



StarUtil 5000

User Guide



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Notices

StarUtil 5000 User Guide
P/N 96-310049-3001
Revision A
January, 2019

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StarFire™ Licensing

The StarFire signal requires a subscription and software option that must be purchased in order to access the service. Licenses are non-transferable, and are subject to the terms of the StarFire Signal License agreement. For further details on the StarFire Signal Network, its capabilities, terms and conditions visit www.navcomtech.com or send an email inquiry to sales@navcomtech.com.

USG FAR

Technical Data Declaration (Jan 1997)

The Contractor, NavCom Technology, Inc., hereby declares that, to the best of its knowledge and belief, the technical data delivered herewith under Government contract (and subcontracts, if appropriate) are complete, accurate, and comply with the requirements of the contract concerning such technical data.

Global Navigation Satellite System

Global Navigation Satellite Systems (i.e., GPS, GLONASS) are under the control of the respective Governmental agencies, and the operation of these satellites may be changed at any time without warning.

GPS Selective availability (S/A code) was disabled on 02 May 2000 at 04:05 UTC. The United States government has stated that present GPS users use the available signals at their own risk.

The U.S. State Department International Traffic in Arms Regulations (ITAR) regulations limit the performance of commercial GNSS products. As a result, access to satellite measurements and navigation results will be limited from display and recordable output when predetermined values of velocity and altitude are exceeded. These threshold values are far in excess of the normal and expected operational parameters of the SF-5050 GNSS receiver.

Revision History

Rev A (Jan 2019)	Initial release
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Use of This Document

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



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



This symbol means Reader Be Careful. Indicates a caution, care, and/or safety situation. The user might do something that could result in equipment damage or loss of data.



This symbol means Danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical and RF circuitry and be familiar with standard practices for preventing accidents.

Revisions to this User Guide can be obtained in a digital format from

<http://www.navcomtech.com/Support/>

Related Documents

SF-5050 GNSS Product User Guide P/N 96-310045-3001

Describes the operation and use of NavCom's SF-5050 GNSS receiver, its software-enabled features, and its performance upgrade path

Onyx Technical Reference Manual P/N 96-312008-3001

Describes the control and output data message formats utilized by this instrument (for customer programming purposes)

RINEXUtil User Guide P/N 96-310021-2101

Describes the conversion program used on NavCom proprietary output data message formats to RINEX ver. 2.10 observation and navigation files (for customer programming purposes)

NavCom Release Notes

Describes software updates for NavCom products. Current and archived Release Notes are available on the NavCom web site:

<http://www.navcomtech.com/Support/DownloadCenter.cfm?category=releasenotes>.

NavCom Customer Support provides software updates described in the Release Notes. Submit a request for software updates via the Request Support web page.

Related Standards

ICD-GPS-200

NAVSTAR GPS Space Segment / Navigation User Interfaces Standard. ARINC Research Corporation; 2250 E. Imperial Highway; El Segundo, California 90245

GLONASS ICD, Version 5.0, 2002

Russian Space Agency, Information Analytical Centre
Internet: <http://www.glonass-ianc.rsa.ru/>

Beidou

BeiDou Navigation Satellite System
Internet: <http://en.beidou.gov.cn/>
Tel: +86 10 62567566
Email: webeditor@beidou.gov.cn

Galileo ICD Issue 1, Revision 2, November 2015

Internet: <https://www.gsa.europa.eu/>
ICD: https://www.gsc-europa.eu/system/files/galileo_documents/Galileo_OS_SIS_ICD.pdf

European GNSS Agency
Janovského 438/2
170 00 Prague 7 – Holesovice
Czech Republic
Tel: +420 234 766 000

RTCM-SC-104

Recommended Standards For Differential GNSS Service. Radio Technical Commission For Maritime Services; 1800 N. Kent St, Suite 1060; Arlington, Virginia 22209

CMR, CMR+

Compact Measurement Record; Trimble Navigation Limited; 935 Stewart Drive; Sunnyvale, CA 94085

RINEX

Receiver Independent Exchange Format; Astronomical Institute of the University of Berne

QZSS

Quasi Zenith Satellite System. Japan Aerospace Exploration Agency (JAXA). 7-44-1 Jindaiji Higashi-machi, Chofu-shi, Tokyo 182-8522.

NMEA-0183

National Marine Electronics Association Standard For Interfacing Marine Electronic Devices. NMEA National Office; 7 Riggs Avenue; Severna Park, Maryland 21146

Publicly Operated SBAS Signals

RTCA/DO-229D

The Radio Technical Commission for Aeronautics (RTCA) develops consensus-based recommendations regarding communications, navigation, surveillance, and air traffic management (CNS/ATM) system issues.

RTCA. 1828 L Street, NW, Suite 805, Washington, DC 20036.

These organizations implement the RTCA/DO-229D standard set by RTCA:

WAAS (Wide Area Augmentation System)

U.S. Department of Transportation. Federal Aviation Administration. 800 Independence Ave, SW, Washington, DC 20591

EGNOS (European Geostationary Navigation Overlay Service)

European Space Agency. 8, 10 rue Mario-Nikis,
F-75738 Paris Cedex 15, France.

MSAS (MTSAT Satellite-based Augmentation System)

Japan Civil Aviation Bureau. Ministry of Transport. Kasumigaseki 2-1-3, Chiyoda-ku, Tokyo 100, Japan.

GAGAN (GPS Aided Geo Augmented Navigation)

Indian Space Research Organization. Antariksh Bhavan, New Bel Road, Bangalore - 560 094, India.

Chapter 1 Establish Communications

StarUtil 5000 Overview

StarUtil 5000 is a NavCom developed utility designed to perform desktop functions for the SF-5050. (Refer to the *Onyx Technical Reference Manual* for the complete set of commands and responses utilized by the SF-5050 receiver.) The SF-5050 includes a variety of webpage features designed to provide operational data not included in the StarUtil 5000 program. The primary capabilities of StarUtil 5000 are the configuration of ports, upload of Firmware / Software Bundles and/or Options / and StarFire License, if purchased, capture and log data, parse certain data records, and convert raw data to the RINEX format.

The SF-5050 software-enabled features (bundled or purchased individually), cover a wide variety of applications. For the SF-5050, refer to the *SF-5050 GNSS Product User Guide* for descriptions of the software options.



StarUtil 5000 is included on the SF-5050 Product Configuration USB Flash Drive supplied with each receiver. It runs only on PCs with Windows 10 Professional. Older Windows OS software are not supported.

File Naming Conventions

Table 1: File Naming Conventions

File Type	Format	Example
Firmware	NAV Firmware: Onyx_<Version>.s19	Onyx_1.0.2.s19
	Onyx_<Bootloader or Application Name>_<Version>.s19	Onyx_boot2_ver1.0.2.s19
Software Options	SN<Unit Serial Number>-PCS<Option ID>.opt	SN13452-PCS6539.opt
StarFire License	SN<Unit Serial Number>-PCS<License ID>.lic	SN13452-PCS2358.lic

Save Folder/Files to PC

StarUtil 5000 (StarUtil5000_v1.0.2.exe) and all the files needed to set up the ordered configuration of the SF-5050 are included on the supplied Product Configuration USB Flash Drive. *Before running StarUtil 5000, copying these folders/files to the PC is recommended to provide a backup:*

- ✓ *Root Directory:* Software Options File and StarFire License (if purchased)
- ✓ *NavCom Folder* includes these sub-folders: Firmware, Marketing Materials, User Guides, User Profiles, and Utilities. The Utilities folder includes the StarUtil 5000 sub-folder with the utility. (The contents of the NavCom folder are subject to change.)
 1. Copy the NavCom folder and the Software Options file and StarFire license (if purchased) to the PC.
 2. Create two folders in the NavCom folder, one for the Software Options file and one for the StarFire license file.

- Open StarUtil 5000 from the PC, if desired, to interface with the main GUI while reading the descriptions below.

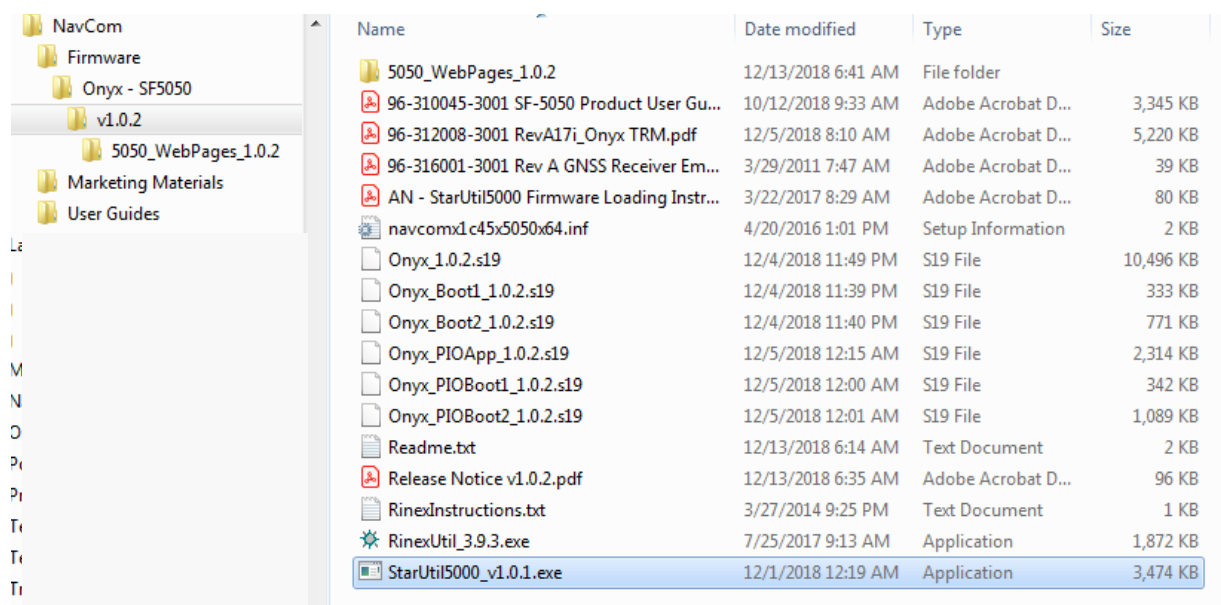


Figure 1: NavCom Folder

StarUtil 5000 Main GUI

The sections below provide general descriptions of the main parts of the GUI identified in Figure 2 and references to chapters that provide more detail.

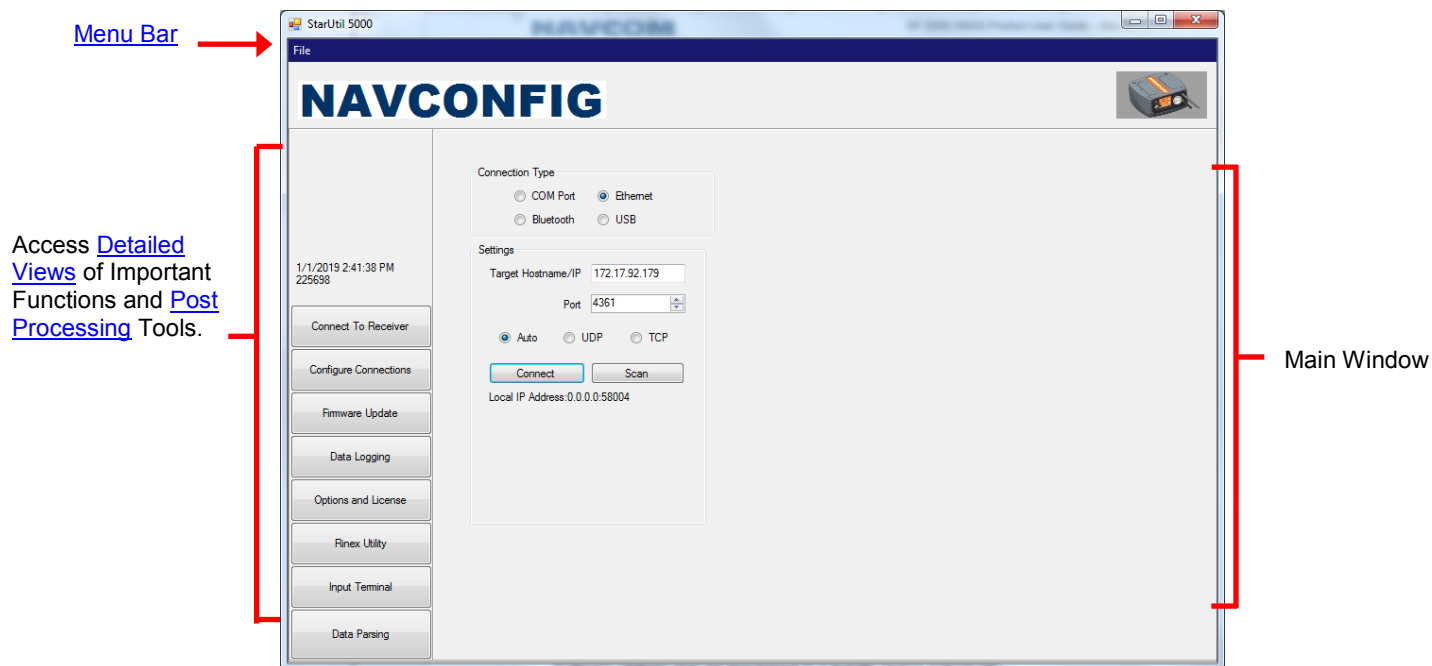


Figure 2: StarUtil 5000 Main GUI

Connect To Receiver

Provides access to port settings and connection to the SF-5050 via the PC COM Port, USB, Bluetooth, or Ethernet, as applicable

- ✓ Establish communications between a PC running StarUtil 5000 and one of the following:
 - RS-232/RS-422
 - USB 2.0
 - Ethernet
- ✓ Configure and establish basic Ethernet communications



Refer to the *SF-5050 GNSS Product User Guide* for a list and descriptions of the supplied and optional data cables.

Establish Serial or USB Device Communications

USB Communications: The USB driver (“navcomx1c45x5050x64.inf”) must be in the same folder as StarUtil 5000 for the USB port to auto-recognize the SF-5050. Confirm that the driver is in the StarUtil 5000 folder on the PC (see Figure 1).

1. Click the *Connect To Receiver* button to establish communications between the PC and the SF-5050 (see Figure 3). The *Port Configuration* dialog box opens.

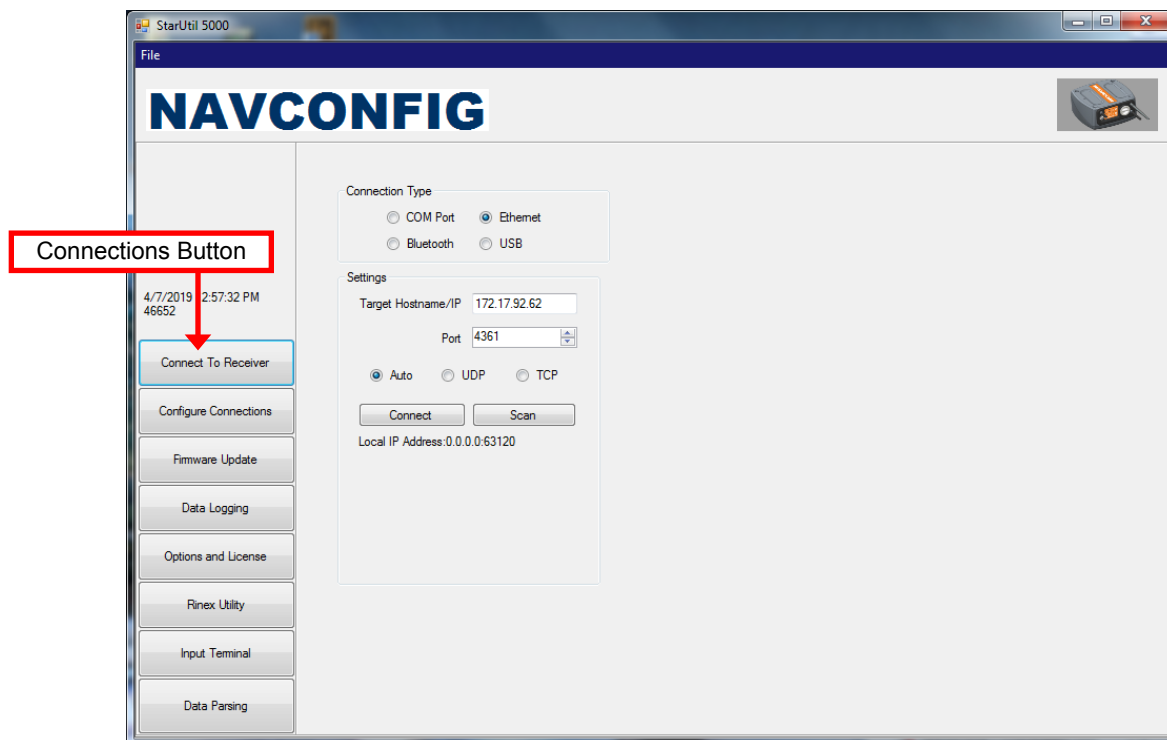


Figure 3: Connections Button

Ethernet Communications: Typically an RS-232 or USB connection is not required prior to an Ethernet connection. This requirement exists only if any of the following apply:

- A previous Ethernet connection was not terminated properly via the [ETHVCOM]ON,0.0.0.0,0 command. The [ETHVCOM]ON,0.0.0.0,0 command is included in the default system setting.

To restore the SF-5050 to the normal “listen for connection” mode so that an Ethernet connection can be established, first establish an RS-232 or USB connection. Then input [ETHVCOM]ON,0.0.0.0,0 via the *Input Terminal* window or the appropriate user profile. The receiver will accept an Ethernet connection, or any of these connection types: RS-232, USB, or Bluetooth.

- The EVCOM port is disabled by a previous [ETHVCOM]OFF command.
- The EVCOM port is configured for a specific connection with an [ETHVCOM]ON,<IP>,<port> command.



For remote operation of the SF-5050, connection to either COM1 or COM2 is highly recommended as a backup to the Ethernet interface. The COM1 or COM2 backup connection can be made via a cell modem, MOXA to Ethernet, etc.

Refer to Figure 4 for the steps below:

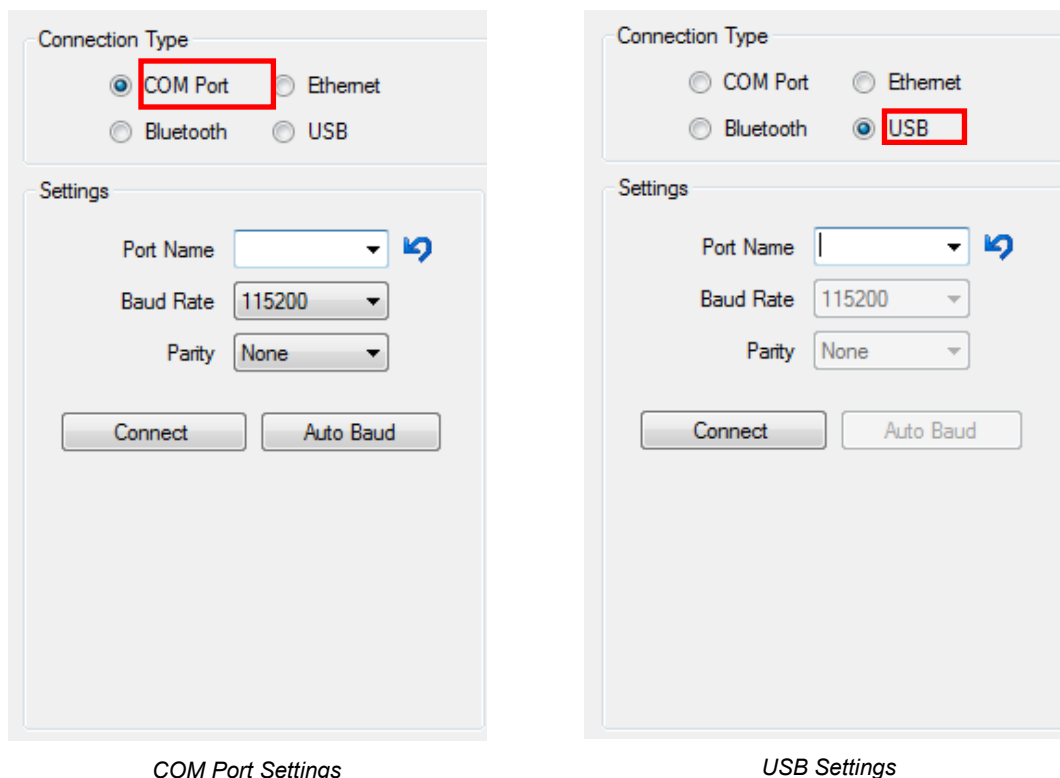



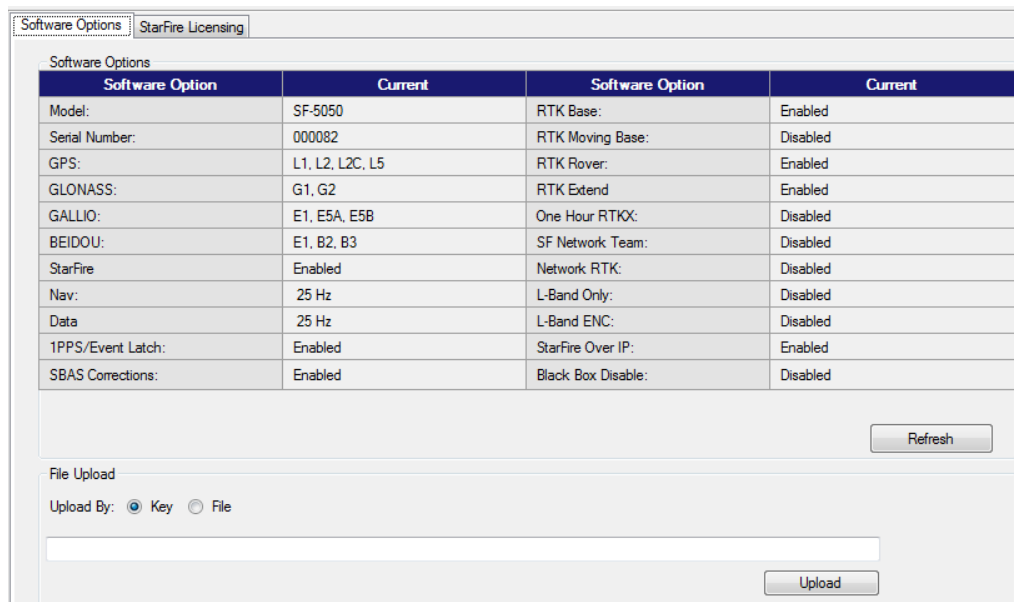


Figure 4: Port Configuration

2. Set the appropriate options according to the Connection Type and connect:
 - COM Port:
 - *COM Port*: the appropriate PC COM Port
 - *Baud Rate*: 115200 (keep the default)
 - *Parity*: None (keep the default)

- Click  for StarUtil to sequence through the available baud rates and connect to the selected port if the default baud rate fails to establish a connection.
- Or
- USB Port:
 - *COM Port*: the appropriate virtual PC COM port (refer to [Configure Virtual PC COM Port](#) below, to establish and verify this port).
 - *Show All Com Ports*: Shows any ports that are USB configured but are not accessed by clicking the USB radio button.
 -  : Finds all ports including those configured in non-Windows operating systems (e.g. Linux).
 - Click  to connect to the selected port.
3. Verify that the SF-5050 is connected to the PC. View the receiver Software option in the Options and License window indicate that a valid connection is established at the required baud rate (see Figure 5).



The screenshot shows the 'Software Options' and 'StarFire Licensing' tabs. The 'Software Options' tab is active, displaying a table of receiver settings. The 'StarFire' option is set to 'Enabled', and the 'Nav' and 'Data' options are set to '25 Hz'. The 'StarFire' option is also set to 'Enabled'.

Software Option	Current	Software Option	Current
Model:	SF-5050	RTK Base:	Enabled
Serial Number:	000082	RTK Moving Base:	Disabled
GPS:	L1, L2, L2C, L5	RTK Rover:	Enabled
GLONASS:	G1, G2	RTK Extend:	Enabled
GALLIO:	E1, E5A, E5B	One Hour RTKX:	Disabled
BEIDOU:	E1, B2, B3	SF Network Team:	Disabled
StarFire:	Enabled	Network RTK:	Disabled
Nav:	25 Hz	L-Band Only:	Disabled
Data:	25 Hz	L-Band ENC:	Disabled
1PPS/Event Latch:	Enabled	StarFire Over IP:	Enabled
SBAS Corrections:	Enabled	Black Box Disable:	Disabled

Below the table, there is a 'File Upload' section with a radio button for 'Key' (selected) and 'File'. A text input field and an 'Upload' button are also present.

Figure 5: Options and License Window – Valid Connection

Configure Virtual PC COM Port

Install the USB Driver

1. Place the provided Flash Drive into a USB port on the PC.
2. Browse to the NavCom folder and copy it to the PC.
3. Connect the USB cable from the receiver to the PC.
4. On the *Welcome to the Found New Hardware Wizard* dialog box, select the option *Install from a list or specific location (Advanced)*; then click the *Next* button (refer to Figure 6).

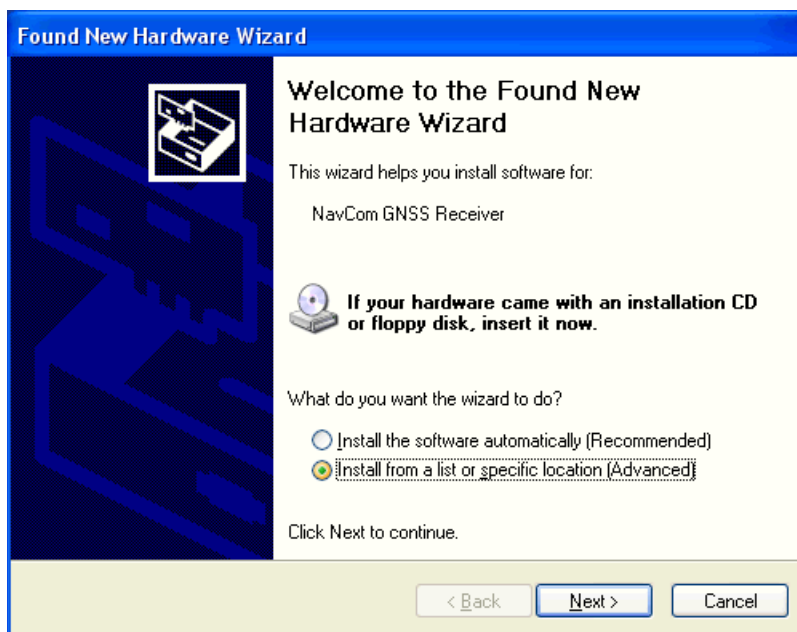


Figure 6: Found New Hardware Wizard/Install Software

5. On the *Please choose your search and installation options* dialog box, select *Search for the best driver in these locations*, and then click *Browse* (see Figure 7).

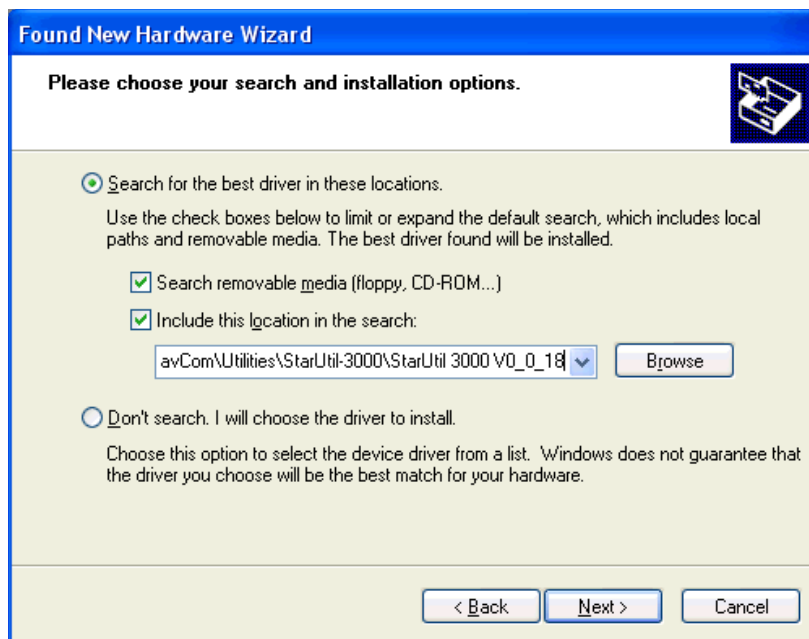


Figure 7: Found New Hardware Wizard/Choose Your Search and Installation Options

6. Browse to the *NavCom\Utilities\StarUtil 5000* folder on your PC, open the folder of the most current version of StarUtil 5000, and click OK.
7. On the installation warning message, click the *Continue Anyway* button (see Figure 8).

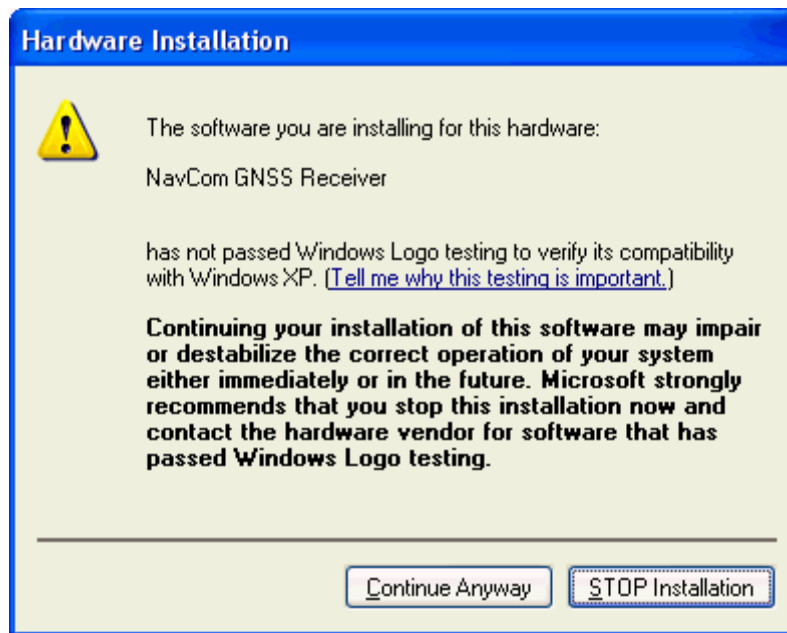


Figure 8: Software Installation Warning Message

8. Click *Finish* on the *Completing the Found New Hardware Wizard* message dialog box (see Figure 9).

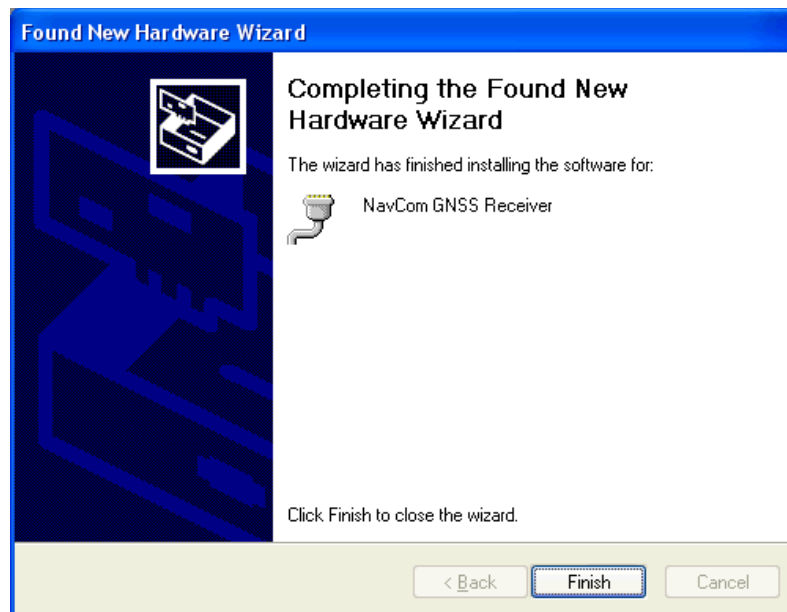


Figure 9: Completing the Found New Hardware Wizard

Verify the Virtual PC Com Port

9. On the *Windows Explorer* window, right-click *My Computer* and click *Properties* on the drop-down menu (see Figure 10).

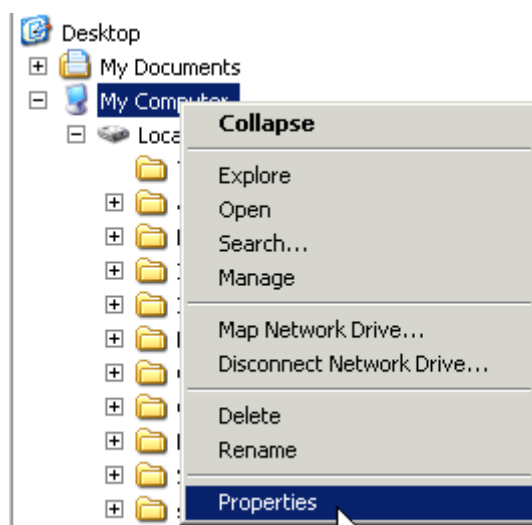


Figure 10: My Computer/Properties

10. On the *System Properties* dialog box, open the Hardware tab and then click the *Device Manager* button (see Figure 11).

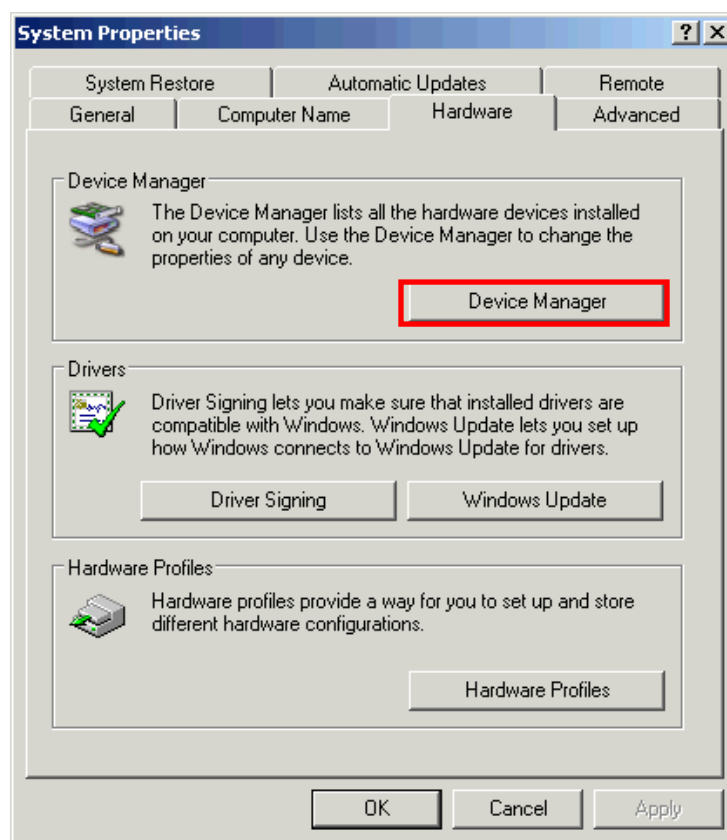


Figure 11: System Properties/Hardware Tab/Device Manager Button

11. On the *Device Manager* window (see Figure 12), check to confirm that the COM port has been configured.

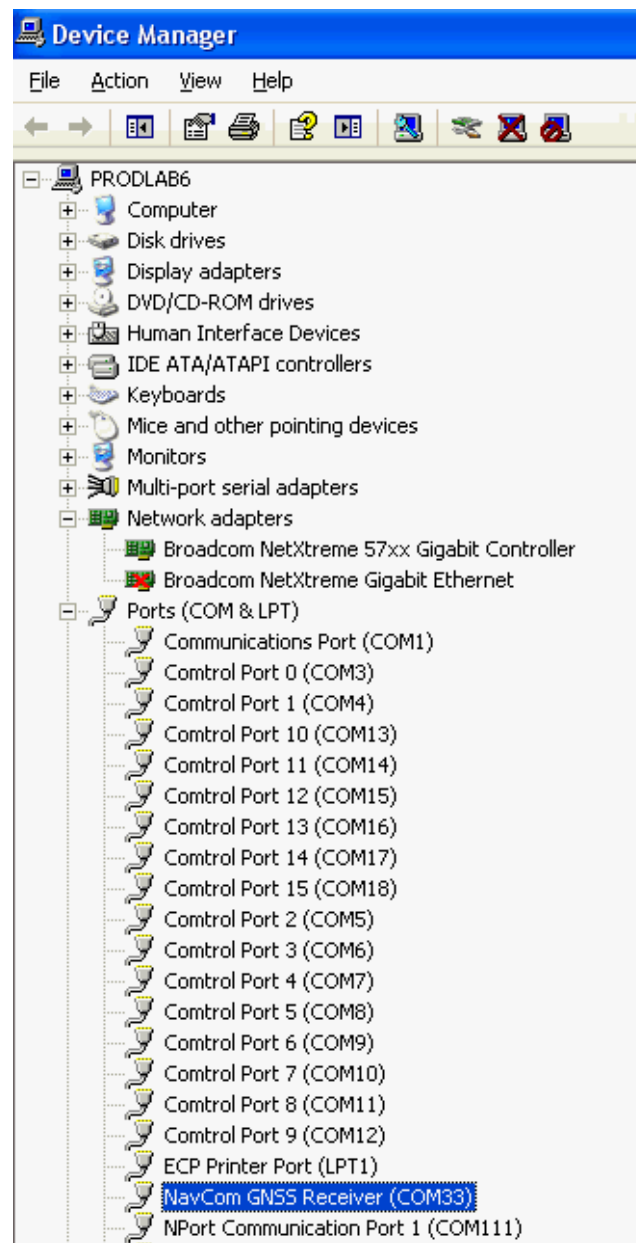


Figure 12: Device Manager



The SF-5050 must be in “[USBMODE] Device” for this connection to work. This is the factory default setting. Refer to the *Sapphire Technical Reference Manual* for details (see *Related Documents* in the fore-matter).

Ethernet Communications

The SF-5050 supports both UDP and TCP connections. This section provides only the basic configuration for a direct Ethernet connection between the SF-5050 and a PC.

Configure and Establish Ethernet Communications

There are 4 Ethernet modes: UDP1, UDP2, TCP1, and TCP2.

Perform the following steps to configure the receiver for an Ethernet connection:

1. In the *Connect To Receiver* window, select the Ethernet button.
2. In the Settings box either enter the target parameters or click on *Scan* to view available devices.

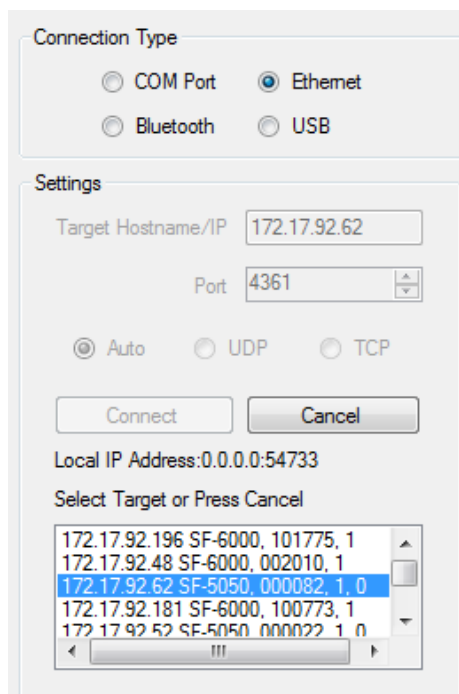


Figure 13: Scanned Ethernet Port Device List

3. Double click on the desired device from the list to populate the *Target Hostname/IP* and *Port* fields under *Settings*.
4. Click on *Cancel* to terminate the scan.
5. Click on *Connect* to establish communication on the selected port.

If manually setting the Ethernet port parameters from either a USB or COM port interface, follow the instructions below.

1. Log on to any available port, such as USB or a serial COM port.
2. On the StarUtil 5000 Configure Connections menu, click View Raw Data and the Data View window opens (refer to. This is where you can view all response data).
3. On the *Input Terminal* window, enter [ETHVCOM] with no parameters to view the current settings. It might look like this if port ETH1 has been busy:

```
[ETHVCOM] ON, 204.54.86.67, 4116, UDP2, 4361, ETH1
[ETHVCOM] OFF, 0.0.0.0, 0, UDP1, 4362, ETH2
[ETHVCOM] OFF, 0.0.0.0, 0, TCP1, 4363, ETH3
[ETHVCOM] OFF, 0.0.0.0, 0, TCP1, 4364, ETH4
```



These values may have been assigned dynamically and therefore may not be usable. To create working parameters, enter the Virtual COM port command:

[ETHVCOM] ON, 0.0.0.0,0 UDP2, 4361, ETH1, where:

ON – sets the virtual port ON

“0.0.0.0” – puts the virtual port into a mode to accept the next caller (you)

“0” – clears the internal port

“UDP2” – names the protocol, from UDP1, UDP2, TCP1

“4361” – names the port (note: 4361 is the NavCom default port # for ETH1)

“ETH1” – identifies which logical port this command configures from ETH1/2/3/4

4. On the *Input Terminal* window, re-enter the [ETHVCOM] command with no parameters to verify the EVCOM settings:

[ETHVCOM] ON, 0.0.0.0, 0, UDP2, 4361, ETH1

[ETHVCOM] OFF, 0.0.0.0, 0, UDP1, 4362, ETH2

[ETHVCOM] OFF, 0.0.0.0, 0, TCP1, 4363, ETH3

[ETHVCOM] OFF, 0.0.0.0, 0, TCP1, 4364, ETH4



To verify a simple direct connection on port ETH1, enter the [PING] command on the *Input Terminal*. The response should be [PING]ETH1.

5. On the *Input Terminal* window, enter [ETHCONFIG] to view the current Ethernet Port IP settings to use for the connections dialog:

[ETHCONFIG]AUTO,204.54.86.4,255.255.254.0,204.54.87.1,204.54.87.20,204.54.87.39, where:

“204.54.86.4” is the SF-5050 IP address; *make a note of this*

“255.255.254.0” is the network address mask

“204.54.87.1” is the gateway address

“204.54.87.20” is the primary DNS server

“204.54.87.39” is the secondary DNS server



The [ETHCONFIG] command can also be entered with MANUAL. (MANUAL means assign a fixed IP and AUTO means use DHCP.) You can use AUTO, but keep in mind that if the receiver drops offline, it may be difficult to retrieve the IP address. If you specify MANUAL, the IP address does not change if the receiver drops offline for power cycle, for downline load of new firmware, etc.



If the MANUAL IP address is used other than on a direct connection between a PC and the SF-5050, the user should have enough knowledge of networking to ensure that the selected IP address does not conflict with other units connected to the same LAN and is a valid address for that network.



The logical ports ETH1-ETH4 are used when configuring output messages on the Ethernet ports (e.g., [OUTPUT]PVT1B,ONTIME,1,ETH1).



To make a change to [ETHCONFIG] permanent, enter [PROFILE]SAVEAS "PROFILENAME" and power cycle the receiver. This change will not take effect until after the power cycle.

Example:

[ETHCONFIG]MANUAL,204.54.86.4,255.255.254.0,204.54.87.1,204.54.87.20,
204.54.87.39

Basic Ethernet Configuration: Direct Connection via Static IP Address

Setup

This setup uses the factory default IP address of the SF-5050:

192.168.0.2,255.255.255.0,0.0.0.0

↑ ↑ ↑

IP Address Network Mask Gateway

The PC IP address is set manually in Windows.

1. Connect the Positronic 9-Pin connector of the Ethernet cable (P/N 94-310265-3006LF) to COM1 – LAN of the SF-5050. Connect the RJ45 plug end to the computer.
2. In Windows, right-click *My Network Places* and select *Properties* from the pop-up menu. The *Network Connections* window opens.
3. Right-click *Local Area Connection* (or the equivalent) and click *Properties* from the pop-up menu. The *Local Area Connection* dialog box opens.
4. Click *Internet Protocol (TCP/IP)*. See Figure 14.

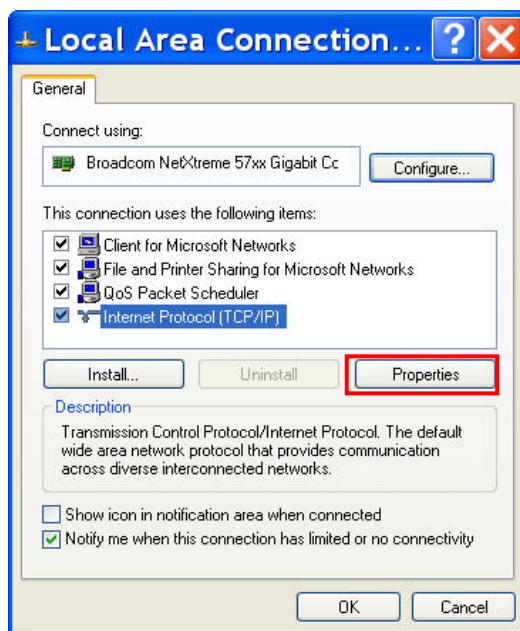


Figure 14: Local Area Connection

5. Click the *Properties* button. The *Internet Protocol* dialog box opens.

Refer to Figure 15 for the steps below:

6. Select *Use the following IP address*.

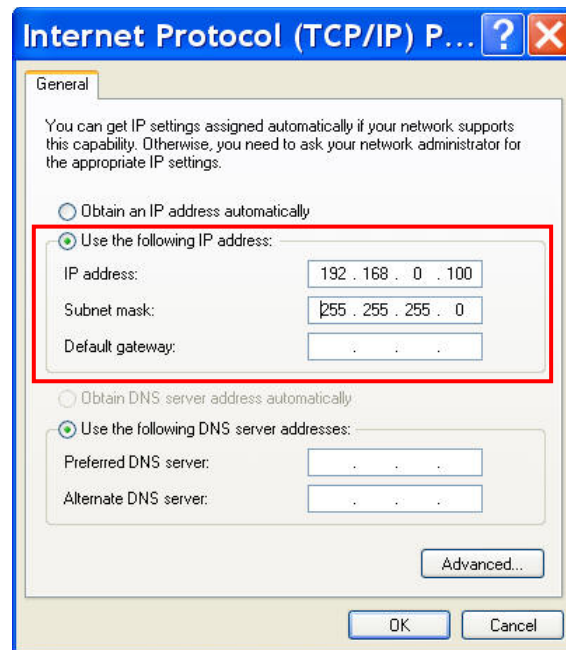


Figure 15: Internet Protocol

7. Enter the IP address for the PC. In this case, enter 192.168.0.100.



The first part of the IP address, 192.168.0, is the same for the SF-5050 and the PC. The last part of the IP address must be unique for every device. In this case, it is 100 for the PC.

8. Press the Tab button on the keyboard. The Subnet mask is automatically populated.
9. Click the OK button on this dialog box and also on the Local Area Connection dialog box.
10. Continue to the next section for connection instructions.

Connect SF-5050 to the PC

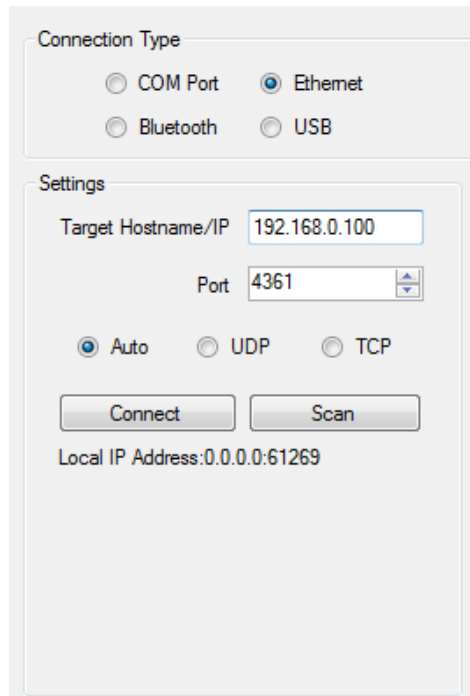
1. Open StarUtil 5000.
2. Click the Connections button to establish communications between the PC and the SF-5050 (see Figure 3). The Port Configuration dialog box opens.

Refer to Figure 16 for the steps below:

3. Select *Ethernet* as the *Connection Type*.



Do not change the default Ethernet Settings: 192.168.1.2 is the factory default IP address of the SF-5050. The default virtual COM port is 4361 (logical port ETH1) and the protocol is UDP2.




The screenshot shows a configuration window titled "StarUtil 5000". It has two main sections: "Connection Type" and "Settings".

Connection Type: Contains four radio buttons: "COM Port", "Ethernet" (which is selected), "Bluetooth", and "USB".

Settings: Contains a text field for "Target Hostname/IP" with the value "192.168.0.100", a "Port" spinner box set to "4361", and three radio buttons: "Auto" (selected), "UDP", and "TCP".

At the bottom of the "Settings" section are two buttons: "Connect" and "Scan". Below these buttons, the text "Local IP Address: 0.0.0.0:61269" is displayed.

Figure 16: Ethernet Port Configuration

4. Click .
5. Verify that the SF-5050 is connected to the PC. Messages scrolling in the Communication window indicate that the connection is established (see Figure 5).



If an Ethernet connection is not established, use StarUtil 5000 to verify the IP address of the SF-5050. A serial connection must be used to determine the receiver's IP address.

Chapter 2 Firmware

This chapter provides instructions on how to

- ✓ Determine if the firmware installed in the receiver is the most current
- ✓ Determine firmware versions
- ✓ Upload a unified firmware file to the receiver
- ✓ Upload a single firmware file to the receiver
- ✓ Verify loaded firmware

Determine If Installed Firmware Is the Most Current

⚠ The most current firmware must be installed to ensure the proper operation of the receiver.

The use of the *Firmware Info* window on the *Receiver Options* tab is the easiest way to determine if the installed firmware is the most current. An alternative method is to use the *Input Terminal* window. Both methods are described below.

Determine Firmware Versions – Receiver Options Tab/Firmware Info Window

Click *Input Terminal* on the menu to open the command and control window (see Figure 17).

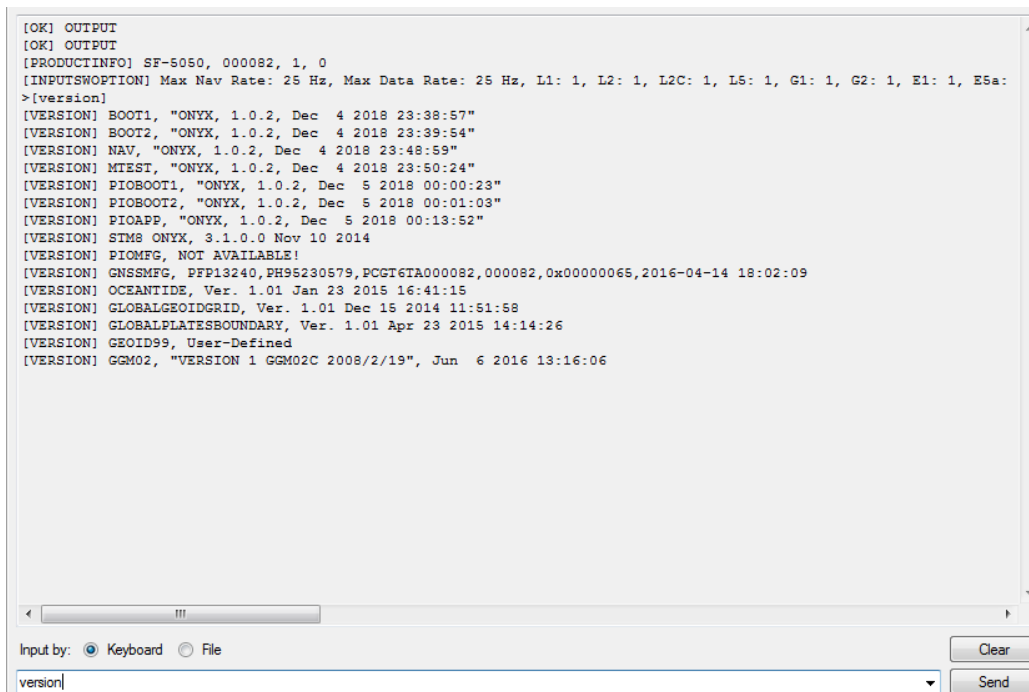


Figure 17: Input Terminal

1. Select *Input by Keyboard* at the bottom of the screen and enter: *version*. Click *Send*.
2. The receiver will return a list of loaded files similar to Figure 17. Verify these against the firmware provided on the USB drive provided with the product. If the USB drive has newer files, load those files following the procedure which follows.



The firmware is identified by version number. For example, the NAV firmware displayed in Figure 17 is version 1.0.2. Firmware ensembles are always referenced to the Navigation Firmware Number.

3. Browse to the NavCom\Firmware folder on the PC (see Figure 18).
4. The Firmware folder is copied from the SF-5050 Product Configuration USB Flash Drive. It contains the most current firmware (see example files in Figure 18). The firmware file extension is *.s19.

Name	Date modified	Type	Size
5050_WebPages_1.0.2	1/16/2019 8:14 AM	File folder	
96-310045-3001 SF-5050 Product User Gu...	1/16/2019 8:06 AM	Adobe Acrobat D...	7,956 KB
96-312008-3001 RevA17i_Onyx TRM.pdf	12/5/2018 8:10 AM	Adobe Acrobat D...	5,220 KB
96-316001-3001 Rev A GNSS Receiver Em...	3/29/2011 7:47 AM	Adobe Acrobat D...	39 KB
AN - StarUtil5000 Firmware Loading Instr...	3/22/2017 8:29 AM	Adobe Acrobat D...	80 KB
navcomx1c45x5050x64.inf	4/20/2016 1:01 PM	Setup Information	2 KB
Onyx_1.0.2.s19	12/4/2018 11:49 PM	S19 File	10,496 KB
Onyx_Boot1_1.0.2.s19	12/4/2018 11:39 PM	S19 File	333 KB
Onyx_Boot2_1.0.2.s19	12/4/2018 11:40 PM	S19 File	771 KB
Onyx_PIOApp_1.0.2.s19	12/5/2018 12:15 AM	S19 File	2,314 KB
Onyx_PIOBoot1_1.0.2.s19	12/5/2018 12:00 AM	S19 File	342 KB
Onyx_PIOBoot2_1.0.2.s19	12/5/2018 12:01 AM	S19 File	1,089 KB
Readme.txt	1/16/2019 8:08 AM	Text Document	2 KB
Release Notice v1.0.2.pdf	1/16/2019 8:12 AM	Adobe Acrobat D...	96 KB
RinexInstructions.txt	3/27/2014 9:25 PM	Text Document	1 KB
RinexUtil_3.9.3.exe	7/25/2017 9:13 AM	Application	1,872 KB
StarUtil5000_v1.0.2.exe	12/22/2018 1:55 AM	Application	3,484 KB

Figure 18: Firmware Folder Contents

5. Compare the current NAV Firmware version in the Firmware folder with the installed version displayed in the *Firmware Info* window (see Figure 17).
6. If the NAV firmware installed in the receiver is not the most current version:
 - a. Check the versions of the other firmware.
 - b. Write down all the firmware that must be updated.

Upload Firmware

PC Baud Rate Requirements for Firmware Upload via Serial Connection

The requirements below only apply to firmware uploaded via a Serial connection. They do not apply to firmware uploaded via a USB 2.0 Device or Ethernet connection.

■ GNSS Firmware

SF-5050 COM1: The maximum PC baud rate to upload the appropriate Bootloader and the NAV firmware file via a Serial connection is 115200.

SF-5050 COM2: The required PC baud rate to upload the appropriate Bootloader and the NAV firmware file via a Serial connection is 115200.

■ PWRIO Firmware

SF-5050 COM2: The maximum PC baud rate to upload the PWRIO Bootloader and the PWRIO firmware file via a Serial connection is 115200.



If the firmware fails to load, set the StarUtil baud rate and upload rate to 57600. Turn the receiver OFF. Begin the file load and then turn the receiver ON. The receiver allows 500ms at startup to “capture” the port at 57600, regardless of the setting in the active profile. Once StarUtil starts the upload, it pings the receiver every 200ms. A successful capture begins the file upload sequence.



Never attempt to upload firmware over the Bluetooth port.



Firmware may be uploaded via Ethernet or USB. Remote equipment users are strongly encouraged to also remotely connect one of the RS-232 ports as a backup, preferably COM 1.



Typically, if any firmware needs to be updated, it is NAV and PIOAPP. (Bluetooth® and WiFi software are hardcoded and are loaded only at the time of manufacture.)



The receiver must be navigating at the time of the firmware upload.



Always cycle power to the receiver after a firmware update. Failure to do so may result in the unit being unable to track StarFire.

Upload a Unified Firmware File

1. Click *Firmware Update* on the menu to open the *Receiver Options* tab (see Figure 19).

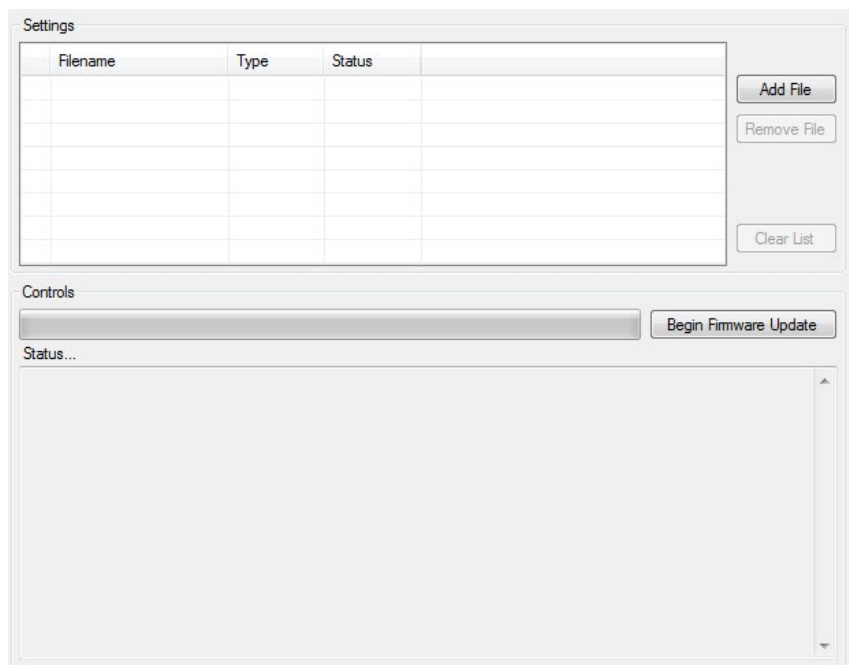


Figure 19: Firmware Update Window

2. Select *Add File* (see Figure 20).

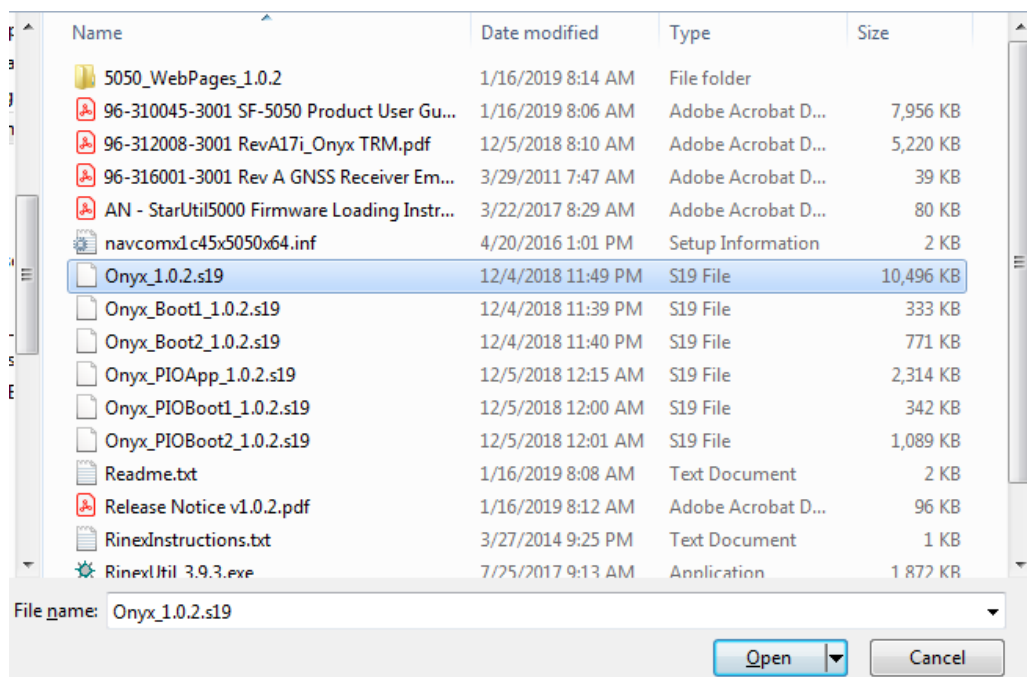


Figure 20: File Upload – Unified File Loader Option

3. Click *Open*.
4. Repeat this process until all needed files are captured for upload (see Figure 21).

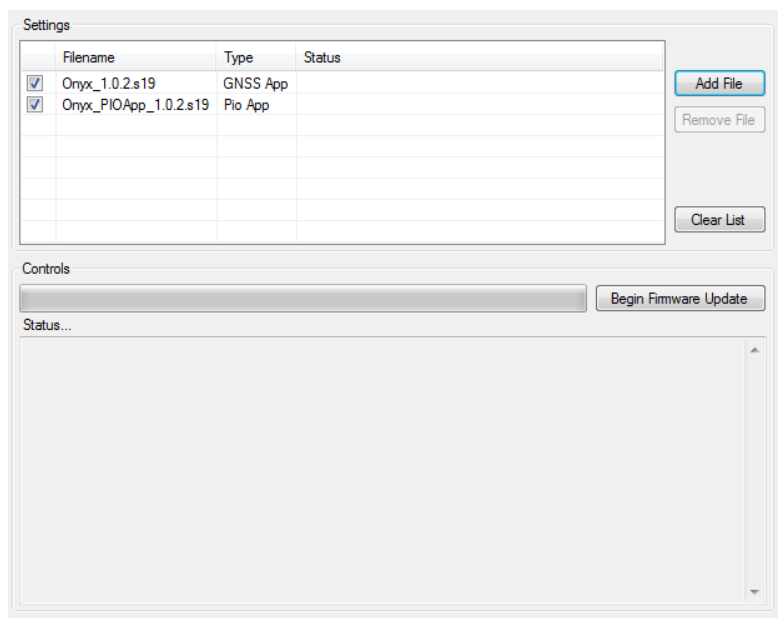
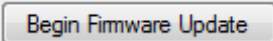


Figure 21: Firmware To Upload

5. Click  (see Figure 20).
6. Update status is provided as the process runs (see Figure 22). At the end of each file upload, there is a quiet period while files are verified, written from temporary memory to permanent memory and the receiver cycles power.

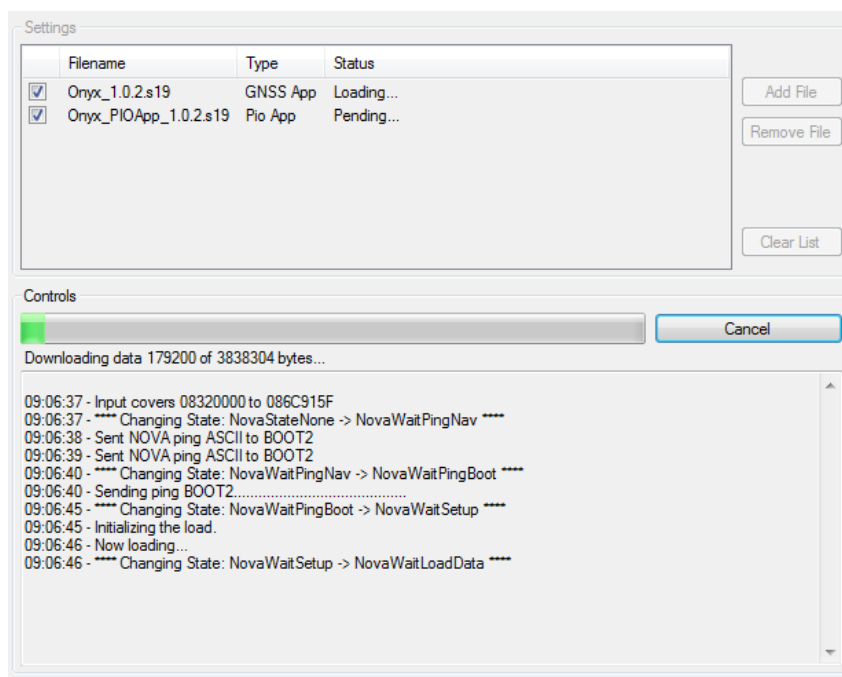


Figure 22: Ready to Downline Load File

7. Once the firmware files are uploaded, the *Loaded Successfully* dialog box is displayed (see Figure 23).
8. Click OK.

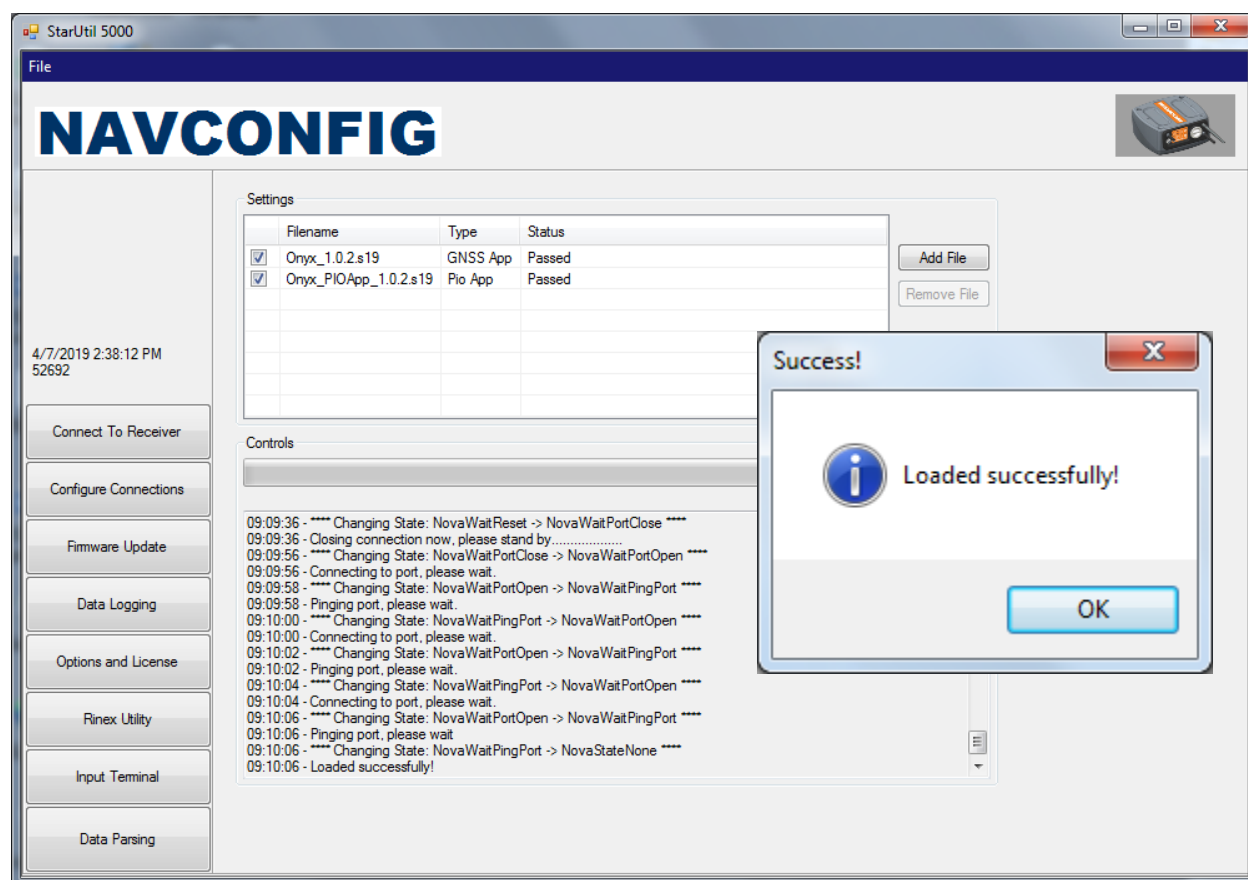


Figure 23: Finished with All Downline Loads

Chapter 3 Software Options

This chapter provides instructions for uploading Software Options to enable the robust functionality of the SF-5050 in the initial configuration purchased by the user, or as a performance upgrade.

The SF-5050 are designed with a long-term performance upgrade path to meet changing needs via software upgrades. Increased functionality does not typically require the costly purchase of additional hardware.



The SF-5050 software-enabled features (bundled for the SF-5050 and available for purchase individually for the SF-5050), cover a wide variety of applications. For the SF-5050, refer to the *SF-5050 GNSS Product User Guide* for descriptions of the software options in each bundle: SF-5050G, SF-5050S, and SF-5050M.



For the *initial* setup of the SF-5050, Software Options must be loaded before loading the StarFire License (if purchased).

How to Purchase Software Options

Contact a NavCom authorized representative or the [NavCom Sales Department](mailto:sales@navcomtech.com) (sales@navcomtech.com) to purchase software options.



The options code is receiver-dependent and cannot be uploaded into multiple receivers. Archive the software options file in case a reload is necessary.

Upload Software Options



The receiver must be navigating at the time of the software upload.

Perform these steps to load software options:

1. Click *Options and License* on the menu. Available options will be displayed.
2. In the *File Upload* window, select the *File* button.
3. Select the *Browse* button. See Figure 24.

Software Options StarFire Licensing

Software Options

Software Option	Current	Software Option	Current
Model:	SF-5050	RTK Base:	Enabled
Serial Number:	000082	RTK Moving Base:	Disabled
GPS:	L1, L2, L2C, L5	RTK Rover:	Enabled
GLONASS:	G1, G2	RTK Extend:	Enabled
GALLIO:	E1, E5A, E5B	One Hour RTKX:	Disabled
BEIDOU:	E1, B2, B3	SF Network Team:	Disabled
StarFire	Enabled	Network RTK:	Disabled
Nav:	25 Hz	L-Band Only:	Disabled
Data	25 Hz	L-Band ENC:	Disabled
1PPS/Event Latch:	Enabled	StarFire Over IP:	Enabled
SBAS Corrections:	Enabled	Black Box Disable:	Disabled

Refresh

File Upload

Upload By: ☐ Key ☒ File

Browse

Upload

Figure 24: File Upload – Software Options

4. Browse to NavCom\Software Options on the PC (see Figure 1).

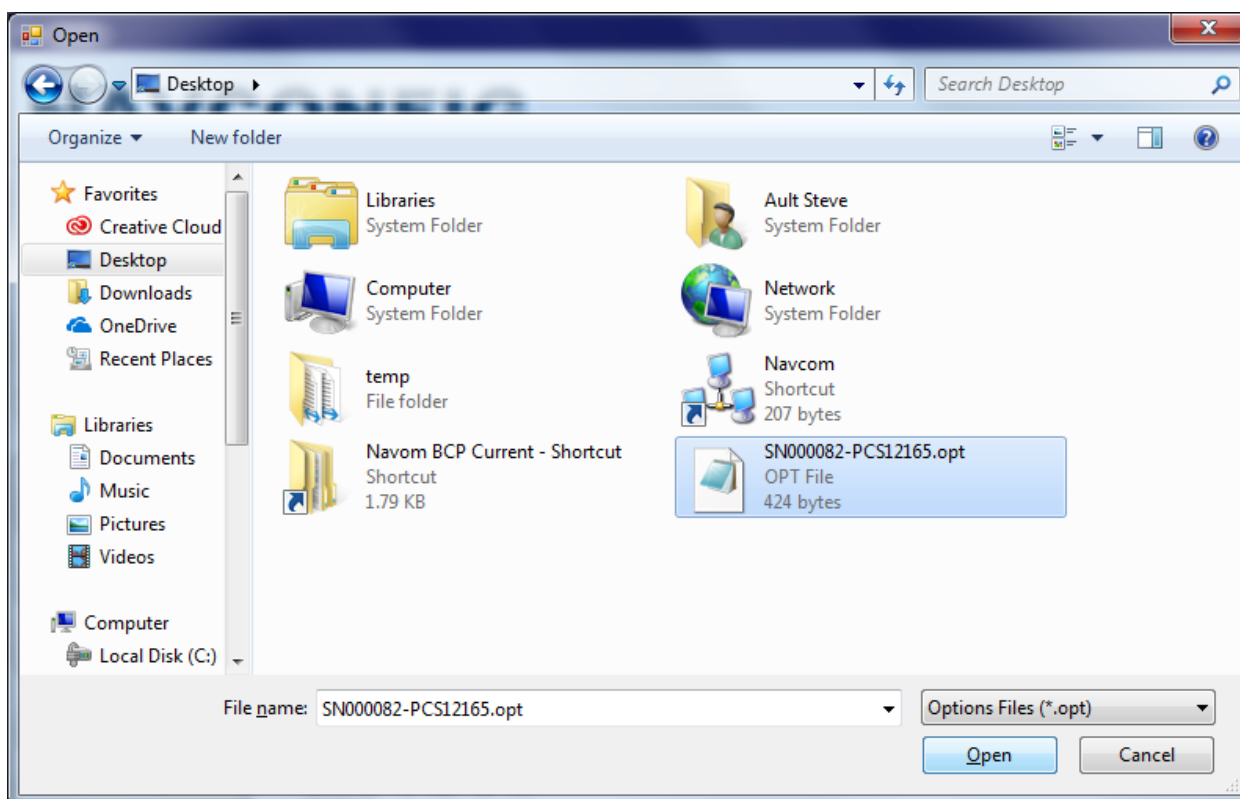


Figure 25: Browse File Upload – Software Options

5. The software options file extension is *.opt. Each file includes the specific SF-5050 serial number in the file name, for example “SN000082”.

6. Select the software options file. The path to the file appears in the upload field (see Figure 26).

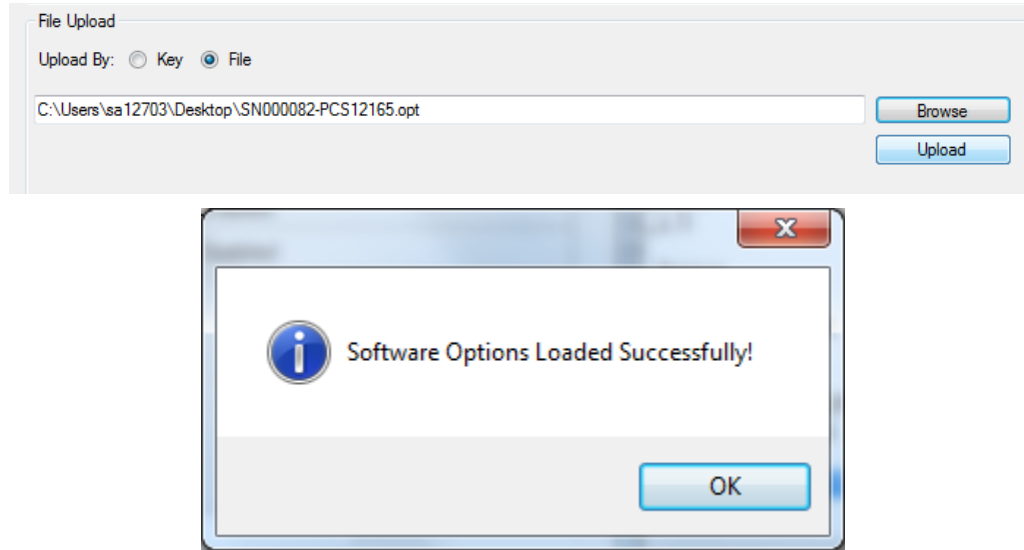



Figure 26: Software Options Window

7. Click . At the end of the upload, a confirmation box opens. Click OK.



“StarFire: Enabled” indicates that the StarFire Software Option is loaded. It does not indicate that a StarFire License is installed. Refer to [Chapter 7/StarFire License Data](#) for descriptions of the windows that provide confirmation of an installed StarFire License.

8. Do not close StarUtil 5000. Perform one of these steps:
 - If a StarFire license is purchased, go to the *How to Upload a StarFire License via Data Cable* section.
 - If a StarFire license is not purchased, go to *How to Purchase Software Options*.
 - The SF-5050 returns the entire list of loaded software options. However, StarUtil 5000 does not display the entire list in the *Software Options* window. Perform these steps to verify the software in the SF-5050:
 1. Type the command [INPUTSWOPTION] in the *Input Terminal* window.
 2. Click *Send*.
 3. Highlight and copy the entire output.
 4. Open any text editor, i.e., Microsoft Notepad, and paste the output there.
 5. Verify that all software options have been uploaded to the receiver.



If the above method fails to upload any of the purchased software options, refer to the next section below, *Use the Input Terminal to Upload Software Options*.

Use the Input Terminal to Upload Software Options

Perform the following steps to upload software options using the *Input Terminal*:

1. Open the software option file in any text editing program (e.g., Notepad)
2. Locate the option code at the bottom of the file (e.g., 74C91E91 789FA173 8E70296A 3259B2E6).
3. Highlight and copy the option code.
4. In the *Input Terminal* window, enter the command followed by the option code:
[INPUTSWOPTION] 74C91E91 789FA173 8E70296A 3259B2E6
5. Click *Send* on the *Input Terminal* window. If the software options loaded successfully, the *Input Terminal* window displays a confirmation message.

Chapter 4StarFire Operation

The SF-5050 is hardware ready for StarFire. The StarFire License *and* the StarFire Software Option are required to enable the StarFire Subscription Service. In addition, the StarFire navigation mode must be enabled on the receiver.

The StarFire Software Option is standard for the SF-5050 G, S, and M Software Bundles, and may also be purchased individually. The StarFire License, used to determine the subscription period, is a purchased item in addition to the StarFire Software Option.

For the initial setup of the SF-5050, the StarFire license is installed via data cable. Subsequent renewals of the license are typically transmitted to the receiver via radio broadcast.

Refer to these sections for details on:

- ✓ [How to Access the StarFire Service](#)
- ✓ [How To Upload StarFire License via Data Cable](#)
- ✓ [Over the Air \(OTA\) StarFire Licensing](#)
- ✓ [How to Upload a StarFire License via the Input Terminal](#)
- ✓ [How to Cancel a StarFire License](#)

Description of the StarFire Network

The StarFire Network is a global system for the distribution of SBAS corrections giving users the ability to measure their position anywhere in the world with exceptional reliability and unprecedented accuracy of better than 5cm (2 in.). Because the SBAS corrections are broadcast via INMARSAT geo-stationary satellites, the user needs no local reference stations or post-processing to get this exceptional accuracy. Furthermore, the same accuracy is available virtually anywhere on the earth's surface on land or sea from a 10-degree look angle to the INMARSAT satellite under track.

RTK Extend

RTK Extend¹ is a purchased software option for NavCom StarFire receivers, such as the SF-5050. It enables continuous real-RTK/RTK level positioning accuracy during radio communication outages by utilizing NavCom's global StarFire corrections.

Traditionally, when an RTK rover loses communication with the base station, it is unable to continue to provide centimeter position updates for more than a few seconds, resulting in user down-time and reduced productivity. With RTK Extend, a NavCom StarFire receiver operating in RTK mode, can transition to RTK Extend mode and maintain centimeter level positioning during communication loss for up to 15 minutes (15 minutes for a non-NCT base station). RTK Extend allows more efficient and uninterrupted work, enabling focused concentration on the work rather than the tools.



RTK Extend, if purchased, is included in the Software Options file. Refer to *Chapter 5 Software Options* for more information.

¹ Not Standard in Software Bundles

How to Access the StarFire Service

StarFire is a subscription service. The user pays a subscription, which licenses the use of the service for a predetermined period of time. In addition to the StarFire license, the SF-5050 receiver requires a StarFire Software Option, which is standard for the SF-5050 G, S, and M Software Bundles, and may also be purchased individually.

StarFire subscriptions can be purchased for quarterly, biannual or annual periods and are available via a NavCom authorized representative, or by contacting [NavCom Sales Department](#).

An authorized subscription will provide an encrypted keyword, which is specific to the serial number of the NavCom receiver to be authorized. This is entered into the receiver using StarUtil 5000 or the embedded webpage (refer to the *SF-5050 Product User Guide*).

For the SF-5050 receiver only, the initial StarFire license and StarFire Software Option are installed by an authorized dealer or the user.

For the SF-5050 receiver only, subsequent renewals of the license can be transmitted to the receiver via satellite upon request (refer to the *SF-5050 Product User Guide*).

StarFire Licensing Terminology

Table 2: StarFire Licensing Terminology

Terms	Description
Precise	Indicates that the license type is a StarFire license.
World Wide or Land Only*	Indicates the license type in regard to valid areas of StarFire operation: <ul style="list-style-type: none"> World Wide: Valid globally. Land Only: Valid only on land (or near land as defined by NavCom).
Calendar Time or Run-Time (Elapsed Time)	Indicates the license type in regard to duration of StarFire operation: <ul style="list-style-type: none"> Calendar Time: The receiver is licensed for a specified duration. Run-Time: This feature is no longer supported.
Active or Inactive	Indicates the current status of the StarFire license.
Canceled or Expired	Indicates how the StarFire license was terminated: <ul style="list-style-type: none"> Canceled: Terminated by the user Expired: The end date for the license is reached or all the run-time days are used.

*See also the [Point Radius](#) section on the next page.

Point Radius

This feature applies only to receivers with a Land Only StarFire license. The Point Radius definition is separate from the StarFire license. It allows the use of StarFire if the user is outside the boundary lines of a Land Only StarFire license, but on a land mass (i.e., an island).

The user must provide the coordinates to NavCom Customer Service for the Point Radius definition. NavCom provides StarFire use at the coordinates and within a determined radius. The Point Radius definition is only for one point and radius circle.

StarFire Satellites

Table 3: StarFire Satellites

Network	Satellite ID	Longitude	Satellite Name	Uplink Site
Net 1	402	97.65W	PAC-E	Laurentides
	643	143.5E	PAC-W	Auckland
	525	25E	IND-W	Burum
Net 2	678	178E	POR	Santa Paula
	564	64E	IND-E	Perth
	446	54W	AOR-W	Southbury

Before Uploading a StarFire License

Before uploading a StarFire License, either by data cable or Over the Air (OTA) StarFire Licensing, ensure that the receiver is configured for StarFire. The navigation mode, *StarFire*, must be set to *ON* in the *Set Navigation Modes* window (see Figure 27) to enable StarFire navigation (refer to the *SF-5050 Product User Guide*).

SET NAVIGATION MODES		
		CURRENT NAVIGATION SETTING
RTCM Code:	On ▼	ON
SBAS:	On ▼	ON
StarFire:	On ▼ Internal ▼	ON , INTERNAL
<input type="button" value="Apply Navigation Settings to the Receiver"/>		

Figure 27: Webpage view of StarFire ON

How to Upload a StarFire License via Data Cable

This section provides instructions to upload the StarFire license via data cable. A data cable must be used to upload the StarFire license during the initial setup of the SF-5050. Subsequent renewals of the license are typically transmitted to the receiver via radio broadcast.



The receiver must be tracking GPS satellites and providing a valid position solution at the time of the StarFire license upload to accept the license.

Confirm the position solution on the *PVT Data* window (see Figure 28) from the webpage (refer to the *SF-5050 Product User Guide*).

PVT Data

Position		Velocity		Error Estimate			
Lat:	N 33° 50' 28.250000"	East:	0.0000 m/s	Position FOM:		5 cm	
Lon:	W 118° 20' 37.125366"	North:	0.0010 m/s	Time FOM:		5	
Ht:	8.833 m	Up:	-0.0029 m/s	NORTH:		0.04 m	PDOP: 1.4
Alt:	43.747 m	Ground Speed:	0.0010 m/s	EAST:		0.03 m	HDOP: 0.7
Datum:	ITRF 2008 / GEOID99	Ground Track:	0.00°	UP:		0.08 m	VDOP: 1.2

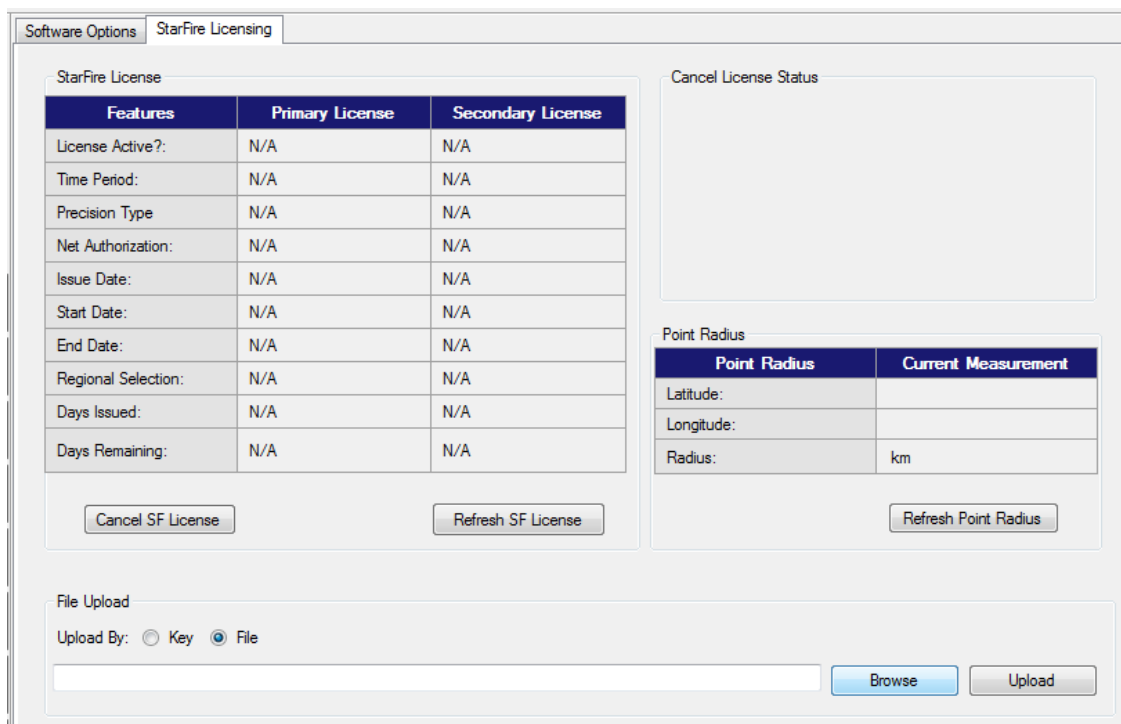
Navigation Status	
Summary Nav Status:	Nav valid / No Doppler / GeoFence not used / Rapid Recovery Inactive
Nav Mode:	StarFire Dual:GNSS : 3D : Dual freq
Constellation:	GPS / GLONASS
StarFire Engine Mode:	GPS and GNSS Modes; GNSS Takes Priority
StarFire Source:	INTERNAL
Correction Age:	4 sec
Age Limit:	1200 sec

Antenna Offset	
Phase Center(H1):	Not Applied
Slant Range:	Not Applied
Radius Antenna Body:	Not Applied

Solid Earth Tide	
North:	-61 mm
East:	1 mm
Up:	0 mm

Figure 28: Navigation Status

1. Click the *Options and License* menu.
2. Select *StarFire License* tab (see Figure 29).
3. Select the File button.



The interface shows the 'StarFire Licensing' tab with a 'StarFire License' section containing a table of license details. Below this are buttons for 'Cancel SF License' and 'Refresh SF License'. To the right is a 'Cancel License Status' section. Below that is a 'Point Radius' section with a table for current measurements and a 'Refresh Point Radius' button. At the bottom is a 'File Upload' section with radio buttons for 'Key' and 'File', a file input field, and 'Browse' and 'Upload' buttons.

Features	Primary License	Secondary License
License Active?:	N/A	N/A
Time Period:	N/A	N/A
Precision Type	N/A	N/A
Net Authorization:	N/A	N/A
Issue Date:	N/A	N/A
Start Date:	N/A	N/A
End Date:	N/A	N/A
Regional Selection:	N/A	N/A
Days Issued:	N/A	N/A
Days Remaining:	N/A	N/A

Point Radius	Current Measurement
Latitude:	
Longitude:	
Radius:	km

Figure 29: File Upload – StarFire License

4. Browse to NavCom\StarFire License on the PC. Select the StarFire license file. The StarFire license file extension is *.lic. Figure 30 displays the contents of a typical StarFire license file.

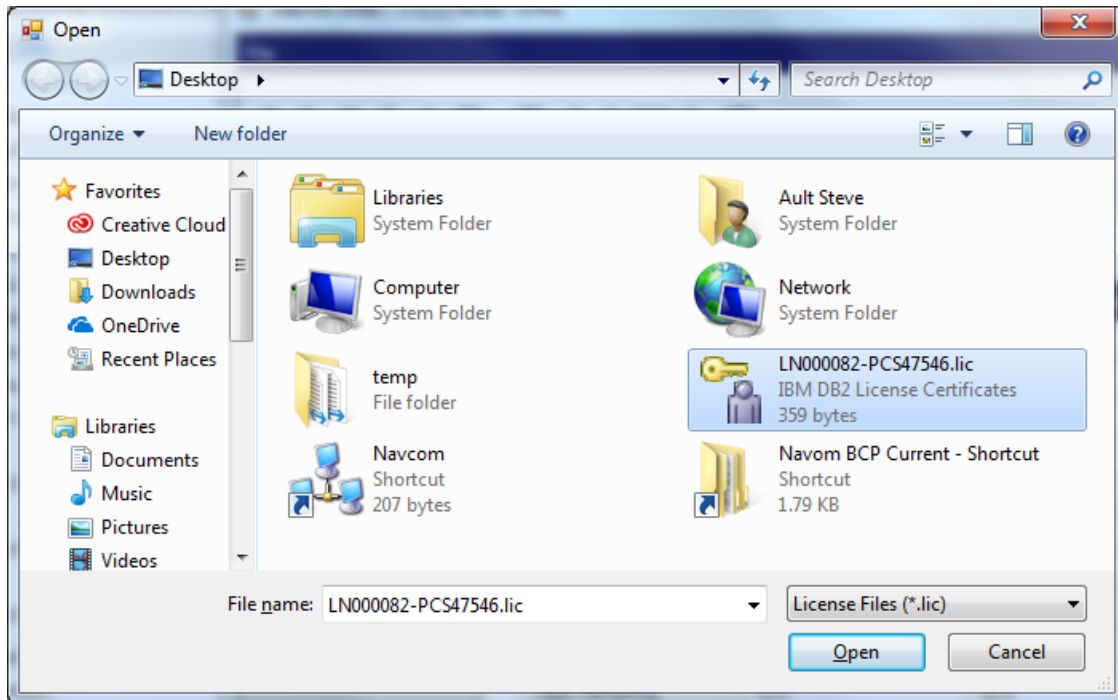


Figure 30: StarFire License Example

5. Click **Open**. The file location will populate StarUtil 5000.
6. Click **Upload**. At the end of the upload, a confirmation message is displayed. Click **OK**.
7. Click **Refresh SF License** to view the uploaded license.

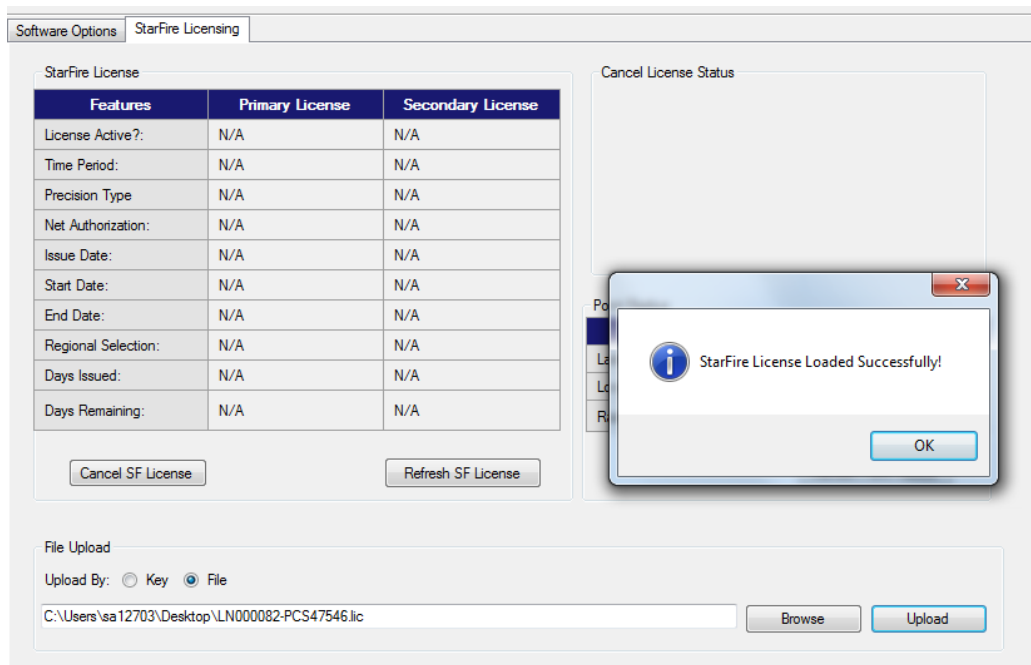


Figure 31: StarFire License Upload Success

Software Options StarFire Licensing

StarFire License

Features	Primary License	Secondary License
License Active?:	Active	N/A
Time Period:	Calendar	N/A
Precision Type	Precise	N/A
Net Authorization:	All	N/A
Issue Date:	1/18/2019 18:19:32	N/A
Start Date:	1/18/2019	N/A
End Date:	1/18/2022	N/A
Regional Selection:	Land Only	N/A
Days Issued:	0	N/A
Days Remaining:	N/A	N/A

Cancel License Status

Point Radius

Point Radius	Current Measurement
Latitude:	
Longitude:	
Radius:	km

File Upload

Upload By: ☐ Key ☒ File

C:\Users\sa12703\Desktop\LN000082-PCS47546.lic

Figure 32: StarFire License Refresh

How to Upload a StarFire License via the Input Terminal

1. Locate the StarFire .lic file in the root directory on the USB flash drive supplied with the unit, open that file in Notepad, and copy the license code.
2. On the StarUtil 5000 *Input Terminal*, select *Input by Keyboard* type the command [INPUTSFLICENSE] and paste the license code directly following that command (see Figure 34).

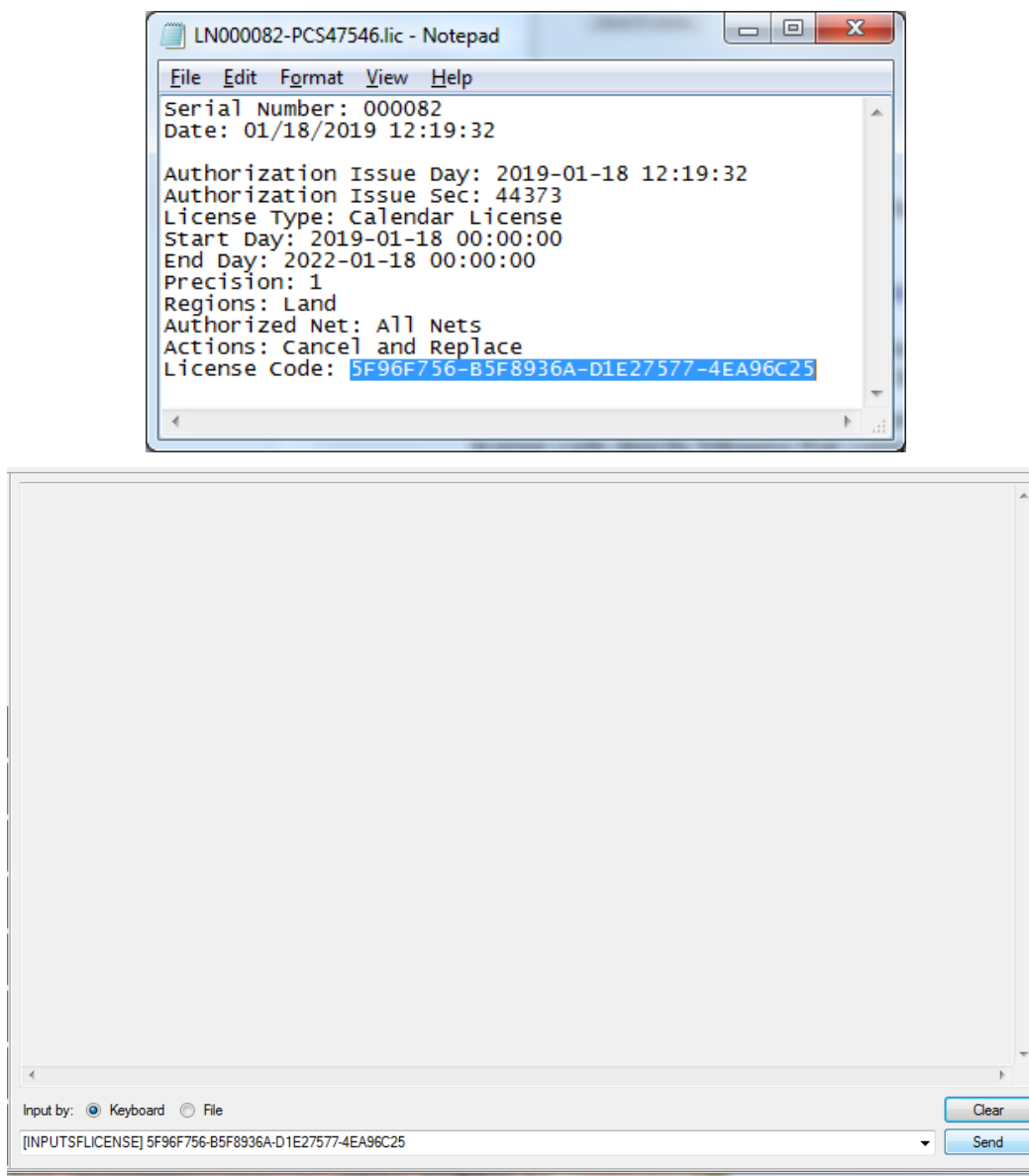


Figure 33: Notepad – StarFire License Code

3. Click **Send** to upload the license. A confirmation message is displayed in the *Input Terminal* window.

Over the Air StarFire Licensing

Over the Air (OTA) StarFire Licensing is the easiest way to install a StarFire license. The installation of a purchased license is accomplished via radio broadcast. Over The Air StarFire Licensing is especially convenient for receivers in remote locations in the field.

The requirements to obtain a StarFire license are as follows:

- ✓ Valid Purchase Order
- ✓ Signed License Agreement
- ✓ Appropriate Credit Terms with NavCom Technology or an Authorized Dealer; including a valid P.O.

NavCom recommends that customers process new StarFire license requests through an authorized dealer or NavCom Sales 15 to 30 days before the expiration of the current license.

The customer selects the date and time in GMT for the Over The Air broadcast of the StarFire License.

- ✓ The scheduled broadcast must be at least 3 business days after a valid P.O. is received by NavCom Sales.
- ✓ Specify broadcast date and time in GMT on the P.O.
- ✓ NavCom confirms the date & time of broadcast via email.



The broadcast procedure for Over The Air StarFire Licensing is subject to change.



For special-case scenarios, customers may request to receive the StarFire license via email to upload via data cable using StarUtil 5000 or another controller solution. The request must be specified in the P.O.

Over the Air Broadcast

The StarFire license is broadcast at the scheduled time and 5 minutes later as a backup.



To ensure reception, turn on the receiver before the specified broadcast time. Do not turn off the receiver until verifying that the license is saved.



The receiver must be tracking StarFire satellites at the broadcast times, though the receiver is not required to be operating in StarFire mode during the broadcasts.

Confirm that a StarFire satellite is tracked on the *StarFire Status* window, or check the position solution on the *PVT Data* window in the webpage (refer to the *SF-5050 Product User Guide*).

SFSTATUS1B Message						
	StarFire Channel Block 1		StarFire Channel Block 2		StarFire Channel Block 3	
Signal Strength:	21.18		6.34		9.97	
Good Packet Percentage:	100.00 %		100.00 %		100.00 %	
Idle Packet Percentage:	9.06 %		9.06 %		9.06 %	
Re-synchronization Counts:	1		1722		1	
Signal Status:	TRCK		TRCK		TRCK	
StarFire License Status:	Active		Active		Active	
Frequency Offset:	225 Hz		-560 Hz		195 Hz	
AGC Voltage:	34.35 V		34.35 V		34.35 V	
Satellite ID:	402		678		446	
Downlink Beam Indicator:	98W Laurentides		178E Santa Paula, CA		54W Southbury	
Hub ID:	SF GPS	SF GNSS	SF GPS	SF GNSS	SF GPS	SF GNSS
	3	1	3	1	3	1
Hub ID Valid?:	Valid		Valid		Valid	

External Hub ID
255

Figure 34: StarFire Status Webpage

Cancel SF License

This button under the StarFire Licensing tab provides the ability for the user to manually cancel an active StarFire license. A warning window is displayed to aid in preventing accidental cancellation of the active StarFire license.

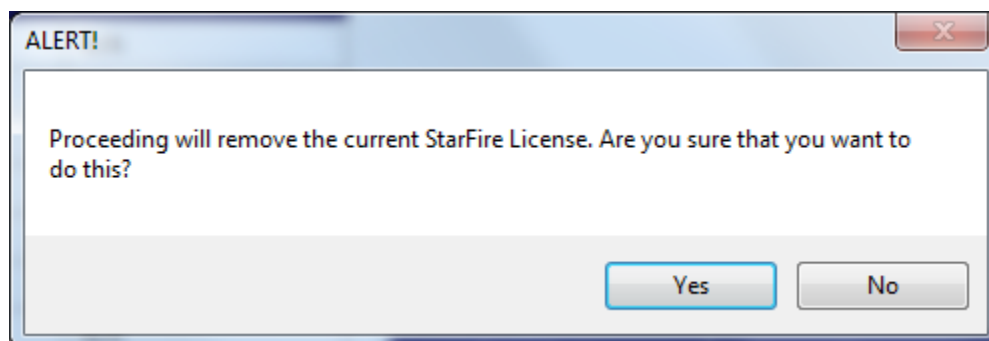


Figure 35: Cancel StarFire License Warning

The history of the last StarFire license cancellation and a cancel code to affirm the cancellation of the last StarFire license before the expiration date are displayed in the StarFire Licensing tab.

Chapter 5 Data Logging

This chapter provides instructions to log output data for NCT Proprietary Messages and NMEA Messages. This data can be used in a number of industry-standard GPS data analysis programs either in NCT format, after conversion to RINEX format, or by using the NMEA output.



NavCom's RINEX conversion program, RINEXUtil, is embedded within StarUtil 5000 and supplied on the SF-5050 Product Configuration USB Flash Drive. Refer to Chapter 6 and *Related Documents* in the fore-matter for information about the RINEXUtil User Guide.

Refer to these sections for detailed logging instructions:

- ✓ [Logging Data to a PC/Configure Logging Options](#): Log the data from scheduled messages continuously in a single file or in 24-hour data file splits.
- ✓ [Logging Data to the SF-5050](#): Log the data from scheduled messages directly to the SF-5050 internal memory.

Logging Data to a PC

Configure Logging Options

- ✓ Click the *Data Logging* button to open the logging options dialog box (see Figure 40).

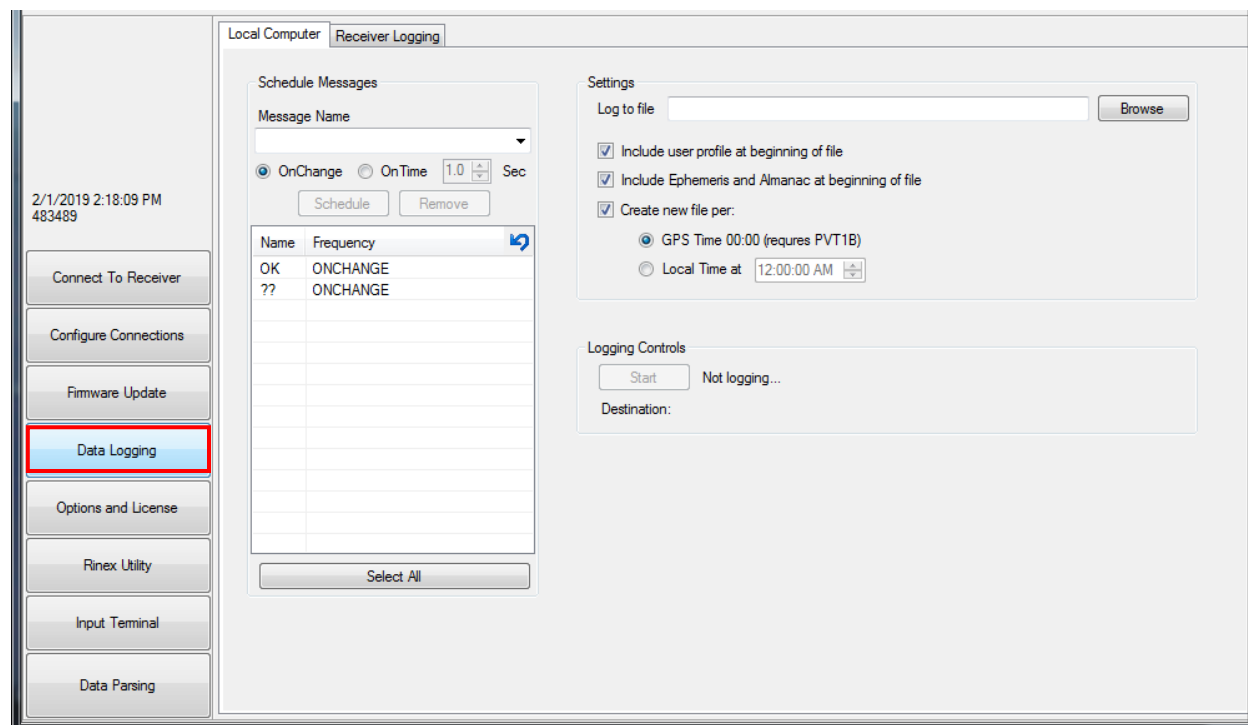


Figure 36: Configure Logging Options, Logging Configuration

Refer to Figure 40 for the options below:

Local Computer Tab

- ✓ **Message Name:** Select from the desired messages from the drop-down list.
- ✓ Select either *OnChange* or *OnTime*
 - OnChange: outputs the message as soon as it is generated. For example, PVT1B will be output at the selected navigation rate (i.e. 5 Hz), whereas EPHEM1B will occur once every 2-hours after receipt from the navigation satellite.
 - OnTime: outputs the message at the user selected interval, which may be set in fractional second intervals. Take care when using this feature to not overflow the buffer either on the SF-5050 or on the recording device.
 - Select *Schedule* to add the message to the list.

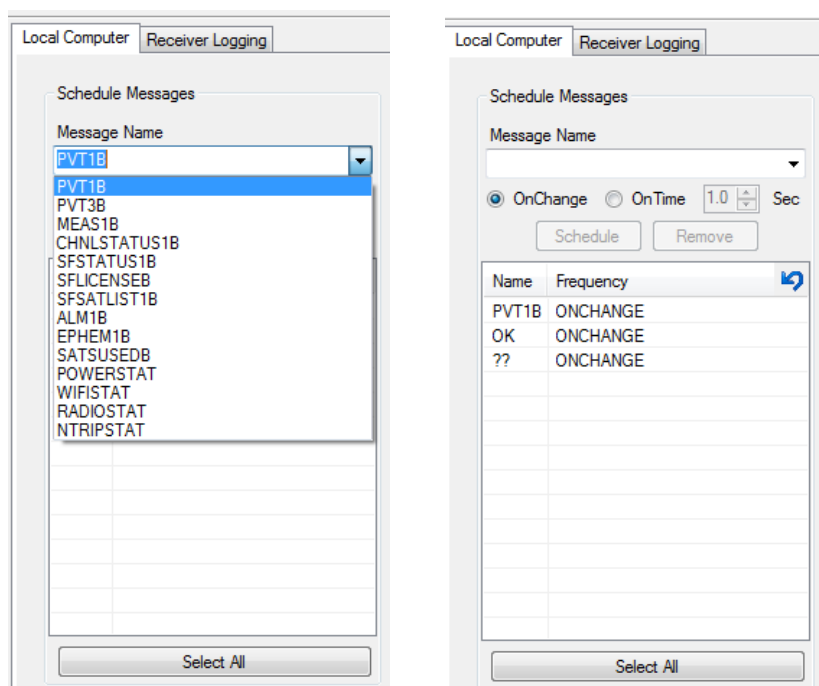


Figure 37: Configure Messages for Logging

- ✓ **Log to File:** Enter file name.
- ✓ Click *Browse* to select a directory in which to save the file.
StarUtil 5000 creates a folder under the selected directory, named in the yymmdd format. For example, the directory path d:\NavComWorking\Data becomes d:\NavComWorking\Data\yyymmdd.
- ✓ **Include user profile at beginning of file:** Checked by default. This data is needed by NavCom to aid in analyzing data.
- ✓ **Include Ephemeris and Almanac at beginning of file:** Checked by default. Almanac and Ephemeris are required for post processing.
- ✓ **Create a new file at GPS or Local Time Rollover per (required PVT1B message):**
 - GPS Time (checked by default): Logs data from scheduled messages in 24-hour data file splits. The file splits restart at 00:00:00 GMT and create a new folder name at each 24-hour period.

- Local Time at: Logs data from scheduled messages in 24-hour data file splits. The file splits restart at 00:00:00 local time and creates a new folder name at each 24-hour period.



The GPS time (seconds into the week) always starts on Sunday morning at 00:00 GMT.

- ✓ Click the *Start* button to start logging. *Logging to File...* is illuminated on the left side of the Status Bar (see Figure 41).

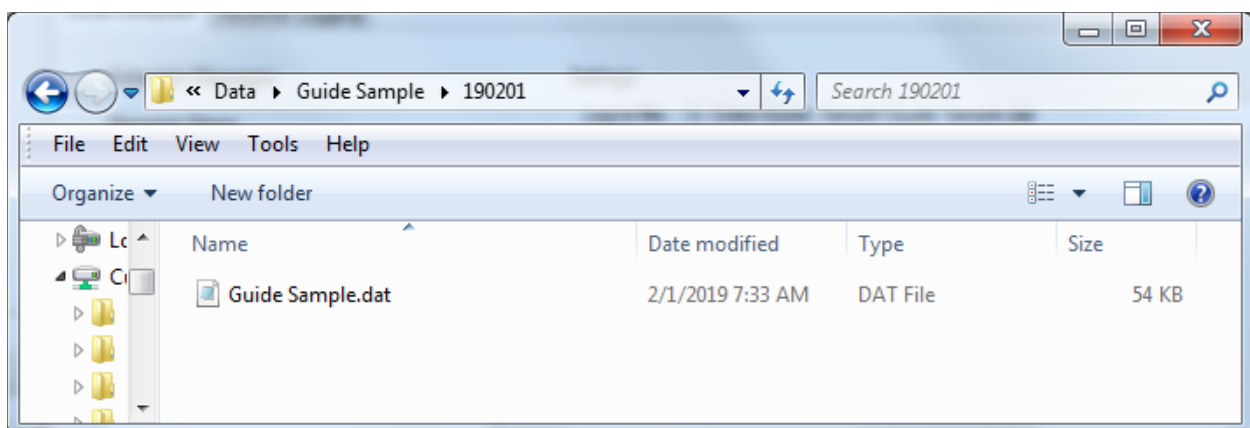
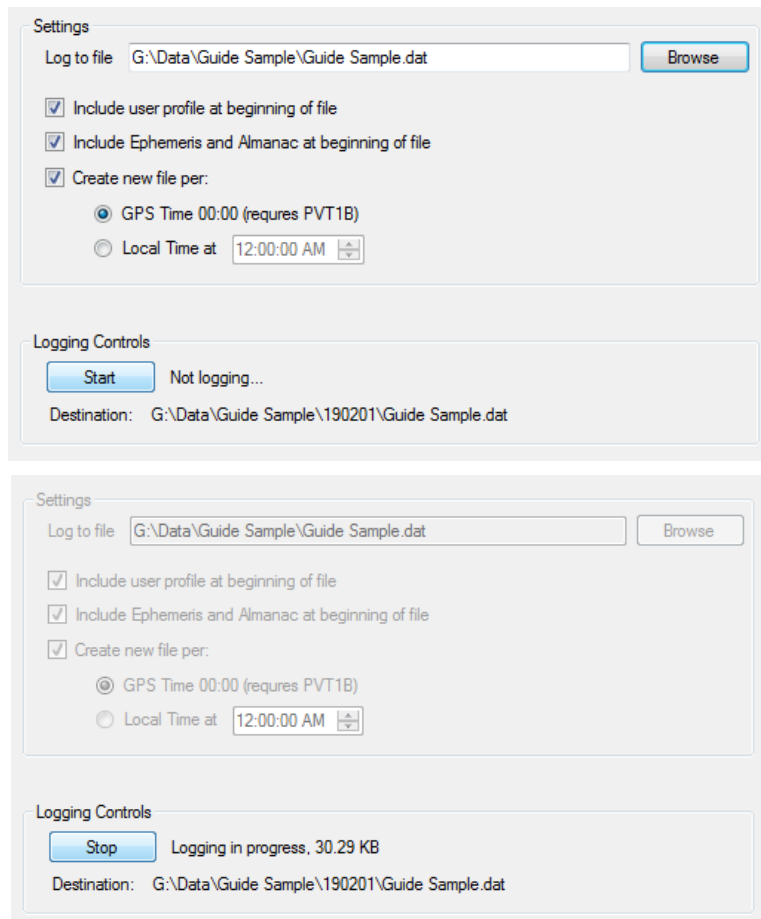


Figure 38: Logging Indicator

Logging Data to the SF-5050 Removable SD Card

This section provides instructions on how to log scheduled messages to the SF-5050 removable SD card.

Scheduling Messages

- ✓ *Message Name*: Select from the desired messages in the drop-down list.
- ✓ Select either *OnChange* or *OnTime*
 - OnChange: outputs the message as soon as it is generated. For example, PVT1B will be output at the selected navigation rate (i.e. 5 Hz), whereas EPHEM1B will occur once every 2-hours after receipt from the navigation satellite.
 - OnTime: outputs the message at the user selected interval, which may be set in fractional second intervals. Take care when using this feature to not overflow the buffer either on the SF-5050 or on the recording device.
 - Select *Schedule* to add the message to the list.

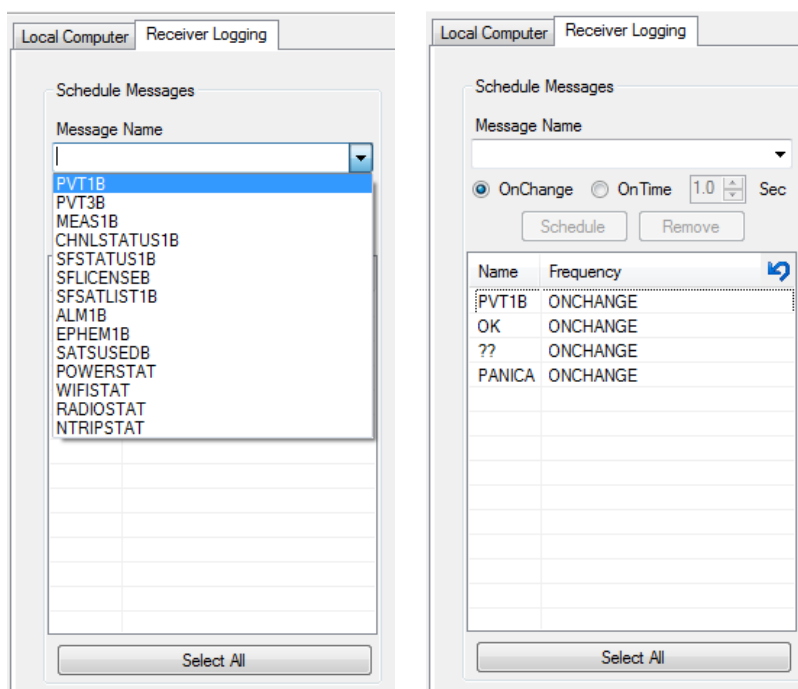


Figure 39: SD Card Message Scheduling

Settings

- ✓ *Drive*: Select C: from the drop-down menu
- ✓ *Name*: Enter file name.
- ✓ *Timeout*: sets the file size interval (when checked).
- ✓ *Delay*: sets the time wait before logging begins (when checked) from the moment *Start* is selected.
- ✓ *Enable Logging on Bootup*: sets the receiver to automatically begin data logging upon power-up (when checked).
- ✓ Click *Submit* to create the file on the SD card.

Figure 40: SD Card File Settings

Logging Controls

- ✓ *Include user profile at beginning of file*: Checked by default. This data is needed by NavCom to aid in analyzing data.
- ✓ *Include Ephemeris and Almanac at beginning of file*: Checked by default. Almanac and Ephemeris are required for post processing.
- ✓ *Create a new file at GPS or Local Time Rollover per (required PVT1B message)*:
 - GPS Time (checked by default): Logs data from scheduled messages in 24-hour data file splits. The file splits restart at 00:00:00 GMT and create a new folder name at each 24-hour period.
 - Local Time at: Logs data from scheduled messages in 24-hour data file splits. The file splits restart at 00:00:00 local time and creates a new folder name at each 24-hour period.





The GPS time (seconds into the week) always starts on Sunday morning at 00:00 GMT.

- ✓ Click the *Start* button to start logging. *Logging to File...* is illuminated on the left side of the Status Bar (see Figure 41).

Downloading Data from Internal Memory to a PC (SF-5050)

1. Create a directory on the PC for storing the logged data.

2. Type [USBMODE]Device, MassStorage on the *Input Terminal*. The SF-5050 2GB internal memory flash will show in Windows Explorer as an additional “removable” drive (see Figure 42).
 3. Open the datalog folder (see Figure 42) on the removable drive and select the folders or files to store on the PC.
 4. Drag and drop these folders or files into the designated folder on the PC.
-  After power cycle, file logging is in Stopped status.
-  Each time data logging is restarted, a new log file is created (see Figure 44).

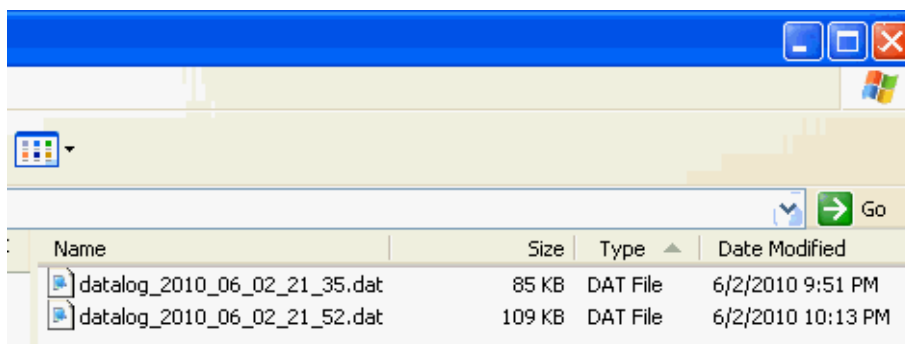



Figure 41: Automatically Generated Datalog Files

-  Removing data from the internal memory is a slow process, so it is better to keep the files small and remove them soon after data logging is complete. In the current software, downloading 1GB of data requires approximately 1.5hrs. File sizes are accumulated based on the number and frequency of messages scheduled to log. At 1Hz, a typical log file used for survey purposes will be above 20MB.

Chapter 6..... Post Processing

This chapter provides instructions to parse data.

Data Parsing

Use the *Data Parsing* window to extract selected NavCom proprietary messages from a binary log file to *.txt files. Individual ASCII messages may also be extracted to a *.txt file. There are various options that control the data parsing.

- ✓ Click the *Data Parsing* option to open the window.

Select Data File

File Name

Select Messages to Extract

<input type="checkbox"/>	NOVA	Sub ID	Start	End	Epochs
<input type="checkbox"/>	PVT1B				
<input type="checkbox"/>	CHNLSTATUS1B				
<input type="checkbox"/>	CHNLSTATUS1B	AZEL			
<input type="checkbox"/>	CHNLSTATUS1B	TRK			
<input type="checkbox"/>	CHNLSTATUS1B	CNO			
<input type="checkbox"/>	MEAS1B				
<input type="checkbox"/>	EPHEM1B				
<input type="checkbox"/>	SFSATLIST1B				
<input type="checkbox"/>	SFSTATUS1B				
<input type="checkbox"/>	ALM1B				
<input type="checkbox"/>	ECHODGPSB				
<input type="checkbox"/>	RTKSTATUS1B				
<input type="checkbox"/>	MBRTK1B				
<input type="checkbox"/>	NAVCONFIG1B				
<input type="checkbox"/>	ASCII message...				

Time Span

Time Start:

Time End:

Truth Position

Latitude (DMS)

Longitude (DMS)

Height (m)

Latitude/Longitude as DD MM SS.SSSS
Height as HH.HHHH

Example:
Latitude: 33 24 28.1234
Longitude: -115 32 21.231
Height: 12.1234

Format File

☐ Format for Matlab

☐ Create a new file after 64000 lines of text

ASCII messages (separated by spaces)

Figure 42: Data Parsing Window

Refer to Figure 42 for the options below:

- ✓ **File Name:** Click *Browse* to select a binary log file to parse.

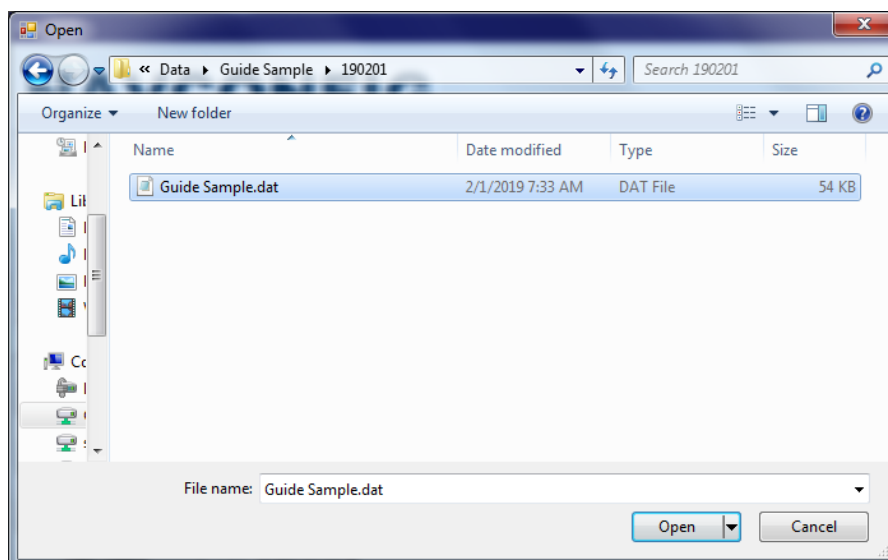
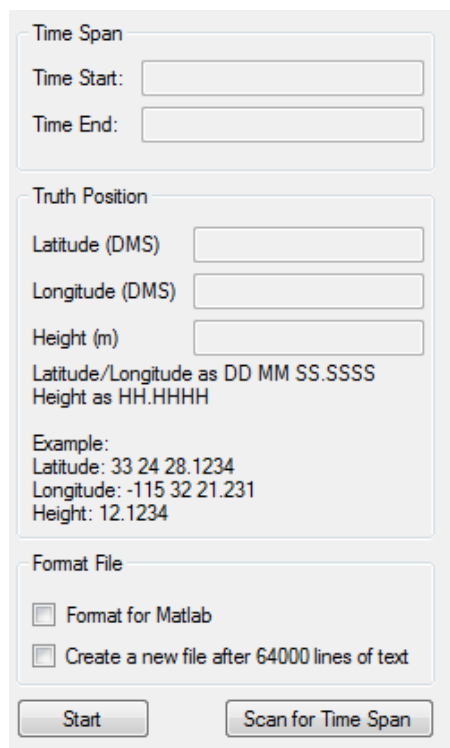


Figure 43: Data Parsing File Selection

- ✓ **Select Messages to Extract:** Check individual messages or click the top box in the column description to select all.



To extract an ASCII message, scroll down to the bottom of the message list. Check “ASCII message”. Type only one message mnemonic, for example [PANICA], in the ASCII message field.



Time Span

Time Start:

Time End:

Truth Position

Latitude (DMS)

Longitude (DMS)

Height (m)

Latitude/Longitude as DD MM SS.SSSS
Height as HH.HHHH

Example:
Latitude: 33 24 28.1234
Longitude: -115 32 21.231
Height: 12.1234

Format File

☐ Format for Matlab

☐ Create a new file after 64000 lines of text

Figure 44: Data Parsing Options

Refer to Figure 44 for the options below:

Time Span

✓ **Time Start/Time End:** Enter a specific time to use as the start and/or end time. Only data appropriate to the timestamps in these fields is extracted.

- Use the *Scan For Time Span* button on the bottom right to scan the file for GPS time bookends.
- Entering only a start time leaves out the data that has an earlier timestamp.
- Entering only an end time extracts all data that has a timestamp less than the entered value.



Entering Start/End times is useful to focus on an issue that occurred during a specific time period.

Truth Position

Entering known accurate coordinates (i.e. from a RINEX post-processed result) allows the parsed file to include the delta difference from the truth to the recorded position. This helps to identify outlier epochs.

Format File

- ✓ **Format for Matlab:** Check to extract the data in Matlab format.
- ✓ **Create a new file after 64000 lines of text** helps to manage csv or xls files.

Parse Data

- ✓ Click on **Start** to process the data. The output file has the primary file name and data recorded appended to the file name, along with “.txt” extension.

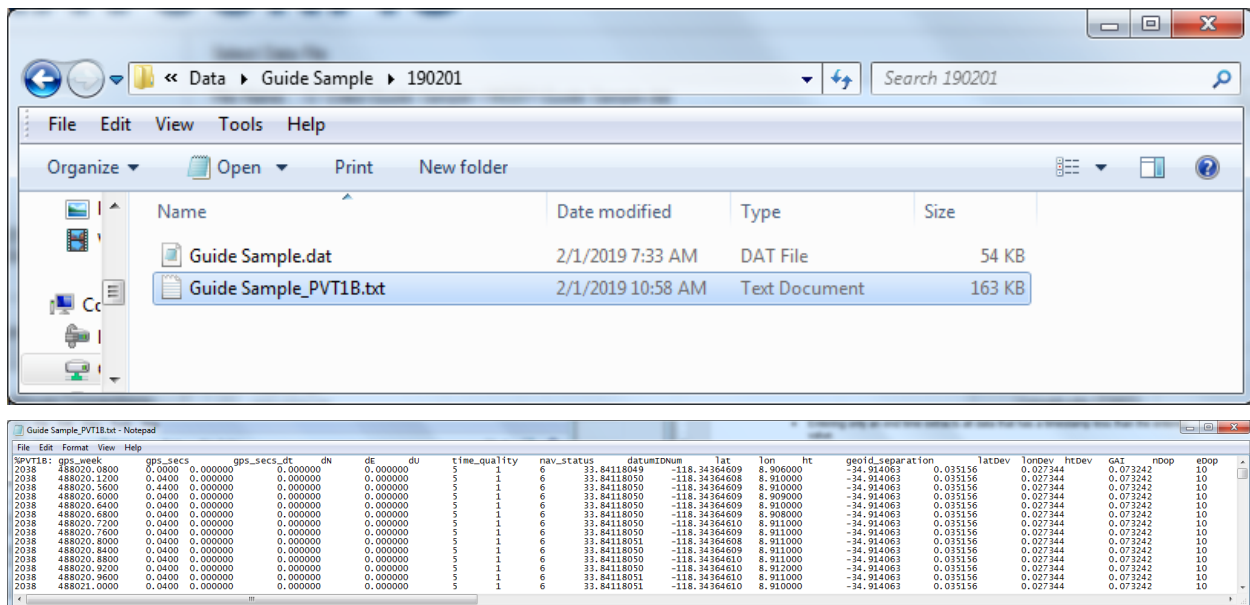


Figure 45: Parsed Data File

RINEX File Processing

The RINEX Utility converts NCT (NavCom Technology) binary raw data (MEAS1B, PVT1B, ALM1B, and EPHEM1B messages) to RINEX v2.1 format. Converting NCT raw data to RINEX provides a means to post-process the raw data when third-party software packages do not support the NCT Binary format but do possess the ability to import RINEX Standard measurement data.



Most post-processing programs require a minimum of 60 minutes of data to process almanac and ephemeris data at the beginning of the file.

Figure 46: NavCom RINEX Utility

The NCT RINEX Utility GUI is divided into four major areas:

- ✓ File I/O
- ✓ User Input
- ✓ Options
- ✓ Execution and Progress

File I/O

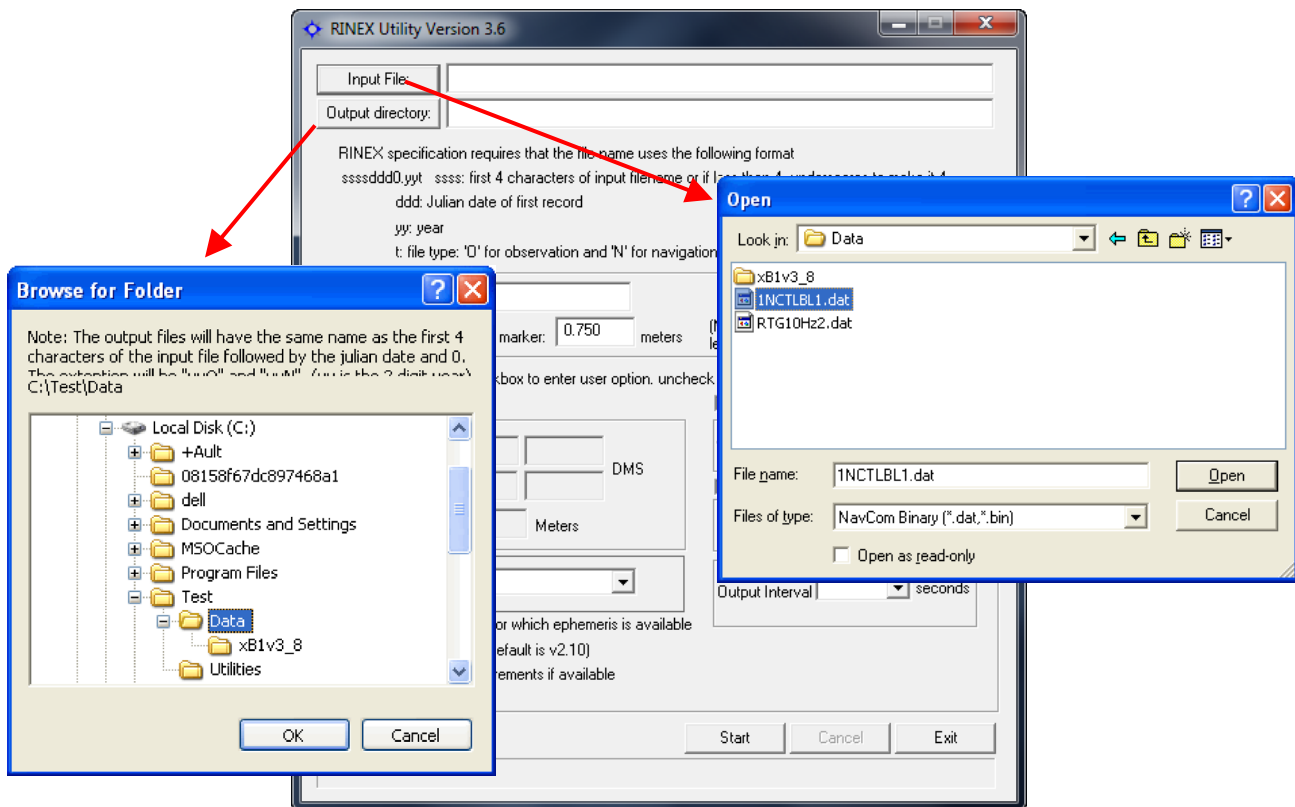


Figure 47: Input File and Output Directory

Refer to Figure 49 for the steps below:

- ✓ Click the *Input File* button to navigate to and select the NCT binary raw data file (*.dat) to be converted to the RINEX v2.1 format.



Note that the NCT will be formatted according to the NavCom file naming convention.

E.g. **04490111.dat** where:

04 represents the hour in GPS time

49 represents the minute

011 is the Julian Calendar Day of the year (number of days since January 1)

1 is the sequence number of the files processed for this day

.dat is the file type.

- ✓ Click the *Output Directory* button to select the folder to save the converted files. The RINEX Utility converts the NCT data file into two RINEX files, one with GPS navigation data and the other with observation data (refer to the section below, *RINEX File Naming Conventions*).



The conversion options available in the *User Input* and *Options* areas of the RINEX Utility window are not always necessary to complete the conversion. However, selecting the appropriate *Antenna Type* is always recommended to obtain the best results (see Figure 53).

If the user enters conversion options, the headers of the RINEX files display the user specific information. If the user does not enter options, the headers display the default information shown in Table 4.

Table 4: RINEX Utility Defaults

Leap Seconds	0 or Last Entered
Marker Name	None or Last Entered
Antenna Height	0.0 or Last Entered
Marker Position	Disabled
Output Times (Start and End)	Disabled
Sat Ephemeris when Available	Disabled

✓ These conversion options are available:

- *User Input: Marker Name, Leap Seconds, and Antenna Height Above Marker*
- *Options: Marker Position, Output Start / End Times, Antenna Type, Output Interval, and Ephemeris Output*



Refer to the sections below, User Input and Options, for details.

✓ If no conversion options are desired, click the *Start* button to generate the RINEX files.

RINEX File Naming Conventions

RINEX requires the file naming convention to follow a specific format. The easiest way to relate files is to use the same naming convention for all related files in a given directory and to use separate directories for files recorded on the same date. The file naming convention is:

- ✓ File names are limited to 8 characters followed by a 3 character extension (MS-DOS compatible; ssssddd0.yyt)
- ✓ ssss = a unique file identifier. All four characters must be used. If less than 4 characters are used, enter “_” (underscore) to fill the space. Any alpha-numeric character is acceptable (A-Z and 0-9).



If the name of the data file is longer than four characters, it is truncated when the RINEX files are generated. For example, “cnav8b.DAT” becomes “cnav”.

- ✓ ddd = the Julian date of the year; i.e. March 23, 2007 = Julian date 082
- ✓ 0 = required fill character
- ✓ yy = last two digits of the calendar year
- ✓ t = file type; the output files will be tagged as either O for observation or N for navigation, for example, “cnav0820.07N” and “cnav0820.07O”.

User Input

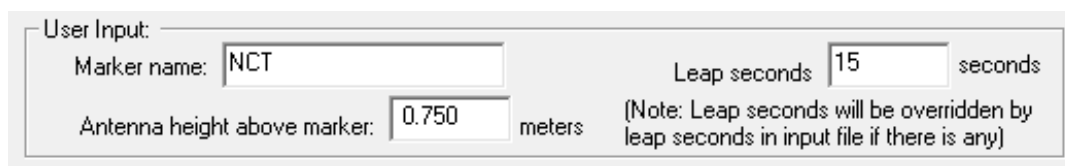


Figure 48: User Input Area

Completing the *User Input* fields is optional. Entries in these fields are included in the headers of the RINEX navigation or observation files.

Figure 50 shows the *User Input* area of the RINEX Utility.

- ✓ **Marker name:** Allows up to 60 characters to identify the site where the data was collected.
- ✓ **Leap seconds:** Allows the user to insert the current GPS Leap Second value, if known. If left blank no leap second value will be reported in the RINEX ephemeris (navigation) file header, or the RINEX Utility will use the leap second time reported in the raw data file (if one exists). If the raw data file has a larger leap second value reported than the user entered value, the raw data file value will be used instead.
- ✓ **Antenna height above marker:** Allows the user to insert antenna base height above the survey point. This adjustment can often be made in the Post Processing Software package as well.

Options

Figure 49: Options Area

Completing the *Options* fields is optional. Check (✓) the box above to modify an option.

Figure 51 shows the *Options* area of the RINEX Utility.

- ✓ **Marker Position:** Allows the user to input the Latitude, Longitude, and Height of the surveyed position in Degrees Minutes and Seconds. These coordinates are converted to Cartesian ECEF format and inserted into the “Approximate Position XYZ” area of the RINEX observation file. If left disabled, the RINEX Utility will average the position based on the range measurements received from the total number of epochs in the data collection period.



RINEX Utility conforms to RINEX Standard 2.10, which states that the Cartesian ECEF position in the observation file header is WGS84. This means that the height entered in the RINEX Utility must be WGS84. The RINEX Utility makes no attempt to convert other datum heights to WGS84. Using height data from a datum other than WGS84 will result in errors in the Z-axis.

- ✓ *Output start time / Output end time*: If enabled, the *Output Start* and *Output End* times allow the user to parse a large raw data file into a smaller snap shot of the overall data collection period. Caveats are that the GPS Week Number, and the GPS Time Of Week (TOW in seconds) be entered. Refer to the sections below, *GPS Week Number* and for details on these values.
- ✓ If the *Output Start* and *Output End* times are disabled, the RINEX Utility will process the entire data collection period.

GPS Week Number

The GPS Week Number count began at midnight on the evening of 05 January 1980 / morning of 06 January 1980. Since that time, the count has been incremented by 1 each week, and broadcast as part of the GPS message. The GPS Week Number field in the data stream is modulo 1024. This meant that at the completion of week 1023, the GPS Week Number rolled over to 0 on midnight GPS Time of the evening of 21 August 1999 / morning of 22 August 1999.

The SF-5050 use an adjusted 16-bit integer (U16) in the data to avoid this confusion. They can handle up to week 65535.

For example, in Figure 51 the GPS Week Number for the *Output Start / End* times is 1313. To determine the week/date, subtract 1024 from 1313, which is 290. Then add 290 weeks to 21 August 1999. The result is Sunday 6 March 2005.

GPS Time

The GPS time (seconds into the week) always starts on Sunday morning at 00:00 GMT. Each 24 hour period contains 86,400 seconds. A full week contains 604,800 seconds. Please see the table below for a breakdown of hourly / daily increments.

Table 5: GPS Time

GMT	Sun	Mon	Tue	Wed	Thu	Fri	Sat
0:00:00	0	86400	172800	259200	345600	432000	518400
1:00:00	3600	90000	176400	262800	349200	435600	522000
2:00:00	7200	93600	180000	266400	352800	439200	525600
3:00:00	10800	97200	183600	270000	356400	442800	529200
4:00:00	14400	100800	187200	273600	360000	446400	532800
5:00:00	18000	104400	190800	277200	363600	450000	536400
6:00:00	21600	108000	194400	280800	367200	453600	540000
7:00:00	25200	111600	198000	284400	370800	457200	543600
8:00:00	28800	115200	201600	288000	374400	460800	547200
9:00:00	32400	118800	205200	291600	378000	464400	550800
10:00:00	36000	122400	208800	295200	381600	468000	554400
11:00:00	39600	126000	212400	298800	385200	471600	558000
12:00:00	43200	129600	216000	302400	388800	475200	561600
13:00:00	46800	133200	219600	306000	392400	478800	565200
14:00:00	50400	136800	223200	309600	396000	482400	568800
15:00:00	54000	140400	226800	313200	399600	486000	572400
16:00:00	57600	144000	230400	316800	403200	489600	576000
17:00:00	61200	147600	234000	320400	406800	493200	579600
18:00:00	64800	151200	237600	324000	410400	496800	583200
19:00:00	68400	154800	241200	327600	414000	500400	586800
20:00:00	72000	158400	244800	331200	417600	504000	590400
21:00:00	75600	162000	248400	334800	421200	507600	594000
22:00:00	79200	165600	252000	338400	424800	511200	597600
23:00:00	82800	169200	255600	342000	428400	514800	601200
23:59:59	86399	172799	259199	345599	431999	518399	604799



Example: 518400 = Sat 0:00:00 GMT

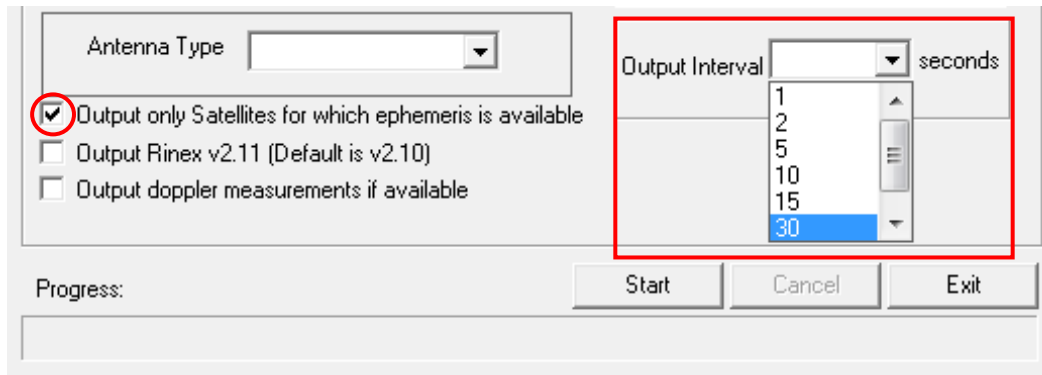


Figure 50: Output Interval and Ephemeris Output

- ✓ **Ephemeris Output:** If enabled, outputs the ephemeris (navigation) file, but only with ephemeris data for those satellites that have been tracked over the data collection period. If disabled the ephemeris file will contain data on all satellites.
- ✓ **Output Interval:** Select the output interval in seconds to decimally parse the data, if desired.

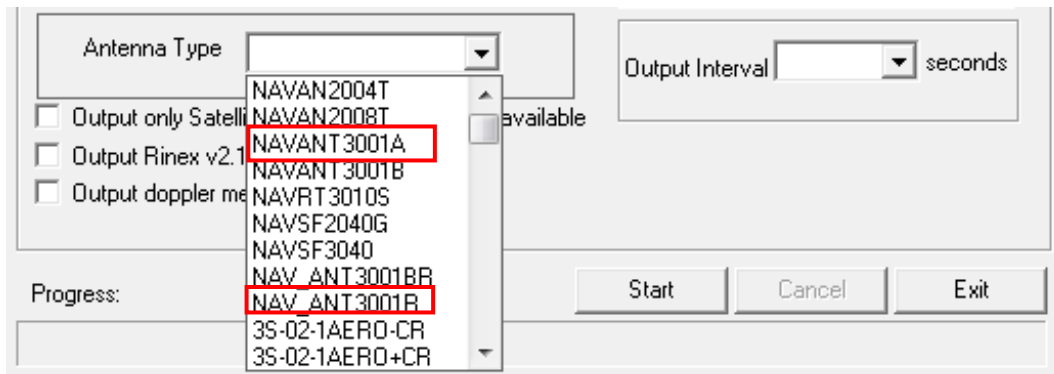


Figure 51: Antenna Type

- ✓ **Antenna Type:** Select the antenna type used to collect the data. Figure 53 identifies the NavCom antennae available in the drop-down list:

- **NAVAN3001R:** The standard integrated antenna. It tracks all GPS, GLONASS, WAAS/EGNOS/MSAS/GAGAN and StarFire™ signals. Our compact GPS antenna has excellent tracking performance and a stable phase center for signals. This antenna is listed in the NOAA GPS Antenna Calibration tables, as NAVAN3001R.
- **NAVAN3001A:** The airborne integrated antenna. It tracks all GPS, GLONASS, WAAS/EGNOS/MSAS/GAGAN and StarFire™ signals. Our compact antenna has excellent tracking performance and a stable phase center for all signals. This antenna is listed in the NOAA GPS Antenna Calibration tables, as NAVAN3001A. It is included with the VueStar system, and is an option for many (but not all) NavCom GPS receivers.



Execution and Progress

The *Start* button engages the conversion process, which can be stopped at any time by clicking the *Cancel* button. The *Exit* button closes the utility at any time, including during program execution, thereby canceling the process.



Figure 52: Progress of RINEX Conversion

A.....NCT Solid Earth Tide (SET) Message Format

The SET message is a NavCom proprietary NMEA type message. 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 6 details the information contained in this example NCT SET output message:

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

Table 6: NCT Solid Earth Tide (SET) NMEA message

\$PNCTSET	hhmmss.ss	xxxx.xxx	xxxx.xxx	xxxx.xxx	xxxx.xxx	xxxx.xxx	xxxx.xxx	xxxx.xxx	xxxx.xxx	xxxx.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