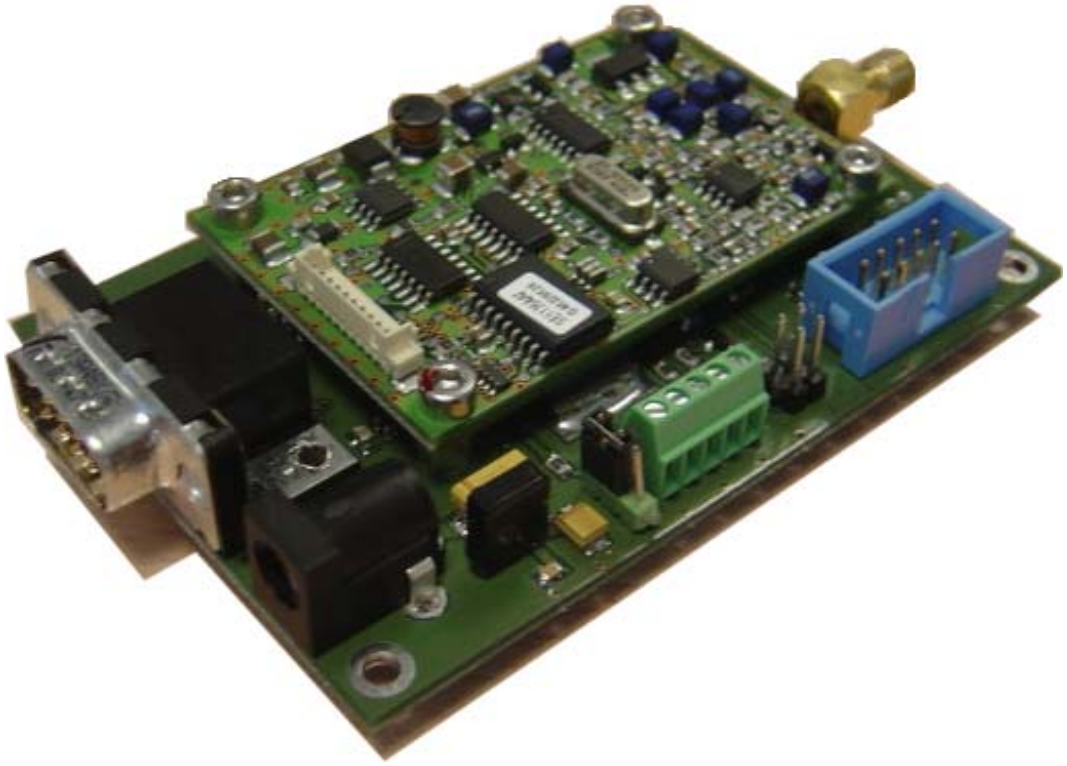
Medio P013 Reader

Command Set

Version 1.0



TAGSYS

February 2005

Publishing Information

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Document Reference: DOC11527A0

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 TAGSYS RFID Tag.

Digital Signal Processor This part of the Radio Processing Unit (RPU) performs real-time TAGSYS RFID 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 TAGSYS RFID 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 field emitted by two antennas. This feature is dedicated to rotating field applications and three-dimensional volume TAGSYS RFID 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 TAGSYS RFID 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 TAGSYS RFID 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 TAGSYS RFID Tag decoding.

Reader Electronic system for the communication between TAGSYS RFID 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.

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

Tag TAGSYS RFID Tag.

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

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1 Certification

1.1 Occupational Health and Safety Notices

TAGSYS Products have been designed not to exceed the limits given in the European Standard EN 50364 “Limitation of human exposure to electromagnetic fields from devices used in Electronic Article Surveillance (EAS), Radio Frequency Identification (RFID) and similar applications” in conjunction with the European Standard EN 50357 describing how to evaluate the exposure level.

It is the responsibility of the CIT (Certified Integrator of TAGSYS) to install the Medio P013 TAGSYS RFID Tag Reader as described in TAGSYS Product Manuals or TAGSYS Documentation and with the appropriate antennas.

Modification of any TAGSYS System is prohibited without the written consent of TAGSYS. Unauthorized modifications may void the conformity of the equipment to safety standards and will void the TAGSYS warranty.

1.2 Regulatory Notices

An RFID system typically composed of an RF emission device such as the Medio P013 is subject to national regulations that may differ by country.

One important item to consider is the maximum permissible magnetic field intensity at a distance of 10 meters from the antenna that must not exceed 42 dBµA/m in Europe and 38 dBµA/m in US.

The Medio P013 TAGSYS RFID Tag Reader meets these limits.



It is the responsibility of the CIT (Certified Integrator of TAGSYS) to install the Medio P013 TAGSYS RFID Tag Reader as described in this Integrator’s Guide or in TAGSYS Documentation.

1.2.1 In Europe (CE and RTTE Directives)

The Medio P013 TAGSYS RFID Tag Reader complies with the European EMC directive.

The Medio P013 complies with the requirements of the Telecommunication Terminal Equipment Act (FTEG) and the RTTE Directive 1995/5/EC.

Any modification of the Medio P013 TAGSYS RFID Tag Reader is prohibited without the written consent of TAGSYS. Unauthorized modifications may void the conformity of the equipment to CE and RTTE Directives and will void the TAGSYS warranty.



If a Medio P013 is further integrated in a different product, it is the responsibility of the manufacturer of this complementary product to obtain the required approvals for this product.

1.2.2 In USA (FCC Directive)

The Medio P013 TAGSYS RFID Tag Reader has been designed to comply with Part 15 of the FCC Rules. Furthermore typical configurations based on a Medio P013 have been successfully tested with Part 15 of the FCC rules.

Medio P013 TAGSYS RFID Tag Reader

WARNING TO USERS IN THE UNITED STATES

FEDERAL COMMUNCIATIONS COMMISSION (FCC) RADIO

INTERFERENCE STATEMENT 47 CFR Section 15.105(b)

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and if not installed and used in accordance with the instructions may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different to that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

NO UNAUTHORIZED MODIFICATIONS

47 CFR Section 15.21

CAUTION: This equipment may not be modified, altered, or changed in any way without signed written permission from TAGSYS SA. Unauthorized modification may void the equipment authorization from the FCC and will void the TAGSYS warranty.

ANTENNA REQUIREMENT

47 CFR Section 15.203

CAUTION: This equipment must be professionally installed. The installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded. Non-professional installation or installation of the equipment with an improper antenna may void the equipment authorization from the FCC and will void the TAGSYS warranty.

Operation is subject to the following two conditions: (1) The system devices may not cause harmful interference, and (2) The library system devices must accept any interference received, including interference that may cause undesired operation.

1.2.3 In Canada

Cet appareil numérique de la classe B respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

This Class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

2 Introduction

2.1 General

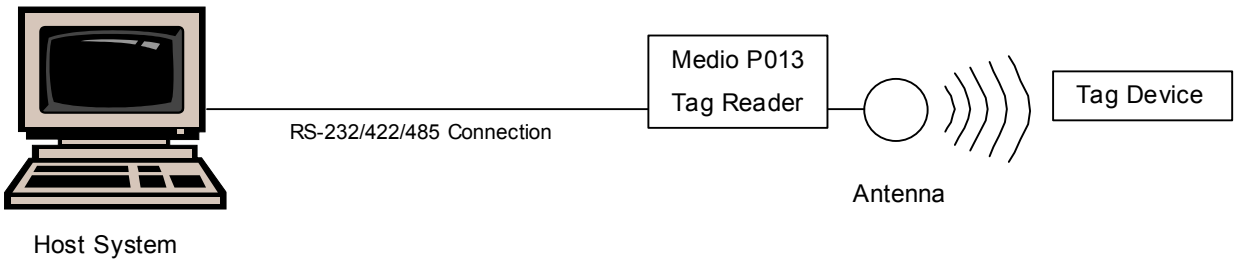
This document provides information about how to install and use the Medium Range Medio P013 TAGSYS RFID Tag Reader.

2.2 Product Description

TAGSYS Medio P013 RFID Tag Reader is intended for Original Equipment Manufacturer (OEM) applications. The Medio P013 is Medium Range 13.56 MHz RFID reader designed to operate with any TAGSYS RFID Tag using any TAGSYS chip (C210 or C240).

Medio P013 reader requires minimal computing power from the host workstation (Windows®-based PC or UNIX environment). It communicates easily with this host at a high speed, using the simple TAGSYS enhanced communication protocol (STX-E) that has already been proven on many TAGSYS readers (Medio S001/S002/S003/S011/S012/S013 and Medio L100/L200).

Figure 1: Medio P013 TAGSYS RFID Tag Reader Application Overview



The Medio P013 TAGSYS RFID Tag readers are easy to integrate because of its :

- small size
- standard communication links

2.3 Medio P013 Key Features

Table 1: Medio P013 Key Features

Description	Medio P013
Operating Frequency	13.56 MHz
Compatibility	TAGSYS (C210 and C240)
Stand-alone Mode	TAGSYS (C210 and C240)
Selectable Serial Link	RS-232, RS-422, RS-485 (Half or Full duplex)
Network Operating	Yes
I/Os	1 input and 1 output
Firmware upgradeable	Yes

2.4 Delivery

The Medio P013 TAGSYS RFID Tag Reader kit contains the following items:

Table 2: Package Contents

Quantity	Item
1	Medio P013 TAGSYS RFID Tag Reader
1	CD-ROM including: • Medio P013 Integrator's Guide • Medio P013 Command Set • User-friendly Px Explorer software provided for test and debug operations on Windows® 9x, NT®, 2000 and XP platforms • Medio STX Windows® DLLs to facilitate the development your own applications on Windows® 9x, NT®, 2000, XP and Windows® Pocket PC 2002 platforms • Medio STX Windows® DLL Programming Guide • One set of Microsoft® Visual C++® source code and executable samples using the Medio STX Windows® DLLs
1	Welcome Letter / Product Return Form

3 STXE-2 Protocol

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

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

The advantage of the STXE-2 protocol is that several readers can be used in a network and a Fast communication mode is available.

3.1 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.

3.1.1 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.

3.1.2 Network Communication

If more than one reader is connected to the host system, a network communication protocol is available.

In a network configuration, several TAGSYS RFID Tag readers can be connected to the same host system via the Reader-to-Host interface.



A network configuration is only available if an RS-485 communication link is used.

If a TTL, RS-232 or RS-422 communication link is installed, a network configuration cannot be used.

There are three types of host commands in a network communication protocol:

1. Non-addressed: Where only one reader must be powered ON in the network in order to avoid transmission conflicts for the response. This mode is used for debugging a network (reader address unknown,…).
2. Addressed: Only the reader with the address specified in the ADD field performs the command and replies.



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

Table 3: 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

Table 4: Command Frames

Host Command Frame Type	ADD Field	Network	Comments
Not Addressed	Not Included	No	The reader replies, whatever its address value
		Yes	Only one reader must be powered on the network in to order to avoid transmission conflicts during the response. Used for debugging a network (unknown reader address, etc.).
Addressed	0 to 255 (0x00 to 0xFF)	No	Only the reader with address ADD performs the command and replies.
		Yes	

3.2 Host-to-Reader Format

Table 5 shows the data frame format for host commands.

Table 5: 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 6: Command Field Descriptions

Field	Description
HDR	Defines the Protocol Transmission Mode.
ADD	Reader Adress informs which reader in a network configuration is concerned by the frame. May be absent according to the byte HDR value.
CMD	Command sent by the host to the reader.
CLEN	Length of the data field (0 to 255). Medio P013 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 3.6, "Cyclical Redundancy Check (CRC16)".

3.3 Reader-to-Host Formats

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

Table 7: 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 8: 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 9: Response Field Descriptions

Field	Description
AHDR	Confirms the Protocol Transmission Mode (HDR value).
ADD	Reader Adress informs which reader in a network configuration is concerned by the frame. May be absent according to the byte HDR value.
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 10: 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		

3.4 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 an error is detected by the reader, the corresponding error code is return in this field. For more information, refer to Section 6, "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.



Medio P013 TAGSYS RFID Tag Readers never use the Variable Length Response Frame.

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 3.6, "Cyclical Redundancy Check (CRC16)".

3.5 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, no more BLOCK fields will be sent by the reader. The transmission will end with the transmission of the CRC16 field if requested.

3.6 Cyclical Redundancy Check (CRC16)

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

1. For Host Command Frames:
   - CMD, CLEN, DATA1 , … , DATACLEN
2. For Reader Response Frame in Fixed Length Format:
   - ANS, ALEN, DATA1 , … , DATAALEN
3. For Reader Response Frame in Variable Length Format:
   - ANS, 0xFF, BLEN1, DATA1,1 , … , DATA1,BLEN1 , BLEN2, DATA2,1 , … , DATA2,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 7, "STXE-2 CRC Calculation Routine".

3.7 Baud Rate and Timeout

The baud Rate can be modified by the command *Set Baud Rate*. The reader takes its new baud rate value after a *Reset* command. The different value are 4800, 9600, 19200 et 38400 Bps.

The interchar timeout for the command frame is 10ms.

4 Command Set

The following STXE-2 compatible commands are used to communicate with TAGSYS read/write chips C210 (read only) and C240 Tags.

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.

4.1 General Reader Setting Commands

RF On 20
RF Off 21
Identify Reader....22
Get Reader Adress 23
Set Reader Adress....24
Set Baud Rate....25
Reset....26
Get IO 27
Set IO....28
Detect Chip Type 29
Set Standalone Mode 31
Get Standalone Mode Settings....36
Get Restriction Bytes 37

RF On	
Command Number	0x0C
Description	Turns the RF amplifier on
Data	None

Response

Data	None
Possible Error	None

RF Off	
Command Number	0x0D
Description	Turns the RF amplifier off
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 “LF11504”
Possible Error			None

Get Reader Adress	
Command Number	0x16
Description	Sends back the reader address.
Data	None

Response

Data	Parameter 1	1 byte	Reader Address
Possible Error			None

Set Reader Adress			
Command Number			0x16
Description			Set the Reader Adress
Data	Parameter 1	1 byte	Reader Adress Value

Response

Data	None
Possible Error	None



Reader address is changed after the reply.

Set Baud Rate

Command Number			0x06
Description			Sets the baud rates for the serial communication
Data	Parameter 1	1 byte	Baud Rates Setting

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Parameter 1							BR1	BR0

BR1	BR0	Baud Rates
0	0	4800 baud/s
0	1	9600 baud/s
1	0	19200 baud/s
1	1	38400 baud/s



The new value of the Baud Rates is applied after a Reset command.

Response

Data	None	
Possible Error	0x82	Bad parameters

Reset	
Command Number	0x0F
Description	Reset the microcontroler
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								Output State

Output State bit sets the status of the output.

0 : Output is inactive.

1 : Output is activated

Response

Data	None
Possible Error	None

Detect Chip Type

Command Number			0x00
Description			Permits to detect the chip type which are in the field (C210 or C240)
Data	Parameter 1	1 byte	Detection Mode

Parameters Description

The reader scans the field with the following priority order :

1. C210
2. C240

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

<table>
<tr><td colspan="5">Automatic configuration (without chip ID Reading)</td></tr>
<tr><td colspan="2">Data</td><td>Parameter 1</td><td>1 byte</td><td>0x07 C210 detected
0x08 C240 detected</td></tr>
<tr><td colspan="3" rowspan="2">Possible Errors</td><td>0xC4</td><td>No chip found</td></tr>
<tr><td>0x88</td><td>RF is turned off</td></tr>
<tr><td colspan="5">Automatic configuration (with chip ID Reading)</td></tr>
<tr><td colspan="2" rowspan="4">Data</td><td>Parameter 1</td><td>1 byte</td><td>0x07 C210 detected
0x08 C240 in any mode detected</td></tr>
<tr><td rowspan="3">Parameter 2</td><td></td><td>Chip ID (this depends on the type of chip)</td></tr>
<tr><td>8 bytes</td><td>ID C210</td></tr>
<tr><td>8 bytes</td><td>ID C240 (Block 0 Page 0)</td></tr>
<tr><td colspan="3" rowspan="2">Possible Errors</td><td>0xC4</td><td>No chip found</td></tr>
<tr><td>0x88</td><td>RF is turned off</td></tr>
</table>

Set Standalone Mode

Command Number			0x0E
Description			Initialise 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	"????????"



If Parameter 1 is greater than 0x05, 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 parameter 1 is 0x00, 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	
	ASCII Message Settings Byte 2					End of Message String	Chip Description String	Header String	STX/ETX Character
	Tag Scan Settings Byte 3							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 set the Baud Rate over the communication link for the Standalone Operating Mode. It could be :

Bit 1	Bit 0	Baud Rate (Bps)
0	0	4800
0	1	9600
1	0	19200
1	1	38400

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*

When 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 :

1. C210
2. C240



If *Tag Scan Settings* byte is null, 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 P013 chooses the best length of the ID depending on the chip type.

If the bit is set to 1, the Medio P013 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 chip	16 (Total memory)	2 to 16
C240 chip	16 (Block 0 Page 0)	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 P013 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 P013 output pin to be used as an output representative of the trigger activity. The trigger led capability can not 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 P013 output to be used as a output representative of the read activity. The reader led capability can not 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

Get Restriction Bytes	
Command Number	0x61
Description	Sends back the supported functions of the reader.
Data	None

Response

Data	Parameter 1	2 bytes	Firmware Version and Revision Number
	Parameter 2	6 bytes	Restriction Bytes
Possible Error			None

4.2 TAGSYS C210 Commands

4.2.1 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.

4.2.2 List of C210 - Specific Commands

Read C210 39

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

4.3 TAGSYS C240 Commands

4.3.1 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 11: 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 12 provides a bit-by-bit description of the page structure.

Table 12: 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 13: 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 14: 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 contain 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 can not program them to the value (0,1)

4.3.2 List of C240 - Specific Commands

Read Block C240 43
Set Password C240 44
Write Page C240 45

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
	0xCD	Can not read after write

5 List of Commands

5.1 List of General Reader Setting Commands

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RF Off 21
Identify Reader....22
Get Reader Adress 23
Set Reader Adress....24
Set Baud Rate....25
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Set IO....28
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5.2 List of C210 - Specific Commands

Read C210....39

5.3 List of C240 - Specific Commands

Read Block C240 43
Set Password C240 44
Write Page C240....45

6 Error Messages

6.1 Error Messages

The following table is a list of possible error codes.

Table 15: Error Codes

Code	Description
0x80	Unknown tag
0x82	Invalid number of pages and/or number of blocks
0x88	RF is turned off
0x8A	Unknown Stand-alone mode parameter
0x8B	Error while setting Stand-alone mode parameters
0x91	C240 password not set
0xA0	Unknown command
0xA4	Incorrect number of data
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
0xCD	Impossible read after write

7 STXE-2 CRC Calculation Routine

7.1 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

End of Document