

R-OEM-LF-M800-485
125 kHz OEM RFID Module
Communication Protocol

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1 Introduction

1.1 About the OEM RFID Module

This module reads only read-only versions of 125 kHz RFID transponders (e.g. EM4100/4200).

1.2 Mechanics

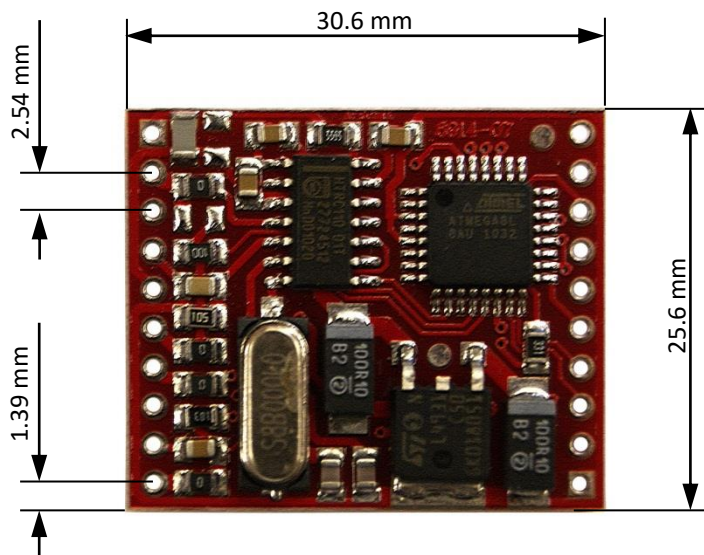


Figure 1 Dimensional Drawing of OEM Module, view onto upper side with RFID reader IC

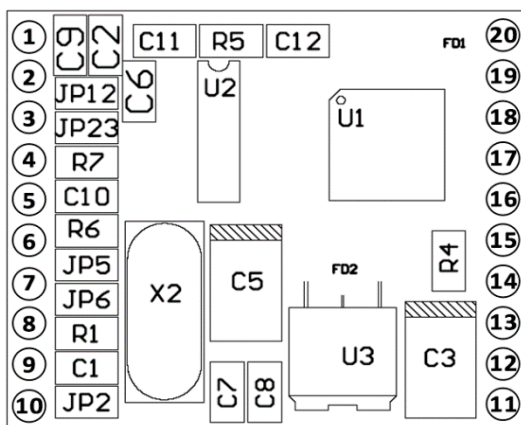


Figure 2 Component position and connector numbering

1.3 Electrical Installation

1.3.1 Connector Pinout

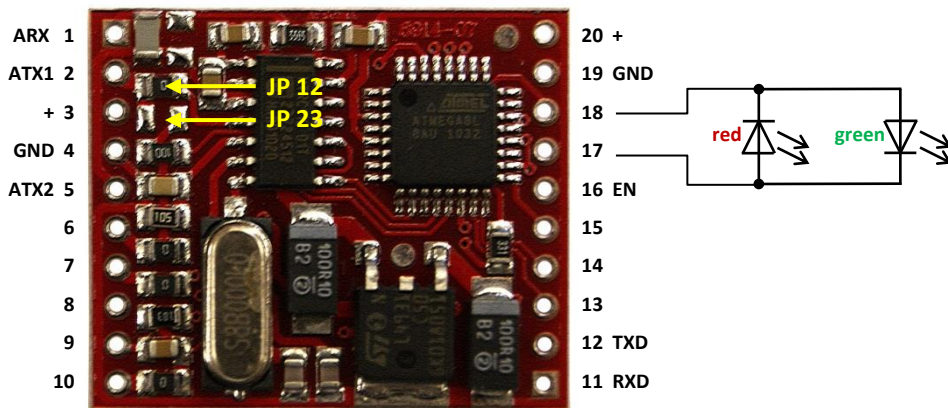


Figure 3 Position and Numbering of Connections

| PIN | Name | Description |
|-----|------|---|
| 1 | ARX | Antenna RX |
| 2 | ATX1 | Antenna TX1 |
| 3 | VDD | +5 Vdc |
| 4 | GND | Ground |
| 5 | ATX2 | Antenna TX2 |
| 6 | OUT1 | Digital Output #1, TTL Level |
| 7 | OUT2 | Digital Output #2, TTL Level |
| 8 | RSV | Reserved for future development, DO NOT CONNECT |
| 9 | GND | Ground |
| 10 | RST | Reset |

| PIN | Name | Description |
|-----|------|---|
| 11 | B+ | RS485+ |
| 12 | B- | RS485- |
| 13 | RSV | Reserved for future development, DO NOT CONNECT |
| 14 | RSV | Reserved for future development, DO NOT CONNECT |
| 15 | IN | Digital Input, TTL Level |
| 16 | EN | Default Open or 5 V = Enable reader, 0 V = disable reader |
| 17 | LED | LED- (Cathode) |
| 18 | LED | LED+ (Anode) |
| 19 | GND | Ground |
| 20 | VDD | +5 Vdc |

1.3.2 Antenna Set-Up

| Joint | Name |
|-------|----------------|
| J12 | Dual antennas |
| J23 | Single antenna |

2 Communication Protocol

This is for the Firmware Cont125 EM4x02 RS485 Multimaster, as of version 1.16

Default setting: 9600, N, 8, 1

RS495 Address: #1 (If not otherwise specified)

2.1 Available commands

for the controller:

- >fix a set up
- <require a set up
- >modify serial configuration
- >recall a logic reset of the controller
- <require the firmware version
- >set the led (and other output)
- >set radio-frequency status and codify type
- <require radio-frequency status and codify type
- <require input status
- <require code of the present badge

2.2 Communication Protocol description

2.2.1 Syntax

On the following pages all control digits will be marked in bold (ex. **STX** corresponds to the sending of the 02h value). All constant alpha-numerical stripes will be indicated between quotation marks (ex. "3"). Variable parameters will be underlined by the characters < > and the meaning of each parameter will be specified after the command description.

2.2.2 Commands structure

Commands and answers are generally included between the control digits **STX** and **ETX**. Stripe is then completed by a Check-sum digit called **BCC** immediately after the **ETX**. **BCC** is calculated by executing the exclusive or of all digits included between **STX** and **ETX**. The digit **STX** for the polling command is executed by **ADDP1** and **ADDP2** while for the selecting commands is executed by **ADDS1** and **ADDS2**.

EOT digit sent to the slave allows a communication re-initialization. It is suggested, but not necessary, the sending of at least 2 **EOT** before sending a command.

Ex. **EOT EOT STX ADDS1/ADDP1 ADDS2/ADDP2 "X" <DATA> ETX BCC**

| | |
|--------------|--|
| EOT | ASCII 04 digit to reset the communication. OPTIONAL |
| STX | ASCII 02 digit for Start Of Text (it opens the serial input). |
| ADDP1 | |
| ADDP2 | individual address in polling of the terminal receiving the message |
| ADDS1 | |
| ADDS2 | individual address in selecting of the terminal receiving the message |
| ETX | ASCII 03 digit for End Of Text (it closes the serial input) |
| BCC | digit representing the exclusive or of the characters included between STX and ETX |

2.2.3 ADDS and ADDP addresses

Each terminal has an address included between 001 and 255; in the multipoint communication the address of the terminal is defined by 2 ASCII digits, both included between '0' and '?' (between 30 and 3f hexadecimal) in case of selecting.

In case of polling the first digit is the same as per the first selecting digit, while the second can be obtained by changing the dozens (from 3 to 2) of the second selecting digit.

For example the selecting address of the terminal 53 is "35" (33, 35 hexadecimal). The related polling address is "3%" (33,25 hexadecimal).

In case of global selecting the 2 address digits will be "" (60,60 hexadecimal).

At your first terminal usage it is suggested to connect it individually to the PC and to send it a command of Serial Setup in global setting. These new inputs will be used by the terminal only after a second restart (or after a command of logic reset). For this reason it is necessary to switch off and again on the terminal.

2.2.4 ADDx1 and ADDx2 addresses

Each terminal is identified from a 3 positions progressive number included between '001' and '255'. Inside each selecting command this identification is composed of 2 ASCII digits indicated by the stripes ADDS1 and ADDS2.

To obtain these ASCII digits it is necessary to follow this reasoning: the decimal number must be changed into the related hexadecimal number. These two different results will be separately taken in consideration. To each one of these results we must add 30h in order to get two hexadecimal numbers included between 30 and 30F. Changing these two ASCII digits we will obtain the coordinates. If for example we want to identify the terminal 225: HEX(225) = E1. We take now E and 1 separately in consideration. We add 3 in front of each value and obtain 3E and 31, which correspond to '>' e '1' in ASCII form. The address of the terminal we are interested in will be then ">1". If we need a polling command instead of a selecting command, we will add 20h instead of 30h to the second hexadecimal number. In this case the terminal of our example will be **HEX (225)**.

2.3 Selecting commands

Answers to the selecting commands

To each received selecting command, the board answers with the following syntax:

STX ADDS1 ADDS2 <TypeCommand> <RESULT> ETX BCC where
 <TypeCommand> Code of the sent command
 <RESULT> Alpha-numerical stripe of 1 character indicating the result of the command

The valid values are:

| | |
|-------|-----------------------|
| "0" | Correct result |
| "1" | Un-existent command |
| "2" | Data format not valid |
| "5" | Wrong BCC |
| "..." | Various |

In case of error the digit "0" changed into another one to indicate a syntax error. Sent value is typical for the remarked error and will be sent just if the two digits corresponding to the beginning and to the end of the text (STX, ETX) have been correctly received. There will be an answer just if the characters **ASSD1-ADDS2** have been correctly received too.

In case of missing answer from the board the master must restart his command after the timeout.

2.3.1 Basic Setup (1)

Through this command it is possible to modify some parameters for the board functionality.

They will be immediately saved in the E2PROM memory and validated. This command has been kept for compatibility to the old versions.

Setup has been sent through a unique stripe with fixed length built as follows:

STX ADDS1 ADDS2 "0" <NINV> <TMCODE> <STATUS> <MODE> <AOUT> ETX BCC where (blanks have no value):

| | |
|----------|--|
| "0" | digit (hex. 30) indicating the command type 'set setup'. |
| <NINV> | numeric stripe made of 2 numbers indicating how many times it is necessary to reiterate the event sending. Values are included between "01" and "10". |
| <TMCODE> | numerical stripe made of 3 numbers indicating the ACK wait in second hundredths. Values are valid from "001" to "999". Event is kept into the <NINV> + 1 memory for the <TMCODE> time, exception made for a new reiteration. |
| <STATUS> | digit '0' or '1'. It indicates the status of the terminal radio-frequency on power on. '1' activated, '0' deactivated |
| <MODE> | digit included between '0' and '1'. It indicates the codify type of the coming back code '0' – Apromix |
| <AOUT> | 5 digits stripe, from 00000 to 29999, indicating the time in second thousandths based on which the action A is differentiated from action B. In case <AOUT> corresponds to "00000" the sending of the action 'A' will be done as soon as the tag will enter into the reading area. |

On receipt of a correct setup the board answers with Result = "0".

Timeout for each answer is at least 200 ms.

2.3.2 Basic Setup (2)

Through this command it is possible to modify some functionality parameters of the board. They will be immediately stored into the E2PROM memory and validated.

Setup is sent via a unique stripe with fixed length made as follows:

STX ADDS1 ADDS2 "0" <NINV> <TMCODE> <STATUS> <MODE> <AOUT> <EV_AB> <EV_C> <TINP> ETX BCC where (blanks have no meaning):

| | |
|---------------------|--|
| "0" | digit (hex. 30) indicating the command type 'set setup'. |
| <NINV> | numerical stripe made of 2 numbers indicating how many times the event sending has to be reiterated. Valid values are included between "01" and "10". |
| <TMCODE> | numerical stripe made of 3 numbers indicating the ACK wait in second hundredth. Valid values are included between "001" and "999". Event is kept in the <NINV> + 1 memory for the <TMCODE> time, except in case of a reiteration. |
| <STATUS> | digit '0' or '1'. It indicates the terminal radio-frequency status at power on. '1' activated, '0' deactivated (in case <TINP> should be 4 this status is subordinated to the condition of the Input – Vada. Tinp) |
| <MODE> | digit included between '0' and '1'. It indicates the codify type of the coming back code '0' – Apromix |
| <AOUT> | Stripe of 5 characters from 00000 to 29999 indicating the time in second thousandths based on which it is possible to differentiate the action type A from the action B. In case <AOUT> should correspond to "00000" the sending of the action A will start as soon as the tag will enter in the reading area. |
| <EV_AB> or not . | numerical stripe of 1 digit indicating if events 'A' and 'B' must be sent Valid values are: '0' – not sending events '1' – sending events |
| <EV_C> | numerical stripe of 1 digit indicating if the event 'C' must be sent or not (tag going out from the reading area). '0' – not sending the event '1' – sending the event |

<TINP> numerical stripe of 1 digit indicating how to handle the input. Valid values are:

- '0' – input not handled
- '1' – event just on input activation
- '2' – event just on input deactivation
- '3' – event on activation and deactivation of the input
- '4' – radio frequency is activated. It allows reading the badge just in case of present input. An event type 'C' will be sent when leaving the input, in case it was activated. If the < STATUS > is '0' the input will not cause any message sending (Parameters <STATUS> and <TINP>=4 word in AND).

On receipt of a correct setup, the board will sent a Result = "0" as an answer.

Timeout for each answer is at least 200 ms.

2.3.3 Serial Set Setup

STX ADDS1 ADDS2 "1" <NADD1> <NADD2> <BAUDRATE> ETX BCC where

"1" digit indicating the command type 'serial setup'.

<NADD1> one digit stripe indicating the first half-byte of the address.
Valid from 30 until 3F (corresponding to "0" and "?").

<NADD2> one digit stripe indicating the second half-byte of the address.
Valid from 30 until 3F (corresponding to "0" and "?").

<BAUDRATE> one numerical digit stripe indicating the new Baud-Rate of the terminal
Valid values are:

| | |
|-----|-------|
| "0" | 1200 |
| "1" | 2400 |
| "2" | 4800 |
| "3" | 9600 |
| "4" | 19200 |
| "5" | 38400 |

New set up will be valid just restarting the terminal (physic reset) or through the command logic reset.

In case of first start or if the memory setup remarks anything wrong:

The board without address will accept just global commands and will not send any event

Default speed will be 19200 bps

2.3.4 Logic Reset

STX ADDS1 ADDS2 "2" ETX BCC where

"2" digit indicating the command type 'Logic Reset'.

It has to be sent after a 'Set Setup' or a 'Set Serial Setup' command in order to activate the modifications. Terminal will not answer to this command. It's equal to a switch off and a following switch on of the terminal.

2.3.5 Set Outputs

This command allows the master to activate the output.

STX ADDS1 ADDS2 "3" <TOUT1> <TOUT2> ETX BCC

"3" digit indicating the command type 'set output'.

<TOUT1> 3 digits stripe defining a second tenths time for the one shoot activation of the related output. Valid from "001" to "900". "000" deactivates the output immediately, "901" converts his logic status, "999" activates it definitely. Values from "902" to "998" bring no status changes.

<TOUT2 > 3 digit stripe indicating a second tenths time for the one shoot activation of the related output. Valid from "001" until "900". "000" deactivates tje output immediately, "901"

converts his logic status, "999" activates it definitely. Values from "902" to "998" bring no status changes.

Timeout for each answer is 100 ms.

2.3.6 Status Set

This command allows the master to activate or not the radio-frequency and the codify type for the code coming back.

STX ADDS1 ADDS2 "4" <STATUS> <MODE> ETX BCC

"4" digit indicating the command type 'status set'.

<STATUS> digit '0' or '1'. It indicates which status the radio-frequency of the terminal must have at the power on: '1' activated, '0' deactivated

<MODE> Digit included between '0' and '1'. It indicated the codify type of the coming back code. '0' – Apromix

Timeout for each answer 100 ms.

2.4 Polling

2.4.1 Request of basic setup

STX ADDP1 ADDP2 "0" ETX BCC where

"0" Digit indicating a polling of 'basic setup'.

If the polling is correctly received, the board answers as follows:

STX ADDP1 ADDP2 "0" <NINV> <TMCODE> <STATUS> <MODE> <AOUT> <EV_AB> <EV_C> <TINP> ETX BCC where data are the ones already seen by selecting (Setup 2).

Timeout for answer is 100 ms.

2.4.2 Request Software Version

STX ADDP1 ADDP2 "2" ETX BCC where

"2" digit indicating the polling of version request.

If the polling is correctly received, the board answers as follows:

STX ADDP1 ADDP2 "2" <VVVVVVVVVVVVVVVV> ETX BCC

Value <VV.VV> represents a 16 digits alpha-numerical text (actually "A& EM4x02 V.1.14"). "V.1.14" indicates the terminal firmware version.

Timeout for answer is 100 ms.

2.4.3 Request present Badge

STX ADDP1 ADDP2 "3" ETX BCC where

"3" digit indicating the polling of present badge request.

If the polling is correctly received, the board answers as follows:

In case of a present tag:

STX ADDP1 ADDP2 "3" "U" "B" <CODE> ETX BCC where

<CODE> is a 10 digit stripe representing the tag UID.

In case of no present tag:

STX ADDP1 ADDP2 "3" "N" ETX BCC where

Timeout for answer is 100 ms.

2.4.4 Status request

STX ADDP1 ADDP2 "4" ETX BCC

"4" digit indicating the command type 'Status request'.

If the polling is correctly received, the board answers as follows:

STX ADDP1 ADDP2 "4" <STATUS> <MODE> ETX BCC where

<STATUS> digit '0' or '1'. It indicates the terminal radio-frequency status at the power on. '1' activated, '0' deactivated
 <MODE> digit included between '0' and '1'. It indicated the codify type of the coming back code. '0' – Apromix

Timeout for answer is 100 ms.

2.4.5 Input Status request

STX ADDP1 ADDP2 "5" ETX BCC

"5" digit indicating the type command 'Input Status request'.

If the polling was correctly received, the board answers as follows:

STX ADDP1 ADDP2 "5" <STATUS_INPUT> ETX BCC where

<STATUS_INPUT> digit '0' or '1'. It indicated the input current status:
 '0' – deactivated
 '1' – activated

Timeout for answer is 100 ms.

2.5 Events

2.5.1 Reading EM4x02

Starting the terminal, it switches automatically to the status decided during the set up: "deactivated radio-frequency" or "activated radio-frequency" with reading wait of a transponder type EM4x02 (Read Only), waits for the antenna of a tag type EM4x02 (or T5557 in emulation) to enter in the reading area. Once a tag like this is read, it sends its related code to the master as per the following syntax:

STX ADDP1 ADDP2 "3" "U" <ACTION> <CODE> ETX BCC where

<CODE> is a 10 digits stripe representing the tag UID.
 <ACTION> digit defining the action type executed 'A', 'B' or 'C'
 'A' – tag has been read and removed from the reading area within the time <AOUT>
 'B' – tag was in the reading area longer than <AOUT>
 'C' – tag has been removed from the reading area

Event 'C' will be sent only if the tag remained in the reading area at least for <AOUT> second thousandths.

Events will be sent as per defined Setup.

2.5.2 Activation and deactivation of the input

At activation or deactivation of the input, as per <TINP> set up, the following message will be sent:

STX ADDP1 ADDP2 "5" <STATUS_INPUT> ETX BCC where

<STATUS_INPUT> digit defining the input status. Valid values are:
 '0' – inactive
 '1' – active

Following to any of the previous events Master must sent the ACK (format as follows)

STX ADDP1 ADDP2 ACK ETX BCC

2.5.3 LED functionality

Led will be switched off as long as it will not receive a basic Setup.

After sending the basic Setup the led will work in two different ways depending on the parameter <STATUS> sent by the Set up.

- If STATUS=0 radio-frequency will be deactivated and the led will be flashing red.
- If STATUS=1 radio-frequency will be activated and led will be fix red.

Getting a tag close to the antenna led will turn green as a feedback of the reading. In case of sending a code in serial, it will be flashing red.

If the reading will be activated just following an input, led will flash when it will not be possible to read any tag (deactivated antenna) or will be fixed in contrary case (activated antenna).