

MODEL:

# AFL2-EM-RFID-KIT

EM RFID reader, 125K Hz, w/o LED indicator, for  
AFL2-W07A/08A/10A/W10A/12A/15A/W15B/17A/W19A Series,  
IEI Assembly Only, R10

## User Manual

# Revision

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Date	Version	Changes
17 April, 2014	1.00	Initial release

# Copyright

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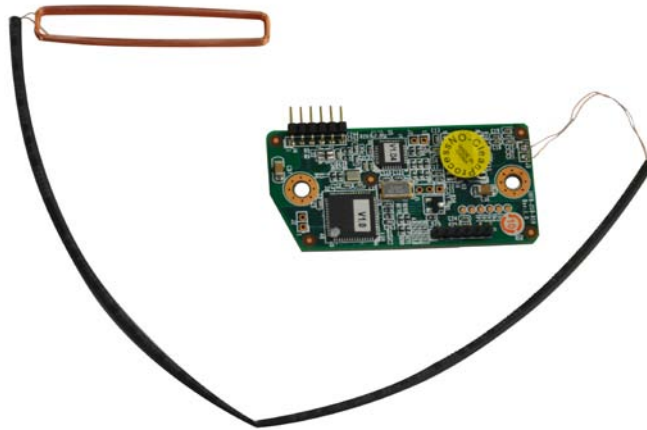
1

# Introduction

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## 1.1 AFL2-EM-RFID-KIT01 Overview



**Figure 1-1: AFL2-EM-RFID-KIT01**

The AFL2-EM-RFID-KIT01 is an RFID reader for Low Frequency (LF) RFID systems and is compliant with ISO 11784 and ISO 11785 industrial standards. The AFL2-EM-RFID-KIT01 also comes with a utility and a software development kit (SDK) for configuring reader module and writing/reading tags.

### 1.1.1 AFL2-EM-RFID-KIT01 Features

The AFL2-EM-RFID-KIT01 has the following features

- 125 KHz radio frequency industrial RFID reading module
- Supports standard protocol ISO 11784 and ISO 11785
- Supports the following EM transponders:
  - EM4100
  - EM4450
  - EM4305
- Single power supply and low power consumption
- Keyboard data entry
- Various interfaces to main system
  - 115.2 Kbps maximum serial communication speeds
  - USB

## AFL2-EM-RFID-KIT01

## 1.2 Technical Specifications

The specifications for the Intel based embedded systems are listed below.

	AFL2-EM-RFID-KIT01
Support Protocol	ISO 11784, ISO 11785 (EM4305/EM4450 R/W)
RF Frequency	125 KHz
Interface	RS-232 serial port or USB
UART	RS-232
USB	USB 2.0 full speed with 3.3 V or 5 V logic levels
RFID ASIC	EM4095
Processor	AT90USB162 and ATMEGA64
Power Consumption	5V @ 150 mA
Storage Temperature	-10°C ~ 70°C
Operating Temperature	0°C ~ 50°C
Operating Humidity	10% ~ 85% RH
Driver Support	Windows XP Windows XPE

**Table 1-1: Technical Specifications**

Chapter

2

# Connectors

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AFL2-EM-RFID-KIT01

2.1 AFL2-EM-RFID-KIT01 RFID Reader

The following sections describe the relevant components and jumpers on the RFID reader module.

2.1.1 AFL2-EM-RFID-KIT01 Layout

Figure 2-1 shows the on-board peripheral connectors and rear panel LEDs.

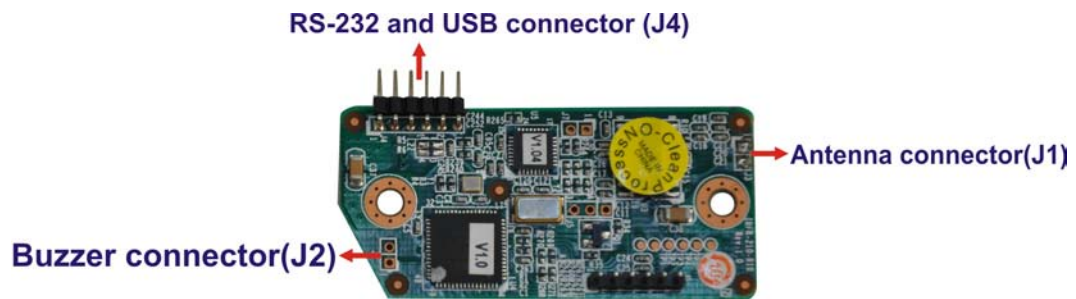


Figure 2-1: Connector and Jumper Locations

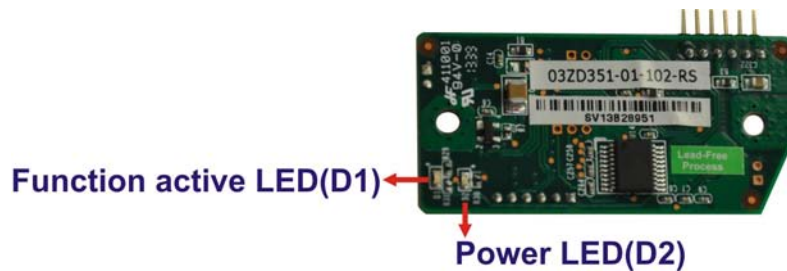


Figure 2-2: LED Locations (Solder Side)

2.1.2 Peripheral Interface Connectors

Table 2-1 shows a list of the peripheral interface connectors on the AFL2-EM-RFID-KIT01. Detailed descriptions of these connectors can be found below.

Connector	Type	Label
Antenna connector	2-pin	J3
Buzzer connector	2-pin	J2
RS-232 and USB connector	6-pin header	J4

Connector	Type	Label
Function active LED (solder side)	LED	D1
Power LED (solder side)	LED	D2

**Table 2-1: Peripheral Interface Connectors and Indicators**

## 2.2 Internal Peripheral Connectors

This section has complete descriptions of all the internal peripheral connectors on the AFL2-EM-RFID-KIT01.

### 2.2.1 Antenna Connector

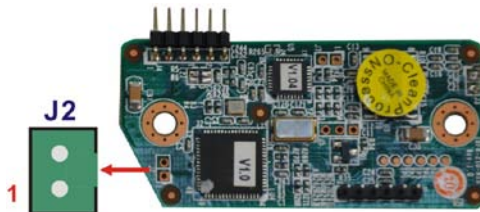
- CN Label: J3
- CN Type: 2-pin
- CN Location: See **Figure 2-1**

The Antenna Connector connects to the 125 KHz antenna.

### 2.2.2 Buzzer Connector

- CN Label: J2
- CN Type: 2-pin
- CN Location: See **Figure 2-3**
- CN Pinouts: See **Table 2-2**

The 2-pin buzzer connector is connected to a buzzer.



**Figure 2-3: Buzzer Connector Location**

AFL2-EM-RFID-KIT01

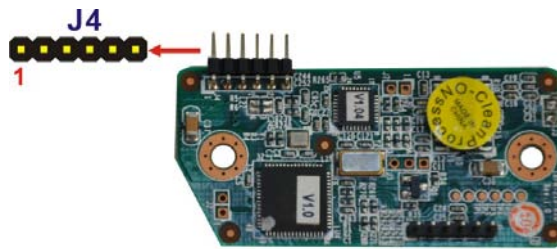
Pin No.	Description
1	GND
2	MIC+

**Table 2-2: Buzzer Connector Pinouts**

2.2.3 RS-232 and USB Connector

- CN Label: J4
- CN Type: 6-pin header
- CN Location: See **Figure 2-4**
- CN Pinouts: See **Table 2-3**

The 6-pin RS-232 and USB connector is connected to a RS-232 and USB Y cable.



**Figure 2-4: RS-232 and USB Connector Locations**

Pin No.	Description
1	GND
2	USBDM
3	USBDP
4	+5V
5	RXD
6	TXD

**Table 2-3: RS-232 and USB Connector Pinouts**

#### 2.2.4 LED Indicators

CN Label: D1 and D2 (Solder Side)

CN Type: On-board LED

There are two LED indicators located on the solder side of the AFL2-EM-RFID-KIT01 module to indicate the power status and activation status.

Chapter

3

# Unpacking

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### 3.1 Anti-static Precautions

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#### WARNING!

Static electricity can destroy certain electronics. Make sure to follow the ESD precautions to prevent damage to the product, and injury to the user.

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Electrostatic discharge (ESD) can cause serious damage to electronic components, including the AFL2-EM-RFID-KIT01-R10. Dry climates are especially susceptible to ESD. It is therefore critical that whenever the AFL2-EM-RFID-KIT01-R10 or any other electrical component is handled, the following anti-static precautions are strictly adhered to.

- **Wear an anti-static wristband:** Wearing a simple anti-static wristband can help to prevent ESD from damaging the board.
- **Self-grounding:** Touch any grounded conducting material before handling the board. During the time the board is handled, frequently touch any conducting materials that are connected to the ground.
- **Use an anti-static pad:** When configuring the AFL2-EM-RFID-KIT01-R10, place it on an anti-static pad. This reduces the possibility of ESD damaging the AFL2-EM-RFID-KIT01-R10.

### 3.2 Packing List

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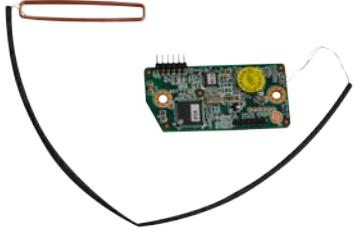

#### NOTE:

If any of the components listed in the checklist below are missing, do not proceed with the installation. Contact the IEI reseller or vendor the AFL2-EM-RFID-KIT01-R10 was purchased from or contact an IEI sales representative directly by sending an email to [sales@iei.com.tw](mailto:sales@iei.com.tw).

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The AFL2-EM-RFID-KIT01-R10 is shipped with the following components:

AFL2-EM-RFID-KIT01

Quantity	Item	Image
1	AFL2-EM-RFID-KIT01-R10	
1	Utility CD	

**Table 3-1: Package List Contents**

Chapter

4

# Software Application

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## 4.1 Chapter Overview

This chapter describes the use of the IRFR-210 module control program. The IRFD-210 Tools is a program providing end user interface to help the user to communicate with 125 kHz operating frequency transponders using IRFD-210.

The IRFD-210 Tools provides almost complete command set to control the IRFD-210 reader and communicate with the following EM transponders:

- EM4100
- EM4450
- EM4305

## 4.2 System Requirement

IEI IRFD-210 Tools can be installed in the following OS:

- Windows 2000
- Windows XP

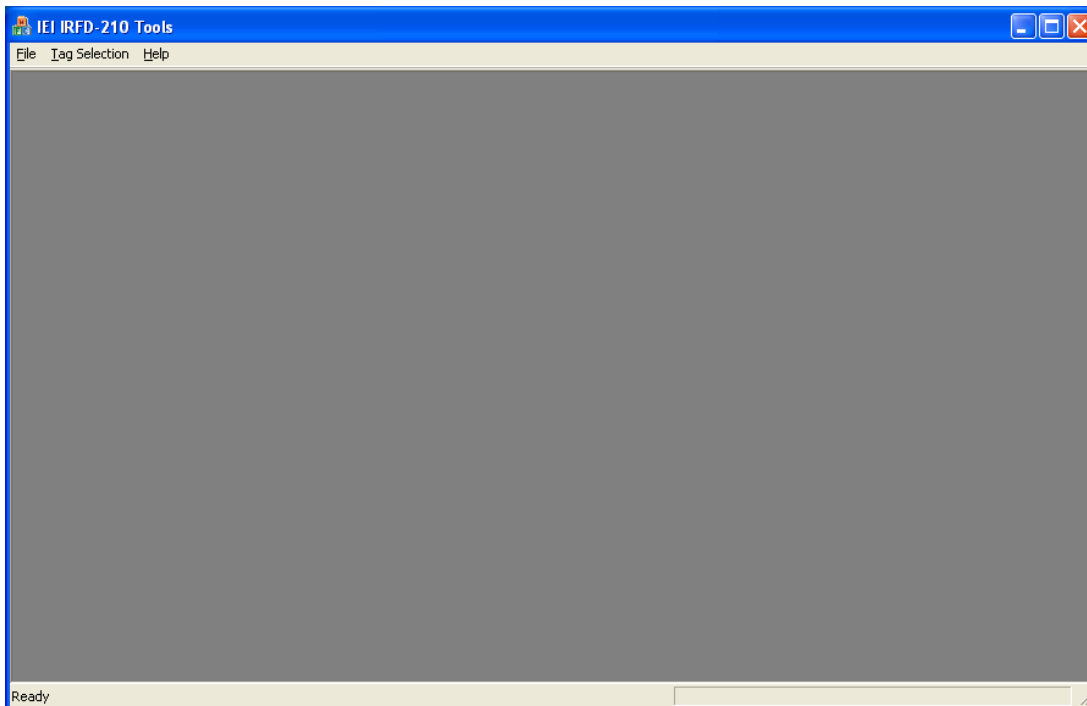
## 4.3 IEI IRFD-210 Tool Support Library

- VC ++
- Visual Base .Net

## 4.4 Software Interface

The IRFD-210 Tools window is shown following. There are two main functions on the tool bar, each contains several function commands:

- **File**
  - Open Device: open IRFD-210
  - Exit: exit IRFD-210 Tools
- **Tag Selection**
  - EM4100
  - EM4450
  - EM4305



**Figure 4-1: Software Interface**

#### 4.4.1 Open IRFD-210

To start using the IEI IRFD-210 Tools with the IRFD-210 reader, follow the steps below.

**Step 1:** Click **Open Device** from the **File** drop-down menu.

**Step 2:** The following window appears. Select a device type (USB or RS-232). Select a connected COM port (COM1 -- COM255).



**Figure 4-2: Open IRFD-210**

## AFL2-EM-RFID-KIT01

## 4.5 EM4100

The IRFD-210 is capable of reading EM4100 tag UID. To read EM4100 tag, follow the steps below.

- Step 1:** Click **EM4100** from the list of the **Tag Selection** tool.
- Step 2:** Place a single EM4100 tag on the IRFD-210.
- Step 3:** Click the **IRFR\_4100ID** button.
- Step 4:** To continuously read EM4100 UID, click the **Start** button.

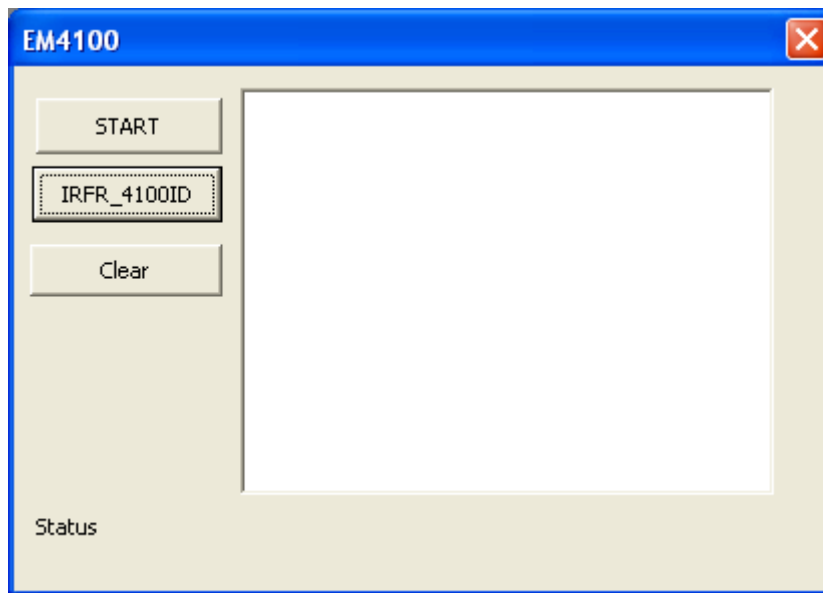


Figure 4-3: EM4100

## 4.6 EM4450

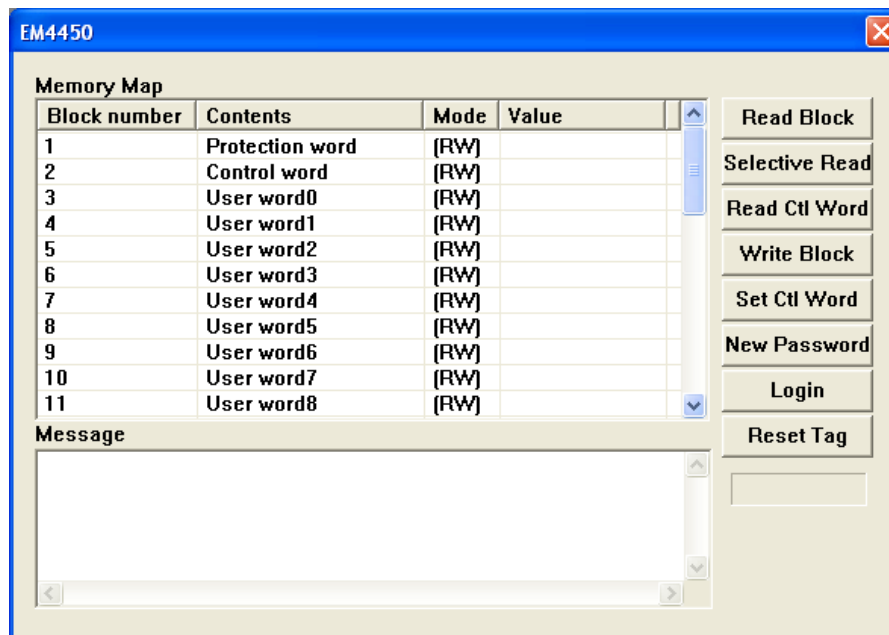


Figure 4-4: EM4450

### 4.6.1 Setup

**Step 1:** Click **EM4450** from the list of the **Tag Selection** tool.

**Step 2:** Place a single EM4450 tag on the IRFD-210.

### 4.6.2 Read Block

To read a single block, the user should:

**Step 1:** Select one block from the Memory Map list.

**Step 2:** Click the **Read Block** button.

### 4.6.3 Write Block

To write a block, the user should:

**Step 1:** Select one block from the Memory Map list.

## AFL2-EM-RFID-KIT01

- Step 2: Click the **Write Block** button.
- Step 3: Enter a value for the new block.
- Step 4: Click the **OK** button.

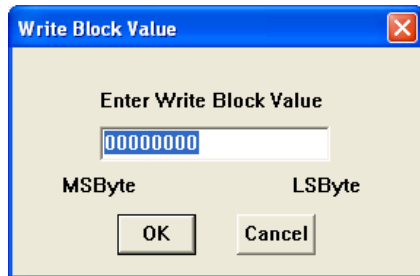


Figure 4-5: Write Block Value



**NOTE:**

The Write Block command can only be used for reading or writing (RW) blocks.



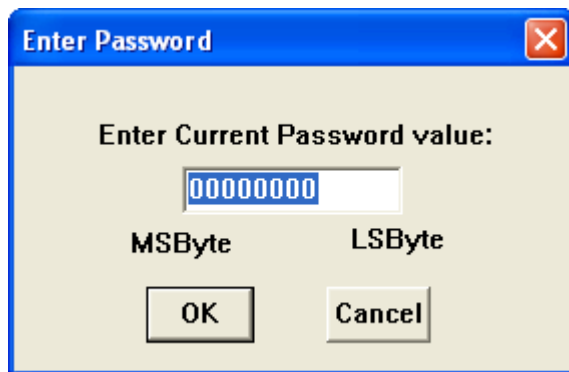
#### 4.6.4 Login

The Login command is used to access protected memory areas. The login status is visible in the Login Status window under the Login command button. To login, the user should:

**Step 1:** Click the **Login** button.

**Step 2:** Enter a current password value.

**Step 3:** Click the **OK** button.



**Figure 4-6: Login – Enter Password**

#### 4.6.5 Selective Read

The Selective Read command is used to read blocks that are defined between First Block Read value and Last Block Read value.

**Step 1:** Click the **Selective Read** button.

**Step 2:** Enter the First and Last Block values. Possible values are:  $1 \leq \text{First Block value} \leq \text{Last Block value} \leq 33$ .

**Step 3:** Click the **OK** button.

## AFL2-EM-RFID-KIT01

## 4.6.6 Set Control Word

The Set Control Word command is used to set the Control Word located in the Block 2. When clicking the Set Control Word button, the actual content of the Control Word is read first. To set control word, the user should:

**Step 1:** Click the **Set Control Word** button.

**Step 2:** The Set Control Word window appears. Change the settings of the Control Word.

**Step 3:** Click the **Set** button to exit.

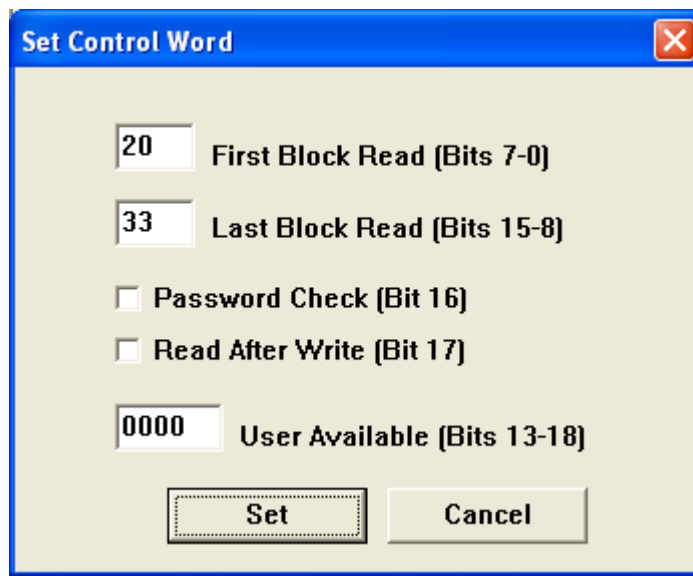


Figure 4-7: Set Control Word

## 4.6.7 Read Control Word

The Read Control Word command reads values of the First Block Read and Last Block Read in the Control Word and then reads blocks which are between these values.

#### 4.6.8 New Password

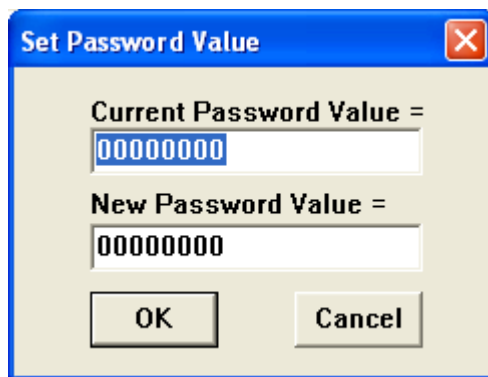
The New Password command is used to change the password. To change the password, the user should:

**Step 1:** Click the **New Password** button.

**Step 2:** Enter the current password.

**Step 3:** Enter a new password.

**Step 4:** Click the **OK** button.



**Figure 4-8: Set Password**

#### 4.6.9 Reset Tag

The Reset Tag command returns tag from any mode to the Standard Read Mode in which the tag sends data continuously, word by word from the memory section defined between the First Block Read and Last Block Read in the Control Word.

## 4.7 EM4305

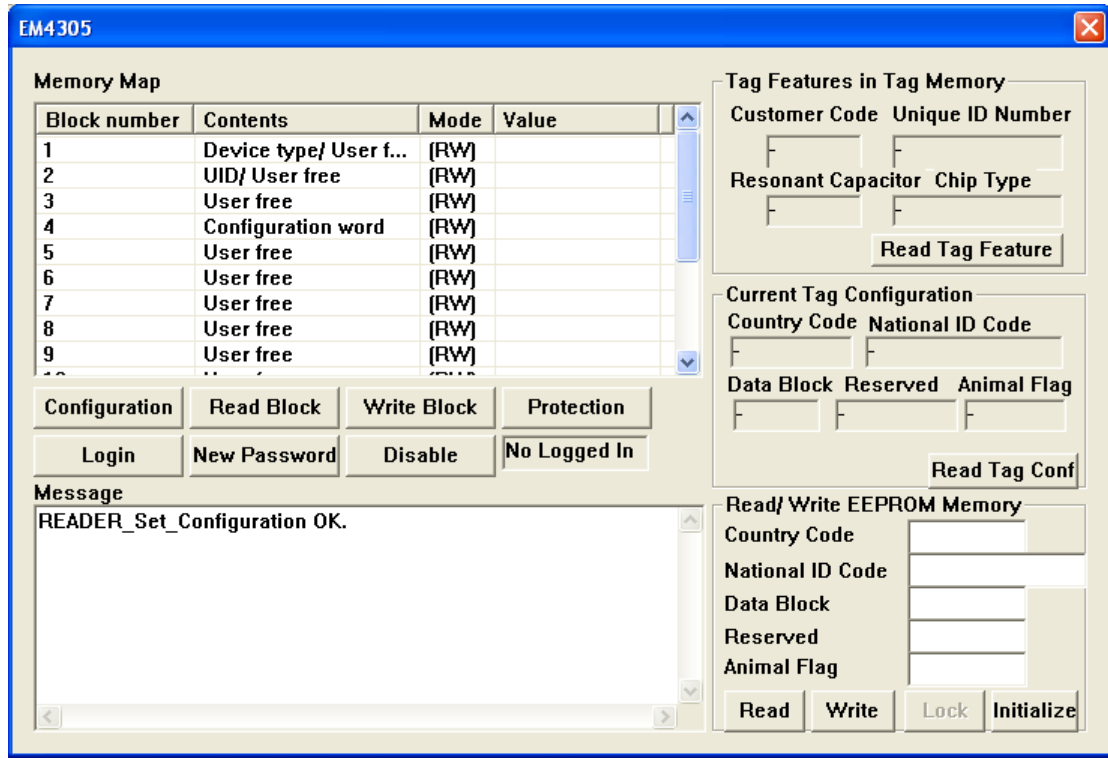


Figure 4-9: EM4305

### 4.7.1 Setup

- Step 1:** Click **EM4305** from the list of the **Tag Selection** tool.
- Step 2:** Place a single EM4305 tag on the IRFD-210.

### 4.7.2 Configuration

Before using any command it is necessary to ensure that the reader and EM4305 transponder have the same configuration. To configure both the reader and transponder, please use the Configuration command. After entering the EM4305 frame, the reader is configured to Biphase RF/32 downlink communication automatically, i.e. the default EM4305 downlink communication configuration. To configure EM4305, the user should:

- Step 1:** Click the **Configuration** button in main window for EM4305 transponder.

**Step 2:** Choose Configuration mode, Code/Data Rate and Last Word Read (LWR). For example; both EM4305 and Reader configuration, Bi/32, and LWR=8.

**Step 3:** Click the **Set** button.

**Step 4:** If the configuration command proceeds successfully the Configuration window closes automatically. Otherwise, the configuration needs to be repeated or canceled until successful. Further guide assumes the reader and the tag configuration matches.

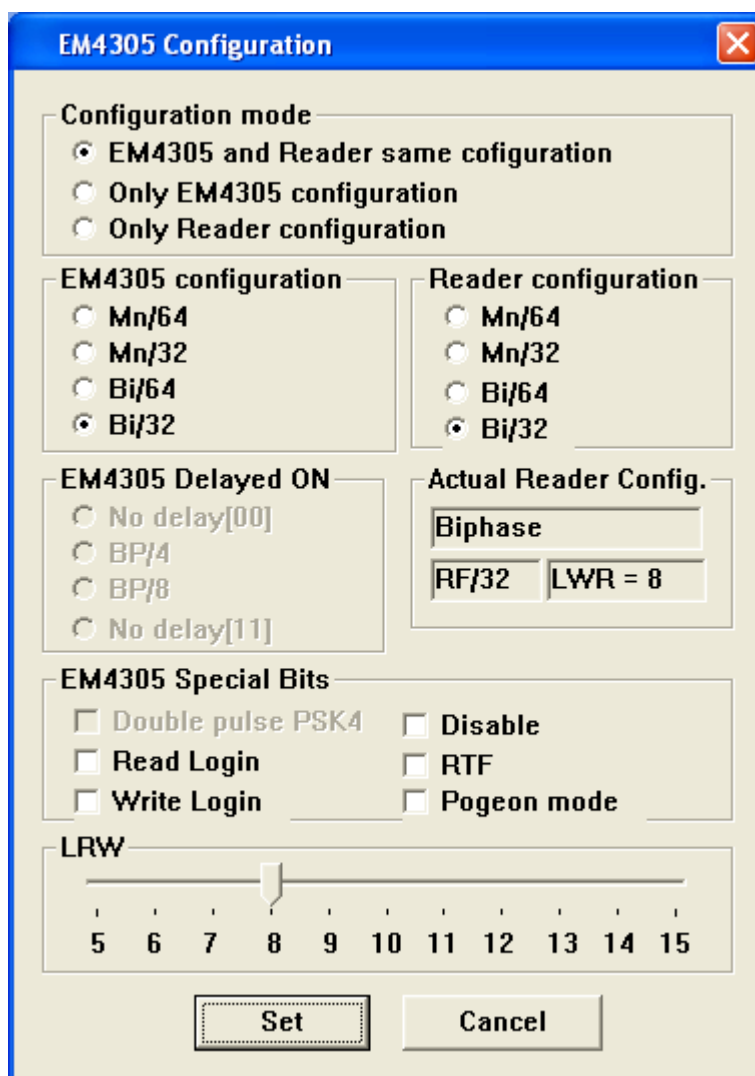


Figure 4-10: EM4305 Configuration

## AFL2-EM-RFID-KIT01

## 4.7.3 Read Block

**Step 1:** Click one block from the Memory Map list.

**Step 2:** Click the **Read Block** button.

**Step 3:** Click the **OK** button.

## 4.7.4 Write Block

**Step 1:** Click one block from the Memory Map list.

**Step 2:** Click the **Write Block** button.

**Step 3:** Enter the block value.

**Step 4:** Click the **OK** button.

**NOTE:**

The Write Block command can only be used for Read/Write (RW) Block.

---

## 4.7.5 Login

Sending Login command is necessary before sending any password protected command. The status of Login command is visible in Login Status window under the Login button. To login, the user should:

**Step 1:** Click the **Login** button.

**Step 2:** Enter a current password value.

**Step 3:** Click the **OK** button.

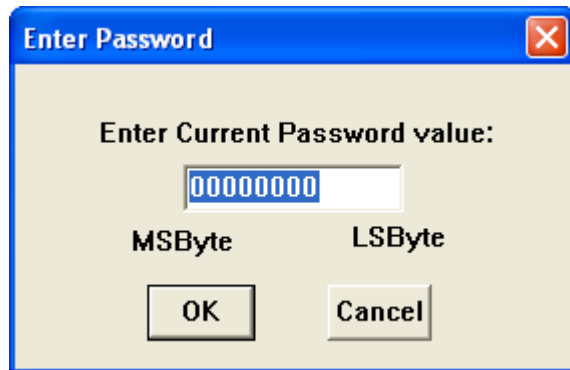


Figure 4-11: Login – Enter Password

#### 4.7.6 New Password



#### NOTE:

Before changing the password values the transponder has to be in Logged state (see Login described above).

The New Password command is used to change the password. To change the password, the user should:

- Step 1:** Click the **New Password** button. If the Login Status is in Not logged state, use Login command to log-in.
- Step 2:** Enter the current password.
- Step 3:** Enter a new password.
- Step 4:** Click the **OK** button.

#### 4.7.7 Protection

Protection command protects Blocks in the transponder memory from being written. After clicking on Protection button the reader sends a command to read current value of the Protection Word. The already protected Blocks are ticked and they have gray color.

**WARNING:**

The bits in Protection word that are stored in the Protection words (Block 14 and 15) are one time programmable (OTP) which means that once they have been set they can not be reset any more.

- Step 1:** Click the **Protection** button.
- Step 2:** Tick the blocks which you would like protect.
- Step 3:** Click the **Set** button in Set Protection Bits window.
- Step 4:** Click the **Yes** button in Warning window.

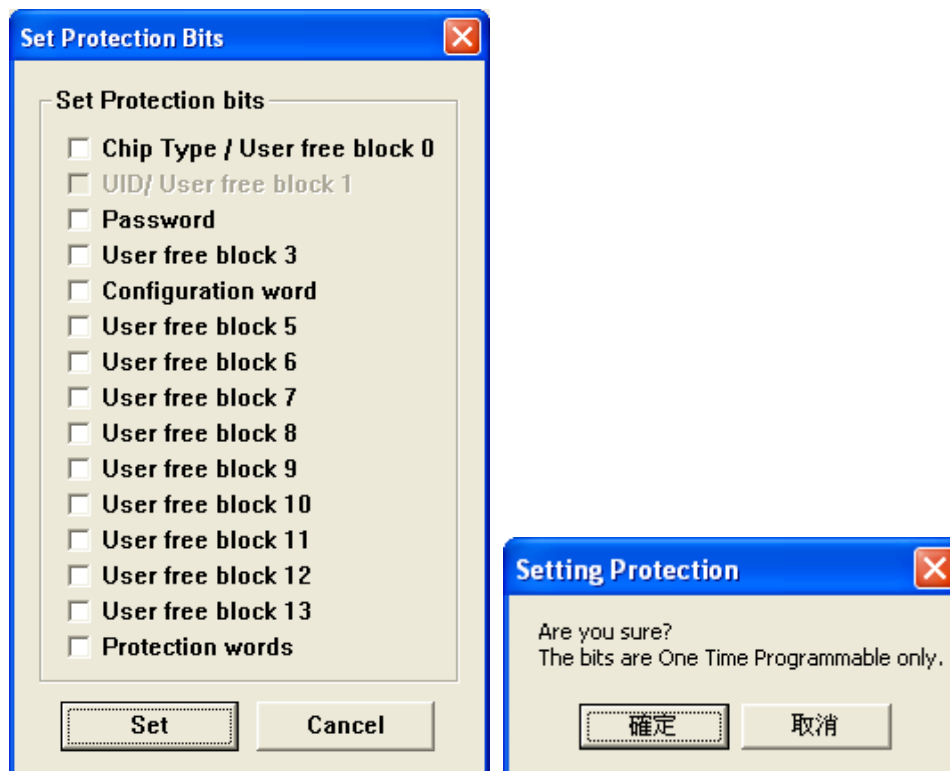


Figure 4-12: Set Protection Bits



#### 4.7.8 Disable

The Disable command is accepted in the case the Disable bit in Tag Special Bits is set to 1 (see Configuration -> EM4305 Special bits selection). When this command is detected, EM4305 or EM4205 tag stops all operations until power-up. If the Disable command is not accepted (Disable bit is set to 0), EM4305 or EM4205 tag returns in Default Read mode.

Within the EM4305 frame, the FDXB and Initialize FDXB indices provide the controls to read and configure the EM4205 or EM4305 tag into the Animal mode (FDXB).

#### 4.7.9 Read Tag Memory

To read tag memory, click the **Read Tag Feature** button. After clicking **Read Tag Feature**, the application software detects the presence of the tags in the RF field. The data is displayed in appropriate panels.

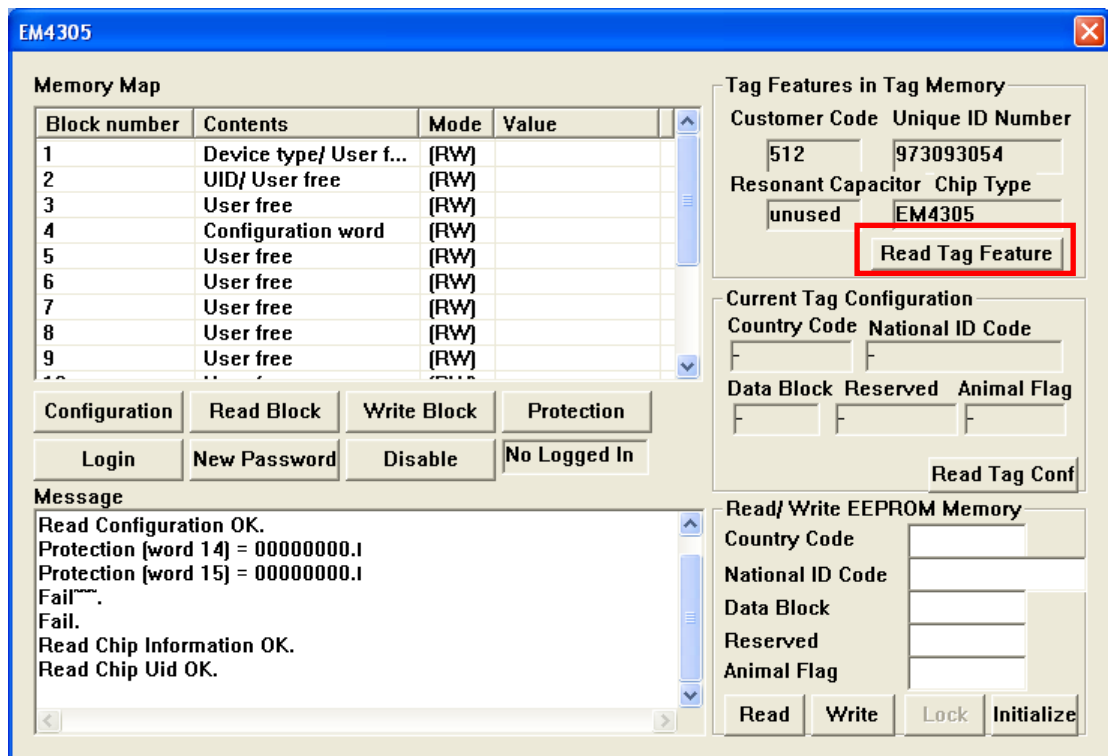


Figure 4-13: Read Tag Feature

AFL2-EM-RFID-KIT01

4.7.10 Initialize Tag Value

The initialize tag value, enter the desired tag data. Then, click the **Write** button within the Initialize section.

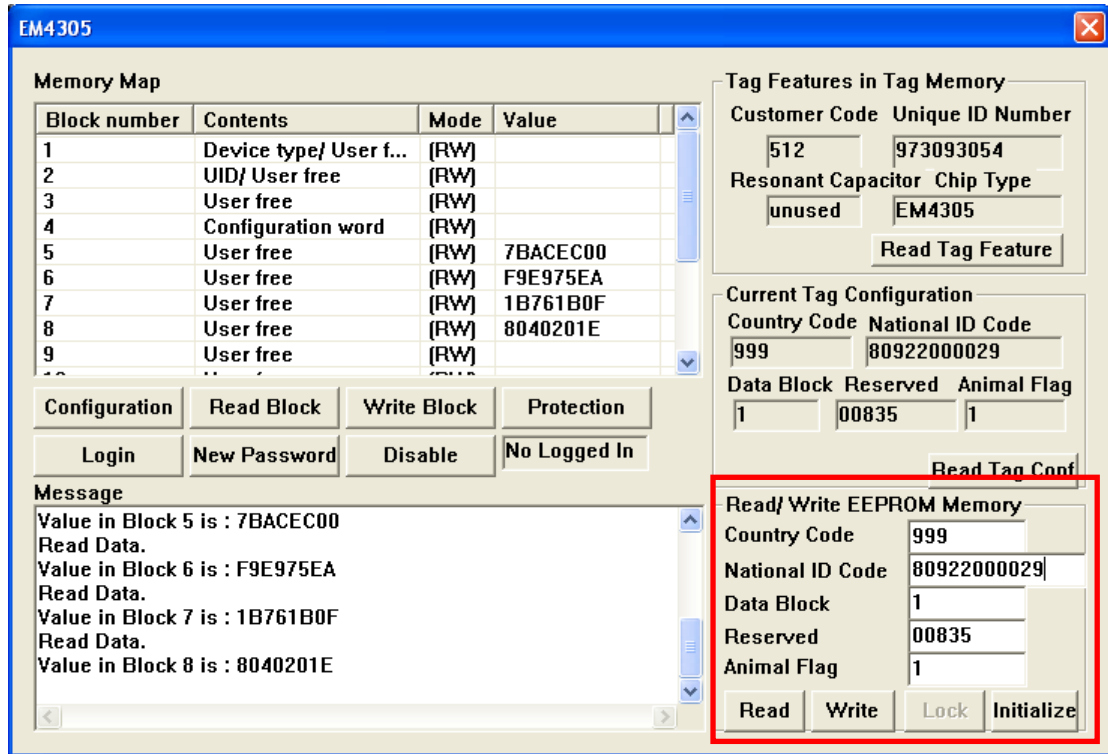


Figure 4-14:InitializeTag Value

Appendix

A

# IRFD-210 Tool Library

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## AFL2-EM-RFID-KIT01

## A.1 IRFD-210-API

```
IRFR_200_API int IRFR_200_OPEN(int i_DeviceType,int i_ComPort);
IRFR_200_API int IRFR_200_4100ID(unsigned char *ID);
IRFR_200_API int IRFR_200_4450_READ(char addr1,char addr2 ,unsigned char*Data);
IRFR_200_API int IRFR_200_4450_WRITE(char addr,unsigned char *data);
IRFR_200_API int IRFR_200_4450_LOGIN(unsigned char *data);
IRFR_200_API int IRFR_200_4450_READCONTROL(unsigned char *data);
IRFR_200_API int IRFR_200_4450_READWORD(unsigned char *data);
IRFR_200_API int IRFR_200_4450_SETCONTROLWORD(unsigned char *data);
IRFR_200_API int IRFR_200_4450_SETPASSWORD(unsigned char *curPass,unsigned char *newPass);
IRFR_200_API int IRFR_200_4450_RESETTAG();
IRFR_200_API int IRFR_200_4305_READ(UCHAR addr,unsigned char *data);
IRFR_200_API int IRFR_200_4305_WRITE(char addr,unsigned char *data);
IRFR_200_API int IRFR_200_4305_LOGIN(unsigned char *data);
IRFR_200_API int IRFR_200_4305_SETPASSWORD(unsigned char *curPass,unsigned char *newPass);
IRFR_200_API int IRFR_200_4305_ENPASSWORD(unsigned char *newPass);
IRFR_200_API int IRFR_200_4305_SETPROTECTION(unsigned char *data);
IRFR_200_API int IRFR_200_4305_READCONFIG(unsigned char *data);
IRFR_200_API int IRFR_200_4305_SETCONFIG(unsigned char *data);
IRFR_200_API int IRFR_200_4305_READCHIPINFO(unsigned char *data);
IRFR_200_API int IRFR_200_4305_READCHIPID(unsigned char *data);
IRFR_200_API int IRFR_200_4305_READTAGID(unsigned char *data);
IRFR_200_API int IRFR_200_4305_DISABLE();
IRFR_200_API int IRFR_200_CLOSE();
```

Appendix

C

# Hazardous Materials Disclosure

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## B.1 Hazardous Materials Disclosure Table for IPB Products Certified as RoHS Compliant Under 2002/95/EC Without Mercury

The details provided in this appendix are to ensure that the product is compliant with the Peoples Republic of China (China) RoHS standards. The table below acknowledges the presences of small quantities of certain materials in the product, and is applicable to China RoHS only.

A label will be placed on each product to indicate the estimated “Environmentally Friendly Use Period” (EFUP). This is an estimate of the number of years that these substances would “not leak out or undergo abrupt change.” This product may contain replaceable sub-assemblies/components which have a shorter EFUP such as batteries and lamps. These components will be separately marked.

Please refer to the table on the next page.

Part Name	Toxic or Hazardous Substances and Elements					
	Lead (Pb)	Mercury (Hg)	Cadmium (Cd)	Hexavalent Chromium (CR(VI))	Polybrominated Biphenyls (PBB)	Polybrominated Diphenyl Ethers (PBDE)
Housing	X	O	O	O	O	X
Display	X	O	O	O	O	X
Printed Circuit Board	X	O	O	O	O	X
Metal Fasteners	X	O	O	O	O	O
Cable Assembly	X	O	O	O	O	X
Fan Assembly	X	O	O	O	O	X
Power Supply Assemblies	X	O	O	O	O	X
Battery	O	O	O	O	O	O

O: This toxic or hazardous substance is contained in all of the homogeneous materials for the part is below the limit requirement in SJ/T11363-2006

X: This toxic or hazardous substance is contained in at least one of the homogeneous materials for this part is above the limit requirement in SJ/T11363-2006

## AFL2-EM-RFID-KIT01

此附件旨在确保本产品符合中国 RoHS 标准。以下表格标示此产品中某有毒物质的含量符合中国 RoHS 标准规定的限量要求。

本产品上会附有“环境友好使用期限”的标签，此期限是估算这些物质“不会有泄漏或突变”的年限。本产品可能包含有较短的环境友好使用期限的可替换元件，像是电池或灯管，这些元件将会单独标示出来。

部件名称	有毒有害物质或元素					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (CR(VI))	多溴联苯 (PBB)	多溴二苯 醚 (PBDE)
壳体	X	O	O	O	O	X
显示	X	O	O	O	O	X
印刷电路板	X	O	O	O	O	X
金属螺帽	X	O	O	O	O	O
电缆组装	X	O	O	O	O	X
风扇组装	X	O	O	O	O	X
电力供应组装	X	O	O	O	O	X
电池	O	O	O	O	O	O

O: 表示该有毒有害物质在该部件所有物质材料中的含量均在 SJ/T11363-2006 标准规定的限量要求以下。  
X: 表示该有毒有害物质至少在该部件的某一均质材料中的含量超出 SJ/T11363-2006 标准规定的限量要求。