MANUAL

Ha-VIS RF-R200 USB/-PoE/module

Standard-Reader

Firmware-Version ≥ 01.00.00

Draft v0.1

Note

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General information's regarding this manual

- 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).

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Revision History of documentation

Revi-sion	Date	Page	Description

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

1. Introduction

1.1. The HA-VIS ® RF-R200 Reader

The RF-R200 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 (max. 10 Transponders in reader field at the same time).

The following versions are available:

- **RF-R200 (MODULE)(module version without housing) with USB interface and RS232- interface. Three external antenna connections and one internal antenna are available.**
- **RF-R200 (USB)(housed version) with USB Interface. One external antenna and one internal antenna are available.**
- **RF-R200 (PoE)version with LAN Interface and Power over Ethernet. One external antenna and one internal antenna are available.**

The different interface versions enable the connectivity to several host systems. Each version of the RF-R200 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 to the RF-R200 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 HA-VIS ® product line. The configuration possibilities of the RF-R200 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.
HARTING IT SOFTWARE DEVELOPMENT Electronic provides a library which allows the user to develop their own host applications to exchange data with the RF-R200.

2. Data Transmission between HA-VIS® RF-R200 and Host

Five different ways of data transmission between HA-VIS® 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		
	RF-R200 module	**RF-R200 USB**	**RF-R200-PoE**
ISO Host Mode	●	●	●
Buffered Read Mode	●	●	●
Scan-Mode	●	●	-
Notification Mode	-	-	●

2.1. 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>

2.2. 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.

Notes:

- ***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 "7.1.1. [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:

<table>
<tr><td>Host (Terminal / PC / ....)</td><td></td><td colspan="2">Reader</td></tr>
<tr><td rowspan="4">Inventory
to get the EPC</td><td>→</td><td colspan="2">Transponder in antenna field ?</td></tr>
<tr><td></td><td>Yes</td><td>No</td></tr>
<tr><td>←</td><td>status /
number of Transponders / EPC</td><td>status =
no Transponder</td></tr>
<tr><td>←</td><td colspan="2"></td></tr>
<tr><td rowspan="4">read data from Transponder with EPC</td><td>→</td><td colspan="2">Transponder with
correct EPC in antenna field ?</td></tr>
<tr><td></td><td>Yes</td><td>No</td></tr>
<tr><td>←</td><td>status /
Transponder read data</td><td>status =
no Transponder
in Reader field</td></tr>
<tr><td>←</td><td colspan="2"></td></tr>
<tr><td rowspan="4">write data to Transponder with EPC</td><td>→</td><td colspan="2">Transponder with
correct EPC in antenna field ?</td></tr>
<tr><td></td><td>Yes</td><td>No</td></tr>
<tr><td>←</td><td>OK status</td><td>status =
no Transponder
in Reader field</td></tr>
<tr><td>←</td><td colspan="2"></td></tr>
</table>

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 / Transponder read data	status = no Transponder in Reader field
	←		
write data	→	Transponder in antenna field ?	
		Yes	No
	←	OK status	status = no Transponder in Reader field
	←		

2.3. 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.

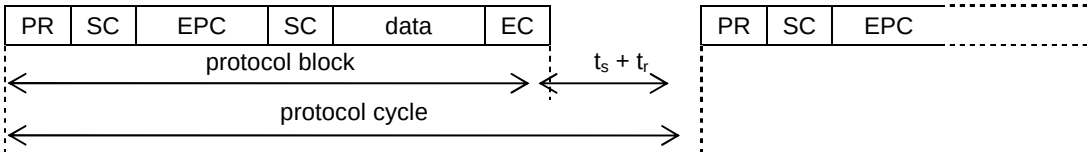
Scan-Mode via asynchronous interface:

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.

Notes:

- ***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.***

2.4. 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 9.4. [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 9.6. [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 4.2. 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 9.7. [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><td>Host (Terminal / PC / ....)</td><td></td><td colspan="2">Reader</td></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 / data protocol</td><td>status = no valid data</td></tr>
<tr><td>←</td><td colspan="2"></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>status = no valid data</td></tr>
<tr><td>←</td><td colspan="2"></td></tr>
</table>

Notes:

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

2.5. 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 4.20. CFG49: Notification Channel (only for RF-R200 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 4.5. CFG11: Read Mode – Read Data and 4.6. 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. 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.

3. 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 3.1. Protocol Frames of TCP/IP protocol. For the asynchronous serial interface the whole protocol frame is described in 3.2. Serial Data Format and Protocol Frames.

The following reader types are currently available:

Module type	Description
RF-R200 (module)	Reader Module with RS232 and USB, external supply voltage of 12-24 V DC and 3 external SMA antenna connectors
RF-R200 (PoE)	Reader Module with Ethernet interface and external supply voltage of 12-24 V DC or PoE and 1 external SMA antenna connector
RF-R200 (USB)	Reader Module with USB interface and external supply voltage of 12-24 V DC and 1 external SMA antenna connector

3.1. 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 3.2. 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.

3.2. Serial Data Format and Protocol Frames

The Reader RF-R200 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

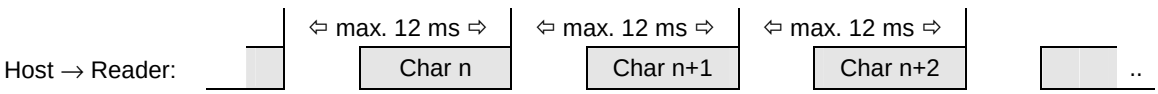
Direction: Backward

Data format:

Start bits:	1
Data bits:	8
Stop bits:	1
Parity:	even (default) odd none

Data timeout:

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



3.3. 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);
        }
}
```

4. 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					

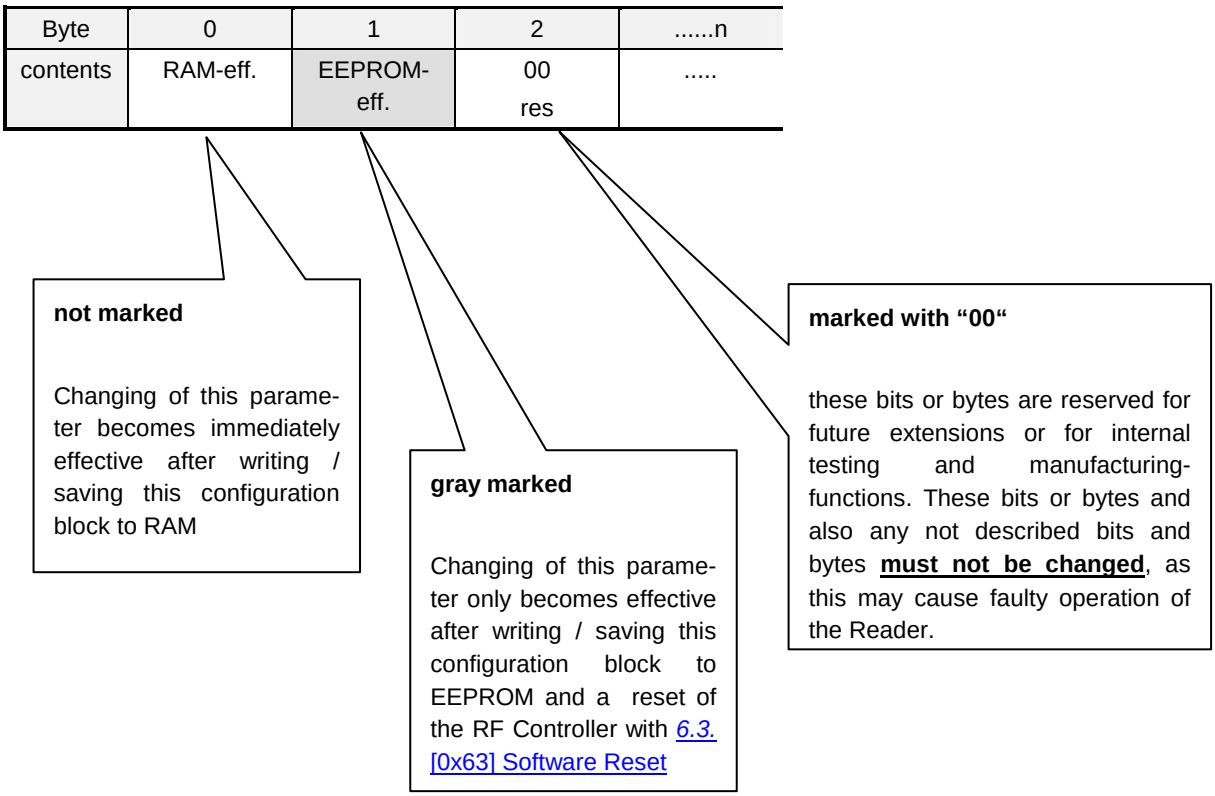
The EEPROM configuration blocks are protected by a 16 bit CRC-checksum. The examination of these checksums is executed after each reset of the Reader. If a checksum error is found, the Reader goes into an error status "EE-Init-Mode" and sets the configuration block which is faulty to the default-values.

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.

Notes:

- ***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 HA-VIS 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: ANNEX E: Labeling of configuration parameter

4.1. 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 5.3. [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 6.10. [0xA0] Reader-Login

Notes:

- ***A READER-ID = 0x00000000 disables the password function.***
- ***A read with the command 5.1. [0x80] Read Configuration will always get '0x00000000'.***
- ***A changed password becomes valid after a 6.4. [0x64] System Reset***
- ***5.3. [0x83] Set Default Configuration (Configuration Reset) doesn't change the CFG0 register if all configuration blocks are used.***
- ***The command 6.10. [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 HARTING IT SOFTWARE DEVELOPMENT 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 6.10. [0xA0] Reader-Login configuration parameters in the EEPROM of the Reader may be read and changed.

4.2. 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		0x08	0x01			0x01
	0x00		*38400 Baud*	*e,8,1*			

Byte	7	8	9	10	11	12	13
Contents	TR-RESPONSE-TIME	0x00	0x02	Protocol Mode	SCAN-INTERFACE	Interface	READER - MODE
Default	0x2C				0x00	0x11	0x00
	1,5 sec.						

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

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

Notes:

- ***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[1]: (*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

Notes:

- ***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[1]**:**

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 –**

Notes:

- ***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

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

Notes:

- ***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.***

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: 3.2. 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 7. 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)**

Notes:

- ***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.***

4.3. 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.*	*1 sec.*		

Notes:

- ***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

4.4. 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

4.5. 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 [1]	TR-DATA-2	TR-DATA-3	BANK	DB-ADR		0
Default	0x31	0x00	0x00	0x00	0x0000		

Byte	7	8	9	10	11	12	13
Contents		DB-N					
Default		0x0001		0x00	0x00	0x00	0x00

TR-DATA-1[1 2]:

Selects the data types for read operation.

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

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

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

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

Notes:

- ***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	-	-	-	-

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

b0: no RSSI

b1: Antenna number with RSSI

Notes:

- ***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_B ANK	-	-	-	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.

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

Notes:

- ***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

Notes:

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

DB-ADR[1]: **(*OperatingMode.ScanMode.DataSource.FirstDataBlock*)**
(*OperatingMode.BufferedReadMode.DataSource.FirstDataBlock*)
(*OperatingMode.NotificationMode.DataSource.FirstDataBlock*)

Address of first data block.

DB-N [1]: (*OperatingMode.ScanMode.DataSource.NoOfDataBlocks*)
(*OperatingMode.BufferedReadMode.DataSource.NoOfDataBlocks*)
(*OperatingMode.NotificationMode.DataSource.NoOfDataBlocks*)

Number of data blocks to be read.

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

4.6. CFG12: Read Mode - Filter

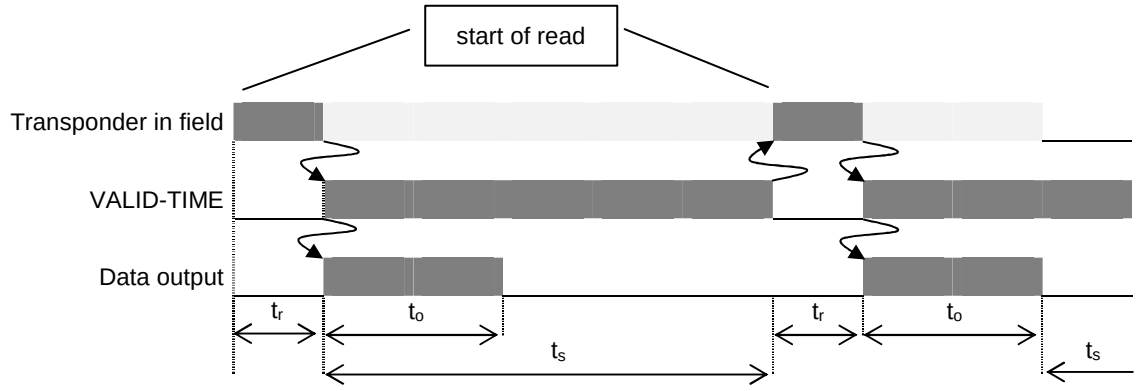
Byte	0	1	2	3	4	5	6
0x00	VALID-TIME[1]		TR-ID				0x00
Default	0x0037 5,5sec.		0x01	0x00	0x00	0x01	

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.

Notes:

- ***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.

4.7. 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

Notes:

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

Notes:

- ***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

4.8. 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

4.9. 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

4.10. 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

Notes:

- ***The persistence reset time is valid for all antennas***
- ***The persistence reset time is retriggered with every new transponder***

4.11. CFG17 .. 21: Reserved

The configuration block CFG17 .. 21 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

4.12. 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	0	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

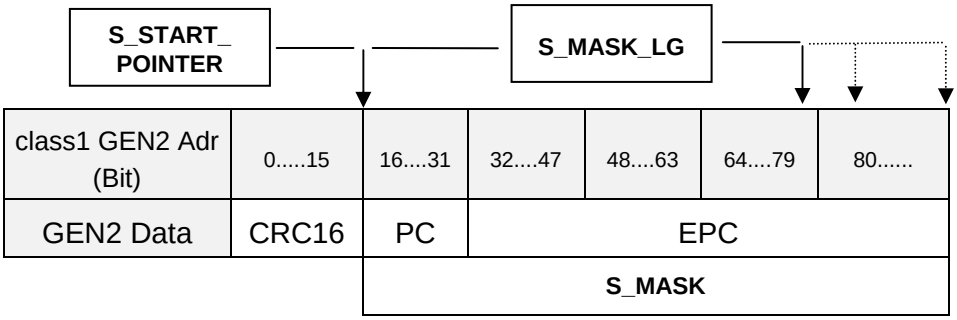
b11 User memory bank

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

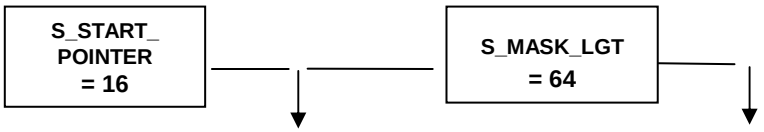
Defines the memory bit address on which the bit String of the Mask is compared to the memory of the Tag.

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

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

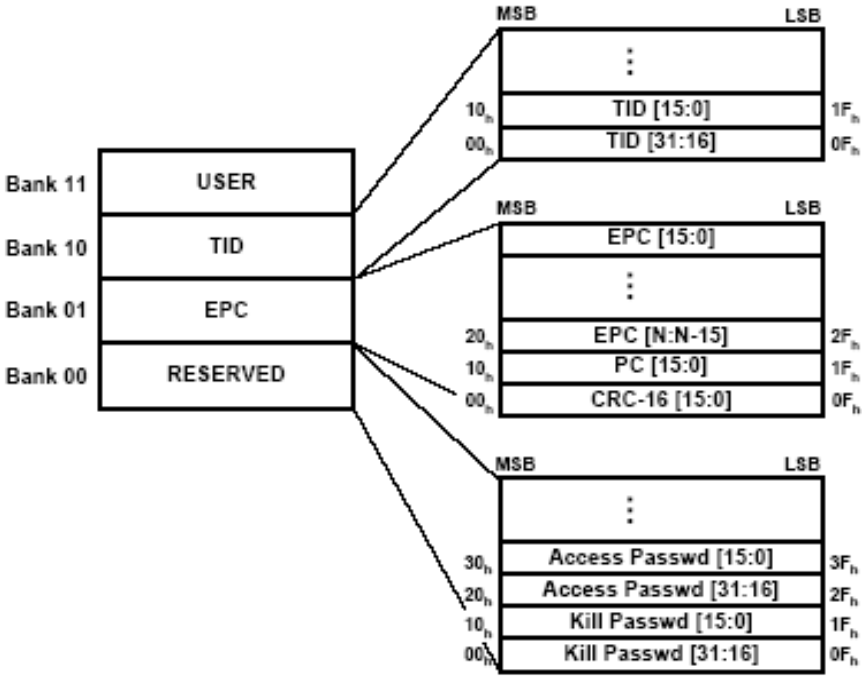


Example:



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:



4.13. CFG24 .. 35: Reserved

The configuration block CFG24 .. 35 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

4.14. 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[1]		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[1]: ***(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.

[1] *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 the different antennas.

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)

Notes:

- ***All antennas will use the same output power.***

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		

0x06	Europe	Switzerland		
		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 - 917MHz
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

Notes:

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

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

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

Notes:

- ***These settings are only applicable if region [0xFE] Manual setting of EU Frequencies (865 MHz – 868 MHz) is selected.***
- ***The command*** 5.3. [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:	0								1							
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

Notes:

- ***These settings are only applicable if region [0xFE] Manual setting of EU Frequencies (865 MHz –868 MHz) is selected.***
- ***The command*** 5.3. [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:	0								1							
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

Notes:

- ***These settings are only applicable if region [0xFF] Manual setting of FCC Frequencies (902 MHz – 928 MHz) is selected.***
- ***The command*** 5.3. [0x83] Set Default Configuration (Configuration Reset) ***has no effect on the frequency settings. Only the output power and transponder driver settings will be reset.***

4.15. 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	0x00	0x00	IDDIB	TID-LENGTH
Default	0x00	0x00	0x00	0x00	0x00	0x00	0x00

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

Notes:

- ***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

Notes:

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

4.16. 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	0x00	0x00	0x00
Default				0x01			

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	

4.17. 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

4.18. CFG40: LAN Settings, Part 1 (only for RF-R200 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.

4.19. CFG41: LAN Settings, Part 2

Byte	0	1	2	3	4	5	6
Contents	SUBNET-MASK-LAN				LAN-OPTIONS	KEEP-CNT	GW-ADDRES-LAN
Default	0xFF *255*	0xFF *255*	0x00 *0*	0x00 *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:

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:

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	0	0	0	0	0	0	KEEP-ALIVE

KEEP-ALIVE:

b0: Keep-Alive option disabled.

b1: Keep-Alive option enabled.

DHCP:

b0: dhcp-client disabled.

b1: dhcp-client enabled.

KEEP-CNT:

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

KEEP-INTERVAL:

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.

Notes:

- ***The command 5.3. [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.***

4.20. CFG49: Notification Channel (only for RF-R200 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.

4.21. 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

5. 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: 3.2. Serial Data Format and Protocol Frames.

Access to the configuration parameters is gained only after a 6.10. [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.

5.1. [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[1]	CFG-REC	CRC16

CFG-ADR[2]:

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.

Notes:

[1] *see ANNEX C: Index of Status Bytes*
[2] *see chapter 4. Configuration Parameters (CFG)*

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

5.2. [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 4. 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[1]	CRC16

CFG-ADR[2]:

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.

Notes:

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

[1] *see ANNEX C: Index of Status Bytes*
[2] *see chapter 4. Configuration Parameters (CFG)*

5.3. [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

Notes:

- ***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.***

6. Protocols for Reader Control

6.1. [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

Notes:

- ***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.***

6.2. [0x55] Start Flash Loader

This protocol starts the Flash Loader inside the Reader. Use the windows program "HA-VISFirmwareUpdateTool" to process the firmware update. This tool will use the command automatically. Please refer to the Application Note "HA-VISFirmwareUpdateTool (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

Notes:

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

6.3. [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[1]	CRC16

Notes:

- ***The RF-field will be switched off after a "CPU Reset"***
- ***The communication interface will not be reset.***

6.4. [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[2]	CRC16

MODE:

Defines the controller which will be reset.

MODE	Controller
0x00	RF Controller

[1] *ANNEX C: Index of Status Bytes*

6.5. [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:

6.5.1. 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 RF-R200 (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	-	-	-	-

6.5.2. Mode = 0x05 (Bootloader version information)

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

6.5.3. 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

[1] *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)

6.5.4. 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	PERMISSI ON	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

6.5.5. 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

6.5.6. Mode = 0x80 (Device_ID)

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

6.6. [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[1]	CRC16

Notes:

- ***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.***

[1] *see ANNEX C: Index of Status Bytes*

6.7. [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[1] 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[2]	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	
b001	RF Power on antenna output 1	Available on all MR(M)U102
b010	RF Power on antenna output 2	Only available on MRMU102-A
b011	RF Power on antenna output 3	Only available on MRMU102-A
b100	RF Power on antenna output (INT)	Available on all MR(M)U102

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

[1] *Scan Mode or Notification Mode*
[2] *see ANNEX C: Index of Status Bytes*

Notes:

- ***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.***

6.8. [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:	-	-	-	-	RF-Decoder	-	-	EE DEV1

EE_DEV1:

Error during the communication with EEPROM Dev 1

RF-Decoder:

Error during the communication with RF-Decoder

6.9. [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[1]	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

[1] *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	

Notes:

- ***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.***

6.10. [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[1]	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 4.1. CFG0: Passwords.

Notes:

- ***A Reader-Login with wrong READER-ID causes a "Logout".***
- ***A "Logout" can be effected via the command*** *6.4.* [0x64] System Reset

[1] *see* ***Fehler! Verweisquelle konnte nicht gefunden werden.***

7. Protocols for Host Commands

The Host commands can be used to access the Transponders.

	Transponder Types
	EPC Class 1 Gen 2
7.1. [0xB0] Host commands	√
7.1.1. [0x01] Inventory	√
7.1.2. [0x23] Read Multiple Blocks	√
7.1.3. [0x24] Write Multiple Blocks	√
8. [0xB3] Host commands for EPC Transponders	√
8.1.1. [0x18] Kill	√
8.1.2. [0x22] Lock	√

7.1. [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	RESPONSE-DATA	CRC16

REQUEST-DATA:

Command specific request

RESPONSE-DATA:

Command specific response

Notes:

- ***Data is only transferred if STATUS = 0x00, 0x83, 0x94, 0x95.***
- ***These commands aren't available if Scan-Mode or Notification Mode is active.***

7.1.1. [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 4.15. 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

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

Notes:

- ***This command supports all Transponders.***
- ***This command is limited to max. 10 Transponders in reader field at the same time.***

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

7.1.2. [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	MORE_DATA	READ_COMPLETE_BANK	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

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

Notes:

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

MORE_DATA

If the protocol length increases the maximum size of the transfer buffer (TX-BUF) a more data request needs to be send.

b0: no More Data request is send

b1: More Data request is send

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)

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.

7.1.3. [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 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)

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.

Notes:

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

8. [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	RESPONSE-DATA	CRC16

REQUEST-DATA:

EPC specific request

RESPONSE-DATA:

EPC specific response

Notes:

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

8.1. EPC Class 1 Commands

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

8.1.1. [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.

Notes:

- ***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.***

8.1.2. [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.

Notes:

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

8.2. 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.

8.2.1. EPC class 1 Gen 2

Memory organization:

Number of blocks	vendor specific
Block size	2 byte

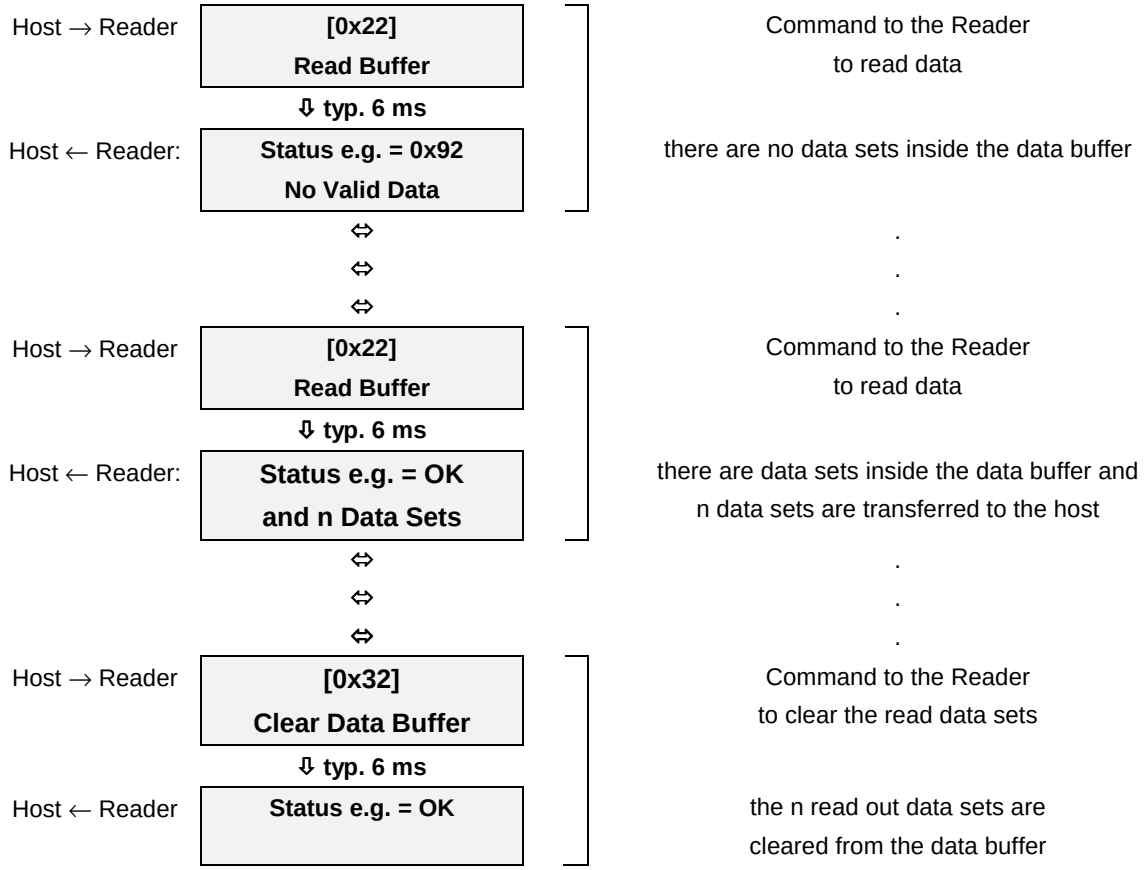
Command Code	Function	Mode		Comment
		non-addressed	addressed	
0xB0 0x01	Inventory			
0xB0 0x23	Read Multiple Blocks	√	√	
0xB0 0x24	Write Multiple Blocks	√	√	
0xB3 0x18	Kill		√	
0xB3 0x22	Lock		√	

9. Protocols for Notification Mode (only RF-R200 PoE)

9.1. 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 4.2. CFG1: Interface and Mode configuration block and configured in the 4.5. CFG11: Read Mode – Read Data and 4.6. 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 6.3. [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***

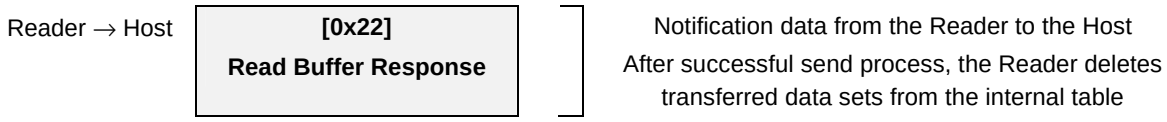
⇔: ***Host is able to do other jobs e.g. to communicate with other Readers***

Additional information about the capacity of the data buffer can be determined with the 9.5. [0x31] Read Data Buffer Info command.

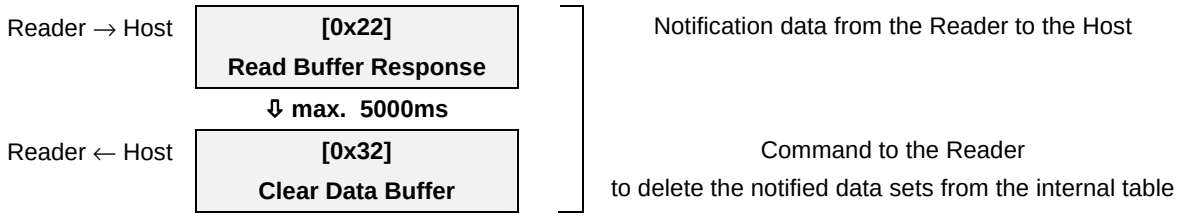
9.2. The Notification Mode Procedure

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 4.2. CFG1: Interface and Mode configuration block and configured in 4.20. CFG49: Notification Channel (only for RF-R200 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 9.6. [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 9.5. [0x31] Read Data Buffer Info command.

In Notification Mode the 9.4. [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 6.8. [0x6E] Reader Diagnostic with mode = 0x01.

9.3. 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 4.16. CFG38: Anticollision UHF configuration block.

After power up or a 6.3. [0x63] Software Reset command the buffered read mode starts with transponder reading.

9.4. [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[1]	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

[1] *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	-	-	-	-

ANT-Ext: Antenna Extended

Antenna number with RSSI

Notes:

- ***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 4.5. 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			
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

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

Notes:

- ***This command reads the same data sets until they are cleared with the*** 9.6. [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.***

9.5. [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[1]	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.

Notes:

- ***Additional information about the data table status is transferred if STATUS = 0x00, 0x84, 0x85, 0x93.***

[1] *see ANNEX C: Index of Status Bytes*

9.6. [0x32] Clear Data Buffer

The command Clear Data Buffer clears the data sets from the data buffer which were transferred with the 9.4. [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[1]	CRC16

[1] *see ANNEX C: Index of Status Bytes*

9.7. [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[1]	CRC16

ANNEX

ANNEX A: Codes of Transponder Types

Value	Transponder type
0x84	EPC class 1 Gen 2

The Information will be send by performing the 7.1.1. [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 7.1.1. [0x01] Inventory command or using the Scan Mode.

ANNEX C: Index of Status Bytes

Hex-value	Transponder Status
0x00	**OK:** • Data / parameters have been read or stored without error • Control command has been executed
0x01	**No Transponder:** • No Transponder is located within the detection field of the Reader. • The Transponder in the detection field has been switched to mute . • The communication between Reader and Transponder has been interfered and the Reader is not able to read the Transponder anymore.
0x02	**Data False:** • CRC16 data error on received data.
0x03	**Write-Error:** Negative plausibility check of the written data: • Attempt to write on a read-only area • Too much distance between Transponder and Reader antenna. • Attempt to write in a noisy area.
0x04	**Address-Error:** The required data are outside of the logical or physical Transponder-address area: • The address is beyond the max. address space of the Transponder. • The address is beyond the configured address space of the Transponder.
0X08	**Authent Error** • If access password is wrong
0x10	**EEPROM-Failure:** • The EEPROM of the Reader is not able to be written on. • Before writing onto the EEPROM a faulty checksum of parameters has been detected.

Hex-value	Parameter Status
0x11	**Parameter-Range-Error:** • The value range of the parameters was exceeded.
0x13	**Login-Request:** • Configuration access without having logged in to the Reader before.
0x14	**Login-Error:** • Login attempt with wrong password.
0x15	**Read Protect:** • The configuration block is reserved for future use.
0x16	**Write Protect:** • The configuration block is reserved for future use.
0x17	**Firmware activation required:** The firmware must be activated first using ISOStart demo program and the command “Set Firmware Upgrade”. The update code must be ordered by HARTING IT Software Development Electronic. 1. Read the Device-ID using the command [0x66] Firmware version (Mode 0x80) 2. Send the Device-ID and the serial number of the reader to HARTING IT Software Development Electronic 3. Write the upgrade code into the reader using the command [0x5F] Set Firmware Update
0x80	**Unknown Command:** • The Reader does not support the selected function.
0x81	**Length-Error:** • The selected function has the wrong number of parameters.
0x82	**Command not available:** • A Host command was sent to the Reader in the Scan Read Mode. • A Scan Mode protocol was sent to the Reader in the standard mode • The command with More bit does not correspond with the last command
0x83	**RF communication error:** This error indicates that there is an error in communication between the Transponder and the Reader. Reason for this can be: • Timeout for Transponder communication. “Transponder-Response-Time” in 4.2. CFG1: Interface and Mode is to short. • The collision handling algorithm was not continued until no collision is detected, reasons for the break:

Hex-value	Interface Status
0x84	**RF-Warning:** Detailed status information can be read with the command 6.8. [0x6E] Reader Diagnostic. • The antenna configuration isn't correct. Check the antenna cables and the antenna matching. • The environment is too noisy. • The RF power doesn't have the configured value.
0x93	**Data Buffer Overflow:** • A data buffer overflow occured.
0x94	**More Data:** • There are more Transponder data sets requested than the response protocol can transfer at once.
0x95	**Tag Error** • A Tag error code was sent from the transponder. The Tag error code is shown in the following byte.
0xF1	**Hardware Warning:** • RF-Decoder works not properly • Communication link between RF-Decoder and RFC works not properly

ANNEX E: Labeling of configuration parameter

Namespace	CFG-Block
AccessProtection.Password	0
AccessProtection.Lock_CFG0	0
AccessProtection.Lock_CFG1	0
AccessProtection.Lock_CFG2	0
AccessProtection.Lock_CFG3	0
AccessProtection.Lock_CFG4	0
AccessProtection.Lock_CFG5	0
AccessProtection.Lock_CFG6	0
AccessProtection.Lock_CFG7	0
AccessProtection.Lock_CFG8	0
AccessProtection.Lock_CFG9	0
AccessProtection.Lock_CFG10	0
AccessProtection.Lock_CFG11	0
AccessProtection.Lock_CFG12	0
AccessProtection.Lock_CFG13	0
AccessProtection.Lock_CFG14	0
AccessProtection.Lock_CFG15	0
AccessProtection.Lock_CFG16	0
AccessProtection.Lock_CFG17	0
AccessProtection.Lock_CFG18	0
AccessProtection.Lock_CFG19	0
AccessProtection.Lock_CFG20	0
AccessProtection.Lock_CFG21	0
AccessProtection.Lock_CFG22_29	0
AccessProtection.Lock_CFG40_49	0
AccessProtection.Lock_CFG50_59	0
HostInterface.Serial.BusAddress	1
HostInterface.Serial.Baudrate	1
HostInterface.Serial.Parity	1
HostInterface.Serial.Databits	1
HostInterface.Serial.Stopbits	1
AirInterface.TimeLimit	1
OperatingMode.ScanMode.DataSelector.UID	11
OperatingMode.ScanMode.DataSelector.Data	11
OperatingMode.ScanMode.DataSelector.Time	11
OperatingMode.ScanMode.DataFormat.BusAddressPrefix	11
OperatingMode.ScanMode.DataSelector.Mode.Enable_AntennaPool	11
OperatingMode.ScanMode.DataSource.ByteOrderOfData	11
OperatingMode.ScanMode.DataSource.BankNo	11

OperatingMode.ScanMode.DataSource.FirstDataBlock	11
OperatingMode.ScanMode.DataSource.NoOfDataBlocks	11
OperatingMode.ScanMode.Filter.TransponderValidTime	12
OperatingMode.Miscellaneous.TransponderIdentification.Source	12
OperatingMode.Miscellaneous.TransponderIdentification.DataBlockNo	12
OperatingMode.Miscellaneous.TransponderIdentification.NoOfDataBlocks	12
OperatingMode.ScanMode.DataFormat.Format	13
OperatingMode.ScanMode.DataFormat.SeparationChar	13
OperatingMode.ScanMode.DataFormat.UserSeparationChar	13
OperatingMode.ScanMode.DataFormat.UserEndChar1	13
OperatingMode.ScanMode.DataFormat.UserEndChar2	13
OperatingMode.ScanMode.DataFormat.UserEndChar3	13
OperatingMode.ScanMode.DataFormat.UserHeaderChar1	13
OperatingMode.ScanMode.DataFormat.UserHeaderChar2	13
OperatingMode.ScanMode.DataFormat.UserHeaderChar3	13
OperatingMode.ScanMode.DataFormat.UserHeaderChar4	13
OperatingMode.ScanMode.DataFormat.NoOfUserEndChars	13
OperatingMode.ScanMode.DataFormat.NoOfUserHeaderChars	13
AirInterface.Multiplexer.Enable	15
Transponder.PersistenceReset.Antenna.No1.PersistenceResetTime	16
OperatingMode.NotificationMode.Transmission.Enable_Acknowledge	49
OperatingMode.NotificationMode.Transmission.KeepAlive.Enable	49
OperatingMode.NotificationMode.Transmission.KeepAlive.IntervalTime	49
OperatingMode.NotificationMode.Transmission.Destination.IPv4.IPAddress	49
OperatingMode.NotificationMode.Transmission.Destination.PortNumber	49
OperatingMode.NotificationMode.Transmission.Destination.ConnectionHoldTime	49
OperatingMode.ScanMode.DataFormat.EndChar	13
DigitalIO.Signaler.LED.Green.IdleState	2
DigitalIO.Signaler.LED.Green.IdleFlashFrequency	2
DigitalIO.Signaler.LED.Green.ActiveState	2
DigitalIO.Signaler.LED.Green.ActiveFlashFrequency	2
DigitalIO.Signaler.LED.Green.ActivationTime	2
AccessProtection.Lock_CFG30_35	0
AccessProtection.Lock_CFG60_62	0
AccessProtection.Lock_CFG63	0
AccessProtection.Lock_CFG36	0
AccessProtection.Lock_CFG37	0
AccessProtection.Lock_CFG38	0
AccessProtection.Lock_CFG39	0
Transponder.Miscellaneous.IdentifierInterpretationMode	37
HostInterface.Miscellaneous.ProtocolSelection	1
OperatingMode.NotificationMode.DataSelector.AntennaNo	11
OperatingMode.ScanMode.DataSelector.AntennaNo	11
OperatingMode.NotificationMode.DataSelector.Data	11

OperatingMode.NotificationMode.DataSelector.Time	11
OperatingMode.NotificationMode.DataSelector.UID	11
OperatingMode.BufferedReadMode.DataSelector.Mode.Enable_AntennaPool	11
OperatingMode.NotificationMode.DataSelector.Mode.Enable_AntennaPool	11
OperatingMode.NotificationMode.DataSource.BankNo	11
OperatingMode.NotificationMode.DataSource.ByteOrderOfData	11
OperatingMode.NotificationMode.DataSource.FirstDataBlock	11
OperatingMode.NotificationMode.DataSource.NoOfDataBlocks	11
OperatingMode.NotificationMode.Filter.TransponderValidTime	12
HostInterface.LAN.IPv4.IPAddress	40
HostInterface.LAN.PortNumber	40
HostInterface.LAN.IPv4.SubnetMask	41
HostInterface.LAN.Keepalive.Enable	41
HostInterface.LAN.Keepalive.RetransmissionCount	41
HostInterface.LAN.IPv4.GatewayAddress	41
HostInterface.LAN.Keepalive.IntervalTime	41
AirInterface.Region.UHF.FCC.Channel.LowerChannel	36
AirInterface.Region.UHF.FCC.Channel.UpperChannel	36
Transponder.Driver.UHF.EPC_Class1Gen2	36
Transponder.UHF.EPC_Class1Gen2.Anticollision.Session	38
Transponder.UHF.EPC_Class1Gen2.SelectionMask.No1.BankNo	22
Transponder.UHF.EPC_Class1Gen2.SelectionMask.No1.FirstBit	22
Transponder.UHF.EPC_Class1Gen2.SelectionMask.No1.Mask	22
Transponder.UHF.EPC_Class1Gen2.SelectionMask.No1.MaskLength	22
HostInterface.LAN.IPv4.Enable_DHCP	41
OperatingMode.NotificationMode.DataSelector.RSSI	11
AirInterface.Region.UHF.Regulation	36
AirInterface.Region.UHF.EU.Channel.EN302208_4_ChannelPlan.PreferredChannels.ChannelNo1	36
AirInterface.Region.UHF.EU.Channel.EN302208_4_ChannelPlan.PreferredChannels.ChannelNo2	36
AirInterface.Region.UHF.EU.Channel.EN302208_4_ChannelPlan.PreferredChannels.ChannelNo3	36
AirInterface.Region.UHF.EU.Channel.EN302208_4_ChannelPlan.PreferredChannels.ChannelNo4	36
AirInterface.Region.UHF.EU.Channel.EN302208_4_ChannelPlan.PreferredChannels.NoOfChannels	36
DigitalIO.Signaler.LED.Red.IdleState	2
DigitalIO.Signaler.LED.Red.IdleFlashFrequency	2
DigitalIO.Signaler.LED.Red.ActiveState	2
DigitalIO.Signaler.LED.Red.ActiveFlashFrequency	2
DigitalIO.Signaler.LED.Red.ActivationTime	2
OperatingMode.Mode	1
AirInterface.Antenna.UHF.No1.OutputPower	36
HostInterface.Interfaces	1
AirInterface.Multiplexer.UHF.Internal.SelectedAntennas	15
OperatingMode.ScanMode.Interface	1
OperatingMode.NotificationMode.DataSelector.Mode.ReadCompleteBank	11
OperatingMode.ScanMode.DataSelector.Mode.ReadCompleteBank	11

Transponder.Miscellaneous.TIDLength	37