

GL - A Distance / Bearing Program for Palm Handheld Organizers

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version 1.02

A useful tool for microwave communication is a program that can calculate the aiming-bearing and the distance between two locations. The PC program BD is easily available and widely used. This article describes a new program, GL, that I have written. This program runs on the small, portable Palm handhelds, or any equivalent that uses the Palm OS.

coding and testing – spread out over about a year – I finally got a program that I like. I think it may be useful to the microwave ham community, and I plan to make it available for free to anyone who wants it.

Introduction

Several years ago I wrote a program for MS DOS-based PCs that I named GLKEY. It computed distance and bearings between two points and also had a CW keyer. I used it during the ARRL 10 GHz contests and found it quite useful.

A few years ago I bought a Palm Pilot Organizer and about a year ago I upgraded to a Palm IIIx. I have used them for various functions during the contests but not to do bearing and distance calculations. I am aware that Paul Wade, W1GHZ, has written a small BD program for the Palm but when I tried it, I found it a bit awkward to use, and it lacked many features that I liked in my DOS GLKEY program, so I stayed with my DOS notebook PC during the contests.

I knew there were free tools for writing programs for the Palm OS, and began investigating them. After much web surfing, I found all the pieces to set up GNU development tools for the Palm from the Free Software Foundation, Inc. The Palm website now even has a section where you can download these tools. It includes a fully functional C compiler and I already knew how to write in C. I decided that a worthwhile project might be to make a version of my GLKEY program that can run on the Palm. After many hours of studying,



A Palm Handheld Running GL

Program Goals

I wrote the Palm program Grid Locator or GL, with several goals in mind. I wanted the Palm program to be at least as good as the DOS program that I had written earlier. I suspected that the Palm user interface even allowed for a much friendlier program. As I had done in my DOS program, I wanted to be able to pull in known locations from

previously saved lists. I also wanted to follow most of the normal Palm conventions so owners of a Palm handheld could easily learn to use it. I think the results have been pretty good.

GL Features

Here is a list of the basic features of the program.

- Quick entry of Base and Target locations that accepts multiple formats.
- Accurate calculation of bearing and distance using standard ellipsoid models of the earth.
- Display of distances both between two exact points and between the centers of the two Maidenhead grids. (The latter is used for contest scoring.)
- Ability to load a location from previously saved lists of locations.
- The location lists are done as MemoPad text files so they can be created easily, either in MemoPad on the Palm or by importing text files into MemoPad on the Desktop.
- The program retains its status after other programs are run or the Palm is powered off.

Program Operation

The main screen of the program shows the Base and Target locations and the bearing and distance for the path between them. When the program is started for the first time it shows two default locations. Figure 1 shows the main screen at start up.

The bottom half of the screen displays the two locations that are the end points for the path. It is arranged in two columns with the Base location on the left and the Target location on the right.

The top half of the screen displays the results of calculating the path from the Base to the Target.

In the bottom half, each column shows (from top to bottom) a header tag for Base or Target, a name tag for this location, the Maidenhead 6-digit grid square for the location, the latitude of the location in degrees, and the longitude of the location in degrees. The values that are enclosed within rounded rectangles are buttons. Tapping on these values allows changing the location information. The location name is not a button and cannot be edited directly on the main screen, but this value can be edited when either the Maidenhead grid or the latitude / longitude is selected for change.



Figure 1. Main Screen

Anytime the main screen is displayed, the information for the Base and Target locations is used to calculate the path and the results are displayed in the top half of the screen.

The bearing and distance are calculated using equations for an ellipsoid model of the earth. The default is WGS 84 . Options allow changing this to NAD27 or a Spherical model with a radius of 6373 km. As far as I can see, the difference between the WGS 84 and NAD27 models is not noticeable in the calculated results. The spherical model is mostly provided as a comparative educational device and should not be used for real calculations or for generating contest distance values.

The field with the heading 'Bearing' displays the azimuth angle in degrees for a path from the Base to the Target. The bearings are

specified in the normal manner, with 0 meaning North, 90 East, and 180 South. This is the aiming bearing that a station at the Base location would use to reach the Target location.

The field under the Reverse Brg header shows the reverse azimuth from the Target to the Base. For those unfamiliar with spherical geometry, the forward and reverse bearings are not exactly 180 degrees apart in most cases. If the path is due north-south or if it is east-west along the equator, they will be 180 degrees apart. All other paths will be a bit off from a 180 degree difference between the forward and reverse directions.

The two fields under the Actual Dist header show the length of the path in kilometers and miles between the two points as defined by the latitude and longitude values. Above that is the Grd2Grd Dist value. This is the length of the path in kilometers from the center of the Base Maidenhead grid to the center of the Target Maidenhead grid.

In most cases the Actual distance will be the most accurate and will be slightly different from the Grd2Grd distance. The Grd2Grd distance is listed because this is used for logging contacts during ARRL contests. In the program, it is possible to enter locations using only the Maidenhead grid. If this is done, the latitude and longitude are calculated and displayed for the center of the grid. If both the Base and Target are entered as Maidenhead grids the Actual and Grd2Grd distances will be the same.

The **Prefs** button on the main screen is a shortcut to the options dialog. The options dialog is described later in the document.

Entering Locations

Locations are changed by tapping on one of the buttons on the main screen. This will open up a new dialog screen for editing or choice selection. The name of the location can be changed in the dialogs for either Maidenhead grid or Lat/Lng. If only the name needs to be changed (not the usual case) you can tap to change either the grid or Lat/Lng and edit only the name.

Latitude and Longitude

To change a location with new latitude and longitude values, you can tap on the button for a path terminus (Base or Target) that contains either the latitude or longitude value. Tapping on either a latitude or a longitude button opens the same basic dialog box that is shown for a Base location in Figure 2.



Figure 2. Latitude / Longitude Entry

In this dialog all the fields are editable. Tap or drag on the Lat and Lng values to edit them with normal Palm methods. You can also edit the Name field with a new name for the location.

After editing the values you can tap **DONE** to make them active or tap **CANCEL** to exit to the main screen without changes. If you tap **DONE** these values will be used to calculate the Maidenhead grid for the location. All of the new location information is displayed on the main screen and the path is calculated.

Latitude and Longitude Formats

The formats for the latitude and longitude values have considerable flexibility in what is acceptable. The normal display format is degrees with a decimal fraction. This is followed by a letter to indicate the hemisphere (N or S for latitude, E or W for longitude). A new value can use this format, but other formats can also be used.

The input can accept degrees and tenths, degrees and minutes with tenths, or degrees minutes and seconds with tenths. For formats such as degrees/minutes/seconds, the values are most easily separated by a space. Other non-numeric characters are

also acceptable for separating the parts of a location.

The hemisphere for the value can be specified several ways. The usual way is to have a space after the last number, followed by a letter. The letter will be either N or S for latitude, or E or W for longitude. Lower case letters are also acceptable. Another option is to precede the number with a minus sign for south latitudes or west longitudes. If there is no sign and no final letter, a positive value would normally be assumed.

The program provides one more shortcut for easier entry. A longitude that is entered with no sign and without an appended E or W would be assumed to be positive, which is an East longitude. A W would be required for any West longitude, which includes all of the Americas. From the program menu several options can be set. Two of the options allow setting a default for W longitudes or for S latitudes. When the program is installed, the option for default West longitude set. This means that a longitude entered without a final letter (E or W) for the hemisphere will assume West. This makes it easier to enter longitudes in the Americas (no W is required). For users in Europe the default West option should be unchecked. If the West default is set, longitudes east of the prime meridian must have E appended. For users in the Southern hemisphere the default S option can be set with similar effect on latitude.

The following list shows several of the possible equivalent ways to enter the same latitude value.

34.23533 N
34.23533 (with S default not set)
34 14.1198
34d 14.1198m
34 14 7.2
34d 14m 7.2s
34d 14' 7.2" n

If something is typed for a longitude or latitude that the program cannot understand, an error message will be displayed asking the user to reenter the

value and the dialog will be refreshed showing the original value.

Maidenhead Grid

From the main screen you can choose to enter a Maidenhead grid to specify a new location. This begins by clicking on the button that shows the Maidenhead grid for either the Base or Target. This will open a dialog box for editing values. Figure 3 shows the dialog box for the Base Maidenhead value.

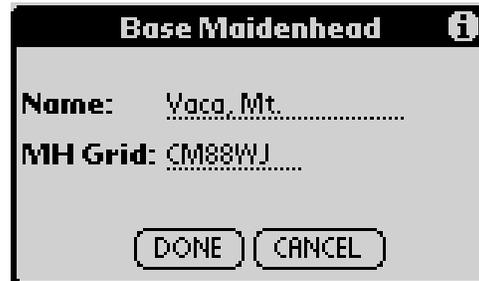


Figure 3. Maidenhead Grid Entry

Both the Name and MH Grid fields can be edited. If the grid is changed and DONE is clicked the values will be placed on the main screen and latitude and longitude values will be calculated that reflect the center of the grid.

The normal format for entering Maidenhead grids is the 6-digit format, but 4-digit grids are also acceptable. If CM88 is entered and DONE clicked, the main screen will show a grid of CM88MM which is the center of the larger 4-digit grid.

As with the Lat/Lng dialog, if the program cannot understand the grid value, an error message will be displayed asking the user to reenter the value and the dialog will be refreshed showing the original value.

Location Lists

When using the program to calculate paths, many of the Target or Base locations will be well known locations, such as mountain tops or commonly used operating points. To facilitate this, the program knows how to read a location from lists of locations that are

saved as MemoPad memos. The program can manage up to 16 lists and each list can hold up to 40 locations. The lists are recognized because they begin with the three characters GL- or gl- . This is followed by a name for the list and one or more location values. The format for this location data will be described later.

Loading a Location from a List

To load a location from a list, you first tap on the header button for the location: BASE LOC or TARGET LOC . This will cause a selection dialog to open as shown in Figure 4.



Figure 4. Action Selection

To find the new location in a list, tap the top button: from List LOAD . The program will scan through the MemoPad database looking for memos that begin with the GL- tag. When it finds one it saves the name of the list that immediately follows the tag. A dialog will be displayed that shows all the lists that were found and allows you to select one. This dialog is shown as Figure 5.

In this example, the MemoPad database contained two lists, one named California and one named NE US. To view a list, just tap on its name in the selection box. Figure 6 shows the dialog that will be displayed if we tap on the list California.

The California list has about 30 locations saved in the memo. The arrow in the bottom-right corner of the location selection box allows you to scroll down through the remainder of locations in the list. The top of this dialog shows the name of the list memo that is being displayed (California) and destination where a selection will be loaded (to Base). To load a location, just tap on the name of the location, for example, Frazier, Mt.

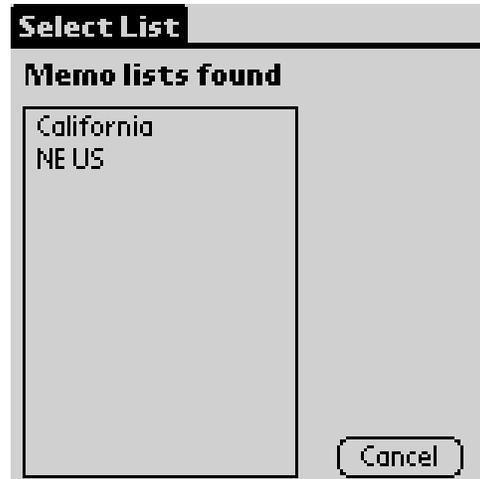


Figure 5. Location List Selection



Figure 6. Location Selection within a List

If you decide you want to change to a different list while this Select Location dialog is active, you can tap on the Chg List button. This will take you back to the dialog shown in Figure 5.

The first time you go through this selection process, the List Selection of Figure 5 is displayed followed by the Location selection of Figure 6. After this process has been done once, the next time you tap the LOAD button on Figure 4, you will go directly to the Location Selection of Figure 6 with the same list displayed that was last used. To select a different list, just tap the Chg List button. If the program detects that the MemoPad database has changed, the previous list may not be valid so the List Selection of Figure 5 will again be displayed first.

Saving Locations

A simple method for saving locations to a list has been provided in this first version of the program. All saves are done into one common memo list. This is a GL- memo with the name <Save>.

To save a location you begin in the same way as for load, by tapping the header button on the main screen for either **Base Loc** or **Target Loc**. The selection screen of Figure 4 will be displayed. Tap on the **SAVE** button. The selected location, Target or Base, will be saved as the first location in the <Save> memo.

If the <Save> list memo does not exist, the program will create it in the MemoPad. The message shown in Figure 7 will be displayed.

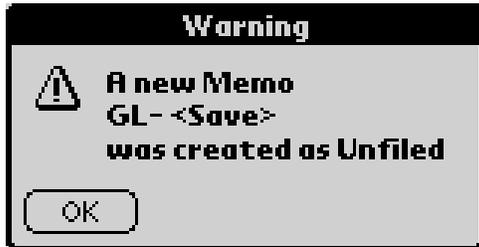


Figure 7. New <Save> Memo Message

After one or more locations has been saved into the <Save> list, this list will be displayed on the List Selection screen of Figure 5. It can be used like any other list as a source of locations for loading. Within the <Save> list, the locations will be organized in the order they were saved with the most recent on top.

These saved locations could be used to update other lists. At present, you will need to do this manually in MemoPad by cutting and pasting.

MemoPad Location List Formats

The Grid Locator program can read lists of locations from special MemoPad memos. The GL program will search all of the Memo Database for records in the GL format. To help organize your Palm, all GL memos can all be put into a category, such as GL or Ham, but this is not required. Standard

MemoPad techniques can be used to create, edit, sync, and categorize GL memos.

The memos containing GL location lists are recognized because they begin with the proper three-letter tag. A GL location memo must begin with the tag 'GL-' or 'gl-'

After this tag, is a string which is used as the name for the whole list. This name will show as part of the memo name in MemoPad and will be displayed in the program. The name might be something like 'California' or 'Massachusetts' or 'Bay Area'. It should end with a new line.

The rest of the memo contains a series of location definitions. Each location definition begins with the character '\$' and includes several parameters which are separated by the delimiter '/'.

For clarity in reading the lists, it is recommended that a line feed precede the '\$' symbol at the start of each location definition so that all locations begin on a new line.

The format of a location definition is as follows:

```
$place_name/[MHgrid]/[latitude]/[longitude]/[ ]
```

The parameters enclosed in '[]' are options and may not all be required. The parameters must be recorded in the order shown. The `place_name` is a string that is used as a name tag for this location definition. The other three parameters define the location.

When the GL program evaluates a location it finds the parameters by looking at the information between the '/' slash characters.

The program first looks for a valid Lat/Lon pair as the 3rd and 4th parameters in the location definition. If it finds them, it calculates a MH grid (ignoring and MHgrid parameter in the definition).

If there is no valid Lat/Lon pair the MHgrid is evaluated. If that is valid, latitude and longitude values are calculated for the center of the grid.

The program has lots of flexibility in how values can be entered. Here are several equivalent ways to record the location for Heaps Peak:

```
$Heaps Peak/DM14KF/34.23533 N/117.139167 W/
$Heaps Peak//34.23533/-117.139167/
$Heaps Peak/dm14kf/34d 14.1198m n/117d 8.35002' w/
$Heaps Peak/DM14KF/34 14 7 N/117d 8' 21" W/
```

(a less accurate location follows...)

```
$Heaps Peak/DM14KF//
```

(and an even less accurate location...)

```
$Heaps Peak/DM14//
```

As can be seen above, a location definition is valid if it has only latitude and longitude, with no Maidenhead grid. Similarly, a location is valid with only a Maidenhead grid and no latitude and longitude. Latitude and longitude values can be entered in many formats from degrees and tenths, to degrees-minutes-seconds, and with or without unit letters such as 'd' for degrees or 'm' for minutes.

Figure 8 shows a GL memo list displayed in MemoPad.

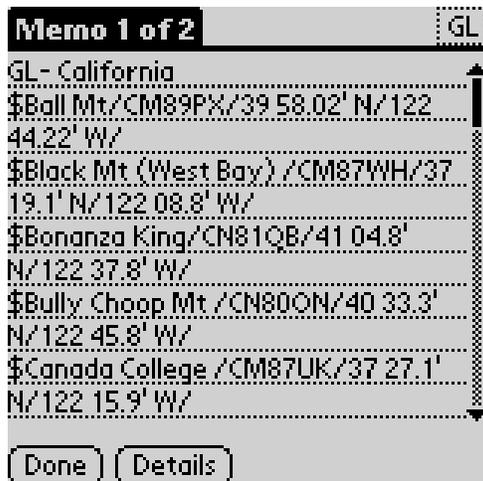


Figure 8. GL- California List in MemoPad

Menus and Options

The program implements a menu selection. The menu is accessed by tapping the Menu icon at the bottom-left of the Palm screen. On recent versions of the Palm OS, it can also be accessed by tapping the title at the

top of a dialog window. Figure 9 shows the menu with the Help item selected.

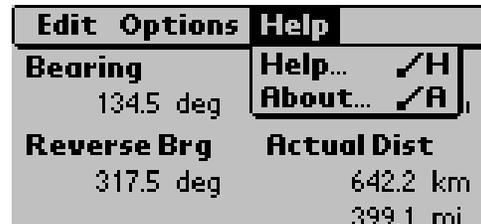


Figure 9. Menu with Help Item Active

If you select the Help item from the pull-down list shown in Figure 9, a text window will open with a description of using the program. The About item displays the name and version of the program.

If you select Edit on the menu you will see Cut and Paste that can be used for editing or copying editable fields in the program.

The Options menu item will open the dialog shown in Figure 10, allowing you to edit program options. The main screen also has a shortcut to the options dialog by tapping the Prefs button.

The Lat/Lon Options section provides two check boxes that can be used to make entering latitude or longitude values easier. These options were described in the section on Latitude and Longitude Formats.

When the program is installed the box for default West Longitude is checked, since this makes it easier to enter longitudes in North America. These check values can be changed for users in other parts of the world.

The Ellipsoid Datum section of the Options dialog defines what model of the earth is used for calculations. WGS 84 is the default, but this can be changed by tapping one of the other two buttons. The WGS 84 and NAD27 options are very close and changing between these two will probably not change the distance or bearing results for most calculations.

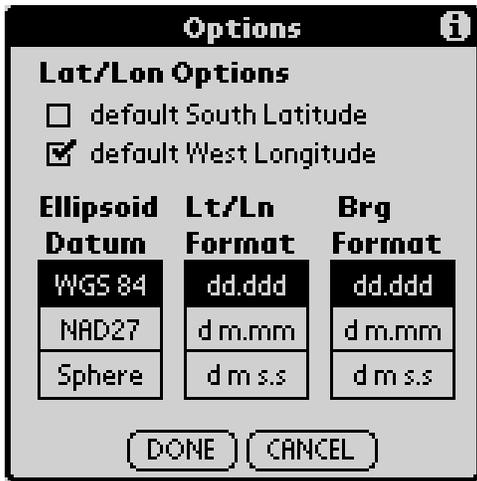


Figure 10. The Options Dialog

The Sphere selection defines a spherical earth with a radius of 6373 km. This selection is not as accurate as the other two and should only be used as a learning tool. Don't trust the distance/bearing to be very accurate with this selection.

The Lt/Ln Format and Brg Format sections of the Options dialog allow you to specify the display format for latitude/longitude points and for bearing and reverse bearing values.

Figure 11 shows the main screen after the Format options for both Lt/Ln and Brg have been set to d m s.s . It can be seen that the position and bearing values now display in degrees-minutes-seconds format. If you click on a position to change the latitude/longitude, the dialog (figure 2) will show the tag symbols (° ' ") in the values, but it is not necessary to include them in new values. You can separate the degree, minutes and seconds values with spaces as described previously.



Figure 11. Display with D M S Format

Information

Some of the dialog boxes have an 'i' in a circle at the right end of the title bar. The dialog in figure 10 is one example. For dialogs that have this, tapping the 'i' will provide some information about using the dialog.

Running on Windows

One person asked if I was planning to do a version of this program that will run on Microsoft Windows. The answer is no.

I later thought about this and realized that it is possible to run this program on Windows or a Macintosh. Palm provides a tool for developers called the Emulator. This software creates a virtual Palm handheld on your PC screen. The picture of my program running on a Palm at the beginning of this article is a screen capture from my PC running the emulator.

The Emulator software can be downloaded from the developer sections of the Palm web pages. Unfortunately, this by itself is not enough. The Emulator must be loaded with an image of the ROM software, just like it is real Palm hardware. One way to do this is to load the ROM image from a real Palm device. ROM images can also be obtained from Palm on the web, but it requires some level of registration with Palm to get access. Anyone who wants to try running the

Emulator can read about this on the Palm web pages.

Future and Feedback

As I am writing this article, I am the only person who has used this program much. One feature that I want to add is the ability to read locations directly from a connection to a GPS receiver. The selection dialog in figure 4 already has a button for this but the software hasn't been added to make it work yet.

Another possible future addition is more complex choices for saving than just the one <Save> memo. I could add some form of contact logging, but this is rather low on my priorities right now.

If anyone can provide me with corrections or additions for the locations, I would definitely like to have that information. I'd like to be able to provide more lists of locations to use with the program.

I'd also like any problem reports or suggestions for new features or improvements.

Reaching Me

I am in CM97AH. My email address is :
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The program can be downloaded from
<http://www.xertech.net/> in the Projects section.