RU224

UHF RFID Reader

User Guide

SCANNEL

Scannel RU224 UHF RFID Reader

User Guide

VERSION: 1.0 REVISION DATE: 03/11/2019

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Revision History

Version	Date	Name	Description
1.0	03/11/2019	Christian Tan	Initial Version
2.0	08/08/2019	ChristianTan	Added FCC Warning & S/W revision

Table of Contents

Introduction to RU224 8
Getting Started 8
RU224 Specifications 9
Technical Specifications / Features 9
Key Features 10
Hardware Introduction 11
Operating System Introduction 13
RU224 ReaderTool Software Introduction 14
RU224 Settings 15
Hardware Configuration 15
RU224 Initial Startup 17
Software Initial Startup 18
Connectivity Setup 18
Bluetooth 18
WiFi 20
Ethernet 20
Configuring your RU224 IP Address 21
Browser 23
File Manager 24
Terminal 25
Reboot, Logout, Shutdown 26
RU224 Software 28
RU224 ReaderTool User Manual 28
RU224 Software Development 38
Customized Software 38

Test standard: FCC rules Part 15 subpart B

Test Result: Radiated Emission. FCC Part 15.109 Class B Test passed.

Test standard: FCC rules Part 15 subpart C 15.247 (2018 - 10)

Test Result: No deviations from the technical specification(s) were ascertained in the course of the tests performed.

Warning

Federal Communication Commission (FCC) Interference Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.
This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

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

FCC Caution
To assure continued compliance, any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment. (Example - use only shielded interface cables when connecting to computer orperipheral devices).

FCC Radiation Exposure Statement
This equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 25 centimeters between the radiator and your body.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

The antennas used for this transmitter must be installed to provide a separation distance of at least 25 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

Contains transmitter module: FCC ID: 2ABCB-RPI3BP

LIMITED WARRANTY

Scannel warrants that the products sold pursuant to this Agreement will perform in accordance with Scannel's published specifications. This warranty shall be provided only for a period of **one year** from the date of the shipment of the product from Scannel (the "Warranty Period"). This warranty shall apply only to the "Buyer" (the original purchaser, unless that entity resells the product as authorized by Scannel, in which event this warranty shall apply only to the first re-purchaser).

During the Warranty Period, should this product fail to conform to Scannel's specifications, Scannel will, at its option, repair or replace this product at no additional charge except as set forth below. Repair parts and replacement products will be furnished on an exchange basis and will be either reconditioned or new. All replaced parts and products become the property of Scannel. This limited warranty does not include service to repair damage to the product resulting from accident, disaster, unreasonable use, misuse, abuse, negligence, or modification of the product not authorized by Scannel. Scannel reserves the right to examine the alleged defective goods to determine whether the warranty is applicable.
Without limiting the generality of the foregoing, Scannel specifically disclaims any liability or warranty for goods resold in other than Scannel's original packages, and for goods modified, altered, or treated without authorization by Scannel.

Service may be obtained by delivering the product during the warranty period to Scannel (8F No. 31 Lane 169, Kang Ning Street, Hsi Chih Dist New Taipei City, Taiwan). If this product is delivered by mail or by an equivalent shipping carrier, the customer agrees to insure the product or assume the risk of loss or damage in transit, to prepay shipping charges to the warranty service location, and to use the original shipping container or equivalent. Scannel will return the product, prepaid, via a three (3) day shipping service. A Return Material Authorization ("RMA") number must accompany all returns. Buyers may obtain an RMA number by contacting with sales@gigatms.com.tw

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Introduction to RU224

The RU224 is part of the Next Generation UHF RFID Reader Series from Scannel. It is developed using the best high performance hardware technology in order to quickly adapt with the fast-evolving technological advances in the age of Internet of Things / Industrial Internet of Things.

Using UHF RFID Technology has never been easier with RU224 integrated with a Linux-based micro-computer and high performance R2000 UHF RFID Chip. The device offers a long read range with the capability of reading multiple tags at fast speeds using its four(4) antenna ports. It complies with EPC Global UHF Class 1 Gen 2 / ISO18000-6C and ISO18000-6B. With advanced heat sink casing design, overheating is prevented when it is at maximum performance. It has built-in multiple connectivity (WiFi, BLE, and TCP/IP) and self-powered GPIO to simplify installation and deployment in various applications.

RU224 RFID Reader (referred to hereafter as “Reader/reader”) is suitable for RFID applications in supply chain management, logistics inventory management, cargo tracking management, warehouse management, shop floor management, class management, etc.

For more information, kindly visit: www.scannel.net or email us at info@scannel.net

Getting Started

Hardware and Software required for configuration and application of the RU224 are as follows:

1. Hardware:

   1.1. RU224 UHF RFID Reader

   1.2. HDMI Cable (Full Size Type A)

   1.3. UHF RFID Antenna with TNC Male Connector to SMA

   1.4. Power Adapter (12V / 3A)

   1.5. Optional: Input/Output devices such as LED Indicator Lights, Sensors, Switches, etc.

2. Software:

   2.1. RU224 ReaderTool V1.0

RU224 Specifications

Technical Specifications / Features

Technical Specifications

RF Specifications	
Air Interface Protocol	EPC global UHF Class 1 Gen 2 / ISO 18000-6C / ISO 18000-6B
UHF Frequency	865Mhz - 928Mhz (ETSI/FCC)
Output Power	0 - 30dBm (1W) (Configurable)
Peak Inventory Speed	>700 tags/sec
Antenna Port	4 Ports (RP-TNC-Female)
Max Baud Rate	115200 bps

System Specifications	
CPU	1.2 Ghz Quad-Core ARM Cortex-A53
RAM	1GB LPDDR2 SDRAM
Storage	16GB
WiFi	Dual-Band 802.11ac wireless LAN (2.4Ghz/5Ghz)
Bluetooth	Bluetooth 4.2
Ethernet	Gigabit Ethernet over USB2.0 (max300Mbps)
Display	HDMI (Full Size Type A)
USB	4 Ports (USB2.0)
GPIO (12V)	4 Input / 4 Output
Operating System	Linux
Software Development	Python / Java /

General Specifications	
Power	Input: 12V / Output: 12V
Dimension	230mm (L) x 160mm (W) x 28mm (H)
Weight	1.8Kg
Operating Temperature	-20°C ~ +55°C
Storage Temperature	-20°C ~ +85°C

Key Features

Impinj R2000 Chip	Top of the line, High Performance UHF RFID Reader Chip.
GS1 EPC Gen2 Protocol	Follows the globally accepted air interface protocol.
Multi-Connectivty	Ethernet, WiFi, Bluetooth(BLE)
Built-in Micro-computer	The RU224 can work independently without the need for a separate computer.
Storage Drive	16GB storage capable to save scanned data for long periods.
HDMI Ready	Allows easy connection for a display screen.
Linux Operating System	The OS makes the RU224 work like a desktop computer.
Multiple Programming Language	Develop your own software using Python, Java, C…
GPIO	Control the GPIO with the UHF Software or independently
12V Power Output	Provides power to your external device without the need for external power adapters.
4 USB Ports	4 USB ports allows you to connect various peripherals such as keyboard, mouse, USB drives, Barcode Scanners, etc.
RTC	Built-in Real-time clock to manage and save current date and time.
4 UHF RFID Antenna Ports	Offers 4 antenna ports for various applications such as portal readers, tunnel readers, etc. RF power can be set independently from each antenna port. Software can recognize which antenna port was used to read a Tag.
RU224 ReaderTool Software	Developed to provide users with a software that has functions and features which can be used in real-life applications such as direct transfer of data to the users database using WiFi or Ethernet. Save data on the local storage to prevent data loss during transfers.

Hardware Introduction

Top View

Front View

Back View

Operating System Introduction

The RU224 has a built-in Linux operating system based on the Debian distribution. The main function of the operating system in the RU224 is to run the UHF RFID software locally without the need of a separate computer. This differentiates the RU224 from the traditional UHF RFID readers which requires a controller or computer to transfer the data it scans to the user. You can develop your own software for the RU224 to locally collect RFID Data, process, analyze, create, and view reports locally or remotely and transfer these to your Middleware or directly to your ERP/MES/WMS database.

A notable feature is the scope of software customization it offers not only for the UHF RFID Software but also for non-related RFID software functions. You can develop your own software to perform tasks unrelated to the UHF RFID Software such as:

- Control the GPIO of the RU224
- Display customized information
- Save data in the local storage of the RU224
- Transfer data within your network
- Automate tasks
- Browse the internet
- etc.

*Note: Certain features may only be used one process at a time. (E.g. If you’re UHF RFID Software is using the GPIO, your other software will not be able to run properly and vice versa.)

RU224 ReaderTool Software Introduction

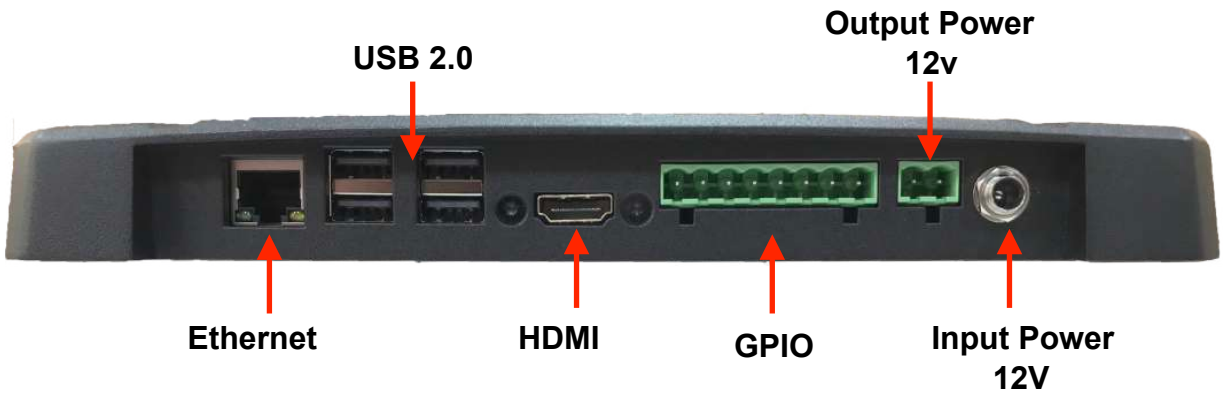
The RU224 comes with pre-installed UHF RFID Reader software called ReaderTool. The software was developed to provide users with a fast and easy way to integrate the RU224 UHF RFID Reader into their system. The features incorporated in the software were gathered from the vast experience of the Scannel RFID Solutions team in various RFID projects.

RU224 ReaderTool main features:

- Read - Shows Total Read Quantity, EPC in HEX and ASCII, Read Count, Read Date/Time, Frequency, Antenna Number.
- Configurable Settings - RF Output Power, Antenna Ports, Session, Target, Region
- Write - Encode UHF RFID Tags in ASCII Format
- Save Data - Save the scanned data on the local storage or to your Database via WiFi or Ethernet.
- GPIO - Start and Stop scanning using the Digital Inputs and use external device such as LED, Buzzer, etc. to indicate scan status using the Digital Outputs.

RU224 Settings

Hardware Configuration



1. Connectivity:
   1.1. Ethernet
   1.2. WiFi
   1.3. Bluetooth

2. USB 2.0 x 4

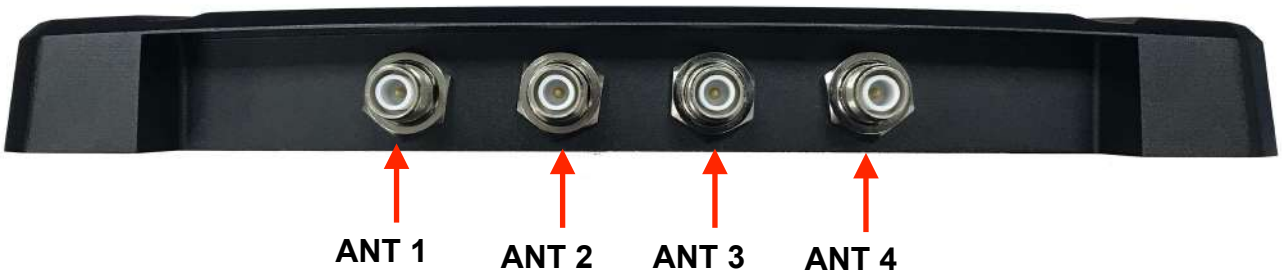
3. HDMI for Display

4. GPIO
   4.1. 4 Input
   4.2. 4 Output

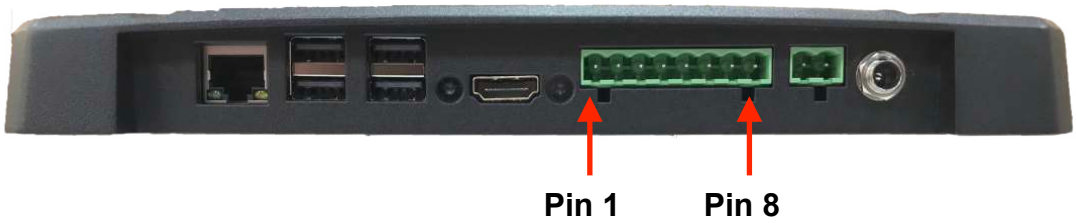
5. Output Power - 12V for external devices (E.g. LED Status Light, Sensor, Switch, Etc.)

6. Input Power - 12V

7. UHF RFID Antenna Ports x4 (RP-TNC-Female)



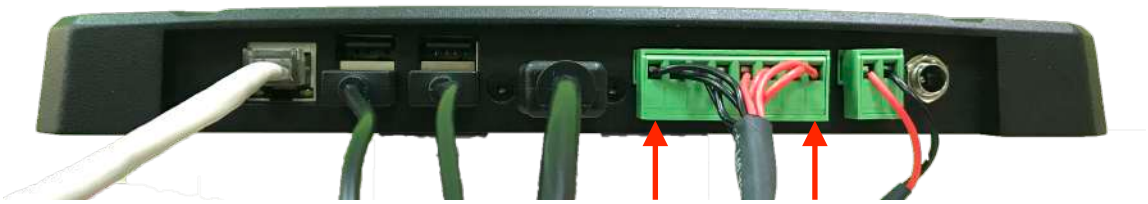
GPIO Pin Definition



PIN ID	Function	Equivalent Circuit	Instructions
PIN 1	I/O Input 1		*ReaderTool Demo Software: I/O Input settings can be configured in the "Digital I/O" Tab. *Customized I/O Control: Can be controlled using various programming language. (Please contact Scannel for more information.)
PIN 2	I/O Input 2		
PIN 3	I/O Input 3		
PIN 4	I/O Input 4		
PIN 5	I/O Output 1		*ReaderTool Demo Software: I/O Output settings can be configured in the "Digital I/O" Tab. *Customized I/O Control: Can be controlled using various programming language. (Please contact Scannel for more information.)
PIN 6	I/O Output 2		
PIN 7	I/O Output 3		
PIN 8	I/O Output 4		

RU224 Initial Startup

1. Connect HDMI cable, Ethernet Cable (if necessary), GPIO Connectors (If Necessary), keyboard and mouse to the RU224.



2. Power the Reader

   2.1. Plug the power cable to the reader, there will be a short beep sound which indicates that the reader is on.

3. Connect the Antenna(s) to the Reader

   3.1. Connect your Antenna to the Antenna Port. Please note that arrangement of the Antennas start from the leftmost as Antenna 1. *This will direct you on how to control the Antennas using the Software.

   3.2.Connect up to 4 Antennas according to your requirements.

Software Initial Startup

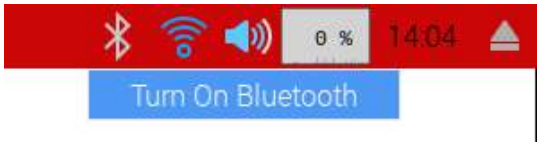
Once you hear the short beep, the RU224 Operating System Desktop will be displayed on your screen.

Connectivity Setup

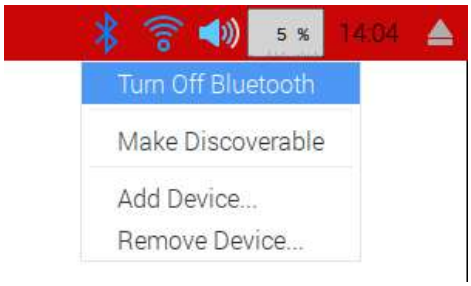
The RU224 has Bluetooth, WiFi, and Ethernet connectivity. You can use the Bluetooth connectivity to pair and interact with external devices (Compatibility may depend on external devices). The WiFi and Ethernet allows you to connect to your network and thru customized software, perform various tasks such as send and receive data, control your GPIO, connect to the internet, automate tasks related to the RU224, etc.

Bluetooth

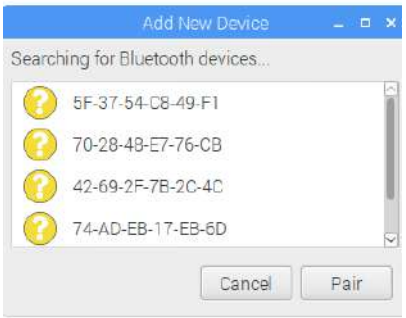
On the top right corner of the screen, you will see the Bluetooth icon. Right click on the Bluetooth icon and click “Turn On Bluetooth” to activate Bluetooth.

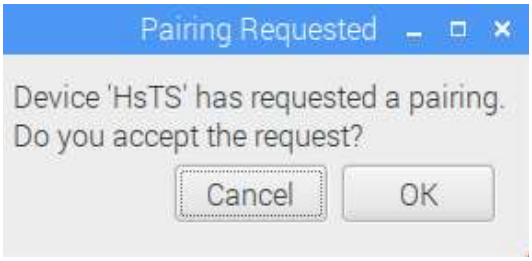


Right click again on the Bluetooth icon and click “Make discoverable” or “Add Device” to pair your device with RU224.

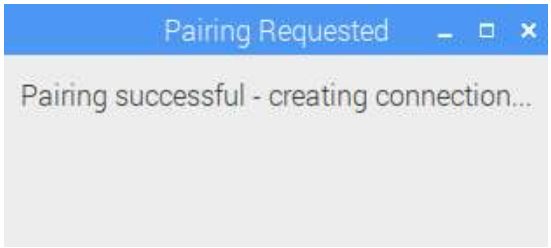


After clicking “Add Device”, a window will pop-up and a list of nearby bluetooth devices will be shown in the same window. (Note: Please make sure that the bluetooth option of your device is enabled.) Select the name of your device to start pairing and click OK.





Pairing will start to create a connection and a message will show that pairing is successful.

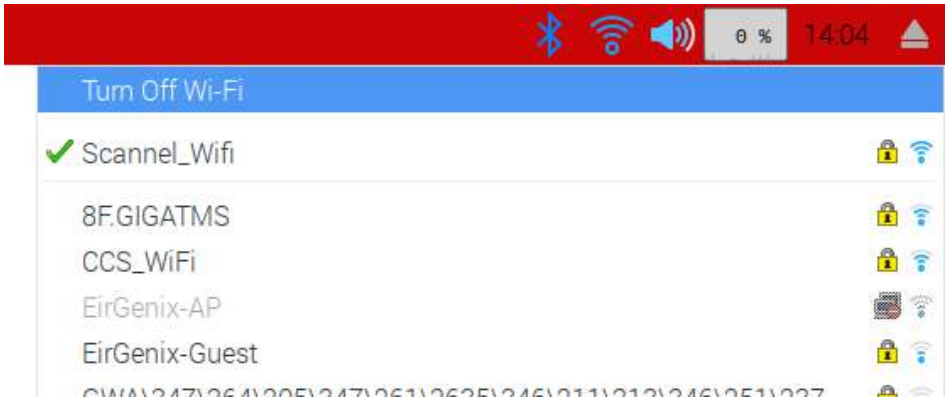


Note: You must have a working bluetooth software application on the RU224 for your external device in order to successfully use the Bluetooth function.

WiFi

The WiFi can be activated/deactivated by clicking on the WiFi icon on the top right corner of the screen. When WiFi is activated, the icon will turn blue.

Right click on the WiFi icon to select which WiFi network you want to join and input the password to join your WiFi network.



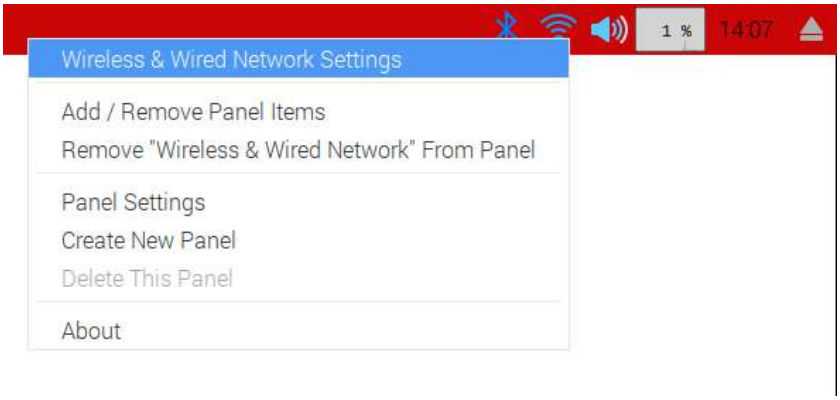
Ethernet

For ethernet connection, simply plug in your ethernet cable to the RU224 and connection will be automatically be established.

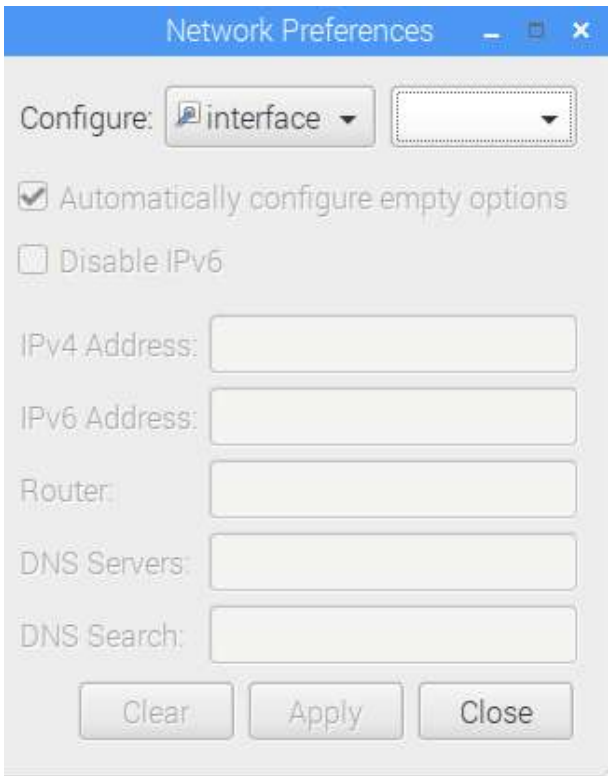
Configuring your RU224 IP Address

In most cases, it is recommended to provide a static IP Address for your RU224 in order to easily manage communication with your RU224. The configuration for the IP Address in Ethernet and WiFi mode are the same. You can use both connections simultaneously if necessary.

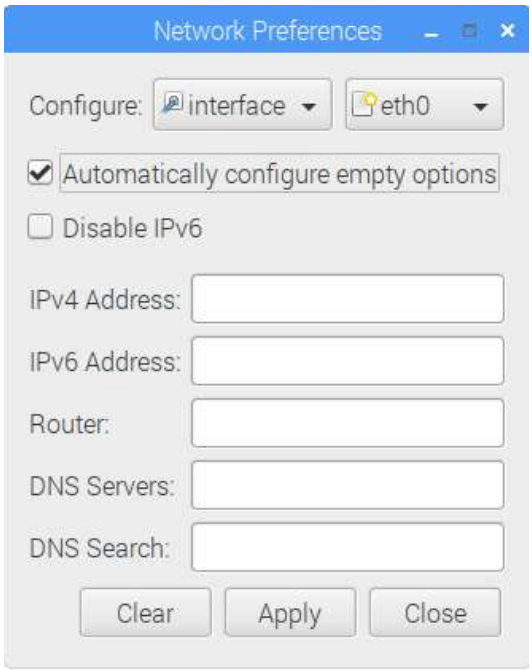
Right click on the Wifi or Ethernet icon on the top right corner of the screen and select “Wireless & Wired Network Settings”.

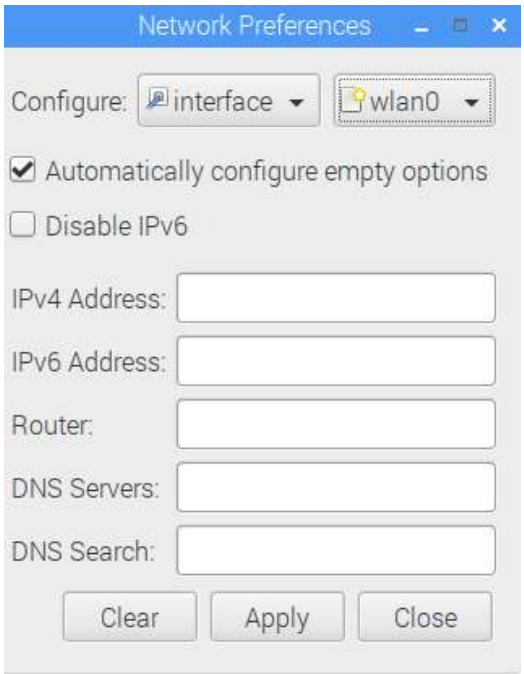


A pop-up window will appear called “Network Preferences”.

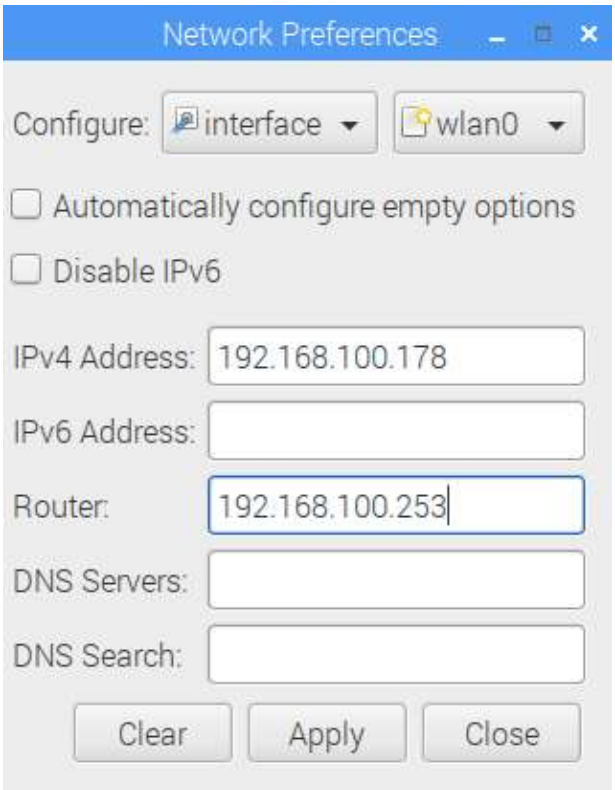


On the dropdown list beside “interface” you can select “eth0” or “wlan0”, depending which connection you will be configuring.





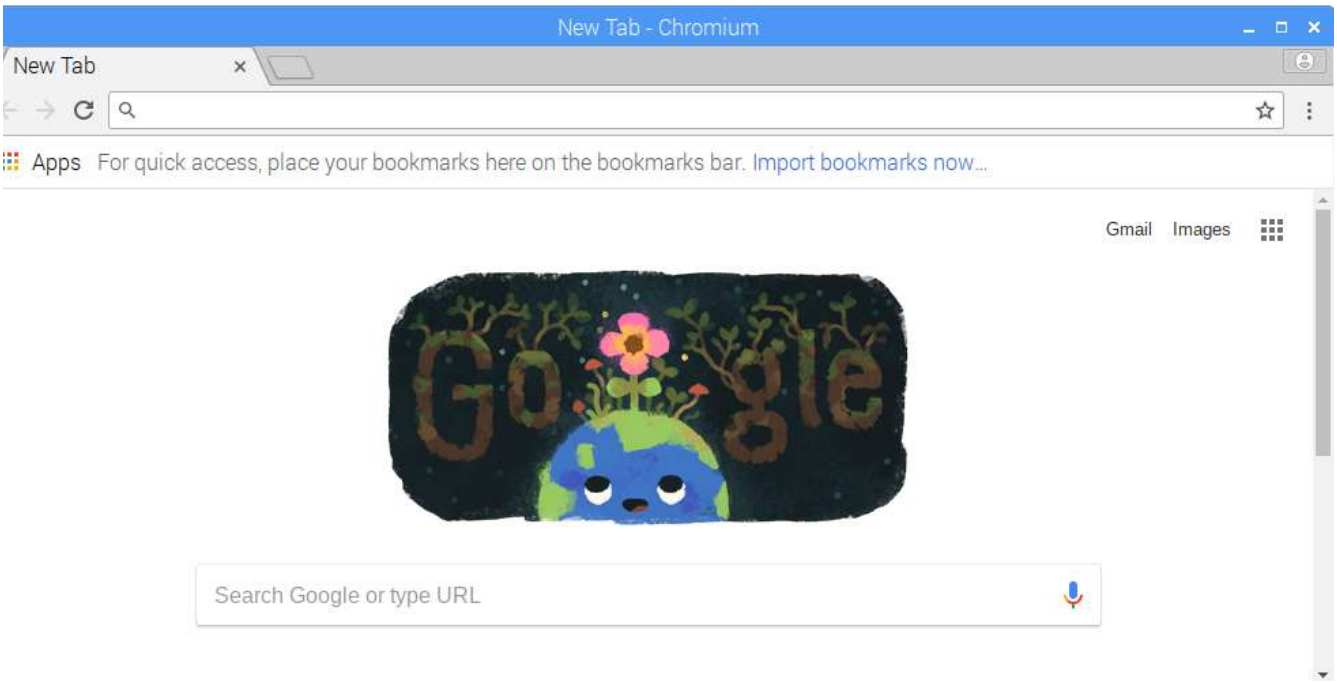
Enter the required fields and click “Apply”. Restart your RU224 to ensure that configurations are saved.



Browser

The RU224 has a pre-installed web browser available to use when you are connected to the internet. You can also use the web browser for your web-based applications which can serve as a local monitor when a display is connected via HDMI on the RU224.

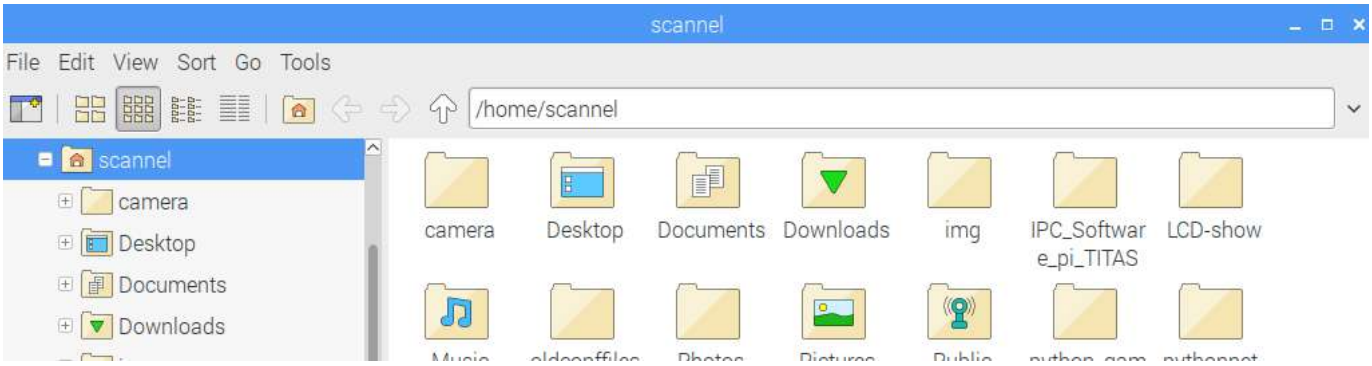
On the Taskbar, click the Web Browser icon to start the program.



File Manager

The File Manager can be used to navigate through the various directories of the RU224. features and functions of the File Manager are the same with most operating systems. You can cut, copy, move, create, and paste files and folders to different locations within the system. Note: Certain files and folders are restricted due to set permissions to avoid corrupting the system.

On the Taskbar, click the File Manager icon to start the program.

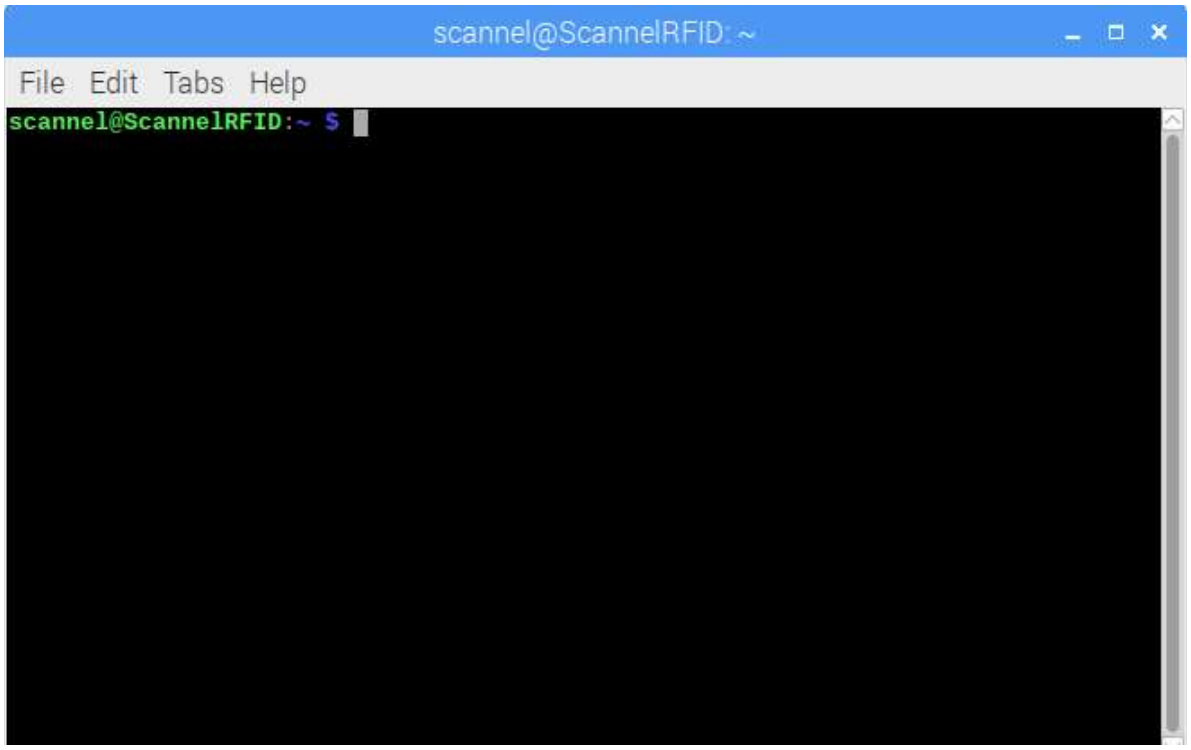


Terminal

The Terminal can be used to go into Command Line mode. You can perform various Linux-based commands on the Terminal such as navigating or browsing the folders inside the RU224, get and set your network configuration, install and update softwares, set permissions, etc.

*Note: Novice users are strongly advised not to use the Terminal or the Command Line mode. Editing or changing certain parameters or programs may cause SYSTEM FAILURE.

On the Taskbar, click the Terminal icon to start the program.



Terminal Interface

Reboot, Logout, Shutdown

It is strongly advised that users do not unplug the power adapter to turn off the RU224. We recommend that users use the “Shutdown” option in the desktop prior to removing the power adapter from the RU224. In case of software updates, kindly use the “Reboot” option in the desktop to restart the RU224.

On the top left corner of the screen, click the “Scannel Icon” and click “Shutdown”. A pop-up window will appear and you can select among three (3) options, “Shutdown” / “Reboot” / “Logout”.

RU224 UHF RFID Reader connected to a display monitor.

RU224 Software

RU224 ReaderTool User Manual

1. General Information

RU224 ReaderTool is a software that you can use to perform basic RFID functions such as read and write a UHF RFID tag. It also has extra features to demonstrate how easy and convenient adapting UHF RFID technology using the RU224. It has the following unique features that you can use straight out of the box without the need to develop your own program:

(1) Save the scanned data on the local drive of the RU224.

(2) Save the scanned data directly to your middleware or your database on a remote host.

(3) Write data to your UHF RFID tag in ASCII format instead of the traditional EPC HEX format. This allows you to have a readable data.

(4) Control and send status indications for scanning using our built-in GPIO.

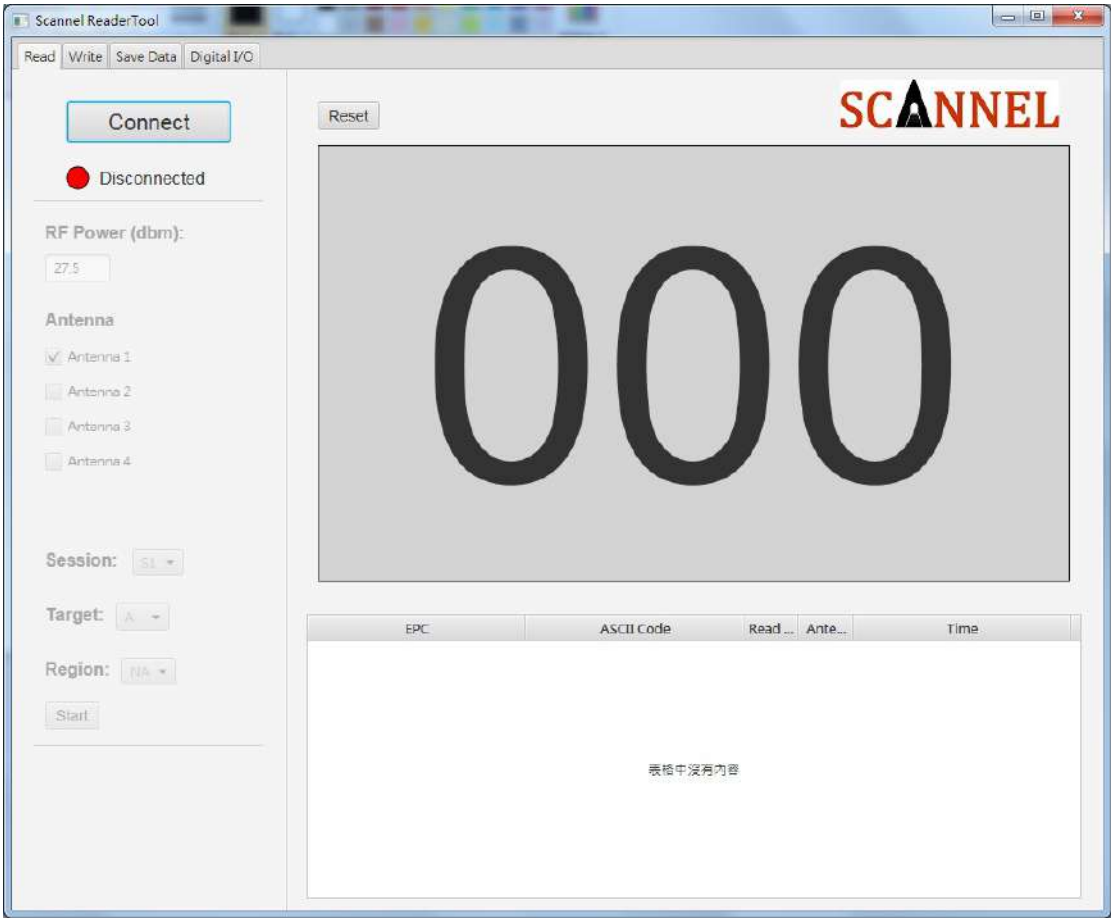
2. Getting Started

2.1. Installation and Execution

Scannel ReaderTool is already installed in the system, so no installation is required. The software is located in the folder “/Desktop/RU224/“. To run the software, just simply open the folder and you will see a file named “start.sh”. Double click the file “start.sh” and click “execute in terminal”. The main window for the Scannel ReaderTool will be displayed on your screen.

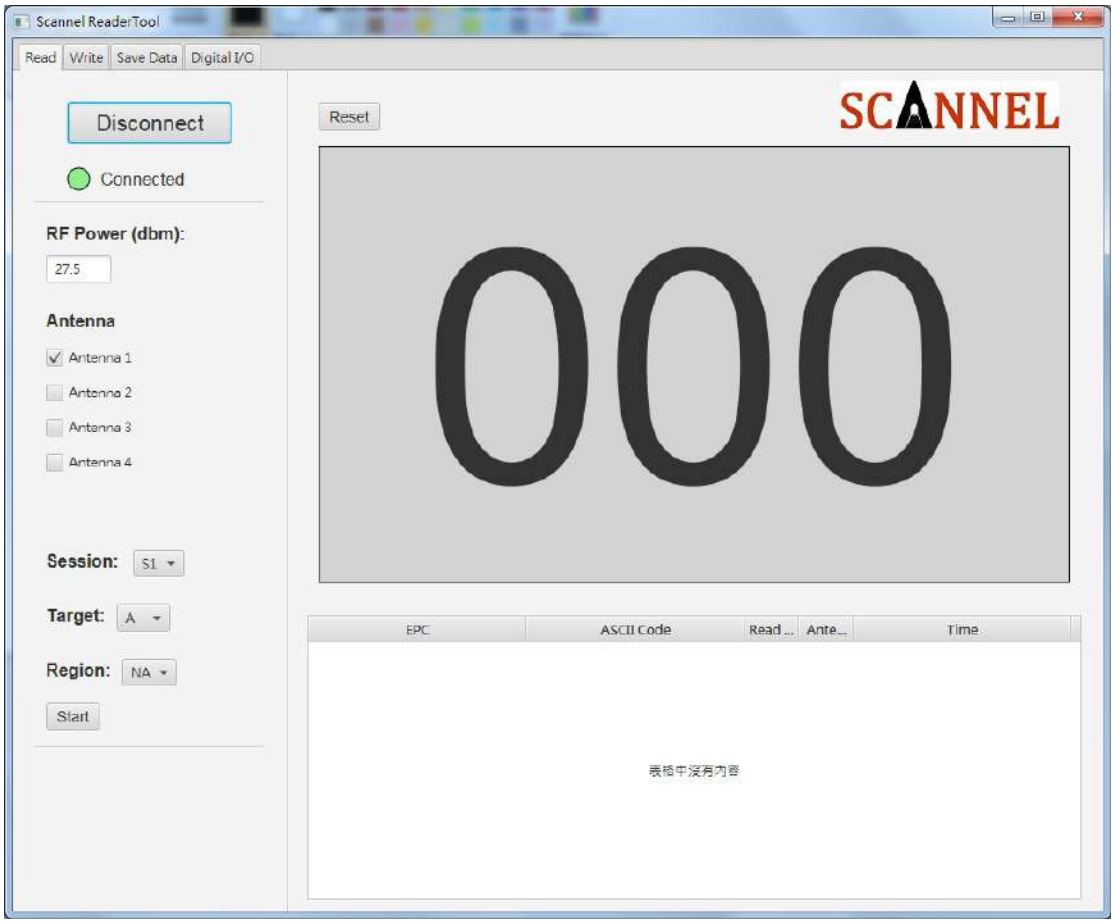
2.2. Read Tag

The default screen of the ReaderTool is the READ tab. In this tab you can connect to the reader and perform the inventory or scan function.



2.3. Connect to Reader

Simply click the “Connect” button to connect the software to the UHF RFID Reader. If the connection is successful, the status light below the “Connect” button will turn Green.



2.4. Modify Reader Setting

There are several options that you can configure in the ReaderTool which you can choose prior to starting the RFID Scanning/Inventory. You will be able to set the parameter for the following options:

(1) Output Power - refers to the strength of the RF output the UHF RFID will produce. It is measured in dBm. Range can be set from 5dBm to 31.5dBm (increments of 0.5dBm).

(2) Antenna - refers to how many antennas are plugged in the RU224.

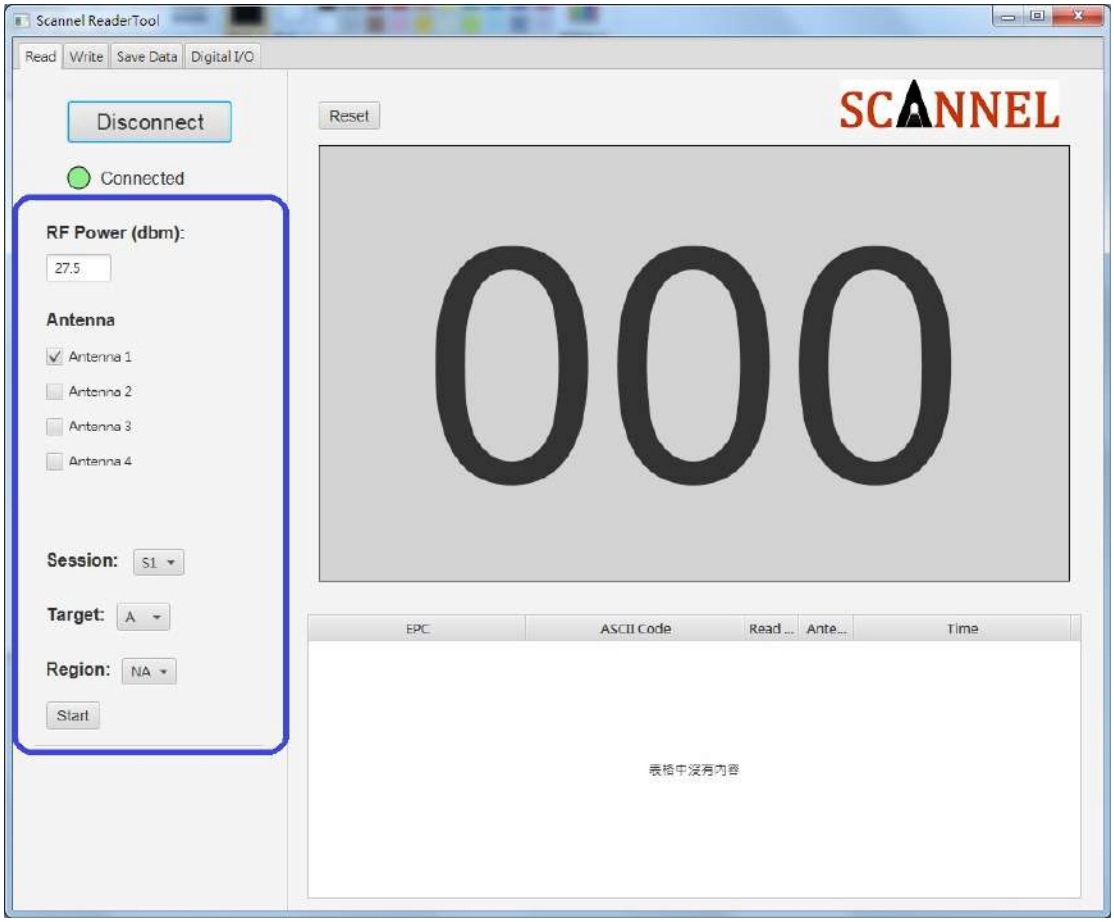
(3) Session - refers to a function in the EPC Gen2 standard for inventory of UHF RFID tags. There are four sessions available in the settings. The following are the recommended settings in various scenarios:

Session 0	Fast Tag Response. Suitable for Tag Population <100
Session 1	Average Tag Response. Suitable for Tag Population >100
Session 2	Normally used when two readers need to do separate inventories and a much longer persistence time can be tolerated. Less often tag response rate.
Session 3	

(4) Target - There are two status for the target, A and B. Target determines whether a UHF RFID Tag will be read in which state, A or B. It is advised that Target be set at A unless necessary.

*For more information about Session and Target, kindly visit GS1 website : https://www.gs1.org/standards/epc-rfid/uhf-air-interface-protocol

Reader Setting:



2.5. Tag Data

Click “Start” to begin scanning/inventory of the RFID Tags. The following will be displayed on the screen when scanning/inventory is in process:

(1) Total Quantity - displayed on the middle area

(2) EPC in HEX - Electronic Product Code of the RFID Tag

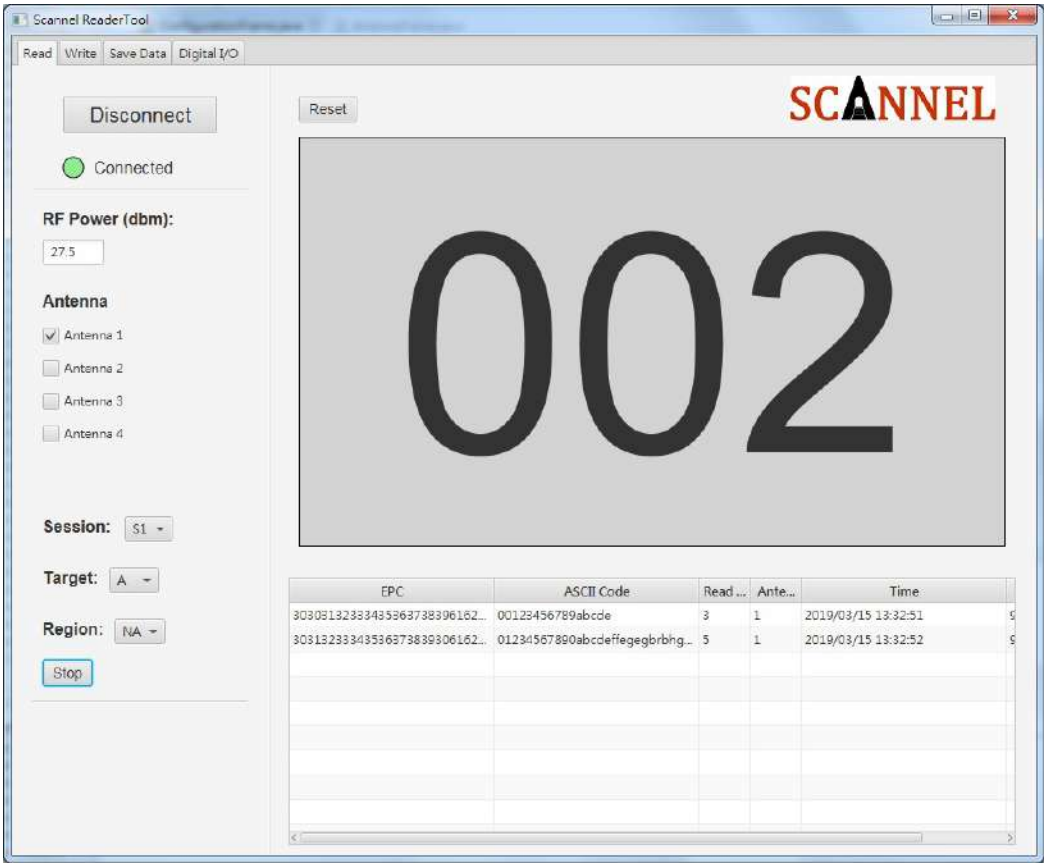
(3) EPC in ASCII - If written using the RU224 ReaderTool, ASCII equivalent of the EPC HEX will be displayed.

(4) Read Count - The number of times a Tag is scanned during the inventory period.

(5) Read Time - The Date/Time the Tag was last scanned.

(6) Read Frequency - The Frequency when the Tag was last scanned.

(7) Read Antenna - Indicates which Antenna Port the Tag was last scanned.



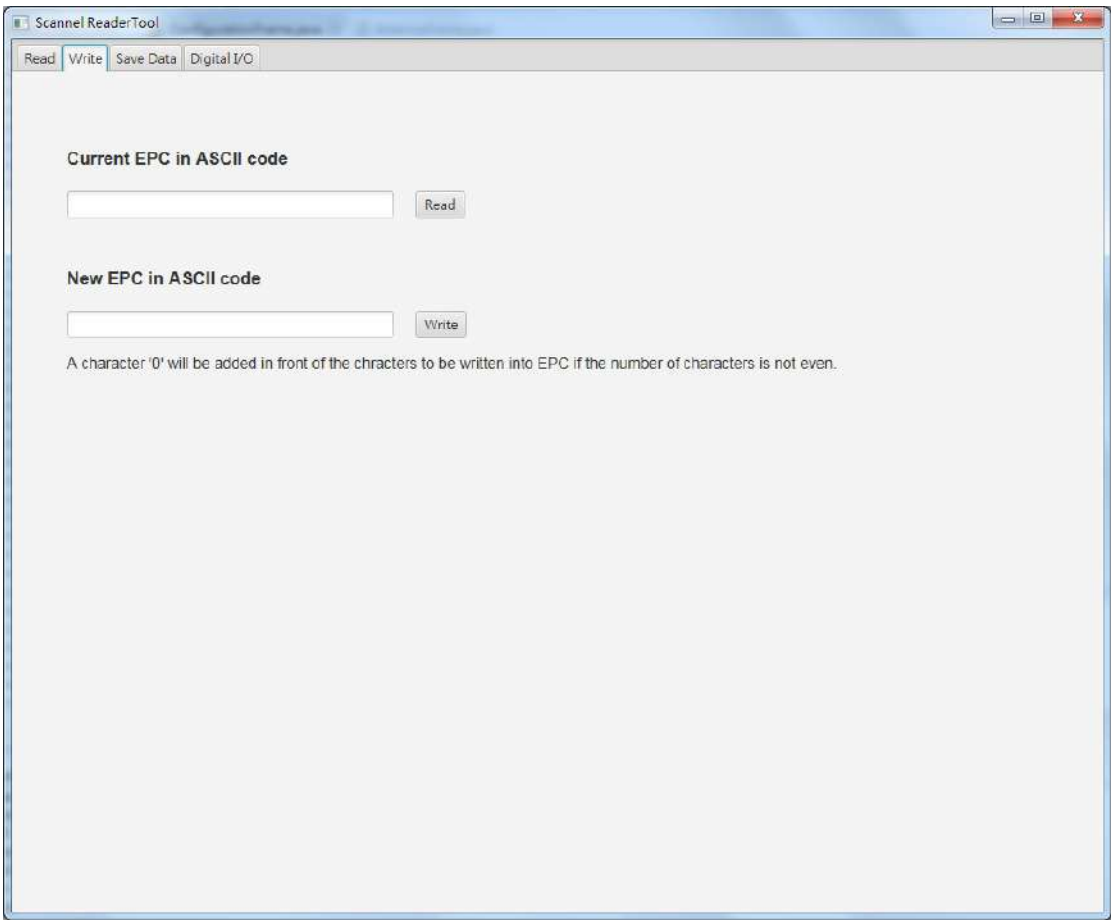
You can restart the scanning/inventory by clicking the “Reset” button.
*Settings will be saved when you close the ReaderTool.

2.6. Write Tag

You can use the ReaderTool to perform read/write function on UHF RFID Tags. To write data on the EPC of the UHF RFID Tag, simply input the string you want to write into the EPC and click the “Write” button. You can click the “Read” button to check and verify the data in the EPC.

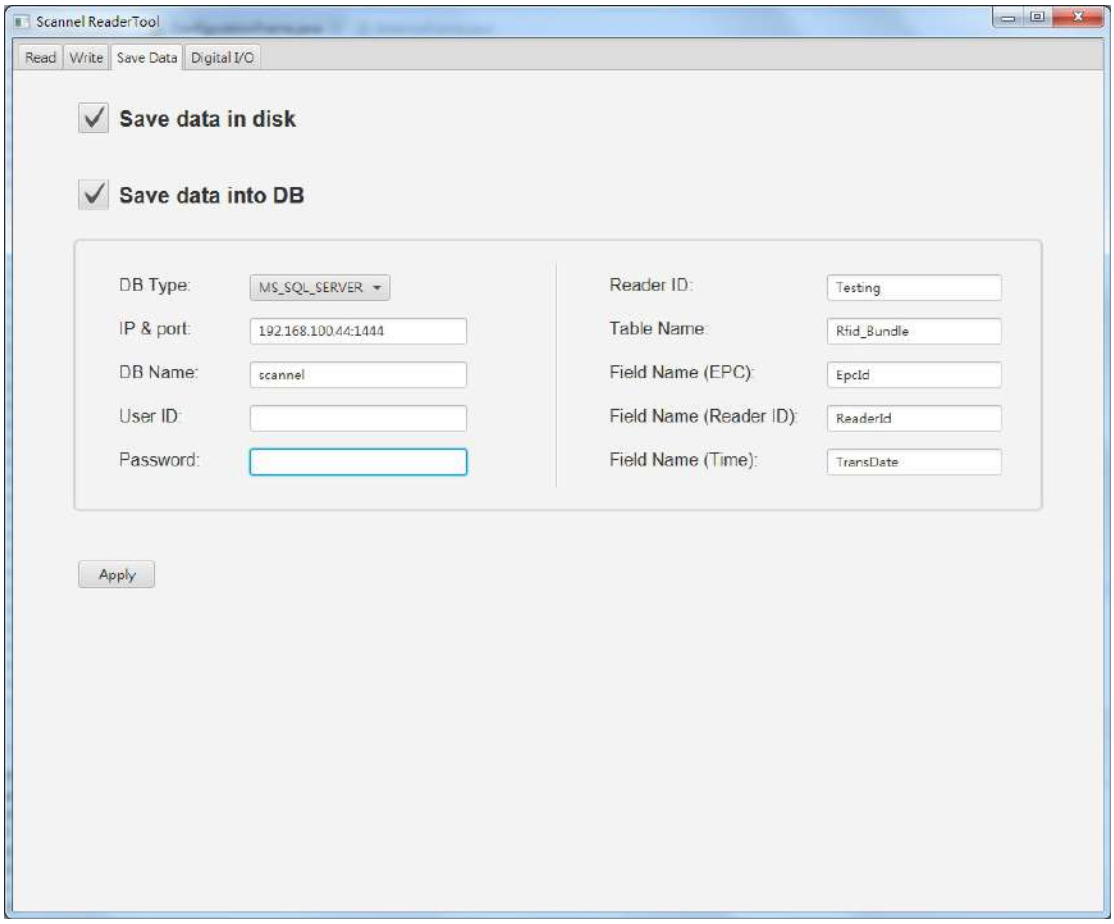
It is important to note that the input string is converted into ASCII code before saving into the EPC bank of the UHF Tag. Due to the conversion process, the data you input on the write field should be an even number (E.g. If you input 1234ABCD, it will write 1234ABCD on the EPC of the RFID Tag.) Otherwise, the ReaderTool will automatically add a “0” in the beginning of the string if your input data is an odd number. (E.g. If you input ABCD123, it will write 0ABCD123 on the EPC of the RFID Tag.)

The Write function can only write on one RFID Tag at a time. If the RU224 scans multiple tags, it will recognize the first RFID it scans and write data on it.



2.7. Save Data

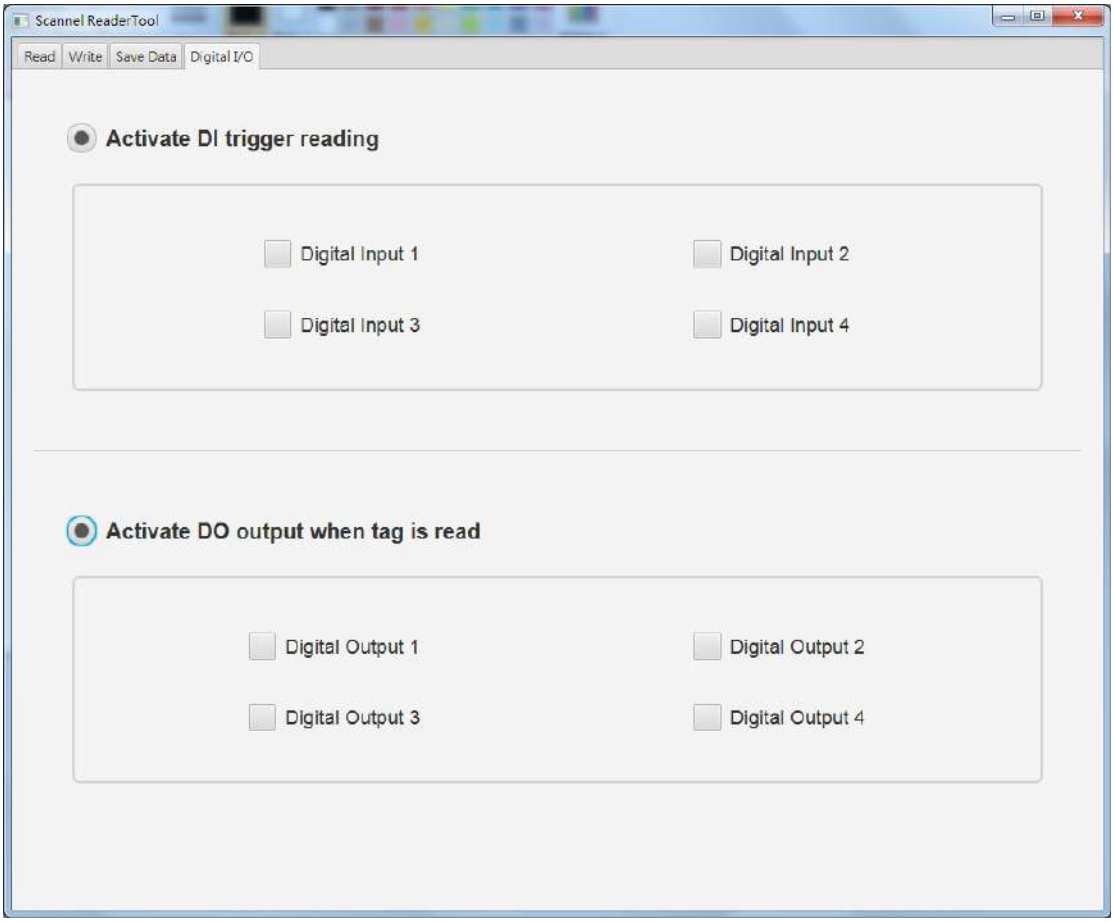
The RU224 ReaderTool has a built-in function to save the scanned/inventoried RFID Tags in the local drive of RU224 and/or save the data into a remote database server. If the option “Save data in disk” is selected, the data will be saved in the folder “/Desktop/RU224/saveData/“ and grouped by date. To save data into your remote database server, click “Save data into DB” and fill the information required to access your database server. Currently, ReaderTool only supports MySQL and MS SQL Server. Other database can be supported through customization.



2.8. Setup GPIO (Digital IO)

Users can use the GPIO to trigger the start/stop of scanning/inventory instead of manually click the “Start” button on the software display. Check the option “Activate DI trigger reading” and select the DI ports your External Device is connected. ReaderTool shall then start/stop the scanning/inventory based on the input signal.

Users can also use the GPIO to indicate status of the inventory/scanning by selecting the “Activate DO output when tag is read” and selecting which digital output your external device is connected. (E.g. When a tag is scanned by RU224, the external device (Example: LED Light) will be triggered by the digital output to light up to notify you that a tag has been scanned,)



2.9. Close ReaderTool

To exit or close the Scannel ReaderTool, just click the close button on the top right corner of the window. We recommend you to stop inventory and disconnect from reader before closing the software.

RU224 Software Development

Customized Software

Most reader functions can be operated through the demo. But in practical applications, user might need to develop their own applications. Please contact Scannel for further details.

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