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Data Sheet

Wiegand.pdf
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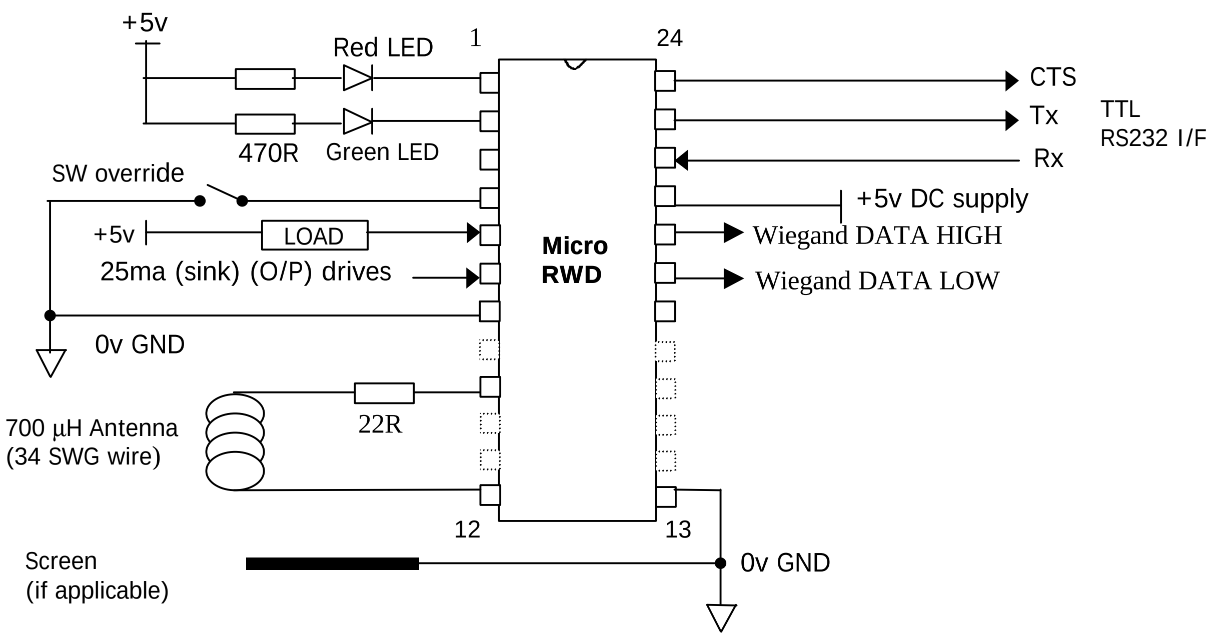
Micro RWD H4001 "Wiegand" Output Version

This version of the Micro RWD product behaves in the same manner as the standard Micro RWD H4001 reader with the additional feature of having "Wiegand" 26 or 36 bit data outputs. The Wiegand DATA high and DATA low signals form the common protocol that has been a standard for many years on door entry and access control readers. The usual TTL serial interface is also supported along with the simple commands to read the tag data and programme the RWD's internal parameters.
The diagram below shows the pinout configuration for the Hybrid chip version; two pins are used to output the DATA high and DATA low signals according to the "Wiegand" protocol. The Micro RWD "Wiegand" version can replace existing door entry systems with a fully compatible contactless smart card solution.

Micro RWD Hybrid chip connections



The Micro RWD "Wiegand" version supports both the 26 and 36 bit output protocols. The particular data length required is selected by clearing or setting the RWD internal EEPROM byte 5 (00 sets 26 bit mode and 01 sets 36 bit mode).
The RWD operates by using the 40 bits of H4001 transponder data to create the 26 or 36 bit DATA high, DATA low outputs, taking the particular bit sequence from the beginning (most significant bit) of the 40 bit transponder sequence.

Wiegand Output Protocol

The Wiegand protocol (26 bit mode) itself is made up of a leading even parity bit (for b0 - b11), 24 bits of data (from transponder data) and a trailing odd parity bit (for b12-b23). The 36 bit mode has the same format except 34 bits are used to form the data sequence.

For example:-

H4001 tag data (Hex): 04 60 22 12 75

Wiegand 26 bit sequence:- E (b0 --------- b11) (b12 -------- b23) O

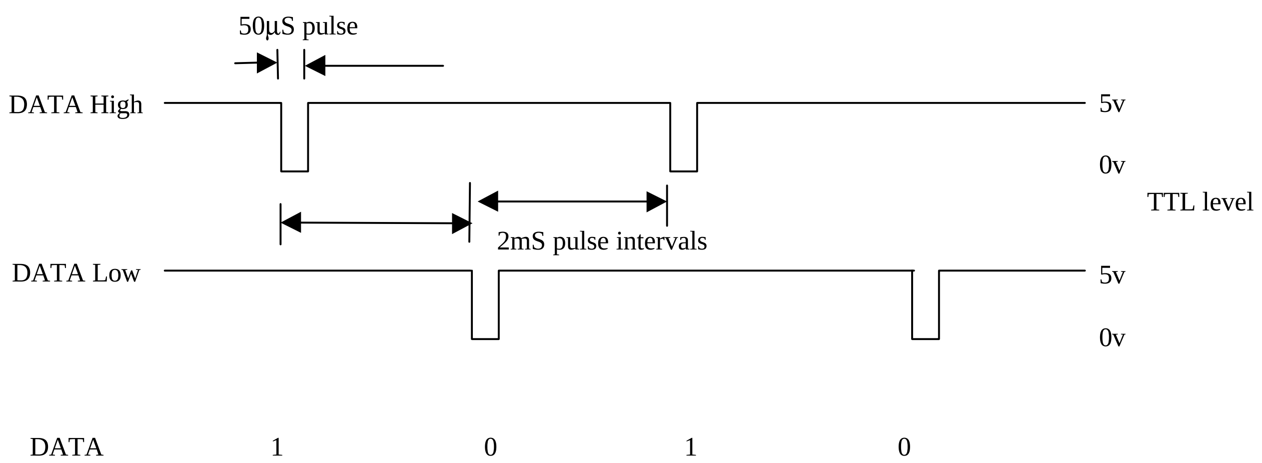
E (0 4 6 0 2 2) O

1 0000 0100 0110 0000 0010 0010 1

Where E is EVEN parity bit for bit 0 to 11 and O is ODD parity bit for bits 12 to 23

The H4001 tags to be used with this system should therefore be ordered with the 40 bits of data the same as the required 24 or 34 bit Wiegand data.
The complete Wiegand bit sequence is output whenever the tag is within the RWD's antenna field and the tag has been validated. This output is independent of the normal TTL serial interface which responds to received commands and replies with the raw 40 bits of H4001 tag data. The physical Wiegand protocol is asynchronously transmitted as low going 50 µS pulses on the appropriate DATA low or DATA high pins. These pulses are separated by 2mS periods.

Wiegand Protocol Timing Diagram



Micro RWD H400x serial protocol specification

The Micro RWD H400X is designed to communicate with EM Marin H400X RF transponders.

The Micro RWD has two basic modes of operation:-

1) Remote mode connected to a host serial interface. This is where the stored list of authorised identification codes can be empty, effectively authorising all transponders for authentication. A simple serial protocol allows a host system to communicate with the Micro RWD in order to program new authorised identification codes, change configuration and perform read operations from the tag itself.

2) Standalone mode where the tag identification codes are checked against the stored list of authorised codes. If an identification code matches, the output drive and Green LED are enabled. Effectively standalone mode occurs when there is no host system communicating with the Micro RWD.

The identification codes described in this text are regarded as the first four bytes (most significant 32 bits) of the tag memory array.

Serial Interface

This is a basic implementation of RS232. The Micro RWD does not support buffered interrupt driven input so it must control a BUSY (CTS) line to inhibit communications from the host when it is fully occupied with tag communication. It is assumed that the host (such as a PC) can buffer received data.
Tx, Rx and RTS signals from the Micro RWD are all TTL level and are converted to +/- 12v levels using an inverting charge pump driver device such as the MAX232 (note the inversion of the TTL levels).

Serial Protocol

The following commands are supported. The corresponding acknowledge code should be read back by the host and decoded to confirm that the command was received and actioned correctly. The serial bit protocol is 9600 baud, 8 bits, 1 stop, no parity (lsb transmitted first).
The status flags returned in the Acknowledge byte are as follows:

```
b7  b6  b5  b4  b3 b2 b1 b0
1   1   1   1   1  1  1  1
        |   |   |  |  |   EEPROM error (Internal EEPROM write error)
        |   |   |  |  Tag OK (Tag ident code matched to list)
        |   |   |  Rx OK  (Tag  comms and acknowledgement OK)
        |   |   RS232  error (Host serial comms error)
        |   RELAY Enabled flag
        HTRC (or Antenna fault) error flag
```

Note that bits 6 and 7 are fixed 1's so that an acknowledge code of D6 (Hex) would generally indicate no errors with a matched (and authenticated) Tag present.
Note also that only the relevant flags are set after each command as indicated in the following specification.

Read H400x Tag

Command to read 5 bytes of data from H400x (40 bit) memory array. If the read was successful, indicated by acknowledge status flags then five bytes of tag data follow.

	B7							B0	
Command:	0	1	0	1	0	0	1	0	(0x52)
Argument1:	x	x	x	x	x	x	x	x	(Dummy Page number e.g 00)
Acknowledge:	1	1	F	F	F	F	F	X	(F = Status flags)

Data only follows if read was successful

Reply1:	D	D	D	D	D	D	D	D	(D = msb data read from H400x)
Reply2:	D	D	D	D	D	D	D	D	
Reply3:	D	D	D	D	D	D	D	D	
Reply4:	D	D	D	D	D	D	D	D	
Reply5:	D	D	D	D	D	D	D	D	(D = lsb data read from H400x)

Note that for the Read Tag command, if an error flag has been set in the Acknowledge code then there will be NO following data.

Tag STATUS

Command to return Tag status.
The acknowledge byte flags indicate general Tag status.

	B7							B0	
Command:	0	1	0	1	0	0	1	1	(0x53)
Acknowledge:	1	1	F	F	F	F	F	X	(F = Status flags)

Message

Command to return product and firmware identifier string to host.

	B7							B0	
Command:	0	1	1	1	1	0	1	0	(0x7A)

Reply: "IDE RD MC200/H400x (SECM200 V1.xx) DD/MM/YY" 0x00

Returned string identifies author, product descriptor, project name, firmware version no. and date of last software change. Note that the string is always NULL terminated.

Note also that the serial communication uses hardware handshaking to inhibit the host from sending the Micro RWD commands while Tag interrogation is in progress. This serial communication protocol allows for a 10ms 'window' every Tag polling cycle indicated by the BUSY line being low. During this 'window' the host must assert the first start bit and start transmitting data. The BUSY goes high again 10ms after the last stop bit is received.

NOTE that only one command sequence is handled at a time.

Program EEPROM

The Micro RWD has some internal EEPROM for storing system parameters such as configuration and authorised ident codes. This command sequence allows individual bytes of the EEPROM to be programmed with new data. Note that due to the fundamental nature of these system parameters, incorrect data may render the system temporarily inoperable.

	B7 B0	
Command:	0 1 0 1 0 0 0 0	(0x50)
Argument1:	x x N N N N N N	(N = EEPROM memory location 0-127)
Argument2:	D D D D D D D D	(D = data to write to EEPROM)
Acknowledge:	1 1 X F X X X F	(F = Status flags)

Internal EEPROM memory map

Byte 0: Tag Polling Rate (x 2.5ms)
Byte 1: RF ON/OFF lock byte (0x55 = RF ON, anything else = OFF, normally set to 0x55)
Byte 2: Reserved (Checksum)
Byte 3: Reserved

Byte 4: Reserved
Byte 5: Wiegand data length, 0x00 = 26 bit output, anything else = 36 bit output, (default setting)
Byte 6: Reserved
Byte 7: Reserved

Byte 8: Reserved
Byte 9: Reserved
Byte 10: Reserved
Byte 11: Reserved

Start of authorised tag codes. List is terminated with FF FF FF FF sequence.
List is regarded as empty (all ident codes valid) if first code sequence in list is (FF FF FF FF).
The tag identity code is taken as the most significant four bytes of the H400x five byte sequence.

Byte 12: 0xFF Empty list
Byte 13: 0xFF
Byte 14: 0xFF
Byte 15: 0xFF

Byte 16: (MSB) Tag ident code
Byte 17:
Byte 18:
Byte 19: (LSB)

Byte 20: (MSB) Tag ident code
Byte 21:
Byte 22:
Byte 23: (LSB)
-
-
Byte 127: Last Internal EEPROM location

Method of Operation

The Micro RWD reader only allows full communication with H4001 transponders if an initial level of security has been passed. The system works by reading the tag memory, stripping off the various parity bits to give the user memory and taking the first four bytes as a serial number (identity code). The Micro RWD internal EEPROM is then checked to see if this serial number is stored in the authorisation list located from byte 12 onwards. If the tag serial number is matched to a serial number stored in the Micro RWD or the list is empty then the tag has passed the validation test. If the Micro RWD has FF FF FF FF (hex) stored at EEPROM locations 12 to 15 then the list is treated as empty and all H4001 tags are accepted through the validation test.

Full communication and Wiegand output signals are only allowed if this initial security check has been passed (or the Micro RWD authorisation list is empty).

No responsibility is taken for the method of integration or final use of Micro RWD

More information on the Micro RWD and other products can be found at the Internet web site:

http://www.ibtechnology.co.uk

Or alternatively contact IB Technology by email at:

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