OBID®
OBID i-scan® HF

MANUAL

ID ISC.M02-B

Reader Module

From Firmware 4.02.129

preliminary – public (B)
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FEIG ELECTRONIC

Note

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General information's regarding this document

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

Contents

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

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

Abbreviations

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

2. Data Transmission between OBID® i-*scan* ID ISC.M02 and Host

Four different ways of data transmission between OBID® i-*scan* Readers and host (terminal, PC) are possible. The **ISO15693Host Commands** and the **Scan Mode** are used for the data exchange between Transponder and host, whereas the **Configuration Commands** and the **Control** serves for adapting the Reader parameters to the individual range of applications. The following chart shows which method of data transmission is supported by which interface:

	asynchronous interface (RS232TTL)	**synchronous Data-/Clock**
Configuration Commands	√	-
Control Commands	√	-
ISO15693Host Commands	√	-
Scan-Mode	√	√

2.1. Configuration Commands and Control Commands

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 must be stored in the EEPROM. After power up the Reader reads the configuration out of the EEPROM.

The Reader control is immediately processed and the response from the Reader contain 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. ISO15693 Host Commands

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

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

The Reader distinguishes between three different modes:

- **Addressed mode:**
  Before reading or writing data in addressed mode, the UID of the Transponder must be known. This is executed by sending the protocol "7.1.1. [0x01] Inventory If a Transponder is located within the detection range of the Reader at that time, it answers with its UID. For all following read- / write orders the Transponder must be addressed with its correct UID.

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

<table>
<tr><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">read data from Transponder with UID</td><td>→</td><td colspan="2">Transponder with
correct UID in antenna field ?</td></tr>
<tr><td></td><td>Yes</td><td>No</td></tr>
<tr><td>←</td><td>status /
Transponder read data</td><td>status =
no Transponder
in Reader field</td></tr>
<tr><td>←</td><td colspan="2"></td></tr>
<tr><td rowspan="4">write data to Transponder with UID</td><td>→</td><td colspan="2">Transponder with
correct UID in antenna field ?</td></tr>
<tr><td></td><td>Yes</td><td>No</td></tr>
<tr><td>←</td><td>OK status</td><td>status =
no Transponder
in Reader field</td></tr>
<tr><td>←</td><td colspan="2"></td></tr>
</table>

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 rowspan="2">←</td><td>status / Transponder read data</td><td rowspan="2">status = no Transponder in Reader field</td></tr>
<tr><td>←</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 rowspan="2">←</td><td>OK status</td><td rowspan="2">status = no Transponder in Reader field</td></tr>
<tr><td>←</td></tr>
</table>

Selected:

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 must be known. This is executed by sending at first the protocol “7.1.1. [0x01] Inventory“. In a second step the Transponder must be selected with the select command (see: 7.1.6.[0x25] Select) which must include its UID.

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

Host (Terminal / PC / ....)		Reader	
Inventory to get the UID	→	Transponder in antenna field ?	
		Yes	No
	←	status / number of Transponders / UID	status = no Transponder
	←		
select Transponder with UID	→	Transponder with the correct UID in antenna field ?	
		Yes	No
	←	status / Transponder read data	status = no Transponder in Reader field
	←		
read data	→	selected Transponder in antenna field ?	
		Yes	No
	←	status / Transponder read data	status = no Transponder in Reader field
	←		
write data	→	selected Transponder in antenna field ?	
		Yes	No
	←	OK status	status = no Transponder in Reader field
	←		

2.3. Scan-Mode

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

In Scan Mode the contents of the message block (UID, data block) can be adapted to each user-application. Scan mode is available via the asynchronous Interface.
The Reader starts the output of the protocol block as soon as all required data have been read correctly from the Transponder. If the number of transmitted user data is too large, only the maximal number of transmitted data will be sent plus the end character.

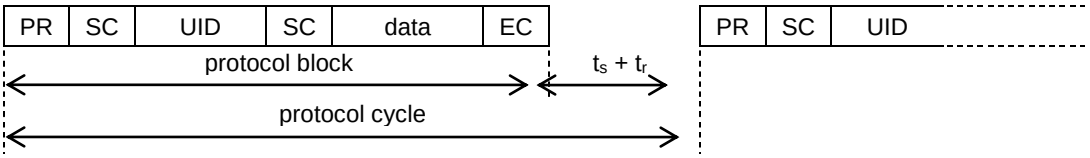
Scan-Mode via asynchronous interface:

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

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

Example 1:

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



Example 2:

3 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.

Note:

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

3. Asynchronous Interface

3.1. Data Format and Protocol Frames

The Reader ID ISC.M02-B can be configured by an asynchronous interface and data may be written on Transponders or read from Transponders. The communication between Reader and connected host (terminal, PC, etc.) is executed by means of fixed protocols. The used protocol is intended for data bus use and is equipped with a bus address.
During data transfer via the asynchronous interface the Reader supplies the required data or a status byte. The reply contain the transmitted control byte.
There is no reply from the Reader if there is a protocol frame failure.

Protocol frame: Standard Protocol-Length (up to 255 Byte)

Host → Reader

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

Host ← Reader

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

Note:

The Reader supports standard protocol frame only.

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

Number of protocol bytes including LENGTH and CRC16.

COM-ADR:

0..254 address of device in bus mode

Note:

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

CONTROL-BYTE:

Defines the command which the Reader should operate.

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

STATUS:

Includes the status message or protocol data from or to the Reader. The data will be sent always as MSB first if the Reader is in the ISO15693Host Command Mode (see also: ANNEX I: Examples for Read Data.)

DATA:

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

CRC16:

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

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

Start Value 0xFFFF

Data format:

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

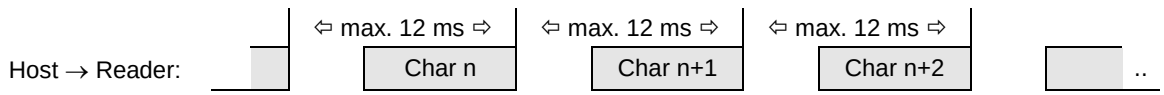
Timing conditions:

Starting delay:

Before sending a starting sign (length byte) of a protocol, there must be a delay of minimum 5 ms.

Data timeout:

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



3.2. 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);
        }
}
```

4. Configuration Parameters (CFG)

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

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

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

The parameters are stored in two different configuration memory locations:

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

Multiple configuration memory locations can be addressed by the value of the parameter CFG-ADR used in chapter 5. Protocols for Reader Configuration

CFG-ADR:

CFGn: memory-address of the required configuration block
LOC: specifies the location of the configuration block (RAM / EEPROM)
MODE: specifies one or all configuration blocks

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

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

While the EE-Init-Mode is active, the LED blinks alternately red and green and the Reader answers external commands with the status "0x10 EEPROM Failure". The "EE-Init-Mode" can be exited now by a new reset (cold start or 6.3. [0x63] 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.

4.1. 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[1]	TRANS-FORM[1]	0x00	0x00	TR-RESPONSE-TIME
Default	0x00 *0x00*		0x08 *38400 Baud*	0x01 *e,8,1*	0x00		0x00

Byte	7	8	9	10	11	12	13
Contents	TR-RESPONSE-TIME	0x00	0x00	0x00	0x00	0x00	READER - MODE
Default	0x0A *1 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 the configured address.***

BAUD[1]:

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

5: 4800 baud
6: 9600 baud
7: 19200 baud
8: 38400 baud

Note:

- ***Changing of BAUD only becomes effective after writing / saving configuration block CFG1 to EEPROM and a reset of the Reader.***
- ***The Reader set the baud rate to 38400 baud, if the user set an invalid baudrate.***

TRANS-FORM[1]:

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

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

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 -**

Note:

- ***Changing of TRANS-FORM only becomes effective after writing / saving configuration block CFG1 to EEPROM and reset of the Reader.***
- ***Always 8 Data Bits and 1 Stop Bits should be used***

TR-RESPONSE-TIME:

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

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

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

Note:

- ***TR-RESPONSE-TIME has no effect with the protocols for Reader Configuration and the protocols for Reader Control.***
- ***The TR-RESPONSE Time must be < “Block Timeout” in the Host COM-Port settings.***

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

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	DC-FORMAT			SCAN-IF	SCAN-E

SCAN-E:

By setting this bit the Scan-Mode can be enabled

b0: **ISO15693Host Mode**
(see chapter 7. Protocols for ISO15693 Host Commands)

b1: **Scan-Mode** (see chapter 4.6. CFG6: Scan-Mode1)

SCAN-IF:

This bit selects the interface for Scan-Mode

b0: Scan-Mode: via asynchronous interface

b1: Scan-Mode: via data-/clock interface

DC-FORMAT:

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

b000: Wiegand emulation (see 4.1.2. Wiegand Emulation)
data format: binary 1:1, according written to Transponder.

b001: magnetic stripe (see 4.1.1. Magnetic Strip Emulation)
data format: binary 1:1, according written to Transponder.

b010: magnetic stripe (see 4.1.1. Magnetic Strip Emulation)
data format: according ISO 7811-2, track 2+3 (5 Bit)

b011: magnetic stripe (see 4.1.1. Magnetic Strip Emulation)
data format: according ISO 7811-2, track 1 (7 Bit)

b100: Wiegand emulation (see 4.1.2. Wiegand Emulation)
data format: Wiegand formatted protocol frame with start and stop sign.

b101: magnetic stripe (see 4.1.1. Magnetic Strip Emulation)
data format: according ISO 7811-2, track 2+3 (5 Bit)
additional a prefix of 16 leading zero clocks before the start character and
additional a trailer of 16 attached zero clocks following to the LRC character.

b110: Wiegand emulation (see 4.1.2. Wiegand Emulation)
data format: Wiegand formatted protocol frame

4.1.1. Magnetic Strip Emulation

Data Format:

The following table shows data coding depending on DC-FORMAT

For cutting the length of data output the parameters D_LGT and D_START (see chapter: 4.6. CFG6: Scan-Mode1) can be use.

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

Example: Output of raw data 0x19BF

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

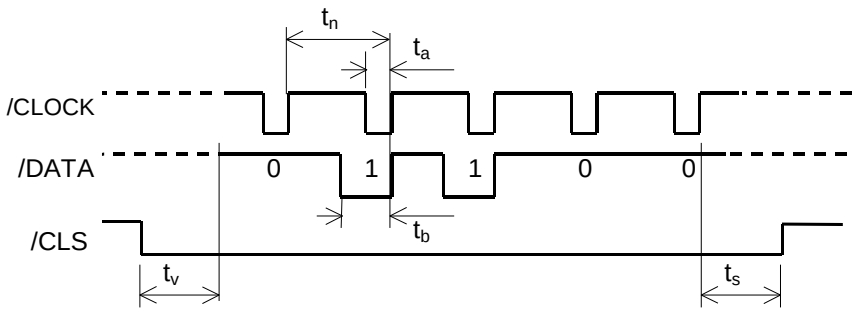
Time →

LRC

XOR operation on Start-, Data and Stop-sign

Timing

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



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

4.1.2. Wiegand Emulation

Data Format:

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

For cutting the length of data output the parameters D_LGT and D_START (see chapter: 4.6. CFG6: Scan-Mode1) can be use.

DC-FORMAT = b000 ⇒ binary 1:1

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

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

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

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

START: b1011

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

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

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

STOP: b1111

DC-FORMAT = b110 ⇒ Wiegand formatted protocol frame

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

1 Bit	n Bit	1 Bit
EVEN	DATA	ODD

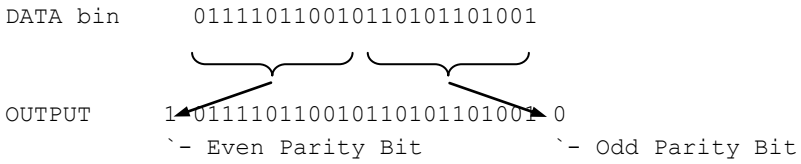
EVEN: Even parity bit calculated across the first half DATA bits.

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

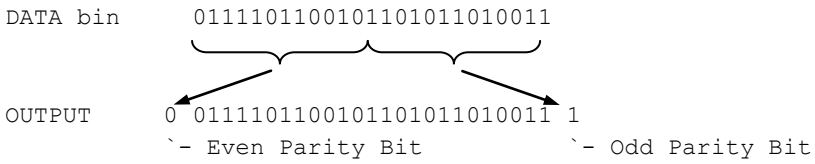
ODD: Odd parity bit calculated across the last half DATA bits.

Example of parity calulation

Example 1: 18 DATA bit

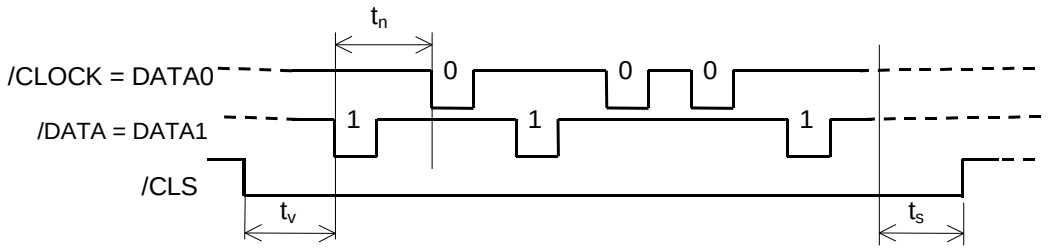


Example 1: 19 DATA bit



Timing

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



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

4.2. CFG2: Reserved

4.3. CFG3: RF-Interface

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

Byte	0	1	2	3	4	5	6
Contents	TAG-DRV[1]		0x00	0x00	0x00	0x00	0x00
Default /	0x0209						

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

TAG-DRV:

Defines the Transponder types that are operated by the Reader.

Byte:	0								1							
Bit:	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Driver	0	0	0	0	0	0	**.J**	0	0	0	0	0	**.D**	0	0	**.A**

b0: Driver for the Transponder type is inactive

b1: Driver for the Transponder type is active

.A: Driver for I-Code 1

.D: Driver for ISO15693

.J: Driver for 18000-3M3 *(must be released first)* On principle, only those Transponder drivers should be active that are used in the actual application. Thus, the reaction time of the Reader for Transponder read- / write-operations is reduced and the danger of a parasitic Transponder access is minimized.

Note:

The 18000-3M3 tag driver must be released with the command "Set Firmware Upgrade" first. For this you have to use the demo program ID ISOStart and the Upgrade Code must be ordered by Feig Electronic.

The standard firmware with support of the ISO18000-3M3 do not support I-Code1. Ask OBID-Support for a different firmware.

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

4.4. 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					0x0B	0x00	0x00

Byte	7	8	9	10	11	12	13
Contents	CUSTOMER OPTION	0x00	0x00	0x00	0x00	IDDIB	ISO-Blocksize
Default	0x00						0x04

ISO 15693 MODE:

Bit:	7	6	5	4	3	2	1	0
Function	0	0	AFI	NO-TS	DATA-RATE	SUB-CARRIER	MOD	DATA CODING

DATACODING

b0: **- do note use -**
b1: Fast Mode (1 / 4)

MOD

b0: **- do note use**
b1: 10%

SUB-CARRIER

b0: ASK (one sub-carrier)
b1: **- do note use -**

DATA-RATE

b0: **- do note use -**
b1: high

NO-TS

b0: 16 timeslots
b1: 1 timeslot

Note:
Anticollision is only possible if NO-TS=16.

AFI

b0: disabled
b1: enabled

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 ISO15693Host 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 10.1. Supported ISO15693 Host commands for ISO15693 Transponders for more details about the correct WR-OPTION.***

CUSTOMER OPTION

Bit:	7	6	5	4	3	2	1	0
Function	0	0	0	0	0	0	0	**Bit0**

Bit0 (INFINEON-OPTION):

b0: Use ISO Cmd's for Read/Write Infineon-Tag (4Byte Blocksize)
b1: Use Infineon Custom Cmd's for Read/Write Infineon-Tag (8Byte Blocksize)

IDDIB (*Transponder.Miscellaneous.IdentifierInterpretationMode*)

(Identifier Data Interpretation Byte)**:**

Defines in which way the Reader interprets and display the Identifier data read during inventory process by using the inventory command.

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

0x02 – EPC and TID

Notes:

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

ISO-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: 10.1. Supported ISO15693 Host commands for 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

4.5. 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							

Byte	7	8	9	10	11	12	13
Contents	0x00	0x00	0x00	0x00	ONT	0x00	0x00
Default					0x05		

ONT:

Defines which Transponder will send to the host.

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

ONT:

b0: all Transponders in the field will be send to the host. The Reader performs a RF Reset before any command reads a UID

b1: only the new selected Transponders will sent to the host

Acoll:

b0: Anticollision disabled

b1: Anticollision enabled

Note:

Anticollision is not available for ISO18000-3M3 transponder. Only one tag at the same time can be supported.

4.6. CFG6: Scan-Mode1

The parameters of the CFG6 configuration block contain Scan-Mode settings. To enable Scan-Mode the SCAN-MODE bit in the configuration block CFG1 (4.1. CFG1: Interface) must be set.

Byte	0	1	2	3	4	5	6
Contents	0x02	0x00	0x00	SCAN-DATA	0x00	0x00	SCAN-LOCK-TIME
Default				0x01			0x00

Byte	7	8	9	10	11	12	13
Contents	SCAN-LOCK-TIME	0x00	0x00	Bank	DB-ADR	D-LGT	D-START
Default	0x0A			0x01	0x05	0x04	0x00

SCAN-DATA

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

Bit:	7	6	5	4	3	2	1	0
Function	Byte Order DB	COM-Prefix	0	0	0	0	DB	UID

Notes:

- ***If the bits UID and DB are set to 0, the scan-mode is switched off.***

UID = Serial No.

Setting of this bit activates the output of the UID

b0 Output of the UID inactive
b1 Output of the UID active

DB = Data Block

Setting of this bit activates the output of a specified data block.
(see also parameter DB_ADR, D_LGT and D-START)

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

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

Byte Order DB

Defines the Byte Order within frame

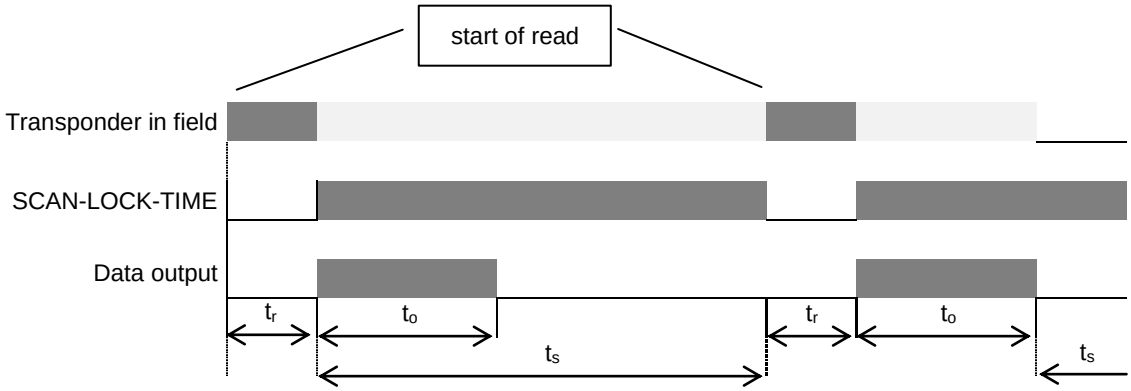
b0 MSB first
b1 LSB first

Note:

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

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 it has 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.

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:

Transponder address of the first data block which will be transferred in Scan-Mode.
Range: 0x00...0xFF.
See for valid addresses: 10.1. Supported ISO15693 Host commands for ISO15693 Transponders

D_LGT:

D_LGT defines the length of raw data which are transmitted in the Scan-Mode. Depending on the selected READER-MODE (see: 4.1. 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.

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

D START = 1

D LGT = 4

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

D START = 1

D LGT = 26

Output Data	b0010 0011	b0100 0101	b0110 0111	b10

D-START:

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

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

The maximum number of the transferred data bytes depends on the reader type and configuration settings and the used sign type.

4.7. CFG7: Scan-Mode2

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

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

DB-USE:

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

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

DB-FORMAT

b0000 unformatted hex-data

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

b0010 ASCII formatted hex-data

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

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

SEP-CHAR:

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

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.

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

5. Protocols for Reader Configuration

Via the protocols for the Reader configuration, the Reader may be adapted to individual conditions of application within wide limits.

5.1. [0x80] Read Configuration

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

Host → Reader

1	2	3	4	5-6
6	COM-ADR	[0x80]	CFG-ADR	CRC16

Host ← Reader

1	2	3	4	5...18	19-20
20	COM-ADR	[0x80]	STATUS[1]	CFG-REC	CRC16

CFG-ADR[2]:

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

CFGn: memory-address of the required configuration block

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

CFG-REC:

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

Note:

Reading from reserved configuration blocks will result in an 0x15 error code.

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

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

5.2. [0x81] Write Configuration

The configuration of the Reader can be changed by means of the Write Configuration command. In order to do this, the configuration memory is written to with 14 bytes block length and addressed by CFGn in the byte CFG-ADR. The description of parameters can be taken from Chapter 4. Configuration Parameters (CFG)

Host → Reader

1	2	3	4	5...18	19-20
20	COM-ADR	[0x81]	CFG-ADR	CFG-REC	CRC16

Host ← Reader

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

CFG-ADR[2]**:**

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

CFGn: memory-address of the required configuration block

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

CFG-REC:

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

Note:

A write to reserved configuration blocks will result in error code 0x16.

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

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

5.3. [0x82] Save Configuration

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

Host → Reader

1	2	3	4	5-6
6	COM-ADR	[0x82]	CFG-ADR	CRC16

Host ← Reader

1	2	3	4	5-6
6	COM-ADR	[0x82]	STATUS[1]	CRC16

CFG-ADR[2]**:**

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

CFGn: memory-address of the required configuration block

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

Note:

- ***To store RAM configuration after power down use 5.3. [0x82] Save Configuration***
- ***A save configuration to EEPROM with reserved configuration blocks will result in error code 0x16.***

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

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

5.4. [0x83] Set Default Configuration (Reset)

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

Host → Reader

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

Host ← Reader

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

CFG-ADR:

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

CFGn: memory-address of the required configuration block

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

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

Notes:

- ***To save the configuration to non-volatile memory, use 5.3. [0x82] Save Configuration***
- ***A set to default configuration with reserved configuration blocks will result in error code 0x16.***

6.Protocols for Reader Control

6.1.[0x52] Baud Rate Detection

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

Host → Reader

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

Host ← Reader

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

Note:

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

6.2.[0x55] Start Flash Loader

This protocol starts the internal Flash Loader in the Reader to perform a firmware update.
Please read the corresponding update description.

Host → Reader

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

Host ← Reader

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

Note:

- ***This command is only available if the correct COM-ADR of the Reader is used.***
- ***All COM-addresses except 255 [0xFF] will be accept.***

6.3. [0x63] CPU Reset

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

Host → Reader

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

Host ← Reader

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

Note:

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

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

6.4. [0x65] Get Software Version

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

Host → Reader

1	2	3	4,5
5	COM-ADR	[0x65]	CRC16

Host ← Reader

1	2	3	4	5...6	7
13	COM-ADR	[0x65]	STATUS[1]	SW-REV	D-REV

8	9	10-11	12,13
HW-Type	SW-TYPE	TR-TYPE	CRC16

SW-REV:

Revision status of the firmware.

D-REV:

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

HW-Type:

Displays options which are supported by the Reader Hardware

SW-TYPE:

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

TR-TYPE:

Displays the Transponders supported by the software.

Bit:	15	14	13	12	11	10	9	8
Function:	-	-	-	-	-	-	18000-3M3	-

Bit:	7	6	5	4	3	2	1	0
Function:			-	-	ISO 15693	-	-	I-Code1

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

6.5. [0x66] Get Reader Info

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

Host → Reader

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

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

MODE = 0x00 (Controller Firmware)

1	2	3	4	5...6	7
16/17	COM-ADR	[0x66]	STATUS[1]	SW-REV	D-REV

8	9	10-11	12,13	14,15	16,17
HW-TYPE	SW-TYPE	TR-TYPE	RX-BUF	TX-BUF	CRC16

Host ← Reader

Mode = 0x10 (Hardware Information)

1	2	3	4	5...6	7...8
17	COM-ADR	[0x66]	STATUS[1]	-	-

9...10	11	12	13	14	15	16,17
-	-	PORT_ TYPE	reserved	-	reserved	CRC16

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

Host ← Reader

Mode = 0x80 (Device_ID)

1	2	3	4	5 ..8	9..12
22	COM-ADR	[0x66]	STATUS[1]	DEV_ID	Custom_L

13,14	15, 16	17,18	19,20	21,22
FW_L	TR_DRV_L	FNC_L	-	CRC16

MODE:

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

0x00: General hard- and firmware information's of the reader firmware

0x10: Hardware information

0x80: Device-ID
This Information's are necessary for some firmware updates or firmware upgrades.

SW-REV:

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

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

see: 6.4. [0x65] Get Software Version

PORT_TYPE:

Flags for supported communication ports

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

RS232: b0: not supported
b1: supported

RX-BUF:

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

TX-BUF:

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

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

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.

6.6. [0x69] RF Reset

The RF-field of the Reader antenna can be switched off for $\mathbf{t_{rf}}$ **= 15 ms** by the command RF Reset. Thus, all Transponders which are within the antenna field of the Reader will be reset to their base setting.

Host → Reader

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

Host ← Reader

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

Notes:

- ***After an RF Reset the Reader is not able to receive a new Transponder before expiration of*** t_{rf} ***.***
- ***After an RF Reset, a Transponder which is located within the field must be re-selected.***
- ***The response of this command will be send after the RF Reset was completed.***

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

6.7. [0x6A] RF ON/OFF

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

Host → Reader

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

Host ← Reader

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

RF:

0x00 RF-Field of Reader antenna is OFF
0x01 RF-Field of Reader antenna is ON

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

6.8. [0x71] Set Output

The command [0x71] is used for temporary limited or unlimited activation of the displays (LED) of the Reader.

Each output takes on the state defined by the byte "OS" for the period of time specified in the protocol. The flashing frequency is defined by the byte "OSF". Via this protocol, the LEDs can be switched on or off for the indicated period of time. If the Reader receives a protocol "Set Output", all times that have been active until then are overwritten by the new times specified in the protocol if they are > 0.

Host → Reader

1	2	3	4,5	6,7	8,9	10,11	12,13
13	COM-Adr	[0x71]	OS	OSF	OS-Time	0x00	CRC16

Host ← Reader

1	2	3	4	5,6
6	COM-Adr	[0x71]	Status[1]	CRC16

OS:

The word OS (Output State) defines the status of the signal emitters (LEDs and beeper) during the time defined in "OS-time". The signal emitters can be selected single or in a group.

Bit:	15	14	13	12	11	10	9	8
Function:	0	0	0	0	0	0	0	0

7	6	5	4	3	2	1	0
0	0	0		LED red mode		LED grn mode	

LED grn-/LED red-mode :

b00	UNCHANGED	OS-Time has no effect on the status of the signal emitter
b01	ON	Signal emitter for OS-Time = active
b10	OFF	Signal emitter for OS-Time = inactive
b11	FLASH	Signal emitter for OS-Time = with "OSF" alternating

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

OSF:

The byte "OSF" (Output State Flash) allows you to assign an individual flashing-frequency to each LED and to the beeper.

Bit:	15	14	13	12	11	10	9	8
Function:	0	0	0	0	0	0	0	0

7	6	5	4	3	2	1	0
0	0	0		LED red frq		LED grn frq	

LED grn-/LED red-frq:

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

OS-Time

By the values defined by "OS-Time", the LEDs can be activated for a temporary or unlimited period.
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	

Note:

- ***In order to reset a continuously active time, "OS-Time = 1" must be sent to the Reader, which effects a change to the idle status after 100 ms***
- ***The continuous activation is canceled after a reset or a power failure .***

7. Protocols for ISO15693 Host Commands

Some ISO15693Host commands can be used to access ISO18000-3m3 Transponders. The following combinations are possible:

	Transponder Types	
	ISO15693	18000-3M3
7.1. [0xB0] Host commands for ISO15693 Mandatory and Optional Commands	√	√
7.1.1. [0x01] Inventory	√	√
7.1.2.[0x02] Stay Quiet	√	
7.1.3. [0x22] Lock Multiple Blocks	√	
7.1.4. [0x23] Read Multiple Blocks	√	√
7.1.5.[0x24] Write Multiple Blocks	√	√
7.1.6.[0x25] Select	√	
7.1.7.[0x26] Reset to Ready	√	
7.1.8.[0x27] Write AFI	√	
7.1.9.[0x28] Lock AFI	√	
7.1.10.[0x29] Write DSFI	√	
7.1.11.[0x2A] Lock DSFI	√	
7.1.12. [0x2B] Get System Information	√	
7.1.13.[0x2C] Get Multiple Block Security Status	√	
8. [0xB1] Host commands for ISO15693 Custom and Proprietary Commands	√	
9.2. [0xBF] ISO15693 Transparent Command	√	
[0xB3] EPC Commands		√
9.1.1. [0xB3] [0x18] Kill		√
9.1.2. [0xB3] [0x22] Lock		√

7.1. [0xB0] Host commands for ISO15693 Mandatory and Optional Commands

This command sends ISO 15693 defined RF commands to the Transponder.

Host → Reader

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

Host ← Reader

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

REQUEST-DATA:

Command specific request

RESPONSE-DATA:

Command specific response

Notes:

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

7.1.1. [0x01] Inventory

This command reads the UID of all Transponders inside the antenna field. If the Reader has detected a new Transponder, the Transponder will be automatically set to the quiet state by the Reader. In this state the Transponder does not send back a response for the next inventory command.

The Transponder sends back a response every time:

- if the Transponder has left the antenna and reentered the antenna field or
- if a command was send to the Reader or
- if the ONT bit in the ONT register of the 4.5. CFG5: Anticollision configuration block is not set.

REQUEST-DATA

4	5
0x01	MODE

RESPONSE-DATA **(standard)**

5	6	7	8...15
DATA-SETS	TR-TYPE	DSFID	UID
	Repeated DATA-SETS times		

RESPONSE-DATA **(ISO18000-3M3 Transponder)**

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

MODE:

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

MORE:

b0 new Inventory requested

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

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: ISO18000-3M3 Transponder

TYPE_NO

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

IDDT: (only ISO18000-3M3)

Identifier Data Type
Defines the type of Data transmit beginning at Byte 9.

DSFID: (only ISO15693 Transponders)

Data Storage Family Identifier.

IDD-LEN:

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

IDD:

Identifier Data of the Transponder

DSFID: (only ISO15693 Transponders)

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

UID:

- Read-only serial number of the Transponder.

Notes:

- ***This command supports all Transponders.***
- ***If ONT = b1 only the UID of those Transponders are read which came into the antenna field since the last Inventory command.***
- ***If ONT = b0 a RF-Reset is performed to read the UID of all Transponders inside the antenna field.***
- ***If the STATUS byte of the protocol frame has the value 0x94, more UID's can be read out of the Reader with MORE = b1.***

7.1.2.[0x02] Stay Quiet

This command sets one Transponder to Quiet State.

REQUEST-DATA

4	5	6-13
0x02	MODE	UID

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.

Note:

- ***This command is only available for ISO15693 Transponders.***

7.1.3. [0x22] Lock Multiple Blocks

This command locks one or more data blocks.
The supported ISO15693Host commands depend on the different ISO15693 Transponder types, they are described in chapter 10.1. Supported ISO15693 Host commands for ISO15693 Transponders.

REQUEST-DATA

4	5	(6...13)	6 / (14)	7 / (15)
0x22	MODE	UID	DB-ADR	DB-N

RESPONSE-DATA (STATUS = 0x03)

5
DB-ADR-E

RESPONSE-DATA (STATUS = 0x95)

5	6
TAG ERROR Code	DB-ADR-E

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.

DB-ADR:

First block number to be locked. First block can be any value between 0 and 255.

DB-N:

Number of data blocks to be locked, starting at DB-ADR.
The maximum number of DB-N, depends on DB-Size and the interface transmit buffer size TX-BUF. The maximum number of DB-N is:
(TX-BUF - 10)/(DB-Size+1).

TAG ERROR code:

TAG ERROR Code of Transponder response. This byte is only available if STATUS = 0x95.

DB-ADR-E:

Block number where the error occurred.

7.1.4. [0x23] Read Multiple Blocks

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

REQUEST-DATA

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

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

RESPONSE-DATA (STATUS = 0x95)

5
TAG ERROR Code

RESPONSE-DATA

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

MODE:

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

ADR:

b000 non-addressed
b001 addressed
b010 selected

SEC:

b0 SEC-STATUS always = 0x00
b1 security status of followed data block in SEC-STATUS

UID_LF:

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

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

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

EXT_ADR:

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

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

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

UID_LNG:

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

UID:

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

BANK:

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

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

BANK_NR:

In case of 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 a 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. Depending on EXT_ADR. First block can be any value between 0 and 255 or 0 and 65535.

DB-N:

Number of data blocks to be read from the Transponder, starting at DB-ADR.
The maximum number of DB-N, depends on DB-Size and the interface transmit buffer size TX-BUF. The maximum number of DB-N is:
(TX-BUF - 10)/(DB-Size+1) e.g. Block size 4 (DB-N = (512 – 10) / (4+1) = 100).

DB-SIZE:

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

SEC-STATUS: (only ISO15693 Transponder)

Block security status of followed data block. If supported by the ISO15693 transponder.

DB:

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

TAG ERROR Code:

TAG ERROR Code of Transponder response. This byte is only available if STATUS = 0x95.

Notes:

- ***Only one Transponder can be read in the non-addressed mode.***
- ***ISO15693:***
  - A read from 1 block uses a Read Single Block command to the ISO15693 Transponder.
  - If a ISO15693 Transponder does not support Read Multiple Blocks commands several Read Single Block commands are used for this Transponder.

7.1.5.[0x24] Write Multiple Blocks

This command writes one or more data blocks.

REQUEST-DATA

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

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

RESPONSE-DATA (STATUS = 0x03)

7	(8)
DB-ADR-E	(DB-ADR-E)[1]

RESPONSE-DATA (STATUS = 0x95)

7	8	(9)
ISO15693 ERROR	DB-ADR-E	(DB-ADR-E)[1]

MODE:

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

ADR:

b000 non-addressed
b001 addressed
b010 selected

UID_LF:

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

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

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

[1] *used in extended address mode*

EXT_ADR:

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

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

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

UID_LNG:

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

UID:

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

BANK:

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

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

BANK_NR:

In case of 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 a 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. Depending on EXT_ADR First block can be any value between 0 and 255 or 0 and 65535.

DB-N:

Number of data blocks to be written to the Transponder, starting at DB-ADR.
The maximum number of DB-N, depends on DB-Size and the interface receiver buffer size RX-BUF. The maximum number of DB-N is:
(RX-BUF - 20)/(DB-Size) e.g. Block size 4 (DB-N = (280 – 20) / 4 = 65)

DB-SIZE:

Number of bytes of one data block.

DB:

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

TAG ERROR Code: (only ISO15693 Transponder)

ISO15693 ERROR code of Transponder response. This byte is only available if STATUS = 0x95.

DB-ADR-E:

Block number where the error occurred.

Notes:

- ***If an error occurred during a write command, the number of the block were the error occurred will be send to host***
- ***ISO15693:***
  - ***A write to 1 block uses a Write Single Block command to the Transponder. This will be managed by the Reader internally.***
  - ***If a Transponder does not support Write Multiple Blocks commands several Write Single Block commands are used for this Transponder.***

7.1.6.[0x25] Select (ISO15693)

This command sets one Transponder to the Select State. Only one ISO15693 Transponder can be selected at once. An already selected Transponder will automatically be set to Ready State.

REQUEST-DATA

4	5	6...13
0x25	MODE	UID

RESPONSE-DATA (STATUS = 0x95)

5
ISO15693 ERROR

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.

ISO15693 ERROR:

ISO15693 ERROR code of Transponder response. This byte is only available if STATUS = 0x95.

Note:

- ***This command is only available for ISO15693 Transponders.***

7.1.7.[0x26] Reset to Ready (ISO15693)

This command sets one Transponder to Ready State.

REQUEST-DATA

4	5	(6...13)
0x26	MODE	UID

RESPONSE-DATA (STATUS = 0x95)

5
ISO15693 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.

ISO15693 ERROR:

ISO15693 ERROR code of Transponder response. This byte is only available if STATUS = 0x95.

Note:

- ***This command is only available for ISO15693 Transponders.***

7.1.8.[0x27] Write AFI (ISO15693)

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 *10.1. Supported ISO15693 Host commands for ISO15693 Transponders*.

REQUEST-DATA

4	5	(6...13)	6 / (14)
0x27	MODE	UID	AFI

RESPONSE-DATA (STATUS = 0x95)

5
ISO15693 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.

ISO15693 ERROR:

ISO15693 ERROR code of Transponder response. This byte is only available if STATUS = 0x95.

Note:

- ***This command is only available for ISO15693 Transponders.***

7.1.9.[0x28] Lock AFI (ISO15693)

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 *10.1. Supported ISO15693 Host commands for ISO15693 Transponders*..

REQUEST-DATA

4	5	(6...13)
0x28	MODE	UID

RESPONSE-DATA (STATUS = 0x95)

5
ISO15693 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.

ISO15693 ERROR:

ISO15693 ERROR code of Transponder response. This byte is only available if STATUS = 0x95.

Note:

- ***This command is only available for ISO15693 Transponders.***

7.1.10.[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 10.1. Supported ISO15693 Host commands for ISO15693 Transponders.

REQUEST-DATA

4	5	(6...13)	6 / (14)
0x29	MODE	UID	DSFID

RESPONSE-DATA (STATUS = 0x95)

5
ISO15693 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.

ISO15693 ERROR:

ISO15693 ERROR code of Transponder response. This byte is only available if STATUS = 0x95.

Note:

- ***This command is only available for ISO15693 Transponders.***

7.1.11.[0x2A] Lock DSFI (ISO15693)

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 10.1. Supported ISO15693 Host commands for ISO15693 Transponders.

REQUEST-DATA

4	5	(6...13)
0x2A	MODE	UID

RESPONSE-DATA (STATUS = 0x95)

5
ISO15693 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.

ISO15693 ERROR:

ISO15693 ERROR code of Transponder response. This byte is only available if STATUS = 0x95.

Note:

- ***This command is only available for ISO15693 Transponders.***

7.1.12. [0x2B] Get System Information (ISO15693)

This command reads the system information from one Transponder.

REQUEST-DATA

4	5	(6...13)
0x2B	MODE	UID

RESPONSE-DATA (STATUS = 0x95)

5
ISO-ERROR

RESPONSE-DATA

5	6...13	14	15...16	17
DSFID	UID	AFI	MEM-SIZE	IC-REF
0x00	Only LS 32bits valid	Manufacturer Code	MEM SIZE	Chip Version

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:

ISO15693 error code of Transponder response. This byte is only available if STATUS = 0x95.

DSFID:

Data Storage Format Identifier of the Transponder.

UID:

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.

Byte	15		16
Bit:	7 .. 5	4 .. 0	7 .. 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

Note:

This command is only available for ISO15693 Transponders.

7.1.13.[0x2C] Get Multiple Block Security Status (ISO15693)

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

REQUEST-DATA

4	5	(6...13)	6 / (14)	7 / (15)
0x2C	MODE	UID	DB-ADR	DB-N

RESPONSE-DATA (STATUS = 0x95)

5
ISO15693 ERROR

RESPONSE-DATA

5	6
DB-N	SEC-STATUS
	Repeated DB-N times

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.

DB-ADR:

First block number from which security status is requested. First block number can be any value between 0 and 255.

DB-N:

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

DB-Size	Max. DB-N
4	0x20 ->32
8	0x10 ->16
x	= 128 / x

ISO15693 ERROR:

ISO15693 ERROR code of Transponder response. This byte is only available if STATUS = 0x95.

SEC-STATUS:

Block security status .

8. [0xB1] Host commands for ISO15693 Custom and Proprietary Commands

This command sends custom defined commands to the Transponder.

Host → Reader

1	2	3	4	5...n-2	n-1,n
n	COM-ADR	[0xB1]	MFR	REQUEST-DATA	CRC16

Host ← Reader

1	2	3	4	5...n-2	n-1,n
n	COM-ADR	[0xB1]	STATUS	RESPONSE-DATA	CRC16

MFR:

Manufacturer code

MFR	
0x02	STMicroelectronics
0x04	NXP
0x05	Infineon
0x07	Texas Instruments
0x08	Fujitsu
0x16	EMMicroelectronic

Note:

If the Transponder type is not known the reader uses for the read multiple block command the block size which is defined in 4.4. CFG4: Transponder Parameters (ISO-Blocksize)

REQUEST-DATA:

Manufacturer specific request

RESPONSE-DATA:

Manufacturer specific response

Notes:

- ***Data is only transferred if STATUS = 0x00, 0x83, 0x94, 0x95.***
- ***This command is not available if the Scan-Mode is switched on.***

9. [0xB3] Host commands for ISO18000-3M3 Transponders

This command sends special commands to ISO18000-3M3 Transponder.

Host → Reader

1	2	3	4...n-2	n-1,n
0x02	COM-ADR	[0xB3]	REQUEST-DATA	CRC16

Host ← Reader

1	2	3	4	5...n-2	n-1,n
0x02	COM-ADR	[0xB3]	STATUS	RESPONSE-DATA	CRC16

REQUEST-DATA:

EPC specific request

RESPONSE-DATA:

EPC specific response

Notes:

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

9.1. ISO18000-3M3 Commands [0xB3]

This commands supports the functions of the ISO18000-3M3 Transponder

9.1.1. [0xB3] [0x18] Kill

This command will kill the ISO18000-3M3 Transponder.

REQUEST-DATA

4	5	1 Byte	EPC_LNG Bytes
0x18	MODE	EPC_LF	EPC

1 Byte	K_PW_LNG Bytes	1 Byte
K_PW_LNG	K_PW	RECOM Bits

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

EPC:

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

K_PW_LNG:

Length of Kill Password. (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	Asserted 2SB	Asserted LSB

9.1.2. [0xB3] [0x22] Lock

This command Lock different memory portions of a ISO18000-3M3 Transponder.

REQUEST-DATA

4	5	1 Byte	EPC_LNG Bytes
0x22	MODE	EPC_LNG	EPC

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

MODE:

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

ADR:

b000 non-addressed
b001 addressed

EPC_LF:

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

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

EPC_LNG:

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

EPC:

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

EPC_Type:

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

LOCK_LNG:

Length of LOCK_DATA Field

LOCK_DATA:

Lock data which will be written to the Tag.

A_PW_LNG:

Length of Access Password. (4Byte)

A_PW:

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

Notes:

- **ISO18000-3M3**
  – A ISO18000-3M3 Transponder can be locked in non addressed mode only
  – LOCK_DATA has to contain the kill code which is written to the Transponder.
  – Lock data length Lock_LNG=3

9.2. [0xBF] ISO15693 Transparent Command

This command sends user transparent commands to the Transponder.

Host → Reader

1	2	3	4	5-6
n	COM-ADR	[0xBF]	MODE	RSP-LENGTH

MODE 1+2

7-8	9...n-2	n-1,n
reserved	REQUEST-DATA	CRC16

MODE 3+4

7-8	9 – 10	11 ... n-2	n-1,n
reserved	EOF-PULSE-DELAY	REQUEST-DATA	CRC16

MODE 5

7-8	9 – 10	11 ... n-2	n-1,n
reserved	MULTIPLE 302us GRIDS	REQUEST-DATA	CRC16

Host ← Reader

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

MODE:

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

– REP-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 a 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”.
- REP-LENGTH if ERROR_FLAG is “0”

HDR_RL: (from firmware version 1.04.06)

b0 Switch off use of High Data Rate(53kBit/s) for Return Link
b1 Switch on use of High Data Rate(53kBit/s) for Return Link

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)

In MR/PR/PRH protocol not used. To avoid problems with other OBID® 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

REQUEST-DATA:

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***

RESPONSE-DATA:

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.***
- ***The response data ever contain the in RSP-LENGTH defined number of data bytes.***

Note:

- ***This command is only available for ISO15693 Transponders.***
- ***This command is not available if the Scan-Mode is witched on.***

10. Supported ISO15693 Host commands

10.1. Supported ISO15693 Host commands for 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.

10.1.1. EM4135 EM MICROELECTRONIC

IC manufacturer identifier: 0x16

memory organization:
36 x 8 Byte = 2304 Bit

Number of blocks	48 (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 Security Status is always 0x00
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 RW-OPTION parameter in *"4.4. CFG4: Transponder Parameters"***

10.1.2. Fujitsu (MB89R116)

IC manufacturer identifier: 0x08

Memory organization: 256 x 8 Byte = 2kBit

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*	√	√	√	√	DB-Size = 8 Security Status is always 0x00
0x24	Write Multiple Blocks**	√	√	√	√	DB-Size = 8, 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 [0xA5] will be used automatically by the Reader.**
- **** The WR-OPTION will be set automatically by the FEIG Readers if the RW-OPTION parameter in "*4.4. CFG4: Transponder Parameters*" is set to "00: automatically set". Up to two blocks of data can be written for one request.**
- **ASK SUB-CARRIER must be configured in the reader (see: "4.4. CFG4: Transponder Parameters")**

10.1.3. Fujitsu (MB89R118)

IC manufacturer identifier: 0x08

Memory organization: 256 x 8 Byte = 2kBit

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 Blocks	√	√	√	√	WR-OPTION = 0 or 1
0x23	Read Multiple Blocks*	√	√	√	√	DB-Size = 8 Security Status is always 0x00
0x24	Write Multiple Blocks*, **	√	√	√	√	DB-Size = 8, 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 will be set automatically by the FEIG Readers if the RW-OPTION parameter in "*4.4. CFG4: Transponder Parameters*" is set to "00: automatically set". Up to two blocks of data can be written for one request.**

10.1.4. Infineon (my-d page mode) 0x60

IC manufacturer identifier: 0x05

Memory organization:

SRF55V10P: 128 x 8 Byte = 8kBit

Number of blocks	128 (user area: 3...127)
Block size	8 byte

SRF55V02P: 32 x 8 Byte = 2kBit

Number of blocks	32 (user area: 3...31)
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 Security Status is always 0x00
0x24	Write Multiple Blocks**	√	-	√	√	DB-Size = 8, 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 RW-OPTION parameter in "*4.4. CFG4: Transponder Parameters*"**
- **** The Custom Specific Commands Read [0x10], Write [0x30] and the Write Byte [0x90] will be used automatically by the Reader.**

10.1.5. Infineon (ISO Address mode) 0xE0

IC manufacturer identifier: 0x05

Memory organization:

SRF55V10P: 256 x 4 Byte = 8kBit

Number of blocks	256 (user area: 0...247)
Block size	4 byte

SRF55V02P: 64 x 4 Byte = 2kBit

Number of blocks	64 (user area: 0...55)
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	√	√	√	√	
Custom specific commands						
0x10	Read	√	√	√	√	DB-Size = 4
0x30	Write	√	√	√	√	DB-Size = 4, WR-OPTION = 0 *
0x90	Write Byte	√	√	√	√	WR-OPTION = 0 *

The WR-OPTION will be set automatically by the FEIG Readers if the RW-OPTION parameter in "CFG4 Transponder Parameters" is set to "00: automatically set" (4.4. CFG4: Transponder Parameters).

10.1.6. NXP (I-Code SLI)

IC manufacturer identifier: 0x04

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 Security Status is always 0x00
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".**

10.1.7. NXP ICode ILT-M (ISO18000-3M3)

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	√		√	

10.1.8. 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 RW-OPTION parameter in "CFG8 General" is set to "00: automatically set" "

10.1.9. Texas Instruments (Tag-it™ HF-I Plus)

The command codes listed in the following table support the various Transponder commands and operations that are available for Tag-it™ HF-I PlusTransponders.

IC manufacturer identifier: 0x07

Product ID / Config : (xxxx / nnn)
Tag-it™ HF-I Plus = b0000 000 or
= b1000 000

Memory organization: 64 x 4 Byte = 2kBit user data

Number of blocks	65 (user area: 0...63)
Block size	4 byte

Command Code	Function		Mode			Comment
			non-addressed	addressed	select	
0x01	Inventory	√	-	-	-	
0x02	Stay Quiet	√	-	√	-	
0x22	Lock Block	√	√	√	√	WR-OPTION = 1 **
0x23	Read Multiple Blocks	√	√	√	√	DB-Size = 4 WR-OPTION = 1 **
0x24	Write Multiple Blocks	-	-	-	-	
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	√	√	√	√	
Custom specific commands						
0xA2	Write_2_Blocks	√	√	√	√	
0xA3	Lock_2_Blocks	√	√	√	√	

**** The WR-OPTION will be set automatically by the FEIG Readers if the WR-OPTION parameter in "CFG4 General Transponder Param" is set to "00: automatically set" (4.4. CFG4: Transponder Parameters).**
By using the "non-addressed " mode the WR-OPTION must be set manually to "WR-OPTION = 1".

Note:

- ***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.***
- ***In the case of writing/locking an odd number of blocks the "Write_2_Blocks"/"Lock_2_Blocks" command will be combined with the "write single Block"/ "Lock single Block" command.***

10.1.10. Texas Instruments (Tag-it™ HF-I Standard, Tag-it™ HF-I Pro)

The command codes listed in the following table support the various Transponder commands and operations that are available for Tag-it™ HF-I Standard and Tag-it™ HF-I Pro Transponders.

IC manufacturer identifier: 0x07

Product ID / Config : (xxxx / nnn)
Tag-it™ HF-I Standard = b1100 000
Tag-it™ HF-I Pro = b1100 010

Memory organization: 8 x 4 Byte = 256Bit user data

Number of blocks	11 (user area: 0...7)
Block size	4 byte

Command Code	Function		Mode			Comment
			non-addressed	addressed	select	
0x01	Inventory	√	-	-	-	
0x02	Stay Quiet	√	-	√	-	
0x22	Lock Block	√	√	√	-	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	-	-	-	-	
Custom specific commands						
0xA4	Kill	√	-	√	-	**only Pro**
0xA5	WriteSingeBlockPwd	√	-	√	-	**only Pro**

****** **The WR-OPTION will be set automatically by the FEIG Readers if the WR-OPTION parameter in "CFG4 Transponder Paramters" is set to "00: automatically set" (4.4. CFG4: Transponder Parameters).**

Note:

- ***Only one block is allowed for Read Multiple Blocks in non addressed mode***

ANNEX

ANNEX A: Codes of Transponder Types

Value	Transponder type
0x03	ISO15693 Tags
0x09	ISO18000-3M3

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

ANNEX B: Time Behavior of the Asynchronous Interface

The execution times of the asynchronous interface depend on:

- The extent of the data that needs to be read or written
- Type and amount of Transponders supported by the Reader
- Position of the Transponder at the time of the request
- Probable local electromagnetic interference present
- The success or failure of the request

	min.	typ.	max.	Unit
EE-Parameter change 1 Block (16 Bytes) all (8) Blocks	5	 22,5 180	 300 600	 ms ms
7.1. [0xB0] Host commands for ISO15693 Mandatory and Optional Commands	5	[1]	[2]	ms
8. [0xB1] Host commands for ISO15693 Custom and Proprietary Commands	5	[1]	[2]	ms
9.2. [0xBF] ISO15693 Transparent Command	5	[1]	[2]	ms

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

[2] *see ANNEX C: Time Behavior of ISO15693 Host Commands for details*

ANNEX C: Time Behavior of ISO15693 Host Commands

The execution times for ISO15693 Host Commands depend on:

- Amount of Transponders in the antenna field (duration of anticollision process),
- The extent of the data that needs to be read or written
- Types of Transponders supported by the Reader,
- Position of the Transponder at the time of the requirement,
- Probable local electromagnetic interference present.
- Environment noise conditions

Time Behavior for [0x01] Inventory and ISO15693 Transponders

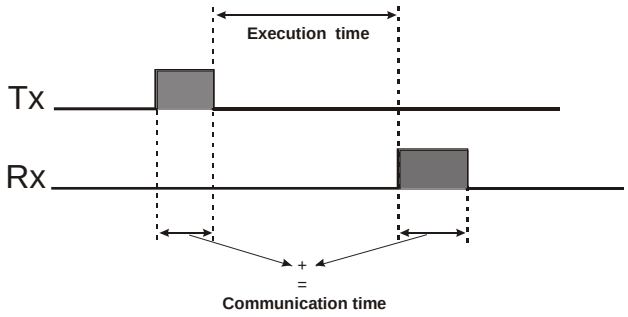
All times apply to the following parameters: ISO15693 MODE = 0x0B (see 4.4. CFG4: Transponder Parameters) and 4.5. CFG5: Anticollision.

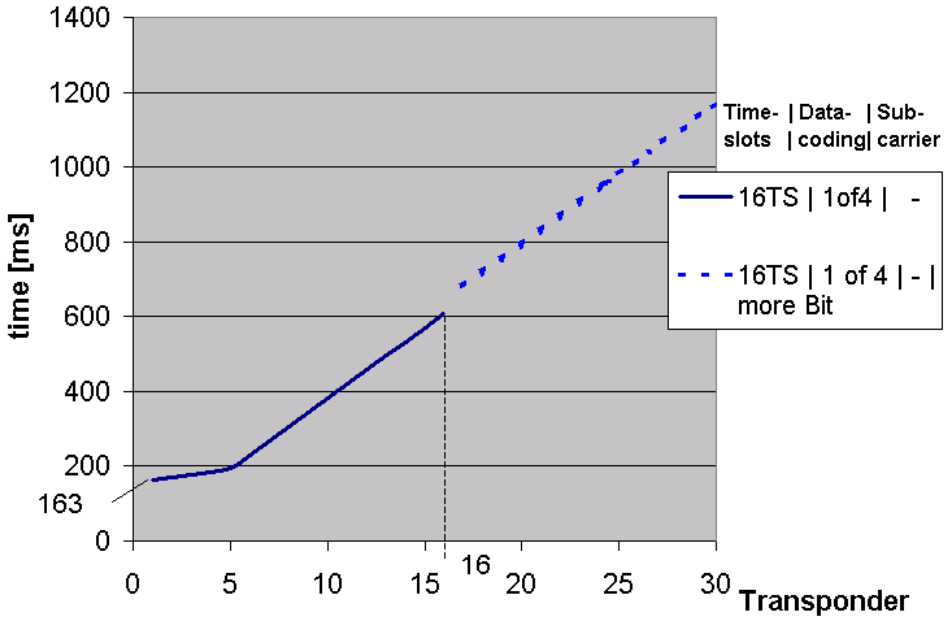
- AFI disabled
- 16 timeslots
- only ISO15693 Transponder driver active
- ONT = Only new Transponder will be send to the host

The modulation and the sub-carrier have a negligible influence on the reaction time.

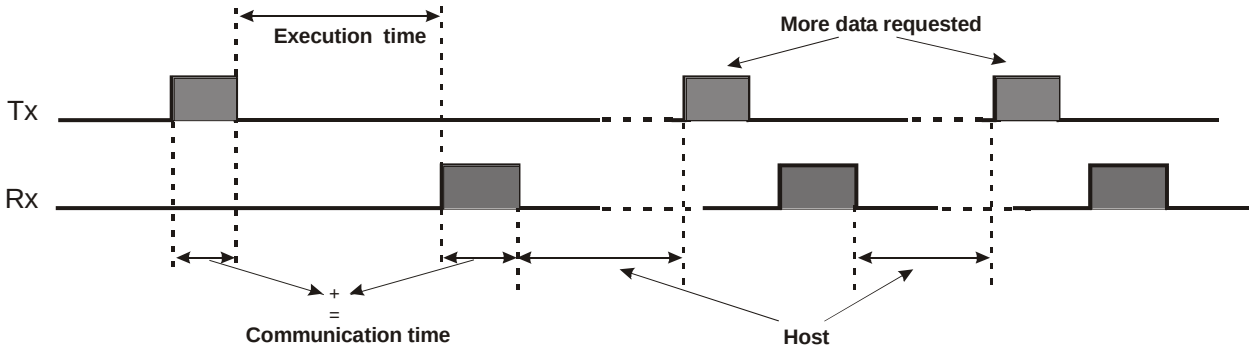
The following diagrams shows the average value of timing behavior, dependent on the number of Transponders. For certain UID's the real timing can by higher or lower as show below.

The timing is measured inclusive of the communication time at 38,4Kbaud. A modified baud rate will slightly increase the timing but the Inventory timing is mostly determined by anticollision so you may neglect the communication time.





Please consider that the timing of the inventory command [0xB0 0x01] is influenced by the “More Bit”. The “More Bit” is set if the number of Transponders exceeds 16. So if the “More Bit” is set in the response of the Reader to the inventory command, the communication time is influenced by the speed of the host system.



Time Behavior for common commands with independent Transponder performance.

functions		**execution time** (ms)		**Communication time at 38,4 kBaud** (ms)	
		addressed	selected	addressed	selected
Stay Quiet		7,5	-	6,1	-
Select		9	-	6	-
Reset to Ready		9	5,5	6	3,8
Get System Information		14	10,2	9,7	7,4
Get multiple block security status	1 block	5,7	6,35	7,2	4,9
	2 block	10,2	6,7	7,4	5,1
	8 block	12,3	8,8	9,2	6,9
	32 block	21	17,3	16	13,7

ANNEX D: 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:** • CRC16 data error on 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.

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.
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] Get Reader Info (Mode 0x80) 2. Send the Device-ID and the serial number of the reader to Feig Electronic 3. Write the upgrade code into the reader using the command [0x5F] Set Firmware Update

Hex-value	Interface Status
0x80	**Unknown Command:** • The Reader does not support the selected function.
0x81	**Length-Error:** • Protocol is too short or too long
0x82	**Command not available:** •

0x83	**RF communication error:** This error indicates that there is an error in communication between the Transponder and the Reader. Reason for this can be: • The collision handling algorithm was not continued until no collision is detected, reasons for the break: - TR-RESPOSE-TIME in CFG1 Interface is too short
0x94	**More Data:** • There are more Transponder data sets requested than the response protocol can transfer at once.
0x95	**ISO 15693 Error:** • An additional error code for ISO15693 Transponders is sent with response data.
0x85	**EPC Error** An additional error code for ISO1800-3M3 Transponders is sent with response data

Error-Code for 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 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
0xA0 - 0xDF	Custom command error codes
all others	reserved for future use

Error-Code for 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

Reference:
EPC Radio-Frequency Identity Protocols Class-1 Generation-2 HF RFID Protocol for Communications at 13.56MHz, Version 2.0.3 (Draft, 18 June, 2010)

ANNEX E: Index of Control Bytes

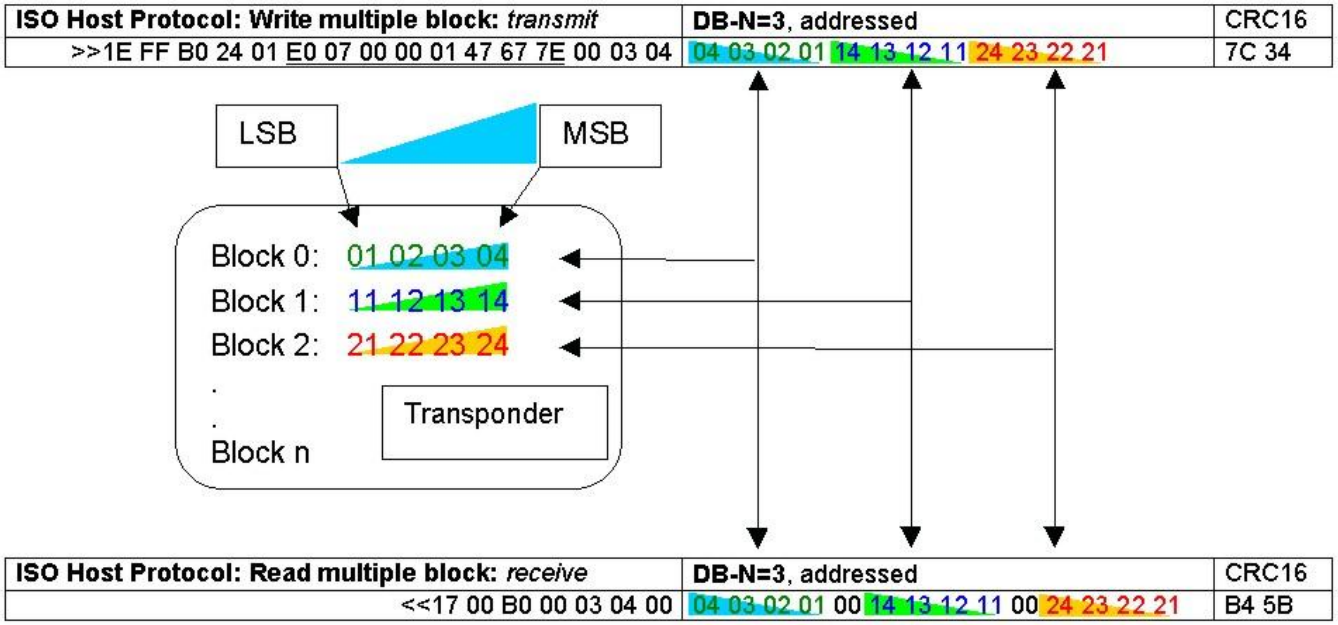
ANNEX F: Index of Configuration Parameters

[1] *as configured in 4.1. CFG1: Interface TR-RESPONSE-TIME*

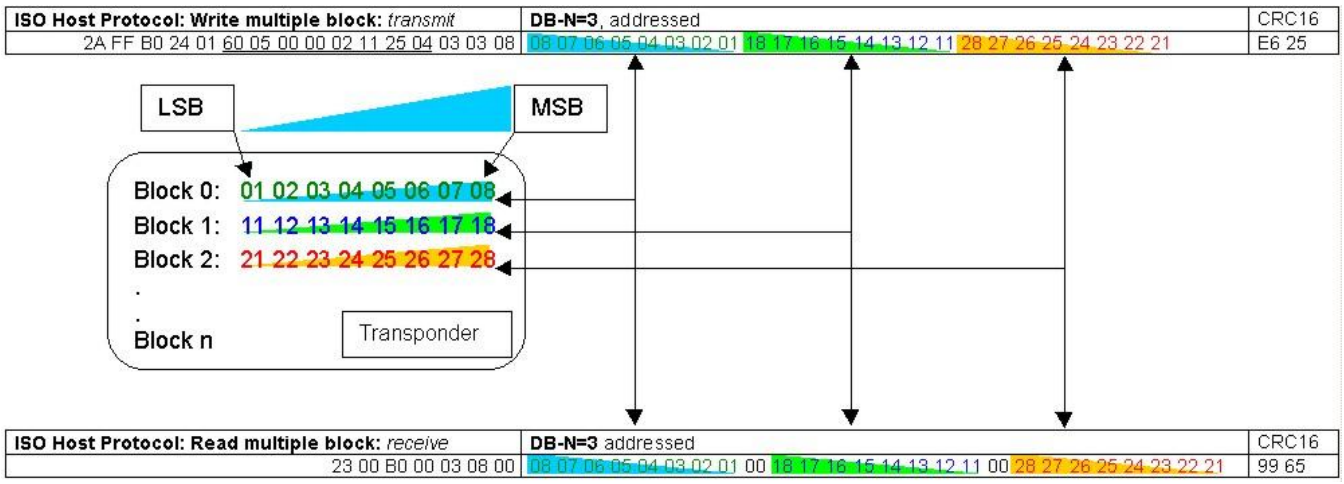
ANNEX I: Examples for Read Data

The setting "**LSB first**" and "**MSB first**" gives the direction of the received data bytes

ISO15693 Host Command (DB-Size of the Transponder = 4 bytes)



ISO15693 Host Command (DB-Size of the Transponder = 8 bytes)



ANNEX K: Codes of Reader Types

No.	Reader Type
11	ID ISC.DAT
12	ID ISC.UMUX
13	ID ISC.GPC
20	ID RW40.30-U
30	ID ISC.M01
31	ID ISC.M02
33	ID ISC.M02M8
40	ID ISC.LR100
41	ID ISC.LR200
42	ID ISC.LR2000
43	ID ISC.LR2500-B
44	ID ISC.LR2500-A
45	ID ISC.LR1002
50	ID ISC.MU02
54	ID ISC.MRU102
55	ID ISC.MRU200
56	ID ISC.MRU200-U
60	ID ISC.PRH101
61	ID ISC.PRH101-U (USB-Version)
62	ID ISC.PRHD102
63	ID ISC.PRH102
71	ID ISC.PRH100–U (USB-Version)
72	ID ISC.PRH100
73	ID ISC.MR100–U (USB-Version)
74	ID ISC.MR100 / .PR100
75	ID ISC.MR200-A / -E
76	ID ISC.MR101-A
77	ID ISC.MR102
78	ID ISC.MR101-U
80	ID CPR.M02
81	ID CPR.02
82	ID CPR40.30-Ux
83	ID CPR40.0x-Ax / -Cx
84	ID CPR.M03 (586/#)
85	ID CPR.03 (584/#)
86	ID CPR30
87	ID CPR.52
88	ID CPR.04-U
92	ID ISC.LRU1000
93	ID ISC.LRU2000
94	ID ISC.LRU3000
100	ID MAX50

ANNEX L: Labeling of configuration parameter

Namespace	Filter	CFG-Block	Byte-No.	No. of Bytes	Bit-No.	No. of Bits
HostInterface.Serial.BusAddress		1	0	1		
HostInterface.Serial.Baudrate		1	2	1		
HostInterface.Serial.Parity		1	3	1	0	2
HostInterface.Serial.Databits		1	3	1	2	1
HostInterface.Serial.Stopbits		1	3	1	3	1
AirInterface.TimeLimit		1	6	2		
OperatingMode.Mode		1	13	1	0	1
OperatingMode.ScanMode.Interface		1	13	1	1	1
HostInterface.DataClock.Format		1	13	1	2	3
DigitalIO.Signaler.LED.Green.IdleState		2	3	1	0	2
DigitalIO.Signaler.LED.Red.IdleState		2	3	1	2	2
DigitalIO.Signaler.Enable_StartupSignal		2	3	1	7	1
DigitalIO.Signaler.LED.Green.IdleFlashFrequency		2	4	1	0	2
DigitalIO.Signaler.LED.Red.IdleFlashFrequency		2	4	1	2	2
DigitalIO.Signaler.LED.Green.ActiveState		2	7	1	0	2
DigitalIO.Signaler.LED.Red.ActiveState		2	7	1	2	2
DigitalIO.Signaler.LED.Green.ActiveFlashFrequency		2	8	1	0	2
DigitalIO.Signaler.LED.Red.ActiveFlashFrequency		2	8	1	2	2
DigitalIO.Signaler.LED.Green.ActivationTime		2	9	1		
DigitalIO.Signaler.LED.Red.ActivationTime		2	10	1		
Transponder.Driver.HF.ISO_18000_3M3		3	0	1	1	1
Transponder.Driver.HF.ISO_15693		3	1	1	3	1
Transponder.HF.ISO_15693. Anticollision.NoOfTimeslots	Expert	4	4	1	4	1
Transponder.HF.ISO_15693. SelectionMask.Enable_AFI	Expert	4	4	1	5	1
Transponder.HF.ISO_15693. SelectionMask.AFI1	Expert	4	5	1		
Transponder.HF.ISO_15693. Miscellaneous.WriteOption		4	6	1	2	2
Transponder.Miscellaneous. IdentifierInterpretationMode	Expert	4	12	1		
OperatingMode.HostMode.Filter.ResponseMode		5	11	1	0	1
OperatingMode.ScanMode.Filter.ResponseMode		5	11	1	0	1
Transponder.Anticollision.Enable		5	11	1	2	1
OperatingMode.ScanMode.DataSelector.UID		6	3	1	0	1
OperatingMode.ScanMode.DataSelector.Data		6	3	1	1	1
OperatingMode.ScanMode.DataFormat. BusAddressPrefix		6	3	1	6	1
OperatingMode.ScanMode.Filter. TransponderValidTime		6	6	2		
OperatingMode.ScanMode.DataSource.BankNo		6	10	1	0	2

OperatingMode.ScanMode.DataSource.FirstDataBlock		6	11	1		
OperatingMode.ScanMode.DataSource.NoOfBytes		6	12	1		
OperatingMode.ScanMode.DataSource.FirstByte		6	13	1		
OperatingMode.ScanMode.DataFormat.Format		7	0	1	0	4
OperatingMode.ScanMode.DataFormat. SeparationChar		7	1	1		
OperatingMode.ScanMode.DataFormat. UserSeparationChar		7	2	1		
OperatingMode.ScanMode.DataFormat. EndChar		7	3	1		
OperatingMode.ScanMode.DataFormat. UserEndChar1		7	4	1		
OperatingMode.ScanMode.DataFormat. UserEndChar2		7	5	1		
OperatingMode.ScanMode.DataFormat. UserEndChar3		7	6	1		
OperatingMode.ScanMode.DataFormat. UserHeaderChar1		7	8	1		
OperatingMode.ScanMode.DataFormat. UserHeaderChar2		7	9	1		
OperatingMode.ScanMode.DataFormat. UserHeaderChar3		7	10	1		
OperatingMode.ScanMode.DataFormat. UserHeaderChar4		7	11	1		
OperatingMode.ScanMode.DataFormat. NoOfUserEndChars		7	13	1	0	4
OperatingMode.ScanMode.DataFormat. NoOfUserHeaderChars		7	13	1	4	4