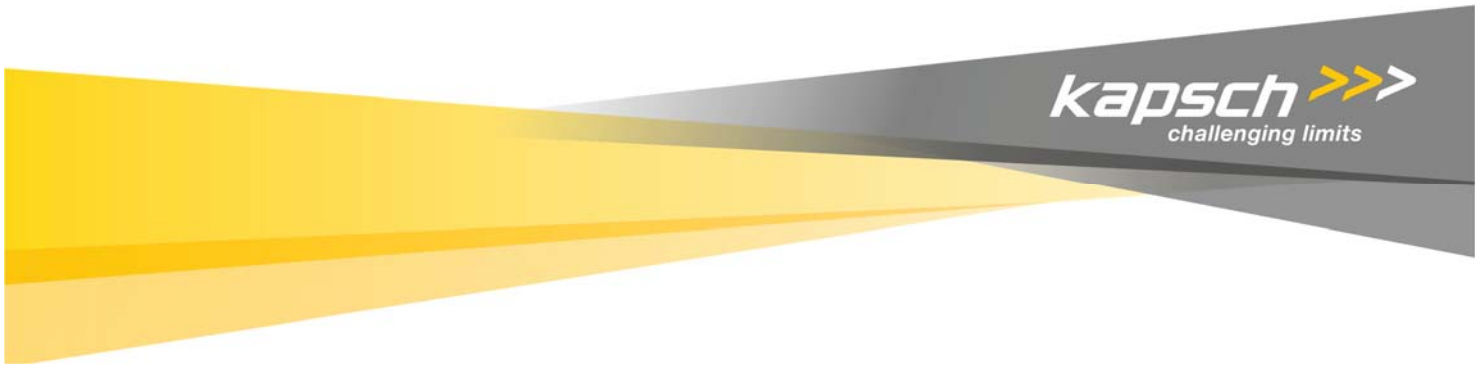

Kapsch TrafficCom

User Manual
SRU-8X1X RFID Reader 18000-63

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1 Preface

Please follow all the information given in this User Manual for the Kapsch UHF RFID SRU-8X1X reader family. We reserve the right to make changes to this guide without prior notice. In particular, this applies to changes made due to technical advancements.

2 About this Manual

This document describes installation, configuration and operation of the reader. Furthermore, it provides detailed technical data in order to better familiarize the user with the features of the reader.

The target group of this guide are specialists who install, configure and put the reader into operation. This document is valid for all Kapsch SRU-8X1X UHF RFID readers.

Tipp	This document applies to all Kapsch SRU-8X1X UHF RFID readers, for both types with and without embedded antenna.

Tipp	Keep these instructions for further reference, and if the device passes to another owner, pass them on to the new owner.

For more information, visit our website https://www.kapsch.net/ktc/Portfolio/Products

The manuals are available for download at the internet product page.

3 Explanation of Symbols and Signal Words

3.1 Symbols

	General warning sign
	Fire hazard
	Radiation hazard
	Risk of material damage or malfunction in safety instructions or call for attention

3.2 Signal Words

Warning	This signal word indicates a hazard with a medium level of risk which can lead to death or severe injuries.
Caution	This signal word indicates a hazard with a low level of risk which can lead to minor or moderate injuries.
Notice	This signal word indicates a hazard which can lead to damage to property or malfunction.
Tipp	This signal word indicates useful tips and recommendations.

3.3 Other Symbols

Symbol	Meaning
►	Operating instruction
1, 2, 3...n	Operating instructions in a fixed order
⇨	Result of an operating instruction
✓	Condition for the execution of an operating instruction
•	List/list entry
Program	connections on the reader; push buttons in the user interface of the *ReaderStart*
dbfdfbdfb	commands and file names
Putty	cross references within the text, proper names or titles of other documents
www.putty.org	hyperlinks
Browse	homepage/Windows elements

4 Professional Installation Guidelines for the U.S.

4.1 Installation Personnel

	**UHF RFID readers require professional installation!** ► You must be a professional installer with RF and related rule knowledge. ► The installation requires special trained professionals to access and setup the system. ► The system is not to be installed by the general public, general user shall not attempt to install the device or change the settings.

4.2 External Antenna

	► You must follow Part 15 of the FCC rules, and specifically Part 15.203 pertaining antenna requirements of an intentional radiator. ► Make sure to use a 13 dBi or less patch antenna. ► Only use antennas which have been approved by the applicant. The use of none-approved antenna(s) may produce unwanted spurious emissions or excessive RF transmitting power which may lead to the violation of the FCC/ISED limit and is prohibited.

4.3 Final OutputPower

	**WARNING** ► Carefully select the installation position. ► Make sure that the final output power does not exceed the limit set in relevant rules. The violation of the rule could lead to serious federal penalty!

	If you are not a professional installer, **STOP**. ► Do not proceed any further with the installation. ► Do not install the unit or change the settings.

5 Safety Instructions

5.1 General Safety Instructions

WARNING

Danger to life from electric shock! Fire hazard!

Improper interventions in the device may jeopardize its electrical safety. 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 fire, electric shock and injuries.

The manufacturer accepts no liability for accidents caused by the user opening or changing the device. Opening the device and attempting to repair it yourself voids all warranty and guarantee claims. The applicable version of the manufacturer's guarantee 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.

- Make sure that all the connection, installation and maintenance work as well as all other work on the unit is carried out by properly qualified and trained staff.
- Make sure that the installation team is properly qualified, familiar with and comply with the safety regulations applicable in the respective country.
- Do not open, change or damage the device and its components.
- Make sure that any repairs on the device are carried out by personnel authorized to perform them.
- Keep and operate the device out of reach of children.
- Do not modify, remove or disfigure the notices and markings applied by the manufacturer.
- Only use the unit for the purpose intended by the manufacturer.
- Before each use, make sure that the device is not damaged.
- Only use the power supply unit supplied.
- Make sure that the power supply cable is not damaged.
- Make sure that a unit with a damaged power supply cable is repaired by an electrical specialist before being used again.

WARNING

Danger to life from electric shock or fire hazard due to incorrect voltage, insufficient ventilation, moisture, direct sunlight, heat or naked flames!

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

- Make sure the unit is operated only at the stated supply voltage; see the rear of the device or the external power supply unit.
- When installing the unit in cabinets or shelves, make sure there is sufficient ventilation.
- Do not cover the ventilation slots on the unit.
- Protect the unit from moisture, dripping and splash water.
- Do not operate the unit in damp areas.
- Only use the unit in a moderate climate, not in tropical conditions.
- Do not place any liquid-filled items on top of the unit.
- Do not expose the unit to inadmissible heat, direct sunlight or fire.
- Do not install the device close to the sources of heat, e.g. heating.
- Do not place anything with a naked flame on the device.

5.2 CE Marking for the Kapsch RFID Readers with the Type Designation ETSI

WARNING

Danger to life due to radiation electromagnetic field!

This reader is designed ETSI for operation according to EN 302208. In some circumstances, heart pacemakers may suffer interference if wearers are close to the antenna when the unit is in operation (reader and antenna).

- When the unit is operated with antennas connected, comply with the human exposure regulations in accordance with EN 50364.
- Ensure a minimum clearance of 35 cm between the antenna and the human body.
- Comply with the operating instructions for RFID antennas.
- In case of doubt, make sure people with peacemakers contact the manufacturer of their peace- maker or their doctor.

5.3 FCC and ISED Canada Regulatory Information

The operator and the specialist company which carries out the installation are responsible for ensuring that only certified systems are used in the United States. Use of this system in any other combination (e.g. several antennas which transmit the same information in the same location) is expressly prohibited. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

To meet the certification regulations according to Part 15 of the FCC regulations in the United States:

- Make sure the 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.
- Make sure the unit is properly installed, see FCC RF Radiation Exposure Statement, p. 11 and ISED RF Radiation Exposure Statement, p. 11.

The readers with the identifier FCC are designed to operate under FCC Part 15 and can be found at the FCC homepage under grantee code WJ9. This device complies with Part 15 of the FCC Rules and with ISED license-exempt RSS standard(s).

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.

ISDE

Le présent appareil est conforme aux CNR d'ISDE applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Under ISED regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by ISED.

► To reduce potential radio interference to other users, choose the antenna type and its gain such that the equivalent isotropically radiated power (EIRP) is not more than that necessary for successful communication.

En vertu des réglementations d'ISDE, cet émetteur radio ne peut être utilisé qu'avec une antenne de type et un gain maximum (ou inférieur) approuvé pour l'émetteur par ISDE.

► Pour réduire les interférences radio potentielles avec d'autres utilisateurs, choisissez le type d'antenne et le gain de sorte que la puissance isotrope rayonnée équivalente (PIRE) ne soit pas supérieure à celle nécessaire pour une communication réussie.

This radio transmitter has been approved by ISED to operate with the antenna types listed in 5.4.2 Recommended Antenna Types with the maximum permissible gain and required antenna impedance for each antenna type indicated

Cet émetteur radio a été approuvé par ISDE pour être utilisé avec les types d'antennes énumérés dans 5.4.2 Recommended Antenna Types avec le gain maximum admissible et l'impédance d'antenne requise pour chaque type d'antenne indiqué.

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

5.3.1 Radiation Exposure Statements

	**WARNING** Danger to life due to radiation electromagnetic field! ► Follow the instructions given in the FCC RF Radiation Exposure Statement, p. 10 and ISED RF Radiation Exposure Statement, p. 10. Ensure a minimum clearance of 35 cm between the antenna and the human body. ► Comply with the operating instructions for RFID antennas. ► In case of doubt, make sure people with peacemakers contact the manufacturer of their peacemaker or their doctor.

FCC RF Radiation Exposure Statement

This transmitter must not be co-location or operating in conjunction with any other antenna or transmitter. This equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment.

► Make sure this equipment is installed and operated with a minimum distance of 23 centimeters between the radiator and your body.

ISED RF Radiation Exposure Statement

This equipment complies with ISED RSS-102 radiation exposure limits set forth for an uncontrolled environment.

► Make sure this equipment is installed and operated with a minimum distance of 34 centimeters between the radiator and your body.

ISDE Déclaration d'exposition aux radiofréquences

Le présent appareil est conforme aux limites d'exposition aux radiofréquences d'ISDE CNR-102 définies pour un environnement non contrôlé.

► Assurez-vous que cet équipement est installé et utilisé avec une distance minimale de 34 centimètres entre le radiateur et votre corps.

5.4 Anatel Brazil Regulatory Information

Anatel RF Exposure Statement

This device complies with the RF exposure guidelines when positioned at least 34 cm away from the body. For more information, see the website of ANATEL at www.anatel.gov.br.

Anatel Declaração de exposição à radiofrequência

Este dispositivo está em conformidade com as diretrizes de exposição à radiofrequência quando posicionado a pelo menos 34 centímetros de distância do corpo. Para maiores informações, consulte o site da Anatel – www.anatel.gov.br

5.4.1 Safety Instructions

	**NOTICE** Risk of harmful radio communication interference! 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. ► Turn the unit on and off to make sure the radio or television reception interference is caused by the unit. ► 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

5.4.2 Recommended Antenna Types

Antenna types not included in this list or having a gain greater than the maximum gain indicated for that type are strictly prohibited for use with this device.

Les types d'antennes non inclus dans cette liste ou avec un gain supérieur au gain maximum indiqué pour ce type sont strictement interdits pour l'utilisation avec cet appareil.

Order number	Type	Shortened designation	Gain	
			circular	linear
34032620100	ANT-UHF-FCC-30/CIRC 11DBIC	UHF RFID wide range antenna FCC 902-928 MHz, 30°/70°, 10.5 dBic, IP65, circ. polarized, N-connector	11 dBiC	8 dBi
34032620110	ANT-UHF-FCC-30/LIN 11DBI	UHF RFID wide range antenna FCC 902-928 MHz, 30°/70°, 11 dBi, IP65, lin. polarized, N-connector	n.a.	11 dBi
34032870100	ANT-UHF-FCC-40/LIN 13DBI	UHF RFID wide range antenna FCC 902-928 MHz, 40°/40°, 13 dBi, IP65, lin. polarized, N-connector	n.a.	13 dBi
34035460100	ANT-UHF-FCC-65/CIRC 8.5DBIC	UHF RFID wide range antenna FCC 902-928 MHz, 65°/65°, 8.5 dBic,IP67, circ. polarized, TNC (f) connector	8.5 dBiC	5.5 dBi

6 Warranty Information

	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. Kapsch accepts no liability if the customer fails to implement the precautions listed here. In such cases, any claims under the warranty/guarantee are void. ► Before installing or servicing the reader, make sure that the person concerned has read the manual and understood its contents.

7 Introduction to the RFID System

7.1 RFID System

An RFID system is comprised of the control computer of the reader, antennas, antenna connection cables and the tags. The figure below shows the schematic structure of the system:

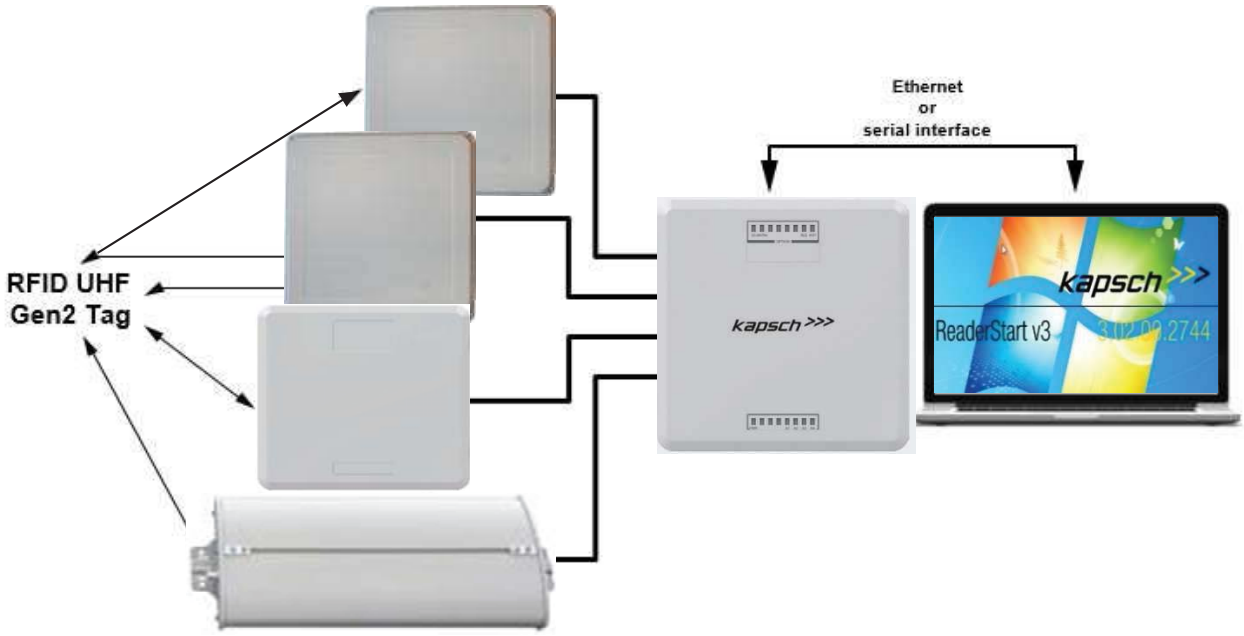


Figure 1 RFID system (example)

The tags consist of an antenna and a small chip. The chip is the true carrier of the information, the EPC (*Electronic Product Code*) number. This number can identify products or product groups. Alternatively, the EPC can be overwritten with new information.

To read the tag information, the reader switches on an RF carrier by means of a selected antenna, thus supplying the tags in the RF field with energy.

To read the information from a tag, it is necessary to inventory the tags and then select a tag from the population of tags. Upon successful completion of the inventory, the EPC number of each tag can be read and sent to the PC. It is possible to attach additional information to the EPC, for example, the antenna which read it or the time at which it was read.

!	**NOTICE** The reader operates using the frequency hopping process to avoid faults and interference between readers. Within the FCC area, this procedure is mandatory. The reader changes its transmission frequency randomly, with equal distribution across the 52 available channels. Each channel is used for max. 400 ms in an interval of 20 s.

The *ReaderStart v3* software can be used for testing and parametrising.

The communication between the ReaderStart v3 and the reader is based on the DLL (Dynamic Link Library), which includes the communication protocol, see document “API Communication Protocol Description V3.x for SRU-8X1X RFID Reader 18000-63”. For specific applications, the user can build its own control software based on the reader DLL. The DLL includes all the relevant commands and functions required to control the reader.

It is necessary for the user to create his own control software. The user-specific control software can run directly on the reader. Therefore, a stand-alone operation without permanent network connection is possible.

	To be able to use the complete range of the reader performance in customer applications, we recommend using the reader SRU-8110. It is not possible to run any customer applications on the basic SRU-8211 reader.

7.2 Further Reference Material

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

The parameters available for the configuration of the reader are described in the Configuration Manual for SRU-8X1X RFID Reader 18000-63. The reader is controlled via a specific reader protocol, the current version of the protocol is described in detail in the API Communication Protocol Description V3.x for SRU-8X1X RFID Reader 18000-63.

Document No.	Document Titel	Application
Bes-47000001742	Product Range Definition for SRU-8110 RFID Reader	setup & installation
Bes-47000001171	API Communication Protocol Description V3.x for SRU-8X1X RFID Reader 18000-63	software development
Bed-47000001741	Configuration Manual for SRU-8X1X RFID Reader 18000-63	commissioning
DatBl-47000001744	UHF RFID Antenna Overview	setup & installation
	EPC™ Radio-Frequency Identity Protocols Class-1 Generation-2 UHF RFID Version 2.1	software development
	Putty – SSH Client (http://www.putty.org)	software development

	Make sure the version of the document matches the software version of the reader, see https://www.kapsch.net/ktc/Portfolio/Products

8 The Reader

8.1 Functional Specification

The Kapsch RFID (Radio Frequency Identification) reader SRU-8X1X series is capable to read active and passive RFID tags in the frequency range from 865 to 868 MHz for Europe and 902 to 928 MHz for the American market. Based on the latest RFID standards, such as *EPC Gen2v2*/ISO 18000-63, the Kapsch SRU-8X1X series support all market leading transponder chip features for security, authentication and encoding. As supplied, the unit can read and write tags in accordance with the *EPC Gen2v2* standard.

It is possible to load additional protocols 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 either by a 4-pin M12 panel connector in A coding or by PoE+ according to 802.3at (10–57) [1].

The Kapsch UHF RFID reader system SRU-8X1X is characterized by great flexibility in regard to RFID applications. One reason for it is the wide variety of reading devices compatible to each other, which allows to select a reader from the Kapsch product portfolio ideally suited for the respective application. Another reason for this flexibility is the wide range of parameters for configuring the reader firmware.

8.2 Features

- basic computing module
- dual-core embedded PC
- 2 Ethernet ports, 1 Ethernet port (SRU-8211)
- GPIO
- PoE+
- LED visualization
- Wi-Fi (in preparation)
- Bluetooth (in preparation)
- 2G/3G (in preparation)

8.3 Scope of Delivery

- SRU-8X1X reader

1) Internal supply of GPIO VCC pin is not possible with PoE+

8.4 Accessories

An overview of the accessories available for the reader can be found in the document “Product range definition for SRU-8X1X RFID readers”. For more information, visit 3

our website at https://www.kapsch.net/ktc/Portfolio/Products

or contact us via email at ktc.office@kapsch.net and please refer to “Product Management” or

at our Headquarters office at Tel.: +43 50 811 0.

The document “Application Note Single Lane SRU-8110 RFID reader” describes how a RFID based roadside station for a single line respectively for a Plaza application can be built by means of the available RFID reader components.

The document “Application Note MLFF SRU-8110 RFID reader” describes how a RFID based roadside station for multi-lane free-flow applications can be built by means of the available RFID reader components.

8.4.1 Antennas

For use with UHF RFID antennas we recommend the antenna types summarized in the document “UHF RFID Antenna Overview”. These antenna types are available for all frequency ranges and are water proof according to at least IP 65 standard.

The document “UHF RFID Antenna Overview” also describes the applicable mounting accessories for the UHF RFID antennas.

9 Connections and Displays

Depending of the device variant, the reader has various connection options. The illustrations below shows an SRU-8110 standard reader with all its connection options. The following chapters provide details of the connections and the pin assignments of plugs and sockets.

9.1 Front View

Figure 2: SRU-8X1X – Displays

No.	Name	Function
①	*PWR*	indicates whether the reader is on; see also 12.4 Reading the PWR LED Indications
②	basic LEDs (A1-A4)	indicate if an RF signal is on for antennas 1–4 (default setting) ► For other functions of the basic LEDs, see 14.4.1 Selecting Functions
③	high-end LEDs1)	See 14.4 LED

Related topics

12.4 Reading the PWR LED Indications

14.4 LED

9.2 Rear View

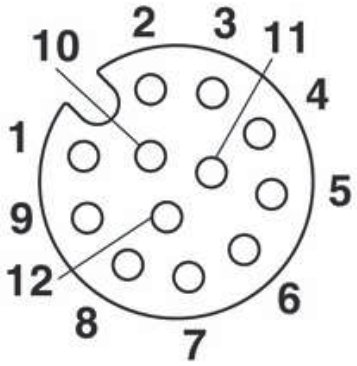
Figure 3: SRU-8X1X rear side

No.	Name	Function
①	ANT 4[1)]	R-TNC, 50 Ohm, to connect an antenna
②	ANT 3	R-TNC, 50 Ohm, to connect an antenna
③	ANT 2	R-TNC, 50 Ohm, to connect an antenna
④	ANT 1	R-TNC, 50 Ohm, to connect an antenna
⑤	GPIO	to detect external sensors and to control external actors; see also 14.6 GPIO Functions
⑥	PWR	to connect to a DC power supply, 10–30 V
⑦	LAN[2)]	second Ethernet port ● to connect to a sub network ● to connect external Ethernet devices
⑧	LAN/PoE	main Ethernet port with PoE+-connectivity ● to control the reader ● to provide power supply over Ethernet

1) In the SRU-8211 readers, there are only 3 antenna ports
2) Available for SRU-8110

9.2.1 GPIO

M12, A-coded, 12-pin, female



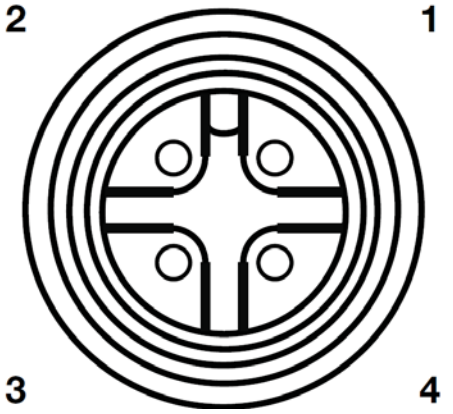
Pin	Allocation
1	OUT_CMN
2	OUTPUT_1
3	INPUT_3
4	INPUT_CMN
5	INPUT_1
6	GND
7	UB
8	OUTPUT_4
9	OUTPUT_3
10	OUTPUT_2
11	INPUT_2
12	INPUT_4

Related topics

14.6 GPIO Functions

9.2.2 Power Supply

The power supply is arranged as a four-pin round-pin plug with an M12 connection thread in A-coding. M12, A-coded, 4-pin, male

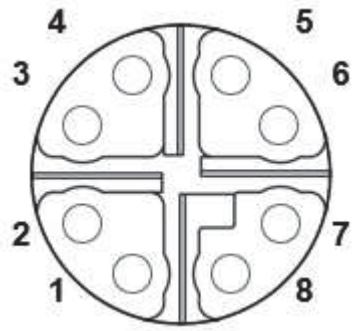


Pin	Allocation
1	+24 V DC
2	GND
3	GND
4	+24 V DC

!	Bear in mind that only power supply units with LPS (*Limited Power Source*) or NEC Class 2 power supply units 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 W.

9.2.3 Ethernet

	**NOTICE** Risk of malfunction! If other cables then specified are used, the communication with the reader is either interrupted or there is a malfunction. ► Only use shielded cables



Pin	Allocation
1	TX+ / PoE+1
2	TX- / PoE+1
3	RX+ / PoE+2
4	RX- / PoE+2
5	PoE+1
6	PoE+2
7	PoE+3
8	PoE+4

9.2.4 Buzzer

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

10 Installing the Reader

When the connections are plugged in, the device satisfies the protection class IP67.

10.1 **Selecting the Installation Site**

 	**WARNING** Danger to life from electric shock or fire hazard due to incorrect voltage, insufficient ventilation, moisture, direct sunlight, heat or naked flames! ► When installing the unit in cabinets or shelves, make sure there is sufficient ventilation. ► When selecting the installation location, make sure there is sufficient space around the unit for appropriate dissipation of the heat generated by the unit. ► Do not expose the unit to inadmissible heat or fire. ► Do not install the device close to the sources of heat, e.g. heating. ► Do not place anything with a naked flame on the device. ► Make sure that the maximum operating temperature from –20 to +55°C is not exceeded. ► Make sure that the support surface has a sufficient load-bearing capacity/strength.

	NOTICE Risk of material damage due to the screws screwed into the reader housing too deep! If the screws are screwed into the reader housing deeper than 10 mm, the housing is no longer water proof. ► When mounting the reader, make sure that the screws are screwed into the unit housing no deeper than 10 mm.

10.2 Installing the Reader

At the rear panel, the reader has threaded holes.

► See the drawing below for the dimensions of the holes.

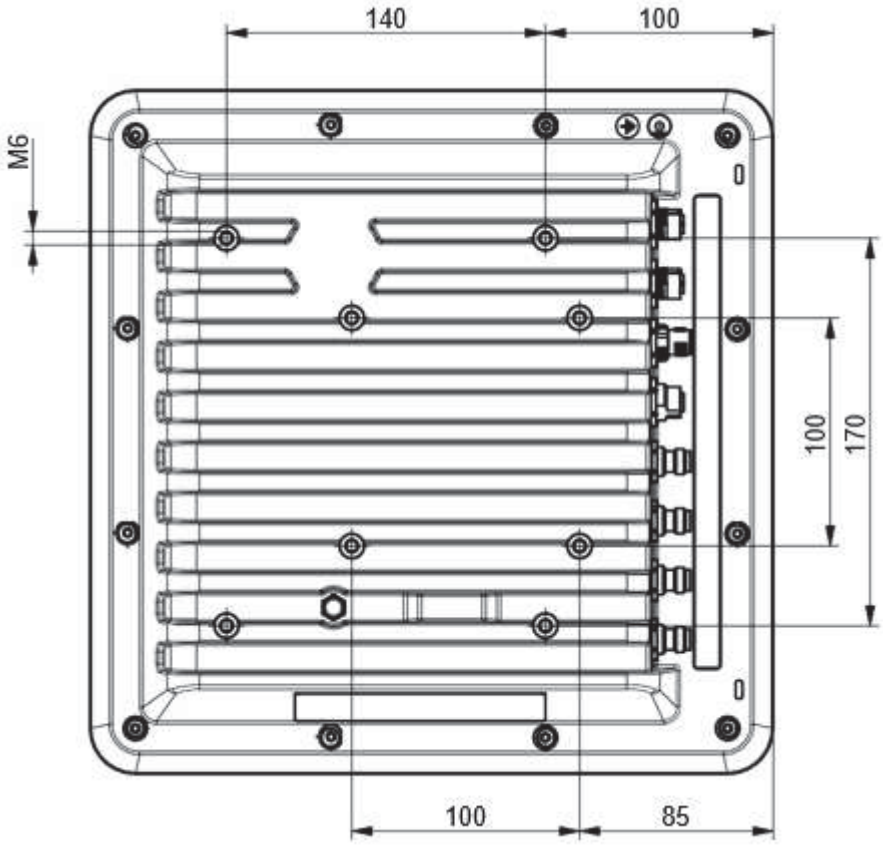


Figure 4: Dimensions, rear view

10.2.1 Wall Mounting

Recommended for SRU-8110, since no alignment is necessary.

10.2.2 Wall/Pole Mounting

Recommended for SRU-8211readers, because the alignment of the reader antenna unit is necessary.

For ease of installation, a bracket is available as an accessory to mount the reader on a wall (76000065210) or a mast (76000065210 and 76000065220). For a detailed overview of the available mounting kits and their corresponding order numbers see the document “Product Range Definition for SRU-8110 RFID Reader”.

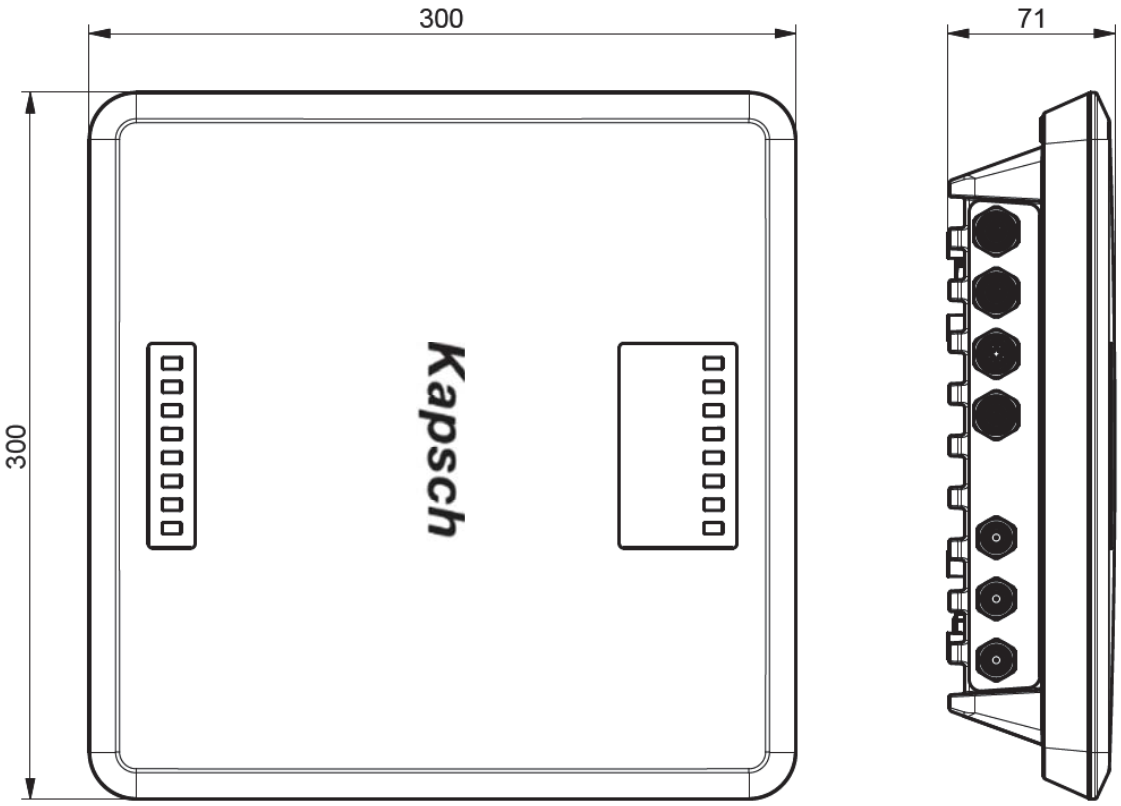


Figure 5 Dimensions, front and side view

11 Transmission Methods

11.1 Ethernet Transmission

The Ethernet transmission protocol supports both the previous RFID reader generation SRU-8100 and the current RFID reader generation SRU-8X1X.

A data transmission layer is used for communication to the Kapsch RFID reader over Ethernet, just like in serial communication. The data transmission layer over Ethernet is a much more simple solution here since the TCP/IP protocol already has a data security layer. As TCP/IP is a stream protocol, only the packet beginning and packet end are necessary.

There are 3 frame types in the protocol used in the SRU-8X1X readers. If no data have been received for 100 milliseconds within a frame, the received part frame is dismissed. The payload (D1 to Dn) is identical to the previous generation SRU-8100 payload.

11.1.1 Ethernet Transmission SRU-8100 Readers (previous generation)

Frame Set-up

A frame looks as follows:

Start + data block + end

The start is made up of *0xAA 0xBB 0x01 0x01*, whereby the first “1” is the Data-transmit byte and the second “1” is a Stuff-byte. The end is made up of *0xAA 0xCC*. If the byte *0xAA* appears in the RFID Reader Protocol frame, it must be doubled (*0XAA 0xAA 0xAA*).

Port

The TCP communication port is the port 4007.

Example

The frame *ASyncGetEPCs* is shown here as an example. The ID for this command is *0x0111*, which makes the frame look as follows:

0xAA 0xBB 0x01 0x01 0x11 0x01 0xAA 0xCC

Extended Block Structure

If a data block to be transmitted exceeds 16 kB, it is necessary to subdivide into several 16-kB blocks. These blocks receive a block number, and the first block contains the total data length. It is necessary to confirm the reception of each block by means of an answer.

First block:

Start + block number always 0 + 4-byte total data length + data block + end

All other blocks:

Start + block number + data block + end

Answer to confirm the reception:

Start + block number + end

The start consists of *0xAA 0xBB 0x0E 0x01*. The end consists of *0xAA 0xCC*. If the *0xAA* occurs in the RFID Reader Protocol frame, it is necessary to double it: *0xAA → 0xAA 0xAA*.

11.1.2 Ethernet Transmission SRU-8X1X Readers

Frame Set-up

Data Frame

5A 50 L1 L2 L3 L4 D1 … Dn A5

5A	start code
50	code for a data frame
L1 – L4	number of data bytes (D1 to Dn) in the data frame (32 bit; LSB first)
D1 – D4	data bytes to be transmitted (payload)
A5	end code

Ping

5A 5F A5

5A	start code
5F	ping code
A5	end code

Response to Ping

5A 5F A5

5A	start code
5F	ping response code
A5	end code

Port

The communication takes place via the TCP port 4007 as in case of SRU-8100 readers.

Example

The frame *ASyncGetEPCs* is shown here as an example. The ID for this command is *0x0111*, which makes the frame look as follows:

0x5A 0x50 0x02 0x00 0x00 0x00 0x11 0x01 0xA5

Extended Block Structure

If a data block to be transmitted exceeds 16 kB, it is necessary to subdivide into several 16-kB blocks. These blocks receive a block number, and the first block contains the total data length. It is necessary to confirm the reception of each block by means of an answer.

First block:

Start + block number always 0 + 4-byte total data length + data block + end

All other blocks:

Start + block number + data block + end

Answer to confirm the reception:

Start + block number + end

The start consists of *0xAA 0xBB 0x0E 0x01*. The end consists of *0xAA 0xCC*. If the *0xAA* occurs in the RFID Reader Protocol frame, it is necessary to double it: *0xAA → 0xAA 0xAA*

12 Connecting the Reader

12.1 Connecting Digital Inputs and Outputs

The activation and evaluation of the inputs and outputs is carried out using the *ReaderStart V3* software, with the DLL supplied or by access to the reader protocol.

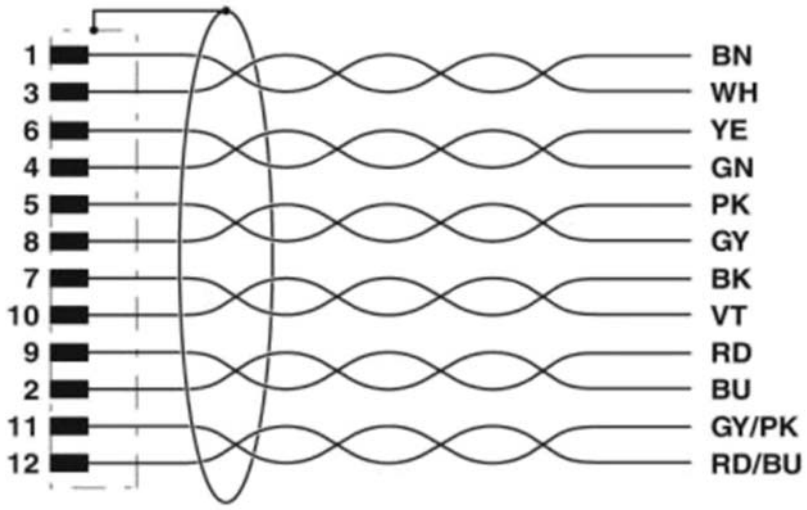


Figure 6 Allocation of the GPIO interface cable

The digital inputs and outputs are provided via a 12-pin sockets in A-coding with M12 connection threads. The inputs are electrically isolated 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.

If the electrical isolation is not required, the power to the input can also be supplied by the reader via pin 6 and 7 see 9.2.1 GPIO.

The outputs are also DC-isolated from the power supply of the reader and have a common pin (OUT_CMN). If the electrical isolation is not required, the power supply can also be taken directly from the reader.

	**NOTICE** **Risk of malfunction!** ► 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. If the auxiliary voltage of the GPIO port of the reader is used, the load can be 1.1 A as a maximum. The inputs and outputs are designed for 30 V DC max. ► For further information, see the reader data sheet. ► Bear in mind that LPS or NEC Class 2 classified power supplied units can be used for the operation of the outputs

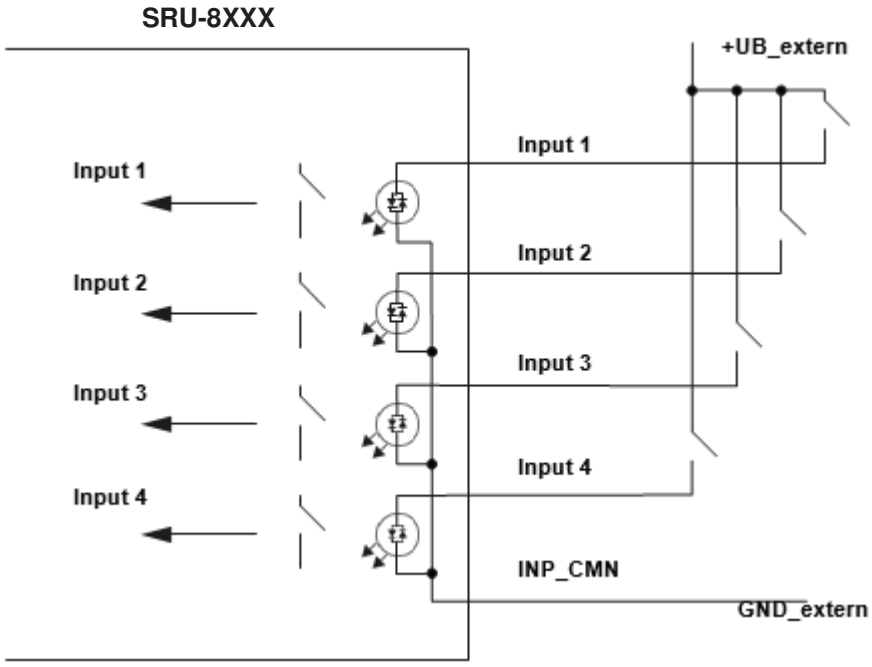


Figure 7 DC-isolated inputs

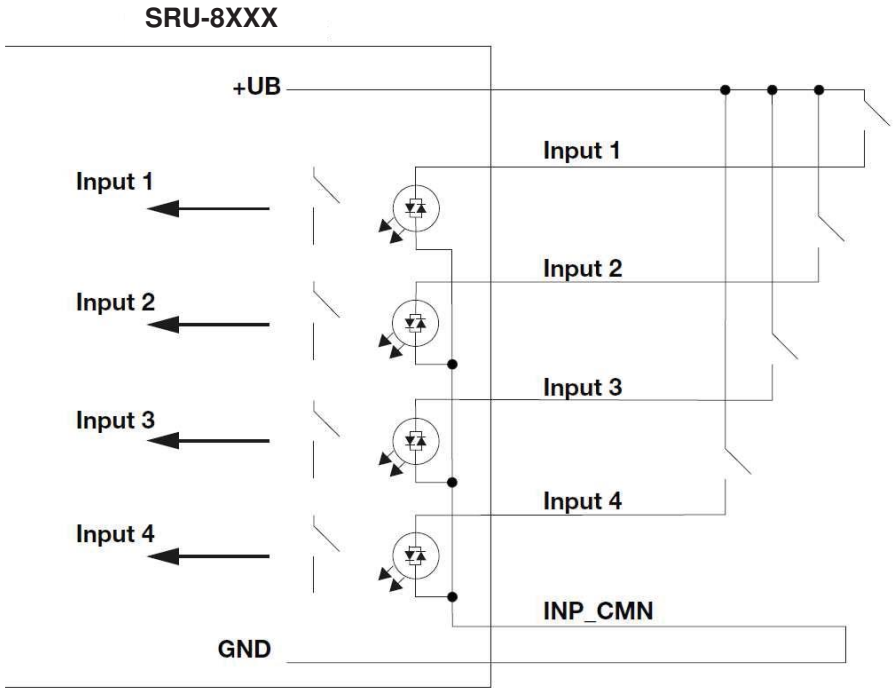


Figure 8 Inputs, not DC-isolated

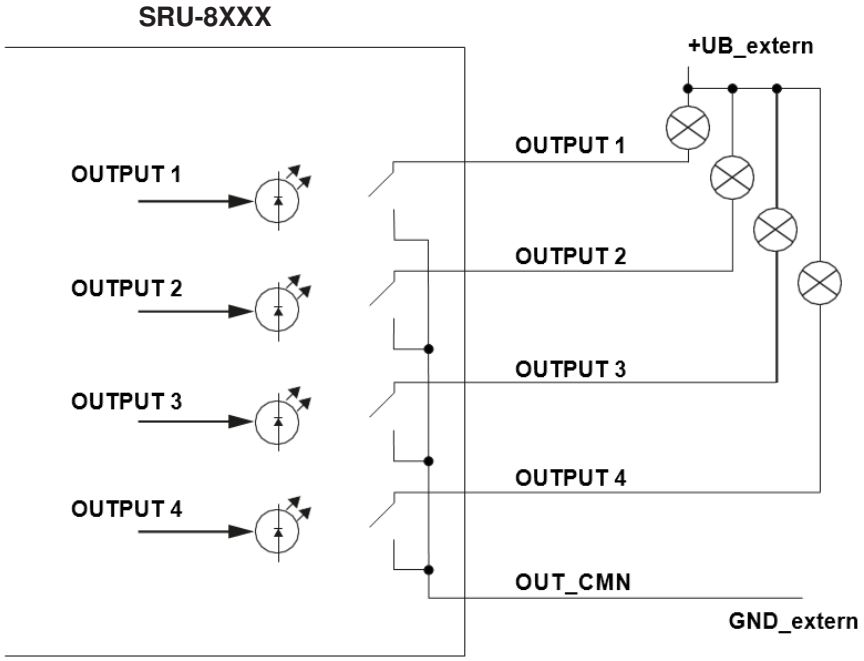


Figure 9 Output, DC-isolated

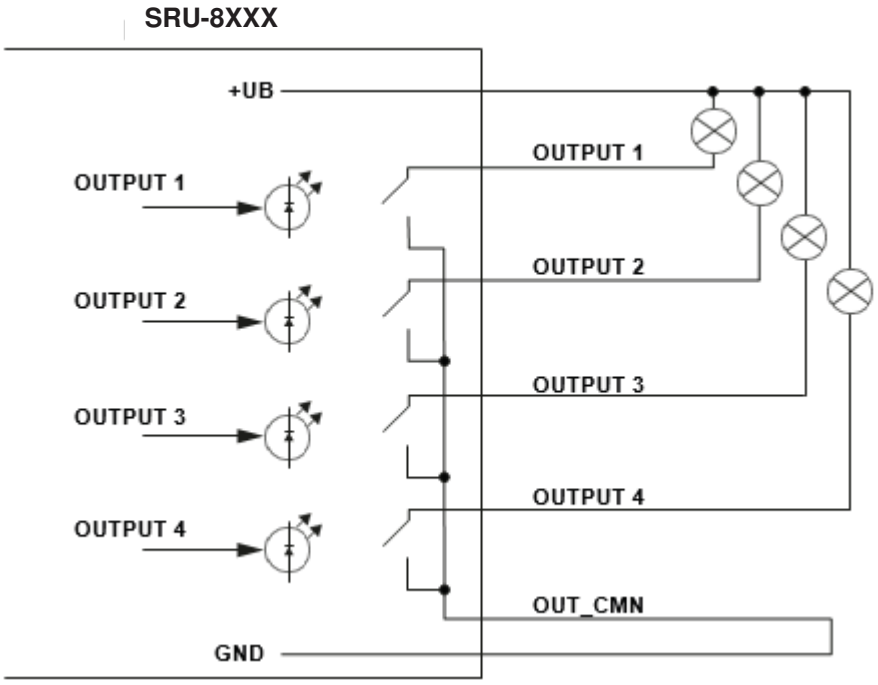


Figure 10 Outputs, not DC-isolated

12.2 Connecting the Antenna

	**NOTICE** **Risk of malfunction!** When using a cable not suitable for the impedance of 50 Ohm, the performance of the reader will be severely limited by the mismatch. If the mismatch is large, the reader may indicate a fault. ► Only use cable suitable for the impedance (50 Ohm).

For the connection to the RFID antennas, the reader has four antenna connections that are of the reverse TNC design.

► Only use the cable from the accessories or equivalent cable for this connection.

12.3 Turning the Reader On and Off

► Connect the reader to the power supply via a *PWR* or to a PoE source according to the 802.3at standard via *LAN /POE* input.

⇨ The reader is on.

12.4 Reading the PWR LED Indications

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:

LED	Action	Meaning
yellow	on	the unit is booting
green yellow	on flashing approx. every 8 seconds	unit is on, normal operation with heartbeat
yellow green	on flashing approx. every 8 seconds	error during booting

Tipp	The SRU-8110 readers have additional 4 LEDs (green/red/red/green) in the antenna cover which can be controlled by means of the software.

13 Operating ReaderStart Software

The reader can be operated using the ***ReaderStart*** software. The software provides all the necessary functionality of the reader for a test in a real environment. As an aid to configuration, various basic settings for application scenarios are available.

► For the current version of the *ReaderStart*, go to our support portal at
https://www.kapsch.net/ktc/Portfolio/Products

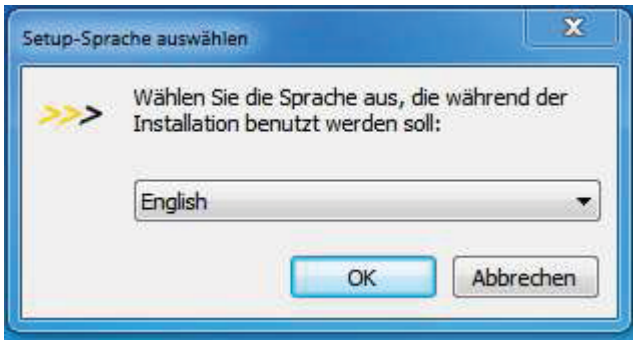
13.1 System Requirements

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

Processor:	X86-compatible
Memory:	512 MB RAM
Operating system:	Windows XP (SP3), Vista (SP1), Windows 7 or higher
Free hard disk memory for:	
- 32-bit operating system:	850 MB (including Microsoft .Net Framework 4)
- 64-bit operating system:	2 GB (including Microsoft .Net Framework 4)

13.2 Installing the Software

Tipp	The setup and the *ReaderStart* software might look different, depending on the operating system and the software version. The following images show the installation of the *ReaderStart V3*. During the installation, it is checked whether the necessary requirements for the installation are met, i.e. 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 software and the DLL for controlling the reader are installed.



1. Download the ReaderStart software at
   https://www.kapsch.net/ktc/Portfolio/Products
2. Extract the downloaded zip file.
3. Double-click on the ReaderStart_v3_Setup.exe file.

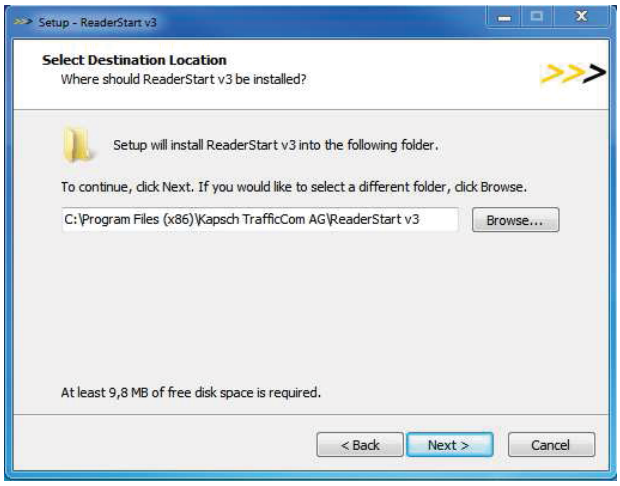
⇨ The following screen with the option to select the language used during the installation appears.

4. Select a language between *German* and *English*
5. Click *OK* to confirm the selection

⇨ The screen on the left appears. It shows additional information on the exact version of the *ReaderStart* software.

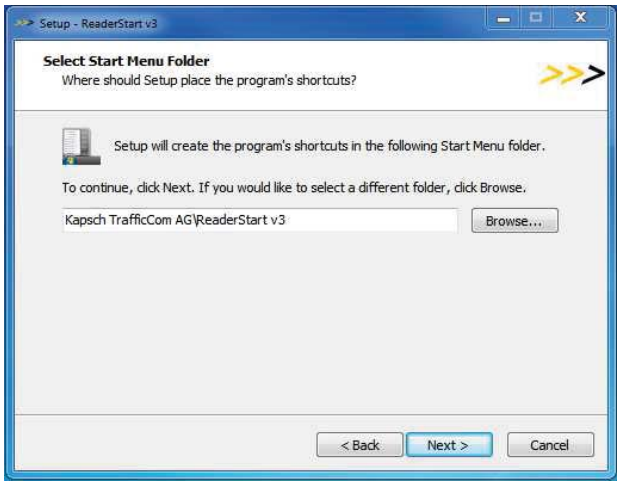
Tipp	After the *ReaderStart* software has been installed, it is possible to access this information in the *Info* drop-down menu in the task bar.

6. Click on *Next* to continue or *Cancel* to exit the setup



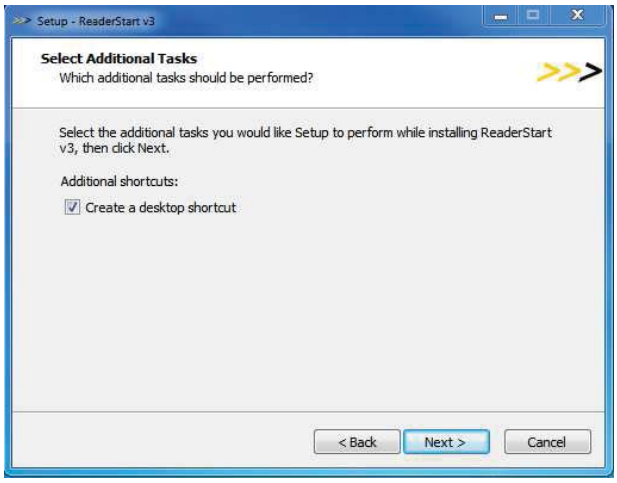
⇨ If you have accepted the license agreement in Step 7 the window on the left appears.

7. Select the destination file for the software to be installed



8. Click *Next.*

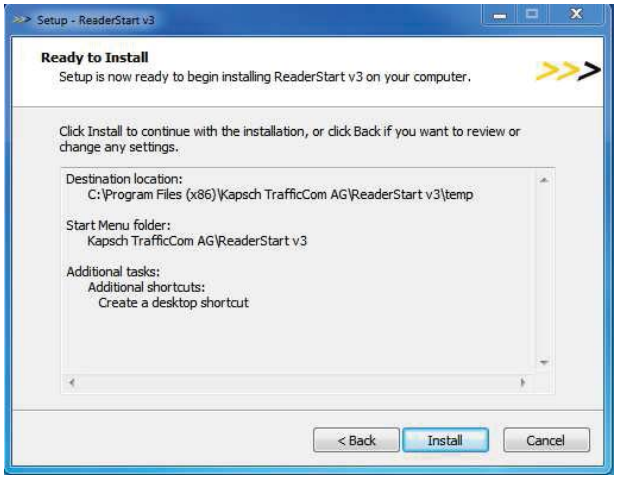
⇨ The screen on the left appears. The standard settings are displayed. It is possible to customize the folder in the Windows start menu.



9. Click *Next*

⇨ The screen on the left appears.

10. Tick the box *Create a desktop icon* if you would like to include the icon in the Windows Quick Launch/on the desktop. The default setting is to create no icons

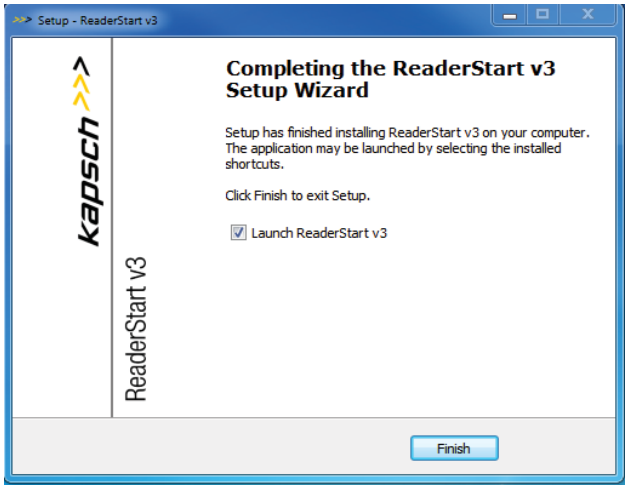


11. Click *Next*

⇨ The summary of all the installation tasks appears.

12. Click *Install* to start the installation.

13. If during the installation the software requests to restart the computer, do so



⇨ If the *ReaderStart* has been installed, the screen on the left appears.

14. If you do not want to start the ReaderStart SW immediately, uncheck the *Launch ReaderStart v3* box. Other- wise, the program will automatically start once clicking on *Finish*

13.3 Connecting the Reader in the *ReaderStart* Software

13.3.1 Requirements

From reader firmware version 2.04, the reader in the ex-works condition has the IP address *192.168.0.1* and the network mask *255.255.255.0*. Earlier reader firmware versions are configured for DHCP.

► To integrate the reader into a corporate network, contact your administrator so that he can allocate you a spare IP address and assign the correct network mask.

Alternatively, it is possible to configure the reader to obtain an IP address automatically. For this service, referred to as DHCP, it is necessary to have an appropriate DHCP server operating in the network.

► For more information, contact your network administrator.

► Make sure that the IP addresses of the control computer and the reader are in the same IP range but are not the same. Ensure that the network mask is identical.

13.3.1.1 Establishing the Connection to the Reader

There are two ways to establish the connection to the reader:

- by entering the IP address to communicate directly with the reader;
  see 13.3.1.2 Establishing the Connection via an IP Address or
- by using the reader's host name;
  see 13.3.1.3 Establishing the Connection Using a Host Name.

► Start the program.

⇨ The splash screen is shown until all the necessary

DLLs have been loaded in the background (see figure on the left).

⇨ After that, the user interface appears. It consists of the menu bar, the tabs and the status field:

Figure 11 Establishing connection to the reader

13.3.1.2 Establishing the Connection via an IP Address

1. Click the *IP address* field (① in Figure 11.
2. Enter the IP address.

13.3.1.3 Establishing the Connection Using a Host Name

1. Click the *Name* field (② in Figure 11.
2. Enter the host name of the reader.

If you do not know the name of the reader, click *Search for Readers*.

⇨ The readers found in the network are shown with their names, see ⑤ in Figure 12

Tipp	► To allow only secure SSH connection with an encrypted transmission to the reader, check the box next to the lock symbol (④ in Figure 11); see also 14.1.1.1 Establishing a Secure Connection

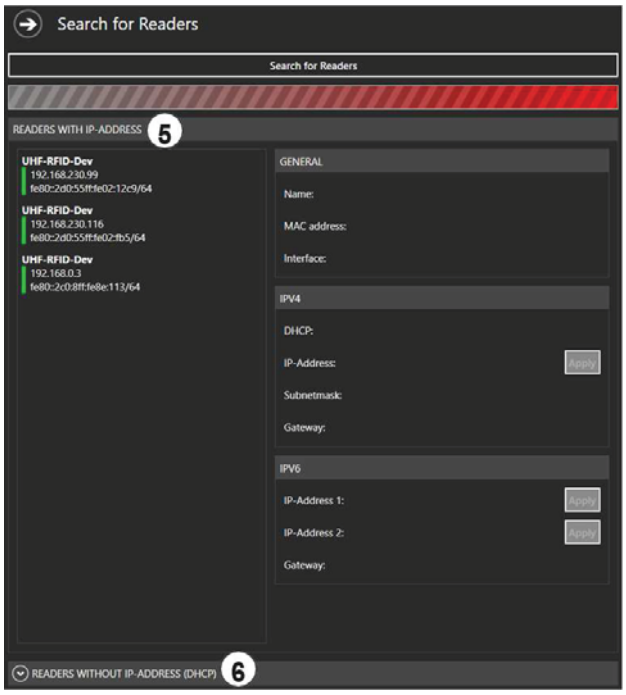


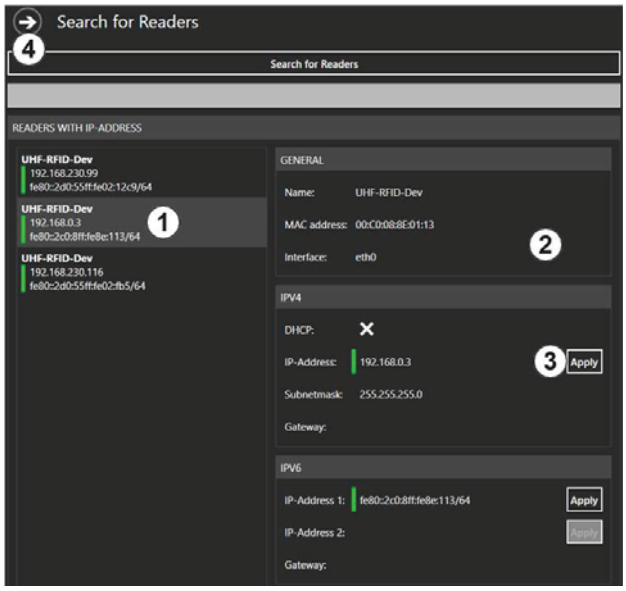
Figure 12 Establishing connection to the reader: search for readers

	The following steps describe establishing the connection for readers with an IP address.

3. In the Ethernet block, click Search for Readers (③ in Figure 11).

⇨ The screen on the left appears.

4. Select a reader under Readers with IP Address (⑤ in the figure on the left).
5. If there have been 2 or more DHCP requests sent by the reader, the Readers without IP Address (DHCP) field (⑥) is expanded. Then it is possible to assign the IP address to the reader.



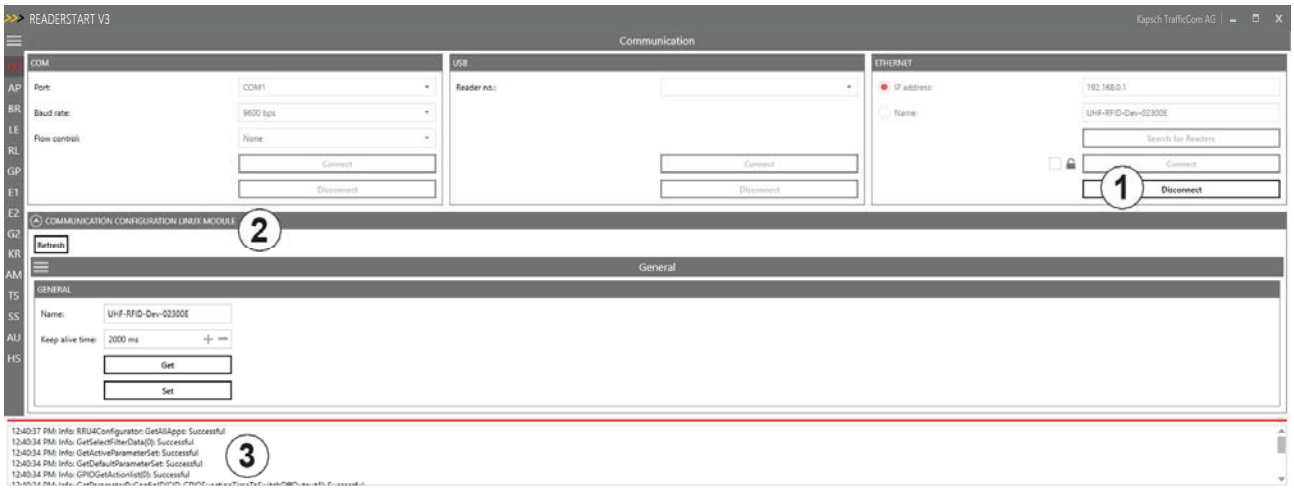
⇨ The view on the screen changes. The selected reader has a grey background (① in the figure on the left) and on the right (②), the properties of the reader are shown.

6. To close this pop-up screen, click Apply (③) or on the arrow (④).

⇨ The user interface returns to the main view. In the Ethernet block, the IP address (① in the figure on the left) and the reader type (②) are shown.

7. Click Connect to connect the reader.

⇨ In the Ethernet block, the Search for Readers and Connect buttons are greyed out. It is possible to disconnect the reader by clicking Disconnect (① in the figure below). The Communication Configuration Linux Module (②) and status messages from the reader/ program are shown in the status field (③).



13.4 Navigating in the *ReaderStart* User Interface

Figure 13 *ReaderStart* user interface

The user interface of the *ReaderStart* consists of the following sections:

- menu bar (①); see 13.4.1 Menu Bar
- settings and controls for the reader, divided into individual functional groups and situated under different tabs (②) and the contents of the tab (③), displayed in the central part of the screen; see 14 Operating the Reader Using the ReaderStart Software

status field containing messages from the reader and the program (④); see 0

- Status Field

Tipp	The contents of the tabs are considerably large and are, therefore, described in a separate chapter; see 14 Operating the Reader Using the ReaderStart Software

13.4.1 Menu Bar

By means of the menu bar, it is possible to customize the program to the user's requirements.

13.4.1.1 File

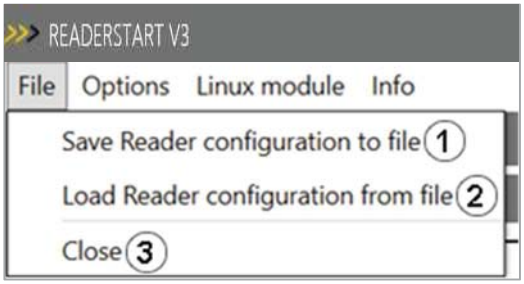


Figure 14 Menu bar: file

①	*Save reader configuration to file*	saves reader configuration in an XML file
②	*Load reader configuration from file*	loads reader configuration from a previously saved XML file
③	*Close*	closes *File*

13.4.1.2 Saving Reader Configuration to File

There is a wide variety of parameters available for configuring the RF front end. It is possible to save the complete setting as a parameter set in an XML file under *File* ► *Save reader configuration to file* and to load it later.

► Under *File*, click *Save reader configuration to file.*
⇨ The following window appears:

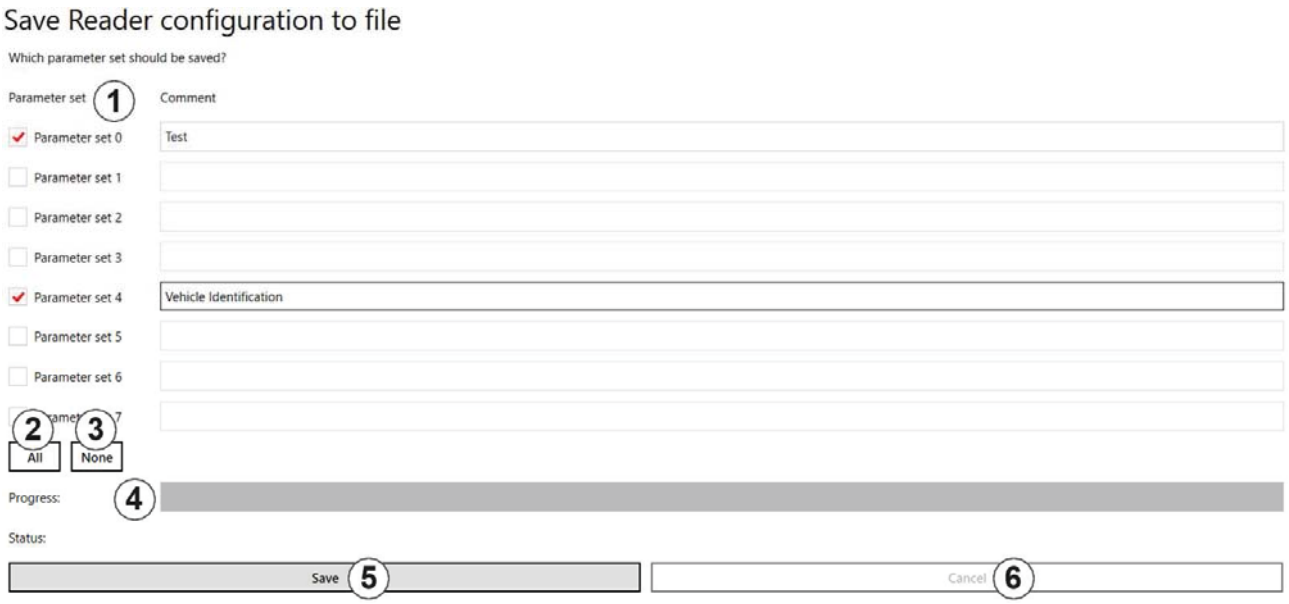
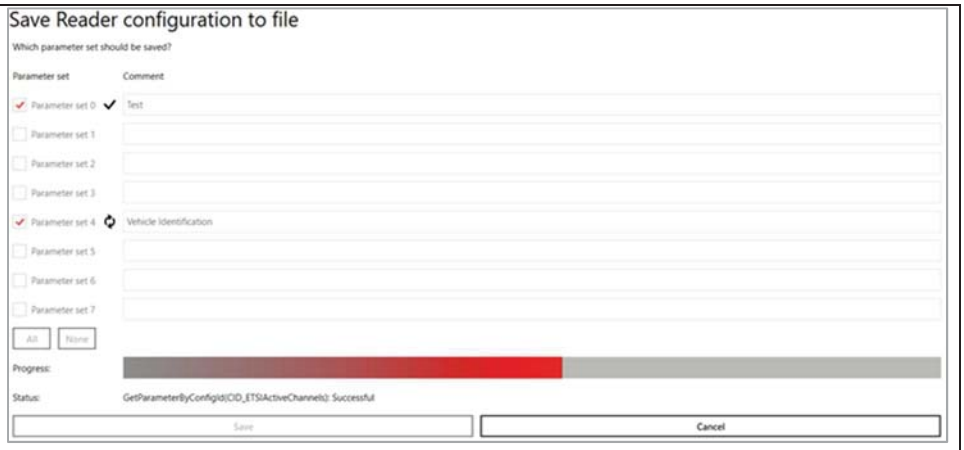


Figure 15 File: save reader configuration to file

①	*Parameter set*	all available parameter sets from 0–7 ► Click the check box to select or unselect the parameter set. ⇨ The selected parameter set is marked with a tick. If the parameter is not selected, the check box is empty.
②	*All*	selects all parameter sets from 0–7
③	*None*	unselects all parameter sets from 0–7
④	*Progress*	shows the progress of the save operation by means of the progress bar; see also Save, p. 41

⑤	*Save*	opens a pop-up window to select the directory in which the configuration file in the XML format will be saved and the file name for it To save reader configuration to file: The parameter sets have been selected/unselected and described. Click *Save*. ⇨ A dialogue appears. Select the file name and the directory in which the configuration file will be saved. Click *OK*. ⇨ The progress bar (④) shows the progress of the save operation:

		 ⇨ After the file has been saved, a pop-up message *Save reader configuration to file Saving done* appears. Click *OK* to close the pop-up message. ⇨ The software returns to the view shown in Figure 15 Click the *X* at the top right-hand corner or press *Escape* on your PC keyboard to leave the dialogue.
⑥	*Cancel*	cancels the saving process

13.4.1.3 Loading Reader Configuration from File

► Under *File*, click *Load reader configuration from file.*

⇨ The following window appears:

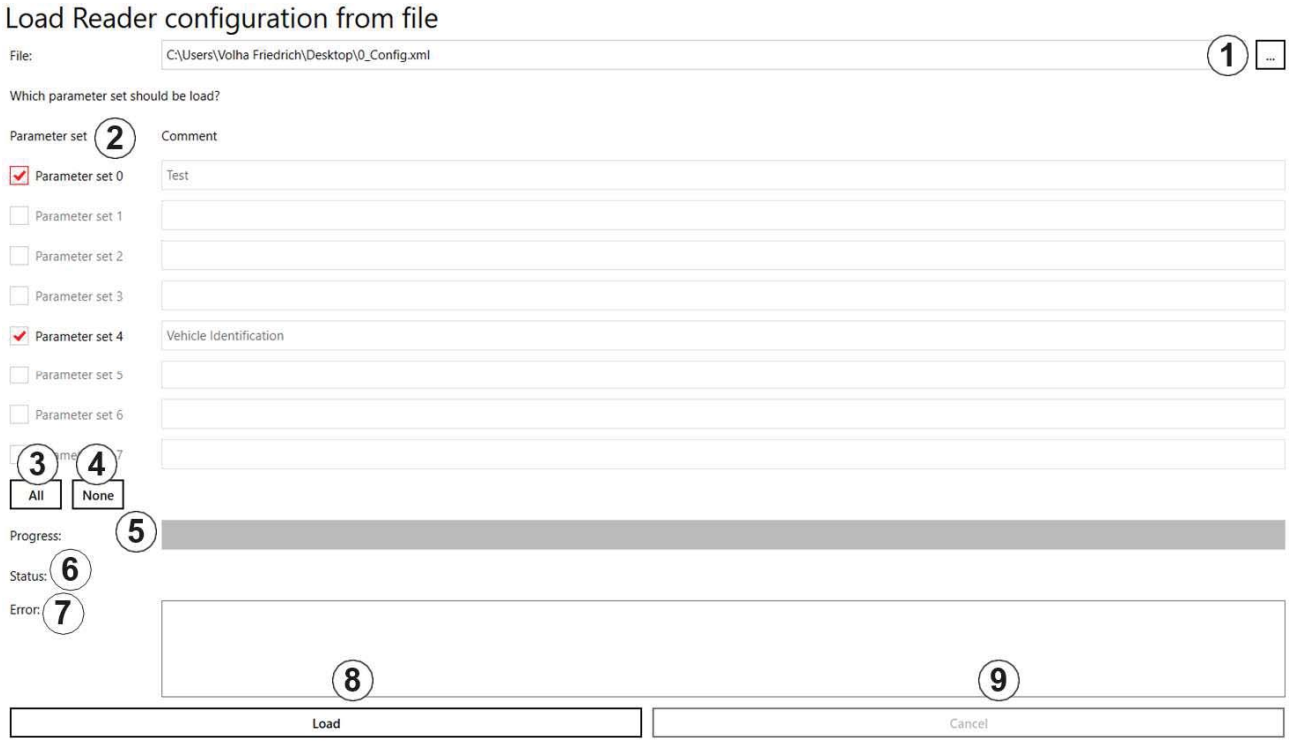
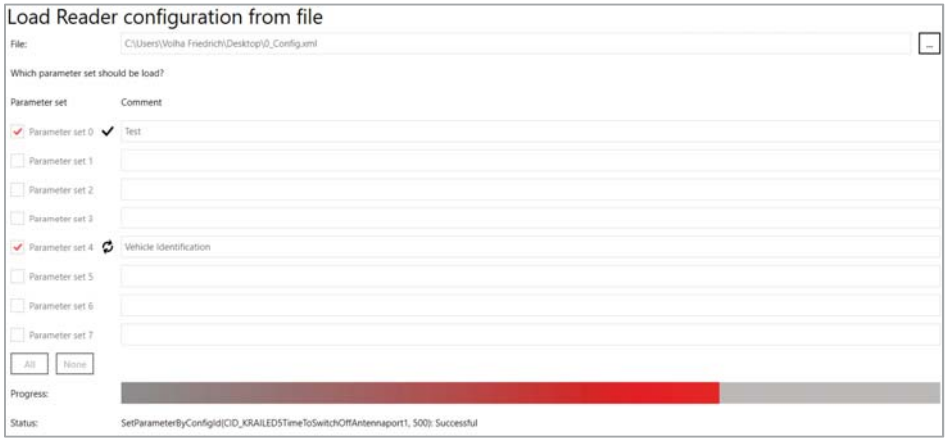


Figure 16 File: load reader configuration from file

①	*File*	opens a dialogue to select the configuration file To load reader configuration to file: 1. Click *File* (④ in Figure 16). ⇨ A dialogue appears. 2. Select the directory and the configuration file from which the parameter sets will be loaded. 3. Click *Open*. ⇨ The parameter sets saved in the configuration file are loaded and are marked with a red tick. ⇨ The progress bar (⑤) shows the progress of the save operation.
②	*Parameter set*	see *Parameter set*
③	*All*	see *AllAllAllAllAllAllAll*
④	*None*	see *None*
⑤	*Progress*	shows the progress of the load operation by means of the progress bar
⑥	*Status*	shows the status of the *SetParameterByConfigID* parameter
⑦	*Error*	shows errors in the *SetParameterByConfigID* parameter

⑧	*Load*	loads the selected parameter sets to the reader ✓ The parameter sets to be loaded have been selected/unselected. 1. Click Load. ⇨ The progress bar (④) shows the progress of the save operation:  ⇨ After the configuration has been loaded, a pop-up message Load reader configuration from file Loading done appears. 2. Click OK to close the pop-up message. ⇨ The software returns to the view shown in Figure 16 3. Click the X at the top right-hand corner or press Escape on your PC keyboard to leave the dialogue.
⑨	*Cancel*	cancels the loading process

13.4.1.4 Close

► Click *Close* to close the *ReaderStart*

13.4.1.5 Options

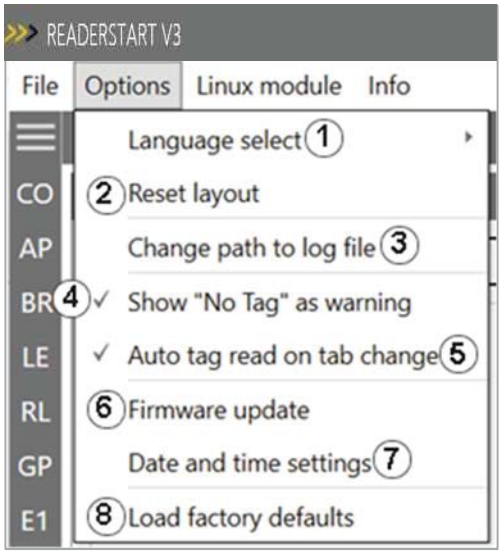


Figure 17 Options

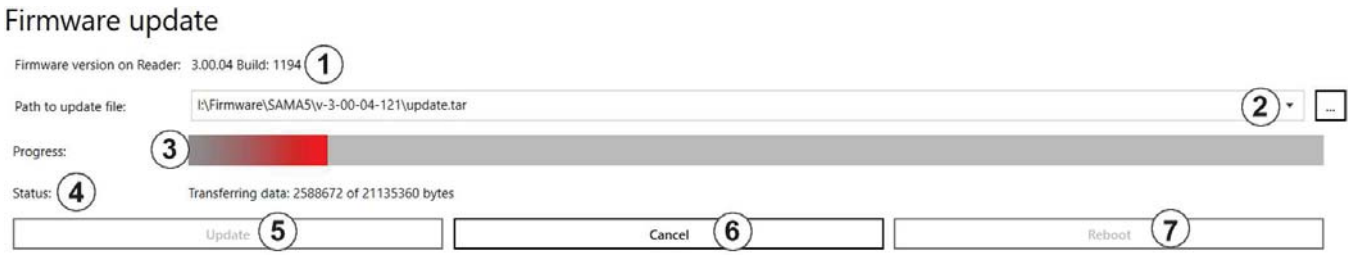
①	*Language select*	selects the user interface language between ***English*/*German*/*Spanish*/*French*** 1.) Click ***Language select*** (① in Figure 17). ⇨ The four languages are shown. The language applied in the user interface is marked with a tick. 2.) Click on the desired language. ⇨ A pop-up message appears: ***Question. Please restart the program to apply changes. Restart now?*** 3.) Click ***Yes*** to restart the program and change the language or Click ***No*** to cancel the changes. ⇨ If you have pressed ***Yes***, the program restarts and the language of the user interface has been changed.
②	*Reset layout*	resets the sequence of the tabs to default settings and reduces the size of the program to the window size
③	*Change path to log file*	opens a dialogue to create a new folder/select a new directory to save logs
④	*Show "No Tag" as warning*	activates or deactivates the warning (yellow) in the status field if no tag has been detected in the antenna field; see 0 0 Status Field If this parameter is not checked, the absence of the tag is shown as error (red) in the status field; see 0 0 Status Field

⑤	*Auto tag read on tab change*	activates or deactivates reading tags after the tab change
⑥	*Firmware update*	updates the reader firmware; see 13.4.1.6 Updating Firmware
⑦	*Date and time settings*	sets date, time and time zone on the reader; see 13.4.1.7 Changing Date and Time Settings
⑧	*Load factory defaults*	loads factory default settings onto the reader; see 13.4.1.8 Loading Factory Default Settings

13.4.1.6 Updating Firmware

1. Click **Firmware update**.

⇨ A dialogue appears. ① shows the current firmware version.



2. Click on the box at ***Path to update file*** (②).

⇨ A dialogue opens to select the file with the current firmware.

3. Having selected the update file, click ***Update*** (⑤).

⇨ The reader firmware is being updated. The update progress is shown by means of the progress bar (③). The status (④) shows what the software is currently performing, e.g. **Preparing, Transferring data: 2588672 of 211353360 bytes, Flashing .**

Click ***Cancel*** (⑥) to stop the update process.

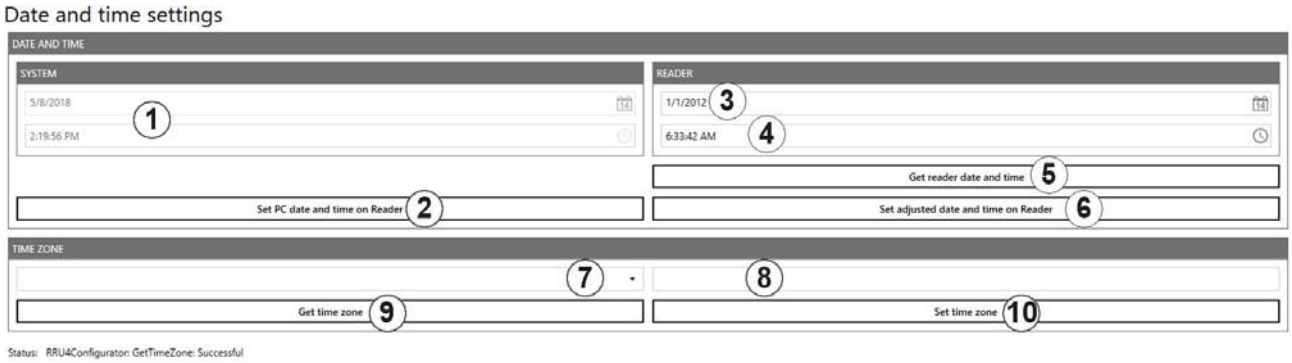
4. After the update has been completed, click ***Reboot*** (⑦) to restart the reader

13.4.1.7 Changing Date and Time Settings

The reader has an integral clock which can deliver the time stamp for a tag operation. It is possible to set the clock using ***Date and time settings*** under ***Options*** in the menu bar. When this menu item is opened, it automatically reads the current date and time from the reader and compares this 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.

1. Click **Date and time settings**.

⇨ A dialogue appears. It automatically reads the current date and time from the reader (③ and ④) and compares them with the date and time from the host computer (①).



①	Date and time of the *ReaderStart SW*	shows the date and time of the *ReaderStart* software; cannot be changed
②	*Set system date and time on reader*	loads the system date and time shown in ① onto the reader
③	Current date of the reader	shows the current date of the reader 1. To change the reader's date, either type the new date into the line or click on the calendar symbol in the line and select the date. 2. Click *Set adjusted date and time on reader*.
④	Current time of the reader	shows the current date of the reader 1. To change the reader's time, either type the new time into the line or click on the clock symbol in the line and select the time. 2. Click *Set adjusted date and time on reader*.
⑤	*Get reader date and time*	reads the current date and time from the reader and displays them in ③ and ④
⑥	*Set adjusted date and time on reader*	sets the adjusted date and time on reader; see ③ and ④
⑦	Time zone selection	selects the time zone 1. Click on the drop-down menu symbol (⑦). 2. Select the continent and the city. ⇨ The time zone is displayed at (⑧).
⑧	*Get time zone*	reads the time zone currently set in the system
⑨	*Set time zone*	sets the time zone selected at ⑦

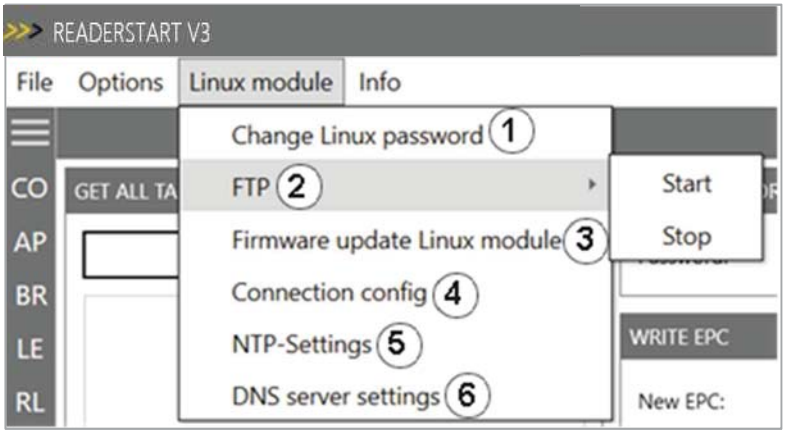
13.4.1.8 Loading Factory Default Settings

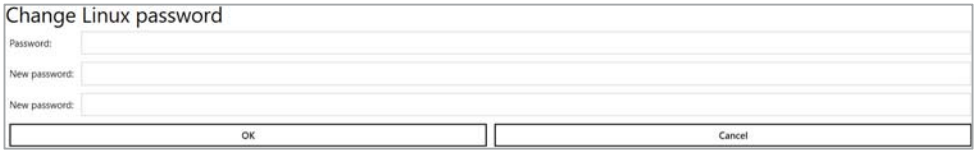
1. Click **Load factory defaults**.

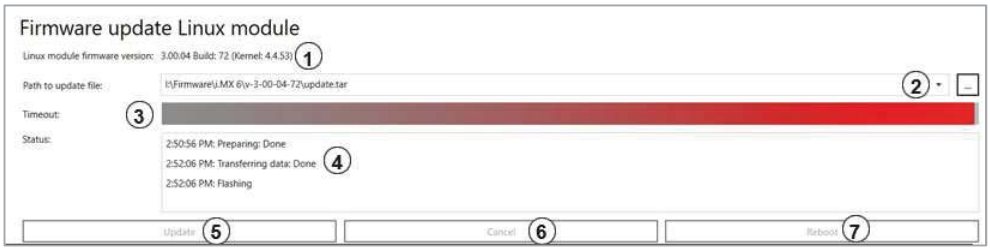
⇨ A pop-up message appears: ***Are you sure to load factory defaults****?*

2. Click ***Yes*** to load factory default settings or Click ***No*** to cancel the operation.

13.4.1.9 Linux Module



①	*Change Linux password*	changes the Linux password 1. To change the password, click *Change Linux password*. ⇨ The following pop-up window appears:  2. Type in the old password. 3. Type in the new password. 4. Confirm the new password. 5. Click *OK* to change the password or Click *Cancel* to stop the process.
②	*FTP*	*Start* starts FTP server
		Stop stops FTP server

③	*Firmware update Linux module*	updates Linux module firmware ► Proceed as described in 13.4.1.6 Updating Firmware Make sure to select the file to update the Linux module firmware at *Path to update file* (②). 
④	*Connection config*	configures the secure connection and the backward compatibility  ① ► Check Allow only secure connection so that all connections are secure. ② activates or deactivates compatibility to Generation 2 Reader protocol ③ reads the current secure connection and backward compatibility configuration ④ sets the secure connection and backward compatibility configuration
⑤	*NTP settings*	enters a preferred NTP[1)] server; see 13.4.1.10 Changing NTP Settings
⑥	*DNS server settings*	changes DNS server settings; see 13.4.1.11 Changing DNS Server Settings

[1)] Network Time Protocol

13.4.1.10 Changing NTP Settings

To simplify the time setting, it is possible to enter a preferred NTP server. This way, in a defined interval, the reader retrieves the information from the NTP server and gets the time from the network, thus setting the internal time settings of the reader.

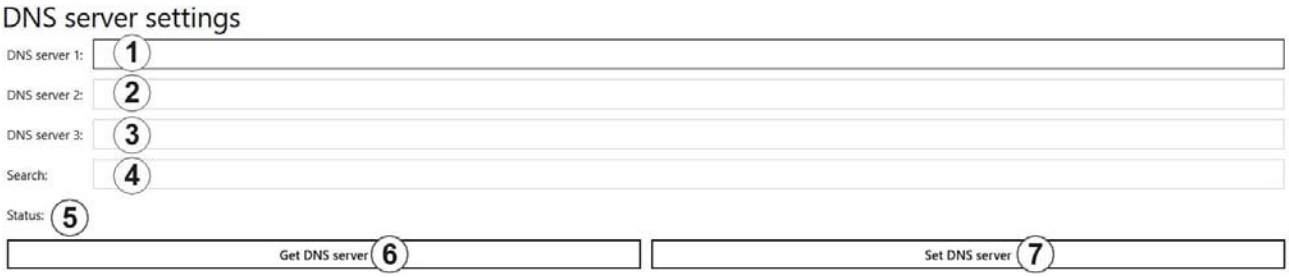
► Click **NTP settings** (②).

⇨ The following dialogue opens

①	*NTP server*	enters an NTP server address, e.g. 0.pool.ntp.org
②	*Interval*	sets the interval in the range 0–4204967295 s to synchronize the time with the NTP server
③	*Time*	shows the current date and time of the reader
④	*Status*	shows the status of the last performed operation in the *NTP settings* dialogue
⑤	*Get NTP server*	reads the NTP server settings currently set in the system
⑥	*Set NTP server*	sets the NTP server selected at ①
⑦	*Get interval*	reads the interval currently set in the system
⑧	*Set interval*	sets the interval selected at ②
⑨	*Get time*	gets the current time of the reader
⑩	*Set time via NTP*	manually synchronizes the time with the NTP server

13.4.1.11 Changing DNS Server Settings

► Click DNS server settings (②).



⇨ The following dialogue opens.

①	*DNS server 1*	enters the DNS server address
②	*DNS server 2*	enters the DNS server address
③	*DNS server 3*	enters the DNS server address
④	*Search*	contains the local domain name
⑤	*Status*	shows the status of the last performed operation in the *DNS server settings* dialogue
⑥	*Get DNS server*	reads the DNS server settings currently set in the system
⑦	*Set DNS server*	sets the DNS server

13.4.1.12 Info

This menu item provides information about the *ReaderStart* software and the reader.

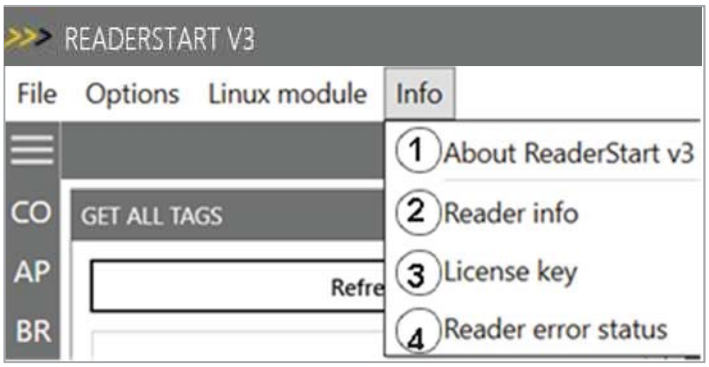
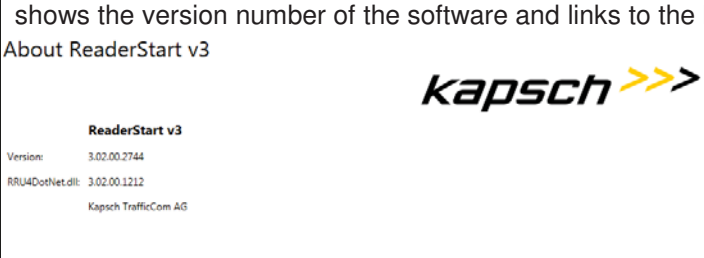
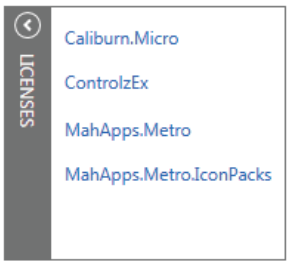


Figure 18 Info

①	*About Reader-Start v3*	shows the version number of the software and links to the licenses  
②	*Reader info*	shows information about the reader; see 13.4.1.13 Showing Reader Information
③	*License key*	automatically reader the license key and show various factory-set reader parameters; see 13.4.1.14 Showing License Key Information
④	*Reader error status*	reads the error status of the reader and shows all errors that are outstanding in the status field

13.4.1.13 Showing Reader Information

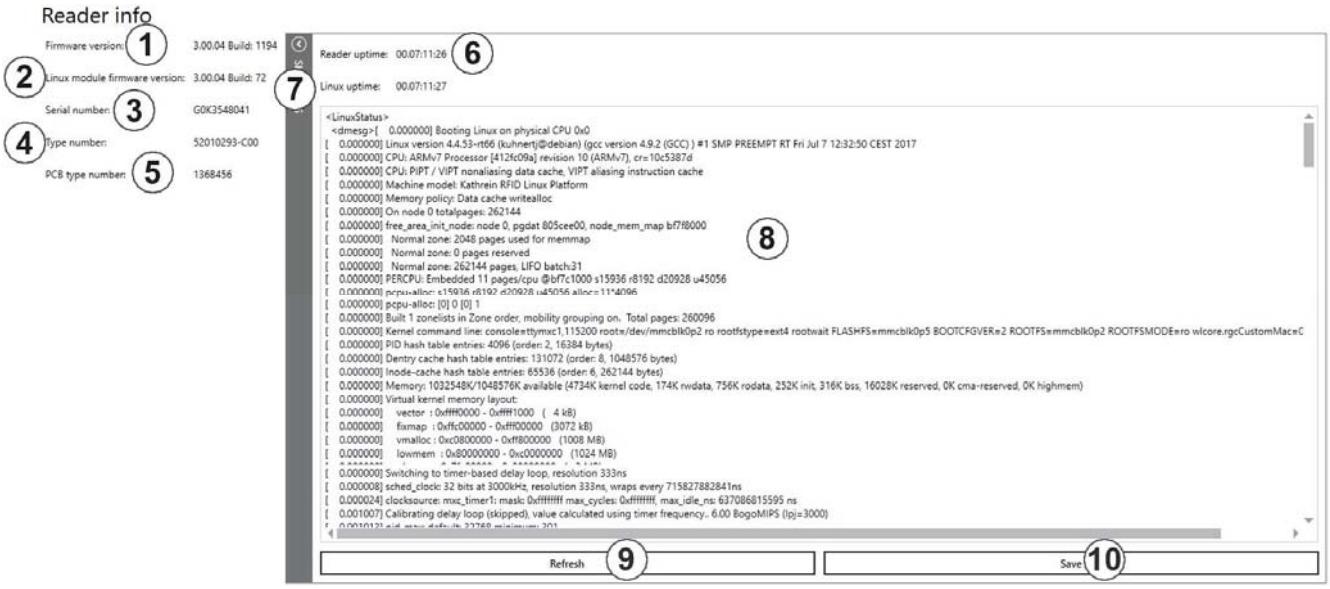


Figure 19 Info: reader info

①	*Firmware version*	shows reader firmware version
②	*Linux module firmware version*	shows Linux module firmware version
③	*Serial number*	shows the reader's serial number
④	*Type number*	shows the reader's type number
⑤	*CPU module*	shows the CPU module number
⑥	*Reader uptime*	shows time during which the reader has been running
⑦	*Linux uptime*	shows time during which the Linux module has been running
⑤	*Details*	shows details about the reader
⑨	*Refresh*	updates the reader and Linux uptime
⑩	*Save*	saves the reader info in an XML file

13.4.1.14 Showing License Key Information

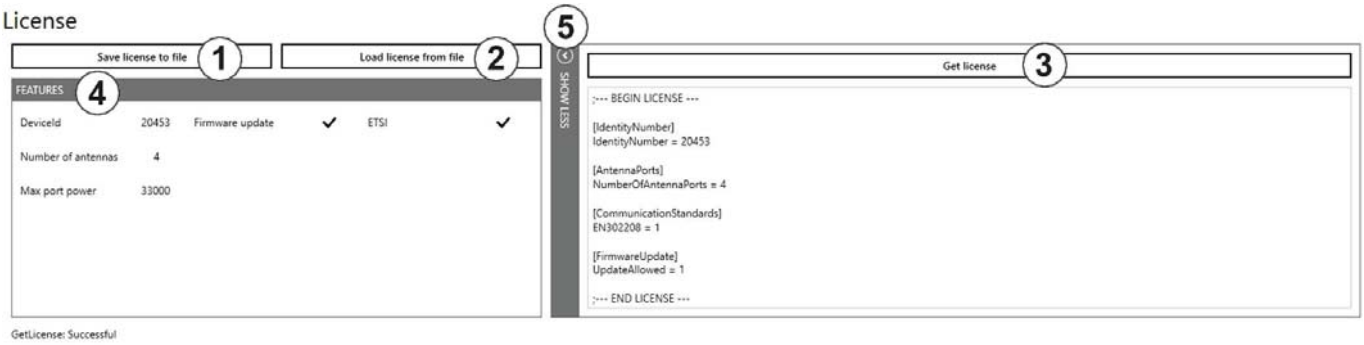


Figure 20 Info: license key

①	*Save license to file*	saves the license key in a license file
②	*Load license from file*	loads a license key from a license file
③	*Get license*	shows the current license key details
④	*Features*	shows factory-set parameters of the reader
⑤	*Show less/Show more*	shows/hides the information shown in the right part of the screen under *Get license*

	In certain cases, it is necessary to send the license key to Kapsch TrafficCom. 1. To do so, click *Save license to file* (① in Figure 20). 2. Select the file name and the destination directory. 3. Send the file via email to ktc.office@kapsch.net to the Kapsch TrafficCom support team.

13.4.2 Status Field

3 message types are defined, see the example below:

Figure 21 Status field

①	*Info*	shows which action has been recently performed
②	*Warning*	indicates possible problems in the structure and configuration
③	*Error*	indicates that the required action could not be executed

Every status message has a time stamp next to it. The status messages are arranged such that the most current one is always at the top of the list.

Tipp	► To expand the status field section and see more status messages, click on the boundary line between the sections (red line in Figure 21) and drag it upwards. ► To minimize the status field section, drag the line downwards.

The status field has a context menu which allows to deactivate warnings, information and errors in the status field. It is also possible to delete status messages.

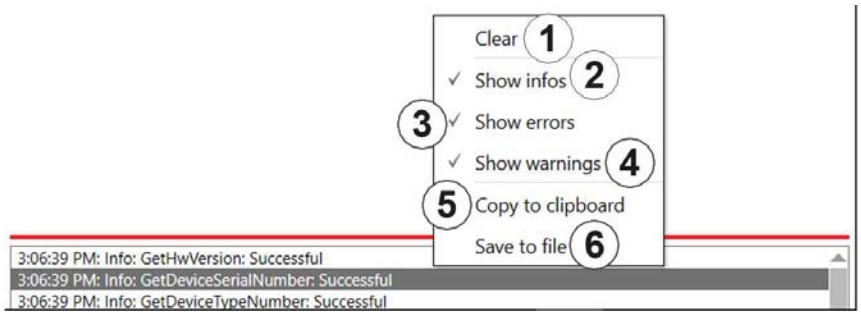


Figure 22 Status field context menu

①	*Clear*	deletes all status messages
②	*Show infos*	shows/hides infos
③	*Show errors*	shows/hides errors
④	*Show warnings*	shows/hides warnings
⑤	*Copy to clipboard*	copies the status field entries to the Windows clipboard
⑥	*Save to file*	saves status messages in the txt. format 4. Click Save to file. ⇨ A pop-up windows appears requiring to select the location of the file. 5. Select the directory/folder. 6. Click *Save*. ⇨ A pop-up message Saving done appears. 7. Click *OK* to close the pop-up message.

14 Operating the Reader Using the ReaderStart Software

14.1 Communication

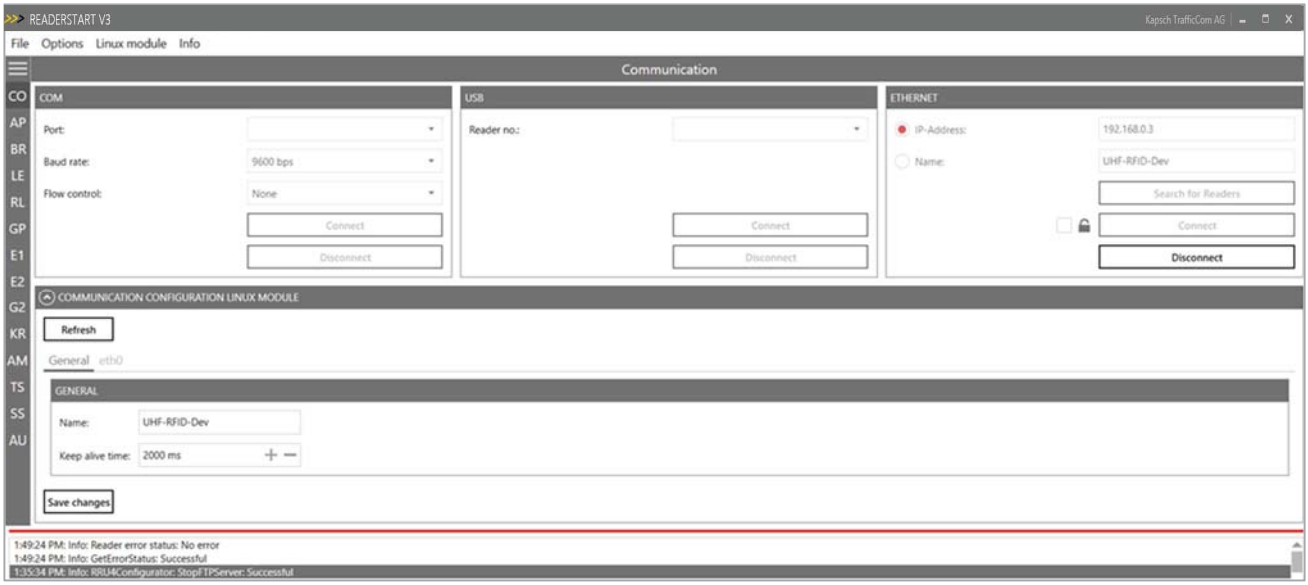


Figure 23 Communication Tab

The communication tab groups together all the functions for establishing connections and configuring the Linux module. The various communication connections are grouped in 3 sections:

- *Ethernet* for connections via TCP/IP;
- *Communication Configuration Linux Module* section to change the Ethernet setting; see 14.1.2 Communication Configuration Linux Module
- *COM* for serial connections via the COM port (RS232/485/422) and *USB* for connections up to version USB 2.0 are not applicable for the RFID Reader SRU-8X1X.

When the connection has been established, the program retrieves the information about the installed Linux module. It is possible to view and change the configuration information via the *Communication Configuration Linux Module*.

14.1.1 Ethernet Section

The Ethernet connection is established by linking the reader into an existing network or by directly connecting the reader and the control computer. To directly connect the reader to the PC, a cross-link cable is required, unless the LAN inter- face on the PC supports *auto-mdi-x*. Alternatively, it is possible to use two standard patch cables and a switch.

Figure 24 Ethernet section

14.1.1.1 Establishing a Secure Connection

✓ The connection to the reader has not yet been established.

1. In the Ethernet section, click the box next to the lock symbol (① in Figure 24).
2. Click *Search for Readers* (②) or *Connect* (③).

⇨ The following pop-up window appears:

3. Type in the user name at *User* (①). The default user name is *root*.
4. Enter the default password *UHF-RFID-Dev* at *Password* (②).

Tipp	You can change the password under *Linux module* ▸ *Connection config*; see 13.4.1.9 Linux Module

5. If you want to use the key file instead, click the box at *Key file* (③).

⇨ A pop-up window to select the key file opens.

6. Select the key file.
7. Click *OK* to establish the secure connection.

⇨ It is possible to configure the secure connection under *Linux module* ▶ *Connection config*; see also 13.4.1.9 Linux Module

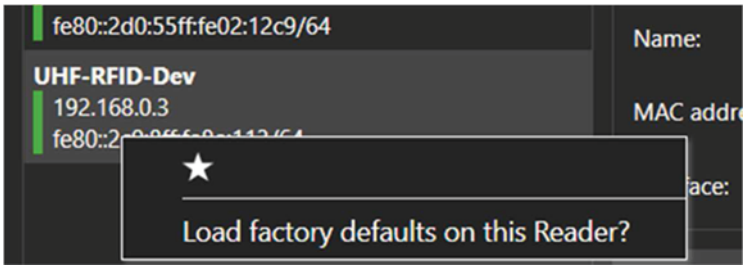
14.1.1.2 Loading Factory Default Settings

When resetting the reader to factory default, the ReaderStart SW sends out a UDP broadcast cmd. It is only possible 30 seconds after power rebooting.

	Note that this command also resets the Linux module settings, such as Linux password, network name, IP address, deactivates the auto start of the apps etc.

1. In the Ethernet section, click Search for Readers.
2. Select the reader onto which you would like to load the factory default settings.
3. Right-click on the reader.

⇨ *The following pop-up message appears:*



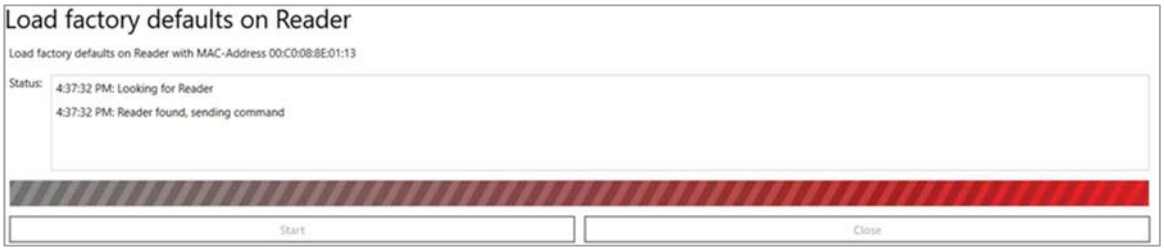
4. Click Load factory defaults on this Reader.

⇨ The pop-up message Are you sure to load factory defaults on this reader appears.

5. Click Yes to set the reader to the factory default settings.

Click *No* to cancel.

⇨ If you have clicked *Yes*, another pop-up window appears:



6. Click *Start*.

⇨ A pop-up message *Are you really sure to load factory defaults on this reader* appears.

7. Click *Yes* to set the reader to the factory default settings.

⇨ The status messages informing about the progress of the reset process are shown in the *Status* field of the pop-up window, see examples in the figure above.

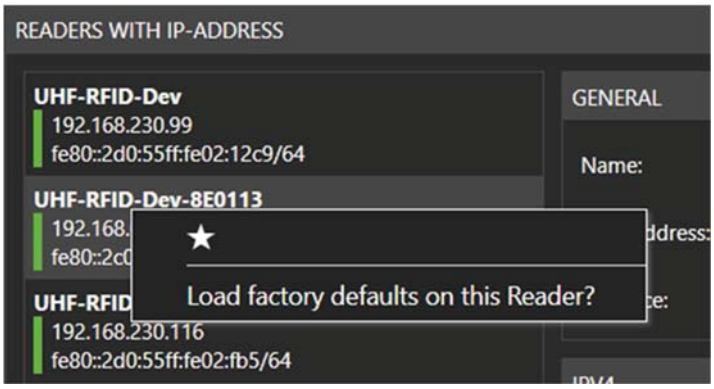
8. After the factory default settings have been loaded onto the reader, click Close.

14.1.1.3 Selecting a Favorite Reader

If there are many readers in the system and the user establishes connection to one reader more frequently than to the others, it is possible to select the preferred reader as a favorite reader, placing it at the top of the reader list.

1. In the Ethernet section, click *Search for Readers*.
2. Select the preferred reader.
3. Right-click on the reader.

⇨ The following pop-up message appears:



4. Click on the star.

⇨ The preferred reader is now placed at the top of the list, making it easier for the user to select it:

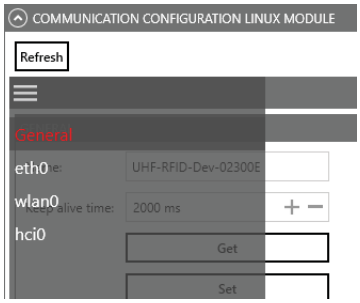
14.1.2 Communication Configuration Linux Module

	Communication Configuration Linux Module has different options, depending on the reader type.

14.1.2.1 Selecting a Linux Module Option

1. Click on the symbol

⇨ The following options appear:



2. Click on one of the four options to change the settings

14.1.2.2 General

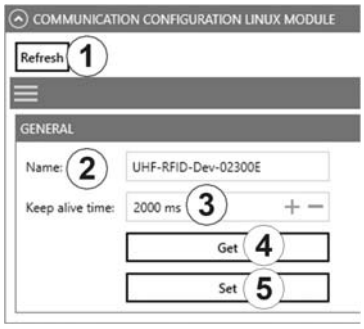


Figure 25 Communication configuration Linux model: general

①	*Refresh*	reads the current settings of the communication configuration Linux module
②	*Name*	shows the host name of the reader which is logged onto the DNS server It is possible to address the reader using this name as an alternative to the IP address.
③	*Keep alive time*	specifies the intervals of time at which the reader sends a data packet to check whether the receiver 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. **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, it is necessary to restart the reader. It is recommended to use the keep-alive time to check the connection between the reader and PC.**
④	*Get*	reads the configured general settings
⑤	*Set*	saves new general settings

14.1.2.3 Ethernet

Figure 26 Communication configuration Linux model: Ethernet

①	*Refresh*	reads the current settings of the communication configuration Linux module
②	*IP address*	manually issues the address **Tipp** | It is only possible to use this parameter if the DHCP (⑥) is deactivated.
③	*Subnet mask*	manually issues a network mask **Tipp** | It is only possible to use this parameter if the DHCP (⑥) is deactivated.
④	*Gateway*	enters the gateway
⑤	*DHCP*	activates/disactivates the automatic issuing of an IP address by a DHCP server; if the network has a configured DNS server, it is also possible to use the host name of the reader.
⑥	*IPv6*	enters the second IPv6 address (the first IPv6 address is the link local address)
⑦	*Status*	shows the current reader IP address (eth0)
⑧	*Get*	gets the currentstatus
⑨	*Set*	saves changes

!	If the data relevant to the current connection (e.g. IP address) are changed, it may cause an error and the connection is lost.

If the interface has been configured incorrectly, it is not possible to establish a connection to the reader.

► Note the following default configuration settings:

Name	UHF-RFID-Dev
IP address	192.168.0.1
Subnet mask	255.255.255.0
Keep-alive time	2000 ms
DHCP	deactivated

14.1.2.4 Wi-Fi

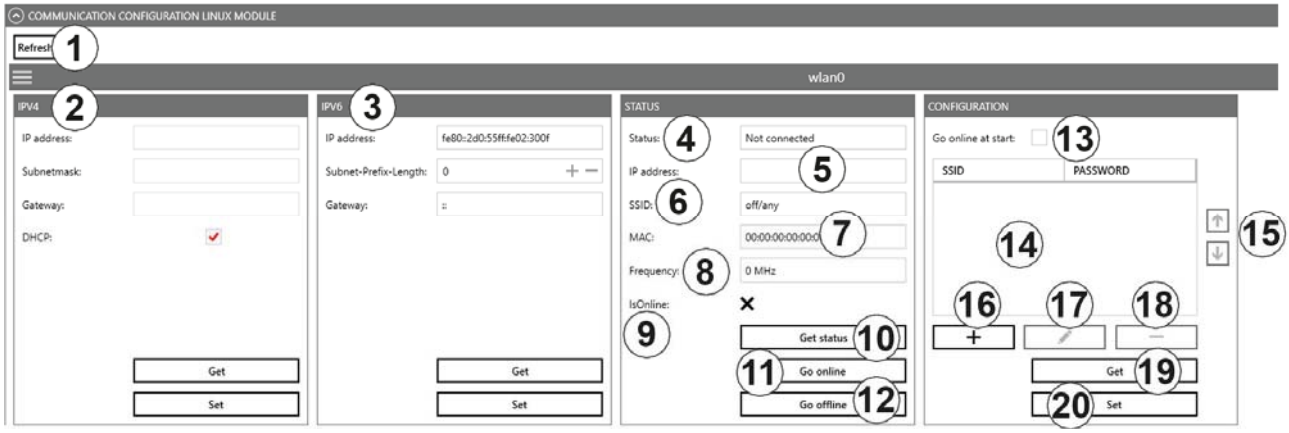
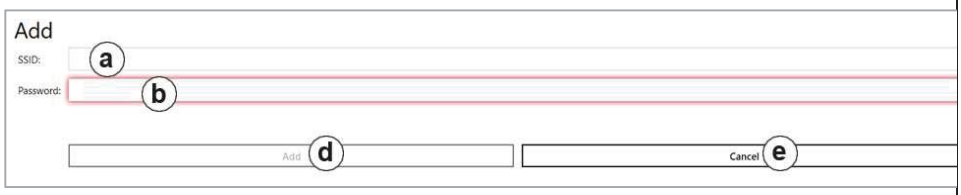
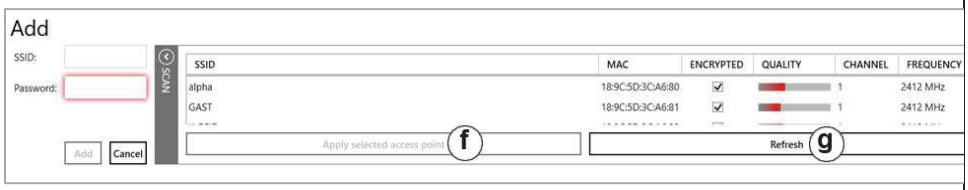
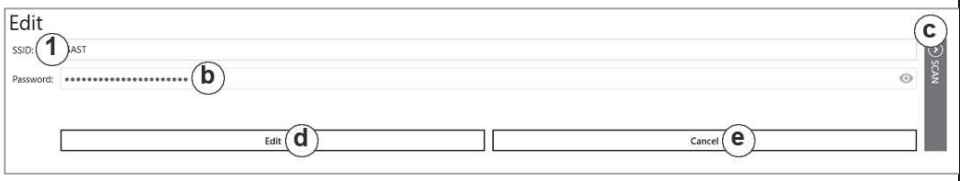


Figure 27 Communication configuration Linux model: Wi-Fi

①	*Refresh*	reads the current settings of the communication configuration Linux module
②	*IP4*	see Figure 26
③	*IP6*	enters the second IPv6 address (the first IPv6 address is the link local address)
④	*Status*	shows the status of the Wi-Fi connection
⑤	*IP address*	shows the current IP address
⑥	*SSID*	shows the name of the access point
⑦	*MAC*	shows the MAC address of the access point
⑧	*Frequency*	shows the frequency of the Wi-Fi connection
⑨	*IsOnline*	shows whether the Wi-Fi module is online
⑩	*Get status*	reads the current status of the Wi-Fi module
⑪	*Go online*	establishes the Wi-Fi connection
⑫	*Go offline*	interrupts the Wi-Fi connection
⑬	*Go online at start*	activates or deactivates the Wi-Fi connection as soon as the reader starts
⑭		shows the list of the configured access points with SSID and password; the access points are shown in the priority order

⑮		changes the priority of the selected access point
⑯	+	adds an access point  ⓐ enters the SSID of the access point ⓑ enters the password for the access point ⓒ opens the list with available access points ⓓ adds an access point ⓔ cancels the operation ► Click *Scan* to open the list with available access points:  ⓕ adds the SSID of the selected access point to ⓐ ⓖ updates the list of available access points
⑰		edits the selected access point  ⓐ changes the SSID of the access point ⓑ changes the password of the access point; only active when securely connected ⓒ opens the list with available access points ⓓ edits the access point ⓔ cancels the operation
⑱	–	deletes the selected access point
⑲	*Get*	reads the configured access points
⑳	*Set*	sets the access points; only active when securely connected

14.1.2.5 Bluetooth

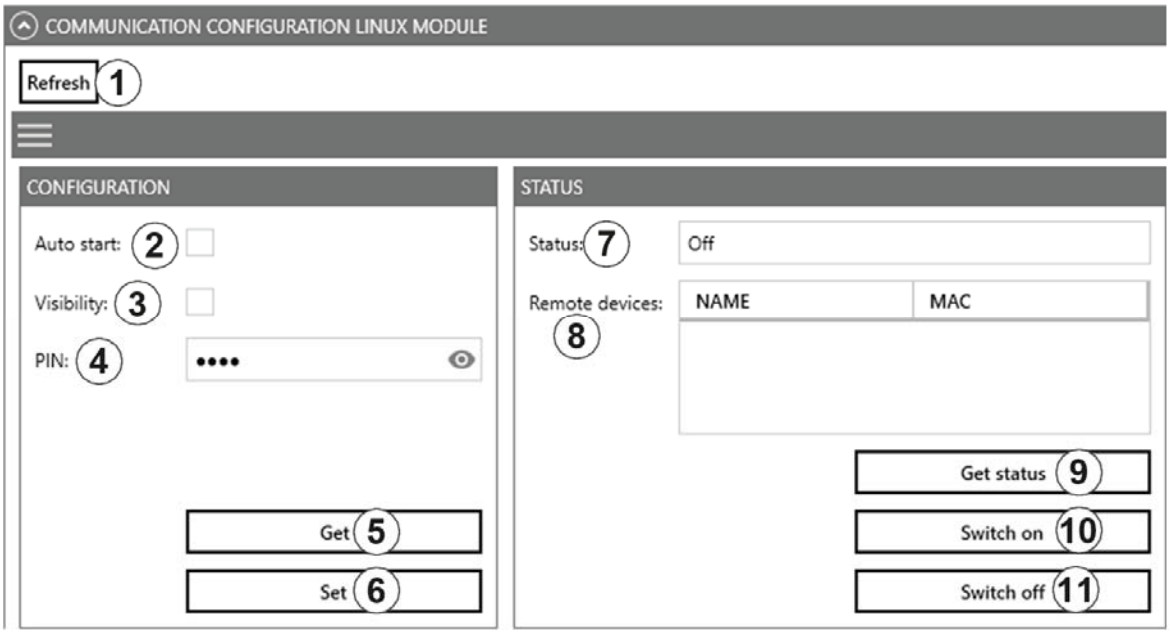


Figure 28 Communication configuration Linux model: Bluetooth

①	*Refresh*	reads the current settings of the communication configuration Linux module
②	*Auto start*	activates or deactivates Bluetooth as soon as the reader starts
③	*Visibility*	activates or deactivates the Bluetooth visibility of the reader for other devices
④	*PIN*	sets the PIN for the Bluetooth connection; the default PIN is 4007
⑤	*Get*	reads the current Bluetooth configuration
⑥	*Set*	sets the con figuration of the Bluetooth connection; only active when securely connected
⑦	*Status*	shows the status of the Bluetooth connection
⑧	*Remote devices*	shows the remote devices connected to the reader
⑨	*Get status*	shows the status of the Bluetooth connection
⑩	*Switch on*	activates the Bluetooth module
⑪	*Switch off*	deactivates the Bluetooth module

14.1.2.6 Mobile Communication Interface (2G/3G)

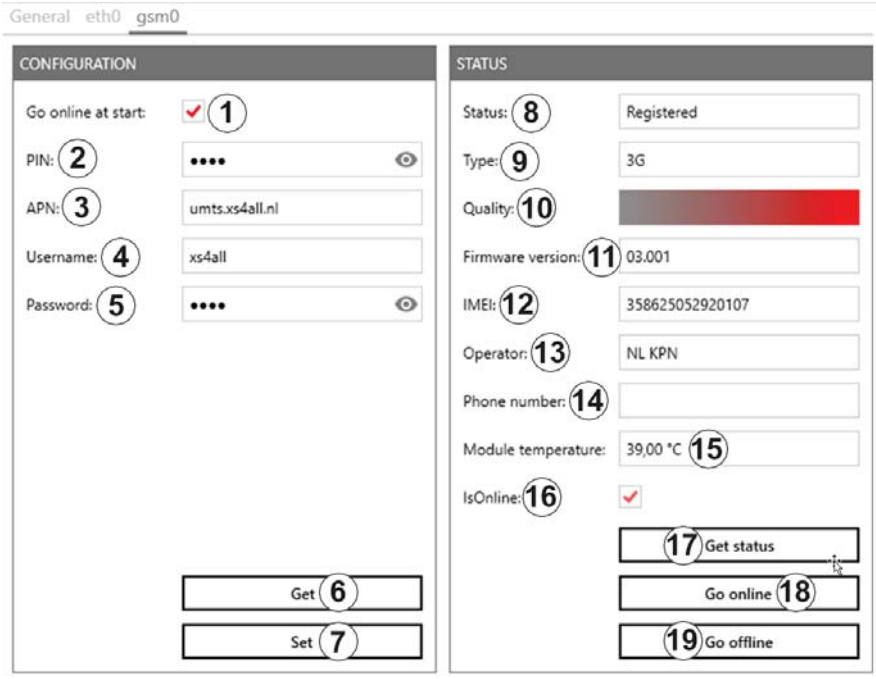


Figure 29 Communication configuration Linux model: mobile communication interface (2G/3G)

①	*Go online at start*	activates or deactivates the GSM connection as soon as the reader starts
②	*PIN*	enters the PIN code for the SIM card
③	*APN*	enters the access point name from the provider
④	*User name*	enters the access point name from the provider
⑤	*Password*	enters the access point name from the provider
⑥	*Get*	reads the current configuration of the GSM module
⑦	*Set*	sets the configuration of the GSM module; only active when securely connected
⑧	*Status*	shows the status of the GSM connection
⑨	*Type*	shows the GSM connection type
⑩	*Quality*	shows the quality of the GSM connection
⑪	*Firmware version*	shows the firmware version of the GSM module
⑫	*IMEI*	shows the serial number of the GSM module
⑬	*Operator*	shows the operator of the GSM connection
⑭	*Phone number*	shows the phone number of the SIM card
⑮	*Module temperature*	shows the temperature of the GSM module
⑯	*IsOnline*	shows whether the GSM module is online
⑰	*Get status*	reads the current status of the GSM module
⑱	*Go online*	establishes the GSM connection
⑲	*Go offline*	interrupts the GSM connection

14.2 Application

The Application tab enables quick and easy configuration of the RFID Reader SRU-8X1X for a selected application

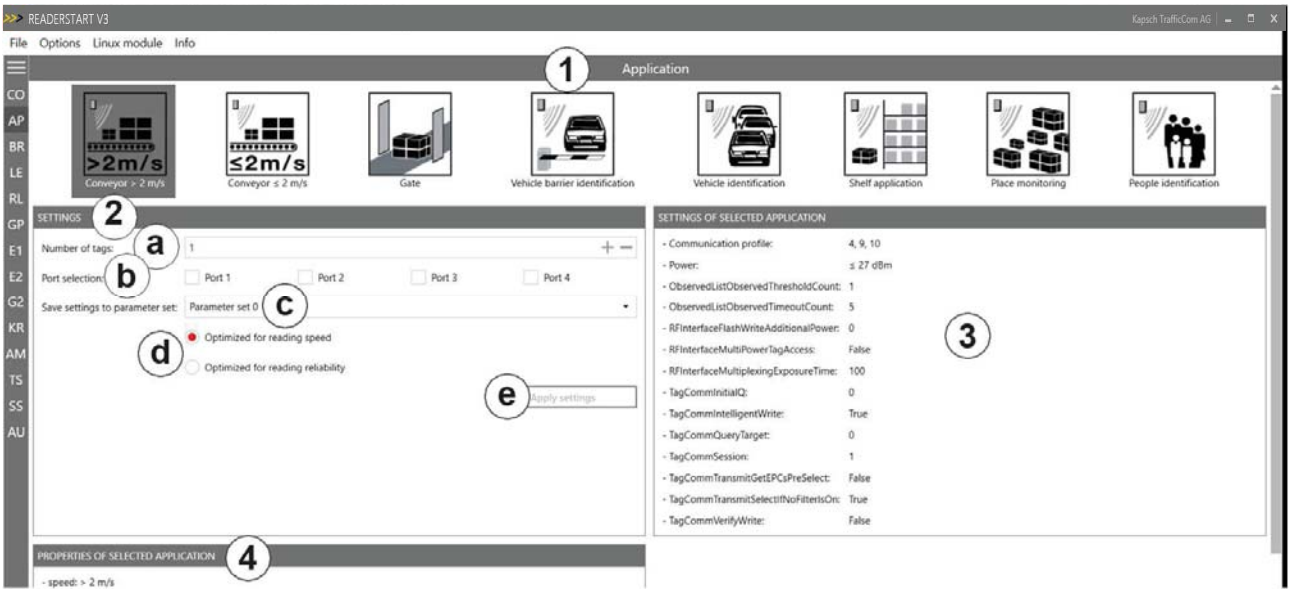


Figure 30 Application Tab

①	*Application*	selects between the available applications represented visually by means of labelled pictograms ► Click on a pictogram to select the application. ⇨ The selected pictogram is marked in a darker color, in Figure 30 it is *Conveyor > 2 m/s.*
②	*Settings*	changes setting of the selected application ⓐ number of the expected tags selects the antenna to be used ⓑ ► Check Ports 1-4 to select the antenna port. It is possible to select one, several or all ports. ⓒ selects the parameter set in which the configuration is saved
		ⓓ Sets the values for max. reading speed or max. reading reliability ► Click Optimized for reading speed or *Optimized for reading reliability*. ⇨ The values in Settings of selected application (③ in Figure 30) change. When the max. read frequency is set (*Optimized for reading speed is activated*), the number of readings is maximized. In this case, the same tag can be read several times, because all tags will be reset in the inventory so that they will respond again. Because of reading the same tag multiple times, in a scenario of moving tags it could happen that not all the tags crossing the antenna field are read. The frequency of detection of the same tag is increased. In some cases, the time allowed for detecting the tags may be insufficient, so that some transponders are not detected. When the max. read reliability is set (*Optimized for reading reliability* is activated), tags that have already been read are not read again in the next inventory, provided they are still being supplied with power. This means that only the tags which have not yet been registered are detected. This way, the probability that all tags are read is increased.

		ⓔ Saves the settings that have been made as the settings for the selected application in the selected parameter set. The ReaderStart SW resets the settings to the factory settings first, thus overwriting the previous configuration. If the settings have been reset, the *Apply settings* button briefly glows green and a success message is displayed in the *Status* field of the ReaderStart SW interface. If case of a fault, the *Apply settings* button briefly glows orange to indicate a warning or red to indicate an error. If the fault has been caused by a missing entry, the field lacking the entry also glows red. A warning/error description is displayed in the *Status* field. After the settings have been loaded, it is possible to go to the *Basic reading* tab and to start the read process.
③	*Settings of selected application*	shows the settings that have been made for the selected application in the selected parameter set
④	*Properties of selected application*	shows the properties of the selected application

Tipp	The read rate is influenced by many parameters. In addition to the selected broadcasting profile with the respective data rates, there are also application-specific data, e.g. how many tags the reader should expect in the field. You can optimize these parameters using the *Expert settings 1* and *2*. ► If you are unsure whether the settings you have chosen are best suited for your application, contact Kapsch support at ktc.office@kapsch.net (please refer to "Product Management")

14.2.1 Available Applications

When the application is selected, the properties and the settings of the selected application are displayed in the respective fields.

The applications available for selection in version 3.00 of the *ReaderStart SW v3* are shortly described in the following chapters.

Conveyor belt > 2 m/s

- 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 must be only a few centimeters

Conveyor belt ≤ 2 m/s

- for detecting and describing individual tags in the antenna field on a conveyor belt moving at a speed less than or equal to 2 m/s
- the distance between the tags and the antenna must be only a few centimeters

Gate

- for detecting multiple tags in the antenna field as they pass through a gate

Vehicle Barrier Identification

- for detecting and describing individual tags in the antenna field which are not moving
- the distance between the tags and the antenna must be less than a few meters

Vehicle Identification

- for detecting and describing multiple tags in the antenna field which are moving at a speed of more than 14 m/s
- the distance between the tags and the antenna must be less than a few meters

Shelf Application

- for detecting and describing individual tags in the antenna field which are not moving
- the distance between the tags and the antenna must be less than 1 m

Place Monitoring

- for detecting and describing multiple tags in the antenna field which are not moving
- the distance between the tags and the antenna must be less than 1 m

Personal Identification

- for detecting multiple tags in the antenna field which are moving at a speed of not more than 3 m/s
- the distance between the tags and the antenna must be less than 1 m

Confidential

14.3 Basic Reading

This tab is divided into two parts, the left part contains a table with information about the read tags (□ in the figure below), the right part (□) shows the statistics as well as options to control the reading process, described in the follow.

The appearance and disappearance of a tag is shown in color 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.

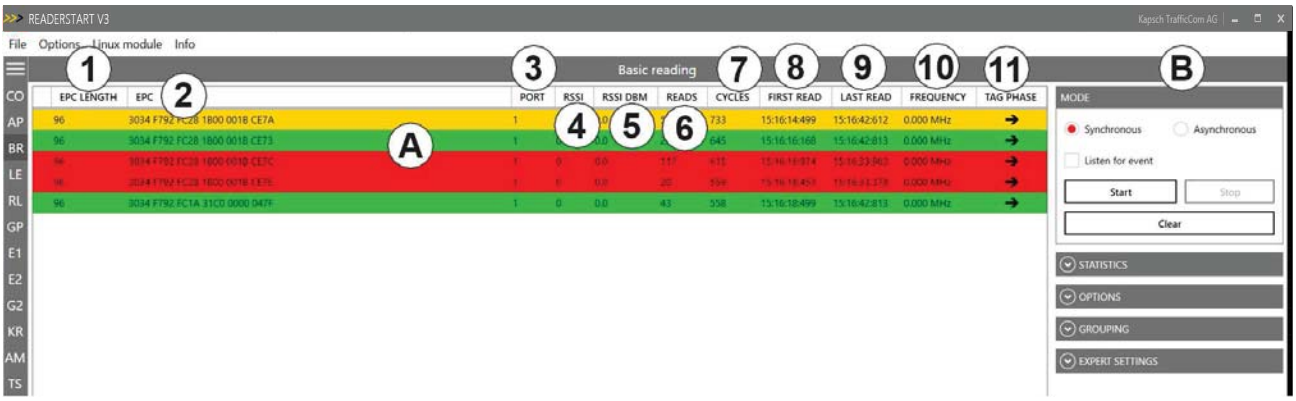


Figure 31 Basic reading

①	*EPC length*	indicates the length in bits of the EPC; valid lengths 0–496
②	*EPC*	EPC of the tag in the hexadecimal representation
③	*Port*	antenna port at which the tag is read; valid values 1–4
④	*RSSI*	unitless (shown as having no units) signal strength of the tag response
⑤	*RSSI DBM*	shows the RSSI value in dBm
⑥	*Reads*	shows how many times this tag has been read successfully
⑦	*Cycles*	indicates how often an inventory has been started
⑧	*First read*	timestamp of the first tag reading
⑨	*Last read*	timestamp of the last tag reading
⑩	*Frequency*	shows the used transmission frequency
⑪	*Tag phase*	shows the tag phase in form of a rotating pointer This parameter is used to distinguish between stationary and moving transponders. If the transponder is moving away from the antenna, the pointer rotates counterclockwise, and clockwise, if the transponder is moving towards the antenna. The movement speed is directly proportional to the rotational speed of the pointer. In a full rotation of 360°, the transponder travels a distance of 17 cm. Note that the reader has to change the transmission frequency every 4 seconds, causing a phase jump. The tag phase is also shown in the TagScan monitor; see 14.10 TagScan *The tag phase is also shown in the TagScan monitor; see* 14.10 TagScan

14.3.1 Mode

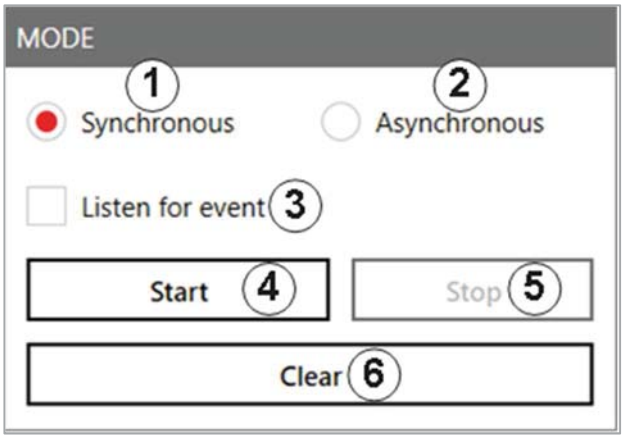


Figure 32 Basic reading: mode

①	*Synchronous*	allows the facility to switch the carrier off during the idle times, saving power. This mode is intended for applications in which the requirements for timing are not very demanding. The inventory of the tags is performed across all the antennas that are configured. Once all the tags in the field have been read on the last antenna, data are sent to the PC. The PC automatically retriggers the inventory of the tags.
②	*Asynchronous*	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 have recently appeared in the field or left it. This way, the time required for communication between the reader and the client is 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. ► For more details of the *ObservedThresholdCnt* and *ObservedTimeoutCnt* parameters, refer to the *Configurational manual reader*.
③	*Listen for event*	deactivates or activates waiting for the result of the command executed by an external trigger and shows the result in □ in *Fig. 30* When deactivated, there is no waiting process and it is possible to start the reading process at any time.
④	*Start*	starts the reading
⑤	*Stop*	stops the reading
⑥	*Clear*	deletes the reading results from the table on the left (□ in Figure 31)

14.3.2 Starting and Stopping the Reading

✓ All the settings have been applied and the mode selected.

► Click *Start* (④ in Figure 32) to start the reading.

► Click *Stop* (⑤) to stop the reading.

► Click *Clear* (⑥) to remove all tag entries from the table (in Figure 31)

14.3.3 Statistics

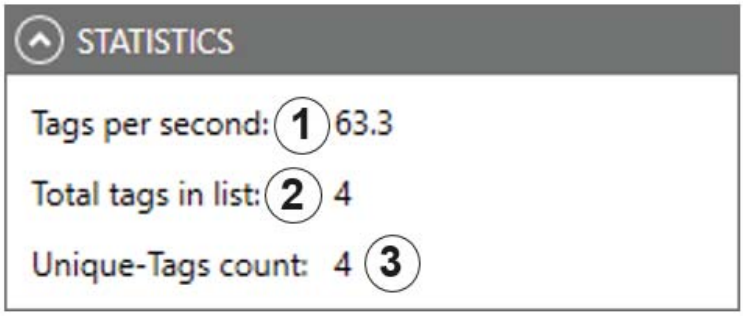


Figure 33 Basic reading: statistics

①	*Tags per second*	displays the current reading performance
②	*Total tags in list*	shows the total number of tags in the list
③	*Unique Tags count*	shows the number of unique tags detected in the inventory

14.3.4 Options

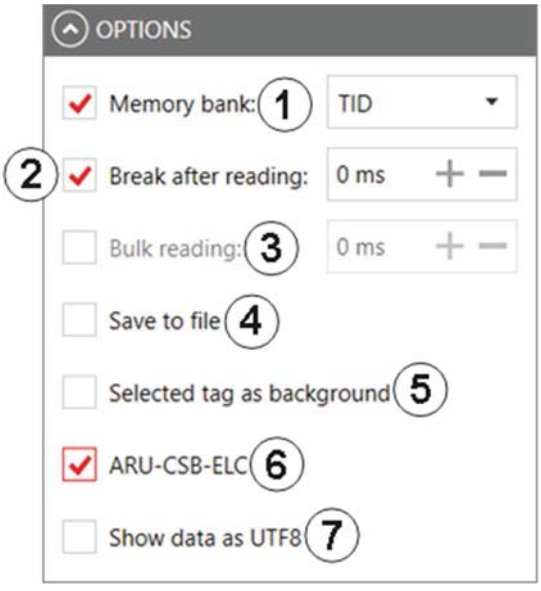


Figure 34 Basic reading: options

①	*Memory bank*	selects between *RFU*, *EPC*, *TID* and *User* memory banks ► Click on the arrow to open a drop-down list to select a memory bank. ► Click *Save to file* (④) to store the values *RFU*, *EPC*, *TID* and *User* in a CSV file.
②	*Break after reading*	specifies the duration of the break between two inventories in milliseconds During the break, the carrier can be deactivated. ► For more information about switching off the carrier, refer to ***Configuration Manual for SRU-8X1X RFID Reader 18000-63.***
③	*Bulk reading*	sets the time in milliseconds after which the result lists of an inventory is sent to the PC. To keep the time between inventories as short as possible in the synchronous mode, data trans- mission between the inventories can be dispensed with. That means that the reader saves all the tags that it finds in the field in its internal RAM and sends them to the PC after the time set in *Bulk reading*.
④	*Save to file*	saves the data displayed at (□ in Figure 31) ► Click *Change path to log file* to select or change the location where the information is saved. ► Right-click on *Save to file* to open or delete the file.
⑤	*Selected tag as background*	changes the basic reading interface background to the color of the selected tag row
⑥	*ARU-CSB-ELC*	activates the additional presentation for an ARU-CSB-ELC antenna
⑦	*Show data as UTF8*	shows tag data in the UTF8 format

14.3.5 Grouping

Figure 35 Basic reading: grouping

It is possible to sort the read result by means of unique tags. This is useful in multi-antenna applications.

If, for example, in a gate application with 4 antennas, a palette of 100 tags is read, the maximum number of the read results is 400. However, not all tags are read by all antennas, therefore, the read result will be about 250.

► Check *Group by unique tags* to find out how many different tags have been read.

14.3.6 Expert settings

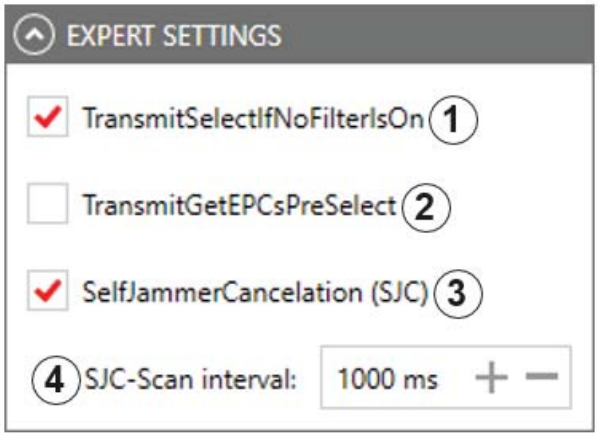


Figure 36 Basic reading: expert settings

①	*TransmitSelectIf-NoFilterIsOn*	resets all the tags that are defined in the field at a given time When the tag count is very high (> 200), it is possible to speed up the detection of the tags by commanding the reader to change to new *Select command*; see *EPCglobal Gen2 Specification*. It is possible to test it in the menu *Expert Settings*. ► Check *TransmitSelectIfNoFilterIsOn*. ⇨ A "select" is sent in each inventory, i.e. all the tags that are defined at this time in the field are reset. However, it can happen that the tags that have been read already are reset and re-recorded again. To capture only new tags, it is necessary to to prevent a renewed "select". ► Uncheck *TransmitSelectIfNoFilterIsOn.* ⇨ The tags are read once. This way, no time is lost due to a re-read. Note that it is not possible to retrieve tags in which the read operation had been interrupted. This way, it may happen that not all the tags are read. Keep that in mind when unchecking this parameter in order to achieve top results. –
②	*Transmit-GetEPCsPreSe-lect*	see Chapter TransmitGetEPCsPreSelect in ***Configuration Manual for SRU-8X1X RFID Reader 18000-63.***
③	*SelfJammerCan-celation (SJC)*	activates/deactivates the optimal receiver sensitivity of the reader This process might be necessary in an industrial environment with increased reflection, e.g. due to metallic structures. However, this process is very time-consuming and slows down the tag detection.
④	*SJC Scan interval*	sets the interval after which the SelfJammerCancelation process is executed

14.4 LED

	Not all readers support the functionality with 12 LEDs; all readers have at least 4 LEDs. Please check the reader data sheet for information.

In this tab, it is possible to assign various functions to the 12 LED channels. It is possible to activate other parameters, depending on the selected function.

Tipp	As supplied to customer, the first 4 LEDs are allocated to antennas 1–4, LED 5 is allocated to GSM, LED 6 to KRAI, LED 11 and LED 12 to Bluetooth and Wi-Fi, respectively. It is possible to customize this allocation.

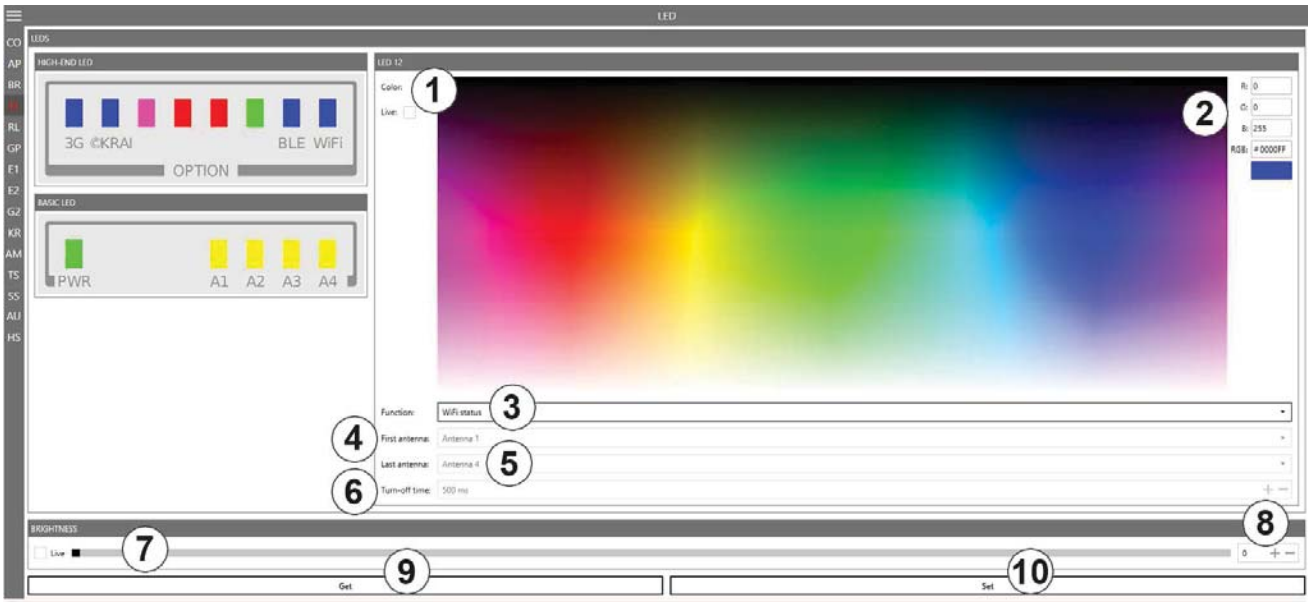


Figure 37 LED

①	*Live*	shows the changed LED colour in real time
②		shows RGB values
③	*Function*	selects between the functions described in 14.4.1 Selecting Functions
④	*First antenna*	the first antenna for the selected function
⑤	*Last antenna*	the last antenna for the selected function
⑥	*Turn-off time*	sets the time for how long LED is on for the selected function
⑦	*Brightness (live)*	changes the LED brightness for all active LEDs (between 0 (auto brightness determined by the integrated light sensor) and 100) ► Move the brightness position along the bar to change the brightness of the LED. ⇨ The number at ⑧ changes.
⑧		changes the LED brightness (between 0 and 100) ► Click + or – to change the brightness of the LED.
⑨	*Get*	shows the current settings for all LEDs
⑩	*Set*	sets the new settings for all LEDs for which the settings have been altered

14.4.1 Selecting Functions

► Click on the arrow (③ in

Figure 37) to select between the following functions:

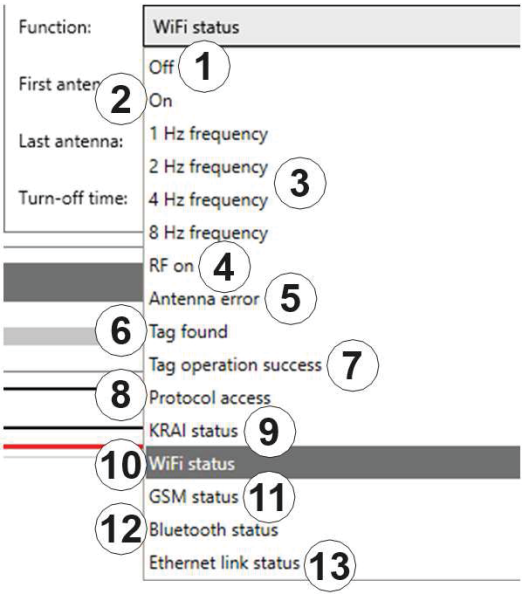


Figure 38 LED: functions

①	*Off*	deactivates the LED
②	*On*	activates the LED (always on)
③	*1 Hz – 8 Hz frequency*	LED flashes at a frequency of 1/2/4/8 Hz
④	*RF on*	LED lights up for *Turn-off time* milliseconds if a radio frequency is present at the antenna *First antenna* to *Last antenna* has been successful
⑤	*Antenna error*	LED lights up for *Turn-off time* milliseconds if an error occurs at the antenna *First antenna* to *Last antenna*
⑥	*Tag found*	LED lights up for *Turn-off time* milliseconds as soon as a tag has been found at the antenna *First antenna* to *Last antenna*
⑦	*Tag operation success*	LED lights up for *Turn-off time* milliseconds if a tag operation at the antenna *First antenna* to *Last antenna* has been successful
⑧	*Protocol access*	enables the protocol to switch the LED on and off
⑨	*KRAI status*	shows whether a @KRAI antenna is connected to the reader
⑩	*Wi-Fi status*	shows the Wi-Fi status • flashing: trying to connect • permanently lit: connected • off: Wi-Fi disabled

⑪	*GSM status*	shows the GSM status • flashing: trying to connect permanently lit connected • off: Wi-Fi disabled
⑫	*Bluetooth status*	shows the Bluetooth status • flashing: trying to connect • permanently lit: connected • off: Wi-Fi disabled
⑬	*Ethernet link status*	shows the Ethernet connection status

14.5 RSSI LED Bar (received signal strength indicator)

This menu is used to determine the strength of the received signal.

Figure 39 RSSI LED Bar

①	*Refresh*	updates the number of detected tags
②		selects a tag from the number of the detected tags by means of the drop-down menu
③	*All/Antenna 1–4*	selects whether the tag has to be read on all antennas or only one antenna
④	*Start LED bar*	measures the signal strength
⑤	*Stop LED bar*	stops the measurement
⑥	*RSSI, Min. RSSI, Max. RSSI*	shows the current RSSI value as well as the minimum and the maximum RSSI values
⑦		shows the read range by means of the colored bars *green* signal strength is high (high RSSI value) *yellow* signal strength is medium (medium RSSI value) *red* signal strength is low (low RSSI value)
⑧	*Details*	shows detail information about RSSI for each antenna and property

14.6 GPIO Functions

Readers with GPIO functionality1) offer the possibility to set up small controls which trigger the reader, for instance by means of a light barrier, or which trigger an action at the outputs of the reader by reading specific tags. Such an action can switch an output to control the flow of goods.

The GPIO tab allows the reader to interact with its environment. The GPIO function tab allows the user to manually read or switch inputs and outputs of the respective application. For more complex procedures, it is possible to create action lists which execute a sequence of commands on the reader. This list can then be linked to various inputs.

Figure 40 GPIO

The GPIO tab is divided into 3 sections, *IO Configuration*, consisting of *Input* and *Output*, *Test Input* and *Test Output*, *Action List* and *Assign Input to Action List* which are described in the following chapters.

14.6.1 IO Configuration

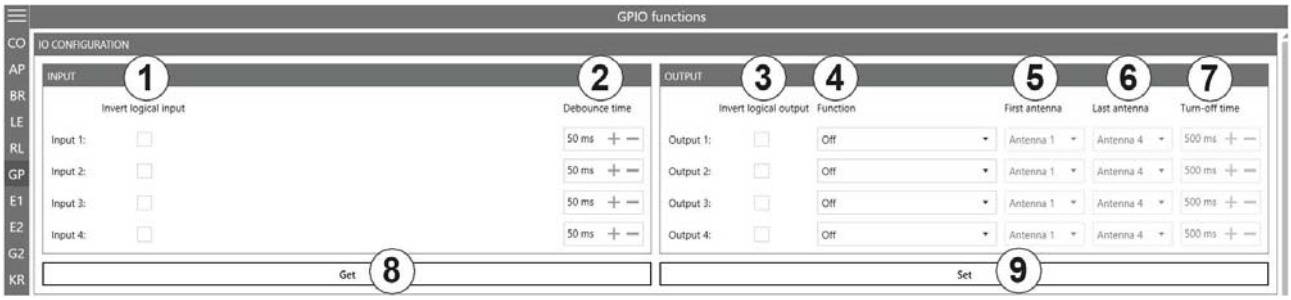


Figure 41 GPIO: IO Configuration

①	*Invert logical input*	negates the electrical input signal and uses this state for processing in the reader; if the parameter is not checked, the signal is used
②	*Debounce time*	assigns a debounce time in milliseconds to each channel depending on the sensor being used (mechanical or electrical switch)

③	*Invert logical output*	negates the electrical output signal
④	*Function*	selects between the functions described in 14.4.1 Selecting Functions
⑤	*First antenna*	the first antenna for the selected function
⑥	*Last antenna*	the last antenna for the selected function
⑦	*Turn-off time*	sets the time for how long the output is on for the *Tag found* and *Tag operation successful* function
⑧	*Get*	reads the current IO configuration settings
⑨	*Set*	sets the output settings

1) All SRU-8X1X readers have GPIO

14.6.2 Test Input and Output

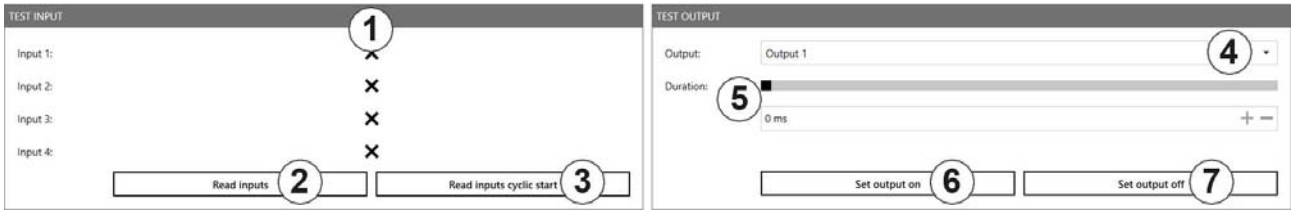


Fig. 42: GPIO: Test Input and Test Output

Test Input

Each input channel has two configuration parameters available:

①	*Input 1–4*	shows logical input 1–4; will only be shown if *Invert logical input* for the respective input has been checked at *IO Configuration* (① in Figure 41)
②	*Read inputs*	reads the inputs once
③	*Read inputs cyclic start/stop*	reads the inputs in a loop/stops the reading

Test Output

④	*Output*	selects output 1–4 by means of the drop-down menu ► In order to use this function, select the *Protocol access* function for the respective output, see 14.6.1 IO Configuration and 14.4.1 Selecting Functions.
⑤	*Duration*	sets time in ms after which the output automatically returns to its idle mode either by moving the bar or by entering the value If the duration is set to its maximum value (65535), the output is permanently on.
⑥	*Set output on*	switches on the output
⑦	*Set output off*	switches off the output

14.6.3 Action List and Assign Input to Action List

To automate the processes, it is possible to store command sequences on the reader in the form of action lists. These are triggered by a change of edge at the selected input.

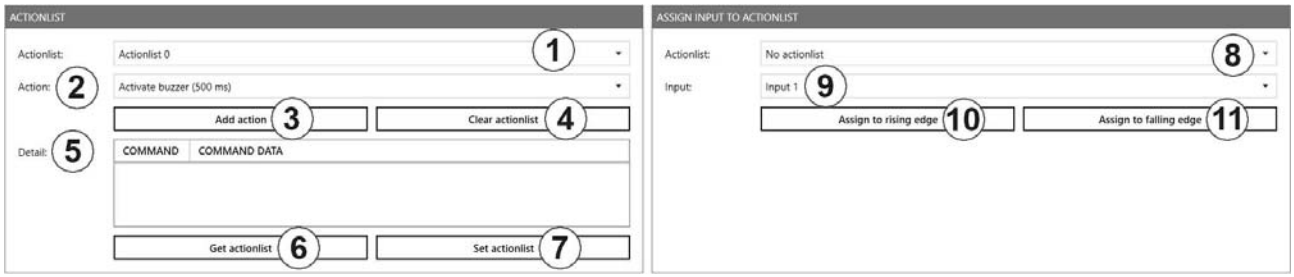


Fig. 43: GPIO: Action List and Assign Input to Action List

14.6.3.1 Action List

Each input channel has two configuration parameters available:

①	*Action list*	selects an action list (0–127) from the drop-down menu to save the action in
②	*Action*	selects an action from the drop-down menu, e.g. *Activate buzzer (500 ms), SyncGetEPCs, ASyncGetEPCs, ASyncStopCommand*; see also 14.6.3.3 Adding Actions to the Program ► To see the commands contained in the current action list, type in *%userprofile%\Documents\Kapsch TrafficCom AG\ReaderStart v3* into the Windows search field.
③	*Add action*	adds action; the action is shown under *Details* (⑤)
④	*Clear action list*	deletes actions; no actions are seen under *Details* (⑤) **Tipp** To remove only one action from the list: *1.* Select an action from the list shown under *Details.* 2. Right-click on the selected action. ⇨ The pop-up message Remove entry appears. 3. Click on Remove *entry* to delete the action. ⇨ The action is deleted from the list.
⑤	*Details*	shows added actions in the chronological order as they have been selected
⑥	*Get action list*	shows the current action list
⑦	*Set action list*	saves the set action list (flashes blue after having added an action to the *Details* (⑤)

14.6.3.2 Assign Input to Action List

⑧	*Action list*	selects an action list (0–127) from the drop-down menu to assign to the input in (⑨)
⑨	*Input*	assigns the action list to input 1–4 from the drop-down menu
⑩	*Assign to rising edge*	assigns the action list to the rising edge
⑪	*Assign to falling edge*	assigns the action list to the falling edge

Tipp	► If you would like to assign the action list to both the rising and the falling edge, click ***Assign to rising edge*** and then ***Assign to falling edge***. To cancel the assignment: ► Restart/reset the reader or select ***No action list*** under ***Action list*** (⑧).

14.6.3.3 Adding Actions to the Program

The action lists consist of a sequence of individual actions which can be loaded in the form of an XML file in the *Action* context menu:

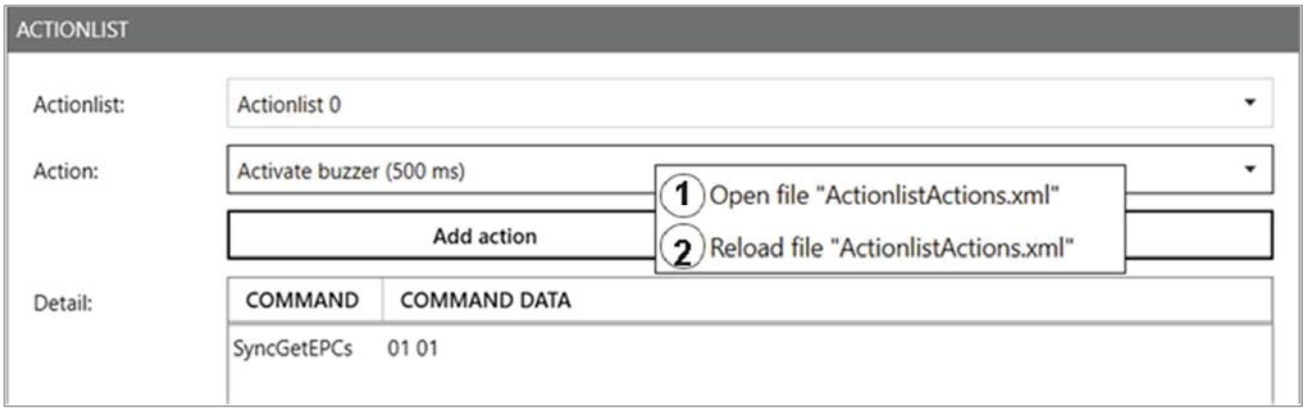


Fig. 44 GPIO: action list, action context menu

①	*Open file "ActionlistActions.xml"*	opens the actions list in the XML format in a text editor
②	*Reload file "ActionlistActions.xml"*	reloads the action list; it is necessary to reload the action list after a new action has been added to the XML file containing the actions or some changes have been made in it

The ReaderStart creates a directory in which the system variables are stored in the folder *%userprofile%\Documents\Kapsch TrafficCom AG\ReaderStart v3*. It is possible to edit the *ActionlistActions.xml* file manually using a text editor.

► To see the individual actions, refer to the *Configuration Protocol* .

The approximately 150 reader commands with corresponding variance of the parameters do not allow for a uniform list. A selection of all options is extensive. Therefore, it is recommended to only list commands required in the application.

The following example demonstrates the syntax of the actions:

```
<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>
```

The example above shows the Activate buzzer 500 ms and Get EPCs actions.

14.7 Expert Settings 1

The ReaderStart SW is a powerful tool for the reader configuration. 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 to the tag so that the reader is optimally customized to the application.

There are eight parameter sets available for saving the reader configuration. It is possible to save all settings for the transmission power, the antenna multiplex configuration, the RF settings and the air interface parameters.

Other parameters can be changed in *Expert settings 2*.

► For more information about the individual parameters, refer to *Reader* ***Configuration Manual for SRU-8X1X RFID Reader 18000-63.***

Figure 45 Expert settings 1

①	*Parameter Set*	selects a parameter set
②	*Get*	reads the current settings of the selected parameter set in the system
③	*Set*	sets the parameters
④	*Enabled*	activates/deactivates the possibility to make changes in the port
⑤	*Power*	changes the power on the port (ERP)
⑥	*dBm/W*	switches between *dBm* and *W*
⑦	*Port power*	shows the selected power on the port
⑧	*Cable attenuation*	selects cable attenuation in the range between 0 and 63.75 dB
⑨	*Antenna type*	selects the antenna type between pre-defined and custom antennas If the pre-defined antenna is selected, the ReaderStart SW sets the antenna gain to the maximum value permitted for this antenna. If Custom antenna is selected, it is possible to freely set the gain and power.

⑩	*Gain*	selects the antenna gain between –32.00 dBiC and 31.75 dBiC
⑪	*ERP/EIRP*	switches between ERP and EIRP
⑫	*Port*	selects the antenna port or deactivates it If the antenna is not activated, the system proceeds to the next antenna in the Port Multiplex Configuration. ► For more details, refer to the Chapter MultiplexingAntennaport1...8 in the **Reader Configuration Manual for SRU-8X1X RFID Reader 18000-63**.
⑬	*Exposure time*	specifies the exposure time on the antenna; only used for asynchronous operation ► For more details, refer to the Chapter MultiplexingExposureTime1...8 in the **Configuration Manual for SRU-8X1X RFID Reader 18000-63**.
⑭	*Communication Standard*	selects a country-specific communication standard; the device version determines which communication standard is permitted
⑮	*Communication Profile*	selects the profile for the data rate and read reliability This option allows the technician to directly influence the performance of the reader and the spectrum of the signal. The profile names contain basic orientation on the transmission and reception data rates.
⑯	*Available channels (only available for ETSI-readers)*	selects the channel for the reader to use Depending on the region, the reader transmits in the frequency range 865–868 MHz for Europe or 902–928 MHz for USA/Canada. In Europe, the number of channels to be used can be limited. For this reason, it is necessary to check the related check box for each channel the reader is to use. This way, it is possible to avoid using specific channels on which there is interference.
⑰	*Initial Q*	reflects the number of tags expected in the field; see also Chapter InitialQ in Reader Configuration Manual
⑱	*Sel*	specifies whether other parameters are of interest for an inventory of the tag population or not; see also Chapter QuerySel in **Configuration Manual for SRU-8X1X RFID Reader 18000-63**
⑲	*Session*	sets which session the reader is to work with; see also Chapter Sessions in Reader Configuration Manual
⑳	*Target*	specifies which tags in the population should take part in the inventory; see also Chapter QueryTarget in **Configuration Manual for SRU-8X1X RFID Reader 18000-63**

To operate the reader in accordance with the related national standards, it is necessary to take into account the antenna gain and the cable attenuation in the transmission power setting.

► Do not exceed the permitted transmission power. Failure to observe this instruction can result in non-compliant operation of the reader leading the termination of the type approval.

14.7.1 Port Power

In Europe, the radiated power is limited in accordance with ETSI 302208 to 2 W ERP. In the FCC/IC region, max. 1 W connected RF power applies with an antenna gain of 6 dBi. If the antenna gain is greater than 6 dBi, it is necessary to reduce the RF power accordingly. While the European standard refers to a half-wave dipole, FCC part 15/RSS 210 refers to an isotropic radiator.

To set the port power, it is necessary to include the length-dependent cable attenuation and the antenna gain into the calculation of the port power. An example for the calculation of the port power for Europe and FCC/IC is given below.

The following applies to the European approval region:

$P_{port} = P_{ERP} + D_{cable} – G_{HW}$,

where P_{port} is the port power of the reader in dBm; P_{ERP} is the port power based on a half-wave dipole in dBm; D_{cable} is the cable attenuation in dB; G_{HW} is the antenna gain based on a half-wave dipole.

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

$D_{cable} = l*D_{dB/m}$,

where D_{cable} is the cable attenuation in dB; I is the length in m; $D_{dB/m}$ is the attenuation in dB/m at 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 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.

$G_{HW} = G_{isot} – 2.14$ dB,

where G_{HW} is gain-based on a half-wave dipole and G_{isot} is gain-based on an 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 port power can be increased by 3 dB.

$G_{HW} = G_{isot} – 2.14$ dB – 3dB,

where G_{HW} is gain-based on a half-wave dipole and G_{isot} is gain-based on an isotropic radiator in dBi

In the FCC/IC 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, it is necessary to reduce the RF power correspondingly. The reader's port power is then:

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

where P_{port} is the port power of the reader in dBm; P_{cond} is the power on antenna output in dBm; D_{cable} is the cable attenuation in dBm; G_{HW} is the antenna gain in dBi.

If the antenna gain is stated in dBic, the reader's transmission power can be increased by 3 dB. The port power for the European variant can be set in 0.25dB steps from 6 dBm to 33 dBm.

14.8 Expert Settings 2

The Expert settings 2 tab is divided into four sections for further configuration of the reader. In this tab, it is possible, for example, to change the default parameter set, copy one parameter set into another, read reader parameters to determine their ID and configure *Select Filter Settings*.

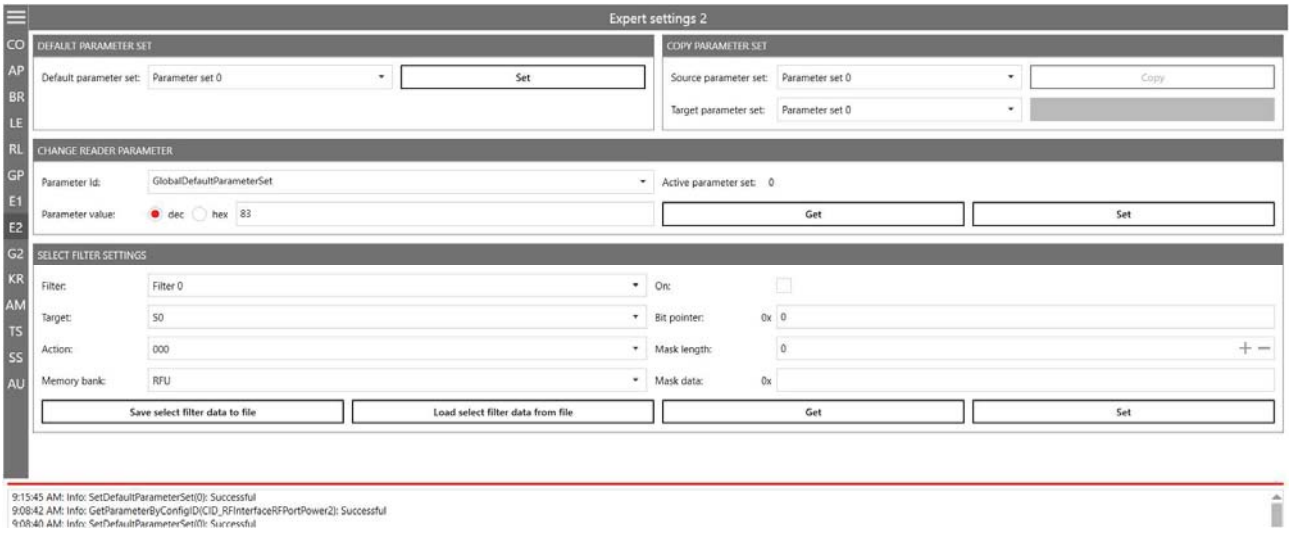


Figure 46 Expert settings 2

14.8.1 Default Parameter Set

The *Default parameter set* allows configuration of the parameter set that is loaded from the Flash into the RAM when the reader is started.

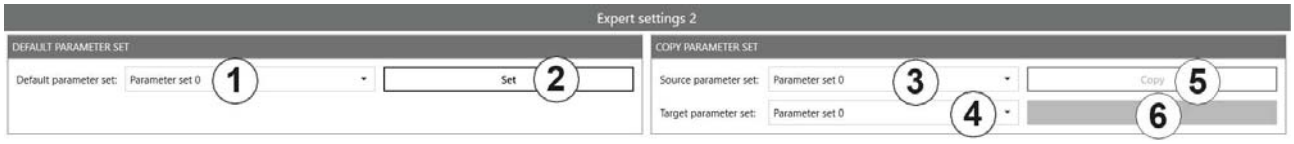


Figure 47 Expert settings 2: default parameter set and copy parameter set

①	*Default Parameter Set*	selects a default parameter set
②	*Set*	sets the selected default parameter set in the reader

14.8.2 Copy Parameter Set

The *Copy parameter set* allows one parameter set to be copied into another.

③	*Source parameter set*	selects the parameter set to be copied
④	*Target parameter set*	selects the parameter set into which the source parameter set is to be copied
⑤	*Copy*	copies the parameter set ► Click *Copy*. ⇨ On successful completion of the copy operation, the *Copy* button briefly glows green and a corresponding message is displayed in the status field. ⇨ If there is an error, the Copy button glows red, an error pop-up message appears and a warning is shown in the status field.
⑥		shows the progress of the copying process

14.8.3 Change Reader Parameter

Change reader parameter allows to change all reader settings using their respective configuration IDs.

Figure 48 Expert settings 2: change reader parameter

①	*Parameter ID*	selects the parameter ID
②	*Parameter value*	shows or sets the parameter value The value is either decimal or hexadecimal, it is possible to switch between *dec* and *hex*.
③	*Active parameter set*	shows the current active parameter set
④	*Get*	reads the value of the current parameter set of the reader and shows it at ②
⑤	*Set*	writes the parameter value (②) into the selected parameter ID (①)

14.8.4 Select Filter Settings

By means of these settings, it is possible to filter certain tags, e.g. to only read tags with the defined data in the respective memory banks. It is possible to set up to 32 filters.

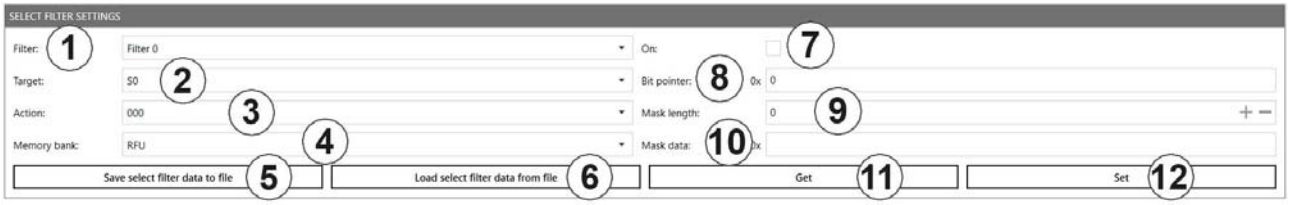
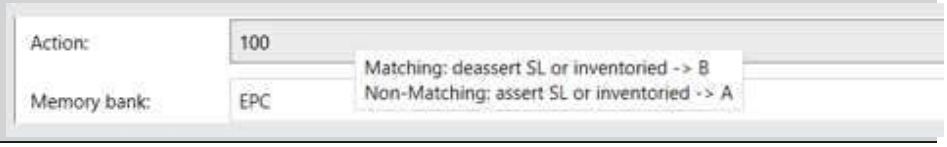


Figure 49 Expert settings 2: select filter settings

①	*Filter*	selects a filter
②	*Target*	selects the tag target session ► Make sure the target matches the session set in ⑲ Figure 46.
③	*Action*	selects the action; see also *EPCglobal Gen 2 Specification* (p. 73) **Tipp** ► To see the description of an action, hover over the *Action* field. ⇨ The description of the action appears in the tooltip: 
④	*Memory bank*	selects the memory bank (*RFU*/*EPC*/*TID*/*User*)
⑤	*Save select filter data to file*	saves the select filter data to file
⑥	*Load select filter data to file*	loads the select filter data from file
⑦	*On*	activates or deactivates the select filter
⑧	*Bit pointer*	sets from which memory address the filter compares the mask data
⑨	*Mask length*	sets the mask length (0–255)
⑩	*Mask data*	sets the data to be filtered
⑪	*Get*	reads the data of the filter selected at ①
⑫	*Set*	sets the select filter

Tipp	In SRU-8X1X readers, select filter data are permanently stored in the reader, e.g. if the select filter has been activated, it is active after a reader restart.

14.8.5 Applying a Select Filter (Example)

You have the following results of the basic reading but you would like only the tags with the *FC28* in the memory address to take part in the inventory:

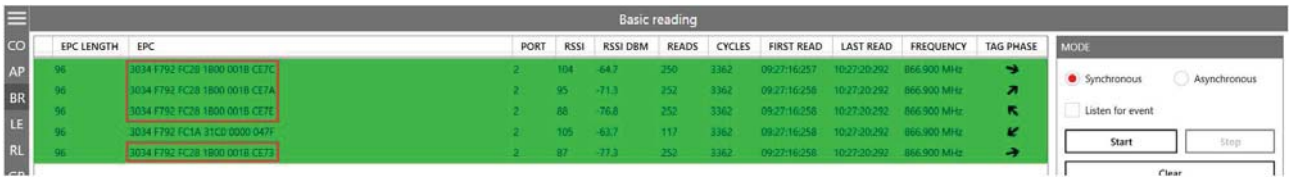
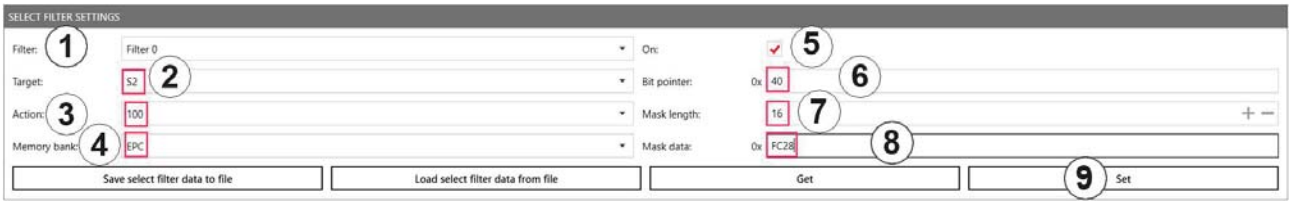


Figure 50 Basic reading: select filter required

To do so, it is necessary to create a select filter. The advantage of this process is that the filtering takes place already at the air interface level.

To create the select filter as shown in the figure below:



1. Select the filter you would like to save the filtering settings to under *Filter* (①).
2. Select the target (②). Make sure the target matches the session set in ⑲ Figure 46.
3. Select an action (③). In the example, the action is set to *100*; see also *EPCglobal Gen 2 Specification*.
4. Select the *EPC* memory bank (④).
5. Activate the select filter (⑤).
6. Refer to the *EPCglobal Gen 2 Specification* to check from which bit pointer the filter will search for the value according to which you would like to filter the tags (*FC28* in the example); see pp. 44–46 in the *EPCglobal Gen 2 Specification V 2.0.*1. In the example, *FC28* is the third word in the EPC memory bank (bit pointer 0x00 is the CRC, bit pointer 0x10 is the PC, bit pointer 0x20 is the first EPC word). Therefore, *FC28* corresponds to the bit pointer 0x40.
7. Enter *40* at *Bit pointer* (⑥).
8. Enter the mask length at ⑦. In the example, *FC28* is one word, therefore, the value is *16*.
9. Enter the value (*FC28*) at ⑧.
10. Click *Set* (⑨).
11. Go to *Expert settings 1*.
12. In Selection Parameters, set the value at target to *B*; see also *EPCglobal Gen 2 Specification*.
13. Start the reading in the *Basic reading* tab:

⇨ The reader only reads the tags with the filtered value (marked green). The tag without the filtered value is not read (marked red).

14.9 Test Gen 2 Functions

This tab makes it possible to access individual tag functions. In addition to the functionality in accordance with the EPC Gen2 standard, it is possible, for example, to read and write tags as well as set and change tag passwords.

The user interface consists of the fields *Get all Tags*, *Password for Operation*, *Write EPC*, *Read data*, *Write data*, *Change Password*, *Lock* and *Kill* that are described in the following chapters.

Figure 51 Test Gen2 functions

14.9.1 Get All Tags

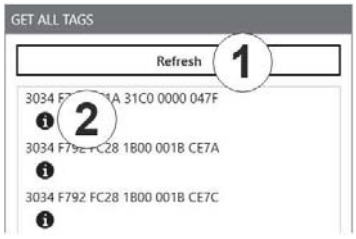


Figure 52 Test Gen2 functions: Get all EPCs

①	*Refresh*	updates the tags read in the field ► For EPC-specific operations, click on a tag to select it from the list.
②	*Info*	shows the information about the tag manufacturer and the chip type ► Click on the information symbol. ⇨ The information about the tag is shown: 3034 F792 FC1A 31C0 0000 047F Manufacturer: Impinj Type: Monza R6 3034 F792 FC28 1B00 001B CE7A Manufacturer: NXP Type: UCODE 7 SL3S1204 3034 F792 FC28 1B00 001B CE7C

14.9.2 Password for Operation

Figure 53 TestGen2: password for operation

①	*Password*	sets the password for the tag operation in the hexadecimal format

14.9.3 Write EPC

In this tab, it is possible to change the EPC of the tag.

Figure 54 TestGen2: write EPC

①	*New EPC*	enters an EPC in the hexadecimal format Make sure to comply with the maximum EPC length supported by the tag. If the maximum length is exceeded, the tag will return an error.
②	*Auto increment*	activates or deactivates increasing the EPC by one with each successful writing process
③	*Write EPC to selected tag*	writes the EPC on the selected tag
④	*Write EPC to tag in field*	writes the EPC entered in 1 to a single tag ► When using this command, make sure there is only one tag in the field. Otherwise, an error message is displayed in the status field.

14.9.4 Read Data

This group supplies 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.

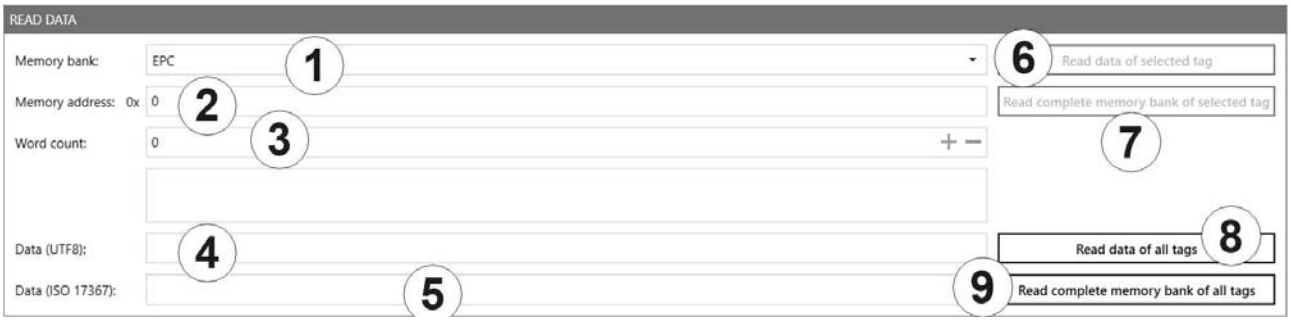


Figure 55 TestGen2: read data

①	*Memory bank*	enters the selected memory bank
②	*Memory address*	enters the address within the memory bank
③	*Word count*	enters the number of words to read
④	*Data (UTF8)*	shows the data in the UTF8 format
⑤	*Data (ISO 17367)*	shows the data in the ISO 17367 format
⑥	*Read data of selected tag*	reads data from the selected tag
⑦	*Read complete memory bank of selected tag*	reads the complete memory bank of the selected tag; up to 255 words
⑧	*Read data of all tags*	reads data from all tags in the field If the tags in the field have different passwords and are configured differently, it is necessary to read the data from each tag individually.
⑨	*Read complete memory bank of all tags*	reads the complete memory bank of all tags in the field; up to 255 words

14.9.5 Write Data

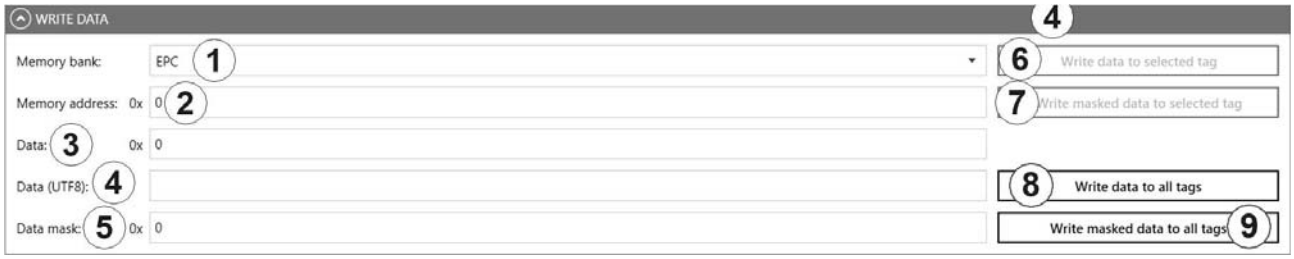


Figure 56 TestGen2: write data

①	*Memory bank*	enters the selected memory bank
②	*Memory address*	enters the address within the memory bank
③	*Data*	enters data to write in the hexadecimal format
④	*Data (UTF8)*	enters data to write in the UTF8 format
⑤	*Data mask*	enters the data mask The data mask allows only individual bits on the tag to be changed.
⑥	*Write data to selected tag*	writes data to the selected tag in the field
⑦	*Write masked data to selected tag*	writes the masked data to the selected tag
⑧	*Write data to all tags*	write data to all tags in the field ► If the data are written to all tags in the field, make sure all the tags have the same configuration (lock and password).
⑨	*Write masked data to all tags*	writes the masked data to the all tags in the field

14.9.6 Change Password

To change the password, enter the current password at ① in Figure 53. If no password has yet been set, the default value is 0.

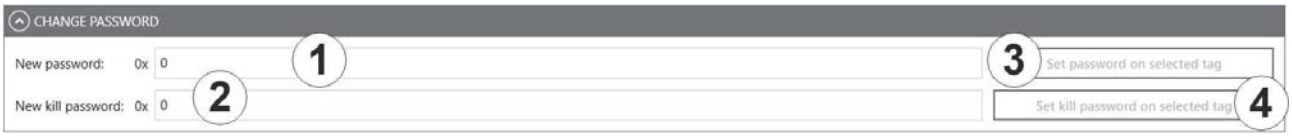


Figure 57 TestGen2: change password

①	*New password*	sets the new password in the hexadecimal format for the selected tag
②	*New kill password*	sets the new password to deactivate the selected tag
③	*Set password on selected tag*	replaces the old password by the new password for the selected tag
④	*Set kill password on selected tag*	replaces the old deactivation password by the new deactivation password for the selected tag

14.9.7 Lock

The *EPC Gen2* standard provides security mechanisms for the tag data areas. This allows individual memory areas and functionalities of the tags to be provided with a password to protect it against access and/or changes.

Under *Lock*, it is possible to lock the memory banks.

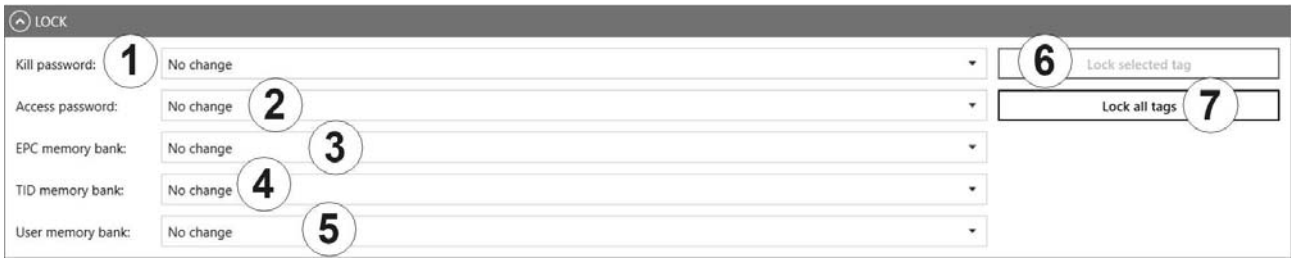


Figure 58 TestGen2: Lock

①	*Kill password*	specifies how the kill password is accessible ► Select one of the following options from the drop-down menu	
		No change	the current setting for the kill password remains unchanged
		Accessible	the kill password is readable and writeable from either the open or secured state
		Accessible with permalock	the kill password is permanently readable and writeable from either the open or secured states and may never be locked
		Accessible with password	the kill password is readable and writeable from the secured state but not from the open state

		Not accessible with permalock the kill password is not readable or writeable from any state
		► For more details, see *EPCGlobal Gen2 Specification*.
②	*Access password*	specifies how the access password is accessible ► Select an option from the drop-down menu; see the options at ①. ► For more details, see *EPCGlobal Gen2 Specification*.
③	*EPC memory bank*	specifies how the EPC memory bank is accessible ► Select one of the following options from the drop-down menu:
		No change the EPC memory remains unchanged
		Writeable the EPC memory bank is writeable from either the open or secured states
		Writeable with permalock the EPC memory bank is writeable from either the open or secured states and may never be locked
		Writeable with password the EPC memory bank is writeable from the secured state but not from the open state
		Not writable with permalock the EPC memory bank is not writeable from any state
④	*TID memory bank*	specifies how the TID memory bank is accessible ► Select an option from the drop-down menu; see the options at ③.
⑤	*User memory bank*	specifies how the User memory bank is accessible ► Select an option from the drop-down menu; see the options at ③.
⑥	*Lock selected tag*	locks the selected tag with the settings from ①–⑤
⑦	*Lock all tags*	locks all the tags with the settings from ①–⑤ ► To lock all the tags, make sure that all the tags have the same password.

14.9.8 Kill

	► To deactivate a tag, set a deactivation password that is not 0; see ② in Figure 57. After a kill command, the tag will be unusable!

Figure 59 TestGen2: Kill

①	Kill selected tag	executes a kill command on the selected tag
②	Kill all tags	executes a kill command on all tags in the field

14.10 TagScan

To represent the relationship between the tag phase and the RSSI value, it is possible to plot both values by means of the TagScan.

✓ There is only one tag in the field or a tag has been selected.

► Click *Start* to activate the TagScan.

⇨ The phase shifts are seen in the frequency switching. The RSSI value does not change because the transponder (tag) is not moved.

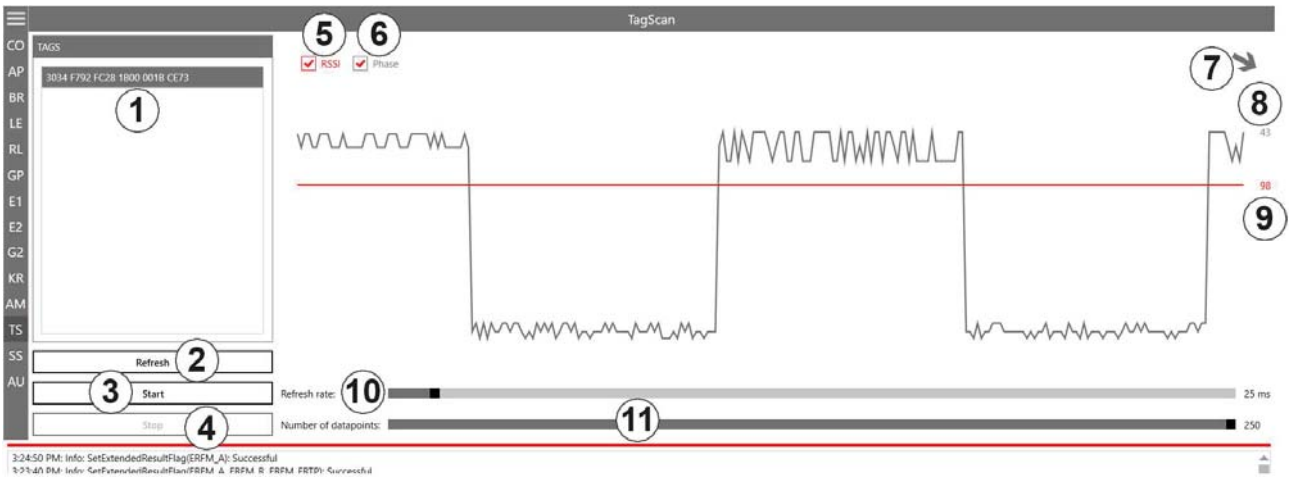


Figure 60 TagScan: phase shift (due to the channel change), transponder is not moved

①	*Tags*	shows the number of the tags present in the antenna field
②	*Refresh*	scans tags in the antenna field anew
③	*Start*	starts TagScan
④	*Stop*	stops TagScan
⑤	*RSSI*	activates/deactivates the presentation of the RSSI value in the graph
⑥	*Phase*	activates/deactivates the presentation of the phase in the graph
⑦		shows the phase in form of the rotating arrow
⑧		shows the current value of the phase
⑨		shows the current RSSI value
⑩	*Refresh rate*	sets the interval between the commands
⑪	*Number of data points*	sets the number of data points in the graph

Tipp	► To eliminate the phase shifts, select only one transmission frequency under *Expert settings 1*; see 14.7 Expert Settings 1

Figure 61 TagScan: phase shift, transponder is moved

Transponder movement is indicated by the amplitude of the phase. The RSSI value changes in small steps. The direction of the movement is indicated by means of the rotating pointer

14.11 Spectral Scan

It may happen that the RFID transmission to or from the transponder is disturbed by frequency interfering. *SpectralScan* shows a qualitative frequency spectrum. Due to the fact that it is received by means of the connected RFID antenna, the frequency assignment on location is made visible.

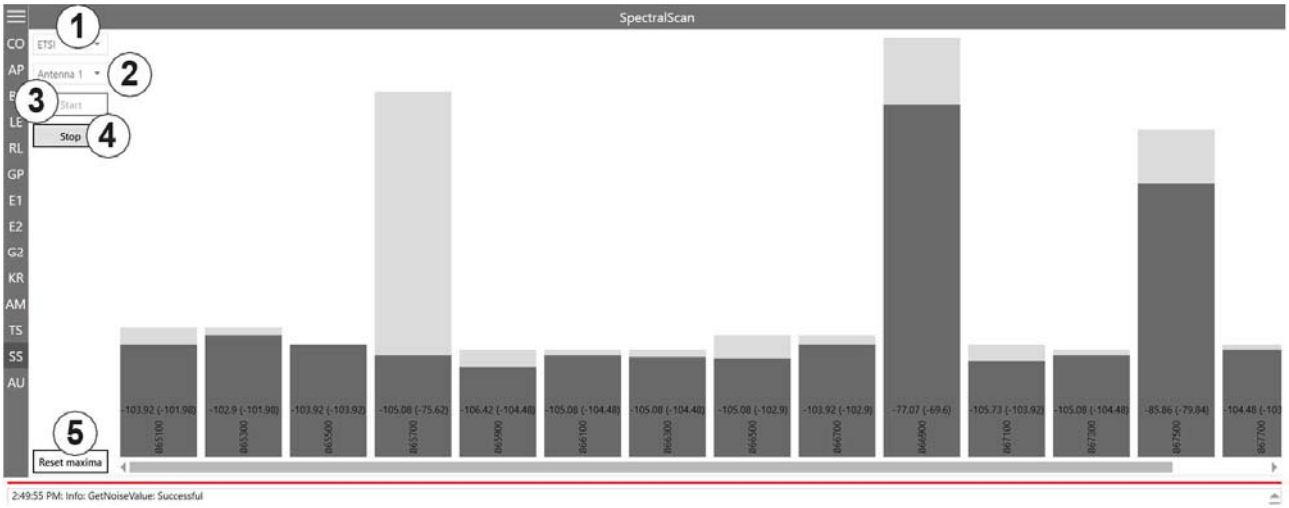


Figure 62 SpectralScan

①	*ETSI*	selects the frequency area
②	*Antenna 1–n*	selects an antenna from the drop-down menu
③	*Start*	starts SpectralScan

④	*Stop*	stops SpectralScan
⑤	*Reset maxima*	resets maxima

If there is more than one reader, spectral scan shows which channels might be occupied by other readers. In

Figure 61, the channels 4, 10 and 13 are occupied by other readers. If the user is not satisfied with the reading results and the interferences keep occurring, it is possible to deactivate channels on which the interference occurs (4, 10 and 13) and only activate the channel that is free (7) to achieve better reading results, see ⑯ in Figure 45

14.12 Authentication

Using this function, it is possible to authenticate a tag.

The Authentication tab consists of 4 areas, *Get All Tags*, *Tags*, *Key* and functions that are described below.

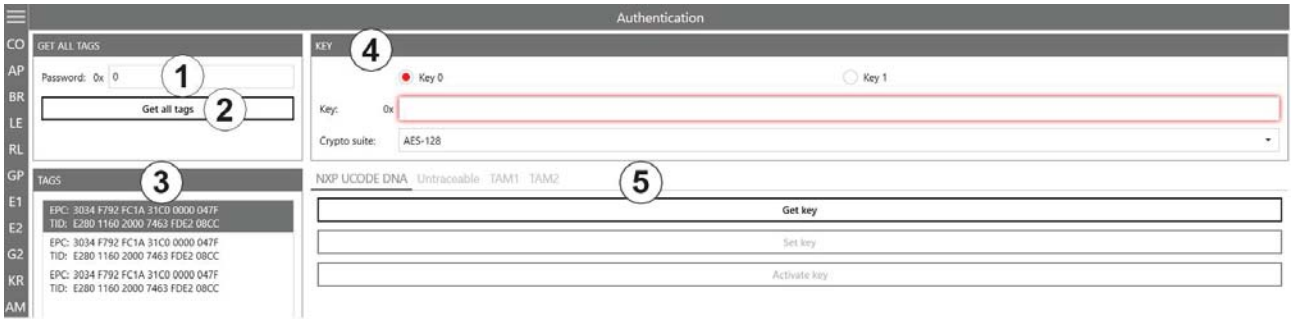


Figure 63 Authentication

①	*Password*	enters the access password; see 14.9.2 Password for Operation
②	*Get all tags*	reads all the tags in the antenna field
③	*Tags*	shows all the detected tags
④	*Key*	see 14.12.114.12.1 Key; necessary for *TAM1* and *TAM2*
⑤	*Functions*	see 14.12.2 Functions

14.12.1 Key

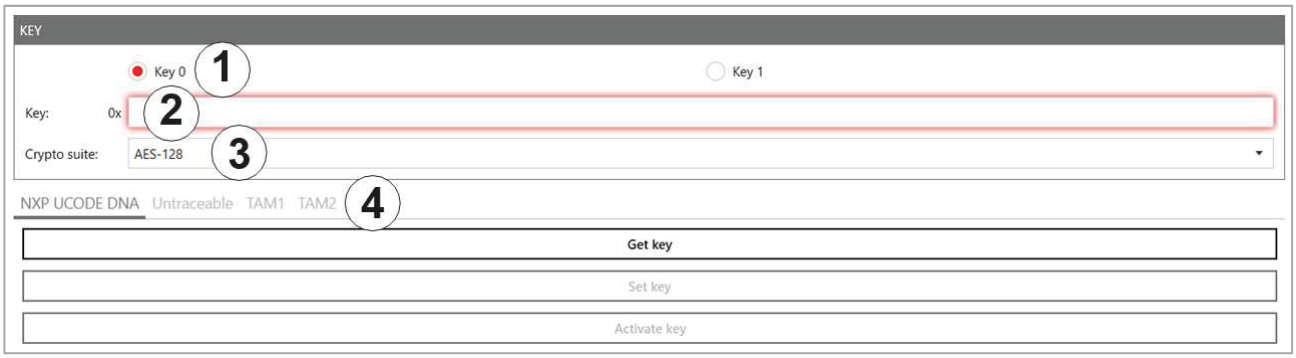


Figure 64 Authentication: Key

①	*Key 0/Key 1*	selects a key for the authentication (*Key 0* is only used for *TAM1*, *Key 1* is used for both *TAM1* and *TAM2*)
②	*Key*	enters the key selected in ①
③	*Crypto suite*	selects the crypto suite
④		see 14.12.2 Functions

14.12.2 Functions

14.12.2.1 NXP UCODE DNA

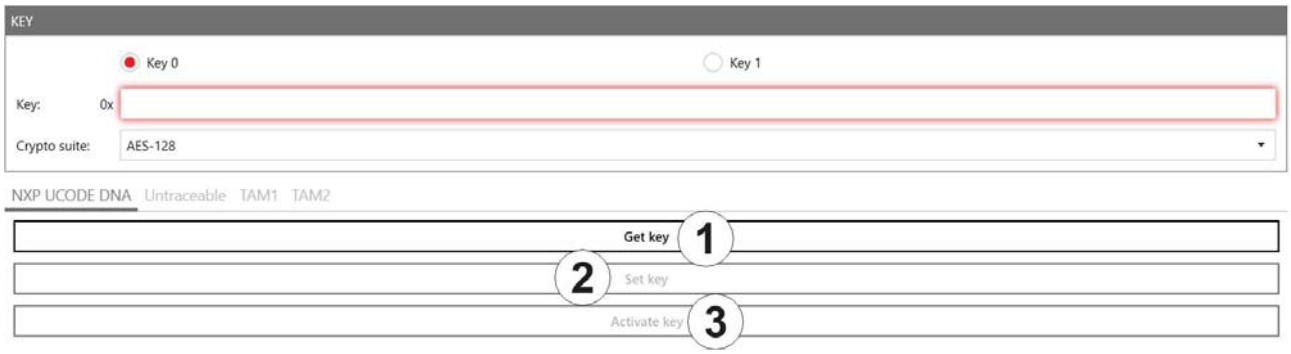


Figure 65 Authentication: NXP UCODE DNA

①	*Get key*	reads key 0 or key 1 currently set in the selected tag; only if the key has not been activated
②	*Set key*	sets key 0 or key 1 on the selected tag
③	*Activate key*	activates key 0 or key 1 on the selected tag

14.12.2.2 Untraceable

Figure 66 Authentication: untraceable

①	*U:*	asserts or deasserts U in XPC_W1; see *EPCglobal Gen2 Specification, p. 106*	
②	*EPC*	shows or hides memory above the visible EPC	
③	*New EPC length*	sets new EPC length in words	
④	*TID*	*Show:*	shows the complete TID
		Truncated:	shows the first two words in case of E2 and only one word in case of E1
		Hide:	hides the complete TID
⑤	*User*	shows or hides the user memory bank	

⑥	*Range*	selects a range	
		Normal:	the tag operates in the normal range
		Toggle temporarily:	The tag temporarily toggles between normal and reduced operating range but reverts to its prior persisting operating range when the tag loses power
		Reduced:	the tag operates in the reduced operating range
⑦	*Set Untraceable on selected tag*	sets settings 1–6 on the selected tag	

14.12.2.3 TAM1

TAM1 is used to check whether the selected tag is authentic.

✓ The tag has at least one activated key, *Key 0* or *Key 1*.

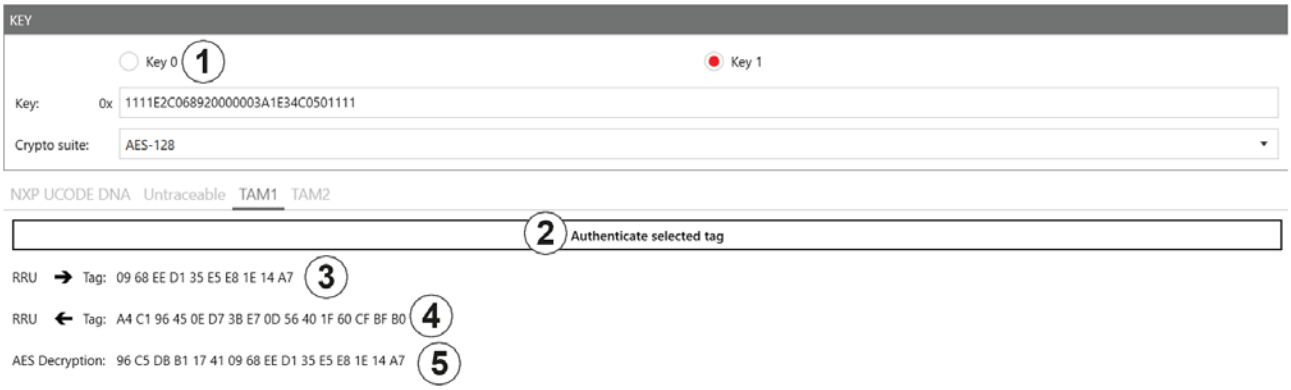


Figure 67 Authentication: key (TAM1)

	Key	see 14.12.114.12.1 Key
①	*Authenticate selected tag*	the reader sends the authenticate command to the selected tag; a pop-up message appears whether the authentication was successful or failed.
②	*RRU → Tag*	shows the random number sent to the tag by the reader
③	*RRU ← Tag*	shows the encrypted random number sent to the reader from the tag
④	*AES Decryption*	shows the data decrypted from ③ by means of the key entered at ② in 14.12.1 Key in the example above, this data contains the random number shown in ②

14.12.2.4 TAM2

TAM2 is used to read the data of the selected tag.

✓ *Key 1* has been activated.

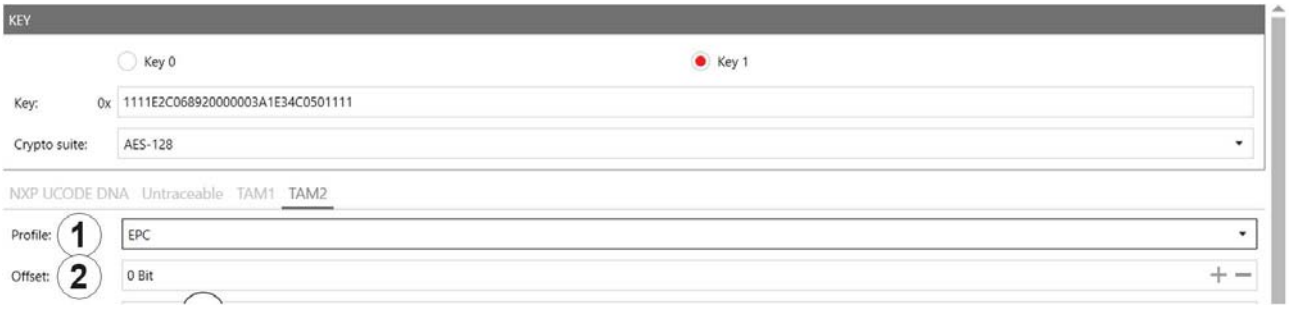


Figure 68 Authentication: key (TAM2)

①	*Profile*	selects a profile the data of which is shown
②	*Offset*	sets the offset for ⑤
③	*Block count*	sets how many bits rare to be read
④	*Protection mode*	selects the protection mode for the TAM2 authentication operation
⑤	*Read data of selected tag*	reads the data of the selected tag provided the correct key 1 has been entered at *Key*
⑥	*Data*	shows data read in ⑤

15 Waste Disposal

Electronic equipment is not domestic waste – in accordance with directive 2002/96/EC OF THE EUROPEAN PARLIAMENT AND THE COUNCIL dated 27th January 2003 concerning used electrical and electronic appliances, it must be disposed of properly. At the end of its service life, take this unit for disposal at a designated public collection point.

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