IDENTIFICATION

MANUAL

ID CPR74 - Family

RFID Reader Module for ISO/IEC14443-A, -B, ISO/IEC15693 and 18000-3M3

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FEIG ELECTRONIC

Note

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

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The installation instructions given in this manual are based on advantageous boundary conditions. FEIG ELECTRONIC GmbH does not give any guarantee promise for perfect function in cross environments.

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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 "[ ]" indicates a command.

Content

Revision History of documentation

Revision	Description
0	Described Firmware: 01.00.00 • First edition
1	Described Firmware: 01.01.00 • Added Mode 0x15 to Command 0x66 Get Reader Info • Additional default antenna setting in CFG17
2	Described Firmware: 01.01.130 • Felica support integrated

Abbreviations

ADR	Address
AFI	Application Family Identifier
ASK	Amplitude Shift Keying
CFG	Configuration Parameter Block
CRC	Cyclic Redundancy Check
DB	data block
frq	Frequency
FSK	Frequency Shift Keying
h	Hour
Hz	Hertz
ID	Identification
IN	Input
LEN	Length
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
TR	Transponder
TS	Timeslot
UID	Unique Identifier (read only Serial Number)
WO	Write Only Access
WR	Write

1. Introduction

1.1. About this Manual

This Manual describes the interface commands, functions and parameters, which are supported by the ID CPR74 RFID reader.

This manual is intended for system integrators, software developers, system designers and all others who are working with the ID CPR74 host interface. The structure and elements of this document are represented in a very similar way also in the Windows® software tool "CPRStart" which is available via download from FEIG ELECTRONIC's web site (www.feig.de).

- Chapter "1. Introduction" gives an overview about the ID CPR74 device family and its main functions.
- Chapter "2. Data Transmission between ID CPR-Reader and Host" describes the communications rules to get in contact via host interface with the reader for reader configuration, reader control and for interacting with RFID transponders or SAMs.
- Chapter "3. Configuration Parameters (CFG)" describes the configuration parameters of the ID CPR74 and how the operating characteristics are influenced by each parameter.
- Chapter "4. Configuration and Control Commands" describes how the operating characteristics of the reader can be controlled via the host interface.
- Chapter "5. ISO Host Commands for Transponder Communication" is the description of all commands which are supported by the ID CPR74 for interacting with RFID Transponders. In connection with chapter 2.2.1. ISO/IEC 14443 Standard Mode and chapter 2.2.2. Contactless EMVCo Mode the mechanisms of transponder communication are specified in detail in this chapter.
- Chapter "6. [0xC0] SAM Commands" is necessary for ID CPR74 devices with SAM sockets and describes how the communication is performed with a SAM.
- Chapter "7. Supported ISO Host commands" summaries which ISOHost command can be performed with which type of RFID Transponder.

1.2. The ID CPR74 Family

Readers of the *classic-pro* ID CPR74 - family are able to process (read and write) Transponders according ISO/IEC 14443 type –A, type –B, ISO/IEC15693 and ISO/IEC18000-3M3 and also the mifare classic security functions.

These readers are offering an operation mode to process Transponder according ISO/IEC 14443 standard as well as an operation mode to process Transponder according EMVCo Contactless Level 1 specification and are suited to design payment solutions according EMVCo Contactless Level 1 if the EMVCo specific antenna specifications are considered.

The CPR74-4SCUSB is equipped with 4 sockets for attachable Security Access Module (SAM), which makes it even suitable for applications such as ticketing, banking, transportation, accounting systems etc. A version (CPR74-CUSB) without SAM sockets is also available.

The readers are offering an internal antenna and a connector for an external antenna. Due to an integrated antenna multiplexer it is possible to switch via software functions between the internal antenna and a connected external antenna during operation.

For data transfer with a host computer the ISO-host mode (polling) is available via the USB and the RS232-TTL interface of the reader. Additionally scan-mode via USB, RS232-TTL or Data/Clock interface is available.

The functionality of the ID CPR74 is based on the well known ID CPR-family, like the reader module ID CPR44 and is compatible with them mainly.

The use of ISO-host commands guarantees an easy creation of user software as well as the module's compatibility with OBID *i-scan*® Reader family.

Beside the **CPRStart** software for demonstration and configuration the reader capabilities and the **Firmware Update Tool** a lot of different **Software Development Kits** (SDK) and drivers are available to support an easy integration into the customer’s application.

The following table gives an overview about the hardware similarities and differences within the ID CPR74 - family.

	CPR74-4SCUSB	**CPR74-CUSB**
Dimensions L x D x H	50 mm x 68 mm x 10 mm	50 mm x 68 mm x 8 mm
Power supply	5 V DC	
Antenna:		
• Internal	●	●
• Eternal	●	●
SAM Socket	4	-
Digital outputs	3	
Interface		
• RS232-TTL	●	●
• USB full-speed	●	●
• (12Mbit/s)Data/Clock	●	●

● included in standard device
○ optional, according to the model
(○) in development
– not available

2. Data Transmission between ID CPR-Reader and Host

Four different ways of data transmission between *classic-pro* Readers and host (terminal, PC) are possible.

The ISO Host Commands (see 2.2. ISO Host Commands for Transponder Communication) and the Scan-Mode (see 2.3. Scan-Mode for Transponder Communication) are used for the data exchange between Transponder and host, whereas the Configuration Commands and the Control Commands are 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		
	asynchronous (RS232)	**USB**	**synchronous Data-/Clock**
Configuration and Control Commands	●	●	-
ISO Host Commands for Transponder Communication	●	●	-
Scan-Mode for Transponder Communication	●	●	●

2.1. Command for Reader Configuration and Reader Control

This method of data transmission is used for Reader configuration and the diagnosis via the asynchronous interface.

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 answer 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. ISO Host Commands for Transponder Communication

The ISO 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.

NOTICE:
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.

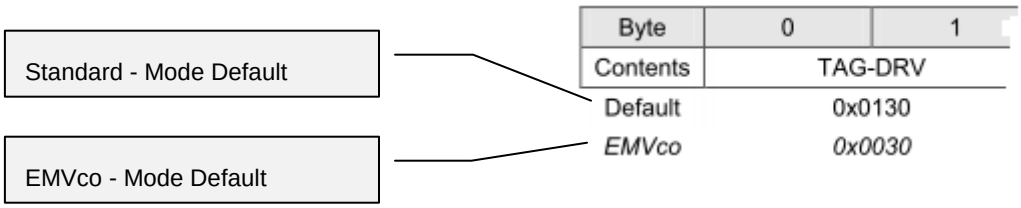
Standard-Mode / EMVCo Mode:

For ISO- Host Commands the reader can operate in EMVCo -Mode or Standard-Mode. EMVCo -Mode can be selected by parameters which are described in chapter 3.13. CFG12: EMVCo Settings.

Standard mode is intended for all common applications like Ticketing, Access-Control or Document verification where card according ISO/IEC 14443 is used. Whereas the EMVCo mode is intended for such applications where the reader shall communicate with contactless payment cards (Credit or Debit Cards).

Details of Standard- and EMVCo -Mode are described in the Chapter 2.2.1. ISO/IEC 14443 Standard Mode and 2.2.2. Contactless EMVCo Mode.

If EMVCo mode is selected the reader uses predefined configurations which can not changed by the host application. This EMVCo default parameters are shown in separate column of the parameter description in chapter 3. Configuration Parameters (CFG).



The EMVCo mode default parameters are stored in the RAM only once the EMVCo mode is activated.

Once the EMVCo mode is left the reader copies the pre-configured standard mode parameters out from the internal EEPROM into the RAM to run in standard mode.

Transponder Addressing Modes:

The Reader supports three different transponder addressing modes "Selected", "Addressed" or “Non Addressed” which are specified by the relevant technical standards or the transponder chip Manufacturer

Selected Transponder Communication:

In this mode the Reader communicates only with the one, selected Transponder.

Before reading or writing data in selected mode, the UID of the Transponder has to be known. This is executed by sending at first the command “ 5.1.1. [0x01] Inventory“. In a second step the Transponder must be selected with the select command (see: 5.1.2. [0x25] Select) which must include its UID.

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

<table>
<tr><td>Host (Terminal / PC / ....)</td><td></td><td colspan="2">Reader</td></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">Select Transponder with UID</td><td>→</td><td colspan="2">Transponder with the
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">Data Exchange with the selected Transponder</td><td>→</td><td colspan="2">selected Transponder
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>
</table>

Addressed Transponder Communication:

Before reading or writing data in addressed mode, the UID of the Transponder has to be known. This is executed by sending the command " 5.1.1. [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 command the Transponder must be addressed with its UID.

The following chart shows 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 rowspan="2">status =
no Transponder</td></tr>
<tr><td>←</td><td></td></tr>
<tr><td rowspan="4">Data exchange by addressing the
with its 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 rowspan="2">status =
no Transponder
in Reader field</td></tr>
<tr><td>←</td><td></td></tr>
</table>

Non-addressed mode:

In non-addressed mode, it is not necessary to know the UID of the Transponder. This mode is useful, 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:

<table>
<tr><th>Host (Terminal / PC / ....)</th><th></th><th colspan="2">Reader</th></tr>
<tr><td rowspan="4">read data</td><td rowspan="2">→</td><td colspan="2">Transponder in antenna field ?</td></tr>
<tr><td>Yes</td><td>No</td></tr>
<tr><td>←</td><td>status / Transponder read data</td><td>status = no Tran-sponder in Reader field</td></tr>
<tr><td>←</td><td colspan="2"></td></tr>
<tr><td rowspan="4">write data</td><td rowspan="2">→</td><td colspan="2">Transponder in antenna field ?</td></tr>
<tr><td>Yes</td><td>No</td></tr>
<tr><td>←</td><td>OK status</td><td>status = no Tran-sponder in Reader field</td></tr>
<tr><td>←</td><td colspan="2"></td></tr>
</table>

2.2.1. ISO/IEC 14443 Standard Mode

If ISO/IEC 14443 Standard Mode is activated the reader handles timeout control and error handling for ISO14443 RFID cards in conformance with ISO/IEC 14443.

In ISO/IEC 14443 standard mode the reader RFID Interface can be adapted by various parameters to the application requirements (see chapters 3.4. CFG3: RF-Interface, 3.5. CFG4: Transponder Parameters and 3.6. CFG5: Anticollision).

The adjacent flowchart shows a typical command flow to process a transponder in ISO/IEC 14443 standard mode.

Inventory Command

The Inventory command has to be used to check if a transponder is in the detection range of the reader. The response includes beneath the UID/PUPI an information about the ISO14443 layer supported by the card. More details are described in chapter 5.1.1. [0x01] Inventory

Select Command (see: 5.1.2. [0x25] Select)

The Select command has to be used for most common ISO/IEC 14443 transponder (see also addressing mode in chapter 2.2. ISO Host Commands).

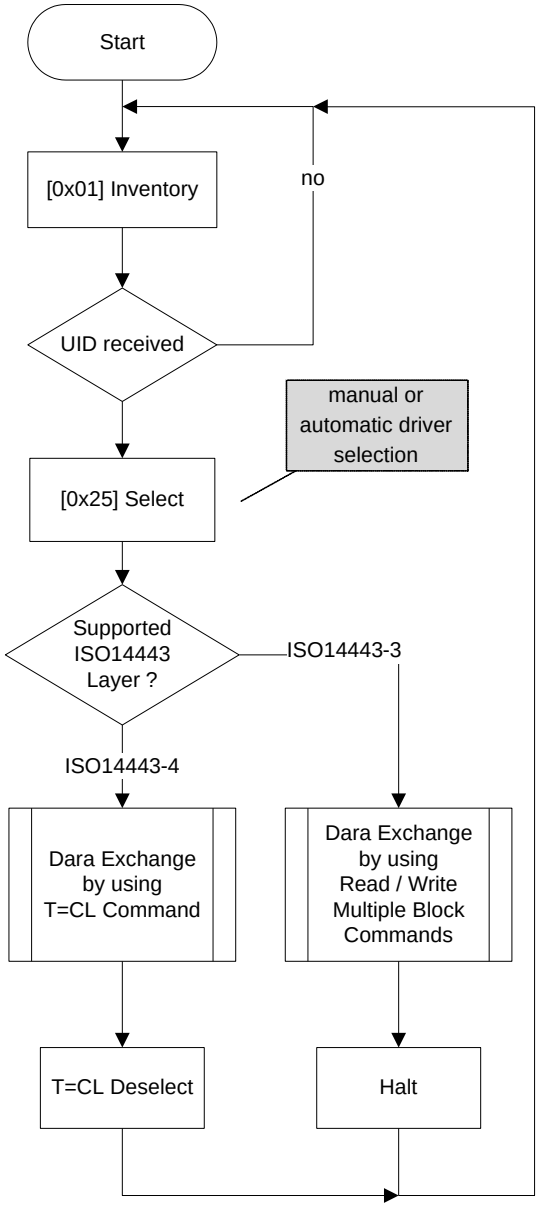
The response includes information's about the selected transponder type.

The select command offers the option of an automatic type identification or to select explicit a Transponder driver.

Data Exchange:

Depending on the ISO14443 Layer supported by the transponder different commands are offered for data exchange.

Details about the supported commands are described in chapter 7. Supported ISO Host commands.



2.2.2. Contactless EMVCo Mode

If contactless EMVCo mode is activated the reader handles timeout control and error handling for ISO14443 RFID cards in conformance with EMVCo contactless Level 1 specification for contactless payment cards.

In EMVCo mode only the drivers for ISO14443-A and ISO14443-B are activated and the data rate is set static to 106 kbit/s.

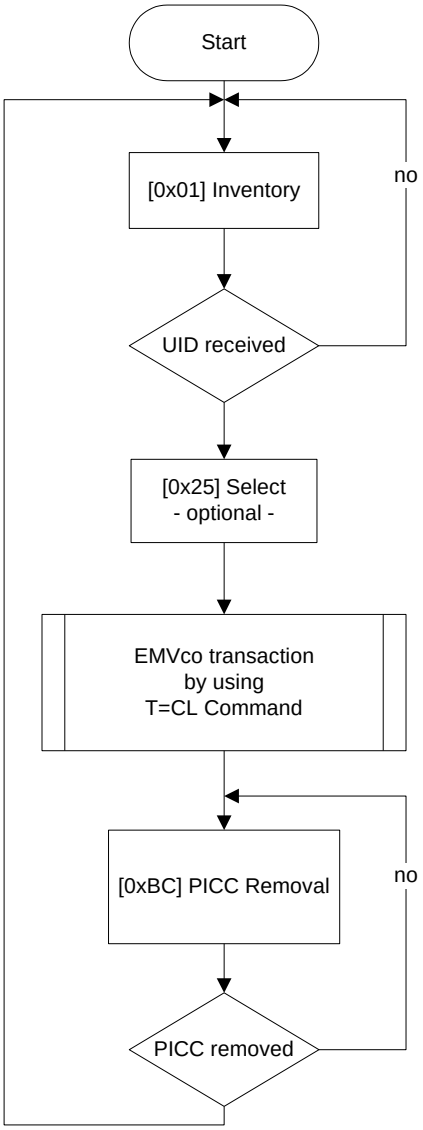
The adjacent flowchart shows a typical command flow to process a transponder in EMVCo mode.

Inventory Command (see: 5.1.1. [0x01] Inventory)

The behavior of the Inventory command is different to the standard mode. Inventory command doesn't include a RF-Reset and inventory command includes the selection of the transponder.

Because the transponder selection is part of the inventory command the UID is transmitted only one time. If the transponder is further located in the detection field of the reader antenna and the inventory command is send a second time the reader responds with Error-Status 0x01 "No Transponder".

In EMVCo mode the UID of a card is transmitted only if only one transponder was detected by the reader. If more than one transponder was detected the reader replies error status 0x0B (Collision Error).



Select Command (see: 5.1.2. [0x25] Select)

Because the Transponder selection is part of the inventory command the select command doesn't process communication with ISO14443-4 Transponder cards. Performing the select command for such cards is only necessary to get further information's about the detected transponder.

PICC Removal (see: 5.4.4. [0xBC] EMVCo PICC Removal)

This command is intended to check if an EMVCo PICC (Transponder) is further present in the operating field of the antenna or has left the operating field after a transaction was finished with the PICC

2.3. Scan-Mode for Transponder Communication

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 are read.

In Scan-Mode the content of the message block can be adapted to the user-application.

Scan-Mode is available via the asynchronous interface. The Scan-Mode interface can be configured by parameters in CFG1 (see chapter 3.2. CFG1: Interface). The kind of data, the data coding and the data volume can be configured (see 3.7. CFG6: Scan-Mode1 and 3.8. CFG7: Scan-Mode 2).

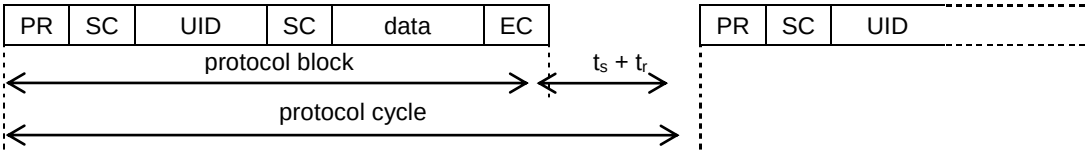
Scan-Mode via asynchronous interface:

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 Transponder in detection range only UID should be read:

PR	SC	UID1	EC	UID2	EC	UID3	EC

Example 3:

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

PR	SC	data1	EC	data2	EC	data3	EC

Example 4:

2 Transponder 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:	SCAN-LOCK-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 data-/clock interface:

The data will be put out depending to their configuration. In Scan-Mode via data-/clock interface the Reader can transmit either the UID or a data block of a Transponder but not both. Available data formats are magnet strip emulation or Wiegand emulation.

NOTICE:

- ***If configuration commands 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 in Scan-Mode.***

2.4. Data Format and Protocol Frames for bi-directional communication

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 offers an address byte for addressing devices within one data bus.

During data transfer the Reader supplies the required data or a status byte. The response contains the transmitted command byte.

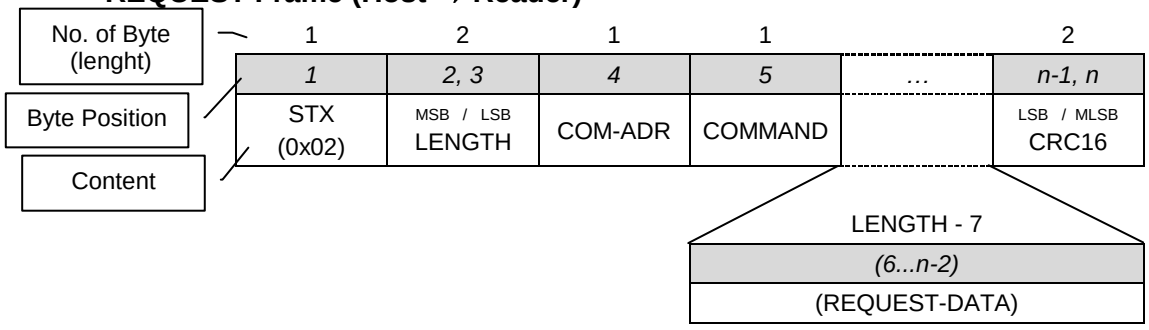
There is no reply from the Reader in case of a protocol frame failure.

The Reader supports two different Protocol frames which are the standard and the advanced protocol frame.

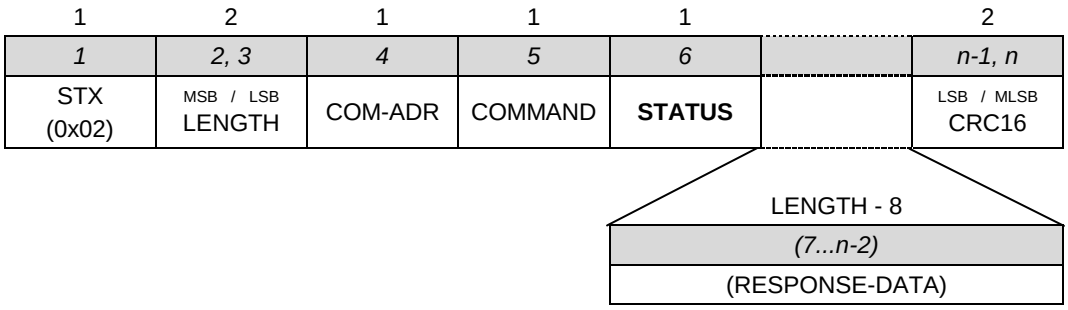
Advanced Protocol Frame

This frame is recommend for all new applications where RFID readers with Advanced Protocol Frame support are used. The Advanced Protocol Frame can transfer up to 65535 Byte per frame and uses a clear defined STX character.

REQUEST Frame (Host → Reader)



RESPONSE Frame (Host ← Reader)



NOTICE:

- ***In this document only the REQUEST-DATA and RESPONSE-DATA block is documented for each command without the protocol frame.***
- ***Optional parameters are documented inside of* round brackets "(Optional)"**

Standard Protocol Frame

The reader supports this frame to ensure the backward compatibility to older RFID reader devices only. The Standard Protocol Frame is limited to a 255 byte protocol length and is not recommended for new applications.

Request: Host → Reader

1	1	1	LENGTH-5	2
1	2	3	4...n-2	n-1, n
LENGTH (n)	COM-ADR	COMMAND	REQUEST-DATA	LSB / MLSB CRC16

Response: Host ← Reader

1	1	1	1	LENGTH-6	2
1	2	3	4	(5...n-2)	n-1, n
LENGTH (n)	COM-ADR	COMMAND	STATUS	(RESPONSE-DATA)	LSB / MLSB CRC16

Frame selection by the reader

If the host application chose advanced protocol frame the Reader will always response with advanced protocol frames.

If the host application chose the standard protocol frame the Reader's response will depend on the length of the response data. If the response data will result a protocol frame with more than 255 Byte the Reader chose the advanced protocol frame otherwise the Reader chose the standard protocol frame for responding.

2.4.1. Protocol Elements

STX:

The STX sign (0x02) at the start of protocol indicates an Advanced Protocol-Frame.

LENGTH:

Standard Protocol Frame (6...255)

Number of protocol bytes including LENGTH and CRC16.

Advanced Protocol Frame (7...65535)

Number of protocol bytes including STX, LENGTH and CRC16

COM-ADR:

0..253 address of device in bus mode

NOTICE:

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

COMMAND:

Defines the Command which the Reader shall operate.

STATUS [1]:

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 ISO-Host Command Mode.

CRC16:

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

Polynomial $x^{16} + x^{12} + x^5 + 1$

Start Value 0xFFFF

[1] see ANNEX C: Index of Status Bytes

2.4.2. Timing Conditions

Protocol Start Synchronization Time (PSST):

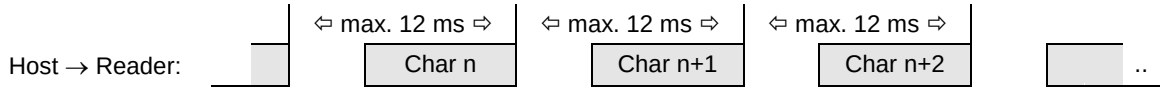
Before starting a new request protocol there must be a gap without any communication of normally 5 ms after the reception of the last byte of the response protocol. The PSST is configurable by the parameter PSST in 3.2. CFG1: Interface.

Block timeout:

Defines the time within the reader response can be expected by the host. The host block timeout shall be set to value longer than the time configured in CFG1.TR-RESPONSE-TIME.

Character timeout:

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



2.4.3. CRC16 Calculation Algorithm

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

Start Value: 0xFFFF $\Rightarrow$ 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);
  }
}
```

3. 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 used in chapter 4. Configuration and Control Commands

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 faulty checksum 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 4.3. [0x63] CPU 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.

Byte	0	1	2	.....n
contents	RAM-eff.	EEPROM-eff.	00 res	.....

not marked

Changing of this parameter becomes immediately effective after writing / saving this configuration block to RAM

gray marked

Changing of this parameter only becomes effective after writing / saving this configuration block to EEPROM and a Reader reset

marked with “00“

these bits or bytes are reserved for future extensions or for internal testing and manufacturing-functions. These bits or bytes and also any not described bits and bytes **must not be changed**, as this may cause faulty operation of the Reader.

3.1. CFG0: Reserved

The configuration block CFG0 is reserved for future use.

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	0x00	0x00
Default	0x00	0x00	0x00	0x00	0x00	0x00	0x00

3.2. CFG1: Interface

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	TRANS-FORM	0x00	PSST	TR-RESPONSE-TIME
Default	0x00	0x00	0x08	0x01	0x00	0x00	0x00
			38400 Baud	*e,8,1*		*0 ms*	
EMVCo							

Byte	7	8	9	10	11	12	13
Contents	TR-RESPONSE-TIME	0x00	0x00	0x00	SCAN-INTERFACE	0x00	READER - MODE
Default	0x3C	0x00	0x00	0x00	0x00	0x00	0x00
	6 sec.						
EMVCo	*0x3C*						
	6 sec.						

COM-ADR:

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 its configured address.***

BAUD[1]**:**

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

BAUD	Baudrate	Unit
0x05	4.800	bit/s
0x06	9.600	bit/s
0x07	19.200	bit/s
0x08	38.400	bit/s
0x09	57.600	bit/s
0x0B	115.200	bit/s
0x0D	230.400	bit/s

NOTICE:

- ***Make sure that your host system supports the selected baud rate. If not it's impossible to communicate with the reader any longer after the baud rate was changed!***
- ***Changing of BAUD only becomes effective after writing / saving configuration block CFG1 to EEPROM and a reset of the Reader.***

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

D: Number of data bits
- b0: 8 data bits
- b1: **- do not use -**

S: Number of stop bits
- b0: 1 stop bit
- b1: **- do not use -**

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

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

NOTICE:

- ***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***

PSST (Protocol Start Synchronization Time) 0...5 ms

By means of this parameter the duration of the minimum communication gap between the reception of the last byte of the response protocol and the first byte of a new protocol can be defined in 1 ms steps (see also 2.4. Data Format and Protocol Frames)

The parameter could be used to speed up the communication via the asynchronous interface.

0: The Reader response starts as soon as possible

5: Maximum value for PSST (5 ms) **TR-RESPONSE-TIME:**
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 be sent an answer protocol. In this case, the current commands between Reader and Transponder are aborted.

	max. response duration
TR-RESPONSE-TIME	0...65535 * 100 ms

NOTICE:

- ***TR-RESPONSE-TIME has no effect with the protocols for Reader Configuration and the protocols for Reader Control.***
- ***The block receive timeout of host computer must set to a value ≥ TR-RESPONSE-TIME.***

SCAN-INTERFACE:

Selection of the communication interface for Scan-Mode

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

IF-NO: Interface Number
b000: RS232
bxx1: **- do not use -**
bx1x: USB
b1xx: **- do not use -**

READER-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 5. ISO Host Commands)

b1: **Scan Mode** (see chapter 3.7. CFG6: Scan-Mode1)

Note:

- ***Scan Mode is not possible if the reader is configured for EMVCO-Mode in*** 3.13. CFG12: EMVCo Settings

3.3. CFG2: Inputs / Outputs general

Via the following parameters the operation mode of the outputs can be configured at any time. Two byte each is reserved for the offline, online and tag-detect position, by means of which the individual operation modes according to the schedule below may be adjusted. In addition to this, different flashing frequencies of the outputs may be defined.

Byte	0	1	2	3	4	5	6
Contents	0x00	0x00	ONLINE-STATE		0x00	0x00	0x00
Default	0x00	0x00	0x0000		0x00	0x00	0x00

Byte	7	8	9	10	11	12	13
Contents	OFFLINE-STATE		OFFLINE-DELAY	TAGDETECT-STATE		TAGDETECT ACTIVATION TIME	CPR-MUX
Default	0x0000		0x14	0x0000		0x00	0x00

ONLINE-STATE

This Parameter defines the behavior of the signal transmitters if they are not activated by any other event.

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

Bit:	7	6	5	4	3	2	1	0
Function:	-		OUT3		OUT2		OUT1	

OUT1 / OUT2 / OUT3

The bit combination defines the behavior of the signal transmitter

b00: OFF
b01: ON
b10: FLASHING SLOW
b11: FLASHING FAST

OFFLINE-STATE

This parameter defines the behavior of the signal transmitter, in case of the reader has detected an offline state. The following cases are possible:

Polling-Mode:

In case of polling mode the reader starts to signalize the offline state if it has received no command from the host for more than the time defined by the parameter OFFLINE-TIME.

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

Bit:	7	6	5	4	3	2	1	0
Function:	-		OUT3		OUT2		OUT1	

OUT1 / OUT2 / OUT3

The bit combination defines the behavior of the signal transmitter

b00: OFF
b01: ON
b10: FLASHING SLOW
b11: FLASHING FAST

OFFLINE-DELAY

This parameter defines the duration in 100 ms increments, after the Reader will signalize the offline state if it had not received a command via the host interface.

0 ... 255 x 100 ms ⇒ 0 ... 25,5 sec

TAGDETECT-STATE

This parameter defines the behavior of the signal transmitter if a new transponder was detected by the reader.

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

Bit:	7	6	5	4	3	2	1	0
Function:	-		OUT3		OUT2		OUT1	

OUT1 / OUT2 / OUT3

The bit combination defines the behavior of the signal transmitter

b00: OFF
b01: ON
b10: FLASHING SLOW
b11: FLASHING FAST

TAGDETECT-ACTIVATION-TIME

This parameter defines the duration in 100 ms increments, the Reader signalize a transponder was detected.

0 ... 255 x 100 ms ⇒ 0 ... 25,5 sec

CPR-MUX:

This parameter enables the communication to the external ID CPR.MUX.

b0: Communication to the external ID.CPR.MUX disabled.
b1: Communication to the external ID.CPR.MUX enabled.

NOTICE:

When the ID.CPR.MUX communication is enabled the command 4.9. [0x72] Set Output ***is not allowed by the firmware.***

3.4. CFG3: RF-Interface

The parameters of the CFG3 configuration block contain global Transponder driver and Reader settings.

Byte	0	1	2	3	4	5	6
Contents	TAG-DRV		ISO14443-DRV		0x00	0x00	0x00
Default	0x0038		0x000F		0x00	0x00	0x00
EMVCo	*0x0030*		*b xxxx xxxx xxxx 1xxx*				

Byte	7	8	9	10	11	12	13
Contents	ISO14443 BIT RATE	0x00	0x00	0x00	0x00	ISO14443 STUPT	ISO14443 FTUR
Default	0x00	0x00	0x00	0x00	0x00	0x00	0x1A
EMVCo							

TAG-DRV[1]**:**

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	SEL	0	N	0	L	K	J	I	0	0	F	E	D	0	0	0
Default	0	0	0	0	1	1	0	1	0	0	1	1	0	0	0	0

b0: Driver for the Transponder type is disabled

b1: Driver for the Transponder type is activated

.D: Driver for ISO15693

.E: Driver for ISO14443A

.F: Driver for ISO14443B

.I Driver for Jewel

.J: Driver for ISO18000-3M3 *(need to be released by an upgrade code)*

.K Driver for SR176

.L Driver for SRIxx

.N Driver for FeliCa

.SEL Selector

This parameter offers the option to enable further drivers which may not part of bit field TAG-DRV and the option to define the call order of the enabled transponder drivers.

b0: Select drivers from CFG3.TAG-DRV with fixed call order.

b1: Select drivers from 3.12. CFG11: Tag Driver Priority List with user defined call order. Drivers from CFG3.TAG-DRV are ignored.

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

Only those Transponder drivers should be active that are used in the current 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.

ISO14443-DRV:

Defines the ISO 14443 Transponder types that are read/write operated by the Reader. Reading of the UID is also possible if the driver is inactive, because of the standardized ISO14443 access conditions.

If more than one Transponder driver is activated The Reader attempted by means of some indications to decide about the Transponder type.

To guarantee that the Reader only processes the correct Transponder type the not required drivers should be disabled.

Byte:	2								3							
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	0	L4	C	B	A

b0: Driver for the Transponder type is disabled

b1: Driver for the Transponder type is activated

- A: Driver for mifare Standard
- B: Driver for my-d proximity SLE55Rxx
- C: Driver NFC Card Type 2 (e.g. mifare ultralight, my-d move, etc.)
- L4 Driver for ISO14443A, Part 4 compatible Transponders

NOTICE

In EMVCo Mode the L4 driver is enabled in any case. The other driver settings are not modified by EMVCo Mode.

ISO14443 BIT RATE:

This parameter defines the highest Bit-Rate which shall be used by the Reader. The actual used Bit-Rate depends on the capabilities of the present Transponder. If the adjusted Bit-Rate is not support by the Transponder the Reader select the highest supported Bit-Rate of the Transponder.

Bit:	7	6	5	4	3	2	1	0
Function	Tx BIT RATE		Rx BIT RATE		-	-	-	-

TX BIT RATE

Used for bit rate selection from Reader to Transponder

b00: 106 kbit / s

b01: 212 kbit / s

b10: 424 kbit / s
b11: 848 kbit / s

RX BIT RATE

Used for bit rate selection from Transponder to Reader
b00: 106 kbit / s
b01: 212 kbit / s
b10: 424 kbit / s
b11: 848 kbit / s

NOTICE:

- ***A high Bit-Rate could affect a reduction of the reading distance due to a higher power consumption of the Transponder***
- ***It is recommended to use identical Bit-Rates for RX and TX.***

ISO14443 STUPT (1 ... 255 * 5 ms = 5 ms ... 1,275 sec)**:**

The Startup Time defines a delay-time which is required by a ISO14443 Transponder for startup after the RF-Field was switched on (e. g. after a command [0x69] RF Reset).

NOTICE:
The value of ISO14443 STUPT must be considered for calculating the TR-RESPONSE-TIME (see 3.2. CFG1: Interface)

ISO14443 FTUR:

In this parameter byte are some special features combined.

Bit:	7	6	5	4	3	2	1	0
Function	UID-ORDER			OPTI	ERROR_RETRY		PLIC	BSLCT

BSLCT (only ISO 14443B Transponder)

This bit selects the response behavior for ISO 14443B Transponder with Bit-Rates above 106 kbit/s.

The Reader principally uses 106 kbit/s for the first communication cycle. If the Transponder supports a higher Bit-Rate and this is configured by the parameter ISO14443 BIT RATE the Reader selects the highest possible Bit-Rate.

Unfortunately the reception from the Transponder could be on 106 kbit/s ore on the new higher Bit-Rate.

b0: The first reception after a Bit-Rate change is expected with 106 kbit/s.

b1: The first reception after a Bit-Rate change is expected with the selected higher Bit-Rate.

PLIC (only ISO 14443-4 Transponder)

This bit enables the power level indicator check function of the Reader.

b0: Power level check is disabled.

b1: Power level check is enabled.
The power level indicator of ISO 14443-4 Transponders will be interpreted by the Reader if it is supported by the Transponder.

If a Transponder response indicates insufficient power the reader breaks the present command and sends an error status.

ERROR_RETRY (only ISO 14443-4 Transponder)

This parameter defines the maximum number of automatic retry loops in case of transmission or protocol errors as described in ISO 14443-4.

b00: disables retry loop

b01: 1 retry loop

b10 2 retry loops

b11: 3 retry loops

OPTI (only ISO14443A Transponder)

By means of this bit some optional information's could be displayed for ISO14443A in the [0x01] inventory response byte OPT_INFO (see also 5.1.1. [0x01] Inventory)

b0: The OPT_INFO byte in [0x01] inventory response is always set to 0.

b1: The OPT_INFO byte in [0x01] inventory response includes further Information's.

UID_ORDER (only ISO14443A Transponder)

By means of this bit the byte order of the UID of ISO14443A Transponder can be swapped.

b0: The UID will be transferred as described in 5.1.1.1. Response-Data – ISO 14443A (TR-TYPE = 0x04).

b1: The byte order of the transferred UID will be swapped (UID transfer will be carried out like described in ISO14443).

Note:

- ***18000-3M3:***
  The parameters for 18000-3M3 are fixed
  - ***Bit modulation: 4 subcarrier pulse modulation (53 kbit/s, FL = 424kHz)***
  - ***Tari = 25***
  - ***Data_0 = 1.0 x Tari, Data_1 = 1.5 x Tari***
  - ***Session = 2***
  - ***Qmax = 4 (16 Slots)***

3.5. CFG4: Transponder Parameters

The parameters of the CFG4 configuration block contain general Transponder settings.

Byte	0	1	2	3	4	5	6
Contents	0x00	0x00	0x00	0x00	ISO 15693 MODE	ISO 15693 AFI	ISO 15693 OPTION
Default					0x0	0x00	0x00

Byte	7	8	9	10	11	12	13
Contents	0x00	ISO14443B-AFI	0x00	0x00	0x00	IDDIB	ISO 15693 BLOCKSIZE
Default		0x00				0x00	0x04

ISO 15693 MODE:

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

AFI

b0: disabled
b1: enabled

Note:

- ***Other parameters are fix***
  - ***DATACODING: Fast Mode (1/4)***
  - ***MOD: 10%***
  - ***SUB-CARRIER: ASK***
  - ***DATA-RATE: High (26.5kbit/s)***
  - ***NO-TS: 1 timeslot***

ISO 15693 AFI:

Application Family Identifier to select a Transponder

ISO 15693 OPTION:

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

WR-OPTION:

b00: automatically set
b10: Tag Option = 0
b11: Tag Option = 1

Note:

- ***If WR-OPTION is automatically set, the Reader sets the WR-OPTION to 0, if the ISO15693 Host Command is in non-addressed mode. In the case of a Tag-it HF-I Standard/Plus/Pro the WR-OPTION must be set to 1 for all Write and Lock commands to respond properly.***

- ***See chapter*** 7.4. ISO15693 Transponders ***for more details about the correct WR-OPTION.***

ISO14443B-AFI: (only ISO14443B Transponders)

Application Family Identifier for ISO14443 type B Transponder. For more information's refer to ISO14443-3.

IDDIB:

(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 for ISO18000-3M3 transponders.

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

ISO15693 BLOCKSIZE:

Bit:	7	6	5	4	3	2	1	0
Function	Read Mode		Blocksize	DB-Blocksize				

DB-Blocksize:

Defines the block size of an ISO-transponder which is not listed in the MFR-table (see: 7.4. ISO15693 Transponders) or if the transponder is used in the non-addressed mode.

Range: 0x01 ... 0x1F

A value of 0x00 will be automatically set to a block size of 4byte.

Blocksize:

b0: Automatic (If transponder is known)

b1: Manuel (As specified in DB-Blocksize)

Read Mode:

b00: Automatic Mode (If transponder is known)

b01 Single Read

b10 Multiple Read

3.6. CFG5: Anticollision

The parameters of the CFG5 configuration block contain anticollision 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
EMVCo							

Byte	7	8	9	10	11	12	13
Contents	0x00	0x00	0x00	reserved	ONT	0x00	0x00
Default	0x00	0x00	0x00	0x02	0x0C	0x00	0x00
EMVCo					*0x0D*		

ONT:

This parameter configures the reply behavior of the Inventory command [0x01]. It defines which Transponder will reply to the host.

Bit:	7	6	5	4	3	2	1	0
Driver	0	0	0	0	AORB_REQ	ACOLL	0	ONT

ONT:

b0: All Transponder in Reader field
The response of the Inventory command [0x01] includes the UID of all detected Transponders in the detection range of the reader.

The Reader performs a RF-Reset before any command reads a UID.

b1: Only new Transponder in Reader field
The response of the Inventory command [0x01] includes only the UID of new detected Transponders.

If the Reader has detected a new Transponder, the Transponder will be automatically set to into the halt state (ISO14443, but not Jewel) by the Reader. In this state the Transponder does not send back a response for the next Inventory command.

The UID of a Transponder will replied only after the Transponder reenters into the detection range of the reader. Otherwise the Reader replies the Status "No Transponder" (0x01).

ACOLL:

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

b0: disabled
In this case the Reader doesn’t process any anticollision procedure with the Transponders inside the antenna field.

If anticollision is disabled, the Reader automatically selects ISO14443 Transponders. The Select command [0x25] is not necessary for further communication with the Transponder.

If more than one Transponder of the same type is in the detection range the Reader replies an error status.

b1: enabled (default)
In this case the Reader processes the anticollision procedure with the Transponders inside of the antenna field and replies the UID of all detected Transponder's.

AORB_REQ:

This parameter defines the abort conditions of the Inventory command [0x01] for ISO14443 Transponder if the ISO14443A and ISO14443B Transponder drivers are activated.

b0: disabled (default)
The Inventory command runs while not all UIDs of ISO14443A and ISO14443B Transponders in the detection range are read.

b1: The Inventory command stops if the UID of all ISO14443A or of all ISO14443B Transponders in the detection range are read. So the Inventory command returns either the presence of ISO14443A or ISO14443B Transponders.

3.7. CFG6: Scan-Mode1

The parameters of the CFG6 configuration block contain Scan-Mode settings. To enable the Scan-Mode the SCAN-MODE bit in configuration block CFG1 (3.2. CFG1: Interface) has to be set.

Byte	0	1	2	3	4	5	6
Contents	UltralightC-KEY_ADR	reserved	reserved	SCAN-DATA1	SCAN-DATA2	AUTH_EN	SCAN-LOCK-TIME
Default	0x00	0x00	0x00	0x11	0x00	0x00	0x00

Byte	7	8	9	10	11	12	13
Contents	SCAN-LOCK-TIME	MAD_AID		SCAN-KEY_ADR	DB_ADR	D_LGT	D_START
Default	0x0A	0x0000		0x00	0x05	0x04	0x00

UltralightC-KEY_ADR (0 … 3):

Defines the Ultralight C key address which will be used for authentication at the secured block which should be read in Scan Mode.

The key for authentication used by the reader can be stored into the readers EEPROM or RAM (see manual: **H01110-xe-ID-B.pdf**).

Note:

- ***To read data blocks from a mifare Ultralight C in Scan Mode the reading of data blocks and the "Authent for mifare Ultralight C" (CFG11.AUTHENT_EN) has to be enabled. Please consider that the Driver for ISO14443-A and also the ISO14443-DRV C-Bit has to be enabled in 3.4. CFG3: RF-Interface configuration block.***

SCAN-DATA1

selects the data types to be sent in the Scan Mode.

Bit:	7	6	5	4	3	2	1	0
Function	Byte Order	COM-Prefix	MAD	Byte Order [ProcessorCards]	0	BCD_UID	DB	UID

NOTICE:

- ***If Scan-Mode via asynchronous interface is selected reading of UID and Data-Block can be configured at the same time.***

UID = Serial No.

Setting of this bit activates the output of the UID

b0 Output of the UID inactive (inactivates the scan-mode)
b1 Output of the UID active

DB = Data Block

Setting of this bit activates the output of a specified data field (see also parameter DB_ADR_H/L, D_LGT and D-START)

b0 Output of a data field inactive
b1 Output of a data field active

In case of memory cards like mifare classic the reader internally uses commands equivalent to the ISO-Host command Read-Multiple Block [0x23] whereby the parameter DB_ADR_H/L, D_LGT and D-START becomes to relevant to define the data which shall be read.

In case of mifare classic data block shall be read see also the parameter SCAN_KEY_ADR, MAD_ID and MAD Bit

CFG10 Scan Mode – Mifare DESFire Settings

BCD_UID = Serial No. in BCD format

Setting of this bit activates the output of the UID in BCD format if the UID Bit set. In this case the least significant 4 hexadecimal Bytes of the UID are transformed into their 10 digit decimal equivalent value.

b0 Output of the BCD_UID inactive (inactivates the scan-mode)
b1 Output of the BCD_UID active

Depending on the selected scan mode interface (see CFG1) and data format (see CFG7, DB-FORMAT) the output of the BCD transformed UID can be configured in different ways.

Example:
The hexadecimal UID is 0x38 F3 7B 29
The decimal value is: 0955480873

Scan-Mode: via asynchronous interface

ASCII formatted hex data
output: 0x30 0x39 0x35 0x35 0x34 0x38 0x30 0x38 0x37 0x33

Byte Order [Processor Cards]

Defines the byte Order within frame

b0 MSB first
b1 LSB first

MAD: (Mifare Application Identifier)

Setting of this bit activates the MAD function for reading data blocks of mifare classic Transponders. It becomes only effect if the DB bit is set to 1.

b0 MAD function is inactive

b1 MAD function is active
In this operation mode the parameter MAD_ID becomes effect and some other scan-mode parameters becomes a different function.

NOTICE
Further details about the MAD functionality are described in Mifare Application Directory documentation issued by NXP Semiconductors.

COM Prefix

When this option is on, the Reader will transmit the COM-ADR before each data set.

b0 COM-ADR of the Reader will not transmit
b1 COM-ADR of the Reader will transmit

Note:
If the COM Prefix is enabled the COM-ADR will be send in front of the Header

Byte Order

Defines the byte Order within frame

b0 MSB first
b1 LSB first

SCAN-DATA2

selects the data types to be sent in the Scan Mode.

Bit:	7	6	5	4	3	2	1	0
Function	0	0	0	ANT_ EXT	0	0	0	INDPD

INDPD

Via this bit an independent transmission of the UID can be configured if the reading of UID and DB is activated.

b0: In this case the reader starts the output of the UID and DB data block as soon as all required data (UID and DB) have been read from the Transponder successful. If the reader cannot read the DB data block no UID will be transmitted.

b1: In this case the Reader transmits the UID independent form a successful reading of the DB data block.

ANT_EXT: Antenna Extended

b1: Antenna number

AUTHENT_EN:

Via the bits of AUTHENT_EN the support of transponder types with proprietary security functions can be enabled and disabled for Scan Mode, if data blocks should be read.

Bit:	7	6	5	4	3	2	1	0
Function	0	0	MFU_C	MFP_SL1	0	0	MFP_SL3	DF

DF (mifare DESFire):

b0: Data reading of mifare DESFire is disabled.

b1: Data reading of mifare DESFire is enabled. Additional settings in configuration block CFG10 are required.

MFP_SL3 (mifare PLUS, Security Level3):

b0: Data reading of mifare PLUS SL3 is disabled.

b1: Data reading of mifare PLUS SL3 is enabled. Additional settings in configuration block CFG9 are required.

MFP_SL1 (mifare PLUS, Security Level1):

This setting can be used to enable the additional security functions of mifare PLUS SL1 in Scan Mode which enables a easy migration from mifare classic to mifare PLUS SL1.

b0: Data reading of mifare Classic and mifare PLUS SL1 are enabled. Therefore additional settings for mifare classic have to be considered.

b1: This setting enables the additional AES Authent for mifare PLUS SL1 which is not supported by mifare classic chips. Additional settings in configuration block CFG 9 are required.

MFU_C (mifare Ultralight C):

This setting can be used to enable the additional security functions of mifare Ultralight C in Scan Mode.

b0: Standard mifare Ultralight / mifare Ultralight C (plain) / NFC Card Type 2 / my-d move (plain) are enabled.

b1: Only mifare Ultralight C (secured) supported. Additional settings in configuration block CFG6 are required.

The following table shows the dependency with CFG11 Tag-Driver configuration block for different transponder types and reading of data blocks:

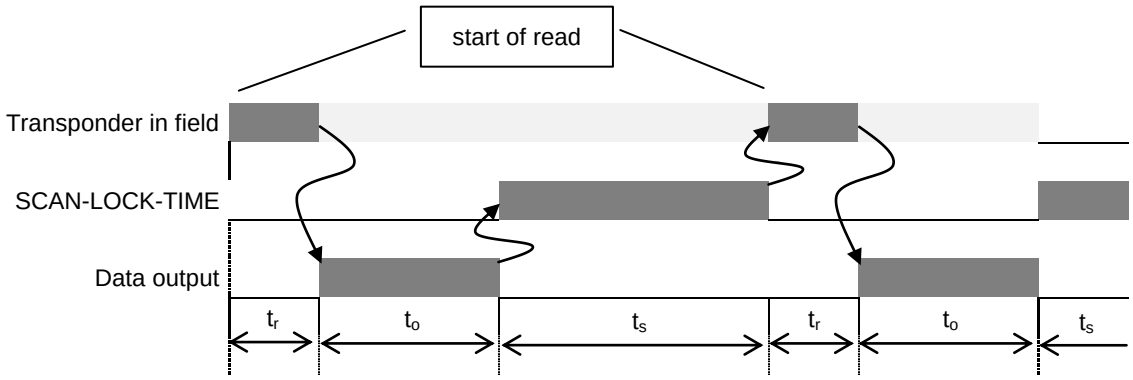
Transponder Type	CFG11.TAG-DRV	CFG3.ISO14443-DRV	CFG6.AUTHENT_EN
ISO15693	ISO15693	-	-
mifare classic and mifare PLUS (SL1)	ISO14443A	A	-
mifare PLUS (SL1) only	ISO14443A	A	MFP_SL1
mifare Ultralight, mifare Ultralight C (plain), NFC Tag Type 2 and and my-d move (plain)	ISO14443A	C	-
mifare Ultralight C (secured) only	ISO14443A	C	MFU_C
mifare DESFire	ISO14443A	L4	DF
mifare PLUS (SL3)	ISO14443A	L4	MFP_SL3

NOTICE:

It is recommend to enable only transponder types which are used in the application.

SCAN-LOCK-TIME: (1 ... 65535 * 100 ms = 100 ms ... 6553,5 sec)

The SCAN-LOCK-TIME defines the period in which the Reader does not transmit the Transponder data a second time, after the Reader had transmitted it the first time (regardless whether the Transponder is in the detection range of the reader during SCAN-LOCK-TIME or not). The SCAN-LOCK-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: SCAN-LOCK-TIME
As long as the SCAN-LOCK-TIME is active, the Transponder can be in the detection range of the reader or outside of it.

MAD_AID

Parameter to configure the 2 byte AID (Application Identifier) of the MAD function.

SCAN-KEY_ADR

Defines the mifare key address to be used for authentication at the mifare block which shall be read in scan-mode.

This parameter is designed to be used if the mifare block is directly addressed via DB_ADR or indirect addressed via MAD function.

The command 4.15. [0xA2] Write Mifare Reader Keys describes how to store a key in the reader.

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

KEY-TYPE:

Defines how the key will be used in authentication process.

0 KEY-A
1 KEY-B

KEY-ADR: (0x0 .... 0xF)

Address of the Key which will be used for authentication.

DB_ADR (0x00 .... 0xFF):

depending on the setting of the MAD bit in parameter SCAN-DATA this parameter can have two functions

case MAD = 0

DB_ADR_H and DB_ADR_L defines the absolute Transponder address of the first data block which will be transferred in Scan-Mode. The maximum address depends on the memory size and organization of the respective Transponder (see 7. Supported ISO Host commands)

case MAD = 1

DB_ADR_H and DB_ADR_L defines the relative data block address within one mifare sector which will be transferred in Scan-Mode in MAD function, if a mifare classic Transponder is currently detected by the reader. The maximum address range depends on the memory size and organization of the respective mifare Transponder as displayed in the following table.

	Sector 0...15	Sector 16...31	Sector 32...39
mifare 1k	0...2(3)	-	
mifare 4k	0...2(3)		0...14(15)

Values in brackets () includes the mifare sector trailer block.

D_LGT:

D_LGT defines the length of raw data which are transmitted in the Scan-Mode. Depending on the selected READER-MODE (see: 3.2. CFG1: Interface) D_LGT will be interpreted in different ways. The Parameter D_LGT has only effect to the transmission of a Data Block, defined by DB_ADR.

NOTICE:
In case of a mifare classic Transponder the maximum range of D_LGT and D_START are limited by the end of the mifare sector.

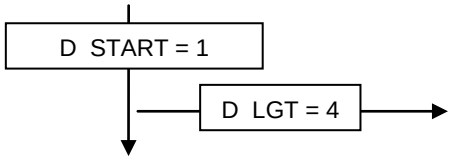
Case Scan-Mode via asynchronous interface:

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

NOTICE:
D_LGT must be less than 128 byte. Otherwise the reader truncates the supernumerary bytes.

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:

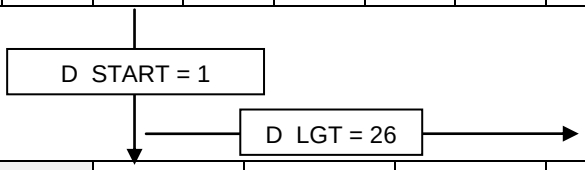
D_LGT = Number of **data bits** to be transferred, started with the D_START.

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

D_START:

This parameter defines the starting byte in the raw data on which D_LGT starts. The Parameter D_START has only effect to the transmission of a Data Block, defined by DB_ADR_1/0.

3.8. CFG7: Scan-Mode 2

The CFG7 configuration block contains additional parameters to format the data output in Scan Mode.

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		

DB-USE:

Defines the output data format for scan mode data (Data Block and UID)

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

DB-FORMAT

depending on the SCAN-MODE interface of the kind of data interpretation and the data format can be configured.

Asynchronous or data-/clock interface

b0000 unformatted hex data

In this case the data are transferred as they were read from the Transponder.

b0010 ASCII formatted hex data

In this case the raw data bytes from the Transponder first are separated into their nibbles and then changed into ASCII chars according Table 1: Hex data to ASCII conversion 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

Table 1: Hex data to ASCII conversion table

SEP-CHAR:

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

SEP-CHAR	ASCII	Hex
b0000 0000	none	none
b0000 0001	CR+LF	0x0D and 0x0A
b0000 0010	LF	0x0A
b0000 0100	CR	0x0D
b0000 1000	TAB	0x07
b0001 0000	‘;’	0x3B
b0010 0000	‘,’	0x2C
b0100 0000	‘ ‘	0x20
b1000 0000	USER	user defined in SEP-USR

Note:

Only one option can be selected.

SEP-USR:

User defined separation character.

END-CHAR:

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

END-CHAR	ASCII	Hex
b0000 0000	none	none
b0000 0001	CR+LF	0x0D and 0x0A
b0000 0010	LF	0x0A
b0000 0100	CR	0x0D
b0000 1000	TAB	0x07
b0001 0000	‘;’	0x3B
b0010 0000	‘,’	0x2C
b0100 0000	‘ ‘	0x20
b1000 0000	USER	user defined in END-USR

NOTICE:

Only one option can be selected.

END-USR1…3:

User defined end character.

HEADER-USR1...4:

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

b0000 END-USR1

b0001 END-USR1

b0010 END-USR1 +2

b0011 END-USR1 + 2 + 3

HEADER-LEN

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

3.9. CFG8: Scan Mode – ISO15693/ISO18000-3M3 Settings

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

Byte	7	8	9	10	11	12	13
Contents	reserved	reserved	BANK	DB_ADR_ISO15693		D_LGT_ ISO15693	D_START_ ISO15693
Default	0x00	0x00	0x00	0x00	0x00	0x00	0x00

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:

In case of ISO18000-3M3 Transponder BANK_NR is defined as follows:

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

DB_ADR _ISO15693 (0x0000 .... 0xFFFF)

DB_ADR_ISO15693 defines the absolute Transponder address of the first data block which will be transferred in Scan-Mode. The maximum address depends on the memory size and organization of the respective Transponder (see 7. Supported ISO Host commands).

D_LGT_ISO15693:

D_LGT_ISO15693 defines the length of raw data which are transmitted in the Scan-Mode. Depending on the selected READER-MODE (see: 3.2. CFG1: Interface) D_LGT_ISO15693 will be interpreted in different ways. The Parameter D_LGT_ISO15693 has only effect to the transmission of a Data Block, defined by DB_ADR_ISO15693.

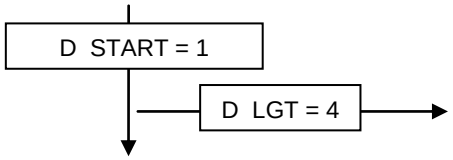
Case Scan-Mode via asynchronous interface:

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

NOTICE:
D_LGT must be less than 128 byte. Otherwise the reader truncates the supernumerary bytes.

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

D_START:

This parameter defines the starting byte in the raw data on which D_LGT_ISO15693 starts. The Parameter D_START_ISO15693 has only effect to the transmission of a Data Block, defined by DB_ADR_15693.

3.10. CFG9: Scan Mode - Mifare Plus Settings

The parameters of the configuration block CFG9 contain settings which have to be defined if data from a mifare PLUS SL3 should be read in Scan Mode or if an additional AES Authent for a mifare PLUS SL1 should be performed.

mifare PLUS SL1:

To perform an additional AES Authent for a mifare PLUS SL1 in Scan Mode the reading of data blocks and the “Authent for mifare PLUS SL1” (CFG6.AUTHENT_EN) has to be enabled. General settings for mifare Classic must be defined in 3.7. CFG6: Scan-Mode1 configuration block.

mifare PLUS SL3:

To read data blocks from a mifare PLUS SL3 in Scan Mode the reading of data blocks and the “Authent for mifare PLUS SL3” (CFG6.AUTHENT_EN) has to be enabled. Please consider that the Driver for ISO14443-A and also the ISO14443-DRV L4-Bit has to be enabled in 3.4. CFG3: RF-Interface configuration block.

The reader internally uses the [0xC2] SoftCrypto commands (see: manual H01110-xe-ID-B) to read and decipher the mifare PLUS data.

Byte	0	1	2	3	4	5	6
Contents	0x00	MFP_SL3_ KEY_TYPE	MFP_SL3_ READER_ KEY_IDX	MFP_SL3_ READ_CMD	0x00	MFP_SL3_ BNO	MFP_SL3_ EXT
Default	0x00	0x00	0x00	0x33	0x00	0x00	0x01

Byte	7	8	9	10	11	12	13
Contents	MFP_SL1_ READER_ KEY_IDX	MFP_SL3_MAD_AID		0x00	0x00	0x00	0x00
Default	0x00	0x00	0x00	0x00	0x00	0x00	0x00

MFP_SL3_KEY_TYPE:

Defines the key type for the authentication with mifare PLUS SL3.

0x00: KEY A

0x01 KEY B

MFP_SL3_READER_KEY_IDX (0...3):

Index of the key which is stored in the reader (see: manual H01110-xe-ID-B) and which shall be used for mifare PLUS SL3 authentication before the read command.

MFP_SL3_READ_CMD (0x30...0x37):

Defines the [0xC2] SoftCrypto read command for mifare PLUS SL3 (see: manual H01110-xe-ID-B)

NOTICE:

Depending on the mifare PLUS SL3 Read-Command different security conditions can be configured. The following table shows how the security functions are influenced by the command.

mifare PLUS READ-CMD	MAC on Command	Data Encrypted	MAC on Response
0x30	yes	Yes	no
0x31	yes	Yes	yes
0x32	yes	No	no
0x33	yes	No	yes
0x34	no	Yes	no
0x35	no	Yes	yes
0x36	no	No	no
0x37	no	No	yes

MFP_SL3_BNO (0x00 … 0xFF):

Block number of the first block to be read from mifare PLUS SL3.

MFP_SL3_EXT:

Number of blocks to be read.

NOTICE:

The internal buffer is limited to 128 bytes of data.

MFP_SL1_READER_KEY_IDX (0...3):

Index of the key which is stored in the reader (see: manual H01110-xe-ID-B) and which shall be used for mifare PLUS SL1 authentication.

MFP_SL3_MAD_AID:

Parameter to configure the 2 byte AID (Application Identifier) of the mifare plus SL3 MAD function.

0x0000: Disables MAD function for mifare plus SL3.

> 0x0000: Enables MAD function for mifare plus SL3.

Note:
If indirect addressing via MAD is activated the parameter CFG9. MFP_SL3_BNO defines the relative data block address within one mifare plus sector which shall be read.

3.11. CFG10: Scan Mode - Mifare DESFire Settings

The configuration block CFG10 contains setting which has to be defined, if a data or a record file from a mifare DESFire shall be read in Scan-Mode.

To read a mifare DESFire file in scan-mode the scan-mode has to enabled in CFG1 (see 3.2. CFG1: Interface) and the reading of Data-Blocks has to be enabled (SCANTDATA1, bit DB = b1, 3.7. CFG6: Scan-Mode1). Please consider that the Driver for ISO14443-A (see 3.4. CFG3: RF-Interface, Parameter TAG-DRV) and also the ISO14443-DRV, L4 Bit has to enabled.

The reader internally uses the [0xC1] SoftCrypto commands (see 5.5. [0xC1] / [0xC3] ISO Host Commands for mifare DESFire Communication) to read and decipher the DESFire data.

Byte	0	1	2	3	4	5	6
Contents	DF_AID			DF_KEY_NO	READER_ KEY_IDX	DF_FILE_ID	DF_FILE _SETTINGS
Default	0x00	0x00	0x00	0x00	0x00	0x00	0x00
	LSB		*MSB*				

Byte	7	8	9	10	11	12	13
Contents	DF_FILE_OFFSET			DF_FILE_ LENGTH	RFU	RFU	0x00
Default	0x00	0x00	0x00	0x00	0x00	0x00	0x00
	LSB		*MSB*				

DF_AID:

DESFire Application ID in which the requested file (see DF_FILE) is stored.

DF_KEY_NO (0x0...0xE)

Defines the number of the key to which the authentication shall be processed on the DES-Fire to get access to the data. The KEY-No on DESFire is specified in the access rights for each file.

0x0....0xD:

DESFire Key no for enciphered access
If a data exchange with a enciphered or MACed file shall be processed the respective KEY-NO has to used here

0xE:

DESFire Key No for free access.

This setting is possible for "read", "write" and "read&write" access rights for each file on the card. If this setting is used for "read&write" access rights a different key setting for "read" access rights or "write" access rights becomes obsolete.

NOTICE:

Depending on the DESFire KEY-NO and FILE-COMM-SETTINGS different security conditions can be configured. The following table shows the possible combinations and how the security functions are influenced by these settings.

DESFire KEY-NO	FILE-COMM-SETTINGS	file access conditions	
		valid authentication required	data exchange
0x0...0xD	0x00	yes	plain
	0x01		plain + MAC
	0x03		enciphered
0xE	0x00 0x01 0x03	no	plain

READER-KEY-IDX (0...3)

Index of the key which is stored in the reader and which shall be used for authentication for the current command.

Notice

The key which is addressed with READER-KEY-IDX defines the authentication command and method. The addressed application has to configure in the same way.

DF_FILE

This parameter defines which file from a DESFire shall be read.

Bit:	7	6	5	4	3	2	1	0
Function	-	-	-	**FILE-NO**				

FILE-NO 0x0...0x1F:

No of the file which shall be read.

DF_FILE_SETTINGS

This parameter defines how a file from a DESFire shall be read.

Bit:	7	6	5	4	3	2	1	0
Function	**FILE-TYPE**		-	-	-	-	**FILE-COMM-SETTINGS**	

FILE-TYPE

coding of the file type of the dedicated file.

b00: Standard Data or Backup Data File

b01: Cyclic or Linear Record File

FILE-COMM-SETTINGS

coding of the communication mode of the dedicated file.

b00: Plain communication

b01: Plain communication secured by MACing

b11: Fully enciphered communication

DF_FILE_OFFSET:

Defines the position within a DESFire file where the read process shall start.

FILE-TYPE	FILE-	DF_FILE_OFFSET
b00	Standard Data File or Backup Data File	Defines the byte position within a DESFire Data file where the read process shall start.
b01	Cyclic Record File or Linear Record File	Defines the record no. which shall be read out. 0x00 00 00 defines the latest written record 0x01 00 00 defines next the latest written record

DF_FILE_LENGTH (1 ...128 Byte):

FILE-TYPE	FILE-	DF_FILE_LENGTH
b00	Standard Data File or Backup Data File	Defines the number of bytes which shall be read.
b01	Cyclic Record File or Linear Record File	Defines the size of the record (in bytes) which shall be read. Data are only transmitted if parameter DF_FILE_LENGHT is equal to the DESFire record length

Notice:

If parameter SCAN-MODE1, D_LGT < DF_FILE_LNGTH

superfluous data are truncated

If parameter SCAN-MODE1, D_LGT > DF_FILE_LNGTH

remaining data are filled with 0

3.12. CFG11: Tag Driver Priority List

The configuration block CFG11 contains a user definable call order of the tag drivers during the command [0xB0][0x01] Inventory.

The settings of CFG11 are only active, if bit CFG3.TAG-DRV.SEL is set.

Byte	0	1	2	3	4	5	6
Contents	TAG DRIVER 1	TAG DRIVER 2	TAG DRIVER 3	TAG DRIVER 4	TAG DRIVER 5	TAG DRIVER 6	TAG DRIVER 7
Default	0x04	0x05	0x03	0xFF	0xFF	0xFF	0xFF

Byte	7	8	9	10	11	12	13
Contents	TAG DRIVER 8	TAG DRIVER 9	TAG DRIVER 10	TAG DRIVER 11	TAG DRIVER 12	TAG DRIVER 13	TAG DRIVER 14
Default	0xFF	0xFF	0xFF	0xFF	0xFF	0xFF	0xFF

A list of supported tag drivers can be found in ANNEX A: Codes of Transponder Types.

A plausibility check is performed by writing these parameters to the Reader. If an error occurs the Reader answers with STATUS = 0x11.

3.13. CFG12: EMVCo Settings

The parameters of the CFG12 configuration block contain EMVCo settings.

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

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

SetEMVCo - contactless

This parameter contains setting to change the proceeding of the contactless RFID reader interface between ISO14443 or EMVCo Contactless Level 1 compliant behavior.

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

EMVCo:

b0: **ISO14443 settings enabled (default)**
Enables the ISO14443 compliant behavior of the contactless RFID interface.

b1: **EMVCo Contactless Level 1 settings enabled:**
Enables the EMVCo Contactless Level1 compliant behavior of the RFID interface. This setting is intended to process contactless credit cards according EMVCo specification.

If enabled the settings of CFG3, CFG5 and CFG9 are changed temporary to EMVCo defaults and cannot changed (command 4.11. [0x81] Write Configuration returns status 0x16 (CFG Write Protection)).

An adjustment of parameter CFG1.TR-RESPONSE-TIME is only possible for values greater or equal 5.5 seconds.

After disabling to b0 the reader internally restores its whole configuration settings out of the EEPROM.

SetEMV - contact

This parameter contains setting to change the proceeding of SAM slot interfaces between ISO7816 or EMVCo Contact Level 1 protocol compliant behavior.

Bit:	7	6	5	4	3	2	1	0
Function	0	0	0	0	SAM4	SAM3	SAM2	SAM1

SAMx

The behavior of each SAM slot can be configured separate

b0: ISO 7816 settings of SAM slot X enabled (default)

b1: EMVCo settings of SAM slot X enabled

NOTICE:

- ***Scan mode is not possible if the EMVCo mode is enabled***
- ***EMVCo mode is only usable with ANT2 (external antenna) and the antenna multiplexing in CFG17 is disabled***
- ***For test purposes only, the ANT1 can be selected with the 4.8. [0x6A] RF Output ON/***OFF ***command***

3.14. CFG13: Reserved

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

3.15. CFG14: Customer Parameters

CFG14 configuration block can be used to store any kind of customer identifiers.

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

3.16. CFG15: Passwords

The parameters of the CFG15 configuration block contain the access conditions for the Reader configuration.

The Reader configuration can be protected by a 32-bit password, the "READER-ID". Depending on access conditions defined in CFG_ACCESS_RD_WR a "Login" with a valid READER-ID (command 4.14. [0xA0] Reader-Login) in necessary to read or write the configuration parameters.

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

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

READER-ID:

Defines the password to get access to read / write the configuration parameter blocks.

The READER-ID can be changed only immediately after a valid Login with command 4.14. [0xA0] Reader-Login.

Notes:

- ***A READER-ID = 0x00000000 disables the password function.***
- ***A changed password becomes valid after a Reader reset.***

CFG_ACCESS_RD_WR:

Defines the Configuration blocks which are read/write accessible after a successful login.

Byte:	4								5							
Bit:	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1
CFG No.	3		2		1		0		7		6		5		4	

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

Byte:	8								9							
Bit:	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1
CFG_NO.	RFU		RFU		RFU		RFU		RFU		RFU		RFU		RFU	

Byte:	10								11							
Bit:	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1
CFG_NO.	RFU		RFU		RFU		RFU		RFU		RFU		RFU		RFU	

CFG_NO

The Bit in CFG_NO defines if the access to the configuration block is free or protected by reader login.

b00 ⇒ Access is free

b01 ⇒ Read Access login protected

b10 ⇒ Write Access login protected

b11 ⇒ Read and Write Access login protected

Notes:

- ***The command 4.13. [0x83] Set Default Configuration doesn't change the CFG15 register if all configuration blocks are used.***

3.17. CFG17: Antenna Multiplexing

The parameters in CFG17 are used to configure for multiplexing of antennas in Scan Mode, except the parameter DEFAULT_ANTENNA.

Byte	0	1	2…9	10	11	12	13
Contents	MUX-MODE	ANT_OUT	0x00	0x00	ANT_OUT_EXT_2	0x00	DEFAULT_ANTENNA
Default	0x00	0x18					

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:

b0: disable
b1: enable

ANT_OUT:

Specifies the antenna outputs used in Scan Mode

Bit	7	6	5	4	3	2	1	0
Function	0	0	0	ANT_SEL		0	0	0
				ANT2	ANT1			

ANT_SEL:

Defines the antennas which are used for the multiplexing

b0: Antenna disabled
b1: Antenna enabled

ANT_OUT_EXT_x (x=2):

Specifies the number of antenna outputs used by an external multiplexer connected to reader antenna output x

Bit	7	6	5	4	3	2	1	0
Function	-	-	-	-	ANT_4	ANT_3	ANT_2	ANT_1

ANT_x (x=1..4):

b0: no reading on antenna x.

b1: reading on antenna x.

DEFAULT_ANTENNA:

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

Antenna-numbers:

antenna	number in HEX
ANT1 (internal antenna CPR74)	0x01
ANT2 (external antenna CPR74)	0x02
MUX 1	0x12
MUX 2	0x22
MUX 3	0x32
MUX 4	0x42

4. Configuration and Control Commands

Via the commands for the Reader Control, the Reader can be controlled by a host via host interface and may be adapted to individual conditions of application.

4.1. [0x52] Baud Rate Detection

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

REQUEST-DATA

1
0x00

RESPONSE-DATA

0
-

NOTICE:

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

4.2. [0x55] Start Flash Loader

This command starts the Flash Loader for executing a firmware update. After the reader has received the command, it switches into the Flash-Loader mode. For leaving the Flash-Loader mode the power supply of the Reader must be interrupted.

REQUEST-DATA

0
-

RESPONSE-DATA

0
-

NOTICE:

- ***COM-ADR = 255 will be ignored by the Reader.***

4.3. [0x63] CPU Reset

This command allows you to reset the CPU on the Reader.

REQUEST-DATA

0
-

RESPONSE-DATA

0
-

NOTICE:

- ***The RF-field will be switched off while a CPU Reset.***
- ***After a CPU-Reset the reader selects the ANT1 (internal) again***

4.4. [0x64] System Reset

This command allows you to reset the device and to set it into standby mode

REQUEST-DATA

1
MODE

RESPONSE-DATA

0
-

MODE:

0x00: RF Controller Reset
executes a hardware reset of the reader CPU.

In case of a USB connection the reader executes a new enumeration after receiving this command.

0x03: RF Decoder Reset
executes a hardware reset of the RF Decoder.

0x10: RF Controller Power Down
Sets the reader hardware to standby mode. After the reader has acknowledged this command it enters to the standby mode and can be awoken only by a new RS232-protocol. (not available over USB)

0x11: RF Controller Power Down with wake up by card.
Sets the reader hardware to standby mode. After the reader has acknowledged this command it enters to the standby mode and can be awoken only by a new RS232-protocol or by a transponder presented to the reader antenna. (not available over USB)

NOTICE:

- ***The RF-field will be switched off while a System Reset.***
- ***After a CPU-Reset the reader selects the ANT1 (internal) again.***

4.5. [0x65] Get Software Version

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

REQUEST-DATA

1
MODE

RESPONSE-DATA

2	1	1	1	2
SW-REV	D-REV	HW-TYPE	SW-TYPE	TR-TYPE

SW-REV:

Version of the firmware.

D-REV:

Revision status of the firmware.

HW-TYPE:

Displays options which are supported by the Reader hardware

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

HWE:

RF-Decoder type of the Reader.

SW-TYPE:

Displays the type / model of the Reader
(see: ANNEX B: Codes of Reader Types)

TR-TYPE:

Displays the Transponders supported by the Reader.

Bit:	15	14	13	12	11	10	9	8
Function:	-	-	-	-	SRIx	SR176	ISO 18000-3M3	Jewel

Bit:	7	6	5	4	3	2	1	0
Function:	-	-	ISO 14443B	ISO 14443A	ISO 15693	-	-	-

4.6. [0x66] Get Reader Info

This command allows you to determine, a lot of firmware and hardware options and version from the reader. Most information's are only required for service and support questions.

REQUEST-DATA

1	1
[0x66]	MODE

RESPONSE-DATA

Depending on the MODE Parameter the reader response has different structures with several information's which are described in the next chapters for each MODE separate.

MODE:

Via the Parameter MODE different information could requested from the Reader.

0x00: General hard- and firmware information's

0x03: RF-decoder information's for factory diagnostic.

0x04: Additional firmware functionality.

0x05: Bootloader version information.

0x08: Supported Tag Drivers information.

0x11: SAM Information

0x12: CPU Information

0x15: RF- and ISO7816 Stack Firmware

0x40: CFG info for read permission

0x41: CFG info for write permission

0x60: I/O Capabilities

0x80: Device-ID: Necessary Information's for firmware updates and firmware upgrades.

0xFF: Read all info modes

4.6.1. Mode = 0x00 (RF Controller Firmware)

RESPONSE-DATA

2	1	1	1	2	2	2
SW-REV	D-REV	HW-TYPE	SW-TYPE	TR-TYPE	RX-BUF	TX-BUF

SW-REV / D-REV / HW-TYPE / SW-TYPE / TR-TYPE:

see chapter 4.5. [0x65] Get Software Version.

RX-BUF:

RX-BUF is the maximum receive buffer size of the Reader. If a protocol from the host exceed the RX-BUF size the Reader response with error code 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.

4.6.2. Mode = 0x03 (RF-decoder information's)

RESPONSE-DATA

2	1	5
DEC_TYPE	SELF_TST	<RFU>

DEC_TYPE:

Information's about the functionality and revision of the RF-decoder for service and support.

SELF_TST:

This byte gives informations about the self test result, which is performed automatically by the reader after a power on reset.

0x00: Self test not OK
The reader has detected an internal failure.

0x01: Self test OK.

4.6.3. Mode = 0x04 (Additional firmware functionality)

RESPONSE-DATA

1	1	1	6	2
TEMPLATE	FNC_LST0	FNC_LST1	<RFU>	FW_IDENT

TEMPLATE:

Indicates how to interpret the following content depending on the reader type

0x01: ID CPR-Family

FNC_LST0:

Each bit represents a firmware functionality.

Bit:	7	6	5	4	3	2	1	0
Function	0	0	0	0	MFP	MFD	MAD	TCL

TCL:

Indicates the support of the T=CL Function (Command [0xB2][0xBE])

b0: T=CL function is not supported

b1: T=CL function is supported

MAD:

Indicates the support of MAD (Mifare Application Directory) in Scan-Mode

b0: MAD is not supported

b1: MAD is supported

MFD (Mifare DESFire high level crypto function):

Indicates the support of crypto functions with DESFire Commands [0xC1][0x##] and [0xC3][0x##].

b0: crypto functions are not supported

b1: crypto functions are supported

MFP (Mifare PLUS high level crypto function):

Indicates the support of crypto functions with mifare Plus Commands [0xC2][0x##].

b0: crypto functions are not supported

b1: crypto functions are supported

FNC_LST1:

Each bit represents firmware functionality.

Bit:	7	6	5	4	3	2	1	0
Function	0	0	0	EMV Slot4	EMV Slot3	EMV Slot2	EMV Slot1	EMVCo

EMVCo :

Indicates EMVCo support (contactless) [Level 1]

b0: EMVCo is not supported

b1: EMVCo is supported

EMV Slot 1:

Indicates EMV support (contact) of contact Slot 1 [Level 1]

b0: EMV is not supported

b1: EMV is supported

EMV Slot 2:

Indicates EMV support (contact) of contact Slot 2 [Level 1]

b0: EMV is not supported

b1: EMV is supported

EMV Slot 3:

Indicates EMV support (contact) of contact Slot 3 [Level 1]

b0: EMV is not supported

b1: EMV is supported

EMV Slot 4:

Indicates EMV support (contact) of contact Slot 4 [Level 1]

b0: EMV is not supported

b1: EMV is supported

FW_IDENT:

Identification code of special firmware version

4.6.4. Mode = 0x05 (Bootloader Version Information)

RESPONSE-DATA

1	1	9
BL_VERSION	BL_REF	<RFU>

BL_VERSION:

Bootloader Version

BL_REV:

Revision of Bootloader Version

4.6.5. Mode = 0x08 (Supported Tag Drivers)

RESPONSE-DATA

30
TAG DRIVERS

TAG_DRIVERS:

List of supported Tag Drivers by the reader [starting with lowest number]
A list of supported tag drivers can be found in ANNEX A: Codes of Transponder Types.

4.6.6. Mode = 0x11 (SAM Information)

This mode can be used to check how many SAM slots are available and if a SAM is inserted into the SAM slot.

RESPONSE-DATA

1	NO_OF_ SLOTS
NO_OF_ SLOTS	SLOT_INFO

NO_OF_SLOTS:

No of available SAM slots.

SLOT_INFO:

Bit:	7	6	5	4	3	2	1	0
CFG_NO	Slot-Type				-	-	-	inserted

Slot-Type:

0000: Universal SAM socket for ID000 SAM

Inserted:

b0 No SAM inserted

b1 SAM is inserted

4.6.7. Mode = 0x12 (CPU Information)

RESPONSE-DATA

4	4
<RFU>	CPU-FLASH

CPU_FLASH:

Memory size in Kbytes

4.6.8. Mode = 0x15 (RF- and ISO7816 Stack Firmware)

RESPONSE-DATA

2	2
SW-Rev RF-Stack	SW-Rev ISO7816 Stack

SW-Rev RF-Stack:

Version of the RFID Firmware part

SW-Rev ISO7816 Stack:

Version of the ISO7816 Firmware part

4.6.9. Mode = 0x40 (CFG info for read permission)

Every bit marks the permission to read.
The flag fields are independent of configurable password protection

RESPONSE-DATA

2	x
NO_OF_ PAGES	PERMISSION

NO_OF_PAGES:

No of available CFG pages.

PERMISSION:

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

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

Byte	9							
Bit:	7	6	5	4	3	2	1	0
CFG_NO	16	17	18	19	20	21	22	23

…

4.6.10. Mode = 0x41 (CFG info for write permission)

Every bit marks the permission to write.
The flag fields are independent of configurable password protection

RESPONSE-DATA

2	x
NO_OF_ PAGES	PERMISSION

NO_OF_PAGES:

No of available CFG pages.

PERMISSION:

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

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

Byte	9							
Bit:	7	6	5	4	3	2	1	0
CFG_NO	16	17	18	19	20	21	22	23

…

4.6.11. Mode = 0x60 (I/O Capabilities)

RESPONSE-DATA

1	1	1
NO_OF_ INPUTS	NO_OF_ OUTPUTS	NO_OF_ RELAYS

NO_OF_INPUTS:

Indicates the number of available Inputs

NO_OF_OUTPUTS:

Indicates the number of available Outputs

NO_OF_RELAYS:

Indicates the number of available Relays

4.6.12. Mode = 0x80 (Device_ID)

RESPONSE-DATA

4	4	2	2	2
DEV_ID	Custom_L	FW_L	TR_DRV_L	FNC_L

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_L:

Indicates which Transponder drivers are licensed on the Reader.

FNC_L

Indicates which optional functions are licensed on the Reader.

4.6.13. Mode = 0xFF (Read all info modes)

MODE 0xFF returns all Info modes within one response.

RESPONSE-DATA

1	1	30
DATASETS	MODE	DATA

Repeated DATASETS times

DATASETS:

Number of transferred datasets (each with a length of 31 byte)

MODE:

Mode byte

DATA:

Data record according to the definition in previous sections.
The data record is always 30 byte long.
Unused bytes are filled with 0x00.

4.7. [0x69] RF Reset

The RF-field of the Reader antenna can be switched off for **t_{rf} = 6 ms** by the command RF Reset. Thus, all Transponders which are within the antenna field of the Reader will be reset to their reset state.

REQUEST-DATA

0
-

RESPONSE-DATA

0
-

NOTES:

- ***After the RF Reset command the Reader is not able to receive any 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 send after the RF Reset was completed.***

4.8. [0x6A] RF Output ON/OFF

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

If the reader works in Scan Mode 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 on the last selected antenna. For selecting a specific antenna without continuing the Auto Read Mode, the option flag HM must be set.

REQUEST-DATA

1
RF_OUTPUT

RESPONSE-DATA

0
-

RF_OUTPUT:

Bit:	7	6	5	4	3	2	1	0
Function	HM	0	0	0	0	0	ANT_OUT	

ANT_OUT:

This parameter could be used to select one antenna.

ANT_OUT	Description
b00	RF OFF
b01	RF Power on output 1(internal antenna)
b10	RF Power on output 2 (external antenna)

HM Maintain Host Mode (applicable only for Scan 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

4.9. [0x72] Set Output

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

Each output takes on the state defined by the byte OUTx-mode for the period of time (OUT-TIME) defined in this command. If the Reader receives a Set Output command, all times that have been active until then are being overwritten by the new times if they are > 0.

REQUEST-DATA

1	1	1	1	1	2
[0x72]	Mode	OUT-N	OUT-NR	OUT-S	OUT-TIME
			Repeated OUT-N times		

RESPONSE-DATA

0
-

Mode:

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

OUT-N:

Defines the number of output records.

OUT-NR:

Defines the type and the number of the output which shall be changed

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

OUT-typ:

b000 Digital Output
b001 LED Output

any other bit configuration is reserved

OUT-Number:

Number of the output which shall be changed.
1: Digital Output DT-OUT1
2: Digital Output DT-OUT2
3: Digital Output DT-OUT3

LED-Number:

Number of the LED which shall be changed.

1: LED green

2: LED red

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	0	0	OUTx-mode	

OUTx-mode:

b00: OFF

b01: ON

b10: FLASHING SLOW

b11: FLASHING FAST

OUT-TIME:

By the values defined by “OUT-TIME”, the outputs can be activated temporary limited or unlimited.

Exceptions 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:

- ***The continuous activation is being set back after a reset or a power failure***
- ***The command is not influenced by the settings of 3.3. CFG2: Inputs / Outputs general***

4.10. [0x80] Read Configuration

By using the Read Configuration command the actual configuration of the Reader can be read out. The configuration is organized in blocks of 14 bytes each and addressed by CFGn in the byte CFG-ADR.

REQUEST-DATA

1
CFG-ADR

RESPONSE-DATA

14
CFG-REC

CFG-ADR[1]:

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-byte configuration block read from address CFGn in CFG-ADR.

NOTICE:

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

[1] see Chapter 3. Configuration Parameters (CFG)

4.11. [0x81] Write Configuration

Via the command Write Configuration the configuration of the Reader can be changed. The configuration memory organized in 14 bytes long blocks and addressed by CFGn in the byte CFG-ADR. The description of parameters can be taken from chapter 3. Configuration Parameters (CFG)

REQUEST-DATA

1	14
CFG-ADR	CFG-REC

RESPONSE-DATA

0
-

CFG-ADR[1]**:**

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 and RAM

CFG-REC:

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

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

[1] see chapter 3. Configuration Parameters (CFG)

4.12. [0x82] Save Configuration

By the command Save Configuration each configuration block of the RAM can be stored in EEPROM.

REQUEST-DATA

1
CFG-ADR

RESPONSE-DATA

0
-

CFG-ADR[1]**:**

Bit:	7	6	5	4	3	2	1	0
Function	0	MODE	CFGn					

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

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

[1] see chapter 3. Configuration Parameters (CFG)

4.13. [0x83] Set Default Configuration

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

REQUEST-DATA

1
CFG-ADR

RESPONSE-DATA

0
-

CFG-ADR:

Bit:	7	6	5	4	3	2	1	0
Function	LOC	MODE	CFGn					

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: EEPROM

Notes:

- ***To store RAM configuration over power down see chapter*** 4.12. [0x82] Save Configuration
- ***A set default configuration with reserved configuration blocks will cause an error code.***

4.14. [0xA0] Reader-Login

The Reader-Login must be executed after every power up or 4.3. [0x63] CPU Reset command, if an access to the configuration parameters is desired.

REQUEST-DATA

4
READER-ID

RESPONSE-DATA

0
-

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 3.16. CFG15: Passwords.

NOTE:

- ***A Reader-Login with wrong READER-ID causes a "Logout".***
- ***A "Logout" can be executed via the command 4.3. [0x63] CPU Reset***

4.15. [0xA2] Write Mifare Reader Keys

The keys which are required by the Reader to authentify itself to a Mifare classic Transponder (mifare classic mini, 1k, 4k) can be stored by this command. Only if the keys of the Reader and of the Transponder correspond, the data exchange between Reader and Transponder can be executed.

REQUEST-DATA

1	1	6
KEY-TYPE	KEY-ADR	KEY

RESPONSE-DATA

0
-

KEY-TYPE:

Defines the key for the authentication.

0x00 KEY-A
0x01 KEY-B

KEY-ADR: (0x00 .... 0x07)

Address where the key is stored in the reader. The address can be any value between 0 and 7.

KEY:

Mifare: 6 byte Key

Notes:

- ***It is not possible to read back the keys off the Reader. After having changed the keys these should be stored at a secured place.***
- ***The factory adjustment of the keys on KEY-ADR 0x00 is:***
  KEY-A: 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF
  KEY-B: 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF

5. ISO Host Commands for Transponder Communication

In the following chapters the Host commands for communication with a Transponder are described. Notice that not all commands are available for each Transponder type. Detailed information about the supported ISO Host commands are described in chapter 7. Supported ISO Host commands, for each Transponder type separate.

5.1. [0xB0] ISO Standard Host Commands

This command sends standard RF commands to the Transponder.

REQUEST-DATA

1	(X)
SUB-COMMAND	PARAMETER

RESPONSE-DATA

(X)
RESPONSE-DATA

SUB-COMMAND, PARAMETER:

Command specific request with variable length. The content is described in the next chapters.

RESPONSE-DATA:

Command specific response with variable length. The content is described in the next chapters.

Notes:

- ***Data are only transferred if STATUS = 0x00, 0x83, 0x94, 0x95.***
- ***These commands are not available if Scan-Mode is active.***

5.1.1. [0x01] Inventory

This command reads the UID of Transponders which are located in the detection range of the reader. The reply behavior of this command depends on several settings.

REQUEST-DATA

1	1	(1)
[0x01]	MODE	NTFC_TIME or ANT_SEL

NOTES:

- ***The operating behavior of the Inventory command depends on some settings in CFG5, parameter ONT and on settings in MODE byte***
  - ***If the CFG5.ONT Bit ONT = b1 only the response of those Transponders are read which came into the antenna field since the last Inventory command.***

    In this case The Reader response includes an UID only if:
    - ***the Transponder has left the antenna field and reentered the antenna field or***
    - ***the command 4.7. [0x69] RF Reset was send to the Reader meanwhile or***
    - ***the Transponder in the antenna field is a Jewel***
  - ***If the CFG5.ONT Bit ONT = b0 a RF-Reset is performed to read the UID of all Transponders inside the antenna field.***
  - ***If CFG5.ONT Bit ACOLL = b0 (anticollision function is disabled) the Reader selects the Transponder itself.***
  - ***If MODE bit PRESC = b1 the response includes the Transponder UIDs without performing a RF-Reset.***
- ***The operating behavior of the Inventory command depends also on Settings of 3.13. CFG12: EMVCo Settings***

MODE:

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

ANT:

b0: Request without antenna number

b1: Request with antenna number (ANT_SEL)

PRESC:

Settling of this bit activates the presence check mode of the Inventory command. This setting is suitable to perform a presence check of all Transponder in detection range of the reader without influencing the UID of Transponder with a random UID

b0: Presence check is deactivated

b1: The response of the Inventory command [0x01] includes the UID of all detected Transponders in the reader detection range.

NOTICE:

The* PRESC = *b1 can only be used if ONT bit and ACOLL bit is set to b1 (see 3.6. CFG5: Anticollision)

NTFC:

Settling of this bit activates the Inventory Notification Mode of the Inventory command.

b0: Standard Inventory command

b1: Inventory in notification mode:
In this case the optional parameter NTFC_TIME must send to the reader.

In Inventory Notification Mode the Inventory command runs internally while one or more Transponders are detected by the reader or while the time defined by NTFC_TIME elapsed.

Multiplexing of both antennas is possible if the multiplexing is enabled in 3.17. CFG17: Antenna Multiplexing. If the reader detects a transponder the multiplexing will be stopped automatically and stays on the antenna were the transponder was detected.

MORE:

this bit can be used, to read out the whole UIDs, after the Reader had signalized more data sets with status 0x94 (see: ANNEX C: Index of Status Bytes)**.**

b0: new Inventory requested
The reader carries out a new inquiry, which Transponder are in his detection range.

b1: more data requested
The reader response contain the UIDs which are not transferred with the last response because of the status 0x94.

NOTICE:

- ***The MORE and NTFC function can be used only exclusive.***
- ***The ANT and NTFC function can be used only exclusive.***
  If NTFC function will switch between antennas, multiplexer must to be enabled in CFG17
- ***An Inventory command without a Mode selection will be performed only on the selected antenna by uing the 4.8. [0x6A] RF Output ON/OFF command***

NTFC_TIME:

This optional parameter defines the maximum duration of the Inventory command in Inventory Notification Mode (see NTFC bit in MODE Byte).

	max. response duration
NTFC_TIME	0...255 * 100 ms

NOTICE:

- ***The NTFC_TIME overwrites the TR-RESPONSE-TIME which is defined in CFG1.***
  The receive block timeout of the host computer must set to a value ≥ NTFC_TIME.
- ***A running Inventory command with NTFC option couldn't be interrupted by any other command while NTFC_TIME.***

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

NOTICE:

- ***In case of a ISO14443 transponder is presented to one of the antennas, the multiplexing of the antennas stops at this antenna and will not continue. In case of presenting a ISO15693 transponder to the first antenna the multiplexing will continue with the next antenna and stops then.***

DATA-SETS:

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

TR-TYPE:

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

RF_TEC:

Indicates the RFID - Technology of the present Transponder:

b00: 13,56 MHz Transponder

b10: UHF Transponder

TYPE_NO

Displays the Transponder type of the present Transponder
(see: ANNEX A: Codes of Transponder Types).

RESPONSE-DATA:

Depending on the Transponder type the response data of the Reader are different as described in the following chapters.

5.1.1.1. Response-Data – ISO 14443A (TR-TYPE = 0x04)

Response data of ISO 14443 Type A compliant Transponder:

RESPONSE-DATA - Case CFG3. ISO14443 FTUR.OPTI = b0 ⇒ OPT_INFO is disabled

1	1	1	1	8 (10)
DATA-SETS	TR-TYPE	TR_INFO	0	UID
	Repeated DATA-SETS times			

RESPONSE-DATA - Case CFG3. ISO14443 FTUR.OPTI = b1 ⇒ OPT_INFO is enabled

1	1	1	1	8 (10)
DATA-SETS	TR-TYPE	TR_INFO	OPT_INFO	UID
	Repeated DATA-SETS times			

TR_INFO (only ISO 14443A Transponder)**:**

This byte represent some information's from the SAK byte as described in ISO14443-3[1].

Bit:	7	6	5	4	3	2	1	0
Function	-	-	L4	-	-	CL3	-	-

CL3: Displays the UID length of the present Transponder.

b0 The UID is transmitted as a 7 byte field
(Transponder with Cascade Level 1 or Level 2)

b1 The UID is transmitted as a 10 byte field
(Transponder with Cascade Level 3)

L4: Displays the compliance of the Transponder with ISO 14443-4 according ISO 14443-3, SAK, b6

b0 Not compliant with ISO 14443-4

b1 Compliant with ISO 14443-4

[1] In case of NXP mifare chips this byte also indicates the chip type. Further information's are given in the NXP Application Note "mifare Interface Platform, Type Identification Procedure" M018412.

OPT_INFO (only ISO 14443A Transponder)**:**

Depending on the setting of CFG3.ISO14443 FTUR.OPTI this byte could optional display further information's about the present Transponder.

It's recommend to use this information if ISO14443-4 Transponder or Transponder with more the 4 byte UID length shall be handled by the reader.

Bit:	7	6	5	4	3	2	1	0
Function	-	-	-	-	-	L4_SLCT	C_LEVEL	

C_LEVEL:

These 2 bits displays the Cascade Level of the Transponder UID

b00: Cascade Level 1 (4 byte UID)

b01: Cascade Level 2 (7 byte UID)

b10: Cascade Level 3 (10 byte UID)

L4_SLCT:

This bit displays the select status of the present Transponder.

b0: The Transponder is not selected in ISO14443-4 level.

b1: The Transponder is selected on ISO14443-4 level by the reader now. A further select command is not necessary for data exchange with this Transponder.

UID:

ISO 14443A UID could have different lengths. This depends on the Cascade Level of the Transponder (see also TR_INFO byte). It is transmitted by the reader with a length of 7 or 10 byte.

The following table shows the structure of the UID in relation to ISO14443-3

transmitted byte	9	10	11	12	13	14	15	16	17	18
Cascade-Level 1	0	0	0	UID3	UID2	UID1	UID0	-	-	-
Cascade-Level 2	UID6	UID5	UID4	UID3	UID2	UID1	UID0(*	-	-	-
Cascade-Level 3	UID9	UID8	UID7	UID6	UID5	UID4	UID3	UID2	UID1	UID0(*

* UID0: Manufacturer ID according ISO/IEC7816-6/AM1

In case of a shorter UID the redundant bytes are filled with 0 at the most significant digits.

Notice:

The UID byte order can be swapped by using the parameter CFG3.ISO14443 FTUR.UID_ORDER

5.1.1.2. Response-Data – ISO 14443B (TR-TYPE = 0x05)

Response data of ISO 14443 Type B compliant Transponder:

RESPONSE-DATA

1	1	1	4	4
DATA-SETS	TR-TYPE	PROTO INFO	APP DATA	PUPI LSB / MSB
	Repeated DATA-SETS times			

PROTO_INFO

This parameter is extracted from the protocol Info bytes as described in ISO14443-3.

Bit:	7	6	5	4	3	2	1	0
Function	Max_Frame_Size				Protocol_Type			

Max_Frame_Size (according ISO14443-3:2001)

Value	0	1	2	3	4	5	6	7	8	9-F
Frame Size (Byte)	16	24	32	40	48	64	96	128	256	RFU > 256

Protocol_Type (according ISO14443-3:2001)

7	6	5	4	Meaning
0	0	0	1	PICC compliant with ISO/IEC 14443-4
0	0	0	0	PICC not compliant with ISO/IEC 14443-4

APP_DATA

4 byte Application Data (according ISO 14443-3:2001).

1	2	1
Number of Applications	CRC_B (AID) LSB / MSB	AFI

PUPI

4 byte Pseudo-Unique PICC Identifier (according ISO 14443-3:2001).

This information is required to select the Transponder.

5.1.1.3. Response-Data – Innovatron [14443-B'] (TR-TYPE = 0x10)

Response data of a transponder, that supports the Innovatron radio protocol:

RESPONSE-DATA

1	1	8	1	1	1	ATR-LEN
DATA-SETS	TR-TYPE	UID	VERLOG	CONFIG	ATR-LEN	ATR
	Repeated DATA-SETS times					

UID:

4 LSBytes of card´s serial number (filled with leading zeros).

VERLOG:

Software version and type of REPGEN.

Bit:	7	6	5	4	3	2	1	0
Function	Type	1	1	Software version				1

Type:

b0 "Short REPGEN" (No additional bytes following)

b1 "Long REPGEN" (Additional bytes following)

Software version:

Software version of the tag (0…14)

CONFIG:

Configuration of REPGEN

Bit:	7	6	5	4	3	2	1	0
Function	WE	TAB	RFU = 0					

WE (Wait enble):

b0 tag doesn´t accept WAIT command frames
(useless in batteryless mode)

b1 tag accepts WAIT command frames
(useless in batteryless mode)

TAB:

b0 no tag ATR bytes are present

b1 tag ATR bytes are present

ATR LENGTH:

Length of the following ATR

ATR:

ATR (according to ISO7816-3) of the transponder

5.1.1.4. Response-Data – Jewel (TR-TYPE = 0x08)

Response data of Jewel Transponder:

RESPONSE-DATA

1	1	1	1	6					
DATA-SETS	TR-TYPE	0	0	UID					
				HR0	HR1	UID0	UID1	UID2	UID3
	Repeated DATA-SETS times								

UID: Read-only UID of the Transponder.

In case of a shorter UID the redundant bytes are filled with 0 at the most significant digits.

HR0, HR1:

metal-mask data selected. 0x01 0x3C for IRT5001W and IRT5001E.

5.1.1.5. Response-Data – SR176 (TR-TYPE = 0x0A)

Response data of STM SR176 Transponder

RESPONSE-DATA

1	1	1	8							
DATA-SETS	TR-TYPE	CHIP_ID	UID							
			UID0	UID1	UID2	UID3	UID4	UID5	UID6	UID7
	Repeated DATA-SETS times									

CHIP_ID:

Optional fixed Chip_ID from block address 15.

UID:

64Bit UID of the Transponder.

5.1.1.6. Response-Data – SRIx (TR-TYPE = 0x0B)

Response data of STM SRI512, SRI4K SRIX4k Transponder:

RESPONSE-DATA

1	1	1	8							
DATA-SETS	TR-TYPE	CHIP_ID	UID							
			UID0	UID1	UID2	UID3	UID4	UID5	UID6	UID7
	Repeated DATA-SETS times									

CHIP_ID:

Optional fixed Chip_ID from block address 255.

UID:

64Bit UID of the Transponder.

5.1.1.7. Response-Data – FeliCa (TR-TYPE = 0x0D)

Response data of Felica Transponder:

RESPONSE-DATA

1	1	1	8	8
DATA-SETS	TR-TYPE	Length	IDm	PMm
	Repeated DATA-SETS times			

Length:

Length of ID - data.

IDm:

Manufacture ID.

PMm:

Manufacture Parameter.

5.1.1.8. Response-Data – ISO15693 (TR-TYPE = 0x03)

Response data of ISO15693 Transponder:

RESPONSE-DATA

1	1	1	8
DATA-SETS	TR-TYPE	DSFID	UID
	Repeated DATA-SETS times		

DSFID:

Data Storage Family Identifier. If not used this value will return 0x00.

UID:

Read-only serial number of the Transponder.

5.1.1.9. Response-Data – ISO18000-3M3 (TR-TYPE = 0x09)

Response data of ISO18000-3M3 Transponder:

RESPONSE-DATA

1	1	1	1	x
DATA-SETS	TR-TYPE	IDDT	IDD_LEN	IDD
	Repeated DATA-SETS times			

IDDT:

Identifier Data Type
Defines the type of IDD.

IDD-LEN:

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

IDD:

Identifier Data of the Transponder

5.1.1.10. Response-Data with antenna request

If ANT Flag is set in the MODE Byte, the reader starts an inventory round over all antennas.

RESPONSE-DATA if ANT = 1 for ISO15693 transponder

1	1	1	1	1	x	1
DATA-SETS	FLAGS	TR-TYPE	DSFID	UID_LEN	UID	ANT_CNT
	Repeated DATA-SETS times					

1	1	1	4
ANT_NR	ANT_STATUS	reserved	reserved
Repeated ANT_CNT times			
Repeated DATA-SETS times			

RESPONSE-DATA if ANT = 1 for all other transponder

1	1	1	1	1	x	1
DATA-SETS	FLAGS	RESPONSE-DATA if ANT = 0				ANT_CNT
	Repeated DATA-SETS times					

1	1	1	4
ANT_NR	ANT_STATUS	reserved	reserved
Repeated ANT_CNT times			
Repeated DATA-SETS times			

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) will be send

DSFID: (only 15693 transponder)

Data Storage Family Identifier. If not used this value will return 0x00.

UID-LEN: (only 15693 transponder)

Unique Identifier Data Length defines the length of the UID (serial number) in Byte.

UID: (only 15693 transponder)

Read-only serial number of the Transponder.

ANT_CNT:

Number of antennas where transponder was read

ANT_NR:

Number of the antenna (1...2)

ANT_STATUS:

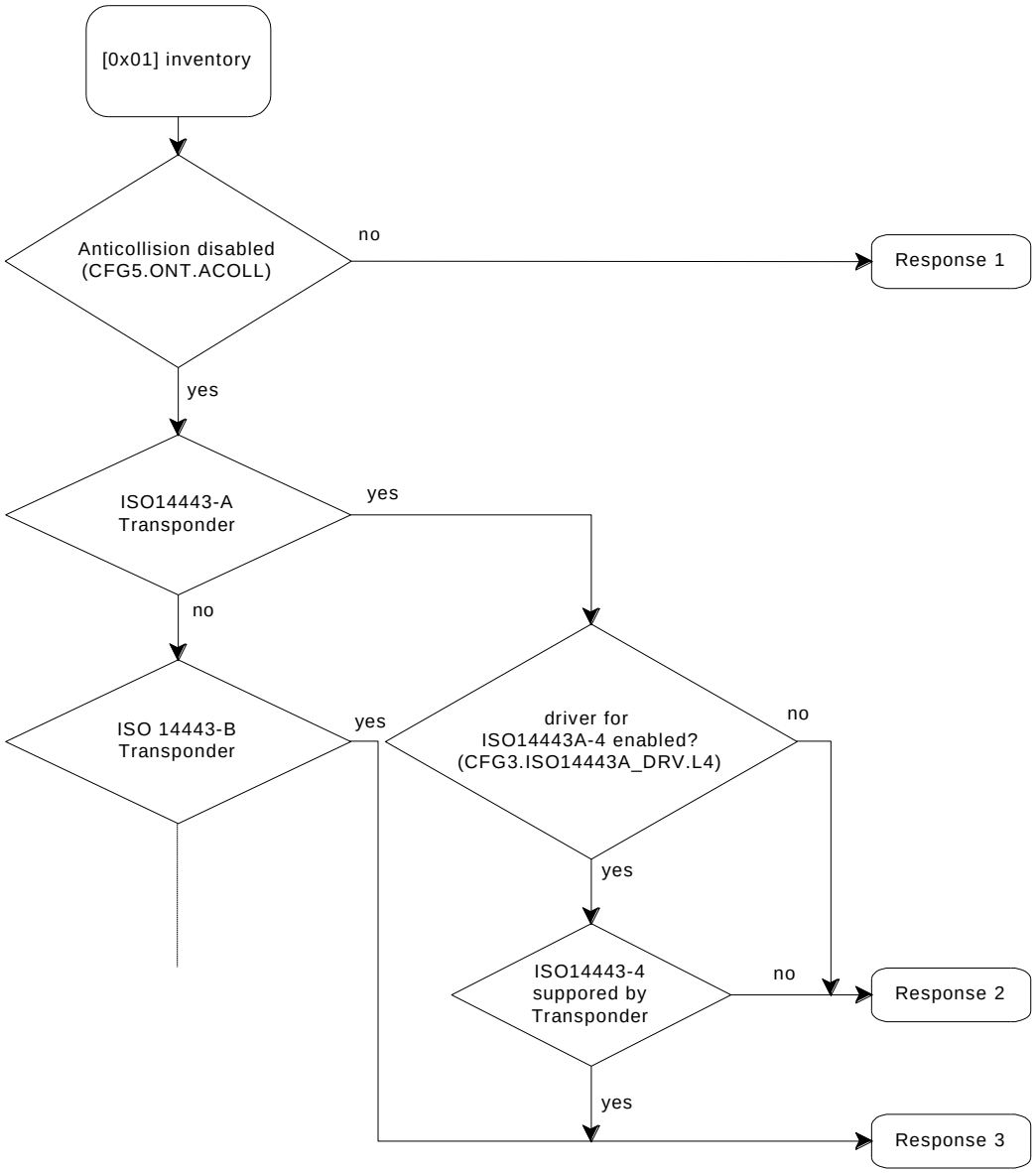
The ANT_STATUS can be 0x00 (OK) or 0x83 (RF communication error)
See: ANNEX C: Index of Status Bytes

NOTICE:

- ***This command supports all Transponders.***
- ***For reading pseudo unique identifiers only one antenna should be selected***
- ***The reader remains on the last antenna. If antennas 1 and 2 are selected, the reader remains on antenna 2 if no transponder was detected.***

5.1.1.11. Sequences of Inventory Command and ISO14443 Transponder

The following chart displays the sequences and effects after an inventory command depending on the Transponder type and the Reader configurations.



	Transponder(s) are selected	**No of announced Transponder**	**next possible commands**
Response 1	no	> 1 (possibly)	5.1.2. [0x25] Select
Response 2	yes one Transponder on ISO14443-3 level	1	Proprietary or standard commands for ISO14443 Transponders (see 5.4. [0xB2] ISO14443 Special Host Commands)
Response 3	yes one Transponder on ISO14443-4 level	1	ISO14443-4 Commands (see 5.4. [0xB2] ISO14443 Special Host Commands

5.1.2. [0x25] Select

This command sets one Transponder to the Select State. Only one ISO Transponder can be selected at once.

The supported ISO Host commands depends on the Transponder types, they are described in chapter 7. Supported ISO Host commands.

REQUEST-DATA

1	1	(1)	(1)	(8)/(UID_LEN)
[0x25]	MODE	TR_DRV	UID_LEN	UID

RESPONSE-DATA if STATUS = 0x95

1
ISO-ERROR

RESPONSE-DATA if STATUS = 0x00 and REQEST-DATA bit MODE.CINF = 1.

(1)	(X)
FORMAT	CARD_INFO

MODE:

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

ADR:

b001 addressed

UID_LF:

If this bit is set the parameter UID_LEN must inserted into the command.

b0: The request data doesn't include the UID_LEN byte and the UID field has a fix length of 8 byte.

b1: The request data includes the parameter UID_LEN. The UID has a variable length as defined in UID_LEN.

CINF:

b0: response data doesn’t include optional CARD_INFO

b1: response data includes optional CARD_INFO

DRV_SEL:

b0: No extra byte TR-DRV included in request data

b1: Extra byte TR-DRV included in request data

TR_DRV:

This optional extra byte offers the possibility to select explicit a Transponder driver for the current select command.

This option may be helpful in such cases where the reader cannot detect the correct type of the transponder e.g. if a processor card emulates any kind of memory card or if NFC devices are presented.

NOTICE

Make sure that the relevant TAG-DRV and ISO14443-DRV is enabled in 3.4. CFG3: RF-Interface.

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

TR-DRIVER-SELECTION

By means of this parameter the host application explicit selects an internal driver to handle the data exchange with the addressed transponder.

TR-DRIVER-SELECTION	Selected Transponder driver
0x01	ISO 14443-4
0x02	mifare classic
0x03	NFC Card Type 2 (e.g. mifare Ultralight, my-d move, etc.)
0x04	mifare plus SL1
0x05	mifare plus SL1 - ISO14443-4
0x06	mifare plus SL2
0x07	mifare plus SL2 - ISO14443-4
0x08	mifare plus SL3
0x09	mifare DESFire
0x0A	my-d proximity
0x0B	my-d move (use this if proprietary my-d move command shall be used)

UID_LEN:

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

NOTICE:

The maximum UID_LEN is limited depending on the reader type. If UID_LEN exceeds the internal buffer size the reader responses an error massage.

UID:

UID, Serial-Number or pseudo unique identifier of the Transponder.

Depending on the UID_LF and UID_LEN the UID field could have a fixed ore a variable length and a variable position in the protocol.

case UID_LF = 0:

If UID_LEN is not used, the following definitions are mandatory depending on the Transponder type.

ISO 14443A

1	1	1	7
[0x25]	b000 0001	0x00	UID

ISO 14443B

1	1	4	4
[0x25]	b000 0001	0x00	PUPI

case : UID_LF = 1

If UID_LEN is activated the specific UID length of the Transponder should be used in the protocol.

1	1	1	UID_LEN
[0x25]	MODE	UID_LEN	UID

ISO-ERROR:

Additional error code if STATUS = 0x95.

FORMAT:

Indicates the format of the CARD_INFO field:

0x00: No further CARD_INFO field available.

0x01: CARD_INFO of an ISO14443-4 Type-A Transponder.

0x02: CARD_INFO of an ISO14443-4 Type-B Transponder.

0x03: CARD_INFO of an ISO14443-3 Type-A Transponder.

0x04: CARD_INFO of an Innovatron radio protocol (ISO14443B') Transponder.

CARD_INFO:

Depending on the FORMAT parameter this data field contains different data's

case FORMAT = 0x01

CARD_INFO contains the ATQA and SAK and parts of the Answer to select (ATS) of the ISO14443 Type-A Transponder as defined in ISO14443-4. The length of CARD_INFO depends on the TL parameter. The response length depends on the TL parameter of the Transponder ATS.

1				1
ATQA				
RFU	Proprietary coding	UID size	RFU	Bit frame anticollision

1	1	TL
SAK	TL	T0, TA(1), TB(1), TC(1) T1, Tk

case FORMAT = 0x02

CARD_INFO contains parts of the answer ATQB response ATTRIB response of the ISO14443 Type-B Transponder as defined in ISO14443-3.

1	1	1			
ATQB Response Protocol Info					
Bit_Rate_capability	Max_Frame_ Size	Protocol_Type	FWI	ADC	F0

1	
1 th Byte of Answer to ATTRIB	
MBLI	CID

case FORMAT = 0x03

CARD_INFO contains the ATQA and SAK parameter after the anticollision loop has finished of ISO14443 Type-A Transponder as defined in ISO14443-3.

1				1
ATQA				
RFU	Proprietary coding	UID size	RFU	Bit frame anticollision

1
SAK

case FORMAT = 0x04

CARD_INFO contains the transponder address and the validator address of Innovatron radio protocol Transponder.

1

TAG ADDRESS	VALIDATOR ADDRESS

5.1.3. [0x23] Read Multiple Blocks

This command reads one or more data blocks from memory cards.

The supported ISO Host commands depends on the different Transponder types, they are described in chapter 7. Supported ISO Host commands.

REQUEST-DATA

1	1	(1)	(UID_LNG)	(1)
[0x23]	MODE	(UID_LNG)	(UID)	BANK

(1)	(A_PW_LGT)	1 or 2	1
A_PW_LGT	A_PW	DB-ADR	DB-N

RESPONSE-DATA if STATUS = 0x00

1	1	1	DB-SIZE
DB-N	DB-SIZE	SEC-STATUS	DB
		Repeated DB-N times	

RESPONSE-DATA if STATUS = 0x95

1
ISO-ERROR

RESPONSE-DATA in case of STATUS = any other

0
-

MODE:

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

ADR:

b000 non-addressed
b001 addressed
b010 selected

SEC:

Requests optional the security status of the followed data block
b0 security status not requested (SEC-STATUS always = 0x00)
b1 security status is requested

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.

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 an 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 UID 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 ISO18000-3M3 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 an ISO18000-3M3 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. First block can be any value between 0 and 255.

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. The maximum number of bytes is 512 byte.

DB-Size	Max. DB-N
1	512
4	128
8	64
x	= 512 / x

ISO-ERROR:

Additional error code if STATUS = 0x95.

DB-SIZE:

Number of bytes of one data block. This value depends on the specification of the Transponder manufacturer, see chapter 7. Supported ISO Host commands.

SEC-STATUS:

Block security status of followed data block.
If SEC-STATUS is not requested or not supported, this value will return 0x00.

DB:

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

Notes:

- ***If a Transponder does not support Read Multiple Blocks commands several Read Single Block commands are used for this Transponder.***
- ***Jewel Transponders are only supported in Addressed Mode***
- ***A read of 1 byte from a JEWEL Transponder uses the JEWEL READ Instruction***
  A read of more than 1 byte from a JEWEL Transponder uses the JEWEL READ-ALL instruction
- ***A read from 1 block uses a Read Single Block command to the ISO15693 Transponder.***

5.1.4. [0x24] Write Multiple Blocks

This command writes one or more data blocks.

The supported ISO Host commands depends on the different Transponder types, which are described in chapter 7. Supported ISO Host commands.

REQUEST-DATA

1	1	(1)	(UID_LNG)	(1)
[0x24]	MODE	(UID_LNG)	(UID)	(BANK)

(1)	(A_PW_LGT)	1 or 2	1	1	DB-SIZE
A_PW_LGT	A_PW	DB-ADR	DB-N	DB-SIZE	DB
					Repeated DB-N times

RESPONSE-DATA if STATUS = 0x00

0
-

RESPONSE-DATA if STATUS = 0x03

1 or 2
DB-ADR-E

RESPONSE-DATA if STATUS = 0x95

1	1 or 2
ISO-ERROR	DB-ADR-E

MODE:

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

ADR:

b000 non-addressed
b001 addressed
b010 selected

WR-NE (JEWEL):

b0 Write-Erase
b1 Write-No-Erase
This settling is necessary for write operations on OTP Bytes.

NOTICE:
To perform write operation on JEWEL Transponder it is recommended to set MIN_LVL (see 3.4. CFG3: RF-Interface) manual to a value > 8.

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.

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 an 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 UID 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 ISO18000-3M3 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 an ISO18000-3M3 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:

Address of the first data block to be written to the Transponder. First block can be any value between 0 and 65535.

DB-N:

Number of data blocks to be written to the Transponder, starting at DB_ADR. The maximum number of DB-N depends on DB-Size.

DB-Size	Max. DB-N
1	512
4	128
8	64
x	= 512 / x

ISO-ERROR:

DB-SIZE:

Number of bytes of one data block. This value depends on the specification of the Transponder manufacturer, see chapter 7. Supported ISO Host commands.

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.

ISO-ERROR:

Additional error code if STATUS = 0x95.

DB-ADR-E:

Block number where the error occurred.
In extended address mode 2 bytes are transmitted.

Notes:

- ***If a Transponder does not support Write Multiple Blocks commands several Write Single Block commands are used for this Transponder.***
- ***If an error occurred during a write command, the number of the block were the error occurred will be send to host***
- ***A write to 1 block uses a Write Single Block command to the 15693 Transponder. This will be managed by the Reader internally.***

5.2. [0xB0] ISO 15693 Standard Host Commands

5.2.1. [0x02] Stay Quiet

This command sets one Transponder to Quiet State.

REQUEST-DATA

1	1	(1)
[0x02]	MODE	(UID)

RESPONSE-DATA

0
-

MODE:

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

ADR:

b001 addressed

UID:

Read-only serial number of the Transponder.

5.2.2. [0x22] Lock Multiple Blocks

This command locks one or more data blocks.
The supported ISO15693 Host commands depend on the different ISO15693 Transponder types, they are described in chapter

REQUEST-DATA

1	1	(1)	1 or 2	1
[0x02]	MODE	(UID)	DB_ADR	DB-N

RESPONSE-DATA if STATUS = 0x00

0
-

RESPONSE-DATA if STATUS = 0x03

1 or 2
DB-ADR-E

RESPONSE-DATA if STATUS = 0x95

1	1 or 2
ISO-ERROR	DB-ADR-E

MODE:

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

ADR:

b000 non-addressed
b001 addressed
b010 selected

UID:

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

DB-ADR:

First block number to be locked. First block can be any value between 0 and 65535.

DB-N:

Number of data blocks to be locked, starting at DB-ADR.
The maximum number of DB-N is 128

ISO-ERROR:

Additional error code if STATUS = 0x95.

DB-ADR-E:

Block number where the error occurred.
In extended address mode 2 bytes are transmitted.

5.2.3. [0x26] Reset to Ready

This command sets one Transponder to Ready State.

REQUEST-DATA

1	1	(8)
[0x26]	MODE	(UID)

RESPONSE-DATA if STATUS = 0x00

0
-

RESPONSE-DATA if STATUS = 0x95

1
ISO-ERROR

MODE:

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

ADR:

b000 non-addressed
b001 addressed
b010 selected

UID:

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

ISO- ERROR:

Additional error code if STATUS = 0x95.

5.2.4. [0x27] Write AFI

This command writes a new AFI code to one or more Transponders

The supported ISO15693 Host commands depend on the different ISO15693 Transponder Types, which are described in chapter

REQUEST-DATA

1	1	(1)	1
[0x27]	MODE	(UID)	AFI

RESPONSE-DATA if STATUS = 0x00

0
-

RESPONSE-DATA if STATUS = 0x95

1
ISO-ERROR

MODE:

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

ADR:

b000 non-addressed
b001 addressed
b010 selected

UID:

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

AFI:

Application Family Identifier of the Transponder.

ISO-ERROR:

Additional error code if STATUS = 0x95.

5.2.5. [0x28] Lock AFI

This command locks the AFI register in one or more Transponders.

The supported ISO15693 Host commands depend on the different ISO15693 Transponder types, which are described in chapter

REQUEST-DATA

1	1	(1)
[0x28]	MODE	(UID)

RESPONSE-DATA if STATUS = 0x00

0
-

RESPONSE-DATA if STATUS = 0x95

1
ISO-ERROR

MODE:

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

ADR:

b000	non-addressed
b001	addressed
b010	selected

UID:

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

ISO-ERROR:

Additional error code if STATUS = 0x95.

5.2.6. [0x29] Write DSFI (ISO15693)

This command writes the DSFID to one or more Transponders.

The supported ISO15693 Host commands depend on the different ISO15693 Transponder types, which are described in chapter

REQUEST-DATA

1	1	(1)	1
[0x29]	MODE	(UID)	DSFID

RESPONSE-DATA if STATUS = 0x00

0
-

RESPONSE-DATA if STATUS = 0x95

1
ISO-ERROR

MODE:

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

ADR:

b000	non-addressed
b001	addressed
b010	selected

UID:

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

DSFID:

Data Storage Format Identifier of the Transponder.

ISO-ERROR:

Additional error code if STATUS = 0x95.

5.2.7. [0x2A] Lock DSFID

This command locks the DSFID register in one or more Transponders.

The supported ISO15693 Host commands depend on the different ISO15693 Transponder types, which are described in chapter

REQUEST-DATA

1	1	(1)
[0x2A]	MODE	(UID)

RESPONSE-DATA if STATUS = 0x00

0
-

RESPONSE-DATA if STATUS = 0x95

1
ISO-ERROR

MODE:

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

ADR:

b000 non-addressed
b001 addressed
b010 selected

UID:

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

ISO-ERROR:

Additional error code if STATUS = 0x95.

5.2.8. [0x2B] Get System Information

This command reads the system information from one Transponder.

REQUEST-DATA

1	1	(8)
[0x2B]	MODE	(UID)

RESPONSE-DATA if STATUS = 0x00

1	8	1	2 or 3	1
DSFID	UID_LSB	AFI	MEM-SIZE	IC-REF

RESPONSE-DATA if STATUS = 0x95

1
ISO-ERROR

MODE:

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

ADR:

b000 non-addressed
b001 addressed
b010 selected

UID:

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

ISO-ERROR:

Additional error code if STATUS = 0x95.

DSFID:

Data Storage Format Identifier of the Transponder.

UID_LSB:

The LSB (32bits) from the Read only Serial Number of the Transponder.

AFI:

Application Family Identifier. If not supported by the Transponder, this value will return 0x00.

Manufacturer Code:

Manufacturer specific code (see: ANNEX A: Codes of Transponder Types)

MEM-SIZE:

Memory size of the Transponder. If not supported by the Transponder, this value will return 0x0000.

Transponder with number of blocks <= 255

Byte	1		1
Bit:	7 .. 5	4 .. 0	7 .. 0
content	res.	Block size in bytes	number of blocks

Transponder with number of blocks > 255

Byte	1		2
Bit:	7 .. 5	4 .. 0	15 .. 0
content	res.	Block size in bytes	number of blocks

IC-REF:

IC reference (version) of the Transponder. If not supported by the Transponder, this value will return 0x00.

Chip Version:

Chip version of the Transponder

5.2.9. [0x2C] Get Multiple Block Security Status

This command reads the public block security status from one Transponder.

REQUEST-DATA

1	1	(8)	1 or 2	1
[0x2C]	MODE	(UID)	DB-ADR	DB-N

RESPONSE-DATA if STATUS = 0x00

1	1
DB-N	SEC-STATUS
	Repeated DB-N times

RESPONSE-DATA if STATUS = 0x95

1
ISO-ERROR

MODE:

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

ADR:

b000 non-addressed
b001 addressed
b010 selected

EXT_ADR:

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

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

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

UID:

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

DB-ADR:

First block number from which security status is requested. First block number can be any value between 0 and 65535.

DB-N:

Number of Security data blocks to be read from the Transponder, starting at DB-ADR. The maximum number of DB-N is 128.

ISO-ERROR:

Additional error code if STATUS = 0x95.

SEC-STATUS:

Block security status.

5.3. [0xB0] ISO 14443 Standard Host Commands

5.3.1. [0xC0] Halt - ISO 14443-3 Transponder

This command sets one ISO14443-3 Transponder into the Halt State.

The supported ISO Host commands depends on the different Transponder types, they are described in chapter 7. Supported ISO Host commands.

REQUEST-DATA

0	0
[0xC0]	MODE

RESPONSE-DATA

0
-

MODE:

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

ADR:

b010 selected

NOTICE:

- ***The reader response is always "OK" independent if the transponder is further one in the detection field of the reader or not.***

5.4. [0xB2] ISO14443 Special Host Commands

The [0xB2] commands are supposed to send special ISO14443 defined commands and proprietary ISO14443 RF commands to the Transponder.

REQUEST-DATA

1	(X)
SUB-COMMAND	PARAMETER

RESPONSE-DATA

(X)
RESPONSE-DATA

SUB-COMMAND, PARAMETER:

Command specific request with variable length. More details are described in the next chapters.

RESPONSE-DATA:

Command specific response with variable length. More details are described in the next chapters.

Notes:

- ***This command is only available in ISOHost mode***

5.4.1. [0x30] Mifare Value Commands

This command provides the Mifare value functions INCREMENT, DECREMENT, TRANSFER and RESTORE of a value formatted Mifare sector block. The command returns an error if the block is not in value block format (details about the Mifare value block format are described in Mifare standard data sheet provided by NXP). The command loads the value from a source address (DB_ADR), operates the value function and stores the result at the destination address (DEST_ADR).

NOTICE:

- ***A previous authentication (see:*** 5.4.2. [0xB0] Authent Mifare classic***) is needed to process the command.***
- ***The Mifare value block format can be written with the reader command*** 5.1.4. [0x24] Write Multiple Blocks

REQUEST-DATA

1	1	1	1	4	1
[0x30]	MODE	MF_CMD	DB_ADR	OP_VALUE *MSB … LSB*	DEST_ADR

RESPONSE-DATA

0
-

MODE:

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

ADR:

b010 selected

MF_CMD

This parameter defines the value operation which shall be operated on the Mifare Transponder.

0x01 INCREMENT
Adds the value OP_VALUE to the value specified by address DB_ADR.

0x02 DECREMENT
Subtracts the value OP_VALUE from the value specified by address DB_ADR.

0x03 COPY
Transfers the value structure from address DB_ADR to address DESTIN_ADR without changing the value.

DB_ADR:

Source Mifare block address of the value formatted data. A formula to calculate DB_ADR could be found in Chapter 7.2.3. NXP - Mifare classic: mini, 1k, 4k / mifare plus

NOTICE:
The specified Mifare block must have been formatted as a Mifare value block.

OP_VALUE:

This parameter contains the 32 Bit value which shall be calculated with the value at DB_ADR.

NOTICE:
In case of the COPY function the content of OP_VALUE has no effect.

DEST_ADR:

Destination address where the result of the value operation shall be stored.

NOTICE:
DEST_ADR and DB_ADR must be in the same Mifare sector.

Example:

- *Formatting of Mifare Sector 2, Block 1 in Mifare value block format with Value = 2 and Adr = 5 by using the command [0x24] Write Multiple Blocks.*

1	*1*	*1*	*16*													
		mifare Byte:	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
DB_ADR	*DB-N*	*DB-SIZE*	*DB*															
0x09	*0x01*	*0x10*	*0xFA Adr.*	*0x05 Adr.*	*0xFA Adr.*	*0x05 Adr*	*0x00000002 Value*				*0xFFFFFFFD Value*				*0x00000002 Value*			

NOTICE:
make sure that the access conditions in the Mifare Sector Trailer for this block are also configured as value block.

- *Formatting of Mifare Sector Trailer by using the command [0x24] Write Multiple Blocks*

1	*1*	*1*	*16*															
		mifare Byte:	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
DB_ADR	*DB-N*	*DB-SIZE*	*Key A*						*Access Bits*				*Key B*					
0x0B	*0x01*	*0x10*	*0xFFFFFFFFFFFF*						*0x69 8F 77 08*				*0xFFFFFFFFFFFF*					

- *Increment Value at Mifare Sector 2, Block 1 with OP_VALUE = 3*

1	*1*	*4*	*1*
MF_CMD	*DB_ADR*	*OP_VALUE*	*DEST_ADR*
0x01	*0x09*	*0x00000003*	*0x05*

5.4.2. [0xB0] Authent Mifare classic

Before access is given to the data stored in the memory of a mifare classic Transponder, the user has to prove his permission for the requested operation. Depending on the MODE.KL bit this command offers to possibilities for key handling. It is possible to use a key which is stored in the readers EERPOM (see: 4.15. [0xA2] Write Mifare Reader Keys) or a temporary key can transferred within the request data.

REQUEST-DATA

case MODE = bxxxx 0010

1	1	1	1	1
[0xB0]	MODE	DB_ADR	KEY-TYPE	KEY-ADR

case MODE = bxxxx 1010

1	1	1	1	6
[0xB0]	MODE	DB_ADR	KEY-TYPE	KEY

RESPONSE-DATA

0
-

MODE:

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

ADR:

b010 selected

KL:

This bit indicates the key location

b0: EEPROM Key, defined by KEY-TYPE and KEY-ADR is used for authentication process.

b1: KEY-TYPE and temporary KEY which are transferred within the request data are used for authentication process.

DB_ADR:

Address of the first data block on which an access is requested .

NOTICE:
The Reader uses a linear addressing mode. For calculating the block address (DB_ADR) the expected mifare Sector and the mifare Block in this sector must be known. A formula to calculate DB_ADR could be found in Chapter 7.2.3. NXP - Mifare classic: mini, 1k, 4k / mifare plus

An authentication to one mifare Block inside a sector have effect to the whole sector.

KEY-TYPE:

Defines the key for the authentication.

0x00: KEY A

0x01 KEY B

KEY-ADR:

EEPROM Address (0x00 ... 0x0F) where the key is stored in the Reader (see: 4.15. [0xA2] Write Mifare Reader Keys).

KEY:

6 byte Mifare Key which shall used for the current authentication process.

5.4.3. [0xBB] ISO 14443-B' (Innovatron) Data Exchange

This command provides the data exchange between a host and the Transponder on ISO 14443-B' (Innovatron) layer. It is special designed for easy APDU data exchange.

NOTICE:

The maximum buffer size of the Reader for data exchange has to be considered and can be determined with command [0x66], Mode = 0x00.

REQUEST-DATA

1	1	x
[0xBB]	MODE	(DATA)

RESPONSE-DATA

4	x
STATUS	(DATA)

MODE:

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

DISC:

b0 "DISCONNECT"
Sends the command "DISCONNECT" to the present Transponder.

b1 "APDU"
Instructs the Reader to send the APDU which is included in the DATA Block to the Transponder.

DATA:

ISO7816 format for commands: CLA/INS/P1/P2/P3/DataIn

STATUS

0x00 OK
This status shows that APDU exchange is completed.
DATA contains further information's

Other

DATA are not present.
This response is given by the Reader if the present command could not be finished, because of transmission errors.
see ANNEX C: Index of Status Bytes

5.4.4. [0xBC] EMVCo PICC Removal

This command is intended to check if an EMVCo PICC (Transponder) is further on in the operating field of the antenna or has left the operating field after a transaction was finished with the PICC.

REQUEST-DATA

1	1
[0xBC]	MODE

RESPONSE-DATA

0
-

MODE:

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

Notes:

***This command is only available if EMVCo proceeding is enabled (see 3.13. CFG12: EMVCo Settings, parameter* SetEMVCo)**

5.4.5. [0xBE] ISO 14443-4 T=CL

This command provides the data exchange between a host and the Transponder on ISO 14443-4 layer. It is special designed for easy APDU data exchange.

NOTICE:
The maximum buffer size of the Reader for data exchange has to be considered and can be determined with command [0x66], Mode = 0x00.

REQUEST-DATA

1	1	(X)
[0xBE]	MODE	(PARAMETER)

RESPONSE-DATA

(1)	(2)	(X)
(PSTAT)	(BLK_CNT)	> depends on PSTAT <

MODE:

Bit:	7	6	5	4	3	2	1	0
Function	FIRST	MORE	-	-	PING	NAD_E	CID_E	INF

MODE bit setting rules

MODE	DATA			
	(1)	(1)	(X)	
b1000 0001	(INF)			APDU without CID or NAD (single block)
b1100 0001	(INF)			APDU without CID or NAD (first chained block)
b0100 0001	(INF)			APDU without CID or NAD (further chained block)
b0000 0001	(INF)			APDU without CID or NAD (last chained block)
b1000 0011	CID	(INF)		APDU with CID (single block)
b1100 0011	CID	(INF)		APDU with CID (first chained block)
b1000 0101	NAD	(INF)		APDU with NAD (single block)
b1100 0101	NAD	(INF)		APDU with NAD (first chained block)
b1000 0111	CID	NAD	(INF)	APDU with CID and NAD (single block)
b1100 0111	CID	NAD	(INF)	APDU with CID and NAD (first chained block)
b1000 0000	-			DESLECT without CID or NAD
b1000 0010	CID	-		DESLECT with CID
b1000 100x	-			PING without CID or NAD
b1000 101x	CID	-		PING with CID

INF:

b0 "DESELECT"
Sends the S-block command "DESELECT" to the present Transponder.

b1 "APDU"
Instructs the Reader to send the INF Block (APDU) which is included in the DATA Block to the Transponder.

CID_E:

b0 The DATA Block includes no CID

b1: The DATA Block includes an optional 1 byte CID Parameter
The CID has to be placed in DATA directly behind the MODE Parameter

NOTICE:
In case of command chaining (see Bit "MORE") only the CID in the first command block is accepted by the Reader.

NAD_E:

b0 The DATA Block includes no NAD

b1: The DATA Block includes an optional 1 byte NAD Parameter
The NAD parameter is only supported in conjunction with INF = b1

NOTICE:
In case of command chaining (see Bit "MORE") only the NAD in the first command block is accepted by the Reader.

PING:

By means of this bit a presence check to the current Transponder can be operated by the host. The response includes only a status message.

b0: PING will not be operated

b1: PING will be operated by the Reader.

NOTICE:
PING is an exclusive function and can not combine with an APDU command. It can use with or without CID.

FIRST:

This bit indicates the first protocol of a new command. It is necessary for single commands and chained commands.

b0: The present protocol block is the second or further part of a chained command.

b1: The present protocol block is a single command or the first part of a chained command.

MORE:

By means of this bit a data chaining from the host to the Reader can realized if the number of data bytes which shall send exceeds the receive buffer size of the Reader.

b0 **No downlink chaining (Host ⇒ Reader)**
The present protocol block includes the complete command.

b1 **downlink chaining (Host ⇒ Reader)**
The present protocol block includes not the complete command.
After the reader has acknowledged the protocol block the host can send further parts of the command.

NOTICE:

- ***If an error status is responded by the Reader the downlink chaining should stopped by the host.***
- ***If a MORE status (0x94) is responded by the Reader the host have to handle this message.***

Protocol examples for Error-free operation with 3 blocks and 1 MORE response

	DATA	
MODE: b11xx 0xx1	(CID), (NAD), INF	Host ⇒ Reader (1. protocol block)
STATUS: 0x94 (MORE)		Host ⇐ Reader
STATUS: 0x00 (OK)		Host ⇐ Reader
b01xx 0001	INF	Host ⇒ Reader (2. protocol block)
STATUS: 0x00 (OK)		Host ⇐ Reader
b00xx 0001	INF	Host ⇒ Reader (last protocol block)
STATUS: 0x00 (OK)		Host ⇐ Reader

DATA:

The DATA Field could be used to transfer the optional CID, NAD and INF Field of the ISO14443-4 communication protocol.

In most cases the INF Field carries an APDU to the Transponder.

STATUS

0x00 OK

This status shows that APDU exchange is completed.
PSTAT and BLK_CNT has to be evaluated

0x94 MORE

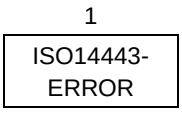
This status shows that further exchange cycles has to be executed.
PSTAT and BLK_CNT has to be evaluated

NOTICE:
In case of STATUS = 0x94 the host has to continue its receiving procedure without sending any further request, because the reader transmits further response data later.

0x96 ISO14443-ERROR

This status shows that an additional ISO14443-ERROR has to be evaluated

RESPONSE-DATA



ISO14443-ERROR

Additional error code if STATUS = 0x96 (see ANNEX C2: Error-Codes

Other

PSTAT and BLK_CNT should not be evaluated.
This response indicates that the present command could not be finished, because of transmission errors.
see ANNEX C: Index of Status Bytes

PSTAT

This parameter represents the processing status of the present command. PSTAT must be evaluated in conjunction with the STATUS byte of the Reader response.

Depending on PSTAT and STATUS the response data of the Reader are different.

0x01 WTXM

This response is given by the Reader if the Transponder needs more time than defined in parameter TR-RESPONSE-TIME (see CFG1) to proceed the present command.

After receiving this response the host shall align his receive timeout to a value greater than indicated by WTXM.

RESPONSE-DATA

1	2	1	1
PSTAT 0x01	BLK_CNT	WTXM	FWI

WTXM and FWI:

refer to ISO 14443-4

The minimum receive timeout could calculated by the following formula:

TIMEOUT = 302µsec * 2^{FWI} * WTXM

WTXM: 1...59
FWI: 0...14

0x02 INF

This response is given by the Reader if the protocol includes data's from the Transponder.

RESPONSE-DATA

1	2	X
PSTAT 0x02	BLK_CNT	APDU-RESPONSE

APDU-RESPONSE:

Response to the APDU from the Transponder (if any).

0xFF BUSY

This response is given by the Reader to re-trigger the receive timeout of the host. This response could occur if an error in data exchange between Transponder and Reader had happened and the Reader retries the process by itself.

RESPONSE-DATA

1	2
PSTAT 0xFF	BLK_CNT

BLK_CNT

The BLK_CNT is a block counter which indexes each transmission from the Reader to the Host. On basis of the BLK_CNT the host could proof and sort the received protocols.

5.4.7. [0x2B] ISO14443-4 Transponder-Info

This command could be helpful to get further information's about the capabilities of the present ISO14443-4 Transponder. The included information are transferred from the Transponder. (For further Information please see ISO/IEC ISO14443-4)

NOTICE:

- ***This command could be used only after the Transponder was selected (see 5.1.2. [0x25] Select).***

REQUEST-DATA

1
[0x2B]

RESPONSE-DATA

1	1	1	1	1	1
FSCI	FWI	DSI	DRI	NAD	CID

FSCI:

Transponder Frame-Size

FSCI	0	1	2	3	4	5	6	7	8	9..255
Bytes	16	24	32	40	48	64	96	128	256	RFU

FWI:

Frame Waiting Time Integer of the Transponder.

Frame Waiting Time (FWT) = 302µsec * 2^{FWI} (FWI_{max} = 14 ⇒ 4949 ms)

DSI (Divisor send Integer)**:**

Displays the present supported data transfer rate from Reader to Transponder.

DSI	**b00**	**b01**	**b10**	**b11**
kbit / s	106	212	424	847

DRI (Divisor receive Integer)**:**

Displays the present supported data transfer rate from Transponder to Reader.

DRI	**b00**	**b01**	**b10**	**b11**
kbit / s	106	212	424	847

NAD:

b1: NAD (Node Address) supported, if bit is set to 1.

CID:

b1: CID (Card Identifier) supported, if bit is set to 1.

5.5. [0xC1] / [0xC3] ISO Host Commands for mifare DESFire Communication

Mifare DESFire can be operated on APDU command level or with high level commands, implemented in firmware.

Chapter 7.1.1. mifare DESFire gives an overview about the available commands for mifare DESFire.

High level commands for mifare DESFire communication are described in separate manuals.

5.6. [0xC2] ISO Host Commands for mifare Plus Communication

Security Level 0, 2 and 3

Mifare Plus in Security Level 0, 2 and 3 can be operated on APDU command level or with high level commands, implemented in firmware.

Chapter 7.1.2. NXP - mifare Plus (Security Level 0, 2, 3) gives an overview about the available commands for this security levels.

Security Level 1

Mifare Plus in Security Level 1 can be operated with commands for mifare classic.

Chapter 7.2.3. NXP - Mifare classic: mini, 1k, 4k / mifare plus (Level 1) gives an overview about the available commands for mifare Plus Security Level 1

5.7. ISO18000-3M3 Standard Host Commands [0xB3]

5.7.1. [0x18] Kill

This command will kill an ISO18000-3M3 Transponder.

REQUEST-DATA

1	1	(1)	EPC_LNG
[0x18]	MODE	(EPC_LNG)	EPC

1	K_PW_LNG	1
K_PW_LNG	K_PW	RECOM_BITS

RESPONSE-DATA if STATUS = 0x00

0
-

RESPONSE-DATA if STATUS = 0x95

1
EPC-ERROR

MODE:

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

ADR:

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.

RECOM

b1: If this bit is set the Recommissioning Bits will be inserted into the protocol.

EPC_LNG:

Is an 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 (4 Byte).

K-PW:

Kill Password.

RECOM_BITS:

Recommissioning Bits according to EPC Global description.

Bit:	7	6	5	4	3	2	1	0
Function	0	0	0	0	0	Asserted 3SB	2SB	LSB

EPC-ERROR:

Additional error code if STATUS = 0x95.

5.7.2. [0x22] Lock

This command locks different memory portions of an ISO18000-3M3 Transponder.

REQUEST-DATA

1	1	(1)	EPC_LNG	1
[0x22]	MODE	(EPC_LNG)	EPC	EPC_TYPE

K_PW_LNG	1	1	A_PW_LNG
LOCK_LNG	LOCK_DATA	A_PW_LNG	A_PW

RESPONSE-DATA if STATUS = 0x00

0
-

RESPONSE-DATA if STATUS = 0x95

1
EPC-ERROR

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 an 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 (= 3)

LOCK_DATA:

Lock data which will be written to the Tag. Contains the kill code which is written to the Transponder.

A_PW_LNG:

Length of Access Password (4Byte).

A_PW:

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

EPC-ERROR:

Additional error code if STATUS = 0x95.

5.8. Special Commands for Transponder Communication

5.8.1. [0xB8] FeliCa Transparent Command

This command sends user transparent commands to FeliCa transponder.

REQUEST-DATA

Mode0

1	2	1	x
MODE	RSP-LENGHT	TIMEOUT	TR-REQUEST

Mode1

1	2	1	1	1	x
MODE	RSP-LENGHT	TIMEOUT	TX-SETTINGS	RX-SETTINGS	TR-REQUEST

RESPONSE-DATA

x
TR-RESPONSE

RSP-LENGTH:

0: The Reader will send the command but not wait for any response

≠ 0: The Reader will send the command and return the response data of the Transponder without Preamble, Sync-Code, Len-Byte and CRC.

TIMEOUT:

The TIMEOUT value defines the time for receiving the whole Transponder response. If the TIMEOUT it exceeded the command will be abort and the Status “NO TRANSPONDER” is returned.

Bit:	7	6	5	4	3	2	1	0
Function	TMO-BASE	Timeout-Value						

TMO-BASE: b0: The Timeout can be adjusted in 1ms steps. (0ms ...127ms)

b1: The Timeout can be adjusted in 100ms steps. (0.1s ...12.7s)

NOTICE:

- ***The value of TIMEOUT must be considered for calculating the HOST-TIMEOUT.***
- ***The value of TIMEOUT must be considered for calculating the TR-RESPONSE-TIME (see:*** 3.2. CFG1: Interface***).***

TX-SETTINGS:

Selects kind and mode of transmission settings.

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

TxBDR

b0: 212 kBaud

b1: 424 kBaud

TxCRCEn

b0: No CRC is inserted

b1: A CRC is calculated over the transmitted data and the CRC byte(s) are appended to the data stream

RX-SETTINGS:

Selects kind and mode of transmission settings.

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

RxBDR

b0: 212 kBaud

b1: 424 kBaud

RxCRCEn

b0: No CRC is checked

b1: The last byte(s) of a received frame is/are interpreted as CRC byte/s

TR-REQUEST:

Transponder request with Len Byte and Packet Data . If “**TxCRCEn”** is “1” the reader appended a calculated CRC (X16+X12+X5+1, Initial-Value = 0x0000) to the date stream. If “**TxCRCEn”** is “0” the application should send the CRC within the **TR-Request**, if the CRC is needed.

NOTICE:

The max. size of Packet Data is 256 Byte

TR-RESPONSE:

Complete transponder response wit with Len Byte and Packet Data. A CRC check is performed inside the reader if "**RxCRCEn"** is "1". However if "**RxCRCEn"** is "0" the transponder CRC is transferred with the response data.

NOTICE:

- ***Data is only transferred if STATUS = 0x00, 0x02, 0x83, 0x84, 0x94.***
- ***The tr-response data ever contains the in RSP-LENGTH defined number of data bytes.***

5.8.2. [0xB9] Jewel Transparent Command

This command sends user transparent commands to Jewel transponder.

REQUEST-DATA

1	2	1	1	1	1
MODE	RSP-LENGHT	TIMEOUT	CRC-INFO	TX-SETTINGS	RX-SETTINGS

2	X
REQ-BITS	TR-REQUEST

RESPONSE-DATA

2	X
RSP-BITS	TR-RESPONSE

MODE:

Options for frame format request.

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

RSP-LENGTH

If RSP-LENGTH is set to “0” the Reader will send the command but not wait for any response.

If RSP-LENGTH is not equal to “0”, it must be set to the number of expected bits **including parity bits** ! The Reader will send the command and return the response data of the transponder without SOF and EOF.

TIMEOUT:

The TIMEOUT value defines the time for receiving the whole Transponder response. If the TIMEOUT it exceeded the command will be abort and the Status “NO TRANSPONDER” is returned.

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

The Timeout-Value can be adjusted in 1ms steps. (0ms ...255ms)

NOTICE:

- ***The value of TIMEOUT must be considered for calculating the HOST-TIMEOUT.***
- ***The value of TIMEOUT must be considered for calculating the TR-RESPONSE-TIME (see CFG1).***

CRC-INFO:

Selects kind and mode of checking the data integrity of the RF-channel.

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

TxCRCEn

b0: No CRC is inserted/transmitted

b1: A CRC is calculated over the transmitted data and the CRC byte(s) are appended to the data stream

RxCRCEn

b0: No CRC is checked

b1: The last byte(s) of a received frame is/are interpreted as CRC byte/s

TX-SETTINGS:

Selects kind and mode of transmission settings.

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

RX-SETTINGS:

Selects kind and mode of reception settings.

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

REQ-BITS:

Number of valid Bits in TR-REQUEST

TR-REQUEST:

Complete transponder request without SOF and EOF. If "**TxCRCEn"** is "1" the reader appended a calculated CRC to the date stream. If "**TxCRCEn"** is "0" the application should send the CRC within the **TR-REQUEST**, if the CRC is needed.

RSP-BITS:

Number of valid Bits in TR-RESPONSE

TR-RESPONSE:

Complete transponder response without SOF and EOF. A CRC check is performed inside the reader if "**RxCRCEn"** is "1". However if "**RxCRCEn"** is "0"the transponder CRC is transferred with the response data.

5.8.3. [0xBD] ISO14443A Transparent Command

This command sends user transparent commands to ISO14443A transponder.

REQUEST-DATA

Mode0, Mode 1

1	2	1	1	x
MODE	RSP-LENGHT	TIMEOUT	CRC-INFO	TR-REQUEST

Mode 2

1	2	1	1	1	x
MODE	RSP-LENGHT	TIMEOUT	CRC-INFO	REQ-BITS	TR-REQUEST

Mode 3

1	2	1	1	1	1
MODE	RSP-LENGHT	TIMEOUT	CRC-INFO	TX-SETTINGS	RX-SETTINGS

2	X
REQ-BITS	TR-REQUEST

RESPONSE-DATA

Mode 0, Mode 1

X
TR-RESPONSE

Mode 2

1	X
RSP-BITS	TR-RESPONSE

Mode 3

2	X
RSP-BITS	TR-RESPONSE

MODE:

Options for frame format request.

The following frame types are defined:
- short frames for commands like REQA, WUPA, ...
- standard frames for regular commands;
- bit oriented anticollision frame for anticollision command

0 = short frame

A short frame is used to initiate communication and consists of, in the following order:

- start of communication;
- 7 data bits transmitted LSB first
- end of communication.
- No parity bit is added.

1 = standard frame

Standard frames are used for data exchange and consist of:

- start of communication;
  - n * (8 data bits + odd parity bit), with n _ 1. The LSB of each byte is transmitted first. Each byte is followed by an odd parity bit. The parity bit P is set such that the number of 1s is odd in (b1 to b8, P);
  - end of communication.

2 = bit oriented frame

Bit oriented Frames are used for anticollision.

RSP-LENGTH

0: The Reader will send the command but not wait for any response

≠ 0: The Reader will send the command and return the response data of the Transponder without SOF, EOF and CRC.

TIMEOUT:

The TIMEOUT value defines the time for receiving the whole Transponder response. If the TIMEOUT it exceeded the command will be abort and the Status “NO TRANSPONDER” is returned.

Bit:	7	6	5	4	3	2	1	0
Function	FWI-VALUE	Timeout-Value						

FWI-VALUE: b0: The Timeout-Value can be adjusted in 1ms steps. (0ms ...127ms)

b1: The Timeout Value is equivalent to the FWI value according to ISO14443-4. (0...14)

With this parameter the Frame waiting time (FWT) according ISO14443-4 could be select by the user

TIMEOUT (FWI)	**approx. Frame waiting time (FWT)**
0	1 ms
1	1 ms
2	2 ms
3	3 ms
4	5 ms
5	10 ms
6	20 ms
7	39 ms
8	78 ms
9	155 ms
10	310 ms
11	619 ms
12	1237 ms
13	2474 ms
14	4948 ms
15..254	- not allowed -

NOTICE:

- ***The value of TIMEOUT must be considered for calculating the HOST-TIMEOUT.***
- ***The value of TIMEOUT must be considered for calculating the TR-RESPONSE-TIME (see:*** 3.2. CFG1: Interface***).***

CRC-INFO:

Selects kind and mode of checking the data integrity of the RF-channel.

Bit:	7	6	5	4	3	2	1	0
Function	-	CRC MSB First	-	-	RxCRC En	TXCRC En	-	Parity En

ParityEn

b0: No parity bit is inserted or expected

b1: An odd parity bit is inserted in the transmitted data stream after each byte and expected in the received data stream after each byte (standard ISO14443A)

TxCRCEn

b0: No CRC is inserted/transmitted

b1: A CRC is calculated over the transmitted data and the CRC byte(s) are appended to the data stream

RxCRCEn

b0: No CRC is checked

b1: The last byte(s) of a received frame is/are interpreted as CRC byte/s

CRCMSBFirst

b0: CRC-calculation starts with the LSB bit (standard ISO14443A)

b1: CRC-calculation starts with the MSB bit

TX-SETTINGS:

Selects kind and mode of transmission settings.

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

BAUDRATE

b00: 106 kBaud

b01: 212 kBaud

b10: 424 kBaud

b11: 848 kBaud

RX-SETTINGS:

Selects kind and mode of reception settings.

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

BAUDRATE

b00: 106 kBaud

b01: 212 kBaud

b10: 424 kBaud

b11: 848 kBaud

REQ-BITS:

Number of valid Bits in TR-REQUEST

TR-REQUEST:

Complete transponder request without SOF and EOF. If "**TxCRCEn"** is "1" the reader appended a calculated CRC to the date stream. If "**TxCRCEn"** is "0" the application should send the CRC within the **TR**-**Request**, if the CRC is needed.

NOTICE:

The max. size of TR-REQUEST is 256 Byte

TR-RESPONSE:

Complete transponder response without SOF and EOF. A CRC check is performed inside the reader if "**RxCRCEn"** is "1". However if "**RxCRCEn"** is "0"the transponder CRC is transferred with the response data.

RSP-BITS:

Number of valid Bits in TR-RESPONSE

NOTICE:

- ***Data is only transferred if STATUS = 0x00, 0x02, 0x83, 0x84, 0x94.***
- ***The response data ever contains the in RSP-LENGTH defined number of data bytes.***

5.8.4. [0xBE] ISO14443B Transparent Command

This command sends user transparent commands to ISO14443B transponder.

REQUEST-DATA

Mode0

1	2	1	1	1	x
MODE	RSP-LENGHT	TIMEOUT	FRAME	CRC-INFO	TR-REQUEST

Mode1

1	2	1	1	1	1	1
MODE	RSP-LENGHT	TIMEOUT	FRAME	CRC-INFO	TX-SETTINGS	RX-SETTINGS

2	X
REQ-BITS	TR-REQUEST

RESPONSE-DATA

x
TR-RESPONSE

RSP-LENGTH:

0: The Reader will send the command but not wait for any response

≠ 0: The Reader will send the command and return the response data of the Transponder without SOF, EOF and CRC.

TIMEOUT:

The TIMEOUT value defines the time for receiving the whole Transponder response. If the TIMEOUT it exceeded the command will be abort and the Status “NO TRANSPONDER” is returned.

Bit:	7	6	5	4	3	2	1	0
Function	FWI-VALUE	Timeout-Value						

FWI-VALUE: b0: The Timeout-Value can be adjusted in 1ms steps. (0ms ...127ms)

b1: The Timeout Value is equivalent to the FWI value according to ISO14443-4. (0...14)

With this parameter the Frame waiting time (FWT) according ISO14443-4 could be select by the user

TIMEOUT (FWI)	approx. Frame waiting time (FWT)
0	1 ms
1	1 ms
2	2 ms
3	3 ms
4	5 ms
5	10 ms
6	20 ms
7	39 ms
8	78 ms
9	155 ms
10	310 ms
11	619 ms
12	1237 ms
13	2474 ms
14	4948 ms
15..254	- not allowed -

NOTICE:

- ***The value of TIMEOUT must be considered for calculating the HOST-TIMEOUT.***
- ***The value of TIMEOUT must be considered for calculating the TR-RESPONSE-TIME (see:*** 3.2. CFG1: Interface***).***

FRAME:

Defines the framing for ISO 14443B transponders.

Bit:	7	6	5	4	3	2	1	0
Function	RxSOF Req	RxEOF Req	-	EOFSOF Width	No TxSOF	No TxEOF	TxEGT	

TxEGT:

These bits define the length of the EGT

b00: 0 Bit
b01: 1 Bit
b10: 2 Bit
b11: 3 Bit

NoTxEOF:

b0: The frame includes EOF
b1: TxCoder suppresses the EOF

NoTxSOF:

b0: The frame includes SOF
b1: TxCoder suppresses the SOF

EOFSOFWidth:

b0: Set the SOF to a length of 10 ETU Low and 2 ETU High
Set the EOF to a length of 10 ETU

b1: Set the SOF to a length of 11 ETU Low and 3 ETU High
Set the EOF to a length of 11 ETU

RxEOF Req:

b0: A data stream with and without EOF is accepted
b1: A EOF is required in data stream

RxSOF Req:

b0: A data stream with and without SOF is accepted
b1: A SOF is required in data stream

CRC-INFO:

Selects kind and mode of checking the data integrity of the RF-channel.

Bit:	7	6	5	4	3	2	1	0
Function	-	CRC MSB First	-	-	RxCRC En	TXCRC En	-	Parity En

ParityEn

b0: No parity bit is inserted or expected (standard ISO14443B)

b1: A parity bit is inserted in the transmitted data stream after each byte and expected in the received data stream after each byte

TxCRCEn

b0: No CRC is inserted

b1: A CRC is calculated over the transmitted data and the CRC byte(s) are appended to the data stream

RxCRCEn

b0: No CRC is checked

b1: The last byte(s) of a received frame is/are interpreted as CRC byte/s

CRCMSBFirst

b0: CRC-calculation starts with the LSB bit (standard ISO14443B)

b1: CRC-calculation starts with the MSB bit

TX-SETTINGS:

Selects kind and mode of transmission settings.

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

BAUDRATE

b00: 106 kBaud

b01: 212 kBaud

b10: 424 kBaud

b11: 848 kBaud

RX-SETTINGS:

Selects kind and mode of reception settings.

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

BAUDRATE

b00: 106 kBaud

b01: 212 kBaud

b10: 424 kBaud

b11: 848 kBaud

REQ-BITS:

Number of valid Bits in TR-REQUEST.

TR-REQUEST:

Complete transponder request without SOF and EOF. If "**TxCRCEn"** is "1" the reader appended a calculated CRC to the date stream. If "**TxCRCEn"** is "0" the application should send the CRC within the **TR-Request**, if the CRC is needed.

NOTICE:

The max. size of TR-REQUEST is 256 Byte

TR-RESPONSE:

Complete transponder response without SOF and EOF. A CRC check is performed inside the reader if "**RxCRCEn"** is "1". However if "**RxCRCEn"** is "0" the transponder CRC is transferred with the response data.

NOTICE:

- ***Data is only transferred if STATUS = 0x00, 0x02, 0x83, 0x84, 0x94.***
- ***The tr-response data ever contains the in RSP-LENGTH defined number of data bytes.***

5.8.5. [0xBF] ISO15693 Transparent Command

This command sends user transparent commands to ISO15693 transponder.

REQUEST-DATA

Mode1 and 2

1	2	2	x
MODE	RSP-LENGHT	reserved	TR-REQUEST

Mode 3 and 4

1	2	2	2	x
MODE	RSP-LENGHT	reserved	EOF-PULSE-DELAY	TR-REQUEST

Mode 5

1	2	1	1	x
MODE	RSP-LENGHT	reserved	MULTIPLE 302us GRIDS	TR-REQUEST

RESPONSE-DATA

X
TR-RESPONSE

MODE:

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

MODE:

Options for request.

b0001(1) = read request

Response is sampled corresponding to ISO15693-3 T1 (318,6µs .... 323,3µs)

b0010(2) = write request with Option “0”

The Reader tries to sample the response after ISO15693-3 T1 (318,6µs .... 323,3µs). If there is no response the Reader tries to sample in a multiple of 302µs. If there is no response within 20ms the command sends back Status “no. Transponder” [0x01].

Depending on the ERROR_Flag in the Transponder response the length of the sampled data is:

- 4 Byte if ERROR_FLAG is “1”.
- RSP-LENGTH if ERROR_FLAG is “0”

b0011(3) = write request with Option “1”

The Reader tries to sample the response after ISO15693-3 T1 (318,6µs .... 323,3µs), if there is no response the Reader sends a EOF after EOF-PULSE-DELAY and tries to sample the response after ISO15693-3 T1 (318,6µs .... 323,3µs)

b0100(4) = inventory request

The Reader tries to sample the response after ISO15693-3 T1 (318,6µs .... 323,3µs). If ISO15693 “Nb_slot_flag” Flag is:

“0”: the Reader sends an EOF after EOF-PULSE-DELAY and tries again to sample the response in the next timeslot (after ISO15693-3 T1 (318,6µs .... 323,3µs)). This is done 16 times.
In this case the RSP-LENGTH defines the response length in one timeslot. Transponder responses with other response length will be ignored. If there is a CRC error in one of the timeslots the protocol status is set to 0x02 [CRC error]. The user should calculate which Transponder data hold the CRC error.

“1”: the Reader sends back the received data.

b0101(5) = write request with Option “0” and grid position of response

The Reader tries to sample the response after ISO15693-3 T1 (318,6µs .... 323,3µs). If there is no response the Reader tries to sample at the time/grid specified in MULTIPLE 302us GRIDS. If there is no response the command sends back Status “no. Transponder” [0x01].
Depending on the ERROR_Flag in the Transponder response the length of the sampled data is:

- 4 Byte if ERROR_FLAG is “1”.
- RSP-LENGTH if ERROR_FLAG is “0”

b0110(6) = read request without any ISO15693 specific data checks and ISO15693 data interpretation

Response is sampled corresponding to CMD-RES-DELAY.
Cause by the fact that no data check is performed inside of the Reader all data with response length same as response length specified in the Host command to the Reader will be transfers with status 0x00. If response length of data from Transponder and response length specified in the Host command to the Reader are unequal, status 0x01 “No Transponder” will be the response of the Reader.
The user of the command mode 6 has to control the data coding and decoding option of the Reader by setting CFG4/Byte 4 – ISO-Mode in the manner the Reader should code the data in the RF forward link and decode the data in the RF return link.

TxCRCEn:

b0 A CRC is calculated over the transmitted data and the CRC byte(s) are appended to the data stream

b1 No CRC is inserted/transmitted

RSP-LENGTH:

Length of the Transponder response in bit without SOF and EOF. During write operations REP-LENGTH is depending on ERROR_FLAG in the Transponder response:

- 4 Byte if ERROR_FLAG is “1”.
- REP-LENGTH if ERROR_FLAG is “0”

reserved (CMD-RSP-DELAY)

Not used. To avoid problems with other i-*scan* Readers value should be value of response delay for Transponder response (ISO15693: t1)
e.g. ISO15693 average value: 0x021F * 590ns = 320,9µs

EOF-PULSE-DELAY:

EOF Pulse delay is used in write operations with ISO15693 write option “1”. EOF to define the in response delay for Transponder response (ISO15693: t1)
e.g. ISO15693 maximum value: 0x846A * 590ns = 20ms

TR-REQUEST:

Complete Transponder request without SOF, CRC16 and EOF

Note:

- ***The read and write option FLAGS in the REQUEST-DATA must correspond to the MODE Byte in the request protocol. Reader is always forcing the command in the way specified by MODE Byte in the request protocol***

TR-RESPONSE:

Complete Transponder response without SOF and EOF. A CRC16 check is performed inside the Reader. However the Transponder CRC16 is transferred with the response data.

Notes:

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

Note:

- ***This command is not available if the Scan-Mode is switched on.***

5.8.5.1. [0xBF] [0xDD]ISO15693 Transparent Command, Channel Select

This protocol is used to set the output channel OUT1-4 on the multiplexer.

Host → MUX

	CMD			Data	
	[0xDD]		0x00	OutCh1	0x00
0x02	8 bits	**0xFE**	0x00	8 bits	0x00

OutCh1:

Output Channel for IN1: 0x00 to 0x04

5.9. [0xBC] Command Queue

This command can be used for sending multiple commands within one protocol frame to the reader to speed up the total processing time. It is like a container for a queue of different commands which shall be processed by the reader sequentially.

REQUEST-DATA

1	2	X
MODE	CMD_NO	CMD_QUEUE

RESPONSE-DATA

1	1	X
0x00	CMD_CNT	QUEUE_RESPONSE

NOTICE:
This command can be used only with commands for Transponder communication as described in chapters 5.1. [0xB0] ISO Standard Host Commands***,*** 5.3. [0xB0] ISO 14443 Standard Host Commands ***and*** 5.4. [0xB2] ISO14443 Special Host Commands***.***

MODE:

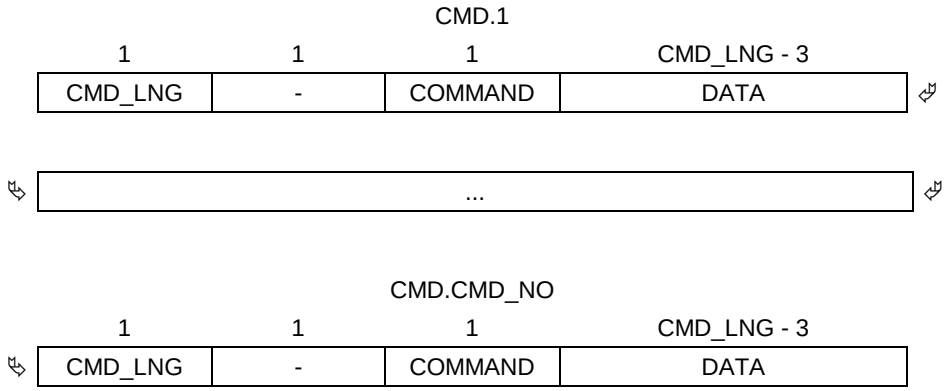
Bit:	7	6	5	4	3	2	1	0
Function	0	0	0	0	0	0	0	0

CMD_NO:

Specifies the number of commands which are included in the queue.

CMD_QUEUE:

This field contains the command queue which shall process by the reader. The structure of a command in queue is identical with the structure of the not queued command, as described in this manual, but without the both CRC16 characters.



CMD_LNG:

Number of command bytes including CMD_LNG.

COMMAND:

Defines the command which shall operated by the reader. .

DATA:

Optional data field with variable length. The number of DATA byte depends on the command.

CMD_CNT:

Indicates the processing step where the reader had stopped the queue processing.

QUEUE_RESPONSE:

The QUEUE_RESPONSE field includes the response of the at last operated command of the command queue. This means that the QUEUE_RESPONSE includes the status and/or data of that command which could be operated at last. If an error occurs while operation of any queued command the queue proceeding will be interrupted and the error status of this last command is send back in the QUEUE_RESPONSE field.

The structure of the QUEUE_RESPONSE is identical with the structure of the not queued QUEUE_RESPONSE as documented in this manual, but without the both CRC16 characters.

1	1	1	1	RSP_LNG - 4
RSP_LNG	COM_ADR	COMMAND	Status[1]	DATA

RSP_LNG:

Number of response bytes including RSP_LNG.

COMMAND:

Command which was operated by the reader at least.

DATA:

Optional data field with variable length. The number of DATA byte depends on the command.

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

EXAMPLE:

The commands
1. [0xB0][0x25] select,
2. [0xB2] [0xB0] authent mifare and
3. [0xB0][0x23] read multiple blocks
shall be operated within one queue.

Host → Reader

1	2	1	3	1	5
STX	LENGTH	COM-ADR	COMMAND	MODE	CMD_NO
0x02	0x002B	0x00	[0xBC]	0x00	0x03

SELECT

1	1	1	10
CMD_LNG	-	COMMAND	DATA
0x0D	0x00	[0xB0]	[0x25] 0x01 0x00 0x00 0x00 0x00 0x6C 0x29 0xA7 0x62

Authent Mifare, DB_ADR: 4, KEY_TYP: A, KEY_ADR: 0

1	1	1	5
CMD_LNG	-	COMMAND	DATA
0x08	0x00	[0xB2]	[0xB0] 0x02 0x00 0x00 0x00

Read Multiple Blocks, DB_ADR: 4, DB_N: 1

1	1	1	4	2
CMD_LNG	-	COMMAND	DATA	CRC16
0x07	0x00	[0xB0]	[0x23] 0x02 0x04 0x01	

Host ← Reader

1	2	1	1	1	1
STX	LENGHT	COM_ADR	COMMAND	STATUS	CMD_CNT
0x02	0x0020	0x00	[0xBC]	0x00	0x03

23	2
RESPONSE-DATA	CRC16
0x17 0x00 0x[B0] 0x00 0x01 0x10 0x00 0x74 0x73 0x65 0x54 0x20 0x6E 0x69 0x65 0x20 0x74 0x73 0x69 0x20 0x73 0x61 0x44	

6. [0xC0] SAM Commands

The [0xC0] commands are supposed for communication with SAMs (security application modules) which could be installed inside the reader, if the reader is equipped with a SAM socket. CPU-based SAM with T0= and/or T=1 protocol are supported as defined in ISO7816-4.

REQUEST-DATA

1	1	1	(X)
SLOT	SC_TIMEOUT	SUB-COMMAND	PARAMETER

RESPONSE-DATA

(X)
SAM-RESPONSE

SLOT:

Defines the physical address of the requested smartcard slot.

1: addresses the smartcard in Slot SD1
2: addresses the smartcard in Slot SD2
3: addresses the smartcard in Slot SD3
4: addresses the smartcard in Slot SD4

SC_TIMEOUT:

Defines the individual timeout for the current command. If the reader can not finish the current command within the defined SC_TIMEOUT it will respond a timeout error.

0: - do not use -
1..255: timeout in 100 ms increments.

The host application has to consider the SC_TIMOUT for setting the timeout on host side.

SUB-COMMAND, PARAMETER:

Command specific request with variable length

SAM-RESPONSE:

Command specific response with variable length.

6.1. [0x01] SAM Activate / Deactivate

With this command a smartcard can be activated and deactivated and also the protocol selection can be performed.

The activation and protocol selection is the first smartcard command which has to be preceded in a communication cycle with a smartcard.

REQUEST-DATA

1	1	1	1	1	1	1
SLOT	SC_TIMEOUT	[0x01]	MODE	EXT_TA1	MODE2	EXT_CLK

1	1	1
EXT_TC1	EXT_TC2	EXT_TBx

RESPONSE-DATA

(X)
ATR

MODE:

Bit:	7	6	5	4	3	2	1	0
Function	SET_ MODE2	0	CLASS		SET_TA1	ACTIVATE		

ACTIVATE

With this parameter the smartcard activation or deactivation and the protocol selection can be done.

In case of an activation command the reader response includes the ATR (Answer to Reset) of the card and/or an error status. The supported baudrates are shown in ANNEX F: Supported SAM Baud Rates.

b000 Deactivation
This setting powers off the addressed smartcard.

b001 T=0 protocol activation [Cold Reset]
This setting powers up the smartcard and performs a smartcard reset and attempts to activate the T=0 protocol of the card, if this protocol is supported by the card.

b011 T=1 protocol activation [Cold Reset]
This setting powers up the smartcard and performs a smartcard reset and attempts to activate the T=1 protocol of the card, if this protocol is supported by the card.

b010 GetATR
This setting activates the addressed smartcard temporary and can be used to evaluate ATR string of the inserted smartcard.

Notice:
This mode deactivates an activated smartcard.

b100 Activate first offered transmission protocol [Cold Reset]
This setting powers up the smartcard and performs a smartcard reset and attempts to activate the first offered transmission protocol of the card.
(T=0 or T=1 support)

b101 T=0 protocol activation [Warm Reset]
This setting performs a smartcard warm reset and attempts to activate the T=0 protocol of the card, if this protocol is supported by the card.

b110 Activate first offered transmission protocol [Warm Reset]
This setting performs a smartcard reset and attempts to activate the first offered transmission protocol of the card.
(T=0 or T=1 support)

b111 T=1 protocol activation [Warm Reset]
This setting performs a smartcard warm reset and attempts to activate the T=1 protocol of the card, if this protocol is supported by the card.

CLASS

With this parameter the smartcard activation of different voltage classes can be done.

b00 AutoMode

This setting tries to activate the smartcard using all voltage classes. The order of activation attempts is Class C, Class B and Class A.

b01 Class A (5V)

This setting tries to activate the smartcard using voltage Class A.

b10 Class B (3V)

This setting tries to activate the smartcard using voltage Class B.

b11 Class C (1.8V)

This setting tries to activate the smartcard using voltage Class C.

SET_TA1:

If this bit is set the optional parameter EXT_TA1 must inserted into the command

SET_MODE2:

If this bit is set the additional byte MODE2 must inserted into the command.

EXT_TA1:

By using this optional parameter it is possible for the application to select an explicit SAM Baud Rate. The structure of EXT_TA1 is equal to the TA(1) byte of ISO 7816-3.

The supported baudrates are shown in ANNEX F: Supported SAM Baud Rates.

Bit:	7	6	5	4	3	2	1	0
Function	Fi				Di			

Fi:

Indicator value of the clock rate conversion factor according ISO 7816-3.

Di:

Indicator value of the baud rate adjustment factor according ISO 7816-3.

MODE2:

By Using this optional parameter additional settings can be enabled.

Bit:	7	6	5	4	3	2	1	0
Function	0	0	0	0	SET_TBx	SET_TC2	SET_TC1	SET_CLK

SET_CLK:

If this bit is set, the optional parameter EXT_CLK must be inserted into the command.

SET_TC1: Global Interface Character TC1: ExtraGuardTime

If this bit is set, the optional parameter EXT_TC1 must be inserted into the command.

SET_TC2: Specific Interface Character [for T=0] TC2: WI (Work Waiting Time Index)

If this bit is set, the optional parameter EXT_TC2 must be inserted into the command.

SET_TBx: Specific Interface Character [for T=1] TBx: BWI|CWI

(Block Waiting Time Index)| (Character Waiting Time Index)

If this bit is set, the optional parameter EXT_TC1 must be inserted into the command.

EXT_CLK:

By using this optional parameter it will be possible for the application to select an explicit SAM card clock. For possible settings please refer to the following table.

EXT_CLK	Card Clock	
	SAM1; SAM3	SAM2; SAM4
0…2	30,00 MHz	15.00 MHz
3…4	15,00 MHz	7,50 MHz
5…6	10,00 MHz	5,00 MHz
7…8	7,50 MHz	3,75 MHz
9…10	6,00 MHz	3,00 MHz
11…12	5,00 MHz	2,50 MHz
13…14	4,29 MHz	2,14 MHz
15…16	3,75 MHz	1,88 MHz
17…18	3,33 MHz	1,67 MHz
19…20	3,00 MHz	1,50 MHz
21…22	2,73 MHz	1,36 MHz
23…24	2,50 MHz	1,25 MHz
25…26	2,31 MHz	1,15 MHz
27…28	2,14 MHz	1,07 MHz
29…30	2,00 MHz	1,00 MHz
31…32	1,88 MHz	1,00 MHz
33…34	1,76 MHz	1,00 MHz
35…36	1,67 MHz	1,00 MHz
37…38	1,58 MHz	1,00 MHz
39…40	1,50 MHz	1,00 MHz
41…42	1,43 MHz	1,00 MHz
43…44	1,36 MHz	1,00 MHz
45…46	1,30 MHz	1,00 MHz
47…48	1,25 MHz	1,00 MHz
49…50	1,20 MHz	1,00 MHz
51…52	1,15 MHz	1,00 MHz
53…54	1,11 MHz	1,00 MHz
55…56	1,07 MHz	1,00 MHz
57…58	1,03 MHz	1,00 MHz
59…60	1,00 MHz	1,00 MHz
61…255	1,00 MHz	1,00 MHz

EXT_TC1:

By using this optional parameter it will be possible for the application to select an explicit extra guard time. The structure of EXT_TC1 is equal to the TC(1) byte of ISO 7816-3.

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

N:

Indicator value of the extra guard time factor according ISO 7816-3.

EXT_TC2:

By using this optional parameter it will be possible for the application to select an explicit work waiting time for T=0 protocol. The structure of EXT_TC2 is equal to the TC(2) byte of ISO 7816-3.

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

WI:

Indicator value of the work waiting time factor according ISO 7816-3.

EXT_TBx:

By using this optional parameter it will be possible for the application to select an explicit block waiting time and character waiting time for T=1 protocol. The structure of EXT_TBx is equal to the TB(x) (for x>2) byte of ISO 7816-3.

Bit:	7	6	5	4	3	2	1	0
Function	BWI				CWI			

BWI:

Indicator value of the block waiting time factor according ISO 7816-3.

CWI:

Indicator value of the character waiting time factor according ISO 7816-3.

6.2. [0x22] GetMoreData

This command has to be executed, if status = 0x94 and PSTAT = 0x01, 0x02, 0x04 or 0xFF is responded by the following commands:

- 6.6. [0xBF] ISO7816 APDU Exchange
- 6.2. [0x22] GetMoreData
- 6.3. [0x23] AckAbortRequest

REQUEST-DATA

1	1	1	1
SLOT	SC_TIMEOUT	[0x22]	MODE

RESPONSE-DATA

1	2	X
PSTAT	BLK_CNT	> depends on PSTAT <

MODE:

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

STATUS

0x00 OK
This status shows that APDU exchange is completed.
PSTAT and BLK_CNT have to evaluated.

0x94 MORE
This status shows that further exchange cycles has to be executed.
PSTAT and BLK_CNT have to evaluated.

Other
PSTAT and BLK_CNT should not be evaluated.
This response indicates that the present command cannot be finished, because of transmission errors. see ANNEX C: Index of Status Bytes

PSTAT

This parameter represents the processing status of the present command. PSTAT must be evaluated in conjunction with the STATUS byte of the Reader response.

Depending on PSTAT and STATUS the response data of the Reader are different.

0x01 WTXM

This response is given by the Reader if the smartcard needs more time than defined in parameter TIMEOUT (see 6. [0xC0] SAM Commands) to proceed the present command.

After receiving this response the host shall align his host timeout to a value greater than indicated by WTXM.

RESPONSE-DATA

1	2	1
PSTAT 0x01	BLK_CNT	WTXM

Calculating the host timeout:

refer to ISO 7816-3:2006 (3rd edition)

The minimum host timeout could be calculated by the following formula:

TIMEOUT = BWT * WTXM

WTXM: 1...255
BWI: 0...9

BWT is calculated by the formula:

$BWT = 11\ etu + 2^{BWI} * 960 * Fd / f$

$= 11 + 2^{BWI} * 960 * 372 / (Fi/Di)\ etu$

$BWT = (2^{BWI} * 960 * 372 / f_{CardClock} + 11 * (1 / Di * Fi / f_{CardClock}))$

Example: BWI = 4; $f_{CardClock}$ = 3,5712 MHz; Di = 1; Fi = 372

$BWT = 1,6 + 0,001146$

$BWT = 1,601146\ s = 1601,146\ ms$

0x02 INF

This response is given by the Reader if the protocol includes data's from the smartcard.

RESPONSE-DATA

1	2	X
PSTAT 0x02	BLK_CNT	APDU-RESPONSE

APDU-RESPONSE:

Response to the ISO7816-4 APDU from the card (if any).

Activated Protocol	Maximum APDU-RESPONSE size	Description
T=0	258 bytes	256 bytes (Data) + 2 Byte (SW1, SW2)
T=1	254 bytes	maximum INF Block Size

0x03 ABORT REQUEST

The response is given by the reader if the smartcard aborts a chaining process. To acknowledge the request the command 6.3. [0x23] AckAbortRequest should be sent.

RESPONSE-DATA

1	2
PSTAT 0x03	BLK_CNT

0x04 IFSC CHANGE REQUEST

This response is given by the reader if the smartcard changes its maximum blocksize (IFSC). The user must adjust the size of the following request APDUs. To acknowledge the request the command 6.2. [0x22] GetMoreData should be sent.

RESPONSE-DATA

1	2	1
PSTAT 0x04	BLK_CNT	IFSC

0xFF BUSY

This response is given by the reader to re-trigger the host timeout of the host. This response could occur if an error in data exchange between smartcard and Reader had happened and the Reader retries the process by itself.

RESPONSE-DATA

1	2
PSTAT 0xFF	BLK_CNT

BLK_CNT

The BLK_CNT is a block counter which indexes each transmission from the Reader to the Host. On basis of the BLK_CNT the host could proof and sort the received protocols.

6.3. [0x23] AckAbortRequest

This command has to be executed, if status = 0x94 and PSTAT = 0x03 is responded by the following commands:

- command 6.6. [0xBF] ISO7816 APDU Exchange
- command 6.2. [0x22] GetMoreData

This command is only needed if chaining is done.

Chaining process from device to smartcard:

After the response of this command, the host should restart the chaining using the first block by using the command 6.6. [0xBF] ISO7816 APDU Exchange.

Chaining process smartcard to device:

The host should discard all previously received data and analyze the response of this command.

REQUEST-DATA

1	1	1	1
SLOT	SC_TIMEOUT	[0x23]	MODE

RESPONSE-DATA

1	2	X
PSTAT	BLK_CNT	> depends on PSTAT <

MODE:

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

RESPONSE-DATA

Please refer to 6.2. [0x22] GetMoreData

6.4. [0xBD] T=0 Data Exchange

This command is to exchange APDU (Application Protocol Data Unit) command and response pairs with the smartcard by using the T=0 protocol.

Before performing this command the T=0 protocol has to be selected and the smartcard has to activated by using the SAM Activate / Deactivate command (see 6.1. [0x01] SAM Activate / Deactivate).

REQUEST-DATA

1	1	1	1	1	1	1
SLOT	SC_TIMEOUT	[0xBD]	MODE	CLA	INS	P1

1	1	P3
P2	P3	DATA

RESPONSE-DATA

P3	1	1
DATA	SW1	SW2

MODE:

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

TR_REC:

This bit specifies the data transfer direction of the current command.

b0: Transmit data to SAM

b1: Receive data from SAM

CLA:

APDU instruction class byte.

INS:

APDU instruction

P1:

APDU parameter byte 1

P2:

APDU parameter byte 2

P3:

Definition according ISO7816 part 3

>0 Defines the number of bytes to be transferred during the command.

=0 depending on TR_REC:

TR_REC: = b0 (transmit data)
Introduces no data transfer.

TR_REC: = b1 (receive data)
Introduces a 256 byte data transfer from the smartcard.

DATA:

APDU command or response data.

SW1, SW2:

Status Code returned by the card.

6.5. [0xBE] T=1 Data Exchange

This command is to exchange APDU (Application Protocol Data Unit) command and response pairs with the smartcard by using the T=1 protocol.

Before performing this command the T=1 protocol has to be selected and the smartcard has to activated by using the SAM Activate / Deactivate command (see 6.1. [0x01] SAM Activate / Deactivate).

The SAM interface has implemented only the common functionality of a smartcard reader. Smartcard functions as WTX handling, chaining and some error recovering proceedings are not implemented into the reader firmware and have do done by the host computer or device driver on host side.

REQUEST-DATA

1	1	1	1	X
SLOT	SC_TIMEOUT	[0xBE]	MODE	(REQ_DATA)

RESPONSE-DATA

(X)
(RSP_DATA)

MODE:

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

REQ_DATA:

The REQ_DATA Field could be used to transfer T=1 APDU and has to build by the optional NAD, PCB, LEN, INF Field of the communication protocol.

In most cases the INF Field carries an APDU to the smartcard.

The EDC field is build internally by the reader

RSP_DATA:

Response to the T1 block from the card (if any).

The EDC field is not included in RSP_DATA.

6.6. [0xBF] ISO7816 APDU Exchange

This command is to exchange APDU (Application Protocol Data Unit) command and response pairs with the smartcard.

Before performing this command the T=0 or the T=1 protocol has to be selected and the smartcard has to activated by using the SAM Activate / Deactivate command (see 6.1. [0x01] SAM Activate / Deactivate).

REQUEST-DATA

1	(X)
MODE	APDU-DATA

RESPONSE-DATA

Please refer to 6.2. [0x22] GetMoreData

MODE:

Bit:	7	6	5	4	3	2	1	0
Function	FOLLOWING	MORE (Downlink) (I-Block Chaining) (only T=1)	-	-	-	NAD_E (only T=1)	-	-

MODE bit setting rules

MODE	REQ-DATA		
	1	x	
b0000 0000	(INF)		APDU without NAD (single block)
b0100 0000	(INF)		APDU without NAD (first chained block)
b1100 0000	(INF)		APDU without NAD (further chained block)
b1000 0000	(INF)		APDU without NAD (last chained block)
b0000 0100	NAD	(INF)	APDU with NAD (single block)
b0100 0100	NAD	(INF)	APDU with NAD (first chained block)

NAD_E (only T=1):

b0 The REQ-DATA Block includes no NAD

b1: The REQ-DATA Block includes an optional 1 byte NAD Parameter

FOLLOWING:

This bit indicates the second or further protocol of a command. It is necessary for chained commands.

b0: The present protocol block is a single command or the first part of a chained command.

b1: The present protocol block is the second or further part of a chained command.

MORE (only T=1):

By means of this bit a I-Block data chaining from the host to the Reader could be realized..

b0 No downlink chaining (Host ⇒ Reader)
The present protocol block includes the complete command.

b1 downlink chaining (Host ⇒ Reader)
The present protocol block includes not the complete command.
After the reader has acknowledged the protocol block the host can send further I-Blocks of the command.

NOTICE:

- ***If an error status is responded by the Reader the downlink chaining should stopped by the host.***
- ***If a MORE status (0x94) is responded by the Reader the host have to handle this message.***

Protocol examples for Error-free operation with 3 blocks and 1 MORE response

	DATA	
MODE: b0100 0x00	(NAD), INF	Host ⇒ Reader (1. protocol block)
STATUS: 0x94 (MORE)		Host ⇐ Reader
[0xC0] [0x22]		Host ⇒ Reader (Get MORE Data)
STATUS: 0x00 (OK)		Host ⇐ Reader
B1100 0000	INF	Host ⇒ Reader (2. protocol block)
STATUS: 0x00 (OK)		Host ⇐ Reader
B1000 0000	INF	Host ⇒ Reader (last protocol block)
STATUS: 0x00 (OK)		Host ⇐ Reader

APDU-DATA:

The APDU-DATA Field could be used to transfer ISO7816-4 APDUs

Activated Protocol	Maximum APDU-DATA size	Description
T=0	260 bytes	CLA, INS, P1, P2, P3, 255 bytes (Data)
T=1	254 bytes / 255[1] bytes	maximum INF Block Size

In T=0 protocol only short APDUs could be sent to the smartcard.

Please refer to ISO7816-3:2006 3rd edition, how to map extended APDUs to short APDUs.

Another possibility is to use the fescr function library (which would handle extended APDUs).

If the T=1 protocol is activated, the APDU-DATA Field could be used to transfer the optional NAD and INF Field of the ISO7816-4 communication protocol.

In most cases the INF Field carries an APDU to the SAM.

Field	Description	Number of bytes
Command header	Class byte denoted CLA	1
	Instruction byte denoted INS	1
	Parameter denoted P1-P2	2
L_c field	Absent for encoding $N_c = 0$, present for encoding $N_c > 0$	0, 1
Command data field	Absent if $N_c = 0$, present as string of N_c bytes if $N_c > 0$	N_c
L_e field	Absent for encoding $N_e = 0$, present for encoding $N_e > 0$	0, 1

[1] 255 bytes, if NAD is used

7. Supported ISO Host commands

The command codes listed in the following chapters gives an overview of the various Transponder commands and operations that are available for each Transponder type.

NOTICE:

Detailed data sheets and information's about the functions and capabilities of each Transponder type are not supplied by FEIG ELECTRONIC. For detailed information's we refer to the original data sheets of the chip manufacturer.

7.1. ISO14443A & B Part 4 compliant Transponder

Memory organization:
Depends on the type and implementation of the used Transponder.

Command Code	Function	Mode			Comment
		non-addressed	addressed	selected	
[0xB0] [0x01]	Inventory	-	-	-	
[0xB0] [0x25]	Select	-	√	-	
[0xB2] [0xBE]	ISO14443-4 T=CL	-	-	√	
[0xB2] [0x2B]	ISO14443-4 Transponder-Info	-	-	√	

7.1.1. mifare DESFire

mifare DESFire (MF3 IC D40)

mifare DESFire EV1 (2k: MF3 IC D21, 4k: MF3 IC D41, 8k: MF3 IC D81)

Standard Commands

Command Code	Function	Mode			Comment
		non-addressed	addressed	selected	
[0xB0] [0x01]	Inventory	-	-	-	
[0xB0] [0x25]	Select	-	√	-	
[0xB2] [0xBE]	ISO14443-4 T=CL	-	-	√	
[0xB2] [0xBF]	ISO14443-4 Container	-	-	√	
[0xB2] [0x2B]	ISO14443-4 Transponder-Info	-	-	√	

[0xC1] High Level Commands

Command Code	Function	Mode			Comment
		non-addressed	addressed	selected	
[0xC1] [0xFA]	DESFire Authent	-	-	√	①
[0xC1] [0xBD]	DESFire Read Standard Data	-	-	√	①
[0xC1] [0x3B]	DESFire Write Standard Data	-	-	√	①
[0xC1] [0x6C]	DESFire Get Value	-	-	√	①
[0xC1] [0x0C]	DESFire Credit	-	-	√	①
[0xC1] [0xDC]	DESFire Debit	-	-	√	①
[0xC1] [0x1C]	DESFire Limited Credit	-	-	√	①
[0xC1] [0x3B]	DESFire Write Records	-	-	√	①
[0xC1] [0xBB]	DESFire Read Records	-	-	√	①
[0xC1] [0xEB]	DESFire Clear Record File	-	-	√	①
[0xC1] [0x5F]	DESFire Change File Settings	-	-	√	①
[0xC1] [0x54]	DESFire Change Key Settings	-	-	√	①
[0xC1] [0xC4]	DESFire Change Key	-	-	√	①

[0xC3] High Level Commands

Command Code	Function	Mode			Comment
		non-addressed	addressed	selected	
[0xC3] [0xFA]	DESFire Authent	-	-	√	① / ②
[0xC3] [0x54]	DESFire Change Key Settings	-	-	√	① / ②

Command Code	Function	Mode			Comment
[0xC3] [0x45]	DESFire Get Key Settings	-	-	√	① / ②
[0xC3] [0xC4]	DESFire Change Key	-	-	√	① / ②
[0xC3] [0x54]	DESFire Get Key Version	-	-	√	① / ②
[0xC3] [0xCA]	DESFire Create Application	-	-	√	① / ②
[0xC3] [0xDA]	DESFire Delete Application	-	-	√	① / ②
[0xC3] [0x6A]	DESFire Get Application IDs	-	-	√	① / ②
[0xC3] [0x6D]	DESFire Get DF Names	-	-	√	① / ②
[0xC3] [0x5A]	DESFire Select Application	-	-	√	① / ②
[0xC3] [0xFC]	DESFire Format PICC	-	-	√	① / ②
[0xC3] [0x60]	DESFire Get Version	-	-	√	① / ②
[0xC3] [0x6E]	DESFire Free Mem	-	-	√	① / ②
[0xC3] [0x5C]	DESFire Set Configuration	-	-	√	① / ②
[0xC3] [0x51]	DESFire Get Card UID	-	-	√	① / ②
[0xC3] [0x6F]	DESFire Get File IDs	-	-	√	① / ②
[0xC3] [0x61]	DESFire Get ISO File IDs	-	-	√	① / ②
[0xC3] [0xF5]	DESFire Get File Settings	-	-	√	① / ②
[0xC3] [0x5F]	DESFire Change File Settings	-	-	√	① / ②
[0xC3] [0xCD]	DESFire Create Standard Data File	-	-	√	① / ②
[0xC3] [0xCB]	DESFire Backup Data File	-	-	√	① / ②
[0xC3] [0xCC]	DESFire Create Value File	-	-	√	① / ②
[0xC3] [0xC1]	DESFire Create Linear Record File	-	-	√	① / ②
[0xC3] [0xC0]	DESFire Create Cyclic Record File	-	-	√	① / ②
[0xC3] [0xDF]	DESFire Delete File	-	-	√	① / ②
[0xC3] [0xBD]	DESFire Read Standard Data	-	-	√	① / ②
[0xC3] [0x3B]	DESFire Write Standard Data	-	-	√	① / ②
[0xC3] [0x6C]	DESFire Get Value	-	-	√	① / ②
[0xC3] [0x0C]	DESFire Credit	-	-	√	① / ②
[0xC3] [0xDC]	DESFire Debit	-	-	√	① / ②
[0xC3] [0x1C]	DESFire Limited Credit	-	-	√	① / ②
[0xC3] [0x3B]	DESFire Write Records	-	-	√	① / ②
[0xC3] [0xBB]	DESFire Read Records	-	-	√	① / ②
[0xC3] [0xEB]	DESFire Clear Record File	-	-	√	① / ②
[0xC3] [0xC7]	DESFire Commit Transaction	-	-	√	① / ②
[0xC3] [0xA7]	DESFire Abort Transaction	-	-	√	① / ②

① See manual H01110-0e-ID-B.doc SoftCrypto functions for reader types without SAM

② See manual H01111-0e-ID-B.doc SAMCrypto functions for reader types with SAM

7.1.2. NXP - mifare Plus (Security Level 0, 2, 3)

For mifare PLUS security Level 1 see: 7.2.3. NXP - Mifare classic: mini, 1k, 4k / mifare plus (Level 1)

Memory organization:

mifare Plus 2k (MF1SPLUS60, MF1PLUS60)

Number of blocks	64	user area: 47
Block size	16 byte	

mifare Plus 4k (MF1SPLUS80, MF1PLUS80)

Number of blocks	256	user area: 215
Block size	16 byte	

mifare Plus (MF1PLUS60, MF1PLUS80)

Command Code	Function	ISO14443 Level	Mode		Comment
			addressed	selected	
[0xB0] [0x01]	Inventory	-	-	-	
[0xB0] [0x25]	Select	-	√	-	
[0xB2] [0xBE]	ISO14443-4 T=CL	-4	-	√	
[0xB2] [0xBF]	ISO14443-4 Container	-4	-	√	
[0xB2] [0x2B]	ISO14443-4 Transponder-Info	-4	-	√	
[0xC2] [0x77]	MFP_SL1_Authent	-3	-	√	①
[0xC2] [0x70]	MFP_FirstAuthentication	-4	-	√	①
[0xC2] [0x76]	MFP_FollowingAuthentication	-4	-	√	①
[0xC2] [0x75]	MFP_SL2_AESandCRYPTO1Authent	-3	-	√	①
[0xC2] [0x38]	MFP_SL2_MultiBlockRead	-3	-	√	①
[0xC2] [0xA8]	MFP_SL2_MultiBlockWrite	-3	-	√	①
[0xC2] [0x78]	MFP_SL3_ResetAuthnetication	-4	-	√	①
[0xC2] [0x30]	MFP_SL3_ReadEncrypted	-4	-	√	①
[0xC2] [0x31]	MFP_SL3_ReadEncryptedMaced	-4	-	√	①
[0xC2] [0x32]	MFP_SL3_ReadPlain	-4	-	√	①
[0xC2] [0x33]	MFP_SL3_ReadPlainMaced	-4	-	√	①
[0xC2] [0x34]	MFP_SL3_ReadEncryptedUnmaced	-4	-	√	①
[0xC2] [0x35]	MFP_SL3_ReadEncryptedUnmacedRespMaced	-4	-	√	①
[0xC2] [0x36]	MFP_SL3_ReadPlainUnmaced	-4	-	√	①
[0xC2] [0x37]	MFP_SL3_ReadPlainUnmacedRespMaced	-4	-	√	①
[0xC2] [0xA0]	MFP_SL3_WriteEncrypted	-4	-	√	①
[0xC2] [0xA1]	MFP_SL3_WriteEncryptedMaced	-4	-	√	①
[0xC2] [0xA2]	MFP_SL3_WritePlain	-4	-	√	①
[0xC2] [0xA3]	MFP_SL3_WritePlainMaced	-4	-	√	①
[0xC2] [0xB0]	MFP_SL3_IncrementEnrypted	-4	-	√	①

Command	Function	ISO14443	Mode		Comment
[0xC2] [0xB1]	MFP_SL3_IncrementEnryptedMaced	-4	-	√	①
[0xC2] [0xB2]	MFP_SL3_DecrementEnrypted	-4	-	√	①
[0xC2] [0xB3]	MFP_SL3_DecrementEnryptedMaced	-4	-	√	①
[0xC2] [0xB4]	MFP_SL3_Transfer	-4	-	√	①
[0xC2] [0xB5]	MFP_SL3_TransferMaced	-4	-	√	①
[0xC2] [0xB6]	MFP_SL3_IncrementTransferEncrypted	-4	-	√	①
[0xC2] [0xB7]	MFP_SL3_IncrementTransferEncryptedMaced	-4	-	√	①
[0xC2] [0xB8]	MFP_SL3_DecrementTransferEncrypted	-4	-	√	①
[0xC2] [0xB9]	MFP_SL3_DecrementTransferEncryptedMaced	-4	-	√	①
[0xC2] [0xC1]	MFP_SL3_Restore	-4	-	√	①
[0xC2] [0xC2]	MFP_SL3_RestoreMaced	-4	-	√	①

① See manual H01110-0e-ID-B.doc SoftCrypto functions

To find the AES Key to the chosen Data-Block you have to use the following calculation:

AES Sector Keys for sector 0 to 39 (40 00h to 40 4Fh)

Key A = sector number multiplied by 2

Key B = sector number multiplied by 2 +1

E.g. Key A for sector 2 has number: 40 04

7.2. ISO14443A Part 3 compliant Transponder

7.2.1. Infineon - my-d move SLE66R01P

Memory organization (SLE66R01P): 38 x 4 byte = 152 byte

Number of blocks	38	user area: 12 ... 32
Block size	4 byte	

Command Code	Function	Mode			Comment
		non-addressed	addressed	selected	
[0xB0] [0x01]	Inventory	-	-	-	
[0xB0] [0x23]	Read Multiple Blocks	-	-	√	Security Status is always 0x00
[0xB0] [0x24]	Write Multiple Blocks	-	-	√	
[0xB0] [0x25]	Select	-	√	-	
[0xB0] [0xC0]	Halt	-	-	√	

Commands for password protected memory and multiple block read/write commands can be carried out by using [0xBD] ISO14443A Transparent Command or by with using the C++ Class Library ID FEDM up from version 3.01.00 (see document H10202-##-ID-B) of software development kit.

7.2.2. Infineon - my-d proximity SLE55Rxx

Memory organization:

SLE55R04: 616 bytes

Number of blocks	82	max. user area: 5...81 min. user area: 32...81
Block size	8 / (10) byte	

SLE55R08: 1024 bytes

Number of blocks	133	max. user area: 5...132 min. user area: 32...132
Block size	8 / (10) byte	

SLE55R16: 2048 bytes

Number of blocks	261	max. user area: 5...260 min. user area: 32...260
Block size	8 / (10) byte	

Command Code	Function	Mode			Comment
		non-addressed	addressed	selected	
[0xB0] [0x01]	Inventory	-	-	-	
[0xB0] [0x23]	Read Multiple Blocks	-	-	√	DB-Size = 8
[0xB0] [0x24]	Write Multiple Blocks	-	-	√	DB-Size = 8
[0xB0] [0x25]	Select	-	√	-	
[0xB0] [0xC0]	Halt	-	-	√	

7.2.3. NXP - Mifare classic: mini, 1k, 4k / mifare plus (Level 1)

Memory organization:

mifare mini (MF1 S20)

Number of blocks	20	user area: 14
Block size	16 byte	

mifare standard 1k (MF1 IC S50)

Number of blocks	64	user area: 47
Block size	16 byte	

mifare standard 4k (MF1 IC S70)

Number of blocks	256	user area: 215
Block size	16 byte	

mifare plus 2k (MF1PLUS60)

Number of blocks	128	user area: 95
Block size	16 byte	

mifare plus 4k (MF1PLUS80)

Number of blocks	256	user area: 215
Block size	16 byte	

Command Code	Function	Mode			Comment
		non-addressed	addressed	selected	
[0xB0] [0x01]	Inventory	-	-	-	
[0xB0] [0x23]	Read Multiple Blocks*	-	-	√	Security Status is always 0x00
[0xB0] [0x24]	Write Multiple Blocks*	-	-	√	
[0xB0] [0x25]	Select	-	√	-	
[0xB0] [0xC0]	Halt	-	-	√	
[0xB2] [0x30]	Mifare value Commands*			√	
[0xB2] [0xB0]	Authent Mifare*	-	-	√	

**** The Reader uses a linear addressing mode. To calculate the Data-Block-Address (DB_ADR) the expected mifare Sector and the mifare Block in the sector must be known.***

DB_ADR calculation method:

MF1 IC S20	Sector 0 ... 4: DB_ADR = MIFARE_SECTOR * 4 + MIFARE_BLOCK
MF1 IC S50	Sector 0 ... 15: DB_ADR = MIFARE_SECTOR * 4 + MIFARE_BLOCK
MF1 IC S70 **MF1 PLUS 80**	Sector 0 ... 31: DB_ADR = MIFARE_SECTOR * 4 + MIFARE_BLOCK Sector 32 ... 39: DB_ADR = (MIFARE_SECTOR - 32) * 16 + MIFARE_BLOCK + 128
MF1 PLUS 60	Sector 0 ... 31: DB_ADR = MIFARE_SECTOR * 4 + MIFARE_BLOCK

7.2.4. NXP - Mifare UltraLight

Memory organization (MF0U10 / MF0U11): 16 x 4 byte = 64 byte

Number of blocks	16	user area: 12
Block size	4 byte	

Command Code	Function	Mode			Comment
		non-addressed	addressed	selected	
[0xB0] [0x01]	Inventory	-	-	-	
[0xB0] [0x23]	Read Multiple Blocks	-	-	√	Security Status is always 0x00
[0xB0] [0x24]	Write Multiple Blocks	-	-	√	
[0xB0] [0x25]	Select	-	√	-	
[0xB0] [0xC0]	Halt	-	-	√	

7.2.5. NXP - Mifare Ultralight C

Mifare Ultralight C (MF0 IC U2): 48 x 4 byte = 192 byte

Number of blocks	48	user area: 36
Block size	4 byte	

Command Code	Function	Mode			Comment
		non-addressed	addressed	selected	
[0xB0] [0x01]	Inventory	-	-	-	
[0xB0] [0x23]	Read Multiple Blocks	-	-	√	Security Status is always 0x00
[0xB0] [0x24]	Write Multiple Blocks	-	-	√	
[0xB0] [0x25]	Select	-	√	-	
[0xB0] [0xC0]	Halt	-	-	√	
[0xB2][0xB2]	Authent Mifare Ultralight C	-	-	√	①

① See manual H01110-0e-ID-B.doc SoftCrypto functions

7.3. ISO14443A Part 2 compliant Transponder

7.3.1. Innovision - Jewel

Memory organization:

IRT5001W / IRT5001E

Number of blocks	120	user area: 8...104; (113...120)
Block size	1 byte	

Command Code	Function	Mode			Comment
		non-addressed	addressed	selected	
[0xB0] [0x01]	Inventory	-	-	-	
[0xB0] [0x23]	Read Multiple Blocks	-	√	-	
[0xB0] [0x24]	Write Multiple Blocks	-	√	-	WRITE-ERASE and WRITE-NO-ERASE

NOTICE:
In case of write operations closely to the reader antenna it could be helpful to increase the MIN_LVL Parameter (see: 3.4. CFG3: RF-Interface***).***

7.4. ISO15693 Transponders

The command codes listed in the following table supports the various Transponder commands and operations that are available for each ISO15693 Transponder type.

7.4.1. EM Microelectronics (EM4034)

Chip ID: 1h = x00001xxb (Bit 46 - 42 of UID)

Memory organization: 14 x 4 Byte = 448Bit

Number of blocks	14 (user area: 3 – 11)
Block size	4 byte

Command Code	Function		Mode			Comment
			non-addressed	addressed	select	
0x01	Inventory	√		-	-	
0x02	Stay Quiet	√	-	√	-	
0x22	Lock Multiple Blocks	-	-	-	-	
0x23	Read Multiple Blocks	√	√	√	-	DB-Size = 4
0x24	Write Multiple Blocks	√	√	√	-	DB-Size = 4, WR-OPTION = 0
0x25	Select	-	-	-	-	
0x26	Reset to Ready	√	√	√	-	
0x27	Write AFI	-	-	-	-	
0x28	Lock AFI	-	-	-	-	
0x29	Write DSFID	-	-	-	-	
0x2A	Lock DSFID	-	-	-	-	
0x2B	Get System Information	-	-	-	-	
0x2C	Get Multiple Block Security Status	-	-	-	-	

- **Reading of one block in non addressed mode is only possible, if parameter "Read Mode" in "CFG4 Transponder Parameters" is set to "b10: Multiple Read".**
- **The WR-OPTION will be set automatically by the FEIG Readers if the WR-OPTION parameter in "CFG4 Transponder Parameters" is set to "00: automatically set".**

7.4.2. EM Microelectronics (EM4135)

Chip ID: 4h = 000100xx (Bit 47 - 42 of UID)

Memory organization: 38 x 8 Byte = 2432Bit

Number of blocks	36 (user area: 13 – 48)
Block size	8 byte

Command Code	Function		Mode			Comment
			non-addressed	addressed	select	
0x01	Inventory	√		-	-	
0x02	Stay Quiet	√	-	√	-	
0x22	Lock Multiple Blocks	√	√	√	√	WR-OPTION = 0
0x23	Read Multiple Blocks	√	√	√	√	DB-Size = 8
0x24	Write Multiple Blocks**	√	√	√	√	DB-Size = 8, WR-OPTION = 0
0x25	Select	√	-	√	-	
0x26	Reset to Ready	√	√	√	√	
0x27	Write AFI	-	-	-	-	
0x28	Lock AFI	-	-	-	-	
0x29	Write DSFID	-	-	-	-	
0x2A	Lock DSFID	-	-	-	-	
0x2B	Get System Information	√	√	√	√	
0x2C	Get Multiple Block Security Status	-	-	-	-	

- **The WR-OPTION will be set automatically by the FEIG Readers if the WR-OPTION parameter in " CFG4 Transponder Parameters " is set to "00: automatically set".**

7.4.3. Fujitsu (MB89R116)

IC manufacturer identifier: 0x08

Chip ID: 0h = 00000000b (Bit 47 - 40 of UID)

Memory organization: 256 x 8 Byte = 16kbit

Number of blocks	256 (user area: 0 – 249)
Block size	8 byte

Command Code	**Function**		**Mode**			**Comment**
			non-addressed	addressed	select	
0x01	Inventory	√		-	-	
0x02	Stay Quiet	√	-	√	-	
0x22	Lock Multiple Blocks	√	√	√	√	WR-OPTION = 0 or 1
0x23	Read Multiple Blocks	√	√	√	√	Security Status is always 0x00
0x24	Write Multiple Blocks	√	√	√	√	WR-OPTION = 0 or 1
0x25	Select	√	-	√	-	
0x26	Reset to Ready	√	√	√	√	
0x27	Write AFI	√	√	√	√	WR-OPTION = 0 or 1
0x28	Lock AFI	√	√	√	√	WR-OPTION = 0 or 1
0x29	Write DSFID	√	√	√	√	
0x2A	Lock DSFID	√	√	√	√	
0x2B	Get System Information	√	√	√	√	
0x2C	Get Multiple Block Security Status	√	√	√	√	

- **The Custom Specific Commands Read Multiple Blocks Unlimited [0xA3] will be used automatically by the Reader. In non addressed Mode only one or two blocks can be read and the parameter DB-Blocksize in "CFG4 Transponder Parameters" should be set to 8.**
- **The WR-OPTION = 0, if the WR-OPTION parameter is set to "00: automatically set" in "CFG4 Transponder Parameters". Up to two blocks of data can be written for one request.**

7.4.4. Fujitsu (MB89R118)

IC manufacturer identifier: 0x08

Chip ID: 1h = 00000001b (Bit 47 - 40 of UID)

Memory organization: 256 x 8 Byte = 16kbit

Number of blocks	256 (user area: 0 – 249)
Block size	8 byte

Command Code	**Function**		**Mode**			**Comment**
			non-addressed	addressed	select	
0x01	Inventory	√		-	-	
0x02	Stay Quiet	√	-	√	-	
0x22	Lock Multiple Blocks	√	√	√	√	WR-OPTION = 0 or 1
0x23	Read Multiple Blocks	√	√	√	√	Security Status is always 0x00
0x24	Write Multiple Blocks	√	√	√	√	WR-OPTION = 0 or 1
0x25	Select	√	-	√	-	
0x26	Reset to Ready	√	√	√	√	
0x27	Write AFI	√	√	√	√	WR-OPTION = 0 or 1
0x28	Lock AFI	√	√	√	√	WR-OPTION = 0 or 1
0x29	Write DSFID	√	√	√	√	
0x2A	Lock DSFID	√	√	√	√	
0x2B	Get System Information	√	√	√	√	
0x2C	Get Multiple Block Security Status	√	√	√	√	

- **The Custom Specific Commands Read Multiple Blocks Unlimited [0xA3] will be used automatically by the Reader. In non addressed Mode only one or two blocks can be read and the parameter DB-Blocksize in "CFG4 Transponder Parameters" should be set to 8.**
- **The WR-OPTION = 0, if the WR-OPTION parameter is set to "00: automatically set" in "CFG4 Transponder Parameters". Up to two blocks of data can be written for one request.**

7.4.5. Fujitsu (MB89R119)

IC manufacturer identifier: 0x08

Chip ID: 2h = 00000010b (Bit 47 - 40 of UID)

Memory organization: 64 x 4 Byte = 2kbit

Number of blocks	64 (user area: 0 – 57)
Block size	4 byte

Command Code	**Function**		**Mode**			**Comment**
			non-addressed	addressed	select	
0x01	Inventory	√		-	-	
0x02	Stay Quiet	√	-	√	-	
0x22	Lock Multiple Blocks	√	√	√	-	WR-OPTION = 0 or 1
0x23	Read Multiple Blocks	√	√	√	-	Security Status is always 0x00
0x24	Write Multiple Blocks	√	√	√	-	WR-OPTION = 0 or 1
0x25	Select	-	-	-	-	
0x26	Reset to Ready	√	√	√	-	
0x27	Write AFI	√	√	√	-	WR-OPTION = 0 or 1
0x28	Lock AFI	√	√	√	-	WR-OPTION = 0 or 1
0x29	Write DSFID	√	√	√	-	
0x2A	Lock DSFID	√	√	√	-	
0x2B	Get System Information	√	√	√	-	
0x2C	Get Multiple Block Security Status	-	-	-	-	

- **The WR-OPTION = 0, if the WR-OPTION parameter is set to “00: automatically set” in “CFG4 Transponder Parameters”. Up to two blocks of data can be written for one request.**

7.4.6. Infineon (ISO address mode) 0xE0

IC manufacturer identifier: 0x05

memory organization:

SRF55V10P: 256 x 4 Byte = 8kbit

Number of blocks	256 (user area: 0...249)
Block size	4 byte

SRF55V02P: 64 x 4 Byte = 2kbit

Number of blocks	64 (user area: 0...57)
Block size	4 byte

Command Code	**Function**		**Mode**			**Comment**
			non addressed	addressed	select	
0x01	Inventory	√		-	-	
0x02	Stay Quiet	√	-	√	-	
0x22	Lock Multiple Blocks	√	√	√	√	WR-OPTION = 0
0x23	Read Multiple Blocks	√	√	√	√	DB-Size = 4
0x24	Write Multiple Blocks	√	√	√	√	DB-Size = 4, WR-OPTION = 0
0x25	Select	√	-	√	-	
0x26	Reset to Ready	√	√	√	√	
0x27	Write AFI	√	√	√	√	WR-OPTION = 0
0x28	Lock AFI	√	√	√	√	WR-OPTION = 0
0x29	Write DSFID	-	-	-	-	
0x2A	Lock DSFID	-	-	-	-	
0x2B	Get System Information	-	-	-	-	
0x2C	Get Multiple Block Security Status	√	√	√	√	

- **The WR-OPTION will be set automatically by the FEIG Readers if the WR-OPTION parameter in " CFG4 Transponder Parameters " is set to "b00: automatically set"**

7.4.7. Infineon (My-d Light)

Chip ID: A1h = 10100001b (Bit 47 - 40 of UID)

Memory organization: 18 x 4 Byte = 576Bit

Number of blocks	18 (user area: 0...12)
Block size	4 byte

Command Code	**Function**		**Mode**			**Comment**
			non-addressed	addressed	select	
0x01	Inventory	√		-	-	
0x02	Stay Quiet	√	-	√	-	
0x22	Lock Multiple Blocks	√	√	√	√	WR-OPTION = 0
0x23	Read Multiple Blocks	√	√	√	√	DB-Size = 4
0x24	Write Multiple Blocks	√	√	√	√	DB-Size = 4, WR-OPTION = 0
0x25	Select	√	-	√	-	
0x26	Reset to Ready	√	√	√	√	
0x27	Write AFI	√	√	√	√	WR-OPTION = 0
0x28	Lock AFI	√	√	√	√	WR-OPTION = 0
0x29	Write DSFID	-	-	-	-	
0x2A	Lock DSFID	-	-	-	-	
0x2B	Get System Information	-	-	-	-	
0x2C	Get Multiple Block Security Status	-	-	-	-	

- **The WR-OPTION will be set automatically by the FEIG Readers if the WR-OPTION parameter in " CFG4 Transponder Parameters " is set to "b00: automatically set".**
- **Reading of one block in non addressed mode is only possible, if parameter "Read Mode" in "CFG4 Transponder Parameters" is set to "b01: Single Read".**

7.4.8. NXP (I-Code SLI)

Chip ID: 1h = 00000001b (Bit 47 - 40 of UID)

Memory organization: 32 x 4 Byte = 1kbit

Number of blocks	32 (user area: 0 – 27)
Block size	4 byte

Command Code	**Function**		**Mode**			**Comment**
			non-addressed	addressed	select	
0x01	Inventory	√	-	-	-	
0x02	Stay Quiet	√	-	√	-	
0x22	Lock Multiple Blocks	√	√	√	√	WR-OPTION = 0
0x23	Read Multiple Blocks	√	√	√	√	DB-Size = 4
0x24	Write Multiple Blocks	√	√	√	√	DB-Size = 4, WR-OPTION = 0
0x25	Select	√	-	√	-	
0x26	Reset to Ready	√	√	√	√	
0x27	Write AFI	√	√	√	√	WR-OPTION = 0
0x28	Lock AFI	√	√	√	√	WR-OPTION = 0
0x29	Write DSFID	√	√	√	√	WR-OPTION = 0
0x2A	Lock DSFID	√	√	√	√	WR-OPTION = 0
0x2B	Get System Information	√	√	√	√	
0x2C	Get Multiple Block Security Status	√	√	√	√	

- **The WR-OPTION will be set automatically by the FEIG Readers if the WR-OPTION parameter in " CFG4 Transponder Parameters " is set to "00: automatically set".**

7.4.9. NXP (I-Code SLI-S)

Chip ID: 2h = 00000010b (Bit 47 - 40 of UID)

Memory organization: 40 x 4 Byte = 1280Bit

Number of blocks	40 (user area: 0 – 39)
Block size	4 byte

Number of pages	10 (user area: 0 – 9)
Page size	16 byte = 4 Blocks

Command Code	**Function**		**Mode**			**Comment**
			non-addressed	addressed	select	
0x01	Inventory	√	-	-	-	
0x02	Stay Quiet	√	-	√	-	
0x22	Lock Multiple Blocks	√	√	√	√	WR-OPTION = 0
0x23	Read Multiple Blocks	√	√	√	√	DB-Size = 4
0x24	Write Multiple Blocks	√	√	√	√	DB-Size = 4, WR-OPTION = 0
0x25	Select	√	-	√	-	
0x26	Reset to Ready	√	√	√	√	
0x27	Write AFI	√	√	√	√	WR-OPTION = 0
0x28	Lock AFI	√	√	√	√	WR-OPTION = 0
0x29	Write DSFID	√	√	√	√	WR-OPTION = 0
0x2A	Lock DSFID	√	√	√	√	WR-OPTION = 0
0x2B	Get System Information	√	√	√	√	
0x2C	Get Multiple Block Security Status	-	-	-	-	

- **The WR-OPTION will be set automatically by the FEIG Readers if the WR-OPTION parameter in " CFG4 Transponder Parameters " is set to "00: automatically set".**
- **Reading of one block in non addressed mode is only possible, if parameter "Read Mode" in "CFG4 Transponder Parameters" is set to "b01: Single Read".**

7.4.10. NXP (I-Code SLI-L)

Chip ID: 3h = 00000110b (Bit 47 - 40 of UID)

Memory organization: 16 x 4 Byte = 512Bit

Number of blocks	16 (user area: 0 – 7)
Block size	4 byte

Number of pages	4 (user area: 0 – 1)
Page size	16 byte = 4 Blocks

Command Code	**Function**		**Mode**			**Comment**
			non-addressed	addressed	select	
0x01	Inventory	√	-	-	-	
0x02	Stay Quiet	√	-	√	-	
0x22	Lock Multiple Blocks	√	√	√	√	WR-OPTION = 0
0x23	Read Multiple Blocks	√	√	√	√	DB-Size = 4
0x24	Write Multiple Blocks	√	√	√	√	DB-Size = 4, WR-OPTION = 0
0x25	Select	√	-	√	-	
0x26	Reset to Ready	√	√	√	√	
0x27	Write AFI	√	√	√	√	WR-OPTION = 0
0x28	Lock AFI	√	√	√	√	WR-OPTION = 0
0x29	Write DSFID	√	√	√	√	WR-OPTION = 0
0x2A	Lock DSFID	√	√	√	√	WR-OPTION = 0
0x2B	Get System Information	√	√	√	√	
0x2C	Get Multiple Block Security Status	-	-	-	-	

- **The WR-OPTION will be set automatically by the FEIG Readers if the WR-OPTION parameter in " CFG4 Transponder Parameters " is set to "00: automatically set".**
- **Reading of one block in non addressed mode is only possible, if parameter "Read Mode" in "CFG4 Transponder Parameters" is set to "b01: Single Read".**

7.4.11. NXP (I-Code SLIX)

Chip ID: 2h = 00000001b (Bit 47 - 40 of UID)

Memory organization: 32 x 4 Byte = 1280Bit

Number of blocks	28 (user area: 0 – 27)
Block size	4 byte

Number of pages	10 (user area: 0 – 9)
Page size	16 byte = 4 Blocks

Command Code	**Function**		**Mode**			**Comment**
			non-addressed	addressed	select	
0x01	Inventory	√	-	-	-	
0x02	Stay Quiet	√	-	√	-	
0x22	Lock Multiple Blocks	√	√	√	√	WR-OPTION = 0
0x23	Read Multiple Blocks	√	√	√	√	DB-Size = 4
0x24	Write Multiple Blocks	√	√	√	√	DB-Size = 4, WR-OPTION = 0
0x25	Select	√	-	√	-	
0x26	Reset to Ready	√	√	√	√	
0x27	Write AFI	√	√	√	√	WR-OPTION = 0
0x28	Lock AFI	√	√	√	√	WR-OPTION = 0
0x29	Write DSFID	√	√	√	√	WR-OPTION = 0
0x2A	Lock DSFID	√	√	√	√	WR-OPTION = 0
0x2B	Get System Information	√	√	√	√	
0x2C	Get Multiple Block Security Status	-	-	-	-	

- **The WR-OPTION will be set automatically by the FEIG Readers if the WR-OPTION parameter in " CFG4 Transponder Parameters " is set to "00: automatically set".**
- **Reading of one block in non addressed mode is only possible, if parameter "Read Mode" in "CFG4 Transponder Parameters" is set to "b01: Single Read".**

7.4.12. NXP (I-Code SLIX-S)

Chip ID: 2h = 00000010b (Bit 47 - 40 of UID)

Memory organization: 64 x 4 Byte = 2048Bit

Number of blocks	40 (user area: 0 – 39)
Block size	4 byte

Number of pages	10 (user area: 0 – 9)
Page size	16 byte = 4 Blocks

Command Code	**Function**		**Mode**			**Comment**
			non-addressed	addressed	select	
0x01	Inventory	√	-	-	-	
0x02	Stay Quiet	√	-	√	-	
0x22	Lock Multiple Blocks	√	√	√	√	WR-OPTION = 0
0x23	Read Multiple Blocks	√	√	√	√	DB-Size = 4
0x24	Write Multiple Blocks	√	√	√	√	DB-Size = 4, WR-OPTION = 0
0x25	Select	√	-	√	-	
0x26	Reset to Ready	√	√	√	√	
0x27	Write AFI	√	√	√	√	WR-OPTION = 0
0x28	Lock AFI	√	√	√	√	WR-OPTION = 0
0x29	Write DSFID	√	√	√	√	WR-OPTION = 0
0x2A	Lock DSFID	√	√	√	√	WR-OPTION = 0
0x2B	Get System Information	√	√	√	√	
0x2C	Get Multiple Block Security Status	-	-	-	-	

- **The WR-OPTION will be set automatically by the FEIG Readers if the WR-OPTION parameter in " CFG4 Transponder Parameters " is set to "00: automatically set".**
- **Reading of one block in non addressed mode is only possible, if parameter "Read Mode" in "CFG4 Transponder Parameters" is set to "b01: Single Read".**

7.4.13. NXP (I-Code SLIX-L)

Chip ID: 2h = 00000011b (Bit 47 - 40 of UID)

Memory organization: 16 x 4 Byte = 512Bit

Number of blocks	8 (user area: 0 – 7)
Block size	4 byte

Number of pages	2 (user area: 0 – 1)
Page size	16 byte = 4 Blocks

Command Code	**Function**		**Mode**			**Comment**
			non-addressed	addressed	select	
0x01	Inventory	√	-	-	-	
0x02	Stay Quiet	√	-	√	-	
0x22	Lock Multiple Blocks	√	√	√	√	WR-OPTION = 0
0x23	Read Multiple Blocks	√	√	√	√	DB-Size = 4
0x24	Write Multiple Blocks	√	√	√	√	DB-Size = 4, WR-OPTION = 0
0x25	Select	√	-	√	-	
0x26	Reset to Ready	√	√	√	√	
0x27	Write AFI	√	√	√	√	WR-OPTION = 0
0x28	Lock AFI	√	√	√	√	WR-OPTION = 0
0x29	Write DSFID	√	√	√	√	WR-OPTION = 0
0x2A	Lock DSFID	√	√	√	√	WR-OPTION = 0
0x2B	Get System Information	√	√	√	√	
0x2C	Get Multiple Block Security Status	-	-	-	-	

- **The WR-OPTION will be set automatically by the FEIG Readers if the WR-OPTION parameter in " CFG4 Transponder Parameters " is set to "00: automatically set".**
- **Reading of one block in non addressed mode is only possible, if parameter "Read Mode" in "CFG4 Transponder Parameters" is set to "b01: Single Read".**

7.4.14. NXP (I-Code SLIX2)

Chip ID: 1h = 00000001b (Bit 47 - 40 of UID)
Type indicator bits: 01b (Bit 36 – 35 of UID)

Memory organization: 80 x 4 Byte = 2560Bit

Number of blocks	80 (user area: 0 – 79)
Block size	4 byte

Command Code	Function		Mode			Comment
			non-addressed	addressed	select	
0x01	Inventory	√	-	-	-	
0x02	Stay Quiet	√	-	√	-	
0x22	Lock Multiple Blocks	√	√	√	√	WR-OPTION = 0
0x23	Read Multiple Blocks	√	√	√	√	DB-Size = 4
0x24	Write Multiple Blocks	√	√	√	√	DB-Size = 4, WR-OPTION = 0
0x25	Select	√	-	√	-	
0x26	Reset to Ready	√	√	√	√	
0x27	Write AFI	√	√	√	√	WR-OPTION = 0
0x28	Lock AFI	√	√	√	√	WR-OPTION = 0
0x29	Write DSFID	√	√	√	√	WR-OPTION = 0
0x2A	Lock DSFID	√	√	√	√	WR-OPTION = 0
0x2B	Get System Information	√	√	√	√	
0x2C	Get Multiple Block Security Status	√	√	√	√	

- **The WR-OPTION will be set automatically by the FEIG Readers if the WR-OPTION parameter in "CFG4 Transponder Parameters" is set to "00: automatically set".**

7.4.15. STMicroelectronics (LRI64)

IC manufacturer identifier: 0x02

memory organization: 16 x 1 Byte = 128Bit

Number of blocks	5 (user area: 10...14)
Block size	1 byte

Command Code	**Function**		**Mode**			**Comment**
			non addressed	addressed	select	
0x01	Inventory	√	-	-	-	
0x02	Stay Quiet	√	-	√	-	
0x22	Lock Multiple Blocks	-	-	-	-	WR-OPTION = 0
0x23	Read Multiple Blocks	√	√	√	-	In non addressed mode DB-N must be 1
0x24	Write Multiple Blocks	√	√	√	-	DB-Size = 1, WR-OPTION = 0
0x25	Select	-	-	-	-	
0x26	Reset to Ready	-	-	-	-	
0x27	Write AFI	-	-	-	-	WR-OPTION = 0
0x28	Lock AFI	-	-	-	-	WR-OPTION = 0
0x29	Write DSFID		-	-	-	
0x2A	Lock DSFID		-	-	-	
0x2B	Get System Information	√	√	√	-	
0x2C	Get Multiple Block Security Status		-	-	-	

- **The WR-OPTION will be set automatically by the FEIG Readers if the WR-OPTION parameter in "CFG4 Transponder Parameters" is set to "00: automatically set".**

7.4.16. STMicroelectronics (LRI2k, LRIS2k)

Chip ID: 8h = 001000xxb (Bit 47 - 42 of UID)

Product Code for LRI2k and LRIS2k:

Bit 63-48 = E0 02, Bit 47-42: Product ID

LRI2k	0010 00
LRIS2k	0010 10

memory organization: 64 x 4 Byte = 2kbit

Number of blocks	64 (user area: 0...63)
Block size	4 byte

Command Code	Function		Mode			Comment
			non ad-dressed	addressed	select	
0x01	Inventory	√	-	-	-	
0x02	Stay Quiet	√	-	√	-	
0x22	Lock Multiple Blocks	√	√	√	√	WR-OPTION = 0
0x23	Read Multiple Blocks	√	√	√	√	DB-Size = 4
0x24	Write Multiple Blocks	√	√	√	√	DB-Size = 4, WR-OPTION = 0
0x25	Select	√	√	√	√	
0x26	Reset to Ready	√	√	√	√	
0x27	Write AFI	√	√	√	√	WR-OPTION = 0
0x28	Lock AFI	√	√	√	√	WR-OPTION = 0
0x29	Write DSFID	√	√	√	√	
0x2A	Lock DSFID	√	√	√	√	
0x2B	Get System Information	√	√	√	√	
0x2C	Get Multiple Block Security Status	√	√	√	√	

- **The WR-OPTION will be set automatically by the FEIG Readers if the WR-OPTION parameter in "CFG4 Transponder Parameters" is set to "00: automatically set".**

7.4.17. STMicroelectronics (M24LR64-R)

IC manufacturer identifier: 0x02

Product Code for M24LR64-R: Bit 47-42 of UID

Bit 47 - 42	Product ID
001011xxb	Bh

memory organization: 64 x 32 x 4 Byte = 64kbit

Number of sectors	64 (0...63)
Number of blocks	2048 (user area: 0...2047) 32 blocks per sector
Block size	4 byte

Command Code	**Function**		**Mode**			**Comment**
			non addressed	addressed	select	
0x01	Inventory	√	-	-	-	
0x02	Stay Quiet	√	-	√	-	
0x22	Lock Multiple Blocks	√	√	√	√	WR-OPTION = 0
0x23	Read Multiple Blocks	√	√	√	√	
0x24	Write Multiple Blocks	√	√	√	√	WR-OPTION = 0
0x25	Select	√	√	√	√	
0x26	Reset to Ready	√	√	√	√	
0x27	Write AFI	√	√	√	√	WR-OPTION = 0
0x28	Lock AFI	√	√	√	√	WR-OPTION = 0
0x29	Write DSFID	√	√	√	√	
0x2A	Lock DSFID	√	√	√	√	
0x2B	Get System Information	√	√	√	√	
0x2C	Get Multiple Block Security Status	√	√	√	√	

- **The WR-OPTION will be set automatically by the FEIG Readers if the WR-OPTION parameter in "CFG4 Transponder Parameter is set to "00: automatically set"**
- **Each sector (32 blocks) must be read separately. For reading data from different sectors a Read Multiple Block command for each sector must be used.**

7.4.18. Texas Instruments (Tag-it HFI Pro / Standard)

IC manufacturer identifier: 0x07

Chip ID: Ch = 1100xxxxb (Bit 47 - 44 of UID)

Standard:
Product ID: 0h = 000b (Bit 43 – 41 of UID)
memory organization: 11 x 4 Byte = 48Byte (8 * 4 Byte = 256 Bit user data)

Number of blocks	11 (user area: 0 – 7)
Block size	4 byte

Pro:
Product ID: 0h = 100b (Bit 43 – 41 of UID)
memory organization: 12 x 4 Byte = 48Byte (8 * 4 Byte = 256 Bit user data)

Number of blocks	12 (user area: 0 – 7)
Block size	4 byte

Command Code	Function		Mode			Comment
			non addressed	addressed	select	
0x01	Inventory	√	-	-	-	
0x02	Stay Quiet	√	-	√	-	
0x22	Lock Multiple Blocks	√	√	√	-	WR-OPTION = 1
0x23	Read Multiple Blocks *	√	√	√	-	DB-Size = 4
0x24	Write Multiple Blocks	√	√	√	-	DB-Size = 4 WR-OPTION = 1
0x25	Select	-	-	-	-	
0x26	Reset to Ready	-	-	-	-	
0x27	Write AFI	-	-	-	-	
0x28	Lock AFI	-	-	-	-	
0x29	Write DSFID	-	-	-	-	
0x2A	Lock DSFID	-	-	-	-	
0x2B	Get System Information	-	-	-	-	
0x2C	Get Multiple Block Security Status	-	-	-	-	

- **Reading of more than one block in non addressed mode is only possible, if parameter "Read Mode" in CFG4 is set to "01: Single Read".**
- **The WR-OPTION will be set automatically by the FEIG Readers if the WR-OPTION parameter in "CFG4 Transponder Parameters" is set to "00: automatically set".**
  When using the "non-addressed" mode the WR-OPTION must be set manually to "WR-OPTION = 1".

7.4.19. Texas Instruments (Tag-it HFI Plus)

IC manufacturer identifier: 0x07

Chip ID: 0h = 0000xxxxb or 8h = 1000xxxxb (Bit 47 - 44 of UID)

memory organization: 64 x 4 Byte = 2kbit user data

Number of blocks	64 (user area: 0 – 63)
Block size	4 byte

Command Code	Function		Mode			Comment
			non addressed	addressed	select	
0x01	Inventory	√	-	-	-	
0x02	Stay Quiet	√	-	√	-	
0x22	Lock Multiple Blocks	√	√	√	√	WR-OPTION = 1
0x23	Read Multiple Blocks	√	√	√	√	DB-Size = 4
0x24	Write Multiple Blocks	√	√	√	√	DB-Size = 4 WR-OPTION = 1
0x25	Select	√	-	√	-	
0x26	Reset to Ready	√	√	√	√	
0x27	Write AFI	√	√	√	√	WR-OPTION = 1
0x28	Lock AFI	√	√	√	√	WR-OPTION = 1
0x29	Write DSFID	√	√	√	√	WR-OPTION = 1
0x2A	Lock DSFID	√	√	√	√	WR-OPTION = 1
0x2B	Get System Information	√	√	√	√	
0x2C	Get Multiple Block Security Status	√	√	√	√	

- **The WR-OPTION will be set automatically by the FEIG Readers if the WR-OPTION parameter in "CFG4 Transponder Parameters" is set to "00: automatically set".**
  When using the "non-addressed" mode the WR-OPTION must be set manually to "WR-OPTION = 1".
- **The "Write_2_Blocks" command and "Lock_2_Blocks" command will be used automatically by the reader. This will only become an effect if the block address starts with an even-numbered address.**

7.5. ISO18000-3M3 Transponders

The command codes listed in the following table supports the various Transponder commands and operations that are available for each ISO18000-3M3 Transponder type.

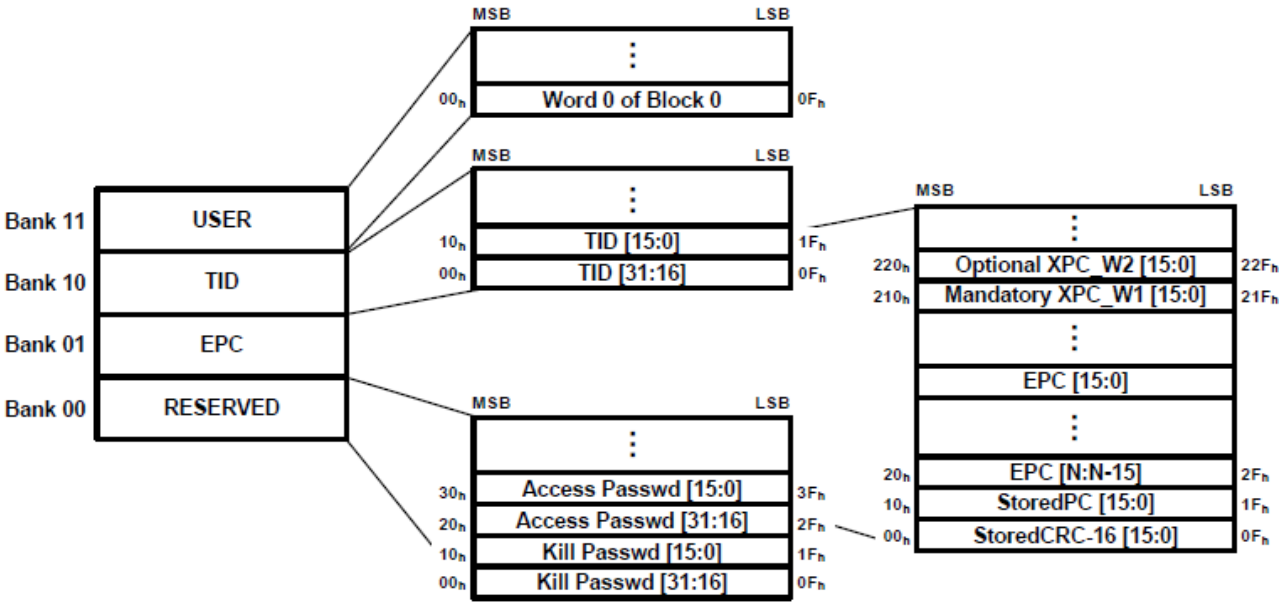
7.5.1. NXP ICode ILT-M

Memory organization:

Reserved memory (32 bit ACCESS and 32 bit KILL password)	64 bit
EPC (excluding 16 bit CRC-16 and 16 bit PC)	240 bit
TID (including unique 48 bit serial number)	96 bit
User memory	512 bit

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	√		√	

For a detailed description of the mandatory Kill command refer to “5.7.1. [0x18] Kill”.



ANNEX

ANNEX A: Codes of Transponder Types

TYPE_NO	Transponder Type	Supported by ID CPR.74
0x00	NXP I-Code1	-
0x03	ISO15693	●
0x04	Transponder according ISO14443A	●
0x05	Transponder according ISO14443B	●
0x06	NXP I-Code EPC	-
0x08	Jewel	●
0x09	ISO18000-3M3	●
0x0A	STMicroelectronics SR176	●
0x0B	STMicroelectronics SRIxx (SRI512, SRIX512, SRI4K, SRIX4K)	●
0x0D	FeliCa	●
0x10	Calypso Innovatron (14443-B')	●
0x11	ASK CTx (CTS256B, CTS512B, CTM512B)	-
0xFF	"free"	●

ANNEX B: Codes of Reader Types

No.	Reader Type
80	ID CPR.M02
81	ID CPR.02
82*	ID CPR40.xx-U with USB interface
83*	ID CPR40.xx- with asynchronous (RS232) interface
84	ID CPR.50.xx
85	ID CPR44.0x-xx
86	ID CPR30.xx
87	ID CPR52.xx
88	ID CPR.04-USB (USB-Version; 596/#)
89	ID CPR46.xx
111	ID CPR47.xx
114	ID CPR74.xx

* If a reader is equipped with both interfaces the reader type is switched dynamical depending on the currently used interface.

ANNEX C: Index of Status Bytes

Hex-value	General
0x00	**OK:** • Data / parameters have been read or stored without error • Control command has been executed

Hex-value	Transponder Status
0x01	**No Transponder:** • No Transponder is located within the detection range of the Reader. • The Transponder in the detection range 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:** • CRC, parity or framing error at received data.
0x03	**Write-Error:** Negative plausibility check of the written data: • Attempt to write on a read-only storing-area. • Too much distance between Transponder and Reader antenna. • Attempt to write in a noise 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: • Attempt to write on or read from a Transponder. • A special command is not applicable to the Transponder.
0x08	**Authent-Error** The reader could not identify itself to the transponder as authorized: • reader- and transponder Keys do not correspond
0x0B	**Collision-Error** • More than one transponder was detected by the reader in EMVCo mode
0x0E	**General-Error** • The Transponder answered with an undefined or general error code
0x83	**RF Communication Error:** • Anticollision could not be finished by the reader. • Corrupted or faulty data exchange between reader and Transponder
0x94	**More Data:** • There are more Transponder data sets requested than the response protocol can transfer at once.
0x95	**ISO15693-Error:** • An additional error code for ISO15693 Transponders is sent with response data.
0x96	**ISO14443-Error:** • An additional error code for ISO14443 Transponders is sent with response data. (see: ANNEX C2: Error-Codes)
0x97	**Crypto Processing Error** • An additional code for source and reason of the error is sent with response data (See: ANNEX C1: Crypto Processing Error - ERROR-CODE

Hex-value	Parameter Status
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's Customer Support** **3. Write the upgrade code into the reader using the command [0x5F] Set Firmware Update**

Hex-value	Interface Status
0x80	**Unknown Command:** • The Reader does not support the selected function.
0x81	**Length-Error:** • The received protocol contains not the expected content.
0x82	**Command (currently) not available:** • The reader is configured in scan-mode and had received an ISO Host-mode command.

Hex-value	Reader Status
0xF1	**Hardware Warning:** • The Firmware is incompatible with the hardware

Hex-value	SAM Status
0x31	**No SAM detected** • The reader get no response from the Smart Card
0x32	**Requested SAM is not activated** • The requested SAM is not activated by the SAM Activate command
0x33	**Requested SAM is already activated**
0x34	**Requested protocol is not supported by the SAM** • Check if T=0 or T=1 protocol is supported by the SAM
0x35	**SAM communication error** • A data transmission error occurred while communication with the SAM
0x36	**Timeout** • The Reader got no response from SAM within the defined timeout
0x37	**Unsupported SAM Baudrate** • The used parameter of Fi and/or Di are not supported by the reader

ANNEX C1: Crypto Processing Error - ERROR-CODE

ERROR-SOURCE = 1:

ERROR-CODE	Status
0x96xx	• ISO14443-Error: An additional error code for ISO14443 Transponders is sent with response data. (see: ANNEX C2: Error-Codes)
0x6581	• Buffer Overflow, because the received data volume exceeds the reader internal buffer size
0x00##	• DESFire Error The ERROR-CODE was received from the DESFire Card (see NXP mifare DESFire functional specification)

ERROR-SOURCE = 3:

ERROR-CODE	Status
0x901E	• An error occurs while authentication, MAC calculation or CRC calculation. The reason can be a not satisfied security status or any kind of transmission errors.

ANNEX C2: Error-Codes

ISO14443A Transponders

Hex-value	Response error code definition
0x01	Lowlevel Error: CRC, Framing or EGT error
0x02	Timeout
0x03	Protocol error
0x04	block-no error (Chaining)
0x05	Insufficient power: The present Transponder indicates insufficient power Maybe is distance between reader antenna and Transponder is high. Too many Transponders in the detection range of the Reader. The power consumption of the Transponder exceeds the antenna power of the Reader.

ISO15693 Transponders

Hex-value	Response error code definition
0x01	The command is not supported, i.e. the request code is not recognized
0x02	The command is not recognized, for example: a format error occurred
0x03	The command option is not supported
0x0F	Unknown error
0x10	The specified block is not available (doesn’t exist)
0x11	The specified block is already locked and thus cannot be locked again
0x12	The specified block is locked and its content cannot be changed
0x13	The specified block was not successfully programmed
0x14	The specified block was not successfully locked
0x15	The specified block is protected
0x40	Generic cryptographic error
0xA0 - 0xDF	Custom command error codes
all others	reserved for future use

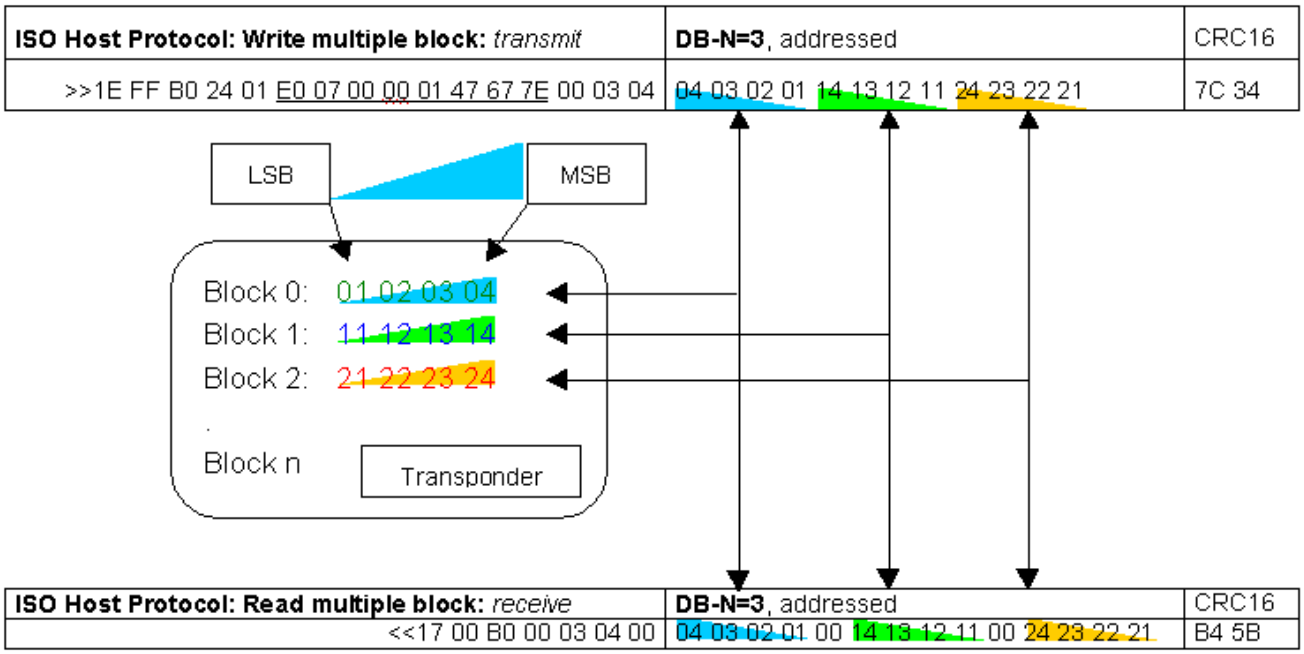
ISO18000-3M3 Transponders

Hex-value	Response error code definition
0x00	Other error
0x03	Memory overrun or unsupported PC value
0x04	Memory locked
0x0B	Insufficient power
0x0F	Non-specific error

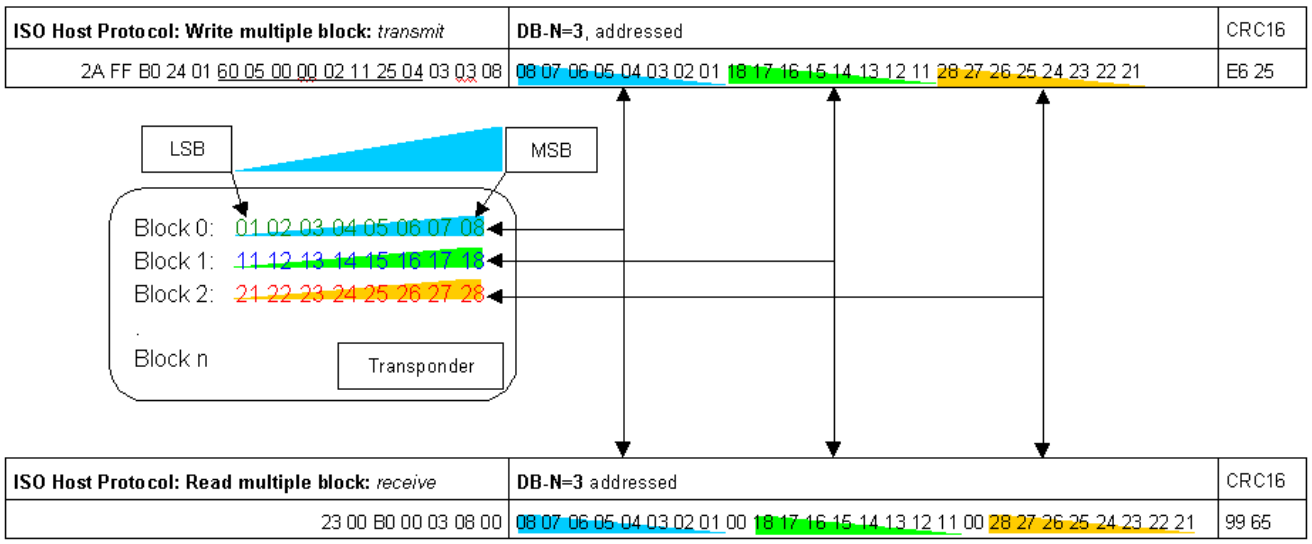
ANNEX E: Examples for Read Data

The setting "**LSB first**" and "**MSB first**" gives the direction of the received data bytes

ISO-Host Command (DB-Size of the Transponder = 4Byte)



ISO-Host Command (DB-Size of the Transponder = 8Byte)



ANNEX F: Supported SAM Baud Rates

The following baud rates are supported by the reader depending on transmission factors FI and DI of TA(1) parameter according ISO7816-3.

ANNEX F1: SAM 1-4

DI	FI											
	b0000 0x0	**b0001 0x1**	**b0010 0x2**	**b0011 0x3**	**b0100 0x4**	**b0101 0x5**	**b0110 0x6**	**b1001 0x9**	**b1010 0xA**	**b1011 0xB**	**b1100 0xC**	**b1101 0xD**
b0001 0x1	10081	13441	8961	9690	8961	10081	8065	9766	7813	9766	9766	7324
b0010 0x2	20161	26882	17921	19380	17921	20161	16129	19531	15625	19531	19531	14648
b0011 0x3	40323	53763	-	38760	35842	40323	32258	39063	31250	39063	39063	29297
b0100 0x4	-	-	-	77519	-	80645	-	78125	62500	78125	78125	58594
b0101 0x5	-	-	-	-	-	161290	-	156250	125000	156250	156250	117188
b0110 0x6	-	-	-	-	-	-	-	312500	250000	312500	312500	234375
b0111 0x7	-	-	-	-	-	-	-	625000	500000	625000	625000	468750
b1000 0x8	120968	161290	-	116279	107527	120968	96774	-	93750	-	117188	-
b1001 0x9	-	-	-	-	--	-	161290	-	-	-	-	-
Card Clock	3,75 MHz	5 MHz	5 MHz	7,5 MHz	10 MHz	15 MHz	15 MHz	5 MHz	6 MHz	10 MHz	15 MHz	15 MHz

RFU parameters according ISO7816-3 are not shown in the table