User manual

Emit Time Station

ETS 2

This user's guide describes the use of *Emit Time Station ETS2*, which is used to register *emiTags*.

The user's guide firstly describes the ETS2's various functions and then explains how the enclosed extra equipment is to be connected and used.

Furthermore we take a look at the ETS2's menu system and go through the menu choices. In the menu you may set the clock, the station's code, the display's appearance, the protocol, the range of the signal, etc. We also discuss how to use the menu system for troubleshooting and explain recommended procedures when problems occur.

To process data from the ETS2 and to generate the result lists you need a PC program which is compatible with emiTag/ETS2.

All available circuit diagrams, illustrations and specifications of extra equipment are included in the "Emitag - koblingsskjema" manual. Not all of them are equally relevant, but we prefer to include too much rather than to omit information that may be of interest for some. Spare parts and extra equipment are marked with Elfa's supply numbers and may be ordered directly from Elfa (our supplier) if you wish to install the parts yourself. Some of the supply numbers from Elfa may however be outdated. The safest option is to buy the parts directly from Emit, installed and ready for use.

The last part of the manual explains how to update the firmware in the ETS2 using the 'eUpdate' program from Emit, and ETS2's technical specifications are displayed on the last page.

We have chosen to mark 'input' (connection ports) with green, 'light emitting diodes' with blue and 'key text' with red to make it easier to distinguish between the different functions.

ETS2 4G is the first transponder-decoder that is FIS-approved for use in all FIS-sports, and for all levels. In order to be FIS-approved a printer has been added. In addition the hardware has been revised and fine-tuned to live up to FIS's requirements on resolution, accuracy and drifting. This includes a precision of up to 31 uS1/1000000 seconds on the printout, if the 'Start/Sync' or 'Finish' inputs are used.

The ETS2 replaces the traditional clock and registers the time when the emiTags pass the eLine loop, internal or external. The start-time and/or finish-time can also be registered using an external start gate and/or photo cells. This enables a timing resolution up to 31 uS accuracy (31/1000000).

The competitor's tag ID and time are transmitted from the emiTags and back to the ETS2 via an internal radio antenna. The data is saved locally before it is transferred to a PC via USB, RS-232, RS-485 or GPRS.

The ETS2 and the emiTags may be used for timing in various sports, including cross country skiing, biathlon, orienteering, ski orienteering, cycling (road racing, time trials, off road, track cycling), running, triathlon, etc.

You may control the ETS2 from a computer or with the built-in keyboard, with six variable menu keys and a numeric keyboard. The ETS2 has five LEDs (light emitting diodes) and a graphic display which shows current information. The LEDs change colour depending on the status of the event it is connected to.

You may use the ETS2 with the internal eLine loop or with up to two external eLine loops. It is also possible to use Emit's 'StandUp Loop', if you prefer to have a loop on the side of the course/track. The accuracy is better when you use two eLine loops (approxiimately 1/100 second depending on the speed). When you use one eLine loop the accuracy is about 1/10 second. Note that the range of the internal eLine loop only is three metres.

Equipment included:

The ETS2 is delivered with the following equipment included:

- Two eLine loops. The loops covers a twelve meters wide track.
- 220 V power cable
- USB cable
- This user's guide

The ETS2 has several ports for connecting external equipment on top of the unit, under the lid. These include (from the left to the right seen from the front):

- **'GPRS'**   - For connecting external GPRS antenna
- **'Finish'**   - Double banana plugs for connecting a photo cell
- **'Start/synk.'**   - Double banana plugs for connecting a start gate
- **'RS-232'**   - RS-232 (serial) port to PC
- **'USB'** -   - USB port to PC
- **'RS-485'**   - For transferring data via RS-485
- **'Loop 1'**   - For connecting external eLine loop 1
- **'Loop 2'**   - For possible connecting of external eLine loop 2
- **'Antenna'**   - For connecting an external radio antenna
- **'110-230V'**   - For connecting a 220V power cable

Charging the built-in batteries:

The ESD1 has eight built-in rechargeable batteries 9Ah NiMH. You charge the batteries by connecting the included power cable. Make sure that the charging switch is set on 'ON'. When the charger is connected, the LED marked 'Charge' will be lit. Charge the ETS2 until the LED turns green. The process usually takes about eight hours if the batteries were flat when you started. If you want top charged batteries, you may continue the charging for 1 or 2 hours more. The batteries will not be damaged by being connected to the charger for a longer period of time.
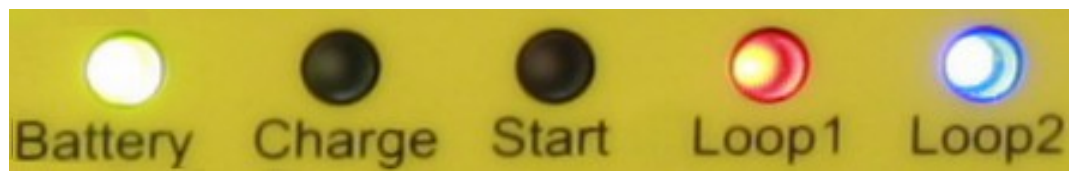
The LED marked 'Battery' indicates the remaining battery capacity. A red light indicates a battery capacity of less than 30%. An orange light indicates a battery capacity of 30--60%. A yellow light indicates 60-90% capacity, and a green light indicates that the battery capacity is more than 90%.

Surroundings
The ETS2 is not waterproof, so make sure that no water seeps into the connection ports on top of the unit. You may use the ETS2 in temperatures as low as -20 °C, and the unit may be placed outside in rain and snow - as long as the lid is locked.

CONNECTIONS

The radio antenna
If you wish to use an external radio antenna, it should be connected to the port marked 'Antenna' You do not need an external antenna as long as the ETS2 is placed no more than five meters from the track, but it may be wise to use an external radio antenna if the distance is longer than this. If that is the case we recommend to use a *Yagi-antenna*, which is sold separately. The Yagi-antenna should be mounted 5-10 meters after the finish-line, and be pointing towards the finish line.

External eLine loops
You should use an external eLine loop if the track is wider than 3 metres or if the competitors pass more than 3 metres from the ETS2. Mill off a track for the loops with a chain saw or some other suitable tool if the loops are to be placed in the snow. If the surface is asphalt or other solid ground, the loops must be taped and secured under mats suitable for the purpose. Make sure that the loops are stable and lie safely, so that they do not disconnect and cause damage!

Place the loop in the track and run the cable to the ETS2. The eLine loop cable has a black plug and is to be connected to the 'LOOP 1' port on the ETS2. When you use two eLine loops you must remember that the blue loop ALWAYS must be placed in front, while the grey loop ALWAYS must be placed at the back. The grey eLine loop's cable has a colourless plug and is to be connected to the port 'LOOP 2' on the ETS2.
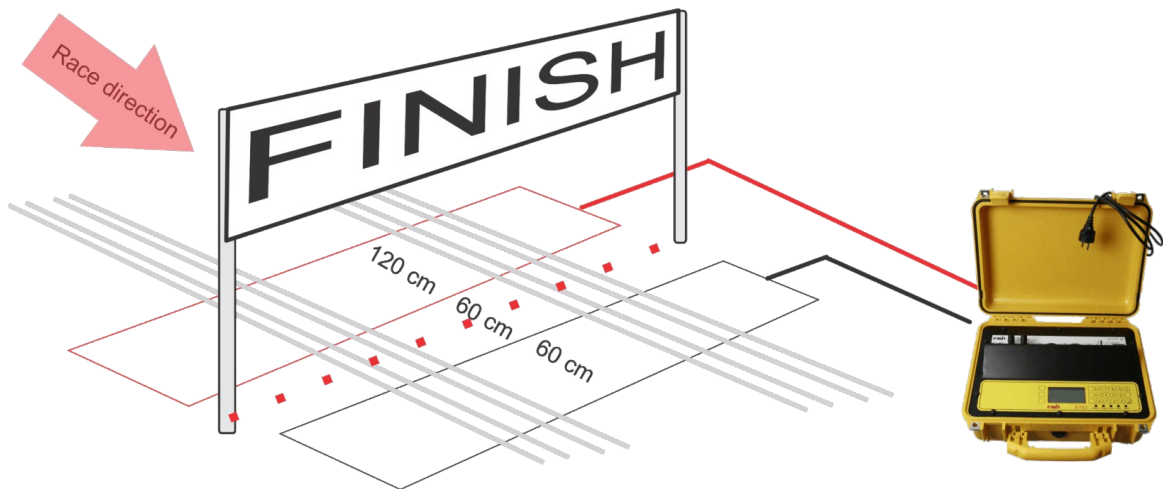
Signal 'contagion'
Note that the wireless signals from the eLine loops may have a range of several meters. It is recommended to establish a 'security zone' of about 3 - 5 meters on both sides of the loops, and about 5 meters parallel to the race direction, to avoid errors with wrongly registered competitors passing in another track.

eLine loops for cycling races
In cycling and other sports where the competitors pass the finishing line in high speed, you must increase the distance between the loop's wires from 120 cm to 200 cm at the finish.

The LED's marked 'LOOP 1' and 'LOOP 2' are green when the eLine loop is connected and functioning. A red light indicates that the eLine loop is

disconnected or not functioning. An orange light indicates that the eLine loop was disconnected when the power was switched on, or that the connection has been broken, but is now OK. A blue light indicates that no connected antenna is needed. This may be the case when you wish to use the ETS2 with only one eLine loop. In such cases you connect the eLine loop to 'LOOP 1', and the 'LOOP 2' LED will be blue.
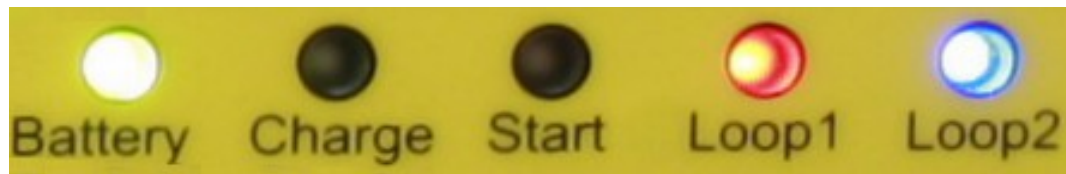
Connecting ETS2 to a PC using USB

Connect the ETS2 to a PC with the enclosed USB cable. The ETS2 and the PC should be switched on before connecting them to the USB cable. Connect the cable to the port marked 'USB' on the ETS2. Connect the other end of the cable to an available USB port on the PC.

The first time you connect the ETS2 to a PC with an USB cable, you might have to install two drivers; 'USB Serial Converter' and 'USB Serial Port'. Normally this is done automatically, depending on the PC's operating system.

A virtual com-port is installed and appears in the Windows control panel, when you connect external USB-equipment. When the equipment is disconnected (or shut off), this com port will not be shown in the control panel. The com port will often be shown as 'com3' or 'com4', depending on how mange com ports that already are installed in the PC. If you wish to keep the same com port number every time, you must connect the ETS2 to the same USB port every time.

Using the RS-485 port

Data may be transmitted long distances from the ETS2 by using the RS-485 port. When you use this port the cables may be several hundred meters long, but you have to convert the signal to RS-232 or USB in the other end of the cable. We have chosen converters from Moxa Inc. for this use, because they are among the best and the most stable converters one can get. We mostly supply Moxa Uport 1450I (4 ports, isolation protection), but we can also provide Uports with 1, 2 and 8 ports. We do not recommend serial converters that doesn't have isolation protection, even if they are much cheaper.

Using photo cells

When using photo cell(s) at the finish you must connect to the double banana plug marked 'FINISH'. When the ETS2 is connected to photo cell(s), it will use the photo cell as finish time and match this time to the correct tag number.

Using a start gate

When a start gate is used to register start times, the start gate must be connected to the input marked 'START/SYNC'.

Synchronising several ETS2

Several ETS2 can be synchronized using the 'START/SYNC'-input, by short-circuiting this contact (with a switch or a short cable). All of the ETS2's to be synchronized must be connected to the same cable AND they must all be in the 'Set Clock'-mode. Use the numeric keys to set a valid time between 00:00:00 and 23:59:59 (on all ETS2's to be synchronized). Start the clock simultaneously on all the ETS2's by short-circuiting the cable connected to the 'START/SYNC'-inputs.

To check that all ETS2's have been synchronized correctly, short-circuit the cable once more and check that the time registered is identical on all ETS2s. The time is printed and shown on the display:

```
F0-1 09:00:13.954672
```
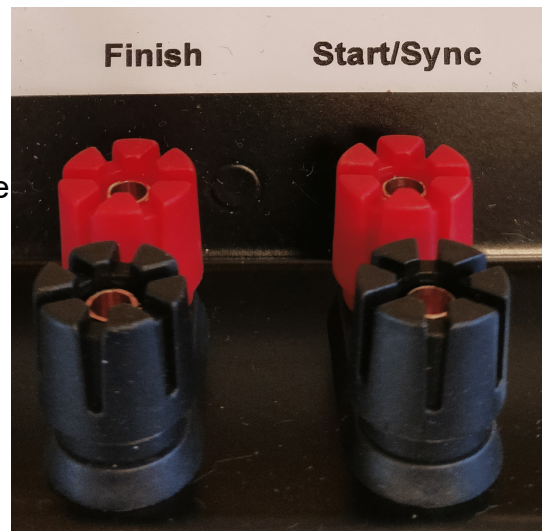
USER INTERFACE
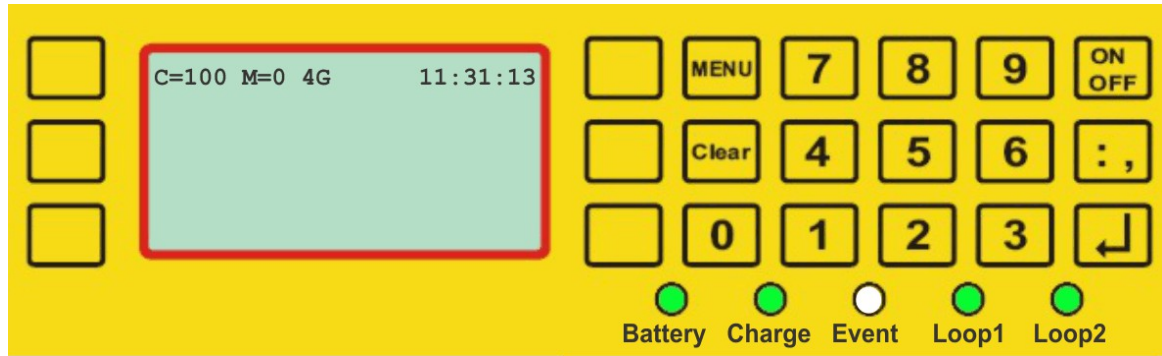
The display of the ETS2 has seven available lines and up to 20 symbols. Three keys on each side of the display control the various menu choices. In addition the keypad has numerical keys and comma, plus four set keys.

- 'Menu'   - in or out of menu modus
- 'Clear'   - deletes the last symbol or leaves the menu
- 'On/Off'   – turns on or off the ETS2 (hold for five sec. to turn off)
- 'Enter'   - accepts choices

Operation mode

Start the ETS2 by pressing the 'On/Off' key. Two seconds later you will see version number, battery status, radio status and clock. You will also hear clicking sounds from the unit – this is the eLine loops' drivers, which are automatically adjusted every time the ETS2 is turned on. When the start-up procedures are done (ca. 5 sec.) the display will show what time it is (HH:MM:SS), how many tags that are registered (M=0) and to which code the ETS2 is set (C=100). If a 4G modem is connected (and enabled) the display will show '4G'next to M=0.

If an external eLine loop is not connected, you will be asked the following question:
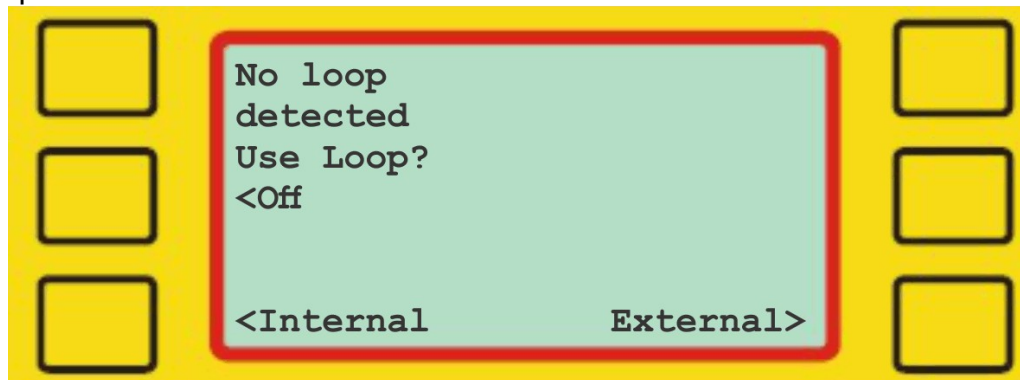
Answer ''Off' if you don't want to use a loop with the ETS2. Choose 'Internal' if you want to use the internal eLine loop. Note that this loop is mounted at the bottom of ETS2, and the range is merely three meters. Answer 'External' if you have connected an external eLine loop to the 'LOOP 1' port on the ETS2.

Check that the LEDs for loop1 og loop2 have the correct colour (see page six for details) and that all cables are properly connected.

The ETS2 is now in operation mode and is ready for use.

MENU SYSTEM

The menu system is used to customize various settings for the ETS2. In this section we'll go through all menu items and explain how they work.
Press the 'Menu'-button to enter the main menu. Pressing 'Menu' again brings you back one step in the menu system - and if you are in the main menu it will return to operating mode. Pressing 'Clear' always brings you back to operating mode.

Main menu (main menu)

```
<Set Clock              Code>


<New Race           Settings>


<Info                  Spool>
```
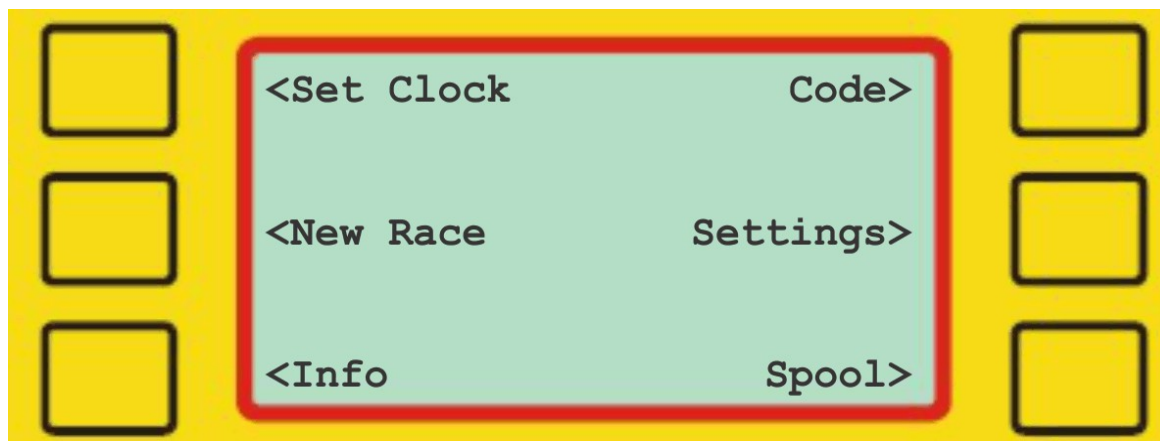
In the main menu you have six choices: setting the clock, starting a new race, displaying technical information, setting the unit's code, changing various settings, and spooling data. Some of the menu choices leads to a sub-menu,

Set Clock (main menu – set clock)

```
New clock=
HH:MM:SS
```
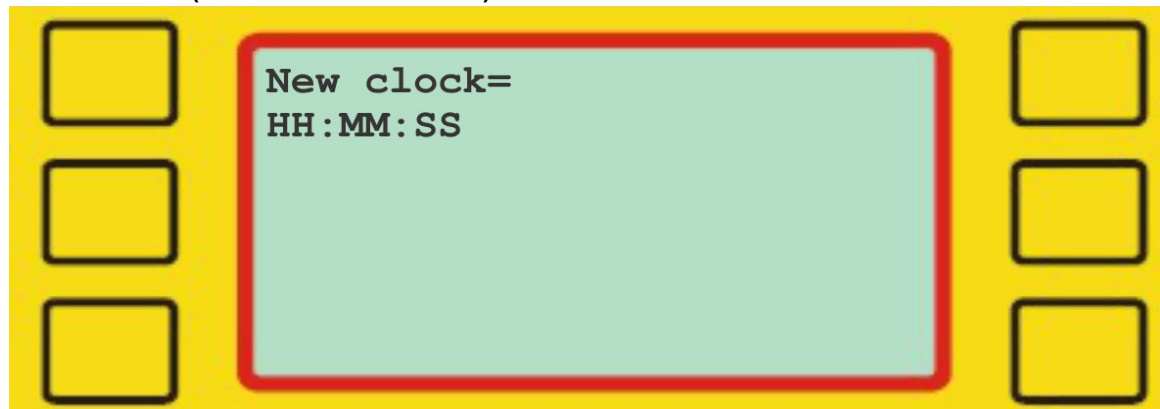
Use the numeric keys to set a valid time between 00:00:00 and 23:59:59. Start the clock by pressing 'Enter' or by short-cutting the 'START/SYNC'-input.

New Race (main menu – new race)

The 'New Race'-function resets the counter for registered emiTags and empties the flash memory in the ETS2. The unit is now ready for use in a new race.
It is strongly recommended to do this before every race.

Info (main menu – info)

```
<General                Modem>


<Power                  Print>


<Versions
```
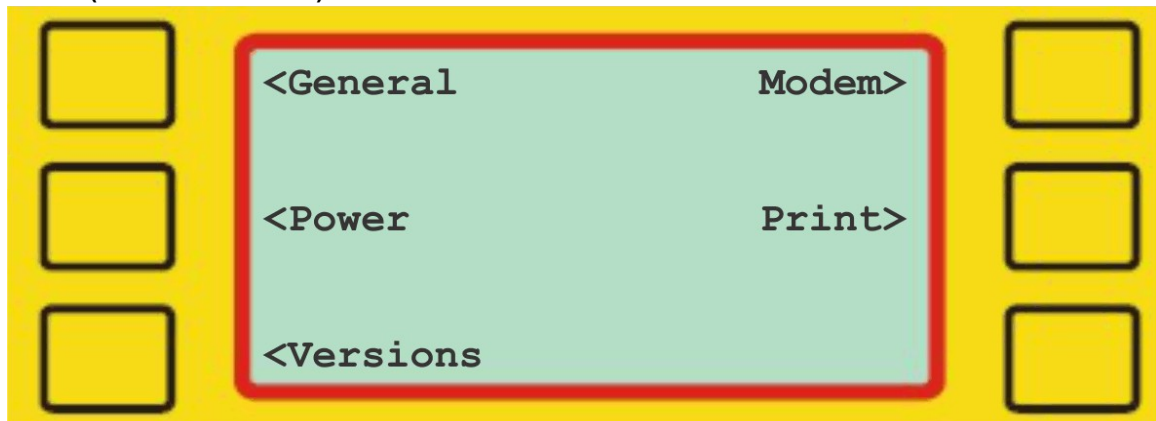
The info menu displays various information for the ETS2. There are five menu choices in the info menu; general, power, versions, modem and print. The four first menu choices lead to a sub menu. Press the 'Print'-key to print all this information on the internal thermal printer.

General (main menu – info – general)

```
Code=100
Passage=0
Sn=876200502
CALIB=0
```
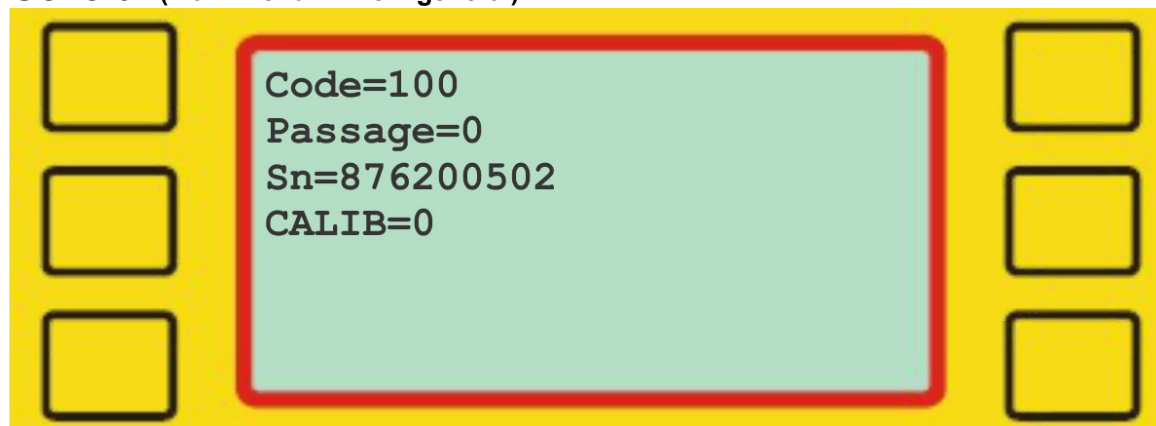
The general info menu shows which code the ETS2 is set to on the first line. The second line shows how many passings it has recorded in the current session. The serial number is shown on the third line, while calibration status is shown on the forth line.

Power (main menu – info – power)

```
Batt=41%
Vbatt=10.2V
Ibatt=258mA
Autonomy=13h
Tbatt=22°C
```
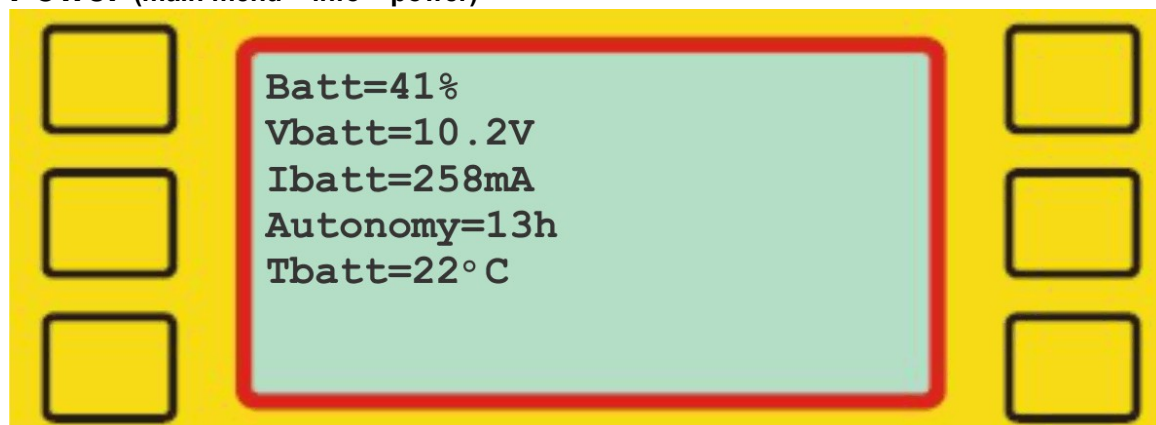
The power info menu shows how much battery capacity that is left on the first line. The second line shows how many volts the battery has, while the third line

shows the ampere. The forth line shows how many running hours the ETS2 has left, while the last line shows the temperature of the battery.

Versions (main menu – info – versions)

```
ETS2 v2.09 r427
UI=22 4G=20 ENQ=20
LOOP1=125 LOOP2=125

        o
```
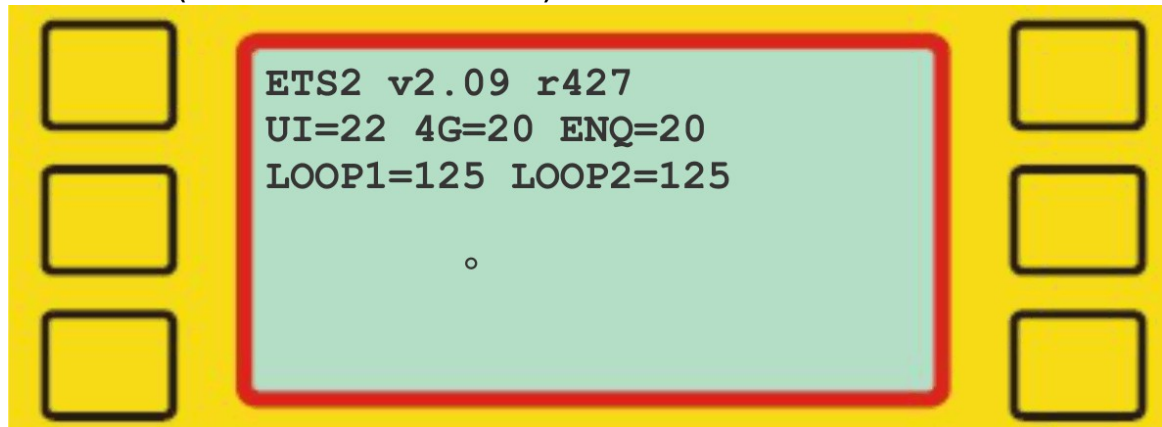
The versions info menu shows the version number for the ETS2 on the first line. The second and third line shows the version numbers for various sub-processes.

Modem (main menu – info – modem)

```
Coverage=2/5
Up=50b
Down=115b

        o

<Reset
```
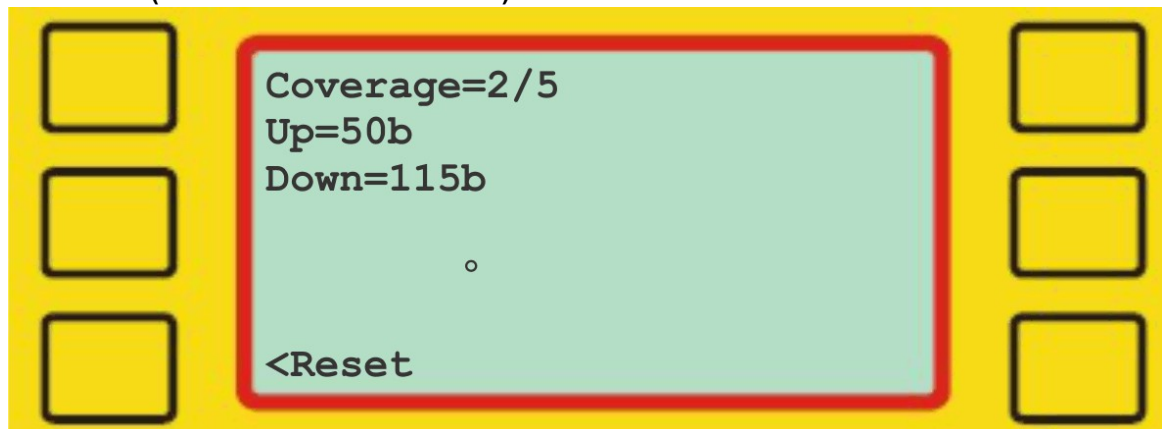
The modem info menu shows the coverage on the first line (0= no coverage, 5= excellent coverage), while the second and third line shows how much data has been uploaded and downloaded. Press 'Reset' to reset this information.

Code (main menu - code)

```
New Code=          Penalty>
XXX

<Intermed.          Start>

<Finish 1l.     Finish 2l.>
```
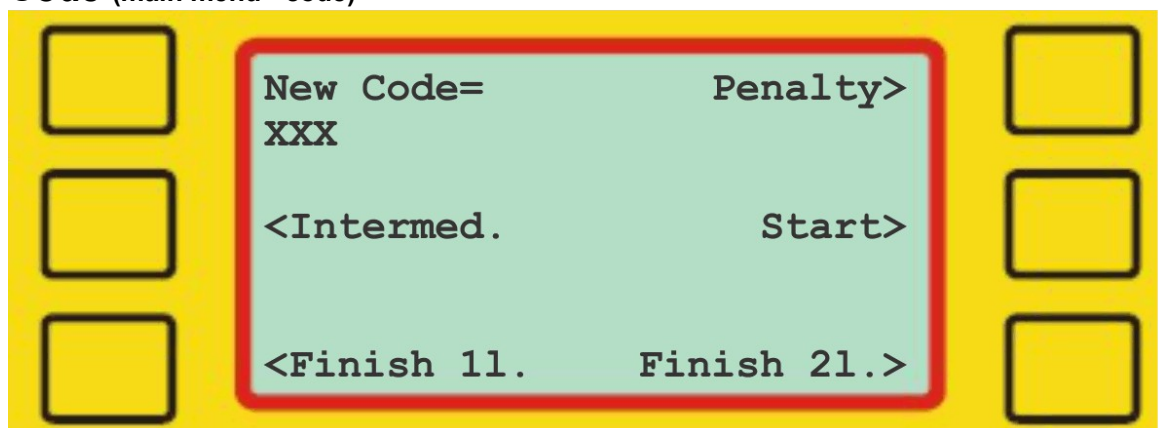
Choose one of the available choices or enter a three-digit code from 031 to 249 with the numeric keys, followed by 'Enter'.

'Penalty' sets the code to 67, which is used for registering penalty-loop passings in biathlon.

'Intermed.'sets the code 70, which is the default code for intermediate/split times.
'Start' sets the code 0, which resets the internal clock in the emiTags.
'Finish 1l.' sets the code 90 and activates loop1.
'Finish 2l.' sets the code 248 and activates both loop1 and loop2. *This is the only choice that uses both loop1 and loop2!*

The code used for the ETS2 decides what kind of registration you will get and which frequency the radio will transmit on. Therefore it is very important to set the right code. We recommend using the following codes:

- Start   -   0
- Relay handover   -   66
- Registration of penalty loops   -   67
- Split time/forewarning   -   70
- Finish, single eLine loop   -   90
- Finish, double eLine loops   -   248
- Backup, finish   -   249

Settings (main menu - settings)

In the 'Settings'-menu it is possible to change how the ETS2 handles different input, how it is shown and how the data is transferred to an external device.

Ack (main menu – settings - ack)
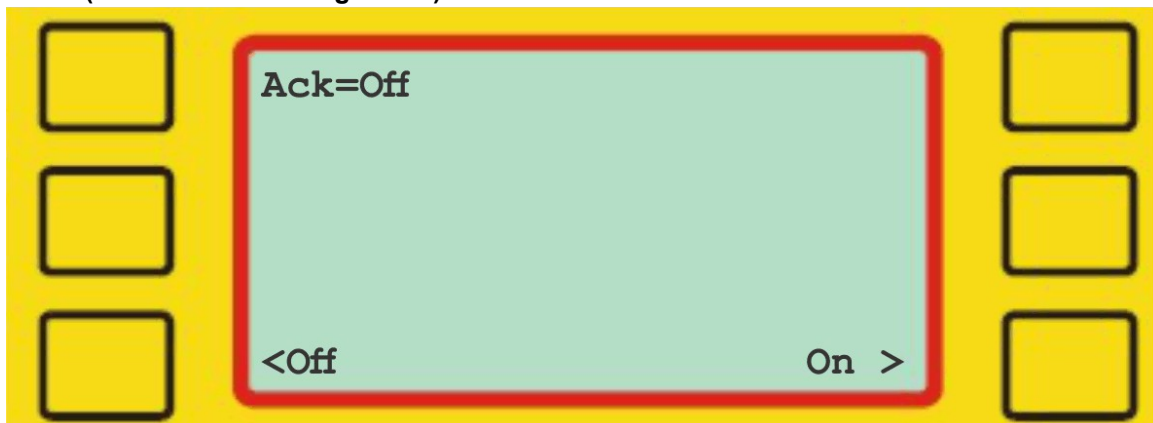
Normally 'Ack' (acknowledgement) should be turned on, which is the default setting. This means that the emiTags stop resending data after receiving 'Ack' from the ETS2. Set 'Ack' to off only when the ETS2 is used in combination with another ETS2.

Printer (main menu – settings- printer)

```
Printer=Off




<Off                          On  >
```
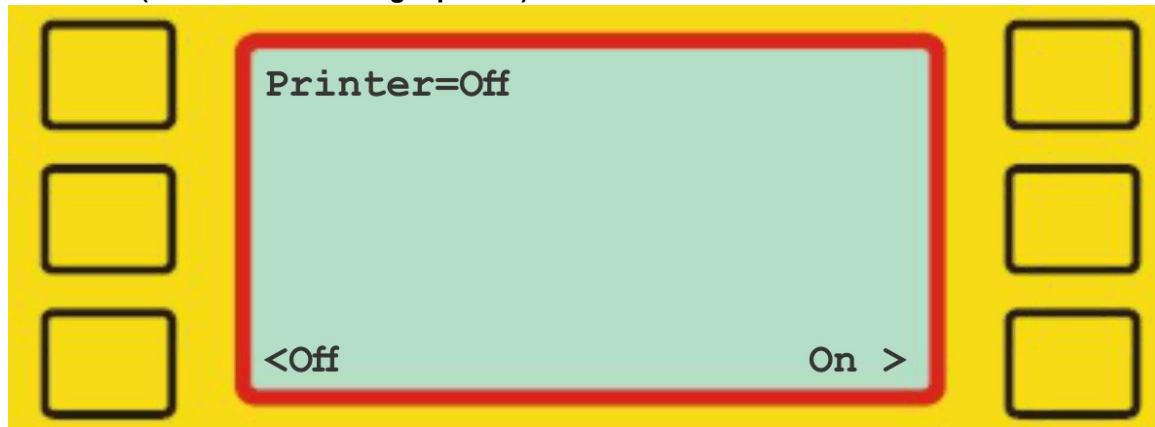
Press 'On' to enable printing, if the ETS2 has a printer installed. Default setting is 'Off*.

Display (main menu – settings – display)

```
<Normal                       GPRS>


<Dev/RSSI


<Loop Sts.
```
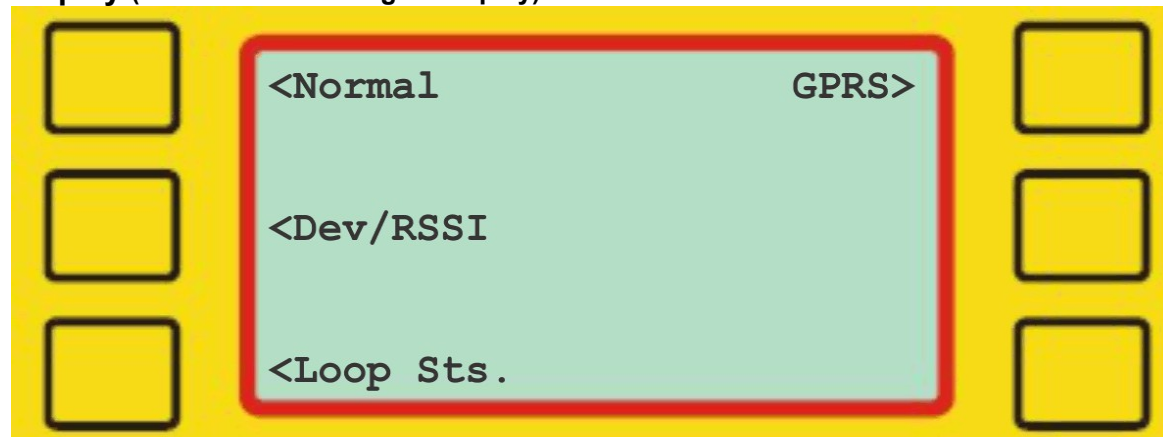
Choose display mode:

Normal: Shows running time, station code, tag number and finishing time.
Dev/RSSI: Shows the radio's deviations in frequency and transmitting ability
Loop Sts.: Shows the eLine loops' consumption of electricity.
GPRS: Shows the signal strength of the modem (0= no signal, 5= best signal)

Store All (main menu – settings – store all)

Use this menu choice to store all messages in the ETS2, without filtering on the code. Normally ETS2 only stores messages with the correct/corresponding code. Default setting is off.

Reset All (main menu – settings – reset all)
 The ETS2 is reset; all data is erased and the original settings are restored!
ONLY TO BE DONE BY AUTHORIZED PERSONNEL!

More... (main menu – settings – more)

```
<Protocol          Precision>


<Loop                 Modem>


<Language              eMat>
```
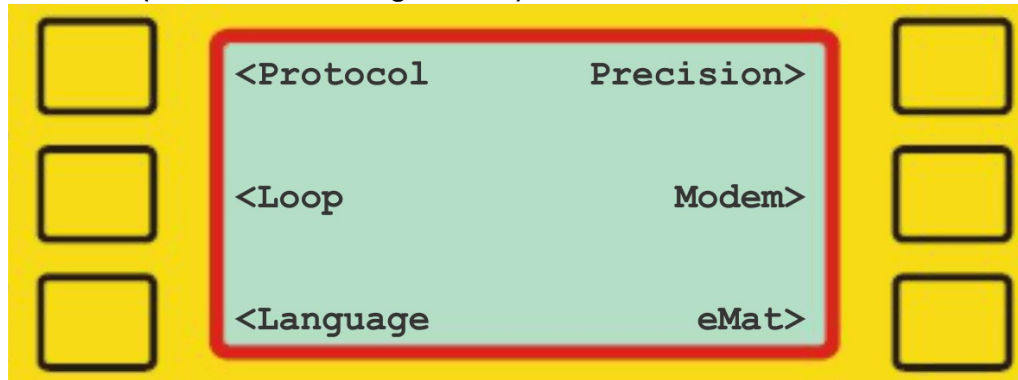
This is the continuation of the settings menu.

Protocol (main menu – settings – more - protocol)
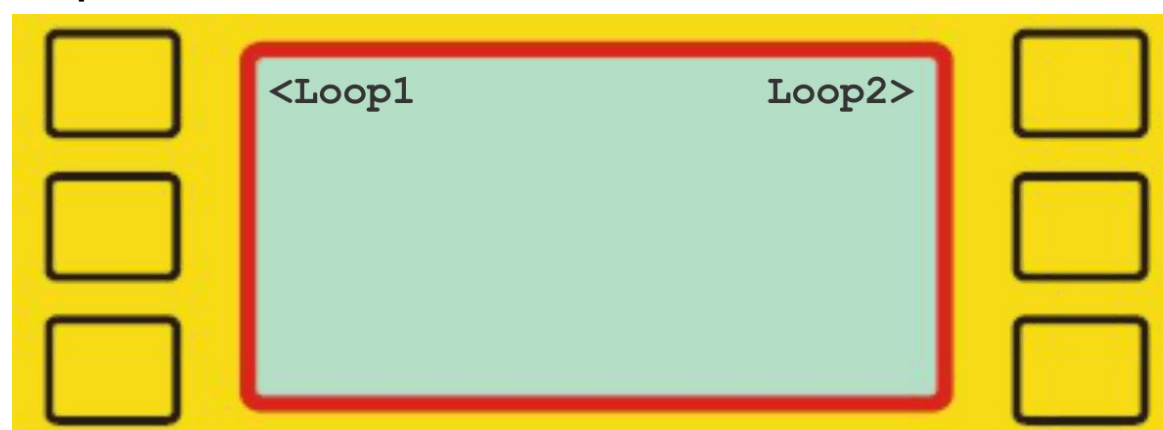
```
<Normal


<Short


<Ext. Dump
```
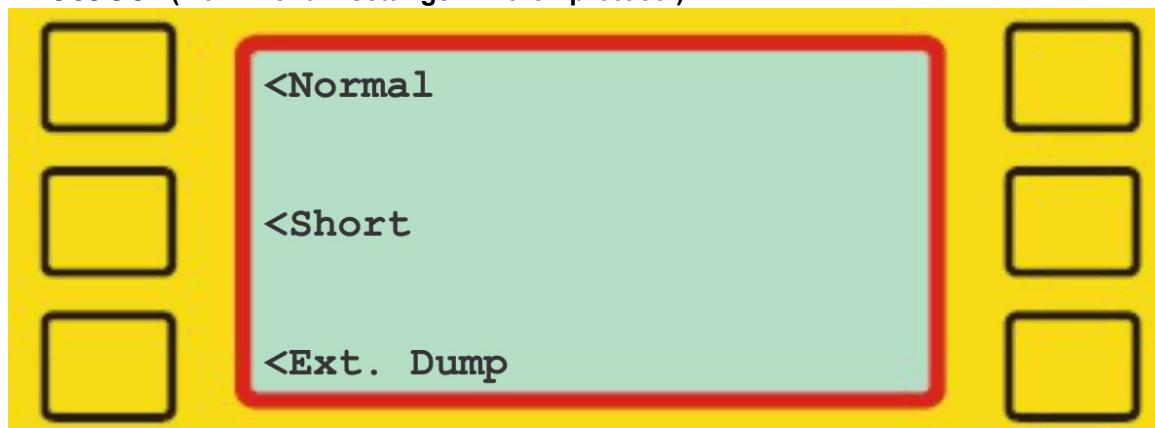
Choose protocol (for transmitting data to a PC):

Normal: Standard values, default setting.
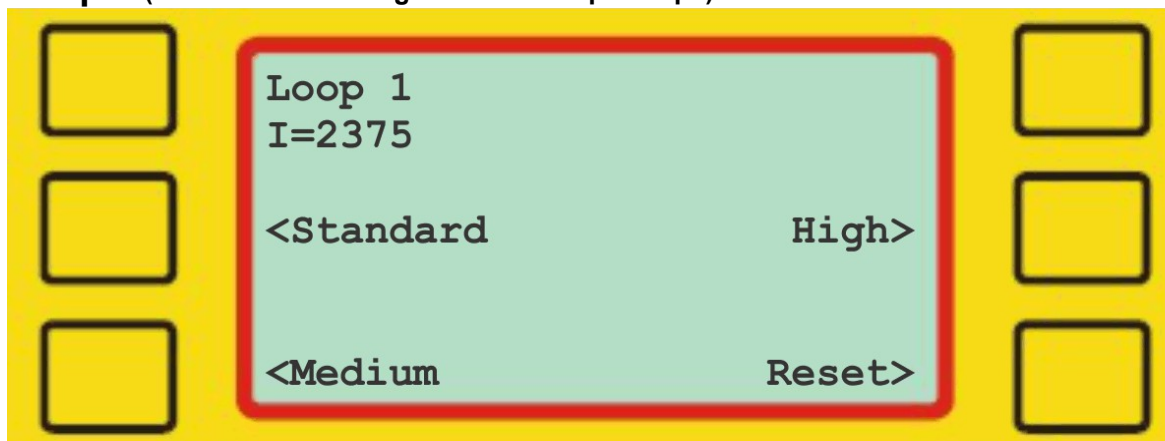Short: Sends 34 bytes. Use with some external devices.
Ext dump: Sets a protocol with extended information, when reading the tags.

Loop (main menu – settings – more - loop)

```
<Loop1                Loop2>
```

Choose which loop to adjust. Loop2 is only in use if the ETS2 is set to code 248.
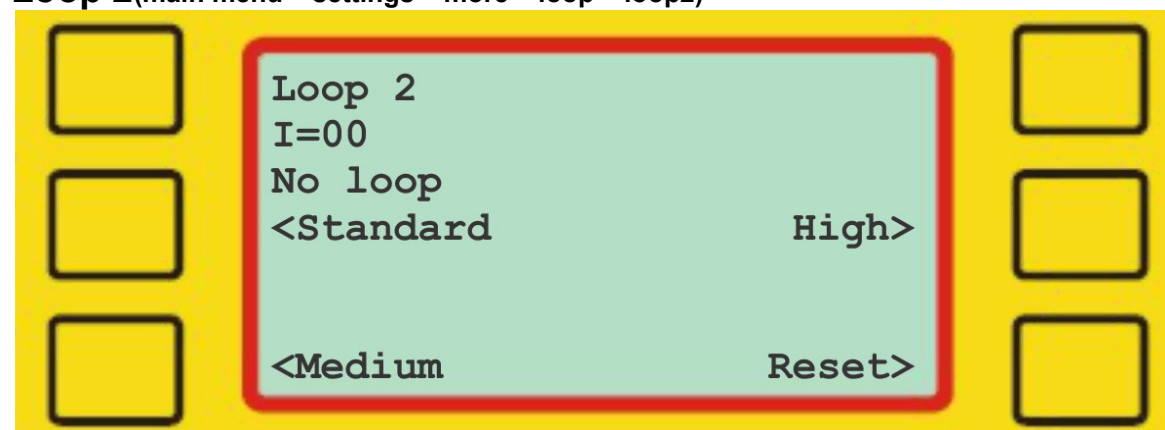
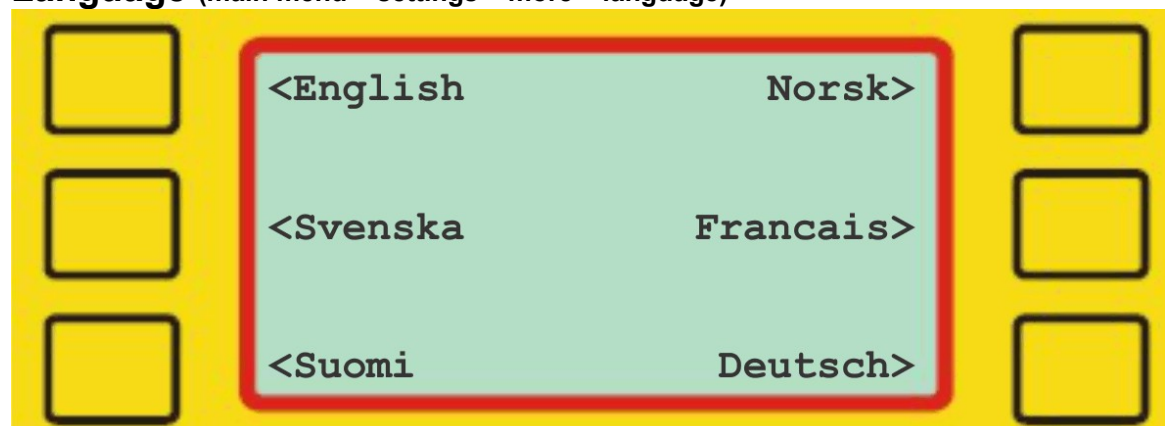## Loop 1 (main menu – settings – more – loop – loop1)

```
Loop 1
I=2375

<Standard              High>


<Medium                Reset>
```

Use this function to adjust the amperage sent to loop1. The second line shows the current amperage (I=2375). Default setting is 'Standard', which should give an amperage of approximately 2300 (+/- 100). Choose 'Medium' to get an amperage of approximately 4700 (+/- 100), and 'High' to get the maximum amperage, which is approximately 6800 (+/- 100). You may reset the amperage for loop1 by choosing 'Reset'.

Loop 2(main menu – settings – more – loop – loop2)

```
Loop 2
I=00
No loop
<Standard              High>



<Medium                Reset>
```

Use this function to adjust the amperage sent to loop2. The second line shows the current amperage (I=2375). Default setting is 'Standard', which should give an amperage of approximately 2300 (+/- 100). Choose 'Medium' to get an amperage of approximately 4700 (+/- 100), and 'High' to get the maximum amperage, which is approximately 6800 (+/- 100). You may reset the amperage for loop1 by choosing 'Reset'.
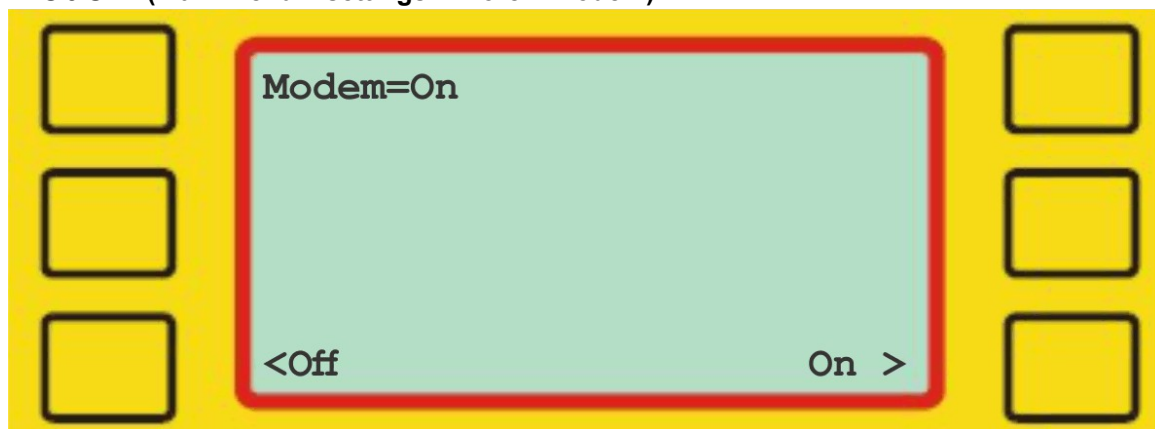
Language (main menu – settings – more – language)

```
<English               Norsk>


<Svenska               Francais>


<Suomi                 Deutsch>
```

Choose the preferred language for the menus. Default menu choice is English.

Precision (main menu – settings – more – precision)

```
<1s                    1/1000s>

<1/10s                 1/10000s>

<1/100s               1/1000000s>
```
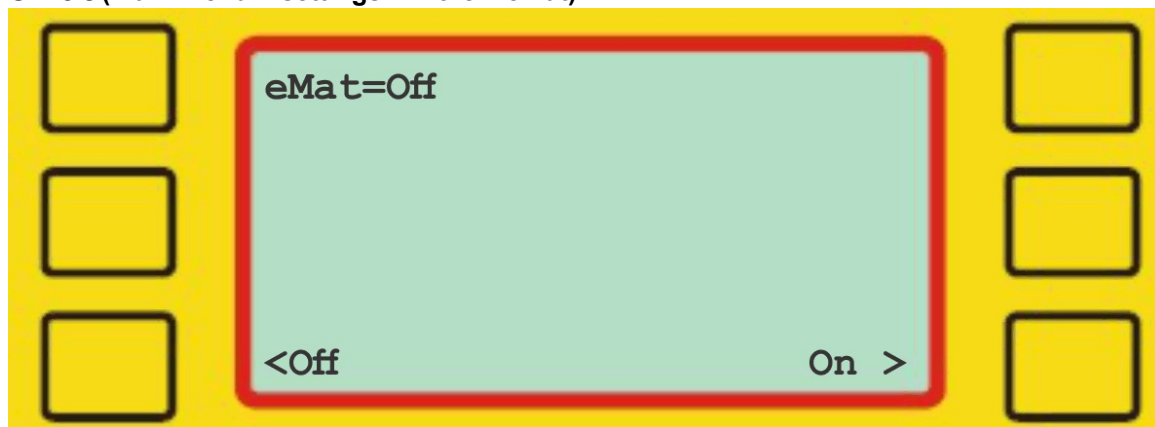
Choose the preferred precision/resolution for ETS2. Default setting is 1/1000. The preferred precision is only used on timing events registered on the 'Start/Sync'- and 'Finish'-inputs. The output of ETS2 (serial, printer, modem) will use the preferred number of decimals on these timing events.

Modem (main menu – settings – more – modem)

```
Modem=On




<Off                      On  >
```

Press 'On' to enable the modem, if the ETS2 has a modem installed. Default setting is 'Off'.

eMat (main menu – settings – more – emat)

```
eMat=Off




<Off                      On  >
```

Press 'On' to enable eMat – which is used in biathlon to match start numbers/targets. Defaults setting is 'Off'.

Spool (main menu – spool)

Press 'All' to resend all data stored in the ETS2. *Use this function with caution. If the ETS2 has a lot of data stored, it will be busy resending data for some minutes, and will not send new data before all the old data is transferred.*
Press 'Day' to resend all data collected today.
Press 'Stop' to stop resending data.

eUpgrade

eUpgrade is a program - provided for free by Emit – that is used to upgrade the internal firmware version of the ETS2. The program may be downloaded from http://195.159.103.189/software/

PLEASE ONLY USE EUPGRADE IF YOU KNOW YOUR ETS2 NEEDS UPGRADING!

After downloading and installing the program, connect ETS2 to an available USB-port and start eUpgrade.
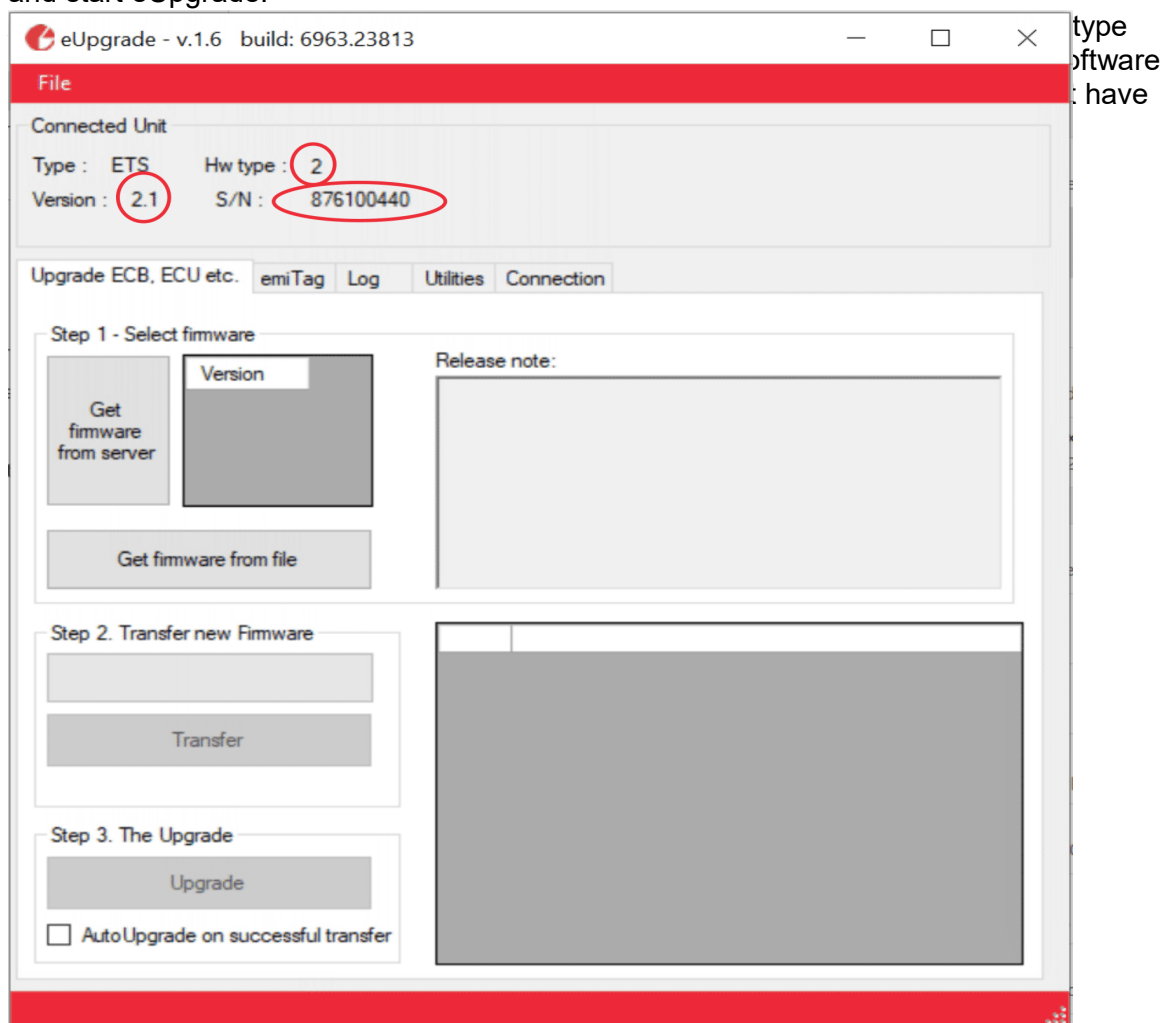
If eUpgrade doesn't show any information, check that the ETS2 is properly connected and that the USB-driver has been correctly installed in Windows.
Click the 'Get firmware from server'-button to obtain the firmware files suited for your ETS2. Choose the newest/highest firmware version and click the 'Transfer'-button.
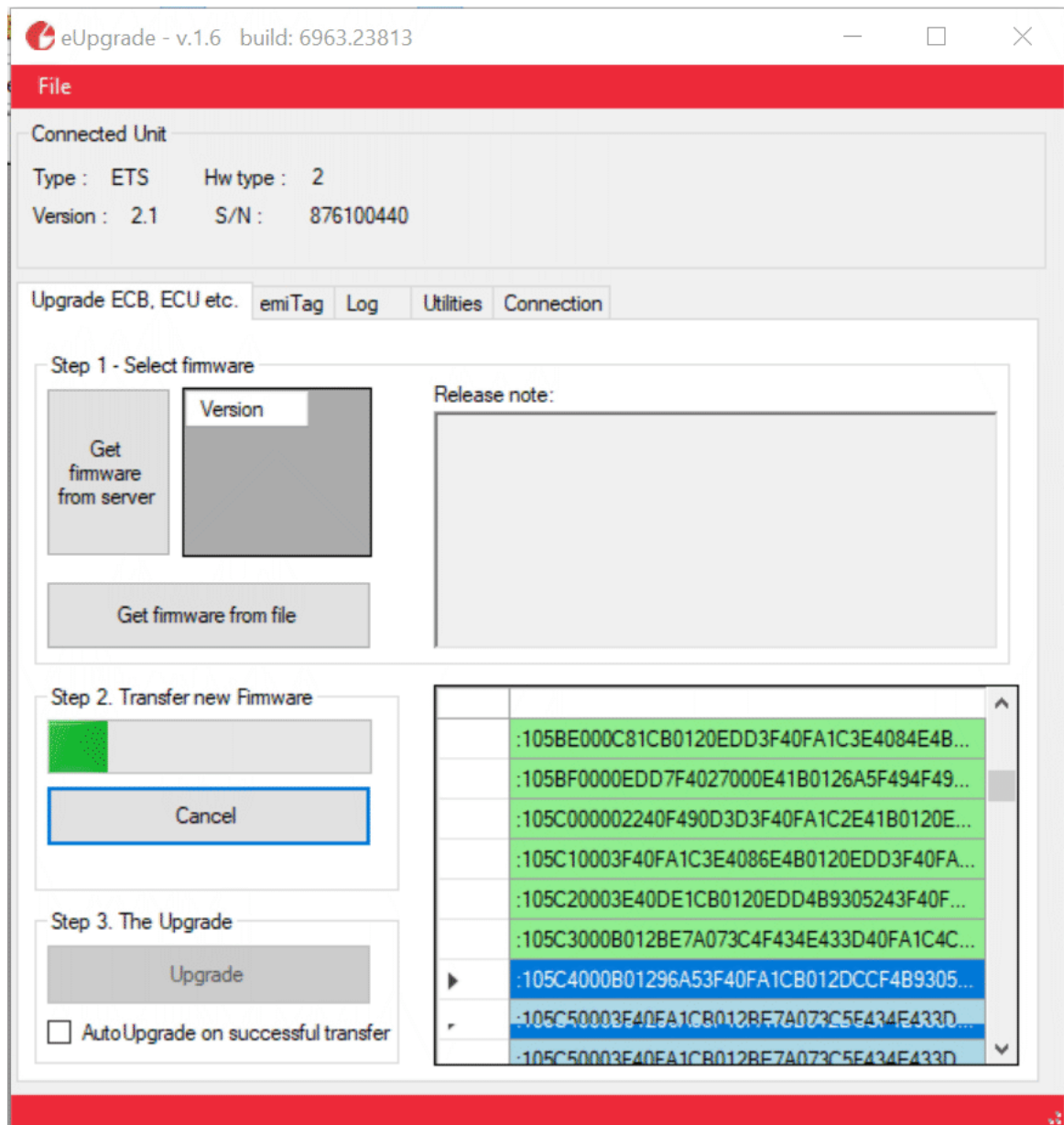
Wait until eUpgrade has finished transferring the new firmware version, and click the 'Upgrade'-button. After approximately ten seconds the ETS2 will restart with the new firmware version.

TROUBLESHOOTING

In the troubleshooting section we have listed the most common problems that may occur, and the recommended solutions.

Problem	Solution
emiTags are not registered with the internal loop	The internal loop is mounted at the bottom of ETS2, and has a range of three meters. Move ETS2 closer to the track, with the bottom side facing the track, or connect an external loop.
emiTags are not registered when they pass the eLine loop(s)	Check if the emiTags flash when they approach/pass the loop(s). If they don't flash: • Check the eLine loop(s). If one loops is used it should be connected to 'Loop1'. If two loops are used, the white loop should always be connected to 'Loop2'. • Reset the loop by using menu option '**main menu – settings – more – loop – loop1 – reset**' or by restarting ETS2. • Check the code. Code 248 should only be used with two loops. If they flash, but are not registered: • Check that the ETS2 is standing close to the track, with the bottom side facing the track. The internal antenna is mounted at the bottom of ETS2 – and has a range of 3-5 meters. • Consider using an external Yagi-antenna.
The ETS2 is not online	There can be several reason for this. • Check when the ETS2 was online last time. Go to Emit's server: http://195.159.103.189 and enter ETS2's serial number (876250xxx) • Check if the modem is enabled (**main menu – settings – more – modem – on)** • Enable GPRS-info on the display (**main menu – settings – display - gprs)** Check the signal strength (0= no signal, 4= best signal) • Check if the modem has a sim-card with a valid subscription. In Norway, this can be done by mailing m2m.kundesaker@telenor.com. Remember to include the phone number and sim-card number in the e-mail. This information is on a sticker on front of the ETS2.
The ETS2 is online, but no times are registered in the result software (eTiming etc.)	• Doublecheck that the ETS2 is online by going to Emit's server: http://195.159.103.189. The status message should be less than a minute old if it is currently online. • Check that the serial number of ETS2 is correctly entered in the software (876250xxx)

TECHNICAL SPECIFICATIONS ETS2 v.2.1

Dimensions: 41x33x18cm

Weight: 7.5Kg

Operating temperature: -20 to 70°C

Relative humidity: 45%

Power supply: 110-230V~ 50/60Hz 40W

Inputs: Two wired inputs (Start/sync, Finish) + two radio receivers (868Mhz)

Outputs: Two external eLine-loop outputs + one internal eLine-loop

Serial interfaces: USB (FTDI), RS232, RS485, 115200 bit/s, 1 stop bit, no parity

Data outputs: USB, printer, LCD, 4G modem.

The S, mS, 1/10000s and uS accuracy is only available on 'Start/sync' and 'Finish' input. It is not available for emiTag-registrations.

Temperature stability: +/- 2 PPM (0°C to +40°C) / +/- 7.5 PPM (-40°C to +85°C)

Quartz Ageing: +/- 1.0 PPM (first year)

Temperature stability (24Hours 23°C): +/-0.2ppm with calibration without charger after two hours.

Battery life: 24 hours

Hardware Version: 81405-2

Firmware Version: V2.1

Protection code: IP67