Geophysical survey and geophysical data processing instructions

IGS.003 The navigation messages format (simplified equipment installation) and additional navigation files format provided for geophysical survey

Appendix to the Instructions (Regulations) "Geophysical Surveying"

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Contents

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02 May 2019 – Document created (Dmitriev I.V.)

20 May 2019 – Added Qinsy settings (Kozhemyakin I.I.)

28 May 2019 – Added line for DigiCourse depth controllers. Added navigation message from GPS tail buoy and seismic cluster (Dmitriev I.V.)

11 July 2020 – Check error in "Messages sent from ET4125 and ET4200 SSS (depth, altitude, heading)", add depth (ETDPT), add MKII cable counter (Dmitriev I.V.)

01 November 2020 – Add recommendation to ETDPT sign control (Kozhemyakin I.I.)

04 November 2020 – Add recommendation concerning additional messages for "Discoverer software". There are follow equipment settings ET3300HM, ET3200SX512i, ET4200 (Dmitriev I.V.)

1 Messages and data files obtained from navigation

1.1 Navigation message for GeoEel streamer (UHR/HR 48 ... 192 channels)

$GPGGA, YYYYMMDD,HHMMSS.SS,Fix,XXXXXX.XX,YYYYYYY.YY,

Head<CR><LF>
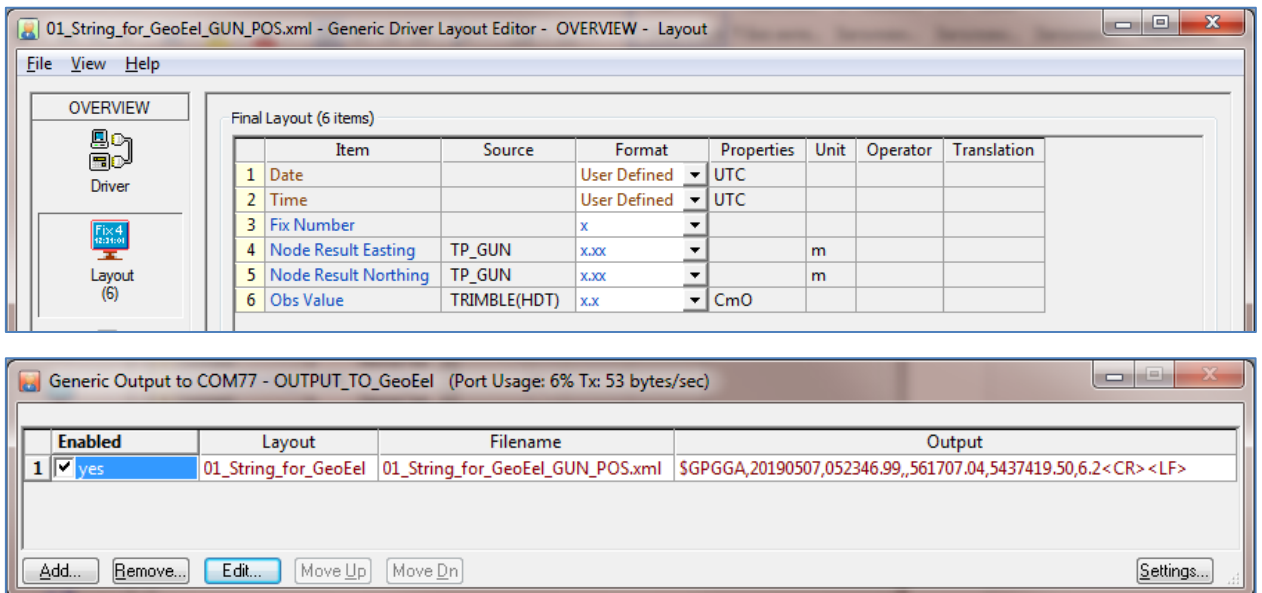
Where,

YYYYMMDD – date;

HHMMSS.SS – time;

Fix – number fix;

XXXXXX.XX – Easting;

YYYYYYY.YY – Northing;

HeadVessel – vessel's heading.

The seismic source's tow point coordinates are transmitted; fields are actually used: date, time, fix number, ship's course.

Geophysicists can requests the following additional files (exported from Qinsy):

1) Seismic cluster tow point position's file, every 1 sec:

YYYYMMDD   HHMMSS.SS   XXXXXX.XX   YYYYYYY.YY   HeadVessel

tab delimited.

2) Seismic streamer tow point position's file, every 1 sec:

YYYYMMDD   HHMMSS.SS   XXXXXX.XX   YYYYYYY.YY   HeadVessel

tab delimited.

3) Seismic cluster position file, every 1 sec:

YYYYMMDD   HHMMSS.SS   XXXXXX.XX   YYYYYYY.YY   HeadVessel

tab delimiter.

It is possible to use gLog-recorded, described in the chapter "Navigation message with GPS tail buoy and seismic cluster".

4) Seismic streamer's tail buoy position file, every 1 sec:

YYYYMMDD   HHMMSS.SS   XXXXXX.XX   YYYYYYY.YY   HeadVessel

tab delimiter.

It is possible to use gLog-recorded file, described in the chapter "Navigation message with GPS tail buoy and seismic cluster".

5) Depth files by echo sounder:

XXXXXX.XX   YYYYYYY.YY   Depth   RayNum   PingNum

tab delimiter.

6) Depth and Direction&Depth Controllers File, described in the chapter "String transmitted from DigiCourse Depth Controllers (System 3)".

1.2   Navigation message from the GPS tail buoy and seismic cluster (UHR/HR)

To obtain the position of the seismic streamer's tail buoy (or the seismic cluster), geophysicists can record messages flow using gLog software. The positioning point coordinates are given by the positioning system in the GPAVL format:

$GPAVL,R#,utc,lat,lon,ht,veast,vnorth,vup,gpstime,xecef,yecef,zecef,vxecef,vyecef,vzecef, *hh <CR><LF>

R# – Remote number (R1, R2...);

Utc – UTC milliseconds of the day;

Lat – latitude, degrees;

Lon – longitude, degrees;

Ht – Height, meters;

Veast – Velocity East;

Vnorth – Velocity North;

Vup – Velocity Up;

Gpstime – seconds of the week;

Xecef – X ECEF coordinate (earth-centered, earth-fixed coordinates);

Yecef – Y ECEF coordinate;

Zecef – Z ECEF coordinate;

Vxecef – X ECEF velocity;

Vyecef – Y ECEF velocity;

Vzecef – Z ECEF velocity.

Wherein,

R1 - the tail buoy position message;

R2 - the seismic cluster position message.

Messages example, gLog recorded:

<46871491,$GPAVL,R1,7275000.000,46.23454877,142.78622902,25.392,0.139,0.736,1.239,352888.000,-3519658.913,2672900.099,4583337.840,-0.343,0.087,1.403*36

<46871545,$GPAVL,R2,7275000.000,46.24022797,142.78706350,24.425,-0.020,-0.109,0.118,352888.000,-3519334.219,2672572.703,4583773.780,-0.116,0.113,0.009*31

<46872211,$GPAVL,R1,7276000.000,46.23456099,142.78622638,25.145,0.083,0.060,-0.527,352889.000,-3519657.872,2672899.564,4583338.602,0.274,-0.313,-0.339*31

<46872264,$GPAVL,R2,7276000.000,46.24023894,142.78705734,24.509,0.766,-0.185,0.022,352889.000,-3519333.277,2672572.584,4583774.684,-0.582,-0.520,-0.112*16

1.3 Navigation message for MultiTrace (UHR, streamer 48 channels)

$CUSTOM,YYYYMMDD,HHMMSS.SS,Fix,XXXXXX.XX,YYYYYYY.YY,

Head<CR><LF>
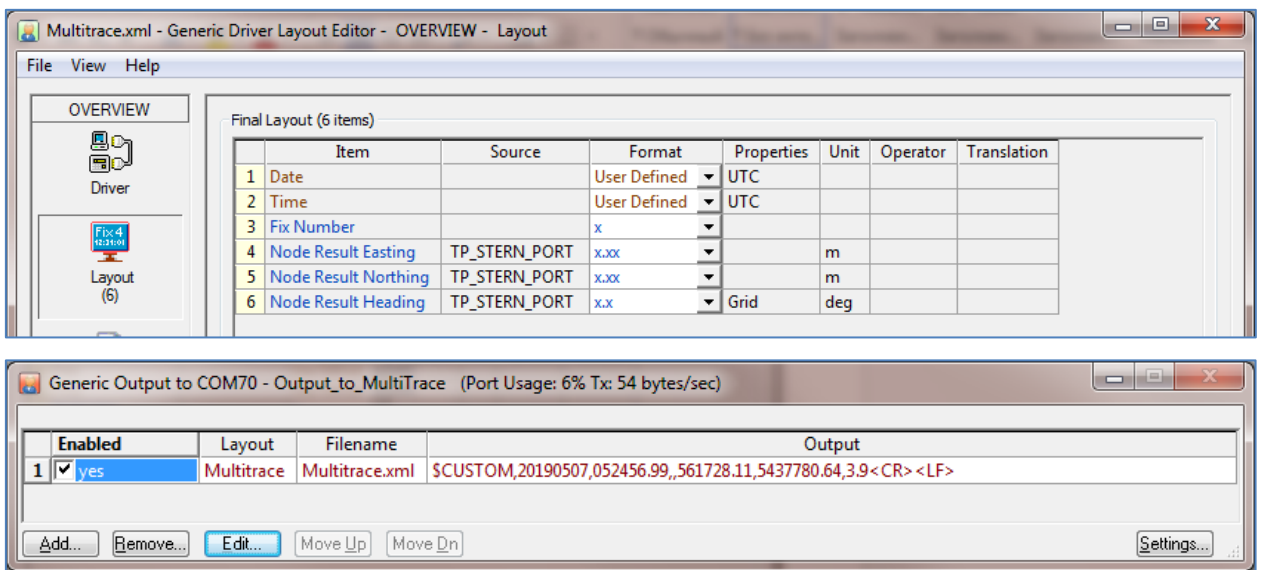
Where,

YYYYMMDD – date;

HHMMSS.SS – time;

Fix – number fix;

XXXXXX.XX – Easting;

YYYYYYY.YY – Northing;

HeadVessel – vessel's heading.

The seismic source's tow point coordinates are transmitted; fields are actually used: date, time, fix number, ship's course.

Geophysicists can requests the following additional files (exported from Qinsy):

1) Seismic source's tow point position file, every 1 sec:

YYYYMMDD   HHMMSS.SS   XXXXXX.XX   YYYYYYY.YY   HeadVessel

tab delimiter.

2) Streamer's tow point position file, every 1 sec:

YYYYMMDD   HHMMSS.SS   XXXXXX.XX   YYYYYYY.YY   HeadVessel

tab delimiter.

3) Seismic cluster position file, every 1 sec (tail buoy with PentaxG6NI equipment or the same):

YYYYMMDD   HHMMSS.SS   XXXXXX.XX   YYYYYYY.YY   HeadVessel

tab delimiter.

4) Seismic streamer's tail buoy position file, every 1 sec (tail buoy with PentaxG6NI equipment or the same):

YYYYMMDD HHMMSS.SS XXXXXX.XX YYYYYYY.YY HeadVessel

tab delimiter.

5) Depth files by MBES-rays:

XXXXXX.XX YYYYYYY.YY Depth RayNum PingNum

tab delimiter.

1.4   Navigation message for MiniTraceII (SBP: Pinger, Boomer, Sparker)

$CUSTOM,DD/MM/YYYY,HH:MM:SS,XXXXXX.XX,YYYYYYY.YY,Head<CR><LF>
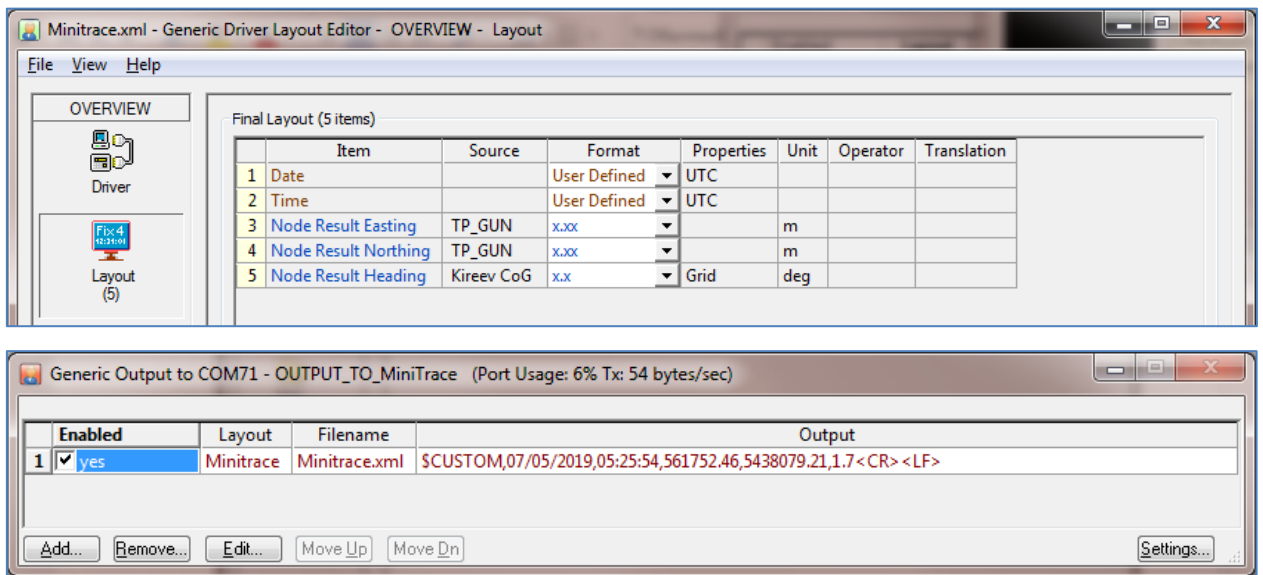
Where:

DD/MM/YYYY – date;

HH:MM:SS – time;

Fix – number fix;

XXXXXX.XX – Easting;

YYYYYYY.YY – Northing;

HeadVessel – vessel's heading.

The seismic source's tow point coordinates or seismic source coordinates are transmitted (at the geophysicist's request).

Geophysicists can requests the following additional files (exported from Qinsy):

1) Seismic source's tow point position file, every 1 sec:

YYYYMMDD   HHMMSS.SS   XXXXXX.XX   YYYYYYY.YY   HeadVessel

tab delimiter.

2) Streamer's tow point position file, every 1 sec:

YYYYMMDD   HHMMSS.SS   XXXXXX.XX   YYYYYYY.YY   HeadVessel

tab delimiter.

3) Depth files by MBES-rays:

XXXXXX.XX   YYYYYYY.YY   Depth   RayNum   PingNum

tab delimiter.

1.5   Navigation message for SES2000Compact Innomar (Parametric profiler)

$GPGGU,xxxxxxxx.x,a,yyyyyyyy.y,b,hhmmss.ss,*hh<CR><LF>
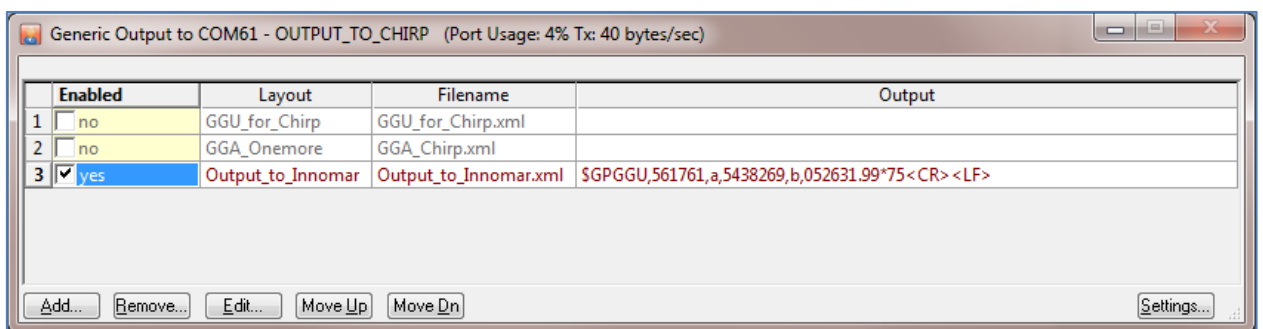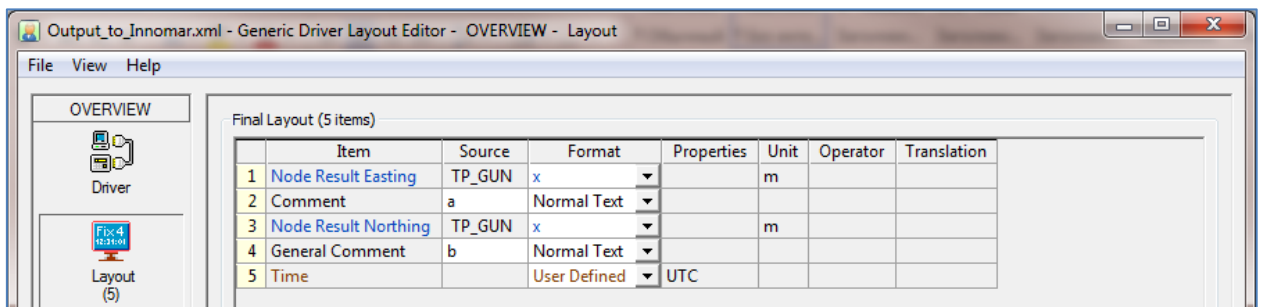
Where,

xxxxxxxx.x – Easting;

a – symbol "X";

yyyyyyyy.y – Northing;

b – symbol "Y";

hhmmss.ss – time.

The coordinates of the SES2000Compact Head attachment point are sent.

Geophysicists can requests the following additional files (exported from Qinsy):

1) Depth files by MBES-rays:

XXXXXX.XX   YYYYYYY.YY   Depth   RayNum   PingNum

tab delimiter.

1.6 Navigation message for towed ET3200SX512i, ET3200SX216S (Chirp)

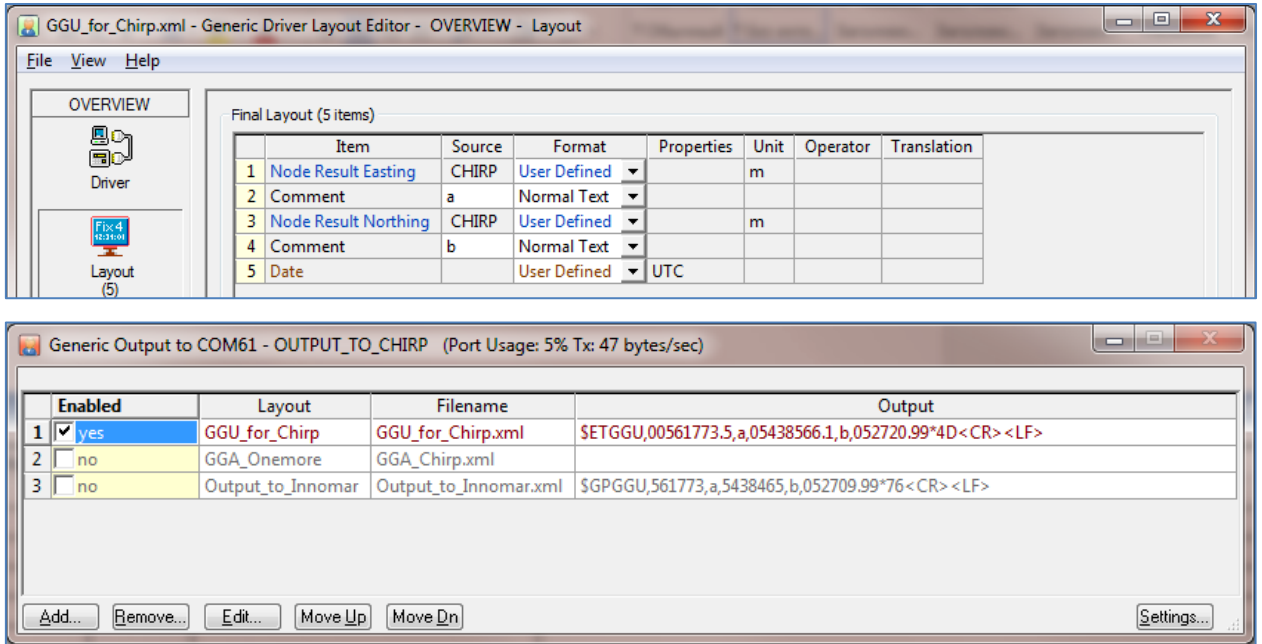### $GPGGU,xxxxxxxx.x,a,yyyyyyyy.y,b,hhmmss.ss,*hh<CR><LF>

Where

xxxxxxxx.x – Easting;

a – symbol "X";

yyyyyyyy.y – Northing;

b – symbol "Y";

HHMMSS.SS – time.

The position of the towed fish ET512i (216S) are sent. The ET512i (216S) towing point coordinates can be presented at the geophysicist request.

The on-line Discoverer software must record: "NMEA string" with towing point coordinates in $GPGGU.

Geophysicists can requests the following additional files (exported from Qinsy):

1) ET512i tow point's position file, every second:

YYYYMMDD HHMMSS.SS XXXXXX.XX YYYYYYY.YY HeadVessel

Separator – tabulation.

2) Depth files by MBES-rays:

XXXXXX.XX YYYYYYY.YY Depth RayNum PingNum

tab delimiter.

1.7　Navigation message for hull mounted ET3300HM (Chirp)

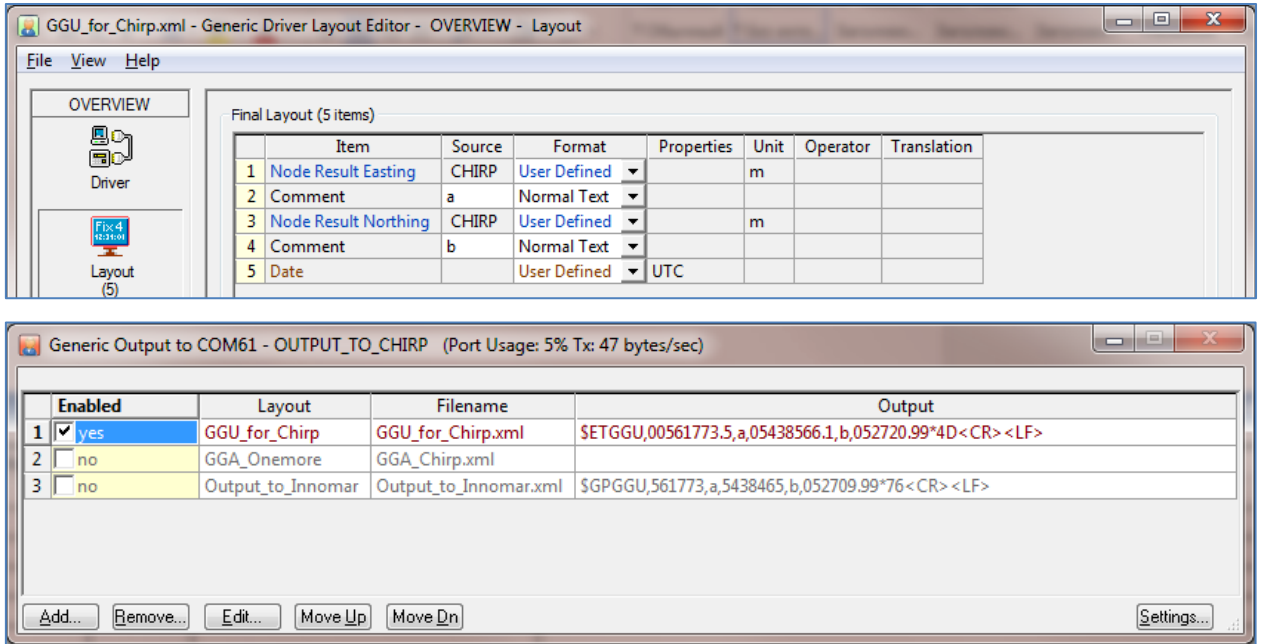$GPGGU,xxxxxxxx.x,a,yyyyyyyy.y,b,hhmmss.ss,*hh<CR><LF>

Where

xxxxxxxx.x – Easting;

a – symbol "X";

yyyyyyyy.y – Northing;

b – symbol "Y";

HHMMSS.SS – time.

The coordinates of the ET3300HM Head are sent.

The on-line Discoverer software must record: "NMEA string" with raw MRU messages in TSS1 format. The TSS1 flow must be encapsulated to ET3300HM "sonar.exe" software data flows. The follow settings must take place:

1) The serial port (number 3, for example) connected to TSS1-string source.

2) The SonarSerial.ini contained follow strings:

=========================

[Serial1]

Create=1

Port=3

Parser=4

Baud=38400

ReadIntervalTimeout=20

ReadTotalTimeout=2000

========================

Where:

Serial1 – is the virtual dataflow number;

Port – is the physical port connected to TSS1-string source;

Parser=4 – the flag "TSS1 string input";

Baud – TSS1 message baud rate.

Additional settings described in "SonarSerial.Txt" file.

Geophysicists can requests the following additional files (exported from Qinsy):

1) Depth files by MBES-rays:

XXXXXX.XX   YYYYYYY.YY   Depth   RayNum   PingNum

tab delimiter.

1.8 Navigation message for G-882 magnetometer

$GPGGA,hhmmss.ss,llll.ll,a,yyyyy.yy,a,q,nn,d.d,a.a,M,g.g,M,e.e,rrrr,*hh<CR><LF>

where

llll.ll – Latitude;

a – Character label for N/S or E/W;

yyyy.yy – Longitude;

q – Quality indicator;
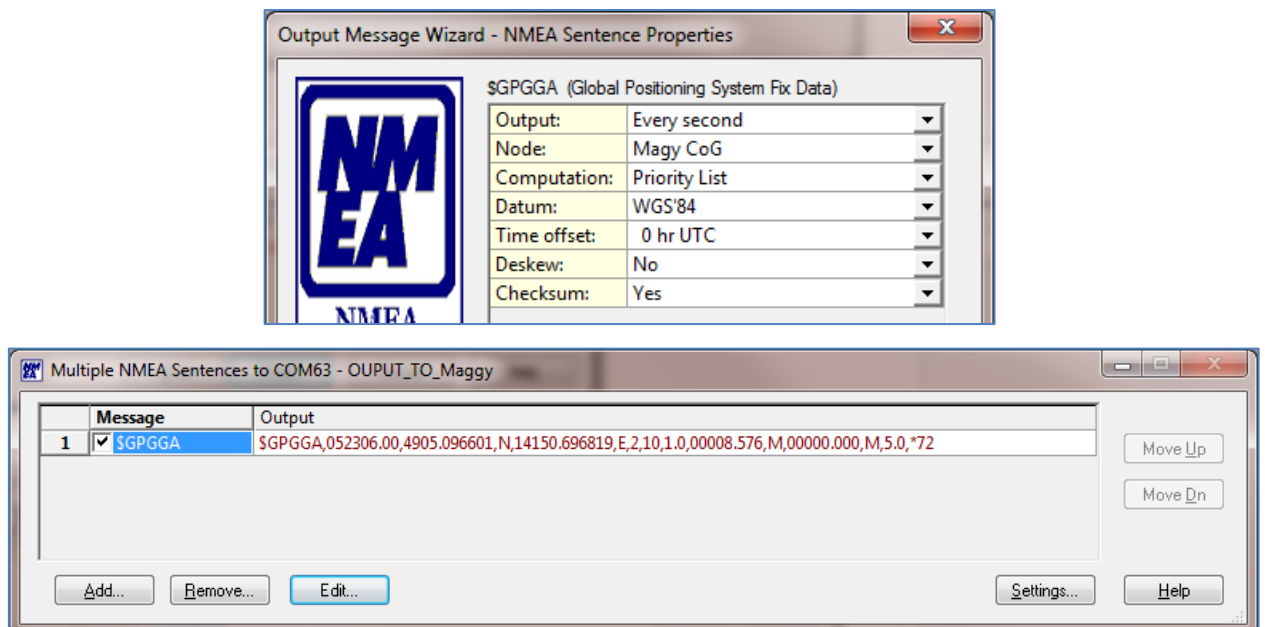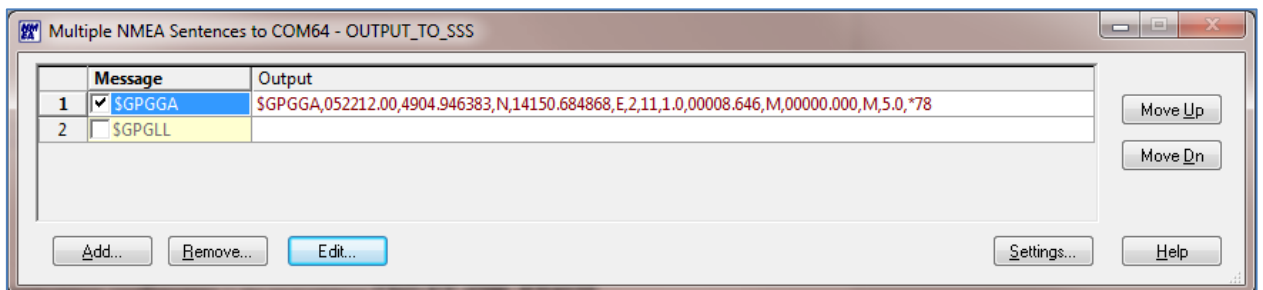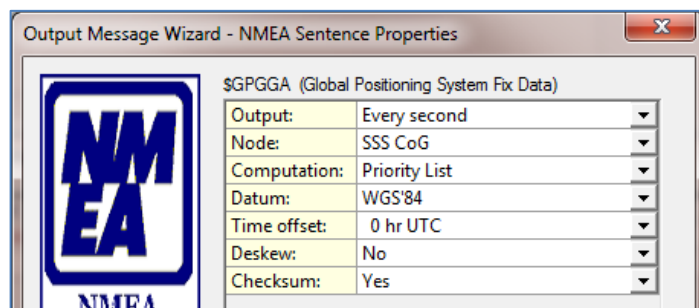
nn – Number of satellites in use;

d.d – Horizontal dilution;

a.a – Altitude;

g.g – Geoidal separation (meters);

e.e – Age of differential data;

rrrr – Reference Station ID.

The coordinates of the towed fish G-882 are sent in navigation message. At the request of geophysics, the coordinates of the towing point G-882 can be presented.

Geophysicists can requests the following additional files (exported from Qinsy):

1) Magnetometer's tow point position file, every second:

YYYYMMDD   HHMMSS.SS   XXXXXX.XX   YYYYYYY.YY   HeadVessel

Separator – tabulation.

2) Depth files by MBES-rays:

XXXXXX.XX   YYYYYYY.YY   Depth   RayNum   PingNum

tab delimiter.

1.9   Navigation message for ET4200, ET4125 (SSS)

$GPGGA,hhmmss.ss,llll.ll,a,yyyyy.yy,a,q,nn,d.d,a.a,M,g.g,M,e.e,rrrr,*hh\<CR\>\<LF\>

llll.ll – Latitude;

a – Character label for N/S or E/W;

yyyyy.yy – Longitude;

q – Quality indicator;

nn – Number of satellites in use;

d.d – Horizontal dilution;

a.a – Altitude;

g.g – Geoidal separation (meters);

e.e – Age of differential data;

rrrr – Reference Station ID.

The coordinates of the towed fish are sent in navigation message. At the request of geophysics, the towing point coordinates can be presented.

The on-line Discoverer software must record:

1) "NMEA string" with raw cable counter's messages in CableCounter's format;

2) "NMEA string" with towpoint messages in $GPGGA and $GPHDG messages with vessel's heading;

3) "NMEA string" with raw USBL-position data or Qinsy-translated USBL-position data (Z must measure by USBL, not other sensors).

Geophysicists can requests the following additional files (exported from Qinsy):

1) SSS tow point's position file, every second:

YYYYMMDD   HHMMSS.SS   XXXXXX.XX   YYYYYYY.YY   HeadVessel

tab delimiter.

2) Depth files by MBES-rays:

XXXXXX.XX   YYYYYYY.YY   Depth   RayNum   PingNum

tab delimiter.

2   Messages passed to the navigation

2.1   Messages sent from C-Max cable-counter

The messages transmitted to the com port from the C-Max Counting Pulley software (menu Pulley => Relay Count). Message transmitted after cable counter rotation and the evidence "new cable length value".

+ZZZZm<CR>

Message Format: C-Max

Sign	4th digit	3rd digit	2nd digit	1st digit	Unit	EOL
+ or -	0..9	0..9	0..9	0..9	"m"	
+	0	0	0	8	m	0x0D

1:+ZZZZm\<CR\>\<LF\>

Message Format: T count

Prefix	Prefix	Sign	4th digit	3rd digit	2nd digit	1st digit	Unit	EOL	EOL
1	:	+ or -	0..9	0..9	0..9	0..9	"m"	0x0D	0x0A
1	:	+	0	0	0	8	m	0x0D	0x0A

Geophysicists can requests the following additional files (exported from Qinsy):

1) File with cable-counter values (cable length), every second:
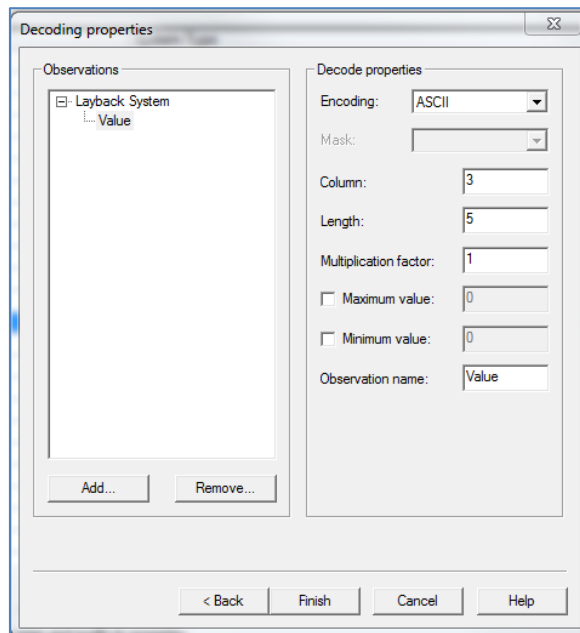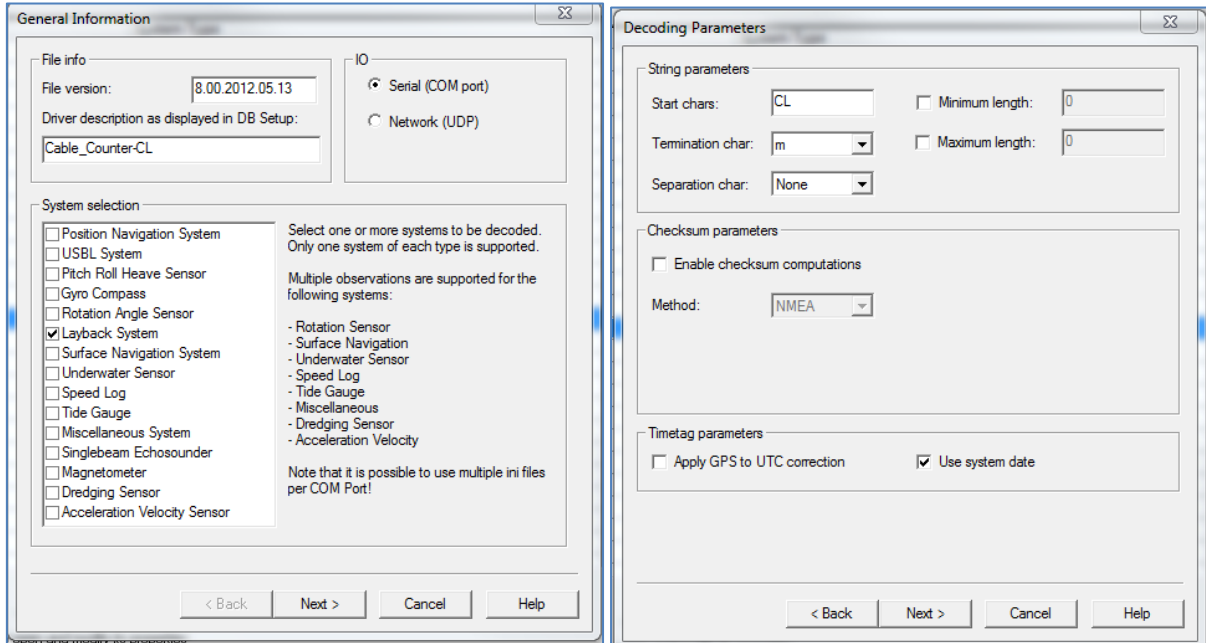
YYYYMMDD   HHMMSS.SS   LLLL

tab delimiter.

2.2   Messages sent from the HY-Tek cable-counter

Messages transmitted from the cable-counter's output, every second.

CL+ZZZZm<CR>

where ZZZZ – cable length (m). Example: CL+0003m

Geophysicists can requests the following additional files (exported from Qinsy):

1) Cable-counter measurements file (cable length), every second:

YYYYMMDD   HHMMSS.SS   LLLL

tab delimiter.

2.3　Messages sent from the MKII cable-counter

Messages transmitted from the cable-counter's output, every second. There can be default or user-defined formats. There can be from 0 to 3 decimal digits. The message example for 1 digit in the default format:

L=6.9m　<LF>

S=0.0m/m <LF>

3 digit in the default format:

L=6.950m <LF>

S=0.0m/m <LF>

A number of spaces are presented in the end of string to string length 10+<0D>. The last symbol is 0DxHH.

L=XXX.XXXm<spaces><LF>

S=YYY.YYYm/m<spaces><LF>

where

X.X – cable length (m), includes from 0 to 3 decimal digits;

Y.Y – cable speed (m/m), includes from 0 to 3 decimal digits;
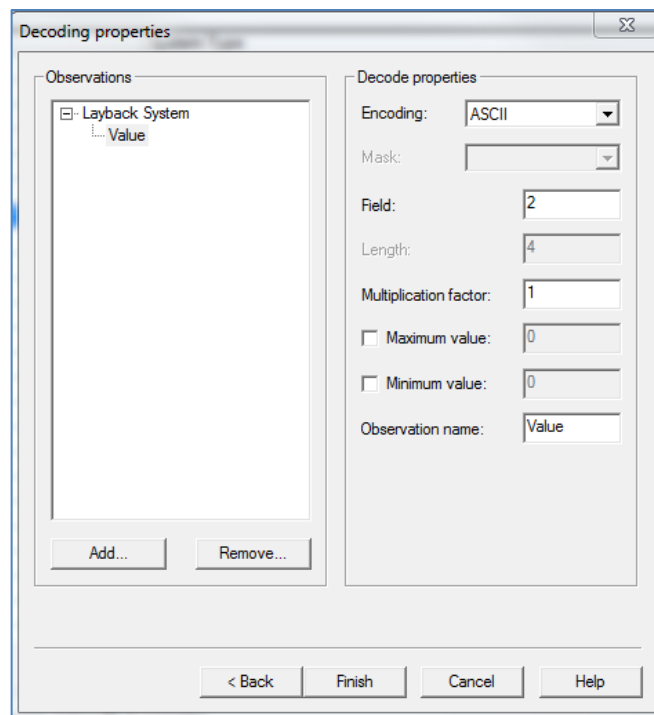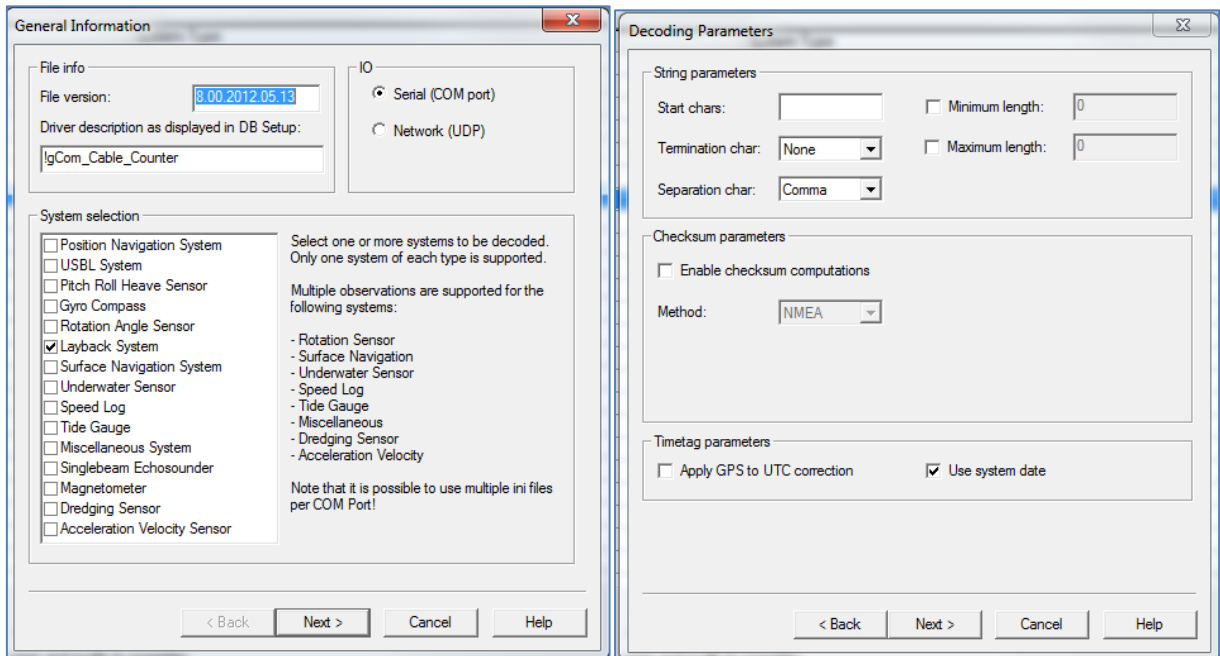
<spaces> – a number of spaces.

2.4   Message sent from gComCC, cable-counter software emulator

Messages transmitted via the com-port from the gComCC software. New message will sent, if press "+" or "-" on the keyboard.

$$+ZZZZm<CR>$$

where ZZZZ – cable length (m). Example: +0003m

**Geophysicists can requests the following additional files (exported from Qinsy):**

1) Cable-counter's measurement file (cable length), every second:

YYYYMMDD   HHMMSS.SS   LLLL

tab delimiter.

2.5 Messages sent from ET4125 and ET4200 SSS (depth, altitude, heading)

Messages sent to com-port from the Discover software, period is 1 second. To start, the follow checkboxes must be set: Configuration >> Navigation >> Outputs menu.
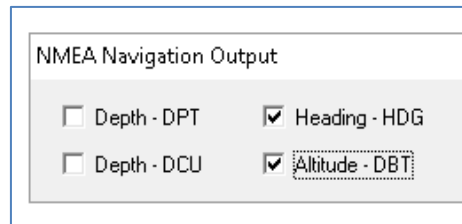
All messages are sent to single port. The output port must be defined in the DiscoverLast.Jni configuration file:

[OUTPUTSERIAL0]

port=5

baud=9600

parity=2

dataBits=8

interval=100

Altitude-message from the bottom tracker (software):
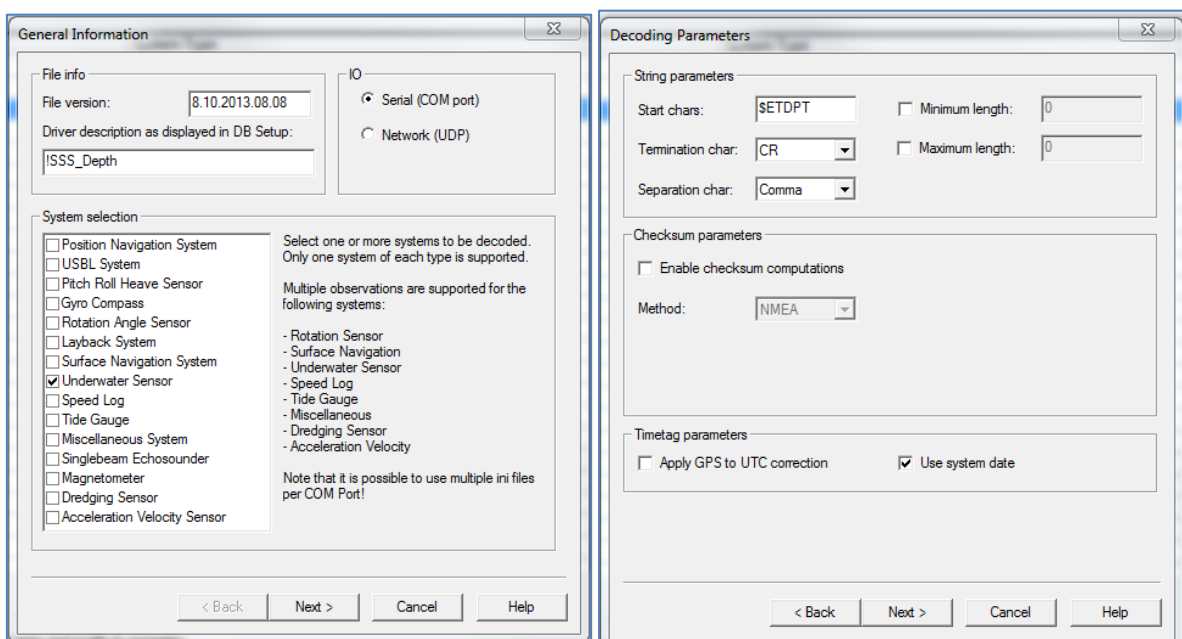
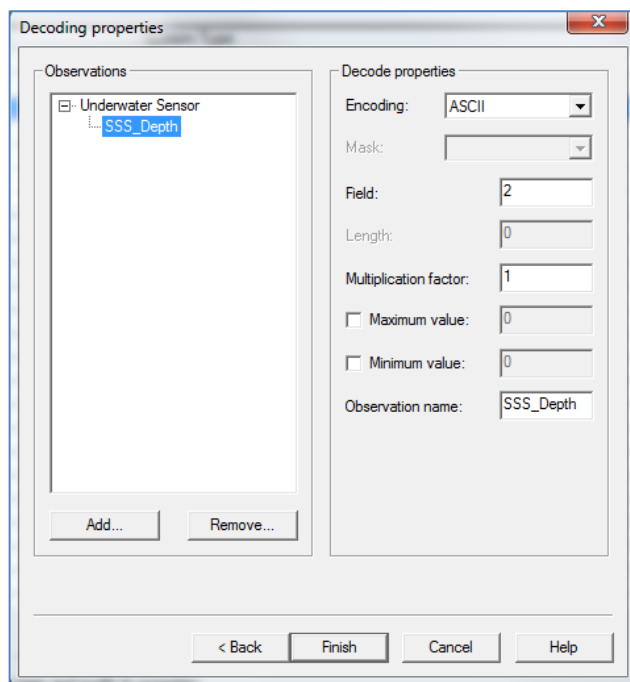$$\textbf{\$ETDBT,x.x,f,x.x,M,x.x,F*hh<CR><LF>}$$

where

x.x,f – altitude (f);

x.x,M – altitude water (m);

x.x,F – altitude water (fathon) (= 6 f, или 182 qt).

Example: $ETDBT,13.2,f,4.0,M,2.2,F*34

Heading-message from the magnetic compass (Hall effect sensor):
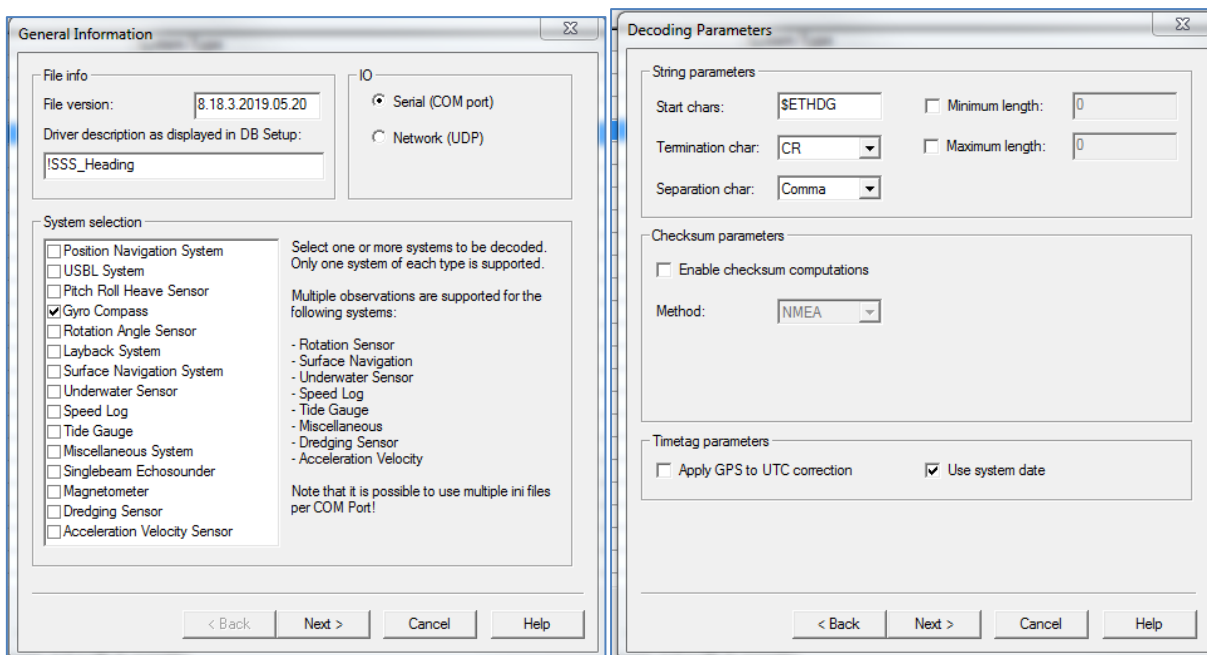
$ETHDG,x.x,y.y,a,z.z,a*hh<CR><LF>

where

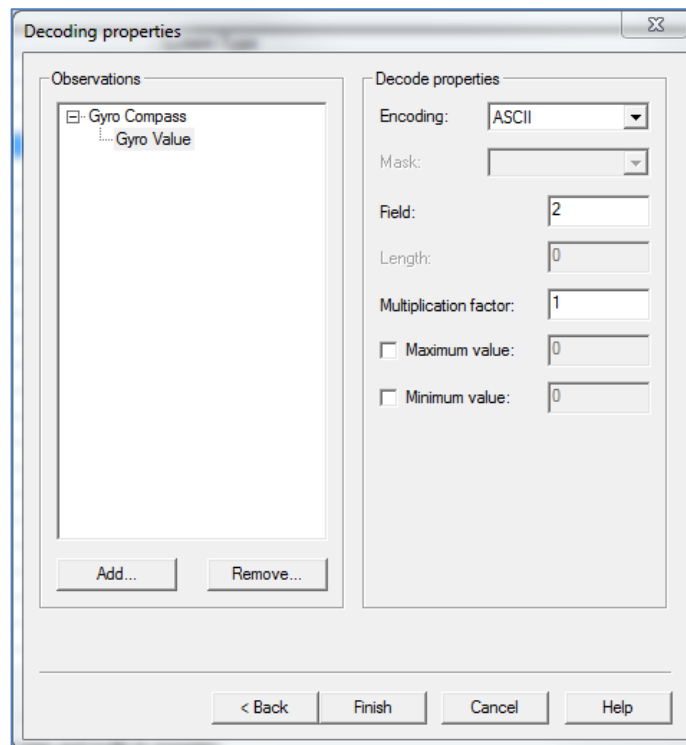x.x − heading on a magnetic sensor, degrees;

y.y − value of magnetic deviation, degrees E/W;

z.z − value of magnetic variation, degrees E/W;

a − the eastern declination (E) added to the magnetic course, the western declination (W) subtracted from the magnetic course; for unknown values, the fields kept empty.

Example: $ETHDG,1.89,,,,*68<CR><LF>

Depth-message from the pressure sensor or USBL:

$ETDPT,x.x,y.y,z.z*hh<CR><LF>

where

x.x – water depth relative to the transducer, (m);

y.y – offset from transducer (*,**), (m);

z.z – maximum range scale in use.

Example: $ETDPT,

* "positive" = distance from transducer to water-line, "-" = distance from transducer to keel

** For IEC applications the offset shall always be applied so as to provide depth relative to the keel.

NMEA description: Water depth relative to the transducer and offset of the measuring transducer. Positive offset numbers provide the distance from the transducer to the waterline. Negative offset numbers provide the distance from the transducer to the part of the keel of interest.

WARNING! If we use Depth for towfish position calculation, it can be used with minus sign in the Qinsy (depend form driver type).

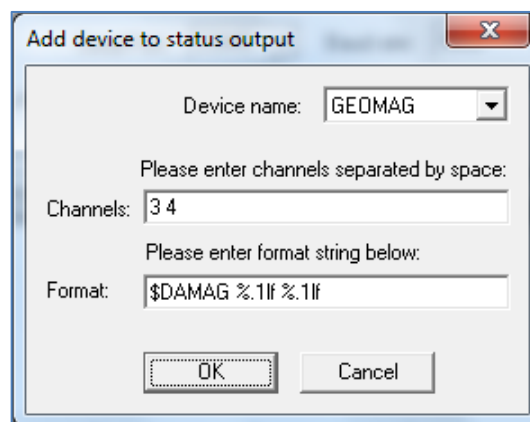## 2.6   Message sent from the G-882 magnetometer (fish's depth and altitude)

Messages are transmitted through a com-port from the MagLog software with the specified period. To start, the follow checkboxes must be set: Output menu. Devises>>Status.
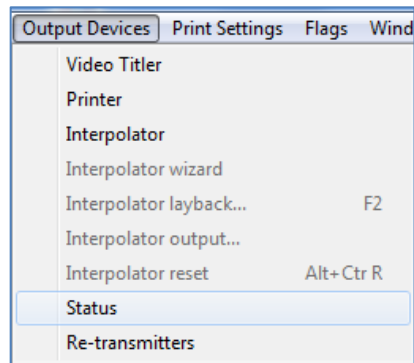
The required settings are shown below.:
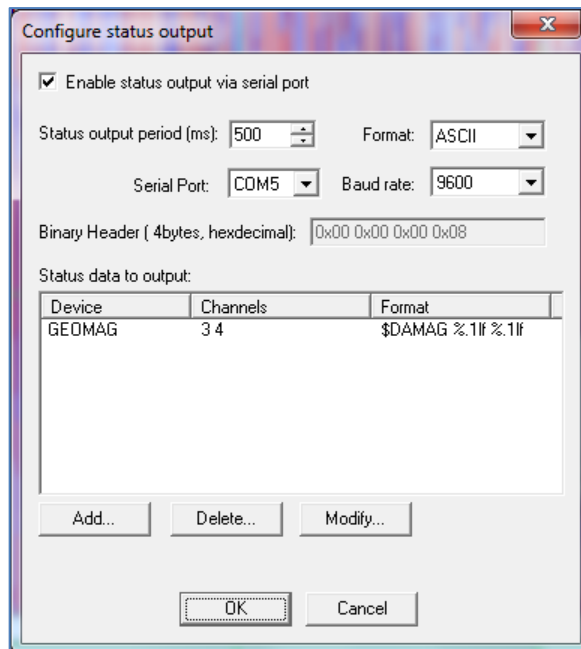
According to the settings in the figure, the messages' period is set to 500 milliseconds.

According to the settings shown in the figure, the data from third (depth) and fourth (altitude) channels are sent to the output. Message prefix – $ DAMAG.

The message's format:
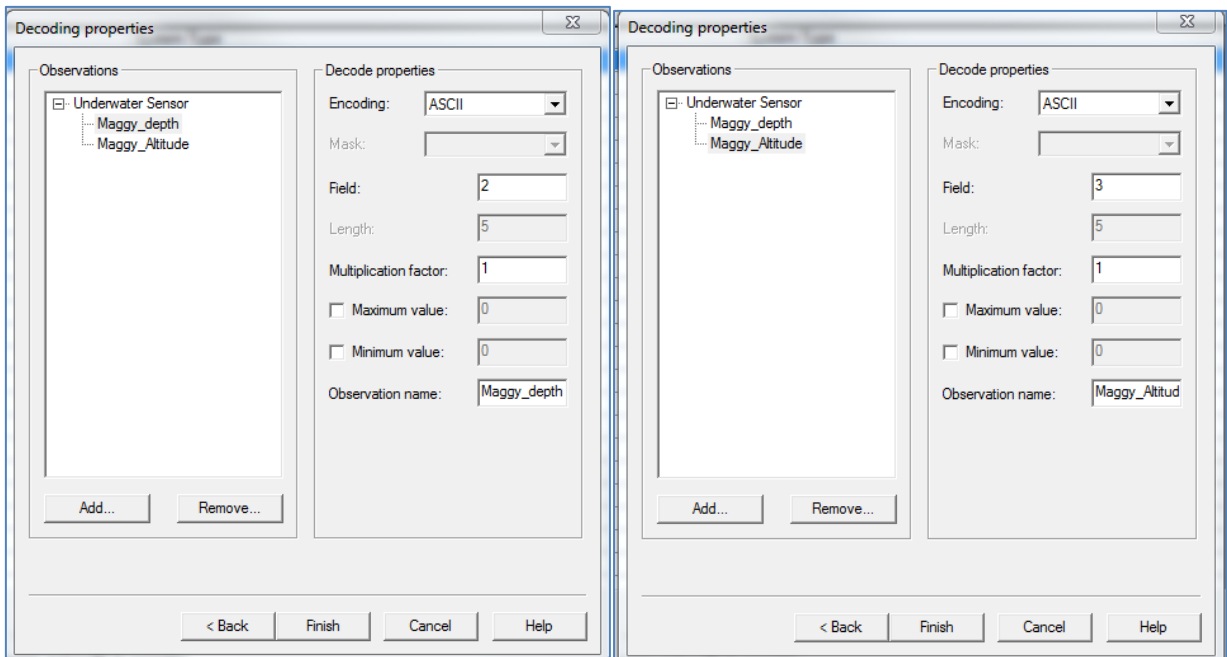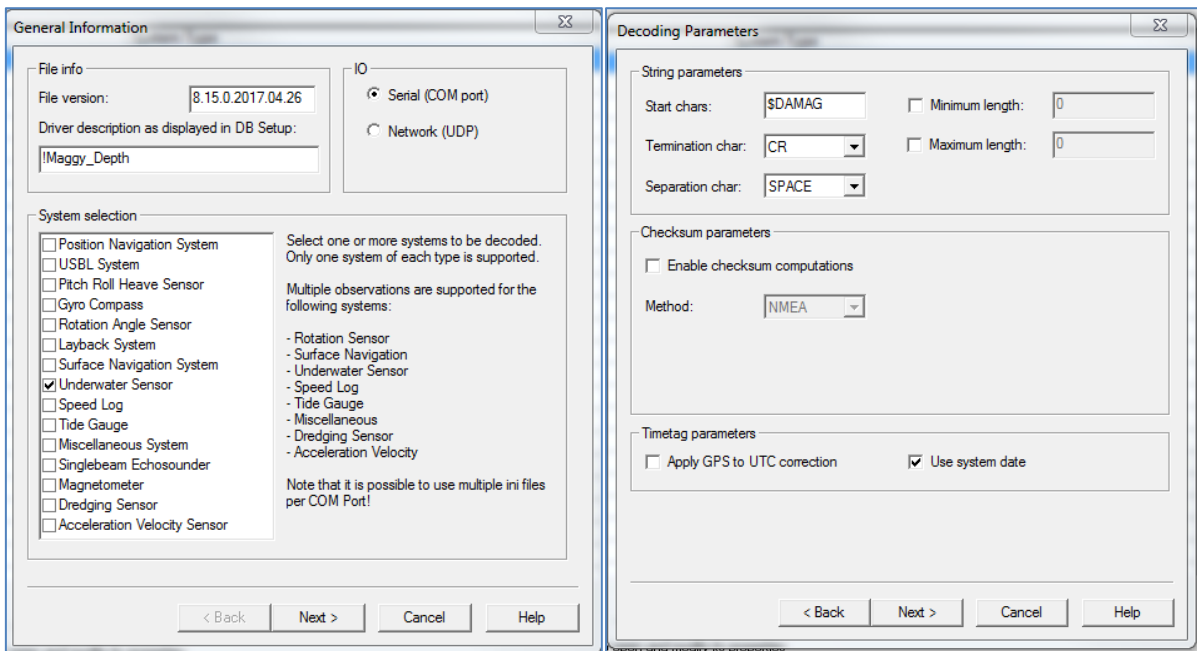
$DAMAG Depth Alt Num 1<CR><LF>

Where

Depth – the depth of the towed magnetometer;

Alt – the height of the magnetometer above the bottom;

Num – the number of measurements for which the current averaged depth and altitude were calculated (with a measurement period of 0.1 seconds, for the averaging interval of 500 milliseconds is 5 measurements).

Example: $ DAMAG -0.6 -0.2 5 1

2.7   Messages sent from DigiCourse Depth Controllers (System 3 controllers)

Messages are transmitted through a com-port from DMU block (com2; initialized Sys3wOI software) with a specified period (the Output string configured in ASCII in the "Host settings").

Messages example:

19:15:010625805C091700C081717C061805C042137C0226380010BT10022300342116BT0903
9600862039BT08042601972000BT07043201312000BT06042601852077BT05043802112039B
T04042601511884BT03046700822039BT02052401512039BT01047600862077
19:15:080625905C091695C081716C061799C042119C0228690010BT10018500342077BT0903
6000862039BT08041702052000BT07043801312000BT06042301852077BT05044602112039B
T04042601511884BT03047000822039BT02051501512039BT01047300862077

Format string description:

19:15:01	Time Not from a computer clock or UTC, possibly from a LIU or DMU.
06258	Message number
05	The number of "compass" birds (data labeled "C")
Cnnxxxx C091700 C081717 C061805 C042137 C022638	"C" or "c" - label meaning "course." Lower case letters mean that the connection with the bird is lost and the last measurement state is transmitted in the string. nn – the current bird number. xxxx – course, the value should be divided by 10 (xxx.x in degrees). The "compass" birds' coding method was presented.
00	Not clarified. No change in value. .
10	The number of "deep" birds (data labeled "BT")
BTnnddddaaaatttt BT10022300342116 BT09039600862039 BT08042601972000 BT07043201312000 BT06042601852077 BT05043802112039 BT04042601511884 BT03046700822039 BT02052401512039 BT01047600862077	"BT" or "bt" – label meaning "depth." Lower case letters mean that the connection with the bird is lost and the last measurement state is transmitted in the string. nn – the current bird number; dddd - depth, it is necessary to divide the value by 100 (dd.dd in meters). aaaa – the angle of wings attack; the value must be divide by 10 and subtract 18.5 (-15 angle = 0035; angle 0 = 0185; angle 15 = 0335). tttt – the temperature, the value must be divide by 100 and subtract 20 (temperature -5.22 = 1478; temperature 0 = 2000; temperature 10.34 = 3034). The tttt step is 38 or 39 units. The "depth" birds' coding method was presented.
0Dh	Messages delimiter.