**COMNAV** **OEM** **BOARD**

**REFERENCE** **MANUAL**

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ComNav Technology Ltd.

Shanghai, 2019

CNT-OEM-RM001, Rev 1.8



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*Approval* *Sheet*

**APPROVAL** **SHEET**

**SUBSCRIPTION**

**SIGNATURE**

**DATE**

Prepared By

Maintained By

Checked By

WLD

RJY

2015/9/24

2019/12/05

Approved By

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**RELEASE** **DATE**

2019/12/05

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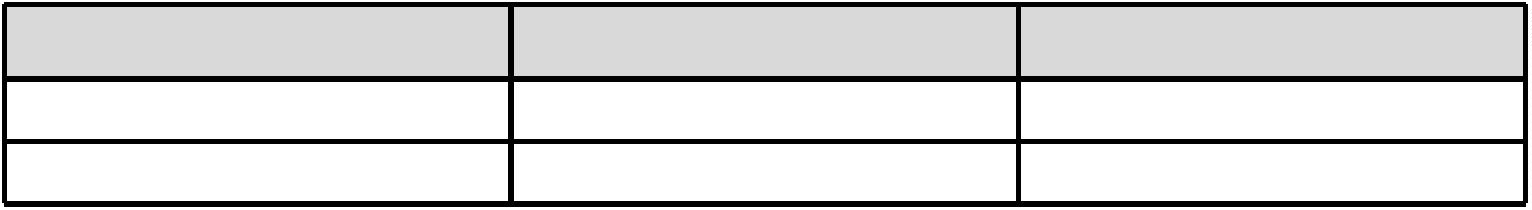
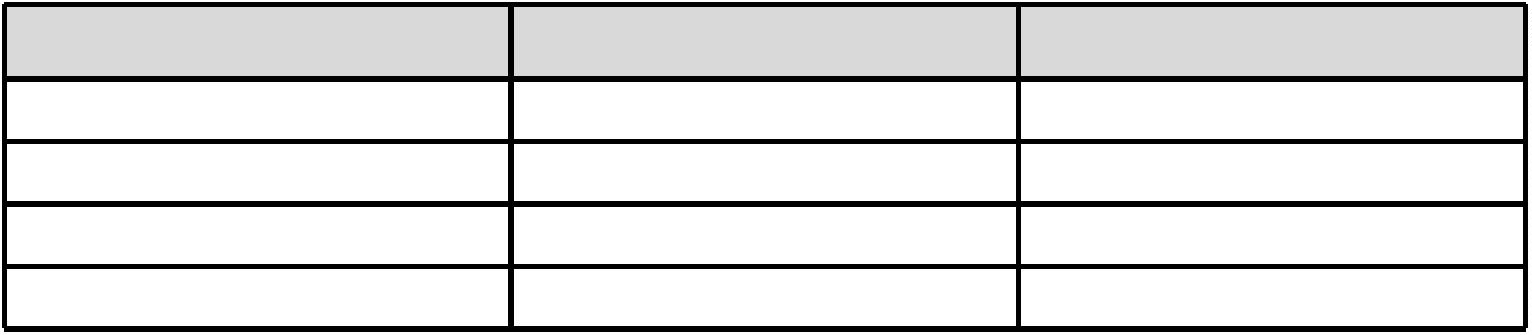
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*Revision* *History*

**REVISION** **HISTORY**

**REVISION** **MODIFICATION**

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1)

New added commands:

a) MARKCONTROL in *3.2.17*

b) MAXVECLENERR in *3.2.18*

c) BD3EPHEM in *4.2.1.2*

d) BD3RAWNAVSUBFRAME in *4.2.1.3*

e) BDSRAWNAVSUBFRAME in *4.2.1.9*

f) GALEPHEMERIS in *4.2.1.14*

g) GALFNAVRAWPAGE in *4.2.1.15*

h) GALINAVRAWWORD in *4.2.1.16*

i) QZSSRAWSUBFRAM in *4.2.1.17*

j) QZSSRAWEPHEM in *4.2.1.18*

k) RAWGPSSUBFRAME in*4.2.1.19*

l) QXWZSDKINFOB in *4.2.7.8*

2)

Add following messages:

a) Add the*Table* *6.* *GNSS* *Name* *and* *Corresponding* *PRN*

*b)* Add the*Table* *7.* *GNSS* *System*

1.8

2019-12-05

c) Add the*Table* *13.* *DGNSS* *Type*

d) Add the*Table* *14.* *Saved* *Configuration*

e) Add the*Table* *16.* *SET* *Type* *and* *Parameter*

*f)* Add the*Table* *19.* *Predefined* *Log* *Message*

g) Add the parameter RTCM1114 in*Table* *21.RTCM* *Message*

h) Add the*Table* *31.* *Solution* *Status*

i) Add the*Table* *32.* *Position* *or* *Velocity* *Type*

j) Add notes to the form in NMEATALKER

k) Add the parameters of the table in RTCMDATA1

l) Add the parameters of the table in GPSEPHEM

m) Add the parameters of the table in INTERFACEMODE

n) Add the parameters and notes of the table in RTKDYNAMICS

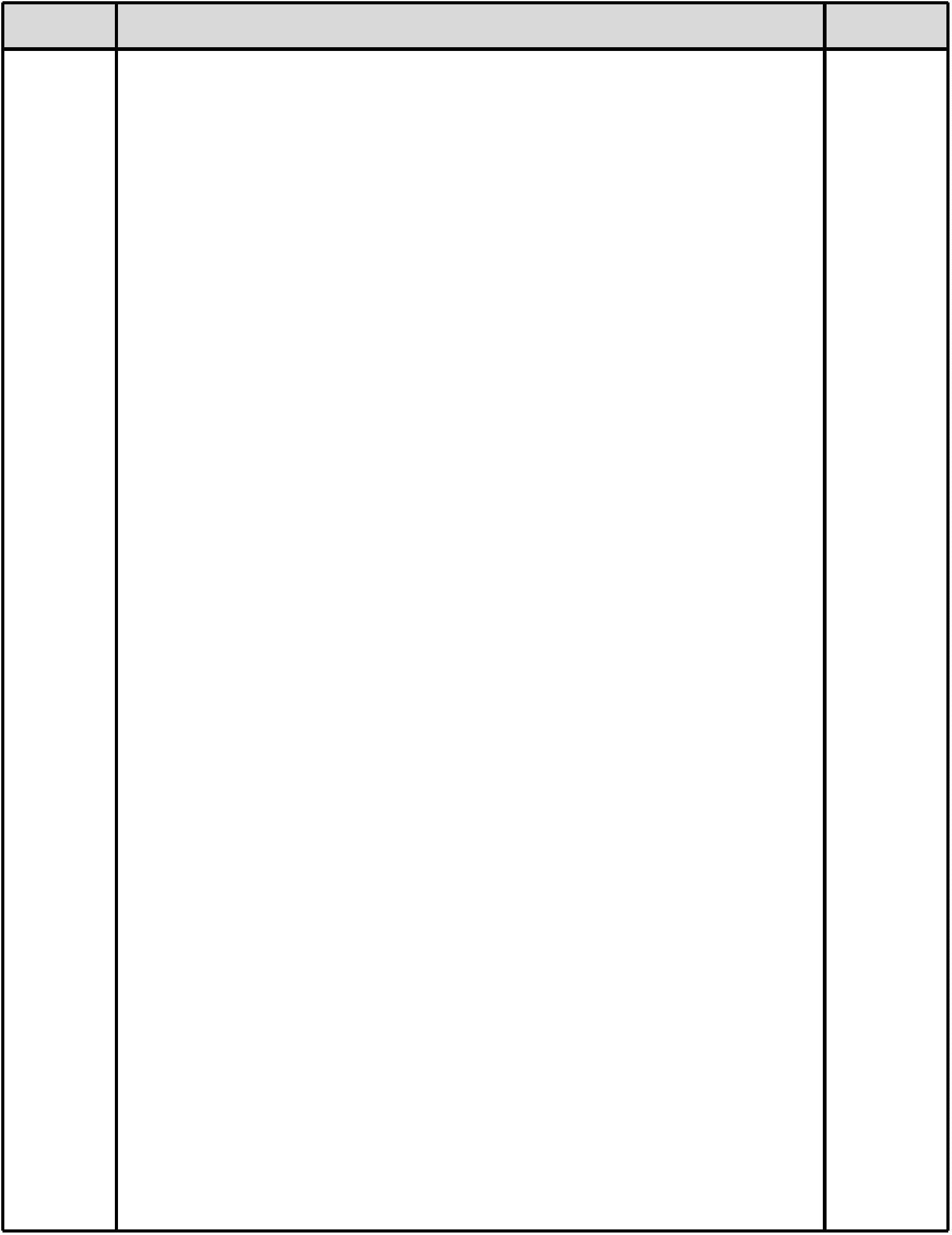
o) Add the parameters of the table in RTKSOLUTION

p) Add the examples of the table in UNDULATION

q) Add the notes of the table in RANGECMP

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3)

Update definition of following commands:

a) Modify the satellite channel number

b) Modify the parameters of the table in IONUTC

c) Modify the parameters of the table in *4.3.1.2.16*

d) Modify the parameters in PRN of the table in *4.3.1.1.5*

e) Modify the format and parameters in RTKQUALITY

f) Adjust the time-delay default and maximum values in RTKFIXHOLDTIME

g) Adjust the time-delay default values in RTKTIMEOUT

h) Support PTNLPJK in *Table* *10*

4)

Change the contact information of the company

5

)

Adjust the document format of whole manual, check errors and correcting

1)

New SET commands:

a) Set GPS L2 PRN code type setting in *3.2.39*

b) Set GLONASS PRN code type setting on G1 and G2 frequency in *3.2.39*

c) Set Auto sending raw data file in *3.2.39*

d) Set external coordinates in *3.2.39*

e) Set cyclesave switcher fileperiod sampleint eraseint in *3.2.39*

f) Set stationmode mode portA portB interval in *3.2.39*

g) Set EMMC ON/OFF in *3.2.39*

h) Set projectiontype *param1* in *3.2.39*

i) Set cp smoother on aa bb in *3.2.39*

j) Set nmeamsgformat in *3.2.39*

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2016-06-12

k) Set GLOPRBIAS gx p1 p2 ……p14\r\n in *3.2.39*

l) Set GLOCHANPRBIAS gx chan p in *3.2.39*

m) Set GLOPRBIAS DEFAULT in *3.2.39*

2)

3)

4)

5)

6)

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9)

MARKCONTROL in*3.2.39* *3.2.17*

MARKPOS in *4.2.5.1*, MARKTIME in *4.2.5.2*

Add NEMA data format in *3.2.12*

Change command “RTKDYNAMICS mode” in *3.2.26*

Add description of RTCM 1033 in *4.3.3.14*

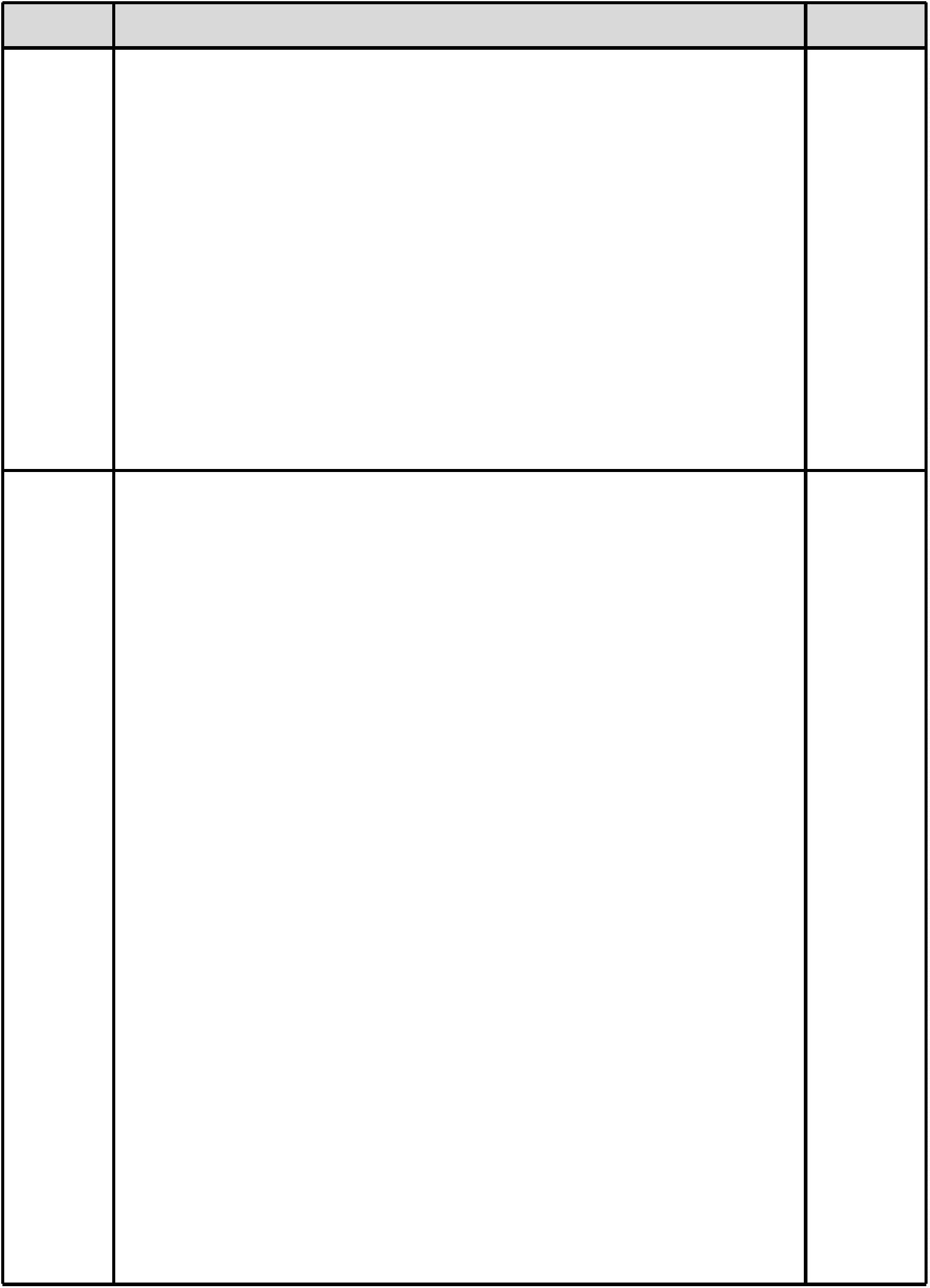
Change the PPS update rate to 10 Hz in *3.2.20*

Add DYNAMIC BASE and ROVER STATION SETTINGS in *6.4*

Add DYNAMIC BASE STATION SETTING in *6.5*

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0) Add RTKQUALITY command in *3.2.39*

1) Add rtcm41 in *4.3.2.6*

2) Add rtcm42 in *4.3.2.7*

3) Add descriptions about GLORAWEPHEM in *4.2.1.8*

4) Delete the reply message in the example of SJ in *A.2.3*

5) Delete the reply message in the example of FX in *A.2.10*

6) Delete the reply message in the example of FC in *A.2.5*

)

New added commands:

a) HEADINGOFFSET in *3.2.11*

b) RTKFIXHOLDTIME in *3.2.28*

c) RTKSOURCE in *3.2.32*

d) SBAS configuration:

i.

ii.

SBASCONTROL in *3.2.36*

SBASECUTOFF in *3.2.37*

SBASTIMEOUT in *3.2.38*

iii.

e) A few SET commands in *3.2.39*

f) UNDULATION in *3.2.40*

2)

Update definition of following commands:

a) COM: Port ID in , Baud rate in .

b) LOG: added keyword ‘offset’ in *3.2.15*

*c)* LOCKOUT:

1.4

2015-9-25

d) *Table* *6.* *GNSS* *Name* *and* *Corresponding* *PRN*

*e)* LOCKOUTSYSTEM:

f) *Table* *7.* *GNSS* *System*

g) MAGVAR in *3.2.16*

h) RTKOBSMODE in *3.2.29*

3

)

)

Add *Table* *24.* *Log* Trigger Types. Logs Supporting ONCHANGED and

ONTRACKED

4

Updated log messages:

a) Correct the message id of BD2RAWEPHEM from ‘413’ to ‘412’ in *4.2.1.5*.

b) Append the message definition table for GPSEPHEM in *4.2.1.9*, which is

also the definition of BD2EPHEM.

c) RAWALM subframe description in *4.2.1.10*

d) SATMSG in *4.2.9.3*

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e) REFSTATION in *4.2.11.1*

*f)* Position or Velocity Type in

g) *Table* *32.* Position or Velocity Type, which is used in BESTPOS, BESTVEL,

BESTXYZ, PSRPOS, PSRVEL, PSRXYZ, HEADING and TRACKSTAT.

New added log messages:

5)

a) Predefined Log in *4.2*:

i.

BINEX records in *4.2.2*: BINEX00DATA, BINEX0101DATA,

BINEX0102DATA, BINEX0105DATA, BINEX7d00DATA,

BINEX7e00DATA, BINEX7f05DATA

ii.

iii.

iv.

MARKPOS in *4.2.5.1*, MARKTIME in *4.2.5.2*

Meteorograph *0*: METEODATA, METEODATAEXT

M925 in *4.2.9.2*, PSRVEL in *4.2.7.6*, PSRXYZ in *4.2.7.7*, SATXYZ in

*4.2.9.5*

v.

SBAS message:

RAWSBASFRAME in *4.2.10.1*;

SBAS0, SBAS1, SBAS2, SBAS3, SBAS4, SBAS5, SBAS6, SBAS7, SBAS9,

SBAS10, SBAS12, SBAS17, SBAS18, SBAS24, SBAS25, SBAS26,

SBAS27, SBAS28 and SBAS63 in *4.2.10*.

b) International Standard messages:

i.

Self-defined NMEA 0183 Sentences: GPNAV in *4.3.1.2.8*, GPTRA in

*.3.1.2.14*, GPYBM in *4.3.1.2.16*

RTCM 3.x in :

3 (Test Message, decoded BDS Ephemeris) in *4.3.3.1*

MSM message: 1074 in *4.3.3.16*, 1084 in *4.3.3.17*, 1124 in *4.3.3.18*

*4*

ii.

6

1003 in *4.3.3.3*, 1011 in *4.3.3.10*

4078 in *4.3.3.19*

iii.

BINEX Records in *4.3.4*: 0x00, 0x01-01, 0x01-02, 0x01-05, 0x7d-00,

x7e-00, 0x7f-05

c) Other Message:

0

i.

Trimble: PTNL,AVR in *4.4.1.3*; PTNL,GGK in *4.4.1.4*

ii.

Command messages for weather instrument (meteorograph)

control in *6.3*: ZZ11ASETDATE, ZZ11ASETTIME, ZZ11ASETID,

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ZZ11ASETAUTOSEND, ZZ11AREADDATE, ZZ11AREADTIME,

ZZ11AREADID, ZZ11AREADAUTOSEND

6)

7)

2)

Add ComNav binary command *RS* in *A.2.14*.

Adjust the document format of whole manual, check errors and correcting.

Remove OEM Board Physical Information and Technical Specifications listed

in Appendix A/B into corresponding Product Specification documents. Refer

to:

*CNT-OEM-PS001,* *K500\_K501\_K501G\_K505* *OEM* *Board* *Product* *Specification*

*CNT-OEM-PS002,* *K502\_K508\_K528* *OEM* *Board* *Product* *Specification*

Move “CHAPTER 4. BINARY COMMANDS AND LOGS” to *Appendix* *A.* *Binary*

*Commands*.

3

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4

Add or update following commands in *Chapter* *3*:

*a)* Update GNSS PRN in

b) *Table* *6.* GNSS Name and Corresponding PRN.

c) Add command NMEATALKER in Section *3.2.17*.

d) Add command RTKOBSMODE in Section *3.2.28*.

e) Update description of RTKSOLUTION in Section *3.2.31*.

Clarify the classifications of log messages in *0* and update

*Table* *19.* *Predefined* *Log* *Message*.

1.3

2013-1-19

*5)*

6)

7)

Add following messages:

a) Add GLOEPHEMERIS (B).

b) Add GLORAWEPHEM (B).

c) Add LOGLIST (A) in Section *0*.

d) Update REFSTATION (A) to support ASCII output in Section *0*.

e) Add GPRRS, GPSEH, GPURA, GPGRS, GPDRC, GPRSC, GPCLH, GPIDM, and

GPPRR in Section *4.3.1*.

f) Add RTCM2.x Message 1, 9 and 31 in Section *4.3.2*.

g) Add RTCM3.x Message 1012, 1019 and 1020 in Section *4.3.3*.

h) Add JAVAD NAVPOS[NP] Message in Section *4.4*.

Adjust the document format of whole manual, check errors and correcting.

Add velocity type “DOPPLER\_VELOCITY” in

8

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*1)*

1.2K

2) *Table* *32.* Position or Velocity Type.

Add description of log message “BD2RAWALM“ in Sec. *4.2.1.3*.

2013-07-05

3)

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4)

5)

6)

Add description of log message “HEADING“ in Sec. *4.2.3.2*.

Update the description in Sec. *6.3* to clarify the usage of “INTERFACEMODE”.

Fix cross reference errors on Solution Status, Position & Velocity type for

BESTPOS, BESTVEL, BESTXYZ, PRSPOS and TRACKSTAT.

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)

Correct the description of Field #5 and #6 of the log message GPNTR.

Update the Pin information of K502 and K508 OEM board in *Appendix* *B.*

*Technical* *Specifications*.

2

1.2J

2013-06-21

3)

Rewording the description of the RTCM messages from Sec *4.3.2.1* ~ Sec

*4.3.3.1* to make them more clearly.

1)

2)

3)

Adjust the document format of whole manual

Update the contact information of ComNav in Sec.*1.5*.

Error checking and correcting:

a) Words and Phrases

b) Cross References to Sections, tables, or Figures (under way)

c) Discrepant Description between Different Sections (under way)

Description rewording or polishing of whole manual

a) Change document name from “Compass OEM Board Reference Manual”

to “***ComNav*** ***OEM*** ***Board*** ***Reference*** ***Manual***”

1.2I

2013-06-05

4)

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)

Release formal document number as ***CNT-OEM-RM001***, based on ComNav’s

document standardization system (Under Construction).

The Latest Card Firmware Version is 1.30D. 1.30D is not released, just in

testing.

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1.2H

2013-05-22

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.2G

.2E

.2F

1) Add message “HEADINGB”, “BESTXYZA”.

2013-05-09

2013-01-25

1) Add message “RANGEB”, “RTCMDATA1B”, “RANGECMPL1B”.

1) Add message “RTCM1002B”, “RTCM1010B”, “RANGEA”, “RANGECMPA”, 2013-02-20

BESTVELA”, “BESTVELB”, “IONUTCA”, “IONUTC”, “IONUTCB”.

1) Add K506 pin definition, in section *Appendix* *B.* *Technical* *Specifications*.

“

1

.2D

.2B

2013-01-09

2013-01-04

1)

1)

1)

Add a serial log commands to check certain configurations or parameters, in

section *4.4.3*.

1

Add “BD2 Elevation Mask Angle”, “GLONASS Elevation Mask Angle” and

1

.2A

.2A

2012-10-16

2012-09-19

“

GALILEO Elevation Mask Angle”, in section *2.3*.

Add “SET CPUFREQ” command, in section *3.2.36*.

1

2) Add “SET PVTFREQ” command, in section *3.2.36*.

Add “SET RTKFREQ” command, in section *3.2.36*

3)

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1)

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4)

Add “INTERFACEMODE” status in “SAVECONFIG” command, in section *3.2.35*;

Add “CLOCKOFFSET” value in “SAVECONFIG” command, in section *3.2.35*;

Add notice of firmware updates, in *Appendix* *C.* *Firmware* *Updates*;

Modify pin definition, in *Appendix* *B.* *Technical* *Specifications*

1.2A

5) Add message “GPNTR”, use command “LOG” to set output.

2012-08-27

6)

configure GNSS cards to work on Common-view time transfer mode is

descripted in section *6.3*.

7)

8)

1)

2)

3)

Add message “GPHPR” in section *4.3.1.2.6.*

Add command “RTKREFMODE” in section *3.2.30*.

Add command “CLOCKOFFSET delay”

Add command “PPSCONTROL switch polarity period width”

Add message “GPCDT”, use command “LOG” to set output

1.2

4) Add command “RTKSOLUTION mode”

2012-07-01

5)

6)

7)

Add command “RTKDYNAMICS mode”

Add command “RTKELEVMASK angle”

Add command “RTKQUALITYLEVEL mode”

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*Chapter* *1.* *Preface*

CHAPTER 1. PREFACE

This preface describes the versions of K-Series OEM board and the main contents of this

manual, and lists the conventions and terminology which used.

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

About this Manual

Using this Manual

Conventions

Warranty Exclusions and Disclaimer

Contact Us

**1**

**.1** **INTRODUCTION**

Welcome to ***ComNav*** ***OEM*** ***Board*** ***Reference*** ***Manual*** released by Compass Navigation

(ComNav) Technology Ltd. The purpose of this manual is to describe the K-Series OEM board

and provide guidelines for developers using ComNav command set. The precise details of each

command, including syntax, reply and any restrictions on its use, are described in this

reference manual.

This information is of primary importance for developers to effectively use and write custom

interfacing software for specific needs and applications. And it’s also useful for the technique

supporters and compatible program developers.

In this manual, a considerable amount of generic information is also included about the

hardware architecture and ComNav software applications, although this usually needs to be

supplemented by detailed implementation-specific information from the technical reference

manual of the device being used, such as *K-Series* *board* *User* *Guide*.

This manual assumes that you are familiar with the principles of the Global Navigation Satellite

System (GNSS), and with the terminology used to discuss it. For example, you should

understand some terms, such as elevation mask, single point positioning and Post Processing

Kinematic (PPK).

This manual also assumes that you are familiar with Microsoft Windows and know how to use

a mouse, select options from menus and dialogs, make selections from lists, and refer to online

help.

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*Chapter* *1.* *Preface*

**1**

**.2** **USAGE** **OF** **THIS** **MANUAL**

The information in this manual is organized into four parts, as listed below.

**PART** **A** **–** **INTRODUCTION** **OF** **OEM** **BOARD**

In Part A, we introduce the hardware architecture and working model of the ComNav OEM

board. It contains following chapters:

***Chapter*** ***2.*** ***Overview*** ***of*** ***OEM*** ***Boards***

To introduce the hardware architecture of the OEM boards using figures and tables. Also

some typical boards are described in this chapter. The memory map and Board’s working

model are given in details. From this chapter, users can realize how the board works and

how the flash memory is distributed.

**PART** **B** **–** **COMMAND** **SET** **AND** **LOG** **MESSAGES**

Part B describes the Command Set and Log Messages of ComNav Board, and it consists of

Chapter 3 & 4:

***Chapter*** ***3.*** ***Compatible*** ***Commands***

Chapter 3 gives the details of commands supported by ComNav board, including ComNav

commands and NovAtel® compatible commands.

***Chapter*** ***4.*** ***Log*** ***Messages***

All log messages produced ComNav OEM board are defined in Chapter 4.

**PART** **C** **–OPERATION** **EXAMPLES**

Part C provides some examples frequently used such as set-up a base station, log raw data

and so on.

***Chapter*** ***5.*** ***Operations*** ***Frequently-Used***

In Chapter 5, the operational commands of several frequently-used operations are

presented in sequence.

***Chapter*** ***6.*** ***Application*** ***Cases***

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*Chapter* *1.* *Preface*

Three kinds of application cases are described in Chapter 6 to provide users with a wider

application perspective.

**PART** **D** **–** **BINARY** **COMMAND** **AND** **OEM** **BOARD** **PRODUCT** **SPECIFICATION**

***Appendix*** ***A.Binary*** ***Commands***

Besides the commands listed in Chapter 3, ComNav also defined some commands for

special function which are presented in Appendix A.

***Appendix*** ***B.Technical*** ***Specifications***

***Appendix*** ***C.*** ***Firmware*** ***Updates***

Appendix B and C of this manual deliver the product specifications of ComNav OEM Board,

including Physical Information, Technical Specifications and Firmware Updates,

respectively.

**1**

**.3** **CONVENTIONS**

This manual employs typographic and other conventions intended to improve its ease of use.

**GENERAL** **TYPOGRAPHIC** **CONVENTIONS**

typewriter

Is used in the main text, including command descriptions, source code examples,

tables and lists, etc.

*italic*

Highlights important notes, introduces special technical terminology, and

denotes the name of device, book, etc.

**bold**

Is used for emphasis in descriptive lists and elsewhere, where appropriate.

Are used for a few terms which have specific technical meanings.

CAPITALS

**OTHER** **SIMPLE** **CONVENTIONS**

The number following 0x is a hexadecimal number.

Command descriptions use the angle bracket symbols ‘<>‘ to represent obligatory

parameters.

Command descriptions use the square brackets, [], to represent the optional parameters.

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*Chapter* *1.* *Preface*

In tables where cells’ value are missing, these cells are assumed to be reserved for future

use.

**ICON** **DESCRIPTIONS**

**note** **box** **that** **contains** **important** **information** **you** **should** **pay** **attention** **to**

**usage** **box** **that** **contains** **additional** **information** **or** **examples** **to** **help** **you** **use**

**your** **board**

**1**

**.4** **WARRANTY** **EXCLUSIONS** **AND** **DISCLAIMER**

These warranties shall be applied only in the event and to the extent that the Products and

Software are properly and correctly installed, configured, interfaced, maintained, stored, and

operated in accordance with ComNav’s relevant operator’s manual and specifications;

The Products and Software are not modified or misused. The preceding warranties shall not

apply to, and ComNav shall not be responsible for defects or performance problems resulting

from:

*The* *combination* *or* *utilization* *of* *the* *Product* *or* *Software* *with* *hardware* *or* *software*

*products,* *information,* *data,* *systems,* *interfacing* *or* *devices* *not* *made,* *supplied* *or* *specified*

*by* *ComNav;*

*The* *operation* *of* *the* *Product* *or* *Software* *under* *any* *specification* *other* *than,* *or* *in* *addition*

*to,* *ComNav’s* *standard* *specifications* *for* *its* *products;*

*The* *unauthorized* *modification* *or* *use* *of* *the* *Product* *or* *Software;*

*Damage* *caused* *by* *accident,* *lightning* *or* *other* *electrical* *discharge,* *fresh* *or* *salt* *water*

*immersion* *or* *spray;*

*Normal* *wear* *and* *tear* *on* *consumable* *parts* *(e.g.,* *batteries);*

*ComNav* *does* *not* *warrant* *or* *guarantee* *the* *results* *obtained* *through* *the* *use* *of* *the*

*Product.*

**1**

**.5** **CONTACT** **US**

Due to the uncertainty in construction of BD2, some configurations and functions of terminal

units should be modified in accordance with the development of BD2, and the reference

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*Chapter* *1.* *Preface*

manual should be updated at the same time, the latest version bulletin should be found in our

website. If any issues are encountered, please contact us, and we are very pleased to help you

to solve your problems. Because BD2 system is not totally completed yet, so some mistakes are

unavoidable in the manual and relevant productions. Notice that, if these mistakes bring you

inconvenience and losses, we can’t afford the responsibilities.

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*COMNAV* *OEM* *BOARD* *REFERENCE* *MANUAL*

*Chapter* *2.* *OEM* *Board* *Overview*

CHAPTER 2. OEM BOARD OVERVIEW

This chapter introduces the primary information of OEM cards. It contains:









Product Summary

Board Catalog

Typical Board Introduction

Memory Allocation Map

**2**

**.1** **PRODUCT** **SUMMARY**

**2**

**.1.1** **The** **introduction** **to** **OEM** **board**

OEM Board is the core product of ComNav. We offer a wide variety of boards for numerous

precision farming applications. Our proprietary positioning technology provides users with high

accuracy and a flexible solution for the most challenging applications and environments.

Furthermore, OEM Boards are continually being updated with advancements in GPS correction

sources and GNSS technology.

More information on ComNav products, please visit our website: [*sinognss.com*](http://comnav.cn/) (Chinese) or

[*comnavtech.com*](http://www.comnavtech.com/) (English).

**2**

**.1.2** **ComNav** **GNSS** **Board**

The ComNav GNSS board is used for a wide range of precise positioning and navigation

applications. It offers centimeter-level accuracy based on RTK/OTF (Real-Time

Kinematic/On-the-Fly) solutions and decimeter accuracy based on L1 C/A (Coarse/Acquisition)

code phase solutions. Automatic initialization and switching between positioning modes allow

for the best position solutions possible. Low latency and high update rates give the response

time and accuracy required for precise dynamic applications.

Designed for reliable operation in all environments, ComNav boards provide a positioning

interface to a PC, external processing device, or control system. The board can be controlled

through a serial port or SPI or IIC or USB or CAN bus using a user interface. User interface lets

you script the ComNav board operation with a single command. Alternatively, you can use

ComNav Utilities, such as Compass Receiver Utility (CRU), to handle board configuration and

controlling.

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*Chapter* *2.* *OEM* *Board* *Overview*

You can configure the ComNav board as an autonomous base station or as a rover board.

Streamed outputs from the board provide detailed information, including the time, position,

quality assurance (figure of merit) numbers, and the number of tracked satellites.

With the improvement of navigation technology, we keep modifying the architecture of

ComNav board to meet latest industrial standards. In this section, hardware architectures will

be described.

**2**

**.1.3** **Preparing** **for** **the** **future**

Some new Global Navigation Satellite Systems (GNSS) are under construction, such as Galileo

system proposed by the European Union and the Beidou-2 System devised by China. ComNav

fully supports this advancement in the GNSS market. We’ll be sure to have Galileo compatible

products available for our customers in the near future.

It is our goal to offer the most productive and competitive equipment that meet our

customers’ needs both now and in the future.

**2**

**.2** **TYPICAL** **BOARDS**

Following figure provides the block diagram of ComNav OEM boards, and more description on

features, dimensions and pin definitions are documented in OEM board PS (refer to [*Appendix*](#br242)

*B*).

**Figure** **1.** **OEM** **Block** **Diagram**

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*Chapter* *2.* *OEM* *Board* *Overview*

**2**

**.3** **MEMORY** **ALLOCATION** **MAP**

In this section, it’s introduced that how board’s memory is distributed. The first 128 bytes are

used to restore the board’s information, including revision information, register code and

operating settings, etc.

**Table** **1.System** **Information** **Section**

**BYTE**

**DESCRIPTION**

**NOTE**

Protocol Class, Board S/N, Date of production, For example:

**0**

**-31**

Hardware Revision by a blank space.

Registration Code, 8 bytes

Reserved

1907 123456 2012-01-01 201

**3**

**4**

**4**

**4**

**4**

**4**

**4**

**5**

**5**

**5**

**5**

**5**

**5**

**5**

**6**

**6**

**9**

**9**

**9**

**2-39**

**0~43**

**4**

Additional symbol of Device type

Internal Oscillator

**5**

**6~47**

Reserved

**8**

Static/Dynamic Flag

Reserved

(0: static, 1: dynamic)

**9**

**0**

GPS Elevation Mask Angle

Memory Size

**1**

(16–8M bytes; 32–16M bytes)

**2** **-** **55**

Firmware Revision, 4 bytes.

BD2 Elevation Mask Angle

GLONASS Elevation Mask Angle

GALIEEO Elevation Mask Angle

Reserved

**6**

**7**

**8**

**9** **-** **62**

**3**

Differential Data Format

P/N Number, 16 bytes

Reserved

(CMR/CMR+/RTCM2/RTCM3/RTCA)

**4** **-** **89**

**0-95**

**6**

Coordinate settings of Base Station

Reserved

**7** **-** **127**

**NOTE:** Users can get S/N, P/N number and size information from the label on shell of board

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*COMNAV* *OEM* *BOARD* *REFERENCE* *MANUAL*

*Chapter* *3.* *Compatible* *Commands*

CHAPTER 3. COMPATIBLE COMMANDS

Except for those commands handled by CPU, ComNav board also support GNSS board

commands. This chapter introduces GNSS board commands, including ComNav Board

Commands and NovAtel® Commands.

Along with the release of GPS board developed by ComNav itself, the board command packets

are issued.

The syntax of ComNav board command is similar to that of NovAtel® OEM board. But there

also exist a little difference. Here, we introduce ComNav board command packets, and

NovAtel® OEM Board Commands will be summarized in next section.

**3**

**.1** **COMMAND** **FORMATS**

In the OEM card, we adopt GNSS card produced by other company, like NovAtel®. So the board

not only supports ComNav commands, but the board commands as well.

**3**

**.1.1** **Format**

The OEM card handles incoming and outgoing data in three different message formats:

Abbreviated ASCII, ASCII, and Binary. This allows for a great deal of versatility in the way the

OEMV family boards can be used. All NovAtel® commands and logs can be entered,

transmitted, output or received in any of the three formats. The board also supports RTCM2.X,

RTCM3.X, RTCM, CMR, and NMEA format message.

**ASCII**

ASCII messages are readable by both the user and a computer. The structures of all ASCII

messages follow the general conventions as noted here:

1

2

3

) The lead code identifier for each record is ‘#’.

) Each log or command is of variable length depending on amount of data and formats.

) All data fields are delimited by a comma with two exceptions. **First** **exception** is the last

header field which is followed by a ‘;’ to denote the start of the data message. **Another**

**one** is the last data field, which is followed by a \* to indicate end of message data.

4

) Each log ends with a hexadecimal number preceded by an asterisk and followed by a line

termination using the carriage return and line feed characters, for example,

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\*

1234ABCD[CR][LF]. This value is a 32-bit CRC of all bytes in the log, excluding the’#’

identifier and the asterisk preceding the four checksum digits.

**Example**

#HEADINGA,COM1,0,60.0,FINESTEERING,2034,301375.000,00000000,0

000,1114;SOL\_COMPUTED,SINGLE,0.000000000,0.000000000,0.000000

000,0.000000000,180.000000000,90.000000000,"AAAA",18,18,18,18,

0,0,0,0\*a3ac87f5

**Abbreviated** **ASCII**

This message format is designed to make the entering and viewing of commands and logs by

the user as simple as possible. The data is represented as simple ASCII characters separated by

spaces or commas and arranged in an easy to understand fashion. There is also no 32-bit CRC

for error detection because it is meant for viewing by the user.

**Example** **Command**

log version

**Response** **Log**

<

VERSION COM1 0 60.0 UNKNOWN

1

0

0.000 00000000 0000 1114

<

<

GPSCARD "S2002" "00902165" "CARD-501AA-22" "1.10A-1.10A" "1.000"

2012/May/ 5" "18:18:52"

"

As you can see the array of 3 logs are offset from the left hand side and start with ‘<‘.

**Binary**

The binary format is similar to that of ComNav format. See *Appendix* *A.* *Binary* *Commands*.

**Command** **Format**

Cmd param1 … paramN\r\n

The sending message is a simple ASCII string in which characters are separated by **spaces** and

arranged in an easy to understand fashion. The first character is command name. And don’t

miss the tail, “\r\n”.

**Reply** **Message**

Except LOG command, other command’s response is:

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If succeed: “OK! \r\n Command Accepted!”

If failed:

“Error! \r\n Unidentifiable Command!”

**3**

**.1.2** **Command** **List**

**Table** **2** **.Command** **List**

**ID** **COMMANDS**

**DESCRIPTIONS**

**REFER** **TO**

**1**

ASSIGN

Assign individual satellite channel to a PRN

Set BD2 satellite elevation cut-off

Adjust for delay in 1 PPS output

COM port configuration control

DGPS transmit ID

*3.2.1*

*3.2.2*

*3.2.3*

*3.2.4*

*3.2.5*

*3.2.6*

*3.2.7*

*3.2.8*

*3.2.9*

*3.2.10*

*3.2.11*

*3.2.12*

**2**

**3**

**4**

**5**

**6**

**7**

**8**

**9**

BD2ECUTOFF

CLOCKOFFSET

COM

DGPSTXID

DYNAMICS

ECUTOFF

Tune receiver parameters

Set satellite elevation cutoff

ERASEFLASH

FIX

Erase all data restored in flash

Constrain fix height or position

Reset and set configuration to factory setting

Add heading and pitch offset values

Set receive or transmit modes for ports

**1**

**0**

**1**

**2**

**3**

**4**

**5**

**6**

**7**

**8**

**9**

**0**

**1**

**2**

**3**

**4**

**5**

**6**

FRESET

**1**

**1**

**1**

**1**

**1**

**1**

**1**

**1**

**1**

**2**

**2**

**2**

**2**

**2**

**2**

**2**

HEADINGOFFSET

INTERFACEMODE

LOCKOUT

Prevent the receiver from using a satellite by specifying its PRN *3.2.13*

LOCKOUTSYSTEM

LOG

Prevent the receiver to using a system

Request a log message

*3.2.14*

*3.2.15*

*3.2.16*

3.2.17

3.2.18

*3.2.17*

*3.2.20*

*3.2.21*

*3.2.22*

*3.2.23*

*3.2.24*

*3.2.25*

*3.2.26*

MAGVAR

Set magnetic variation correction

Mark message control

MARKCONTROL

MAXVECLENERR

NMEATALKER

PPSCONTROL

PPMADJUST

READFLASH

REFAUTOSETUP

RESET

Set the directional flypoint detection threshold

NMEA message talker identifier control

Control the PPS output style

Adjust clock-error

Read restored data in flash

Ref-station auto setup

Perform a hardware reset

RTKCOMMAND

RTKDYNAMICS

Reset or set the RTK filter to its defaults

Set RTK dynamic mode

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**ID** **COMMANDS**

**DESCRIPTIONS**

**REFER** **TO**

**2**

**2**

**2**

**3**

**3**

**3**

**3**

**3**

**3**

**3**

**3**

**3**

**3**

**4**

**4**

**4**

**4**

**4**

**4**

**7**

**8**

**9**

**0**

**1**

**2**

**3**

**4**

**5**

**6**

**7**

**8**

**9**

**0**

**1**

**2**

**3**

**4**

**5**

RTKELEVMASK

RTKFIXHOLDTIME

RTKOBSMODE

RTKREFMODE

RTKSOLUTION

RTKSOURCE

Set the RTK elevation mask angle

Set maximum age of RTK fixed data

Set the observation mode of rover receiver

Set the RTK ref-station position mode

Set RTK solution mode

*3.2.27*

*3.2.28*

*3.2.29*

*3.2.30*

*3.2.31*

*3.2.32*

*3.2.33*

*3.2.34*

*3.2.35*

Set RTK correction source

RTKTIMEOUT

RTKQUALITY

SAVECONFIG

SBASCONTROL

SBASECUTOFF

SBASTIMEOUT

SET

Set maximum age of RTK data

Set rtk quality level

Save current configuration in memory

Enable or disable corrections of SBAS and PRN to be used

Set SBAS satellite elevation cut-off

Set SBAS corrections time out

*3.2.36*

*3.2.37*

*3.2.38*

*3.2.39*

*3.2.40*

*3.2.41*

*3.2.42*

*3.2.43*

*3.2.44*

*3.2.45*

configure according settings

UNDULATION

UNLOCKOUT

UNLOCKOUTALL

UNLOCKOUTSYSTEM

UNLOG

Choose undulation

Reinstate a satellite in the solution computation

Reinstate all previous locked out satellites

Reinstate previously locked out system

Remove log from logging control

UNLOGALL

Remove all logs from logging control

**3**

**.2** **COMMAND** **REFERENCE**

**3**

**.2.1** **ASSIGN**

**Assign** **a** **channel** **to** **a** **PRN**

**Format**

ASSIGN <channel> <prn>

**Description**

This command may be used to aid in the initial acquisition of a satellite by allowing you to

override the automatic satellite/channel assignment and reacquisition processes with manual

instructions. The command specifies that the indicated tracking channel search for a specified

satellite.

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**Parameters**

*channel*

*prn*

Channel number (0~11)

Satellite number (GPS:1~32,BDS:141~177,GLO:38~61,GAL:71~94)

**Example**

ASSIGN 2 19

The above example shows that channel 2 is acquiring satellite PRN 19.

**.2.2** **BD2ECUTOFF** **Set** **BD2** **satellite** **elevation** **cut-off**

**Format**

**3**

BD2ECUTOFF <cutoff-angle>

**Description**

This command sets the elevation cut-off angle for tracked BD2 satellites.

**Parameters**

*cutoff-angle*

**Example**

the value of bd2 cutoff-angle(-90~90 degrees)

BD2ECUTOFF 10

**3**

**.2.3** **CLOCKOFFSET**

**Adjust** **for** **delay** **in** **1** **PPS** **output**

**Format**

CLOCKOFFSET <delay>

**Description**

This command can be used to adjust PPS output delay in nanoseconds. In timing situations, the

time delay is not a fix value attribute to two factors:

1

2

. Signal path from the antenna to the RF, for example, using a cable with 10ns delay should

import a 10ns extra delay in PPS output

. A signal process path delay from the RF to the digital sections, in types of different circuit

boards and signal processing method, a little different delay exists;

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Major common delay has been compensated by default setting, but a residual delay should be

adjusted by user according to different antenna and cables.

**Parameters**

*delay* a positive value indicates a delay output relative to current PPS, a negative value

indicates a forward output.

**Example**

CLOCKOFFSET -200

The above command set a forward 200 nanoseconds PPS output relative to current output.

**3**

**.2.4** **COM**

**Set** **baud** **rate**

**Format**

COM <port> <baudrate>

**Description**

This command permits you to set the baud rate of COM port.

**Parameters**

*port*

*baudrate* valid value refer to .Default baudrate:115200.

**Example**

refer to .

COM COM1 9600

**Table** **4.** **Baud** **Rate**

**BAUDRATE**

**Table** **3.Port** **ID**

**PORT** **ID**

**1**

**4**

**9**

**1**

**3**

**200**

57600

**COM1**

**COM2**

**COM3**

**USB**

**800**

115200

230400

460800

921600

**600**

**9200**

**8400**

**GPRS**

**COM4**

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*Chapter* *3.* *Compatible* *Commands*

**3**

**.2.5** **DGPSTXID**

**DGPS** **transmit** **ID**

**Format**

DGPSTXID <type> <ID>

**Description**

This command sets the station ID value for the receiver when it is transmitting corrections. This

allows for the easy identification of which base station was the source of the data.

For example, if you want to compare RTCM and RTCMV3 corrections, you would be easily able

to identify their base stations by first setting their respective DGPSTXID values.

**Parameter:**

*type*

differential data format such as RTCMV3

reference station ID

*ID*

**Example**

DGPSTXID RTCMV3 10

This command set reference station ID as 10 in RTCMV3 format.

**.2.6** **DYNAMICS** **Tune** **board** **parameters**

**Format**

**3**

DYNAMICS <status>

**Description**

This command adjusts the board dynamics to that of your environment. It is used to optimally

tune board parameters.

**The** **DYNAMICS** **command** **should** **only** **be** **used** **by** **advanced** **users.** **The**

**default** **of** **AIR** **should** **not** **be** **changed** **except** **under** **very** **specific** **conditions.**

**Parameters**

status>

<

**AIR**

**Board** **is** **in** **an** **aircraft** **or** **a** **land** **vehicle,** **for** **example** **a** **high** **speed** **train,** **with**

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**velocity** **greater** **than** **110** **km/h.** **This** **is** **also** **the** **most** **suitable**

**dynamic** **for** **a** **jittery** **vehicle** **at** **any** **speed.**

**LAND**

**FOOT**

Board is in a stable land vehicle with velocity less than 110 km/h

Board is being carried by a person with velocity less than 11 km/h

**Example**

DYNAMICS FOOT

**3**

**.2.7** **ECUTOFF**

**Set** **satellite** **elevation** **cut-off** **angle**

**Format**

ECUTOFF <cutoff-angle>

**Description**

This command sets the elevation cut-off angle for tracked satellites. The board does not start

automatically searching for a satellite until it rises above the cut-off angle. Tracked satellites

that fall below the cut-off angle are no longer tracked unless they were manually assigned (see

*3*

*.2.1* ASSIGN command).

**Parameters**

*cutoff-angle* the value of cut-off angle (-90 ~ 90 degrees).

**Example**

ECUTOFF 10.0

**This** **command** **permits** **a** **negative** **cut-off** **angle;** **it** **could** **be** **used** **in** **these** **situation:**

**.** **The** **antenna** **is** **at** **a** **high** **altitude,** **and** **thus** **can** **look** **below** **the** **local** **horizon.**

**1**

**2**

**.** **Satellites** **are** **visible** **below** **the** **horizon** **due** **to** **atmospheric** **refraction.**

**3**

**.2.8** **ERASEFLASH**

**Erase** **files** **restored** **in** **flash**

**Format**

ERASEFLASH

**Description**

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The receiver erase all files which include GNSS observation and ephemeris restored in flash. If

no corresponding software in your computer to erase these files, this command would be a

good choice.

**Example**

ERASEFLASH

**3**

**.2.9** **FIX**

**Constrain** **to** **fixed** **height** **and** **position**

**Format**

FIX POSITION <lat> <lon> <hgt>

**Description**

This command fixes three parameters of the board: latitude, longitude, height. For various

applications, fixing these values can assist in improving acquisition times and accuracy of

position or corrections.

**Parameters**

*lat*

latitude (-90 to 90 degrees).

*lon*

*hgt*

longitude in degrees. (-180 to 180 degrees)

mean sea level (MSL) height (-1,000 to 20,000,000 m).

**Example**

FIX POSITION 30.0 150.0 50

**3**

**.2.10** **FRESET**

**Reset** **to** **the** **factory** **default**

**Format**

FRESET

**Description**

This command clears data which is stored in non-volatile memory, and set the baud rate to

38400. No data log is outputted.

**Example**

FRESET

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*Chapter* *3.* *Compatible* *Commands*

**3**

**.2.11** **HEADINGOFFSET**

**Add** **heading** **and** **pitch** **offset** **values**

**Format**

HEADINGOFFSET <headingoffsetindeg> <pitchoffsetindeg>

**Description**

This command is used to add an offset in degree in the heading and pitch values of the

HEADING, GPHDT, GPNAV, GPTRA, GPYBM and PTNL,AVR logs.

Both heading offset and pitch offset have the default values of 0 degree.

**Parameters**

*Headingoffsetindeg*

*Pitchoffsetindeg*

**Example**

-180.0 ~ +180.0, default value = 0.0

-90.0 ~ +90.0, default value = 0.0

HEADINGOFFSET 10 10

**3**

**.2.12** **INTERFACEMODE**

**Set** **receive** **or** **transmit** **modes** **for** **ports**

**Format**

INTERFACEMODE <port> <input-mode> <output-mode> <swith>

**Description**

This command configures a port to detect data or output data in specified mode. **Currently**

**output-mode** **is** **not** **affected** **by** **command** **and** **always** **in** **generic** **mode**.

**Parameters**

*port*

refer to .Table 5

*input-mode*

*output-mode*

*swith*

refer to Table 5.

always be GENERIC mode, refer to Table 5

on/off

**Example**

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INTERFACEMODE COM1 RTCMV3 RTCMV3

**Table** **5.** **INTERFACEMODE**

**MODE** **NAME**

**DESCRIPTION**

**SUPPORT**

**NONE**

The port is disabled.

NovAtel® commands and logs

RTCM corrections

RTCA corrections

Y

**NOVATEL**

**RTCM**

Y

Y

**RTCA**

N

Y

**CMR**

CMR corrections

**OMNISTAR**

**IMU**

OMNISTAR corrections

IMU information

N

N

N

N

**RTCMNOCR**

**CDGPS**

RTCM with no CR/LF

GPS \*C code

**TCOM1**

**TCOM2**

**TCOM3**

**TAUX**

Tune mode

N

**RTCMV3**

**NOVATELBINARY**

**GENERIC**

**AUTO**

RTCMV3 corrections

NovAtel® binary messages

No limit

Y

Y

Y

RTCM, RTCMV3 and CMR are auto switched.

ComNav commands and logs

NEMA correction

Y

Y

Y

**COMPASS**

**NEMA**

**3**

**.2.13** **LOCKOUT**

**Prevent** **the** **board** **from** **using** **a** **satellite**

**Format**

LOCKOUT <prn>

**Description**

This command prevents the board from using a satellite by de-weighting its range in the

solution computations. Note that the LOCKOUT command does not prevent the board from

tracking an undesirable satellite. This command must be repeated for each satellite to be

locked out.

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See also the UNLOCKOUT.

**Parameters**

*prn*

PR number of satellite (refer to Table 6).

**Example**

LOCKOUT 10

**Table** **6.** **GNSS** **Name** **and** **Corresponding** **PRN**

**GNSS**

**PRN**

**GPS**

1~32

**GLONASS**

**GALILEO**

**BDS**

38~61

71~106

141~177

**3**

**.2.14** **LOCKOUTSYSTEM**

**Prevent** **the** **receiver** **from** **using** **a** **system**

**Format**

LOCKOUTSYSTEM <system>

**Description**

This command prevents the receiver from using satellites in the specified system in the

solution computation.

**Parameters**

*system*

the name of a specified GNSS system, refer to Table 7

**Example**

LOCKOUTSYSTEM BD2

**Table** **7.** **GNSS** **System**

**GNSS** **SYSTEM**

**GPS**

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**BD2**

**GLONASS**

**GALILEO**

**BD3**

**3**

**.2.15** **LOG**

**Request** **logs** **from** **board**

**Format**

LOG <message-type> [type-trigger] [period] [offset]

**Description**

The board is capable of generating many different logs. Supported log messages are listed in

Table 19 ~ Table 23. *Chapter* *4* will discuss the conventions and definitions on these messages.

**Parameters**

*type*

Choose the data types you want to generate.

*trigger* Choose log type triggers, refer to Table 24

*period* The data for synchronous logs is generated on a regular schedule.

*period* specify the time interval.

*offset* Used for *period* (ONTIME trigger) in seconds.

To log data at 1 second, after every minute, set the period to 60 and the offset to 1. A

valid value is any integer (whole number) smaller than the period. These decimal values,

on their own, are also valid: 0.1, 0.2, 0.25 or 0.5, as well as any multiple of the maximum

logging rate defined by the receiver model. Values less than 1ms will be considered an

offset of 0 ms. The offset cannot be smaller than the minimum measurement period

supported by the model.

**Example**

LOG VERSIONA

The above example shows the ASCII data of board version is logging to the appointed COM

port.

**3**

**.2.16** **MAGVAR**

**Set** **a** **magnetic** **variation** **correction**

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**Format**

MAGVAR <type> [correction [std dev]]

**Description**

The receiver computes directions referenced to True North. Use this command (magnetic

variation correction) if you intend to navigate in agreement with magnetic compass bearings.

The receiver uses the magnetic variation correction 0 degree if you don’t set any magnetic

correction.

**Parameters**

*type*

*correction* As *type* equals to ‘CORRECTION’, magnitude of correction (±180 degrees)

*std* *dev* Standard deviation of correction (±180 degrees, default = 0)

**Example**

‘AUTO’ (default) or ‘CORRECTION’, refer to Table 8

MAGVAR AUTO

MAGVAR CORRECTION 10 0

**Table** **8.** **MAGVAR** **Type**

**DESCRIPTION**

**TYPE**

**AUTO**

Use IGRF corrections according to receiver position

**CORRECTION**

Use the value inputted

**3**

**.2.17** **MARKCONTROL**

**Mark** **message** **control**

**Format**

MARKCONTROL signal switch [polarity] [timebias [timeguard]]

**Description**

The *signal* only supports the key words “mark1”; *switch* supports the key words “enable” and

disable”; *polarity* supports the key words “positive” and “negative”, which separately

“

represent “positive pulse” and “negative pulse”; *timebias* and *timeguard* parameters cannot be

set by now.

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The settings can be saved by *saveconfig* command and the markcontrol status can be checked

by *log* *sysconfig* command.

**Example**

markcontrol mark1 enable negative 0 0

**3**

**.2.18** **MAXVECLENERR** **Set** **the** **directional** **flypoint** **detection** **threshold**

**Format**

MAXVECLENERR <paramater>

**Description**

This instruction is used to set the threshold of baseline difference during flypoint detection in

directional mode.That is, if the difference between the actual calculated baseline length and

the set baseline length is larger than the threshold value, it is considered to be a directional

flying point.

**Parameters**

*paramater* *The* *threshold,*The unit is cm and the default value is 8 cm.

**Example**

MAXVECLENERR 12

**3**

**.2.19** **NMEATALKER**

**NMEA** **message** **talker** **identifier** **control**

**Format**

**(1)** **Control**

NMEATALKER (Sentence ID) (Talker ID)

Manipulate individual or all talker identifiers.

Sentence Identifier (ID): Please refer to column 2 of Table 10. At the moment, 26 sentence

identifiers are available:

CDT, GGA, GGARTK, GLL, GRS, GSA, GST, GSV, HDT, HPR, NAV, NTR, RMC, RRS,

SEH, TRP, URA, VTG, ZDA, DRC, RSC, CLH, IDM, PRR, GTD, ALL

Among these 26 identifiers, the first 25 are sentence identifiers and the last one (‘ALL’) is used

to fulfill the function of manipulating all the first 25 identifiers.

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Talker Identifier (ID): Please refer to column 7 of Table 10. At the moment, 6 sentence

identifiers are available:

GN, GP, BD, GL, GA, AUTO

Among these 6 identifiers, the first 5 are talker identifiers and the last one (‘AUTO’) is used to

indicate that receiver will automatically choose a talker identifier according to constellation

used in current estimates, during which talker identifiers are subject to command ‘lockout’ and

‘

unlockout’. In ‘AUTO’ mode, how receiver choose a talker identifier is subject to the principles

shown in the following table:

**Table** **9.** **NMEATALKER** **Available** **Identifiers**

CONSTELLATION USED IN SOLUTIONS

TALKER IDENTIFIERS

GP

**GPS**

**BDS**

BD

GL

**GLONASS**

**GALILEO**

GA

GN

**two** **or** **more** **constellations**

**(2)** Note: According to the supplement NMEA 0183 V4.10 issued by NMEA and IEC on 19 June

018, BDS Talker ID is no longer allowed to use "BD" and the standard requires the use of

GB".To maintain upward compatibility, sinnac's products use "BD" by default, but allow

customers to change the BDS Talker ID to "GB".

2

"

**(3)** **Query**

NMEATALKER LIST

List talker identifiers for all current NMEA messages.

**(4)** **Reset**

NMEATALKER RESET

Reset talker identifiers to factory defaults, as shown in *Figure* *2*:

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**Figure** **2.** **Factory** **Defaults** **of** **NMEATALKER** **Identifiers**

**Description**

Command is not case-sensitive and keywords are separated by space and each command is

ended with a pair of Carriage Return (CR) and Line Feed (LF).

NMEATALKER commands only affect talker identifiers; LOG commands used to request a log is

unaffected by NMEATALKER commands. Talker identifiers in LOG command remain ‘GP’:

LOG GP~~~ ONTIME 1

In AUTO mode, talker identifier changes subject to results of using LOCKOUT/UNLOCKOUT

commands.

Summary on how to use NMEATALKER manipulating individual or all talker identifiers is

presented in following table:

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**Table** **10.NMEATALKER** **Commands** **and** **All** **Controlled** **NMEA** **Message** **Types**

**Comm** **Sentence**

**ands** **Identifiers**

**Talker**

**Identifiers** **Message**

**Factory** **Defaults**

**GPS**

**GLONASS**

**BDS**

**GNSS**

**(5** **optional** **prefixes)** **Output** **Types** **(Refer** **to** ***Figure*** ***2*)**

**Current**

**NMEATALKER**

**AUTO**

**[GN,GP,BD,GL,GA]**

Note

**Talker** **Identifier**

**Mode** Note

1

2

3

4

5

6

7

8

9

1

1

1

1

1

1

1

1

1

1

2

**CDT**

**GGA**

**GGARTK**

**GLL**

GPCDT

GPGGA

GLCDT

GLGGA

BDCDT

BDGGA

GNCDT

GNGGA

Prefix + CDT

Prefix + GGA

Hybrid

M

M

M

M

A

GP

Hybrid

GP

GPGGARTK GLGGARTK BDGGARTK GNGGARTK Prefix + GGARTK

Hybrid

GP

GPGLL

GPGRS

GPGSA

GPGST

GPGSV

GPHDT

GPHPR

GPNAV

GPNTR

GPRMC

GPRRS

GPSEH

GPTRP

GPURA

GPVTG

GPZDA

GPDRC

GLGLL

GLGRS

GLGSA

GLGST

GLGSV

GLHDT

GLHPR

GLNAV

GLNTR

GLRMC

GLRRS

GLSEH

GLTRP

GLURA

GLVTG

GLZDA

GLDRC

BDGLL

BDGLL

BDGSA

BDGST

BDGSV

BDHDT

BDHPR

BDNAV

BDNTR

BDRMC

BDRRS

BDSEH

BDTRP

BDURA

BDVTG

BDZDA

BDDRC

GNGLL

Prefix + GLL

Prefix + GRS

Prefix + GSA

Prefix + GST

Prefix + GSV

Prefix + HDT

Prefix + HPR

Prefix + NAV

Prefix + NTR

Prefix + RMC

Prefix + RRS

Prefix + SEH

Prefix + TRP

Prefix + URA

Prefix + VTG

Prefix + ZDA

Prefix + DRC

Hybrid

GP

**GRS**

**GSA**

**GST**

By Group

By Group

Hybrid

[GN,GP,BD,GL,GA]

A

[GN,GP,BD,GL,GA]

GNGST

M

A

GP

**GSV**

**HDT**

**HPR**

**NAV**

**NTR**

**RMC**

**RRS**

By Group

Hybrid

[GN,GP,BD,GL,GA]

GNHDT

GNHPR

GNNAV

GNNTR

GNRMC

M

M

M

M

M

A

GP

0

1

2

3

4

5

6

7

8

9

0

Hybrid

GP

Hybrid

GP

Hybrid

GP

Hybrid

GP

By Group

By Group

Hybrid

[GN,GP,BD,GL,GA]

**SEH**

A

[GN,GP,BD,GL,GA]

**TRP**

GNTRP

M

A

GP

**URA**

**VTG**

**ZDA**

**DRC**

By Group

Hybrid

[GN,GP,BD,GL,GA]

GNVTG

GNZDA

M

M

A

GP

Hybrid

GP

By Group

[GN,GP,BD,GL,GA]

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**Comm** **Sentence**

**Talker**

**Identifiers** **Message**

**Factory** **Defaults**

**GPS**

**GLONASS**

**BDS**

**GNSS**

**ands**

**Identifiers**

**RSC**

**(5** **optional** **prefixes)** **Output** **Types** **(Refer** **to** ***Figure*** ***2*)**

2

2

2

2

2

1

2

3

4

5

GPRSC

GPCLH

GPIDM

GPPRR

GPGTD

GLRSC

GLCLH

GLIDM

GLPRR

GLGTD

BDRSC

BDCLH

BDIDM

BDPRR

BDGTD

GNRSC

Prefix + RSC

Prefix + CLH

Prefix + IDM

Prefix + PRR

Prefix + GTD

Hybrid

M

A

GP

**CLH**

By Group

By Group

By Group

Hybrid

[GN,GP,BD,GL,GA]

[GN,GP,BD,GL,GA]

[GN,GP,BD,GL,GA]

GP

**IDM**

A

**PRR**

A

**GTD**

M

**ALL**

applied to all sentence identifiers

GPTRA

GPRMB

Talker identifiers

in these messages

are not affected

Currently Not Available

GPGGALON Currently Not Available

by

nmeatalker

PTNLPJK Available

commands

**NOTE:**

Column 8 ‘Message Output Type’: Hybrid and By Group means NMEA message are serialized in two types: HYBRID and GROUP.

HYBRID: No matter how many constellations are used in PVT solution, receiver output contains only one message, whose PVT solution is a

combined result of all the constellations available.

GROUP: In contrast to COMBINATION mode, each constellation has its own message.

Column 9 ‘Current Mode’: A -- AUTO, M -- MANUAL. Manual and Auto means whether talker identifiers are specified manually or

automatically.

Example

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**Table** **11.Examples** **of** **NMEATALKER** **Commands** **and** **Outputs**

**SENTENCE**

**TALKER**

**COMMAND**

**OUTPUT**

**DESCRIPTION**

**IDENTIFIER** **IDENTIFIER**

Auto mode. All talker identifiers are set automatically according to Table 10. (In contrast, in

manual mode, all talker identifiers are set using appropriate commands). In auto mode,

talker identifiers are controlled by the constellations used in PVT solution. If more than one

constellation is used, talker identifier will be adjusted to ‘GN’ automatically.

**NMEATALKER** ALL

AUTO

Manual mode. All talker identifiers are set as ‘GN’, regardless of how many constellations

are used in PVT solution.

**NMEATALKER** ALL

**NMEATALKER** ALL

**NMEATALKER** GGA

**NMEATALKER** RMC

GN

GP

BD

GP

$GN…, …

Manual mode. All talker identifiers are set as ‘GP’, regardless of how many constellations

are used in PVT solution.

$GP…, …

Manual and hybrid mode. All talker identifiers are set as ‘BD’, regardless of how many

constellations are used in PVT solution.

$BDGGA, …

$GPRMC, …

Manual and hybrid mode. All talker identifiers are set as ‘GP’, regardless of how many

constellations are used in PVT solution.

$

GNGSV, …

$GNGSV, …

GNGSV, …

$GLGLL, …

Manual and Group mode. All talker identifiers are set as ‘GN’, and at each epoch three

messages are given.

**NMEATALKER** GSV

GN

GL

$

**NMEATALKER** GLL

LIST command, listing all possible combinations of sentence and talker identifiers. The

result should look like Figure 2 (Factory defaults).

**NMEATALKER** LIST

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**NMEATALKER** RESET

RESET command, resetting talker identifiers to factory defaults, as shown in *Figure* *2*.

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*Chapter* *3.* *Compatible* *Commands*

**3**

**.2.20** **PPSCONTROL**

**Control** **the** **PPS** **output** **style**

**Format**

PPSCONTROL <switch><polarity><period><pulse-width>

**Description**

This command can be used to set the polarity, period and pulse-width of PPS output. The PPS

can’t be disabled and the update rate can be up to 10 Hz.

**Parameters**

*switch*

‘enable’ or ‘disable’, the switch should be set to ‘enable’, and ‘disable’ is not

allowed.

*polarity*

*period*

‘positive’ and ‘negative’, if ‘positive’, it should be a high level pulse, a low level

pulse correspond to a ‘negative’ mode.

in seconds, ‘period’ can’t be configured, it is constantly 1 second temporary.

*pulse-width* in microseconds, pulse-width should be less than half of period.

**Example**

PPSCONTROL ENABLE POSITIVE 1 1000

**3**

**.2.21** **PPMADJUST**

**Adjust** **PPM** **or** **not**

**Format**

PPMADJUST <status>

**Description**

This command is used to decide whether adjust the PPM or not.

**Parameters**

*status*

**Example**

ON (adjust) / OFF (don’t adjust)

PPMADJUST ON

PPMADJUST OFF

//Adjust PPM.

//Not adjust PPM.

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**3**

**.2.22** **READFLASH**

**Read** **files** **from** **flash**

**Format**

READFLASH

**Description**

The receiver reads all files which include GNSS observation and ephemeris restored in flash and

output to current port. This command only be used in situation that you couldn’t download the

files using corresponding software.

**Example**

READFLASH

**3**

**.2.23** **REFAUTOSETUP**

**Set** **base** **station** **self-starting**

**Format**

REFAUTOSETUP <status>

**Description**

This command is used to decide whether the base station self-starts or not. This command is

defined by ComNav.

**Parameters**

*status*

**Example**

ON (self-start) / OFF (don’t self-start)

REFAUTOSETUP ON

REFAUTOSETUP OFF

//Self-start

//Don’t self-start

**3**

**.2.24** **RESET**

**Perform** **a** **hardware** **reset**

**Format**

RESET

**Description**

This command performs a hardware reset. Following a RESET command, the board initiates a

cold-start boot up.

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**Example**

RESET

**3**

**.2.25** **RTKCOMMAND**

**Reset** **or** **set** **the** **RTK** **filter** **to** **its** **defaults**

**Format**

RTKCOMMAND <action>

**Description**

This command provides the ability to reset the RTK filter and clear any set RTK parameters. The

RESET parameter causes the advance RTK algorithm to undergo a complete reset, forcing the

system to restart the ambiguity resolution calculations.

**Parameters**

*action*

**Example**

RESET

RTKCOMMAND RESET

**3**

**.2.26** **RTKDYNAMICS**

**Set** **RTK** **dynamic** **mode**

**Format**

RTKDYNAMICS <mode>

**Description**

This command can be used to set dynamic mode. In different mode, RTK engine should treat

the observation data in different style to promote the performance of RTK engine.

**Parameters**

*mode* static/foot/land/air.

*air*

the receiver is on a carrier with a velocity greater than 110 km/h.

*land*

the receiver is located on a uniformly moving carrier with a speed less than 110 km/h

(30 m/s).

*foot*

the receiver is carried by personnel traveling at speeds less than 11 km/h (3 m/s).

*static* the receiver is in static mode.

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Note: When K7 series board card is applied to the scene with the speed of more than 514 m/s or the

elevation of more than 18000 m, it needs to use the registration code to open.

**Example**

RTKDYNAMICS FOOT

**3**

**.2.27** **RTKELEVMASK**

**Set** **the** **RTK** **elevation** **mask** **angle**

**Format**

RTKELEVMASK <type> <angle>

**Description**

This command is used to set elevation mask angle of RTK engine. In some situations,

observations of low-elevation satellites may influence the resolution process and result of RTK,

so a higher mask angle should be a good choice to ensure a better performance of RTK engine.

**Parameters**

*type*

‘AUTO’ or ‘USER’.

If ‘auto’ mode is set, RTK engine should set elevation mask automatically,

in ‘user’ mode, RTK engine should set elevation mask as user identified.

integer number. Angle should be more than 0 degree and less than 90 degree.

The default value is 0 degree.

*angle*

**Example**

RTKELEVMASK user 10

**3**

**.2.28** **RTKFIXHOLDTIME**

**Set** **maximum** **age** **of** **RTK** **fixed** **data**

**Format**

RTKFIXHOLDTIME <time-delay>

**Description**

This command is used to set the maximum age of RTK fixed data to use when operating as a

rover station. RTK fixed data received that is older than the specified time is ignored.

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**Parameters**

*time-delay*

**Example**

less than 200s and more than 5s, default value is 20s

RTKFIXHOLDTIME 15

**3**

**.2.29** **RTKOBSMODE**

**Set** **the** **observation** **mode** **of** **rover** **receiver**

**Format**

RTKOBSMODE <mode>

**Description**

This command is used to set the observation mode of rover receiver. In other words, using this

command can set which frequency would be involved in the RTK computation of rover receiver.

**Parameters**

*mode*

= ‘AUTO’: switch observation mode (RTK or RTD) automatically according to

differential data type received by receiver

=

Integer number (Manual Mode), its value can be one of the followings:

**Table** **12.RTKOBSMODE** **Manual** **Mode**

**MANUAL** **MODE** **DESCRIPTION**

Pseudoranges (PRs) and Carrier Phases (CPs) from GPS/BDS/GLONASS all

**0**

frequencies involved; default mode. [Supporting RTCM 3.x PR&CPs

correction related Message Types, RTCM 2.3 Message Types 18/19.]

PRs and CPs from GPS L1, BDS B1 and GLONASS G1C involved

Reserved

**1**

**2**

PRs from GPS L1 (currently supported), BDS B1 (currently NA) and GLONASS

G1C (currently NA) involved; [Supporting RTCM 2.3 Message Type 1]

Reserved

**3**

**4**

**5**

PRs and CPs from GPS L1/L2 and BDS B1/B3.

**1**

**.** **RTCM** **2.3** **Message** **Type** **3** **is** **not** **affected** **by** **this** **command.**

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**2**

**.** **As** **for** ***manual*** ***mode*** ***3*,** **this** **command** **takes** **higher** **priority** **of** **RTKSOLUTION,** **which**

**means** **that:**

**As** **rover** **receiver** **is** **set** **a** **different** **observation** **mode** **with** **this** **command,** **it’s** **not**

**necessary** **to** **send** **a** **RTKSOLUTION** **command** **to** **change** **rover** **receiver’s** **solution**

**mode,** **for** **its** **solution** **mode** **will** **be** **adjusted** **automatically** **per** **its** **observation**

**mode.**

**3**

**.2.30** **RTKREFMODE**

**Set** **the** **RTK** **ref-station** **position** **mode**

**Format**

RTKREFMODE <mode>

**Description**

This command is used to configure rover station to process position of reference station as

moving base station RTK mode or fixed base station RTK.

**Parameters**

*mode*

**Example**

0: fixed base station RTK; 1: moving base station RTK;

RTKREFMODE 1

**3**

**.2.31** **RTKSOLUTION**

**Set** **RTK** **solution** **mode**

**Format**

RTKSOLUTION <mode>

**Description**

This command provides a method to configure RTK resolution engine, which is used by Rover

RTK receiver. In some situations, only RTD is needed to get a quicker initiation process and a

not so accurate result, this command can be used to configure RTK engine to RTD mode.

**Parameters**

mode

integer number, which could be one of the followings:

0

1

: Auto;

: RTD;

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2

3

: Extra-wide;

: Float;

**Example**

RTKSOLUTION 1

**3**

**.2.32** **RTKSOURCE**

**Set** **RTK** **correction** **source**

**Format**

RTKSOURCE <type> [stn id]

**Description**

This command is used to identify from which base station to accept RTK (RTCM, RTCMV3, RTCA,

CMR and OmniSTAR (HP/XP)) differential corrections. This is useful when the receiver is

receiving corrections from multiple base stations.

**Parameters**

*type*

DGNSS type string name, default value is ‘AUTO’, refer to Table 13. If ANY (Default)

chosen, the receiver ignores the ID string. Specify a type when using base station

IDs.

*stn* *id*

Base station ID

**Table** **13.DGNSS** **Type**

**ID**

**TYPE** **STRING** **DESCRIPTION**

**0**

**2**

RTCM

RTCM ID: 0 <= RTCM station ID <=1023 or ANY

CMR ID: 0 <= CMR station ID <=31 or ANY

CMR

**1**

**3**

RTCMV3

RTCM Version 3.0 ID: 0 <= RTCMV3 station ID <=4095 or ANY

**Example**

RTKSOURCE AUTO ANY

RTKSOURCE RTCM ANY

// Specify the format before specifying base station ID

RTKSOURCE RTCMV3 5

RTKSOURCE RTCM 4

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**3**

**.2.33** **RTKTIMEOUT**

**Set** **maximum** **age** **of** **RTK** **data**

**Format**

RTKTIMEOUT <time-delay>

**Description**

This command is used to set the maximum age of RTK data to use when operating as a rover

station. RTK data received that is older than the specified time is ignored.

**Parameters**

*time-delay*

**Example**

less than 200s, default 200s

RTKTIMEOUT 30

**3**

**.2.34** **RTKQUALITY**

**Set** **RTK** **quality** **level**

**Format**

RTKQUALITY <normal/quick/extra-safe>

**Description**

Use this command to select an RTK quality mode.

**Parameters**

normal/extra-safe/quick

normal RTK/extra-safe RTK/quick RTK

*Quick*

Efficiency first, and the fixed rate of the fixed solution is guaranteed as far as

possible.

*Extra-safe* Quality first, ensuring the reliability of the fixed solution as much as possible.

*Normal* Equilibrium mode.

**Example**

Rtkqualityevel normal

Notice: for the geomatics application, the default setting: FFT+QUICK mode

For the attitude determination application, the setting: LAND+QUICK mode.

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**3**

**.2.35** **SAVECONFIG**

**Save** **current** **configuration**

**Format**

SAVECONFIG

**Description**

This command saves the user’s present configuration, including the current log settings (type,

whether output testing data, etc.), FIX settings, baud rate, and so on, refer to Table 14.

**Example**

SAVECONFIG

**Table** **14.Saved** **Configuration**

**DESCRIPTION**

**CONFIGURATION**

**LOG**

All logs in all ports are saved

**FIX**

Just fix position is saved

**COM**

baud rates of all ports are saved

Cutoff-angles include BD2 are saved

Six parameters of PJK are saved

configured offset is saved

**ECUTOFF**

**PJKPARA**

**PPSOFFSET**

**INTERFACEMODE**

**OTHER**

Ports mode status of COM1, COM2 and COM3

**CONFIGURATION**

**3**

**.2.36** **SBASCONTROL**

**Control** **the** **usage** **of** **SBAS** **corrections**

**Format**

SBASCONTROL <switch> [system] [prn]

**Description**

This command is used to dictate how the receiver tracks and uses correction data from one of

Satellite Based Augmentation Systems (SBAS). To enable the position solution corrections,

issue the SBASCONTROL ENABLE command. The receiver does not, by default, attempt to track

or use any SBAS signals satellites unless told to do so by the SBASCONTROL command.

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When using the SBASCONTROL command to direct the receiver to use a specific correction

type, the receiver begins to search for and track the relevant SBAS GEO PRNs for that

correction type only.

The receiver can be forced to track a specific PRN using the ASSIGN command. The receiver can

also be forced to use the corrections from a specific SBAS PRN using the SBASCONTROL

command.

Tracked SBAS PRNs have been presented in log message GPGSV, SATMSG and RANGECMP.

**Parameters**

*switch*

= *‘*ENABLE’: Receiver uses the SBAS corrections it receives

‘DISABLE’ (Default): Receiver does not use the SBAS corrections it receives

=

*system*

it’s an optional parameter as *switch* equals to ‘DISABLE’, refer to Table 15.

**Table** **15.SBAS** **Systems**

**KEYWORD**

**ID**

**DESCRIPTION**

**NONE**

**WAAS**

**EGNOS**

**MSAS**

0

3

4

5

6

Does not use any SBAS satellites

Uses only WAAS satellites

Uses only EGNOS satellites

Uses only MSAS satellites

Uses only GAGAN satellites

**GAGAN**

*prn*

= 0: Receiver uses any PRN (default)

120-138: Receiver uses SBAS corrections only from this PRN

=

**Example**

SBASCONTROL ENABLE EGNOS

SBASCONTROL ENABLE MSAS 129

**3**

**.2.37** **SBASECUTOFF**

**Set** **SBAS** **satellite** **elevation** **cut-off**

**Format**

SBASECUTOFF <angle>

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**Description**

This command sets the elevation cut-off angle for SBAS satellites. The receiver does not start

automatically searching for an SBAS satellite until it rises above the cut-off angle (when satellite

position is known).

**Parameters**

*angle*

**Example**

±90 degree, default value is -5 degree.

SBASECUTOFF -5

**3**

**.2.38** **SBASTIMEOUT**

**Set** **SBAS** **corrections** **time** **out**

**Format**

SBASTIMEOUT <mode> [time-out]

**Description**

This command is used to set the amount of time the receiver remains using the last effective

SBAS corrections if it has been disabled to receive SBAS corrections.

**Parameters**

*mode*

= AUTO (Default), Set the default value (180s) of time delay

SET, Set the time delay in seconds

=

*time-delay*

**Example**

120s ~ 200s, only as *mode* = ‘SET’, default value is 180s

SBASTIMEOUT 150

**3**

**.2.39** **SET**

**configure** **settings**

**Format**

SET <type> <param1> <param2> …

**Description**

This command should be used to configure some special settings such as PJK parameters,

debug information output, and so on.

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**Parameters**

*type*

refer to Table 16.

refer to Table 16.

*param*

**Example**

SET DIFFMATCHMODE synch

SET STATIC on

SET PJKPARA 6378137.0 298.257223563 0 120 0 500000

SET WORKMODE timing

SET TIMINGREFXYZ -2844870.0 4662776.0 3282481.0

SET BD2PVTOBS B2I

SET CPUFREQ 624

SET PVTFREQ 5

SET RTKFREQ 5

SET GPSL2CODETYPE codetype

SET GLONASSCODETYPE codetype

SET AUTOSENDFILE switch period delay

SET EXTERNALCOORD ON

SET CYCLESAVE switcher fileperiod sampleint eraseint

SET STATIONMODE mode portA portB interval

SET EMMC ON/OFF

SET BD2PVTMAXAODC XX

SET BD2PVTMAXAODE XXSET PROJECTIONTYPE Param1

SET CP SMOOTHER aa bb

SET NMEAMSGFORMAT <KEYWORD>

SET GLOPRBIAS gx p1 p2 …… p14

SET GLOCHANPRBIAS gx chan p

SET BLOPRBIAS DEFAULT

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**Table** **16.SET** **Type** **and** **Parameter**

**DESCRIPTION**

**SYNTAX**

**PARAMETER**

**SET** **DIFFMATCHMODE** ***Param1***

*Param1*: SYNCH or ASYNCH

*Param1*:

Set RTK in synchronous mode or asynchronous mode

**SET** **ATOM** ***Param1***

**SET** **ANTHIGH** ***Param1***

**SET** **STATIC** ***Param1***

ON = Enable atom clock

OFF = Disable atom clock

*Param1* is known antenna height of

a receiver

*Param1*:

ON = start a static file collection

OFF = end a static file collection

Start or end static data collection

Set PJK parameters in coordinate conversion. Their default settings

*Param1* … *Param6*:

are:

A: the long axle of the earth

A: 6378137.0;

1

/F: F is the Earth flat rate

F: 1.0 / 298.257223563;

**SET** **PJKPARA** ***Param1*** **…** ***Param6***

B0: reference latitude(in degree)

B0: 0;

L0: reference longitude(in degree)

N0: reference north coordinate

E0: reference east coordinate

L0: 120 / 180 \* PI

N0: 0

E0: 500000

**SET** **TIMINGREFXYZ** ***Param1*** **…** *Param1* … *Param3*:

In timing mode, this command is used to set reference station

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**SYNTAX**

**PARAMETER**

**DESCRIPTION**

***Param3***

X (WGS84), Y (WGS84), Z (WGS84)

coordinates as x, y and z in WGS84 coordination frame.

Set receiver work-mode: PVT mode or Timing Mode. Following a

command set work-mode to timing mode, reference station

coordinates should be set using command below. If switching

work-mode from PVT to TIMING, two commands:

SET WORKMODE TIMING

**SET** **WORKMODE** ***Param1***

*Param1*: PVT or TIMING

SET TIMINGREFXYZ X Y Z

should be needed. If switching work-mode from TIMING to PVT, only

one command is needed:

SET WORKMODE PVT

This command could be used to choose signal of BD2 in PVT

computation.

B1I/B2I/B3I: In PVT computation, observations, ephemeris and

almanac are extracted from B1I, B2I or B3I.

**SET** **BD2PVTOBS** ***Param1***

*Param1*: B1I, B2I or B3I, AUTO

AUTO: In PVT computation, observations, ephemeris and almanac are

extracted from one of signals B1I, B2I and B3I, according to the

quantity of each singal’s observables. The signal with more

observables will be used in PVT computation firstly.

*Param1* is valid CPU frequency in This command could be used to set frequency of CPU core. In some

**SET** **CPUFREQ** ***Param1***

Hz:

08, 416(default), 624, 806.

cases high update rate observation, PVT or RTK is needed, the default

2

CPU core frequency couldn’t bear so huge calculation load, so a higher

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**SYNTAX**

**PARAMETER**

**DESCRIPTION**

frequency is necessary, at the same time, it means more power cost.

ComNav board work in 5hz PVT in default setting, if a higher or lower

PVT update frequency is needed, this command could configure the

PVT update rate at most 20hz. But the calculation ability of CPU is not

unlimited, in 5hz PVT, RTK could work on 5hz; if a 10hz PVT and 10hz

RTK are needed at the same time, a higher CUP frequency at least

*Param1* is valid PVT frequency in

**SET** **PVTFREQ** ***Param1***

Hz:

1

, 2, 5(default), 10, 20.

6

24Mhz is necessary.

*Param1* is valid RTK frequency in

**SET** **RTKFREQ** ***Param1***

Hz:

Notice: please keep RTK frequency is not higher than PVT frequency.

1

, 2, 5(default), 10.

*Param1* is a fixed baseline length of

a rover (>0)

**SET** **BASELINELENGTH** ***Param1***

**SET** **MODIFYCPTOPR** ***Param1***

*Param1*:

Invoke a modulation manipulation on Carrier Phase, to make CP’s

values close to those of corresponding Pseudorange.

ON = to carry out the modulation

OFF = no modulation (default)

Param1: ON = enable Carrier Phase to smooth Pseudorange [Default]

OFF = Disable Carrier Phase to smooth Pseudorange

*Param1*: smooth enable switch,

**SET**

**CPSMOOTHPR**

***Param1*** ON/OFF

Valid range of Param2 is 10 ~ 200 seconds. Its default value is 50s.

Valid range of Param3 is 0 ~ 60 seconds. Its default value is 15s. After

one satellite was tracked for a time period (Param3), receiver starts to

use Carrier Phase to smooth the satellite’s PR.

***[***

***Param2]*** ***[Param3]***

*Param2*: smoothing time contant

*Param3*: Tracking time threshhold

**SET** **RTKOBSMODE** ***Param1***

Param1 is RTK Obs mode

AUTO, MANUAL [Default]

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**SYNTAX**

**PARAMETER**

**DESCRIPTION**

For more information on the mode, refer to 3.2.29

*Param1* is a vector length of a rover

**SET** **VECTORLENGTH** ***Param1***

(>0)

a) AUTO, MANUAL[Default]

code type: Track L2C signal if this satellite has the L2C signals; track L2P

if not.

*Param1* (*codetype*) is:

pcode: P code

b) The setting status can be checked by the command: *log*

*codetype*

**SET** **GPSL2CODETYPE** ***Param1***

ccode: C code

auto: Track the L2C automatically

c) Example: set gpsl2codetype auto

For the GPS L2 automatically choose the PRN code type to

track.

a) Default mode: pcode

*Param1* (*codetype*) is:

pcode: P code

ccode: C code

Auto: N/A

b) Example: set glonasscodetype ccode;

In this command, the PRN tracking code type is: C code.

**SET** **GLONASSCODETYPE**

***Param1***

*switch:* *raw* *data* *file* *send* *switch.*

*Switch:*

*Period*: raw data file send period,

1: open the sending file function

0: close the sending file function

**SET** **AUTOSENDFILE** ***switch*** ***period*** the unit is (seconds).

***delay***

*Delay*: time delay of the raw data *period*: If the period is set with “3600”, it means the file is sent once

file sending out on time, and the every 3600s.

unit is in seconds.

*delay*: The time delay is set for leaving more time for the internet

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**SYNTAX**

**PARAMETER**

**DESCRIPTION**

module connection. If the delay is set “15”, it means the data file will

be sent out 15 seconds delay after the sending period time.

The parameters of this command can be saved by *saveconfig*

command.

This function uses the external coordinates as base station position

external and send these coordinates for differential operation. This function

can be inquired by the command *log* *sysconfig*, and can be saved by

*saveconfig*.

Externalcoord:the

coordinates.

**SET** **EXTERNALCOORD** **ON**

*switcher*: set the cycle saving.

-

This message settings can be saved by *saveconfig* and checked by *log*

*sysconfig*.

the *switcher* corresponds to the “Data log” of the CRU; the “ENABLE”

“ENABLE” is open, and “DISABLE” is

close.

-

*Fileperiod*: set the file saving

period. The parameter is integer in

corresponds to the “AUTO”; “DISABLE” corresponds to the “MANUAL”.

The *Fileperiod* corresponds to the “Data Log Session” of CRU; The

**SET** **CYCLESAVE** ***switcher*** ***fileperiod*** unit of hour.

“

sampleint” corresponds to the “sampleinterval” of CRU.

***sampleint*** ***eraseint***

*Sampleint*: set the file saving

sampling interval. The parameter is

integer in unit of second.

-

Using the *set* *cyclesave* command to set the cycle saving parameters

means modifying the settings of the static file saving of the CRU. Same,

using the CRU to modify the static file saving also means changing the

cyclesave parameters. But the open and close of *cyclesave* can only be

controlled by the input command.

*Eraseint*: set the file erasing time

interval. The parameter is integer

and the unit is seconds.

**SET** **STATIONMODE** ***mode*** ***portA*** *Mode:* set the station style, the (1)example: set stationmode master com2 com3 0.2

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**SYNTAX**

**PARAMETER**

**DESCRIPTION**

In this command, the OEM board is set as master station. It receives

***portB*** ***interval***

parameter is string. “master” is the

base station, “slave” is the rover the correction data from com2 and sending out the correction

station. message to the rover station from com3; the message sending interval

*PortA*: set the communication port is 0.2 seconds.

for receiving the differential data

Additionally, after receiving the command as in the example, the

from the base station. The OEM board will automatically check the current frequencies of the PVT

parameter is “com1”, “com2”, and RTK according to the *interval* parameter. The frequencies will be

“com3”.

tuned automatically if the PVT/RTK frequencies are lower than the

*PortB*: set the communication port message sending frequency.

for sending differential messages

For example, assuming the PVT/RTK frequency is 5 Hz, while

from base station. The parameter is receiving the command “set stationmode master com2 com3 0.1”, the

“com1”, “com2”, “com3”.

PVT/RTK frequencies are set with 10 Hz. However, the frequency of

*Interval*: set the time interval for the CPU cannot be set automatically. If needed, please set manually.

sending the differential messages.

The parameter is float pointing.

The command as former example will execute the following

commands internally:

*Set* *pvtfreq* *5*

*Set* *rtkfreq* *5*

*Interfacemode* *com2* *auto* *auto* *on*

*Interfacemode* *com3* *auto* *auto* *on*

*Log* *com3* *rtcmcompassb* *ontime* *0.2*

(2) set stationmode slave com3 com3 0.2

In the above example, the OEM board is set as slave station, where the

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**SYNTAX**

**PARAMETER**

**DESCRIPTION**

messages from the master are received from com3 and attitude results

are sent back to com3. 0.2 is the interval time which is used to check if

the PVT and RTK frequencies are under the requirement. The function

is same as the master station.

The above command is realized by the following commands:

*set* *pvtfreq* *5*

*set* *rtkfreq* *5*

*interfacemode* *com3* *auto* *auto* *on*

*log* *com3* *rtcmcompass3b* *ontime* *0.2*

*set* *diffmatchmode* *synch*

*rtkrefmode* 1

The adding commands are used for the setting related to the attitude

determination. For the requirement from the master station, it needs

to be set additionally. For example, the command settings for a master

station are as:

*set* *stationmode* *master* *com2* *com3* *0.2*

*log* *gpgga* *ontime* *0.2*

*log* *gptra* *ontime* *0.2*

*for* *the* *slave* *station:*

*set* *stationmode* *master* *com3* *com3* *0.2.*

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**SYNTAX**

**PARAMETER**

**DESCRIPTION**

For the K708 OEM board, the EMMC chip is not activated by default

setting; if the chip is needed, I needs to be activated by the command.

For everytime the EMMC is open/closed, it can be set effectively only

after setting: *saveconfig* command. The EMMC status is finished during

the initialization while starting the receiver. The EMMC status can be

inquired by the *sysconfig* command.

ON: active the EMMC chip

OFF: close the EMMC chip

**SET** **EMMC** **ON/OFF**

This command is used to set the AODC value for the Beidou PVT

solution. The default value is: 1. It can be inquired and saved in the

*sysconfig* command.

**SET** **BD2PVTMAXAODC** **XX**

**SET** **BD2PVTMAXAODE** **XX**

XX: is the AODC value

XX: is the AODE value

This command is used to set the AODE value for the Beidou PVT

solution. The default value is: 2. It can be inquired and saved in the

*sysconfig* command.

Param1 can be set with gauss and Gauss: means setting the projection type as Gauss-Boaga projection

**SET** **PROJECTIONTYPE** ***Param1***

utm.

type.

utm: universal transverse Mercator projection.

*COMNAV*: default setting. Currently the OEM board outputs NMEA

format message.

Keyword: COMNAV, STANDARD,

NORMAL, LONG.

**Set** **nmeamsgformat<keyword>**

*STANDARD*:se Standard NMEA0183 message format.

Reference Table 17.

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**SYNTAX**

**PARAMETER**

**DESCRIPTION**

gx = 1 means G1

gx: GLONASS frequency index. The gx = 2 means G2;

value can be set with 1 or 2. example:

p1: the first channel frequency set gloprbias 1 -700 -600 -500 -400 -300 -200 -100 0 100 200 300 400

correction. 500 600

p14: +6 RF channel settings in unit set gloprbias 2 -700 -600 -500 -400 -300 -200 -100 0 100 200 300 400

**Set** **CLOPRBIAS** **gx** **p1** **p2** **……** **p14**

of mm.

500 600

Note: all 15 parameters should be set in the command.

gx: same as in above.

Example:

chan: RF channel number. Value is

from -7 ~ 6 with respect to the 14

channels of GLONASS.

*Set* *glochanprbias* *1* *-6* *300*

**Set** **GLOCHANPRBIAS** **gx** **chan** **p**

**Set** **GLOPRBIAS** **DEFAULT**

The example means set the G1 frequency in -6 channel of GLONASS

with 300mm.

p: corrections as above.

N/A

Set both corrections of G1 and G2 in all channels to be 0.

Forwarding RTCMV3 differential data

**set** **relayrtcmv3** **on/off**

on/off:switch

**com1/com2/com3/com4**

comX:serial port

**set** **pppsource**

Bqrtcm3 is a new mode: the SSR correction number of RTCM3 of mark

weapon group

**lband/rtcm3/bqrtcm3**

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**SYNTAX**

**PARAMETER**

**DESCRIPTION**

Because the LED pins of the receiver connected to the board card

designed by hardware are opposite to the polarity of the pins of the

board card, the LED lights on the board card and the LED lights of the

receiver are opposite to each other.So increase the command to set

the board card led lights on and off polarity.

**set** **ledlowon** **enable/disable**

Customer customized instructions, use radio led to indicate the state

of directional solution, fixed solution: radio light on;Other solution

state: radio light off.

**set** **headingledshow** **enable**

Note: the radio light on and off of this function is controlled by the set

ledlowon command.

Parameter:

If the baseline length in the scene is fixed, it is recommended to

choose mode 2, which can reduce the flying point and improve the

fixed rate.

1

:Mobile base station mode,

variable base line length .

:Mobile base station mode with

**set** **vectorlenmode** **parameter**

2

If the baseline length in the scenario is not fixed, select mode 1 and

the fixed rate will decrease to some extent.

fixed baseline length.

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**Table** **17.Description** **of** **NMEAMSGFORMAT** **keyword**

COMNAV

Default setting : NEMA message format for current OEM board output

1

2

. no position case: GGA, RMC, VTG, HDT corresponding data are not output, and the message only output comma.

.this key word only influences the GPGGA data accuracy, where the data accuracy adjusts according to the

**Position** **status**

**latitude** **longitude**

**height**

**Undulation**

**Differential** **delay**

**Single**

4-bits

7-bits

4-bits

7-bits

2-bits

2-bits

N/A

Standard

**positioning**

STANDARD

NMEA0183

message format

**Non-single**

**positioning**

4-bits

3-bits

Integer number with 2

digit(receiving

differential data)

positioning mode automatically. The decimal number is:

Non-single positioning: RTD, SBAS, HDT manual setting or simulation input, etc.

3

.when working in single positioning mode, the differential delay of GPGGA and station number are N/A.

NMEA message 1. no position case: GGA, RMC, VTG, HDT corresponding data are not output but only comma.

normal accuracy

NORMAL

2

. this key word only influences the GPGGA data accuracy. The data output accuracy is fixed and the decimal part is

format

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**latitude** **longitude**

**height**

2-bits

4-bits

**Undulation**

2-bits

**Differential** **delay**

**NORMAL**

4-bits

7-bits

4-bits

7-bits

2 digits integer

**LONG**

3-bits

xx.x (2 digits integer, 1

decimal)

NMEA message

LONG

high

accuracy defined as:

Non-single positioning: RTD, SBAS, HDT manual setting or simulation input, etc.

format

3

4

5

. when working in single positioning mode, the differential delay of GPGGA and station number are N/A.

. for the LONG mode, undulation and its unit “M” are still reserved, and same as NovAtel GPGGALONG.

. Reference: NovAtel OME6 Manual book, table 106, Position Precision of NMEA Logs.

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**3**

**.2.40** **UNDULATION**

**Choose** **undulation**

**Format**

UNDULATION <opt> [sep]

**Description**

This command permits user to either enter a specific geoidal undulation value. The undulation

values reported in the position logs are in reference to the ellipsoid of the chosen datum.

**Parameters**

*opt*

Geoidal height model option, refer to Table 18l. Default value is ‘EGM96’.

Undulation value required for the USER option, default value = 0.000.

**Table** **18.Geoidal** **Height** **(Undulation)** **Model**

*sep*

**OPTION**

**ID**

**DESCRIPTION**

**table**

0

1

2

3

Use the internal undulation table (same as EGM96)

Use the user specified undulation value

Use the OSU89B undulation table

**USER**

**OSU89B**

**EGM96**

Use global geoidal height model EGM96 table

**Example**

UNDULATION EGM96

UNDULATION OSU89B

UNDULATION USER 10.000000000

UNDULATION table

**3**

**.2.41** **UNLOCKOUT**

**Reinstate** **a** **satellite** **in** **the** **solution**

**Format**

UNLOCKOUT <prn>

**Description**

This command allows a satellite which has been previously locked out (LOCKOUT command) to

be reinstated in the solution computation. If more than one satellite is to be reinstated, this

command must be reissued for each satellite reinstatement.

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**Parameters**

*prn*

PR number of satellite, refer to Table 6.

**Example**

UNLOCKOUT 10

**3**

**.2.42** **UNLOCKOUTALL**

**Reinstate** **a** **satellite** **in** **the** **solution**

**Format**

UNLOCKOUTALL

**Description**

This command allows all satellites which have been previously locked out (LOCKOUT command)

to be reinstated in the solution computation.

**Example**

UNLOCKOUTALL

**3**

**.2.43** **UNLOCKOUTSYSTEM**

**Reinstate** **previously** **locked** **out** **system**

**Format**

UNLOCKOUTSYSTEM <system>

**Description**

This command allows a system which previously locked out to be reinstated in the solution

computation.

**Parameters**

*system*

**Example**

the name of a specified GNSS system, refer to Table 7.

UNLOCKOUTSYSTEM BD2

**3**

**.2.44** **UNLOG**

**Remove** **a** **log** **from** **logging** **control**

**Format**

UNLOG <message-type>

**Description**

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This command permits you to remove a specific log request from the system.

**Parameters**

*message-type*

**Example**

refer to Table 19 ~ Table 23.

UNLOG VERSIONB

**3**

**.2.45** **UNLOGALL**

**Remove** **all** **logs** **from** **logging** **control**

**Format**

UNLOGALL <port>

**Description**

This command disables all logs on the port if port is specified, if no port is specified, all logs of

all ports would be disabled.

**Parameters**

*port*

**Example**

refer to .

UNLOGALL COM1

UNLOGALL

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CHAPTER 4. LOG MESSAGES

Many different types of data can be logged using LOG command. This chapter covers all types

of data logs supported by ComNav board.

**4**

**.1** **CONVENTIONS**

**4**

**.1.1** **Command** **Format**

**Send**

LOG <message-type> [trigger] [period] [offset]

Refer to Section *3.2.15*.

**Reply**

The format of reply message is Binary, which is quite different from sending message. The

board also supports NMEA string.

**4**

**.1.2** **Binary** **Message** **Layout** **and** **Header** **Definition**

**FORMAT**

**Header** 3 Sync bytes plus 25 bytes of header information. The header length is variable as

fields may be appended in the future. Always check the header length.

**Data** variable

**CRC**

32-bit CRC performed on all data including the header.

**HEADER**

Binary Binary

Field# Field Name

Field Type

Description

Byte

Offset

**1**

**2**

**3**

**4**

**5**

**6**

Sync

Char

Hexadecimal 0xAA.

Hexadecimal 0x44.

Hexadecimal 0x12.

Length of the header.

Message ID

1

1

1

1

2

1

0

1

2

3

4

6

Sync

Char

Sync

Char

Header Lgth

Message ID

Reserved

Uchar

Ushort

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Binary Binary

Field# Field Name

Field Type

Ushort

Description

Byte

1

Offset

7

**7**

**8**

Reserved

Message

Length

The length in bytes of the body of the message.

This does not include the header nor the CRC.

2

8

**9**

**1**

**1**

**1**

Reserved

Reserved

Reserved

Week

2

1

1

2

10

12

13

14

**0**

**1**

**2**

Ushort

GPS week number.

Milliseconds from the beginning of the GPS

week.

**1**

**3**

ms

GPS time

4

16

**1**

**1**

**4**

**5**

Reserved

Reserved

Receiver S/W

Version

4

2

20

24

Ushort

Ushort

Reserved for internal use.

This is a value (0 - 65535) that represents the

receiver software build number.

**1**

**6**

2

26

**NOTE:**

In current version, the length of header is always 28 bytes.

The length of data block is variable.

**4**

**.1.3** **Log** **Message** **List**

Currently supported messages are listed in alphabetical order below.

**4**

**.1.3.1** **Predefined** **Log** **Message** **List**

**Table** **19.Predefined** **Log** **Message**

**NO** **ID**

**LOG** **MESSAGE**

**FORMAT** **DESCRIPTION**

**REFER** **TO**

**1**

**2**

71

72

BD2EPHEM

BD3EPHEM

BD3RAWNAVSU

BFRAME

B

B

BD2 decoded ephemeris information

*4.2.1.1*

*4.2.1.2*

BD3 decoded ephemeris information

**3**

157

B

*4.2.1.3*

**4**

**5**

**6**

741 BD2RAWALM

412 BD2RAWEPHEM

1695 BDSRAWNAVSU

B

B

B

BD2 raw almanac

*4.2.1.4*

*4.2.1.5*

*4.2.1.6*

BD2 Raw ephemeris

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*COMNAV* *OEM* *BOARD* *REFERENCE* *MANUAL*

*Chapter* *4.* *Log* *Messages*

**NO** **ID**

**LOG** **MESSAGE**

**FORMAT** **DESCRIPTION**

**REFER** **TO**

BFRAME

BESTPOS

BESTVEL

**7**

42

99

A, B

Best position data

*4.2.7.1*

*4.2.7.2*

*4.2.7.3*

**8**

**9**

A,B, Abb Best velocity data

241 BESTXYZ

A, B

B

Position information in xyz.

BINEX Record 0x00 encapsulated by Binary

**1**

**0**

**1**

**2**

**3**

**4**

**5**

**6**

110 BINEX00DATA

*4.2.2.1*

*4.2.2.2*

*4.2.2.3*

*4.2.2.4*

*4.2.2.5*

*4.2.2.6*

*4.2.2.7*

header & CRC-32

BINEX Record 0x01-01 encapsulated by Binary

header & CRC-32

**1**

**1**

**1**

**1**

**1**

**1**

81

82

85

BINEX0101DATA

BINEX0102DATA

BINEX0105DATA

B

B

B

B

B

B

BINEX Record 0x01-02 encapsulated by Binary

header & CRC-32

BINEX Record 0x01-05 encapsulated by Binary

header & CRC-32

BINEX Record 0x7d-00 encapsulated by Binary

header & CRC-32

114 BINEX7D00DATA

115 BINEX7E00DATA

120 BINEX7F05DATA

BINEX Record 0x7e-00 encapsulated by Binary

header & CRC-32

BINEX Record 0x7f-05 encapsulated by Binary

header & CRC-32

**1**

**1**

**1**

**7**

**8**

**9**

317 COMCONFIG

A, B

B

COM configuration Information in ASCII Format

Decoded GLONASS Ephemeris

723 GLOEPHEMERIS

792 GLORAWEPHEM

*4.2.1.8*

*4.2.1.9*

B

GLONASS raw ephemeris message.

A single set of decoded GNSS ephemeris whose

message ID is different from NovAtel® definition

Galileo ephemeris parameters

**2**

**2**

**2**

**0**

**1**

**2**

71

GPSEPHEM

B

B

B

*4.2.1.10*

*4.2.1.11*

*4.2.1.12*

1122 GALEPHEMERIS

GALFNAVRAWP

1413

AGE

The raw Galileo FNAV page data

The raw Galileo INAV word data

GALINAVRAWW

1414

ORD

**2**

**3**

B

*4.2.1.13*

**2**

**2**

**2**

**2**

**2**

**4**

**5**

**6**

**7**

**8**

712 GPSEPHEM

971 HEADING

B

GPS decoded ephemeris information

Heading angle message

*4.2.1.10*

*4.2.4.1*

*4.2.9.1*

*4.2.3.2*

*4.2.9.2*

A, B

8

5

IONUTC

LOGLIST

A,B, Abb Ionosphere and UTC parameters

A

B

Log settings in each port.

925 M925

Extended Satellite Information

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*COMNAV* *OEM* *BOARD* *REFERENCE* *MANUAL*

*Chapter* *4.* *Log* *Messages*

**NO** **ID**

**LOG** **MESSAGE**

**FORMAT** **DESCRIPTION**

**REFER** **TO**

**2**

**3**

**3**

**3**

**3**

**3**

**3**

**3**

**3**

**9**

**0**

**1**

**2**

**3**

**4**

**5**

**6**

**7**

181 MARKPOS

A, B

A, B

B

Position at time of mark input event

*4.2.5.1*

*4.2.5.2*

*4.2.6.1*

231 MARKTIME

106 METEODATA

108 METEODATAEXT

174 PSRDOP

Time of mark input event

Basic Meteorograph Data Message

B

Extended Meteorograph Data Message

DOP of SVs currently tracking

*4.2.6.2*

*4.2.7.4*

*4.2.7.5*

*4.2.7.6*

*4.2.7.7*

*4.2.7.8*

B

47

PSRPOS

A,B, Abb Pseudorange Position

100 PSRVEL

A, B

A, B

B

Pseudorange Velocity

243 PSRXYZ

Pseudorange Cartesian position and velocity

The SDK Log-on Message of Qianxun SI

901 QXWZSDKINFOB

QZSSRAWSUBFR

**3**

**3**

**8**

**9**

1330

AM

B

B

QZSS raw ephemeris informationfor subframes

QZSS raw ephemeris informationfor

*4.2.1.14*

*4.2.1.15*

QZSSRAWEPHE

1331

M

**4**

**4**

**4**

**0**

**1**

**2**

43

RANGE

A,B, Abb Detailed range information

*4.2.8.1*

*4.2.8.2*

*4.2.1.17*

140 RANGECMP

A,B, Abb Compressed version of the RANGE log

74

25

41

RAWALM

B

Raw almanac

The raw subframe data without parity bits,only

RAWGPSSUBFRA

ME

**4**

**3**

B

240bits per frame, and only outputs the *4.2.1.16*

sub-frames passing the check

**4**

**4**

**4**

**4**

**4**

**4**

**5**

**5**

**5**

**5**

**5**

**5**

**5**

**4**

**5**

**6**

**7**

**8**

**9**

**0**

**1**

**2**

**3**

**4**

**5**

**6**

RAWEPHEM

B

Raw ephemeris

*4.2.1.18*

*4.2.10.1*

*4.2.11.1*

*4.2.8.3*

*4.2.9.3*

*4.2.9.4*

973 RAWSBASFRAME

175 REFSTATION

396 RTCMDATA1

911 SATMSG

A

Raw SBAS frame data

A, B

B

Base station Position

Pseudorange correction message

Satellite status (defined by ComNav)

Satellite visibility

B

48

SATVIS

B

270 SATXYZ

976 SBAS0

977 SBAS1

982 SBAS2

987 SBAS3

992 SBAS4

994 SBAS5

A, B

A

Satellite positions in ECEF Cartesian coordinates *4.2.9.5*

Do Not Use for Safety Applications

PRN Mask Assignments

*4.2.10.2*

*4.2.10.3*

A

A

A

Fast Corrections

*4.2.10.4*

A

A

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*COMNAV* *OEM* *BOARD* *REFERENCE* *MANUAL*

*Chapter* *4.* *Log* *Messages*

**NO** **ID**

**LOG** **MESSAGE**

**FORMAT** **DESCRIPTION**

**REFER** **TO**

**5**

**5**

**5**

**6**

**7**

**8**

**9**

**0**

995 SBAS6

996 SBAS7

A

A

A

A

Integrity Information

*4.2.10.5*

*4.2.10.6*

*4.2.10.7*

*4.2.10.8*

Fast Correction Degradation Factor

GEO Navigation Message

Degradation Factors

997 SBAS9

978 SBAS10

SBAS Network Time/UTC/GLO Time Offset

Parameters Message

**6**

**1**

979 SBAS12

A

*4.2.10.9*

**6**

**6**

**2**

**3**

980 SBAS17

981 SBAS18

A

A

GEO Almanacs

*4.2.10.10*

*4.2.10.11*

Ionospheric Grid Point Masks

Mixed Fast Corrections/Long Term Satellite

Error Corrections

**6**

**4**

983 SBAS24

A

*4.2.10.12*

**6**

**6**

**6**

**6**

**6**

**7**

**7**

**7**

**5**

**6**

**7**

**8**

**9**

**0**

**1**

**2**

984 SBAS25

985 SBAS26

986 SBAS27

975 SBAS28

1003 SBAS63

101 TIME

A

A

A

A

A

B

B

Long Term Satellite Error Corrections

Ionospheric Delay Corrections

SBAS Service

*4.2.10.13*

*4.2.10.14*

*4.2.10.15*

*4.2.10.16*

*4.2.10.17*

*4.2.12.1*

*4.2.3.3*

Clock-Ephemeris Covariance Matrix Message

Null Message

Board time information

83

37

TRACKSTAT

VERSION

Satellite tracking status

A,B, Abb Board software and hardware version

*4.2.3.4*

**4**

**.1.3.2** **International** **Standard** **Message** **List**

ComNav boards also support NMEA, RTCM 2.X, RTCM 3.X messages. Please reference the

NMEA and RTCM protocol manual for details.

**Table** **20.NMEA** **Message**

**NO** **ID**

**Standard**

**LOG** **MESSAGE**

**DESCRIPTION**

**1**

218

219

221

222

223

GPGGA

GPGLL

GPGSA

GPGST

GPGSV

GPS Fix Data and Undulation

**2**

**3**

**4**

**5**

Latitude and Longitude of Present Vessel Position

GPS DOP and Active Satellites

Only Dop Values are Valid Currently

GPS Satellites in View

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*COMNAV* *OEM* *BOARD* *REFERENCE* *MANUAL*

*Chapter* *4.* *Log* *Messages*

**NO** **ID**

**LOG** **MESSAGE**

**DESCRIPTION**

**6**

228

225

226

227

GPHDT

GPRMC

GPVTG

GPZDA

Actual Vessel Heading in Degrees True

GPS Specific Information

**7**

**8**

**9**

The Track Made Good and Speed Relative to the Ground

UTC Time and Date

**ComNav** **Proprietary**

GPCDT

**1**

211

267

265

259

220

237

268

264

209

271

263

266

261

207

262

87

Differential timing result

**2**

**3**

**4**

**5**

**6**

**7**

**8**

**9**

GPCLH

GPDRC

GPGGARTK

GPGRS

GPHPR

GPIDM

GPNAV

GPNTR

GPPRR

GPRRS

GPRSC

GPSEH

GPTRA

GPURA

GPYBM

Constellation Health

Delta Range Correction

GPS Fix Data and Undulation

Pseudorange Residual

Parameters of Attitude Angles

Constellation Health

ComNav Navigation Information Message

Information about navigating to reference station.

Pseudorange and Range Rate Residual

Differential GPS and BDS Corrections

Reference Station Coordinates

Satellite Health Indication

**1**

**0**

**1**

**2**

**3**

**4**

**5**

**6**

**1**

**1**

**1**

**1**

**1**

**1**

Heading, Pitch and Roll (reserved) Message

Satellite User Range Accuracy (URA)

Position, Velocity,, Heading, Pitch and PJK information

**Table** **21.RTCM** **Message**

**NO** **ID**

**LOG** **MESSAGE**

**FORMAT** **DESCRIPTION**

**RTCM** **2.X**

**1**

107 RTCM1

B

B

B

B

B

Pseudorange correction message in RTCM2.3

Type 3 Base Station Parameters

**2**

**3**

**4**

**5**

402 RTCM3

275 RTCM9

399 RTCM1819

864 RTCM31

GPS Partical Correction Set

Type18 and Type 19 Raw Measurements

Differential GLONASS Corrections

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*COMNAV* *OEM* *BOARD* *REFERENCE* *MANUAL*

*Chapter* *4.* *Log* *Messages*

**NO** **ID**

**LOG** **MESSAGE**

**FORMAT** **DESCRIPTION**

**6**

RTCM41

RTCM42

B

B

GNSS pseudorange corrections

**7**

General partial corrections

**RTCM** **3.X**

89

**1**

**2**

**3**

**4**

**5**

**6**

**7**

**8**

**9**

RTCM0063

B

B

B

B

B

B

B

B

B

B

B

B

B

B

B

B

B

B

B

B

BDS Ephemerides (a test message)

785 RTCM1002

RTCM1003

Extended L1-Only GPS RTK Observables

L1 and L2 GPS RTK Observables

787 RTCM1004

788 RTCM1005

789 RTCM1006

856 RTCM1007

857 RTCM1008

898 RTCM1010

RTCM1011

Extended L1/L2 GPS RTK Observables

RTK Base Station ARP

Base Station ARP with Height

Extended Antenna Descriptor and Setup Information

Extended Antenna Descriptor and Setup Information

Extended L1-OnlyGLONASS RTK Observables

GLONASS L1/L2 RTK

**1**

**0**

**1**

**2**

**3**

**4**

**5**

**6**

**7**

**8**

**9**

**0**

**1**

**1**

**1**

**1**

**1**

**1**

**1**

**1**

**1**

**2**

900 RTCM1012

893 RTCM1019

895 RTCM1020

999 RTCM1033

781 RTCM1104

624 RTCM1074

644 RTCM1084

674 RTCM1124

684 RTCM1114

RTCM4078

Extended L1 & L2 GLONASS Observables

GPS Ephemerides

GLONASS Ephemerides

Receiver and Antenna Descriptors

Extended B1, B2 or B3 BD2 RTK Observables

GPS MSM4 — Full PRs and Phase Ranges plus CNR

GLO MSM4 — Full PRs and Phase Ranges plus CNR

BDS MSM4 — Full PRs and Phase Ranges plus CNR

QZSS MSM4

A RTCM 3.x Proprietary Message for ComNav

**Table** **22.BINEX** **Message**

**FORMAT** **DESCRIPTION**

**NO** **RECORD** **LOG** **MESSAGE**

**Standard**

**1**

0x00

BINEX00

B

B

B

Site Metadata

**2**

**3**

0x01-01

0x01-02

BINEX0101

BINEX0102

Decoded GPS Ephemeris

Decoded GLONASS — FDMA Ephemeris

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*COMNAV* *OEM* *BOARD* *REFERENCE* *MANUAL*

*Chapter* *4.* *Log* *Messages*

**NO** **RECORD** **LOG** **MESSAGE**

**FORMAT** **DESCRIPTION**

**4**

0x01-05 BINEX0105

0x7d-00 BINEX7D00

0x7e-00 BINEX7E00

B

B

B

B

Decoded Beidou-2/Compass Ephemeris

**5**

**6**

**7**

Receiver Internal State

Ancillary Site Data Prototyping

GNSS Observable Prototyping

0x7f-05

BINEX7F05

**BINEX** **Records** **encapsulated** **by** **ComNav** **Binary** **Message** **Header** **and** **CRC-32**

**1**

**2**

**3**

**4**

**5**

**6**

**7**

0x00

BINEX00DATA

B

B

B

B

B

B

B

Refer to *4.2.2.1*

Refer to *4.2.2.2*

Refer to *4.2.2.3*

Refer to *4.2.2.4*

Refer to *4.2.2.5*

Refer to *4.2.2.6*

Refer to *4.2.2.7*

0x01-01 BINEX0101DATA

0x01-02 BINEX0102DATA

0x01-05 BINEX0105DATA

0x7d-00 BINEX7D00DATA

0x7e-00 BINEX7E00DATA

0x7f-05

BINEX7F05DATA

**4**

**.1.3.3** Other Message List

**Table** **23.Other** **Message**

**NO** **ID**

**LOG** **MESSAGE**

**FORMAT** **DESCRIPTION**

**Trimble** **Proprietary** **Messages**

**1**

390 CMROBS

391 CMRREF

B

B

Base station satellite observation information

**2**

Base station position information

Time, yaw, tilt, range, mode, PDOP, and number of SVs

for Moving Baseline RTK

**3**

224 PTNLAVR

A

**4**

**5**

76

PTNLGGK

A

A

Time, position, position type, and DOP values

PJK Position

229 PTNLPJK

**JAVAD** **Proprietary** **Messages**

52 NAVPOS

**Parameter** **Messages**

**1**

A

[NP] Navigation Positon

**1**

2001 BD2ECUTOFF

2002 ECUTOFF

BD2 cutoff angle.

**2**

**3**

**4**

GPS cutoff angle.

2017 GLOECUTOFF

2018 MAGVAR

GLONASS cutoff angle.

Magnetic variation correction.

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*COMNAV* *OEM* *BOARD* *REFERENCE* *MANUAL*

*Chapter* *4.* *Log* *Messages*

**NO** **ID**

**LOG** **MESSAGE**

**FORMAT** **DESCRIPTION**

**5**

2013 PJKPARA

PJK Parameters Used in PTNLPJK Message

PVT frequency.

**6**

**7**

**8**

**9**

2019 PVTFREQ

2003 REFMODE

2022 REFPJKXYH

2015 REGLIST

Reference mode, auto-started, SPP or fixed position.

Ref-Station position in PJK mode.

Registered functions list

**1**

**0**

**1**

**2**

2020 RTKFREQ

2008 RTKTIMEOUT

2021 SYSCONFIG

RTK frequency.

**1**

**1**

Time thresh of differential data could be used.

Main system configuration parameters.

**Command** **Messages** **for** **Weather** **Instrument** **(Meteorograph)**

**1**

932 ZZ11ASETDATE

933 ZZ11ASETTIME

934 ZZ11ASETID

A

A

A

A

A

A

A

A

Set date of ZZ11A Meteorograph

**2**

**3**

**4**

**5**

**6**

**7**

**8**

Set time of ZZ11A Meteorograph

Set ID of ZZ11A Meteorograph

935 ZZ11ASETAUTOSEND

936 ZZ11AREADDATE

937 ZZ11AREADTIME

938 ZZ11AREADID

Set output period of ZZ11A Meteorograph

Read date from ZZ11A Meteorograph

Read time from ZZ11A Meteorograph

Read ID of ZZ11A Meteorograph

939 ZZ11AREADAUTOSEND

Read the output period of ZZ11A Meteorograph

**4**

**.1.4** **Trigger** **Types**

The receiver is capable of generating many different logs. These logs are divided into three

types: synchronous, asynchronous, and polled.





The data for synchronous logs is generated on a regular schedule.

Asynchronous data is generated at irregular intervals. If asynchronous logs were collected

on a regular schedule, they would not output the most current data as soon as it was

available.



The data in polled logs is generated on demand. An example would be RXCONFIG. It would

be polled because it changes only when commanded to do so. Therefore, it would not

make sense to log this kind of data ONCHANDED, or ONNEW.

The following table outlines the log types and the valid triggers to use:

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*COMNAV* *OEM* *BOARD* *REFERENCE* *MANUAL*

*Chapter* *4.* *Log* *Messages*

**Table** **24.Log** **Trigger** **Types**

**TYPE**

**RECOMMENDED** **TRIGGER**

**ILLEGAL** **TRIGGER**

**Synch**

**Asynch**

**Polled**

ONTIME

ONNEW, ONCHANGED

ONCHANGED

ONCE or ONTIME

-

ONNEW, ONCHANGED

**Table** **25.Logs** **Supporting** **ONCHANGED** **and** **ONTRACKED**

**NO** **ID**

**LOG** **MESSAGE**

**REFER** **TO**

**1**

8

IONUTC

*4.2.9.1*

*4.2.1.17*

*4.2.1.1*

*4.3.4.2*

*4.3.4.2*

*4.3.4.2*

*4.3.3.1*

*NA*

**2**

**3**

**4**

**5**

**6**

**7**

**8**

**9**

41

RAWEPHEM

BD2EPHEM

BINEX0101

BINEX0102

BINEX0105

RTCM0063

71

79

80

84

89

90

RTCM4011

104

175

412

712

723

792

893

895

RTCM4013

*NA*

**1**

**0**

**1**

**2**

**3**

**4**

**5**

**6**

REFSTATION

BD2RAWEPHEM

GPSEPHEM

GLOEPHEMERIS

GLORAWEPHEM

RTCM1019

*4.2.11.1*

*4.2.1.5*

*4.2.1.9*

*4.2.1.4*

*4.2.1.8*

*4.3.3.12*

*4.3.3.13*

**1**

**1**

**1**

**1**

**1**

**1**

RTCM1020



***NOTE*** ***for*** **Table** **25**：

**(1)** **Most** **log** **messages** **listed** **in** **this** **table** **are** **relevant** **to** **GNSS** **satellite**

**almanacs** **or** **ephemeris.**

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*COMNAV* *OEM* *BOARD* *REFERENCE* *MANUAL*

*Chapter* *4.* *Log* *Messages*

**(2)** **As** **for** **each** **log** **message** **listed** **in** **this** **table,** **if** **‘ONTIME’** **trigger** **is** **chosen** **for**

**it,** **receiver/OEM** **board** **will** **output** **the** **message** **which** **only** **contains** **ONE**

**satellite’s** **data** **(e.g.** **one** **satellite** **ephemeris)** **for** **each** **sending.**

**(3)** **If** **ONCHANGED/ONTRACKED** **trigger** **is** **used,** **receiver/OEM** **board** **will**

**output** **the** **message** **containing** **all** **valid** **satellites’** **data** **for** **the** **first** **time**

**sending.** **After** **first** **sending,** **only** **those** **valid** **satellites** **data** **which** **have**

**changed** **or** **just** **be** **tracked** **since** **last** **sending,** **will** **be** **output.**

**4**

**.1.5** **Examples**

For example, if the receiver supports 5 Hz logging, the minimum logging period is 1/5 Hz or 0.2

s. The following are valid examples for a synchronous or asynchronous log, on a receiver that

can log at rates up to 5 Hz:

log bestposb 0.2

[5 Hz]

log bestposb 0.5

[2 Hz]

log bestposb ontime 1

log bestposb ontime 2

log bestposb ontime 10

[1 Hz]

[0.5 Hz]

[0.1 Hz]

**4**

**.2** **PREDEFINED** **LOG** **MESSAGES**

**4**

**.2.1** **Almanacs** **and** **Ephemeris**

This section defines those log messages which contains raw or decoded almanacs and

ephemeris of GNSS satellites.

*Attention* *please,* *user* *can* *refer* *to* ***Table*** **25** ***to*** ***get*** ***more*** ***information*** ***on*** ***how*** ***to*** ***properly*** ***use***

***ONCHANGED/ONTRACKED*** ***trigger*** ***for*** ***almanacs*** ***and*** ***ephemeris*** ***log*** ***messages.***

**4**

**.2.1.1** **BD2EPHEM**

**BD2** **Ephemeris**

**Description**

This message contains the BD2 ephemeris parameters.

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*COMNAV* *OEM* *BOARD* *REFERENCE* *MANUAL*

*Chapter* *4.* *Log* *Messages*

*Message* *ID*

7

1

*Recommended* *Input*

*Supported* *Format*

*log* *bd2ephemb* *onchanged*

*binary*

**Reply** **(Binary)**

Refer to *4.2.1.9.*

**4**

**.2.1.2** **BD3EPHEM**

**BD3** **Ephemeris**

**Description**

This message contains the BD3 ephemeris parameters.

*Message* *ID*

7

2

*Recommended* *Input*

*Supported* *Format*

*log* *bd3ephemb* *onchanged*

*binary*

**Reply** **(Binary)**

Field

Binary Binary

Field Type

Data Description

Log Header

Format

uchar

#

Byte

Offset

BD3EPHEMEM

Header

Prn

**1**

H

0

**2**

**3**

Satellite PRN number (1-63)

Ephemeris reception ID

Satellite Orbit Type

uchar

uchar

1

1

H

Valid

H+1

**4**

sattype

uchar

1

H+2

0

1 : GEO , 10 : IGOS , 11 : MEO

**5**

**6**

**7**

**8**

**9**

health

URAI

Satellite health indicator

User distance accuracy index

Issue of data Ephemeris

Issue of data clock

uchar

uchar

uchar

uchar

uchar

1

1

1

1

1

H+3

H+4

H+5

H+6

H+7

IODE

IODC

BRsv0

Reserved

Signal integrity identification

(0 : normal state , 1 : abnormal state)

System warning sign

**1**

**0**

**1**

SIF

uchar

1

H+8

**1**

AIF

(0 : This signal SISMAI is effective , 1 : This uchar

signal SISMAI is invalid)

1

H+9

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Field

Binary Binary

Field Type

Data Description

Format

#

**12**

**13**

**14**

**15**

**16**

**17**

**18**

**19**

Byte

1

Offset

H+10

H+11

H+12

H+13

H+14

H+15

H+16

H+20

BRsv1

BRsv2

BRsv3

BRsv4

BRsv5

BRsv6

toe

Reserved

uchar

uchar

uchar

uchar

uchar

uchar

uint

Reserved

1

Reserved

1

Reserved

1

Reserved

1

Reserved

1

Eph time

4

toc

Time of clock-para

uint

4

The deviation of the major axis at the

reference time from the reference value

Rate of change of the major axis

The difference between the average

**2**

**2**

**0**

**1**

Delt\_A

Dot\_A

double

double

8

8

H+24

H+32

**2**

**2**

Delt\_n0

angular velocity of the satellite and the double

calculated value at the reference time

8

H+40

The rate of change of the difference

between the average angular velocity of

double

**2**

**2**

**3**

**4**

Dot\_n0

M0

8

8

H+48

H+56

the satellite and the calculated value at the

reference time

The Angle of the plane near the reference

double

moment

**2**

**2**

**5**

**6**

e

Eccentricity ratio

double

double

8

8

H+64

H+72

w

Near-geocentric amplitude

Longitude of ascending node of orbit plane

at weekly epoch

**27**

Omega0

double

8

H+80

**28**

**29**

**30**

i0

Inclination angle at ref. times.

The rate of the right ascension

The rate of the orbit inclination

Amplitude of the cosine harmonic

double

double

double

8

8

8

H+88

H+96

H+104

Omega\_dot

i\_dot

**3**

**3**

**1**

**2**

Cuc

Cus

correction term to the augument of double

latitude

8

8

H+112

H+120

Amplitude of the sine harmonic correction

double

term to the augument of latitude

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Field

Binary Binary

Field Type

Crc

Data Description

Format

double

#

Byte

Offset

Amplitude of the cosine harmonic

correction term to the orbit radius

Amplitude of the sine harmonic correction

term to the orbit radius

**3**

**3**

**4**

**5**

**6**

8

H+128

**3**

**3**

**3**

Crs

Cic

Cis

double

double

double

8

8

8

H+136

H+144

H+152

Amplitude of the cosine harmonic

correction term to the angle of inclination.

Amplitude of the sine harmonic correction

term to the angle of inclination.

Deviation coefficient of satellite clock

Drift coefficient of satellite clock

Drift rate coefficient of satellite clock

Group delay differential of the B1C pilot

component

**3**

**3**

**3**

**7**

**8**

**9**

a0

a1

a2

double

double

double

8

8

8

H+160

H+168

H+176

**4**

**4**

**0**

**1**

tgdB1Cp

tgdB2ap

double

double

8

8

H+184

H+192

Group delay differential of the B2a pilot

component

Group delay differential between the B1C

data and pilot components

**4**

**4**

**2**

**3**

tgdB1Cd

CRC

double

Hex

8

4

H+200

H+208

32-bit CRC Code

**4**

**.2.1.3** **BD3RAWNAVSUBFRAME**

**BD3** **Original** **Text** **Subframe**

4

.2.1.4 **Description**

4

.2.1.5 This text is the original navigation message data of BD3 (B1C only) after the solution

interleaving. According to the beidou satellite navigation system space interface

control file (public service signal B1C (version 1.0)), the message is defined as the

following format:

*Message* *ID*

*1*

*57*

*Recommended* *Input*

*Supported* *Format*

*log* *bd3rawnavsubframeb* *onchanged*

*binary*

*4*

*.2.1.6* **Reply** **(Binary)**

**Binary** **Binary**

Field#

Field Type

**Data** **Description**

**Format**

**Byte**

**Offset**

**1**

BD3RAWNAVSUBFRAM Log header

H

0

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*Chapter* *4.* *Log* *Messages*

**Binary** **Binary**

Field#

Field Type

**Data** **Description**

**Format**

**Byte**

**Offset**

E header

**2**

**3**

Signal channel

Satellite ID

Signal channel number

Satellite ID

Ulong

Ulong

4

4

H

H+4

The data source

(0 : B1C Signal data

**4**

**5**

Data source

Enum

4

H+8

1

: B2a Signal data)

Primitive

navigation

text

Raw subframe data

Hex[110] 110

H+12

subframe[Note](#br92)

**6**

**7**

CRC32

32-bit CRC (ASCII and Binary only)

Sentence terminator (ASCII only)

Hex

-

4

-

H+122

-

[CR][LF]



*Note:*The high two bits of the first byte of the fifth field of this text are invalid, and the

subframe data starts at the third bit.

**4**

**.2.1.7** **BD2RAWALM**

**Raw** **BD2** **Almanac**

**Description**

This message contains raw almanac sub frames received from BDS satellites.

*Message* *ID*

*7*

*41*

*Recommended* *Input*

*Supported* *Format*

*log* *bd2rawalmb* *ontime* *1*

*binary*

**Reply** **(Binary)**

Binary

Byte

Field#

Field Type

Data Description

Format

Binary Offset

**1**

**2**

**3**

**4**

**5**

**6**

BD2RAWALM header

Ref week

Ref secs

Log header

Almanac reference week number Ulong

H

4

0

H

Almanac reference time (s)

Number of subframes to follow

SV ID (satellite vehicle ID)

Subframe page data *Note*

Ulong

Ulong

UShort

Hex

4

H+4

H+8

H+12

H+14

Subframes

svid

4

2

data

40

**7**

**...**

Next subframe offset = H + 12 + (subframe \* 42)

H+12+(42 \*

subframes)

**variable** xxxx

32-bit CRC (ASCII and Binary only) Hex

4

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Binary

Field#

Field Type

Data Description

Format

-

Binary Offset

-

Byte

-

**variable** [CR][LF]

Sentence terminator (ASCII only)



***Note*.** **Length** **of** **one** **subframe** **almanac** **is** **10** **words** **(30** **bits** **per** **word,** **MSB** **first).**

**Subframe** **4** **Page** **1~24** **and** **Subframe** **5** **Page** **1~6** **contain** **30** **frames** **BDS**

**satellites’** **almanac** **(Refer** **to** **Beidou-ICD-1.0** **table** 5-11-1 and 5-11-2). One word

(30 bits) is **split** **into** **4** **bytes** **data** **(first** **two** **bits** **of** **1st** **byte** **is** **unused),** **then** **one**

**almanac** **subframe** **data** **is** **expressed** **in** **40** **bytes** **as** **following** **Figures** **shows:**

**4**

**.2.1.8** **BD2RAWEPHEM**

**Raw** **BD2** **Ephemeris**

**Description**

This log contains the raw ephemeris of BD2 satellites, and each raw ephemeris message is 400

bytes long. Each ephemeris page is 300 bits long, and the log contains all bits, although some

bits are not used in current definition. For GEO satellites, ephemeris bits are all in sub frame 1,

which is composed of 10 pages, each page is 10 words long and there are 30 bits in each word.

Notice, just higher 150 valid bits are used in page, so all pages are needed to be decoded. For

IGSO and MEO satellites, ephemeris bits are in sub frame 1, 2 and 3 and each sub frame is 10

words long and all 300 bits are valid, the other sub frames are invalid in the log. The page or

sub frame structure in bytes arrays are showed in the below figure. If detailed information

needed, please refer to BD2 ICD.

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*COMNAV* *OEM* *BOARD* *REFERENCE* *MANUAL*

*Chapter* *4.* *Log* *Messages*

*Message* *ID*

*4*

*12*

*Recommended* *Input*

*Supported* *Format*

*log* *bd2rawephb* *onchanged*

*binary*

**Reply** **(Binary)**

Binary

Byte

Binary

Offset

Field# Field Type

Data Description

Format

**1**

**2**

**3**

**4**

**5**

**6**

**…**

**7**

**8**

**9**

BD2RAWEPHEM header Log header

H

4

0

prn

Satellite PRN number

Ulong

H

ref week

Ephemeris reference week number Ulong

4

H+4

H+8

H+12

H+52

…

ref secs

Ephemeris reference time (s)

Sub-frame 1 or page1 data

Sub-frame 2 or page2 data

…

Ulong

Hex

Hex

…

4

Subframe1 or page1

subframe2 or page2

…

40

40

…

40

4

Subframe10 or page 10 Sub-frame 10 or page10 data

Hex

Hex

-

H+372

H+412

-

xxxx

32-bit CRC (ASCII and Binary only)

Sentence terminator (ASCII only)

[CR][LF]

-

**4**

**.2.1.9** **BDSRAWNAVSUBFRAME**

**Description**

**BD2** **Original** **Navigation** **Text** **Subframe**

4

.2.1.10This paper contains BD2 original subframe data with the check bits removed, and only

outputs the subframes that pass the check.

*Message* *ID*

*1*

*695*

*Recommended* *Input*

*Supported* *Format*

*Log* *bdsrawnavsubframeb* *onchanged*

*ASCII,binary*

**Reply** **(Binary)**

Binary Binary

Field# Field Type

Data Description

Format

Byte

Offset

BD2RAWNA

**1**

VSUBFRAME Log header

header

H

0

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*Chapter* *4.* *Log* *Messages*

Binary Binary

Field# Field Type

Data Description

Format

Ulong

Byte

Offset

Signal

**2**

Signal channel number

Satellite PRN number

4

H

channel

**3**

**4**

**5**

Satellite ID

Ulong

Enum

Ulong

4

4

4

H+4

Data source Data source, refer to *Table* 26

Subframe ID Subframe number

Raw

H+8

H+12

Hex[28

]

**6**

subframe

data

Original subframe data

28

H+16

**7**

**8**

xxxxx

32-bit CRC (ASCII and Binary only)

Sentence terminator (ASCII only)

Hex

-

4

-

H+44

-

[CR][LF]

**Table** **26.Signal** **source**

**ASCII**

**BINARY** **DESCRIPTION**

**B1D1**

**B1D2**

**B2D1**

**B2D2**

0

The data comes from B1/D1 signal

1

The data comes from B1/D2 signal

The data comes from B2/D1 signal

The data comes from B2/D2 signal

65536

65537

**4**

**.2.1.11**

**GLOEPHEMERIS**

**Decoded** **GLONASS** **Ephemeris**

**Description**

This log contains GLONASS ephemeris information. GLONASS ephemerides are referenced to

the PZ90.02 geodetic datum. No adjustment between the GPS and GLONASS reference frames

are needed to perform PVT solution. Messages are grouped and transmitted. One message per

satellite ID.

*Message* *ID*

*7*

*23*

*Recommended* *Input*

*Supported* *Format*

*Log* *gloephemerisa* *onchanged*

*ASCII,binary*

**Reply** **(Binary)**

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*COMNAV* *OEM* *BOARD* *REFERENCE* *MANUAL*

*Chapter* *4.* *Log* *Messages*

Binary Binary

Field# Field Type

Data Description

Log header

Format

Byte

Offset

GLOEPHEME

**1**

H

0

RIS header

**2**

**3**

sloto

freqo

Slot information offset - PRN identification (Slot + 37). Ushort

2

2

H

Frequency channel offset in the range 0 to 20

Satellite type where

Ushort

H+2

0

1

2

= GLO\_SAT

**4**

sat type

Uchar

1

H+4

= GLO\_SAT\_M (M type)

= GLO\_SAT\_K (K type)

**5**

**6**

Reserved

e week

1

2

H+5

H+6

Reference week of ephemeris (GPS reference time)

Reference time of ephemeris (GPS reference time) in

ms

Ushort

Ulong

**7**

**8**

**9**

e time

4

4

2

H+8

Integer seconds between GPS and GLONASS time. A

t offset

positive value implies GLONASS is ahead of GPS Ulong

reference time.

H+12

H+16

Calendar number of day within 4 year interval starting

Nt

Ushort

at Jan 1 of a leap year

**1**

**1**

**0**

**1**

1

1

H+18

H+19

Reserved

issue

1

5

minute interval number corresponding to

**1**

**2**

Ulong

Ulong

4

H+20

ephemeris reference time

Ephemeris health where

0-3 = GOOD

**1**

**3**

health

4

H+24

4

-15 = BAD

X coordinate for satellite at reference time (PZ-90.02),

in meters

**1**

**1**

**1**

**1**

**4**

**5**

**6**

**7**

pos x

pos y

pos z

vel x

Double

Double

Double

Double

8

8

8

8

H+28

H+36

H+44

H+52

Y coordinate for satellite at reference time (PZ-90.02),

in meters

Z coordinate for satellite at reference time (PZ-90.02),

in meters

X coordinate for satellite velocity at reference time

(PZ-90.02), in meters/s

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*COMNAV* *OEM* *BOARD* *REFERENCE* *MANUAL*

*Chapter* *4.* *Log* *Messages*

Binary Binary

Field# Field Type

Data Description

Format

Double

Byte

Offset

Y coordinate for satellite velocity at reference time

(PZ-90.02), in meters/s

**1**

**1**

**2**

**2**

**2**

**2**

**8**

**9**

**0**

**1**

**2**

**3**

vel y

8

H+60

Z coordinate for satellite velocity at reference time

(PZ-90.02), in meters/s

vel z

Double

Double

Double

Double

Double

8

8

8

8

8

H+68

H+76

H+84

H+92

H+100

X coordinate for lunisolar acceleration at reference

time (PZ-90.02), in meters/s/s

LS acc x

LS acc y

LS acc z

tau\_n

Y coordinate for lunisolar acceleration at reference

time (PZ-90.02), in meters/s/s

Z coordinate for lunisolar acceleration at reference

time (PZ-90.02), in meters/s/s

Correction to the nth satellite time t\_n relative to

GLONASS time t\_c, in seconds

Time difference between navigation RF signal

**2**

**4**

delta\_tau\_n transmitted in L2 sub-band and navigation RF signal Double

transmitted in L1 sub-band by nth satellite, in seconds

8

H+108

**2**

**2**

**5**

**6**

gamma

Frequency correction, in seconds/second

Time of frame start (since start of GLONASS day), in

seconds

Double

8

4

H+116

H+124

Tk

Ulong

**2**

**2**

**2**

**7**

**8**

**9**

P

Technological parameter

User range

Ulong

Ulong

Ulong

4

4

4

H+128

H+132

H+136

Ft

age

Age of data, in days

**3**

**0**

Flags

Ulong

4

H+140

Information flags, refer to Table 27

**3**

**3**

**1**

**2**

xxxx

32-bit CRC (ASCII and Binary only)

Sentence terminator (ASCII only)

Hex

-

4

-

H+144

-

[CR][LF]

**Table** **27.GLOEPHEMERIS** **Info** **Flags**

**NIBBLE#** **BIT#**

**MASK**

**DESCRIPTION**

**RANGE** **VALUE**

0

1

(LSB) 0x00000001 P1 Flag: Time Interval between adjacent iIssue(fb) 00: 0 minutes

**N0**

0x00000002 values

01: 30 minutes

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*COMNAV* *OEM* *BOARD* *REFERENCE* *MANUAL*

*Chapter* *4.* *Log* *Messages*

**NIBBLE#** **BIT#**

**MASK**

**DESCRIPTION**

**RANGE** **VALUE**

1

1

0: 45 minutes

1: 60 minutes

2

3

0x00000004 P2 Flag: Oddness or Evenness of iIssue (fb) value

0 = Even, 1 = Odd

P3 Flag: Number of Satellites with almanac

0x00000008

0 = Four, 1 = Five

information within current subframe

**N1** **–** **N7** 4 - 31

…

Reserved

**4**

**.2.1.12**

**GLORAWEPHEM**

**Raw** **GLONASS** **Ephemeris**

**Description**

This log contains the raw ephemeris of GLONASS satellites.

*Message* *ID*

*7*

*92*

*Recommended* *Input*

*Supported* *Format*

*log* *glorawephemb* *onchanged*

*Binary*

**Reply** **(Binary)**

Binary Binary

Field#

Field Type

GLORAWEPH

Data Description

Format

Byte

Offset

**1**

Log header

H

0

EM header

Slot information offset - PRN identification

(Slot + 37).

**2**

sloto

Ushort

2

H

**3**

**4**

**5**

freqo

Frequency channel offset in the range 0 to 20

Signal channel number

Ushort

Ulong

GPSec

2

4

4

H+2

H+4

H+8

sigchan

week

GPS reference week, in weeks

GPS reference time, in milliseconds

(binarydata) or seconds (ASCII data)

Number of records to follow

**6**

time

Ulong

4

H+12

**7**

**8**

**9**

#recs

Ulong

Uchar[]

Uchar

4

H+16

H+20

H+31

string

GLONASS data string

11

1

Reserved

**1**

**0…**

Next record offset = H+20+(#recs x 12)

**variable** xxxx

32-bit CRC (ASCII and Binary only)

Hex

4

H+20+(#r

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*COMNAV* *OEM* *BOARD* *REFERENCE* *MANUAL*

*Chapter* *4.* *Log* *Messages*

Binary Binary

Field#

Field Type

Data Description

Format

-

Byte

Offset

ecsx12)

**variable** [CR][LF]

Sentence terminator (ASCII only)

-

-

***Notice:***

1

4

. GLORAWEPH message includes four GLONASS raw ephemeris string, which is shown in the figure

.2a.

2

. Each of the first four strings is from m4 to KX8 including 84-bits. The corresponding string is set

with Bit84 ~ Bit1 from higher-order to lower-order bit.

3

. According to the GLORAWEPHEM message, the 8th data field “string GLONASS data string”

includes 88 bits of 11 bytes. The first 4-bits is 0000, and the left 84-bits are reserved to store the

Bit84~Bit1 of one GLONASS raw ephemeris string. After the 11th byte, GLORAWEPHEM message is

reserved with 1 byte as shown in the following figure.

**4**

**.2.1.13**

**GPSEPHEM**

**GPS** **Ephemeris**

**Description**

A single set of decoded GNSS ephemeris whose message ID is different from NovAtel®

definition.

*Message* *ID*

*7*

*1*

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*COMNAV* *OEM* *BOARD* *REFERENCE* *MANUAL*

*Chapter* *4.* *Log* *Messages*

*Recommended* *Input*

*Supported* *Format*

*log* *gpsephemb* *onchanged*

*binary*

**Reply** **(Binary)**

**Field**

**Binary** **Binary**

**Field** **Type**

**Data** **Description**

**Format**

**#**

**Byte**

**Offset**

GPSEPHEMEM

B/BD2EPHEME

M

**1**

Log Header

H

0

Header

**2**

**3**

**4**

wSize

Struct size

unsigned short

2

1

1

H+0

H+2

H+3

blFlag

Eph valid flag

BYTE

BYTE

bHealth

Satellite health flag

Satellite prn id (1~177), GPS: 1~32, BD2:

**5**

ID

BYTE

1

H+4

1

41~177

**6**

**7**

**8**

**9**

bReserved

uMsgID

reserved

BYTE

1

2

2

2

H+5

H+6

H+8

H+10

ignored

unsigned short

short

m\_wIdleTime

iodc

ignored

Issue of data clock

Reference to URA in paga-84 of GPS ICD

*IS-GPS-200-vD*

short

**1**

**0**

accuracy

short

2

H+12

**1**

**1**

**1**

**1**

**1**

**1**

**1**

**1**

**1**

**1**

**2**

**3**

**4**

**5**

**6**

**7**

**8**

**9**

week

iode

tow

toe

Gps week

unsigned short

int

2

4

4

8

8

8

8

8

8

H+14

H+16

H+20

H+24

H+32

H+40

H+48

H+56

H+64

Issue of data

time of eph be sent

Eph time

int

double

double

double

double

double

double

toc

Time of clock-para

Time drift (s)

af2

af1

Time speed (s)

af0

Time offset (s)

Ms0

Mean Anomaly

Mean motion difference from computed

value

**2**

**0**

deltan

double

8

H+72

**2**

**2**

**1**

**2**

es

Eccentricity

double

double

8

8

H+80

H+88

roota

square root

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*COMNAV* *OEM* *BOARD* *REFERENCE* *MANUAL*

*Chapter* *4.* *Log* *Messages*

**Field**

**Binary** **Binary**

**Field** **Type**

**Data** **Description**

**Format**

**#**

**Byte**

**Offset**

Longitude of ascending node of orbit plane

at weekly epoch

**2**

**3**

omega0

double

8

H+96

**2**

**2**

**2**

**2**

**4**

**5**

**6**

**7**

i0

Inclination angle at ref. times.

Argument of perigee

double

double

double

double

8

8

8

8

H+104

H+112

H+120

H+128

ws

omegaot

itoet

Rate of right ascension

Rate of inclination angle

Amplitude of the cosine harmonic

**2**

**8**

Cuc

correction term to the augument of double

latitude

8

H+136

Amplitude of the sine harmonic correction

double

**2**

**3**

**3**

**3**

**3**

**3**

**9**

**0**

**1**

**2**

**3**

**4**

Cus

Crc

Crs

Cic

Cis

8

8

8

8

8

8

H+144

H+152

H+160

H+168

H+176

H+184

term to the augument of latitude

Amplitude of the cosine harmonic

double

correction term to the orbit radius

Amplitude of the sine harmonic correction

double

term to the orbit radius

Amplitude of the cosine harmonic

double

correction term to the angle of inclination.

Amplitude of the sine harmonic correction

double

term to the angle of inclination.

Reference to paga-90 of GPS ICD

tgd

double

*IS-GPS-200-vD*

**3**

**3**

**5**

**6**

tgd2

CRC

Only used in BD2 satellite, refer to BD2-ICD. double

8

4

H+192

H+200

32-bit CRC Code

Hex

**4**

**.2.1.14**

**GALEPHEMERIS**

**Galileo** **Ephemeris**

**Description**

This message contains the Galileo ephemeris parameters.

*Message* *ID*

*1*

*122*

*Recommended* *Input*

*Supported* *Format*

*log* *galephemb* *ontime* *60*

*binary*

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*COMNAV* *OEM* *BOARD* *REFERENCE* *MANUAL*

*Chapter* *4.* *Log* *Messages*

**Reply** **(Binary)**

**Field**

**Binary** **Binary**

**Field** **Type**

**Data** **Description**

**Format**

**#**

**Byte**

**Offset**

GALEPHEMERI

SB

**1**

Log Header

H

0

Header

Satld

**2**

**3**

**4**

Satellite identifier（1-36）

Ulong

BOOL

BOOL

4

4

4

H

FNAVReceived Indicates FNAV almanac data received

INAVReceived Indicates INAV almanac data received

H+4

H+8

E1B health status bits (only valid if

**5**

**6**

**7**

E1BHealth

Uchar

Uchar

Uchar

1

1

1

H+12

H+13

H+14

INAVReceived is TRUE)

E5a health status bits(only valid if

E5aHealth

FNAVReceived is TRUE)

E5b health status bits (only valid if

E1bHealth

INAVReceived is TRUE)

**8**

**9**

**1**

**1**

**1**

**1**

**1**

**1**

E1BDVS

E5aDVS

E5bDVS

SISA

E1B data validity status

Uchar

Uchar

Uchar

Uchar

Uchar

Ulong

Ulong

Double

1

1

1

1

1

4

4

8

H+15

H+16

H+17

H+18

H+19

H+20

H+24

H+28

E5a data validity status

**0**

**1**

**2**

**3**

**4**

**5**

E5b data validity status

Signal inspace accuracy (unitless)

Reserved

IODNav

T0e

Issue of data ephemeris

Ephemeris reference time (s)

square root

RootA

Mean motion difference from computed

value

**1**

**6**

DeltaN

Double

8

H+36

**1**

**1**

**1**

**7**

**8**

**9**

M0

Mean anomaly at ref time (radians)

Eccentricity (dimensionless)

Argument of perigee (radians)

Amplitude of the cosine harmonic

Double

Double

Double

8

8

8

H+44

H+52

H+60

Ecc

Omega

**2**

**0**

Cuc

correction term to the augument of Double

latitude

8

H+68

Amplitude of the sine harmonic correction

Double

**2**

**2**

**1**

**2**

Cus

Crc

8

8

H+76

H+84

term to the augument of latitude

Amplitude of the cosine harmonic Double

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*COMNAV* *OEM* *BOARD* *REFERENCE* *MANUAL*

*Chapter* *4.* *Log* *Messages*

**Field**

**Binary** **Binary**

**Field** **Type**

**Data** **Description**

**Format**

**#**

**Byte**

**Offset**

correction term to the orbit radius

Amplitude of the sine harmonic correction

term to the orbit radius

**2**

**2**

**2**

**3**

**4**

**5**

Crs

Cic

Cis

Double

Double

Double

8

8

8

H+92

Amplitude of the cosine harmonic

correction term to the angle of inclination.

Amplitude of the sine harmonic correction

term to the angle of inclination.

H+100

H+108

**2**

**2**

**6**

**7**

I0

Inclinationangle at ref time (radians)

Rate of inclinationangle (radians/s)

Longitude of ascending node of orbital

plane at weekly epoch(radians)

Double

Double

8

8

H+116

H+124

IDot

Omega0

Double

Double

Double

8

H+132

H+140

H+148

**2**

**2**

**8**

**9**

OmegaDot

FNAVT0c

Rate of right ascension(radians/s)

Clock difference parameter reference

time(only valid if FNAV Received is TRUE)

SV clock bias correctioncoefficient from the

F/NAV message (s)

8

4

8

8

8

8

8

**3**

**3**

**3**

**3**

**3**

**3**

**0**

**1**

**2**

**3**

**4**

**5**

FNAVAf0

FNAVAf1

FNAVAf2

INAVT0c

INAVAf0

INAVAf1

Ulong

H+152

H+160

H+168

H+176

H+180

H+188

SV clock drift correctioncoefficient from the

F/NAV message (s/s)

Double

Double

Double

Double

Double

SV clock drift rate correctioncoefficient

from the F/NAV message (s/s^2)

Clock difference parameter reference

time(only valid if INAV Received is TRUE)

SV clock bias correctioncoefficient from the

I/NAV message (s)

SV clock drift correctioncoefficient from the

I/NAV message (s/s)

SV clock drift rate correctioncoefficient

from the I/NAV message (s/s^2)

**3**

**3**

**3**

**3**

**6**

**7**

**8**

**9**

INAVAf2

E1E5aBGD

E1E5bBGD

xxxx

Double

Double

Double

Hex

8

8

8

4

H+196

H+204

H+212

H+220

E1, E5a broadcast group delay

E1, E5b broadcast group delay(only valid if

INAV Received is TRUE)

32-bit CRC (ASCII and Binary only)

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*COMNAV* *OEM* *BOARD* *REFERENCE* *MANUAL*

*Chapter* *4.* *Log* *Messages*

**Field**

**Binary** **Binary**

**Field** **Type**

**Data** **Description**

**Format**

**#**

**4**

**Byte**

**Offset**

**0**

[CR][LF]

Sentence terminator (ASCII only)

-

-

-

**4**

**.2.1.15**

**GALFNAVRAWPAGE**

**FNAV** **data**

Page

**Description**

This log contains the raw Galileo FNAV page data.

*Message* *ID*

*1*

*413*

*Recommended* *Input*

*Supported* *Format*

*log* *galfnavrawpageb* *onchanged*

*binary*

**Reply** **(Binary)**

**Field**

**Binary** **Binary**

**Field** **Type**

**Data** **Description**

**Format**

**#**

**Byte**

**Offset**

GALFNAVRAW

**1**

PAGE

Log Header

H

0

Header

**2**

**3**

Signal channel Signal channel providing the data

Ulong

Ulong

4

4

H

SVID

Raw

data

ID

SVID of transmitting satellite

frame Raw F/NAV page (214bits).Does not include

CRC or Tail bits

H+4

**4**

Hex[27]

27

H+8

**5**

**6**

32-bit CRC (ASCII and Binary only)

Sentence terminator (ASCII only)

Hex

-

4

-

H+35

-

[CR][LF]

**4**

**.2.1.16**

**GALINAVRAWWORD**

**Raw** **Galileo** **INAV** **word** **data**

**Description**

This log contains the raw Galileo INAV word data.

*Message* *ID*

1

414

*Recommended* *Input*

*Supported* *Format*

*log* *galinavrawwordb* *onchanged*

*binary*

**Reply** **(Binary)**

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*COMNAV* *OEM* *BOARD* *REFERENCE* *MANUAL*

*Chapter* *4.* *Log* *Messages*

**Field**

**Binary** **Binary**

**Field** **Type**

**Data** **Description**

**Format**

**#**

**Byte**

**Offset**

GALINAVRAW

WORD

**1**

Log Header

H

0

Header

**2**

**3**

**4**

Signal channel Signal channel providing the data

Ulong

Ulong

Enum

4

4

4

H

SVID

SVID of transmitting satellite

H+4

H+8

Signal type

refer to *Table* 28

Raw

data

frame Raw F/NAV page (214bits).Does not include

CRC or Tail bits

**5**

Hex[16]

16

H+12

3

2-bit CRC (ASCII and Binary only)

**6**

**7**

ID

Hex

-

4

-

H+28

-

[CR][LF]

Sentence terminator (ASCII only)

**Table** **28** **Signal** **type**

**ASCII**

**SIGNAL** **TYPE**

**DESCRIPTION**

**1**

**1**

**1**

**1**

**1**

**1**

**1**

**1**

**1**

**1**

**0433** GALE1

Galileo E1

**0466** GALE5A

**0499** GALE5B

Galileo E5A

Galileo E5B

**0532** GALALTBOC

**0565** GALE6C

Galileo ALT-BOC

Galileo E6C

**0572** GALE6B

Galileo E6B

**4753** QZSS L1CA

**4760** QZSS L1Cp

**4787** QZSS L2CM

**4891** QZSS L6P

QZSS L1 C/A -code

QZSS L1C P-code

QZSS L2 C/A-code

QZSS L6P

**4**

**.2.1.17**

**Description**

This log contains the QZSS raw ephemeris informationfor subframes.

**QZSSRAWSUBFRAM**

**QZSS** **Raw** **ephemeris** **information**

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*COMNAV* *OEM* *BOARD* *REFERENCE* *MANUAL*

*Chapter* *4.* *Log* *Messages*

*Message* *ID*

1330

*Recommended* *Input*

*Supported* *Format*

*log* *qzssrawsubframeb* *onchanged*

*binary*

**Reply** **(Binary)**

**Field**

**Binary** **Binary**

**Field** **Type**

**Data** **Description**

**Format**

**#**

**Byte**

**Offset**

QZSSRAWSUB

FRAME

**1**

Log Header

H

0

Header

**2**

**3**

**4**

PRN

Satellite PRN number

Subframe ID

Ulong

4

H

Subframe ID

Data

Ulong

4

H+4

H+8

Raw subframe data

Hex[30]

32a

Signal channel number that the frame was

decoded on

**5**

Chan

Ulong

4

H+40

3

2-bit CRC (ASCII and Binary only)

**6**

**7**

xxxx

Hex

-

4

-

H+44

-

[CR][LF]

Sentence terminator (ASCII only)



***a***：***In*** ***the*** ***binary*** ***log*** ***case,an*** ***additional*** ***2*** ***bytes*** ***of*** ***padding*** ***are*** ***added*** ***to*** ***maintain*** ***4-byte*** ***alignment***

**4**

**.2.1.18**

**QZSSRAWEPHEM**

**QZSS** **Raw** **ephemeris** **information**

**Description**

This log contains the QZSS raw ephemeris informationfor.

*Message* *ID*

*1*

*331*

*Recommended* *Input*

*Supported* *Format*

*log* *qzssrawephema* *onchanged*

*binary*

**Reply** **(Binary)**

**Binary** **Binary**

**Field#** **Field** **Type**

**Description**

**Format**

**Byte**

**Offset**

**1**

QZSSRAWEPHEM Log header

H

0

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*COMNAV* *OEM* *BOARD* *REFERENCE* *MANUAL*

*Chapter* *4.* *Log* *Messages*

**Binary** **Binary**

**Field#** **Field** **Type**

**Description**

**Format**

**Byte**

**Offset**

Header

**2**

**3**

**4**

**5**

PRN

Satellite PRN number

Ulong

4

H

Ref week

Ref secs

Subframe1

Subframe2

Subframe3

xxxx

Ephemeris reference week number Ulong

4

H+4

H+8

H+12

H+42

H+72

H+102

-

Ephemeris reference time (s)

Subframe 1 data

Ulong

Hex

Hex

Hex

Hex

-

4

30

30

30

4

Subframe 2 data

Subframe 3 data

**6**

**7**

32-bit CRC (ASCII and Binary only)

Sentence terminator (ASCII only)

[CR][LF]

-

**4**

**.2.1.19**

**RAWGPSSUBFRAME**

**Raw** **GPS** **subframe** **data**

**Description**

This log contains the raw subframe data without parity bits,only 240bits per frame, and only

outputs the sub-frames passing the check.

*Message* *ID*

*2*

*5*

*Recommended* *Input*

*Supported* *Format*

*log* *rawgpssubframeb* *onchanged*

*binary*

**Reply** **(Binary)**

Binary Binary

Field#

Field Type

RAWGPSSUBFRAM

Data Description

Format

Byte

Offset

**1**

E

Log header

H

Header

**Decode#**

PRN

**2**

**3**

**4**

**5**

Frame decoder number

Satellite PRN number

Ulong

Ulong

Ulong

4

4

4

H

H+4

H+8

H+12

**Subframe** **ID**

Data

Subframe ID

Raw subframe data

Hex[30] 32a

Signal channel number that the

frame was decoded on

32-bit CRC (ASCII and Binary only)

**6**

**7**

Signal channel

xxxx

Ulong

Hex

4

4

H+14

H+48

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CNT-OEM-RM001, Rev 1.8

*COMNAV* *OEM* *BOARD* *REFERENCE* *MANUAL*

*Chapter* *4.* *Log* *Messages*

Binary Binary

Field#

Field Type

[CR][LF]

Data Description

Format

-

Byte

-

Offset

-

**8**

Sentence terminator (ASCII only)



***a:In*** ***thebinarylogcase,an*** ***additional2*** ***bytesofpaddingareaddedtomaintain*** ***4-bytealignment.***

**4**

**.2.1.20**

**RAWALM**

**Raw** **Almanac** **Information**

**Description**

This message contains raw almanac sub frames received from GPS satellite.

*Message* *ID*

*7*

*4*

*Recommended* *Input*

*Supported* *Format*

*log* *rawalmb*

*binary*

**Reply** **(Binary)**

Binary Binary

Field#

Field Type

RAWALM header

Data Description

Format

Byte

H

Offset

0

**1**

**2**

**3**

**4**

**5**

**6**

Log header

ref week

ref secs

subframes

svid

Almanac reference week number

Almanac reference time (s)

Number of subframes to follow

SV ID (satellite vehicle ID)

Subframe page data

Ulong

Ulong

Ulong

UShort

Hex

4

H

4

H+4

H+8

H+12

H+14

4

2

data

30

**7**

**...**

Next subframe offset = H + 12 + (subframe x 32)

H + 12 + (32

x subframes)

-

**variable** xxxx

32-bit CRC (ASCII and Binary only)

Sentence terminator (ASCII only)

Hex

-

4

-

**variable** [CR][LF]

**4**

**.2.1.21**

**RAWEPHEM**

**Raw** **Ephemeris** **Information**

**Description**

This message contains raw ephemeris information received from GPS satellite.

*Message* *ID*

*4*

*1*

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*COMNAV* *OEM* *BOARD* *REFERENCE* *MANUAL*

*Chapter* *4.* *Log* *Messages*

*Recommended* *Input*

*log* *rawephemb* *onchanged*

*binary*

*Supported* *Format*

**Reply** **(Binary)**

Binary

Byte

Binary

Offset

Field# Field Type

Data Description

Format

**1**

**2**

**3**

**4**

**5**

**6**

**7**

**8**

**9**

RAWEPHEM header Log header

H

4

0

prn

Satellite PRN number

Ulong

Ulong

Ulong

Hex

H

ref week

ref secs

subframe1

subframe2

subframe3

xxxx

Ephemeris reference week number

Ephemeris reference time (s)

4

H+4

H+8

H+12

H+42

H+72

H+102

-

4

Subframe 1 data, refer to following NOTE

Subframe 2 data, refer to following NOTE

Subframe 3 data, refer to following NOTE

32-bit CRC (ASCII and Binary only)

Sentence terminator (ASCII only)

30

30

30

4

Hex

Hex

Hex

[CR][LF]

-

-



***NOTE*.** **Subframe** **1** **~** **3** **data** **layout**

***Subframe*** ***1:*** ***GPS*** ***Ephemeris*** ***Word1*** ***-Word10***

***Subframe*** ***2:*** ***GPS*** ***Ephemeris*** ***Word11-Word20***

***Subframe*** ***3:*** ***GPS*** ***Ephemeris*** ***Word21-Word30***

**Each** **Word** **has** **24** **bits** **data** **which** **take** **three** **bytes** **of** **subframe** **in** **order.** **Each**

**subframe** **has** **30** **bytes** **to** **hold** **10** **GPS** **ephemeris** **words.**

**4**

**.2.2** **BINEX** **Records** **Data**

This section presents log messages including BINEX record data encapsulated by ComNav

binary message header and CRC-32. Those standard BINEX record messages are defined in

Section *4.3.4*.

**4**

**.2.2.1** **BINEX00DATA**

**BINEX** **Record** **0x00** **Data**

**Description**

This message outputs BINEX Record 0x00 data encapsulated by binary header and CRC-32.

*Message* *ID*

*1*

*10*

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CNT-OEM-RM001, Rev 1.8

*COMNAV* *OEM* *BOARD* *REFERENCE* *MANUAL*

*Chapter* *4.* *Log* *Messages*

*Recommended* *Input*

*log* *binex00datab* *ontime* *10*

*Binary*

*Supported* *Format*

**Reply** **(Binary)**

Binary Binary

Field# Field Type

Data Description

Log header

Format

Byte

Offset

BINEX00DATA

**1**

H

0

header

**2**

**3**

**4**

Record 0x00

xxxx

BINEX Record 0x00 data (L is record length)

32-bit CRC (ASCII and Binary only)

Sentence terminator (ASCII only)

BINEX

Hex

-

L

4

-

H

H + L

-

[CR][LF]

**4**

**.2.2.2** **BINEX0101DATA**

**BINEX** **Record** **0x01-01** **Data**

**Description**

This message outputs BINEX Record 0x01-01 data encapsulated by binary header and CRC-32.

*Message* *ID*

*8*

*1*

*Recommended* *Input*

*Supported* *Format*

*log* *binex0101datab* *ontime* *1*

*Binary*

**Reply** **(Binary)**

Binary Binary

Field# Field Type

Data Description

Format

Byte

Offset

BINEX0101DATA

**1**

Log header

H

0

header

**2**

**3**

**4**

Record 0x01-01

BINEX Record 0x01-01 data (L is record length)

32-bit CRC (ASCII and Binary only)

BINEX

Hex

-

L

4

-

H

xxxx

H + L

-

[CR][LF]

Sentence terminator (ASCII only)

**4**

**.2.2.3** **BINEX0102DATA**

**Description**

This message outputs BINEX Record 0x01-02 data encapsulated by binary header and CRC-32.

**BINEX** **Record** **0x01-02** **Data**

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CNT-OEM-RM001, Rev 1.8

*COMNAV* *OEM* *BOARD* *REFERENCE* *MANUAL*

*Chapter* *4.* *Log* *Messages*

*Message* *ID*

*8*

*2*

*Recommended* *Input*

*log* *binex0102datab* *ontime* *1*

*Binary*

*Supported* *Format*

**Reply** **(BINEX)**

Binary Binary

Field# Field Type

Data Description

Log header

Format

Byte

Offset

BINEX0102DATA

**1**

H

0

header

**2**

**3**

**4**

Record 0x01-02

xxxx

BINEX Record 0x01-02 data (L is record length)

32-bit CRC (ASCII and Binary only)

BINEX

Hex

-

L

4

-

H

H + L

-

[CR][LF]

Sentence terminator (ASCII only)

**4**

**.2.2.4** **BINEX0105DATA**

**BINEX** **Record** **0x01-05** **Data**

**Description**

This message outputs BINEX Record 0x01-05 data encapsulated by binary header and CRC-32.

*Message* *ID*

*8*

*5*

*Recommended* *Input*

*Supported* *Format*

*log* *binex0105datab* *ontime* *1*

*Binary*

**Reply** **(Binary)**

Binary

Byte

Binary

Offset

Field# Field Type

Data Description

Format

BINEX0105DATA

**1**

Log header

BINEX Record 0x01-05 data (L is record length) BINEX

H

0

header

**2**

**3**

**4**

Record 0x01-05

L

4

-

H

xxxx

32-bit CRC (ASCII and Binary only)

Sentence terminator (ASCII only)

Hex

-

H + L

-

[CR][LF]

**4**

**.2.2.5** **BINEX7D00DATA**

**Description**

This message outputs BINEX Record 0x7d-00 data encapsulated by binary header and CRC-32.

**BINEX** **Record** **0x7d-00** **Data**

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CNT-OEM-RM001, Rev 1.8

*COMNAV* *OEM* *BOARD* *REFERENCE* *MANUAL*

*Chapter* *4.* *Log* *Messages*

*Message* *ID*

*1*

*14*

*Recommended* *Input*

*log* *binex7d00datab* *ontime* *1*

*Binary*

*Supported* *Format*

**Reply** **(Binary)**

Binary Binary

Field# Field Type

Data Description

Log header

Format

Byte

Offset

BINEX7D00DATA

**1**

H

0

header

**2**

**3**

**4**

Record 0x7d-00

xxxx

BINEX Record 0x7d-00 data (L is record length) BINEX

L

4

-

H

32-bit CRC (ASCII and Binary only)

Sentence terminator (ASCII only)

Hex

-

H + L

-

[CR][LF]

**4**

**.2.2.6** **BINEX7E00DATA**

**BINEX** **Record** **0x7e-00** **Data**

**Description**

This message outputs BINEX Record 0x7e-00 data encapsulated by binary header and CRC-32.

*Message* *ID*

*1*

*15*

*Recommended* *Input*

*Supported* *Format*

*log* *binex7e00datab* *ontime* *1*

*Binary*

**Reply** **(BINEX)**

Binary Binary

Field# Field Type

Data Description

Format

Byte

Offset

BINEX7E00DATA

**1**

Log header

BINEX Record 0x7e-00 data (L is record length) BINEX

H

0

header

**2**

**3**

**4**

Record 0x7e-00

L

4

-

H

xxxx

32-bit CRC (ASCII and Binary only)

Sentence terminator (ASCII only)

Hex

-

H + L

-

[CR][LF]

**4**

**.2.2.7** **BINEX7F05DATA**

**Description**

This message outputs BINEX Record 0x7f-05 data encapsulated by binary header and CRC-32.

**BINEX** **Record** **0x7f-05** **Data**

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*Message* *ID*

*1*

*20*

*Recommended* *Input*

*log* *binex7f05datab* *ontime* *1*

*Binary*

*Supported* *Format*

**Reply** **(Binary)**

Binary Binary

Field# Field Type

Data Description

Log header

Format

Byte

Offset

BINEX7F05DATA

**1**

H

0

header

**2**

**3**

**4**

Record 0x7f-05

xxxx

BINEX Record 0x7f-05 data (L is record length)

32-bit CRC (ASCII and Binary only)

BINEX

Hex

-

L

4

-

H

H + L

-

[CR][LF]

Sentence terminator (ASCII only)

**4**

**.2.3** **Configuration** **and** **Status**

**.2.3.1** **COMCONFIG** **COM** **Port** **Configuration**

**Description**

**4**

This message contains configurations of ports such as baud rate, COM ID and so on.

*Message* *ID*

*3*

*7*

*Recommended* *Input*

*Supported* *Format*

*log* *comconfigb*

*ASCII,* *binary*

**Reply** **(Binary)**

Binary Binary

Field# Field Type

Data Description

Log header

Format

Bytes

Offset

COMCONFI

**1**

H

0

G header

**2**

**3**

**4**

**5**

**6**

**7**

#port

Number of ports with information to follow

Serial port identifier

Long

4

4

4

4

4

4

H

port

Enum

Ulong

Enum

Ulong

Ulong

H+4

H+8

H+12

H+16

H+20

baud

Communication baud rate

Parity

parity

databits

stopbits

Number of data bits

Number of stop bits

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Binary Binary

Field# Field Type

Data Description

Format

Enum

Bytes

4

Offset

H+24

**8**

**9**

handshake Handshaking

When echo is on, the port is transmitting any

echo

input characters as they are received. 0 = OFF 1 = Enum

ON

4

H+28

**1**

**1**

**1**

**1**

**1**

**0**

**1**

**2**

**3**

**4**

breaks

Breaks are turned on or off 0 = OFF 1 = ON

The status of the receive interface mode

The status of the transmit interface mode

Responses are turned on or off 0 = OFF 1 = ON

Enum

Enum

Enum

Enum

4

4

4

4

H+32

H+36

H+40

H+44

rx type

tx type

response

next port offset = H + 4 + (#port x 44)

H+4+(#po

**1**

**1**

**5**

**6**

xxxx

32-bit CRC (ASCII and Binary only)

Hex

-

4

-

rt x44)

-

[CR][LF]

Sentence terminator (ASCII only)

**4**

**.2.3.2** **LOGLIST**

**List** **all** **System** **Logs**

**Description**

This log outputs a complete list of all log entries available in the system. The following tables

show the binary and ASCII output.

*Message* *ID*

*5*

*Recommended* *Input*

*Supported* *Format*

*log* *loglista* *once*

*ASCII*

**Reply** **(ASCII)**

#LOGLISTA,COM1,0,60.0,FINESTEERING,1776,125044.700,00000000,0000,1114;

COM1,GPGGA,ABBASCII,ONTIME,1.000,

COM3,GPGSV,ABBASCII,ONTIME,5.000,

COM3,RTCM1019,BINARY,ONTRACKED,1.000,

Field#

Field Type

Data Description

Format

**1**

**2**

LOGLIST (ASCII) header Log header

#logs Number of messages to follow, maximum = 64

Long

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Field#

Field Type

port

Data Description

Format

Enum

Output port see Table 3

**3**

**4**

**5**

**6**

**7**

message

message types

trigger

Message name of log

Char[]

Char[]

Enum

Double

Enum

Hex

ASCII, ABBASCII, BINARY

ONCHANGED, ONTIME, ONTRACKED

Log period for ONTIME

period

Next port

xxxx

32-bit CRC

[CR][LF]

Sentence terminator (ASCII only)

-

**4**

**.2.3.3** **TRACKSTAT**

**Tracking** **State**

**Description**

This log provides channel tracking status information for each of the receiver parallel channels.

*Message* *ID*

*8*

*3*

*Recommended* *Input*

*Supported* *Format*

*log* *trackstatb* *ontime* *1*

*binary*

**Reply** **(Binary)**

Binary Binary

Field#

Field Type

Data Description

Log header

Format

Byte

Offset

TRACKSTAT

header

**1**

H

0

**2**

**3**

sol status

pos type

Enum

Enum

4

4

H

Solution status (refer to Table 31)

Position type (refer to Table 32)

H+4

**4**

**5**

cutoff

Tracking elevation cut-off angle

Number of hardware channels with information to

follow

Float

Long

4

4

H+8

# chans

H+12

**6**

PRN/slot

Short

2

H+16

Satellite PRN number of range measurement (refer

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Binary Binary

Field#

Field Type

Data Description

to Table 6)

Format

Byte

Offset

**7**

**8**

glofreq

Only used in GLONASS, null yet

Short

2

4

H+18

H+20

ch-tr-status

ULong

Channel tracking status (refer toTable 37)

Pseudorange (m) - if this field is zero but the

channel tracking status in the previous field

**9**

psr

indicates that the card is phase locked and code Double

locked, the pseudorange has not been calculated

yet.

8

H+24

**1**

**1**

**0**

**1**

Doppler

C/No

Doppler frequency (Hz)

Float

Float

4

4

H+32

H+36

Carrier to noise density ratio (dB-Hz)

Number of seconds of continuous tracking (no cycle

slips)

**1**

**2**

locktime

Float

4

H+40

**1**

**1**

**1**

**1**

**3**

psr res

Pseudorange residual from pseudorange filter (m)

Range reject code from pseudorange filter

Pseudorange filter weighting

Float

Enum

Float

4

4

4

H+44

H+48

H+52

**4**

reject

**5**

psr weight

**6...**

Next PRN offset = H + 16 + (#chans x 40)

H+16+

(#chans

x 40)

-

xxxx

32-bit CRC (ASCII and Binary only)

Sentence terminator (ASCII only)

Hex

-

4

-

[CR][LF]

**4**

**.2.3.4** **VERSION**

**Version** **Information**

**Description**

This log contains the version information of aboard.

*Message* *ID*

*3*

*7*

*Recommended* *Input*

*Supported* *Format*

*log* *version*

*ASCII,* *binary* *and* *abbreviated*

*ASCII*

**Reply** **(Abbreviated** **ASCII)**

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<

VERSION COM1 0 60.0 UNKNOWN

1

0

0.000 00000000 0000 1114

<

<

"

GPSCARD "S2002" "00902165

" "CARD-501AA-22"

1.10A-1.10A" "1.000" "2012/May/ 5" "18:18:52"

Binary Binary

Field# Field Type

Data Description

Format

Byte

H

Offset

0

**1**

**2**

**3**

**4**

**5**

**6**

**7**

**8**

**9**

**1**

**1**

VERSION Header

Log Header

#comp

Number of components, value =1

Component type, value = 0

Long

4

H

type

Enum

4

H+4

model

Model Information (refer to Figure 3)

Product serial number (refer toFigure 4)

Hardware version (refer toFigure 5)

Software version (refer toFigure 6)

Boot code version

Char[] 16

Char[] 16

Char[] 16

Char[] 16

Char[] 16

Char[] 12

Char[] 12

H+8

PSN

H+24

H+40

H+56

H+72

H+88

H+100

H+112

Hw version

Sw version

Boot version

Comp date

Comp time

CRC

Firmware compile date (refer to Table 30)

Firmware compile time (refer to *Table* 30)

32-bit CRC

**0**

**1**

Hex

4

In Figure 3, each number denotes frequency No. in corresponding GNSS system; the first

denotes GPS, GLONASS, GALILEO and BD2 in turns.

**Figure** **3.** **Model**

**Figure** **4.** **Product** **Serial** **No.**

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**Figure** **5.** **Hardware** **(HW)** **Version**

**Figure** **6.** **Software** **(SW)** **Version**

**Table** **29.** **Serial** **Port** **Type**

**SERIAL** **PORT** **FLAG** **PORT** **CONFIGURATION**

**2**

**4**

**T**

**X**

RS232

RS422

LV TTL

Selectable configuration

**Table** **30.Compile** **Date** **and** **Time**

**YYYY:** **Year**

**MM:** **Month**

**DD:** **Day**

YYYY/MM/DD

HH:MM:SS

**HH:Hour**

**MM:Minute**

**SS:Second**

**4**

**.2.4** **Heading,** **Pitch** **and** **Roll** **Messages**

**4**

**.2.4.1** **HEADING** **Heading** **Information**

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**Description**

The heading is the angle from True North of the base to rover vector in a clockwise direction.

*Message* *ID*

*9*

*71*

*Recommended* *Input*

*Supported* *Format*

*log* *headingb* *onchanged*

*ASCII* *and* *Binary*

**Reply**

Field

#

Binary Binary

Field type

Data Description

Format

Bytes

H

Offset

0

**1**

HEADING header Log header

**2**

sol stat

Enum

Enum

4

4

H

Solution status, see Table 31

**3**

pos type

H+4

Position type, see Table 32

**4**

**5**

**6**

**7**

**8**

**9**

length

Baseline length (0 to 3000 m)

Heading in degrees (0 to 360.0 degrees)

Pitch (±90 degrees)

Float

4

4

4

4

4

4

4

1

1

1

H+8

heading

pitch

Float

H+12

H+16

H+20

H+24

H+28

H+32

H+36

H+37

H+38

Float

Reserved

hdg std dev

ptch std

stn ID

Float

Heading standard deviation in degrees

Pitch standard deviation in degrees

Station ID string

Float

Float

**1**

**1**

**1**

**1**

**0**

**1**

**2**

**3**

Char[4]

Uchar

Uchar

Uchar

#SVs

Number of observations tracked

Number of satellites in solution

Number of satellites above the elevation mask

Number of satellites above the mask angle with

L2

#solnSVs

#obs

**1**

**4**

#multi

Uchar

1

H+39

**1**

**1**

**1**

**5**

**6**

**7**

Reserved

ext sol stat

Reserved

Uchar

Uchar

Uchar

1

1

1

H+40

H+41

H+42

Extended solution status (default: 0)

Signals used mask - if 0, signals used in solution

are unknown. See Table 33.

**1**

**8**

sig mask

Uchar

1

H+43

**1**

**2**

**9**

**0**

xxxx

32-bit CRC (ASCII and Binary only)

Sentence terminator (ASCII only)

Hex

-

4

-

H+44

-

[CR][LF]

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**4**

**.2.5** **Mark** **Event** **Messages**

**.2.5.1** **MARKPOS** **Position** **at** **time** **of** **mark** **input** **event**

**Description**

**4**

This log message contains the estimated position of the antenna when a pulse is detected at a

mark input. It’s generated when a pulse occurs on the event input from receiver EVENT

interface.

*Message* *ID*

*1*

*81*

*Recommended* *Input*

*Supported* *Format*

*log* *markposa* *onnew*

*ASCII,* *Binary*

**Reply**

Binary

Byte

Binary

Offset

Field# Field Type

Data Description

Log header

Format

MARKPOS

**1**

H

4

0

header

**2**

**3**

sol status

pos type

Enum

Enum

H

Solution status (refer toTable 31)

Position type (refer to Table 32)

4

H+4

**4**

**5**

**6**

lat

Latitude

Double

Double

Double

8

8

8

H+8

lon

hgt

Longitude

H+16

H+24

Height above mean sea level

Undulation - the relationship between the

geoids and the WGS84 ellipsoid (m)

Datum ID number

**7**

undulation

Float

4

H+32

**8**

**9**

**1**

**1**

**1**

**1**

**1**

datum id#

lat σ

Enum

Float

Float

Float

Char[4]

Float

Float

4

4

4

4

4

4

4

H+36

H+40

H+44

H+48

H+52

H+56

H+60

Latitude standard deviation

Longitude standard deviation

Height standard deviation

Base station ID

**0**

**1**

**2**

**3**

**4**

lon σ

hgt σ

stn id

diff\_age

sol\_age

Differential age in seconds

Solution age in seconds

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Binary

Byte

Binary

Offset

Field# Field Type

Data Description

Format

**1**

**1**

**1**

**1**

**1**

**2**

**2**

**5**

**6**

**7**

**8**

**9**

**0**

**1**

#SVs

Number of satellite vehicles tracked

Uchar

Uchar

Uchar

Uchar

Uchar

Hex

1

1

1

1

1

1

1

H+64

H+65

H+66

H+67

H+68

H+69

H+70

#solnSVs

Number of satellite vehicles used in solution

Reserved

ext sol stat

Reserved

Extended solution status (default: 0)

Hex

Signals used mask - if 0, signals used in

solution are unknown. SeeTable 33.

**2**

**2**

sig mask

Hex

1

H+71

**2**

**2**

**3**

**4**

xxxx

32-bit CRC (ASCII and Binary only)

Sentence terminator (ASCII only)

Hex

-

4

-

H+72

-

[CR][LF]

**4**

**.2.5.2** **MARKTIME**

**Time** **of** **mark** **input** **event**

**Description**

This message includes the time of the leading edge of the detected mark input pulse. It’s

generated when a pulse occurs on the event input from receiver EVENT interface. The message

setting can be saved in the *saveconfig*, and the message status can be checked by *log* *loglista*.

*Message* *ID*

*2*

*31*

*Recommended* *Input*

*Supported* *Format*

*log* *marktimea* *onnew*

*ASCII,* *Binary*

**Reply**

Binary

Byte

Binary

Offset

Field# Field Type Data Description

MARKTIME

Format

Long

**1**

Log header

H

4

0

header

week

**2**

GPS reference week number

H

Seconds into the week as measured from the

**3**

**4**

seconds

offset

receiver clock, coincident with the time of electrical Double

closure on the Mark Input port

8

8

H+4

Receiver clock offset, in seconds. A positive offset Double

H+12

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Binary

Byte

Binary

Offset

Field# Field Type Data Description

Format

implies that the receiver clock is ahead of GPS

reference time. To derive GPS reference time, use

the following formula:

GPS reference time = receiver time - (offset)

Standard deviation of receiver clock offset (s)

This field represents the offset of GPS reference

time from UTC time (s), computed using almanac

parameters. UTC time is GPS reference time plus

the current UTC offset plus the receiver clock

offset.

**5**

**6**

offset std

Double

Double

8

8

H+20

H+28

utc offset

UTC time = GPS reference time + offset + UTC offset

(0 indicates that UTC time is unknown because

there is no almanac available in order to acquire

the UTC offset.)

**7**

status

Enum

4

H+36

Clock model status, see Table 48

**8**

**9**

xxxx

32-bit CRC (ASCII and Binary only)

Sentence terminator (ASCII only)

Hex

-

4

-

H+40

-

[CR][LF]

**4**

**.2.6** **Meteorograph** **Data**

This section presents a set of messages of meteorograph data from some weather instrument.

**.2.6.1** **METEODATA** **Basic** **Meteorograph** **Data** **Message**

**4**

**Description**

This log message contains the basic data information from ZZ11A Meteorograph, such as date,

time, weather instrument ID, normal temperature, humidity and air pressure, etc.

*Message* *ID*

*1*

*06*

*Recommended* *Input*

*Supported* *Format*

*log* *meteodatab* *ontime* *60*

*ASCII,* *Binary*

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**Reply** **(ASCII)**

#

METEODATAA,COM1,0,60.0,FINESTEERING,1856,352733.000,00000000,0000,111

;TMQD,20150803,135200,00007,30.5,0,1006.0\*2E682D01

4

Binary Binary

**Field#** Field Type

Data Description

Log header

Format

UShort

Byte

H

Offset

0

**1**

**2**

**3**

**4**

METEODATA header

1

2

= data per minute

= data per hour

Data Indicator

2

4

4

H

Year, Month, Day

Hour, Minute, Second

yyyymmdd, refer to NOTE after this table ULong

H+2

H+6

hhmmss (ss is reserved), refer to NOTE

ULong

after this table

**5**

**6**

**7**

**8**

**9**

**1**

Sensor ID

Temperature

Humidity

Air Pressure

xxxx

Meteorograph Sensor ID: xxxxx

±xxx.x (°C)

ULong

Float

UShort

Float

Hex

4

4

2

4

4

-

H+10

H+14

H+18

H+20

H+24

-

xxx (%RH)

xxxx.x (hPa)

32-bit CRC (ASCII and Binary only)

Sentence terminator (ASCII only)

**0**

[CR][LF]

-

**NOTE:**

Year

Month

Day

= (Ulong)( yyyymmdd / 10000)

= (Ulong)((yyyymmdd - (Year \* 10000)) / 100)

= (Ulong)( yyyymmdd - (Year \* 10000) - (Month \* 100))

Hour

= (Ulong)( hhmmss / 10000)

Minutes

Seconds

= (Ulong)((hhmmss - (Hour \* 10000)) / 100)

= (Ulong)( hhmmss - (Hour \* 10000) - (Minutes \* 100))

**4**

**.2.6.2** **METEODATAEXT**

**Extended** **Meteorograph** **Data** **Message**

**Description**

This log message contains extended data information from ZZ11A Meteorograph, such as date,

time, weather instrument ID, temperature (normal, maximum and minimum), humidity

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(normal, minimum), air pressure (normal, maximum and minimum), water pressure, dew-point

temperature, battery voltage, mainboard temperature etc.

*Message* *ID*

*1*

*08*

*Recommended* *Input*

*Supported* *Format*

*log* *meteodataexta* *ontime* *60*

*ASCII,* *Binary*

**Reply** **(ASCII)**

#METEODATAEXTA,COM1,0,60.0,FINESTEERING,1856,352733.000,00000000,0000,

1114;TMQD,20150803,135200,00007,30.5,31.1,130900,30.5,135100,0,0,13090

0,1006.0,1006.5,130900,1006.0,134800,0.0,0.0,12.0,32.6\*3B1FCCAA

Binary Binary

Field# Field Type

Data Description

Log header

Format

Byte

H

Offset

0

**1**

**2**

METEODATAEXT header

1

2

= data per minute

= data per hour

Data Indicator

UShort

ULong

ULong

2

4

4

H

yyyymmdd, refer to the NOTE

defined in *4.2.6.1*

**3**

**4**

Year, Month, Day

Hour, Minute, Second

H+2

H+6

hhmmss (ss is reserved), refer to

the NOTE defined in *4.2.6.1*

Meteorograph Sensor ID: xxxxx

±xxx.x (°C)

**5**

**6**

**7**

**8**

**9**

**1**

**1**

**1**

**1**

**1**

**1**

**1**

**1**

**1**

Sensor ID

ULong

Float

4

4

4

4

4

4

2

2

4

4

4

4

4

4

H+10

H+14

H+18

H+22

H+26

H+30

H+34

H+36

H+38

H+42

H+46

H+50

H+54

H+58

Temperature

Max Temp

±xxx.x (°C)

Float

Max Temp Time

Min Temp

hhmmss (ss is reserved)

±xxx.x (°C)

ULong

Float

**0**

**1**

**2**

**3**

**4**

**5**

**6**

**7**

**8**

Min Temp Time

Humidity

hhmmss (ss is reserved)

xxx (%RH)

ULong

UShort

UShort

ULong

Float

Min Humidity

Min Humidity Time

Air Pressure

xxx (%RH)

hhmmss (ss is reserved)

xxxx.x (hPa)

Max Air Pressure

Max Air Pressure Time

Min Air Pressure

Min Air Pressure Time

xxxx.x (hPa)

Float

hhmmss (ss is reserved)

xxxx.x (hPa)

ULong

Float

hhmmss (ss is reserved)

ULong

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*Chapter* *4.* *Logs* *Messages*

Binary Binary

Field# Field Type

Data Description

Format

Byte

Offset

H+62

H+66

H+70

H+74

H+78

H+80

-

**1**

**2**

**2**

**2**

**2**

**2**

**2**

**9**

**0**

**1**

**2**

**3**

**4**

**5**

Water Pressure

Dew-point temperature

Battery Voltage

Mainboard Temperature

Reserved

xxx.x (hPa)

Float

Float

Float

Float

4

4

4

4

2

4

-

±xxx.x (°C)

xx.x (V)

xxx.x (°C)

Reserved

xxxx

32-bit CRC (ASCII and Binary only)

Sentence terminator (ASCII only)

Hex

-

[CR][LF]

**4**

**.2.7** **Position** **and** **Velocity** **Messages**

Log messages mainly related to Position and velocity information are defined in this section.

**.2.7.1** **BESTPOS** **Best** **Position**

**4**

**Description**

This log contains the best available GNSS position (in meter) computed by the board. In

addition, it reports several status indicators, including differential age, which is useful in

predicting anomalous behavior brought about by outages in differential corrections. A

differential age of 0 indicates that no differential correction was used.

*Message* *ID*

*4*

*2*

*Recommended* *Input*

*Supported* *Format*

*log* *bestposb* *ontime* *1*

*binary*

**Reply** **(Binary)**

Binary Binary

Field# Field Type

Data Description

Format

Byte

H

Offset

0

**1**

**2**

Bestpos Header Log Header

Sol stat

Enum

Enum

4

4

H

Solution status (refer to Table 31)

**3**

Pos type

H+4

Position type (refer to Table 32)

**4**

**5**

**6**

Lat

Lon

hgt

Latitude

Double

Double

Double

8

8

8

H+8

Longitude

H+16

H+24

Height above mean sea level

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Binary Binary

Field# Field Type

Data Description

Format

Float

Byte

Offset

the ralationship between the geoid and the

ellipsoid of the chosen datum

Datum id number

**7**

undulation

4

H+32

**8**

**9**

**1**

**1**

**1**

**1**

**1**

**1**

**1**

**1**

**1**

**1**

**2**

**2**

Datum id#

Lat σ

Enum

Float

4

4

4

4

4

4

4

1

1

1

1

1

1

1

H+36

H+40

H+44

H+48

H+52

H+56

H+60

H+64

H+65

H+66

H+67

H+68

H+69

H+70

Latitude standard deviation

Longitude standard deviation

Height standard deviation

Base station id

**0**

**1**

**2**

**3**

**4**

**5**

**6**

**7**

**8**

**9**

**0**

**1**

Lon σ

Float

Hgt σ

Float

Stn id

Char[4]

Float

Diff\_age

Sol\_age

#SVs

Differential age in seconds

Solution age in seconds

Number of satellite tracked

SV number used in solution

L1 number

Float

UCHAR

UCHAR

UCHAR

UCHAR

UCHAR

UCHAR

UCHAR

#solnSVs

#ggL1

#ggL1L2

reserved

ext sol stat

reserved

L1 &L2 number

Reserved bytes

Extended solution status

Reserved bytes

Signals used mask - if 0, signals used in solution

are unknown. See Table 33

**2**

**2**

**2**

**3**

sig mask

CRC

UCHAR

Hex

1

4

H+71

H+72

32-bit CRC Code

**Table** **31.Solution** **Status**

**SOLUTION** **STATUS**

**DESCRIPTION**

**(BINARY)**

**(ASCII)**

**0**

**1**

**6**

SOL\_COMPUTED

INSUFFICIENT\_OBS

COLD\_START

Solution computed

Insufficient observations

Not yet converged from cold start

The fixed position, entered using the

FIX positioncommand, is not valid

**1**

**9**

INVALID\_FIX

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**Table** **32.Position** **or** **Velocity** **Type**

**TYPE** **(BINARY)**

**TYPE** **(ASCII)**

**DESCRIPTION**

**0**

**1**

**8**

NONE

No solution

FIXEDPOS

Position has been fixed by the FIX POSITION command

Velocity computed using instantaneous Doppler

Single point position

DOPPLER\_VELOCITY [*Note*](#br127)

SINGLE

**1**

**1**

**1**

**3**

**3**

**4**

**5**

**5**

**6**

**6**

**6**

**7**

**8**

**4**

**5**

**9**

**0**

**1**

**4**

**5**

PSRDIFF

Pseudorange differential solution

Solution calculated using corrections from an SBAS

Floating narrow-lane ambiguity solution

Derivation solution

SBAS

NARROW\_FLOAT

FIX\_DERIVATION

WIDE\_INT

Integer wide-lane ambiguity solution

Integer narrow-lane ambiguity solution

Super wide-lane solution

NARROW\_INT

SUPER WIDE-LANE

OMNISTAR\_HP

OMNISTAR\_XP

Positioning solution

Positioning solution

Converging TerraStar-C, TerraStar-C PRO or TerraStar-X

solution

**6**

**8**

PPP\_CONVERGING

**6**

**7**

**9**

**0**

PPP

Converged PPP solution

OPERATIONAL

Solution accuracy is within UA Loperational limit

Solution accuracy is outside UAL operational limit but

within warning limit

**7**

**7**

**1**

**2**

WARNING

OUT\_OF\_BOUNDS

Solution accuracy is outside UAL limits



***Note*.** **Herein,** **the** **instantaneous** **doppler** **used** **for** **velocity** **computation** **comes**

**directly** **from** **the** **tracking** **loop** **of** **OEM** **board,** **which** **means** **this** **doppler**

**velocity** **has** **not** **nearly** **latency.** **In** **theory,** **its** **latency** **is** **smaller** **than** **the** **timing**

**accuracy** **of** **OEM** **board.**

**Table** **33.Signal-Used** **Mask**

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**BIT** **MASK** **DESCRIPTION**

**0**

0x01

0x02

GPS L1 used in Solution

**1**

GPS L2 used in Solution

GPS L5 used in Solution

BDS B1 used in Solution

GLONASS L1 used in Solution

GLONASS L2 used in Solution

BDS B2 used in Solution

BDS B3 used in Solution

**2**

**3**

**4**

**5**

**6**

**7**

0x04

0x08

0x10

0x20

0x40

0x80

**4**

**.2.7.2** **BESTVEL**

**Best** **Available** **Velocity** **Data**

**Description**

This message contains the best available velocity information computed by the receiver. In

addition, it reports a velocity status indicator, which is useful in indicating whether or not the

corresponding data is valid. The velocity measurements sometimes have a latency associated

with them. The time of validity is the time tag in the log minus the latency value.

*Message* *ID*

*9*

*9*

*Recommended* *Input*

*Supported* *Format*

*log* *bestvelb* *ontime* *1*

*ASCII,* *Binary*

Direction of motion over ground in this log is derived from north speed and east speed, so the

direction error is related to motion status. Higher speed means less direction error, and lower

speed means more direction error. For example, in Doppler frequency velocity mode, we could

assume a typical velocity error of 0.2m/s, and carrier velocity is 70km/hour, or 19.4m/s, the

maximum direction error is:

Dir\_error = arctan (0.2/19.4) = 0.59 degree.

**Reply**

Binary Binary

Field# Field Type

Data Description

Log header

Format

Bytes

Offset

BESTVEL

**1**

H

0

header

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Binary Binary

Field# Field Type

Data Description

Format

Enum

Bytes

Offset

**2**

**3**

sol status

vel type

4

H

Solution status, see Table 31

Enum

4

4

H+4

H+8

Velocity type, see Table 32

A measure of the latency in the velocity time tag in

**4**

latency

seconds. It should be subtracted from the time to Float

give improved results.

**5**

**6**

age

Differential age in seconds

Float

4

8

H+12

H+16

hor spd

Horizontal speed over ground, in meters per second Double

Actual direction of motion over ground (track over

Double

ground) with respect to True North, in degrees

**7**

trk gnd

8

H+24

Vertical speed, in meters per second, where positive

values indicate increasing altitude (up) and negative Double

values indicate decreasing altitude (down)

Float

**8**

vert spd

8

H+32

**9**

**1**

**1**

Reserved

xxxx

4

4

-

H+40

H+44

-

**0**

**1**

32-bit CRC (ASCII and Binary only)

Sentence terminator (ASCII only)

Hex

-

[CR][LF]

**4**

**.2.7.3** **BESTXYZ**

**Best** **Available** **Cartesian** **Position** **and** **Velocity**

**Description**

This log contains the receiver’s best available position and velocity in ECEF coordinates. The

position and velocity status fields indicate whether or not the corresponding data is valid.

*Message* *ID*

*2*

*41*

*Recommended* *Input*

*Supported* *Format*

*log* *bestxyzb* *ontime* *1*

*ASCII,* *Binary*

**Reply**

Binary

Bytes

Binary

Offset

Field# Field Type

Data Description

Format

**1**

BESTXYZ header Log header

H

0

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*COMNAV* *OEM* *BOARD* *REFERENCE* *MANUAL*

*Chapter* *4.* *Logs* *Messages*

Binary

Bytes

Binary

Offset

Field# Field Type

Data Description

Format

Enum

**2**

**3**

P-sol status

pos type

4

4

H

Solution status, see Table 31

Position type, see Table 32

Enum

H+4

**4**

**5**

**6**

**7**

**8**

**9**

P-X

Position X-coordinate (m)

Position Y-coordinate (m)

Position Z-coordinate (m)

Standard deviation of P-X (m)

Standard deviation of P-Y (m)

Standard deviation of P-Z (m)

Double

Double

Double

Float

8

8

8

4

4

4

H+8

P-Y

H+16

H+24

H+32

H+36

H+40

P-Z

P-X σ

P-Y σ

P-Z σ

Float

Float

**1**

**1**

**0**

**1**

V-sol status

vel type

Enum

Enum

4

4

H+44

H+48

Solution status, see Table 31

Velocity type, see Table 32

**1**

**1**

**1**

**1**

**1**

**1**

**1**

**2**

**3**

**4**

**5**

**6**

**7**

**8**

V-X

Velocity vector along X-axis (m/s)

Velocity vector along Y-axis (m/s)

Velocity vector along Z-axis (m/s)

Standard deviation of V-X (m/s)

Standard deviation of V-Y (m/s)

Standard deviation of V-Z (m/s)

Base station identification

Double

Double

Double

Float

8

8

8

4

4

4

4

H+52

H+60

H+68

H+76

H+80

H+84

H+88

V-Y

V-Z

V-X σ

V-Y σ

V-Z σ

stn ID

Float

Float

Char[4]

A measure of the latency in the velocity time

**1**

**9**

V-latency

tag in seconds. It should be subtracted from the Float

time to give improved results.

4

H+92

**2**

**2**

**2**

**2**

**2**

**0**

**1**

**2**

**3**

**4**

diff\_age

sol\_age

#SVs

Differential age in seconds

Float

4

4

1

1

1

H+96

Solution age in seconds

Float

H+100

H+104

H+105

H+106

Number of satellite vehicles tracked

Number of satellite vehicles used in solution

Number of GPS plus BDS L1 used in solution

Number of GPS plus BDS L1 and L2 used in

solution

Uchar

Uchar

Uchar

#solnSVs

#ggL1

**2**

**5**

#ggL1L2

Uchar

1

H+107

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Binary

Bytes

Binary

Offset

Field# Field Type

Data Description

Format

**2**

**2**

**2**

**6**

**7**

**8**

Reserved

ext sol stat

Reserved

Char

Hex

Hex

1

1

1

H+108

H+109

H+110

Extended solution status

Signals used mask - if 0, signals used in solution

are unknown. See Table 33

**2**

**9**

sig mask

Hex

1

H+111

**3**

**3**

**0**

**1**

xxxx

32-bit CRC (ASCII and Binary only)

Sentence terminator (ASCII only)

Hex

-

4

-

H+112

-

[CR][LF]

**4**

**.2.7.4** **PSRDOP**

**Pseudorange** **DOP**

**Description**

The dilution of precision data is calculated using the geometry of only those satellites that are

currently being tracked and used in the position solution by the board. This log is updated once

every 60 seconds or whenever a change in the satellite constellation occurs. Therefore, the

total number of data fields output by the log is variable and depends on the number of SVs

that are being tracked.

*Message* *ID*

*1*

*74*

*Recommended* *Input*

*Supported* *Format*

*log* *psrdopb* *ontime* *1*

*binary*

**Reply** **(Binary)**

Binary

Byte

Field# Field Type

Data Description

Format

Binary Offset

**1**

**2**

**3**

**4**

PSRDOP Header Log Header

H

4

4

4

0

gdop

Pdop

Hdop

Geometric dilution of precision

Position dilution of precision

horizontal dilution of precision

Float

H

Float

Float

H+4

H+8

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Binary

Field# Field Type

Data Description

Format

Float

Binary Offset

H+12

Byte

Horizontal position and time dilution

of precision

**5**

Htdop

4

**6**

**7**

**8**

**9**

**1**

**1**

Tdop

Cutoff

#prn

Prn

Time dilution of precision

Elevation cut-off angle

Float

Float

Long

Ulong

4

4

4

4

H+16

H+20

H+24

H+28

Number of satellites PRNs to follow

PRN of SV PRN tracking

**0**

**1**

Next prn offset = H+28+(#prn\*4)

CRC

32-bit CRC

Hex

4

H+28+(#prn\*4)

**4**

**.2.7.5** **PSRPOS**

**Pseudorange** **Position**

**Description**

This message includes position calculated using pseudorange and other information such as

differential age, station id and so on.

*Message* *ID*

*4*

*7*

*Recommended* *Input*

*Supported* *Format*

*log* *psrposb* *ontime* *1*

*binary*

**Reply** **(Binary)**

Binary

Byte

Binary

Offset

Field# Field Type

Data Description

Format

**1**

**2**

PSRPOS header Log header

H

0

sol status

pos type

Enum

Enum

4

H

Solution status (refer to Table 31)

Position type (refer to Table 32)

**3**

4

H+4

**4**

**5**

**6**

lat

Latitude

Double

Double

Double

8

8

8

H+8

lon

hgt

Longitude

H+16

H+24

Height above mean sea level

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*COMNAV* *OEM* *BOARD* *REFERENCE* *MANUAL*

*Chapter* *4.* *Logs* *Messages*

Binary

Byte

Binary

Offset

Field# Field Type

Data Description

Format

Float

Undulation - the relationship between the

geoids and the WGS84 ellipsoid (m)

Datum ID number

**7**

undulation

4

H+32

**8**

**9**

**1**

**1**

**1**

**1**

**1**

**1**

**1**

**1**

**1**

**1**

**2**

**2**

datum id#

lat σ

Enum

Float

Float

Float

Char[4]

Float

Float

Uchar

Uchar

Uchar

Uchar

Uchar

Hex

4

4

4

4

4

4

4

1

1

1

1

1

1

1

H+36

H+40

H+44

H+48

H+52

H+56

H+60

H+64

H+65

H+66

H+67

H+68

H+69

H+70

Latitude standard deviation

Longitude standard deviation

Height standard deviation

**0**

**1**

**2**

**3**

**4**

**5**

**6**

**7**

**8**

**9**

**0**

**1**

lon σ

hgt σ

stn id

Base station ID

diff\_age

sol\_age

#SVs

Differential age in seconds

Solution age in seconds

Number of satellite vehicles tracked

Number of satellite vehicles used in solution

#solnSVs

Reserved

ext sol stat

Reserved

Extended solution status (default: 0)

Hex

Signals used mask - if 0, signals used in

solution are unknown. See Table 33.

**2**

**2**

sig mask

Hex

1

H+71

**2**

**2**

**3**

**4**

xxxx

32-bit CRC (ASCII and Binary only)

Sentence terminator (ASCII only)

Hex

-

4

-

H+72

-

[CR][LF]

**4**

**.2.7.6** **PSRVEL**

**Pseudorange** **Velocity**

**Description**

In the PSRVEL log the actual speed and direction of the receiver antenna over ground is

provided. The velocity measurements sometimes have a latency associated with them. The

time of validity is the time tag in the log minus the latency value.

*Message* *ID*

*1*

*00*

*Recommended* *Input*

*Supported* *Format*

*log* *psrvela* *ontime* *1*

*ASCII,* *Binary*

**Reply** **(ASCII)**

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*COMNAV* *OEM* *BOARD* *REFERENCE* *MANUAL*

*Chapter* *4.* *Logs* *Messages*

#PSRVELA,COM1,0,60.0,FINESTEERING,1865,486344.000,00000000,0000,1114;S

OL\_COMPUTED,DOPPLER\_VELOCITY,0.000,0.000,0.0329,132.511867,0.0907,0.0\*

e24644e1

Binary Binary

Field# Field Type

Data Description

Log header

Format

Bytes

Offset

PSRVEL

**1**

H

0

header

**2**

**3**

sol status

vel type

Enum

Enum

4

4

H

Solution status, see Table 31

H+4

Velocity type, see Table 32

A measure of the latency in the velocity time tag in

**4**

latency

seconds. It should be subtracted from the time to Float

give improved results.

4

H+8

**5**

**6**

age

Differential age in seconds

Float

4

8

H+12

H+16

hor spd

Horizontal speed over ground, in meters per second Double

Actual direction of motion over ground (track over

Double

ground) with respect to True North, in degrees

**7**

trk gnd

8

H+24

Vertical speed, in meters per second, where positive

values indicate increasing altitude (up) and negative Double

values indicate decreasing altitude (down)

Float

**8**

vert spd

8

H+32

**9**

**1**

**1**

Reserved

xxxx

4

4

-

H+40

H+44

-

**0**

**1**

32-bit CRC (ASCII and Binary only)

Sentence terminator (ASCII only)

Hex

-

[CR][LF]

**4**

**.2.7.7** **PSRXYZ**

**Pseudorange** **Cartesian** **Position** **and** **Velocity**

**Description**

This message includes the receiver’s pseudorange position and velocity in ECEF coordinates.

The position and velocity status field’s indicate whether or not the corresponding data is valid.

*Message* *ID*

*2*

*43*

*Recommended* *Input*

*Supported* *Format*

*log* *psrxyza* *ontime* *1*

*ASCII,* *Binary*

**Reply** **(ASCII)**

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*COMNAV* *OEM* *BOARD* *REFERENCE* *MANUAL*

*Chapter* *4.* *Logs* *Messages*

#PSRXYZA,COM3,0,60.0,FINESTEERING,1865,486590.000,00000000,0000,1114;S

OL\_COMPUTED,SINGLE,-2844802.6861,4662742.6630,3282473.3324,0.6379,1.28

5

3,0.6043,SOL\_COMPUTED,DOPPLER\_VELOCITY,0.0036,-0.0616,-0.0187,0.6379,

.2853,0.6043,"",0.000,99.000,1.000,20,20,0,0,0,02,00,91\*17626BB9

1

Binary

Bytes

Binary

Offset

Field# Field Type

Data Description

Log header

Format

**1**

**2**

PSRXYZ header

H

0

P-sol status

pos type

Enum

Enum

4

H

Solution status, see Table 31

Position type, see Table 32

**3**

4

H+4

**4**

**5**

**6**

**7**

**8**

**9**

P-X

Position X-coordinate (m)

Position Y-coordinate (m)

Position Z-coordinate (m)

Standard deviation of P-X (m)

Standard deviation of P-Y (m)

Standard deviation of P-Z (m)

Double

Double

Double

Float

8

8

8

4

4

4

H+8

P-Y

H+16

H+24

H+32

H+36

H+40

P-Z

P-X σ

P-Y σ

P-Z σ

Float

Float

**1**

**1**

**0**

**1**

V-sol status

vel type

Enum

Enum

4

4

H+44

H+48

Solution status, see Table 31

Velocity type, see Table 32

**1**

**1**

**1**

**1**

**1**

**1**

**1**

**2**

**3**

**4**

**5**

**6**

**7**

**8**

V-X

Velocity vector along X-axis (m/s)

Velocity vector along Y-axis (m/s)

Velocity vector along Z-axis (m/s)

Standard deviation of V-X (m/s)

Standard deviation of V-Y (m/s)

Standard deviation of V-Z (m/s)

Base station identification

Double

Double

Double

Float

8

8

8

4

4

4

4

H+52

H+60

H+68

H+76

H+80

H+84

H+88

V-Y

V-Z

V-X σ

V-Y σ

V-Z σ

stn ID

Float

Float

Char[4]

A measure of the latency in the velocity time

**1**

**9**

V-latency

tag in seconds. It should be subtracted from the Float

time to give improved results.

4

H+92

**2**

**2**

**0**

**1**

diff\_age

sol\_age

Differential age in seconds

Solution age in seconds

Float

Float

4

4

H+96

H+100

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*COMNAV* *OEM* *BOARD* *REFERENCE* *MANUAL*

*Chapter* *4.* *Logs* *Messages*

Binary

Bytes

Binary

Offset

Field# Field Type

Data Description

Format

**2**

**2**

**2**

**2**

**3**

**4**

#SVs

Number of satellite vehicles tracked

Number of satellite vehicles used in solution

Number of GPS plus BDS L1 used in solution

Number of GPS plus BDS L1 and L2 used in

solution

Uchar

Uchar

Uchar

1

1

1

H+104

H+105

H+106

#solnSVs

#ggL1

**2**

**5**

#ggL1L2

Uchar

1

H+107

**2**

**2**

**2**

**6**

**7**

**8**

Reserved

ext sol stat

Reserved

Char

Hex

Hex

1

1

1

H+108

H+109

H+110

Extended solution status

Signals used mask - if 0, signals used in solution

are unknown. See Table 33

**2**

**9**

sig mask

Hex

1

H+111

**3**

**3**

**0**

**1**

xxxx

32-bit CRC (ASCII and Binary only)

Sentence terminator (ASCII only)

Hex

-

4

-

H+112

-

[CR][LF]

**4**

**.2.7.8** **QXWZSDKINFOB**

**SDK** [**Log-on** **Message**](file:///D:/%E6%9C%89%E9%81%93/8.6.0.0/resultui/html/index.html) **of** **Qianxun** **SI**

**Description**

This message includes the SDK Log-on Message of Qianxun SI. which contains three parts,

appkey, appsecrethe and the SN number of the receiver. The data information of message

format can be obtained by sending instructions to the receiver.

*Message* *ID*

9

01

*Recommended* *Input*

*Supported* *Format*

*log* *qxwzsdkinfob*

*Binary*

**Reply** **(ASCII)**

**Binary**

**Bytes**

**Binary**

**Offset**

**Field#** **Field** **Type**

**Data** **Description**

**Format**

QXWZSDKINFOB

**1**

Log header

H

0

Header

**2**

**3**

**4**

SN length

SN length

BYTE

BYTE

BYTE

1

1

1

H

AppKey length

AppKey length

H+1

H+2

AppSecret length APPSecret length

**5**

Encrypted sign

BYTE

1

H+3

Whether the subsequent content is encrypted:

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**Binary**

**Bytes**

**Binary**

**Offset**

**Field#** **Field** **Type**

**Data** **Description**

:NO; 1:YES

**Format**

0

**6**

**7**

**8**

**9**

SN

Receiver serial number

APPKey

Char[]

Char[]

Char[]

UINT32

variable H+4

variable

variable

4

AppKey

AppSecret

CRC

AppSecret

CRC check

**4**

**.2.8** **Raw** **Observations** **and** **Corrections**

This section presents a set of log messages which contain GNSS raw observables and

corrections for RTK and Pseudorange differential positioning, generally broadcasted by

reference station.

**4**

**.2.8.1** **RANGE**

**Detailed** **Observation** **Information**

**Description**

This message includes detailed observation information such as pseudorange, carrier phase,

Doppler, signal to noise ration and so on. At the same time, detailed channel states are involved.

*Message* *ID*

*4*

*3*

*Recommended* *Input*

*Supported* *Format*

*log* *rangeb* *ontime* *1*

*Binary*

**Reply**

Binary Binary

Field#

Field Type Description

Format

Byte

Offset

RANGE

header

**1**

Log header

H

0

Number of observations with information to follow

a

**2**

**3**

# obs

Long

4

2

H

Satellite PRN number of range measurement

(seeTable 36)

PRN/ slot

UShort

H+4

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Binary Binary

Field#

Field Type Description

Format

Byte

Offset

H+6

**4**

**5**

**6**

glofreq

psr

(GLONASS Frequency + 7)

Pseudorange measurement (m)

UShort

Double

2

8

4

H+8

psrstd

Pseudorange measurement standard deviation (m) Float

Carrier phase, in cycles (accumulated Doppler

H+16

**7**

adr

Double

8

H+20

range)

**8**

**9**

adrstd

dopp

Estimated carrier phase standard deviation (cycles) Float

4

4

H+28

H+32

Instantaneous carrier Doppler frequency (Hz)

Carrier to noise density ratio C/No

Float

=

**1**

**1**

**0**

**1**

C/No

Float

4

4

H+36

H+40

1

#

0[log10(S/N0)] (dB-Hz)

of seconds of continuous tracking (no cycle

locktime

Float

slipping)

ch-tr-stat

us

Tracking status (see Table 34, Channel Tracking

Status)

**1**

**1**

**2**

ULong

4

H+44

**3...**

Next PRN offset = H + 4 + (#obs x 44)

H+4+

xxxx

32-bit CRC (ASCII and Binary only)

Hex

-

4

-

(#obs x

4

-

4)

[CR][LF]

Sentence terminator (ASCII only)

**4**

**.2.8.2** **RANGECMP**

**Compressed** **Range** **Information**

**Description**

This message contains the channel measurements for the currently tracked satellites.

*Message* *ID*

*1*

*40*

*Recommended* *Input*

*Supported* *Format*

*log* *rangecmpb* *ontime* *1*

*binary*

**Reply** **(Binary)**

**Table** **34.Channel** **Tracking** **Status**

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**DATA**

**BIT(S)** **FIRST** **TO** **LAST**

**LENGTH** **(BITS)** **SCALE** **FACTOR**

**UNITS**

**Channel** **Tracking** **Status**

0-31

32

-

See Table 39

**Doppler** **Frequency**

**Pseudorange** **(PSR)**

32-59

60-95

28

36

1/256

1/128

Hz

m

**Accumulated**

**(ADR)**

**Doppler**

**Range**

9

6-127

32

1/256

cycles

**StdDev-PSR**

**StdDev-ADR**

128-131

132-135

4

4

m

(n + 1)/512

cycles

**PRN/Slot**

**Lock** **Time**

136-143

144-164

8

-

1

(SeeTable 36**)**

2

2

5

1 (maximum:

1/32

s

,097,151)

**C/No** **(valid** **range:** 20-51 dB-Hz**)**

165-169

170-191

(20 + n)

dB-Hz

**Reserved**

22

***Annotation:***



***a.***ADR (Accumulated Doppler Range) is calculated as follows:

ADR\_ROLLS = (RANGECMP\_PSR / WAVELENGTH + RANGECMP\_ADR) / MAX\_VALUE

Round to the closest integer

IF (ADR\_ROLLS ≤ 0)

ADR\_ROLLS = ADR\_ROLLS - 0.5

ELSE

ADR\_ROLLS = ADR\_ROLLS + 0.5

At this point integerise ADR\_ROLLS

CORRECTED\_ADR = RANGECMP\_ADR (MAX\_VALUE\*ADR\_ROLLS)

ADR has units of cycles,MAX\_VALUE= 8388608

GPS L1:WAVELENGTH = 0.1902936727984

GPS L2:WAVELENGTH = 0.2442102134246

GLONASS satellites emit L1and L2 carrier waves at a satellite-specific frequency, refer to the GLONASS

section of AnIntroductionto GNSS available on our website



***b.***

**table** **35.** **StdDev-PSR** **Values**

**CODE** **STDDEV-PSR** **(M)**

0

0.050

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**1**

**2**

**3**

**4**

**5**

**6**

**7**

**8**

**9**

0.075

0.113

0.169

0.253

0.380

0.570

0.854

1.281

2.375

4.750

9.500

19.000

38.000

76.000

152.000

**1**

**1**

**1**

**1**

**1**

**1**

**0**

**1**

**2**

**3**

**4**

**5**





***c.***Refer to PRN Numbers on

***d.***Number of seconds of continuous tracking (no cycle slipping) This field is constrained to a maximum value

of 2,097,151which represents a lock time of 65535.96875s (2097151/32).



***e.***Carrier to noise density ratio The C/No is constrained to a value between 20-51dB-Hz. Thus, if it is reported

that C/No = 20dB-Hz, the actual value could be less. Likewise, if it is reported that C/No = 51, the true value

could be greater.

**Table** **36.PRN** **Definition** **in** **Binary** **Message**

**GNSS**

**GPS**

**PRN**

**OFFSET**

1~32

0

**GLONASS** 38~61

37

0

**SBAS**

**BD2**

120~138

141~177 140

**Galileo**

1~36

0

**Table** **37.Tracking** **State**

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**STATE** **DESCRIPTION**

**STATE** **DESCRIPTION**

**0**

**2**

**3**

**4**

Idle

7

9

Frequency-lock loop

Channel alignment

Code search

Wide frequency band pull-in

Narrow frequency band pull-in 10

Phase lock loop

11

Aided phase lock loop

**Table** **38.Correlator** **Type**

**STATE** **DESCRIPTION**

**0**

**1**

**2**

**3**

**4**

**5**

N/A

Standard Correlator: spacing = 1 chip

Narrow Correlator: spacing < 1 chip

Reserved

Pulse Aperture Correlator (PAC)

Reserved

**-6**

**Table** **39.Channel** **Tracking**

**NIBBLE** **#** **BIT** **#** **MASK**

**DESCRIPTION**

**RANGE** **VALUE**

0

1

2

3

4

5

6

7

8

9

0x00000001

0x00000002

0x00000004

0x00000008

0x00000010

0x00000020

0x00000040

0x00000080

0x00000100

0x00000200

**N0**

**N1**

**N2**

Tracking state

Refer to Table 37

SV channel number

Tracking channel ID

0

1

= Not locked,

= Locked

1

0

0x00000400

Phase lock flag

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**NIBBLE** **#** **BIT** **#** **MASK**

**DESCRIPTION**

**RANGE** **VALUE**

0 = Not known1 = Known

1

1

1

2

0x00000800

0x00001000

Parity known flag

Code locked flag

0

1

= Not locked

= Locked

**N3**

**N4**

**N5**

13

0x00002000

0x00004000

0x00008000

0x00010000

0x00020000

Correlator type

1

1

1

1

4

5

6

7

Refer to Table 38

0 = GPS

1= GLONASS

2

3

= SBAS

Satellite system

= GALILEO

1

8

0x00040000

4 = BD2

5

7

-6 = Reserved

= Other

1

2

9

0

0x00080000

0x00100000

Reserved

Grouping

0

1

= Not grouped,

= Grouped

21

0x00200000

0x00400000

0x00800000

0x01000000

Dependent on satellite system

2

2

2

2

3

4

above:

GPS:

0

2

5

9

1

= L1 C/A

= L5

= L2 P

= L2 P codeless

7 = L2C

Signal type

GLONASS:

0

1

5

= L1 C/A

= L2 C/A

= L2 P

**N6**

2

5

0x02000000

BD2:

0

1

2

= L1 C/A

7 = L2 C/A

= L3 C/A

SBAS:

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**NIBBLE** **#** **BIT** **#** **MASK**

**DESCRIPTION**

**RANGE** **VALUE**

0

= L1 C/A

Other:

1

2

9 = OmniSTAR

3 = CDGPS

2

2

6

7

0x04000000

0x08000000

Forward Error Correction

Primary L1 channel

0 = Not FEC, 1 = FEC

0 = Not primary, 1 = Primary

0

1

= Half Cycle Not Added,

= Half Cycle Added

2

2

3

3

8

9

0

1

0x10000000

0x20000000

0x40000000

0x80000000

Carrier phase measurement

Reserved

**N7**

0

1

= PRN Not Locked Out

= PRN locked Out

PRN lock flag

Channel assignment

0 = Automatic, 1 = Forced

**4**

**.2.8.3** **RTCMDATA1**

**Pseudorange** **Correction**

**Description**

This message is used for pseudorange differential corrections, include all information of RTCM1

message of standard RTCM2.3.

*Message* *ID*

*3*

*96*

*Recommended* *Input*

*Supported* *Format*

*log* *rtcmdata1b* *ontime* *1*

*binary*

**Reply** **(Binary)**

Binary Binary

Field#

Field type

Data Description

Log header

Format

Byte

Offset

RTCMDATA1

header

**1**

-

H

0

**2**

**3**

RTCM header RTCM message type

Ulong

Ulong

4

4

H

Station ID

Base station ID

H+4

Modified Z count where the Z count week

number is the week number from subframe 1

**4**

ModifZ\_c

Ulong

4

H+8

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Binary Binary

Field#

Field type

Data Description

Format

Byte

Offset

of the ephemeris

Sequence number

Length of frame

**5**

**6**

Seqence NO

Frame\_len

Station\_healt

h

Ulong

Ulong

4

4

H+12

H+16

**7**

**8**

**9**

Base station health, see REFSTATION.

Ulong

Ulong

Ulong

Ulong

Ulong

4

4

4

4

4

H+20

H+24

H+28

H+32

H+36

#prn

Number of PRNs with information to follow

Scale where 0 = 0.02 m and 0.002 m/s 1 = 0.32

m and 0.032 m/s

scale

**1**

**1**

**0**

**1**

UDRE

User differential range error

Satellite PRN number of range measurement

(GPS: 1-32 and BD2: 141~177)

Scaled pseudorange correction (meters)

Scaled range rate correction

PRN/slot

**1**

**1**

**1**

**1**

**2**

psrcorr

rate corr

IOD

Long

Long

Long

4

4

4

H+40

H+44

H+48

**3**

**4**

Issue of data

**5...**

Next PRN offset = H+28 + (#prns x 24)

xxxx 32-bit CRC (ASCII and Binary only)

CR][LF] Sentence terminator (ASCII only)

H+4+(#

prn\*44)

-

Hex

-

4

-

[

**4**

**.2.9** **Satellite** **Measurements**

Log messages containing GNSS satellite measurements and information are defined in the

following sections.

**4**

**.2.9.1** **IONUTC**

**Ionospheric** **and** **UTC** **Data**

**Description**

The Ionospheric Model parameters (ION) and the Universal Time Coordinated parameters (UTC)

are provided.

*Message* *ID*

*8*

*Recommended* *Input*

*Supported* *Format*

*log* *ionutcb* *onchanged*

*ASCII,* *Binary* *and* *Abb-ASCII*

**Reply**

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*COMNAV* *OEM* *BOARD* *REFERENCE* *MANUAL*

*Chapter* *4.* *Logs* *Messages*

Binary Binary

Field# Field Type

Data Description

Format

Byte

H

8

Offset

0

**1**

**2**

**3**

**4**

**5**

**6**

**7**

**8**

**9**

**1**

**1**

**1**

**1**

**1**

IONUTC header Log header

a0

Alpha parameter constant term

Alpha parameter 1st order term

Alpha parameter 2nd order term

Alpha parameter 3rd order term

Beta parameter constant term

Beta parameter 1st order term

Beta parameter 2nd order term

Beta parameter 3rd order term

UTC reference week number

Double

Double

Double

Double

Double

Double

Double

Double

Ulong

H

a1

8

H+8

a2

8

H+16

H+24

H+32

H+40

H+48

H+56

H+64

H+68

H+72

H+80

H+88

a3

8

b0

8

b1

8

b2

8

b3

8

**0**

**1**

**2**

**3**

**4**

utc wn

tot

A0

4

Reference time of UTC parameters

UTC constant term of polynomial

UTC 1st order term of polynomial

Future week number

Ulong

4

Double

Double

Ulong

8

A1

8

wn lsf

4

Day number (the range is 1 to 7 where Sunday =

**1**

**5**

dn

Ulong

4

H+92

1

and Saturday = 7)

**1**

**1**

**1**

**6**

**7**

**8**

deltat ls

deltat lsf

deltat utc

Delta time due to leap seconds

Future delta time due to leap seconds

Time difference

Long

Long

Ulong

4

4

4

H+96

H+100

H+104

H+4+(#p

rn\*44)

-

**1**

**2**

**9**

**0**

xxxx

32-bit CRC (ASCII and Binary only)

Sentence terminator (ASCII only)

Hex

-

4

-

[CR][LF]

**4**

**.2.9.2** **M925**

**Extended** **Satellite** **Information**

**Description**

This log provides extended information of satellites, like PRN numbers, elevation, azimuth, and

some board’s information, including signal strength and battery status.

For integrative receivers, much information should be collected from numbers of messages to

display in screen or other media, so this message involved nearly all the information you need

is strongly recommended.

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*It’s* *an* *updating* *version* *of* *SATMSG,* *and* *could* *replace* *the* *latter.*

*Message* *ID*

*Chapter* *4.* *Logs* *Messages*

*9*

*25*

*Recommended* *Input*

*Supported* *Format*

*log* *m925b*

*binary*

**Reply** **(Binary)**

Field

Binary Binary

Field Type

Data Description

Format

Byte

#

Byte

H

Offset

0

**1**

M925 Header1

M925 Header2

Length

Log Header, its length H = 28

**2**

Header2 Length = 64 (Ver: 0x03)

1

H

**3**

**4**

**5**

Sat Number

GPRS Str

Satellite number

Byte

Byte

Byte

1

1

1

H+1

H+2

H+3

GPRS signal strength: 4(type) - 4(strength)

Bluetooth signal strength: 4(type) - 4(strength)

*Refer* *to* *follow*ing *NOTE* *on* *Field#6,* *Battery*

*Status* *(i.e.* *electric* *quantity),* *one* *byte*

Receiver tempature, or other status parameters

Bluetooth Str

**6**

Battery Status

Byte

1

H+4

**7**

Rcvr Temp

which might be sent with an interval, controlled Byte

by a flag

1

H+5

**8**

**9**

Fre Flag

Byte

1

1

H+6

H+7

Frequence Flag1, refer to Table 40

Frequence Flag2, refer to Table 40

Fre Flag2

Byte

**1**

**1**

**0**

**1**

Data-link status

Diff Data Type

Radio status: type, on-off, strength, TxD or RxD

Differential data type

Byte

Byte

1

1

H+8

H+9

Receiver work mode: fixed or movable ref

station, rover reveiver or single positioning.

**1**

**1**

**2**

**3**

Work Mode

Fix Status

Byte

Byte

1

1

H+10

H+11

Position Type, refer to Table 32

**1**

**1**

**1**

**1**

**1**

**4**

**5**

**6**

**7**

**8**

Diff Age

PDOP

Differential data age in second

Byte

1

1

1

1

8

H+12

H+13

H+14

H+15

H+16

Scale factor: 0.1

Byte

RMS

Postiong Accuracy RMS, scale factor: 0.1

Byte

Reserved

Latitude

-

Byte

In degree

Double

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*COMNAV* *OEM* *BOARD* *REFERENCE* *MANUAL*

*Chapter* *4.* *Logs* *Messages*

**1**

**2**

**9**

**0**

Longitude

Height

In degree

Double

Double

8

8

H+24

H+32

Ellipsoidal height of fix (antenna height above

ellipsoid), in meter

**2**

**2**

**2**

**2**

**1**

**2**

**3**

**4**

Undulation

Height undulation, in meter

Float

Float

Float

Float

4

4

4

4

H+40

H+44

H+48

H+52

Covariance E

Covariance N

Covariance V

Postion Error Cov in East direction (m)

Postion Error Cov in North direction (m)

Postion Error Cov in Vertial direction (m)

**2**

**5**

FreqHealth1

Byte

1

H+56

Signal Frequency Helth Flag 1, refer to Table 41

**2**

**2**

**2**

**6**

**7**

**8**

FreqHealth2

Use Sats

Signal Frequency Helth Flag 2, refer to *Table* *42.*

Satellite Number used in solution

Byte

Byte

Byte

1

1

1

H+57

H+58

H+59

Tracking Sats

Satellite Number continuously tracked

**2**

**9**

GPRS status

Byte

1

H+60

GPRS connection status, refer to Table 43

**3**

**3**

**3**

**0**

**1**

**2**

Reserved

Reserved

Reserved

Byte

Byte

Byte

1

1

1

H+61

H+62

H+63

H1(=

**3**

**3**

PRN

Byte

1

Satellite ID (1~177), Refer to Table 6

H+64)

**3**

**3**

**4**

**5**

Azimuth

Degree (°)

Degree (°)

Short

Byte

2

1

H1+1

H1+3

Elevation

**3**

**6**

L1 Status

Byte

1

H1+4

Frequency status about L1, refer to Table 45

**3**

**3**

**3**

**4**

**4**

**4**

**7**

**8**

**9**

**0**

**1**

**2**

L1 SNR

L1 signal noise ratio

Byte

Byte

Byte

1

1

1

4

4

H1+5

H1+6

H1+7

H1+8

H1+12

L1 RMS

L1 RMS

L1 Lost Counter

Next Fre Infor

Next Fre Infor

L1 track lost counter

May be L2 Infor, according to fre-flag

May be L5 infor, according to fre-flag

Next Sat Offset: H1 + Sat × (4 + Fre No\*4), where H1 = H+64 (Ver: 0x03)

H1+Sat

×(4+Fr

eNo\*4)

**4**

**3**

CRC

32-bit CRC Code

Hex

4

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**NOTE:** **Field#6,** **battery** **status** **(i.e.** **electric** **quantity),** **one** **byte**

**BIT7** **BIT6** **BIT5** **BIT4** **BIT3** **BIT2** **BIT1** **BIT0**

**BIT7**: Battery #2

**BIT6**: Battery #1

**BIT5-BIT0**: Electric quantity of Battery #1 or Battery #2 which is subject to the value of BIT7 and BIT6.

The battery electric quantity percent (0% ~ 100%) is represented by 64 numbers (0 ~ 63). An exception

is that the number ‘0’ represents the battery is not available or not mounted, since it’s impossible a

battery has a %0 electric quantity.

The electric quantity of Battery #1 and #2 is presented in each M925 and SATMSG log message

alternately. If BIT7 is set as 1, the value of BIT5-BIT0 represents Battery #2’s electric quantity, and a zero

value of BIT5-BIT0 means that Battery #2 is not available. Similarly, if BIT6 is set as 1, the value of

BIT5-BIT0 represents Battery #1’s electric quantity, and a zero value of BIT5-BIT0 means that Battery #1

is not available. It’s definitely impossible that both BIT7 and BIT6 are set to as 1 at the same time.

If Field#6 is extracted, battery electric quantity can be calculated as:

**Battery** **electric** **quantity** **=** **Round** **up** **the** **value** **of** **((Field#6** **&** **0x3F)** **×** **101** **/** **0x40)**

Attention please, once battery electric quantity decreases down to 10%, it would drop down steeply

and a warning for changing a new battery is necessary.

**Table** **40.Frequency** **Flag** **(Version** **3)**

**BIT**

**DESCRIPTION**

**BIT7** G2 information involved (GLONASS: G2)

**BIT6** G1 information involved (GLONASS: G1)

**BIT5** B3 information involved (BD2: B3)

**BIT4** B2 information involved (BD2: B2)

**BIT3** B1 information involved (BD2: B1)

**BIT2** L5 information involved (GPS: L5)

**BIT1** L2 information involved (GPS: L2)

**BIT0** L1 information involved (GPS: L1)

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**Table** **41.Frequency** **Health** **Flag** **1**

**BIT**

**DESCRIPTION** **VALUE**

**BIT7** GLONASS G2

**BIT6** GLONASS G1

**BIT5** BDS B3

**BIT4** BDS B2

**BIT3** BDS B1

**BIT2** GPS L5

0: healthy

1: unhealthy

**BIT1** GPS L2

**BIT0** GPS L1

**Table** **42.Frequency** **Health** **Flag** **2**

**DESCRIPTION**

**BIT**

**BIT7**

**BIT6**

**BIT5**

**BIT4**

**BIT3**

**BIT2**

**BIT1**

**BIT0**

Reserved for future GNSS frequency

**Table** **43.GPRS** **Connection** **Status**

**BIT**

**DESCRIPTION**

**STATUS**

**BIT7** Reserved

**BIT6** Reserved

**BIT5** Reserved

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**BIT**

**DESCRIPTION**

**STATUS**

**BIT4** Reserved

**BIT3** CORS Status

**BIT2** Net Register Status

**BIT1** SIM Card Status

**BIT0** Module Status

0

0

: not connected; 1: connected

: not registered; 1: registered

0: not ready; 1: ready

0

: not ready; 1: ready

**4**

**.2.9.3** **SATMSG**

**Satellite** **Information**

**Description**

This log provides both the information of satellites, like PRN numbers, elevation, azimuth, and

some board’s information, including signal strength and battery status.

For integrative receivers, much information should be collected from numbers of messages to

display in screen or other media, so this message involved nearly all the information you need

is strongly recommended.

*Message* *ID*

*9*

*11*

*Recommended* *Input*

*Supported* *Format*

*log* *satmsgb*

*binary*

**Reply** **(Binary)**

Binary Binary

Field# Field Type

Data Description

Format

Byte

H

Offset

**1**

SATMSG Header

Log Header

0

**2**

Sat Number

Satellite number

Byte

Byte

1

H

From Version Number: 2, frequency flag and

frequency status become effective

GPRS signal strength

**3**

Version Number

1

H+1

**4**

**5**

GPRS Str

Byte

Byte

1

1

H+2

H+3

Bluetooth Str

Bluetooth signal strength

Refer to the *NOTE* *on* *Field#6,* *Battery* *Status*

**6**

**7**

Battery Status

Fre Flag

*(i.e.* *electric* *quantity),* *one* *byte* defined in Byte

1

1

H+4

H+5

*4*

*.2.9.2* *M925*

Byte

Frequency flag, refer to Table 44

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**8**

PRN

Byte

1

H+6

Satellite ID (1~177), Refer to Table 6

**9**

**1**

Azimuth

Degree (°)

Degree (°)

Short

Byte

2

1

H+7

H+9

**0**

**1**

Elevation

**1**

L1 Status

Byte

1

H+10

Frequency status about L1, refer to Table 45

**1**

**1**

**1**

**1**

**1**

**1**

**2**

**3**

**4**

**5**

**6**

**7**

L1 SNR

L1 signal noise ratio

Byte

Byte

Byte

1

1

1

4

4

H+11

H+12

H+13

H+14

H+18

L1 RMS

L1 RMS

L1 Lost Counter

Next Fre Infor

Next Fre Infor

L1 track lost counter

May be L2 Infor, according to fre-flag

May be L5 infor, according to fre-flag

Next Sat Offset: H + 6 + Sat × (4 + Fre No\*4)

H+10+Sat\*

(4+FreNo\*

**1**

**8**

CRC

32-bit CRC Code

Hex

4

4

)

**Table** **44.Frequency** **Flag** **(Version** **2)**

**BIT**

**DESCRIPTION**

**BIT7** Reserved

**BIT6** Reserved

**BIT5** Reserved

**BIT4** Reserved

**BIT3** Reserved

**BIT2** L3 information involved (GPS: L5; BD2: B3)

**BIT1** L2 information involved (GPS: L2; BD2: B2)

**BIT0** L1 information involved (GPS: L1; BD2: B1)

**Table** **45.Frequency** **Status**

**BIT**

**DESCRIPTION**

**VALUE**

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**BIT**

**DESCRIPTION**

**VALUE**

**BIT7**

**BIT6**

**BIT5**

**BIT4**

**BIT3**

**BIT2**

**BIT1**

**BIT0**

In RTK calculation, if reference satellite

Reserved

1: reference satellite

0: not

Reserved (Lockout status of the satellite)

In RTK calculation, if involved in combined ambiguity

In RTK calculation, if ambiguity fixed

In RTK calculation, if carrier-phase used

In RTK calculation, if pseudorange used

This frequency information if valid

1: used

1: used

1: used

1: used

1: valid

0: not used

0: not used

0: not used

0: not used

0: invalid

**4**

**.2.9.4** **SATVIS**

**Satellite** **Visibility**

**Description**

This message contains satellite visibility information such as elevation and azimuth.

*Message* *ID*

*4*

*8*

*Recommended* *Input*

*Supported* *Format*

*log* *satvisb* *ontime* *5*

*binary*

**Reply** **(Binary)**

Field

Binary Binary

Field Type

Data Description

Format

#

**1**

**2**

**3**

**4**

**5**

**6**

**7**

**8**

**9**

**1**

**1**

**1**

Byte

H

4

Offset

0

SATVIS Header Log Header

Sat vis

Comp alm

#sat

Is satellite visibility valid: 0 = false, 1 = true

Complete GPS almanac used? 0=false, 1= true

Number of satellites

Enum

Enum

Ulong

Short

H

4

H+4

4

H+8

PRN/slot

glofreq

health

Elev

PRN of range measurement (GPS: 1-32)

Not used

2

H+12

H+14

H+16

H+20

H+28

H+36

H+44

Short

2

Satellite health

Ulong

Double

Double

Double

double

4

Elevation (degrees)

8

Az

Azimuth (degrees)

8

**0**

**1**

**2**

True dop

App dop

Theoretical Doppler of satellite

Apparent Doppler for this board

8

8

Next satellite offset = H+12+(#sat\*40)

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Field

Binary Binary

Field Type

CRC

Data Description

32-bit CRC

Format

Hex

#

Byte

Offset

H+12+(#s

at\*40)

**1**

**3**

4

**4**

**.2.9.5** **SATXYZ**

**Satellite** **Positions** **in** **ECEF** **Cartesian** **Coordinates**

**Description**

This message contains the decoded healthy satellite information necessary to compute the

solution: satellite coordinates (ECEF WGS84), satellite clock correction, ionospheric corrections

and tropospheric corrections.

*Message* *ID*

*2*

*70*

*Recommended* *Input*

*Supported* *Format*

*log* *satxyzb* *ontime* *5*

*ASCII,* *Binary*

**Reply** **(ASCII)**

#

SATXYZA,COM3,0,60.0,FINESTEERING,1865,474754.000,00000000,0000,1114;0.

,22,

0

1

5,-15084222.3606,6578111.4367,20797324.0055,-82716.737,1.939505301,3.

50863906,0.000000000,0.000000000,

2

1

8,331939.5836,16396859.9411,21377137.9648,132303.811,2.181498551,3.18

969806,0.000000000,0.000000000,

3

1

4,14332302.7311,22342874.5826,2543349.8588,8761.333,5.964851393,11.68

728685,0.000000000,0.000000000,

3

2

0,-20937088.1269,13183406.6559,9607131.0245,108446.846,1.734673649,2.

86741179,0.000000000,0.000000000,

8

2

1,-561165.7287,24827903.5557,9661802.3609,-145528.329,2.153225620,3.0

9855033,0.000000000,0.000000000,

1

1

2,-21186097.7357,10768124.0658,-11738353.6757,100528.613,3.932592236,

1.646636609,0.000000000,0.000000000,

1

2

4,-14558949.4706,19131262.1052,11076165.7393,-1804.985,1.658385230,2.

65761340,0.000000000,0.000000000,

4

1

42,7261670.7669,41527286.5505,-117059.2936,-22006.452,6.492729818,4.4

3330966,0.000000000,0.000000000,

5

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143,-14811002.3199,39447763.4671,-956706.2550,-25834.066,4.676105362,3.

131226458,0.000000000,0.000000000,

1

44,-39628887.7279,14486292.9577,-346788.5894,59380.037,5.782862006,4.

33089765,0.000000000,0.000000000,

2

1

45,21933086.9619,35994587.1747,-551147.5582,52360.344,10.164416051,9.

10727002,0.000000000,0.000000000,

5

1

46,-18423459.0520,21354484.3222,31373249.6331,-34315.885,3.442801813,

.601635931,0.000000000,0.000000000,

2

1

47,-21638134.9976,36315776.2488,-1833791.2176,28313.409,4.622843134,3.

10330994,0.000000000,0.000000000,

1

149,-732990.3528,24461063.7700,34401050.0440,110974.229,3.870875851,3.

011551144,0.000000000,0.000000000,150,-11016086.5712,37999666.2144,-14

874307.5423,37494.950,7.398493056,4.994304421,0.000000000,0.000000000,

1

41,-32334540.2436,27078823.6741,-499709.4237,-56949.895,4.730575008,3.

59515751,0.000000000,0.000000000,

2

4

3,-1458650.9146,11004205.3443,22954676.5578,-22871.512,2.315825486,3.

15196014,0.000000000,0.000000000,

5

4

2,-19512711.3525,4690307.7077,15742060.7042,-2453.082,2.128749742,3.6

5844930,0.000000000,0.000000000,

0

5

3,-17722019.9252,17620756.8073,5323458.1164,-5538.798,1.813382812,2.7

6211254,0.000000000,0.000000000,

9

5

8,10706156.5231,22641811.6824,4741145.3140,-9878.178,4.497215083,6.81

739645,0.000000000,0.000000000,

0

4

6,-9937718.8939,20466356.2848,-11454304.7735,-4963.400,4.041715928,7.

85728332,0.000000000,0.000000000,

5

5

2,-14342256.7827,2476448.5517,20935199.3460,-16602.556,2.329772824,4.

18819136,0.000000000,0.000000000\*15FB91FA

0

Field

#

Binary Binary

Field Type

Data Description

Format

Byte

H

Offset

0

**1**

**2**

**3**

SATXYZ Header Log Header

Reserved

#sat

Reserved

Double

Ulong

8

H

Number of satellites

4

H+8

**4**

PRN/slot

ULong

4

H+12

PRN of range measurement, refer to Table 6

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Field

Binary Binary

Field Type

Data Description

Format

#

**5**

**6**

**7**

**8**

**9**

**1**

**1**

**1**

**1**

Byte

8

Offset

H+16

H+24

H+32

H+40

H+48

H+56

H+64

H+72

X

Satellite X co-ordinates (ECEF,m)

Satellite Y co-ordinates (ECEF,m)

Satellite Z co-ordinates (ECEF,m)

Satellite clock correction (m)

Ionosphere delay (m)

Troposphere delay (m)

Reserved

Double

Double

Double

Double

Double

Double

Double

Double

Y

8

Z

8

clk corr

iono delay

tropo delay

Reserved1

Reserved2

8

8

**0**

**1**

**2**

**3**

8

8

Reserved

8

Next satellite offset = H+12+(#sat\*68)

H+12+

(#sat\*68)

-

**1**

**1**

**4**

**5**

xxxx

32-bit CRC (ASCII and Binary only)

Sentence terminator (ASCII only)

Hex

-

4

-

[CR][LF]

**4**

**.2.10** **SBAS** **Message** **Types**

This section presents the set of message types of SBAS per RTCA DO-229D.

**.2.10.1** **RAWSBASFRAME** **Raw** **SBAS** **Information**

**4**

**Description**

This message contains raw SBAS frame data of 226 bits, including 8-bit preamble, 6-bit message

type and 212 bits of data but without a 24-bit CRC. Only frame data with a valid preamble and

CRC are reported.

*Message* *ID*

*9*

*73*

*Recommended* *Input*

*Supported* *Format*

*log* *rawsbasframea* *ontime* *1*

*ASCII*

**Reply** **(ASCII)**

#RAWSBASFRAMEA,COM1,0,60.0,FINESTEERING,1865,350002.000,00000000,0000,

1114;0,129,25,c666115ffb06e1381283067a05043c80000000000000000000000000

00,0\*CA686A12

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#

1

0

RAWSBASFRAMEA,COM1,0,60.0,FINESTEERING,1865,350002.000,00000000,0000,

114;0,137,25,c666115ff906c140140305fa84843c80000000000000000000000000

0,0\*AE57377C

#RAWSBASFRAMEA,COM1,0,60.0,FINESTEERING,1865,350003.000,00000000,0000,

1114;0,129,26,5369c407e1ef0ff883c5dc21e0cf047815c05e01f81bc43e1ef1d760

00,0\*327DC1E6

#RAWSBASFRAMEA,COM1,0,60.0,FINESTEERING,1865,350003.000,00000000,0000,

1114;0,137,63,53fc0000000000000000000000000000000000000000000000000000

00,0\*E9307D42

Binary

Byte

Binary

Offset

Field# Field Type

Data Description

Format

**1**

**2**

**3**

**4**

RAWEPHEM header

Log header

H

4

4

4

0

decode #

PRN

Frame decoder number

Ulong

Ulong

Ulong

H

SBAS satellite PRN number

SBAS message type (0 ~ 63)

Raw SBAS frame data. There are 226

bits of data and 6 bits of padding

Signal channel number that the frame

was decoded on

H+4

H+8

SBAS Msg id

**5**

**6**

data

chan

Hex[29] 32

H+12

H+44

Ulong

4

**7**

**8**

xxxx

32-bit CRC (ASCII and Binary only)

Sentence terminator (ASCII only)

Ulong

-

4

-

H+48

-

[CR][LF]

**4**

**.2.10.2**

**SBAS0**

**Do** **Not** **Use** **for** **Safety** **Applications**

**Description**

The first SBAS message type, Message Type 0, will be used primarily during system testing. The

receipt of a Message Type 0 will result in the cessation of the use of any ranging data and all

message types 1-7, 9-10, 18, 24-28 obtained from that SBAS signal (PRN code). Other message

types may be retained, such as message type 17, for potential performance enhancements. In

addition, that SBAS signal (PRN code) will be deselected for at least one minute.

While testing, WAAS will broadcast the contents of a type 2 message in each type 0 message.

Other SBAS service providers may broadcast both Type 0 and Type 2 messages during testing.

For users who do not require integrity (equipment under test or equipment used for

non-safety applications), the message type 0 that is not empty may be used for ranging and

corrections.

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*Message* *ID*

9

76

*Recommended* *Input*

*log* *sbas0a* *ontime* *1*

*ASCII*

*Supported* *Format*

**Reply** **(ASCII)**

Binary

Field#

Field Type

Data Description

Log header

Format

ULong

Binary Offset

Byte

**1**

**2**

**3**

**4**

SBAS0 header

PRN

H

4

4

-

0

SBAS SV PRN number

H

xxxx

32-bit CRC (ASCII and Binary only) Hex

H + 4

-

[CR][LF]

Sentence terminator (ASCII only)

-

**4**

**.2.10.3**

**SBAS1**

**PRN** **Mask** **Assignments**

**Description**

SBAS Message Type 1 givers the PRN Mask. It consists of 210 ordered slots, each of which

indicates if data is provided for the corresponding satellite. The satellites for which corrections

are provided are ordered from 1 to a maximum of 51, in order to decode Message Types 2 - 5,

6

, 7, 24, 25 and 28.

*Message* *ID*

9

77

*Recommended* *Input*

*Supported* *Format*

*log* *sbas1a* *ontime* *1*

*ASCII*

**Reply** **(ASCII)**

#

SBAS1A,COM1,0,60.0,FINESTEERING,1863,557215.000,00000000,0000,1114;12

,7FFFFFFF0000000000000000000000008080000000000000000000,0\*F83CE234

9

#

SBAS1A,COM1,0,60.0,FINESTEERING,1863,557239.000,00000000,0000,1114;13

,7FFFFFFF0000000000000000000000008080000000000000000000,0\*5328422C

7

Binary Binary

Field#

Field Type

Data Description

Format

Ulong

Byte

H

Offset

0

**1**

**2**

**3**

**4**

**5**

SBAS1 header

PRN

Log header

Source PRN of message

PRN bit mask [1-byte padding]

Issue of PRN mask data

4

H

mask

Uchar[27] 28

H+4

H+32

H + 36

IODP

Ulong

4

4

xxxx

32-bit CRC (ASCII and Binary only) Hex

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Binary Binary

Field#

Field Type

[CR][LF]

Data Description

Format

-

Byte

-

Offset

-

**6**

Sentence terminator (ASCII only)

**4**

**.2.10.4**

**SBAS2** **-** **5**

**Fast** **Corrections**

**Description**

SBAS Message Types 2 to 5 are broadcasted to provide fast corrections. Message Type 2

contains the data sets for the first 13 satellites designated in the PRN mask. Message Type 3

contains the data sets for satellites 14 - 26 designated in the PRN mask, etc., through Message

Type 5, which contains the data sets for satellites 40 through 51 designated in the PRN mask.

The last data set of Message Type 5 is not used due to the constraint that corrections can only

be provided for 51 satellites.

*Message* *ID*

*9*

*82,* *987,* *992,* *994*

*log* *sbas2a* *ontime* *1*

*log* *sbas3a* *ontime* *1*

*log* *sbas4a* *ontime* *1*

*log* *sbas5a* *ontime* *1*

*ASCII*

*Recommended* *Input*

*Supported* *Format*

**Reply** **(ASCII)**

#SBAS2A,COM1,0,60.0,FINESTEERING,1863,557234.000,00000000,0000,1114;12

9,0,0,-4,2047,2047,-2,2047,2047,2047,2047,2047,2047,2047,-4,2047,6,14,

14,6,14,14,14,14,14,14,14,6,14\*D3CEE5E5

#SBAS2A,COM1,0,60.0,FINESTEERING,1863,557234.000,00000000,0000,1114;13

7,0,0,-1,2047,2047,1,2047,2047,2047,2047,2047,2047,2047,-2,2047,6,14,1

4,6,14,14,14,14,14,14,14,6,14\*5BE2F027

#SBAS3A,COM1,0,60.0,FINESTEERING,1863,557236.000,00000000,0000,1114;12

9,1,0,-11,2047,2047,2047,2047,-1,35,2047,2047,-2,2047,2047,2047,7,14,1

4,14,14,6,10,14,14,10,14,14,14\*E4E406B0

#SBAS3A,COM1,0,60.0,FINESTEERING,1863,557235.000,00000000,0000,1114;13

7,0,0,-8,2047,2047,2047,2047,4,45,2047,2047,14,2047,2047,2047,7,14,14,

14,14,6,10,14,14,10,14,14,14\*198F75A3

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#

9

1

SBAS4A,COM1,0,60.0,FINESTEERING,1863,557235.000,00000000,0000,1114;12

,1,0,-18,-2,0,2047,2047,16,3,2047,2047,2047,2047,2047,2047,14,7,6,14,

4,14,12,15,15,15,15,15,15\*FFBFB51C

#SBAS4A,COM1,0,60.0,FINESTEERING,1863,557236.000,00000000,0000,1114;13

7,1,0,-15,0,3,2047,2047,16,18,2047,2047,2047,2047,2047,2047,14,7,6,14,

14,14,12,15,15,15,15,15,15\*90EE6A

Field# Field Type

Data Description

Format

Binary Byte Binary Offset

**1**

**2**

**3**

**4**

SBAS2~4 header Log header

H

4

4

4

0

PRN

Source PRN of message

Issue of fast corrections data

Issue of PRN mask data

*PRC[i]*: Fast corrections

(-2048 to +2047) for the PRN in

(SBAS2: i = 0- 12)

ULong

Ulong

Ulong

H

IODF

IODP

H+4

H+8

H+8+k\*4

**5**

**~** **17** *PRC[i]*

Long[13]

4 \* 13

(k = 1 ~ 13)

(SBAS3: i = 13- 25)

(SBAS4: i = 26- 38)

*UDREi*:

User differential range error

indicator for the PRN in slot i

(SBAS2: i = 0- 12)

H+60+k\*4

(k = 1 ~ 13)

**1**

**8~30** *UDRE[i]*

Ulong[13] 4 \* 13

(SBAS3: i = 13- 25)

(SBAS4: i = 26- 38)

**3**

**3**

**1**

**2**

xxxx

32-bit CRC (ASCII and Binary only) Hex

4

-

H + 116

-

[CR][LF]

Sentence terminator (ASCII only)

-

Field# Field Type

Data Description

Format

Binary Byte Binary Offset

**1**

**2**

**3**

**4**

SBAS5 header

Log header

H

4

4

4

0

PRN

Source PRN of message

Issue of fast corrections data

Issue of PRN mask data

*PRC[i]*: Fast corrections

ULong

Ulong

Ulong

H

IODF

IODP

H+4

H+8

H+8+k\*4

**5**

**1**

**~** **16** *PRC[i]*

(-2048 to +2047) for the PRN in Long[12]

slot i (SBAS5: i = 39 - 50)

4 \* 12

4

(k = 1 ~ 12)

**7**

*PRC* *Reserved*

Invalid, do not use

Long

H+60

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Field# Field Type

Data Description

Format

Binary Byte Binary Offset

*UDRE[i]*:

User differential range error

indicator for the PRN in slot i

(SBAS5: i = 39- 50)

H+60+k\*4

**1**

**8~29** *UDRE[i]*

Ulong[12] 4 \* 12

(k = 1 ~ 12)

**3**

**3**

**3**

**0**

**1**

**2**

*UDRE* *Reserved*

(Invalid, do not use)

Ulong

4

4

-

H+112

H + 116

-

xxxx

32-bit CRC (ASCII and Binary only) Hex

[CR][LF]

Sentence terminator (ASCII only)

-

**4**

**.2.10.5**

**SBAS6**

**Integrity** **Information**

**Description**

The integrity information is provided by Message Type 6, which allows the fast corrections of

Message Type 2-5 and 24 to be updated infrequently, commensurate with the dynamics of the

satellite clock errors. It can also be used to indicate an alert condition on multiple satellites.

*Message* *ID*

9

95

*Recommended* *Input*

*Supported* *Format*

*log* *sbas6a* *ontime* *1*

*ASCII*

**Reply** **(ASCII)**

Binary

Byte

Field#

Field Type

SBAS6 header

Data Description

Format

Binary Offset

**1**

**2**

**3**

**4**

**5**

**6**

Log header

H

4

4

4

4

4

0

PRN

SBAS SV PRN number

Issue of fast corrections data

Issue of fast corrections data

Issue of fast corrections data

Issue of fast corrections data

*UDRE[i]*:

ULong

Ulong

Ulong

Ulong

Ulong

H

IODF2

IODF3

IODF4

IODF5

H+4

H+8

H+12

H+16

**7**

**~** **57**

*UDRE[i]*

User differential range error indicator Ulong[51]

for the PRN in slot I (i = 0 - 50)

4 \* 51 H+16+(i+1)\*4

**5**

**5**

**6**

**8**

UDRE Reserved Invalid, do not use

Ulong

Hex

-

4

4

-

H+224

H + 228

-

**9**

**0**

xxxx

32-bit CRC (ASCII and Binary only)

Sentence terminator (ASCII only)

[CR][LF]

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**4**

**.2.10.6**

**SBAS7**

**Fast** **Correction** **Degradation** **Factor**

**Description**

The Type 7 message of SBAS specifies the applicable IODP, system latency time (*tlat*) and the

fast correction degradation factor indicator (*aii*) for computing the degradation of fast and long

term corrections.

*Message* *ID*

9

96

*Recommended* *Input*

*Supported* *Format*

*log* *sbas7a* *ontime* *1*

*ASCII*

**Reply** **(ASCII)**

#SBAS7A,COM1,0,60.0,FINESTEERING,1863,555697.000,00000000,0000,1114;12

9,1,0,0,15,15,15,15,15,15,15,15,15,15,15,15,15,15,15,15,15,15,15,15,15,

15,15,15,15,15,15,15,15,15,15,15,15,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,

0,0\*7825412F

#SBAS7A,COM1,0,60.0,FINESTEERING,1863,555714.000,00000000,0000,1114;13

7,1,0,0,15,15,15,15,15,15,15,15,15,15,15,15,15,15,15,15,15,15,15,15,15,

15,15,15,15,15,15,15,15,15,15,15,15,15,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,

0,0\*6D5BC66

Binary

Field#

Field Type

Data Description

Format

Binary Offset

Byte

H

**1**

**2**

**3**

**4**

**5**

SBAS7 header

PRN

Log header

0

SBAS SV PRN number

System latency (s)

Issue of PRN mask data

Unused spare bits

*ai[i]*:

ULong

Ulong

Ulong

Ulong

4

H

latency

4

H+4

H+8

H+12

IODP

4

spare bits

4

**6**

**~** **56**

*ai[i]*

Degradation factor indicator for the Ulong[51] 4 \* 51 H+12+(i+1)\*4

PRN in slot i (i = 0-50)

**5**

**5**

**6**

**9**

ai Reserved

xxxx

Invalid, do not use

Ulong

Hex

-

4

4

-

H+220

H + 224

-

**9**

**0**

32-bit CRC (ASCII and Binary only)

Sentence terminator (ASCII only)

[CR][LF]

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**4**

**.2.10.7**

**SBAS9**

**GEO** **Navigation** **Message**

**Description**

The SBAS Type 9 GEO Navigation Message represents the position, velocity and acceleration of

the geostationary satellite, in ECEF Coordinates, and its apparent clock time and frequency

offsets. Also included is the time of applicability (*t0*) and an accuracy exponent (URA)

representing the health of the GEO ranging signal. *aGf* and *aGf* will be an estimate of the time

*0*

*1*

offset and drift with respect to SBAS Network Time. Their combined effect will be added to the

estimate of the satellite's transmit time.

Message ID

9

97

*Recommended* *Input*

*Supported* *Format*

*log* *sbas9a* *ontime* *1*

*ASCII*

**Reply** **(ASCII)**

#SBAS9A,COM1,0,60.0,FINESTEERING,1863,555689.000,00000000,0000,1114;12

9,107,37312,14,-34558908.00,24173308.00,32571.6,0.112500,1.610000,0.69

6,0.0001000,0.0000625,-0.0001875,-2.579763532E-07,-3.092281986E-11\*620

FBD67

#SBAS9A,COM1,0,60.0,FINESTEERING,1863,555689.000,00000000,0000,1114;13

7,7,37312,6,-34558924.00,24173288.00,32547.6,0.112500,1.610625,0.696,0.

0001000,0.0000625,-0.0001875,-1.182779670E-07,-3.001332516E-11\*CD13FE8

D

Field# Field Type

Data Description

Format

Binary Byte

Binary Offset

0

**1**

**2**

**3**

**4**

**5**

**6**

**7**

**8**

**9**

**1**

**1**

**1**

SBAS9 header Log header

H

4

4

4

4

8

8

8

8

8

8

8

PRN

IOD

t0

Source PRN of message

Issue of GEO navigation data

Time of applicability

URA value

Ulong

H

Ulong

H+4

Ulong

H+8

URA

X

Ulong

H+12

H+16

H+24

H+32

H+40

H+48

H+56

H+64

ECEF X coordinate (m)

ECEF Y coordinate (m)

ECEF Z coordinate (m)

X rate of change (m/s)

Y rate of change (m/s)

Z rate of change (m/s)

X rate of rate change (m/s2)

Double

Double

Double

Double

Double

Double

Double

Y

Z

Xvel

Yvel

Zvel

Xaccel

**0**

**1**

**2**

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Field# Field Type

Data Description

Format

Double

Double

Double

Double

Binary Byte

Binary Offset

H+72

**1**

**1**

**1**

**1**

**1**

**1**

**3**

**4**

**5**

**6**

**7**

**8**

Yaccel

Zaccel

af0

Y rate of rate change (m/s2)

Z rate of rate change (m/s2)

Time offset (s)

8

8

8

8

4

-

H+80

H+88

af1

Time drift (s)

H+96

xxxx

32-bit CRC (ASCII and Binary only) Hex

H+104

-

[CR][LF]

Sentence terminator (ASCII only)

-

**4**

**.2.10.8**

**SBAS10**

**Degradation** **Factors**

**Description**

Message Type 10 provides the degradation factors. These factors are used as described in

RTCA DO-229D.

*Message* *ID*

*9*

*78*

*Recommended* *Input*

*Supported* *Format*

*log* *sbas10a* *ontime* *1*

*ASCII*

**Reply** **(ASCII)**

#SBAS10A,COM1,0,60.0,FINESTEERING,1863,555743.000,00000000,0000,1114;1

29,1,38,76,256,152,100,311,83,256,6,228,300,0,0,0,0,000000000000000000

0000\*AA059256

#SBAS10A,COM1,0,60.0,FINESTEERING,1863,555743.000,00000000,0000,1114;1

37,1,38,76,256,152,100,311,83,256,6,228,300,0,0,0,0,000000000000000000

0000\*C3D6489E

Binary Binary Scale

Field# Field Type

Data Description

Log header

Format

Byte

Offset Factor

SBAS10

**1**

H

0

-

header

**2**

**3**

PRN

Source PRN of message

ULong

Ulong

4

H

-

Estimated noise and round off error

parameter

Brcc

4

H+4

0.002

Maximum round off due to the least

**4**

**5**

Cltc\_ lsb

significant bit (lsb) of the orbital Ulong

clock

4

4

H+8

0.002

Cltc\_Vl

Velocity error bound

Ulong

H+12

0.00005

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Binary Binary Scale

Field# Field Type

Data Description

Format

Byte

Offset Factor

**6**

**7**

**8**

Iltc\_vl

Update interval for v=1 long term

Bound on update delta

Ulong

Ulong

Ulong

4

4

4

H+16

H+20

H+24

-

Cltc\_v0

Iltc\_v1

0.002

-

Minimum update interval v = 0

Maximum round off due to the lsb of

the orbital clock

**9**

**1**

**1**

**1**

**1**

Cgeo\_lsb

Cgeo\_v

Igeo

Ulong

Ulong

Ulong

Ulong

Ulong

4

4

4

4

4

H+28

H+32

H+36

H+40

H+44

0.0005

0.00005

-

**0**

**1**

**2**

**3**

Velocity error bound

Update interval for GEO navigation

message

Cer

Degradation parameter

Bound on ionospheric grid delay

difference

0.5

Ciono\_step

0.001

Minimum

interval

ionospheric

update

**1**

**1**

**4**

**5**

Iiono

Ulong

Ulong

4

4

H+48

H+52

-

Rate of ionospheric corrections

change

Ciono\_ramp

0.000005

**1**

**1**

**1**

**1**

**1**

**2**

**6**

**7**

**8**

**9**

**9**

**0**

RSSudre

RSSiono

User differential range error flag

Root sum square flag

Ulong

Ulong

Ulong

4

4

4

H+56

H+60

H+64

H+68

H+79

-

-

-

Ccovariance

Spare bits

xxxx

Covariance

0.1

-

Spare 88 bits, possibly GLONASS

32-bit CRC (ASCII and Binary only)

Sentence terminator (ASCII only)

Hex[11] 11

Hex

-

4

-

[CR][LF]

**4**

**.2.10.9**

**SBAS12**

**SBAS** **Network** **Time/UTC/GLO** **Time** **Offset** **Parameters** **Message**

**Description**

SBAS Message Type 12 will consist of a preamble, a message type identifier (= 12) followed by

the UTC parameters, then followed by a flag to indicate the UTC time standard from which the

offset is determined. The next item are the Time of Week (TOW) in seconds of the beginning of

the message, followed by a GPS Week number (WN). The spare 75 bits possibly to be partially

replaced with the difference between SBAS Network Time and GLONASS time.

*Message* *ID*

*9*

*79*

*Recommended* *Input*

*log* *sbas12a* *ontime* *1*

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*Chapter* *4.* *Logs* *Messages*

*Supported* *Format*

*ASCII*

**Reply** **(ASCII)**

Binary

Byte

Binary

Offset

Field# Field Type

Data Description

Format

**1**

**2**

**3**

**4**

**5**

**6**

**7**

**8**

SBAS12 header Log header

H

4

8

8

4

2

2

2

0

PRN

A1*SNT*

A0*SNT*

t0t

Source PRN of message

Time drift (s/s)

ULong

Double

Double

Ulong

H

H+4

H+12

H+20

H+24

H+26

H+28

Time offset (s)

Seconds into the week (s)

WNt

dtLS

Week number

Ushort

Short

Delta time due to leap seconds

Week number, leap second future

Day of the week (the range is 1 to 7 where

Sunday = 1 and Saturday = 7)

Delta time, leap second future

UTC Standard identifier

WNLSF

Ushort

**9**

DN

Ushort

2

H+30

**1**

**1**

**1**

**1**

**0**

**1**

**2**

**3**

dtLSF

Ushort

Ushort

Ulong

Ulong

2

2

4

4

H+32

H+34

H+36

H+40

UTC ID

GPS TOW

GPS WN

GPS reference time of the week

GPS de-modulo week number

Is GLONASS information present?

**1**

**1**

**4**

**5**

GLO Indicator

Reserved

Enum

4

H+44

H+48

0

= FALSE, 1 = TRUE

Reserved array of hexabytes for GLONASS

time offset

Char[10]

10 + 2

**1**

**1**

**6**

**7**

xxxx

32-bit CRC (ASCII and Binary only)

Sentence terminator (ASCII only)

Hex

-

4

-

H +60

-

[CR][LF]

**4**

**.2.10.10** **SBAS17**

**GEO** **Almanacs**

**Description**

Almanacs for GEOs will be broadcast periodically to alert the user of their existence, location,

the general service provided and health and status. Almanacs for three satellites will be

broadcast in the GEOs Almanacs Message Type 17. These messages will be repeated to include

all GEOs. Unused almanacs will have a PRN number of 0 and should be ignored.

*Message* *ID*

*9*

*80*

*Recommended* *Input*

*log* *sbas17a* *ontime* *1*

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*Supported* *Format*

*ASCII*

**Reply** **(ASCII)**

Binary

Field#

Field Type

Data Description

Log header

Format

Binary Offset

Byte

SBAS17

header

PRN

**1**

**2**

**3**

H

0

Source PRN of message

Number of almanac entries with

information to follow

Data ID type

ULong

Ulong

4

H

#ents

4

H+4

**4**

**5**

**6**

**7**

**8**

**9**

Data ID

Entry PRN

Health

X

Ushort

Ushort

Ushort

Long

2

H+8

PRN for this entry

2

H+10

H+12

H+16

H+20

H+24

H+28

H+32

H+36

Health bits

4a

4

ECEF X coordinate (m)

ECEF Y coordinate (m)

ECEF Z coordinate (m)

X rate of change (m/s)

Y rate of change (m/s)

Z rate of change (m/s)

Y

Long

4

Z

Long

4

**1**

**1**

**1**

**1**

**4**

**5**

**6**

**0**

X vel

Long

4

**1**

Y vel

Long

4

**2**

Z vel

Long

4

**3** **…**

Next entry

H+8+(#ents x 32)

**+#ents\*9** t0

Time of day in secs (0 ~ 86336)

Ulong

4

4

-

H+8+ (#ents x32)

**+#ents\*9** xxxx

**+#ents\*9** [CR][LF]

32-bit CRC (ASCII and Binary only) Hex

H+12+(#ents x32)

-

Sentence terminator (ASCII only)

-

**4**

**.2.10.11** **SBAS18**

**Ionospheric** **Grid** **Point** **Masks**

**Description**

The ionospheric delay corrections are broadcast in SBAS Message Type 18 as vertical delay

estimates at specified ionospheric grid points (IGPs), applicable to a signal on L1. In order to

facilitate flexibility in the location of these IGPs, a fixed definition of densely spaced IGP

locations is used, resulting in a large number of possible IGPs. The predefined IGPs are

contained in 11 bands (numbered 0 to 10). Bands 0-8 are vertical bands on a Mercator

projection map, and bands 9-10 are horizontal bands on a Mercator projection map.

The density of these predefined IGPs, is dictated by the possible large variation in the

ionosphere vertical delay during periods of high solar activity, especially at lower latitudes.

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Since it would be impossible to broadcast IGP delays for all possible locations, a mask is

broadcast to define the IGP locations providing the most efficient model of the ionosphere at

the time.

*Message* *ID*

*9*

*81*

*Recommended* *Input*

*Supported* *Format*

*log* *sbas18a* *ontime* *1*

*ASCII*

**Reply** **(ASCII)**

#

3

9

SBAS18A,COM1,0,60.0,FINESTEERING,1863,555684.000,00000000,0000,1114;1

7,3,0,3,0003FFC180FFC0C03FF0001FF00007FC0000FC00003F00000000,0\*3F6D65

4

Binary Binary

Field# Field Type

Data Description

Format

Byte

H

Offset

0

**1**

**2**

**3**

SBAS18 header

Log header

PRN

Source PRN of message

ULong

Ulong

4

H

#bands

Number of bands broadcast

Specific band number that identifies which

of the 11 IGP bands the data belongs to

Issue of ionospheric data

IGP mask

4

H+4

**4**

Band Num

Ulong

4

H+8

**5**

**6**

**7**

**8**

**9**

IODI

Ulong

Uchar[26]

Ulong

Hex

4

H+12

H+16

H+44

H+48

-

IGP mask

spare bit

xxxx

26+2

One spare bit

4

4

-

32-bit CRC (ASCII and Binary only)

Sentence terminator (ASCII only)

[CR][LF]

-

**4**

**.2.10.12** **SBAS24**

**Mixed** **Fast** **Corrections/Long** **Term** **Satellite** **Error** **Corrections**

**Description**

This section presents the Type 24 Mixed Fast Correction/Long Term Satellite Error Corrections

Message. The first half of the message consists of six fast data sets according to the PRN mask

sequence, followed by the IODP, a Block ID indicating which corrections block is provided, and

the IODF. The Block ID (0, 1, 2, 3) will indicate whether the Type 24 message contains the fast

corrections associated with a Type 2, Type 3, Type 4, or Type 5 message, respectively. The left

data fields are composed of a half message as described in Message Type 25.

*Message* *ID*

*9*

*83*

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*Chapter* *4.* *Logs* *Messages*

*Recommended* *Input*

*log* *sbas24a* *ontime* *1*

*ASCII*

*Supported* *Format*

**Reply** **(ASCII)**

Binary Binary Scale

Field# Field Type

Data Description

Format

Byte

Offset Factor

SBAS24

**1**

Log header

H

0

header

**2**

**3**

**4**

**5**

**6**

**7**

**8**

**9**

**1**

**1**

**1**

**1**

**1**

**1**

**1**

**1**

**1**

**1**

**2**

**2**

**2**

**2**

**2**

**2**

**2**

**2**

PRN

Source PRN of message

ULong

Long

4

4

4

4

4

4

4

4

4

4

4

4

4

4

4

4

4

4

4

4

4

4

4

4

4

4

H

-

-

-

-

-

-

-

-

-

-

-

-

-

-

PRC0

PRC1

PRC2

PRC3

PRC4

PRC5

UDRE0

UDRE1

UDRE2

UDRE3

UDRE4

UDRE5

IODP

Block ID

IODF

H+4

Long

H+8

PRC[i]:

Long

H+12

H+16

H+20

H+24

H+28

H+32

H+36

H+40

H+44

H+48

H+52

H+56

H+60

H+64

H+68

H+72

H+76

H+80

H+84

H+88

H+92

H+96

H+100

Fast corrections (-2048 to +2047) for the

PRN in slot I (i = 0-5)

Long

Long

Long

Ulong

Ulong

Ulong

Ulong

Ulong

Ulong

Ulong

Ulong

Ulong

Ulong

Ulong

Ulong

Ulong

Long

**0**

**1**

**2**

**3**

**4**

**5**

**6**

**7**

**8**

**9**

**0**

**1**

**2**

**3**

**4**

**5**

**6**

**7**

UDRE[i]:

User differential range error indicator

for the PRN in slot i (i = 0-5)

Issue of PRN mask data

Associated message type

Issue of fast corrections data

Spare value

-

spare

vel

-

Velocity code flag

-

mask1

IODE1

dx1

Index into PRN mask (Type 1)

Issue of ephemeris data

Delta x (ECEF)

-

-

0.125

0.125

0.125

2-31

-

dy1

Delta y (ECEF)

Long

dz1

Delta z (ECEF)

Long

daf0

Delta af0 clock offset

Second index into PRN mask (Type 1)

Second issue of ephemeris data

Long

mask2

IODE2

Ulong

Ulong

-

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Binary Binary Scale

Field# Field Type

Data Description

Format

Byte

Offset Factor

H+104 2-11

H+108 2-11

H+112 2-11

H+116 2-39

H+120 16

**2**

**2**

**3**

**3**

**3**

**3**

**8**

**9**

**0**

**1**

**2**

**3**

ddx

ddy

ddz

daf1

t0

Delta delta x (ECEF)

Long

Long

Long

Long

Ulong

Ulong

4

4

4

4

4

4

Delta delta y (ECEF)

Delta delta z (ECEF)

Delta af1 clock offset

Applicable time of day

Issue of PRN mask data

Spare value when velocity code is equal

to 0

IODP

H+124

-

**3**

**4**

corr spare

Ulong

4

H+128

-

**3**

**3**

**5**

**6**

xxxx

32-bit CRC (ASCII and Binary only)

Sentence terminator (ASCII only)

Hex

-

4

-

H +132

-

[CR][LF]

**4**

**.2.10.13** **SBAS25**

**Long** **Term** **Satellite** **Error** **Corrections**

**Description**

SBAS Message Type 25 will be broadcast to provide error estimates for slow varying satellite

ephemeris and clock errors with respect to WGS-84 ECEF coordinates. These corrections are

estimated with respect to the GNSS broadcast clock and ephemeris parameters. These

long-term corrections are not applied for SBAS satellites operated by that service provider.

Instead, the Type 9 GEO Navigation Message will be updated as required to prevent slow

varying GEO satellite errors.

*Message* *ID*

*9*

*84*

*Recommended* *Input*

*Supported* *Format*

*log* *sbas25a* *ontime* *1*

*ASCII*

**Reply** **(ASCII)**

#SBAS25A,COM1,0,60.0,FINESTEERING,1863,555690.000,00000000,0000,1114;1

29,1,4,66,-1,-30,-21,-26,0,0,1,0,0,0,2321,0,0,1,19,4,-26,9,3,-24,0,0,4,

-1,0,2,2321,0,0\*45D51D97

#SBAS25A,COM1,0,60.0,FINESTEERING,1863,555690.000,00000000,0000,1114;1

37,1,4,66,1,-29,-19,-28,0,0,1,0,-1,0,2321,0,0,1,19,4,-32,6,5,-25,0,0,4,

-1,0,1,2321,0,0\*D8356EA3

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Binary Binary Scale

Field# Field Type

Data Description

Format

Byte

H

4

Offset Factor

**1**

**2**

**3**

**4**

**5**

**6**

**7**

**8**

**9**

SBAS25 header

Log header

0

PRN

Source PRN of message

ULong

Ulong

Ulong

Ulong

Long

H

1st half vel

1st half mask1

1st half IODE1

1st half dx1

1st half dy1

1st half dz1

1st half af0

Velocity code flag (0 or 1)

Index into PRN mask (Type 1)

Issue of ephemeris data

4

H+4

-

4

H+8

-

4

H+12

H+16

H+20

H+24

H+28

-

Delta x (ECEF)

4

0.125

0.125

0.125

2-31

Delta y (ECEF)

Long

4

Delta z (ECEF)

Long

4

Delta af0 clock offset

Long

4

Second index into PRN mask (Type 1)

Dummy value when vel code = 1

Second issue of ephemeris data

Dummy value when vel code = 1

Delta delta x (ECEF) when vel code = 1

Delta x (dx) when vel code = 0

Delta delta y (ECEF) when vel code = 1

Delta y (dy) when vel code = 0

Delta delta z (ECEF) when vel code = 1

Delta z (dz) when vel code = 0

Delta af1 clock offset when vel code = 1

Delta af0 clock offset when vel code = 0

Applicable time of day

**1**

**1**

**1**

**1**

**1**

**1**

**0**

**1**

**2**

**3**

**4**

**5**

1st half mask2

1st half IODE2

1st half ddx

1st half ddy

1st half ddz

1st half af1

Ulong

Ulong

Long

Long

Long

Long

4

4

4

4

4

4

H+32

H+36

H+40

H+44

H+48

H+52

-

-

2-11

2-11

2-11

2-39

**1**

**1**

**1**

**6**

**7**

**8**

1st half t0

Ulong

Ulong

Ulong

4

4

4

H+56

H+60

H+64

16

-

Dummy value when vel code = 0

Issue of PRN mask data

1st half IODP

1

st half corr Spare value when vel code = 0

-

spare

Dummy value when vel code = 1

Velocity code flag (0 or 1)

Index into PRN mask (Type 1)

Issue of ephemeris data

Delta x (ECEF)

**1**

**2**

**2**

**2**

**2**

**2**

**9**

**0**

**1**

**2**

**3**

**4**

2nd half vel

2nd half mask1

2nd half IODE1

2nd half dx1

2nd half dy1

2nd half dz1

Ulong

Ulong

Ulong

Long

4

4

4

4

4

4

H+68

H+72

H+76

H+80

H+84

H+88

-

-

-

0.125

0.125

0.125

Delta y (ECEF)

Long

Delta z (ECEF)

Long

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Binary Binary Scale

Field# Field Type

Data Description

Format

Long

Byte

4

Offset Factor

**2**

**2**

**5**

**6**

2nd half af0

Delta af0 clock offset

H+92

2-31

Second index into PRN mask (Type 1)

Dummy value when vel code = 1

Second issue of ephemeris data

Dummy value when vel code = 1

Delta delta x (ECEF) when vel code = 1

Delta x (dx) when vel code = 0

Delta delta y (ECEF) when vel code = 1

Delta y (dy) when vel code = 0

Delta delta z (ECEF) when vel code = 1

Delta z (dz) when vel code = 0

Delta af1 clock offset when vel code = 1

Delta af0 clock offset when vel code = 0

Applicable time of day

2nd half mask2

Ulong

Ulong

Long

Long

Long

Long

4

4

4

4

4

4

H+96

-

**2**

**2**

**2**

**3**

**3**

**7**

**8**

**9**

**0**

**1**

2nd half IODE2

2nd half ddx

2nd half ddy

2nd half ddz

2nd half af1

H+100

-

H+104 2-11

H+108 2-11

H+112 2-11

H+116 2-39

H+120 16

**3**

**3**

**3**

**2**

**3**

**4**

2nd half t0

Ulong

Ulong

Ulong

4

4

4

Dummy value when vel code = 0

Issue of PRN mask data

2nd half IODP

H+124

H+128

-

-

2

nd half corr Spare value when vel code = 0

spare

xxxx

Dummy value when vel code = 1

32-bit CRC (ASCII and Binary only)

Sentence terminator (ASCII only)

**3**

**3**

**5**

**6**

Hex

-

4

-

H +132

-

[CR][LF]

**4**

**.2.10.14** **SBAS26**

**Ionospheric** **Delay** **Corrections**

**Description**

The SBAS Message Type 26 Ionospheric Delay Corrections Message provides the users with

vertical delays (relative to a GPS L1 signal) and their accuracy at geographically defined IGPs

identified by band number and IGP number. Each message contains a band number and a block

ID that indicates the location of the IGPs in the respective band mask.

*Message* *ID*

*9*

*85*

*Recommended* *Input*

*Supported* *Format*

*log* *sbas26a* *ontime* *1*

*ASCII*

**Reply** **(ASCII)**

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#

3

2

SBAS26A,COM1,0,60.0,FINESTEERING,1863,555756.000,00000000,0000,1114;1

7,7,3,15,20,12,17,13,14,13,13,14,11,14,24,15,24,15,69,14,46,14,35,14,

4,12,19,12,16,12,14,13,12,13,3,0\*A92A4AC3

#SBAS26A,COM1,0,60.0,FINESTEERING,1863,555762.000,00000000,0000,1114;1

29,0,0,15,21,15,11,15,16,15,10,15,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,

0,0,0,0,3,0\*33A69AE7

Binary

Byte

Scale

Field#

Field Type

Data Description

Format

Binary Offset

0

Factor

SBAS26

header

PRN

**1**

Log header

H

**2**

**3**

**4**

Source PRN of message

ULong

Ulong

Ulong

4

4

4

H

Band Num Band number

H+4

H+8

-

-

Block ID

Block ID

Number of grid points with

information to follow

IGP vertical delay estimates

Grid ionospheric vertical error

indicator

**5**

**6**

**7**

#pts

Ulong

Ulong

Ulong

4

4

4

H+12

H+16

H+20

-

IGPvde

GIVEI

0.125

-

-

-

**8**

**6**

**)**

**…**

Next #pts entry

H+16+ (#pts x 8)

**+(#ptsx2**

**+(#ptsx2**

**+(#ptsx2**

**+(#ptsx2**

IODI

spare

xxxx

Issue of data - ionosphere

Ulong

Ulong

4

4

4

-

H+16+(#ptsx8)

**7**

**)**

7 spare bits

H+20+(#ptsx8)

-

-

-

**8**

**)**

32-bit CRC (ASCII and Binary only) Hex

H + 4

-

**9**

**)**

[CR][LF]

Sentence terminator (ASCII only)

-

**4**

**.2.10.15** **SBAS27**

**SBAS** **Service**

**Description**

SBAS Type 27 messages may be transmitted to increase the σUDRE values in selected areas. Type

27 message parameters apply only to the service provider transmitting the message.

The Number of Service Messages parameter in each Type 27 message indicates the total

number of unique Type 27 messages for the current Issue of Data, Service (IODS). Each unique

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message for that IODS includes a sequential Service Message Number. The IODS is

incremented in all messages, each time that any parameter in any Type 27 message is changed.

*Message* *ID*

*9*

*86*

*Recommended* *Input*

*Supported* *Format*

*log* *sbas27a* *ontime* *1*

*ASCII*

**Reply** **(ASCII)**

Binary

Byte

Binary

Offset

Field#

Field Type

Data Description

Log header

Format

**1**

**2**

**3**

**4**

**5**

**6**

SBAS27 header

PRN

H

4

4

4

4

4

0

Source PRN of message

Issue of slow corrections data

Low-by-one count of messages

Low-by-one message number

Priority code

ULong

Ulong

Ulong

Ulong

Ulong

H

IODS

H+4

H+8

H+12

H+16

#messages

message Num

Priority code

Delta user differential range error -

inside

**7**

**8**

**9**

dUDRE inside

dUDRE outside

#reg

Ulong

Ulong

Ulong

4

4

4

H+20

H+24

H+28

Delta user differential range error -

outside

Number of regions with information

to follow

**1**

**1**

**1**

**1**

**0**

**1**

**2**

**3**

lat1

lon1

lat2

lon2

Coordinate 1 latitude

Long

Long

Long

Long

4

4

4

4

H+32

H+36

H+40

H+44

Coordinate 1 longitude

Coordinate 2 latitude

Coordinate 2 longitude

Shape where: 0 = triangle

**1**

**4**

shape

Ulong

4

H+48

1

= square

**1**

**1**

**)**

**5…**

Next #reg entry

t0

H+32+ (#reg x 20)

**0+(#regx5**

H+32+

4

Time of applicability

Ulong

Hex

-

(#reg x 20)

**1**

**)**

**1+(#regx5**

**2+(#regx5**

xxxx

32-bit CRC (ASCII and Binary only)

Sentence terminator (ASCII only)

4

-

H + 4

**1**

**)**

[CR][LF]

-

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**4**

**.2.10.16** **SBAS28**

**Clock-Ephemeris** **Covariance** **Matrix** **Message**

**Description**

Message Type 28 may be broadcast to provide the relative covariance matrix for clock and

ephemeris errors. This is an expansion of the information contained in the σUDRE in that it

specifies the correction confidence as a function of user location. Message Type 28 provides

increased availability inside the service volume and increased integrity outside.

*Message* *ID*

*9*

*75*

*Recommended* *Input*

*Supported* *Format*

*log* *sbas28a* *ontime* *1*

*ASCII*

**Reply** **(ASCII)**

#SBAS28A,COM1,0,60.0,FINESTEERING,1863,557256.000,00000000,0000,1114;1

29,1,2,12,1,390,370,217,16,94,143,20,864,1007,850,33,5,243,187,87,1,92

5,79,263,166,937,8\*E60BB71E

#SBAS28A,COM1,0,60.0,FINESTEERING,1863,557256.000,00000000,0000,1114;1

37,1,2,12,1,393,370,218,16,94,145,20,864,1006,849,33,5,243,187,87,1,92

5,79,263,166,937,8\*28785BD8

Binary Binary

Field#

Field Type

Data Description

Format

Byte

H

Offset

0

**1**

**2**

**3**

SBAS header

PRN

Log header

Source PRN of message

Issue of PRN mask data

Number of PRN with information to

follow (0 ~ 2)

ULong

ULong

4

H

IODP

4

H+4

**4**

#prn

ULong

4

H+8

**5**

**6**

**7**

**8**

**9**

Mask1

Index into PRN mask (Type 1)

Scale exponent of 1st Satellite

UShort

UShort

UShort

UShort

UShort

UShort

UShort

UShort

UShort

2

2

2

2

2

2

2

2

2

H+12

H+14

H+16

H+18

H+20

H+22

H+24

H+26

H+28

Scale exponent1

E\_11 (1st satellite) E1,1 of Cov Matrix E for 1st satellite

E\_22 (1st satellite) E2,2 of Cov Matrix E for 1st satellite

E\_33 (1st satellite) E3,3 of Cov Matrix E for 1st satellite

E\_44 (1st satellite) E4,4 of Cov Matrix E for 1st satellite

E\_12 (1st satellite) E1,2 of Cov Matrix E for 1st satellite

E\_13 (1st satellite) E1,3 of Cov Matrix E for 1st satellite

E\_14 (1st satellite) E1,4 of Cov Matrix E for 1st satellite

**1**

**1**

**1**

**1**

**0**

**1**

**2**

**3**

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Binary Binary

Field#

Field Type

Data Description

Format

Byte

Offset

H+30

H+32

H+34

**1**

**1**

**1**

**1**

**4**

E\_23 (1st satellite) E2,3 of Cov Matrix E for 1st satellite

E\_24 (1st satellite) E2,4 of Cov Matrix E for 1st satellite

E\_34 (1st satellite) E3,4 of Cov Matrix E for 1st satellite

Next #prn entry

UShort

UShort

UShort

2

2

2

**5**

**6**

**7…**

H+12+(#prn x 24)

H+12+

**5**

**6**

**+(#prnx12)** xxxx

32-bit CRC (ASCII and Binary only)

Sentence terminator (ASCII only)

Hex

-

4

(#prnx24)

**+(#prnx12)** [CR][LF]

-

-

**4**

**.2.10.17** **SBAS63**

**Null** **Message**

**Description**

The Null Message Type 63 is used as a filler message if no other message is available for

broadcast for the one-second time slot.

*Message* *ID*

*1*

*003*

*Recommended* *Input*

*Supported* *Format*

*log* *sbas63a* *ontime* *1*

*ASCII*

**Reply** **(ASCII)**

#

SBAS63A,COM1,0,60.0,FINESTEERING,1863,557249.000,00000000,0000,1114;1

9\*4438AB42

2

#

SBAS63A,COM1,0,60.0,FINESTEERING,1863,557249.000,00000000,0000,1114;1

7\*BA9BB704

3

Field# Field Type

Data Description

Format

Binary Byte

Binary Offset

**1**

**2**

**3**

**4**

SBAS63 header Log header

H

4

4

-

0

PRN

Source PRN of message

ULong

Hex

-

H

xxxx

32-bit CRC (ASCII and Binary only)

Sentence terminator (ASCII only)

H + 4

-

[CR][LF]

**4**

**.2.11** **Station** **Information**

**4**

**.2.11.1** **REFSTATION**

**Base** **Station** **Position** **and** **Health**

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**Description**

This message includes base station position and health information received from differential

messages.

*Message* *ID*

*1*

*75*

*Recommended* *Input*

*Supported* *Format*

*log* *refstationb* *onchanged*

*ASCII,* *Binary*

**Reply** **(ASCII)**

#

REFSTATIONA,COM1,0,60.0,UNKNOWN,1776,107978.450,00000000,0000,1114;00

00000,0.000,0.000,0.000,0,0,"0000"\*b7e5bd12

0

**Table** **46.Base** **Station** **Status**

**BIT** **#** **MASK**

**DESCRIPTION**

**BIT** **=** **0**

**BIT** **=** **1**

**0**

0x00000001 Validity of the base station.

Valid

Invalid

**Table** **47.Base** **Station** **Type**

**BASE** **STATION** **TYPE**

**DESCRIPTION**

**(BINARY)** **(ASCII)**

**0**

**1**

**2**

**3**

**4**

NONE

RTCM

RTCA

Base station is not used

Base station is RTCM

Base station is RTCA

Base station is CMR

Base station is RTCMV3

CMR

RTCMV3

Binary

Byte

Binary

Offset

Field# Field Type

Data Description

Log header

Format

**1**

**2**

**3**

REFSTATION header

H

4

8

0

Status of the base station information

(refer toTable 46)

status

X

ULong

H

ECEF X value

Double

H+4

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Binary

Byte

Binary

Offset

Field# Field Type

Data Description

Format

**4**

**5**

**6**

Y

ECEF Y value

Double

Double

Ulong

8

8

4

H+12

H+20

H+28

Z

ECEF Z value

health

Base station health(0: Health OK)

Base station type (refer toTable 47)

**7**

stn type

Enum

4

H+32

**8**

**9**

**1**

stn ID

xxxx

Base station ID

Char[5]

8a

4

-

H+36

H+44

-

32-bit CRC (ASCII and Binary only)

Sentence terminator (ASCII only)

Hex

-

**0**

[CR][LF]

a. In binary format messages, add an extra 3 bytes of padding to keep 8 bytes aligned.

**4**

**.2.12** **Time** **Messages**

**4**

**.2.12.1** **TIME** **Time** **Data**

**Description**

This log provides several time related pieces of information including board clock offset and

UTC time and offset. It can also be used to determine any offset in the PPS signal relative to

GPS time.

*Message* *ID*

*1*

*01*

*Recommended* *Input*

*Supported* *Format*

*log* *timeb* *ontime* *1*

*binary*

**Reply** **(Binary)**

Binary

Byte

Binary

Offset

Field# Field Type

Data Description

Format

Enum

**1**

**2**

TIME Header Log Header

H

0

Clock status

4

H

Clock model status, refer to Table 48

**3**

**4**

**5**

**6**

**7**

**8**

Offset

Board clock offset

Double

Double

Double

Ulong

8

8

8

4

1

1

H+4

Offset std

Utc offset

Utc year

Utc month

Utc day

Board clock offset standard deviation.

The offset of GPS time from UTC time

UTC year

H+12

H+20

H+28

H+32

H+33

UTC month (0-12)

Uchar

UTC day (0-31)

Uchar

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*Chapter* *4.* *Logs* *Messages*

Binary

Byte

Binary

Offset

Field# Field Type

Data Description

Format

**9**

**1**

**1**

**1**

**1**

Utc hour

Utc min

Utcms

UTC hour (0-23)

Uchar

Uchar

Ulong

Enum

Hex

1

1

4

4

4

H+34

H+35

H+36

H+40

H+44

**0**

**1**

**2**

**3**

UTC minute (0-59)

UTC millisecond (0-60999)

UTC status: 0 = Invalid, 1 = Valid, 2 = Warning

32-bit CRC

Utc status

CRC

**Table** **48.Clock** **Model** **Status**

**VALUE**

**CLOCK** **STATUS**

**DESCRIPTION**

**0**

**1**

**2**

**3**

**4**

VALID

The clock model is valid

CONVERGING

ITERATING

INVALID

The clock model is near validity

The clock model is iterating towards validity

The clock model is not valid

Clock model error

ERROR

**4**

**.3** **INTERNATIONAL** **STANDARD** **MESSAGES**

**4**

**.3.1** **NMEA** **sentences**

**4**

**.3.1.1** **Standard** **NMEA** **sentences**

.3.1.1.1 GPGGA GNSS Fix Data

4

**Description**

This message is a standard NMEA log, but a little different from the standard one in position

precision. The position precision of this log is the same as GPGGARTK, in order to be used in

greater conditions. The header of GPGGA is always “GP” regardless if other GNSS information

involved in solution computation.

*Message* *ID*

*2*

*18*

*Recommended* *Input*

*Supported* *Format*

*log* *gpgga* *ontime* *1*

*ASCII*

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**Reply** **(ASCII)**

$

GPGGA,024941.00,3110.4693903,N,12123.2621695,E,1,16,0.6,57.0924,M,0.0

0,M,99,AAAA\*55

0

Field# Structure

Description

Symbol

Example

$GPGGA

**1**

**2**

$GPGGA

utc

Log header

UTC time of position (hours/minutes/seconds/

decimal seconds)

hhmmss.ss

202134.00

**3**

**4**

**5**

**6**

lat

Latitude (DDmm.mm)

llll.lllllll

a

3110.4693903

N

latdir

lon

Latitude direction (N = North, S = South)

Longitude (DDDmm.mm)

yyyyy.yyyyyyy 121232621695

a W

londir

Longitude direction (E = East, W = West)

GPS Quality indicator

0

1

2

= fix not available or invalid

= GPS fix

= C/A differential GPS, OmniSTAR HP,

OmniSTAR XP, OmniSTAR VBS, or CDGPS

4

5

= RTK fixed ambiguity solution (RT2)

**7**

GPS qual

x

1

= RTK floating ambiguity solution (RT20),

OmniSTAR HP or OmniSTAR XP

6

7

8

9

= Dead reckoning mode

= Manual input mode (fixed position)

=Super wide-lane mode

= SBAS

Number of satellites in use. May be different

to the number in view

**8**

# sats

xx

10

**9**

**1**

**1**

hdop

alt

Horizontal dilution of precision

x.x

1.0

**0**

**1**

Antenna altitude above/below mean sea level x.x

1062.22

M

a-units

Units of antenna altitude (M = meters)

Undulation - the relationship between the

geoid and the WGS84 ellipsoid

M

**1**

**2**

undulation

x.x

-16.271

**1**

**1**

**3**

**4**

u-units

age

Units of undulation (M = meters)

M

xx

M

Age of Differential GPS data (in seconds) b

(empty when no

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Field# Structure

Description

Symbol

Example

differential data is

present)

**1**

**5**

stn ID

Differential base station ID, 0000-1023

xxxx

\*hh

**1**

**1**

**6**

**7**

\*xx

Checksum

\*48

[CR][LF]

Sentence terminator

[CR][LF]

4

.3.1.1.2 GPGLL

Geographic Position

**Description**

This message is a standard NMEA log, include information such as time, latitude, longitude and

so on. Be different from GPGGA, if BD2or other GNSS information is involved in, the header of

GLL would become “GN” instead of “GP” which is outputted in only GPS information used in

solution computation. If only BD2 information is used, header becomes “BD”.

*Message* *ID*

*2*

*19*

*Recommended* *Input*

*Supported* *Format*

*log* *gpgll* *ontime* *1*

*ASCII*

**Reply** **(ASCII)** **GPS** **and** **BD2**

$GNGLL,3110.4702936,N,12123.2629222,E,031449.00,A,A\*7C

**Reply** **(ASCII)** **GPS** **only**

$GPGLL,3110.4705303,N,12123.2635741,E,031544.00,A,A\*68

**Reply** **(ASCII)** **BD2** **only**

$BDGLL,3110.4685408,N,12123.2615164,E,031628.00,A,A\*76

Field# Structure

Description

Format

Example

**1**

**2**

$GPGLL

lat

Log header

$GPGLL

Latitude (DDmm.mm)

Latitude direction

llll.lllllll

a

3110.4702936

**3**

**4**

**5**

latdir

lon

N

(N = North, S = South)

Longitude (DDDmm.mm)

Longitude direction

(E = East, W = West)

yyyyy.yyyyyyy 12123.2629222

londir

a

W

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Field# Structure

Description

Format

Example

UTC time of position (hours/minutes/

seconds/decimal seconds)

**6**

utc

hhmmss.ss

220152.50

**7**

**8**

**9**

**1**

data status Data status: A = Data valid, V = Data invalid

A

A

mode ind

\*xx

Positioning system mode indicator

Checksum

a

A

\*hh

\*1B

**0**

[CR][LF]

Sentence terminator

[CR][LF]

4

.3.1.1.3 GPGSA

GNSS DOP and Available Satellite

**Description**

This message contains available satellites used in solution computation and DOP values.

*Message* *ID*

*2*

*21*

*Recommended* *Input*

*Supported* *Format*

*log* *gpgsa* *ontime* *1*

*ASCII*

**Reply** **(ASCII)** **GPS** **and** **BD2**

$

GNGSA,M,3,25,14,15,18,31,27,09,21,22,12,,,0.8,0.6,0.5\*2A

GNGSA,M,3,141,143,144,146,147,148,149,150,,,,,0.8,0.6,0.5\*2C

$

**Reply** **(ASCII)** **GPS** **only**

$GPGSA,M,3,25,14,15,18,31,27,09,21,22,12,,,1.5,0.9,1.3\*30

**Reply** **(ASCII)** **BD2** **only**

$BDGSA,M,3,141,143,144,146,147,148,149,150,,,,,2.7,1.7,2.2\*2B

Field# Structure Description

Symbol

Example

$GPGSA

**1**

**2**

**3**

$GPGSA

Log header

A = Automatic 2D/3D M = Manual, forced to operate in 2D or

mode MA

M

x

M

3

D

mode 123 Mode: 1 = Fix not available; 2 = 2D; 3 = 3D

3

PRN numbers of satellites used in solution (null for unused

25,14,

**4**

**-** **15**

prn

fields), total of 12 fields

GPS = 1 to 32

xx,xx,..... 15,18,

31,27,

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Field# Structure Description

Symbol

Example

SBAS = 33 to 64 (add 87 for PRN number)

09,21,

GLO = 65 to 96

22,12,,,,

BD2 =141 to 177

**1**

**1**

**1**

**1**

**2**

**6**

**7**

**8**

**9**

**0**

pdop

hdop

vdop

\*xx

Position dilution of precision

Horizontal dilution of precision

Vertical dilution of precision

Checksum

x.x

x.x

x.x

\*hh

1.5

0.9

1.2

\*3F

[CR][LF]

Sentence terminator

[CR][LF]

4

.3.1.1.4 GPGST

Pseudorange Measurement Noise Statistics

**Description**

This message is a standard NMEA log. Pay attention to that rms, smjrstd, smnrstd and orient

values are absent in the message currently.

*Message* *ID*

*2*

*22*

*Recommended* *Input*

*Supported* *Format*

*log* *gpgst* *ontime* *1*

*ASCII*

**Reply** **(ASCII)**

Field# Structure Description

Symbol

Example

$GPGST

**1**

**2**

$GPGST

utc

Log header

UTC time of position (hours/minutes/seconds/ decimal

seconds)

hhmmss.ss 173653.00

RMS value of the standard deviation of the range inputs

**3**

rms

to the navigation process. Range inputs include x.x

pseudorange and DGPS corrections.

**4**

**5**

smjrstd

smnrstd

Standard deviation of semi-major axis of error ellipse (m) x.x

Standard deviation of semi-minor axis of error ellipse (m) x.x

Orientation of semi-major axis of error ellipse (degrees

**6**

orient

x.x

from true north)

**7**

**8**

latstd

Standard deviation of latitude error (m)

Standard deviation of longitude error (m)

x.x

x.x

2.51

1.94

lonstd

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Field# Structure Description

Symbol

Example

**9**

**1**

**1**

alt std

\*xx

Standard deviation of altitude error (m)

Checksum

x.x

4.30

**0**

**1**

\*hh

\*6E

[CR][LF]

Sentence terminator

[CR][LF]

**Reply** **(ASCII)** **GPS** **and** **BD2**

$GNGST,035330.00,,,,,0.22,2.37,1.44,\*54

**Reply** **(ASCII)** **GPS** **only**

$GPGST,035330.00,,,,,0.22,2.37,1.44,\*54

**Reply** **(ASCII)** **BD2** **only**

$BDGST,035330.00,,,,,0.22,2.37,1.44,\*54

4

.3.1.1.5 GPGSV

GNSS Satellites in View

**Description**

This is a standard NMEA message which includes PRN numbers, elevation, azimuth, and SNR

values of satellites in view. Messages of GPS satellites use header “GP” and BD2 use “BD”.

*Message* *ID*

*2*

*23*

*Recommended* *Input*

*Supported* *Format*

*log* *gpgsv* *ontime* *1*

*ASCII*

**Reply** **(ASCII)**

$GPGSV,3,1,09,14,67,095,51,31,55,331,50,25,38,041,50,22,25,188,46\*70

$GPGSV,3,2,09,30,43,228,49,29,29,096,47,32,29,303,45,16,17,219,43\*7B

$GPGSV,3,3,09,20,07,318,41,,,,,,,,,,,,\*4A

$

BDGSV,2,1,08,141,49,145,47,143,36,237,45,144,34,122,45,146,13,196,39\*

E

6

$

BDGSV,2,2,08,147,63,004,50,148,39,173,45,149,25,222,42,150,51,324,46\*

D

6

Field#

Structure

$GPGSV

Description

Log header

Symbol

Example

$GPGSV

**1**

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Field#

Structure

Description

Symbol

Example

**2**

**3**

# msgs

msg #

Total number of messages (1-9)

Message number (1-9)

x

x

3

1

Total number of satellites in view. May be different

than the number of satellites in use

Satellite PRN number

**4**

# sats

xx

09

GPS = 1 to 32

**5**

prn

SBAS = 120-138

xx

03

GLO = 1-36

BD2 = 141~177

**6**

**7**

**8**

elev

Elevation, degrees, 90 maximum

Azimuth, degrees True, 000 to 359

SNR (C/No) 00-99 dB, null when not tracking

Next satellite PRN number, elev, azimuth, SNR, ... Last

satellite PRN number, elev, azimuth, SNR,

Checksum

xx

51

azimuth

SNR

xxx

xx

140

42

**.**

**..** **...** **...**

... ... ...

**variable**

**variable**

\*xx

\*hh

\*72

[CR][LF]

Sentence terminator

[CR][LF]

4

.3.1.1.6 GPHDT

Vessel Heading

**Description**

This message is a standard log which includes actual vessel heading for True North in degrees.

*Message* *ID*

*2*

*28*

*Recommended* *Input*

*Supported* *Format*

*log* *gphdt* *ontime* *1*

*ASCII*

**Reply** **(ASCII)** **GPS** **and** **BD2**

$GNHDT,89.2769,T\*20

**Reply** **(ASCII)** **GPS**

$GPHDT,154.6566,T\*06

**Reply** **(ASCII)** **BD2**

$BDHDT,47.8506,T\*2C

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Field#

Structure

Description

Symbol

Example

**1**

**2**

**3**

**4**

**5**

$GPHDT

heading

True

Log header

$GPHDT

89.2769

T

Heading in degrees

Degrees True

x.x

T

\*xx

Checksum

\*hh

\*36

[CR][LF]

Sentence terminator

[CR][LF]

4

.3.1.1.7 GPRMC

GNSS Specification Information

**Description**

This is a standard NMEA message which includes time, date, speed and true heading.

*Message* *ID*

*2*

*25*

*Recommended* *Input*

*Supported* *Format*

*log* *gprmc* *ontime* *1*

*ASCII*

**Reply** **(ASCII)** **GPS** **and** **BD2**

$

GNRMC,065029.00,A,3110.4722495,N,12123.2644026,E,0.456,330.1,050512,-

.0,W,A\*12

0

**Reply** **(ASCII)** **GPS**

$

GPRMC,065141.00,A,3110.4723882,N,12123.2636328,E,0.657,140.7,050512,-

.0,W,A\*00

0

**Reply** **(ASCII)** **BD2**

$

BDRMC,064944.00,A,3110.4700351,N,12123.2651820,E,0.862,89.6,050512,-0.

,W,A\*26

0

Field# Structure

Description

Symbol

Example

**1**

**2**

$GPRMC

utc

Log header

$GPRMC

UTC of position

hhmmss.ss

065029.00

Position status:

**3**

**4**

pos status

lat

A

A

A = data valid, V = data invalid

Latitude (DDmm.mm)

llll.ll

3110.4722495

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*Chapter* *4.* *Logs* *Messages*

Field# Structure

Description

Symbol

Example

Latitude direction:

**5**

**6**

**7**

latdir

lon

a

N

N = North, S = South

Longitude (DDDmm.mm)

Longitude direction:

yyyyy.yy

a

12123.2644026

E

londir

E = East, W = West

**8**

**9**

**1**

**1**

**1**

**1**

**1**

**1**

speed Kn

track true

date

Speed over ground, knots

Track made good, degrees True

Date: dd/mm/yy

x.x

x.x

xxxxxx

x.x

a

0.456

330.1

050512

0.0

**0**

**1**

**2**

**3**

**4**

**5**

mag var

vardir

Magnetic variation, degrees

Magnetic variation direction E/W

Positioning system mode indicator

Checksum

W

mode ind

\*xx

a

A

\*hh

\*12

[CR][LF]

Sentence terminator

[CR][LF]

4

.3.1.1.8 GPVTG

Track Make Good and Ground Speed

**Description**

This is a standard NMEA message which includes make good and ground speed.

*Message* *ID*

*2*

*26*

*Recommended* *Input*

*Supported* *Format*

*log* *gpvtg* *ontime* *1*

*ASCII*

**Reply** **(ASCII)** **GPS** **and** **BD2**

$GNVTG,304.723,T,304.723,M,0.365,N,0.677,K,A\*3B

**Reply** **(ASCII)** **GPS** **only**

$GPVTG,213.710,T,213.710,M,0.304,N,0.563,K,A\*24

**Reply** **(ASCII)** **BD2** **only**

$BDVTG,29.710,T,29.710,M,0.836,N,1.548,K,A\*37

Field# Structure Description

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Symbol Example

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Field# Structure Description

Symbol Example

$GPVTG

**1**

**2**

**3**

$GPVTG

Log header

track true Track made good, degrees True

x.x

T

213.710

T

T

True track indicator

Track made good, degrees Magnetic;

Track mag = Track true + (MAGVAR correction)

Magnetic track indicator

**4**

track mag

M

x.x

213.710

**5**

**6**

**7**

**8**

**9**

**1**

**1**

**1**

M

x.x

N

M

speed Kn Speed over ground, knots

0.304

N

N

Nautical speed indicator (N = Knots)

speed Km Speed, kilometers/hour

x.x

K

0.563

K

K

Speed indicator (K = km/hr)

**0**

**1**

**2**

mode ind Positioning system mode indicator

a

A

\*xx

Checksum

\*hh

\*24

[CR][LF]

[CR][LF]

Sentence terminator

4

.3.1.1.9 GPZDA

UTC Time and Date

**Description**

This message is a standard NMEA log which includes UTC time and date.

*Message* *ID*

*2*

*76*

*Recommended* *Input*

*Supported* *Format*

*log* *gpzda* *ontime* *1*

*ASCII*

**Reply** **(ASCII)**

$GPZDA,071642.00,05,05,2012,,\*61

Field#

Structure

Description

Symbol

Example

**1**

**2**

**3**

**4**

**5**

$GPZDA

utc

Log header

UTC time

$GPZDA

hhmmss.ss 071642.000

day

Day, 01 to 31

Month, 01 to 12

Year

xx

05

month

year

xx

05

xxxx

2012

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*COMNAV* *OEM* *BOARD* *REFERENCE* *MANUAL*

*Chapter* *4.* *Logs* *Messages*

Field#

Structure

Description

Symbol

Example

**6**

**7**

**8**

**9**

null

Local zone description - not available

Local zone minutes description - not available

Checksum

xx

(empty when no

data is present)

\*6F

null

xx

\*xx

\*hh

[CR][LF]

Sentence terminator

[CR][LF]

**4**

**.3.1.2** **ComNav** **Proprietary** **NMEA** **sentences**

4

.3.1.2.1 GPCDT Time Difference between Ref PPS and Rover PPS

**Description**

This message is a self-defined log to indicate the time difference between reference PPS and

rover PPS. GPS, BD2, GLONASS and GALILEO systems’ information are all included in this

message, if valid flag is 1, the corresponding data is valid, and otherwise the data should be

ignored. **This** **log** **is** **only** **valid** **in** **rover’s** **RTD** **mode**.

*Message* *ID*

*2*

*11*

*Recommended* *Input*

*Supported* *Format*

*log* *gpcdt* *ontime* *1*

*ASCII*

**Reply** **(ASCII)**

Field# Structure

Description

Log header

Format

Example

$GPCDT

**1**

**2**

$GPCDT

UTC time of position (hours/minutes/seconds/

decimal seconds)

UTC Time

hhmmss.ss 202134.00

Difference between base station and rover

station, in nanoseconds.

**3**

**4**

**5**

**6**

**7**

GPS information

GPS valid

xx.x

x

3.2

1

Valid flag

Difference between base station and rover

station, in nanoseconds.

BD2 information

xx.x

x

5.1

1

BD2 valid

Valid flag

GLONASS

Difference between base station and rover

station, in nanoseconds.

xx.x

x

0.0

information

GLONASS valid

GALILEO

**8**

**9**

Valid flag

0

Difference between base station and rover xx.x

0.0

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*Chapter* *4.* *Logs* *Messages*

Field# Structure

information

Description

Format

Example

station, in nanoseconds.

Valid flag

**1**

**1**

**1**

**0**

**1**

**2**

GALILEO valid

\*xx

x

0

Checksum

\*hh

\*1B

[CR][LF]

Sentence terminator

[CR][LF]

4

.3.1.2.2 GPCLH

Constellation Health

**Description**

Each field is defined as it appears in RTCM2.3 #5 and data fields are serialized as standard

RTCM2.3, without application of scaling factor. Each message consists 3 satellites and comma

will be used as place holder if the last message contains less than 3 satellites.

*Message* *ID*

*2*

*67*

*Recommended* *Input*

*Supported* *Format*

*log* *gpclh* *ontime* *1*

*ASCII*

**Sentence** **Header:**

$GPIDM,Msg NO (total number of sentences in this message),Msg ID(Message

ID),Station ID,M-Z Counter,Sequence NO,Data Word Length,Station Health,

**Sentence** **Fields:**

SatID#1(int),IODL(int),Data Health(int),SNR(int),Health Enable(int),New

Data(int),Loss of Satellite Warning(int),Time to Unhealthy(int),

SatID#2(int),IODL(int),Data Health(int),SNR(int),Health Enable(int),New

Data(int),Loss of Satellite Warning(int),Time to Unhealthy(int),

SatID#3(int),IODL(int),Data Health(int),SNR(int),Health Enable(int),New

Data(int),Loss of Satellite Warning(int),Time to Unhealthy(int)\*CC

**Example**

$

GPCLH,3,1,4,5553,0,7,0,12,0,0,25,0,0,0,0,22,0,0,26,0,0,0,0,14,0,0,23,

,0,0,0\*7F

0

$

GPCLH,3,2,4,5553,0,7,0,25,0,0,22,0,0,0,0,31,0,0,18,0,0,0,0,24,0,0,20,

,0,0,0\*70

0

$GPCLH,3,3,4,5553,0,7,0,18,0,0,24,0,0,0,0,,,,,,,,,,,,,,,,\*76

$

BDCLH,4,1,4,5553,0,10,0,141,0,1,21,0,0,0,0,142,0,0,17,0,0,0,0,143,0,0,

3,0,0,0,0\*6B

2

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*COMNAV* *OEM* *BOARD* *REFERENCE* *MANUAL*

*Chapter* *4.* *Logs* *Messages*

$BDCLH,4,2,4,5553,0,10,0,144,0,0,20,0,0,0,0,146,0,0,23,0,0,0,0,147,0,0,

25,0,0,0,0\*6C

$

BDCLH,4,3,4,5553,0,10,0,149,0,0,25,0,0,0,0,150,0,0,20,0,0,0,0,153,0,0,

2,0,0,0,0\*63

2

$BDCLH,4,4,4,5553,0,10,0,145,0,0,11,0,0,0,0,,,,,,,,,,,,,,,,\*6E



***Note*.** **In** **current** **version,** **among** **such** **fields** **as** **SatID,** **IODL,** **Data** **Health,** **SNR,**

**Health** **Enable,** **New** **Data,** **Loss** **of** **Satellite** **Warning,** **Time** **to** **Unhealthy,** **only**

**these** **four** **are** **valid:** **SatID,** **IODL,** **Data** **Health** **and** **SNR**

4

.3.1.2.3 GPDRC

Delta Range Correction

**Description**

Each field is defined as it appears in RTCM2.3 #2 and data fields are serialized as standard

RTCM2.3, without application of scaling factor. Each message consists 3 satellites and comma

will be used as place holder if the last message contains less than 3 satellites.

*Message* *ID*

*2*

*65*

*Recommended* *Input*

*Supported* *Format*

*log* *gpdrc* *ontime* *1*

*ASCII*

**Sentence** **Header:**

$GPDRC,Msg NO (total number of sentences in this message),Msg ID(Message

ID),Station ID,M-Z Counter,Sequence NO,Data Word Length,Station Health,

**Sentence** **Fields:**

SatID#1(int),SF(int),UDRE(int),Delta PRC(int),Delta RRC(int),IOD(int),

SatID#2(int),SF(int),UDRE(int),Delta PRC(int),Delta RRC(int),IOD(int),

SatID#3(int),SF(int),UDRE(int),Delta PRC(int),Delta RRC(int),IOD(int)

\*CC

**Example**

$

GPDRC,4,1,4,2020,6,20,0,23,0,0,1256,0,0,3,0,0,457,1,0,27,0,0,522,255,

\*6C

0

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$GPDRC,4,2,4,2020,6,20,0,19,0,0,277,1,0,13,0,0,633,1,0,16,0,0,692,255,

0\*6E

$

GPDRC,4,3,4,2020,6,20,0,7,0,0,245,1,0,8,0,0,756,254,0,9,0,0,793,254,0

54

\*

$GPDRC,4,4,4,2020,6,20,0,11,0,0,345,1,0,6,0,0,651,1,0,1,0,0,484,1,0\*60

$

BDDRC,3,1,4,2020,6,12,0,141,0,0,582,1,0,142,0,0,529,0,0,143,0,0,476,0,

\*4C

0

$

BDDRC,3,2,4,2020,6,12,0,144,0,0,822,0,0,147,0,0,461,0,0,148,0,0,386,2

5,0\*45

5

$BDDRC,3,3,4,2020,6,12,0,150,0,0,324,0,0,,,,,,,,,,,,\*4F

4

.3.1.2.4 GPGGARTK

GNSS Fix Data

**Description**

This message is the same as GPGGA; refer to GPGGA information in this document.

*Message* *ID*

*2*

*59*

*Recommended* *Input*

*Supported* *Format*

*log* *gpggartk* *ontime* *1*

*ASCII*

**Reply** **(ASCII)**

$

GPGGA,024941.00,3110.4693903,N,12123.2621695,E,1,16,0.6,57.0924,M,0.0

0,M,99,AAAA\*55

0

4

.3.1.2.5 GPGRS

Pseudorange Residual

**Description**

*Message* *ID*

*2*

*20*

*Recommended* *Input*

*Supported* *Format*

*log* *gpgrs* *ontime* *1*

*ASCII*

**Reply**

$GPGRS,hhmmss.ss,a,b.b,b.b,b.b,b.b,b.b,b.b,b.b,b.b,b.b,b.b,b.b,b.b\*61

a: mode. 0: pseudorange residual is used in position estimation; 1: pseudorange residual is

computed after position estimation;

b.b: pseudorange residual, corresponding to SV number in GPGSA;

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**Example**

$GPGRS,033944.00,0,1.80,0.23,-0.37,0.56,-2.57,2.11,-0.84,-0.93,,,\*61

$

BDGRS,033944.00,0,0.40,1.17,0.69,-1.24,1.32,0.83,-0.39,-2.07,-0.71,,\*

C

6

4

.3.1.2.6 GPHPR

Parameters of Attitude Angles

**Description**

This message is a non-standard message, which includes heading, pitch or roll angle of carrier

on which two antennas are placed on.

*Message* *ID*

*2*

*37*

*Recommended* *Input*

*Supported* *Format*

*log* *gphpr* *ontime* *1*

*ASCII*

**Reply** **(ASCII)**

$GPHPR,070901.00,090.10,000.20,000.00,4,14,1.00,0004\*42

Field#

Structure

Description

Symbol

Example

**1**

**2**

**3**

**4**

**5**

$GPHPR

utc

Log header

$GPHPR

070901.00

090.10

UTC time

hhmmss.ss

hhh.hh

ppp.pp

rrr.rr

heading

pitch

Heading, 0~360 degree

Pitch, -90~90 degree

Roll, -90~90 degree

GPS Quality indicator

000.20

roll

000.00

0

1

2

4

5

6

7

8

9

= fix not available or invalid

= GPS fix

= C/A differential

= RTK fixed ambiguity solution

= RTK floating ambiguity solution

= Dead reckoning mode

= Manual input mode (fixed position)

=Super wide-lane mode

= SBAS

**6**

QF

q

4

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Field#

Structure

Description

Symbol

Example

**7**

**8**

**9**

sat No.

age

satellite number

differential age

reference station ID

Checksum

n

14

dd.dd

xxxx

\*hh

1.00

0004

\*42

stn ID

\*xx

**1**

**1**

**0**

**1**

[CR][LF]

Sentence terminator

[CR][LF]

4

.3.1.2.7 GPIDM

Ionospheric Delay Message

**Description**

Each field is defined as it appears in RTCM2.3 #15 and data fields are serialized as standard

RTCM2.3, without application of scaling factor. Each message consists 3 satellites and comma

will be used as place holder if the last message contains less than 3 satellites.

*Message* *ID*

*2*

*68*

*Recommended* *Input*

*Supported* *Format*

*log* *gpidm* *ontime* *1*

*ASCII*

**Sentence** **Header:**

$GPIDM,Msg NO (total number of sentences in this message),Msg ID(Message

ID),Station ID,M-Z Counter,Sequence NO,Data Word Length,Station Health,

**Sentence** **Fields:**

SysID(GPS: 0, GLO: 1, BDS: 2),SatID#1(int),Iono Delay(int),Iono Change

Rate(int),

SysID(GPS: 0, GLO: 1, BDS: 2),SatID#2(int),Iono Delay(int),Iono Change

Rate(int),

SysID(GPS: 0, GLO: 1, BDS: 2),SatID#3(int),Iono Delay(int),Iono Change

Rate(int)\*CC

**Example**

$GPIDM,4,1,4,2353,7,18,0,0,23,1211,0,0,3,457,0,0,27,753,0\*70

$GPIDM,4,2,4,2353,7,18,0,0,19,0,0,0,13,1036,0,0,16,593,0\*46

$GPIDM,4,3,4,2353,7,18,0,0,7,173,0,0,8,686,0,0,9,778,0\*42

$GPIDM,4,4,4,2353,7,18,0,0,11,245,0,0,6,781,0,0,1,1402,0\*4B

$BDIDM,3,1,4,2353,7,11,0,2,141,1068,0,2,142,1564,0,2,143,1569,0\*69

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$

BDIDM,3,2,4,2353,7,11,0,2,144,1702,0,2,147,1489,0,2,148,1477,0\*66

BDIDM,3,3,4,2353,7,11,0,2,150,1918,0,,,,,,,,\*69

$



***Note*.** **In** **current** **version,** **among** **such** **fields** **as** **‘SatID,Iono** **Delay,Iono** **Change**

**Rate’,** **only** **two** **are** **valid:** **SatID** **and** **Iono** **Delay.**

4

.3.1.2.8 GPNAV

ComNav Navigation Information Message

**Description**

This message is a non-standard message, which includes position, velocity, position and

tracking information, and also heading, pitch and roll (reserved) angles output while dual

antennas are used.

*Message* *ID*

*2*

*64*

*Recommended* *Input*

*Supported* *Format*

*log* *gpnav* *ontime* *1*

*ASCII*

**Reply** **(ASCII)**

$GPNAV,20151003,123707.00,17,3,,31.17432494563,121.38795557054,41.7907,

10.7811,176.628,0.000,0.000,,0.000,-0.002,-0.010,0.002,1,NN,7,0.000,8,

5,9,,,8,5,9,,,,,,,\*6F

Field# Structure

Description

Symbol

Example

**1**

**2**

**3**

$GPNAV

Date

$GPNAV

Date: year, month, day

yyyymmdd

hhmmss.ss

20141110

072033.00

UTC Time UTC Time: hour minute second

GPS leap

**4**

**5**

GPS vs UTC, empty as invalid

second

x

16

BDS leap

BDS vs UTC, empty as invalid

second

x

x

2

**6**

**7**

**8**

Reserved

Latitude

leap second (XXX vs UTC)

XX

WGS84, Latitude, in degree; +: north, -: south

.xxxxxxxxxxx 39.97577397443

.xxxxxxxxxxx 116.36426309103

Longitude WGS84, Longitude, in degrees; +: east, -: west

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Field# Structure

Description

Symbol

Example

**9**

**1**

Altitude

height above sea level (WGS84), (m)

.xxxx

.xxxx

69.4144

-9.5116

**0**

**1**

separation Geoidal separation (m)

Tracking

**1**

0~360 degree, tracking angle, same as GPRMC

.xxx

354.549

angle

Heading, The angle between true North and

Heading (from true north to heading clockwise), .xxx

~360 deg

**1**

**2**

**3**

Heading

42.916

0

Pitch, positive from horizontal surface to zenith,

negative from horizontal surface to downword,

**1**

Pitch

.xxx

58.991

-90~90 deg

**1**

**1**

**1**

**1**

**1**

**4**

**5**

**6**

**7**

**8**

Roll

Ve

-90~90 deg, empty as invalid [Reserved]

Velocity North (m/s)

.xxx

.xxx

.xxx

.xxx

.xxx

-0.001

0.012

0.055

0.012

Vn

Vu

Vg

Velocity East (m/s)

Velocity Universe (m/s)

Velocity Ground (m/s)

receiver RTK positioning quality indicator:

0

1

2

4

5

6

7

8

9

= fix not available or invalid

= GNSS fix

= C/A differential

= RTK fixed ambiguity solution

= RTK floating ambiguity solution

= Dead reckoning mode

= Manual input mode (fixed position)

=Super wide-lane mode

= SBAS

**1**

**9**

Status1

x

4

Heading solution indicator (Master receiver +

Slave receiver): NV, VN, NN, VV

**2**

**2**

**0**

**1**

Status2

XX

NV

GNSS systems used in solution

GPS: 1(0x01, 00000001), GLO: 2(0x02, 00000010)

BDS: 4(0x04, 00000100), GAL: 8(0x08, 00001000)

GPS+GLO: 3 (0x01 + 0x02 = 0x03, 00000011)

GPS+BDS: 5 (0x01 + 0x04 = 0x05, 00000101)

GPS+GAL: 9 (0x01 + 0x08 = 0x09, 00001001)

System

Mask

x

5

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Field# Structure

Description

Symbol

Example

GLO+BDS: 6 (0x02 + 0x04 = 0x06, 00000110)

GPS+GLO+BDS: 7 (0x01 + 0x02 + 0x04= 0x07,

0

0000111)

GPS+GLO+BDS+GAL: 15 (0x01 + 0x02 + 0x04 +

x08 = 0x0F, 00001111)

Baseline length (m)

0

**2**

**2**

**2**

Baseline

.xxx

3.898

Satellite

Number

used

from

**3-27** #SV Used

x,x,x,,

5,6,8, ,

GPS/GLONASS/BDS/XXX/XXX

#

SV

Satellite

Number

tracked

from

**2**

**8-32**

x,x,x,,

5,6,8,,

Tracked

Reserved

Reserved

Reserved

Reserved

\*xx

GPS/GLONASS/BDS/XXX/XXX

**3**

**3**

**3**

**3**

**3**

**3**

**3**

**4**

**5**

**6**

**7**

**8**

Checksum

\*hh

[CR][LF]

Sentence terminator

4

.3.1.2.9 GPNTR

Information on How to navigate to Reference Station

**Description**

This self-defined NMEA message includes distance between reference station and rover station,

distance in east, distance in north, and in vertical dimension.

*Message* *ID*

*2*

*09*

*Recommended* *Input*

*Supported* *Format*

*Log* *gpntr* *ontime* *1*

*ASCII*

**Reply** **(ASCII)**

$GPNTR,024404.00,1,17253.242,+5210.449,-16447.587,-49.685,0004\*40

Field# Structure

Description

Symbol

Example

$GPNTR

**1**

**2**

$GPNTR

utc

Log header

UTC of position

hhmmss.ss 024404.00

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Field# Structure

Description

Symbol

Example

GPS Quality indicator

0

1

2

= fix not available or invalid

= Single point position

= C/A differential GPS, OmniSTAR HP,

OmniSTAR XP, OmniSTAR VBS, or CDGPS

4

5

= RTK fixed ambiguity solution (RT2)

**3**

pos status

I

1

= RTK floating ambiguity solution (RT20),

OmniSTAR HP or OmniSTAR XP

6

7

8

9

= Dead reckoning mode

= Manual input mode (fixed position)

=Super wide-lane mode

= SBAS

**4**

**5**

**6**

distance

In meters

dddd.ddd

dddd.ddd

dddd.ddd

17253.242

+5210.449

-16447.587

distance in north

distance in east

direction: +:North, -: South

direction: +:East, -: West

Distance

Vertical direction

Station ID

\*xx

in

**7**

direction: +:Up, -: Down

dddd.ddd

-49.685

**8**

**9**

**1**

0~1023, or AAAA(No ref-station)

Checksum

I

0004

\*hh

\*12

**0**

[CR][LF]

Sentence terminator

[CR][LF]

4

.3.1.2.10 GPPRR

Pseudorange and Range Rate Residual

**Description**

Each field is defined as it appears in RTCM2.3 #19. Each message consists 3 satellites and

comma will be used as place holder if the last message contains less than 3 satellites.

*Message* *ID*

*2*

*71*

*Recommended* *Input*

*Supported* *Format*

*log* *gpprr* *ontime* *1*

*ASCII*

**Sentence** **Header:**

$GPPRR,Rsim ID(19),Msg Total Num(total number of sentences in this

message),Msg ID(Message ID),Utc Time(double, rounded to the nearest tenth),

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**Sentence** **Fields:**

SatID#1(int),Pr Res(double, rounded to the nearest hundredth),Rr Res(double,

rounded to the nearest hundredth), Cr QI(double, rounded to the nearest

hundredth),Pr V Est(double, rounded to the nearest hundredth), Cr Age(double,

rounded to the nearest tenth),

SatID#2(int),Pr Res(double, rounded to the nearest hundredth),Rr Res(double,

rounded to the nearest hundredth),Cr QI(double, rounded to the nearest

hundredth),Pr V Est(double, rounded to the nearest hundredth), Cr Age(double,

rounded to the nearest tenth),

SatID#3(int),Pr Res(double, rounded to the nearest hundredth),Rr Res(double,

rounded to the nearest hundredth),Cr QI(double, rounded to the nearest

hundredth),Pr V Est(double, rounded to the nearest hundredth), Cr Age(double,

rounded to the nearest tenth)\*CC

**Example**

$

GPPRR,19,4,1,022537.0,3,-0.51,0.00,0.00,0.00,0.0,27,-0.65,0.00,0.00,0.

0,0.0,19,1.46,0.00,0.00,0.00,0.0\*41

0

$

GPPRR,19,4,2,022537.0,13,0.62,0.00,0.00,0.00,0.0,16,-1.35,0.00,0.00,0.

0,0.0,7,2.78,0.00,0.00,0.00,0.0\*69

0

$

GPPRR,19,4,3,022537.0,8,1.22,0.00,0.00,0.00,0.0,9,-0.77,0.00,0.00,0.0

,0.0,11,1.12,0.00,0.00,0.00,0.0\*56

0

$

GPPRR,19,4,4,022537.0,6,-0.05,0.00,0.00,0.00,0.0,1,-3.86,0.00,0.00,0.

0,0.0,,,,,,\*5F

0

$

BDPRR,19,3,1,022537.0,141,0.00,0.00,0.00,0.00,0.0,142,0.00,0.00,0.00,

.00,0.0,143,0.00,0.00,0.00,0.00,0.0\*58

0

$

BDPRR,19,3,2,022537.0,144,0.00,0.00,0.00,0.00,0.0,147,0.00,0.00,0.00,

.00,0.0,148,0.00,0.00,0.00,0.00,0.0\*50

0

$BDPRR,19,3,3,022537.0,150,0.00,0.00,0.00,0.00,0.0,,,,,,,,,,,,\*5B



***Note*.** **Among** **such** **fields** **as** **‘SatID,** **Pr** **Res,** **Rr** **Res,** **Cr** **QI,** **Pr** **V** **Est,** **Cr** **Age’,** **only**

**two** **are** **valid** **now:** **SatID** **and** **Pr** **Res.**

4

.3.1.2.11 GPRRS

Differential GPS and BDS Corrections

**Description**

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*Message* *ID*

*2*

*63*

*Recommended* *Input*

*log* *gprrs* *ontime* *1*

*ASCII*

*Supported* *Format*

**Reply**

$GPRRS,hhmmss.ss,a,b,x,c,d.d,e.e,f.f,g.g,h.h,i,c,d.d,e.e,f.f,g.g,h.h,i,

c,d.d,e.e,f.f,g.g,h.h,i\*CC

a: total number of messages;

b: message number;

x: number of satellites in this constellation;

c: PRN number;

d.d: PRC;

e.e: RRC rate;

f.f: PR Acceleration;

g.g: UDRE;

h.h: Z-Counter;

i: IOD;

**Example**

$

GPRRS,033944.00,2,1,18,-12.1,0.0,0.0,1.3,435.6,102,9,-11.5,0.0,0.0,1.

,435.6,3,21,-10.1,0.0,0.0,1.2,435.6,52\*CC

1

$GPRRS,033944.00,2,2,24,-10.2,0.0,0.0,1.5,435.6,97\*CC

$

BDRRS,033944.00,2,1,1,-12.3,0.0,0.0,1.9,435.6,1,2,-11.9,0.0,0.0,2.1,4

5.6,1,3,-12.0,0.0,0.0,2.2,435.6,1\*CC

3

$

BDRRS,033944.00,2,2,4,-10.9,0.0,0.0,2.1,435.6,1,5,-13.9,0.0,0.0,2.3,4

5.6,1,5,-11.5,0.0,0.0,2.2,435.6,1\*CC

3

4

.3.1.2.12 GPRSC

Reference Station Coordinates

**Description**

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Each field is defined as it appears in RTCM2.3 #3 and data fields are serialized as standard

RTCM2.3, without application of scaling factor. Each message contains one sentence.

*Message* *ID*

*2*

*66*

*Recommended* *Input*

*Supported* *Format*

*log* *gprsc* *ontime* *1*

*ASCII*

**Sentence:**

$GPRSC,Station ID,M-Z Counter,Sequence NO,Data Word Length,Station

Health,x(int),y(int),z(int)\*CC

**Example**

$GPRSC,4,2145,2,4,0,-284479926,466274235,-284479926\*64

4

.3.1.2.13 GPSEH Satellite Health Indication

**Description**

*Message* *ID*

*2*

*61*

*Recommended* *Input*

*Supported* *Format*

*log* *gpseh* *ontime* *1*

*ASCII*

**Reply**

$GPSEH,hhmmss.ss,h,h,h,h,h,h,h,h,h,h,h,h,h,h,h,h,h,h,h,h,h,h,h,h,h,h,h,

h,h,h,h,h\*CC

h: SV health, based on similar information in extracted ephemeris. 0 for ‘Health’ and 1 for

‘

Unhealth’. SV whose health status is available will have the corresponding bit set as 1 for

. If its health is unknown, the position will be held but not set.

0

For example, in the first sentence, GPS prn 5,6,7,9,10,16,17,18,19,20 is set ‘health’ while

all the others’ health status is unknown.

**Example**

$GPSEH,092055.20,,,,,,,,,,,,0,,0,,,,0,,,,0,,0,0,,,,,,0,\*72

$BDSEH,092055.20,,0,0,0,,0,0,,0,0,,,,,,,,,,,,,,,,,,,,,,,,,,,\*4F

$GLSEH,092055.20,0,0,0,,,,,,,,,0,0,,,,,,,,,,,\*6E

4

.3.1.2.14 GPTRA

Heading, Pitch and Roll (reserved) Message

**Description**

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This self-defined NMEA message includes heading, pitch and roll (reserved) angles of the

baseline vector between two antennas, as which are used with dual GNSS RF input receiver for

attitude determination.

*Message* *ID*

*2*

*07*

*Recommended* *Input*

*Supported* *Format*

*Log* *gptra* *ontime* *1*

*ASCII*

**Sentence** **(ASCII)**

$

GPTRA,hhmmss.ss,hhh.hh,ppp.pp,rrr.rr,l,n,dd.dd,xxxx\*CC<CR><LF>

GPTRA,063027.30,101.78,071.19,-00.00,4,10,0.00,0004\*51

**Example**

$

Field# Structure

Description

Symbol

Example

$GPTRA

**1**

**2**

**3**

**4**

**5**

$GPTRA

utc

Log header

UTC of position

0 ~ 360 degree

-90 ~ 90 degree

[Reserved]

hhmmss.ss 063027.30

heading

pitch

roll

hhh.hh

ppp.pp

rrr.rr

101.78

071.19

-00.00

solution indicator

0

1

2

= fix not available or invalid

= Single point position

= C/A differential GPS, OmniSTAR HP, OmniSTAR

**6**

sol status

I

4

XP, OmniSTAR VBS, or CDGPS

4

5

= RTK fixed ambiguity solution (RT2)

= RTK floating ambiguity solution (RT20),

OmniSTAR HP or OmniSTAR XP

Number of satellites in use. May be different to

the number in view

**7**

# sats

n

10

**8**

**9**

**1**

**1**

age

Age of Differential GPS data (in seconds)

Differential base station ID, 0000-1023

Checksum

dd.dd

xxxx

\*hh

0.00

stn ID

\*xx

0004

\*12

**0**

**1**

[CR][LF]

Sentence terminator

[CR][LF]

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.3.1.2.15 GPURA

Satellite User Range Accuracy (URA)

**Description**

*Message* *ID*

*2*

*62*

*Recommended* *Input*

*Supported* *Format*

*log* *gpura* *ontime* *1*

*ASCII*

**Reply**

$GPURA,hhmmss.ss,u,u,u,u,u,u,u,u,u,u,u,u,u,u,u,u,u,u,u,u,u,u,u,u,u,u,u,

u,u,u,u,u\*CC

u: URA. SV whose URA is available will have the corresponding bit set as appropriate level.

If its URA is unavailable, the position will be held but not set. For example, in the first

sentence, GPS prn 1,5,7,8,12,13,14,27 is set 1,2,2,3,3,4,2,2 respectively while all the

others’ URA is unknown.

**Example**

$GPURA,033944.00,1,,,,2,,2,3,,,,3,4,2,,,,,,,,,,,,,2,,,,,\*CC

$BDURA,033944.00,1,2,2,2,2,2,2,3,3,4,2,3,4,2,,,,,,,,,,,,,,,,,,,,,,,\*CC

4

.3.1.2.16 GPYBM

Position, Velocity, Heading, Pitch and PJK information

**Description**

This message is a non-standard message, which includes position, velocity, PJK information,

and also heading and pitch angles output as dual antennas are used.

*Message* *ID*

*8*

*7*

*Recommended* *Input*

*Supported* *Format*

*log* *gpybm* *ontime* *1*

*ASCII*

**Reply** **(ASCII)**

$GPYBM,SN00520429,070326.00,+31.170243388,+121.398934274,15.286,346.84

0,1.290,0.000,-0.002,0.003,0.002,3449917.897,538032.213,-451.861,1088.

741,4,4,12,1,,,,\*4B

Field# Structure

Description

Format

**1**

**2**

$GPYBM

Log header

Serial NO.

Serial Number of OEM board

SNxxxxxxxx, x = 0 ~ 9

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Field# Structure

Description

UTC time

Format

**3**

**4**

utc

Lat

HHMMSS.SS

+

: north, -: south;

ddd.mmmmmmmmmmm

: east, -: west;

Latitude, in degrees

Longitude, in degrees

+

**5**

**6**

**7**

**8**

Lon

ddd.mmmmmmmmmmm

Ellipsoidal height of fix (antenna height above

ellipsoid)

ElpHeight

Heading

Pitch

.xxx (m)

Heading, The angle between true North and Heading 0~360 degree

(from true north to heading clockwise) .xxx (deg)

Pitch, positive from horizontal surface to zenith, -90~90 degree

negative from horizontal surface to downword

Velocity North

.xxx (deg)

.xxx (m/s)

.xxx (m/s)

.xxx (m/s)

.xxx (m/s)

**9**

**1**

**1**

**1**

Vel N

**0**

**1**

**2**

Vel E

Velocity East

Vel D

Velocity down

Vel G

Velocity Ground

Coordinate

Northing

Coordinate

Easting

North

**1**

**1**

**1**

**1**

**3**

**4**

**5**

**6**

refer to PTNL,PJK

refer to PTNL,PJK

.xxx (m)

.xxx (m)

Distance to Ref station in North direction, refer to +: north, -: south;

GPNTR .xxx (m)

Distance to Ref station in East direction, refer to +: east, -: west;

Distance

East

Distance

GPNTR

.xxx (m)

receiver RTK positioning quality indicator:

0

1

2

= fix not available or invalid

= GNSS fix

= C/A differential

Position

4 = RTK fixed ambiguity solution

5 = RTK floating ambiguity solution

**1**

**7**

x

Indicator

6

7

8

9

= Dead reckoning mode

= Manual input mode (fixed position)

=Super wide-lane mode

= SBAS

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Field# Structure

Attitude

Description

Format

x

receiver RTK heading and pitch quality indicator,

refer to GPTRA, PTNL,AVR

**1**

**8**

Indicator

Sat

NO

**1**

**9**

satellite number used in solution

xx

Used

**2**

**2**

**0**

**1**

Diff Age

Station ID

Baseline

length

differential age

xx

reference station id

0000

distance between master station and slave station

(baseline length between two antennas)

number of satellites that anticipate in calculation of

slave station

**2**

**2**

**2**

**3**

.xxx (m)

solution sv

Only supported by board and overall units which

contain inertial module

**2**

**2**

**4**

**5**

rolling

\*xx

.xxx (deg)

\*hh

Checksum

[CR][LF]

Sentence terminator

**4**

**.3.2** **RTCM** **2.X** **messages**

**.3.2.1** **RTCM1** **Differential** **GPS** **Corrections**

**Description**

**4**

This message is a standard log of RTCM2.X which contains differential GPS corrections. It

contains satellite ID, pseudorange correction, range rate correction and Issue of Data (IOD), for

all satellites in view of the reference station.

*Message* *ID*

1

07

*Recommended* *Input*

*Supported* *Format*

*log* *rtcm1b* *ontime* *1*

*binary*

**Reply** **(Binary)**

If detailed information about this message is needed, please refer to standard RTCM SC104 2.X

documents.

**4**

**.3.2.2** **RTCM3**

**Base** **Station** **Information**

**Description**

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This message is a standard log of RTCM2.X which contains base station parameters.

*Message* *ID*

*4*

*02*

*Recommended* *Input*

*Supported* *Format*

*log* *rtcm3b* *ontime* *5*

*binary*

**Reply** **(Binary)**

If detailed information about this message is needed, please refer to standard RTCM SC104 2.X

documents.

**4**

**.3.2.3** **RTCM9**

**GPS** **Partial** **Correction** **Set**

**Description**

This message is a standard log of RTCM2.X which serves the same purpose as the Type 1

Message of RTCM2.X, in that it contains the primary differential GPS corrections. Each message

contains the corrections for only three satellites.

*Message* *ID*

*2*

*75*

*Recommended* *Input*

*Supported* *Format*

*log* *rtcm9b* *ontime* *1*

*binary*

**Reply** **(Binary)**

If detailed information about this message is needed, please refer to standard RTCM SC104 2.X

documents.

**4**

**.3.2.4** **RTCM1819**

**Raw** **Measurement**

**Description**

This message is a standard log of RTCM2.X which contains GPS dual frequency observables.

*Message* *ID*

*3*

*99*

*Recommended* *Input*

*Supported* *Format*

*log* *rtcm1819b* *ontime* *1*

*binary*

**Reply** **(Binary)**

If detailed information about this message is needed, please refer to standard RTCM SC104 2.X

documents.

**4**

**.3.2.5** **RTCM31**

**Differential** **GLONASS** **Corrections**

**Description**

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*Chapter* *4.* *Logs* *Messages*

This message is a standard log of RTCM2.X which contains differential GLONASS corrections. It

contains satellite ID, pseudorange correction, range rate correction and time of day, for all

satellites in view of the reference station.

*Message* *ID*

*8*

*64*

*Recommended* *Input*

*Supported* *Format*

*log* *rtcm31b* *ontime* *1*

*binary*

**Reply** **(Binary)**

If detailed information about this message is needed, please refer to standard RTCM SC104 2.X

documents.

**4**

**.3.2.6** **RTCM41**

**Pseudorange** **observable** **Corrections**

**Description**

This message is a standard log of RTCM2.X which contains pseudorange observable corrections.

RTCM41 message contains the correction data of all satellites of the constellation. The

message contains the satellite *gnssID*: “rtcm41gps”, “rtcm41bds” and “rtcm41glo”; logging

*data* *rate* *(Hz)*; for all satellites in view of the reference station. No “A” or “B” need to be added

to the command.

For the different GNSS systems, the log messages are shown in following tables separately.

a) GPS system

*Message* *ID*

*1*

*24*

*Recommended* *Input*

*Supported* *Format*

*log* *rtcm41gps* *ontime* *1*

*binary*

b) GLONASS system

*Message* *ID*

*1*

*25*

*Recommended* *Input*

*Supported* *Format*

*log* *rtcm41glo* *ontime* *1*

*binary*

c) BeiDou system

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*Message* *ID*

*1*

*26*

*Recommended* *Input*

*Supported* *Format*

*log* *rtcm41bds* *ontime* *1*

*binary*

In above example, the logging information is the GPS/GLONASS/BDS pseudorange observable

corrections and the logging data rate is 1 Hz.

**Reply** **(Binary)**

If detailed information about this message is needed, please refer to standard RTCM SC104 2.X

documents.

**4**

**.3.2.7** **RTCM42**

**General** **Partial** **Corrections**

**Description**

This message is a standard log of RTCM2.X which contains pseudorange observable corrections.

RTCM42 message contains the main GNSS corrections. However, RTCM42 does not need all

satellites and the corrections are logged at different time. The reference station needs more

stable clock because the clock drift is not modeled. The logging message contains the RTCM42

and satellite *gnssID*: “rtcm42gps”, “rtcm42bds” and “rtcm42glo”; logging *data* *rate* *(Hz)*; for all

satellites in view of the reference station. No “A” or “B” need to be added to the command.

a) GPS system

*Message* *ID*

*1*

*27*

*Recommended* *Input*

*Supported* *Format*

*log* *rtcm42gps* *ontime* *1*

*binary*

b) GLONASS system

*Message* *ID*

*1*

*30*

*Recommended* *Input*

*Supported* *Format*

*log* *rtcm42glo* *ontime* *1*

*binary*

c) BeiDou system

*Message* *ID*

*1*

*32*

*Recommended* *Input*

*log* *rtcm42bds* *ontime* *1*

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*COMNAV* *OEM* *BOARD* *REFERENCE* *MANUAL*

*Chapter* *4.* *Logs* *Messages*

*Supported* *Format*

*binary*

In above messages, the logging information is the GPS/GLONASS/BDS pseudorange observable

corrections and the logging data rate is 1 Hz.

**Reply** **(Binary)**

If detailed information about this message is needed, please refer to standard RTCM SC104 2.X

documents.

**4**

**.3.3** **RTCM** **3.X** **messages**

**.3.3.1** **RTCM0063** **BDS** **Ephemeris** **(A** **Test** **Message)**

**Description**

**4**

This message is a test log of RTCM3.x which contains BDS satellite ephemeris information.

*Message* *ID*

*8*

*9*

*Recommended* *Input*

*Supported* *Format*

*log* *rtcm0063b* *ontime* *1*

*Binary*

**Reply** **(Binary)**

If detailed information about this message is needed, please refer to standard RTCM SC104 3.X

document.

**4**

**.3.3.2** **RTCM1002**

**Extended** **L1** **GPS** **Observables**

**Description**

This message is a standard log of RTCM3 which contains extended L1 GPS observables of

reference station.

*Message* *ID*

*7*

*85*

*Recommended* *Input*

*Supported* *Format*

*log* *rtcm1002b* *ontime* *1*

*Binary*

**Reply** **(Binary)**

If detailed information about this message is needed, please refer to standard RTCM SC104 3.X

document.

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*Chapter* *4.* *Logs* *Messages*

**4**

**.3.3.3** **RTCM1003**

**L1** **and** **L2** **GPS** **RTK** **Observables**

**Description**

RTCM1003 includes GPS L1 and L2 RTK observables. ComNav receivers support to decode

RTCM1003 data and use it for RTK computation. But RTCM1003 log message output is not

supported currently.

**Reply** **(Binary)**

If detailed information about this message is needed, please refer to standard RTCM SC104 3.X

document.

**4**

**.3.3.4** **RTCM1004**

**Extended** **L1/L2** **GPS** **Observables**

**Description**

This message is a standard log of RTCM3 which contains extended L1 and L2 GPS observables

of reference station.

*Message* *ID*

*7*

*87*

*Recommended* *Input*

*Supported* *Format*

*log* *rtcm1004b* *ontime* *1*

*Binary*

**Reply** **(Binary)**

If detailed information about this message is needed, please refer to standard RTCM SC104 3.X

document.

**4**

**.3.3.5** **RTCM1005**

**Base** **Station** **Position**

**Description**

This message is a standard log of RTCM3 which includes position information of reference

station.

*Message* *ID*

*7*

*88*

*Recommended* *Input*

*Supported* *Format*

*log* *rtcm1005b* *ontime* *5*

*binary*

**Reply** **(Binary)**

If detailed information about this message is needed, please refer to standard RTCM SC104 3.X

document.

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*Chapter* *4.* *Logs* *Messages*

**4**

**.3.3.6** **RTCM1006**

**Base** **Station** **Position** **and** **Antenna** **Height**

**Description**

This message is a standard log of RTCM3 which includes position information and antenna

height of reference station.

*Message* *ID*

*7*

*89*

*Recommended* *Input*

*Supported* *Format*

*log* *rtcm1006b* *ontime* *5*

*binary*

**Reply** **(Binary)**

If detailed information about this message is needed, please refer to standard RTCM SC104 3.X

document.

**4**

**.3.3.7** **RTCM1007**

**Extended** **Information** **about** **Base** **Station**

**Description**

This message is a standard log of RTCM3 which includes position, antenna height and

descriptions of reference station.

*Message* *ID*

*8*

*56*

*Recommended* *Input*

*Supported* *Format*

*log* *rtcm1007b* *ontime* *5*

*binary*

**Reply** **(Binary)**

If detailed information about this message is needed, please refer to standard RTCM SC104 3.X

document.

**4**

**.3.3.8** **RTCM1008**

**Extended** **Information** **about** **Base** **Station**

**Description**

This message is a standard log of RTCM3 which includes position, antenna height and

descriptions of reference station.

*Message* *ID*

*8*

*57*

*Recommended* *Input*

*Supported* *Format*

*log* *rtcm1008b* *ontime* *5*

*binary*

**Reply** **(Binary)**

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*Chapter* *4.* *Logs* *Messages*

If detailed information about this message is needed, please refer to standard RTCM SC104 3.X

document.

**4**

**.3.3.9** **RTCM1010**

**Extended** **L1-Only** **GLONASS** **Observables**

**Description**

This message is a standard log of RTCM3 which contains extended L1 GLONASS observables of

reference station.

*Message* *ID*

*8*

*98*

*Recommended* *Input*

*Supported* *Format*

*log* *rtcm1010b* *ontime* *1*

*Binary*

**Reply** **(Binary)**

If detailed information about this message is needed, please refer to standard RTCM SC104 3.X

document.

**4**

**.3.3.10**

**RTCM1011**

**GLONASS** **L1/L2** **RTK**

**Description**

RTCM1011 includes GLONASS L1 and L2 RTK observables. ComNav receivers support to decode

RTCM1011 data and use it for RTK computation. But RTCM1011 log message output is not

supported currently.

**Reply** **(Binary)**

If detailed information about this message is needed, please refer to standard RTCM SC104 3.X

document.

**4**

**.3.3.11**

**RTCM1012**

**Extended** **L1** **&** **L2** **GLONASS** **Observables**

**Description**

This message is a standard log of RTCM3 which contains extended L1 & L2 GLONASS

observables of reference station. It supports dual-frequency RTK operation, and includes an

indication of the satellite carrier-to-noise (CNR) as measured by the reference station.

*Message* *ID*

*9*

*00*

*Recommended* *Input*

*Supported* *Format*

*log* *rtcm1012b* *ontime* *1*

*Binary*

**Reply** **(Binary)**

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*COMNAV* *OEM* *BOARD* *REFERENCE* *MANUAL*

*Chapter* *4.* *Logs* *Messages*

If detailed information about this message is needed, please refer to standard RTCM SC104 3.X

document.

**4**

**.3.3.12**

**RTCM1019**

**GPS** **Ephemerides**

**Description**

This message is a standard log of RTCM3 which contains GPS satellite ephemeris information.

*Message* *ID*

*8*

*93*

*Recommended* *Input*

*Supported* *Format*

*log* *rtcm1019b* *ontime* *5*

*Binary*

**Reply** **(Binary)**

If detailed information about this message is needed, please refer to standard RTCM SC104 3.X

document.

**4**

**.3.3.13**

**RTCM1020**

**GLONASS** **Ephemerides**

**Description**

This message is a standard log of RTCM3 which contains GLONASS satellite ephemeris

information.

*Message* *ID*

*8*

*95*

*Recommended* *Input*

*Supported* *Format*

*log* *rtcm1020b* *ontime* *5*

*Binary*

**Reply** **(Binary)**

If detailed information about this message is needed, please refer to standard RTCM SC104 3.X

document.

**4**

**.3.3.14**

**RTCM1033**

**Extended** **Information** **about** **Base** **Station**

**Description**

This message is a standard log of RTCM3 which includes position, antenna height and

descriptions of reference station. In order to enhance the compatibility, the rover needs to

receive the RTCM1033 message from the base station to identify the station type and the

GLONASS freq-bias; the message 1033 is combined with message 1005/1006 or

RTCMCOMPASSB; once one of these messages is ouput, the message 1033 outputs

automatically.

*Note*: the station type in the message is ***SINOGNSS***.

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*Chapter* *4.* *Logs* *Messages*

*Message* *ID*

*9*

*99*

*Recommended* *Input*

*log* *rtcm1033b* *ontime* *5*

*binary*

*Supported* *Format*

**Reply** **(Binary)**

If detailed information about this message is needed, please refer to standard RTCM SC104 3.X

document.

**4**

**.3.3.15**

**RTCM1104**

**BD2** **RTK** **Message**

**Description**

Because no available message could be applied to involve BD2 observables in RTCM3, a

non-standard message is defined for currently applications. The message might be disabled if a

standard RTCM3 message which includes BD2 observables is published. Just like messages

about GPS RTK, a similar message style is adopted to encode information of BD2 satellites, as

descript in Table 49to Table 53.

*Message* *ID*

*7*

*81*

*Recommended* *Input*

*Supported* *Format*

*log* *rtcm1104b* *ontime* *1*

*binary*

**Reply** **(Binary)**

Each frequency of BD2 is independent of the others, so an indicator should be defined to reflect

which frequency is involved. Be different from standard RTCM3 message header, an additional 3

bits are added to descript the involved frequency, refer to the last content-line in Table 51*.*

**Table** **49.BD2** **RTK** **Message**

**MESSAGE** **TYPE**

**Observations**

**MESSAGE** **CONTENTS**

**ID**

BD2 B1/B2/B3 observables

1104

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**Table** **50.BD2** **RTK** **Message** **Data** **Field**

DF #

DF Name

DF Range

DF Resolution Data Type

DF Notes

**DF001** Reserved

**DF002** Message Number

**DF003** Reference Station ID

**DF004** BD2 Epoch Time(TOW)

0-4095

uint12

uint12

0-4095

0-604,799,999 ms

1 ms

uint30

Synchronous

Message Flag

GNSS

**DF005**

**DF006**

**DF007**

bit(1)

The Number of BD2 Satellite Signals Processed refers to the

number of satellites in the message. It does not necessarily

equal the number of satellites visible to the Reference Station.

No. of BD2 Satellite

Signals Processed

0-31

uint5

BD2 Divergence-free

Smoothing Indicator

bit(1)

bit(3)

**DF008** Smoothing Interval

Indicator CombineB1B2B3

B1=0 No B1 Observations

B2=0 No B1 Observations

B3=0 No B1 Observations

**DF009** BD2 B1/B2/B3 Indicator

bit(3)

**DF010** BD2 Satellite ID

0-63

uint6

bit(2)

**DF011** BD2 Code Indicator

0= C/A

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*Chapter* *4.* *Logs* *Messages*

DF #

DF Name

DF Range

DF Resolution Data Type

DF Notes

The BD2 B1/B2/B3 Pseudorange field provides the raw

pseudorange measurement at the reference station in meters,

modulo one light-millisecond (299,792.458 meters). The BD2

B1/B2/B3 pseudorange measurement is reconstructed by the

user receiver from the B1/B2/B3pseudorange field by:

**DF012** BD2 Pseudorange

0-299,792.46 m

0.02 m

uint24

(BD2 B1/B2/B3 pseudorange measurement) = (BD2 B1/B2/B3

pseudorange field) modulo (299,792.458 m) + integer as

determined from the user receiver’s estimate of the reference

station range, or as provided by the extended data set. If

DF013 is set to 80000h, this field does not represent a valid

BD2 B1/B2/B3 pseudorange.

BD2 B1/B2/B3

**DF013** Phase Range –B1/B2/B3

Pseudorange

± 262.1435 m

0.0005 m

int20

uint7

BD2 B1/B2/B3

**DF014**

Time Indicator

The BD2 Integer B1/B2/B3 Pseudorange Modulus Ambiguity

represents the integer number of full pseudorange modulus

divisions (299,792.458m) of the raw B1/B2/B3 pseudorange

measurement.

BD2 Integer B1/B2/B3

**DF015** Pseudorange

2

99,792.458

uint8

uint8

m

Modulus Ambiguity

**DF016** BD2 B1/B2/B3 CNR

0.25 dB-Hz

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DF #

DF Name

DF Range

DF Resolution Data Type

DF Notes

**DF017** BD2 BLOCK

Refer to Table 53

The Type 1104 Message supports single-frequency, dual-frequency and triple-frequency RTK operation. The frequency number included in each satellite is

referred to DF009.

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**Table** **51.Contents** **of** **BD2** **RTK** **Message** **Header**

**DATA** **FIELD**

**DF** **NUMBER**

**DATA** **TYPE**

**BIT** **NO.**

**Message** **Number** **(e.g.,“1001”=** **0011** **1110** **1001)**

**Reference** **Station** **ID**

DF002

DF003

DF004

DF005

DF006

DF007

DF008

DF009

Uint12

uint12

Uint30

bit(1)

uint5

12

12

30

1

**BD2** **Epoch** **Time** **(TOW)**

**Synchronous** **GNSS** **Flag**

**No.** **of** **BD2** **Satellite** **Signals** **Processed**

**BD2** **Divergence-free** **Smoothing** **Indicator**

**BD2** **Smoothing** **Interval**

5

bit(1)

bit(3)

bit(3)

1

3

**BD2** **B1/B2/B3** **Indicator**

3

**TOTAL**

**67**

**Table** **52.Contents** **of** **the** **Satellite-Specific** **Portion,** **Each** **Satellite**

**DATA** **FIELD**

**DF** **NUMBER**

**DATA** **TYPE**

**NO.** **OF** **BITS**

**BD2** **Satellite** **ID**

DF010

DF017

DF017

DF017

Uint6

6

**BD2** **Block(according** **to** **DF009)**

**BD2** **Block(according** **to** **DF009)**

**BD2** **Block(according** **to** **DF009)**

**TOTAL**

69

69

69

**6+69\*n**

**Table** **53.DF017** **(BD2** **Block)-Frequency** **Contents** **of** **BD2** **Satellite**

**DATA** **FIELD**

**DF** **NUMBER**

**DATA** **TYPE**

**BIT** **NO.**

**BD2** **Code** **Indicator**

DF011

DF012

DF013

DF014

bit(2)

uint24

int20

uint7

2

**BD2** **Pseudorange**

24

20

7

**BD2** **Phase** **Range** **–** **Pseudorange**

**BD2** **Lock** **time** **Indicator**

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**BD2** **Integer** **Pseudorange** **Modulus** **Ambiguity**

DF015

DF016

uint8

uint8

8

**BD2** **CNR**

**TOTAL**

8

**69**

**4**

**.3.3.16**

**RTCM1074**

**GPS** **MSM4** **—** **Full** **PRs** **and** **Phase** **Ranges** **plus** **CNR**

**Description**

This message is a standard log of RTCM 3.x MSM4 (Multiple Signal Message) which includes full

pseudoranges, phase ranges and CNR (carrier-no-noise ratio) for GPS signals.

*Message* *ID*

*6*

*24*

*Recommended* *Input*

*Supported* *Format*

*log* *rtcm1074b* *ontime* *1*

*binary*

**Reply** **(Binary)**

If detailed information about this message is needed, please refer to standard RTCM SC104 3.X

document.

**4**

**.3.3.17**

**RTCM1084**

**GLONASS** **MSM4** **—** **Full** **PRs** **and** **Phase** **Ranges** **plus** **CNR**

**Description**

This message is a standard log of RTCM 3.x MSM4 (Multiple Signal Message) which includes full

pseudoranges, phase ranges and CNR (carrier-no-noise ratio) for GLONASS signals.

*Message* *ID*

*6*

*44*

*Recommended* *Input*

*Supported* *Format*

*log* *rtcm1084b* *ontime* *1*

*binary*

**Reply** **(Binary)**

If detailed information about this message is needed, please refer to standard RTCM SC104 3.X

document.

**4**

**.3.3.18**

**RTCM1124**

**BDS** **MSM4** **—** **Full** **PRs** **and** **Phase** **Ranges** **plus** **CNR**

**Description**

This message is a standard log of RTCM 3.x MSM4 (Multiple Signal Message) which includes full

pseudoranges, phase ranges and CNR (carrier-no-noise ratio) for BDS signals.

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*Chapter* *4.* *Logs* *Messages*

*Message* *ID*

*6*

*74*

*Recommended* *Input*

*log* *rtcm1124b* *ontime* *1*

*binary*

*Supported* *Format*

**Reply** **(Binary)**

If detailed information about this message is needed, please refer to standard RTCM SC104 3.X

document.

**4**

**.3.3.19**

**RTCM1114**

**Full** **QZSS** **pseudoranges** **and** **PhaseRanges** **plus** **CNR**

**Description**

This message is a standard log of RTCM 3.x MSM4 (Multiple Signal Message) which includes full

pseudoranges, phase ranges and CNR (carrier-no-noise ratio) for QZSS signals.

*Message* *ID*

684

*Recommended* *Input*

*Supported* *Format*

*log* *rtcm1114b* *ontime* *1*

*binary*

**Reply** **(Binary)**

If detailed information about this message is needed, please refer to standard RTCM SC104 3.X

document.

**4**

**.3.3.20**

**RTCM4078**

**ComNav** **Proprietary** **Message**

**Description**

This message is a RTCM 3.X proprietary message of ComNav Technology Ltd, which is assigned

by RTCM SC-104. RTCM4078 would be defined for miscellaneous applications by ComNav or

ComNav’s customers.

If someone or some organization would like to share its sub-messages, please contract

ComNav for more information.

*Message* *ID*

*xxx*

*Recommended* *Input*

*Supported* *Format*

*log* *rtcm4078smXXXXb* *ontime* *1*

*binary*

**4**

**.3.4** **BINEX** **(BINary** **EXchange** **Format)**

BINEX, for "BINary EXchange", is an operational binary format standard for GNSS research and

operational purposes. The format has been designed to grow and allow encapsulation of any

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data or metadata allowed in the common ASCII exchange formats such as RINEX, IONEX, SP3,

SINEX, and so on, including GNSS-related data and metadata as encountered.

**4**

**.3.4.1** **Record** **0x00**

**Site** **Metadata**

**Description**

BINEX record 0x00 will (eventually) encapsulate all pertinent information (i.e. metadata) about

the *site*, *monument*, *marker*, *reference* *point*, and *equipment* *setup* for the collection of GPS,

GLONASS, SBAS, and other GNSS type data and other possible site-related information like

meteorological, geophysical, etc. equipment.

Log message BINEX00 will output standard BINEX record including all possible 0x00 fields. The

values of BINEX 0x00 fields could be set by command ‘SET SITEMETADATA’ defined in Table 16

*Message* *ID*

*7*

*7*

*Recommended* *Input*

*Supported* *Format*

*log* *binex00b* *ontime* *10*

*Binary*

**Reply** **(BINEX)**

For more information on BINEX records, please refer to the website *binex.unavco.org*.

**.3.4.2** **Record** **0x01** **GNSS** **Navigation** **Information**

**Description**

**4**

Each BINEX record 0x01 holds GNSS navigation information for a specific satellite. The format

depends on the specific subrecord value. Depending on the subrecord, the navigation

information may correspond to the binary broadcast message, a decoded version of the

message analogous to what would appear in a RINEX NAV file, or other orbit formats such as

SP3, and so on.

*Subrecord* *0x01:* *0x01-01* *—* *Decoded* *GPS* *Ephemeris*

*Subrecord* *0x02:* *0x01-02* *—* *Decoded* *GLONASS* *—* *FDMA* *Ephemeris*

*Subrecord* *0x05:* *0x01-05* *—* *Decoded* *Beidou-2/Compass* *Ephemeris*

*Message* *ID*

*7*

*9,* *80,* *84*

*log* *binex0101b* *onchanged*

*log* *binex0102b* *onchanged*

*log* *binex0105b* *onchanged*

*Binary*

*Recommended* *Input*

*Supported* *Format*

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**Reply** **(BINEX)**

For more information on BINEX records, please refer to the website *binex.unavco.org*.

**.3.4.3** **Record** **0x7d** **Receiver** **Internal** **State**

**Description**

**4**

BINEX Record 0x7d serves as a test bed for working out the details of ways of storing receiver

internal state variables, including, for example, internal temperature.

***Subrecord*** ***0x00:*** ***0x7d-00***

This subrecord is being developed for receiver internal state variables, e.g. internal

temperature, power, and so on.

*Message* *ID*

*1*

*12*

*Recommended* *Input*

*Supported* *Format*

*log* *binex7d00b* *ontime* *1*

*Binary*

**Reply** **(BINEX)**

For more information on BINEX records, please refer to the website *binex.unavco.org*.

**.3.4.4** **Record** **0x7e** **Ancillary** **Site** **Data** **Prototyping**

**Description**

**4**

BINEX Record 0x7e serves as a test bed for working out the details of new ways of storing

ancillary site data, including, for example, site meteorological (MET) data.

***Subrecord*** ***0x00:*** ***0x7e-00***

This subrecord is being developed for hold ancillary site data, e.g. site meteorological data

(pressure, temperature, humidity, etc.), local geophysical data (tilt, strain, etc.), and so on.

*Message* *ID*

*1*

*13*

*Recommended* *Input*

*Supported* *Format*

*log* *binex7e00b* *ontime* *5*

*binary*

**Reply** **(BINEX)**

For more information on BINEX records, please refer to the website *binex.unavco.org*.

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**4**

**.3.4.5** **Record** **0x7f**

**GNSS** **Observable** **Prototyping**

**Description**

BINEX Record 0x7f serves as a test bed for working out the details of new ways of storing GNSS

observables for new records.

***Subrecord*** ***0x05:*** ***0x7f-05***

Subrecord 0x05 can be used for other receiver data, as long as the following requirements are

met:



the time resolution for each time tag is to the millisecond, sufficient to store the time tags for

receivers nominally collecting data at integer second values.







epoch-by-epoch data is needed (RINEX model)

the number of satellites being tracked is 1-64

the GNSS satellite being tracked can be GPS, GLONASS (FDMA-broadcasting), SBAS, QZSS as a

separate constellation, Galileo, Compass although other possible constellations could be

accommodated in the future up to a maximum of 16 systems.



the satellite number, i.e. the PRN # for all except GLONASS-FDMA and the slot # for

GLONASS-FDMA, is 1-255





10-bit signal-to-noise values in units of 0.1 dBHz with a range of 0 — 102.1 dBHz

other observables desired to be stored are some combination of:

o

o

o

pseudorange to 0.001 meter resolution (= RINEX pseudorange resolution)

phase to 0.02 mm resolution (~ 10x RINEX phase resolution)

Doppler to 1/256 Hz resolution (~ 1/4 RINEX doppler resolution)

*Message* *ID*

*8*

*6*

*Recommended* *Input*

*Supported* *Format*

*log* *binex7f05b* *ontime* *1*

*binary*

**Reply** **(BINEX)**

For more information on BINEX records, please refer to the website *binex.unavco.org*.

**4**

**.4** **OTHER** **LOG** **MESSAGES**

**4**

**.4.1** **Trimble** **Proprietary** **Messages**

**4**

**.4.1.1** **CMROBS**

**Base** **Station** **Satellite** **Observation**

**Description**

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This message is a standard log defined by Trimble Navigation Ltd. to transfer pseudorange and

carrier-phase information for high-precision GPS, refer to corresponding document.

*Message* *ID*

*3*

*90*

*Recommended* *Input*

*Supported* *Format*

*log* *cmrobsb* *ontime* *1*

*binary*

**Reply** **(Binary)**

Refer to corresponding document.

**.4.1.2** **CMRREF** **Base** **Station** **Position**

**Description**

**4**

This message is a standard log defined by Trimble Navigation Ltd. to transfer base station

position.

*Message* *ID*

*3*

*91*

*Recommended* *Input*

*Supported* *Format*

*log* *cmrrefb* *ontime* *5*

*binary*

**Reply** **(Binary)**

Refer to corresponding document.

**4**

**.4.1.3** **PTNL,AVR**

**Baseline** **RTK**

**Time,** **yaw,** **tilt,** **range,** **mode,** **PDOP,** **and** **number** **of** **SVs** **for** **Moving**

**Description**

This message is a standard log defined by Trimble Navigation Ltd. to output time, yaw, tilt,

range, mode, PDOP, and number of SVs for moving baseline RTK. For more details, please refer

to Trimble’s document.

The output of yaw and tilt values is under the control of command ‘SET RECEIVERROLE’ defined

in Table 16

*Message* *ID*

*2*

*24*

*Recommended* *Input*

*Supported* *Format*

*log* *ptnlavr* *ontime* *1*

*ASCII*

**Reply** **(ASCII)**

$PTNL,AVR,095548.82,+0.0000,Yaw,+0.0000,Tilt,,,0.000,1,1.4,20\*3E

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*Chapter* *4.* *Logs* *Messages*

**4**

**.4.1.4** **PTNL,GGK**

**Time,** **position,** **position** **type,** **and** **DOP** **values**

**Description**

This message is a standard log defined by Trimble Navigation Ltd. to output time, position,

position type and DOP values. For more details, please refer to Trimble’s document.

The type of height value in PTNL,GGK message can be configured using command ‘SET

PTNLGGKHEIGHT’ as defined in Table 16

*Message* *ID*

*7*

*6*

*Recommended* *Input*

*Supported* *Format*

*log* *ptnlggk* *ontime* *1*

*ASCII*

**Reply** **(ASCII)**

$PTNL,GGK,090845.00,092815,3110.45948454,N,12123.27659269,E,1,21,0.7,E

HT54.187,M\*42

**4**

**.4.1.5** **PTNL,PJK**

**Local** **Coordinates** **Calculated** **in** **Specified** **Parameters**

**Description**

This message is used to make local measurement in specified PJK parameters configured by

user such as A0, F, N0, E0, B0, L0. (Refer toTable 16)

*Message* *ID*

*2*

*29*

*Recommended* *Input*

*Supported* *Format*

*log* *ptnlpjk* *ontime* *1*

*ASCII*

**Reply** **(ASCII)**

$

PTNL,PJK,090856.00,050712,+3451152.262,N,+632295.897,E,1,13,0.9,EHT+5

.181,M\*7D

8

**4**

**.4.2** **JAVAD** **Proprietary** **Messages**

**.4.2.1** **NAVPOS** **[NP]** **Navigation** **Position**

**Description**

**4**

This message is a standard log defined by JAVAD GNSS, including the receiver's navigational

and positioning parameters. The number of BDS satellites used in position computation are

appended after the number of GLONASS satellites by ComNav Tech, to support BDS. For more

information, please refer to JAVAD GREIS.

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*Message* *ID*

*5*

*2*

*Recommended* *Input*

*log* *navpos* *ontime* *1*

*ASCII*

*Supported* *Format*

**Reply** **(Binary)**

NP0B6,NAVPOS,V,091255.00,0,AA,{08,05,09},W84,N31o10'27.579537",E121o23

'

16.579926",+00053.7719,V,+010.7811,0.68,1.06,0.544,0.737,0.1486,-0.69

1,217.703,N,217.703,0.046,0.063,100.00,999,@28

9

**4**

**.4.3** **Parameter** **Messages**

**Description**

Some log commands are designed for requesting and checking system configuration

parameters, such as cut-angle, reference mode and so on. To set up a reference station, a

group of logs are needed, some examples are demonstrated in *Chapter* *5*.

Key words listed in Table 23 could be added after key word ‘log’ to request the corresponding

parameters.

**4**

**.4.3.1** **PJKPARA**

**Parameters** **Used** **in** **Message** **PTNLPJK**

**Description**

This message is used to check the six parameters used in PTNLPJK message; for detailed

information and definition please refer toTable 16.

*Message* *ID*

*2*

*013*

*Recommended* *Input*

*Supported* *Format*

*log* *pjkpara*

*ASCII*

**Reply** **(ASCII)**

A:6378137.000, 1/F:298.257, B0:0.000000deg, L0:120.000000, N0:0.000,

E0:500000.000

**4**

**.4.4** **Command** **Messages** **for** **Weather** **Instrument** **(Meteorograph)**

**Description**

These command messages are used to set parameters of ZZ11A Meteorograph, and read

information from it.

Setting command messages are as follows:

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*Chapter* *4.* *Logs* *Messages*

*ZZ11ASETDATE*

*ZZ11ASETTIME*

*ZZ11ASETID*

*Set* *date* *of* *ZZ11A* *Meteorograph*

*Set* *time* *of* *ZZ11A* *Meteorograph*

*Set* *ID* *of* *ZZ11A* *Meteorograph*

*ZZ11ASETAUTOSEND*

*Set* *output* *period* *of* *ZZ11A* *Meteorograph*

*Message* *ID*

9

32, 933, 934, 935

*log* *zz11asetdate*

*log* *zz11asettime*

*log* *zz11asetid*

*log* *zz11asetautosend*

*ASCII*

*Recommended* *Input*

*Supported* *Format*

Reading command messages are as follows:

*ZZ11AREADDATE*

*ZZ11AREADTIME*

*ZZ11AREADID*

*Read* *date* *from* *ZZ11A* *Meteorograph*

*Read* *time* *from* *ZZ11A* *Meteorograph*

*Read* *ID* *of* *ZZ11A* *Meteorograph*

*ZZ11AREADAUTOSEND* *Read* *the* *output* *period* *of* *ZZ11A* *Meteorograph*

*Message* *ID*

9

36, 937, 938, 939

*log* *zz11areaddate*

*log* *zz11areadtime*

*log* *zz11areadid*

*log* *zz11areadautosend*

*ASCII*

*Recommended* *Input*

*Supported* *Format*

**Reply** **(ASCII)**

Setting command messages:

DATA 2015-09-28 0xCA 0x0D 0x0A

TIME 10:06:40 0xC9 0x0D 0x0A

ID 00004 0xE6 0x0D 0x0A

AUTOSEND 10 0xCD 0x0D 0x0A

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*COMNAV* *OEM* *BOARD* *REFERENCE* *MANUAL*

*Chapter* *5.* *Frequently-Used* *Operations*

CHAPTER 5. FREQUENTLY-USED CONFIG PROCEDURES

**5**

**.1** **SET** **BAUDRATE** **OF** **COM** **PORT**

Command 1: com port baudrate

**NOTICE:**





PORT TYPE: COM1/COM2/BLUETOOTH/GPRS

DEFAULT COM1

BAUDRATE: 4800/9600(BLUETOOTH 9600)/19200/38400/57600/115200 (COM1 DEFAULT)

**5**

**.2** **STOP** **ALL** **OUTPUT**

Command1: unlogall

**NOTICE:**

Shut down all data output

Change dynamic differential data format

**5**

**.3** **START** **BASE** **STATION**

Command1: Log port obsdata ontime x

Command2: Log port refdata ontime x

Command3: Fix position / Refautosetup on

Command4: Saveconfig

**NOTICE:**









PORT TYPE:

COM1/COM2/BLUETOOTH/GPRS DEFAULT CURRENT PORT

MAX = 5HZ NORMAL 0.2/1/5/10/15/30/60 S

ONTIME X:

OBSDATA TYPE:

REFDATA TYPE:

RTCM1819B/ RTCM1004B /RTCM1104B /CMROBSB

RTCM3B /RTCM1005B /CMRREFB

**5**

**.3.1** **RTCM** **2.X**

**Set** **up** **reference** **station** **in** **RTCM2** **format,** **outputted** **from** **COM1**

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Command1: LOG COM1 RTCM3B ONTIME 5

Message 3 outputted from COM1 every 5 second

Command2: LOG COM1 RTCM1819B ONTIME 1

Message 1819 outputted from COM1 every 1 second

Command3: FIX AUTO

Fix reference station coordinates in auto mode

Command3: FIX POSITION 30.0 150.0 50

Fix reference station coordinates in manual mode

Command4: SAVECONFIG

Save configurations in flash

**Description**

Just like above example, the way to set up a RTCM2 base station is as below.

**LOG** **TYPE**

**SYNCH**

**NOTE**

interfacemode com2 none rtcm

fix position 30.123 121.456 50.789

log com2 rtcm3b ontime 10

configure port

**Recommended**

**Input**

Identify station position

Set position message

Set observables message

log com2 rtcm1819b ontime 1

**5**

**.3.2** **RTCM** **3.X**

**Description**

Because BD2 differential messages are not involved in RTCMV3 official documents, we define

message: 1104 to encode BD2 observations currently.

BD2 differential data not defined in RTCMV3 official documents, so message 1104

may be updated or disabled in the future.

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**LOG** **TYPE**

**SYNCH**

**NOTE**

interfacemode com2 none rtcm

fix position 30.123 121.456 50.789

log com2 rtcm1005b ontime 10

log com2 rtcm1104b ontime 1

log com2 rtcm1004b ontime 1

configure port

Identify station position

Set position message

**Recommended**

**Input**

Set BD2 observables message

Set GPS observables message

**Set** **up** **reference** **station** **in** **RTCMV3** **format,** **outputted** **from** **COM2**

Command1: LOG COM2 RTCM1004B ONTIME 1

Message 1004 outputted from COM2 every 1 second

Command2: LOG COM2 RTCM1005B ONTIME 5

Message1005 outputted from COM2 every 5 second

Command3: FIX AUTO

Fix reference station coordinates in auto mode

Command4: SAVECONFIG

Save configurations in flash

**Set** **up** **reference** **station** **in** **RTCMV3** **using** **BD2** **observations**

Command1: LOG COM3 RTCM1104B ONTIME 1

Message 1104 outputted from COM3 every 1 second

Command2: LOG COM3 RTCM1005B ONTIME 5

Message 1105 outputted from COM3 every 5 second

Command3: REFAUTOSETUP ON

Fix reference station coordinates in auto mode

Command4: SAVECONFIG

Save configurations in flash

**5**

**.4** **LOG** **RAW** **DATA**

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Command1: ecutoff y

Command2: log port rangecmpb ontime z

Command3: log port rawephemb onchanged

Command3: log port bd2rawephemb onchanged

Command4: log port rawalmb onchanged

**NOTICE:**

PORT TYPE: COM1/COM2/COM3/BLUETOOTH

ONTIME Z: MAX = 2HZ

DEFAULT CURRENT PORT

NORMAL 0.5/1/5/10/15/30/60 S

**5**

**.4.1** **CMR**

**Set** **up** **reference** **station** **in** **CMR** **format,** **outputted** **from** **current** **port**

Command1: LOG CMRREFB ONTIME 5

Message cmrrefb outputted from current port every 5 second

Command2: LOG CMROBSB ONTIME 1

Message cmrobsb outputted form current port every 1 second

Command3: FIX AUTO

Fix reference station coordinates in auto mode

Command4: SAVECONFIG

Save configurations in flash

**Description**

The published CMR messages are only about GPS, so currently we could not broadcast BD2

information in CMR format. An example is given below to show how to setup a CMR base

station.

**LOG** **TYPE**

**SYNCH**

**NOTE**

interfacemode com2 none cmr

configure port

**Recommended** fix position 30.123 121.456 50.789

Identify station position

Set position message

Set observables message

**Input**

log com2 cmrrefb ontime 10

log com2 cmrobsb ontime 1

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CHAPTER 6. APP CASES & RECOMMENDED CONFIGS

In some applications, a group of commands should be input to configure GNSS cards; this is a

tough problem for some users to configure GNSS boards correctly. This chapter introduces

these scenes and explains these commands and functions in detail.

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**.1** **VEHICLE** **APPLICATION**

**6**

**.1.1** **Precise** **Positioning** **for** **Land** **Vehicle**

RTK configurations for vehicle positioning will be presented in this section.

**6**

**.1.2** **Vehicle** **Attitude** **Determination**

In vehicle attitude determination, a normal base station (B0), a main rover station (R1) and a

vice-rover station (R2) are involved. B0 is a fixed base station, it broadcasts differential

messages to R1. Using B0’s differential messages, R1 make a normal RTK calculation, at the

same time, R1 sends differential messages to R2, and so R1 is a normal rover station and a

moving base station. R2 is a vice rover station. Notice, the base station coordinates in R1’s

differential messages are changeable, not as B0’s.

**Figure** **7.** **Attitude** **Determination** **System**

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**.2** **TIMING**

In PVT mode, the precision of PPS is about 20ns. A typical Figure is shown below. If higher

precision is needed, please contact us.

**Figure** **8.** **PPS** **error**

**6**

**.3** **COMMON-VIEW** **TIME** **TRANSFER** **MODE** **AND** **SETTING**

**NOTICE:**

Not all kinds of GNSS cards support the common-view time transfer mode, the detailed

information about this is needed, please contact with ComNav Technology Ltd.

**Setup** **reference** **station:**

Command1: log com2 rtcmcompassb ontime 1

Command2: fix auto

Command 1 configures com2 to output message “rtcmcompassb”, which is a self-defined

message including position, observations and some hardware information of reference station.

Command 2 configures reference to work on auto-setup mode.

**Setup** **rover** **station:**

Command1: interfacemode com2 auto generic on

Command2: set diffmatchmode 100

Command3: rtksolution 1

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Command4: log gpcdt ontime 1

Command 1 configures com2 to work on auto input mode to confirm differential message type

automatically. Currently, the output mode is always ‘GENERIC’ (refer to Sec. *3.2.11*)

Command 2 configures GNSS cards to work on synchronous mode.

Command 3 configures GNSS cards to work on RTD mode.

Command 4 configures GNSS cards to output message “gpcdt”.

If all the settings are configured correctly, the GNSS board who works as a rover station should

output message “gpcdt” to indicate the PPS time difference between reference station and

rover station. Just like below:

$GNCDT,063631.00,1.9,1,-12.5,1,0.0,0,0.0,0\*4A

If message “gpgga” is logged, the time-lag should be 0, and position status flag should be 2, just

like below:

$

GPGGA,063631.00,3110.4709438,N,12123.2629884,E,2,12,1.6,59.3650,M,0.0

0,M,00,0004\*5C

0

**6**

**.4** **DYNAMIC** **BASE** **AND** **ROVER** **STATION** **SETTING** **–** **ENABLES** **THE** **USE** **OF**

**DYNAMIC** **BASE** **AND** **ROVER** **STATIONS**

**NOTICE:**

The base and rover station are both in dynamic mode. If the detailed information about this is

needed, please contact with ComNav Technology Ltd.

By the dynamic base and rover settings, you can obtain a centimeter-level xyz baseline estimate, and the

base station and possibly the rover are dynamic. Unlike the normal RTK application dynamic base station

receives the OmniStar corrections for positioning and broadcasts these corrections to the possibly dynamic

rover stations. As shown in

Figure 9. Dynamic Base Station, only one OmniStar is fixed on the dynamic base carrier, and other possibly

dynamic rovers can also receive the corrections to enhance the positioning performance. By using this

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working mode, only one OmniStar is arranged on the dynamic base station. Additionally, the dynamic base

station is allowed to transmit the messages without a fixed position.

**Figure** **9.** **Dynamic** **Base** **Station**

For the dynamic base and rover station application, the mode settings can be setup in the following steps.

**Setup** **dynamic** **base** **station:**

1. The dynamic base station is set to receive data in NMEA format:

Command1: interfacemode com2 nmea general on

Function: set com2 for receiving the NMEA format data.

2

3

. Set the reference station with the external coordinates:

Command2: set external coord on

Function: use the external coordinates as reference station coordinates for broadcasting.

. Setup reference station:

Suggest to use the differential message in Sino data format.

Command3: log com3 rtcmcompassb ontime 1

Command4: log com3 rtcmextcoormesb onnew

**Step:** **Setup** **the** **rover** **station:**

Set the differential com and reference station solution mode.

Command1: interfacemode com2 auto auto on

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Command2: rtkrefmode 1

Command3: set diffmatchmode asynch

RTK works in asynchronous mode and real time position output with no time delay.

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**.5** **DYNAMIC** **BASE** **STATION**

**NOTICE:**

The base station is in dynamic mode. If the detailed information about this is needed, please

contact with ComNav Technology Ltd.

In this application case, two OEM boards with two antennae are used and one of the OEM boards is used for

the dynamic base station and the other one is applied as a rover station.

The settings are used to enable or disable a receiver from working with a dynamic base station. In this case,

both of the dynamic base and rover stations are fixed on the vehicle where the rover station is static with

respect to the dynamic base station.

The dynamic base station is similar to the normal RTK which can provide centimeter-level accuracy position.

Corrections can be sent between the dynamic base and rover receivers, where the dynamic base receives

the corrections from the fixed base station, which in turn can send corrections to the rover. In addition, the

dynamic base station transmits the carrier phase and pseudorange observations to the rover station for

attitude determination. The commands of this application must be used to allow the base to transmit

messages without a fixed position.

**Figure** **10.Dynamic** **Base** **and** **relative** **static** **rover** **stations**

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To setup the dynamic and rover station, the following log messages are recommended to be used when in

**Setup** **dynamic** **base** **station:**

Command1: Interfacemode com2 auto auto on

Command2: Interfacemode com3 auto auto on

Command3: log com3 rtcmcompassb ontime 1

Command4: log com1 gpgga ontime 1

Command5: log com1 heading ontime 1

**Setup** **rover** **station:**

Command1: interfacemode com3 auto auto on

Command2: Log com3 headingp ontime 1

Command3: rtkrefmode 1

Command4: saveconfig

This set of commands allow the base to do the RTK positioning with the fixed station and also display the

attitude information to the user. The rover station is used for attitude determination computation and send

the results back to the dynamic base station

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APPENDIX A. BINARY COMMANDS

This chapter describes the syntax and usage of board commands defined by ComNav.

**A.1** **COMMAND** **FORMATS**

**A.1.1** **ComNav** **Command** **Formats**

$

$

Cmd Direct Len Data Cksum \r \n

**Table** **54.Description** **of** **Parameters**

ITEM

LENGTH

DESCRIPTION

**$**

**$**

2 bytes

2 bytes

Prompt

**Cmd**

Command Code

1

1

byte

bytes (2 bytes before Ver5.0)

ID of Source device and Target device

***Direct\****

Length of Data

***Len\****

**Data**

N bytes

byte

2 bytes

Data

1

Checksum

***Cksum\****

**\**

**r\n**

Carriage return and line feed. Tail of Command

**NOTE:**

**Direct**

**\***

The high 4 bits is id of source device, and the low 4 bits is id of target device. All IDs are listed

inTable 56. For example:

@=0x18

Where source device id =0001 (PC/PDA COM Port), destination device id=1000 (Data

controller).

**\***

**Len**

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Only the low 6 bits are used to store the length of data package (exclude prompt ‘$$’ and tail

‘\r\n’).

**\***

**Cksum**

From the first byte of *Cmd* block to the last byte of *Data* block, perform XOR operation one

byte by one byte. And the result is checksum.

C++ example:

BYTE strStream[MAX\_SUM];

BYTE bSum=0;

For(int i=2; i<num; i++)

bSum ^= strStream[i];

**A.1.2** **Error** **Message** **List**

The board is capable of outputting several responses for various conditions. Most of these

responses are error messages to indicate where something is incorrect.

The output format of the messages is dependent on the format of the input command. The

responses are always packaged in **ST** message.

**Table** **55.Response** **Messages**

MESSAGES. RESPONSE MESSAGES DESCRIPTION

**Checksum** **Error**

**No** **Field**

The checksum byte you send is wrong.

The command you send doesn’t exist!

**Command** **Invalid!**

The command you call is not available at current condition

**A.1.3** **Examples** **of** **Error** **Messages**

Checksum Error

**Description**

If you sent a command string with a wrong checksum byte, the response would hint you,

Checksum Error.

**Send** **(Hex)**

24 24 53 49 18 00 03 0d 0a

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The checksum byte (0x03) is wrong. It should be 0x02.

**Reply** **(Hex)**

2

4 24 53 54 81 13 5b 43 68 65 63 6b 20 53 75 6d 20 45 72 72 6f 72 5d 0d

a 40 0d 0a

0

Checksum Error

No Field

**Description**

If you sent a command that doesn’t exist, the board would reply with a message “No

Field”.

**Send** **(Hex)**

24 24 53 53 18 00 18 0d 0a

Send “SS” (this command doesn’t exist).

**Reply** **(Hex)**

24 24 53 54 81 0a 4e 6f 20 46 69 65 6c 64 0d 0a c8 0d 0a

ST “No Field”

Command Invalid

**Description**

If you sent a command that is invalid in current condition, the board would reply with a

message “Command Invalid”.

**Send** **(Hex)**

24 24 52 52 18 0018 0d 0a

Send “RR” command which is only valid in B20 board.

**Reply** **(Hex)**

24 24 53 54 81 12 43 4f 4d 4d 41 4e 44 20 49 4e 56 41 4c 49 44 21 0d 0a

84 0d 0a

Command Invalid!

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**A.1.4** **Device** **ID** **List**

ComNav defined a set of id codes for specifying device. These id codes are mainly used in

command sentences as a parameter. All of them are listed in the following table.

**Table** **56.Device** **ID**

CODE (BINARY)

DESCRIPTION

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*Appendix* *B.* *Technical* *Specifications*

APPENDIX B. TECHNICAL SPECIFICATIONS

Please refer to ComNav OEM Board Product Specifications:

*CNT-OEM-PS001,* *K500\_K501\_K501G\_K505* *OEM* *Board* *Product* *Specification*

*CNT-OEM-PS002,* *K502\_K508\_K528* *OEM* *Board* *Product* *Specification*

*CNT-OEM-PS003,* *K708* *OEM* *Board* *Product* *Specification*

*CNT-OEM-PS004,* *K700* *OEM* *Board* *Product* *Specification*

*CNT-OEM-PS005,* *K705* *OEM* *Board* *Product* *Specification*

*CNT-OEM-PS006,* *K706* *OEM* *Board* *Product* *Specification*

*CNT-OEM-PS007,* *K728* *OEM* *Board* *Product* *Specification*

*CNT-OEM-PS008,* *K726* *OEM* *Board* *Product* *Specification*

*CNT-OEM-PS009,* *K703* *OEM* *Board* *Product* *Specification*

*CNT-OEM-PS010,* *K727* *OEM* *Board* *Product* *Specification*

*CNT-OEM-PS021,* *K707* *OEM* *Board* *Product* *Specification*

*CNT-OEM-PS031,* *K723* *OEM* *Board* *Product* *Specification*

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*Appendix* *C.* *Firmware* *Updates*

APPENDIX C. FIRMWARE UPDATES

Firmware updates are released on our website after they become available; user could

download the newest firmware updates and keep your GNSS cards have a better performance.

**NOTICE:**

When process of firmware updates is completed, external three seconds should be waited to

make sure the GNSS cards accomplish all the internal reconfigurations. Three seconds later,

you could turn off the power and restart the GNSS cards to enjoy your new firmware! To

confirm firmware have been updated successfully, command “log version” could be used to

check the firmware information.

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