them to a collection point for used batteries.

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# 1. Safety Instructions/Information

## Figure legend



**Caution**

Indicates a potentially dangerous situation that can result in minor to serious injuries and/or damage to the unit on failure to observe.

**Note**

Provides information that makes it easier to understand a specific topic and/or to be able to optimally utilise the functionality of the unit.

## General safety instructions



### Caution!



Before you start to install or replace the unit, the manual provided must be read carefully and understood.

The details given in our data sheets and in this manual must be carefully followed and observed during the installation of the reader and during operation!

The installation team must hold suitable qualifications and be familiar with the relevant national safety regulations.

Connection, setup, maintenance and other work on the unit are only allowed to be undertaken by suitably qualified staff with appropriate training.

The unit is only allowed to be used for the purpose intended by the manufacturer.

Unauthorised modifications and the usage of spare parts and additional units that are not sold or recommended by the manufacturer can cause fires, electric shock and injuries. Such actions will therefore result in exclusion of liability and the manufacturer will not provide any warranty.

The version of manufacturer's warranty conditions applicable at the time of purchase apply to the unit. No liability is accepted for unsuitable manual or automatic adjustment of the unit's parameters or the unsuitable usage of the unit.

Repairs are only allowed to be undertaken by authorised personnel. Opening the unit and attempting to repair it yourself will void all warranty claims! Improper work on the unit may jeopardise the electrical safety of the unit.

**The manufacturer accepts no liability for accidents caused by the user opening the unit!**

The related applicable safety regulations must be followed when working on the unit.

## Mains voltage



### Caution

Make sure that the mains cable (power supply cable) is not damaged. Units with a damaged mains cable must be disconnected from the mains (disconnect mains connector) and repaired by a qualified engineer before setup. Only use the power supply unit provided!



**Mortal danger due to electric shock!**

Only operate the unit at the specified mains voltage (indicated on the rear of the unit or on the external power supply unit)!

**If the mains voltage is too high, there is a risk of fire!**

# 1. Safety Instructions/Information

## Ventilation



### Caution!

The heat generated in this unit is adequately dissipated. However, the unit should never be installed in a cupboard or on shelves with inadequate ventilation. Never cover over the unit's ventilation slots.

**There is a risk of fire!**

## Damp, sunlight, heat, naked flames



### Caution!

The unit should be protected from damp, dripping water and splashing. Do not place the unit close to a heater or expose it to direct sunlight and do not operate it in damp locations. Only use the unit in a moderate climate, not in tropical conditions! Do not place any naked flames on the unit! <sup>1)</sup>

**There is a risk of fire!**

## Radiated electromagnetic fields



### Caution!

This reader is designed for operation as per EN 302208. On the operation of the unit with antennas connected, the human exposure regulations in accordance with EN 50364 are to be observed. Ensure there is a minimum distance of 23 cm between antenna and human bodies. In some circumstances, heart pacemakers may suffer interference if wearers are close to the antenna when the unit is in operation (reader and antenna). In case of doubt, the people affected are requested to contact the manufacturer of their pacemaker or their doctor.

The reader output power is to be reduced as a function of the antenna cable length and the antenna gain.

## Battery



### Attention!

The battery incorporated in the device may be replaced only by a battery of the same type. It must be installed by a trained fitter. If the battery is replaced by one of the wrong type or is wrongly connected.

**There is the risk of an explosion.**

## CE and FCC marking

The unit complies with the applicable CE requirements and FCC part 15.

Brand Name: Kathrein RRUI4 RFID-UHF-Reader  
Model Name: 52010025 - 52010034  
FCC ID: \_\_\_\_\_

This device complies with part 15 of the FCC Rules. 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.

<sup>1)</sup> If the unit is not expressly designed for these installation locations/conditions.

# 1. Safety Instructions/Information

| Kathrein     |          | FCC-ID                   |                        | ICC-ID                     |   |                                     |
|--------------|----------|--------------------------|------------------------|----------------------------|---|-------------------------------------|
| Type details | Part no. | XXX                      |                        | XXXXXX                     | - | YYYYYYYY                            |
|              |          | Grantee code applied for |                        | Company number applied for |   | Unique Product Number 8 digits free |
|              |          |                          | ID code 14 digits free |                            |   |                                     |
| RRUI4-RS4-U4 | 52010025 | WJ9                      | - RRUI4RS4U4           | 5530C                      | - | RRUI4RS4                            |
| RRUI4-USB-U4 | 52010026 | WJ9                      | - RRUI4USB4U4          | 5530C                      | - | RRUI4UB4                            |
| RRUI4-ETH-U4 | 52010027 | WJ9                      | - RRUI4ETHU4           | 5530C                      | - | RRUI4EH4                            |
| RRUI4-ETG-U4 | 52010028 | WJ9                      | - RRUI4ETGU4           | 5530C                      | - | RRUI4EG4                            |
| RRUI4-RS4-U5 | 52010029 | WJ9                      | - RRUI4RS4U5           | 5530C                      | - | RRUI4RS5                            |
| RRUI4-ETH-U5 | 52010030 | WJ9                      | - RRUI4ETHU5           | 5530C                      | - | RRUI4EH5                            |
| RRUI4-ETG-U5 | 52010031 | WJ9                      | - RRUI4ETGU5           | 5530C                      | - | RRUI4EG5                            |
| RRUI4-RS4-U6 | 52010032 | WJ9                      | - RRUI4RS4U6           | 5530C                      | - | RRUI4RS6                            |
| RRUI4-ETH-U6 | 52010033 | WJ9                      | - RRUI4ETHU6           | 5530C                      | - | RRUI4EH6                            |
| RRUI4-ETG-U6 | 52010034 | WJ9                      | - RRUI4ETGU6           | 5530C                      | - | RRUI4EG6                            |

## Note

**Changes or modifications made to this equipment not expressly approved by Kathrein may void the FCC authorization to operate this equipment.**

*This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.*

*However, there is no guarantee that interference will not occur in a particular installation.*

*If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by taking one or more of the following measures:*

- *Reorient or relocate the receiving antenna.*
- *Increase the distance between the equipment and receiver.*
- *Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.*
- *Consult the dealer or an experienced radio/TV technician for help.*

### **RF Exposure Warning**

*This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20 cm between the radiator and your body.*

### **Professional Installation Notice:**

*To comply with FCC part 15 rules in the United States, the system must be professionally installed to ensure compliance with the part 15 certification. It is the responsibility of the operator and professional installer to ensure that only certified systems are deployed in the United States. The use of the system in any other combination (such as co-located antennas transmitting the same information) is expressly forbidden.*

## 2. Introduction

### 2.1 The reader

The Kathrein RFID (Radio Frequency Identification) Reader RRUI4 is a multiprotocol reader for reading active and passive tags in the frequency range from 865 MHz to 868 MHz for Europe or 902 MHz to 928 MHz for FCC. The unit operates, depending on the approval region, with 2 W RF output power or 1 W RF power at the antenna socket. As supplied the unit can read and write tags in accordance with the EPC-Gen2 standard. Additional protocols can be loaded using software updates. The unit has various interfaces for communication.

The reader has four antenna connections for connecting transmitting/receiving antennas for communication with RFID tags. The unit has various interfaces for the connection to the PC, depending on the configuration and degree of protection. Depending on the variant, the unit can be supplied with power via the RS 485/ RS 422 interface or via a 3-pin M8 connector.

### 2.2 Product package

- 1 RRUI4 (colour scheme: black housing with red cover)
- 1 CD with demo software and operating instructions
- 1 Plug-in power supply unit 24 V/45 W
- 1 Mains cable (not heat resistant)
- 1 USB cable (A to B)
- 1 Data sheet

### 2.3 Accessories

Antennas: → Can be used with UHF RFID antennas; Kathrein antenna types are recommended e. g. 52010003, 52010004 and 52010060

Antenna cable:

| Designation             | Order no. | 50-Ω cable type | Connector 1 | Connector 2 | Length (cm) |
|-------------------------|-----------|-----------------|-------------|-------------|-------------|
| Cable 3 m, SMA-N        | 52010049  | RG058-PE        | SMA (m)     | N (m)       | 300         |
| Cable 3 m, SMA-SMA      | 52010050  | RG058-PE        | SMA (m)     | SMA (m)     | 300         |
| Cable 1 m, TNC-TNC(rev) | 52010051  | RG058-PE        | TNC(f)-rev  | TNC(m)      | 100         |
| Cable 2 m, TNC-TNC(rev) | 52010052  | RG058-PE        |             |             | 200         |
| Cable 3 m, TNC-TNC(rev) | 52010053  | RG058-PE        |             |             | 300         |
| Cable 6 m, TNC-TNC(rev) | 52010054  | RG058-PE        |             |             | 600         |
| Cable 1 m, N-TNC(rev)   | 52010055  | RG058-PE        | TNC(f)-rev  | N (m)       | 100         |
| Cable 2 m, N-TNC(rev)   | 52010056  | RG058-PE        |             |             | 200         |
| Cable 3 m, N-TNC(rev)   | 52010057  | RG058-PE        |             |             | 300         |
| Cable 6 m, N-TNC(rev)   | 52010058  | RG058-PE        |             |             | 600         |

Table: Original Kathrein antenna cables

### 2.4 Installation location

The standard version of the unit complies with the degree of protection IP 40. Variants with a higher protection class are available on request and comply with the related IP requirements specified.

## 2. Introduction

### 2.5 Connections/Displays

The figure below shows the front of the reader with all available connections on the IP 40 variant.

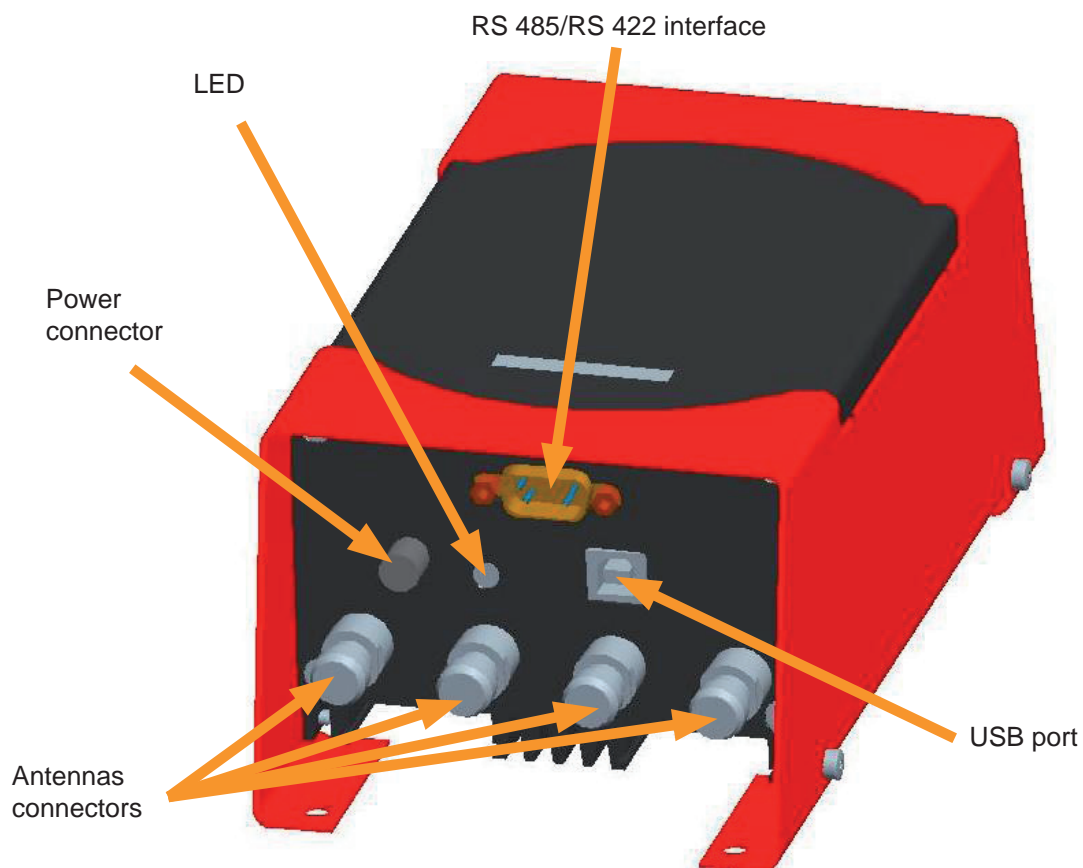
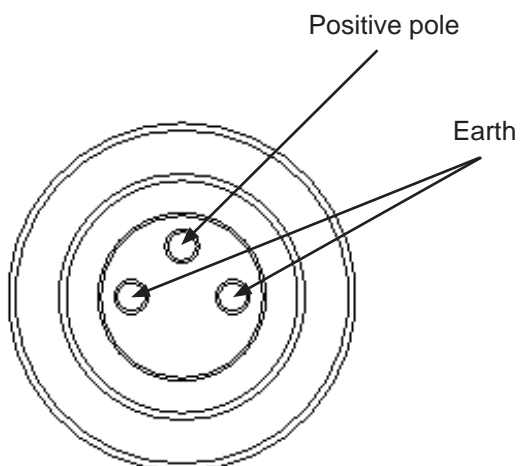


Figure: Front end of the RRUI 4

#### 2.5.1 Supply of power

The power is supplied via a 3-pin M8 connector or via the 9-pin Sub-D socket. The pin assignments on the housing connector are shown in the illustration below:





## 2. Introduction

### 2.5.2 RS 422/RS 485

The reader's interface card is equipped with a combined RS 485/RS 422 interface. The interface is switched between RS 485 and RS 422 with the supplied configuration tool (see 4.3.4.2). The unit can also be supplied with power via this interface. The table on the right shows the pin assignments for the 9-pin Sub-D socket, as well as the M12 connector:

| PIN             | Sub-D 9-pin | M12 |
|-----------------|-------------|-----|
| RS 485 - A      | 3           | 5   |
| RS 422 - A - TX | 4           | 4   |
| RS 485 - B      | 8           | 6   |
| RS 422 - B - TX | 9           | 2   |
| GND screen      | Screen      | 8   |
| + 24 V Ub       | 7           | 1   |
| Ground Ub       | 2           | 3   |

*Table: Connector pin assignment, Sub-D socket*

For operation with RS 422, the RS 485 wires are switched to RX.

### 2.5.3 Connection via USB (only IP 40 units)

For configuration purposes the reader is equipped with a USB socket of type B. The DLL file on the CD supplied requires to operate the unit using this port.

### 2.5.4 Antenna connection

For connecting the RFID antennas the reader has four antenna connectors designed in "reverse TNC". Please only use the cables from the accessories (see 2.3) or equivalent cables for this connection.

#### Note

*Please only use cable suitable for the impedance (50 Ohm), as otherwise the performance of the reader will be severely limited by the mismatch. If the mismatch is large, the reader may indicate a fault ("Antenna faults").*

### 2.5.5 LED

The reader has a 2-colour LED for the indication of the operating state. The table below shows the colours used and the related operating state.

| Red                             | Green                           | Operating state                 |
|---------------------------------|---------------------------------|---------------------------------|
| X                               | Flashes approx. every 8 seconds | Error during initialisation     |
| X                               | X                               | Unit is booting                 |
| Flashes approx. every 8 seconds | X                               | Normal operation with heartbeat |

*Table: Indication of the operating states by the LED*

### 2.5.6 Buzzer

The reader also has a buzzer that, in addition to the LED, indicates successful booting (1 x short) or an error (2 x long).

## 2. Introduction

### 2.6 Data sheet

# RRUI 4 RFID UHF Reader System

## 4-Way Antenna Interface

### Order no. 520 100xx

**KATHREIN**  
Antennen · Electronic

The Kathrein RRUI 4 Series is a new GEN2 modularly designed reader system which allows the user to select a wide range of different function blocks to obtain an optimised solution for today's RFID challenges.

The RRUI 4 Series is targeted to the next generation of RFID UHF applications to solve problems in the supply chain and in the manufacturing area. Key segments are the Automotive Industry, Automation Systems, Telecommunications and Logistics.

The RRUI 4 Series is based on the Impinj Indy R1000 UHF chipset to provide highest performance with essential reduction of system costs.



| General Specifications:           | ECE Version   | US Version               |
|-----------------------------------|---|--------------------------|
| Frequency range                   | 865-868 MHz   | 902-928 MHz              |
| Output power                      | + 30 dBm  | + 30 dBm conducted (FCC) |
| Emitted power (max.)              | + 33 dBm ERP  | -                        |
| Protocols                         | EPC Class1 GEN2/ISO 18000-6C                              |                          |
| Nominal impedance (antenna ports) | 50 ohms   |                          |
| LBT Sensitivity                   | -96 dBm   |                          |
| Antenna interface                 | 4 Port TX/RX interface with TNC-reverse (male) connectors |                          |
| Communication interface           | see Reader overview                                       |                          |
| Operating system                  | Kathrein Firmware @ ARM 9 Proc.                           |                          |
| Power supply                      | + 24 V DC ±10%  |                          |
| Operating temperature range       | -20°C to +55°C  |                          |
| Storage temperature range         | -20°C to +85°C  |                          |
| Dimensions                        | 200 x 108 x 81 mm   |                          |
| Weight                            | 1.32 kg   |                          |
| Environmental Protection          | see RFID UHF Reader overview                              |                          |
| Conform to:                       | EN 302 208-1, EN 301 489-3, CE, ETSI,                     | FCC                      |

#### Technical Features:

- System compliant to EPCglobal Gen2/ISO 18000-6C standards
- Software-defined radio architecture based on Impinj Indy R1000
- Combined TX/RX antenna ports
- Support LBT Listen before talk (ETSI EN 302 208-1)
- Dense Reader Mode (DRM)
- Modulation modes: DSB, PR-ASK
- Output power range justable from 20 dBm upto 33 dBm (100 mW up to 2 W)
- Ready for Kathrein RFID Antenna Interface **KRAI** ©

#### Delivery scope:

- Reader System RRUI4-xxx-xx
- Network adapter + 24 V DC (only covers IP 40)
- Types with USB port: USB connecting cable A → B
- CD-ROM with manual and data sheet (pdf)

## 2. Introduction

**KATHREIN**  
Antennen · Electronic

| Region (Norm) | Device                                     | Type         | Order No. | Housing | Connectors |            |          |              | Protection class |
|---------------|--|--------------|-----------|---------|------------|------------|----------|--------------|------------------|
|               |  |              |           |         | USB        | RS 422/485 | Ethernet | Eth. M. GPIO |                  |
| EU (CE)       | <b>Kathrein-RRUI4</b><br>(4-way multiplex) | RRUI4-RS4-E4 | 52010009  | sw/rt   | X          | X          |          |              | IP 40            |
|               |  | RRUI4-USB-E4 | 52010016  | sw/rt   | X          |            |          |              | IP 40            |
|               |  | RRUI4-ETH-E4 | 52010017  | sw/rt   | X          |            | X        |              | IP 40            |
|               |  | RRUI4-ETG-E4 | 52010018  | sw/rt   | X          |            |          | X            | IP 40            |
|               |  | RRUI4-RS4-E5 | 52010019  | sw/rt   |            | X          |          |              | IP 54            |
|               |  | RRUI4-ETH-E5 | 52010020  | sw/rt   |            |            | X        |              | IP 54            |
|               |  | RRUI4-ETG-E5 | 52010021  | sw/rt   |            |            |          | X            | IP 54            |
|               |  | RRUI4-RS4-E6 | 52010022  | sw/rt   |            | X          |          |              | IP 65            |
|               |  | RRUI4-ETH-E6 | 52010023  | sw/rt   |            |            | X        |              | IP 65            |
|               |  | RRUI4-ETG-E6 | 52010024  | sw/rt   |            |            | X        | IP 65        |                  |
| US (FCC)      | <b>Kathrein-RRUI4</b><br>(4-way multiplex) | RRUI4-RS4-U4 | 52010025  | sw/rt   | X          | X          |          |              | IP 40            |
|               |  | RRUI4-USB-U4 | 52010026  | sw/rt   | X          |            |          |              | IP 40            |
|               |  | RRUI4-ETH-U4 | 52010027  | sw/rt   | X          |            | X        |              | IP 40            |
|               |  | RRUI4-ETG-U4 | 52010028  | sw/rt   | X          |            |          | X            | IP 40            |
|               |  | RRUI4-RS4-U5 | 52010029  | sw/rt   |            | X          |          |              | IP 54            |
|               |  | RRUI4-ETH-U5 | 52010030  | sw/rt   |            |            | X        |              | IP 54            |
|               |  | RRUI4-ETG-U5 | 52010031  | sw/rt   |            |            |          | X            | IP 54            |
|               |  | RRUI4-RS4-U6 | 52010032  | sw/rt   |            | X          |          |              | IP 65            |
|               |  | RRUI4-ETH-U6 | 52010033  | sw/rt   |            |            | X        |              | IP 65            |
|               |  | RRUI4-ETG-U6 | 52010034  | sw/rt   |            |            | X        | IP 65        |                  |

## 3. Installation

### 3.1 Hole pattern (mm)

The reader has four holes of 5.5 mm diameter in its cover for fastening.

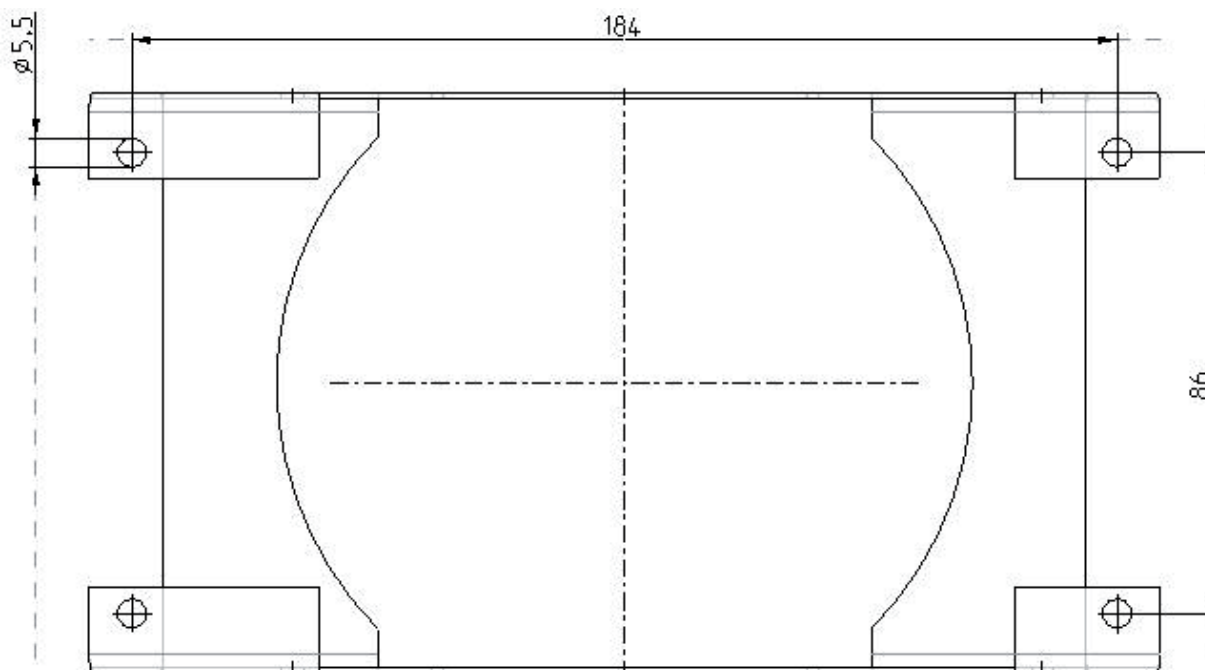


Figure: Underside of RRUI 4 with fastening holes



### Caution!



Prior to installing, read the safety instructions at the start of this manual!

### 3.2 Selecting the installation site

Pay attention to the unit's degree of protection when selecting the installation site. The standard version (IP 40) of the reader is only designed for usage indoors. The installation site must be protected against water splashes in this case. Space is to be provided around the unit so that the heat produced in the unit can dissipate adequately.

### 3.3 Installing the reader

- The reader (the unit) is only to be fastened using the holes on the cover
- Attention is to be paid to the mounting surface when selecting the fastening material
- Strain relief should be used on the cables to protect the connections

## 4. Software

For test purposes the reader can be operated using the demo software on the CD supplied. This software includes all the reader's functionality. For integration in enterprise resource planning systems, there is a DLL file on the CD for programming custom routines.

### 4.1 System requirements

To ensure correct operation using the software on your PC/laptop, your PC/laptop should meet the following minimum requirements:

|                        |                 |
|------------------------|-----------------|
| Processor:             | X 86 compatible |
| Memory:                | 512 MB RAM      |
| Operating system:      | Windows XP      |
| Spare hard disk space: | 3 MB            |

### 4.2 Installation

The demo software is installed by running "KathreinRFIDDemoSetup.exe" on the CD-ROM supplied. During this process the demo software and the DLL for controlling the reader are installed. You can change the language used during the installation in the dialog box that now opens. Accept your selection by clicking the "OK" button.



Figure: Installation, language selection

Now follow the instructions in the dialog box. Select an installation folder and a name for the folder on the Start menu, if you want to change the defaults.

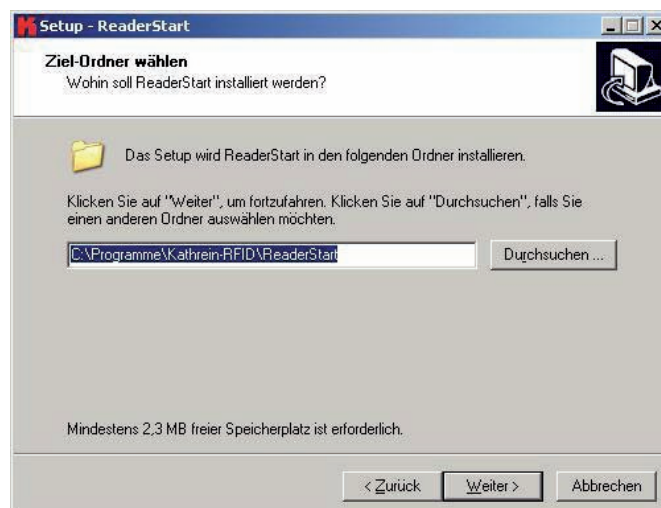
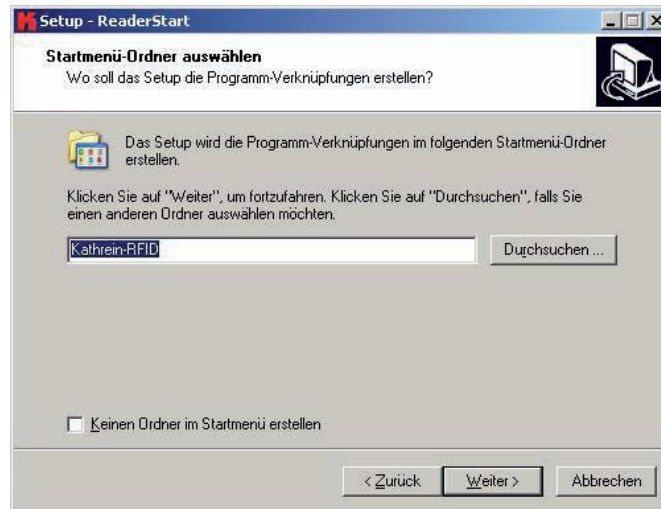


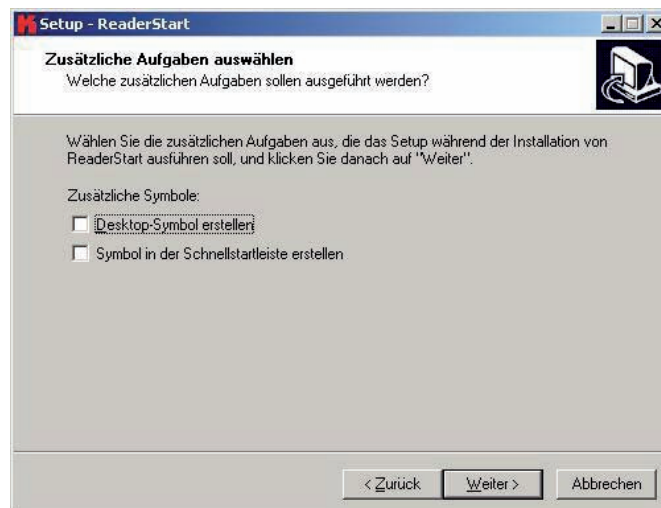
Figure: Installation, selecting installation folder

## 4. Software



*Figure: Installation, select Start menu folder*

In the next dialog box, define whether the setup is to create a desktop icon and an icon on the quick start toolbar.



*Figure: Installation, Zusätzliche Aufgaben auswählen (Select additional tasks)*

## 4. Software

A summary of the installation tasks is then displayed. Start the installation process by clicking the “Installieren” (Install) button.

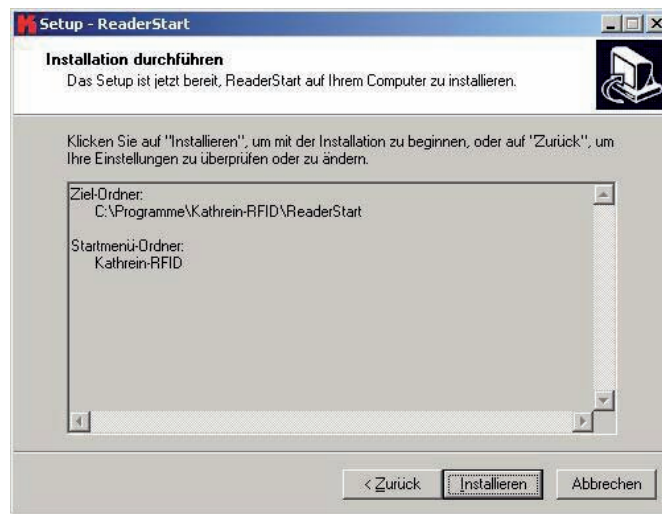


Figure: Installation, summary of the installation tasks “Installation durchführen” (Install)

### 4.3 Operation

The test software “ReaderStart” for the RRUI4 is described in the section that follows. Before the description addresses the user interface and the individual configuration features and controls, the principle of operation of this RFID reader system is described.

#### 4.3.1 General

An RFID system comprises, along with a control computer and the actual reader, also the antennas for the reader, the antenna connection cables and the tags. The figure below shows the schematic layout of the system:

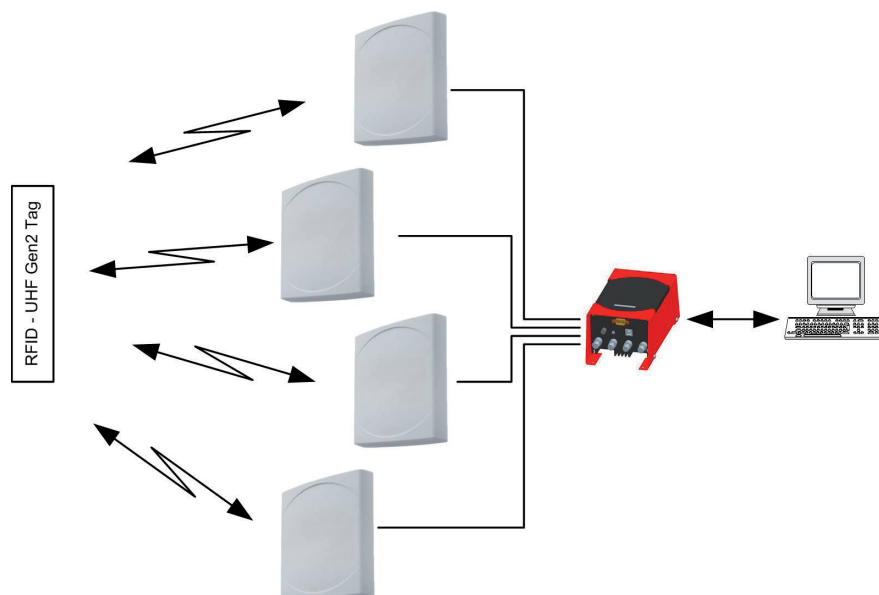


Figure: Schematic illustration of an RFID reader system

## 4. Software

The computer controls the reader via one of the available interfaces and receives over this interface the EPCs and data from the tags read.

To read from an EPC tag, the reader emits an RF carrier via the active antenna and in this way supplies the tag with power. If the information on the tag is now to be read, a connection to the tag is established. For this purpose the tag is selected from a possible number of tags (singularisation). For the transmission of data from and to the tag, the reader requests a handle from the tag. The rest of the communication with the tag can be undertaken using this handle and the EPC read.

The tag's EPC is transferred from the reader to the PC and displayed on the PC with additional information. This information includes, along with the time the tag was read, also the antenna used for communication with the tag. It is always possible to communicate directly with the tag using this EPC, as soon as the tag is in range of the reader.

The ReaderStart application communicates with the reader using the DLL supplied. On the user interface it provides information on all the unit's functions of relevance to the user. Every connection between the application and the reader over the various interfaces in the reader is made using this DLL. The functions that can be used are listed in the header file "ReaderDll.h".

### 4.3.2 User interface description

The program is started by double-clicking "ReaderStart.exe". After a splash screen, the program's user interface appears.

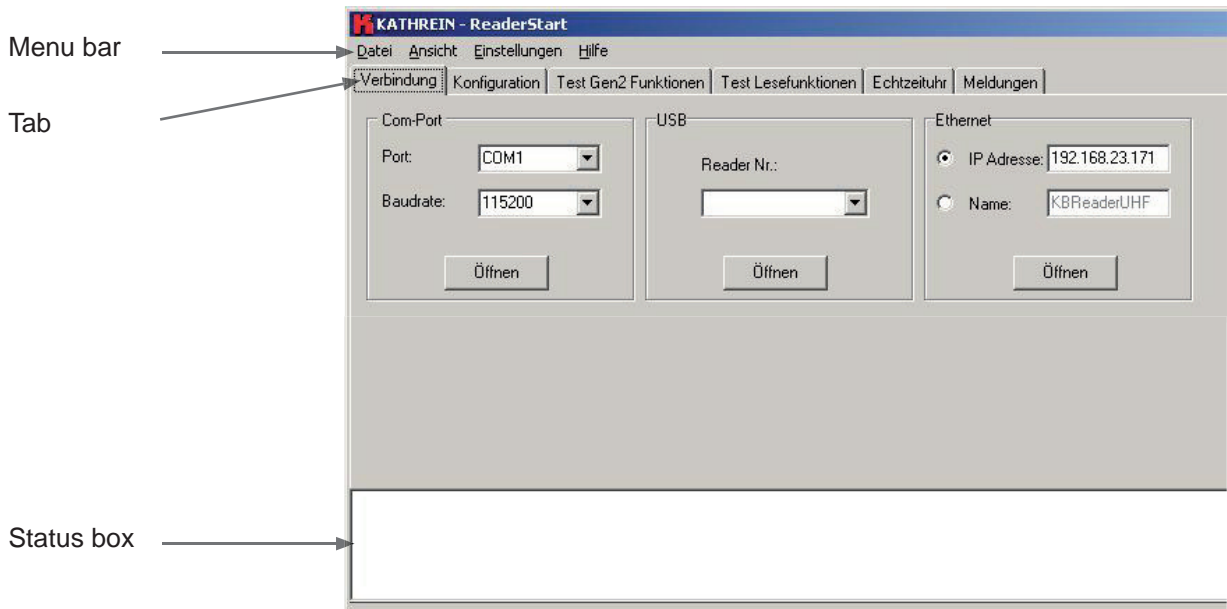


Figure: ReaderStart user interface

The status box contains current messages from the reader and can be seen on every tab.



## 4. Software

### 4.3.3 Establishing connection

The “Verbindung” (Connection) tab contains all controls for establishing a connection to the reader. Depending on the unit, it is possible to establish a connection via RS 485 or RS 422, via USB or via Ethernet.

#### 4.3.3.1 “ComPort” group box

The serial interface is used for the communication with the reader via RS 485 or RS 422. The RS 485/RS 422 interface card supports the standard data rates of the serial interface on a PC. A level converter is also required for the communication to convert the RS 232-compliant signal from the PC into a differential RS 485/RS 422 signal.

A serial com port on the PC can be opened in this group box. For this purpose the correct serial interface must be selected in the “Port” drop-down list box. Only the ports available on the PC are displayed in this list box. It is not checked whether this port is already in use by other applications.

The required baud rate must also be set in the list box below. The com port is opened by clicking the “Öffnen” (Open) button and the port is then no longer available for other applications. If this port is already in use by another application, a corresponding error message is displayed. If the port is free, the reader can be operated using this port.

#### 4.3.3.2 “USB” group box

If an RRUI4 is connected to the PC via USB, the unit is installed in the system as a USB HID-compliant device. Correct installation can be seen in the application if a number appears in the drop-down list box after reader installation. This number is unique for each reader. If several readers are connected to the PC, the related reader can be selected on this menu. The connection between the reader and PC is now established by clicking “Öffnen” (Open).

#### 4.3.3.3 “Ethernet” group box

The application offers two ways of establishing a connection to the reader via Ethernet (only possible on readers with Ethernet interface). On the one hand, it is possible to communicate directly with the reader by entering the IP address, on the other hand it is also possible to establish a connection using the reader's host name.

To integrate the reader into a corporate network, please contact your administrator who will be able to allocate you a spare IP address. If you want to connect the reader directly to the PC, please use a cross-link cable (crossed network cable). You can use a standard patch cable for connecting to the PC using a hub or switch.

If you have a spare IP address, you must allocate this address to the reader. For this purpose a connection must be established to the reader (e. g. via USB). It is now possible to enter the IP address on the “Konfiguration” (Configuration) tab. After the configuration has been saved it is possible to communicate with the reader using this address. For this purpose, mark the “IP-Adresse” (IP address) box and enter this address. The connection is established by clicking the “Öffnen” (Open) button.

For the connection using a DNS name, there must be a correspondingly configured DHCP and DNS server in the network. If the reader is registered on the DHCP server and the DNS server, it is also possible to connect to the reader using a network name. For this purpose, select the “Name” box and enter the name agreed for the reader. The connection to the RRUI4 is established by clicking the “Öffnen” (Open) button.

## 4. Software

### 4.3.4 Konfiguration (Configuration)

On the “Konfiguration” (Configuration) tab it is possible to set all the RF parameters for the reader as well as to set the parameters for the communication interfaces. It is also possible to read and write the licence key for the reader on this tab.

If a connection has been established to the reader, the settings in the reader are read when the “Konfiguration” (Configuration) tab is opened. The configuration can also be read manually from the reader by clicking the “Konfiguration lesen” (Read configuration) button. During this process all settings in the user interface are overwritten. The current settings are saved in the reader by clicking “Konfiguration schreiben” (Write configuration). This action includes all parameters in the “RF-Einstellungen” (RF settings) group box.

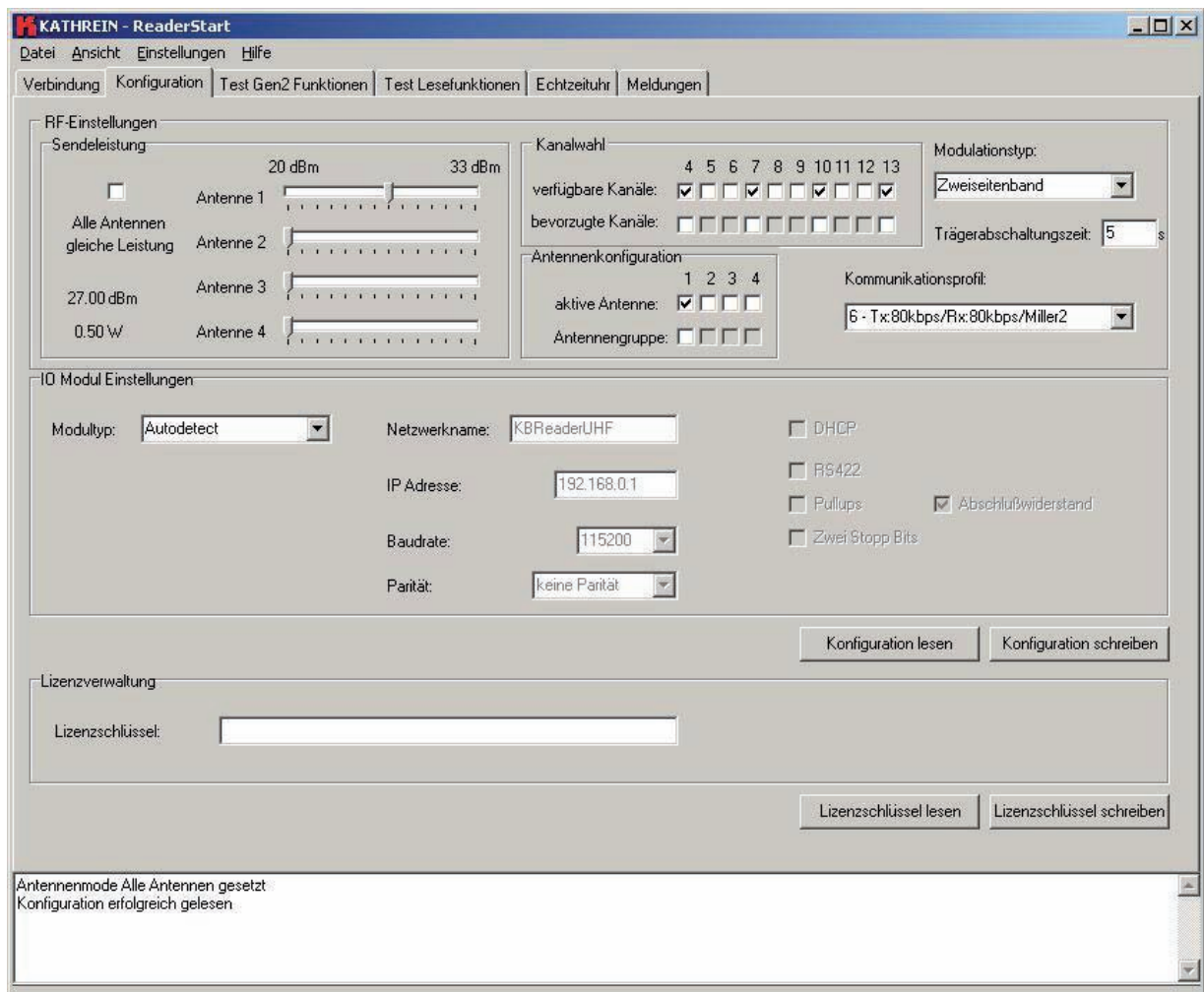


Figure: “Konfiguration” (Configuration) tab

## 4. Software

### 4.3.4.1 “HF-Einstellungen” (RF settings) group box

In this group box the radio frequency parameters, such as the transmission power, transmission channel (EU only) and the spectrum can be set. The applicable standards in the related approval region are to be observed when setting the transmission power.

#### Note

*To operate the reader in accordance with the related national standards, the antenna gain and the cable attenuation must be taken into account in the transmission power setting. In no circumstances is it allowed to exceed the permitted transmission power. Failure to observe this instruction can result in non-compliant operation of the reader rendering void the unit's type approval.*

#### Sendeleistung (Transmission power)

The RFID reader's transmission power can be set separately for each antenna or all antennas at the same time. If the “Alle Antennen gleiche Leistung” (All antennas same power) check box is selected, the sliders for the other antennas are set to the same power when a slider for the power for antenna 1-4 is adjusted. If this check box is not selected, the power at the antennas can be set separately for each output.

The radiated power is limited in Europe in accordance with ETSI 302208 to 2 W ERP. In the FCC region, max. 1 W connected RF power applies with an antenna gain of 6 dBi. While the European standard refers to a half-wave dipole, FCC part 15 refers to an isotropic radiator.

To set the transmission power, the length-dependent cable attenuation and the antenna gain must be included in the calculation of the transmission power. An example for the calculation of the transmission power for Europe and FCC is given in the following.

The following applies to the European approval region:

$$P_{\text{Reader}} = P_{\text{ERP}} + D_{\text{Cable}} - G_{\text{Antenna}}$$

$P_{\text{Reader}}$  ... Reader's transmission power in dBm

$P_{\text{ERP}}$  ... Radiated power referred to a half-wave dipole in dBm

$D_{\text{Cable}}$  ... Cable attenuation in dB

$G_{\text{HW}}$  ... Gain of the antenna referred to a half-wave dipole

The cable attenuation is the length-dependent attenuation of the cable at the related frequency:

$$D_{\text{Cable}} = L * D_{\text{per m}}$$

$D_{\text{Cable}}$  ... Cable attenuation in dB

L ... Length in m

$D_{\text{per m}}$  ... Attenuation in dB/m

The antenna gain is stated in various different units. These units include dBi and dBic. The units dBi and dBic refer to an isotropic (spherical) radiator, where dBic refers to a circularly polarised isotropic radiator and dBi to a linearly polarised isotropic radiator.

## 4. Software

In the European approval area, the radiated power must not exceed 2 W ERP. This figure refers to a half-wave dipole. The relationship shown below exists between an isotropic radiator (dBi) and a half-wave dipole.

$$G_{\text{HW}} = G_{\text{isot}} - 2.14 \text{ dB}$$

$G_{\text{HW}}$  ... Gain referred to half-wave dipole

$G_{\text{isot}}$  ... Gain referred to isotropic radiator in dBi

If the gain of the antenna is referred to the polarisation of a circular isotropic antenna (dBic), the linear gain of the antenna is 3 dB lower. As a result the transmission power can be increased by 3 dB.

$$G_{\text{HW}} = G_{\text{isot}} - 2.14 \text{ dB} - 3 \text{ dB}$$

$G_{\text{HW}}$  ... Gain referred to half-wave dipole

$G_{\text{isot}}$  ... Gain referred to isotropic radiator in dBic

- In the FCC approval region, the RF power connected at the antenna input must not exceed 1 W
- If the gain of the antenna is higher than 6 dBi, the RF power connected must be reduced correspondingly
- The reader's transmission power is then:

$$P_{\text{Reader}} = P_{\text{cond}} + D_{\text{Cable}}, \text{ with } P_{\text{cond}} \leq 1 \text{ W and } G_{\text{isot}} \leq 6 \text{ dB}$$

$P_{\text{Reader}}$  ... Reader's transmission power in dBm

$D_{\text{Cable}}$  ... Cable attenuation

$G_{\text{isot}}$  ... Gain of the antenna in dBi

$P_{\text{cond}}$  ... Power at the antenna input in dBm

If the antenna gain is stated in dBic, the reader's transmission power can be increased by 3 dB.

The transmission power for the European variant can be set in 0.25 dB steps from 20 dBm to 33 dBm.

### Kanalwahl (Channel selection)

The reader transmits, dependent on the approval region, in the frequency range 865 MHz to 868 MHz for Europe or 902 MHz to 928 MHz for USA. In Europe the number of channels to be used can be limited. For this purpose the related check box must be selected on the "verfügbare Kanäle" (Available channels) list for each channel the reader is to use. In this manner it is possible to avoid from the start the usage of specific channels on which there is interference. In the case of a read command, the reader searches for a spare transmission channel using LBT (Listen Before Talk). The reader starts to search through the channels in ascending order. As soon as it finds a free transmission channel, the reader starts to send its data on this channel.

## 4. Software

The order with which the channels are to be searched using LBT can be defined with the aid of the selection of the preferred channels. The channels selected here are searched first in ascending order. If a spare channel is not found in the preferred channels, the remaining channels are searched.

In the USA the RF power connected at the antenna input is related to a minimum number of channels used.

### Antennenkonfiguration (Antenna configuration)

If all antenna outputs on the reader are selected, the reader attempts to read the tags in the field starting at antenna 1. Once no more new tags are found, the reader switches to the next antenna. It is then again attempted to read all tags that reply to the reader's request. This process starts again from the beginning after the last antenna.

If not all antennas are selected, the reader starts its request with the lowest antenna selected and then switches through all antennas selected in ascending order.

It is possible to quickly select the antennas to be used on the "Test Gen2-Funktionen" (Test Gen2 functions) tab by forming an antenna group. For this purpose a selection must be made from the active antennas by selecting the check boxes in the "Antennengruppe" (Antenna group) list. The resulting group can now be selected using the "Test Gen2-Funktionen" (Test Gen2 functions). The "Tags lesen" (Read tags) function is then only performed for this group.

### Modulationstypen (Modulation types)

The modulation type can be switched between "Zweiseitenband" (double sideband) and PR-ASK modulation in this drop-down list box.

### Trägerabschaltzeit (Carrier shut down time)

The "Trägerabschaltzeit" (carrier shut down time) defines how long an RF carrier remains enabled after the last command from the reader to the tag. If the time between two commands is long, it is recommended to shut down the carrier to save energy and to avoid using the channel unnecessarily. The shut down time can be set as an integer from 0 to 65535 seconds.

### Mögliche Kommunikationsprofile (Possible communication profiles)

If the configuration is read, the communication profiles that can be used are read from the reader and can be selected in the drop-down list box. The profile defines the speed at which data are transmitted to and from the tag. The person configuring the reader thus has direct control over the performance of the reader and the spectral characteristics of the transmission signal.

| Profile number | Profile name                 |
|----------------|------------------------------|
| 1              | Tx:40kbps/Rx:80kbps/FM0      |
| 2              | Tx:40kbps/Rx:40kbps/Miller2  |
| 3              | Tx:40kbps/Rx:160kbps/FM0     |
| 4              | Tx:40kbps/Rx:80kbps/Miller2  |
| 5              | Tx:80kbps/Rx:160kbps/FM0     |
| 6              | Tx:80kbps/Rx:80kbps/Miller2  |
| 7              | Tx:80kbps/Rx:160kbps/Miller2 |

*Table: List of communication profiles*

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### 4.3.4.2 "IO-Modul-Einstellungen" (IO module settings) group box

The reader is supplied either with an Ethernet or RS 485/422 interface depending on its features. The configuration of the interface can be adapted to the application using this group box.

#### Note

*Incorrect settings can result in an interruption of the connection to the reader. The settings on readers without USB can only be reset using an interface that matches the configuration.*

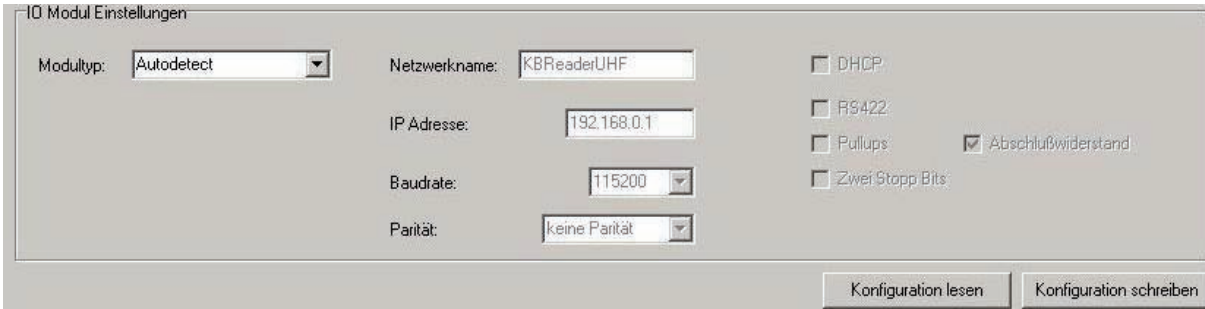


Figure: Part of the "Konfiguration" (Configuration) tab

The card type for the reader can be set in the "Modultyp" (Module type) drop-down list box. The remaining configuration boxes in this group box are activated depending on the card type selected. The following settings are possible:

- Autodetect:

The reader detects which I/O card is installed. The settings for the card detected are made in accordance with the default configuration (see section 4.3.4.3).

- RS 485:

The reader expects a corresponding RS 422/485 card. To set the interface type from RS 485 to RS 422, the RS 422 check box must be selected. It is also possible to enable pull-ups and a terminating resistor in the receive and transmit path. The terminating resistor is imperative for a reliable point-to-point connection. It should only be deactivated in RS 485/422 networks in which the reader is not installed at one of the ends of the network. The data transfer can also be made using two stop bits. The transmission speed is set in the "Baudrate" drop-down list box. The parity is set in the "Parität" (Parity) box to suit the required setting.

- Ethernet:

If the "Ethernet" module type is selected, it is possible to enter the network name and IP address. If DHCP is activated by selecting the check box with the same name, the reader logs into the DHCP server in the network and gets its IP address from there. For this reason the "IP-Adresse" (IP address) field is also deactivated. An appropriate network name can still be entered; this name can then be used to communicate with the reader in the network provided there is an appropriately configured DNS server.



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### 4.3.5 Test Gen2-Funktionen (Test Gen2 functions)

This tab makes it possible to test the individual reader functions. This includes, along with the functionality in accordance with the EPC-Gen2 standard, e. g.: reading individual tags, writing tags, setting passwords, also the measurement of the temperature inside the reader, as well as the selection of the antenna.

Along with the “Temperatur lesen” (Read temperature), “EPCs lesen” (Read EPCs) buttons, antenna selection and the box for displaying the EPCs read, this tab comprises the “Schreibe EPC auf einzelnen Tag” (Write EPC to an individual tag), “Passwörter verändern” (Change passwords), “Daten lesen schreiben” (Read write data), “Lock Tag” and “Kill Tag” group boxes. The sections that follow explain this functionality in more detail.

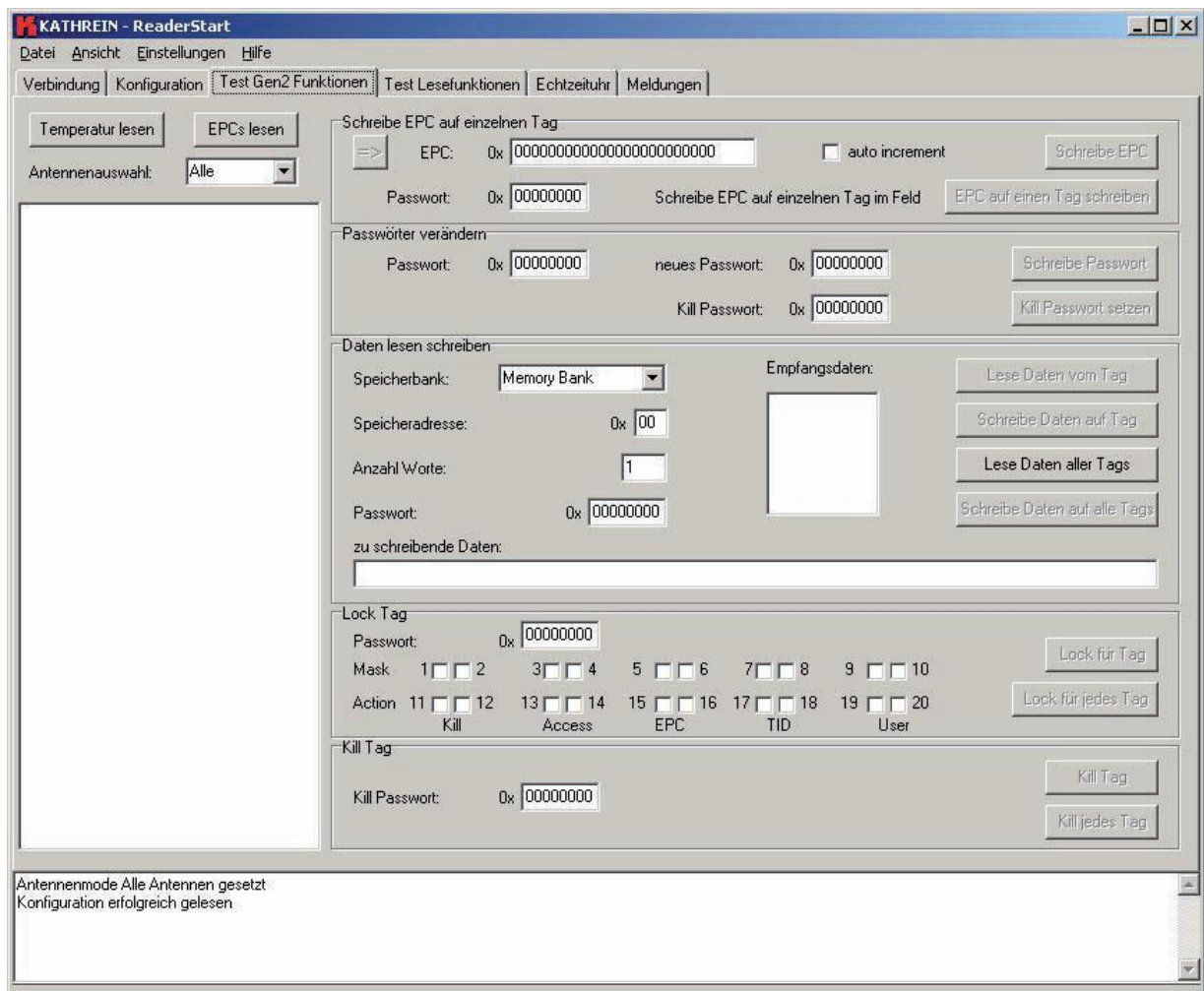


Figure: The “Test Gen2-Funktionen” (Test Gen2 functions) tab

#### 4.3.5.1 Reading tag

To read a tag on this tab, the “EPCs lesen” (Read EPCs) button must be clicked once the reader is correctly configured. The reader now tries to read once all the tags in the field of the selected antenna. If the number of antennas is limited in the “Antennenwahl” (Antenna selection) drop-down list box, only the available antennas or the antenna group set in the configuration are used for reading. The EPCs from the tags read successfully are displayed in the field below. The status box shows the EPCs of the tags read in relation to the antenna used.

The actual temperature inside the reader can be requested using the “Temperatur lesen” (Read temperature) button. This function is for information only.



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### 4.3.5.2 "Schreibe EPC auf einzelnen Tag" (Write EPC to an individual tag) group box

The figure below shows the tab after successfully reading tags:

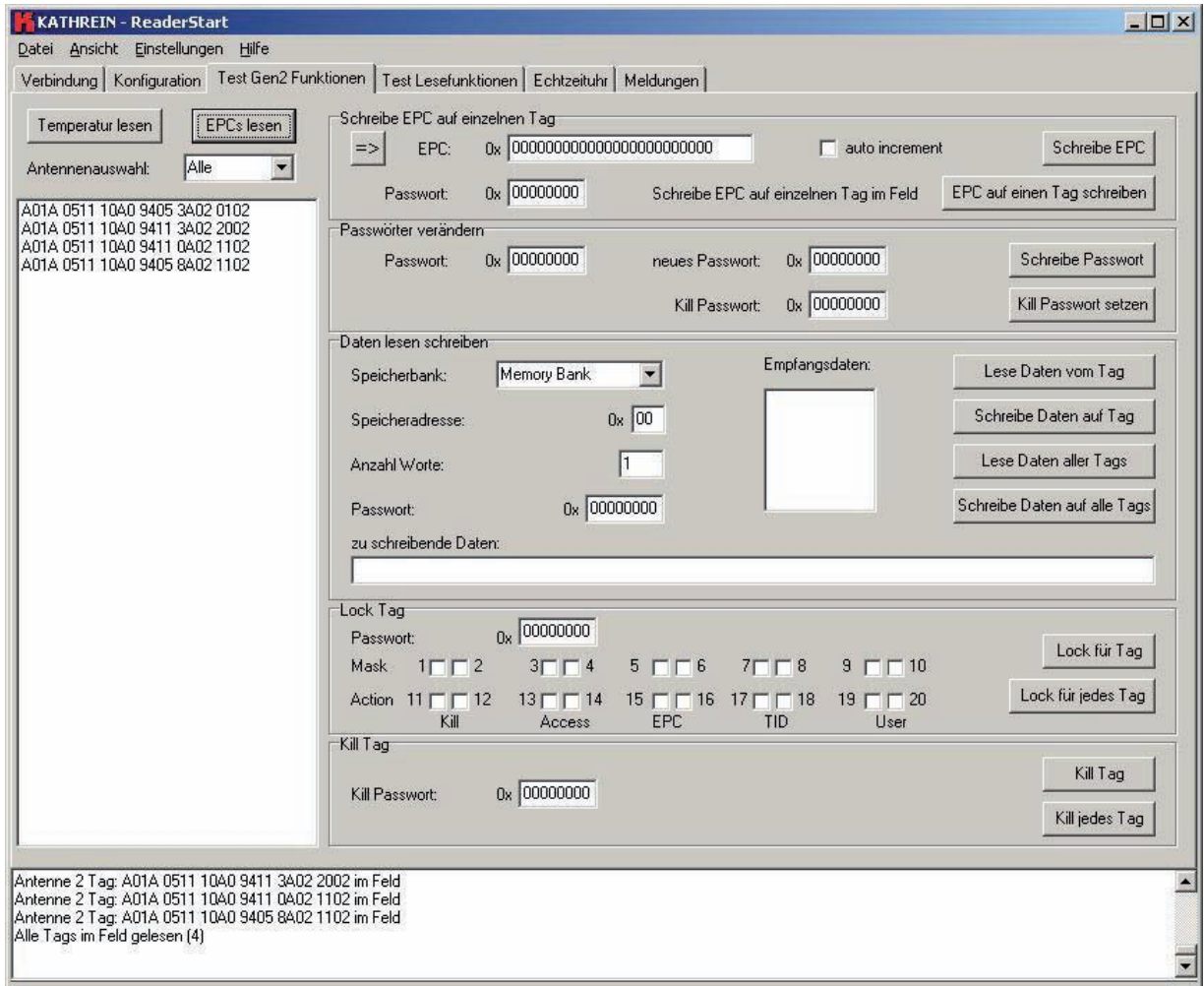


Figure: The "Test Gen2-Funktionen" (Test Gen2 functions) tab with tags read

There are two ways of writing a tag's EPC in this group box. The first is to change an existing tag or to write to any tag in the field.

"übernehme EPC" (Copy EPC) button

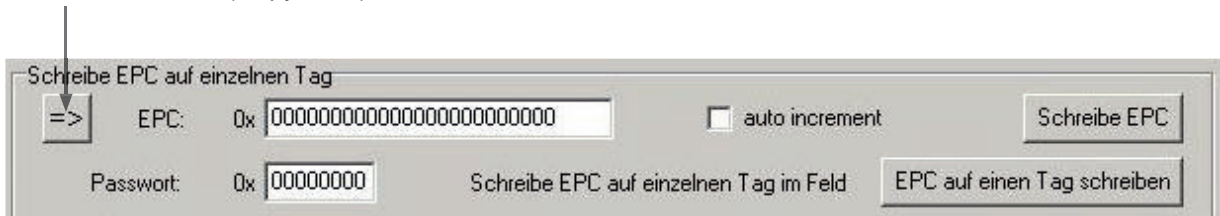


Figure: The "Schreibe EPC auf einzelnen Tag" (Write EPC to an individual tag) group box

## 4. Software

To change an existing EPC, the EPC must be selected in the “gelesene EPCs” (EPCs read) box. The EPC is copied to the editable “EPC” box using the “übernehme EPC” (Copy EPC) button. There the code can be changed either manually or using the “auto-inkrement” (Auto-increment) function; the latter function increases the EPC by 1 each time the code is written successfully to a tag. The “Schreibe EPC” (Write EPC) button transfers the number from the EPC box to the selected tag. If the “EPC auf einen Tag schreiben” (Write EPC to a tag) button is used it is not necessary to know the EPC on the tag. But there must only be one tag in the field. This tag is detected by the reader and the new EPC written to the tag. If the data area on the tag is protected with an access password, this password must be entered in the “Passwort” (Password) box prior to the write operation.

### 4.3.5.3 “Passwörter verändern” (Change passwords) group box

According to the EPC standard, the access to the individual memory areas of a tag can be restricted. The configuration of which area is protected is defined in the “Passwörter verändern” (Change passwords) and “Lock Tag” group boxes.

The access password and the kill password can be set in the first group box. For this purpose the old password must be entered first. If a password has not been set, 0 must be entered. The new password is entered in the “neue Passwort” (New password) box. The old password is replaced with the new password by clicking the “Schreibe Passwort” (Write password) button. To set a kill password, the access password must also be entered. The kill password is only needed for the final deactivation of the tag.

#### Note

*The tag will be unusable after a “Kill Tag” command!*

The new kill password is entered in the field and transferred to the tag by clicking the “Kill Passwort setzen” (Set kill password) button. Once this process has been completed, the new password applies.

### 4.3.5.4 “Lock Tag” group box

In this group box, the access to individual tag data areas can be inhibited as per the EPC standard. Access is then only possible using a valid password, or is no longer possible until the inhibit is removed.

The access is configured in 3 steps:

1. Enter the access password
2. Set mask bits for the “Kill”, “Access”, “EPC”, “TID” and “User” data areas. If a check box is selected, the related action bit is defined as per the setting, otherwise it is ignored
3. Set action bits for the data areas. The function of the bits for each area is identical and is shown in the following table. A set bit is the same as the selection of a check box on the user interface

You will find more detailed information on these bits and the related memory areas in the latest version of standard “Radio-Frequency Identity Protocols Class-1 Generation-2 UHF RFID” from EPC global.

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| pwd-write | Permalock | Description   |
|-----------|-----------|---|
| 0         | 0         | Area can be written with and without password                       |
| 0         | 1         | Area cannot be locked, but can be written with and without password |
| 1         | 0         | Area can only be written with valid password                        |
| 1         | 1         | Area cannot be written  |

*Table: Lock bit functionality*

After the definition of the functionality, this configuration is written to the tag by clicking the “Lock für Tag” (Lock for tag) button. This configuration is transferred to every tag in the field with the same access password using the “Lock für jedes Tag” (Lock for every tag) button.

### 4.3.5.5 “Daten lesen und schreiben” (Read and write data) group box

Each memory bank in the tag can be read and written in this group box. The exact layout of the tag memory is given in the EPC Global standard “Radio-Frequency Identity Protocols Class-1 Generation-2 UHF RFID”.

### 4.3.5.6 “Kill Tag” group box

The tags can be finally deactivated in this group box.

#### Note

*The tag will be unusable after a “Kill Tag” command!*

To start this operation, the correct kill password must be entered. The “Kill Tag” button only deactivates the tag marked on which the kill password matches the password entered. Groups of tags can be deactivated using the “Kill jedes Tag” (Kill every tag) button; here it is also required that the tags have the same kill password.

### 4.3.6 Test Lesefunktion (Test read function)

Using the functions available on this tab the “Read Performance” can be tested. Part of the tab is designed for cyclically polling the tags in the field.

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EPCs read

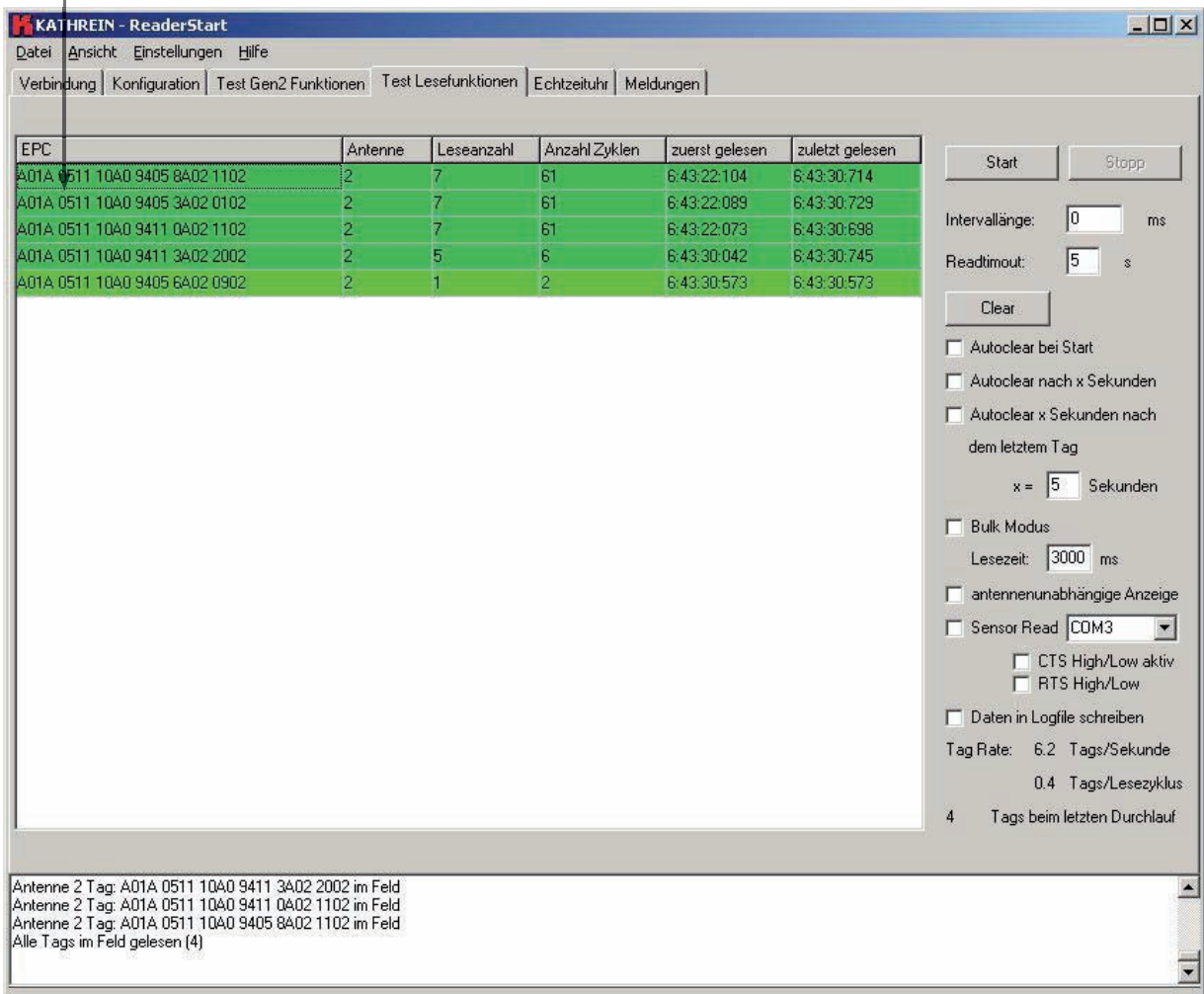


Figure: "Test Lesefunktionen" (Test read functions)

The largest part of the tab is taken up by the "gelesene EPCs" (EPCs read) box. This box contains a table that displays each tag read. Additional information is shown for each tag:

- Antenne (Antenna) This number is the same as the antenna port on the reader via which the tag has been read
- Leseanzahl (Number of reads) Indicates the number of successful read processes completed
- Anzahl Zyklen (Number of cycles) Indicates the total number of read cycles since the start of the read process
- zuerst gelesen (Read first) Time the tag was read for the first time
- zuletzt gelesen (Last read) Time the tag was active in the field for the last time

The right part of the tab contains various options that affect the reader's mode of operation.

The "Start" and "Stop" buttons start and end the reader's read cycle. The "Intervalllänge" (Interval length) box defines how long the software waits after a read command until the next read command is sent to the reader. The interval length can be between 0 and 9999 ms.

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If there is a very large number of tags in the field, the reader may take a very long time to singularise and read the EPCs on the tags. In such a case the software may end the read process with a timeout. In the “Readtimeout” (Read timeout) box you can define how long the software waits for a reply from the reader before the read command is declared invalid and the software outputs an error message. This time is entered in seconds and can be a maximum of 99 seconds.

The “gelesene EPCs” (EPCs read) table can be completely erased manually using the “Clear” button. The check boxes underneath this button make it possible to reset the table:

- Either on each start
- After a specific time in seconds
- Or a specific time after the last tag was read.

The related function is activated by selecting the related check box. The maximum waiting time before the table is cleared is 999 seconds.

The “Bulk-Modus” (Bulk mode) changes the reading behaviour of the reader such that the EPCs for the tags successfully read are not logged into the reader immediately after the end of a read process. The reader automatically starts read commands on all available antennas until the time stated in the “Lesezeit” (Read time) field has elapsed. All the tags read are then transferred to the software. If there is a large number of tags in the field, the transmission time from the reader to the PC is optimised using this function and the performance of the reader improved.

The “Antennen unabhängige Anzeige” (Antenna-independent indication) check box makes it possible to suppress the multiple indication of tags that are read via more than antennas. With this indication, each tag, irrespective of which antenna is used to read it, is added to the EPC list and counted only once.

A trigger event can send the read command to the reader using the “Sensor Read” function. For this purpose a suitable signal must be applied to a spare serial port on the PC. If the condition is met, the PC sends read commands to the reader until the condition is no longer met.

| Signal | I/O | Pin Sub-D 9 |
|--------|-----|-------------|
| TD     | O   | 3           |
| RD     | I   | 2           |
| SG     |     | 5           |
| DTR    | O   | 4           |
| DSR    | I   | 6           |
| CD     | I   | 1           |
| RTS    | O   | 7           |
| CTS    | I   | 8           |

*Table: Connector pin assignment Sub-D 9-pin*

To set the correct signal level, a check box can be used to switch between RTS and CTS. CTS is the input as per table 7. RTS is set to the required active level. The correct level to trigger the trigger event is set on CTS using the check box.

To configure this function, the level for RTS and CTS must first be defined. In the next step, the required port must be selected in the drop-down list box. The com port is opened by selecting the “Sensor Read” check box, and the related settings made.

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By selecting the “Daten in Log File schreiben” (Write data to log file) check box the data from the status box are saved in the file “log.txt” in the program folder.

### 4.3.7 Echtzeituhr (Real-time clock)

Here the reader's real-time clock can be read and set. Click the “Zeit lesen” (Read time) button to read the RTC from the reader and display it in the “Uhrzeit” (Time) and “Datum” (Date) fields.

The time can be set by manually entering the time in the “Uhrzeit” (Time) and “Datum” (Date) fields. An easier variant is to select the “PC Zeit setzen” (Set PC time) check box. Then the current time is transferred to the related boxes. The time is transferred to the reader by clicking the “Uhrzeit setzen” (Set time) button.

### 4.3.8 Meldungen (Messages)

All reader error messages are logged on this tab. These include whether the connection to the PC was established successfully, whether the connection to the PC has been interrupted, whether it was not possible to find a free transmission channel or whether the reader has detected an antenna fault.

### 4.3.9 Menu bar

#### 4.3.9.1 Datei (File)

On this menu you can open and save the configuration as well as the settings for the software in the form of a XML file. The “Beenden” (Exit) command closes the application.

#### 4.3.9.2 Ansicht (View)

On this menu the contents of the status box can be deleted. All messages that occur during operation are saved in this box and deleted at specific intervals. If you want to reset the box, use the “Ansicht” (View) menu.

#### 4.3.9.3 Einstellungen (Settings)

On the “Einstellungen” (Settings) tab the access to the reader's write operations on the tag can be inhibited for unauthorised personnel. If a write password is set, the user cannot perform any write operations on the tag without entering the password and the related buttons are not available.

The following dialog box is displayed by clicking the “Schriftart EPCs lesen ändern” (Change read EPCs font) command (see next page):

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Figure: Changing font

Here the format of the font for the EPC field on the “Test Lesefunktionen” (Test read functions) tab can be changed. It is possible to improve the legibility of the read results on the monitor even from larger distances by increasing the size of the font.

### 4.3.9.4 Hilfe (Help)

The “Hilfe” (Help) menu contains the Info..., Reader Info and Firmwareupdate (Firmware update) commands.

The “Info” command provides the version information on the ReaderStart application, as well as copyright information. The “Readerinfo” command requests information on the software in the reader to which a connection is currently established and displays this information.

Once a connection has been established to the reader, a reader software update can be started using the “Firmwareupdate” (Firmware update) command on the “Hilfe” (Help) menu. If you click this command, a file selection dialog box appears in which you can select the file with the new firmware with the file extension “.bin”. You can obtain this file either from our support department or from the web site “www.kathrein.de”. Up to software version 1.23.00 it is only possible to update with a later version of the software. With all later software versions it is also possible to downgrade the firmware.

Once a file has been selected, start the download process by clicking the “Öffnen” (Open) button. The software is transferred initially to the reader's RAM, the progress is indicated in the status box. If no errors have occurred during this process, the software is transferred to the flash in the 2<sup>nd</sup> step. Whether the update process was successful can be seen in the status box, the reader's LED also illuminates green. The duration of the update process is dependent on the interface selected.

## 5. Contact Addresses

Headquarters:

**KATHREIN-Werke KG**

RFID-Systeme

P.O. Box 100 444

D-83004 Rosenheim

Fax: +49 8031 184-52794

e-mail: [rfid@kathrein.de](mailto:rfid@kathrein.de)

Innovation centre:

**KATHREIN-RFID GmbH**

Am Kroit 25-27

D-83123 Amerang

e-mail: [rfid@kathrein.de](mailto:rfid@kathrein.de)

[www.kathrein-rfid.de](http://www.kathrein-rfid.de)

936.3456/A/1108/ZWT - Technical data subject to change.