RFID TRANSPONDER **TECHNOLOGY**

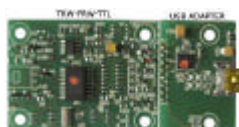# FRW   13.56MHz - ISO15693 READER/WRITER
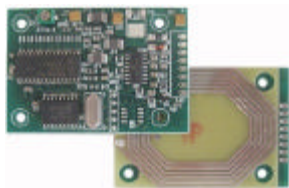
| FRW-PCB | FRW-ONDA | FRW-SHELL | FRW-BOX |

FRW-USBN   **FRW-POCKET USBN**

1.0 FEATURES AND SPECIFICATIONS
The FRW is a Front Side Serial Tag Reader/Writer with **built-in Antenna**, with three interface options TTL-RS232-RS485.
- **ISO 15693 ICODE Sli-SL2**
- No Anticollision.
- Mechanically compatible with the TR-SERIES modules.

TRANSPONDERS SUPPORTED:
- ICODE STANDARD

2.0 CONFIGURATIONS
FRW-TTL-IS-5	TTL interface. Polling.
FRW-TTL-IH-5	TTL interface. Spontaneous.
FRW-232-IS-5	RS232 interface. Polling.
FRW-232-IH-5	RS232 interface. Spontaneous.
FRW-485-IS-12	RS485 interface. Polling. 125 device address.
FRW-USBN-BS-5 –(Case)	USB interface. Polling. Powered by USB.
FRW-USBN-BH-5 –(Case)	USB interface. Spontaneous. Powered by USB.

Glossary: **FR/FRW=**Model   **TTL**= TTL interface   **232**=RS232 interface   **485**=RS485 interface **USBN**=USB interface
I= TAG ICODE
S= Polling   **H**= Spontaneous
5/12=5V(standard)/12V power supply. **3.3V** accepted only on TTL versions.
Case= SHELL/ONDA/ POCKET USB

DIMENSION FRW-TTL/232/485

FRONT VIEW — values in mm
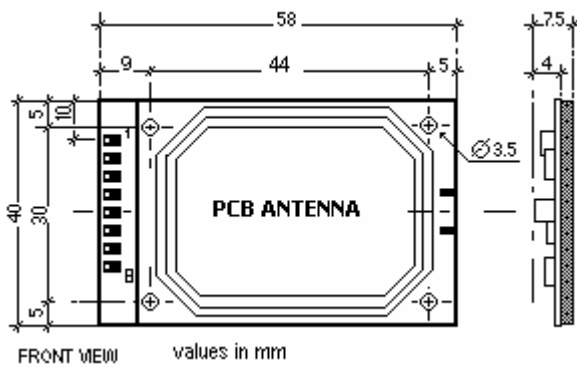
CONNECTION FRW-TTL

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

Pin Number	Description	
1	+3.3 to +5VDC	
2	GND	
3	RX	TTL input
4	TX	TTL output
5	No Connect	
6	No Connect	
7	Out1	Open Collector output.
8	LED-OUT	TTL output trough internal 1k?

CONNECTION FRW-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 output trough internal 1k?

CONNECTION FRW-232
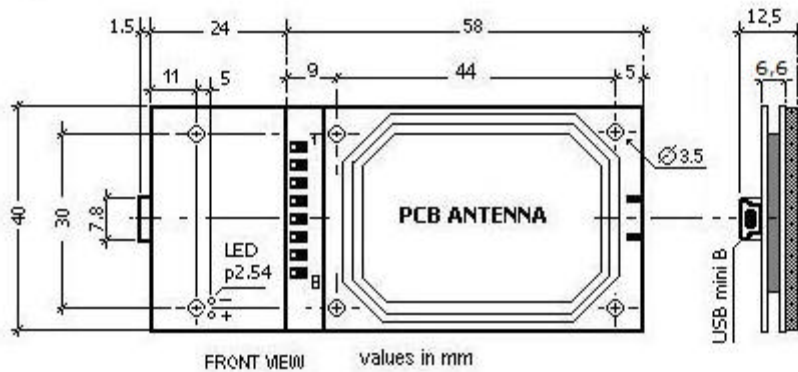
The on-board connector is an 8 pin .1″ soldering type.

Pin Number	Description	
1	+5VDC	
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 output trough internal 1k?

DIMENSIONS PCB USB ASSEMBLED

FRONT VIEW — values in mm
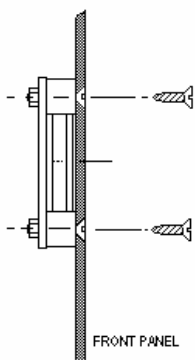
2.3 INSTALL

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

FRONT PANEL

3.0 PROTOCOL

The standard protocols for the TRW are:
- **-IS** Polling   Suitable for application where the Host continuously polls the FRW.
- **-IH** Spontaneous   Suitable for application point to point. The FRW transmits data only when a TAG is really present.
       The HOST normally works in receive mode and can operate on other task in absence of TAG. Not with RS485.

The protocol FORMAT is described below.

STX	Start of string synchronization code.
DEVICE..	Is the Device Number **(for RS485 only). For the FRW-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.
SPARE0 to SPARE3.....................................	Is an area reserved for future use.
DATA0 to DATAn..	Are the data exchanged.
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 IS

The structure of **ICODE** previews:
GENERAL INFO SYSTEM   containing an UID (8 bytes) E0-MANUFACTURER(04=PHILIPS)-TAG TYPE (01==SL2)-MANUFACTURER CODE (5 bytes).
DATA BLOCKS   User DATA is formed by 28 BLOCKS of 4 bytes each.
The FRW-IS operates in Polling-Selecting mode. The HOST is Master.
With any Command the RF Field has turned on and remain till the end of the sequence.

3.1.1 COMMANDS from HOST to FRW

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 FR memory. Must be executed on any FR one-by-one befor to install.
		In DATA0 insert the DEVICE NUMBER assigned to FR.

COMMAND#P :   **POLL DATA**

DESCRIPTION	STX	DEVICE	LENGTH	FUNCTION	BLOCK	N-BLOCKS	BCC
HEX VALUE	02H	00-7CH	04H	See below	00H-1BH	00H-01H-04H	00H-FFH

FUNCTION	VALUE	DESCRIPTION
GENERAL INFO	**04H**	**BLOCK**=00H **N-BLOCKS**=0 Read for UID. If valid, replay with a READ UID.
POLL BLOCK	**04H**	**BLOCK**=00H to 1BH **N-BLOCKS**=1 or 4. Read 1 or 4 consecutive BLOCKS. If valid, replay with a READ BLOCK.
		Otherwise with STATUS.

COMMAND#0 :   **WRITE BLOCK**

DESCRIPTION	STX	DEVICE	LENGTH	FUNCTION	FWB	N-BLOCKS	SPARE (4 bytes)	DATAn (4 -16)	BCC
HEX VALUE	02H	00-7CH	0CH-18H	See below	00H-1BH	01H-04H	00-00-00-00H	00H to FFH	00H-FFH

FUNCTION	VALUE	DESCRIPTION
WRITE BLOCK	**22H**	Write command on the TAG .
		BLOCK=00 to 1B N-BLOCKS=1 or 4. Write 1 or 4 consecutive BLOCKS on the Tag.
		If valid, replay with a READ BLOCK. Otherwise with STATUS.

COMMAND#L :   **LOCK BLOCK**

DESCRIPTION	STX	DEVICE	LENGTH	FUNCTION	FWB	N-BLOCKS	BCC
HEX VALUE	02H	00-7CH	04H	See below	00H-1BH	01H	00H-FFH

FUNCTION	VALUE	DESCRIPTION
LOCK BLOCK	**25H**	Lock the block number written in FWB.
		If valid, replay with STATUS OK . Otherwise with STATUS ERROR.
		If the block was yet locked replay STATUS error.

COMMAND #5 :   **TURN ON/TURN OFF** the OUT1 transistor.

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

FUNCTION	VALUE	DESCRIPTION
TURN-ON	**02H**	The HOST send this Command to TURN-ON (closed) the OUT1 open collector.
TURN-OFF	**01H**	The HOST send this Command to TURN-OFF (open) the OUT1 open collector.

COMMAND#V :   **READ VERSION**

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

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

3.1.2 STRINGS from FRW 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	STATUS	BLOCK	N-BLOCKS	DATAn (n=4-8-16)	BCC
HEX VALUE	02H	00H-7CH	08H-0CH-14H	See below	00H-3FH	00H-01H-04H	00H to FFH	00H-FFH

FUNCTION	VALUE	DESCRIPTION
READ UID	04H	Read the 8 bytes containing the UID.
READ BLOCK	04H	Read a single BLOCK DATA0-1-2-3 (DATAn=4) or four consecutive BLOCKs DATA0 to DATA15 (DATAn=16).

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: TTL/RS232-XS=**33H** TTL/RS232-XH=**34H** RS485-XS=**35H.**

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	The data detected on the TAG are corrupted or incomplete. RF noise environment detected.
NO TAG	02H	The FRW has detected a no valid tag present during a COMMAND or POLLING sequence.
COMMAND ERR	20H	The command was not executed because a parameter out of limit on the command string or a data error was dectected.
COMMAND OK	04H	The command has been correctly executed.

In the case the FRW detects a BCC error on the received string, don't exec the Command and don't transmit any Reply.

3.1.3 DATA FLOW FRW-IS

The exchange of strings in a typical operation is described below. The HOST is considered as Master, the FRW as Slave.

HOST				FRW-IS		
		READ SEQUENCE				
GENERAL INFO	===>	(poll time min 30mS)		<===	if OK	**READ UID**
				<===	if NOTAG/ERROR	**STATUS**
POLL BLOCK	===>	(poll time min 40mS)		<===	if OK	**READ BLOCK**
				<===	if ERROR	**STATUS**
		WRITE SEQUENCE				
WRITE BLOCK	===>	(response time max 80mS)		<===	if OK	**STATUS**

3.2 PROTOCOL FRW-IH

The FRW-IH operates in spontaneous mode.
The GENERAL INFO is internally generated by the FRW module.

3.2.1 STRINGS from FRW to HOST

REPLY#0 :   READ

DESCRIPTION	STX	DEVICE	LENGTH	STATUS	BLOCK	N-BLOCKS	DATAn (n=4-8-16)	BCC
HEX VALUE	02H	00H	08H-0CH-14H	See below	00H-3FH	00H-01H-04H	00H to FFH	00H-FFH

FUNCTION	VALUE	DESCRIPTION
READ UID	04H	Read the 8 bytes containing the UID.
READ BLOCK	04H	Read a single BLOCK DATA0-1-2-3 (DATAn=4) or four consecutive BLOCKs DATA0 to DATA15 (DATAn=16).

REPLY#V :   VERSION

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

FUNCTION	DESCRIPTION
VERSION	Show the actual version (MM=Model RR=Firmware release).
	For this model the value **MM** is: TTL/RS232-XS=**33H** TTL/RS232-XH=**34H** RS485-XS=**35H.**

REPLY#1 :   STATUS

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

FUNCTION	VALUE	DESCRIPTION
NO_TAG	02H	The data detected on the TAG are corrupted or incomplete. RF noise environment detected.
READ DATA ERR	01H	The data detected on the TAG are corrupted or incomplete. RF noise environment detected.
AUTH ERR	10H	The command was not executed because a bad parameter in the Authentication Keys was detected.
COMMAND ERR	20H	The command was not executed because a parameter out of limit on the command string or a data error was dectected.
COMMAND OK	04H	The command has been correctly executed.

3.2.2 STRINGS from HOST to FRW

COMMAND#0 : WRITE BLOCK

DESCRIPTION	STX	DEVICE	LENGTH	FUNCTION	FWB	N-BLOCKS	SPARE (4 bytes)	DATAn (4 -16)	BCC
HEX VALUE	02H	00	0CH-18H	See below	00H-1BH	01H-04H	00-00-00-00H	00H to FFH	00H-FFH

FUNCTION	VALUE	DESCRIPTION
WRITE BLOCK	22H	Write command on the TAG .
		BLOCK=00 to 1B N-BLOCKS=1 or 4. Write 1 or 4 consecutive BLOCKS on the Tag.
		If valid, replay with a READ BLOCK. Otherwise with STATUS.

COMMAND#4 : ACK

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

FUNCTION	VALUE	DESCRIPTION
ACK	10H	The HOST send this Command to the FRW to close a sequence. After this command the FRW wait for a TAG extraction.

COMMAND #5: TURN ON/TURN OFF the OUT1 transistor.

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

FUNCTION	VALUE	DESCRIPTION
TURN-ON	02H	The HOST send this Command to TURN-ON (closed) the OUT1 open collector.
TURN-OFF	01H	The HOST send this Command to TURN-OFF (open) the OUT1 open collector.

COMMAND#V : READ VERSION

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

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

In the case the FRW detects a BCC error on the received string, don't exec the Command and don't transmit any Reply.

3.2.3 DATA FLOW FRW-IH

The FRW continously send a GENERAL INFO command , waiting for a valid READ BLOCK.
When fully received, the HOST can send a COMMAND in a **time window** of 250 mS.
Over this time, if no command has been sent, the FRW automatically repeat a GENERAL INFO sequence till TAG extraction or a COMMAND receive, except for COMMAND#4 ACK.
If receive COMMAND#4 ACK the FRW close the sequence and wait for a TAG extraction.
The **time window** on FRW is **reloaded** at any reply during a COMMAND sequence, except for critical errors.
A tipycal data flow, in spontaneous mode, is described below.

```
HOST                                                              FRW
                          READ DATA sequence
Internal GENERAL INFO is generated and a TAG is correctly read    <===    READ UID
                   Open time window......250 mS......

                   COMMAND sequence in time window
NO COMMAND      ===>                                      Repeat READ DATA sequence
POLL  BLOCK     ===>        (max response time 50mS)      <===    if OK      READ BLOCK
                   New time window.....
WRITE BLOCK     ===>        (max response time 80mS)      <===    if OK      READ BLOCK
                                                         <===    if ERROR   STATUS
                   New time window.....
TURN-ON/OFF     ===>        (max response time 100mS)     <===    if OK       STATUS
                   New time window.....
ACK             ===>                                      Wait  for TAG extraction....
```

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#S

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.
IN INTERNAL MODE:
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 FRW-USBN-IS/IH-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 FRW-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 FRW-USB module use a standard 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 TRW-USB module is powered by the 5VDC on the USB connector.

The available models for order are:
FRW-USBN-IS/IH-5 (PCB version) and   FRW-USBN-IS/IH-5-POCKET
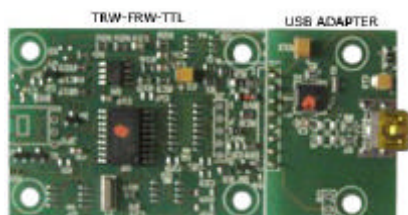
FRW-USBN-Version PCB

FRW-USBN- Version POCKET

6.0 FRW-IS/IH-12-ONDA and FRW-IS/IH-12-SHELL

Dimension SHELL	H 77 x L 112 x D 30 mm
Dimension ONDA	H 51 x L 115 x D 24 mm

CABLE PIN FUNCTION

COLOUR	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:
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.

ONDA

SHELL

7.0 FRW-232-IS-12-BOX

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

FRW-232-12-BOX

MECHANICAL

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

OPERATING

Power Requirements	9 to 12 VDC not stabilized max. current 50mA
Serial interface **Data=8 Parity=N Stop=1**	Polling Mode
Speed	9600 baud
Read Distance (TAG in center of RF field)	CARD ICODE typ 50 mm

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

Cannon 9S Connector

8.0 SPECIFICATIONS

OPERATING	
Power Requirements max. Ripple 10mVp-p	5 VDC ? 5% at max 90mA (peak) 3.3 VDC ? 5% at max 90mA (peak) only for TTL version.
Serial interface **Data = 8bit Parity = none Stop = 1bit**	IS: BiNARY asynchronous half duplex, polling-selecting protocol . IH: BINARY asynchronous half duplex, spontaneous protocol .
Baud Rate	9600 bits per second
Reading Distance (with TAG in center of RF field)	CARD: typ. 60mm
Writing Distance (with TAG in center of RF field)	CARD: typ. 60mm

MECHANICAL PCB	
Dimensions	40mm x 58mm x 10 mm
Weight	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