



**AQ-300-U**

**High Sensitivity**

**GPS Receiver**

**User's Manual Guide**

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## Contents

### Quick Use

Turn on your machine.....	3
Check Connector.....	3
Connect AQ-300 to your machine.....	3
Turn on your machine.....	3

### Introduction

Overview.....	4
Features.....	4
Technical Specifications.....	5

### Operational Characteristics

Initialization.....	6
Navigation.....	6

### Hardware Interface

Dimension.....	7
Hardware Interface.....	7
Connector.....	7
Accessories.....	8

### USB Driver

System Requirement.....	10
Installation.....	10
Important.....	10

### Waranty

.....	11
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### Appendix A Software Interface

NMEA Transmitted Sentences.....	12
RTCM Received Data.....	15

### Appendix B Earth Datums and Output Setting

Accessories.....	16
Product Combination.....	16

### Appendix C Products Information

Earth Datums.....	17
Setting.....	17

## Quick Use

### Check GPS Package

#### Standard Package

AQ-300 (GPS Receiver) + CD + Warranty Card + Quick Use

#### Optional Package

The shop may bundle different accessories for you as follows:

1. PC Cable
2. PDA Cable
3. PDA Holder
4. Software (Navigation Software + Digital Map)
5. Others

### Check connector

- a. C3000 RS-232 Serial Port Connector
- b. C3001 USB Connector, please install USB driver first.
- c. When you connect your PDA to AQ-300, you need an optional cable. Check the **e mark (FCC)** for safety and ensure the cigarette adapter with correct model number to avoid damaging your PDA.
- d. Various cables are ready for optional devices.

Connect AQ-300 to your machine.

Turn on your machine.

Your AQ-300 starts to provide you full GPS function.

## Introduction

### Overview

The **AQ-300 Smart Antenna** is a total solution GPS receiver, designed based on **SiRF Star II** Architecture. The AQ Max GPS technology is a low power (70mA), cost effective and easy integration GPS system. This positioning application meets strict needs such as car navigation, mapping, surveying, security, agriculture and so on.

Only clear view of sky and certain power supply are necessary to the unit. It communicates with other electronic utilities via compatible dual-channel through RS-232 or TTL and saves critical satellite data by built-in backup memory. **AQ-300** tracks up to 12 satellites at a time, reacquires satellite signals in 100 ms and updates position data every second. A sleeping mode will save power consumption dramatically to allow critical low power applications.

## Features

The AQ-300 provides a host of features that make it easy for integration and use.

1. SiRF Star II chipset with embedded R3000 level, MIPS I class, 32-bit RISC processor available for customized applications in firmware.
2. High performance receiver tracks up to 12 satellites while providing first fast fix and low power consumption.
3. Differential capability utilizes real-time RTCM corrections producing 1-5 meter position accuracy.
4. Compact design ideal for applications with minimal space.
5. A rechargeable battery sustains internal clock and memory. It is recharged during normal operation.
6. User initialization is not required.
7. Dual communication channels and user selectable baud rates allow maximum interface capability and flexibility.
8. Optional communication levels, RS-232 and TTL meet ordinary application and new fashions of connecting PDA with TTL or RS-232 output.
9. FLASH based program memory: New software revisions upgradeable through serial interface.
10. LED display status: The LED provides users visible positioning status. LED "ON" when power connected and "BLINKING" when AQ-300 position identified. No more extra device is needed.
11. Built-in WAAS demodulator.
12. Built-in magnets for using on top of the car.
13. Waterproof (1 meter) design for all weather.



# Technology specifications

## Physical Dimension

Size: Single construction integrated antenna/ receiver.  
 59.8(W) x 47.6(D) x 21.4(H) (mm)  
 2.35"(W) x 1.87"(D) x 0.84"(H) (inch)

Weight: 98g

## Environmental Characteristics

Operating temperature: -40°C to +85°C (internal temperature).  
 Storage temperature: -55°C to +100°C.

## Electrical Characteristics

Input voltage: +4.75 ~ 5.5 VDC without accessories.  
 +6 ~ 30VDC with accessory C3004.

Backup power: 3V Rechargeable Lithium cell battery, up to 767 hours (32 days) discharge.

## Performance

### Tracks up to 12 satellites.

**Update rate:** 1 second.

### Acquisition time

Reacquisition 0.1 sec., averaged  
 Hot start 8 sec., averaged  
 Warm start 38 sec., averaged  
 Cold start 45 sec., averaged

### Position accuracy:

Non DGPS  
 (Differential GPS)  
     Position 5-25 meters CEP with SA off  
     Velocity 0.1 meter/second, with SA off  
     Time 1 microsecond synchronized GPS time

DGPS  
 (Differential GPS)  
     Position 1 to 5 meters, typical  
     Velocity 0.05 meter/second, typical

### Dynamic Conditions:

Altitude 18,000 meters (60,000 feet) max  
 Velocity 515 meters / second (1000 knots) max  
 Acceleration 4 G max  
 Jerk 20 meters/second<sup>3</sup>, max

## Interfaces

- a. Dual channel RS-232 or TTL compatible level, with user selectable baud rate (4800-Default, 9600, 19200, 38400).
- b. NMEA 0183 Version 2.2 ASCII output (GPGGA, GPGSA, GPGSV, GPRMC, GPVTG).
- c. Real-time Differential Correction input (RTCM SC-104 message types 1, 5 and 9).
- d. SiRF protocol.

## Operational characteristics

### Initialization

As soon as the initial self-test is complete, the AQ-300 begins the process of satellite acquisition and tracking automatically. Under normal circumstances, it takes approximately 45 seconds to achieve a position fix, 38 seconds if ephemeris data is known. After a position fix has been calculated, information about valid position, velocity and time is transmitted over the output channel.

The AQ-300 utilizes initial data, such as last stored position, date, time and satellite orbital data, to achieve maximum acquisition performance. If significant inaccuracy exists in the initial data, or the orbital data is obsolete, it may take more time to achieve a navigation solution. The AQ-300 Auto-locate feature is capable of automatically determining a navigation solution without intervention from the host system. However, acquisition performance can be improved when the host system initializes the AQ-300 in the following situation:

- 1) Moving further than 1,500 kilometers.
- 2) Failure of data storage due to the inactive internal memory battery.

### Navigation

After the acquisition process is complete, the AQ-300 sends valid navigation information over output channels. These data include:

- 1) Latitude/longitude/altitude
- 2) Velocity
- 3) Date/time
- 4) Error estimates
- 5) Satellite and receiver status

The AQ-300 sets the default of auto-searching for real-time differential corrections in RTCM SC-104 standard format, with the message types 1, 5, or 9. It accomplishes the satellite data to generate a differential (DGPS) solution. The host system, at its option, may also command the AQ-300 to output a position whenever a differential solution is available.

## Hardware interface

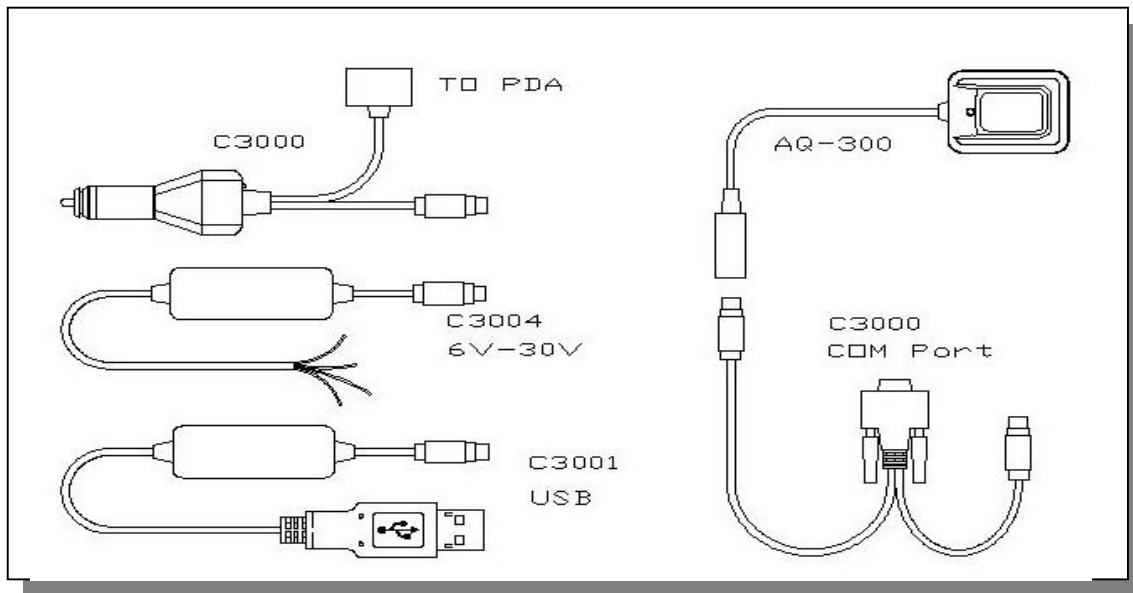
### Dimension

Size: 59.8(W) x 47.6(D) x 21.4(H) (mm)  
2.35"(W) x 1.87"(D) x 0.84"(H) (inch)

Weight: 98g

### Hardware Interface

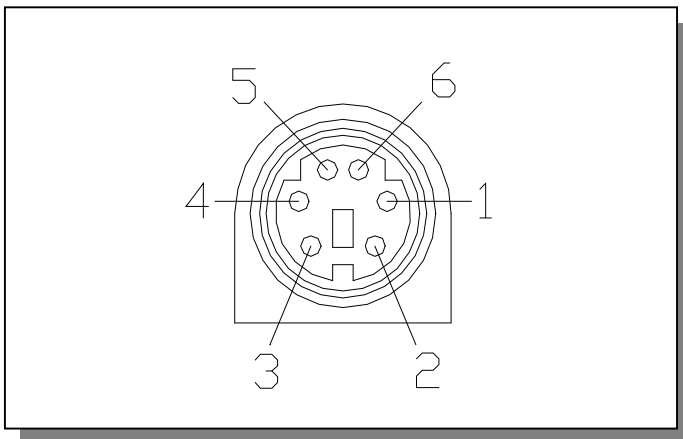
The AQ-300 includes an antenna in a unique style and waterproof gadget. Simply connect PS-2 female connector to one of the optional accessories and link to either your notebook PC, PDA or other devices. The one-piece cigarette adapter allows you to connect AQ-300 to your PDAs. Optional color, input voltage and output connector are listed and described below:



### Connector

Standard cable: 2 meters with female PS-2 connector.  
The AQ-300 is also equipped with optional customized connectors.

### Function definition of standard PS-2 composite connector



Pin	Signal
1	Tx (RS-232)
2	+5VDC
3	Tx (TTL)
4	Ground
5	Rx (TTL)
6	Rx (RS-232)

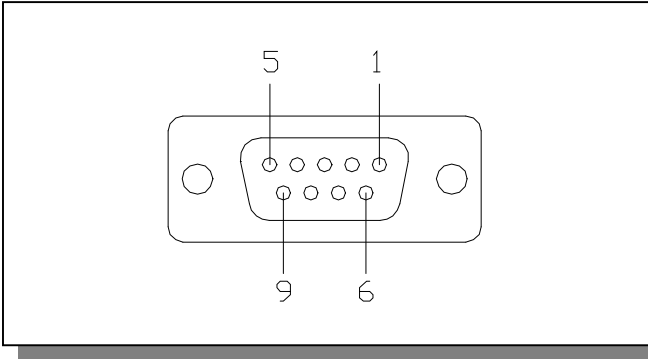
## Accessories

### C3000 Mini Din

Female and PS-2  
male connector:

Cable Length: To AQ-300: 1 meter  
RS-232 to PS-2: 45 cm

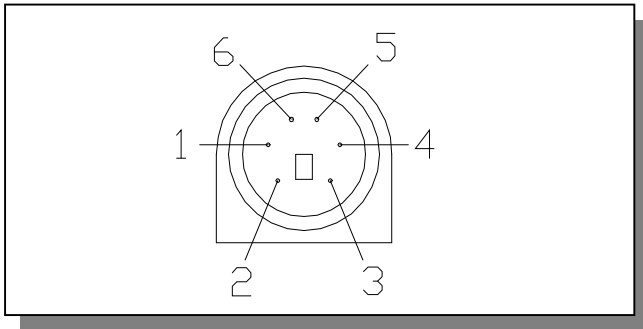
#### Mini Din Female connector function definition:



Pin	Signal Name
1	N.C
2	Tx
3	Rx
4	N.C
5	Ground
6	N.C
7	N.C
8	N.C
9	DGPS in

N.C = No connection

#### PS2 composite connector function definition (to PC):

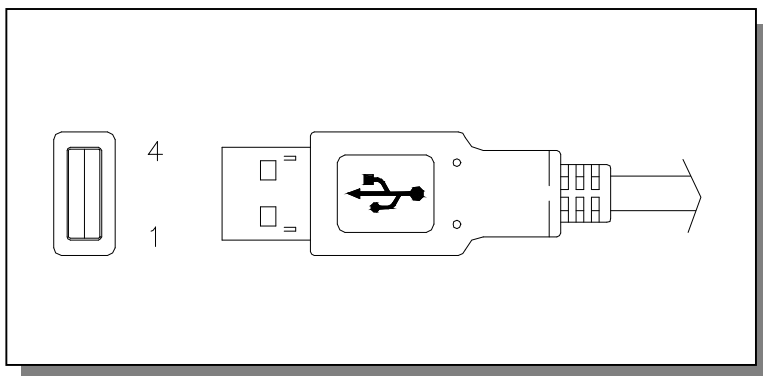


Pin	Signal Name
1	+5V
2	N.C
3	N.C
4	Ground
5	N.C
6	N.C

N.C = No connection

### C3001 USB connector

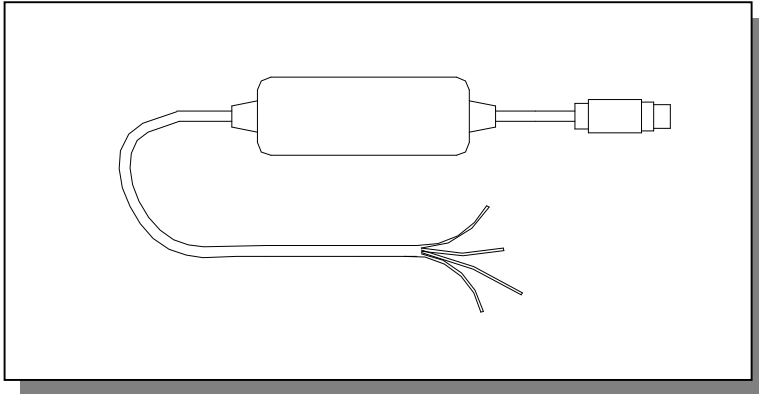
The function definition of the A Type USB connector is as follows:



Pin	Signal Name
1	+5V
2	D +
3	D -
4	Ground



## C3004 High power connector



Color	Signal
Black	Ground
Red	+6~30 VDC
Green	Tx
White	Rx
Orange	DGPS IN

## C3002 Optional Cigarette Adapter

The optional cigarette adapter with 2-meter core cable is for using in a car or boat. It must be used together with a C3000 or an old standard COM + PS-2 GPS receiver.

Input voltage: DC12V - 26V

## C3003 Cigarette adapter and PDA connector:

1	CA-ASUSA600	ASUS A-600
2	CA-ASUSA620	ASUS A-620
3	C3003-AR	ACER S60 / N20 series
4	CA-BESTA I-WINNA	BESTA I-WINNA
5	CA-Cassio E-115	Casio E-115
6	CA-Cassio E-125	Casio E-125
7	CA-Cassio E-200	Casio E-200
8	CA-Dell X5	Dell Axim X-5
9	CA-Eten P603	Eten P603
10	CA-Jornada	HP Jornada 52xx / 54xx / 56xx
11	CA-HandSpring Treo	HandSpring Treo
12	CA-HandSpring Visor	HandSpring Visor\Prism
13	CA-HandSpring Edge	HandSpring Edge
14	CA-Siemens LOOX	Siemens LOOX
15	CA-MIO528NEC	Mitac Mio 528 / 338 / Yakumo Alpha+Delta
16	CA-NEC 300E	NEC 300E
17	CA-Palm Vx	Palm Vx
18	CA-Palm	Palm / IBM WorkPad 500/505/Tungsten
19	CA-IPAQ36XX	I-Paq 36xx / 37xx
20	CA-IPAQ38XX	I-Paq 38xx / 39xx / 54xx
21	CA-Sony N-Type	Sony N-7xx / S-xx
22	CA-Sony T-Type	Sony T-6xx / NR-xx / SL-xx / SJ-xx
23	CA-Siemens SX-45	Siemens SX-45
24	CA-Toshiba e570	Toshiba E-570
25	CA-Toshiba e330/e740	Toshiba E-330/740
26	CA-XDAO2	O 2 – XDA / T-Mobiles – MDA

## USB Driver

### System Requirements

IBM, Pentium or above and other compatible PC; 16 MB and above memory; Windows 98/Me/2000; VGA Graphic Adapter.

### Installation

1. Copy entire <AQ-300 USB> folder from CD to hard disk.
2. Connect AQ-300 USB connector to computer. While the computer automatically starts the installation program, please direct the driver to the <AQ-300 USB> folder.
3. After the installation is complete, go to <Device Manager> and select <Ports (COM & LPT)> to verify if a virtual COM port <USB to Serial Port> was created.

### Important

Verify the COM port # to start using your own navigating software.

1. Click <**Start**> menu, select <**Settings**>, then enter <**Control Panel**>.
2. After entering <**Control Panel**>, select <**System**>.
3. Select <**Device Manager**>.
4. Find the <**Connect Port**> and check the Virtual COM Port, which was created by the USB driver. Please note that the Virtual COM Port number might be different from every computer. Before using navigating software, please confirm the COM Port numbers created by your computer and provided by your navigation software. They must be the same Com Port numbers. Otherwise, the navigating software won't receive the satellite signal for the un-match COM Port setting.

## Warranty

The limited warranty provided by AQ Max Technology Inc. is subject to the terms set forth below:

1. AQ Max provides certain warranty service to AQ Max products without charge for **two year** warranty period from the purchase date.
2. The warranty for accessories is **six months**.
3. Repairs or replacement will be made within warranty period at no charge to the customer either for parts or labor cost. The customer is, however, responsible for any transportation.
4. Beyond warranty period, parts repair cost and labor cost will be charged.
5. This warranty does not cover any defect due to abuse, misuse, accident or unauthorized alteration of repairs. AQ Max Technology Inc. assumes no responsibility for special, incidental, punitive or consequential damages, or loss of use.

Model number	
Series number	
Date of Purchase	
Name	
City, Zip code	
State, Country	
E-mail	
Address	
Distributor Stamp Here	



# Appendix A Software Interface

## NMEA Transmitted Messages

The AQ-300 interface protocol is based on the National Marine Electronics Association's NMEA 0183 ASCII interface specification, which is defined in NMEA 0183, Version 2.2 and the Radio Technical Commission for Maritime Services (RTCM Recommended Standards For Differential Navstar GPS Service, Version 2.1, RTCM Special Committee No.104).

The AQ-300 supported by SiRF Technology Inc. also outputs data in NMEA-0183 format as defined by the National Marine Electronics Association (NMEA), Standard. The default communication parameters for NMEA output are 4800 baud, 8 data bits, stop bit, and no parity.

**Table A-1 NMEA-0183 Output Messages**

NMEA Sentence	Description
GPGGA	Global positioning system fixed data
GPGLL	Geographic position latitude \ longitude
GPGSA	GNSS DOP and active satellites
GPGSV	GNSS satellites in view.
GPRMC	Recommended minimum specific GNSS data
GPVTG	Course over ground and ground speed

### Global Positioning System Fix Data (GGA)

Table A-2 contains the values for the following example:

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

**Table A-2 GGA Data Format**

Name	Example	Units	Description
Message ID	\$GPGGA		GGA protocol header
UTC Time	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 5-3
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 A-3 Position Fix Indicator**

Value	Description
0	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

## Geographic Position with Latitude/Longitude (GLL)

Table A-4 contains the values for the following example:

**\$GPGLL,3723.2475,N,12158.3416,W,161229.487,A\*2C**

**Table A-4 GLL Data Format**

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

## GNSS DOP and Active Satellites (GSA)

Table A-5 contains the values for the following example:

**\$GPGSA,A,3,07,02,26,27,09,04,15, , , , , ,1.8,1.0,1.5\*33**

**Table A-5 GSA Data Format**

Name	Example	Units	Description
Message ID	\$GPGSA		GSA protocol header
Mode 1	A		See Table 5-6
Mode 2	3		See Table 5-7
Satellite Used (1)	07		Sv on Channel 1
Satellite Used (1)	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

(1) Satellite used in solution.

**Table A-6 Mode 1**

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

**Table A-7 Mode 2**

Value	Description
1	Fix Not Available
2	2D
3	3D



## GNSS Satellites in View (GSV)

Table A-8 contains the values for 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 A-8 GSV Data Format**

Name	Example	Units	Description
Message ID	\$GPGSV		GSV protocol header
Number of Messages	2		Range 1 to 3
Message Number	1		Range 1 to 3
Satellites in View	07		Range 1 to 12
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

**NOTE:** Items <4>,<5>,<6> and <7> repeat for each satellite in view to a maximum of four (4) satellites per sentence. Additional satellites in view information must be sent in subsequent sentences. These fields will be null if unused.

## Recommended Minimum Specific GNSS Data (RMC)

Table A-9 contains the values for the following example:

```
$GPRMC,161229.487,A,3723.2475,N,12158.3416,W,0.13,309.62,120598, ,*10
```

**Table A-9 RMC Data Format**

Name	Example	Units	Description
Message ID	\$GPRMC		RMC protocol header
UTC Time	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 (1)		Degrees	E=east or W=west
Checksum	*10		
<CR> <LF>			End of message termination

(1) SiRF Technology Inc. does not support magnetic declination. All “course over ground” data are geodetic WGS84 directions.

## Course Over Ground and Ground Speed

Table A-10 contains the values for the following example:

**\$GPVTG,309.62,T, ,M,0.13,N,0.2,K\*6E**

**Table A-10 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 (1)
Speed	0.13	Knots	Measured horizontal speed
Units	N		Knots
Speed	0.2	Km/hr	Measured horizontal speed
Units	K		Kilometers per hour
Checksum	*6E		
<CR> <LF>			End of message termination

(1) SiRF Technology Inc. does not support magnetic declination. All "course over ground" data are geodetic WGS84 directions.

## RTCM Received Data

The default communication parameters for DGPS Input are 9600 baud, 8 data bits, stop bit, and no parity. Position accuracy of less than 5 meters can be achieved with the AQ-300 by using Differential GPS (DGPS) real-time pseudo-range correction data in RTCM SC-104 format, with message types 1, 5, or 9. As using DGPS receiver with different communication parameters, AQ-300 may decode the data correctly to generate accurate messages and save them in battery-back SRAM for later computing.

## Appendix B

### Ordering Information

#### Accessories

#### Cables

Seq.	Part No.	Appl. Model
1	CA-ASUSA600	ASUS A-600
2	CA-ASUSA620	ASUS A-620
3	CA-ACER	ACER S60 / N20 series
4	CA-BESTA I-WINNA	BESTA I-WINNA
5	CA-Cassio E-115	Casio E-115
6	CA-Cassio E-125	Casio E-125
7	CA-Cassio E-200	Casio E-200
8	CA-Dell X3	Dell Axun X-3
9	CA-Dell X5	Dell Axim X-5
10	CA-Eten P603	Eten P603
11	CA-Jornada	HP Jornada 52xx / 54xx / 56xx
12	CA-HandSpring Treo	HandSpring Treo
13	CA-HandSpring Visor	HandSpring Visor\Prism
14	CA-HandSpring Edge	HandSpring Edge
15	CA-Siemens LOOX	Siemens LOOX
16	CA-MIO528NEC	Mitac Mio 528 / 338 / Yakumo Alpha+Delta ViewSonic V35/V36
17	CA-NEC 300E	NEC 300E
18	CA-Palm Vx	Palm Vx
19	CA-Palm M5XX	Palm / IBM WorkPad 500/505/Tungsten
20	CA-RS232	COM PORT
21	CA-IPAQ36XX	I-Paq 36xx / 37xx
22	CA-IPAQ38XX	I-Paq 38xx / 39xx / 54xx
23	CA-Sony N-Type	Sony N-7xx / S-xx
24	CA-Sony T-Type	Sony T-6xx / NR-xx / SL-xx / SJ-xx
25	CA-SP230(ET180)	
26	CA-Siemens SX	Siemens SX-45
27	CA-TOSHIBA e400/e800	Toshiba E400/E800
28	CA-Toshiba e570	Toshiba E-570
29	CA-Toshiba e330/e740	Toshiba E-330/740
30	CA-USB	USB
31	CA-XDAO2	O 2 – XDA / T-Mobiles – MDA

Remarks: All Cigarette Adapters are up to 2A and with certificate of **CE, FCC** and **e mark**.

#### Product Combination

##### Standard package

AQ-300 (GPS Receiver) + Documents CD + Warranty Card + Quick Use



## Appendix C Earth Datums & Output Setting

### Earth Datums

The AQ-300 is built in earth datum with WGS84.

### Setting

#### Manufacturing Default

Datum: WGS84.  
Baud Rate: 4800.  
Output: GGA, GSA, GSV, RMC, VTG.

#### Baud Rate and Output Sentences Setting

By SiRF demo  
Program

- 1) Connect your AQ-300 to PC (either COM or USB)
- 2) Execute SiRFdemo.exe (Program is in the CD)
- 3) When "Data Source Setup" shows, select the port (COM 1, 2 or 3....) you used, click "OK".
- 4) Click "Action", select "Open Data Source." Then you will see lots of sentences show. All the sentences start with \$GPxxxx. This is NMEA protocol. If you do not see these sentences, please click "View", "Select Message", then click "Development". The message will appear. If it still shows nothing, then continue below steps.
- 5) There is a screen "Selection of Target Receiver Software" might appear, please select "SiRF Star II".
- 6) Click "Action." Select "Switch to SiRF Protocol". Then you will see SiRF binary and the sentences start with #Time, shows every 4 lines and you can not see the sentences start with \$GP. These sentences are for setting or viewing the GPS receiver's performance. If your software is using standard NMEA protocol, please do the following:
- 7) Click "Action." Select "Switch to NMEA Protocol". You will see GGA, GSV, GSA and RMC in black and the Baud Rate is 4800. These are the default we put inside the receiver. Please click "OK". Then you can use it as a standard GPS receiver. If your software uses different sentences, please choose the sentences you need.

After above actions, the new setting will be kept in SRAM. If no power supplied to AQ-300 for more than 30 days, user must reset again when power on.

By other SiRF based  
demo program

There are a few companies or private websites providing some very good demo software.