4000SE/SSE/SSi

RS-232 Interface

Data Collector Format

Specification Manual

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Revision Notice

This is the fourth release of this guide, 4000SE/SSE/SSi RS-232 Interface Data Collector Format Specification Manual, Part Number (22794-00) Revision D, May 1995.

Reader Comment Form

A reader comment form is provided at the end of this guide. If this form is not available, comments and suggestions can be sent to Trimble Navigation Limited, 645 North Mary Avenue, Post Office Box 3642, Sunnyvale, CA 94088-3642. All comments and suggestions become the property of Trimble Navigation Limited.

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Table of Contents

A Troubleshooting

Index

List of Tables

Preface

Welcome to the 4000SE/SSE/SSi RS-232 Interface Data Collector Format Specification Manual. This document describes the commands available to an external device for control and inquiry of the state of Trimble Navigation's Series 4000 receivers.

Even if you have used other Global Positioning System (GPS) receivers we recommend you spend some time reading this manual. The following section provides you with a guide to this manual, as well as other documentation you have received with your Trimble Series 4000 receiver.

Organization

This manual includes the following chapters and appendices:

- Chapter 1, Data Collector Format - discusses the communication format and how to handle communication errors.
- Chapter 2, Function Definitions - provides details for each function in the 4000SE/SSE/SSi RS-232 interface data collector format.
- Appendix A, Troubleshooting - lists known bugs and limitations of the functions and gives the NAV processor version compatibility for the functions.

Thank you for purchasing this Trimble product. At the end of this manual you will find a reader comment form. We appreciate any feedback you have about this manual.

Related Information

This manual contains specific information on the RS-232 interface data collector format specification. Other sources of information are discussed in the following sections.

Update Notes

You will find a Warranty Activation Sheet with your receiver documentation. By sending in your Warranty Activation Sheet, you are automatically sent update notes as they become available. When you receive these packages, read them. They contain important information about the changing software and hardware. Contact your local Trimble Dealer for more information about support agreement contracts for software and firmware, and an extended warranty for hardware.

Trimble Bulletin Board Service

If you have a modem, check the Trimble Surveying and Mapping Bulletin Board Service (BBS) on a regular basis for application notes, new software release notices, and other information. The phone numbers are:

+408-732-6717
+408-732-8514
+408-732-8936 (for a high speed modem)

Technical Assistance

If you have problems and cannot find the information you need in the Series 4000 documentation, call the Trimble Technical Assistance Center (TAC). The phone numbers are:

1-800-SOS-4TAC (in North America)
+408-481-6940 (International)
+408-737-9142 (fax)

The Technical Assistance Center phones are answered from 6 AM to 6 PM Pacific Time. A support technician can take your call, isolate your difficulty, and provide technical assistance.

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The FaxBack system is available 24 hours a day, seven days a week. Documents you can order include data sheets, application notes, technical documentation, configuration guides, assembly drawings, and general information. Simply dial the number below and follow the voice prompts.

FaxBack: +408-481-7704

Document Conventions

Italics identify software menus, menu commands, dialog boxes, and the dialog box fields.

SMALL CAPITALS identify DOS commands, directories, filenames, and filename extensions.

`Courier` represents what is printed on the screen by the DOS system or program.

`Courier Bold` represents information that you must type in a software screen or window.

Return or Ctrl + c identifies a hardware function key or key combination that you must press on a PC, data collector, or receiver.

Helvetica Bold represents a software command button.

Notes, Cautions, and Warnings

Notes, cautions, and warnings are used to emphasize important information.

Note – Notes give additional significant information about the subject to increase your knowledge, or guide your actions. A note can precede or follow the text it references.

Caution – Cautions alert you to situations that could cause hardware damage or software error. A caution precedes the text it is referencing.

Warning – Warnings alert you to situations that could cause unrecoverable data loss. A warning precedes the text it is referencing.

1 Data Collector Format

The data collector format allows a handheld computer to be the user interface for a survey, and allows control of other aspects of the survey receiver. Originally, the format was implemented as ASCII data with binary framing to eliminate formatting problems encountered with some external devices. Currently, most handheld computers support programming in the C language, which has extensive bit/byte manipulation capabilities. As a result, all of the earlier functions described in this document use ASCII data, and all of the later functions use more compact binary data. Also, as the versatility of the Series 4000 receivers has expanded, more powerful functions have been included to allow the external device to configure the GPS receiver, making user access of the receivers front panel unnecessary.

The data collector interface operates with 4000SE/SSE/SSi and compatible receivers with various NAV version numbers. A few commands work with 4000ST/SST receivers. These commands are noted with the command listings and in the NAV version compatibility list given in Appendix A.

1.1 Communications Format

Supported data rates are 150, 300, 600, 1200, 2400, 4800, 9600, 19200 and 38400 baud. Any of these data rates can be used, however, realistically only 4800 baud or higher should be used. Only an 8-bit word format is supported, with ODD, EVEN or NO parity, and 1 or 2 STOP BITS. The default communications format for the receiver is 9600, 8, ODD and 1 stop bit.

Every message, regardless of its source and except for protocol sequences, has the same format as shown in Table 1-1:

Table 1-1. Communications Format

Byte	Message	Description
byte 0	STX (02H)	Start of transmission
byte 1	Status	Receiver status indicator
byte 2	Message Type	
byte 3	Length	Single byte # of data bytes, limits data to 248 bytes
byte 4	Data bytes	from 0..length bytes, ASCII data
byte length+4	Checksum	(status + type + length + data bytes) mod 256
byte length+5	ETX (03H)	End of transmission

Every message from the data collector to the receiver is answered by the receiver. Messages not requiring a specific response receive a ACK or NAK (see below) from the receiver.

Protocol calls are responded to instantly. However, in some cases, the receiver is slow processing other RS-232 requests or performing other internal functions. This may occur when a number of storage requests are made concurrently and if the receiver is busy making measurements. Multiple storage requests may incur a time lag (generally less than 1/3 second) between the reception of the transmission and the response. Nominally, answers are responded to in 50 ms, but the delay can be as high as 500 ms.

To determine whether the receiver can accept RS-232 commands, the protocol request ENQ (05 hex) may be used. The response is either ACK (06 hex) or NAK (15 hex). ENQ/ACK/NAK correspond to Are you ready?, I am ready, and I am not ready. This quick 1-byte test may be sent before any other command to ensure the RS-232 line is clear and operational. Recent enhancements to the SE/SSE/SSi receiver interrupt servicing should ensure that a NAK is never received due to the receiver being busy. If an SE/SSE/SSi receiver is busy, the response should just be delayed. On a ST/SST however, a NAK reply is possible.

1.1.1 Data Collector Format Functions

The data collector format functions can be divided into three broad categories:

- Information requests and replies
- Control functions
- Storage request

Information requests such as GETSTAT1, GETSVS and GETPOS2 can be sent at any time. The expected reply is always sent. Control Functions such as STARTSURV, RTCMCTRL and SETIDLE may result in a NAK reply because the request is invalid. Storage requests result in a NAK if a survey is not currently being performed (data is not being stored internally or externally) or if memory is unavailable.

In summary, a NAK may be received if:

- The 4000ST/SST is momentarily too busy to process requests.
- The request is invalid for that particular receiver (a specific option is not installed).
- The receiver is instructed to store information and it cannot do so, due to an incorrect receiver operation mode (a survey is not under way) or the memory board is full.

Due to the previous reason 3., responses to a request to store information should always be checked.

An additional inquiry/response exchange can facilitate the determination of the current baud rate and parity of the receiver. ENQ2 (07h) and ACK2 (08h) may be substituted in place of ENQ and ACK. ACK2 is only sent in response to ENQ2. ENQ2 and ACK2 are only available on 4000SE receivers.

Warning – Virtually no range checking is performed by the GPS receiver on t he values supplied by the external device. It is extremely important the external device adheres exactly to the ranges specified within this document. FAILURE TO DO SO MAY RESULT IN A RECEIVER CRASH AND/OR LOSS OF DATA.

Note – Some commands described in this manual only work when the appropriate option (RTCM inputs) are installed in the receiver.

Note – The data collector must wait for the receivers response before sending another her RS-232 command.

Note – This system of communications is completely different and separate to that used in the older 4000 receivers (4000S, 4000SX, 4000SL, 4000SLD) and is available on the newer receivers. In this document, the older format is referred to as the OLD PROTOCOL commands or REPORT MODE. The new protocol will not work if the receiver is in report mode (has had an Attention byte - 23 hex). This may create problems if communications corruption occurs under this system resulting in an Attention byte being received at the receiver, or the receiver is left in report mode from a previous function. Enhancements have been made to the 4000SE/SSE/SSi receivers to ensure that the receiver cannot be switched into report mode while communicating with a data collector. To use the old protocol commands under the data collector format see OLDCMD (83h).

1.2 Communication Errors

Errors at both the receiver and data collector ends should be handled as follows:

1. Bytes out of context: Not framed by 02, 03. Incorrect position within framing.

   Solution: Send the Request again or request RESEND (13h) last message.

2. Message type not recognized.

   Solution: Send the Request again or request RESEND (13h) last message.

3. Checksum does not check.

   Solution: Send the Request again or request RESEND (13h) last message.

4. Nonsense or erroneous values in a data field.

   Solution: Send the Request again or request RESEND (13h) last message.

5. No response to data collector request (data collector only).

   Solution: The data collector times-out and sends 249 CANCEL commands (18 hex) to clear the RS-232 line. The data collector then sends an ENQ which is responded by an ACK. The data collector must then resend the last request. If the last request was for a position, it is possible that the receiver processed the request and the new position and measurement flags have been set to old. In this case, the old position cannot be accessed by the data collector.

6. Fewer bytes than expected but some received (bytes lost).

   Solution: The receiver does not time-out due to bytes being lost. The receiver waits until the data collector times-out while waiting for the response. This situation then becomes case 5. If the data collector receives fewer bytes than expected, it times-out and then either resends the last request sends a RESEND (13h).

A Resend Last Message Command should only be sent once by the data collector. It will not work for some commands such as GETRAW. If the response is still invalid, the original request should then be sent again. The time-out interval should be around 500 ms between messages and 50 ms between bytes.

1.3 The Status Byte

The status byte contains important indicators that usually require immediate attention by the data collector. The receiver never makes a request of the data collector, except to request a resend of the last message. Each bit of the status byte identifies a particular problem.

More than one problem may be indicated by the status byte. The status byte codes are listed in Table 1-2:

Table 1-2. Status Byte Codes

Bit	Byte Value	Meaning
Bit 0	1	< 10kb Memory remaining
Bit 1	2	Low Battery
Bit 2-7	4-128	Reserved

1.4 Reading Binary Values

The Series 4000 receivers store numbers internally in Motorola format. The byte order of these numbers is the opposite of what many external devices expect (Intel format). In order to supply or interpret binary numbers (8 byte doubles, 4-byte longs and 2-byte integers), most external devices need to reverse the byte order of these values.

2 Function Definitions

Details are provided for each function in the following sections.

05h REMARK General Remark

REMARK stores a remark in the internal memory of the receiver. Table 2-1 lists the REMARK command sequence.

Table 2-1. REMARK Command Sequence

Receiver		Data Collector
	<--------	(02h) STX
	<--------	(00h) STATUS
	<--------	(05h) TYPE
	<--------	(??h) LENGTH
	<--------	1... 240 char REMARK
	<--------	(??h) CHECKSUM
	<--------	(03h) ETX
ACK (06h)	-------->	

Note – Remarks are stored in the receiver with a GPS week second time tag. This value is internally generated and is available through the *.SSF and *.DAT files. In the *.DAT files, remarks are stored as record 16s with an ASCII time tag as the 1st 6 characters of the remark.

This function is available for all 4000SE/SSE/SSi receivers. It is also available for 4000ST/SST receivers using NAV version 4.20 and above.

06h GETSERIAL Get Receiver & Antenna Serial Information

GETSERIAL requests receiver and antenna information. Table 2-2 lists the GETSERIAL command sequence.

Table 2-2. GETSERIAL Command Sequence

Receiver		Data Collector
	<--------	(02h) STX
	<--------	(00h) STATUS
	<--------	(06h) TYPE
	<--------	(00h) LENGTH
	<--------	(06h) CHECKSUM
	<--------	(03h) ETX
RSERIAL	-------->	

This function is available for all 4000SE/SSE/SSi receivers. It is also available for 4000ST/SST receivers using NAV version 4.20 and above.

07h RSERIAL Receiver & Antenna Information

This function is the response to the GETSERIAL request. RSERIAL returns the receiver and antenna serial numbers, types, processor versions, and number of channels. Table 2-3 lists the RSERIAL command sequence.

Table 2-3. RESERIAL Command Sequence

Receiver		Data Collector
(02h) STX	-------->	
(??h) STATUS	-------->	
(07h) TYPE	-------->	
(2Dh) LENGTH	-------->	
8 char RECEIVER SERIAL #	-------->	
8 char RECEIVER TYPE	-------->	
5 char NAV PROCESS VERSION	-------->	
5 char SIG PROCESS VERSION	-------->	
5 char BOOT ROM VERSION	-------->	
8 char ANTENNA SERIAL #	-------->	
2 char ANTENNA TYPE	-------->	
2 char # CHANNELS	-------->	
2 char # CHANNELS L1	-------->	
(??h) CHECKSUM	-------->	
(03h) ETX	-------->	

Where:

RECEIVER SERIAL # is the 8 digit serial number.

RECEIVER TYPE may be either:

4000ST
4000SST
4000SDT (Dual Frequency)

4000STP (P-Code)
4000SE
4000SSE
4000SSi

The NAV PROCESSOR VERSION, SIG PROCESSOR VERSION, and BOOT ROM VERSION are the version numbers of the firmware and ROMs in the receiver.

ANTENNA SERIAL # is the same as the receiver serial number if the internal antenna is being used. If no antenna serial number is supplied, the field is filled with spaces. The number of channels may be from 01 to 24.

ANTENNA TYPE is listed in Table 2-4.

Table 2-4. Antenna Type

Code	Description
I_	Internal (ST)
IE	Internal Attachable SE
EK	External Kinematic (ST, SST: Default for external)
EG	External Geodetic L1 only (ST, SST)
E_*	External (unknown type)
EH	External Helical (SX, round ground plane
EX	External Dual Frequency Helical (SX, round ground plane
EM	External Microstrip (SL, square ground plane)
ED	External Dual Frequency (SL, square ground plane)
EC	External Compact Dome
EF	External SSE Kinematic Dual Frequency
E2	External Geodetic Dual Frequency (SST, SSE round ground plane with notches
G0	Compact L1/L2 with ground plane
K0	Compact L1/L2

Table 2-4. Antenna Type

Code	Description
_ indicates space * Antenna height assumed vertical	

Note – If the receiver returns a blank string (spaces) for the RECEIVER TYPE field, the receiver is a 4000ST.

Note – The ST series receiver only knows that either an internal or external (I or E) antenna is being used until the antenna type is set by the SETANT (1Bh) command. All SE series receivers have external antennas.

This function is available for all 4000SE/SSE/SSi receivers. It is also available for 4000ST/SST receivers using NAV version 4.20 and above.

08h GETSTAT1 Get Receiver Status, Variable

GETSTAT1 requests receiver status information regarding position determination, number of satellites locked, battery capacity remaining, memory remaining. Table 2-5 lists the GETSTAT1 command sequence.

Table 2-5. GETSTAT1 Command Sequence

Receiver		Data Collector
	<--------	(02h) STX
	<--------	(00h) STATUS
	<--------	(08h) TYPE
	<--------	(00h) LENGTH
	<--------	(08h) CHECKSUM
	<--------	(03h) ETX
RECSTAT1	-------->	

This function is available for all 4000SE/SSE/SSi receivers. It is also available for 4000ST/SST receivers using NAV version 4.20 and above.

09h RECSTAT1 Receiver Status, Variable

This function is the response to the GETSTAT1 request. RECSTAT1 returns receiver status information regarding position determination, number of satellites locked, battery capacity remaining, memory remaining. Table 2-6 lists the RECSTAT1 command sequence.

Table 2-6. RECSTAT1 Command Sequence

Receiver		Data Collector
(02h) STX	-------->	
(??h) STATUS	-------->	
(09h) TYPE	-------->	
(15h) LENGTH	-------->	
1 char POSITION FIX	-------->	
1 char MEASUREMENT STATUS	-------->	
2 char # SVS LOCKED	-------->	
3 char # MEAS TO GO	-------->	
3 char % BATTERY REMAINING	-------->	
4 char DEC HOURS OF MEM	-------->	
1 char STATUS OF SURVEY	-------->	
4 char STATUS OF RECEIVER	-------->	
2 char # L2 CHANNELS OPER	-------->	
(??h) CHECKSUM	-------->	
(03h) ETX	-------->	

Where:

POSITION FIX is either:

0 (zero), position not determined
0 same position as last request
1 0D clock only fix (1+ SV)
2 1D height only (1+ SV)
3 2D height and clock fixed (2+ SVs)

4 2D height fixed (3+ SVs)
5 3D (4+ SVs)

MEASUREMENT STATUS is N or O (New or Old), Survey measurement.

SVs LOCKED has a range of 00 to 12.

MEAS TO GO refers to kinematic surveys which is out of the scope of this document.

% BATTERY REMAINING is 000 to 101.

DEC HOURS OF MEM = 00.0 to 99.9 (switches to 0100-9999 hours if > 99.9 for NAV Processor version 5.50 and above).

STATUS OF SURVEY is either:

0 Session not started since receiver power up
1 waiting for start time
2 waiting for SV to reach mask
3 pre-survey positioning
4 one cycle delay as measured are unsynced
5 logging data to the memory board
6 completed a session since power up

STATUS OF RECEIVER is either:

SETT: Setting time
GETD: Updating ION/UTC/Health data
CAL1: Calibrating
MEAS Static Survey Measurements
KINE: Kinematic Survey

L2 CHANNELS OPER is the number of L2 channels selected for taking measurements.

Note – MEASUREMENT STATUS is set to OLD (zero) after this message is sent. The POSITION FIX STATUS is set to OLD (zero) when the POSITION message is sent.

Note – A survey may be regarded as started when Status Survey of 5 is achieved. At this point storage requests may be made of the memory board.

This function is available for all 4000SE/SSE/SSi receivers. It is also available for 4000ST/SST receivers using NAV version 4.20 and above.

0Bh GETPOS Request Position

GETPOS requests time tagged position and PDOP information. Table 2-7 lists the GETPOS command sequence.

Table 2-7. GETPOS Command Sequence

Receiver		Data Collector
	<--------	(02h) STX
	<--------	(00h) STATUS
	<--------	(0Bh) TYPE
	<--------	(00h) LENGTH
	<--------	(0Bh) CHECKSUM
	<--------	(03h) ETX
POSITION	-------->	

This function is available for all 4000SE/SSE/SSi receivers. It is also available for 4000ST/SST receivers using NAV version 4.20 and above.

0Ch POSITION Position & PDOP

This function is the response to the GETPOS request. POSITION sends time tagged position and PDOP information. Table 2-8 lists the POSITION command sequence.

Table 2-8. POSITION Command Sequence

Receiver		Data Collector
(02h) STX	-------->	
(??h) STATUS	-------->	
(0Ch) TYPE	-------->	
(42h) LENGTH	-------->	
13 char LATITUDE	-------->	
13 char LONGITUDE	-------->	
8 char HEIGHT	-------->	
7 char GPS TIME (SEC)	-------->	
4 char GPS WEEK #	-------->	
5 char PDOP	-------->	
5 char HDOP	-------->	
5 char VDOP	-------->	
3 char POSITION TYPE	-------->	
2 char # SVS USED	-------->	
1 char NEW/OLD POSITION	-------->	
(??h) CHECKSUM	-------->	
(03h) ETX	-------->	

Where:

LATITUDE/LONGITUDE format ±DDD.dddddddd where DDD.dddddddd is right justified zero buffered decimal degrees with 8 decimal places.

HEIGHT is in the range -999.999 to 9999.999 meters.

GPS TIME is in GPS seconds of the week, rounded to the nearest second.

PDOP, HDOP and VDOP are in the range 001.0 to 999.9

POSITION TYPE = C/A or L12

SVS USED = 01 to 12 in position fix.

NEW/OLD POSITION is either:

0	old, position not determined
0	same value as last accessed
1	0D clock only fix (1+ SV)
2	1D height only (1+ SV)
3	2D height and clock fixed (2+ SVs)
4	2D height fixed (3+ SVs)
5	3D (4+ SVs)

Note – The POSITION FIX STATUS is set to OLD (zero) after this message is sent. Its value is also affected by the number of satellites available, the user-selected positioning mode and the user-selected PDOP mask.

This function is available for all 4000SE/SSE/SSi receivers. It is also available for 4000ST/SST receivers using NAV version 4.20 and above.

0Dh GETCHAN Request Tracking Information

GETCHAN requests the cumulative and continuous number of measurements (carrier phase) on each channel. This function also requests the SV PRN # for each channel. Table 2-9 lists the GETCHAN command sequence.

Table 2-9. GETCHAN Command Sequence

Receiver		Data Collector
	<--------	(02h) STX
	<--------	(00h) STATUS
	<--------	(0Dh) TYPE
	<--------	(00h) LENGTH
	<--------	(0Dh) CHECKSUM
	<--------	(03h) ETX
CHANCC	-------->	

This function is available for all 4000SE/SSE/SSi receivers. It is also available for 4000ST/SST receivers using NAV version 4.20 and above.

0Eh CHANCC Tracking Information

This function is the response to the GETCHAN request. CHANCC returns the cumulative and continuous measurements made on each satellite since the start of the survey. Table 2-10 lists the CHANCC command sequence.

Table 2-10. CHANCC Command Sequence

Receiver		Data Collector
(02h) STX	-------->	
(??h) STATUS	-------->	
(0Eh) TYPE	-------->	
(??h) LENGTH	-------->	
2 char # SVS TRACKED	-------->	
1 char L1	-------->	
2 char PRN #	-------->	Always present
4 char/long CUMULATIVE L1	-------->	Not present when L1 = 0
4 char/long CONTINUOUS L1	-------->	Not present when L1 = 0
4 char/long CUMULATIVE L2	-------->	Not present if L1 = 0, 1 or 3
4 char/long CONTINUOUS L2	-------->	Not present if L1 = 0, 1 or 3
(??h) CHECKSUM	-------->	
(03h) ETX	-------->	

Where:

SVS TRACKED = number of satellite currently tracked

L1 or L1/L2 is either:

- 0 a survey is not being made and only the satellitE numbers are sent
- 1 indicates a L1 receiver and only the satellite numbers and the L1 values are sent
- 2 indicates a L1/L2 receiver and all values are sent
- 3 indicates a L1 receiver and only the satellite numbers and the L1 values are sent. Values are LONG INTEGERS rather than characters
- 4 indicates a L1/L2 receiver and all values are sent. Values are LONG INTEGERS rather than characters

CUMULATIVE is the total number of measurements on that satellite since the start of the survey.

CONTINUOUS is the total number of measurements on that satellite since the start of the survey or the last loss of lock on that satellite.

Note – In NAV processor firmware version 5.50 and higher, 3 and 4 appear as values L1/L2 flag indicating that binary rather than ASCII values are sent. This fixes the cumulative/continuous value rollover bug that exists in previous firmware versions.

This function is available for all 4000SE/SSE/SSi receivers. It is also available for 4000ST/SST receivers using NAV version 4.20 and above.

0Fh LOCKKEY Request Keyboard Lockout

LOCKKEY requests that the keyboard on the front panel of the receiver be locked out to avoid accidental keystrokes while backpacking or moving. The CLEAR key on the front panel of the receiver unlocks the front panel. Table 2-11 lists the LOCKKEY command sequence.

Table 2-11. LOCKKEY Command Sequence

Receiver		Data Collector
	<--------	(02h) STX
	<--------	(00h) STATUS
	<--------	(0Fh) TYPE
	<--------	(00h) LENGTH
	<--------	(0Fh) CHECKSUM
	<--------	(03h) ETX
ACK (06h)	-------->	

This function is available for all 4000SE/SSE/SSi receivers. It is also available for 4000ST/SST receivers using NAV version 4.41 and above.

10h GETMESS Request the GPS Message

GETMESS requests the special message from the receiver. Table 2-12 lists the GETMESS command sequence.

Table 2-12. GETMESS Command Sequence

Receiver		Data Collector
	<--------	(02h) STX
	<--------	(00h) STATUS
	<--------	(10h) TYPE
	<--------	(00h) LENGTH
	<--------	(10h) CHECKSUM
	<--------	(03h) ETX)
MESSAGE	-------->	

This function is available for all 4000SE/SSE/SSi receivers. It is also available for 4000ST/SST receivers using NAV version 4.20 and above.

11h MESSAGE Return the GPS Message

This function is the response to the GETMESS request. MESSAGE returns the special 22-character message received from the satellite. 22 spaces are returned if no message has been received. Table 2-13 lists the MESSAGE command sequence.

Table 2-13. MESSAGE Command Sequence

Receiver		Data Collector
(02h) STX	-------->	
(??h) STATUS	-------->	
(11h) TYPE	-------->	
(16h) LENGTH	-------->	
22 char MESSAGE	-------->	
(??h) CHECKSUM	-------->	
(03h) ETX	-------->	

This function is available for all 4000SE/SSE/SSi receivers. It is also available for 4000ST/SST receivers using NAV version 4.20 and above.

13h RESEND Resend Last Message

RESEND resends the last message. Table 2-14 lists the RESEND command sequence.

Table 2-14. RESEND Command Sequence

Receiver		Data Collector
	<--------	(02h) STX
	<--------	(00h) STATUS
	<--------	(13h) TYPE
	<--------	(00h) LENGTH
	<--------	(13h) CHECKSUM
	<--------	(03h) ETX
Last Response is resent	-------->	

This function is available for all 4000SE/SSE/SSi receivers. It is also available for 4000ST/SST receivers using NAV version 4.20 and above.

14h GETTIME Get GPS Time & Week Number

GETTIME requests the current GPS time and week number. Table 2-15 lists the GETTIME command sequence.

Table 2-15. GETTIME Command Sequence

Receiver		Data Collector
	<--------	(02h) STX
	<--------	(00h) STATUS
	<--------	(14h) TYPE
	<--------	(00h) LENGTH
	<--------	(14) CHECKSUM
	<--------	(03h) ETX
GPSTIME	-------->	

This function is available for all 4000SE/SSE/SSi receivers. It is also available for 4000ST/SST receivers using NAV version 4.20 and above.

15h GPSTIME Return GPS Time & Week Number

This function is the response to the GETTIME request. GPSTIME returns the current GPS time and week number. Table 2-16 lists the GPSTIME command sequence.

Table 2-16. GPSTIME Command Sequence

Receiver		Data Collector
(02h) STX	-------->	
(??h) STATUS	-------->	
(15h) TYPE	-------->	
(14h) LENGTH	-------->	
7 char TIME (SEC)	-------->	
4 char WEEK #	-------->	
2 char GPS/UTC OFFSET	-------->	
4 char TIME OFFSET (MIN)	-------->	
3 char TIME MODE	-------->	
(??h) CHECKSUM	-------->	
(03h) ETX	-------->	

Where:

TIME (SEC) is seconds since beginning of GPS week. (Midnight Sat/Sun, 5th Jan. 1980, mod 6048000).

WEEK # is the GPS week number since the above date.

GPS/UTC OFFSET is the integer number of seconds between GPS time and UTC. UTC = GPS + offset.

TIME OFFSET (MIN) is the local time zone set in the receiver (not applied to the any times in this message).

TIME MODE is the current time mode selected on the receiver. It is either UTC, L24 or L12 where L indicates local time.

This function is available for all 4000SE/SSE/SSi receivers. It is also available for 4000ST/SST receivers using NAV version 4.20 and above.

16h GETSVS Request Satellite Information

GETSVS requests the azimuth elevation and SNR for each satellite listed by channel. Table 2-17 lists the GETSVS command sequence.

Table 2-17. GETSVS Command Sequence

Receiver		Data Collector
	<--------	(02h) STX
	<--------	(00h) STATUS
	<--------	(16h) TYPE
	<--------	(00h) LENGTH
	<--------	(16h) CHECKSUM
	<--------	(03h) ETX
SVDATA	-------->	

This function is available for all 4000SE/SSE/SSi receivers. It is also available for 4000ST/SST receivers using NAV version 4.20 and above.

17h SVDATA Satellite Azimuth, Elevation & SNR

This function is the response to the GETSVS request. SVDATA returns the azimuth, elevation and SNR of each satellite. Table 2-18 lists the SVDATA command sequence.

Table 2-18. SVDATA Command Sequence

Receiver		Data Collector
(02h) STX	-------->	
(00h) STATUS	-------->	
(17h) TYPE	-------->	
(??h) LENGTH	-------->	
2 char # SVs TRACKED	-------->	
1 char L1/L2	-------->	
Repeat for N channels	-------->	
2 char PRN #	-------->	
3 char AZIMUTH DEGREES	-------->	
2 char ELV DEGREES	-------->	
3 char SNR x 10 L1	-------->	
5 char SNR x 100 L2	-------->	Not present for L1 only
(??h) CHECKSUM	-------->	
(03h) ETX	-------->	

Where:

SVS TRACKED = number of satellite currently tracked.

L1/L2 = 0 (not tracked currently) 1 or 2, if 1, the L2 value is not sent.

SNR values on L2 may be negative. A value of -9999 indicates that L2 is not tracked for this satellite.

This function is available for all 4000SE/SSE/SSi receivers. It is also available for 4000ST/SST receivers using NAV version 4.20 and above.

18h UNLOCK Request Keyboard Unlock

UNLOCK requests that the keyboard on the front panel of the receiver be unlocked. Table 2-19 lists the UNLOCK command sequence.

Table 2-19. UNLOCK Command Sequence

Receiver		Data Collector
	<--------	(02h) STX
	<--------	(00h) STATUS
	<--------	(18h) TYPE
	<--------	(00h) LENGTH
	<--------	(18h) CHECKSUM
	<--------	(03h) ETX
ACK (06h)	------->	

This function is available for all 4000SE/SSE/SSi receivers. It is also available for 4000ST/SST receivers using NAV version 4.41 and above.

1Bh SETANT Input Antenna Information

SETANT informs the receiver of the antenna type and serial. Table 2-20 lists the SETANT command sequence.

Table 2-20. SETANT Command Sequence

Receiver		Data Collector
	<--------	(02h) STX
	<--------	(00h) STATUS
	<--------	(1Bh) TYPE
	<--------	(0Ah) LENGTH
	<--------	2 char ANTENNA TYPE
	<--------	8 char ANT SERIAL #
	<--------	(??h) CHECKSUM
	<--------	(03h) ETX
ACK (06h)	-------->	

Where:

ANTENNA TYPE may either be either:

- I_ Internal (standard)
- IE Internal Attachable SE
- EK External Kinematic (ST, SST: Default for external)
- EG External Geodetic L1 only (ST, SST)
- E_ External (unknown type)
- EH External Helical (SX, round ground plane)
- EX External Dual Frequency Helical (SX, round ground plane)
- EM External Microstrip (SL, square ground plane)
- ED EXTERNAL DUAL FREQUENCY (SL, square ground plane)
- EC External Compact Dome
- EF External SSE/SSi Kinematic Dual Frequency

E2 External Geodetic Dual Frequency (SST, SSE) round ground plane with notches)
G0 Compact L1/L2 with ground plane
K0 Compact L1/L2
_ indicates space

Note – Antenna information is stored in the receiver with a GPS week second time tag. This value is internally generated and is available through the *.SSF and *.DAT files as well as through the GETSERIAL command.

This function is available for all 4000SE/SSE/SSi receivers. It is also available for 4000ST/SST receivers using NAV version 4.20 and above.

1Ch SETMET Input Meteorological Data

SETMET inputs wet and dry temperature and pressure. Table 2-21 lists the SETMET command sequence.

Table 2-21. SETMET Command Sequence

Receiver		Data Collector
	<--------	(02h) STX
	<--------	(00h) STATUS
	<--------	(1Ch) TYPE
	<--------	(1Bh) LENGTH
	<--------	6 char PRESSURE
	<--------	6 char DRY TEMPERATURE
	<--------	6 char WET TEMPERATURE
	<--------	4 char RELATIVE HUMIDITY
	<--------	5 char WEATHER CODE
	<--------	(??h) CHECKSUM
	<--------	(03h) ETX
ACK (06h)	-------->	

Where:

PRESSURE is in millibars, for example 1013.5.

DRY and WET TEMPERATURE are in degrees Celsius. The valid range is -99.99 to 99.99.

RELATIVE HUMIDITY is expressed as a percentage. The valid range is 0.0 to 99.9.

The WEATHER CODE is defined by the U.S. Blue Booking standards and is given by Table 2-22.

Table 2-22. Weather Code

Characteristic	0	1	2
PROBLEMS	None	Encountered	Encountered
VISIBILITY	Good	Fair	Poor
TEMPERATURE	Warm 0°-27°C 32°-80°F	Hot Over 27°C Over 80°F	Cold Below 0°C Below 32°F
SKY	Clear	50% Overcast	Full Overcast
WIND	Calm	Moderate	Strong

For example, 01001 = None, Fair, Warm, Clear, Moderate

Note – Meteorological data is stored in the receiver with a GPS week second time tag. This value is internally generated and is available through the *.SSF and *.DAT files.

Note – If the Weather Code is not entered, 99999 is sent.

Note – The meteorological data is not currently used by any Trimble software.

This function is available for all 4000SE/SSE/SSi receivers. It is also available for 4000ST/SST receivers using NAV version 4.20 and above.

21h SUSPEND Suspend Storage of Data to the Receiver's Internal Memory

SUSPEND request that the receiver stop storing data internally. The receiver continues observing the satellites. Storage to the receiver's internal memory is recommenced by sending the RESUME command. Table 2-23 lists the SUSPEND command sequence.

Table 2-23. SUSPEND Command Sequence

Receiver		Data Collector
	<--------	(02h) STX
	<--------	(00h) STATUS
	<--------	(23h) TYPE
	<--------	(00h) LENGTH
	<--------	(23h) CHECKSUM
	<--------	(03h) ETX
ACK (06h)	-------->	

This function is available for all 4000SE/SSE/SSi receivers using NAV version 6.11 and above.

22h RESUME Resume Storage of Data to the Receiver's Internal Memory

RESUME requests that data resume being stored internally. This command cancel a SUSPEND request. Table 2-24 lists the SUSPEND command sequence.

Table 2-24. RESUME Command Sequence

Receiver		Data Collector
	<--------	(02h) STX
	<--------	(00h) STATUS
	<--------	(23h) TYPE
	<--------	(00h) LENGTH
	<--------	(23h) CHECKSUM
	<--------	(03h) ETX
ACK (06h)	-------->	

This function is available for all 4000SE/SSE/SSi receivers using NAV version 6.11 and above.

23h TIMEEVNT Store an Event Mark

TIMEEVNT requests that a GPS time tag (event) be placed in the data file. This event may be linked with ADDEVNT records occurring later in the file. The event time tag has an accuracy of +/-20 msec. The number for the event assigned by the receiver may be retrieved with the GETEVNT command. Table 2-25 lists the TIMEEVNT command sequence.,

Table 2-25. TIMEEVNT Command Sequence

Receiver		Data Collector
	<--------	(02h) STX
	<--------	(00h) STATUS
	<--------	(23h) TYPE
	<--------	(00h) LENGTH
	<--------	(23h) CHECKSUM
	<--------	(03h) ETX
ACK (06h)	-------->	

This function is available for all 4000SE/SSE/SSi receivers. It is also available for 4000ST/SST receivers using NAV version 4.20 and above.

25h GETEVNT Get Last Event Number

GETEVNT requests the time and number assigned by the receiver to the last Event Marker. Table 2-26 lists the GETEVNT command sequence.

Table 2-26. GETEVNT Command Sequence

Receiver		Data Collector
	<--------	(02h) STX
	<--------	(00h) STATUS
	<--------	(25h) TYPE
	<--------	(00h) LENGTH
	<--------	(25h) CHECKSUM
	<--------	(03h) ETX
LASTEVNT	-------->	

Note – This function returns the last event marker regardless of its source. The source may be the RS-232 port (TIMEEVNT 23h), the event marker port, or the front panel of the receiver.

This function is available for all 4000SE/SSE/SSi receivers. It is also available for 4000ST/SST receivers using NAV version 4.41 and above.

26h LASTEVNT Returns the Last Event Number

This function is the response to the GETEVNT request. LASTEVNT returns the last internally assigned time tag number and time (milliseconds) of GPS week, independent of the time tag source. Table 2-27 lists the LASTEVNT command sequence.

Table 2-27. LASTEVNT Command Sequence

Receiver		Data Collector
(02h) STX	-------->	
(??h) STATUS	-------->	
(26h) TYPE	-------->	
(1Eh) LENGTH	-------->	
5 char TIME EVENT #	-------->	
9 char GPS TIME (MILLISEC)	-------->	
(??h) CHECKSUM	-------->	
(03h) ETX	-------->	

Where:

TIME EVENT # is in the range 0 65,535.

GPS TIME is in milliseconds of GPS week.

Note – The time tag may be generated by TIMEEVNT (23h), 4000ST keyboard entry or through the event marker port. The GPS millisecond is accurate to +/- 1 msec of the correct value stored on the memory board. The exact value can only be determined after the data is downloaded. RS-232 and front panel events are only recorded to the nearest 20 msec. LASTEVNT is implemented in NAV firmware versions 4.41 and higher. Use the GETSERIAL command to determine whether LASTEVNT is supported.

This function is available for all 4000SE/SSE/SSi receivers. It is also available for 4000ST/SST receivers using NAV version 4.41 and above.

2Bh AUTONANT Autonomous Antenna Height

AUTONANT stores the antenna height on the memory board of the receiver. Table 2-28 lists the AUTONANT command sequence.

Table 2-28. AUTONANT Command Sequence

Receiver		Data Collector
	<--------	(02h) STX
	<--------	(00h) STATUS
	<--------	(2Bh) TYPE
	<--------	(09h) LENGTH
	<--------	8 char ANTENNA HEIGHT
	<--------	1 char ANT SLOPE/VER
	<--------	(??h) CHECKSUM
	<--------	(03h) ETX
ACK (06h)	-------->	

This function is available for all 4000SE/SSE/SSi receivers. It is also available for 4000ST/SST receivers using NAV version 4.41 and above.

2Ch GETPOS2 Request Position with RTCM Information

GETPOS2 requests a time-tagged position, PDOP information, and RTCM status. Table 2-29 lists the GETPOS2 command sequence.

Table 2-29. GETPOS2 Command Sequence

Receiver		Data Collector
	<--------	(02h) STX
	<--------	(00h) STATUS
	<--------	(2Ch) TYPE
	<--------	(00h) LENGTH
	<--------	(2Ch) CHECKSUM
	<--------	(03h) ETX (2Ch)
POSRTCM	-------->	

This function is available for 4000SE/SSE/SSi receivers using NAV version 5.40 and above.

2Dh POSRTCM Position & PDOP with RTCM Status

The function is the response to the GETPOS2 request. POSRTCM sends time tagged position, PDOP information, and RTCM Status. Table 2-30 lists the POSRTCM command sequence.

Table 2-30. POSRTCM Command Sequence

Receiver		Data Collector
(02h) STX	-------->	
(??h) STATUS	-------->	
(2Dh) TYPE	-------->	
(48h) LENGTH	-------->	
13 char LATITUDE	-------->	
13 char LONGITUDE	-------->	
8 char HEIGHT	-------->	
7 char GPS TIME (SEC)	-------->	
4 char GPS WEEK #	-------->	
5 char PDOP	-------->	
5 char HDOP	-------->	
5 char VDOP	-------->	
3 char POSITION TYPE	-------->	
2 char # SVS USED	-------->	
1 char NEW/OLD POSITION	-------->	
1 char RTCM IN USE	-------->	
5 char RTCM AGE	-------->	
(??h) CHECKSUM	-------->	
(03h) ETX	-------->	

Where:

LATITUDE/LONGITUDE format ±DDD.dddddddd, where DDD.dddddddd is right justified zero buffered decimal degrees with 8 decimal places.

HEIGHT is in the range -999.999 to 9999.999 meters.

GPS TIME is in GPS seconds of the week, rounded to the nearest second.

PDOP, HDOP and VDOP are in the range 001.0 to 999.9.

POSITION TYPE = C/A or L12.

SVS USED = 01 to 12 in position fix.

NEW/OLD POSITION is either:

0	old, position not determined
0	same value as last accessed
1	0D clock only fix (1+ SV)
2	1D height only (1+ SV)
3	2D height and clock fixed (2+ SVs)
4	2D height fixed (3+ SVs)
5	3D (4+ SVs)

RTCM IN USE, 0 for RTCM not in use, 1 for RTCM in use.

RTCM AGE is delta time in seconds (104.2) since last Type 1 RTCM correction. 999.9 when invalid or > 999.9 seconds.

Note – The POSITION FIX STATUS is set to OLD (zero) after this message is sent. Its value is also affected by the number of satellites available, the selected positioning mode and the selected PDOP mask.

This function is available for 4000SE/SSE/SSi receivers using NAV version 5.40 and above.

2Eh GETPOSVS Request Position & Satellite IODE Information

GETPOSVS requests the time tagged position, the satellites used for that position, and the IODE of the ephemeris used information. Table 2-31 lists the GETPOSVS command sequence.

Table 2-31. GETPOSVS Command Sequence

Receiver		Data Collector
	<--------	(02h) STX
	<--------	(00h) STATUS
	<--------	(2Eh) TYPE
	<--------	(00h) LENGTH
	<--------	(2Eh) CHECKSUM
	<--------	(03h) ETX
RETPOSVS	-------->	

This function is available for 4000SE/SSE/SSi receivers using NAV version 5.40 and above.

2Fh RETPOSVS Position & Satellite IODE Information

This function is the response to the GETPOSVS request. RETPOSVS sends time-tagged position and PDOP information. Table 2-32 lists the RETPOSVS command sequence.

Table 2-32. RETPOSVS Command Sequence

Receiver		Data Collector
(02h) STX	-------->	
(??h) STATUS	-------->	
(2Fh) TYPE	-------->	
(??h) LENGTH	-------->	
13 char LATITUDE	-------->	
13 char LONGITUDE	-------->	
9 char HEIGHT	-------->	
8 char GPS TIME (SEC)	-------->	
@ 2 char SV PRN #	-------->	
@ 3 char IODE	-------->	
(??h) CHECKSUM	-------->	
(03h) ETX	-------->	
@ repeated for all satellites		

Where:

LATITUDE/LONGITUDE format are in radians.

HEIGHT is in the range -9999.99 to 999999.99 meters.

GPS TIME is in GPS seconds of the week to the nearest 0.1 second.

SV PRN # indicates the PRN numbers of the satellites used. How many satellites are present can be determined by examining the length of the reply. The number of satellites sent is given by # SVs = (length -43)/5.

IODE indicates what ephemeris was used to calculate the satellite position.

Note – The POSITION FIX STATUS is set to OLD (zero) after this message is sent. Its value is also affected by the number of satellites available, the user-selected positioning mode and the user-selected PDOP mask.

This function is available for 4000SE/SSE/SSi receivers using NAV version 5.40 and above.

37h GETLOCALP Request Ellipsoid, Datum Transformation, or Zone Data

The receiver contains a list of supplied ellipsoids, datum transformations and zones. Zone group headings can also be accessed. In addition an application can define one custom ellipsoid, a 3- or 7-parameter datum transformation, and a local zone defining a Transverse Mercator or Parallel Lambert Projection. GETOCALP allows an application to access a full description of each ellipsoid, datum transformation, and zone contained within the receiver. Table 2-33 lists the GETOCALP command sequence.

Table 2-33. GETOCALP Command Sequence

Receiver		Data Collector
	<--------	(02h) STX
	<--------	(00h) STATUS
	<--------	(37h) TYPE
	<--------	(1Ch) LENGTH
	<--------	1 (byte) REQUEST DATA TYPE
	<--------	2 (short) DATA INDEX
	<--------	8 (double) TEST LATITUDE
	<--------	8 (double) TEST LONGITUDE
	<--------	8 (double) TEST HEIGHT
	<--------	1 (byte) RESERVED
	<--------	(??h) CHECKSUM
	<--------	(03h) ETX
RETLOCALP or NAK	-------->	

Where:

REQUEST DATA TYPE indicates what is requested:

- 0 Summary of local datum, ellipsoid and zone values. Provides current ellipsoid, transformation and zone names, and index ranges and the number of zone groups (including user-defined).
- 1 Datum transformation values
- 2 Ellipsoid values
- 3 Zone values
- 4 Zone group. Zone group heading and zone index information. For example, zone group 1 may the U.S. State Plane 1983 zones and occupy zone indices from 87 to 159.
- 5 Test Values. This indicates that a WGS-84 Latitude, Longitude and Spheroid height is supplied to the transformed/projected to test selected transformation/zone parameters.

DATA INDEX is the number of the ellipsoid, datum transformation, zone or zone group requested to be output. Ignored for the Summary and Test Values.

TEST LATITUDE, LONGITUDE and HEIGHT is a WGS-84 position to be transformed/projected using the currently selected parameters. These values are ignored for REQUEST DATA TYPES 0 to 4. The test values allows verification of supplied and/or user-defined transformation/zone parameters. The input must be in decimal degrees and meters. Zero values for both latitude and longitude are used as flags and thus are not valid input as test values.

RESERVED byte is for future enhancements. 0 should be sent until defined.

Note – Indices start at 0.

Note – The reply for this command is usually be a RETLOCALP.

Note – An application should always request a summary of local datum, ellipsoid an d zone values (REQUEST DATA TYPE 0) to ensure that subsequent request do not overstep the range of indices.

Note – The user-defined indices for the local coordinate parameters are as follows:

Last Ellipsoid Index	user-defined ellipsoid (WGS-84 is default at 0)
Last Datum Index	user-defined datum transformation (WGS-84 datum is default at 0)
Last Zone Index	user-defined zone (Default zone (0) = no projection = geographic coordinates)

Note – Returns a NAK if:

Local datums/zones option not installed.
REQUEST DATA TYPE out of range 0-5.
DATA INDEX out of range of bounds given in the RETLOCALP Summary reply.
Nonsensical Test Values.

This function is available for 4000SE/SSE/SSi receivers using NAV version 5.68 and above.

38h RETLOCALP Report Ellipsoid, Datum Transformation, or Zone Data

RETLOCALP returns ellipsoid, datum transformation, or zone data depending upon the request. Table 2-34 lists the RETLOCALP command sequence

Table 2-34. RETLOCALP Command Sequence

Receiver		Data Collector
(02h) STX	-------->	
(??h) STATUS	-------->	
(38h) TYPE	-------->	
(??h) LENGTH	-------->	
1 (byte) DATA TYPE INDICATOR	-------->	
SUMMARY		
2 (short) MAX DATUM INDEX	-------->	
2 (short) MAX ELLIPSOID INDEX	-------->	
2 (short) MAX ZONE INDEX	-------->	
2 (short) MAX ZONE GROUP INDEX	-------->	
2 (short) SELECTED DATUM INDEX	-------->	
2 (short) SELECTED ELLIPSOID INDEX	-------->	
2 (short) SELECTED ZONE INDEX	-------->	
7 (char) SELECTED DATUM SHORT NAME	-------->	
30 (char) SELECTED DATUM LONG NAME	-------->	
20 (char) SELECTED ELLIPSOID NAME	-------->	
7 (char) SELECTED ZONE SHORT NAME	-------->	
30 (char) SELECTED ZONE LONG NAME	-------->	

Table 2-34. RETLOCALP Command Sequence

Receiver		Data Collector
DATUM DATA		
2 (short) MAX DATUM INDEX	-------->	
2 (short) SELECTED DATUM INDEX	-------->	
2 (short) THIS DATUM INDEX	-------->	
7 (char) DATUM SHORT NAME	-------->	
30 (char) DATUM LONG NAME	-------->	
2 (short) ELLIPSOID INDEX	-------->	
1 (byte) TRANSFORMATION TYPE	-------->	
8 (double) DELTA X	-------->	
8 (double) DELTA Y	-------->	
8 (double) DELTA Z	-------->	
8 (double) ROTATION ABOUT X	-------->	
8 (double) ROTATION ABOUT Y	-------->	
8 (double) ROTATION ABOUT Z	-------->	
8 (double) SCALE FACTOR	-------->	
ELLIPSOID DATA		
2 (short) MAX ELLIPSOID INDEX	-------->	
2 (short) SELECTED ELLIPSOID INDEX	-------->	
2 (short) THIS ELLIPSOID INDEX	-------->	
20 (char) ELLIPSOID LONG NAME	-------->	
8 (double) SEMI-MAJOR AXIS	-------->	
8 (double) INVERSE FLATTENING	-------->	
ZONE DATA		
2 (short) MAX ZONE INDEX	-------->	
2 (short) SELECTED ZONE INDEX	-------->	
2 (short) THIS ZONE INDEX	-------->	

Table 2-34. RETLOCALP Command Sequence

Receiver		Data Collector
7 (char) ZONE SHORT NAME	-------->	
30 (char) ZONE LONG NAME	-------->	
2 (short) DATUM INDEX	-------->	
1 (byte) PROJECTION TYPE	-------->	
FOR TRANSVERSE MERCATOR	-------->	
8 (double) ORIGIN LATITUDE	-------->	
8 (double) CENTRAL MERIDIAN	-------->	
8 (double) FALSE NORTHING	-------->	
8 (double) FALSE EASTING	-------->	
8 (double) SCALE FACTOR	-------->	
FOR LAMBERT 1 STANDARD PARALLEL		
8 (double) STANDARD PARALLEL	-------->	
8 (double) ORIGIN LONGITUDE	-------->	
8 (double) FALSE NORTHING	-------->	
8 (double) FALSE EASTING	-------->	
8 (double) SCALE FACTOR	-------->	
FOR LAMBERT 2 STANDARD PARALLELS		
8 (double) ORIGIN LATITUDE	-------->	
8 (double) ORIGIN LONGITUDE	-------->	
8 (double) FALSE NORTHING	-------->	
8 (double) FALSE EASTING	-------->	
8 (double) STANDARD PARALLEL 1	-------->	
8 (double) STANDARD PARALLEL 2	-------->	

Table 2-34. RETLOCALP Command Sequence

Receiver		Data Collector
ZONE GROUP		
2 (short) ZONE GROUP INDEX	-------->	
30 (char) ZONE GROUP NAME	-------->	
2 (short) START ZONE INDEX	-------->	
2 (short) END ZONE INDEX	-------->	
TEST VALUES		
2 (short) SELECTED DATUM INDEX	-------->	
2 (short) SELECTED ZONE INDEX	-------->	
1 (byte) ZONE COORDS VALID	-------->	
8 (double) DATUM LATITUDE	-------->	
8 (double) DATUM LONGITUDE	-------->	
8 (double) DATUM HEIGHT	-------->	
8 (double) PROJECTED NORTHING	-------->	
8 (double) PROJECTED EASTING	-------->	
(??h) CHECKSUM	-------->	
(03h) ETX	-------->	

Where:

DATA TYPE INDICATOR indicates what information is contained in the reply. Only one of the following data types is contained within the reply. The LENGTH of the reply varies accordingly.

- 0 Summary of local datum, ellipsoid and zone values. Provides current ellipsoid, transformation and zone names, and index ranges.
- 1 Datum transformation Values
- 2 Ellipsoid values

3 Zone values

4 Zone group

5 Test values

SUMMARY

MAX DATUM INDEX indicates the last index into the datum array. This is the number of datums - 1 that are available, including user-defined.

MAX ELLIPSOID INDEX indicates the last index into the ellipsoid array. This is the number of ellipsoids - 1 that are available, including user-defined.

MAX ZONE INDEX indicates the last index into the zone array. This is the number of zones - 1 that are available, including user-defined.

MAX ZONE GROUP INDEX is the number of zone groups defined - 1.

SELECTED DATUM INDEX indicates the datum-transformation currently being performed on the WGS-84 geographic positions.

SELECTED ELLIPSOID INDEX indicates which ellipsoid is being used for the selected datum transformation.

SELECTED ZONE INDEX indicates what zone is being applied to the selected datum transformed coordinates.

SELECTED DATUM SHORT NAME is a 7-character datum identifier that appears on the local coordinates screen.

SELECTED DATUM LONG NAME is a 30-character descriptive name for the datum.

SELECTED ELLIPSOID NAME is a 20-character descriptive name for the ellipsoid.

SELECTED ZONE SHORT NAME is a 7-character zone identifier that appears on the local coordinates screen.

SELECTED ZONE LONG NAME is a 30-character descriptive name for the zone.

DATUM DATA

MAX DATUM INDEX indicates the last index into the datum array. This is the number of datums - 1 that are available, including user-defined.

SELECTED DATUM INDEX indicates the datum transformation currently being performed on the WGS-84 geographic positions.

THIS DATUM INDEX is the index within the receiver of the datum in this message.

DATUM SHORT NAME is a 7-character datum identifier that appears on the local geographic coordinates screen if this datum were the selected datum.

DATUM LONG NAME is a 30-character descriptive name for the datum in this message.

ELLIPSOID INDEX is an index into the ellipsoid array indicating which ellipsoid is used by this datum. To access the ellipsoid values send a GETLOCALP with REQUEST DATA TYPE = 2 and DATA INDEX = ELLIPSOID INDEX.

TRANSFORMATION TYPE indicates the transformation process being performed on the WGS-84 coordinates. Valid values are:

0	No datum transformation
1	3 parameter Molondensky transformation
2	7 parameter Bursa-Wolfe transformation

DELTA X, Y, Z are the offsets in meters between the origins of ECEF WGS-84 to the local datum.

ROTATION ABOUT X, Y, Z are the rotations about the X, Y and Z axes in seconds of arc (") between WGS-84 and the local datum for the 7 parameter transformation (0.0 for 3 parameter).

SCALE FACTOR is the scale factor for the 7 parameter transformation (1.0 for 3 parameter).

ELLIPSOID DATA

MAX ELLIPSOID INDEX indicates the last index into the ellipsoid array. This is the number of ellipsoids - 1 that are available, including user-defined.

SELECTED ELLIPSOID INDEX indicates which ellipsoid is being used for the selected datum transformation.

THIS ELLIPSOID INDEX is the index within the receiver for the ellipsoid values in this message.

ELLIPSOID NAME is a 20-character descriptive name for the ellipsoid in this message.

SEMI-MAJOR AXIS is the values of the ellipsoid semi-major axis.

INVERSE FLATTENING is the inverse flattening value for the ellipsoid (usually about 298).

ZONE DATA

MAX ZONE INDEX indicates the last index into the zone array. This is the number of zones - 1 that are available, including user-defined.

SELECTED ZONE INDEX indicates what zone is being applied to the selected datum transformed coordinates.

THIS ZONE INDEX is the index within the receiver of the zone in this message.

ZONE SHORT NAME is a 7-character zone identifier that appears on the local coordinates screen if this were the selected zone.

ZONE LONG NAME is a 30-character descriptive name for the zone.

DATUM INDEX is the index of the datum used by the zone in this message.

PROJECTION TYPE is a byte indicating which type of projection this message contains. Defined values are:

0	No projection (no data values passed)
3	Transverse Mercator (see below)
5	Lambert Conformal, 1 Standard Parallel (see below)
6	Lambert Conformal, 2 Standard Parallels (see below)
7	New Zealand Map Grid (no data values passed)

TRANSVERSE MERCATOR

ORIGIN LATITUDE defines the origin of the projection and is in decimal degrees.

CENTRAL MERIDIAN is the central meridian of the projection in decimal degrees.

FALSE NORTHING, EASTING are the offsets from a zero origin for the projection and are in meters.

SCALE FACTOR is the scale factor at the central meridian.

LAMBERT 1 PARALLEL

STANDARD PARALLEL is the value of the standard parallel for the projection in decimal degrees.

ORIGIN LONGITUDE defines the origin of the projection and is in decimal degrees.

FALSE NORTHING, EASTING are the offsets from a zero origin for the projection and are in meters.

SCALE FACTOR is the scale factor for the projection.

LAMBERT 2 PARALLELS

ORIGIN LATITUDE defines the origin of the projection and is in decimal degrees.

ORIGIN LONGITUDE defines the origin of the projection and is in decimal degrees.

FALSE NORTHING, EASTING are the offsets from a zero origin for the projection and are in meters.

STANDARD PARALLEL 1 and 2 are the values of the standard parallels in decimal degrees (order is not important).

ZONE GROUP

ZONE GROUP INDEX is the index of this zone group.

ZONE GROUP NAME is a string identifier which describes the contents of the zone group. For example, U.S. State Plane 1983 is a group containing all State Plane zones for the U.S. on the NAD 1983 datum. The user-defined zone is in a group of it own called user-defined.

START INDEX is the index of the first zone in the zone group.

END INDEX is the index of the Last zone in the zone group.

TEST VALUES

SELECTED DATUM INDEX indicates the datum transformation currently being performed on the WGS-84 geographic and the supplied test positions.

SELECTED ZONE INDEX indicates what zone is being applied to the selected datum transformed coordinates.

ZONE COORDINATES VALID byte indicates if a zone has been performed on the transformed values. If set to invalid, the projected coordinates (Northing and Easting) is zero. Defined vales are:

0	zone coordinates invalid
1	zone coordinates valid

LATITUDE, LONGITUDE and HEIGHT and the NORTHING and EASTING are transformed and then projected using the current receiver settings. The original coordinates were supplied by the GETLOCALP command.

Note – Indices start at 0.

Note – Returns a NAK if request is made and:
Local datums/zones option not installed.
GETLOCALP DATA TYPE out of range 0-4.
GETLOCALP DATA INDEX out of range of bounds given in the RETLOCALP Summary reply.
GETLOCALP Test Values are nonsensical.

This function is available for 4000SE/SSE/SSi receivers using NAV version 5.68 and above.

39h SETLOCALP Select or Define Ellipsoid, Datum Transformation, or Zone Data

The receiver contains a list of supplied ellipsoids, datum transformations, and zones. In addition, an application may define one custom ellipsoid, a 3- or 7-parameter datum transformation and Transverse Mercator or Parallel Lambert Projection. SETLOCALP allows an application to select which supplied datum transformation and/or zone to use. An application may also define one ellipsoid, datum transformation, and zone using this command and then select that as the current datum transformation and/or zone.

SETLOCALP allows an external device to select a datum transformation or zone. It also allows the definition of the user-defined ellipsoid, datum transformation or zone. Table 2-35 lists the SETLOCALP command sequence.

Table 2-35. SETLOCALP Command Sequence

Receiver		Data Collector
	<--------	(02h) STX
	<--------	(00h) STATUS
	<--------	(39h) TYPE
	<--------	(??h) LENGTH
	<--------	1 (byte) SELECT/DEFINE
	<--------	1 (byte) DATUM/ELLIPSOID/ZONE
	<--------	2 (short) INDEX
		DEFINE DATUM TRANSFORMATION
	<--------	7 (char) DATUM SHORT NAME
	<--------	30 (char) DATUM LONG NAME
	<--------	2 (short) ELLIPSOID INDEX
	<--------	1 (byte) TRANSFORMATION TYPE
	<--------	8 (double) DELTA X
	<--------	8 (double) DELTA Y
	<--------	8 (double) DELTA Z
	<--------	8 (double) ROTATION ABOUT X
	<--------	8 (double) ROTATION ABOUT Y
	<--------	8 (double) ROTATION ABOUT Z
	<--------	8 (double) SCALE FACTOR
		DEFINE ELLIPSOID
	<--------	20 (char) ELLIPSOID NAME
	<--------	8 (double) SEMI-MAJOR AXIS
	<--------	8 (double) INVERSE FLATTENING

Table 2-35. SETLOCALP Command Sequence

Receiver		Data Collector
		DEFINE ZONE
	<--------	7 (char) ZONE SHORT NAME
	<--------	30 (char) ZONE LONG NAME
	<--------	2 (short) DATUM INDEX
	<--------	1 (byte) PROJECTION TYPE
		FOR TRANSVERSE MERCATOR
	<--------	8 (double) ORIGIN LATITUDE
	<--------	8 (double) CENTRAL MERIDIAN
	<--------	8 (double) FALSE NORTHING
	<--------	8 (double) FALSE EASTING
	<--------	8 (double) SCALE FACTOR
		FOR LAMBERT 1 STANDARD PARALLEL
	<--------	8 (double) STANDARD PARALLEL
	<--------	8 (double) ORIGIN LONGITUDE
	<--------	8 (double) FALSE NORTHING
	<--------	8 (double) FALSE EASTING
	<--------	8 (double) SCALE FACTOR
		FOR LAMBERT 2 STANDARD PARALLELS
	<--------	8 (double) ORIGIN LATITUDE
	<--------	8 (double) ORIGIN LONGITUDE
	<--------	8 (double) FALSE NORTHING
	<--------	8 (double) FALSE EASTING
	<--------	8 (double) STANDARD PARALLEL 1
	<--------	8 (double) STANDARD PARALLEL 2
	<--------	(??h) CHECKSUM

Table 2-35. SETLOCALP Command Sequence

Receiver		Data Collector
	<--------	(03h) ETX
ACK or NAK	-------->	

Where:

SELECT/DEFINE indicates whether this message selects an existing datum transformation or zone or defines a new ellipsoid, transformation or zone. Defined values are:

0 Select existing datum/zone
1 Define datum/ellipsoid/zone

DATUM/ELLIPSOID/ZONE indicates whether an datum, ellipsoid or zone is to be selected or defined. Ellipsoids cannot be selected independently of a datum. Thus selecting an ellipsoid is an invalid option but defining one is not. Defined values are:

1 Datum transformation
2 Ellipsoid
3 Zone

INDEX is an index into the datum or zone array in the receiver. The indices, name and values of these datums and zones may be accessed with the GETLOCALP command. The user-defined datum and zone always have the last index available. This value is assumed (ignored) if SELECT/DEFINE is set to 1 (define).

The following values should only be present if SELECT/DEFINE is set to 1 (define). Only one of the following data segments must be present. The LENGTH of the message must be varied accordingly.

DEFINE DATUM TRANSFORMATION

DATUM SHORT NAME is a 7-character name that appears with transformed geographic coordinates.

DATUM LONG NAME is a 30-character long descriptive name to be associated with the datum.

ELLIPSOID INDEX is an index into the receivers ellipsoid array. The indices, name and values of these ellipsoids may be accessed with the GETLOCALP command.

TRANSFORMATION TYPE indicates the transformation process being performed on the WGS-84 coordinates. Valid values are:

1 3 parameter Molondensky transformation
2 7 parameter Bursa-Wolfe transformation

DELTA X, Y, Z are the offsets in meters between the origins of ECEF WGS-84 to the local datum.

ROTATION ABOUT X, Y, Z are the rotations about the X, Y and Z axes in seconds of arc (") between WGS-84 and the local datum for the 7 parameter transformation (0.0 for 3 parameter).

SCALE FACTOR is the scale factor for the 7 parameter transformation (1.0 for 3 parameter).

DEFINE ELLIPSOID

ELLIPSOID NAME is the name the application would like to associate with the ellipsoid defined.

SEMI-MAJOR AXIS is the semi-major axis of the ellipsoid in meters

INVERSE FLATTENING if the inverse flattening value of the ellipsoid (usually about 298).

DEFINE ZONE

ZONE SHORT NAME is a 7-character name that appears with projected local coordinates.

ZONE LONG NAME is a 30-character long descriptive name to be associated with the zone.

DATUM INDEX is an index into the receivers datum array. The indices, name and values of these datums may be accessed with the GETLOCALP command.

PROJECTION TYPE is a byte indicating which type of zone this message contains. Defined values are:

3	Transverse Mercator
5	Lambert Conformal, 1 Standard Parallel
6	Lambert Conformal, 2 Standard Parallels

TRANSVERSE MERCATOR

ORIGIN LATITUDE defines the origin of the projection and is in decimal degrees.

CENTRAL MERIDIAN is the central meridian of the projection in decimal degrees.

FALSE NORTHING, EASTING are the offsets from a zero origin for the projection and are in meters.

SCALE FACTOR is the scale factor at the central meridian.

RESERVED is ignored.

LAMBERT 1 PARALLEL

STANDARD PARALLEL is the value of the standard parallel for the projection in decimal degrees.

ORIGIN LONGITUDE defines the origin of the projection and is in decimal degrees.

FALSE NORTHING, EASTING are the offsets from a zero origin for the projection and are in meters.

SCALE FACTOR is the scale factor for the projection.

RESERVED is ignored.

LAMBERT 2 PARALLEL

ORIGIN LATITUDE defines the origin of the projection and is in decimal degrees.

ORIGIN LONGITUDE defines the origin of the projection and is in decimal degrees.

FALSE NORTHING, EASTING are the offsets from a zero origin for the projection and are in meters.

STANDARD PARALLEL 1 and 2 are the values of the standard parallels in decimal degrees (order is not important).

Note – Indices start at 0.

Note – Returns a NAK if:
the Local datums/zones option not installed.
the indices are out of range.
the values are nonsensical.

This function is available for 4000SE/SSE/SSi receivers using NAV version 5.68 and above.

42h SETSESSTN Set Survey Session/Station Parameters

SETSESSTN allows the loading of survey session parameters into the receiver. Table 2-36 lists the SETSESSTN command sequence

Table 2-36. SETSESSTN Command Sequence

Receiver		Data Collector
	<--------	(02h) STX
	<--------	(00h) STATUS
	<--------	(42h) TYPE
	<--------	(??h) LENGTH
	<--------	1 (byte) SESS/STAT INDICATOR
		INDIVIDUAL SESSION
	<--------	1 (byte) SESSION INDEX
	<--------	4 (char) SESSION ID
	<--------	2 (byte) START TIME
	<--------	2 (byte) STOP TIME
	<--------	4 (byte) START DATE
	<--------	4 (byte) STOP DATE
	<--------	2 (unsigned short) EPOCH INTERVAL
	<--------	1 (byte) STATION INDEX
	<--------	1 (byte) SURVEY SCHEDULE MODE
	<--------	1 (byte) ELEVATION MASK
	<--------	1 (byte) MINIMUM # OF SVS
	<--------	1 (byte) POSITION STORAGE RATE
	<--------	1 (byte) TYPE OF POSITIONS
	<--------	1 (byte) OVER DET. POSITIONS OFF
	<--------	1 (byte) SMOOTH C/A CODE POS
	<--------	1 (byte) RESERVED

Table 2-36. SETSESSTN Command Sequence

Receiver		Data Collector
	<--------	1 (byte) MSL HEIGHTS
	<--------	1 (byte) USE USER HEIGHT
	<--------	8 (double) REFERENCE HEIGHT (m)
	<--------	4 (long) ANTENNA SERIAL #
		INDIVIDUAL STATION
	<--------	1 (byte) STATION INDEX
	<--------	8 (char) STATION ID
	<--------	50 (char) STATION NAME
	<--------	1 (byte) STATION ACCURACY
	<--------	8 (double) LATITUDE
	<--------	8 (double) LONGITUDE
	<--------	8 (double) HEIGHT
	<--------	(??h) CHECKSUM
	<--------	(03h) ETX
ACK (06h)	-------->	

Where:

SESSION/STATION INDICATOR indicates the type of data contained within the record. It is in the range:

0 Individual Session
1 Individual Station

INDIVIDUAL SESSION

SESSION INDEX is an unsigned 1 byte session number. Range is 0 to 40.

START TIME is the minutes of every day on which to start the survey and is an unsigned short integer. The START TIME is only valid if the SCHED MODE is set to 255.

STOP TIME is the minutes of every day which to end the survey and is an unsigned short integer. The STOP TIME is only valid if the SCHED MODE is set to 255.

START DATE is the time at which to start a once only survey and is in seconds since midnight of SAT/SUN JAN. 5th/6th 1980. It is an unsigned long integer.

STOP DATE is the time at which to stop a once only survey and is in seconds since midnight of SAT/SUN JAN. 5th/6th 1980. It is an unsigned long integer.

EPOCH INTERVAL is the measurement rate at which to observe the satellites and is in tenths of seconds. It is an unsigned short integer.

STATION INDEX is the index assigned to the station in the station table. Range is 0 to 30. The Reference Position of the receiver (index 31) cannot be specified as the STATION INDEX.

SURVEY SCHEDULE MODE is either:

0	Auto
2	Once only specific date and time
255	Any day at the given time.

ELEVATION MASK is in degrees (0-90).

MINIMUM # OF SVS for survey is 0->...Less than this value causes the receiver to cease logging data.

POSITION STORAGE RATE is either

0	5 minutes
1	every epoch
2	every epoch with no raw measurements (positions only)

TYPE OF POSITIONS is either:

0	3D/2D
1	3D only
2	2D only

OVER DETERMINED POSITIONS OFF is true for a non-zero value:

0	Calculate over-determined positions
1	Use best satellite combination of 3 or 4 satellites

SMOOTHED L1 C/A CODE POSITIONS is true for a non-zero value:

0	No smoothing
1	Smooth pseudo ranges

RESERVED is for future enhancements.

MSL HEIGHTS if set, the receiver outputs mean sea level heights using its internal geoid model.

0	ellipsoidal heights
1	Mean Sea Level Heights

USE USER ENTERED HEIGHT means use the height given below for 2D fixes rather than the computed height if a non zero value.

0Do not use value given below
1Use supplied fixed height

REFERENCE HEIGHT in meters to be used for 2D fixes.

ANTENNA SERIAL # is an unsigned long integer.

INDIVIDUAL STATION

STATION INDEX indicates where the station is to be stored in the station table. The valid range is:

0 - 30	Stations relating to sessions
31	Receiver Reference Position (see notes)

STATION ID is the 8 character station identifier. Ignored for Reference Position (Station Index 31).

STATION NAME is a 50 character station name. Names less than 50 characters should be padded with spaces. Ignored for Reference Position (Station Index 31).

STATION ACCURACY indicates whether the coordinates given below were user-supplied (assumed high accuracy) or computed/ not supplied (low accuracy). Ignored for Reference Position (Station Index 31).

0 Low accuracy
1 High accuracy

LATITUDE/LONGITUDE is the user-supplied or computed coordinates of the station in degrees.

HEIGHT is the user-supplied or computed coordinates of the station in meters.

Note – The STATION ID currently only supports 4 characters in the station table. Thus, the first 4 characters are used.

Note – Do not supply station coordinates when sending a station unless the coordinates are reasonably accurate (within 100 km). This may cause the receiver problems in locking onto satellites even if the STATION ACCURACY flag is set to LOW ACCURACY. Zeros should be sent for the latitude, longitude and height instead of an erroneous position.

Note – Reference Position (index 31) was added to this command in 4000SE/SSE/SSi NAV version 5.68

This function is available for 4000SE/SSE/SSi receivers using NAV version 5.50 and above.

43h GETSESSTN Request Session/Station Information

GETSESSTN requests the Session or Station information for the index given. Table 2-37 lists the GETSESSTN command sequence.

Table 2-37. GETSESSTN Command Sequence

Receiver		Data Collector
	<--------	(02h) STX
	<--------	(00h) STATUS
	<--------	(43h) TYPE
	<--------	(02h) LENGTH
	<--------	1 (byte) SESSION/STATION REQ.
	<--------	1 (byte) INDEX
	<--------	(??h) CHECKSUM
	<--------	(03h) ETX
RETSESSTN	-------->	

Where:

SESSION/STATION REQUEST is 0-3:

0 Individual Session
1 Individual Station
2 Session Summary
3 Station Summary

INDEX is an index into the session/station table. It is ignored for SESSION/STATION types 2 and 3. It has the following ranges:

0 - 40	Session indices	
0 - 31	Station indices	
	0 - 30	Stations from the station table
	31	Receiver Reference Position

Note – Reference Position (index 31) was added to this command in 4000SE/SSE/SSi NAV version 5.68

This function is available for 4000SE/SSE/SSi receivers using NAV version 5.50 and above.

44h RETSESSTN Return Survey Session/Station Parameters

RETSESSTN returns the session parameters as requested in GETSESSTN. Table 2-38 lists the RETSESSTN command sequence.

Table 2-38. RETSESSTN Command Sequence

Receiver		Data Collector
(02h) STX	-------->	
(??h) STATUS	-------->	
(44h) TYPE	-------->	
(??h) LENGTH	-------->	
(1 byte) SESS/STAT INDICATOR	-------->	
INDIVIDUAL SESSION		
1 (byte) SESSION INDEX	-------->	
4 (char) SESSION ID	-------->	
2 (byte) START TIME	-------->	
2 (byte) STOP TIME	-------->	
4 (byte) START DATE	-------->	
4 (byte) STOP DATE	-------->	
2 (byte) EPOCH INTERVAL	-------->	
1 (byte) STATION INDEX	-------->	
1 (byte) SURVEY SCHED MODE	-------->	
1 (byte) ELEVATION MASK	-------->	
1 (byte) MINIMUM # OF SVS	-------->	
1 (byte) POS STORAGE RATE	-------->	
1 (byte) TYPE OF POSITIONS	-------->	
1 (byte) OVER DET. POS OFF	-------->	
1 (byte) SMOOTH C/A CODE	-------->	
1 (byte) RESERVED	-------->	

Table 2-38. RETSESSTN Command Sequence

Receiver		Data Collector
1 (byte) MSL HEIGHTS	-------->	
1 (byte) USE USER HEIGHT	-------->	
8 (double) REFERENCE HEIGHT (m)	-------->	
4 (long) ANTENNA SERIAL #	-------->	
INDIVIDUAL STATION		
1 (byte) STATION INDEX	-------->	
8 (char) STATION ID	-------->	
50 (char) STATION NAME	-------->	
1 (byte) STATION ACCURACY	-------->	
8 (double) LATITUDE	-------->	
8 (double) LONGITUDE	-------->	
8 (double) HEIGHT	-------->	
SESSION/STATION SUMMARY		
1 (byte) # OF SESS/STAT	-------->	
@ 1 (byte) INDEX	-------->	
@ 4/8 (char) SESS/STAT ID	-------->	
(??h) CHECKSUM	-------->	
(03h) ETX	-------->	
@ repeated for number of SESS/STAT		

Where:

SESSION/STATION INDICATOR indicates the type of data contained within the record. It is in the range:

0 Individual Session
1 Individual Station
2 Session Summary
3 Station Summary

INDIVIDUAL SESSION

SESSION INDEX is an unsigned 1 byte session number.

START TIME is the minutes of every day on which to start the survey and is an unsigned short integer. The START TIME is only valid if the SCHED MODE is set to 255.

STOP TIME is the minutes of every day which to end the survey and is an unsigned short integer. The STOP TIME is only valid if the SCHED MODE is set to 255.

START DATE is the time at which to start a once only survey. Seconds since midnight of SAT/SUN JAN. 5th/6th 1980. It is an unsigned long integer.

STOP DATE is the time at which to stop a once only survey. Seconds since midnight of SAT/SUN JAN. 5th/6th 1980. It is an unsigned long integer.

EPOCH INTERVAL is the measurement rate. It is in tenths of seconds. It is an unsigned short integer.

STATION INDEX is the index assigned to the station in the station table.

SURVEY SCHEDULE MODE is either:

0	Auto
2	Once only specific date and time
255	Any day at the given time.

ELEVATION MASK is in degrees (0-90).

MINIMUM # OF SVS for survey is 0->...

POSITION STORAGE RATE is either:

0	5 minutes
1	every epoch
2	every epoch with no raw measurements (positions only)

TYPE OF POSITIONS is either:

0 3D/2D
1 3D only
2 2D only

OVER DETERMINED POSITIONS OFF is true for a non-zero value:

0 Calculate over-determined positions
1 Use best satellite combination of 3 or 4 satellites

SMOOTHED L1 C/A CODE POSITIONS is true for a non-zero value:

0 No smoothing
1 Smooth pseudo ranges

RESERVED byte is for future enhancements.

MSL HEIGHTS if set, the receiver outputs mean sea level heights using its internal geoid model:

0 Ellipsoidal heights
1 Mean Sea Level heights

USE USER ENTERED HEIGHT means use the height given below for 2D fixes rather than the default value.

0Do not use value given below, use default (last) value
1Use supplied fixed height

REFERENCE HEIGHT in meters to be used for 2D fixes.

ANTENNA SERIAL # is an unsigned long integer

INDIVIDUAL STATION

STATION INDEX indicates where the station is to be stored in the station table. Index 31 = Reference Position.

STATION ID is the 8-character station identifier. For the Reference Position (Station Index 31), 4 spaces and 4 NULL (char (0)) are sent.

STATION NAME is a 50 character station name. Names less than 50 characters are padded with spaces. For the Reference Position (Station Index 31), 50 spaces are sent.

STATION ACCURACY indicates whether the coordinates given below were user-supplied (assumed high accuracy) or computed/not supplied (low accuracy):

0 Low accuracy
1 High accuracy

LATITUDE/LONGITUDE is the user-supplied or computed coordinates of the station in degrees.

HEIGHT is the user-supplied or computed coordinates of the station in meters.

SESSION/STATION SUMMARY

OF SESSIONS/STATIONS indicates the number of sessions/stations given in the summary and thus the number of indices and identifiers to read. This summary does not contain the Reference Position (Station index 31).

INDEX is the SESSION/STATION index in the SESSION/STATION table. This value is used to access the individual session station information.

SESSION/STATION ID is the 4/8 character identifier assigned to the SESSION/STATION by the user.

Note – The station table only supports 4 characters for the STATION ID (and not 8 as in this message). Thus, the last 4 characters are set to NULL (char (0)).

Note – Reference Position (index 31) was added to this command in 4000SE/SSE/SSi NAV version 5.68

This function is available for 4000SE/SSE/SSi receivers using NAV version 5.50 and above.

48h SETCOMMS Set RS-232 Port Communications Parameters

SETCOMMS sets the baud rate, data bits, parity and stop bits on the port specified. Table 2-39 lists the SETCOMMS command sequence.

Table 2-39. SETCOMMS Command Sequence

Receiver		Data Collector
	<--------	(02h) STX
	<--------	(00h) STATUS
	<--------	(48h) TYPE
	<--------	(8h or Ch) LENGTH added NAV version 6.00 for FLOW CONTROL support
	<--------	1 (byte) PORT #
	<--------	4 (long) BAUD RATE
	<--------	1 (byte) DATA BITS
	<--------	1 (byte) PARITY
	<--------	1 (byte) STOP BITS added NAV version 6.00
	<--------	1 (byte) FLOW CONTROL
	<--------	1 (byte) CTS DELAY
	<--------	(??h) CHECKSUM
	<--------	(03h) ETX
ACK (06h) or NAK (15h)	-------->	

Where:

PORT # is in the range 1 to 4.

BAUD RATE is in the range 110 to 38400.

DATA BITS is either 7 or 8.

PARITY can be either:

0 = NONE
1 = ODD
2 = EVEN STOP

STOP BITS can be either 1 or 2.

The values below only take effect for NAV version 6.00 or higher.

FLOW CONTROL is in the range of 0-2 and is only valid for Ports 2 and 4. Defined values are:

0	NONE
1	XON/XOFF
2	CTS

CTS DELAY is the Clear to Send delay in tenths of seconds. This value is ignored if FLOW CONTROL is not CTS. Valid range is 0 to 99 (9.9 sec).

Note – The new port parameters become current immediately after the ACK is sent. It is possible to change the communications parameters on the current port.

Note – FLOW CONTROL and CTS DELAY were added NAV version 6.00. Both the 08h and 0Ch lengths are supported by that and following firmware versions.

Note – Not all combinations of WORD SIZE, PARITY and STOP BITS are supported. Those that are supported are listed in Table 2-40.

Table 2-40. Communication Port Combinations

Communication Combination	Available Port 1	Available Ports 2 to 4
8 data, NONE, 1 Stop	YES	YES
8 data, NONE, 2 Stop	YES	YES
8 data, EVEN, 1 Stop	YES	YES
8 data, EVEN, 2 Stop	NO	YES
8 data, ODD, 1 Stop	YES	YES
8 data, ODD, 2 Stop	NO	YES

This function is available for 4000SE/SSE/SSi receivers using NAV version 5.50 and above.

49h COMMOUT Request Input/Output at a RS-232 Port

COMMOUT requests that the input/output specified is enabled at a multiple of the epoch interval to the requested RS-232 port. Table 2-41 lists the COMMOUT command sequence.

Table 2-41. COMMOUT Command Sequence

Receiver		Data Collector
	<--------	(02h) STX
	<--------	(00h) STATUS
	<--------	(49h) TYPE
	<--------	(6h) LENGTH
	<--------	1 (byte) PORT #
	<--------	1 (byte) ON/OFF
	<--------	1 (byte) INPUT/OUTPUT TYPE
	<--------	2 (integer) EPOCH RATE
	<--------	1 (byte) FLAGS
	<--------	(??h) CHECKSUM
	<--------	(03h) ETX
ACK (06h)	-------->	

Where:

PORT # is in the range 1 to 6:

1 RS-232 Port 1 - POWER 1
2 RS-232 Port 2
3 RS-232 Port 3
4 RS-232 Port 4
5 Event-Marker Port
6 Pulse Per Second Port

ON/OFF switches are dependent upon the port and output type. Port types are RS-232, Event-Marker and PPS. The supported Input/Output types are RS-232 messages, power and pulses.

RS-232 Message Output (Port 1 to 4, Output types 5 to 46):

0 OFF
1 ON
2 ALL OFF (switch all Output off)

RS-232 RTCM Input (Port 1 to 4, Output type 5 only):

0 OFF
1 ON
3 ON/AUTO

RS-232 Power Output (Port 1 to 4, Output type 0 only):

0 OFF
4 ON, Battery charger enabled I/O-POWER1, POWER2 and 3 (not RS-232 2 and 3) and I/O2
5 ON, Power out enabled I/O-POWER1 and I/O2

Event Marker Input (Port 5, Output types 1, 2 and 3 only):

0 OFF (Disabled)
6 ON (Enabled), beeper off
7 ON(Enabled), beeper on
8 ON (Enabled), beeper on during survey only

PPS Output (Port 6, Output types 1 and 2 only):

0 OFF
1 ON

INPUT/OUTPUT TYPE is a message type defined by the following information (OUTPUT assumed unless specified):

0 Power out the Port
1 Positive Slope (Event and PPS)
2 Negative Slope (Event and PPS)
3 Reserved

4	Reserved
5	RTCM BINARY Corrections INPUT
6	RTCM ASCII Corrections
7	RTCM AUXILIARY Corrections
8	RTCM BINARY Corrections
9	RTCM ASCII Corrections Printout
10	Position Calculation ASCII
11	Position Calculation BINARY
12	Raw Measurements ASCII
13	Raw Measurements BINARY
14	Ephem., ION, UTC ASCII
15	Ephem., ION, UTC BINARY
16	Position Statistics ASCII
17	Position Statistics BINARY
18	Navigation Calculations ASCII
19	Navigation Display Unit ASCII
20	Reserved
21	Raw L1 Phase Message
22	Reserved
23	Reserved
24	PPS ASCII Time Tag
25	NMEA-0183 GXP (no longer available after NP version 5.53)
25*	NMEA-0183 WPL
26	NMEA-0183 GGA
27	NMEA-0183 GLL
28	NMEA-0183 VTG
29	NMEA-0183 ZDA
30@	NMEA-0183 PTNL TSS
31@	NMEA-0183 PTNL TSN
32	NMEA-0183 BWC
33	NMEA-0183 XTE
34*	NMEA-0183 ALM
35*	NMEA-0183 GSA
36*	NMEA-0183 GSV
37*	NMEA-0183 RMB

38* NMEA-0183 RMC
39* NMEA-0183 PTNL DOP
40* Position Calculations type 2 (expanded precision) ASCII
41* Position Calculations type 2 (expanded precision) Binary
42* Navigation Calculations type 2 (expanded precision) ASCII
43$ NMEA-0183 GRS
44$ NMEA-0183 GST
45$ NMEA-0183 GBS
46° Local coordinates
47° RT Survey Data, Expanded or Concise Format

* indicates added to NP version 5.60 and above
@ indicates changed preamble NP version 5.60 and above
$ Not released at time of printing
° indicates added to NP version 5.68 and above

EPOCH RATE is the number of measurement epochs per one packet of the Output type being sent. For example, a value of 1 request that the output be sent every epoch, 2 every second epoch an so on. This is currently only implemented for the RT Survey Data Output (OUTPUT 47) for Nav version 6.11 and above. All other output will operate at the current receiver epoch interval.

FLAGS allows for some modification of the output to be specified. Currently it is only defined for REAL TIME SURVEY DATA output (output 47).

RT Survey Data Output (RAWDATA) (see notes):

bit 0	set	Send Concise Format rather than Expanded *.DAT Record 17 format
bit 1	set	Send Survey Data Record with real-time flags and IODE information

bit 2	set	Stream Ephemeris (SVDATA) with RT Survey Data
bit 3	set	Stream Positions (RAWDATA) with RT Survey Data

Note – Making a request that cannot be met returns a NAK.

Note – The only EPOCH RATE currently supported is 1 (at the set epoch interval) except for the RT Survey Data Output (OUTPUT 47) which supports multiples of the receiver epoch interval. This support was added in Nav Version 6.11.

Note – Any combination of the above outputs can be switched on to the same port simultaneously.

Note – For OUTPUT types 14 and 15, the EPH, ION and UTC outputs are sent every 5 minutes after the request to send them is made. These output types (14 and 15) ignore the EPOCH RATE value.

Note – NMEA-0183 outputs can be directed to one port only. For example, cannot request NMEA-0183 GXP at Port 1 and NMEA-0183 XTE at Port 2.

Note – Some Input/Output types require additional information in order to operate (RTCM for example). The other parameters, such as base station Id, message scheduling, must be setup with SETIDLE, RTCMCTRL, prior to initiating Input/Output. The COMMOUT function must be the last step in the Input/Output setup process in order for the receiver to operate as expected.

Note – Switching the RTCM mode may affect the current satellite tracking mode. For example, on SSEs, switching RTCM off causes P-code tracking to be re-enabled. Thus it might be wise to send a CHANCTRL command after changing the RTCM Input/Output or switching off all outputs.

Note – Slope Swap Events (Input/Output type 3) is not currently implemented.

Note – Power out and battery charge enabled are mutually exclusive.

Note – Requesting power out on/off at either I/O-POWER1 or I/O2 results in power switching at both ports as they are hardwired together.

Note – RT SURVEY DATA (output 47) allows for the addition of both ephemeris and position information. If ephemeris is requested (bit 2 of FLAGS set), ephemeris and ION/UTC information in SVDATA format is output, one record per epoch starting with ION/UTC information, until ephemeris for all tracked satellites has been transmitted. In addition, as each new ephemeris is decoded, it is also automatically streamed, one satellite per epoch. ION/UTC information is not automatically streamed due to an ION/UTC update. ION/UTC and Ephemeris information is streamed for all tracked satellites directly after a power fail.

This function is available for 4000SE/SSE/SSi receivers using NAV version 5.50 and above.

4Ah GETOPT Request Receiver Options

GETOPT requests a list of receiver options that are installed on the receiver. Table 2-42 lists the GETOPT command sequence.

Table 2-42. GETOPT Command Sequence

Receiver		Data Collector
	<--------	(02h) STX
	<--------	(00h) STATUS
	<--------	(4Ah) TYPE
	<--------	(0h) LENGTH
	<--------	(4Ah) CHECKSUM
	<--------	(03h) ETX
RETOPT	-------->	

This function is available for 4000SE/SSE/SSi receivers using NAV version 5.54 and above.

4Bh RETOPT Return Receiver Options

This function is the response to the GETOPT request. RETOPT returns the receiver options installed at the factory. Table 2-43 lists the RETOPT command sequence.

Table 2-43. RETOPT Command Sequence

Receiver		Data Collector
(02h) STX	-------->	
(??h) STATUS	-------->	
(4Bh) TYPE	-------->	
(31h) LENGTH	-------->	
1 (byte) ELEVATION MASK	-------->	
1 (byte) PDOP MASK	-------->	
2 (integer) SYNC TIME	-------->	
2 (integer) FASTEST MEAS RATE	-------->	
1 (byte) CURRENT PORT ID	-------->	
1 (byte) PORTS AVAILABLE	-------->	
1 (byte) L1/L2 OPERATION	-------->	
1 (byte) CARRIER PHASE	-------->	
1 (byte) KINEMATIC MODE	-------->	
1 (byte) LOCATOR MODE	-------->	
1 (byte) POWER-UP OPTION	-------->	
1 (byte) RTK OPTION	-------->	
1 (byte) RESERVED	-------->	
1 (byte) RESERVED	-------->	
1 (byte) RESERVED	-------->	
1 (byte) RESERVED	-------->	
1 (byte) NMEA-0183 OUTPUTS	-------->	
1 (byte) RTCM 1 INPUT	-------->	
1 (byte) RTCM 2 INPUT	-------->	

Table 2-43. RETOPT Command Sequence

Receiver		Data Collector
1 (byte) RTCM 1 OUTPUT	-------->	
1 (byte) RTCM 2 OUTPUT	-------->	
1 (byte) NAV OPTION	-------->	
1 (byte) FIRMWARE UPDATE	-------->	
1 (byte) EVENT MARKER	-------->	
1 (byte) PULSE PER SEC	-------->	
1 (byte) EXT TIME INPUT	-------->	
1 (byte) COCOM ALT/SPEED	-------->	
2 (short) MEMORY INSTALLED	-------->	
1 (byte) % MEMORY USED	-------->	
1 (byte) RTCM NETWORK	-------->	
1 (byte) RESERVED	-------->	
1 (byte) DATA FORMAT	-------->	
2 (short) DATA OFFSET	-------->	
1 (byte) POSITION STATISTICS	-------->	
1 (byte) REMOTE DOWNLOAD	-------->	
1 (byte) LOCAL DATUM & ZONE	-------->	
1 (byte) REAL-TIME SURVEY DATA	-------->	
1 (byte) CALTRANS OPTION	-------->	
7 (byte) RESERVED	-------->	
(??h) CHECKSUM	-------->	
(03h) ETX	-------->	

Where:

ELEVATION MASK has a range 0 to 90 degrees.

PDOP MASK (scale 0.1) has a range 0 to 255. If PDOP > 25.5, 255 is returned. (added NAV 6.00)

SYNC TIME (scale 0.1 sec) has a scale 0.0 to 6553.5 sec.

FASTEST MEAS RATE (scale 0.1 sec) has a scale 0.0 to 6553.5 sec.

CURRENT PORT ID has a range of 1 to 4.

PORTS AVAILABLE has a range of 1 to 4.

L1/L2 OPERATION has the following values:

1 L1
2 L1/L2

CARRIER PHASE is either installed (1) or unavailable (0).

KINEMATIC MODE is either installed (1) or unavailable (0).

LOCATOR MODE is either installed (1) or unavailable (0).

POWER-UP OPTION is either installed (1) or unavailable (0).

RTK OPTION is either installed (1) or unavailable (0).

RESERVED bytes are for future enhancements.

NMEA-0183 OUTPUTS is either installed (1) or unavailable (0).

RTCM 1 INPUT is either installed (1) or unavailable (0).

RTCM 2 INPUT is either installed (1) or unavailable (0).

RTCM 1 OUTPUT is either installed (1) or unavailable (0).

RTCM 2 OUTPUT is either installed (1) or unavailable (0).

NAV OPTION is either installed (1) or unavailable (0).

FIRMWARE UPDATE is either installed (1) or unavailable (0).

EVENT MARKER is either installed (1), installed and off (2), or unavailable (0).

PULSE PER SEC is either installed (1), installed and off (2), or unavailable (0).

EXT TIME INPUT is either:

0	unavailable
1	installed and not active
5	installed and set for 5 MHz
10	installed and set for 10 MHz

COCOM ALT/SPEED is either installed (1) or unavailable (0).

MEMORY INSTALLED is the number of KB of memory installed (modulus 65 MB).

% MEMORY USED is the percentage of memory used by data.

RTCM NETWORK capability is either installed (1) or unavailable (0).

RESERVED bytes are for future enhancements.

DATA FORMAT describes the data format being stored to the memory board.

0	compact
1	standard (Record 7)

DATA OFFSET is the number of milliseconds offset from the standard epoch for compact data.

POSITION STATISTICS are either installed (1) or unavailable (0).

REMOTE DOWNLOAD is either installed (1) or unavailable (0).

LOCAL DATUMS & ZONES are either installed (1) or unavailable (0) (Added NAV version 5.68)

REAL-TIME SURVEY DATA is either installed (1) or unavailable (0) (Added NAV version 5.71)

RESERVED bytes are for future enhancements.

This function is available for 4000SE/SSE/SSi receivers using NAV version 5.54 and above.

4Ch STARTSURV Request Start of Survey

STARTSURV requests start of survey. The survey can be a Scheduled Session, Quickstart, Kinematic, Real-Time Kinematic, Fast Static, or PathFinder survey. Table 2-44 lists the STARTSURV command sequence.

Table 2-44. STARTSURV Command Sequence

Receiver		Data Collector
	<--------	(02h) STX
	<--------	(00h) STATUS
	<--------	(4Ch) TYPE
	<--------	(??h) LENGTH
	<--------	1 (byte) SURVEY TYPE
	<--------	1 (byte) REPLACE EXISTING
	<--------	2 (byte) RESERVED
		SCHEDULED SURVEY #
	<--------	1 (byte) TIMER/SESSION
	<--------	1 (byte) SLEEP B/W SESSIONS
	<--------	1 (byte) SESSION INDEX
	<--------	8 (double) ANTENNA HEIGHT
		QUICKSTART #
	<--------	1 (byte) ELEVATION MASK
	<--------	2 (integer) EPOCH INTERVAL
	<--------	1 (byte) POS. STORAGE RATE
	<--------	1 (byte) MINIMUM # OF SVs
	<--------	4 (long) ANTENNA SERIAL #
	<--------	8 (double) ANTENNA HEIGHT

Table 2-44. STARTSURV Command Sequence

Receiver		Data Collector
		KINEMATIC #
	<--------	1 (byte) ELEVATION MASK
	<--------	2 (integer) EPOCH INTERVAL
	<--------	1 (byte) POS. STORAGE RATE
	<--------	1 (byte) MINIMUM # OF SVs
	<--------	4 (long) ANTENNA SERIAL #
	<--------	1 (byte) PDOP ALARM
	<--------	1 (byte) START IN STATIC/ROVE
		FAST-STATIC #
	<--------	1 (byte) ELEVATION MASK
	<--------	2 (integer) EPOCH INTERVAL
	<--------	1 (byte) POS. STORAGE RATE
	<--------	1 (byte) MINIMUM # OF SVs
	<--------	4 (long) ANTENNA SERIAL #
	<--------	1 (byte) MIN. MEAS TIME 4 SVs
	<--------	1 (byte) MIN. MEAS TIME 5 SVs
	<--------	1 (byte) MIN. MEAS TIME 6 SVs
	<--------	(??h) CHECKSUM
	<--------	(03h) ETX
ACK (06h)	-------->	
# Only the SURVEY TYPE specified is present		

Where:

SURVEY TYPE is the type of survey to commence and defines what parameters follow:

0 Scheduled Survey
1 QuickStart
2 Kinematic
3 Fast-Static

REPLACE EXISTING, if set to 1, replaces the existing default survey parameters with those supplied below for the QuickStart, Kinematic surveys. It is ignored for Scheduled surveys. If REPLACE EXISTING is set to 0, then the current survey parameters (epoch interval, masks) are used and the parameters for the QuickStart, Kinematic surveys are ignored.

0 USE CURRENT RECEIVER DEFAULTS, values not supplied below
1 REPLACE EXISTING, use values supplied below.

RESERVED bytes are for future enhancements. Zeros should be sent.

SCHEDULED SURVEYS

TIMER/SESSION is set to timer if it is required that all pre-programmed sessions should be started. Set to Session if only a particular session should be started.

0 Timer
1 Particular Session

SLEEP BETWEEN SESSIONS if set causes the receiver to awake only for the programmed surveys, otherwise the receiver stays awake until the first session starts and between sessions. Ignored if TIMER/SESSION = 1.

0 Stay Awake
1 Sleep

SESSION INDEX must be defined if TIMER/SESSION is set to 1 (session) and is ignored if TIMER/SESSION is set to 0 (timer). This value is an index into the session/station table with the range 0 to 40 sessions.

ANTENNA HEIGHT is in meters

QUICKSTART, KINEMATIC

ELEVATION MASK is in degrees (0 to 90).

EPOCH INTERVAL is the measurement rate at which to observe the satellites and is in tenths of seconds. It is an unsigned short integer.

POSITION STORAGE RATE is either:

0 5 minutes
1 every epoch

MINIMUM # OF SVS for a survey is 0 to the maximum number of channels available. Less than this value halts data logging.

ANTENNA SERIAL # is an unsigned long integer

ANTENNA HEIGHT is in meters.

KINEMATIC

PDOP ALARM is only relevant to kinematic surveying or a PathFinder survey and is either:

0 off
1 on

START IN STATIC/ROVE - for a kinematic survey, the receiver may start in either STATIC or ROVING mode:

1 STATIC
2 ROVING

FAST STATIC

MINIMUM MEASUREMENT TIMES for FAST-STATIC survey occupation for a particular number of satellites is in minutes.

Note – Sending a STARTSURV when the memory board is full returns a NAK.

This function is available for 4000SE/SSE/SSi receivers using NAV version 5.54 and above.

4Dh ENDSURV Request End of Current Survey

ENDSURV requests the survey be stopped. Table 2-45 lists the ENDSURV command sequence.

Table 2-45. ENDSURV Command Sequence

Receiver		Data Collector
	<--------	(02h) STX
	<--------	(00h) STATUS
	<--------	(4Dh) TYPE
	<--------	(01h) LENGTH
	<--------	1 (byte) ANTENNA FLAG
	<--------	(??h) CHECKSUM
	<--------	(03h) ETX
ACK (06h) or NAK (15h)	-------->	

Where:

ANTENNA FLAG indicates how to handle antenna height not previously input:

- 0 End survey either using previously input antenna height or without antenna height.
- 1 Returns a NAK if antenna height not recorded for survey. Do not End Survey if NAK.

Note – If the antenna flag is set to 1 and a NAK is returned, you should be prompted for an antenna height. This can then be stored with an AUTONANT (2Bh) command.

This function is available for 4000SE/SSE/SSi receivers using NAV version 5.54 and above.

4Eh RTCMCTRL Setup the RTCM Controls

RTCMCTRL sets up the RTCM Input and Output controls. The COMMOUT function must be used to initiate input or output. Table 2-46 lists the RTCMCTRL command sequence.

Table 2-46. RTCMCTRL Command Sequence

Receiver		Data Collector
	<--------	(02h) STX
	<--------	(00h) STATUS
	<--------	(4Eh) TYPE
	<--------	(??h) LENGTH
	<--------	1 (byte) OUTPUT/INPUT
	<--------	1 (byte) VERSION
		OUTPUT
	<--------	2 (integer) STATION ID
	<--------	1 (byte) CTS->XMT DELAY
	<--------	1 (byte) CARRIAGE RETURN ON/ OFF
	<--------	1 (byte) RTCM BIT RATE
	<--------	1 (byte) LENGTH TYPE 16 MESS.
	<--------	?? (char) TYPE 16 MESSAGE
	<--------	1 (byte) # MESSAGE SCHEDULED
	<--------	$ 1 (byte) MESSAGE TYPE
	<--------	$ 1 (byte) MESSAGE FREQUENCY
		INPUT
	<--------	1 (byte) BEEPER ON/OFF
	<--------	1 (byte) CORRECTION PROP.
	<--------	2 (byte) STATION SELECT/ID
	<--------	(??h) CHECKSUM
	<--------	(03h) ETX

Table 2-46. RTCMCTRL Command Sequence

Receiver		Data Collector
ACK (06h)	-------->	
$ Repeated for each of the # OF MESSAGES SCHEDULED		

Where:

OUTPUT/INPUT specifies what definition follows.

0 OUTPUT
1 INPUT

VERSION is the version of RTCM corrections to input or output.

1 Version 1
2 Version 2

OUTPUT

STATION ID indicates the Base Station ID. The valid range is 0 to 1023.

CTS->XMT DELAY may have to be defined to allow for the processing delay in some devices. The units are tenths of seconds. The valid range is 0 to 99 (0 to 9.9 seconds)

CARRIAGE RETURN ON/OFF at the end of each message.

0 OFF
1 ON

RTCM BIT RATE is in multiples of 25 bits.

0 OFF
1 25
2 50
4 100
6 150

LENGTH TYPE 16 MESSAGE indicates the number of characters in the following string. The valid range is 0 to 63.

TYPE 16 MESSAGE is an ASCII string that may be sent at a rate specified by the message frequency below. The valid range is a character string 0 to 63 characters long.

MESSAGE SCHEDULED indicates the number of MESSAGE TYPE and MESSAGE FREQUENCY definitions to follow. If set to zero then the default messages and frequencies are used. If set to a non-zero value, ALL messages required and their frequencies must be defined.

MESSAGE TYPE indicates the message to be sent at the frequency below. Message Type 1 does not have to be included as it is sent at every measurement epoch.

MESSAGE FREQUENCY indicates at what epoch frequency of message type 1 to send another type of message. e.g.

MESSAGE TYPE = 16
MESSAGE FREQUENCY = 10

indicates send a message 16 every 10th Message 1.

INPUT

BEEPER ON/OFF

0 ON
1 OFF

CORRECTION PROPAGATION is the number of seconds to propagate RTCM corrections after the last correction is received. The valid range is 5, 10, 20, 50, and 100 (sec).

STATION SELECT/ID can be set to a specific station or can receiver corrections from any station:

0 - 1023 Specific Station
>1023 Any Station

This function is available for 4000SE/SSE/SSi receivers using NAV version 5.54 and above.

4Fh SETIDLE Set Receiver Parameters Outside a Survey

SETIDLE allows the setting of the epoch rate and positioning type outside of a survey. For NAV Versions 6.00 and above, flags have been added to allow the setting of these values at any time. Table 2-47 lists the SETIDLE command sequence.

Table 2-47. SETIDLE Command Sequence

Receiver		Data Collector
	<--------	(02h) STX
	<--------	(00h) STATUS
	<--------	(4Fh) TYPE
	<--------	(10h) LENGTH
	<--------	2 (byte) EPOCH INTERVAL
	<--------	1 (byte) ELEVATION MASK
	<--------	1 (byte) TYPE OF POSITIONS
	<--------	1 (byte) CALCULATION FLAG
	<--------	1 (byte) PDOP MASK
	<--------	1 (byte) EXTRAPOLATE
	<--------	1 (byte) USE USER HEIGHT
	<--------	8 (double) REFERENCE HEIGHT (m)
	<--------	(??h) CHECKSUM
	<--------	(03h) ETX
ACK (06h) or NAK (15h)	-------->	

Where:

EPOCH INTERVAL is the measurement rate at which to observe the satellites and is in tenths of seconds. It is an unsigned short integer.

ELEVATION MASK is in degrees (0 to 90).

TYPE OF POSITIONS is either:

0	3D/2D
1	3D only
2	2D only

CALCULATION FLAG indicates:

bit 0	Set	Best 3/4 satellites
	Clear	Calculate over-determined positions
bit 1	Reserved	
bit 2	Set	MSL height output
	Clear	WGS-84 height output/displayed
bit 3	Set	Smooth pseudo-ranges
	Clear	No smoothing
bit 4	Set	Weighted Position solution off
	Clear	Weighted Position solution on
bit 5	Set	Apply Sync/Masks to Positioning mode even if survey is being conducted
	Clear	Returns a NAK if a survey is being conducted
bit 6	Set	Apply Sync/Masks to current Survey
	Clear	Apply Sync/Masks to Positioning mode.
bit 7	RESERVED	

PDOP MASK is in tenths. Range 0 to 25.5.

EXTRAPOLATE, if set to a non zero value, causes the receiver to model antenna movement for a short period after loss of lock of the satellite signals.

0	Do not extrapolate
1	Extrapolate measurements USE USER

USE USER ENTERED HEIGHT means use the height given below for 2D fixes rather than the computed height if a non zero value.

0	Do not use value given below
1	Use supplied fixed height (WGS-84)
2	Use supplied fixed height (MSL)

REFERENCE HEIGHT in meters to be used for 2D fixes.

Note – SETIDLE values are ignored and returns a NAK if a survey is currently being performed (NAV versions 6.00 and above see note 2 below).

Note – SETIDLE values are ignored and returns a NAK if a survey is currently being performed and bit 5 and/or 6 of the CALCULATION FLAG is not set (Bits 5 and 6 valid for NAV version 6.00 and above only).

Note – Bit 0 of the CALCULATION FLAG is not currently implemented. Bit 3 of the CALCULATION FLAG was implemented in NAV version 6.10.

Note – The MSL option of the USE USER ENTERED HEIGHT is not implemented.

Note – EXTRAPLOATE is not currently implemented.

Note – Sending 255 for the PDOP MASK sets it to 99.9.

Note – Bit 5 of the CALCULATION FLAG allows SETIDLE to operate while a survey is being conducted. Added NAV version 6.00.

Note – Bit 6 of the CALCULATION FLAG allows the changing of Survey Sync/Masks while a survey is being conducted. Added NAV version 6.00

Note – Setting Bits 5 and 6 at the same time ensures that the Survey and Positioning masks are identical.

This function is available for 4000SE/SSE/SSi receivers using NAV version 5.54 and above.

53h CHANCTRL Setup Receiver Channel Tracking Modes

CHANCTRL enables P-code or C/A code and L1/L2 tracking modes. Table 2-48 lists the CHANCTRL command sequence.

Table 2-48. CHANCTRL Command Sequence

Receiver		Data Collector
	<--------	(02h) STX
	<--------	(00h) STATUS
	<--------	(53h) TYPE
	<--------	(03h) LENGTH
	<--------	1 (byte) TRACKING MODES
	<--------	2 (bytes) RESERVED
	<--------	(??h) CHECKSUM
	<--------	(03h) ETX
ACK (06h) or NAK (15h)	-------->	

Where:

TRACKING MODES byte is setup as follows:

bit 0	clear	L1 C/A code
	set	L1 P code
bit 1	clear	L2 C/A code
	set	L2 P code
bit 2	clear	L2 not active
	set	L2 active
bit 3	clear	P-Code on L2
	set	Encrypted L2
bits 4-7	RESERVED	

RESERVED is for future enhancements. 0 should be sent until this value is defined.

Note – L2 C/A code mode is not currently available and returns a NAK.

Note – TRACKING MODE requests made of a receiver not capable of the tracking mode requested returns a NAK with no change to the current tracking mode. A handheld computer should inquire with either a GETOPT (4Ah) or a GETSERIAL (06h) to find out if receiver is capable of L2 mode.

Note – RS-232 control over Encrypted mode on L2 was implemented in NAV version 5.68

Note – Selecting L1 P-code and L2 Encrypted mode is not available from the front panel.

Note – L1 C/A code and L2 Encrypted tracking are the default tracking modes for Block II satellites with Anti-Spoofing (A/S) active.

This function is available for 4000SE/SSE/SSi receivers using NAV version 5.60 and above.

54h GETSVDATA Request SV Flags, Ephemeris or Almanac, Enable/Disable SVs

GETSVDATA requests satellite data. Request may be for an array of flags indicating what satellite data is available, a particular satellite ephemeris or almanac. In addition, satellites may be enabled/disabled with this command. Table 2-49 lists the GETSVDATA command sequence

Table 2-49. GETSVDATA Command Sequence

Receiver		Data Collector
	<--------	(02h) STX
	<--------	(00h) STATUS
	<--------	(54h) TYPE
	<--------	(03h) LENGTH
	<--------	1 (byte) DATA SWITCH
	<--------	1 (byte) SV PRN #
	<--------	1 (byte) RESERVED
	<--------	(??h) CHECKSUM
	<--------	(03h) ETX
RETSVDATA or NAK	-------->	

Where:

DATA SWITCH indicates what is requested.

- 0 SV Flags indicating Tracking, Ephemeris and Almanac, Enable/Disable state.
- 1 Ephemeris
- 2 Almanac
- 3 ION/UTC data
- 4 Disable Satellite
- 5 Enable Satellite

SV PRN # is the satellite number for which ephemeris/almanac is required or to be Enabled/Disabled. Ignored if SV Flags or ION/UTC is requested. The valid range is 1 to 32.

RESERVED byte is for future enhancements. 0 should be sent until defined.

Note – The reply for this command is usually be a RETSVDATA.

Note – Enable/Disable satellite always returns RETSVDATA as if SV Flags were requested.

Note – Returns a NAK if:
SV PRN out of range 1-32 (except for SV Flags)
Data Switch out of range
Data not available for SV requested

This function is available for 4000SE/SSE/SSi receivers using NAV version 5.68 and above.

55h RETSVDATA Return Ephemeris, Almanac Data, or SV Flags

This function is the response to the GETSVDATA command. RETSVDATA returns either the Ephemeris/Almanac for the SV PRN requested, ION/UTC values, or an array of flags indicating which satellites are being tracked, which have Ephemeris/Almanac available and their Enable/Disable state. Table 2-50 lists the RETSVDATA command sequence.

Table 2-50. RETSVDATA Command Sequence

Receiver		Data Collector
(02h) STX	-------->	
(??h) STATUS	-------->	
(55h) TYPE	-------->	
(??h) LENGTH	-------->	
1 (byte) DATA TYPE INDICATOR	-------->	
1 (byte) SV PRN #	-------->	
SV FLAGS (48 bytes)		
4 (double word) EPHEMERIS FLAGS	-------->	
4 (double word) ALMANAC FLAGS	-------->	
4 (double word) SVS DISABLED FLAGS	-------->	
4 (double word) SVS UNHEALTHY FLAGS	-------->	
4 (double word) TRACKING L1 FLAGS	-------->	
4 (double word) TRACKING L2 FLAGS	-------->	
4 (double word) Y-CODE FLAGS	-------->	
4 (double word) P-CODE ON L1 FLAGS	-------->	
4 (double word) RESERVED	-------->	
4 (double word) RESERVED	-------->	
4 (double word) RESERVED	-------->	

Table 2-50. RETSVDATA Command Sequence

Receiver		Data Collector
4 (double word) RESERVED	-------->	
EPHEMERIS DATA (174 bytes)		
2 (short) EPH WEEK #	-------->	
2 (short) IODC	-------->	
1 (byte) RESERVED	-------->	
1 (byte) IODE	-------->	
4 (long) TOW	-------->	
4 (long) TOC	-------->	
4 (long) TOE	-------->	
8 (double) TGD	-------->	
8 (double) AF2	-------->	
8 (double) AF1	-------->	
8 (double) AF0	-------->	
8 (double) CRS	-------->	
8 (double) DELTA N	-------->	
8 (double) M SUB 0	-------->	
8 (double) CUC	-------->	
8 (double) ECCENTRICITY	-------->	
8 (double) CUS	-------->	
8 (double) SQRT A	-------->	
8 (double) CIC	-------->	
8 (double) OMEGA SUB 0	-------->	
8 (double) CIS	-------->	
8 (double) I SUB 0	-------->	
8 (double) CRC	-------->	
8 (double) OMEGA	-------->	

Table 2-50. RETSVDATA Command Sequence

Receiver		Data Collector
8 (double) OMEGA DOT	-------->	
8 (double) I DOT	-------->	
4 (double word) FLAGS	-------->	
ALMANAC (67 bytes)		
4 (unsigned long) ALM DECODE TIME	-------->	
2 (short) AWN	-------->	
4 (unsigned long) TOA	-------->	
8 (double) SQRTA	-------->	
8 (double) ECCENT	-------->	
8 (double) ISUBO	-------->	
8 (double) OMEGADOT	-------->	
8 (double) OMEGSUBO	-------->	
8 (double) OMEGA	-------->	
8 (double) MSUBO	-------->	
1 (byte) ALM HEALTH	-------->	
ION/UTC (121 bytes)		
UTC parameters		
8 (double) ALPHA 0	-------->	
8 (double) ALPHA 1	-------->	
8 (double) ALPHA 2	-------->	
8 (double) ALPHA 3	-------->	
8 (double) BETA 0	-------->	
8 (double) BETA 1	-------->	
8 (double) BETA 2	-------->	
8 (double) BETA 3	-------->	

Table 2-50. RETSVDATA Command Sequence

Receiver		Data Collector
ION parameters		
8 (double) ASUB0	-------->	
8 (double) ASUB1	-------->	
8 (double) TSUB0T	-------->	
8 (double) DELTATLS	-------->	
8 (double) DELTATLSF	-------->	
8 (double) IONTIME	-------->	
1 (byte) WNSUBT	-------->	
1 (byte) WNSUBLSF	-------->	
1 (byte) DN	-------->	
6 (bytes) RESERVED	-------->	
(??h) CHECKSUM	-------->	
(03h) ETX	-------->	
# Added NAV version 5.71		

Where:

DATA TYPE INDICATOR indicates what SV information is contained in the reply.

- 0 SV Flags indicating tracking, ephemeris, almanac and enabled status.
- 1 Ephemeris
- 2 Almanac
- 3 ION-UTC Data

SV PRN # is the satellite number for which ephemeris/almanac is required. 0 if SV Flags are returned and original request was for SV flags (PRN of satellite if resulting from enable/disable request). The valid range is 0 to 32.

FLAGS

EPHEMERIS FLAGS consist of 32 bits, one for each SV PRN (bit 0 = PRN 1). Bit SET indicates ephemeris is available for that satellite.

ALMANAC FLAGS consist of 32 bits, one for each SV PRN (bit 0 = PRN 1). Bit SET indicates almanac is available for that satellite.

SATELLITE DISABLED FLAGS consist of 32 bits, one for each SV PRN (bit 0 = PRN 1). Bit SET indicates that satellite is currently DISABLED (not used by receiver for any purpose)

SATELLITE UNHEALTHY FLAGS consist of 32 bits, one for each SV PRN (bit 0 = PRN 1). Bit SET indicates that satellite is currently UNHEALTHY (non zero health byte).

TRACKING L1 FLAGS consist of 32 bits, one for each SV PRN (bit 0 = PRN 1). Bit SET indicates that satellite is currently being tracked on L1 band.

TRACKING L2 FLAGS consist of 32 bits, one for each SV PRN (bit 0 = PRN 1). Bit SET indicates that satellite is currently being tracked on L2 band.

Y-CODE FLAGS consist of 32 bits, one for each SV PRN (bit 0 = PRN 1). Bit SET indicates that satellite currently has Anti-Spoofing ON (from ephemeris indication only).

P-CODE ON L1 FLAGS consist of 32 bits, one for each SV PRN (bit 0 = PRN 1). Bit SET indicates that satellite is currently tracking P-CODE on the L1 band. Flags are not set if satellite not being tracked at all on L1. (Added NAV version 5.71)

EPHEMERIS

Data follows the standard defined within ICD200 except for CUC, CUS, CIS, CIC. These values need to be multiplied by π to become the units specified in the ICD200 document.

FLAGS are defined as follows:

Bit(s)	Description	Locatio
b0	Data flag for L2 P-code	Sub 1, word 4, b1
b1-b2	Codes on L2 channel	Sub 1, word 3, b11-b12
b3	Anti-spoof flag: y-code on: from ephemeris	Sub 1-5, HOW, b19
b4-b9	SV health: from ephemeris	Sub 1, word 3, b17-b22
b10	Fit interval flag	Sub 2, word 10, b17
b11-b14	URA: User Range Accuracy	Sub 1, word 3, b13-b16
b15	URA may be worse than indicated Block I: Momentum Dump flag	Sub 1-5, HOW, b18
b16-b18	SV Configuration: SV is Block I or Block II	Sub 4, page 25, word and bit depend on SV
b19	Anti-spoof flag: y-code on	(Sub 4, page 25, word and bit depend on SV

ALMANAC

Data follows the standard defined within ICD200.

ALM DECODE TIME is full GPS seconds from the start of GPS time.

ION/UTC DATA

Data follows the standard defined within ICD200 except that some parameters have been expanded.

Note – Returns a NAK if request GETSVDATA meets one of the following criteria:

SV PRN out of range 1-32 (except for SV Flags)
Data Switch out of range
Data not available for SV requested

This function is available for 4000SE/SSE/SSi receivers using NAV version 5.68 and above.

56h GETRAW Request Position or Real-Time Survey Data

GETRAW requires raw satellite data in *.DAT Record 17 format or Concise format. The request may specify if Real-Time attribute information is required. Alternatively, request receiver position in *.DAT record 11 format. Table 2-51 lists the GETRAW command sequence.

Table 2-51. GETRAW Command Sequence

Receiver		Data Collector
	<--------	(02h) STX
	<--------	(00h) STATUS
	<--------	(56h) TYPE
	<--------	(03h) LENGTH
	<--------	1 (byte) TYPE RAW DATA
	<--------	1 (byte) FLAGS
	<--------	1 (byte) RESERVED
	<--------	(??h) CHECKSUM
	<--------	(03h) ETX
RAWDATA or NAK	-------->	

Where:

TYPE RAW DATA indicates what type of data is requested. Defined values are:

0	Real-Time Survey Data Record
1	Position Record

FLAGS modifies the data request.

For TYPE DATA 0:

bit 0	set	Send Concise Format rather than Expanded *.DAT Record 17 format
bit 1	set	Send Enhanced Record with real-time flags and IODE information
bit 2-7	reserved	

For TYPE DATA 1, Not Defined, send 0.

RESERVED byte is for future enhancements. 0 should be sent until defined.

Note – The reply for this command is usually be a RAWDATA.

Note – Returns a NAK if Real-Time Survey Data is not supported by receiver.

This function is available for 4000SE/SSE/SSi receivers using NAV version 5.68 and above.

57h RAWDATA Return Real-Time Survey Data

The function is the response to the GETRAW command and response to request for streamed Real-Time Survey Data via the COMMOUT command or front panel selection. RAWDATA may contain Expanded Format (.DAT record 17 style) raw satellite measurements, Concise Format measurements or the current computed position depending upon what was requested.

Additional Information: The Raw satellite data responses following either the Expanded or the Concise format and are likely to span more than one RAWDATA reply. To overcome this, page information and an epoch counter are supplied as an extended framing. The first and subsequent RAWDATA record pages are filled with a maximum of 248 bytes consisting of 4 bytes of page and flag information and 244 bytes of raw satellite data. The raw satellite data is split where ever the 244 byte boundary falls, regardless of internal variable boundaries. Therefore the external device receiving the multiple pages must reconstruct the raw satellite record using the 244 byte pages before parsing the data. This format is maintained for the position record, even though it never extends beyond 244 bytes.

Table 2-52 lists the RAWDATA command sequence.

Table 2-52. RAWDATA Command Sequence

Receiver		Data Collector
(02h) STX	-------->	
(??h) STATUS	-------->	
(57h) TYPE	-------->	
(??h) LENGTH	-------->	
1 (byte) RECORD TYPE	-------->	
1 (byte) PAGE COUNTER	-------->	
1 (byte) REPLY #	-------->	

Table 2-52. RAWDATA Command Sequence

Receiver		Data Collector
1 (byte) RECORD INTERPRETATION FLAGS	-------->	
EXPANDED FORMAT (RECORD 17)		
Header (17 bytes)		
8 (double) RECEIVE TIME	-------->	
8 (double) CLOCK OFFSET	-------->	
1 (byte) # OF SVS IN RECORD	-------->	
block repeated for up to 12 SVS (8 bytes)		
1 (byte) SV PRN #	-------->	
1 (byte) FLAGS1	-------->	
1 (byte) FLAGS2	-------->	
1 (byte) FLAG STATUS	-------->	
2 (signed integer) ELEVATION ANGLE	-------->	
2 (integer) AZIMUTH	-------->	
L1 Data: Non Zero if bit 6 of FLAGS1 set (40 bytes)		
8 (double) L1 SNR	-------->	
8 (double) FULL L1 C/A CODE P-RANGE	-------->	
8 (double) L1 CONTINUOUS PHASE	-------->	
8 (double) L1 DOPPLER	-------->	
8 (double) L1 RESERVED	-------->	
L2 Data: avail if bit 0 of FLAGS1 set (24 bytes)		
8 (double) L2 SNR	-------->	
8 (double) L2 CONTINUOUS PHASE	-------->	

Table 2-52. RAWDATA Command Sequence

Receiver		Data Collector
8 (double) L2 P-CODE - L1 C/A CODE P-RANGE	-------->	
Real-Time Data: available only if RECORD INTERPRETATION		
FLAGS bit 1 set (12 bytes)		
1 (byte) IODE	-------->	
1 (byte) L1 SLIP COUNTER	-------->	
1 (byte) L2 SLIP COUNTER	-------->	
1 (byte) RESERVED	-------->	
8 (double) L2 DOPPLER	-------->	
CONCISE FORMAT		
Header (17 bytes)		
8 (double) RECEIVE TIME	-------->	
8 (double) CLOCK OFFSET	-------->	
1 (byte) # OF SVS IN RECORD	-------->	
block repeated for up to 12 SVS (6 bytes)		
1 (byte) SV PRN #	-------->	
1 (byte) FLAGS1	-------->	
1 (byte) FLAGS2	-------->	
1 (signed char) ELEVATION ANGLE	-------->	
2 (integer) AZIMUTH	-------->	
L1 Data: Non Zero if bit 6 of FLAGS1 set (21 bytes)		
1 (byte) L1 SNR * 4	-------->	
8 (double) FULL L1 C/A CODE P-RANGE	-------->	
8 (double) L1 CONTINUOUS PHASE	-------->	

Table 2-52. RAWDATA Command Sequence

Receiver		Data Collector
4 (float) L1 DOPPLER	-------->	
L2 Data: avail if bit 0 of FLAGS1 set (13 bytes)		
1 (byte) L2 SNR * 4	-------->	
8 (double) L2 CONTINUOUS PHASE	-------->	
4 (float) L2 P-CODE - L1 C/A CODE P-RANGE	-------->	
Real-Time Data: available only if RECORD INTERPRETATION		
FLAGS bit 1 set (3 bytes)		
1 (byte) IODE	-------->	
1 (byte) L1 SLIP COUNTER	-------->	
1 (byte) L2 SLIP COUNTER	-------->	
POSITION RECORD (RECORD 11)		
(78 + (nSVs * 2) bytes)		
8 (double) LATITUDE	-------->	
8 (double) LONGITUDE	-------->	
8 (double) ALTITUDE	-------->	
8 (double) CLOCK OFFSET	-------->	
8 (double) FREQUENCY OFFSET	-------->	
8 (double) PDOP	-------->	
8 (double) LATITUDE RATE	-------->	
8 (double) LONGITUDE RATE	-------->	
8 (double) ALTITUDE RATE	-------->	
4 (unsigned long) GPS MSEC OF WEEK	-------->	
1 (byte) POSITION FLAGS	-------->	

Table 2-52. RAWDATA Command Sequence

Receiver		Data Collector
1 (byte) # OF SVS	-------->	
Repeated for each satellite		
1 (byte) CHANNEL #	-------->	
Repeated for each satellite		
1 (byte) PRN #	-------->	
(??h) CHECKSUM	-------->	
(03h) ETX	-------->	

Where:

RECORD TYPE indicates which raw data record type is being sent. Defined values are:

0 Real-Time Survey Data
1 Position

PAGE COUNTER indicates how many pages there are for this epoch and what this page number is. (e.g. 1 of 3, 2 of 3, 3 of 3) This byte is split into two sections of 4 bits allowing for 15 pages.

bits 0-3 Page total
bits 4-7 Current Page number

REPLY # is a 0-255 rollover counter which is incremented with every reply but remains constant across pages within one reply. This value should be checked on 2nd and subsequent pages to ensure that pages of the same reply are recombined rather than those from different reply.

RECORD INTERPRETATION FLAGS indicates special attributes of the record that must be used in parsing values. Defined values are:

Real-Time Survey Data

bit 0	set	Concise format
bit 1	set	Enhanced Record with real-time flags and IODE information
bits 2-7	reserved	

Position Data

Not Defined

Start Of Real-Time Survey Data EXPANDED/CONCISE Format

RECEIVE TIME (common to code and phase) is in milliseconds of GPS week.

CLOCK OFFSET is in milliseconds. A value of 0.0 for the clock offset has not been determined.

OF SVS IN RECORD is the number of SV data block within this record.

Block Repeated For up to 12 SVS

SV PRN # is the satellite PRN number.

FLAGS1 indicates what data is loaded, is valid:

bit 0	set	L2 data loaded and phase valid (see also b6)
bit 1	set	L1 cycle-slip (since last record 17 write)
bit 2	set	L2 cycle-slip (since last record 17 write)
bit 3		L1 phase lock point (redundant, for diagnostics)
bit 4	set	L1 phase valid (lock-point valid)

bit 5	set	L2 pseudo range valid, reset = squared - L2 phase (for 4000SSE/SSi receivers bit 5 = bit 0)
bit 6	set	L1 data valid (non-zero but bytes always present) (see also bit 4), reset = only L2 data loaded (see FLAG STATUS field below)
bit 7	set	New position computed this receiver cycle

FLAGS2 indicates additional useful information:

bit 0	set	L1 tracking P-code, reset = L1 tracking C/A code
bit 1	set	L2 tracking P-code, reset = L2 tracking C/A code or Encrypted mode
bit 2	set	L2 tracking Encrypted mode
bit 3	set	Filtered L1 pseudo range
bits 4-7	reserved	

FLAG STATUS indicates whether FLAGS2 is valid. (Not present for CONCISE):

bit 0	set	bit 6 of FLAGS1 and bit 0-7 of FLAGS2 are valid (always set for RAWDATA)
	reset	bit 6 of FLAGS1 and bit 0-7 of FLAGS2 are undefined
bit 2	set	Receiver is a 4000SSi
bits 2-7	(unused and reset)	

ELEVATION ANGLE is in degrees and can be negative.

AZIMUTH is in degrees.

L1 Data: Valid (non-zero) only if bit 0 of FLAGS1 byte set but always present

L1 SNR count is a measure of the satellite signal strength. (CONCISE needs to be divided by 4.)

FULL L1 C/A-CODE P-RANGE (or P-code see bit 0 of FLAGS2) is the pseudo range in meters.

L1 CONTINUOUS PHASE is in L1 cycles. Range-Rate sign convention: When the pseudo-range is increasing, the phase is decreasing and the Doppler is negative.

L1 DOPPLER is in Hz.

RESERVED (L1 Int. Doppler -> carrier phase residual) (Not present for CONCISE.)

L2 Data: Available only if bit 0 of FLAGS1 byte set

L2 SNR count is a measure of the satellite signal strength. (CONCISE needs to be divided by 4.)

L2 CONTINUOUS PHASE is in:

L2 cycles if bit 5 of FLAGS1 set
L2 squared cycles if bit 5 of FLAGS1 clear

L2 P-CODE (or L2 Encrypted, see bit 1, bit 2 of FLAGS2) - L1 C/A-CODE (or P-code, see bit 0 of FLAGS2) P- RANGE is the pseudo range in meters valid only if bit 5 of FLAGS1 set.

Real-Time Data: Available only if RECORD INTERPRETATION FLAGS bit 1 set

This record is never present for record 17s stored to the receivers internal memory. To be compatible with Trimble Software, this data must be stripped off before a record 17 is stored in a *.DAT file.

IODE indicates what the IODE value of the current ephemeris is for this satellite. When this number changes a new ephemeris is available.

L1 SLIP COUNTER is a 0-255 rollover counter which is incremented for each occurrence of detected cycle-slips on the L1 carrier phase.

L2 SLIP COUNTER is a 0-255 rollover counter which is incremented for each occurrence of detected cycle-slips on the L2 carrier phase. Always incremented when L2 changes mode (C/A <-> Encrypted).

RESERVED byte is for future enhancements. (Not present for CONCISE.)

L2 DOPPLER is in Hz. (Not present for CONCISE.) (Not reported correctly in NAV version 5.68. Fixed NAV version 5.71.)

POSITION RECORD

LATITUDE is in semi-circles.

LONGITUDE is in semi-circles.

ALTITUDE is in meters.

CLOCK OFFSET is in meters.

FREQUENCY OFFSET in Hertz from 1536*1.023 MHz.

PDOP is dimensionless.

LATITUDE RATE is in radians/second.

LONGITUDE RATE is in radians/second.

ALTITUDE RATE is in meters/second.

GPS MSEC OF WEEK is the position time tag in milliseconds.

POSITION FLAGS indicate what type of position has been determined. It is defined as follows:

bits 0-2 define the new position flag and position type
- 0 0D clock only solution [1+ SVs] (if # of SVs used is non-zero)
- 1 1D height only solution with fixed latitude/longitude [2+ SVs]
- 2 2D solution with fixed height and clock [2+ SVs]
- 3 2D solution with fixed height [3+ SVs]
- 4 3D solution [4+ SVs]

bit 3 If set, position is fixed integer bias (RTK), else float

bit 4 If set, position corrected with RTCM differential corrections.
If reset, position not corrected with RTCM differential corrections

bit 5 Reserved

bit 6 If set, position is from RTK

bit 7 If set, position is derived while static (RTK only)

OF SVS indicates the number of channels and PRN numbers to follow.

CHANNEL # indicate which channel is being used. 0 reported for RTK positions.

PRN # indicates which satellites were used for the position.

Note – Returns a NAK if RT Survey Data option is not installed.

Note – A RESEND has unpredictable results with this command. It is recommended that a GETRAW be sent before the next epoch occurs (if possible) to re-acquire lost data.

Note – The total length of the Raw Satellite Data (ignoring the protocol framing and the 4 page counter bytes) may be computed as follows:

Expanded Format: length = 17 + N*48 + M*24 + N*J*12
Concise Format: length = 17 + N*27 + M*13 + N*J*3
where: N is the number of satellites
M is the number of satellites with L2 data
J is either 1, for real-time data ON, or 0 for real-time data OFF.

This function is available for 4000SE/SSE/SSi receivers using NAV version 5.68 and above.

58h RESETRCVR Request Reset of 4000SE/SSE/SSi Set to Known State

RESETRCVR requests that the 4000SE/SSE/SSi is reset to a know state. This causes some or all of the receiver parameters and/or memory to be cleared. Table 2-53 lists the RESETRCVR command sequence.

Table 2-53. RESETRCVR Command Sequence

Receiver		Data Collector
	<--------	(02h) STX
	<--------	(00h) STATUS
	<--------	(58h) TYPE
	<--------	(07h) LENGTH
	<--------	1 (byte) RESET SEVERITY
	<--------	1 (byte) RESERVED
	<--------	5 (string) RESET
	<--------	(??h) CHECKSUM
	<--------	(03h) ETX
ACK or NAK	-------->	

Where:

RESET SEVERITY indicates what type of RESET is requested. Defined values are:

0 Default Controls
1 Factory Defaults
2 Clear all RAM including survey data and ephemeris
3 Power Cycle (added NAV version 5.71)
4 Default Controls with Power Cycle (added NAV version 5.71)

RESERVED bytes are for future enhancements. 0 should be sent until defined.

RESET is a literal string which must be sent. It is intended to lengthen the RESETRCVR command such that an accidental erasure of receiver memory is less likely due to a bad communications line.

Note – For all Reset Levels, the current communications parameters are maintained on the port the command is given.

Note – Level 0 DEFAULT CONTROLS sets the receiver in the same state as the DEFAULT CONTROLS key on the CONTROL menu except that the receiver does not power cycle. The current communications parameters are maintained on all ports. The receiver forces a loss of lock on all channels. Position determinations should resume in a few seconds.

Note – Level 1 FACTORY DEFAULTS clears all user defined values including the Reference Position. Survey data stored within the receiver is not deleted. The current communications parameters are cleared on all ports except that on which the command is given. The receiver is power cycled and enters into anywhere fix positioning mode upon power up. The first position fix may take a couple of minutes.

Note – Level 2 CLEAR ALL RAM sets Factory Defaults and clears both ephemeris and survey data. The receiver is power cycled. The current communications parameters are cleared on all ports except that on which the command is given. The receiver has to update its internal GPS database from the satellites broadcast message before it is able to compute a position. This may take up to 20 minutes.

Note – Level 3 POWER CYCLE is equivalent to powering down and then powering up the receiver. Level 3 was added to NAV firmware version 5.71.

Note – Level 4 DEFAULT CONTROLS with POWER CYCLE. Level 4 is identical to selecting the DEFAULT CONTROLS key on the CONTROL menu. Level 4 was added to NAV firmware version 5.71.

Note – Returns a NAK if RESET SEVERITY is out of range or RESET string does not compare with receiver copy.

This function is available for 4000SE/SSE/SSi receivers using NAV version 5.68 and above.

81h KEYSIM Simulate Front Panel Keypress

KEYSIM simulates a keypress from a remote terminal on a 4000SE. Table 2-54 lists the KEYSIM command sequence.

Table 2-54. KEYSIM Command Sequence

Receiver		Data Collector
	<--------	(02h) STX
	<--------	(00h) STATUS
	<--------	(81h) TYPE
	<--------	(01h) LENGTH
	<--------	(xxh) KEY ID
	<--------	(??h) CHECKSUM
	<--------	(03h) ETX
ACK (06h)	-------->	

Where:

KEY ID is:

CLEARKEY	(7Fh)	<del>
ENTERKEY	(0Dh)	<cr>
CHOICE1	(41h)	A
CHOICE2	(42h)	B
CHOICE3	(43h)	C
CHOICE4	(44h)	D
ARROWLTKEY	(1Dh)	
ARROWRTKEY	(1Ch)	
ZEROKEY	(30h)	0
ONEKEY	(31h)	1
TWOKEY	(32h)	2
THREEKEY	(33h)	3
FOURKEY	(34h)	4
FIVEKEY	(35h)	5
SIXKEY	(36h)	6
SEVENKEY	(37h)	7
EIGHTKEY	(38h)	8
NINEKEY	(39h)	9
STATKEY	(4Ch)	L
SESSKEY	(4Ah)	J
SATKEY	(4Bh)	K
SURVKEY	(4Fh)	O
CTRLKEY	(4Dh)	M
ALPHAKEY	(50h)	P
MODIFYKEY	(4Eh)	N
POWERKEY	(1Bh)	

This function is available for 4000SE/SSE/SSi receivers using NAV version 5.30 and above.

82h SCRDUMP Request Front Panel Screen Dump

SCRDUMP requests an image of the front panel for the 4000SE receiver. Table 2-55 lists the SCRDUMP command sequence.

Table 2-55. SCRDUMP Command Sequence

Receiver		Data Collector
	<--------	(02h) STX
	<--------	(00h) STATUS
	<--------	(82h) TYPE
	<--------	(00h) LENGTH
	<--------	(82h) CHECKSUM
	<--------	(03h) ETX
(02h) STX		
(??h) STATUS		
(82h) TYPE		
(A1h) LENGTH		
160 (char) ASCII DATA		
1 (byte) CURSOR POSITION		
(??h) CHECKSUM		
(03h) ETX	-------->	

Note – This command operates differently from all others in that the reply type ha s the same identifier as the request type.

This function is available for 4000SE/SSE/SSi receivers using NAV version 5.30 and above.

83h OLDCMD Send an Old Protocol Command

OLDCMD sends an Old Protocol command bounded by the data collector interface protocol. Receive the answer also bounded by the data collector protocol. Table 2-56 lists the OLDCMD command sequence.

Table 2-56. OLDCMD Command Sequence

Receiver		Data Collector
	<--------	(02h) STX
	<--------	(00h) STATUS
	<--------	(83h) TYPE
	<--------	(??h) LENGTH
	<--------	(ZZh) COMMAND
	<--------	(??h) DATA
	<--------	(??h) CHECKSUM
	<--------	(03h) ETX
(06h) ACK	-------->	
	or	
(02h) STX	-------->	
(??h) STATUS	-------->	
(ZZh) COMMAND	-------->	
(??h) LENGTH	-------->	
(??h) DATA	-------->	
*	-------->	
*	-------->	
*	-------->	
(??h) CHECKSUM	-------->	
(03h) ETX	-------->	

Note – The first byte within the data block must contain the old protocol command number. The remaining data bytes should then be formatted identically to the format that was used in the old protocol. If no data are required, then only the command Id is sent.

Note – If the request does not require a specific response, the receiver returns an ACK.

Note – If a specific reply is required, the receiver transmits the formatted message with the type byte set to the old style command number. The data block contain exactly what would have been transmitted with the old protocol.

Note – Use with caution. This command operates differently from all others, in that the reply type takes on the value of the command subtype given by the request. If the reply is not stored with the request in a RS-232 tracking file, it is difficult to determine whether the reply is reply to a data collector format request or an old protocol request. Also, a reply processing algorithms must now have knowledge of the request given.

Note – The data block is not restricted to ASCII characters.

Note – There is one old command reply that does not fit into the 248 bytes allowed for the data. The reply to the old command EPHDATA (06h) is split into two parts: the ephemeris and the almanac. The data is exactly as given by the old protocol (06h). To access the data, request old commands (F0h) for the ephemeris data and (F3h) for the almanac data.

This function is available for 4000SE/SSE/SSi receivers using NAV version 5.30 and above.

A Troubleshooting

This appendix lists known bugs and limitations of the functions and gives the NAV processor version compatibility for the functions.

A.1 Known Bugs and Limitations

The following are a list of know bugs and limitations. If available, known workarounds are also discussed.

1. If an external antenna is connected, a survey started, the antenna disconnected and then reconnected, RSERIAL returns a nonsensical 10-digit antenna serial number. Only 8 digits are allowed in the command format. As a result, the checksum and framing are not in their correct positions.

   Fixed in NP versions 4.50 and higher

   Possible work around:

   The RSERIAL response should not change for the duration of a survey. Only send a GETSERIAL once. If the framing/ checksum of the response fails, try again (RESEND), notify the user, and on the second or third try, if the situation has not improved, ignore the response. RSERIAL is for the users/data collector information only. No other commands should be affected by the response of RSERIAL.

2. The number of hours of receiver memory remaining as reported by the RECSTAT 1 command may exceed 99.9 in certain situations. This is a similar situation to that of bug 1 except that the length reported by the length byte is correct, as are the checksum and framing. Their positions have changed due to the hours remaining string being too long. This situation is likely to occur if:

   - An infrequent epoch interval is selected (>1 minute).
   - A large amount of memory is available on the receiver.

   Fixed in NP version 5.50 and higher

   Possible work around:

   Unfortunately, RECSTAT1 is commonly polled almost constantly. Thus, the work around suggested in bug (1) will not work here. A solution is to set a higher observation frequency (lower epoch interval) although this is usually undesirable. If the RS-232 records are read and the length transmitted is different to that reported in this document and the checksum and framing are correct, then the record may still be read and used. The extra characters can be assumed to be in the DECIMAL HOURS OF MEMORY hours of memory remaining field and the following fields should be moved by the corresponding amount.

3. The TIMEEVNT command will not cause the event marker number to increment in NP versions 4.52 and below.

4. The continuous and cumulative measurements as reported by the CHANCC (0Eh) function suffer from the same problem as the Decimal hours of memory remaining field in bug 2. On receivers with large memory boards and/or fast update rates, the field may overflow. As in bug 2, the length reported by the reply is that actually transmitted and thus the reply can be read without getting out of sync. It is, however, very difficult to determine which channel is overflowing and thus, that data

generally cannot be interpreted. Note the fix given in the notes with the function.

5. RTCM options reported installed while not installed in all NAV versions up to and including 5.65.

   Possible work around:

   The RTCMCTRL command returns a NAK if RTCM is not installed. This can be used to verify RTCM installation.

6. REAL-TIME SURVEY DATA was added in NAV version 5.68 but not reported in the RETOPT command until NAV version 5.71.

   Possible work around:

   The REAL-TIME SURVEY DATA option did not become generally available until NAV version 5.71 and thus this should not cause too much of a problem.

7. RAWDATA command did not report L2 Doppler correctly until NAV version 5.71.

A.2 NAV Processor Version Compatibility

Table A-1 lists the NAV processor version compatibility for the functions.

Table A-1. NAV Processor Version Compatibility

ID	Description	ST/SST Comp	SE/ SSE/ SSi Comp
05h	REMARK General Remark	4.20	ALL
06h	GETSERIAL Get Receiver & Antenna Serial Information	4.20	ALL
07h	RSERIAL Receiver & Antenna Information	4.20	ALL

Table A-1. NAV Processor Version Compatibility

ID	Description	ST/SST Comp	SE/ SSE/ SSi Comp
08h	GETSTAT1 Get Receiver Status, Variable	4.20	ALL
09h	RECSTAT1 Receiver Status, Variable	4.20	ALL
0Bh	GETPOS Request Position	4.20	ALL
0Ch	POSITION Position & PDOP	4.20	ALL
0Dh	GETCHAN Request Tracking Information	4.20	ALL
0Eh	CHANCC Tracking Information	4.20	ALL
0Fh	LOCKKEY Request Keyboard Lockout	4.41	ALL
10h	GETMESS Requests the GPS Message	4.20	ALL
11h	MESSAGE Return the GPS Message	4.20	ALL
13h	RESEND Resend Last Message	4.20	ALL
14h	GETTIME Get GPS Time & Week Number	4.20	ALL
15h	GPSTIME Returns GPS Time & Week Number	4.20	ALL
16h	GETSVS Request Satellite Information	4.20	ALL
17h	SVDATA Satellite Azimuth, Elevation, & SNR	4.20	ALL
18h	UNLOCK Request Keyboard Unlock	4.41	ALL
1Bh	SETANT Input Antenna Information	4.20	ALL
1Ch	SETMET Input Meteorological Data	4.20	ALL
21h	SUSPEND Suspend Storing Data to Receiver's Internal Memory	NONE	6.11
22h	RESUME Resume Storing Data to Receiver's Internal Memory	NONE	6.11
23h	TIMEEVNT Store an Event Mark	4.20	ALL
25h	GETEVNT Get Last Event Number	4.41	ALL
26h	LASTEVNT Returns the Last Event Number	4.41	ALL
2Bh	AUTONANT Autonomous Antenna Height	4.41	ALL

Table A-1. NAV Processor Version Compatibility

ID	Description	ST/SST Comp	SE/ SSE/ SSi Comp
2Ch	GETPOS2 Request Position with RTCM Information	NONE	5.40
2Dh	POSRTCM Position & PDOP with RTCM Status	NONE	5.40
2Eh	GETPOSVS Request Position & Satellite IODE Information	NONE	5.40
2Fh	RETPOSVS Position & Satellite IODE Information	NONE	5.40
37h	GETLOCALP Request Ellipsoid, Datum Transformation, or Zone Data	NONE	5.68
38h	RETLOCALP Reply Ellipsoid, Datum Transformation, or Zone Data	NONE	5.68
39h	SETLOCALP Select or Define Ellipsoid, Datum Transformation, or Zone Data	NONE	5.68
42h	SETSESSTN Set Survey Session/Station Parameters	NONE	5.50
43h	GETSESSTN Request Session/Station Information	NONE	5.50
44h	RETSESSTN Return Survey Session/Station Parameters	NONE	5.50
48h	SETCOMMS Set RS-232 Port Communications Parameters	NONE	5.50
49h	COMMOUT Request Output to a RS-232 Port	NONE	5.50
4Ah	GETOPT Request Receiver Options	NONE	5.54
4Bh	RETOPT Return Receiver Options	NONE	5.54
4Ch	STARTSURV Request Start of Survey	NONE	5.54
4Dh	ENDSURV Request End of Current Survey	NONE	5.54
4Eh	RTCMCTRL Setup the RTCM Controls	NONE	5.54
4Fh	SETIDLE Set Receiver Parameters Outside a Survey	NONE	5.54
53h	CHANCTRL Setup Receiver Channel Tracking Modes	NONE	5.60

Table A-1. NAV Processor Version Compatibility

ID	Description	ST/SST Comp	SE/ SSE/ SSi Comp
54h	GETSVDATA Request SV Flags, Ephemeris or Almanac, Enable/Disable SVs	NONE	5.68
55h	RETSVDATA Return Ephemeris, Almanac Data or SV Flags	NONE	5.68
56h	GETRAW Request Position or Real-Time Survey Data	NONE	5.68
57h	RAWDATA Return Real-Time Survey Data	NONE	5.68
58h	RESETRCVR Request Reset of 4000SE/SSE/SSi Set to Known State	NONE	5.68
81h	KEYSIM Simulate Front Panel Keypress	NONE	5.30
82h	SCRDUMP Request Front Panel Screen Dump	NONE	5.30
83h	OLDCMD Send an Old Protocol Command	NONE	5.30

Index

Symbols

Numerics

A

B

C

D

E

F

G

H

I

K

L

M

N

O

P

R

S

T

U

V

W

Y

Z

Reader Comment Form

RS-232 Interface Specification Manual **May 1995**
P/N: 22794-00 **Revision D**

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