OBID i-scan® UHF

MANUAL

ID ISC.MU02.02-AD/-CU

UHF Reader Module

Firmware-Versions

RFC: ≥ 01.04.00

final – public (B)
2013-01-30 – H90701-2e-ID-B.docx

FEIG ELECTRONIC

Note

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General information's regarding this document

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

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

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

2. Revision History of Documentation

Revi-sion	Date	Page	Description
0e	14.07.09		Initial revision
1e	02.01.12	11	Data Clock
		76	RSSI for Inventory
2e	30.01.12		new Design

3. Abbreviations

ADR	Address
ASK	Amplitude Shift Keying
CB	Config Block
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
UID	Unique Identifier (read only Serial Number)
WO	Write Only Access
WR	Write

4. Introduction

4.1. The OBID i-scan® ID ISC.MU02 Reader

The ID ISC.MU02 Short Range Reader is a high flexible and cost effective Reader which is aimed for UHF applications which work with a short read range and a reduced RF power. The ID ISC.MU02 is available in two versions.

- ID ISC.MU02.02-CU with a USB interface and a RS232-LVTTL interface.
- ID ISC.MU02.02-AD version with RS232 and Data Clock Interface.

The different interface versions enable the connectivity to several host systems. Each version of the ID ISC.MU02.02 product series has the following key RF features:

- Powerful RF interface to work with maximum speed in European or US DRM (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.
- Reader is available in different versions to fulfil the different national radio rules of UHF.

In addition to the ID ISC.MU02.02 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 OBID i-*scan*® product line. The configuration possibilities of the ID ISC.MU02.02 reader makes it easy to adapt the reader to wide a range of applications by software and hardware configurations.

The RF section of the reader is controlled by a dedicated ARM controller and a FPGA based RF decoder.

In combination, the powerful and flexible RF transmitter and receiver and the 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 Class1 GEN2, optional ISO18000-6-C.
FEIG Electronic provides a library which allows the user to develop their own host applications to exchange data with the ID ISC.MU02.02.

5. Data Transmission between OBID® i-*scan* ID ISC.MU02.02 and Host

Four different ways of data transmission between OBID® i-*scan* Readers and host (terminal, PC) are possible. The **Host Commands 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**	**Data Clock**
Configuration Commands	√	√	X
Reader Control Commands	√	√	X
Host Commands	√	√	X
Scan Mode	√	√*	√

*) HID

5.1. Configuration Commands and Control Commands

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

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

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

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

5.2. Host Commands

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

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

The Reader to Transponder addressing mode:

Addressed mode:

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

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

<table>
<tr><th>Host (Terminal / PC / ....)</th><th></th><th colspan="2">Reader</th></tr>
<tr><td rowspan="4">Inventory
to get the UID</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 / UID</td><td>status =
no Transponder</td></tr>
<tr><td>←</td><td colspan="2"></td></tr>
<tr><td rowspan="4">read data from Transponder with UID</td><td>→</td><td colspan="2">Transponder with
correct UID 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 UID</td><td>→</td><td colspan="2">Transponder with
correct UID 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>

5.3. Scan-Mode

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

In Scan Mode the contents of the message block (UID, data block) can be adapted to each user-application. Scan mode is available via the RS232 Interface, the USB Interface and the Data-Clock 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.

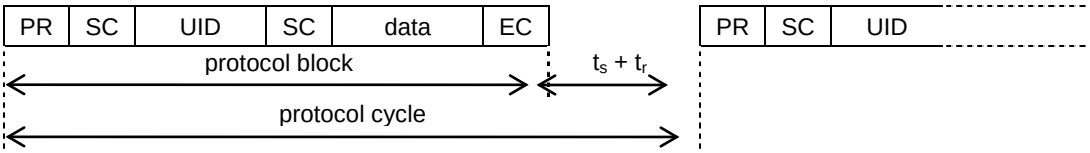
The Reader starts the output of the protocol block as soon as all required data have been read correctly from the Transponder. If the number of transmitted user data is too large, only the maximal number of transmitted data will be sent plus the end character.

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 UID and data block should be read:



Example 2:

3 Transponders in detection range only UID should be read:

PR	SC	UID1	EC	UID2	EC	UID3	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 UID and data block should be read:

PR	SC	UID1	SC	data1	EC	UID2	SC	data2	EC

PR:	Com-Prefix (optional)	ts:	VALID-TIME
UID:	Serial-Number. (fix)	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				UID	Separation Character	Data-Blocks	END Character		
COM-ADR	SEP-CHAR	USR1	USR2	USR3	USR4	UID	SEP-CHAR	DB	USR 1	USR 2	USR 3

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

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

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

NOTE:

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

Only read operations are available with the Scan-Mode.

6. Interface

The Reader ID ISC.MU02.02 has 4 different interface ports. The protocol frame of these ports can be different. For the asynchronous serial interface the whole protocol frame is described in 6.1. Serial Data Format and Protocol Frames.

The following module types are currently available:

Module type	Description
ID ISC.MU02.02-AD	Reader Module with RS232 and data/clock interface, external supply voltage of 5 V DC
ID ISC.MU02.02-CU	Reader Module with RS232-LVTTL and USB interface, external supply voltage of 5 V DC or directly over USB

6.1. Serial Data Format and Protocol Frames

The Reader ID ISC.MU02.02 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: Standard Protocol-Length (up to 255 Byte)

Host → Reader

1	2	3	4...n-2	n-1	n
LENGTH = n	COM-ADR	CONTROL-BYTE	(DATA)	LSB CRC16	MSB CRC16

Host ← Reader

1	2	3	4	(5...n-2)	n-1	n
LENGTH (n)	COM-ADR	CONTROL-BYTE	STATUS	(DATA)	LSB CRC16	MSB CRC16

Protocol frame: Advanced Protocol-Length

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

The Reader supports both Protocol frames, standard and advanced protocol frame. The Host application can choose which protocol frame is used.

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

NOTE:

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 an optional data field with variable length. The number of DATA bytes 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

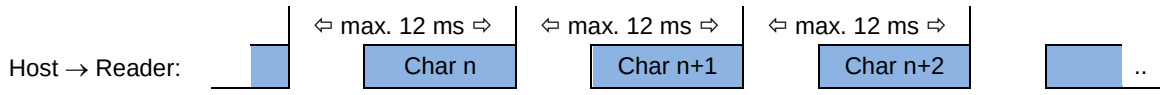
Direction: Backward

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.



6.2. CRC16 Calculation Algorithm

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

Start Value: 0xFFFF ⇒ CRC_PRESET = 0xFFFF;

C-Example:

```
unsigned int crc = CRC_PRESET;

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

7. Configuration Parameters (CFG)

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

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

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

The parameters are stored in two different configuration memory locations:

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

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

CFG-ADR:

CFGn: memory-address of the required configuration block

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

MODE: specifies one or all configuration blocks

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

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

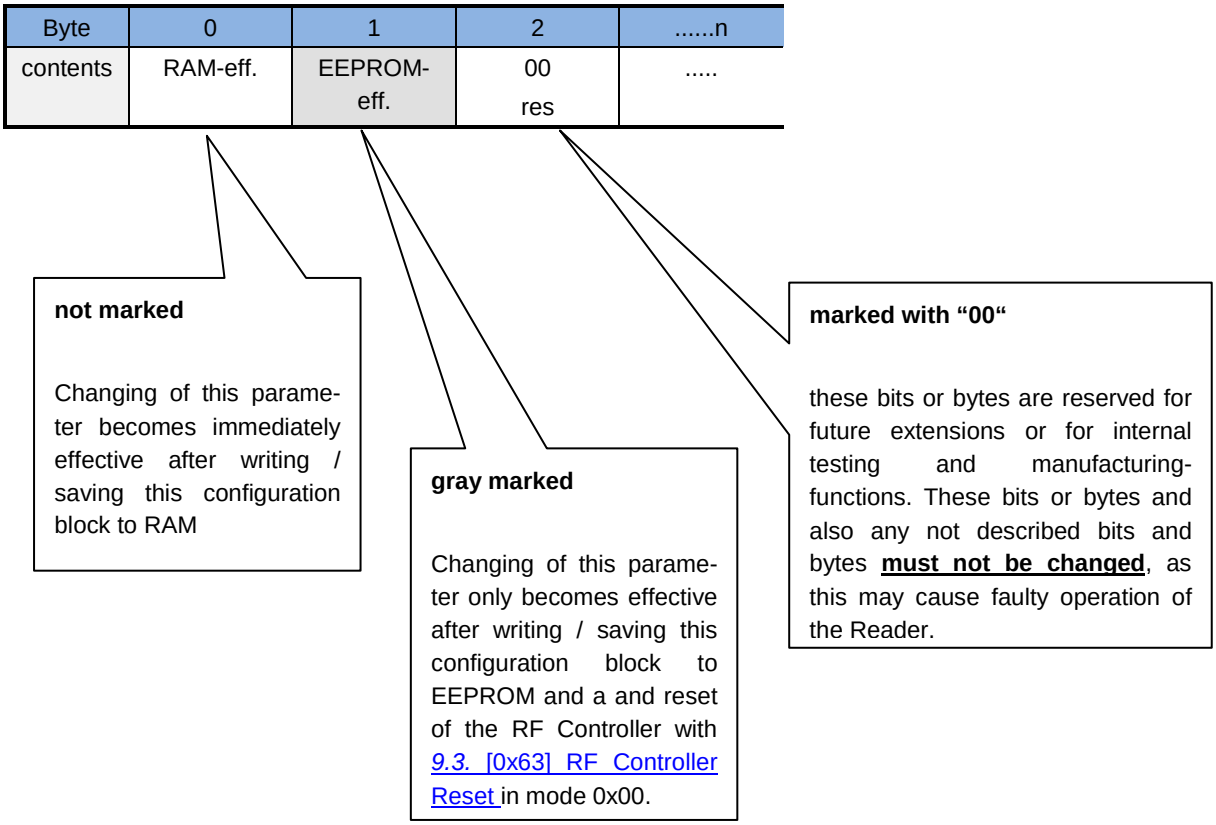
While the EE-Init-Mode is active, the LED blinks alternately red and green and the Reader answers external commands with the status "0x10 EEPROM Failure". The "EE-Init-Mode" can be exited now by a new reset (cold start or *9.3.* [0x63] RF Controller Reset command**).** If after this the checksums of all data records are correct, the Reader shifts to the configured operation mode.

NOTE:

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

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

Structure of configuration parameter description.



Labeling of configuration parameters.

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

Example 1:

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

Example 2:

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

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

The reason for the launch of structured long names is to unify all parameter names for all OBID i-scan 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

7.1. CFG0: Passwords

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

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

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

READER-ID: *(AccessProtection.Password)*

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

CFG_ACCESS: (*AccessProtection.Lock_CFGX*)

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

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

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

CFG_NO

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

b0 ⇒ Access if free

b1 ⇒ Access need a login

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

NOTE:

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

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

A changed password becomes valid after a 9.3. [0x63] RF Controller Reset.

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

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

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

Config Protection

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

7.2. CFG1: Interface and Mode

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

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

Byte	7	8	9	10	11	12	13
Contents	TR-RESPONSE-TIME	0x00	0x02	0x00	SCAN-INTERFACE	INTERFACE	READER - MODE
Default	0xF0 *1,2 sec.*				0x00	0x11	0x00

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

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

NOTE:

Do not configure address 255!

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

BAUD[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

NOTE:

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

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

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

TRANS-FORM[2]**:**

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

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

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

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

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

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

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

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

NOTE:

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

Always 8 Data Bits and 1 Stop Bits should be used

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

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

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

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

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

NOTE:

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

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

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

Selection of the communication port for Scan-Mode

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

IF-NO: Interface Number

b000: RS232
b001: **- do not use -**
b010: USB
b011: Data Clock
b1xx: **- do not use -**

DC-FORMAT:

By means of this parameter the kind of data transmission via data-/clock interface could by selected:

b000: Wiegand emulation (see 7.2.2. Wiegand Emulation)
data format: binary 1:1, according written to Transponder.

b001: magnetic stripe (see 7.2.1. Magnetic Stripe Emulation)
data format: binary 1:1, according written to Transponder.

b010: magnetic stripe (see 7.2.1. Magnetic Stripe Emulation)
data format: according ISO 7811-2, track 2+3 (5 Bit)

b011: magnetic stripe (see 7.2.1. Magnetic Stripe Emulation)
data format: according ISO 7811-2, track 1 (7 Bit)

b100: Wiegand emulation (see 7.2.2. Wiegand Emulation)
data format: Wiegand formatted protocol frame with start and stop sign.

b101: magnetic stripe (see 7.2.1. Magnetic Stripe Emulation)
data format: according ISO 7811-2, track 2+3 (5 Bit)
additional a prefix of 16 leading zero clocks before the start character and
additional a trailer of 16 attached zero clocks following to the LRC character.

b110: Wiegand emulation (see 7.2.2. Wiegand Emulation)
data format: Wiegand formatted protocol frame

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

Flags for enabling the communication ports (fix).

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

RS232: b0: disable
b1: enable

USB: b0: disable
b1: enable

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:	0	0	0	0	0	0	0	SCAN-E

SCAN-E:

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

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

7.2.1. Magnetic Stripe Emulation

Data Format:

The following table shows data coding depending on DC-FORMAT.

For cutting the length of data output the parameters D_LGT and D_START.

DC-FORMAT	b001 binary 1:1	b010 b101 according ISO 7811-2 (5 bit)	b011 according ISO 7811-2 (7 bit)
raw data	MSB.....LSB	P / MSB.....LSB	P / MSB.....LSB
0x0	b 0 0 0 0	b 1 / 0 0 0 0	b 0 / 0 1 0 0 0 0
0x1	b 0 0 0 1	b 0 / 0 0 0 1	b 1 / 0 1 0 0 0 1
0x2	b 0 0 1 0	b 0 / 0 0 1 0	b 1 / 0 1 0 0 1 0
0x3	b 0 0 1 1	b 1 / 0 0 1 1	b 0 / 0 1 0 0 1 1
0x4	b 0 1 0 0	b 0 / 0 1 0 0	b 1 / 0 1 0 1 0 0
0x5	b 0 1 0 1	b 1 / 0 1 0 1	b 0 / 0 1 0 1 0 1
0x6	b 0 1 1 0	b 1 / 0 1 1 0	b 0 / 0 1 0 1 1 0
0x7	b 0 1 1 1	b 0 / 0 1 1 1	b 1 / 0 1 0 1 1 1
0x8	b 1 0 0 0	b 0 / 1 0 0 0	b1 / 0 1 1 0 0 0
0x9	b 1 0 0 1	b 1 / 1 0 0 1	b 0 / 0 1 1 0 0 1
0xA	b 1 0 1 0	b 1 / 1 0 1 0	b 1 / 1 0 0 0 0 1
0xB	b 1 0 1 1	b 0 / 1 0 1 1	b 1 / 1 0 0 0 1 0
0xC	b 1 1 0 0	b 1 / 1 1 0 0	b 0 / 1 0 0 0 1 1
0xD	b 1 1 0 1	b 0 / 1 1 0 1	b 1 / 1 0 0 1 0 0
0xE	b 1 1 1 0	b 0 / 1 1 1 0	b 0 / 1 0 0 1 0 1
0xF	b 1 1 1 1	b 1 / 1 1 1 1	b 0 / 1 0 0 1 1 0
Start „%“	-	b 0 / 1 0 1 1	b 1 / 0 0 0 1 0 1
Stop „?“	-	b 1 / 1 1 1 1	b 0 / 0 1 1 1 1 1

Example: Output of raw data 0x19BF

Sign / DC-FORMAT	prefix (16*0)	Start %	0x1	0x9	0xB	0xF	Stop ?	LRC	trailer (16*0)
b001	-	-	0001	1001	1011	1111	-	-	-
b010	-	1101/0	1000/0	1001/1	1101/0	1111/1	1111/1	0001/0	-
b101	000...000	1101/0	1000/0	1001/1	1101/0	1111/1	1111/1	0001/0	000...000
b011	-	101000/1	100010/1	100110/0	010001/1	011001/0	111110/0	011010/0	-

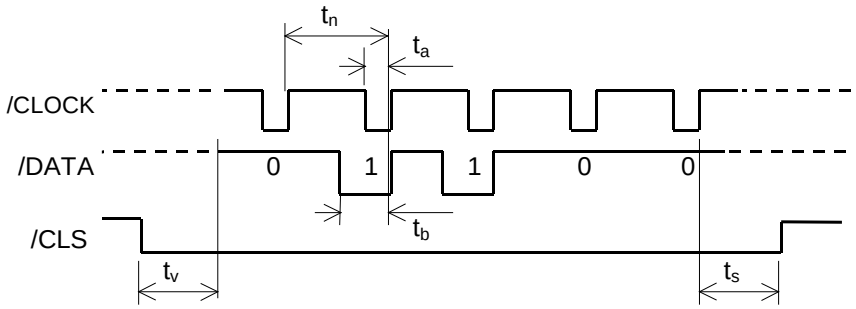
Time →

LRC

XOR operation on Start-, Data and Stop-sign

Timing

The following diagram represents the signal response of the 3 data lines of the data-/clock-interface in magnetic strip emulation.



t_n = 0,5 ms
$t_{a(n)} \approx t_n / 3$
$t_{b(n)} \approx t_n / 2$
$t_v = t_s$ = 10...12 ms

7.2.2. Wiegand Emulation

Data Format:

The following description represents the data coding depending on DC-FORMAT

DC-FORMAT = b000 ⇒ binary 1:1

In this configuration the output data format is equal to the data coding on the Transponder. The Reader doesn't add a protocol frame e.g. parity Bits or start or stop signs across the data stream.

DC-FORMAT = b100 ⇒ Wiegand formatted protocol frame with start and stop sign

In this configuration the Reader build the protocol frame with one even parity bit at the beginning and one odd parity bit at the end and one start and one stop sign:

4 Bit	1 Bit	n Bit	1 Bit	4 Bit
START	EVEN	DATA	ODD	STOP

START: b1011

EVEN: Even parity bit calculated across the first half DATA bits.

DATA: Data bits as read from the Transponder and defined in scan-mode settings.

ODD: Odd parity bit calculated across the last half DATA bits.

STOP: b1111

DC-FORMAT = b110 ⇒ Wiegand formatted protocol frame

In this configuration the Reader build the protocol frame with one even parity bit at the beginning and one odd parity bit at the end

1 Bit	n Bit	1 Bit
EVEN	DATA	ODD

EVEN: Even parity bit calculated across the first half DATA bits.

DATA: Data bits as read from the Transponder and defined in scan-mode settings.

ODD: Odd parity bit calculated across the last half DATA bits.

Example of parity calulation

Example 1: 18 DATA bit

```
DATA bin     011110110010110101101001

OUTPUT     1 011110110010110101101001 0
           `- Even Parity Bit         `- Odd Parity Bit
```

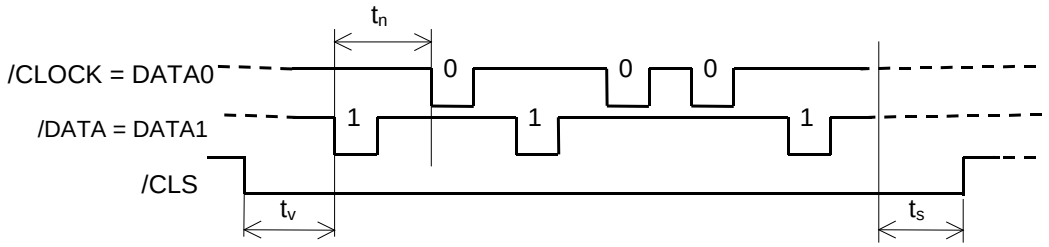
Example 1: 19 DATA bit

```
DATA bin     0111101100101101011010011

OUTPUT     0 0111101100101101011010011 1
           `- Even Parity Bit          `- Odd Parity Bit
```

Timing

The following diagram represents the signal response of the 3 data lines of the data-/clock-interface in Wiegand emulation.



t_n = 0,5 ms
t_v = t_s = 10..12 ms

7.3. CFG2: Inputs / Outputs general

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

The Reader's LED can be configured through software.

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-BLUE-TIME	ACTIV-RED-TIME	0x00	0x00
Default	0x96	0x00	0x0A	0x0A	0x0A		
			1 sec.	*1 sec.*	*1 sec.*		

IDLE-STATE / ACTIVE-STATE ***(DigitalIO.Signaler……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	RED		BLUE		GRN	

Bit combination	LED State
b01	on
b10	off
b11	flashing

GRN ***(DigitalIO.Signaler.LED.Green….State)***

BLUE ***(DigitalIO.Signaler.LED.Blue….State)***

RED ***(DigitalIO.Signaler.LED.Blue….State)***

Startup LED (only idle state) ***(DigitalIO.Signaler.Enable_StartupSignal)***

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 powered. If the Reader is reset by software, only both LEDs switch on for 2 seconds.

IDLE-FLASH / ACTIV-FLASH: ***(DigitalIO.Signaler…….FlashFrequency)***

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		BLUE		GRN	

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

ACTIV-xxx-TIME ***(DigitalIO.Signaler……..ActivationTime)***

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-BLUE-TIME	0...255 x 100 ms
ACTIV-RED-TIME	0...255 x 100 ms

NOTE:

LED green and LED red are blinking alternately if a read error of the EEPROM occurred. After power-up or a 9.3. [0x63] RF Controller Reset command all LEDs are blinking for 2 seconds

7.3.1. Dedicated Input / Output Functions

LED	Color	Dedicated Function
1	red	1. The Reader is initializing after power up or a 9.3. [0x63] RF Controller Reset command. 2. 1 second blink. 3. Alternately blink with green LED after an EEPROM error.
2	green	1. The Reader is initializing after power up or a 9.3. [0x63] RF Controller Reset command. 2. Alternately blink with red LED after an EEPROM error.
2	blue	1. The Reader is initializing after power up or a 9.3. [0x63] RF Controller Reset command. 2. The RF interface has a faultless communication with a Transponder.

7.4. CFG3 .. 10: Reserved

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

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

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

7.5. CFG11: Read Mode – Read Data

The parameters of the CFG11 configuration block contain Scan Mode settings. To enable Scan Mode the Scan bit in the READER-MODE register of the configuration block 7.2. CFG1: Interface and Mode must be set.

Byte	0	1	2	3	4	5	6
Contents	TR-DATA-1 [3]	TR-DATA-2	TR-DATA-3	BANK	DB-ADR		0
Default	0x21	0x00	0x00	0x00	0x0000		

Byte	7	8	9	10	11	12	13
Contents		DB-N			D-START	D-LGT	
Default		0x0001				0x0004	

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	0	ANT	Byte Order DB	0	DB	SNR

SNR: (*OperatingMode.ScanMode.DataSelector.UID*)

b0: no Serial Number will be stored
b1: Serial Number will be stored

DB: (*OperatingMode.ScanMode.DataSelector.Data*)

b0: no data block will be stored
b1: data block will be stored

Byte Order DB: (*OperatingMode.ScanMode.DataSource.ByteOrderOfData*)

b0: MSB first
b1: LSB first

ANT: **(*OperatingMode.ScanMode.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.

Extension:

If this flag is set TR-DATA-2 is present

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

NOTE:

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

If Scan-Mode via data-/clock interface is selected the reader can only transmit the UID or a Data Block. If both options are activated the reader only transmits the UID. If Scan-Mode via asynchronous interface is selected reading of UID and Data-Block can be configured at the same time.

TR-DATA-2:

Selects the data types for read operation.

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

Extension

If this flag is set TR-DATA-3 is present

TR-DATA-3:

Selects the data types for read operation.

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

COM Prefix: (*OperatingMode.ScanMode.DataFormat.BusAddressPrefix*)

b0: no COM Prefix is send

b1: The Reader will transmit the COM-ADR before each data set.

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*)

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

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

NOTE:

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

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

0x00...0xFF
Address of first data block. Range: 0x00...0xFF.

DB-N [4]: (*OperatingMode.ScanMode.DataSource.NoOfDataBlocks*)

Number of data blocks. Range: 0x01...0x20.

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

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

NOTE:

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

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

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

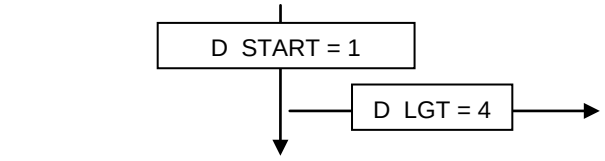
D-LGT defines the length of raw data which are transmitted in the Scan-Mode. Depending on the used ScanMode Interface D-LGT is interpreted either in Bits or Bytes. IF Scan Mode interface is USB or serial D-LGT is interpreted in Bytes. If Data-Clock is used as Scan Mode Interface D-LGT is interpreted in Bits.

Case Scan-Mode via asynchronous interface:

D_LGT = Number of **data bytes** to be transferred, started with the D_START.

Example: data block

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



Output Data	0x23	0x45	0x67	0x89

Case Scan-Mode via data-/clock interface:

D_LGT = Number of **data bits** to be transferred, started with the D_START.

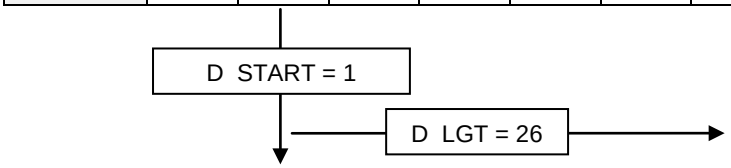
0: D_LGT = 256 bit.

1...255: D_LGT = Parameter value

In case if DB-FORMAT = ASCII format, the number of D_LGT data bits must be multiplied with 2 to get the whole data block

Example: data block

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



Output Data	b0010 0011	b0100 0101	b0110 0111	b10

7.6. CFG12: Read Mode - Filter

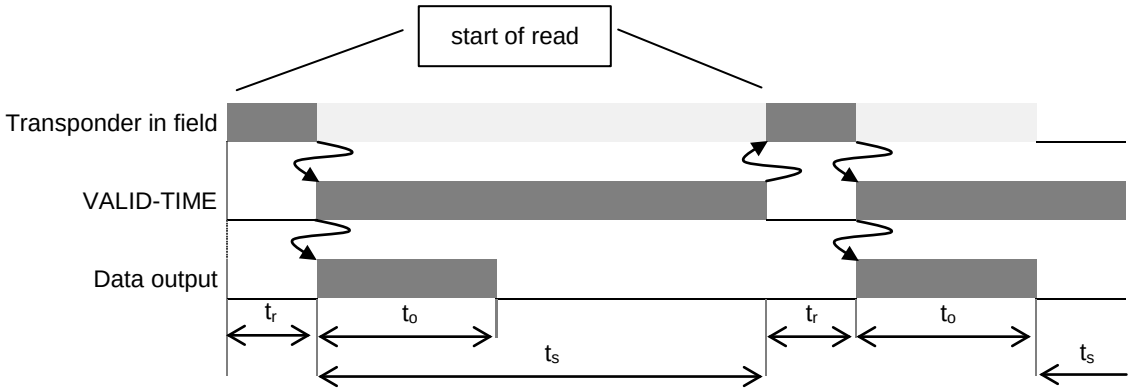
Byte	0	1	2	3	4	5	6
0x00	VALID-TIME[1]		0x00	0x00	0x00	0x00	0x00
Default	0x0037 5,5sec.		0x00	0x00	0x00	0x00	0x00

Byte	7	8	9	10	11	12	13
Contents	0x00	0x00	0x00	0x00	0x00	SCAN- BREAK-TIME	
Default	0x00					0x0001	

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

(OperatingMode.ScanMode.Filter.TransponderValidTime)

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



t_r: Time to read the Transponder data

t_o: Data Transmission from the Reader to the host

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

NOTE:

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

7.7. CFG13 Scan Mode

The configuration block CFG13 contains the Scan Mode settings

Byte	0	1	2	3	4	5	6
Contents	DB-USE	SEP-CHAR	SEP-USR	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:

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

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

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

b0000 unformatted hex-data

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

b0010 ASCII formatted hex-data

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

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

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

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

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

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

NOTE:

Only one option can be selected.

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

User defined separation character.

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

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

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

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

NOTE:

Only one option can be selected.

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

User defined end character.

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

User defined Header character.

LEN-USR:

Defines the length of the HEADER character and END character.

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

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

b0000 END-USR1

b0001 END-USR1

b0010 END-USR1 +2

b0011 END-USR1 + 2 + 3

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

b0000 no HEADER byte

b0001 HEADER-USR1

b0010 HEADER-USR1 +2

b0011 HEADER-USR1 + 2 + 3

b0100 HEADER-USR1 + 2 + 3 + 4

Example of scan data:

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

7.8. CFG14: Reserved

The configuration block CFG14 is reserved for future use.

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

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

7.9. CFG15: Antenna Multiplexing

The parameters in CFG15 are used to configure the multiplexing of the antennas in Scan Mode.

Byte	0	1	2	3	4	5	6
Contents	MUX-MODE	ANT_OUT	MUX-VALID-TIME-ANT_1		MUX-VALID-TIME-ANT_2		0x00
Default	0x00	0x9A	0x0014 20 x 5ms = 100ms		0x0014 20 x 5ms = 100ms		

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

Bit:	7	6	5	4	3	2	1	0
Function	ANT_ SEL	ANT_OUT_INT				ANT_OUT_INT_NR		

ANT_SEL: ()

b0: ANT_OUT_INT defines the number of antennas of the internal multiplexer.

The reader starts always with antenna 1.

b1: ANT_OUT_INT is a bit field and defines the antennas which are used for the internal multiplexing.

ANT_OUT_INT: ()

This parameter is depended of Bit ANT_SEL

ANT_OUT_INT_NR: ()

number of antennas (1..2)

Example: Reader shall read on antenna 2

ANT_SEL = b1, ANT_OUT_INT = b0010, ANT_OUT_INT_NR is not relevant

MUX-VALID-TIME-ANT_x: (*AirInterface.Multiplexer.UHF.Internal.Antenna.NoX.ActiveTime*)

Immediately this time has expired (value x 5ms), the next antenna output is selected.
If **MUX Switch Condition** is “no response” the Reader switches from the active antenna to the next antenna if there is no response from any Transponder on the active antenna. If the Transponder communication time on the active antenna exceed the MUX-VALID-TIME-ANT_x the Transponder communication on the active antenna is stopped, and the Reader switches to the next antenna.

7.10. CFG16 .. 21: Reserved

The configuration blocks CFG16 .. 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

7.11. CFG22 .. 23: Selection mask for EPC Gen 2

The configuration blocks CFG22 .. 23 hold a selection mask for the selection EPC Class 1 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

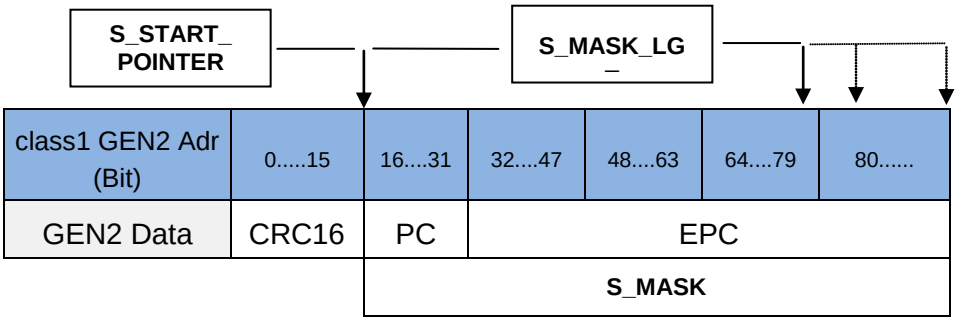
b11 User memory bank

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

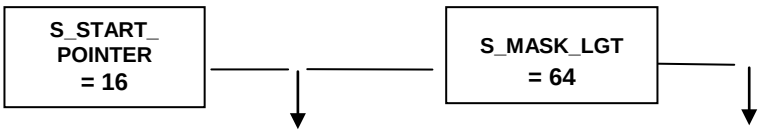
Defines the memory bit address on which the bit String of the Mask is compared to the memory of the Tag.

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

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

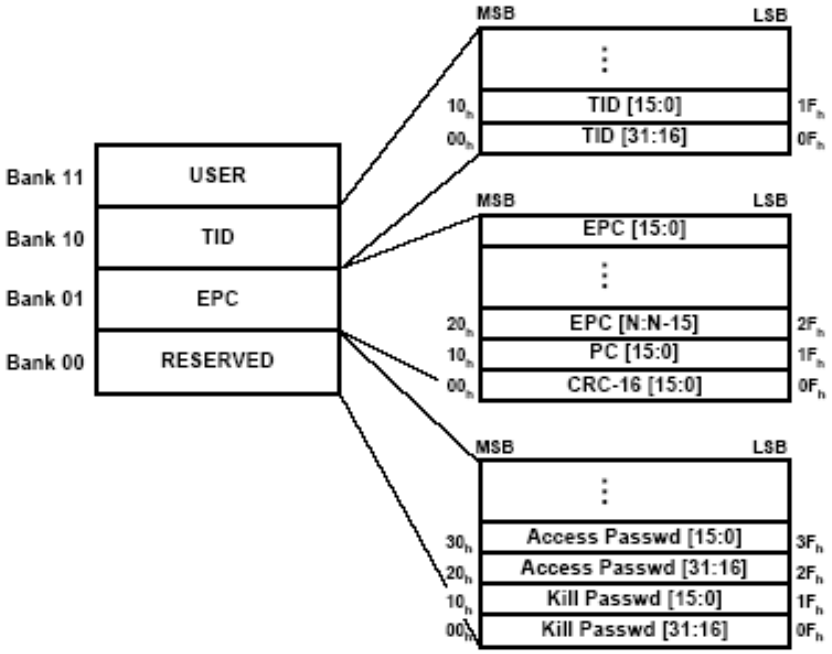


Example:



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	0x15A**1**	0x6789	-->	NO
S_MASK	**not checked**	**0x3000**	**0xA02A**	**0x0510**	**0x15A0**	**not checked**		

EPC class GEN2 Memory specification:



7.12. CFG24 .. 35: Reserved

The configuration blocks CFG24 .. 39 are reserved for future use.

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

Default

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

Default

7.13. CFG36: RF-Interface UHF

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

Byte	0	1	2	3	4	5	6
Contents	TAG-DRV[5]		UHF-Power	REG	0x00	0x00	0x00
Default	0x0010		0x00	0x06			

Byte	7	8	9	10	11	12	13
Contents	0x00	FREQ_US		0x00	Nr Prefered Chn	Prefered Chn	
Default		0x3201			0x04	0x4A7D	

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.

UHF-Power:

0x00: Full Power
0x01: Medium Power
0x02: Low Power

REG:

0x04 = FCC 902 MHz – 928 MHz

0x06 = EN 302208 865 MHz – 868 MHz

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

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)*

Channel which is used by the Reader (Region FCC 47 CFR Part 15)

upper/lower channel	Frequency	Bits
1	902,75MHz	b000001
2	903,00MHz	b000010
3	903,25MHz	b000011
...		…
50	927,25MHz	b110010

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

Number of channels (1- 4) for region 6 (EN 302208 4 Channel Plan).

1 Channel: 0x01
2 Channels: 0x02
3 Channels: 0x03
4 Channels: 0x04

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

Defines the prefered channels for region 6 (EN 302208 4 Channel Plan).

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

7.14. 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	0x00
Default						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.

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

0x02 – EPC and TID (EPC and TID are combined to one serial number)

NOTE:

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

7.15. CFG38: Anticollision UHF

The configuration block CFG38 contains 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 EPC Gen 2 Transponder will be used in Inventory process.

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

b00: Session 0

b01: Session 1

b10: Session 2

b11: Session 3

7.16. CFG39 .. 62: Reserved

The configuration blocks CFG39 .. 62 are reserved for future use.

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

Default

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

Default

7.17. CFG63: Customer Parameter

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

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

Default

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

Default

8. Protocols for Reader Configuration

The Reader configuration protocols allow the Reader to be adapted to the conditions found in individual applications. For details about the Protocol Frame see: 6.1. Serial Data Format and Protocol Frames.

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

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

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

8.1. [0x80] Read Configuration

By using the Read Configuration command 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
6	COM-ADR	[0x82]	CFG-ADR	CRC16

Host ← Reader

1	2	3	4	5 .. 18	19-20
20	COM-ADR	[0x82]	STATUS[6]	CFG-REC	CRC16

CFG-ADR[7]:

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

CFGn: memory-address of the required configuration block

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

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

NOTE:

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

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

[7] *see Chapter 4. Configuration Parameters (CFG)*

8.2. [0x81] Write Configuration

The configuration of the Reader can be changed by means of the Write Configuration command. In order to do this, the configuration memory is written 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...18	19-20
20	COM-ADR	[0x81]	CFG-ADR	CFG-REC	CRC16

Host ← Reader

1	2	3	4	5-6
6	COM-ADR	[0x81]	STATUS[8]	CRC16

CFG-ADR[9]:

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

CFGn: memory-address of the required configuration block

LOC: specifies the location of the configuration block

b0 RAM

b1 RAM and EEPROM

CFG-REC:

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

NOTE:

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

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

[9] *see chapter 4. Configuration Parameters (CFG)*

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

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

Host → Reader

1	2	3	4	5...6
6	COM-ADR	[0x83]	CFG-ADR	CRC16

Host ← Reader

1	2	3	4	5...6
6	COM-ADR	[0x83]	STATUS	CRC16

CFG-ADR:

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

CFGn: memory-address of the required configuration block

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

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

NOTE:

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

9. Protocols for Reader Control

9.1. [0x52] Baud Rate Detection

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

Host → Reader

1	2	3	4	5,6
6	COM-ADR	[0x52]	0x00	CRC16

Host ← Reader

1	2	3	4	5,6
6	COM-ADR	[0x52]	0x00	CRC16

NOTE:

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

9.2. [0x55] Start Flash Loader

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

Host → Reader

1	2	3	4,5
5	0x00	[0x55]	CRC16

Host ← Reader

1	2	3	4	5,6
6	0x00	[0x55]	0x00	CRC16

NOTE:

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

9.3. [0x63] RF Controller Reset

This protocol allows you to reset the RF Controller.

Host → Reader

1	2	3	4,5
5	COM-ADR	[0x63]	CRC16

Host ← Reader

1	2	3	4	5,6
6	COM-ADR	[0x63]	STATUS[10]	CRC16

NOTE:

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

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

9.4. [0x65] Get Software Version

This protocol allows you to determine the software version of the Reader, its type and the types of the Transponders which are supported by the software.

Host → Reader

1	2	3	4	5	6,7
0x02	07		COM-ADR	[0x65]	CRC16

Host ← Reader

1	2	3	4	5	6	7…8
0x02	15		COM-ADR	[0x65]	STATUS[11]	SW-REV

9	10	11	12...13	14…15
D-REV	HW-TYPE	SW-TYPE	TR-TYPE-UHF	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
0x32 ID ISC.MU02

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	-	-	-	-

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

9.5. [0x66] Get Reader Info

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

Host → Reader

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

MODE:

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

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

0x04: Additional firmware functionality (unsupported)

0x05: General firmware information of the Bootloader

0x40: CFG Info for read permission

0x41: CFG Info for write permission

0x60: I/O Info

0x10: Hardware information

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:

9.5.1. Mode = 0x00 (Controller Firmware)

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

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

18,19
CRC16

SW-REV:

Revision status of the Firmware. Depending on the Mode and Reader type different controllers 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
0x32 ID ISC.MU02.02 (50)

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 into account that a response protocol of the Reader can have this length.

TR-TYPE-UHF:

Displays the UHF-Transponders supported by the software.

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

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

9.5.2. Mode = 0x05 (Bootloader version information)

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

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

BL_VERSION:

Bootloader Version

BL_REV:

Revison of Bootloader Version

9.5.3. Mode = 0x10 (Hardware Information)

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

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

17	18,19
reserved	CRC16

HW-INFO:

Hardware Information

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

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

D-HW:

internal use

A-HW:

internal use

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

FREQUENCY:

Flags for supported frequency's

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

EU: b0: EU frequencies not supported
b1: EU frequencies supported

FCC: b0: FCC frequencies not supported
b1: FCC frequencies 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:	-	-	-	USB	-	-	-	RS232

RS232: b0: not supported
b1: supported

USB: b0: not supported

b1: supported

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

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

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

9.5.5. Mode = 0x60 (I/O Info)

Defines the number of inputs, outputs and relays.

1	2	3	4	5	6	7	8
02	00	0B	COM-ADR	[0x66]	STATUS	NR_OF_ INPUTS	NR_OF_ OUTPUTS

9	10...11
NR_OF_ RELAYS	CRC16

9.5.6. 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.

9.6. [0x69] RF Reset

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

Host → Reader

1	2	3	4,5
5	COM-ADR	[0x69]	CRC16

Host ← Reader

1	2	3	4	5,6
6	COM-ADR	[0x69]	STATUS[13]	CRC16

NOTE:

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

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

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

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

9.7. [0x6A] RF Output ON/OFF

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

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

Host → Reader

1	2	3	4	5,6
6	COM-ADR	[0x6A]	RF_OUTPUT	CRC16

Host ← Reader

1	2	3	4	5,6
6	COM-ADR	[0x6A]	STATUS[15]	CRC16

RF-OUTPUT:

Set one of two 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
b010	RF Power on antenna output 2

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

NOTE:

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

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

[14] *Scan Mode, Buffered Read Mode or Notification Mode*

9.8. [0x6E] Reader Diagnostic

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

Host → Reader

1	2	3	4	5...6
6	COM-ADR	[0x6E]	MODE	CRC16

Host ← Reader

1	2	3	4	5...n-2	n-1...n
n	COM-ADR	[0x6E]	STATUS	DATA	CRC16

MODE:

Reader Diagnostic Modes

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

0x20 Listing of detail information for STATUS = 0x18 (Wrong firmware)

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

MODE = 0x20:

ASCII-String with a description of the error.

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

9.9. [0x72] Set Output

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

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

Host → Reader

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

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

Host ← Reader

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

Mode:

0x01 (reserved)

OUT-N:

Defines the number of output records.

OUT-NR:

Defines the Type and the number of the output

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

OUT-type:

b0 Digital Output

The following outputs are available:

- ***OUT-1: LED green***
- ***OUT-2: LED blue***
- ***OUT-3: LED red***

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

OUT-S:

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

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

OUTx-mode:

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

OUTx-frq:

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

OUT-TIME:

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

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

NOTE:

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

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

9.9.1. Set Output Examples

Example:

OUT1 (LED green) is alternating with 4 Hz for 500 ms.
OUT2 (LED blue) is not activated for 200 ms.
OUT3 (Beeper) is activated for 1000ms

OUT-N	OUT-NR	OUT-S	OUT-TIME
0x0003	*0x01*	*0x07*	*0x0005*
	OUT-NR	OUT-S	OUT-TIME
	0x02	*0x02*	*0x0002*
	OUT-NR	OUT-S	OUT-TIME
	0x04	*0x01*	*0x000A*

9.10. [0xA0] Reader-Login

The Reader-Login must be executed after every power up or 9.3. [0x63] RF Controller Reset command, if an access to the configuration parameters is desired.

Host → Reader:

1	2	3	4...7	8...9
9	COM-ADR	[0xA0]	READER-ID	CRC16

Host ← Reader

1	2	3	4	5...6
6	COM-ADR	[0xA0]	STATUS[17]	CRC16

READER-ID:

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

NOTE:

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

A "Logout" can be effected via the command 9.3. [0x63] RF Controller Reset.

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

10. Protocols for Host Commands

The Host commands can be used to access the Transponders.

	EPC Class 1 Gen 2
10.1. [0xB0] Host commands	√
10.1.1. [0x01] Inventory	√
10.1.2. [0x23] Read Multiple Blocks	√
10.1.3. [0x24] Write Multiple Blocks	√
11. [0xB3] Host commands for EPC Transponders	√
11.1.1. [0x18] Kill	√
11.1.2. [0x22] Lock	√

10.1. [0xB0] Host commands

These command sends RF commands to the Transponder.

Host → Reader

1	2	3	4...n-2	n-1,n
n	COM-ADR	[0xB0]	REQUEST-DATA	CRC16

Host ← Reader

1	2	3	4	5...n-2	n-1,n
n	COM-ADR	[0xB0]	STATUS	RESPONSE-DATA	CRC16

REQUEST-DATA:

Command specific request

RESPONSE-DATA:

Command specific response

NOTE:

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

This commands aren't available if Scan-Mode is active.

10.1.1. [0x01] Inventory

This command reads the IDD (Identifier Data) of all Transponders inside the antenna field. IDD can be UID or EPC.

REQUEST-DATA

4	5	(6)
0x01	MODE	ANT_SEL

RESPONSE-DATA if ANT = 0

5	6	7	8	9...n
DATA-SETS	TR-TYPE	IDDT	IDD_LEN	IDD
	Repeated DATA-SETS times			

RESPONSE-DATA if ANT = 1

5	6	7	8	9	10...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	reserved 0xFF	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	-	-	-	-	-	-	ANT2	ANT1

ANT1...2

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 informations will be send
b1 antenna informations (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)

NOTE:

This command supports all Transponders.

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

10.1.2. [0x23] Read Multiple Blocks

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

REQUEST-DATA

4	5	1 Byte	UID_LNG Bytes	1Byte
0x23	MODE	UID_LNG	UID	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

5	6	7	8...n
DB-N	DB-SIZE	SEC-STATUS	DB
		Repeated DB-N times	

MODE:

Bit:	7	6	5	4	3	2	1	0
Function	0	0	EXT_ADR	UID_LF		ADR		

ADR:

b000 non-addressed
b001 addressed

UID_LF:

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

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

b1: The protocol includes the parameter UID_LNG. The UID has a variable length as defined in UID_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

UID_LNG:

Is a optional parameter and depends on the setting of UID_LF (see MODE). UID_LNG defines the length of the following UID field.

UID:

Read-only serial number of the Transponder. The UID 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.

10.1.3. [0x24] Write Multiple Blocks

This command writes one or more data blocks.

REQUEST-DATA

4	5	1 Byte	UID_LNG Bytes	1Byte
0x24	MODE	UID_LNG	UID	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)

5
DB-ADR-E

MODE:

Bit:	7	6	5	4	3	2	1	0
Function	0	0	EXT_ADR	UID_LF		ADR		

ADR:

b000 non-addressed
b001 addressed

UID_LF:

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

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

b1: The protocol includes the parameter UID_LNG. The UID has a variable length as defined in UID_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

UID_LNG:

Is a optional parameter and depends on the setting of UID_LF (see MODE). UID_LNG defines the length of the following UID field.

UID:

Read-only serial number of the Transponder. The UID 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.

NOTE:

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

11. [0xB3] Host commands for EPC Transponders

This command sends special commands to EPC Transponder.

Host → Reader

1	2	3	4...n-2	n-1,n
n	COM-ADR	[0xB3]	REQUEST-DATA	CRC16

Host ← Reader

1	2	3	4	5...n-2	n-1,n
n	COM-ADR	[0xB3]	STATUS	RESPONSE-DATA	CRC16

REQUEST-DATA:

EPC specific request

RESPONSE-DATA:

EPC specific response

NOTE:

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

11.1. EPC Class 1 Commands

These commands support the functions of the EPC class1 Gen 2 Transponder

11.1.1. [0x18] Kill

This command kills a transpoder. It will not respond anymore to any RF command.

REQUEST-DATA

4	5	1 Byte	EPC_LNG Bytes	1 Byte	K_PW_LNG Bytes
0x18	MODE	EPC_LF	EPC	K_PW_LNG	K_PW

MODE:

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

ADR:

b000 non-addressed
b001 addressed

EPC_LF:

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

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

EPC_LNG:

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

EPC:

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

K_PW_LNG:

Length of Kill Password.

K-PW:

Kill Password.

NOTE:

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

Kill password K_PW has to contain the kill code.

Kill password length K_PW_LNG=4.

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

11.1.2. [0x22] Lock

This command Lock different memory portions of a EPC Transponder.

REQUEST-DATA

4	5	1 Byte	EPC_LNG Bytes
0x22	MODE	EPC_LNG	EPC

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

MODE:

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

ADR:

b000 non-addressed
b001 addressed

EPC_LF:

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

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

EPC_LNG:

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

EPC:

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

EPC_Type:

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

LOCK_LNG:

Length of LOCK_DATA Field

LOCK_DATA:

Lock data which will be written to the Tag.

A_PW_LNG:

Length of Access Password.

A_PW:

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

NOTE:

Lock data length Lock_LNG=3.

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

11.2. Supported Host commands for Transponders

The command codes listed in the following table supports the various Transponder commands and operations that are available for each Transponder type.

11.2.1. EPC class 1 Gen 2

Memory organization:

Number of blocks	vendor specific
Block size	2 byte

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

ANNEX

ANNEX A: Codes of Transponder Types

Value	Transponder type
0x84	EPC class 1 Gen 2

The Information will be send by performing the 10.1.1. [0x01] Inventory command.

ANNEX B: Codes of Identifier Data Types (IDDT)

Value	IDDT
0x00	SNR or UID
0x02	EPC and TID

The Information will be send by performing the 10.1.1. [0x01] Inventory command or using the Scan Mode.

ANNEX C: Index of Status Bytes

Hex-value	Transponder Status
0x00	**OK:** • 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.
0x05	**Wrong Transponder-type:** This command is not applicable at the Transponder: • A special command is not applicable to 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.
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 Feig 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 Feig 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 7.2. CFG1: Interface and Mode is to short. • The collision handling algorithm was not continued until no collision is detected, reasons for the break:
0x84	**RF-Warning:** Detailed status information can be read with the command 9.8. [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.
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 D: Codes of Reader Types

No.	Reader Type
30	ID ISC.M01
31	ID ISC.M02
60	ID ISC.PRH101
61	ID ISC.PRH101-U (USB-Version)
62	ID ISC.PRHD102
71	ID ISC.PRH100–U (USB-Version)
72	ID ISC.PRH100
73	ID ISC.MR100–U (USB-Version)
74	ID ISC.MR100 / .PR100
75	ID ISC.MR200-A / -E
76	ID ISC.MR101-A
78	ID ISC.MR101-U
40	ID ISC.LR100
41	ID ISC.LR200
42	ID ISC.LR2000
55	ID ISC.MRU200
56	ID ISC.MRU200-U
92	ID ISC.LRU1000
93	ID ISC.LRU2000
80	ID CPR.M02
81	ID CPR.02
82	ID CPR40.30-Ux
83	ID CPR40.0x-Ax / -Cx
84	ID CPR.M03 (586/#)
85	ID CPR.03 (584/#)
87	ID CPR.04 (596/#)
88	ID CPR.04-U
50	ID ISC.MU02.02

ANNEX E: Labeling of configuration parameter

Label	Namespace	CFG-Block	Start Byte-No.	No. of Bytes	Start Bit-No.	No. of Bits
READER-ID	AccessProtection.Password	0	0	4		
CFG_ACCESS	AccessProtection.Lock_CFG0	0	8	1	0	1
CFG_ACCESS	AccessProtection.Lock_CFG1	0	8	1	1	1
CFG_ACCESS	AccessProtection.Lock_CFG2	0	8	1	2	1
CFG_ACCESS	AccessProtection.Lock_CFG3	0	8	1	3	1
CFG_ACCESS	AccessProtection.Lock_CFG4	0	8	1	4	1
CFG_ACCESS	AccessProtection.Lock_CFG5	0	8	1	5	1
CFG_ACCESS	AccessProtection.Lock_CFG6	0	8	1	6	1
CFG_ACCESS	AccessProtection.Lock_CFG7	0	8	1	7	1
CFG_ACCESS	AccessProtection.Lock_CFG8	0	9	1	0	1
CFG_ACCESS	AccessProtection.Lock_CFG9	0	9	1	1	1
CFG_ACCESS	AccessProtection.Lock_CFG10	0	9	1	2	1
CFG_ACCESS	AccessProtection.Lock_CFG11	0	9	1	3	1
CFG_ACCESS	AccessProtection.Lock_CFG12	0	9	1	4	1
CFG_ACCESS	AccessProtection.Lock_CFG13	0	9	1	5	1
CFG_ACCESS	AccessProtection.Lock_CFG14	0	9	1	6	1
CFG_ACCESS	AccessProtection.Lock_CFG15	0	9	1	7	1
CFG_ACCESS	AccessProtection.Lock_CFG16	0	10	1	0	1
CFG_ACCESS	AccessProtection.Lock_CFG17	0	10	1	1	1
CFG_ACCESS	AccessProtection.Lock_CFG18	0	10	1	2	1
CFG_ACCESS	AccessProtection.Lock_CFG19	0	10	1	3	1
CFG_ACCESS	AccessProtection.Lock_CFG20	0	10	1	4	1
CFG_ACCESS	AccessProtection.Lock_CFG21	0	10	1	5	1
CFG_ACCESS	AccessProtection.Lock_CFG22_29	0	10	1	6	1
CFG_ACCESS	AccessProtection.Lock_CFG30_35	0	10	1	7	1
CFG_ACCESS	AccessProtection.Lock_CFG40_49	0	11	1	0	1
CFG_ACCESS	AccessProtection.Lock_CFG50_59	0	11	1	1	1
CFG_ACCESS	AccessProtection.Lock_CFG60_62	0	11	1	2	1
CFG_ACCESS	AccessProtection.Lock_CFG63	0	11	1	3	1
CFG_ACCESS	AccessProtection.Lock_CFG36	0	11	1	4	1
CFG_ACCESS	AccessProtection.Lock_CFG37	0	11	1	5	1
CFG_ACCESS	AccessProtection.Lock_CFG38	0	11	1	6	1
CFG_ACCESS	AccessProtection.Lock_CFG39	0	11	1	7	1
COM-ADR	HostInterface.Serial.BusAddress	1	0	1		
BAUD	HostInterface.Serial.Baudrate	1	2	1		
TRANS-FORM (P)	HostInterface.Serial.Parity	1	3	1	0	2
TRANS-FORM (D)	HostInterface.Serial.Databits	1	3	1	2	1
TRANS-FORM (S)	HostInterface.Serial.Stopbits	1	3	1	3	1
TR-RESPONSE-TIME	AirInterface.TimeLimit	1	6	2		
RF-INTERFACE (UHF)	Transponder.Driver.Enable_UHF	1	9	1	1	1

INTERFACE	HostInterface.Interfaces	1	12	1	0	4
READER-MODE:	OperatingMode.Mode	1	13	1	0	1
IDLE-STATE (GRN)	DigitalIO.Signaler.LED.Green.IdleState	2	3	1	0	2
IDLE-STATE (BLUE)	DigitalIO.Signaler.LED.Blue.IdleState	2	3	1	2	2
IDLE-STATE (RED)	DigitalIO.Signaler.LED.Red.IdleState	2	3	1	4	2
IDLE-FLASH (GRN)	DigitalIO.Signaler.LED.Green.IdleFlashFrequency	2	4	1	0	2
IDLE-FLASH (BLUE)	DigitalIO.Signaler.LED.Blue.IdleFlashFrequency	2	4	1	2	2
IDLE-FLASH (RED)	DigitalIO.Signaler.LED.Red.IdleFlashFrequency	2	4	1	4	2
ACTIVE-STATE (GRN)	DigitalIO.Signaler.LED.Green.ActiveState	2	7	1	0	2
ACTIVE-STATE (BLUE)	DigitalIO.Signaler.LED.Blue.ActiveState	2	7	1	2	2
ACTIVE-STATE (RED)	DigitalIO.Signaler.LED.Red.ActiveState	2	7	1	4	2
ACTIVE-FLASH (GRN)	Digita-lIO.Signaler.LED.Green.ActiveFlashFrequency	2	8	1	0	2
ACTIVE-FLASH (BLUE)	DigitalIO.Signaler.LED.Blue.ActiveFlashFrequency	2	8	1	2	2
ACTIVE-FLASH (RED)	DigitalIO.Signaler.LED.Red.ActiveFlashFrequency	2	8	1	4	2
ACTIV-GRN-TIME	DigitalIO.Signaler.LED.Green.ActivationTime	2	9	1		
ACTIV-BLUE-TIME	DigitalIO.Signaler.LED.Blue.ActivationTime	2	10	1		
ACTIV-RED-TIME	DigitalIO.Signaler.LED.Red.ActivationTime	2	11	1		
TAG-DRV	(Transponder.Driver.HF.Drivers)	3	1	1		
TR-DATA-1 (SNR)	OperatingMode.ScanMode.DataSelector.Uid	11	0	1	0	1
TR-DATA-1 (DB)	OperatingMode.ScanMode.DataSelector.Data	11	0	1	1	1
TR-DATA-1 (Byte Or-der)	OperatingMode.ScanMode.DataSource.ByteOrder	11	0	1	3	1
TR-DATA-3 (COM Prefix)	OperatingMode.ScanMode.DataFormat. BusAddressPrefix	11	2	1	0	1
Bank	OperatingMode.ScanMode.DataSource.BankNo	11	3	1	0	2
DB-ADR	Operating-Mode.ScanMode.DataSource.FirstDataBlock	11	4	2		
D-START	OperatingMode.ScanMode.DataSource.FirstByte	11	11	1		
D-LGT	Operating-Mode.ScanMode.DataSource.NoOfBytes	11	12	2		
VALID-TIME	Operating-Mode.ScanMode.Filter.TransponderValidTime	12	0	2		
DB-USE / DB-Format	OperatingMode.ScanMode.DataFormat.Format	13	0	1	0	4
SEP-CHAR	Operating-Mode.ScanMode.DataFormat.SeparationChar	13	1	1		
SEP-USR	Operating-Mode.ScanMode.DataFormat.UserSeparationChar	13	2	1		
END-CHAR	OperatingMode.ScanMode.DataFormat.EndChar	13	3	1		
END-USR1	Operating-Mode.ScanMode.DataFormat.UserEndChar1	13	4	1		
END-USR2	Operating-Mode.ScanMode.DataFormat.UserEndChar2	13	5	1		
END-USR3	Operating-Mode.ScanMode.DataFormat.UserEndChar3	13	6	1		
DER-USR1	Operating-Mode.ScanMode.DataFormat.UserHeaderChar1	13	8	1		
DER-USR2	Operating-Mode.ScanMode.DataFormat.UserHeaderChar2	13	9	1		
DER-USR3	Operating-Mode.ScanMode.DataFormat.UserHeaderChar3	13	10	1		
DER-USR4	Operating-Mode.ScanMode.DataFormat.UserHeaderChar4	13	11	1		

LEN-USR (END-LEN)	Operating-Mode.ScanMode.DataFormat.NoOfUserEndChars	13	13	1	0	4
LEN-USR (HEADER-LEN)	Operating-Mode.ScanMode.DataFormat.NoOfUserHeaderChars	13	13	1	4	4
RF-MOD	AirInterface.Miscellaneous.HF.Modulation	20	0	1		
S_MASK_LGT	Transponder.UHF.EPC_Class1Gen2.SelectionMask.MaskLength	22	0	1		
S_MODE (S_Bank)	Transponder.UHF.EPC_Class1Gen2.SelectionMask.BankNo	22	1	1	0	2
S_START_POINTER	Transponder.UHF.EPC_Class1Gen2.SelectionMask.FirstBit	22	2	2		
S_MASK	Transponder.UHF.EPC_Class1Gen2.SelectionMask.Mask	22-23	4	24		
TAG-DRV	Transponder.Driver.UHF.Drivers	36	1	1		
TAG-DRV €	Transponder.Driver.UHF.EPC_Class1Gen2	36	1	1	4	1
FREQ_US (Upper channel)	AirInterface.Region.UHF.FCC.Channel.UpperChannel	36	8	1	0	6
FREQ_US (C_ALOC)	AirInterface.Region.UHF.FCC.Channel.ChannelAllocationMode	36	8	1	6	2
FREQ_US (lower channel)	AirInterface.Region.UHF.FCC.Channel.LowerChannel	36	9	1	0	6
IDDIB	Transponder.Miscellaneous.IdentifierInterpretationMode	37	12	1		
SESSION	Transponder.UHF.EPC_Class1Gen2.Anticollision.Session	38	10	1	0	2