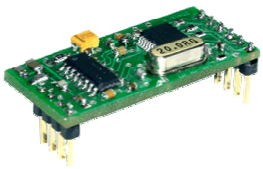
Technical Data Sheet

UM-RWD-M

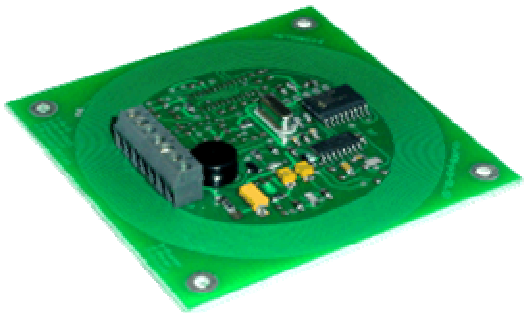
and

CTU-RWD-M
CTU-232-M
CTU-485-M

UM_CTU_RWD-doc-3.1
in reference to
UMRDW-3.0 and CTURDW-3.0



UM-RWD-M



CTU-RWD-M CTU-232-M CTU-485-M

1. Table of contents

2. Introduction

The UM-RWD-M, CTU-RWD-M, CTU-232-M and CTU-485-M devices operate on basis contactless reading the unique identification number from Unique transponder (RFID).

Features of modules:

- transmission of ID number of red-out transponder to master device via serial interface
- configuration of electric connection type (for UM-RWD-M and CTU-RWD-M)
- available serial interface types:
    - RS-TTL
    - RS-232
    - RS-48
    - Dallas 1 Wire (DS1990A)
    - Wiegand
- configurations of serial interfaces available
  for all modules:
    - repeatability of an ID number transmission state

  for RS-XXX:
    - autonomous communication
    - group addressing (Broadcast)
    - selective addressing (Unicast)
    - setting an address

  for Dallas:
    - address
    - family code

  for Wiegand:
    - bit number

  - implemented **MasterID** feature for 40 transponders
  (Operation with cards without using additional master systems),
  quick ID number saving in internal transponder base, quick ID number deleting in internal transponder base, operation with master card)

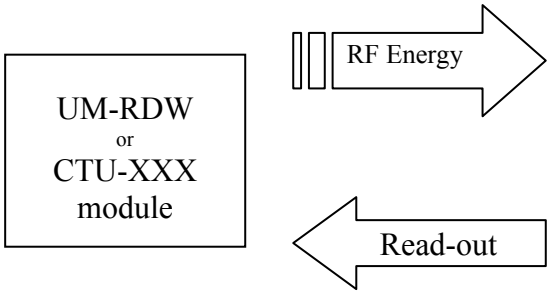
  - driving the two state outputs, depends on recognized transponder
  - driving the two state outputs, depends on remotely assigned value
  - configuring of two state outputs
    - driving the signal source
    - active state hold up time
    - modulation times
    - active state choice
    - repeatability of active state
  - reading out the two state outputs and data transmitting via RS-XXX interface

3. **Principle of operation**

An antenna in form of air coil should be connected to UM-RWD-M module. It will generate electromagnetic field and supply a transponder, which is present in this field.
The CTU-RWD-M, CTU-232-M, CTU-485-M modules have built-in antenna.

After applying of transponder to a reader, module performs following operations:

- generates field and reads data out from transponder,
- compares read-out ID number with internal card base,
- drives the two-state outputs according to set-up,
- in compliance with set-up, sends data to master device via one serial connector: RS-TTL, RS-232, RS-485, Dallas or Wiegand.



Byte no.	Unique transponder
1	ID1 (8 bytes)
2	ID2 (8 bytes)
3	ID3 (8 bytes)
4	ID4 (8 bytes)
5	ID5 (8 bytes)
6	Parity 1 (8 bytes)
8	Parity 2 (6 bytes)

4. Technical data

Module type	Interfaces available	Number of two-state inputs / outputs	Supply voltage	Supply current	Built-in antenna	Built-in buzzer
UM-RWD-M	RS-TTL Wiegand Dallas	2	5 V +/- 0.25 V	5…75 mA	no	no
CTU-RWD-M	RS-TTL Wiegand Dallas	1 + 1 buzzer output	5V +/-0.25 V	5…75 mA	yes	yes
CTU-232-M	RS-232	1 + 1 buzzer output	8....13 V	5…75 mA	yes	yes
CTU-485-M	RS-485	1 + 1 buzzer output	8....13 V	5…75 mA	yes	yes

Technical data common for all modules	
Rated operation RF frequency of module	125 kHz
Data velocity received from transponder	RF/64 (1953 bps)
Modulation of data received from transponder	Manchester
Max. read-out frequency	5 read-outs/s
Max. load current of two-state outputs and interface	5 mA
Read-out distance from transponder	up to 12 cm
Antenna for UM-RWD-M module	1 mH ±5%
RS interface configuration data	2400, 4800, 9600, 19200, 38400, 57600, 115200 bps, 8 data bits, 1 stop bit, no parity
Transponder type	EM MICROELECTRONIC-MARIN H4102

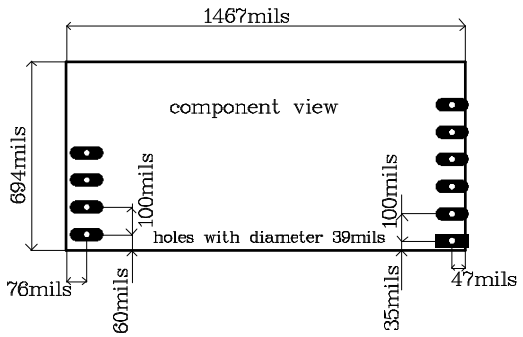
5. Terminal description

5.1. UM-RWD-M module

			O	input / output P1
		UM-RWD-M	**O**	input / output P0
antenna 1	**O**		**O**	ground
antenna 2	**O**	37 x 18 mm	**O**	ground
supply ground	**O**		**O**	serial data D1
supply 5 V	**O**		**O**	serial data D0

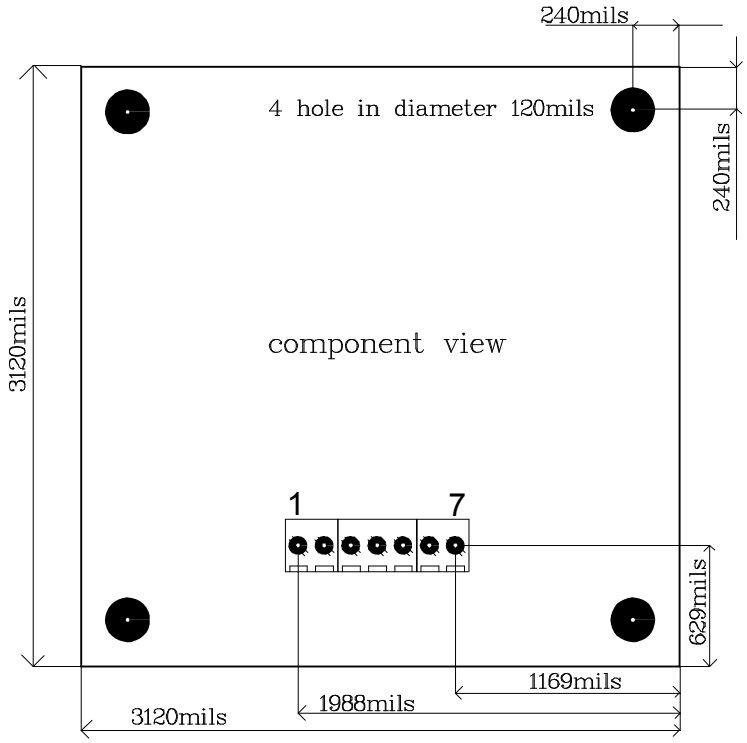
Drawing: terminal configuration - view from component side

antenna1, antenna2	internal antenna with inductance of 1 mH
supply ground and supply voltage 5V	circuit supply
terminal P0	two-state input / output for general use
terminal P1	two-state input / output for general use
ground	ground for: P0, P1, D0, D1
serial data D0	RS-RX or Wiegand-0
serial data D1	RS-TX or Wiegand-1 or Dallas



Drawing: PCB dimensions

5.2. CTU-RWD-M, CTU-232-M and CTU-485-M modules



1 - serial data D0	RS232-RX or RS485-B or Wiegand-0
2 - serial data D1	RS232-TX or RS485-A or Wiegand-1 or Dallas
3 - supply LED	auxiliary LED output for supply presence signaling
4 - terminal P0	output / input - two-state terminal for general use
5 - terminal P1	output - two-state for general use (the built-in user is connected to the terminal)
6 - supply	supply voltage Vdd (plus)
7 - ground	supply voltage - ground (minus); common terminal for terminals D0, D1, P0 and P1

6. Serial data transmission format

6.1. RS-XXX protocol

The protocol is based on serial (RS-232) transmission with voltage levels depending on given type of module.

The RS protocol is described in separate data sheet "Netronix Protocol".

Described modules can operate in following modes:

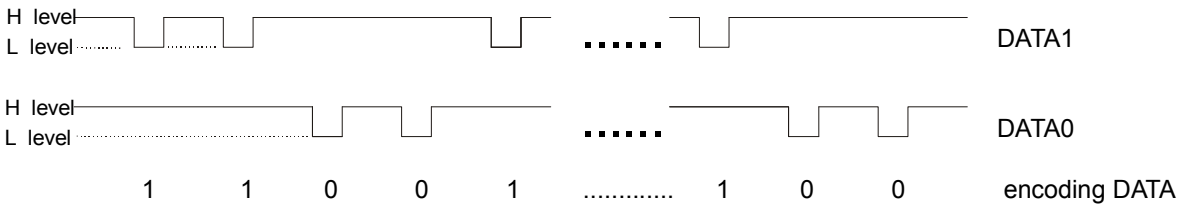
- automatic communication
- selective addressing - Unicast
- group addressing - Broadcast

Module operation with RS protocol can be tested by means of FRAMER tool software.

6.2. **Wiegand**

The format conforms WIEGAND protocol specification for N bits. During operation, a module tries to read-out transponder periodically. If it fails (no successful read-out), module does not send data (bus does not "see" the module). If module reads out the transponder, the module starts to send data via Wiegand bus.

Pulse sequence from left to right.



Total number of pulses (level L) is equal to N. The first being bit sent complements up to parity the bits from first half of total bits. The last bit N complements up to non-parity the bits from second half of bits being sent.
It means, that two bits out of N bits assure the transmission correctness. Information is being sent is written by means bits 2 to N-1, it gives N information bits.

Check sums for bit sequence:

```
for even N:

EXXXXXXXXXXXXYYYYYYYYYYYYO

or for odd N:

EXXXXXXXXXXXXXXXXXX..................
..................YYYYYYYYYYYYYYYYYYO
```

Where:
E = bit complementing up to parity
O = bit complementing up to non-parity

X = mask for parity calculation
Y = mask for non-parity calculation

6.3. **Dallas**

Family code	ID1…ID5	Address	CRC
1 byte	5 bytes	1 byte	1 bytet

ID1...5 – unique ID number of transponder
CRC_DAL- check sum of data send

The format conforms 1-WIRE Dallas (e.g.. DS1990A). It means, that described module could be used as a replacement of DS1990A drop.
During operation, a module tries to read-out transponder periodically. If it fails (no successful read-out), module does not response for pulses sent from 1-WIRE master unit. Bus does not "see" the module, which corresponds with lack of reader applying, it means applying the DS1990A drop to drop reader. If module reads out the transponder, the module starts to send data via 1-WIRE bus.

Calculate the CRC value

According to DS1990A specification C value is calculated from equation x^8+x^5+x^4+1 with initial value equal to 0x00. The CRC is calculated on basis of all frame bytes excluding the last one.

An example of CRC value calculation procedure written in C language

```
unsigned char CalcCRCDallas(unsigned char *SourceAdr)
{
unsigned char i,k,In,CRC=0;
        for(i=0;i<7;i++)
        {
                In=*SourceAdr;
                for(k=0;k<8;k++)
                {
                        if((In^CRC)&1) CRC=((CRC^0x18)>>1)|0x80;
                        else CRC=CRC>>1;
                        In>>=1;
                }
                SourceAdr++;
        }
        return(CRC);
}
```

where *SourceAdr is beginning flag of data buffer

7. Features of Unique transponder

The Unique transponder (EM Microelectronic –Marin SA H4102 standard) comprises 5 bytes with the laser written non-repeatable ID number. The correctness of the written data is secured with parities written in the next two bytes. Owing to the UM-005 reader, the ID number is red, the read-out correctness is checked automatically, and then the number is sent to the master unit via serial interface.

Byte no.	The Unique transponder
1	ID1 (8 bits)
2	ID2 (8 bits)
3	ID3 (8 bits)
4	ID4 (8 bits)
5	ID5 (8 bits)
6	Parity 1 (8 bits)
8	Parity 2 (6 bits)

8. Module configuration

After power on, all mentioned modules operate at the moment in mode with RS-XXX serial interface. The modules operate in UNICAST mode with given 0x01 address.
This state lasts for 2 s.

If after power on of the module, during 2 s:

- the module does not receive suitable command, switches its interface over interface complied with actual interface configuration.
- the module receives proper command, performs given command, sends a response and prolongs time, in which it remains when it operates in RS-XXX mode, for the next 10 s.

Serial interface before and after 2 s from power on.

Module type	Interface 2 s before power on	Interface after 2 s from power on
UM-RWD-M	RS-232 TTL	RS-232 TTL or WIEGAND N or Dallas (depending on configuration)
CTU-RWD-M	RS-232 TTL	RS-232 TTL or WIEGAND N or Dallas (depending on configuration)
CTU-232-M	RS-232 C	RS-232 C
CTU-485-M	RS-485	RS-485

During set-up procedure of serial interface and P0, P1 port, the proper command is sent to the module, with suitable parameters D0 .....Dn together.

RS interface set-up frame:

module address 1 byte	frame length 1byte	command 1 byte	parameters 4 bytes	CRCH,CRCL 2 bytes
0x01	0x09		D0 ..... Dn	xx xx

Please refer to technical data sheet “Netronix Protocol”.

9. Commands used in RS-XXX modes

Please refer to technical data sheet “Netronix Protocol”.

9.1. Reading out of ID number of transponder in field

Command:

	C_UniqueRead		

Response:

	C_UniqueRead+1	ID1 ID2 ID3 ID4 ID5	KodOperacji	

Where:
ID1 ... ID5 – ID number of transponder (ID5 – less significant byte of ID number).
Jf (KodOperacji==OC_Successful), it means, that entire operation has been performed successfully.
If (KodOperacji==OC_ParityError), it means, that no transponder present within antenna field or read-out error.

9.2. Reading out of software version

Command:

	C_SoftwareVersion		

Response:

	C_SoftwareVersion+1	ASCII1.....ASCIIn	KodOperacji	

Where:
ASCII1.....ASCIIn is ASCII code dot sequence describing software version.
when KodOperacji==OC_Successful, it means, that operation has been performed successfully.

9.3. **Configure the P0 and P1 port**

Command:

	C_SetPortConfig	D0 D1 D2 D3 D4 D5 D6	

Response:

	C_SetPortConfig+1		KodOperacji	

Where:
D0 ...D6 - set-up data
when KodOperacji==OC_Successful, it means, that operation has been performed successfully.

Byte	Allowable limits		Description
D0	0x00 - port P0 settings 0x01 - port P1 settings		choice of port number
D1	0x00 - output 0x01 - input		data flow direction
D2	0x00	fixed logic 0	output type
	0x01	fixed logic 1	
	0x02	signaling presence of any transponder in field	
	0x03	signaling presence of any transponder in field, but which is existing in card base	
	0x04	describes set-up state of virtual port WP0, driven via RS interface	
	0x05	describes set-up state of virtual port WP1 driven via RS interface	
	0x06	monostable output driven MasterID unit (depending on recognized card)	
	0x07	monostable output driven MasterID device and additionally remembers last state, after power shut-off	
D3	0x00...0xff		hold-up time of output incitement x100 ms
D4	0x00...0xff		time duration of output state H x100 ms

D5	0x00...0xff	time duration of output state L x100 ms
D6	bit0 =0 – activity during incitement bit0 =1 – activity when incitement bit1 =0 – normally open bit1 =1 – normally close	bit 0 - type of output activity triggering bit 1 – output type

D2,D3,D4,D5 and D6 a re not valid, in case of port is set as a input.

9.4. Configure the serial interface

Command:

	C_SetInterfaceConfig	D0 D1 D2 D3	

Response:

	C_SetInterfaceConfig +1		KodOperacji	

Where:
D0 ...D3 are set-up data
If KodOperacji==OC_Successful it means, that operation has been performed successfully.

Interface type depends on D0 parameter.

9.4.1. Operation of RS-XXX interface in automatic communication mode

This mode is based on automatic data sending via RS interface, at the moment of applying the transponder.

Byte	Allowable limits	Description
D0	0x00	RS-XXX interface in automatic mode of communication
D1	0x01...0xfe	module address
D2	0x01=2400 b/s 0x02=4800 b/s 0x03=9600 b/s 0x04=19200 b/s 0x05=38400 b/s 0x06=57600 b/s 0x07=115200 b/s	baud rate
D3	0x00 – data will be sent periodically, till the transponder is in vicinity of the antenna 0x01 – data will be send one time only, at the moment of applying	periodicity of data sending

9.4.2. Operation of RS-XXX interface in BROADCAST or UNICAST type of addressing

In this mode, module does not send data automatically, in case of it, it senses a module in field. To get any information, send command to module. The module performs the command and sends response back.

Byte	Allowable limits	Description
D0	0x01	RS-XXX in address mode
D1	0x01...0xfe	module address
D2	0x01=2400 b/s 0x02=4800 b/s 0x03=9600 b/s 0x04=19200 b/s 0x05=38400 b/s 0x06=57600 b/s 0x07=115200 b/s	baud rate
D3	0x00 – data will be sent periodically, till the transponder is in vicinity of the antenna 0x01 – data will be send one time only, at the moment of applying	periodicity of data sending

9.4.3. Dallas 1-Wire

This mode conforms Dallas 1-Wire protocol. Additionally it is possible to set sending address and family code.

Byte	Allowable limits	Description
D0	0x02	Dallas 1-Wire
D1	0x00...0xff	address
D2	0x00...0xff	family code
D3	0x00 – data will be sent periodically, till the transponder is in vicinity of the antenna 0x01 – data will be send one time only, at the moment of applying	periodicity of data sending

9.4.4. Wiegand, N - bits

Byte	Allowable limits	Description
D0	0x03	Wiegand N-bits
D1	0x00...0x28	number of bits sent typical values: 26, 37
D2	0x00...0xff	not valid
D3	0x00 – data will be sent periodically, till the transponder is in vicinity of the antenna 0x01 – data will be sent one time only, at the moment of applying	periodicity of data sending

9.5. Driving the P0 or P1 port

The driving is preformed indirectly by means writing of WP0 and WP1 virtual ports in. Information from WP0 and WP1 ports can be sent to any output, and depends on the output configuration.

Command:

	C_WritePorts	D0	

Response:

	C_WritePorts +1		KodOperacji	

Where:
bit0 D0 (D0.0) is copying to virtual port WP0
bit1 D0 (D0.1) is copying to virtual port WP1
if "KodOperacji==OC_Successful", it means, that operation has been performed successfully

9.6. Reading out of P0 or P1 port

Command:

	C_ReadPorts		

Response:

	C_ReadPorts +1	D0	KodOperacji	

Where:
State from P0 port is copying to bit: bit0 D0 (D0.0)
State from P1 port is copying to bit: bit1 D0 (D0.1)
if "KodOperacji==OC_Successful", it means, that operation has been performed successfully

Read-out operation will be done properly, if given port P0 or P1 is configured as a output.

9.7. Summary of names and command digital presentation

Command name	Command code
C_UniqueRead	0x02
C_SetInterfaceConfig	0x36
C_SetPortConfig	0x40
C_WritePorts	0x70
C_ReadPorts	0x72
C_SoftwareVersion	0xfe

9.8. Summary of names and operation code presentation

Operation code name	Code
OC_Successful	0xff
OC_ParityError	0x1a
OC_Error	0xfe

10. **MasterID Mechanism**

By means of "master card", it is possible to add and remove quickly user card to and from a reader memory.

To register card as a "master card”, clear card memory first.
When memory clearing is done, apply in any moment chosen card to the module. The card becomes "master card" automatically”. You can never remove nor add the "master card" by means of another card.

In case you need to register card as a "user card", apply a "master card" to reader, and then apply to it register card during two seconds.

In case you need to remove "user card" from memory, apply during two seconds a "master card" to reader, and then apply to it removed card.

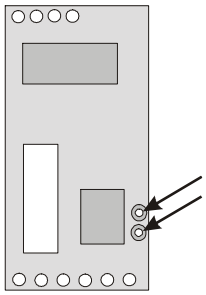
After applying "user card" to a reader, the reader will perform preprogrammed action.

10.1. **Clearing of memory card**

To clear memory card, short during 1 s two terminals located on module.

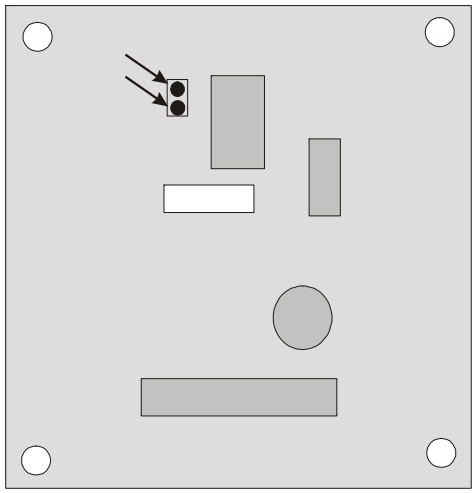
10.1.1. **UM-RWD-M module**

Arrows below show terminals to be shorted, to clear transponder memory.



10.1.2. **CTU-XXX module**

Arrows below show terminals to be shorted, to clear transponder memory.



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