

Callidus UHF RFID POS

(FW RFID_ReaderGen2_v0.94)

INSTALLATION AND SERVICE GUIDE



Version 1.0
May 2022



HISTORY OF REVISIONS AND REPAIRS

22.4.2022 - initial version

FEATURES

The “Callidus UHF RFID POS” is device for reading data from UHF RFID GEN2 tags and editing via user adjustable algorithm.

This can be used to:

- change the data stored on the tag, which will trigger alarm when passing through RFID EAS system (for example pedestal with Callidus UHF RFID reader)
- sending read data from the tag on a pay server (future implementation)

REFERENCE MANUAL

CONTENT

1. Operation guidelines	3
2. Basic information	3
3. Pre-install tasks	3
3.1 Installation equipment for UHF RFID POS	3
4. Specifications	4
4.1 UHF RFID	4
4.2 Power	4
4.3 Connectivity	4
4.4 User interface	4
4.5 Software interface	4
4.6 Mechanical specifications	4
4.7 Environmental	4
5. UHF RFID POS	5
5.1 Operation description	5
5.2 Controls description	5
6. connection SETTINGS and software description	6
6.1 Connecting to the PC/Laptop	6
6.2 Login details	6
6.3 Software description	6
6.4 Buttons settings	7
6.5 POS settings	8
6.5 Read and write power settings	12
7. REST API Implementation	13
7.1 Advantages of REST API	13
8. Declaration	14
8.1 Equipment modification caution	14
8.2 Limitation of liability	14
9. Recommended literature about UHF RFID	14
10. Notes	14

LIST OF PICTURES

Figure 1 Device discovery software - eComm Discoverer	6
Figure 2 Login page.....	6
Figure 3 The Buttons settings are located in "GPIO" tab.....	7
Figure 4 The POS settings are located in "Autonomous mode" tab	8
Figure 5 Principle of content creation for new EPC ID with "TID combined with flag" settings.....	9
Figure 6 Principle of content creation for new EPC ID with "EPC combined with flag" setting.....	10
Figure 7 Principle of content creation for new value in EPC bank when setting is "Only flag at specific location"	11
Figure 8 Read and write power settings are located in "RFID" tab	12
Figure 9 Example in PowerShell (Windows)	13
Figure 10 Example in Bash (Linux)	13

1. OPERATION GUIDELINES



CAUTION! Before operating this device, all operating technicians should study this manual and device technical data to understand and follow the safety instructions. Keep these instructions with the device for further reference. If you have any questions, contact your device representative or distributor.

This is a Class A product. In a domestic environment, this product may cause high-frequency interference. In this case, it may require the user to take appropriate precautions.

2. BASIC INFORMATION

- "Callidus UHF RFID POS" is device for reading and editing data in UHF RFID GEN2 tags, via user adjustable algorithm
- user interface is designed for simple control and consists of two robust backlit buttons, status RGB LED light and internal buzzer
- it is powered via POE
- all configuration parameters and device functionality can be configured and controlled with browser via internal webserver or with customized software that communicate with reader via REST API

3. PRE-INSTALL TASKS

3.1 Installation equipment for UHF RFID POS

- 1x POS
- 1x LAN cable (PC <-> switch/injector)
- 1x PoE injector or switch with PoE feature
- Laptop with browser (Google Chrome recommended)

4. SPECIFICATIONS

4.1 UHF RFID

Operating frequency US version	902 - 928 MHz
Operating frequency EU version	865,6 - 867,6 MHz
RFID protocol support	GEN2
Editing speed	Up to 5 tags/sec
Editing distance	Up to 1m (depending on multiple factors as set transmit power, GEN2 settings, used tags, and more)
Transmit power	Adjustable from -10 dBm to +30 dBm in 1 dBm steps

4.2 Power

Power over Ethernet	PoE 802.3 af
Power consumption	Max. 12 W

4.3 Connectivity

LAN	10/100Mbit Ethernet, IPv4 DHCP or static IP, 2 m (78.7 in) cable length
------------	---

4.4 User interface

Button	2x backlit button
Status light indicator	RGB LED
Sound indicator	Internal buzzer

4.5 Software interface

RFID API	Callidus REST API
-----------------	-------------------

4.6 Mechanical specifications

Width	220 mm
Length	300 mm
Height	48 mm
Weight	1.8 kg

4.7 Environmental

Ambient temperature	0 - 35 °C (equipment for normal indoor use)
Relative humidity	0 - 90 % (non-condensing)

5. UHF RFID POS

5.1 Operation description

The cashier's services of this device consist of 2 simple actions, that will write specific data sequence into the EPC bank GEN2 tags and lock them against further unauthorized actions as overwriting them. Depending on the settings described below ([Buttons settings](#), [POS settings](#)), two algorithms will be created. The first algorithm, activated by pressing the "Activation button" will be used in case when tag should trigger an alarm while passing through RFID EAS system. Pressing the button will result in rewriting specific alarm sequence into the tags. The second algorithm, activated by pressing "Deactivation button" should be used in case when tag should NOT trigger an alarm. Pressing the button will result in rewriting non-alarm sequence to the tags. Writing according to selected algorithm will be performed with all visible tags and the result will be optically and acoustically indicated.

5.2 Controls description

- 1. SPACE FOR TAGS**
– that should be activated or deactivated
- 2. STATUS RGB LED LIGHT**
– indicating status and performed operations
- 3. ACTIVATION BUTTON**
– red backlit button for tags activation
(will trigger alarm)
- 4. DEACTIVATION BUTTON**
– green backlit button for tags deactivation
(will NOT trigger alarm)

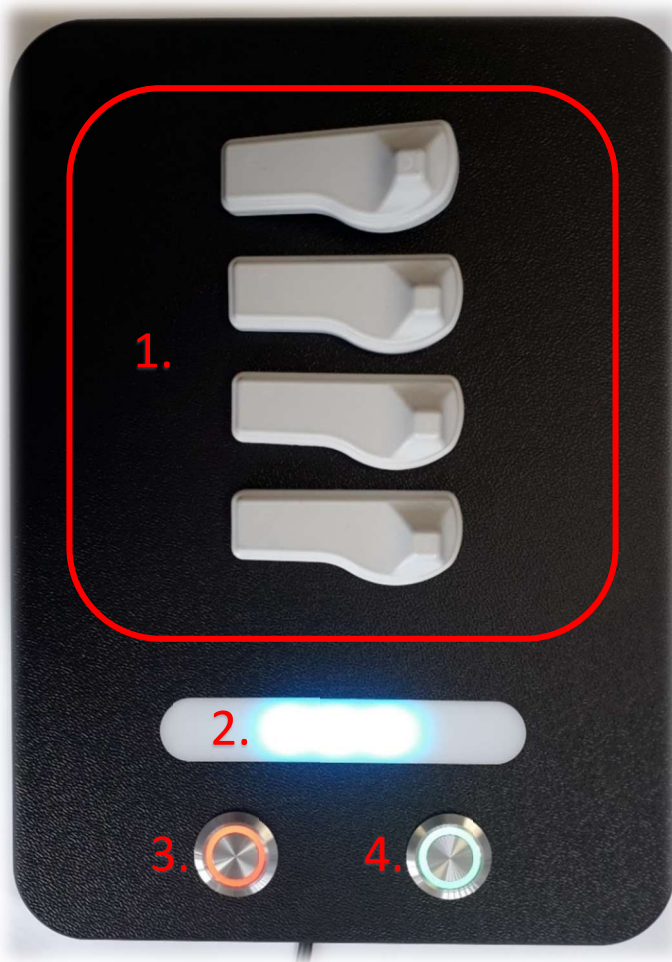


Table 1 "status RGB light" colors and their meaning

Glows blue	Device is idle and ready to use
Glows orange	Tag editing is in progress
Flashes green	Tag editing is complete, writing to all visible tags was successful
Flashes red	Tag editing is complete, writing to one or more tags failed

6. CONNECTION SETTINGS AND SOFTWARE DESCRIPTION

6.1 Connecting to the PC/Laptop

The device can be powered by ethernet cable itself if the network supports PoE feature or PoE injector has to be used.

- The ethernet cable must be connected with the device and the PC/Laptop in the same ethernet network.
- Then the device has to be discovered. RFID reader is very simple to find. Just open up “eComm Discoverer” and search for name “C8PURDR”. Then just double click on that row and new window with login should appear.

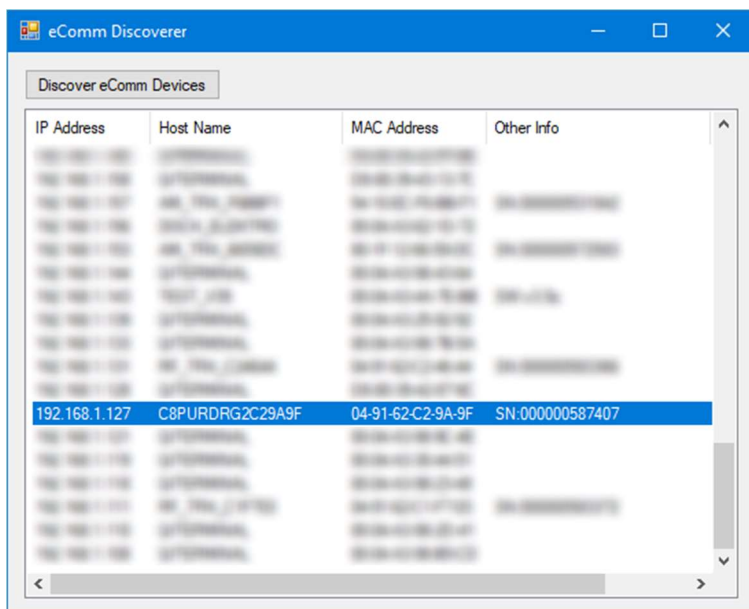


Figure 1 Device discovery software - eComm Discoverer

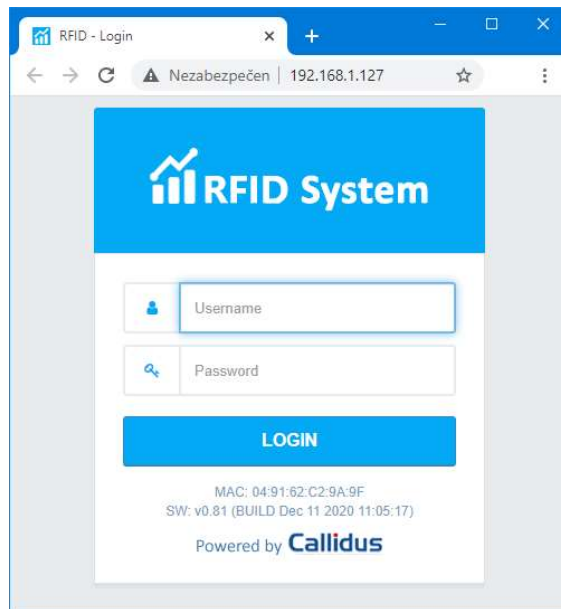


Figure 2 Login page

6.2 Login details

Username for user with limited rights: **user**
Default password: Call + last 6 numbers of MAC
Example for MAC '1A:2B:3C:4D:5E:6F': Call4D5E6F

Username for admin with full rights: **admin**
Default password: Call + last 6 numbers of MAC with reverted double digits
Example for MAC '1A:2B:3C:4D:5E:6F': CallD4E5F6

6.3 Software description

After successful login as admin, Dashboard page should appear. On the left side is menu consisting of 12 tabs:

1. **Dashboard** – basic information about reader such as device and system statuses, tags memory etc.
2. **Tags** – list of saved tags, reading statistics, start/stop inventorying
3. **Edit tags** – used for editing access or kill password, EPC, user memory, tag locks or simply for inspection of all banks
4. **RFID** – all settings about RFID like region, power, antenna ports, hop table, protocols and filters
5. **Autonomous mode** – settings for triggering an alarm in autonomous mode, settings for POS mode
6. **People counting** – PC settings, status and counters if internal PC used (irrelevant settings for POS)
7. **Alarms** – alarm indication settings (irrelevant settings for POS)
8. **GPIO** – input and output configuration and settings for POS actions
9. **Date & time** – time synchronization and time zone offset settings
10. **Networking** – IP settings like DHCP, IP address, etc.
11. **Firmware update**
12. **Factory reset**

6.4 Buttons settings

This setting is used to select POS action that will be performed with all GEN2 tags once the activation or deactivation button is pressed.

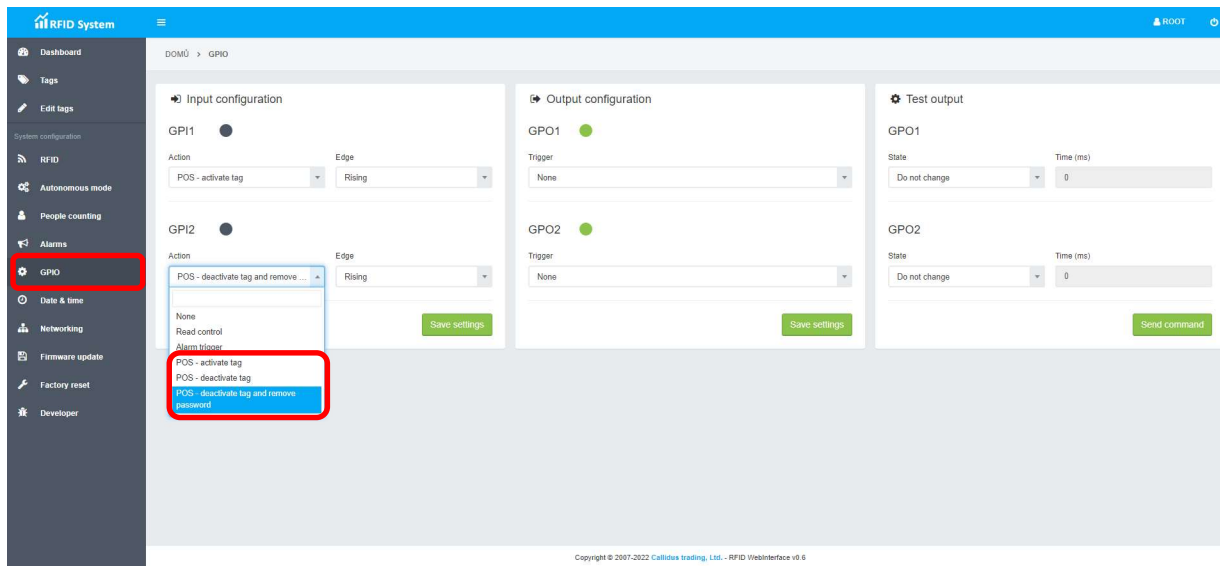


Figure 3 The Buttons settings are located in "GPIO" tab

It is possible to choose from these actions:

- POS – activate tag - activates all GEN2 tags in range by writing alarm sequence (specified in the POS settings) to the EPC bank and then locks the bank with a password against further unauthorized overwriting
- POS – deactivate tag - deactivates all GEN2 tags in range by writing NON-alarm sequence (specified in the POS settings) to the EPC bank and then locks the bank with a password against further unauthorized overwriting
- POS – deactivate tag and remove password - deactivates all GEN2 tags in range by writing NON-alarm sequence (specified in the POS settings) to the EPC bank, access password will be reset to zeros and locks will NOT be applied. This is default setting for deactivation.

6.5 POS settings

These settings are used to create two algorithms, which will be used for activation (alarm) sequence and deactivation (non-alarm) sequence. Those sequences will be written to the EPC bank in GEN2 tags.

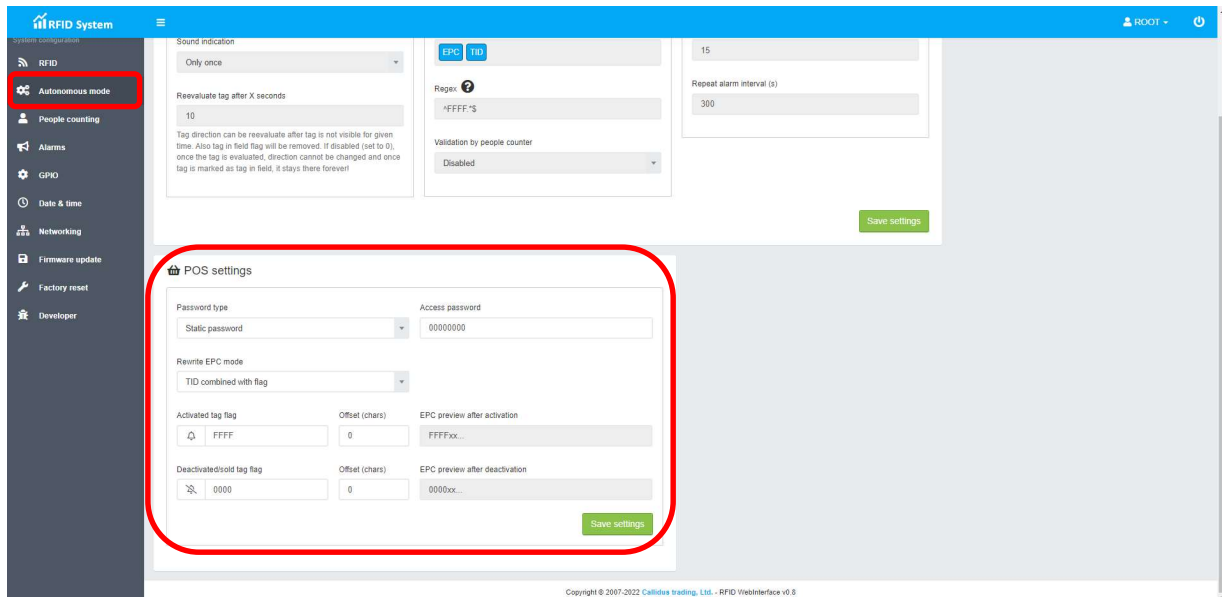


Figure 4 The POS settings are located in "Autonomous mode" tab

It is possible to set these parameters.

Password type:



NOTE: Access password is a 32-bit value stored in Reserved memory bank in GEN2 tag. If non zero value is used and lock for memory bank is activated then it is not possible perform writing to EPC or USER bank, and reading/writing to Reserved bank GEN2 tag without knowledge of this password.

- No password - no password will be used when reading and writing from/to the GEN2 tag, this configuration is not secure and not recommended
- Static password - when reading and writing from/to the all GEN2 tags same password will be used, password is specified as "Access password" parameter
- Dynamic password - for each GEN2 tag will be used unique internally generated password

Activated tag flag: content to be inserted when the "Activation" button is pressed

Deactivated tag flag: content to be inserted when the "Deactivation" button is pressed

Offset: determines the insert position for "Activated tag flag" or "Deactivated tag flag" content

If it is positive or zero, the content of "Tag flag" will be inserted at the beginning of new EPC ID shifted by this value to the right side.

If it is negative, the content of "Tag flag" will be inserted to the end of new EPC ID shifted by this value to the left side.

Rewrite EPC mode: defines how the new content of EPC bank will be created

- TID combined with flag - new EPC ID will be created by copying the current content of the TID and then pasting the content of the "Tag flag" into the position specified by the value "Offset".
If the offset is zero, then "Tag flag" will be inserted at the beginning of the new EPC ID. If the offset is positive, then "Tag flag" will be shifted to the right from the start by "Offset" value.
If the offset is negative, then "Tag flag" will be inserted to the end of the new EPC ID and shifted to the left from the end by "Offset" value. The new EPC ID will be written instead of the current EPC ID.

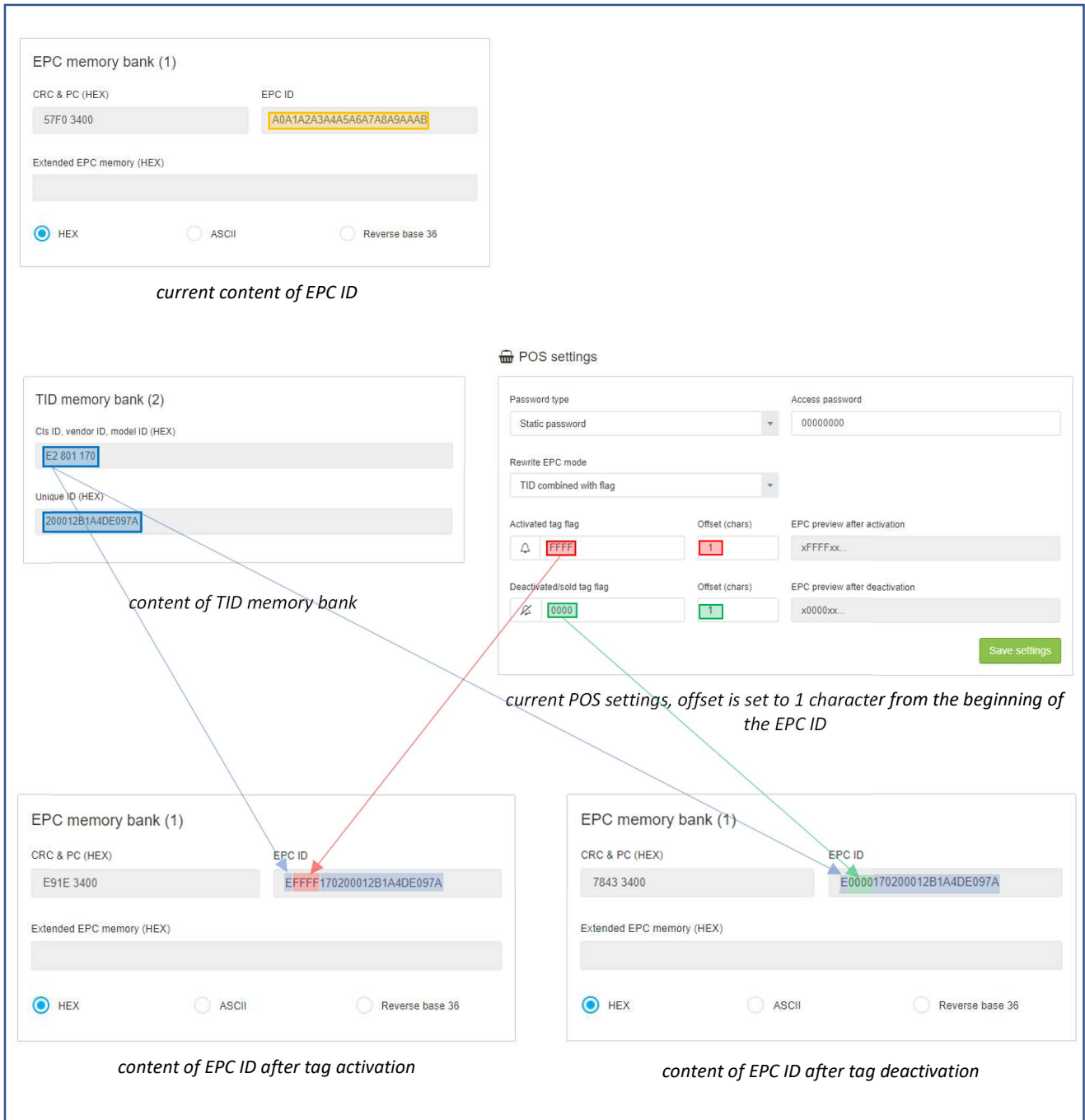


Figure 5 Principle of content creation for new EPC ID with "TID combined with flag" settings

- EPC combined with flag – new EPC ID will be created by copying the current contents of the EPC ID and then pasting the contents of the "Tag flag" into the position specified by the value "Offset".
Offset has the same meaning as before in case of "TID combined with flag".
If offset will be bigger than length of actual EPC, then writing will fail. The new EPC ID will be written instead of the current EPC ID.

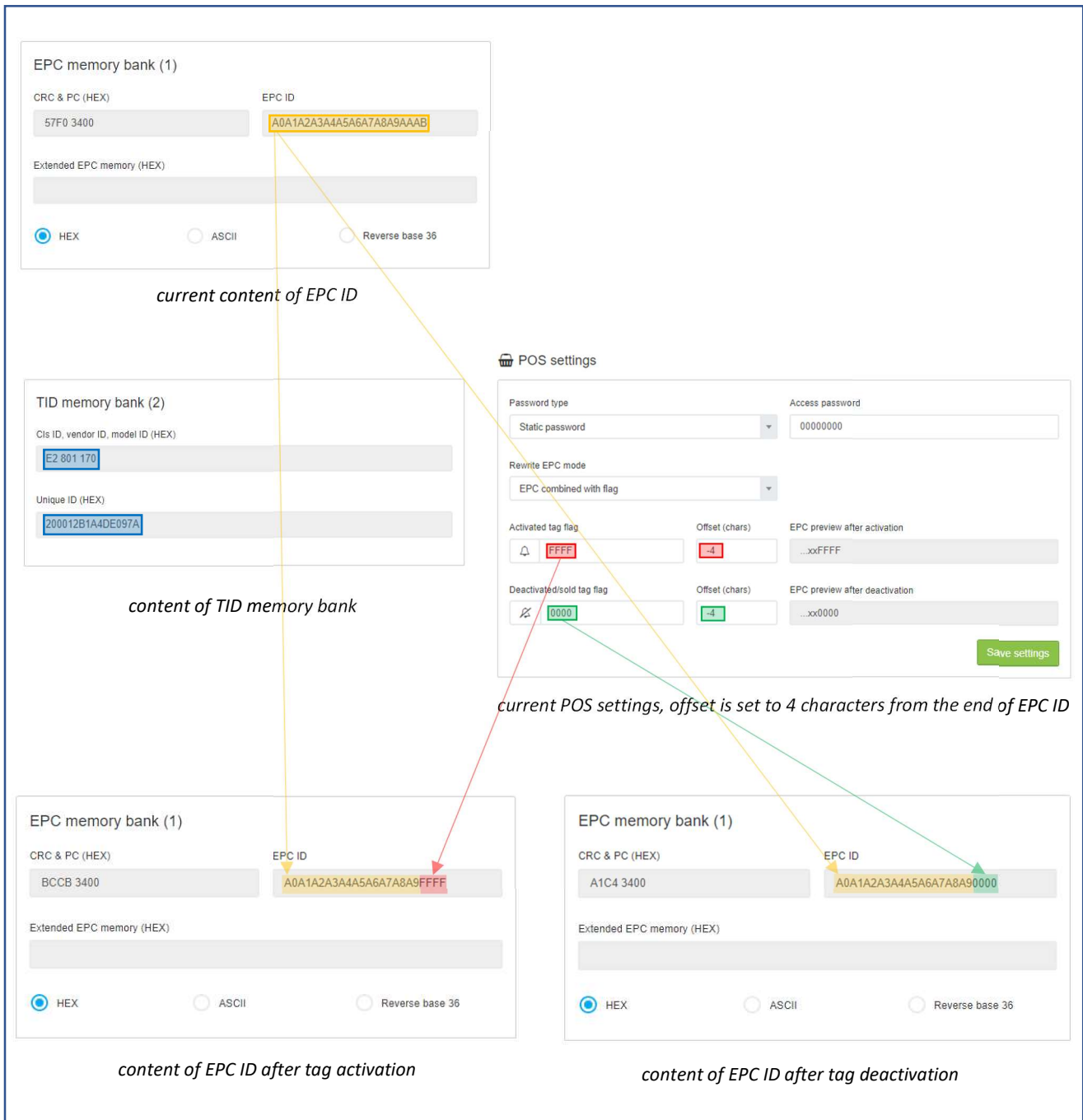


Figure 6 Principle of content creation for new EPC ID with "EPC combined with flag" setting

- Only flag at specific location - the content of the "Tag flag" will be written to EPC memory bank to start position of EPC ID depending on "Offset" value. Content of the flag in this mode has to have full words (multiple of 4 hexadecimal characters, e.g. FFAAFFAA). If the offset is zero, then "Tag flag" will be inserted at the beginning of the new EPC ID. If the offset is positive, then "Tag flag" will be shifted to the right from the start by "Offset" value, but offset has to be a multiple of 4 (valid values: 0, 4, 8, 12, ...). Negative offset is not allowed in this setting. This setting allows writing the contents of the "tag flag" in any valid position of the EPC bank, with the exception of the position for CRC and PC.

EPC memory bank (1)

CRC & PC (HEX): 57F0 3400

EPC ID: A0A1A2A3A4A5A6A7A8A9AAAB

Extended EPC memory (HEX):

HEX ASCII Reverse base 36

current content of EPC ID

TID memory bank (2)

Cis ID, vendor ID, model ID (HEX): E2 801 170

Unique ID (HEX): 200012B1A4DE097A

content of TID memory bank

POS settings

Password type: Static password, Access password: 00000000

Rewrite EPC mode: Only flag at specific location

Activated tag flag: FFFF, Offset (chars): 24, EPC preview after activation: xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxXXXXxx...

Deactivated/sold tag flag: 0000, Offset (chars): 24, EPC preview after deactivation: xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx0000xx...

Save settings

current POS settings, offset is set to 24 characters from the beginning of the EPC ID

EPC memory bank (1)

CRC & PC (HEX): 57F0 3400

EPC ID: A0A1A2A3A4A5A6A7A8A9AAAB

Extended EPC memory (HEX):

HEX ASCII Reverse base 36

EPC ID after tag activation stays the same

EPC memory bank (1)

CRC & PC (HEX): 57F0 3400

EPC ID: A0A1A2A3A4A5A6A7A8A9AAAB

Extended EPC memory (HEX):

HEX ASCII Reverse base 36

EPC ID after tag deactivation stays the same

Inspector

Showing tag: EPC ID = A0A1A2A3A4A5A6A7A8A9AAAB

Memory bank: EPC, Offset (words): 0, Length (words): 10

00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F	0123456789ABCDEF
00000000 57 F0 34 00 A0 A1 A2 A3 A4 A5 A6 A7 A8 A9 AA AB	W04: {E#} \$@#
00000010 FF FF AE AF	yy*

content of EPC ID remains same, the activation flag is inserted after EPC ID area

Tags action

Showing tag: EPC ID = A0A1A2A3A4A5A6A7A8A9AAAB

Memory bank: EPC, Offset (words): 0, Length (words): 10

00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F	0123456789ABCDEF
00000000 57 F0 34 00 A0 A1 A2 A3 A4 A5 A6 A7 A8 A9 AA AB	W04: {E#} \$@#
00000010 00 00 AE AF	..*

content of EPC ID remains same, the deactivation flag is inserted after EPC ID area

Figure 7 Principle of content creation for new value in EPC bank when setting is "Only flag at specific location"

Table 2 examples of creation content EPC bank according to setting "Rewrite EPC mode" and "Offset"

Tag flag	Current TID	Current EPC ID	Current value in EPC bank (EPC ID area and area after the EPC ID)
FFFF	A0A1A2A3A4A5A6A7A8A9AAAB	B0B1B2B3B4B5B6B7B8B9BABB	C0C1C2C3C4C5C6C7C8C9CACB ... CCDCCECF

Rewrite EPC mode	TID combined with flag	EPC combined with flag	Only flag at specific location
Offset	New EPC ID	New EPC ID	New value in EPC bank
0	FFFFA2A3A4A5A6A7A8A9AAAB	FFFFB2B3B4B5B6B7B8B9BABB	FFFFC2C3C4C5C6C7C8C9CACB ... CCDCCECF
3	A0AFFFF3A4A5A6A7A8A9AAAB	B0BFFFF3B4B5B6B7B8B9BABB	Offset has to be a multiple of 4 in this mode. Data in EPC bank will be unchanged.
8	A0A1A2A3FFFFA6A7A8A9AAAB	B0B1B2B3FFFFB6B7B8B9BABB	C0C1C2C3FFFFC6C7C8C9CACB ... CCDCCECF
24	Offset is out of bounds. EPC ID will be unchanged.	Offset is out of bounds. EPC ID will be unchanged.	C0C1C2C3C4C5C6C7C8C9CACB ... FFFFCECF
-3	Flag length is bigger than offset. EPC ID will be unchanged.	Flag length is bigger than offset EPC ID will be unchanged.	Negative offset is not possible in this mode. Data in EPC bank will be unchanged.
-5	A0A1A2A3A4A5A6A7A8AFFFFB	B0B1B2B3B4B5B6B7B8BFFFFB	Negative offset is not possible in this mode. Data in EPC bank will be unchanged.
-16	A0A1A2A3FFFFA6A7A8A9AAAB	B0B1B2B3FFFFB6B7B8B9BABB	Negative offset is not possible in this mode. Data in EPC bank will be unchanged.

6.5 Read and write power settings

The setting of the read and write power values has a fundamental effect on the maximum distance at which the data in the tag can be edited. This setting must be chosen as a compromise between maximal data editing reliability and limiting the maximum distance above, where editing tags is no longer desired.



NOTE: Default values are set 20dB for reading and 23dBm for writing. This setting appears as optimal for reliable editing at distance up to 30cm and at the same time labels at a distance greater than approx. 120cm are not visible.

If you need to increase the editing distance, it is possible to increase the reading and writing power and vice versa. For reliable writing into the tag, it is advisable to follow the principle of setting the writing power by approximately 3dBm greater than the reading power.

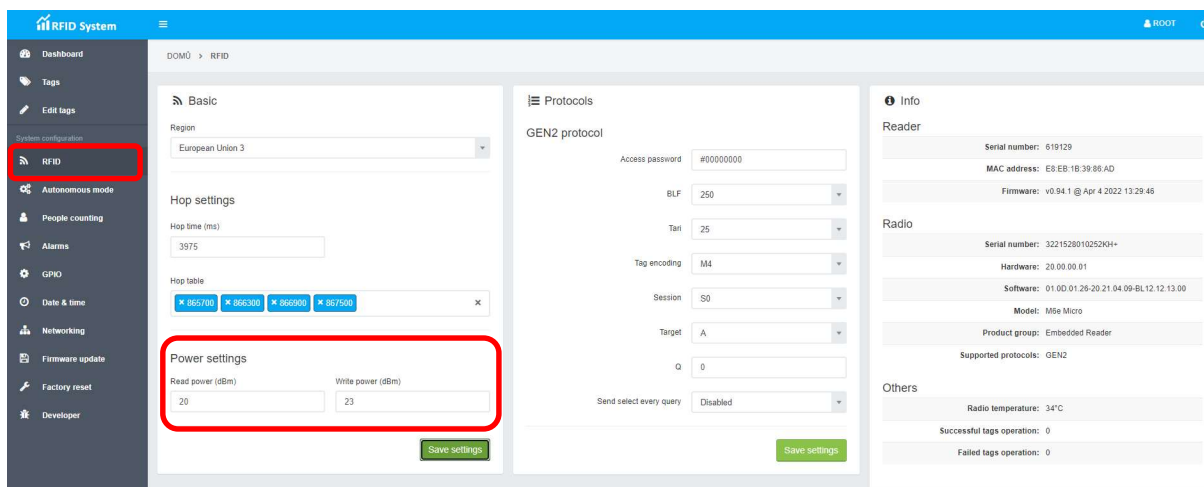


Figure 8 Read and write power settings are located in "RFID" tab

