TECHNICAL INFORMATION

RFU Parameter Description

SICK
Sensor Intelligence.

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Legal notes

Original document

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Contents

1 About this document 6
2 Setting up SOPAS ET for RFU6xx 7
3 Quickstart 9
3.1 Quickstart 9
3.1.1 Transponder List 10
4 Tag access 12
4.1 Password Management and Tag Locking 12
4.1.1 Password Management 12
4.1.2 Lock Tag 13
4.2 Memory Bank 10 – TID 13
4.3 Memory Bank 01 – UII/EPC 14
4.3.1 UII 14
4.3.2 URI 15
4.3.3 CRC 15
4.3.4 PC 16
4.3.5 UII Length 16
4.3.6 UMI 16
4.3.7 ISO/EPC 17
4.3.8 AFI 17
4.3.9 EPC table 18
4.3.10 Write UII 19
4.4 Memory Bank 11 – User Memory 19
5 Parameters 20
5.1 General 20
5.2 Here I am 20
6 Antenna Configuration 21
6.1 Advanced Power Control Mode 21
6.2 Antenna detection 22
6.3 Antenna (internal and external) 22
6.3.1 Transmitting power 22
6.3.2 Antenna Gain and Cable Loss 23
6.3.3 Dwell-time and rounds 23
6.3.4 Priority 24
6.3.5 Minimum APC Transmitting Power and APC Power Range 25

7 Performance Optimization 26
7.1 Link Profile 26
7.2 Inventory Algorithm 26
7.2.1 Inventory Algorithm: Fix Q 27
7.2.2 Inventory Algorithm: Dynamic Q 28
8 Data Preprocessing 29
8.1 RSSI Filter 29
8.2 Relative RSSI Filter 29
8.3 Adaptive transponder suppression and Transponder monitoring 30
8.4 Filter Diagnostics 31
9 Transponder Processing 33
9.1 Read Verification following Write command 33
9.2 Passwords 33
9.3 Transponder Processing 34
10 Frequency Channel Configuration 36
11 Tag Select 37
11.1 General 37
11.2 Select-Form 37
12 Object trigger control 39
12.1 Inventory control 39
12.1.1 Free-run and Inventory Delay 39
12.1.2 Sync Mode 39
12.1.3 Start/Stop of Object Trigger 40
12.1.4 Trigger delay 40
12.1.5 Start by 41
12.1.6 Stop by 42
12.1.7 Start Delay/Stop Delay 43
12.1.8 Reading gate open/Reading gate closed 43
12.2 Trigger Distribution 43
13 Increment Configuration 45
13.1 Increment 45
14 Real Time Data Processing 47
15 Output Control 49
16 Evaluation Conditions 50
16.1 Good Read Conditions 50

16.2 Evaluation Condition 50
17 Output Format 52
17.1 Output Format 1 and 2 52
17.2 Heartbeat format 53
18 Filters/Sorters for Output Format 54
19 Application Counters 55
20 Log File Diagnosis Settings 56
20.1 General log settings 56
20.1.1 Log Aspect 56
20.1.2 Ring memory 56
20.2 Data source 56
20.3 Save Destination 56
20.4 File Path 57
20.5 File Format 58
20.6 Stored Log Files 58

1 About this document

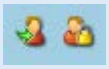
Purpose of this document

This document is intended to support users in configuring applications of the RFU6xx using the SOPAS Engineering Tool (SOPAS ET). To this end, the UHF RFID-specific parameters of all RFU6xx device variants are explained up to the `Service` user level.

The structure of the document follows the graphical user interface (GUI) of SOPAS ET. This is intended to enable users to find specific information on individual parameters.

Note:

The parameters visible on the SOPAS GUI depend on the device variant as well as the user level.



Users can log in to the various user levels using the icons shown in the upper menu bar in SOPAS ET device window.

More information is available in the basic documentation of the SOPAS Engineering Tool.

Target group

The present document is aimed at users of SOPAS Engineering Tool who require technology-specific support when configuring UHF-RFID applications.

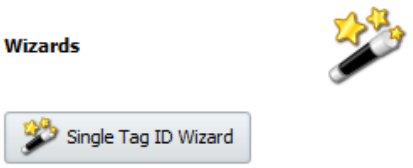
More sources of information

The SOPAS ET manual contains basic information about the structure and functions of the Engineering Tool. In SOPAS ET it can be accessed in the **Help** menu.

The RFU6xx telegram list contains the commands and device responses most frequently used during normal operation. Publication available on request.

The operating instructions cover the basic functions for using the device (commissioning, mounting, installation, operation, maintenance). Download here www.sick.com/[productfamily], e.g. www.sick.com/RFU63x.

Commissioning with the setup wizard



Alternatively to adjusting the individual SOPAS Engineering Tool parameters, a device configuration setup wizard is also available; it's located at the lower left of the SOPAS GUI. The wizard guides users through the setup process by displaying appropriate instructions; after working through the steps, the basic device parameters will be configured.

This allows for optimal device configuration for less complex applications, even with little prior knowledge.

2 Setting up SOPAS ET for RFU6xx

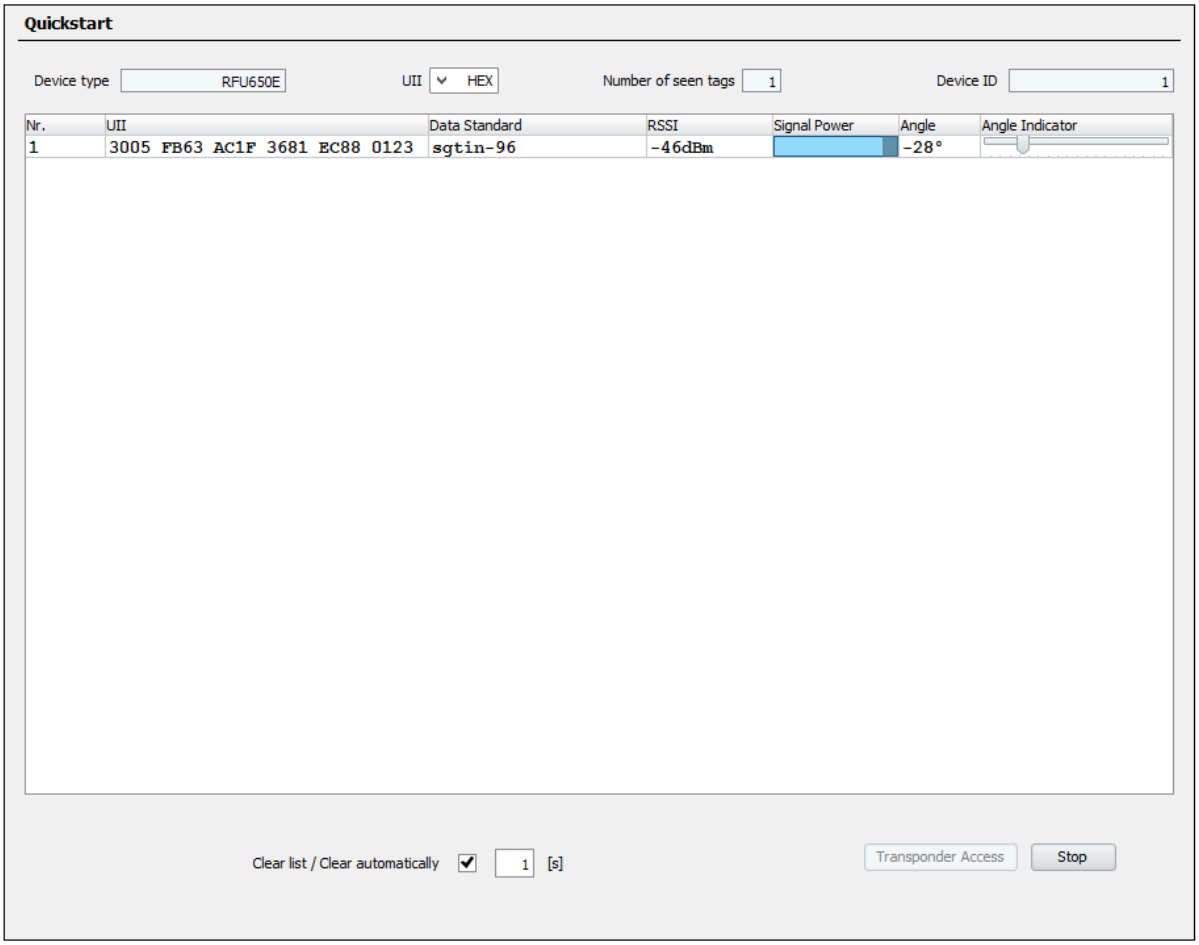
The following table explains the individual tabs on the SOPAS interface and describes their function for configuring the RFU6xx device.

Chapter no.	Tab name	What it does
3	Quickstart	The Quickstart displays all transponders within the scanning range of the read/write device, based on current device settings. Users can then review these settings.
4	Transponder access	Through transponder data visualization and adjustment options, Transponder Access serves to identify, validate and simulate the data structures of the application.
5	Parameters	The Parameters tab is used to configure basic device settings, e.g., setting up password protection to prevent unauthorized device access.
6	Antenna Configuration	The Antenna Configuration tab is used to manage the antenna-specific device parameters, e.g., transmitting power, which determines the scanning range for reading and describing the transponders.
7	Performance Optimization	The Performance Optimization tab is used to optimize communication speed on the air interface. Since the standard device settings are sufficient for most applications, it's not recommended that anyone other than experienced users configure these parameters.
8	Data Preprocessing	The Data Preprocessing tab is used to make the read/write device preprocess read results. Changing appropriate settings here prevents unexpected transponders in the background from appearing in the read results; moreover, it can be ensured that a transponder outputs just once when a read-point is passed.
9	Transponder Processing	The Transponder Processing tab contains settings for defining how the device handles transponder data. This makes it possible to set which memory sectors should be set up aside from UII and whether additional information should be written to the transponder.
10	Frequency Channel Configuration	The Frequency Channel Configuration tab is for the user's information only. The various frequency channels are assigned by the respective regional telecommunication authorities and cannot be adjusted by the user.
11	Tag Select	The Tag Select tab allows the device to communicate with the desired transponders in the scanning range. The UII request can be accelerated by having data transmitted only by certain transponders. Also when a write command is issued, settings here prevent data from undesired transponders from being overwritten.
12	Object Trigger Control	The Object Trigger Control tab is used to configure the opening and closing of reading gates.

Chapter no.	Tab name	What it does
13	Increment Configuration	The Increment Configuration tab allows the device to determine path distances, such as for conveyor system operation. These path distances can be used to set up triggers and output times.
14	Real Time Data Processing	The Real Time Data Processing tab makes it possible to configure passage events including the direction for transponders on a device with transponder angle detection.
15	Output Control	The Output Control tab is used to define the time at which the data is output by the device to the host.
16	Evaluation Conditions	The Evaluation Conditions tab is used to define certain “events” that trigger an action. These conditions can be used to define a successful read (**GoodRead**) or a digital output can be activated upon occurrence of an event.
17	Output Format	The Output Format tab is used to define the data strings output via the various device interfaces. This includes transponder data content, for example, but also read information used for diagnostic purposes.
18	Filters/Sorters for Output Format	The Filters/Sorters for Output Format tab is used to structure the output based on the defined output format in order to simplify processing by the host.
19	Application Counters	The Application Counters tab is used to derive the absolute frequency of occurrence for certain events. This data can be used for diagnostic and application optimization purposes.
20	Log File Diagnostics Settings	The Log File Diagnostics Settings tab is used to record (on the device) data transmission that occurs via the device interfaces. This data can then be used for diagnostic purposes.

3 Quickstart

3.1 Quickstart



Transponder List in the Quickstart group displays all compatible transponders within the scanning range of the RFID read/write device. Transponder search is started and stopped with the **Start / Stop** command.

Please note that Quickstart is not an operational mode and should be ended once device configuration is complete. The conditions for starting and ending reading gates in operational mode are configured in the Object Trigger Control tab. The transponders read via the Object Trigger Control settings are displayed in the Quickstart.

Note:

Quickstart is performed on the basis of all configured device parameters. The parameter settings for Transmitting Power as well as filtration and selection of transponders (Data Preprocessing / Transponder Processing) are used in this mode. If expected transponders not displayed in the Transponder List, it's recommended to review these settings.

Write commands activated in the Transponder Processing area are also executed during Quickstart.

Aside from the Transponder List the following additional control elements are found in the Quickstart parameter group:

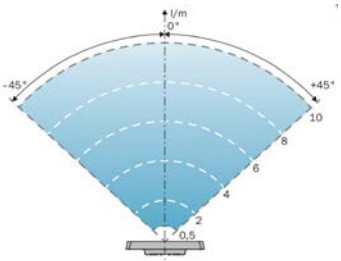
Device type	Displays the type of read/write device used
UII	Enables definition of the UII output format in the Transponder List to **HEX** or **ASCII**.

Number of tags viewed	Displays the number of transponders in the Transponder List .
Device ID	Displays the device ID of the RFID read/write device. This is required to operate the device in a CAN network and can be changed in the **Network/Interfaces/IOs** tab.
Delete/Automatically Delete List	Shows transponders in the Transponder List once they are no longer detected by the RFID read/write device within the set time interval.
Start/Stop	This command starts or ends the transponder search in Quickstart. Executing the **Start** command displays all compatible transponders in the Transponder List according to the device settings.
Transponder Access	This command opens the Tag Access tab. The desired transponder must be selected in the Transponder List beforehand. Prerequisites: 1. Quickstart is stopped using the **Stop** command. 2. The transponder is within the scanning range of the RFID read/write device. 3a. The **Device Access Password** corresponds to the **Tag Access Password**. 3b. The **Device Access Password** is not activated. (I.e. the **Device Access Password** is **0000 0000**). The Tag Access tab makes it possible to access all user-related memory sectors in the transponder.

3.1.1 Transponder List

The Transponder List summarizes the transponders in the scanning range along with important reading indicator values. These can be used to review the application. The following information is displayed:

Nr. (No.)	Assigns a unique number from 1 to N to the transponders detected in the field.
UII	The UII (Unique Item Identifier) is a transponder's unique identification number. It is the only transponder content displayed in Quickstart. The UII can be assigned by the user in the Tag Access tab.
Data Standard	If the UII is defined according to the EPC data standard, the respectively used EPC scheme is displayed. (e.g., **sgtin-96** or **sgln-96**) Otherwise **Non-EPCglobal** is displayed.
RSSI	Displays the current RSSI value (Received Signal Strength Indicator) in [dBm]. The RSSI value represents the signal strength received by the RFID read/write device from the respective transponder.
Signal strength	The RSSI value is visualized in this column as a dynamic bar diagram.

Angles	Displays the angle between the perpendicular on the read/write device and the transponder. The prefixes of the value correspond to the designation on the device.  This value is only displayed by units in the **RFU650 device family** capable of detecting and outputting the transponder angle.
Angle Indicator	The value of the angle between the transponder and read/write device is visualized in this column as a movable slider. This value is only displayed by units in the **RFU650 device family** capable of detecting and outputting the transponder angle.

4 Tag access

The Tag Access tab is used to adjust the various memory sectors of the transponder.

The data structures of the application can be identified, verified and simulated in this tab. The Transponder Processing tab is used to define commands for reading and writing to the memory sectors during normal operation.

The memory sectors are displayed in the Tag Access tab:

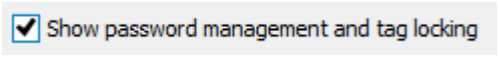
Memory sectors according to ISO 18000-6C	
Memory Bank 00 – Reserved	• Access Password • Kill Password
Memory Bank 01 – USER	• Cyclic Redundancy Check (CRC) • Protocol Control (PC) • Unique Item Identifier (UII)
Memory Bank 10 – TID	• Transponder Identification Number (TID)
Memory Bank 11 – USER	• User-defined data content

Note:

Only the UII, TID and Reserved are provided for according to ISO 18000-6C. The User Memory is optional and is determined based on the IC type used. The size of the preset memory sectors also varies by IC. Consult the data sheet for the respective transponder or IC for this data.

For detailed information on the structure and use of the memory sectors, consult ISO standard 18000-6C or in agreement the “EPC UHF Gen2 Air Interface Protocol” of GS1.

4.1 Password Management and Tag Locking



This sector is only shown when the **Display Password Management and Tag Locking** checkbox is activated. It consists of Password Management and Tag Locking. Password Management is used to set the **Tag Access Password** and **Tag Kill Password** (to deactivate the transponder). Tag Locking is used to set which memory sectors are password protected.

The use of passwords is recommended to regulate and monitor access to transponder data and functionality.

4.1.1 Password Management

For the **Tag Access Password** and **Tag Kill Password** of the transponder, use the command **Get** to output and the command **Set** to set to the value entered.

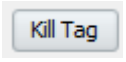
The**Tag Access Password** protects the content on the transponder (UII & user memory) from willful and unintended manipulation. In order to get full access to a transponder, the **device access password** (Passwords in the Transponder Processing) tab must correspond to the **Tag Access Password**.

The **Tag Kill Password** enables permanent deactivation of a transponder. To permanently deactivate a transponder, a tag kill password must be set beforehand.

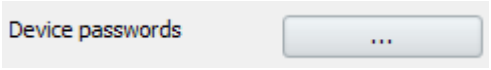
Note:

The**Tag Access Password** and the **Tag Kill Password** are each composed of 8 hex characters.

Default: 0000 0000

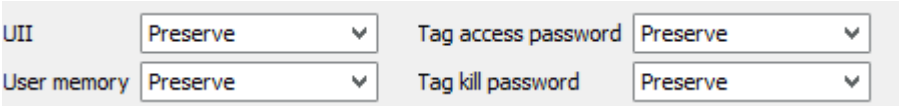


To deactivate the transponders, use the command **Kill tag (Kill)**. This cannot be undone. Afterwards it will not be possible to read data or write new data to the transponder.



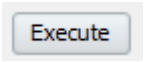
Click the **Device Passwords** link to access the Passwords section in the Transponder Processing tab.

4.1.2 Lock Tag



The Lock Tag group is used to manage the access rights for the various transponder memory sectors (**UII**, **User memory**, **Tag Password**, **Tag Kill Password**).

- **Undo** retains the prior settings for the memory sector.
- **Unlock** cancels password protection for the memory sector. The data content can then be changed without the **device access password** (Passwords).
- **Lock** initiates password protection. The memory sector can only be changed by the RFID read/write device if the **device access password** (Passwords) matches the **Tag Access Password**.
- **Permanent Unlock** permanently cancels password protection for the memory sector. The data content can then be changed without the **device access password** (Passwords).
- **Permanent Lock** prevents additional write access to the data content of the memory sector. The memory sector can no longer be changed.



The **Run** command is used to set these new access rights according to the selected transponder settings.

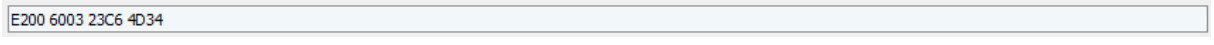
4.2 Memory Bank 10 – TID

Memory Bank 10 – TID contains the globally unique transponder identification number (TID).

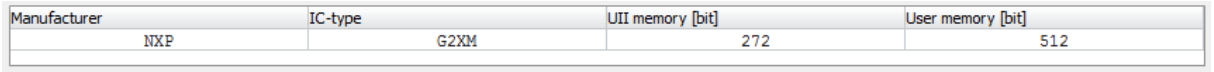
This is assigned by the manufacturer during production of the integrated circuits (ICs) and basically consists of the manufacturer ID number, the type of IC and a serial number. This numerical area cannot be changed by the user.

Note:

Depending on the type of IC, it is possible to program part of an additional part of the TID. This cannot be done via Tag access , however can be done using Transponder Processing.



The TID is displayed in HEX format.



Manufacturer	IC-type	UII memory [bit]	User memory [bit]
NXP	G2XM	272	512

Essential data derived from the TID are displayed in a table. These are as follows: the IC **manufacturer** and **IC type** as well as the size of the **UII memory** and **user memory**.

The TID is for the user's information only. It can be used for filtering purposes and to select transponders (Tag Select) and enables unique tracking in the event of quality defects.

Note:

The TIDs assigned are updated with each new firmware version. If the text "unknown" is displayed in the table, the transponder has not yet been designed for the firmware version being used.

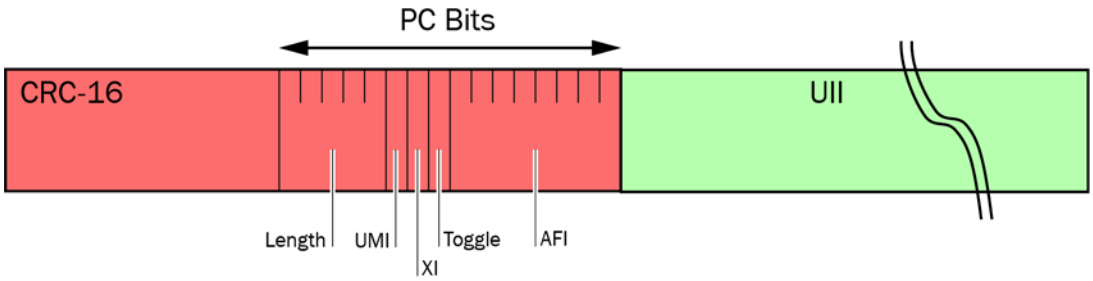
4.3 Memory Bank 01 – UII/EPC

Memory Bank 01 – UII/EPC enables global identification of the object labeled by the transponder. It consists of the following elements:

- UII (also EPC = Electronic Product Code): this is the unique identification number of a specific object. It can be freely assigned by the user. (taking data standards into account, if necessary)

The CRC (Cyclic Redundancy Check) verifies (confirms), whether the content of the UII was correctly transmitted from the transponder to the read/write device.

- PC Word (Protocol Control): The PC Word provides information about some of the transponder's basic data contents. (Length of the UII and data standard used, existence of user memory) In addition the AFI (Application Family Identifier) is an important filter criterion for displaying the intended purpose of the designed object.



Due to the UII and other filter criteria (PC-Word) the use of Memory Bank 01 plays a central role in implementing an RFID solution into the business processes.

In this regard, a data standard should be taken into account when assigning the UII. This ensures that the assigned number is globally unique within the standard. In particular for open process chains in which transponders are used across systems and companies, this is an important prerequisite for the functionality of the processes.

Note:

The way Memory Bank 01 – UII/EPC is depicted in the SOPAS user interface changes depending on the data standard used. (ISO / EPC)

4.3.1 UII

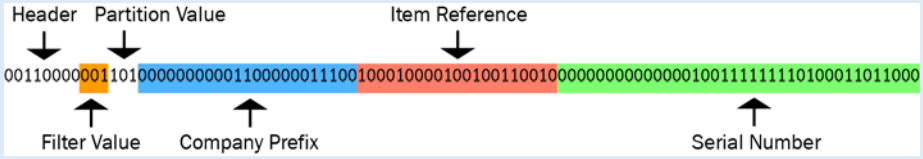
The transponder UII is displayed in the UII input field. The user can change the transponder UII and can write the changes made to the transponder using the command Write UII .

It is recommended to take a data standard into account when defining the transponder UII. This ensures that the assigned number is globally unequivocal within the standard. In particular for open process chains in which transponders are used across systems and companies, this is an important prerequisite for the functionality of the processes.

Note:

Data standards enable the establishment of object types and serialization within this group, and result in the following typical structure of a UII (the number of bits per segment can vary):

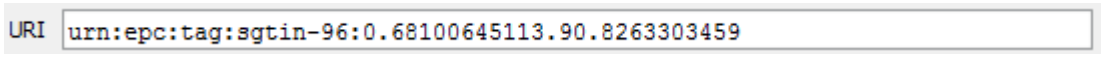
Company Prefix – Item Reference (object type) – serialization



Bit Position indicates the position of the cursor in the "Bit" input field. The UII can be displayed in **HEX**, **BIN**, **ASCII** and **VDA** format:

- **HEX**: display in hexadecimal notation. One character consists of 4 bits.
- **BIN**: display in binary notation.
- **ASCII**: display according to the ASCII character table. One character consists of 8 bits.
- **VDA**: display according to VDA directive series 55XX issued by the German Automotive Association (VDA). data is stored with reduced character strings (6-bit coding) and follow additional rules.

4.3.2 URI



The Unique Resource Identifier (URI, EPC Tag URI) is derived from the UII. The user therefore cannot directly adjust the URI. The window serves display purposes only. The URI displayed consists of the Pure Identity EPC URI, as well as additional information (length of the identifiers in bits and filter value) intended to facilitate data handling.

The Pure Identity EPC URI serves to represent objects in business applications divested of RFID technology.

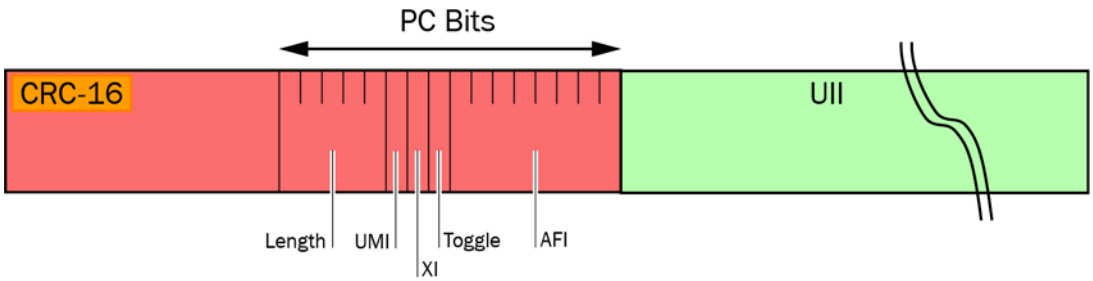
Note:

In order to display a URI that matches the UII, it is necessary to assign a UII according to the EPC data standard.

4.3.3 CRC

The CRC (Cyclic Redundancy Check) is a checksum. It verifies correct transmission of the UII between the transponder and RFID read/write device. In the process the RFID read/write device calculates the CRC from the UII and compares it to the CRC value read by the transponder.

Since the CRC is calculated based on the UII it cannot be adjusted by the user. The CRC value can then be used as a filter in the Tag Select parameter group.



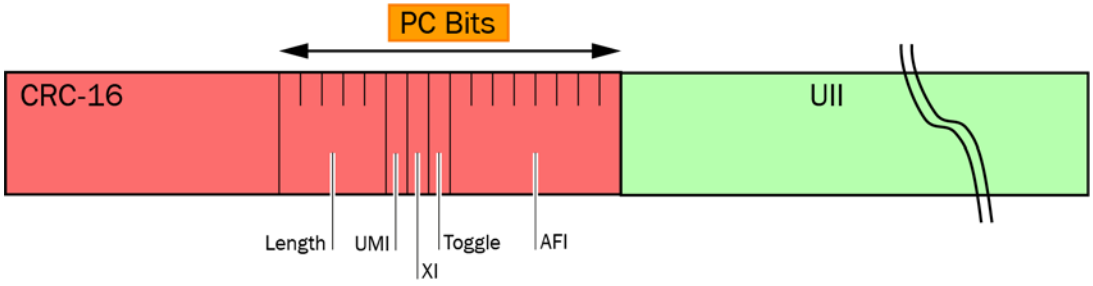
4.3.4 PC

The PC Word (Protocol Control) supports data transmission between the transponder and read/write device by transmitting information about the data content of the transponder. The components of the PC Word can be individually adjusted. It is therefore grayed out and is not a configuration option. It is displayed in HEX format and contains the following data:

Length of the UII (UII Length)

- User Memory Indicator (UMI)
- Extended Protocol Control Indication (XPC)
- Toggle-Bit (ISO / EPC)
- Application Family Identifier (AFI)

The PC Word can then be used as a selection criterion in Tag Select.



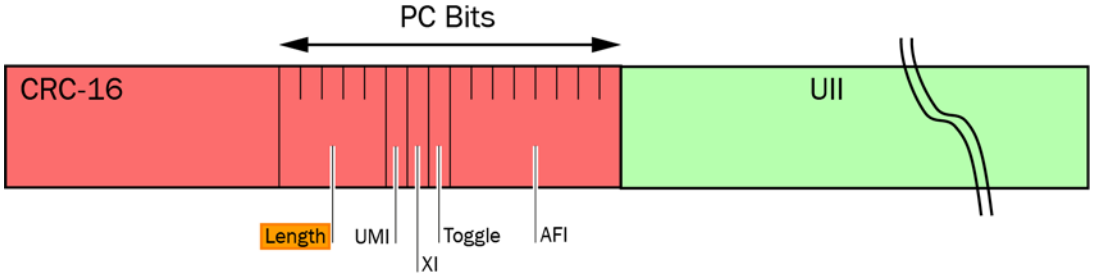
4.3.5 UII Length

In the UII Length field, the number of bits in the UII is displayed. This information is part of the PC Word. It is possible to adjust the length of the UII. The input is in bits and should always be done in 16-bit steps.

The maximum length of the UII is limited by the intended memory capacity of the transponder ICs. This memory capacity can be found in the data sheet for the transponder used and can be displayed via SOPAS in the Memory Bank 10 – TID table.

Note:

If a data standard is used, a certain number of bits is usually preset for the UII Length. For example, an sgtin-96 consists of 96 bits, while a sgtin-192 has 192 bits.



4.3.6 UMI

The UMI (User Memory Indicator) represents an individual bit of the PC Word. It provides information on the existence and content of Memory Bank 11 - User Memory. The configuration options available to users varies by transponder IC manufacturer.

Three cases can be differentiated:

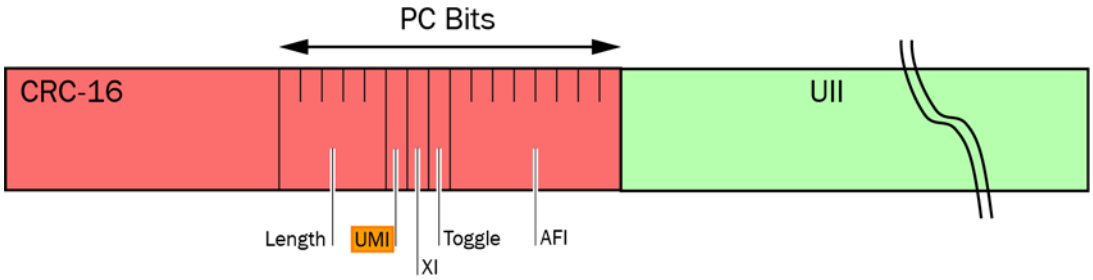
1. The UMI is permanently set by the IC manufacturer during production. (memory bank for User Memory present/not present)

2. The UMI is created automatically once the User Memory is written to.

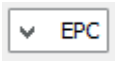
3. The user can freely set the UMI according to the needs of the application.

If the first or second case applies, the checkbox is automatically activated. If an attempt is made to change the UMI, an error message appears. In the third case, the user can activate and deactivate the checkbox as an additional parameter, such as for filtering purposes.

The use of the UMIas a filter value makes it possible to impose restrictions on the reading of User Memory on the transponders whose memory is actually being written. This accelerates the reading process.

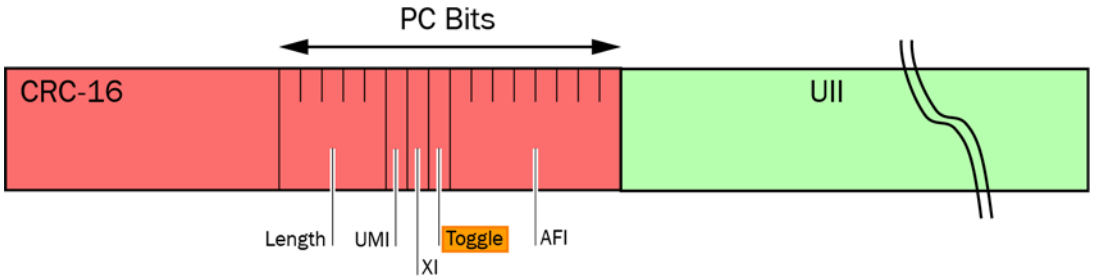


4.3.7 ISO/EPC



The toggle bit is part of the PC Word and specifies the data standard in use. The following applies to the toggle values: **0** = EPC, **1** = ISO. The toggle is set by selecting ISO/EPC . Please note that the toggle bit is not automatically set according to the input in the UII. It must be set manually.

The toggle bit helps to accelerate the reading of a transponder since, depending on the data standard in use, the following 8 bits (18 – 1F) of the PC Word are used differently. The AFI follows for the ISO data standard; for the EPC standard, use has not been established except for one bit (1F – Hazardous Materials).

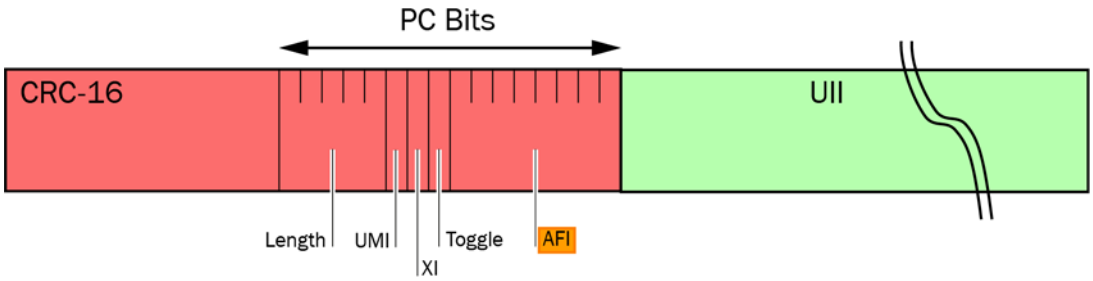


4.3.8 AFI

The AFI (Application Family Identifier) consists of 2 hex characters (8 bits) and applies exclusively under the ISO data standard. It gives information about the type and intended purpose of the detected object and is provided as

a criterion for transponder selection. (cf. Tag Select) The user can enter an Application Family Identifier in this field according to their application.

An AFI makes it possible to differentiate the transponder in a pallet from the transponders in the boxes stacked upon it.



Example of an Application Family Identifier (from VDA directive series 55xx)

AFI	Standard (definition of application)
A1	ISO 17367 – Supply chain applications of RFID – Product tagging
A2	ISO 17365 – Supply chain applications of RFID – Transport unit
A3	ISO 17364 – Supply chain applications of RFID – Returnable transport item
A4	ISO 17367 – Supply chain applications of RFID – Product tagging (HazMat)
A5	ISO 17366 – Supply chain applications of RFID – Product packaging

4.3.9 EPC table

Scheme	sgtin-96
Filter	0
GS1 Company Prefix	68100645113
Indicator, Item ...	90
Serial	8263303459

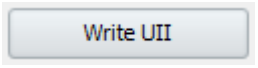
The EPC Table shows the content of the UII under the EPC data standard divided up into its various segments. These are:

Scheme	Depending on the application, the EPC tag data standard makes use of various schemes. For example, the SGTIN (Serialized Global Trade Item Number), SSCC (Serial Shipping Container Code) or GIAI (Global Individual Asset Identifier)
Filters	Various filter options are available in individual EPC schemes. The standard provides 3 bits for each. The significance of the filter values differs from scheme to scheme.
GS1 Company Prefix	This prefix assigns to an organization a numerical range within which it can issue globally unique identification numbers.

Item, Object Class or similar	This enables various object types to be established, which enables classification.
Serial	With serialization, each individual object in a class can be made uniquely identifiable.

This table primarily serves to visualize the contents of the UII. It is used to verify the correctness and structure of the UII.

4.3.10 Write UII



When the command Write UII is executed, all changes made to the UII, if applicable the UMIs and UII Length as well as to the toggle bit (ISO / EPC) and AFI are written to the transponder. The following prerequisites apply:

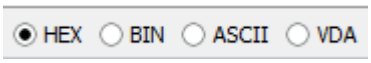
- The transponder is within the scanning range of the RFID read/write device.

The Transmitting Power for writing is sufficient.

- The UII is not password protected or the device password and transponder password are not identical.

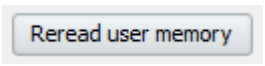
4.4 Memory Bank 11 – User Memory

In the Memory Bank 11 - User Memory group the content of the User Memory can be read and changed.

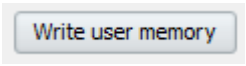


The content can be displayed in HEX, BIN, ASCII or VDA format. If the dual editor is used, two different formats can be displayed simultaneously.

The **Start address** and **End preset** (each in 16-bit steps) make it part to define a certain part of the User Memory that is to be read and displayed. Displaying the **Bit Position** facilitates navigation within the editor. **Bit Position 0** relates to the first bit shown in each case.



The command **Reread** allows the User Memory to be read again, e.g., if an error occurred during the first read operation.



Changes made to the User Memory can be saved on the transponder using the command **Write content** . The following prerequisites apply:

- The User Memory is not password protected or the device password and transponder password are not identical.
- The transponder is within the scanning range of the RFID read/write device.

The Transmitting Power for writing is sufficient.

The User Memory can be used for decentralized data provision in processes. For example, work steps, whether already done or yet to be done, can be saved directly to the object on the transponder. This allows object-specific information to be called up and saved at read points without a network connection.

Note:

Not all transponders have a user memory. In this case, the section is grayed out.

5 Parameters

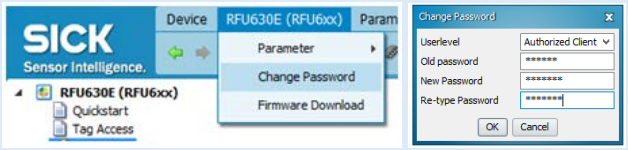
5.1 General

Parametrization is guarded by password ☐

When the parameter **Parameters password-protected** is activated, you must log into the device at the user level Authorized Customer or higher in order to configure any parameters. You can use the SOPAS options (which are located outside of the device configuration) without logging in. Password protection is activated the next time the device is restarted.

Password protection ensures that only authorized users can modify device parameters. This prevents incorrect settings from being made.

Note:



The device passwords for the various user levels can be changed by the user.

5.2 Here I am

The Here I am parameter group enables the position of a reader to be determined by software command.

Light ☑ Beeper ☑

Check buttons are used to select the desired signal type. The **FB Light** option makes the read/write device identifiable via an optical signal (the LEDs light up). The **Beeper** option makes the read/write device identify itself via an acoustic signal. **Beeper** is not available for all RFU family-devices.

Find me

Executing the **Find me** option makes the read/write device identify itself via the selected signal type.

This parameter group provides support for determining, among a plurality of read/write devices in a customer installation, which device is currently connected.

6 Antenna Configuration

The Antenna Configuration tab is used to manage the antenna-specific device parameters for all antennas of the read/write device. Depending on the type of device, these can be integrated or external antennas.

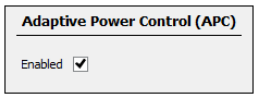
The real transmitted power is always set as the Transmitting Power. For external antennas, the device requires the input of cable loss and antenna gain, which are evident from the data sheet for the connected components, in order to calculate the power settings in the device.

6.1 Advanced Power Control Mode

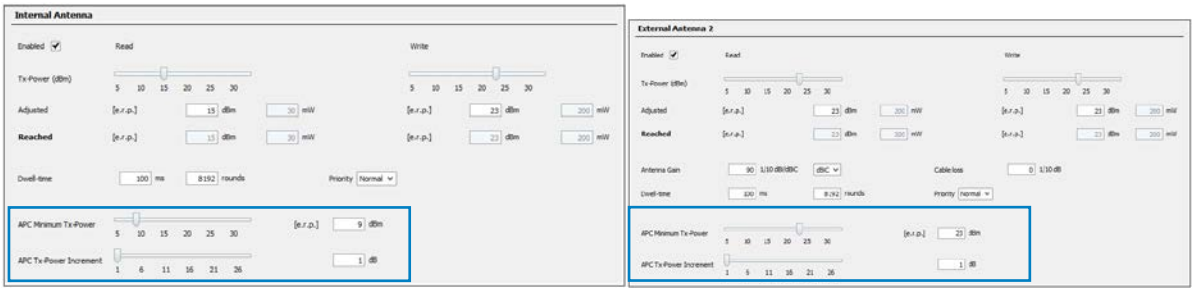
When Advanced Power Control Mode (APC), is activated, the read/write device does not immediately start operating at the set Transmitting Power, but rather increases it incrementally.

This makes it possible, during each read procedure, to only transmit at the power actually required to reliably detect the desired transponder. For statistical applications, this is intended to prevent transponders in the “background” that should not be read from being included due to excess transponder range. The use of APC mode is not recommended in dynamic applications.

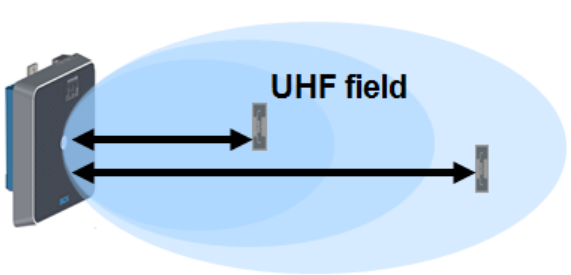
By recording the RSSI values for the reads via Output format, data can be determined for analysis and quality control of transponders.

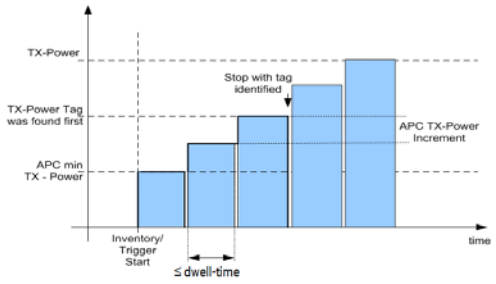


Advanced Power Control Mode is activated using a checkbox. All other settings are made in the Antennas (Internal and External) parameter group.



The device starts the read process based on the **minimum APC Transmitting Power** (APC min TX-Power) and raises it incrementally to the **APC Power Range** (APC TX-Power Increment). The maximum value transmitted in APC mode is the set Transmitting Power of the antennas for **Read** operations. If the trigger-stop condition equals **Good Read**, the process is ended at the transmitting power at which a transponder could be read.





Note:

The time interval in which the Transmitting Power is adjusted is defined via the Dwell-time and rounds parameters. The maximum time interval before increasing the transmitting power corresponds to the value entered for the **Dwell-time** parameter.

If Advanced Power Control Mode is used to prevent unexpected transmitters from being read, the **Minimum APC transmitting power** should be set to the power required for a typical transponder. It's recommended to set the **APC Power Range** low enough that it is not possible for the target transponder and an undesired transponder to be read on a single power level.

If the expected distance between the target transponder and the undesired transponder is low, a low APC power range should be set to ensure successful selection. However a low APC power range results in longer read times if a significantly higher value than the set **minimum APC transmitting power** is required for reading.

6.2 Antenna detection

The **Feedback Threshold** allows the user to set the intensity at which interference detected at the antenna port causes a warning to be output in **System Status**. This parameter does not directly affect device function, but rather supports the resolution of system errors.

A warning indicates the following potential impairments of the installation: antenna cable and antenna port not screwed in correctly; antenna cable defects; external antenna defects. Moreover, reflections from metallic objects can cause interference at the antenna port.

The following levels can be established at which a warning occurs in **System Status**:

- **Sensitive**: A warning is output even with low interference at the antenna port. This setting is generally recommended.
- **Moderate**: A warning is output with moderate interference at the antenna port.
- **Robust**: A warning is only output with a high level of interference at the antenna port.

Since the detection of interference is merely for the user's information and does not affect the functionality of the read/write device, the **Sensitive** setting is generally recommended.

6.3 Antenna (internal and external)

6.3.1 Transmitting power

The Transmitting Power serves to supply energy to passive transponders. It directly determines the achievable scanning range. **Write** requires a higher value Transmitting power than does **Read**, presuming identical distance between the transponder and read device. Use the **adjustment bar** or **input field** to enter this value.

It's recommended that the Transmitting Power settings ensure a stable read/write process despite expected process fluctuations, such as caused by deviations in transponder quality. At the same time, excess ranges, such as due to reflections on metal, should be avoided.

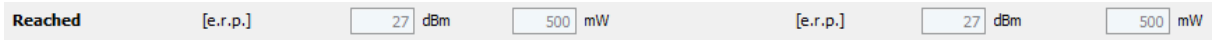
Note:

Different transponders achieve different scanning ranges with identical transmitting power. The primary transponder characteristics that affect this are as follows:

- Which transponder IC is used, since ICs require different energy levels for activation.
- The transponder antenna (and therefore transponder size), since the received power increases proportional to antenna area.

- The frequency for which the transponder was designed. If a transponder is operated beyond its optimal frequency range, the achievable scanning range falls. Thermal loads and moisture can result in distortion of the optimal frequency range.
- Due to manufacturing tolerances, the optimal frequency range and maximum achievable scanning range may differ for two transponders of the same type.

Aside from the transponders themselves, the ambient conditions and the surface on which the transponder is mounted affect the transmitting power settings that are necessary. Fluid tends to dampen the signal while metallic surfaces cause shielding and reflections.



If an external antenna is connected to the read/write device, it automatically calculates and configures the power that has to be output via the antenna ports in order to reach the set transmitting power at the antenna itself. This calculation is performed based on the values shown on the data sheet for the connected antenna. (Antenna Gain and Cable Loss)

Since the power that the read/write device can output via the antenna port is limited, the **Achieved** fields display the extent to which the set transmitting power can actually be sent out by the antenna. With an antenna with low gain or a cable with high loss, it may not be possible to achieve the set transmitting power.

6.3.2 Antenna Gain and Cable Loss

The parameters Antenna Gain and Cable Loss are values that must be entered for each external antenna connected. Consult the data sheet for the respective antenna or cable for this data. Based on these values the read/write device automatically calculates the power that has to be output via the port in order to reach the set transmitting power .

Please note the units in which the entry is made. The **Antenna Gain** is specified in $\frac{1}{10}$ dBi or dBiC. (dBi: linear polarized antenna, dBic: circular polarized antenna; see the data sheet also for the unit) **Cable Loss** is always specified in $\frac{1}{10}$ dB.

Note:

Entering the correct values for Antenna Gain and Cable Loss is required to ensure that the power sent out corresponds to the local limits.

6.3.3 Dwell-time and rounds

The parameters Dwell-time and rounds define the Inventory Process in which the read/write device reads out the UII of all transponders in its scanning range. An inventory process comprises several rounds. In each round, the read/write device attempts to read out the UII of all transponders in its scanning range. The **rounds** parameter is used to set the number of completed rounds after which the read/write device ends the inventory process. It is necessary for the inventory process to end in order to output data to the host at the end of a reading gate. (cf. Object Trigger Control)

Since the duration of a round depends on the number of transponders in the field and the Inventory algorithm used, and as such is not permanently set, **Dwell-time** represents a timeout for the entire inventory process. The inventory process is ended no later than the expiry of the set Dwell time, regardless of whether the set number of rounds was performed and the data for the transponders covered up to that point is provided for output to the host.

Dwell-time and **rounds** can be set individually for each antenna.

The read reliability can be augmented by increasing the number of rounds, whereby transponders are read several times. This allows transponders that are only read once to be filtered out due to excess range or reflections, for example.

The set Dwell time ensures that at the end of a reading gate, data is available for output to the host.

6.3.4 Priority

If multiple antennas are connected to a read/write device, priority determines how frequently they perform an inventory process . There are three different ways to set the Priority:

- Antennas with **High** priority are switched on at least twice as often during an inventory process than antennas with **Normal** priority.
- Antennas with **Low** priority is activated only once per reading gate.

Proactively makes it possible to differentiate antennas that should perform more frequent inventories from antennas that require less frequent ones.

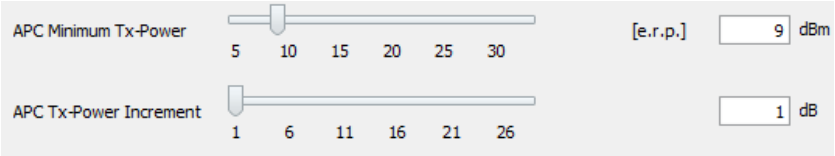
Note:

The maximum time for which each antenna is activated corresponds to the **Dwell-time.** (Dwell-time and rounds) If the antennas are each active for this time, it must be ensured that the reading gate is long enough. Otherwise one or more antennas may not be activated during the reading gate and no data is provided for output. The following table helps you to determine how many times the Dwell-time has to expire before all antennas can be reliably activated.

Priority				Antenna sequence
Antenna 1	Antenna 2	Antenna 3	Antenna 4	
Normal	Normal	Normal	Normal	1 2 3 4
High	Normal	Normal	Normal	1 2 1 3 1 4
Normal	Normal	Normal	Low	1 2 3 1 2 3 4
High	Normal	Normal	Low	1 2 1 3 1 2 1 3 4
High	High	Normal	Normal	1 2 3 4 1 2
Normal	Normal	Normal	Disabled	1 2 3
High	Normal	Normal	Disabled	1 2 1 3
Normal	Normal	Low	Disabled	1 2 1 2 3
High	Normal	Low	Disabled	1 2 1 1 2 1 3
Normal	Normal	Disabled	Disabled	1 2
High	Normal	Disabled	Disabled	1 2 1
Normal	Low	Disabled	Disabled	1 1 2
High	Low	Disabled	Disabled	1 1 1 1 2
Normal	Disabled	Disabled	Disabled	1
High	Disabled	Disabled	Disabled	1

Priority				Antenna sequence
Antenna 1	Antenna 2	Antenna 3	Antenna 4	
Low	Disabled	Disabled	Disabled	1

6.3.5 Minimum APC Transmitting Power and APC Power Range



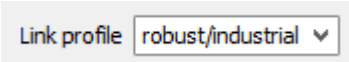
These parameters relate to Advanced Power Control-Mode and are explained in that section.

7 Performance Optimization

The Performance Optimization tab provides parameters that affect the duration and stability of reading the UII by the read/write device.

The parameters on this tab serve in particular to realize applications in which either individual transponders are located in the scanning range of the device only for a very short time or in which involve a large number of transponders that are to be read; for example in a gate application.

7.1 Link Profile



The Link Profile parameter is used to configure the stability and speed of data transmission between the read/write device and transponder despite external sources of electromagnetic interference. Stability derives from the redundancy with which the data is sent to the read/write device. Three link profiles are available:

- `Robust/Industrial`: This option achieves maximum transmission reliability, however results in lower transmission speeds. This profile is recommended especially in environments where strong electromagnetic interference is expected.
- `Balanced`: This option provides faster transmission speed with moderate transmission reliability.
- `Rapid`: This option provides the fastest transmission speed, however with reduced transmission reliability. This profile is recommended in environments with low interference, in which many transponders have to be read in a short time, but not necessarily completely, such as in gate applications.

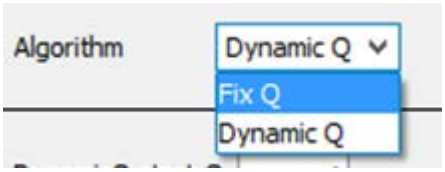
Note

The link profiles relate exclusively to read processes. Write processes are not affected by this parameter.

7.2 Inventory Algorithm

Inventory (read device “collects” the UIIs of the transponders in the field) is performed using a slotted based Aloha process. Here the read device provides a certain number of slots that is determined by the Q factor. (Slots: 0 ... 2^Q; cf.. Inventory Algorithm: Fix Q / Inventory Algorithm: Dynamic Q) Each individual transponder sends its UII to one of these slots according to a randomized process. The slots are requested sequentially by the read/write device.

Only one transponder can send its data in a slot, in order to avoid collisions in the data transmission. Otherwise the transponder has to be read during another round. The more transponders in the field, therefore, the more slots are required.

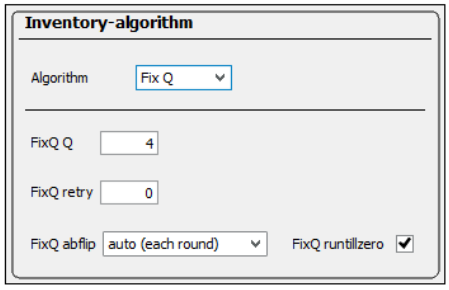


The **Algorithm** makes it possible to establish whether the device dynamically adjusts the number of slots in ongoing operation:

- `Dynamic Q`: The number of slots is automatically adjusted by the read/write device during the inventory process according to the number of transponders in the scanning range. (cf. Inventory Algorithm: Dynamic Q)
- `Fix Q`: The number of slots remains constant based on the setting entered by the user. (cf.. Inventory Algorithm: Fix Q) This setting is advantageous primarily when a fixed number of transponders is always expected in the field. These can be individual transponders or a fixed large number of transponders.

Generally, the Dynamic Q algorithm and its standard settings are suitable for performing this application. The Inventory-Algorithm should only be adjusted by experienced users.

7.2.1 Inventory Algorithm: Fix Q



When the `Fix Q` algorithm is used, the number of slots that the transponders can select to send their UII remains constant.

The number of slots is calculated based on the factor **FixQ Q**: *number of slots* = $2^{FixQ\ Q}$

Therefore if the factor increases by 1, the number of slots doubles.

The **FixQ retry** parameter is used to set how often the read/write device repeats the querying of slots each round (cf. Dwell-time and rounds). This parameter has no effect if the **FixQ runtillzero** checkbox is activated. In this case, the read/write device repeats the Aloha process until all transponders in the scanning range have been read.

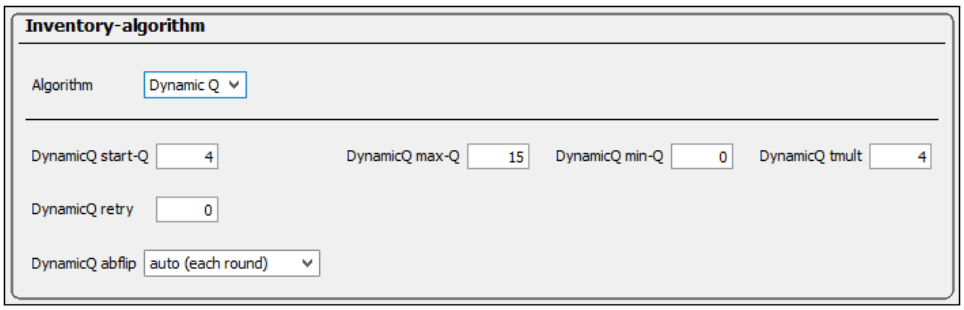
The **FixQ abflip** parameter defines the time from which read transponders can participate in the inventory again, and be read again:

- `Autom. (each round)`: after the read/write device ends a round, all transponders participate in the inventory again. Transponders can therefore be read multiple terms during an inventory. For example, transponders that are only read once due to excess range or reflections can be filtered out.
- `Autom. (each Inventory)`: Transponders only participate again in the inventory once no new transponders are read. This setting makes sense when a one-off inventory of the transponder is sufficient and transponders that are not read at first have to be inventoried quickly. This is the case for gate applications, for example.

Note:

If, for the **FixQ abflip** parameter, the option `autom. (each Inventory)` is selected, the **FixQ runtillzero** option will not be available.

7.2.2 Inventory Algorithm: Dynamic Q



When the `Dynamic Q` algorithm is used, the read/write device adjusts the number of slots dynamically during a round. If the number of transponders within the scanning range of the read/write device increases, the number of slots also increases. The number of slots is determined based on the following factors:

DynamicQ Start-Q	This factor is used to determine the initial number of slots at the beginning of a round. The number of slots is determined in the following manner: *Number of Slots* = $2^{DynamicQ\ Start\text{-}Q}$
DynamicQ Max-Q	This factor is used to determine the maximum number of slots made available during a round. The number of slots is determined in the following manner: *Number of Slots* = $2^{DynamicQ\ Max\text{-}Q}$
DynamicQ Min-Q	This factor is used to determine the minimum number of slots made available during a round. The number of slots is determined in the following manner: *Number of Slots* = $2^{DynamicQ\ Min\text{-}Q}$
DynamicQ tmult	This value represents the increment by which the Q-Factor is either reduce or increased when the number of slots is adjusted.
DynamicQ retry	This factor determines how often the read/write device has to make available the same number of slots before increasing or reducing it.

The **DynamicQ abflip** parameter defines the time from which read transponders can participate in the inventory again, and be read again:

- `Autom. (each round)`: after the read/write device ends a round, all transponders participate in the inventory again. Transponders can therefore be read multiple terms during an inventory. For example, transponders that are only read once due to excess range or reflections can be filtered out.
- `Autom. (each Inventory)`: Transponders only participate again in the inventory once no new transponders are read. This setting makes sense when a one-off inventory of the transponder is sufficient and transponders that are not read at first have to be inventoried quickly. This is the case for gate applications, for example.

8 Data Preprocessing

The settings in the Data Preprocessing tab make the read/write device pre-process read results. This simplifies the process of integrating the device into a system as well as the IT processes involved.

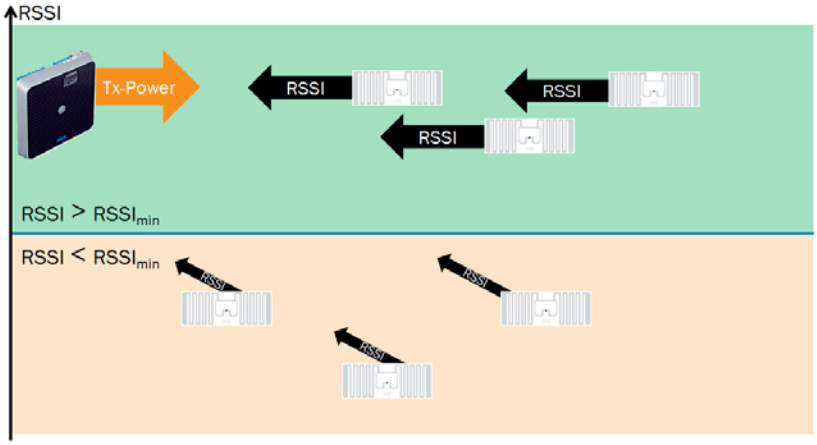
Note:

The settings on the Data Preprocessing tab do not result in selection of transponders on the air interface. Communication between the read/write device and the transponder cannot be accelerated in this case.

To exclude transponders from the Inventory process and thereby to accelerate communication on the air interface, selection criteria can be defined in the Tag Select tab.

8.1 RSSI Filter

The RSSI filter verifies the input power of the transponder signal at the receiver. If it falls below the **minimum threshold**, the transponder will not output.

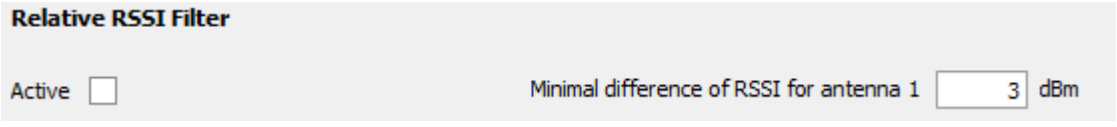


The RSSI filter should be used if additional transponders that shouldn't output are located adjacent to the target transponder(s) at the edge of the read/write device's scanning range.

Note:

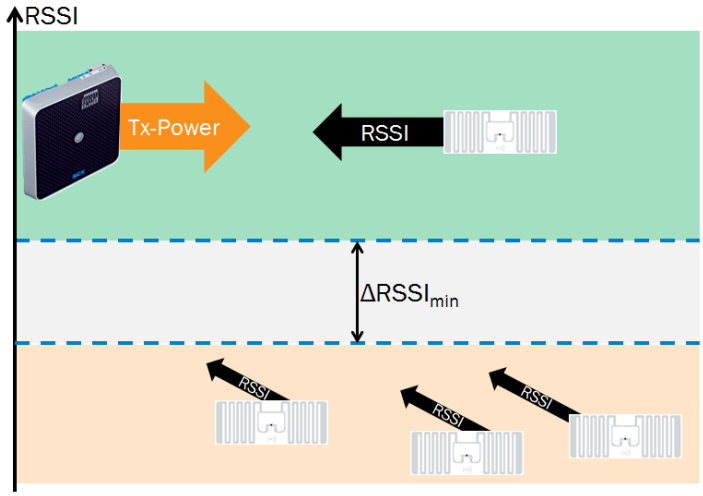
When Filter Diagnostics is activated, the RSSI filter may not lose its function. The respective characteristics of Filter Diagnostics must be taken into account.

8.2 Relative RSSI Filter



When a relative RSSI filter is used, a **minimum RSSI differential** is set, namely that between the transponder with the maximum RSSI value and the transponder with the second-highest RSSI value. If this condition is satisfied, only the transponder with the maximum value will output and all other transponders will be filtered out. If the value falls below the set differential, all transponders will be rejected and the **GoodRead condition** will not be satisfied.

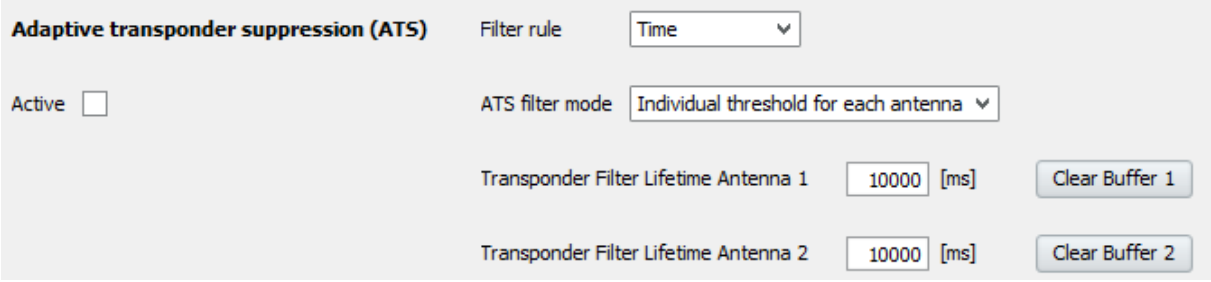
This filter can be used to clearly separate the target transponder from the other transponders (with this filter, only one transponder/one UII per reading gate will be output).



Note:

When Filter Diagnostics is activated, the relative RSSI may not function either. The respective characteristics of Filter Diagnostics must be taken into account.

8.3 Adaptive transponder suppression and Transponder monitoring



If **Adaptive transponder suppression** (ATS) is activated, for the period in which a transponder remains within the scanning range of the read/write device without interruption, that transponder will only output one read result. The **Transponder Filter Limit** is used to define a period (**filter criterion** = `Time`) or a number of reading gates (**filter criterion:** = `Reading gates`). Only when the transponder cannot be detected by the read/write device for the set period or set number of reading gates, it will be output again as a read result when it is redetected.

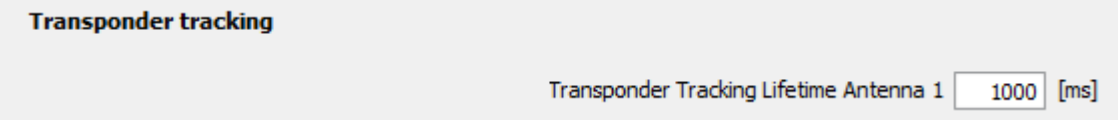
The command **Delete Buffer** resets the filter and previously read transponders in the scanning range of the read/write device are output again.

ATS Filter Mode is used to determine whether a threshold is defined per antenna or for all antennas.

Adaptive transponder suppression is used if the passage of a transponder (such as by a RFID gate) is to be registered as a single read result.

Note:

When Filter Diagnostics is activated, Adaptive Transponder Suppression may not function either. The respective characteristics of Filter Diagnostics must be taken into account.



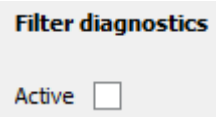
Transponder Monitoring serves to extend the functionality of **Adaptive transponder suppression**. It can only be used when ATS is activated.

If the transponder has not been detected by the respective antenna during the set **monitoring time**, this is interpreted as leaving the reading field . On the basis of these parameter settings, the device can be subscribed to Tag Arrival and Tag Departure Events. The following commands are used to do this: sEN TTRNewArrTags 1 and sEN TTRDepTags 1.

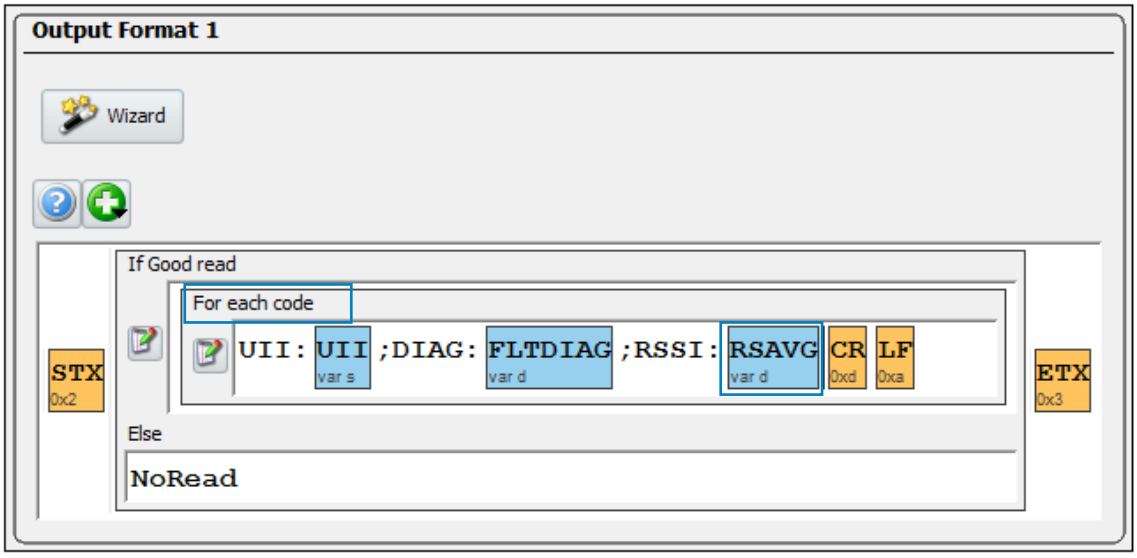
These commands are described in the Telegram Listing of the RFU6xx.

If there are holes in the reading field, the **Monitoring time** should be set to a higher value. This prevents multiple Arrival and Departure events from being generated for a single transponder.

8.4 Filter Diagnostics



When Filter Diagnostics is activated in connection with a respective Output format all filtered transponders will be output under “Notes” for the respective criterion. An output format must be defined `for each code`.



As shown in the table below, the FLTDIAG output format outputs which filter was applied to the transponder:

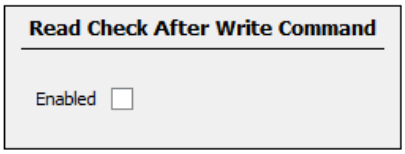
Value of FLTDIAG	Description
0 (default)	Tag meets all filter criteria or Filter Diagnostics is deactivated.
1	Filtered by the RSSI filter
2	Filtered by Adaptive Transponder Suppression
3	Filtered by the relative RSSI filter

Filter Diagnostics can be used to display all transponders in the scanning range of the read/write device. Applications can be analyzed based on the information whether a filter was applied and if so, which one. In this case, however, an additional output format or an Evaluation Condition must be implemented on the control in order to differentiate the accepted from the filtered transponders in the application.

9 Transponder Processing

The Transponder Processing tab is used to configure how the read/write device handles transponders in ways that go beyond reading the UII . This includes describing and outputting defined memory sectors of the transponder as well as managing the passwords that regulate access rights to the read/write device on password-protected transponders.

9.1 Read Verification following Write command



When Read Verification following Write command is activated, the read/write device, after describing a transponder, again outputs the described memory sector and verifies whether the write process was performed correctly. In this case, the response sent by the device to the control regarding the Write command can only be reported as successful when the transponder data corresponds to the Write command.

9.2 Passwords

In the Passwords group, the **Device Access Password** and **Device Kill Password** can be changed. These two device passwords must correspond, according to the lock/key principle, with the transponders' passwords (Password Management) in order to gain full access to the functionalities of the transponder.

The **Device Access Password** is used to assign the authorizations of the read/write device in order to output and describe the memory sectors of a transponder.

The Device Access Password consists of 8 HEX characters. The **Password in Use** indicator shows whether a password is active. The access password is assigned to the device by entering a corresponding combination of characters. Entering 0000 0000 deactivates the **Device Access Password** .

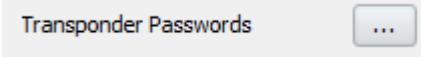
If the **Device Access Password** is activated, it must match the **Tag Access Password** (Password Management) in order to output and describe the password-protected memory sectors of the transponder. (cf.. Lock Tag) If the passwords differ, only the UII of the transponder can be read. This also applies if no **Tag Access Password** (0000 0000\) is set.

If the **Device Access Password** is deactivated, full read and write access is granted to unprotected transponders. If memory sectors are protected by a password, all memory sectors of the transponder (other than the passwords) can at least be output. No write access exists, however.

The **Device Kill Password** must match the **Tag Kill Password** (Password Management) in order to deactivate the target transponder. (**Tag Kill**, Password Management)

Note:

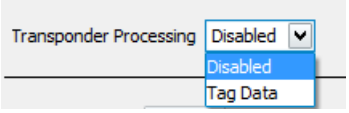
A deactivated transponder cannot be read or described again. It is not capable of functioning. Deactivating a transponder cannot be undone.



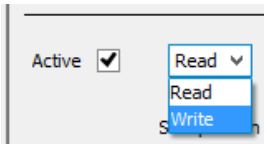
The **Transponder Passwords** button links to the Password Management where the corresponding transponder passwords can be managed.

9.3 Transponder Processing

In the Transponder Processing parameter group, it's possible to define read and write processes that the read/write device executes for each transponder. Up to 3 actions can be activated and defined using the checkboxes Active .



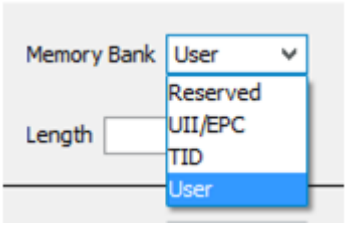
Full functioning is activated by using the `Tag Data` dropdown menu for the **Transponder Processing** parameter.



Another dropdown allows the user to select whether to define a read or write process.

Note:

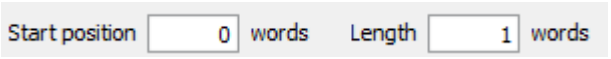
If a write process (`Write`) is defined, it must be ensured that it is initially unaddressed, and therefore will be applied to each transponder in the scanning range of the read/write device. If only certain transponders are to be described, they must be defined in the Tag Select tab.



The **Memory Bank** dropdown is used to select the memory sector in which the read or write process is to be run.

Note:

For detailed information on the structure and use of the memory sectors, consult ISO standard 18000-6C or in agreement the "EPC UHF Gen2 Air Interface Protocol" of GS1.



The parameters **Start position** and **Length** are used to limit the part of the selected memory sector that should be read or written. A word corresponds to 16 bits, i.e., 4 HEX characters. This means that both parameters can be defined in 16-bit steps.

By defining the **Start position** and **Length**, read and/or write processes are accelerated since only the data that is relevant to the respective station is read or written.

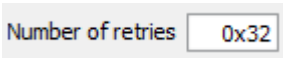
Note:

If a transponder date that is different from the UII is to be output via an Output Format, a read process must be defined for the memory sector in question; this is done in Transponder Processing.

If a write command is defined, the information that will be written to the transponder appears in the **Data** field. The input is in HEX format.

Note:

The number of the data entered as HEX characters must correspond to the defined length of the write process. If this is not the case, the write process will not be executed.



The **Number of Repeat Attempts** determines how often the read/write device attempts to execute the defined read or write process. The user input follows this scheme:

0x the following characters correspond to HEX format

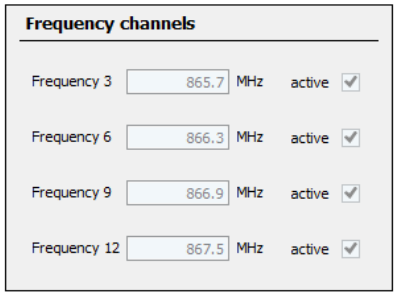
[0...7] Number of attempts on the same frequency channel

[0...5] Number of changes between all frequency channels

A default value of 0x32 is usually suitable for most applications.

If while verifying the settings it is determined that stable reading or writing is not possible, the number of attempts can be increased. However, it is recommended in this case to verify the system, including the transponders, and to identify and eliminate potential sources of interference as a first step.

10 Frequency Channel Configuration



The Frequency Channel Configuration tab displays the **frequency channels** that the read/write device uses for transponder communication on the air interface. The frequency band available to a read/write device is specified by national and international standards and regulations for the specific region.

Consequently, the frequency channels cannot be configured by the user.

11 Tag Select

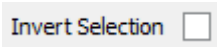
The Tag Select tab allows selection criteria (**Select Forms**) to be defined for when a transponder will participate in communication with the read/write device. Transponders that do not meet the selection criteria will not take part in the data exchange. They will therefore neither send their data to the read/write device nor will their data content be changed by a write command. The transponders are selected based on their data content.

By using selection criteria, the efficiency of transponder communication can be enhanced by having only certain transponders take part in the process. This accelerates communication over the air interface and data processing by the read/write device. Moreover, transponders whose data content should not be changed can also be prevented from being described.

11.1 General

The **logic operator** determines the relationship when defining multiple Select Forms:

AND	The transponder meets the selection criteria if it meets all of the points defined on the Select Form.
OR	The transponder meets the selection criteria if it meets one or more of the points defined on the Select Form.



The **Invert Selection** parameter is used to set whether transponders that correspond to the defined selection criteria (Select Form) are selected or suppressed.

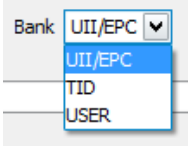
not enabled	All transponders that meet the selection criteria will take part in communication with the read/write device. All other transponders will be suppressed.
enabled	All transponders that meet the selection criteria will take part in communication with the read/write device. All other transponders participate in communication.

If the user wants to communicate with only one group among many transponders that shares a common selection criterion, it is recommended to select **do not invert**. An example would be intentionally addressing the transponders that designate a loaded pallet.

If it is desired that the group of transponders that shares a common selection criterion is not to be read, it is recommended to select **invert**. An example would be an application with small-load carriers that transport a wide variety of objects that bear transponders. If it is intended to not include the small-load carriers in a real time inventory, their specific transponders can be suppressed.

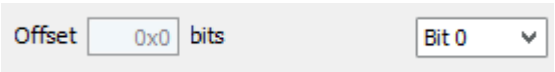
11.2 Select-Form

The Select Form allows selection criteria to be defined for when a transponder is selected to participate in communication with the read/write device. Up to four Select-Forms can be defined, each of which can be enabled and disabled.



Selection criteria can be defined for the transponder memory **banks** `UII/EPC`, `TID` or `USER`.

UII/EPC	Due to its structure, the UII can be used as a selection criterion to select a certain type of object (load carrier, trade item). When international data standards are used, the UII offers maximum reliability in open, intercompany process chains. Moreover in the ISO data standard, part of the UII, the Application Family Identifier, is explicitly provided for use in filter and selection methods.
TID	If various transponders with various ICs are used in certain applications or for certain objects, transponders can be selected using the transponder ID (`TID`).
USER	If additional information about the object is stored on the User Memory, specific selection features can be stored there and used via a corresponding Select-Form.



Offset is used to select the sector in the memory bank to which the Select-Form should be applied. Certain sectors of the memory banks UII/EPC and TID can be specifically set using a dropdown menu.

Alternatively, the **Offset** can be set in number of bits. For the memory banks UII/EPC and TID, `Manual` should be additionally selected in the dropdown menu. The input is in HEX format:

0x this header indicates that the input is in HEX format.

10 the two following numbers give the offset in bits (note: HEX format).

In accordance with the UHF-RFID data standards, certain sectors of the memory banks are provided specifically for selection of transponders. The Select-Form parameter is used to specifically address these sectors.

The data content that is to be used to select transponders in the selected memory sector is entered in the **Form** input field. The input on the **Form** is in HEX format. Entering a HEX character in the **Form** causes a 4-bit block to be written.

Description allows users to make a note regarding the defined selection criterion.

12 Object trigger control

The Object Trigger Control tab is used to define the conditions to open and close reading gates by the read/write device. During a reading gate, the read/write device reads the UII of all compatible transponders, based on the defined selection criteria (Tag Select).

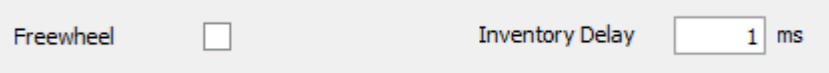
Executing additional read and write processes (Transponder Processing) occurs after the reading gate, and therefore after the reading of the UIIs. The Inventory Control group makes it possible to set trigger settings optimized for the special characteristics of RFID technology as an identification solution. The Object Trigger Start/Stop group offers a range of the trigger setting options typical of identification solutions.

12.1 Inventory control

Inventory Control contains the parameters used to optimize the initialization and sequence of read/write processes.

Free-run and Inventory Delay makes it possible to set cyclical reading gates without external triggers. Sync Mode uses a master/slave function to synchronize multiple devices and thereby avoid concurrent interference on the air interface.

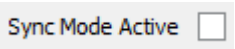
12.1.1 Free-run and Inventory Delay



When **Free-run** is enabled, the read/write device opens a new reading gate cyclically. Once Inventory and additional Transponder Processing (reading additional memory sectors, write processes) ends, a new reading gate is opened. However, not until the **Inventory Delay** between the two inventories has elapsed.

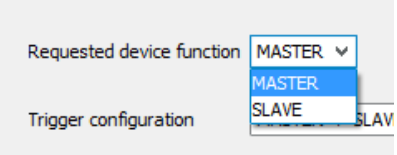
Using **Free-run** is recommended if at the read point it is not possible or necessary to set up a trigger, and it is intended to continue communicating with transponders indefinitely.

12.1.2 Sync Mode

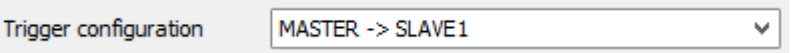


Sync Mode is enabled by using the **Sync Mode Active** checkbox; it's purpose is to synchronize the reading gates of multiple read/write devices. Use is recommended when the reading fields of multiple read/write devices overlap. This prevents mutual interference with communication on the air interface.

In this regard a master control up to three slaves by giving each a trigger signal to open a reading gate.



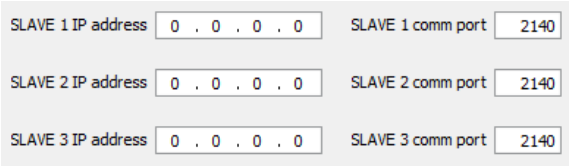
The **New Device Function** is used to set whether the device is acting as a MASTER or SLAVE.



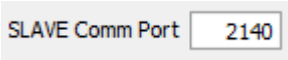
Trigger Configuration is used to establish the sequence in which the MASTER and SLAVE(s) execute transponder communication. The settings are always made via the MASTER. The options are as follows:

MASTER → SLAVE1	The inventories are carried out in this sequence: MASTER, then SLAVE1
MASTER → SLAVE1 → SLAVE2	The inventories are carried out in this sequence: MASTER, then SLAVE1, then SLAVE2
MASTER SLAVE2 → SLAVE1	The inventories are carried out in this sequence: MASTER and SLAVE2 simultaneously, then SLAVE1
MASTER → SLAVE1 → SLAVE2 → SLAVE3	The inventories are carried out in this sequence: MASTER, then SLAVE1, then SLAVE2, then SLAVE3
(MASTER and SLAVE2) → (SLAVE1 and SLAVE3)	The inventories are carried out in this sequence: MASTER and SLAVE2 simultaneously, then SLAVE1 and SLAVE3 simultaneously

MASTER:



SLAVE:

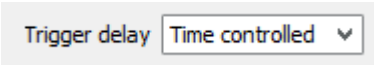


If **New Device Function** is set to `MASTER`, the slave devices are assigned to the master device via the **SLAVE IP addresses 1-3**. In turn, the slave devices must have **New Device Function** set to `SLAVE`. The respectively set **SLAVE Comm Ports** of MASTER and SLAVE must match.

12.1.3 Start/Stop of Object Trigger

The Start/Stop of Object Trigger parameter group is used to define the conditions for opening and closing the reading gate.

12.1.4 Trigger delay



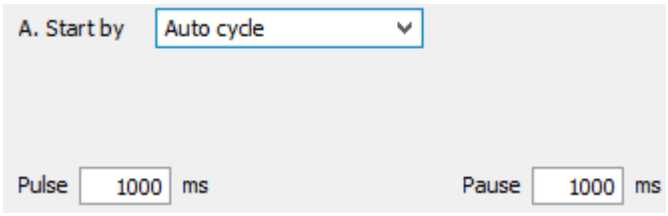
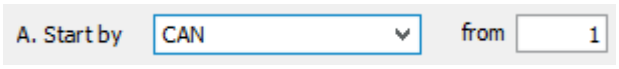
The Trigger Delay parameter is used to define the whether the opening and closing of reading gates is based on time units or path distances. This relates to the `Auto cycle` (Start by) and `Timer/Path` (Stop by) as well as Start Delay/Stop Delay.

`Time-controlled`	For the above parameters, respective time intervals are set as a baseline value.
`Path-controlled`	For the above parameters, respective path distances are set as a baseline value. The paths that must be covered in this regard are calculated by the device based on the Increment Configuration.

12.1.5 Start by

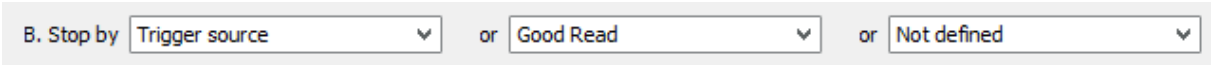
To open a reading gate (**A. Start by**), the following options are available:

`Sensor / Input 1`
`Sensor / Input 2`
`External input 1`
`External input 2`
	The reading gate is opened by a signal (e.g., photoelectric retro-reflective sensor) at the digital input or an external digital input (e.g., a CDF or CDB).

`SOPAS Command`	The reading gate is opened by a standard command, e.g., from an external control (programmable logic controller). Consult the list of command language for the standard commands. (available from Sick)
`Auto cycle`	 Auto-cycle opens a new reading gate cyclically. The reading gate is automatically opened after expiry of the **pulse** time. The reading gate opens again if the set **Pause** expires. Pulse and pause are set either in time intervals (ms) or path distances (mm). This is defined using the Trigger Delay parameter. For RFID devices, use of Free-run(Inventory Control) is recommended instead of Auto-cycle.
`CAN`	 In a CAN network, one device passes on its trigger signal to the other devices in the network. The address of the device from which a trigger signal is to be received is set using the input field **of**.
`User-defined command`	 The user has the option to define their own **Start command** that opens the reading gate. When the **Trigger Echo** function is enabled (using the checkbox), the command received from the device is sent back to the control. This allows the control to check the SOPAS command that has been sent.

Fieldbus input	The device uses a Fieldbus trigger bit. (available for Profinet and Profibus DP, Ethernet/IP, CANopen) The reading gate is opened once the trigger bit is set to active, and remains open until it is deactivated. Additional trigger stop conditions can also be defined (Stop by). Consult the appropriate field bus standard for details on the trigger bits.

12.1.6 Stop by



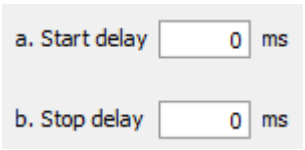
If the reading gate is opened by the Start by conditions Auto-cycle or CAN, this also defines the condition for closing the reading gate.

For all other Start by conditions, the reading gate is closed by one of the following conditions. Up to three stop conditions can be defined, which are connected via a **or**.

Not defined	Not defined: No function defined for closing the reading gate.
Read cycle source	Read cycle source: The reading gate is closed by the same signal source that opened it. (e.g., the reading gate opens as soon as an object trips a photoelectric retro-reflective sensor and closes again as soon as the object is clear of the photoelectric retro-reflective sensor).
Sensor / Input 1 Sensor / Input 2 External input 1 External input 2	The reading gate is opened by a signal (e.g., photoelectric retro-reflective sensor) at the digital input or an external digital input (e.g., a CDF or CDB).
SOPAS Command	The reading gate is opened by a standard command, e.g., from an external control (programmable logic controller). Consult the list of command language for the standard commands. (available from Sick)
Timer/Path	 The reading gate remains open for a define time/path that is set in **Reading Gate Length**. The selection of time or path is made in Trigger Delay. If a path is set, the device determines it based on the Increment configuration settings.
Good Read	The reading gate closes as soon as the conditions for a GoodRead are met. This can be a certain number of read transponders, for example, and is defined in the **Good Read Conditions** settings in the Evaluation Conditions tab.

User-defined command	 The user has the option to define their own **Start command** that opens the reading gate. When the **Trigger Echo** function is enabled (using the checkbox), the command received from the device is sent back to the control. This allows the control to check the SOPAS command that has been sent.
Condition	Additional conditions can be defined in the Evaluation Conditions tab. These can also be used as a condition for closing a reading gate and are shown in the dropdown menu.

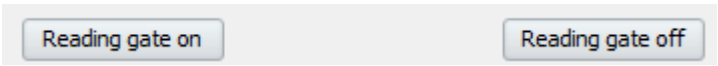
12.1.7 Start Delay/Stop Delay



Start Delay and Stop Delay are used to make reading gates open or close with a delay after the trigger input. The delay can be based on time units or path lengths, which is evident from the Trigger Delay settings.

Having a reading gate open after a delay is useful in order to make the device available for data processing after the trigger occurs.

12.1.8 Reading gate open/Reading gate closed



The commands **Open reading gate**and **Close reading gate** are used to manually open or close a reading gate.

These parameters can simulate a machine trigger without having to connect an external source, for example.

12.2 Trigger Distribution

Trigger signal communication is activated/deactivated and assigned to a communication network via the **Distribute to** parameter.

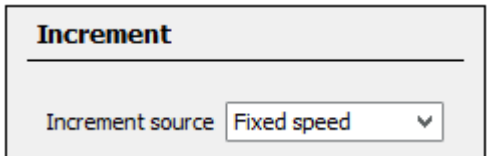
Disabled	• Deaktiviert: The trigger is not distributed to other network users.
CAN	In a group of devices that communicate with each other via the CAN network, the signal for opening the reading gate can be distributed. This involves an appropriate trigger signal being received by one of the devices – usually the master – and distributed to the remaining devices on the CAN network.

In the case of a network with several reading devices, it is often sufficient to use a photoelectric retro-reflective sensor or connect a reading device to the control. The trigger signal is then distributed to the network nodes.

The Trigger Distribution function is used to reduce the trigger signals and the number of photoelectric retro-reflective sensors considerably. This leads to a significant reduction in system complexity and cost.

13 Increment Configuration

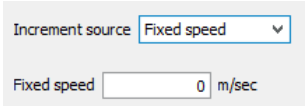
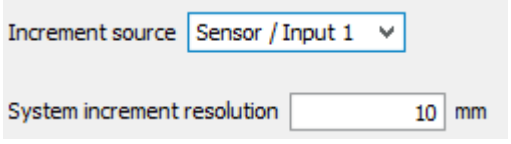
13.1 Increment

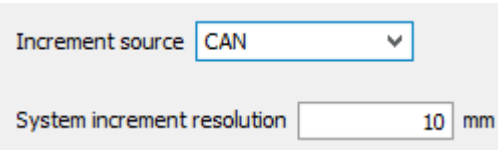
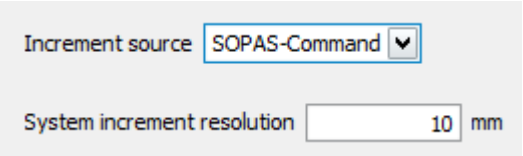


The Increment parameter group is used to establish the data basis upon which the device can determine path distances. This is needed for opening and closing reading gates in the Start/Stop of Object Trigger parameter group.

Path distances generally relate to conveyor distances covered by an object on a conveyor belt and which derive from the speed of the belt. If constant belt speed cannot be presumed (e.g., due to intentional changes in belt speed or system inaccuracies), incremental encoders are used. These are connected to the belt machinery and output signals for each path distance covered.

The following **Increment Sources** can be used by the device:

`Fixed speed`	 Fixed belt speed is presumed and entered as a value. The device determines the path distanced based on the configured value and elapsed time.
`Sensor / Input 1 (or 2)`	 An incremental encoder is connected to the digital input (1 or 2). The path distances are calculated by the device based on the **System increment resolution** entered times the number of pulses received from the incremental encoder. This option is recommended if belt speed is variable or cannot be kept constant. It requires an additional sensor in the form of the incremental encoder, which has to be integrated into the system.

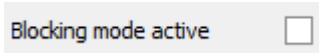
CAN	 Signals from an incremental encoder are received via the CAN network. The path distances are calculated based on the **System increment resolution** entered times the number of pulses received from the incremental encoder.
SOPAS Command	 The increment signals are received as SOPAS commands. The path distances are calculated based on the **System increment resolution** entered times the number of signals received via SOPAS commands.

14 Real Time Data Processing

In Real Time Data Processing, events are defined for transponder passage on devices with angle detection. The RFU650 is currently equipped with this functionality. Outputting corresponding events via the device interfaces is configured in the Output format tab. The transponder's direction of motion can be output there, among other things.

In addition modules are available for describing the events.

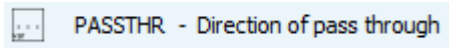
The **Active** button is used to enable passage events to be generated.

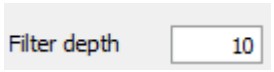


When **Blocking Mode** is used in connection with Free-run and Inventory Delay (Object Trigger Control) only one event per passage is generated and there is only one transponder output in the Output format.

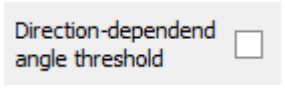
This means that that for the host can be dispensed with since the transponder data only have to processed once per passage.

The **Invert Passage Flag** parameter relates to the Output Format direction of pass through. By default, an output of 2 means passage from plus to minus; a 1 means passage from minus to plus. If this parameter is enabled, these values will be inverted.





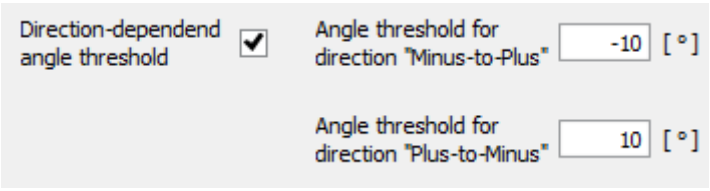
The filter breadth is used to set how often a transponder has to be read after exceeding the angle threshold value (see below) in order to trigger a passage event.



To trigger the event, a certain angle threshold has to be passed. Either an individual angle limit can be defined which when exceeded triggers a passage event regardless of direction, or alternatively, a direction-dependent angle threshold can be enabled that defines specific thresholds for passages from + to - as well as from - to +.

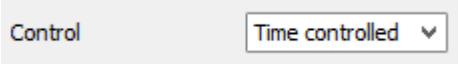
This option is defined using the parameter **Direction-dependent angle threshold**.

`disabled`	 A single angle threshold is defined. If it is exceeded independently of the direction of passage, this is interpreted as a passage event. With this setting, please note that the angle values can differ slightly from reading to reading. If the transponder remains above this angle threshold, it is possible for multiple passages to be output due to the angle values "jumping." This can be avoided by using a direction-dependent angle threshold.

enabled	 When direction-dependent angle thresholds are used, different thresholds can be set for both directions of passage. This prevents a stationary or slow-moving transponder from “jumping” left and right, thereby preventing multiple passage events from being triggered when only a single passage occurs.

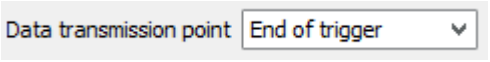
15 Output Control

Output Control is used to define the time of output for Output format 1 and 2.



Control is used to define how the **Output Time** is determined. The following options are available:

Time-controlled	The output time is determined based on a time interval.
Path-controlled	The output time is determined based on a path distance covered. The data basis for the device's calculation of the path distances is defined in the Increment Configuration tab.



The output of Output Format 1 and 2 occurs at the defined **Output Time**. For RFID devices the generally recommended output setting is `End of reading cycle`. With this setting, data is output until the trigger stop. (cf. Stop by)

Depending on the Control settings (`Time-controlled/Path-controlled`, see above) a time interval or path distance can be set as the **Delay**. Based on these settings, the **Output Time** is delayed so as to adjust it to the timing of processes, such as those of the control (programmable logic controller).

16 Evaluation Conditions

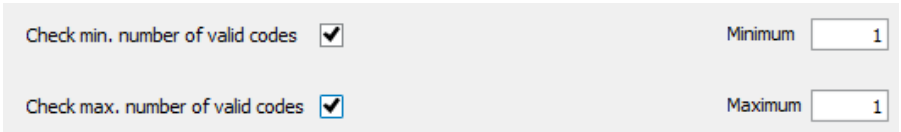
In the Evaluation Tab, conditions are defined that are checked by the device during each reading gate. This is done in the Evaluation Conditions parameter group. If defined conditions are satisfied, certain actions can be perfected by the device. Such actions primarily include setting an output signal (**Digital outputs**) or ending the reading gate. (Stop by)

Evaluation conditions can be used to define situations that serve as reference points in the device software for flexible process control and data processing. The use of evaluation conditions shifts the complexity of control tasks from the external controls (PLCs) into the read/write device, meaning costs are reduced.

The Good Read Conditions parameter group is used to define criteria on the basis of which a successful read can be identified as a **GoodRead**.

16.1 Good Read Conditions

The Good Read Conditions group is used to define the condition on the basis of which a read is deemed good (Good Read). For example, a GoodRead can be used as a condition for a trigger stop (Stop by) and thereby for an associated data output, or the output of a signal (**Digital Outputs**). The condition is selected using a selection list:

`Use min./max. Number of codes`	 A read is deemed a **GoodRead** if the number of read transponders lies above the **min. number** and/or under the **max. number.**. Checkboxes are used to define the criteria that are to be verified. A minimum number of valid codes can then be selected if a minimum number of transponders is to be read during a bulk read. The maximum number of valid codes can then be verified if reading and outputting of undesired transponders can be thereby excluded.
`Condition`	The Evaluation Conditions parameter group offers additional criteria that can be defined, upon the basis of which a **GoodRead** can be determined and which are provided in the selection list. For example, a minimum reception strength (RSSImin) can be defined as a **GoodRead** condition.

16.2 Evaluation Condition

The Evaluation Conditions group is an editor. It allows situations to be defined that can be used by the device as a **GoodRead** (Good Read Condition) and an associated data output, or be used as a condition for outputting a digital signal. (**Digital outputs**)

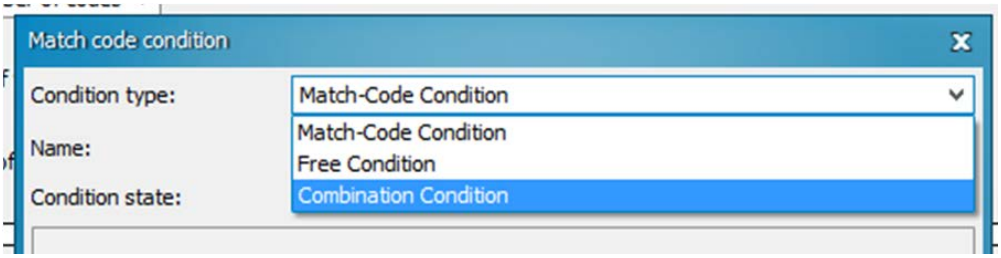
The conditions can be edited by using the following icons.

Conditions that have already been created can be edited via the  button. A dialog box opens which specifies the condition in detail.

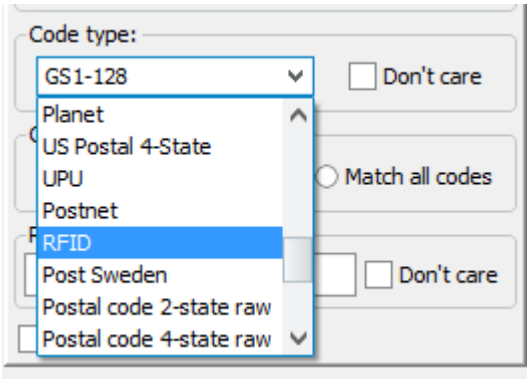
Conditions that have been taught in can be deleted via the  button.

A further new condition can be created via the  button. A dialog box opens which allows you to specify the condition precisely. The condition type and name are precisely defined in the dialog box along with the condition itself.

An evaluation condition is created ( ) and revised ( ) in an editor window:



The user can select three **Condition Types**:

`Match Code Condition`	 When `Match Code Condition`is used, the **Code type** must be set as `RFID`. The condition defined in this manner relates to the PC-UII of the transponder. (PC-Word + UII) The input of the code content is in HEX format.
`Free Condition`	With `Free Condition`, multiple fields can be defined and logically connected. Potential values that can be defined in `Free Condition` include RSSI values, content and lengths of memory banks and many more.
`Combination Condition`	A `Combination Condition` represents the logical conjunction of two or more previously defined Evaluation Conditions.

17 Output Format

The format of the data strings for outputting the reading results are defined on the Output Format tab. Aside from the data content in the various memory sectors of the transponder, this also includes the output of additional information on the reading as well as diagnostic data.

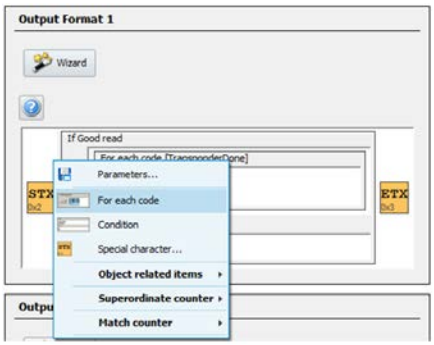
Note:

If transponder data other than the UII (i.e., the User Memory or TID) is to be output in the Output Format, a read command must be defined for this in the Transponder Processing parameter group. Otherwise an “empty” output will result.

17.1 Output Format 1 and 2

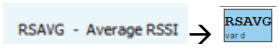
You can define up to 2 different output formats. They can be output either via the various interfaces (e.g., **serial** or **Ethernet**) and this data exchange can also be recorded in log files in the device for diagnostic purposes. Output Diagnostics Log File

With Output Formats, on the one hand, a process can be controlled, while on the other, the application can be optimized by analyzing the data.



Right-click in the output format to open a selection list from which various modules can be selected:

For each code	In the module `For each code`, data elements can be inserted that are output for each individual transponder. This can be content or lengths of the various memory sectors as well as RSSI values. The  symbol is used to restrict the output. For example, only transponders read by a certain antenna or a certain RSSI can be made to output. Additional conditions defined in the Evaluation Conditions tab can be set a criterion. If this criterion is not satisfied, no output occurs.
Condition	The `Condition` module allows the definition of an output format for a reading gate that provides two alternative outputs. One output occurs in the case that the condition is satisfied (typically Good Read Condition), otherwise an alternative data string is output. (e.g., **NoRead** or another format can be defined) The defined output format is output once for the entire reading gate.
Special character...	This option is used to insert various predefined text components, such as STX or ETX (Start/End of Text), that facilitates data processing by the host.

	Various `data components` are available for defining the output format. For instance, contents of the transponder memory banks (e.g., PCUII, UII, TID, User Memory), information about the reading of the specific transponder (antenna ID, RSSI values), counter values or the entire reading gate (reading gate length, number of detected transponders) can be determined in the output format.

Aside from the mentioned output format components, the user can also enter free text to structure the output format. Elements of the output format can be copied and rearranged using the standard commands Ctrl+C, Ctrl+X and Ctrl+V.

17.2 Heartbeat format

Via the Heartbeat, the device outputs a signal via the interface at a regular, defined time interval. In this way, the availability of the device can be checked via the interface. The Heartbeat Format is used to define a data string that is output via the interface as the Heartbeat.

The Heartbeat itself must be enabled and configured for the respective interface. (**Serial**, **Ethernet**, **CAN**)

18 Filters/Sorters for Output Format

Using the graphical interface on the Filters/Sorters for Output Format tab, it's possible to filter the data output for the read results (filtering) and to define the sequence according to which the data is output (sorting). This means you can individually control how the data is output by combining filters and sorters.

A data sort or filter criterion can be dragged and dropped into the field. The respective element is configured via the x  interface.

For example, transponders can be filtered or sorted by length of the data contents (UII, TID, User Memory) or data on the reading, such as RSSI values, the reliability of the reading (`Code Reliability`). Please note that in order to use criteria for filtering, these must be previously defined in the output format (cf. Output Format 1 and 2)

19 Application Counters

Application Counters are used to count and save certain events, such as GoodReads, the number of reading gates or the number of signals at the digital inputs or outputs of the device. The user can determine which events are counted.

Based on this data, Evaluation Conditions can be defined to trigger the output of data or digital signals.

The default setting is for the data to be saved temporarily in RAM. When the **Permanently Save Counter Value** parameter is enabled, the data is saved every 6 minutes in the device's Flash memory and are therefore available even after a voltage drop or device restart.

The command **Save Current Counter Values Now** causes the current counter value to be stored as a single copy in the Flash memory of the device.

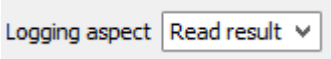
The command **Reset Counters** resets all counters (in RAM, temporary) to 0. If the user wants to also reset the counter values in the permanent Flash memory, the additional command **Save Current Counter Values Now** must be executed.

20 Log File Diagnosis Settings

The Output Diagnostics Log File tab is used to record data transmission via the device interfaces in the internal memory on a MicroSD card. This makes it possible to collect analysis data without a connection to an external PC.

20.1 General log settings

20.1.1 Log Aspect



The Log Aspect parameter is used to determine which data is written to the Save destination. There are two configuration options:

Read results	Exclusively the data from Output Format 1 and 2 is recorded. This setting is recommended for analyzing the application and reading performance of the device.
Entire data exchange	All data received and sent out via the interface is recorded. In addition to Output Format 1 and 2, this also includes received commands and sent status messages. This setting is recommended when it is desired to analyze the device's communication with the host and network.

20.1.2 Ring memory

Activating the Ring memory means that the oldest data in a log file is overwritten once the maximum log file size is reached. This prevents logging cessation and the loss of current data this would entail. The data is always overwritten in the active log file.

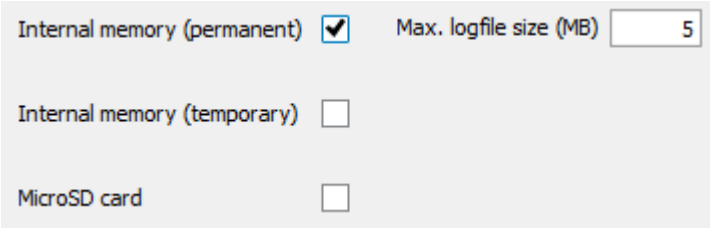
Note:

If new log files are created hourly or daily (File Path), this occurs until the entire available memory capacity of the saving destination is exhausted. Once this occurs, current log data will no longer be recorded despite the ring memory.

20.2 Data source

Data Source is used to set the device interfaces via which data is to be recorded. To record the data for the desired interface(s), they have to be connected.

20.3 Save Destination



Save destination is used to determine which memory sector the log files are written to:

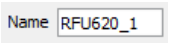
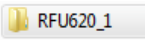
`Internal memory (permanent)`	Data written to the Internal memory (permanent) remains available even after voltage drop or device restart.
`Internal memory (temporary)`	Data written to the Internal memory (temporary) is lost after a voltage drop or device restart
`MicroSD card`	Data written to the Internal memory (permanent) remains available even after voltage drop or device restart. If it is desired to remove the MicroSD card to access the data on the device, the command “Remove SD card” should be executed beforehand.

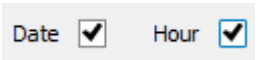
Max. log file size limits the size of an individual log file. This ensures other device functions (such as parameter cloning via the SD card or installed apps) are not limited. The pre-requisite is that new log files be cyclically created. (File Path)

20.4 File Path

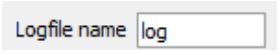
Trigger Configuration is used to establish the sequence in which the MASTER and SLAVE(s) execute transponder communication.

the **Folder Name** defines the name of the folder in which the device log files are stored. This name should ensure that it’s always possible to associate the data with the device.

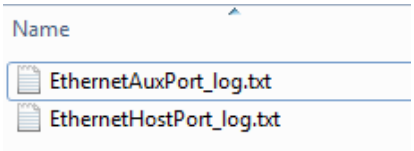
`Serial-Number`	The Folder Name consists of the Header SN and serial number of the device: 
`Device-Name`	 The Folder Name itself can be defined by assigning a unique **Name**: 



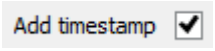
When the **Date** or **Hour** checkbox is selected, new folders are created daily for the new log files. The folders are always named according to the date or time:



The name of log file consists of the device interface recorded as well as the **File Name** as a suffix, identifying it as a log file:



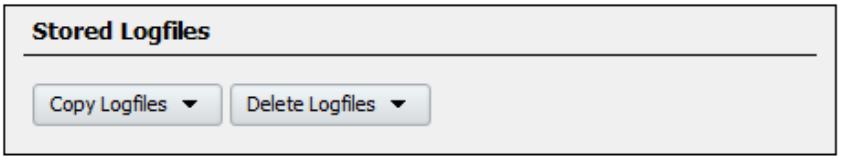
20.5 File Format



When the **Add Time Stamp** parameter is enabled, every Log Aspect recorded in the log files is given a time stamp. This can facilitate allocating the recorded data:

Logging without time stamp:	TT=7ms OTL=0mm CC=1 OI=57 30003005FB63AC1F3681EC880123 TT=7ms OTL=0mm CC=1 OI=58 30003005FB63AC1F3681EC880123 TT=7ms OTL=0mm CC=1 OI=59 30003005FB63AC1F3681EC880123
Logging with time stamp:	[2017-12-21 11:23:46:838] TT=6ms OTL=0mm CC=1 OI=8 30003005FB63AC1F3681EC880123 [2017-12-21 11:23:46:988] TT=7ms OTL=0mm CC=1 OI=9 30003005FB63AC1F3681EC880123 [2017-12-21 11:23:47:138] TT=6ms OTL=0mm CC=1 OI=10 30003005FB63AC1F3681EC880123

20.6 Stored Log Files



The Saved Log File group is used to manage the log data recorded on the device or MicroSD card. The commands **Copy Log Files** and **Delete Log Files** are Available.

These commands can be executed for each of the three possible Save destinations (permanent and temporary internal memory as well as MicroSD card).

Running the command **Copy Log Files** allows the user to select a target folder on the PC where the data should be copied.

8023085/en/2018-10-11

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