OBID® i-*scan*

MANUAL

ID ISC.MR100
ID ISC.PR100
ID ISC.PRH100

Standard-Reader

from Firmware-Version 2.11

ID ISC.PRH100

ID ISC.PR100

ID ISC.MR100
ID ANT340/240

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FEIG ELECTRONIC

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

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General information's regarding this manual

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

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3e	12.09.02	24	New Parameter in CFG 4 Transponder Parameters: I-Code Mode
		27	New Parameters in CFG 6 Scan Mode1: D-LGT; D-START. Changed function of the SCAN-LOCK-TIME
			Some more little changes will be indicated by the sign "☞"

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

1. Data Transmission between OBID® i-*scan* ID ISC.MR/PR/PRH100 and Host

For 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 way of data transmission is supported by which interface:

	asynchronous interface (RS232 / RS485)
Configuration Commands	√
Control Commands	√
ISO15693Host Commands	√
Scan-Mode	√

1.1. Configuration Commands and Control Commands

This way of data transmission serves for Reader configuration and the diagnosis via the asynchronous interface or USB.

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

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

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

1.2. ☞ 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 has to be secured that the Transponder is located within the detection range of the Reader during the entire process. If the Transponder will be taken out of the detection range of the Reader during a writing process, this will cause a loss of data.

The Reader distinguish between three different modes:

Addressed mode:

Before reading or writing data in addressed mode, the UID of the Transponder has to be known. This is executed by sending the protocol "6.1.1. [0x01] Inventory If a Transponder is located within the detection range of the Reader at that time, he answers with his UID. For all following read- / write orders the Transponder must be addressed with his correct UID.

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

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

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:

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

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 has to be known. This is executed by sending at first the protocol "6.1.1. [0x01] Inventory". In a second step the Transponder must be selected with the select command (see: 6.1.6. [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 Trans-ponders / 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
	←		

1.3. ☞ Scan-Mode

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

Turned to 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 (see also: 3.7. ☞ CFG6: Scan-Mode1).

The Reader starts the output of the protocol block as soon as all required data have been read correctly from the Transponder. If the Reader is not able to read all data of a protocol block completely and faultlessly, it doesn't put out data. For example, if the address of the data block is invalid, the UID of the Transponder will not send out.

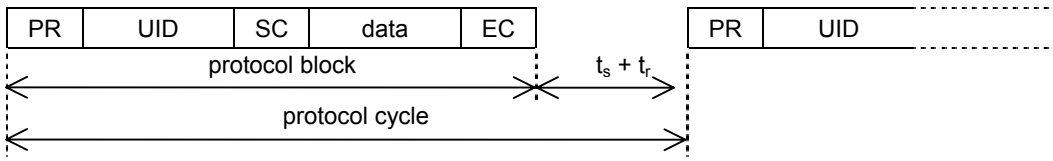
Scan-Mode via asynchronous interface:

The data will be put out depending to their configuration according to the following scheme, of which the order 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 reange only UID should be read:

PR	UID1	EC	UID2	EC	UID3	EC

Example 3:

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

PR	data1	EC	data2	EC	data3	EC

Example 4:

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

PR	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)		

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.***

2. Asynchronous Interface

2.1. Data Format and Protocol Frames

The Reader ID ISC.MR100-A 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 contains the transmitted control byte.

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

Protocol frame:

Host → Reader

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

Host ← Reader

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

LENGTH n:

Number of protocol bytes 1- n (6 - 255) incl. length byte and checksum

COM-ADR:

0..254 address of device in bus mode

Note:

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

STATUS / PROTOCOL-DATA:

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

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

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

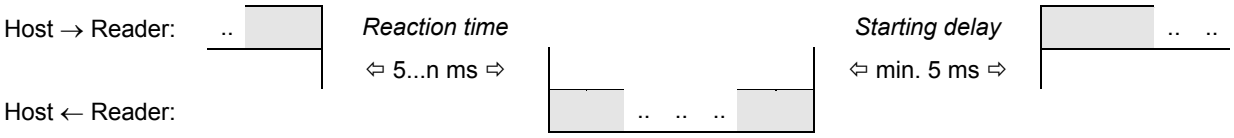
Data format:

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

Timing conditions:

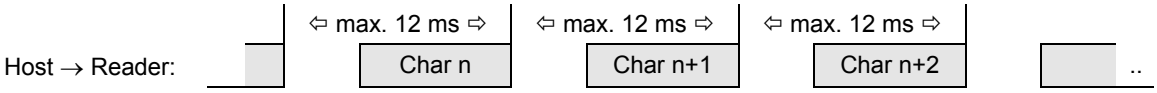
Starting delay:

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.



2.2. CRC16 Calculation Algorithm

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

Start Value: 0xFFFF ⇒ CRC_PRESET = 0xFFFF;

C-Example:

```
unsigned int crc = CRC_PRESET;

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

3. Configuration Parameters (CFG)

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

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

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

The parameters are stored in two different configuration memory locations:

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

Multiple configuration memory locations can be addressed by the value of the parameter CFG-ADR used in chapter 4. 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 being executed after each reset of the Reader. If the checksum examination detects a faulty checksum, 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 is blinking alternately red and green and the Reader answers external commands with the status "0x10 EEPROM Failure". The "EE-Init-Mode" can be left by a new reset (cold start or 5.3. ☞ [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 without their described range or if unspecified parameters have been changed!***
- ***A firmware update resets the EEPROM to default settings and the Reader goes into the error status "EE-Init-mode".***

Structure of configuration parameter description.

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

not marked

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

gray marked

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

marked with "00"

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

3.1. CFG0: Reserved

The configuration block CFG0 is reserved for future use.

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

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

3.2. ☞ CFG1: Interface

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

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

Byte	7	8	9	10	11	12	13
Contents	TR-RESPONSE-TIME	0x00	0x00	0x00	0x00	0x00	READER - MODE
Default	0x1E						MR/PR: 0x00 PRH: 0x01
	3 sec.						

COM-ADR:

Bus address of the Reader (0 .. 254) for communication via the asynchronous interface, especially for applications with the RS485 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.***

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

☞**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 baudrate 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.

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

P: Kind of Parity
b00: non 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***

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

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 to 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.***

READER-MODE:

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

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

SCAN-E:

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

b0: **ISO15693Host Mode**
(see chapter 6. Protocols for ISO15693 Host Commands)

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

3.3. CFG2: Inputs / Outputs general

Via the following parameters the operation mode of the LED and the buzzer (only ID ISC.PRH100) can be configured at any time. One byte each is reserved for the active and mute position, by means of which the individual operation modes according to the schedule below may be adjusted. In addition to this, for the active- and mute position different flashing frequencies of the LED and intervals of the buzzer may be defined. So, the LED may be used as an operation indicator.

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

Byte	7	8	9	10	11	12	13
Contents	ACTIV-STATE	ACTIV-FLASH	ACTIV-GRN-TIME	ACTIV-RED-TIME	ACTIV-BUZZER-TIME	0x00	0x00
Default	MR/PR: 0x26 PRH: 0x16	0x00	0x0A *1 sec.*	0x0A *1 sec.*	MR/PR: 0x0A PRH: 0x05 *1 sec.*		

Note:

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

  Colors ID ISCMR / PR:

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

- ***The buzzer is only with the ID ISC.PRH100 available.***

IDLE-STATE / ACTIVE-STATE

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

Bit:	7	6	5	4	3	2	1	0
Function:	Startup Buzzer/ LED	0	BUZZER		RED		GRN	

GRN / RED / BUZZER

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

Startup Buzzer / LED (only idle state)

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

IDLE-FLASH / ACTIV-FLASH:

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

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

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

ACTIV-xxx-TIME

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

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

3.4. CFG3: RF-Interface

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

Byte	0	1	2	3	4	5	6
Contents	TAG-DRV[1]		0x00	0x00	0x00	0x00	0x00
Default	0x000B						

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

TAG-DRV[1]:

Defines the Transponder types that are operated by the Reader.

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

b0: Driver for the Transponder type is inactive

b1: Driver for the Transponder type is active

- **.A:** Driver for I-CODE1
- **.B:** Driver for Tag-it HF
- **.D:** Driver for ISO15693

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.

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

3.5. ☞ CFG4: Transponder Parameters

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

Byte	0	1	2	3	4	5	6
Contents	I-CODE-MODE	FAM-CODE	APP-ID	0x00	ISO 15693 MODE	ISO 15693 AFI	ISO 15693 OPTION
Default	0x00	0x00	0x00		0x0F	0x00	0x00

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

I-CODE-MODE: (only I-Code Transponder)

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

Mapping:

b0: FEIG Memory Model (default)
b1: Original I-Code Memory Model

Note:

- ***If Mapping is set to "original I-Code Memory Model" the ISO15693 Host Command Read Config Block[0xA0] and Write Config Block [0xA1] will not be available. To change the Config Block 0,1,2 can now be done with Write Multiple Blocks [0x24] on the original I-Code Address 2,3,4.***

FAM-CODE: (only I-CODE1 Transponders)
Family Code to select a Transponder

APP-ID: (only I-CODE1 Transponders)
Application ID to select a Transponder

Note:
If FAM-CODE and APP-ID are zero, all I-CODE1 Transponders will response. Otherwise only the Transponders with matching FAM-CODE and APP-ID will respond.

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 subcarrier)
b1: SK (two subcarrier)

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 HFI the WR-OPTION must be set to 1.***
- ***See chapter 8.1. ☞Supported ISO15693 Host commands for ISO15693 Transponders for more details about the correct WR-OPTION.***

3.6. CFG5: Anticollision

The parameters of the CFG5 configuration block contain anticollision settings.

Byte	0	1	2	3	4	5	6
Contents	TIMESLOTS[1]	0x00	0x00	0x00	0x00	0x00	0x00
Default	0x02						

Byte	7	8	9	10	11	12	13
Contents	0x00	0x00	0x00	0x00	ONT	0x00	0x00
Default					0x01		

TIMESLOTS: (only I-CODE1 Transponders)

Number of timeslots with which Transponders will be read.

TIMESLOTS	Number of Timeslots
0x03	16
0x02	8
0x01	4
0x00	1

Each I-CODE1 Transponder responds in a chosen timeslot. Choosing too few timeslots compared to the number of Transponders in the antenna field causes that only a small number of Transponders can be selected at one time. On the other hand are too many timeslots very time consuming. The optimum number of timeslots is about twice the number of I-CODE1 Transponders expected in the antenna field at the same time.

ONT:

Defines which Transponder will sent to the host.

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

ONT:

b0: all Transponders in the field will sent 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

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

3.7. ☞ CFG6: Scan-Mode1

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

Byte	0	1	2	3	4	5	6
Contents	SCANNER-MODE	0x00	0x00	SCAN-DATA	0x00	0x00	SCAN-LOCK-TIME
Default MR100	0x02			0x01			0x00
Default PRH100	0x80			0x01			0x00

Byte	7	8	9	10	11	12	13
Contents	SCAN-LOCK-TIME	0x00	0x00	0x00	DB-ADR	D-LGT	D-START
Default MR100	0x0A 1 sec.				0x00	0x04	0x00
Default PRH100	0x00				0x00	0x04	0x00

SCANNER-MODE

defines the mode of the scanner.

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

mode:

b000: **Single Read:** (active for read duration – stops after good read)
When all Transponders in detection range has been decoded, the Reader will stop the scan. The Reader must be triggered again to read other Transponders.

b010: **Continuos Read:**
The Reader will read as much Transponders as it can decode regardless whether it is the same or not. This mode is mainly used for demonstration and diagnostic.

Trigger:

b0: **Trigger disabled:**
The Reader scans all the time. However, this mode increase the current consumption

b1: **Trigger enabled: (only ID ISCPRH100)**
The Reader start the scan, if the trigger is activated by the external switch.

Note
If Trigger is enabled an not activated by the external switch, the RF-field will be switched off.

SCAN-MODE

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

Bit:	7	6	5	4	3	2	1	0
Function	Byte Order	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 field.

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

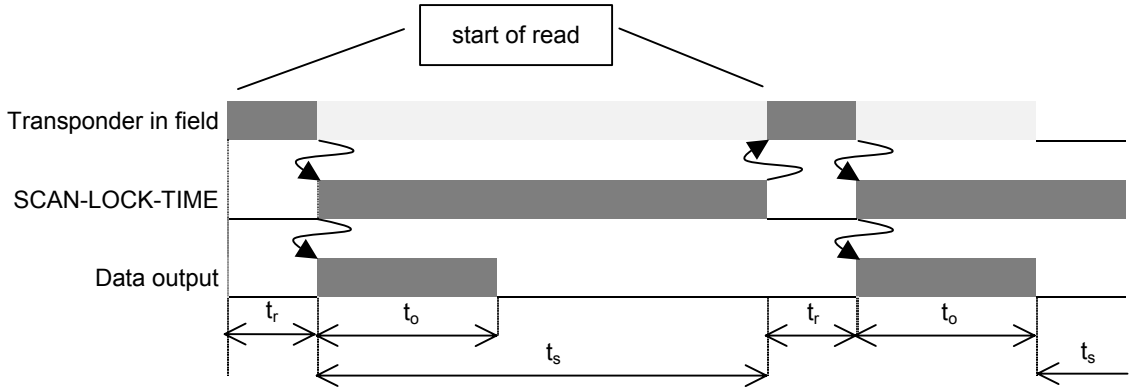
Byte Order

Defines the Byte Order within frame

b0 MSB first
b1 LSB first

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

The SCAN-LOCK-TIME defines the period in which the Reader do not transmit the Transponder data a second time, after he had transmitted it the first time. Regardless whether the Transponder is in the detection range of the reader during SCAN-LOCK-TIME or not. The SCAN-LOCK-TIME starts after the data transmission from the Transponder to the Reader.



t_r: Time to read the Transponder data

t_o: Data Transmission from the Reader to the host

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

DB-ADR:

Transponder address of the first Data Block which will be transferred in Scan-Mode.
Range: 0x00...0xFF.
See for valid addresses: ANNEX G: Memory Model I-CODE1 Transponders and 8.1. ☞Supported ISO15693 Host commands for ISO15693 Transponders

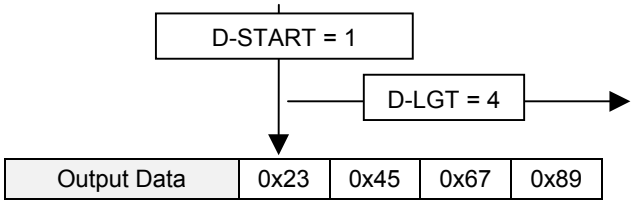
D-LGT:

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

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

Example:
Data Block

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



Output Data	0x23	0x45	0x67	0x89

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.

3.8. ☞ CFG7: Scan-Mode2

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

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

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 there 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

ASCII	Hex
CR+LF	0x0D and 0x0A
CR	0x0D
LF	0x0A
TAB	0x07
‘;’	0x3B
‘,’	0x2C
‘ ‘	0x20
USER	user defined in SEP-USR

Note:

Only one option could 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

ASCII	Hex
CR+LF	0x0D and 0x0A
CR	0x0D
LF	0x0A
TAB	0x07
‘;’	0x3B
‘,’	0x2C
‘ ‘	0x20
USER	user defined in SEP-USR

Note:

Only one option could be selected.

END-USR:

user defined end character.

4. Protocols for Reader Configuration

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

4.1. [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 being 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

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

Note:

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

[1] *see ☞ ANNEX D: Index of Status Bytes*
[2] *see Chapter 3. Configuration Parameters (CFG)*

4.2. [0x81] Write Configuration

Via the command Write Configuration the configuration of the Reader can be changed. In order to do this, the configuration memory is written on with 14 bytes long blocks and addressed by CFGn in the byte CFG-ADR. The description of parameters can be taken from chapter 3. Configuration Parameters (CFG)

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

CFG-REC:

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

Note:

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

[1] *see ☞ ANNEX D: Index of Status Bytes*
[2] *see chapter 3. Configuration Parameters (CFG)*

4.3. [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 over power down use 4.3. [0x82] Save Configuration***
- ***A save configuration to EEPROM with reserved configuration blocks will cause an 0x16 error code.***

[1] *see ☞ ANNEX D: Index of Status Bytes*
[2] *see chapter 3. Configuration Parameters (CFG)*

4.4. [0x83] Set Default Configuration

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

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 store RAM configuration over power down use 4.3. [0x82] Save Configuration***
- ***A set default configuration with reserved configuration blocks will cause an error code.***

5. Protocols for Reader Control

5.1. [0x52] Baud Rate Detection

This serves protocol for the determination of the actual baud rate of the asynchronous interface of the Reader.

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.***

5.2. [0x55] Start Flash Loader

This protocol starts the Flash Loader inside the Reader. Use the windows program “SKWizard“ to process the firmware update. Please refer to the Application Note “Firmware Update ID ISC.MR100” (N10301-2d/e.....pdf) for details.

Host → Reader

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

Host ← Reader

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

Note:

- ***This command is only available if the COM-ADR of the Reader is set to ‘0’***

5.3. ☞ [0x63] CPU Reset

By this protocol, a reset of the CPU on the Reader can be started.

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 switched off after a "CPU Reset"

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

5.4. [0x65] Get Software Version

By this protocol, the software version of the Reader, its type and the types of the Transponders which are supported by the software can be determined.

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
-	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.

SW-TYPE:

Type of Reader firmware
0x48 ID ISCPRH100-A (72)
0x4A ID ISCMR/PR100-A (74)

TR-TYPE:

Displays the Transponders supported by the software.

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

Bit:	7	6	5	4	3	2	1	0
Function:	-	-	-	-	ISO15693	-	Tag-it HF	I-CODE1

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

5.5. ☞ [0x69] RF Reset

The RF-field of the Reader antenna can be switched off for **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 a RF Reset the Reader is not able to receive a new Transponder before expiration of t_{rf} .***
- ***After a RF Reset, a Transponder which is located within the field has to be re-selected.***
- ***The response of this command will be sent after the RF Reset was completed.***

5.6. [0x6A] RF ON/OFF

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

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[2]	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*
[2] *see ☞ ANNEX D: Index of Status Bytes*

5.7. [0x71] Set Output

The command [0x71] serves temporary limited or unlimited activation of the digital outputs or displays (LED, beeper) of the Reader.

Each output takes on the state defined by the byte "OS" for the period of time included in the protocol. The flashing frequency is defined by the byte "OSF". Via this protocol, the beeper and 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 being overwritten by the new times included in the protocol if they are > 0.

Host → Reader

1	2	3	4,5	6,7
13	COM-Adr	[0x71]	OS	OSF

8,9	10,11	12,13
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	Beeper mode *(only PRH100)*		LED red mode		LED grn mode	

LED grn-/LED red-/Beeper-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) provides the possibility to allocate an own 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	Beeper (OUT1) frq *(only PRH100)*		LED red frq		LED grn frq	

LED grn-/LED red-/Beeper-frq:

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

OS-Time

By the values defined by "OS-Time", the LEDs, the beeper can be activated temporary limited or unlimited.
An exception are the time values 0 and 65535 (0xFFFF) (see following table).

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

Note:

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

6. Protocols for ISO15693 Host Commands

Some ISO15693Host commands can be used to access I-CODE1 and Tag-it HF Transponders. The additional commands **Read Config Block** and **Write Config Block** were created by FEIG ELECTRONIC to provide full Transponder configuration capabilities for I-CODE1 Transponders via the OBID® i-*scan* memory model (see ANNEX G: Memory Model I-CODE1 Transponders). The following combinations are possible:

	Transponder Types		
	I-CODE1	Tag-it HF	ISO15693
6.1. [0xB0] Host commands for ISO15693 Mandatory and Optional Commands	√	√	√
6.1.1. [0x01] Inventory	√	√	√
6.1.2. [0x02] Stay Quiet			√
6.1.3. [0x22] Lock Multiple Blocks		√	√
6.1.4. [0x23] Read Multiple Blocks	√	√[1]	√
6.1.5. ☞ [0x24] Write Multiple Blocks	√	√	√
6.1.6. [0x25] Select			√
6.1.7. [0x26] Reset to Ready			√
6.1.8. [0x27] Write AFI			√
6.1.9. [0x28] Lock AFI			√
6.1.10. [0x29] Write DSFI			√
6.1.11. [0x2A] Lock DSFI			√
6.1.12. ☞ [0x2B] Get System Information		√	√
6.1.13. [0x2C] Get Multiple Block Security Status			√
6.1.14. ☞ [0xA0] Read Config Block	√[2]		
6.1.15.☞ [0xA1] Write Config Block	√[3]		
7.2. [0xB1] Host commands for ISO15693 Custom and Proprietary Commands			√
7.3. [0xBF] ISO15693 Transparent Command			√

[1] *Lock status of the Tag-it HF is visible within the Security Byte "SEC-STATUS" see: 6.1.4. [0x23] Read Multiple Blocks*

[2] [3] *Read and Write Config Block will only be available if the I-CODE_MODE (MAPPING)is set to "FEIG Memory Model" see: 3.5. ☞ CFG4: Transponder Parameters*

6.1. [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.***
- ***This commands aren't available if Scan-Mode is active.***

6.1.1. [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 in the quiet state by the Reader. In this state the Transponder doesn't 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 5.5. ☞ [0x69] RF Reset command was send to the Reader or
- if the ONT bit in the ONT register of the 3.6. CFG5: Anticollision configuration block is not set.

REQUEST-DATA

4	5
0x01	MODE

RESPONSE-DATA

5	6	7	8...15
DATA-SETS	TR-TYPE	DSFID	UID
	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 than 16 data sets are available)

DATA-SETS:

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

TR-TYPE:

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

DSFID: (only ISO15693Transponders)

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

UID:

Read only UID 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 can be read out of the Reader with MORE = b1.***

6.1.2. [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 UID of the Transponder.

Note:

- ***This command is only available for ISO15693Transponders.***

6.1.3. [0x22] Lock Multiple Blocks

This command locks one or more Data Blocks.

The supported ISO15693Host commands depends on the different ISO15693Transponder types, they are described in chapter 8.1. ☞Supported ISO15693 Host commands for ISO15693 Transponders.

Note:
This command is only available for ISO15693Transponders and Tag-it HF.

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
ISO15693 ERROR	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 UID 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. The maximum number of bytes is 128 byte.

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.

DB-ADR-E:

Block number were the error occurred.

6.1.4. [0x23] Read Multiple Blocks

This command reads one or more Data Blocks.

the supported ISO15693Host commands depends on the different ISO15693Transponder types, they are described in chapter 8.1. ☞Supported ISO15693 Host commands for ISO15693 Transponders.

REQUEST-DATA

4	5	(6...13)	6 / (14)	7 / (15)
0x23	MODE	UID	DB-ADR	DB-N

RESPONSE-DATA (STATUS = 0x95)

5
ISO15693 ERROR

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	0	0	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:

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

DB-ADR:

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

DB-N:

Number of Data Blocks to be read from the Transponder, starting at DB-ADR.
The maximum number of DB-N, depends on DB-Size. The maximum number of bytes is 128 byte.

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.

DB-SIZE:

Number of bytes of one Data Block. This value depends on the specification of the Transponder manufacturer, see chapter 8.1. ☞Supported ISO15693 Host commands for ISO15693 Transponders.

SEC-STATUS:

Block security status of followed Data Block. If supported by the ISO15693 transponder. I-CODE1 Transponder doesn't support this function.

DB:

Requested Data Block. The block size is defined by DB-SIZE.

Notes:

- ***A read from 1 block uses a Read Single Block command to the Transponder.***
- ***If a Transponder doesn't supports Read Multiple Blocks commands several Read Single Block commands are used for this Transponder.***
- ***Only one Transponder can be read in the non addressed mode.***
- ***I-CODE1 and Tag-it HF Transponders cannot be read in the selected mode.***
- ***An addressed read on the I-Code1 needs an 6.1.1. [0x01] Inventory command first to select the transponder, even if the UID is known.***
- ***A non-addressed read on the I-Code1 can't be performed if the transponder was selected by an inventory command first. They needs to be deselected by using the command 5.5. ☞ [0x69] RF Reset.***

6.1.5. ☞ [0x24] Write Multiple Blocks

This command writes one or more Data Blocks.

The supported ISO15693Host commands depends on the different ISO15693Transponder types, they are described in chapter 8.1. ☞Supported ISO15693 Host commands for ISO15693 Transponders.

REQUEST-DATA

4	5	(6...13)	6 / (14)	7 / (15)	8 / (16)	9...n / (17...n)
0x24	MODE	UID	DB-ADR	DB-N	DB-SIZE	DB
						Repeated DB-N times

RESPONSE-DATA (STATUS = 0x03)

5
DB-ADR-E

RESPONSE-DATA (STATUS = 0x95)

5	6
ISO15693 ERROR	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 UID of the Transponder. The UID is required only in the addressed mode.

DB-ADR:

Address of the first Data Block to be written to the Transponder. First block can be any value between 0 and 255.

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. The maximum number of bytes is 128 byte.

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

DB-SIZE:

Number of bytes of one Data Block. This value depends on the specification of the Trans-

ponder manufacturer, see chapter 8.1. ☞Supported ISO15693 Host commands for ISO15693 Transponders.

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.

ISO15693 ERROR:

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

DB-ADR-E:

Block number were the error occurred.

Notes:

- ***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 doesn't supports Write Multiple Blocks commands several Write Single Block commands are used for this Transponder.***
- ***A write command on I-CODE1 Transponders can only be performed in the addressed mode.***
- ***A write command on Tag-it HF Transponders cannot be performed in the selected mode.***
- ***If an error occurred during a write command, the number of the block were the error occurred will be send to host***
- ***If the Reader uses the "original I-Code Memory Model" see:3.5. ☞CFG4: Transponder Parameters the original I-Code addresses in DB-ADR has to be used.***

6.1.6. [0x25] Select

This command sets one Transponder to the Select State. Only one ISO15693 Transponder can be selected at once. A 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 UID. 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.***

6.1.7. [0x26] Reset to Ready

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 UID 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.***

6.1.8. [0x27] Write AFI

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

The supported ISO15693 Host commands depends on the different ISO15693 Transponder Types, they are described in chapter 8.1. ☞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 UID 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.***

6.1.9. [0x28] Lock AFI

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

The supported ISO15693 Host commands depends on the different ISO15693 Transponder types, they are described in chapter 8.1. ☞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 UID 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.***

6.1.10. [0x29] Write DSFI

This command writes the DSFID to one ore more Transponders.

The supported ISO15693 Host commands depends on the different ISO15693 Transponder types, they are described in chapter 8.1. ☞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 UID 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.***

6.1.11. [0x2A] Lock DSFI

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

The supported ISO15693 Host commands depends on the different ISO15693 Transponder types, they are described in chapter 8.1. ☞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 UID 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.***

6.1.12. ☞ [0x2B] Get System Information

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	←ISO
0x00	Only LS 32bits valid	Manufacturer Code	MEM SIZE	Chip Version	←Tag-it-HF

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 .. 4	3 .. 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 and Tag-it HF Transponders.

6.1.13. [0x2C] Get Multiple Block Security Status

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 UID 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 .

Note:

This command is only available for ISO15693 Transponders.

6.1.14. ☞ [0xA0] Read Config Block

This command reads one config block of the *i-scan* memory model (see ANNEX G: Memory Model I-CODE1 Transponders).

REQUEST-DATA

4	5	6...13	14
0xA0	MODE	UID	CB-ADR

RESPONSE-DATA

5...8
CB

MODE:

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

ADR:

b001 addressed

UID:

Read only UID of the Transponder.

CB-ADR:

Address of the config block to be read from the Transponder.

CB:

Requested config block.

Note:

- ***This command is only available for I-CODE1 and Tag-it HF Transponders.***
- ***The command is not available if the Reader is set to original I-Code Memory Mode. (see 3.5. ☞ CFG4: Transponder Parameters, I-Code-Mode). To read the Config Block 0,1,2 can now be done with Read Multiple Blocks [0x23] on the original I-Code Address 2,3,4.***

6.1.15.☞ [0xA1] Write Config Block

This command writes one config block of the *i-scan* memory model (see ANNEX G: Memory Model I-CODE1 Transponders).

REQUEST-DATA

4	5	6...13	14	15...18
0xA1	MODE	UID	CB-ADR	CB

MODE:

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

ADR:

b001 addressed

UID:

Read only UID of the Transponder.

CB-ADR:

Address of the config block to be read from the Transponder.

CB:

Config block to be written to the Transponder.

Note:

- ***This command is only available for I-CODE1 and Tag-it HF Transponders.***
- ***The command is not available if the Reader is set to original I-Code Memory Model. (see 3.5. ☞ CFG4: Transponder Parameters, I-Code-Mode). To write the Config Block 0,1,2 can now be done with Write Multiple Blocks [0x24] on the original I-Code Address 2,3,4.***
- ***Example for write config block 0 of a Tag-it HF Transponder (Config 0 activated protective functions of the Transponder ("1": r/w, "0": ro))***

  The Reader only evaluates the bits which are "0" in the LSB (Byte 0)

3	2	1	0
b xxxx xxxx	b xxxx xxxx	b xxxx xxxx	b 1001 1010

and tries to lock the blocks 0,2,5 and 6. If one block is already locked, the status will be set to 0x00.

By using ISO15693 Transponders the command 6.1.3. [0x22] Lock Multiple Blocks should be used.

7. ☞ Special Commands

7.1. ☞ [0x1B] Reset QUIET Bit (only I-CODE1 Transponders)

This command resets the Quiet Bit of all I-CODE1 Transponders in the antenna field. After using this command a Transponder once stayed in QUIET mode is activated again. How to activate the QUIET mode in I-CODE1 Transponders see ANNEX G: Memory Model I-CODE1 Transponders for details.

Host → Reader

1	2	3	4...5
5	COM-ADR	0x1B	CRC16

Host ← Reader

1	2	3	4	5...6
6	COM-ADR	0x1B	STATUS[1]	CRC16

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

7.2. [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	
0xXX	

REQUEST-DATA:

Manufacturer specific request

RESPONSE-DATA:

Manufacturer specific response

Notes:

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

7.3. [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:

Options for request.

1 = read request

Response is sampled corresponding to ISO15693-3 T1 (318,6us .... 323,3us)

2 = write request with Option “0”

The Reader tries to sample the response after ISO15693-3 T1 (318,6us .... 323,3us). If there is no response the Reader tries to sample in a multiple of 302us. If there is no response within of 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”

3 = write request with Option “1”

The Reader tries to sample the response after ISO15693-3 T1 (318,6us .... 323,3us), if there is no response the Reader send a EOF after EOF-PULSE-DELAY and tries to sample the response after ISO15693-3 T1 (318,6us .... 323,3us)

4 = inventory request

The Reader tries to sample the response after ISO15693-3 T1 (318,6us .... 323,3us). If ISO15693 “Nb_slot_flag” Flag is:

“0” the Reader send a EOF after EOF-PULSE-DELAY and tries again to sample the response in the next timeslot (after ISO15693-3 T1 (318,6us .... 323,3us)). 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 by 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 date hold the CRC error.

“1” the Reader sends back the received data.

5 = write request with Option “0” and grid position of response

The Reader tries to sample the response after ISO15693-3 T1 (318,6us .... 323,3us). 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”

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 contains the in RSP-LENGTH defined number of data bytes.***

Note:

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

8. Supported ISO15693 Host commands

8.1. ☞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.

8.1.1. Infineon (my-d)

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 "3.5. ☞ CFG4: Transponder Parameters"**

** **The Custom Specific Commands Read [0x10], Write [0x30] and the Write Byte [0x90] will be used automatically by the Reader.**

8.1.2. Philips (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 RW-OPTION parameter in "CFG8 General" is set to "00: automatically set" (3.5. ☞ CFG4: Transponder Parameters).**

8.1.3. STMicroelectronics (LRI512)

IC manufacturer identifier: 0x02

memory organization: 16 x 4 Byte = 512Bit

Number of blocks	16 (user area: 0...15)
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	√	(√)	√	√	In non addressed mode DB-N must be 1
0x24	Write Multiple Blocks	√	√	√	√	DB-Size = 4, WR-OPTION = 0 *
0x25	Select	√	-	√	-	
0x26	Reset to Ready	√	√	√	√	
0x27	Write AFI	√	√	√	√	WR-OPTION = 0 *
0x28	Lock AFI	√	√	√	√	WR-OPTION = 0 *
0x29	Write DSFID		-	-	-	
0x2A	Lock DSFID		-	-	-	
0x2B	Get System Information		-	-	-	
0x2C	Get Multiple Block Security Status		-	-	-	

* **The WR-OPTION will be set automatically by the FEIG Readers if the RW-OPTION parameter in "CFG8 General" is set to "00: automatically set" (3.5. ☞ CFG4: Transponder Parameters).**

8.1.4. Texas Instruments (Tag-it HFI)

IC manufacturer identifier: 0x07

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

Number of blocks	64 (user area: 0...63)
Block size	4 byte

Command Code	Function		Mode			Comment
			non addressed	addressed	select	
0x01	Inventory	√	-	-	-	
0x02	Stay Quiet	√	-	√	-	
0x22	Lock Multiple Blocks	√	√	√	√	WR-OPTION = 1 **
0x23	Read Multiple Blocks	√	√	√	√	DB-Size = 4
0x24	Write Multiple Blocks	√	√	√	√	DB-Size = 4 WR-OPTION = 1 **
0x25	Select	√	-	√	-	
0x26	Reset to Ready	√	√	√	√	
0x27	Write AFI	√	√	√	√	WR-OPTION = 1 **
0x28	Lock AFI	√	√	√	√	WR-OPTION = 1 **
0x29	Write DSFID	√	√	√	√	WR-OPTION = 1 **
0x2A	Lock DSFID	√	√	√	√	WR-OPTION = 1 **
0x2B	Get System Information	√	√	√	√	
0x2C	Get Multiple Block Security Status	√	√	√	√	

** **The WR-OPTION will be set automatically by the FEIG Readers if the WR-OPTION parameter in "CFG8 General" is set to "00: automatically set" (3.5. ☞ 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.***

8.2. ☞Supported ISO15693 Host commands for I-CODE1 Transponders

The commands codes listed in the following table support the various Transponder commands and operations that are available for I-CODE1 Transponders.

memory organization: 16 x 4 Byte = 512 Bit

Number of blocks	16 (user area: 0...11)
Block size	4 byte

Command Code	Function		Mode			Comment
			non addressed	addressed	select	
0x01	Inventory	√	-	-	-	
0x02	Stay Quiet	-	-	-	-	
0x22	Lock Multiple Blocks	-	-	-	-	
0x23	Read Multiple Blocks	√	√	√	-	
0x24	Write Multiple Blocks	√	-	√	-	
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	-	-	-	-	
0xA0	Read Config Block	√	-	√	-	
0xA1	Write Config Block	√	-	√	-	

8.3. ☞Supported ISO15693 Host commands for Tag-it HF Transponders

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

memory organization: 8 x 4 Byte = 256 Bit

Number of blocks	8 (user area: 0...7)
Block size	4 byte

Command Code	Function		Mode			Comment
			non addressed	addressed	select	
0x01	Inventory	√	-	-	-	
0x02	Stay Quiet	-	-	-	-	
0x22	Lock Multiple Blocks	√	√	√	-	
0x23	Read Multiple Blocks	√	√	√	-	
0x24	Write Multiple Blocks	√	√	√	-	
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	-	-	-	-	
0xA0	Read Config Block	-	-	-	-	
0xA1	Write Config Block	-	-	-	-	

ANNEX

ANNEX A: Codes of Transponder Types

Value	Transponder type
0x00	Philips I-CODE1
0x01	Texas Instruments Tag-it HF
0x03	ISO15693 Tags

The Information will be send by performing the 6.1.1. [0x01] Inventory command.

ANNEX B: Time Behavior of the Asynchronous Interface

The execution times of the asynchronous interface depends on:

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

	min.	typ.		max.	Unit
		I-CODE1	Tag-it HF		
EE-Parameter change 1 Block (16 Bytes) all (8) Blocks	5	22,5 180		300 600	ms ms
7.1. ☞ [0x1B] Reset QUIET Bit (only I-CODE1 Transponders)	5	5,1	-	300	ms
5.5. ☞ [0x69] RF Reset		5,1			ms
6.1. [0xB0] Host commands for ISO15693 Mandatory and Optional Commands	5	[1]		[2]	ms
7.2. [0xB1] Host commands for ISO15693 Custom and Proprietary Commands	5	[1]		[2]	ms
7.3. [0xBF] ISO15693 Transparent Command	5	[1]		[2]	ms

[1] *see ANNEX C: Time Behavior of ISO15693 Host Commands for details*
[2] *as configured in 3.2. ☞ CFG1: Interface TR-RESPONSE-TIME*

ANNEX C: Time Behavior of ISO15693 Host Commands

The execution times for ISO15693 Host Commands depends on:

- Amount of Transponders in the antenna field (duration of the 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 present local electromagnetic interferences.

☞ Time Behavior for I-CODE 1 and Tag-it HF Transponders (only execution time)

All times apply to the following parameters: ISO15693 MODE = 0x0B (see 3.5. ☞ CFG4: Transponder Parameters) and 3.6. CFG5: Anticollision.

- only the used Transponder driver active
- ONT = Only new Transponder will be send to the host

	typ.		unit
	I-CODE1	Tag-it HF	
Inventory with 1 Transponder: 1 timeslot 16 timeslots	- 15 123	62 - -	ms ms ms
Read Multiple Blocks: 1 Block, non addressed 1 Block, addressed 4 Blocks, non addressed 4 Blocks, addressed	**see table below**	 11,5 17,5 42 65	 ms ms ms ms
Write Multiple Blocks (1 Block, non addressed): (4 Blocks, non addressed):	 - -	 26,5 103	 ms ms
Write Multiple Blocks (1 Block, addressed): 1 timeslot 16 timeslots	 - 25 153	 32 - -	 ms ms ms
Write Multiple Blocks (4 Blocks, addressed): 1 timeslot 16 timeslots	 - 65 435	124 - - -	 ms ms ms

Read Multiple Blocks (I-CODE1 Transponders)

No. Blocks	Timeslots			
	1		16	
	non addressed	addressed	non addressed	addressed
1 (4 Bytes)	6,5	13,5	38,5	95
4 (16 Bytes)	11	17,5	97	153

☞ Time Behavior for [0x01] Inventory and ISO15693 Transponders

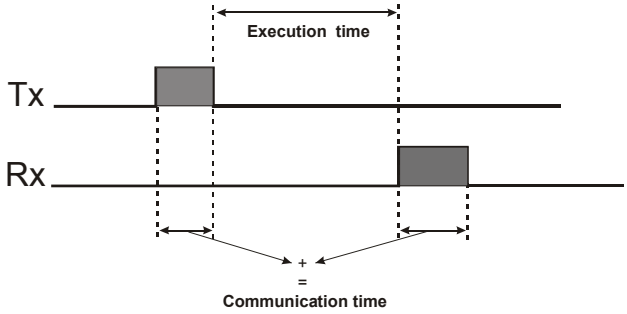
All times apply to the following parameters: ISO15693 MODE = 0x0B (see 3.5. ☞ CFG4: Transponder Parameters) and 3.6. CFG5: Anticollision.

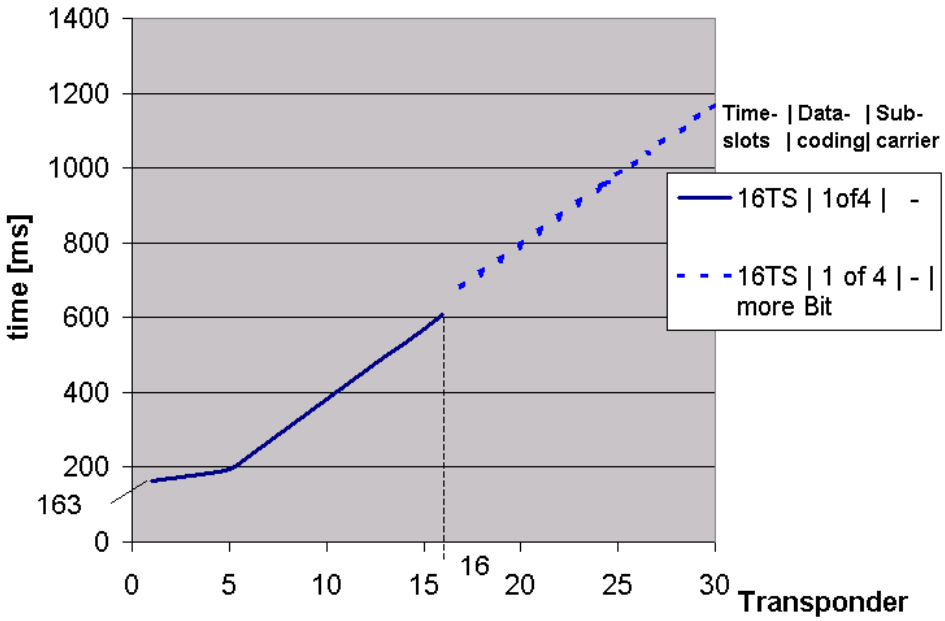
- AFI disabled
- 16 timeslot
- only ISO15693 Transponder driver active
- ONT = Only new Transponder will be send to the host

The modulation and the subcarrier have a hardly measurable influence of the reaction time.

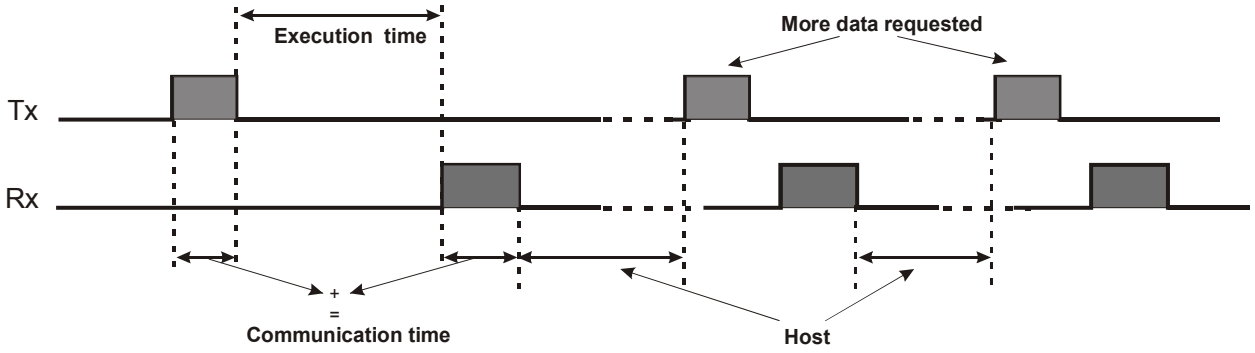
The following diagrams shows the average value of timing behavior, dependent on the number of Transponder. For certain UID's the real timing can by higher or lower as show below.

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 determine by the anticollision so you can 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 amount of Transponders exceed 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

☞ Time Behavior for read functions

Read	Infineon my-d					
	execution time (ms)				Communication time at 38,4 kBaud (ms)	
	without security-block		with security-block			
	addressed	selected	addressed	selected	addressed	selected
1 block 8Byte	13,5	10,1	13,5	10,1	9,8	7,5
4 block 32Byte	49	35,5	49	35,5	17,5	15,2
16 block 128 Byte	188	138	188	138	48,9	46,6

Read	Philips i-code SLI					
	execution time (ms)				Communication time at 38,4 kBaud (ms)	
	without security-block		with security-block			
	addressed	selected	addressed	selected	addressed	selected
1 block 4Byte	10,8	7,4	11,2	7,7	8,6	6,2
2 block 8Byte	12,7	9,2	13,3	9,8	10,1	7,8
8 block 32 Byte	21,6	18,2	24,1	20,7	18,7	16,4
(28 block) 112 Byte	51,5	48,5	60	56,5	47,2	44,9

Read	Texas Instruments Tag-it HFI					
	execution time (ms)				Communication time at 38,4 kBaud (ms)	
	without security-block		with security-block			
	addressed	selected	addressed	selected	addressed	selected
1 block 4Byte	10,8	7,4	11,2	7,7	8,6	6,2
2 block 8Byte	12,7	9,2	13,3	9,8	10,1	7,8
8 block 32 Byte	21,6	18,2	24,1	20,7	18,7	16,4
32 block 128 Byte	57,8	54,3	67,5	64	53	50,7

Read	STMicroelectronics (LRI512)					
	execution time (ms)				Communication time at 38,4 kBaud (ms)	
	without security-block		with security-block			
	addressed	selected	addressed	selected	addressed	selected
1 block 4Byte	10,8	7,4	11,2	7,7	8,6	6,2
2 block 8Byte	20,1	13,5	20,6	14	10,1	7,8
8 block 32 Byte	74,6	49,5	77,2	52	18,6	16,3
(16 block) 64 Byte	147,4	97,5	152,4	102,6	29,9	27,6

☞ *Time Behavior for write functions*

Write	Infineon my-d							
	WR-Option = 0							
	execution time (ms)				Communication time at 38,4 kBaud (ms)			
	write Data Block		**lock Data Block**		**write Data Block**		**lock Data Block**	
	addressed	selected	addressed	selected	addressed	selected	addressed	selected
1 block 8Byte	17,5	14	15	11,5	9,2	6,8	6,7	4,4
4 block 32Byte	65	51,5	54	41	16	13,8	6,7	4,4
16 block 128 Byte	251	202	210	161	43,4	40,7	6,7	4,4

Write AFI	13	9,5		6,1	4	
Lock AFI	12,5	9		6	3,8	
Write DSFID	-	-		-	-	
Lock DSFID	-	-		-	-	

Write	I-code SLI							
	WR-Option = 0							
	execution time (ms)				Communication time at 38,4 kBaud (ms)			
	write Data Block		**lock Data Block**		**write Data Block**		**lock Data Block**	
	addressed	selected	addressed	selected	addressed	selected	addressed	selected
1 block 4Byte	14,5	11,5	11	7,5	8	5,7	6,7	4,4
2 block 8Byte	28	21,5	20	13,5	9,2	6,7	6,7	4,4
8 block 32 Byte	106,5	81,5	58,5		14,2	13,7	6,7	4,4
(28 block) 112 Byte	368	281			39	35,6	6,7	4,4

Write AFI	12,5	10		6,3	4	
Lock AFI	10,5	7		6	3,7	
Write DSFID	12,5	10		6,3	4	
Lock DSFID	10,5	7		6	3,7	

Write	Texas Instruments Tag-it HFI							
	WR-Option = 1							
	execution time (ms)				Communication time at 38,4 kBaud (ms)			
	write Data Block		**lock Data Block**		**write Data Block**		**lock Data Block**	
	addressed	selected	addressed	selected	addressed	selected	addressed	selected
1 block 4Byte	21,5	18	19,5	16,5	8	5,8	6,7	4,4
2 block 8Byte	23,5	20	37,5	30,5	9,1	6,9	6,7	4,4
8 block 32 Byte	89	76	93	77,5	16	13,6	6,7	4,4
32 block 128 Byte	350	299			43,3	41,3	6,7	4,4

Write AFI	20	16		6,3	4,1	
Lock AFI	19	15,5		7	3,7	
Write DSFID	20	16		6,3	4,1	
Lock DSFID	19	15,5		7	3,7	

Write	STMicroelectronics (LRI512)							
	WR-Option = 0							
	execution time (ms)				Communication time at 38,4 kBaud (ms)			
	write Data Block		**lock Data Block**		**write Data Block**		**lock Data Block**	
	addressed	selected	addressed	selected	addressed	selected	addressed	selected
1 block 4Byte	39	32,5			8	5,8		
2 block 8Byte	76	63			9,1	6,9		
8 block 32 Byte	298	249			16,1	13,5		
(16 block) 64 Byte	594	494			25,1	23,1		

Write AFI	-	-		-	-	
Lock AFI	-	-		-	-	
Write DSFID	-	-		-	-	
Lock DSFID	-	-		-	-	

☞ ANNEX D: Index of Status Bytes

Hex-value	General
0x00	**OK:** • Data / parameters have been read or stored failure-free • 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 position. • 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 at received data.
0x03	**Write-Error:** Negative reasonableness 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.

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 to 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.

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

ANNEX E: Index of Control Bytes

ANNEX F: Index of Configuration Parameters

[1] *WO = write only access; R/W = read and write access; '-' = no access*

ANNEX G: Memory Model I-CODE1 Transponders

The memory is subdivided into areas with an access size of 4 bytes each.

I-CODE1 address	I-Scan address	contents	description	comment
0...1	-	UID	Serial-No (8 Bytes)	read-only
2	C0	Config	Write Access Conditions	read/write
3	C1		Special Function (EAS, QUIET-Bit)	read-only configurable
4	C2		Family Code / Application ID	
5	D0	User	User-Memory	read/write
6	D1			read only configurable
7	D2			
8	D3			
9	D4			
10	D5			
11	D6			
12	D7			
13	D8			
14	D9			
15	D10			

Note:
During the writing of data on a Transponder, it must be ensured that the Transponder stays completely in the antenna field for the whole time.

S-No.:

This block contains the unique read only 64 bit UID of the Transponder.

Bit	Byte	Function
0-7	0	MSB UID
8-15	1	
16-23	2	
24-31	3	
32-39	4	
40-47	5	
48-55	6	
56-63	7	LSB UID

Config Block 0:

By this config block protective functions of the Transponder can be activated.

The bits can be set only to 0 and never be reversed to 1. If block C0 is set into write protected state, no further protective functions can be activated (hardware write protected state).

Bit	Byte	Function	Operation	
			Block I-Scan	Block I-CODE1
0	0	”1” = r/w, ”0” = ro	D0	5
1		"1" = r/w, ”0” = ro	D1	6
2		"1" = r/w, ”0” = ro	D2	7
3		"1" = r/w, ”0” = ro	D3	8
4		”1” = r/w, ”0” = ro	D4	9
5		"1" = r/w, ”0” = ro	D5	10
6		"1" = r/w, ”0” = ro	D6	11
7		"1" = r/w, ”0” = ro	D7	12
8	1	"1" = r/w, ”0” = ro	D8	13
9		"1" = r/w, ”0” = ro	D9	14
10		”1” = r/w, ”0” = ro	D10	15
11		-	-	-
12		-	-	-
13		-	-	-
14		-	-	-
15		-	-	-
16-23	2	-	-	-
24	3	-	-	-
25		-	-	-
26		-	-	-
27		”1” = r/w, ”0” = ro	C2	4
28		”1” = r/w, ”0” = ro	C1	3
29		"1" = r/w, ”0” = ro	C0	2
30		”0” = ro	S-NO	1
31		”0” = ro	S-NO	0

Config Block 1:

Special functions (EAS / QUIET-Mode) can be enabled by config block 1.

If EAS (Electronic Article Surveillance) mode is enabled, all Transponders will answer at an EAS command.

If QUIET mode is enabled, the Transponder is permanently disabled. It can be activated with a „Reset QUIET bit“ command. The I-CODE1 Transponder does not response to any command with exception of the EAS command.

Bit	Byte	Function
0	0	"1”: EAS enable "0”: EAS disable
1		"1": QUIET-Mode enable "0": QUIET-Mode disable
2-7		-
8-15	1	-
16-23	2	-
24-31	3	-

Bits 2-31 are reserved for future use and will be set to „0“

Config Block 2:

By config block 2 the family code and the application ID can be defined.

This feature offers the possibility to create „Transponder families“ and are only enable if they are unequal to zero (see chapter).

Bit	Byte	Function
0-7	0	Family Code
8-15	1	Application ID
16-23	2	-
24-31	3	-

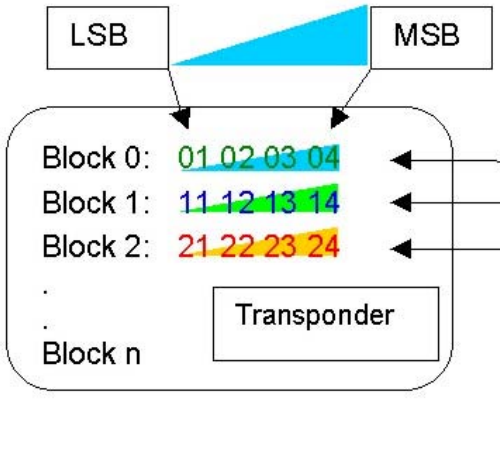
Bits 16 - 31 can be used for user data without restriction.

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 = 4Byte)

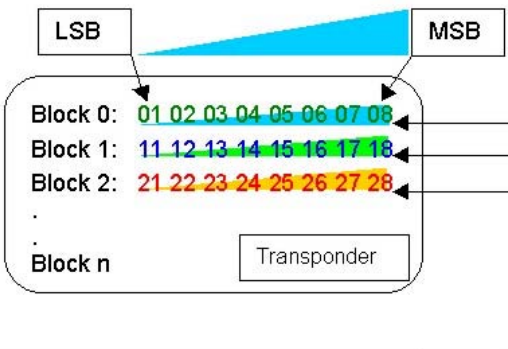
ISO Host Protocol: Write multiple block: *transmit*	**DB-N=3**, addressed	CRC16
>>1E FF B0 24 01 E0 07 00 00 01 47 67 7E 00 03 04	04 03 02 01 14 13 12 11 24 23 22 21	7C 34



ISO Host Protocol: Read multiple block: *receive*	**DB-N=3**, addressed	CRC16
<<17 00 B0 00 03 04 00	04 03 02 01 00 14 13 12 11 00 24 23 22 21	B4 5B

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

ISO Host Protocol: Write multiple block: *transmit*	**DB-N=3**, addressed	CRC16
2A FF B0 24 01 60 05 00 00 02 11 25 04 03 03 08	08 07 06 05 04 03 02 01 18 17 16 15 14 13 12 11 28 27 26 25 24 23 22 21	E6 25



ISO Host Protocol: Read multiple block: *receive*	**DB-N=3** addressed	CRC16
23 00 B0 00 03 08 00	08 07 06 05 04 03 02 01 00 18 17 16 15 14 13 12 11 00 28 27 26 25 24 23 22 21	99 65