User Guide
V4.02

ARU 3500 Gen4
ARU 3560 Gen4
ARU 3570 Gen4
RRU 4500 Gen4
RRU 4560 Gen4
RRU 4570 Gen4

IMPORTANT
Read carefully before use!



Kathrein generation 4 UHF RFID reader

English

Quality made in Germany

KATHREIN

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1 Preface

Dear customer,

Please follow all the information given in this guide. KATHREIN Solutions GmbH has made every effort to ensure the information and descriptions are correct and complete.

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 guide

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

The target group of this guide is specialist personal who install, configure and put the reader into operation.

This document is valid for all Generation 4 Kathrein RFID readers.

Tip This document applies to all Generation 4 Kathrein RFID readers. Even if it's referred to in the text as RRU 4xxx, it is possible to control all other readers using the same commands.

Tip 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 www.kathrein-solutions.com.

⇨ All manuals are available for download at the product page of the Kathrein Solutions website.

3 Reader

This guide applies to the following readers:

Type	Order Number ETSI / FCC	Replaces the reader of the 3rd generation	Order Number ETSI / FCC
RRU 4500 Gen4	52010678 / 52010682	RRU 4500 Gen3	52010288 / 52010296
RRU 4560 Gen4	52010679 / 52010683	RRU 4560 Gen3	52010289 / 52010297
RRU 4570 Gen4	52010680 / 52010684	RRU 4570 Gen3	52010290 / 52010298
ARU 3500 Gen4	52010681 / 52010685	ARU 3500 Gen3	52010292 / 52010300
ARU 3560 Gen4	52010686 / 52010687	ARU 3560 Gen3	52010293 / 52010301
ARU 3700 Gen4	52010688 / 52010689	ARU 3570 Gen3	52010294 / 52010302

4 Explanation of symbols and signal words

4.1 Symbols

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

4.2 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.
Tip	This signal word indicates useful tips and recommendations.

4.3 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*
www.putty.org	hyperlinks
Browse	homepage/Windows elements

5 Professional installation guidelines

5.1 Installation personnel



UHF RFID readers require professional installation!

- ► You must be a professional installer with knowledge of RF and the relevant rules.
- ► The installation requires special trained personnel to access and set up the system.
- ► The system must not be installed by people without special knowledge. General users may not install the readers or change the settings.

5.2 External antenna



- ► You must comply with part 15 of the FCC rules, specifically part 15.203 regarding antenna requirements of an intentional radiator.
- ► Make sure to use a patch antenna with 13 dBi or less.
- ► Only use antennas which have been approved by the applicant. The use of none-approved antenna(s) may result in unwanted emissions or excessive RF power which may result in a violation of the FCC/ISED limits and is prohibited.

5.3 Final output power



WARNING

- ► Choose the installation location carefully
- ► Ensure that the final output power does not exceed the limit specified in the relevant regulations. Failure to comply with the regulation may result in severe fines!

If you are not a professional installer, **STOP**.

- ► Do not continue with the installation.
- ► Do not install the device and do not make any changes to the settings.

6 Safety instructions

6.1 General safety instructions



WARNING

Danger to life due to electric shock! Fire hazard!

Improper interventions in the device may jeopardise 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 authorised 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, 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 type label 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 cooling fins of 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 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.

NOTICE

Risk of malfunction!

- ► Ensure the reader is properly earthed according to the relevant national standards.
- ► Ensure that the diameter of the earthing cable is at least 6 mm^2 (typ. 10 mm^2).
- ► Make sure that the reader is earthed in such way that the distance between the earthing point of the reader and the earthing point in the building is as short as possible.
- ► Note that the equipotential bonding does not replace lighting protection.

Risk of malfunction due to water ingress!

- ► Only use readers, antennas and accessories intended for this purpose outdoors.
- ► For readers with protection class IP 68, use appropriate protective caps for the connections that are not terminated with Kathrein cables.

6.2 CE marking for the Kathrein ETSI RFID readers



WARNING

Danger to life due to radiation in the electromagnetic field!

This reader is designed in accordance with ETSI for operation in accordance with EN 302208. Under certain circumstances, pacemakers may be disturbed if the wearer is in the vicinity of the antenna when the device (reader and antenna) is in operation.

- ► If the device is operated with connected antennas, the regulations on human exposure in accordance with EN 50364 must be observed.
- ► Maintain a minimum distance of 35 cm between the antenna and the human body.
- ► Observe the operating instructions for RFID antennas.
- ► If in doubt, make sure that people with pacemakers contact the manufacturer or their doctor.

6.3 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* and *ISED RF Radiation Exposure Statement*.

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

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

(1) This device may not cause interference;

(2) This device must accept any interference, including interference that may cause undesired operation of the device.

ISDE

Cet appareil contient des émetteurs / récepteurs exemptés de licence conformes aux RSS (RSS) d'Innovation, Sciences et Développement économique Canada. Le fonctionnement est soumis aux deux conditions suivantes:

(1) Cet appareil ne doit pas causer d'interférences;

(2) Cet appareil doit accepter toutes les interférences, y compris celles susceptibles de provoquer un fonctionnement indésirable de l'appareil.

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 *Recommended Antenna Types, p. 14* 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 *Recommended Antenna Types, p. 14* 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 express permission of Kathrein may invalidate the FCC permit for the operation of this unit.

6.3.1 Radiation exposure statements



WARNING

Danger to life due to radiation electromagnetic field!

► As a result of the RF exposure information given in the *FCC RF Radiation Exposure Statement and ISED RF Radiation Exposure Statement,* 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 pacemakers contact the manufacturer of their pacemaker or their doctor.

FCC RF radiation exposure statement

This transmitter must not be in 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 30 centimetres between the radiator and your body.

► Due to the fact that the ARU 3560 contains a WLAN module, make sure to keep the minimum distance of 31 centimetres between the radiator and your body.

► Due to the fact that the ARU 3570 contains a cellular module, make sure to keep the minimum distance of 37 centimentres 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 centimetres between the radiator and your body.
- ► Due to the fact that the ARU 3560 contains a WLAN module, make sure to keep the minimum distance of 35 centimetres between the radiator and your body.
- ► Due to the fact that the ARU 3570 contains a cellular module, make sure to keep the minimum distance of 54 centimentres 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.
- ► Comme l'ARU 3560 contient un module WLAN, assurez-vous que cet équipement est utilisé avec une distance minimale de 35 centimètres entre le radiateur et votre corps.
- ► Comme l'ARU 3570 contient un module cellulaire, assurez-vous que cet équipement est utilisé avec une distance minimale de 54 centimètres entre le radiateur et votre corps.

6.3.2 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.

6.3.3 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
52010584	WiRa 30° 70° PRO FCC	Wide Range 30° / 70° antenna FCC, 902–928 MHz, 30° circular	11.5 dBiC	8.5dBi
52010252	WiRa 40° PRO FCC	Wide Range 40° antenna FCC, 902–928 MHz, 40° linear	n.a.	13 dBi
52010083	MiRa 100° PRO FCC	Mid Range antenna FCC, 902–928 MHz, 100° circular	2.5 dBiC	–0.5 dBi
52010172	S-MIRA 100° PRO ETSI-FCC	Short Mid Range antenna ETSI/FCC, 865–928 MHz, 100° circular	–10 dBiC	–13 dBi
52010085	LORA PRO FCC	Low Range antenna FCC, 902–928 MHz	n.a.	–15 dBi
52010092	U-LORA PRO ETSI-FCC	Ultra Low Range antenna FCC, 865–928 MHz	n.a.	–30 dBi
52010219	SMSH LG ETSI-FCC	SMSH antenna/-module, 865–928 MHz, circular	–7 dBiC	–10 dBi
52010334	WiRa 70° PRO FCC	Wide Range antenna, 902–928 MHz, circular	8.5 dBiC	5.5 dBi
52010711	Mid Range 90° EDGE	Mid Range 100° antenna FCC, 902–928 MHz, 100° circular	6.5 dBiC	3.5 dBi
52010713	Wide Range 55° EDGE	Wide Range 55° antenna FCC, 902–928 MHz, 55° circular	10.0 dBiC	7.0 dBi
52010726	Wide Range 80° EDGE	Wide Range 80° antenna FCC, 902–928 MHz, 80° circular	7.5 dBiC	4.5 dBi

7 Warranty information

► Before installing or maintaining the reader, make sure that the person concerned has read the manual and understood its contents.

8 Introduction to the RFID system

8.1 RFID system

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

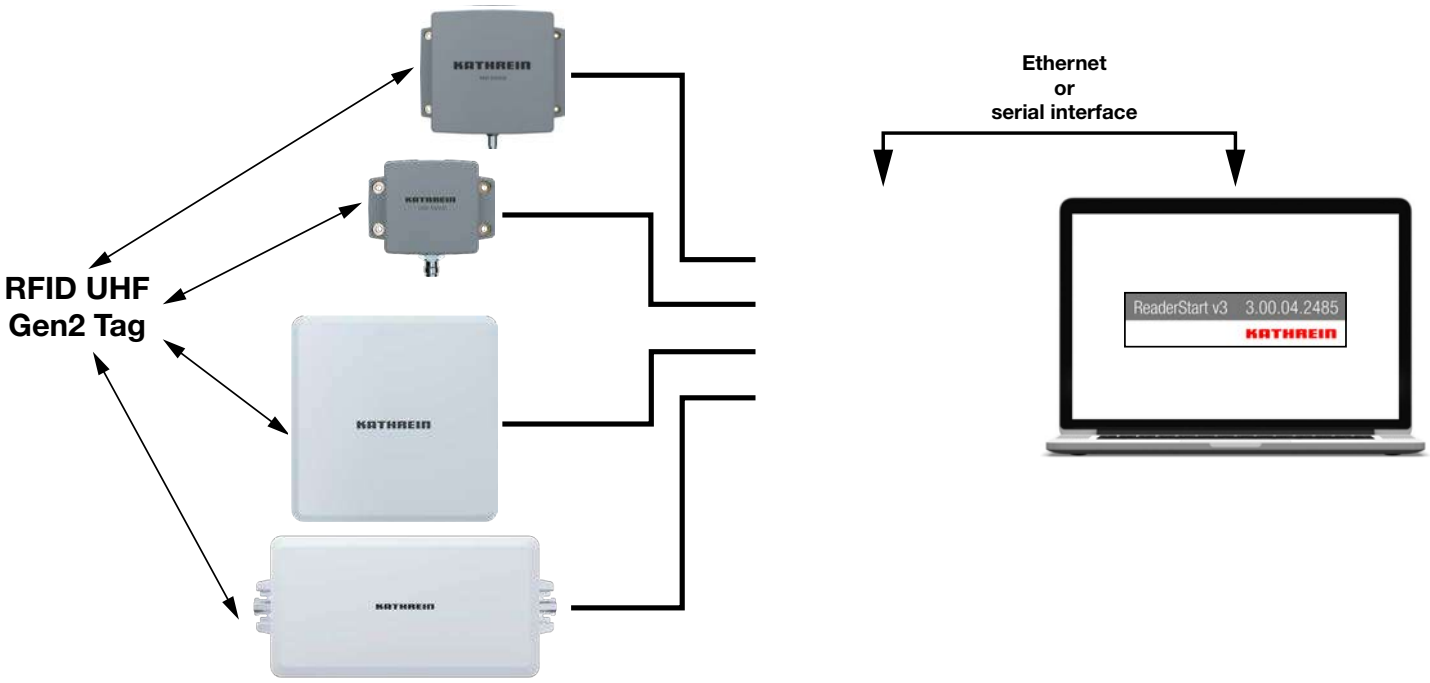


Fig. 1: RFID system (example)

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 parameterization.

The communication between the *ReaderStart v3* and the reader is based on the DLL (*Dynamic Link Library*), which includes the communication protocol, see *Communication Protocol Kathrein RFID UHF Readers*. 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.

8.2 Kathrein RFID Antenna Interface ©KRAI

With the ©KRAI product range, Kathrein has introduced a revolutionary system. By using Kathrein ©KRAI antennas, it is possible to dynamically adapt flexibility through controllable antenna characteristics at an installation point (for PLS and CSB antennas) and functionality (for cascading SMSH antennas).

KRAI consists of a digital control bus that establishes a connection between the RFID reader and the RFID antennas in order to increase the reading performance through optimized antenna properties. The optimum antenna characteristics are either tested in advance and then specified during operation. Alternatively, all antenna properties can be dynamically exchanged sequentially and the resulting read values distributed to a higher-level instance for further statistical evaluation.

8.2.1 WIRA 70 ©KRAI Polarisation Switch Antenna (PLS)

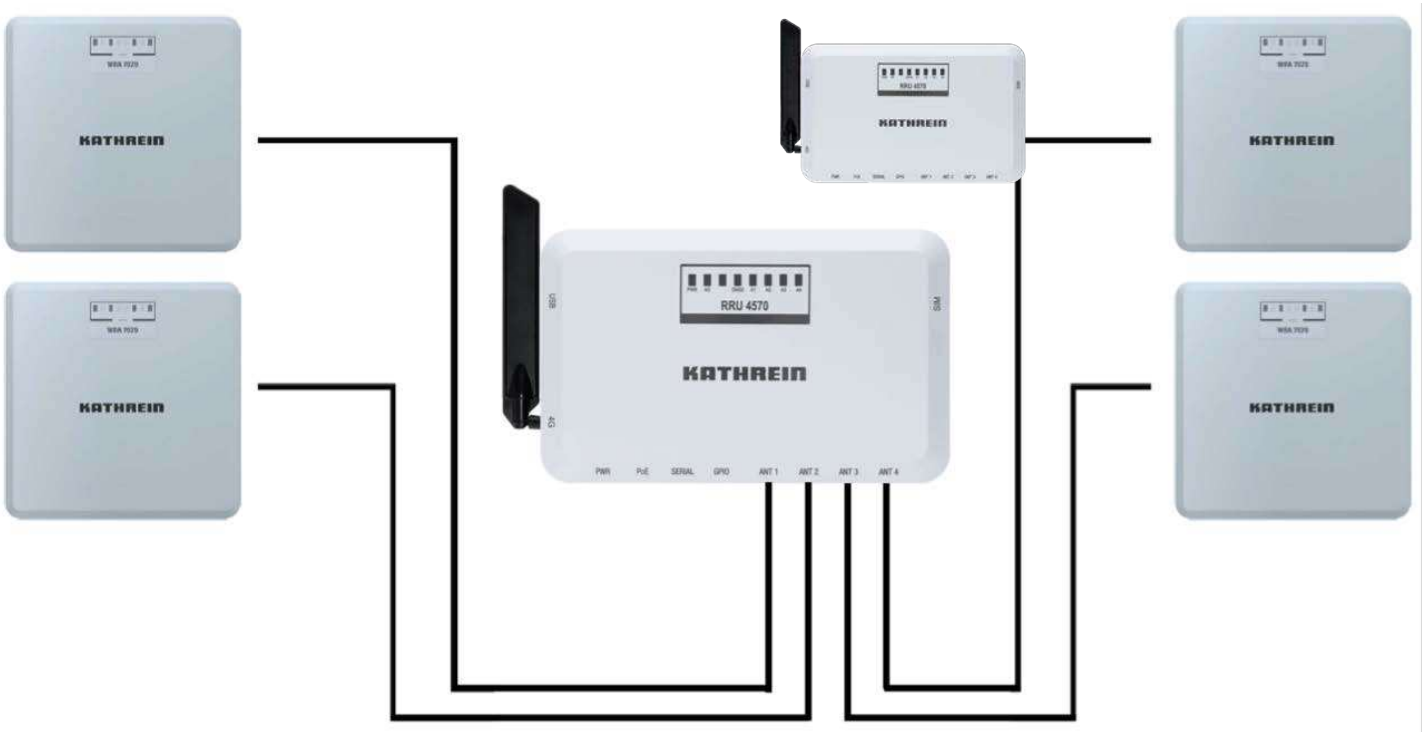


Fig. 2: PLS antennas connected to a reader

With the ©KRAI PLS antenna, built as a wide range 70° antenna, the polarization can be switched statically or dynamically:

- circular LHCP
- circular RHCP
- linear horizontal
- linear vertical.

It is possible to select the best polarization for wide-range use and to flexibly adjust the polarization on the antenna on site.

Type	Order number	Far-field half-power beam width	Polarization	Frequency range
WIRA 7070 ©KRAI ETSI	52010335	70°/70°	Linear Horizontal Linear Vertical Circular Clockwise Circular Counterclockwise	865–868 MHz
WIRA 7070 ©KRAI FCC	52010336	70°/70°	Linear Horizontal Linear Vertical Circular Clockwise Circular Counterclockwise	902–928 MHz

Tip PLS antennas have 4 LEDs to visualise customer applications.
The LEDs are supplied and controlled by the RRU 4xxx reader via the existing antenna cable.

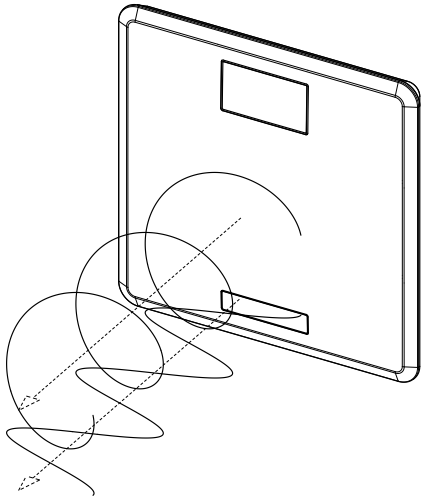


Fig. 3: Circular and linear polarisation

8.2.2 Kathrein ARU RFID reader with circular switch-beam antenna

The ARU 3500, ARU 3560 and ARU 3570 readers have a built-in circular en switch beam antenna (see Fig. 4 a, b, c).

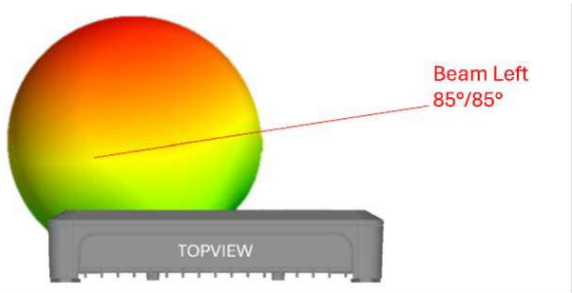


Fig. 4a: Beam left

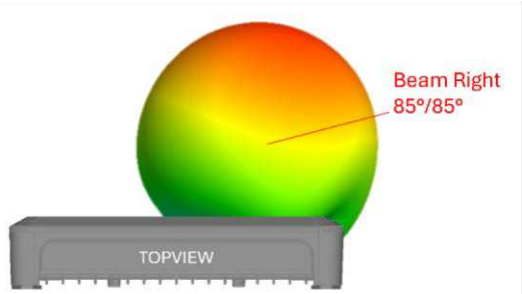


Fig. 4b: Beam right

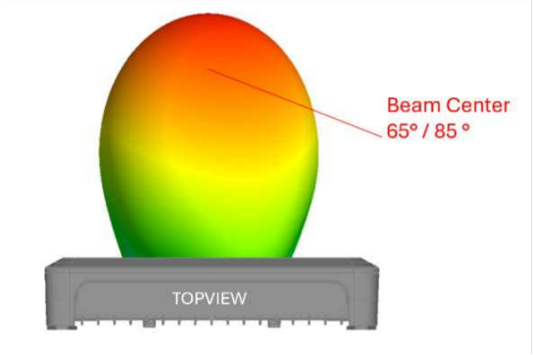


Fig. 4c: Center beam

T This makes it possible to change the three antenna beams statically or dynamically in order to track the tagged goods and determine the direction of movement. In addition, the wide right and left beams can be used to extend the reading range of the reader. This can be used, for example, to extend the search range when used on a forklift truck.

The following settings are possible in any combination:

- Antenna-Beam CENTER (Radiation 90° to the longitudinal alignment of the antenna)
- Antenna-Beam LEFT swiveled 15° to the left
- Antennas-Beam RIGHT swiveled 15° to the right

8.2.3 Kathrein ©KRAI SMSH (Smart Shelf) antennas

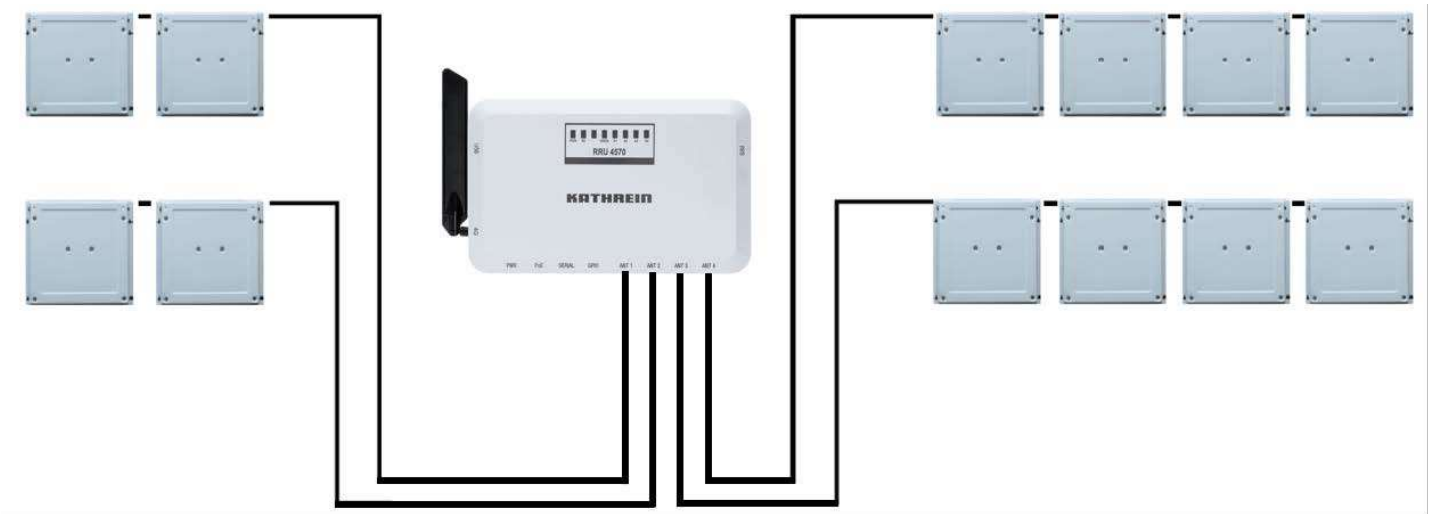


Fig. 5: ©KRAI smart shelf antennas connected to the reader (cascaded)

Up to 8 ©KRAI smart shelf (SMSH) antennas can be cascaded per reader port; 8 antennas x 4 ports = 32 SMSH antennas in total.

The SMSH @KRAI antenna was developed for point of sale applications, smart shelf applications and Kanban solutions. The antenna is characterized by an extremely homogeneous reading range, which is very strongly aligned to the front. The antennas are therefore suitable for the static detection of multiple transponders. Thanks to its extremely thin design, the antenna module can be easily integrated into various applications.

The antenna is equipped with an intelligent bypass circuit that allows cascading of up to 8 SMSH antennas per reader

connection. The 4th generation of Kathrein RFID readers is controlled via the RRU 4xxx and also via the ARU 3xxx. The ©KRAI control signals are transmitted via the existing standard antenna cable.

Type	Order number	Far-field half-power beam width	Polarization	Frequency range
SMSH Antenna ETSI	52010523	60°/60°	circular	865–868 MHz
SMSH Antenna KRAI ETSI	52010524	60°/60°	circular	865–868 MHz
SMSH Antenna FCC	52010525	60°/60°	circular	902 - 928 MHz
SMSH Antenna KRAI FCC	52010526	60°/60°	circular	902 - 928 MHz

8.3 Further reference material

In order to configure the reader correctly and adapt it to the respective application, detailed knowledge of the EPCglobal standard from GS is required. This standard describes the functional principle of the interface between tag and reader.

The parameters available for the configuration of the reader are described in the *configuration manual for Kathrein RFID UHF Readers*.

The reader is controlled via the Kathrein Burgstaedt reader protocoll (KBRP), the current version of which is described in detail in the *Kathrein RFID UHF Reader Communication Protocol*.

Document	Application
Communication Protocol Kathrein RFID UHF Readers	software development
Configuration Manual for Kathrein RFID UHF Readers	commissioning
Installation Manual for Kathrein Antennas	setup and installation
EPCglobal Gen2 Specification[1)]	software development
Putty – SSH Client (http://www.putty.org)	software development

[1)] EPC™ Radio-Frequency Identity Protocols Class-1 Generation-2 UHF RFID Version 2.0.1 at https://www.gs1.org/epcrfid/epc-rfid-uhf-air-interface-protocol/2-0-1.



Make sure the version of the document matches the software version of the reader, see https://www.kathrein-solutions.com/get-started.

9 The reader family

9.1 Functional specification

The Kathrein RFID (Radio Frequency Identification) readers are multi-protocol-capable devices for reading 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 Kathrein readers support all market leading transponder chip functions for security, authentication and encoding. As delivered, the reader can read and write tags according to the EPC Gen2v2 standard.

It is possible to load additional protocols via software updates.

The device has a maximum of four external antenna ports for connecting the transwith/receive antennas for communication with RFID tags.

Depending on the variant, the device has different communication interfaces for integration into different infrastructures. Power is supplied either via a 4-pin M12 panel connector in A-coding or via PoE+ in accordance with 802.3at (10-57).

The Kathrein UHF RFID reader system is characterized by great flexibility with regard to RFID applications. One reason for this is the wide variety of compatible readers, which allow you to select the reader from the Kathrein product portfolio that is best suited to the respective application. Another reason for this flexibility is the wide range of parameters for configuring the reader firmware.

Kathrein Solutions GmbH guarantees the IP protection class specified in the data sheet only in conjunction with original Kathrein accessories such as cables, protective caps and mounting brackets. All damage caused by non-original or incorrectly installed accessories is excluded from any warranty.

9.2 Guide for reader selection

The tables show the features of the different reader types RRU 45xx and ARU 35xx:

	RRU 4500	RRU 4560	RRU 4570
Air Interface Protocol	RAIN RFID / ISO 18000-63 and EPCglobal Gen2v2		
Number of antenna ports	4 Antenna Ports for external Antennas		
Read zones with ©KRAI	32		
Transmission power	max. +33 dBm		
Sensitivity	max. -92 dBm		
Transponder per second	1.100		
Processor	iMX8 Cortex A35 dual core @800 MHz		
Flash-memory eMMC [Mbyte]	8.000		
RAM DDR2 [Mbyte]	1.000		
Communication connections	1x Ethernet / 1x Serial		
GPIO - Input/Output	4/4		
LED Display	4+8		
Degree of protection	IP68 *		
Wireless interfaces	–	WiFi 6, Bluetooth SPP	4G; 5G ready
Localization	–	GNSS	GNSS

* if all connections are made with a Kathrein cable or have Kathrein protective caps

	ARU 3500	ARU 3560	ARU 3570
Air Interface Protocol	RAIN RFID / ISO 18000-63 and EPCglobal Gen2v2		
Number of antenna ports	1x internal CSB antenna (left/central/right) 3x antenna ports für externe antennas		
Read zones with ©KRAI	24 (via external antenna ports)		
Transmission power at the socket via internal antenna	max. +33 dBm max.+33 dBm e.r.p.		
Sensitivity	max. -92 dBm		
Transponder per second	1.100		
Processor	iMX8 Cortex A35 dual core @800 MHz		
Flash-memory eMMC [Mbyte]	8.000		
RAM DDR2 [Mbyte]	1.000		
Communication connections	1x Ethernet / 1x Serial		
GPIO - Input/Output	4/4		
LED Display	4+8		
Degree of protection	IP68 *		
Wireless interfaces	–	WiFi 6, Bluetooth SPP	4G; 5G ready
Localization	–	GNSS	GNSS

* if all connections are made with a Kathrein cable or have Kathrein protective caps

9.3 Use cases

The readers can be used for a wide range of applications. The following tables show the typical use cases for the respective reader types.

Use cases	RRU 4500	RRU 4560	RRU 4570
Manufacturing and automotive	✓	✓	✓
Logistics	✓	✓	✓
Track & Trace	✓	✓	✓
Intelligent Transportation Systems	✓	✓	✓
Healthcare	✓		

Use cases	ARU 3500	ARU 3560	ARU 3570
Manufacturing and automotive	✓	✓	✓
Logistics	✓	✓	✓
Track & Trace	✓	✓	✓
Intelligent Transportation Systems	✓	✓	✓
Healthcare	✓	✓	✓

9.4 Kathrein RFID antennas

For the best and most stable reading results, combine the 4th generation of Kathrein RFID readers with the Kathrein RFID antennas from the PRO and EDGE families. The RFID antennas of the PRO family are particularly suitable for outdoor use when the focus is on the highest requirements for weather resistance and tightness.

If compactness and installation in machines or vending machines are required, the RFID antennas of the EDGE family are the right choice.

Detailed documentation for both antenna series can be found here:

RFID antennas - Efficient solutions for industry & logistics

9.4.1 Kathrein PRO Line antennas

For use with UHF RFID antennas, we recommend the Kathrein antenna types ULoRa, LoRa, MiRa, WiRa from the PRO antenna range. These antennas are waterproof to at least IP65.

Further information can be found in the Kathrein RFID antennas user manual.

Order number	Type	Description	Antenna Gain	
			circular	linear
52010489	Wide Range Antenna PRO WiRa 25° 35° ETSI	Wide Range Antenna 25° 35°, 865–868 MHz, linear	n.a.	15 dBi
52010490	Wide Range Antenna PRO WiRa 25° 35° FCC	Wide Range Antenna 25° 35°, 902-928 MHz, linear	n.a.	15 dBi
52010583	Wide Range Antenna PRO WiRa 30°70° ETSI	Wide Range Antenna 30° 70°, 865–868 MHz, circular	11.5 dBiC	8.5 dBi
52010584	Wide Range Antenna PRO WiRa 30°70° FCC	Wide Range Antenna 30° 70°, 902–928 MHz, circular	11.5 dBiC	8.5 dBi
52010251	Wide Range Antenna PRO WiRa 40° ETSI	Wide Range Antenna 40°, 865–868 MHz, linear	n.a.	12.5 dBi
52010252	Wide Range Antenna PRO WiRa 40° FCC	Wide Range Antenna 40°, 902-982 MHz, linear	n.a.	13 dBi
52010333	Wide Range Antenna PRO WiRa 70° ETSI	Wide Range Antenna 70°, 865–868 MHz, circular	8.5 dBiC	5.5 dBi
52010334	Wide Range Antenna PRO WiRa 70° FCC	Wide Range Antenna 70°, 902-928 MHz, circular	8.5 dBiC	5.5 dBi
52010335	Wide Range Antenna PRO ©KRAI WiRa 70° ETSI	Wide Range Antenna 70°, ©KRAI 865–868 MHz, circular	6.5/6.5/ -/- dBiC	3.5/3.5/ 7/7dBi
52010334	Wide Range Antenna PRO ©KRAI WiRa 70° FCC	Wide Range Antenna 70°, ©KRAI 902-928 MHz, circular	6.5/6.5/ -/- dBiC	3.5/3.5/ 7/7dBii
52010423	Wide Range Antenna PRO WiRa 60° ETSI	Wide Range Antenna 60°, 865–868 MHz, circular	6.5 dBiC	3.5 dBi
52010424	Wide Range Antenna PRO WiRa 60° FCC	Wide Range Antenna 60°, 902-928 MHz, circular	6.5 dBiC	3.5 dBi
52010082	Mid Range Antenna PRO MiRa 100° ETSI	Mid Range Antenna 100°, 865–868 MHz, circular	2.5 dBiC	-0.5 dBi

52010083	Mid Range Antenna PRO MiRa 100° FCC	Mid Range Antenna 100°, 902-928 MHz, circular	2.5 dBiC	-0.5 dBi
52010172	SMid Range Antenna PRO SMiRa 100° ETSI/FCC	Short Mid Range Antenna 100°, 865–928 MHz, circular	-10 dBiC	-13 dBi
52010084	Low Range Antenna PRO LoRa ETSI	Low Range Antenna, 865–868 MHz, circular	n.a.	-15 dBi
52010085	Low Range Antenna PRO LoRa FCC	Low Range Antenna, 902-928 MHz, circular	n.a.	-15 dBi
52010092	ULow Range Antenna PRO ULoRa ETSI/FCC	Ultra Low Range Antenna, 865–928 MHz, circular	n.a.	-30 dBi

9.4.2 Kathrein EDGE Line antennas

The Kathrein antennas of the EDGE-Line family are available as Mid Range and Wide Range antennas. These antennas are the first choice, especially when space is limited. These wide range antennas of the EDGE-Line family are IP 54 waterproof and can be used outdoors. The mid-range antennas of the EDGE-Line family are IP 40 waterproof and should not be used outdoors without protection.

Order number	Type	Description	Antenna Gain	
			circular	linear
52010523	SMSH Antenna EDGE 60°ETSI	Smart Shelf Antenna,60° 865-868 MHz, circular	5 dBiC	2 dBi
52010524	SMSH Antenna EDGE; ©KRAI 60°ETSI	Smart Shelf Antenna, 60° ©KRAI 865-868 MHz, circular	4.5 dBiC	1.5 dBi
52010525	SMSH Antenna EDGE 60°FCC	Smart Shelf Antenna,60° 902-928 MHz, circular	5 dBiC	2 dBi
52010526	SMSH Antenna EDGE; ©KRAI 60°FCC	Smart Shelf Antenna, 60° ©KRAI 902-928 MHz, circular	4.5 dBiC	1.5 dBi
52010722	Mid Range EDGE Antenna MiRa 100° ETSI	Mid Range 100° Antenna, 865-868 MHz, circular	5 dBiC	2 dBi
52010710	Mid Range EDGE Antenna MiRa 90° ETSI	Mid Range 90° Antenna, 865-868 MHz, circular	6 dBiC	3 dBi
52010711	Mid Range EDGE Antenna MiRa 90° FCC	Mid Range 90° Antenna, 902-928 MHz, circular	6 dBiC	3 dBi
52010725	Wide Range EDGE Antenna MiRa 80° ETSI	Wide Range 80° Antenna, 865-868 MHz, circular	7.5 dBiC	4.5 dBi
52010726	Wide Range EDGE Antenna MiRa 80° FCC	Wide Range 80° Antenna, 902-928 MHz, circular	7.5 dBiC	4.5 dBi
52010712	Wide Range EDGE Antenna MiRa 55° ETSI	Wide Range 55° Antenna, 865-868 MHz, circular	10.0 dBiC	4.5 dBi
52010713	Wide Range EDGE Antenna MiRa 55° FCC	Wide Range 55° Antenna, 902-928 MHz, circular	10.0 dBiC	4.5 dBi

9.5 Kathrein RFID accessories

9.5.1 Antenna cables

Order number	Type	Description
52010174	R-AC 3 TNC-TNCR	LL240 flex, 3 m, IP67 resistant
52010175	R-AC 6 TNC-TNCR	LL240 flex, 6 m, IP67 resistant
52010176	R-AC 10 TNC-TNCR	LL240 flex,10 m, IP67 resistant
52010177	R-AC 15 TNC-TNCR	LL240 flex,15 m, IP67 resistant

9.5.2 Antenna adapters

Order number	Type	Description
52010178	R-AA TNC-N (f-m)	Adapter TNC-N (f-m)
52010598	R-AA TNC-TNC (f-m)	Angled adapter TNC-TNC (f-m)

9.5.3 Antenna mounting accessories – wall pole mounting

Order number	Type	Description
52010262	MK-WM-100-100 Outdoor	Wall mounting kit for WiRa 40° antennas
52010351	MK-WPM3-OSS Outdoor	Wall/pole mounting kit for RRU 4xxx, ARU 3xxx, WRA 7070 antenna
52010368	MK-PMA-OGV	Pole mounting adapter for 52010351
52010751	MK-WiRa 25° 35° Gantry Mount	Wall mounting kit for WiRa 25° 35° antennas

9.5.4 Antenna protective cover

Order number	Type	Description
52010734	SMSH-25-25-PC	Protective cover for SMSH 70° antennas

9.5.5 Reader connecting cables

Order number	Type	Description
52010358	R-CC3-10 DC	RRU/ARU DC power cable, 10 m
52010360	R-CC3-10 ETH	RRU/ARU Ethernet cable M12/RJ45, 10 m
52020361	R-CC3-03 ETH	RRU/ARU Ethernet cable M12/RJ45, 3 m
52010362	R-CC3-10 GPIO	RRU/ARU GPIO cable M12, 10 m
52010363	R-CC3-03 GPIO	RRU/ARU GPIO cable M12, 3 m
52010743	R-CC4-10-MPP	RRU/ARU Serial Cable M12, 10 m
52010744	R-CC4-03-MPP	RRU/ARU Serial Cable M12, 3 m

9.5.6 Reader AC/DC power supply unit

Order number	Type	Description
52010364	R-RPA3 24 VDC – 90 W	RRU/ARU AC/DC adapter 24 V/90 W

9.5.7 Reader protective covers and caps

Order number	Type	Description
52010376	PCS-G3-IP67	Protective cap for all IP68 readers
52010741	R-RVP4-VPP-ALU	Vandalism protection cover for 4th generation RFID readers RRU 4xxx and ARU 3xxx

10 Interfaces and displays

10.1 RRU 4500 and ARU 3500

The RRU 4500 and ARU 3500 readers are identical with regard to the mechanical connections and the displays, except for the missing antenna socket 1 on the ARU 3500. The connections and displays on the respective RRU 4500 variant are explained below.

10.1.1 Front view

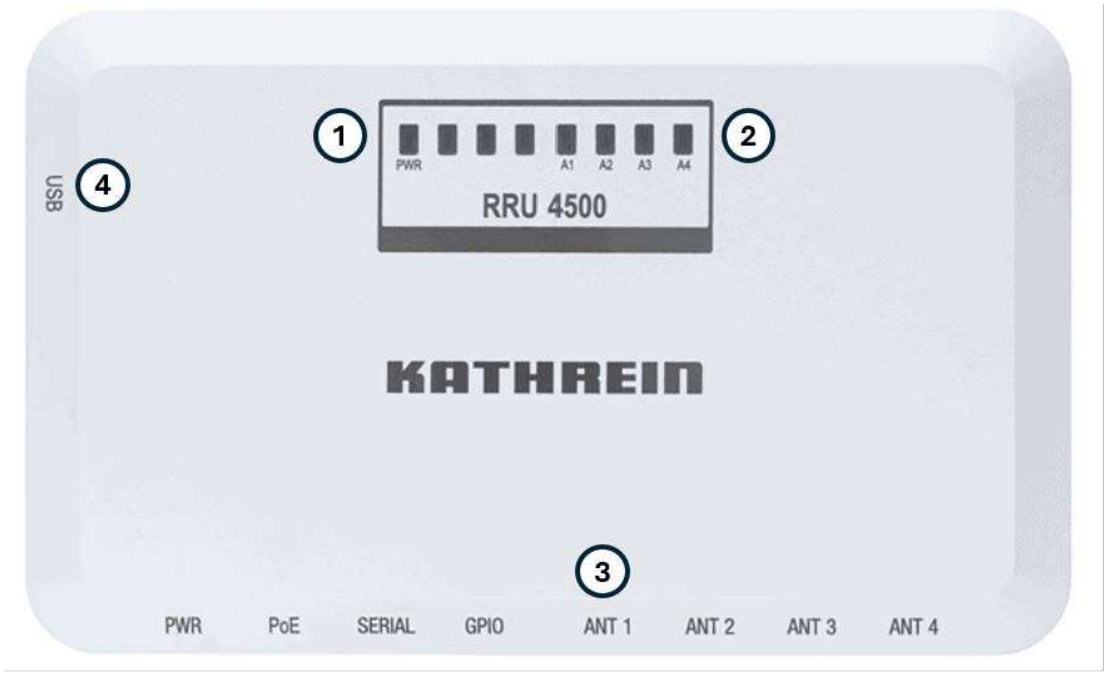


Fig. 6: RRU 4500 / ARU 3500 – display and printing

No.	**Name**	**Function**
①	*PWR*	Indicates whether the reader is switched on; see also *14.6 Reading the PWR LED displays*
②	LEDs (A1-A4)	Indicate whether an RF signal is present for antennas 1-4 (default setting) ► For further functions of the basic LEDs, see *16.4.1 Selecting the functions* ► The other LEDs without description can be used if required In general, all LEDs (with the exception of the PWR LED) are freely programmable. Either via predefined functions, which are described in chapter *16.4.1 Selecting the functions* or via direct SW access.
③	ANT 1	The ANT 1 connection for an external antenna is only available for the RRU 4500. This external socket is not available on the ARU 3500 readers, but is connected directly to the internal antenna
④	*USB*	A USB-C socket is located under a metal screw connection

10.1.2 Back view

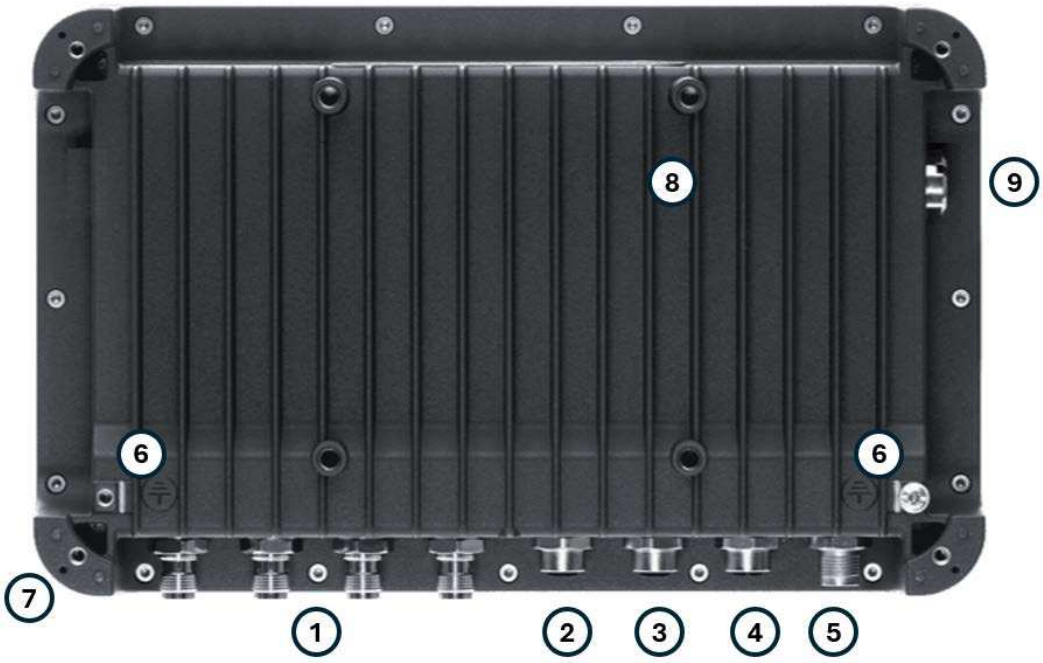


Fig. 7: RRU 4500 / ARU 3500 – connections

No.	**Name**	**Function**
①	*ANT 1-4*	Antenna Connections 1-4 R-TNC 50 Ohm, for connecting an antenna The ANT 1 antenna connection is not available on the ARU 3500
②	*GPIO*	For connecting external sensors or external switches; see also *16.6 GPIO function*
③	*SERIAL*	Multi-protocol connection for serial connection to a controller see also *16.7 Functions of the multi-protocol port*
④	*PoE/Ethernet*	Ethernet connection for the IP connection to an Internet-based controller Input socket for the Power over Ethernet (PoE) power supply
⑤	*PWR*	For connection to a DC power supply, 10-30 V DC
⑥	⏚	Earthing points to connect the reader to earth in a defined manner to prevent residual currents
⑦	Front mounting	Position for mounting brackets, which can be screwed on in 45° increments to find the optimum mounting position. These mounting brackets are screwed to a wall or suitable mounting brackets from the front.
⑧	3D-Mounting	Mounting field 100 x 100 mm for the mounting kit 52010351or 52010736. This mounting kit allows the reader to be aligned in 3 planes.
⑨	USB	A USB-C socket is located under a metal screw connection

10.1.3 USB-C port

As shown in the previous section, the 4th-generation Kathrein RFID readers feature a USB-C port as their connection interface.



For more information on the USB-C port, see "*15.2 USB-C Transmission Protocol"* and *"18.2.2 Settings for the USB-C Port."*

Once the metal protective cap is removed, a standard USB-C cable can be connected to the reader.



NOTE

Please note the following restrictions when using the USB-C port.

- ► The USB-C port is designed for communication purposes only. It is not intended for DC charging of external devices.
- ► Please note that opening the USB protective screw cap may allow water and dust to enter the reader, thereby compromising the reader's water resistance.
- ► The USB-C port is also available on the ARU 3560, ARU 3570, RRU 4560, and RRU 4570 readers.

10.2 RRU 4560 and ARU 3560

The RRU 4560 and ARU 3560 readers are identical with regard to the mechanical connections and the displays, except for the missing antenna socket 1 on the ARU 3560. The connections and displays on the respective RRU 4560 variant are explained below.

10.2.1 Front view

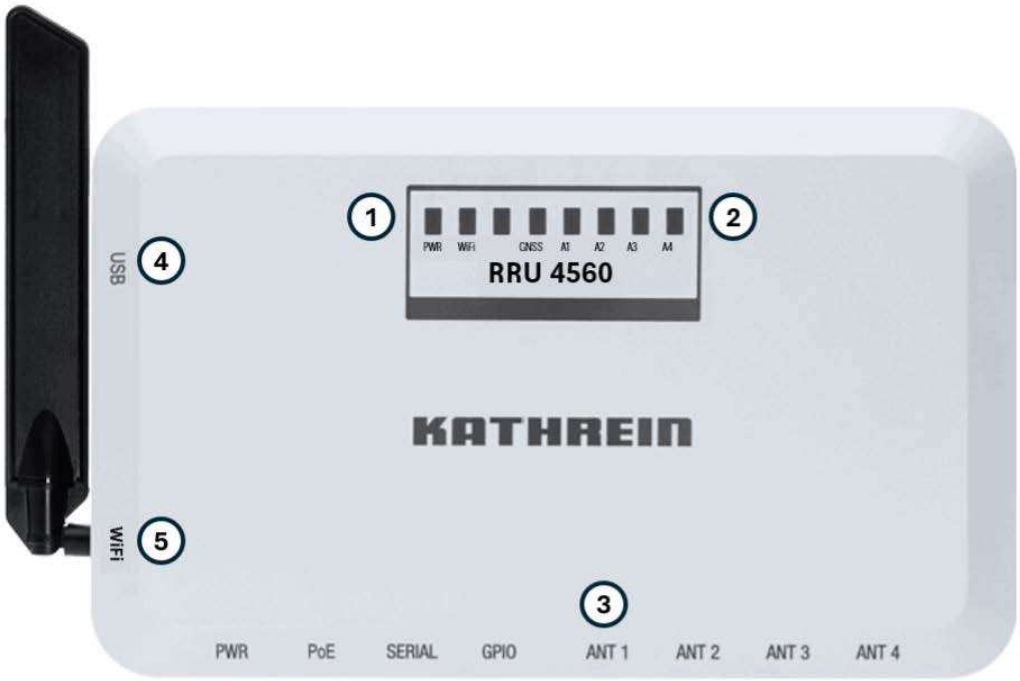


Fig. 8: RRU 4560 / ARU 3560 – Display and printing

No.	**Name**	**Function**
①	*PWR*	Indicates whether the reader is switched on; see also *14.6 Reading the PWR LED displays*
②	LEDs (A1-A4)	Indicate whether an RF signal is present for antennas 1-4 (default setting) ► For further functions of the basic LEDs, *16.4.1 Selecting the functions* ► Status LEDs for Wi-Fi and GNSS ► The other LEDs without Description can be used if required In general, all LEDs (with the exception of the PWR LED) are freely programmable. Either via predefined functions, which are described in chapter *16.4.1 Selecting the functions* or via direct SW access.
③	ANT 1	The ANT 1 connection for an external antenna is only available for the RRU 4560. This external socket is not available on the ARU 3560 readers, but is connected directly to the internal antenna
④	USB	A USB-C socket is located under a metal screw connection
⑤	WiFi	SMA connector for external WiFi/Bluetooth antenna

10.2.2 Back view

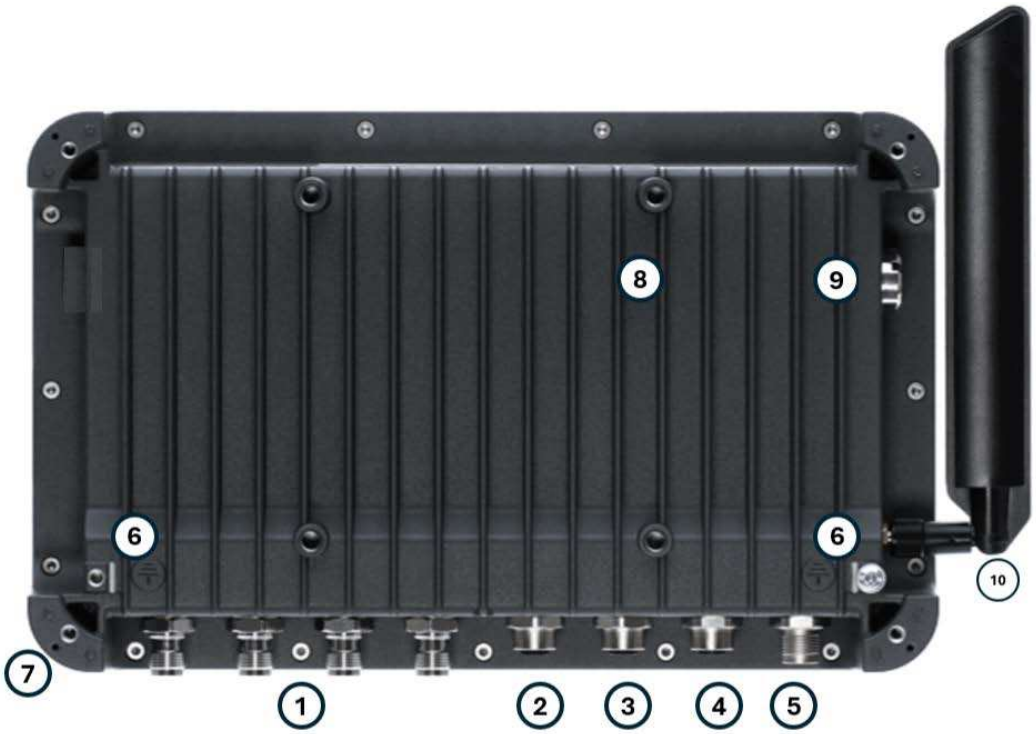


Fig. 9: RRU 4560 / ARU 3560 connections

No.	**Name**	**Function**
①	*ANT 1-4*	Antenna Connections 1-4 R-TNC 50 Ohm, for connecting an antenna The ANT 1 antenna connection is not available on the ARU 3500
②	*GPIO*	For connecting external sensors or external switches; see also *16.6 GPIO function*
③	*SERIAL*	Multi-protocol connection for serial connection to a controller see also *16.7 Functions of the multi-protocol port*
④	*PoE/Ethernet*	Ethernet connection for the IP connection to an Internet-based controller Input socket for the Power over Ethernet (PoE) power supply
⑤	*PWR*	For connection to a DC power supply, 10-30 V DC
⑥	⏚	Earthing points to connect the reader to earth in a defined manner to prevent residual currents
⑦	Front mounting	Position for mounting brackets, which can be screwed on in 45° increments to find the optimum mounting position. These mounting brackets are screwed to a wall or suitable mounting brackets from the front.
⑧	3D-Montage	Mounting field 100 x 100 mm for the mounting kit 52010351or 52010736. This mounting kit allows the reader to be aligned in 3 planes.
⑨	USB	A USB-C socket is located under a metal screw connection
⑩	WiFi	SMA connection for external WiFi/Bluetooth antenna

10.3 RRU 4570 and ARU 3570

The RRU 4570 and ARU 3570 readers are identical with regard to the mechanical connections and the displays, except for the missing antenna socket 1 on the ARU 3570. The connections and displays on the respective RRU 4570 variant are explained below.

10.3.1 Front view

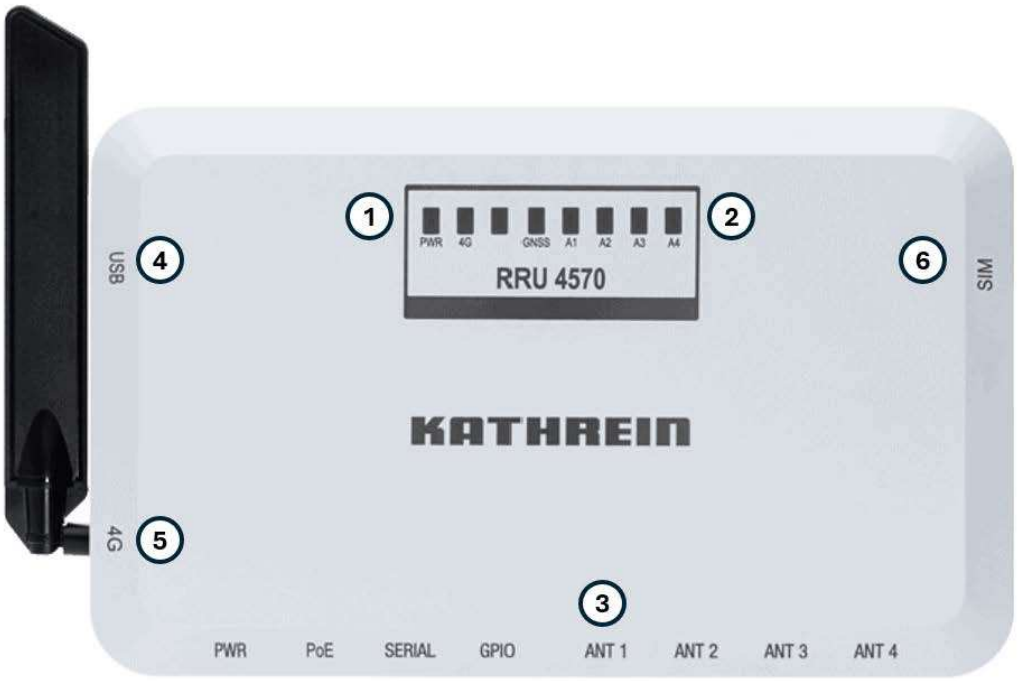


Fig. 10: RRU 4570 / ARU 3570 Display and printing

No.	**Name**	**Function**
①	*PWR*	Indicates whether the reader is switched on; see also *14.6 Reading the PWR LED displays*
②	LEDs (A1-A4)	Indicate whether an RF signal is present for antennas 1-4 (default setting) ► For further functions of the basic LEDs, 16.4.1 Selecting the functions ► Status LEDs for 4G and GNSS ► The other LEDs without Description can be used if required In general, all LEDs (with the exception of the PWR LED) are freely programmable. Either via predefined functions, which are described in chapter *16.4.1 Selecting the functions* or via direct SW access.
③	ANT 1	The ANT 1 connection for an external antenna is only available for the RRU 4560. This external socket is not available on the ARU 3560 readers, but is connected directly to the internal antenna
④	USB	A USB-C socket is located under a metal screw connection
⑤	4G	SMA connector for external 4G antenna
⑥	SIM	SIM card insert for µSIM cards

10.3.2 Back view



Fig. 11: RRU 4570 / ARU 3570 connections

No.	**Name**	**Function**
①	*ANT 1-4*	Antenna Connections 1-4 R-TNC 50 Ohm, for connecting an antenna The ANT 1 antenna connection is not available on the ARU 3500
②	*GPIO*	For connecting external sensors or external switches; see also *16.6 GPIO function*
③	*SERIAL*	Multi-protocol connection for serial connection to a controller see also *16.7 Functions of the multi-protocol port*
④	*PoE/Ethernet*	Ethernet connection for the IP connection to an Internet-based controller Input socket for the Power over Ethernet (PoE) power supply
⑤	*PWR*	For connection to a DC power supply, 10-30 V DC
⑥	⏚	Earthing points to connect the reader to earth in a defined manner to prevent residual currents
⑦	Front mounting	Position for mounting brackets, which can be screwed on in 45° increments to find the optimum mounting position. These mounting brackets are screwed to a wall or suitable mounting brackets from the front.
⑧	3D-Montage	Mounting field 100 x 100 mm for the mounting kit 52010351or 52010736. This mounting kit allows the reader to be aligned in 3 planes.
⑨	USB	A USB-C socket is located under a metal screw connection
⑩	4G	SMA connector for external 4G antenna
⑪	SIM	SIM card insert for µSIM cards

10.3.3 SIM Card Slot

The RRU 4570 and ARU 3570 readers offer a connection option for cellular networks. This chapter describes how to insert a SIM card into the reader. The SIM card slot is labeled “SIM.”

Please make sure you have a micro-SIM card that has already been activated.

1. Loosen the screw on the slot. The SIM card slot will become visible:
2. Insert the micro-SIM card into the slot as shown in the illustration. Make sure the SIM card is oriented correctly using the notched corner as a guide.





3. Lock the slot.
4. Tighten the screw to secure the SIM card slot.

NOTE

Please note the following restrictions when inserting the SIM card.

- ► Opening the protective screw cap for the SIM card may allow water and dust to enter the reader. When the protective screw cap is open, the reader is no longer watertight.
- ► Information on cellular connections for the ARU 3570 / RRU 4570 readers can be found in Chapter *18.2.6 Cellular Settings*.

10.4 Reader interfaces

All RRU 45xx and ARU 35xx readers have the identical interfaces. The following values describe the individual interfaces in detail and are valid for all 4th generation readers.

10.4.1 Ethernet / PoE interface

The main interface of Kathrein RFID readers is the Ethernet interface, via which the reader can communicate with IP-based network components. As a rule, a connection with the back-end server is established via this Ethernet interface in order to receive commands and tasks on the one hand and to deliver read data, together with other event data, to the higher-level instance on the other.

In addition, a power supply for the readers can be provided via this interface.

With suitable PoE injectors or PoE-capable network routers, a standardized AC voltage can be processed in addition to the data. The local DC supply can be omitted for this. However, it is possible to connect both supply lines. If one of them fails, the system automatically switches to the second supply line.

In contrast to the 3rd generation readers, the 4th generation Kathrein RFID readers can be operated with PoE instead of with PoE+ as before. This is because the power dissipation has been reduced from 25.3 W to 12.5 W. In addition to the advantage of lower power dissipation, the cheaper PoE components can be used.

NOTE

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

GPIO and remote supply via PoE

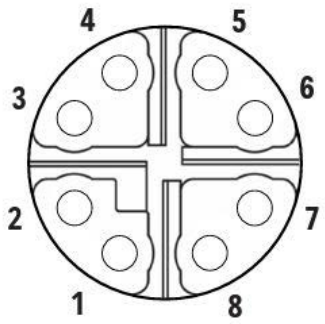
► Please note that only the "galvanically isolated" operating mode is possible and that no supply of the external sensors or actuators via the GPIO port of the reader is possible.

The Ethernet/PoE connection cables are identical to the versions for the 3rd generation readers and can be obtained from Kathrein Solutions under the following order numbers:

Order number	Type	Description
52010360	R-CC3-10 ETH	RRU/ARU Ethernet-Cable M12/RJ45, 10 m
52010361	R-CC3-3 ETH	RRU/ARU Ethernet-Cable M12/RJ45, 3 m

Pin assignment of the Ethernet/PoE socket

M12, X-coded, 8-pin, Buchse Pinout Communication PoE+



Pin	Data	PoE
1	TX+	PoE Mode A
2	TX-	PoE Mode A
3	RX+	PoE Mode A
4	RX-	PoE Mode A
5		PoE Mode B
6		PoE Mode B
7		PoE Mode B
8		PoE Mode B

10.4.2 USB-C interface

The 4th generation Kathrein RFID readers have a USB-C interface. This is located on the left side of the reader, well protected by a metal screw connection.

10.4.3 Multi protocol interface

The Kathrein RFID readers of the 4th generation have a multi-protocol interface via which various serial protocols can be run.

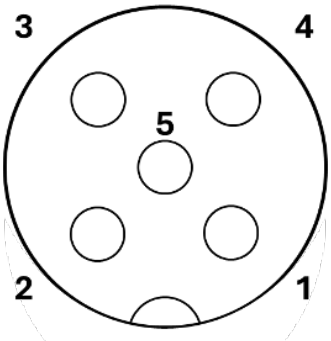
- RS-232 for serial point-to-point connections
- RS-485 for asynchronous serial connection for data exchange in bus systems
- Open Supervised Device Protocol (OSDP) is a communication standard for access control, for interoperability between access control and security products

The multi-protocol connection cable can be obtained from Kathrein Solutions under the following order numbers:

Order number	Type	Description
52010743	R-CC4-10-MPP	RRU/ARU Serial Cable M12, 10 m
52010744	R-CC4-3-MPP	RRU/ARU Serial Cable M12, 3 m

Pin assignment of the multi protocol interface

M12, A-coded, 5-pin, female



Pin	Assignment
1	RS 232 - Tx
2	RS 232 - Rx
3	RS 485 A
4	RS 485 B
5	GND

10.4.4 GPIO interface

The 4th generation Kathrein RFID readers have a General Purpose Input Output (GPIO) interface that can be used to connect up to 4 sensors and up to 4 actuators to the reader. This makes it possible to control the reading of the reader via the sensors. Actions can be triggered with the actuators, depending on the data read or defined states of the reader.

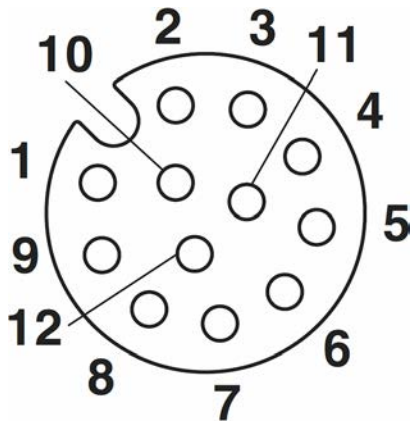
For example, the reading of the reader can be started or stopped with an inductive ground loop or a light barrier. A barrier can also be opened, for example, if the read results correspond to a predefined value, or a warning light can be switched on if certain reader errors are visualized.

The GPIO connection cables are identical to the versions for the 3rd generation readers and can be obtained from Kathrein Solutions under the following order numbers:

Order number	Type	Description
52010362	R-CC3-10 GPIO	RRU/ARU GPIO Cable M12, 10 m
52010363	R-CC3-3 GPIO	RRU/ARU GPIO Cable M12, 3 m

Pin assignment of the GPIO interface

M12, A-coded, 12-pin, female



Pin	Assignment
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

10.4.5 DC interface

The Kathrein RFID readers of the 4th generation have a DC interface to supply the reader with a DC voltage in the range of 10 VDC to 30 VDC.

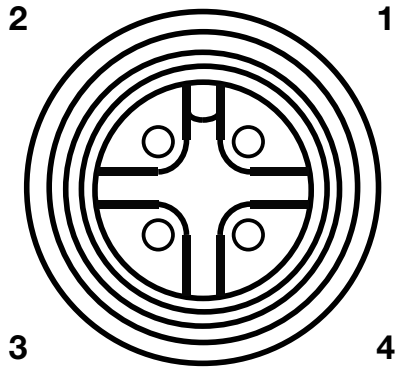
The power supply is designed as a four-pin edge connector with M12 connection thread in A-coding

The DC connection cables are identical to the versions for the 3rd generation readers and can be obtained from Kathrein Solutions under the following order numbers:

Order number	Type	Description
52010358	R-CC3-10 DC	RRU/ARU DC Power cable, 10 m

Power supply

M12, A-coded, 4-pin, male



Pin	Assignment
1	+10 ... 30 V DC
2	GND
3	GND
4	+10 ... 30 V DC

Please note that only power supply units with LPS (Liwithed 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 must be limited to a maximum output of 100 W

10.4.6 Buzzer

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

10.4.7 Positions of the reader interfaces

Please note that the tightness of the readers is only guaranteed if the connections are fitted with Kathrein connection cables or if non-equipped connections are sealed with the protective caps from the Kathrein program (52010367)



Fig. 12: Positions of the reader interfaces

11 Reader dimensions

The figures shown here are from the RRU 4500. All other Kathrein RFID readers of the 4th generation have identical dimensions.

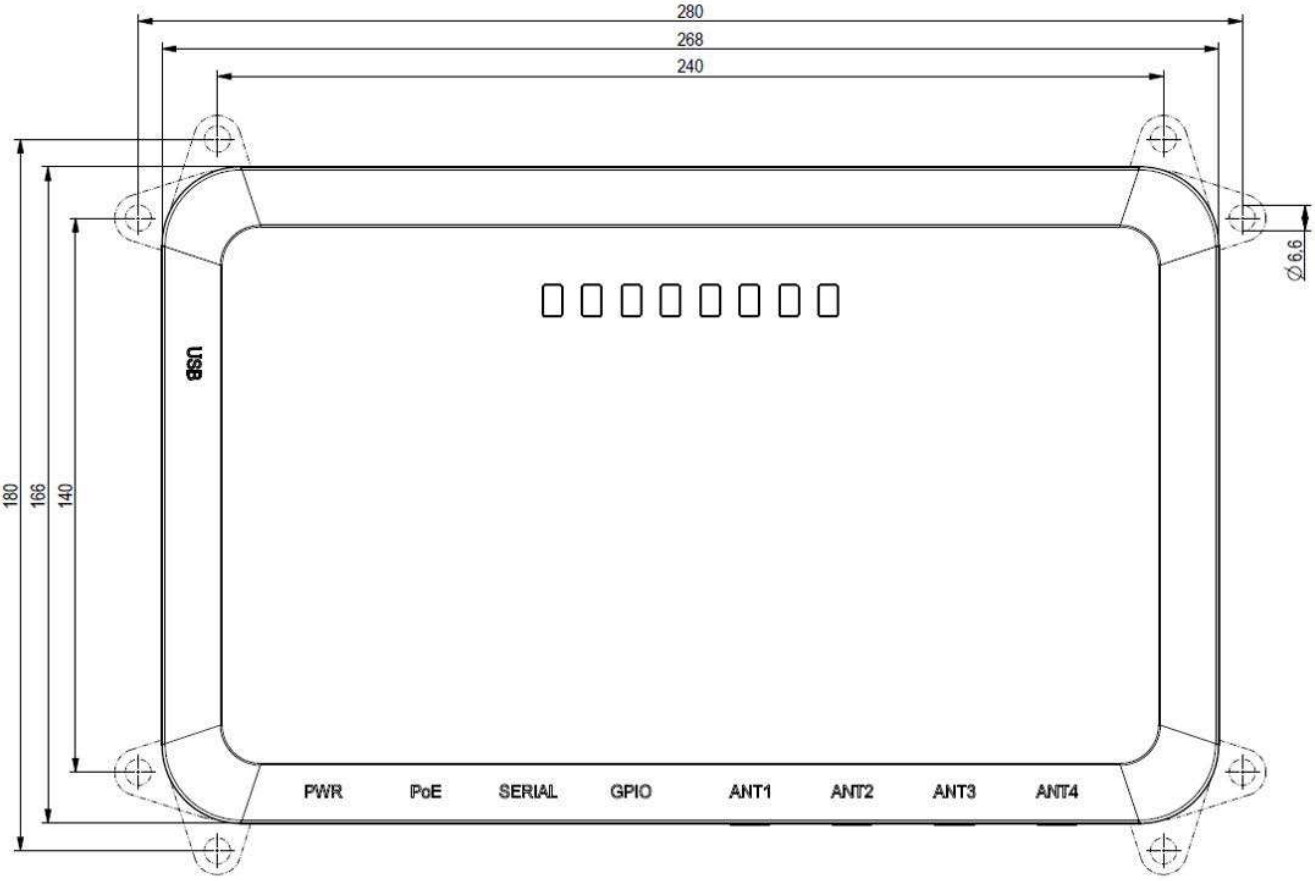


Fig. 13: Front view

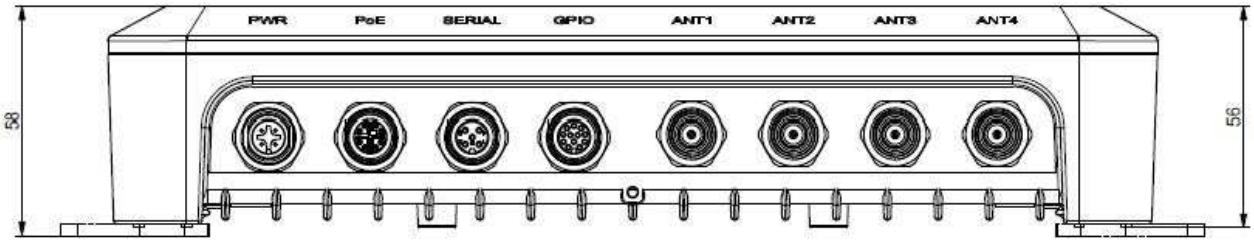


Fig. 14: Connector view

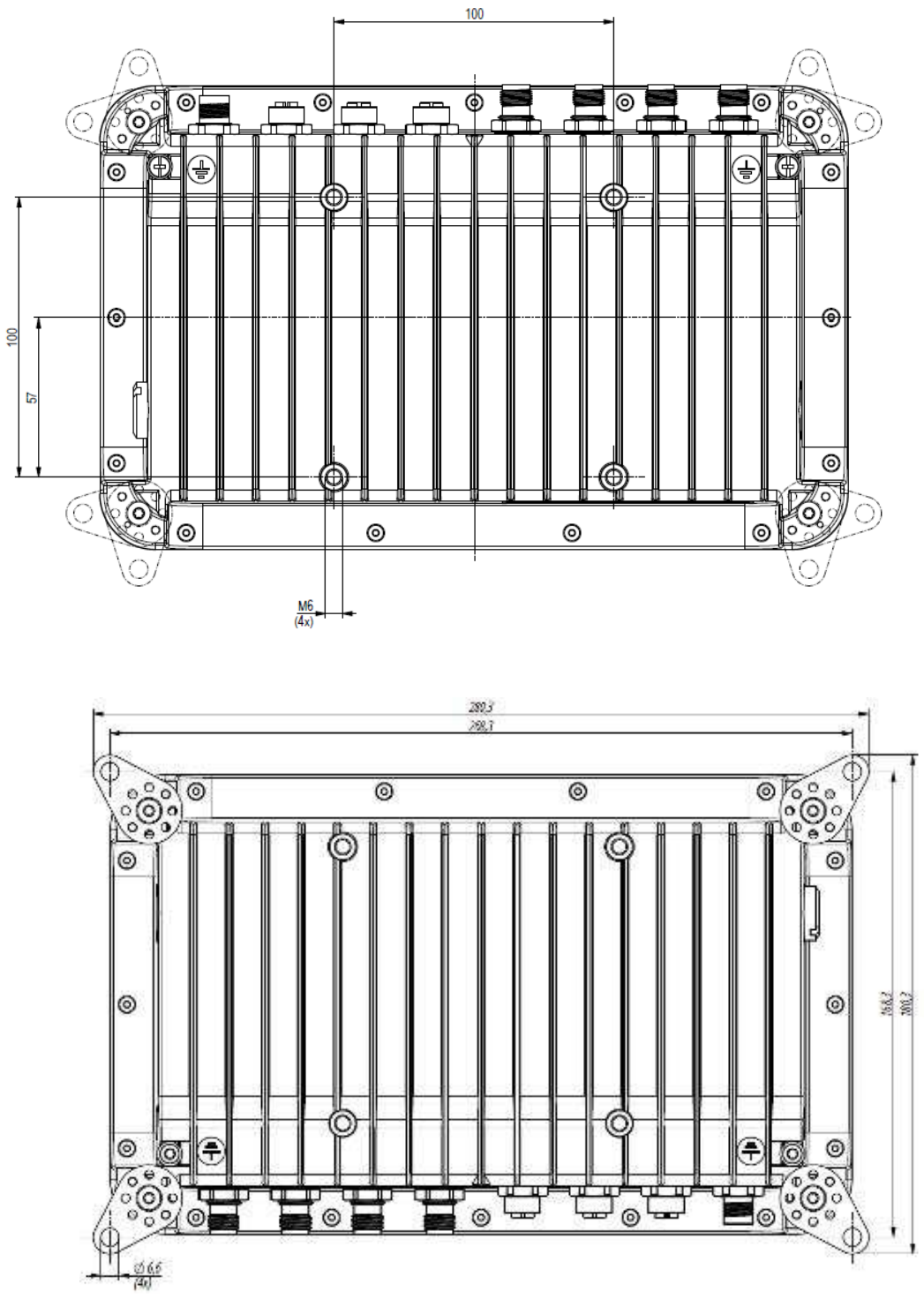


Fig. 15: Back view

The 3D data of the readers can be found on the product page of the Kathrein homepage and can be downloaded here.

HINWEIS
Beachten Sie, dass die 4 Montagelaschen des Readers im 45° Raster geschwenkt werden können.

12 Installing the reader

With plugged-in connections, the device fulfils protection class IP68 (RRU 45xx and ARU 35xx of the 4th generation).

12.1 Selecting the installation location





WARNING

Danger to life due to electric shock or fire hazard due to incorrect voltage, inadequate ventilation, moisture, heat or naked flames!

- ► If you install the appliance in cabinets or shelves, ensure sufficient ventilation.
- ► When selecting the installation location, ensure that there is sufficient space around the appliance to allow adequate dissipation of the heat generated by the appliance.
- ► Do not expose the appliance to excessive heat or fire.
- ► Do not install the appliance near heat sources, e.g. a heater.
- ► Do not place any objects with an open flame on the device.
- ► Ensure that the maximum operating temperature specified in the data sheet is not exceeded.
- ► Ensure that the base has sufficient load-bearing capacity/strength.

NOTE

Risk of material damage due to screws screwed too deeply into the reader housing!

If the screws are screwed deeper than 10 mm into the reader housing, the housing is no longer watertight.

- ► When installing the reader, ensure that the screws are not screwed deeper than 10 mm into the device housing

NOTE

Kathrein Solutions GmbH guarantees the IP protection class specified in the data sheet only in conjunction with original Kathrein accessories such as cables, protective caps and mounting brackets.

All damage caused by non-original or incorrectly mounted accessories is excluded from any warranty.

12.2 Mounting the reader

12.2.1 Wall mounting

As the RRU 45xx readers do not have a built-in antenna, they do not need to be aligned. This is why the RRU 45xx readers are usually screwed directly to the wall or into a shelf system.

For this purpose, mounting brackets are attached to the rear of the reader, which can be adjusted in 45° increments.

Please refer to the following drawing for the dimensions of the holes.

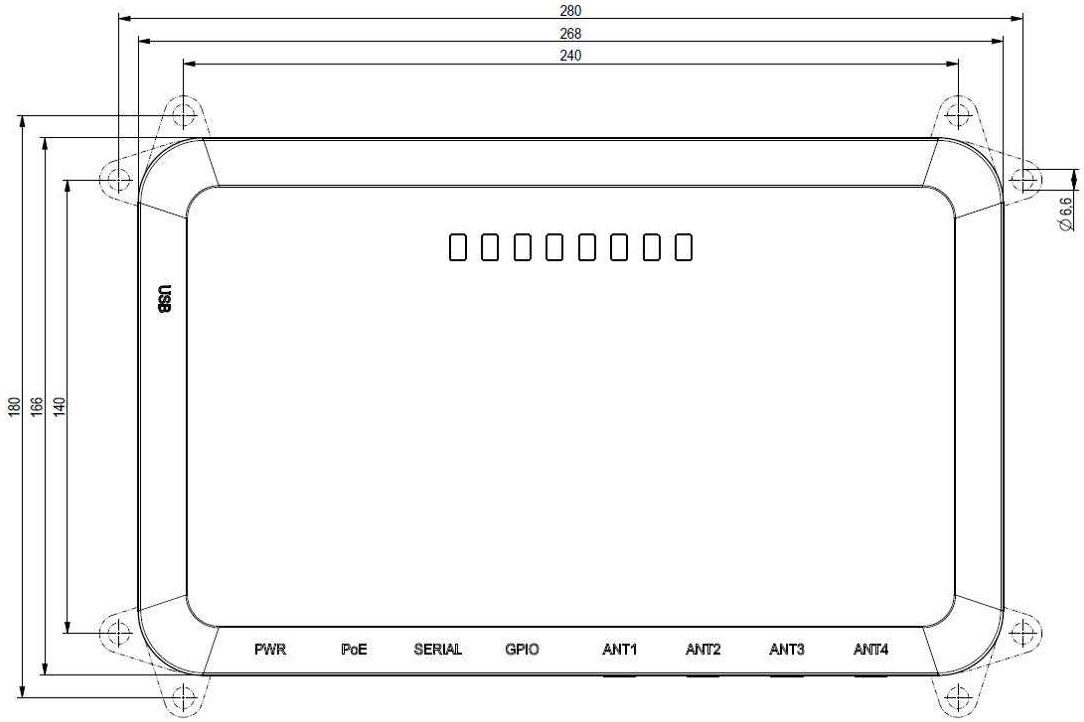


Fig. 16: ARU 35xx / RRU 45xx dimensions of the mounting brackets

HINWEIS

Please note that the reader's four mounting tabs can be rotated in 45° increments.

12.2.2 3D wall / pole mounting

The MK-WPM3-OSS Outdoor mounting kit 52010351 is particularly recommended for the 4th generation ARU 35xx readers, which need to be aligned accordingly due to the built-in antenna.

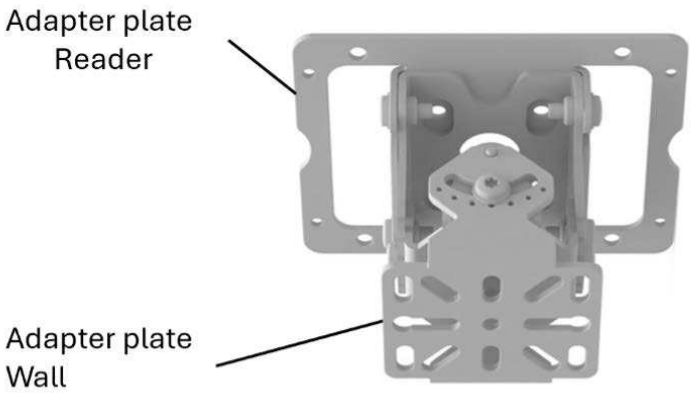


Fig. 17: Mounting Kit MK-WPM3-OSS Outdoor 52010351

The Reader adapter plate can be removed from the holder and is screwed onto the rear panel of the ARU 35xx reader.

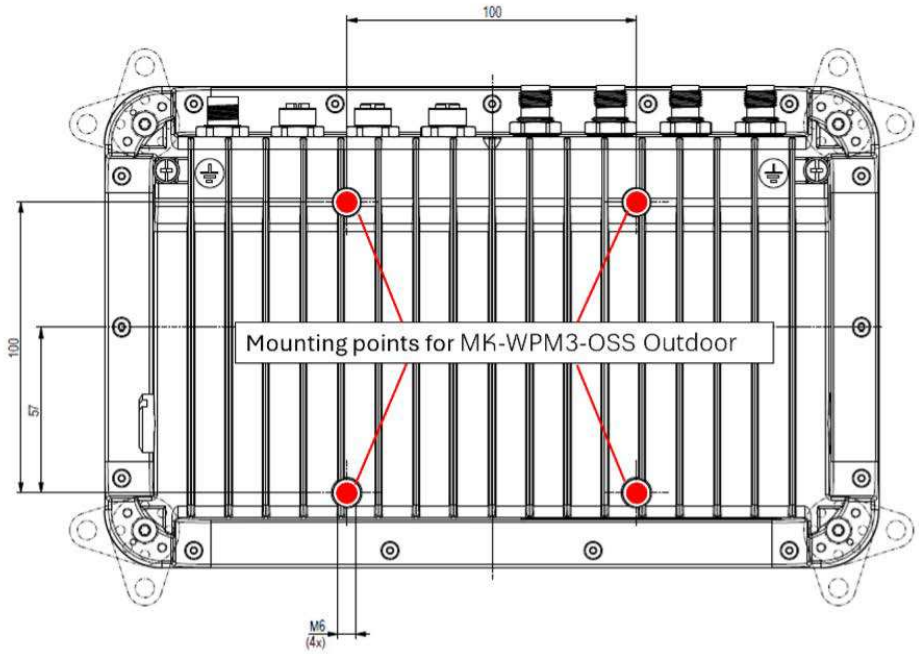


Fig. 18: Mounting points on the reader rear panel for mounting the Kit MK-WPM3-OSS Outdoor 52010351

The MK-WPM3-OSS Outdoor holder 52010351 is screwed flat to a wall or mounting shelf using the adapter plate. The reader can then be hooked into the holder and aligned.

NOTE

Make sure that the depth at which the screws are inserted into the housing of the reader does not exceed 10 mm. Select the screw length accordingly!

All damage caused by non-original or incorrectly fitted accessories is excluded from any warranty.

With the mounting kit MK-PMA-OGV Kit 52010368 the bracket can be extended to a mast mounting kit.

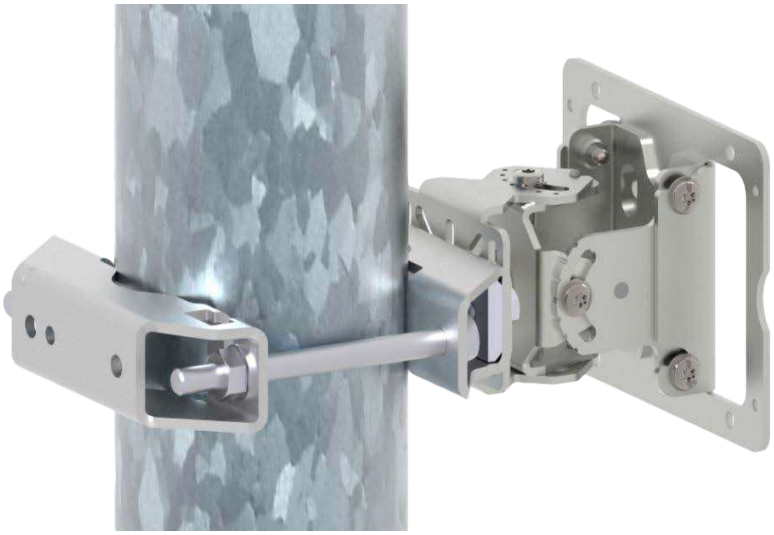


Fig. 19: MK-PMA-OGV Pole mount Outdoor 52010368

13 Mounting the external antenna

13.1 WiFi / Bluetooth antenna

The RRU 4560 and ARU 3560 readers have an external antenna for WiFi and Bluetooth. This antenna is supplied with the respective reader and can be screwed onto the existing SMA socket.

NOTE
Please do not use any tools to install the external antenna. Tighten the knurled nut of the antenna by hand only.



Fig. 20: Front view RRU 4500

13.2 4G antenna

The RRU 45670 and ARU 3570 readers have an external antenna for communication via 4G mobile networks. This antenna is supplied with the respective reader and can be screwed onto the existing SMA socket.

NOTE
Please do not use any tools to install the external antenna. Tighten the knurled nut of the antenna by hand only.



Fig. 21: Front view RRU 4570

14 Transfer methods of the reader

14.1 UART transmission (RS232 and RS485)

14.1.1 Physical layer

A full or half-duplex connection such as RS232 or RS485 is used for the physical layer.

14.1.2 Data link layer

The transmission takes place in frames and blocks. A block consists of a maximum of 256 frames. A frame consists of a maximum of 256 bytes, of which a maximum of 250 bytes can be user data. This results in a maximum block size of 64,000 bytes of user data.

The data link layer is used to secure the data between sender and recipient. The sender receives a response from the recipient for each correctly received frame. If the sender does not receive a response from the receiver within a time window of 350 milliseconds after sending a frame, the sent frame is repeated until the error counter signals that the transmission has been aborted.

Frame structure

5A LL SS FF DD ... DD P1 P2

5A	Start code for synchronization
LL	Number of bytes in the frame, without the start code
SS	Status byte
FF	Frame number
DD	User data
P1	16-Bit- Checksum, Low-Byte
P2	16-Bit- Checksum, High-Byte

Start code and synchronization

The start code is used to synchronize the receiver with the transmitter. In addition, the receiver synchronizes to the start of a frame if no data has been received for 100 milliseconds.

Status Byte

The status byte has the following meaning

50	Data package
A0	Answer OK
LL	Response Memory error (the receiver could not allocate memory for the received data block)

A response is only 3 bytes long and is not CRC-checked.

OK	5A 02 A0
Memory error	5A 02 A1

Frame number

The frame number indicates how many additional frames belong to this data block. Only the first frame of a data block can be shorter than 256 bytes. Each additional frame must have a length of 256 bytes (length byte LL is FF).

It is therefore possible to calculate the block size based on the number of the first frame, see the following example
A block with 700 bytes of user data is to be transferred. To do this, the block is divided into three frames:

1. Frame: 5A CD 50 02 - 200 bytes of user data follow - P1 P2
2. Frame: 5A FF 50 01 - 250 bytes of user data follow - P1 P2
3. Frame: 5A FF 50 00 - 250 bytes of user data follow - P1 P2

The receiver can use the frame number of the first frame (here 02) and its length byte to calculate the block size (block size = frame number * 250 bytes + length byte -5) (here in the example: 2 * 250 bytes + 205 bytes - 5 bytes = 700 bytes) and reserve a corresponding amount of memory for the data.

User data

User data are the bytes in a frame that flow into the transmitted block.

Checksum

The checksum is calculated using the polynomial x^16 + x^12 + x^5 + 1 with a pre-initialization of 0x0000 from the start code to the last user data byte.

Network layer

Since the KBRP is a point-to-point protocol, there is no network layer.

Transport layer, session layer, display layer

Are not available.

Application layer

The application layer transmits data blocks from 1 to a maximum of 64000 bytes.

14.2 LLRP protocol

Based on the TCP communication protocol, the Kathrein RFID reader with Linux operating system masters the so-called Low Level Reader Protocol (LLRP).
This is a communication interface standardized by EPCglobal (http://www.epcglobalinc.org/standards/llrp) between an RFID reader and LLRP-capable application software. The standard port for LLRP is 5084.

The LLRP protocol is roughly divided into the following parts:

- ► Automatic query of the reader functions via the application software
- ► Configuration of the reader functions via the application software
- ► Triggering read and write processes on the air interface via the application software
- ► Transferring the detected tag data to the application software

To start the LLRP application, use the AppManager of the ReaderStart. In the menu, it is possible to load the LLRP protocoll engine via Install App and start it via Start App. The open source programming tool Eclipse (IDE) can be used to test the Kathrein reader with the LLRP protocoll. With the so-called LLRP Commander it is possible to control and operate the reader.

NOTE
Eclipse (IDE) and LLRP Commander are not part of the Kathrein RFID software

14.3 Ethernet transmission protocol

A data transmission layer was used for communication with our reader via Ethernet, just as with serial communication.
The data transmission layer via Ethernet is a much simpler solution here, as the TCP/IP protocol already has a data protection layer. As TCP/IP is a stream protocol, only the start and end of the packet are required.
If no data has been received within a frame for 100 milliseconds, the received subframe is discarded.

Frame structure

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 bits; LSB first)
D1 – D4	Data bytes to be transmitted (user data)
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
AF	Ping Response Code
A5	End code

Connection

The communication takes place via TCP port 4007.

Example

The ASyncGetEPCs frame is shown here as an example. The ID for this command is 0x0111, so that the frame looks like this:

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

Extended block structure

If a data block to be transferred exceeds 16 kB, it is necessary to divide it into several 16 kB blocks. These blocks are given a block number and the first block contains the entire data length. The receipt of each block must be confirmed by a response for each block.

First Block:

Start + Block number always 0 + 4 Byte Total data length + Data block + End

All other blocks:

Start + Block number + Data block + End

Response to confirm receipt:

Start + Block number + End

14.4 Serial transmission protocol RS 232 / RS 485

For connection to a serial controller, connections can be established via the COM port (RS232/485).

The serial interface is used for communication with the reader via RS232 and RS485. The standard data rates of the serial interface of a PC are supported for RS485.RS-232, also known as EIA/TIA-232, is a serial communication standard that defines the electrical and mechanical characteristics of the connection between data terminals and the reader.

RS 232 uses asymmetrical signal levels, whereby a logical "1" is represented by a voltage between -3V and -15V and a logical "0" by a voltage between +3V and +15V.

The maximum transmission rate of RS-232 is typically 20 kbit/s, but can be higher in some applications. In contrast to RS 485, RS 232 is designed for short distances of up to 15 meters and works as a point-to-point connection.

RS-485, also known as TIA/EIA-485, is a standard for serial data transmission that is widely used in many industrial and commercial applications. RS-485 uses a differential transmission method with two signal lines (A and B). This method provides high noise immunity and noise suppression

RS-485 supports transmission rates of up to 10 Mbit/s, which makes it suitable for applications with high speed requirements. Another advantage of RS 485 is that data can be transmitted over distances of up to 1200 meters.

Unlike RS 232, RS 485 allows communication between multiple devices (up to 32 drivers and 32 receivers), making it suitable for multi-node networks.

Communication takes place in half-duplex mode, in which data can be transmitted in both directions, but not simultaneously.

These features make RS-485 particularly suitable for applications in industrial automation, building control and other areas where robust and reliable communication is required.

14.5 USB-C transmission protocol

USB-C, also known as USB Typee-C, is a versatile and modern standard for data and power transfer. USB-C connectors are symmetrical and can be plugged in in both directions (reversible), which makes handling easier.

USB-C supports various transmission protocols, including USB 3.1, USB 3.2 and USB4. The transfer rates can reach up to 40 Gbit/s, depending on the version used.

Although USB-C plugs are not directly compatible with older USB standards, adapters can be used to connect older devices.

These features make USB-C a universal connection for many modern devices, such as smartphones and laptops.

If the reader is connected to the PC via USB, the device is registered in the system as a USB-HID-compliant device.

HINWEIS

Please be aware of the following restrictions when using the USB-C port.

- The USB-C port is installed as a communication port. It is not designed to provide DC charging for external devices.
- Please note that opening the USB protective screw cap may allow water and dust to enter the reader, thereby compromising its water resistance.

15 Connecting the reader

15.1 Reader switching on and off

Connect the reader to the power supply via the PWR connection. Voltages between 10 VDC and 30 VDC can be used. Please note that the power supply unit used must be capable of delivering at least 15 W. Please also take into account the power that may be added by connecting external sensors to the GPIO port.

Alternatively, the reader can be connected to a PoE source in accordance with the 802.3at standard via the POE input.

► the reader is switched ON

15.2 Reading the PWR LED

The reader has a 2-color LED to indicate the operating status. The table below shows the colors used and the respective operating status:

LED	Action	Description
Yellow	ON	Reader is booting
Green Yellow	ON Flashes approx. every 8 seconds	Reader is ON Normal mode with heartbeat
Green Yellow	Flashes approx. every 8 seconds ON	Error during booting

15.3 Connecting the digital inputs and outputs of the Kathrein RFID -Reader

The inputs and outputs are controlled and evaluated with the ReaderStart V3 software, with the supplied DLL or by accessing the reader protocol.

The digital inputs and outputs are provided via a 12-pin socket in A-coding with M12 connection thread. The inputs are galvanically isolated from the power supply of the reader and can be operated independently 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 galvanic isolation is not required, the input can also be powered from the reader via pins 6 and 7 (see GPIO, p. 33).

The outputs are also electrically isolated from the reader's power supply and have a common pin (OUT_CMN). If galvanic isolation is not required, the power supply can also be taken directly from the reader.

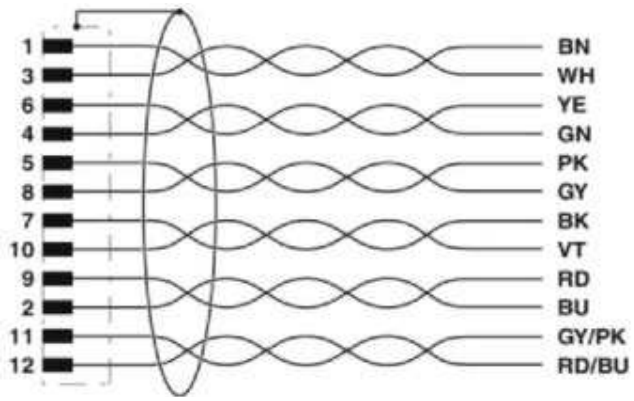


Fig. 22: Assignment of the GPIO interface cable

NOTE

Danger of malfunction!

- ► Please note that the load per channel is limited to a maximum of 0.5 A and the total load across all channels must not exceed 1.5 A. If the auxiliary voltage of the GPIO port of the reader is used, the load can be a maximum of 1.1 A. The inputs and outputs are designed for max. 30 V DC.
- ► Further information can be found in the reader data sheet.
- ► Please note that LPS or NEC Class 2 classified power supply units can be used to operate the outputs.

The connection examples for the inputs are shown in the following figures:

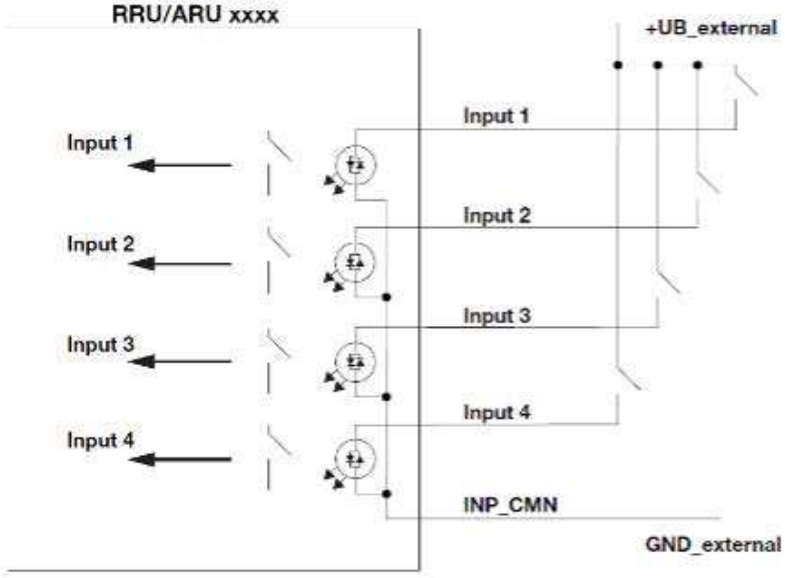


Fig. 23: Galvanically isolated inputs

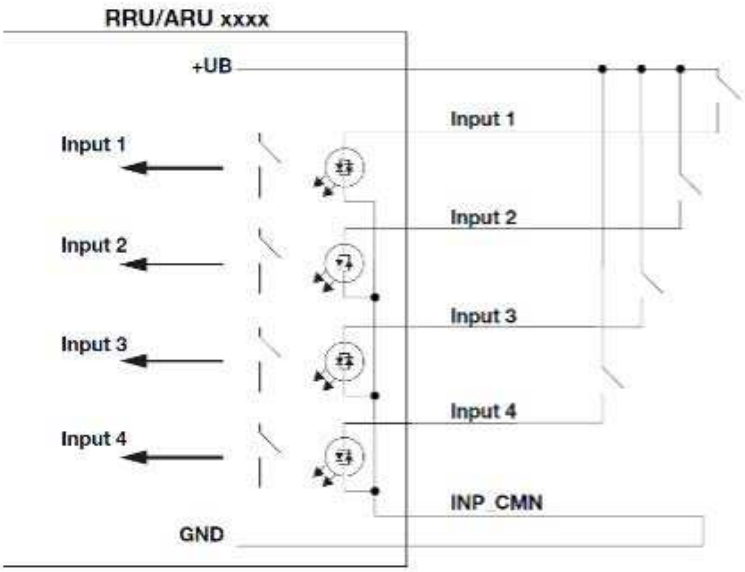


Fig. 24: Galvanically non-isolated inputs

The connection examples for the outputs are shown in the following figures:

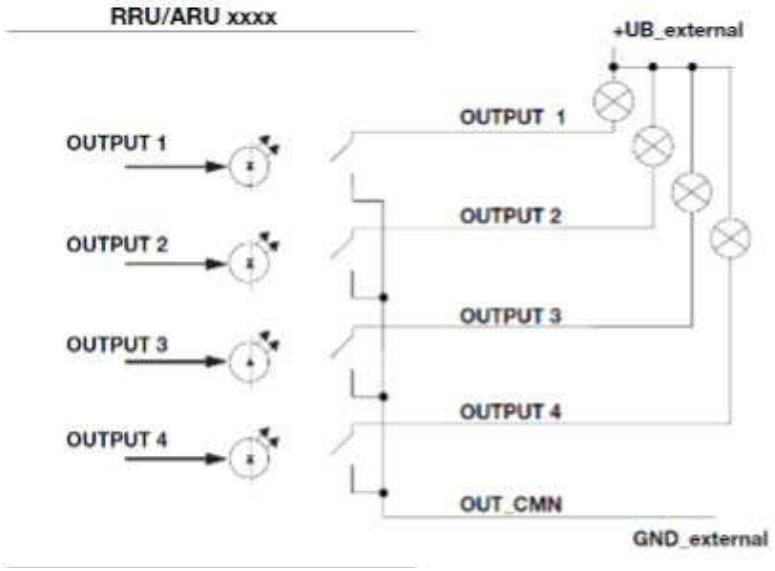


Fig. 25: Galvanically isolated outputs

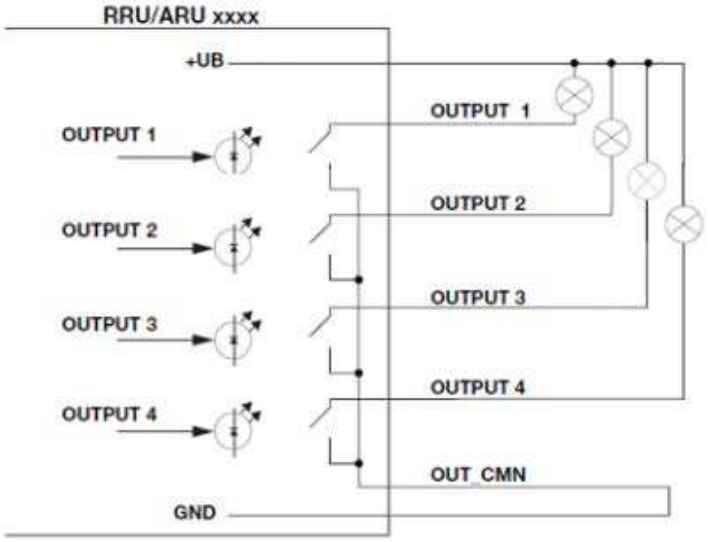


Fig. 26: Galvanically isolated outputs

The inputs and outputs are controlled and evaluated with the ReaderStart V3 software, with the supplied DLL or by accessing the Kathrein Burgstädt Reader Protocol.

15.3.1 DC supply of the readers via the connection box

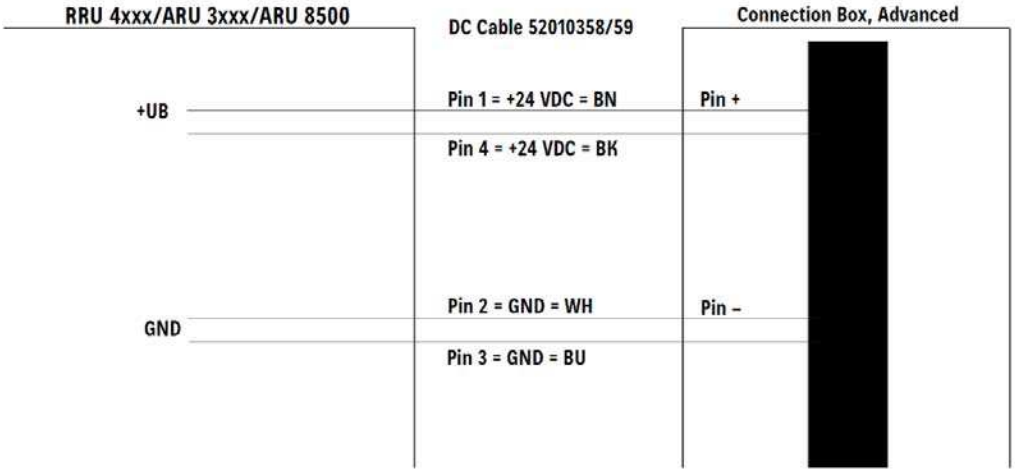


Fig. 32: DC supply of the readers via the connection box

15.4 Connecting the antenna

NOTE

Danger of malfunction!

- ► If a cable that is not suitable for an impedance of 50 ohms is used, the performance of the reader will be severely restricted by the mismatch. If the mismatch is large, the reader may display an error.
- ► Only use cables that are suitable for the impedance (50 Ohm).

Four (RRU 45xx) or 3 (ARU 35xx) antenna connections in TNCrev design are available for connection to the RFID antennas.

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

16 Operating the ReaderStart software

The reader can be operated using the *ReaderStart* software. The software offers all the necessary functions of the reader for a test in a real environment. Various grand settings for application scenarios are available to help with configuration.

► The current version of *ReaderStart* can be found on our homepage on the software page or with the product.
https://www.kathrein-solutions.com/de/product/readerstart-software/

16.1 System Requirements

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

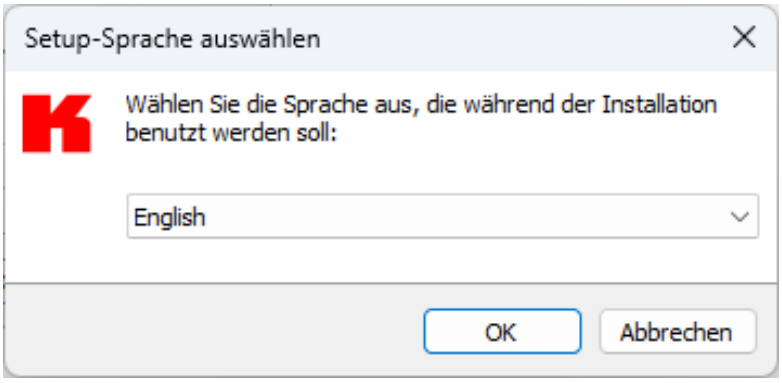
Processor	X86-compatible
Memory	512 MB RAM
Operating system	Windows 10 or higher
Free hard disk space:	
32-bit system	850 MB (including Microsoft .Net)
64-bit system	2 GB (including Microsoft .Net)

16.2 Installing the Software

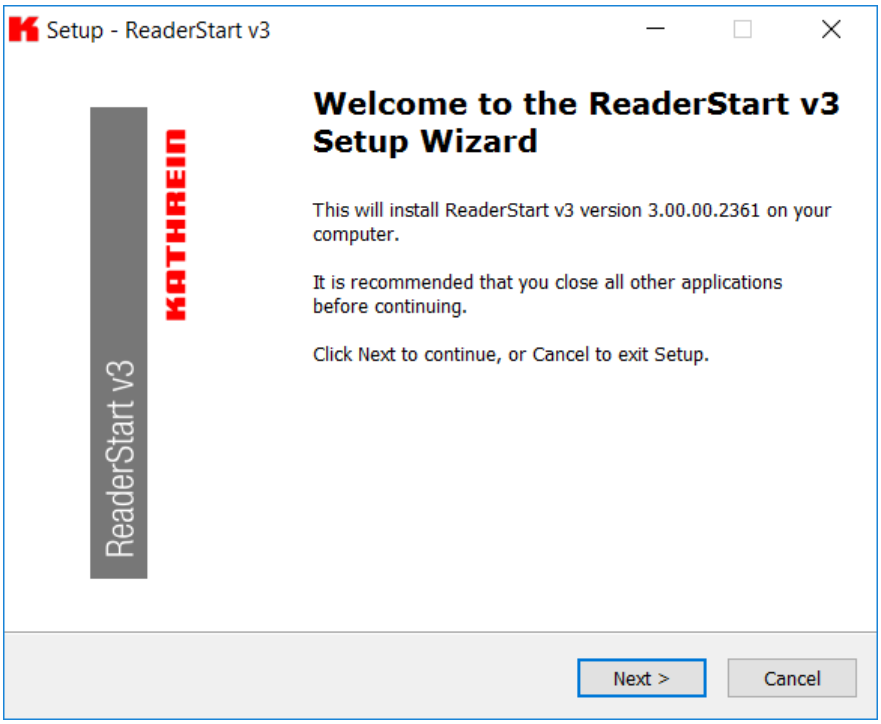
Tip

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 from the Kathrein Solutions website.
2. Double-click on the file to start the installation
3. Follow the instructions displayed during installation


Setup - ReaderStart v3
Welcome to the ReaderStart v3 Setup Wizard
This will install ReaderStart v3 version 3.00.00.2361 on your computer.
It is recommended that you close all other applications before continuing.
Click Next to continue, or Cancel to exit Setup.
KATHREIN
ReaderStart v3
Next >
Cancel


Setup - ReaderStart v3
License Agreement
Please read the following important information before continuing.
Please read the following License Agreement. You must accept the terms of this agreement before continuing with the installation.
AGREEMENT (EULA)
KATHREIN Sachsen GmbH, Lindenstrasse 3, 09241 Muehlau (hereinafter referenced as “KATHREIN”) agrees to grant to Customer, and Customer accepts, a license to the identified Licensed Software to the terms and conditions of this End User License Agreement (“EULA”).
I accept the agreement
I do not accept the agreement
< Back
Next >
Cancel

17 Connecting the reader to the ReaderStart software

17.1 Prerequisites

The default IP address of the reader is 192.168.0.1 and the network mask 255.255.255.0.

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

Alternatively, the reader can also be configured so that it automatically obtains an IP address. This service, known as DHCP, requires a corresponding DHCP server to be operated in the network.

For further information, please contact your network administrator.

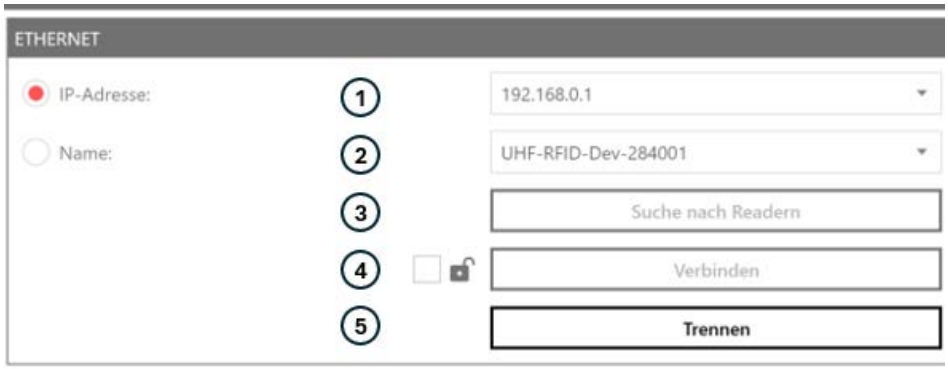
► Make sure that the IP addresses of the control computer and the reader are in the same IP range, but are not identical. Make sure that the network mask is identical

17.2 Establishing a connection with the reader

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

- **by entering the IP address** to communicate directly with the reader; see *Establishing a connection via an IP address* or
- **by using the host name of the reader**; see *Establishing the connection using a host name.*

Start the *ReaderStart* SW and follow the instructions in the SW. If you have further questions about the *ReaderStart* SW, we can recommend the Kathrein Solutions YouTube channel.

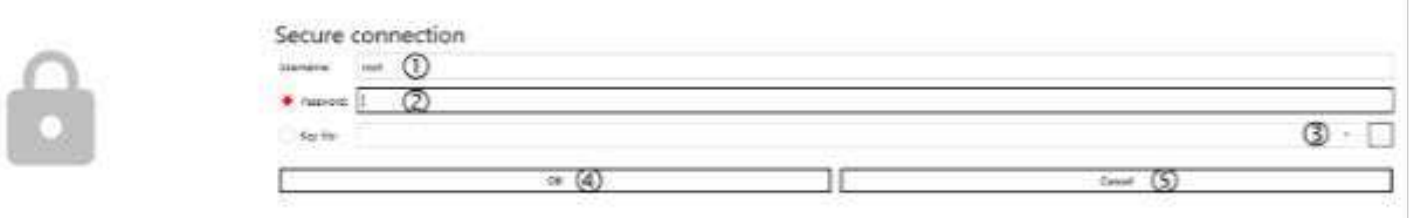


Establishing the connection via an IP address

To connect the reader via the Ethernet port, enter the IP address at ① and the start the connection with ④.

Establishing a <u>safe</u> connection via an IP address

To connect the reader securely via the Ethernet port, enter the IP address under ① and then select the lock symbol ④. Click on the “Connect” button to open an input window. Either a password or a key file can be entered there so that communication with the reader is encrypted.



Enter the user name at ①. The default user name is “root”. Enter the default password at *Password* ②. From Linux version 3.51.0, the default password is identical to the serial number of the reader. This can be found on the reader's device sticker.

Tip You can change the password in the Linux module and thus create a unique password for each reader separately ▸ Connection configuration

If you want to use the key file instead, click on the box next to key file ③.

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

Select the key file.

Click OK to establish the secure connection.

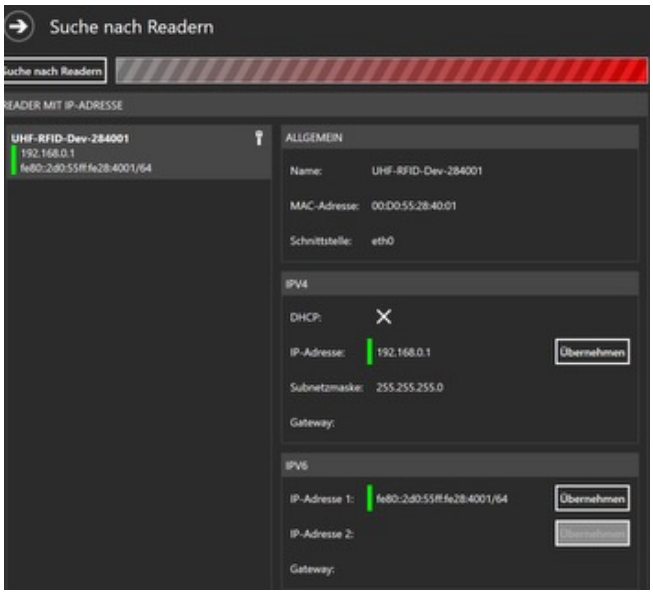
⇨ It is possible to configure the secure connection under the Linux module ▸ “Configure connection”; see also Linux module.

Establishing the connection using a host name

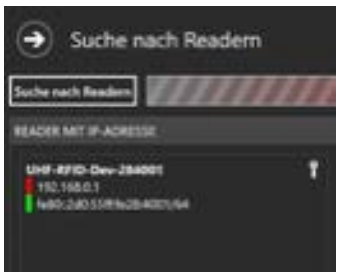
If the host name of the reader is known, the connection can also be established by entering the host name at ②.

If the IP address and host name are not known, the reader can be found using the "Reader search".

This search can be started with ③ "Search for reader". All readers in the network are requested to send their IP address via the so-called broadcast (= to all). The IP address can therefore be received even if the IPV4 network connection to this address is not possible.



If the connection is possible, a green bar appears in front of the IPV4 or IPV6 addresses and the IP address can be used to establish the connection.



If the IP4 address is in a different address range, this is indicated by a red bar and an IPV4 connection is not possible

NOTE

Special functions!

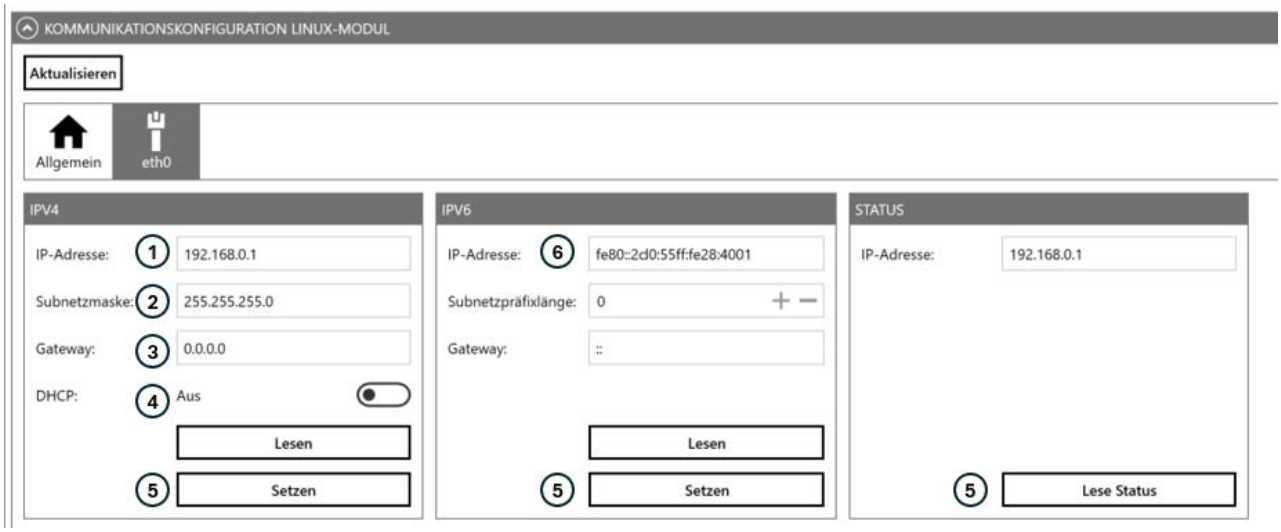
- ► Especially if the list of possible readers is long, the preferred reader can be declared a favorite. To do this, place the mouse pointer over the respective reader and select the star symbol with the right mouse button.
- ► The reader can be reset to factory settings within approx. 45 seconds of starting the reader. To do this, place the mouse pointer on the relevant reader and use the right mouse button to call up the "Load factory settings" function and then confirm the questions. Then reboot the reader and the reader parameters are reset.

17.2.1 Ethernet Settings

The IP settings (IP address, host name, DHCP) can only be changed if the ReaderStart SW is connected to the reader. To do this, enter the new IP address ① or the subnet mask ② or the new gateway address ③ in the "COMMUNICATION CONFIGURATION LINUX MODULE" window or DHCP On/Off ④ and save with ⑤.

The IPV6 address can also be changed at ⑥ and saved using ⑤.

The status can be read in the right-hand part of the window with ⑦.



NOTE

Settings for connecting readers to communication networks!

The information provided in sections *17.2.1* through *17.2.3* regarding Ethernet, USB-C, and serial connections applies to all 4th-generation Kathrein readers.

- ► Information on Wi-Fi and Bluetooth connectivity for the ARU 3560 / RRU 4560 readers can be found in Chapters *17.2.4* and *17.2.5*
- ► Information on cellular connectivity for the ARU 3570 / RRU 4570 readers can be found in Chapter *17.2.6*

17.2.2 USB-C Settings

The settings for the USB-C connection can only be changed when the ReaderStart software is connected to the reader. In the "COMMUNICATION CONFIGURATION LINUX MODULE" window, the USB mode can be selected using ① and set using ②.

The status can be read using ③.



The following entries can be selected for USB mode ①:

- None
- Serial
- Serial (KBRP)

NOTE

Please note the following restrictions when using the USB-C port.

► The USB-C port is designed as a communication port. It is not intended for DC charging of external devices.

► Please note that opening the USB protective screw cap may allow water and dust to enter the reader, thereby compromising its water resistance.

17.2.3 Settings for the Multi-Protocol Interface (MPI)

The settings for connection via the RS232 and RS485 serial protocols can only be changed when the ReaderStart software is connected to the reader. In the “COMMUNICATION CONFIGURATION LINUX MODULE” window, the respective mode can be selected using ①.

For the “RS485” operating mode, you can use ② to select whether a terminating resistor is set.

The baud rate for the transmission can be selected using ③.

The parity bit can be set using ④.

The stop bits are set using ⑤.

Use ⑥ to apply the settings, and ⑦ to display the current status.



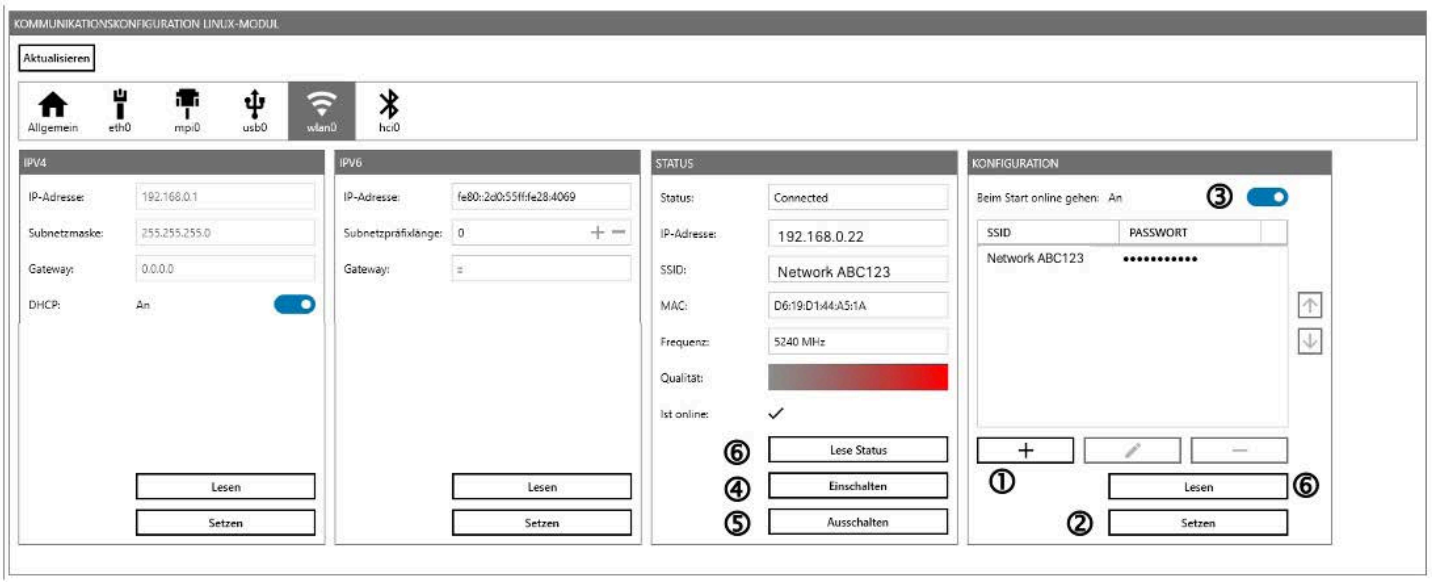
The following settings can be selected:

MPI-Mode	RS485 terminating resistor	Baud rate	Parity	Sopp bits
RS232	Off	115200 bps	None	1
RS485	On	300 - 57600 bps	Odd	1.5
RS232 (KBRP)		230400 bps	Straight	2
RS485 (KBRP)			Marking	
			Space	

The information in the first line are the default values.

17.2.4 Wi-Fi Settings

The settings for the wireless connection via Wi-Fi for the ARU 3560 and RRU 4560 readers can only be changed when the ReaderStart software is connected to the reader. The respective settings can be selected in the “COMMUNICATION CONFIGURATION LINUX MODULE” window.



To connect the ARU 3560 and RRU 4560 readers to a Wi-Fi network, first select the correct network. Pressing ① opens an input menu where you can enter the SSID and password. Press the “SCAN” button to find the currently available Wi-Fi networks.

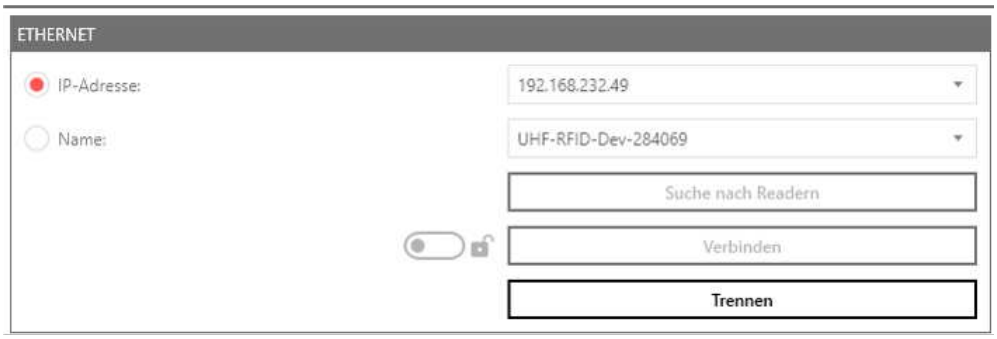
Select the SSID of the appropriate network from the list. Enter the correct password and click the “Add” button to add the network to the list.

Press ② to permanently save the settings. Optionally, use ③ to specify whether the reader should go online immediately upon startup.

Use the ④ and ⑤ buttons to turn the reader’s Wi-Fi interface on or off, respectively.

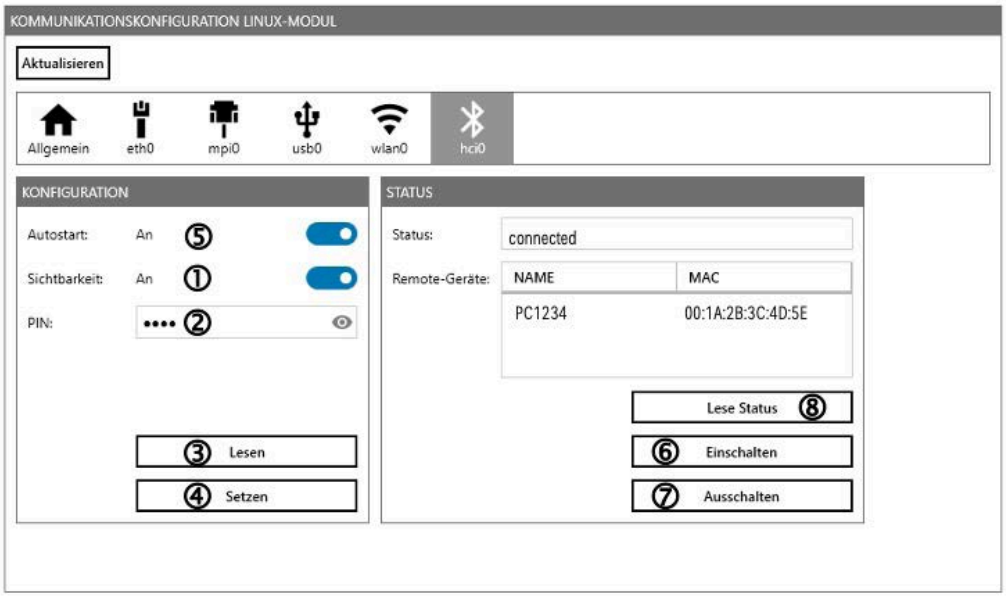
Use the ⑥ button to check the current connection status.

You can then disconnect the Ethernet connection and reconnect the reader via Wi-Fi.



17.2.5 Bluetooth Settings

The settings for the wireless Bluetooth connection of the ARU 3560 and RRU 4560 readers can only be changed when the ReaderStart software is connected to the reader. The respective settings can be selected in the “COMMUNICATION CONFIGURATION LINUX MODULE” window.



To connect the ARU 3560 and RRU 4560 readers via Bluetooth, use ① to set visibility to “ON.” You can enter the PIN required for the connection using ②. By default, this PIN is set to “4007.” Use the ③ and ④ keys to read or set the reader’s Bluetooth settings, respectively. Press ⑤ to select the option that turns Bluetooth on automatically when the reader starts up.

Use the ⑥ and ⑦ buttons to turn Bluetooth on or off. Set Bluetooth to “On” and open the Bluetooth menu on the other device (PC, laptop, or mobile device) to search for available Bluetooth devices.

There, select the reader, which you can identify by the ID “UHF-RFID-Dev-xxxxxx.” Enter the selected PIN and establish the Bluetooth connection.

You can then access the reader via this external device using the SPI Serial Port Profile.

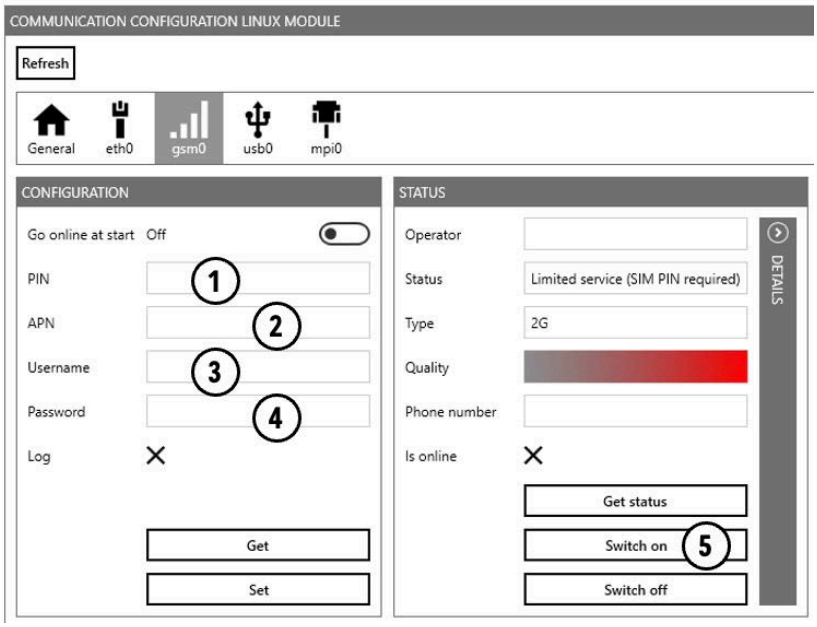
While the connection is being established, the Bluetooth LED flashes blue. Once a connection is established, the Bluetooth LED remains lit blue. You can check the status of the Bluetooth connection using ⑧.

17.2.6 Mobile Network Settings

The settings for the wireless cellular connection of the ARU 3570 and RRU 4570 readers can only be changed when the ReaderStart software is connected to the reader. The respective settings can be selected in the “COMMUNICATION CONFIGURATION LINUX MODULE” window.

NOTE
Activating the SIM Card!
► The SIM card must be activated before it is inserted into the reader!

With a SIM card inserted, the TAG Communication screen appears as follows:



Next, enter the SIM card’s PIN in field ①, the APN (Access Point Name) in field ②, the username in field ③, and the password in field ④. Press ⑤ to enable the cellular connection.

NOTE
Enabling the GSM Logs!
► It may be necessary to monitor the GSM connection during operation. To do this, select the “Logs” option under “Linux Module.” There, you can enable both the Linux log and the GSM log. Once enabled, all events are written to a log file and can be reviewed later.

17.3 Basic setting ReaderStart SW

17.3.1 Loading and saving the reader configuration

The readers have up to 8 parameter sets to save the respective reader configuration.
All functions are stored in the "File" menu item.



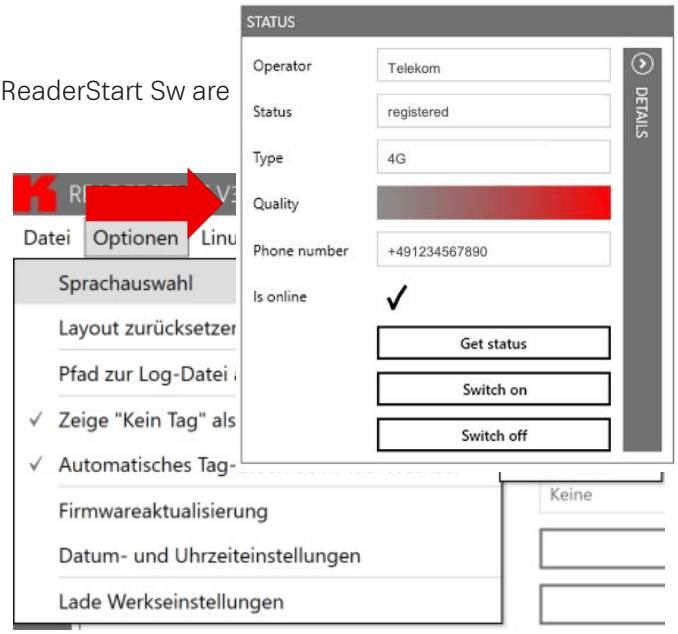
NOTE

Save reader configuration!

► To make it easier to assign the reader configuration, the respective serial number of the reader is automatically suggested as the file name.

17.3.2 Options for the ReaderStart SW

The most important menu items for controlling and setting the ReaderStart Sw are



The respective display language can be selected via language can be selected

The file storage for the read logs can be selected with "Path to the log file"

With firmware update, a new FW can be installed and can be loaded into the reader.

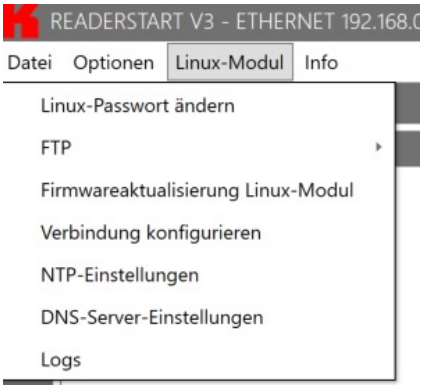
Date and time are set here

With the last menu item, the reader can can be reset to factory settings

17.3.3 Settings for the Linux module

The following settings can be changed here:

- Linux Password
- FTP Server
- Updateing of the Linux-Module
- SSH or Standard-Connection
- NTP-Settings
- DNS-Server-Settings
- Log-Files for Linux- and GSM-Modul

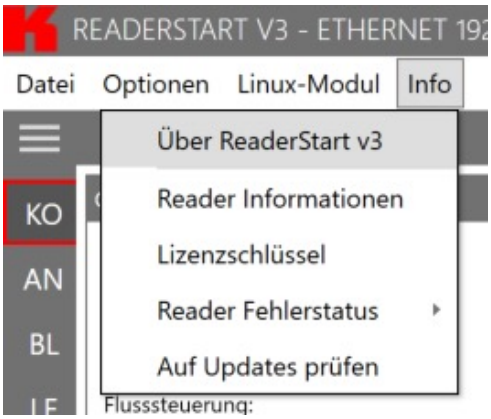


17.3.4 Info about ReaderStart SW

By selecting "Info", several pieces of information about the ReaderStart SW and the reader can be called up.

The following settings can be changed here

- Information about the ReaderStart SW
- Information about the connected reader
- Information about the license key
- SSH or standard connection
- Information on the error status
- Information about possible updates



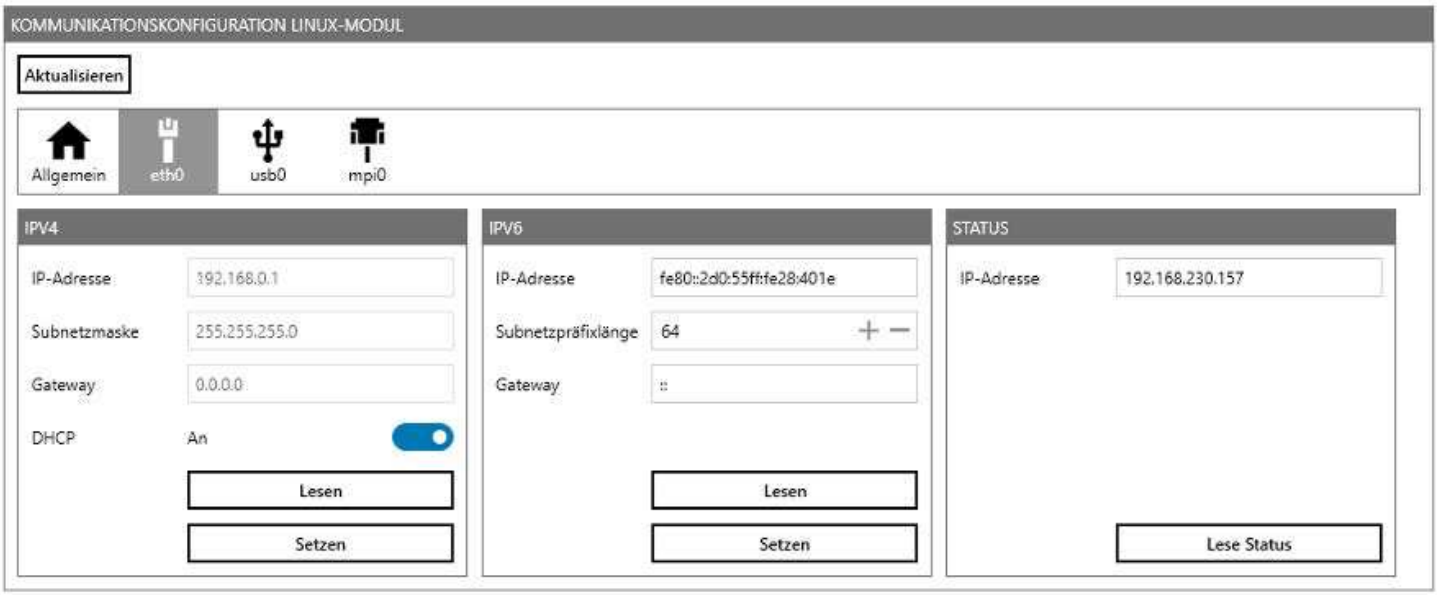
17.4 Operating the reader with the ReaderStart SW

The *ReaderStart* SW is divided into different TABs, which can be found on the left-hand side of the window. The respective tabs are abbreviated, e.g. KO for COMMUNICATIONS and can be expanded using the hamburger symbol ☰

The most important windows are displayed on the following pages



17.4.1 LINUX MODULE COMMUNICATION CONFIGURATION



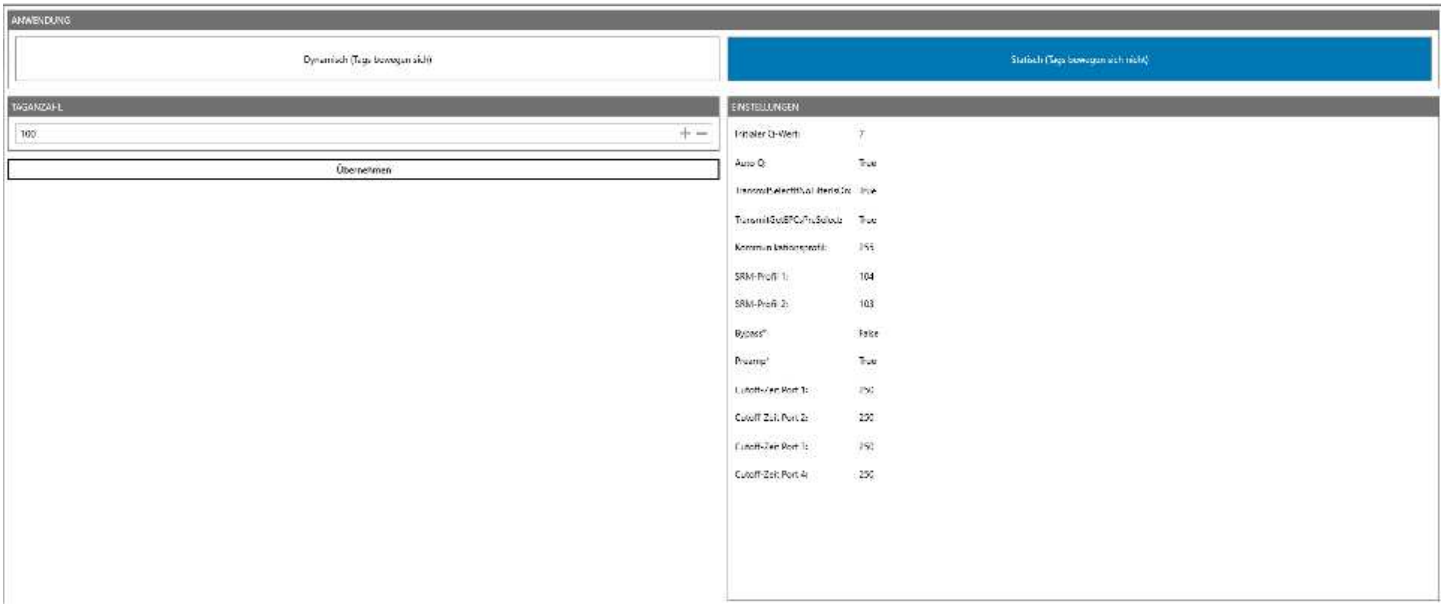
The “COMMUNICATION CONFIGURATION” tab allows you to configure the settings for the Ethernet and COM ports (RS232/RS485 serial connection, USB-C).

These settings are the same for all Kathrein readers.

The Wi-Fi and Bluetooth settings for the ARU 3560 and RRU 4560 can be found in sections *17.2.4* and *17.2.5*.

The cellular settings for the ARU 3570 and RRU 4570 can be found in section *17.2.6*.

17.4.2 APPLICATION



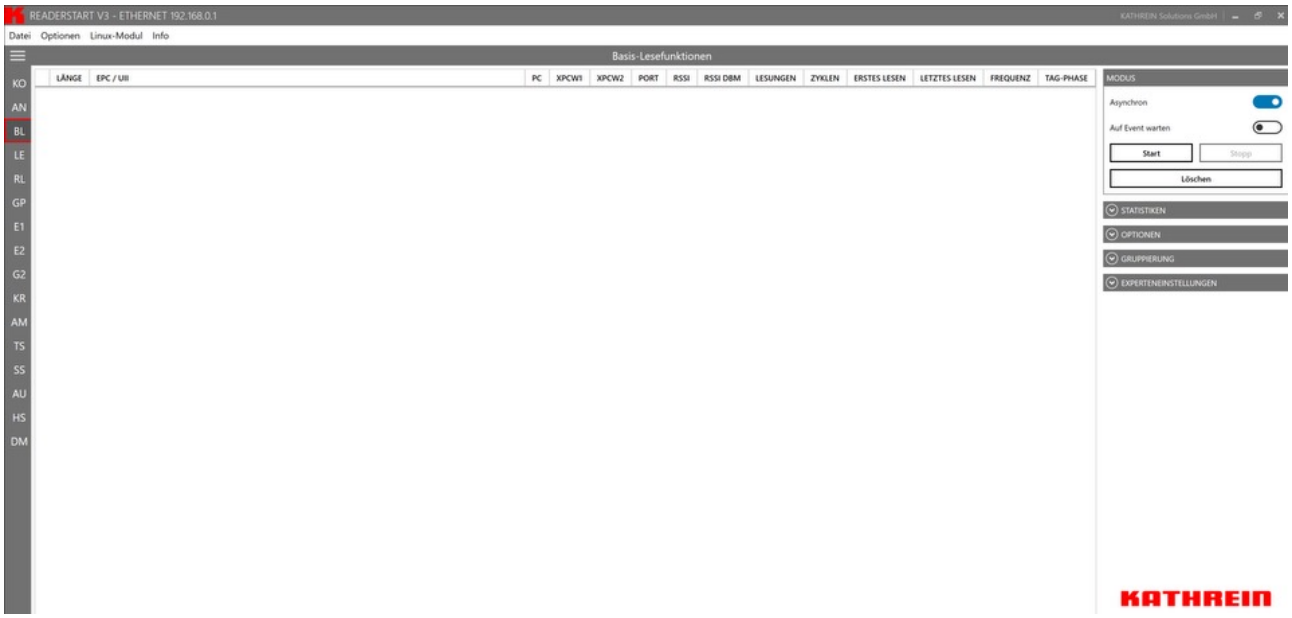
The “APPLICATION” tab allows you to optimally configure the reader for the specific application.

Whereas a large number of parameters were previously required, the SmartReader Mode has reduced the settings to only the essentials.

The reader automatically optimizes the relevant parameters even during reading to find the optimal settings. To do this, this menu only requires you to specify whether it is a dynamic application (tags are moving) or a static application (tags are not moving) and the number of expected transponders.

17.4.3 BASIC READING

If the settings are set via the "APPLICATION" tab, you can start reading with the reader immediately.



The reader can be set to its basic reading mode using the "Synchronous" or "Asynchronous" selection button.

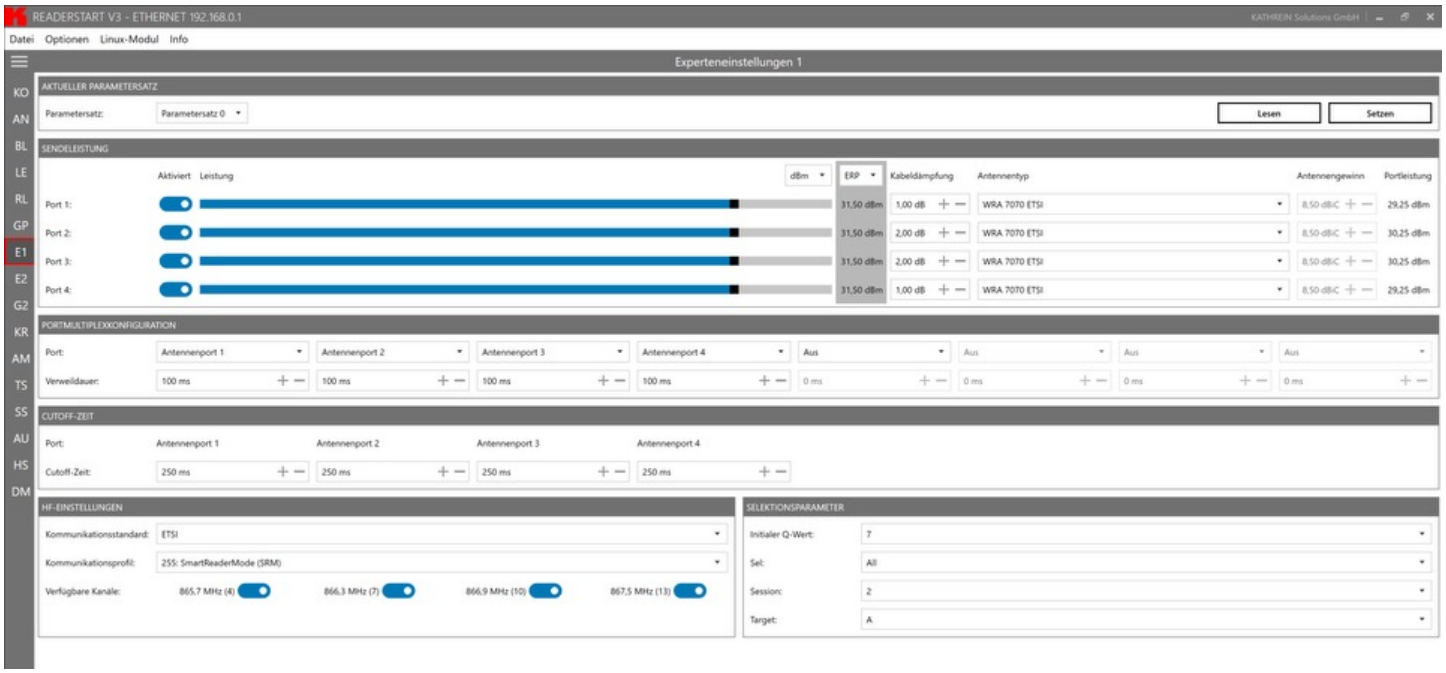
Synchronous	enables the carrier to be switched off during idle times and thus save power. This mode is intended for applications where the timing requirements are not very high. The inventory of tags is carried out across all configured antennas. As soon as all tags in the field have been read by the last antenna, the data is sent to the PC. If a new read is required, this must be triggered explicitly by the PC (in this case automatically by the *ReaderStart* SW).
Asynchronous	is designed for applications where maximum reading performance is required The reader starts the inventory as quickly as possible and at the end of an inventory does not deliver every day read to the PC, but only those that have recently appeared or left the field. In this way, the time required for communication between the reader and the client is reduced to a minimum. The time when a tag has been reliably read in the field and when the tag no longer appears in the field can be defined more precisely using parameters.

17.4.4 EXPERT SETTINGS 1

The *ReaderStart* software is a powerful tool for configuring the reader. It can be used to adapt the reader to any application if the grand setting of the SmartReader mode has not led to the desired result. With the expert settings 1 and 2, the RF interface and the communication profile of the reader can be optimized for the tag so that the reader is optimally adapted to the application.

Eight parameter sets are 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 the *Expert Settings 2*.



NOTE

European Upper Band

- ► If the reader is installed in a country in which the European Upper Band (915 - 921 MHz) is permitted, the user can select this under the "Communication standard" menu item
- ► Further information can be found here RFID Reader - Innovative solutions for industry & automotive

NOTE

Further TAB of the ReaderStart SW

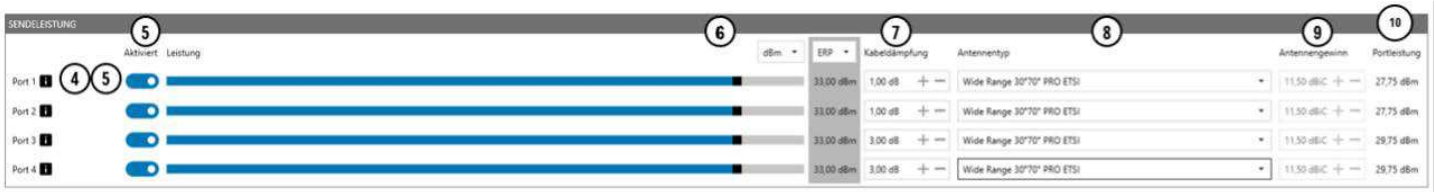
- ► Depending on the application, it may be necessary to use additional *ReaderStart* SW windows. We recommend a basic training course to familiarize yourself with the possible applications and the respective settings.
- ► You can find more information about the *ReaderStart* SW on the Kathrein Solutions YouTube channel

The following settings can be configured using Expert Setting 1:



Up to 8 parameter sets (0–7) are available and are permanently stored in the reader.

Using ①, you can select ② and save ③ the desired parameter set.



The most important parameters are grouped in the “Transmit Power” selection area. Use ④ to display the currently

adjustable range of transmit power. Use ⑤ to turn the respective antenna port on or off. The transmit power can be adjusted by dragging. To do this, click and drag the cursor with ⑥ and adjust it as needed.

The power radiated by the antennas is set in dBm e.r.p. The user can switch the display from dBm to W and from effective radiated power (e.r.p.; used in Europe) to equivalent isotropic radiated power (EIRP; used in the U.S.).

To set all active antennas to a specified transmission power, right-click on the antenna with the correct output power. This displays an icon ; selecting it sets all other antennas to the specified power.

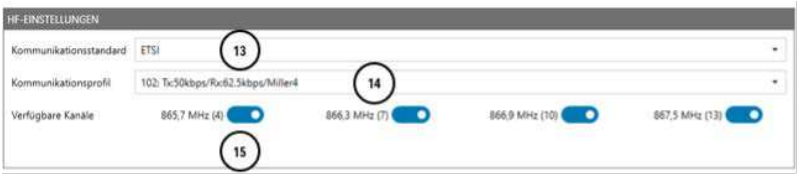


Port multiplexing allows you to specify the order in which the active antennas are selected. With the default setting "1-2-3-4," the antennas are selected in this order when a read command is issued. If Antenna 1 is the main antenna in the application, reading from this antenna can be performed more frequently by changing the order to, for example, "1-2-1-3-1-4." In this case, a read command will read from Antenna 1 three times and from each of the other antennas once.

Additionally, the dwell time for asynchronous reading can be set for each antenna. The default value is 100 ms, meaning the system will attempt to read from this antenna for at least 100 ms before switching to the next antenna.

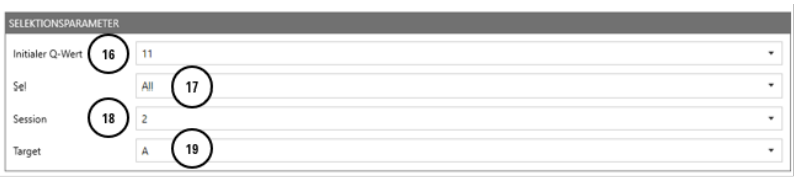


The CutOff time is used to set when the reader should provide an interim result of the readings. This is particularly useful for very large tag populations, when reading all tags takes several seconds. With the default setting, an interim result is provided after 250 ms. These times accumulate for each active antenna. With 4 active antennas, a list of interim values is provided 1000 ms after startup. The next data set is provided after another 1000 ms. This continues until all transponders have been detected.



The RF settings are used to configure frequency-specific parameters. This allows you to specify the communication standard, such as ETSI (865–868 MHz) or ETSI Upper Band (915–921 MHz).

The communication profile determines the speed of communication between the reader and the transponder.
It sets the data rate for transmission to the transponder (Tx) and for reception from the transponder (Rx). It also specifies whether the data is encoded using Miller or FM0.



The selection parameters are used to specify how communication with the transponders should take place. The initial Q value specifies the number of transponders expected to be active simultaneously in the application. This value is an exponent to the base 2; that is, if Q = 3, the system expects $2^3 = 8$ transponders to be active in the field at the same time.

This Q value is an initial value. An algorithm in the reader checks whether this value is appropriate and dynamically

adjusts it as the number of tags increases or decreases. The target value specifies whether communication should take place with the “unread” transponders (= Target A) or with the “read” transponders

(= Target B). The “Sel” setting determines whether communication should take place with all transponders or with specific ones.

NOTE

Global UHF RFID Standard

► You can download the specifications on which the settings in Expert Settings 1 are based from the “EPC UHF Gen2 Air Interface Protocol” on the GS1 website:

EPC UHF Gen2 Air Interface Protocol | GS1

17.4.5 EXPERT SETTINGS 2

The Expert Settings 2 section covers the more advanced aspects of the configuration.

Here, you can use the “Reader Parameter ID” to read and modify all of the reader's parameters.

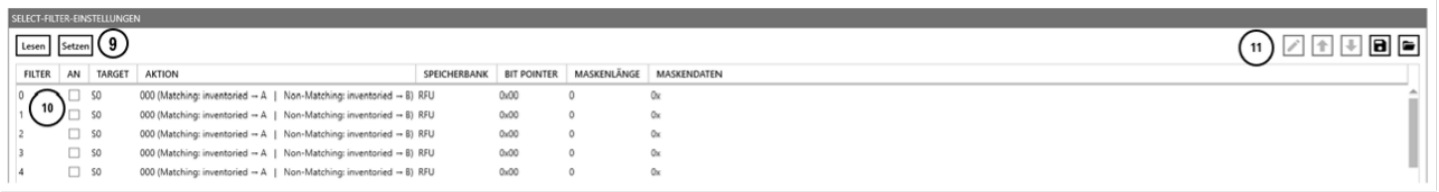


Use ① to select the parameter and ② to select the value. The value is displayed in ③. The parameter can be displayed as a decimal or hexadecimal value. The field ③ is editable, allowing you to change values and save them using ④.

In addition, parameter sets are managed using Expert Setting 2. Use ⑤ to specify which parameter set the reader should start with. Parameter sets can also be copied to test changes without losing the original data set. To do this, use ⑥ to select the source data set and ⑦ to select the destination parameter set. Then, use ⑧ to start the copy process.



One important feature is the use of a select filter, which ensures that communication occurs not with all transponders, but only with those for which the select filter is valid.



To do this, you can use ⑨ to read and set the Select filters being used. The individual Select filters can be selected using ⑩ and edited using ⑪. This opens a window where you can specify the Target, Action, Memory Bank, Bit Pointer, Mask Length, and Mask Data.

NOTE

Global UHF RFID Standard

► You can download the specifications on which the settings in Expert Settings 1 are based from the “EPC UHF Gen2 Air Interface Protocol” on the GS1 website:

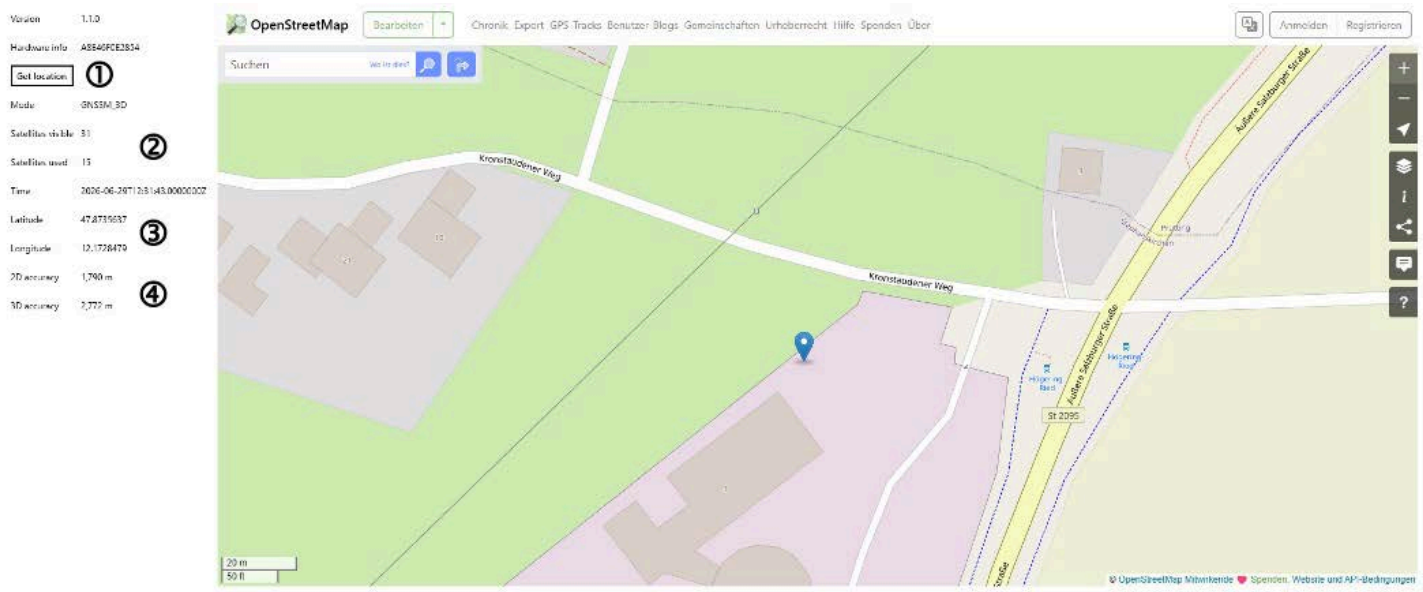
EPC UHF Gen2 Air Interface Protocol | GS1

17.4.6 Global Navigation Satellite System GNSS

The 4th-generation Kathrein RFID readers, in the ARU 3560 / RRU 4560 and ARU 3570 / RRU 4570 wireless configurations, also include a module that tracks and reports the local position based on the Global Navigation Satellite System (GNSS).

To test the function, open the GN=GNSS tab and select button ① “Get Location.”

The first time you open the app, a message appears stating that it uses OpenStreetMap maps, which are freely available under an open license. You can close this message by clicking the X in the upper-right corner of the OpenStreetMap notification window.



You can find the specific OpenStreetMap options on the right-hand side. On the left-hand side, you can check your current location at any time at ②. At ①, you can see the currently visible satellites and how many of them are being used. Your local location in latitude and longitude is displayed at ③. In addition, the built-in GNSS module calculates the current 2D and 3D accuracy at ④.

The API command used to retrieve the GNSS position is “GNSSGetLocation.”

NOTE

OpenStreetMap

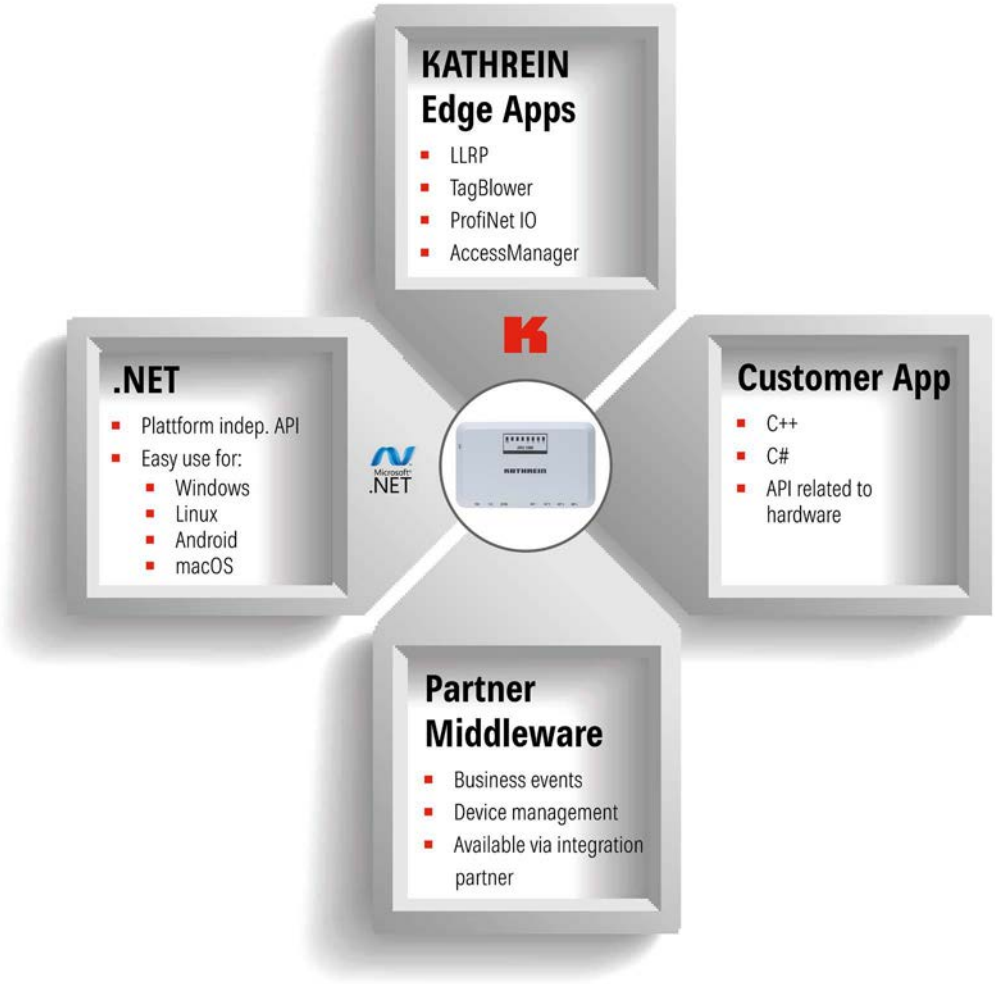
► The *ReaderStart* software uses OpenStreetMap's display directly. Therefore, Kathrein has no control over the available options or the map display in this window.

For more information on this, please visit https://www.openstreetmap.org/

18 Software programming for edge applications

18.1 General

The Kathrein RFID readers can be controlled via different ways for customer applications. For the readers of the 4th generation, it is also possible to run the application directly on the reader.
The following diagram is intended to explain the different control paths.



18.2 Kathrein apps

The Kathrein apps offer a simple and cost-effective way to collect and distribute data.

The following apps are offered for this purpose:

- LLRP app - Low Level Reader Protocol for applications with LLRP controller
- ProfiNet app - for controlling applications in the vicinity of industrial machinery.
- TagBlower app - to share read data in a simple way
- AccessManager app - to combine read results with incoming or outgoing events

You can also find instructions for the Kathrein apps on our YouTube channel.

18.3 Kathrein CrossTalk SW

Efficient AutoID systems for automatic object identification and data capture, as well as Internet of Things (IoT) systems, require not only excellent hardware but also AutoID and IoT software that is at least as excellent. Our partners also offer such software solutions, such as the CrossTalk Software Suite. The CrossTalk Software Suite is one of the most advanced software systems for AutoID and IoT device management. The software can be adapted to virtually any new challenge and deployed across a wide variety of industries. It reduces your costs and accelerates data processing.

18.4 Development of customer apps in C++ and C

If you are used to developing edge applications in C++ and C#, Kathrein offers you a suitable interface.
Examples can be found on the Reader product page

```
// This demo is written to can be compiled under windows and linux. To run this demo on a reader
// of type RRU4-ETL-XX or RRU4-ELC-XX you have to use a cross-compiler.

// ------------------------------------------------------------------------
// includes

#include <stdio.h>
#include <stdlib.h>
#include <string.h>

#ifdef _WIN32
#include <windows.h>
#include <conio.h>
#else
    #include <semaphore.h>
    #include <termios.h>
    #include <time.h>
    #include <unistd.h>
#endif

#include "../../API/Headers/konfigids.h"
#include "../../API/Headers/RRU4.h"

// ========================================================================
```

18.5 Development of .NET customer apps

If you are used to programming customer applications in a .NET environment, you will also find corresponding examples here

The following target platforms for the .NET applications are supported:

- Windows
- Linux
- Android
- Mac OS

```
using RRUCoreNative;

namespace ConsoleDemoNET6;

internal class Program
{
    private static readonly RRU _reader = new();
    private static readonly AutoResetEvent _resultHandlerEvent = new(false);
    private static tResultFlag _resultFlag;
    private static tConfigID _configID;
    private static uint _configIDValue;

    private static void Main()
    {
        // ------------------------------------------------------------------------
        // Let's save the current settings for the console to restore them on exit.
        var foregroundColor = Console.ForegroundColor;
        var backgroundColor = Console.BackgroundColor;

        Console.BackgroundColor = ConsoleColor.Black;
        Console.ForegroundColor = ConsoleColor.White;

```

19 Contact information

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20 Waste disposal



Electronic devices are not household waste - in accordance with Directive 2002/96/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of January 27, 2003 on waste electrical and electronic equipment, they must be disposed of properly. At the end of its service life, take this appliance to a designated public collection point for disposal