IDENTIFICATION

MANUAL

# ID ISC.MRU102 – all Versions

## UHF Mid Range Reader


**Firmware-Version: ≥ 02.00.00**

**final – public (B)**
**2020-12-14 – H10410-13e-ID-B.docx**

FEIG ELECTRONIC

# Note



FEIG ELECTRONIC GmbH
Lange Strasse 4
D-35781 Weilburg
Tel.: +49 6471 3109-0
http://www.feig.de

With this edition of the document, all previous editions become void. Indications made in this manual may be changed without previous notice.



Composition of the information in this document has been done to the best of our knowledge. FEIG ELECTRONIC GmbH does not guarantee the correctness and completeness of the details given in this manual and may not be held liable for damages ensuing from incorrect or incomplete information. Since, despite all our efforts, errors may not be completely avoided, we are always grateful for your useful tips.

The instructions given in this manual are based on advantageous boundary conditions. FEIG ELECTRONIC GmbH does not give any guarantee promise for perfect function in cross environments and does not give any guaranty for the functionality of the complete system which incorporates the subject of this document.

FEIG ELECTRONIC call explicit attention that devices which are subject of this document are not designed with components and testing methods for a level of reliability suitable for use in or in connection with surgical implants or as critical components in any life support systems whose failure to perform can reasonably be expected to cause significant injury to a human. To avoid damage, injury, or death, the user or application designer must take reasonably prudent steps to protect against system failures.

FEIG ELECTRONIC GmbH assumes no responsibility for the use of any information contained in this document and makes no representation that they free of patent infringement. FEIG ELECTRONIC GmbH does not convey any license under its patent rights nor the rights of others.

# General information's regarding this document

- The sign "☞" indicates extensions or changes of this manual compared with the former issue.
- If bits within one byte are filled with "-", these bit spaces are reserved for future extensions or for internal testing- and manufacturing-functions. These bit spaces must not be changed, as this may cause faulty operation of the reader.
- The following figure formats are used:
  0...9: for decimal figures
  0x00...0xFF: for hexadecimal figures,
  b0...1 for binary figures.
- The hexadecimal value in brackets "[ ]" marks a control byte (command).

# Contents

## 1. Safety Instructions / Warning - Read before start-up !

- The device may only be used for the intended purpose designed by for the manufacturer.
- The operation manual should be conveniently kept available at all times for each user.
- Unauthorized changes and the use of spare parts and additional devices which have not been sold or recommended by the manufacturer may cause fire, electric shocks or injuries. Such unauthorized measures shall exclude any liability by the manufacturer.
- The liability-prescriptions of the manufacturer in the issue valid at the time of purchase are valid for the device. The manufacturer shall not be held legally responsible for inaccuracies, errors, or omissions in the manual or automatically set parameters for a device or for an incorrect application of a device.
- Repairs may only be executed by the manufacturer.
- Installation, operation, and maintenance procedures should only be carried out by qualified personnel.
- Use of the device and its installation must be in accordance with national legal requirements and local electrical codes .
- When working on devices the valid safety regulations must be observed.
- Special advice for carriers of cardiac pacemakers:
  Although this device doesn't exceed the valid limits for electromagnetic fields you should keep a minimum distance of 25 cm between the device and your cardiac pacemaker and not stay in an immediate proximity of the device respective the antenna for some time.

## 2. Revision History of Document

| Revision | Date | Page | Description |
|---|---|---|---|
| 1e | 26.03.2012 | | Initial revision |
| 2e | 14.01.2013 | | New Design |
| 3e | 18.10.2013 | 49 | New Configuration Parameter CFG20 / Byte 9 – Default Antenna for ISO Host Mode |
| 4e | 30.04.2014 | 52 | CFG22: New Parameter S_NOT |
| | | 58 | CFG36: New Region 0x54 – Japan added |
| | | 66 | CFG38: New Parameter ONT |
| 5e | 22.01.2015 | 56 | CFG33..34: New Configuration Pages LAN-Hostname |
| | | 69 | CFG41: New configuration parameters LAN-OPTION |
| 6e | 27.08.2015 | 28 | CFG1: New Parameter “Power on Mode” |
| 7e | 17.09.2015 | 88 | Reader Diagnostic Mode 0x04: New Flags added |
| 8e | 07.06.16 | | Cosmetic changes |
| 9e | 15.03.18 | 35 | CFG11: Output of the MAC-Address in reader automatic modes |
| | | 49 | CFG20: RSSI-Filter implemented |
| | | 111 114 121 93 | UCODE DNA supported |
| 10e | 18.06.18 | 49 | CFG20: New Parameter for RF-Power Antenna 2,3 and internal |
| 11e | 25.06.19 | 35 | CFG11: New Parameter “ANT-STORE” |
| 12e | 08.08.2020 | 35 | CFG11: D-LGT parameter integrated |
| | | 64 | CFG37 Tag-Authent integrated |

# 3. Abbreviations

| | |
|---|---|
| ADR | Address |
| ASK | Amplitude Shift Keying |
| CFG | Configuration Parameter Block |
| CRC | Cyclic Redundancy Check |
| DB | Data Block |
| DIP | Dual Inline Plastic |
| DRM | Dense Reader Mode |
| FIFO | First in First out |
| frq | Frequency |
| FSK | Frequency Shift Keying |
| h | Hour |
| Hz | Hertz |
| ID | Identification |
| IDD | Identifier Data |
| IN | Input |
| LEN | Length |
| LOC | Location |
| LSB | Least Significant Byte |
| min | Minutes |
| ms | Milliseconds |
| MSB | Most Significant Byte |
| N | Number |
| OUT | Output |
| R/W | Read / Write Access |
| RD | Read |
| REL | Relay |
| RF | Radio Frequency |
| RSSI | Received Signal Strength Indicator |
| RTC | Real Time Clock |
| TAB | Table |
| TR | Transponder |
| TS | Timeslot |
| EPC | Unique Identifier (read only Serial Number) |
| WO | Write Only Access |
| WR | Write |

# 4. Introduction

## 4.1. The ID ISC.MR(M)U102 Reader

The ID ISC.MR(M)U102 UHF Mid Range Reader is a high flexible and cost effective Reader. It is aimed for UHF applications which work with a short to medium read range and a smaller tag population.

The following versions are available:

| Model | Description | Order Number |
|---|---|---|
| ID ISC.MRMU102-A | Module version with asynchronous RS232- and USB- Interface,<br>3 x SMA connectors for external antennas , 50Ohm<br>1 x integrated antenna | 3779.000.00 |
| ID ISC.MRU102-A | Housed version with asynchronous RS232- Interface,<br>3 x SMA connectors for external antennas , 50Ohm<br>1 x integrated antenna | 4495.000.00 |
| ID ISC.MRU102-POE | Housed version with Ethernet- Interface, Power over Ethernet<br>3 x SMA connectors for external antennas , 50Ohm<br>1 x integrated antenna | 4492.000.00 |
| ID ISC.MRU102-USB | Housed version with USB- Interface,<br>3 x SMA connectors for external antennas , 50Ohm<br>1 x integrated antenna | 4494.000.00 |
| ID ISC.MRU102-POE-LED | Housed version with Ethernet- Interface, Power over Ethernet<br>1 x integrated antenna<br>3 x optical and 1 x acoustic signaler | 3888.000.00 |

The different interface versions enable the connectivity to several host systems. Each version of the ID ISC.MRU102 product series has the following key RF features:

- Powerful RF interface supports US and European Dense Reader Mode
- RF front end with blocking features to supporting adjacent channel operation of RF Readers.
- Reader protection against various fault conditions as e.g. antenna shortcut and electrostatic discharge.
- Output of RSSI Values
- Operating temperature control

In addition the ID ISC.MR(M)U102 Reader series provides configuration possibilities and a reader command set. The base set of commands and features are compatible with the commands used within the UHF-RFID reader product line. The configuration possibilities of the ID ISC.MR(M)U102 reader makes it easy to adapt the reader to wide a range of applications by software and hardware configurations.

In combination, the powerful and flexible RF transmitter and receiver and intelligent digital controller form the basis of an agile, multi-protocol reader that can be updated as future protocols and

features are created. The Reader supports the transponder protocols EPC Class1 Gen2, ISO18000-6-C is supported after installation of an Upgrade Code.
FEIG Electronic provides a library which allows the user to develop their own host applications to exchange data with the ID ISC.MR(M)U102.

## 5. Data Transmission between ID ISC.MR(M)U102 and Host

Five different ways of data transmission between Readers and host (terminal, PC) are possible. The **Host Commands and Automated Reader Modes (Buffered Read Mode, Notification Mode and Scan Mode)** are used for the data exchange between Transponder and host, where as the **Configuration Commands** and the **Reader Control Commands** serves for adapting the Reader parameters to the individual range of applications. The following chart shows which method of data transmission is supported by which interface:

| | interface | | |
|---|---|---|---|
| | **RS232** | **USB** | **LAN** |
| Configuration and control commands | ● | ● | ● |
| ISO Host Commands | ● | ● | ● |
| Buffered Read Mode | ● | ● | ● |
| Scan-Mode | ● | ● (HID) | - |
| Notification Mode | - | - | ● |

Which reader modes are supported by the reader is depending on the used hardware according to the availability of the different interfaces:

| | Reader Version | | | | |
|---|---|---|---|---|---|
| | **MRMU102-A** | **MRU102-A** | **MRU102-USB** | **MRU102-POE** | **MRU102-POE-LED** |
| ISO Host Mode | ● | ● | ● | ● | ● |
| Buffered Read Mode | ● | ● | ● | ● | ● |
| Scan-Mode | ● (USB=HID) | ● | ●(HID) | - | - |
| Notification Mode | - | - | - | ● | ● |

## 5.1. Configuration Commands and Control Commands

This method of data transmission is used for Reader configuration and the diagnosis via the different Hardware Interfaces of the Reader.

The Reader-configuration parameters will be stored in the Reader memory. To store the current configuration during a power down of the Reader the Reader-Configuration has to be stored in the EEPROM. After power up the Reader reads the configuration out of the EEPROM.

The Reader control is immediately processed and the response from the Reader contains status or data information of the control command.

<table>
<tr><th>Host (Terminal / PC / ....)</th><th></th><th colspan="2">Reader</th></tr>
<tr><td rowspan="2">parameter- / control command</td><td rowspan="2">→</td><td colspan="2">parameter received and stored / control command processed</td></tr>
<tr><td>yes</td><td>no</td></tr>
<tr><td rowspan="2"></td><td>←</td><td>status / data</td><td rowspan="2">error status</td></tr>
<tr><td>←</td><td colspan="2"></td></tr>
</table>

## 5.2. Host Commands

The Host Commands provide the exchange of data between a host and Transponders via the Reader as long as the Transponder remains in the detection range of the Reader.

***NOTE:***

***During the writing of data on a Transponder, it must be ensured that the Transponder is located within the detection range of the Reader during the entire process. If the Transponder is removed from detection range of the Reader during a writing process, this will cause a loss of data.***

The Reader to Transponder addressing mode:

**Addressed mode:**

Before reading or writing data in addressed mode, the EPC of the Transponder has to be known. This is executed by sending the protocol 10.1.1. [0x01] Inventory. If a Transponder is located within the detection range of the Reader at that time, it answers with its EPC. For all following read- / write orders the Transponder must be addressed with its correct EPC.

The following chart will show the necessary steps for the communication with a Transponder in addressed mode:

| Host (Terminal / PC / ....) | | Reader | |
|---|---|---|---|
| Inventory<br>to get the EPC | → | Transponder in antenna field ? | |
| | | Yes | No |
| | ← | status /<br>number of Transponders / EPC | status =<br>no Transponder |
| | ← | | |
| read data from Transponder with EPC | → | Transponder with<br>correct EPC in antenna field ? | |
| | | Yes | No |
| | ← | status /<br>Transponder read data | status =<br>no Transponder<br>in Reader field |
| | ← | | |
| write data to Transponder with EPC | → | Transponder with<br>correct EPC in antenna field ? | |
| | | Yes | No |
| | ← | OK status | status =<br>no Transponder<br>in Reader field |
| | ← | | |

**Non-addressed mode:**

In non-addressed mode, it is not necessary to know the UID of the Transponder. This mode is only applicable, if only one Transponder is located within the range of the Reader.

The following chart will show the necessary steps for the communication with a Transponder in non-addressed mode:

| Host (Terminal / PC / ....) | | Reader | |
|---|---|---|---|
| read data | → | Transponder in antenna field ? | |
| | | Yes | No |
| | ← | status /<br>Transponder read data | status = no Transponder<br>in Reader field |
| | ← | | |
| write data | → | Transponder in antenna field ? | |
| | | Yes | No |
| | ← | OK status | status = no Transponder<br>in Reader field |
| | ← | | |

## 5.3. Scan-Mode

In this operation-mode the Reader autonomously sends out data to the host as soon as a Transponder is within the detection range and valid data could be read.

In Scan Mode the contents of the message block (EPC, data block) can be adapted to each user-application. Scan mode is available via the asynchronous Interface and the USB Interface.
If an USB-Reader is used in scan mode, the reader sends its data automatically over the HID interface of the operating system. In this case, you cannot catch the data with the FEUSB.DLL or any other libraries. The reader works like a keyboard.

The Reader starts the output of the protocol block as soon as all required data have been read correctly from the Transponder. If the number of transmitted user data is too large, only the maximal number of transmitted data will be sent plus the end character.

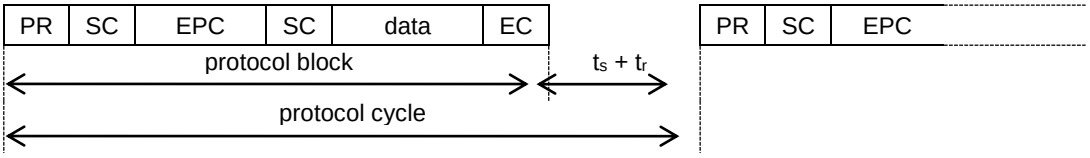
**Scan-Mode via asynchronous interface:**

The data will be sent out depending on their configuration according to the following scheme, the sequence of which cannot be changed.

Depending to the configuration and the number of Transponders in the detection range of the Reader the transmitted protocols have a different format.

Example 1:

One Transponder in detection range and EPC and data block should be read:




Example 2:

3 Transponders in detection range only EPC should be read:

| PR | SC | EPC1 | EC | EPC2 | EC | EPC3 | EC |
|---|---|---|---|---|---|---|---|

Example 3:

3 Transponders in detection range only data block should be read:

| PR | SC | data1 | EC | data2 | EC | data3 | EC |
|---|---|---|---|---|---|---|---|

Example 4:

2 Transponders in detection range EPC and data block should be read:

| PR | SC | EPC1 | SC | data1 | EC | EPC2 | SC | data2 | EC |
|---|---|---|---|---|---|---|---|---|---|

| | | | |
|---|---|---|---|
| PR: | Com-Prefix (optional) | ts: | VALID-TIME |
| EPC: | EPC-Number. | tr: | time to the next new Transponder reading |
| data: | data blocks (free programmable) | | |
| SC | Separation character (optional) | | |
| EC | End character (optional) | | |

Example 5:

| COM-ADR | Separation Character | Header | | | | EPC | Separation Character | Data-Blocks | END Character | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| COM-ADR | SEP-CHAR | USR1 | USR2 | USR3 | USR4 | EPC | SEP-CHAR | DB | USR 1 | USR 2 | USR 3 |

**Scan-Mode via USB-Interface (HID-Mode):**

If an USB-Reader is set to Scan-Mode the reader works like a keyboard. The data will be transferred as USB Key Code or as hex-values.
The user defined Sep- and End- Character will be transferred as USB Key Code.

If the number of transmitted user data is too large, only the maximal number of transmitted data will be sent plus the end character.

***NOTE:***

***If configuration protocols shall be sent to the Reader while the Scan-Mode is active, no Transponder should be within the detection range of the Reader during this time.***

***Only read operations are available with the Scan-Mode.***

## 5.4. Buffered Read Mode

The Buffered Read Mode is a high level operating mode to detect Transponders which are within the detection range of the Reader. This operation mode is especially designed for applications which use Transponders to identify objects. The Buffered Read Mode processes all Transponder read data and filter operations to make the user interface transparent to Transponder data and to minimize data transfers between Reader and host. There are only three commands used to control Buffered Read Mode.

In this operating mode the Reader automatically selects Transponders which are within the detection range of the Reader and reads their requested data. The read Transponder data is stored in a 'FIFO' organized data buffer. The data buffer is a ring buffer that can store up to 100 datasets.

The sampled Transponder data can be read with the 12.4. [0x22] Read Buffer command. This command always reads the first available data sets from the data buffer. However already read data has to be deleted with the 12.6. [0x32] Clear Data Buffer command before the next data sets in the data buffer can be reached with the read command.

If the Buffered Read Mode is enabled in the 7.2. CFG1: Interface and Mode configuration block the Reader immediately starts sampling Transponder data after power up. The Buffered Read Mode can be reinitialized with the 12.7. [0x33] Initialize Buffer command.

If turned to Buffered Read Mode the Reader answers every valid message with data- or status-protocol. The answer includes the control byte which has been received by the Reader.

<table>
<tr><th>Host (Terminal / PC / ....)</th><th></th><th colspan="2">Reader</th></tr>
<tr><td rowspan="4">read data</td><td>→</td><td colspan="2">Transponder data in data buffer ?</td></tr>
<tr><td></td><td>Yes</td><td>No</td></tr>
<tr><td>←</td><td>status /<br>data protocol</td><td rowspan="2">status = no valid data</td></tr>
<tr><td>←</td><td></td></tr>
<tr><td rowspan="4">clear data</td><td>→</td><td colspan="2">Transponder data read ?</td></tr>
<tr><td></td><td>Yes</td><td>No</td></tr>
<tr><td>←</td><td>OK status</td><td rowspan="2">status = no valid data</td></tr>
<tr><td>←</td><td></td></tr>
</table>

***NOTE:***

***Only read operations are available with the Buffered Read Mode.***

## 5.5. Notification Mode

In Notification Mode queued Transponder data are notified automatically and asynchronously to a host with the response protocol. The destination address and the notification conditions can be set in 7.24. CFG49: Notification Channel (only for ID ISC.MRU102-PoE) configuration block. In general, the notification channel can be used simultaneously with the host interface.

A notification is normally not acknowledged by the host. The deletion of the transferred data with a separate clear buffer command is not necessary. As an option, the acknowledgement can be enabled to synchronize the notifications with the host to prevent notification overflow in the host application.

The notification message format depends on the settings for the read mode in 7.5. CFG11: Read Mode – Read Data and 7.6. CFG12: Read Mode - Filter. The following table lists the message formats:

| **Notification Trigger: continuous** | |
|---|---|
| | Data Event |
| Read Trigger enabled | Notification immediately after a tag was detected.<br>The message format depends on settings in TR-DATA of CFG11. |

An additional option of the Notification Mode is the Keepalive message, which can be sent periodically to the host. The Keepalive message transports valuable information about the reader hardware and antenna tuning status. Keepalive messages are always never acknowledged by the host. The Keepalive message should not be mistaken with the Keepalive option of a LAN connection initiated by a host.

# 6. Interface

Depending on the used version the reader is equipped with different interfaces. The protocol frame of these ports can by different. For the Ethernet Interface the protocol frame is described in 6.1. Protocol Frames of TCP/IP protocol. For the asynchronous serial interface the whole protocol frame is described in 6.2. Serial Data Format and Protocol Frames.

The following reader types are currently available:

| Module type | Description |
|---|---|
| ID ISC.MRMU102-A | Reader Module with RS232 and USB, external supply voltage of 12-24 V DC and 3 external SMA antenna connectors |
| ID ISC.MRU102-U | Housed reader with USB interface and external supply voltage of 12-24 V DC and 1 external SMA antenna connector |
| ID ISC.MRU102-PoE | Housed reader with Ethernet interface and external supply voltage of 12-24 V DC or PoE and 1 external SMA antenna connector |
| ID ISC.MRU102-PoE-LED | Housed reader with Ethernet interface and external supply voltage of 12-24 V DC or PoE and 1 internal antenna. Additionally equipped with three configurable LEDs and one Buzzer. |

## 6.1. Protocol Frames of TCP/IP protocol

If the Reader uses the Ethernet Interface the data is packaged in a TCP/IP protocol frame. This means the whole data format and protocol frame which is described in 6.2. Serial Data Format and Protocol Frames is packaged as the data of a TCP/IP protocol frame. By using the FETCP.DLL you can easily extract or package the application data you receive from or you sent to the Reader.

If you use the TCP/IP protocol please be aware that the data packaged in the TCP/IP frame is transferred with **Protocol frame: Advanced Protocol-Length** as describe below.

The LAN socket on the reader side uses the **keepalive option** for detecting interrupted connections. The default parameters for keepalive are initialized as listed in the table:

| Parameter | Value | Note |
|---|---|---|
| repeat count | 2 | If a keepalive probe is not acknowledged, the reader repeats the probe only two times with an interval of 5 seconds. |
| interval | 5 second | |

If the time span is expired and no keepalive probe response is obtained from the client the connection is closed and the client application must enable a new connection. The keepalive parameters can be modified in the configuration pages for LAN. This keepalive option should not be mistake with the Keepalive message for notification mode.

## 6.2. Serial Data Format and Protocol Frames

The Reader ID ISC.MR(M)U102 can be configured by different interfaces and data may be written on Transponders or read from Transponders. The communication between Reader and connected host (terminal, PC, etc.) is executed by means of fixed protocols. The used protocol is intended for data bus use and is equipped with a bus address.

During data transfer via the asynchronous interface the Reader supplies the required data or a status byte. The reply contains the transmitted control byte.

There is no reply from the Reader if there is a protocol frame failure.

**Protocol frame: Advanced Protocol-Length (recommended mode)**

Reader ← Host

| 1 | 2 | 3 | 4 | 5 | (6...n-2) |
|---|---|---|---|---|---|
| STX (0x02) | MSB ALENGTH | LSB ALENGTH | COM-ADR | CONTROL-BYTE | (DATA) |

| n-1 | n |
|---|---|
| LSB CRC16 | MSB CRC16 |

Host ← Reader

| 1 | 2 | 3 | 4 | 5 | 6 | (7...n-2) |
|---|---|---|---|---|---|---|
| STX (0x02) | MSB ALENGTH | LSB ALENGTH | COM-ADR | CONTROL-BYTE | STATUS | (DATA) |

| n-1 | n |
|---|---|
| LSB CRC16 | MSB CRC16 |

**STX:**

If the responded protocol of the Reader starts with the STX sign (0x02) the protocol includes more than 255 Byte. Then the protocol length is defined by the 2 Byte Parameter ALENGTH.

**ALENGTH (n = 8...65535):**

Number of protocol bytes including STX, ALENGTH and CRC16

**LENGTH (n = 6...255): Standard Protocol-Length (up to 255 Byte)**

Number of protocol bytes including LENGTH and CRC16.

**COM-ADR:**

0..254 address of device in bus mode

***Notes:***

- ***The Reader can be addressed via COM-ADR 255 at any time!***

**CONTROL-BYTE:**

Defines the command which the Reader should operate.

**STATUS:**

Includes the status message or protocol data from or to the Reader.

**DATA:**

Is a optional data field with variable length. The number of DATA byte depends on the command. The data will be sent always as MSB first if the Reader is in the Host Command Mode.

**CRC16:**

Cyclic redundancy check of the protocol bytes from 1 to n-2, as specified by CCITT-CRC16

Polynom: $x^{16} + x^{12} + x^5 + 1$ (0x8408)

Start Value: 0xFFFF

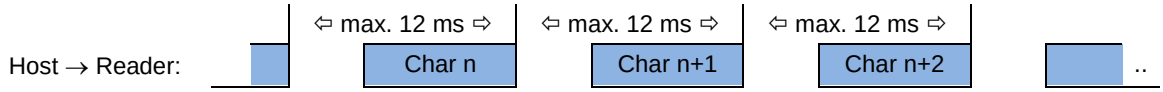
Direction: Backward

**Data format:**

| | |
|---|---|
| Start bits: | 1 |
| Data bits: | 8 |
| Stop bits: | 1 |
| Parity: | even (default)<br>odd<br>none |

**Data timeout:**

Within one protocol, the characters have to follow each other in intervals of maximum 12 ms.



## 6.3. CRC16 Calculation Algorithm

Polynom: $x^{16} + x^{12} + x^5 + 1$ ⇒ CRC_POLYNOM = 0x8408;

Start Value: 0xFFFF ⇒ CRC_PRESET = 0xFFFF;

C-Example:

```
unsigned int crc = CRC_PRESET;

for (i = 0; i < cnt; i++)       /* cnt = number of protocol bytes without CRC */
{
        crc ^= DATA[i];
        for (j = 0; j < 8; j++)
        {
                if (crc & 0x0001)
                        crc = (crc >> 1) ^ CRC_POLYNOM;
                else
                        crc = (crc >> 1);
        }
}
```

# 7. Configuration Parameters (CFG)

The configuration memory of the Reader is organized in configuration blocks of 16 byte each. These are divided into 14 byte configuration parameters and a 2 byte CRC16 checksum. Each of these configuration blocks takes a number (CFG 0...CFG n).

Structure of a configuration block in Reader configuration memory and Reader EEPROM (CFG):

| Byte | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Contents | PARAMETER | | | | | | | | | | | | | | CRC16 | |

The parameters are stored in two different configuration memory locations:

- Reader RAM
- Backup EEPROM (used for storing parameter over power down)

Multiple configuration memory locations can be addressed by the value of the parameter CFG-ADR.

**CFG-ADR:**

**CFGn:** memory-address of the required configuration block

**LOC:** specifies the location of the configuration block (RAM / EEPROM)

**MODE:** specifies one or all configuration blocks

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function | LOC | MODE | CFGn: address of configuration block | | | | | |

The EEPROM configuration blocks are protected by a 16 bit CRC-checksum. The examination of these checksums is executed after each reset of the Reader. If a checksum error is found, the Reader goes into an error status "EE-Init-Mode" and sets the configuration block which is faulty to the default-values.

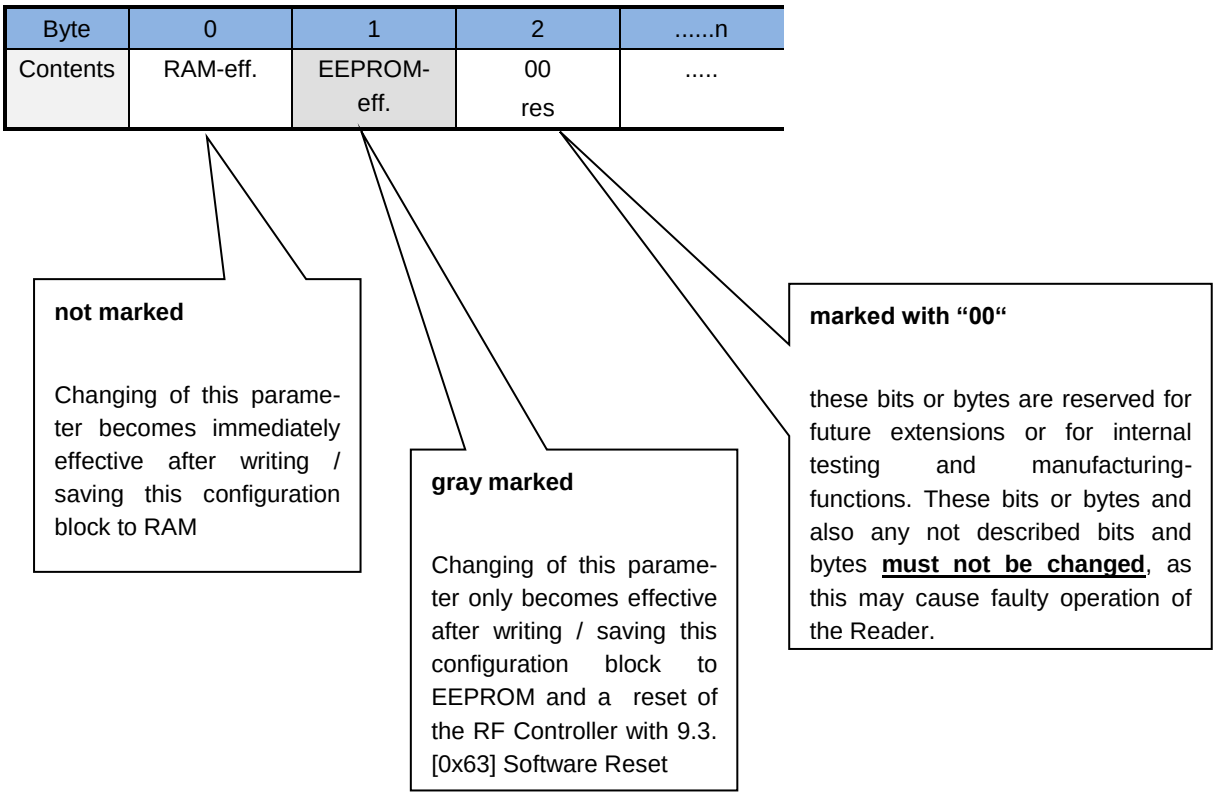
While the EE-Init-Mode is active, the LED blinks alternately red and green and the Reader answers external commands with the status "0x10 EEPROM Failure". The "EE-Init-Mode" can be exited now by a new reset (cold start or 6.3. [0x63] RF Controller Reset command**).** If after this the checksums of all data records are correct, the Reader shifts to the configured operation mode.

***NOTE:***

***Malfunctions may occur if parameters are configured outside their described range or if unspecified parameters have been changed!***

***A Firmware update resets the EEPROM to default settings and the Reader goes into the error status "EE-Init-mode.***

## Structure of configuration parameter description.




## Labeling of configuration parameters.

Each configuration parameter has a short name and a structured long name, like:
**SHORT-NAME:** ***(Long-Name)***

Example 1:

**READER-MODE:** ***(OperatingMode.Mode)***

Example 2:

**BAUD:** ***(HostInterface.Serial.Baudrate)***

The short name is used inside the hex bar because of limited space. The structured long name is the proper parameter name and is placed in brackets behind the short name, when the parameter is described in detail.

The reason for the launch of structured long names is to unify all parameter names for all Readers. Structured long names are built with one or more namespaces divided by a point and an attached parameter name.

The structured long names are used as from now in ISOStart 8.0 and beginning with version 3.0.0 of Software Development Kits (SDK).

A summary of the parameter are shown in chapter: **Fehler! Verweisquelle konnte nicht gefunden werden.**

## 7.1. CFG0: Passwords

The parameters of the CFG0 configuration block contain the identification codes to personalize the Reader for a user to prevent outside access to some features of the Reader. For security reasons data from this configuration block cannot be read from the host, they are “write-only”. Also the command 8.3. [0x83] Set Default Configuration (Configuration Reset) isn’t available for this configuration block.

| Byte | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| Contents | READER-ID | | | | 0x00 | 0x00 | 0x00 |
| Default | 0x00000000 | | | | | | |

| Byte | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|
| Contents | 0x00 | CFG_ACCESS | | | | 0x00 | 0x00 |
| Default | | | | | | | |

**READER-ID: *(AccessProtection.Password)***

Defines the password with which the host logs into the Reader for a read / write access to the configuration parameter blocks.

**CFG_ACCESS: (*AccessProtection.Lock_CFGX*)**

Defines the Configuration blocks which are accessible only if the user has had a successful login to the Reader.

| Byte: | 8 | | | | | | | | 9 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bit: | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| CFG No. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |

| Byte: | 10 | | | | | | | | 11 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bit: | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| CFG_NO. | 16 | 17 | 18 | 19 | 20 | 21 | 22-29 | 30-35 | 40-49 | 50-59 | 60-62 | 63 | 36 | 37 | 38 | 39 |

CFG_NO

The Bit in CFG_NO defines if the access to the configuration block is free or if the user should login to the Reader to get access to the configuration block.

b0 ⇒ Access if free

b1 ⇒ Access need a login

**To change the READER-ID** you must write to the CFG0 immediately after the Login to the Reader with the command 9.10. [0xA0] Reader-Login

***NOTE:***

***A READER-ID = 0x00000000 disables the password function.***

***A read with the command 8.1. [0x80] Read Configuration will always get '0x00000000'.***

***A changed password becomes valid after a 9.4. [0x64] System Reset***

***8.3. [0x83] Set Default Configuration* (Configuration Reset) *doesn't change the CFG0 register if all configuration blocks are used.***

***The command 9.10. [0xA0] Reader-Login is used to enable configuration data access***

***It is possible to disable the READER-ID with an activation code, if the READER-ID is unknown. The activation code must be ordered by your supplier or FEIG Electronic GmbH.***

**Config Protection**

By means of Config Protection, the access to the configuration parameters stored within the Reader is protected by a 32-bit password, the "READER-ID". This means that only after a "Login" with a valid READER-ID by the command 9.10. [0xA0] Reader-Login configuration parameters in the EEPROM of the Reader may be read and changed.

## 7.2. CFG1: Interface and Mode

The parameters of the CFG1 configuration block contain the data communication settings.

| Byte | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| Contents | COM-ADR | 0x00 | BAUD[1] | TRANS-FORM[1] | 0x00 | 0x00 | TR-RESPONSE-TIME |
| Default | 0x00<br>*0x00* | | 0x08<br>*38400 Baud* | 0x01<br>*e,8,1* | | | 0x01 |

| Byte | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|
| Contents | TR-RESPONSE-TIME | POWER-ON-MODE | 0x00 | Protocol Mode | SCAN-INTERFACE | Interface | READER - MODE |
| Default | 0x2C<br>*1,5 sec.* | | | | 0x00 | 0x11 | 0x00 |

**COM-ADR: (*HostInterface.Serial.BusAddress*)**

Bus address of the Reader (0 .. 254) for communication via the asynchronous interface.

***NOTE:***

***Do not configure address 255!***

***Via the COM-ADR 255 in the send protocol, the Reader is able to be addressed at any time. It answers then with the configured address.***

**BAUD: (*HostInterface.Serial.Baudrate*)**

By means of this byte the baud rate of the asynchronous interface can be defined.

0x05: 4800 baud
0x06: 9600 baud
0x07: 19200 baud
0x08: 38400 baud
0x09: 57600 baud
0x0A: 115200 baud
0x0B: 230400 baud

***NOTE:***

***Changing of BAUD only becomes effective after writing / saving configuration block CFG1 to EEPROM and a reset of the Reader.***

***The Reader sets the baud rate to 38400 baud, if the user sets an invalid baudrate.***

[1] *A reasonableness check is performed by writing this parameter to the Reader. If an error occurs the Reader answers with STATUS = 0x11.*

**TRANS-FORM:**

By means of this byte, several parameters for the data transmission format of the asynchronous interface can be defined.

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function: | 0 | 0 | 0 | 0 | S | D | P | |

**P:** **(*HostInterface.Serial.Parity*)**

Kind of Parity
b00: no Parity
b01: even Parity
b10: odd Parity
b11: **- do not use -**

**D:** **(*HostInterface.Serial.Databits*)**

Number of Data Bits
b0: 8 Data Bits
b1: **- do not use -**

**S:** **(*HostInterface.Serial.Stopbits*)**

Number of Stop Bits
b0: 1 Stop Bit
b1: **- do not use –**

***NOTE:***

***Changing of TRANS-FORM only becomes effective after writing / saving configuration block CFG1 to EEPROM and reset of the Reader.***

***Always 8 Data Bits and 1 Stop Bits should be used***

**TR-RESPONSE-TIME: (*AirInterface.TimeLimit*)**

By means of this parameter the maximum duration for the Transponder command can be defined.

The TR-RESPONSE-TIME starts after the Reader has received a new command. At the latest after the TR-RESPONSE-TIME elapsed the Reader will send an answer protocol. In this case, the current commands between Reader and Transponder are aborted. If this time is too short the Interface Status “0x83 RF Communication Error“ will appear.

| | max. response duration |
|---|---|
| TR-RESPONSE-TIME | 0...65535 * 5 ms |

***NOTE:***

***TR-RESPONSE-TIME has no effect with the protocols for Reader Configuration and the protocols for Reader Control.***

***The TR-RESPONSE Time must be < "Block Timeout" in the Host Interface settings.***

**POWER-ON-MODE:**

By setting of this parameter the behavior of the reader can be set after power on.

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function: | - | - | - | - | - | - | - | BRM |

**BRM:** Behavior of the reader in BRM-Mode

b0: The reader automatically starts the BRM-Mode after power on or a reset of the reader.

b1: The BRM-Mode is stopped after power on or system reset. The user has to start the BRM-Mode manual with RF-On.

**Protocol Mode:**

By setting of this parameter the Protocol Mode can be enabled

0x00: support of Advanced Protocol Mode (default)

0x01: support of Advanced and Standard Protocol Mode.

**We recommend to use Advanced Protocol Mode**!

See: 6.2. Serial Data Format and Protocol Frames

**SCAN-INTERFACE: (*OperatingMode.ScanMode.Interface*)**

Selection of the communication port for Scan-Mode

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function: | - | - | - | - | - | IF-NO | | |

**IF-NO:** Interface Number

b000: RS232

b001: **- do not use -**

b010: USB

b011: **- do not use -**

b1xx: **- do not use -**

**INTERFACE:** ***(HostInterface.Interfaces)***

Flags for enabling the communication ports (fix)

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function: | Discovery | - | - | USB | - | LAN | - | RS232 |

**RS232:** b0: disable
b1: enable

**LAN:** b0: disable
b1: enable

**USB:** b0: disable
b1: enable

**Discovery:** b0: disable (only with TCP/IP interface)
b1: enable (only with TCP/IP interface)

**READER-MODE: (*OperatingMode.Mode*)**

By means of this byte, the Reader mode can be defined.

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function: | BRM-E | NTFE | 0 | 0 | 0 | 0 | 0 | SCAN-E |

**SCAN-E:**

By setting of this bit the Scan-Mode can be enabled

b0: **Host Mode** (see chapter 10. Protocols for Host Commands)
b1: **Scan Mode**

**BRM-E:**

By setting of this bit the Buffered Read Mode can be enabled

b0: **Host Mode** or **Scan Mode**
b1: **Buffered Read Mode**

**NTFE: (only LAN reader version)**

By setting of this bit the Notification-Mode can be enabled

b0: **Off**
b1: **On (only if BRM-E is set)**

***NOTE:***

***Notification Mode only becomes active if Bits for BRM-E and NTFE are set.***

***Buffered Read Mode and Notification Mode can store up to 100 datasets into the internal reader buffer.***

## 7.3. CFG2: Inputs / Outputs general

Via the following parameters the operation mode of the LED can be configured at any time. One byte each is reserved for the active and mute position, by means of which the individual operation modes according to the schedule below may be adjusted. In addition to this, for the active- and mute position different flashing frequencies of the LED may be defined. So, the LED may be used as an operation indicator.

| Byte | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| Contents | 0x00 | 0x00 | 0x00 | IDLE-STATE | IDLE-FLASH | 0x00 | 0x00 |
| Default | | | | 0xA9 | 0x00 | | |

| Byte | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|
| Contents | ACTIV-STATE | ACTIV-FLASH | ACTIV-GRN-TIME | ACTIV-RED-TIME | 0x00 | 0x00 | 0x00 |
| Default | 0x26 | 0x00 | 0x0A | 0x0A | | | |
| | | | *1 sec.* | *1 sec.* | | | |

***NOTE:***

***The Readers dispose of a two colored LED (red / green). The color orange can be obtained by combining both basic colors red and green.***

Colors

| LED Color: | red | green |
|---|---|---|
| red | 1 | 0 |
| green | 0 | 1 |
| orange | 1 | 1 |

**IDLE-STATE / ACTIVE-STATE**

One byte each for idle- and tag-detect state is used to set the operation mode of the signal transmitter.

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function: | Startup LED | 0 | 0 | | RED | | GRN | |

**GRN / RED**

| Bit Combination | Signal device |
|---|---|
| b00 | unchanged |
| b01 | on |
| b10 | off |
| b11 | flashing |

**Startup LED** (only idle state)

When this option is selected, the Reader will switch the LEDs on for two seconds to indicate that the Reader is ready after the Reader is supplied with power. If the Reader is reset by software, only both LEDs switch on for 2 seconds.

### IDLE-FLASH / ACTIV-FLASH:

By means of the two bytes "IDLE-FLASH" and "ACTIV-FLASH" the signal transmitter may be provided with a flashing frequency for idle and active position.

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function: | 0 | | 0 | | RED | | GRN | |

| Bit combination | flashing frequency |
|---|---|
| b11 | 1 Hz |
| b10 | 2 Hz |
| b01 | 4 Hz |
| b00 | 8 Hz |

### ACTIV-xxx-TIME

If a Transponder was detected, the transmitter and the duration can be set by the bytes ACTIV-STATE and ACTIV-FLASH. Each signal transmitter (LED) may be activated temporarily limited.

| Signal transmitter | time range |
|---|---|
| ACTIV-GRN-TIME | 0...255 x 100 ms |
| ACTIV-RED-TIME | 0...255 x 100 ms |

## 7.4. CFG3 .. 10: Reserved

The configuration block CFG3 and CFG10 are reserved for future use.

| Byte | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| Contents | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

Default

| Byte | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|
| Contents | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

Default

## 7.5. CFG11: Read Mode – Read Data

The parameters of the CFG11 configuration block contain settings for the automated reader modes. To use these options the reader must be set to Scan Mode, Buffered Read Mode or Notification Mode.

| Byte | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| Contents | TR-DATA-1[2] | TR-DATA-2 | TR-DATA-3 | BANK | DB-ADR[2] | | 0x00 |
| Default | 0x31 | 0x00 | 0x00 | 0x00 | 0x0000 | | |

| Byte | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|
| Contents | 0x00 | DB-N[3] | | 0x00 | D-START | D-LGT | |
| Default | | 0x0001 | | | 0x00 | 0x0004 | |

**TR-DATA-1:**

Selects the data types for read operation.

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function | Extension | 0 | TIMER | ANT | Byte Order DB | 0 | DB | SNR |

**SNR** (***OperatingMode.ScanMode.DataSelector.EPC***)
(***OperatingMode.BufferedReadMode.DataSelector.EPC***)
(***OperatingMode.NotificationMode.DataSelector.EPC***)
b0: no Serial Number will be stored
b1: Serial Number will be stored

**DB** (***OperatingMode.ScanMode.DataSelector.Data***)
(***OperatingMode.BufferedReadMode.DataSelector.Data***)
(***OperatingMode. NotificationMode.DataSelector.Data***)
b0: no data block will be stored
b1: data block will be stored

[2] *A reasonableness check is performed by writing this parameter to the Reader. If an error occurs the Reader answers with STATUS = [0x11].*

[3] *A plausibility check is performed by writing this parameter to the Reader. If an error occurs the Reader answers with STATUS = [0x11].*

**Byte Order DB** (***OperatingMode.ScanMode.DataSource.ByteOrderOfData***)
(***OperatingMode.BufferedReadMode.DataSource.ByteOrderOfData***)
(***OperatingMode. NotificationMode.DataSource.ByteOrderOfData***)
b0: MSB first
b1: LSB first

**ANT** (***OperatingMode.ScanMode.DataSelector.AntennaNo***)
(***OperatingMode.BufferedReadMode.DataSelector.AntennaNo***)
(***OperatingMode. NotificationMode.DataSelector.AntennaNo***)
b0: the number of the antenna will not be stored
b1: the number of the antenna (1-2) where the Transponder has been detected, will be stored.

**TIMER** (***OperatingMode.ScanMode.DataSelector.Time***)
(***OperatingMode.BufferedReadMode.DataSelector.Time***)
(***OperatingMode.NotificationMode.DataSelector.Time***)

b0: no internal system timer
b1: internal system timer will be active

***NOTE:***

***The internal system timer is not a real time clock (RTC) and the accuracy cannot be guaranteed.***

**Extension**

b0: extension flag disabled, Data from TR-Data2 will not be requested
b1: extension flag enabled, Data from TR-Data2 will be requested

**TR-DATA-2:**

Selects the data types for read operation.

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function | - | - | - | ANT_ Ext | - | - | MAC | - |

**MAC:**

b0: no MAC-Address will be stored and transferred
b1: MAC-Address of the reader will be stored and transferred

**ANT_Ext: Antenna Extended**
**(OperatingMode.Buffred ReadMode.DataSelector.RSSI)**
**(OperatingMode.NotificationMode.DataSelector.RSSI)**

b0: no RSSI

b1: Antenna number with RSSI

***NOTE:***

***If Antenna Extended is enabled the bit for number of antenna must be disabled.***

**TR-DATA-3:**

Selects the data types for read operation.

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function | - | - | - | - | READ_ COMPL ETE_ BANK | - | ANT- STORE | COM- PREFIX |

**COM-PREFIX: (Scan Mode only)**

**(*OperatingMode.ScanMode.DataFormat.BusAddressPrefix*)**

b0: no COM Prefix is send

b1: The Reader will transmit the COM-ADR in front of each data set.

**ANT-STORE:**

**(*OperatingMode.BufferedReadMode.DataSelector.Mode.Enable_AntennaPool*)**

**(*OperatingMode.NotificationMode.DataSelector.Mode.Enable_AntennaPool*)**

**(*OperatingMode.ScanMode.DataSelector.Mode.Enable_AntennaPool*)**

If this bit is set, the reader stores only one data set also if a tag has been detected of more than one antenna. If this bit is not set, the reader stores a data set for each antenna.

Examples:
1) ANT-STORE = 1, Tag was detected by antenna 1 and 4

| **Antenna** | **8** | **7** | **6** | **5** | **4** | **3** | **2** | **1** |
|---|---|---|---|---|---|---|---|---|
| Bit | 7 | 6 | 5 | 4 | **3** | 2 | 1 | **0** |
| detected | 0 | 0 | 0 | 0 | **1** | 0 | 0 | **1** |

one data set, antenna number = 0x09

***NOTE:***

***If ANT-STORE = 1 and a Tag was detected by antenna 1 and the data set was transmitted to the host, the reader doesn't store new data sets for this transponder if read on another antenna, while the valid time has not expired.***

**READ_COMPLETE_BANK:**
**(*OperatingMode.ScanMode.DataSelector.Mode.Read_Complete_Bank*)**
**(*OperatingMode.BufferedReadMode.DataSelector.Mode.Read_Complete_Bank*)**
**(*OperatingMode.NotificationMode.DataSelector.Mode.Read_Complete_Bank*)**

If this bit is set the reader will read out all memory blocks from the selected Memory BANK.

b00 Reader reads out the memory blocks according to the settings in DB-ADR, DB-N, D-Start and D-LGT.

b01 Reader reads out all blocks of the selected memory bank

***NOTE:***

***This functionality is limited to memory banks with a maximum size of 255 Byte.***

**BANK:**

Memory bank of the Transponder which will be accessed by the Reader

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function | 0 | 0 | 0 | 0 | 0 | 0 | BANK_NR | |

**BANK_NR:** **(*OperatingMode.ScanMode.DataSource.BankNo*)**
**(*OperatingMode.BufferedReadMode.DataSource.BankNo*)**
**(*OperatingMode.NotificationMode.DataSource.BankNo*)**
In case of Class 1 Gen 2 Transponder BANK_NR is defined as follows:

b00 reserved
b01 EPC memory bank
b10 TID memory bank
b11 User memory bank

***NOTE:***

***EPC Class1 Gen 2 memory banks can only be read in open state.***

**DB-ADR:** **(*OperatingMode.ScanMode.DataSource.FirstDataBlock*)**
**(*OperatingMode.BufferedReadMode.DataSource.FirstDataBlock*)**
**(*OperatingMode.NotificationMode.DataSource.FirstDataBlock*)**

Address of first data block.

**DB-N:** **(*OperatingMode.BufferedReadMode.DataSource.NoOfDataBlocks*)**
**(*OperatingMode.NotificationMode.DataSource.NoOfDataBlocks*)**

Number of data blocks to be read.

**D-START: (*OperatingMode.ScanMode.DataSource.FirstByte*)**

This parameter defines the first byte in the raw data (defined by DB-ADR and D-LGT), which will be transferred in Scan-Mode. To transfer the whole data block D-START must be set to 0.

***NOTE:***

***The size of one data block depends on the type of Transponder.***

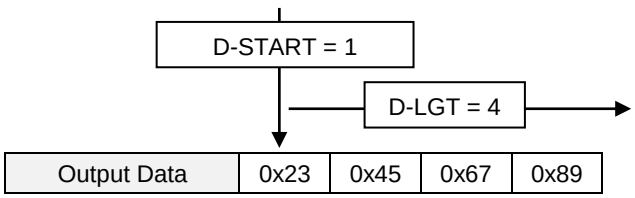
**D-LGT: (*OperatingMode.ScanMode.DataSource.NoOfBytes*)**

D-LGT defines the length of raw data which are transmitted in the Scan-Mode.

Number of **data bytes** to be transferred, starting with the D-START.

Example:
data block

| Byte | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| Data | 0x01 | 0x23 | 0x45 | 0x67 | 0x89 | 0xAB | 0xCD | 0xEF |




| Output Data | 0x23 | 0x45 | 0x67 | 0x89 |
|---|---|---|---|---|

## 7.6. CFG12: Read Mode - Filter

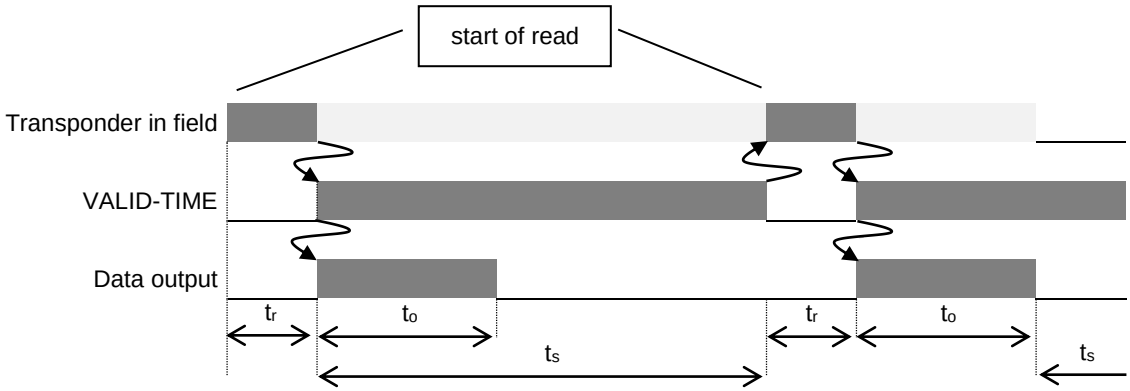
| Byte | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| Contents | VALID-TIME[1] | | TR-ID | | | | 0x00 |
| Default | 0x0037<br>5,5 sec. | | 0x01 | 0x00 | 0x00 | 0x01 | |

| Byte | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|
| Contents | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |
| Default | | | | | | | |

**VALID-TIME:** (0...65535 x 100 ms = 0 ms ... 6553,5 sec)

***(OperatingMode.ScanMode.Filter.TransponderValidTime)***
***(OperatingMode.BufferedReadMode.Filter.TransponderValidTime)***
***(OperatingMode.NotificationMode.Filter.TransponderValidTime)***

The VALID-TIME defines the period in which the Reader does not transmit the Transponder data a second time, after it has transmitted it the first time. (regardless whether the Transponder is in the detection range of the reader during VALID-TIME or not). The VALID-TIME starts after the data transmission from the Transponder to the Reader..




$t_r$: Time to read the Transponder data

$t_o$: Data Transmission from the Reader to the host

$t_s$: VALID-TIME
As long as the VALID-TIME is active, the Transponder can be in the detection range of the reader or outside of it.

***NOTE:***

***Changing of VALID-TIME only becomes effective after writing / saving configuration block CFG12 to EEPROM.***

**TR-ID:**

TR-ID sets the parameters for Transponder identification.
If several Transponders has the same content in the addressed data block, only one dataset will be generated.

| Byte: | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Function | TR-ID-SOURCE | TR-ID-DB-ADR | | TR-ID-DB-N |

**TR-ID-SOURCE: (*OperatingMode.Miscellaneous.TransponderIdentification.Source*)**

Sets the data source for Transponder identification.

b0 data block

b1 Serial Number

**TR-ID-DB-ADR: (*Operating-Mode.Miscellaneous.TransponderIdentification.DataBlockNo*)**

Sets the address of the data block for Transponder identification. If ID-SOURCE selects the Serial Number as data source, the ID-DB-ADR will be ignored.

**TR-ID-DB-N: (*Operating-Mode.Miscellaneous.TransponderIdentification.NoOfDataBlocks*)**

Sets the number of data blocks to be read for Transponder identification. If ID-SOURCE selects the Serial Number as data source, the ID-DBN will be ignored.

## 7.7. CFG13: Scan Mode

The configuration block CFG13 contains the Scan Mode settings

| Byte | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| Contents | DB-USE | SEP-CHAR | SEP-USER | END-CHAR | END-USR1 | END-USR2 | END-USR3 |
| Default | 0x02 | 0x20 | 0x2C | 0x01 | 0x0D | 0x00 | 0x00 |

| Byte | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|
| Contents | 0x00 | HEADER-USR1 | HEADER - USR2 | HEADER - USR3 | HEADER - USR4 | 0x00 | LEN-USR |
| Default | | 0x00 | 0x00 | 0x00 | 0x00 | | 0x00 |

**DB-USE:** ***(OperatingMode.ScanMode.DataFormat…..)***

Defines the data format of the data and the value of the data.

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function | 0 | 0 | 0 | 0 | DB-FORMAT | | | |

**DB-FORMAT** **(*OperatingMode.ScanMode.DataFormat.Format*)**

**b0000 unformatted hex-data**

In this case the data are transferred as they were read by the reader

**b0010 ASCII formatted hex-data**

In this case the raw data from the Transponder were converted to ASCII - Code before transfer. For this purpose, the data bytes first are separated into their Nibbles and then changed into ASCII signs according the following table.

| raw data (hex / binary) | | ASCII data (ASCII / hex) | |
|---|---|---|---|
| 0x0 | b0000 | '0' | 0x30 |
| 0x1 | b0001 | '1' | 0x31 |
| 0x2 | b0010 | '2' | 0x32 |
| 0x3 | b0011 | '3' | 0x33 |
| 0x4 | b0100 | '4' | 0x34 |
| 0x5 | b0101 | '5' | 0x35 |
| 0x6 | b0110 | '6' | 0x36 |
| 0x7 | b0111 | '7' | 0x37 |
| 0x8 | b1000 | '8' | 0x38 |
| 0x9 | b1001 | '9' | 0x39 |
| 0xA | b1010 | 'A' | 0x41 |
| 0xB | b1011 | 'B' | 0x42 |
| 0xC | b1100 | 'C' | 0x43 |
| 0xD | b1101 | 'D' | 0x44 |
| 0xE | b1110 | 'E' | 0x45 |
| 0xF | b1111 | 'F' | 0x46 |

**SEP-CHAR:** **(*OperatingMode.ScanMode.DataFormat.SeparationChar*)**

Selects the separation character between two data types for the send data.

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function | USER | ‘ ‘ | ‘,‘ | ‘;’ | TAB | CR | LF | CR+LF |

| ASCII | Hex |
|---|---|
| CR+LF | 0x0D and 0x0A |
| LF | 0x0A |
| CR | 0x0D |
| TAB | 0x09 |
| ‘;’ | 0x3B |
| ‘,’ | 0x2C |
| ‘ ‘ | 0x20 |
| USER | user defined in SEP-USR |
| none | 0x00 |

***NOTE:***

***Only one option can be selected.***

**SEP-USR:** **(*OperatingMode.ScanMode.DataFormat.UserSeparationChar*)**

User defined separation character.

**END-CHAR:** **(*OperatingMode.ScanMode.DataFormat.EndChar*)**

Selects the end character between two data types for the send data.

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function | USER | ‘ ‘ | ‘,‘ | ‘;’ | TAB | CR | LF | CR+LF |

| ASCII | Hex |
|---|---|
| CR+LF | 0x0D and 0x0A |
| LF | 0x0A |
| CR | 0x0D |
| TAB | 0x09 |
| ‘;’ | 0x3B |
| ‘,’ | 0x2C |
| ‘ ‘ | 0x20 |
| USER | user defined in SEP-USR |
| none | 0x00 |

***NOTE:***

***Only one option can be selected.***

**END-USR1...3: (*OperatingMode.ScanMode.DataFormat.UserEndCharX*)**

User defined end character.

**HEADER-USR1...4: (*OperatingMode.ScanMode.DataFormat.UserHeaderCharX*)**

User defined Header character.

**LEN-USR:**

Defines the length of the HEADER character and END character.

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function | HEADER-LEN | | | | END-LEN | | | |

**END-LEN (*OperatingMode.ScanMode.DataFormat.NoOfUserEndChars*)**

**b0000** END-USR1

**b0001** END-USR1

**b0010** END-USR1 +2

**b0011** END-USR1 + 2 + 3

**HEADER-LEN (*OperatingMode.ScanMode.DataFormat.NoOfUserHeaderChars*)**

**b0000** no HEADER byte

**b0001** HEADER-USR1

**b0010** HEADER-USR1 +2

**b0011** HEADER-USR1 + 2 + 3

**b0100** HEADER-USR1 + 2 + 3 + 4

Example of scan data:

| COM-ADR | Separation Character | Header | | | | EPC | Separation Character | Data-Blocks | END Character | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| COM-ADR | SEP-CHAR | USR1 | USR2 | USR3 | USR4 | EPC | SEP-CHAR | DB | USR1 | USR2 | USR3 |

## 7.8. CFG14: Reserved

The configuration block CFG14 are reserved for future use.

| Byte | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| Contents | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

Default

| Byte | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|
| Contents | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

Default

## 7.9. CFG15: Antenna Multiplexing

The parameters in CFG14 are used to configure for multiplexing of antennas in Scan Mode.

| Byte | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| Contents | MUX-MODE | ANT_OUT | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |
| Default | 0x00 | 0x48 | | | | | |

| Byte | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|
| Contents | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |
| Default | | | | | | | |

**MUX-MODE:**

Activates or deactivates multiplexing and determines when the next output is selected.

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Multiplexing |

**Multiplexing:** **(*AirInterface.Multiplexer.Enable*)**

b0: disable

b1: enable

**ANT_OUT:** **(*AirInterface.Multiplexer.UHF.Internal.NoOfAntennas*)**

Specifies the number of antenna outputs used in Scan Mode or Notification Mode.

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function | - | ANT_OUT_INT | | | | - | | |
| | | ANT(INT) | ANT3 | ANT2 | ANT1 | | | |

**ANT_OUT_INT: ()**

This parameter defines the used antennas if multiplexing is enabled.
(not available in ISO Host Mode)

b0: Antenna disabled

b1: Antenna enabled

Example: Reader shall read on antenna 2
ANT_OUT_INT = b0010

## 7.10. CFG16: Persistence Reset

The parameters in CFG16 are used to configure the Reader reset timing of the persistence flags of the Transponders. The timing for reset of the persistence flags is used by the Reader in Host Mode and Scan Mode.

| Byte | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| Contents | 0x00 | 0x00 | PER-RESET-TIME | | 0x00 | 0x00 | 0x00 |
| Default | 0x00 | 0x00 | 0x0028 | | 0x00 | 0x00 | 0x00 |
| | | | 40 x 5ms = 200ms | | | | |

| Byte | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|
| Contents | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |
| Default | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

**PER-RESET-TIME: (Transponder.PersistenceReset.Antenna.No1.PersistenceResetTime)**

The timer value specifies a time which determine the reset of the Transponder persistence flags by the Reader. The timer PER-RESET-TIME starts after the Reader gets a response at the antenna port. After this time has expired the Reader send a persistence reset command to the Transponders at the antenna port.
Timer ticks = 5ms
Maximum timer value = 5ms x 65534[0xFFFE] = 5,46125 min.

The value 65535 [0xFFFF] indicates that no persistence reset is performed by the Reader

***NOTE:***

***The persistence reset time is valid for all antennas***

***The persistence reset time is retriggered with every new transponder***

## 7.11. CFG17 .. 19: Reserved

The configuration block CFG17 .. 19 are reserved for future use.

| Byte | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| Contents | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

Default

| Byte | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|
| Contents | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

Default

## 7.12. CFG20: RF-Parameter

The configuration register CFG20 contains further RF-Parameter.

| Byte | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| Contents | RSSI-Filter ANT 1 | RSSI-Filter ANT 2 | RSSI-Filter ANT 3 | RSSI-Filter ANT INT | 0x00 | 0x00 | RF-POWER-ANT2 |
| Default | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x14 |

| Byte | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|
| Contents | RF-POWER-ANT3 | RF-POWER-ANTINT | DEFAULT_ ANTENNA_ HOST_ MODE | 0x00 | 0x00 | 0x00 | 0x00 |
| Default | 0x14 | 0x14 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

**RSSI-Filter: *AirInterface.Antenna.UHF.RSSI-Filter-ANTx* (x=1..3, INT)**

Defines the RSSI Filter Level

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function | Filter Level | | | | | | | |

**Filter-Level**

Level of the RSSI-Filter

| Filter-Level | Level |
|---|---|
| 0x00 | No Filtering |
| 0x01 | -1 dBm |
| 0x02 | -2 dBm |
| 0x03 | -3 dBm |
| 0x04 | -4 dBm |
| 0x05 | -5 dBm |
| 0x06 | -6 dBm |
| 0x07 | -7 dBm |
| 0x08 | -8 dBm |
| 0x09 | -9 dBm |
| 0x0A | -10 dBm |
| 0x0B | -11 dBm |
| 0x0C | -12 dBm |
| 0x0D | -13 dBm |
| 0x0E | -14 dBm |
| 0x0F | -15 dBm |
| 0x10 | -16 dBm |
| … | - … dBm |
| 0xFF | -255 dBm |

***NOTE:***

***Only Transponders will be displayed whose received signal strength is above the defined Filter Level.***

**RF-POWER-ANTx[4]:** **(*AirInterface.Antenna.UHF.No2.OutputPower*)**

**(*AirInterface.Antenna.UHF.No3.OutputPower*)**

**(*AirInterface.Antenna.UHF.No4.OutputPower*)**

Defines the RF output power for antenna 2, 3 and 4 (internal).

| Bit | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function | 0 | 0 | LEVEL | | | | | |

**LEVEL**

Level of the RF output power

| LEVEL | RF-POWER |
|---|---|
| 0x08 | Full Power – 10 dB (approx. 50 mW) |
| 0x10 | Full Power – 7 dB (approx. 100 mW) |
| 0x11 | Full Power – 4 dB (approx. 200 mW) |
| 0x12 | Full Power – 2 dB (approx. 300 mW) |
| 0x13 | Full Power – 1 dB (approx. 400 mW) |
| 0x14 | Full Power (approx. 500 mW) |

***NOTE:***

***If region = Japan, the maximal output power is Full Power – 4 dB (0x11).***

***If output power = 0x00, then the Power which is configured in CFG36 for antenna 1 will be used.***

***The output power for Antenna 1 can be configured in 7.18. CFG36: RF-Interface UHF.***

**DEFAULT_ANTENNA_HOST_MODE:** **(AirInterface.Antenna.UHF.Miscellaneous.Type)**

Defines which antenna is used by default in ISO Host Mode after a power up of the reader or a RF-Controller Reset.

0x00 External Antenna – ANT 1 (default)
0x01 Internal Antenna – ANT 4

[4] *A plausibility check is performed by writing this parameter to the Reader. If an error occurs the Reader answers with STATUS = [0x11].*

## 7.13. CFG21: Reserved

The configuration block CFG21 is reserved for future use.

| Byte | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| Contents | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

Default

| Byte | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|
| Contents | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

Default

## 7.14. CFG22 .. 23: Selection mask for EPC Gen 2

The configuration blocks CFG22..23 hold a selection mask for selection of EPC Class1 Gen 2 Transponders.

**CFG 22:**

| Byte | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| Contents | S_MASK_LGT | S_MODE | S_START_ POINTER | | S_MASK_MSB | | |
| Default | 0x00 | 0x01 | 0x0010 | | 0x30 | 0x00 | 0x00 |

| Byte | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|
| Contents | S_MASK | | | | | | |
| Default | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

**CFG 23:**

| Byte | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| Contents | S_MASK | | | | | | |
| Default | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

| Byte | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|
| Contents | S_MASK | | | | | | |
| Default | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

**S_MASK_LGT:** ***(Transponder.UHF.EPC_Class1Gen2.SelectionMask.MaskLength)***

Defines the length of the mask in Bit

If S_MASK_LGT is 0 the selection mask is disabled

**S_MODE:** ***(Transponder.UHF.EPC_Class1Gen2.SelectionMask…..)***

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function | 0 | 0 | 0 | 0 | 0 | S_NOT | S_BANK | |

**S_BANK:** ***(Transponder.UHF.EPC_Class1Gen2.SelectionMask.BankNo)***

Defines whether mask applies to EPC, TID, User memory

b00 reserved

b01 EPC memory bank

b10 TID memory bank

b11 User memory bank

**S_NOT: (*Transponder.UHF.EPC_Class1Gen2.SelectionMask.Negation*)**

Enable negated selection.

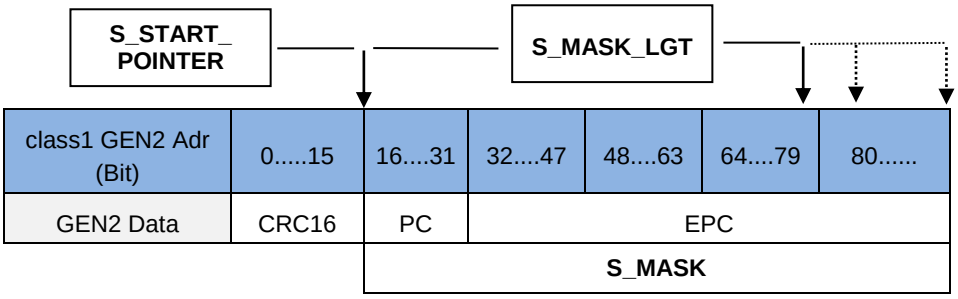
b0 no negation
b1 negation

**S_START_POINTER: *(Transponder.UHF.EPC_Class1Gen2.SelectionMask.FirstBit)***

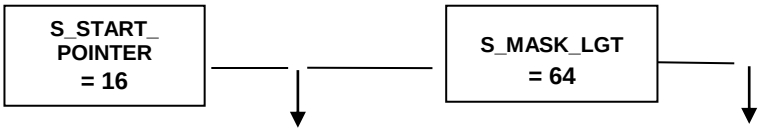
Defines the memory bit address on which the bit String of the Mask is compared to the memory of the Tag.

**S_MASK: *(Transponder.UHF.EPC_Class1Gen2.SelectionMask.Mask)***

contains the bit string that the Tag compares against the memory location.

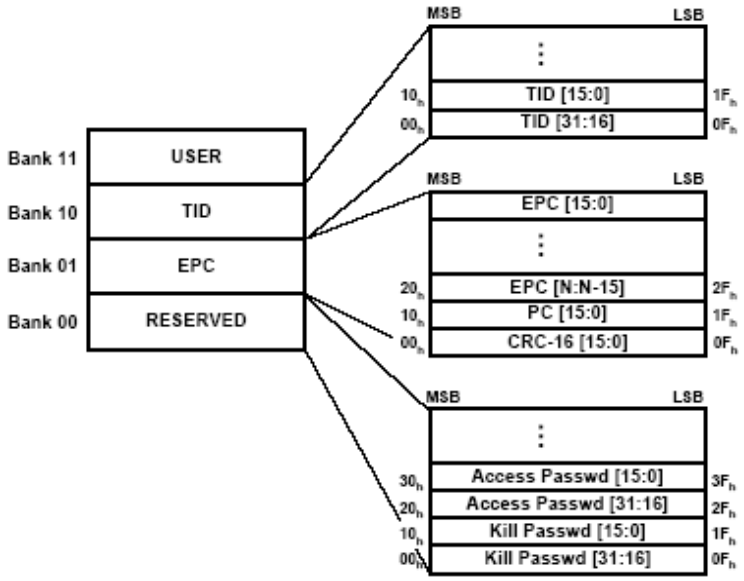



Example:




| class1 GEN2 Adr (Bit) | 0.....15 | 16....31 | 32....47 | 48....63 | 64....79 | 80..... | | Transponder Response |
|---|---|---|---|---|---|---|---|---|
| EPC 1 | CRC16 | 0x3000 | 0xA02A | 0x0510 | 0x15A0 | 0x1234 .... | --> | YES |
| EPC 2 | CRC16 | 0x3000 | 0xA02A | 0x0510 | 0x15A0 | 0x6789 .... | --> | YES |
| EPC 3 | CRC16 | 0x3000 | 0xA02A | 0x0510 | 0x15A1 | 0x6789 .... | --> | NO |
| **S_MASK** | **not checked** | **0x3000** | **0xA02A** | **0x0510** | **0x15A0** | **not checked** | | |
| | | | | | | | | |

**EPC class GEN2 Memory specification:** **Source: EPCglobal**



## 7.15. CFG24 .. 32: Reserved

The configuration block CFG24 .. 32 are reserved for future use.

| Byte | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| Contents | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

Default

| Byte | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|
| Contents | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

Default

## 7.16. CFG33 .. 34: LAN-Hostname

The configuration blocks CFG33 .. 34 hold the LAN-Hostname.

**CFG 33:**

| Byte | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| Contents | LENGTH | LAN-HOSTNAME | | | | | |
| Default | 0x00 | 0x000000000000 | | | | | |

| Byte | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|
| Contents | LAN-HOSTNAME | | | | | | |
| Default | 0x00000000000000 | | | | | | |

**CFG 34:**

| Byte | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| Contents | LAN-HOSTNAME | | | | | | |
| Default | 0x00000000000000 | | | | | | |

| Byte | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|
| Contents | LAN-HOSTNAME | | | | | | |
| Default | 0x00000000000000 | | | | | | |

**LENGTH:** ***(HostInterface.LAN.Hostname.Length)***

Defines the length of the LAN-Hostname

0x00 disabled
0x01 1 Byte
0x02 2 Bytes
…
0x1B 27 Bytes

***NOTE:***

***The LAN-Hostname can have a maximum length of 27 Bytes.***

**LAN-HOSTNAME:** ***(HostInterface.LAN.Hostname.Name)***

Defines the LAN-Hostname

## 7.17. CFG35: Reserved

The configuration block CFG35 is reserved for future use.

| Byte | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| Contents | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

Default

| Byte | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|
| Contents | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

Default

## 7.18. CFG36: RF-Interface UHF

The parameters of the CFG36 configuration block contain global Transponder drivers and Reader settings for UHF.

| Byte | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| Contents | TAG-DRV[5] | | RF-Power | REG | 0x00 | 0x00 | 0x00 |
| Default | 0x0010 | | 0x14 | 0x00 | | | |

| Byte | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|
| Contents | 0x00 | FREQ_US | | 0x00 | Nr Prefered Chn | Prefered Chn | |
| Default | 0x0000 | | | | 0x00 | 0x0000 | |

**TAG-DRV:** ***(Transponder.Driver.UHF.Drivers)***

Defines the Transponder types that are operated by the Reader.

| Byte: | 0 | | | | | | | | 1 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bit: | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| Driver | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **E** | 0 | 0 | 0 | 0 |

b0 ⇒ Driver for the Transponder type is inactive

b1 ⇒ Driver for the Transponder type is active

**.E:** ***(Transponder.Driver.UHF.EPC_Class1Gen2)***

EPC class 1 Gen 2

In principle, only those Transponder drivers should be active that are used in the actual application. Thus, the reaction time of the Reader for Transponder read- / write-operations is reduced and the danger of a parasitic Transponder access is minimized.

[5] *A reasonableness check is performed by writing this parameter to the Reader. If an error occurs the Reader answers with STATUS = [0x11].*

**RF-POWER:** ***(AirInterface.Antenna.UHF.No1.OutputPower)***

Defines the RF output power for antenna 1.

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function | 0 | 0 | LEVEL | | | | | |

**LEVEL**

Level of the RF output power

| LEVEL | RF-POWER |
|---|---|
| 0x08 | Full Power – 10 dB (approx. 50 mW) |
| 0x10 | Full Power – 7 dB (approx. 100 mW) |
| 0x11 | Full Power – 4 dB (approx. 200 mW) |
| 0x12 | Full Power – 2 dB (approx. 300 mW) |
| 0x13 | Full Power – 1 dB (approx. 400 mW) |
| 0x14 | Full Power (approx. 500 mW) |

***NOTE:***

***If region = Japan, the maximal output power is Full Power – 4dB (0x11).***

***The output power for Antenna 2-4 can be configured in 7.12. CFG20: RF-Parameter.***

**REG: (*AirInterface.Region.UHF.Regulation*)**

| REG | Name | Countries | Number of Channels | Frequency Band |
|---|---|---|---|---|
| **0X06** | Europe | Armenia | 4 | 865 MHz – 868 MHz |
| | | Austria | | |
| | | Azerbaijan | | |
| | | Belgium | | |
| | | Bosnia Herzegovina | | |
| | | Bulgaria | | |
| | | Croatia | | |
| | | Cyprus | | |
| | | Czech Republic | | |
| | | Denmark | | |
| | | Estonia | | |
| | | Finland | | |
| | | France | | |
| | | Germany | | |
| | | Greece | | |
| | | Hungary | | |
| | | Iceland | | |
| | | Ireland | | |
| | | Italy | | |
| | | Latvia | | |
| | | Lithuania | | |
| | | Luxembourg | | |
| | | Macedonia | | |
| | | Malta | | |
| | | Moldova | | |
| | | Netherlands | | |
| | | Norway | | |
| | | Poland | | |
| | | Portugal | | |
| | | Romania | | |
| | | Serbia & Montenegro | | |
| | | Slovak Republic | | |
| | | Slovenia | | |
| | | Spain | | |
| | | Sweden | | |

| REG | Name | Countries | Number of Channels | Frequency Band |
|---|---|---|---|---|
| **0x06** | Europe | Switzerland | 4 | 865 MHz – 868 MHz |
| | | Turkey | | |
| | | United Kingdom | | |
| **0x16** | Asia / Arabia | Hong Kong | 4 | 865 MHz – 868 MHz |
| | | Iran | | |
| | | Jordan | | |
| | | Oman | | |
| | | Pakistan | | |
| | | United Arab Emirates | | |
| **0x26** | Russia | Russia | 3 | 866 MHz – 868 MHz |
| **0x36** | Africa | South Africa | 4 | 865 MHz – 868 MHz |
| | | Tunesia | | |
| **0x46** | India | India | 3 | 865 MHz – 867 MHz |
| **0x04** | America | Argentina | 50 | 902 MHz – 928 MHz |
| | | Canada | | |
| | | Chile | | |
| | | Colombia | | |
| | | Costa Rica | | |
| | | Dominican Republic | | |
| | | Mexico | | |
| | | Panama | | |
| | | Peru | | |
| | | Puerto Rico | | |
| | | USA | | |
| | | Uruguay | | |
| | | Venezuela | | |
| **0x24** | Australia / New Zealand | Australia | 9 | 921,5 MHz – 926 MHz |
| | | New Zealand | | |
| **0x34** | Brazil | Brazil | 25 | 915 MHz – 927,5 MHz |
| **0x44** | Israel | Israel | 4 | 915 MHz – 917 MHz |
| **0x54** | Japan | Japan | 3 | 921 MHz – 923 MHz |
| **0xFE** | Manual EU- Frequencies 865 - 868 MHz | Other countries based on EU frequencies | 1..4 | Manually in the range 865 – 868 MHz |
| **0xFF** | Manual FCC- Frequencies 902 - 928 MHz | Other countries based on FCC frequencies | 1..50 | Manually in the range 902 – 928 MHz |

***NOTE:***

***If Region is [0xFE] or [0xFF] please contact your supplier to setup the correct frequency configuration for your country.***

***If CFG36 is password protected (see 7.1. CFG0: Passwords)changing of the region settings requires a special procedure. For further information please contact your supplier.***

**NR_PREFERD_CHN: (*AirInterface.Region.UHF.EU.Channel.EN302208_4_ChannelPlan.PreferredChannels.NoOfChannels*)**

Number of channels (1- 4) for region 0xFE.

***NOTE:***

***These settings are only applicable if region [0xFE] Manual setting of EU Frequencies (865 MHz – 868 MHz) is selected.***

***The command*** 8.3. [0x83] Set Default Configuration (Configuration Reset) ***has no effect on the frequency settings. Only the output power and transponder driver settings will be reset.***

**PREFERED_CHN: (*AirInterface.Region.UHF.EU.Channel.EN302208_4_ChannelPlan.PreferredChannels.ChannelNoX*)**

Frequencies which are used by the Reader if Region 0xFE is selected

| Byte: | 12 | | | | | | | | 13 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bit: | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| Function | 1. Pref Chn | | | | 2. Pref Chn | | | | 3. Pref Chn | | | | 4. Pref Chn | | | |

Channel 1: 865,7 MHz = b0100
Channel 2: 866,3 MHz = b0111
Channel 3: 866,9 MHz = b1010
Channel 4: 867,5 MHz = b1101

***NOTE:***

***These settings are only applicable if region [0xFE] Manual setting of EU Frequencies (865 MHz –868 MHz) is selected.***

***The command*** 8.3. [0x83] Set Default Configuration (Configuration Reset) ***has no effect on the frequency settings. Only the output power and transponder driver settings will be reset.***

**FREQ_US:** ***(AirInterface.Region.UHF.FCC.Channel….)***

Defines the Reader specific frequency channel usage .

| Byte: | 8 | | | | | | | | 9 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bit: | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| Function | 0 | 0 | upper channel | | | | | | 0 | 0 | lower channel | | | | | |

**Upper channel** ***(AirInterface.Region.UHF.FCC.Channel.UpperChannel)***
**lower channel** ***(AirInterface.Region.UHF.FCC.Channel.LowerChannel)***

Frequencies which are used by the Reader if Region 0xFF is selected

| upper/lower channel | Frequency | Bits |
|---|---|---|
| 1 | 902,75 MHz | b000001 |
| 2 | 903,25 MHz | b000010 |
| 3 | 903,75 MHz | b000011 |
| ... | … | … |
| 50 | 927,25 MHz | b110010 |

***NOTE:***

***These settings are only applicable if region [0xFF] Manual setting of FCC Frequencies (902 MHz – 928 MHz) is selected.***

***The command 8.3. [0x83] Set Default Configuration (Configuration Reset) has no effect on the frequency settings. Only the output power and transponder driver settings will be reset.***

## 7.19. CFG37: Transponder Parameters UHF

The parameters of the CFG37 configuration block contain general Transponder settings.

| Byte | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| Contents | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |
| Default | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

| Byte | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|
| Contents | 0x00 | 0x00 | 0x00 | TAG_ AUTHENT | 0x00 | IDDIB | TID-LENGTH |
| Default | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

**TAG_AUTHENT: (*Transponder.UHF.EPC_Class1Gen2.Miscellaneous.TagAuthent*)**

Defines if an automatic Tag-authentication is performed. Only if the authentication was successfully, the data exchange between reader and transponder can be successful executed.

| Bit | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Contents | - | - | - | - | - | AUTHENT-TYPE | | |

AUTHENT-TYPE:

b000: Tag-authentication disabled

b001: Use Access Password to read hidden data

b010: TAM1 Authentication with Key 0
Tag-authentication for AES encrypted tags according ISO 29167-10 (e.g. UCODE DNA)

b011: TAM2 Authentication with Key 1
Tag-authentication and Data-decryption for AES encrypted tags according ISO 29167-10 (e.g. UCODE DNA)

b101: TAM1 Authentication with Key 1
Tag-authentication for AES encrypted tags according ISO 29167-10 (e.g. UCODE DNA)

b110: TAM2 Authentication with Key 0
Tag-authentication and Data-decryption for AES encrypted tags according ISO 29167-10 (e.g. UCODE DNA City)

***NOTE:***

***The authentication mode is only available in Buffered Read Mode, Notification Mode and Scan Mode.***

***Only one authentication mode is possible.***

***To store the Key0,1 in the reader see 9.11. [0xA3] Write AES Reader Keys***.

***Some tags (e.g. NXP UCODE DNA City) contains only one AES Key (Key0) for authentication. For further information please check the documentation of the transponder chip manufacturer.***

***It is not possible to read additional data blocks from the tag if authentication enabled.***

**IDDIB (*Transponder.Miscellaneous.IdentifierInterpretationMode*)**
(Identifier Data Interpretation Byte)**:**
Defines in which way the Reader interprets and display the Identifier data read during inventory process by using the inventory command.

0x00 – automatic Mode (IDD Type is automatic set by the Reader)

0x02 – EPC and TID

***NOTE:***

***If IDDIB is 0x02 then only the TID must be used to address commands (e.g. read, write...) to the tag.***

**TID-LENGTH:**

**(*Transponder.Miscellaneous.TID-Length*)**
Defines the length of the TID to be expected when IDDIB is EPC and TID.

0x00 – automatic Mode

0x20 – 32 Bits

0x40 – 64 Bits

0x60 – 96 Bits

***NOTE:***

***If TID-Length is 0x00 the reader will automatically add the complete content of the TID memory bank.***

## 7.20. CFG38: Anticollision UHF

The parameters of the CFG38 configuration block contain anticollision settings for UHF.

| Byte | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| Contents | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |
| Default | | | | | | | |

| Byte | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|
| Contents | 0x00 | 0x00 | 0x00 | SESSION | ONT | 0x00 | 0x00 |
| Default | | | | 0x01 | 0x04 | | |

**ONT:**

Defines which Transponder will be sent to the host.

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function | 0 | 0 | 0 | 0 | 0 | ACOLL | 0 | 0 |

**ACOLL: (*Transponder.Anticollision.Enable*)**

This bit activates Anticollision Mode. In Anticollision Mode the Reader automatically sets Transponder specific communication parameters.

b0: disabled
In this case the Reader doesn't processes any anticollision procedure for Transponders inside the antenna field.

b1: enabled (default)
In this case the Reader processes the anticollision procedure for Transponders inside of the antenna field.

***NOTE:***

***If ACOLL is disabled (b0) the Reader forces a Query (with Q=1), ACK, Req_RN sequence and set the Tag in the OPEN/SECURED state.***

**SESSION:** ***(Transponder.UHF.EPC_Class1Gen2.Anticollision.Session)***

Defines which Session of an EPC Class1 Gen 2 Transponder will be used during an Inventory process.

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function | 0 | 0 | 0 | 0 | 0 | 0 | SESSION | |

## 7.21. CFG39: Reserved

The configuration block CFG39 is reserved for future use.

| Byte | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| Contents | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

Default

| Byte | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|
| Contents | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

Default

## 7.22. CFG40: LAN Settings, Part 1 (only for ID ISC.MRU102-PoE)

| Byte | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| Contents | IP_ADDRESS_LAN | | | | - | - | - |
| Default | 0xC0 | 0xA8 | 0x0A | 0x0A | 0x00 | 0x00 | 0x00 |
| | *192* | *168* | *10* | *10* | | | |

| Byte | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|
| Contents | - | IP_PORT_NUMBER_LAN | | - | - | - | - |
| Default | 0x00 | 0x27 | 0x11 | 0x00 | 0x00 | 0x00 | 0x00 |
| | | *10001* | | | | | |

**IP_ADDRESS_LAN:** ***(HostInterface.LAN.IPv4.IPAddress)***

Defines the IP address for wired LAN connection. Changing of this parameter only becomes effective after writing this configuration block to EEPROM and a [0x64] System Reset of the LAN-adapter.

**IP_PORT_NUMBER_LAN:** ***(HostInterface.LAN.PortNumber)***

Defines the port number for wired LAN connection. Changing of this parameter only becomes effective after writing this configuration block to EEPROM and a [0x64] System Reset of the LAN-adapter.

## 7.23. CFG41: LAN Settings, Part 2

| Byte | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| Contents | SUBNET-MASK-LAN | | | | LAN-OPTIONS | KEEP-CNT | GW-ADDRESS-LAN |
| Default | 0xFF<br>*255* | 0xFF<br>*255* | 0x00<br>*0* | 0x00<br>*0* | 0x01 | 0x02 | 0x00 |

| Byte | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|
| Contents | GW-ADDRES-LAN | | | 0x00 | 0x00 | KEEP-INTERVAL | |
| Default | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x05 |

**SUBNET_MASK_LAN:** ***(HostInterface.LAN.IPv4.SubnetMask)***

Defines the subnet mask for wired TCP/IP connection. Changing of this parameter only becomes effective after writing / saving this configuration block to EEPROM and a [0x64] System Reset of the RFC

**GW_ADDRESS_LAN:** ***(HostInterface.LAN.IPv4.GatewayAddress)***

Defines the gateway address for TCP/IP connection. Changing of this parameter only becomes effective after writing / saving this configuration block to EEPROM and a [0x64] System Reset of the RFC

**LAN-OPTIONS:**

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function: | DHCP | SPEED | DUPLEX | LAN-HOST NAME | AUTO NEGOTIATION | 0 | 0 | KEEP-ALIVE |

**KEEP-ALIVE:** ***(HostInterface.LAN.Keepalive.Enable)***

b0: Keep-Alive option disabled

b1: Keep-Alive option enabled

**AUTONEGOTIATION:** ***(HostInterface.LAN.Autonegotiation.Disable)***

b0: Autonegotiation disabled

b1: Autonegotiation enabled

**LAN-HOSTNAME:** ***(HostInterface.LAN.Hostname.Enable)***

b0: LAN-Hostname disabled

b1: LAN-Hostname enabled

**DUPLEX:** ***(HostInterface.LAN.Autonegotiation.Duplex)***

b0: Half Duplex

b1: Full Duplex

**SPEED:** ***(HostInterface.LAN.Autonegotiation.Speed)***

b0: 10 MBit

b1: 100 MBit

**DHCP:** ***(HostInterface.LAN.IPv4.Enable_DHCP)***

b0: DHCP client disabled

b1: DHCP client enabled

**KEEP-CNT:** ***(HostInterface.LAN.Keepalive.RetransmissionCount)***

Specifies the maximum number of retransmissions. This is the number of times that the reader retransmits a keepalive packet to the host to check for connectivity. The valid range is 1..255.

**KEEP-INTERVAL:** ***(HostInterface.LAN.Keepalive.IntervalTime)***

Set the Keepalive Interval. This is the polling frequency used to determine if a keepalive exchange is needed. This interval is used when the connection failed. The valid range is 1..255 sec.

***NOTE:***

***The command 8.3. [0x83] Set Default Configuration (Configuration Reset) has no effect on this setting***

***Changing of this parameter only becomes effective after writing / saving this configuration block to EEPROM and a [0x64] System Reset of the RFC.***

## 7.24. CFG49: Notification Channel (only for ID ISC.MRU102-PoE)

| Byte | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| Contents | MODE | 0x00 | 0x00 | 0x00 | KEEP-ALIVE | KEEP-ALIVE-TIME | |
| Default | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |
| | *continuously* | | | | *Off* | *0s* | |

| Byte | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|
| Contents | DEST-IP-ADDRESS | | | | DEST-IP-PORT | | HOLD-Time |
| Default | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x01 |

**MODE:**

Defines the basic settings for the notification channel.

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function | ACK | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

**ACK:** Acknowledge Notification ***(Operating-Mode.NotificationMode.Transmission.Enable_Acknowledge)***

b0: Notification must not be acknowledged
b1: Notification must be acknowledged with protocol [0x32] Clear Data Buffer

**KEEP-ALIVE:**

Mode for keep alive notification.

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function | 0 | 0 | 0 | 0 | 0 | 0 | 0 | EN |

**EN:** ***(OperatingMode.NotificationMode.Transmission.KeepAlive.Enable)***

b0: disabled
b1: enabled

**KEEP-ALIVE-TIME:**

***(OperatingMode.NotificationMode.Transmission.KeepAlive.IntervalTime)***

Defines the cycle time for keep alive notification.

| | max. time period |
|---|---|
| KEEP-ALIVE-TIME | 0...65535 * 1s |

**DEST-IP-ADDRESS:** ***(Operating-Mode.NotificationMode.Transmission.Destination.IPv4.IPAddress)***
Defines the destination IP address.

**DEST-IP-PORT-NUMBER:** ***(Operating-Mode.NotificationMode.Transmission.Destination.PortNumber)***
Defines the destination port number.

**HOLD-Time:** ***(Operating-Mode.NotificationMode.Transmission.Destination.ConnectionHoldTime)***
Defines the connection hold time.

## 7.25. CFG63: Customer Parameter

The configuration block CFG63 is used for customer parameter.
Any kind of customer hex data can be stored in this EEPROM or RAM memory area.

| Byte | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| Contents | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

Default

| Byte | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|
| Contents | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

Default

# 8. Protocols for Reader Configuration

The Reader configuration protocols allow the Reader to be adapted to the conditions found in individual applications. For details about the Protocol Frame see: 6.2. Serial Data Format and Protocol Frames.

Access to the configuration parameters is gained only after a 9.10. [0xA0] Reader-Login command with the correct READER-ID.

In order to avoid unauthorized data access, the Reader is equipped with the following protection mechanism:

**Config-Protection:**
Access locking for the configuration parameters stored in the EEPROM of the Reader.

## 8.1. [0x80] Read Configuration

By using the Read Configuration the actual configuration of the Reader can be detected. In order to do this, the configuration is read in blocks of 14 bytes each and addressed by CFGn in the byte CFG-ADR.

Host → Reader

| 1 | 2 | 3 | 4 | 5 | 6 | 7-8 |
|---|---|---|---|---|---|---|
| STX (0x02) | MSB ALENGTH | LSB ALENGTH | COM-ADR | [0x82] | CFG-ADR | CRC16 |

Host ← Reader

| 1 | 2 | 3 | 4 | 5 | 6 | 7 .. 20 | 21-22 |
|---|---|---|---|---|---|---|---|
| STX (0x02) | MSB ALENGTH | LSB ALENGTH | COM-ADR | [0x82] | STATUS[6] | CFG-REC | CRC16 |

**CFG-ADR[7]:**

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function | LOC | 0 | CFGn: Address of Configuration Block | | | | | |

**CFGn:** memory-address of the required configuration block

**LOC:** specifies the location of the configuration block
b0 RAM
b1 EEPROM

**CFG-REC:**
14 bytes configuration block read from address CFGn in CFG-ADR.

[6] *see ANNEX C – Index of Status Bytes*

[7] *see chapter 7. Configuration Parameters (CFG)*

***NOTE:***

***A read configuration from EEPROM with reserved configuration blocks will cause a 0x15 error code.***

## 8.2. [0x81] Write Configuration

The configuration of the Reader can be changed by means of the Write Configuration command. In order to do this, the configuration memory is written to with 14 bytes long blocks and addressed by CFGn in the byte CFG-ADR. The description of parameters can be taken from Chapter 7. Configuration Parameters (CFG)

Host → Reader

| 1 | 2 | 3 | 4 | 5 | 6 | 7...20 | 21-22 |
|---|---|---|---|---|---|---|---|
| STX (0x02) | MSB ALENGTH | LSB ALENGTH | COM-ADR | [0x81] | CFG-ADR | CFG-REC | CRC16 |

Host ← Reader

| 1 | 2 | 3 | 4 | 5 | 6 | 7-8 |
|---|---|---|---|---|---|---|
| STX (0x02) | MSB ALENGTH | LSB ALENGTH | COM-ADR | [0x81] | STATUS[8] | CRC16 |

**CFG-ADR[9]:**

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function | LOC | 0 | CFGn: Address of Configuration Block | | | | | |

**CFGn:** memory-address of the required configuration block

**LOC:** specifies the location of the configuration block

b0 RAM

b1 RAM and EEPROM

**CFG-REC:**

14 bytes configuration block stored in the configuration memory of the Reader at address CFGn.

***NOTE:***

***A write configuration to EEPROM with reserved configuration blocks will cause a 0x16 error code.***

[8] *see ANNEX C – Index of Status Bytes*

[9] [9] *see chapter 7. Configuration Parameters (CFG)*

## 8.3. [0x83] Set Default Configuration (Configuration Reset)

Using the command Set Default Configuration each configuration block can be reset to the manufacturer's setting.

Host → Reader

| 1 | 2 | 3 | 4 | 5 | 6 | 7...8 |
|---|---|---|---|---|---|---|
| STX (0x02) | MSB ALENGTH | LSB ALENGTH | COM-ADR | [0x83] | CFG-ADR | CRC16 |

Host ← Reader

| 1 | 2 | 3 | 4 | 5 | 6 | 7...8 |
|---|---|---|---|---|---|---|
| STX (0x02) | MSB ALENGTH | LSB ALENGTH | COM-ADR | [0x83] | STATUS | CRC16 |

**CFG-ADR:**

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function | LOC | MODE | CFGn: Address of Configuration Block | | | | | |

**CFGn:** memory-address of the required configuration block

**MODE:** specifies one or all configuration blocks
- b0 configuration block specified by CFGn
- b1 all configuration blocks

**LOC:** specifies the location of the configuration block
- b0 RAM
- b1 RAM and EEPROM

***NOTE:***

***A set default configuration with reserved configuration blocks will cause an error code.***

***This command will have no impact on the TCP/IP settings in CFG40...41 and the Notification Mode settings in CFG49.***

# 9. Protocols for Reader Control

## 9.1. [0x52] Baud Rate Detection

This protocol serves to determine the actual baud rate of the Reader' asynchronous interface.

Host → Reader

| 1 | 2 | 3 | 4 | 5 | 6 | 7,8 |
|---|---|---|---|---|---|---|
| STX (0x02) | MSB ALENGTH | LSB ALENGTH | COM-ADR | [0x52] | 0x00 | CRC16 |

Host ← Reader

| 1 | 2 | 3 | 4 | 5 | 6 | 7,8 |
|---|---|---|---|---|---|---|
| STX (0x02) | MSB ALENGTH | LSB ALENGTH | COM-ADR | [0x52] | 0x00 | CRC16 |

***NOTE:***

***The return protocol will only be sent if the inquiry is executed with the baud rate and actual parity of the Reader.***

***A USB reader will send status 0x00 (OK) if reader can be detected.***

## 9.2. [0x55] Start Flash Loader

This protocol starts the Flash Loader inside the Reader. Use the windows program "OBIDFirmwareUpdateTool" to process the firmware update. This tool will use the command automatically. Please refer to the Application Note "OBIDFirmwareUpdateTool (N30300-xe-ID-B.pdf) for details.

Host → Reader

| 1 | 2 | 3 | 4 | 5 | 6,7 |
|---|---|---|---|---|---|
| STX (0x02) | MSB ALENGTH | LSB ALENGTH | 0x00 | [0x55] | CRC16 |

Host ← Reader

| 1 | 2 | 3 | 4 | 5 | 6 | 7,8 |
|---|---|---|---|---|---|---|
| STX (0x02) | MSB ALENGTH | LSB ALENGTH | 0x00 | [0x55] | 0x00 | CRC16 |

***NOTE:***

***This command is only available if the correct COM-ADR of the Reader is used. (Do not use 0xFF)***

## *9.3.* [0x63] Software Reset

This protocol allows you to perform a reset of the Reader CPU.

Host → Reader

| 1 | 2 | 3 | 4 | 5 | 6,7 |
|---|---|---|---|---|---|
| STX (0x02) | MSB ALENGTH | LSB ALENGTH | COM-ADR | [0x63] | CRC16 |

Host ← Reader

| 1 | 2 | 3 | 4 | 5 | 6 | 7,8 |
|---|---|---|---|---|---|---|
| STX (0x02) | MSB ALENGTH | LSB ALENGTH | COM-ADR | [0x63] | STATUS[10] | CRC16 |

***NOTE:***

***The RF-field will be switched off after a "CPU Reset"***

***The communication interface will not be reset.***

## *9.4.* [0x64] System Reset

This protocol allows you to reset the RF Controller.

Host → Reader

| 1 | 2 | 3 | 4 | 5 | 6 | 7,8 |
|---|---|---|---|---|---|---|
| STX (0x02) | MSB ALENGTH | LSB ALENGTH | COM-ADR | [0x64] | Mode | CRC16 |

Host ← Reader

| 1 | 2 | 3 | 4 | 5 | 6 | 7,8 |
|---|---|---|---|---|---|---|
| STX (0x02) | MSB ALENGTH | LSB ALENGTH | COM-ADR | [0x64] | STATUS[11] | CRC16 |

**MODE:**

Defines the controller which will be reset.

| MODE | Controller |
|---|---|
| 0x00 | RF Controller |

[10] *ANNEX C – Index of Status Bytes*

## 9.5. [0x66] Get Reader Info

This protocol allows you to determine, the Firmware version, its type and the types of the Transponders which are supported by the Firmware, and some other hard- and firmware options of the Reader. Also the Device_ID can be determined.

Host → Reader

| 1 | 2 | 3 | 4 | 5 | 6 | 7,8 |
|---|---|---|---|---|---|---|
| 0x02 | 08 | | COM-ADR | [0x66] | MODE | CRC16 |

**MODE:**

Via the Parameter MODE different information can be requested from the Reader.

0x00: General hard- and firmware information of the Reader Firmware

0x05: RFC-Bootloader Firmware

0x10: Hardware information

0x40: CFG Info for read permission

0x41: CFG Info for write permission

0x50 Reader MAC

0x51 Reader TCP/IP Address

0x52 Reader TCP/IP Subnet Mask

0x53 Reader TCP/IP Gateway Address

0x80: Device-ID (These Information are necessary for some Firmware updates or Firmware upgrades.)

Host ← Reader

Depending on the MODE Parameter the Reader response has a differing structure with several information's:

### 9.5.1. Mode = 0x00 (Controller Firmware)

| 1 | 2 | 3 | 4 | 5 | 6 | 7…8 |
|---|---|---|---|---|---|---|
| 0x02 | 19 | | COM-ADR | [0x66] | STATUS[1] | SW-REV |

| 9 | 10 | 11 | 12…13 | 14,15 | 16,17 |
|---|---|---|---|---|---|
| D-REV | HW-TYPE | SW-TYPE | TR-TYPE-UHF | RX-BUF | TX-BUF |

| 18,19 |
|---|
| CRC16 |

**SW-REV:**

Revision status of the Firmware. Depending on the Mode and Reader type different controller's are meant.

**D-REV:**

Revision status of the development Firmware. D-REV is set to '0' in customized Firmware revisions.

**HW-TYPE:**

Displays options which are supported by the Reader Hardware

**SW-TYPE:**

Type of Reader Firmware
0x36 ID ISC.MR(M)U102 (54)

**RX-BUF:**

RX-BUF is the maximum receive buffer size of the Reader. If a protocol from the host exceeds the RX-BUF size the Reader responds with 0x81 PROTOCOL LENGTH ERROR.

**TX-BUF:**

TX-BUF is the maximum transmit buffer size of the Reader. The Host has to take in to account that a response protocol of the Reader can have this length.

**TR-TYPE-UHF:**

Displays the UHF-Transponders supported by the software.

| Bit: | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 |
|---|---|---|---|---|---|---|---|---|
| Function: | - | - | - | - | - | - | - | - |

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function: | - | - | - | EPC G2 | - | - | - | - |

## 9.5.2. Mode = 0x05 (Bootloader version information)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|
| 02 | 00 | 13 | COM-ADR | [0x66] | STATUS[12] | BL_VERSION | BL_REF |

| 9...10 | 11...12 | 13...14 | 15...16 | 17 | 18...19 |
|---|---|---|---|---|---|
| - | - | - | - | - | CRC16 |

**BL_VERSION:**

Bootloader Version

**BL_REV:**

Revison of Bootloader Version

## 9.5.3. Mode = 0x10 (Hardware Information)

| 1 | 2 | 3 | 4 | 5 | 6 | 7…8 |
|---|---|---|---|---|---|---|
| 0x02 | 00 | 13 | COM-ADR | [0x66] | STATUS[1] | HW-INFO |

| 9…10 | 11…12 | 13 | 14 | 15 | 16 |
|---|---|---|---|---|---|
| D_HW | A_HW | FREQUENCY | PORT_TYPE | reserved | RFC-INFO |

| 17 | 18,19 |
|---|---|
| reserved | CRC16 |

**HW-INFO:**

Hardware Information

| Bit: | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 |
|---|---|---|---|---|---|---|---|---|
| Function: | - | - | - | - | - | - | - | - |

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function: | - | - | - | - | - | - | - | - |

**D-HW:**

internal use

**A-HW:**

internal use

[12] *see: ANNEX C – Index of Status Bytes*

**FREQUENCY:**

Flags for supported frequency's

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function: | - | UHF | - | - | - | - | FCC | EU |

**EU:** b0: EU frequency's not supported
b1: EU frequency's supported

**FCC:** b0: FCC frequency's not supported
b1: FCC frequency's supported

**UHF:** b0: UHF not supported
b1: UHF supported

**PORT_TYPE:**

Flags for supported communication ports

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function: | Discovery | - | - | USB | - | LAN | - | RS232 |

**RS232:** b0: not supported
b1: supported

**USB:** b0: not supported
b1: supported

**LAN:** b0: not supported
b1:supported

**Discovery:** b0: disable (only with TCP/IP interface)
b1: enable (only with TCP/IP interface)

### 9.5.4. Mode = 0x40 / 0x41 (CFG Info for read and write permission)

Every bit marks the permission to read (write) the configuration block. The reader must send always complete bytes, but no more bytes as necessary. The flag fields are independent of configurable password protection

| 1 | 2 | 3 | 4 | 5 | 6 | 7...8 | 9...n-2 | n-1...n |
|---|---|---|---|---|---|---|---|---|
| 02 | n | | COM-ADR | [0x66] | STATUS[1] | NR_OF_ PAGES | PERMISSION | CRC16 |

**PERMISSION:**

| Byte | 9 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| CFG_NO | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

| Byte | 10 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| CFG_NO | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |

| Byte | 11 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| CFG_NO | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 |

## 9.5.5. Mode = 0x50 .. 0x53 (LAN Configuration)

In case of setting Ethernet parameters per DHCP, these parameters can be requested with the following format.

Host ← Reader

| 1 | 2 | 3 | 4 | 5 | 6...n-2 | n-1...n |
|---|---|---|---|---|---|---|
| n | COM-ADR | [0x66] | STATUS | FLAGS | DATA | CRC16 |

**FLAGS: indicates additional settings**

| Byte | 5 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| | 0 | 0 | DHCP v4 | 0 | Disa-bled v4 | 0 | Sup-ported v4 | 0 |

**Supported v4:**

b0: not supported
b1: supported

**Disabled v4:**

b0: LAN channel is enabled
b1: LAN channel is disabled

**DHCP v4:**

b0: disabled
b1: enabled

**DATA (Mode 0x50..0x53):**

| MODE | | DATA |
|---|---|---|
| 0x50 (LAN-MAC) | FLAGS | 6 Byte MAC |
| 0x51 (LAN-IP-Address) | FLAGS | IPv4: 4 Byte IP-Address |
| 0x52 (LAN-Netmask) | FLAGS | IPv4: 4 Byte Netmask |
| 0x53 (LAN-Gateway) | FLAGS | IPv4: 4 Byte Gateway |

## 9.5.6. Mode = 0x80 (Device_ID)

| 1 | 2 | 3 | 4 | 5 | 6 | 7…10 |
|---|---|---|---|---|---|---|
| 0x02 | 00 | 16 | COM-ADR | [0x66] | STATUS | DEV_ID |

| 11…14 | 15,16 | 17,18 | 19,20 | 21,22 |
|---|---|---|---|---|
| Custom_L | FW_L | TR_DRV _UHF_L | FNC_UHF_L | CRC16 |

**DEV_ID:**

Individual device identifier of the Reader.

**CUSTOM_L**

Indicates which customer Firmware is licensed on the Reader.

**FW_L:**

Indicates which Firmware version is licensed on the Reader.

**TR_DRV_UHF_L:**

Indicates which UHF-Transponder drivers are licensed on the Reader.

**FNC_UHF_L**

Indicates which optional functions for UHF-Transponders are licensed on the Reader.

## 9.6. [0x69] RF Reset

The RF-field of the Reader antenna can be switched off for **$t_{rf}$ = 10 ms** by the command RF Reset.

Host → Reader

| 1 | 2 | 3 | 4 | 5 | 6,7 |
|---|---|---|---|---|---|
| STX (0x02) | MSB ALENGTH | LSB ALENGTH | COM-ADR | [0x69] | CRC16 |

Host ← Reader

| 1 | 2 | 3 | 4 | 5 | 6 | 7,8 |
|---|---|---|---|---|---|---|
| STX (0x02) | MSB ALENGTH | LSB ALENGTH | COM-ADR | [0x69] | STATUS[13] | CRC16 |

***NOTE:***

***After a RF Reset the Reader is not able to receive a new Transponder before expiration of $t_{rf}$ .***

***After a RF Reset, a Transponder which is located within the field has to be re-selected.***

***The response of this command will be sent after the RF Reset was completed.***

[13] *see ANNEX C – Index of Status Bytes*

## 9.7. [0x6A] RF Output ON/OFF

The command RF ON/OFF switches the RF field of the Reader antenna ON and OFF.

If the reader works in Auto Read Mode[14] the RF communication can be interrupted by transmitting RF OFF and continued with RF ON. After RF OFF, the reader accepts every Host command and the RF communication is handled over the last selected antenna. For selecting a specific antenna without continuing the Auto Read Mode, the option flag HM must be set.

Host → Reader

| 1 | 2 | 3 | 4 | 5 | 6 | 7,8 |
|---|---|---|---|---|---|---|
| STX (0x02) | MSB ALENGTH | LSB ALENGTH | COM-ADR | [0x6A] | RF-OUTPUT | CRC16 |

Host ← Reader

| 1 | 2 | 3 | 4 | 5 | 6 | 7,8 |
|---|---|---|---|---|---|---|
| STX (0x02) | MSB ALENGTH | LSB ALENGTH | COM-ADR | [0x6A] | STATUS[15] | CRC16 |

**RF-OUTPUT:**

Set one of four antenna output.

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function | HM | 0 | 0 | 0 | 0 | Antenna Output | | |

**Antenna Output**

Set one RF output active or RF Power of

| Antenna Output | Description | |
|---|---|---|
| b000 | RF OFF | Available on all MR(M)U102 |
| b001 | RF Power on antenna output 1 | |
| b010 | RF Power on antenna output 2 | |
| b011 | RF Power on antenna output 3 | |
| b100 | RF Power on antenna output (INT) | |

**HM** Maintain Host Mode (applicable only for Auto Read Mode)

b0: Auto Read Mode is continued, if Antenna Output is greater than zero
b1: Host Mode is maintained and Antenna Output is selected, if greater than zero

[14] *Scan Mode or Notification Mode*

[15] *see ANNEX C – Index of Status Bytes*

***NOTE:***

***In the case of sending* RF output ON/OFF *with antenna output = b000 the Reader sends a command to reset the persistence flags of the Transponder. This command is sent on the antenna port which was active before the RF output ON/OFF command is sent to the Reader.***

***Switching of antenna is also possible in Scan-Mode, if multiplexer is disable.***

## 9.8. [0x6E] Reader Diagnostic

The command Reader Diagnostic displays several hardware diagnostics on the Reader.

Host → Reader

| 1 | 2 | 3 | 4 | 5 | 6 | 7,8 |
|---|---|---|---|---|---|---|
| STX (0x02) | MSB ALENGTH | LSB ALENGTH | COM-ADR | [0x6E] | MODE | CRC16 |

Host ← Reader

| 1 | 2 | 3 | 4 | 5 | 6 | 7...n-2 | n-1...n |
|---|---|---|---|---|---|---|---|
| STX (0x02) | MSB ALENGTH | LSB ALENGTH | COM-ADR | [0x6E] | STATUS | DATA | CRC16 |

**MODE:**

Reader Diagnostic Modes

0x04 Listing of detail information for STATUS = 0x10 (EEPROM-Failure)

**DATA:**

Response for Reader Diagnostic Modes

**MODE = 0x04:**

| 5-6 |
|---|
| INT_ERROR |

**INT_ERROR:**

| Bit: | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 |
|---|---|---|---|---|---|---|---|---|
| Function: | - | - | - | - | - | - | - | - |

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function: | - | Periph-erie Error | TEMP_ WARN | Parame-ter Mis-match | RF-Decoder | - | - | EE_ DEV1 |

**EE_DEV1:**

Error during the communication with EEPROM Dev 1

**RF-Decoder:**

Error during the communication with RF-Decoder

***TEMP_WARN:***

***Warning due to high temperature. So the Reader performance may not be the optimum.***

***Peripherie-Error:***

***Error during the communication with any other components.***

***Parameter Mismatch***

***Warning due to a wrong configuration in the reader. Two or more parameters in the configuration do not harmonize with each other or one or more parameters are invalid (e.g. no region is set).***

## 9.9. [0x72] Set Output

The command Set Output serves temporary limited or unlimited activation of the outputs of the Reader.

Each output takes on the state defined by the byte OUTx-mode for the period of time (OUT-TIME) included in the protocol. The flashing frequency is defined by the byte OUTx-frq. Via this protocol the outputs can be switched on or off for the indicated period of time. If the Reader receives a command Set Output, all times that have been active until then are being overwritten by the new times included in the protocol if they are > 0.

Host → Reader

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| 0x02 | n | | COM-ADR | [0x72] | Mode | OUT-N |

| 8 | 9 | 10,11 | n-1...n |
|---|---|---|---|
| OUT-NR | OUT-S | OUT-TIME | CRC16 |
| Repeated OUT-N times | | | |

Host ← Reader

| 1 | 2 | 3 | 4 | 5 | 6 | 7,8 |
|---|---|---|---|---|---|---|
| 0x02 | n | | COM-ADR | [0x71] | STATUS[16] | CRC16 |

**Mode:**

0x01 (reserved)

**OUT-N:**

Defines the number of output records.

**OUT-NR:**

Defines the type and the number of the output

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function: | OUT-Typ | | | 0 | OUT-Number | | | |

**OUT-Typ:**

b001 LED

**OUT-Number:**

b0001 LED green
b0010 LED red

[16] *see ANNEX C – Index of Status Bytes*

**OUT-S:**

OUT-S (Output State) defines the status of the output during the time defined in OUT-TIME and provides the possibility to allocate its own flashing-frequency to each output.

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function: | 0 | 0 | 0 | 0 | OUTx-frq | | OUTx-mode | |

**OUTx-mode:**

| | | |
|---|---|---|
| b00 | UNCHANGED | OUT-TIME has no effect on the status of the output |
| b01 | ON | output for OUT-TIME = active |
| b10 | OFF | output for OUT-TIME = inactive |
| b11 | FLASH | output for OUT-TIME = with OSF alternating |

**OUTx-frq:**

| | |
|---|---|
| b11 | 1 Hz |
| b10 | 2 Hz |
| b01 | 4 Hz |
| b00 | 8 Hz |

**OUT-TIME:**

By the values defined by “OUT-TIME”, the outputs can be activated temporary limited or unlimited.
An exception are the time values 0 and 65535 (0xFFFF) (see following table).

| | | |
|---|---|---|
| 0x0001 | 1 x 100ms | -> 100ms |
| ... | ... | |
| 0xFFFE | 65534 x 100ms | -> 1:49:13 h |
| 0xFFFF | continuously active | |

***NOTE:***

***In order to reset a continuously active time, OUT-TIME = 1 has to be sent to the Reader, which effects a change to the idle status after 100 ms.***

***The continuous activation is being set back after a reset or a power failure.***

## 9.10. [0xA0] Reader-Login

The Reader-Login must be executed after every power up or  command, if an access to the configuration parameters is desired.

Host → Reader:

| 1 | 2 | 3 | 4 | 5 | 6-9 | 10,11 |
|---|---|---|---|---|---|---|
| STX (0x02) | MSB ALENGTH | LSB ALENGTH | COM-ADR | [0xA0] | READER-ID | CRC16 |

Host ← Reader

| 1 | 2 | 3 | 4 | 5 | 6 | 7,8 |
|---|---|---|---|---|---|---|
| STX (0x02) | MSB ALENGTH | LSB ALENGTH | COM-ADR | [0xA0] | STATUS[17] | CRC16 |

**READER-ID:**

The READER-ID is a password which protects the configuration parameters from any read and write access.
The READER-ID can be changed in the configuration block 7.1. CFG0: Passwords.

***NOTE:***

***A Reader-Login with wrong READER-ID causes a "Logout".***

***A "Logout" can be effected via the command*** *9.4.* [0x64] System Reset

[17] *see ANNEX C – Index of Status Bytes*

## 9.11. [0xA3] Write AES Reader Keys

The keys which are required by the Reader in order to authenticate itself to an AES encrypted transponder (e.g. UCODE DNA) will be stored in the reader by this command. Only if the keys of the reader and the transponder correspond, the data exchange between reader and transponder can be successful executed.

**REQUEST-DATA**

| 1 | 1 | 1 | 1 | KEY-LEN |
|---|---|---|---|---|
| MODE | READER-KEY-IDX | AUTH-MODE | KEY-LEN | KEY |

**RESPONSE-DATA**

| 0 |
|---|
| - |

**MODE:**

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function | 0 | 0 | 0 | 0 | 0 | 0 | 0 | LOC |

**LOC:**

Specifies the location where the KEY should be stored in the reader

b0: RAM
The KEY will be stored only temporary in the RAM of the reader. After the supply power was interrupted the keys has to be loaded once again into the RAM. This option is recommended, if the reader is used on a public place, if anybody can to take the reader away easily.

b1: EEPROM
The KEY will be stored in the EEPROM and in the RAM of the reader. The key can be used also after the supply power was interrupted. This option can be used, if the reader is used on a secured place.

***NOTICE:***
***The keys in the EEPROM are not strong protected against hacking its content.***

**READER-KEY-IDX (0...1):**

Address where the key is stored in the reader.

**AUTH-MODE:**

This parameter defines the authentication mode which will be performed by the reader with this key

| AUTH-MODE | authentication method | KEY-LEN |
|---|---|---|
| **5** | AES | 16 Byte |

**KEY-LEN :**

This parameter defines the length of the following key (fix 16 bytes).

**KEY:**

Key which has to be used for authentication.

## 10. Protocols for Host Commands

The Host commands can be used to access the Transponders.

| | Transponder Types |
|---|---|
| | EPC Class 1 Gen 2 |
| 10.1. [0xB0] Host commands | √ |
| 10.1.1. [0x01] Inventory | √ |
| 10.1.2. [0x23] Read Multiple Blocks | √ |
| 10.1.3. [0x24] Write Multiple Blocks | √ |
| | |
| 11. [0xB3] Host commands for EPC Transponders | √ |
| 11.1.1. [0x18] Kill | √ |
| 11.1.2. [0x22] Lock | √ |
| 11.1.3. [0x30] Untraceable | √ |
| 11.1.4. [0x31] Authenticate | √ |
| 11.1.5. [0x32] Challenge | √ |

## 10.1. [0xB0] Host commands

These commands send RF commands to the Transponder.

Host → Reader

| 1 | 2 | 3 | 4 | 5 | 6...n-2 | n-1,n |
|---|---|---|---|---|---|---|
| STX (0x02) | MSB ALENGTH | LSB ALENGTH | COM-ADR | [0xB0] | REQUEST-DATA | CRC16 |

Host ← Reader

| 1 | 2 | 3 | 4 | 5 | 6 | 7...n-2 | n-1,n |
|---|---|---|---|---|---|---|---|
| STX (0x02) | MSB ALENGTH | LSB ALENGTH | COM-ADR | [0xB0] | STATUS[18] | RESPONSE-DATA | CRC16 |

**REQUEST-DATA:**

Command specific request

**RESPONSE-DATA:**

Command specific response

***NOTE:***

***Data is only transferred if STATUS = 0x00, 0x83, 0x94, 0x95.***

***These commands aren't available if Scan-Mode or Notification Mode is active.***

[18] *see ANNEX C – Index of Status Bytes*

### 10.1.1. [0x01] Inventory

This command reads the IDD (Identifier Data) of all Transponders inside the antenna field. IDD can be “EPC” or “EPC and TID”. The format is depending on the settings in 7.19. CFG37: Transponder Parameters UHF.

REQUEST-DATA

| 6 | 7 | (8) |
|---|---|---|
| 0x01 | MODE | ANT_SEL |

RESPONSE-DATA if ANT = 0

| 7 | 8 | 9 | 10 | 11...n |
|---|---|---|---|---|
| DATA-SETS | TR-TYPE | IDDT | IDD_LEN | IDD |
| | Repeated DATA-SETS times | | | |

RESPONSE-DATA if ANT = 1

| 7 | 8 | 9 | 10 | 11 | 12...n | n+1 |
|---|---|---|---|---|---|---|
| DATA-SETS | FLAGS | TR-TYPE | IDDT | IDD_LEN | IDD | ANT_CNT |
| | Repeated DATA-SETS times | | | | | |

| n+2 | n+3 | n+4 | n+5...n+8 |
|---|---|---|---|
| ANT_NR | ANT_STATUS | RSSI | reserved |
| Repeated ANT_CNT times | | | |
| Repeated DATA-SETS times | | | |

**MODE:**

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function | MORE | | 0 | ANT | 0 | 0 | 0 | 0 |

**MORE:**

b0 new Inventory requested

b1 more data requested (IF Status 0x94 appears-> more data sets are available)

**ANT:**

b0 Request without antenna number

b1 Request with antenna number (ANT_SEL)

**ANT-SEL:**

Is a bit field and defines the corresponding bits of antenna where the reader starts an Inventory. ANT-SEL will be only transmitted if Bit "ANT" is set in Mode-Byte.

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function | - | - | - | - | ANT(INT) | ANT3 | ANT2 | ANT1 |

**ANT1...3 + (INT),** *(INT=internal antenna)*

b0 no reading on this antenna output

b1 reading on this antenna output

**DATA-SETS:**

Number of Transponder data sets to be transferred in this Reader response.

**FLAGS:**

Is a bit field and defines which data will be send.

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function | - | - | - | ANT | - | - | - | IDD |

**IDD:**

b0 no IDD will be send
b1 IDD will be send

**ANT:**

b0 no antenna information will be send
b1 antenna information (ANT_CNT, ANT_NR, ANT_STATUS, RSSI) will be send

**TR-TYPE:**

Transponder type. See: ANNEX A – Codes of Transponder Types

**IDDT:** (Identifier Data Type)

Defines the type of Data transmit beginning at Byte 10. Possible Inventory Data Type see: ANNEX B – Codes of Identifier Data Types (IDDT)

**IDD-LEN:**

Identifier Data Length defines the length of the IDD in Byte.

**IDD:**

Identifier Data of the Transponder

**ANT_CNT:**

Number of antennas where transponder was read

**ANT_NR:**

Number of the antenna (1...255)

**ANT_STATUS:**

The ANT_STATUS can be 0x00 (OK) or
0x83 (RF communication error) See: ANNEX C – Index of Status Bytes

**RSSI:**

Received Signal Strength Identification in dBm

***NOTE:***

***This command supports all Transponders.***

***If the STATUS byte of the protocol frame has the value 0x94 more IDD can be read out of the Reader with MORE = b1.***

## 10.1.2. [0x23] Read Multiple Blocks

This command reads one or more data blocks. The supported Host commands depend on the different UHF Transponder types.

REQUEST-DATA

| 6 | 7 | 1 Byte | EPC_LNG Bytes | 1Byte |
|---|---|---|---|---|
| 0x23 | MODE | EPC_LNG | EPC | BANK |

| 1 Byte | A_PW_LGT Bytes | 1 or 2 Bytes ( def. by EXT_ADR) | 1 Byte |
|---|---|---|---|
| A_PW_LGT | A_PW | DB-ADR | DB-N |

RESPONSE-DATA

| 7 | 8 | 9 | 10...n |
|---|---|---|---|
| DB-N | DB-SIZE | SEC-STATUS | DB |
| | | Repeated DB-N times | |

**MODE:**

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function | 0 | READ_COMPLETE_BANK | EXT_ADR | EPC_LF | 0 | ADR | | |

**ADR:**

b000 non-addressed
b001 addressed

**EPC_LF:**

If this bit is set the parameter EPC_LNG must inserted into the protocol.

b0: The protocol EPC_LNG doesn't include the EPC_LNG byte and the EPC field has a fixed length of 8 byte, from byte 6 to byte 13.

b1: The protocol includes the parameter EPC_LNG. The EPC has a variable length as defined in EPC_LNG.

**EXT_ADR:**

If this bit is set the command includes extended address fields.

b0: Transponder memory addressing is done by the 1 byte DB-ADR Field.

b1: Transponder memory addressing is done by BANK and **2** byte DB-ADR Field

**READ_COMPLETE_BANK:**

If this bit is set the reader will automatically read out all blocks of the selected memory bank..

b0: Reader reads out the memory blocks according to the settings for DB-ADR and DB-N

b1: Read reads out the compete memory bank

***NOTE:***

***The read complete bank functionality is limited for memory banks with a maximum size of 128 blocks.***

**EPC_LNG:**

Is a optional parameter and depends on the setting of EPC_LF (see MODE). EPC_LNG defines the length of the following EPC field.

**EPC:**

Read-only serial number of the Transponder. The EPC is required only in the addressed mode.

**BANK:**

Memory bank of the Transponder which will be accessed by the Reader

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function | A_FLAG | 0 | 0 | 0 | 0 | 0 | BANK_NR | |

**BANK_NR:**

In case of Class 1 Gen 2 Transponder BANK_NR is defined as follows:

b00 reserved

b01 EPC memory bank

b10 TID memory bank

b11 User memory bank

**A_FLAG:**

Indicates whether the reader tries to read a Gen 2 tag in Secured State. If A_FLAG is set the protocol contains the access password.
A_FLAG:
b0 no access password in protocol
b1 access password and access password length in protocol. Reader execute access command

**A_PW_LNG:**

Length of Access Password.

**A_PW:**

Access password which is used to access to the secured state of the Tag.

**DB-ADR:**

First block number to be read. Depending on EXT_ADR. First block can be any value between 0 and 255 or 0 and 65535.

**DB-N:**

Number of data blocks to be read from the Transponder, starting at DB-ADR.
The maximum number of DB-N, depends on DB-Size and the interface transmit buffer size TX-BUF. The maximum number of DB-N is:
(TX-BUF - 10) / (DB-Size + 1) e.g. Block size 2 (DB-N = (512 – 10) / (2 + 1) = 167).

**DB-SIZE:**

Number of bytes of one data block. This value depends on the specification of the Transponder

**SEC-STATUS:**

Block security status of following data block.

**DB:**

Requested data block. The block size is defined by DB-SIZE.

## 10.1.3. [0x24] Write Multiple Blocks

This command writes one or more data blocks.

REQUEST-DATA

| 6 | 7 | 1 Byte | EPC_LNG Bytes | 1Byte |
|---|---|---|---|---|
| 0x24 | MODE | EPC_LNG | EPC | BANK |

| 1 Byte | A_PW_LGT Bytes | 1 or 2 Bytes ( def. by EXT_ADR) | 1 Byte | 1 Byte | DB-N times DB-SIZE Bytes |
|---|---|---|---|---|---|
| A_PW_LGT | A_PW | DB-ADR | DB-N | DB-SIZE | DB |
| | | | | | Repeated DB-N times |

RESPONSE-DATA (STATUS = 0x03)

| 7 |
|---|
| DB-ADR-E |

**MODE:**

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function | 0 | 0 | EXT_ADR | EPC_LF | | ADR | | |

**ADR:**

b000 non-addressed
b001 addressed

**EPC_LF:**

If this bit is set the parameter EPC_LNG must inserted into the protocol.

b0: The protocol EPC_LNG doesn't include the EPC_LNG byte and the EPC field has a fixed length of 8 byte, from byte 6 to byte 13.

b1: The protocol includes the parameter EPC_LNG. The EPC has a variable length as defined in EPC_LNG.

**EXT_ADR:**

If this bit is set the command includes extended address fields.

b0: Transponder memory addressing is done by the 1 byte DB-ADR Field.

b1: Transponder memory addressing is done by BANK and 2 byte DB-ADR Field

**EPC_LNG:**

Is a optional parameter and depends on the setting of EPC_LF (see MODE). EPC_LNG defines the length of the following EPC field.

**EPC:**

Read-only serial number of the Transponder. The EPC is required only in the addressed mode.

**BANK:**

Memory bank of the Transponder which will be accessed by the Reader

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function | A_FLAG | 0 | 0 | 0 | 0 | 0 | BANK_NR | |

**BANK_NR:**

In case of Class 1 Gen 2 Transponder BANK_NR is defined as follows:

b00 reserved
b01 EPC memory bank
b10 TID memory bank
b11 User memory bank

**A_FLAG:**

Indicates whether the reader tries to read a Gen 2 tag in Secured State. If A_FLAG is set the protocol contains the access password.
A_FLAG:

b0 no access password in protocol

b1 access password and access password length in protocol. Reader execute access command

**A_PW_LNG:**

Length of Access Password.

**A_PW:**

Access password which is used to access to the secured state of the Tag.

**DB-ADR:**

First block number to be read. Depending on EXT_ADR First block can be any value between 0 and 255 or 0 and 65535.

**DB-N:**

Number of data blocks to be written to the Transponder, starting at DB-ADR.
The maximum number of DB-N, depends on DB-Size and the interface receiver buffer size RX-BUF. The number of DB-N is also depending on the length of the UID.

$DB\text{-}N_{max}$= 128

**DB-SIZE:**

Number of bytes of one data block.

**DB:**

Data of the data block to be written to the Transponder. The required block size is defined by DB-SIZE. The number of the expected bytes are DB-N * DB-SIZE.

**DB-ADR-E:**

Block number were the error occurred.

***NOTE:***

***If an error occurred during a write command, the number of the block were the error occurred will be send to host***

## 11. [0xB3] Host commands for EPC Transponders

This command sends special commands to EPC Transponder.

Host → Reader

| 1 | 2 | 3 | 4 | 5 | 6...n-2 | n-1,n |
|---|---|---|---|---|---|---|
| STX (0x02) | MSB ALENGTH | LSB ALENGTH | COM-ADR | [0xB3] | REQUEST-DATA | CRC16 |

Host ← Reader

| 1 | 2 | 3 | 4 | 5 | 6 | 7...n-2 | n-1,n |
|---|---|---|---|---|---|---|---|
| STX (0x02) | MSB ALENGTH | LSB ALENGTH | COM-ADR | [0xB3] | STATUS[19] | RESPONSE-DATA | CRC16 |

**REQUEST-DATA:**

EPC specific request

**RESPONSE-DATA:**

EPC specific response

***NOTE:***

***Data is only transferred if STATUS = 0x00, 0x83, 0x94, 0x95.***

[19] *see ANNEX C – Index of Status Bytes*

## 11.1. EPC Class 1 Commands

This commands supports the functions of the EPC class1 Gen 2 Transponder

### 11.1.1. [0x18] Kill

This command writes one or more data blocks by using the Block write command of C1G2 Transponder or using the kill command for C1G1.

REQUEST-DATA

| 6 | 7 | 1 Byte | EPC_LNG Bytes |
|---|---|---|---|
| 0x18 | MODE | EPC_LF | EPC |

| 1 Byte | K_PW_LNG Bytes |
|---|---|
| K_PW_LNG | K_PW |

**MODE:**

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function | 0 | 0 | 0 | EPC_LF | | ADR | | |

**ADR:**

b000 non-addressed
b001 addressed

**EPC_LF:**

If this bit is set the parameter EPC_LNG must inserted into the protocol.

b1: The protocol includes the parameter EPC_LNG. The EPC has a variable length as defined in EPC_LNG.

**EPC_LNG:**

Is a optional parameter and depends on the setting of EPC_LF (see MODE). EPC_LNG defines the length of the following EPC field.

**EPC:**

EPC of the Transponder. The EPC is required only in the addressed mode.

**K_PW_LNG:**

Length of Kill Password.

**K-PW:**

Kill Password.

***NOTE:***

***A EPC class 1 Transponder can be killed in addressed mode only***

***Kill password K_PW has to contain the kill code***

***Kill password length K_PW_LNG=4***

***A kill password of "00 00 00 00" has no effect and will be ignored by the transponder.***

## 11.1.2. [0x22] Lock

This command Lock different memory portions of a EPC Transponder.

REQUEST-DATA

| 6 | 7 | 1 Byte | EPC_LNG Bytes |
|---|---|---|---|
| 0x22 | MODE | EPC_LNG | EPC |
| | | | |

| 1 Byte | 1 Byte | LOCK_LNG Bytes | 1 Byte | A_PW_LNT Bytes |
|---|---|---|---|---|
| EPC_TYPE | LOCK_LNG | LOCK_DATA | A_PW_LNG | A_PW |

**MODE:**

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function | 0 | 0 | 0 | EPC_LF | 0 | ADR | | |

**ADR:**

b000 non-addressed
b001 addressed

**EPC_LF:**

If this bit is set the parameter EPC_LNG must inserted into the protocol.

b1: The protocol includes the parameter EPC_LNG. The EPC has a variable length as defined in EPC_LNG.

**EPC_LNG:**

Is a optional parameter and depends on the setting of EPC_LF (see MODE). EPC_LNG defines the length of the following EPC field.

**EPC:**

Read-only serial number of the Transponder. The EPC is required only in the addressed mode.

**EPC_Type:**

Type of Transponder according ANNEX A – Codes of Transponder Types.

**LOCK_LNG:**

Length of LOCK_DATA Field

**LOCK_DATA:**

Lock data which will be written to the Tag.

**A_PW_LNG:**

Length of Access Password.

**A_PW:**

Access password which is used to access to the secured state of the Tag.

***NOTE:***

**Further details can be found in the Application Note N11121-Xe-ID-B.pdf**

### 11.1.3. [0x30] Untraceable (DNA)

This command hides parts of the tag's TID, EPC and/or user memory.

REQUEST-DATA

| Byte | 6 | 7 | 1 Byte | EPC_LNG Bytes | 1 Byte |
|---|---|---|---|---|---|
| Contents | 0x30 | MODE | EPC_LNG | EPC | Bank |

| 1 Byte | A_PW_LNT Bytes | 1 Byte | 2 Bytes | 1 Byte |
|---|---|---|---|---|
| A_PW_LNG | A_PW | U_FLAG | HIDE | RANGE |

RESPONSE-DATA (STATUS = 0x95)

| 7 |
|---|
| ISO-ERROR |

**MODE:**

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function | 0 | 0 | EXT_ADR | EPC_LF | 0 | ADR | | |

**ADR:**

b000 non-addressed
b001 addressed

**EPC_LF:**

If this bit is set the parameter EPC_LNG must inserted into the protocol.

b1: The protocol includes the parameter EPC_LNG. The EPC has a variable length as defined in EPC_LNG.

**EXT_ADR:**

If this bit is set the command includes the bank field. This bit has to be set, because the Access-Password is always needed.

**EPC_LNG:**

Is a optional parameter and depends on the setting of EPC_LF (see MODE). EPC_LNG defines the length of the following EPC field.

**EPC:**

Read-only serial number of the Transponder. The EPC is required only in the addressed mode.

**BANK:**

Memory bank of the Transponder which will be accessed by the Reader

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function | A_FLAG | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

**A_FLAG:**

Indicates whether the reader tries to read a Gen 2 tag in Secured State. If A_FLAG is set the protocol contains the access password.

A_FLAG:

b0 no access password in protocol

b1 access password and access password length in protocol. Reader execute access command

**A_PW_LNG:**

Length of Access Password.

**A_PW:**

Access password which is used to access to the secured state of the Tag.

**U_FLAG:**

reserved, should be 0.

**HIDE:**

| Bit: | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 |
|---|---|---|---|---|---|---|---|---|
| Function | 0 | 0 | HIDE_ EPC | NEW_EPC_LEN | | | | |

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function | | | | | | HIDE_TID | | HIDE_ USER |

**HIDE_USER:**

Specifies whether a tag untraceably hides USER memory.

b0: view

b1: hide

**HIDE_TID:**

Specifies whether a tag untraceably hides part of TID memory.

b00: view

b01: hide some

b10: hide all

b11: RFU

**NEW_EPC_LEN:**

Specifies a new EPC length field.

**HIDE_EPC:**

Specifies whether a tag untraceably hides parts of EPC memory.

b00: show memory above EPC

b01: hide memory above EPC

**RANGE:**

Specifies an operating range.
b00: normal
b01: toggle temporarily
b10: reduced
b11: RFU

## 11.1.4. [0x31] Authenticate (DNA)

This command performs tag, reader, or mutual authentication.

REQUEST-DATA

| Byte | 6 | 7 | 1 Byte | EPC_LNG Bytes | 1 Byte |
|---|---|---|---|---|---|
| Contents | 0x31 | MODE | EPC_LNG | EPC | Bank |

| 1 Byte | A_PW_LNT Bytes | 1 Byte | 1 Byte | 1 Byte |
|---|---|---|---|---|
| A_PW_LNG | A_PW | AUTH_MODE | CSI | CRYPTO_ TIME |

| 2 Byte | n Bytes |
|---|---|
| MSG_LEN | MSG |

RESPONSE-DATA (STATUS = 0x95)

| 7 |
|---|
| ISO-ERROR |

RESPONSE-DATA (STATUS = 0x00) for Key management in the reader

| 7..8 | 9 .. (9+DATA_LEN) |
|---|---|
| DATA_LEN | DATA |

RESPONSE-DATA (STATUS = 0x00) for Key management in the Host system

| 7..8 | 9..(9+DATA_LEN) |
|---|---|
| DATA_LEN | CRYPTOGRAPH IC RESPONSE |

**MODE:**

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function | 0 | 0 | EXT_ADR | EPC_LF | 0 | ADR | | |

**ADR:**

b000 non-addressed
b001 addressed

**EPC_LF:**

If this bit is set the parameter EPC_LNG must inserted into the protocol.

b1: The protocol includes the parameter EPC_LNG. The EPC has a variable length as defined in EPC_LNG.

**EXT_ADR:**

If this bit is set the command includes the bank field. This bit has to be set, because the Access-Password is always needed.

**EPC_LNG:**

Is a optional parameter and depends on the setting of EPC_LF (see MODE). EPC_LNG defines the length of the following EPC field.

**EPC:**

Read-only serial number of the Transponder. The EPC is required only in the addressed mode.

**BANK:**

Memory bank of the Transponder which will be accessed by the Reader

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function | A_FLAG | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

**A_FLAG:**

Indicates whether the reader tries to read a Gen 2 tag in Secured State. If A_FLAG is set the protocol contains the access password.
A_FLAG:
b0 no access password in protocol
b1 access password and access password length in protocol. Reader execute access command

**A_PW_LNG:**

Length of Access Password.

**A_PW:**

Access password which is used to access to the secured state of the Tag.

**AUTH_MODE:**

Defines the format of the request and the response

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function | KEY-LOC | 0 | 0 | 0 | 0 | CRYPTO _FLAG | 0 | 0 |

**KEY-LOC:**

Defines the key store

*b0: Keys are stored in the reader. Authentication of the transponder is done by the reader*

*b1: Keys are stored in the host system. Authentication of the transponder is done by the host system*

**CRYPTO_FLAG:**

If CRYPTO FLAG is set the protocol contains the crypto exexcution time.

b0: no crypto execution time in protocol

b1: crypto execution time in protocol

***NOTE:***

***If bit KEY-LOC is set to 1 the relevant keys are stored in the Host system. The host has to generate the challenge (80 bits random number) and has to transmitted the number to the reader. The readers response to the host system consists of the encrypted tag response. With knowledge of the relevant keys the host system encrypts the transmitted data and authenticates the transponder.***

**CSI:**

Crypto Suite Identifier

| CSI | Part | Crypto Suite |
|---|---|---|
| 0x00 | ISO/IEC 29167 - 10 | AES128 |
| 0x01 | ISO/IEC 29167 – 11 | PRESENT 80 |
| 0x02 | ISO/IEC 29167 – 12 | ECC-DH |
| 0x03 | ISO/IEC 29167 - 13 | GRAIN 128 |
| 0x04 | ISO/IEC 29167 – 14 | AES128-OFB |
| 0x05 | ISO/IEC 29167 – 15 | XOR |
| 0x06 | ISO/IEC 29167 – 16 | ECSDA-ECDH |
| 0x07 | ISO/IEC 29167 - 17 | GPS |
| 0x08 | ISO/IEC 29167 – 18 | Humming Bird 2 |
| 0x09 | ISO/IEC 29167 - 19 | RAMON |

**CRYPTO_TIME:**

crypto execution time in ms

**MSG_LEN:**

Length of the message in bytes

**MSG:**

Message defined by the crypto suite specified by the CSI

### *11.1.4.1. Message TAM1*

Send Interrogator challenge and request Tag authentication response.

Message TAM1 format

| 1 | 1 | (10) |
|---|---|---|
| MSG_CMD | KEY_ID | (CHALLENGE) |

**MSG_CMD:**

Defines Authent Methode and Custom Data

| Bit | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Contents | AuthMethode | | Custom Data | TAM1_RFU | | | | |
| Default | 00 | | 0 | 00000 | | | | |

AuthMethod:

00b: specifies the use of TAM

CustomData:

0b: indicate that no custom data is requested (TAM1)

TAM1_RFU:

00000b: reserved

**KEY_ID:**

Defines which Key is used for TAM1

| Bit | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Contents | - | - | - | - | - | KEY-TYPE | | |

KEY-TYPE:

b000: Key 0 is used

b001: Key 1 is used

**CHALLENGE:**

80-bit random challenge that the Interrogator has generated for use in TAM1
***Only necessary when authentication is done by the host system (KEY-LOC = 1).***

**DATA_LEN:**

Number of bits

**DATA:**

Requested decrypted data

**CRYPTOGRAPHIC RESPONSE:**

Requested encrypted data

### *11.1.4.2. Message TAM2*

Send Interrogator challenge and request Tag authentication response with custom data.

Message TAM2 format

| 1 | 1 | (10) | 3 |
|---|---|---|---|
| MSG_CMD | KEY_ID | (CHALLENGE) | TAM2_ PARAMETER |

**MSG_CMD:**

Defines Authent Methode, Custom Data and BlockSize

| Bit | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Contents | AuthMethode | | Custom Data | BlockSize | TAM2_RFU | | | |
| Default | 00 | | 1 | 0 | 0000 | | | |

AuthMethod:

00b: specifies the use of TAM

CustomData:

1b: specified that custom data requested (TAM2)

BlockSize:

Defines the size of custom data bock

0b: 64-bit block

1b: 16-bit block

TAM2_RFU:

0000b: reserved

**KEY_ID:**

Defines which Key is use for TAM2

| Bit | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Contents | - | - | - | - | - | KEY-TYPE | | |

KEY-TYPE:

b000: Key 0 is used

b001: Key 1 is used

**CHALLENGE:**

80-bit random challenge that the Interrogator has generated for use in TAM2
***Only necessary when authentication is done by the host system (KEY-LOC = 1).***

**TAM2_PARAMETER:**

Defines the parameter for TAM2

| Bit: | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 |
|---|---|---|---|---|---|---|---|---|
| Function: | PROFILE | | | | OFFSET | | | |

| Bit: | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 |
|---|---|---|---|---|---|---|---|---|
| Function: | OFFSET | | | | | | | |

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function: | BLOCK_COUNT | | | | PROT_MODE | | | |

**PROFILE:**

Defines the memory profile for the addition of custom data
0x00: EPC memory bank
0x01: TID memory bank
0x02: USER memory bank

**OFFSET:**

Defines the start address of the custom data block

**BLOCK_COUNT:**

Defines the size of the customer data as a number of 64-bit blocks (4 memory blocks).
One memory block has 16 bits.
Size = (BLOCK_COUNT+1) * 64

**PROT_MODE:**

Defines the operation mode that shall be used to process the custom data.

| PROT_MODE | Description |
|---|---|
| 0x00 | Plaintext |
| 0x01 | CBC |
| 0x02 | CMAC |
| 0x03 | CBC + CMAC |

## 11.1.5. [0x32] Challenge (DNA)

This command allows an interrogator to instruct multiple tags to simultaneously yet independently precompute and store a cryptographic value.

No response is send from tag on a challenge command.

REQUEST-DATA

| Byte | 6 | 7 | 1 Byte | EPC_LNG Bytes |
|---|---|---|---|---|
| Contents | 0x32 | MODE | EPC_LNG | EPC |

| 1 Byte | 1 Byte | 1 Byte | 2 Byte | n Bytes |
|---|---|---|---|---|
| AUTH_MODE | CSI | CRYPTO_ TIME | MSG_LEN | MSG |

**MODE:**

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function | 0 | 0 | 0 | 0 | 0 | ADR | | |

**ADR:**

b000 non-addressed

***NOTE:***

***Only non addressed Mode is supported.***

**AUTH_MODE:**

Defines the format of the request and the response

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function | 0 | 0 | 0 | 0 | 0 | CRYPTO _FLAG | 0 | 0 |

**CRYPTO_FLAG:**

If CRYPTO FLAG is set the protocol contains the crypto exexcution time.

b0: no crypto execution time in protocol

b1: crypto execution time in protocol

**CSI:**

Crypto Suite Identifier

| CSI | Part | Crypto Suite |
|---|---|---|
| 0x00 | ISO/IEC 29167 - 10 | AES128 |
| 0x01 | ISO/IEC 29167 – 11 | PRESENT 80 |
| 0x02 | ISO/IEC 29167 – 12 | ECC-DH |
| 0x03 | ISO/IEC 29167 - 13 | GRAIN 128 |
| 0x04 | ISO/IEC 29167 – 14 | AES128-OFB |
| 0x05 | ISO/IEC 29167 – 15 | XOR |
| 0x06 | ISO/IEC 29167 – 16 | ECSDA-ECDH |
| 0x07 | ISO/IEC 29167 - 17 | GPS |
| 0x08 | ISO/IEC 29167 – 18 | Humming Bird 2 |
| 0x09 | ISO/IEC 29167 - 19 | RAMON |

**CRYPTO_TIME:**

crypto execution time in ms

**MSG_LEN:**

Length of the message in bytes

**MSG:**

Message defined by the crypto suite specified by the CSI

### *11.1.5.1. Message TAM1*

Interrogator sends a challenge.

Message TAM1 format

| 1 | 1 | 10 |
|---|---|---|
| MSG_CMD | KEY_ID | CHALLENGE |

**MSG_CMD:**

Defines Authent Methode and Custom Data

| Bit | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Contents | AuthMethode | | Custom Data | TAM1_RFU | | | | |
| Default | 00 | | 0 | 00000 | | | | |

AuthMethod:

00b: specifies the use of TAM

CustomData:

0b: indicate that no custom data is requested (TAM1)

TAM1_RFU:

00000b: reserved

**KEY_ID:**

Defines which Key is used for TAM1

| Bit | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Contents | - | - | - | - | - | KEY-TYPE | | |

KEY-TYPE:

b000: Key 0 is used

b001: Key 1 is used

**CHALLENGE:**

80-bit random challenge that the Interrogator has generated for use in TAM1

### *11.1.5.2. Message TAM2*

Interrogator sends a challenge.

Message TAM2 format

| 1 | 1 | 10 | 3 |
|---|---|---|---|
| MSG_CMD | KEY_ID | CHALLENGE | TAM2_ PARAMETER |

**MSG_CMD:**

Defines Authent Methode, Custom Data and BlockSize

| Bit | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Contents | AuthMethode | | Custom Data | BlockSize | TAM2_RFU | | | |
| Default | 00 | | 1 | 0 | 0000 | | | |

AuthMethod:

00b: specifies the use of TAM

CustomData:

1b: specified that custom data requested (TAM2)

BlockSize:

Defines the size of custom data bock

0b: 64-bit block

1b: 16-bit block

TAM2_RFU:

0000b: reserved

**KEY_ID:**

Defines which Key is use for TAM2

| Bit | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Contents | - | - | - | - | - | KEY-TYPE | | |

KEY-TYPE:

b000: Key 0 is used

b001: Key 1 is used

**CHALLENGE:**

80-bit random challenge that the Interrogator has generated for use in TAM2

**TAM2_PARAMETER:**

Defines the parameter for TAM2

| Bit: | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 |
|---|---|---|---|---|---|---|---|---|
| Function: | PROFILE | | | | OFFSET | | | |

| Bit: | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 |
|---|---|---|---|---|---|---|---|---|
| Function: | OFFSET | | | | | | | |

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function: | BLOCK_COUNT | | | | PROT_MODE | | | |

**PROFILE:**

Defines the memory profile for the addition of custom data
0x00: EPC memory bank
0x01: TID memory bank
0x02: USER memory bank

**OFFSET:**

Defines the start address of the custom data block

**BLOCK_COUNT:**

Defines the size of the customer data as a number of 64-bit blocks (4 memory blocks).
One memory block has 16 bits.
Size = (BLOCK_COUNT+1) * 64

**PROT_MODE:**

Defines the operation mode that shall be used to process the custom data.

| PROT_MODE | Description |
|---|---|
| 0x00 | Plaintext |
| 0x01 | CBC |
| 0x02 | CMAC |
| 0x03 | CBC + CMAC |

## 11.1.6. [0x33] ReadBuffer

This command allows to read data stored in a tag response buffer.

REQUEST-DATA

| Byte | 6 | 7 | 1 Byte | EPC_LNG Bytes | 1 Byte |
|---|---|---|---|---|---|
| Contents | 0x33 | MODE | EPC_LNG | EPC | Bank |

| 1 Byte | A_PW_LNT Bytes | 2 Byte | 2 Byte |
|---|---|---|---|
| A_PW_LNG | A_PW | START_ADR | NB |

RESPONSE-DATA (STATUS = 0x95)

| 7 |
|---|
| ISO-ERROR |

RESPONSE-DATA (STATUS = 0x00)

| 7..8 | 9 .. (9+DATA_LEN) |
|---|---|
| DATA_LEN | DATA |

**MODE:**

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function | 0 | 0 | EXT_ADR | EPC_LF | 0 | ADR | | |

**ADR:**

b000 non-addressed
b001 addressed

**EPC_LF:**

If this bit is set the parameter EPC_LNG must inserted into the protocol.

b1: The protocol includes the parameter EPC_LNG. The EPC has a variable length as defined in EPC_LNG.

**EXT_ADR:**

If this bit is set the command includes the bank field. This bit has to be set, because the Access-Password is always needed.

**EPC_LNG:**

Is a optional parameter and depends on the setting of EPC_LF (see MODE). EPC_LNG defines the length of the following EPC field.

**EPC:**

Read-only serial number of the Transponder. The EPC is required only in the addressed mode.

**BANK:**

Memory bank of the Transponder which will be accessed by the Reader

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function | A_FLAG | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

**A_FLAG:**

Indicates whether the reader tries to read a Gen 2 tag in Secured State. If A_FLAG is set the protocol contains the access password.

A_FLAG:

b0 no access password in protocol

b1 access password and access password length in protocol. Reader execute access command

**A_PW_LNG:**

Length of Access Password.

**A_PW:**

Access password which is used to access to the secured state of the Tag.

**START_ADR:**

Defines the starting address for the read buffer

**NB:**

Number of bits to read. If NB=0 the complete buffer will be read.

**DATA_LEN:**

Number of bytes

**DATA:**

Requested data

## 11.2. Supported Host commands for Transponders

The command codes listed in the following table supports the various Transponder commands and operations that are available for each Transponder type.

### 11.2.1. EPC class 1 Gen 2

**Memory organization:**

| | |
|---|---|
| Number of blocks | vendor specific |
| Block size | 2 byte |

| Command Code | Function | Mode | | Comment |
|---|---|---|---|---|
| | | non-addressed | addressed | |
| 0xB0 0x01 | Inventory | | | |
| 0xB0 0x23 | Read Multiple Blocks | √ | √ | |
| 0xB0 0x24 | Write Multiple Blocks | √ | √ | |
| 0xB3 0x18 | Kill | | √ | |
| 0xB3 0x22 | Lock | | √ | |
| 0xB3 0x30 | Untraceable | √ | √ | |
| 0xB3 0x31 | Authenticate | √ | √ | |
| 0xB3 0x32 | Challenge | √ | | |

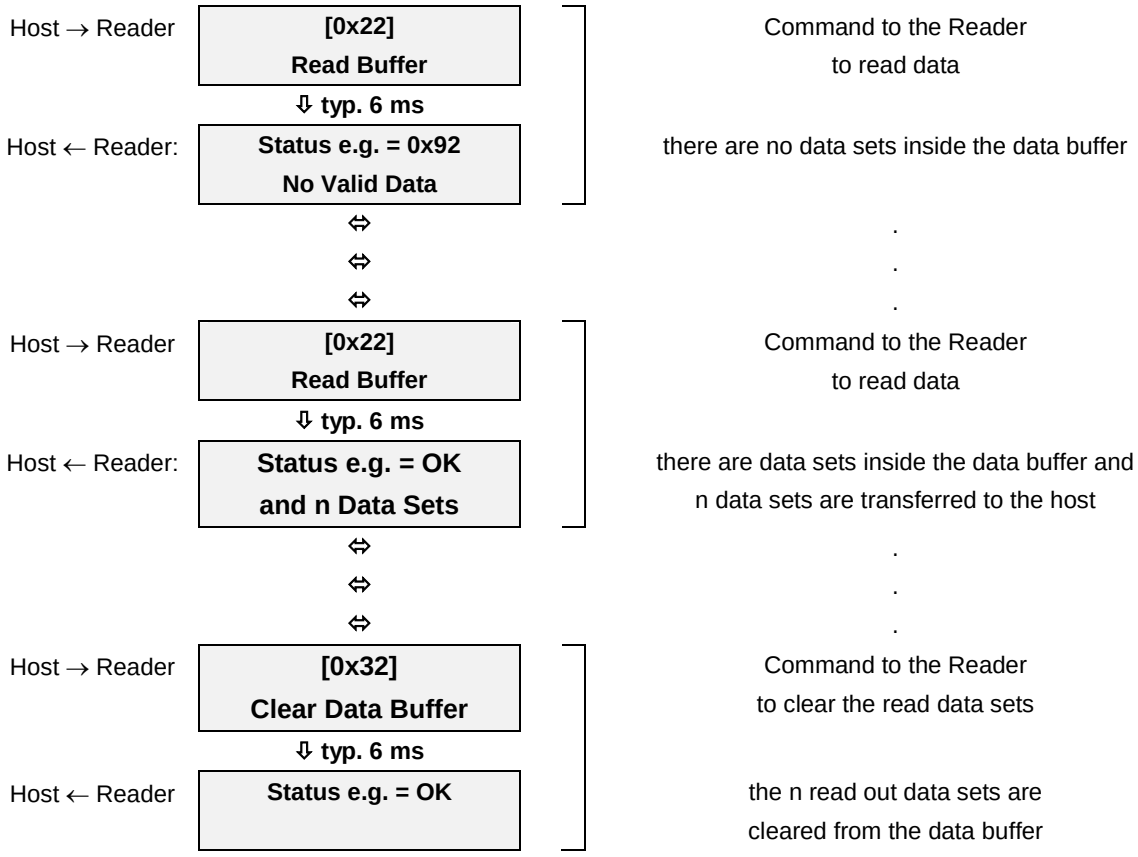
***Note***
***A separate Application Note is available, which describes the "0xB4" NXP Customer commands. Please contact identification-support@feig.de***

# 12. Protocols for Notification Mode (only MRU102-PoE)

## 12.1. The Buffered Read Mode Procedure

By using the “BRM” the Reader itself reads data from every Transponder which is inside the antenna field. This mode must be enabled in the 7.2. CFG1: Interface and Mode configuration block and configured in the 7.5. CFG11: Read Mode – Read Data and 7.6. CFG12: Read Mode - Filter configuration blocks.

The sampled Transponder data sets are stored in a FIFO organized data buffer inside the Reader. The buffered read mode runs offline from any host commands and it is immediately started after power up or a 9.3. [0x63] Software Reset command. Only two commands are necessary to read out sampled Transponder data sets. The figure below illustrates the Buffered Read Mode procedure:




***⇩: Host waits for an answer from the Reader***

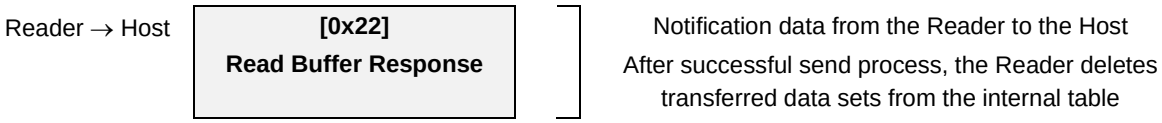
***⇔: Host is able to do other jobs e.g. to communicate with other Readers***

Additional information about the capacity of the data buffer can be determined with the 12.5. [0x31] Read Data Buffer Info command.

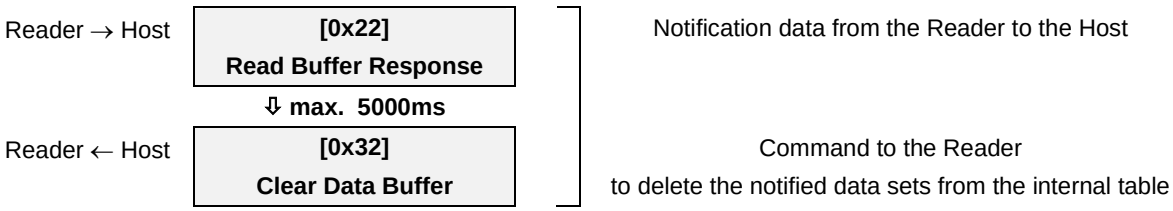
## 12.2. The Notification Mode Procedure

By using Notification Mode together with the Buffered Read Mode the Reader itself reads data from every Transponder which is inside the antenna field **and** enables a connection to a host to send the queued data asynchronously. This mode must be enabled in the 7.2. CFG1: Interface and Mode configuration block and configured in 7.24. CFG49: Notification Channel (only for ID ISC.MRU102-PoE). The settings for the Read Mode define the notification information sent to the host.

Only one command is necessary to send sampled Transponder data sets. The figure below illustrates the Notification Mode procedure:




The reader sends notifications as fast as possible, if the notification trigger is set to continuously or a very short cycle time in time-triggered mode is defined. To prevent a notification overflow in a host application the acknowledgement option can be set. In this case the notification must be acknowledged by the host with an response protocol to synchronize the notification process with the host application. The figure below illustrates this procedure:




The acknowledge 12.6. [0x32] Clear Data Buffer must be in the space of 5 seconds. If no acknowledge is received the Reader repeats the notification as it is configured.

Additional information about the capacity of the data buffer can be determined with the 12.5. [0x31] Read Data Buffer Info command.

In Notification Mode the 12.4. [0x22] Read Buffer command is not applicable.

As an additional option Keepalive messages can be sent periodically to a host. Keepalive notifications are always never acknowledged. The information sent by a Keepalive notification is identical with the command 9.8. [0x6E] Reader Diagnostic with mode = 0x01.

## 12.3. Transponder Access in Buffered Read Mode and Notification Mode

The Notification Mode only reads data blocks from the Transponders in the antenna field

The anticollision procedure can be configured in the 7.20. CFG38: Anticollision UHF configuration block.

After power up or a 9.3. [0x63] Software Reset command the buffered read mode starts with transponder reading.

## 12.4. [0x22] Read Buffer

The command Read Buffer reads a number of data sets from the data buffer.

Host → Reader

| 1 | 2 | 3 | 4 .. 5 | 6...7 |
|---|---|---|---|---|
| 7 | COM-ADR | [0x22] | DATA-SETS | CRC16 |

Host ← Reader

| 1 | 2 | 3 | 4 | 5 | (6) | 6, 7 (7, 8) |
|---|---|---|---|---|---|---|
| n | COM-ADR | [0x22] | STATUS[20] | TR-DATA1 | TR-DATA2 | DATA-SETS |

| (8 or 9 ... n-2) | n-1, n |
|---|---|
| DATA | CRC16 |

**DATA-SETS:**

Number of data sets to be transferred from the data buffer. If the data buffer does not contain the requested number of data sets, the Reader responds with all available data sets and an error will occur.

**TR-DATA1:**

Selects the data types for read operation.

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function | ExFlag | - | TIMER | ANT | Byte Order | - | DB | IDD |

**IDD** = Identifier Data (UID or EPC)

**DB** = data block

**Byte Order** = b0:MSB first, b1:LSB first

**ANT** = Antenna number

**TIMER** = internal system timer

**ExFlag** = Extension flag, if b1= TR-DATA2 will be send

[20] *see ANNEX C – Index of Status Bytes*

**TR-DATA2:**

Selects the data types for read operation.

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function | - | - | - | ANT_Ext | - | - | MAC | - |

**MAC:**

MAC address of the Reader

**ANT-Ext: Antenna Extended**

Antenna number with RSSI

***NOTE:***

***If the ANT bit in TR_DATA (CFG11) is set in Buffer-Info-Mode:***

***When a Transponder is detected by multiple antennas, only one data set is stored. The Valid-Time is only set at the first detection. If a data set is transferred to the host and the same Transponder is detected in another antenna but the Valid-Time has not yet elapsed, no other data set is stored.***

***If the ANT bit in TR_DATA (CFG11) is not set in Buffer-Info-Mode and a Transponder is detected by multiple antennas, the data set for each antenna is stored.***

**DATA:**

Requested number of data sets from the data buffer. Only selected data will be transferred to the host. See chapter 7.5. CFG11: Read Mode for more details.
Each data set has the following structure:

| Data Type | | DATA | | | |
|---|---|---|---|---|---|
| Record Length | byte no. | 1 | 2 | | |
| | | MSB RecLen | LSB RecLen | | |
| Serial Number | byte no. | 1 | 2 | 3 | 3+LEN |
| | | TR-TYP | IDDT | IDD-LEN | IDD |
| data blocks | byte no. | 1 | 2 | 3 | 4…4+DB-N*DB-SIZE |
| | | DB-N | | DB-SIZE | DB |
| Timer | byte no. | 1...4 | | | |
| | | TIMER | | | |
| Antenna | byte no. | 1 | | | |
| | | ANT-NO | | | |
| MAC | byte no. | 6 | | | |
| | | MAC-ADR | | | |
| Antenna-Extended | byte no. | 1 | 2 | 3 | 4...7 |
| | | ANT-CNT | ANTx | RSSIx | reserved |
| | | | Repeated ANT-CNT times | | |

**ANT-NO** = Antenna number

ANT is a bit field. If the tag is read on more than one antenna and the configuration option "all antenna ports act as one reading point" is set, the corresponding bits of each antenna were the Transponder is read will be set in the bit field.

| Bit: | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Function | - | - | - | - | ANT INT | ANT3 | ANT2 | ANT1 |

**ANT1...ANT INT**

b0 this antenna has not read transponder data

b1 this antenna has read transponder data

**MAC-ADR**

MAC address of the reader.

**ANT-CNT** = antenna counter

Shows the antennas on which a transponder was read.

**ANTx** = antenna number

The antenna number depends on the number of the output of the multiplexer and the connection of that multiplexer in the structure. The decimal places of the antenna number describe the active outputs of the multiplexers on all 3 levels to switch to the antenna.

ANT-CNT = (Level 2 Mux Channel) * 10 + (Level 1 Mux Channel) * 1

Example:
– Mux on output 2 Level 1
– Mux on output 4 Level 2

ANT-CNT = 4 * 10 + 2 * 1 = 42

**RSSIx** = Receive signal strength identification

***NOTE:***

***This command reads the same data sets until they are cleared with the 12.6. [0x32] Clear Data Buffer command.***

***This command is only available in the Buffered Read Mode, but describes the structure of the received data sets in Notification Mode.***

***Data are only transferred if STATUS = 0x00, 0x83, 0x84, 0x93, 0x94.***

***If STATUS = 0x83, 0x84, 0x85 the TR-DATA and DATA SETS will be always transferred.***

## 12.5. [0x31] Read Data Buffer Info

The command Read Data Buffer Info reads the actual parameters of the data buffer.

Host → Reader

| 1 | 2 | 3 | 4...5 |
|---|---|---|---|
| 5 | COM-ADR | [0x31] | CRC16 |

Host ← Reader

| 1 | 2 | 3 | 4 | 5...6 | 7,8 |
|---|---|---|---|---|---|
| 12 | COM-ADR | [0x31] | STATUS[21] | TAB-SIZE | TAB-START |

| 9,10 | 11,12 |
|---|---|
| TAB-LEN | CRC16 |

**TAB-SIZE:**

Maximum count of Transponder data sets in the data buffer.

**TAB-START:**

Address of first Data Set in the data buffer.

**TAB-LEN:**

Number of Transponder data sets reserved in the data buffer.

***NOTE:***

***Additional information about the data table status is transferred if STATUS = 0x00, 0x84, 0x85, 0x93.***

## 12.6. [0x32] Clear Data Buffer

The command Clear Data Buffer clears the data sets from the data buffer which were transferred with the 12.4. [0x22] Read Buffer command.

Host → Reader

| 1 | 2 | 3 | 4...5 |
|---|---|---|---|
| 5 | COM-ADR | [0x32] | CRC16 |

Host ← Reader

| 1 | 2 | 3 | 4 | 5...6 |
|---|---|---|---|---|
| 6 | COM-ADR | [0x32] | STATUS[22] | CRC16 |

[21] *see ANNEX C – Index of Status Bytes*

[22] *see ANNEX C – Index of Status Bytes*

## 12.7. [0x33] Initialize Buffer

The command Initialize Buffer clears the data buffer to an initial state. It does not matter if the data sets in the data buffer were read or not.

Host → Reader

| 1 | 2 | 3 | 4...5 |
|---|---|---|---|
| 5 | COM-ADR | [0x33] | CRC16 |

Host ← Reader

| 1 | 2 | 3 | 4 | 5...6 |
|---|---|---|---|---|
| 6 | COM-ADR | [0x33] | STATUS[23] | CRC16 |

[23] *see ANNEX C – Index of Status Bytes*

# ANNEX

## ANNEX A – Codes of Transponder Types

| Value | Transponder type |
|---|---|
| 0x84 | EPC class 1 Gen 2 |

The Information will be send by performing the 10.1.1. [0x01] Inventory command.

## ANNEX B – Codes of Identifier Data Types (IDDT)

| Value | IDDT |
|---|---|
| 0x00 | SNR or EPC |
| 0x02 | EPC and TID |

The Information will be send by performing the 10.1.1. [0x01] Inventory command or using the Scan Mode.

# ANNEX C – Index of Status Bytes

| Hex-value | Transponder Status |
|---|---|
| 0x00 | **OK:**<br>Data / parameters have been read or stored without error<br>Control command has been executed |
| 0x01 | **No Transponder:**<br>No Transponder is located within the detection field of the Reader.<br>The Transponder in the detection field has been switched to mute .<br>The communication between Reader and Transponder has been interfered and the Reader is not able to read the Transponder anymore. |
| 0x02 | **Data False:**<br>CRC16 data error on received data. |
| 0x03 | **Write-Error:**<br>Negative plausibility check of the written data:<br>Attempt to write on a read-only area.<br>Too much distance between Transponder and Reader antenna.<br>Attempt to write in a noisy area. |
| 0x04 | **Address-Error:**<br>The required data are outside of the logical or physical Transponder-address area:<br>The address is beyond the max. address space of the Transponder.<br>The address is beyond the configured address space of the Transponder. |
| 0x08 | **Authent Error**<br>If access password is wrong |
| 0x10 | **EEPROM-Failure:**<br>The EEPROM of the Reader is not able to be written on.<br>Before writing onto the EEPROM a faulty checksum of parameters has been detected. |
| 0x11 | **Parameter-Range-Error:**<br>The value range of the parameters was exceeded. |
| 0x13 | **Login-Request:**<br>Configuration access without having logged in to the Reader before. |
| 0x14 | **Login-Error:**<br>Login attempt with wrong password. |
| 0x15 | **Read Protect:**<br>The configuration block is reserved for future use. |

| | |
|---|---|
| 0x16 | **Write Protect:**<br>The configuration block is reserved for future use. |
| 0x17 | **Firmware activation required:**<br>The firmware must be activated first using ISOStart demo program and the command “Set Firmware Upgrade”. The update code must be ordered by Feig Electronic.<br>1. Read the Device-ID using the command [0x66] Firmware version (Mode 0x80)<br>2. Send the Device-ID and the serial number of the reader to Feig Electronic<br>3. Write the upgrade code into the reader using the command [0x5F] Set Firmware Update |
| 0x80 | **Unknown Command:**<br>The Reader does not support the selected function. |
| 0x81 | **Length-Error:**<br>The selected function has the wrong number of parameters. |
| 0x82 | **Command not available:**<br>A Host command was sent to the Reader in the Scan Read Mode.<br>A Scan Mode protocol was sent to the Reader in the standard mode.<br>The command with More bit does not correspond with the last command. |
| 0x83 | **RF communication error:**<br>This error indicates that there is an error in communication between the Transponder and the Reader. Reason for this can be:<br>Timeout for Transponder communication. “Transponder-Response-Time” in 7.2. CFG1: Interface and Mode is to short.<br>The collision handling algorithm was not continued until no collision is detected, reasons for the break. |
| 0x84 | **RF-Warning:**<br>Detailed status information can be read with the command 9.8. [0x6E] Reader Diagnostic.<br>The antenna configuration isn’t correct. Check the antenna cables and the antenna matching.<br>The environment is too noisy.<br>The RF power doesn’t have the configured value. |
| 0x93 | **Data Buffer Overflow:**<br>A data buffer overflow occured. |
| 0x94 | **More Data:**<br>There are more Transponder data sets requested than the response protocol can transfer at once. |
| 0x95 | **Tag Error:**<br>A Tag error code was sent from the transponder. The Tag error code is shown in the following byte. |
| 0xF1 | **Hardware Warning:**<br>RF-Decoder works not properly<br>Communication link between RF-Decoder and RFC works not properly |

## ANNEX D – Codes of Reader Types

| No. | Reader Type |
|---|---|
| 11 | ID ISC.DAT |
| 12 | ID ISC.UMUX |
| 13 | ID ISC.GPC |
| 20 | ID RW40.30-U |
| 30 | ID ISC.M01 |
| 31 | ID ISC.M02 |
| 33 | ID ISC.M02M8 |
| 40 | ID ISC.LR100 |
| 41 | ID ISC.LR200 |
| 42 | ID ISC.LR2000 |
| 43 | ID ISC.LR2500-B |
| 44 | ID ISC.LR2500-A |
| 50 | ID ISC.MU02 |
| 54 | ID ISC.MRU102 |
| 55 | ID ISC.MRU200 |
| 56 | ID ISC.MRU200-U |
| 60 | ID ISC.PRH101 |
| 61 | ID ISC.PRH101-U (USB-Version) |
| 62 | ID ISC.PRHD102 |
| 63 | ID ISC.PRH102 |
| 71 | ID ISC.PRH100–U (USB-Version) |
| 72 | ID ISC.PRH100 |
| 73 | ID ISC.MR100–U (USB-Version) |
| 74 | ID ISC.MR100 / .PR100 |
| 75 | ID ISC.MR200-A / -E |
| 76 | ID ISC.MR101-A |
| 78 | ID ISC.MR101-U |
| 80 | ID CPR.M02 |
| 81 | ID CPR.02 |
| 82 | ID CPR40.30-Ux |
| 83 | ID CPR40.0x-Ax / -Cx |
| 84 | ID CPR.M03 (586/#) |
| 85 | ID CPR.03 (584/#) |
| 86 | ID CPR30 |
| 87 | ID CPR.52 |
| 88 | ID CPR.04-U |
| 92 | ID ISC.LRU1000 |
| 93 | ID ISC.LRU2000 |
| 94 | ID ISC.LRU3000 |
| 100 | ID MAX50 |