RW52GPS GPS Vector File Convertor

Date: 20 August 2016
Build: 111
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General Description

RW52GPS is a 32-bit Windows convertor. It is distributed as a single code-signed .exe file.

The convertor takes a .RW5 Carlson Raw File and extracts all of the GPS vector information (Phase Center to Phase Center) and converts the vectors into GRP (Ground Mark) to GRP (Ground Mark) vectors in a '.GPS' file intended to be used with Star*Net.

The advantage of GRP to GRP vectors is that you can modify HI's to fix instrument height blunders.

The convertor includes some handy accelerators for editing input files and making/saving changes to the input file.

Settings

The convertor has a 'Settings' tab where convertor options can be configured. Changes made on the 'Settings' tab are saved to an '.ini' file in the local AppData folder on your machine.

For example, on my machine the settings are stored at this location:

C:\Users\Mark\AppData\Local\RW52GPS.ini

Where 'Mark' is my user name.

In addition to the settings, the last converted file (name and path) plus the last window location and size are stored in the '.ini' file.

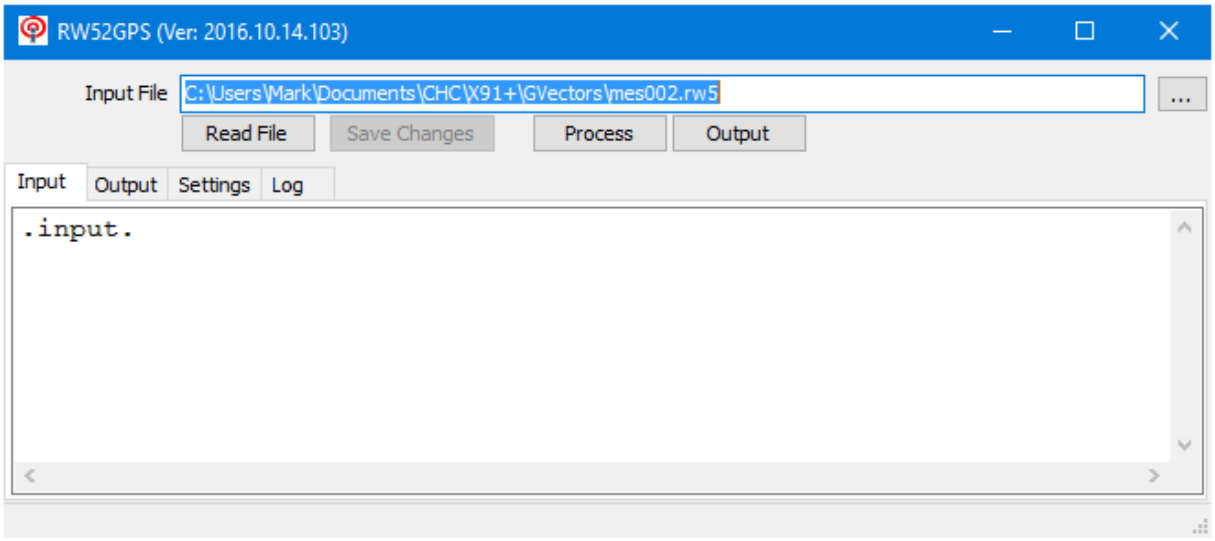
Running RW52GPS

If you invoke the convertor from a command line with an argument, the argument is assumed to be a file to process.

```
C:\_tmp\RW52GPS>RW52GPS C:\working\8Aug2016_.rw5
```

The specified file will be read, processed and an output file with the ''.GPS' extension will automatically be created and written. To facilitate editing and verification, the convertor tool will not automatically terminate at the conclusion of processing.

If you invoke the convertor without an argument, the convertor will start and the filename will be the same filename as previously used. You then need only click the 'Read File' to initiate reading the file, processing and outputting the result.



'…' Button

You can click the '…' button to the right of the 'Input File' entry to browse for an existing .RW5 file to open.

If you use the '…' button, the file will automatically be read into the 'Input' tab, processed and saved to the output file. (i.e. the file is read, then the 'Process' button is pressed, which in turn presses the 'Output' button.

'Read File' Button

If you click on the 'Read File' button the file specified by the 'Input File' is read, processed and then output.

The '.BKK' file

Every time a .RW5 file is read into the 'Input' tab, the convertor checks to see if a matching '.BKK' file exists. (The '.BKK' file would have the same file path and base filename as the input file, only the extension would be changed.) If the '.BKK' file does not exist, a copy of the input file is automatically created in the same folder as the input file.

The .BKK file is only updated if it does not exist. It is intended to be an original copy of the .RW5 file produced by SurvCE without any user edits.

No automated provision is included for recovering the .BKK file.

Editing the data on the 'Input' tab; 'Save Changes'

Once you read a file into the program, it will automatically processed and written as a '.GPS' file.

You may choose to edit the input file by selecting the 'Input' tab and making changes inside the text box. Once you alter the data in the input tab, the 'Save Changes' button will be enabled.

Clicking the 'Save Changes' button will save your changes to the source .RW5 file AND automatically process the input data and write an output file.

'Process' Button

Clicking the 'Process' button will process the data in the 'Input' tab and write a .GPS output file. (Changes will not be saved.)

'Output' Button

It is also possible to edit the data on the 'Output' tab and save the edited data to the .GPS file by pressing the 'Output' button.

You should be careful with this option as most other operations will rewrite your changes and replace the output file.

Modifying HI's in the Input File

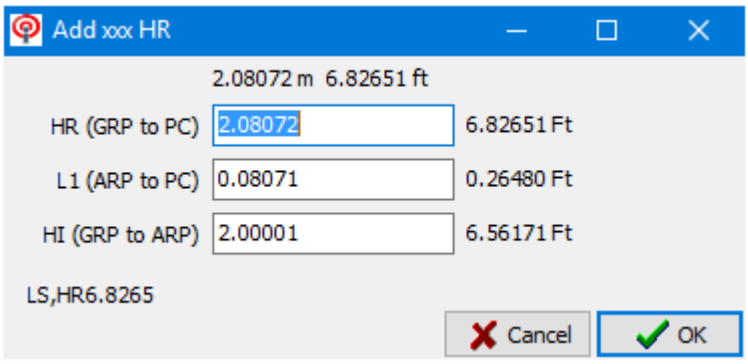
The convertor reads HI (Instrument Height, Ground Mark to ARP), the L1 Offset (ARP to Antenna Phase Center) and the HR (Rod Height = Ground Mark to Phase Center.)

The HR is specified by the 'LS' record in the '.RW5' file. HR is the only value that the converter needs, however the convertor tracks the HI and L1 to assist you in editing the HR.

The HR is related to the HI and L1:

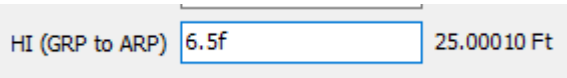
$$HR = HI + L1$$

If you place your cursor in the Input tab, before a rover point and click the button 'Add Rover HR' this dialog is shown with the last values from reading the file:



The top line "20.8072m 6.82651" shows the last processed HR in the file in meters and feet (the shot at the very bottom of the file.)

The values are always displayed in the editing area in meters, however you can enter a value in feet by appending the letter 'F' after an imperial value. For example, if you enter 6.5f:



When you tab out of the entry box, the value will be changed to meters and the caption to the right of the box will update with the equivalent distance in feet:

If you change the L1 value, the HR will be recomputed using the displayed HI:

HR = HI + L1

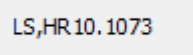
If you change the HI value, the HR will be recomputed using the displayed L1:

HR = HI + L1

If you change the HR value, the HI will be recomputed using the displayed L1:

HI = HR – L1

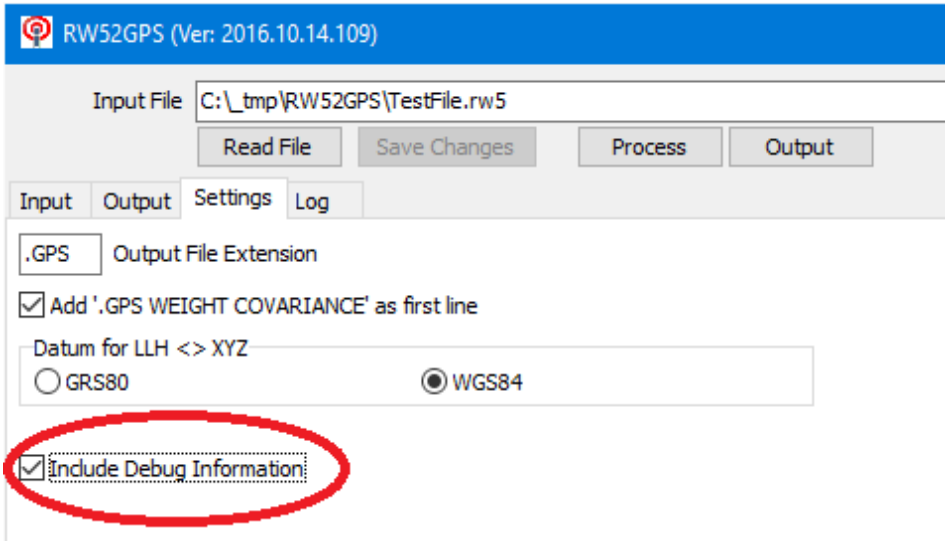
The LS statement that will result from your changes is always displayed in the lower left corner of the edit box:



If you click on the 'OK' button the LS record will be inserted at the previous cursor location in the source file. If you click on 'Cancel' no action is taken.

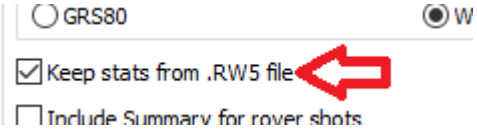
Debugging the Converter

There is a debug checkbox on the 'Settings' tab:



Checking this box generates copious additional output.

Keep Statistics from .RW5 File

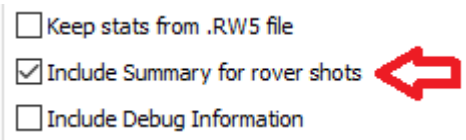


Clicking 'Keep stats…' keeps the statistics lines from the .RW5 file in the output file:

```
# GPS,PN12697,LA40.425929576408,LN-109.335198358956,EL2727.417424,--POL 4BAR 107
# ***** V1
C 12697 'POL 4BAR 107
#  --GS,PN12697,N 27455.3368,E 22287.5888,EL8982.4726,--POL 4BAR 107
G0 'V1 2016/08/11 17:22:28 (Average)   Base ID read at rover: 0017
# PC to PC > G1 17-12697 -796.98059 1307.41542 1192.09745
# GRP to GRP:
G1 17-12697 -796.98024 1307.41492 1192.09690
G2 0.00016340 0.00071499 0.00041887
G3 0.00014321 -0.00010427 -0.00035813
#  --GT,PN12697,SW1909,ST408148000,EW1909,ET408165000
#  --Valid Readings: 15 of 15
#  --Fixed Readings: 15 of 15
#  --Nor Min: 27455.3223  Max: 27455.3493
#  --Eas Min: 22287.5767  Max: 22287.6055
#  --Elv Min: 8982.4324  Max: 8982.5202
#  --Nor Avg: 27455.3368  SD: 0.0091
#  --Eas Avg: 22287.5888  SD: 0.0098
#  --Elv Avg: 8982.4726  SD: 0.0198
#  --NRMS Avg: 0.0449 SD: 0.0035 Min: 0.0414 Max: 0.0507
#  --ERMS Avg: 0.0380 SD: 0.0029 Min: 0.0351 Max: 0.0428
#  --HSIG Avg: 0.0589 SD: 0.0045 Min: 0.0542 Max: 0.0664
#  --VSIG Avg: 0.1020 SD: 0.0083 Min: 0.0939 Max: 0.1163
#  --HDOP Avg: 0.8944  Min: 0.8773 Max: 0.9174
#  --VDOP Avg: 1.2170 Min: 1.1362 Max: 1.3379
#  --PDOP Avg: 1.5109 Min: 1.4355 Max: 1.6222
#  --Number of Satellites Avg: 14 Min: 13 Max: 16
#  --DT08-11-2016
#  --TM11:23:46
```

Include Summary

Checking the 'Include Summary for Rover Shots' checkbox:



adds a short summary for each rover shot.

```
G0 'V1 2016/08/11 17:22:28 (Average)   Base ID read at rover: 0017
# PC to PC > G1 17-12697 -796.98059 1307.41542 1192.09745
# GRP to GRP:
G1 17-12697 -796.98024 1307.41492 1192.09690
G2 0.00016340 0.00071499 0.00041887
G3 0.00014321 -0.00010427 -0.00035813
#
# Summary 12697; Max PDOP 1.62; Min SV: 13
```

```
#  _       AVG         Range        StdDev          RMS
#  N   27455.3368        0.0270        0.0091       0.0449
#  E   22287.5888        0.0288        0.0098       0.0380
#  H    8982.4726        0.0878        0.0198       0.0449
#
```

The summary includes the values that I personally think are most important for evaluating an RTK shot. Here are the trip points where I become concerned about an RTK shot's quality (for a 30-point or more epoch average):

Max PDOP	higher than 2.1
Min SV count	8 or lower
N and E Range	higher than 0.05'
H Range	higher than 0.75'
N and E StdDev	higher than 0.01
H StdDev	higher than 0.02

I consider the range to be the single important indicator of danger.

Sample Conversion

The initial convertor will accept a .RW5 entry like:

```
JB,NM2016-08-11,DT08-11-2016,TM08:53:16
MO,AD0,UN2,SF1.00000000,EC0,EO0.0,AU0
BP,PN17,LA40.420961424003,LN-
109.330136597994,EL2681.5447,AG2.0000,PA0.0807,ATAPC,SRBASE,--
--GS,PN17,N 7430589.8089,E 2180952.8996,EL8790.8748,--Base
--GT,PN17,SW1909,ST400076000,EW1909,ET400076000
--Geoid Separation File: \Program Files\SurvCE\Data\Geoids\G12A_UT_SLCB.gsf
N39°01'00.0" W112°49'59.0" N42°01'59.0" W108°0
--Coordinate System: SILVERKING
--User Defined: SILVERKING
--GPS Scale: 1.00000000
--Entered Rover HR: 6.5617 ft, Vertical
--Antenna Type: [CHCX91+S        NONE],RA0.0000m,SHMP0.0000m,L10.0807m,L20.0866m,--
Internal geodetic antenna. GPS: L1/L2/L
LS,HR6.8265
GPS,PN12697,LA40.425929576408,LN-109.335198358956,EL2727.417424,--POL 4BAR 107
--GS,PN12697,N 27455.3368,E 22287.5888,EL8982.4726,--POL 4BAR 107
G0,2016/08/11 17:22:28,(Average) - Base ID read at rover: 0017
G1,BP17,PN12697,DX-796.98059,DY1307.41542,DZ1192.09745
G2,VX0.00016340,VY0.00071499,VZ0.00041887
G3,XY0.00014321,XZ-0.00010427,YZ-0.00035813
--GT,PN12697,SW1909,ST408148000,EW1909,ET408165000
--Valid Readings: 15 of 15
--Fixed Readings: 15 of 15
--Nor Min: 27455.3223  Max: 27455.3493
--Eas Min: 22287.5767  Max: 22287.6055
--Elv Min: 8982.4324  Max: 8982.5202
--Nor Avg: 27455.3368  SD: 0.0091
--Eas Avg: 22287.5888  SD: 0.0098
--Elv Avg: 8982.4726  SD: 0.0198
--NRMS Avg: 0.0449 SD: 0.0035 Min: 0.0414 Max: 0.0507
--ERMS Avg: 0.0380 SD: 0.0029 Min: 0.0351 Max: 0.0428
```

```
--HSIG Avg: 0.0589 SD: 0.0045 Min: 0.0542 Max: 0.0664
--VSIG Avg: 0.1020 SD: 0.0083 Min: 0.0939 Max: 0.1163
--HDOP Avg: 0.8944  Min: 0.8773 Max: 0.9174
--VDOP Avg: 1.2170 Min: 1.1362 Max: 1.3379
--PDOP Avg: 1.5109 Min: 1.4355 Max: 1.6222
--Number of Satellites Avg: 14 Min: 13 Max: 16
--DT08-11-2016
--TM11:23:46
```

And generate the following entry in the output .GPS file:

```
.GPS WEIGHT COVARIANCE
# Generated from C:\_tmp\RW52GPS\TestFile.rw5 at 8/19/2016 9:03:59 PM
# GPS,PN12697,LA40.425929576408,LN-109.335198358956,EL2727.417424,--POL 4BAR 107
# ***** V1
C 12697 'POL 4BAR 107
G0 'V1 2016/08/11 17:22:28 (Average)   Base ID read at rover: 0017
# PC to PC > G1 17-12697 -796.98059 1307.41542 1192.09745
# GRP to GRP:
G1 17-12697 -795.55382 1311.42866 1188.43088
G2 0.00016340 0.00071499 0.00041887
G3 0.00014321 -0.00010427 -0.00035813
```


Build History

105: removed ‘ ’ (space) after – on G1 record.

111: added debug output and summary