RFID TRANSPONDER **TECHNOLOGY**

DOC. 134-R1

TRW SERIAL TYPE H - HITAG 1-2-S

TRW-PCB   **TRW-ONDA**   **TRW-SHELL**   **TRW-BOX**

TRW-USB   **TRW-POCKET USB**

1.0   FEATURES AND SPECIFICATIONS
The TRW is a Front Side Serial Tag Reader/Writer with **built-in Antenna.**
The module operate with all HITAG series and auto-detect the TAG type.

INTERFACE OPTIONS:
TTL - RS232 - RS485 - USB

TRANSPONDERS SUPPORTED:
 HITAGS 256 / 2048
 HITAG1
 HITAG2

WORKING METHODS:
In our application we use only the **PAGE** number.

HITAGS is Read and Written in **Standard mode**.
Memory is mapped in 16 BLOCKS any with 4 PAGES of 4 bytes each.
The configuration is normally set in **RTF** mode for READ-WRITE-CONFIG commands.
Can be set in **TTF** spontaneous mode on PAGE 4-5, if **UNIQUE** emulation is requested,.
PAGES 4-5 can be programmed in UNIQUE format (5 bytes) and can be readable from any UNIQUE reader.
PAGES 4-5 can be read in Standard or in UNIQUE mode.
PAGE 8 to 63 used for Read and Write.

HITAG1 operates in **Standard Protocol Mode** , no Crypto allowed.
Memory is mapped in 16 BLOCKS any with 4 PAGES of 4 bytes each.
PAGE 2 to 15 are SECRET and not readable.
PAGE 16 to 63 used for Read and Write.

HITAG2 operates in **Password Mode**.
Memory is mapped in 8 PAGES of 4 bytes each.
PAGE 1 PASSWORD-RWD. Value default = 4DH-49H-4BH-52H. PASSWORD-RWD can be changed.
PAGE 3 PASSWORD-TAG. Default = AAH-48H-54H. No change of PASSWORD-TAG is permitted.
PAGE 2 NOT PERMITTED.
PAGE 4 to 7 used for Read and Write.

2.0   VERSIONS
TRW-TTL-HS-5	TTL interface. Polling.
TRW-232-HS-12	RS232 interface. Polling.
TRW-485-HS-12	RS485 interface. Polling.
TRW-USB-HS-5	USB2.0 interface. Polling. Powered by USB connector.

Glossary: **H=**TAG type HITAG   **S**= Polling mode   **12/5**= Power supply

2.1 DIMENSIONS PCB TTL/232/485/USB

CONNECTION TRW-TTL

The on-board connector is an 8 pin .1" soldering type.

Pin Number	Description	
1	+5VDC	
2	GND	
3	RX	TTL input
4	TX	TTL output
5	Spare	TTL i/o
6	Spare	TTL i/o
7	Out1	Open Collector output.
8	LED-OUT	TTL output trough internal 1k?
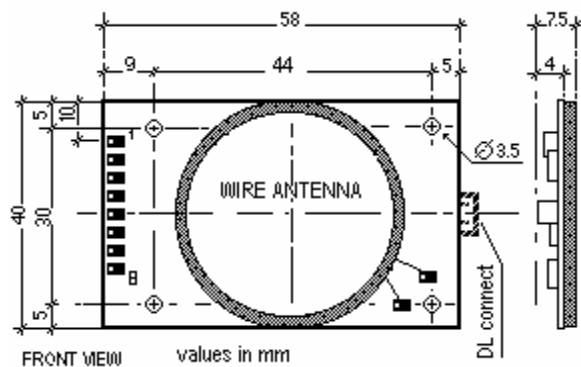
CONNECTION TRW-485

The on-board connector is an 8 pin .1" soldering type.

Pin Number	Description	
1	+12VDC	
2	GND	
3	RS485-A	
4	RS485-B	
5	No Connect.	
6	No Connect	
7	Out1	Open Collector output.
8	LED-OUT	TTL out internal 1k?

CONNECTION TRW-232
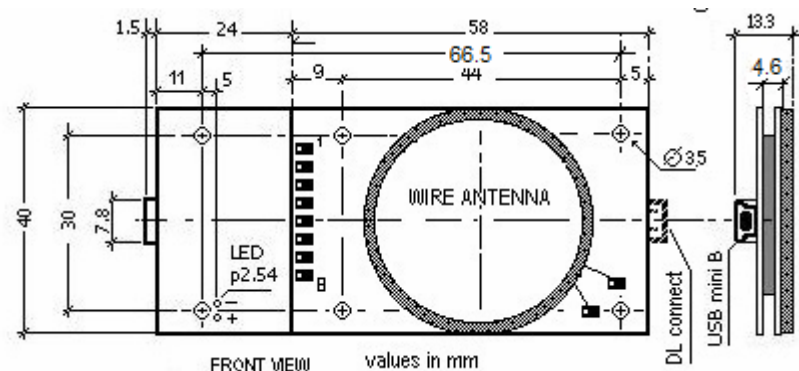
The on-board connector is an 8 pin .1" soldering type.

Pin Number	Description	
1	+12VDC	
2	GND	
3	RX	RS232 input
4	TX	RS232 output
5	No Connect.	
6	No Connect.	
7	Out1	Open Collector output.
8	LED-OUT	TTL out internal 1k?

DIMENSIONS PCB USB ASSEMBLED

Pin Number	Description
1	+5VDC from PC
2	D+
3	D-
4	GND
LED	TTL out (internal 1k?)

2.2 INSTALL

Due to the Radio Frequency emissions of the Reader Antenna is important to avoid the usage of metal panels in front, rear and lateral sides of the Reader.

Although the TRW provides an high resistance to EMC corruption, avoid to install it in high RF emission environments, the reading distance may result reduced.
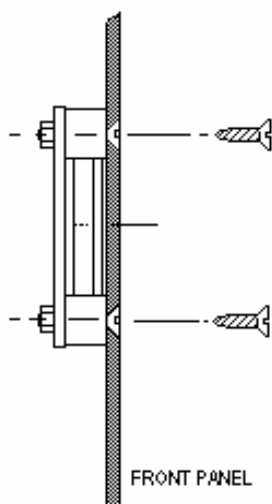
3.0 PROTOCOL

The standard protocols for the TRW are:

-HS Polling-Selecting   Suitable for application where the Host continuously polls the TRW.
Is simple but force the HOST to be always operative else is absence of TAG.

The protocol FORMAT is described below.

STX .... Start of string synchronization code.
DEVICE.. Is the Device Number. **For the TRW-TTL/RS232 is always 00H.**
LENGTH.. Is the number of bytes following the LENGTH.
     Example: STX-DEVICE-LENGTH-FUNCTION-DATA0....DATA11-BCC
     The length is 14 DEC = 0D HEX.
FUNCTION /STATUS.. Is the FUNCTION to be executed or the STATUS of an operation executed.
DATA0 to DATAn.. Are the data exchanged for a max of 16 bytes.
PASSW0 to PASSW3.. Is the Password code that permits commands exec on TAG PASSWORD PROTECTED.
BCC.. Is calculated as the XOR of all bytes from STX to last DATA included.
     Example: STX-DEVICE-LENGTH-STATUS-BCC ✍ 02H-00H-02H-01H-BCC
     where BCC= 01H.

3.1 PROTOCOL HS

3.1.1 STRINGS from HOST to TRW

COMMAND #S :   **SET DEVICE**   **VALID ONLY FOR TR-485**

DESCRIPTION	STX	DEVICE	LENGTH	FUNCTION	DATA0	BCC
HEX VALUE	02H	FFH	03H	See below	00H to 7CH	00H-FFH

FUNCTION	VALUE	DESCRIPTION
SET DEVICE	61H	The device number is set into the TRW memory. Must be executed on any TRW one-by-one befor to install. In DATA0 insert the DEVICE NUMBER assigned to TR.

COMMAND#P :   **POLL DATA**

DESCRIPTION	STX	DEVICE	LENGTH	FUNCTION	FRP	N-PAGEs	BCC
HEX VALUE	02H	00H-7CH	04H	See below	00H-3FH	01H or 04H	00H-FFH

FUNCTION	VALUE	DESCRIPTION
POLL_UID	04H	FRP=0 N-PAGES=1 **Read UID+ PAGE0** is performed. 8 Bytes are transmitted. This command is MANDATORY to be executed before any other command. Only after execution of this command the tag enter the ACTIVE STATE. If an error occurs on any other command or the TAG was removed from RF field, the ACTIVE STATE was lost and a new command has to be executed. TRW automatically recognizes the HITAG type and verify the parameter compatiblity on any COMMAND.
POLL_DATA	04H	The Tag data are read in sequential order from the First Read Page (FRP) for 1 PAGE or 4 PAGES.

                 FRP=1 to 63 N-PAGES=1   Read one PAGE is performed. 4 Bytes are transmitted.
                 FRP=0 to 63 N-PAGES=4   Read 4 PAGEs (1 BLOCK) is performed. 16 Bytes are transmitted.
                                              For a correct read the FRP has to be the first of the BLOCK . Example:...-12-16-20 .....
                 FRP=4 N-PAGES=4   If RTF Configured Read as normal BLOCK.
                                                If TTF Configured read as UNIQUE Format (5 bytes).

COMMAND#0 :   **WRITE DATA**

DESCRIPTION	STX	DEVICE	LENGTH	FUNCTION	FWP	N-PAGES	U	SPARE (3)	DATAn (n=4-5-16)	BCC
HEX VALUE	02H	00H-7CH	0CH-18H	See below	02H-3FH	01H-04H	00H or 0FH	00-00-00	00H to FFH	00H-FFH

FUNCTION	VALUE	DESCRIPTION
WRITE DATA	22H	DATAn are written in sequential order into the TAG, from the First Write Page (FWP) for N-PAGES.

                 FWP=2 to 63 N-PAGES=1 U=00H   Write one PAGE is performed. 4 Bytes are written.
                 FWP=0 to 63 N-PAGES=4 U=00H   Write 4 PAGEs (1 BLOCK) is performed. 16 Bytes are written.
                                              For a correct write the PAGE has to be the first of the BLOCK.
                 FWP=4   N-PAGES=2 U=0FH   The 5 Bytes are formatted UNIQUE and written in PAGES 4-5.

IMPORTANT: Before send this command be sure the TAG is properly positioned on the RF field.
                 Don't move it till the STATUS command OK has been received.

COMMAND#1 :   **CHANGE CONFIGURATION**

DESCRIPTION	STX	DEVICE	LENGTH	FUNCTION	FWP	N-PAGES	SPARE (4 bytes)	FBR	LBR	MODE	SPARE	BCC
HEX VALUE	02H	00H-7CH	0CH	See below	01H	01H	00-00-00-00	04H	02H	00H or 01H	00H	00H-FFH

FUNCTION	VALUE	DESCRIPTION
CHANGE CONF	80H	Write the CONFIGURATION WORD on TAG for Manchester-RF64-. MODE=0 RTF mode MODE=1 TTF mode. BLOCKS 4-5 will be spontaneously transferred when TAG in RF field. Normally used with BLOCK 4-5 written in UNIQUE format. See WRITE DATA.

IMPORTANT: Before send this command be sure the TAG is properly positioned on the RF field.
                 Don't move it till the STATUS command OK has been received.

COMMAND#SWP :   SET WORKING PASSWORD-RWD (apply to HITAG2 only)

DESCRIPTION	STX	DEVICE	LENGTH	FUNCTION	W_PASS(4 Bytes)	BCC
HEX VALUE	02H	00H-7CH	06H	See below	00H-FFH	00H-FFH

FUNCTION	VALUE	DESCRIPTION
SET_W_PASS	9FH	This command write in the RAM memory of the EK20 the PASSWORD-RWD to be used for entering the ACTIVE STATE with the POLL_UID command.

COMMAND#WP :   WRITE PASSWORD-RWD (apply to HITAG2 only)

DESCRIPTION	STX	DEVICE	LENGTH	FUNCTION	FWP	N-PAGES	U	SPARE (3 bytes)	PASSW-RWD (4 bytes)	BCC
HEX VALUE	02H	00H-7CH	0CH	See below	01H	01H	00H	00-00-00	00H to FFH	00H-FFH

FUNCTION	VALUE	DESCRIPTION
WRITE_PASS	99H	Write the **PASSW-RWD into the TAG.** **After correct execution of this command the PASSWORD-RWD on the TAG has been changed.** *REMEMBER* THE NEW PASSWORD-RWD WRITTEN IN THE TAG. **BEFORE ANY NEW OPERATION ON HITAG2, EXEC THE COMMAND#SWP WITH THE CORRECT PASSWORD.**

IMPORTANT: Before send this command be sure the TAG is properly positioned on the RF field.
Don't move it till the STATUS command OK has been received.

COMMAND#V :   READ VERSION

DESCRIPTION	STX	DEVICE	LENGTH	FUNCTION	BCC
HEX VALUE	02H	00H-7CH	03H	See below	00H-FFH

FUNCTION	VALUE	DESCRIPTION
READ VERSION	76H	Read the actual firmware version of the module.

3.1.2 STRINGS from TRW to HOST

IN RS485 MODE THE DEVICE BIT7 IS ALWAYS SET TO 1. So the address 00H is 80H and the 7CH is FCH.

REPLY#0 :   READ

DESCRIPTION	STX	DEVICE	LENGTH	FUNCTION	DATAn (4-5-16)	BCC
HEX VALUE	02H	00H-7CH	06-07-0AH-12H	See below	00H to FFH	00H-FFH

FUNCTION	VALUE	DESCRIPTION
READ HS	04H	**HITAGS Type recognized** Data READ from the TAG are complete. The data are read in the same order they were written. Depending on **POLL** settings the replay can be: 4 Bytes UID0-1-2-3 4 Bytes PAGE 2 to 63 : DATA0-1-2-3 16 Bytes BLOCK : PAGEn=DATA0-1-2-3 PAGEn+1=DATA0-1-2-3 PAGEn+2=DATA0-1-2-3 PAGEn+3=DATA0-1-2-3 5 Bytes UNIQUE FORMAT
READ H1	C4H	**HITAG1 Type recognized** Data READ from the TAG are complete. The data are read in the same order they were written. Depending on **POLL** settings the replay can be: 4 Bytes UID0-1-2-3 4 Bytes PAGE 16 to 63 : DATA0-1-2-3 16 Bytes BLOCK PAGEn=DATA0-1-2-3 PAGEn+1=DATA0-1-2-3 PAGEn+2=DATA0-1-2-3 PAGEn+3=DATA0-1-2-3
READ H2	44H	**HITAG2 Type recognized** Data READ from the TAG are complete. The data are read in the same order they were written. Depending on **POLL** settings the replay can be: 4 Bytes UID0-1-2-3 4 Bytes PAGE 4 to 7 : DATA0-1-2-3 16 Bytes BLOCK PAGEn=DATA0-1-2-3 PAGEn+1=DATA0-1-2-3 PAGEn+2=DATA0-1-2-3 PAGEn+3=DATA0-1-2-3
READ H1V	84H	**HITAG1Vegas Type recognized** Data READ from the TAG are complete. The data are read in the same order they were written. Depending on **POLL** settings the replay can be: 4 Bytes UID0-1-2-3 4 Bytes PAGE 2 to 63 : DATA0-1-2-3 16 Bytes BLOCK PAGEn=DATA0-1-2-3 PAGEn+1=DATA0-1-2-3 PAGEn+2=DATA0-1-2-3 PAGEn+3=DATA0-1-2-3 5 Bytes UNIQUE FORMAT

REPLY#V :   VERSION

DESCRIPTION	STX	DEVICE	LENGTH	VERSION (2 bytes)	BCC
HEX VALUE	02H	00-7CH	03H	MMH-RRH	00H-FFH

FUNCTION	DESCRIPTION
VERSION	Show the actual version (MM=Model RR=Firmware release). For this model the value **MM** is: RS232-XS=**22H** RS485-XS=**23H**

REPLY#1 :   STATUS

DESCRIPTION	STX	DEVICE	LENGTH	STATUS	BCC
HEX VALUE	02H	00H-7CH	02H	See below	00H-FFH

FUNCTION	VALUE	DESCRIPTION
READ DATA ERR	01H	Data detected on the TAG are corrupted or incomplete. RF noise environment detected.
NO TAG	02H	No tag detected during a COMMAND or POLLING sequence.
COMMAND OK	04H	The command has been correctly executed.
COMMAND ERR	20H	The command was not executed because a parameter out of limit on the string or a data error was dectected during execution.

3.1.3 DATA FLOW TRW-HS

HOST				TRW		
		ENTER ACTIVE STATE				
POLL_UID	===>	**READ UID SEQUENCE** (poll time min 100ms)		<===	if OK	**READ**
POLL_DATA	===>	**READ PAGE/BLOCK SEQUENCE** (poll time min 100ms)		<===	if OK	**READ**
				<===	if ERROR	**STATUS**
					Repeat ENTER ACTIVE STATE	
WRITE_DATA	===>	**WRITE PAGE/BLOCK/PASSW SEQUENCE** (response time max 200ms)		<===	if OK	**READ**
				<===	if ERROR	**STATUS**
					Repeat ENTER ACTIVE STATE	
CHANGE CONFIG	===>	**CONFIGURE SEQUENCE** (response time max 200ms)		<===	if OK	**STATUS**
				<===	if ERROR	**STATUS**
					Repeat ENTER ACTIVE STATE	
SET_WORK_PASS	===>	**SET WORKING PASSWORD RWD** (response time max 100ms)		<===	if OK	**STATUS**
				<===	if ERROR	**STATUS**
					Repeat ENTER ACTIVE STATE	

4.0 OUT1
The Out1 is an Open Collector output driving a max. load of 80 ma at 12VDC.
It will goes ON/OFF with the COMMAND#5.

4.1 LED-OUT
The LED-OUT is a TTL output, active high, with a 1 k? internal series resistor suitable to drive an external LED connected to GND.
It will turn ON when a KEY/CARD is moved in the RF-Field and is correctly read.
It will turn OFF when the KEY/CARD is removed by the RF-Field.

### 5.0 TRW-USB-HS-5 USB2.0 modules

Before any operation need to INSTALL the drivers.
1)Unzip the package "MCP2200 Windows Driver.zip"
2)Open the folder "Driver Installation Tool"
3)Open the folder "x64" for 64bit platforms or "x86" for 32bit platforms.
4)Launch the application "MCP2200DriverInstallationTool.exe".
5)Connect the TRW-USB device and follows the Microsoft instructions to complete the INSTALL on your platform.
6)The install assign a COM PORT to your device. Now you can communicate on this PORT.

To connect the TRW-USB module use a cable of the desired length mounting the connectors:
USB 2.0 TYPE A PLUG (side HOST) and USB2.0 MINI TYPE B PLUG (side FRW)

The available models for order are:
TRW-USB-HS-5 (PCB version) and TRW-USB-HS-5-POCKET
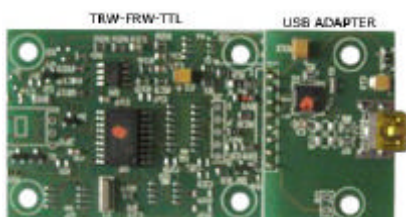
TRW-USB-Version PCB   **TRW-USB- Version POCKET**

6.0 TRW-HS-12-SHELL/ONDA

These models are suggested **only for READ purpose**.
The use of **WRITE** commands has to be made by experienced operators
that use a sure method of positioning and keeping the tag in the RF FIELD.
Otherwise the tag can be damaged.
Has the same electrical functions of the standard TRW-232.

Dimension electronic board	Height 40 x Length 58 x depth 7.5 mm
Dimension SHELL	Height 77 x Length 112 x depth 30 mm
Dimension ONDA	Height 51 x Length 115 x depth 24 mm

TRW-ONDA   TRW-SHELL

CABLE PIN FUNCTION

COLOR	232	485
WHITE	+12VDC	+12VDC
BROWN	GND	GND
YELLOW	RX 232	RS485-A
GREEN	TX 232	RS485-B
GREY	GND	GND

EXAMPLE: HOW TO CONNECT TO A   9 PIN D-TYPE S (Female)

TR- 232-S cable	**D-TYPE S connector**
YELLOW(RX)	PIN 3
GREEN(TX)	PIN 2
GREY(GND)	PIN 5

IMPORTANT NOTE:
DURING A WRITE COMMAND THE TAG MUST BE MANTAINED IN THE PROPER RF FIELD TILL A REPLAY#1 OR STATUS ERROR STRING HAS BEEN RECEIVED.
MOVING THE TAG CAN CAUSE A NON RECOVERABLE FAILURE ON THE TAG ITSELF.
THIS MODEL PERMIT ONLY THE USE OF THE WRITE DATA COMMAND.

7.0 TRW-HS-12-BOX

The module TRW is inserted into a BOX plastic enclosure.
Has the same electrical functions of the standard TRW-232.
A Cannon 9S connect all the signals. Connection with PC through a STRAIGHT CABLE.
The 12VDC power supply is connected by a standard 2mm/2,1mm plug-in:
Internal PIN   +12V
External PIN   GND
The TRW is protected against polarity inversion.

TRW-232-12-BOX

MECHANICAL

Dimensions	Length	11.2cm
	Width	6.8cm
	Height	2.8cm
Weight		Typ 100g

OPERATING

Power Requirements	9 to 12 VDC not stabilized max. absorption 50mA
Serial interface **Data=8bit Parity=none Stop=1bit**	Async. Half Duplex
Speed	9600 bits per second
Reading Distance (with TAG in center of RF field)	CARD Q5 typ 55 mm

Cannon 9S Connector

PIN	DESCRIPTION
1	
2	TX 232
3	RX 232
4	
5	GND
6	NOT CONNECTED
7	NOT CONNECTED
8	NOT CONNECTED
9	NOT CONNECTED

2.1 SPECIFICATIONS TTL - 232 - 485 - USB

OPERATING

Power Requirements max. Ripple 50mVp-p	12 VDC ? 10% at max 55mA 5 VDC ? 5% at max 50mA max ripple 10mV
Serial interface **Data = 8bit Parity = none Stop = 1bit**	HS: BINARY asynchronous half duplex, polling-selecting protocol .
Baud Rate TTL - 232 – 485 - USB	9600 bits per second
Reading Distance (with TAG in center of RF field)	CARD: tip. 70mm
Writing Distance (with TAG in center of RF field) **IMPORTANT: Don't remove the TAG/CARD during the whole writing.**	CARD: tip. 60mm

MECHANICAL

Dimensions (PCB)	40mm x 58mm x 10 mm
Weight (PCB)	Max 60g

ENVIRONMENTAL

Temperature	Operating	-10°C to 60°C
	Storage	-30°C to 70°C
Humidity	Operating	10% to 90% non condensing
	Storage	0% to 95% non condensing