2018-05-07
Nordic ID Sampo S2 User Guide
Version 1.2

NORDIC ID SAMPO S2
NORDIC ID SAMPO S2 ONE-SERIES

USER GUIDE

TABLE OF CONTENTS

1. GETTING STARTED

1.1. GENERAL

Nordic ID Sampo S2 is a versatile fixed UHF RFID reader with SW controllable low and normal gain functionalities. This reader offers both EU and US frequencies in one reader and multiple connectivity options. This versatile reader is suitable for multiple use cases e.g. in POS and various gate options. It's integrated computer enables installation and operation of 3rd party applications.

Nordic ID Sampo S2 One-series is a powerful fixed UHF RFID reader with multiple connectivity options. This versatile reader offers both EU and US frequencies in one reader and is suitable for multiple use cases e.g. in POS and various gate options. It's integrated computer enables installation and operation of 3rd party applications. Nordic ID Sampo S2 One-series is equipped with the new Nordic ID NUR2-1W module.

Nordic ID Sampo S2 text is used in the user guide to cover both products unless otherwise stated.

1.2. DIFFERENCES BETWEEN NORDIC ID SAMPO S2 AND NORDIC ID SAMPO S2 ONE-SERIES

Differences between Nordic ID Sampo S2 and Nordic ID Sampo S2 One-series have been listed in the Table 1.

Table 1 Differences between Nordic ID Sampo S2 and Nordic ID Sampo S2 One-series

FEATURE	NORDIC ID SAMPO S2	NORDIC ID SAMPO S2 ONE-SERIES
UHF RFID module	NUR-05WL2	NUR2-1W
Supported standard	ISO 18000-63 (EPC Class 1 Gen2v2) AES authentication in accordance with ISO/IEC 29167-10 supported	ISO 18000-63 (EPC Class 1 Gen2v2) AES authentication and sensor tags to be supported
Radiated power	Normal mode: 1W (30dBm) ERP Low-gain mode: 100mW (20dBm) ERP	2W (33dBm) ERP
Conducted power for external antenna ports	500mW (27dBm)	1W (30dBm)
Nominal reading distance	Up to 5m	Up to 10m
Nominal reading speed	200 tags/s	Up to 1000 tags/s

1.3. AVAILABLE VARIANTS

Nordic ID Sampo S2 is available in 3 different variants that are:

Table 2 Nordic ID Sampo S2 variant

CODE	DESCRIPTION
NPG00003	Nordic ID Sampo S2 / UHF RFID (USB / LAN 10 /100&PoE)
NPG00004	Nordic ID Sampo S2 / UHF RFID (USB / LAN 10 /100&PoE / WLAN)
NPG00005	Nordic ID Sampo S2/ UHF RFID (USB / LAN 10 /100&PoE / WLAN / WWAN (3G))

Nordic ID Sampo S2 One-series is available in 3 different variants that are:

CODE	DESCRIPTION
NPG00006	Nordic ID Sampo S2 One-series / UHF RFID (USB / LAN 10 /100&PoE)
NPG00007	Nordic ID Sampo S2 One-series / UHF RFID (USB / LAN 10 /100&PoE / WLAN)
NPG00008	Nordic ID Sampo S2 One-series / UHF RFID (USB / LAN 10 /100&PoE / WLAN / WWAN (3G))

1.4. AVAILABLE ACCESSORIES

CODE	DESCRIPTION
ACN00142	Nordic ID Power supply 100-240 VAC, 50-60 Hz / 24 VDC for Nordic ID AR and Sampo S2 readers, EU (Includes power supply and cable)
ACN00143	Nordic ID Power supply 100-240 VAC, 50-60 Hz / 24 VDC for Nordic ID AR and Sampo S2 readers, UK (Includes power supply and cable)
ACN00145	Nordic ID Power supply 100-240 VAC, 50-60 Hz / 24 VDC for Nordic ID AR and Sampo S2 readers, US (Includes power supply and cable)
CWH00045	Nordic ID External antenna cable (Length 1m, SMA-male -connectors)
CWH00020	Nordic ID External antenna cable (Length 3m, SMA-male -connectors)
CWH00019	Nordic ID External antenna cable (Length 5m, SMA-male -connectors)
CWH00042	Nordic ID External antenna cable (Length 10m, SMA-male -connectors)

1.5. PACKAGE CONTENT

Nordic ID Sampo S2 package contains following items

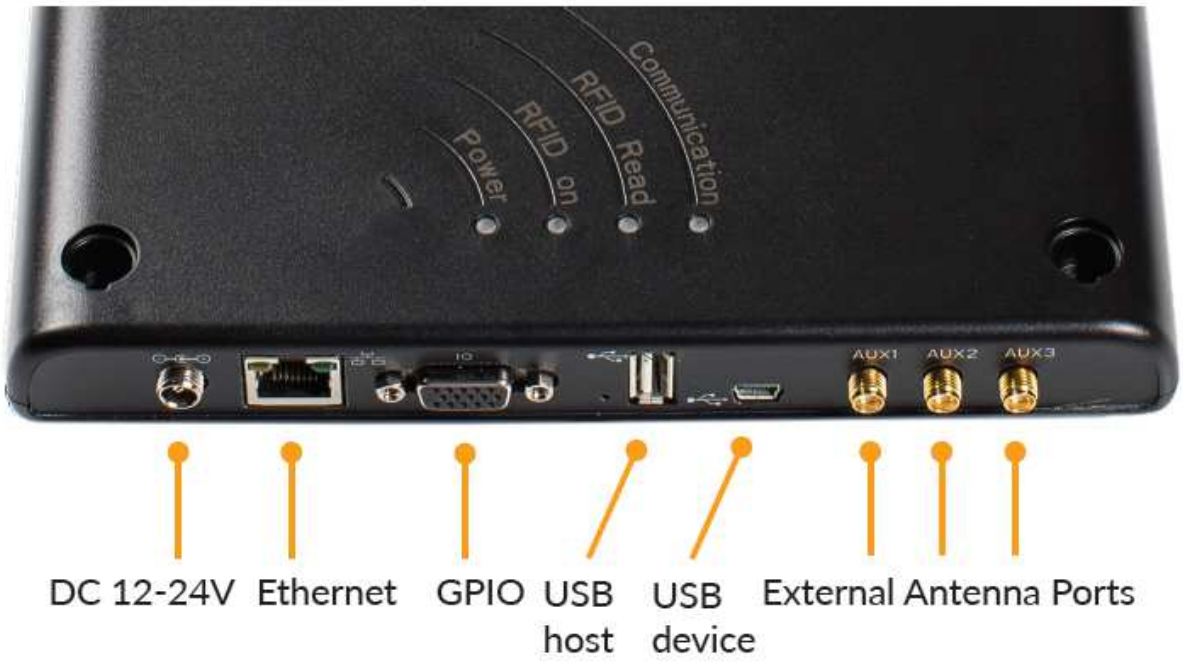
- Nordic ID Sampo S2 / Nordic ID Sampo S2 One-series

- Installation kit
- Safety and regulations guide

NOTE! Power supply not included

1.6. FEATURES AND CONNECTORS OVERVIEW

WLAN and WWAN (3G) variants of Nordic ID Sampo S2 UHF RFID reader include internal WLAN and WWAN antennas.



Picture 1 Connector panel of Nordic ID Sampo S2

1.7. MOUNTING

Nordic ID Sampo S2 and Nordic ID Sampo S2 UHF RFID readers can be mounted using assembly holes of the reader. Dimensional drawing about the assembly holes can be find from Figure 1.

Nordic ID Sampo S2 One-series UHF RFID reader can be mounted also with M5 threaded screws to any VESA 75 and VESA 100 mounting equipment (sold separately).

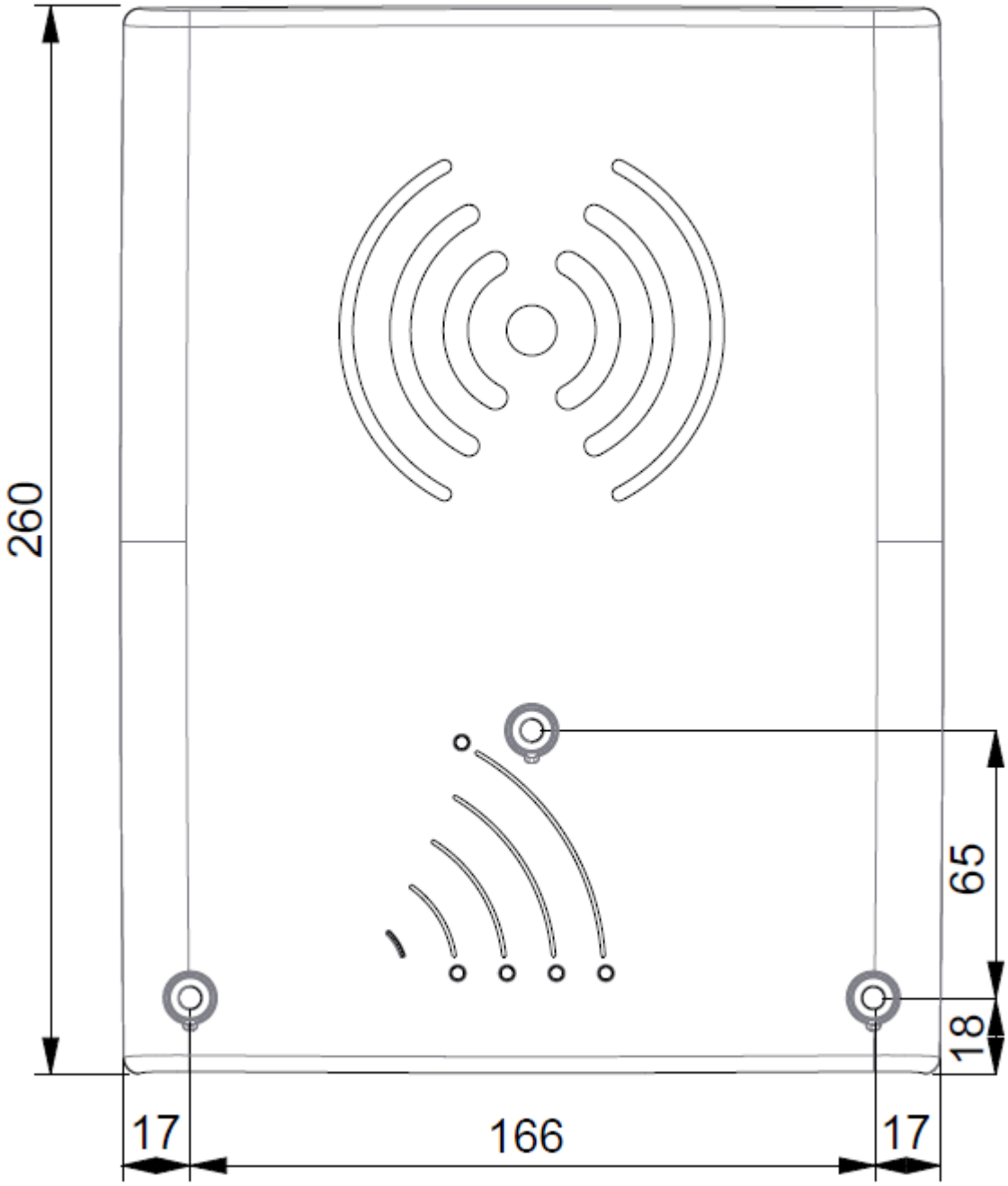


Figure 1 Assembly holes of Nordic ID Sampo S2 and Nordic ID Sampo S2 One-series readers

1.8. POWERING THE READER

Nordic ID Sampo S2 can be powered via DC power supply (sold separately) or ethernet port if the network supports power over Ethernet (PoE) feature or PoE injector is being used. Regardless of what powering method is used, the data communication can be handled via USB connection or if IP connectivity is required then via WWAN, WLAN or ethernet. Nordic ID Sampo S2 powers up automatically when connected to DC power supply or PoE.

The rated maximum power consumptions for Nordic ID Sampo S2 reader are:

- Powered via 802.3af PoE: 12W
- Powered via DC power supply (sold separately): 20W (12-24V DC)

NOTE! WLAN and 3G are disabled If the reader is powered via the PoE. 802.3af PoE can't provide enough power to the reader to keep WLAN and 3G features working as expected.

1.9. PHYSICAL CONNECTORS

Nordic ID Sampo S2 includes the following physical connectors:

- DC connector for supplying power if PoE capability is not used (power supply sold separately)
- GPIO connector (4 optically isolated inputs and outputs)
- 3 pcs SMA female antenna connectors for connecting external antennas to the reader
- USB 2.0 device mini B connector (USB HID profile supported)
- USB 2.0 host Type A connector
- Ethernet 10/100Mbps with 802.3af support
- Dual band WLAN (optional)
- WWAN cellular connectivity (optional)
- Slot for mini SIM card (optional)

1.9.1. DC CONNECTOR

DC connector is used to power up the reader using Nordic ID provided power supplies. More information about the Nordic ID power supplies can found from table 0. Supported input voltage is 12 – 24V DC.

1.9.2. GPIO CONNECTOR

Nordic ID Sampo S2 includes a multipurpose GPIO connector that contains the following functionalities:

- RS-232 serial port
- 4 x opto-isolated inputs
- 4 x opto-isolated outputs
- +5VDC supply

- 12VDC / 24 VDC supply

12VDC if the reader is powered via PoE and 24VDC if the reader is powered via external power supply. The multipurpose GPIO connector can be accessed via DE15 connector located on rear panel of the reader. Pin-out of the DE15 connector can be seen in Figure 2. Functions and electrical specification of the GPIO connector can be found from

Table **3** and Table 4.

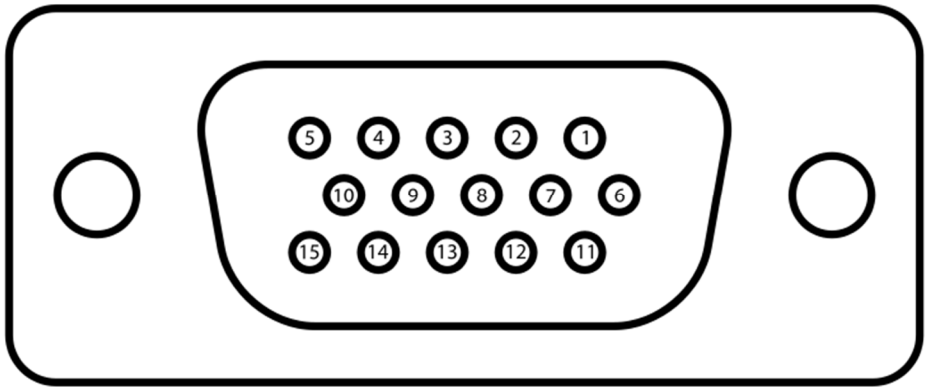


Figure 2 Pin-out of DE15 connector

Table 3 Signal of GPIO connector

PIN	SIGNAL NAME	DESCRIPTION
1	5V output	5V DC output, switchable on/off
2	RS232 TX	RS232 output
3	RS232 RX	RS232 input
4	Ground	Ground
5	Output 0	Isolated output 0
6	Output 1	Isolated output 1
7	Output 2	Isolated output 2
8	Output 3	Isolated output 3
9	V-	Isolated ground for inputs and outputs
10	Input 0	Isolated input 0
11	Input 1	Isolated input 1
12	Input 2	Isolated input 2

13	Input 3	Isolated input 3
14	V+	Pull-up voltage for outputs, 10kΩ pull up resistors
15	12V / 24V output	12V out with POE powered and 24V out with external power supply

Table 4 Electrical specifications of the signals

SIGNAL NAME	VOLTAGE MIN (V)	VOLTAGE NOMINAL (V)	VOLTAGE MAX (V)	CONDITIONS
5V out		5		<200mA
RS232 TX, high	5	5,4		3KΩ load to Ground
RS232 TX, low		-5,4	-5	3KΩ load to Ground
RS232 RX, high	2,4		25	
RS232 RX, low	-25		0,6	
Ground		0		
Outputs 0 - 3, high			30	10KΩ pull up to V+
Outputs 0 - 3, low		0	0,6	max 25mA, max 150mW
V-		0		
Inputs 0 - 3, high	3		30	Between V+ and V-, max 6mA at 30V
Inputs 0 - 3, low	0		0,7	Between V+ and V-
V+			30	Between V+ and V-
12V / 24V output		12 / 24		<200mA

Example schematics about how to create non-isolated and isolated solutions can be found from section 10.1.

NOTE! If 5V or 12V / 24V output is used, connect pins 4 and 9 together.

1.9.3. ANTENNA PORTS

Nordic ID Sampo S2 includes 3pcs SMA female antenna connectors for connecting external antennas to the reader. Impedance of antenna ports is 50Ω and maximum radiated output power is

- Nordic ID Sampo S2: 27dBm
- Nordic ID Sampo S2 One-series: 30dBm

The antenna ports can be configured independently via NUR API.

1.9.4. USB 2.0 DEVICE WITH MINI B CONNECTOR

Nordic ID Sampo S2 includes USB 2.0 device mini B connector for connecting reader to host device. Nordic ID Sampo S2 supports also USB HID class which means the reader can act as a standard USB input device for host devices.

NOTE! Web management interface can't be access using USB connector. Web management interface can be accessed only using ethernet, WLAN and WWAN connections.

1.9.5. USB 2.0 HOST WITH TYPE A CONNECTOR

Nordic ID Sampo S2 includes USB 2.0 host Type A connector for connecting peripheral USB devices to the reader. The USB 2.0 host Type A connector can be used to connect needed USB peripherals to the reader to expand its functionalities. Maximum current out from the USB 2.0 host Type a connector is 500mA.

1.9.6. ETHERNET

Nordic ID Sampo S2 includes standard RJ-45 ethernet connector. The reader supports 10/100Mbps speed class and 802.3af PoE.

1.9.7. DUAL BAND WLAN (OPTIONAL)

Certain variants of Nordic ID Sampo S2 include dual band WLAN supporting 2.4GHz and 5.0GHz frequency bands. WLAN antenna is built-in, so no external WLAN antenna needed. Nordic ID Sampo S2 can work as a WLAN access point to other WLAN devices thus enabling simple and cost-efficient network of several readers and devices.

1.9.8. WWAN CELLULAR CONNECTIVITY (OPTIONAL)

Certain variants of Nordic ID Sampo S2 include WWAN connectivity supporting 2G and 3G cellular networks. WWAN antenna is built-in, so no external WWAN antenna needed. WWAN connectivity needs a SIM card to be functional. Please find more information about how the SIM card is inserted to the Nordic ID Sampo S2 from section 1.9.9.

1.9.9. SLOT FOR MINI SIM CARD (OPTIONAL)

The WWAN variant of Nordic ID Sampo S2 includes a slot for mini SIM card. Mini SIM card is to be inserted in the slot in a right orientation to be functional. The correct insertion orientation of mini SIM card can be seen from the Picture 2.

Picture 2 Insertion orientation of mini SIM card

1.10. USER INTERFACE

User interface of Nordic ID Sampo S2 consists of 4 LED indicators and a reset button on the back of the reader.

1.10.1. LED INDICATORS

Nordic ID Sampo S2 has four programmable LEDs for user indications. Location of the LEDs can be seen from

Picture 3. It's possible to enable/disable all the LEDs via web management UI and/or reader API. By default the LEDs are enabled. LEDs of the reader are:

1. Power LED
2. RFID On LED
3. RFID Read LED
4. Communication LED

Picture 3 Location of LEDs

1.10.1.1. POWER LED

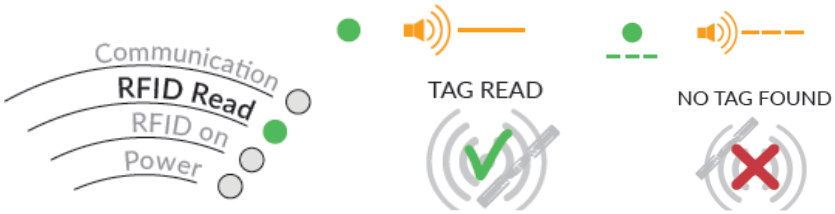
By default, Power LED indicates if the power is supplied to the device via DC power supply or PoE.

1.10.1.2. RFID ON LED

RFID On LED indicates whether the RFID reading is ON or OFF. Functionality of the RFID On LED can be configured via NUR API if needed.

1.10.1.3. RFID READ LED

RFID Read LED indicates when tag is read. Functionality of the RFID Read LED can be configured via NUR API if needed.



1.10.1.4. COMMUNICATION LED

Communication LED indicates whether the reader has established USB, ethernet, WLAN or WWAN connection. Functionality of the Communication LED can be configured via NUR API if needed. Functionality of the Communication LED differs depending on whether USB or TCP/IP (ethernet, WLAN and WWAN) connection is used.

- USB connection in use
    - LED off: The USB cable is unplugged.

- LED on: The USB cable is connected.

- Ethernet, WLAN or WWAN connection in use
  - LED off: The reader has no IP address.
  - LED blinking: The reader has IP address, but the client application is not connected
  - LED on: The reader has IP address and the client application is connected.

1.10.2. RESET BUTTON

Reset button of Nordic ID Sampo S2 contains the following functionalities:

- Rebooting the reader
  - Press the reset button 2s (red COMMUNICATION LED starts blinking once the reset button is pressed) and release it once 3 green LEDs are turned on.

- Boot to recovery mode*
  - If reset button is not released, green RFID Read and RFID On LEDs do turn off and green Power LED is on. Communication LED starts blinking in red. After a while green RFID READ LED is turned on.
  - Release the reset button when the RFID READ LED has turned on to enter to the recovery mode. This mode can be entered within 5s after the RFID READ LED has been turned on.

- Factory reset
  - If reset button is not released red COMMUNICATION LED starts blinking even faster and green RFID ON LED is turned on
  - Release the reset button when the RFID ON LED has turned on to enter to the factory reset mode. This mode can be entered within 5s after the RFID ON LED has turned on.

* Recovery mode can be used to repair the reader

NOTE! If reset button is pressed over 5s after the RFID ON LED has turned on and the red COMMUNICATION LED has started blinking even faster, releasing the reset button will perform a normal reboot.

1.10.3. BUZZER

Nordic ID Sampo S2 includes a buzzer for sound indications. The buzzer can be controlled via SW.

1.10.4. CAPACITIVE SENSOR

Nordic ID Sampo S2 includes a capacitive sensor for triggering reading. The capacitive sensor can be controlled via SW. Location of the capacitive sensor can be found from Figure 3. Diameter of the capacitive sensor is 27mm.

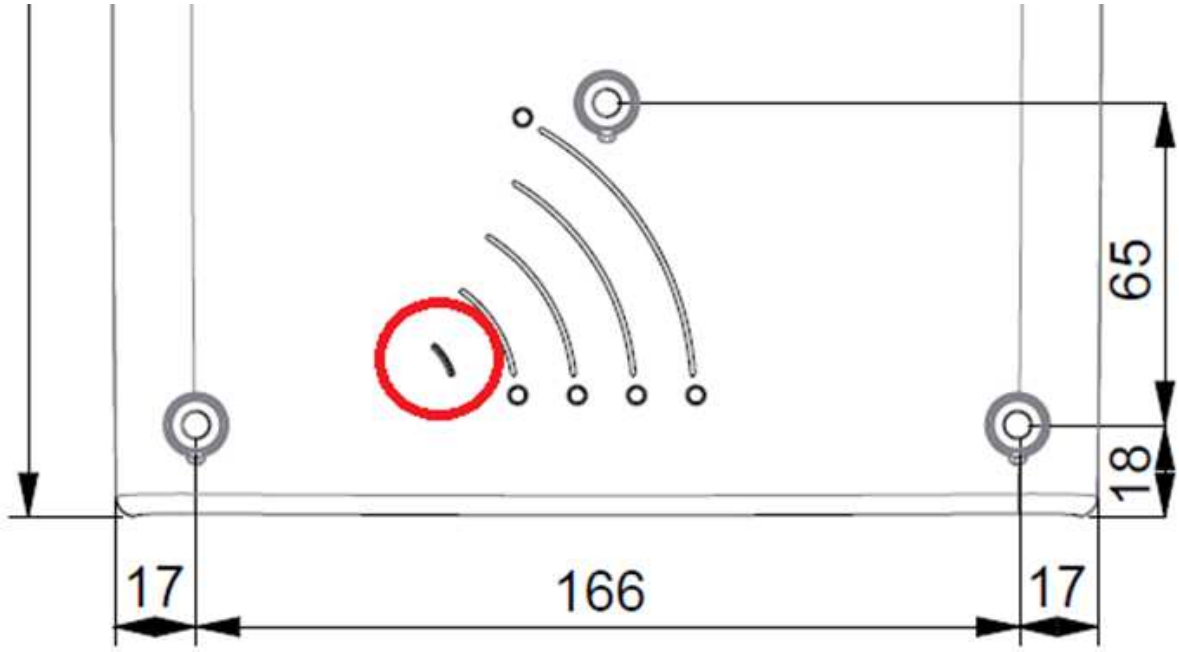


Figure 3 Location of capacitive sensor

1.11. RF PROFILES

This section applies only to Nordic ID Sampo S2 One-series reader. Nordic ID NUR2-1W UHF RFID module supports three different kind of RF profiles. The profiles are Robust, Nominal and High speed. It's important to select the correct RF profile based on use case and environment. More detailed description about the RF profiles can be found below:

- **Robust**
    - Robust RF profile is intended to be used in challenging environments. It provides the best filtering against the interfering signals coming from nearby reader(s), other signal sources and from reflective environment. This profile uses link frequency of 250 kHz and Miller

4 coding scheme providing read rates up to 200 tags/s. Due to the low data speed and best filtering the Robust RF profile provides the best sensitivity.

- **Nominal**
    - Nominal RF-profile is the default setting of readers containing Nordic ID NUR2-1W UHF RFID module. It uses link frequency of 300 kHz and Miller 2 coding providing read rates up to 350 tags/s.
- **High speed**
    - High speed RF profile is intended to be used in use cases where the highest read rates are required. It uses link frequency of 400 kHz and FM0 coding and provides read rates up to 1000 tags/s. Due to the high data speed the profile is quite sensitive to interferences.

NOTE! Read rates will depend from the environment, reader settings, tag population and tag type.

1.12. ANTENNA CHARACTERISTICS

Nordic ID Sampo S2 reader includes an internal wideband circularly polarized UHF RFID antenna. Nominal reading distances are:

- Nordic ID Sampo S2 in normal mode: 5 m / 16 ft
- Nordic ID Sampo S2 in low-gain mode: 1.5 m / 5 ft
- Nordic ID Sampo S2 One-series: 10 m / 33 ft

NOTE! The reading range depends on used tag and environment

1.12.1. USING EXTERNAL ANTENNAS WITH NORDIC ID SAMPO S2

Sometimes there can be challenging areas in the reading environment that needs extra coverage. For this purpose, there are 3 SMA female connectors (AUX1, AUX2 & AUX3) in the Nordic ID Sampo S2 reader. The external antennas can be enabled/disabled via SW and be used to improve reading performance and accuracy if needed.

1.13. THERMAL MANAGEMENT

Nordic ID Sampo S2 reader includes sophisticated thermal management features that do prevent overheating issues if reader is used in too warm environments. The reader monitors temperatures of onboard computer and UHF RFID module and adjusts operation points based on the temperature information.

Onboard computer starts mitigation scheme (for example clock frequencies of CPUs are dropped) when temperature of the onboard computer reaches 85°C.

Thermal mitigation scheme of the UHF RFID module follows following temperatures:

- 80°C – UHF RFID reading operations are suspended for 100ms. Suspend time is increased 20ms by every °C temperature rises until the temperature reaches 90°C. The thermal mitigation scheme is turned off once the temperature drops below 80°C. High temperature warning

message (TEMP_HIGH) is sent via NUR API to host. The warning message contains also current temperature information.

- 90°C – UHF RFID reading operations are shut down until temperature goes below 90°C. Once the temperature is below 90°C, above mentioned mitigation scheme is taken in use. Over temperature warning message (TEMP_OVER) is sent via NUR API to host. The warning message contains current temperature information.

2. SOFTWARE

All documentation about SW, SW features and application development can be find from GitHub.

https://github.com/NordicID/ar8x_samples

2.1. NORDIC ID RFID APPLICATIONS FOR NORDIC ID SAMPO S2

Nordic ID provides following Windows tools to test and configure the reader. The tools are available via Nordic ID Support pages:

http://www.nordicid.com/en/downloads/

2.1.1. NORDIC ID RFID DEMO

Nordic ID RFID Demo application is for conducting the reading tests. It allows connecting the devices and commencing the reading procedure. The application provides statistics on the reading performance and logging capabilities for more thorough evaluation. As the Nordic ID RFID Configurator, this application also allows adjusting the RFID parameters on the fly for better understanding how they impact on the reading performance. The difference however is that altered settings cannot be stored permanently into the device. The settings are reverted to defaults upon power cycle.

2.1.2. NORDIC ID RFID CONFIGURATOR

Nordic ID RFID Configurator is meant for configuring the reader settings. The settings can be e.g. related to network settings or RFID reading parameters and stored into the device as new defaults. Note that e.g. the RFID reading parameters can be assigned to the reader by the host application after successfully connected to the device also. The RFID Configurator is also the tool for updating the device firmware if seen necessary.

2.1.3. NORDIC ID AR8X APPLICATION SIGNING TOOL

To provide more security to the SW platform, the application zip-files need to be signed with Nordic ID provided signing tool. The public key generated to the zip-file will be then verified against the list of files when installing the zip-file to the reader. This makes sure that only valid content from the zip-file can be installed.

The tool in question is called Nordic ID Application Signing Tool. The tool can be used to sign pre-built zip-files, as also to create new zip-files from scratch.

3. WEB MANAGEMENT INTERFACE

Nordic ID Sampo S2 includes a web management interface which can be accessed with a web browser. The web management interface is used to configure the reader and manage applications. Documentation about web management interface can be find from GitHub.

https://github.com/NordicID/ar8x_samples

NOTE! Web management interface cannot be accessed using USB connectors. Web management interface can be accessed only using ethernet, WLAN and WWAN connections.

4. REGIONAL SETTINGS

Nordic ID UHF RFID readers support operating frequency range between 860 - 960MHz. Some of the readers cover full operating frequency band and some of them have two sub bands that are 868 ETSI band (865.6 - 867.6 MHz) and 915 FCC band (902 - 928 MHz). Regional organizations as ETSI and FCC have set rules and requirements for operating frequencies, output power and other RF parameters for the UHF RFID readers to comply local regional requirements.

Nordic ID has created a set of regional settings in order to fulfil local regulations. Nordic ID is required to ensure that compliance of Nordic ID products will remain after production. Solution for this is that products including UHF RFID functionality are set and locked in production based on customer order e.g. if a product is ordered to Europe, it will be locked to ETSI region. And, if a product is ordered to Australia region, it is locked to Australia region. When a product is locked to individual region, it will comply local regulations of the region.

5. SERVICE AND SUPPORT

For technical enquiries regarding Nordic ID devices or software development, please contact our Technical Support:

E-mail: support@nordicid.com
Telephone: +358 2 727 7790

As a manufacturer, Nordic ID stands responsible for providing repair services for its devices during and after the warranty period. Together with partners Nordic ID serves customers globally. When your Nordic ID device needs repair, always use Nordic ID Service or our authorized service partners. We want to make sure that your Nordic ID product serves you the best possible way, and by using our preferred service partners the quality of the service is trustworthy and the spare parts are original. This way the existing product warranty remains, and you receive a 3-month service warranty for the repaired devices.

Nordic ID works together with full support and primary support partners. Full support partners can handle both warranty and non-warranty repairs on behalf of Nordic ID in their own regions. In addition, Nordic ID has a network of smaller repair centers, primary support partners, who offer the first line of support to their customers locally.

For any enquiries about Nordic ID repair service please contact:

E-mail: service@nordicid.com
Telephone: +358 2 727 7791

6. WARRANTY

Nordic ID warrants that the Products are at the time of delivery free from defects in materials and workmanship, provided the Products remain unmodified and are operated under normal and proper conditions. Warranty period is the longer of twenty-four (24) months from the date of delivery in case the Customer is end-customer or twenty-seven (27) months from the date of manufacture in case the Customer is reseller. Spare parts are warranted against defects in workmanship and materials for a period of ninety (90) days from the date of delivery to Customer.

For more detailed information about the warranty can be found from Nordic ID Sales Terms.

7. RELATED DOCUMENTS AND CONTENT

Documents mentioned below can be found from Nordic ID Support pages (link):

- Nordic ID Sampo S2 Datasheet
- Nordic ID Sampo S2 Quick Guide
- Nordic ID Safety and Regulations Guide
- Nordic ID GitHub account for developers (https://github.com/NordicID)

8. ABOUT NORDIC ID

Nordic ID is at the center of today's real-time item tracking and reliable RFID technology. We help organizations fight the damaging effects of item loss, facilitate streamlined business procedures, and stay ahead of the competition.

We are ready to help you take advantage of our wide range of products and services designed to fit your needs. Contact us now, and we will help you to tackle your challenges and get your business to the next level.

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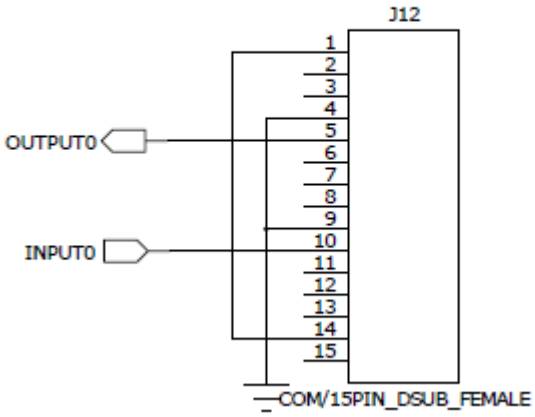
9. VERSION HISTORY

Version	Date	Modifications
1.0	19.1.2018	The first version
1.1	5.4.2018	Reset button section updated
1.2	7.5.2018	Picture 2 corrected. Changes to several sections.

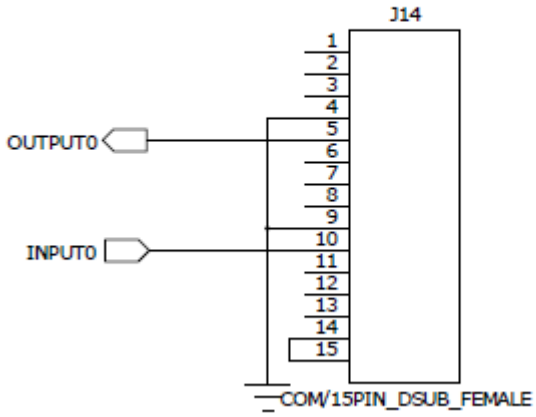
10. APPENDICES

10.1. EXAMPLE SCHEMATICS OF GPIO INTERFACE

No isolation, 5V pull up voltage



No isolation, 12V / 24V pull up voltage



Isolated inputs and outputs, 12V / 24V pull up voltage