

RF Field product family

Installation Manual

SRU-8100 RFID Reader 18000-63

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Overview of changes

No.	Version	Status	Date	Responsible	Type of the change
1	00-01	processed	2014-07-31	C. Diemberger	Initial creation
2	00-20	processed	2014-09-24	C. Diemberger	Adapt for SRU-8100 Product
3	01	released	2014-11-03	C. Diemberger	First release

Table 1 Overview of changes

Reference to the status- and version administration:

Status:

processed	the document is being processed
released	the document has been checked and released by quality assurance, it can only be modified if the version number is updated.

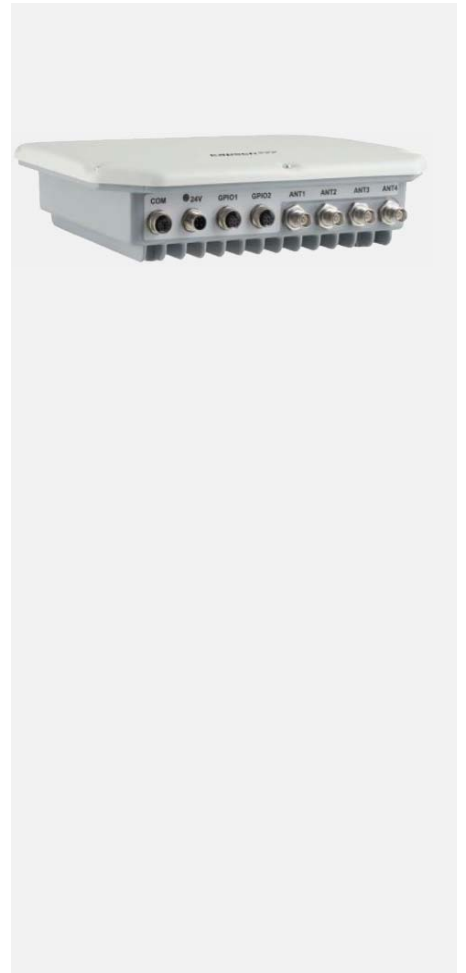
Versions:

Take place in two stages. Accepted documents receive the next higher integral version number.

00-01, 00-02 etc.	not released versions, with the status " processed "
01	first released version with the status " released "
01-01, 01-02 etc.	Versions, which supplement the version 01-00 and " processed " are
02	second released version with the status " released "

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SRU-8100 RFID Reader 18000-63



Installation Manual

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Trademarks

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Table of contents

Page

1	About this document	8
1.1	List of referenced documents	8
1.2	Text conventions	8
1.3	Acronyms and abbreviations	9
1.4	History of document updates	10
2	Preface	11
2.1	Copyright notice	11
2.2	Scope	11
2.3	General information	11
2.4	Warranty	11
2.5	Disposal instruction	11
3	Safety instructions / information	12
4	Introduction	15
4.1	The reader	15
4.2	RFID system	15
4.3	Kathrein RFID Antenna Interface © KRAI	15
4.4	Software Integration Kit	16
5	Installation	17
5.1	Selecting the installation site	17
5.2	Installing the reader	17
6	Connectors and displays	18
6.1	Power supply	19
6.2	Ethernet (COM)	19
6.3	Digital inputs and outputs (GPIOx)	19
6.4	Antenna Connection (ANTx)	22
6.5	LED	22
6.6	Buzzer	22
7	ReaderStart v2: test, setup and demo software	23
7.1	General	23
7.2	System requirements	23
7.3	Installation	23
7.4	Operation & configuration	27
7.4.1	User interface overview	27
7.4.2	Menu bar	28
7.4.3	Communication Tab	34
7.4.4	Application tab	38
7.4.5	Basic writing function	43
7.5	GPIO functions	45

7.6	Expert settings 1.....	48
7.6.1	Expert settings 2.....	53
7.7	Test Gen2 functions	54
7.8	© KRAI-Settings	57
7.9	App Manager	57
8	Building host applications by using the API.....	58
8.1	Preparation.....	58
8.2	Using the examples with Windows.....	58
8.3	Using the examples with Linux on a PC.....	58

List of figures

Figure 1	RFID Reader subsystem (up to 4 antennas possible)	15
Figure 2	Bottom side of the reading and mounting holes	17
Figure 3	Side view of reader with connectors	18
Figure 4	Inputs double insulated with +UB extern	20
Figure 5	Inputs double insulated with +UB intern	20
Figure 6	Outputs double insulated +UB extern	21
Figure 7	Outputs double insulated +UB intern	21
Figure 8	Saving the configuration in a file	28
Figure 9	Loading a configuration from the file	29
Figure 10	Changing the GUI language.....	30
Figure 11	Setting the warnings.....	30
Figure 12	Updating the firmware	31
Figure 13	Setting the date and time	31
Figure 14	About reader start v2.....	32
Figure 15	Interrogating information about the reader.....	32
Figure 16	Displaying the license key.....	33
Figure 17	Tab for the Communication by Ethernet I/O card	34
Figure 18	Configuration of the GPIO card.....	36
Figure 19	Configuration parameters for the Ethernet module.....	37
Figure 20	Application tab.....	39
Figure 21	Basic read functions tab.....	41
Figure 22	Basic write function tab	43
Figure 23	GPIO functions tab	45
Figure 24	GPIO settings in communication tab.....	46
Figure 25	Expert settings 1 tab	49
Figure 26	Expert settings 2 tab	53
Figure 27	The Test Gen2 functions menu tab.....	54

List of tables

Table 1	Overview of changes.....	2
Table 2	List of used and other supporting documents	8
Table 3	Acronyms and abbreviations.....	9
Table 4	History of document updates	10

Table 5	LED and connectors of the RFID reader.....	18
Table 6	Power Supply pin allocation	19
Table 7	Ethernet (COM) Connector	19
Table 8	Digital inputs and outputs pin (GPIO) allocation	19

1 About this document

This document describes the installation, configuration and setup of the SRU-8100 KTC RFID Reader 18000-63.

The target audience of this document is system integrators, technicians, and service engineers, who install and maintain the SRU-8100 RFID Reader 18000-63. The manual is also suitable for detailed engineering and design, regarding cabling, electrical calculations, and cabinet/gantry schematics.

In order to configure the reader correctly and adapt it to the respective application, detailed knowledge of the EPCGlobal standards of GS1 is necessary. This standard describes the principle of operation of the interface between the RFID tag and RFID reader.

1.1 List of referenced documents

The available configuration parameters of the reader device are described in the “Configuration Manua” [2].

The reader device is controlled via a TCP/IP based Application Specific Interface (API) which is described in detail in the document “API Communication Protocol Description” [1].

Note: Each document has an identifier which shows the validity of the document version with respect to the firmware version of the RFID reader device.

Ref. no.	Doc. no.	Title	Document type
[1]	47000001171	SRU-8100 RFID Reader 18000-63	API Communication Protocol Description
[2]	47000001168	SRU-8100 RFID Reader 18000-63	Configuration Manual
[3]	47000001181	SRU-8100 RFID Reader 18000-63	Product Range Definition
[4]	47000001182	SRU-8100 RFID Reader 18000-63	Datasheet

Table 2 List of used and other supporting documents

1.2 Text conventions

Optical aids and standard text formats are used in the documentation to help you easily locate and identify information. You will find the following typographical formats:

Style	Used for
bold	Accentuations, commands, menu names, dialog box names, command options, filenames, parameters
<i>italics</i>	Labelling and cross-references
CAPITAL LETTERS	Acronyms
Code	Program fragment, messages

Table 2 Text and their meaning

Note: contains additional information on that subject.

1.3 Acronyms and abbreviations

The following table contains a list of most important acronyms and abbreviations used within this document to enable an easy reading.

Acronym or abbreviation	Explanation
ANT	Antenna
API	Application programming interface
CPU	Central processing unit
CSV	Comma-separated values, a file format (usually with .csv extension)
DHCP	Dynamic host configuration protocol
DLL	Dynamic link library
DNS	Domain name system
EIRP	Equivalent isotropic radiated power
EPC	Electronic product code
ERP	Effective radiated power
ETSI	European telecommunications standards institute
FCC	Federal communications commission
GPIO	General-purpose input/output
GUI	Graphical user interface
IP	Internet protocol
KTC	KapschTrafficCom AG
LAN	Local area network
LED	Light-emitting diode
RAM	Random access memory
RFID	Radio frequency identification
RSSI	Received signal strength indication
SRU	Single reader unit
TAG	Synonym for on-board unit (OBU)
TCP	Transmission control protocol
TID	Touch input device
UDP	User datagram protocol
UHF	Ultrahigh frequency
XML	Extensible markup language

Table 3 Acronyms and abbreviations

1.4 History of document updates

Updates will be issued when needed and noted on this page in the following issues of this document.

Edition	Description
01 / 2014-11-03	First released issue

Table 4 History of document updates

2 Preface

2.1 Copyright notice

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2.2 Scope

The information contained in this manual is intended for the support of the development process and as development guidance for the customer. In addition this manual offers supporting information about the standards to be applied at the place of installation and the relevant safety standards for installation and configuration of the reader device.

2.3 General information

This manual contains information on installation, configuration, operation and maintenance of the reader. In addition it gives detailed technical data in order better to familiarize the user with the features of the reader. In order to ensure a long working life and fault-free operation, this manual should therefore be read carefully and all the instructions and information contained in it should be complied with.

2.4 Warranty

Switching on the AC or DC power supply prior to connecting the LAN cable is considered incorrect installation. Any functional defect arising as a result is excluded from the warranty/guarantee. Before installing or servicing the reader, the person concerned must have read the manual and understood its contents. KTC accepts no liability if the customer fails to implement the precautions listed here. In such cases, any claims under the warranty/guarantee are void.

2.5 Disposal instruction

	Electronic equipment is not classed as household waste and must be disposed of properly in accordance with Directive 2002/96/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 27 January 2003 on used electrical and electronic equipment. At the end of its service life, take this device for disposal at a designated public collection point.
	Used batteries are special waste! Do not put used batteries into your domestic waste; instead take them to a collection point for used batteries!

3 Safety instructions / information



Before starting installation work or replacing the unit, the accompanying manual must be read carefully and its contents understood.

The detailed information in the data sheets and in this manual must be complied with carefully during installation and operation of the reader!

The installation team must be properly qualified and familiar with the safety regulations applicable in the country concerned.

Connection, installation and maintenance work, as well as all other work on the unit, may only be carried out by properly qualified and trained employees.

The unit may only be used for the purpose intended by the manufacturer.

Unauthorized changes to the unit and the use of spare parts and peripheral devices which are not sold or recommended by the manufacturer can result in fires, electric shocks and injuries. Such actions therefore result in exclusion of liability and make the manufacturer's warranty/guarantee null and void.

The applicable version of the manufacturer's warranty is that which was valid at the time of purchase. We accept no liability for unsuitable manual or automatic adjustments made to the unit's parameters and inappropriate use of the unit. Repairs may only be undertaken by personnel authorized to perform them. Opening or attempting to repair the unit makes all guarantee/warranty claims null and void! Improper work on the unit may jeopardize electrical safety.

The manufacturer is not liable for accidents caused by the user opening the unit!

Always shut off power supplies during installation work with the equipment.

To avoid damage during transportation, the equipment must be transported in the original package and not be exposed to rapid temperature variations, direct sunshine, or extreme humidity.

Cables are handled mainly during the installation. Consider the following: Handle cables carefully so that the insulation or shield is not damaged. Do not bend cables to a smaller radius than the cable manufacturer has specified

Act to prevent tools from falling down of the working place onto the traffic lanes. Vehicles passing under the gantry may be hit, with severe damage consequence.

When carrying out work on the unit, the valid safety regulations must be complied with.

Supply voltage

Make sure that the mains cable (power supply cable) is not damaged. If the mains cable is damaged, the device must not be used. Instead it must be disconnected from the mains and repaired by a qualified technician.

Risk of fatal injury due to electric shock!

The device may be operated only at the stated supply voltage (*see the rear of the device or external power supply unit*)!

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

Ventilation

Appropriate means are provided to dissipate the heat generated within this equipment. The device must however not be installed in a cabinet or on shelves with insufficient ventilation. The ventilation slots on the device must not be covered.

There is a risk of fire!

Moisture, direct sunlight, heat, naked flames

Protect the device from moisture, dripping water and spraying water. The device must not be placed close to sources of heat, exposed to direct sunlight or operated in a damp environment. Do not place anything which has a naked flame on the device!

There is risk of fire!

Radiated electromagnetic fields

CE marking for the RFID reader with type designation "EU":

The device fulfils the requirements of the following EU directives:

- 1999/5/EC, R&TTE
- 2004/108/EC, Electromagnetic compatibility
- 2006/95/EC, Low voltage
- 2011/65/EU, RoHS2
- 2002/96/EC, WEEE

CE-marking (as visible on the type plate of the device): 

Hereby, **Kapsch TrafficCom AG** declares that the product SRU-8100-EU is in compliance with the essential requirements and all other relevant provisions of Directive 1999/5/EC.

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FCC marking for the RFID reader with type designation "US":

The reader with the identifier "US" are designed to operate under FCC Part 15 and are listed under FCC ID "XZU" on the FCC website.

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.

Modifications or conversions which are carried out on this unit without the express permission of KTC may invalidate the FCC permit for the operation of this unit.

Note: To meet part 15 of the FCC regulations in the United States, the system must be properly installed to guarantee adherence to the certification regulations according to part 15. The operator and the specialist company which carries out installation are responsible for ensuring that only certified systems are used in the United States.

Note: Following corresponding tests, it has been ascertained that this unit adheres to the limit values for class B digital units in accordance with part 15 of the FCC regulations. These limit values are intended to provide private user's systems with appropriate protection against harmful radio interference. This unit generates and uses energy in the radio frequency range and is also able to radiate this; if it is not installed and used in accordance with the regulations, the unit may cause harmful radio communication interference. However, there is no guarantee that interference will not occur in a specific system. If this unit causes harmful radio or television reception interference, which can be ascertained by switching the unit on and off, we recommend that the user attempts to rectify this interference via one or more of the following measures:

- Realign the receive antenna or change its position.
- Increase the distance between the unit and the receiver.
- Plug the unit into a socket in a current circuit other than that to which the receiver is connected.
- Seek advice from the retailer or an experienced radio/television technician.

Warning regarding exposure to RF radiation

Ensure a minimum clearance of 20 cm between the antenna and the human body, and comply with the operating instructions for RFID antennas. 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 must be reduced as a function of the antenna cable length and the antenna gain.

4 Introduction

4.1 The reader

The KTC RFID (Radio Frequency Identification) reader is a multi-protocol-capable device for reading active and passive RFID tags in the frequency range from 865 to 868 MHz for Europe type “EU” and 902 to 928 MHz for the American market type “US”. 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 device has a maximum of four external antenna ports for connection of the transmission/reception antennas for communication with RFID tags.

For integration into a variety of infrastructures, the device has different communication interfaces depending on the variant. The power supply is provided by a 4-pin M12 panel connector in A-coding.

4.2 RFID system

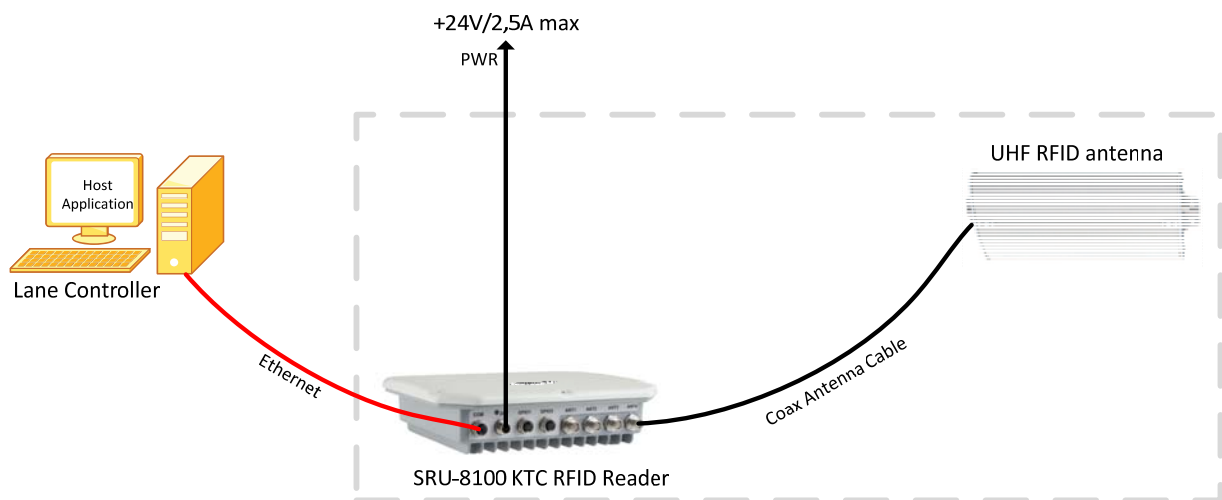


Figure 1 RFID Reader subsystem (up to 4 antennas possible)

To read the tag information, the reader sends an RF carrier by an active antenna and thus supplies the tag in the RF field with energy.

For testing and parameterizing the reader the Demo Software **ReaderStart v2** can be used. The communication between the **ReaderStart v2** and the reader is based on a Dynamic Link Library (DLL) called **RRU4DotNet.dll**, which may also be used for creating user specific lane controller applications. The DLL includes all the relevant commands and functions, which are needed to control the reader. Additionally, the reader may also be controlled by direct TCP communication.

The user-specific control software may also run on the reader directly. Thus, a stand-alone operation without permanent network connection is possible

4.3 Kathrein RFID Antenna Interface © KRAI

The KTC RFID reader is able to control antennas from the manufacturer Kathrein by using their proprietary communication interface ©KRAI. Those Kathrein antennas are not included in the product portfolio of KTC and thus in combination with the KTC RFID reader device there is no active support given by KTC when using KRAI antennas.

4.4 Software Integration Kit

A software kit is available on CD-ROM containing the test software (ReaderStart v2), programming examples and the DLL and all necessary documentation (see *Chapter 7 on page 23*) Order Numbers:

Part view	Product type	Article no.	Description
Core components			
	SRU-8100-US	34032600100	Kapsch RFID reader 18000-63 w/o antenna, extended firmware, 24V, 4xAntPort, 1GHz CPU/4GB RAM, max. 4W EIRP, TNC connectors, FCC 902-928 MHz; protection Caps;10m power cable with open end
	SRU-8100-EU	34032600000	Kapsch RFID Reader 18000-63 w/o antenna, extended firmware, 24V, 4xAntPort, 1GHz CPU/4GB RAM, max. 2W EIRP, TNC connectors, ETSI 865-868 MHz; protection caps;10m power cable with open end

Additionally a wide range of accessories (antennas, cables, power supplies, brackets and fixings, protection circuits, etc.) is available. For the latest list of available accessories please refer to [3].

5 Installation

5.1 Selecting the installation site

When the connectors are plugged in, the device satisfies the protection class IP65. When selecting the installation location, make sure there is sufficient space around it for appropriate dissipation of the heat generated by the device. Do not install it close to external sources of heat. The maximum operating temperature listed in the data sheet must not be exceeded. The support surface must have a sufficient load-bearing capacity/strength.

5.2 Installing the reader

The device has threaded holes at the rear for attaching the reader. The dimensions of the holes pattern can be found in the drawing below. For ease of installation a bracket is available as an accessory, which offers the option of mounting on a mast or wall.

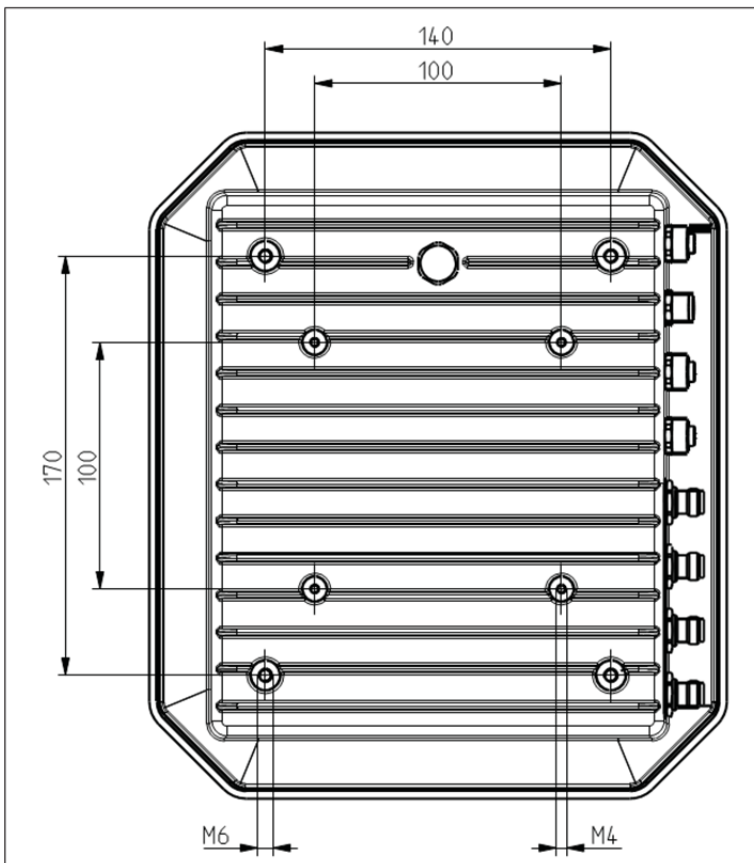


Figure 2 Bottom side of the reading and mounting holes

6 Connectors and displays

The illustration below shows the reader with all its connectors. Details of the connections and the pin assignments of plugs and sockets are provided in the following pages.



Figure 3 Side view of reader with connectors

Component	Description
COM	Ethernet connection: M12 (female), 4 Pin, D-coded
24V	Power supply connection: M12 (male), 4-pin, A-coded
GPIO1	GPIO connection 1: M12 (female), 8-pin, A-coded
GPIO2	GPIO connection 2: M12 (female), 8-pin, A-coded
ANT1	Antenna connection 1: R-TNC (male) 50 Ohm
ANT2	Antenna connection 2: R-TNC (male) 50 Ohm
ANT3	Antenna connection 3: R-TNC (male) 50 Ohm
ANT4	Antenna connection 4: R-TNC (male) 50 Ohm
LED	Status indicator: 3 states: red, green, orange

Table 5 LED and connectors of the RFID reader

6.1 Power supply

The power supply is arranged as a four-pin round-pin plug with and M12 connection thread and A-coding.

Note: Only power supply units with power limitation are approved for operation with the device. This means that the secondary side of the power supply unit is limited to a power of maximum 100 VA.

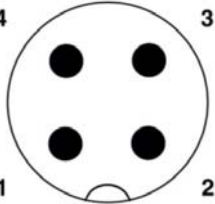
Connector	Pin	Signal	Description
	1	+24 V DC	Pin out of the power cable (Included in the delivery of the reader device)
	2	--	
	3	GND	
	4	--	

Table 6 Power Supply pin allocation

6.2 Ethernet (COM)

This interface is arranged as a 4-pin M12 socket with D-coding. Only shielded cables may be used.

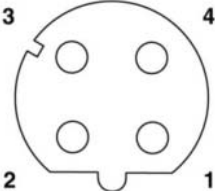
Connector	Pin	Ethernet
	1	TD+
	2	RD+
	3	TD-
	4	RD-

Table 7 Ethernet (COM) Connector

6.3 Digital inputs and outputs (GPIOx)

The activation and evaluation can be performed using the software **ReaderStart v2**, with the DLL supplied, or via the reader communication protocol (API).

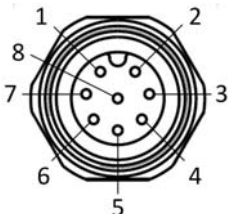
Connector	Pin	GPIO 1	GPIO 2
	1	OUT_CMN	OUT_CMN
	2	INPUT 4	INPUT 1
	3	INP_CMN	INP_CMN
	4	GND	GND
	5	UB	UB
	6	OUTPUT 4	OUTPUT 2
	7	OUTPUT 3	OUTPUT 1
	8	INPUT 3	INPUT 2

Table 8 Digital inputs and outputs pin (GPIO) allocation

The digital inputs and outputs are built as two eight-pin sockets in A-coding with M12 threads. The inputs are double insulated from the power supply of the reader and can be operated irrespective of the polarity of the input signal. For this reason there is a common pin for the inputs (**INP_CMN**). The connection variants for the inputs are shown below.

Note: Please note that the load per channel is limited to a maximum of 0.5 A, and the total load across all the channels must not exceed 1.5 A. The inputs and outputs are designed for a maximum voltage of 30 V DC. Further information can be found in the data sheet for the reader.

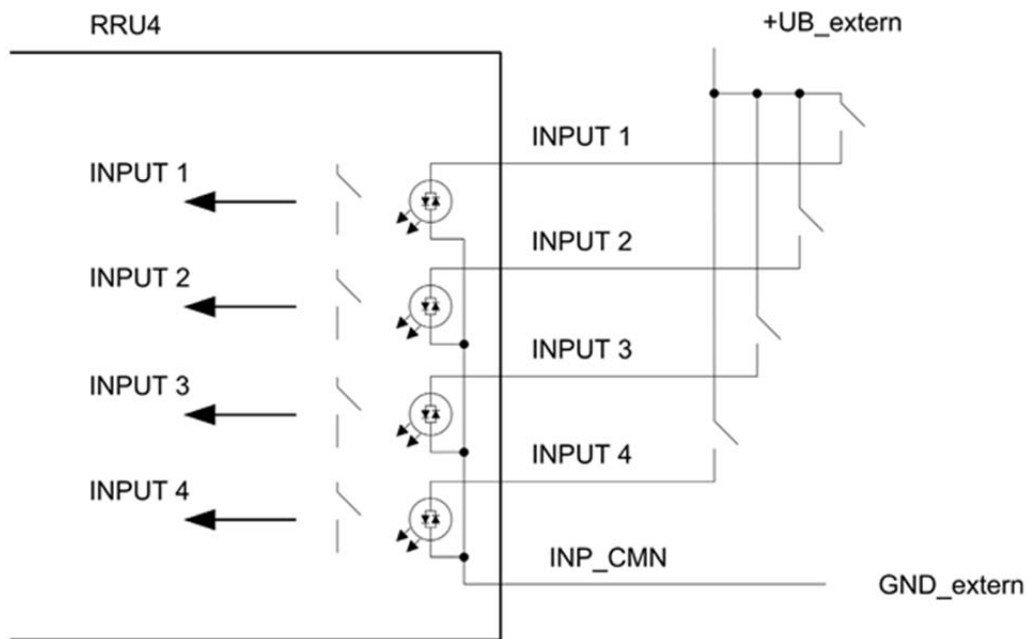


Figure 4 Inputs double insulated with +UB extern

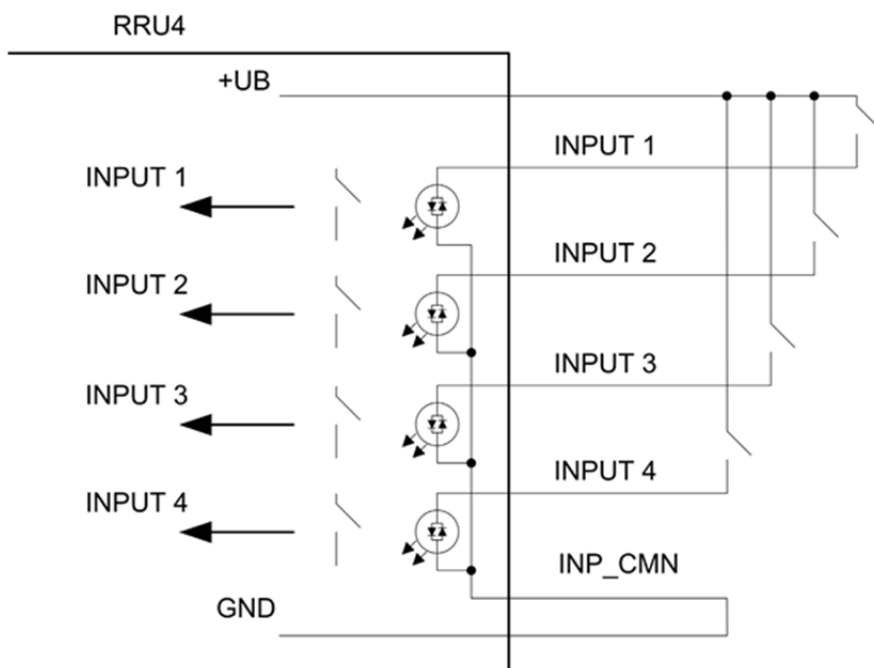


Figure 5 Inputs double insulated with +UB intern

The outputs are also double insulated from the power supply to the reader and have a common pin (**OUT_CMN**). If the double insulation is not required, the power supply can also be taken directly from the reader's power source.

The connection examples for the outputs are shown in the next figures.

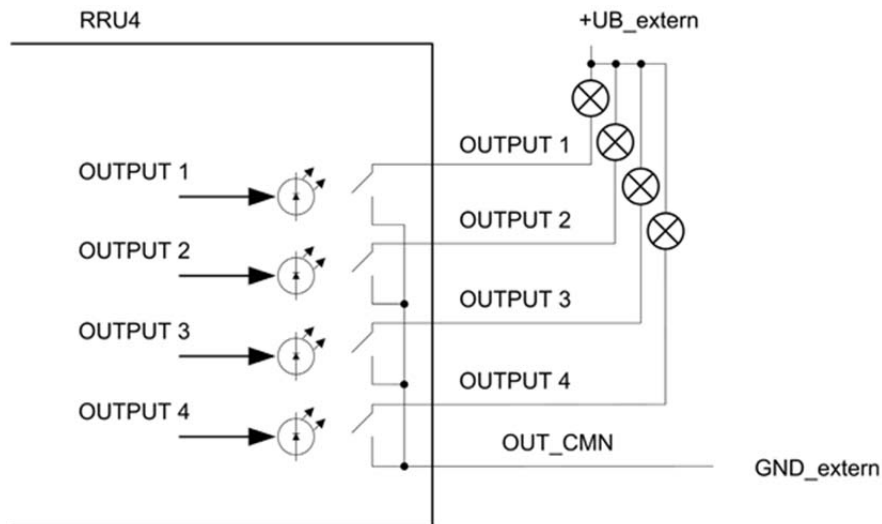


Figure 6 Outputs double insulated +UB extern

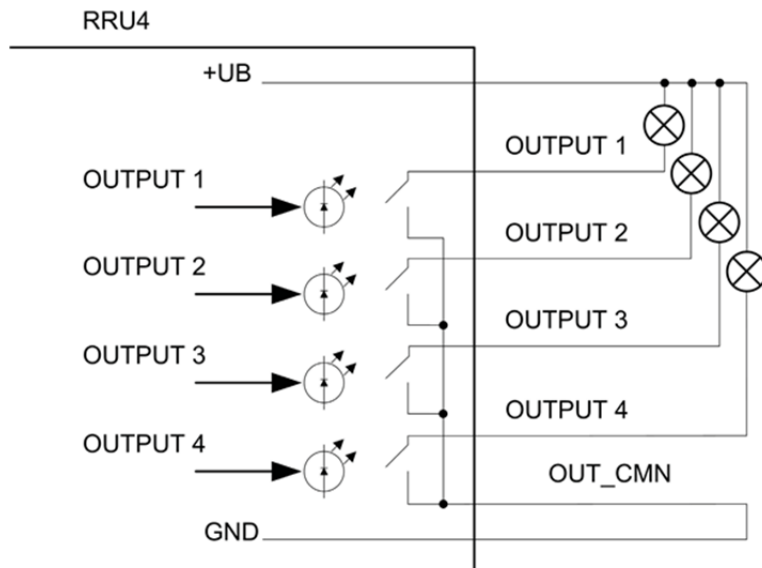


Figure 7 Outputs double insulated +UB intern

6.4 Antenna Connection (ANTx)

The activation and evaluation can be performed using the software **ReaderStart** v2, with the DLL supplied, or by access to the reader protocol.

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.

6.5 LED

The reader has a 2-colour LED for the indication of the operating state. The table below shows the colors used and the related operating state. When red and green is lit, the visible indication is orange.

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

Table 9 Indication of the operating states by the LED

6.6 Buzzer

Furthermore the reader is also fitted with a buzzer which, in addition to the LED, indicates successful booting (1 x short) or an error (2 x long).

7 ReaderStart v2: test, setup and demo software

7.1 General

For test and setup purposes the reader can be operated using the demo software **ReaderStart v2**. This software provides all necessary functionality of the reader for a test in a real environment. As an aid to configuration, various basic settings for application scenarios are provided.

A CD-ROM is available under part-no.: **34032900000** (delivered by KTC on request – please contact your sales agent) containing:

- **ReaderStart v2** Software (latest version)
- data sheet of the reader
- Product documentation: API Communication protocol description
- Product documentation: Configuration Manual
- Product documentation: Installation Manual (this manual)
- API DLLs for the simplified activation of the reader with Borland and Visual Studio together with some simple programming examples
- .NET Framework 4
- C++ 2008 redistributable

7.2 System requirements

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

Component	Value
Processor	X86 compatible
Memory	512 MB RAM
Operating system	Windows XP (SP3), Vista (SP1), Windows7
32-bit operating system	Free HDD space: 850 MB (including Microsoft .Net Framework 4)
64-bit operating system	Free HDD space: 2 GB (including Microsoft .Net Framework 4)

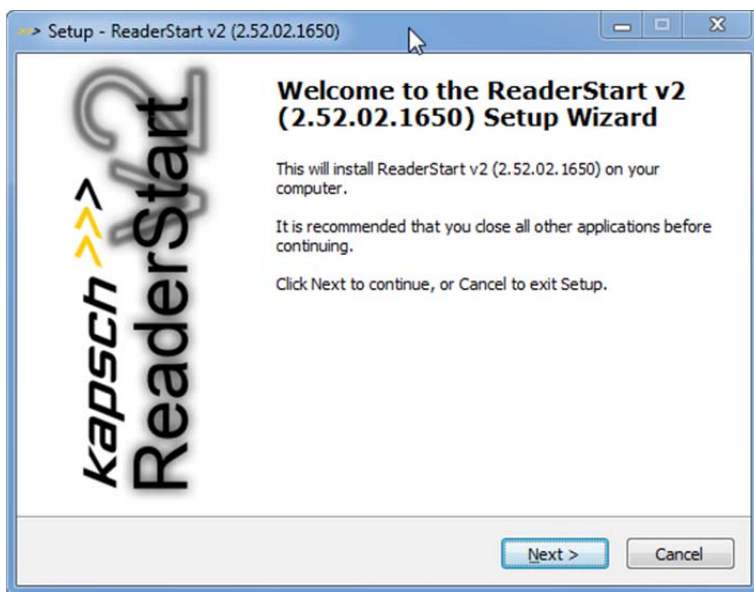
7.3 Installation

The demo software is installed by running **KapschRFIDDemoSetup.exe** from the CD-ROM. During the installation a check is made whether the necessary preconditions for the installation are satisfied. This means that a check is made whether all the dependencies such as the necessary Windows Service Packs, the .NET Framework in the respective version together with the C++ redistributables are installed. If this is the case, the demo software and the DLL for controlling the reader are installed.

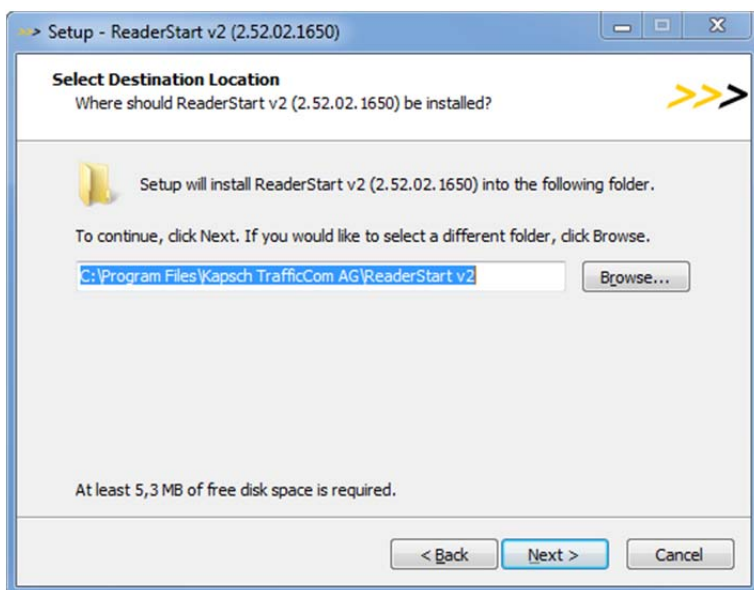
After the start of the set-up, you can change the language used during the installation in the window that now opens. Confirm your selection by clicking on the **OK** button.



This information can later be retrieved via the drop-down menu in the menu bar **Info**.



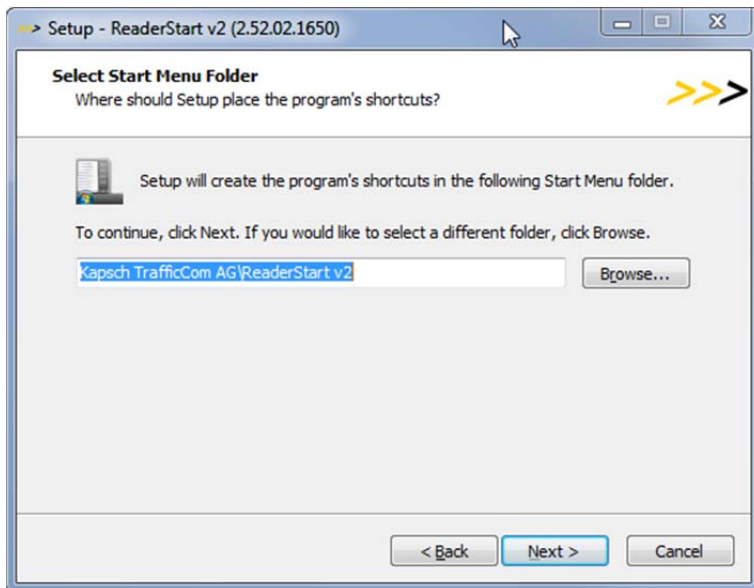
Click the button **Next >**. The dialog **Setup** for **Select Destination Location** appears.



Click the button **Browse...** to select the target drive.

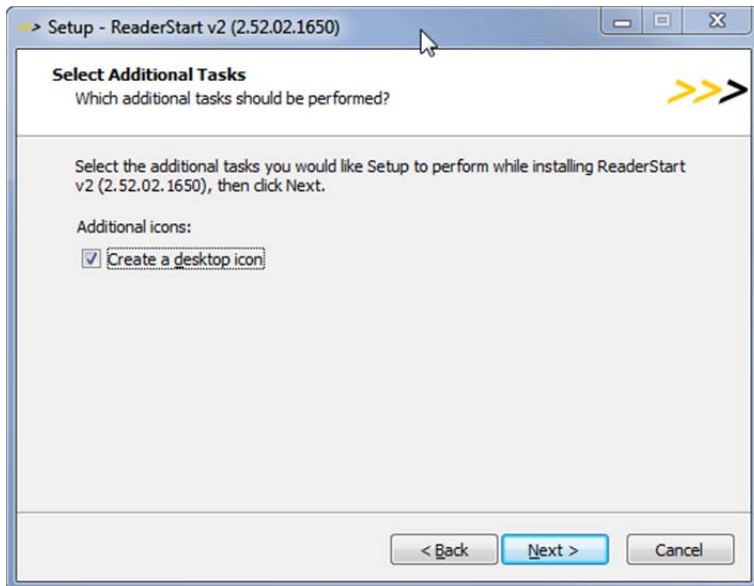
Click the button **Next >**. The dialog **Setup** for **Select Start Menu Folder** appears.

On the next dialog you can customize the folder in the Windows **start menu**.



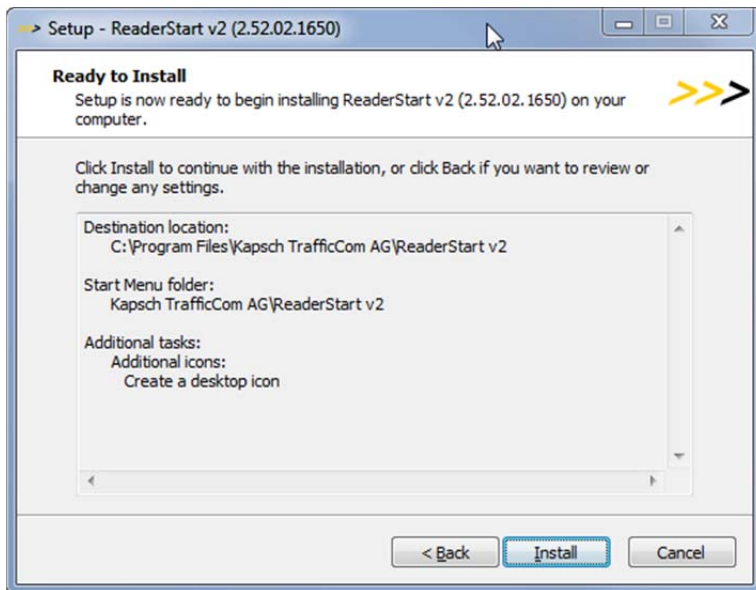
Click the button **Next >**. The dialog **Setup** for **Select Additional Tasks** appears.

In this dialog you can specify whether you wish an icon to be included in the Windows Quick Launch and/or on the Desktop. The default is to generate no icons.



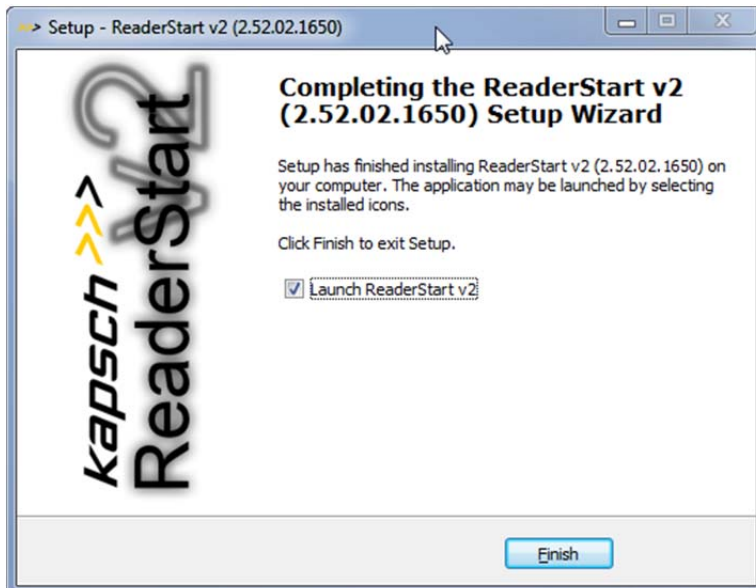
Click the button **Next >**. The dialog **Setup** for **Ready to Install** appears.

This dialog shows a summary of all installation tasks.



Click on the **Install** button to start the installation.

If during the installation procedure a request is made to restart the computer, please do so. Successful completion of the installation is shown in the following dialog.



If you do not wish to start using the software straight away, please uncheck the **Launch ReaderStart v2**, box, otherwise the program will start immediately.

Click the button **Finish** to exit the setup.

7.4 Operation & configuration

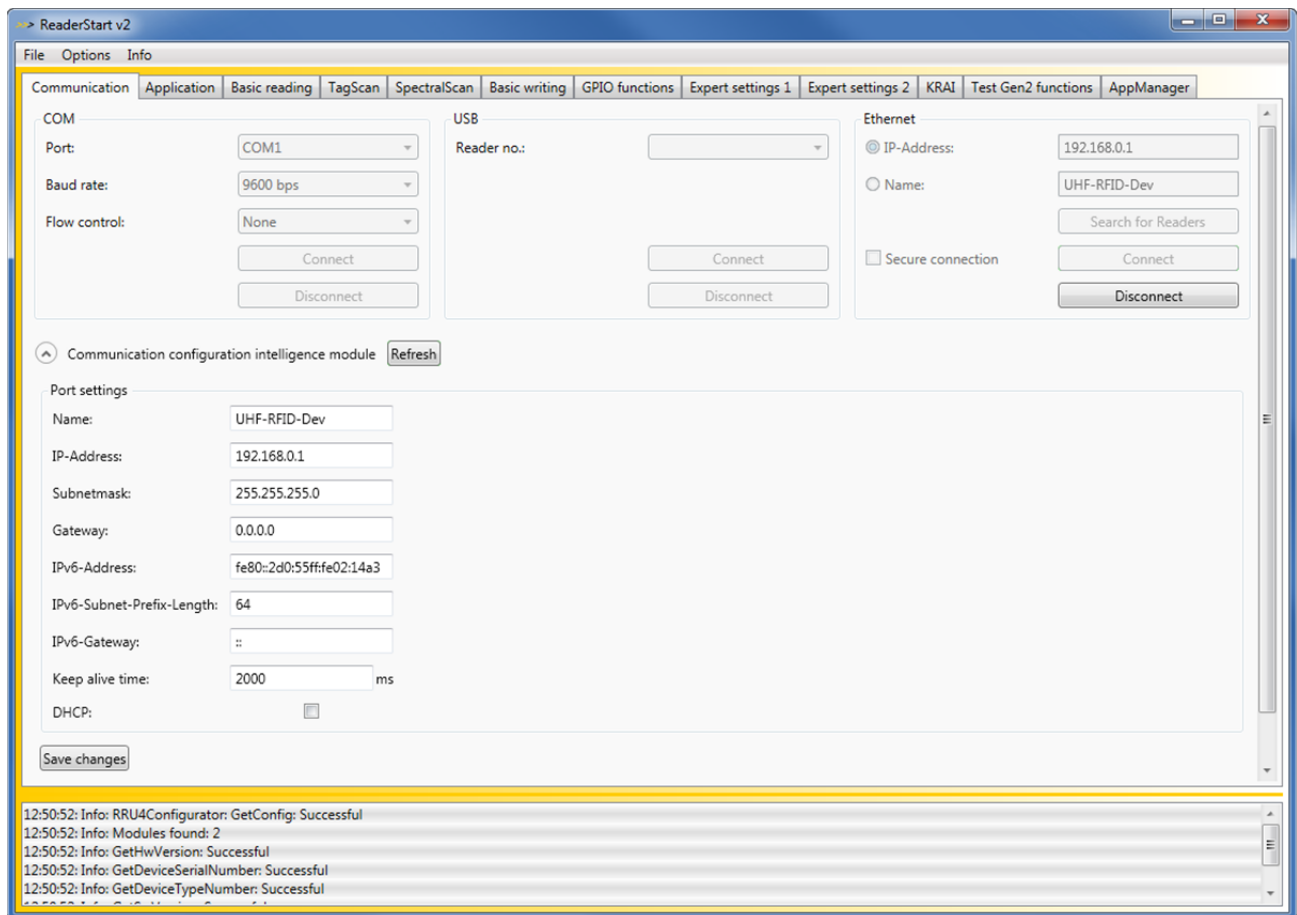
7.4.1 User interface overview



The program is started by **ReaderStart v2.exe** or click the icon **ReaderStart v2**.

The splash screen is displayed until all the necessary DLLs have been loaded in the background. After this the user interface shown below appears. In general, consisting of:

- Menu bar
- Tabs with their specific content
- Status window



Note: Functions that are unavailable are displayed *grey*. Some of the tabs are hidden at application startup but get available, when the reader device is connected to the application.

The settings and controls for the reader are divided into individual functional groups under different tabs. The individual sheets can be selected using the **tabs**. The sequence of the tabs can be changed by “drag and drop”.

All status messages from the reader and the program are shown in the **status window**, and may also be logged. 3 message types are defined:

Info	Shows which action was just performed
Warning	Indicates possible problems in the structure and configuration
Error	Indicates that the desired action could not be executed

Every message is provided with a time stamp. The latest message always appears on top.

The **status window** has a context menu which allows deactivation of warnings, information and errors in the status field. Messages that have expired can be deleted via this menu.

7.4.2 Menu bar

The menu bar consists of the entries items: **file**, **options** and **info**.

7.4.2.1 File

There are a wide variety of parameters available for configuring the RF front end. A complete setting can be saved as a parameter set as an XML file, and later reloaded.

Under the item **Save Reader Configuration to File**, a dialogue opens which displays all the available parameter sets (0 - 7). The selection can be changed by checking/unchecking the boxes. Furthermore each parameter set can be given a brief description. Selecting **Save** opens a further dialogue in which a respective save location and a file name must be selected / filled in, in order to successfully save the file. The progress of the save operation is shown by a progress bar.

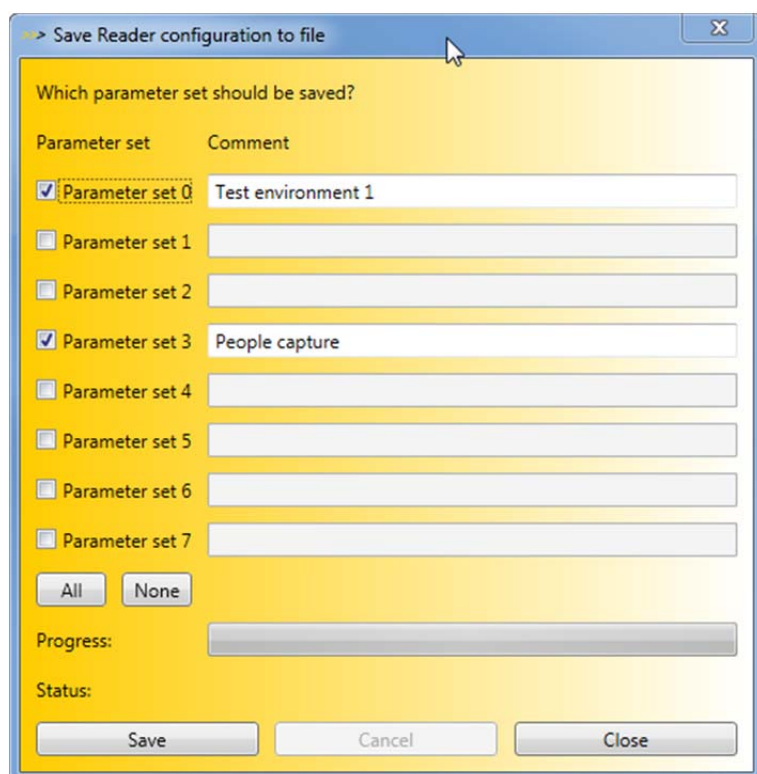


Figure 8 Saving the configuration in a file

Reloading the settings starts with the selection of the parameter file. In the opening input mask all available parameter sets are displayed. The assignment of them to the individual save locations can be reassigned here. For this purpose the desired parameter set on the reader can be selected in the drop-down menu. Selection of the item **None** means this parameter set is not loaded into the reader. In the default setting a 1:1 assignment applies. Choosing **Assign parameter sets 1:1** resets all the changes in the assignment to default. Choosing **Delete Assignment** deletes all assignments of the saved parameter sets to those in the reader. In the drop-down menu this is indicated by **None**.

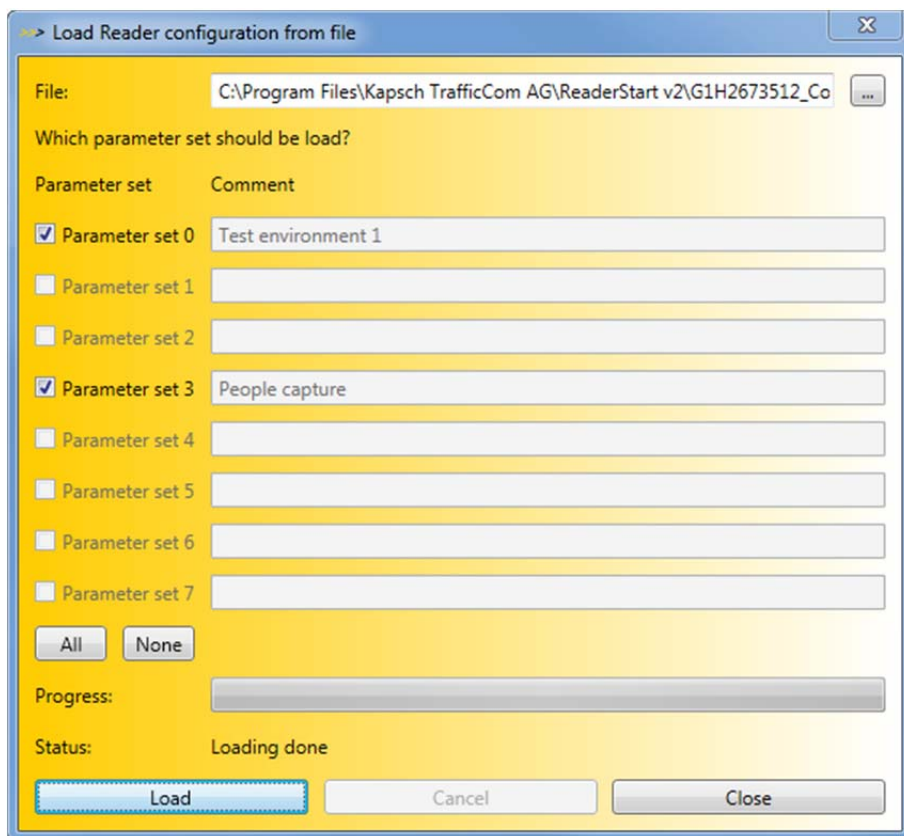


Figure 9 Loading a configuration from the file

7.4.2.2 Options

The first four entries in this menu include changing the language, selection of the warnings that are displayed, resetting the layout and deletion of the status messages in the **status field**. The language used in the program set to the desired language by clicking on **Language Selection** in the menu item. The currently selected language is shown by a check; if a computer restart is necessary in order to load the change, the program will indicate this.

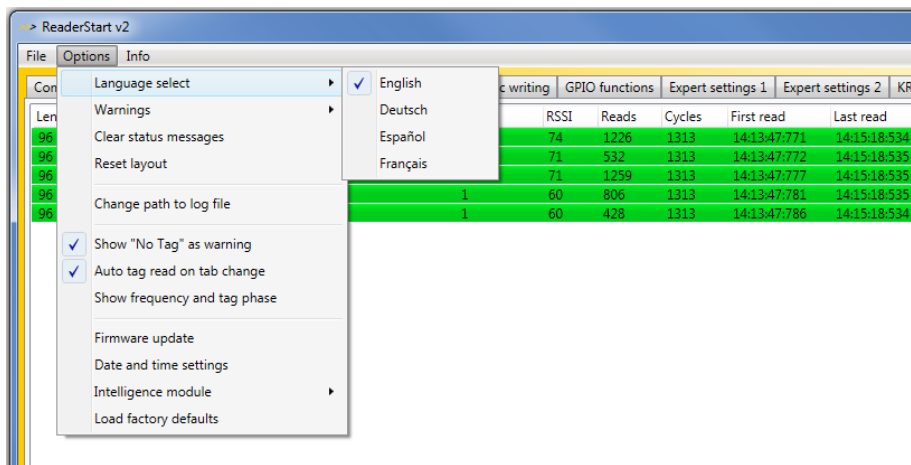


Figure 10 Changing the GUI language

The item **Warnings** allows filtering of messages the **Status Window**.

Note: Changing the memory content of the tags can render them unusable

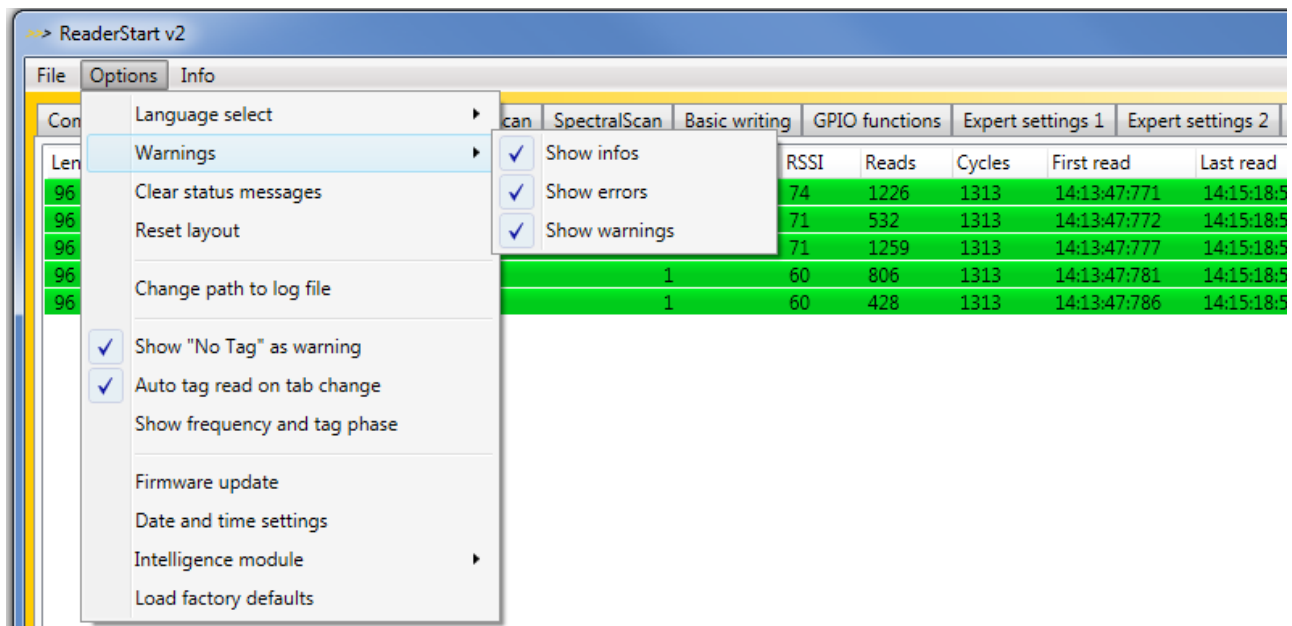


Figure 11 Setting the warnings

The option **Change path to logfile** changes the path where log data generated in the tab **Basic reading** is stored.

The option **Show “no Tag” as warning** shows orange warnings in the status window if a tag was expected to be detected but was not able to find.

The option **Auto Tag read on tab change** refreshes the list of detected tags when browsing over the tabs.

The option **Load factory defaults** resets configuration parameters of ReaderStartSW and reader device to factory default setting, but the network settings of the reader device are preserved.

If there is the need to recreate the original layout of the program in respect of window size and sequence of tabs, this can be achieved by means of the **Reset layout** menu item.

The **Firmware Update** item permits the update of the reader firmware. The window that opens shows the version currently active in the reader. After selection of a firmware file, this version is shown in the next line. Pressing the Update button starts the procedure. The progress is shown in the **Update progress** bar. After successful update the reader must be restarted, either by pressing the Restart button or by switching the power supply off and on again.

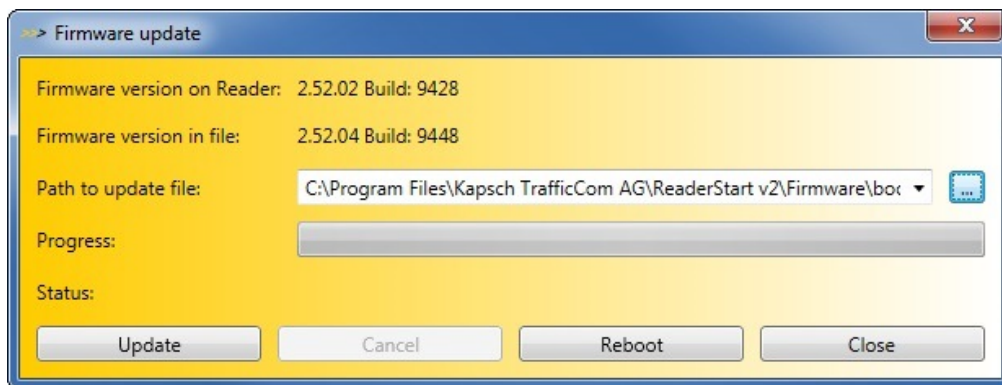


Figure 12 Updating the firmware

The reader has an integral clock which can deliver the time stamp for a tag operation. This clock is set using the **Date and time settings** in the menu. When this menu item is opened, it automatically reads the current date and time from the reader and compares it with the date and time from the host computer. The date and time of the host computer can now be loaded to the reader by pressing the **Set system date and time on Reader** button. There is also the possibility to set the reader date and time manually and load it to the reader. This is done by entering the desired date and time on the reader side and pressing the **Set adjusted system date and time on Reader** button. The status line indicates which action was just executed and whether the action was successful.

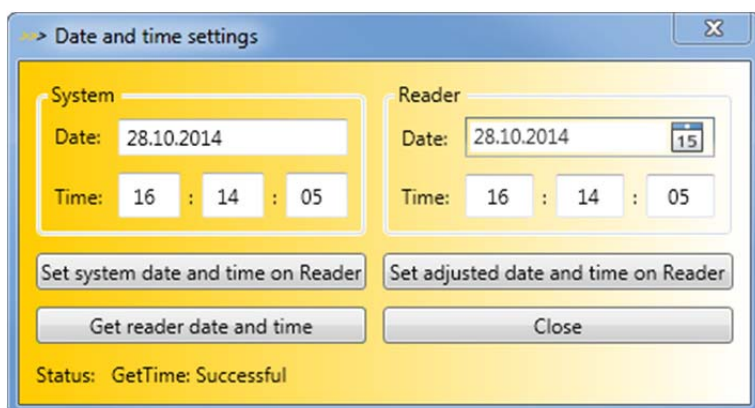


Figure 13 Setting the date and time

7.4.2.3 Info

This item on the menu bar allows information about the **ReaderStart v2** software and the respective DLL used by it.



Figure 14 About reader start v2

The second item supplies detailed information about the software and hardware versions of the reader. The firmware is specified with version number and a build number. The list shows CPU module, PA module and the various I/O modules.

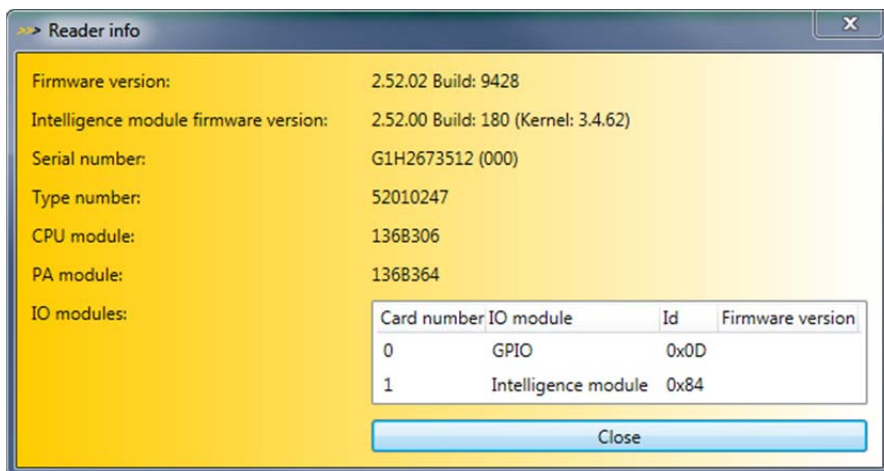


Figure 15 Interrogating information about the reader

The third item reads the active license key from the reader and displays the active regulatory profiles predefined upon reader delivery. The key reflects those factory settings. Via a copy/paste operation it is possible to transmit the key via email to: **ktc.office@kapsch.net** (please refer to "Product Management")

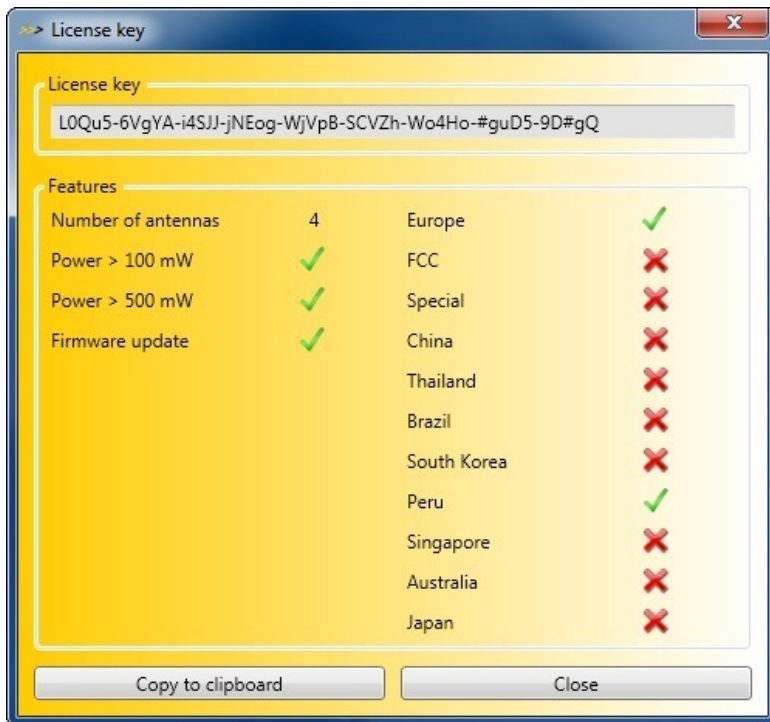


Figure 16 Displaying the license key

The Error status item reads the error status of the reader and shows all errors that are still pending in the **status field**.

7.4.3 Communication Tab

The communication tab contains functions for establishing connections and configuring the interface cards. The various communication connections are grouped in 3 sections: **COM** for serial connections via the port (RS232/485/422), **USB** for connections up to version USB 2.0 and **Ethernet** for connections via TCP/IP. Within this installation manual, only the **Ethernet** section is described in detail.

When the connection is established, the program interrogates the information about the installed I/O cards. The information can be viewed and changed via the I/O card configuration

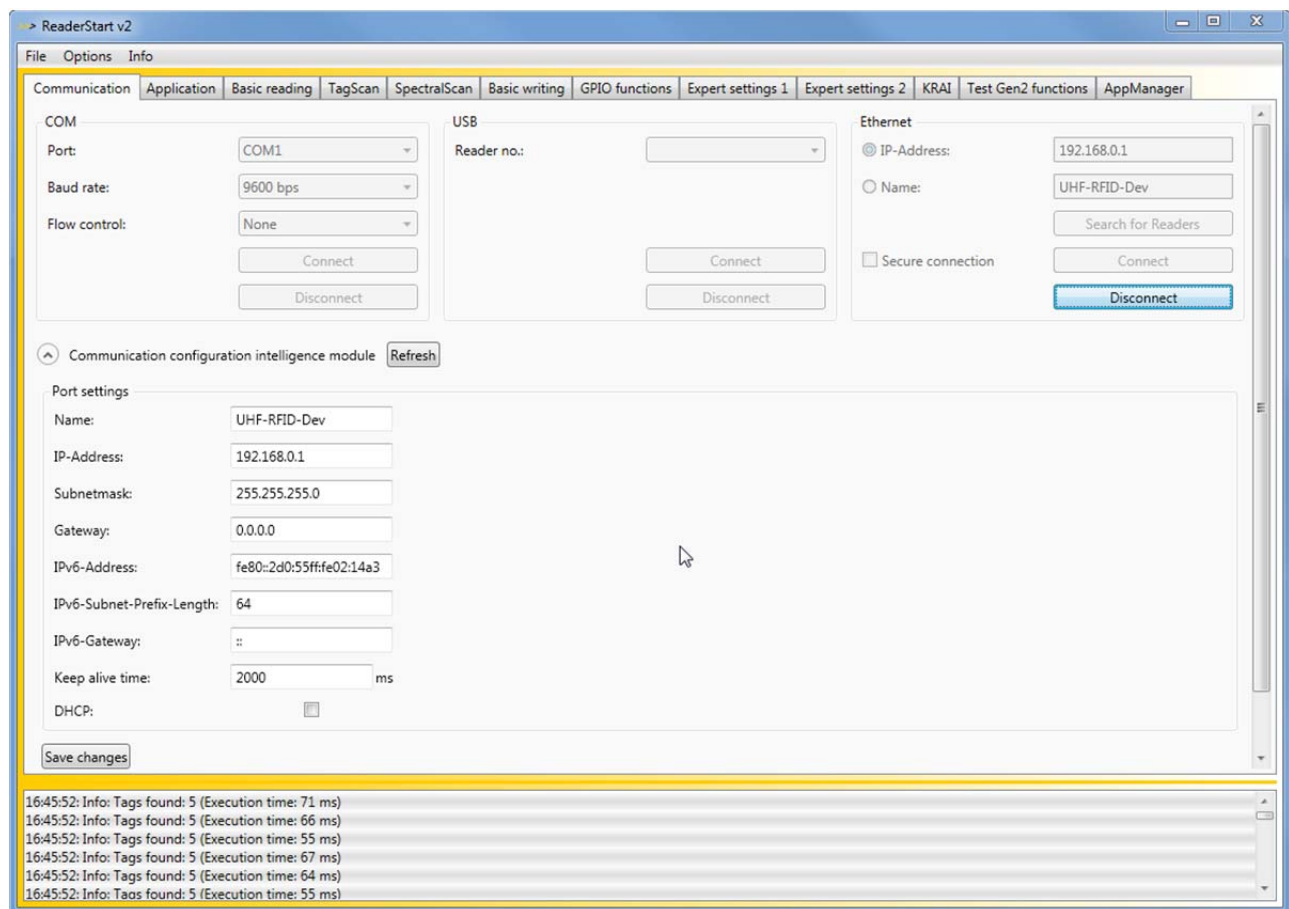


Figure 17 Tab for the Communication by Ethernet I/O card

The Ethernet connection can be achieved by connecting the reader onto an existing network, or by a direct connection between the reader and the host computer. For direct connection of the reader to the PC, a cross-link cable is required (unless the LAN interface on the PC supports “auto-mdi-x”).

Note: From reader firmware 2.04, by factory default the reader has the IP address 192.168.0.1 with the network mask 255.255.255.0. Reader versions earlier than this are configured for DHCP.

To integrate the reader into a corporate network, please contact your administrator who will be able to allocate you a spare IP address and assign the correct network mask. Alternatively the reader can also be configured to obtain an IP address automatically. For this service, referred to as DHCP, an appropriate DHCP server must be operating in the network. You can obtain more details about this from your network administrator.

Note: The IP addresses of the control computer and the reader must be in the same IP range, but they must not be the same. The network mask on the other hand must be identical.

In order to establish the connection to the reader, the program offers two options: 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.

For the connection using a host name, there must be a correspondingly configured DHCP server and a DNS in the network. After power up, the reader makes a DHCP request and queries the DHCP server. This assigns the reader an IP address and reports the network name and IP address to the DNS server. If now the connection has been established, the IP address of the reader is determined by a query on the DNS server.

The correct IP address or the host name of the reader must be entered in the corresponding field. Pressing the **Connect** button tries to establish the connection to the reader.

As an alternative, the function **Search for Readers** allows a lookup for connected readers without knowing their IP address. This feature searches for KTC RFID reader devices on the network by sending an UDP broadcast - Please make sure to be in the same network segment as the reader is.

The communication interface settings can be changed using the **IO card configuration**. All available I/O cards are displayed here in as tabs. Clicking on the respective tab opens the associated card and displays all respective configuration parameters, together with the card type that was detected.

Under the IO card type header there is a drop-down menu, in which the card type can be set to **Auto detect**, **Card not used** or to the actual card type. Automatic detection restores the interface to the default settings. If the card type is set to **not used**, this interface can no longer to used.

All card-specific configuration parameters are displayed on the card sheet when the recognized card type is set. These parameters are described in the following sections for the respective card. The settings are saved to the reader by pressing the **Save changes** button.

Note: The new parameters, provided nothing to the contrary is specified for the specific card, become valid only when the reader has been restarted. If incorrect parameters are loaded, the reader can no longer be accessed!

GPIO settings:

The GPIO card allows the reader to interact with its environment. In this tab, the inputs and outputs can be configured for the respective application under the headings **Input** and **Output**.

Note: Refer to the electrical characteristics of the inputs and outputs in the data sheet; if these characteristics are exceeded the card and the reader may be damaged.

IO card configuration Refresh

GPIO Intelligence module

IO card type
Change IO card type: GPIO

Detected IO card type
IO card type: GPIO

Input			Output					
	Invert logical input	Debounce time		Invert logical output	Function	First antenna	Last antenna	Turn-off time
Input 1:	☐	0 ms	Output 1:	☐	Off	Antenna 1	Antenna 4	2000 ms
Input 2:	☐	0 ms	Output 2:	☐	Off	Antenna 1	Antenna 4	2000 ms
Input 3:	☐	0 ms	Output 3:	☐	Off	Antenna 1	Antenna 4	2000 ms
Input 4:	☐	0 ms	Output 4:	☐	Off	Antenna 1	Antenna 4	2000 ms

Save changes

Figure 18 Configuration of the GPIO card

Each input channel has two configuration parameters. The **Invert logical input** option negates the electrical input signal and uses this status for processing in the reader. If the check is not set, the signal is used unchanged. Depending on the sensor being used (mechanical or electrical switch), a debounce time in milliseconds can be assigned to each channel.

Various functions can be assigned to the output ports. Further parameters can be activated, depending on the function selected. The following functions are available:

No.	Parameter	Function
1	Off	The selected output is deactivated
2	On	The selected output is always on
3	1Hz frequency	The selected output flashes at a frequency of 1 Hertz
4	2Hz frequency	The selected output flashes at a frequency of 2 Hertz
5	4Hz frequency	The selected output flashes at a frequency of 4 Hertz
6	8Hz frequency	The selected output flashes at a frequency of 8 Hertz
7	RF on	The output is active for Turn - off time milliseconds as soon as the radio frequency is present at the antenna First antenna to Last antenna .
8	Antenna error	The output is active for Turn - off time milliseconds as soon as an antenna error occurs at antenna First antenna to Last antenna .
9	Tag found	The output is active for Turn - off time milliseconds as soon as a tag is found at the antenna. First antenna to Last antenna .
10	RF on	The output is active for Turn - off time milliseconds as soon as an air communication operation on a tag was successful at the antenna First antenna to Last antenna .
11	Protocol access	The output is released and can be activated with commands on the API communication interface

Note: If the output is not set to protocol access, it cannot be accessed when processing action lists. See the *GPIO functions* section for more details on action lists.

Once all the settings have been performed, the changes are loaded to the reader by pressing the **Save changes** button, and take effect immediately.

Default configuration: No default configuration is foreseen for this card type.

Note: If this card setting is changed from **Auto detect** or **Card not used** to **GPIO**, the reader must be restarted so that the card is correctly initialized.

Ethernet settings:

Figure 19 Configuration parameters for the Ethernet module

The parameters have the following meaning:

Parameter	Function
Name	Here the host name of the reader which is logged on to the DNS server is stated. The reader can be addressed by this name as an alternative to the IP address.
IP-Address	For manual issuing of the address. This parameter can be used only if the DHCP is deactivated
Subnetmask	For manual issuing of a network mask. This parameter can be used only if the DHCP is deactivated.
Gateway	Manual input of IP default gateway. This parameter can be used only if DHCP is deactivated.

Parameter	Function
Keep-alive time	This time specifies the intervals of time at which the reader sends a data packet to check whether the host is still available. If the connection to the reader is broken, the reader shuts down the connection. If this parameter is deactivated (0 ms), the socket is shut down only when the reader is restarted.
DHCP	Activates the automatic issuing of an IP address by a DHCP server; if the network has a configured DNS server, the host name of the reader can also be used.

Note: If no keep-alive time is set it may happen that the reader cannot take up any further connections because the existing connections have not been properly shut down (e.g. following a breakage in the wire). In this case the reader has to be restarted. It is recommended that the keep-alive time is used to check the connection between the reader and PC.

The data is saved in the reader by pressing the **Save changes** button. The data are however not loaded to the active configuration until the reader is restarted.

Note: If the interface is wrongly configured, no connection to the reader can be established.

The IP default configuration is as follows:

Host name: **UHF-RFID-Dev**
IP address: **192.168.0.1**
Subnet mask: **255.255.255.0**
Keep-alive time: **2000ms**
DHCP: **deactivated**

7.4.4 Application tab

The **Application** tab enables quick and easy configuration of the RFID Reader for a selected application. The available applications are represented visually in the upper area of the tab by labelled pictograms. Under the **Settings** header, the number of tags expected, the antennas to be used, the parameter set in which the configuration should be saved and the values for **max. read frequency** and **max. read reliability** options are stated.

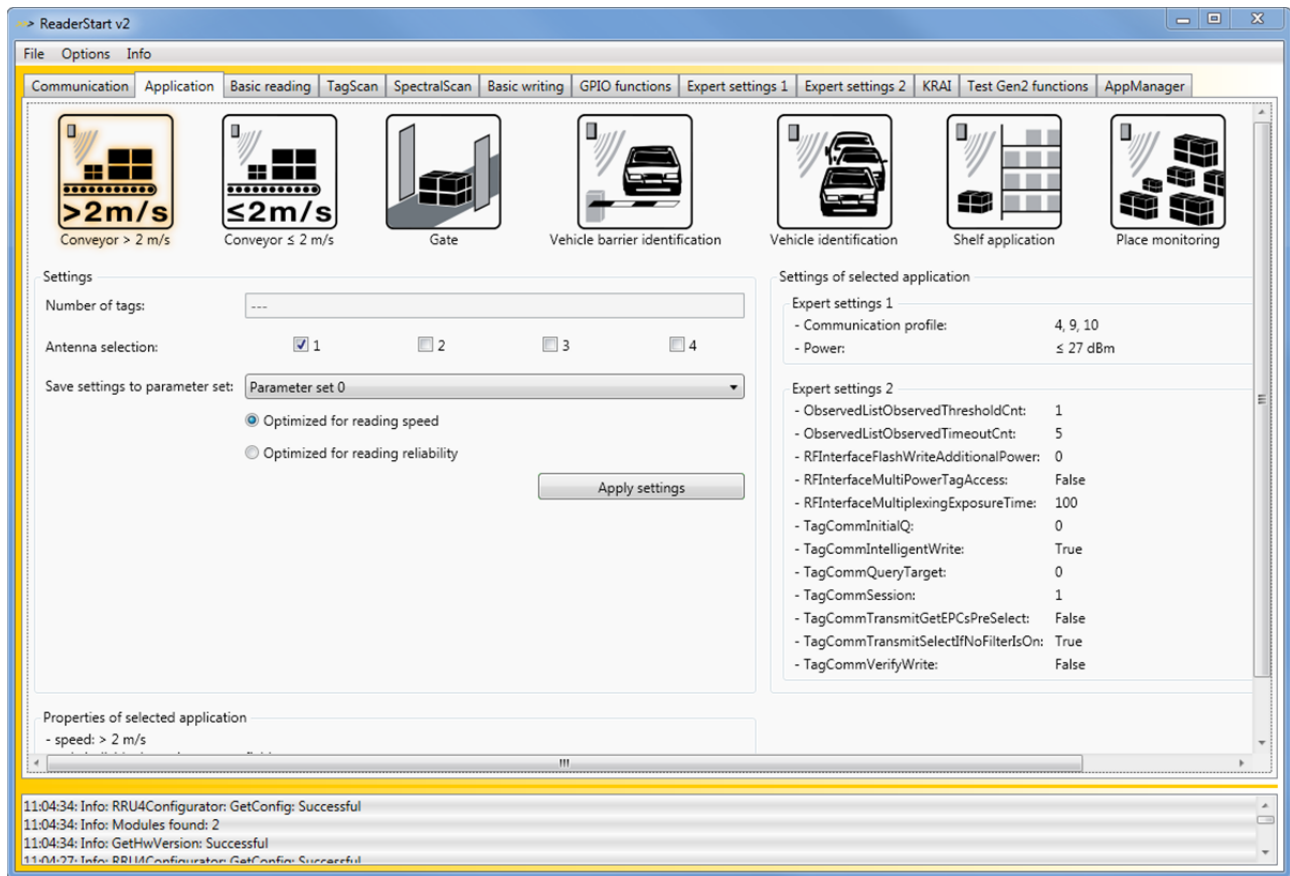


Figure 20 Application tab

When the button for the desired application is clicked, it glows green continuously. In addition the designation, the properties and the settings of the selected application are displayed in the respective fields.

The following applications are available for selection in version 2.00 and later of the **ReaderStart v2**:

- Conveyor belt > 2 m/s
 - Application for detecting individual tags in the antenna field on a conveyor belt moving at more than 2 m/s
 - the distance between the tags and the antenna is only a few centimeters
- Conveyor belt ≤ 2 m/s
 - Application for detecting and writing on individual tags in the antenna field on a conveyor belt moving
 - at less than or equal to 2 m/s
 - the distance between the tags and the antenna is only a few centimeters
- Gate
 - Application for detecting multiple tags in the antenna field as they pass through a gate
- Vehicle identification (barrier)
 - Application for detecting and writing on individual tags in the antenna field, which are not moving
 - the distance between the tags and the antenna should be less than a few meters
- Vehicle identification

- Application for detecting and writing on multiple tags in the antenna field, which are moving at more than 14 m/s
 - the distance between the tags and the antenna should be less than a few meters
- Shelf application
 - Application for detecting and writing on very many tags in the antenna field, which are not moving
 - the distance between the tags and the antenna should be less than 1 m
- Place monitoring
 - Application for detecting multiple tags in the antenna field, which are moving at not more than 3 m/s
 - the distance between the tags and the antenna should be less than 1 m

If there are more applications than fit on the screen, the buttons alongside the applications are activated to allow scrolling.

Clicking on the **Apply settings** button saves the settings that were made, as well as the settings for the selected application in the selected parameter set. This is done by first resetting them to the factory settings and thus overwriting the previous configuration. This must be acknowledged.

Success is indicated by the **Apply settings** button glowing briefly, and by display of a success message in the status window. If the process fails, the button glows briefly **orange** for a **warning** or briefly **red** for an **error** (and if the failure was due to an entry being omitted, in addition the field that is lacking the entry glows red), and by display of a warning description or error description in the **status window**.

If the settings have been loaded successfully we may had on to the **Basic reading** tab.

Note: If more than one hundred tags simultaneously in the field, the application may be tuned with respect to:

When the max. read frequency option is set, on every detection (inventory) all tags are reset in order to read them fresh. Under some circumstances the time allowed for detecting the tags may be insufficient, so that some transponders are not detected. The tag frequency detection is thus increased.

When the max. read reliability option is set, tags that have already been read are not reset at every detection (inventory), provided they are still being supplied with power. This means that only those tags which have not yet been registered are detected. The confidence that all tags are read is thus increased. Basic read functions

This index card is divided into two columns, the first column contains a table with information about the read tags, and in the second column you can find the controls, which control the reading process.

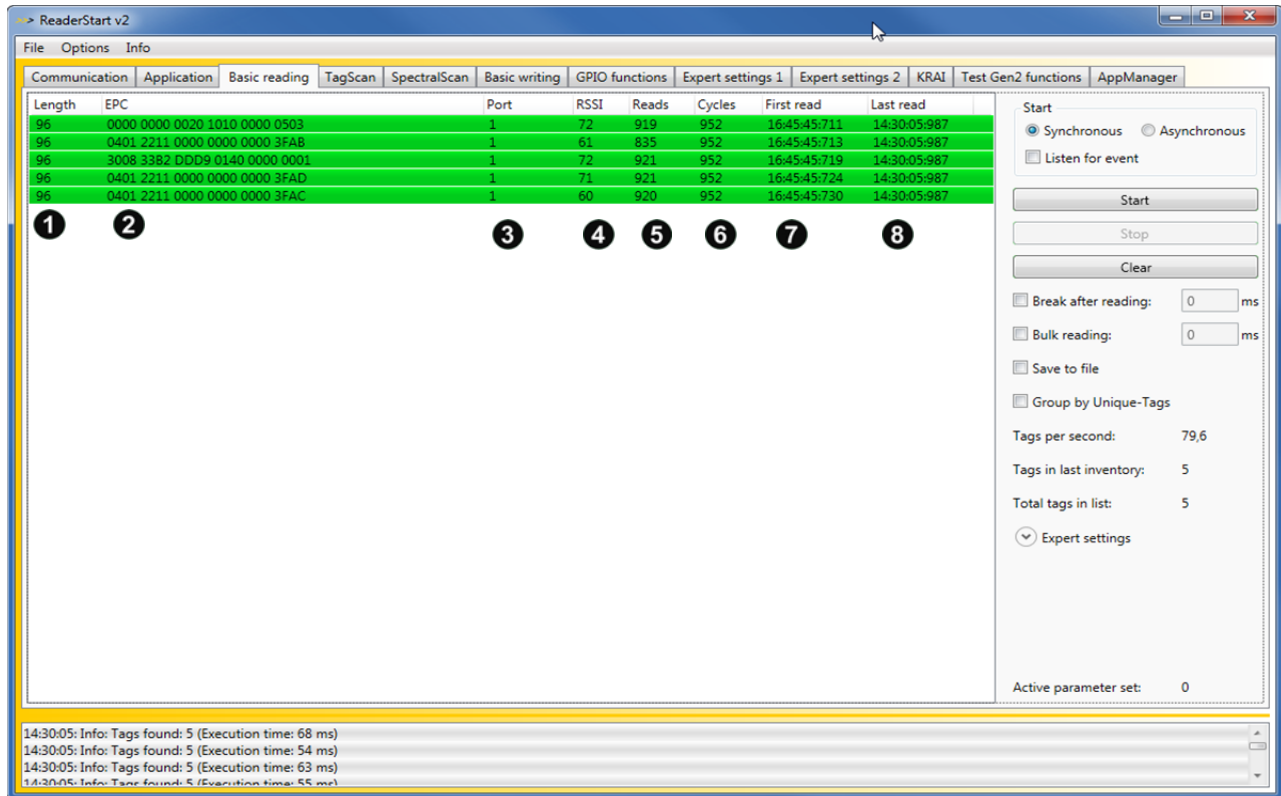


Figure 21 Basic read functions tab

The entries show the following information:

No.	Parameter	Function
1	Length	indicates the length in bits of the EPC, valid lengths 0-496 bit
2	EPC	Electronic Product Code (EPC) of the tag in hexadecimal representation
3	Port	Tag was read over this antenna port - valid values 1-4
4	RSSI	Signal strength of the tag response, valid values 0-255
5	Reads	Shows how many times this tag has been read successfully
6	Cycles	Indicates how often a search/lookup operation was started
7	First read	Is the timestamp of the first reading of the tag
8	Last read	Is the timestamp of the last reading of the tag

The appearance and disappearance of the tag is shown in color in the field for better visual effect.

When a tag appears in the field, the row is represented by the green tag information, when it disappears the row is red.

The tag reading options are listed on the right side of the window. Two modes are available: „**synchronous**“ and „**asynchronous**“ (see below for details).

One option is **sort for unique tags**. This is especially useful in multi-antenna applications and counts distinguishable tags in the communication field.

☒ Group by Unique-Tags	
Tags per second:	79,6
Tags in last inventory:	5
Total tags in list:	5
Unique-Tags count:	5

The row "**number of unique tags**" specifies how many different tags were read.

When the amount of tags is very high (> 200) the detection of the tags can be speeded up by omitting a newly initiated "**Select**" command (see *EPC global standard*).

This can be tested by selecting **Expert settings** directly in read mode. If the read operation box is ticked with **TransmitSelectIfNoFilterIsOn** a "**Select**" command is sent in each **Inventory**. This means that all the tags that are identified at this time in the field will be reset. It can also happen that tags that have been read are sometimes reset and re-identified again. In order to capture only new tags, a renewed "**Select**" can be prevented. This tick box is cleared on **TransmitSelectIfNoFilterIsOn** and thus all tags defined only once read. This selection result is that no time is lost due to a re-read. Please note, however, that tags in which the read operation was interrupted cannot be retrieved! Thus, it may be that not 100% of the tags are read. Therefore, this parameter should be used with care in order to achieve top results.

Synchronous mode:

This mode is intended for applications when the requirements for timing are not critical. This mode allows the device to switch the carrier off during the idle times, thus saving power.

The inventory of the tags (the read process) is performed across all the antennas that are configured. Once all tags in the field have been read on the last antenna, data are sent to the host PC. The inventory of the tags is then automatically retriggered by the PC.

The **Break after reading** option specifies how many milliseconds to pause between two inventory processes. During this waiting time the carrier can be deactivated. See reference [2] „*Configurational manual*“ for more information about how to perform this.

In order to keep the time between inventories as short as possible in synchronous mode, data transmission between the inventories can be omitted. That means that the reader caches all the tags that it finds in the field in its internal RAM. After a configurable time this tag list is sent to the host PC. This time is given in milliseconds by the **Bulk read** parameter.

The current reading performance is displayed under the item **Tags per second**.

Asynchronous mode:

This mode is intended for applications for which maximum performance is required.

The reader starts the inventory as quickly as possible, and at the end of an inventory it does not deliver every tag that was read to the PC, but only those that had newly appeared in the field or left it. This allows the time required for communication with the host PC to be minimized.

The timing of when a tag was reliably read in the field and when the tag no longer appears in the field can be defined more precisely using parameters. Details of these **ObservedThresholdCnt** and **ObservedTimeoutCnt** parameters can be found in section [2] Configuration Manual.

Note: The read rate is influenced by many parameters. These is, in addition to the selected regulatory profile with the respective data rates, also application-specific data such as how many tags the reader is expecting in the field. You can optimize these parameters using the **expert settings** tabs (see below).

If the tags that have been read are to be saved to a file, this can be done by activating the **Save to file** option. The EPC, the length of the EPC, the antenna on which the tag was read, the RSSI value together with the time stamp when the tag was read are saved.

The data are then saved in a CSV file in the program's working directory. In the File menu, you are able to change this via "change to the log file File / Options / Path"

Once the mode and the parameters have been selected, the read process can be started. Both modes are stopped by pressing the Stop button. The Delete button removes all tag entries from the table.

7.4.5 Basic writing function

The **Basic writing** tab allows easy writing on tags. A fundamental distinction is to be made between synchronous writing - **write on command** - and asynchronous writing - **write on arrival**.

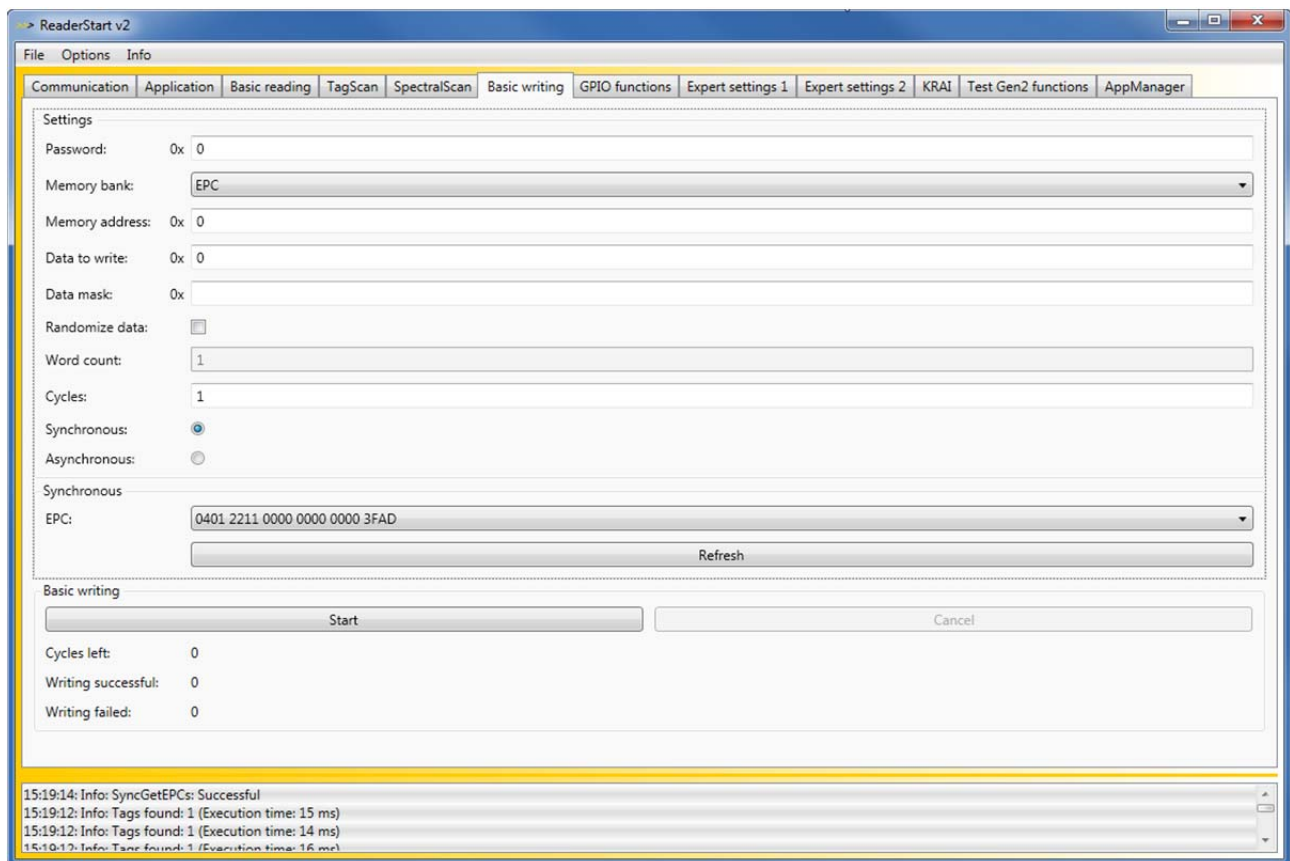


Figure 22 Basic write function tab

Synchronous writing:

In this type of writing the data can only be written selectively to one EPC. This is selected in the **EPC** combo box in the center of the input window. Clicking the **Refresh** button detects once again all tags in the antenna field and adds them to the combo box.

When all necessary data such as **password**, **memory bank** and **memory address** have been input a decision can be made whether to specify the data to be written or to generate them as random values. If specified data should be written, optionally a data mask can be specified. When using random data, the amount of them should be stated in words (16-bit).

Note: Right-clicking on the **Data to write** field opens a context menu, which allows the selected EPC to be copied into this field.

Note: Right-clicking on the **Data mask** field allows this to be filled optionally with **0** or **F** according to the amount of the data to be written.

Clicking on **Start** starts the execution of the previously specified number of write attempts. The error-free completion of all write attempts is once again indicated by the button glowing green and by a message in the status window. If any necessary data are lacking, the button briefly glows red and the field lacking the data glows red somewhat longer. The associated error message appears in the **status window**.

The **Writing successful** and **Writing failed** fields indicate how often the write attempt succeeded or failed. Hovering the mouse over the number of failed write attempts (provided indeed any failures did occur), calls up a window with detailed information.

Asynchronous writing:

In this type of writing the data is written to every EPC that shows up in the antenna field. When all necessary data (**password**, **memory bank**, **memory address** and **data to write**) have been entered, clicking on **Start** starts the asynchronous write process. Successful and failed write attempts are shown in the respective fields. Hovering the mouse over the number of failed write attempts (provided indeed any failures did occur), calls up a window with detailed information.

Note: Right-clicking on the **Data mask** field allows this to be filled optionally with **0** or **F** according to the amount of the data to be written.

7.5 GPIO functions

Readers with GPIO functionality offer the possibility to set up small controls which trigger the reader via one of its GPIO inputs, e.g. by a light barrier or similar. On the other hand, GPIO outputs are able to communicate reader states to the outside world, e.g. reading of specific tags or similar.

The GPIO function offers various possibilities. One is testing the inputs and outputs directly via the GUI application. For more complex procedures, action lists can be created, which execute a sequence of commands on the reader. This list can then be linked to various inputs.

The tab is divided into 5 sections. In order to perform settings on an IO card, the card number must be selected in the GPIO card drop-down menu. It shows only cards of the appropriate type.

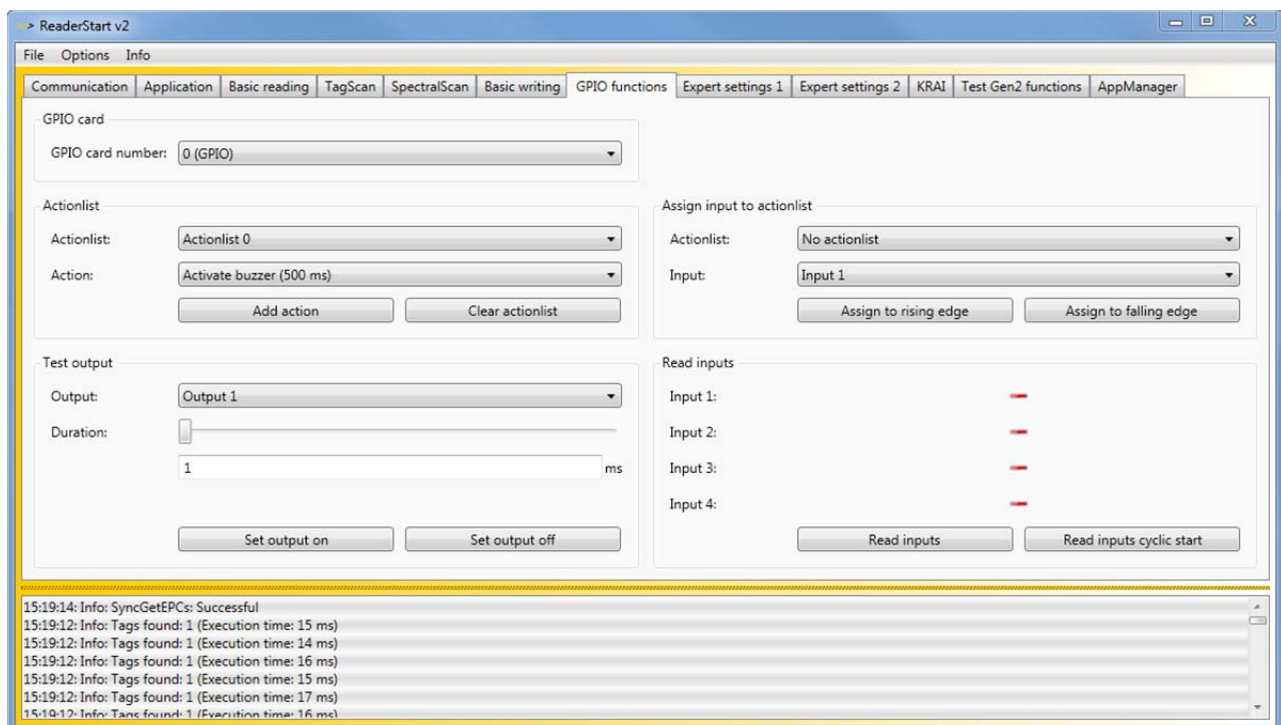


Figure 23 GPIO functions tab

The **Test output** section can be used in order to selectively operate an output manually. In order to enable this access, the respective output of this card must previously have been connected to protocol access (see *I/O card configuration Chapter 7.4.3*). The **Output** in the drop-down menu is now selected in the header, and time is defined using the **Duration** parameter, until the output automatically returns to its idle mode. The IO operations can now be made using the **Set output on** and **Set output off** buttons.

The inputs to the reader can be interrogated in the **Read inputs** section. Whether an input is set or not is shown in the signal fields. A one-off read process can be triggered by pressing the **Read inputs** button. If this reading shall be performed automatically, this process can be started by pressing the **Read inputs cyclic start** button.

To automate the processes, command sequences in the form of action lists can be stored on the reader. These are triggered on edge of the signal transition at the selected input on the respective GPIO card.

The action lists consist of a sequence of individual actions, which can be loaded in the form of an XML file. Use right mouse over the **Action** drop down menu to access the respective context menu. This file can be

created or edited manually, using a text editor. See [2]. In order to use the newly added actions in the program, the file must be reloaded via the context menu.

The **Actionlist** must be selected from the drop-down list. The Button **Add action** writes the action list into the reader. Pressing the **Clear actionlist** button clears down the selected list.

Note: When the action list has been created, it is assigned under the **Assign input to Actionlist** header to an input and a selected signal edge. If it is desired to assign the list to both edges, the assignment must be made once for the rising edge and once for the downward edge.

The assignment can be cancelled again by a restart/reset of the reader or by assignment of the **No Actionlist** item.

The **Actionlists** created are stored only in the RAM of the reader. When restarting the reader these lists are deleted. For usage within an operational application, the respective commands to program the actions lists have to be executed by the host application on reader startup.

The basic I/O configuration is set within the **communication** tab (see Chapter 7.4.3):

The screenshot shows the 'GPIO' settings window under the 'Intelligence module' tab. It contains the following elements:

- IO card type:** A dropdown menu set to 'GPIO' with a warning icon next to it.
- Detected IO card type:** A text field displaying 'GPIO'.
- Input section:** A table with 4 rows (Input 1 to Input 4). Each row has a checkbox for 'Invert logical input' (all unchecked) and a text field for 'Debounce time' (all set to '0 ms').
- Output section:** A table with 4 rows (Output 1 to Output 4). Each row has a checkbox for 'Invert logical output' (all unchecked), a 'Function' dropdown (all set to 'Off'), 'First antenna' and 'Last antenna' dropdowns (all set to 'Antenna 1' and 'Antenna 4' respectively), and a 'Turn-off time' text field (all set to '2000 ms').

Figure 24 GPIO settings in communication tab

The **ActionlistAction.xml** as well as the **ReaderStart v2** software local configuration file is available in the local windows directory **My Documents**.

Please see the following example for the **ActionlistAction.xml**:

```
<?xml version='1.0' encoding='UTF-8'?>
<ActionlistActions>
<!--Activate buzzer for 500 ms, CommandID: 0x0045, Parameter: 0x01F4-->
<Action>
<Description>Activate buzzer (500 ms)</Description>
<CommandID>0045</CommandID>
<!--LSB first-->
<Parameter>F4</Parameter>
<Parameter>01</Parameter>
</Action>
<!--Get EPCs, CommandID: 0x0101-->
<Action>
<Description>Get EPCs</Description>
<CommandID>0101</CommandID>
<!--LSB first-->
</Action>
</ActionlistActions>
```

In this example, the commands **Buzzer** and **Get EPCs** were used in an exemplary matter –see [1] for details.

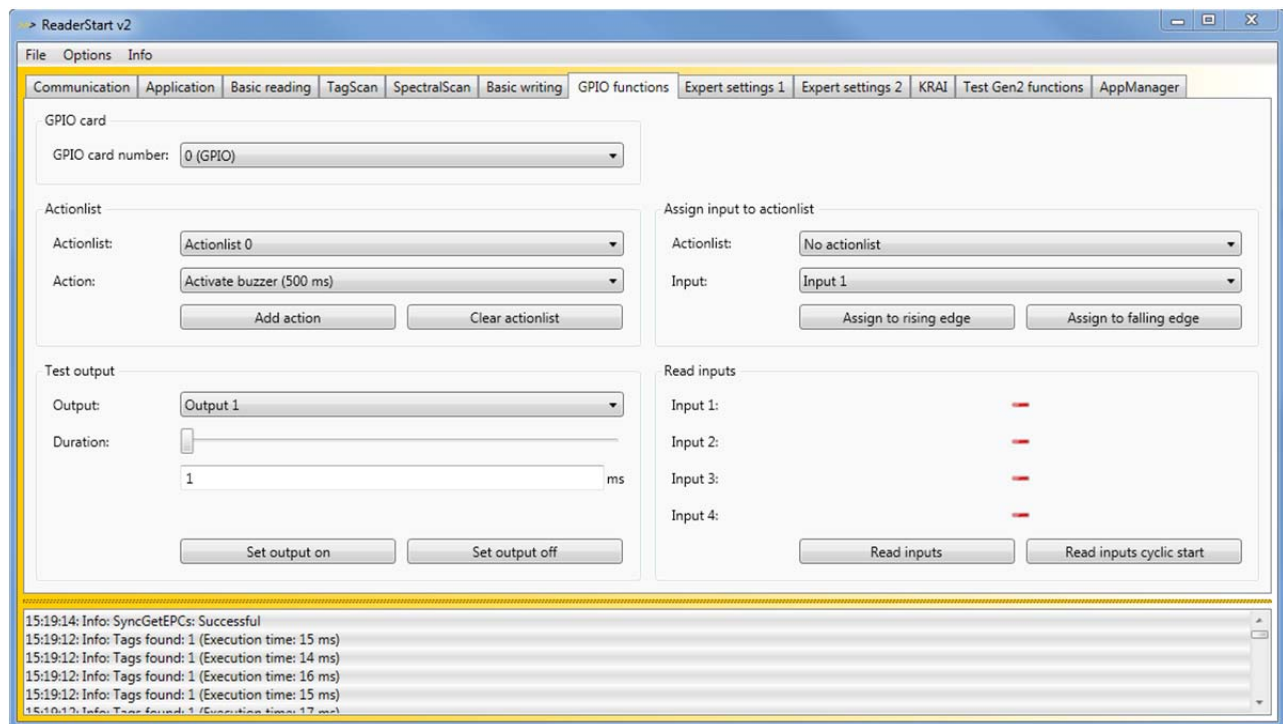
The **ActionlistAction.xml** is automatically loaded into the application **ReaderStart v2** during program start.

Selecting commands from the ACTION list

The commands defined in **ActionlistAction.xml** are now available in the menu item Action

By pressing „**Add action**“ the commands are written in the chronological list within the reader device. If successful, the status window prints **GPIOAddActionToActionlist (9): Successfully acknowledged**.

Assigning the Actionlist to the respective inputs



The right side of the **GPIO functions** tab within the section **Assign input to Actionlist** allows the assignment of action list to the respective physical input ports. The assignment gets finally active by choosing **Assign to rising edge** or **Assign to falling edge**. Please note the respective acknowledgement in the status window.

Note: The Action List is only capable to perform basic logic operations. A real whitelist handling based on the EPC values of tags and their assignment to output functions is not possible.

7.6 Expert settings 1

The **ReaderStart v2** software is a powerful tool for configuration of the reader. It allows the reader to be customized to any application. The expert settings 1 and 2 allow the reader's RF interface and communications profile to be optimized with respect to tag reading performance.

There are eight parameter sets available which are stored inside the reader device. The settings are able to be changed via the ReaderStart v2 software. Those settings allow a modification of the RF parameters to be used in the air-interface communication, See section [2] *Configurational Manual* for more information about the individual parameters.

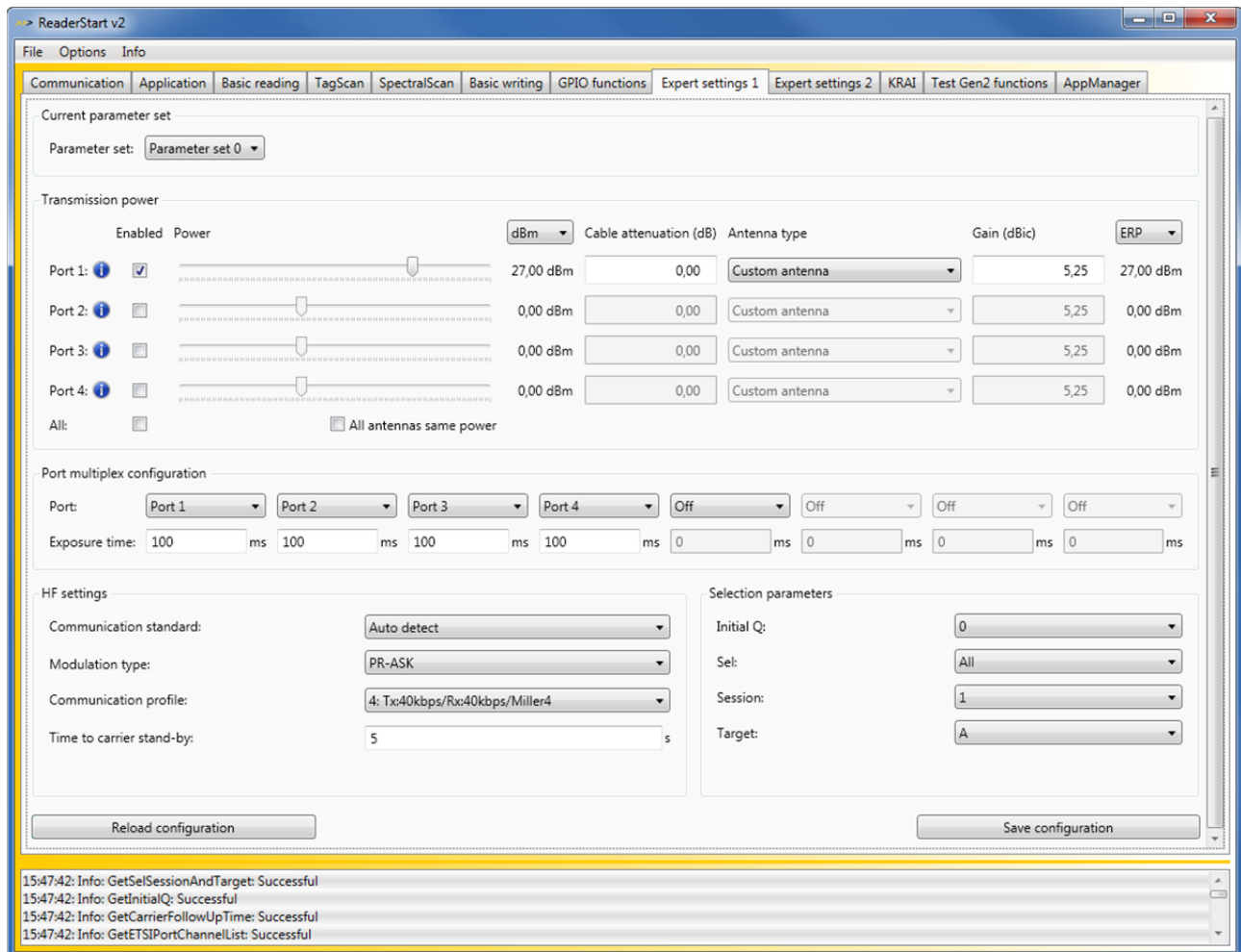


Figure 25 Expert settings 1 tab

By choosing an entry in the drop down box **Parameter set** the respective set gets activated in the reader device. Changes made on the respective parameter settings have to be saved to the reader device by choosing **Save configuration**. By choosing **Reload configuration** the made change on the GUI are discarded and overwritten by the settings stored in the reader.

When changing the transmission channels are only available in the “EU” version of the reader.

Note: When changing the transmission power you need to stick to the applicable national regulations. 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.

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

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 below:

The following applies to the European region, Reader type "EU":

$$P_{\text{Reader}} = P_{\text{ERP}} + D_{\text{Kabel}} - G_{\text{HW}}$$

P_{Reader} Transmission power of the reader in dBm

P_{ERP} Transmission power based on a half-wave dipole in dBm

D_{Kabel} Cable attenuation in dB

G_{HW} Antenna gain based on a half-wave dipole

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

$$D_{\text{Kabel}} = l \cdot D_{\text{dB/m}}$$

D_{Kabel} Cable attenuation in dB

l Length in m

$D_{\text{dB/m}}$ Attenuation in dB/m at specific frequency

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 polarized isotropic radiator and dBi to a linearly polarized isotropic radiator.

In the European regulation area, the radiated power must not exceed 2 W ERP. This figure refers to a half-wave dipole. Please see the equation below, showing the relationship between an isotropic radiator (dBi) and a half-wave dipole.

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

G_{HW} Gain based on a half-wave dipole

G_{isot} Gain based on an isotropic radiator in dBi

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

If the gain of the antenna is referred to the polarization of a circular isotropic antenna (dBic), the linear gain of the antenna is 3 dB lower.

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

G_{HW} Gain based on a half-wave dipole

G_{isot} Gain based on an isotropic radiator in dBic

The following applies to the US region, Reader type "US":

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:

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

P_{Reader} Transmission power of the reader in dBm

P_{cond} Power on antenna output in dBm

D_{Kabel} Cable attenuation in dBm

G_{HW} Antenna gain in dBi

Note: The antenna gain must be stated in dBic.

The RFID reader's transmission power can be set separately for each antenna or all antennas at the same time. If **the All antennas same power** check box is set, 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.

Pre-defined antennas can be selected in the Antenna type selection drop-down menu. This selection sets the antenna gain in the program, and limits the transmission power to the maximum value permitted for this antenna. If **Custom antenna** is selected, the gain and power can be freely set.

Antenna multiplex configuration

The sequence in which the antennas are used to read the tag can be set under this header. If this antenna is not activated, the system proceeds to the next entry on the multiplex list. For asynchronous operation of the reader, the exposure time on the antenna can also be specified. See section [2] „Configurational manual“, sections *MultiplexingAntennaport* and *MultiplexingExposureTime* for more details.

RF settings

Depending on the regulative region, the reader transmits in the frequency range 865 MHz to 868 MHz for Europe or 902 MHz to 928 MHz for USA / FCC.

In Europe the number of channels to be used can be limited. For this purpose the related check box for each channel the reader is to use must be selected on the **Available channels** pick list. In this manner it is possible to avoid from the start the usage of specific channels on which there is or might be interference.

Each read command connects the channels under country-specific conditions and in accordance with the selected communications standard. The reader then starts to search through the channels in ascending order.

In the **Communication standard** drop-down menu, the reader can be switched to a different country-specific communications standard. The device firmware defines which customized standards are available.

The **modulation type** can be switched between double sideband and PR-ASK modulation in this drop-down menu.

The communications profile is critical for the data rate and the read reliability. This option allows the technician to directly influence the performance of the reader and the spectrum of the signal. The profile denominations contain basic indications on the transmission and reception data rates.

Note: The optimal data rate may be subject of the used tag.

The **Time until carrier stand-by** parameter specifies how long the carrier of the reader remains active on the air interface after the last action. Once this time has elapsed the carrier is switched off.

Selection parameters

In this section the user can configure the simulation the tags to the EPC standard (see *EPC global standard*). The parameters can be selected in the drop-down menu and have the following meanings:

No.	Parameter	Function
1	Initial Q value	Reflects the number of tags expected in the field. (see [2] and look for <i>InitialQ</i>)
2	Sel	Specifies whether other parameters are of interest for an inventory of the tag population, or not. (see [2] and look for <i>QuerySel</i>)
3	Sessions	This configuration parameter instructs the reader the session with which it should work. (see [2] and look for <i>Sessions</i>)
4	Target	Specifies which tags in the population should participate in the inventory. (see [2] and look for <i>QueryTarget</i>)

7.6.1 Expert settings 2

The Expert settings 2 tab is split into four sections for further configuration of the reader device.

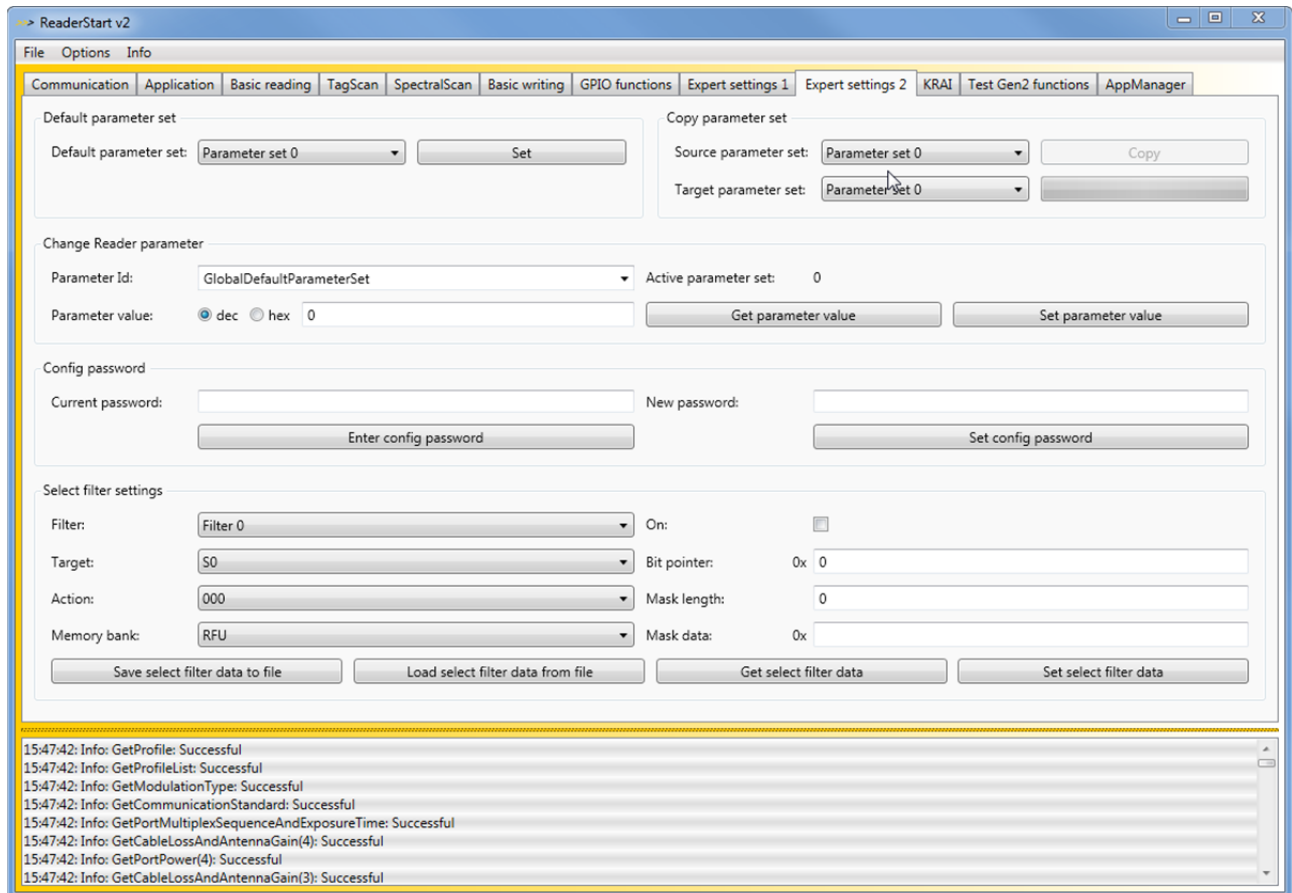


Figure 26 Expert settings 2 tab

The **Default parameter set** drop down menu allows configuration of the parameter set that is loaded from the EEPROM into the RAM when the RFID reader device boots up.

The **Copy parameter set** section allows one parameter set to be copied into another. On successful completion of the copy operation, the **Copy** button is lid green and a corresponding message is displayed in the **status window**, otherwise the **Copy** button glows red.

The **Change reader parameter** section allows reader settings to be read or changed using their respective configuration IDs. After selection of the **parameter ID**, the corresponding value of the current parameter set of the reader device is read by clicking on **Get parameter value** and displayed in the field **parameter value**, optionally as a decimal (**dec**) or hexadecimal (**hex**) value. A value that has already been read can be converted to dec or hex by pressing the respective radio buttons. The **Set parameter value** button writes the value stated in the **Parameter value** field into the reader device. The two actions (read and set) are shown by the respective buttons glowing the respective color to indicate success and failure, and a message appears in the **status window** accordingly.

In the **Select settings** area, filters can be set which are brought into effect by means of a “Select” command. This offers the facility to filter out certain tags, or to detect only tags with certain defined data in the respective memory banks. Up to 32 filters can be set in total. Successful reading of the values of the selected filter and successful writing of the filter values is indicated by the respective button glowing green

and a text appearing in the **status window**. Otherwise the respective button glows red and a description of the error is given.

The functionality **Config Password** offers the possibility to define a configuration password for the values displayed in the section **Change Reader Parameter** and thus offers an additional protection mechanism for readers installed in the field.

7.7 Test Gen2 functions

This tab makes it possible to access individual functions of the reader. This includes, along with the functionality in accordance with the EPC-Gen2 standard, e. g.: read individual tags, describe tags, set and change passwords, and also select the antenna for the operation.

The user interface consists of the sections **Get all EPCs**, **Write EPC**, **Change password**, **Read/write data**, **Lock**, **Kill** and the display window for EPCs that have been read. The sections that follow explain this functionality in more detail.

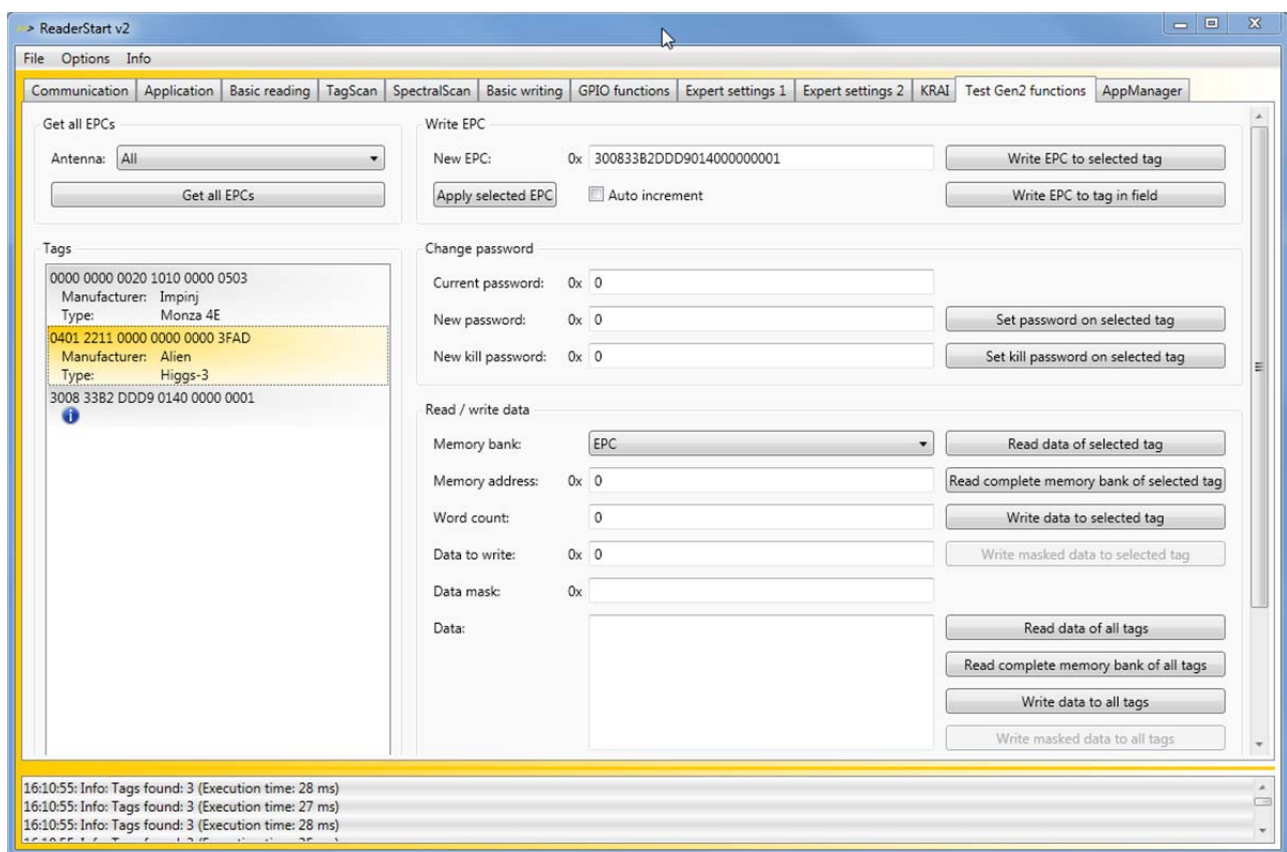


Figure 27 The Test Gen2 functions menu tab

Note: Additional information about the manufacturer and the chip type are displayed on the „i“ symbol. Left click on this icon, this information can be retrieved.

Get all EPCs

To read a tag in this menu, the **Get all EPCs** button must be clicked once the reader has been correctly configured. The reader now tries once again to read all the tags in the field of the selected antenna. If in the **Antenna selection** drop-down menu the number of antennas has been restricted, reading will now be performed using the currently selected antenna, or using the antenna selected with **All** in the **Expert settings 1**.

The EPCs from the tags read successfully are displayed in the field below. For the following operations, a tag can be selected from this list by clicking on it.

Write EPC

The EPC of the tag can be modified. For this purpose an EPC in hexadecimal format must be entered in the **New EPC** field.

Note: Comply with the maximum EPC length supported by the tag - if this is exceeded the tag will return an error.

If the requirement is only to amend an existing tag, this tag can be loaded to the field by pressing the **Apply selected EPC** button. Now the EPC can be changed manually, or by using the **Auto increment** option → increased by one at each write event.

The write event itself can optionally be executed on this tag by pressing the **Write EPC to selected tag** button. At this time there may be several tags in the field, but at least one tag from the list must be selected. The second option is to write the specified EPC without a tag being selected. When using this function, make sure there is just one single tag in the field.

Change password

The EPC standard specifies that the tag should have two modes, the *open* and the *secured state*. In the open state, operations can be performed on the tag if the associated memory areas are not secured with a password greater than 0. If a password has been set and the **Lock** section (bottom of the **Test Gen2 functions** tab) of the GUI has been used to set the memory areas to password protected, the desired operation will not be executed and the tag will report an access error. Normal access remains available in areas that are not blocked.

On access with the valid password, the tag switches into the secured state and access is available even in blocked areas. Setting the password and setting how individual areas are blocked is performed under the **Change password** and **Lock** section of the SW.

Under the first section the password for restricting access to the tag and the password for deactivation of the tag are set. The access password can be used to restrict access to the tag in the open state. Depending on the configuration under the **Lock** section, parts of the tag can be provided with completely or partially restricted access rights.

The **deactivation password** is required to deactivate the tag permanently by means of a Kill command.

Note: After a **Kill tag** command, the tag will be unusable. To change the password, the **current password** must be given. If no password has yet been set, the default value is 0. The new password is entered in the field of the same name, in hexadecimal format. Clicking on the **Set password on selected tag** button replaces the old password with the new password. The **deactivation password** is entered in the field of the same name by clicking on the associated button.

If the password is changed and the memory area in question is already protected by the access password, in addition to the new password the access password must be entered in the **Current password** field.

Read / write data

This section offers detailed access to all the data areas of the tag. Access is obtained by entering the selected memory bank, the address within the memory bank and the number of words, expressed as 16-bit words.

If data are to be written, it must be entered in the **Data to write** field. The data mask allows only individual bits on the tag to be changed. To do this, the mask must be entered in the **Data mask** field. The reader uses this mask to change the data read from the tag at the points where 1 bits are written in the mask, and writes the result back into the tag. The desired data can optionally be written to a single tag in the field or to all tags in the field. If it is written to every tag in the field, these tags must all have the same configuration (lock and password).

This GUI section also offers the possibility to read data from the selected tag or from all tags in the field. If the tags in the field have differing passwords and are configured differently, the data must be read by individual tags.

The next section deals in more detail with the saving of the individual memory areas.

Lock

The EPC Gen 2 standard provides security mechanisms for the tag data areas. This allows individual memory areas and functionalities of the tags being secured with a password to protect it against access and/or changes.

Under the **Lock** section the mask that specifies access to the areas in accordance with the EPC Gen 2 standard can be customized to suit the application. If no changes are required for an area, **No change** must be selected in the respective drop-down menu. The areas are grouped as follows:

No.	Parameter	Function
1	Kill password	Specifies whether or not a Kill password is necessary for deactivating the Tag. See <i>EPCglobal Class-1 Gen-2 standard</i> for details.
2	Access password	Specifies whether an access password is necessary for accessing a tag. If no access password is set, the Tag can be addressed in the open state condition. Further details can be found in the <i>EPC global standard</i> .
3	EPC memory bank password	Allows specification of whether or not the access password is necessary for changing the EPC.
4	TID memory bank password	This area contains general information about the tag. This area can also be protected against user access by setting the access password.

No.	Parameter	Function
5	USER memory bank	If the tag has a memory area provided for user data, these can be protected by setting the access password.

The respective items in the drop-down menu are divided into access blocks, which prevent reading and writing, and write blocks.

Clicking on the **Lock selected tag** button loads the mask that was created to the list of the selected tag. Alternatively all the tags in the field can be blocked, on the precondition that the tags all have the same password.

Note: Wrongly configuring the **Lock** section can render the tag unusable.

Kill

Pressing the **Kill selected tag** button, with the stated password, executes a Kill command on this tag. The **Kill all tags** button, with the stated password, attempts to execute a Kill command on all the tag in the field.

Note: For the deactivation of a tag, a deactivation password that is not 0 must have been set.

Note: After a Kill tag command, the tag will be unusable.

7.8 © KRAI-Settings

The KTC RFID reader is able to control antennas from the manufacturer Kathrein by using their proprietary communication interface ©KRAI. Those Kathrein antennas are not included in the product portfolio of KTC and thus in combination with the KTC RFID reader device there is no active support given by KTC when using KRAI antennas.

7.9 App Manager

The AppManager manages applications that are directly run on the reader. Please ask KTC for possibilities with respect to customized applications.

The application can be uploaded to the reader device by using the **Install app** function on the GUI. For this purpose the application structure has to be available in *.tar format. Using the Reader Start software the applications can then be managed using the tab **AppManager (Get, Install, Start, Stop, Uninstall, Start app at boot time)**.

For the configuration options of the respective KTC specific applications please refer to the application specific configuration manuals.

8 Building host applications by using the API

8.1 Preparation

The examples have been tested on **Windows 7** and **Debian 6.0**. Before the programs are compiled, the environment must be adapted. Copy the folder **/ AP** and **/ RFIDDemoApp** in your user directory.

Note: The example is based on the connection parameters from the factory default settings of the IO cards. This may need to be adapted.

The necessary libraries for the programs can either be stored in the respective program folder or the default library folder of the operating system.

8.2 Using the examples with Windows

The C #, C + + and VB.Net folder containing the example programs and project files for Visual Studio 2010 based on the **ReaderDIIDotNet**. Download the appropriate project file and compile the program.

8.3 Using the examples with Linux on a PC

The program is built in the **/ RFIDDemoApp / Linux** by using the command **make**. If the compiler finds all the necessary data, the program **Console Linux demo** is created in the same folder.

The library LibReaderLib.so is need and available in **/API/Linux**. Use the root userto copy this file to the **/usr/lib** or leave in it the folder containing the source code files.

Documentation feedback

Installation Manual: **SRU-8100 RFID Reader 18000-63**
Kapsch order no.: **Ins-47000001169**
Manual release: **01**

To the reader: Your opinions are important to us because we want our manuals to meet your needs. By completing and returning this form you helps us make the next issue of this manual even better.

Disposition

1. Does the table of contents make it easy to find information in the manual?
2. Are chapter headings self-explanatory and informative?
3. Is the information in the appropriate order?

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☐	☐	☐	☐

Usefulness

4. Does the information in the manual cover your needs?

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Clarity

5. Are the instructions easy to understand?
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