User Manual

Version 5.2

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Release Notice

This is the August 2011 release of the *C-NaviGator User Manua*l.

Revision History

Date	Version	Changes	Comments
08/04 /2011	5.2	CJC	Updates to meet C-NaviGator v6.1.4
01/12/2011	5.1	CJC	Updates to meet C-NaviGator v6.1.0
09/05/2010	4.0.2	CJC	Updates to meet C-NaviGator v5.0.8
10/06/2009	4.0	CJC	Updates to meet C-NaviGator v5.0.1 with C-Nav3050
12/09/2008	3.5	CJC	Update GPLv2
9/17/2008	3.4	CJC	Updated to include the C-Nav1010 Features
01/23/2008	2..0.4		Updates to meet C-NaviGator v2.0.4 released 01/23/2008
12/22/2006	2.0		Updates to meet C-NaviGator v2.00 released 12/22/2006
06/01/2006	1.1		Updates to meet C-NaviGator v2.00 released 06/01/2006
12/12/2005	1.0		Updates to meet C-NaviGator v1.10 released 11/10/2005
05/22/2005	0.9		Updates to meet C-NaviGator v1.02 released 05/22/2005
04/04/2005	0.8		Reorganize
02/21/2005	0.7		Draft
02/13/2005	0.6		Draft
02/02/2005	0.5		Draft
01/31/2005	0.4		Draft

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Table of Contents

Manual Organization

This manual describes how to install, configure, and operate the C-NaviGator GNSS Control & Display unit from C & C Technologies, Inc. Sections are organized in a manner that facilitates quick operator orientation.

An overview of the hardware is in Section 2 - Hardware (Page 11). Instructions to guide the operator through installation and setup are provided in Section 3 - Operator Instructions (page 15).

Detailed menu descriptions can be found in Section 4 – Menus (page 19). Configuration for supported devices is in Section 5 - Devices (page 35).

Section 6 - Maintenance (page 60) concentrates on maintenance and troubleshooting.

Section 1 - Overview

Introduction

C-NaviGator is a self-contained, Control/Display Unit that provides a number of visual aids to help the user monitor the quality, performance, and accuracy of the position information supplied by the GNSS receiver. Position calculations are performed by the C-NaviGator along with data quality assessments to create visual and graphical data representations that instantly convey critical information to the operator. Information from external sensors is displayed in a form that enables the user to quickly recognize a decrease in reliability of the position solution. C-NaviGator's processor-based, windows style operating environment is straightforward and easy to use.

Information screens provide the necessary user interface. Data entry and command functions are entered through the use of the touch-screen. Information displays, alarm indicators, parameter settings, data analysis, etc. are displayed on the C-NaviGator color LCD screen. Alarm or alert states are configured by the operator.

Position calculations are performed for data output to other systems as configured by the operator. Through C-NaviGator, the operator has easy access to input and output controls.

Features and Functions

- Monitor NMEA compliant GNSS systems
- Save/load settings
- Logging of GNSS data

- User selectable units for distance, height and speed
- User selectable time zones
- Day/night display brightness settings
- Help documentation
- Software updates via USB
- Input / Output all NMEA versions (2.1 / 3.0 / 3.1)
- Multiple Input/Output ports (4 x RS232)
- Monitoring screens include
  - Position Information
  - Satellite Information
  - Error Ellipse
  - Scatter Plot
  - Quality Alert Graphs
  - Event Log “Fixes”
  - Alarms
- Display of current Quality Information with Alerts
  - Frequency Mode of Solution
  - 2D / 3D Status
  - Correction Type
  - Correction Age
  - Number of Satellites used for Solution
  - HDOP, VDOP and PDOP
  - Figure of Merit

C-Nav Specific Features and Functions

- Control and monitoring of C-Nav3050 receivers
- Control and monitoring of C-Nav1010 receivers
- Control and monitoring of C-Nav2050 receivers
- Control and monitoring of C-Nav2000 receivers
- Interface for the user to enter Activation / Deactivation Codes
- Monitor and control the correction signal demodulator.
- Update the receiver’s firmware.
- View L1 and L2 signal strengths for each tracked satellite.

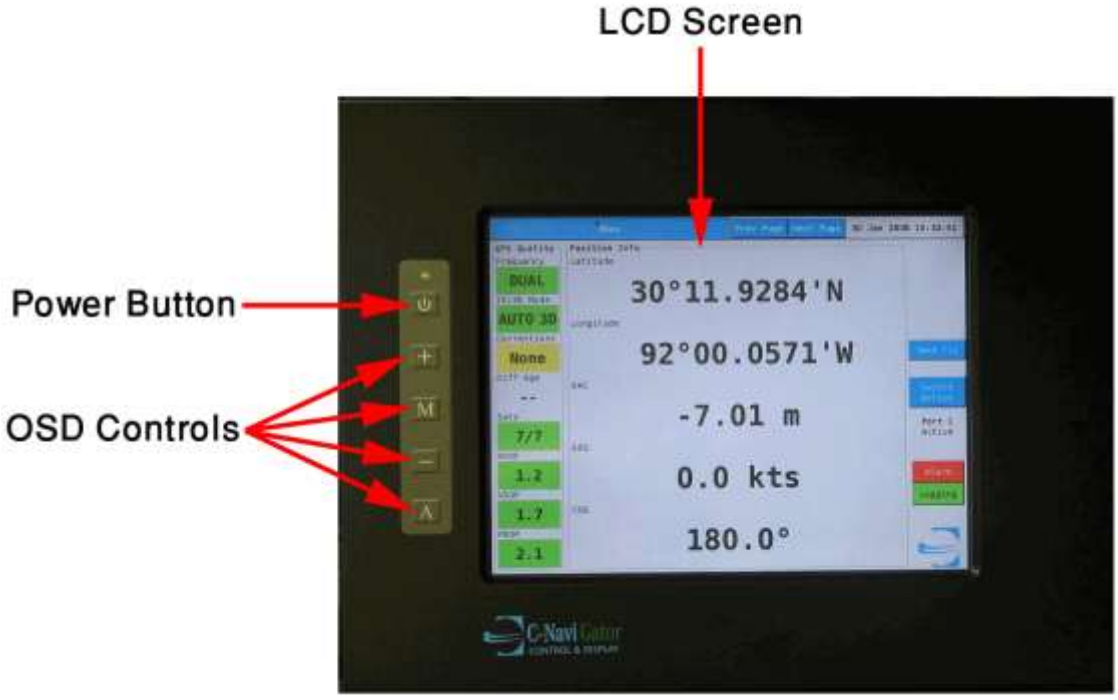
Section 2 - Hardware

C-NaviGator II

Controls

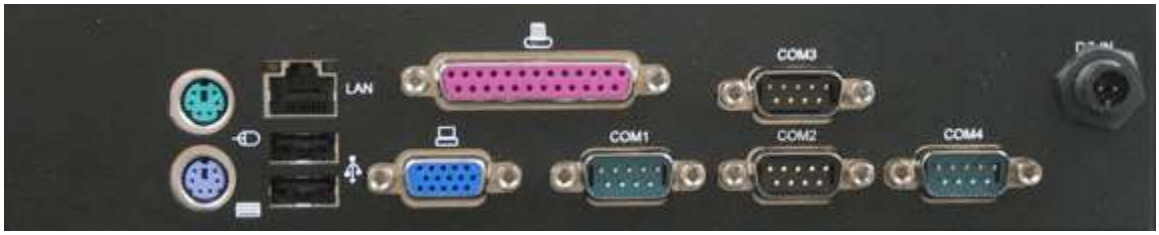
The C-NaviGator is designed to provide the operator with a functional and easy to navigate user interface. At Power-Up, the LCD screen automatically defaults to the "Position Info" screen. The pull-down menus are activated using the ***Menu*** button in the upper left corner of the LCD display.

Use the On-Screen-Display (OSD) control buttons to adjust the contrast, brightnees and other display settings.



Back Panel

All connections to the C-NaviGator are made through the connectors on the back panel.



Power Section

Includes the input PWR plug

Mouse/Keyboard

Keyboard and mouse connections (PS/2) are provided for your optional use. During typical operations, these are not needed. The C-NaviGator works with many USB keyboards and mice.

USB Ports

Connections for USB devices such as flash sticks and external solid-state drives are provided. A C-Nav thumb drive is supplied with the unit. With most receivers, data can be logged directory to your USB device.

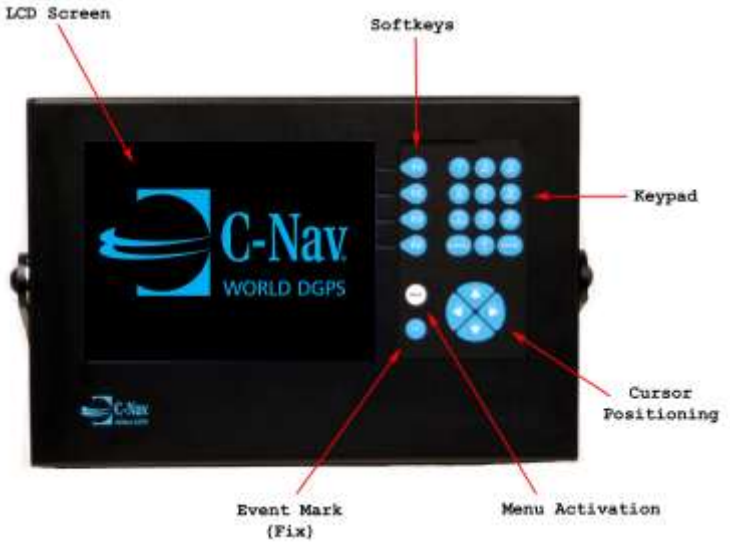
Input/Output Ports

Connections to input and output devices are through these standard PC type COM ports. There are 4 RS232 ports (1 – 4) available for use.

C-NaviGator

Controls

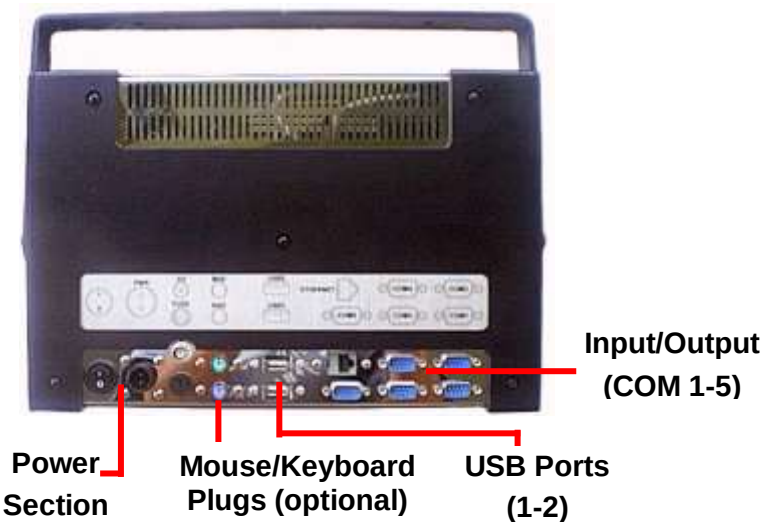
The C-NaviGator is designed to provide the operator with a functional and easy to navigate user interface. At Power-Up, the LCD screen automatically defaults to the “”position Info” Screen. The pull-down menus are activated using the white MENU button to the right of the LCD display and the Cursor Position arrows to navigate to the desired screen.



The functions and commands activated by the Softkeys (*F1-F4*) are linked to the current screen display.

Back Panel

All connections to the C-NaviGator are made through the connectors on the back panel.



Power Section

Includes the input PWR plug, FUSE, and ON/OFF switch.

Mouse/Keyboard

Keyboard and mouse connections (PS/2) are provided for your optional use. During typical operations, these are not needed. The C-NaviGator works with many USB keyboards and mice.

USB Ports

Provide connections for USB device such as flash sticks and external solid-state drives. A C-Nav thumb drive is supplied the unit.

Input/Output Ports

Connections to input and output devices are through these standard PC type COM ports. There are 4 RS232 ports (1 – 4) available for use. Port 5 is reserved for future development. Port 5 may be configured for RS422/485 at the factory

Section 3 - Operator Instructions

Power Up

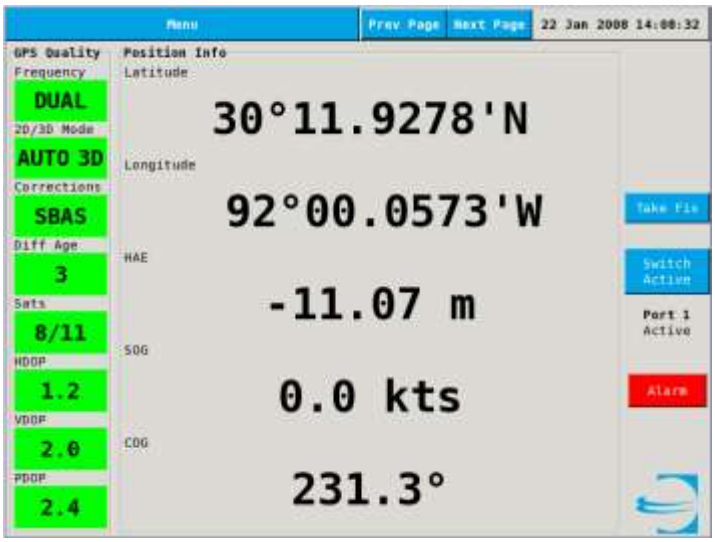
During the power up sequence, the operator has the option to install new software from C & C Technologies. As updates become available, the user will be able to download the software from the C-Nav ftp site and transfer it to a USB memory device. A flash memory stick is supplied with each unit. See Updating (page 61) for details.

Allow at least one minute for the system to initialize. Program start is automatic and the last settings stored by the user are recalled. The default screen is the "Position Info" screen.

For a description of the C-NaviGator display items, see View (page 22). If this screen does not contain the information described, refer to Troubleshooting (page 60).

Screen Layout

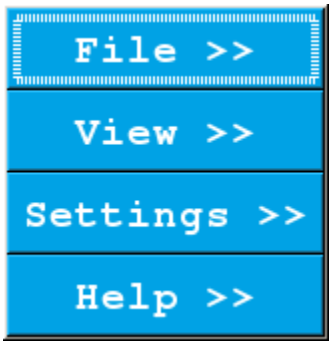
The C-NaviGator screen provides easy access to system information and control functions. System performance and the quality of the position solution are conveyed by means of red, yellow and green indicators in the left screen panel (GNSS Quality Indicators). The main system "Alarm" appears in red on the right side of the screen along with an "Active Port" indicator. Indicator colors change according to the limits set by the operator for each parameter. See GNSS Quality Alerts (page 28) for details.



Along the top edge of the C-NaviGator screen are the pull-down menus and the date/time display. The type of information to be displayed in the center of the screen is selected by the operator using the pull-down menus described in Section 4 – Menus (page 19).

Pull-Down Menus (top left):

- **File** – Configuration storage, recall and reset
- **View** – Monitoring screen selection (Defaults to "Position Info" at power up)
- **Settings** – View, enter, or adjust operating parameters
- **Help** – Display and control screen setting descriptions

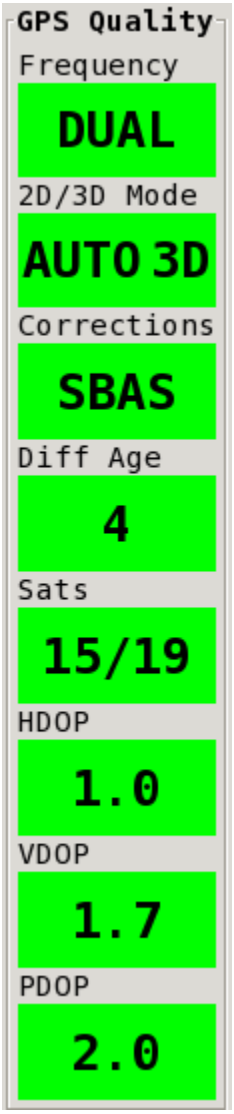


Local Information (top right):

- **Date and time**

GNSS Quality Alert Indicators (left frame):

- **Frequency** – Mode of operation.
- **2D/3D Mode** – Position solutions with or without height.
- **Corrections** – Indicates the current source of correction data.
- **Diff Age** – Time in seconds since last valid correction.
- **Sats** – Number of satellites used in position solution.
- **HDOP** – Horizontal Dilution of Precision
- **VDOP** – Vertical Dilution of Precision
- **PDOP** – Position Dilution of Precision



Operation

1) Apply power to the C-NaviGator by connecting the power supply to the back of the C-NaviGator unit.
2) In a few seconds, the system menu will appear allowing the option to update the internal program, calibrate the touch-screen, or begin normal operation (default). If no action from the operator is detected, C-NaviGator will automatically launch the program. This will take several seconds.
3) C-NaviGator automatically recalls the last settings saved and displays the "Position Info" screen (page 22). System operating modes and status indicators are seen on the left under GNSS Quality Alerts (page 28). To the right are the active ports switch, the active port indicator, and the general "Alarm" Indicators. The ***Switch Active*** button provides a means to quickly switch between different input sources for monitoring. The actual port programming and activation are accessed from the ***Menu / Settings / Ports*** screen as described in Ports (page 29).
4) Press ***Prev Page*** and ***Next Page*** on the C-NaviGator display to scan through the various view screens. Alternatively, press ***Menu / View*** to select the specific view screen.

Section 4 - Menus

Pull down menus (upper left of the screen) allow operator access to C-NaviGator configuration, display options, parameter settings, support documentation, etc. Menus are selected by pressing ***Menu*** on the display and pressing each subsequent menu item.

File Menu

Load Defaults

The user can quickly revert the C-NaviGator to all factory settings as a starting point for a new configuration. When ***File / Load Defaults*** is selected, the user is required to configure the system, starting with assigning devices to Ports (page 29).

Load Settings

Similar to "Load Defaults" – ***Menu / File / Load Settings*** recalls the last configuration saved by the operator using the "Save Settings" command.

Save Settings

To store C-NaviGator's current configuration, select ***Menu / File / Save Settings*** and press ***Save***. These settings can be recalled with the "Load Settings" command.

Take Snapshot

Store the current C-NaviGator configuration to a USB device

Almanac Export

Copy the current Almanac to a USB device

Almanac Import

Import an Almanac from a USB device

Upload File

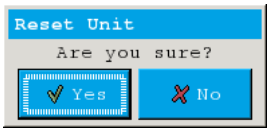
This opens the file upload screen, allowing the user to quickly upload a file to a device.

WARNING
Uploading an inappropriate file to the device may render the device inoperable. Use care to only upload files designed for the device.

Reset Unit

Reset Unit causes C-NaviGator to restart the internal program.

The operator is asked to confirm the ***Reset Unit*** command.



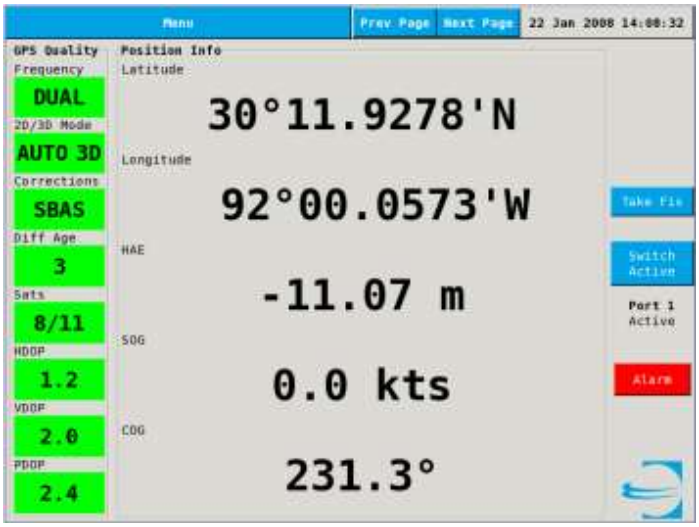
View

Pressing the ***Prev Page*** and ***Next Page*** buttons from any of these screens will 'walk' through the available View screens. Pressing ***Switch Active*** will change between available position devices to display.

Position Info

This is the default screen for C-NaviGator. "Position Info" displays horizontal position (in Latitude/Longitude), Height Above Ellipsoid (HAE), Speed Over Ground (SOG), and Course Over Ground (COG).

The height and speed units can be configured on the General settings screen (page 27).



Satellite Info

This screen provides the operator with information about the constellation configuration and the signal strengths received from each visible satellite. Relative locations of the GNSS satellites to the GNSS receiver are plotted based on azimuth and elevation information provided by the GNSS receiver. The plot includes corrections satellite information. Additionally, the receiver's current elevation mask is annotated on the plot.

Each visible satellite is represented in the plot by a circle with the satellite ID number inside. All satellites used to compute the PVT solution are identified as

green circles. Circles turn red if data from the satellite becomes too noisy or obstructed.

Circles with a blue border represent GNSS satellites and those with an orange border represent GLONASS satellites.

The graphic center point reference represents a point directly overhead and the grid lines from the center of the graph inversely indicate satellite elevation. There is a circle every 15 degrees of elevation and azimuth lines at every 45 degrees.

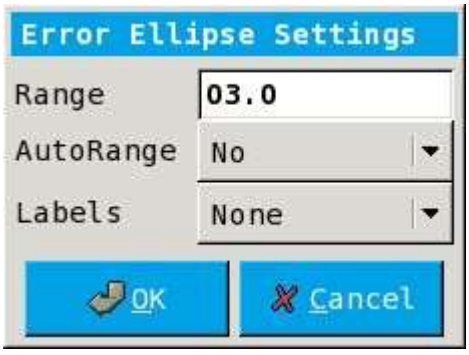
Error Ellipse

The error ellipse graphically represents the sum of the horizontal error uncertainty in the system.

Graphics on the “Error Ellipse” screen show the error estimate of the PVT solution accuracy (in meters) based on residual analysis.

The range, the distance from the center of the graph to the outer ring, is user configurable using ***Settings***.

Error Ellipse Settings



Allows the user to set the range of the graph or set it to auto range. When auto range is selected, the range will grow to accommodate the size of the error ellipse.

Scatter Plot

This screen displays a history of the positions received from the GNSS receiver. The reference Latitude and Longitude shown indicates the center position of the graph.

New positions are computed and presented on the scatter plot with error displacements shown referenced to the reference position. The reference position may be set to a “Fixed” position or set to “Follow” the latest GNSS fix. The range is the distance from the center of the graph to the outer ring.

The reference position and range settings may be changed by pressing the ***Settings*** button.

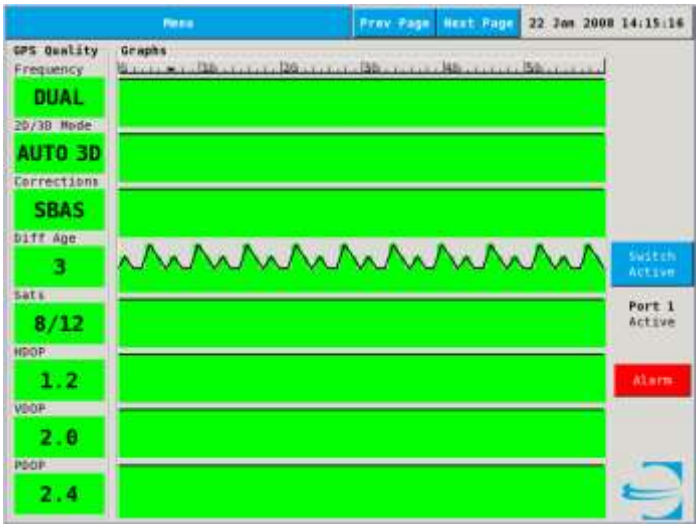
Scatter Plot Settings

Using the Center drop down you can set position for the center of the graph. Select “Track Current” to track the current position. Choose “Fixed (Manual), to enter the latitude and longitude. Choose “Fixed (Here)”, to use the current position as the graph center.

Enter the range for the graph in the Range field. The display can also be set to automatically adjust the range of the graph if Auto-Range is set to yes.

Graphs

Quality information for the previous 60 seconds is displayed in graphs. The colors change based on the quality alert settings.



Fixes

Position fixes are logged into the C-NaviGator memory when the ***Take Fix*** button is pressed. The ***Edit*** button allows the user to name/describe the fix.

Alarms

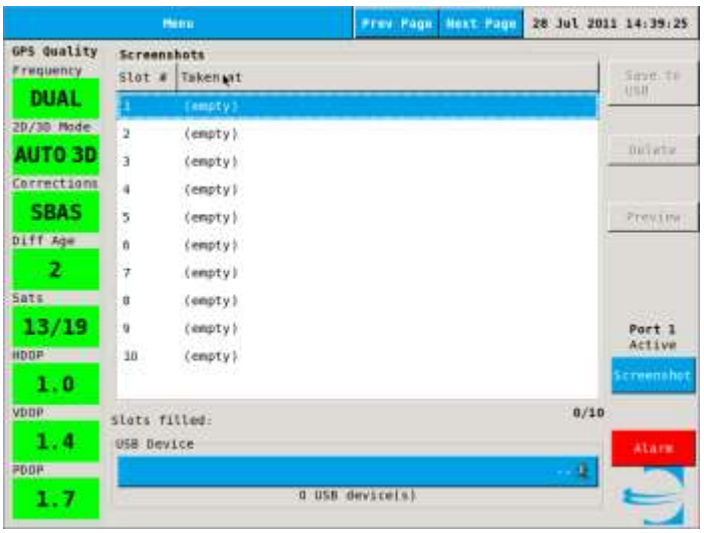
Several alarm conditions are logged and displayed on this screen. The ***Ack*** button can be used to turn off the alarm indicator in the lower right corner of the display until a new alarm is raised.

Certain more serious alarms will continuously cause the alarm indicator to light up.

See Appendix C - Alarm List (page 69) for a detailed list of available alarms.

Screenshots

From this page, the operator can preview existing screenshots. Images can be copied to USB devices. Screenshots in the list can be deleted. To preview a screenshot, select it in the list and press **Preview**. To copy one to a USB device, select the screenshot in the list and choose a USB device, then press **Save to USB.**



Settings

General

Three major system settings are accessed through this screen. These include:

- Active GNSS
- Timezone
- Units

Select Active GNSS

The active GNSS is used to populate the View screens and GNSS Quality Alerts.

The active GNSS device can also be selected with ***Switch Active*** button while viewing any of the View screens.

Set Timezone Offset

The offset from UTC time is set here by adjusting the hour and minute values.

Units

Distance and speed units used for the C-NaviGator displays are selected in this section of the screen.

NOTE:
Changing the Active GNSS port settings does not alter the unit's data output.

Display

Brightness of the C-NaviGator LCD backlight and screen colors is controlled through settings on this screen. It can be adjusted for optimum viewing depending on the time of day and physical location of the unit. Night mode settings are necessary for installations on the bridge of a vessel where bright lights interfere with the helmsman's view.

Current Mode

This option selects the 'Day' or 'Night' color palette and backlight levels. The 'Night' palette is much darker then the 'Day' palette.

Auto Mode Settings

Programs the display to automatically switch between 'Day' and 'Night' modes. Day and night start times can be configured in 15 minute increments.

GNSS Quality Alerts

The pane on the left side of the screen display various GNSS quality figures that are color coded based on user-configurable limits. Red indicates that the data or status of the parameter is out of the acceptable range selected by the user. Similarly, yellow indicates that the value being displayed is in the range that is borderline or requires attention. A green indicator signifies that the value or status of the parameter is within the acceptable limits.

The ***Menu / Settings / GNSS Quality Alerts*** page allows you to configure when the quality indicators change colors. "Single Frequency" and "Auto 2D" positioning may or may not indicate a problem, depending on the situation. So, you can select any of the colors for these states. For the rest of the alerts, you have 2 columns of settings. In the "Warn (Yellow) if not" column, you select at what point the indicator turns from green to yellow. In the "Alert (Red) if not" column, you select at what point the indicator turns from yellow to red.

Ports

This screen allows the operator to assign input/output devices to the desired ports. Each port is activated by selecting a device in the "Type" column. Also adjustable are the serial data transfer settings, including Baud Rate (Speed), number of Data Bits, Parity and the number of Stop Bits. Always press ***OK*** after all changes are made.

NOTE:

For C-Nav2000 and C-Nav2050, factory default communication settings are 19200 8/None/1

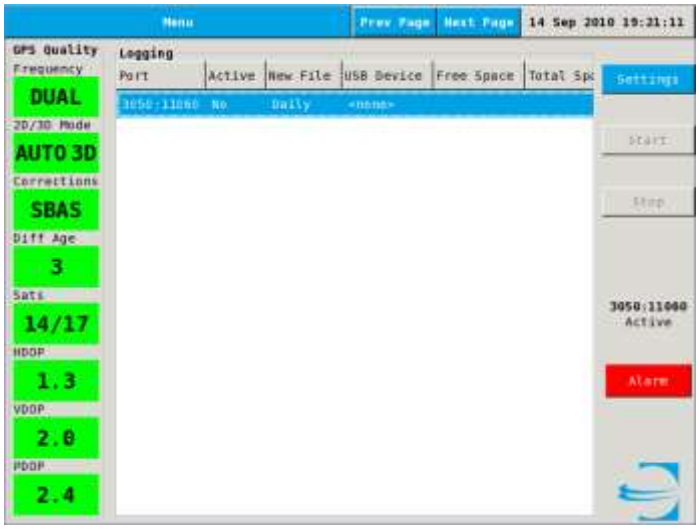
For C-Nav1010 and C-Nav3050, factory default communication settings are 57600 8/None/1

All C-NaviGator active ports are listed below ***Menu / Settings / Port*****.** In the example above, Port 1 is set to "C-Nav 2050". Additional device status, settings, and control information are available for each port when selected.

See Appendix B - NMEA Data Strings (page 68) for a table of NMEA strings and the data extracted from each.

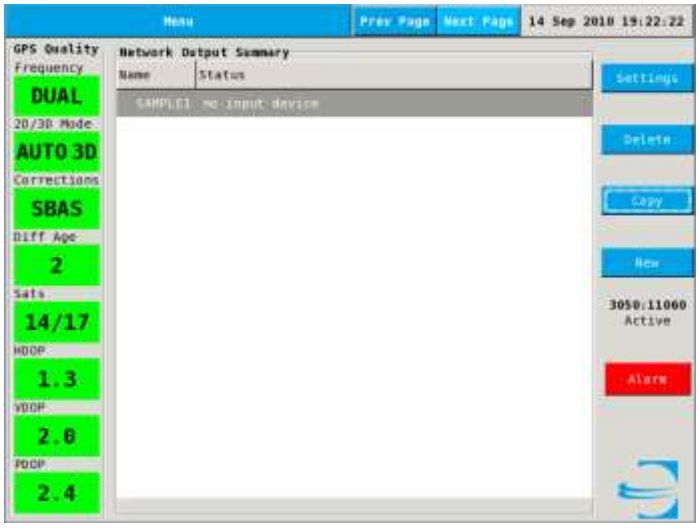
Logging

This screen allows the operator to assign configure logging of the data from an input device to a USB mass storage device. Each port can be configured to log input data. Select the port from the list, and press the settings button. On the logging settings dialog select the frequency to create new files, and the USB device to place the files. Once configured you can use the “Start” and “Stop” buttons to control data logging.



Network Virtual Ports

This screen shows the network virtual port summary and allows the operator to configure network output messages. Press the “New” button to create a new output. Use the “Settings” to show details of an existing network output. To copy an existing configuration, press the “Copy” button. Pressing “Delete” will remove a network output. See the **Configure Network Output** and **Message Configure** screens for more information.

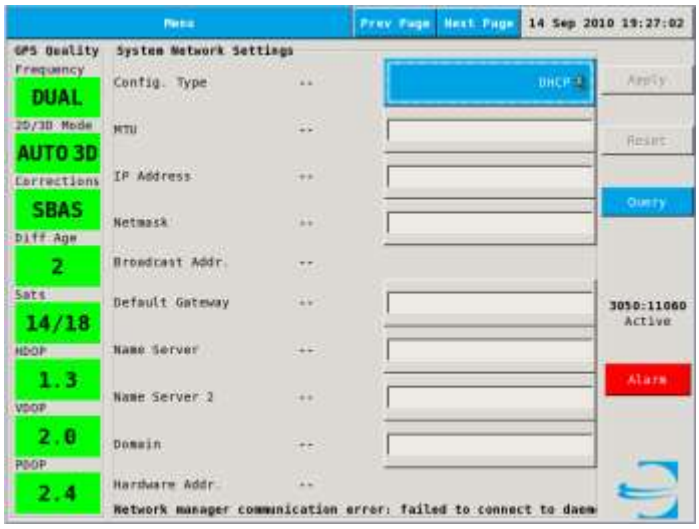


Configure Network Output

This screen allows the operator to configure the settings for a network connection. Specify the name, protocol, source and destination ports, and the destination host, then press “Apply”. A device will be created for each virtual network port. The device can be configured from the **Settings/{DeviceName}** menu item. See the sections on hardware devices for more information on configuration for the selected device types.

System Network Settings

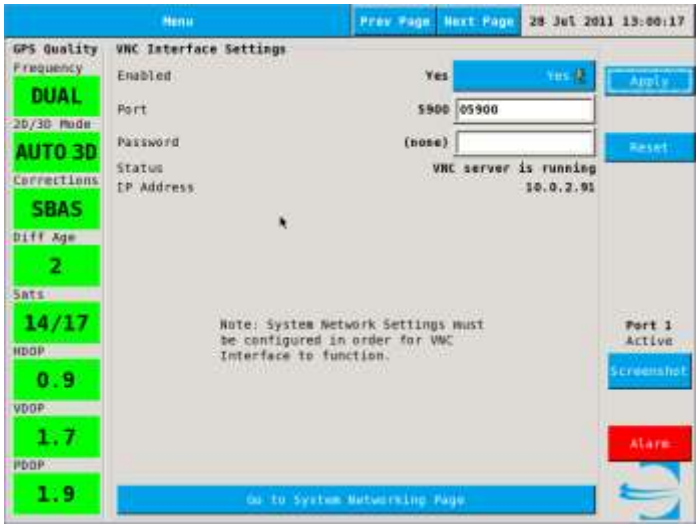
This screen allows the operator to networking configuration for the unit. Choose the configuration type **DHCP, Static,** or **Disabled**. Provide settings from your network administrator, and press the ***Apply*** button.



VNC Interface

This screen allows the operator to configure the VNC server. Once configured, VNC clients can connect and control the C-NaviGator.

System networking must be configured in order for VNC to function.



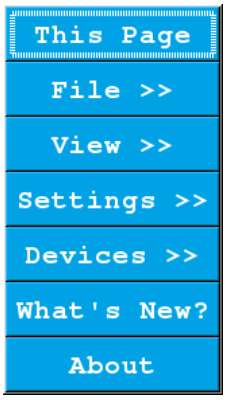
Clean Screen

Choose this option to physically clean the screen of the unit. Choosing this option, the display will ignore input from the touch screen for 10 seconds.

Help

This Page

As an operator aid, ***Menu / Help / This Page*** contains information about the screen currently displayed. It provides a quick reference should there be a question that requires a quick answer.

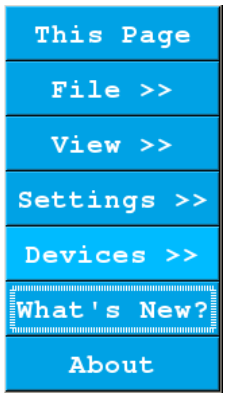


File, View, Settings

Under ***Menu / Help***, the operator can also find the latest information relating to other menu items. The information here is similar to that presented in this manual.

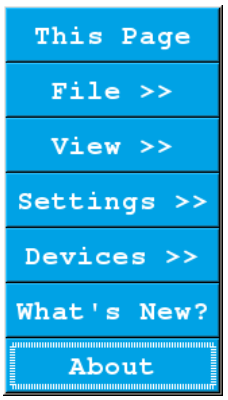
What's New?

As each new version is released, ***Menu / Help / What's New?*** describes the modifications, additions, and corrections. These may include software enhancements, bug fixes, new feature, etc. The user should always review these changes after installing new software.



About

Support contact information from C & C Technologies can be found by selecting ***Menu / Help / About*** menu. There you will find the current version number, contact information, etc. to assist the operator should problems arise.



Section 5 - Devices

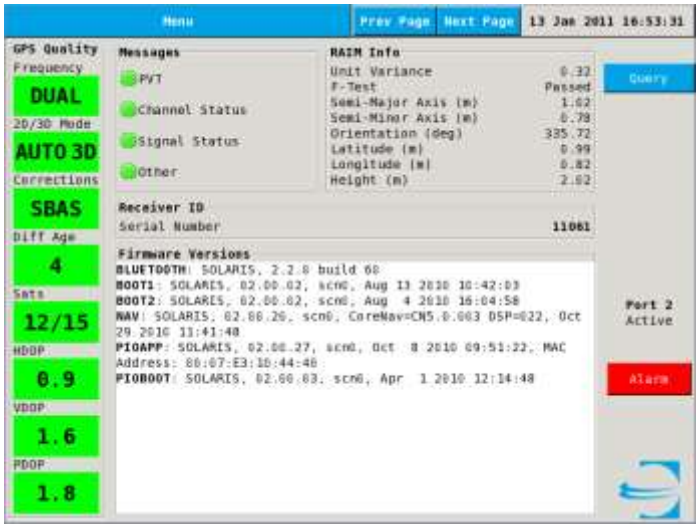
This section describes the available device drivers and their use.

C-Nav3050

Receiver Information

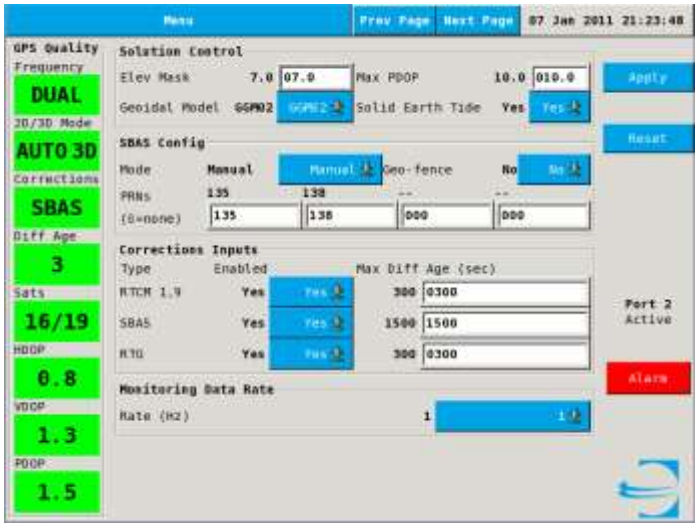
General information about the C-Nav3050 GNSS receiver (such as firmware / hardware versions, serial numbers, etc.) is displayed on this screen. Message indicators (green/white circles) indicate when data messages are received.

The Query button can be used to request updated information from the receiver.



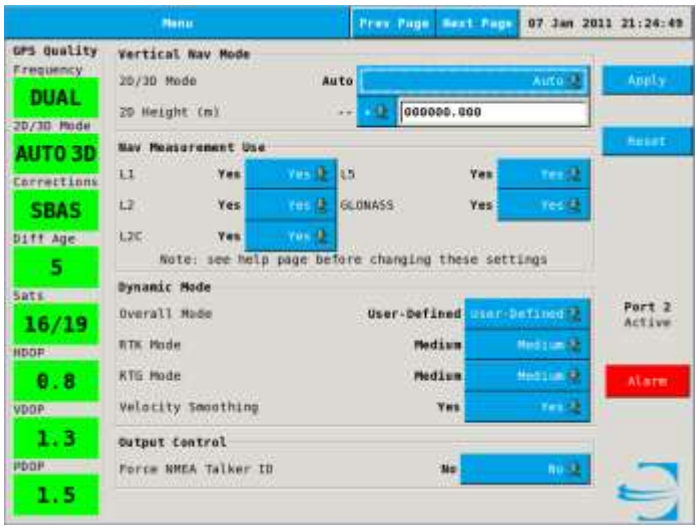
Solution Control

Control settings relevant to computing the position are displayed on this screen. The user can configure the use of corrections. See Appendix A - “SBAS” for a description of “Correction Signals”.



Navigation Mode

This screen allows the user to configure the navigation modes for the C-Nav3050. The vertical navigation mode, which signals to use for measurements and the dynamic mode of the receiver can be set here.



Antenna Identification

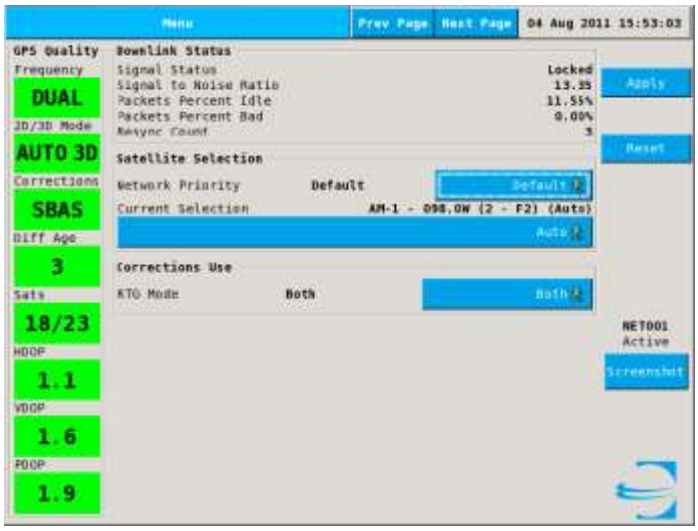
Use this page to adjust the phase center height, slant range, and radius of your antenna.

RTK Configure

Use this page to adjust your RTK settings, and MB-RTK settings.

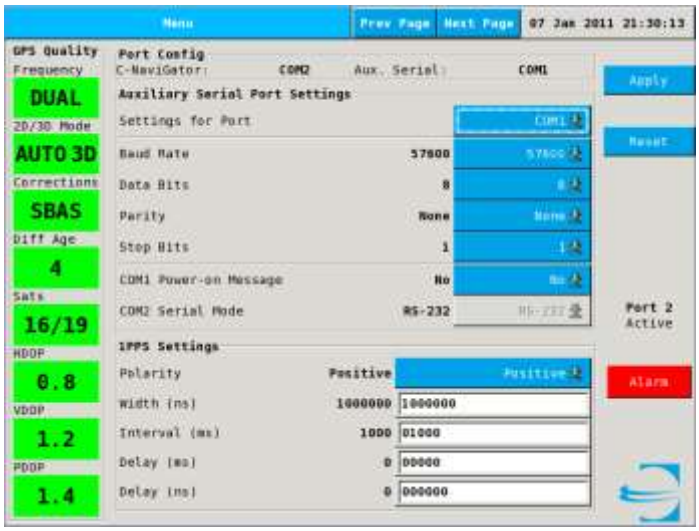
Corrections Receiver

This screen contains status indicators relative to GNSS corrections received. Also, the user can manually set the C-Nav corrections frequency here.



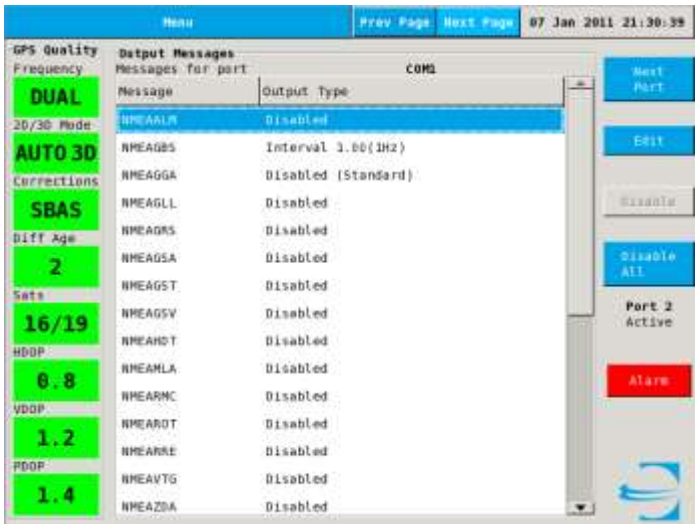
Auxiliary Port Configuration

COM1 and COM2 on the C-Nav3050 receiver can be configured here. Serial data transfer parameters (Baud Rate and Parity) should be set to match that of the C-NaviGator port. Settings for the 1PPS output can also be modified.



Output Control

Output data strings from the C-Nav3050 can be chosen by the settings in this screen. Some messages can be output on change, thus output at the navigation rate. The Navigation Rate can be set on the "Solution Control" page. Other strings can be set to output every ‘fixed’ number of seconds. Input/output protocols for the C-Nav Auxiliary Port and the PPS port can also be accessed,

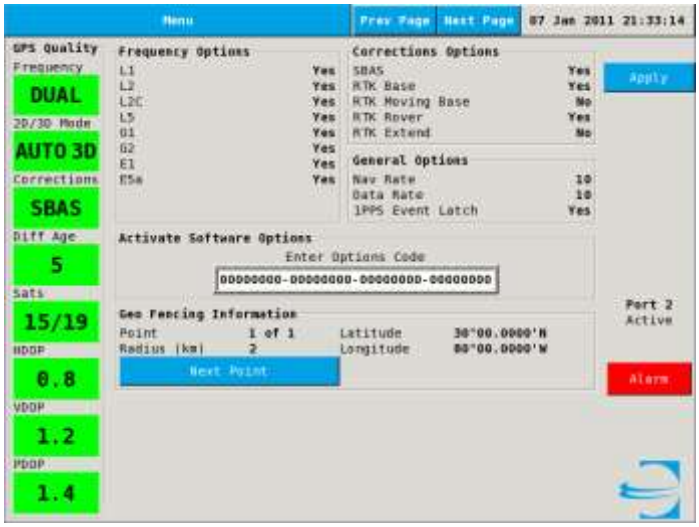


Differential Config

The RTCM (Radio Technical Commission for Maritime Services) standard SC-104 correction type and rates for the C-Nav3050 are implemented here.

Software Options

The options available to the user are encoded into and activated by the Options Code. This determines which settings and features are enabled in the system. Various system operational status indicators are shown including status of the RTK remote units (if applicable).



Corrections Authorization

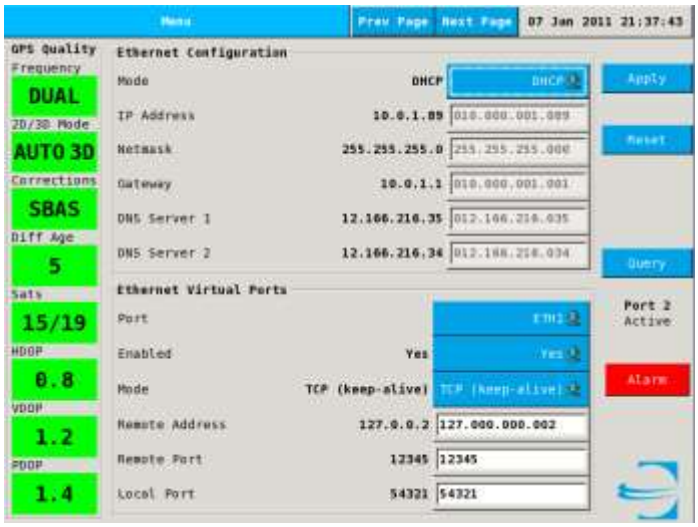
License information is displayed and authorization code entered here.

Hardware Settings

This page allows the user to configure the USB mode, control logging to the internal memory and USB devices when in host mode. Restarting the receiver can also be done from this page.

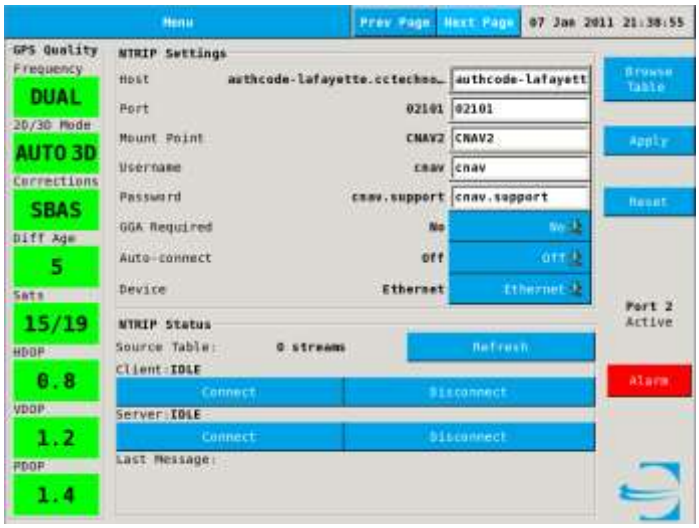
Ethernet Configuration

Use this page to configure the Ethernet settings for the receiver. Virtual Ports for the C-Nav3050 are also configured on this page.



NTRIP Settings

This page allows users to configure the settings for NTRIP input to the receiver.

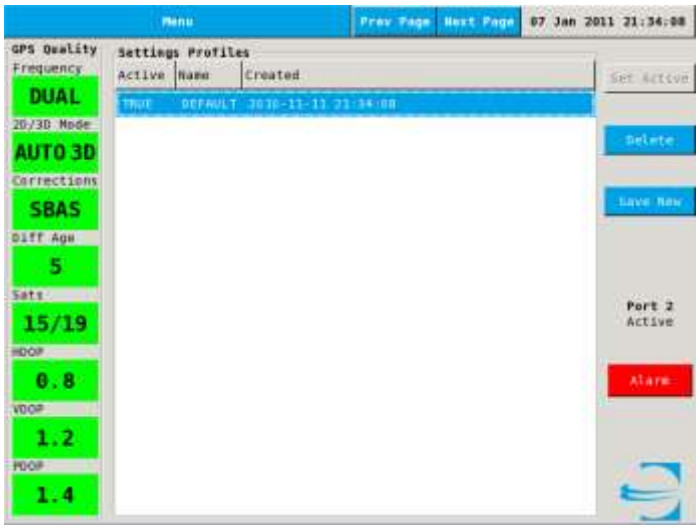


Bluetooth Settings

This page allows you to configure the Bluetooth settings for the C-Nav3050.

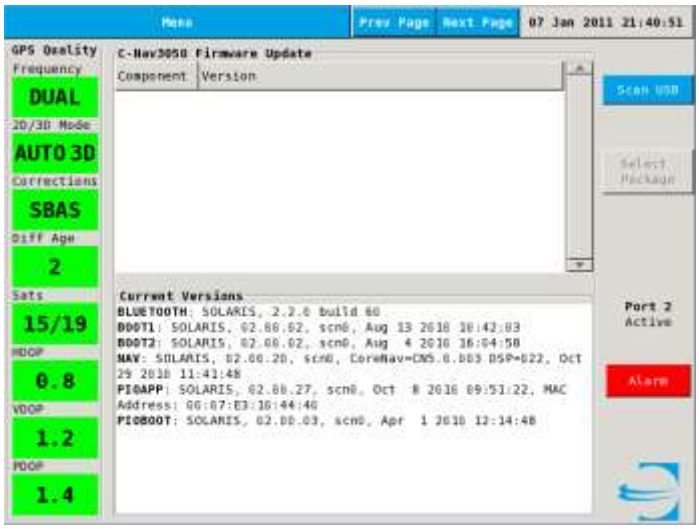
Settings Profile

Settings can be saved in the C-Nav3050. Use this dialog to save and activate settings profiles within the receiver.



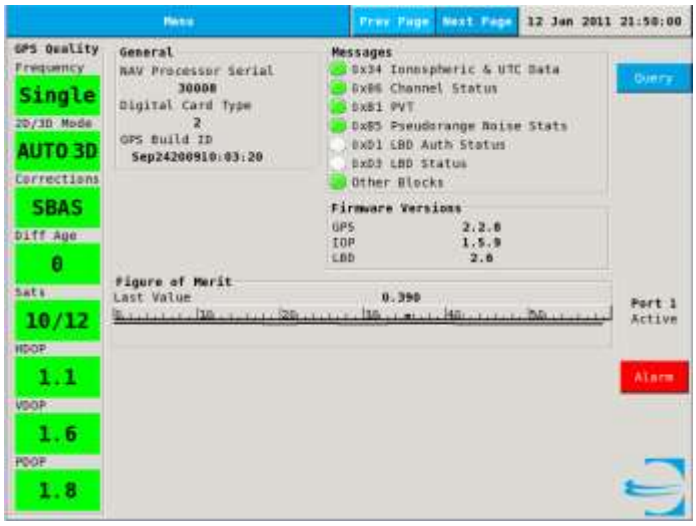
Firmware Update

Use this page to update the firmware of your C-Nav3050.



C-Nav1010

Receiver Information



General information about the C-Nav1010 GNSS receiver (such as firmware / hardware versions, serial numbers, etc.) is displayed on this screen. Message indicators (green/white circles) indicate when data messages are received.

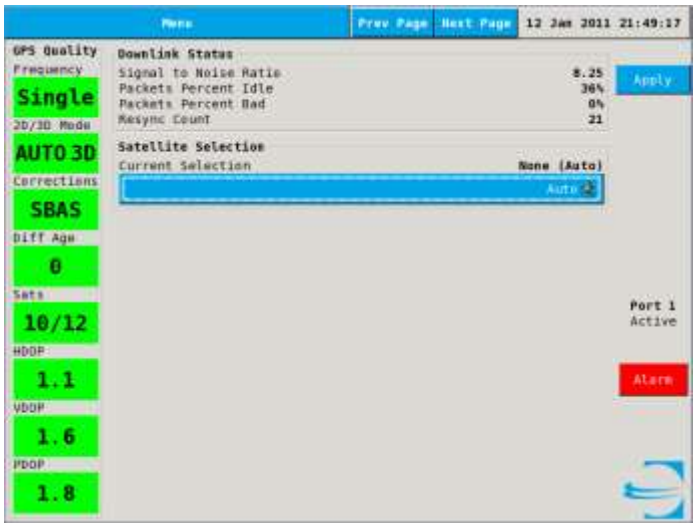
The ***Query*** button can be used to request updated information from the receiver.

Solution Control

Various status indicators and control settings relevant to the corrections applied in the position solution are displayed on this screen. This information verifies system performance with respect to limits set by the operator. See Appendix A - “SBAS” for a description of “Correction Signals”.

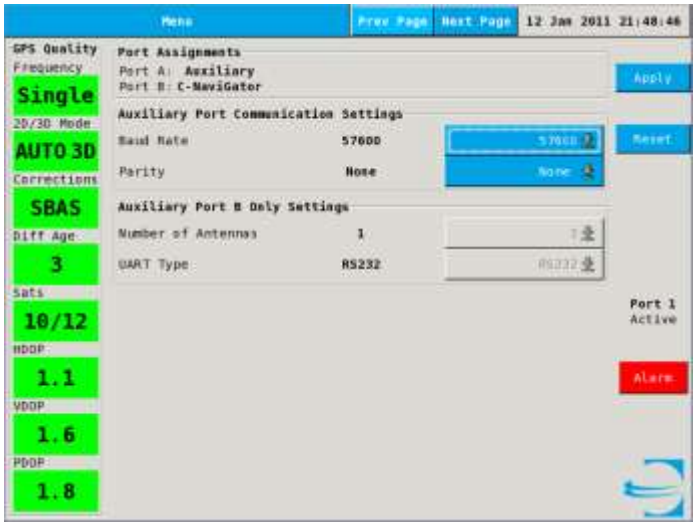
Corrections Receiver

This screen contains status indicators relative to GNSS corrections received. Also, the user can manually set the C-Nav corrections frequency here.



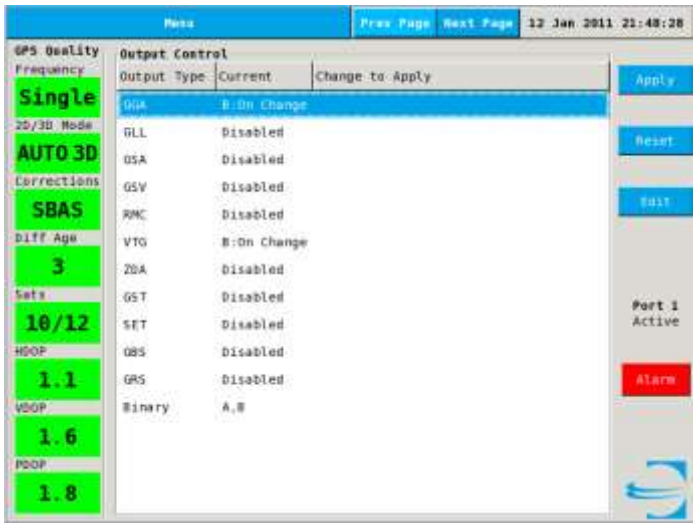
Port Configuration

COM1 and COM2 on the C-Nav1010 receiver can be configured here. Serial data transfer parameters (Baud Rate and Parity) should be set to match that of the C-NaviGator port. Input/output protocols for the C-Nav Auxiliary Port and the PPS port can also be accessed,



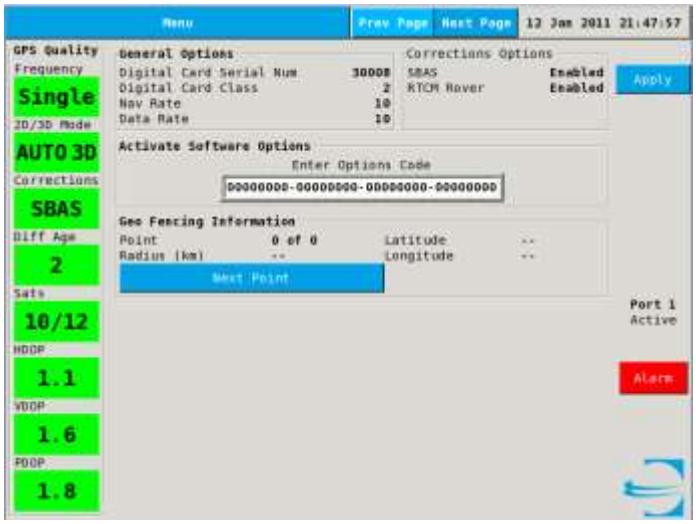
Output Control

Output data strings from the C-Nav1010 can be chosen by the settings in this screen. Some messages can be output on change, thus output at the navigation rate. The Navigation Rate can be set on the "Solutions Control" page. Other strings can be set to output every 'fixed' number of seconds.



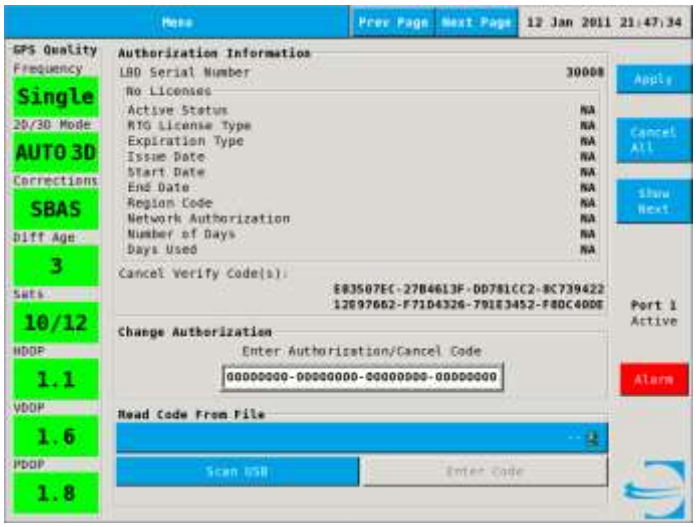
Software Options

The options available to the user are encoded into and activated by the Options Code. This determines which settings and features are enabled in the system. Various system operational status indicators are shown including status of the RTK remote units (if applicable).



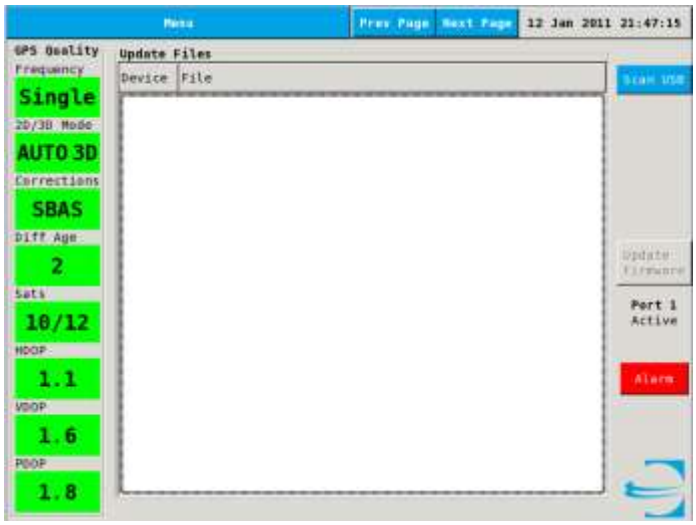
Corrections Authorization

License information is displayed and authorization code entered here.



Firmware Update

The C-Nav1010 receiver's firmware can be installed from this screen. Ensure that the USB memory device is installed. Press the ***Scan USB*** button to search the USB memory stick for available firmware. Press ***Update Firmware*** to upload the new code into C-Nav1010 memory. Information regarding the new version is displayed in the information window.



C-Nav2050

Receiver Information

General information about the C-Nav2050 GPS receiver (such as firmware / hardware versions, serial numbers, etc.) is displayed on this screen. Message indicators (green/white circles) indicate when data messages are received.

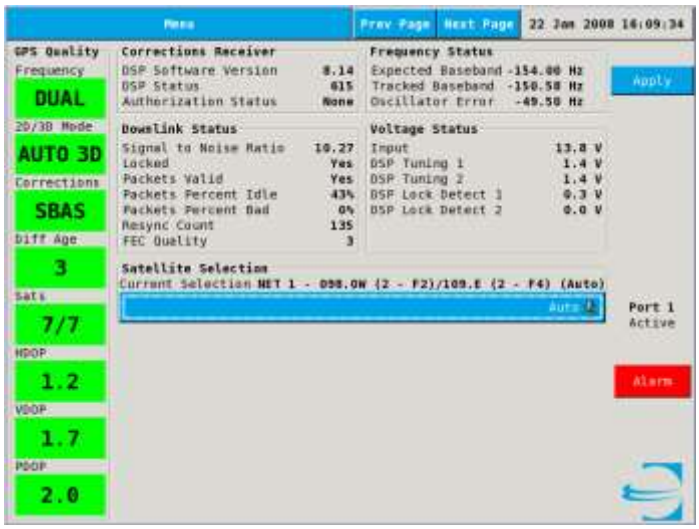
The ***Query*** button can be used to request updated information from the receiver.

Solution Control

Various status indicators and control settings relevant to the corrections applied in the position solution are displayed on this screen. This information verifies system performance with respect to limits set by the operator. See Appendix A - “SBAS” for a description of “Correction Signals”.

Corrections Receiver

This screen contains status indicators relative to GNSS corrections received. Also, the user can manually set the C-Nav corrections frequency here.



Port Configuration

COM 1 and COM2 on the C-Nav2050 receiver can be configured here. Serial data transfer parameters (Baud Rate and Parity) should be set to match that of the C-NaviGator port. Input/output protocols for the C-Nav Auxiliary Port and the 1PPS port can also be accessed,

NMEA Output Control

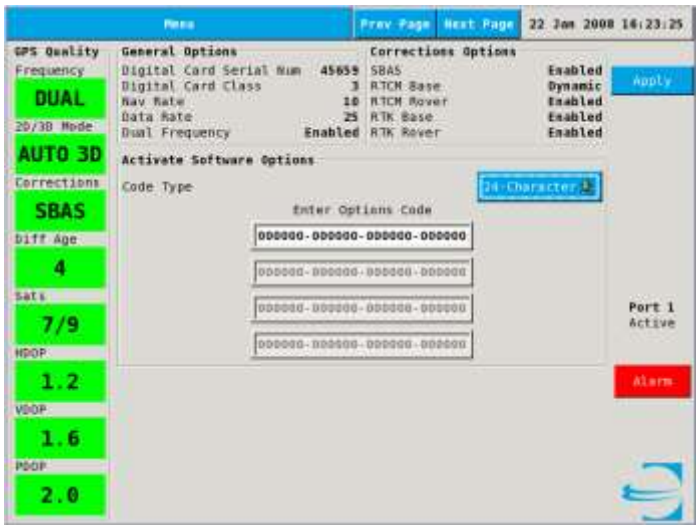
Output data strings from the C-Nav2050 can be chosen by the settings in this screen. Some messages can be output on change, and will be delivered when new data is available; typically this is at the navigation rate of the receiver. The Navigation Rate can be set on the "Solutions Control" page. Other strings can be set to output every 'fixed' number of seconds.

RTCM Output Control

The RTCM (Radio Technical Commission for Maritime Services) standard SC-104 correction type and rates for the C-Nav2050 are implemented here.

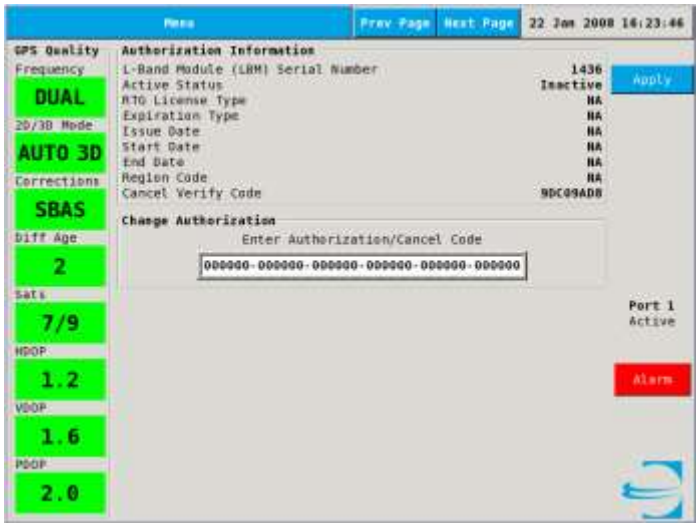
Software Options

The options available to the user are encoded into and activated by the Options Code. This determines which settings and features are enabled in the system. Various system operational status indicators are shown including status of the RTK remote units (if applicable).



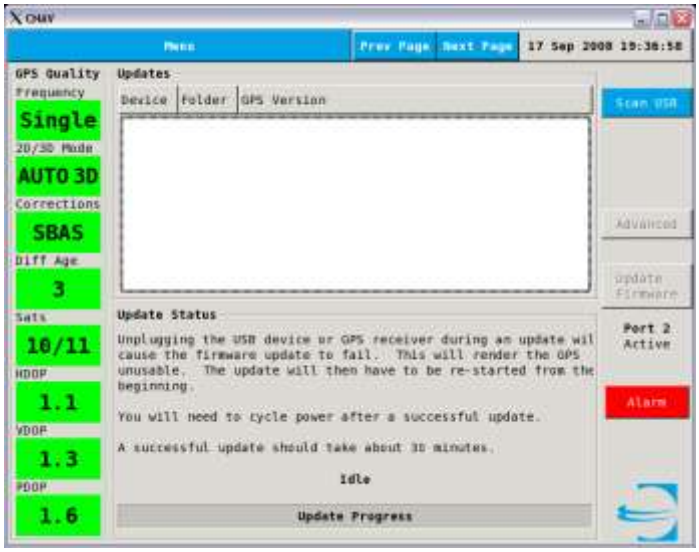
Corrections Authorization

License information is displayed and authorization code entered here.



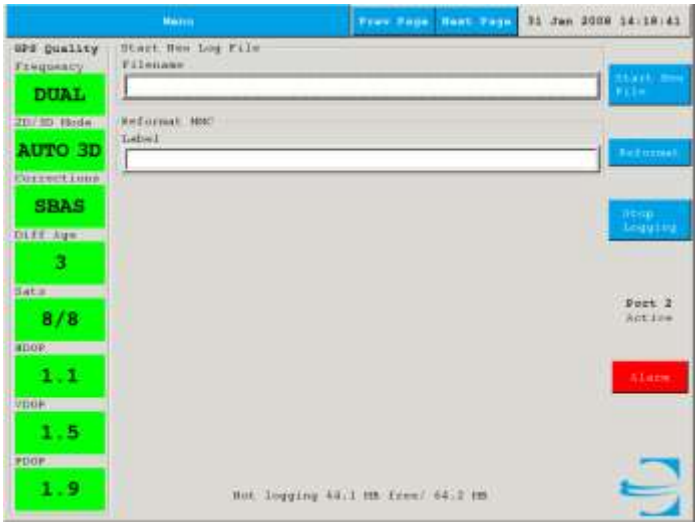
Firmware Update

The C-Nav2050 receiver's firmware can be installed from this screen. Ensure that the USB memory device is installed. Press the ***Scan USB*** button to search the USB memory stick for available firmware. Press ***Update Firmware*** to upload the new code into C-Nav2050 memory. Information regarding the new version is displayed in the information window.



MultiMediaCard (MMC) Administration

Control of the internal MMC Logging is handled here. Data can be logged to the internal MMC of the C-Nav2050.



MMC Files

Control of files on the MMC Internal memory is handled here. Including transferring a file to a USB device.

C-Nav2000

Receiver Information

Specific information regarding the GNSS receiver (including firmware / hardware version, etc) is displayed on this screen. Message indicators (green/white circles) indicate the Message status. Green circles indicate messages are being received by C-NaviGator.

The ***Query*** button can be used to request updated information from the receiver.

Solution Control

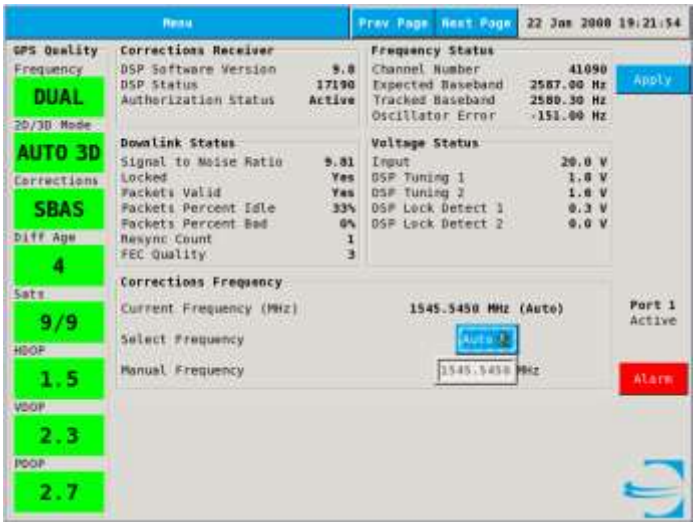
General operating parameters and position solution control are for the C-Nav2000 are accessed here. These settings define the acceptable operating limits, correction signal settings, vertical/3D control, correction devices and signals, etc.

Output Control

NMEA and RTCM output are controlled from this screen.

Corrections Receiver

This screen contains mainly status indicators relative to the GNSS corrections received by the system. Also, the user can manually set the C-Nav corrections frequency here.



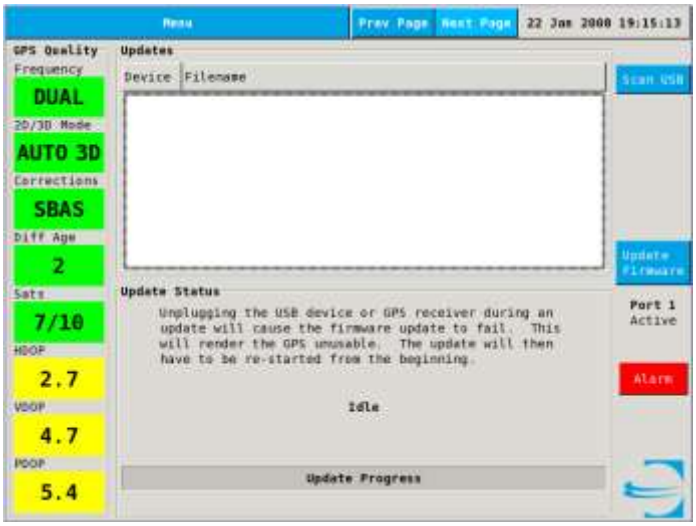
Corrections Authorization

The operator can access information and enter the authorization code into the C-Nav2000 receiver. As part of standard procedure, operators should periodically check the expiration date to avoid gaps in service.

Firmware Update

The C-Nav2000 receiver's firmware can be installed from this screen. Ensure that the USB memory device is installed. Press the ***Scan USB*** button to search the USB memory stick for available firmware. Press ***Update Firmware*** to upload the new code into C-Nav2000 memory. Information regarding the new version is displayed in the information window.

Updates of a C-Nav2000 typically require 25-30 minutes. This process should not be interrupted as it may leave the receiver in an inoperable state if not completed successfully.



Warning
Do not unplug the USB device while the memory is uploading

NMEA Input

Status

Sentence string status indicators identify which information the GNSS receiver supplies.

Output

Settings

All output control and data transfer functions are accessible from this screen. These include Port information, NMEA string selections, output filter settings, etc.

Section 6 - Maintenance

Troubleshooting

No Position Information

"Position Info" screen is blank.

1) Check cable interconnections.
2) Go to – ***Menu / Settings / Ports*** and verify that the settings correspond to the correct input connection.
3) Go to – ***Menu / Settings / General*** to verify that the correct "COM Port" is selected as the *Active GNSS Port*.

NOTE

Active Port # is displayed on the right side on View screens.

No Serial Input/Output

The most common cause of data transfer problems is an incorrect setting in the port configuration.

1) Check that the serial port settings are correct and that they match the input/output device. Select ***Menu / Settings / Ports / xxxx***.
2) The C-Nav20xx data transfer settings should be *19.2K / 8 / None / 1*.

Updating Software

New software versions for the C-NaviGator will be posted on the C-Nav web site at www.cnavGNSS.com. The software can be downloaded and saved to the supplied USB Thumb Drive for use with C-NaviGator.

To verify that the latest software is installed, check the About page from the Help menu.

Follow these procedures:

1) Plug the USB memory device that contains the new software into one of the USB ports on the C-NaviGator rear panel.
2) Reset the C-NaviGator unit.
3) When the system menu screen appears, press the ***Update*** button.
4) Follow the on screen instructions.

Appendix A - Glossary of Terms

1PPS	**(1 P**ulse **P**er **S**econd**)** A precision electronic pulse output (at TTL levels) from the GNSS receiver that marks exact second intervals (1 s). It is used for precise timing and to synchronize sensors and acquisition computers.
Azimuth	The horizontal angle of the observer's bearing in surveying, measured clockwise from a referent direction, as from the north, or from a referent celestial body, usually Polaris.
Bad Packets	The percentage of bad C-Nav correction packets received since the unit was turned on.
Bit Error Rate	Number of received bits of a data stream over a communication channel that have been altered due to noise, interference, distortion or bit synchronization errors. The Bit Error Rate is considered good if less than 20. The maximum reported value is 500.
C-Monitor	A utility program used to monitor the quality of the position information received from a GNSS receiver. No position calculations are done in C-Monitor. C-Monitor simply creates a visual representation of the data received from a GNSS unit.
C-Nav	The C-Nav GNSS receiver combines a dual-frequency, geodetic grade, GNSS receiver with an integrated LBAND communication RF detector and decoder -- all linked by an internal microprocessor. The entire assembly is combined into a single integrated package that is durable, lightweight and water/weatherproof.
C-Nav1010	The C-Nav GNSS receiver combines a dual-frequency, geodetic grade, GNSS receiver with an integrated LBAND communication RF detector and decoder -- all linked by an internal microprocessor. The entire assembly is combined into a single integrated package that is durable, lightweight and water/weatherproof.

C-Nav2000

The C-Nav2000 GNSS navigational receiver is a 10-channel dual frequency unit with two additional channels for receiving Satellite Based Augmentation System (SBAS) signals and an L-Band demodulator for reception of the C-Nav correction service. For more information, go to www.cnavGNSS.com.

C-Nav2050

The C-Nav2050 survey GNSS receiver has expanded capabilities including RTK, PPS output, etc. As with the model 2000, the 2050 is a 10-channel, dual frequency, precision GNSS receiver, with two additional channels for receiving SBAS signals and an L-Band demodulator for reception of C-Nav subscription signals. Maximum data output rate is 50Hz and Position Velocity Time (PVT) data can output at 25Hz. Two 115kbps serial ports are available. For more information, go to www.cnavGNSS.com.

C-Nav3050

The C-Nav3050 survey GNSS receiver has expanded capabilities including RTK, PPS output, etc. As with other C-Nav receivers, the C-Nav3050 includes dual frequency, precision GNSS receiver, with two additional channels for receiving SBAS signals and an L-Band demodulator for reception of C-Nav subscription signals. For more information, go to www.cnavGNSS.com.

Correction Signal

The Correction Signal-to-Noise ratio. This graph is only available with the C-Nav system.

Correction Type

The type or source of differential corrections being applied to the GNSS receiver.

Course True

The course computed by the GNSS receiver.

Differential Age	The time in seconds since the GNSS unit received the last differential correction update.
Differential GPS	A technique for improving GPS solution accuracy by reducing the error based on signals received at a known location. Single point code positioning with pseudorange corrections are applied from simultaneous observations at the known position. One to ten meter accuracy is typical.
DOP	**D**ilution **o**f **P**recision is a scale factor representing the effect of satellite constellation geometry positioning accuracy. Standard terms for GNSS applications are:

GDOP **G**eometric **D**ilution of **P**recision -- three coordinates plus clock offset

PDOP **P**osition **D**ilution **o**f **P**recision) -- three coordinates (See PDOP definition below)

HDOP **H**orizontal **D**ilution **o**f **P**recision -- two coordinates

VDOP **V**ertical **D**ilution **o**f **P**recision -- height only

TDOP **T**ime **D**ilution **o**f **P**recision) -- clock offset only

Elevation	Height of the GNSS antenna above the reference ellipsoid.
Error Ellipse	A statistical measure of the positional error at a given point computed from the propagation of all errors affecting the position solution and expressed by its semi-major and semi-minor axis (vectors of greatest and least magnitude) and the covariance (rotation angle in the reference coordinate system). Two-dimensional errors are typically propagated at one-standard deviation (39.4% probability that the position lies on or within the ellipse) or 2.1447 times the standard deviation (95% confidence) level.
FOM	**F**igure **o**f **M**erit
GNSS Receiver	A GNSS receiver consists of a number of basic components: an antenna with optional preamplifier, a radio-frequency and

	intermediate- frequency (RF/IF) "front end" section, a signal tracker/correlator section, and a micro- processor to control the receiver, process the signals, and compute the receiver's coordinates. The receiver will also include a power supply and memory devices to store instructions and data.
HAE	**H**eight **A**bove **E**llipsoid – RTK vertical reference plane.
L1-L2 Sig. Strength	GNSS satellites transmit spread spectrum signals in two frequency bands, L1 and L2 (1575.42 and 1223.6 MHz, respectively). The satellite signals carry both time information and a data strings, referred to as the GNSS navigation message. This message is transmitted at a rate of 50 bits per second. Using the data from 4 or more satellites, a GNSS receiver can accurately determine local latitude, longitude and height. Civilian applications are confined to the L1 band for computing position. The C & C Technologies and military receivers employ both L1 and L2 bands, offering a significant improvement in accuracy.
NMEA 0183	This guideline for Interfacing marine electronics devices is a voluntary industry standard, first released in March of 1983. NMEA 0183 defines electrical signal requirements, data transmission protocol, timing, and specific sentence formats for up to 38.4K-baud serial data bus.
PDOP	**P**osition **D**ilution **o**f **P**recision is the most common mathematical expression of the quality of solutions. It is based on the geometry of the satellites with the best case being a value of 1. Higher numbers indicate worse quality. The best DOP would occur with one satellite directly overhead and three others evenly spaced about the horizon. PDOP has a multiplicative effect on range error. For example, a range error of 32 meters with a PDOP of 1 would give a user an assumed best accuracy of 32 meters. A PDOP of 2 would result in an assumed accuracy of 64 meters. C-NaviGator can be programmed to stop providing position solutions above a specific PDOP level (6 is common).

Position	Includes Current Latitude, Longitude, Geoidal Height, HDOP, PDOP, Type of corrections, Current Station ID, Differential Age, Velocity, UTC Time and UTC Date if available.
PPS	**P**recise **P**ositioning **S**ervice – a positioning service that includes velocity and timing information. PPS is continuously available, worldwide to authorized users. PPS information is usually (but not always) encrypted to prevent use by unauthorized users.
Pseudorange	A measure of the apparent propagation time from the satellite to the receiver antenna, expressed as a distance. The apparent propagation time is determined from the time shift required to align a replica of the GNSS code generated in the receiver with the received GNSS code. The time shift is the difference between the time of signal reception (measured in the receiver time frame) and the time of emission (measured in the satellite time frame). Pseudorange is obtained by multiplying the apparent signal-propagation time by the speed of light. Pseudorange differs from the actual range by the amount that the satellite and receiver clocks are offset, by propagation delays, and other errors including those introduced by selective availability.
PVT	**P**osition **V**elocity **T**ime
RTCM	**R**adio **T**echnical **C**ommission for **M**aritime Services) – A Commission set up to define a differential data link to relay GNSS correction messages from a monitor station to a field user. The RTCM SC-104 recommendation is the defacto standard for differential GNSS correction transmission. It defines the correction message format and 16 different correction message types.
RTG	**R**eal **T**ime **G**ypsy -- Developed by NASA's Jet Propulsion Laboratory (JPL) to provide centimeter-level accuracy for space applications. A single RTG subscription service, combined with C-Nav hardware, can provide you with worldwide positioning capability on the order of 0.1 meter.

RTK	**R**eal **T**ime **K**inematic (or Kinematic Surveying) involves a roving receiver that does not need to stop to collect precision information. Meter/centimeter level accuracy is available using modern dual-frequency carrier-phase measurement techniques.
SBAS	**S**atellite **B**ased **A**ugmentation **S**ystem - Includes, but is not limited to: WAAS (**W**ide **A**rea **A**ugmentation **S**ystem) and EGNOS (**E**uropean **G**eo-stationary **N**avigation **O**verlay **S**ystem). Ranging signals generated on the ground and provided via C-band (or K-band) downlink are provided to the end user. These signals contain integrity data on satellite system.
Sky Plot	This option displays a plot of the current GNSS satellite locations with reference to the GNSS receiver. C-NaviGator refers to this presentation as “Position Information”.
Scatter Plot	This option displays a plot of satellite positions relative to the receiver and provides an indication of relative signal strength in the two frequency bands.
Visible Sats	The number of Satellites used by the receiver in the position solution.
WAAS	**W**ide **A**rea **A**ugmentation **S**ervice -- A system of satellites and ground stations that provide GNSS signal corrections over a wide area. An accuracy improvement on the order of three meters, with 95 percent confidence, is realized.
WCT	**W**ide Area **C**orrection **T**ransform

Appendix B - NMEA Data Strings

C-NaviGator is capable of reading and writing NMEA 0183 compliant messages as they relate to positioning. Version 2.1, 3.0 and 3.01 are supported. The following table lists the available strings:

NMEA String	Description
ALM	Almanac data
GBS	GNSS Satellite Fault Detection
GRS	GPS Range Residuals
MLA	GLONASS Almanac Data
GGA	Global Positioning System Fix Data
GLL	Geographic Position – Latitude / Longitude
GNS	GNSS Fix Data
GSA	GNSS DOP and Active Satellites
GST	GNSS Pseudorange Error Statistics.
GSV	GNSS Satellites in View
RMC	Recommended Minimum Specific GNSS Data
VTG	Course Over Ground and Ground Speed
ZDA	Time & Date

In addition to standard NMEA messages, C-NaviGator recognizes the following C-Nav proprietary sentences:

NMEA String	Description
DPGGA	Filtered GGA output for DP vessels.
RTCM	C-NaviGator can output RTCM if a C-Nav2000 is connected.
SATS	Sky Plot Information
TRINAV	Statistical information.

Appendix C - Alarm List

General Alarms

Invalid Navigation:

Valid navigation data is unavailable on the Device port. The communication link is operational.

No Communications:

C-NaviGator can no longer communicate with the attached device.

Output Error: Output data and/or commands from this serial port has failed.

C-Nav3050 Alarms

Correction Signal Invalid Messages:

Information received in the correction signal is missing or incorrect.

Correction Signal Lost Lock:

Input of the correction signal has failed.

Too few measurements:

The number of satellites available is too low to compute a position.

PDOP too high:

The positional dilution of precision exceeds the user-configured maximum.

Export height/velocity limits exceeded:

Input of the correction signal has failed.

Requested mode unavailable:

The settings requested are not available with the receiver's configured options.

No Valid C-Nav Corrections License:

The C-Nav Subscription Service has expired. Please contact C-Nav Support:

E-mail: C-Nav.Support@cnavGNSS.com -or-

Phone: +1 (337) 210-0000

C-Nav1010 Alarms

Correction Signal Invalid Messages:

Information received in the correction signal is missing or incorrect.

Correction Signal Lost Lock:

Input of the correction signal has failed.

Correction Signal Poor Reception:

The selected correction signal source is weak.

No Valid C-Nav Corrections License:

The C-Nav Subscription Service has expired. Please contact C-Nav Support:

E-mail: C-Nav.Support@cnavGNSS.com -or-

Phone: +1 (337) 210-0000

Unstable GPS Clock:

The GPS receiver's internal clock (time reference) has become unstable. The receiver's ability to measure pseudo ranges is compromised.

C-Nav2050 Alarms

Correction Signal Invalid Messages:

Information received in the correction signal is missing or incorrect.

Correction Signal Lost Lock:

Input of the correction signal has failed.

Correction Signal Poor Reception:

The selected correction signal source is weak.

Low voltage x.x V:

The GNSS receiver input voltage is too low.

No Valid C-Nav Corrections License:

The C-Nav Correction Service has expired. Please contact C-Nav Support:

E-mail: C-Nav.Support@cnavGNSS.com -or-

Phone: +1 (337) 210-0000

Unstable GPS Clock:

The GPS receiver's internal clock (time reference) has become unstable. The receiver's ability to measure pseudo ranges is compromised.

C-Nav2000 Alarms

Correction Signal Invalid Messages:

Information received in the correction signal is missing or incorrect.

Correction Signal Lost Lock:

Input of the correction signal has failed.

Correction Signal Poor Reception:

The selected correction signal source is weak.

Failed Geofence:

The C-Nav receiver is outside the Land Based correction signal area. To extend, Contact C-Nav Support for a marine license:

E-mail: C-Nav.Support@cnavGNSS.com -or-

Phone: +1 (337) 210-0000

Firmware Update Mode:

A firmware update is in progress or has failed.

Low Voltage x.x V:

The GNSS receiver input voltage is too low.

No Valid C-Nav Corrections License:

The C-Nav Subscription Service has expired. Please contact C-Nav Support:

E-mail: C-Nav.Support@cnavGNSS.com -or-

Phone: +1 (337) 210-0000

Unstable GNSS Clock:

The GNSS receiver's internal clock (time reference) has become unstable. The receiver's ability to measure pseudo ranges is compromised.

Output Alarms

Position Filtered - Max Error:

The position solution has exceeded the error allowance.

Position Filtered - Max HDOP:

The Horizontal Dilution of Precision computation has exceeded the alarm setting (See GNSS Quality Alerts).

Position Filtered - Min 2D/3D Time:

The Min 2D/3D time computation has exceeded the alarm setting (See GNSS Quality Alerts).

Position Filtered - Min Satellites:

The number of usable satellites has dropped below the minimum number set on the GNSS Quality Alerts screen.

Position Filtered - No Data:

Data through the C-NaviGator active port is not present or is invalid.

Simulator Alarms

Simulator mode:

C-NaviGator is in Simulator mode (operator selected as the active port on the ”Ports” screen). This alarm cannot be acknowledged.

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