REB-22R User Manual

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0. Revision History

Rev	Release Date	Change Description	Editor
1.0	2007/3/20	Initial Draft	Amanda Lee

RoyalTek REB-22R Series User Manual

1 Introduction

REB-22R is the heritage from REB-21R, and REB-22R Pinout compatibility as REB-21R. However, REB-22R has higher sensitivity than REB-21R, and much more power saving than REB-21R.

REB-22R also consists of SiRF Star II technology and RoyalTek proprietary navigation algorithm that providing you more stable navigation data.

1.1 Product Features.

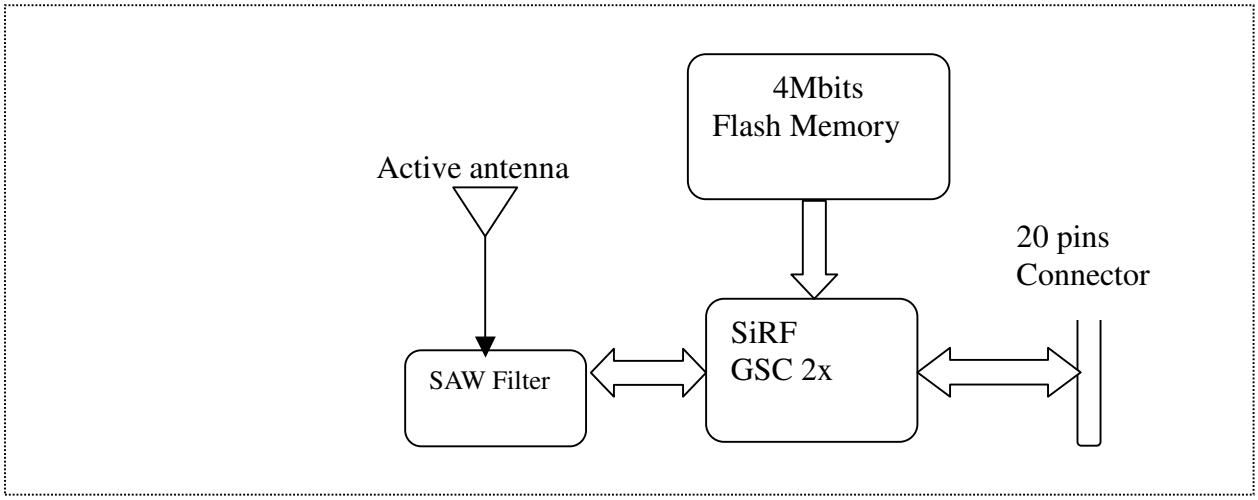
- Pinout compatibility as REB-21R
- Much more power saving than REB-21R
- Higher sensitivity than REB-21R
- OEM product development is fully supported through applications engineering and WEB technique forum.
- 12 parallel channels
- Enhanced algorithm for navigation stability.
- NMEA-0183 compliant protocol/custom protocol.
- Excellent sensitive for urban canyon and foliage environments.
- Single satellite positioning.
- Dual multi path rejection.
- WAAS/EGNOS supported

1.2 Product applications

- Automotive applications
- Personal positioning and navigation
- Marine navigation
- Timing application

1.3 REB-22R Series Block diagram

The block diagram is described as follows.



1.4 Technique specifications

The specification list of REB-22R

- Channels ： 12 Channels
  Frequency：L1, 1575.42MHz.
  C / A code :1.023MHz chip rate.
- Hot start ： 8sec., typical
- Warm start：38sec. typical
- Cold start：48sec., typical
- Reacquisition：1 sec. typical
- Position accuracy：25m CEP without SA
- Velocity accuracy：0.1 meters/second without SA
- Dynamics：
  Altitude ： 18000 meters (60000 feet) Max.
  Velocity ： 515 meters / second Max.
  Acceleration ： 4 g. , Max.
- DGPS Accuracy :
  Position:1 to 5 m, typical
  Velocity: 0.05 meters/second, typical
- Datum: WGS-84.
- Navigation update rate ： 1 Hz.
- RTC reset function,
- Battery<2.0V: cold start;
- TTL level 【3.3V 、5V(option)】
- GPIO (option)
- Clock offset: 90000Hz≦Clock offset≦100000Hz
- Clock drift: ≦ 200Hz in 60 sec.
- Software interface (Output Messages)
  - RS-232 interface(Data format): 9600bps, 8bit data, 1 stop bit and no

parity.

- It supports the following NMEA-0183 messages: GGA, GGL, GSA, GSV, RMC and VTG (default).

- Differential Input: It shall provide external serial RTCM 104

2 Hardware Interface

- Digital Interface connector type
- Connector Number : U402 (RF Interface connector type)
- Antenna connector is female MCX or others type.
- Connector Number : CON1 (20pin I/O interface connector)

2.1 For 5V TTL Output .

Pin NO	Signal Name	I/O	Description	Characteristics
1	ANT_PWR (*Note3)	I	Antenna DC Voltage	Depending on the user required.
2	VCC_5V (*Note1)	I	+5V DC Power Input	DC +5V ± 10%.
3	VBAT (*Note11)	I	User Supply +2.6 ~ +3.6V DC Power Input	DC +2.6 ~ +3.6V. Current ≤ 10uA w/o battery
4	NC	-	NC	
5	NC	-	NC	
6	NC	-	NC	
7	Boot / (*Note13)	I	HA:Boot HS:NC	TTL : 4.5V≤ V_{IH} ≤5.5V 0v≤ V_{OL} <1.35V
8	NC			
9	NC			
10	GND (*Note4)	G	Ground	
11	TXA (*Note8)	O	NMEA Output 9600bps, 8 data bits, no parity, 1 stop bit	TTL : 4.5V≤ V_{OH} ≤5.5v (Ioh= -50uA) 0V≤ V_{OL} ≤0.1V, (Iol=50uA)
12	RXA (*Note6)	I	Serial Data Input A	TTL : 4.5V≤ V_{IH} ≤5.5V 0v≤ V_{IL} <1.35V
13	GND (*Note4)	G	Ground	
14	TXB (*Note9)	O	Serial Data Output B	TTL : 4.5V≤ V_{OH} ≤5.5v (I_{OH} = -50uA) 0V≤ V_{OL} ≤0.1V, (I_{OL} =50uA)
15	RXB (*Note7)	I	RTCM 104 differential GPS input.	TTL : 4.5V≤ V_{IH} ≤5.5V 0v≤ V_{IL} ≤1.35V
16	GND (*Note4)	G	Ground	
17	BOOT/NC (*Note13)	I	HA : NC HS : BOOT	TTL : 4.5V≤ V_{IH} ≤5.5V 0v≤ V_{IL} ≤1.35V
18	GND (*Note4)	G	Ground	
19	TIMEMARK (*Note10)	O	1PPS Time Mark Output.	TTL : 4.5V≤ V_{OH} ≤5.5v (I_{OH} = -50uA) 0V≤ V_{OL} ≤0.1V, (I_{OL} =50uA)
20	NC	-	NC	

Notes: HA boot pin: pin 7, HS Boot pin: pin 17

2.2 For 3.3V TTL Output .

Pin NO	Signal Name	I/O	Description	Characteristics
1	ANT_PWR (*Note3)	I	Antenna DC Voltage	Depending on the user required.
2	NC	-	NC	
3	VBAT (*Note11)	I	User Supply +2.6~3.6V DC Power Input w/o battery	DC +2.6 ~ +3.6V. Current ≤ 10uA (w/o battery)
4	VCC_3V (*Note2)		DC+3.3V ± 10%	DC +3.3V ± 10%
5	NC	-	NC	
6	NC/GPIO15 (*Note12)	I/O	HA:NC HS:GPIO15	TTL: $2 \le V_{IH} \le 3.15V$ $-0.3 \le V_{IL} \le 0.84$ $3.3 \ge V_{OH} \ge 2.2V$ $0 \le V_{OL} \le 0.7V$
7	Boot / GPIO3 (*Note13,12)	I/O	HA:Boot HS:GPIO3	TTL: $2 \le V_{IH} \le 3.15V$ $-0.3 \le V_{IL} \le 0.84$ $3.3 \ge V_{OH} \ge 2.2V$ $0 \le V_{OL} \le 0.7V$
8	NC/GPIO7 (*Note12)	I/O	HA:NC HS:GPIO7	TTL: $2 \le V_{IH} \le 3.15V$ $-0.3 \le V_{IL} \le 0.84$ $3.3 \ge V_{OH} \ge 2.2V$ $0 \le V_{OL} \le 0.7V$
9	NC/GPIO5 (*Note12)	I/O	HA:NC HS:GPIO5	TTL: $2 \le V_{IH} \le 3.15V$ $-0.3 \le V_{IL} \le 0.84$ $3.3 \ge V_{OH} \ge 2.2V$ $0 \le V_{OL} \le 0.7V$
10	GND (*Note4)	G	Ground	
11	TXA (*Note8)	O	NMEA Output 9600bps, 8 data bits, no parity, 1 stop bit	TTL: $3.6 \ge V_{OH} \ge 2.9V$ $0v \le V_{OL} \le 0.1V$
12	RXA (*Note6)	I	Serial Data Input A	TTL : $2.4V \le V_{IH} \le 3.6V$ $0v \le V_{IL} \le 0.9V$
13	GND/GPIO10 (*Note4,12)	G	HA:Ground HS:GPIO10	TTL: $2 \le V_{IH} \le 3.15V$ $-0.3 \le V_{IL} \le 0.84$ $3.3 \ge V_{OH} \ge 2.2V$ $0 \le V_{OL} \le 0.7V$
14	TXB (*Note9)	O	Serial Data Output B	TTL: $3.6 \ge V_{OH} \ge 2.9V$

				0v≤ V_{OL} ≤ 0.1V
15	RXB (*Note7)	I	RTCM 104 differential GPS input.	TTL : 2.4V≤ V_{IH} ≤3.6V 0v≤ V_{IL} ≤0.9V
16	GND/GPIO6 (*Note4,12)	I/O	HA:GROUND HS:GPIO6	TTL: 2≤ V_{IH} ≤3.15V -0.3≤ V_{IL} ≤ 0.84 3.3≥ V_{OH} ≥2.2V 0≤ V_{OL} ≤0.7V
17	BOOT/NC (*Note13)	I	HA : NC HS : BOOT	TTL: 2≤ V_{IH} ≤3.15V -0.3≤ V_{IL} ≤ 0.84 3.3≥ V_{OH} ≥2.2V 0≤ V_{OL} ≤0.7V
18	GND (*Note4)	G	Ground	
19	TIMEMARK (*Note10)	O	1PPS Time Mark Output.	TTL: 3.6≥ V_{OH} ≥ 2.9V 0v≤ V_{OL} ≤ 0.1V
20	NC	-	NC	

Notes: HA version: non GPIO, HS version: with GPIO

2.3 Connector number : U203 (JTAG Connector)

Pin NO	Signal Name	I/O	Description	Characteristics
1	VDD	O	DC+2.85V ± 5%	DC+2.85V ± 5%
2	GND	G	Ground	
3	NICERST	O	Low level sensitive reset to initialize the system and ARM7TDMI to known states	V_{OH} ≥ 2.4V V_{OL} ≤ 0.4V
4	GND	G	Ground	
5	JTDI	I/O	JTAG Interface	VDD+0.3V≥ V_{IH} ≥ 0.7V*VDD, -0.3≤ V_{IL} ≤ 0.3V*VDD V_{OH} ≥ 0.75*VDD V_{OL} ≤ 0.25*VDD
6	GND	G	Ground	
7	JTMS	I/O	JTAG interface	VDD+0.3V≥ V_{IH} ≥ 0.7V*VDD, -0.3≤ V_{IL} ≤ 0.3V*VDD V_{OH} ≥ 0.75*VDD V_{OL} ≤ 0.25*VDD
8	GND	G	Ground	
9	JTCK	I/O	JTAG interface	VDD+0.3V≥ V_{IH} ≥ 0.7V*VDD, -0.3≤ V_{IL} ≤ 0.3V*VDD V_{OH} ≥ 0.75*VDD V_{OL} ≤ 0.25*VDD
10	GND	G	Ground	
11	JTDO	I/O	JTAG interface	VDD+0.3V≥ V_{IH} ≥ 0.7V*VDD, -0.3≤ V_{IL} ≤ 0.3V*VDD V_{OH} ≥ 0.75*VDD V_{OL} ≤ 0.25*VDD
12	NC	-	NC	
13	VCC3	O	DC+2.85V ± 5%	DC+2.85V ± 5%
14	GND	G	Ground	

VCC_5V (+5V DC Power Input)

This is the main DC power supply for a +5V powered.

VCC_3V (+3.3V DC Power Input)

This is the main DC supply for a +3.3V powered.

ANT_PWR

DC voltage for an active antenna is not required for operation with a passive antenna. The antenna power may be supplied through the interface connector (CON1).

GND provides the ground for the Engine board. Connect all grounds.

The Engine supports two full duplex serial channels. All four connections are at TTL levels or RS-232 levels supporting variable baud rates, and can be controlled from the appropriate screens in SIRFdemo

RXA

This is the main receiver channel and is used to receive software commands to the Engine board from SIRFdemo software or from user written software.

This is the auxiliary receive channel and is used to input differential corrections to the Engine board to enable DGPS navigation.

This is the main transmit channel and is used to output navigation and measurement data to SiRFdemo or user written software.

For user's application (not currently used).

This pin provides one pulse-per-second output from the Engine board, which is synchronized to GPS time. This is not available in Trickle Power mode.

Backup battery (VBAT)

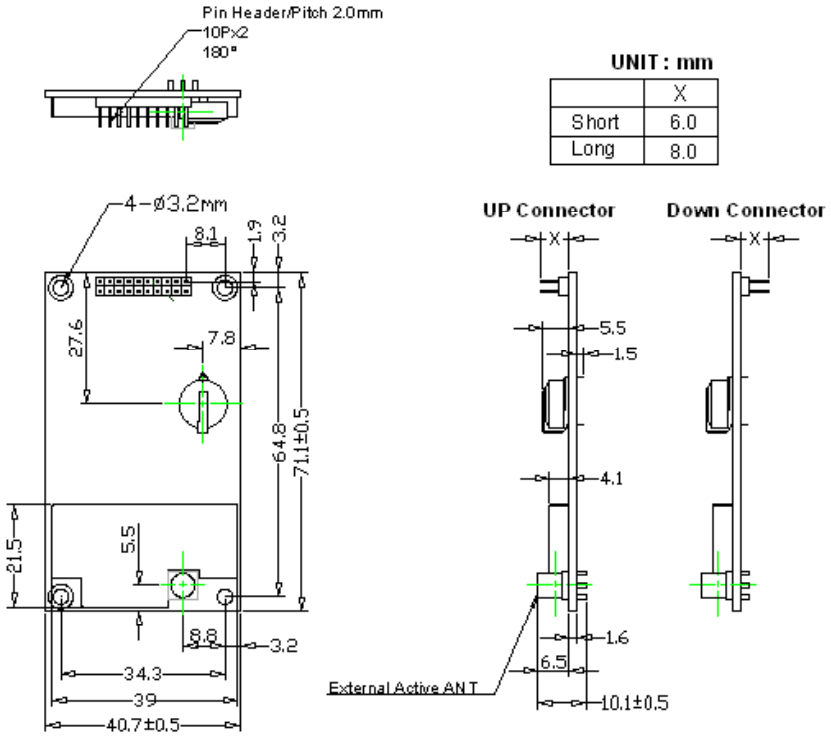
This is the battery backup input that powers the SRAM and RTC when main power is removed. Typical current draw is 10uA.
Without an external backup battery or super cap, the Engine will execute a cold start after every power on. To achieve the faster start-up offered by a hot or warm start, either a battery backup must be connected or a super cap installed.
To maximize battery lifetime, the battery voltage should not exceed the supply voltage and should be between 2.6 and 3.6V.
With the super cap (B1) installed, and after at least ten minutes of continuous operation, the data retention is about seven hours.
Note that even though all other components are rated at –40 to +85 deg C , a typical super cap is specified over a temperature range of –25 to +70 deg C and a typical rechargeable Lithium battery is over –20 to +60 deg C.

Several I/Os of STAR-Ⅱ are connected to the digital interface connector for custom applications.

Notes:

- For 3.3V design, +3.3V at pin 4 is required and pin2 (5V) is unused.
- For 5V design, +4.5 to 5.5V at pin 2 is required and pin 4 (3.3V) is unused.
- Used this pin to start the execution of the resident Boot Loader code. To upload new firmware, tie this pin high and cycle the power.

3 Mechanical Layout.



4 Active antenna

4.1 GSP Antenna

Characteristics	Specification
Center frequency	1575.42 ± 1.023MHz
Bandwidth	2MHz Min
Gain at Zenith	2.0 dBi Min.
Gain at 10° elevation	4.0 dBi Min
Polarization	R.H.C.P
Axial Ratio	4.0dB Max

4.2 5V Filter/LNA

Characteristics	Specification
Center frequency (fo)	1575.42 ± 1.023MHz
Gain	28dB Min.
Noise Figure	2.0dB Max.
Out band attenuation	2dB Min. fo ± 20MHz 12dB Min. fo ± 50MHz 22dB Min. fo ± 100MHz
Output V.S.W.R.	2.0 dB max.
Voltage	5.0 ± 0.5V
Current	12mA Max.

4.3 3.3V Filter/LNA

Characteristics	Specification
Center frequency (fo)	1575.42 ± 1.023MHz
Gain	26dB Min.
Noise Figure	2.0dB Max.
Out band attenuation	2dB Min. fo ± 20MHz 12dB Min. fo ± 50MHz 22dB Min. fo ± 100MHz
Output V.S.W.R.	2.0 dB max.
Voltage	3.3 ± 0.3V
Current	12mA Max.

4.4 Absolute maximum ratings

Parameter	Symbol	Unit	Min. Value	Max. Value
Supply voltage	VCC_5	V	-0.3	6
RTC power	VBAT	V	-0.3	3.6

5 Software interface

5.1 NMEA V2.2 Protocol

It is the TTL interface:9600 bps, 8 bit data, 1 stop bit and no parity. It supports the following NMEA-0183 messages:GGA, GLL, GSA, GSV, RMC and VTG.

5.1.1 NMEA Output Messages

The Engine board outputs the following messages as shown in Table 1:

Table 1 NMEA-0183 Output Messages

NMEA Record	Description
GGA	Global positioning system fixed data
GLL	Geographic position – latitude / longitude
GSA	GNSS DOP and active satellites
GSV	GNSS satellites in view
RMC	Recommended minimum specific GNSS data
VTG	Course over ground and ground speed

5.1.2 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	N		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 2-1
Satellites Used	07		Range 0 to 12
HDOP	1.0		Horizontal Dilution of Precision
MSL Altitude	9.0	meters	
Units	M	meters	
Geoid Separation		meters	
Units	M	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 3 Position Fix Indicators

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

5.1.3 GLL-Geographic Position – Latitude/Longitude

Table 3 contains the values of the following example:$GPGLL, 3723.2475, N, 12158.3416, W, 161229.487, A*2C

Table 3 GLL Data Format

Name	Example	Units	Description
Message ID	$GPGLL		GLL protocol header
Latitude	3723.2475		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	12158.3416		Dddmm.mmmm
E/W Indicator	W		E=east or W=west
UTC Position	161229.487		hhmmss.ss
Status	A		A=data valid or V=data not valid
Checksum	*2C		
＜CR＞＜LF＞			End of message termination

5.1.4 GSA-GNSS DOP and Active Satellites

Table 4 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 4　GSA Data Format

Name	Example	Units	Description
Message ID	$GPGSA		GSA protocol header
Mode 1	A		See Table 4-2
Mode 2	3		See Table 4-1
Satellite Used	07		Sv on Channel 1
Satellite Used	02		Sv on Channel 2
….			….
Satellite Used			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＞			End of message termination

Table 4-1　Mode 1

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

Table 4-2　Mode 2

Value	Description
M	Manual-forced to operate in 2D or 3D mode
A	Automatic-allowed to automatically switch 2D/3D

5.1.5 GSV-GNSS Satellites in View

Table 5 contains the values of the following example: $GPGSV, 2, 1, 07, 07, 79, 048, 42, 02, 51, 062, 43, 26, 36, 256, 42, 27, 27, 138, 42*71$GPGSV, 2, 2, 07, 09, 23, 313, 42, 04, 19, 159, 41, 15, 12, 041, 42*41

Table 5 GGA Data Format

Name	Example	Units	Description
Message ID	$GPGSV		GSV protocol header
Number of Messages[1]	2		Range 1 to 3
Messages Number[1]	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＞			End of message termination

5.1.6 RMC-Recommended Minimum Specific GNSS Data

Table 6 contains the values of the following example: $GPRMC, 161229.487, A, 3723.2475, N, 12158.3416, W, 0.13, 309.62, 120598, ,*10

Table 6 GGA Data Format

Name	Example	Units	Description
Message ID	$GPRMC		RMC protocol header
UTC Position	161229.487		hhmmss.sss
Status	A		A=data valid or V=data not valid
Latitude	3723.2475		ddmm.mmmm
N/S Indicator	N		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＞			End of message termination

5.1.7 VTG-Course Over Ground and Ground Speed

Table 7 contains the values of the following example:$GPVTG, 309.62, T, , M,0.13, N, 0.2, K*6E

Table 7 VTG Data Format

Name	Example	Units	Description
Message ID	$GPVTG		VTG protocol header
Course	309.62	degrees	Measured heading
Reference	T		True
Course		degrees	Measured heading
Reference	M		Magnetic
Speed	0.13	knots	Measured horizontal speed
Units	N		Knots
Speed	0.2	km/hr	Measured horizontal speed
Units	K		Kilometer per hour
Checksum	*6E		
＜CR＞＜LF＞			End of message termination

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