Enigma Route and Waypoint file format

This document describes the Enigma waypoint file format. This format is also used for Enigma route files.
This file format has been created to support the Enigma series of EFIS instruments from MGL Avionics.
MGL Avionics grants any interested party the right to use this waypoint format whether this is in support of a MGL Avionics product or not.

Any party making use of this document and described file format will do so at their own discretion, responsibility and risk.

MGL Avionics places this document and the data format it describes in the public domain in order to foster the use of a common, compact waypoint and route file format that is particularly optimized for use with resource limited systems and/or systems that require fast access to individual items in the waypoint files in order to increase overall systems performance.

In order to allow recognition of the format any party adopting this format agrees to refer to this format as the “Enigma waypoint format”. All data using this format should be considered to be in the public domain and the implementer will make reasonable effort to allow any interested party to use the data.

Exceptions:
MGL Avionics reserves copyright and denies use of this data format for any military or related purpose.

Comments are welcome: info@MGLAvionics.co.za

Waypoint format

The waypoint file has a fixed name when used with an instrument, however any file name could be used. The default filename is “WAYPOINT.EWD”.

Within this file an unrestricted number of waypoint records are stored. Each waypoint record is exactly 48 bytes in size, starting at the first byte in the file. An empty waypoint file has zero records.

Each waypoint record has the following format:

Latitude:	32 bit signed integer
Longitude:	32 bit signed integer
Data field:	32 bits, contents depend on waypoint type
Waypoint type:	byte
Short name:	1 byte length of string (1..6), followed by six ASCII characters
Long name:	1 byte length of string (0..27), followed by 27 ASCII characters

Strings are stored starting with a length byte, followed by a field that is the size of the maximum number of characters that can be stored in the string. Unused characters in a string are “don't care” values.

The short name entry must have at least one character and may be up to six characters in size. This entry is used as “key” and in aviation terms would contain the short identifier of an airfield or navaid beacon. This key is used to lookup related data in other databases, for example an airport data base containing details of an airport such as frequencies and runway headings.

The long name contains a human readable description of the waypoint. For example: “Los Angeles International”. The long name is arbitrary and not used as search key for any purpose.

All integer values are stored in “little endian” format (also known as Intel style). The LSB occupies the lowest address location in the file.

Waypoint types

Defined waypoint types are currently any of the following:

0 – 'WAYPOINT' Waypoint of unspecified type

1 – 'AIRPORT' Typical assignment for medium sized airports

2 – 'MAJOR AIRPORT' Typical assignment for large and international airports

3 – 'SEAPLANE BASE'

4 – 'AIRFIELD' Typical assignment for smaller municipal airfields, glider fields etc

5 – 'PRIVATE AIRFIELD'

6 – 'ULTRALIGHT FIELD'

7 – 'INTERSECTION' (reporting point, boundary crossing)

8 – 'HELIPORT'

9 – 'TACAN'

10 – 'NDB/DME'

11 – 'NDB'

12 – 'VOR/DME'

13 – 'VORTAC'

14 – 'FAN MARKER'

15 – 'VOR'

16 – 'REP-PT'

17 – 'LFR'

18 – 'UHF-NDB'

19 – 'M-NDB'

20 – 'M-NDB/DME'

21 – 'LOM'

22 – 'LMM'

23 – 'LOC/SDF'

24 – 'MLS/ISMLS'

25 – 'OTHER NAV' Navaid not falling into any of the above types

26 – 'ALTITUDE CHANGE' Location at which altitude should be changed

Please note: If you add a waypoint type that you believe is of general interest – please let us know so we can update this document. Contact e-mail: info@MGLAvionics.co.za

Data field

The data field contains waypoint type related information.

Waypoint types 0-6,8: Field contains waypoint altitude in feet. Negative altitudes are supported. Value is a 32 bit signed integer

Waypoint type 7 does not use the data field and the contents are “don't care”

Waypoint types 9-25: Field contains frequency in steps of 1000Hz. For example a frequency or 118.00 Mhz would result in the value 118000. 32 bit unsigned integer.

Waypoint type 26: Field contains target altitude in feet. 32 bit signed integer.

Position data format

Position latitude and longitude are stored as signed 32 bit integers.

Degrees are multiples of the value 180000 and any degree fraction is a multiple of 1/180000.

Degrees North and East are positive while degrees South and West are negative.

Example: North 45 degrees, 59 minutes, 30 seconds is 8278500.

Example: North 0 degrees, 30 minutes, 0 seconds is 90000.

Route files

Route files follow the exact same format as a waypoint file. Route waypoints are stored in the file in order of their appearance in the route. A route should have at least one waypoint.

Routes are stored in filenames with the extension ".RTE", for example "MYROUTE.RTE".

Comments

The fixed length entry waypoint and route file makes it very efficient for a micro controller to access a particular entry as the location of the entry is a simple calculation. This also makes it possible to easily edit individual entries or move their position.

There is no demand that waypoints are stored in any particular order in the waypoint file. They might be sorted by short name or waypoint type but this is of little consequence.

The order of waypoints in the file matters only for route files.

It is common to create an index file containing a simple list of indexes, one to each entry in the waypoint file, sorted by a particular criteria (for example distance of the waypoint to a given location), rather than sorting the actual waypoint list itself. This is a method commonly employed by database applications.

The number of waypoint records in a file is easily determined: Simply divide the file size by 48.