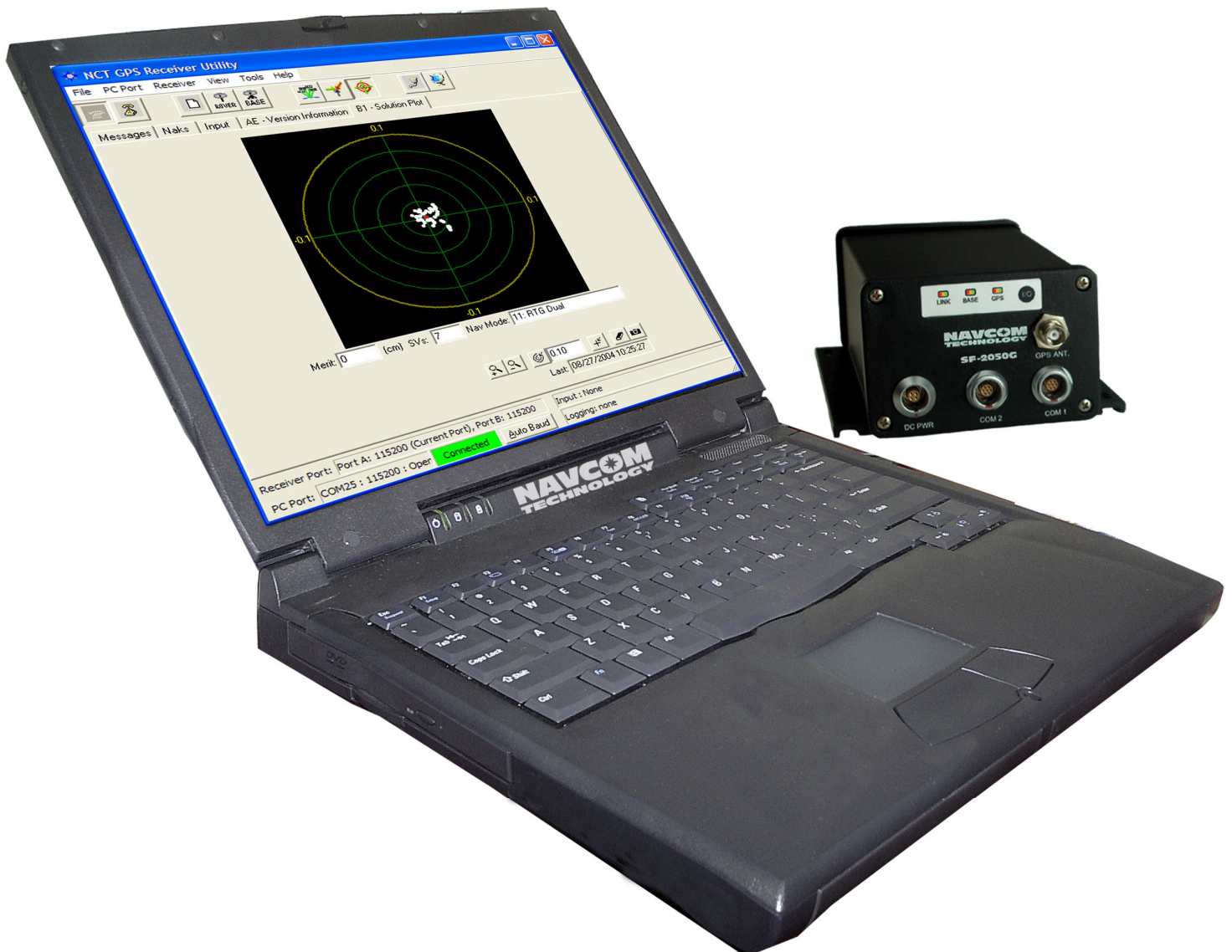




# StarUtil

## User Guide



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## Notices

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## Use of this Document

This User Guide is intended to be used by someone familiar with the concepts of *GPS* and satellite surveying equipment.

 Note indicates additional information to make better use of the product.

 Indicates a caution, care, and/or safety situation.

---

## Chapter 1

## Introduction

---

### StarUtil Overview

StarUtil is designed for use as an Engineering/OEM application. This utility is primarily used to assist in the development of user controller solutions. It is a powerful utility that allows the user to view, and or configure any of the NavCom Technology, Inc. GPS receivers to any Base or Rover configuration. It also affords the user the luxury of viewing receiver operations such as Channel Status, Position Information, Raw Measurements, and many other engineering level receiver operations, which are not necessarily useful to a user.

StarUtil allows the user to log output data to a file on the computer's hard drive or to the internal Memory Module Card (MMC). This data can then be used for post processing or data analysis.

All examples and references in this User Guide are relative to the factory default setup, which is Rover configuration. In the examples and references to Base setup, NavCom Technology, Inc. proprietary binary RTK Base configuration is assumed.

---


### Program Initialization

After clicking on the StarUtil Icon, the utility automatically reads the available serial ports (i.e. RS-232 ports) from the Windows<sup>®</sup> OS registry. You are then given the option to manually choose a baud rate for the PC port you have chosen, or you may have the program automatically detect the baud rate for you.

---

### Output Message Selection

The NCT-2100/NCT-2000 GPS Engine receiver comes with a default list of messages enabled. In the case of the NCT binary messages, you will see these messages scrolling upward on the Messages screen of StarUtil. The Technical Reference Manual (TRM) provides a detailed accounting of all NCT binary messages that can be output from the receiver, any of which can be included or excluded in the NCT-2100/NCT-2000 Messages window. The user has the ability to choose the rate at which the messages are output from the receiver at any of 6-present rates, or by manually entering a value. The user has the additional option of choosing a message to be output "on change" indicating that the receiver will not output a particular message until a minimum of 1 bit has changed in the message. NMEA output messages can be viewed, and logged in their own display screen, while the output rate is chosen in a similar fashion as the NCT binary.

 *The NMEA messages GGA, RMC, and VTG follow the output rate of the 0xB1 message up to a rate of 10 HZ, when NMEA output rate for these messages are set to "On Change". Setting the 0xB1 message rate greater than 10 HZ will force the GGA, RMC, and VTG messages to a 1 Hz output rate.*

---

### Receiver Setup Parameters

StarUtil has been designed to allow the user the flexibility of configuring the receiver as a Base or Rover receiver. Tool bar icons are provided to simplify the process of configuring the receiver for typical Base or Rover operation (i.e. single button setup). If the user has more specific requirements,



they may access additional menu screens that allow setup of such items as the internal radio, or L-Band Module.

---

## Receiver Initial Position

After removing the receiver from the box and powering up, the position first seen may be the location of the NavCom Technology, Inc. production center. It is recommended that this position be changed to a position within 500km of your actual location in order to quickly acquire satellites and receive a new almanac from the GPS system.

---

## Viewing Output Messages

Only a limited number of the many NCT2000D output messages can be viewed within the utility. These can be found under the "View" menu of the main StarUtil window. When a message is checked on this menu, a screen with a selection tab will be created in the main workspace window and displaying for the corresponding message. If you wish, you can remove the screen from the main workspace window by dragging the tab and placing it anywhere on the Windows® desktop. This will make the display a freestanding window. If you wish to put it back, simply drag the window frame back to the StarUtil main workspace window.

---

## Initiating Data Logging

You can create a log file of the messages from the receiver by selecting "File\Logging..." from the main StarUtil window menu. Simply select a folder and enter a file name to begin logging. A folder named in year, month, day [yymmdd] format will be created under the chosen folder, and the logged data will be placed there. To stop logging, select "File\Close log" from the main StarUtil window menu.

## Chapter 2

## Establishing Communications & Control

In order to execute StarUtil double click on the icon. Once StarUtil is active, communications with the GPS system must be established by pressing the Configure Com Port button on the main StarUtil window toolbar, see Figure 1. This can also be accomplished via the Menu bar by clicking PC Port\Configure PC COM Port.



Figure 1: StarUtil Toolbar

A new window will appear as in Figure 2. StarUtil includes an Auto Baud Detect feature that will allow for quick protocol connection between the PC, and the GPS receiver. You are also given an opt-out if you choose to manually pick a baud rate. Check the Auto Baud box to initiate automatic detection, uncheck the box to choose a baud rate from the pop-up window.

StarUtil automatically reads the available serial ports (i.e. RS-232 ports) from the Windows® registry, and displays them in a pop-up window. Choose the Com Port that you will be using to control the GPS receiver. Typically RTS/DTR and Parity options will remain in the default states unless your system requires that these options be changed. Once the connection is established the PC COM Port Status Bar at the bottom of the main StarUtil window will provide connection information as shown in Figure 3. Information provided is PC COM port baud rate, GPS receiver port baud rate for both Com Ports, Data Logging Status, and any Input activity. There is also an Auto Baud button, which only becomes active after the initial connection has been established.

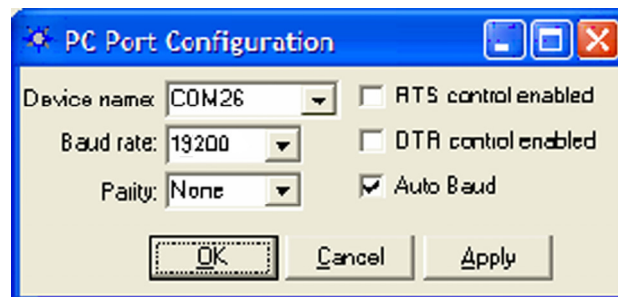


Figure 2: PC Port Configuration

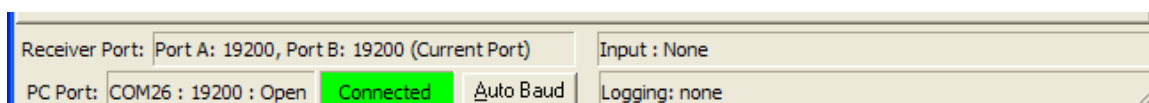


Figure 3: PC Port Status Bar

Now that PC Port Configuration has been established, the receiver must have its logical ports setup to meet the specific requirements of the application. At this point you may choose to change the Control Port to Com 1, elect an output port for NMEA, or an input port for the correction information being received from an external source. The Unit Port Configuration screen can be reached by pressing the Ports icon on the Toolbar, or from the Menu Bar pressing RECEIVER\SETUP\PORTS. Figure 4 shows a typical Unit Port Configuration used for outputting NMEA data via the Data Port [Port A/Com 1], controlling the receiver via Com 2 [Port B], and receiving RTK corrections via the \*internal radio. The Physical Ports area of Figure 4 displays the baud rate, and parity at which the port communicates to the Controller Solution.

*\* Internal radio option available on the RT-3010 & RT-3020 models only.*

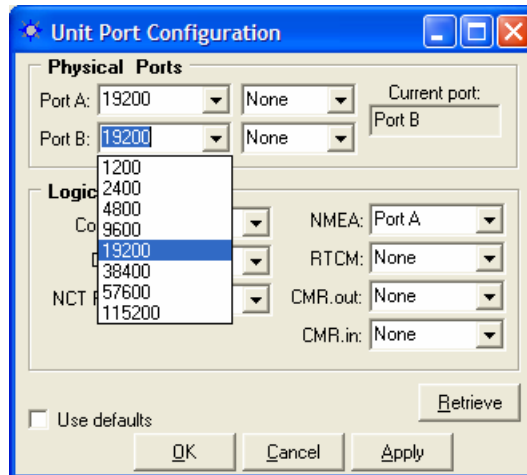


Figure 4: Unit Port Configuration

The Default Settings of the Physical Ports is set to 19200. The baud rate can be changed by simply clicking on the pull-down menu for port A and B and selecting any of the predetermined baud rates as shown in Figure 4.

The default logical physical mapping places the Control in the Current Port B, and Data, & NMEA, in the Non-Current Port A. The logical physical mapping of ports can be changed by clicking on any port and the pull-down menu shown in Figure 4. Logically, there are six ports and physically there are two, Port A [Com1], and B [Com 2]. The six logical ports are Control, Data, NCT RTK, NMEA, RTCM, and CMR as shown in Figure 4. Control and NCT RTK are very similar and work with proprietary messages. The RTCM port receives differential corrections as a rover, and sends out RTCM 104 corrections if the receiver has been set up as a base station; the CMR port operates in similar fashion. The NMEA port communicates messages using a protocol for communications between marine instrumentation. This interface permits flexibility in communication and control of the various message streams.

The “Apply” button sends the changes to the receiver, and will store the values in NVRam for recovery after a power cycle. The “Retrieve” button will send a request to the receiver for the information stored in NV-Ram pertinent to this particular display. These two buttons operate as described for each window in which they appear. Checking the Use Defaults box will apply the factory default configuration for both Physical and Logical Ports.

## Chapter 3

## Navigation & Data Output Configuration

At this point the GPS receiver is ready to be configured for your specific application requirements. The GPS receiver is factory defaulted to output 7 NCT binary messages via the factory default control port Com 2. After successfully establishing communications with the receiver, you should see NCT messages scrolling up in the Messages tab of StarUtil's main window as seen in Figure 5.

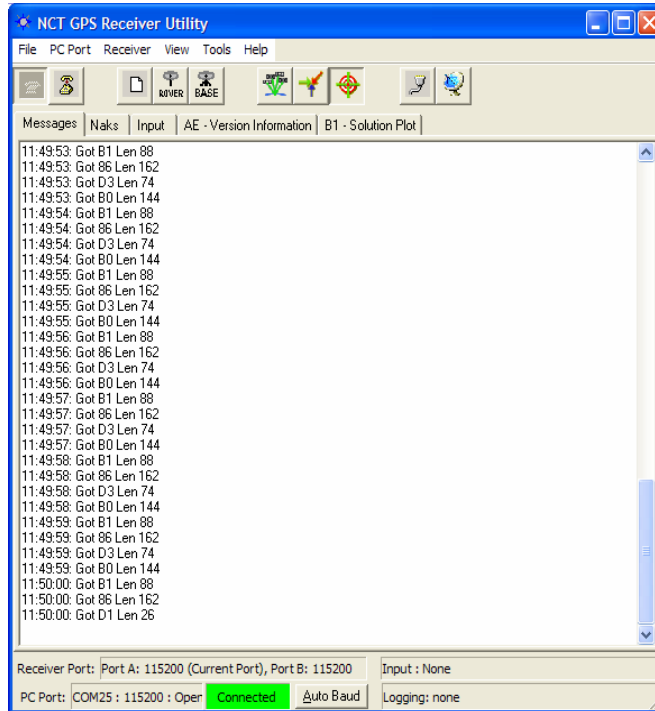


Figure 5: StarUtil Main GUI Window

The messages chosen afford the user the ability to get started viewing, collecting, and analyzing GPS receiver data immediately. The default messages output from the receiver are shown in Table 1.

Message	Rate	Description
44	On Change	Packed <i>Almanac</i>
81	On Change	Packed <i>Ephemeris</i>
86	On Change	<i>Channel Status</i>
B0	On Change	Raw Measurement Data
B1	On Change	<i>PVT</i> Block
A0	On Change	Alerts
AE	600 Sec	Software Versions

Table 1: NCT Binary Default Output Messages

The user is allowed to add or delete NCT and/or NMEA message from each format's output list. This is established by clicking on RECEIVER\MESSAGES\NCT OUTPUT from the StarUtil Menu bar as shown in Figure 6.

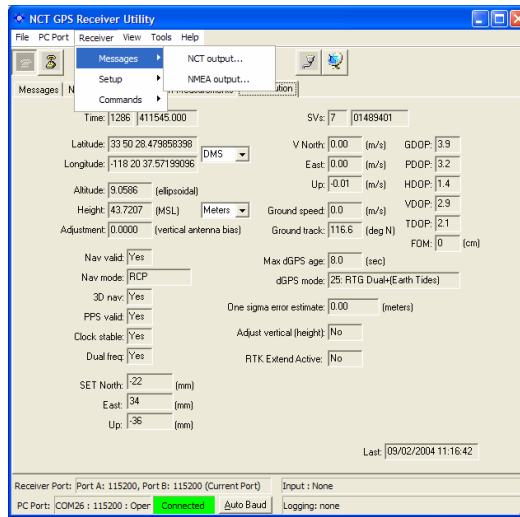


Figure 6: Message Output List Control

After choosing the message output type [in this case NCT Binary] the window shown in Figure 7 will appear allowing you to add or delete any of the NCT Binary messages, and schedule the frequency of their output.

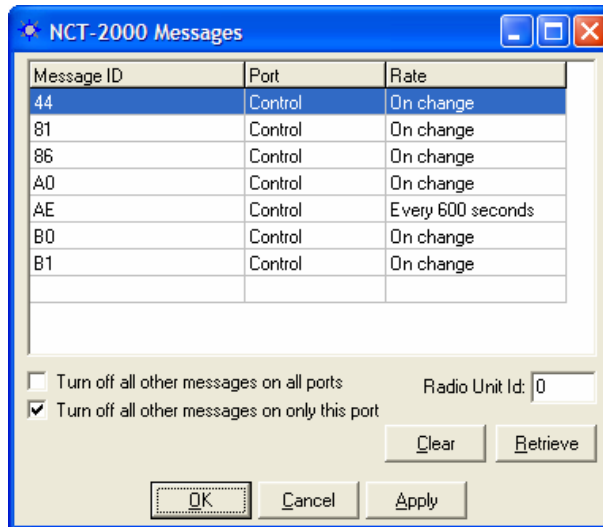


Figure 7: NCT-2100/NCT-2000 Message List

To add messages to the NCT Output List right click in the blank Message ID cell. A list of commonly used messages will appear; see Figure 8. Click on the message of your choice and it will be added to the list. Right click on the Port cell to choose where the message will be sent; see Figure 9. Right click on the Rate cell and you will be given several options as to the frequency of the output for the message; see Figure 10. Pressing the "Apply" button will send the new list, and scheduling information to the receiver. If a message you wish to schedule is not in the preset list, choose "Other" and you will be given the opportunity to manually enter the hex ID of the message you need.

There are two check boxes that allow the end user to quickly delete all messages in the NCT-2100/NCT-2000 Message List. By checking the “Turn Off All Other Messages On All Ports” box, and clicking Apply, all NCT-2100/NCT-2000 messages previously scheduled for output on Control, Data, or NCT RTK will be deleted from the message list and data output will stop.

By checking the “Turn Off All Other Messages On Only This Port” box, and clicking Apply, all NCT-2100/NCT-2000 messages previously scheduled for output on Control will be deleted from the message list and data output on the Control Port will stop, leaving any data scheduled for output on the Data or NCT RTK port to flow freely as scheduled.

Pressing the Clear button will clear the NCT-2100/NCT-2000 messages list on the screen, but will not affect the output of the receiver.

Deleting a message can be accomplished in one of two ways, either click on the message and press the Delete key on the keyboard, or Right click on the message, and choose Delete from the popup menu; see Figure 8.

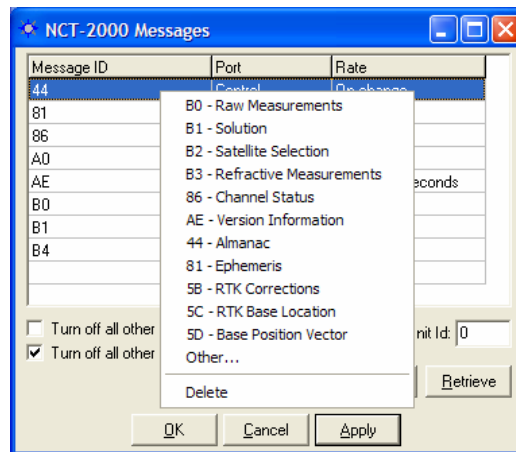


Figure 8: NCT Message Choice Added to Output List

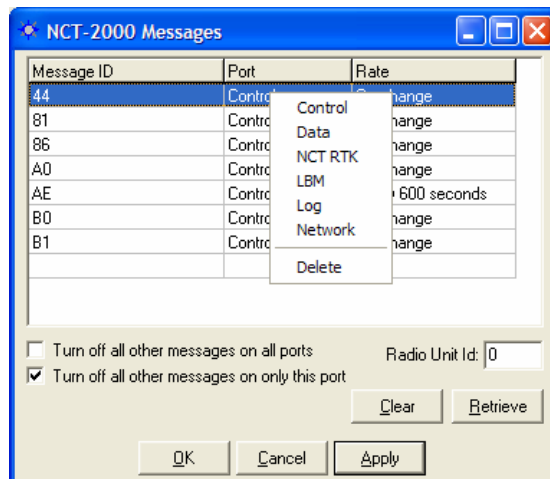


Figure 9: NCT Message Logging Port Choice

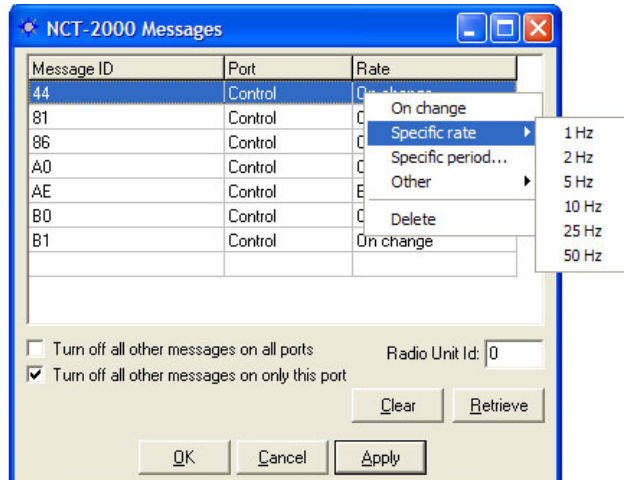


Figure 10: NCT Message Output Rate Choice

The NCT messages scheduled should appear scrolling up in the Messages tab of the main StarUtil window as seen in Figure 5, StarUtil Main GUI Window.

NMEA messages and output rates are chosen in similar fashion via the RECEIVER\NMEA\MESSAGES menu choice. Additionally, the end user can now have a NCT Proprietary NMEA Type string output from the NMEA port by choosing NCT SET from the NMEA messages list as shown in Figure 11, which will provide Solid Earth Tide (SET) correction information.

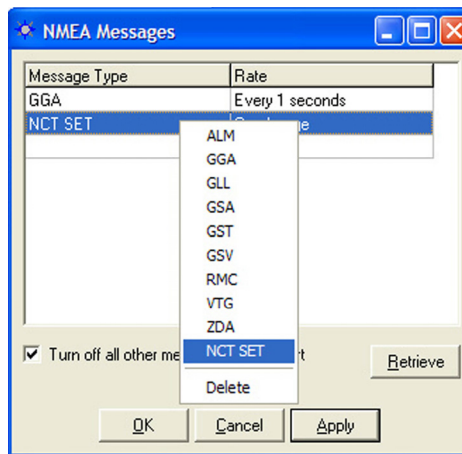


Figure 11: NMEA Messages Scheduling Window

## Solid Earth Tide (SET) Implementation

In order to have the SET correction information applied to the position solution there are several caveats that must be engaged.

1. Navigation MUST be valid.
2. SET Software Option is Enabled.
3. Navigation Mode is set to RTG from the Rover / Tracking & Navigation Setup, Figure 15.
4. SET are applied ("USE") from the Rover / Tracking & Navigation Setup, Figure 15.
5. SET correctors are valid (minimum of 1 run of the SET algorithm).

Once the criteria above have been met, the SET corrections will be applied to the position solution, and displayed as North, East, and Up corrections in millimeters on the B1 Solution Window. It will also be output on the NMEA port. A sample SET message appears in Figure 12, a detailed description of the NMEA Type message structure can be found in Appendix A Table A1.

```
$PNCTSET,161625.00,-0.008,0.003,-0.099,,,,,*47
```

Figure 12: NCT SET NMEA Sample

## Receiver Initial Position Setup

Depending on your Latitude & Longitude, you may be required to enter an initial position in order to start navigating in the shortest period of time. This is accomplished by clicking on the menu bar RECEIVER\SETUP\INITIAL POSITION as shown in Figure 13.

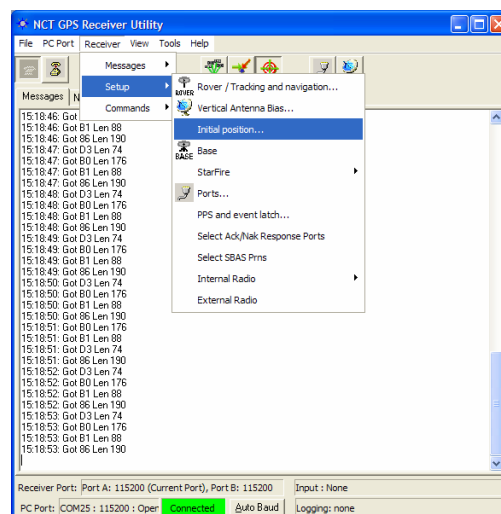


Figure 13: Initial Position Location



The Set Receiver Position screen will appear as shown in Figure 14. The Receiver Position Menu is comprised of Message Block 0x46 Initial Time and Position.

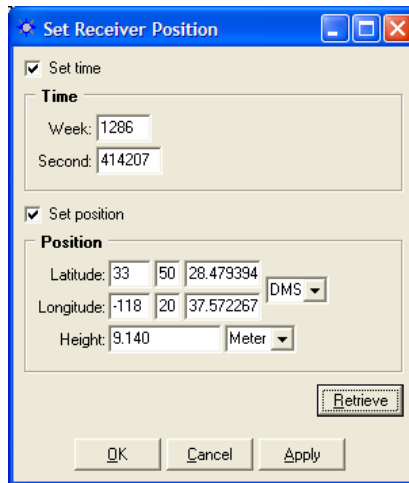


Figure 14: Set Receiver Position

Click the Set Time box to change the elapsed time since the beginning of the week in seconds if known. It is not mandatory to set this field since once a satellite is tracked GPS Week Number, and GPS Week Seconds will automatically update. After the receiver starts tracking satellites, time cannot be set since the time from the satellite is assumed to be more accurate.

Click the Set Position box in order to change the initial position the receiver will use to track satellites. Typically a position within 500km will be close enough to pickup satellites and acquire almanac and ephemeris information. The position can be entered in DDMSS format, or by use of the pull down window DDMM format. Similarly the ellipsoidal height can be entered in meters or feet.

Once the position has been entered, press the “Apply” button and the receiver will use the newly entered position to locate its first satellite and update almanac and ephemeris information. Collection of a new almanac requires 12.5 uninterrupted minutes of continuous satellite tracking.

---

## Rover / Navigation & Tracking Setup

Typically the receiver will come from the factory setup as a GPS autonomous rover. Depending on the options purchased, you may set the receiver up to accept dGPS/RTK/RTG corrections from an external source. Figure 15 shows the Navigation & Tracking Setup window and the various options available to the user as a rover. This menu comprises message blocks 0x47 (SV Tracking Control), and 0x49 (Solution Control). Access this window by clicking RECEIVER/SETUP/ROVER-TRACKING & NAVIGATION, or click the Rover icon on the main StarUtil toolbar.

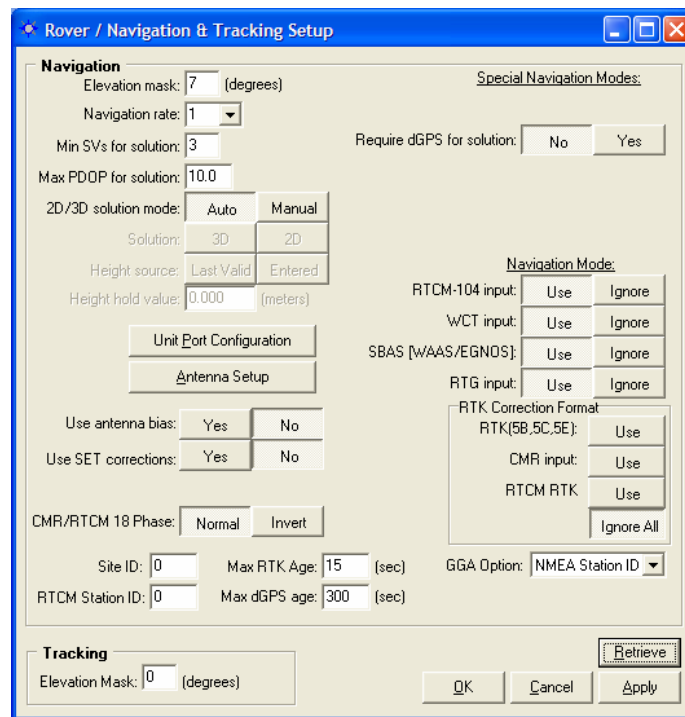


Figure 15: Rover Navigation & Tracking Parameters Setup

The Navigation Elevation Mask selects the elevation angle the receiver starts processing GPS data from the satellites. The default is set to 7 degrees because GPS measurements of satellites at lower elevation tend to deteriorate accuracy.

The Navigation Rate is the number of Navigation Solutions per second. The default rate is 1 Hz and can be increased up to 25 hz as a purchased option.

*The Navigation Rate of the 0xB1 message is changed here and **NOT** on the NCT Message Output list. Attempting to change the Nav Rate in the NCT Message Output list will delete the 0xB1 message from the output list.*

The minimum amount of satellites required for navigation is a user input value =>3. The default is 3 and denotes a 2 dimensional navigation solution. If height solution is needed, an additional satellite must be manually entered bringing the total to 4. Obviously, the larger the number of satellites required for navigation, yields a longer period of time before position output

The default setting for Max PDOP is 10. The quality of GPS data is dependent on the geometry between the receiver and satellites; this includes the number of satellites that can be "seen" by the receiver and the angle between the receiver and satellites. A satellite near the horizon usually provides a lower quality signal because of greater atmospheric interference and the increased likelihood of the signal reflecting from surface features, this is known as "multipath" error. The effect of geometry on GPS quality is measured by PDOP (position dilution of precision). PDOP is the overall measure of the precision obtainable with a given satellite geometry. For example, a PDOP of 4 or less yields excellent precision, a PDOP between 5 and 7 is acceptable and a PDOP of 7 or more is considered poor.

A 2D solution is an altitude hold mode. This typically indicates that the receiver is navigating using only 3 satellites, and the altitude component is a manually entered valued. This altitude value used can either be the value entered or the last computed altitude. A 3D solution typically indicates that the receiver is navigating using 4 or more satellites. When the 2D/3D button is in the Auto mode,

the receiver will transition from a 2D [3 satellite] to a 3D [4 satellite] navigation mode automatically, and use the user selected choice of a manually entered height or the last valid computed height measurement recorded to achieve a 3D navigation state.

The Unit Port Configuration button will bring up the window displayed in Figure 4. The operation of this window is described in detail in the Establishing Communications section of this manual.

The Antenna Setup button will bring up the window shown in Figure 16. This feature allows you to enter antenna specific adjustments.

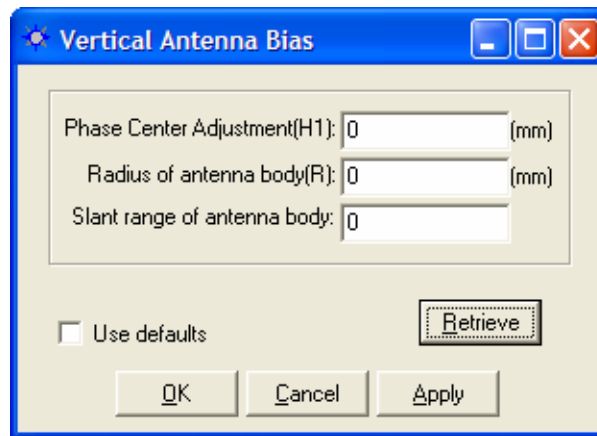


Figure 16: Vertical Antenna Bias

After entering the Antenna Bias information, you are given the option of whether or not to apply the biases to the measurements by pressing the Yes/No button adjacent to “Use Antenna Bias”.

In a small number of instances, there may be a requirement where the RTCM phase corrections are received in an “inverted” state. StarUtil will correct the sign of the corrections automatically so they may be applied without prejudice. This will be accomplished if the Invert button (see Figure 15) adjacent to RTCM 18 Phase is set to Inverted.

The Site ID field (see Figure 15) defaults to 0, which indicates that the receiver will accept RTK corrections from any base receiver that is transmitting. In order to use the RTK corrections from a specific base receiver, the Site ID field in the base and rover must be the same value. The RTCM Site ID works in similar fashion for dGPS.

Max dGPS Age and Max RTK age is a user input integer that relates to the maximum amount of time in seconds the received correction will be used in case of an outage or drop in the reception of corrections from the base.

The “Require dGPS for Solution” button allows the user to determine whether or not a position solution will be output using dGPS as a caveat. This feature is useful when only dGPS corrected position solutions are desired. The default position is set to No which indicates that all computed position solutions will be output whether differentially corrected or not.


The Navigation Mode section is where the user will Use/Ignore a specific type of dGPS correction data if available, while the RTK Correction Format section is where the user will Use/Ignore the type of RTK corrections that will be applied to the navigation solution.

The Tracking Elevation Mask selects the elevation angle the receiver starts tracking satellites. The default is set to 0 degrees and can be changed by the operator.

The GGA Option provides the end user the ability to output a GGA message that strictly conforms to the NMEA Standard v3.01 by choosing NMEA Station ID, or by choosing the NCT Station ID the end user can populate the Differential Reference Station ID field with values that will provide information pertaining to the Navigation Mode, correction signal, and correction data stream that has been applied to the position information in the GGA message. See Appendix B, Table B1 for the NCT Station ID matrix.

## NCT Operating Parameter Displays

The StarUtil program provides a list of 22 NCT binary messages can be viewed in ASCII format (see Figure 17), two of which can also be viewed in a graphical plot format. By clicking on View from the main StarUtil window, you can select a desired NCT binary message and have it displayed in a tabbed inset window of the main StarUtil window, as shown in Figure 19. This tabbed inset window can be dragged to another area of your Windows® OS desktop and act independently of the main StarUtil window as shown in Figure 19.

 *Any independently operating window may be closed without affecting the main StarUtil program, however if the main StarUtil program is closed, all open windows will be terminated.*

In order for the information in the View windows to update, the associated message must be enabled in the NCT-2100/NCT-2000 Message List, see Figure 7. The rate at which the View window data is updated will be at the output data rate chosen in the NCT-2100/NCT-2000 Message List, with the exception of the 0xB1 message. The data rate for the 0xB1 message is controlled through the Rover Navigation & Tracking window; see Figure 15.

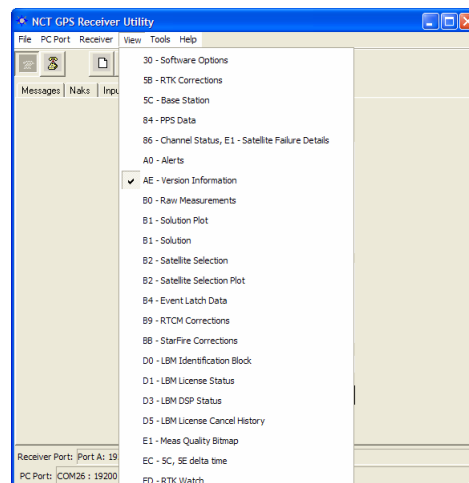


Figure 17: View NCT in ASCII Choice

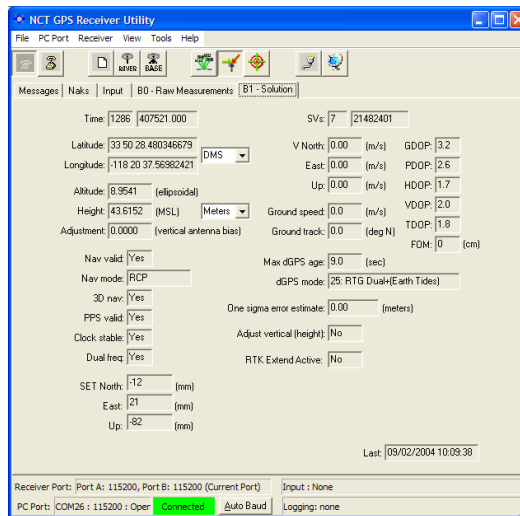


Figure 18: View of Tabbed NCT Messages in ASCII

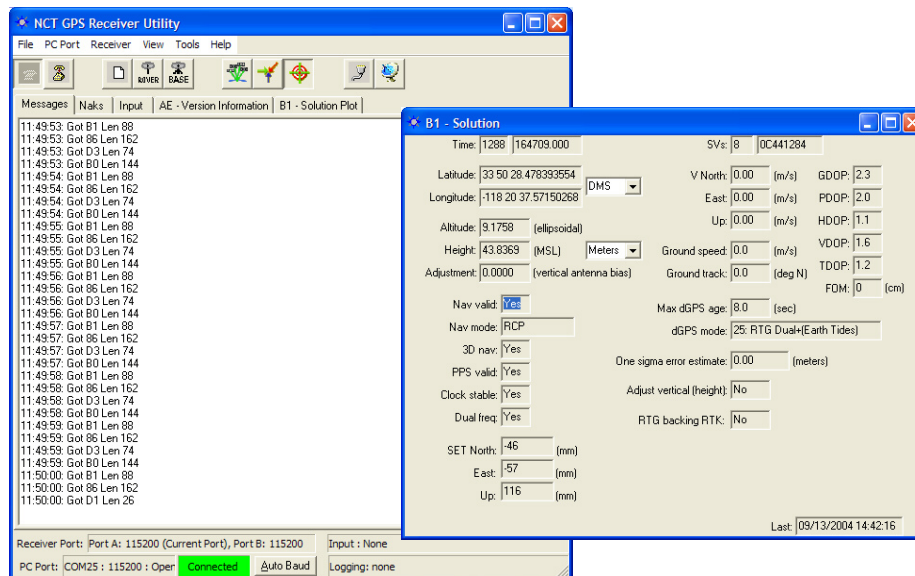


Figure 19: View of Tabbed 0xB1 in ASCII; Independent Window

Once the receiver is setup and tracking satellites, the signal characteristics of the satellites being tracked can be viewed by navigating to VIEW/86 Channel Status – E1 Satellite Failure Details. The window as shown in Figure 20 will appear.

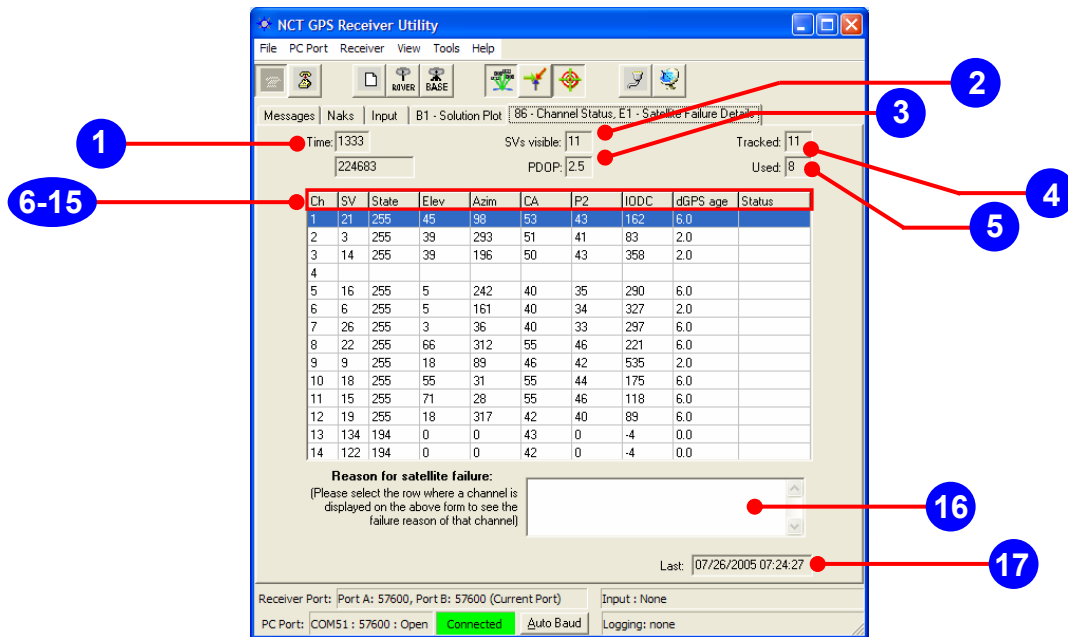


Figure 20: View of Receiver Channel Status

The Channel Status window provides the user with a powerful tool, which allows for instantaneous diagnosis of signal quality, and performance. The number of channels displayed in the 0x86 window is dependant on the model of GPS engine sensed by StarUtil. While the NCT-2100 will display 14 dual frequency channels as shown in Figure 20 (12 GPS + 2 WAAS/EGNOS), the NCT-2000 will display 12 channels of dual frequency satellite information (10 GPS + 2 WAAS/EGNOS). Below is a description of the various information found on this screen.

- 1. Time:** Top field indicates the GPS Week number; bottom field indicates GPS Seconds into the week.
- 2. SVs Visible:** The number of GPS satellites that should be visible according to the current almanac stored in NVRam.
- 3. PDOP:** Position Dilution of Precision value, which should typically be between 2 and 5 during periods of optimal performance.
- 4. Tracked:** The number of GPS satellites currently being tracked by the receiver.
- 5. Used:** Of the number being tracked, the actual number of GPS satellites currently being used in the navigation filters to determine position, velocity, and time.
- 6. Ch:** The channel number of the receiver. The number of channels noted is dependant on the type of GPS receiver. The NCT-2100 will display GPS satellites on channels 1 – 12, and WAAS/EGNOS satellites on channels 13 and 14, while The NCT-2000 will display GPS satellites on channels 1 – 10, and WAAS/EGNOS satellites on channels 11 and 12.

7. **SV:** The GPS satellite number assigned to that particular channel.
8. **State:** The NCT proprietary satellite tracking value assigned to each satellite tracked that indicates the type of tracking mode the satellite is in. This value ranges between 0 and 255, with 255 being optimal dual frequency performance. Any value other than 255 is considered to be less than optimal performance by the receiver.
9. **Elevation:** The vertical angle of the satellite off the horizon ranging from 0 degrees to a zenith of 90 degrees.
10. **Azimuth:** The horizontal angle of the satellite in reference to North ranging from 0 (360°) degrees to 359 degrees.
11. **CA:** The L1 signal-to-noise value, which will vary depending on satellite State. Optimal performance range for L1 C/N0 is 46dB to 52dB, although higher and lower values can be noted.
12. **P2:** The L2 signal-to-noise value, which will vary depending on satellite State. Optimal performance range for L2 C/N0 is 42dB to 48dB, although higher and lower values can be noted.
13. **IODC:** Issue of Data Clock, which indicates the issue number of the data as provided from the GPS satellite in accordance with ICD-200C.
14. **dGPS Age:** The age of the current aided navigation correction. This value will change depending on the correction source, and the correction interval.
15. **Status:** This is the channel tracking status of each individual channel.
16. **Satellite Failure:** Populated with information determining why a particular satellite is having difficulty being tracked or providing reliable position information.
17. **Last:** Shows the MM:DD:YY and HH:MM:SS of the last 0x86 window update.

## Chapter 4

## Base Station Setup

Throughout the first three chapters, your receiver has been navigating as an autonomous state rover. Below are several examples of how to set the receiver up to transmit RTK Extend/RTK/dGPS corrections via internal and external radios.

*RTK Extend Base Station operation can only be accomplished with a StarFire™ equipped receiver that has the software option enabled.*

### RTK/dGPS Base Using Internal Radio

Initially the user must decide several key factors:

- The Base Station Network ID; which is used as a unique Base Station identifier assuring that only corrections from said base are used if there are multiple base stations setup in radio range of the rover on the same frequency. *This ID MUST match the Rover ID!*
- The Site ID [0-1023]; which is used as a check for which Base Station site the receiver will process corrections from. This can be used when it is desirable to have multiple Base Station setups on a single Network ID, but with a separate Site ID for each base receiver.
- Power level used.
- Enable Master (Base) mode.

The Base Station Network ID is a unique value, which is “pinged” from one radio to another. Once a matching connection is established between the radio pairs, any data received will be processed and passed on. The Base Station Network ID can be located from the main StarUtil window by clicking RECEIVER\SETUP\INTERNAL RADIO\NETWORK CONFIGURATION, as seen in Figure 21.

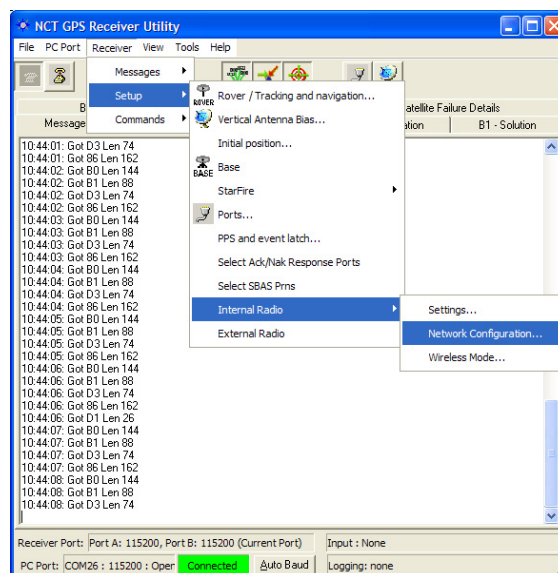


Figure 21: Network Configuration Location



Figure 22 shows the window that will appear. The Network ID can be set to any value as low as 1 and as high as 65535. The rover receiver must also be set to this value. The Local Radio/Unit ID is the serial number of the NCT2100/NCT-2000 GPS Engine. Clicking “Apply” sends the changes to the receiver, and “Retrieve” confirms those changes, thus ensuring a unique hardware identifier.

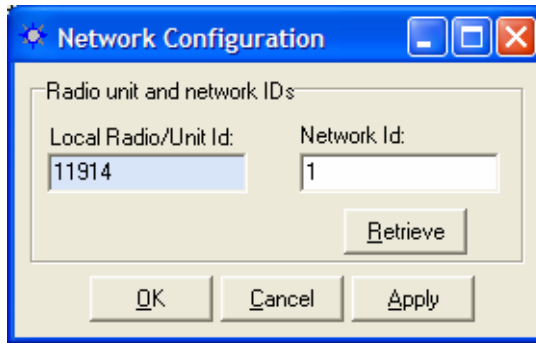


Figure 22: Network Configuration

Press the Base Icon on the StarUtil main window, and Base Configuration window shown in Figure 23 will appear. This window is where the majority of controls are that will enable the receiver to operate as a Base Station.

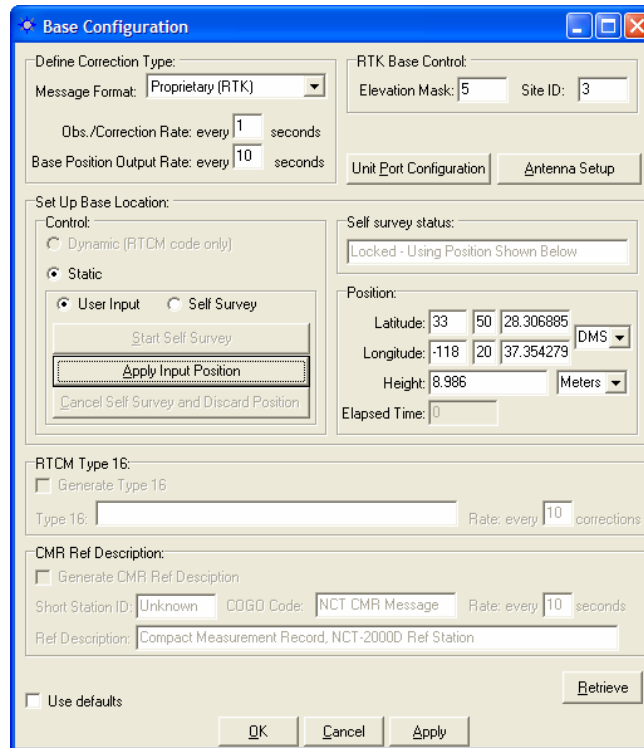


Figure 23: Base Configuration Window

In the Define Correction Type area of Figure 23, you will choose the corrections that are required for output, the Correction Output Rate, and the Base Position Output Rate. In this instance you will choose Proprietary RTK. Figure 24 shows the available correction types the receiver can transmit.

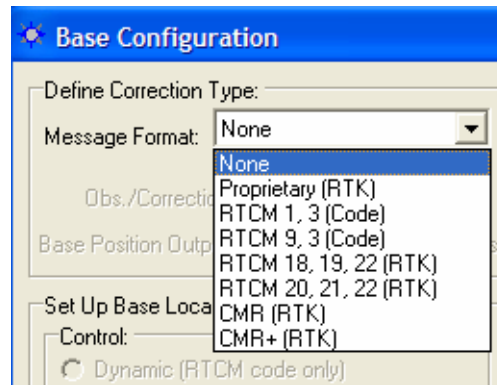


Figure 24: Output Correction Types

In the RTK Base Control area of this window you will choose an Elevation Mask, and a Base Station Site ID. The Unit Port Configuration button in this screen brings up the window described in Chapter 2 Figure 4 set to the default parameters, and the Antenna Setup button brings up the window described in Chapter 3 Figure 16.

The Setup Base Location area of the Base Configuration window allows the user to manually enter a Base position, for which corrections will be generated, or have the receiver automatically generate a position relative to phase positions collected and averaged over a period of time. Figure 25 & 26 show what this area will look like when “User Input” or “Self Survey” is enabled.

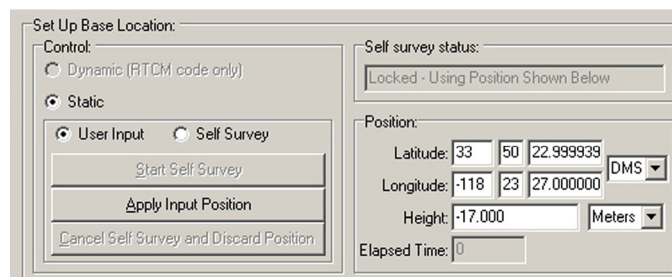


Figure 25: Setup Base Location; User Input

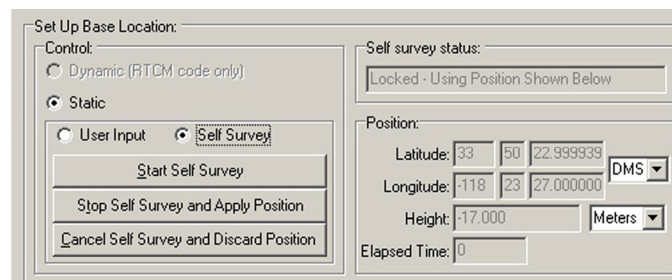


Figure 26: Setup Base Location; Self-Survey

The user must enter a Base Location through one of the modes described before output of valid corrections can commence.

Since in this example we are taking advantage of the on board radio, we need to setup the power output, and set up the receiver to the Master (Base) mode of operation. Clicking on RECEIVER\SETUP\INTERNAL RADIO\SETTINGS accesses both of these commands, as shown in Figure 27.

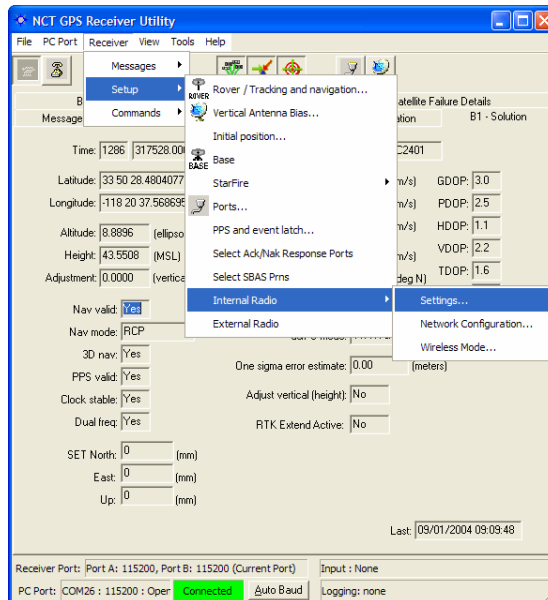


Figure 27: Internal Radio Settings Location

After choosing Settings, the window in Figure 28 will appear allowing the user to change a variety of internal radio parameters. Typically it is unnecessary to change 99% of these options. There are only two that are of major concern at this point, Operation Mode and Power Level.

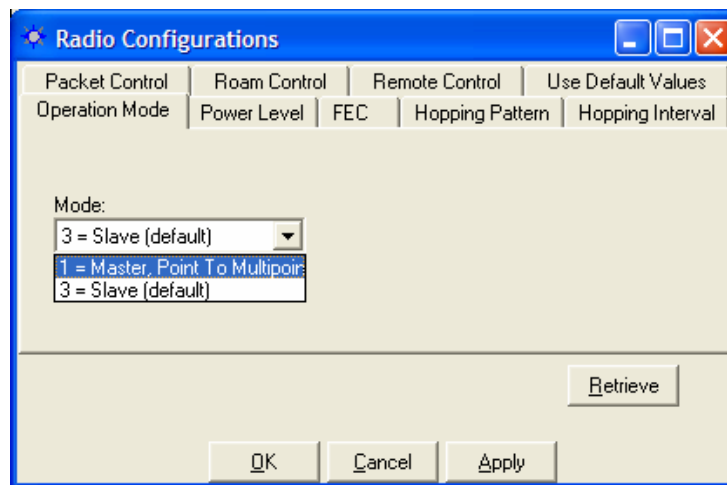


Figure 28: Radio Configuration; Operation Mode

In order to change the Operation Mode from Slave (Rover Default) to Master (Base), select Master in the Mode pull down menu as seen in Figure 28. Click on the Power Level Tab in this window, and the display will resemble Figure 29. Choose the appropriate power level required to reach the Rover receiver.

*Please note that the maximum allowable power setting is controlled by NavCom Technology, Inc. as per United States of America FCC regulations.*

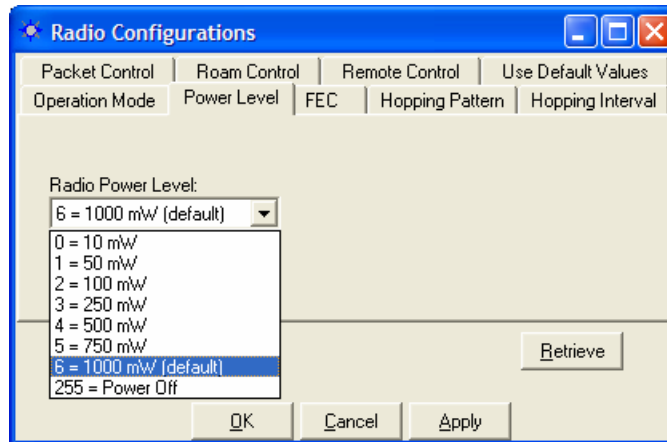


Figure 29: Radio Configuration; Power Level

Now that the unit is configured to output the corrections, the output port for those corrections must be chosen. In this example we are utilizing the internal radio, so we must choose the NCT RTK port as Port Radio as shown in Figure 30. However, the corrections can be simultaneously sent to any of the logical ports, and also the internal MMC Memory Module for logging.

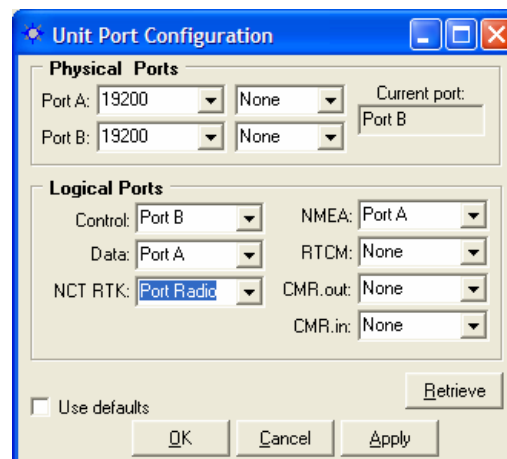


Figure 30: Corrections Output to Internal Radio Port Configuration

RTCM, CMR+, and CMR Base Stations are setup in the same manner as the Proprietary RTK output. After choosing your dGPS format, the appropriate areas of the Base Configuration window will become active. As with the example above, provide the necessary information, and click "Apply" or "OK" to have your changes preserved in the receiver. In the Unit Port Configuration window in Figure 30, choose the port the dGPS corrections will be output to.

---

## RTK Extend/RTK/dGPS Base Using External Radio

Setup the external radio in compliance with the documentation received with the radio. You should know the baud rate of the radio, and the transmission protocols before connecting the GPS receiver's data output to the radio.

Press the Base Icon on the StarUtil main window, and Figure 23 will appear. This is the Base Configuration window, where the majority of controls are that will enable the receiver to operate as a Base Station.

In the Define Correction Type area of Figure 23, you will choose the corrections that are required for output, the Correction Output Rate, and the Base Position Output Rate. In this instance you will choose Proprietary RTK. Figure 24 shows the available correction types the receiver can output.

In the RTK Base Control area of this window you will choose an Elevation Mask, and a Base Station Site ID. The Unit Port Configuration button brings up the window described in Chapter 2 Figure 4, and Antenna Setup brings up the window described in Chapter 3 Figure 16. The Unit Port Configuration window may open set to the default parameters. At this point you should direct the NCT RTK corrections to an external port for output. If the NCT RTK port is not set to A or B [any port other than the Control Port, Port Radio, or NONE], change the NCT RTK port to the opposite of the Control Port, i.e. Control is B (default) then NCT RTK will be A, and press "Apply". Connect the output port cable to the external radio; you should now have corrections sent out over the external radio link.

The Setup Base Location area of the Base Configuration window allows the user to manually enter a Base position, for which corrections will be generated, or have the receiver automatically generate a position relative to phase positions collected and averaged over a period of time. Figure 25 & 26 shows what this area will look like when User Input or Self Survey is enabled. The user must enter a Base Location through one of the modes described so the output of valid corrections can commence.

RTCM, CMR+, and CMR Base Stations are setup in the same manner as the Proprietary RTK output. After choosing your dGPS format, the appropriate areas of the Base Configuration window will become active. As with the example above, provide the necessary information, and click "Apply" or "OK" to have your changes preserved in the receiver. An additional step is required to output these formats; in the Unit Port Configuration window in Figure 30, the user must choose the port the dGPS corrections will be output to.

**RTK Extend Users:**

An additional message must be transmitted over your external radio link in order to enable the RTK Extend feature in the Rover. Follow the procedure in Chapter 3 Navigation & Data Output Configuration, to enable the 0x5D message. The 5D message rate should be "On Change", and the Output port will be the same as is configured for the 0x5B and 0x5C messages. Figures 6 – 10 detail just how to accomplish this. After completing all actions, your NCT Messages window will appear as shown in Figure 31.

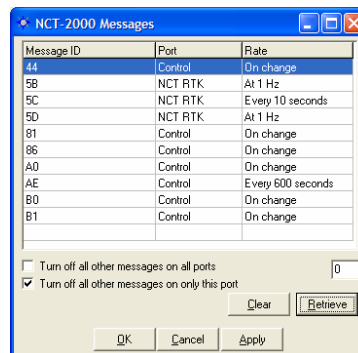


Figure 31: RTK Base Message Output List

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## Chapter 5

## RTK Extend / RTK / dGPS / SBAS Rover Setup

Depending on the options you have purchased, the receiver can use any one of the various correction sources available as detailed in the Rover Operating Mode section of this manual. Below are several examples of how to set the rover receiver up to accept RTK/dGPS corrections:

---

### RTK/dGPS Rover Internal Radio Setup

The internal radios for the Rover are setup similarly to the Base setup, except for a few Rover specific choices that are required. All of the same menu items used to configure the Base Radio will be used to configure the Rover.

Initially the user must decide several key factors:

- The Base Station Network ID; which is used as a unique Base Station identifier assuring that only corrections from said base are used if there are multiple base stations setup in radio range of the rover on the same frequency. *This ID MUST match the Base ID!*
- The Site ID [0-1023]; which is used as a check for which Base Station site the receiver will process corrections from. This can be used when it is desirable to have multiple Base Station setups on a single Network ID, but with a separate Site ID for each base receiver. A "0" entered in this field denotes that any Base Station corrections received on the Network ID chosen will be used.
- Power level used.
- Enable Slave (Rover) mode.

The Rover Network ID is a unique value, which is "pinged" from one radio to another. Once a matching connection is established between the radio pairs, any data received will be processed. The Rover Network ID can be located from the main StarUtil window by clicking RECEIVER\SETUP\INTERNAL RADIO\NETWORK CONFIGURATION, as seen in Figure 21.

After choosing Settings, the window in Figure 28 will appear allowing the user to change a variety of internal radio parameters. Typically it is unnecessary to change 99% of these options. There are only two that are of major concern at this point, Operation Mode and Power Level.

Change the Operation Mode to "Slave" (Rover) as seen in Figure 28. Click on the Power Level Tab in this window, and the display will resemble Figure 29. Choose the appropriate power level required; typically this will match the Base power level.

---

### NCT RTK Extend Input

 *This example assumes the receiver has been setup in compliance with Chapters 2 & 3, and a correction source has been established in compliance with Chapter 4.*

RTK Extend is a feature that allows your RTK-optional StarFire™ receiver to coast on a StarFire™ solution maintaining centimeter level integrity. When the RTK link becomes unstable the mode transitions smoothly to RTK Extend rather than dropping out of RTK and reverting to a multi-meter level position fixes. This feature requires that the RTK option be purchased for the StarFire™ receiver

Base & Rover pair for optimal performance, and also requires an external RTK link be established. RTK Extend is only available in NavCom Technology receivers that are StarFire™ capable. To learn more about RTK Extend follow this link: <http://www.navcomtech.com/products/rtkextend.cfm>

To enable RTK Extend in the Rover receiver, go to the Rover Navigation & Tracking window shown in Figure 15; in the RTK Corrections Format area click the “USE” button adjacent to RTK (5B, 5C, 5E). Then click the “USE” button adjacent to RTG Input. Click “Apply” and then “Retrieve” to ensure your choices have been saved at the receiver.

Ensure that an input port for your RTK Extend corrections has been established in the Unit Ports Configuration window as shown in Figure 30.

Once the corrections have been successfully received and applied, the resulting RTK Extend Navigation indicators can be viewed in the dGPS Mode area of the B1 Solution display shown in Figure 18.

---

## NCT RTK Input

 *This example assumes the receiver has been setup in compliance with Chapters 2 & 3, and a correction source has been established in compliance with Chapter 4.*

Go to the Rover Navigation & Tracking window shown in Figure 15; in the RTK Corrections Format area click the “USE” button adjacent to RTK (5B, 5C, 5E). Click “Apply” and then “Retrieve” to ensure your choices have been saved at the receiver.

Ensure that an input port for your corrections has been established in the Unit Ports Configuration window as shown in Figure 30.

Once the corrections have been successfully received and applied, the resulting RTK Navigation indicators can be viewed in the dGPS Mode area of the B1 Solution display shown in Figure 18.

---

## RTCM RTK Input

 *This example assumes the receiver has been setup in compliance with Chapters 2 & 3, and a correction source has been established in compliance with Chapter 4.*

Go to the Rover Navigation & Tracking window shown in Figure 15; in the RTK Corrections Format area click the “USE” button adjacent to RTCM RTK. Click “Apply” and then “Retrieve” to ensure your choices have been saved at the receiver.

Ensure that an input port for your corrections has been established in the Unit Ports Configuration window as shown in Figure 30.

Once the corrections have been successfully received and applied, the resulting RTK Navigation indicators can be viewed in the dGPS Mode area of the B1 Solution display shown in Figure 18.

---


## CMR+/CMR RTK Input

 *This example assumes the receiver has been setup in compliance with Chapters 2 & 3, and a correction source has been established in compliance with Chapter 4.*

Go to the Rover Navigation & Tracking window shown in Figure 15; in the dGPS Corrections area click the “USE” button adjacent to CMR Input. *Enabling CMR input will allow CMR+ or CMR corrections to be applied.* Click “Apply” and then “Retrieve” to ensure your choices have been saved at the receiver.

Ensure that an input port for your corrections has been established in the Unit Ports Configuration window as shown in Figure 30.

Once the corrections have been successfully received and applied, the resulting RTK Navigation indicators can be viewed in the dGPS Mode area of the B1 Solution display shown in Figure 18.

 *In all of the above examples if an external radio is used, connect the data cable from the GPS receiver’s Data Port to the data port of the radio. Depending on the radio’s output port configuration, a null modem may be required.*

## SBAS

### StarFire™

The StarFire™ corrections are automatically applied to the position solution when the “USE” button adjacent to RTG Input or WCT Input is chosen in the Rover Navigation & Tracking window, see Figure 15.

### WAAS/EGNOS

The WAAS/EGNOS corrections are automatically applied to the measurements when the “USE” button adjacent to WAAS/EGNOS is chosen in the Rover Navigation & Tracking window see Figure 15.

A new feature has been added that will allow the user to choose the L1 SBAS satellite PRN that corrections will be received from, or allow the receiver to choose for you. The window in Figure 32 can be accessed by clicking RECEIVER\SETUP\SELECT SBAS PRNS.

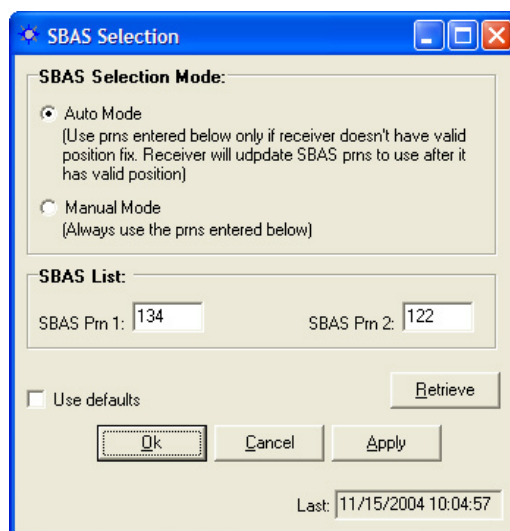


Figure 32: L1 SBAS Selection Window



## Chapter 6

## NMEA Setup and Output

The receiver has the ability to output 9 industry standard NMEA data strings, and 1 NCT Proprietary NMEA type string. To view the available NMEA messages, and enable them for output go to the main StarUtil menu bar and click on RECEIVER\MESSAGES\NMEA OUTPUT as shown in Figure 33 below.

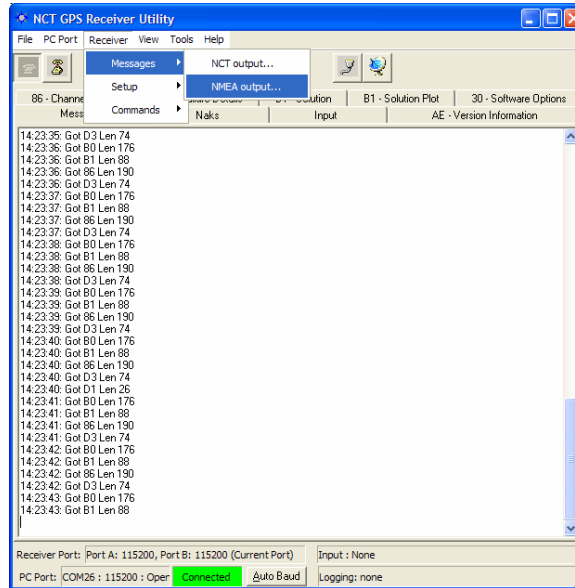


Figure 33: NMEA Output Menu Location

Clicking on NMEA Output will bring up the NMEA Messages window seen in Figure 34. The operation of this window is similar to that of the NCT Messages screen as messages can be enabled for output, and scheduled at a user variable rate. However, the output port for NMEA is chosen from the Unit Port Configuration window seen in Figure 30.

- The NMEA messages GGA, RMC, & VTG follow the output of the Navigation Rate up to 10 HZ max, when NMEA output rate "On Change" is selected for these messages. Click on the Rover icon, and then choose a Navigation Rate from the pop-up window. **Receiver must be optioned for multi-hertz Navigation Rate to achieve multi-hertz NMEA output.***

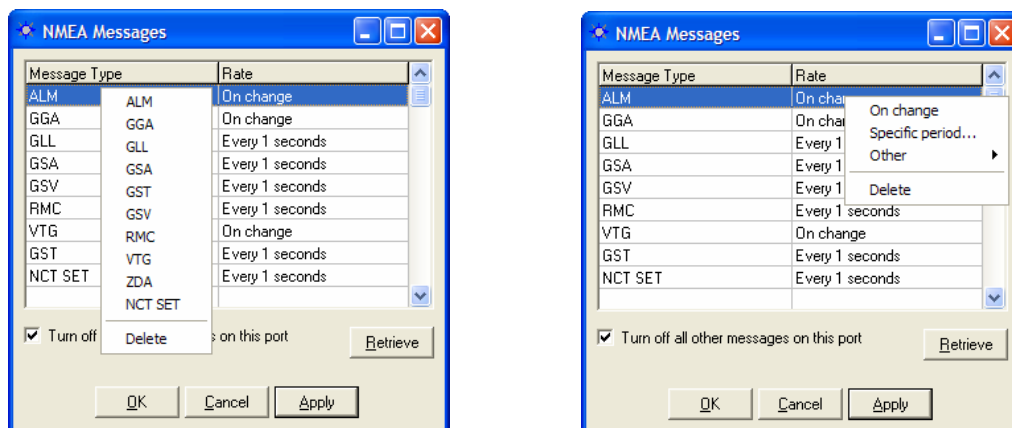


Figure 34: NMEA Message Choices & Data Rate

- NMEA messages cannot be output on the same port that is used for Control.*

NMEA can be logged and/or viewed using the NMEA Viewer window, although any ASCII RS232 port viewer will suffice. This allows the user a convenient place to monitor the NMEA output. To get to the NMEA Viewer window, from the main StarUtil menu click on TOOLS\NMEA VIEWER as shown in Figure 35.

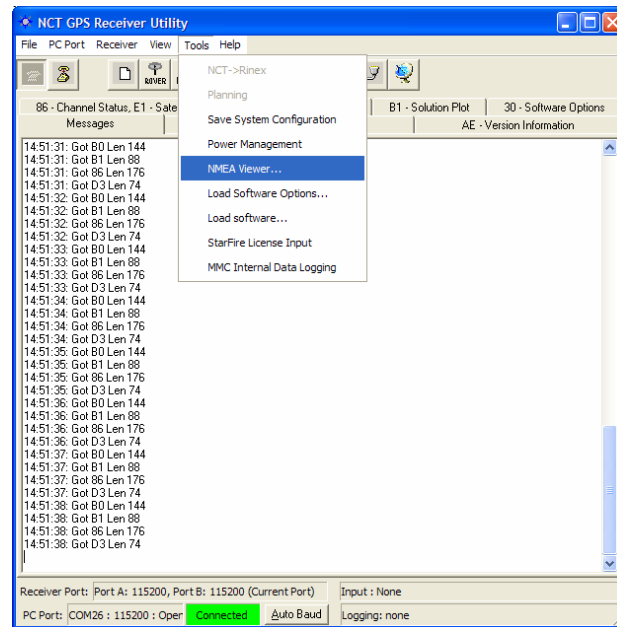


Figure 35: NMEA Viewer Menu Location

Figure 36 shows what a typical NMEA data output would look like in the viewer. The NMEA Viewer contains a Browse button so data can be logged to any media device that can communicate with the data port.

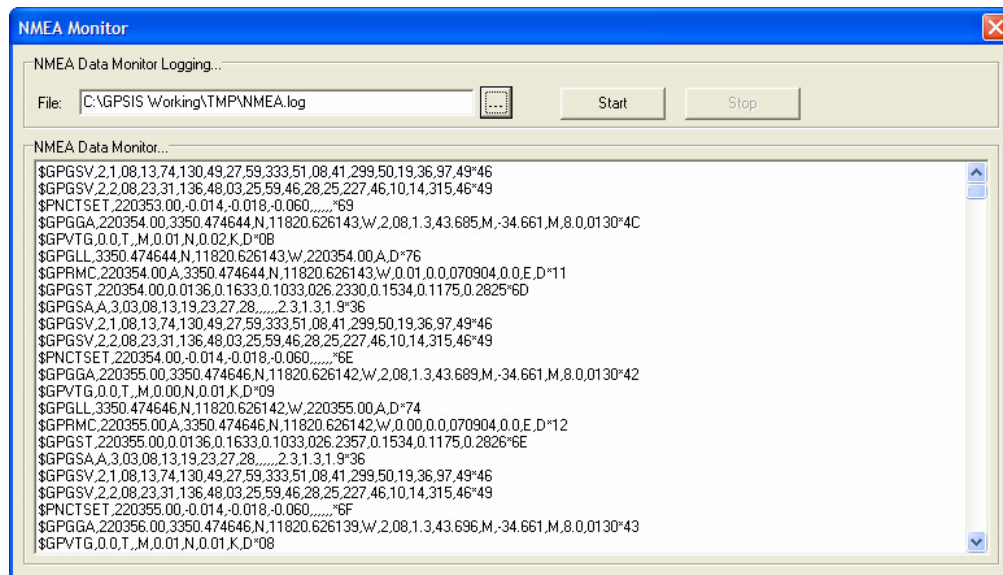


Figure 36: NMEA Viewer & Data Logging

A second instance of StarUtil must be run, and connected to the Data Port in order for the NMEA Viewer to display the NMEA data messages.

## NMEA GGA Station ID Field 14

The NMEA GGA message field 14 is now user configurable and can display information that strictly conforms to the NMEA 3.01 Standard or the receiver’s Navigation Mode. The Navigation Mode information will be the same as contained in Word 22 of the binary B1 output message. A break down of field 14 contents as it relates to the Navigation Mode information can be found in Appendix B of this user guide. Information on the NMEA Standard can be found in the official NMEA 3.01 Standard Manual.

To choose the contents of field 14 of the GGA message, click on the ROVER icon on the StarUtil icon bar. The window shown in Figure 15 will appear. In the lower right portion of the window you will see GGA Option as shown in Figure 37. NMEA Station ID conforms to the NMEA 3.01 Standard, while NCT Station ID conforms to Appendix B of this user guide. Choose your option from the pull down menu, and press “OK” or “Apply” to save your choice to the receiver’s memory.

- ☐ *The default option for this feature is to comply with the NMEA 3.01 Standard, which is NMEA Station ID.*

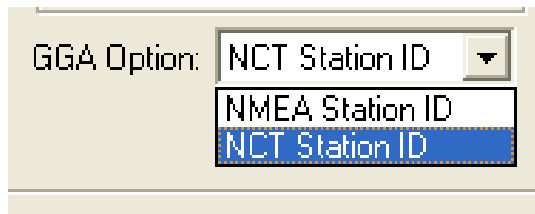


Figure 37: NMEA GGA Field 14 Option

## Chapter 7

## Data Logging

Data can be logged from either of the physical ports, or to the on board 64 Megabyte Memory Module Card (MMC). This data can be used in a number of industry standard GPS data analysis programs either in NCT Binary format, after being converted to RINEX format, or by using the NMEA output.

### External NCT Binary Logging

Once the receiver is setup and navigating to your specifications, go to the main StarUtil menu and click FILE\LOG DATA TO FILE as shown in Figure 38.

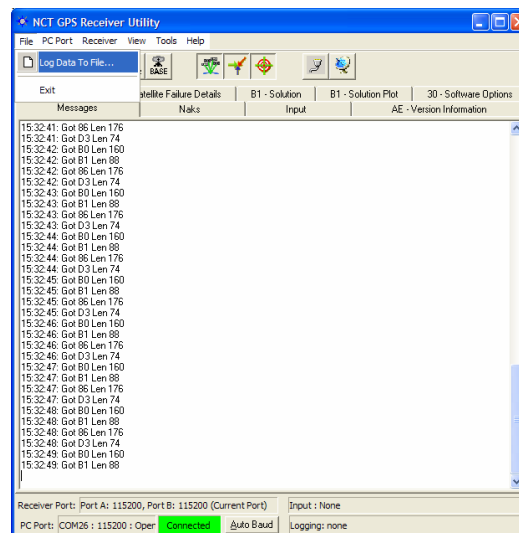


Figure 38: NCT External Logging Menu Location

Once you click on this item, the window in Figure 39 will appear. This window not only allows for immediate data logging, but also allows for automatic 24-hour data file splits.

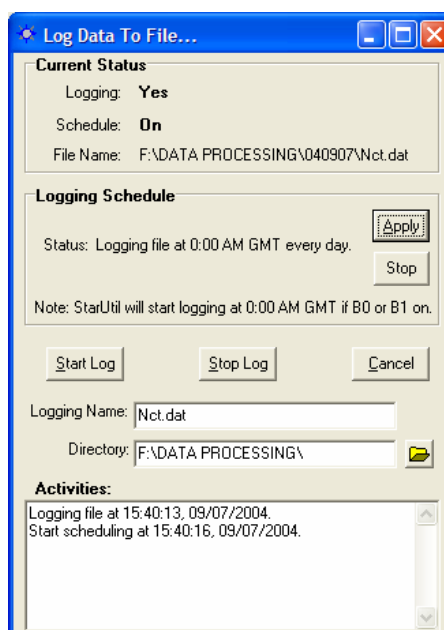


Figure 39: External Logging Setup

The Current Status area lets the user know if logging is enabled, if the scheduler [24-hour splits] is enabled, and the path to the logging data.

Clicking the “Apply” button the Logging Schedule area will enable the scheduling of the 24-hour data file splits. These file splits restart at 00:00:00 GMT, and create a new folder name at each 24-hour period.

A logging name must be provided before logging can commence, NCT.dat is a default name that will appear whenever logging is initiated.

Logging cannot start without a Directory path being assigned. StarUtil will create a folder under the Directory path chosen named in the yymmdd format; i.e. if your Directory path chosen is d:\NavComWorking\Data, the true path to your data will be d:\NavComWorking\Data\yymmdd.

The activities area is to inform the user of what processes have taken place in the logging area.

*Almanac & Ephemeris data currently in the receiver’s NVRam is automatically downloaded to the data file when logging is initiated, regardless of whether the Almanac & Ephemeris messages are scheduled in the NCT Output Messages list shown in Figure 7.*

### Internal NCT Binary Logging

Logging internally is accomplished through an onboard 64MB Memory Module Card (MMC). Scheduling of NCT binary message to be logged is done through the NCT-2100/NCT-2000 Message window as shown in Figure 7. Since StarUtil’s GUI is driven from the NCT Messages list, it is recommended that a separate instance of each message required for internal logging be enable.

Choose the messages for internal logging as shown in Figure 40. Alternately, pressing the “Schedule Default Messages” button shown in Figure 42 will add a set of commonly used messages to the NCT Output list directed to the LOG Port as shown in Figure 40. In order to log data internally, the LOG port must be chosen in the Ports field for any given message as shown in Figure 40. A default data rate of On Change or 1 Hz will be assigned.

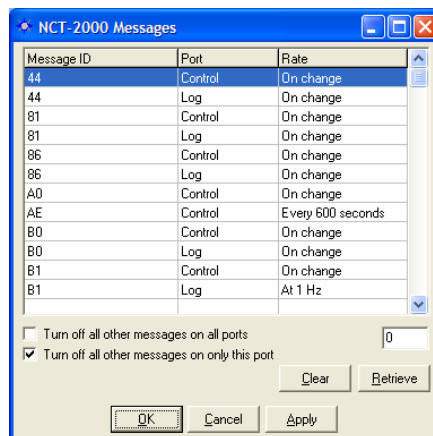


Figure 40: MMC Internal Logging Port Selection

*Although the Data Rate field for the LOG Port will indicate a choice of multi-hertz rates, the internal MMC logging is limited to On Change & 1 Hz data rates.*

Once the messages have been scheduled to the Log Port, open up the MMC window by going to the main StarUtil menu and clicking on TOOLS\MMC INTERNAL DATA LOGGING as shown in Figure 41.

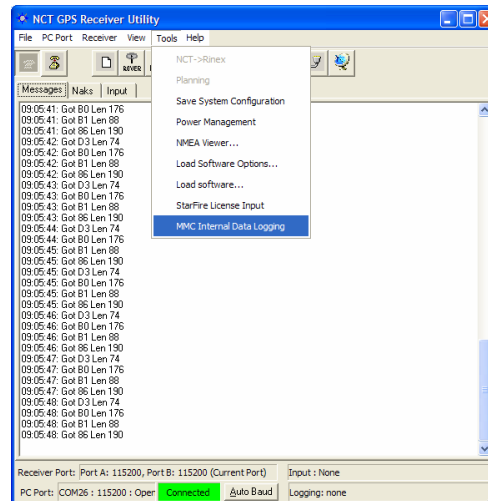


Figure 41: MMC Internal Logging Control Location

This will bring up the window in Figure 42. From here you will be able to initiate internal logging, download, format the memory module, sort the files directory, delete files, and more. A status bar at the bottom of this window allows the user to see how much space has been used and the total memory size available. The number of files on the disk, and how much space they occupy, and the date & clock information are also here.

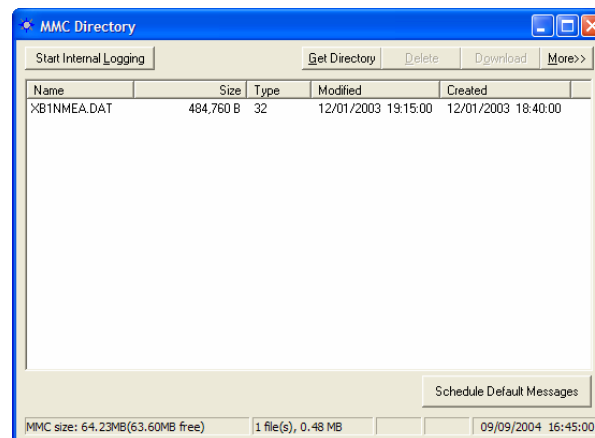


Figure 42: MMC Internal Data Logging

If internal logging is enabled and power is turned off, internal logging will resume on power up creating a new filename with an extension of .001. A new file will be generated and the extension value incremented for each power off-on cycle, if logging has not manually been stopped by the end user.

With this feature the user can initiate the logging parameters at the office, and start the logging process. Then power off the receiver and move it to a remote location. As soon as power is applied to the receiver and it initializes, internal data logging will begin. This allows the user to collect data without having an external data collection device connected.

If you have never used the internal logging feature, the MMC must be formatted. Click on the More button shown in Figure 42, and then click the Format MMC menu item as shown in Figure 43.

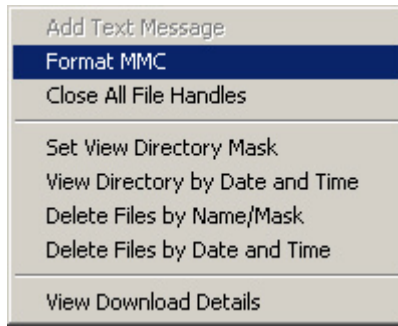


Figure 43: More Button Choices

A Warning window will appear giving you the opportunity to opt-out of the formatting process. Pressing Yes will bring up the Format MMC Label window shown in Figure 44 asking to label the MMC; a suggestion would be to enter the serial number of your GPS receiver here although any name or none would do.

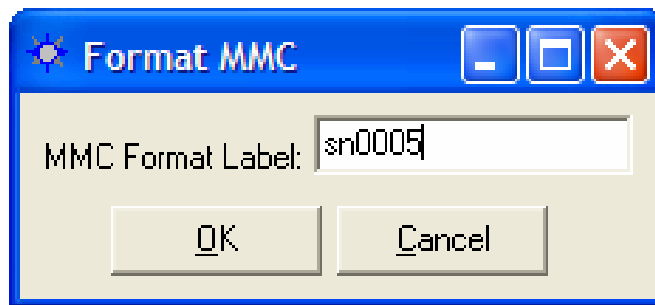


Figure 44: MMC Format Label

To start logging click the Start Internal Logging button shown in Figure 39. This will bring up the window shown in Figure 45.

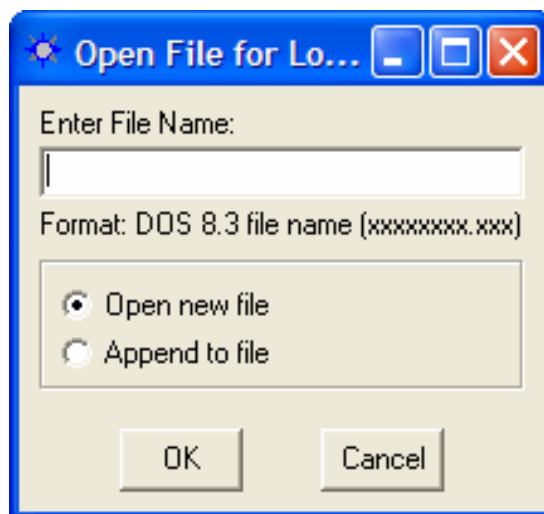


Figure 45: MMC Open File for Logging

Enter the logging filename in MS-DOS 8.3 format. Once logging has begun, the Start Internal Logging button shown in Figure 42 transforms into the Close Internal Logging button. When logging is complete click on the Close Internal Logging button, it will again become the Start Internal Logging button.

The directory information in the MMC window does not auto-update. In order to see the current file information you must click the Get Directory button.

To download the data file, click on the filename. If attempting to download a file from Com2 of the receiver you will get the information dialog box shown in Figure 46. Typically this will occur only if Com2 is chosen as the Control Port. Although operation and configuration of the MMC can be accomplished through either Com1 or Com2, the download process can only be done via Com1. If you receive this dialog, 1) ensure a connection to Com1 (via Control Port), 2) remove the Limo connector from Com2 and place it in Com1, 3) repeat the download process.

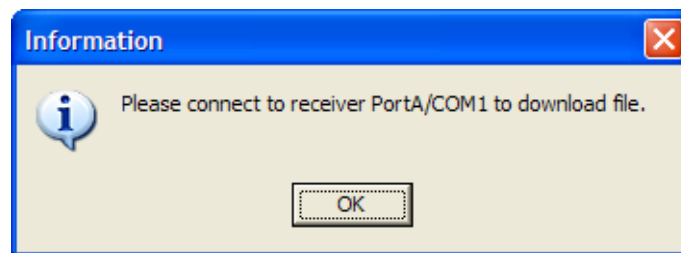


Figure 46: MMC Download Dialog

The Delete and Download buttons will become accessible. Click the Download button and a Save As window will appear allowing you to browse for a download location. Once the path has been established, the download progress window will appear as in Figure 47.

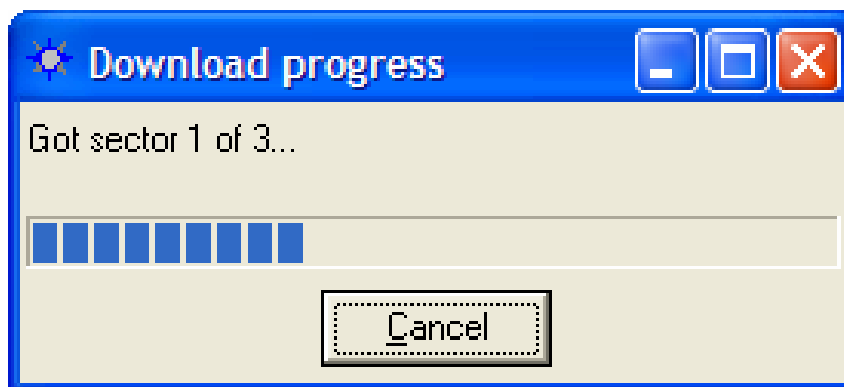


Figure 47: MMC Download Progress Bar



## Chapter 8

## StarFire™ Specific Operation

There are several StarUtil menu options that are specific only to StarFire™ enabled receivers. These options provide the user with the ability to use an alternate frequency to receive StarFire™ corrections in the event the main channel is down for routine maintenance, or commence centimeter level accuracy within a minute rather than 30 minutes. These features can be accessed from the main StarUtil window by clicking RECEIVER\SETUP\STARFIRE as shown in Figure 48.

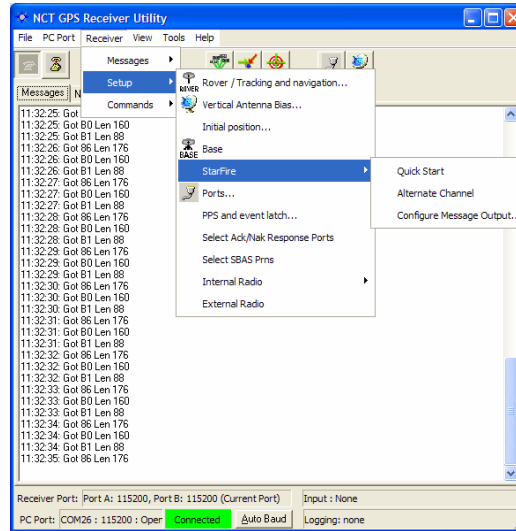


Figure 48: StarFire™ Specific Menu

### Configure LBM Message Output

The window shown in Figure 49 allows the user the flexibility of outputting information pertinent to the StarFire™ L-Band Module (LBM). Messages can be scheduled for output in similar fashion to the NCT Message Output List as seen in Chapter 3 Navigation & Data Output Configuration Figure 7.

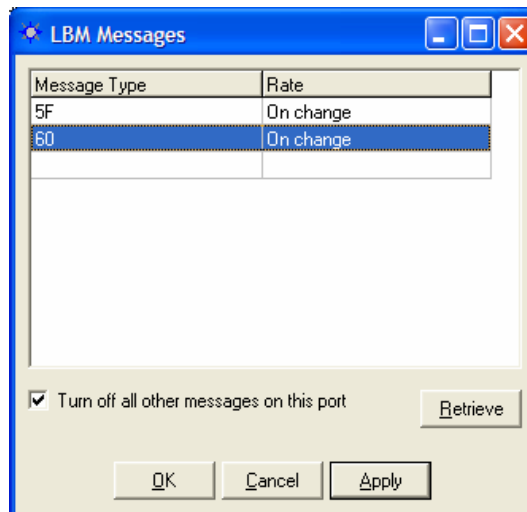


Figure 49: LBM Output Message List

## Alternate Channel & StarFire™ Frequencies

Figure 50 allows the end user to assign an alternate StarFire™ frequency for reception of StarFire™ corrections via the LBM. Its main use is to force a unit to start using a particular frequency so that it does not have to go through the frequency table to search for the StarFire™ signal. This is useful during periods of routine maintenance on the StarFire™ Network. Once the Alternate Channel value has been entered, the user has the option whether or not to actually use the Alternate Channel.

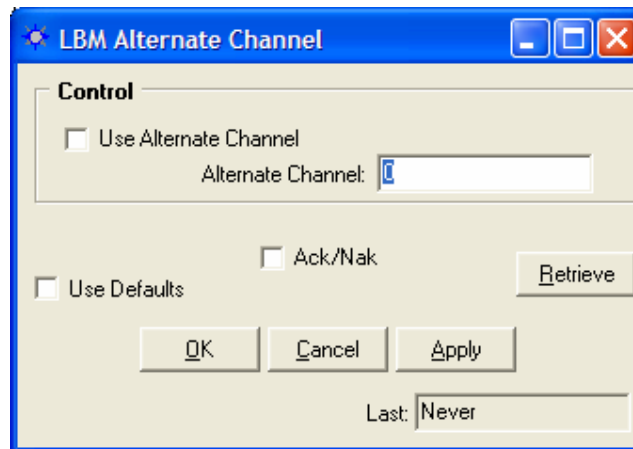


Figure 50: LBM Alternate Channel

Figure 51 allows the end user to view information about the StarFire™ signal and channel being used. The “Last” field contains date and time information pertaining to the most recent update of the information in this window. The SF Channel Number is relevant to just which channel the receiver is using for StarFire™ corrections. This channel number is uniquely associated with a particular Inmarsat satellite; thus in the illustration of Figure 51 channel 41090 is being tracked by the receiver. Table 2 details the frequency values you should see in the SF Channel Number field and the Inmarsat satellite associated with that particular number.

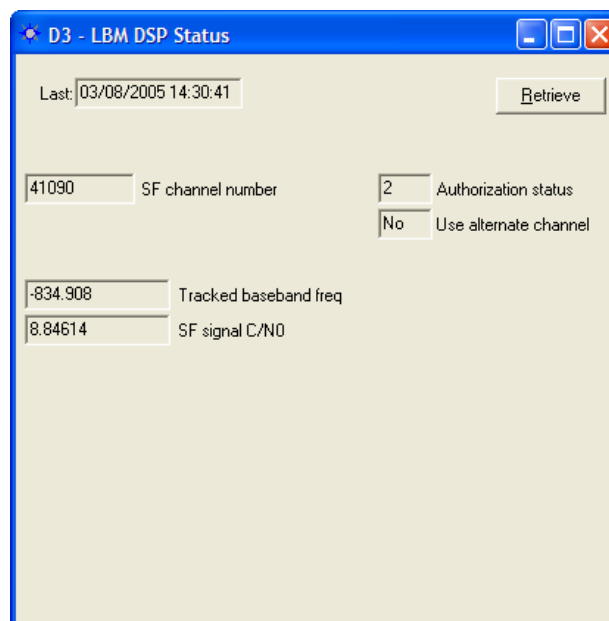


Figure 51: LBM Frequency & Channel Status

INMARSAT Americas	41090
INMARSAT EAME	41080
INMARSAT ASPAC	41090

Table 2: StarFire™ Channel Numbers and Satellites

The Tracked Baseband Frequency should be a value between -5000 and +5000 for optimal performance. This frequency value should be relatively stable when locked on to the StarFire™ signal. The StarFire™ Signal C/N0 value should be ~10 for optimal performance, a value of 4 is considered good while less than 4 is marginal to bad reception.

## QuickStart

This function allows the StarFire™ RTG navigation solution to be initialized to an accurately known ITRF00 position and therefore eliminate lengthy pull-in times. This is typically a position previously surveyed and converted to ITRF00 prior to initialization. NCT Binary message 0x42 allows an external controller to initiate a QuickStart based on a known position, and to monitor the progress and status of the QuickStart operation. Figure 52 shows the QuickStart Initialization window.

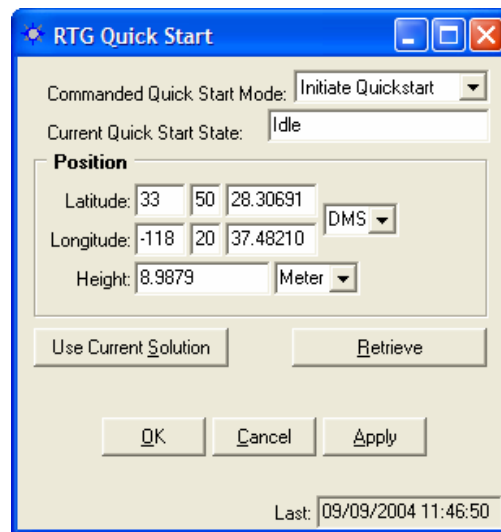



Figure 52: RTG QuickStart Initialization

The QuickStart process goes through the following modes:

1. **Idle:** Following power-on and prior to any QuickStart having been requested, the QuickStart mode is reported as 'Idle'. Once a QuickStart has been initiated, the 'Idle' mode will not be reported again until one of the following occurs.
  - a. Power is cycled on the unit.
  - b. A QuickStart 'Idle' has been requested. If a QuickStart has been initiated and is still in progress, this will cancel it but not reset RTG navigation. This may result in only partial completion of the operation. If the reported QuickStart mode indicates

successful completion or proximity failure, this request will return the reported QuickStart mode to 'Idle'.

- c. A QuickStart 'reset' request has been requested. This causes a restart of the entire RTG navigation mode with no a-priori position information i.e. full pull-in duration.
2. **Initiated:** This mode is reported after a QuickStart initiation request has been received but before the QuickStart operation has actually started. The QuickStart operation will not begin until RTG navigation commences. This requires **at least five satellites each with full dual frequency tracking and at least 10 seconds of code-carrier smoothing**. If, for example, a QuickStart initiation request is given shortly after power-on, it may be a few minutes before these conditions are met. During this period, the reported QuickStart mode would be 'Initiated'.
3. **In Progress:** This mode is reported after a QuickStart has actually commenced up until the time that either the operation completes or fails or until an 'Idle' or 'Reset' request are received.
4. **Completed:** This mode is reported when a QuickStart operation has completed successfully. It takes 50 seconds from the time the QuickStart first begins (In Progress reported) until successful completion is reported.
5. **Failed Proximity Limit:** While a QuickStart operation is in progress, a check is performed at each 1Hz navigation epoch, which compares the 3D radial distance between the RTG code solution and the 'known' position input with the QuickStart initiation request. If this distance exceeds 25 meters on the first QuickStart epoch, or 15 meters on any of the subsequent epochs in the 50 second period, the QuickStart is terminated, RTG navigation is reset (full pull-in required), and the QuickStart mode is reported as 'Failed Proximity Limit'. The RTG code solution is the weighted least squares navigation solution performed with smoothed code (could be single or dual frequency depending on prefilter status) and RTG clock and orbit corrections. It is independent from the full RTG solution, which uses the phase biases, estimated by the RTG extended Kalman filter. It is the latter, which is initialized by a QuickStart operation.

 *For example, vehicular installations can be initialized using the last position from when it was parked and powered down.*

## StarFire™ License Installation Using StarUtil

The StarFire™ Network is a subscriber service, and each StarFire™ equipped receiver must have a license issued for a certain period of time. When this license expires, a new one must be purchased and uploaded into the receiver. To upload a new StarFire™ license using StarUtil, from the main StarUtil menu go to TOOLS\STARFIRE LICENSE INPUT as seen in Figure 53.

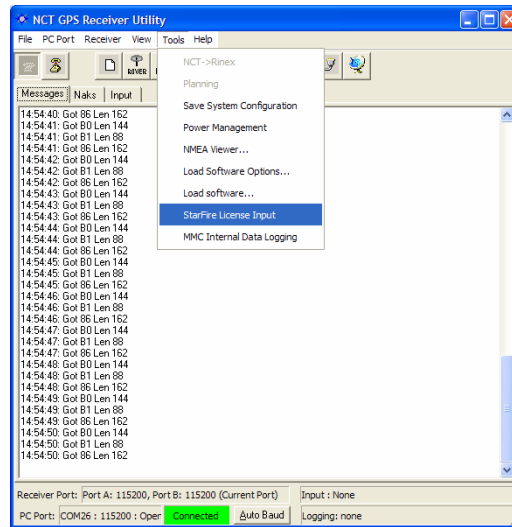


Figure 53: StarFire™ License Upload Location

After executing this menu item, the LBM License Upload window seen in Figure 54 will appear.

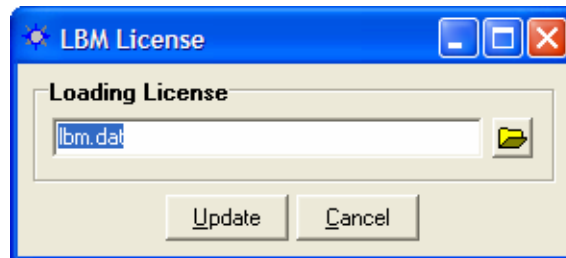


Figure 54: LBM License Upload

Using the browse button, path your way to the location of the new StarFire™ License file, then click Update. You will be informed via a new window if the upload was successful.

## Chapter 9

## 1PPS/Events

The 1 PPS output pulse output from the receiver is synchronized with GPS time, and is shaped as described in Words 1 through 6 of NCT Binary Message 0x16. To get to the control window, from the main StarUtil window click RECEIVER\SETUP\PPS AND EVENT LATCH as shown in Figure 55.

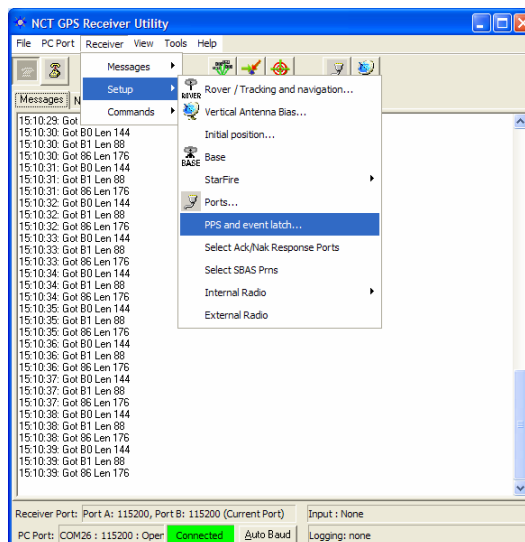


Figure 55: 1 PPS & Events Location

Once here you can shape the characteristics of the 1 PPS pulse to suit your application requirements, see Figure 56. The user allowable adjustment limits of the pulse are shown below and detailed in the Technical Reference Manual (TRM).

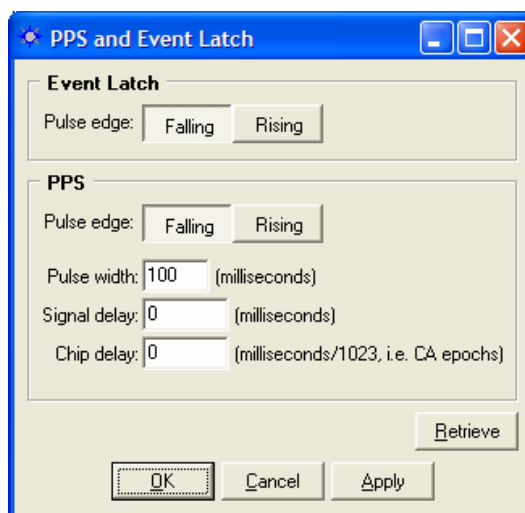


Figure 56: 1 PPS & Event Latch Configuration

The Events Input can be triggered on the Falling, or Rising edge of the input pulse. The Event Latch message (0xB4) must be enabled in the NCT Message Output list shown in Figure 7 of Chapter 3; however the Message Rate for the 0xB4 must be set to "On Trigger". The "On Trigger" message rate can be located by Right- Clicking on the Rate area adjacent to the B4 Message ID, and following the menus as seen in Figure 57. The Event Latch Message 0xB4 will only be output when the chosen pulse edge of the incoming event is sensed by the receiver.

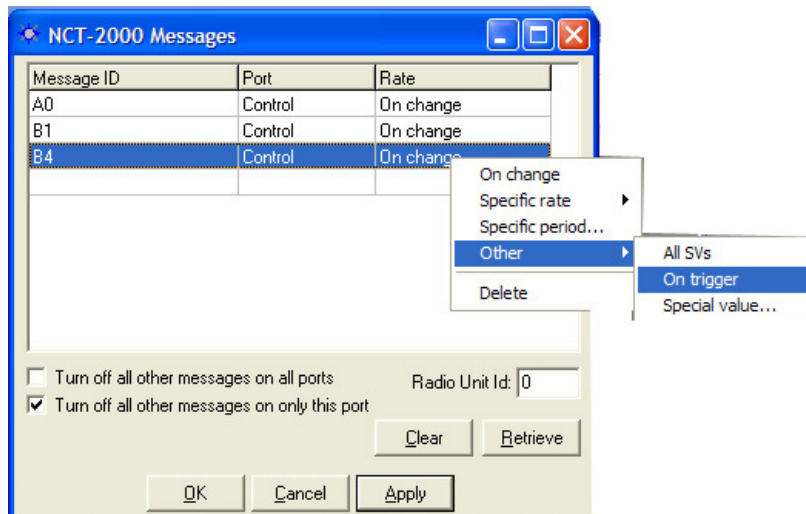



Figure 57: Event Latch Output Rate Configuration

 Please refer to the Product's User Guide for hardware interfacing specifics, and wiring. The latest versions can be downloaded in PDF format from our website at the following link <http://www.navcomtech.com/support/docs.cfm>.

## Chapter 10

## Ack/Nacks & General Commands

This section details fundamental response sent back from the unit whenever a request for information is seen at the receiver. It also covers several “Get” actions that could prove useful in setting up other systems.

### Ack/Nack

To set the Ack/Nack Logical Port, go to the main StarUtil menu and click RECEIVER\SETUP\SELECT ACK/NACK RESPONSE PORTS, as shown in Figure 58.

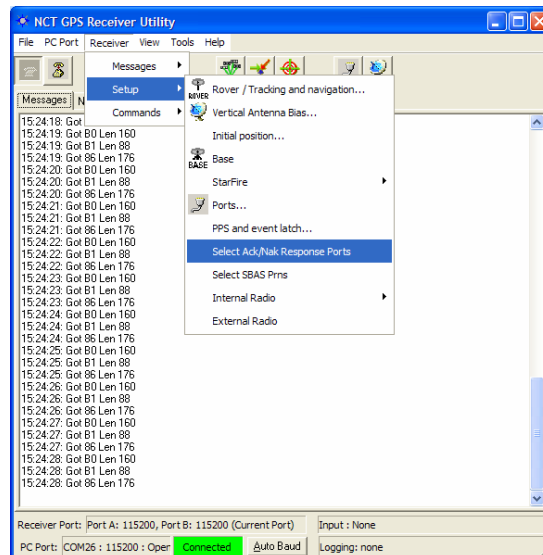


Figure 58: Select Ack/Nack Logical Ports Location

Once here the window in Figure 59 will appear allowing you to select which port the responses from the receiver are heard on. This permits greater flexibility when determining if a message was actually received by the receiver. The receiver response can be ported somewhere other than the Control port.

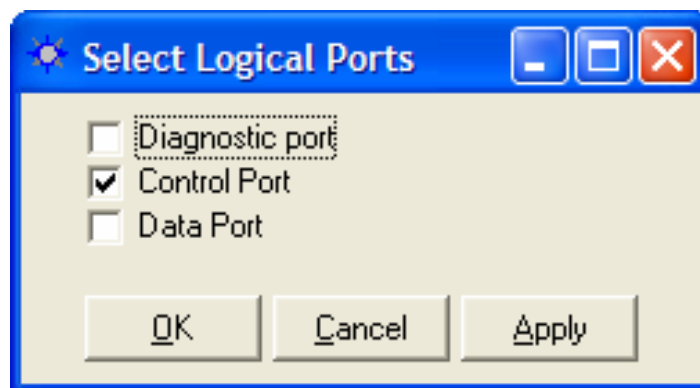


Figure 59: Select Ack/Nack Logical Ports



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## General Duty Commands

Here is where almanac is downloaded, and uploaded from/to the receiver. This is a great benefit when several receivers are to be setup, and one has a current almanac, which can be uploaded into numerous others. From the main StarUtil menu, go to RECEIVER\COMMANDS as shown in Figure 60.

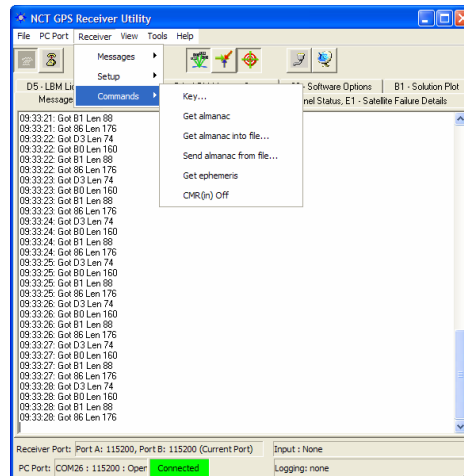


Figure 60: General Receiver Commands

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### Key

Used as an input for special receiver operating functions, and troubleshooting.

 *These codes should only be used with NavCom's Technical Support assistance.*

---

### Get Almanac

Retrieves the current almanac in the receiver and outputs it via the Control Port.

---

### Get Almanac To File

Retrieves the current almanac in the receiver and outputs it via the Control Port to a user defined file location. This file can then be uploaded into another receiver.

---

### Send Almanac From File

Uploads the almanac file downloaded with the Get Almanac To File menu item to another receiver via the Control Port.

---

### Get Ephemeris

Retrieves the current Ephemeris in the receiver and outputs it via the Control Port.

---

### CMR (In) Off

Disables the use of CMR differential corrections being input into the receiver.

## Chapter 11

## Tools Menu

The Tools menu is an area of StarUtil where the user will upload new firmware, StarFire™ licenses, and Receiver Options. This is also where the NMEA Viewer and MMC Internal Data logging menu items discussed in previous chapters are located. In this chapter we will concentrate on those items that have not been previously mentioned. Figure 61 shows the sub menus under the TOOLS menu item.

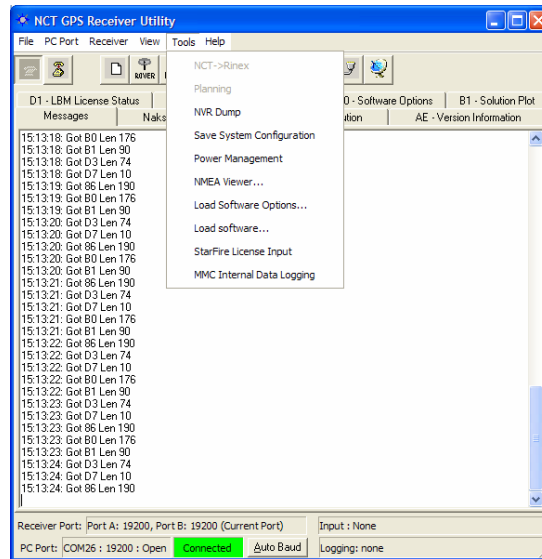


Figure 61: Tools Commands

## Power Management

This feature allows the user to configure the unit's power up status. Clicking on Power Management brings up the window shown in Figure 62. There are three choices available:

- I/O Switch: In this position the power On/Off status is controlled exclusively via the front panel On/Off button.
- On With Power: With this radio button chosen, the unit will automatically power up when DC voltage is sensed at the input circuitry.
- Sensor's Last State: When enabled, this mode will remember the last MANUAL state of the ON/OFF button when power is removed via the input source.

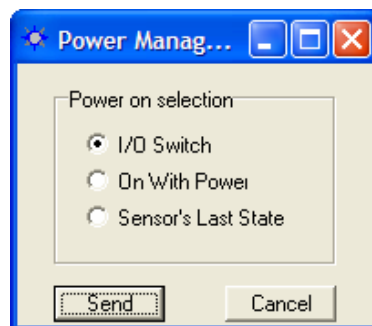


Figure 62: Power Management Control Window

## Save System Configuration

This feature allows the user's system configuration information to be written to a text file. Clicking on Save System Settings will bring up a Save dialog box as seen in Figure 63. After choosing a filename and directory path, click on the Save File button. A list of NCT messages in ASCII format will be saved to the specified file and location.

The contents of this file are not necessarily messages that have been scheduled for output from the NCT Messages window shown in Figure 7, but are messages that have been queried for a single instance from the receiver. This output file will assist in the troubleshooting of the receiver, and can be e-mailed to a Support Engineer if the user has to call in to NCT Customer Support for help. Table 2 details which NCT Binary messages will be stored in the output file in their ASCII form.

- ☐ *Save System Configuration is not a file that contains user configured parameters, and cannot be uploaded into the receiver. Saving and uploading user setup configurations capability will be implemented in a future release.*

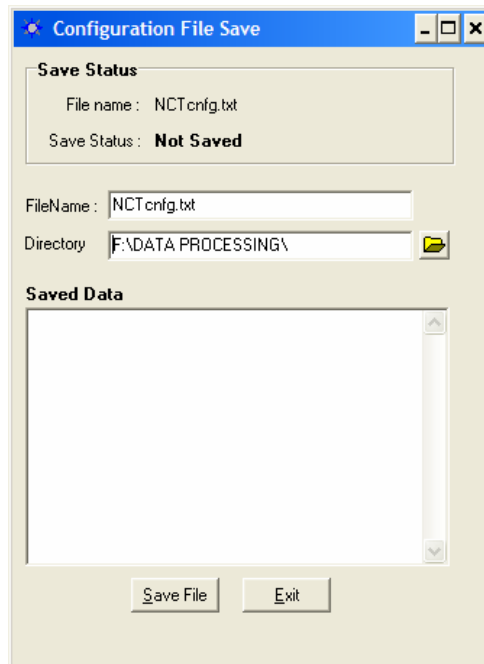


Figure 63: System Configuration Dump Window

MSG ID	DISCRIPTION
1A	Port Configuration Block
20	Data Request
30	Software Options
49	Solution Control
AE	Identification Block
D0	LBM Identification Block
D1	LBM Authorization Status Block
D5	LBM Cancel History

Table 3: Save System Settings Text File Contents

## Load Software Options

If you have purchased your receiver as a basic configuration, and would like to take advantage of the multi-hertz measurement processing and output, or any of the other non-standard features, it is not necessary to return the receiver to the factory for reconfiguration. The system can be reconfigured without dismantling your existing hook-ups. Simply call or e-mail in to your NavCom Technology, Inc. dealer, and purchase the necessary options. A file containing the reconfiguration codes will be sent to you usually via e-mail. Save the file to your local hard drive in the folder you have executed StarUtil from. To initiate an Options Upload go to the main StarUtil window and click on TOOLS\LOAD SOFTWARE OPTIONS as seen in Figure 61.

*It is recommended that you archive your software options as you may be required to reload them at some point. Please note that the options file is receiver dependant and cannot be uploaded into multiple receivers.*

After clicking on Load Software Options the window in Figure 64 will appear. Open your options file using any text file viewer, i.e. NotePad, WordPad, etc. as shown in Figure 65.

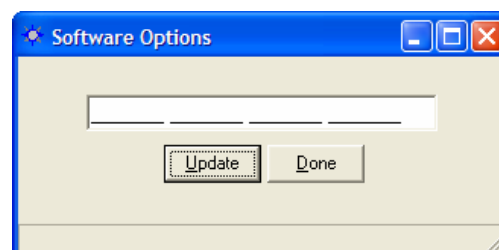


Figure 64: Software Options Code Input

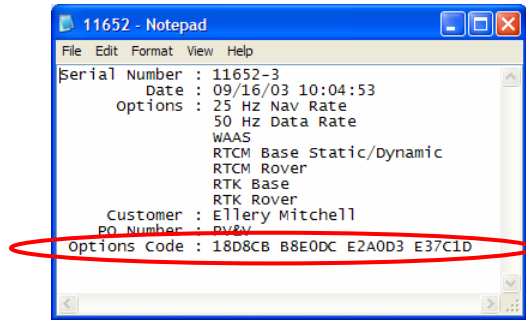


Figure 65: Options File Opened In NotePad

At the bottom of the file text there will be a 24 character Options Code, as shown in Figure 65. The user can copy and paste this code into the Software Options window, seen in Figure 66 then click the Update button in order to commence the Options Update.

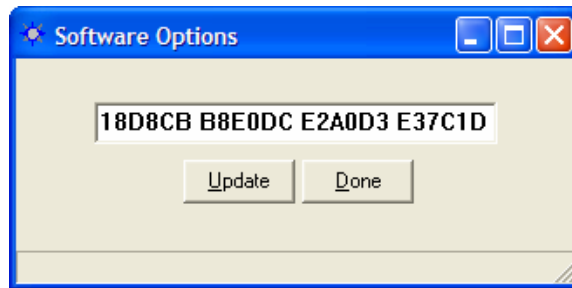


Figure 66: Software Options Sent

To verify your options, go to the main StarUtil window and click VIEW\ 30 – SOFTWARE OPTIONS, as seen in Figure 67, then click the “Retrieve” button. The options should coincide with the information seen when the Options File was opened in NotePad, see Figure 65.

*The 0x30 Options displayed will vary depending on the type of receiver sensed by StarUtil.*

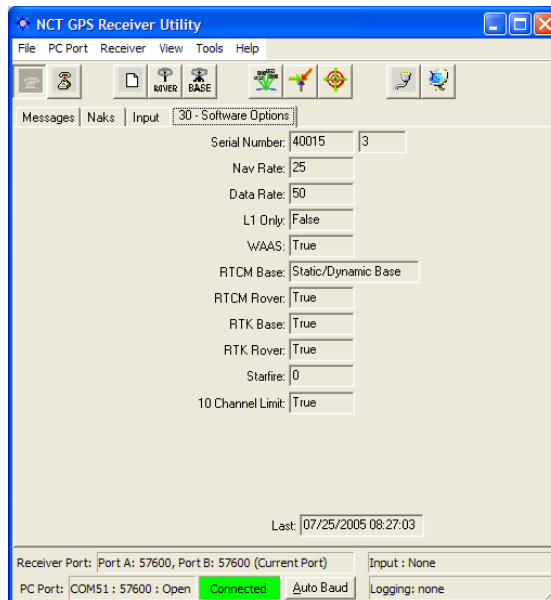


Figure 67: View Installed Software Options

## Load Software

Although there is a separate utility designed specifically to update the various software modules in the NavCom Technology receivers in a single step, StarUtil will allow the user to upload software into these hardware modules directly. However, it is recommended that you use the Install Utility that you received with the new code builds to accomplish the upload.

Typically you will receive an update that is comprised of three files, a .BIN, and two .HEX files. Create a folder on your local hard drive, and label it as the .BIN software version you will be uploading. This will help differentiate between various software builds you may receive so you can easily go back to a previous build if required.

*It is recommended that you archive your previous software versions as you may be required to reload them at some point.*

From the main StarUtil menus go to TOOLS\LOAD SOFTWARE as seen in Figure 61.

After clicking on Load Software the window in Figure 68 will appear allowing the user to choose a baud rate, and type of software to load. The baud rate chosen operates independently of the StarUtil/PC connections, thus any available upload baud may be chosen. Pressing the browse button allows the user to locate the folder where the new code is stored.

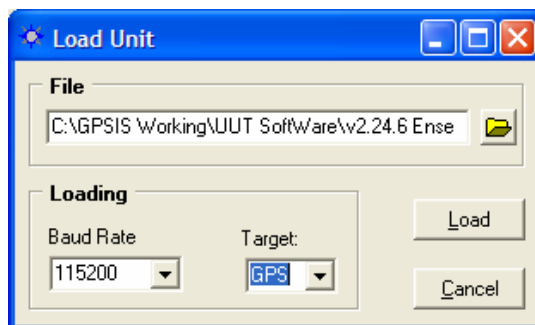


Figure 68: Load Software

Clicking on the Load button executes the software upload. A progress window as shown in Figure 69 will appear. This information window details what stage the upload progress is in. The upload process can also be canceled from this window.

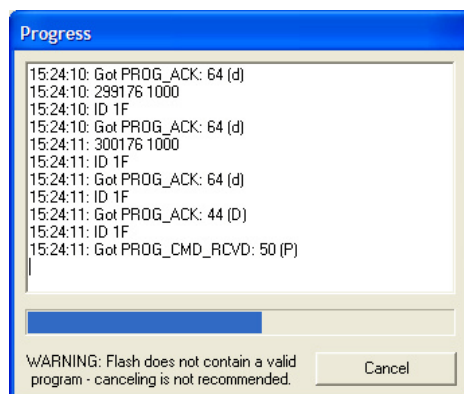


Figure 69: Software Upload Progress

The next window you see will be Figure 70 stating that the software upload has been successful. This process must be repeated for each of the three (if available) software module versions.

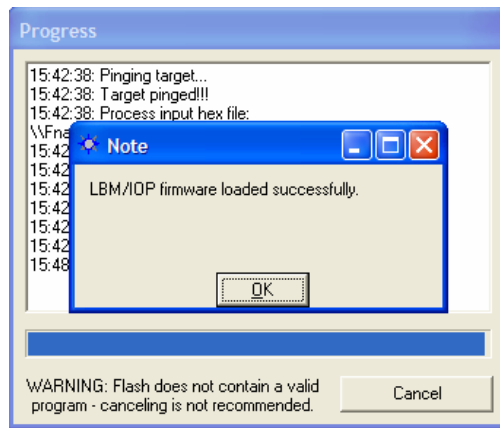


Figure 70: Upload Completed Successfully

## Appendix A NCT Solid Earth Tide (SET) Message Format

The SET message output via the NMEA port is a NavCom proprietary NMEA type message. This means that it conforms to the header, checksum, and electrical characteristics of a standard NMEA string, but is not recognized by the NMEA governing body as an officially sanctioned message.

Table A1 details the information contained in the following actual NCT SET output message.

```
$PNCTSET,214040.00,-0.060,-0.018,0.110,,,,,*47
```

\$PNCTSET	hhmmss.ss	xxx.xxx	xxx.xxx	xxx.xxx	xxx.xxx	xxx.xxx	xxx.xxx	xxx.xxx	xxx.xxx	xxx.xxx	xxx.xxx	*hh
Label	UTC	SET dN (meters)	SET dE (meters)	SET dU (meters)	PT dN (meters)	PT dE (meters)	PT dU (meters)	Ocean Loading dN (meters)	Ocean Loading dE (meters)	Ocean Loading dU (meters)	CK SUM	

Table A1: NCT Solid Earth Tide (SET) NMEA message



**Appendix B**

**NCT Station ID NMEA GGA Field 14 Definitions**

Tables B1 & B2 detail the information contained in field 14 of the GGA message when NCT STATION ID is chosen as seen in Figure 33. Note that the Navigation Mode in field 14 is the same as that of the 0xB1 binary message.

The format of field 14 when NCT STATION ID is chosen is a 3 digit integer value as denoted below as *XYZ*, where *X* is the StarFire™ satellite beam in use and *YY* is the GPS correction signal type being used.

ID (X)	DOWNLINK BEAM
0	None selected, or error
1	INMARSAT Americas
2	INMARSAT EAME
3	INMARSAT ASPAC
4	- reserved - (Inmarsat AOR-E)
5	- reserved - (Inmarsat POR)
6	- reserved -
7	- reserved -
8	- reserved -
9	Forced to unknown frequency (Manual selection)

Table B1: Beam Selection; ID X

ID (YY)	GPS CORRECTION SIGNAL
00	Non dGPS
01	dGPS, RTCM type 1 or 9, Single Freq
02	WAAS/EGNOS, Single Freq., (See GSA for SBAS Id in use)
03	WAAS/EGNOS Dual Freq., (See GSA for SBAS ID in use)
04	StarFire WCT, Single freq.
05	StarFire WCT, Dual freq.
06	StarFire RTG, single freq. (no 'Tide' Adjustment)
07	- reserved -
08	- reserved -
09	- reserved -
10	dGPS, RTCM type 1 or 9, Dual Freq.
11	StarFire RTG dual freq. (no 'Tide' Adjustment)
12	Code base Nav, Single Frequency, NCT Proprietary Format
13	Code base Nav, Single Frequency, RTCM 18/19
14	Code base Nav, Single Frequency, RTCM 20/21
15	Code base Nav, Single Frequency, CMR
16	Code base Nav, Dual Frequency, NCT Proprietary Format
17	Code base Nav, Dual Frequency, RTCM 18/19
18	Code base Nav, Dual Frequency, RTCM 20/21
19	Code base Nav, Dual Frequency, CMR
20	RTK Mode, NCT Proprietary Format (5e/5c or 5b/5c)
21	RTK Mode, RTCM 18/19
22	RTK Mode, RTCM 20/21
23	RTK Mode, CMR
24	StarFire RTG, single freq., Adjusted for "Tides"
25	StarFire RTG, dual freq., Adjusted for "Tides"
26	RTK Extend

Table B2: Navigation Mode; ID YY