

G7TO/W

GARMIN/LOWRANCE/EAGLE GPS to PC

Interface Software

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G7TO Version 3.04.02

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DISCLAIMER(s):

There are no guarantees expressed or implied with g7to and/or its documentation. The package works for me, it may or may not work for anyone else. It's even possible that *proper* use of g7to.exe could corrupt the data stored in your GPS or on your computer.

As part of its functionality, g7to creates DeLorme MapDoc (*.sa3, *.sa4, *.sa5 and/or *.sa6) files from GPS data. The data may then be displayed overlaid on a SA3/4/5/6 map. The data is not real time and should not be used for critical navigation purposes. In my opinion, the Lat/Long grid shown in SA3/4/5/6 is not accurate enough for *critical* navigation applications. For instance, in the Corvallis area of Oregon, SA3/4 is in error about 150 feet to the East at magnification 16. For example, plotting a known Lat/Long on SA3/4 results in a point on the SA map that is approximately 150 feet east of its actual location. The error varies from place to place and with the magnitude of the displayed map. I've heard rumors that SA3 is up to 1/4 mile off in some areas, but I've not personally observed an error that large.

The Garmin64 and navigate.exe support has not been tested since g7to version 2.05. I no longer actively use those formats. However, if use of one of those formats results in an error, please report it.

Document definitions:

download:	Primary data flow is from the GPS to the PC
upload:	Primary data flow is from the PC to the GPS
LEI:	Lowrance and/or Eagle GPS
G7TO text file:	This is the file that is created by re-directing the standard output of a g7to command line to a file. For example:

```
g7to -i g45wrt >g45info.txt
```

will create the file g45info.txt and it is by definition a 'g7to text file'.

Unless otherwise stated, all references to the GPS-45 apply equally to all supported Garmin receivers.

Unless otherwise stated, all references to g7to apply equally to g7tow.

Command Line option sequence

g7to scans the input line reading the options specified. File names encountered are placed in buffers and other parameters are executed when they are scanned.

The input file list is scanned and each file is opened in sequence. The file is read and its contents stored in a buffer internal to g7to.

If the -s option is *not* specified the internal data buffer is then sorted and duplicate data points are removed.

The list of output files is scanned and if one of the destinations is a LEI GPS the data is immediately sent to the unit and the LEI GPS entry is removed from the output file list. The Garmin units will re-create the waypoint when reading the route. The LEI units will not, therefore data to a LEI unit must be sent prior to the next step.

Waypoint entries, which duplicate waypoint entries within routes, are deleted.

The output file list is then scanned and the content of the internal data buffer is output to each file in sequence.

GPS Unit Supported

Garmin

GPS-45	GPS-12	GPS-II	Street Pilot
GPS-45XL	GPS-12XL	GPS-II+	GPS-III

Other Garmin units may interface correctly to g7to, but they have not been tested.

Lowrance/Eagle (LEI)

All LEI GPS units featuring LEI protocol Version 1 or Version 2 are supported. This includes, but is not limited to the Lowrance GlobalMap Series, the Lowrance GlobalNav Series, the Eagle Explorer Series, the Eagle AccuMap Series, the Eagle AccuNav Series, and the Eagle Expedition Series.

Program Features:

Transfer data between a Garmin GPS and a PC

- Copy a Garmin GPS III or Garmin Street Pilot display to a Windows bitmap file.
- Upload/download Track/Waypoint/Route data to/from a Garmin GPS.
- Almanac data may be uploaded to the Garmin receivers in the Yuma format. If 'g7to -i fname' is executed and file fname contains almanac data in Yuma format then the data will immediately be sent to the GPS. This command should be used alone, i.e. no other -i or -o processing on the same command line.
- The current position and time can be retrieved from the Garmin GPS. This function can be set to repeat every 'n' seconds.
- The Backlight can be turned on and off. On the GPS II+ , GPS 12XL Versions greater than 3.02 and the GPS III the level of the backlight can be set. The backlight value ranges from 0 which is off to 255 which is full on. Lower levels, i.e. below 40 or so, are hard to see. A useful starting place is g7to -o g45L40. The maximum useful value appears to be about 95.
- On the Garmin 45 and 12XL units the LCD contrast can be set.
- The Garmin internal and external voltages can be read from those units supporting that portion of the Garmin protocol.

Proximity waypoints:

- Proximity waypoints may not be sent to Garmin64 or .SA3 files. They may be sent to SA4/5/6 files as a circle object.
- The distance parameter stored in the g7to text file is in meters.
- The 12XL Versions 2.02 and up support Proximity Waypoints, however on versions 3.50, 3.51, and 2.52 proximity waypoints cannot be uploaded or downloaded via the GRMN/GRMN protocol.
- If a waypoint exists which has the same coordinates as the center of the circle, it is used as the identifier for the proximity circle. If such a waypoint does not exist, one is created with the name PROXxx where xx is a number representing the nth waypoint created.
- If the waypoint in the center of the circle is moved so that it no longer resides at the center of the circle and the file is then downloaded by g7to, a pseudo proximity waypoint will be created. In other words, a waypoint is tied to a circle and becomes a proximity waypoint if and only if the waypoint is at the exact center of the circle.

Uploading proximity waypoints to the Garmin 12XL first deletes all proximity waypoints and adds those in the current upload. This means that you can have 8 proximity waypoints stored in the 12XL, send one new proximity waypoint and end up with only the new one, not 9 in the 12XL.

Transfer data between a LEI GPS and a PC

- The program does an autobaud search for the proper baud rate to communicate with Lowrance/Eagle units. Some LEI units echo all characters sent to them. These units can fool the autobaud search and it may be necessary to manually set the baud rate using the **-6 baud** command line parameter.
- Copy a Lowrance/Eagle GPS display to a Windows bitmap file.
- Upload/download Track/Waypoint/Route/Icon data to/from a LEI GPS.

Other program data files supported

Street Atlas 3/4/5/6

- MapDoc files
- .gpl (track log) files.

Fugawi

- Fugawi exported waypoint files.
- Fugawi exported track files.

OziExplorer

- OziExplorer waypoint files *.wpt
- OziExplorer event files *.evt
- OziExplorer track (plot) files *.plt
- OziExplorer route files *.rte

Serial Communications Port Settings

To communicate with *g7to*, the Garmin GPS must have its interface set to GRMN/GRMN. The GRMN/GRMN baud rate for Garmin units is fixed at 9600.

The Lowrance/Eagle units should have the NMEA data turned off. *g7to* will perform an autobaud search for the proper communication rate with the LEI unit. If the autobaud search fails, the user can set the baud rate via a command line parameter:

```
g7to -i lwrw -6 19200
```

g7to defaults to 9600 baud on COM1 for Garmin units and 115200 also on COM1 for LEI units. Other standard PC baud rates can be chosen via command line flags. The default is COM1 at I/O address 0x3f8, IRQ 4. Other parameters are:

command line	Port I/O	Address	Interrupt
-2	COM2	0x2f8	3
-3	COM3	0x3e8	4
-4	COM4	0x2e8	3

For users with non-standard COM ports the flag -5 can be used to select COM port parameters, IO address and IRQ. This flag is not supported in *g7tow*. The format is as follows.

-5 Port,IOaddr,IRQ (no spaces allowed) where:

- Port is 1-4 (for COM1-COM4)
- IOaddr in hex (0xnnn) or decimal
- IRQ (3-15) decimal

For LEI GPS units which can operate at baud rates other than the standard the -6 parameter will select a new baud rate:

-6 BaudRate

For example, to set COM2 at IO 0x345 IRQ 10 Baud 56k

```
g7to -5 2,0x345,10 -6 57600 -i <inputs> -o <outputs>
```

Autobaud search is enabled for LEI units. However, some LEI units, such as the GlobalMap Sport, echo all characters received and can interfere with the baud selection. Newer units, i.e. the Eagle Expedition II and the GlobalMap 100 do not echo all characters received and the autobaud search works well. However, if you know the baud rate your GPS serial port is set to and it isn't the default then setting the baud rate on the command line will cause the program to execute more quickly. The autobaud search can take several seconds.

The MS-DOS version of the program, *g7to.exe*, will accept the command line option -v which will print the COM port statistics after a serial port communication.

Supported Input Formats:

Suffix information

The suffixes in the following files are in some cases those used by the software which wrote the file. For instance, the suffixes .wpt, .evt, .rte, and .plt are from OziExplorer. These are text files whose formats are set by OziExplorer.

The suffixes .fwp and .trk are suffixes defined by g7to. Fugawi uses .txt for the suffixes of these files. After saving the data using Fugawi, the file should be renamed to .fwp for waypoints and .trk for tracks before access with g7to.

Input File Suffix Table

Suffix	File type
.CLG	Navigate.exe route
.FWP	Fugawi exported waypoint file
.GPL	Street Atlas plot file
.EVT	OziExplorer Icon file
.PLT	OziExplorer Plot file
.RTE	OziExplorer Route file
.WPT	OziExplorer Waypoint file
.SA3	Street Atlas 3 MapDoc file
.SA4	Street Atlas 4 MapDoc file
.SA5	Street Atlas 5 MapDoc file
.SA6	Street Atlas 6 MapDoc file
.TRK	Fugawi Track file
.TXT	g7to text file
.CSV	Comma Separated Value file

Text

- similar to Gardown7 format with all non printing characters removed

```
#Wed Dec 16 08:12:36 1998 GMT
D WGS-84
! -t cblack -t wt -t sn
N New Track Start
T N44 30.4296 W123 34.7715 Mon Dec 14 22:46:41 1998
T N44 30.4468 W123 34.7477 Mon Dec 14 22:46:41 1998
! -w coblue -w ctblue -w sovs -w stvs -w ane
I N44 30.8899 W123 33.6013 ; 18;
I N44 30.8899 W123 33.5866 ; 18;
R 03
W 003 N44 30.0000 W123 30.0000 Sun Aug 16 21:16:15 1998 TEST POINT ; 18;2;0
W 126TRN N44 25.2782 W122 00.1112 Sun Aug 16 21:16:15 1998 HWY 20-126 ; 18;2;0
W 1ST-B N44 33.9769 W123 16.0457 Sun Aug 16 21:16:15 1998 FIRST BAPTIST ; 10;2;0
E 03
```

- Modified for Street Pilot waypoints

See *Multiple Line Waypoint Record* for the Street Pilot waypoint format

Street Atlas track log files

- .gpl track log files

GarDown7

- Input/Output files used by Gardown7
- Garmin64 format.
 - Track and waypoint only
- Navigate.exe routes file, routes.clg.

OziExplorer

- OziExplorer Route files: fname.rte
- OziExplorer waypoint files: fname.wpt
- OziExplorer track files: fname.plt
- OziExplorer event files: fname.evt (LEI Icons)

Fugawi

- Fugawi waypoint when exported as txt files (.fwp)
- Fugawi track files (save & load, these are binary) (.trk)

SA3/4/5/6

- MapDocs (fname.sa3/4/5/6).
 - All symbols are output as Waypoints.
 - The first 6 characters of an object's name become the waypoint name. The 7th character is skipped. Therefore, it is a good idea to make the 7th character a ';' or other character that isn't actually part of the useful info. The 8th->Xth (see below for values of 'X') character becomes the waypoint comment. The waypoint time is taken from the time stamp on the input file.

X==20 for Text output (24 on some newer Garmins)

X==20 for Garmin64 output format.

NOTE: Many of the newer Garmin receivers do not fully support the time stamp on GRMN/GRMN input and output.

- SA4/SA5 startup files (fname.sa4 or fname.sa5 as of g7to version 3.02.05). As of version 2.07 the supported items are lines and areas -- which are sent to the text file as track data, circles which are sent as proximity waypoints, the normal waypoints previously supported in SA3 files.
- The SA4 route is supported and routes 0-19 in the Garmin are supported with up to 30 waypoints in each route.
- The Garmin route 0 is also supported as the SA4 route.

NOTE: When the input is a .sa[3456] file the time of all records sent to the Garmin become the date of the input file. If you have a GPS that sends/receives the correct date of the record then it would be better to use text files as an intermediate storage in order to preserve the dates of origination.

Supported Output Formats:

Output File Suffixes

In addition to the input file suffixes listed above the following suffixes are available for output:

.BMP	Windows bitmap representation of Garmin and LEI display
.G64	Garmin64 data file

.WTT Waypoints output as a track
 .IGC Glider data format used by IGC-Approved GNSS Flight Recorders. This program supports a minimal subset needed to output track files in IGC format.

SA4/5/6 files

- SA startup files (fname.sa3, fname.sa4, fname.sa5, or fname.sa6). The default object is a small square. The default text location is NE of the object. The '.saX' suffix is not added by the program, it must be input on the command line.

Tracks output to a SA3 files are converted to numbered waypoints. Adding a -8 to the command line will direct g7to(w) to add the time of the track point to the waypoint name. This is a one way operation.

- Tracks are converted to SA4 lines, proximity waypoints to circles and routes 0-19 are converted to symbols with a specific text format.
- Provision is made to change the parameters of lines and circles via '! command lines.

Default is ON for the following:

- ry = turn on route line drawing for routes 1-19
- rn = turn off route line drawing for routes 1-19

- rwy = turn on route waypoints for routes 1-19
- rwn = turn off route waypoints for routes 1-19

- r0y = turn on route 0 objects to sa4/sa5
- r0n = turn off route 0 objects to sa4/sa5

- r0ly = turn on route 0 line drawing to sa4/sa5
- r0ln = turn off route 0 line drawing to sa4/sa5

- r0wy = turn on route 0 waypoints
- r0wn = turn off route 0 waypoints

- r0wy or -ry must be used for routes to be output to sa3 files

- by turns on all sa outputs
 i.e. -by is a synonym for -wy -ty -ry -r0y -py -r0wy -rwy

- bn turns off all sa outputs
 i.e. -bn is a synonym for -wn -tn -rn -r0n -pn -r0wn -rwn

- r cxx = set route line color
- r txx = set route line thickness
- r sxx = set route line style

Text file.

- Format is defined under *Supported Input Formats* above.
- A text file is normally output when no other outputs are specified on the command line (-o fname.xxx). If an output file is specified via -o fname.xxx, adding a -a to the command line will turn text output back on. This output is to the display and can be redirected to a file. For instance, the following command line will read the GPS waypoints from the GPS via the serial port and output the data to a comma separated value file. It will also send the text output to the file fname.txt:

g7to -i g45w -o fname.csv -a >fname.txt

Garmin64 format (fname.g64)

See the GARMIN64 documentation for an explanation of this format.

Garmin and LEI GPS units

via COMx port, the file name must be **G45x** for Garmin units or **lwrx** for LEI units
See below for options on **'-i G45x'** and **'-i lwrx'**

Navigate.exe routes file

routes.clg.

Street Atlas track log

Fname.gpl

OziExplorer files:

OziExplorer waypoint files
OziExplorer route files
OziExplorer track (plot) files
OziExplorer event (icon) files

Fugawi

waypoint and **track** files when exported as text files (? .fwp and ? .ftr respectively)

Comma Separated Values.

Waypoints, events (LEI Icons), and Tracks will be output if the suffix is .csv. The first data line output is the Datum of the file:

Datum:,outputdatum

Followed by one or more of the following

W,NAME,Latitude,Longitude,Month,DayofMonth,Year,hour,minute,seconds,Comment
T,Latitude,Longitude,Month,DayofMonth,Year,hour,minute,seconds,
I,Latitude,Longitude,icon_symbol

NOTE: The time for tracks created on the GPS is in UTC. The time for waypoints and for tracks that were uploaded to the GPS is the PC's clock time when the waypoint/track was downloaded. Most Garmin units do not support uploading of the element time. The LEI units support time on waypoints only, not on tracks or events.

If track files are output to a text file a command line option is available which will sum the distances in each track segment and in the total track. This command line option is **-d**.

g7to -i trackfile -d >trkfile.txt

will result in a file similar to the following

```
#Sun Dec 20 23:26:06 1998 GMT
D WGS-84
! -t cblack -t wt -t sn
N New Track Start
T N44 28.0076 W123 30.4263 Sun Dec 20 23:25:38 1998
T N44 28.0066 W123 30.4565 Sun Dec 20 23:25:38 1998
T N44 30.8551 W123 34.2777 Sun Dec 20 23:25:38 1998
Dist: 3.9647 nm, 4.5625 sm, 7.3427 km
DSum: 3.9647 nm, 4.5625 sm, 7.3427 km
N New Track Start
T N44 30.8290 W123 34.6756 Sun Dec 20 23:25:38 1998
T N44 30.8448 W123 34.6707 Sun Dec 20 23:25:38 1998
Dist: 0.0162 nm, 0.0186 sm, 0.0299 km
DSum: 3.9809 nm, 4.5811 sm, 7.3726 km
```

where Dist is the distance of the just printed segment and DSum is the summation of the distances through the last printed segment.
nm-Nautical Miles, sm-Statute miles and km-kilometers.

Waypoints converted to tracks

If output suffix .wtt is chosen g7to will output the currently loaded waypoints as a track list. This is useful when using waypoints to define a track with Fugawi. For instance, starting with a map loaded one creates series of numbered waypoints that follow a desired track. This set of waypoints is then exported to a Fugawi waypoint file. g7to will read the waypoint file and output a track file which follows the waypoint sequence:

```
g7to -i fugawi.fwp -o fugawi.wtt
```

The file fugawi.wtt can then be sent to a Garmin or LEI unit by

```
g7to -i fugawi.wtt -o g45, or  
g7to -i fugawi.wtt -o lwr1, or  
g7to -i fugawi.wtt -o lwr2
```

Command line help available:

- **g7to -hi**
- **g7to -ho**
- **g7to -hd**
- **g7to -y 1** will print the programs internal datum conversion table

Each of the above lines will cause g7to to print abbreviated 'help'.

Typical command lines:

INPUT command lines

Note: Unless otherwise specified all references to g7to also include g7tow.

Garmin GPS Units

```
g7to -i G45w -i g45r -i g45t -i g45x -o file.sa3 -o file.sa4 -a >file.txt
```

This command line will download waypoint, route, track and proximity waypoint data from the Garmin and store it in the SA3 startup files file.sa3, file.sa4 and also write it to the text file file.txt.

Note: The -i g45 commands can be placed in a single command with the option letters concatenated after the g45. Therefore, the above command line can be shortened to:

```
g7to -i G45wrtx -o file.sa3 -o file.sa4 -a >file.txt
```

NOTE: The above example reads proximity waypoints, if they exist, from the Garmin. It also sends the data to several locations, one of which is a Street Atlas 3 file. SA3 does not support proximity waypoints, so, proximity waypoints, if they exist in the Garmin will be stripped from the data sent to the .sa3 file.

```
g7to -i g45j >file.txt
```

This command will send a list of the protocols supported by the Garmin gps to the text file file.txt. Here is the output from a GPSIII:

Product ID: 72, Version string: 'GPS III Software Version 2.07'

This GPS supports the following Protocols (source: GPS Protocol Array)

Product Data : A000, Physical : P000
Link : L001, Command : A010
Waypoint Transfer : A100, Waypoint Data : D104
Route Transfer : A200, Route Header : D201, Route Data: D104
Track Transfer : A300, Track Data : D300
Proximity Transfer: None, Proximity Data: None
Almanac Transfer : A500, Almanac Data : D501
Date/Time Transfer: A600, Date/Time Data: D600
Position Transfer : A700, Position Data : D700
PVT Transfer : A800, PVT Data : D800

Lowrance/Eagle GPS units

g7to -i lwrw -i lwrr -i lwr1 -i lwr2 -i lwri >file.txt

This command will download waypoints, routes, track 1, track2, and events (icons) from the LEI unit and store the data in file.txt. The program starts out using 115200 baud and searches for the baud rate. Adding '-6 baud' to the command line will allow you to set the baud rate.

Note: The -i lwr commands can be placed in a single command with the option letters concatenated after the lwr. Therefore, the above command line can be shortened to:

g7to -i lwrwr12i >file.txt

Street Atlas File Input

g7to -o G45 -i file.sa3 -i file.sa4 -a >waypoint.txt

This command uploads waypoint data to the GPS from the SA3 startup file file.sa3 and also writes it to the text file waypoint.txt. By default, waypoint data is sorted and waypoints with the same name are removed. To disable sorting and duplicate name removal, specify -s on the command line, i.e.

g7to -s -o G45 -i file.sa3 -i file.sa4 -a >waypoint.txt

NOTE: When the input is a .sa3 or .sa4 file the time of all records sent to the Garmin becomes the date of the input file. If you have a GPS that sends/receives the correct date of the record then it would be better to use text files as an intermediate storage in order to preserve the dates of origination.

NOTE: Substitute '-o lwr' for '-o G45' to send the data to the LEI GPS.

If no output file is specified then the output is assumed to be text. If a COM port is required and none is specified then COM1 is assumed.

PVT for Garmin units

Some Garmin units support automatic reporting of data via the COM port. The -i g45g command will start the GPS sending PVT data approximately once a second. Typing an 'X' or 'x' will cause the data flow to stop and g7to will exit. The data is formatted in comma separated values. The data values are:

alt	altitude above WGS 84 ellipsoid (meters)
epe	estimated position error, 2 sigma (meters)
eph	epe, but horizontal only (meters)
epv	epe, but vertical only (meters)

fix	type of position fix unusable 0 failed integrity check invalid 1 invalid or unavailable 2D 2 two dimensional 3D 3 three dimensiona 2D_diff 4 two dimensional differential 3D_diff 5 three dimensional differential
tow	time of week (seconds) The number of seconds into the current week which begins on Sunday at 12:00 AM (i.e., midnight Saturday night-Sunday morning).
latitude	N is positive and S is negative in degree
longitude	E is positive and W is negative. in degrees
east	velocity east (meters/second)
north	velocity north (meters/second)
up	velocity up (meters/second)
msl_hgh	height of WGS 84 ellipsoid above MSL (meters)
leap_scnds	difference between GPS and UTC (seconds)
wn_days	week number days--the number of days since Jan 1st, 1990 to the beginning of the current week

NOTE: The 12XL version 3.53 supports the PVT data, and I assume some of the newer units will also. GPS III apparently do support the PVT data, starting with version 2.06. Use g7to -i g45j to determine if the PVT data element is supported by your unit.

g7to output from the -ig45g command:

```
alt epe eph epv fix tow lat long east north up msl_hgh ls days
65.881538,111.762314,53.607468,94.871986,3,314407.999961,44.598521,-123.259085,-0.436293,-0.164178,-2.170609,21.438652,12,3276
67.182388,119.940247,53.794605,103.926758,3,314408.999959,44.598523,-123.259093,-0.432684,-0.165981,-2.164219,21.438652,12,3276
68.327530,119.940247,53.794605,103.926758,3,314409.999961,44.598524,-123.259101,-0.428032,-0.166015,-2.156440,21.438652,12,3276
```

Display Download

Garmin GPS

g7to -o file.bmp

g7to first identifies the attached GPS. If it is a Garmin GPS III or a Street Pilot g7to will download the display into the file 'file.bmp'. The file is a standard 16 color grayscale bitmap that is 160 pixels wide and 100 (for SP it is 240) pixels high. If different GPS is connected, the download will probably fail and a warning message is printed. In this case g7to will still attempt to do the download. The output file may need to be rotated.

LEI GPS

Display data can be downloaded from a LEI GPS with the following command:

g7to -7 -o file.bmp

and the output file should not need to be rotated.

LEI Units

LEI Waypoint Storage in the GPS

The LEI units store waypoints in a numbered 'slot' which is numbered from 1 to n where n is the maximum number of waypoints specified. g7to sends waypoints starting at the first slot. Waypoints above the number actually sent are not changed. However, if the user wishes to mark the rest of the waypoints in the unit as 'Inactive' a -I can be attached to the command line.

LEI command line examples

If your LEI unit supports 750 waypoints and you are using g7to to send 50 waypoints the first 50 waypoints are overwritten and the remaining 700 are not changed:

```
g7to -i file.txt -o lwr
```

The first 50 waypoints are overwritten and the remaining 700 are marked inactive:

```
g7t -i file.txt -l -o lwr
```

Marking a waypoint inactive for all practical purposes deletes the waypoint.

The transfer can be set to begin at a particular waypoint number in the LEI units. For instance, if you desire to leave the first 20 waypoints active and start the upload at waypoint 21 the command would be:

```
g7to -i file.txt -o lwrs21
```

The 's' suffix to the -o lwr should not be used when sending route information. The waypoint numbering for routes would be incorrect.

The command:

```
g7to -i G45r -o routes.sa4 -a >routes.txt
```

downloads the routes in the Garmin to a SA4 file and creates an intermediate text file, routes.txt.

The command:

```
g7to -i lwrr -o routes.sa6 -a >routes.txt
```

downloads LEI routes.

NOTE: Route number 'n' will show up in the Lowrance as route number n+1. The text files start numbering routes at '0' and the Lowrance starts numbering them at '1'.

Lowrance route number '1' will be treated as any other route '0' for SA output.

The command:

```
g7to -i lwrs34,39 > wpts.txt
```

downloads LEI waypoints 34 through 39 from the LEI unit

The command:

```
g7to -i track.txt -o tracks.gpl
```

will read file track.txt and create track.gpl which can be read into SA as a track log

NOTE: The maximum number of track points supported by g7to.exe defaults to 4096. This value can be increased to 32767 by the parameter -f. However, each track point read requires approximately 80 bytes of memory.

The command:

```
g7to -i xxx -o g45 -f 10000
```

sets the program to allow ten thousand track points

If a value of 0 is used then a temporary file is created and used to hold the tracks. This will cause g7to to run much slower, but track files with up to 65534 points can be accommodated.

NOTE: The maximum number of track points for g7tow.exe is 65535, therefore there is no reason to use the -f parameter with g7tow.exe.

The command:

```
g7to -i file.txt -o file.sa4 -b
```

will transfer file.txt to file.sa4. If routes 1-19 exist in the input file then lines will be drawn between the route points. The parameters of the lines can be set by the -r command.

NOTE: a -r implies -b and the -b is not required.

The command:

g7to -i waypoint.txt -o waypoint.sa3 -c Tblue -s Tm

reads the input file waypoint.txt, outputs a SA3 file,output.sa3. When SA3 displays the file the text is blue, and the text size is medium.

g7to text file command line options

Text files created by g7to will contain lines which start with an exclamation point. These are command lines. They can be used to modify parameters while the text file is being read. They are normally used for changing the attributes of objects in .SA files.

The command:

g7to -i waypoint.sa3 >waypoint.txt

reads the .sa file waypoint.sa3 and outputs the output file, waypoint.txt. Each time an aspect of an object changes a '!' line will be inserted into the text file. This is a gto command line.

The 'command line' output to a line in waypoint.txt will be similar to:

! -w cblack -w ctblue -w sovs -w stm -w ane

This line signifies that the object will be black, the text will be blue, the object will be very small and the text size will be medium. The text alignment will be North East of the object.

'!' command line (track) options:

- allowable thickness: VT T M K VK
- allowable colors : black red blue green yellow
- allowable styles : normal hatched *highlight

! -t cblue -t s*h -t wvt

This line indicates that lines following this command are blue (**-t cblue**), highlighted (**-t s*h**) and very thin (**-t wvt**)

Text options:

- -t cxx = set text color
- -t txx = set text thickness (width)
- -t sxx = set text style

For route lines which are drawn for routes 1-19 when a -b is present on the command line:

Line options:

- -r cxx = set line color
- -r txx = set line thickness (width)
- -r sxx = set line style

Circle options:

! -p ly -p fy -p cblue -p wvt -p ared -p s*h

To draw a circle with very thin blue line, fill circle with color red highlighted

- -p lxx = set circle outer line draw no/yes
- -p fxx = set circle fill no/yes
- -p cxx = set circle line color
- -p txx = set circle line thickness (width)
- -p axx = set circle area fill color
- -p sxx = set circle area fill style

- allowable thickness: VT T M K VK
- allowable colors : black red blue green yellow
- allowable styles : normal hatched *highlight
- allowable drawline : no yes
- allowable drawfill : no yes

default icon:

When translating icons it's possible that the destination will not be able to display the icon. In this case, the icon is converted to the default icon. There are four default icons, one for the 12XL, one for the 'other' Garmin GPS's, one for the LEI units and one for SA5.

The command line parameter is '-w D<GS2L>xxx' where xxx is the Garmin symbol number and the G, S or 2 refers to the Garmin units, to SA5 or, to the 12XL/II+. This translates into a 'Square' in SA, a small square in the 12XL/II+ and a 'white dot' symbol in the other Garmin units. The 'L' refers the Lowrance units default icon. The Garmin units do not support icon "markers". The LEI units support icon "markers". A icon marker is an 'event'.

'!' command line startup defaults:

Garmin	18, a waypoint dot
Garmin 12/II+	0, a square
LEI units	0, (for the GM100 it's the funny diamond)
SA	46, a square

If the destination Garmin unit cannot display the default Garmin icon, it will display it's unique default icon. See the GARMIN SYMBOL TABLE below.

One additional Garmin<->SA 'default' can be set. The parameter

-w xaa,bb

will set the 2nd default Garmin symbol to the value of aa and the 2nd SA default object to the value bb. Whenever a SA5 symbol is read, if it is the 2nd default symbol, it is converted to the internal Garmin symbol aa. For example:

g7to -i file.txt -o file.sa5 -w x18,12

will cause all of the squares (Garmin 18) in the file to be converted to circles (12) in the SA file.

The command

g7to -i file.sa5 -w x18,12

will cause all of the circles in the file file.sa5 to be converted to squares (18) in the file file.txt.

Command line examples

"Don't output command line for object properties" option: '-e':

g7to -i waypoint.sa3 -o waypoint.txt -e

No object info is output (! lines) in the text file.

SA output only Options

The 'SA output only' options are **-c,-t,-r,-m,-n,** and **-qx**

-c <Lat> -c <Long> - The first time the -c parameter appears on the command line it is assumed to be the desired latitude of the center of the .sa output file. The second time it appears in the command line it is taken to be the Longitude of the center of the .sa file.

Positive values are used for N or E and negative values are used for S or W. The '+' is assumed if the '-' is not used. The input format of the number is: (-)DDDdMM.mmmm.

For example:

```
-c 44d35.2 -c -121d46.9
```

would set the center of the map to N44 35.2000, W121 46.9000

SA Object Parameters

allowable thickness: VT T M K VK

allowable colors : black red blue green yellow

allowable styles : normal hatched *highlight

-t set track Line draw parameters:

-t cxx = set line color

-t txx = set line thickness (width)

-t sxx = set line style

-r set route Line draw parameters (routes 1-19 only):

-r cxx = set line color

-r txx = set line thickness (width)

-r sxx = set line style

-ry must be used for route lines to be output to sa4 files

-rp must be used for route waypoints for routes 1-19 to be output to sa4 files

-r0 must be used for route 0 to be output to sa4 files

-r0w or -ry must be used for routes to be output to sa3 files

-r0w must be used to output route 0 waypoints

NOTE: -n is for sa3 only as tracks in sa4 are actual lines.

Force Center Latitude and Longitude

-m <Magnitude> Magnitude of the output .sa file 4-18

Modify Waypoint Text labels

-n Points from a track file do not contain text information, and the 'waypoint name' normally becomes the position in the source file. For instance, if you have 10 points in your track source file then the points are 'named' 1-10.

-n suppresses this number and only the default symbol, a small circle, is displayed. -n also overrides the -q option and on a waypoint will pass on only the default symbol.

NOTE: The use of the **-q** options will cause a loss of data in the SA file. Do not use a SA file created with a -q option as an input file without being aware of the data that will be lost.

-q 0 - all items written (default)

-q 1 - comment not written on regular waypoints

-q 2 - comment not written on route waypoints

-q 4 - the symbol display parameter not written

-q 8 - route name is not written on first route point

-q 16 - (nn:nn) is not printed on route waypoints. This is true whenever nameonly&16 = 16, it is not overridden by any other commands.

The parameter values can be summed to turn off more than one option. For example -q 9 (the sum of 8 + 1) would turn off the writing of comments on regular waypoints and turn off writing the route name on the first route waypoint

-w <parms> - set waypoint parameters where:

text alignment:	NW xN xNE xW xE xSW xS xSE	x = a
text colors:	black xxred xxblue xxgreen xxyellow	xx = ct
obj colors:	black xxred xxblue xxgreen xxyellow	xx = co
text sizes:	vs xxs xxm xxl xxvl	xx = st
obj sizes:	vs xxs xxm xxl xxvl	xx = so

For example, to set waypoints to have very large NE text alignment, have blue text, and red icon color with a very large icon the command would be

```
! -w aNE -w stvl -w ctblue -w cored -w sovl
```

NOTE: The program automatically performs a scan of all input points in order to calculate a proper center and magnitude of .SA3 and .SA4 output files. If a latitude, longitude or magnification is entered on the command line it will override the calculated value.

```
g7to -i fname -o xxx.sa3 -c N44d44.0 -c W122d45.0
```

The magnitude calculation is designed to return a magnification that will be slightly smaller than might be shown on a single page, therefore, all points should be displayed.

Text Output of Waypoints

Text (.txt) file format

The .txt file created by this program can contain command lines, waypoint data, proximity waypoint data; (the waypoint data may be in multiple line format), track data, route start, and route end, This program assumes WGS84 datum, which is the datum used internally by the Garmin GPS units and is the datum transferred via GRMN/GRMN protocol, If the data is in a datum other than WGS84 the first line of the text file should identify the datum.

Use of the -j option will cause data loss in .txt files:

- j 0 - all items written
- j 1 - comment not written on regular waypoints
- j 2 - the symbol display information not written
- j 3 - Comment & symbol display information not written

Waypoint storage/retrieval accuracy

The GPS45 sends/receives latitude/longitude data encoded in 4 byte 'long' variable. However, the last byte of this variable is always rounded by the GPS45. Because of this there will be times when the waypoint downloaded from the GPS45 will differ from that sent to it.

For instance if the waypoint:

```
W TESTP2      N44 35.8931 ???????????? Mon Mar 25 15:28:04 1996 TEST WAYPOINT
```

is sent to the GPS45 it will be returned as

```
W TESTP2      N44 35.8929 ???????????? Mon Mar 25 15:28:04 1996 TEST WAYPOINT
```

This 'rounding' applies to both the latitude and longitude variables.

A similar rounding error occurs in LEI units.

UTM Support

Adding the paramter '-U' will cause the printed output to be in UTM format.

g7to -i file.txt -u

where file.txt contains:

```
#Wed Dec 16 08:12:36 1998 GMT
D WGS-84
! -t cblack -t wt -t sn
N New Track Start
T N44 30.4296 W123 34.7715 Mon Dec 14 22:46:41 1998
T N44 30.4468 W123 34.7477 Mon Dec 14 22:46:41 1998
! -w coblue -w ctblue -w sovs -w stvs -w ane
I N44 30.8899 W123 33.6013 ; 18;
I N44 30.8899 W123 33.5866 ; 18;
R 03
W 003 N44 30.0000 W123 30.0000 Sun Aug 16 21:16:15 1998 TEST POINT ; 18;2;0
W 126TRN N44 25.2782 W122 00.1112 Sun Aug 16 21:16:15 1998 HWY 20-126 ; 18;2;0
W 1ST-B N44 33.9769 W123 16.0457 Sun Aug 16 21:16:15 1998 FIRST BAPTIST ; 10;2;0
E 03
```

will cause the output to be in UTM format:

```
#Wed Dec 16 08:11:34 1998 GMT
D WGS-84
! -t cblack -t wt -t sn
N New Track Start
T 10T 453934.7 4928367.8 Mon Dec 14 22:46:41 1998
T 10T 453966.5 4928399.5 Mon Dec 14 22:46:41 1998
! -w coblue -w ctblue -w sovs -w stvs -w ane
I 10T 455490.8 4929209.2 ; 18;
I 10T 455510.3 4929209.1 ; 18;
R 03
W 003 10T 460251.1 4927530.7 Sun Aug 16 21:16:15 1998 TEST POINT ; 18;2;0
W 126TRN 10T 579457.2 4919152.2 Sun Aug 16 21:16:15 1998 HWY 20-126 ; 18;2;0
W 1ST-B 10T 478764.2 4934806.4 Sun Aug 16 21:16:15 1998 FIRST BAPTIST ; 10;2;0
E 03
```

The -U parameter works on .csv files and text file. UTM cannot be output in any other file type.

Text and .csv files in UTM format may also be used as input files.

DATUM CONVERSION

g7to supports datum conversion from WGS-84 to <datum> where <datum> can be found in the file g7datums.txt. g7to maintains an internal conversion table. The internal table is used if the requested datum is not available in g7datums.txt. The contents of the internal table can be displayed by executing:

g7to -Y 1

The datum record *D* <datum> or *D nn* <datum> where nn is a number in a .txt file will cause the latitude and longitude data to be converted from the Datum <datum> to WGS-84. In other words, g7to assumes that all records in the text file which follow the *D* <datum> record have Latitude and Longitude coordinates in the Datum <datum>.

The command line

g7to -i <whatever> -Y datum >fname.txt

will take the inputs from <whatever> and output it to the file fname.txt.

The coordinates in the file will be in the Datum 'datum' providing the program can find the conversion data in the file 'g7datums.txt'. g7to searches for the file along the environment variable PATH. If the file g7datums.txt cannot be found along the path, the program will search its internal tables for the conversion information. If the conversion data isn't found internally g7to will print an error message and use WGS-84.

This allows the user to add data conversion for datums that are not in the program by inserting them in the g7datums.txt file. At this time the data internal and the data in the file is the same so the file doesn't need to be available.

The case of the string 'datum' is not significant, but all other characters are significant.

See URL:

<http://www.utexas.edu/depts/grg/gcraft/notes/datum/datum.html>

or

<http://geodesy.uslig.gov.au/gopher/bbs/georef/molodens.txt>

for more information on datum conversion.

The formulas used are the Molodensky formulas which can be found in several places on the Web. The above URL contains some information on transformation.

A standard web search for "Molodensky" should turn up others.

Text File Record Format

Comment Lines

All lines which do not begin with a D,N,P,W,R,E,T,! or a c are considered comment lines and are skipped and not processed. The author normally uses a # or a ; as a comment line indicator.

A line beginning with a 'c' is a continuation line for Street Pilot waypoints. A line beginning with a '!' is a command line. It is processed at the time it is read. Comments can be inserted between continuation lines. Any other line will terminate continuation line processing.

W.....

c1

#

c2

is ok, while

W.....

c1

!

c2

is incorrect and will cause the program to fail.

Map datum record:

```
1111111111
123456789012345678
D 100 WGS 84
```

This form is allowed to provide compatibility with Gardown7 which outputs an index into the datum conversion table as part of the datum line.

or

```
1111111111
123456789012345678
D WGS 84
```

Route begin:

```
11111111112222222222333333333344444444445555555555666666666677777777778
123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890
R 01 ROUTE NAME
```

Route end:

```
123456
E 01
```

Proximity waypoints, regular waypoints, and Tracks

```
11111111112222222222333333333344444444445555555555666666666677777777778
12345678901234567890123456789012345678901234567890123456789012345678901234567890
N New Track Start
W YAQBRG N44 37.3259 W124 03.4229 Sun Mar 17 04:02:26 1996 YAQUINA BAY BRDG
P YAQBRG N44 37.3259 W124 03.4229 Sun Mar 17 04:02:26 1996 YAQUINA BAY BRDG;;534.5
T N44 35.9589 W123 15.4792 Sun Jan 21 22:47:51 1996
```

Icons in SA files

```
11111111112222222222333333333344444444445555555555666666666677777777778
12345678901234567890123456789012345678901234567890123456789012345678901234567890
W YAQBRG N44 37.3259 W124 03.4229 Sun Mar 17 04:02:26 1996 YAQUINA BAY BRDG;1;1;0
```

The first field after the first semicolon ';' contains the Garmin icon symbol number.

The second field after the first semicolon ';' is the icon display style and it can be a ' ', '1', '3' or '5'.

The third field following the first semicolon ';' is 1 if the waypoint is part of a SA6 route 'Via' and 0 if it is not. This only has significance in uploading a text file to a SA6 route.

NOTE: Executing 'g7to -hd' will print out the internal datum conversion table. This will scroll off of most screens, so it may be better to execute 'g7to -hd | more'.

NOTE: Ozi files do not contain data as to whether the icons are from Garmin units or Lowrance units. g7to assumes Garmin units. Adding a '-x' to the command line will change the assumption to Lowrance/Eagle units. For example if a waypoint with the symbol 'home' is created in OziExplorer and saved into a waypoint file the waypoint will have the symbol #4. This translates into the Garmin symbol #10 (from the LEI column). If that waypoint is sent to an LEI

unit it will again be #4 if the -x is used. If output to a LEI gps is specified on the same command line as the Ozi is specified as input then the -x is assumed and LEI mode is the default.

Another problem results because Ozi files do not differentiate between the types of Garmin units, either. g7to assumes all Garmin units used by Ozi are GPS III, i.e. 48 icons. If the data transfer is to be between Ozi and a 16 icon Garmin unit, i.e. GPS 12, 12XL and II+, then the command line parameter -1 should be used. This will result in proper icon conversions between Ozi and Garmins with 16 icons.

The following examples should help to clarify this.

Desire: SA4 icon to be an Airport. The Garmin Symbol Table shows the Garmin Icon number used is 16384. The waypoint record in a g7to text file would be similar to:

```
W AIRPRT          N54 33.8269 W121 14.1090 Wed May 28 17:44:04 1997 MY AIRPORT;16384;1
```

Desire: A waypoint to be sent to a 12XL (with icons) or GPS II+ to have the Exit symbol.

The II+ icons are displayed in the II+ user manual as a 4x4 grid which g7to numbers and names:

0	SQUARE	1	HOUSE	2	GAS	3	CAR
4	FISH	5	BOAT	6	ANCHOR	7	SUNKEN WRECK
8	EXIT	9	DANGER	10	BOUY	11	CAMP
12	CROSSING	13	DEER	14	FIRST AID	15	TRAIL

It can be seen that the EXIT symbol is number 8. In the Garmin Symbol table below, the II+/12XL(3.02&>) symbol 8 translates into the g7to 'Text' symbol number 8200. Therefore, the waypoint would be similar to:

```
W MYWAYP          N54 33.8269 W121 14.1090 Wed May 28 17:44:04 1997 MY WAYPOINT; 8200;1
```

If this waypoint is sent to an SA4 file the waypoint symbol would be 'Large City'

Note: See the default icon flag, '-w dxxx' to change the mapping between the II+ '0' and the SA4 object. The default mapping is to a square which is similar to the II+ default icon's actual shape.

Garmin-Ozi-LEI Symbol Table

The Garmin # is the number that is stored in g7to text and .csv files.

* GPS-III versions 2.06 and above.

Garmin #	Garmin Name	GPS III name *	LEI#	12XL#	OziG	SA#	SA Name
0	white anchor	Marina	25		22	51	Triangle Up
1	white bell	School	0		33	18	Education
2	green diamond						
3	red diamond						
4	diver down flag 1						
5	diver down flag 2						
6	white dollar	Bank	1	2	2	7	Bank
7	white fish	Fishing Area	21	13	13	20	Fishing
8	white fuel	Gas Station	6	14	14	21	Fuel
9	white horn						
10	white house	Residence	4		29	25	Home
11	white knife & fork	Restaurant	8		30	44	Restaurant
12	white light						
13	white mug	Bar	15	3	3	2	Amusement
14	white skull & crossbones	Danger Area	20	11	11	11	Cemetery
15	green square						
16	red square						

17	white buoy waypoint		27				
18	waypoint dot	Waypoint	3		46	46	Square
19	white wreck	Shipwreck	24		35	34	One Way Right
20	null symbol (transparent)						
21	man overboard	Man Overboard	23		21	47	Star
22	amber map buoy						
23	black map buoy						
24	blue map buoy						
25	green map buoy						
26	green/red map buoy						
27	green/white map buoy						
28	orange map buoy						
29	red map buoy						
30	red/green map buoy						
31	red/white map buoy						
32	violet map buoy						
33	white map buoy						
34	white/green map buoy						
35	white/red map buoy						
36	white dot		16			24	Historic Site
37	radio beacon					55	Church
150	boat ramp	Boat Ramp	26	4	4	9	Boat Ramp
151	campground	Campground	13	5	5	10	Campground
152	restrooms	Restroom	19		31	23	Government Building
153	shower	Shower	22		38	56	Police
154	drinking water	Drinking Water		12	12	3	Arrow Down
155	telephone	Telephone	7		43	38	Phone
156	first aid	Medical Facility	2		23	19	Emergency
157	information	Information	10		20	27	Information
158	parking	Parking Area			26	37	Parking
159	park	Park	11		25	36	Park
160	picnic	Picnic Area	14		27	39	Picnic
161	scenic area	Scenic Area			32	49	Stop Sign
162	skiing	Skiing Area			39	17	Doctor/Dentist
163	swimming	Swimming Area			41	8	Beach
164	dam	Dam			10	54	Bridge
165	controlled area					32	One Way Down
166	danger						
167	restricted area					41	Power
168	null						
169	ball	Ball Park		1	1	45	Sports
170	car	Car	5	6	6	15	Delivery Stop
171	deer	Hunting Area	17		19	0	Agricultural
172	shopping cart	Shopping Center			36		
173	lodging	Hotel			18	29	Lodging
174	mine	Mine			47	14	Cross
8192	interstate hwy					48	State Capitol
8193	us hwy						
8194	state hwy						
8195	mile marker						
8196	TracBack (feet)	TracBack Point	18		44	4	Arrow Left
8197	golf	Golf Course			16	22	Golf Course
8198	small city	City (Small)		9	9	12	Circle
8199	medium city	City (Medium)		8	8	43	Religious Cross
8200	large city	City (Large)		7	7	42	Religious Star
8201	intl freeway hwy					28	Library
8202	intl national hwy						

8203	capitol city (star)					31	National Capitol	
8204	amusement park							
8205	bowling							
8206	car rental							
8207	car repair							
8208	fast food							
8209	fitness					53	Bike	
8210	movie							
8211	museum							
8212	pharmacy							
8213	pizza							
8214	post office					40	Post Office	
8215	RV park							
8216	school							
8217	stadium							
8218	dept. store							
8219	zoo					52	Zoo	
16384	airport	Airport	9	0	0	1	Airport	
16385	intersection							
16386	non-directional beacon							
16387	VHF omni-range							
16388	heliport	Heliport				17	26	Industrial
16389	private field	Private Field				28	13	Construction
16390	soft field	Soft Field				40	16	Diamond
16391	tall tower	Tall Tower				42	6	Arrow Up
16392	short tower	Short Tower	12			37	30	Mountain
16393	glider	Glider Area		15		15	5	Arrow Right
16394	ultralight	Ultralight Area				45	35	One Way Up
16395	parachute	Parachute Area				24	50	Triangle Down
16396	VOR/TACAN							-
16397	VOR-DME							
16398	first approach fix							
16399	localizer outer marker							
16400	missed approach point							
16401	TACAN							
16402	Seaplane Base	Seaplane Base				34	33	One Way Left

The character after the ';' which follows the icon type is the icon display style and it can be a ' ', '1', '3' or '5'. This represents how the icon symbol is displayed on the map page. A blank, ' ', will be translated to the default, 3.

- 1 - Symbol alone
- 3 - Symbol & waypoint name
- 5 - Symbol & waypoint comment

Lowrance Icons

The Lowrance/Eagle GPS units have Icons which can be placed on their chart/map. The symbols are the same as for their waypoints. The Lowrance/Eagle icon record in text files has the following format:

```
I N44 35.7449 W123 15.5563 ; 18;
I N44 35.6270 W123 15.5563 ; 6;
I N44 35.4853 W123 15.5563 ; 156;
I N44 35.3436 W123 15.5563 ; 18;
```

Where the value between the semi-colons is the Garmin icon equivalent. This equivalency is based on the GM100, so it may not be an exact match for other LEI GPS units.

When Icons are sent to an SA file they become waypoints with the name "Icon" and no comment is attached.

Multiple Line Waypoint Records

Street Pilot

The Street Pilot waypoint record has more fields than can be displayed on a single line. Therefore, up to 3 additional 'continuation' lines are defined for each StreetPilot waypoint.

The continuation lines must come in order, c1, c2, c3. They can be separated by comment lines or command lines, but the instance of a regular data line, i.e. a line beginning with a D,N,P,W,R,E or a T will end the continuation line processing. If a continuation line does not follow a 'W' line, command line '!', or a comment line it will be ignored as if it were a comment line.

Waypoint Symbols (Icons) for GPS .txt files for the Street Pilot have one extra 'line'.

```
1111111111222222222233333333333344444444445555555555666666666677777777778
1234567890123456789012345678901234567890123456789012345678901234567890
W YAQBRG N44 37.3259 W124 03.4229 Sun Mar 17 04:02:26 1996 YAQUINA BAY BRDG:1;1
c1 StreetPilotWaypointName -- up to 256 characters are allowed in the record, however
the SP uses only 10.
```

If the waypoint is a route waypoint, two more additional continuation lines are defined:

```
1111111111222222222233333333333344444444445555555555666666666677777777778
1234567890123456789012345678901234567890123456789012345678901234567890
R 00 POWRSFRYRD TO LONGSL
W SPW004 N33 53.8847 W084 24.7331 Fri Jul 17 23:53:26 1998 LONG ISLAND DR;8223;1
c1 LONG ISLAND DR
c2 LONG ISLAND DR
c3 93 0C 00 68 04 FB 2E A0 03 AE 0C 00 FB 2E
W SPW005 N33 53.6620 W084 24.6070 Fri Jul 17 23:53:27 1998 POWERS FERRY RD;8223;1
c1 POWERS FERRY RD
c2 POWERS FERRY RD
c3 94 04 00 6A 04 FB 2E A0 67 28 0C 00 FB 2E
W SPW006 N33 53.8114 W084 24.0276 Fri Jul 17 23:53:27 1998 LONDONBERRY RD;8223;1
c1 LONDONBERRY RD
c2 LONDONBERRY RD
c3 94 0D 00 68 04 FB 2E A0 B6 C1 0C 00 FB 2E
W SPW007 N33 53.7161 W084 23.6387 Fri Jul 17 23:53:27 1998 LONG ISLAND DR;8223;1
c1 LONG ISLAND DR
c2 LONDONBERRY RD
c3 94 0C 00 68 04 FB 2E A0 B6 C1 0C 00 FB 2E
W SPW008 N33 54.1448 W084 23.7817 Fri Jul 17 23:53:27 1998 LONG ISLAND DR;8223;1
c1 LONG ISLAND DR
c2 LONG ISLAND DR
c3 93 0C 00 68 04 FB 2E A0 03 AE 0C 00 FB 2E
E 00
```

Where c1 is the waypoint name as above. c2 is used in the routing as a link identification and c3 is some binary data associated with the waypoint. Refer to the Garmin Protocol Specification for more information on the Street Pilot waypoint format. c2 and c3 should not be changed without an understanding of the waypoint format.

GPS III Pilot

The GPS III Pilot also has additional entries. these are Name, City, State, Country code, waypoint type, and waypoint record type. These entries are encoded in a text file as semi-colon separated items. The continuation line is labelled c4.

c4 ORLY;PARIS;;LF;0;155;

The waypoint type is a number 0-4 where 0-3 are assigned to waypoints which are internal to the Pilot and should not be changed. The '4' is for user defined waypoints.

The waypoint record type should always be 155 for the Pilot. It is only used in Text to Text files. The number will be changed for output to the GPS.

Street Atlas Text String

The representation for normal waypoints in a SA Text string is:

name;comment;icon display

and for route waypoints:

(rr:pp)name;comment;icon display;route name for the first point.

(rr:pp)name;comment;icon display for other than the first point.

where rr is the 2 digit route number and pp is the 2 digit number representing the nth position in the route.

The icon type is encoded as the SA object symbol.

If a mapnote element or a maptext element is read from an SA4 file the text format must be:

NAME;COMMENT;icon type;icon style

If this is not the case then text output and uploading to the Garmin can cause icon translation errors.

Routes in Text files

If input is from a SA file, time is taken from the time stamp of the input (-i) file. For gardown7 or text input the time is taken from the input record. The GPS45 ignores the time stamp on upload of track information. The XL series does not store time, therefore the time values on records from the XL receivers is not meaningful unless the track point was created on the GPS. In that case, it is the time the point was created.

On the GPS III, if a track point is from a compressed track the time will be set to 'Fri Jan 18 03:14:07 2058, which represents the maximum size integer in a 32 bit word. The actual value in the record is 0x7fffffff.

Distance:

The track distance calculation uses the Sinnot formula.

SA3 Notes

Street Atlas 3 has at least 3 objects that can be stored in the .sa3 file. These objects are Text, Place and MapNotes.

Places are very similar to waypoints, i.e. there is a Lat/Long location and a name. All waypoints in a txt file or from the GPS45 become Places during a conversion to .sa3.

All three .sa3 objects are converted to waypoints during a .sa3 to GPS45 upload and/or a .txt conversion (and therefore would become Places if the .txt file were used to create a new .sa3 file).

SA4 notes:

Street Atlas 4 adds three more objects beyond those in sa3: an Area, a Circle and Lines. The perimeter of an Area is converted to track points by g7to. The Circle is converted to proximity waypoints and Lines are converted to tracks.

Miscellaneous

Version History is in the file HISTORY.TXT

Latest Version of g7to

The latest version of g7to can be found at:

<http://www.proaxis.com/~crh/gps/g7to/g7to.htm>

If I happen to be working on a beta release, it may be found at

<http://www.proaxis.com/~crh/gps/g7to/beta.zip>

Remember, it will be a *beta* and many features may not work.

Special thanks

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- Brent Hildebrand, the author of Waypoint+ for his help with the Garmin Protocol in various Garmin GPS receivers.

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