# Sapphire

# **GPS** Receiver

**User Manual** 



RGM-2000

## **Contents**

WHAT IS SAPPHIRE ?
WHAT IS INSIDE ?
WHAT IS GPS ?
WHAT HAVE INSIDE THE PACKAGE?
HOW TO INSTALL & OPERATE SAPPHIRE ( RS-232 ) ?
HOW TO INSTALL & OPERATE SAPPHIRE ( USB ) FOR WINDOWS 98 <sup>®</sup> ?7
HOW TO INSTALL & OPERATE SAPPHIRE ( USB ) FOR WINDOWS ME <sup>®</sup> ? 13
HOW TO INSTALL & OPERATE SAPPHIRE ( USB ) FOR WINDOWS 2000 <sup>®</sup> ? 17
HOW TO INSTALL & OPERATE SAPPHIRE ( USB ) FOR WINDOWS XP <sup>®</sup> ?26
HOW TO TEST YOUR SAPPHIRE
HOW TO SYNCHRONIZE YOUR PDA
PHYSICAL CHARACTERISTICS
SOFTWARE DATA
TROUBLESHOOTING
APPENDIX : CONNECTOR INTERFACE
LIMITED WARRANTY

## What Is Sapphire ?

Congratulation on your purchase of Sapphire, offering diverse GPS (Global Positioning System) applications. Sapphire represents the latest ingenious GPS technology from the leading GPS receiver manufacturer. Connecting to the notebook PC implementing a map or navigation software, Sapphire helps you locate one or multiple objects, conduct personal & vehicle navigation, and/or apply for geographical surveys.

## What Is Inside ?

Before you start up, make sure that your package includes the following items. If any items are missing or damaged, contact RoyalTek immediately. Please refer to the contact information on the last page of this manual.



# What Is GPS ?

In 1974 the USA Department of Defense set about developing a Global Positioning System (GPS), a constellation of 24 satellites that Orbits 12,000 miles above the Earth. Using triangulation of signals from four of the satellites, a receiving unit on earth can pinpoint its current location to within a few meters. A GPS device receive the data, then convert the longitude, latitude, and altitude (LLA) data into a location point. Position and navigation information is vital to a wide range of professional and recreational activities covering surveying, search and rescue, tracking, hiking, navigating, and so forth.

# What Have Inside the Package?

Before you start up, make sure your package includes the following items. If any item is missing or damaged, contact your dealer immediately. Please refer to the contact information on the last page of this manual.

- ♦ GPS Receiver♦ Application CD
- Cable for RS232 or USB (depending on what you buy)



# How to Install & Operate Sapphire (RS-232)?

## **Getting Started**

Step 1:Plug RS-232 to COM port of your Notebook PC or Handheld PC.

Step 2:Plug PS2 connector in the PS2 mouse outlet of your Notebook PC or Handheld

PC.



Step 3:Place your Sapphire on the outside roof of your vehicle with magnetic base.

Step 4: Power on your Notebook PC or Handheld PC. If you have ordered a cigarette

adaptor, please plug the cigarette adaptor into the cigarette outlet of the car.

Step 5: Choose the correct COM port for running the map or navigation software.

Step 6:Run the Sapphire test program. Please refer to "How to test your Sapphire".

Notice:

- (1) Make sure the power is off before started.
- (2) For safety reason, please do not install Sapphire while driving.
- (3) To receive NMEA0183 navigational data, please use the Hyper Terminal program of Windows95/98<sup>®</sup>/ME<sup>®</sup>/2000<sup>®</sup>. Please setup the COM port connected with Sapphire to:

Baud rate	: 4800
Data bit	: 8
Parity	: None
Stop bit	:1
Flow control	: None.

- (4) The formats of NMEA messages are illustrated on Software Data section.
- (5) To prevent from the poor contact, the 4-pin mini din connector was designed as good fitting. It is strongly recommend that user doesn't plug and unplug this connector frequently.

# How to Install & Operate Sapphire ( USB ) for Windows $98^{\ensuremath{\mathbb{R}}}$ ?

### **Getting Started**

Step 1:Plug USB connector to USB port of your Notebook PC or Handheld PC.

Step 2: After plug in the Sapphire, it will automatically detect the hardware and show up pop-up dialog as follows. Click "**Next**>" button.



Assert the "Search for the best driver for your device". Click "Next>" button.

Add New Hardware Wiz	ard states and states a
	What do you want Windows to do?
	<ul> <li>Search for the best driver for your device. (Recommended).</li> </ul>
	C Display a list of all the drivers in a specific location, so you can select the driver you want.
8	
	< <u>B</u> ack Next > Cancel

Please assert the "Specify a location" and select the correct directory of the driver,

"\USB\_DRIVER" in CD-Disc. Click the "**Next**>" button.

Add New Hardware Wiz	ard
	Windows will search for new drivers in its driver database on your hard drive, and in any of the following selected locations. Click Next to start the search. Eloppy disk drives CD-ROM drive Microsoft Windows Update Specify a location: C:\USB_DRIVER
	< <u>B</u> ack Next > Cancel

It will find the driver from the CD-Disc automatically. Click "Next>" button.

Add New Hardware Wiz	ard states and states a
	Windows driver file search for the device:
	USB High Speed Serial Converter
	Windows is now ready to install the best driver for this device. Click Back to select a different driver, or click Next to continue.
🛛 🍪 🏤 🗌	Location of driver:
	C:\USB_DR~1\FTDIBUS.INF
Ľ,	
	<pre></pre>
	< <u>B</u> ack <u>Next</u> Cancel

The USB Serial converter driver is installed now.

Add New Hardware Wiz	ard
	USB High Speed Serial Converter
	Windows has finished installing the software that your new hardware device requires.
<b>`</b>	
	< Back Finish Cancel

You can check the COM port number of Sapphire from the System properties now.

System Properties ?	×
General Device Manager Hardware Profiles Performance	
<ul> <li>View devices by type</li> <li>View devices by connection</li> <li>Computer</li> <li>CDROM</li> <li>Disk drives</li> <li>Display adapters</li> <li>Floppy disk controllers</li> <li>Hard disk controllers</li> <li>Keyboard</li> <li>Monitors</li> <li>Mouse</li> <li>Network adapters</li> <li>Ports (COM &amp; LPT)</li> <li>System devices</li> <li>Universal Serial Bus controllers</li> <li>Intel 82371AB/EB PCI to USB Universal Host Controller</li> <li>USB High Speed Serial Converter</li> </ul>	
P <u>r</u> operties Re <u>f</u> resh R <u>e</u> move Pri <u>n</u> t	
OK Cancel	

The default COM port is COM3 in this example.

System P	operties				?	×
General	Device Mana	ager Hardwa	re Profiles	Performanc	e	
📃 C	w devices by	type O	View devid	ces by <u>c</u> onne	ection	
	CDROM Disk drives Display ada				- 1	
	Floppy disk Hard disk co Keyboard					
÷	V Monitors Mouse Network ad	apters				
	J Commur J Commur J ECP Pri	nications Port ( nications Port ( nter Port (LPT1	СОМ2) )		- 1	
	] System devi	rial Port (COM) ices			-	
Pro	operties	Re <u>f</u> resh	R <u>e</u>	move	Pri <u>n</u> t	
				OK	Cancel	

Step 3:Place your Sapphire on the outside roof of your vehicle with magnetic base.

Step 4:Power on your Notebook PC or Handheld PC.

Step 5: Choose the correct COM port for running the map or navigation software.

Step 6:Run the Sapphire test program. Please refer to "How to test your Sapphire".

Notice:

- (1) Make sure the power is off before started.
- (2) For safety reason, please do not install Sapphire while driving.
- (3) To receive NMEA0183 navigational data, please use the Hyper Terminal program of Windows 95/98<sup>®</sup>. Please setup the COM port connected with Sapphire to:

Baud rate	: 4800
Data bit	: 8
Parity	: None
Stop bit	:1
Flow control	: None.

- (4) NMEA 0183 data formats are illustrated on Software Data section.
- (5) To prevent the poor contact, the 4-pin mini din connector was designed as good fitting. We strongly recommend user that do not plug and draw this connector frequently.

# How to Install & Operate Sapphire ( USB ) for Windows $Me^{\circledast}?$

Step 1:Plug USB connector (①) to USB port to your Notebook PC or Handheld PC.

Step 2:After plug in the Sapphire, it will detect the hardware automatically. Click the "**Next>**" button.

Add New Hardware Wiza	ard
	Windows has found the following new hardware: USB <-> Serial Windows can automatically search for and install software that supports your hardware. If your hardware came with installation media, insert it now and click Next. What would you like to do? Mutomatic search for a better driver (Recommended) Specify the location of the driver (Advanced)
	< Back Next > Cancel

Please assert the "Specify a location" and select the correct directory of the driver in CD-Disc,

"\USB\_DRIVER". Click the "**Next**>" button.

Add New Hardware Wiz	ard
	<ul> <li>Windows will search for new drivers in its driver database on your hard drive, and in any of the following selected</li> <li>Search for the best driver for your device. (Recommended).</li> <li>Removable Media (Floppy, CD-ROM)</li> <li>Specify a Jocation:</li> <li>D:NUSE_DRIVER</li> <li>Browse</li> <li>Display a list of all the drivers in a specific location, so you can select the driver you want.</li> </ul>
	< <u>B</u> ack Next > Cancel

Windows Me will search and find the USB serial driver. Click "Next>" button.

Add New Hardware Wiz	ard
	Windows driver file search for the device:
	USB High Speed Serial Converter
	Windows is now ready to install the best driver for this device. Click Back to select a different driver, or click Next to continue.
🏽 🥸 🌫 🛛	Location of driver:
	C:\USB_DR~1\FTDIBUS.INF
	< <u>B</u> ack Next> Cancel

The USB Serial converter driver is installed now.



You can check the COM port number of Sapphire from the System properties now.

System Properties	? ×
General Device Manager Hardware Profiles Performance	
View devices by type     View devices by connection	
E Computer ⊕ 20 CDROM ⊕ E Disk drives	
<ul> <li></li></ul>	
Mouse     Metwork adapters     Press	
Ports (COM & LPT)     Sommunications Port (COM1)     Sommunications Port (COM2)	
ECP Printer Port (LPT1)	
System devices	•
Properties Refresh Remove Print	
ОК	Cancel

Step 3:Place your Sapphire on the outside roof of your vehicle with magnetic base.

Step 4:Power on your Notebook PC or Handheld PC.

Step 5: Choose the correct COM port for running the map or navigation software.

Step 6:Run the Sapphire test program. Please refer to "How to test your Sapphire".

Notice:

- (1) Make sure the power is off before started.
- (2) For safety reason, please do not install Sapphire while driving.
- (3) To receive NMEA0183 navigational data, please use the Hyper Terminal program of Windows Me<sup>®</sup>. Please setup the COM port connected with Sapphire to:

Baud rate	: 4800
Data bit	: 8
Parity	: None
Stop bit	: 1
Flow control	: None.

- (4) NMEA 0183 data formats are illustrated on Software Data section.
- (5) To prevent the poor contact, the 4-pin mini din connector was designed as good fitting. We strongly recommend user that do not plug and draw this connector frequently.

# How to Install & Operate Sapphire ( USB ) for Windows $2000^{\$}$ ?

Step 1:Plug USB connector (①) to USB port to your Notebook PC or Handheld PC.

Step 2:After plug in the Sapphire, it will detect the hardware automatically. Click the "**Next**>"

button.



Please select "Search for a suitable driver for my device". Click "Next>" button.

Found New Hardware Wizard
Install Hardware Device Drivers A device driver is a software program that enables a hardware device to work with an operating system.
This wizard will complete the installation for this device:
A device driver is a software program that makes a hardware device work. Windows needs driver files for your new device. To locate driver files and complete the installation click Next.
What do you want the wizard to do?
<ul> <li>Search for a suitable driver for my device (recommended)</li> </ul>
Display a list of the known drivers for this device so that I can choose a specific driver
< Back Next > Cancel

## Please select the "Specify a location". Click "**Next>**" button.

Found New Hardware Wizard
Locate Driver Files Where do you want Windows to search for driver files?
Search for driver files for the following hardware device:
USB <-> Serial
The wizard searches for suitable drivers in its driver database on your computer and in any of the following optional search locations that you specify.
To start the search, click Next. If you are searching on a floppy disk or CD-ROM drive, insert the floppy disk or CD before clicking Next.
Optional search locations:
Floppy disk drives
CD-ROM drives
Specify a location
Microsoft Windows Update
< Back Next > Cancel

Please browse the CD-Disc and select the directory, "\USB\_DRIVER".

#### Click "OK" button.

Found New Hard	ware Wizard
Locate Drive Where do	er Files you want Windows to search for driver files?
Found Ne	w Hardware Wizard X
2	Insert the manufacturer's installation disk into the drive OK selected, and then click OK. Cancel
	Copy manufacturer's files from: E:\USB_DRIVER  Browse  Browse
	< Back Next > Cancel

Windows 2000 will find the USB Serial converter device. Click the "**Next>**" button.

Found New Hardware Wizard
Driver Files Search Results The wizard has finished searching for driver files for your hardware device.
The wizard found a driver for the following device:
USB <-> Serial
Windows found a driver for this device. To install the driver Windows found, click Next.
e:\usb_driver\ftdibus.inf
< Back Next > Cancel



The USB Serial driver is installed in Windows 2000<sup>®</sup> now.

It will setup the USB Serial port driver for Sapphire. Please click "Next>" button.



Please select the "Search for a suitable driver for my device". Click "**Next**>" button.



Please select the "Specify a location". Click "**Next>**" button.

Found New Hardware Wizard
Locate Driver Files Where do you want Windows to search for driver files?
Search for driver files for the following hardware device:
USB Serial Port
The wizard searches for suitable drivers in its driver database on your computer and in any of the following optional search locations that you specify.
To start the search, click Next. If you are searching on a floppy disk or CD-ROM drive, insert the floppy disk or CD before clicking Next.
Optional search locations:
Floppy disk drives
CD-ROM drives
Specify a location
Microsoft Windows Update
< Back Next > Cancel

Please select the directory of the Sapphire, "\USB\_DRIVER". Click "OK".

Found New Hardware Wizard	
Locate Driver Files Where do you want Windows to search for driver files?	
Found New Hardware Wizard	X
Insert the manufacturer's installation disk into the selected, and then click OK.	e drive OK Cancel
Copy manufacturer's files from: E:\USB_DRIVER	Browse
< Back	Next > Cancel

It will find the driver and install it.

Found New Hardware Wizard
Driver Files Search Results The wizard has finished searching for driver files for your hardware device.
The wizard found a driver for the following device:
USB Serial Port
Windows found a driver for this device. To install the driver Windows found, click Next.
e:\usb_driver\ftdiport.inf
< Back Next > Cancel

The USB Serial Port driver is installed in Windows 2000<sup>®</sup> now.



You can check the Com port number of the Sapphire from Device Manager. It is COM3 in this example.

🖳 Device Manager	
$   \underline{A}ction  \underline{V}iew    \leftarrow \rightarrow   \implies \blacksquare  [\blacksquare]  [\blacksquare]  [\textcircled{2}]  [\underbrace{3}]  [\underbrace{3}]$	
HWENG Computer Disk drives Display adapters DVD/CD-ROM drives Floppy disk controllers Floppy disk drives Floppy disk drives Floppy disk drives DE ATA/ATAPI controllers Keyboards Monitors Monitors Ports (COM & LPT) Communications Port (COM1) Communications Port (COM2) ECP Printer Port (LPT1) Sound, video and game controllers System devices Universal Serial Bus controllers	

Step 3:Place your Sapphire on the outside roof of your vehicle with magnetic base.

Step 4:Power on your Notebook PC or Handheld PC.

Step 5: Choose the correct COM port for running the map or navigation software.

Step 6:Run the Sapphire test program. Please refer to "How to test your Sapphire".

Notice:

(1) Make sure the power is off before started.

(2) For safety reason, please do not install Sapphire while driving.

(3) To receive NMEA0183 navigational data, please use the Hyper Terminal program of Windows 2000<sup>®</sup>. Please setup the COM port connected with Sapphire to:

Baud rate	: 4800
Data bit	: 8
Parity	: None
Stop bit	:1
Flow control	: None.

- (4) NMEA 0183 data formats are illustrated on Software Data section.
- (5) To prevent the poor contact, the 4-pin mini din connector was designed as good fitting. We strongly recommend user that do not plug and draw this connector frequently.

# How to Install & Operate Sapphire ( USB ) for Windows $XP^\circledast ?$

- Step 1:Plug USB connector (①) to USB port to your Notebook PC or Handheld PC and insert CD supported by Royaltek.
- Step 2:After plug in the Sapphire, it will detect the hardware automatically. Please select the "Install the software automatically [Recommended]". Click the "Next>" button.



Please select "Continue Anyway" and Click this button.



Please select the "Finish". Click "Next>" button.

Found New Hardware Wizard	
	Completing the Found New Hardware Wizard The wizerd has finished installing the software for: USB High Speed Serial Converter
	< Back Finish Cancel

The USB Serial driver is installed in Windows  $\mathrm{XP}^{\circledast}$  now. Please wait for about one minute.

It will setup the USB Serial port driver for Sapphire. Please select the "Install the software automatically [Recommended]". Click "**Next**>" button.



Please select "Continue Anyway" and Click this button.



The USB Serial Port driver is installed in Windows XP<sup>®</sup> now.



You can check the Com port number of the Sapphire from Device Manager. It is COM3 in this example.



Step 3:Place your Sapphire on the outside roof of your vehicle with magnetic base.

Step 4: Power on your Notebook PC or Handheld PC.

Step 5: Choose the correct COM port for running the map or navigation software.

Step 6:Run the Sapphire test program. Please refer to "How to test your Sapphire".

Notice:

- (1) Make sure the power is off before started.
- (2) For safety reason, please do not install Sapphire while driving.
- (3) To receive NMEA0183 navigational data, please use the Hyper Terminal program of Windows 2000<sup>®</sup>. Please setup the COM port connected with Sapphire to:

Baud rate	: 4800
Data bit	: 8
Parity	: None
Stop bit	:1
Flow control	: None.

- (4) NMEA 0183 data formats are illustrated on Software Data section.
- (5) To prevent the poor contact, the 4-pin mini din connector was designed as good fitting. We strongly recommend user that do not plug and draw this connector frequently.

# How to test your Sapphire

- 1. Run the test program by double clicking the \Test programs\GPSDemo.exe file. Then the test program will automatically install into your computer.
- 2. Run the testing program by clicking the shortcut on your Window's program group.
- 3. Testing program will display as follow:

🕼 GPSDemo	
Setup <u>E</u> dit <u>V</u> iew <u>H</u> elp	
B∕ ♣ △	
Lon: 0 • 00'00.0"N	Speed: 0.0 KM
Lat: 0 • 00'00.0"E	Alt: 0.0 M
Date: 2000/00/00	Mode: Fix not available
Time: 00:00:00	Status: Disconnect
	: 0.0 PDOP: 0.0
Ready	

- 4. Before running the test program, make sure you have connected Sapphire to the PC correctly.
- 5.Click the icon on toolbar or click the Start test on the Setup menu. Then the program will automatically detect the serial port and start testing.



6.When finish the test, there is a message box showing the test result. If the test is successful, it will show the following message:

SYSTEM NOTE 🛛 🔀			
	TEST SUCCESSFUL		
[	OK		

If the test fails, it will show the following message:



If it cannot open the COM port, it will show the following message:



7.If the GPS connection is successful, you can see the satellite tracking diagram and the updated data of longitude, latitude, altitude, date time etc.



# How to Synchronize your PDA

Run the msaync890725.exe in the CD path(PDA synchronization \ msaync890725.exe)

After installation, double click the "Microsoft ActiveSync" icon.



Put the PDA on the cradle, then you will see the icon on the task bar from:



# **Physical characteristics**

Dimension: 62+/-0.5 mm (L) x 50+/-0.5 mm (W) x 28+/-0.5 mm (H) Weight 180 grams

## **Temperature characteristics**

Storage temperature:  $-10^{\circ}C \sim +85^{\circ}C$ . Operating temperature:  $0^{\circ}C \sim +70^{\circ}C$ .

#### General

Channels	12 channels
L1	1575.42 MHz.
C/A code	1.023MHz chip rate.

### Accuracy

Position accuracy : 25m, CEP without SA. Velocity accuracy : 0.1 meter / second without SA

### Datum

WGS-84.

## Position update rate

Once per second.

## **Dynamic conditions**

Altitude	: 18000 meters (60000 feet) max.
Velocity	: 514 meters / second max.
Jerk	$\therefore$ 20 meters / second <sup>3</sup> , max.
Acceleration	: 4 G, max.

#### Power

PS2/USB input power: DC 5V  $\pm$  5 %, 180mA, typical

Car cigarette power adaptor:  $+9V \sim +16V$ .

### Certification

FCC/CE compliant

# **Software Data**

#### **NMEA V2.2 Protocol**

It is the RS-232 interface : 4800 bps, 8 bit data, 1 stop bit and no parity.

#### **NMEA Output Messages**

The Sapphire outputs the following messages as shown in Table 1 :

TABLE 1NMEA OUTPUT MESSAGES

NMEA Record	Description	
GGA	Global positioning system fixed data	
GSA	GNSS DOP and active satellites	
GSV	GNSS satellites in view	
RMC	Recommended minimum specific GNSS data	

## **GGA**-Global Positioning System Fixed Data

Table 2 contains the values of the following example :

\$GPGGA, 161229.487, 3723.2475, N, 12158.3416, W, 1, 07, 1.0, 9.0, M, , , ,0000\*18

#### TABLE 2 GGA DATA FORMAT

Name	Example	Units	Description
Message ID	\$GPGGA		GGA protocol header
UTC Position	161229.487		hhmmss.sss
Latitude	3723.2475		ddmm.mmmm
N/S Indicator	Ν		N=north or S=south
Longitude	12158.3416		dddmm.mmmm
E/W Indicator	W		E=east or W=west
Position Fix Indicator	1		See Table 5-1
Satellites Used	07		Range 0 to 12
HDOP	1.0		Horizontal Dilution of Precision
MSL Altitude	9.0	meters	
Units	М	meters	
Geoid Separation		meters	
Units	М	meters	
Age of Diff. Corr.		second	Null fields when DGPS is not used
Diff. Ref. Station ID	0000		
Checksum	*18		
<CR $>$ $<$ LF $>$			End of message termination

#### TABLE 2-1 POSITION FIX INDICATOR

Value	Description		
0	Fix not available or invalid		
1	GPS SPS Mode, fix valid		
2	Differential GPS, SPS Mode, fix valid		
3	GPS PPS Mode, fix valid		

#### **GSA**-**GNSS** DOP and Active Satellites

Table 3 contains the values of the following example : \$GPGSA, A, 3, 07, 02, 26, 27, 09, 04, 15, , , , , , 1.8, 1.0, 1.5\*33

#### TABLE 3 GSA DATA FORMAT

Name	Example	Units	Description
Message ID	\$GPGSA		GSA protocol header
Mode 1	A		See Table 3-2
Mode 2	3		See Table 3-1
Satellite Used <sup>1</sup>	07		Sv on Channel 1
Satellite Used <sup>1</sup>	02		Sv on Channel 2
Satellite Used <sup>1</sup>			Sv on Channel 12
PDOP	1.8		Position Dilution of Precision
HDOP	1.0		Horizontal Dilution of Precision
VDOP	1.5		Vertical Dilution of Precision
Checksum	*33		
<cr><lf></lf></cr>			End of message termination

#### TABLE 3-1 MODE 1

Value	Description
1	Fix not available
2	2D
3	3D

#### TABLE 3-2 MODE 2

Value	Description		
М	Manual-forced to operate in 2D or 3D mode		
А	Automatic – allowed to automatically switch 2D/3D		

### **GSV**-**GNSS** Satellites in View

Table 4 contains the values of the following example :

\$GPGSV, 2, 1, 07, 07, 79, 048, 42, 02, 51, 062, 43, 26, 36, 256, 42, 27, 27, 138, 42\*71

#### TABLE 4 GSV DATA FORMAT

Name	Example	Units	Description
Message ID	\$GPGSV		GSV protocol header
Number of Messages <sup>1</sup>	2		Range 1 to 3
Messages Number <sup>1</sup>	1		Range 1 to 3
Satellites in View	07		
Satellite ID	07		Channel 1(Range 1 to 32)
Elevation	79	degrees	Channel 1(Maximum 90)
Azimuth	048	degrees	Channel 1(True, Range 0 to 359)
SNR (C/No)	42	dBHz	Range 0 to 99, null when not tracking
Satellite ID	27		Channel 4(Range 1 to 32)
Elevation	27	degrees	Channel 4(Maximum 90)
Azimuth	138	degrees	Channel 4(True, Range 0 to 359)
SNR (C/No)	42	dBHz	Range 0 to 99, null when not tracking

Checksum	*71	
<cr><lf></lf></cr>		End of message termination

## **RMC**-Recommended Minimum Specific GNSS Data

Table 5 contains the values of the following example : \$GPRMC, 161229.487, A, 3723.2475, N, 12158.3416, W, 0.13, 309.62, 120598, \*10

#### TABLE 5 RMC DATA FORMAT

Name	Example	Units	Description
Message ID	\$GPRMC		RMC protocol header
UTC Position	161229.487		hhmmss.sss
Status	А		A=data valid or V=data not valid
Latitude	3723.2475		ddmm.mmmm
N/S Indicator	Ν		N=north or S=south
Longitude	12158.3416		dddmm.mmmm
E/W Indicator	W		E=east or W=west
Speed Over Ground	0.13	knots	
Course Over Ground	309.62	degrees	True
Date	120598		ddmmyy
Magnetic Variation		degrees	E=east or W=west
Checksum	*10		
<cr><lf></lf></cr>			End of message termination

# Troubleshooting

Problem	Reason	Solution	
Test fail	Poor connection	Check the RS232 and PS2 connector or USB connector make sure they are well connected.	
	Wrong BIOS setting for PS2	Check the BIOS setting to make sure the PS2 port is enable.	
		If you still get the testing fail message, contact your local distributor.	
Open com port fail		Close all the other application programs and rerun the Sapphire Testing program.	
There is nothing showing on the tracking diagram even if	Sapphire can not receive the GPS signal on the	Move Sapphire to somewhere there is exposed to outdoors.	
the test result is success.	testing area.	Note: normally we cannot receive the GPS signal indoors.	
No position output but timer is counting	1.Weak or no GPS signal can be received at the place Sapphire are.	Go outdoor place without high building to block the signal and retest the Sapphire again.	
	2.At outdoor space but GPS signal is block by buildings		
If operated Sapphire over 5 minutes with nothing showing on the tracking diagram	Maybe Sapphire received not enough data to sure tracking.	Utilize the test program GPSDemo.exe to reset Sapphire. Please Click the icon A on toolbar.	

# **Appendix : Connector Interface**

## 9 pin D-SUB

Pin NO	Signal Name	I/O	Description	Characteristics
1	No connect			
2	TX	0	Serial Data Output	High: -3V ~ -15V
				Low: +3V ~ +15V
3	RX	Ι	Serial Data Input	High: -3V ~ -15V
				Low: +3V ~ +15V
4	No connect			
5	GND	G	Ground	
6	No connect			
7	No connect			
8	No connect			
9	No connect			



## 6 pin mini din

Pin NO	Signal Name	I/O	Description	Characteristics
1	No connect			
2	No connect			
3	GND	G	Ground	
4	VCC	Ι	+5V DC Power Input	$DC + 5V \pm 10\%.$
5	No connect			
6	No connect			



## **USB A Type Connector**

Pin NO		Ι/	Description	Characteristics
	Name	0		
1	GND	-	Ground	Ground
2	D+	I/O	Data plus	Data plus
3	D-	I/O	Data Minus	Data Minus
4	VCC	+	+5V DC Power	+5V DC Power
			Input	Input



## **Limited Warranty**

RoyalTek Company Ltd. grants a warranty for this product for one year starting from the date of purchasing of the product. Please retain the sales receipt as proof of purchase. During the warranty period, the product is eligible for replacement in case of defects in material and workmanship. In such case, the defective unit will be repaired or replaced according to an assessment by RoyalTek. However this warranty does not cover damages caused by improper use or from unauthorized modifications by third parties. In addition, this warranty does not cover expendable materials and defects, which constitute as normal wear or tear. Please contact us as following:

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