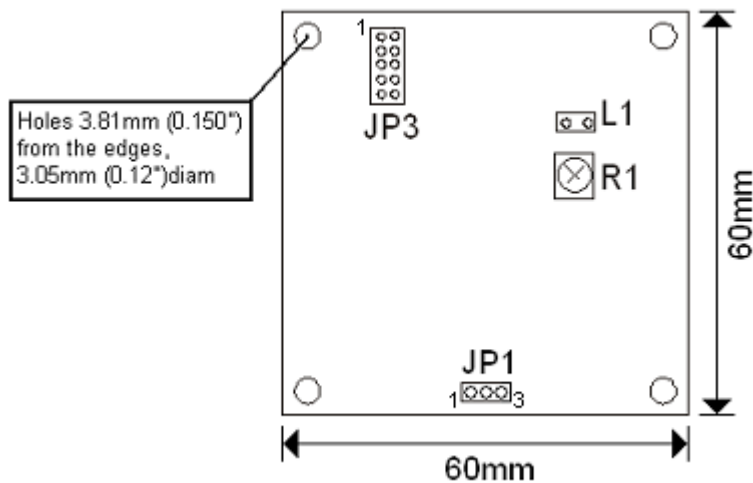


## RW02OEM

The RW02OEM is a complete reader/writer board for passive RW RFID tags. A power source and an antenna is all that is required to use the reader. It can read and write to Bi-Phase or Manchester modulated/encoded ASK type transponders at speeds of RF/32 to RF/128. It is a perfect solution for easy programming and reading of Atmel's e555x type transponders. Communication to and from the reader is via one of three different interfaces: RS485, RS232 or TTL. Communication speed is set to 9600 bps but can be factory modified upon request.



### Specifications

Function	Reader/writer/decoder for passive (no battery) 125 kHz ASK Bi-Phase or Manchester RF identification tags.
Interface	RS485 or RS232 or TTL, 9600 baud, 8 data bits, no parity, 1 stop bit
Antenna type	1.62 mH coil (calculated, see note)
Read range	Antenna and tag dependent
Power requirements	12 - 16 VDC regulated, 100 mA max
Dimensions	60 mm x 60 mm x 16 mm (2.375 inches x 2.375 inches x 0.625 inches)
Operating temperature	0 to +50 C
Humidity	non-condensing
Connections	Standard: 10-pin (RS232), .1 header (L1)

**General Description**

The RW02OEM board performs all functions necessary for a passive RFID tag read/write station. It can power transponders and decode the data transmitted by them upon command. It can also write and modify the data stored in the tag.

**Communication**

The information is sent using a RS485, RS232 or TTL interface. It operates at a baud rate of 9600. The data format is 8 data bit, no parity, 1 stop bit.

**Connections**

JP3 is the main connector. It is a 10-pin 0.100-inch spacing double row male header.

2	4	6	8	10
+VDC	GND	A+	B-	RXD TTL
•	•	•	•	•
•	•	•	•	•
GND	GND	TXD	RXD	TXD TTL
1	3	5	7	9

Power:

GND (JP3.1) Connect to negative side (ground) of power supply 1  
 +VDC (JP3.2) Connect to positive side of power supply  
 A 12 to 16 VDC linear regulated supply is preferred.

Communication (connect at least one):

RS-232

GND (JP3.3) Connect to GND (PC DB9.5) of RS232 terminal  
 TXD (JP3.5) Connect to RXD (PC DB9.2) of RS232 terminal  
 RXD (JP3.7) Connect to TXD (PC DB9.3) of RS232 terminal

RS-485

A+ (JP3.6) Connect to A+ (PC DB9.1 & PC DB9.3) of RS485 terminal  
 B- (JP3.8) Connect to B- (PC DB9.2 & PC DB9.9) of RS485 terminal  
 GND (JP3.4) Connect to GND (PC DB9.5) of RS485 terminal

TTL

TXD (JP3.9) Connect to TTL level RXD of a UART or microcontroller input.  
 RXD (JP3.10) Connect to TTL level TXD of a UART or microcontroller output.

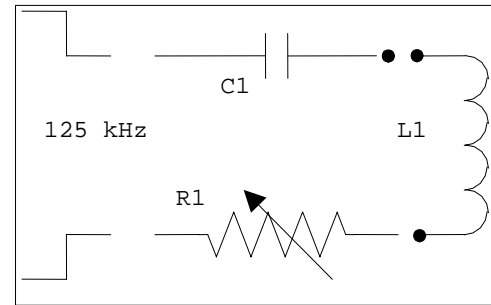
L1 is a 2-pin 0.200-inch spacing single row male header.



It is used to connect the antenna.

### **Antenna Design**

A single antenna is required for communication with the transponders. The antenna is used in a series resonant circuit, formed by C1, L1, and R1. The board requires, based on calculation with the on-board 1nF capacitor, an antenna with an inductance of 1.62 milliHenries. Proper value and shape of the antenna are installation dependent and must be determined by the user. The nominal resonant frequency is 125 kHz. To improve the reading range, the board will automatically adjust the driver's frequency to the resonance of the antenna circuit. The antenna can



be a simple air wound coil. As an example, the demo kit antenna is a square antenna 9 cm x 9 cm with 83 turns (about 30 meters of 0.254 mm diameter (30 AWG)) wire; its inductance is 1.58mH with 10 ohm DC resistance. The reading range is spherical with the antenna located at the equator. Minimum and maximum read range is determined, in great part by the size of both the reader and tag antennas

### **Q-Factor Adjustment**

The Quality factor of the resonant circuit can be adjusted using the trimmer potentiometer, R1. Although increasing the Q factor (turning clockwise) of the circuit can slightly increase the read range, it also increases the amount of spurious signal received. Therefore the boards should be individually adjusted with each attached antenna in their final environment.

Writing and selective reading require a minimum amount of noise. Therefore R1 should be adjusted until no errors are given and the correct data is stored and read.

### **Reading and Writing**

Due to the many different memory organizations of the read/write tags that can be read by the RW02OEM, and the way data can be encoded in the tag, the reader reads only upon receipt of a read command (see P or S command).

The reader must be set to the same modulation and speed as the tag.

It is highly recommended to append a 'header' byte to the data. Without a 'header' or start byte the reader cannot determine where a data block starts or ends. Therefore the same tag data could be represented in many different ways.

The Selective Read command will correctly read all the bits. The bits may not be however in the order that they are stored. Without a start byte or start bits the data should be viewed as if stored in a circular buffer. The data should be interpreted carefully as the first bit may not be displayed at the start of the data string.

Writing to the tag requires more power than reading the tag data. Therefore the write distance is generally 50% to 75% less than the read distance.

This reader is optimized for reading and writing to the following Atmel Corporation type transponders: e5550, e5551, T5557, ATA5567, ATA5570, ATA5577, T5554, TK5551 and other e5550 compatible tags. Before using this reader please thoroughly read and understand the data sheet for the RW RFID tag that you are using. Especially how it stores, retrieves, locks and protects its data.

### **Commands**

All commands start with '>' followed by the device address then the command and any data corresponding to the command. Every command should be followed by a carriage return (0Dh).

A	(41h)	Sets the communication address of the RW02OEM.
C	(43h)	Turns the coil (i.e. energizing field) on or off.
E	(45h)	Dumps the contents of the EEPROM in hex.
F	(46h)	Changes the RF bit/rate for reading tags.
M	(4Dh)	Changes the modulation used for reading tags.
P	(50h)	Regular read.
R	(52h)	Sends reset command to tag.
S	(53h)	Selective read. Reads designated page from tag.
V	(56h)	Returns the version of the software.
W	(57h)	Writes to designated block in tag.
X	(58h)	Sends stop command to tag.

Example:

As typed: >01X[cr]  
As sent: 3E3031580D

*Note: All values are sent in hexadecimal. Commands and hex characters must be sent in upper case letters.*

After a command is received and executed, the RW02OEM will respond either with:

OK or a hex string if the command was understood and executed without error  
or  
ERR if the command could not be understood or executed.

Tag commands

The following commands are used for modifying or accessing the data in the RFID tag.

- P (Regular read)**      Resets the tag and displays the data transmitted by the tag in regular mode.  
The user must provide the unique header stored in the tag data. Without it the reader cannot determine the start or stop of the data stream sent by tag.
- Example:      Send 'P' command to the reader at device address 01. Header byte is 'FFh':  
>01PFF[cr]
- R (Reset tag)**      Resets (00) the tag to regular read mode.
- Example:      Send 'R' command to reader at device address 31:  
>31R[cr]
- S (Selective Read)**      Performs a block read.  
The page number[0-1], optional password[4 bytes] and 3 bit block address [0-7] must be provided.
- Examples:      Send 'S' command to reader at device address 45 with password 01040303 to read block 1 of page 0:  
>45S0010403021[cr]  
Send 'S' command to reader at device address 12 to read:  
block 1 of page 1.  
>12S11[cr]
- W (Write tag)**      Writes a block of data to the tag.  
The page number [0-1], block address [0-7], optional password [4 bytes], lock bit [0-1], and 4 bytes of data must be provided
- Examples:      Send 'W' command to reader at device address 2 with password FFFDFCFB to write 12345678 to block 5 of page 0:  
>02W050FFFDFCFB12345678[cr]  
Send 'W' command to reader at device address 10 to write 0 to block 1 of page 0, and lock it:  
>10W01100000000[cr]
- X (Stop tag)**      Resets (11) the tag to regular read mode.  
Certain tags require a different reset value than sent by the R command.
- Example:      Send the 'X' command to reader at device address 6:  
>06X[cr]

Reader Commands

The following commands are used for controlling the RW02OEM's function.

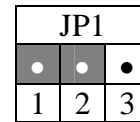
- |                     |   |
|---------------------|---|
| A (Set address)     | Changes the device address of the RW02OEM board.<br>The current device address [00-FF] and the new device address [00-FF] is required. It is up to the user to ensure that each device on a single communication line have different device addresses.<br>The factory default is 01.                                |
| Example:            | Send the A command to reader at device address 01 to change it address to 22:<br>>01A22[cr]   |
| C (Coil on/off)     | Turns the energizing field on or off. By default when the reader is first powered on the field is also on and remains on. If the field is turned off using this command, it only stays off until the next P,R,S,W,X command.<br>To turn the field on, send the value 81h. To turn the field off, send the value 80h |
| Example:            | Turn the energizing field off at reader with device address 28:<br>>28C80[cr]<br>Turn the energizing field on at reader with device address 82:<br>>82C81[cr]   |
| E (Get EEPROM)      | Transmits the setting stored in the EEPROM<br>The board will transmit the 3-byte setting: device address, RF bit rate and encoding.   |
| Example:            | Request the settings of reader with a device address of 17:<br>>17E[cr]   |
| F (Set RF bit Rate) | Set the bit rate at which the data is received from the tag.<br>This is the speed at which the reader reads the tag data. It does not change the tag control word. Valid values are 32, 40, 50, 64, 100 and 128. The factory default is 64. It does not   |
| Example:            | Set the RF bitrate to 32 for the reader with a device address of 66:<br>>66F20[cr]  |
| M (Set modulation)  | Set the modulation/encoding for decoding the tag transmission.<br>The reader can read tags that either use Manchester or Bi-Phase encoding.<br>Send a 1 for Bi-Phase or 0 for Manchester. The factory default is Manchester.<br>This command does not change the tag control word.                                  |
| Example:            | Set the reader with address 9 to use Bi-phase encoding<br>>09M01[cr]  |
| V (Version)         | Transmits the board firmware version<br>Request   |
| Example:            | Request the information from the board at device address 10<br>>10V[cr]   |

**Resetting the Board to Factory Defaults**

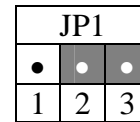
The settings for the RW02OEM are stored in an EEPROM. A jumper on JP1 can be used to erase the setting and return to factory defaults.

The factory defaults are 01h for the device address, 40h for the bit rate, and 00h for the modulation/encoding.

To restore the factory default turn off the RW02OEM. Move the jumper on JP1 to pin 1 and pin 2 (center pin). The EEPROM is reset as soon as power is applied to the board.



For normal operation the jumper should be removed or placed on pin 3 and 2.



**Ordering Information**

RW02OEM