TAGSYS RFID™
e-connecting goods

Medio P101

Firmware Command Set

Revision 1.1

May 2006

Publishing Information

Disclaimer and Limitation of Liability

All information herein is either public information or is the property of and owned solely by TAGSYS who shall have and keep the sole right to file patent applications or any other kind of intellectual property protection in connection with such information.

Nothing herein shall be construed as implying or granting to you any rights, by license, grant or otherwise, under any intellectual and/or industrial property rights of or concerning any of TAGSYS' information.

This document can be used for informational, non-commercial, internal and personal use only provided that:

- the copyright notice below, the confidentiality and proprietary legend and this full warning notice appear in all copies.
- this document shall not be posted on any network computer or broadcast in any media and no modification of any part of this document shall be made.

Use for any other purpose is expressly prohibited and may result in severe civil and criminal liabilities.

The information contained in this document is provided "AS IS" without any warranty of any kind. Unless otherwise expressly agreed in writing, TAGSYS makes no warranty as to the value or accuracy of information contained herein. The document could include technical inaccuracies or typographical errors. Changes are periodically added to the information herein. Furthermore, TAGSYS reserves the right to make any change or improvement in the specifications data, information, and the like described herein, at any time.

Therefore TAGSYS assumes no liability and is not responsible for customer applications or product or software, which include TAGSYS products.

TAGSYS HEREBY DISCLAIMS ALL WARRANTIES AND CONDITIONS WITH REGARD TO THE INFORMATION CONTAINED HEREIN, INCLUDING ALL IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, TITLE AND NON-INFRINGEMENT. IN NO EVENT SHALL TAGSYS BE LIABLE, WHETHER IN CONTRACT, TORT OR OTHERWISE, FOR ANY INDIRECT, SPECIAL OR CONSEQUENTIAL DAMAGES OR ANY DAMAGES WHATSOEVER INCLUDING BUT NOT LIMITED TO DAMAGES RESULTING FROM LOSS OF USE, DATA, PROFITS, REVENUES, OR CUSTOMERS, ARISING OUT OF OR IN CONNECTION WITH THE USE OR PERFORMANCE OF INFORMATION CONTAINED IN THIS DOCUMENT.

TAGSYS does not and shall not warrant that this product/system/equipment will be resistant to all possible attacks, and shall not incur, and disclaims, any liability in this respect. Even if each product is compliant with current security standards in force on the date of their design, security mechanisms' resistance necessarily evolves according to the state-of-the-art in security and notably under the emergence of new attacks. Under no circumstances shall TAGSYS be held liable for any third party actions, and in particular in case of any successful attack against systems or equipment incorporating TAGSYS products.

TAGSYS disclaims any liability with respect to security for direct, indirect, incidental or consequential damages that result from any use of its products. It is further stressed that independent testing and verification by the person using the product is particularly encouraged, especially in any application in which defective, incorrect, or insecure functioning could result in damage to persons or property, denial of service, or loss of privacy.

© 2000-2006 TAGSYS. All rights reserved.

Microsoft, Visual C++, Windows, and Windows NT are either registered trademarks or trademarks of Microsoft Corporation in the U.S.A. and/or other countries.

I-Code is a registered trademark of Philips.

Tag-It is a registered trademark of Texas Instruments.

Printed in France.

TAGSYS – 180 Chemin de St Lambert, 13821 LA PENNE SUR HUVEAUNE, France.

Tel: +33 (0)4.91.27.57.00 / Fax: +33 (0)4.91.27.57.01

Document Reference: 12038A1

Read This First

Welcome to the TAGSYS range of products operating at the 13.56 MHz frequency. This range of products is used to implement high-quality RFID systems for demanding applications.

Audience

This document requires familiarity with RFID technology. It is intended for people in charge of installing and using the product.

Conventions

Symbol	Meaning
	**CAUTION**: A note that advises users that a specific action could result in the loss of data or damage the hardware. **WARNING**: A note that advises users that a specific action may result in physical harm.
	A note that provides additional information that helps the user perform a task or obtain the best performance from the product.

Abbreviations and Acronyms

AFI	Application Family Identifier
AON	All Or None
API	Application Programming Interface
ASK	Amplitude Shift Keying
CPU	Central Processing Unit
CRC	Cyclic Redundancy Check
DLL	Dynamic-Link Library
DPU	Digital Processing Unit
DSFID	Data Storage Format Identifier
DSP	Digital Signal Processor
EAS	Electronic Article Surveillance
ETX	End of Text
HPI	Host Port Interface
I/O	Input/Output
IFD	Interface Device
ILS	Integrated Library System
LED	Light Emitting Diode
LSB	Least Significant Bit

MSB	Most Significant Bit
OS	Operating System
PC	Personal Computer
PCB	Printed Circuit Board
RAM	Random Access Memory
RF	Radio Frequency
RFID	Radio Frequency IDentification
RFU	Reserved for Future Use
RPU	Radio Processing Unit
RTC	Real Time Clock
RTF	Reader Talks First
SAM	Security Access Module
STX	Start of Text
TTF	Tag Talks First
TTL	Transistor-Transistor Logic
TTY	TeleTYpe
UID	Unique Identifier

Glossary

Anti-Collision Tag capability making it readable while other tags are present in the RF field.

Antenna An aerial that receives and/or transmits radio frequency signals. Aerials are manufactured in a variety of forms, shapes and sizes.

Baud A unit of measure of data transmission speed representing the number of signal changes per second.

BNC Connector Cylindrical metal connector with a copper core that is located at the tip of a coaxial cable, and is used to connect cables together. It attaches by pushing and twisting the outer cylinder on to two locking pins.

Coupler See Reader.

Data Storage Format Identifier Identifies the structure of the data stored in the tag.

Digital Signal Processor This part of the Radio Processing Unit (RPU) performs real-time tag decoding and manages the Medio L200 configuration.

Dynamic-Link Library Executable routines that are stored as separate files with DLL extensions and executed only when needed by the program.

Host Port Interface Interface used to access the DSP memory.

IEC Connector Three-pin connector used on sockets that carry mains electricity to the computer. All PCs use a male IEC connector and mains lead with a female IEC connector.

Interrogation Pulse A signal transmitted by the coupler to activate the tag's transponder.

Monitoring Port Parallel Port granting access to the HPI. It communicates directly with the Radio Processing Unit

Multi-Read See Anti-Collision

Nibble Half a byte (4 bits)

Packaged Reader A reader in its casing.

Phase Shift Difference of phase between the 13.56 MHz fields emitted by two antennas. This feature is dedicated to rotating field applications and three-dimensional volume tag detection.

Protocol A set of rules governing a particular function, such as the flow of data/information in a communication system (communication between a tag and a reader or a reader and a PC or host computer).

Radio Frequency Identification System (RFID) An automatic identification and data capture system comprising one or more readers and one or more tags in which data transfer is achieved by means of suitable modulated inductive or radiating electromagnetic carriers.

Radio Processing Unit This unit controls the main features of the Medio L200, such as the RF channels, the multiplexer and the tag decoding.

Reader Electronic system for the communication between tags and host computers.

Reader Talks First Chip protocol for exchanges between the reader and the chip, whereby the chip waits for a command from the reader to which it responds.

RS-232 Electronic Industries Association (EIA) standard for serial interfaces between computers and peripherals, which defines the function, the electrical characteristics and the timing of signals.

RS-485 Electronic Industries Association (EIA) standard for multipoint, differential data transmission. It allows multiple nodes to communicate bi-directionally over 1 or 2 twisted pairs.

Smart Label See Tag.

Tag Small, flexible tag from the 13.56 MHz TAGSYS product line. A tag is made of a chip connected to an etched antenna.

Tag Talks First Chip protocol for exchanges between the reader and the chip, whereby the tag sends information continuously, without waiting for a specific command from the reader.

Transceiver A combined transmitter and receiver.

Transponder A combined receiver/transmitter that automatically transmits a signal when a ‘trigger’ is received by it. The trigger is often a pulse, called an interrogation pulse.

If you need assistance

Please contact your nearest TAGSYS sales representative or the TAGSYS welcome desk at:

Telephone: +33 (0) 4 91 27 57 00
Fax: +33 (0) 4 91 27 57 01
E-Mail: info@tagsysrfid.com
Website: http://www.tagsysrfid.com

Contact for Comments

We welcome your feedback to help us provide high quality documentation.

For technical comments, please contact our welcome desk:

Telephone: +33 (0) 4 91 27 57 00
Fax: +33 (0) 4 91 27 57 01
E-Mail: info@tagsysrfid.com

Please remember to quote the Document Reference Number 12038A1, your job title and your company.

Quality Issues

TAGSYS implements stringent quality controls at all stages of its manufacturing process. However, should you find a defect with this product, please notify your TAGSYS Quality Service representative using the dedicated Product Return Form.

Telephone: +33 (0) 4 91 27 57 36
Fax: +33 (0) 4 91 27 57 02

Table of Contents

Publishing Information 2
Disclaimer and Limitation of Liability 2
Read This First 3
Audience 3
Conventions 3
Abbreviations and Acronyms 3
Glossary 4
If you need assistance 6
Contact for Comments 6
Quality Issues 6
1 STXE-2 Protocol 9
1.1 Protocol Transmission Modes 9
1.1.1 Fast Communication Mode 9
1.2 Host-to-Reader Format 10
1.3 Reader-to-Host Formats 11
1.4 Commands and responses 12
1.5 Fixed and Variable Length Response Frame Decoding 12
1.6 Cyclical Redundancy Check (CRC16) 12
1.7 Baud Rate 13
2 Command Set 14
2.1 General Reader Commands 14
2.2 TAGSYS C210 Commands 30
2.2.1 C210 Memory Organization 30
2.2.2 List of C210 - Specific Commands 30
2.3 TAGSYS C220 Commands 32
2.3.1 C220 Memory Organization 32
2.3.2 List of C220-specific Commands 33
2.4 TAGSYS C240 Commands 38
2.4.1 C240 Memory Organization 38
2.4.2 List of C240 - Specific Commands 40
2.5 TAGSYS C270 (Philips I-Code™) Commands 44
2.5.1 C270 Memory Organization 44
2.5.2 Special Functions 45
2.5.3 List of C270 - Specific Commands 45
2.6 ISO-15693 Compatible Commands 58
2.6.1 Memory Organization 58
2.6.2 General Parameters 58
2.6.3 List of ISO 15693-specific Commands 58
2.7 TAGSYS C320 Commands 65
2.7.1 C320 Memory Organization 65

2.7.2 C320 Operating Mode 66
2.7.3 List of C320-Specific Commands 66
2.8 I-CODE EPC/I-CODE UID Commands 72
2.8.1 I-CODE EPC/I-CODE UID Memory Organization 72
2.8.2 I-CODE EPC/I-CODE UID Operating Mode 74
2.8.3 List of I-CODE EPC/I-CODE UID-Specific Commands 74
3 List of Commands 81
3.1 List of General Reader Setting Commands 81
3.2 List of C210 - Specific Commands 81
3.3 List of C220 - Specific Commands 81
3.4 List of C240 - Specific Commands 81
3.5 List of C270 (Philips I. Code) – Specific Commands 81
3.6 List of ISO15693 – Specific Commands 81
3.7 List of C320 - Specific Commands 82
3.8 List of I-CODE EPC/I-CODE UID - Specific Commands 82
4 Error Messages 83
4.1 Error Messages 83
5 STXE-2 CRC Calculation Routine 84
5.1 CRC Calculation Routine 84

1 STXE-2 Protocol

The STX Extended Version 2 (STXE-2) protocol is used by TAGSYS for the MEDIO P101 reader and can be used to communicate with other TAGSYS Readers (Medio P013, L-P101, TR-P101, Medio S00x, Medio S01x and Lx00 platforms).

The STXE-2 is a simplified protocol with a reduced frame format (with respect to the configuration of the start of transmission byte).

The advantages of the STXE-2 protocol are the followings :

- several readers can be used in a network
- a Fast communication mode

1.1 Protocol Transmission Modes

The STXE-2 protocol is selected depending on the:

- rapidity of the communication,
- number of TAGSYS RFID Tag readers and their configuration.

1.1.1 Fast Communication Mode

The transmission rate between the reader and the host system can be increased by disabling the Cyclical Redundancy Check (CRC16) function. This Fast communication mode is selected in the HDR or AHDR fields.



It is important to note that **data is not secure** when using Fast communication mode. Do not use not secured communications in a network configuration or when using long communication cables.



When the CRC16 function is disabled, **data is not secure**.

Table 1: Protocol Transmission Modes

HDR/AHDR Value	ADD Field	CRC16 Field	Comments
0x02	Present	Present	Standard mode
0x06	Present	Not Included	Not secured
0x0E	Not Included	Present	Not addressed
0x1E	Not Included	Not Included	Fast mode



To comply with the other Px Family readers, the addressed field can be present in the command but the addressed field is not used by the Medio P101 and has no functionality.



As the reader communicates thanks to a securitized USB protocol or a securitized WIFI/Ethernet module, the CRC16 (mode 0x02 and 0x0E) is not required. Mode 0x1E is recommended with Medio P101 reader.

1.2 Host-to-Reader Format

Table 2 shows the data frame format for host commands.

Table 2: Host-to-Reader Command Frame

Field Description	Header	Reader Address	Command	Data Length	Encapsulated Data			Cyclical Redundancy Check (16 bits)	
Name	HDR	ADD	CMD	CLEN	$DATA_1$	...	$DATA_{CLEN}$	CRC16 (MSB)	CRC16 (LSB)
Field Length	1 byte	1 byte	1 byte	1 byte	CLEN bytes			1 byte	1 byte

Table 3: Command Field Descriptions

Field	Description
HDR	Defines the Protocol Transmission Mode.
ADD	Set to 0x00
CMD	Command sent by the host to the reader.
CLEN	Length of the data field (0 to 255). The MEDIO P101 limits this value to 32. It stops receiving more characters and cancels the command frame.
$DATA_N$	Data exchanged between the host and the reader. If ALEN (or CLEN) is 0, these bytes are absent.
CRC16	A 16-bit Cyclical Redundancy Check that secures the transmissions between the host and the reader. May be absent depending on the Protocol Transmission mode (HDR value).

The host first specifies the protocol transmission mode in the HDR field. The HDR value defines the format of the frames sent in the current transmission, as well as in the response transmission.

The command to be performed by the reader is sent by the host in the CMD field.

The command needs a defined range of data. The CLEN field defines the size of the command data, which is transmitted in the DATA field.

A 16-bit cyclical redundancy check (CRC16) is used to verify the validity of the transmission. For more information, refer to Section 1.6, “Cyclical Redundancy Check(CRC16)”.

1.3 Reader-to-Host Formats

The following tables show the data frame format for reader response. Two formats are possible :

Table 4: Reader-to-Host Response Frame (Fixed Length)

Field Description	Header	Reader Address	Answer Code	Data Length	Encapsulated Data			Cyclical Redundancy Check (16 bits)	
Name	AHDR	ADD	ANS	ALEN	$DATA_1$	...	$DATA_{ALEN}$	CRC16 (MSB)	CRC16 (LSB)
Field Length	1 byte	1 byte	1 byte	1 byte	ALEN bytes			1 byte	1 byte

Table 5: Reader-to-Host Response Frame (Variable Length)

Field Description	Header	Reader Address	Answer Code	Block Marker	Encapsulated Blocks		Block Marker	Cyclical Redundancy Check (16 bits)	
Name	AHDR	ADD	ANS	0xFF	$BLOCK_1$	...	0xFF	CRC16 (MSB)	CRC16 (LSB)
Field Length	1 byte	1 byte	1 byte	1 byte	Variable		1 byte	2 bytes	

Table 6: Response Field Descriptions

Field	Description
AHDR	Confirms the Protocol Transmission Mode (HDR value).
ADD	Set to 0x00
ANS	Code returned by the reader to check whether the command was successfully performed or not.
ALEN	Length of the data field (0 to 254). Value 255 (0xFF) is reserved for variable length response recognition.
$DATA_N$	Data exchanged between the host and the reader. If ALEN (or CLEN) is 0, these bytes are absent.
$BLOCK_N$	Block of data exchanged from the reader to the host in case of a Variable Length Response. A $BLOCK_N$ structure is a sequence of bytes defined as shown in the table below. Where, $BLEN_N$ is the value corresponding to the number of bytes of the Block Encapsulated Data Field. It ranges from 1 to 254 (0x01 to 0xFE).
CRC16	A 16-bit Cyclical Redundancy Check that secures the transmissions between the host and the reader. May be absent depending on the Protocol Transmission mode (AHDR value).

Table 7: BLOCK structure for Variable Length Response

Block Field Description	Block Data Length	Block Encapsulated Data		
Name	$BLEN_N$	$DATA_{N,1}$	...	$DATA_{N,BLENN}$
Field Length	1 byte	BLEN bytes		

1.4 Commands and responses

If the command was successfully performed by the reader, the reader returns the command code (CMD value) in the ANS field. If the reader detects an error, the corresponding error code is return in this field. For more information, refer to Section 4, "Error Messages".



Command codes range from 0x00 to 0x7F.
Error codes range from 0x80 to 0xFF.

Depending on the command requested by the host, the reader decides whether a Fixed or Variable Length Response is returned.

Each command needs a defined range of data. The CLEN field defines the size of the command data, which is transmitted in the DATA field.

A 16-bit cyclical redundancy check (CRC16) is used to verify the validity of the transmission. For more information, refer to Section 1.6, “Cyclical Redundancy Check(CRC16)”.

1.5 Fixed and Variable Length Response Frame Decoding

After receiving the ANS field, the next character can be :

1. ALEN (0 to 254) field. The frame is in Fixed Length Format. In this case, ALEN characters should be received (plus the CRC16 field according to the protocol mode).
2. A marker (255 or 0xFF). The frame is in Variable Length Format. In this case, the next character can be:
   - BLEN (1 to 254) field corresponding to the Encapsulated DATA of a BLOCK. In this case, BLEN characters should be received before the next BLOCK field
   - A marker (255 or 0xFF). In this case, the reader will send no more BLOCK fields. The transmission will end with the transmission of the CRC16 field if requested.

1.6 Cyclical Redundancy Check (CRC16)

The CRC-16 value is calculated using the following fields (if present) respectively:

1. For Host Command Frames:
   - CMD, CLEN, $DATA_1$, … , $DATA_{CLEN}$
2. For Reader Response Frame in Fixed Length Format:
   - ANS, ALEN, $DATA_1$, … , $DATA_{ALEN}$
3. For Reader Response Frame in Variable Length Format:
   - ANS, 0xFF, $BLEN_1$, $DATA_{1,1}$, … , $DATA_{1,BLEN1}$, $BLEN_2$, $DATA_{2,1}$, … , $DATA_{2,BLEN2}$, … , 0xFF

The CCITT Recommendation X.41 CRC-16, which is based on the generated polynomial $g(x) = x^{16} + x^{12} + x^5 + 1$, is used.

First, the 16-bit CRC-register is pre-set to 0000h. Then the first byte of the message, which starts right after STX, is loaded into the eight least significant bits of the CRC-16 register.

The full 16-bit contents are then shifted one bit to the right before being added to 0x8048, provided that the least significant bit is 1, or only shifted right (without calculation of a sum) if the least significant bit is 0.

This operation is repeated eight times before the next byte of the message is loaded.

For additional details, refer to Section 5, “STXE-2 CRC Calculation Routine”.

1.7 Baud Rate

The Baud Rate value is 115200 Bps.

2 Command Set

The Medio P101 is delivered with three different firmwares which can be downloaded into the reader:

- Library LF 12039
- Textile rental LF 12041
- I&L LF 12040

This Command set document contains all the supported commands.

Textile rental LF 12041 firmware is set by default.

The General Reader Commands are available on the three firmwares and each firmware is able to perform a chip dedicated command regarding the following table:

Firmware	Chips
Library	C220, C320, C370(ISO 15693)
Textile Rental	C210, C240, C270(Philips I Code), C370(ISO15693)
I&L	C270 (Philips I-CODE), C370 (ISO15693), I-CODE EPC/I-CODE UID

The STXE-2 compatible commands are used to communicate with TAGSYS read/write chips.

The command number is transmitted thanks to the STXE-2 CMD field. If the command is not standard, that is, if it is not referenced in the command set, the coupler returns error value 0xA0 in STXE-2 ANS field.

Each command needs a defined range of data, which are transmitted in the Data field. If the number of data does not match the command's requirements, the coupler returns error value 0xA4.

2.1 General Reader Commands

RF On / Reset RF 15
RF Off 16
Identify Reader 17
Monitor Power Supply 18
Reset 19
Get IO 20
Set IO 21
Detect Chip Type 22
Set Standalone Mode 24
Get Standalone Mode Settings 29

RF On / Reset RF	
Command Number	0x0C
Description	Turn on the RF amplifier or reset it
Data	None

Response

Data	None
Possible Error	None



If RF is on before sending this command, the RF field is reset

RF Off	
Command Number	0x0D
Description	Turns off the RF amplifier.
Data	None

Response

Data	None
Possible Error	None

Identify Reader	
Command Number	0x60
Description	Returns the firmware version and revision numbers and the product firmware reference.
Data	None

Response

Data	Parameter 1	2 bytes	Firmware Version and Revision Numbers
	Parameter 2	7 bytes	ASCII Firmware Reference “LFxxxxx” LF 12039 is returned if Library firmware is loaded in MEDIO P101 LF 12041 is returned if Textile Rental firmware is loaded in MEDIO P101 LF 12040 is returned if I&L firmware is loaded in MEDIO P101
Possible Error			None

Monitor Power Supply

Command Number	0x76
Description	Provide the power supply level
Data	None

Response

Data	Parameter 1	Range Value
Possible Error		None

Response parameter description

Range Value returns a value corresponding to the power supply level range.

Range Value	Power Supply Range	State of Charge
0x00	< 7.7V	Low
0x01	7.7V< < 8.0V	
0x02	8.0V< < 8.3V	
0x03	8.3V< < 8.5V	
0x04	8.5V< < 8.8V	
0x05	8.8V< < 9.0V	
0x06	9.0V< < 9.3V	
0x07	9.3V< < 9.6V	Medium
0x08	9.6V< < 9.9V	
0x09	9.9V < <10.1V	
0x0A	10.1V < <10.4V	
0x0B	10.4V < <10.7V	
0x0C	10.7V < <10.9V	High
0x0D	10.9V < <11.2V	
0x0E	11.2V < <11.5V	
0x0F	11.5V < <11.7V	
0x10	> 11.7V	



This command is useful especially with a battery pack.

Reset	
Command Number	0x06
Description	Reset the microcontroller
Data	None

Response

Data	None
Possible Error	None

Get IO	
Command Number	0x07
Description	Returns the current status of the input and the output.
Data	None

Response

Data	Parameter 1	1 byte	I/0 State
Possible Error			None

Response Parameter Description

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
I/O State Parameter 1							Input State	Output State

Output State bit gives the status of the output.

0 : Output is inactive.

1 : Output is activated

Input State bit gives the status of the input.

0 : A low level voltage or a shortcut is applied on the input

1 : A high level voltage or an opened circuit is applied on the input.

Set IO			
Command Number			0x07
Description			Sets the status of the only output.
Data	Parameter 1	1 byte	Output Setting



When the reader is in Standalone mode, the state of the output is controlled automatically.

Parameter Description

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Output Setting Parameter 1							Input State	Output State

Output State bit sets the status of the output.

0 : Output is inactive.

1 : Output is activated

Input State bit gives the status of the input.

0 : A low level voltage or a shortcut is applied on the input

1 : A high level voltage or an opened circuit is applied on the input.

Response

Data	None
Possible Error	None

Detect Chip Type			
Command Number			0x00
Description			Detect the type of any chip present in the RF field
Data	Parameter 1	1 byte	Detection Mode

Parameters Description

The reader scans the field with the following priority order :

Order	Library	Textile Rental	I&L
1	C210	C320	C370 (ISO15693)
2	C240	C370 (ISO15693)	I-CODE UID
3	C270 (Philips I-CODE)	C220	I-CODE EPC
4	C370 (ISO15693)		C270 (Philips I-CODE)

Depending on the parameter value, the reader can send back the ID of any chip detected in the field.



RF must be turned on. If not, error code 0x88 is returned

	Value	Read ID
Define Chip Type Settings Parameter 1	0x00	No
	0x01	Yes



The Define Chip Type command only works when a single chip is present in the field. If not, the reader chip setting is unchanged.

Response Description

Manual configuration				
Data			None	
Possible Errors			0x80	Unknown type of chip
Automatic configuration (without chip ID Reading)				
Data	Parameter 1	1 byte	0x07 C210 detected 0x08 C240 detected 0x0B C220 detected 0x0C C320 detected 0x0D C270 detected 0x0E ISO15693 detected 0x0F I-CODE UID 0x12 I-CODE EPC	
Possible Errors			0xC4	No chip found
			0x88	RF is turned off
Automatic configuration (with chip ID Reading)				
Data	Parameter 1	1 byte	0x07 C210 detected 0x08 C240 detected 0x0B C220 detected 0x0C C320 detected 0x0D C270 detected 0x0E ISO15693 detected 0x0F I-CODE UID 0x12 I-CODE EPC	
	Parameter 2		Chip ID (this depends on the type of chip)	
		8 bytes	ID C210	
		8 bytes	ID C240 : Block 0 Page 0	
		8 bytes	ID C270 (Philips I-CODE) Block 1 et Block 0	
		8 bytes	ISO15693 : UID (8 bytes)	
		12 bytes	I-CODE EPC: EPC user free memory (block 0-11)	
		5 bytes	I-CODE UID: UID content (block 14-18)	
		5 bytes	C220: Lockable memory	
		10 bytes	C320: EAS page (bytes) and first block (8 bytes)	
Possible Errors			0xC4	No chip found
			0x88	RF is turned off

Set Standalone Mode			
Command Number			0x0E
Description			Initialize Standalone Operating Mode
Data	Parameter 1	1 byte	Parameter to be set
	Parameter 2	16 bytes	Settings

Parameters Description

Parameter 1 refers to the standalone mode parameter to be set.

Parameter 1 Value	Standalone mode settings	Number of bytes in Parameter 2	Default Value
0x00	Standalone Mode General Settings	7	See Below
0x01	Header String	0 to 16	"TAGSYS-"
0x02	C210 Chip Description String	0 to 16	"C210-"
0x03	C240 Chip Description String	0 to 16	"C240-"
0x04	End of Message String	0 to 16	<CR/LF>
0x05	No Read Message String	0 to 16	"????????"
0x06	C220 Chip Description String	0 to 16	“C220-“
0x07	C320 Chip Description string	0 to 16	“C320-“
0x08	C270 (Philips I-CODE) Chip Description String	0 to 16	“C270-“
0x09	ISO15693 Chip Description String	0 to 16	“ISO15693-“
0x0A	UID Chip Description String	0 to 16	“UID-“
0x0D	EPC Chip Description String	0 to 16	“EPC-“



If Parameter 1 is not in this table, error 0x8A is sent back.

If parameter 1 is not *0x00*, parameter 2 is an ASCII string (16 character maximum, its length is defined by the number of data in parameter 2). If not, parameter 2 has 7 bytes which description is given as follows :

		Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Standalone Mode Settings Parameter 2	Communication Settings Byte 1	Standalone Mode At Power On					Baud Rate Setting (used with Get Stand-Alone Mode Command)		
	ASCII Message Settings Byte 2					End of Message String	Chip Description String	Header String	STX/ETX Character
	Tag Scan Settings Byte 3	UID	EPC	Scan for ISO15693	Scan for C270	Scan for C320	Scan for C220	Scan for C240	Scan for C210
	Reply Settings Byte 4	Fixed ID Length		Send Once	Trigger Capability On/Off	ID Length			End Trigger Reply
	Trigger Input Settings Byte 5							I/O1 Trigger Level	
	Trigger Led Settings Byte 6				I/O0 Trigger Led On/Off				I/O0 Trigger Led Value
	Read Led Settings Byte 7				I/O0 Read Led On/Off				I/O0 Read Led Value

Communication Settings

Standalone Mode At Power On bit define the operating mode of the reader (Normal Operating Mode if set to 0, Standalone Operating Mode when set to 1) at the next power on

Baud Rate Setting bits are ignored by the reader because its baud rate ca not be changed. Anyway, the value returned by the Get Stand Alone Command is 101b, meaning that the reader is set at 115200 Bps.

ASCII Message Settings

This byte describes the ASCII message sent by the reader for the Standalone Operating Mode. The global message could be :

	Start of Text	Header	Chip Description	ID	End of Message	End of Text
Example of a message after the reading of a C210 chip	<STX>	TAGSYS-	C210-	27A1000015EDFED7	<CR/LF>	<ETX>
Example of a message after the trigger ends without reading	<STX>	TAGSYS-		????????	<CR/LF>	<ETX>
Bit setting the presence of this part of the message	*STX/ETX Character*	*Header String*	*Chip Description String*	Always present	*End of Message String*	*STX/ETX Character*

If the corresponding bit is set to 1, the ASCII message includes its corresponding part.

Tag Scan Settings

Only chips with the corresponding *Scan* bit set to 1 are retained during the scan. The RF field is scanned with the following priority order :

Order	Library	Textile Rental	I&L
1	C210	C320	C370 (ISO15693)
2	C240	C370 (ISO15693)	I-CODE UID
3	C270 (Philips I-CODE)	C220	I-CODE EPC
4	C370 (ISO15693)		C270 (Philips I-CODE)



If in the field “Tag Scan Settings” no bit is set to 1, all the Standalone Operating Mode definition is ignored and error 0x8B is returned.

Reply Settings

The Fixed ID Length bit sets the number of digits in the ID of the Stand-Alone ASCII Message. If the bit is set to 0, the MEDIO P101 chooses the best length of the ID depending on the chip type.

If the bit is set to 1, the MEDIO P101 sends back only the number of digits defined by the ID Length bits (bits[3:1]). The ID always ends with the Least Significant digit of the ID.

Chip Type	*Fixed ID Length* = 0 Number of digits sent	*Fixed ID Length* = 1 Number of digits sent Defined by the *ID Length* bits
C210	16 (Total memory)	2 to 16
C240	16 (Block 0 Page 0)	2 to 16
C270 (Philips I-CODE)	16 (Block 1 and Block 0)	2 to 16
ISO 15693	16 (UID)	2 to 16
C220	10 (Lockable data + Config bits)	2 to 16 (Non-existing bytes are padded with 0x00)
C320	16 (Block 0)	2 to 16
I-CODE UID	10 (UID memory)	2 to 16 (Non-existing bytes are padded with 0x00)
I-CODE EPC	20 (EPC memory)	2 to 16

The *ID Length* bits (bits [3:1]) define the number of pairs of digits in the ID field of the Stand-alone ASCII Message when *Fixed ID Length* bit is set to 1. The following table gives the number of digits in the ID field. The *ID Length* bits are ignored if the *Fixed ID Length* bit is set to 0.

000b 2 digits
001b 4 digits
010b 6 digits
...
111b 16 digits

When *Send Once* bit is set to one, the ASCII message is send only when the chip type or chip ID is different from the last one successfully read or when the scan failed 4 times before finding a tag. When *Send Once* bit is set to 0, the ASCII message is sent each time a tag is read.

When *Trigger Capability* bit is set to 1, a trigger signal is used to start and stop the RF scanning. The trigger signal is connected to the MEDIO P101 inputs defined by the *Trigger Input Setting Parameter*.

When *End Trigger Reply* bit is set to 1, an ASCII message is send at the end of the trigger. If a tag has been read during the trigger activity, the message corresponds to the last chip read. If not, the “no read” message is sent. When *End Trigger Reply* bit is set to 0, the reader reply is described by the *Send Once* bit.



If the *Trigger Capability* bit is set to 0, the *End Trigger Reply* bit is forced to 0.

Trigger Input Settings

I/O1 Trigger Level bit corresponds to the voltage that must be applied on the trigger pin for the trigger to be active (set to 1 for a high level active voltage, 0 for a low level active voltage). If *I/O1 Trigger Capability* bit is set to 0, this bit is forced to 0.

Trigger Led Settings

I/O0 Trigger Led bit set to 1 enables the MEDIO P101 output pin to be used as an output representative of the trigger activity. The trigger led capability cannot be assigned to the output if it has already reserved for a trigger led. In this case, error 0x8B is returned.

I/O0Trigger Led Value bit corresponds to the activity of the reader output when the trigger is active (set to 1 for an active output , 0 for an inactive output). If *I/O0 Trigger Led* bit is set to 0, this bit is forced to 0.

Read Led Settings

I/O0 Read Led bit set to 1 enables the MEDIO P101 output to be used as an output representative of the read activity. The reader led capability cannot be assigned to the output if it has already reserved for a trigger led. In this case, error 0x8B is returned.

I/O0 Read Led Value bit corresponds to the activity of the reader output when a successful scan is performed (set to 1 for an active output , 0 for an inactive output). If the scan ends with no tag found, the opposite activity is applied on the output. If *I/O0 Read Led* bit is set to 0, this bit is forced to 0.

Response

Data	None	
Possible Errors	0x8A	Unknown Setting
	0x8B	Standalone Mode setting error

Get Standalone Mode Settings			
Command Number			0x0E
Description			Get Standalone Mode settings
Data	Parameter 1	1 byte	Parameter to be get

Parameters Description

Parameter 1 refers to the standalone mode parameter to be read.



See "Set Standalone Mode" command for parameter description.

Response

Data			Parameter 1 is 0x00	
	Data 1	7 byte	Standalone Mode General Settings	
			Parameter 1 is not 0x00	
	Data 1	0 to 16 bytes	ASCII String corresponding to parameter 1	
Possible Errors			0x8A	Unknown Setting

2.2 TAGSYS C210 Commands

2.2.1 C210 Memory Organization

The memory of the C210 tag contains 64 bits. These bits cannot be modified (Read Only) and contains the unique identifier (UID) of the chip.

2.2.2 List of C210 - Specific Commands

Read C210 _____ 31

Read C210	
Command Number	0x01
Description	Read the UID of a C210 chip.
Data	None

Response

Data	Data 1	8 bytes	C210 Unique ID	
Possible Error			0xC4	No chip found
			0xC5	Can not read the chip

2.3 TAGSYS C220 Commands



The EAS is the Electronic Article Surveillance Anti-theft System. The Medio P101 reader can set or clear the function, but the EAS signal can not be detected by this reader.

2.3.1 C220 Memory Organization

The C220 chip memory consists of 10 bytes and is divided into three areas.

1. Lockable Memory (40 bits). S1 bit set the lock state of this memory
2. Configuration Memory (7 bits). Contains the chip configuration bits
3. Maskable Memory (33 bits). S2 bit set the mask state of this memory.

Table 8: C220 Memory Mapping

Byte	1	2	2	4	5	6	7	8	9	10	11
Area	Lockable memory (D39 to D0)					Configuration Memory	Maskable memory (D72 to D40)				



Bit D72 (Maskable Memory) is the LSB of Byte 7. All the other bits of the Byte 7 are null.

The description of the Configuration Memory is given in Table 9.

Table 9: C220 Chip Configuration Bits

Bit #	7	6	5	4	3	2	1	0
Name		R1	R0	TH	S3	S2	S1	S0
Function		Reserved		Anti-theft	Response reiteration period	Masking	Locking	Not Used
Value	0	0x00		0: Disabled 1: Enabled	0: Slow mode 1: Fast mode	0: Short Reply Mode 1: Long Reply mode	Protection System 1: Enabled 0: Disabled	$= \overline{S1}$
Protection by S bit	NU	NU		No	Yes	Yes	Yes	Yes

Reserved (Bits R[1:0])

These bits are reserved for future use and forced to 0.

Anti-Theft Protection (Bit TH)

This bit triggers the chip Anti-Theft mode. If set, the chip will emit an EAS signal at power on. This bit cannot be masked or protected.

0: Anti-Theft mode disabled
1: Anti-Theft mode enabled

Response Reiteration Period (Bit S3)

This bit determines the chip response reiteration period. A Fast Reply Rate reduces the chip's read time, but is detrimental to anti-collision performances. This mode is not recommended for use in anti-collision mode if more than five chips are involved.

0: Normal Reply Rate
1: Fast Reply Rate

Masking (Bit S2)

This bit masks the Maskable Memory. If this bit is set (Short Reply mode), the chip will not return information related to this memory. In this case, the chip response time is shortened, accelerating the anti-collision procedure.

0: Long Reply mode (Memory is unmasked)
1: Short Reply mode (Memory is masked)



A chip with a mask has bit S2 set to 0. This value provides information about the size of the data sent by each chip.

Data Protection (Bits S1)

These bits determine the protection of bits D[39:0] of lockable memory and bits S[3:0] of the Configuration memory.

1: Locked
0: Unlocked



Once bits S1 are set in Locked mode, writing to bits (D[39:0] and S[3:0]) is prohibited.

On the other hand, bitTH is always programmable, as is Maskable Memory, provided the latter is not masked (bit S2 set to 1).

2.3.2 List of C220-specific Commands

Read Chip C220 ____ 34
Write Chip C220 ____ 35
Write EAS C220 ____ 36
Quiet C220 ____ 37

Read Chip C220	
Command Number	0x10
Description	Reads one or several C220 chips.
Data	None

This command is used to read C220 chips.



The reading is not selective if several chips are present in the field at once. Chip selection is random.

Response

Data	Parameter 1	6 or 11 bytes	C220 Chip Data (6 bytes for a masked C220 chip and 11 bytes for an unmasked C220 chip)	
Possible Errors			0xC4	No chip found
			0xC5	Can not read the chip

Write Chip C220			
Command Number			0x11
Description			Write data to all C220 chip presents in the field.
Data	Parameter 1	5 bytes	Data to program in Lockable Memory (if not locked)
	Parameter 2	1 byte	Memory configuration
	Parameter 3	5 bytes	Data to program in the Maskable Memory

Response

Data	None
Possible Error	None

Write EAS C220			
Command Number			0x11
Description			Write EAS to all C220 chip presents in the field
Data	Parameter 1	1 byte	EAS Value

Parameters Description

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
EAS Value	Skip	X	X	X	X	X	X	EAS State

If the bit ***EAS state*** is set to 1, after the write operation all the programmable C220 chips in the field will have the EAS active. If set to 0, the EAS will be desactivated.

If the ***Skip*** bit is set, all the locked C220 chip in the field will be programmed accordingly to the EAS bit state. All the unlocked chip will not be programmed.



If the Skip bit is set to 0, all unlocked chip will have the lockable memory set to 0.

Response

Data	None
Possible Error	None

Quiet C220	
Command Number	0x11
Description	Quiet all C220 chip presents in the field
Data	None



Any RF reset will wake up the quiet chips.

Response

Data	None
Possible Error	None

2.4 TAGSYS C240 Commands

2.4.1 C240 Memory Organization

The 2KByte memory is divided into eight blocks of four pages each, and each page contains 64 bits of available user memory space.

Table 10: C240 Memory Organization

	Page 0	Page 1	Page 2	Page 3
Block 0	ID	Protection	Password 0*	Password 1*
Block 1	64 usable bits	64 usable bits	64 usable bits	64 usable bits
Block 2	64 usable bits	64 usable bits	64 usable bits	64 usable bits
Block 3	64 usable bits	64 usable bits	64 usable bits	64 usable bits
Block 4	64 usable bits	64 usable bits	64 usable bits	64 usable bits
Block 5	64 usable bits	64 usable bits	64 usable bits	64 usable bits
Block 6	64 usable bits	64 usable bits	64 usable bits	64 usable bits
Block 7	64 usable bits	64 usable bits	64 usable bits	64 usable bits

* When reading Block 0, Password 0 and Password 1 are never sent for security reasons.

Block 0, Page 0

This page cannot be modified. It contains the unique identifier of the C240 chip.

Block 0, Page 1

This page contains the configuration of the protection for each block of the chip. Table 11 provides a bit-by-bit description of the page structure.

Table 11: Block 0, Page 1 Memory Organization

<table>
<tr><td colspan="4">Bits 63 to 48</td></tr>
<tr><td colspan="4">Available User Memory Space</td></tr>
<tr><td colspan="2">Bits 47 to 41</td><td colspan="2">Bits 40 to 32</td></tr>
<tr><td colspan="2">Reserved</td><td colspan="2">Available User Memory Space</td></tr>
<tr><td>Bits 31 to 28</td><td>Bits 27 to 24</td><td>Bits 23 to 20</td><td>Bits 19 to 16</td></tr>
<tr><td>NIB0</td><td>NIB1</td><td>NIB2</td><td>NIB3</td></tr>
<tr><td>Bits 15 to 12</td><td>Bits 11 to 8</td><td>Bits 7 to 4</td><td>Bits 3 to 0</td></tr>
<tr><td>NIB4</td><td>NIB5</td><td>NIB6</td><td>NIB7</td></tr>
</table>

Available User Memory Space bits

Bits [63:48] and [40:32]

Chip Protections

Each NIBx values corresponds to a nibble, which is half a byte; i.e., four bits. These bits control the protection against reading from and/or writing to the corresponding block. The following tables describe the value corresponding to the required protection.

Table 12: NIB0 Value (Block 0)

Bit 3	Bit 2	Bit 1	Bit 0	Description
0	x	x	x	Temporary inhibition protected by password 0
1	x	x	x	Temporary inhibition protected by password 1
x	x	0	0	No write-protection for Page 1 of Block 0
x	x	0	1	Protection against writing Page 1 of Block 0 by password 1
x	x	1	0	Protection against writing Page 1 of Block 0 by password 0
x	x	1	1	Protection against writing Page 1 of Block 0 by either password

Table 13: NIB1 to NIB7 Values (Blocks 1 to 7)

Bit 3	Bit 2	Bit 1	Bit 0	Description
0	0	x	x	No protection against reading
0	1	x	x	Protection against reading with password 1
1	0	x	x	Protection against reading with password 0
1	1	x	x	Protection against reading with either password
x	x	0	0	No protection against writing
x	x	0	1	Protection against writing with password 1
x	x	1	0	Protection against writing with password 0
x	x	1	1	Protection against writing with either password

Blocks 1 to 7, Pages 0 to 3

Each of these pages contains 64 bits of available memory space that can be used to store additional data by the user.

Block 7, Page 3

Bits [63:62] are reserved. You cannot program them to the value (0,1)

2.4.2 List of C240 - Specific Commands

Read Block C240 _____ 41
Set Password C240 _____ 42
Write Page C240 _____ 43

Read Block C240

Command Number			0x01
Description			Read any page or any block of pages of a C240 Chip
Data	Parameter 1	1 byte	Block number, first page to read and passwords
	Parameter 2	1 byte	Number of pages to be read
RF Activity after the command			Reverts to its initial state after the command has been executed.

The memory consists of eight blocks of four pages each, and each page consists of eight bytes.

When this command is performed, the reader attempts reading of a specified block of the chip memory and returns up to four consecutive pages of a block.

Parameters Description

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Parameter 1		Block Number (B)			Send Password 1	Send Password 0	First Page to read (P_P)	
Parameter 2						Number of pages (N_P)		

The first page number and the number of pages must be linked as follows:

$$1 \leq N_P \leq 4$$

Block 0: $1 \leq Pp + N_P \leq 2$

Other blocks: $1 \leq Pp + N_P \leq 4$

Most pages can be secured by passwords (reading). To access the chip, the correct password must be sent to the chip first. ***Password*** bits must be set accordingly to the chip password protection. To use a password, it must have been define first by the *Set Password C240* command. If not, error 0x91 is returned.

Response

Data	Parameter 1	8 bytes	Page P_P Block B	
	…		…	
	Parameter N_P	8 bytes	Page (N_P + P_P - 1) Block B	
Possible Error			0x82	Page Number and number of pages inconsistent
			0x88	RF is turned off
			0x91	Password has not been defined
			0xC4	No chip found in the field
			0xC5	Cannot read chip contents
			0xC7	Incorrect password

Set Password C240

Command Number			0x02
Description			Log the chip with the dedicated password
Data	Parameter 1	1 byte	Password Number
	Parameter 2	8 bytes	Password

This command enables the user to access the protected parts of a C240 chip, and to set one of two expected 64-bit passwords (Parameter 2).

Parameters Description

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Parameter 1								Password Number



If parameter 2 is not present, the command clears the corresponding password definition.



No RF activity is required for this command

Response

Data	None
Possible Error	None

Write Page C240

Command Number			0x03
Description			Writes a page of a block
Data	Parameter 1	1 byte	Page Description and checking
	Parameter 2	8 bytes	Data to be written

The command writes a page of a C240 chip in standard mode with the data contained in Parameter 2.

Parameters Description

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Parameter 1		Block Number			Send Password 1	Send Password 0	Page to be written	

If a block is protected by a password, this password must be sent before a page can be written into that block. Certain pages have programming restrictions or need specific functions.

- Block 0 Page 0 : No writing
- Block 0 Page 1 : Change chip configuration
- Block 0 Page 2 : Permanently change password 0
- Block 0 Page 3 : Permanently change password 1
- Block 7 Page 3 : Forbidden programming bits (63:62) to (01) binary value.

Most pages can be secured by passwords (writing). To access the chip, the correct password must be sent to the chip first. ***Password*** bits must be set accordingly to the chip password protection. To use a password, it must have been define first by the *Set Password C240* command. If not, error 0x91 is returned.

Response

Data	None	
Possible Error	0x82	Page Number and number of pages inconsistent
	0x88	RF is turned off
	0x91	Password has not been defined
	0xC4	No chip found in the field
	0xC5	Cannot read chip contents
	0xC7	Incorrect password
	0xC8	Writing failed
	0xC9	Writing these data is not allowed for Block 7 Page 3
	0xCA	Tag Not Logged
	0xCD	Can not read after write

2.5 TAGSYS C270 (Philips I-Code™) Commands

The C270 chip is used for multiple identification-related applications. Several chips can operate simultaneously. Data is stored in a non-volatile memory of 512 bits organized in 16 blocks of 32 bits each. Four blocks are dedicated to chip control and 12 are free for user data.

The C270 chip main characteristics are:

- Read (512 bits) / Write (488 bits)
- Data protection against Write commands
- Anti-collision
- Electronic Article Surveillance (EAS).
- Chip selection

2.5.1 C270 Memory Organization

Table 14: C270 Chip Memory Mapping

Block	Byte 3	Byte 2	Byte 1	Byte 0
Block 0	Serial number (4 least significant bytes)			
Block 1	Serial number (4 most significant bytes)			
Block 2	Block protection against write command			
Block 3	Reserved		Quiet	EAS
Block 4	Data		Application ID	Family Code
Block 5	Data			
...	...			
Block 15	Data			

Serial Number (Blocks 0 and 1)

The Serial Number is unique and it cannot be programmed.

Block Protection (Block 2)

Protection bits in Block 2 set access conditions for writing in blocks. By default set to 1 (except for Blocks 0 and 1), they can be set to zero only once.



The protection of a block is an irreversible operation.
Protecting Block 2 locks write access and configures the chip permanently.

Block 2 is mapped as follows:

Table 15: Block Write Protection Mapping (Block 2)

	Byte 3				Byte 2				Byte 1				Byte 0			
	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	00	00
Block	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

The Write Protection bits of each block must be cleared to protect the block.

11: Write Protection is disabled
00: Write Protection is enabled
10 and 01: Reserved. Do not use.



Block writing must take place in a secure environment. The chip must stay in the RF field (near the antenna) during the entire programming sequence.

2.5.2 Special Functions

Quiet Mode

Quiet mode is used to deactivate a chip so that it will not respond to any commands except for the EAS command. The chip is set in Quiet mode using bits [3:2] of Byte 0 in Block 3. These bits can only be cleared using a Reset Quiet command.

00: Quiet mode is disabled
11: Quiet mode is enabled
01 or 10: Reserved. Do not use.

When a chip is set in Quiet mode, its location is not free in terms of chip timeslot allocation. As long as the timeslot is allocated, it is impossible to select a chip. To free the timeslot, the field can be re-initialized or the Refresh Selection - C270 command can be used.

The Reset Quiet command sets the mask value to 0. An awakened chip sends data from its initial timeslot. If this timeslot is used by another chip, it will create a collision, which makes it impossible to read the chips in this timeslot.

Electronic Article Surveillance (EAS) Mode

EAS mode is used to provide an Anti-theft function. The chip is set in EAS mode using bits [1:0] of Byte 0 in Block 3.

00: EAS mode is disabled
11: EAS mode is enabled
01 or 10: Reserved. Do not use.

Family Code and Application ID

The chip offers the possibility of specifying a family code and an application ID over two bits. These values are set using bits [7:0] of Byte 0 (Block 4) for the Family Code and bits [7:0] of Byte 1 (Block 4 for the Application ID. If these values are not used, these bits can be used to store normal, non-specific user data.

There is no default value for the Family Code and Application ID bytes.

2.5.3 List of C270 - Specific Commands

Anti-Collision Select - C270 ____ 46
Selected Read - C270 ____ 49
Write Block - C270 ____ 51
Halt - C270 ____ 53
Reset Quiet- C270 ____ 55
Unselected Read - C270 ____ 56

Anti-Collision Select - C270

Command Number			0x30
Description			I-Code Tag Selection Procedure
Data	Parameter 1	1 byte	Command Flags
	Parameter 2	1 byte	Hash Value
	Parameter 3	1 byte	Family code
	Parameter 4	1 byte	Application number
	Parameter 5	1 byte	Number of TimeSlots
	Parameter 6	N bytes	Quit mask

This command addresses unselected chips in the field, selects them and allocates a timeslot for them through which to communicate with the chip. The procedure tries to select all C270 chips present in the field, but an unselected C270 chip could remain in the field (for instance, if there are insufficient timeslots for them).



Note that several anti-collision queries must be sent to the reader in order to select the maximum number of chips.

Two selection modes are available:

1. Initialization mode resets the RF, sets the number of timeslots and begins the selection.
2. Selection mode selects the C270 chips present in the field in free timeslots to add them in the current selection.

Parameters Description

Command Flags parameter

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
ISO 15693 Command Flags	Reset RF	X	X	X	X	X	X	X

If the ***Reset RF*** bit is set, the reader turns off the RF field before to send the Anti-collision Select procedure and all the chips are unselected. It permits to start a new selection.

If this bit is not set, selected chips are not reset and maintain their previously allocated timeslot. It is used to add chips that have subsequently entered the field.

Hash Value parameter is a pointer used by the C270 tags to calculate their timeslots. The values for the Hash value are from 0 to 31. But with the MEDIO P101 reader we can only choose a multiple of 8 therefore the Hash value is 0, 8, 16 or 24.

If the ***Family Code*** parameter is other than zero, only chips with this value are selected. If the Family Code is set to zero, all chips will be selected regardless of their family code.

If the ***Application Number*** parameter is other than zero, only chips with this value are selected. If the Application Number is set to zero, all chips will be selected regardless of their application number.

The ***Number of TimeSlots*** parameter indicates the maximum number of timeslots where the reader can selected a tag. The number of possible timeslots for the MEDIO P101 reader is 1,4,8,16, 32, 64 and 128.

The ***Quit Mask*** parameter is used to choose the timeslots that you can (or want to) select. The byte numbers N of this parameter depends on the ***Number of TimeSlots*** parameter. N is equal to the number of TimeSlots divided by 8. For example if the number of TimeSlots is 16, also the length of ***Quit Mask*** is 2 bytes.

		Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Quit Mask For 16 TimeSlots	MSB	Timeslot 15	Timeslot 14	Timeslot 13	Timeslot 12	Timeslot 11	Timeslot 10	Timeslot 9	Timeslot 8
	LSB	Timeslot 7	Timeslot 6	Timeslot 5	Timeslot 4	Timeslot 3	Timeslot 2	Timeslot 1	Timeslot 0

A TimeSlot bit is set to 1 if the corresponding TimeSlot can be allocated. If the bit is clear no tag can be selected in this TimeSlot.

Response

Data	Parameter 1	N bytes	Selected timeslots	
Possible Error			0x82	Bad Parameters : for example incorrect number of TimeSlots

Response Data Description for 16 TimeSlots

		Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Used Timeslots Parameter 1	MSB	Timeslot 15	Timeslot 14	Timeslot 13	Timeslot 12	Timeslot 11	Timeslot 10	Timeslot 9	Timeslot 8
	LSB	Timeslot 7	Timeslot 6	Timeslot 5	Timeslot 4	Timeslot 3	Timeslot 2	Timeslot 1	Timeslot 0

The response represents the timeslots after the selection procedure. When a chip is selected, it is allocated a timeslot. Timeslot bits are set to 0 when a selected chip is allocated to the corresponding timeslot.

Selected Read - C270

Command Number			0x31
Description			Read Block of selected chip
Data	Parameter 1	1 byte	Slot Number
	Parameter 2	1 byte	Number of blocks (N_B - 1)
	Parameter 3	1 byte	First block (P_B)
	Parameter 4	1 byte	Number of TimeSlots

Parameters Description

Selected chips are read according to their timeslot . In this case the ***Slot Number*** parameter is the TimeSlot of the selected chip to read. (For example value 0x0 for Timeslot 0, value 0xF for Timeslot 15). The Slot Number value is limited to 127.



The ***Number of TimeSlots*** parameter must be equal to the value chosen in the Anti-collision Select Command. If it is not the case you have some chance to do not read any tag.



Note that the ***Slot Number*** must be lower than the ***Number of TimeSlot*** parameter of the Anti-collision Select Command. If it is not the case error 0xC4 will be returned.

The Parameters 2 and 3 are respectively the ***First Block to read*** and the ***Number of Blocks*** to read. The First Block value must be lower than 15.

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Parameter 2					Number of blocks to be read (N_B)			
Parameter 3					First Block to be read (P_B)			



The Bits 7 to 4 of the parameters 2 and 3 are ignored.
If you want to read N_B Blocks the parameter ***Number of Blocks*** must be equal to $N_B - 1$.

The values of the ***First Block*** and the ***Number of Blocks*** must comply with the following rule:

$$P_B + N_B - 1 \leq 15$$

Response

Data	Data 1	4 bytes	Data in the first block to be read.	
	...	...	...	
	Data n	4 bytes	Data in the last block to be read.	
Possible Errors			0x82	Invalid number of blocks to be read
			0xC4	Chip not found.
			0xC5	Read Error
			0xCC	Collision

Write Block - C270

Command Number			0x32
Description			Write Block of selected chip
Data	Parameter 1	4 bytes	Data to Write
	Parameter 2	1 byte	Block number to Write
	Parameter 3	1 byte	Number of TimeSlots
	Parameter 4	N bytes	Write Mask

Parameters Description



The ***Number of TimeSlots*** parameter must be equal to the value chosen in the Anti-collision Select Command. If it is not the case you have some chance to do not write any tag or write a bad tag.

The ***Write Mask*** parameter is used to choose the timeslots that you want to write. The byte numbers N of this parameter depends on the ***Number of TimeSlots*** parameter. N is equal to the number of TimeSlots divided by 8. For example if the number of TimeSlots is 16, also the length of ***Write Mask*** is 2 bytes.

		Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Block Number Parameter 2						Block Number			
Write Mask parameter for 16 TimeSlots	MSB	Timeslot 15	Timeslot 14	Timeslot 13	Timeslot 12	Timeslot 11	Timeslot 10	Timeslot 9	Timeslot 8
	LSB	Timeslot 7	Timeslot 6	Timeslot 5	Timeslot 4	Timeslot 3	Timeslot 2	Timeslot 1	Timeslot 0

Bits set to 1 in ***Write Mask*** parameter correspond to the timeslots containing a chip to be written.

Response

Data	Data 1	2 bytes	Successfully written chips	
Possible Error			0x82	Bad Parameters

Response Data Description for 16 TimeSlots

		Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Successfully Written Chips Data 1	MSB	Timeslot 15	Timeslot 14	Timeslot 13	Timeslot 12	Timeslot 11	Timeslot 10	Timeslot 9	Timeslot 8
	LSB	Timeslot 7	Timeslot 6	Timeslot 5	Timeslot 4	Timeslot 3	Timeslot 2	Timeslot 1	Timeslot 0

If the selected chip has been successfully written, the bit of the corresponding timeslot is set to 0.

Halt - C270			
Command Number			0x33
Description			Halt a selected chip
Data	Parameter 1	1 byte	Number of TimeSlots
	Parameter 2	N bytes	Halt Mask

This command is used to halt (mute) selected chips. The timeslots corresponding to these chips are then free to be re-allocated.

Halted chips remain mute as long as they remain in the RF field (chip power supply is on). They do not respond to any instruction until the next power-on reset.

Parameters Description



The ***Number of TimeSlots*** parameter must be equal to the value chosen in the Anti-collision Select Command. If it is not the case you have some chance to halt a bad tag.

The ***Halt Mask*** parameter is used to choose the timeslots that you want to halt. Like the previous command the byte numbers N of this parameter depends on the ***Number of TimeSlots*** parameter. N is equal to the number of TimeSlots divided by 8.

		Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Halt Mask for 16 TimeSlots	MSB	Timeslot 15	Timeslot 14	Timeslot 13	Timeslot 12	Timeslot 11	Timeslot 10	Timeslot 9	Timeslot 8
	LSB	Timeslot 7	Timeslot 6	Timeslot 5	Timeslot 4	Timeslot 3	Timeslot 2	Timeslot 1	Timeslot 0

Bits set to 1 in Parameter 1 correspond to the timeslots containing a chip to be halted.

Response

Data	Data 1	2 bytes	Successfully halted chips	
Possible Errors			0x82	Bad Parameters

Response Data Description for 16 TimeSlots

		Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Successfully Written Chips	MSB	Timeslot 15	Timeslot 14	Timeslot 13	Timeslot 12	Timeslot 11	Timeslot 10	Timeslot 9	Timeslot 8
	LSB	Timeslot 7	Timeslot 6	Timeslot 5	Timeslot 4	Timeslot 3	Timeslot 2	Timeslot 1	Timeslot 0

If the selected chip has been successfully halted, the bit of the corresponding timeslot is set to 0.

Reset Quiet- C270	
Command Number	0x34
Description	Awakens all chips (selected or not) from the Quiet Mode
Data	None

This command clear the Quiet bit of all tags in the field, and all chips in Quiet mode are reset to Normal mode.

Response

Data	None
Possible Errors	None

Unselected Read - C270

Command Number			0x35
Description			I-Code Unselected Read or Inventory procedure
Data	Parameter 1	1 byte	Command Flags
	Parameter 2	1 byte	Hash Value
	Parameter 3	1 byte	Family code
	Parameter 4	1 byte	Application number
	Parameter 5	1 byte	Number of TimeSlots
	Parameter 6	1 byte	Number of blocks (N_B - 1)
	Parameter 7	1 byte	First block (P_B)
	Parameter 8	1 byte	Maximum Round
	Parameter 9	1 byte	Maximum Chip

This command addresses unselected chips in the field.

Parameters Description

Command Flags parameter

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
ISO 15693 Command Flags	Reset RF	X	X	X	X	X	X	X

If the ***Reset RF*** bit is set, the reader turns off the RF field before to send the Unselected Read procedure and all the chips become unselected. It permits to re-enter in the procedure the previous selected chips.

Hash Value parameter is a pointer used by the C270 tags to calculate their timeslots. The value for the ***Hash value*** is from 0 to 31. But with the MEDIO P101 reader we can only choose a multiple of 8 therefore the Hash value is 0, 8, 16 or 24.

If the ***Family Code*** parameter is other than zero, only chips with this value are selected. If the Family Code is set to zero, all chips will be selected regardless of their family code.

If the ***Application Number*** parameter is other than zero, only chips with this value are selected. If the Application Number is set to zero, all chips will be selected regardless of their application number.

The ***Number of TimeSlots*** parameter indicates the maximum number of timeslots where the reader can read a tag. The number of possible timeslots for the MEDIO P101 reader is 1,4,8,16, 32, 64 and 128.

Like the Selected Read Command the values of the ***First Block*** and the ***Number of Blocks*** (N_B – 1) must comply with the following rule:

$$P_B + N_B - 1 \leq 15$$

The Parameters 8 must not be null. In this case, error 0x82 is returned.

Maximum Round parameter is the maximal number of round where the reader tries to read chips. The maximum value for this parameter is 0x3F = 63.

Maximum Chip parameter is the maximal number of C270 tags that the reader should read. The maximum value for this parameter is 0x3F = 63.

Response



For an Unselected Read C270 Command, the reader response frame is in Variable Length Format. Each blocks of the reply corresponds to a chip and has the following structure.

Data	Parameter 1	N_B * 4 bytes	Block **i** to Block **i+ N_B** of the first C270 chip read	
	Parameter 2	N_B * 4 bytes	Block **i** to Block **i+ N_B** of the second C270 chip read	
		N_B * 4 bytes	.....	
	Parameter N	N_B * 4 bytes	Block **i** to Block **i+ N_B** of the N^{st} C270 chip read	
Possible Error			0x82	Bad parameters

Each Block of the C270 tag contains 4 bytes.

Here *N* is the Number of chip, which have been read during the unselected read Procedure.

The indices **i** correspond to the number of the first block to read.



Note that you have the best performances for an inventory with the highest baud rates

2.6 ISO-15693 Compatible Commands



Refer to Part-2 and Part-3 of ISO 15693 specifications for specific terms.

2.6.1 Memory Organization

ISO 15693 tag memories are organized into blocks of a fixed size. Up to 256 blocks can be addressed and each block can consist of up to 256 bits. This provides a maximum memory size of 8 kilobytes (KB).

2.6.2 General Parameters

Tags communicate with the reader using the ASK modulation principle. Two indexes (10% and 100%) are used to define the position of a 'pause' that determines the pulse position modulation for data coding purposes.



MEDIO P101 does not support the 1 out of 4 data coding for uplink.



MEDIO P101 does not support the 2 sub carrier flags (ISO flags) for downlink.

2.6.3 List of ISO 15693-specific Commands

ISO 15693 Inventory 59
ISO 15693 Raw Request 62

ISO 15693 Inventory			
Command Number			0x20
Description			Launch an inventory of the ISO15693 chips in the field, and manage the anti-collision sequence.
Data	Parameter 1	1 byte	Command Flags
	Parameter 2	1 byte	Maximum chips
	Parameter 3	1 byte	AFI (Optional)
	Parameter 4	1 byte	First Block to read (Optional)
	Parameter 5	1 byte	Number of blocks to read (Optional)

The ISO-15693 Inventory command implements the whole recursive algorithm described in the Part-3 of ISO 15693 specification, Inventory Process.

Parameters Description

Command Flags parameter

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
ISO 15693 Command Flags	Reset RF	C370 Fast Inventory Read	C370 Inventory Read	Send AFI		Answer Data Rate	EOF Modulation Type	Request Modulation Type

The ***Request Modulation Type*** bit sets the modulation type used for the ISO 15693 Requests.

0: OOK Modulation
1: ASK Modulation

The ***EOF Modulation Type*** bit sets the modulation type for EOF sequences used in an Inventory type Request.

0: OOK Modulation
1: ASK Modulation



As specified in the Part-3 of ISO 15693 specifications, the inventory procedure is slow down using an ASK modulation.

The ***Answer Data Rate*** bit sets the ISO 15693 Tags Data Rate for downlink communication.

0: Data Rate is 6,62 kbits/s
1: Data Rate is 26,48kbits/s



If a C370 Fast inventory read (bits *C370 Inventory Read* and *C370 Fast Inventory Read* set) is used (See I-CODE SLI Specification), the *Answer Data Rate* bit is ignored and the Inventory is performed at 52,96 kbits/s.

The ***Send AFI*** bit is set to 1 if the AFI value is required during the inventory process. In this case, parameter 3 must be sent and corresponds to the AFI (Application Family Identifier).

The ***C370 Inventory Read*** bit is reserved for C370 chips and permits to perform an inventory read procedure (I-CODE SLI Custom command 0xA0). The option flag is not supported (forced to 0) and the chip does not send the UID. Only the request memory blocks of the C370 tag are returned.



If you want to use the Inventory Read custom command (0xA0), please use the ISO RAW command.



If this bit is set, Parameter 4 and 5 are required.



If this bit is set and if the desired chip content is identical between several C370 chips, the reader may not be able to detect incoming chip collisions.

The ***C370 Fast Inventory Read*** bit is also reserved for C370 chips to perform a fast inventory read procedure (I-CODE SLI Custom command 0xA1). The option flag is not supported (forced to 0) and the chip does not send the UID. Only the request memory blocks of the C370 tag are returned. This bit is ignored if ***C370 Inventory Read*** is cleared.



If this bit is considered,), the *Answer Data Rate* bit is ignored and the Inventory is performed at 52,96 kbps.

If the ***Reset RF*** bit is set, the reader turns off the RF field before to send the inventory procedure.

Maximum chip parameter is the maximal number of IS0 15693 tags that the reader should read. It must not be null. In this case, error 0x82 is returned.

AFI parameter is the Application Family Identifier. It must be sent if the *Send AFI* bit is set.

First block parameter and ***Number of block*** must only be used if the *C370 Inventory Read* bit is set. ***Number of block*** parameter is equal to the number of block to be read minus 1. This value is limited to 0X11, which corresponds to 18 blocks read. If this value is greater, error 0x82 is returned.

Response



For an ISO Inventory command, the reader response frame is in Variable Length Format. Each blocks of the reply corresponds to a chip and has the following structure.

- ISO15693 Typical Inventory

Data	Parameter 1	1 byte	Chip ISO Flag	
	Parameter 2	1 byte	DSFID (Data Storage format identifier)	
	Parameter 3	8 bytes	UID (Unique Identifier)	
Possible Error			0x82	Bad parameters

- C370 Inventory read

Data	Parameter 1	1 byte	Answer ISO Flag	
	Parameter 2	N *4 bytes	N consecutive C370 Data Block	
Possible Error			0x82	Bad parameters

ISO 15693 Raw Request			
Command Number			0x21
Description			Permits to send all the command respecting the ISO 15693 Standard
Data	Parameter 1	1 byte	Command Flags
	Parameter 2	1 byte	ISO 15693 Flags
	Parameter 3	1 byte	ISO 15693 Command
	Parameter 4	n bytes	ISO 15693 Data
	Parameter 5	1 bytes	Extended value (Optional)



If you want to use the ISO15693 Raw Request it is advised to read the ISO Standard Part 3 before.

Parameters Description

Command Flags

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Request Type Parameter 1	Reset RF	53kbits/s			Write Request	Wait Reply	EOF Modulation Type	Request Modulation Type

The ***Request Modulation Type*** bit sets the modulation type used for the ISO 15693 Requests.

0: OOK Modulation

1: ASK Modulation

The ***EOF Modulation Type*** bit sets the modulation type for EOF sequences used in an Inventory type Request.

0: OOK Modulation
1: ASK Modulation

The ***Wait Reply*** bit indicates to the reader that it must wait a reply from the tag.

The ***Write Request*** bit informs the reader that the request must be performed as a *Writing Request*.

The ***53kbits/s*** bit must be set if the tag answers with a baud rate equal to 52,96 kbits/s.

If the ***Reset RF*** bit is set, the reader turns off the RF field before to send a request.

Extended value parameter as 2 different meaning depending on the ISO Flags:

- In case of a write alike ISO request (*Write request* bit set to 1), if the ISO Option flag (bit 6 of the ISO Flags parameter) is set, the ISO specification requires a delay between the write ISO request and the EOF that should be sent by the reader (VCD) to get the VICC reply (see ISO Part 3 Specification). This delay (T_{OEOF}) is determined by this parameter that must be sent following the equation :

  t_{OEOF} (µs) =(Extended parameter+1)*302,065

  Bits 6 and 7 of this byte are ignored: the *Extended Value* parameter cannot exceed 63 (0x3F)

- In case of an ISO inventory request (bit 1 of the ISO Flag parameter set to 1) with 16 slots (bit 5 of the ISO Flag parameter set to 1), if an ASK modulation is required (*EOF Modulation Type* or *Request modulation Type* bit set to 1), the *Extended Value* parameter corresponds to the number of bytes expected in the chip reply (excepting CRC16).

  For example if you want to send a standard inventory with 16 slots, the value of the extended parameter is 0x0A. In every slot you can have a tag answer with the ISO flag (1 byte), the DSFID (1 byte) and the UID (8 bytes), which is equal to a length of 10 bytes.



If the extended parameter (parameter 5) is present whereas you are not in one of the case described above, this parameter is considered as an ISO data (parameter 4), by the reader. In this case, the tags will probably not interpret the request.

Parameters 2 to 4 are sent respectively to the chip, using the ISO-15693 standard.



Depending on the ISO 15693 Command, Parameter 4 (No data required in the ISO command) and 5 (See above) may be omitted.

Response



If an Inventory Request 16 slots is sent to the chip (bit 5 and 2 of the ISO Flag set to 1), the reader response frame is in Variable Length Format. Otherwise, the reader uses the Fixed Length Format.

Inventory Request 16 slots

Each STXE-2 block sent by the reader represents a timeslot (First block dedicated to Slot 0, second block to slot 1,…) 16 Blocks are returned :

Data	Parameter 1	1 byte	Timeslot Error
	Parameter 2	m bytes	Chip response (Including Flags)
Possible Error			None

Timeslot Error parameter

Error Code	Description	Note
0x00	No Error	
0xC4	No Tag	Timeslot has no response
0xCC	Chip Collision	Reader has detected a collision
0xC5	Bad read	Can not read the chip



If a reading error occurs in the timeslot, Parameter 2 is empty.

Parameter 2 contains all the bytes of the chip response, the first byte is the first byte sent by the chip.

Non Inventory 16 slots Request

Data	Parameter 1	M bytes	Chip response (Including Flags)	
Possible Error			0xC4	No Tag
			0xCC	Chip Collision
			0xC5	Can not read the tag
			0x81	Buffer Full



Bytes of parameter 1 are sent LSB first accordingly to the ISO 15693 Standard.

2.7 TAGSYS C320 Commands

The C320 is a TAGSYS specified CMOS integrated circuit operating without battery at 13,56 MHz.

The C320 chip main characteristics are:

- Conformance to ISO 18000-3 protocol
- 256 bits programmable EEPROM
- Permanently lockable memory sections
- ID Contactless Personalisation by the customer
- High Performance Multiple-Tag read (anticollision) capability
- Fast moving object detection Mode.
- Multiple-Tag write capability
- 52 kbps Fast Data transaction rate
- EAS Long Range burst on separate sub-carrier.
- Combined EAS Reset and Check EAS command

2.7.1 C320 Memory Organization

The user memory contains 16 pages of 16 bits numbered 1 to 16 and 4 pages to a block. The pages can be written to, one by one or by block.

Simultaneous writing of the same data to several tags is possible. Addressed writing to a single tag in a multi-read environment is not possible.

The EAS (*Electronic Article Surveillance*) Status is given on the first page of the memory (page 0). A specific command must be used to write to this page.

The Lock Status is given on the last page of the memory (page 17). A specific command must be used to write to this page. This page can not be erased (e.g. locked pages can not be unlocked). The user memory pages can be locked four by four (pages 1-4, 5-8, 9-12, 13-16).

Table 16: C320 Memory Organization

Page	15(MSB) 0(LSB)	Description
0	EAS Status	All reply modes start here
1 2 3 4	4 x 16-bits user memory	Block 0 STAR mode short reply ends here
5 6 7 8	4 x 16-bits user memory	Block 1
9 10 11 12	4 x 16-bits user memory	Block 2
13 14 15 16	4 x 16-bits user memory	Block 3 NSNT mode ends here
17	Non erasable Lock Status	STAR mode long reply ends here

2.7.2 C320 Operating Mode

Two operating mode are available :

- NSNT Mode → Reply page 0 to page 16 (16 bits EAS page + 256 bits of Data)
- STAR Mode → 2 types of reply:
    1. Short reply page 0 to page 4 (16 bits EAS page + 64 bits of data)
    2. Long reply page 0 to page 17 (16 bits EAS page + 256 bits of Data + 16 bits Lock Status page)

NSNT for the Non Slotted Non Terminating mode and STAR for the Slotted Terminating Adapted Round mode.



The Medio P101 Reader processes the two modes.

2.7.3 List of C320-Specific Commands

C320 Inventory _____ 67
Read C320 NSNT _____ 69
Write Page C320 _____ 71

C320 Inventory			
Command Number			0x24
Description			Manage an inventory of the C320 tags presents in the RF field.
Data	Parameter 1	1 byte	Command Flags
	Parameter 2	2 bytes	Slot Number
	Parameter 3	1 byte	Wake Up Rate
	Parameter 4	1 byte	Maximum chips



For an inventory command the reader works in STAR operating mode.

Parameters Description

Command Flags parameter

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
ISO 15693 Command Flags	Reset RF			Set EAS	Long reply			Quiet Chip

If the ***Reset RF*** bit is set, the reader resets the RF field before sending the inventory procedure. All the quiet tags return to the active state after a reset.

If the ***Set EAS*** bit is set all the tag read during the inventory command set their EAS bit.

The ***Long Reply*** bit selects which pages are read from the chip during the inventory process :

0 : The chips return the EAS page and the first block (1+4 pages)
1 : The chips return its whole content (1 + 16 + 1 pages)

If the ***Quiet Chip*** bit is set a tag successfully read is quiet (it will return in the active state only after any RF reset).



If this bit is set to 0 :

- a same chip can be read several time during an inventory.
- The reading is not selective if several chips are present in the field at once. Chip selection is random.

Slot Number parameter is equal to the maximum number of slots minus 1 in which the reader will try to read a chip. Note that any C320 chip will reply 1 time each 32 slots. This number must be between 0x0000 to 0x0FFF. The 4 MSb of this value are ignored.

A Wake Up command permits a C320 chip to enter the inventory process. Each inventory process starts with a wake up command. The ***Wake Up Rate*** parameter corresponds to the minimum number of slot before a new Wake Up command is sent in the RF field during the inventory. This parameter allows new chips entering the RF field to be read in the inventory process.

Maximum Chip parameter corresponds to the maximum number of chip that can be read during the inventory process. A null value returns a 0x82 error.

Response



For C320 Inventory command, the reader response frame is in Variable Length Format. Each blocks of the reply corresponds to a chip and has the following structure. If the chip is not quiet, it can be read several times.

Data	Parameter 1	10 or 36 bytes	Chip Content (depending on the *Long Reply* bit)	
Possible Error			0x82	Maximum chip parameter is null

Response Data Description

Data is sorted as follows:

- Byte 0..1 : C320 EAS page
- Byte 2..3: C320 Page 1, MSB first
- Byte 4..5: C320 Page 2, MSB first
- …
- Byte 8..9 : C320 Page 4, MSB first (End here in case of a short reply)
- …
- Byte 32,33: C320 Page 16, MSB first
- Byte 34,35: C320 Lock page, MSB first

The EAS bit corresponds to the Bit 0 of Byte 0. All other bits of the EAS page are set to 0.

The lock bits are located in byte 34.

- Bit 7 corresponds to the locking state of block 0 (1 for a locked block)
- Bit 6 corresponds to the locking state of block 1
- Bit 5 corresponds to the locking state of block 2
- Bit 4 corresponds to the locking state of block 3

All the other bits of this page are set to 0.

Read C320 NSNT			
Command Number			0x04
Description			Read a C320 chip in NSNT mode
Data	Parameter 1	1 byte	Reset RF and wake up chip

Parameters Description

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
ISO 15693 Command Flags	Reset RF and wake up chip							

If the ***Reset RF and wake up chip*** bit is set, the reader resets the RF field before initialting a read procedure. As soon as a read procedure is initiated, all the chips present in the RF field are waken up, and can be read with several read command with this bit cleared.



The reading is not selective if several chips are present in the field at once. Chip selection is random.



If the last command sent to the reader is not a Read C320 NSNT command, this bit is automatically set to 1. Moreover, this bit is always set until the first Read C320 NSNT command is successful.



The chip replies its whole content, except the Lock page.

Response

Data	Parameter 1	34 bytes	Chip Content except lock page	
Possible Error			0xC4	No chip found
			0xC5	Can not read chip

Response Data Description

Data is sorted as follows:

- Byte 0..1 : C320 EAS page
- Byte 2..3: C320 Page 1, MSB first
- Byte 4..5: C320 Page 2, MSB first
- …
- Byte 32,33: C320 Page 16, MSB first

The EAS bit corresponds to the Bit 0 of Byte 0. All other bits of the EAS page are set to 0.

Write Page C320

Command Number			0x25	
Description			Writes several consecutive pages of a C320 chip	
Data	Parameter 1	1 byte	1st page to write	
	Parameter 2	1 byte	If Parameter 1 = 0	EAS State
		1 byte	If Parameter 1 = 17	Lock State
		2 to 32 bytes	List of 16 bits data corresponding to the consecutive page to be written	

Parameters Description

Parameter 1 must be a value between 0x00 and 0x11

- 0x00 corresponds to the EAS page, 1 byte is expected in Parameter 2 as follows:

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Parameter 2 For EAS write								EAS state

EAS state bit is set to 1 to enable EAS function of the C320 chip

- 0x11 corresponds to the lock status page of the C320 chip, 1 byte is expected in Parameter 2 as follows:

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Parameter 2 For lock status page	Lock status for block 0	Lock status for block 1	Lock status for block 2	Lock status for block 3				

- First page to write (0x01 to 0x10) for a user data page writing. Parameter 2 contains the data of all the consecutive pages to be written.



The 16 pages can be written consecutively.

Response

Data	None	
Possible errors	0x82	First page and number of page to be written are inconsistent
	0x88	RF is off

2.8 I-CODE EPC/I-CODE UID Commands

The EPC/UID is a specified CMOS integrated circuit which main characteristics are:

- Contactless transmission of data and supply energy (no battery needed)
- Operating distance: up to 1.5 m (depending on antenna geometry)
- Operating frequency: 13.56 MHz (ISM, world-wide licence free available)
- Modulation Read/Write→ Label: 10% ASK
- Fast data transfer: up to 53 kbits/s
- High data integrity: 16-bit CRC, framing
- Anticollision with high identification speed (approx.200 I.CODE EPC smart labels per second)
- Label DESTROY command with 24-bit Destroy Code protection

2.8.1 I-CODE EPC/I-CODE UID Memory Organization

2.8.1.1 I-CODE EPC Memory Organization

The memory has a capacity of 136 bits organized in 17 blocks, consisting of 1 byte each. All MSBytes of the different fields (EPC, CRC 16, Destroy Code) are located at the lowest block addresses of the corresponding memory blocks.

The I.CODE EPC Smart Label IC memory contains as shown in Table 17 , following elements:

- The electronic product code (EPC) can be of 96 bits in extent. The values of EPC are defined by the EPCglobal Inc.
- A 16-bit Cyclic redundancy Check (CRC 16)
- A 24-bit Destroy Code.

Table 17: I-CODE EPC Memory Organization

Block #	LSB				BITS			MSB	
0									OTP
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									CRC 16
13									
14									Destroy Code
15									
16									

2.8.1.2 I-CODE UID Memory Organization

The memory has a capacity of 192 bits organized in 24 blocks, consisting of 1 byte each. All MSBytes of the different fields (UD, UD CRC 16, UID, Destroy Code) are located at the lowest block addresses of the corresponding memory blocks.

The I.CODE UID Smart Label IC memory contains, as shown in Table 18 , following elements:

- The 152-bit Identifier Data (IDD) consists of 96 bit User Data, 16-bit Cyclic Redundancy Check for the User Data (UD CRC 16) and 40-bit Unique Identifier (UID). The 40-bit UID is programmed by Philips Semiconductors.
- A 16-bit Cyclic redundancy Check for the Unique Identifier (CRC 16)
- A 24-bit Destroy Code.

Table 18 : I-CODE UID Memory organization

Block #	MSB LSB BITS									
0									User Data (UD)	MSBytes
1										
2										
3										
4										
5										
6										
7										
8										Identifier Data (IDD)
9										
10										
11										
12									UD CRC 16	
13										
14									UID	
15										
16										
17										
18										LSByte
19									CRC 16	
20										
21									Destroy Code	
22										
23										

R/W
RO
OTP

2.8.2 I-CODE EPC/I-CODE UID Operating Mode

Please see Data sheet SL2 ICS10 I.CODE EPC and SL2 ICS11 I.CODE UID.



The Medio P101 Reader processes the two modes.

2.8.3 List of I-CODE EPC/I-CODE UID-Specific Commands

EPC/UID Inventory ____ 75
Write Blocks EPC/UID ____ 78
Destroy EPC/UID ____ 80

EPC/UID Inventory			
Command Number			0x26
Description			Launch an inventory of the EPC or UID chips in the field, and manage the anti-collision sequence.
Data	Parameter 1	1 byte	Command Flags
	Parameter 2	1 byte	HValue Incremental Cycle (Optional)
	Parameter 3	1 byte	Mask Length
	Parameter 4	n bytes	Selection Mask (Optional)
	Parameter 5	1 byte	Number of Slots
	Parameter 6	1 byte	Maximum Round Number
	Parameter 7	1 byte	Maximum chips

The EPC/UID Inventory command send several round of anti-collision process (depending on maximum round number) to inventory tags.

Parameters Description

Command Flags parameter

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Command Flags Parameter 1	Reset RF	Don't Check CRC			Send Fix Slot			EPC/UID Request

The *EPC/UID Request* bit defines whether the request is send with EPC or UID format.

0: EPC

1: UID



If *EPC/UID* bit is set to 0 (EPC mode), parameter 2 (HValue Incremental Cycle) must be present.
This parameter sets the number of necessary round before incrementing the HValue.
If *EPC/UID* bit is set to 1 (EPC mode), parameter 2 (HValue Incremental Cycle) must be absent.

The *Send Fix Slot* bit defines whether a Fix Slot command must be sent after a successful read to quiet the chip.

0: No Fix Slot command is sent

1: Fix slot command sent

The *Don't Check CRC* bit defines whether the reader must check the CRC16 of the air transmission (1 CRC for the EPC, 2 for the UID).

0: CRC16 is checked

1: CRC16 is not checked

If the *Reset RF* bit is set, the reader turns off the RF field before starting the inventory procedure.

Mask Length, Selection Mask and ***Number of Slots*** must be set accordingly to the EPC/UID datasheet.



Selection Mask parameter is absent if *Mask Length* parameter is null.



Number of Slots must be set accordingly to the following rule (see EPC/UID Datasheet) :

- 0x00 for 1 slot
- 0x01 for 4 slots
- 0x03 for 8 slots
- 0x07 for 16 slots
- 0x0F for 32 slots
- 0x1F for 64 slots
- 0x3F for 128 slots
- 0x7F for 256 slots
- 0xFF for 512 slots

Maximum chip parameter is the maximal number of EPC/UID tags that the reader should read. It must not be null. In this case, error 0x82 is returned.

Maximum Round parameter is the maximal number of inventory rounds that the reader should perform. It must not be null. In this case, error 0x82 is returned.

Response



The reader response frame is in Variable Length Format. Each blocks of the reply corresponds to a chip and has the following structure.

Data	Parameter 1	n byte	EPC/UID Truncated Reply	
Possible Error			0x82	Bad parameters



The chip content is truncated accordingly to the Selection Mask (see EPC/UID datasheet).

Write Blocks EPC/UID			
Command Number			0x27
Description			Driver Raw Command EPC/UID
Data	Parameter 1	1 byte	Command Flags
	Parameter 2	1 byte	First Block Number to be written
	Parameter 3	1 byte	Number of blocks to be written - 1
	Parameter 4	n bytes	Data to be written

The writing procedure performs the following actions :

- read the whole chip (except if the whole memory is programmed)
- write required blocks
- calculate and write CRC16



Only one tag is allowed at the same time in the RF field during the writing procedure. If not, 0xCC error (cannot read chip) may be returned.



The writing is not verified.



I-CODE EPC chip with OTP memory is only one time programmable. Writing needs to take place in a secure environment. The writing command must write the whole memory.

Parameters Description

Command Flags

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Command Flags Parameter 1	Reset RF	Don't Check CRC						EPC/UID Request

The *EPC/UID Request* bit defines whether the request is send with EPC or UID format.

0: EPC

1: UID

The *Don't Check CRC* bit defines whether the reader must check the CRC16 of the air transmission during the reading phase(1 CRC for the EPC, 2 for the UID). If the command intends to write the whole memory the *Don't Check CRC* bit is ignored.

0: CRC16 is checked

1: CRC16 is not checked

If the *Reset RF* bit is set, the reader turns off the RF field before sending a request.

Response

Data	None	
Possible Error	0x82	Incorrect number of blocks
	0xC4	No tag
	0xC5	Unreadable tag
	0xCC	Tag collision detected
	0x81	Reader Buffer Full
	0x89	Unstable Receiver

Destroy EPC/UID			
Command Number			0x28
Description			Driver Raw Command EPC/UID
Data	Parameter 1	1 byte	Command Flags
	Parameter 4	n bytes	IDD/EPC Value and Destroy Code



The whole content of the chip (including CRC) followed by the chip destroy code must be sent to destroy the chip. Once destroy, the chip cannot be reverted to a readable state.



The destruction is not verified.

Parameters Description

Command Flags

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Command Flags Parameter 1	Reset RF							EPC/UID Request

The *EPC/UID Request* bit defines whether the request is send with EPC or UID format.

0: EPC

1: UID

If the *Reset RF* bit is set, the reader turns off the RF field before sending a request.

Response

Data	None
Possible Error	None

3 List of Commands

3.1 List of General Reader Setting Commands

RF On / Reset RF 15
RF Off 16
Identify Reader 17
Monitor Power Supply 18
Reset 19
Get IO 20
Set IO 21
Detect Chip Type 22
Set Standalone Mode 24
Get Standalone Mode Settings 29

3.2 List of C210 - Specific Commands

Read C210 31

3.3 List of C220 - Specific Commands

Read Chip C220 34
Write Chip C220 35
Write EAS C220 36
Quiet C220 37

3.4 List of C240 - Specific Commands

Read Block C240 41
Set Password C240 42
Write Page C240 43

3.5 List of C270 (Philips I. Code) – Specific Commands

Anti-Collision Select - C270 46
Selected Read - C270 49
Write Block - C270 51
Halt - C270 53
Reset Quiet- C270 55
Unselected Read - C270 56

3.6 List of ISO15693 – Specific Commands

ISO 15693 Inventory 59
ISO 15693 Raw Request 62

3.7 List of C320 - Specific Commands

C320 Inventory 67
Read C320 NSNT 69
Write Page C320 71

3.8 List of I-CODE EPC/I-CODE UID - Specific Commands

Read Block C240 41
Set Password C240 42
Write Page C240 43

4 Error Messages

4.1 Error Messages

The following is a list of possible error codes.

Table 19: Error Codes

Code	Description
0x80	Unknown tag
0x81	Reader Buffer Full
0x82	Invalid number of pages and/or number of blocks
0x86	Incorrect chip configuration for this command
0x88	RF is turned off
0x89	Unstable Receiver
0x90	No converter value available
0x91	C240 password not set
0xA0	Unknown command
0xA4	Incorrect number of data
0xAF	EEPROM Failure
0xC4	No chip found in the field
0xC5	Can not read the chip
0xC7	Incorrect password
0xC8	Write Error
0xC9	Impossible to write data in Block 7 Page 3 (C240)
0xCA	Locked access to a tag
0xCC	Collision
0xCD	Impossible read after write

5 STXE-2 CRC Calculation Routine

5.1 CRC Calculation Routine

```
#define PRESET     0x0000          /* CRC-16 preset value */
#define ADDITION   0x8408          /* CRC-16 addition value */

unsigned int CRC_16_Calculation (unsigned char *data, unsigned int cnt)
{
     unsigned int crc16 = PRESET;  /* CRC-16 preset */
                                   /* data array contains all bytes of
                                   the message frame
                                   cnt contains the number of bytes in
                                   the frame */
     for (i=0; i<cnt; i++)         /* Performs CRC-16 calculation on
                                   all bytes of message frame */
     {
          crc16 ^=data];           /* Adds incoming data to the lowest
                                   8 bits of the CRC-16 register */
          for (j=0; j<8; j++)      /* Performs the operation bit-wise */
          {
               if (crc16 & 0x0001) /* Tests the Least Significant Bit of
                                   the CRC-16 Register */
               {
                    crc16 = (crc16 >> 1) ^ 0x8408;    /* Right Shift and
                                   then addition if LSB == 1 */
               }
               else
               {
                    crc16 = (crc16 >> 1); /* Right Shift only if LSB == 0 */
               }
          }
     }
     return (crc16);
}
```



If the data and the corresponding CRC16 (MSB first) are fed into this algorithm, the result should be 0. If not, it means that the CRC16 does not correspond to the data.

Examples of CRC-16 Calculation Results:

Command: Define Type Auto

Frame Bytes: 0x0E 0x00 0x01 0x13

CRC-16 result: 0x3B 0xC2