

## **GEMLink Help & Operational Manual**

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# **1 Welcome**

Welcome to the V5.3 version of GEMLink for Windows.

It supports all Windows (8/7/Vista/XP/2000/98/95). It supports more USB-RS232 adaptors with reliable and rugged connection among Mag/Grad with PCs.

This version of GEMLink is intended to provide a reliable and robust system for rugged applications. Also it gives an upgraded interface to the Windows Operating system and to streamline data transfer to and from the magnetometer. If you experience any difficulties or have suggestions, we would appreciate hearing your comments. Please send an email to [info@gemsys.ca](mailto:info@gemsys.ca) and include "GEMLink V5.3" in the header line of your email.

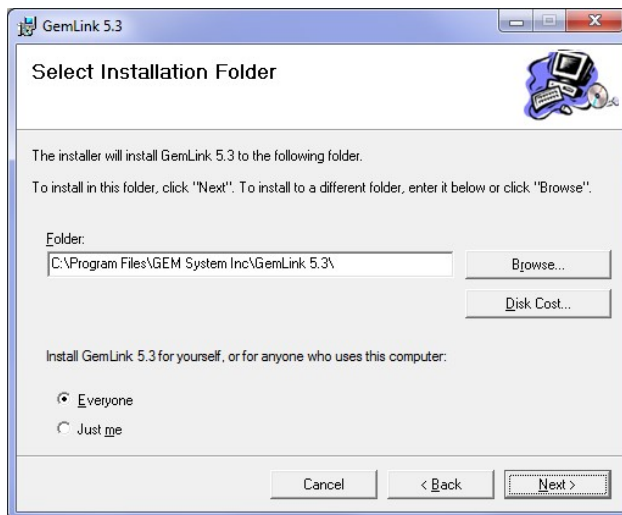


## 2 INSTALLATION

1. If you are a previous GEMLink user, we strongly advise you to install latest version from our website. so that you can take advantage of the new features and fixes in this version.

<http://www.gemsys.ca/technology/software/>

2. When installing a newer version of GEMLink, uninstall the older version first. This is a general rule that should be followed when installing any software to ensure that Windows functions properly.
3. To uninstall the previous version, click 'START' from the Windows task bar. Select 'Settings' and click 'Control Panel'. Double-click on 'Add/Remove Programs'. Locate and click on GEMLink and click the 'Add/Remove' button.
4. To install GEMLink, first run setup.exe and follow the instructions. You may need administrator privilege to do it.



### **3 PERFORMANCE NOTES**

1. Slower, older computers may not be able to perform if the baud rate is set too high. If the capacity of the data buffer is exceeded, the 'Received' panel of the status bar will indicate "OVERFLOW", and "BUFFER OVERFLOW" will be inserted between the data lines.

If new data arrives to the port before the UART's FIFO is emptied (operating system failure), the status bar will indicate "OVER RUN" and "PORT OVER RUN" will be inserted between the data lines.

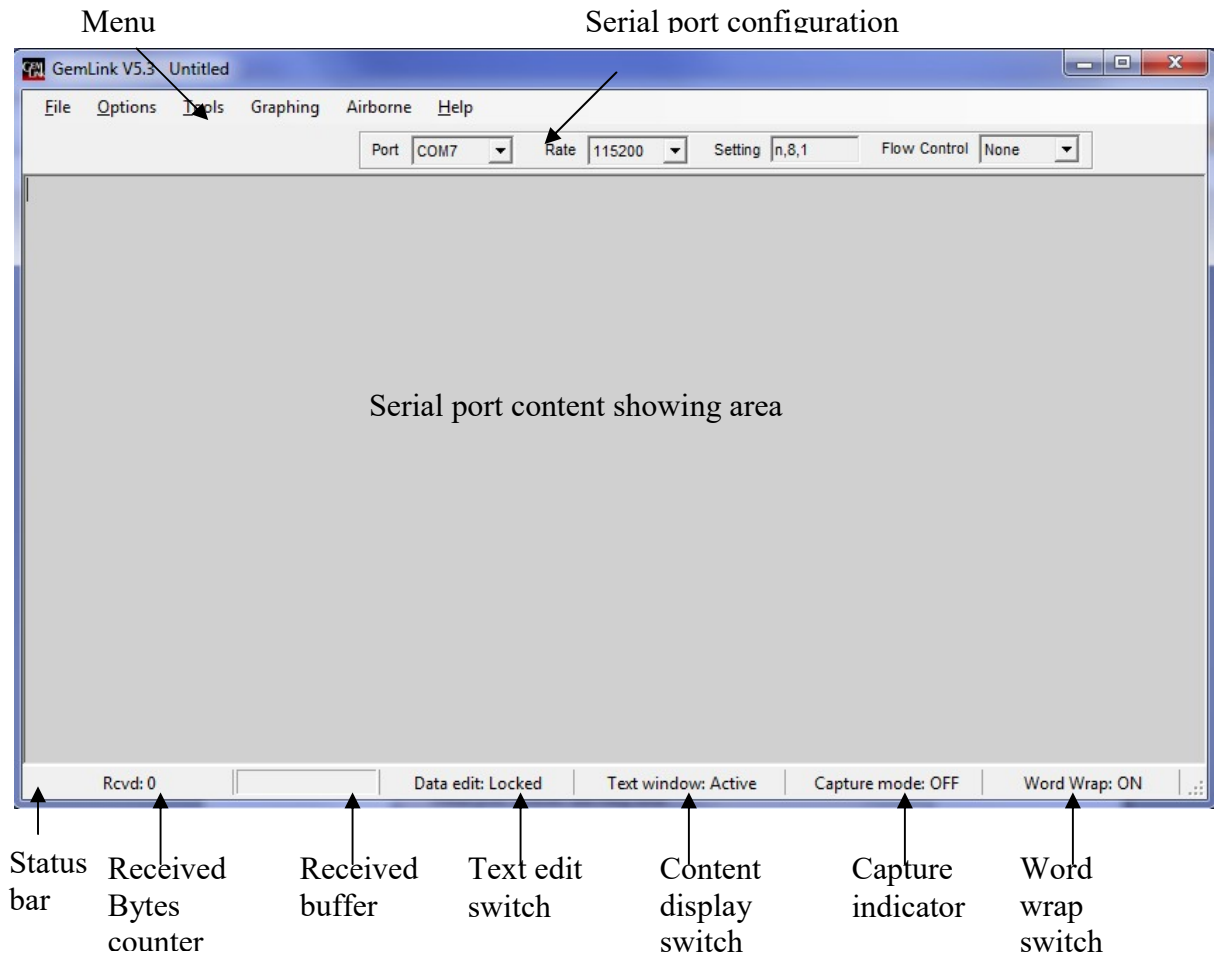
To avoid this problem, reduce the baud rate and compare the number of bytes received from the same file over several runs to establish a safe rate of operation.

2. The overall performance of older computers not only depends on the speed of the processor. It is greatly affected by the characteristics of the port itself and also the video card.

You may be able to achieve higher transmission rates by setting the text window to 'Not Active'. This alleviates the processor and Windows of having to update the screen and frees resources for data transferring.

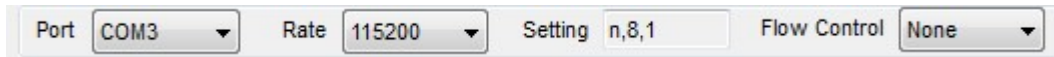
## 4 Function Description

### 4.1 GEMLink main user interface and functions



GEMLink main user interface contains menu bar, Serial Port Configure panel, text window to show serial port content and status bar which can be used to set configuration and status indication. There is detail information description for those functions in below.

### 4.1.1 Serial Port Configuration



#### 1. Port

When the application starts, the program searches for available serial ports on the PC, the port and port settings are the ones used in the last session by default.

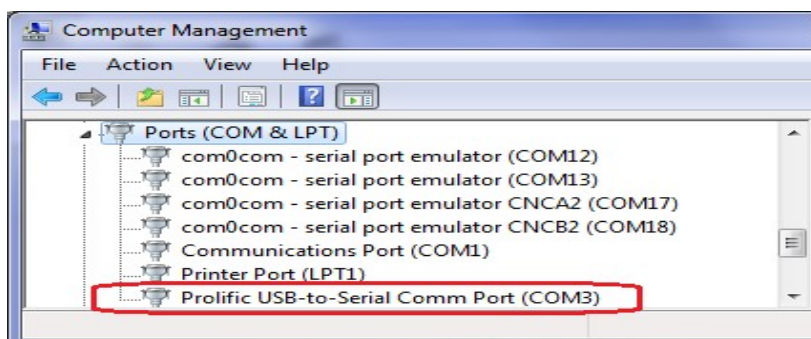
If the default port is unavailable (i.e. because another application is using it), the system selects the first one available.

If there are no ports available at all on the PC, GEMLink will display a message. To correct this, you must free the ports that are in use by closing other applications. Then click the drop-down arrow of 'Port' or click 'Find ports' command under the 'Options' menu in GEMLink or use the F12 shortcut. Select a port from the updated entries in the Ports dropdown list.

If you want to use another port or to change the current port, you can do so by using the Port dropdown list, or by pressing the F7 key to scroll through the available port one by one.

If user is using USB serial port adapter, in case of there is no COM port shown in GEMLink's port list, or not sure about the port of the USB serial port adapter, please check as following step:

- 1) Please click startup icon-> right click "computer"->click popup menu "properties" --> click "Device Manager" in shown window "Control panel .... system".
- 2) Please check item "Ports" in the hardware list, there should like "Prolific USB-to-Serial Comm Port(COM3)" which will display your RS-232 converter brand and set it into COM port in GEMLink.
- 3) If there is no such hardware showing in your "Device Manager", and there is a question mark for some unknown-device, please install the driver GEM system Inc. provided, unplug/plug the converter again.



## 2. Rate

Use the Rate dropdown list in GEMLink to select the receiving baud rate. You can also increment the rate one step at a time using the F8 key. Note that this rate must match the transmission rate of the data source. Usually using 115200 is for most MAG of GEM system Inc.

## 3. Setting

Set other port settings (such as parity and stop bits) by clicking on the 'Settings' text box in GEMLink. Use commas to separate the characters you enter. Illegal entries will be rejected. Usually using 'n,8,1' is for most MAG of GEM system Inc.

## 4. Flow Control

Flow Control supports mode None, Xon/Xoff and Hardware.

### 4.1.2 Status bar

Rcvd: 0		Data edit: Locked	Text window: Active	Capture mode: OFF	Word Wrap: ON
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#### 1. Rcvd

Serial port received data length in byte. The progress bar on the right indicates buffer status of the text window. Clicking the progress bar, user can set a new buffer number for the test window. It recommends that the window buffer is limited below 80MB, otherwise the performance will be impacted if text window stores too much content or lead to out of memory crash for program.

#### 2. Data edit

Locked: text window can not be edited online.

Not Locked: text window can be edited online.

#### 3. Text window

Active: Data received from serial will show on the text window.

Not Active: Data received from serial will not show on the text window.

#### 4. Capture mode

OFF: There is not in capture mode.

Binay: Program is in binary capture mode.

Text: Program is in Text capture mode.

#### 5. Word Wrap

ON : Text window is word wrap enabled. Long line data will be interrupted into following line.

OFF: Text window is word wrap disabled. One line content show in the same line, user have to move scroll bar right to see the over-length data.

### 4.1.3 Serial Port Data Collection operation steps

1. Once a serial port is open, the application is ready for action. Any data received by the port will be transferred to the text window, provided it is set to 'Active'. To see the current status, select the 'Options' menu > 'Text window' submenu in GEMLink.
2. You can change the text window status by:
  - using the 'Options' menu > 'Text window' submenu
  - the F3 shortcut
  - clicking on the 'Text window' panel of the status bar.
3. GEMLink treats data in the text window the same as any text typed in a text editor. You can save it, print it, and (depending on the status of the 'Data edit' command) edit it. To see the current status, select the the 'Options' menu > 'Data edit' submenu.
4. By default, the default edit condition is 'Locked' so that data integrity is protected. If you change the 'Data edit' condition to 'Not Locked', you will find that all the normal keyboard editing shortcuts are supported. You can also access standard Windows editing commands by right-clicking on the text window.
5. You can change the data edit status by:
  - the 'Options' menu > 'Data edit' submenu
  - the F2 shortcut
  - Clicking on the 'Data edit' panel of the status bar.
6. All keystrokes on the text window are transmitted to the serial port as ASCII characters. This is necessary on units, such as the GSM-90, that are controlled through the RS232 line, and also for external RS232 trigger. For your reference, each transmitted character and its decimal and hexadecimal values are displayed above the text window and under the menu bar.

If you use this feature when editing is Not Locked, you may see double characters on the text window. One is the one you typed, and the second is the one echoed by the unit via the RS232 line (not all units echo the commands).

7. The 'Capture' command under the 'File' menu allows you to write to a file as the data is being received. Text and Binary modes are supported.

If the incoming data is composed of ASCII characters, both modes function the

same way. If the data is in hexadecimal format, you must select the binary mode.

To select a mode, either access the 'File' > 'Capture' command or use the appropriate shortcut (F4 for text and F5 for binary).

8. When finished receiving data, you can close the captured file by:
  - using the 'File' > 'Capture' > 'Stop capturing' command
  - the F4 shortcut
  - clicking on the 'Capture mode' panel in the status bar

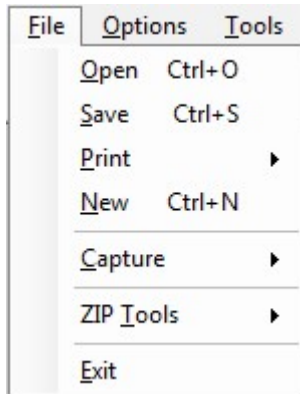
When capturing in binary mode, the text window is disabled since it is only capable of displaying text. Once the captured file is closed, the status of the text window will depend on the current text window setting.

9. The 'Rcvd' panel in the status bar displays the number of characters or bytes received. The counter will reset when opening or saving a file, or when opening a capture file.

When closing a capture file, the counter is reset but the number remains on display. You can also reset the counter manually at any time by clicking on the 'Received' panel of the status bar.



#### 4.1.4 File Menu functions



##### 1. Open(Ctrl + O)

This function will prompt an open file dialog which user can select the MAG log file user want to load it.

The files must be ASCII text files. The end of each line of text must have a CR (carriage return) or CRLF (carriage return/Line feed). Lines terminated only with LF cannot be used since they are treated as a single one.

##### 2. Save(Ctrl + S)

This function is to save current content to a file. If the file is already loaded (file name is in the caption of the application window), the text window content will be written into it. Otherwise, application will pop up a save file dialog and ask user choose a new file name.

##### 3. Print

Print function contains 2 sub functions: Print setup, Print preview and Print

Print setup: a Page Setup window will pop up to let user change the print page format.

Print preview: a print preview window will pop up to show preview of the text window content.

Print: This function will send text window content to the printer which user selected.

##### 4. New (Ctrl + N)

This function will clear text window content and create a untitled document for the serial port data receiving.

##### 5. Capture

Capture function has two mode: Text and Binary.

Text(F4): Serial port data will be received and written into a \*.txt file. After clicking this menu, application will ask user to assign a text file name to store the log. After finishing logging, clicking 'Capture' → 'Stop capturing' will end the log writing process.

Information will be shown to user to indicate that how much byte content has been written into the log file.

Binary(F5): Serial port data will be received and written into a \*.bin file. After clicking this menu, application will ask user to assign a binary file name to store the log. After finishing logging, clicking 'Capture' → 'Stop capturing' will end the log writing process. Information will be shown to user to indicate that how much byte content has been written into the log file.

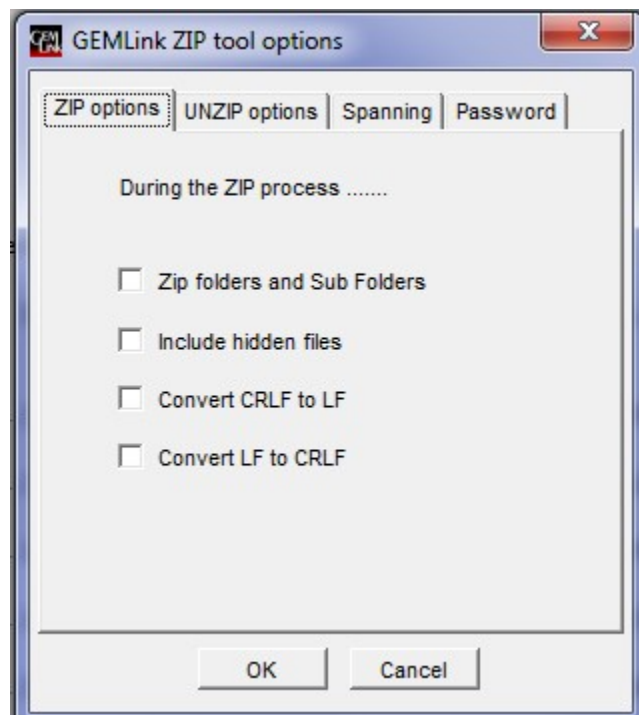
## 6. ZIP Tools

Usually, MAG log file in text format will use much more storage space than the zip format file. GEMLink provide 'ZIP file(s)' and 'UnZip' function for user to compress and decompress the log file.

'ZIP file(s)': Click Menu 'ZIP file(s)' → Select or create a zip file → Select source file → GEMLink generate zip file.

'UnZip': Click Menu 'UnZip' → Select source zip file → Select unzip file → GEMLink generate unzipped file.

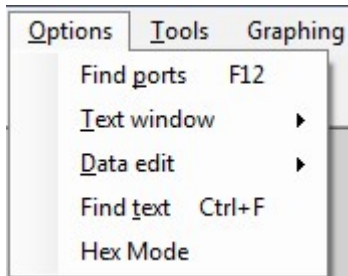
Options: it will prompt an option window for zip/unzip progress with. Click the tab page you can set options by clicking checkbox.



## 7. Exit

Exit GEMLink application.

#### 4.1.5 Options Menu functions



Options menu is for serial data receiving and text window showing.

##### 1. Find ports(F12)

'Find ports' command under the 'Options' menu in GEMLinkW or use the F12 shortcut. It's for selecting a port from the updated entries in the Ports dropdown list.

##### 2. Text window

Text window contains 3 sub functions:

###### **Active:**

Checked status: Data received from serial will show on the text window.

Not checked status: Data received from serial will not show on the text window.

###### **Receiving Buffer:**

By clicking this menu button, user can set a new buffer number for the test window. It recommends that the window buffer is limited below 80MB, otherwise the performance will be impacted if text window stores too much content or lead to out of memory crash for program.

###### **Word wrap:**

Checked status: Text window is word wrap enabled. Long line data will be interrupted into following line.

Not checked status: Text window is word wrap disabled. One line content show in the same line, user have to move scroll bar right to see the over-length data.

##### 3. Data edit

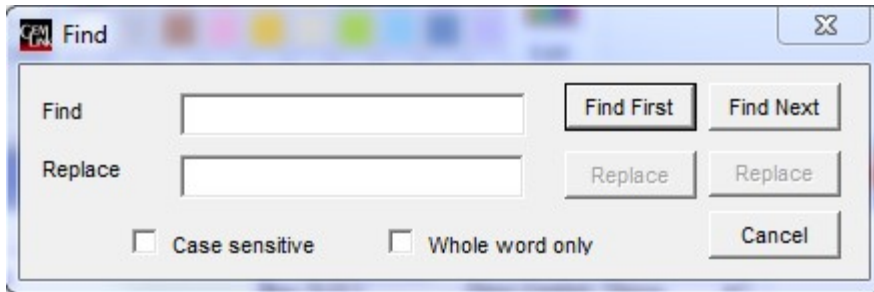
Checked status: text window can not be edited online.

Not checked status: text window can be edited online.

##### 4. Find text(Ctrl + F)

Find function is to search whole text window content for the text string filled by user in the find option window as following.

Note: In data edit lock mode the replace is not available.

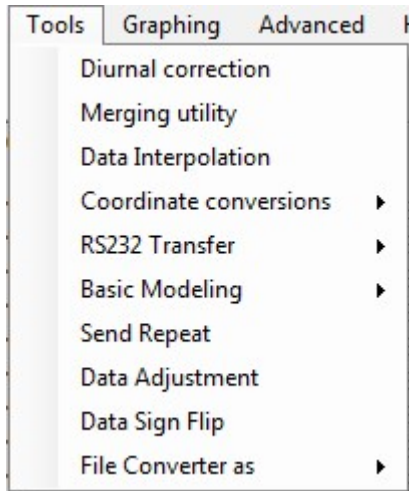


## 5. Hex Mode

Checked status: text window shows string text in Hex mode.

Not checked status: text window show string text in character/text mode.

#### 4.1.6 Tools Menu functions



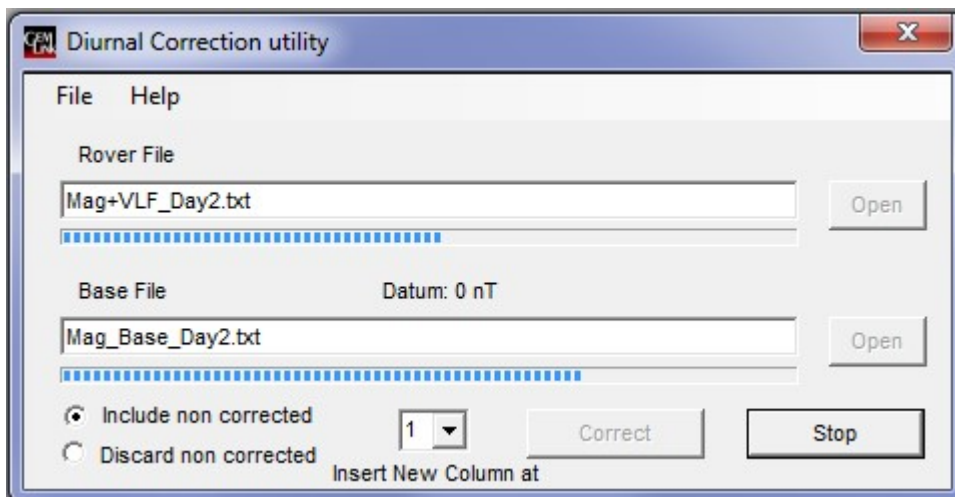
##### 1) Diurnal correction

This utility is designed to perform corrections of Magnetic Diurnal Variations to data files on the PC instead of using the diurnal correction feature of the magnetometers.

Now, you can correct Base and Rover files that have already been dumped (even erased from the magnetometer's memory). This utility also eliminates the need to interconnect the two instruments.

Two files are needed to run the utility. One from the Rover (or mobile) magnetometer and the other from the Base Station magnetometer.

The result will be a third file which contains all the information of the Rover file, plus the corrected magnetic field appended at the end of the line.



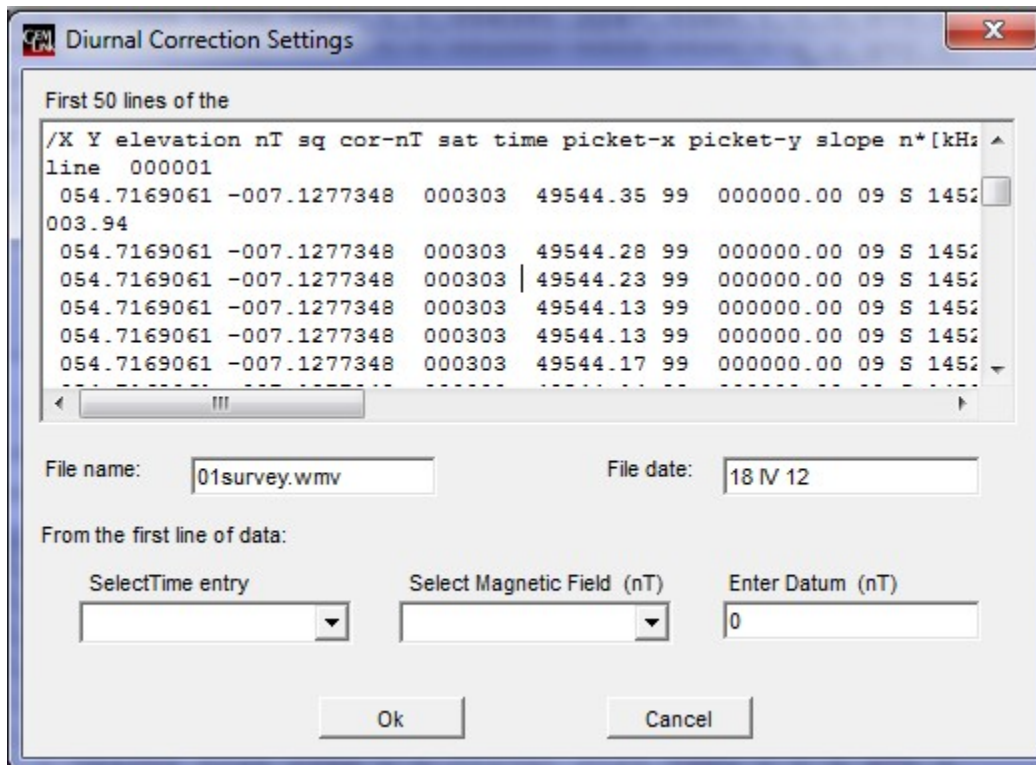
## FILE NOTES:

The files must be ASCII text files. The end of each line of text must have a CR (carriage return) or CRLF (carriage return/Line feed). Lines terminated only with LF cannot be used since they are treated as a single one.

The default delimiter between fields or columns is SPACE. A different delimiter can be selected from the 'Field Delimiter' menu under the 'File menu'. The selection will be save as a permanent setting, it means it is still effective next time you use GEMLink.

Note that both Base and Rover files must have the same delimiter. If you choose an incorrect delimiter, the system may product unexpected results or errors. Here is an example of format of Data:

```
/X Y elevation nT sq cor-nT sat time picket-x picket-y slope n*[kHz ip op h1 h2 pT]
line 000001
054.7169061 -007.1277348 000303 49544.35 99 000000.00 09 S 145205.0 06055N 0000057 N 0000N
16.0 +027.5 +051.0 034 067 000.90 19.6 -064.3 +011.7 042 072 013.04 24.0 -058.6 +000.7 006 061
003.94
```



## TIME STAMP NOTES:

Since the release of GEMLink 2.4, the diurnal correction utility offers increased flexibility regarding the format of the time stamps. Base AND Rover files accept

the following time stamps in 24hr (military format):

HHMMSS; HHMMSS.s; HHMMSS.ss; HHMMSS.sss; HH:MM:SS;  
HH:MM:SS.s; HH:MM:SS.ss and HH:MM:SS.sss

Entries not matching these formats are rejected. Furthermore, if 240000.0 is found as a time stamp representing midnight, it will be considered as 000000.0 . Minutes and seconds cannot exceed 59. Entries that match these formats but have an illegal value for Hours Minutes or Seconds are also rejected.

#### **TIME CONVERSION NOTES:**

To help facilitate comparison of time entries, all times are converted to tenths of seconds (1/10 sec) by a simple weighed addition of hours, minutes, seconds and fraction of seconds.

Although times stamps with three decimal places are accepted, the times are only compared to the tenth of a second. The 2nd and 3rd decimal places are discarded with no rounding.

Time stamps such that  $0 \leq |\text{Base time} - \text{Rover time}| \leq 0.099$  sec are considered to be equal.

#### **SYNCHRONIZATION NOTES:**

To perform Diurnal corrections the Base and Rover units must, of course, be synchronized to the same starting time before the survey. This facilitates accurate data reduction following the survey.

If both units are equipped with GPS they automatically synchronize to UTC and their reading cycle is therefore controlled by the GPS timing.

If only one unit is equipped with GPS, you may want to synchronize that unit to UTC and then use the synchronization cable to transfer the UTC time to the other.

In this case, the cycling of one unit is synchronized to GPS time with every reading taken. The other unit runs on its internal timer with no further GPS synchronization. Therefore, there may be a time discrepancy between the two units. This is only an issue for long surveys or unattended base stations without GPS.

If none of the units is equipped with GPS, set the time manually in one of them and use the synch cable to transfer the time to the other.

#### **DATE NOTES:**

The date of the files is not checked. Make sure both files belong to the same day.

The file times must not cross over midnight since no provisions have been taken to compare times in this case.

Note: Since the release of GEMLink 5.3, the diurnal correction utility will check if the date of Rover file and Base file are the same date. If they are not in the same date, application will show warning. It strongly recommends that Rover file and Base file should be generated at the same date.

#### **INCLUSION OF CORRECTED LINES:**

If the 'Include non corrected lines' is checked (default) on the Diurnal Correction utility dialog box, the system stores the data lines that could not be corrected without any changes. The result is a file with all the readings of the Rover, however, only the corrected lines will show the corrected magnetic Field appended at the end of the line.

If the option 'Discard non corrected lines' is checked, the result is a file containing only the lines that were successfully corrected.

#### **USAGE NOTES:**

After you open a file for the Base or for the Rover, the system displays the Setup window. The text box shows the first 50 lines of the file for your reference.

The program then checks the selected file to determine the first and last lines of data. The first line is defined as the first of 3 consecutive lines with the same length. The last line is defined as the line closest to the end of the file that has the same length and number of field delimiters as the first.

The first line of data is parsed based on the current field delimiter setting, and values are passed to the Time and Magnetic Field dropdowns. The values of the drop-down boxes are used to determine the position of each field within the line and its format.

It is not possible to select other values than the ones presented as options (from the first line of data). If other values are encountered, you will see an error message. The conversion process will fail or yield unexpected results if the fields of the lines are not separated by the selected field delimiter.

A datum can be entered at any time either on the Rover or the Base setup window.

When you are ready to start the correction process (i.e. when both files are open), press the 'Correct' button in the Diurnal Correction utility dialog box.

The program first checks the files to determine if they have readings in common.



If the time intervals from beginning to end of the two files do not overlap, then correction is not possible and the process stops.

Once again, remember that the files are only compared according to their time and the date is not taken into account. Make sure both files belong to the same day.

The time extracted from the first data line of the Rover's file is compared to the times of the Base file.

If the time of the Rover is not one of the readings in common, (i.e. its time does not fall within the overlapping time intervals), the data line is either passed untouched or discarded depending on the setting of the 'Include' 'Discard' options.

If it is a common reading, correction could be made in one of two ways.

If the exact same time is found in the Base file, then the magnetic field correction is calculated as:

$$\text{Corrected Value} = \text{Rover Field} - \text{Base Field} + \text{Datum}$$

The corrected value is appended at the end of the Rover's data line and the line will be flagged with "i---"

If the times do not match exactly, then the Field of the Base is linearly interpolated from the closest-in-time readings of the Base file. The corrected Field is then calculated as:

$$\text{Corrected Value} = \text{Rover Field} - \text{Interpolated Base Field} + \text{Datum}$$

As a measure of the quality of the results, the time interval (in seconds) of the Base lines used for the interpolation is also added at the end of the line. For example, a corrected field interpolated from base readings 5 seconds apart will be flagged with "i005".

If the time interval exceeds 999 seconds the line will be flagged with "i+++".

The same process continues with the other lines of the Rover and until all lines are checked.

Invalid data lines in the Rover file (such as position labels or comments, or lines that do not contain a valid time format or the field separator) are passed to the new file untouched. If the line contains a valid time but some of its values cannot be extracted, you will be warned with a message showing the invalid line and the line will pass to the final file flagged with "Error".

Previous versions of GEMLink were less tolerant of invalid data lines in the Base file.

However, since GEMLnkW 2.4, you are now warned with a message displaying the invalid line and the process will continue with the next valid line. To avoid seeing these messages, we recommend that you do not edit the files (i.e. use them exactly as they are dumped from the magnetometers).

At the end of the cycle, a summary message displays the number of readings that were:

corrected directly

corrected using interpolation

not corrected.

The number of time stamps that had correct formats but illegal numbers, such as Hours, Minutes or Seconds (if any), are also displayed.

You can use this information to inspect and modify files. However, you must first determine in which file the illegal entries are located and their location within the file. If the bad time was from the Rover file, it will be in the final file flagged as '\*\*\*\*\*'. The same summary is inserted at the end of the corrected file.

During the cycle the corrected data is stored in a temporary file named dummy.dmy which is created automatically. This file is saved even in the event of a fatal error. To recover the data you have corrected so far, you should open the dummy file which is located in the folder in which GEMLink is installed. The dummy.dmy file is overwritten with no warning when a new correction cycle begins.

#### **SAVING THE DATA:**

When exiting the utility, you are asked to save the final file. This process simply renames the dummy file to the path and file name of your choice. In the event of an error when saving (for example, when the path or drive is not available), the program will display a message indicating that your merged data is still available in the dummy.dmy file and showing its location. Should you decide to cancel and exit without saving/renaming the file, the dummy file will remain intact.

Note that some other GEMLink tools, such as the merging utility (GPSmerge), use the same dummy.dmy file. Always save or rename your file to avoid losing the data. During GEMLink usage, Diurnal Correction's base file can be stored at text edit box for multi-rover log correction. But in order to avoid leading user to make mistake, after closing GEMLink, this base file information will be cleaned.

## **2) Merging Utility**

This GEMLnkW tool is a merging utility to overwrite or append the positioning data obtained from the magnetometer's memory with the post-processed DGPS coordinates obtained from GPS post-processing software.

Two files are needed to run the utility:

Rover or mobile GPS/magnetometer file that contains the magnetic field readings with the time stamp and the raw or uncorrected GPS coordinates.

One with the corrected DGPS coordinates. This second file is normally obtained from a third-party DGPS software (such as GrafNav from Waypoint Consulting Inc) by combining or post-processing the binary GPS data stored during survey in the Base Station and Rover GPS/magnetometer units.

The utility creates a third file containing all the rover magnetic information and/or the post-processed DGPS coordinates.

#### **FILE NOTES:**

The files must be ASCII text files. The end of each line of text must have a CR (carriage return) or CRLF (carriage return/Line feed). Lines terminated only with LF cannot be used since they are treated as a single one.

The default delimiter between fields or columns is SPACE. A different delimiter can be selected from the 'Field Delimiter' menu under the 'File menu'. The selection is not a permanent setting. SPACE is the default delimiter each time GEMLinkW opens.

Note that both Base and Rover files must have the same delimiter. If you choose an incorrect delimiter, the system may product unexpected results or errors.

#### **TIME STAMP NOTES:**

Since the release of its version 2.4, GEMlinkW offers increased flexibility regarding the format of the time stamps. Base AND Rover files accept the following time stamps in 24hr (military format):

HHMMSS; HHMMSS.s; HHMMSS.ss; HHMMSS.sss; HH:MM:SS; HH:MM:SS.s;  
HH:MM:SS.ss and HH:MM:SS.sss

Entries not matching these formats are rejected. Furthermore, if 240000.0 is found as a time stamp representing midnight, it will be considered as 000000.0 . Minutes and seconds cannot exceed 59. Entries that match these formats but have an illegal value for Hours Minutes or Seconds are also rejected.

For this reason, when exporting the data from the DGPS post-processing application, care must be taken in selecting one of these formats.

Note that both GPS and magnetometer times must be in the same units. Since the time of the magnetometer file is normally HHMMSS.s UTC, you cannot merge to a GPS file

with the time in, for example, seconds of the week. The files must not cross over midnight since no provisions have been taken to compare the times in such case.

#### **TIME CONVERSION NOTES:**

To help facilitate comparison of time entries, all times are converted to tenths of seconds (1/10 sec) by a simple weighed addition of hours, minutes, seconds and fraction of seconds.

Although times stamps with three decimal places are accepted, the times are only compared to the tenth of a second. The 2nd and 3rd decimal places are discarded with no rounding.

Time stamps such that  $0 \leq |\text{Base time} - \text{Rover time}| \leq 0.099$  sec are considered to be equal.

#### **WAYPOINT'S GrafNav SOFTWARE NOTES:**

Waypoint's GrafNav DGPS post processing software includes a very versatile export wizard that allows full customization of the output formats, units and parameters. The export formats can be also saved as profiles for future use. In the installation CD for GEMLinkW, there are 2 files named "GEM time - UTM.prf" and "GEM time - Lat Long.prf" that are fully transportable export profiles for Waypoint's GrafNav GPS software.

If you purchased Waypoint software and wish to use these profiles, copy the files into the folder where you installed GrafNav (normally is C:\program files\wayptGPS) and the profiles will be ready for use from the export wizard.

#### **NOTE:**

Files copied from a CD into a hard drive always have the 'Read only' attribute. The GrafNav profiles will not work properly in this condition. To remove the 'Read only' attribute, right-click on the profile files you saved in the hard drive, click 'Properties', uncheck the Read only check box, and click OK.

Note that both GPS and magnetometer times must be in the same units. Since the time of the magnetometer file is normally HHMMSS.s UTC, you cannot merge to a GPS file with the time in, for example, seconds of the week. The files must not cross over midnight since no provisions have been taken to compare the times in such case.

#### **DATA OUTPUT FORMAT AND MERGING OPTIONS:**

New features were added since GEMLinkW 2.4 to adjust the format of the output data . The number of decimal places and number of most significant digits (MSD) as well as

zero padding can be selected from the Output Format frame.

Selecting the 'Copy' option causes the merged DGPS coordinate to take the same number of digits and decimal places as the Mag coordinate that is being replaced but padded with zeros if possible. Note that since the DGPS coordinates may have more decimal places than the coordinates stored in the Mag memory, this option may truncate the data.

The 'As is' option transfers the DGPS coordinates as they are (i.e. regardless of whether they are original or interpolated values) and with no zero padding. Note that interpolated values may have a number of decimal places different than the one of the original values and result in columns with irregular widths.

Clicking the 'User defined' option activates the drop-downs to select the number of digits (MSD) and the number of decimal places, and the option for zero padding.

The formats with no zero padding may display as non-equally aligned columns on a text window. However, since each field is delimited by a field separator, the files can still be used with plotting and interpretation software (including MSEXcel). Formats with correct zero padding display as neatly aligned columns which are easier to inspect visually.

On the 'Merging options' frame, the 'Overwrite original coordinates' option means the Mag's coordinates will be overwritten by the corresponding coordinates of the DGPS file. If 'Append at the end of the line' is selected, the magnetometer readings will not be modified and the DGPS data will be appended at the end of each Mag's line. The final file will therefore have both, the 'Raw' and the DGPS coordinates.

The 'Interpolate missing epochs' check box enables or disables interpolation of the DGPS data.

If the times of a Mag line and a DGPS line do not match exactly and the interpolate check box is checked, the DGPS coordinates will be linearly interpolated from the closest-in-time coordinates of the DGPS file. The letter 'i' at the end of the line indicates the interpolation option was active.

If interpolation is active but the readings are merged directly, the lines will be flagged with "i---"

As a measure of the quality of the results, the time interval (in seconds) of the DGPS lines used for the interpolation is also added at the end of the line. For example if the time interval is 10 seconds, the line will be flagged with "i010". If the DGPS data is at 1Hz, the time interval of the interpolation directly represents the number of missing DGPS lines or epochs (missing epochs = Time interval / GPS freq). The interpolation is mainly intended to generate the coordinates for magnetometers cycling faster than the GPS engine. If the time interval exceeds 999 seconds, the line will be flagged with "i+++".

If the number of missing epoch is too large, a simple linear interpolation may not produce

the desired results. Adjusting the parameters on the DGPS post-processing application and analyzing the GPS data is the way to go.

All these settings for output format are saved. The ones used the last time will become available when the merging utility starts even after closing GEMLinkW.

Make sure you select a format that suits your data. For example, you should not use the same number of decimal places for coordinates in UTM(Universal Transverse Mercator) as you would use for coordinates in Decimal Degrees Lat/Long where more decimal resolution is needed.

#### **USAGE NOTES:**

After opening a file for the Mag or for the GPS, the program displays the Setup window. The text box on the Setup window shows the first 50 lines of the file for your reference.

GPSmerge then checks the selected file to determine the first and last lines of data. The first line is defined as the first of 3 consecutive lines with the same length. The last line is defined as the line closest to the end of the file that has the same length and number of field delimiters as the first.

From the first line of data GPS merge parses the fields based on the current field delimiter setting. It uses the values obtained to populate the Time, Coordinate 1 and Coordinate 2 dropdowns with the options.

The values of the dropdown boxes are used to determine the position of each field within the line and its format. It is not possible to select values other than the ones presented as options (from the first line of data). This process will fail or yield unexpected results if the fields of the lines are not separated by the selected field delimiter.

When both files are open, the 'Merge' command starts the process. First the files are checked to determine if they have readings in common.

If the time intervals from beginning to end of the two files do not overlap, then merging is not possible and the process stops. Once again, remember that the files are only compared according to their time and the date is not taken into account. Make sure both files belong to the same day.

The time extracted from the first data line of the Mag file is compared to the times of the DGPS file. If the time of the Mag is not one of the readings in common (i.e. its time does not fall within the overlapping time intervals), the data line is passed to the new file. This data is tagged with '-RAW' at the end of the line since it does not contain DGPS coordinates.

If time stamps match exactly (to the 1/10th of a second), the GPS coordinates are passed on according to the overwrite or append selection. If you want to interpolate common

readings that do not match exactly, select the interpolate checkbox.

The same process continues with the other lines of the Mag and until the end of the files.

Invalid data lines in the Mag file (such as position labels, comments lines that do not contain a valid time format or the field separator) are passed to the new file untouched. If the line contains a valid time but some of its values cannot be extracted, you will be warned with a message showing the invalid line and the line will pass to the final file flagged with 'Error'.

Previous versions of GEMLinkW were less tolerant of invalid data lines in the Base file. However, since GEMLinkW 2.4, you are now warned with a message displaying the invalid line and the process will continue with the next valid line. To avoid seeing these messages, we recommend that you do not edit Base files before dumping (i.e. use them exactly as they are dumped from the magnetometer), or export them from the DGPS software with the correct format.

At the end of the cycle, a summary message displays the number of readings that were:

merged directly

merged using interpolation

not merged or "Raw" readings.

The number of time stamps that had correct formats but illegal numbers, such as Hours, Minutes or Seconds (if any), are also displayed.

You can use this information to inspect and modify files. However, you must first determine in which file the illegal entries are located and their location within the file. If the bad time was from the Rover file, it will be in the final file flagged as '\*\*\*\*'. The same summary is inserted at the end of the merged file.

During the cycle the corrected data is stored in a temporary file named dummy.dmy which is created automatically. This file is saved even in the event of a fatal error.

To recover the data you have corrected so far, you should open the dummy file which is located in the folder in which GEMLinkW is installed. The dummy.dmy file is overwritten with no warning when a new correction cycle begins.

#### **SAVING THE DATA:**

When exiting the utility, you are asked to save the final file. This process simply renames the dummy file to the path and file name of your choice. In the event of an error when saving (for example, when the path or drive is not available), the program will display a message indicating that your merged data is still available in the dummy.dmy file and showing its location. Should you decide to cancel and exit without saving/renaming the file, the dummy file will remain intact.

Note that some other GEMLinkW tools use the same dummy.dmy file. Always save or rename your file to avoid losing the data.

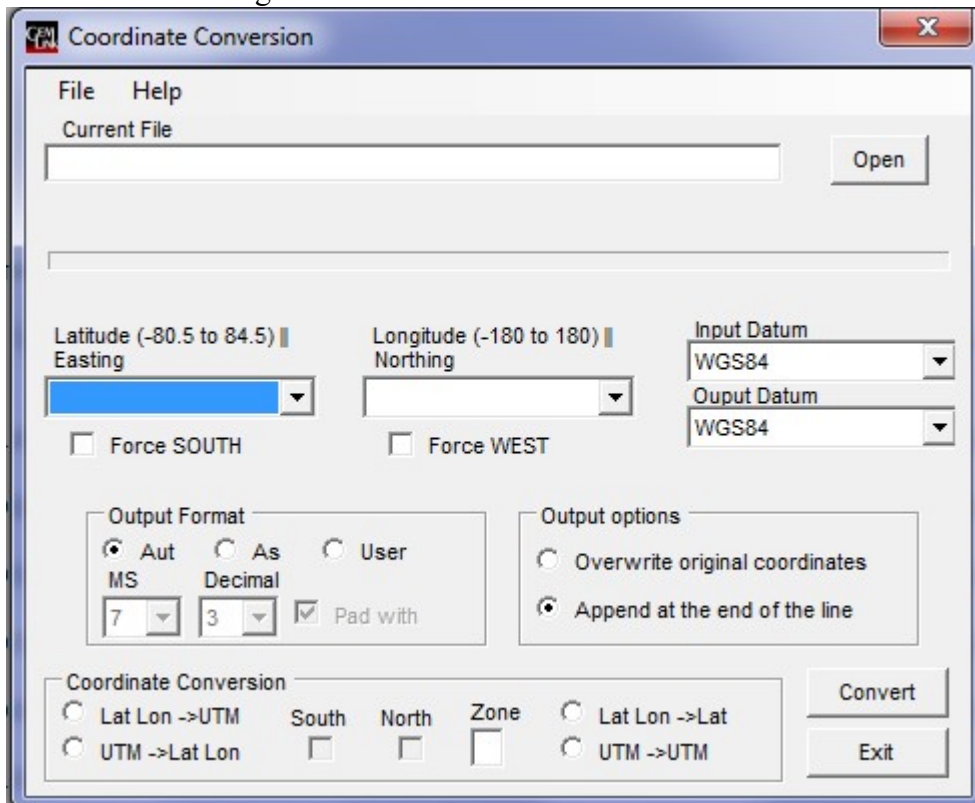
### 3) COORDINATE CONVERSION

#### *I. Convert coordination in file*

The Coordinate Conversion utility is intended to convert the coordinate system of the data contained in a file. The supported coordinate systems are geodetic (latitude and longitude) and Universal Transverse Mercator (UTM).

Conversion to a different datum is also supported and it is calculated using the Standard Molodensky transform.

The utility creates a new file with the converted coordinates. Optionally, the file may contain both the original and the converted coordinates.



#### FILE NOTES:

The files must be ASCII text files. The end of each line of text must have a CR (carriage return) or CRLF (carriage return/Line feed). Lines terminated only with LF cannot be used since they are treated as a single one.

The default delimiter between fields or columns is SPACE. A different delimiter can be selected from the 'Field Delimiter' menu under the 'File menu'. The selection is not a



permanent setting. SPACE is the default delimiter each time GEMLinkW opens.

#### **DATA INPUT FORMAT AND UNITS:**

Geodetic input coordinates must be in Decimal Degrees (D.d). There is no limit to the number of decimal places. However the values must fall within the accepted ranges. These are

-80.5 to 84.5 degrees for LATITUDE where '-' represents WEST

-180 to 180 degrees for LONGITUDE where '-' represents SOUTH

UTM input coordinates are in meters (M.m). There is no limit to the number of decimal places and the accepted ranges are

100,000 to 900,000m for EASTING

0 to 10,000,000m for NORTHING

1 to 60 for UTM zone

When the input is in UTM, the UTM zone and the hemisphere must also be supplied.

#### **DATA OUTPUT FORMAT AND UNITS:**

The units of the converted coordinates are

Decimal Degrees (D.d) for geodetic output coordinates

Meters (M.m) for UTM output coordinates.

The number of decimal places and number of most significant digits (MSD) as well as zero padding can be selected from the 'Output Format' frame.

Selecting the 'Auto' option causes the converted coordinates to take the appropriate number of digits and decimal places that suit the output coordinate system.

The Auto output formats are:

DDD.dddddddd for geodetic coordinates

MMMMMMM.mmmm for UTM coordinates.

both padded with zeros.

The 'As is' option transfers the converted coordinates in the format they are calculated. The number of decimal places of each value may vary and this could result in columns with irregular widths.

Clicking the 'User defined' option activates the drop-downs to select the number of digits (MSD) and the number of decimal places, and the option for zero padding.

The formats with no zero padding may display as non-equally aligned columns on a text window. However, since each field is delimited by a field separator, the files can still be used with plotting and interpretation software (including MSEXcel). Formats with correct zero padding display as neatly aligned columns which are easier to inspect visually.

On the 'Output options' frame, the 'Overwrite original coordinates' option means the original coordinates will be overwritten by the corresponding converted coordinates. If 'Append at the end of the line' is selected, the original values will not be modified and the new coordinates will be appended at the end of each line. The final file will therefore have both, the original and the converted coordinates.

#### **USAGE NOTES:**

Click on the 'Open' button and select the file that contains the coordinates you want to convert. The program displays the Setup window. The text box on the Setup window shows the first 50 lines of the file for your reference.

The selected file is then checked to determine the first line of data. The first line is defined as the first of 3 consecutive lines with the same length.

From the first line of data the utility parses the fields based on the current field delimiter setting. It uses the values obtained to populate the Latitude/Easting and Longitude/Northing dropdowns with the options.

The default delimiter between fields or columns is SPACE. A different delimiter can be selected from the 'Field Delimiter' menu under the 'File menu'. The selection is not a permanent setting. SPACE is the default delimiter each time GEMLinkW opens.

Click the 'OK' button to accept your selections. The range of the selected values are checked according to the expected ranges. For example, if you are converting from UTM to Lat Lon, your selections must fall within the range of the UTM input coordinates (see DATA INPUT FORMAT AND UNITS above).

On the conversion frame, check the 'Lat Lon to UTM' or the 'UTM to Lat Lon' option buttons to determine the direction of the conversion and the range of the input coordinates. If you enter UTM to Lat Lon you must also provide the UTM zone and the hemisphere.

#### **NOTE:**

The validity (see [Input format and Units](#)) of the selected fields is checked only during the setup and before the conversion cycle begins. Since the selected values are obtained from the first line of data of the file, this means that only the first data line of the file is checked for compliance. It is assumed that all the following lines of the file will contain a valid entry in the selected column. Make sure that the file meets this assumption to avoid incorrect results.

### GEODETIC DATUMS:

Three built-in datums are available from the 'Input datum' and 'Output datum' dropdowns

WGS84	a = 6378137	1/f = 298.257223563	dx = 0	dy = 0	dz = 0
NAD27	a = 6378206.4	1/f = 294.9786982	dx = -8	dy = 160	dz = 176
SAD69	a = 6378160	1/f = 298.25	dx = -60	dy = -2	dz = -41

The default datum for both input and output is WGS84.

If none of these datums apply to your data, you may define up to two custom datums. To do this, select Custom 1 or Custom 2 from the datum dropdowns. You must then enter five parameters to define the datum. The parameters are:

Semi-major axis (a)

inverse flattening (1/f)

x, y, z deviation from WGS84 in meters (dx, dy, dz)

You may also enter a name to identify your custom datums. The name must not exceed 20 characters.

These datum parameters and the name are saved and will be available next time you use the utility. If you change the definition of these datums, the previous values will be overwritten.

When all the selections have been made click the 'Convert' button to start the cycle.

During the cycle the converted data is stored in a temporary file named dummy.dmy which is created automatically. This file is saved even in the event of a fatal error.

To recover the data you have corrected so far, you should open the dummy file which is located in the folder in which GEMLinkW is installed. The dummy.dmy file is overwritten with no warning when a new conversion cycle begins.

### SAVING THE DATA:

When exiting the utility, you are asked to save the final file. This process simply renames the dummy file to the path and file name of your choice. In the event of an error when saving (for example, when the path or drive is not available), the program will display a message indicating that your merged data is still available in the dummy.dmy file and showing its location. Should you decide to cancel and exit without saving/renaming the file, the dummy file will remain intact.

Note that some other GEMLinkW tools, such as the merging utility (GPSmerge) or the Diurnal correction utility, use the same dummy.dmy file. Always save or rename your file to avoid losing the data.

#### IMPORTANT NOTES:

The fact that the number of decimal places can reach or exceed 0.0001m or 0.00001sec does not imply that the precision of the calculation is such. The actual accuracy of the result could be less depending on the selected datum and their error estimate.

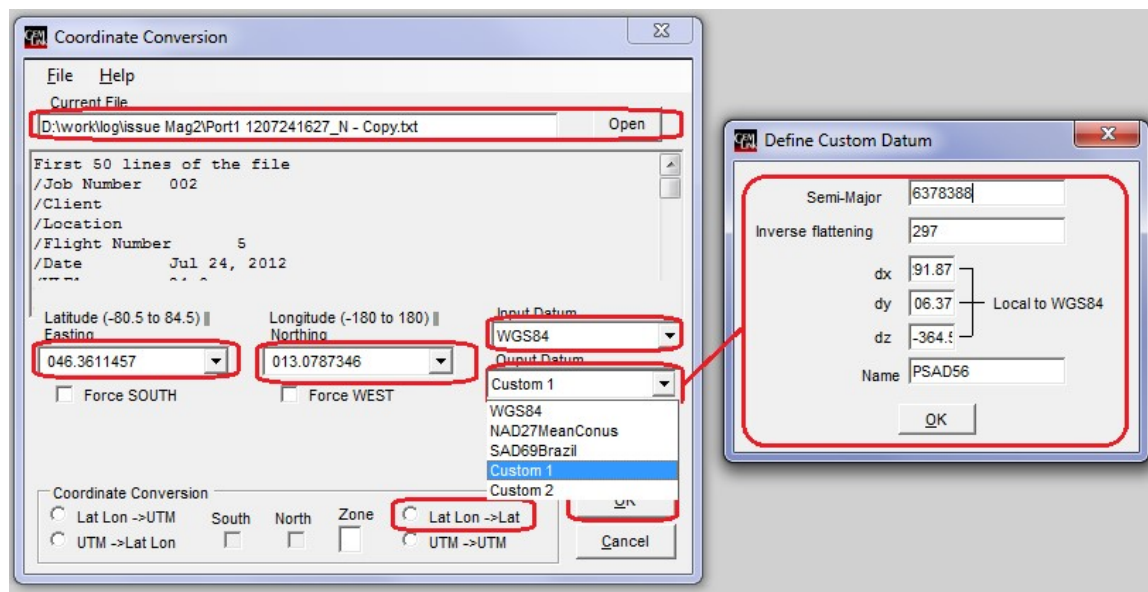
The validity of the selected fields is checked only during the setup and before the conversion cycle begins. Since the selected values are obtained from the first line of data of the file, this means that only the first data line of the file is checked for compliance. It is assumed that all the following lines of the file will contain a valid entry in the selected column. Make sure that the file meets this assumption to avoid incorrect results.

Different datums normally apply to certain geographic areas. This utility does NOT check for compatibility of datum and input coordinates. Make sure the coordinates are within the area of coverage of the selected datum.

#### Example of create a new datum and convert it:

1. Open GEMLink,click menu "Tools"--> "Corrdinate conversion"-->"Convert Coord in File"

It will show the window as following.



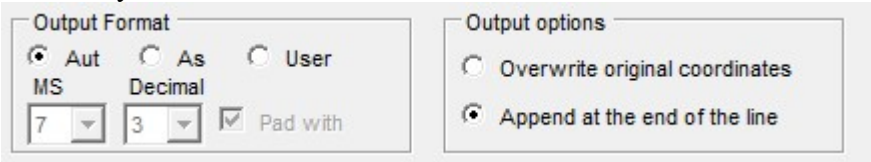
2. Select file that contains WGS84 coordinates by clicking button "open".

3. Select "Latitude", "Longitude", "Input Datum"(here is WGS84), "Output Datum"(here is Custom1, a Define Custom Datum window will show, please fill related parameters to local PSAD datum). Take Brazil as example here:

Semi-Major Axis: 6378388  
Inverse Flattening: 297  
X-axis translation -291.87  
Y-axis translation 106.37  
Z-axis translation -364.52

4. Select “Coordinate Conversion” as “Lat Lon → Lat”

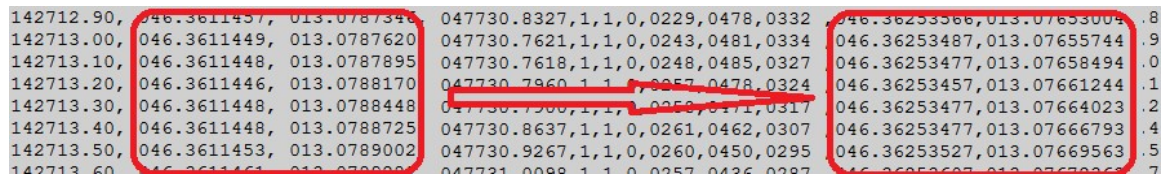
5. Click button “OK”, it will change to “Conver”, click it. A output option will show, select as you want.



If there is no error, click “exit”.

A dialog will pop up let you save the result file. The converted datum should be appended to every line end.

Result:



```
142712.90, 046.3611457, 013.0787346, 047730.8327,1,1,0,0229,0478,0332, 046.36253366,013.07653004 .8
142713.00, 046.3611449, 013.0787620, 047730.7621,1,1,0,0243,0481,0334, 046.36253487,013.07655744 .9
142713.10, 046.3611448, 013.0787895, 047730.7618,1,1,0,0248,0485,0327, 046.36253477,013.07658494 .0
142713.20, 046.3611446, 013.0788170, 047730.7960,1,1,0,0257,0478,0324, 046.36253457,013.07661244 .1
142713.30, 046.3611448, 013.0788448, 047730.7960,1,1,0,0258,0471,0317, 046.36253477,013.07664023 .2
142713.40, 046.3611448, 013.0788725, 047730.8637,1,1,0,0261,0462,0307, 046.36253477,013.07666793 .4
142713.50, 046.3611453, 013.0789002, 047730.9267,1,1,0,0260,0450,0295, 046.36253527,013.07669563 .5
142713.60, 046.3611453, 013.0789002, 047731.0088,1,1,0,0257,0436,0287, 046.36253527,013.07670263 .7
```

## II. Coordinate Calculator

Coordinate Calculator is to exchange between individual geographic coordinate and UTM coordinate. The function will be effective by inputting the data and pressing arrow button. User can select different coordinate Datum to do the change.

#### 4) RS232 Transfer

##### *I. Receive DGPS BINARY*

This utility has been designed to safely transfer the DGPS binary data from the memory of GEM Systems' magnetometers equipped with on-board GPS and with post-processing option, to a file on the PC.

The binary DGPS data is stored in the magnetometer's memory during surveys with GPS when the post-processing option is enabled.

The previous versions of GEMLinkW captured the binary DGPS data to a file using File Capture in binary mode (F5). While this worked well with 2 or 3 MB files, the Windows environment proved to be unreliable for larger files. DGPS binary files may be much larger than 2 or 3 MB and in those cases, part of the data was lost during the transfer even at low rates.

While the File Capture in binary mode is still available in GEMLinkW 2.4, the use of the new DGPS Binary Data Transfer utility is strongly recommended.

## **USAGE NOTES:**

To access the utility click the 'Tools' menu, point to 'RS232 transfer' and then click 'Receive DGPS binary' on the GEMLinkW menu bar.

To dump the DGPS binary data, follow the step-by-step instructions provided by this utility. These instructions correspond to the latest release of software for the magnetometers

## ***II. TRANSFER GPS WAYPOINTS***

This utility is intended to transfer the coordinates of survey waypoints from a PC text (ASCII) file to GSM-19 or GSMP-30 v6.0 consoles equipped with on-board GPS and full lane guidance option.

The text files may be created using GEMlinkW in editing mode, or with any other word processor capable of saving as plain ASCII text. Spreadsheet programs such as Microsoft Excel can also be used provided the files are saved as text (space, comma, TAB , or colon separated) and not as worksheets or workbooks.

After creating the text file on the PC, just follow the step-by-step instructions provided by this utility. These instructions correspond to the latest release of software for the magnetometers.

If any of the steps don't match the options or screens available from your unit, it is either because your unit does not support the waypoint feature or you have an older software version. Please contact GEM Systems for assistance.

To ensure proper data transfer, the following file formatting is required.

## **TEXT FILE REQUIREMENTS:**

### **a) General considerations**

The files must have two columns; one for each coordinate of the waypoints. The default delimiter between fields (or columns) is SPACE. A different delimiter can be selected from the 'Field Delimiter' menu under the 'File' menu. The selection is not a permanent setting. Space will be the default delimiter each time GEMlinkW opens. Consecutive separators will be treated as a single one.

The magnetometer consoles can store up to 1000 waypoints. Therefore, the files should have 1000 (or less) lines or rows. However, if the file is larger only the first 1000 lines will be transferred. The end of each line is determined by a CR (carriage return) or CRLF

(carriage return/Line feed). Lines terminated only with LF cannot be used since they are treated as a single line.

A general condensed description of the file format follows:

Coord1WPoint1	Separator	Coord2WPoint1	CRLF
Coord1WPoint2	Separator	Coord2WPoint2	CRLF
Coord1WPoint3	Separator	Coord2WPoint3	CRLF
Coord1WPoint1000	Separator	Coord2WPoint1000	CRLF

Separator is space.

The coordinates of the waypoints can only be entered as UTM.

Use the option buttons “Meter” or “Centimetre” in 'Unit of UTM' to select the units of the UTM coordinates of your file.

Then next sections describe the format expected for the coordinates when entered as UTM.

#### **b) UTM coordinates**

The first column of the file represents the Easting and the second the Northing coordinates of the waypoint. The units are meters and decimal fractions are rounded to the nearest whole number. Negative numbers are rejected. The maximum allowed value for Easting or Northing is 9999999 whether this represents a valid coordinate or not.

The following is an example of valid UTM coordinates in meter for waypoints with SPACE as field delimiter between columns.

```
629260 4857196
629268 4857195
629271 4857194
629361 4857194
629262 4857192
```

### ***III. PROGRAMMABLE BASE***

Optionally, Version above v6.0 GEM Systems magnetometers may be equipped with a Programmable Base Station feature. The programmable base allows entering up to 30 base station survey programs or schedules.

Each schedule contains the date and time in which the survey starts and the date



and time in which the survey ends. These dates and times can be entered directly using the unit's keypad or you can also use this utility to transfer them to the unit from a text file on your PC through the RS232 link.

The text files may be created using GEMlink in editing mode, or with any other word processor capable of saving as plain ASCII text. Spreadsheet programs such as Microsoft Excel can also be used provided the files are saved as text (space, comma, TAB, or colon separated) and not as worksheets or workbooks.

After creating the text file on the PC, just follow the step-by-step instructions provided by this utility. These instructions correspond to the latest release of software for the magnetometers.

If any of the steps don't match the options or screens available from your unit is either because your unit does not support programmable base mode or you have an older software version. Please contact GEM Systems for assistance.

To ensure proper data transfer, the following file formatting requirements must be met.

#### **TEXT FILE REQUIREMENTS:**

##### **1. General considerations**

The files must have two columns; one for Start and the other for the Stop date and time. The default delimiter between fields (or columns) is SPACE. A different delimiter can be selected from the 'Field Delimiter' menu under the 'File' menu. The selection is not a permanent setting. SPACE is the default delimiter each time GEMlink opens. Consecutive separators will be treated as a single one.

The magnetometer consoles can store up to 30 programs or schedules. Therefore, the files should have 30 (or less) lines or rows. However, if the file is larger only the first 30 lines will be transferred. The end of each line is determined by a CR (carriage return) or CRLF (carriage return/Line feed). Lines terminated only with LF cannot be used since they are treated as a single line.

A general, condensed description of the file format may be written as follows:

Start date and time

Stop date and time

YYMMDDhhmmProg1	Separat or	YYMMDDhhmmProg1	CRLF
YYMMDDhhmmProg2	Separat or	YYMMDDhhmmProg2	CRLF

YYMMDDhhmmProg3	Separat	YYMMDDhhmmProg3	
0	or	0	CRLF

The columns must have date and time entered as YYMMDDhhmm (Year, Month, Day, hours, minutes) with the hours in 24hr format.

- MM for the month cannot exceed 12,
- DD for the day cannot exceed 31,
- hh for the hour cannot exceed 23 (24:00 is not accepted as midnight),
- and mm for the minutes cannot exceed 59.

Invalid entries for months, days, hours or minutes will be rejected. A message will indicate on which line the invalid entry has been detected so you can edit the file and correct the error.

For example if you are using SPACE as field separator, and want to automatically start the base on May 20 2002 at 11:30 AM and stop it on May 25 2002 at midnight, you should enter the line as:

0205201130 0205252359 (file will be 1min short) or

0205201130 0205260000

Note that the date of the schedules only includes 2 digits for the year. When the Stop time is found to be BEFORE than the Start time (Stop in the past as compared with the Start time), you will be prompted to accept or reject the entry.

#### ***IV. Software upgrade***

GEM Systems Inc magnetometer software which is above v6.0 can be upgraded from a PC using the unit's 6-pin connector for the RS-232 port, and the cables supplied for file transfer. The Upgrade utility provides all the functionality required to upload the new software to the unit.

To avoid hardware/software incompatibility, the source software files are released as required and normally named as the serial number of the unit with extension '.bin'.

The Upgrade tool will only upload the software if the embedded serial number of the source file exactly matches the serial number of the unit.

If you have been supplied with a new software version, just make it available to this utility from any directory or drive of your computer.

Connect the RS-232 of your console to the active serial port of the PC where you are currently running GEMLinkW, and follow the instructions provided by the upgrade utility.

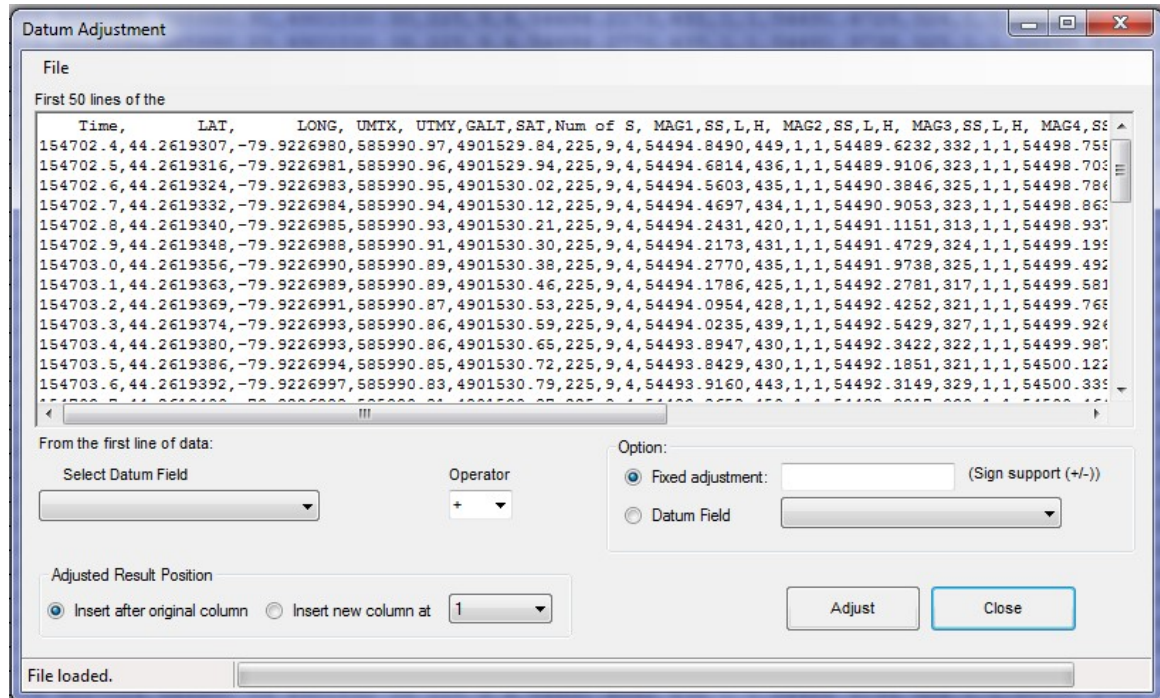
You will find step by step information on how to proceed with software upgrades in [GEM Systems website](#).

Please click [here](#) for a direct link to the information.

## 5) Datum Adjustment

### 1. Open Datum Adjustment window

Click Menu "Tools"-->"Datum Adjustment". The following window will be shown.



### 2. Load file and Set parameter

Click Menu "File" --> "Open" to select airborne log file and open it.

Text box will show the first 50 lines of the file content.

Select Altitude Field from the below Combobox and enter the adjustment parameter. Datum adjust can be done with fixed adjustment parameters or other data column selected by the Combobox. Operator can support "+", "-", "/", "\*", "/", "/".

Adjusted result column's position is followed altitude field by default. But user still can assign a position index by selecting group radio button "Insert new column at" and new column index. The adjusted value will use the same string format as the "Select Datum Field"

If the Datum shows value abnormal, it's probably that the Field Delimiter needs to be changed. Please click menu "File"--> "Field Delimiter" to change it.

### 3. Start adjustment

Click button "Adjust". The progress bar in the bottom will show the progress of the adjustment. Program will calculate the altitude plus the adjustment value and insert it into the new column.

After processing finished, a save file dialog will be popped out and ask user to save the result.

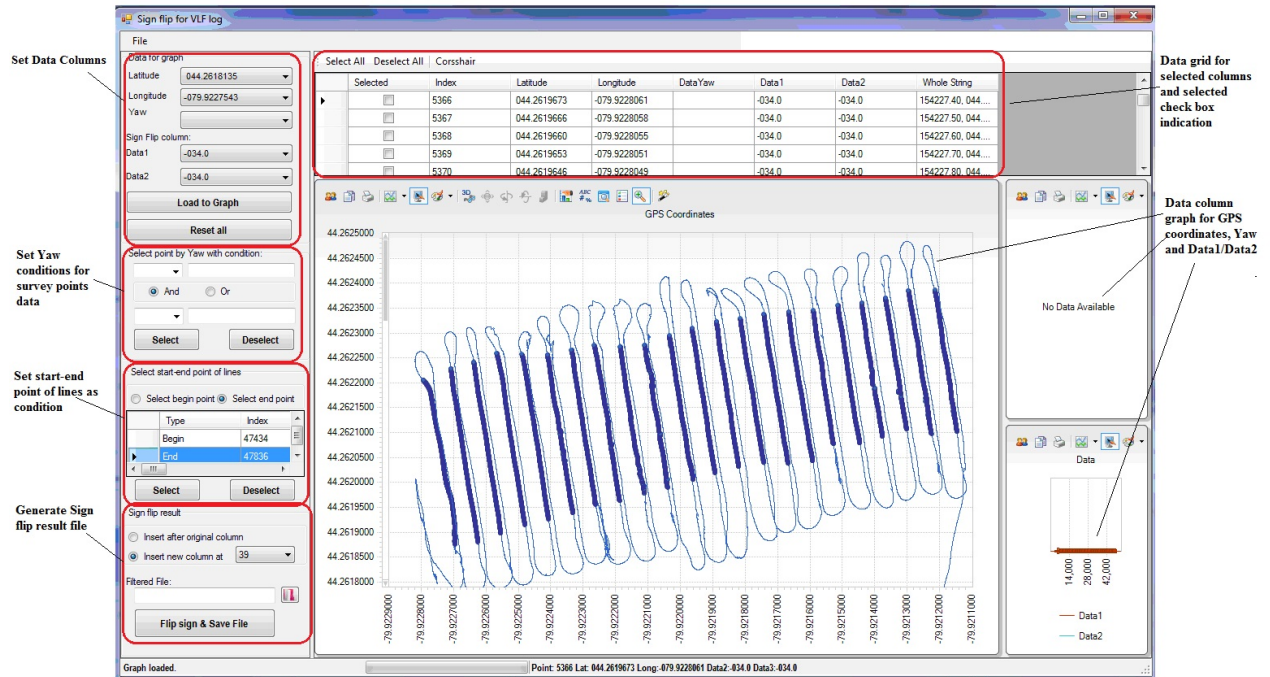
### 4. Check the adjusted log

Click button "Close". Click GEMLink's main window Menu "File" --> "Open" .

Select the adjusted log file to check the adjusted result.

## 6) Data Sign Flip

Data Sign Flip function is to change the sign of data like VLF in-phase data when survey direction is turned around.



### 1 Set Data columns

Open Data Sign Flip window from menu “tools”-> “Data Sign Flip”.

Set correct delimiter for data string, then load data file by menu file->Open. Select data from column for “Latitude”, “Longitude”, “Yaw”, “Data1” and “Data2”.

“Latitude”, “Longitude”, “Yaw” are for the condition that can help user to select survey points which data is needed to be flip the sign.

“Data1” or “Data2” are the column that user want to flip the sign and one of them must be selected at least.

Button “Load to Graph” is for drawing graph for coordinates survey lines, Yaw data and Data1/Data2.

Button “Reset all” is for clear the graph, table and points selected.

### 2 Set Yaw conditions for survey points data

There are two general conditions that user can set for this function to select data, one is to set Yaw condition and the other is set line’s begin point and end point.

If survey has yaw information, user can use “Yaw” as direction to determine which line is needed to be changed. There are two yaw condition which can be combined by “And” or “Or”. The basic condition supports following formula:

“=”: equals,

“!=”: does not equal,

“>”: is greater than

“>=”: is greater than or equal to

“<”: is less than

“<=”: is less than or equal to

Button “Select”: after yaw condition set, click “Select” will mark those points by circle in graph which match the criteria and “selected” in data grid will be ticked.

Button “Deselect”: this function can removed the selection which match the criteria.

### 3 Set start-end point of lines as condition

Radio button “Select begin point” and “Select end point”: if any of these two radio button clicked, user can pick begin point and end point at right graph of GPS coordinate, Yaw, Data1/Data2 graph.

Button “Select”: after yaw condition set, click “Select” will mark those points by circle in graph which match the criteria and “selected” in data grid will be ticked.

Button “Deselect”: this function can removed the selection which match the criteria.

### 4 Sign flip result

Raw data will be kept and sign flip data will be copied to a new column.

User can decide the sign flipped data inserted to the place after Data1/Data2 or at a new column set by dropdown combo box.

User can decide the result file’s directory by setting the result file name click the right directory button.

Button “Flip Sign & Save File”: this function will perform the sign flip process for selected points’ data and save to the file.

## 7) File Converted as

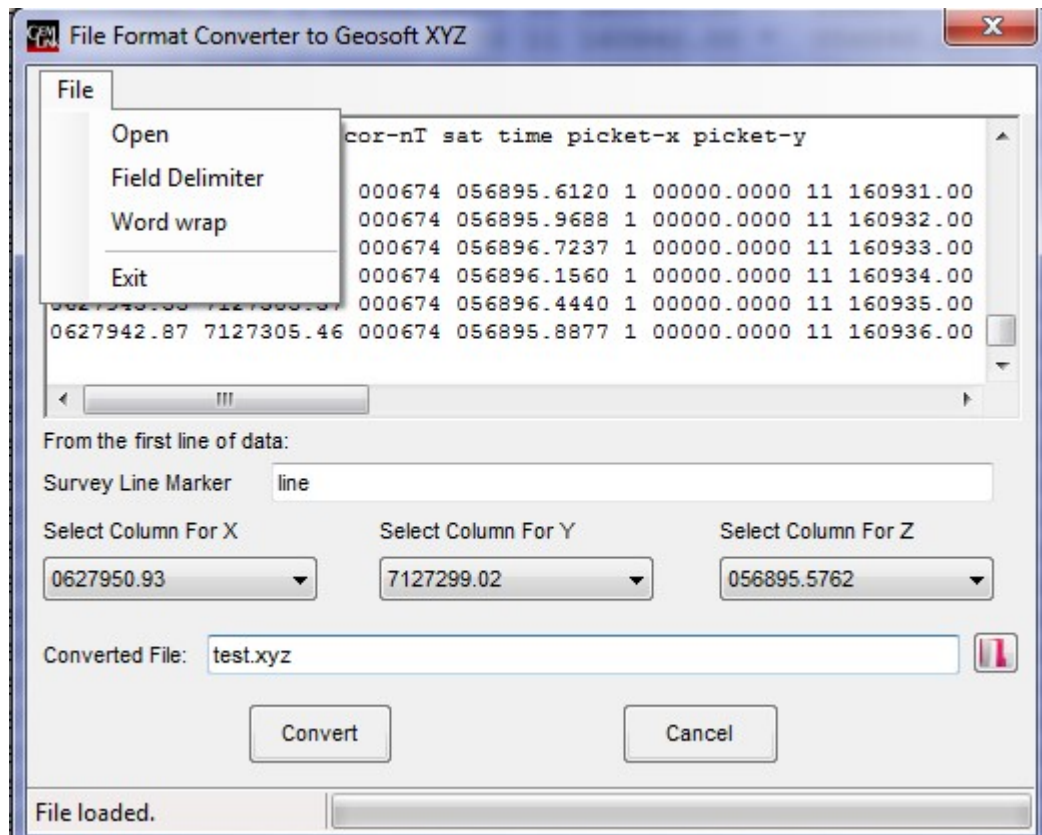
This tool is to convert Magnetometers log file to following file content format:

1 Geosoft XYZ file

Geosoft XYZ file contains line, X,Y, Z information which can be selected from dropdown combobox as following picture.

User click Menu “File”→“Open” to select mag’s log in GEMLink. With right field delimiter setting, User can set the X,Y, Z and line marker value from the magnetometer’s log file. Set click right button of the converted file text box to set the new XYZ file name.

Click button “Convert”, GEMLink will generate the Geosoft XYZ file.



## 8) Data Format Cleanup

It can help you to clean up the data format, removing empty space at the beginning and end of line, remove empty lines, replace "/line" to "line", change end of line sign.

Data Format Cleanup

File

Original File:

Select

```

/Gem Systems GSMP-35 008150C v7.0 1 II 2013 ek21.v7o
/ID 1 file 01survey.wm 13 II 17
/UTC+11

/X Y elevation nT li cor-nT sat time picket-x picket-y
/line 019530

0598683.48 6089530.22 000616 058211.2576 1 00000.0000 09 144745.50 * * -000232.5024
0598682.66 6089530.59 000616 058211.2841 1 00000.0000 09 144746.00 * * -000232.5059
0598683.91 6089529.98 000616 058210.9878 1 00000.0000 09 144746.50 * * -000232.7422
0598682.66 6089530.59 000616 058211.2808 1 00000.0000 09 144747.00 * * -000232.4692
0598684.30 6089529.64 000616 058212.4494 1 00000.0000 09 144747.50 * * -000231.3306
    
```

Cleanup Options

☒ Remove empty lines

☒ Replace "/line" with "line"

Change end of line to:

☒ Keep original
 ☐ CR+LF
 ☐ CR
 ☐ LF

Cleanup

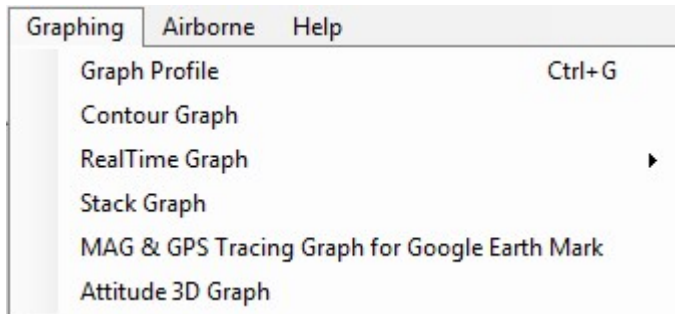
Close

File loaded.

4



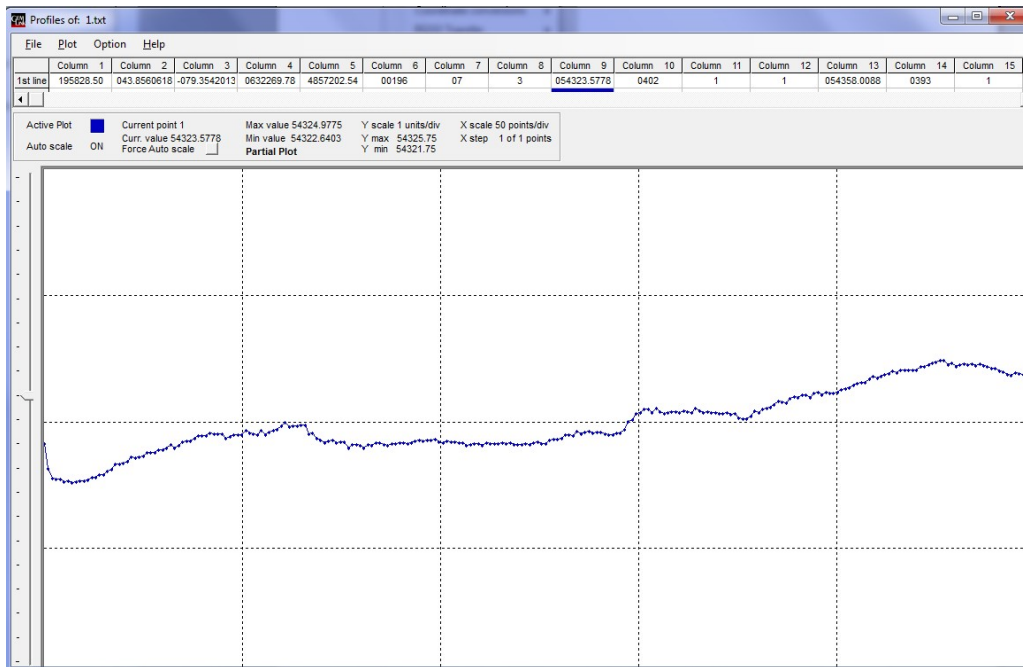
### 4.1.7 Graphing Menu functions



**Note: GEMLink is free software and its graphical function is to provide some level information. Please purchase other commercial software for your official usage.**

#### 1) Graph Profile

This new GEMLink utility provides basic profile plots of magnetic data. To access the utility, use the 'Graph Profile' menu under 'Tools' or the shortcut Ctrl+G



#### OPENING A FILE FOR PROFILE

The profile utility reads the files from their location in the computer. Files that are visible on the text window but have not yet been saved to a disk file cannot be opened for profiles.

The files must be ASCII text files. The end of each line of text must have a CR (carriage

return) or CRLF (carriage return/Line feed). Lines terminated only with LF cannot be used since they are treated as a single one.

The files can be accessed in 2 different ways

From the text window

From the profile window

Initially, the disk files opened from the text interface are transferred to the profile utility interface. Opening, saving or closing a disk file in the text window, clears the existing profile(s) and updates the grid of the profile window.

However, files can be opened independently from the profile window without affecting the file displayed on the text window. To do this, use the profile window 'Open' menu under 'File' or the Ctrl+O keyboard shortcut.

This is specially suited for large files which would take time and memory resources to open and display as text, but can be plotted when accessed from the profile window.

Once a file is open for plotting, it is checked to determine its first and last lines of data. The first line is defined as the first of 3 consecutive lines with the same length. The last line is defined as the line closest to the end of the file that has the same length and the same number of field delimiters as the first. Then, the first data line is displayed on the grid. The columns of the grid are populated with the fields from the line.

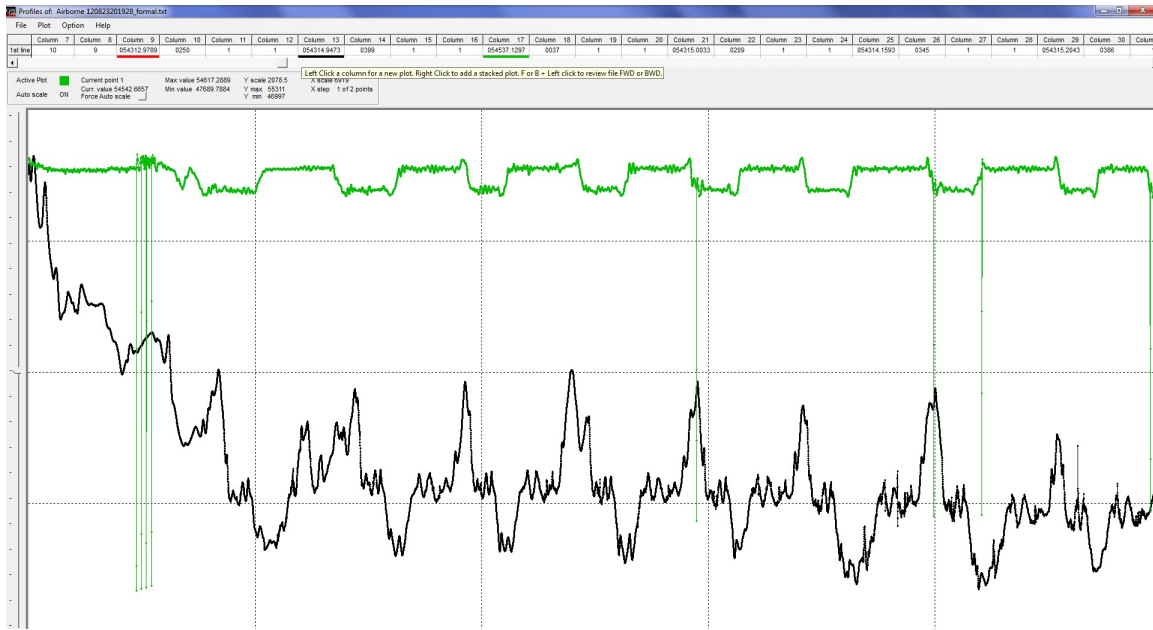
The default delimiter between fields or columns is SPACE. If the lines are delimited by a different character the columns of the grid will not be evenly populated. Rather, all fields of the line will appear together in the first column. A different delimiter can be selected from the 'Field Delimiter' menu under the 'File menu'. The selection will be save as a permanent setting, it means it is still effective next time you use GEMLink.

## **TO DRAW A PROFILE**

Profiles can be single or stacked.

LEFT-click on the desired column of the grid to draw a single profile.

RIGHT-click on the grid to add a stacked profile with different colour.



## NOTES:

Colours of stacked plots change in a sequence and a label indicates the colour of the active plot (the last plot of the stack)

Statistics such as Max and Min values, correspond to the active plot (the last of the stack).

If Auto scale is enabled, the previous profiles will be not to scale. Y axis scale will correspond to the active plot (the last of the stack). The benefit of this scaling method is that total magnetic field and gradient for example, can be visualized superimposed despite the normally large difference of the values.

Resizing the window or autoscaling the plot will clear the old profiles and only the current one (last of the stack) will be redrawn.

If a file is too long and the maximum number of points on the profile is exceeded, some points may be skipped. For example, every second or third point will be transferred to the profile. "X step" in the statistics area of the profile window represents the number of points plotted and the ones left behind.

## TO CHANGE SCALE

The scale of the Y axis can be adjusted automatically or manually. Use the 'Auto scale' menu or the Ctrl+A keyboard shortcut to enable and disable auto scaling.

If the 'Auto scale' menu is checked the Y scale adjusts automatically with each new single or stacked plot.

Use the 'Force auto scale' button in the statistics area to auto scale the profile at any time regardless if the auto scale setting is ON or OFF.

If 'Auto scale' menu is not checked, the Y axis scale is constant and it can only be changed manually.

To adjust the Y scale manually use the 'Y Min/Max' menu or the Ctrl+Y keyboard shortcut and enter the desired scale in the Y axis scale window.

You may also increase or decrease the Y axis scale by right-clicking on the slider or by dragging its cursor.

#### NOTES:

If you right-click or drag the slider while pressing the SHIFT key, the profile will be shifted up or down without affecting the Y scale.

Re-scaling, shifting or resizing the profile window, will redraw the current plot but previous, stacked plots will be cleared.

Plot menu also available right clicking on the plot

## PROFILE STATISTICS

The statistics area of the profile window shows Y axis scale in units/division, the maximum and minimum values of the Y axis, the maximum and minimum values of the profile, and the value at the current point.

Right click on plot to see values of the active plot at the click point. Right click and drag to see values of active plot changing along with the mouse position.

## TO ZOOM IN

Press SHIFT, right click and drag the mouse over the part of the plot you want to zoom. The message 'Partial Plot' will be displayed on the statistics area to remind you that only part of the file is currently displayed.

## TO ZOOM OUT

Use 'Zoom out' menu or the Ctrl+Z keyboard shortcut to redraw the profile of the entire file.

#### NOTE:

Zoom out redraws only the current active plot for the entire file. Old, stacked plots will be cleared.

Plot menu also available right clicking on the plot

## **TO FIND A POINT OF THE PROFILE IN THE TEXT WINDOW**

Place the mouse pointer on the desired point of the profile. Right-click while holding shift pressed.

The line of data containing the selected point of the active profile will be located in GEMLink's text window.

### **NOTE:**

If the files of the profile and text windows are different, you will be prompted to open the current profile file as text.

## **TO CHANGE PLOT STYLE**

You can change the style of the profile line using the 'Style' menu. The options are

- *Line*: joins points with a continuous line
- *Points*: each point is shown separately with a marker
- *Line and point*: combines line and point markers
- *Pen#* sets different thickness of the line and/or the point markers

### **NOTE:**

Changing plot style or pen size will redraw only the active plot. Stacked plots will be cleared.

## **TO REVIEW A FILE**

Press and hold "F" and click on the desired column of the grid to start scrolling the profile FORWARD.

Press and hold "B" and click on the desired column of the grid to start scrolling the profile BACKWARD.

### **NOTES:**

Scrolling file review from a partial (zoomed) plot starts at the current left-most point of the profile.

To start the file review from the beginning of the file zoom out the plot or begin scrolling immediately after opening the file for profiling.

You can set the number of points of a scrolling profile with the 'X axis', 'File review' menu. The default value is 250 points (or 50 points/div).

## **TO PRINT / SAVE PROFILE**

Use the 'Print' menu to print the profile window. The image quality is better when printing large or maximized windows.

Use the 'Save' menu to save the profile window as a bitmap. The image quality is better when printing large or maximized windows but saved file becomes larger.

### **NOTES:**

Saved profiles may be viewed/opened with MS Paint or any other application capable of handling bitmap graphics.

You may use GEMLink's ZIP utility to compress saved bitmaps.

## **ADDITIONAL HELP**

Use the 'Commands list' menu or the keyboard shortcut F2 to open a reminder of the profile window commands.

You may also use the mouse pointer help. Make sure the 'Mouse pointer help' menu is checked. Then position the mouse over a control of the profile and wait for a description of the control to pop up.

## **2) Contour/Surface Graph**

### **Open contour window by GEMLink Menu “Graphing” □ “Contour graph”**

This function is to draw a contour graph for MAG value with GPS coordinates. A basic magnetic map plotting feature is added as shown below.

The default delimiter between fields or columns is SPACE. A different delimiter can be selected from the 'Field Delimiter' menu under the 'File menu'. . The selection will be saved as a permanent setting, it means it is still effective next time you use GEMLink. After right delimiter is selected, user can select field Longitude(or UTMX), Latitude(or UTM Y) and Magnetic(or Gradient) from dropdown combo box. Click button ‘OK’, contour graph of MAG with coordinates will be shown with default graph resolution of 200. Please change it to the value adapted to your survey range.

In order to get a more discrimination picture, contour function will check the smaller value and generate a gradient picture basing on that value.

## Contour Parameter Setting:

**Longitude:** Longitude coordinates or UMTX

**Latitude:** Latitude coordinates or UMTY

**Magnetic:** Mag value or Grad value

**Gallery type:** Contour or Surface, Surface is 3D graph.

**Graph resolution:** better to set from 50-200. The calculation time is longer with the bigger graph resolution number. Please change it to the value adapted to your survey range and graph requirement.

**Color resolution:** 1-255, higher value with more color for Magnetic value

**Color opaque:** 1-255, higher color opaque means with less transparent.

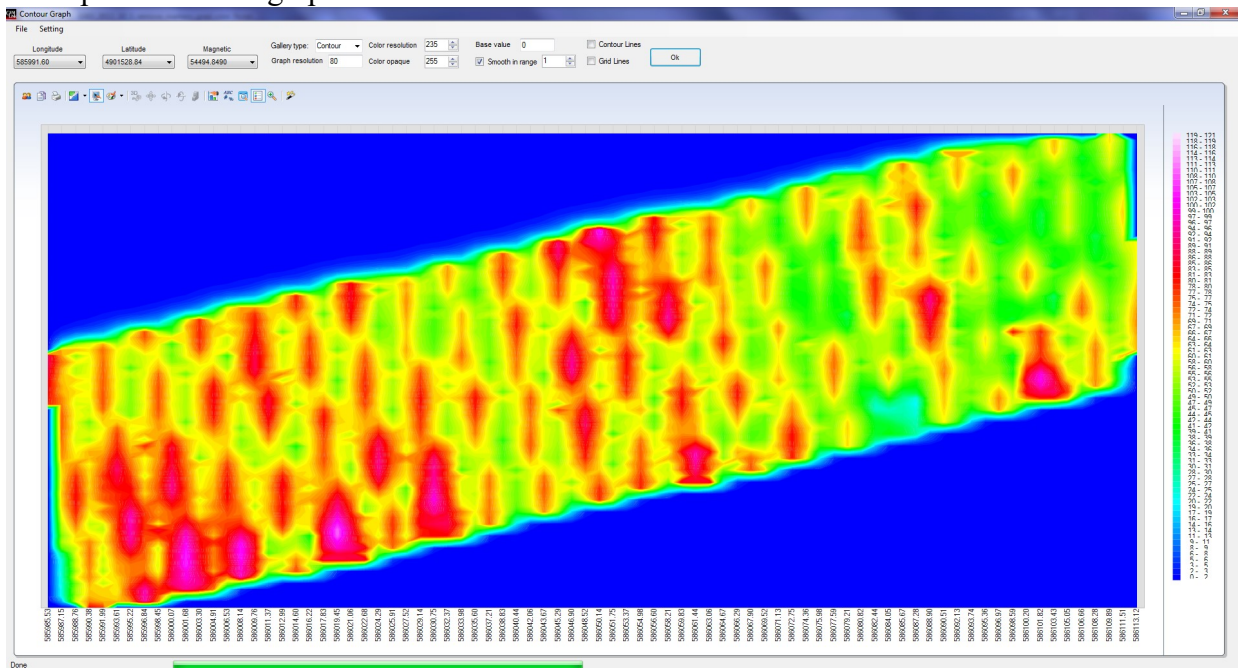
**Base Value:** It uses inputted value as background color's Magnetic value.

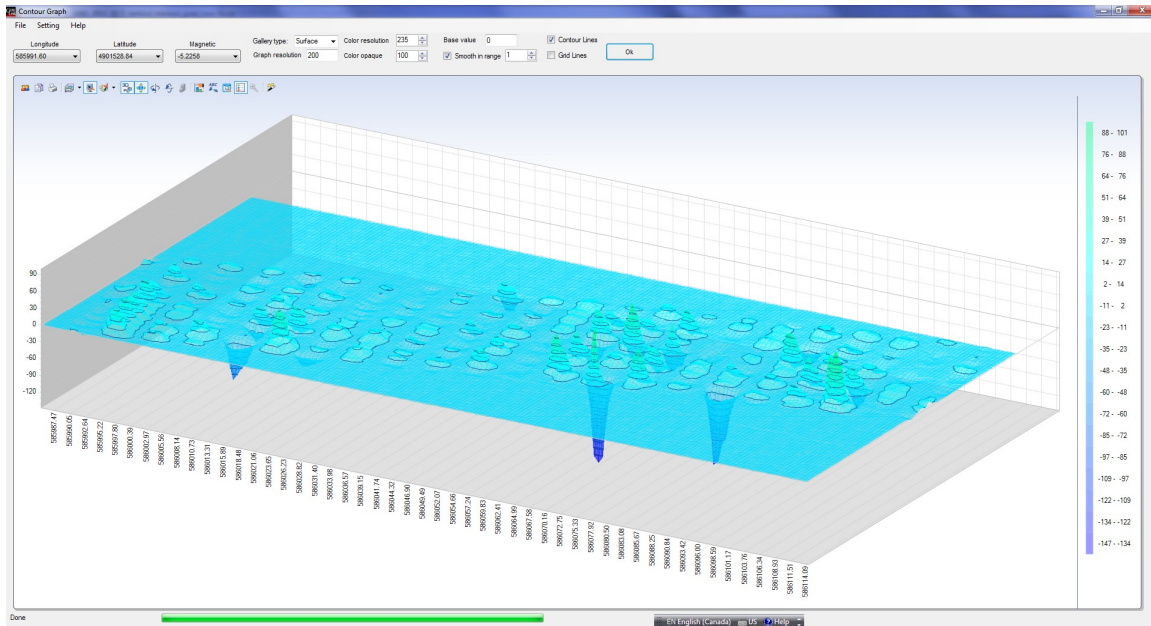
**Smooth in range:** If selecting the check box, software will generate smooth picture with range value.

**Contour Lines:** If selecting the check box, contour line will be displayed. If the color can not give a clear image, please select it.

**Grid Line:** If selecting the grid line for latitude and longitude will be displayed. Default not enabled.

Example of contour graph





### 3) Real-time Graph

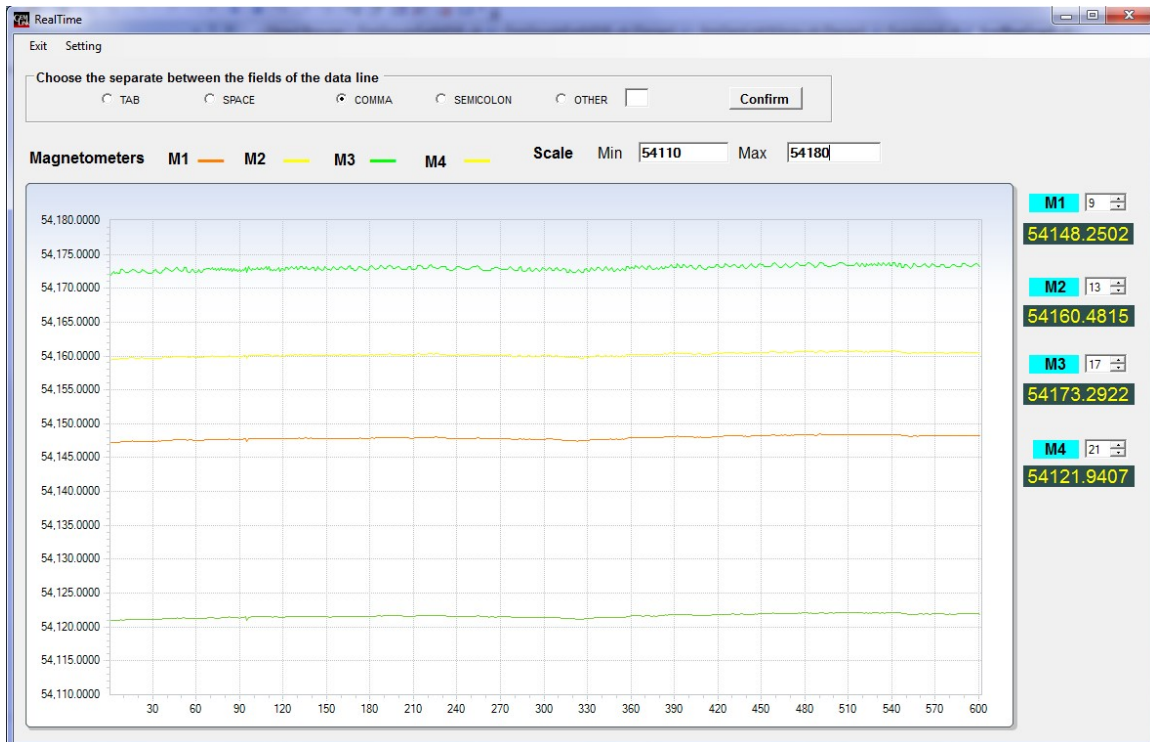
#### ***I. MAGs Real-time Graph-- User-defined Multiple Channel Real-time Data Plotting***

As shown below, users can capture real-time sampling on main window while plotting on other windows simultaneously. User can select the columns to monitor magnetic fields simultaneously up to four channels. By changing the Min/Max values manually, the plot can be zoomed in/out. It is very useful to set up, tune system.

It can show up to 600 points historic data. If set interval time in menu 'setting'→'Update interval' to 1000ms, totally 10 minutes data can be seen in one graph. If set interval time in menu 'setting'→'Update interval' to 100ms, totally 1 minutes data can be seen in one graph.

Note: it's not recommended to set update interval below 100ms, the first reason is most MAG data from serial port is slow than 100ms per data sentence, the second is Windows platform is not real time system, windows timer below 100ms may not be so accuracy.



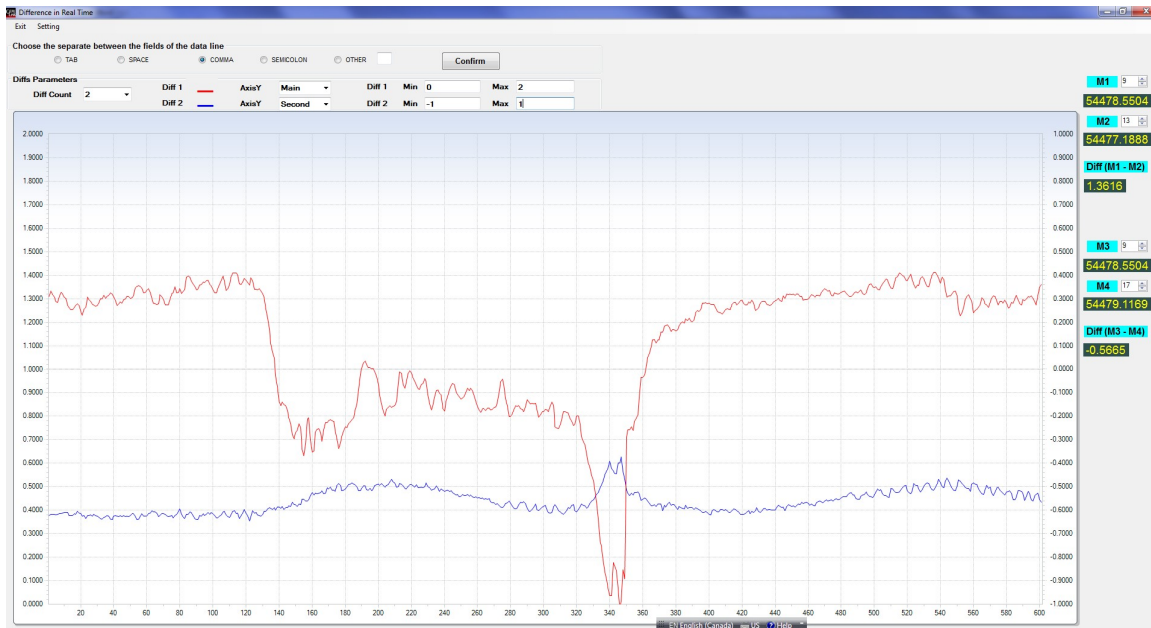


## II. GRAD Real-time Graph

As shown below, users can capture real-time sampling of M1 and M2, application will calculate  $\text{Diff1}(M1-M2)$  or  $\text{Diff2}(M3-M4)$  which means GRADs value between MAGs. The GRAD value show to user on right of main window while plotting on other windows simultaneously. User can select the columns to monitor magnetic fields simultaneously up to four channels. By changing the Min/Max values manually, the plot can be zoomed in/out. It is very useful to set up, tune system.

It can show up to 600 points historic data. If set interval time in menu 'setting'→'Update interval' to 1000ms, totally 10 minutes data can be seen in one graph. If set interval time in menu 'setting'→'Update interval' to 100ms, totally 1 minutes data can be seen in one graph.

Note: it's not recommended to set update interval below 100ms, the first reason is most MAG data from serial port is slow than 100ms per data sentence, the second is Windows platform is not real time system, windows timer below 100ms may not be so accuracy.



#### 4) Stack graph

For some application such as VLF, it may need to plot stacked or mirror pictures to tune or adjust sensors & systems. The stack graph is for this feature.

After loading MAG and VLF log data file, select proper delimiter, Log file first data line will be shown in the grid.

Take following log as example, the 'Stack Column' is referred to VLF IP value's column, the 'Reference Column' is referred to station index of one line, the index will increase from 0 to 30 and go back to 0 for every reading. After selecting the column, then press 'Confirm', Graph will draw a picture of In-phase value picture with the index of station like below.

/Gem Systems GSM-19WV 8032671 v7.0 25 IX 2008 M ewv6fl.v7vbs

/ID 1 file 03survey.v2 15 11 00

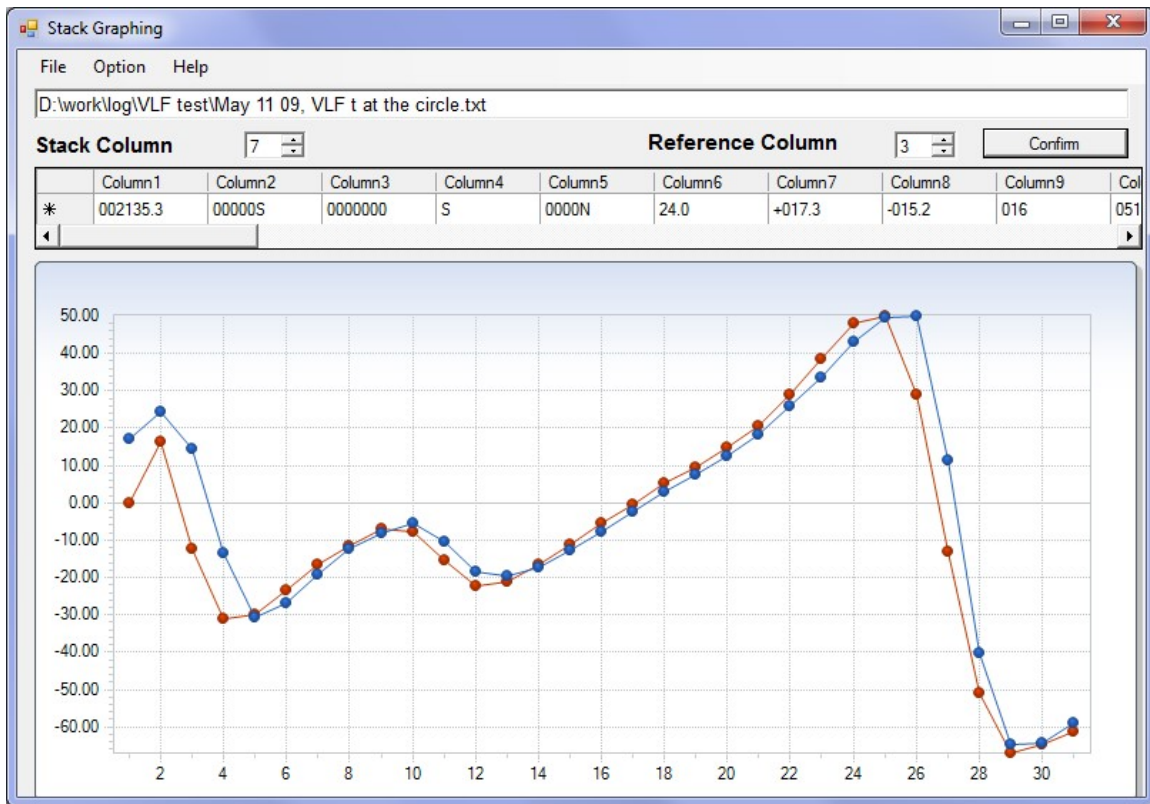
/

/Time	Line	Station	Slope	Freq	IP	OP	H1	H2	SS
002135.3	00000S	0000000 S	0000N	24.0	+017.3	-015.2	016	051	027.33
002201.3	00000S	0000001 S	0000N	24.0	+024.5	-013.4	011	057	029.62
002214.3	00000S	0000002 S	0000N	24.0	+014.6	-005.1	008	069	035.63
.....									
002538.3	00000S	0000026 S	0000N	24.0	+011.2	+005.9	032	092	050.09
002546.3	00000S	0000027 S	0000N	24.0	-040.3	+003.0	016	084	043.96
002554.6	00000S	0000028 S	0000N	24.0	-064.8	-000.7	008	064	033.08
002602.5	00000S	0000029 S	0000N	24.0	-064.3	-001.3	004	054	028.00
002610.9	00000S	0000030 S	0000N	24.0	-059.1	+000.6	005	050	026.06
002624.9	00001S	0000030 S	0000N	24.0	-061.3	-000.4	001	054	027.55
002633.8	00001S	0000029 S	0000N	24.0	-064.8	-001.1	004	057	029.30
002642.1	00001S	0000028 S	0000N	24.0	-067.0	-001.0	004	065	033.37
002650.5	00001S	0000027 S	0000N	24.0	-050.8	+001.5	011	082	042.11
002659.7	00001S	0000026 S	0000N	24.0	-013.0	+006.1	020	097	050.63
.....									
.....									

```

003009.5 00001S 0000003 S 0000N 24.0 -031.0 +013.5 048 118 032.42
003021.8 00001S 0000002 S 0000N 24.0 -012.3 +004.4 054 127 035.29
003031.6 00001S 0000001 S 0000N 24.0 +016.5 -007.3 020 062 033.12
003040.7 00001S 0000000 S 0000N 24.0 +019.2 -013.6 016 052 028.00

```



## 1) Attitude 3D Graph

If customer's system has attitude sensor, like **VN-100 Rugged IMU**. GEMLink can show the real-time 3D graph as below, users can see real-time sampling on main window while plotting on other windows simultaneously. User can select the columns to monitor Yaw, pitch, roll simultaneously.

Three vector mapping to axis:

Yaw-rotate around Z axis

Pitch-rotate around Y axis

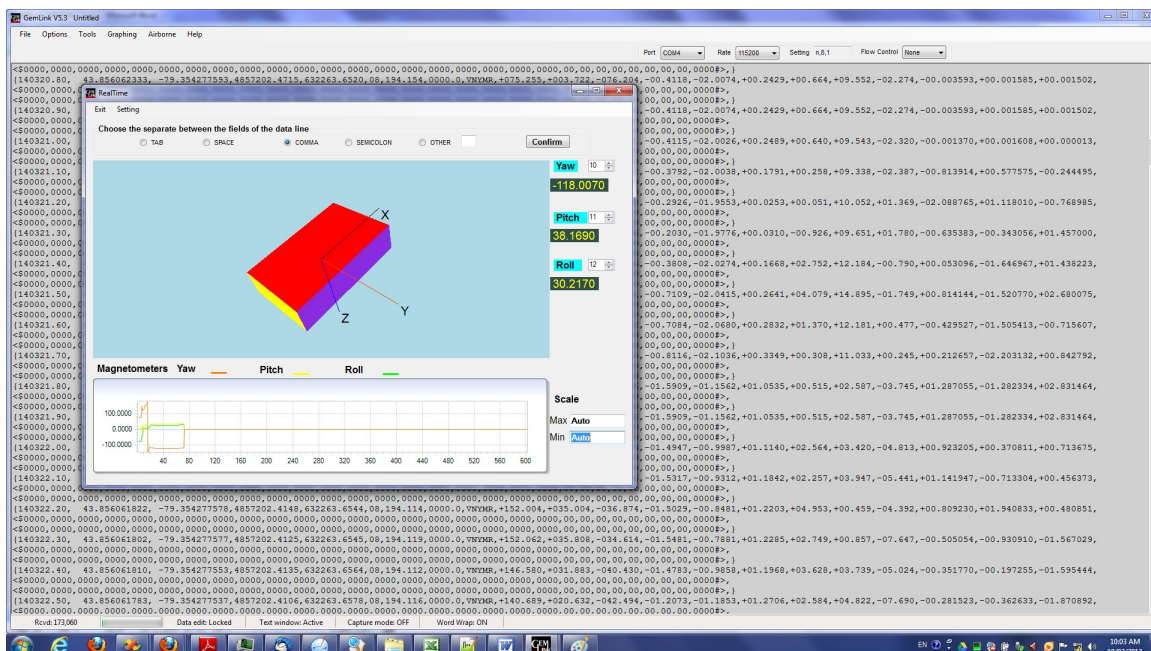
Roll-rotate around X axis

On the right of graph, user can adjust the column index of the original raw data to get the exact value, and the delimiter can be selected in the radio button group.

The chart below the graph is record for the history data for attitude value. By changing the Min/Max values manually, the plot can be zoomed in/out. It is very useful to set up, tune system.

It can show up to 600 points historic data. If set interval time in menu 'setting'→'Update interval' to 1000ms, totally 10 minutes data can be seen in one graph. If set interval time in menu 'setting'→'Update interval' to 100ms, totally 1 minutes data can be seen in one graph.

Note: it's not recommended to set update interval below 100ms, the first reason is most MAG data from serial port is slow than 100ms per data sentence, the second is Windows platform is not real time system, windows timer below 100ms may not be so accuracy.

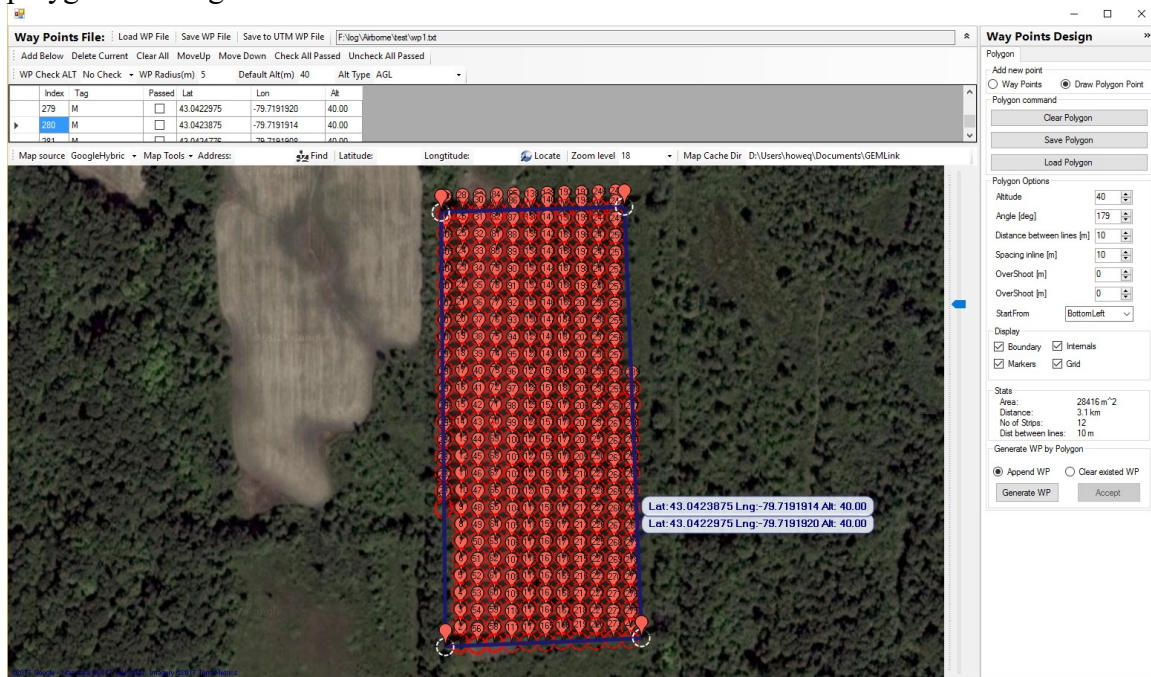




### 4.1.8 Waypoint Plan functions

GEMLink waypoint function includes function “Waypoint Plan” and “Waypoint Tracking”.

“Waypoint Plan” is for customer to automatically generate survey points by quick polygon drawing function. Detail function will be listed below.



#### 1) Waypoint file operation

**Load WP File:** Load saved waypoint file into edit map, file name will be shown at the right text box of same menu bar.

**Save WP File:** Save current edit waypoint into opened file. If there is no opened file, a save dialog will be popped up for user to set file directory and file name.

**Save to UTM WP File:** Convert all current waypoints' GPS coordinate to UTM file in meter. GEMLink can transfer those UTM point into console by menu function “Tools->RS232 Transfer->Transfer GPS Waypoints->PC To Console”

#### 2) Waypoint file general rules

**WP Check ALT:** Enable altitude check for waypoint, this is usually used in airborne or UAV survey work.

**WP Radius(m):** If survey point GPS coordinate is inside the radius of the waypoint circle, waypoint **Passed** will be set to true

**Default Alt(m):** When click map and add new waypoint into the list, this value will be default set as waypoint's altitude

**Alt Type:** can be set to AGL(above ground level) or GPS, this value will indicate user when they are using function **Waypoint Tracking**, which altitude should be used to monitor the survey line.

### **3) Waypoint list operation**

**Add below:** add new waypoint at the current select waypoint, then input GPS coordinate by manual

**Delete Current:** delete current select waypoint

**Clear All:** clear all way point

**Move Up:** exchange previous waypoint position with current select waypoint

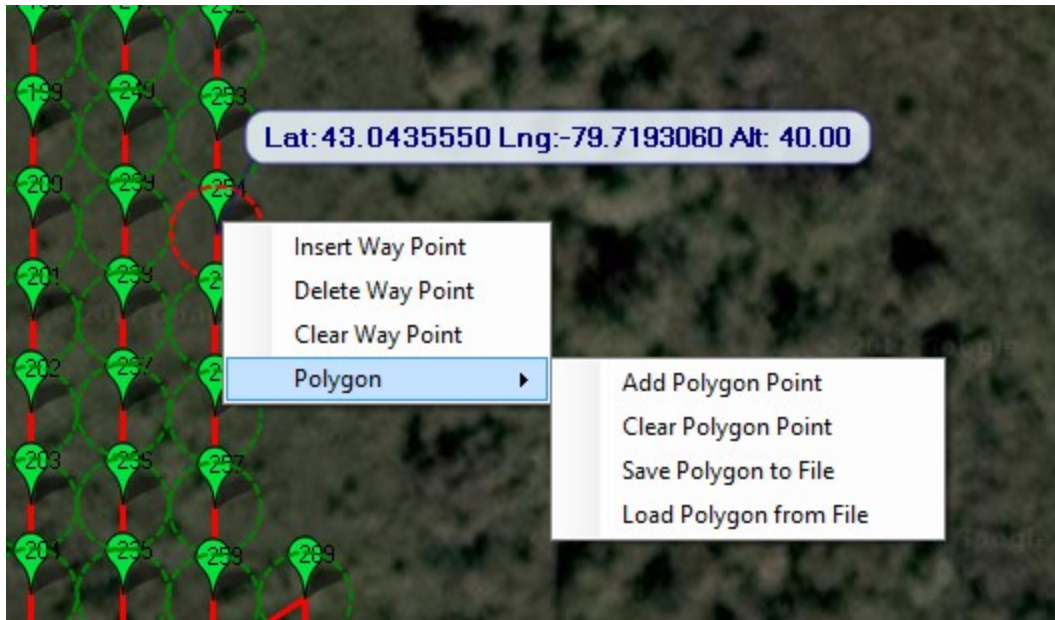
**Move Down:** exchange following waypoint position with current select waypoint

**Check All Passed:** make all waypoint Passed checked, and that waypoint's color will be set to green. If all waypoints reached, whole survey line path's color will be set to green.

**Uncheck All Passed:** make all waypoint Passed un-checked, if anyone of the waypoints is set to unchecked, the survey line path's color will be set to red.

**Mouse Right click:** mouse right click will pop up menu for waypoint operation and polygon point operation

**Mouse Left click:** mouse left click will make a new waypoint basing on mouse point's GPS coordinate and with the default Alt set mentioned above.



**WayPoint grid list:** Except **Index**, Waypoint information can be shown and changed directly in the grid view list. Waypoint provides Tag(waypoint name), Passed(Real Survey line passed this waypoint), latitude, longitude and altitude.

#### 4) Map operation

**Internet is need to download map content at the beginning**, but GEMLink provides map **prefetch** and **download** function to cache the map inside your PC's disk for offline usage.

Please be ware that there could be some GPS coordinate offset or difference between the Map and the real world.

**Map source:** select Map content provided in the combo box like Google, Yahoo!, Bing, OpenStreetMap etc. Please be ware that some map source server may not be connected or not shown, switch to other map source.

**Map tools-> Prefetch:** If there is no internet access at the flight test field, user can pre-fetch **map source** at the place which has internet and download the current map content and cache it in the local computer. The cache map will be stored at the **Map Cache Dir** directory, current File Name with the directory name *gmapcache*. This function will pull the current showing map area to the zoom level 20 with assigned **map source**, so it could use lots of time and disk storage to cache the map from map provider's server.

**Map tools-> Rotate Map:** rotate map image by the heading degree inputted from a popped up dialog.

**Map tools-> Zoom to:** zoom to the place inputted from a popped up dialog.

**Address:** Input the name of location and then press enter or click button *Find*, map will show the address at the center. This function is only available with internet access.

**Latitude/Longitude:** Input Latitude and Longitude then click button **Locate**. Map control will show the place of input at the center. This function is only available with internet access.

Press Key “Alt” and click point in the map, the Latitude and Longitude will show the coordinate from the click points.

**Zoom level:** Map’s zoom level from 0-20, defines the zoom level of the map, which determines the magnification level of the map. Zoom level can be adjusted by rolling of mouse middle wheel too. A slide bar on right has the same zoom function.

Press key “Ctrl” and click at the map and draw a rectangle and map to show the area that you want to zoom into.

**Map Cache Dir:** Set the Map cache directory for map content, directory name *gmapcache* will be created inside this directory for contain all offline map data.

#### **Tips:**

**Mouse Right click+ move:** User can move the map by this operation, press Esc can disable the pop up menu.

**Mouse middle wheel:** zoom in or zoom out map

Select & zoom to area while **holding shift and dragging mouse**, switching between maps keeps selected area in the center

## **5) Auto Waypoint Design**

This function allows you to draw a polygon (enable Radio button of Draw Polygon Point + right click) and automatically create waypoints over the selected area.

**Add new point:** User can add two types of points on the map, waypoint or polygon point. this function is to select new insert point’s type on the map

**Polygon command:** Clear/Save/Load Polygon point to the map

**Polygon Options:** After draw a polygon area on the map, GEMLink can generate waypoints automatically basing on these options.

Altitude: Default altitude for generated waypoint

Angle[deg]: waypoint survey line angle to the north

Distance between lines[m]: Survey line distance

Spacing inline: waypoint distance inline with the survey line

Overshoot[m]: how long the survey line is longer than polygon area

Start from: waypoint index increased from which edge

**Display:** set waypoint display mode

Boundary: Show Polygon line

Internals: generate survey line internal waypoint or just begin and end of survey line

Marks: Show waypoint marker on the map

Grid: show survey line



**Stats:** Statistics for the survey area and survey line

Area: Polygon area

Distance: Total survey line length

No of Strips: number of survey strips

Dist between lines: distance between survey line.

**Generate WP by polygon:** decide how the new automatically generated waypoints add to the list

Append WP: generated new waypoint appended at the end of existing waypoint

Clear existed WP: remove all existed waypoints in the list and add the new waypoint at the beginning.

**Generate WP:** will temporarily show the waypoint in the map, user still can adjust “Polygon Options” and change the design.

**Accept:** If user satisfies the waypoint design, click this button will insert those new waypoints into waypoint list, then the waypoints can be saved to file.

## **6) General idea of operation for auto waypoint design**

Firstly zoom to the place user want to do geophysics survey area. Prefetch and download map with internet

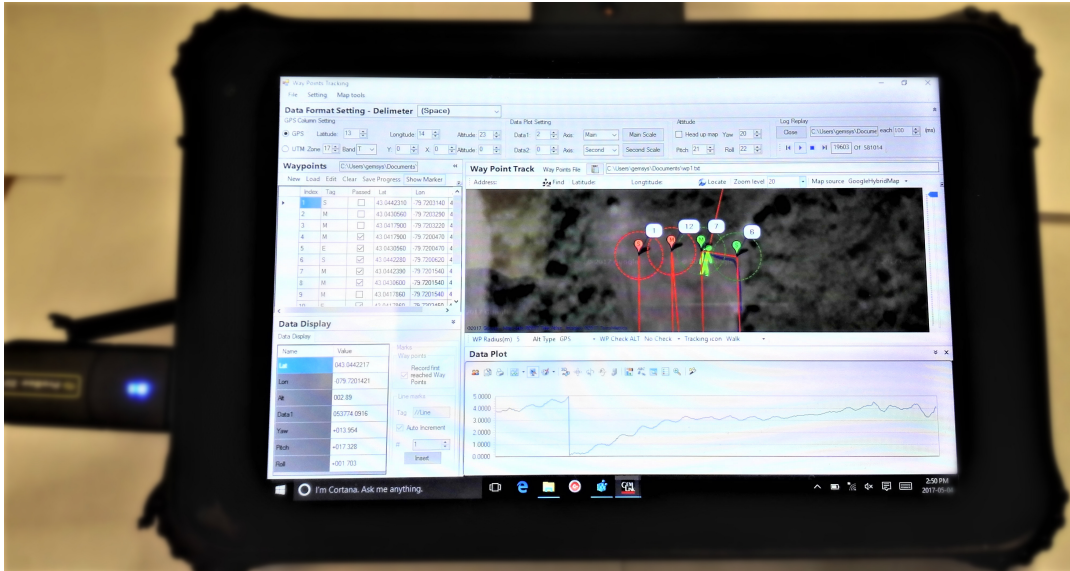
Secondly set the “add new point” to “Draw Polygon Point”, then make a polygon cover all the area user wants to survey. Set “Polygon Options” and click “Generate WP”. click “Accept” button, if user satisfies the waypoint design.

Last click “Save WP File” to save waypoint into file, and click “Save to UTM WP File” to save UTM coordinate and transfer them to magnetometer console by the message guidance.

### **4.1.9 Waypoint Tracking Function**

Waypoint tracking function is to plot and graph data received from serial or survey log file replay to check every set waypoint is reached during the survey by set GPS information and data information.

Below is an example picture of Windows 10 Rugged tablet running waypoint tracking function with USB wireless zigbee receiver.



## 1) Data Format Setting

**Delimiter:** delimiter can be set as coma, space and etc.

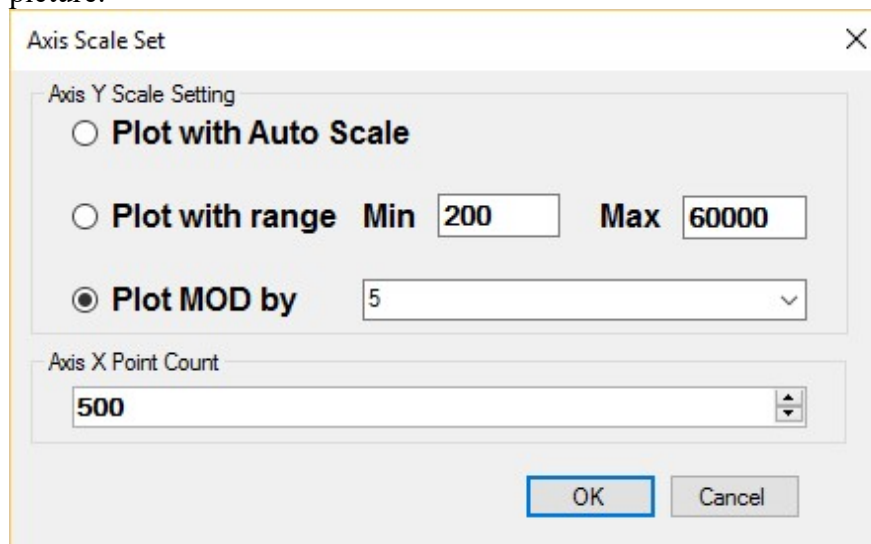
**GPS column Setting:** Set GPS Latitude Longitude and altitude column for the received data.

If UTM position used, GEMLink can convert UTM coordinate to GPS with user provide UTM zone information, note UTM zone and band information is for real GPS position, not column index. Y, X and altitude is for data column index.

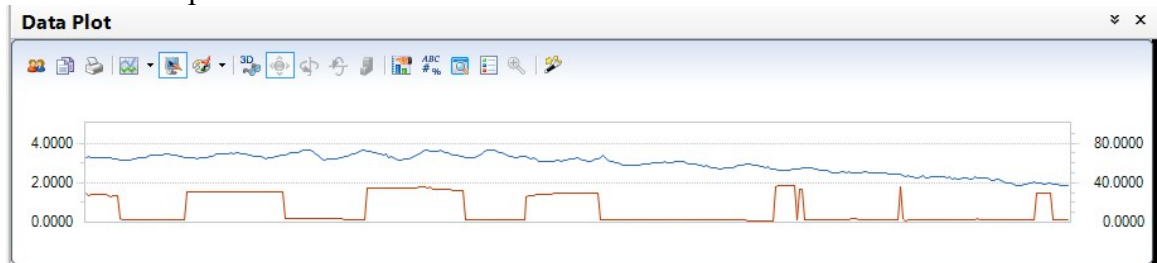
## 2) Data Plot Setting

2 columns data can be plotted in the bottom chart with main and second axis for different range data like total field and gradient data.

**Main scale and Second scale:** plot Y axis scale can be set 3 mode as following picture.



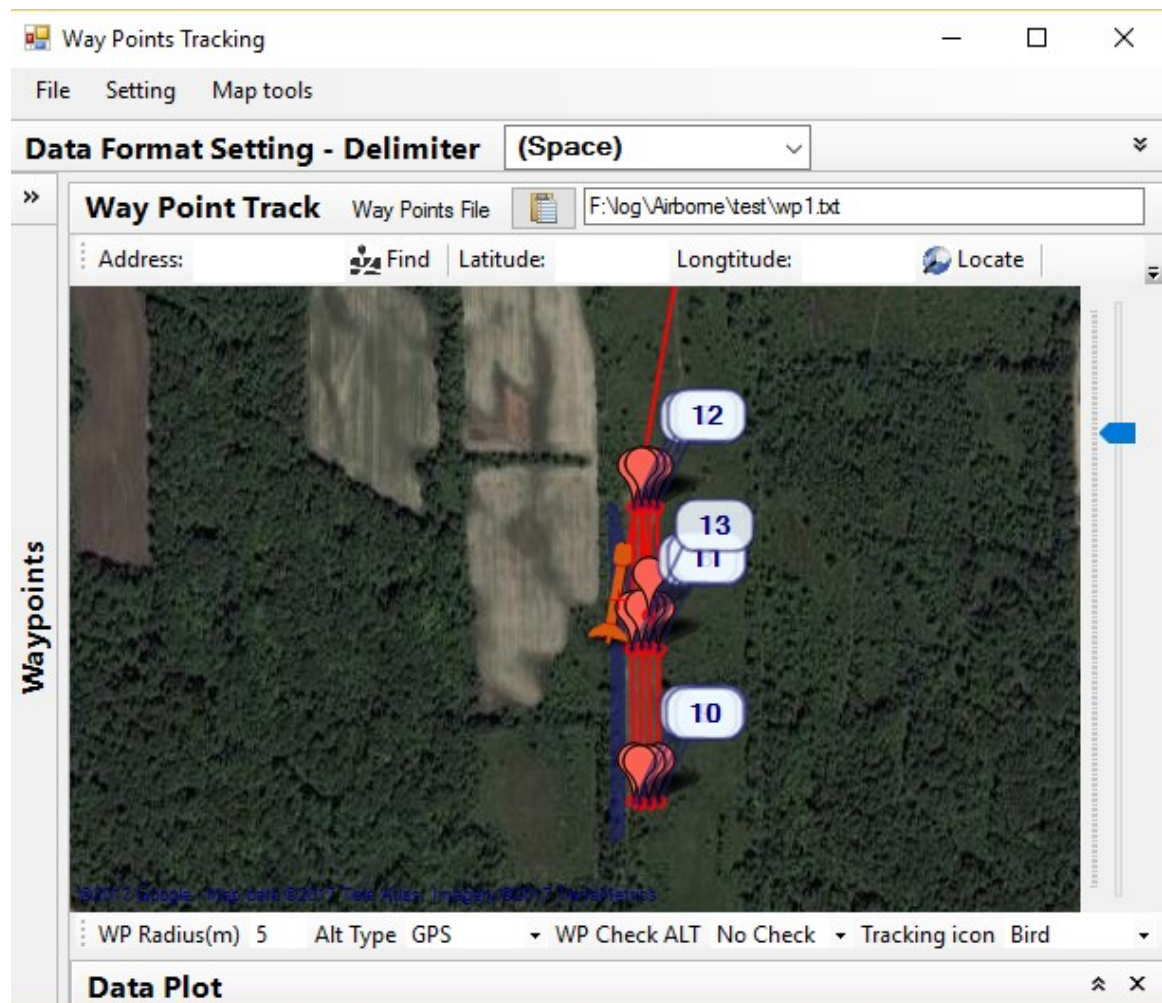
2 Data can be plotted in the chart with same or different axis.



### 3) Attitude for Navigation

If data contain heading, pitch and roll information, there will be a redline with icon in the map to indication the heading direction. If **Head up** checked, the map will rotate the bearing to keep the heading always head up, this can be used for GPS navigation with the survey line and waypoint on the map.

When user click collapse button(>>) , all setting, data display and plot graph can be hidden to give map maximum window size for GPS navigation



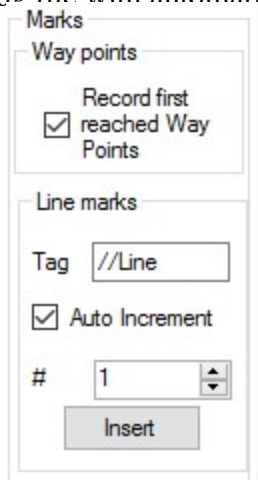
#### 4) Log Replay

**Log Replay or real time data from Serial port:** waypoint tracking can support either to show real time serial data input to GEMLink or to show download log replay for survey log.

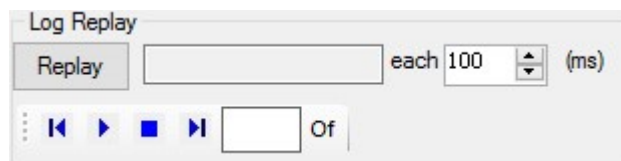
When **plot real time data from Serial port**, the map and plot update rate depends on timer setting in menu **Setting->Serial Data Update Interval**. It can be set from 100ms to 10 second. Please be ware that if real time data input rate is higher than this, some GPS data could be ignored and relative way point could not be checked.

If Checkbox for **Record first reached Waypoints** selected, GEMLink will automatically record the waypoint information in save log file with waypoint index leading with “/” .

And user can manual click **Insert** button to insert mark line number information into log file with automatically increment line number setting.



When **Log Replay**'s button **Replay** clicked, a log file open pop up dialog will show to user. User can go through the log data with GPS/UTM coordinates and data plot for quality checking. The log read interval time can be changed by the setting in spin edit box.



When replay the log, GEMLink will only show the graph and check the waypoint status, but not modify log file content, so the **Marks** function will be disabled as following picture and user can not insert waypoint and line mark into the file.

**Data Display**

Data Display

Name	Value
UTMY	4766417.00
UTMX	0604238.26
Alt	000.23
Data1	053759.5560
Data2	053759.5560
Yaw	-078.796
Pitch	-000.676
Roll	-001.913

Marks

Way points

Record first reached Way Points
☒

Line marks

Tag //Line

☒ Auto Increment

# 1

Insert

## 5) Waypoint map operation and file operation

Waypoint map operation is similar with the **Waypoint Plan** function. User can refer above part for the information. One **Tracking Icon** combo box can be used to set icon for the map navigation.

Waypoints can be listed in the left grid view box with information got from opened waypoint file. Button **New**, **Edit** can call **Waypoint Plan** function out for create or modify the waypoint file. Button **Load** will pop up and open dialog to ask user select waypoint file. **Clear** will remove waypoint list and close current waypoint file.

**Save Progress** can save current Passed waypoint information into a new waypoint file for work progress record. **Show Marker**

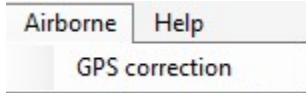
And **Show Grid** is to set the waypoints and survey line display mode on the map.

Waypoints						
F:\log\Airborne\test\wp1.txt						
New Load Edit Clear Save Progress Show Marker Show Grid						
	Index	Tag	Passed	Lat	Lon	Alt
▶	1	S	<input type="checkbox"/>	43.0442310	-79.7203140	40.00
	2	M	<input type="checkbox"/>	43.0430560	-79.7203290	40.00
	3	M	<input type="checkbox"/>	43.0417900	-79.7203220	40.00
	4	M	<input checked="" type="checkbox"/>	43.0417900	-79.7200470	40.00
	5	E	<input type="checkbox"/>	43.0430560	-79.7200470	40.00
	6	S	<input type="checkbox"/>	43.0442280	-79.7200620	40.00
	7	M	<input type="checkbox"/>	43.0442390	-79.7201540	40.00
	8	M	<input type="checkbox"/>	43.0430600	-79.7201540	40.00
	9	M	<input type="checkbox"/>	43.0417860	-79.7201540	40.00
	10	E	<input type="checkbox"/>	43.0417860	-79.7202450	40.00
	11	S	<input type="checkbox"/>	43.0430600	-79.7202380	40.00
	12	M	<input type="checkbox"/>	43.0442390	-79.7202300	40.00
	13	E	<input type="checkbox"/>	43.0433350	-79.7201460	40.00
*			<input type="checkbox"/>			



#### 4.1.10 Airborne Menu functions

##### 1) GPS correction



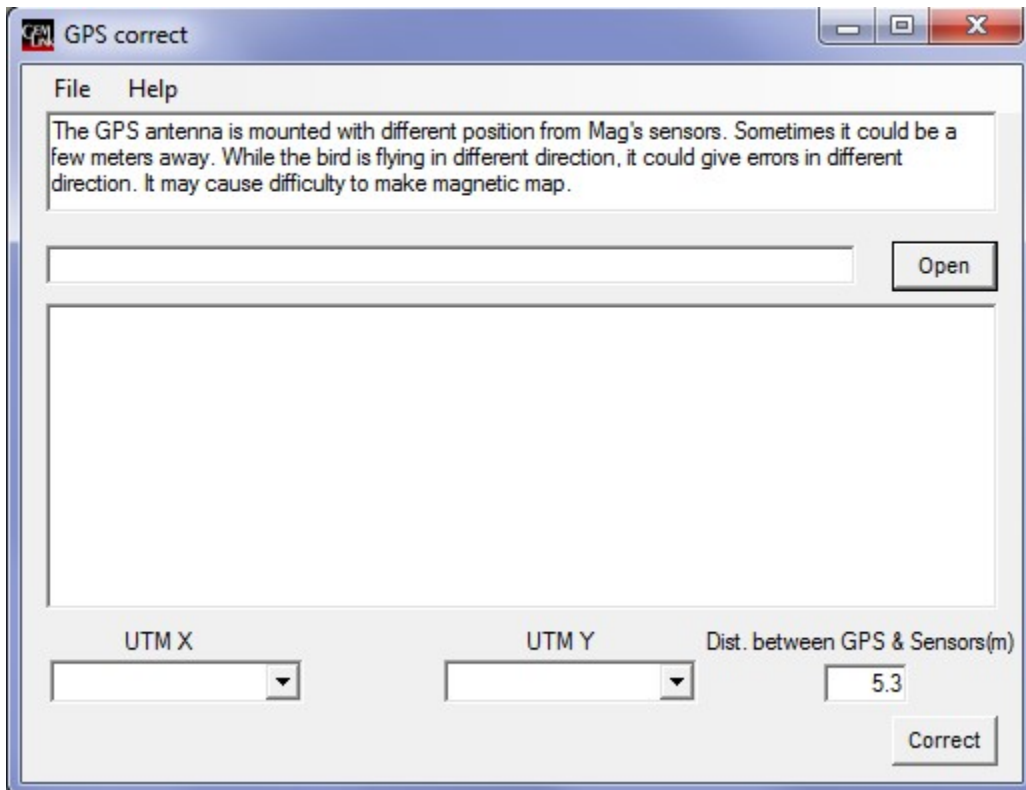
The GPS antenna is mounted with different position from MAG's sensors. Sometimes it could be a few meters away. While the bird is flying in different direction, it could give errors in different direction. It may cause difficulty to make magnetic map.

This function is to correct the UTMX and UTM Y coordinates by given distance between GPS antenna and Sensors position.

After loading the airborne data file, by clicking 'Open' button, select UTMX and UTM Y column in the dropdown list of combo box, input distance between GPS antenna and Sensors position in meter.

Clicking button 'Correct', corrected coordinates will be appended to every line from the third data line.

If correction is successful, a save file dialog will be popped up to let user to save the result.



## 2) Survey Path Extract

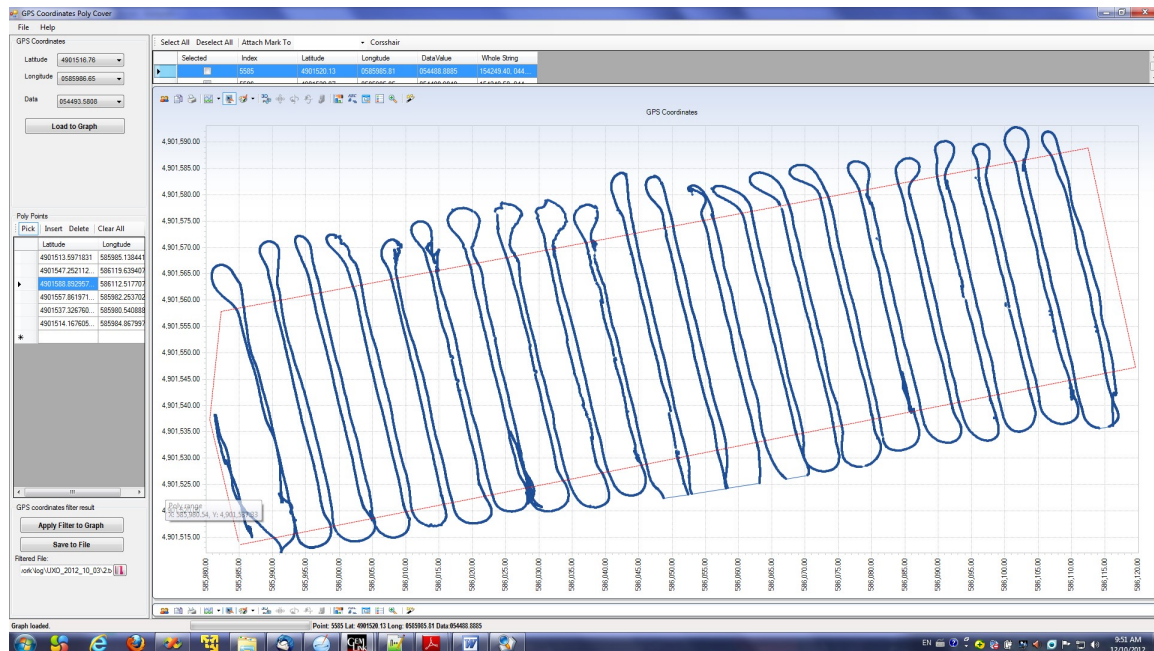
Click Menu "Airborne"-->"Survey Path Extract" to enable the function.

GEMLink provides function to clean the survey path e.g. turn around, out of survey area.

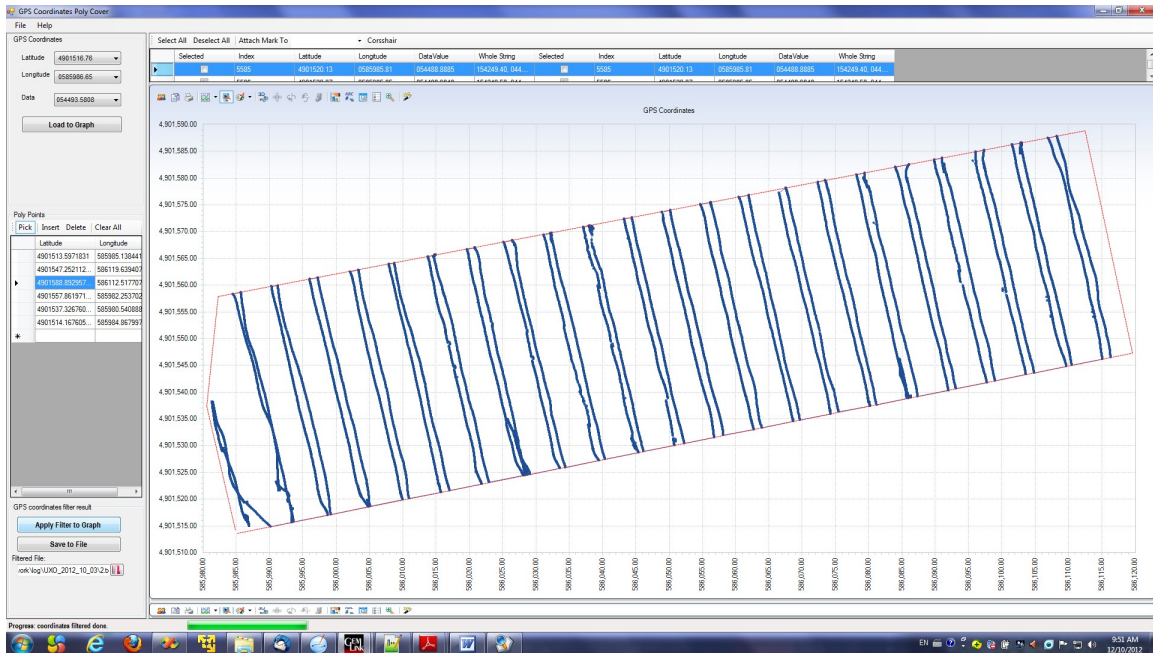
1. After loading the data log file, and selecting GPS coordinates by dropdown box and reference data field. If it is potassium Mag, unlock filter can be used to exclude those unlock points by select the unlock indication value. Click "Load to Graph". A survey path with GPS information will be drawn in right top area and a reference data field will be shown on the below graph.

2. Start selection polygon point by clicking button "Pick" in the middle of left menu bar, you can start to select the polygon point which can cover you interesting area. After that uncheck the clicking button "Pick", then click "Apply Filter to Graph", out of polygon graph will be excluded as the next picture.

3. Click "Save to File", the cut area data will be saved to a new log file which you can set a new file name for it.



Before cutting



After cutting

### 3) Grad calculation

1. Open Datum Adjustment window

Click Menu "Airborne"-->"Grad Calculation". The following window will be shown.

Gradient Data Calculation

File

First 50 lines of the

```

/Job Number 1
/Client GEM Systems Inc
/Location Bolton
/Flight Number 1
/Date Mar 08, 2013
/VLF1 24.0
/VLF2 24.0
/GPS Type E-SBAS
/GPS Location
/Sweep Max 70000
/Sweep Min 50000
/Datum S5000
/Operator Mike Wilson
/Pilot Andrew Dunt
/Heli Company National Helicopters
  
```

From the first line of data:

UP Mag data field: 054437.6135 LEFT Mag data field: 054437.8306 RIGHT Mag data field: 054437.4993

UTMX: 0604291.80 UTM Y: 4860509.27

Set distance between Mags:

Dv(Height in meter from UP to the middle of LEFT and RIGHT): 2.5 Dh(Width in meter from LEFT to RIGHT): 2 Df(distance in meter from previous record to current calculated by UTM)

Select calculation output:

☒ Vertical Grad per meter((UP-(LEFT+RIGHT)/2)/Dv) ☒ Horizontal Grad per meter((LEFT-RIGHT)/Dh) ☒ Forward Grad per meter(((UP+LEFT+RIGHT)/3)/Df)

Adjusted Result Position

☐ Insert after original column ☒ Insert new column at 36

Calculate Close

File loaded.



## 2. Load file and Set parameter

Click Menu "File" --> "Open" to select airborne log file and open it.

Text box will show the first 50 lines of the file content.

If the Datum shows value abnormal, it's probably that the Field Delimiter needs to be changed. Please click menu "File "--> "Field Delimiter " to change it.

Select Up,Left,Right Mag Field from the below Combobox and UTMX,UTMY parameters. Set distance between mags. And tick related checkbox for output.

## 3. Start Grad Calculation

Click button " Calculation ". The progress bar in the bottom will show the progress of the Calculation. Program will calculate the Grad and insert it into the new column.

After processing finished, a save file dialog will be popped out and ask user to save the result.

## 4. Check the adjusted log

Click button "Close". Click GEMLink's main window Menu "File" --> "Open" .

Select the adjusted log file to check the adjusted result.

#### 4) MAG&GPS tracing graph for Google Earth Mark

This function is useful when you want to quickly check the result of walking or airborne Magnetic field result. It can contains 3 factors including GPS, altitude, 3 MAG value or what you can select in the result text format file column.

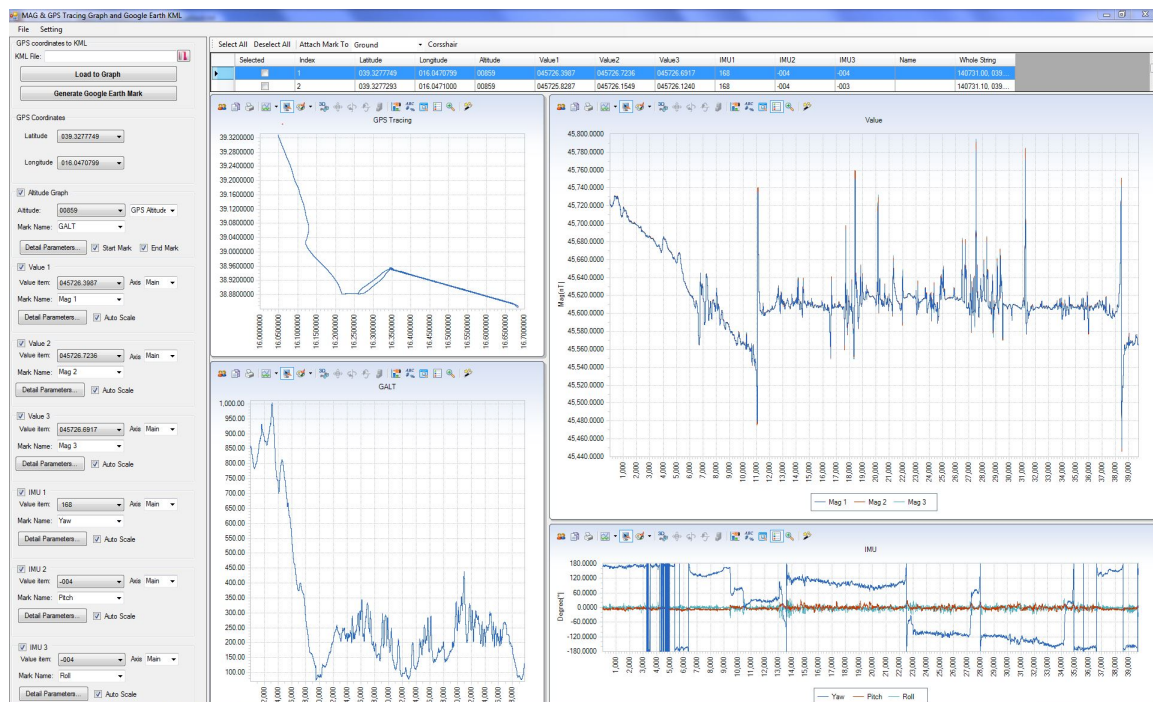
If want to check the GPS position, altitude, MAGs value's relationship, the feature of 'MAG & GPS tracing graph for Google Earth Mark' will be the exact tool.

GEMLink can select GPS coordinates, altitude and 3 MAGs value information to show in an analysis window.

Furthermore, if user installed a Google Earth software (Please download it from Google Earth web site), GPS tracing, altitude and MAGs value can be shown in the Google Earth Map with track and the interesting position tag.

This feature can show the culture factors impacting the MAG result and the magnetic abnormal position directly in a real MAP directly without third party complex processing software.

It's helpful for Walking MAG and airborne system's result analysis.

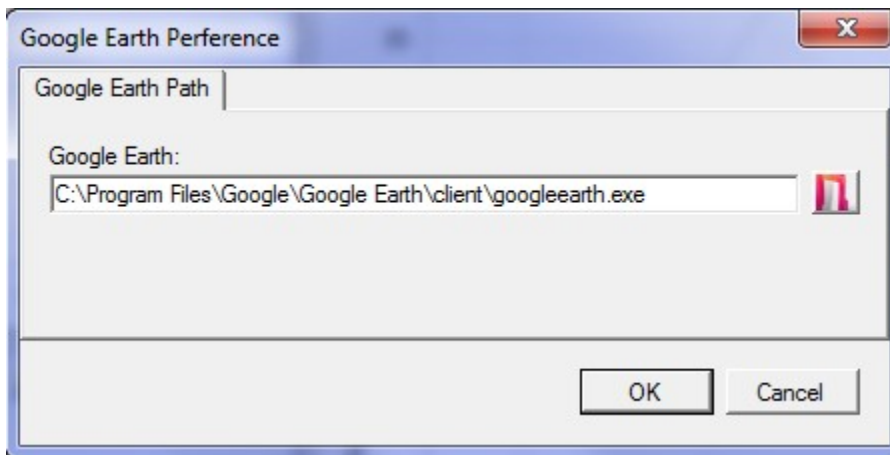


## ***I. Operation Steps***

### ***a) Select Google Earth application path***

**Note:** GEMLink does not include Google Earth software, please download it from Google Earth web site and download it. GPS position, altitude, MAGs value's relationship graph can be displayed, but you can not display the generated mark file if without Google Earth software.

If this is the first time you open this feature in GEMLink, a Google Earth Path setting window will pop up to show the application googleearth.exe path which is gotten from system register, if this path is right, please click 'OK' to save it. If this path is not right, please click folder image button in the right of path text box to select proper googleearth.exe path.



### ***b) Open File with proper delimiter***

Select log file from menu 'File' → 'Open' of GEMLink main window or 'MAG & GPS tracing graph for Google Earth Mark' sub window with proper delimiter.

If want to change the delimiter, please select right delimiter by menu 'File' → 'Field Delimiter'. Application will reload the file and prepare the field for selection in field dropdown combo box.

If loaded file changed from Main window after this feature window opened, please select 'File' → 'Reload' to reload the file.

### ***c) Select GPS Coordinates***

Select GPS coordinates by clicking dropdown combo box

***d) Select Altitude column***

Altitude: Select altitude by clicking dropdown combo box.

There are two type of altitude, one is GPS altitude, and another is Laser/Radar altitude.

This type is used for Google Earth Altitude type. The former one is absolute and the next one is related to ground.

‘Mark Name’: If log file has title for columns, then ‘Mark Name’ will be automatically shown in the dropdown combo box. If it’s not right, then you can select it or fill it directly.

‘Star Mark’ and ‘End Nark’: It will show start point and end point mark in the Google Earth map for altitude path tracing.

‘Detail Parameters’: If clicking this button, all parameters related to Google Earth Mark will be shown in the following window.



Min: Minimum data value in selected column

Max: Maximum data value in selected column

Map to height: Map the Max and Min value to scale 'Map to height' and 0 meter altitude in Google Earth. Google Earth provides 3D view of tracing path, altitude and MAG value can be drawn as height in Google Earth. Airborne altitude and MAG's result can be seen directly at exact GPS coordinate. MAG's value range is too much so it need map to some small scale for better display.

Style: Poly style and Line Style

Height Mode:

- clampToGround

This mode ignores any altitude value, and places the KML feature on the surface of the ground, following the terrain. If you want to see your path rather than the altitude please select this option.

- relativeToGround

Measures the altitude from the ground level directly below the coordinates.

- absolute

The absolute altitude mode measures altitude relative to sea level, regardless of the actual elevation of the terrain beneath the feature

- relativeToSeaFloor

Measures the altitude from the sea floor directly below the feature, if the feature is placed over a major body of water. If not over water, the altitude will be measured from the ground level.

- clampToSeaFloor

As with clampToGround, this mode ignores the altitude value. It places the feature on the bottom of any major body of water; if the feature is located away from a body of water, the feature will be clamped to the ground level, instead.

Color: Line's color

Width: Line's width

Opacity: Line opacity in percentage.

Extend path to ground: Checked, Line in air will be extended to ground, else it's hang in the air.

### ***e) Select MAG and IMU value columns***

Totally there are 3 MAGs/IMUs value can be shown in one time. If log has more than 3 MAG value need to be shown, more than one file for others MAGs/IMUs value should be created with the same coordinate column selected.

The screenshot shows a software configuration window with two sections. The top section is for 'Value 1' and the bottom section is for 'IMU 1'. Both sections have a checked checkbox at the top left. In the 'Value 1' section, 'Value item' is set to '045726.3987', 'Axis' is set to 'Main', and 'Mark Name' is set to 'Mag 1'. There is a 'Detail Parameters...' button and a checked 'Auto Scale' checkbox. The 'IMU 1' section has 'Value item' set to '168', 'Axis' set to 'Main', and 'Mark Name' set to 'Yaw'. It also has a 'Detail Parameters...' button and a checked 'Auto Scale' checkbox.

Value: Magnetometer's value or Gradient Value

IMU: IMU Yaw/Pitch/Roll value

'Mark Name': If log file has title for columns, then 'Mark Name' will be automatically shown in the dropdown combo box. If it's not right, then you can select it or fill it directly.

'Detail Parameters': If clicking this button, all parameters related to Google Earth Mark. The meaning of 'Detail Parameters' can be referred in above content.

Auto Scale: If selected, application will calculate the line height in Google Earth automatically, otherwise, it will use 'Detail Parameters' Max and Min value as line height in Google Earth.

### f) Load to Graph

#### Load to Graph

After selecting 'Parameters', clicking button 'Load to Graph', Selected column value will be filled into the grid of data as following table:

	Selected	Index	Latitude	Longitude	Altitude	MAG1	MAG2	MAG3	Name	Whole String
<input type="checkbox"/>		28340	046.1544428	-072.8539386	00009	054248.8236	054251.3874			215650.40, 046.1544428,-072.8539386, 0665
<input type="checkbox"/>		28341	046.1544528	-072.8539113	00009	054248.7682	054251.5437			215650.50, 046.1544528,-072.8539113, 0665
<input type="checkbox"/>		28342	046.1544629	-072.8538838	00009	054248.8298	054251.6939			215650.60, 046.1544629,-072.8538838, 0665
<input type="checkbox"/>		28343	046.1544728	-072.8538563	00009	054249.0533	054251.7948			215650.70, 046.1544728,-072.8538563, 0665
<input type="checkbox"/>		28344	046.1544827	-072.8538288	00009	054249.2426	054251.7714			215650.80, 046.1544827,-072.8538288, 0665
<input type="checkbox"/>		28345	046.1544926	-072.8538013	00009	054249.2074	054251.6981			215650.90, 046.1544926,-072.8538013, 0665

Selected: Mark the interesting point by GPS information in Google Earth

Index: Point Index of data line

Latitude: GPS latitude

Longitude: GPS Longitude

Altitude: altitude information in the log

MAG1: the first selected MAG value

MAG2: the second selected MAG value

MAG3: the third selected MAG value


Name: Interesting GPS point mark name

Whole String: original raw data line stream

The following GPS tracing, altitude and MAG graph will be drawn with the above grid data.

### g) Generate Google Earth Mark file and loading it to Google Earth

GPS coordinates to KML

KML File:


Load to Graph

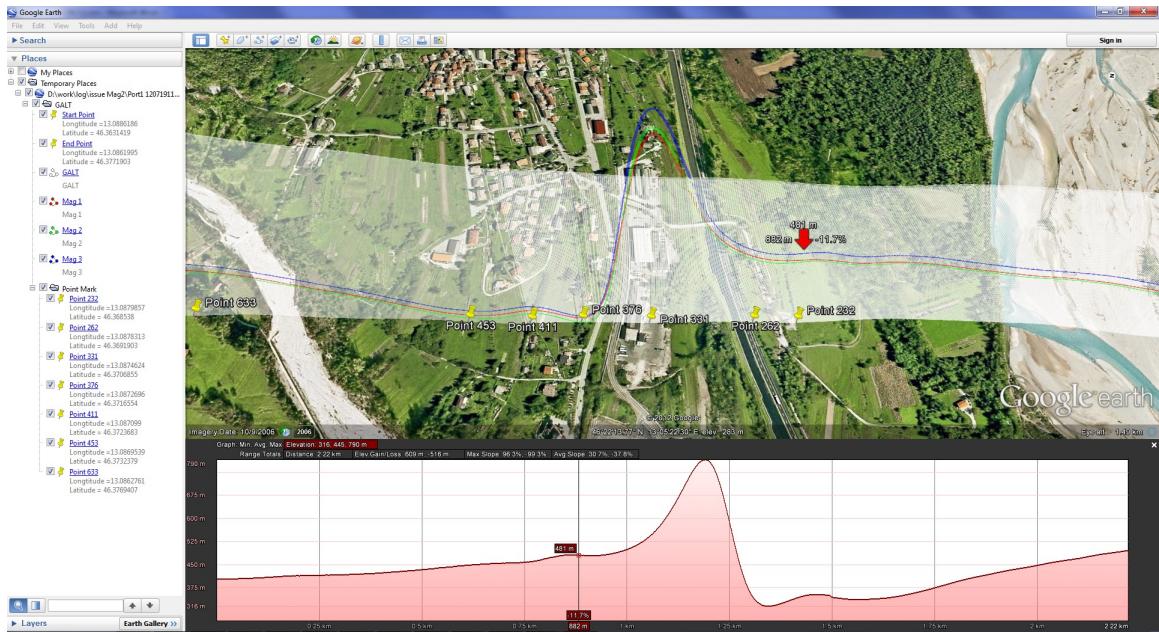
Generate Google Earth Mark

Click button 'Generate Google Earth Mark' as above, a save file dialog will pop up to let user to decide the saving directory and file name for the Google Earth Mark file. Then application will call out software Google Earth and load the saved file. The file name will be stored in text box of 'KML file', be careful not to overwrite the existing file. You can select another file name by clicking the folder image button on the right.

In Google Earth, the Mark name is listed in left slide bar, by tick and un-tick the mark name can show or hide the tracing path. By default, white is the altitude ploy line graph. Red, yellow and blue line will be MAG value mapping to height line in the air. Some Interesting Point (value abnormal point) is in point mark in the Google Earth.

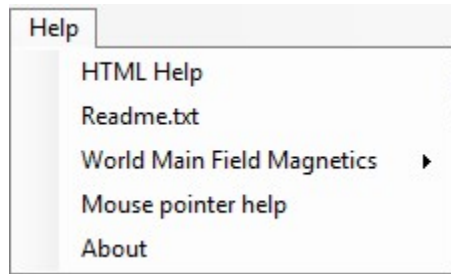
Please refer to Google Earth manual for detail Google Earth operation like graph rotate, zoom in and zoom out etc.







#### **4.1.11 Help Menu functions**



##### **1) HTML Help**

This function will show this help.

##### **2) Readme.txt**

Readme.txt show the history of version updating information.

##### **3) World Main Field Magnetics**

Following world main field magnetic map in PDF will be opened for your information.

US/UK World Magnetic Model -- Epoch 2010.0 Main Field Declination

US/UK World Magnetic Model -- Epoch 2010.0 Main Field Total Intensity

US/UK World Magnetic Model -- Epoch 2010.0 Main Field Horizontal Intensity

US/UK World Magnetic Model -- Epoch 2010.0 Main Field Inclination

US/UK World Magnetic Model -- Epoch 2010.0 Main Field Down Component

##### **4) Mouse pointer help**

If enable this menu check button, a help hint will pop up when mouse stay over some of the control component.

##### **5) About**

An about box will be shown with version information.