

# **Royaltek**

## **RMC-2000**

# **Opeaational Manual & Protocol document**

**V0.2**

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Prepared by  
RoyalTek Company LTD.

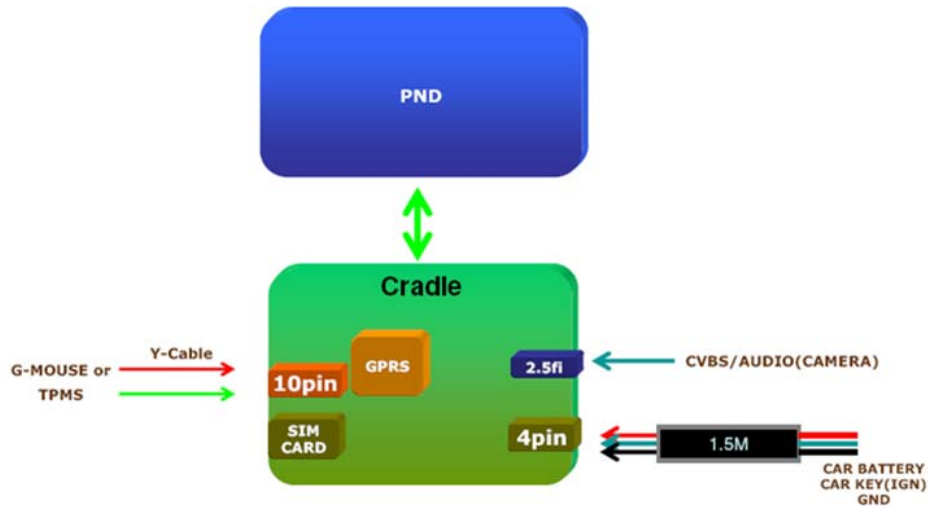
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## 1. Feature:

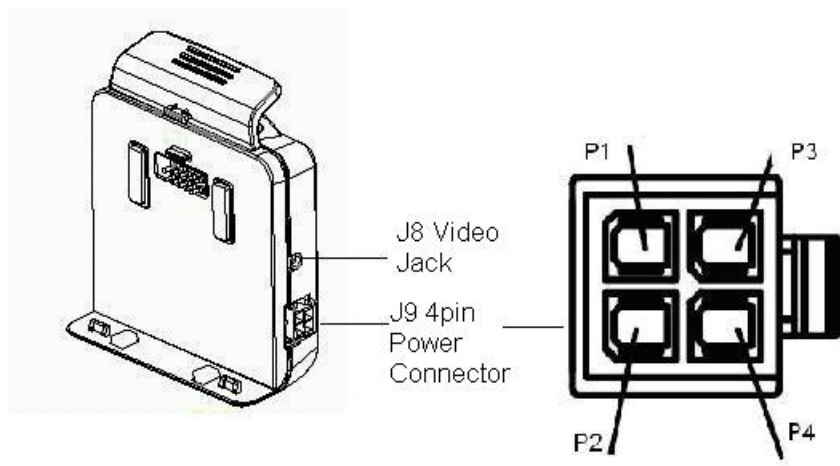
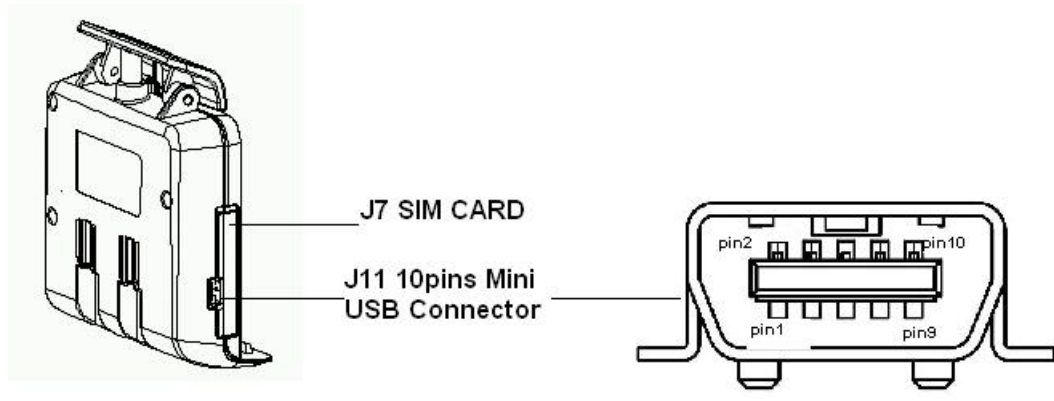
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- Digital Input for Ignition (5.5v~36v)
- Car battery is the main power source
- Support 4 external TPMS sensors
- Internal GPRS antenna
- 1 mini-USB 10 pin serial ports connect with TPMS receiver and G-mouse via Y Cable
- 4 pins power connector connect with car battery or car charger.
- video jack for CVBS input

## 2. HW Spec:

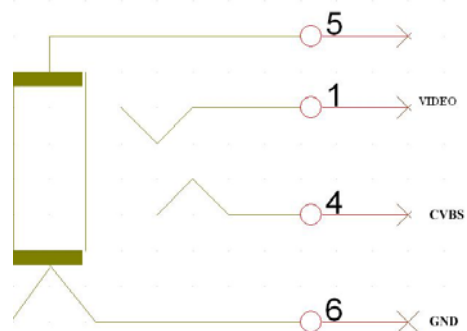
### 2.1 Interface definition



J9



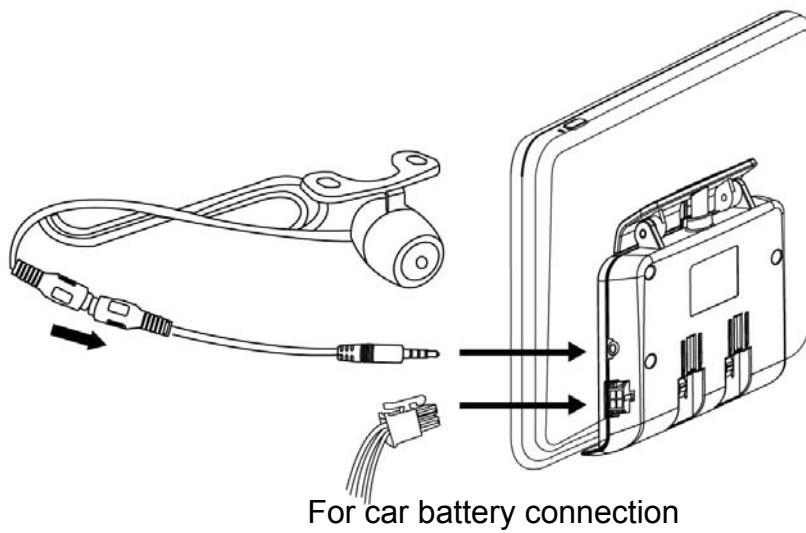
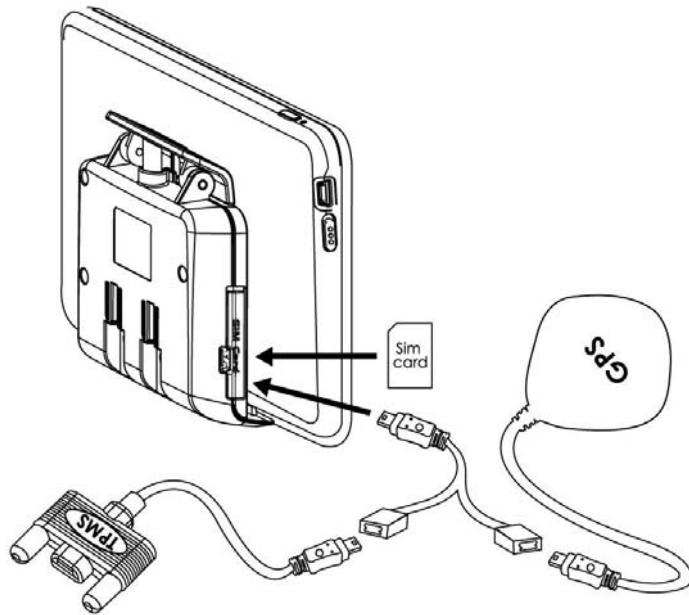
J8



### Pin definition

Interface	Pin	Signal Name	I/O	Description	Characteristics
J7		SIM card connector	I/O	SIM card input	
(J8) Video Jack	1	Audio input	I	L-sound output to PND	L-sound
	4	CVBS input	I	CVBS video signal output to PND	CVBS output
	5	NC			
	6	GND		Ground	
(J9) 4 Pins power connector	1	IGN	I	RMC-200 Ignition input	DC 5.5V~36V
	2	GND	I	Ground	
	3	Main power input		DC 12V input for RMC-2000	DC 5.5V~36V
	4	GPIO	I/O	MCU GPIO control	$V_{OH} \geq 2.9V$ $V_{OL} \leq 0.4V$ $3.6V \geq V_{IH}$ $-0.3 \leq V_{IL} \leq 0.8V$
(J10) 10Pins Mini USB connector	1	G-mouse VCC	O	For G-mouse power output	DC 5V±5% / 500mA
	2	TPMS VCC	O	For TPMS power output	DC 5V±5% / 500mA
	3	G-mouse RX	O	The TX signal to G-mouse RX	$V_{OH} \geq 2.9V$ $V_{OL} \leq 0.4V$
	4	TPMS RX	O	The TX signal to TPMS RX	$V_{OH} \geq 2.9V$ $V_{OL} \leq 0.4V$
	5	G-mouse TX	I	The G-mouse TX signal to RMC-2000 RX	$3.6V \geq V_{IH}$ $-0.3 \leq V_{IL} \leq 0.8V$
	6	TPMS TX	I	The TPMS TX signal to RMC-2000 RX	$3.6V \geq V_{IH}$ $-0.3 \leq V_{IL} \leq 0.8V$
	7	G-mouse GPI	I/O	The G-mouse detector	$3.6V \geq V_{IH}$ $-0.3 \leq V_{IL} \leq 0.8V$
	8	TPMS GPI	I/O	The TPMS detector	$3.6V \geq V_{IH}$ $-0.3 \leq V_{IL} \leq 0.8V$
	9	GND		Ground	
	10	GND		Ground	
SW1		SIM card door	I	SIM card door detector	* Push down to GND, GSM power is on else off. * Pull out the SIM Card door cover, there have a GSM detection switch and must close the SIM Cover before GSM into operation mode.

## 2.2 HW Connection



### 3. SOFTWARE

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#### Features

- Protocol messages sent to server through GPRS connection according to the sending rules and status changes. (*See Appendices for details*)
- Static Navigation is ON when in GPS configuration.
- There is a WatchDogTimer like mechanism to make device operating 24/7/365. The device will reboot itself if software is not responding.
- Ignition status will be shown in GUI to see if ignition connection made correct.
- Data should be logged when GPRS is not available. (or all data should be logged and sent one by one according to GPRS status.)
- After server receives each protocol msg, it will send back an acknowledge msg as "TK" to inform device that protocol message arrived successfully. The device can delete logged protocol message after receiving this acknowledge message. This settings can be turned on and off using configuration file. (default is off)
- Tyre temperature and pressure range settings are available in configuration file. Each tyre have separate temperature and pressure setting range.

## Software Settings

- GPRS settings should be available in a setting file. (APN Name, User Name, Password) This setting can also be configured by SMS as *AT+GPRS="APN\_NAME,User\_Name,Password"*. *AT+GPRS?* SMS msg should sent configuration back via SMS.
- Protocol messages should be sent either TCP or UDP port. (default is *UDP/36490*) This configuration can be edited from a setting file. (no need for GUI). Protocol message receiving server settings should be available in setting file. (Server IP address or host name which GPRS Protocol messages are delivered, Server Port, Server Port Type) This setting can also be configured by SMS as *AT+SERVER="Server\_IP,Server\_Port,TCP or UDP"*. *AT+SERVER?* SMS msg should sent configuration back via SMS.
- GPRS IP address should be displayed in GUI. *AT+IP?* SMS message should respond GPRS IP Address via SMS msg.
- There should be a list of mobile phone numbers setting which are allowed to send SMS to device. This settings can be set by SMS using *AT+SMS="GSM\_Number\_1, GSM\_Number\_2, GSM\_Number\_3, GSM\_Number\_4, GSM\_Number\_5"*. *AT+SMS?* sms msg or *SMS?* msg sent through GPRS should return the list of mobile phone numbers.
- There should be a configuration which contains FTP server login details to update software. This configuration can be set using SMS msg as

*AT+FTP="Server\_IP,Server\_Port,User\_Name>Password,Path" or  
FTP="Server\_IP,Server\_Port,User\_Name>Password,Path" command  
through GPRS. AT+FTP? SMS msg or FTP? msg sent through GPRS  
should sent configuration back.*

- The software can be updated through GPRS. In order to update device, *AT+UPDATE* msg via SMS or *UPDATE* msg via GPRS should be sent. After msg received, PND should connect to FTP server and download latest software and update itself. (a version.txt file in FTP can be used to check if there is a new software available to update or update check can be made by using file name which includes version number.)
- *AT+VERSION?* SMS msg or *VERSION?* msg over GPRS should return back software version.
- *AT+ID?* SMS msg or *ID?* msg over GPRS should return back Unit ID information.
- *AT+RESTART* SMS msg or *RESTART* msg over GPRS should restart device.
- *AT+FACTORY* SMS msg or *FACTORY* msg over GPRS should change settings into factory default settings.
- GPRS commands only coming from server should be accepted which is set in *AT+SERVER* setting.

### **GPRS Protocol Message**

- Protocol message should be in ASCII format.



- Protocol message should be sent to server according to the sending rules and status codes. (can be found in Appendix)
- Should be in below format:

A,B,C,D,E,F,G,H,I,J[,K,L,M,N,O,P,R,S]

*\* Values between brackets [ ] are only available in TPMS version. There should be a setting to enable/disable TPMS in protocol message.*

**Example:**

1001275058,20100113181938,28.957008,41.052723,45.0,38.5,39.5, 9,  
0xF112,1[,40,30,40,30,40,30,40,30]

**A = Device ID**

- Unique ID for each device.

1001275058 is UnitID in above example. 100 is the constant in this ID and remaining is the last 7 digits of IMEI number. (We can discuss about Unit ID for this new device.)

**B = Date & Time**

- YYYYMMDDhhmmss (GMT)

20100113181938 is Date & Time in above example which means that:

Year: 2010, Month: 01, Day: 13, Hour: 18, Minute: 19, Second: 38

according to GMT.

**C = Longitude**

- Should be in decimal fraction. (not in degree form) 6 decimal is required.

28.957008 is Longitude in above example.

**D = Latitude**

- Should be in decimal fraction. (not in degree form) 6 decimal is required.

41.052723 is Latitude in above example.

**E = Speed**

- Should be in km/h format.

45.0 is Speed in above example.

**F = Heading Angle**

- Heading angle should be gathered from GPS. (in degrees)

38.5 degree is Heading Angle in above example.

**G = Altitude**

- Altitude should be gathered from GPS. (in meters)

39.5 meters is Altitude in above example.

**H = Number of Satellites**

- Number of satellites should be gathered from GPS.

9 is the number of satellites in the above example.

**I = Status Code**

- Status code messages should be sent in this field. Check Appendix for all status codes.
- When status code field changes, a protocol message should be created and send to server immediately if GPRS connection available.
- If GPRS connection is not available, created message should be logged and send after a successful GPRS connection is established.

**J = Digital Input (=IGNITION)**

- In this project, there is only one digital input which is used for ignition.  
When ignition is off, this field should be 0. When ignition is on, this field should be 1.

**K = Temperature (Tyre 1)**

- Tyre1 Temperature should be gathered from TPMS sensor and send to server in Celcius degrees.

**L = Pressure (Tyre 1)**

- Tyre1 Pressure should be gathered from TPMS sensor and send to server in psi.

**M = Temperature (Tyre 2)**

- Tyre2 Temperature should be gathered from TPMS sensor and send to server in Celcius degrees.

**N = Pressure (Tyre 2)**

- Tyre2 Pressure should be gathered from TPMS sensor and send to server in psi.

**O = Temperature (Tyre 3)**

- Tyre3 Temperature should be gathered from TPMS sensor and send to server in Celcius degrees.

**P = Pressure (Tyre 3)**

- Tyre3 Pressure should be gathered from TPMS sensor and send to server in psi.

**R = Temperature (Tyre 4)**

- Tyre4 Temperature should be gathered from TPMS sensor and send to server in Celcius degrees.

**S = Pressure (Tyre 4)**

- Tyre4 Pressure should be gathered from TPMS sensor and send to server in psi.

## APPENDICES

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### A. Sending Rules

There are 3 protocol message sending rules based on ignition status and device motion status.

#### 0.Rule

This rule should be active when ignition is on and vehicle is moving. This rule settings can be also set up using SMS msg as below: (this setting can be configured from a setting file as xml or ini)

*AT+RULE="0,(0-3),(XXXX),(YYYY)"*

In this SMS msg;

- 1st parameter: This parameter is the rule ID number which is 0.
- 2nd parameter: This parameter is protocol message sending criteria:
  - 0 means no protocol message should be send.
  - 1 means protocol message should be send every XXXX seconds
  - 2 means protocol message should be send every YYYY meters
  - 3 means protocol message should be send every XXXX seconds or send every YYYY meters. (protocol message should be sent once one condition occurs)

- 3rd parameter: This parameter is the time duration setting and needed if 2nd parameter is set to 1 or 3. If 2nd parameter is set to 0 or 2, this should be 0.
- 4th parameter: This parameter is the distance setting and needed if 2nd parameter is set to 2 or 4. If 2nd parameter is set to 1 or 3, this should be 0 or shouldn't be included.

*Default setting for 0.Rule: AT+RULE="0,1,180" or AT+RULE="0,1,180,0"*

### **1.Rule**

This rule should be active when ignition is on and vehicle is NOT moving. This rule settings can be set up using SMS msg as below: (this setting can be configured from a setting file as xml or ini)

*AT+RULE="1,(0-3),(XXXX),(YYYY)"*

In this SMS msg;

- 1st parameter: This parameter is the rule ID number which is 1.
- 2nd parameter: This parameter is protocol message sending criteria:
  - 0 means no protocol message should be send.
  - 1 means protocol message should be send every XXXX seconds
  - 2 means protocol message should be send every YYYY meters
  - 3 means protocol message should be send every XXXX seconds or send every YYYY meters. (protocol message should be sent once one condition occurs)

- 3rd parameter: This parameter is the time duration setting and needed if 2nd parameter is set to 1 or 3. If 2nd parameter is set to 0 or 2, this should be 0.
- 4th parameter: This parameter is the distance setting and needed if 2nd parameter is set to 2 or 4. If 2nd parameter is set to 1 or 3, this should be 0 or shouldn't be included.

*Default setting for 1.Rule: AT+RULE="1,1,300" or AT+RULE="1,1,300,0"*

## **2.Rule**

This rule should be active when ignition is off. This rule settings can be set up using SMS msg as below: (this setting can be configured from a setting file as xml or ini)

*AT+RULE="2,(0-3),(XXXX),(YYYY)"*

In this SMS msg;

- 1st parameter: This parameter is the rule ID number which is 2.
- 2nd parameter: This parameter is protocol message sending criteria:
  - 0 means no protocol message should be send.
  - 1 means protocol message should be send every XXXX seconds



- 2 means protocol message should be send every YYYY meters
- 3 means protocol message should be send every XXXX seconds  
or send every YYYY meters. (protocol message should be sent  
once one condition occurs)
- 3rd parameter: This parameter is the time duration setting and needed if  
2nd parameter is set to 1 or 3. If 2nd parameter is set to 0 or 2, this  
should be 0.
- 4th parameter: This parameter is the distance setting and needed if 2nd  
parameter is set to 2 or 4. If 2nd parameter is set to 1 or 3, this should  
be 0 or shouldn't be included.

*Default setting for 2.Rule: AT+RULE="2,3,900,500"*

*Note: When ignition connection isn't made properly or purposely, 0.Rule and 1.Rule should work as default, 2.Rule won't be available. Thus, this means that ignition status should be on as default even if ignition connection is not made.*

## **B. Status Codes**

- ✓ All status codes can be enabled and disabled separately using a configuration file. No need for GUI, only a setting file is enough. (like ini file or xml file)

### **STATUS QUERY = 0xF040**

- ✓ This status code should be sent when a query made to device. Queries can be made in 2 different ways:
  - Through GPRS using "LOCATION?" command
  - With "AT+LOCATION?" SMS message

### **STATUS MOTION START = 0xF111**

- ✓ This status code should be sent when vehicle starts moving and ignition is on. (shouldn't be sent when ignition is off)

### **STATUS MOTION IN MOTION = 0xF112**

- ✓ This status code should be sent when vehicle is in motion and ignition is on. (shouldn't be sent when ignition is off)

### **STATUS MOTION STOP = 0xF113**

- ✓ This status code should be sent when vehicle stops moving and ignition is on. (shouldn't be sent when ignition is off)

**STATUS MOTION DORMANT = 0xF114**

- ✓ This status code should be sent when vehicle is not moving and ignition is off. (shouldn't be sent when ignition is on)

**STATUS MOTION IDLE = 0xF116**

- ✓ This status code should be sent when vehicle is not moving and ignition is on. (shouldn't be sent when ignition is off)

**STATUS MOTION EXCESS SPEED = 0xF11A**

- ✓ This status code should be sent when vehicle speed is over limit.
- ✓ There should be a configuration to set excess speed in km/h in setting file.
- ✓ There should be another configuration to set duration for detecting excess speed. For example, this motion excess speed status code should be only send if the vehicle speed is over 100km/h more than 60 secs. 100km/h and 60 secs are the configuration settings in this example. This configuration can be also set by SMS msg as AT+SPEEDLIMIT="100,60" or through GPRS using SPEEDLIMIT="100,60".

**STATUS MOTION MOVING = 0xF11C**

- ✓ This status code should be sent when vehicle is moving and ignition is off. (shouldn't be sent when ignition is on.) This is useful for tracking when the device pulled over.

**STATUS IGNITION ON = 0xF401**

- ✓ This status code should be sent when ignition is turned on.

**STATUS IGNITION OFF = 0xF403**

- ✓ This status code should be sent when ignition is turned off.

**STATUS TEMPERATURE RANGE 0 = 0xF730**

- ✓ This status code should be sent when tyre1 sensor temperature is detected out of range.

**STATUS TEMPERATURE RANGE 1 = 0xF731**

- ✓ This status code should be sent when tyre2 sensor temperature is detected out of range.

**STATUS TEMPERATURE RANGE 2 = 0xF732**

- ✓ This status code should be sent when tyre3 sensor temperature is detected out of range.

**STATUS TEMPERATURE RANGE 3 = 0xF733**

- ✓ This status code should be sent when tyre4 sensor temperature is detected out of range.

**STATUS PRESSURE RANGE 0 = 0xF770**

- ✓ This status code should be sent when tyre1 sensor pressure is detected out of range.

**STATUS PRESSURE RANGE 1 = 0xF771**

- ✓ This status code should be sent when tyre2 sensor pressure is detected out of range.

**STATUS PRESSURE RANGE 2 = 0xF772**

- ✓ This status code should be sent when tyre3 sensor pressure is detected out of range.

**STATUS PRESSURE RANGE 3 = 0xF773**

- ✓ This status code should be sent when tyre4 sensor pressure is detected out of range.

**STATUS CONNECT = 0xF821**

- ✓ This status code should be sent when GPRS connection established.  
This is useful when debugging GPRS stability problems. (SIM Card problems, GPRS network problems etc.)

**STATUS DISCONNECT = 0xF822**

- ✓ This status code should be sent when GPRS connection disconnected.  
This is useful when debugging GPRS stability problems. (SIM Card problems, GPRS network problems etc.)

**STATUS LOW BATTERY = 0xFD10**

- ✓ This status code should be sent when internal battery is low.

**STATUS POWER FAILURE = 0xFD13**

- ✓ This status code should be sent when power connection to car battery fails.

**STATUS POWER RESTORED = 0xFD15**

- ✓ This status code should be sent when power connection is fixed after a power failure to car battery.

**STATUS GPS EXPIRED = 0xFD21**

- ✓ This status code should be sent when GPS data changes from A-Data to V-Data. This is useful for debugging and field tests.

**STATUS GPS FAILURE = 0xFD22**

- ✓ This status code should be sent when GPS can not be started.

## Contact Royaltek

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## Revision History

Title	RMC-2000		
	Operational Manual & Protocol document		
Revision Number	Date	Author	Change notice
0.1	2010/10/21	May Chen	Initial Release
0.2	2010/11/30	May Chen	Modification: 1) HW interface spec and contact information