

EM63 FORMATS AND COMMUNICATION PORTS

FILE FORMATS

The GEONICS EM63 metal detector records and dumps data in binary format files. These can then be translated to an ASCII format (with optional filtering) for further processing.

Format specifications are as follows.

1 EM63 Binary file and GPS.INI formats

1.1 Binary file records.

EM63 stores data in binary records, each record being either:

- * a header record beginning with the characters "EM63HDR" and partitioned as given in the C structure "hdr" below,
- * a data record beginning "EM63DAT" and partitioned as structure "dd", or
- * a GPS record beginning "EM63GPS" and containing position information, partitioned as described in section 1.4 below.

Header records appear every 100 measurements or when settings are changed
GPS records appear once per second if available.

Record length is always 160 bytes for all record types. I.e v[33] is the last 4 bytes of a data record, and header records are padded to 160 bytes.

This format is used for measurements stored in the logger file, or sent out via RS232 as they are being taken or dumped on review.

1.2 Record Structure: data & header records

```
struct hdr{char id[8]; long recn, stn, cnt, tyx;          // Header record structure
           char ln[10], stc[10], Opr[20];
           int dl, ds, fr, grf, gyn, nin, nps, trg; struct date YDM;
           char cfg[8]; int nod, nofm, kShf; float ssc;}
hdr;

union{char RecBuf[];                                  // Record buffer. Partitioned as:
      struct dd{char id[8]; long recn, stn, cnt, tyx; // Counters & clock
              float v[34];}                          // & A to D readings
      d;                                               // ( data records)
      struct hdr // or partitioned as  hdr
      h;                                               // (header records)
      }v;

short ihtyx=20, ihlin=24, ihstn=34; // Byte positions for tics, line & station labels
```

1.3 Structure members are:

id[8] - Identifies record as header or data ('EM63HDR' or 'EM63DAT').
recn - Record number within data file,
stn - Station number,
cnt - Wheel count,
tyx - Clock ticks since midnight (18.2000 ticks = 1 second),
ln[10] - Line label,
stc[10] - Station label (including non-numeric characters),
Opr[20] - Name of operator,
dl - Line step,
ds - Station step,
fr - Repetition rate (72=H, 76=L, 77=M)
grf - Grid frequency (5=50Hz, 6=60Hz),
gyn - A/d gain (doesn't change scaling),
nin - Number of measurements to average(1),
nps - Number of sets stored per sec,
YDM - Year, date, month (2 bytes=year, 1byte=day, 1byte=month)
trg - Trigger for station advance (wheel, auto, or manual),
v[1-30] - Gate measurements (mV),
v[31] - Top coil, 400-800us;
v[32] - Tx Current, Amp
v[33] - = 'MARK' if F3 or X key pressed; 'SKI?' if bad data (? = any character).

cfg[8]- Label for the current configuration,
nod - Tunoff delay number,
nofm - Turnoff time = nofm x 10us at M rate,
kShf - Gate times are shifted by kShf x 10us,
ssc - Station scale factor (adjusts distances for wheel size).

1.4 GPS records

Records beginning EM63HDR contain GPS information, partitioned as

```
char id[8]; long tyx; char GPSPos[];
```

where tyx was the clock tic reading (4 bytes) at the start of the previous measurement.

The string GPSPos[] is the response message received from the GPS (selected according to the four character message identifier and minimum length specified in file GPS63.Ini).

Eg. using an Ashtec GPS, if the POS message, beginning \$PASHR,POS...., has been selected latitude is found after the 5th comma in this string and longitude following the 7th, in the form:

```
ddmm.mmmmm,s for latitude  
dddmm.mmmmm,s for longitude,
```

where the d's gives the degrees, the m's give the minutes to 5 decimal places, and s is N S E or W.

The GPS measurement UTC time is found following the 4th comma in hours, minutes and seconds, in the form

```
hhmmss.ss
```

For the GGA message UTC follows the first comma, latitude follows the second and longitude the 4th.

If a file contains GPS measurements it will begin with the text

```
EM63HDR GPS
```

1.5 GPS63.INI

GPS monitoring is set up according to text entries in the ASCII file GPS63.INI.

A line in the file beginning with / can specify as follows

```
/Bxxxxbaud rate xxxx (eg 9600)
/Ixxxxx      an identifier for GPS messages to be recorded:
              only 4 characters are used. (E.g. $PAS... or $GPG...)
/Lxx        a minimum length xx for messages to be recorded.
```

These entries can be all on a single line or they can be on separate lines.

Any other lines in the file are sent to the GPS receiver. When the logger is started the program processes GPS63.INI and checks the serial port for a response with the specified ID. This is repeated up to 5 times if there is no response.

When logging, any GPS messages beginning with the first 4 ID characters and longer than the specified minimum length will be stored in the binary file.

Eg if the ID is set to \$GPG the logger will record both GGA and GSA messages if the length is set smaller than the GSA message length, or just GGA messages if it set longer.

You can customize the file for a particular GPS receiver as necessary. The following (file GPS63.AS1) will configure Ashtec model BR2G, and likely many others, to send the POS message.

```
/b9600 /150 /i$PASH...
$PASHS,RST
$PASHS,RTC,AUT,Y
$PASHS,NME,PER,1.0
$PASHS,NME,POS,A,ON
```

File GPS63.TR1 sets up to read the GGA message from a pre-configured Trimble AgGPS114 with

```
/b4800 /150 /i$GPG...
```

You can edit GPS.INI on the logger by typing from DOS

```
PE GPS.INI
```

2 EM63 ASCII format

For data translated to ASCII format the file consists of 256 byte records. Each record includes has one line with header information and a second line with numeric data.

Each EM63 H measurement generates one record (ie 2 lines). M measurements generate 2 records (4 lines).

2.1 Header lines

have 50 characters, including Cr/LF, structured as follows:

4chr = date (ddmm), or MARK (marked points), or SKI? (bad data - ? = any character).
5chr = line label.
6chr = station.
1chr = component (always Z).
2 blanks
3chr = mode: must read OPR, otherwise not a valid decay measurement.
5 blanks.
1chr = gate set: H = 1st 20 gates, J = gates 21 - 33.
6 blanks
7chr = wheel count.
1chr = /
7chr = time to the nearest .1 sec, in the form hhmmst.
2chr = carriage return & line feed (ASCII 13 10).

2.2 Data lines

for OPR records have 24 numeric fields 8 characters wide, a 25th field 6 wide, and end with /rrrr , where rrrr is the logger record number.

The numeric fields, v0-v24, are

v0 measurement for the the top coil

H gates:

v1 - v20 EM63 gates 1-20

J gates: (2nd record for M measurements)
v1 - v10 EM63 gates 21-30
v11 EM61 equivalent bottom gate Vb (see below)
v12 EM61 top gate (=V0)
v13 Depth

either type:

v21 Turnoff (ms)
v22 Center of v1 gate (.18 ms H record, 8.9ms J)
v23 Tx Current
v24 Tx area (20)

2.3 Other modes

If the mode field in the header line is not OPR the record is not a valid decay; eg bad records may be marked XXX, or records may contain text entries.

If mode is HDR the record contains logger header information.

If mode is GPS the data line gives a GPS response string.

2.4

The EM61 equivalent bottom gate is formed from EM63 gates 8-11 using

$$Vb = (v8 \times .782 + v9 + v10 \times 1.264 + v11 \times 1.621)/4.6667$$

COMMUNICATION PORTS

The EM63 console has two 9 pin RS232 format serial communication ports, to receive outputs from a GPS while logging, and at the same time to send measurements to an external computer to avoid problems of limited memory in the logger.

COM1 is on the right side of the console near the top. When no GPS is used the data is transmitted from this port continuously whenever the system is operating. This is also the port usually used for transferring files. When a GPS is used it plugs into COM1 and output is instead from COM2, on the top end of the console near the right side.

9 Pin D Connector Pinouts

The following pins are used for both connectors

Pin	Function
2	Receive Data (RCD)
3	Transmit Data (TXD)
5	Ground

In addition, COM1 accepts the battery charger input on Pin 1