

REV 1.13

GPS WorkBench Users Guide

iTrax02 Evaluation Kit

1.08

This document is the User Guide for the GPS WorkBench of iTrax02 Evaluation Kit. It describes the main features of the GPS WorkBench and how to use them to control and configure the iTrax receiver.

2002-12-12

Fastrax Oy

CHANGE LOG

Rev.	Notes	Date
1.7	Changes for release 1.08	05-12-2002
1.8	Updated pagenumbers	11-12-2002
1.12	Added file names	12-12-2002
1.13	Fixed typos	12-12-2002

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COMPLEMENTARY READING

The following reference documents are complementary reading for this document:

Ref. #	File	Document
01	Install.pdf	iTrax02 Evaluation Kit: Software Installation Manual
02	SysArch.pdf	ISuite SDK: System Architecture Overview
03	Uguide.pdf	iTrax02 Evaluation Kit: GPS Workbench Users Guide
04	ITalk.pdf	iTrax02 Evaluation Kit: iTalk Protocol Specification
05	Formats.pdf	iTrax02 Evaluation Kit: GPS WB Data Formats Description
06	Evkit_UM.pdf	iTrax02 Evaluation Kit: User Manual

1. GENERAL

GPS WorkBench for iTrax02 Evaluation Kit is a graphical user interface for controlling the iTrax receiver.

GPS Workbench includes following features to control the iTrax receiver:

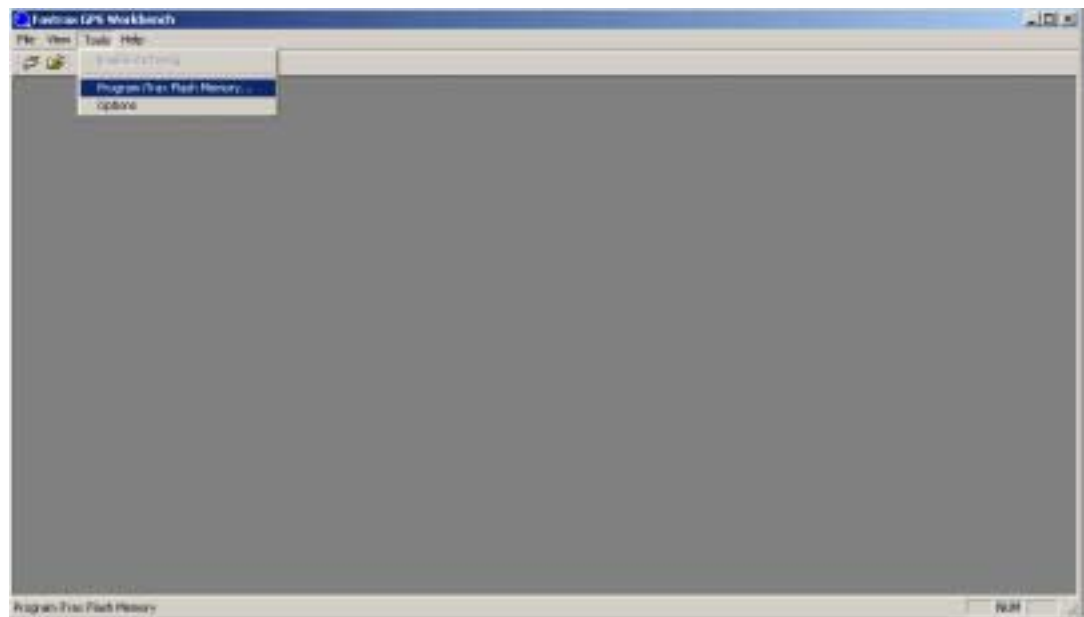
- ❑ DSP code loading to iTrax receiver via a serial port
- ❑ Starting the measurement on iTrax
- ❑ Collecting all measurement data and storing it to a disk file
- ❑ Simulating a measurement from previously stored file archive
- ❑ Connections to external system
- ❑ Setting and storing parameters to iTrax on real-time

2. USING GPS EVALUATION SOFTWARE

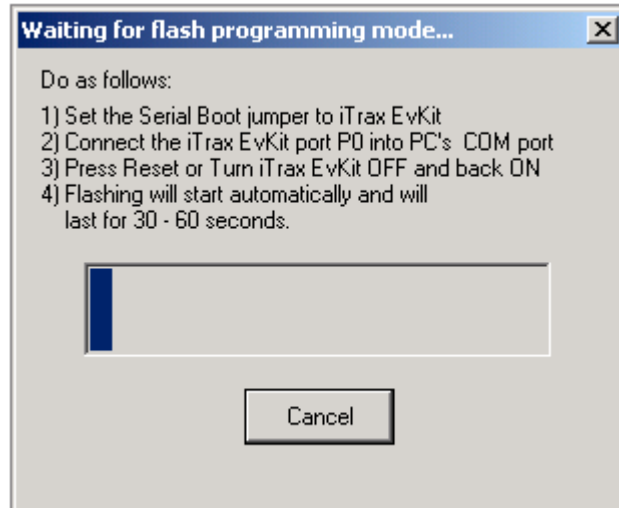
2.1 Updating iTrax Firmware

NOTE: Updating firmware is only necessary if you have received an updated “iTrax02.fls” file from Fastrax.

Choose “Tools”→”Program iTrax Flash Memory” to start flashing procedure. Alternatively press the “lightning” icon in the toolbar starts the flashing also.

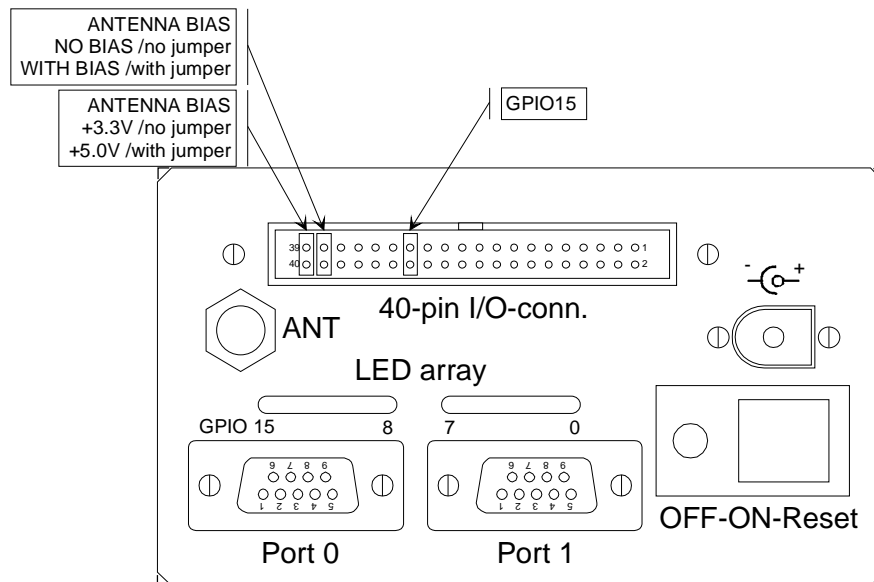


Open file dialog appears. The valid iTrax Flash Image files are denoted with the “.fls” file extension. After choosing the image file click “OK”.



An instruction dialog will appear. Follow the instructions before proceeding.

- 1) Put a jumper in GPIO15 (7th from the left). Refer to [06] for additional information.

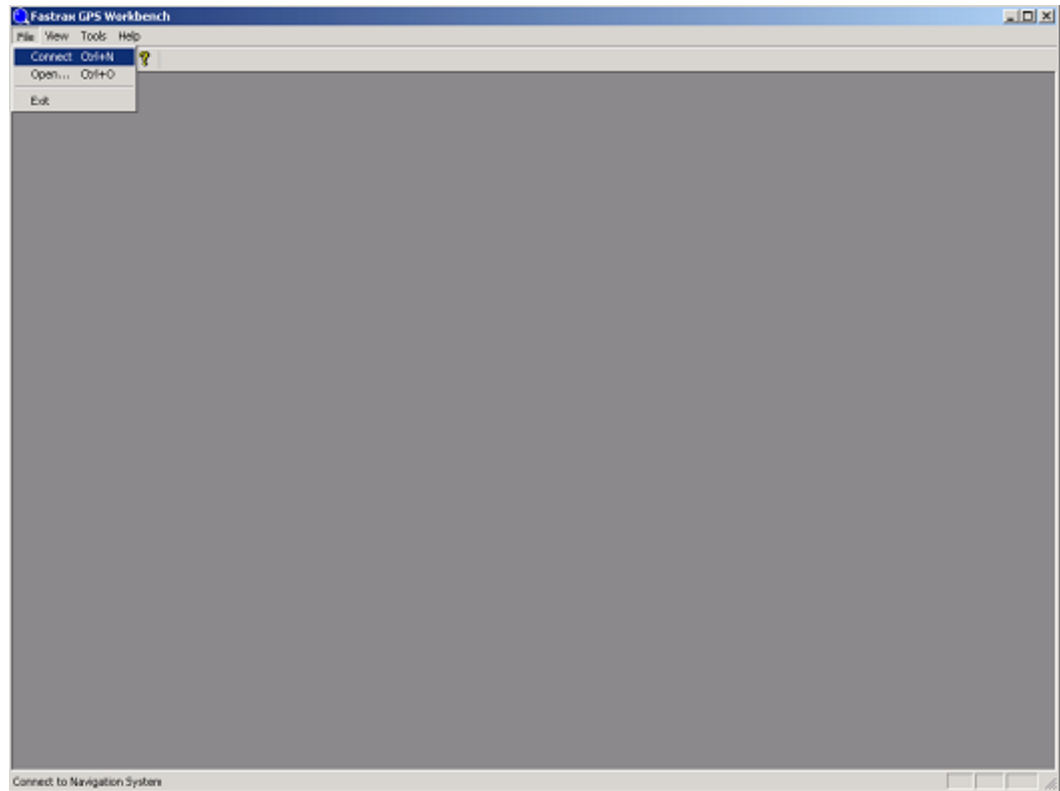


- 2) Connect port 0 of the iTrax receiver to a serial port of the host PC (the default port is COM1).
- 3) Press RESET or turn iTrax OFF and ON. This will automatically start the flashing procedure. Flashing takes time up to one minute during which Windows may stop responding. Please wait patiently until flashing procedure is complete.
- 4) Click the “OK” button. After flashing is complete a dialog box appears and asks to remove the jumper and to reset the iTrax. Flashing is now complete.

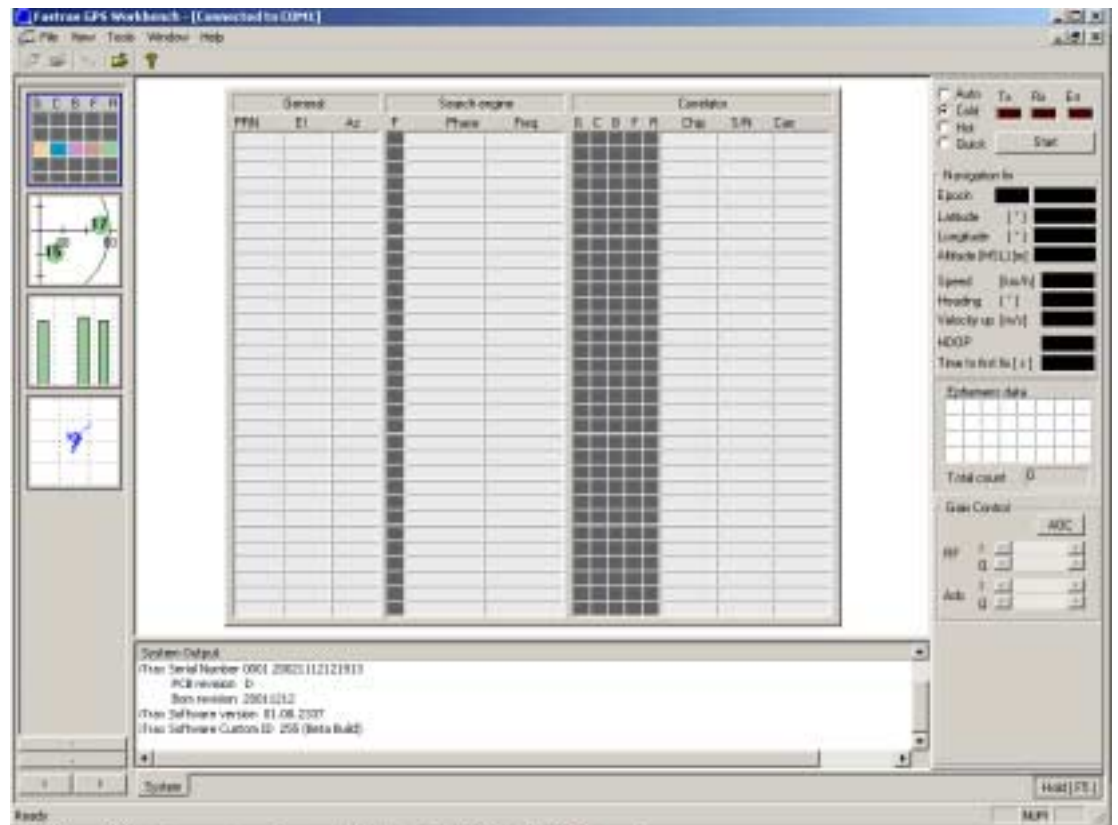
In case of error, please try again. If errors persist, send email with detailed error report to swsup@fastrax.fi.

2.2 Starting Measurement

To start measurement, select “Connect” from the “File”-menu or click the “connect” icon in the toolbar.



After loading User Interface Modules the application window will appear. To start measurement press “Start” button from the control bar. If iTrax was already started, the application window starts updating immediately.



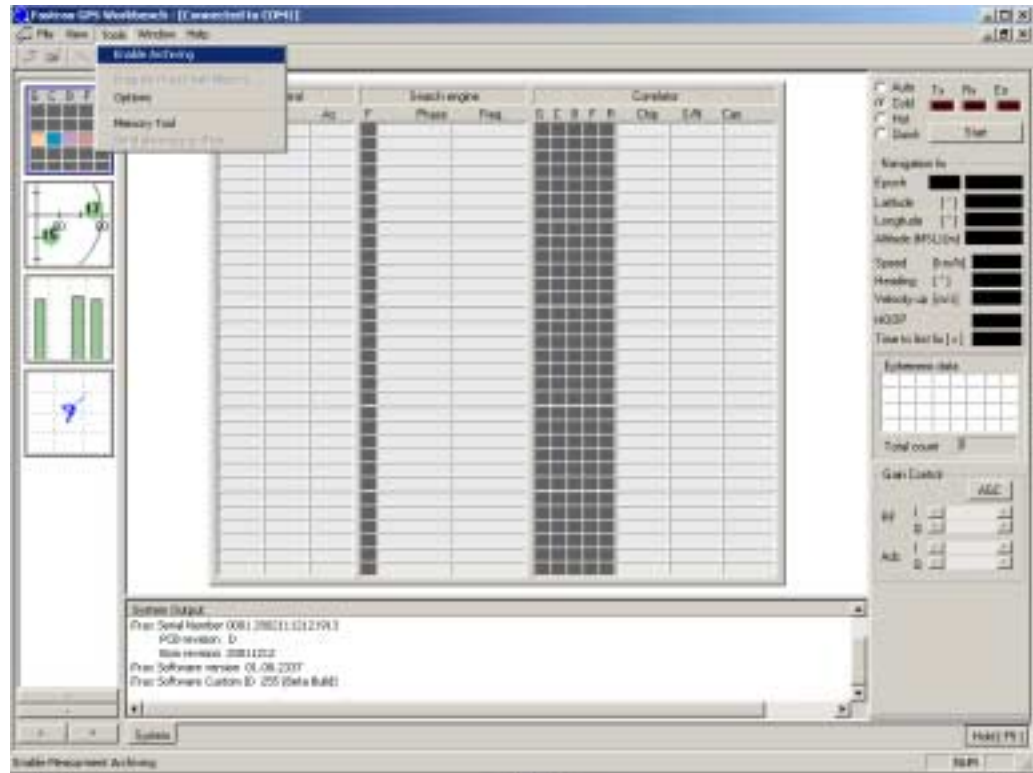
If the red “Rx”- led (in the upper right hand corner) is not blinking after start, then there is something wrong with the connection to the iTrax or the antenna connection to iTrax.


2.3 Archiving Data

If you have selected the “Enable archiving”- option from the “Tools”- menu, then all measured data will be stored to file archive (see the “iTrax01 Evaluation Kit Data Format Description”- document for description of these files).

Enable archiving before starting the measurement by selecting:

“Tools”->“Options”->“Enable Archiving”

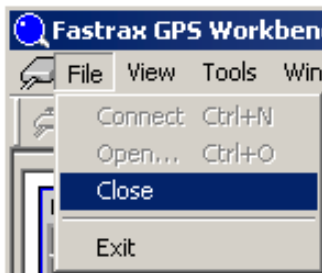


Alternative way to enable archiving is to click  icon in the tool bar.

To open a previously archived measurement, use "File"->"open" to open "Archive.ini" from the archive directory. If the "Open" menu entry is disabled, you need to close the connection to iTrax by selecting "File"->"Close". The evaluation kit provides one sample measurement for testing. Please note that you can not select archiving if measurement is in progress.

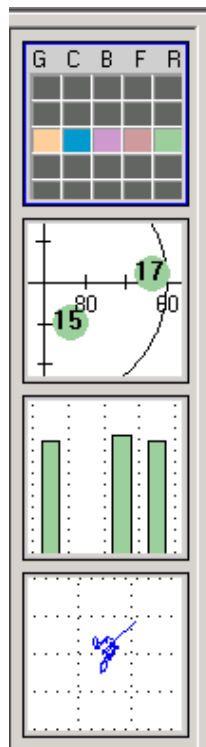
2.4 Operating GPS Workbench

2.4.1 Stopping and Restarting the measurement



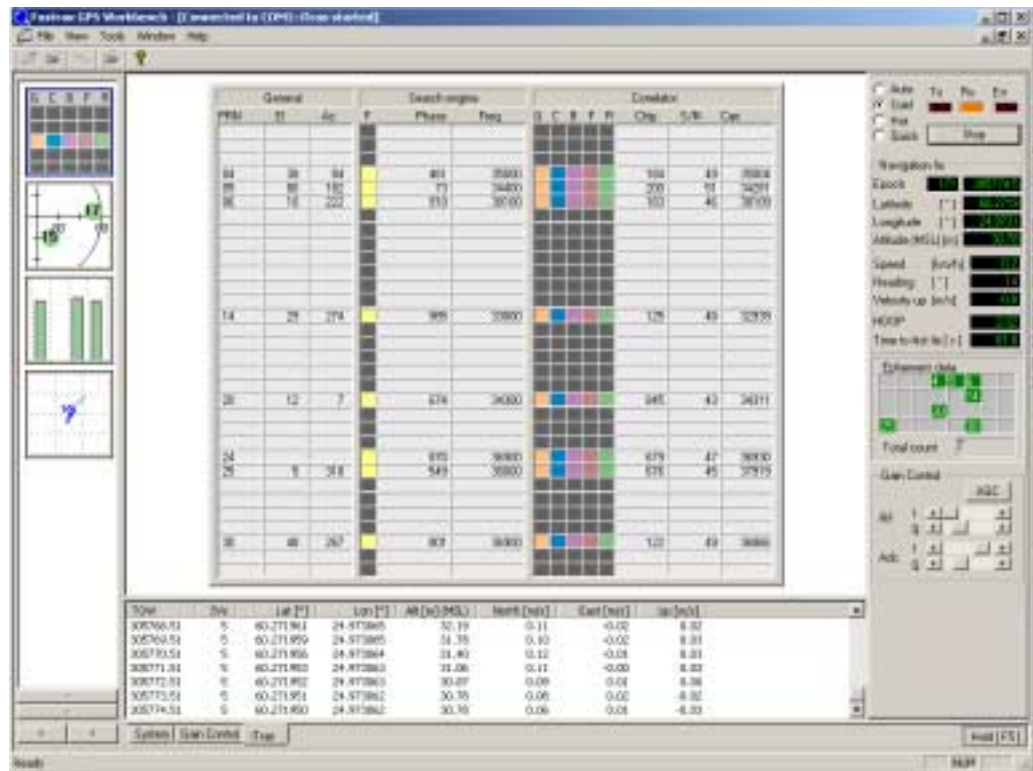
During the measurement, it is possible to stop/restart the simulation at any time by pressing the “Stop” / ”Start”- button on the Workbench control bar. Please note that connecting to iTrax or exiting from WorkBench does not stop navigation. You can also stop the measurement by selecting “File”->”Close” or just close the GPS WorkBench application. This closes the connection to the iTrax.

2.4.2 Selecting between views



To select a graphical view, select the appropriate “miniview” with a mouse.

The default view is the Search/Correlator status view.



Where:

PRN	Satellite PRN
El	Elevation angle of the satellite
Az	Azimuth of the satellite
F indicator	Satellite found by the search engine
Phase	Phase of the satellite
Freq.	Frequency of the satellite signal
G indicator	C/A code lock
C indicator	Carrier lock

B indicator	Bit lock
F indicator	Frame sync
R indicator	Reference TOW decoded
Chip	Current C/A code chip
S/N	Signal to noise ratio [dBHz]
Carr.	Carrier frequency relative to IF

2.4.3 Text Scroll Views

To select a text scroll view, click the appropriate “tab” with a mouse.

TOW	S/s	Lat [°]	Lon [°]	Alt [m] (MSL)	North [m/s]	East [m/s]	Up [m/s]
112225.87	10	60.271847	24.973040	29.20	0.16	0.02	0.20
112226.87	10	60.271842	24.973043	29.02	0.12	0.02	0.17
112227.87	10	60.271838	24.973046	28.76	0.11	0.02	0.17
112228.87	10	60.271837	24.973048	28.41	0.10	0.01	0.19
112229.87	10	60.271835	24.973050	27.83	0.09	-0.01	0.18
112230.87	10	60.271831	24.973046	26.68	0.10	-0.01	0.18

“System” shows the system information about the WorkBench version, iTrax serial number, PCB version, Bill of Materials and iTrax software version.

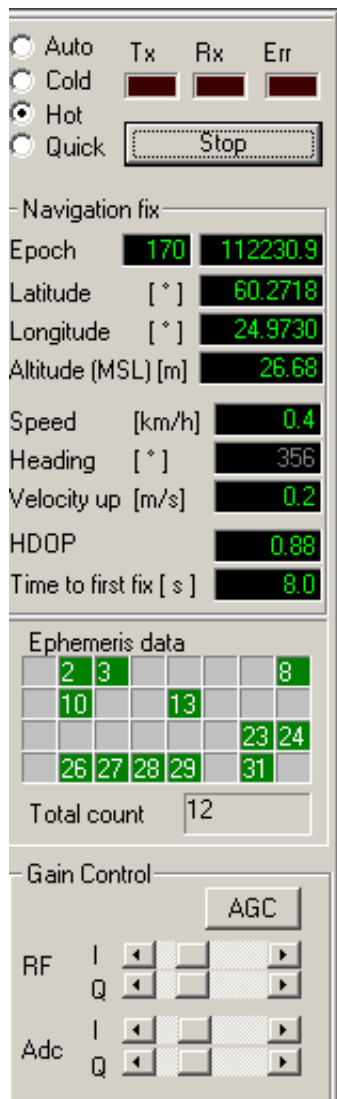
“Trace” shows some system messages. “Trace” view is added if you use “Memory Tool” in “Tools” menu.

“AGC” stands for Automatic Gain Control. Shows the current AGC setting.

“iTrax” shows the current navigation fix.

Pressing the “Hold” button or pressing F5 causes the text scroll view to stop updating. Navigation still goes on. This will make reading of text easier.

2.4.4 Control Bar



On the right hand side is the control bar. It contains information about the overall operation of the iTrax receiver as well as the navigation fix and ephemeris data. "Tx", transmit data, indicator flashes when the host PC is transmitting data through the serial cable to the iTrax. "Rx", receive data, flashes when the iTrax is receiving data from the iTrax. "Err", error, is lit when there is an error.

Starting mode can be controlled with radio buttons:

Auto	Automatic mode. iTrax determines whether the Quick or Hot start modes are available. This is the default mode.
Cold	Cold starting mode. No ephemeris or GPS time data is available.
Hot	Can be used if GPS Time sync is not known but valid ephemeris are available.
Quick	Can be used when iTrax knows the GPS time and is able to start tracking immediately.

“Navigation fix” shows the current fix: Epoch, position, speed, heading, velocity, HDOP and Time to first fix.

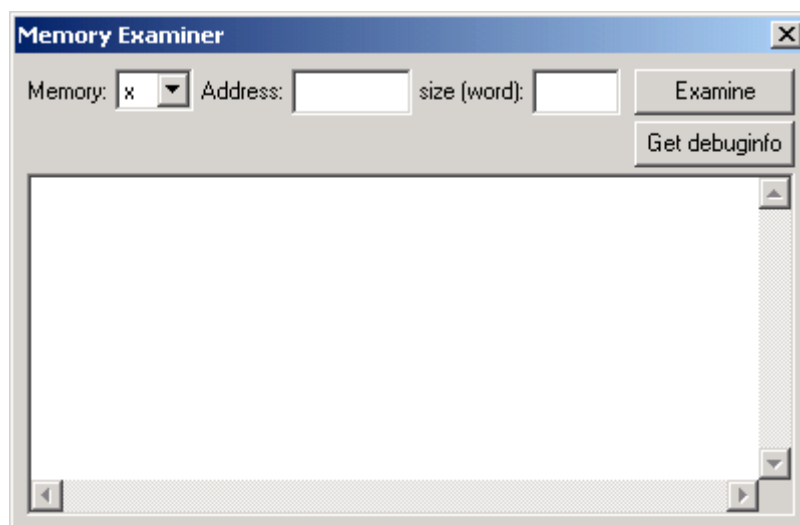
“Ephemeris data” tells the satellite ID number whose ephemeris data is available and gives the totalcount of ephemeris.

“Gain control” enables you to manually adjust either RF or AGC gain. Note that this is usually not necessary or recommended and is for test purposes only. Use “I” to adjust In-phase and “Q” to adjust Quadrature phase. Pressing “AGC” causes iTrax to automatically to adjust the signal level. The changes made with the sliders can be seen in the text scroll view by pressing “AGC” tab. Pressing "AGC" will revert back to automatic gain control mode.

2.4.5 Memory Tool

NOTE: The memory tool is useful for the SDK users only.

The memory tool can be used to examine the iTrax module's memory space and to monitor iTrax task and message queue states. Selecting "Memory Tool" from "Options" opens the following dialog window:



Memory examination:

To examine the iTrax module's memory contents, enter the memory examination parameters on the following fields and push the "Examine" button:

- "Memory": Use this to select the target iTrax memory page (X, Y or I)
- "Address": Enter here the beginning of the examined memory area in hexadecimal notation.
- "size": Enter here the size of the examined memory area in words in decimal notation. X- and Y-memory pages use 16 bit words and I memory page uses 32 bit words. Please notice that currently the memory tool displays a memory dump of max. 171 words long at a time (X- & Y-memories, 85 words of I memory).

Task state monitoring:

GPS Workbench retrieves the task state information from the iTrax module when the “Get Debuginfo” button is pushed. The task state dump contains useful information for software developers about the iTrax module’s message queues and task states. The task state information is displayed on the GPS Workbench’s text console view, on a page labeled “Trace”. Below is an example of a state dump output:

```

Debug Trace
MskTask= 20c, Msk= 80035b30, PSize= 18, Alloc= 4, Max= 15, AFail= 0, FFail= 0
TASK      State  SSize  SAddr  Sptr   SPeak  SigR    SigW
ISYS_TASK_MAIN,      3,    256,   128,   180,   131,  0x0000, 0x0000
ISYS_TASK_ITALK_TX,  4,    150,   534,   565,    41,  0x0000, 0x0400
ISYS_TASK_ITALK_RX,  4,    150,   384,   439,    67,  0x0000, 0x0300
ISYS_TASK_NAV,       3,    500,  1559,  1662,   221,  0x0000, 0x0000
ISYS_TASK_MSG,       4,    300,  1059,  1095,   123,  0x0000, 0x0400
ISYS_TASK_CSP,       4,    250,   809,   865,    79,  0x0000, 0x0300
ISYS_TASK_CONTROL,  4,    125,   684,   724,   100,  0x0000, 0x8000
ISYS_TASK_CSP_OUT,  4,    200,  1359,  1387,   143,  0x0000, 0x0c00

```

System iTrax Trace

Explanation of the task state dump fields:

MskTask	The task ID number to whom the iTalk message mask (see below) is applied. See [4] for more information about iTalk messages.
Msk	The iTalk message mask. The bits that are zero in this mask mean that the corresponding iTalk messages aren’t delivered to the task with an ID number of “MskTask”. This mask is used to reduce serial port traffic between an iTrax module and the host, usually a PC. See [4].
PSize	iTalk message pool size, i.e. the maximum number of concurrently available iTalk messages.
Alloc	How many iTalk messages are currently being used.

Max	Largest momentary number of concurrently allocated iTalk messages since resetting the iTrax module.
AFail	How many times iTalk message allocations have failed since resetting the iTrax module. A message allocation fails if all the available messages (PSize) are in use at the same time.
FFail	How many times freeing an iTalk message have failed so far.
Task	This column has names of the tasks running in the iTrax module.
State	iTrax task states. See the "exec.h" header file in the iSuite SDK for the possible state values.
SSize	iTrax task stack sizes, in words. Notice that as the tasks actually have same amount of task memory on both X- and Y-memory pages, the total stack memory size is double this number.
SAddr	iTrax task stack starting addresses. Both the X- and Y-memory page stack areas begin at the same address.
SPtr	Current iTrax task stack pointers.
SPeak	iTrax task peak stack usages. This column tells the largest momentary stack usage since resetting the iTrax module. Notice that this figure is never larger than the "SSize" value; however if they are same, a stack overflow has occurred.
SigR	A bit mask indicating the signals that the tasks have currently received.
sigW	A bit mask indicating the signals that the tasks are currently waiting for.

2.4.6 Sending almanacs to iTrax

When navigation is started, Workbench receives the almanacs data from iTrax and saves it to the "Almanacs.dat" file. You can pass this almanacs data to iTrax with "Send almanacs to iTrax". Note that you need to start measurement first.

3. **CONNECTING TO COMMERCIAL MAP APPLICATIONS**

It is possible to connect the iTrax receiver any system accepting standard NMEA input including many commercial map applications.

iTrax writes NMEA data to serial port P1 (see section 4 for NMEA parameters) . To use a map application in the same computer as GPS WorkBench, you will need to connect cable from iTrax P1 (see the layout picture) to any available COM port of your host computer. iTrax default connection is COM1, so COM2 or higher is recommended for NMEA input.

4. OPTIONS AND PARAMETERS

To change preferences and options, select menu item “Tools”→”Options”. There are 8 pages of parameters: **iTalk, NMEA, General, 1 PPS, Autocontrol, Navigation, Tracking** and **Post-processing**. Note that, if you are not connected to iTrax, you can only configure iTalk and NMEA parameters.

4.1 Changing parameter values

To change any option, select it and click “Change”- button to give a new option value. In BOOLEAN type parameters double-clicking a parameter entry will change the value directly.

4.2 Loading default values

To load default values, select “Load defaults”. This will retrieve default values in all pages. Select “Apply” or “OK” to apply the changes or “Cancel” to quit.

4.3 Sending all parameters

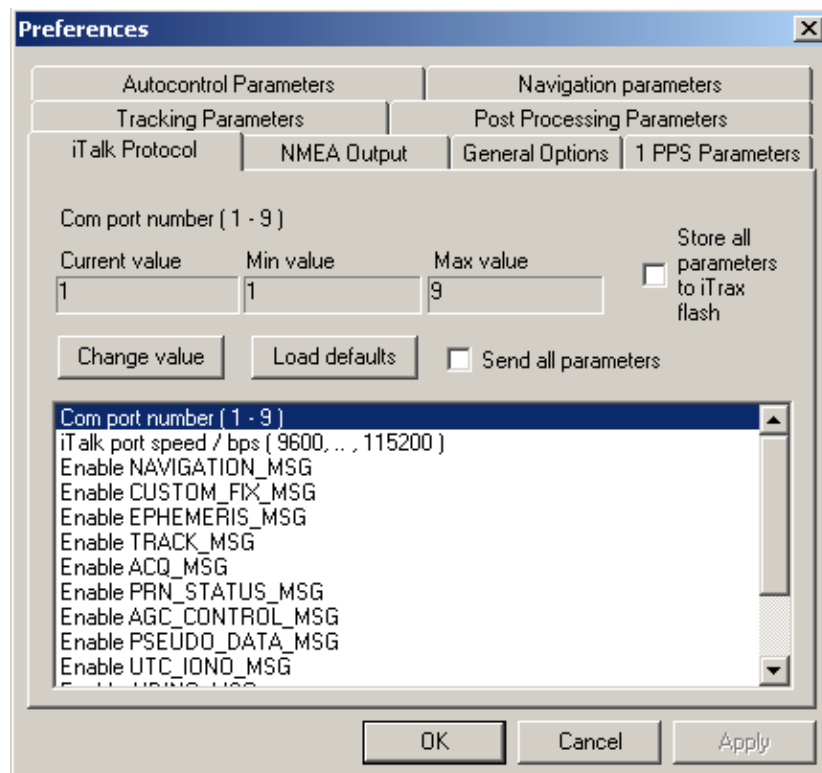
If this check-box is enabled, WorkBench will send all parameters to iTrax. Click “Apply” or “OK” to make your changes effective.

4.4 Storing all parameters to iTrax flash

As the name states, this feature will store all parameters to iTrax flash memory. Clicking this check-box will enable “Send all parameters”. Click “Apply” or “OK” to make your changes effective.

4.5 iTalk Protocol

By selecting the “iTalk Protocol”- tab, you can change the following:



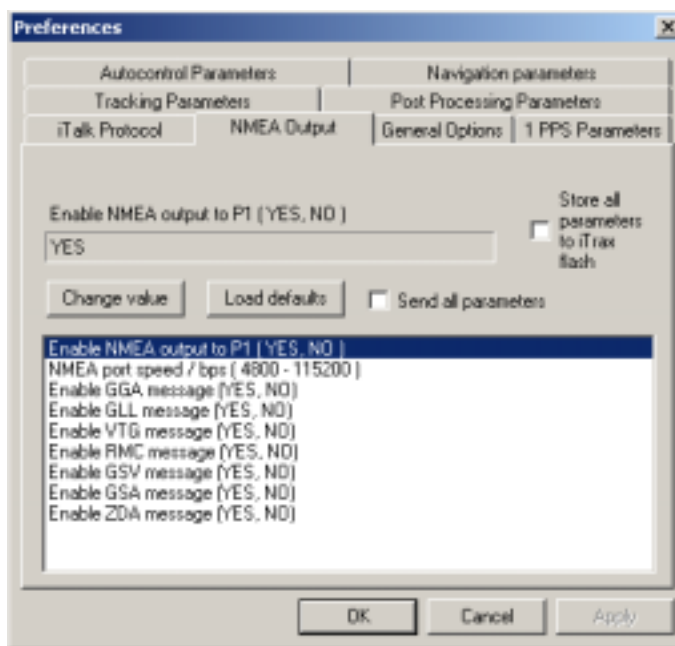
Com port name	name of the communications port (from “COM1” to “COM9”)
Speed	Default = 115200. Can be set to as low as 9600.
Enable NAVIGATION_MSG	Yes/No
Enable CUSTOM_FIX_MSG	Yes/No
Enable EPHEMERIS_MSG	Yes/No
Enable TRACK_MSG	Yes/No
Enable ACQ_MSG	Yes/No
Enable PRN_STATUS_MSG	Yes/No
Enable AGC_CONTROL_MSG	Yes/No
Enable PSEUDO_DATA_MSG	Yes/No
Enable UTC_IONO_MSG	Yes/No
Enable AIDING_MSG	Yes/No
Enable PPS_TIME_MSG	Yes/No
Enable SUBFRAME_MSG	Yes/No

Enable ITALK_SYSTEM_STATE_MSG	Yes/No
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iTrax transmission parameters are currently fixed to 8 data bits, No parity, and one stop bit.

4.6 NMEA parameters

By selecting the “NMEA Output”-tab you can toggle the basic NMEA messages on and off. The iTrax will now output a selected NMEA messages in once per second.

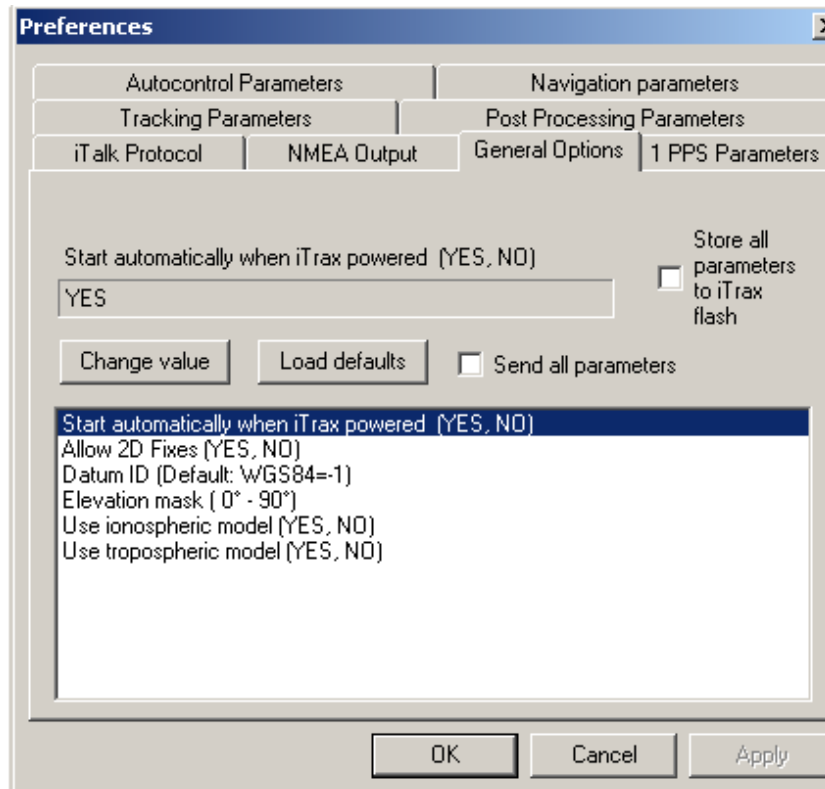


First parameter defines whether the NMEA message output is enabled from port 1 in the iTrax.

Please note that the maximum NMEA speed is 115200.

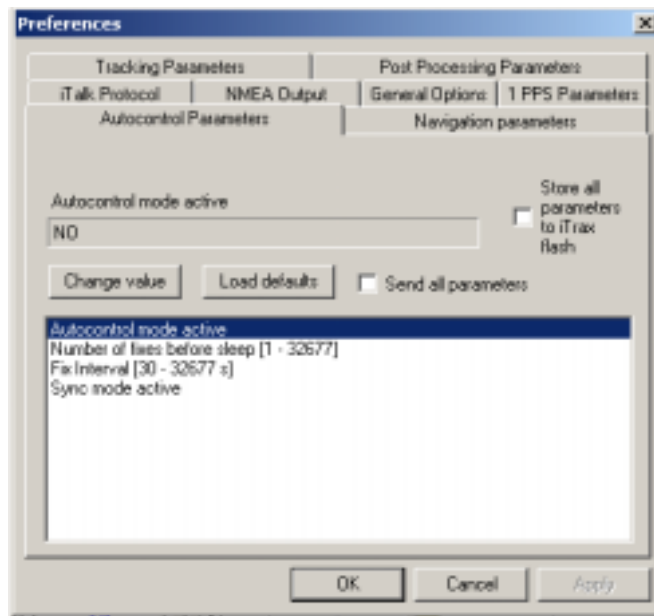
4.7 General Options

In “General Options” tab you can configure following parameters:



Start automatically when iTrax powered (YES, NO)	Start automatically navigation when iTrax powered
Allow 2D fixes (YES, NO)	In “2D fixes” -mode the altitude is constant
Datum ID	Geodetic coordinate system. Default is WGS84 (-1)
Elevation mask	Satellites lower than this will be excluded.
Ionospheric model	Yes/No.
Tropospheric model	Yes/No.

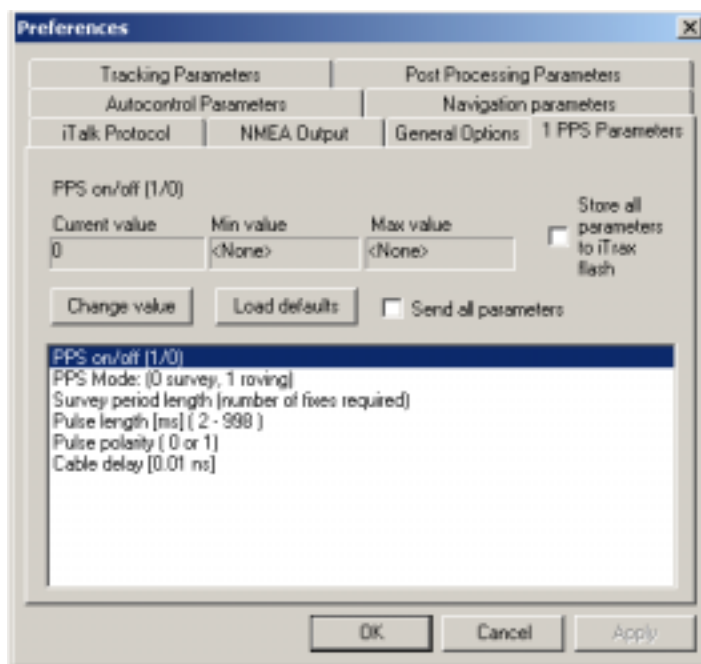
4.8 Autocontrol Parameters



Autocontrol mode active	Yes/No. By default, the auto-control mode is OFF.
Number of fixes before sleep [1 – 32677]	Minimum number of fixes before going to sleep mode
Fix Interval [0 – 32677]	Estimated time between fixes. The default value is 60 s.
Sync mode active	Yes/No. By default, the sync mode is ON.

4.9 1 PPS parameters

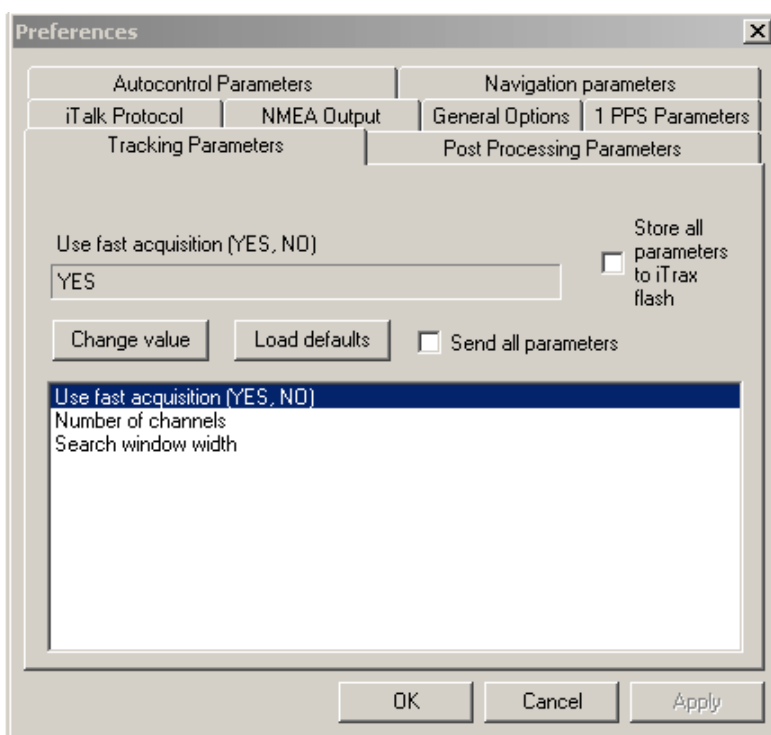
PPS parameters are used to configure iTrax 1 PPS characteristics.



PPS on/off	As default, PPS is not set on.
PPS mode	Determines PPS status. Default is PPS survey mode.
Survey period length (number of fixes required)	Number of fixes needed to determine the average position of the antenna. The receiver does not output 1 PPS before completion of survey period. The default value is 1200 fixes.
Pulse length [ms] (2-988)	The default value is 800 ms.
Pulse polarity (0 or 1)	The default value is 1.
Cable delay [0,01 ns]	Delay caused by the cabling. The default value is 0 ns.

4.10 Tracking Parameters

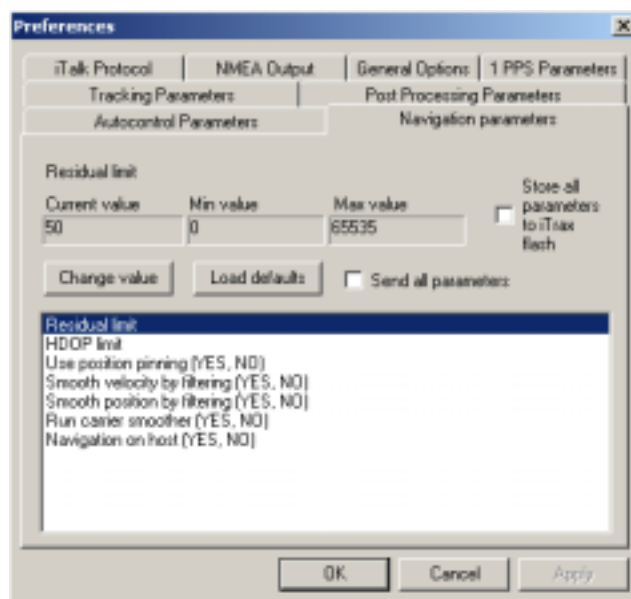
In “Tracking Parameters” tab you can configure following, Search engine –related parameters:



Use fast acquisition (YES, NO)	Can improve searching satellites with weak (passive) antenna. May slow down the navigation.
Number of channels	Number of channels used in tracking. Default is 12.
Search window width	Satellite search window width (Hz) to both directions from the window center, default is 7000

4.11 Navigation Parameters

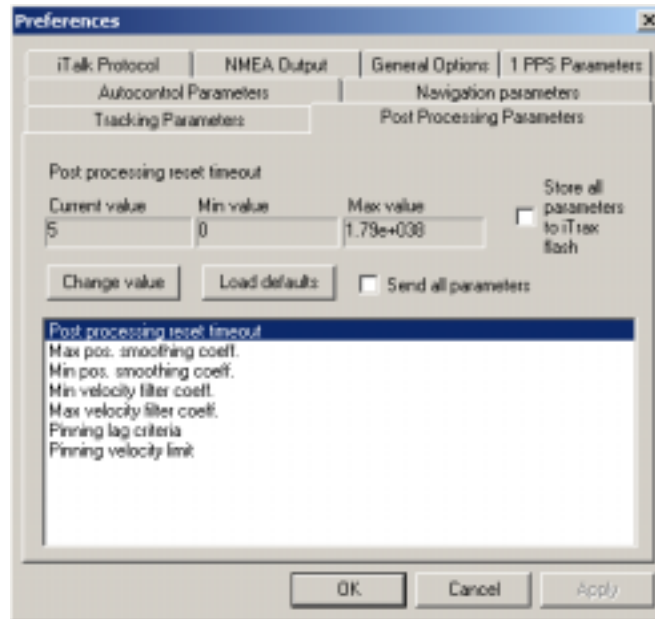
In “Navigation parameters” tab, you can configure following parameters:



Residual limit	FOM limit for rejecting the fix. Default is 50.
HDOP limit	HDOP limit for rejecting the fix. Default is 22.
Use position pinning (YES, NO)	If enabled, the position is filtered more in small velocity conditions.
Smooth velocity by filtering (YES, NO)	If enabled, the velocity is filtered before output.
Smooth position by filtering (YES, NO)	If enabled, the position is filtered before output.
Run carrier smoother (YES, NO)	If enabled, the pseudoranges are smoothed by using the carrier frequency measurements.
Navigation on host (YES, NO)	If enabled, navigation is run on the host side.

4.12 Post-Processing Parameters

In “Post-Processing” tab, you can configure following parameters:



Post processing reset timeout	Timeout for resetting the post filters (default = 5 sec, 0 = never)
Max pos. smoothing coeff.	Coefficient for position smoothing. The smoothing ratio is adjusted between high and low using FOM value [0..1]
Min pos. smoothing coeff.	See above
Min velocity filter coeff.	Coefficient for velocity smoothing. The smoothing ratio is adjusted between high and low using velocity residual [0..1]
Max velocity filter coeff.	See above
Pinning lag criteria	Position pinning stiffness. How much the pinned position may lag behind the actual position in pinning mode. Default is 3 (meters).
Pinning velocity limit	Position pinning velocity limit. If velocity is below this value, goes to position pinning mode. Default is 1 (m/s).