

R-OEM-LF-M800
125 kHz OEM RFID Module
Installation and Operation Manual

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Issue 2.0
– 26. March 2019 –

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Printed in Germany

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1 Introduction

1.1 About the OEM RFID Module

The controller module allows the reading and writing of the main types of tags based on 125 kHz technology. It supports Hitag 1 and 2, EM4x02, EM 4x50.

Using an external antenna and a serial interface it can easily be connected to a host or a PC.

1.2 Available Interface Versions

Interface	Order code (old)	Order code (new)
TTS	R-OEM-LF-880-TTL	R-OEM-LF-M800-TTL
RS232	R-OEM-LF-880-232	R-OEM-LF-M800-232
RS485	R-OEM-LF-880-485	R-OEM-LF-M800-485

Important Notes

- The R-OEM-LF-M800-485 uses a different communication protocol and cannot be operated with the software described in this manual.
- The available operating voltages (5 Vdc or 12 Vdc) are not encoded in the order code. Please specify when ordering!

1.3 Mechanics

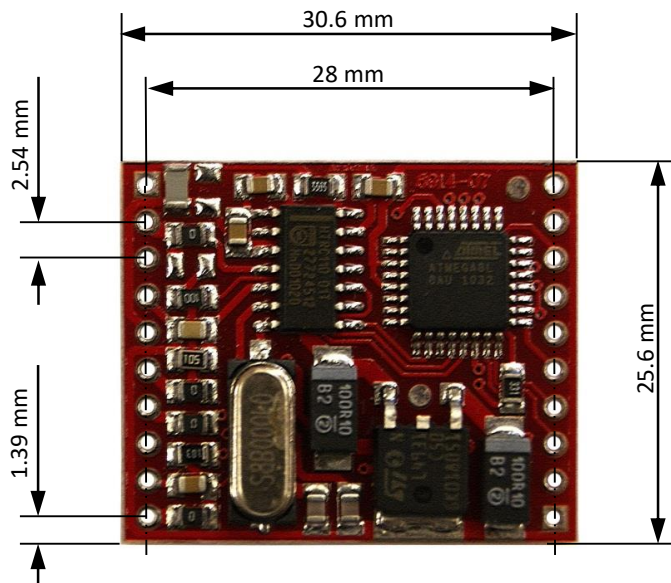


Figure 1 Dimensional Drawing of OEM Module, view onto upper side with RFID reader IC

1.4 Hardware Identification

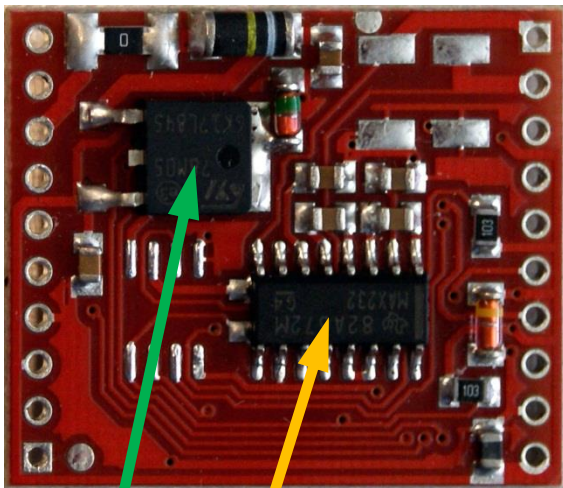
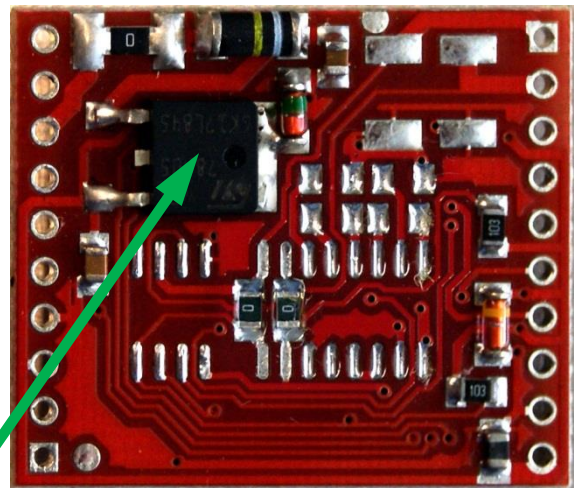


Figure 2 Version 12 Vdc, RS232



Version 12 Vdc, TTL

Voltage is determined by this IC (voltage regulator)

Interface (TTL or RS232) is determined by the interface IC (MAX232)

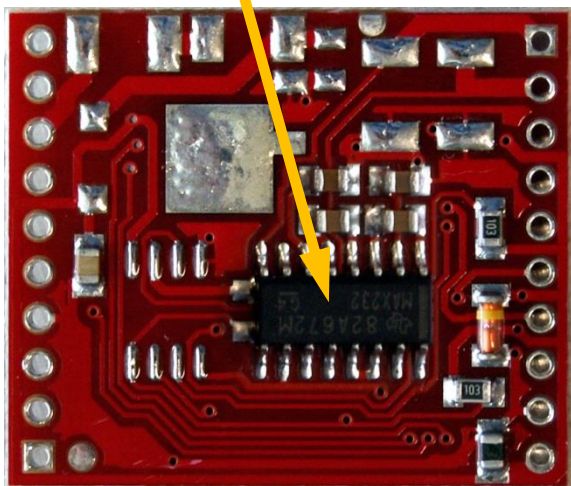
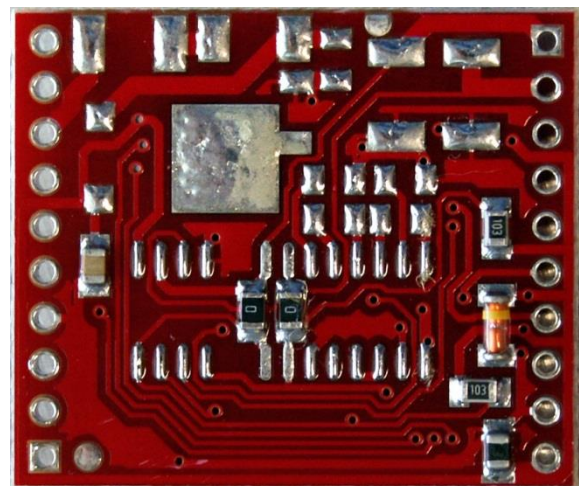


Figure 3 Version 5 Vdc, RS232



Version 5 Vdc, TTL

2 Electrical Installation

2.1 Connector Pinout

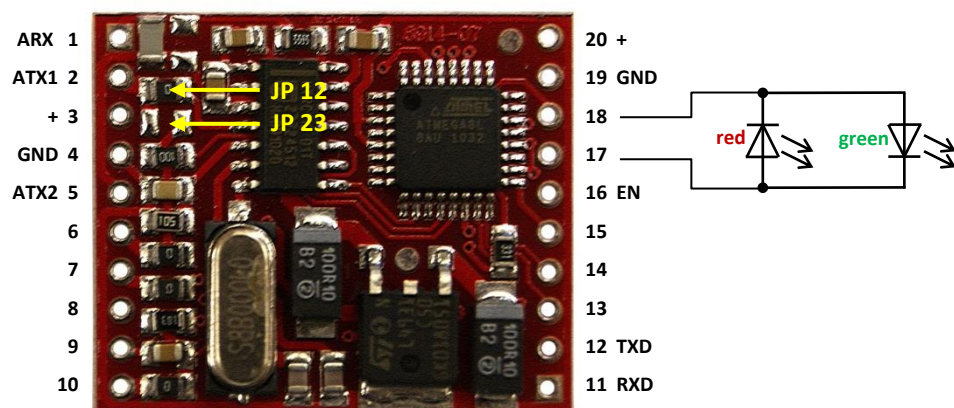


Figure 4 Position and Numbering of Connections

PIN	Name	Description
1	ARX	Antenna RX
2	ATX1	Antenna TX1
3	VDD	+5 Vdc (connect this only on the version for 5 Vdc)
4	GND	Ground
5	ATX2	Antenna TX2
6	GND	Ground
7	RSV	Reserved for future development, DO NOT CONNECT
8	RSV	+12 Vdc (connect this only on the version for 12 Vdc)
9	RSV	Reserved for future development, DO NOT CONNECT
10	RSV	Reserved for future development, DO NOT CONNECT

PIN	Name	Description
11	RXD	Receive Data from PC, data input (RS232 TX pin 3 of DB)
12	TXD	Transmit Data to PC, data output (RS232 RX pin 2 of DB)
13	RSV	Reserved for future development, DO NOT CONNECT
14	RSV	Reserved for future development, DO NOT CONNECT
15	RSV	Reserved for future development, DO NOT CONNECT
16	EN	Default Open or 5 V = Enable reader, 0 V = disable reader
17	LEDr	LED red
18	LEDg	LED green (reading received)
19	GND	Ground
20	VDD	+5 Vdc (connect this only on the version for 5 Vdc)

2.2 Antenna Set-Up

Joint	Name
J12	Dual antennas
J23	Single antenna

2.3 Electrical Characteristics

PINs	Name	Electrical	Description	Current (max)
1 2	ARX ATX1	Depends on calibration of the antenna	Antenna Input Antenna Output An inductance equal 470μH has to be connected between these pins 27 Ohm (Max).	200 mApp
5	ATS2		Antenna driver 2 (does not need external connection)	
11	RX	USART*	Transmission of data receipt to TTL, RS232 or RS485 device driver	
12	TX	USART*	Transmission of data receipt to TTL, RS232 or RS485 device driver	
16	EN	Enable	<ul style="list-style-type: none"> Open or 5V = Enable controller (default) 0V disable controller 	
17	LEDr	GND**	Activation LEDs Cathode (–) Led green/ Anode Led red	25 mA
18	LEDg	LED**	Activation LEDs anode led green/ cathode led red Internally connected with 330 Ohms	25 mA
4, 19	GND	0 V	Supply 0 Vdc	
3, 20	VDD	+5 Vdc	Supply +5 Vdc (connect this only on the version for 5 Vdc)	150 mA
8	VDD	+ 12Vdc	Supply +12 Vdc (connect this only on the version for 12 Vdc)	150 mA
7, 8, 9, 10, 13, 14, 15	N.C.	—	Unused, DO NOT CONNECT	

* Universal Synchronous Asynchronous Receiver Transmitter

** The controller is disposed to activate two LEDs (red/green) in anti-parallel connection what permits to activate one at a time. Besides, the green led is activated automatically whenever a noted badge is identified.

3 Antenna Design

3.1 Coil Antenna

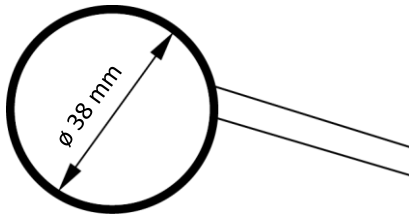


Figure 5 Example of Coil Antenna

Coil of \varnothing 38 mm, 70 turns of 0.22 22/0,355 copper wire, connect to PIN 1 and 2 of reader module

Electrical Data of the Coil Antenna

Inductivity: 390 μ H

Quality: $Q < 15$

Use serial resistor to reduce too high Q and performance. Typical value range is 5 – 100 Ohms.

Technical Date of OEM Module with Coil Antenna

Communication range: 80 mm (4x02 or 4x50 ISO Card)

Power consumption: 30 mA

3.2 PCB Antenna

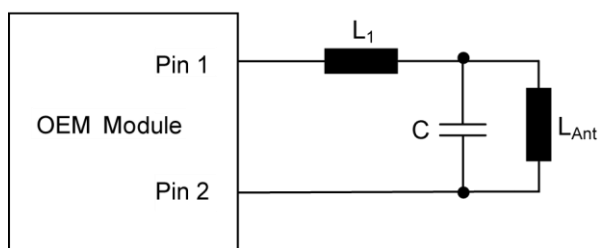


Figure 6 Wiring of PCB Antenna

L1: 470 μ H (core inductor)

LANT: PCB, 6-40 turns, 0.2 -1 mm track width, 2000 - 4000 mm² area

C: capacitor tuned to resonance with LANT (2.2 ... 330 nF)

Operating distance: 60-80 mm (4x50 or 4x02 ISO Card)

Power consumption: 150mA

Example 1

PCB Antenna 64 × 64 mm, 6 turns, 1 mm track width, C = 330 nF COG, L1 = 470 μ H, communication range 70 mm

Example 2

PCB Antenna 84 × 40 mm, 34 turns, 0.2 mm track width, C = 3.6 nF polypropylene 63 V, L1 = 470 μ H

Operating distance: 70 mm

3.3 Inductor Antenna

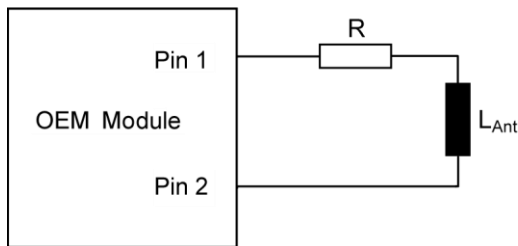


Figure 7 Wiring of Inductor Antenna

R: 5.6 Ohms
 LANT: 470 μ H (core inductor)
 Communication range: 45-50 mm (4x02 or 4x50 ISO Card)
 Power consumption: 140 mA

Example 1

LANT high frequency inductor 470 μ H, available at RS Components, part no. 308-9012

3.4 Mid-Range Coil Antenna

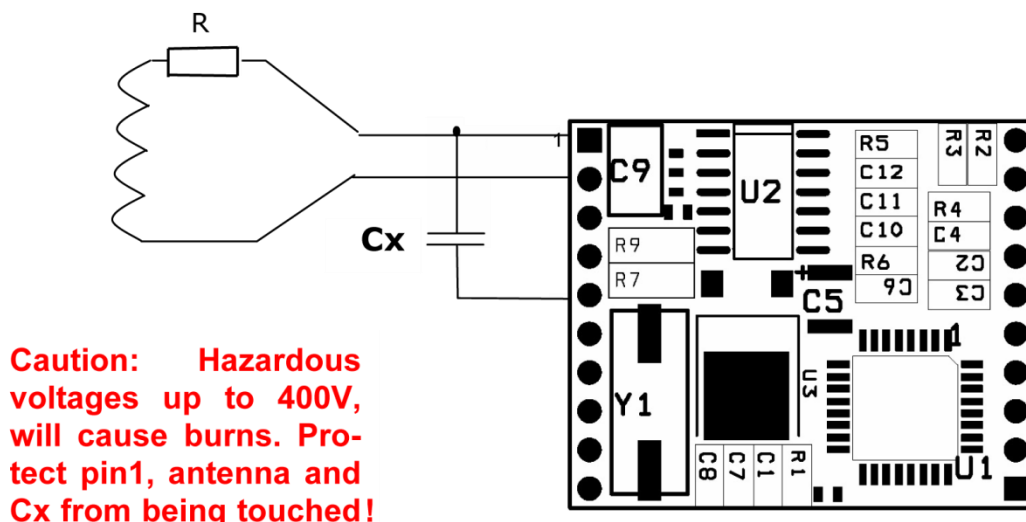


Figure 8 Wiring for Mid-Range Operation

Important Safety Notes

The driver output of the reader module is specified with 200 mApp continuously and 400 mApp pulsed. This results in voltages at Cx (3.3 nF) and antenna of 155 Vpp continuously or 310 Vpp pulsed. Make sure, that humans are protected from those voltages and that the module does not get overloaded. The voltage can be lowered using detuned antennas or by putting an resistor in series (R).

- Hazardous voltages up to 400V, will cause burns.
- Protect pin1, antenna and Cx from being touched!
- Cx = WIMA FKP1 3.3 nF, 630 VDC Polypropylene 5 %
- C09 must be removed

Wire antenna 180 \times 180 mm, 28 turns, 0.355 mm copper wire, L = 465 μ H

Communication range: 200 mm (4x02 or 4x50 ISO Card)

Power consumption: 200 mA

4 Communication Protocol

Important Note: The R-OEM-LF-M800-485 uses a different communication protocol and cannot be operated with the software described in this manual.

4.1 Preface

The baud rate of the serial is fixed and equal 9600; the number of bits per character is always 8, there is no parity and 1 bit of stop is designated. The commands can also be issued using a terminal program. The data is transmitted as ASCII characters that can be displayed on any terminal program (e.g. HyperTerminal).

4.1.1 Syntax

In this document all control characters are written in bold-style (ex. CR corresponds on booting in serial to the value 13dec or rather 0Dhex). The constant alphanumerical strings are indicated between quotation marks (ex. "3"). The variable parameters are concluded between the characters < e >, the signification of the parameters will be specified after the description of each command

4.1.2 Structure of the Commands

This protocol has been developed for a very simple administration of the communication. Generally the commands and the answers are forwarded as single ASCII characters and the controller adds CR + LF (Carriage Return + Line Feed) to each answer.

Example

"X" <Data>

CR character ASCII 13dec (0D hex) for Carriage Return.

LF character ASCII 10dec (0D hex) for Line Feed.

4.1.3 Commands

In the following table are specified all the commands that are accepted from the controller. On each command the controller responds to the host apart from explicit indicated cases. The activation of the green led indicates the correct execution of a reading or writing command.

Command Table

CMD	Description
'x' or 'z'	Reset
'v'	Version request
'c'	Reading continues
'l'	Login
'r'	Read page
'w'	Write page
'd'	Denomination of LED
'p'	Antenna power off

4.1.4 Error codes

The following table shows all error messages returned from the controller.

Code	Description
'?'	Invalid command
'N'	Command not executed
'S'	Continuous read stopped

4.2 Command Descriptions

4.2.1 Reset "x" or "z"

This command executes a reset software. The forwarding of this command causes a reset of the controller and of possible transponders in the reading-zone.

If the command has been received correctly, the controller answers as following:

- "MULTITAG-125 a.01" CR LF and enters into the continuous read mode.

4.2.2 Get Version "v"

This command requests the currently implemented firmware from the controller.

If the command has been received correctly, the controller answers as following:

- "MULTITAG-125 a.01" CR LF

4.2.3 Continuous read (default function mode after power on) "c"

Following this command, the controller reads and forwards continuously the serial number of the transponder that remains in the reading zone. This command can be interrupted by forwarding any character to the controller. The reader supports different types of tags even if only one type of tag at a time can be identified.

In this reading mode the controller effects a fast scanning of all the designated tags and forwards the serial number of the identified tag via serial-line.

If the command has been received correctly, the controller answers as following:

- <IdType> <SerialNumber>

<IdType>

One-digit character string identifies the single type of the tag. Can be used in order to determine the type of the tag presented to the reader and control tag specific commands. The different types of supported transponders have UID in different lengths, for example the tags EM4x02 use an UID of 5 bytes whereas Hitag 1 and Hitag 2 use only 4 bytes.

The following table shows a list of specified IdType of all the supported tags

IDType	Designation	Length UID
"U"	EM 4x02, 5551 (Q5)/5567 & read-only emulation	5 bytes
"T"	EM 4x50, Titan	4 bytes
"Z"	ISO FDXB	8 bytes
"h"	HITAG 1, Hitag S	4 bytes
"H"	HITAG 2	4 bytes

<SerialNumber>

n-digit alphanumerical string.

4.2.4 Login "l" <Password>

This command is necessary for the authentication for tags of the type EM 4x50 and HITAG 2.

For the transponder EM 4x50 the command signification of the Login is the same as described on the datasheet of this transponder: it is necessary to forward the Login-command followed by the Password in order to have access to the protected memory area. For example it is necessary to forward this command in order to execute the scripture of the password onto the transponder of the type EM4X50. Keep in mind that, as described in the respective datasheet, the password on EM4X50 is the Long word n°00 and that it cannot be read but only written if it (the current) is known.

For the transponder HITAG2 it is necessary to know the password before any access in reading or writing is possible. In both cases the login is affected automatically with the default values based on the ultimate identified type of tag.

<Password> 4-bytes alphanumerical string represents the code used for the login

If the command has been received correctly, the controller answers as following:

- "L" CR LF In case of successfully effected login
or
- "N" CR LF In case of Error. Password wrong or tag removed from the reading zone

4.2.5 Read page "r" <PageAddr>

This command allows the reading of a block of data of a tag. The dimension of the data returned by an answer depends on the type of tag used. The valid values of the number of the requested page depend also on the type of tag in use. The reading command of page 00 in case of tags of the type EM 4x02 and ISO FDXB returns the serial number of the tag.

<PageAddr> 1-byte numerical string represents the number of the page to read

If the command has been received correctly, the controller answers as following:

- <IdTipo><SerialNumber> CR LF In case of correctly received reading
or
- "N" CR LF In case of Error or tag removed from the reading zone

4.2.6 Write page "w" <PageAddr> <Data>

This command allows the writing of a block of data of a tag. After typing in the data, they will be automatically re-read in order to verify the correct writing. Not all types of tags support the writing.

- <PageAddr> 1-byte numerical string represents the number of the page to write
- <Data> n-byte alphanumerical string represents the data to write

Tag Type	Bytes	Description
Hitag 1	4	48 pages of 4 byte each
Hitag 2	4	8 pages of 4 byte each
EM 4x05	4	32 pages of 4 byte each
EM 4x02	-	Not supported
ISO FDXB	-	Not supported

If the command has been received correctly, the controller answers as following:

- "w" <Data> CR LF in case of successfully effected writing
or
- "N" CR LF in case of error.
Writing failed due to bad transmission conditions or false dimensions of <Data> relating to the characteristics of the tag.

Example

w0412345678 CR LF writes the data 12345678 on page 04 of the tag

4.2.7 Set LED “d” <StatusLED>

This command allows the administration of the led. The user is able to set the state of the LED manually.

<StatusLED> 1-byte alphanumerical string represents the parameter of the activation of the LED

Command	Description
“dg”	Activates the green led and deactivates the red LED
“dr”	Activates the red led and deactivates the green LED
“dn”	Deactivates both LEDs

If the command has been received correctly, the controller answers as following:

- “DG” CR LF on the command “dg”
- “DR” CR LF on the command “dr”
- “DN” CR LF on the command “dn”

Example

dr Answer “DR CR LF” and activation of the red LED

4.2.8 ANTENNA power off “p”

This command switches off the antenna power. The controller enters the stand-by mode, the consumption of the controller is reduced down to app. 40 mA. All the tags presented in the area of the antenna are shut off and reset.

If the pin 16 (Enable) is set to logic low (OV) the entire controller is in Stand-by. In this function mode the antenna is switched off and all serial commandos are ignored.

In order to exit this mode one has to change the pin 16 (Enable) from logic low or set it to logic high (which means: Enable=Open or +5V => Enable controller).

After carrying out this operation the controller starts to work in function mode “Continuous read”.

If the command has been received correctly, the controller answers as following:

- “P” CR LF confirms the acceptance of the command

Power on is only performed sending a reset command (“x” or “z”)

Example

p Answer “P” CR LF and the controller passes into stand-by mode

5 Testing the Module with the Demo-Software

5.1 Installing the Demo-Software

Before starting the program you have to make sure, that the module is correctly connected to the PC. After insertion of the Demo-Kit CD a new window will be opened automatically. Go to the menu item .Software. on the left side of the window. This page allows you to install the software by simply clicking .Installation.. When starting the installation a window will appear and you will be asked to open or save the file. Click open to proceed.

Install the program according to the instructions of the installation software. After successfully completed installation you can start to run the program (Start => . Programs => Cont125).

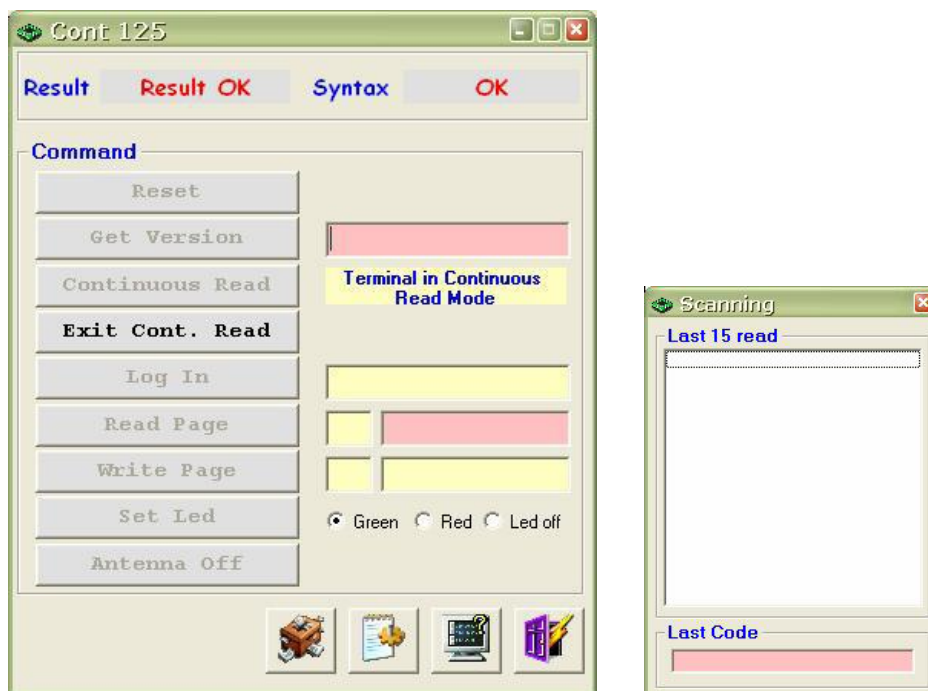


Figure 9 Main Program Window with additional Scanning Dialog

5.2 Reading a transponder

Starting the program, the controller is in .Continuous read. mode. Approximating the badge to the module the .scanning. window will show the last 15 read codes. To exit from the .Continuous read. mode you need to press .Exit Cont. Read.. After this you are able to use all the buttons of the program. (The reader does not accept any command if it is in continuous read mode)

5.3 Description of the command buttons

Reset

This command executes a reset of the controller. Pressing this button a reset of the controller and of possible transponders in the reading-zone is caused. After successful reset, following message will appear in the .Scanning. window:

- .MULTITag-125 a.01. and the module enters into the continuous reading mode.

Get Version

This command requests the currently implemented firmware from the controller.

Following message will appear:

- .MULTITAG-125 a.01.

Continuous Read

Following this command, the controller reads and shows continuously the serial number of the transponder that remains in the reading zone. The reader supports different types of tags even if only one type of tag at a time can be read.

In the continuous reading mode the controller effects a fast scanning of all the designated tags and forwards the serial number of the identified tag via serial-line.

Exit Cont. Read

This button allows you to exit the continuous reading mode.

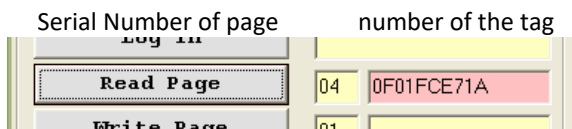
Log In

This command is necessary for the authentication for tags of the type EM 4x50 and HITAG 2. For the transponder EM 4x50 the command signification of the Login is the same as described on the datasheet of this transponder: it is necessary to forward the Login-command followed by the Password in order to have access to the protected memory area. For example it is necessary to forward this command in order to execute the scripture of the password onto the transponder of the type EM4X50. Keep in mind that, as described in the respective datasheet, the Password on EM4X50 is the Long Word n°00 and that it cannot be read but only written if it (the current) is known. For the transponder HITAG2 it is necessary to know the password before any access in reading or writing is possible.

In both cases the login is effected automatically with the default values based on the ultimate identified type of tag.

Read page

This command allows the reading of a block of data of a tag (single reading). The dimension of the data returned by an answer depends on the type of tag used. Enter the number of page you would like to read (in hex), approximate the badge and click .Read Page.. The valid values of the number of the requested page depend also on the type of tag in use. The reading command of page 00 in case of tags of the type EM 4x02 and ISO FDXB returns the serial number of the tag.



Write page

This command allows the writing of a block of data of a tag. After typing in the data, they will be automatically reread in order to verify the correct writing. Not all types of tags support the writing. The controller uses the type of tag, that has recently been read in the continuous reading mode. Enter the number of page and the code you would like to write and consequently press .Write page..





Set LED

This command allows the administration of the leds. The user is able to set the state of the led manually by activating the desired state and consequently pressing .Set Led..

Antenna off

This command switches off the antenna power. The controller enters the stand-by mode, the consumption of the controller is reduced. All the tags presented in the area of the antenna are shut off and reset. By pressing .Reset. or .Continuous Read., the module works again in the Continuous reading mode.

5.4 Description of the Menu Buttons

PINs	Name	Description
	SCANNING	Open and close the .Scanning. window
	COMMUNICATION MONITOR	This button opens a new window which shows the transactions carried out by the module and the communication with the PC.
	EXIT	Allows to exit the program.
	SETUP	Opens the dialog to configure the Demo-Software.



- Choose the Com Port of your cable connection.
- “Serials Research” updates the list of all the ports, available on the respective PC.
- “Quit” allows to exit the program.
- “Save” saves the changes carried out in this window.
- Translate code outputs the Bytes bit-reversed, this works only for read-only tag types, e.g. EM4100

5.4.1 Example for Translate Code

UID in hex values: 803092D1C2

UID in bit values: 1000.0000.0011.0000.1001.0010.1101.0001.1100.0010

Translated

UID in hex values: 010C498B43 (translated)

UID in bit values: 0000.0001.0000.1100.0100.1001.1000.1011.0100.0011

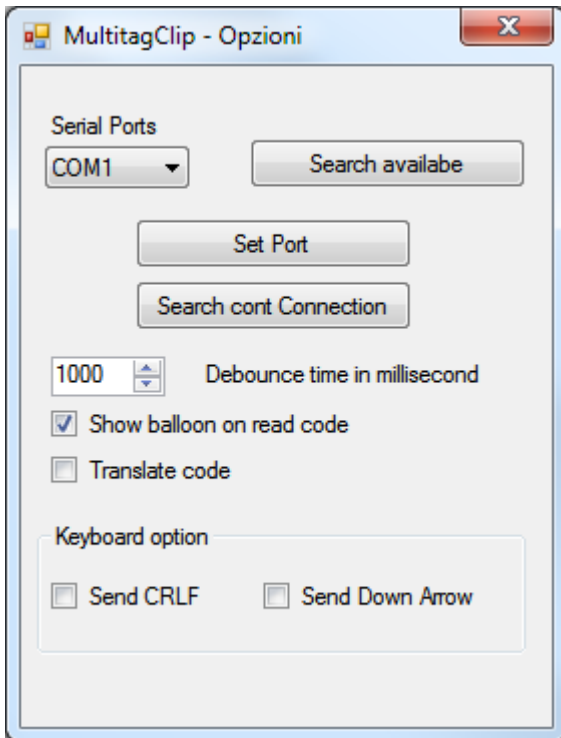
6 Keyboard Emulation

6.1 Installation

Install the emulation software by starting this executable:

Desktop_Stick_OEM_Reader_LF\Keyboard Emulation for Windows\setup.exe

6.2 Operation



1. Select the serial com port installed with the RFID reader. If no serial port is shown chose "Search available".

2. Select desired actions when auto-reading a tag, e.g.:

- "Show balloon on read code". During standard operation this may disturb, but for a first operation check this is a helpful option. The balloon with the tag's UID is shown above the systray.
- Select "Keyboard options" to simulate confirming the entered code and jump to the next position for further entries.

3. Confirm the selected serial port with "Set Port".

Now the keyboard emulation is operating.

"Search cont Connection" will produce an error message without a tag on the reader.

7 Tag Information

7.1 EM4100 (64 bits), EM4102 (64 bits), EM4200 (128 bits)

This are read-only chip types, so you can only retrieve a UID.

7.2 EM4450/4550 (1 kbits)

Memory blocks (pages) of 32 bits/4 Bytes.

Block #	Hex Address	Access	Description
1	00	Read-only	Password, default 00000000h
2	01	Read-only	Protection Word
3	02	Read-only	Control Word
4	03	Read/write	User Memory
...	User Memory
31	1F	Read/write	User Memory
32	20	Read-only	Device Serial Number (UID)
33	21	Read-only	Device Identification

7.3 Hitag S 2048 (2 kbits, 256 Bytes)

Memory blocks (pages) of 32 bits/4 Bytes.

Block #	Hex Address	Access	Description
1	00	Read-only	UID
2	01	Read/write	Configuration Word, Hitag S 2048: CA0000AA, Hitag S 256: C90000AA
3	02	Read/write	Default value: 48544F4E
4	03	Read/write	Default value: 4D494B52
5	04	Read/write	User Memory
6	05	Read/write	User Memory
7	06	Read/write	User Memory
8	07	Read/write	User Memory, Limit for Hitag S 256 (HTSICH56)
9	08	Read/write	User Memory
...	User Memory
64	3F	Read/write	User Memory, Limit for Hitag S 2048 (HTSICH48)

7.4 Hitag 1 (2 kbits, 256 Bytes)

Memory blocks (pages) of 32 bits/4 Bytes.

Block #	Hex Address	Access	Description
1	00	Read-only	UID
2	01	Read/write	Configuration Word, Hitag 1: FF77AA00
3	02	No access	—
...	...	No access	—
16	0F	No access	—
17	10	Read/write	User Memory
...	User Memory
64	3F	Read/write	User Memory

7.5 Hitag 2 (256 bits, 32 Bytes)

Memory blocks (pages) of 32 bits/4 Bytes.

Block #	Hex Address	Access	Description
1	00	Read-only	UID
2	01	Read/write	Password RWD, default 4D494B52h
3	02	No access	—
4	03	Read/write	Configuration Word, password protected, default PW: 0000 0000 h
5	04	Read/write	User Memory / 64 bits read-only memory layout for read-only emulation
6	05	Read/write	User Memory / 64 bits read-only memory layout for read-only emulation
7	06	Read/write	User Memory
8	07	Read/write	User Memory

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