6 The Configuration File

The configuration file is used during the power-up sequence to configure the Kinetamap behaviour. The configuration file can be partially modified via the Bluetooth connection or via a ASCII text editor once the Kinetmap is connected via a UBS cable to a computer. The configuration file is named "kineta_config.txt".

The configuration file contains the following parameters:

```
config_menu=0
log_gps=5
log_accel=10
send_gps_to_bt=0
log_batt=0
save_txt=0
save_binary=1
save_nmea=0
accel_X=0
accel_Y=0
accel_Z=0
g_FSrange=0
```

The configuration menu must be kept in this format. If you want to change any of the parameters simply change the right value according to your needs. Don't forget, you can also change some of the the parameters from the Config Menu accessible via Bluetooth. However, if you wish to disable the Config Menu and to change the last seven parameters, then you will have to use a text editor.

As a side note, if you have somehow corrupted your config file, or if your Kinetamap does not seem to be adhering to the configuration settings, simply connect the Kinetamap to a PC via an UBS cable and delete the kineta_config.txt file. The next time the Kinetamap is started, it will automatically create a new config file with the default settings.

Note that the procedure that parses the configuration file is extremely primitive. It is absolutely necessary to leave the configuration item in the order shown above and not to add any separator (e.g. space or tab) between the equal sign and the actual value.

6.1 config_menu parameter

The config_menu parameter enables/disables the configuration menu. By default the config menu is enabled (config_menu=1). When the config menu is enabled data is not logged to the SD card. By disabling this parameter the Kinetamap will start logging data immediately after the unit is turned on or the UBS cable is disconnected (of course if save_txt, save_nmea, or save_binary are set to 1).

6.2 log_gps parameter

The log_gps parameter tells the Kinetamap if it should log GPS data or not. By default the log_gps parameter is enabled. If the parameter is changed to 0, the Kinetamap will not save the GPS coordinates to the SD card.

The log_gps express the frequency in seconds used to collect gps data, the value is an integer between 0 and 255, where 0 means do not collect gps data, 1 means collect gps data every second, 2 every two seconds... Default is to collect data every 5 seconds (log_gps=5). This value should be kept as high as possible (e.g. every 5, or 10 seconds or even higher) to reduce the size of the logs and improve accuracy of acceleration collection rate.

6.3 log_accel parameter

The log_accel parameter tells the Kinetamap if it should log the X,Y, and Z acceleration values or not. By default the log_accel parameter is enabled. If the parameter is changed to 0, the Kinetamap will not save the acceleration values to the SD card. The log_accell express the approximate frequency in Hz used to collect acceleration data, the value is an integer between 0 and 200, where 0 means do not collect data, 1 means collect data every seconds, 60 means to collect data at an approximate 60Hz frequency,... Default is to collect 10 samples every seconds (log_accel=10). .The value is of course an approximate value in Hz, Actual sampling rate will change depending on how other parameters are configured and will be affected by other events like saving data on the SD card, GPS collection interval expiration... This value should be kept as low as possible (e.g. 60Hz or lower) to reduce the size of the logs and improve accuracy of the collection rate.

Acceleration are expressed as integer values between -127 and 128 (+/- the accel_X/Y/Z offset), corresponding to a scales of ± 2g/± 8g as described in the LIS302DL data sheet, note also that the value of g_FSrange will affect the meaning of the accelerometer and the accel_X, Y, and Z calibration values are added to the value read from the device (see infra for the accel_X parameter).

6.4 send_gps_to_bt parameter

The send_gps_to_bt parameter tells the Kinetamap that it should send the NMEA messages received from the EM-408 module to the Bluetooth module. This means that if an SPP Bluetooth connection has been established between another device and the Kinetamap, the GPS message will be sent to the connected device (i.e. Blackberry). If the config menu is also enabled, then the GPS messages will only be transmitted once the config menu has been exited or option 6 is selected.

By default this parameter is enabled. Turning the parameter off will prevent the GPS messages from being sent over the Bluetooth connection.

*Hint: Battery life can be improved by turning both the config_menu and send_gps_to_bt parameters off.

6.5 log_batt parameter

The log_batt parameter tells the Kinetamap if it should log the battery voltage value or not. By default the log_batt parameter is disabled (log_batt=0). If the parameter is changed to 1, the Kinetamap will save the battery voltage values to the SD card. Note that the battery value are not stored in the binary file, if you are interested in battery value you need to enable the save_txt.

6.6 save_txt parameter

The save_txt parameter tells the Kinetamap if it should log the collected samples in a text file or not. By default the save_txt parameter is enabled (save_txt=1) to emulate the legacy configuration. If the parameter is enabled, power is turned on, the config_menu is turned off, the UBS cable is disconnected, and space is available on the SD card a tab delimited text file will be created in the root directory of the SD card. The content of the text file is described infra.

The text file is called KinetaMapXXX.tsv, where XXX is a numeric identifier ranging from 000 to 250. The application will try to use 000 first; if a file with the same identifier exist the identifier is incremented until an unused identifier is found (or the maximum is reached).

6.7 save_binary parameter

The save_binary parameter tells the Kinetamap if it should log the collected samples in a binary format or not. By default the save_binary parameter is disabled (save_binary=0) to emulate the legacy configuration. Using the binary format is of course the preferred way to save the data as it will require less cpu cycle and less disk space. Note that save_txt, save_binary, and save_nmea described below are not exclusive and all can be enabled, but of course this will greatly reduce the performances of the Kinetamap.

Two tools are provided to parse the binary file; generateKML and generateAccel. The first creates a KML file directly usable in Google ™ Earth (http://earth.google.com/), Google ™ Maps, NASA WorldWind, ESRI ArcGIS ™ Explorer, and other. ParseAccel creates a tab delimited file with collection time, and acceleration data.

The binary file is called km-binXXX.dat, where XXX is a numeric identifier ranging from 000 to 250. The application will try to use 000 first; if a file with the same identifier exist the identifier is incremented until an unused identifier is found (or the maximum is reached).

Note that if the #define BINARY_ONLY 1 is uncommented in main.c (or if you copy the FW.SFE found in the BIN_ONLY directory to the SD card) the Kinetamap will only save data in binary format (save_txt and save_nmea will be ignored) and the performances of the Kinetamap will improve.

6.8 save_nmea parameter

The save_nmea parameter tells the Kinetamap if it should log the collected nmea string received from the EM-408. By default the save_nmea parameter is disabled (save_nmea=0) to emulate the legacy configuration. Note that save_txt save_nmea, and save_binary are not exclusive and all of them can be enabled, but of course this will greatly reduce the performances of the Kinetamap. This parameter should be enabled only to collect debug data or to supply the nmea commands to tools that operate directly on the nmea strings. See http://www.sparkfun.com/datasheets/GPS/NMEA%20Reference%20Manual1.pdf for detail on the format of the GGA and RMC messages.

The nmea file is called km-nmeaXXX.dat, where XXX is a numeric identifier ranging from 000 to 250. The application will try to use 000 first; if a file with the same identifier exist the identifier is incremented until an unused identifier is found (or the maximum is reached).

6.9 accel_X, accel_T, accel_Z parameters

These parameters are used to calibrate the acceleration values, the calibration data is added to the value read from the accelerometer before the data is written to the text file, this implies that the actual range of values for the accelerometer is not -127 ..128 if the calibration values are not zero.

By default the calibration values are set to 0 (accel_X=0, accel_Y=0, accel_Z=0).

In the binary file the data is stored in the original format, however, the calibration values are added by the parseAccel tool when creating the relevant text file.

6.10 g_FSrange parameter

The g_FSrange parameter tells the LIS302DL to use the full scale (approx ± 8g range) or not (approx ± 2g range). Possible values are 0 or 1, where 1 means full scale, 0 means no full scale.

By default the g_FSrange is set to Full Scale (g_FSrange=1) to emulate the legacy configuration.

7 Data Files

7.1 g_KinetaMap file

The text file, created when the save_txt parameter is enabled, will contain a sequence of tab delimited entries like these:

```
Time                    X       Y       Z     Batt Fix Latitude  Longitude Alt HDOP Num Satell
                  -1    3       0
                  -1    3       0
                  0     3       0
22:19:54.000            0       0       0
22:19:54 (12224)        0       0       0
22:19:54 (18782)        0       0       0
22:19:54 (25342)        0       0       0
22:19:54 (31902)        -1      -1      1
22:19:54 (38460)        0       -1      -1
22:19:54 (45020)        0       0       0
```

```
22:19:54 (51580)       0       -1      -1
22:19:54 (58138)       0       0       0
22:19:54 (64698)       0       0       -1
22:19:55.000                                    1  33.78251  -111.98126 190.6    1.6     7
22:19:55 (5722)        0       0       0
```

From left to right the values are current time, X,Y, and Z acceleration samples, battery charge value, GPS Fix flag, Latitude, Longitude, Altitude, Horizontal Dilution of Precision, and Number of Satellite available to the GPS receiver.
As evident from the example above, the content of each record may vary. In that example the first three acceleration samples were collected before the Kinetmap was able to synch its hardware clock with the GPS signal and for that reason no time was reported. Once the Kinetamap clock is synchronized time will start to be reported. Note that UTC time received by the GPS satellites is reported as hh:mm:ss.nnn; usually the reception of a full nmea message and acceleration collection do not happen at the same time so GPS time is rarely associated with acceleration data. When the GPS time is not available the hardware Real Time clock is used to mark the time. The format for RTC time is hh:mm:ss (nnnnn). The RTC of the LPC2148 does not provide time with the same precision of the GPS, so the current Clock tick value is provided in parenthesis to better define when the acceleration values were collected (65536 ticks per second). Note that the RTC is synchronized with the GPS UTC only once after startup (or when in standby mode) and the higher precision provided by the GPS cannot be used to set the RTC, so in the long run the two times will drift apart. The GPS time should then be used to correctly identify the wall clock time (UTC), while the RTC data can be used to understand the approximated interval between each sample.
Acceleration are expressed as integer values in the range -127 to 128 (+/- the accel_X/Y/Z offset), corresponding to a scales of ± 2g/± 8g as described in the LIS302DL data sheet, note that the value of g_FSrange will determine the range and the accel_X, Y, and Z calibration values are added to the value read from the device.

Note that the Latitude and Longitude values are not expressed in degrees/minutes as in the nmea message but as decimal degrees where the latitude sign is negative for the southern hemisphere and the longitude sign is negative for the western one. These values can be used directly within Google Tm Maps (http://maps.google.com)to find the position on a map.
Altitude and the Horizontal Dispersion of Precision (HDOP) are expressed in meters.
Refer to http://www.sparkfun.com/datasheets/GPS/NMEA%20Reference%20Manual1.pdf for an explanation of the HDOP, altitude, and number of satellites.

7.2 g_km-nmea file

The nmea text file, created when the save_nmea parameter is enabled, will contain a sequence of entries like these:

```
$GPRMC,204655.000,A,3329.1294,N,11130.8788,W,0.11,114.67,131208,,
$GPGGA,204656.000,3339.1485,N,11130.8987,W,1,07,2.6,444.4,M,-26.2,M,,0000
$GPGGA,204657.000,3339.1482,N,11130.8989,W,1,07,2.6,441.5,M,-26.2,M,,0000
$GPGGA,204658.000,3339.1480,N,11130.8988,W,1,07,2.6,442.4,M,-26.2,M,,0000
$GPGGA,204659.000,3339.1476,N,11130.8989,W,1,07,2.6,439.8,M,-26.2,M,,0000
$GPGGA,204700.000,3339.1473,N,11130.8991,W,1,07,2.6,436.7,M,-26.2,M,,0000
$GPGGA,204701.000,3339.1471,N,11130.8992,W,1,07,2.6,434.4,M,-26.2,M,,0000
$GPGGA,204702.000,3339.1470,N,11130.8993,W,1,07,2.6,433.4,M,-26.2,M,,0000
$GPGGA,204703.000,3339.1467,N,11130.8991,W,1,06,2.7,430.5,M,-26.2,M,,0000
$GPGGA,204704.000,3339.1474,N,11130.8989,W,1,06,2.7,431.8,M,-26.2,M,,0000
$GPGGA,204705.000,3339.1477,N,11130.8990,W,1,07,2.6,432.6,M,-26.2,M,,0000
```

Where each record is separated by a newline.
Usually the first one is an RMC message used to obtain the initial date and time followed by GGA messages. Note that from time to time, the GPS receiver may generate incorrect/incomplete entries.
See http://www.sparkfun.com/datasheets/GPS/NMEA%20Reference%20Manual1.pdf for detail on the format of the GGA and RMC messages.

7.3 g_km-bin file

The binary data file, created when the save_bin parameter is enabled, will contain a fixed 4 bytes header followed by a sequence of zero or more binary data records.
The header contains the following sequence of bytes that identifies the file as a Kinetamap binary:

```
0x4b 0x4d 0x30 0x31
```

That correspond to 'K','M','0','1'.
After the header there could be zero or more instances of data records. There are seven different types of data record used to save GGA, RMA, Acceleration, and config data.
The structure of these seven data records can be easily understood from the source code and is not repeated here. See parse.cpp, generateAcell.cpp, or generateKML.cpp include din the TOOLS/ subdirectory for details.

In the TOOL/ subdirectory there are two MS Windows executables and their source files: generateAccell.exe and generateKML.exe. These two executables can be used to dump the content of the binary data saved when save_bin is enabled.

Both utilities accept as input the path to the binary data file and will dump on sysout the output.
Usage example:

```
generateKML H:\km-bin000.dat > path_000.kml
```

in this case the path_000.kml will be created in the current directory

```
generateAccell H:\km-bin000.dat > C:\tmp\accel_000.tsv
```

in this case the acceleration text file will be created in the tmp directory of the C: disk

```
generateAccell H:\km-bin000.dat > accel_000.txt
```

8 Operations

8.1 Restaring the Kinetamap

The Kinetamap restarts when the power is turned on, when the USB is disconnected, or when exiting the config menu accessed via a Bluetooth terminal connection.

8.2 Operations with Bluetooth config_menu enabled

The Kinetamap will behave differently according to the configuration read from the kineta_config.txt. If the default configuration is used (default configuration is created when the kineta_config.txt is deleted) the config_menu parameter will be enabled, so once the Kinetamap is restarted and the USB cable is not connected the green LED will be turned on for a few seconds followed by a blue LED. The green light marks the initial startup phase while the steady blue light signifies that the Kinetamap is connected (or waiting to be connected) to a Bluetooth terminal.
In this state nothing is recorded. To exit from this state you can use the Bluetooth terminal to change the configuration via Bluetooth or connect an USB cable and power cycle the device.

8.3 Operations with USB cable connected

If the USB cable is connected when the power is applied, the red LED will be turned on and the SD card will be visible as an external removable disk on your computer. The configuration file can be accessed by any ASCII text editor and modified.
In this state nothing is recorded. To exit from this state you must disconnect the USB cable.

8.4 Normal Operations mode

If the USB cable is not connected when the power is applied or when the USB cable is disconnected, and Bluetooth is disabled (config_menu=0), the green LED will be turned on for few seconds. After that the green light will start blinking. Note that the blue LED will be shortly turned on to signify that the initial GPS sync was reached. If no GPS signal is received the blue light will not turn on.
The green LED will blink whenever the Kinetmap is saving the buffered data to the SD card, the frequency is then related to how much data is being saved. If text data, nmea data, binary data are all being saved and the sampling frequency is high the LED will flash very fast; on the contrary if only binary data is being saved, the rate will decrease.
Keep in mind that sampled data is kept in a local buffer and copied to the SD card only when the buffer is full, if power is removed from the Kinetamap the content of the buffer not yet saved will be lost. The buffer is automatically flushed to the SD card whenever the USB cable is connected or the device is forced into standby mode.
When in this state the Kinetamap will be recording everything that had been enabled in the configuration file.

8.5 Standby mode

When in Normal Operation mode (see previous paragraph), the Kinetamap is listening to "Double Click" interrupts generated by LIS302DL. If you double tap with your finger on the Kinetamap enclosure, and the tap is recognized as a double click, the blue LED will be turned on and after a few seconds the blue light will start blinking. Note that in this standby mode the Kinetamp is listening to GPS messages and syncing its RTC time to the GPS. If no GPS signal can be received the Kinetamap will not start blinking.
Before entering the standby mode the previously buffered data is flushed to disk, but nothing is being recorded.
If you "Double Click" again the green LED will be turned on for a few seconds and the Kinetamap will go back to Normal Operation Mode. Going from powered off to Normal Operation mode implies that the GPS receiver will perform a cold startup while in standby mode the system is continuously syncing with GPS so a restart from this mode is faster.
Note that the accelerometer does not have any context information to understand if the tapping was a voluntary double click or an accidental sequence of bumps, so it is possible that the Kinetamap enters in standby mode when accidentally hit or when connecting the USB cable. To reduce the risk the "Double Click" configuration has been constrained as much as possible but this implies that you need to tap with the right timing, a bit if experimenting may be required.