

## FR 2104 An Introduction to the Garmin GPS 12CX Receiver

Garmin Corporation (<http://www.garmin.com>) markets a number of recreational-grade GPS receivers. Although different Garmin receivers have somewhat different features, most notably whether they can display uploaded maps, they all share a common set of capabilities useful in collecting point, line, and polygon data as well as navigating to pre-programmed locations. We will present operating principles using the Garmin 12 series, specifically the Garmin 12CX, for illustration. One feature of the Garmin 12CX is an ability to connect to an external antenna, important for using the device in a vehicle or under a canopy.

Garmin recreational-grade receivers lack several features common to GPS-grade receivers including recording of elevation, the ability to record complete attribute data associated with spatial features, and the ability to control the acceptable level of error for collecting satellite readings. Most importantly, such receivers (as advertised) do not record individual readings or pseudorange data, eliminating the possibility of post processing the data to increase accuracy. Combining inexpensive recreational-grade receivers with a handheld computer and appropriate software can, however, overcome many of these shortcomings. Some Garmin recreational-grade receivers can be used in conjunction with a beacon receiver for real time differential correction, increasing accuracy from a published 15m to a published 1-5m. Garmin also sells several WAAS-ready units.

There is much information about recreational-grade GPS receivers available on the Internet. One particularly comprehensive, must-see, site is (<http://joe.mehaffey.com>).

### **Basic Operation**

We will present only the bare essentials of collecting spatial data, for subsequent incorporation into a GIS, with Garmin receivers. With this start you should be able to more easily utilize the manual that came with the receiver to configure various options and utilize additional capability.

Information is presented on five screens or pages on the Garmin 12CX. Movement between pages and within a page is accomplished with the keys and rocker above the unit's display (Figure 1).

The "light bulb" key is used to turn the unit on and to turn it off (you must hold the key down for a period to power the unit off). When you turn the unit on, a welcome screen will appear while a self-test is conducted. When you turn the unit off, a countdown (three seconds on a Garmin 12CX) will occur before the unit actually shuts off; this helps avoid inadvertently shutting off the unit.

The internal antenna is located at the top of the unit (under the Garmin globe logo); that part of the unit should be exposed to as much clear sky as is available when relying on the internal antenna.



Figure 1: Keys on Garmin GPS receiver.

The PAGE key is used to move forward sequentially between pages while the QUIT key moves backward sequentially between pages. You can also use these keys to move out of sub-pages within pages.

The Rocker is used to move within a page, for example to move between options. You can move up, down, left, right, or diagonally with the Rocker by pressing along its circumference.

The ENTER key provides access to additional capability (when available) buried within a page. For example pressing ENTER on a page often presents configuration options. The QUIT key moves you back out to the page. The ENTER key also selects highlighted options.

Points are referred to as waypoints in Garmin terminology. Multiple waypoints can be recorded, the number varying between models. The Garmin 12CX can store 1000 waypoints. Similarly, lines and polygons constitute tracks. A single track log can be recorded, though the track log can have multiple segments. On a Garmin 12CX the track log can occupy up to 2048 points. Newer Garmin units allow storing of multiple track logs.

### **Information Pages**

The sequential order of pages on a Garmin 12CX is: Satellite, Position, Map, Navigation, and Menu.

*Satellite Page:* Once the unit is powered and links with satellites are established, the Satellite Page appears (Figure 2). The Satellite Page displays battery power (left side of display), the location of visible satellites with satellite numbers (bulk of display), and signal strength bars for satellites being used to calculate position (bottom of display). The page also lists whether you are in 2D or 3D collection mode (or acquiring signals) and provides a “proprietary to Garmin” Estimated Positional Error (EPE). The EPE is related to HDOP (horizontal dilution of precision); HDOP can be displayed via an undocumented key sequence.

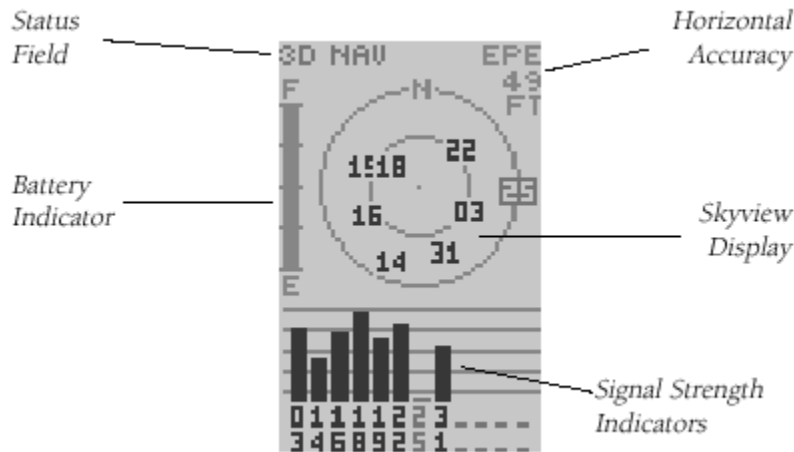


Figure 2: Satellite page.

*Position Page:* The Position Page (Figure 3) displays a compass that is active while you move with the unit as well as the coordinates of your current location (including elevation). This page can also be configured to display various types of distance and speed information.

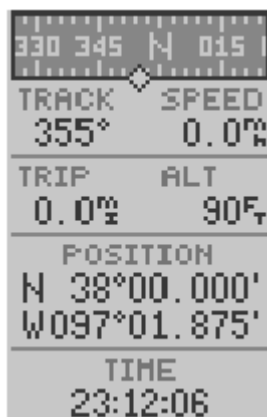


Figure 3: Position page.

*Map Page:* The Map Page graphically displays (nearby) waypoints, as labels, and the track log as a thin line (Figure 4). The diamond on this page represents your current

location. You can use the Rocker to pan on the Map Page and the IN and OUT keys to zoom. Several configuration options are available for this page via the ENTER key.

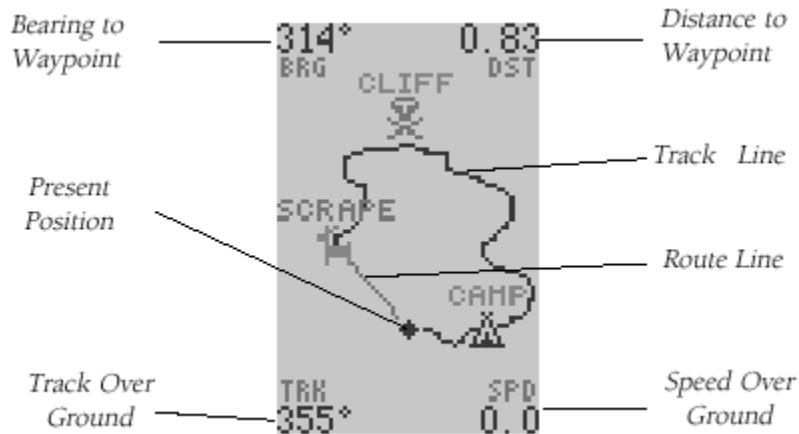


Figure 4. Map page.

*Navigation Page:* Two formats are available for display on the Navigation Page: compass and highway (Figure 5). Format is selected by pressing the ENTER key while on the page.

The compass format displays the distance and direction to a waypoint (top), a compass ring and arrow indicating the direction to the waypoint relative to the direction you are moving (bulk of display), and your current direction and speed (under the compass ring). To move directly to the desired waypoint you should keep the arrow pointing straight up. The last field, Estimated Time Enroute (ETE) by default, can be configured to display one of several navigational aids. See the manual that came with the unit for details.

It will be convenient to switch back and forth between the Navigation and Map Pages while moving to a desired waypoint. The Map Page provides a spatial depiction of your current location relative to the desired waypoint while the Navigation Page provides more detail on direction and time of travel. Note, however, that neither page provides for exacting measurement; their use allows you to get “in the neighborhood” of the desired waypoint.

*Menu Page:* Options on the Menu Page (Figure 6) allow you to work with waypoints and configure the unit. For example, the ‘SETUP MENU’ option allows you to select position format (projection), units of display, and map datum. See the manual that came with the unit for details.

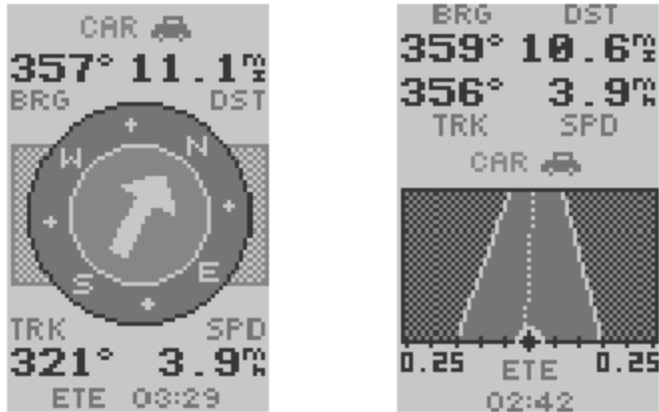


Figure 5: Navigation page. Compass and highway formats.



Figure 6: Main Menu page.

### Collecting a Point Feature (Waypoint)

Pressing the MARK key from any page takes you to the 'MARK POSITION' panel (Figure 7).

Use the Rocker, pressing down, to move to the waypoint label field (a three digit number by default). Press the ENTER key to enable entry of your own label. Labels can be up to six (6) characters in length. Alternate characters are displayed by pressing up or down on the Rocker. Character positions are highlighted for entry by pressing left or right on the Rocker. Press the ENTER key again when you have provided your label.

Press down on the Rocker until the 'AVERAGE?' field is highlighted. Press the ENTER key. Multiple fixes will be averaged until you press the ENTER key again. You will see the EPE change during the averaging process. With the 'SAVE?' field highlighted pressing ENTER will save the averaged 2D coordinates of the point.



Figure 7: Mark position panel.

## Waypoint List

The 'WAYPOINT LIST' panel allows review and editing of stored waypoints. Selecting this option from the Menu Page (Figure 6) displays the panel (Figure 8, top left).

Waypoints are stored alphabetically by label according to the tabs on the 'WAYPOINT LIST' panel. Press Rocker up or down to move between the tabs. Press Rocker right to move to the waypoints under a tab (Figure 8, middle) and Rocker left to move back to the tab. Once in the waypoints under a tab, press Rocker up or down to move between stored waypoints. With a waypoint highlighted, pressing the ENTER key will display information about the waypoint (Figure 8, bottom right). Use the Rocker and ENTER key in the usual ways to highlight and change waypoint information fields. The comment field, which by default displays the date and time of point creation, can be edited to add extra attribute data, 16 characters worth, for the point. Unfortunately, no attribute data beyond a label and comment can be associated with a waypoint.



Figure 8: Working with the Waypoint List.

## Collecting a Line or Polygon Feature (Track Log)

*Configuring tracking:* Go to the Map Page (Figure 4) and press the ENTER key. Use the Rocker to highlight 'TRACK SETUP' on the panel that appears and press the ENTER key. The 'TRACK SETUP' panel will appear (Figure 9). Set the 'RECORD:' option to OFF and the 'METHOD:' option to timed (using the Rocker and ENTER key in the usual way to set these options). Set the time interval to an appropriate number of seconds (depending on how fast and far you will travel and how detailed a track you wish to collect). Highlight 'CLEAR LOG?' and press the ENTER key. Verify that you wish to clear the current track log: Rocker left to 'YES?' and press the ENTER key.



Figure 9: Track Setup panel.

*Adding to a track log:* Navigate on-the-ground to the start of the line or polygon you wish to digitize. Go to the Map Page (Figure 4) and press the ENTER key. Use the Rocker to highlight 'TRACK SETUP' on the panel that appears and press the ENTER key. The 'TRACK SETUP' panel will appear (Figure 9). Set the 'RECORD:' option to FILL (using the Rocker and ENTER key in the usual way) and press the ENTER key. Press the QUIT key to display the Map Page to observe your progress. Walk along the line of interest or around the polygon of interest. When you reach the end (assuming you are still on the Map Page), press the Enter key. Use the Rocker to highlight 'TRACK SETUP' and press the ENTER key. The 'TRACK SETUP' panel will appear (Figure 9). Set the 'RECORD:' option to OFF to turn off tracking and press the ENTER key. You have now recorded a track log segment.

You can record multiple lines and polygons as multiple track log segments, up to the available track log memory (2048 points with a Garmin 12CX). You will need to set the time interval with which you are collecting points (see Configuring tracking above) appropriately to ensure you have sufficient memory to store your mission data.

Unfortunately track log segments cannot be labeled like waypoints (nor can attributes be recorded).

Acquired track log segments are displayed on the Map Page.

### Pre-Defining a Waypoint

You may wish to mark a position to which you will subsequently navigate.

Go to the Menu Page (Figure 6). Rocker to the 'WAYPOINT' option and press the ENTER key. The 'WAYPOINT' panel will appear (Figure 10). Rocker to the 'NEW?' field and press the ENTER key. You should give the waypoint a name using the Rocker and ENTER key in the usual way. Highlight the position coordinates field and press the ENTER key. Enter the coordinates of the waypoint (using the Rocker and ENTER key in the usual way) and press the ENTER key. Press the ENTER key once more to confirm the 'DONE?' prompt.

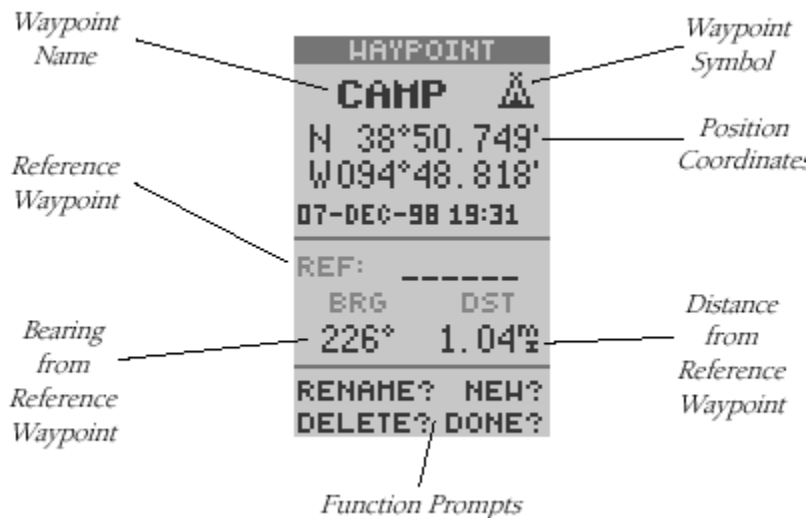


Figure 10: Waypoint panel.

### Navigating to an Existing Waypoint

Press the GOTO key from any page. The 'GOTO WAYPOINT' panel will appear (Figure 11).

Highlight the waypoint of interest as described in the Waypoint List section above. Once the desired waypoint is highlighted, pressing the ENTER key will set the point for navigation. The Navigation Page (Figure 5) will appear to assist in navigation. Recall that it is convenient to switch back and forth between the Navigation and Map Pages while moving to a desired waypoint.

Once you reach your desired location you should cancel the GOTO. Press the GOTO key, highlight the 'OPT' tab on the 'WAYPOINT' panel, highlight the 'CANCEL GOTO?' option under this tab, and press the ENTER key.

The "GOTO" approach just presented takes you "cross-country" to your destination. If it is more convenient to take a particular route to a destination (for example if you are driving), multiple waypoints can be used to define the route. Consult the manual that came with the unit for instructions on setting and using routes.

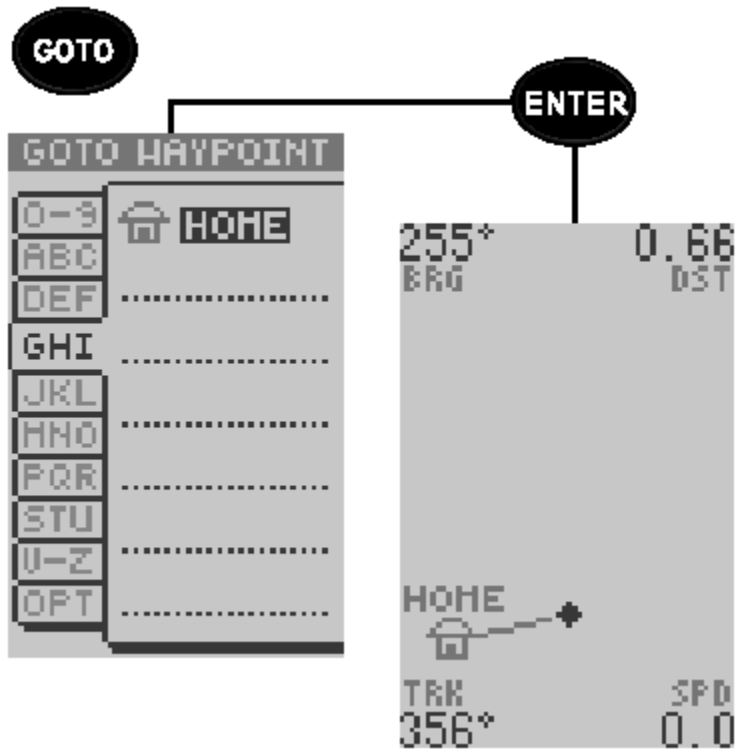


Figure 11: GoTo Waypoint panel used with Map page.