

User Guide

ARU 2400
ARU 3xxx
RRU 4xxx
English

IMPORTANT
Read carefully
before use!



Kathrein RFID UHF Readers



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 3 Kathrein RFID readers.





Tip This document applies to all Generation 3 Kathrein RFID readers. Even if it's referred to in the text as RRU 4xxx, it is possible to control all other readers of the RRU 4xxx, ARU 3xxx and ARU 2xxx series 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.
 - ⇒ The manuals are available for download at the internet product page.

3 Explanation of Symbols and Signal Words

3.1 Symbols

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

3.2 Signal Words

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

3.3 Other Symbols

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

4 Professional Installation Guidelines for the U.S.

4.1 Installation Personnel



UHF RFID readers require professional installation!

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

4.2 External Antenna



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

4.3 Final Output Power



WARNING

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



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

- ▶ Do not proceed any further with the installation.
- ▶ Do not install the unit or change the settings.

5 Safety Instructions

5.1 General Safety Instructions



WARNING

Danger to life from electric shock! Fire hazard!

Improper interventions in the device may 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, direct sunlight, heat or naked flames!

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

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





NOTICE

Risk of malfunction!

- ▶ Make sure the reader is properly grounded according to the corresponding national standards.
- ▶ Make sure that the diameter of the ground cable is min. 6 mm² (typ. 10 mm²).
- ▶ Make sure to ground the reader such that the distance between the reader ground point and the ground point in the building is as short as possible.
- ▶ Note that the equipotential bonding does not replace lightning protection.

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



WARNING

Danger to life due to radiation electromagnetic field!

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

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

5.3 FCC and ISED Canada Regulatory Information



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

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

- ▶ Make sure the operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.
- ▶ Make sure the unit is properly installed, see *FCC RF Radiation Exposure Statement, p. 11* and *ISED RF Radiation Exposure Statement, p. 11*.

The readers with the 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. 12 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. 12 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.

5.3.1 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*, p. 11 and *ISED RF Radiation Exposure Statement*, p. 11. 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 co-location or operating in conjunction with any other antenna or transmitter.

This equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment.

- ▶ Make sure this equipment is installed and operated with a minimum distance of 23 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 24 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 centimetres between the radiator and your body.

ISED RF Radiation Exposure Statement

This equipment complies with ISSED 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 centimetres 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.

5.4 Anatel Brazil Regulatory Information

Anatel RF Exposure Statement

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

Anatel Declaração de exposição à radiofrequência

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

Declaration about the Frequency Range

For the Brazil market, the product will be provided with the frequency range 915 to 928 MHz.

Declaração sobre a Configuração de Frequência

Para o Mercado Brasileiro o produto será fornecido com a configuração de frequência 915 a 928 MHz.

5.4.1 Safety Instructions



NOTICE

Risk of harmful radio communication interference!

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

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

5.4.2 Recommended Antenna Types

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

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

Order number	Type	Shortened designation	Gain	
			circular	linear
52010087	WIRA-30-circular-FCC	wide-range 30° antenna FCC, 902–928 MHz, 30° circular	11 dBiC	8 dBi
52010228	WIRA-30-CSB-KRAI-FCC	wide-range 30° CSB KRAI antenna FCC, 902–928 MHz, 30° circular	6 dBiC	3 dBi
52010249	WIRA-30-linear-FCC	wide-range 30° antenna FCC, 902–928 MHz, 30° linear	n.a.	11 dBi
52010252	WIRA-40-linear-FCC	wide-range 40° antenna FCC, 902–928 MHz, 40° linear	n.a.	13 dBi
52010079	WIRA-70-circular-FCC	wide-range 70° antenna FCC, 902–928 MHz, 70° circular	8.3 dBiC	5.3 dBi
52010194	WIRA-70-KRAI-FCC	wide-range 70° KRAI antenna FCC, 902–928 MHz, 70° circular	7/7/n.a./n.a.	4.5/4.5/ 7.5/7.5
52010083	MIRA-100-circular-FCC	mid-range antenna FCC, 902–928 MHz, 100° circular	2.5 dBiC	–0.5 dBi
52010172	S-MIRA-100-circular-ETSI-FCC	short mid-range antenna ETSI/FCC, 865–928 MHz, 100° circular	–10 dBiC	–13 dBi
52010085	LORA-FCC	low-range antenna FCC, 902–928 MHz	n.a.	–15 dBi
52010092	U-LORA-ETSI-FCC	ultra low-range antenna FCC, 865–928 MHz	n.a.	–30 dBi
52010219	SMSH-30-30-ETSI-FCC antenna modul	SMSH antenna/-module, 865–928 MHz, circular	–7 dBiC	–10 dBi
52010258	SMSH-30-30-KRAI-ETSI-FCC antenna	SMSH KRAI antenna/-module, 865–928 MHz, circular	–7 dBiC	–10 dBi
52010318	SMSH-HighGain-30-30-KRAI-FCC	SMSH antenna/-module, 902–928 MHz, circular	5 dBiC	2 dBi
52010319	SMSH-HighGain-30-30-FCC	SMSH antenna/-module, 902–928 MHz, circular	5 dBiC	2 dBi
52010334	WRA 7070 antenna unit	wide-range antenna, 902–928 MHz, circular	8.5 dBiC	5.5 dBi
52010336	WRA 7070 KRAI antenna unit	wide-range antenna, 902–928 MHz, circular/linear	7/7/n.a./n.a.	4.5/4.5/ 7.5/7.5
52010424	WRA 6060	wide-range antenna FCC, 902–928, circular	5.5 dBiC	2.5 dBi

6 Warranty Information



Switching on the AC or DC power supply prior to connecting the LAN cable is considered incorrect installation. Any functional defect arising as a result is excluded from the warranty/guarantee. Kathrein accepts no liability if the customer fails to implement the precautions listed here. In such cases, any claims under the warranty/guarantee are void.

- ▶ Before installing or servicing the reader, make sure that the person concerned has read the manual and understood its contents.

7 Introduction to the RFID System

7.1 RFID System

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

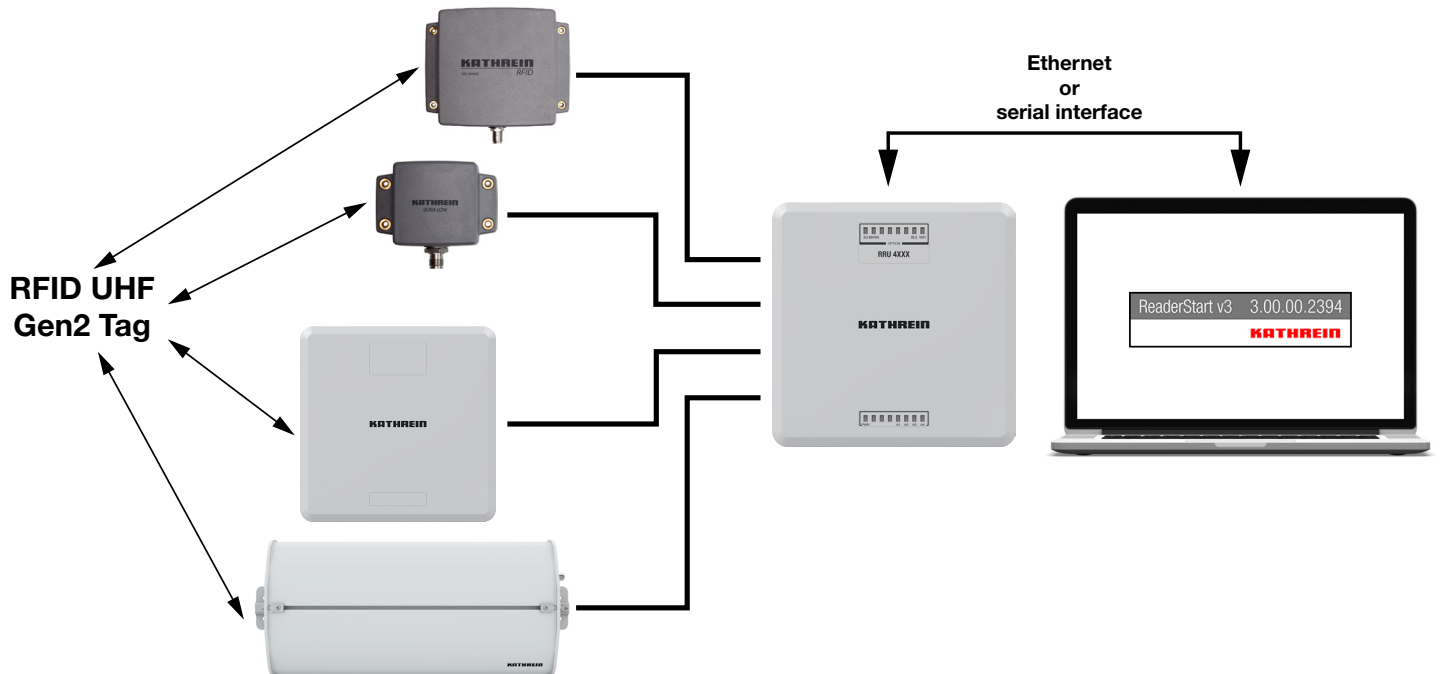


Fig. 1: RFID system (example)

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 parametrising.

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.



To be able to use the complete range of the reader performance in customer applications, we recommend using the readers ARU 3500 or RRU 4500. It is not possible to run any customer applications on the basic readers, i.e. ARU 2400, ARU 3400 and RRU 4400.

7.2 Kathrein RFID Antenna Interface ©KRAI

With the ©KRAI product series, Kathrein has introduced a revolutionary system. By using Kathrein ©KRAI antennas, it is possible to increase the flexibility due to having several antenna properties at one installation point (in case of PLS and CSB antennas) and functionality (when cascading SSMH antennas).

©KRAI consists of a digital control bus which enables connection between the RFID reader and the RFID antennas to allow control and regulation tasks in remote antennas

7.2.1 WIRA 70 ©KRAI Polarisation Switch Antenna (PLS)

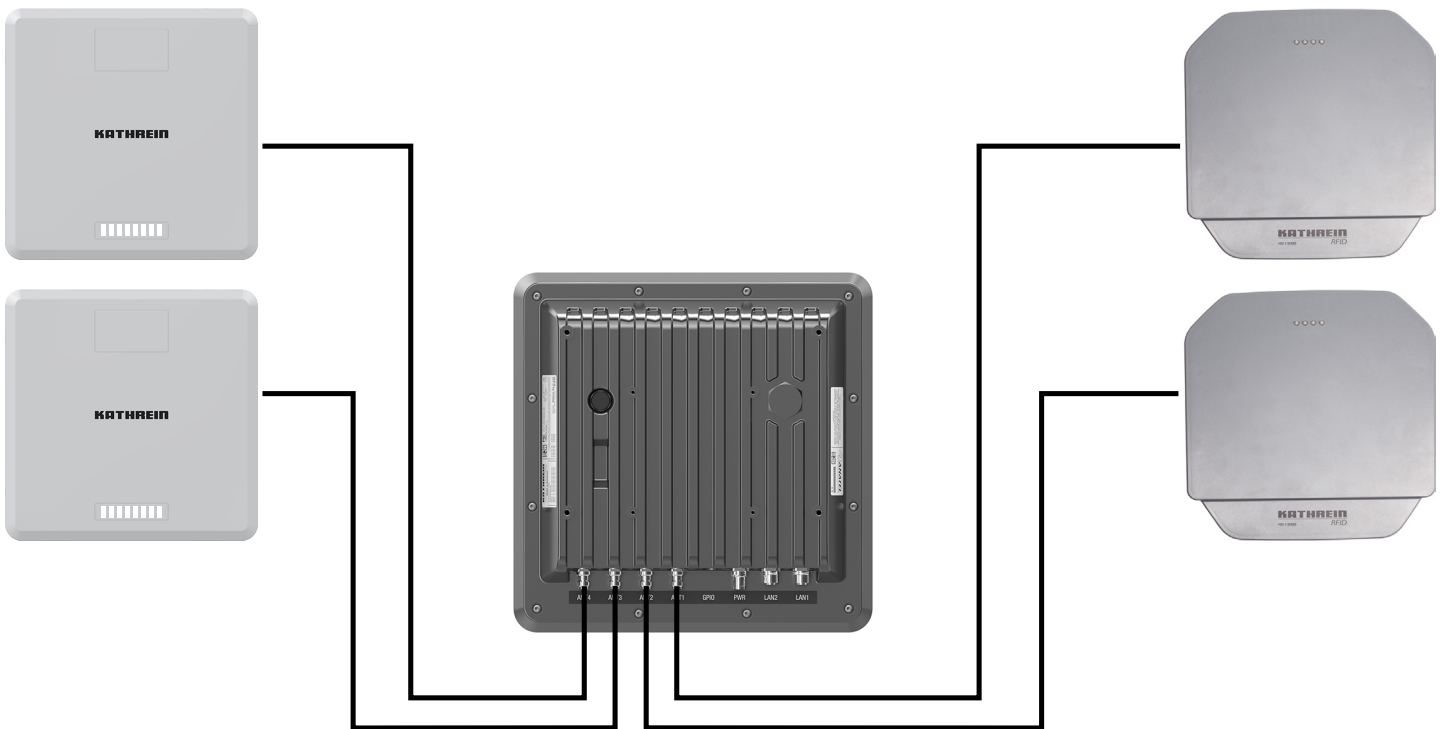


Fig. 2: PLS antennas connected to the reader

With the ©KRAI PLS antenna, built as a WiRa 70° antenna, the polarisation can be switched statically or dynamically. The following settings are possible in any combination:

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

It is possible to select the best polarisation for wide-range application and to carry out a flexible adjustment of the antenna on site.

Furthermore, it is possible to increase the read rate via the switching circular LHCP/RHCP by up to 33%.

Type	Order number	Far-field half-power beam width	Polarisation	Frequency range
WIRA 70 ©KRAI ETSI	52010193	70°/70°	circular	865–868 MHz
WIRA 70 ©KRAI FCC	52010194	70°/70°	circular	902–928 MHz
WRA 7070 ©KRAI ETSI	52010335	70°/70°	circular	865–868 MHz
WRA 7070 ©KRAI FCC	52010336	70°/70°	circular	902–928 MHz

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

Tip Note that for the internal antenna, the ARU 3560 reader has all four polarisations already built in. The ARU 3560 reader cannot switch polarisation for external antennas.

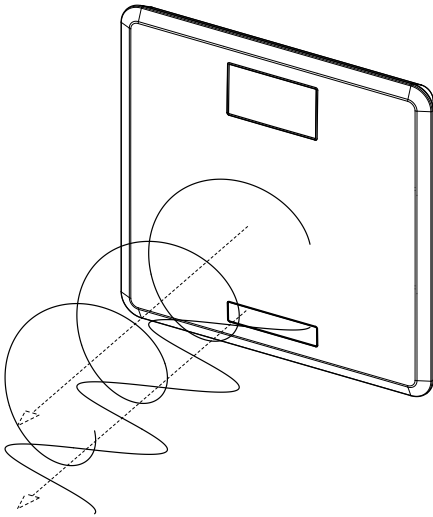


Fig. 3: Circular and linear polarisation

7.2.2 ©KRAI SMSH (Smart Shelf) Antenna

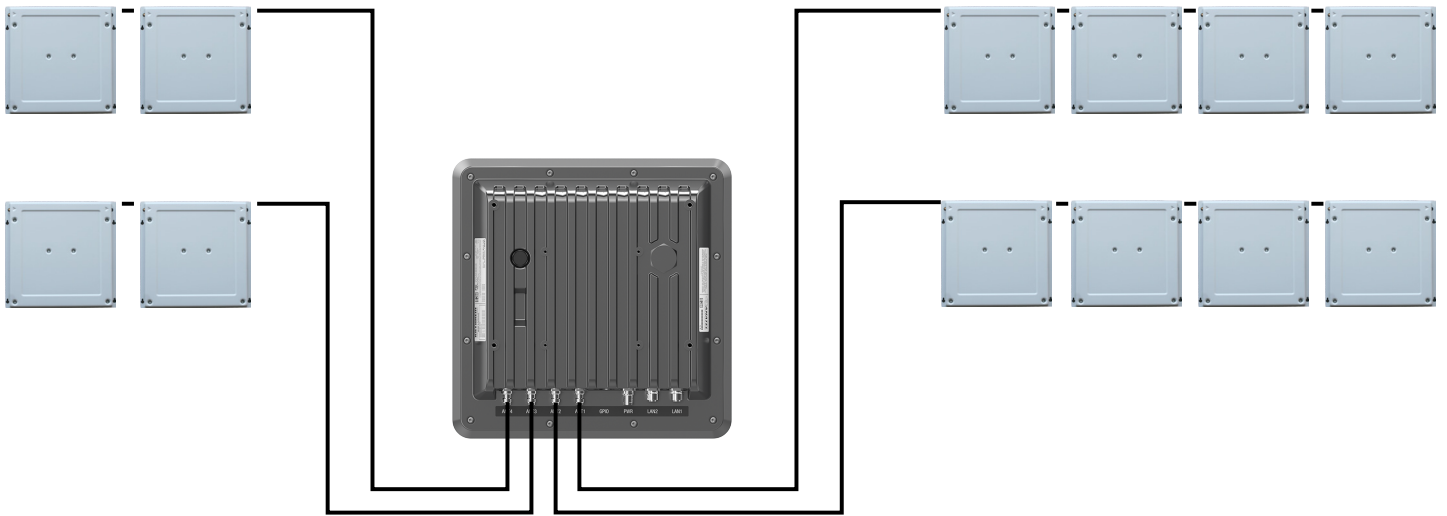


Fig. 4: ©KRAI smart shelf antennas connected to the reader (cascaded)

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 3030 ©KRAI slave antenna was developed for applications in the field of point of sale, smart shelf applications and Kanban solutions. The antenna is characterised by an extremely homogeneous read zone, which is emitted by the high front-to-back ratio. Therefore, it is suitable for static detection of multiple transponders. Due to the extremely thin design, the antenna module can be integrated into different applications.

The antenna is equipped with an intelligent bypass circuit that allows for cascading up to 8 SMSH antennas per reader port. The control is done by a RRU 4xxx Kathrein RFID reader. The ©KRAI control signals are transmitted via the standard antenna cable.

Type	Order number	Far-field half-power beam width	Polarisation	Frequency range
SMSH 3030 ©KRAI ETSI FCC antenna	52010258	60°/60°	circular	865–928 MHz
SMSH high-gain 3030 ©KRAI ETSI antenna	52010259	60°/60°	circular	865–868 MHz
SMSH high-gain 3030 ©KRAI FCC antenna	52010318	60°/60°	circular	902–928 MHz

Tip

Note that the ©KRAI SMSH high-gain antennas have a read range of up to 3 m. The ©KRAI SMSH standard antennas read transponders at a distance of up to 1 m.

Tip

Note that the SMSH high-gain antennas (order no. 52010260) and SMSH standard antennas (order no. 52010219) do not have ©KRAI and cannot be cascaded.

7.3 Further Reference Material

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

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

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

Document	Application
<i>Communication Protocol Kathrein RFID UHF Readers</i>	software development
<i>Configuration Manual for Kathrein RFID UHF Readers</i>	commissioning
<i>Installation Manual for Kathrein Antennas</i>	setup and installation
<i>EPCglobal Gen2 Specification¹⁾</i>	software development
Putty – SSH Client (http://www.putty.org)	software development



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

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>.

8 The Reader

8.1 Functional Specification

The Kathrein RFID (Radio Frequency Identification) reader of the RRU 4xxx and ARU 3xxx series is a multi-protocol-capable device 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 RRU 4xxx series support all market leading transponder chip features for security, authentication and encoding. As supplied, the unit can read and write tags in accordance with the *EPC Gen2v2* standard.

It is possible to load additional protocols using software updates.

The device has a maximum of four external antenna ports for connection of the transmission/reception antennas for communication with RFID tags.

For integration into a variety of infrastructures, the device has different communication interfaces, depending on the variant. The power supply is provided either by a 4-pin M12 panel connector in A coding or by PoE+ according to 802.3at (10–57)¹⁾.

The Kathrein UHF RFID reader system RRU 4xxx is characterised by great flexibility in regard to RFID applications. One reason for it is the wide variety of reading devices compatible to each other, which allows to select a reader from the Kathrein product portfolio ideally suited for the respective application. Another reason for this flexibility is the wide range of parameters for configuring the reader firmware.

8.2 Features

- basic computing module
- dual-core embedded PC
- 1 Ethernet port (RRU 4400, ARU 3400 and ARU 2400)
- 2nd Ethernet port (with the intelligent switch) (RRU 45xx, ARU 35xx)
- GPIO
- ©KRAI (RRU 4xxx and ARU 2400)
- PoE+
- LED visualisation
- Wi-Fi (RRU 4560 and ARU 3560)
- Bluetooth (RRU 4560 and ARU 3560)
- 2G/3G (RRU 4570 and ARU 3570)

8.3 Scope of Delivery

- RRU 4xxx reader
- QR code to the Kathrein Solutions GmbH homepage

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

8.4 Accessories

This chapter gives an overview of the accessories available for the reader. For more information, visit our website at <https://www.kathrein-solutions.com/products/hardware/accessories> or contact our sales office at + 49 8036 90831 20.

8.4.1 Antennas

For use with UHF RFID antennas we recommend the Kathrein antenna types ULoRa, LoRa, MiRa, WiRa. These antenna types are available for all frequency ranges and are water proof according to at least IP 65 standard.

For more information, refer to *User Guide Kathrein RFID Antennas*.

8.4.2 Antenna Cables

Order number	Type	Description
52010174	R-AC 3 TNC-TNCR	LL240 flex, 3 m, IP 67 ruggedised
52010175	R-AC 6 TNC-TNCR	LL240 flex, 6 m, IP 67 ruggedised
52010176	R-AC 10 TNC-TNCR	LL240 flex,10 m, IP 67 ruggedised
52010177	R-AC 15 TNC-TNCR	LL240 flex,15 m, IP 67 ruggedised
52010250	R-AA N-TNC	LL440 flex,15 m, IP 67 ruggedised
52010090	R-AC 3 SMA-TNCR	RG 58, 3 m
52010208	R-AC 05 SMA-SMA	RG 58, 5 m
52010451	R-AC 1 SMA-FAKRA	RFID antenna cable L=1 m, IP40; FAKRA Z-coded to SMA (m); right angle antenna plug
52010452	R-AC 3 SMA-FAKRA	RFID antenna cable L=3 m, IP40; FAKRA Z-coded to SMA (m); right angle antenna plug
52010453	R-AC 5 SMA-FAKRA	RFID antenna cable L=5 m, IP40; FAKRA Z-coded to SMA (m); right angle antenna plug
52010461	R-AC 1 TNC-FAKRA	RFID antenna cable L=1 m, IP40; FAKRA Z-coded to TNC (m); right angle antenna plug
52010462	R-AC 3 TNC-FAKRA	RFID antenna cable L=3 m, IP40; FAKRA Z-coded to TNC (m); right angle antenna plug
52010463	R-AC 5 TNC-FAKRA	RFID antenna cable L=5 m, IP40; FAKRA Z-coded to TNC (m); right angle antenna plug

8.4.3 Antenna Adapters

Order number	Type	Description
52010178	R-AA TNC-N(f-m)	adapter TNC-N (f-m)
52010243	R-AA TNC-SMA (f-m)	adapter TNC-SMA (f-m)

8.4.4 Antenna Mounting Accessories

Pole Mounting

Order number	Type	Description
52010005	MK-AMB-100 Outdoor	wall mount/mast mount kit for WIRA 30° antennas

Wall Mounting

Order number	Type	Description
52010261	MK-WM-100-100 Indoor	wall mount kit for all readers and WRA 6060/7070 antennas

Wall/Pole Mounting

Order number	Type	Description
52010262	MK-WPGM-100-100 Outdoor	wall/pole mount kit for WIRA 40° antennas

8.4.5 Antenna Protective Cover

Order number	Type	Description
52010224	SMSH-30-30PC	protective cover for SMSH
52010356	SMSH-BP-ALU	aluminium backplate for SMSH

8.4.6 Reader Connecting Cables

Order number	Type	Description
52010358	R-CC3-10 DC	RRU/ARU DC power cable, 10 m
52010359	R-CC3-03 DC	RRU/ARU DC power cable, 3 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
52010373	R-BC3-10 ETH	RRU/ARU Ethernet bridge cable

8.4.7 Reader AC/DC Adapters

Order number	Type	Description
52010364	R-RPA3 24 VDC – 90 W	RRU/ARU AC/DC adapter 24 V/90 W
52010365	R-RPA 24 VDC – 72 W	RRU/ARU AC/DC adapter 24 V/72 W
52010366	R-RPA 24 VDC – 90 W	RRU/ARU AC/DC adapter 24 V/90 W
52010474	R-RPA 24DC-18W	AC/DC adapter, 24 V/18 W, AC 110–230 V, power plug device, interchangeable AC plug

8.4.8 PoE+ Power Supply Unit

Order number	Type	Description
52020369	R-ETH-SW-100	PoE+ Ethernet switch, 4-port
52010370	R-POE-ONJ-30	PoE+ injector, 30 W, 100Mbit für RRU, ARU and M-ARU

8.4.9 Reader and Antenna Wall/Pole Mounting Kit

Order number	Type	Description
52010351	MK-WPM3-OSS Outdoor	wall/pole mount kit for RRU 4xxx, ARU 3xxx, WRA 7070 antenna
52010368	MK-PMA-OGV	pole mount adapter for 52010351

8.4.10 Reader Protective Covers and Caps

Order number	Type	Description
52010376	PCS-G3-IP67	protective cap for RRU 4xx and ARU 3xxx, IP 67
52010367	R-RVP3-VPP-SS	vandalism protective cover for RRU 4xxx and ARU 3xxx

9 Connections and Displays

The following chapters provide details of the connections and the pin assignments of plugs and sockets.

9.1 RRU 4xxx and ARU 3xxx

Depending of the device variant, the reader has various connection options. The illustrations below shows an RRU 4000 standard reader with all its connection options.

9.1.1 Front View

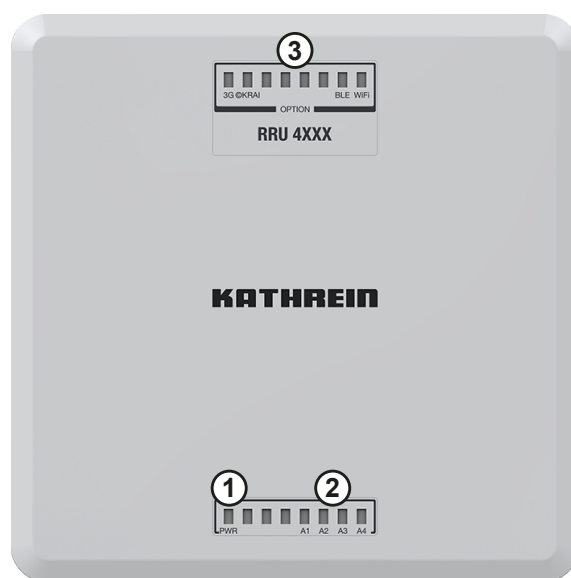


Fig. 5: RRU 4000 – Displays

No.	Name	Function
①	PWR	indicates whether the reader is on; see also <i>12.5 Reading the PWR LED Indications, p. 45</i>
②	basic LEDs (A1-A4)	indicate if an RF signal is on for antennas 1–4 (default setting) ► For other functions of the basic LEDs, see <i>Selecting Functions, p. 88</i>
③	high-end LEDs ¹⁾	see <i>LED, p. 87</i>

Related topics

12.5 Reading the PWR LED Indications, p. 45

14.4 LED, p. 87

¹⁾ Available for RRU 45xx and ARU 35xx

9.1.2 Rear View



Fig. 6: RRU 4000

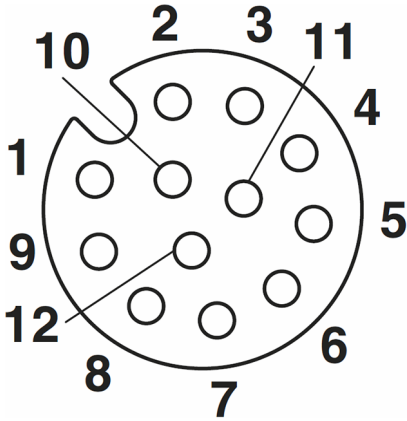
No.	Name	Function
①	ANT 4 ¹⁾	R-TNC, 50 Ohm, to connect an antenna
②	ANT 3	R-TNC, 50 Ohm, to connect an antenna
③	ANT 2	R-TNC, 50 Ohm, to connect an antenna
④	ANT 1	R-TNC, 50 Ohm, to connect an antenna
⑤	GPIO	to detect external sensors and to control external actors; see also <i>GPIO Functions</i> , p. 90
⑥	PWR	to connect to a DC power supply, 10–30 V
⑦	LAN ²⁾	second Ethernet port <ul style="list-style-type: none"> to connect to a sub network to connect external Ethernet devices
⑧	LAN/PoE	main Ethernet port with PoE+-connectivity <ul style="list-style-type: none"> to control the reader to provide power supply over Ethernet

¹⁾ In the ARU 3xxx readers, there are only 3 antenna ports

²⁾ Available for RRU 45xx and ARU 35xx

GPIO

M12, A-coded, 12-pin, female



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

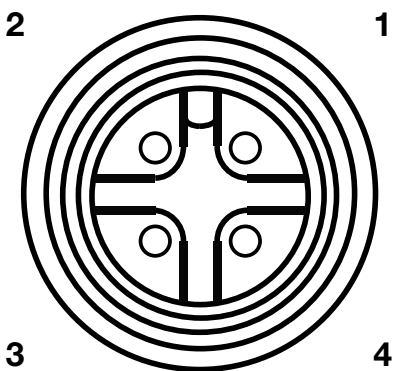
Related topics

14.6 GPIO Functions, p. 90

Power Supply

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

M12, A-coded, 4-pin, male



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



Bear in mind that only power supply units with LPS (*Limited Power Source*) or NEC Class 2 power supply units are approved for operation with the device. This means that the secondary side of the power supply unit is limited to a power of maximum 100 W.



N'oubliez pas que seuls les blocs d'alimentation avec LPS (Limited Power Source, source d'alimentation limitée) ou les blocs d'alimentation NEC de classe 2 sont autorisés pour fonctionner avec l'appareil. Cela signifie que le côté secondaire du bloc d'alimentation est limité à une puissance de maximum 100 W.

Ethernet



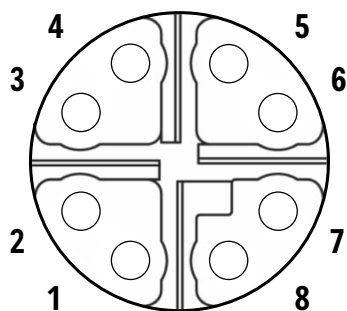
NOTICE

Risk of malfunction!

If other cables than specified are used, the communication with the reader is either interrupted or there is a malfunction.

- Only use shielded cables.

M12, X-coded, 8-pin, female



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

Buzzer

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

9.2 ARU 2400

9.2.1 Front View



Fig. 7: ARU 2400 – Displays

No.	Name	Function
①	PWR	indicates whether the reader is on; see also <i>12.5 Reading the PWR LED Indications, p. 45</i>
②	basic LEDs (A1-A4)	indicate if an RF signal is on for antennas 1–4 (default setting) ► For other functions of the basic LEDs, see <i>Selecting Functions, p. 88</i>

Related topics

12.5 Reading the PWR LED Indications, p. 45

9.2.2 Rear View

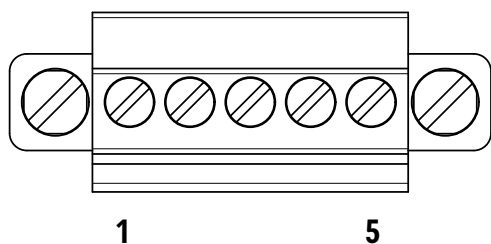


Fig. 8: ARU 2400

No.	Name	Function
①	<i>ANT 3</i>	R-TNC, 50 Ohm, to connect an antenna
②	<i>ANT 2</i>	R-TNC, 50 Ohm, to connect an antenna
③	<i>ANT 1</i>	R-TNC, 50 Ohm, to connect an antenna
④	<i>GPIO</i>	to detect external sensors and to control external actors; see also <i>GPIO Functions</i> , p. 90
⑤	<i>LAN/PoE</i>	main Ethernet port with PoE connectivity <ul style="list-style-type: none"> • to control the reader • to provide power supply over Ethernet
⑥	<i>PWR</i>	to connect to a DC power supply, 10–30 V
⑦		4 x tapped holes to connect to the MK-WPM3-OSS Outdoor wall/pole mount kit (order number 52010351 or 52010262)
⑧	<i>LAN/PoE</i>	8 x tapped holes to connect to the MK-SHM-4IP shelf mounting kit (order number 52010479)
⑨		earth bolt

GPIO

Printed circuit board connector, 5-pole, screw connection with tension sleeve



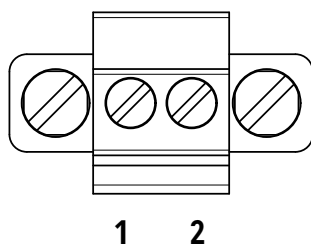
Pin	Allocation
1	GND OUT_CMN
2	INPUT_1
3	INPUT_2
4	OUTPUT_1 (open drain)
5	OUTPUT_2 (open drain)

Related topics

14.6 GPIO Functions, p. 90

Power Supply

Printed circuit board connector 2-pole, screw connection with tension sleeve



Pin	Allocation
1	GND
2	+24 V DC



Bear in mind that only power supply units with LPS (*Limited Power Source*) or NEC Class 2 power supply units are approved for operation with the device. This means that the secondary side of the power supply unit is limited to a power of maximum 100 W.



N'oubliez pas que seuls les blocs d'alimentation avec LPS (Limited Power Source, source d'alimentation limitée) ou les blocs d'alimentation NEC de classe 2 sont autorisés pour fonctionner avec l'appareil. Cela signifie que le côté secondaire du bloc d'alimentation est limité à une puissance de maximum 100 W.

Ethernet



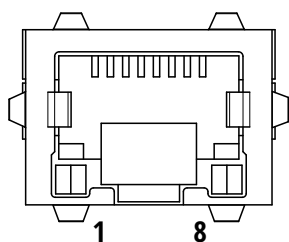
NOTICE

Risk of malfunction!

If other cables than specified are used, the communication with the reader is either interrupted or there is a malfunction.

- ▶ Only use shielded cables.

RJ45, 8-pole



Pin	Allocation
1	TX+ / PoE1
2	TX- / PoE1
3	RX+ / PoE2
4	RX- / PoE2
5	PoE1
6	PoE2
7	PoE3
8	PoE4

Buzzer

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

10 Installing the Reader

When the connections are plugged in, the device satisfies the protection class IP65 (RRU and ARU).

10.1 Selecting the Installation Site



WARNING

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



- ▶ When installing the unit in cabinets or shelves, make sure there is sufficient ventilation.
 - ▶ When selecting the installation location, make sure there is sufficient space around the unit for appropriate dissipation of the heat generated by the unit.
 - ▶ Do not expose the unit to inadmissible heat or fire.
 - ▶ Do not install the device close to the sources of heat, e.g. heating.
 - ▶ Do not place anything with a naked flame on the device.
 - ▶ Make sure that the maximum operating temperature from -20 to $+55^{\circ}\text{C}$ is not exceeded.
 - ▶ Make sure that the support surface has a sufficient load-bearing capacity/strength.
-



NOTICE

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

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

- ▶ When mounting the reader, make sure that the screws are screwed into the unit housing no deeper than 10 mm.
-

10.2 Installing the RRU 4xxx and ARU 3xxx Readers

10.2.1 Wall Mounting

At the rear panel, the reader has threaded holes.

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

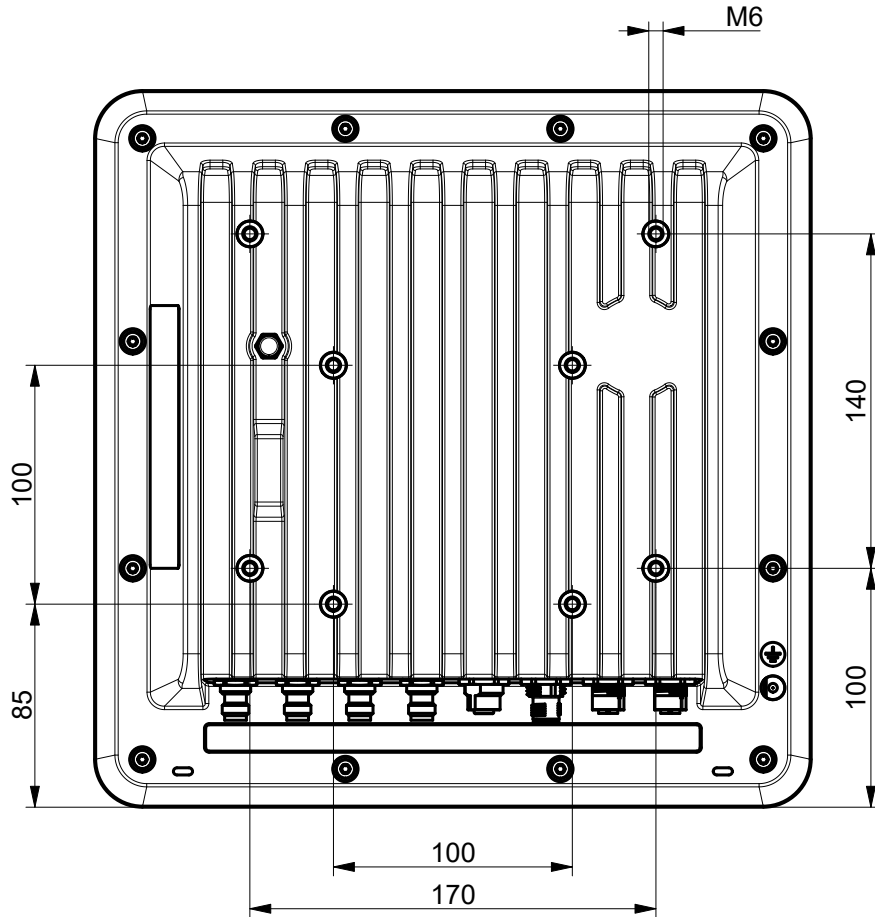


Fig. 9: RRU 4xxx and ARU 3xxx dimensions, rear view

10.2.2 Wall/Pole Mounting

For ease of installation, a bracket is available as an accessory to mount the reader on a wall (52010351 or 52010262) or a mast (52010351 and 52010368).

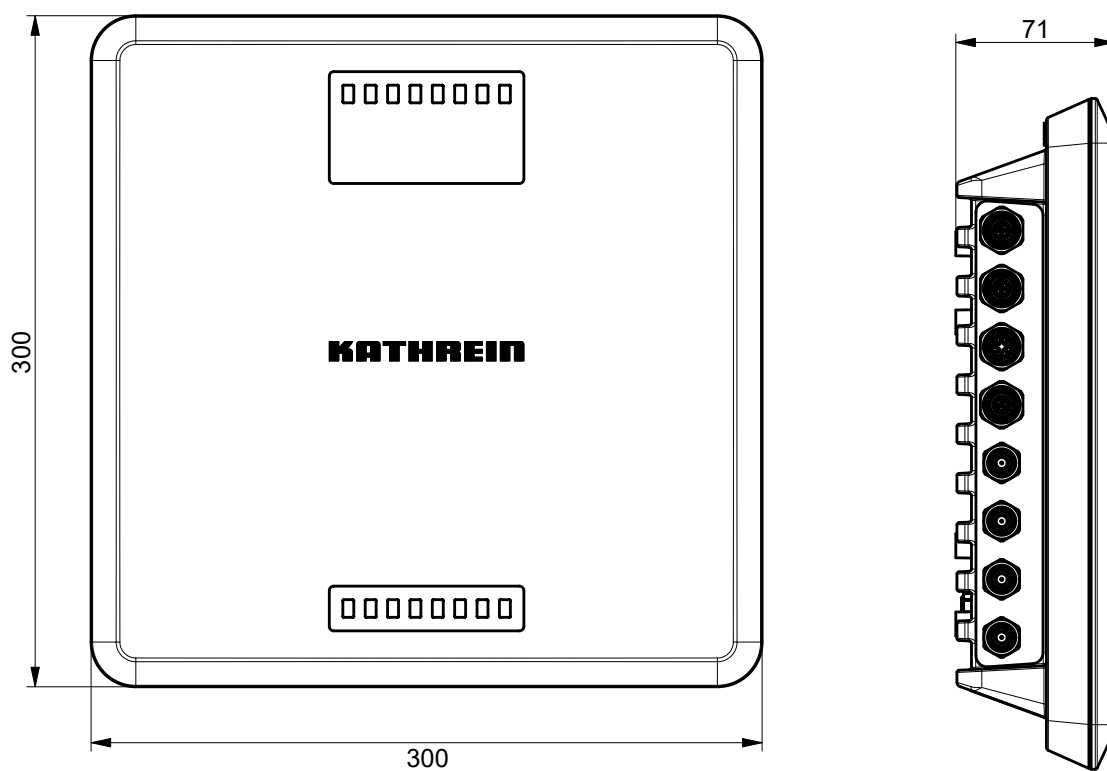


Fig. 10: RRU 4xxx and ARU 3xxx dimensions, front and side view

10.3 Installing the ARU 2400 Reader

10.3.1 Wall Mounting

At the rear panel, the reader has 4 threaded holes.

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

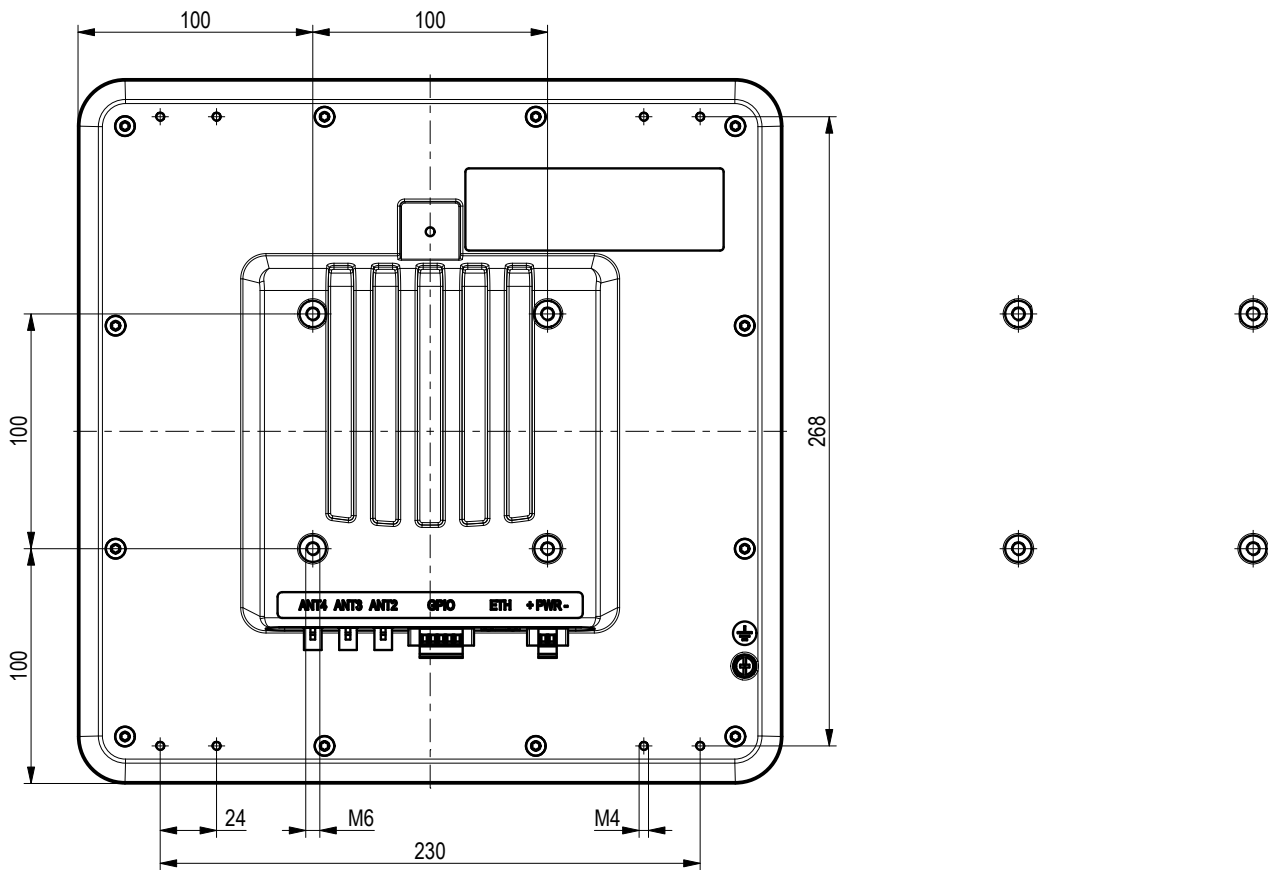


Fig. 11: ARU 2400 dimensions, rear view

10.3.2 Shelf Mounting

At the rear panel, the reader has 8 threaded holes for the MS-SHM-4IP shelf mounting kit (available as an accessory, order number 52010479), for mounting on ITEM or Bosch Rexroth shelves.

► See the drawing below for the dimensions of the 8 holes.

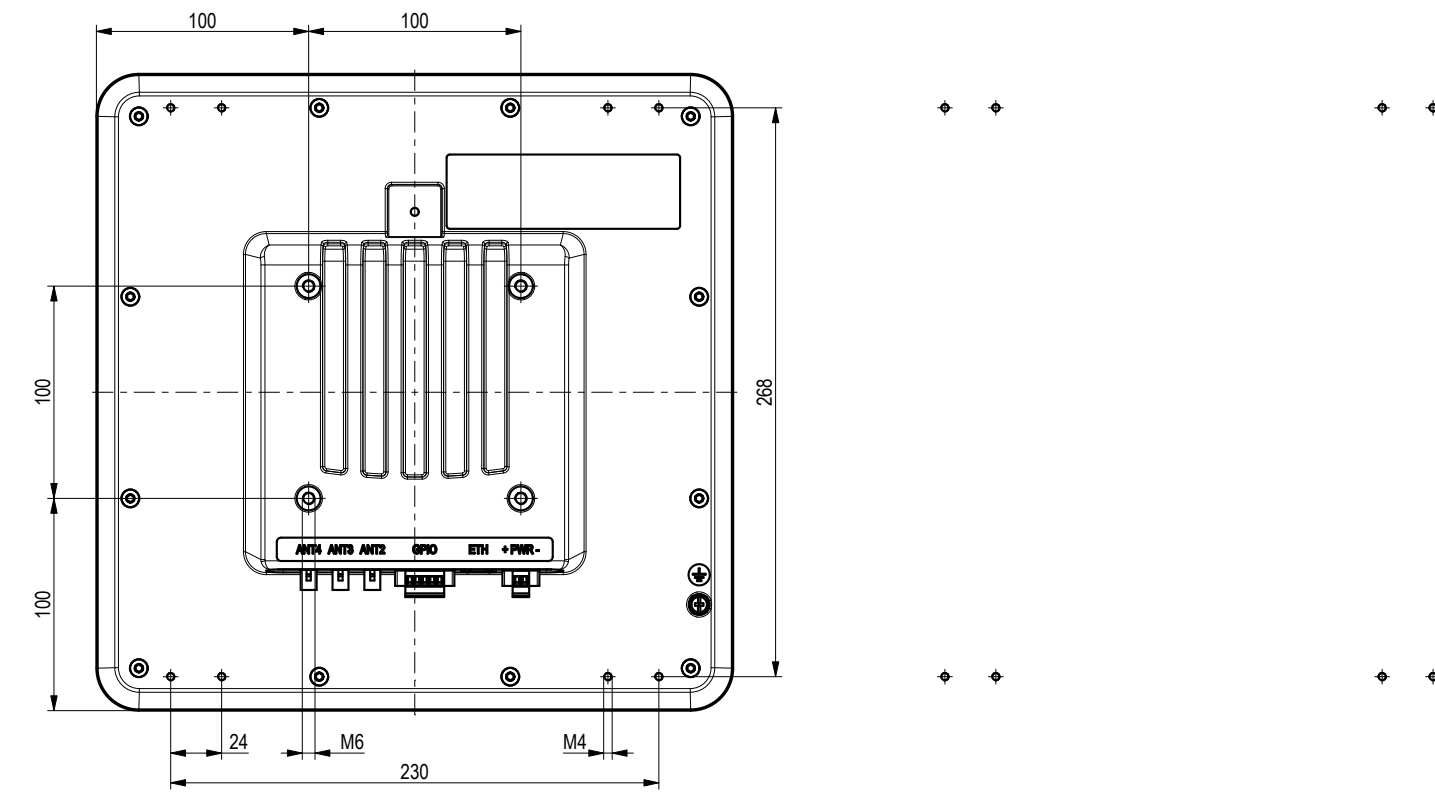


Fig. 12: ARU 2400 dimensions, rear view

11 Transmission Methods

11.1 UART transmission (RS232, RS422, RS485 or similar)

11.1.1 Physical Layer

A full or half-duplex connection such as RS232, RS422 or RS485 is used for the physical layer.

11.1.2 Data Link Layer

Transmission takes place in frames and blocks. A block comprises a maximum of 256 frames. A frame comprises a maximum of 256 bytes, of which a maximum of 250 bytes can be user data. The result is a maximum block size of 64000 bytes of user data.

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

Frame Structure

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

5A	start code for synchronisation
LL	number of bytes in the frame, not including 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 Synchronisation

The start code is used to synchronise the recipient to the sender. Furthermore, the recipient synchronises to the start of a frame when no data have been received for 100 milliseconds.

Status Byte

The status byte has the following meaning:

50	data packet
A0	response <i>OK</i>
LL	response <i>Memory error</i> (the recipient was unable to allocate any memory for the received data block)

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

<i>OK</i>	5A 02 A0
<i>Memory error</i>	5A 02 A1

Frame Number

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

Therefore, it is possible to calculate the block size from the first frame number, see the example below.

A block with 700 bytes of user data is to be transmitted. For this purpose, the block is divided into three frames:

1st frame: *5A CD 50 02* — 200 bytes of user data follow — P1 P2

2nd frame: *5A FF 50 01* — 250 bytes of user data follow — P1 P2

3rd 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 an appropriate amount of memory for the data.

User Data

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

Checksum

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

Network Layer

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

Transport Layer, Session Layer, Presentation Layer,

Do not exist.

Application Layer

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

11.2 LLRP Protocol

Based on the TCP communication protocol, the Kathrein RFID reader with the Linux operating system can handle the so-called *Low Level Reader Protocol* (LLRP).

It is a communication interface between an RFID reader and a LLRP-enabled application software standardised by *EPCglobal* (<http://www.epcglobalinc.org/standards/llrp>). The default 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 of read and write operations on the air interface via the application software
- Transfer of the found 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 protocol engine by means of **Install App** and start it using **Start App**.

To test the Kathrein reader with the LLRP protocol, it is possible to use the open-source programming tool *Eclipse (IDE)*. By means of the so-called *LLRP Commander* it is possible to control and operate the reader.



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

11.3 Ethernet Transmission

A data transmission layer has been used for communication to our reader over Ethernet, just like in serial communication.

The data transmission layer over Ethernet is a much more simple solution here since the TCP/IP protocol already has a data security layer. As TCP/IP is a stream protocol, only the packet beginning and packet end are necessary.

There are 3 frame types in the protocol used in the Generation 3 readers.

If no data have been received for 100 milliseconds within a frame, the received part frame is dismissed. The payload (D1 to Dn) is identical to the Generation 2 payload.

11.3.1 Ethernet Transmission Generation 2 Readers

Frame Set-up

A frame looks as follows:

Start + data block + end

The start is made up of *0xAA 0xBB 0x01 0x01*, whereby the first 1 is the Datetransmit byte and the second 1 is a Stuffbyte. The end is made up of *0xAA 0xCC*. If the byte *0xAA* appears in the KBRP frame, it must be doubled (*0xAA 0xAA 0xAA*).

Port

The TCP communication port is the port 4007.

Example

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

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

Extended Block Structure

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

First block:

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

All other blocks:

Start + block number + data block + end

Answer to confirm the reception:

Start + block number + end

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

11.3.2 Ethernet Transmission Generation 3 Readers

Frame Set-up

Data Frame

5A 50 L1 L2 L3 L4 D1 ... Dn A5

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

D1 – D4	data bytes to be transmitted (payload)
A5	end code

Ping

5A 5F A5

5A	start code
5F	ping code
A5	end code

Response to Ping

5A 5F A5

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

Port

The communication takes place via the TCP port 4007 as in case of Generation 2 readers.

Example

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

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

Extended Block Structure

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

First block:

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

All other blocks:

Start + block number + data block + end

Answer to confirm the reception:

Start + block number + end

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

12 Connecting the Reader

12.1 Connecting Digital Inputs and Outputs of the RRU 4xxx and ARU 3xxx Readers

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

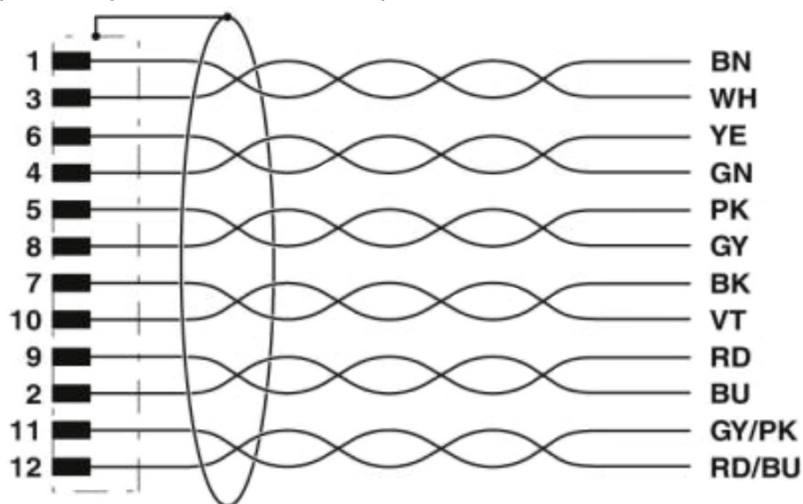


Fig. 13: Allocation of the GPIO interface cable

The digital inputs and outputs are provided via a 12-pin sockets in A-coding with M12 connection threads. The inputs are electrically isolated from the power supply of the reader and can be operated irrespective of the polarity of the input signal. For this reason, there is a common pin for the inputs (INP_CMN). The connection variants for the inputs are shown below.

If the electrical isolation is not required, the power to the input can also be supplied by the reader via pin 6 and 7 (see *GPIO*, p. 26).

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



NOTICE

Risk of malfunction!

- ▶ Note that the load per channel is limited to a maximum of 0.5 A, and the total load across all the channels must not exceed 1.5 A. If the auxiliary voltage of the GPIO port of the reader is used, the load can be 1.1 A as a maximum. The inputs and outputs are designed for 30 V DC max.
- ▶ For further information, see the reader data sheet.
- ▶ Bear in mind that LPS or NEC Class 2 classified power supplied units can be used for the operation of the outputs.



ATTENTION

Risque de dysfonctionnement !

- ▶ Notez que la charge par canal est limitée à un maximum de 0,5 A et que la charge totale sur tous les canaux ne doit pas dépasser 1,5 A. Si la tension auxiliaire du port GPIO du lecteur est utilisée, la charge peut être de 1,1 A au maximum. Les entrées et sorties sont conçues pour 30 V DC max.
- ▶ Pour plus d'informations, voir la fiche technique du lecteur.
- ▶ Tenez compte du fait que les alimentations classées LPS (Limited Power Source, source d'alimentation limitée) ou NEC classe 2 peuvent être utilisées pour le fonctionnement des sorties.

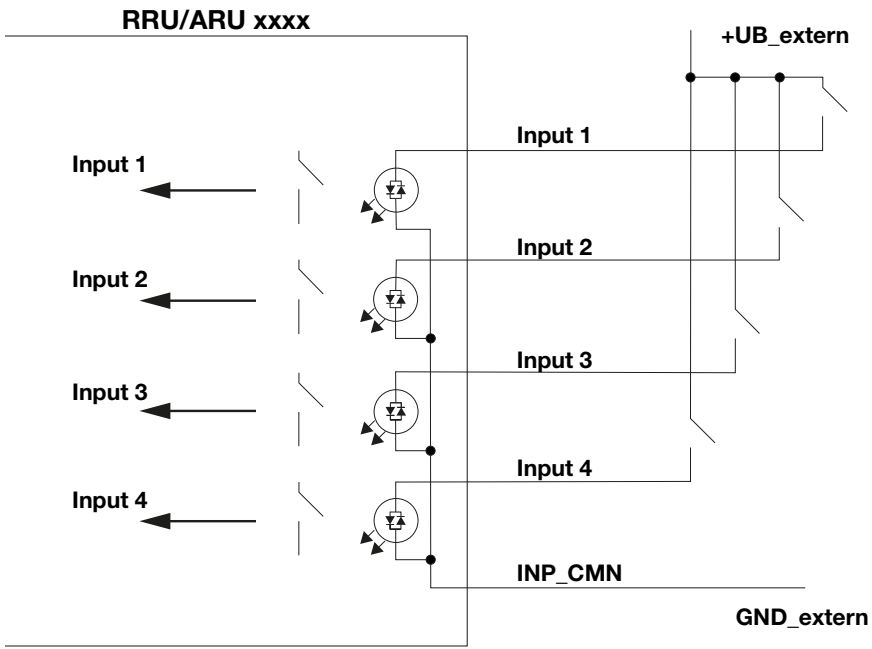


Fig. 14: DC-isolated inputs

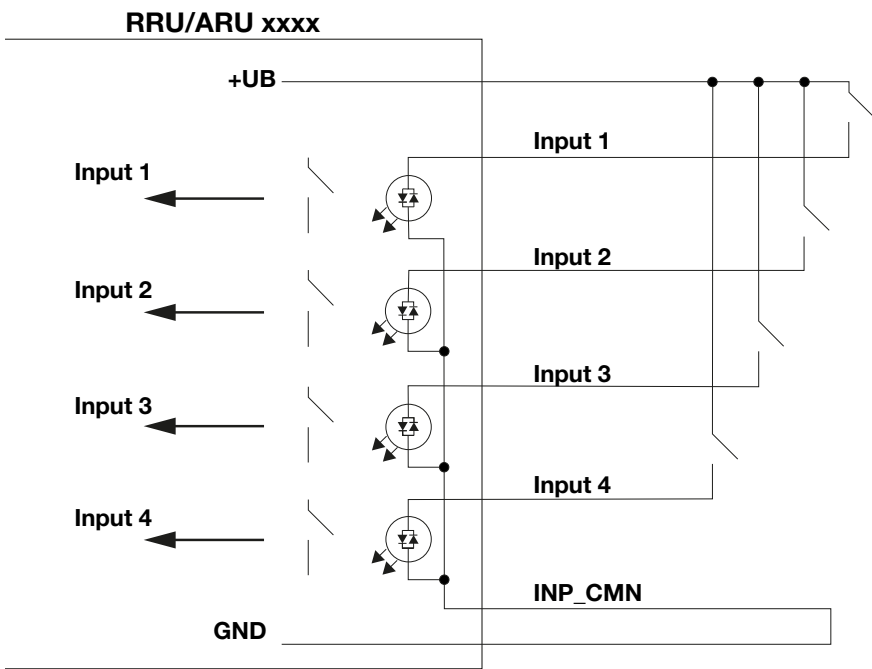


Fig. 15: Inputs, not DC-isolated

The connection examples for the outputs are shown in the next illustrations:

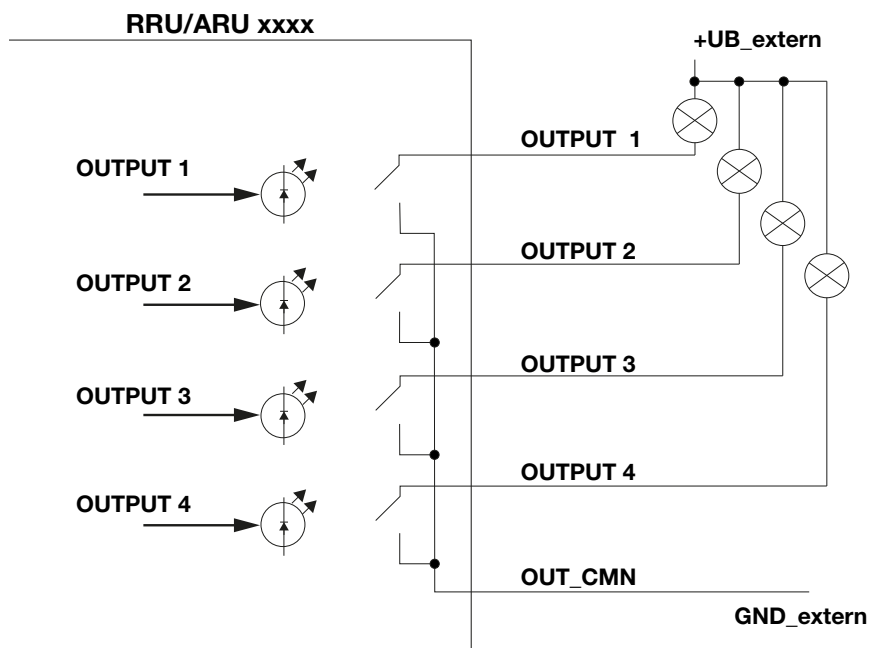


Fig. 16: DC-isolated outputs

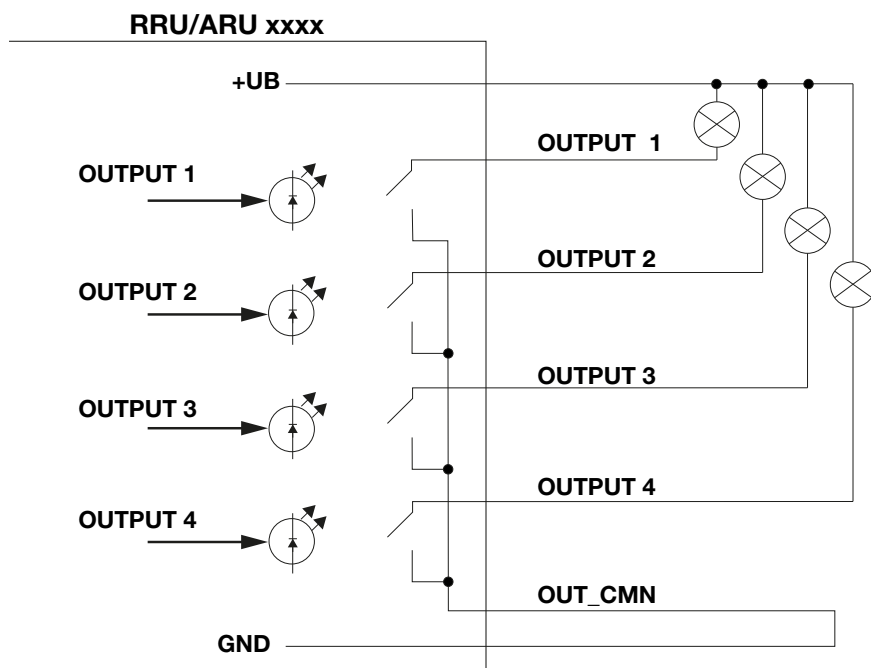
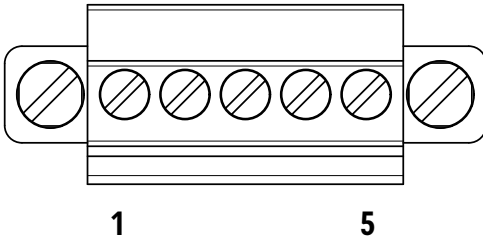


Fig. 17: Outputs, not DC-isolated

12.2 Connecting Digital Inputs and Outputs of the ARU 2400 Reader

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

Printed circuit board connector, 5-pole, screw connection with tension sleeve



Pinout general purpose input output

Pin	Allocation
1	GND OUT_CMN
2	INPUT_1
3	INPUT_2
4	OUTPUT_1 (open drain)
5	OUTPUT_2 (open drain)

Fig. 18: Allocation of the GPIO interface cable

The digital inputs and outputs are provided via a printed circuit board connector, 5-pole with open screw connection with tension sleeve. It is possible to use an industrial isolated wire with a diameter of $> 1\text{mm}^2$.

The inputs are electrically isolated from the power supply of the reader. The outputs are also DC-isolated from the power supply of the reader and have a common pin (GND OUT_CMN).



NOTICE

Risk of malfunction!

- ▶ Note that the load per channel is limited to a maximum of 0.190 A. The inputs and outputs are designed for 30 V DC max.
- ▶ For further information, see the reader data sheet.

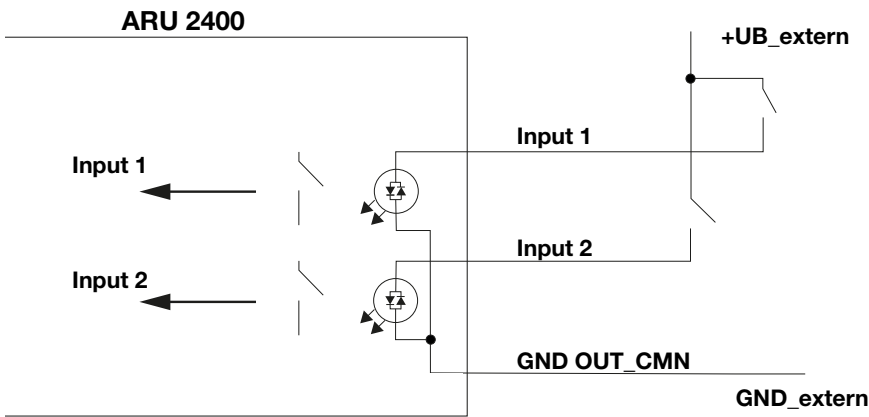


Fig. 19: DC-isolated inputs

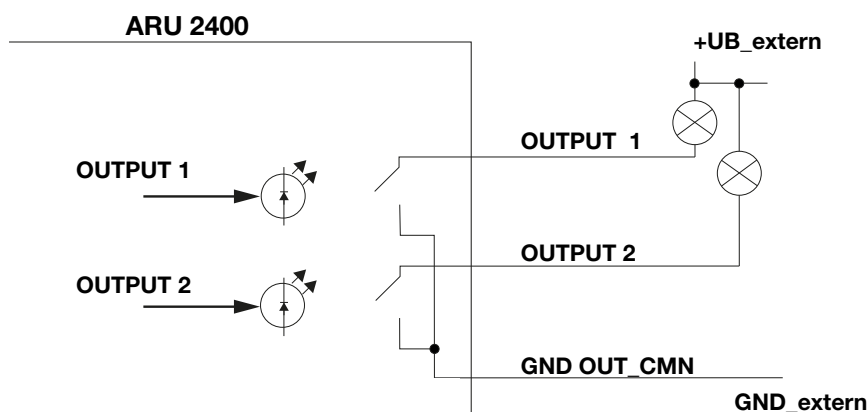


Fig. 20: DC-isolated outputs

12.3 Connecting the Antenna



NOTICE

Risk of malfunction!

When using a cable not suitable for the impedance of 50 Ohm, the performance of the reader will be severely limited by the mismatch. If the mismatch is large, the reader may indicate a fault.

- ▶ Only use cable suitable for the impedance (50 Ohm).

For the connection to the RFID antennas, the RRU 4xxx/ARU 3xxx readers have four antenna connections that are of the reverse TNC design.

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

For the connection to the RFID antennas, the ARU 2400 reader has three antenna connections that are of the FAKRA design.

- ▶ Only use the cables from the accessories list or an equivalent cable for this connection.

12.4 Turning the Reader On and Off

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

⇒ The reader is on.

12.5 Reading the PWR LED Indications

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

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

Tip

The ARU 3xxx readers have additional 4 LEDs (green/red/red/green) in the antenna cover which can be controlled by means of the software.

13 Operating *ReaderStart* Software

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

► For the current version of the *ReaderStart*, go to our support portal at <https://support.kathrein-solutions.com/>.

13.1 System Requirements

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

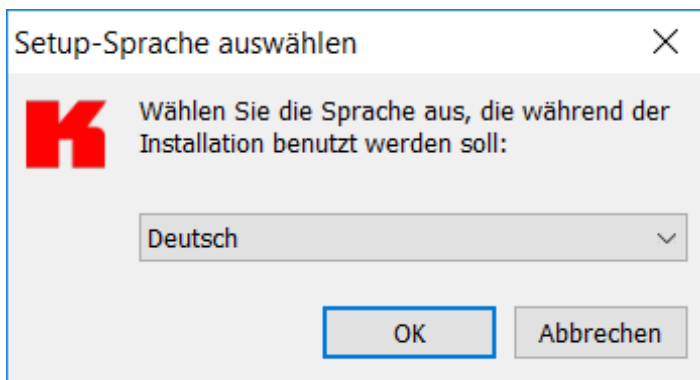
Processor	X86-compatible
Memory	512 MB RAM
Operating system	Windows XP (SP3), Vista (SP1), Windows 7 or higher
Free hard disk memory for:	
32-bit operating system	850 MB (including Microsoft .Net Framework 4)
64-bit operating system	2 GB (including Microsoft .Net Framework 4)

13.2 Installing the Software

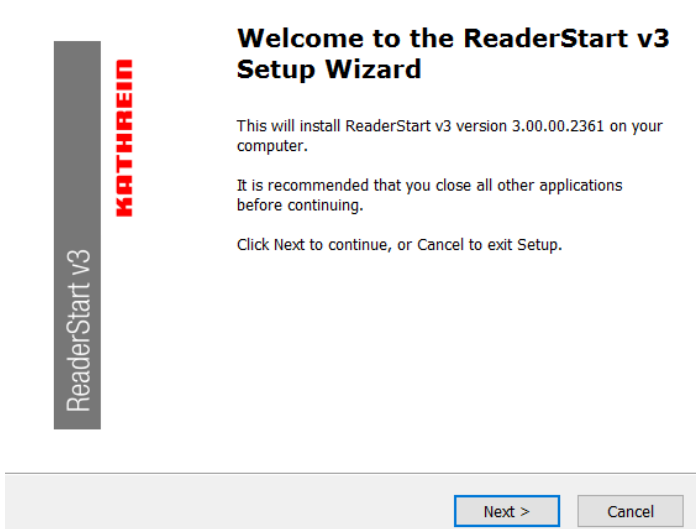
Tip

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.



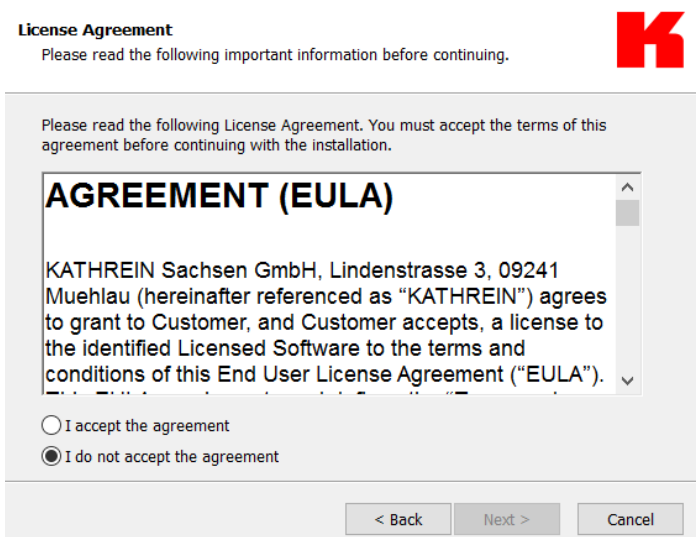
1. Download the ReaderStart software at <https://support.kathrein-solutions.com>.
2. Extract the downloaded zip file.
3. Double-click on the ReaderStart_v3_Setup.exe file.
⇒ The following screen with the option to select the language used during the installation appears.
4. Select a language between *German* and *English*.



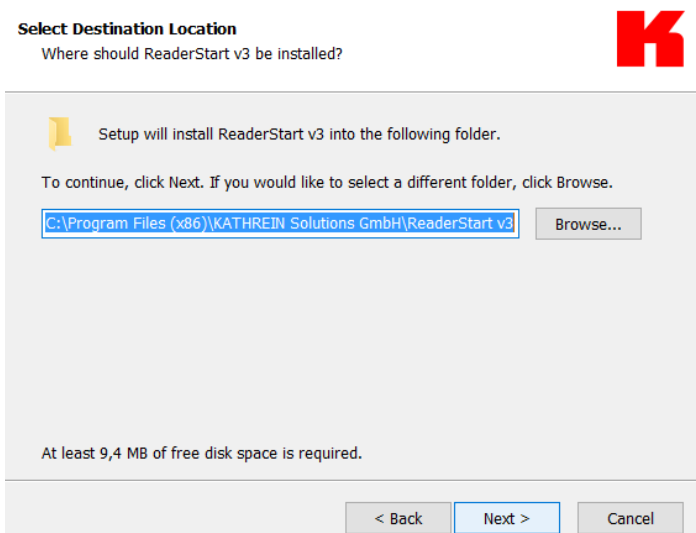
5. Click *OK* to confirm the selection.
⇒ The screen on the left appears. It shows additional information on the exact version of the *ReaderStart* software.

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

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



7. Select *I accept the agreement* to continue
or
I do not accept the agreement to exit the setup.



8. Select the destination file for the software to be installed.
⇒ If you have accepted the license agreement in Step 7, the window on the left appears.

Select Start Menu Folder

Where should Setup place the program's shortcuts?



Setup will create the program's shortcuts in the following Start Menu folder.

To continue, click Next. If you would like to select a different folder, click Browse.

9. Click *Next*.

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

Select Additional Tasks

Which additional tasks should be performed?



Select the additional tasks you would like Setup to perform while installing ReaderStart v3, then click Next.

Additional shortcuts:

Create a desktop shortcut

10. Click *Next*.

⇒ The screen on the left appears.

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

Ready to Install

Setup is now ready to begin installing ReaderStart v3 on your computer.



Click Install to continue with the installation, or click Back if you want to review or change any settings.

Destination location:
C:\Program Files (x86)\KATHREIN Solutions GmbH\ReaderStart v3

Start Menu folder:
KATHREIN Solutions GmbH\ReaderStart v3

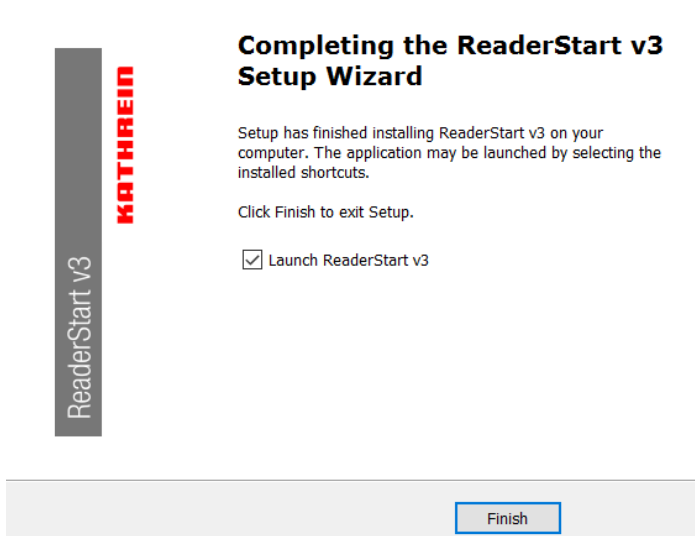
Additional tasks:
Additional shortcuts:
Create a desktop shortcut

12. Click *Next*.

⇒ The summary of all the installation tasks appears.

13. Click *Install* to start the installation.

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



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

15. If you do not want to start the programme immediately, uncheck the **Launch ReaderStart v3** box. Otherwise, the programme will automatically start once clicking on **Finish**.

13.3 Connecting the Reader in the *ReaderStart* Software

13.3.1 Requirements

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

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

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

- ▶ For more information, contact your network administrator.
- ▶ Make sure that the IP addresses of the control computer and the reader are in the same IP range but are not the same. Ensure that the network mask is identical.

Establishing the Connection to the Reader

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

- by entering the IP address to communicate directly with the reader; see *Establishing the Connection via an IP Address* or
- by using the reader's host name; see *Establishing the Connection Using a Host Name*, p. 50.



- ▶ Start the programme.
 - ⇒ The splash screen is shown until all the necessary DLLs have been loaded in the background (see figure on the left).

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

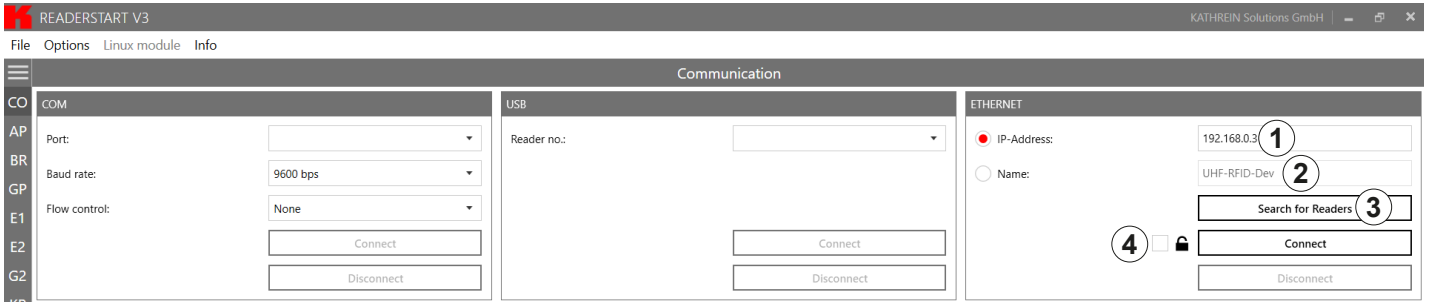


Fig. 21: Establishing connection to the reader

Establishing the Connection via an IP Address

1. Click the *IP address* field (① in Fig. 21).
2. Enter the IP address.

Establishing the Connection Using a Host Name

1. Click the *Name* field (② in Fig. 21).
2. Enter the host name of the reader.
If you do not know the name of the reader, click *Search for Readers*.

⇒ The readers found in the network are shown with their names, see ⑤ in Fig. 22.

Tip ▶ To allow only secure SSH connection with an encrypted transmission to the reader, check the box next to the lock symbol (④ in Fig. 21); see also *Establishing a Secure Connection*, p. 68.

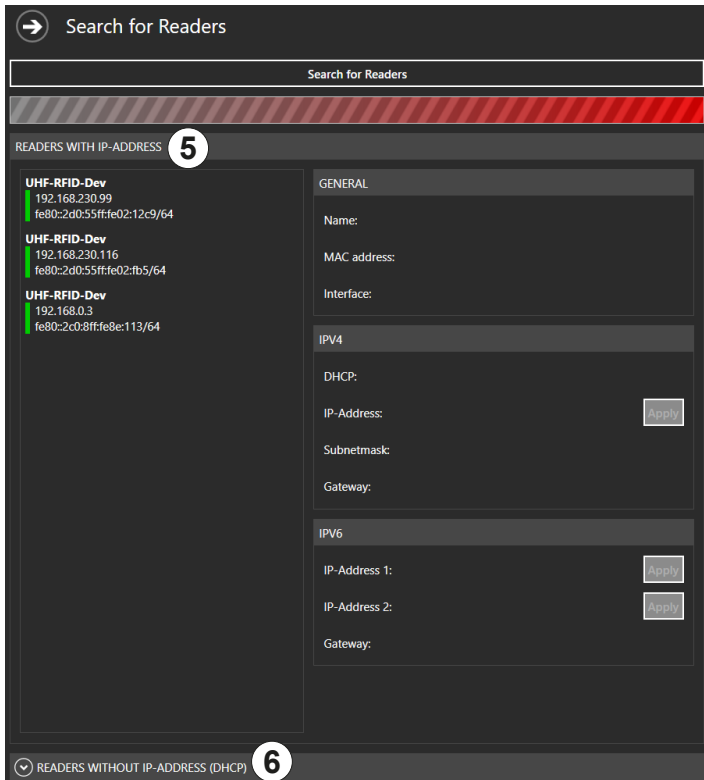
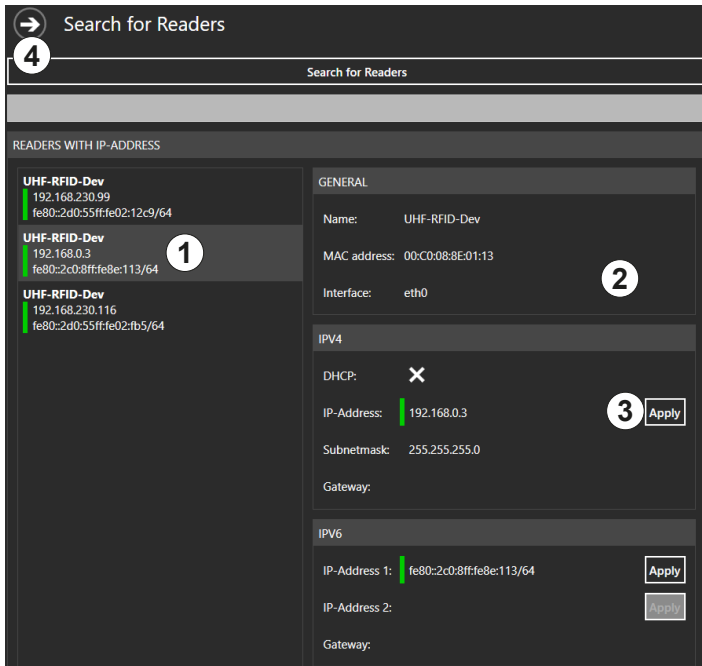


Fig. 22: Establishing connection to the reader: search for readers

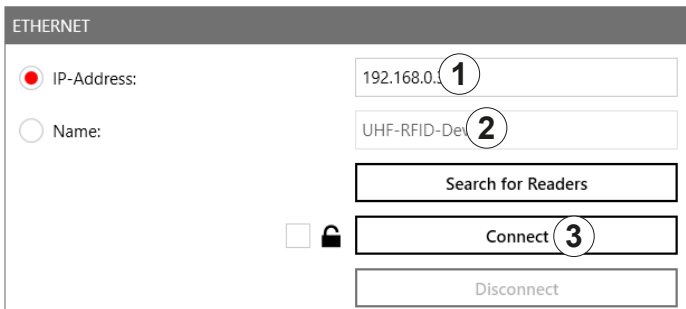
! The following steps describe establishing the connection for readers with an IP address.

3. In the *Ethernet* block, click *Search for Readers* (③ in Fig. 21).
⇒ The screen on the left appears.
4. Select a reader under *Readers with IP Address* (⑤ in the figure on the left).
5. If there have been 2 or more DHCP requests sent by the reader, the *Readers without IP Address (DHCP)* field (⑥) is expanded. Then it is possible to assign the IP address to the reader.



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

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



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

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

