



REV 1.2

Logging System

iTrax02

1.08

This document covers the iTrax02 Logging System features and usage.

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CONTENTS

1.	OVERVIEW	6
2.	QUICK START	7
	Step 1: Logging settings	7
	Step 2: Logging start mode	7
	Step 3: Start navigation	8
	Step 4: Download logged data	8
	Step 5: Erasing logs	10
	Step 6: Disable logging	10
	2.1 Summary	11
3.	LOGGING SETTINGS	12
	3.1 Logging filters	12
	3.1.1 Position and interval limits	12
	3.1.2 Logging data level.....	13
	3.1.3 Configuring filter settings	14
	3.2 Start modes	14
	3.3 Log name	15
4.	DOWNLOADING LOGGED DATA TO HOST	16
	4.1 Download log data using NMEA	16
	4.2 Download log data using LogTool	16
	4.3 Download log data using iTalk	17
5.	NMEA PROTOCOL SUPPORT	18
6.	LOGTOOL	19
	6.1 Setup	19
	6.1.1 Serial port configuration	19
	6.1.2 Running the program	19
	6.2 Commands	20
	6.2.1 Clear Logs	20
	6.2.2 Disable Logging	21
	6.2.3 Get log data	21
	6.2.4 Help	22
	6.2.5 Show log information	22
	6.2.6 List logs	23

6.2.7	Number of logs	23
6.2.8	Set logging settings	24
6.2.9	System status	24
6.3	LogTool source codes.	25
7.	USAGE CONSIDERATIONS	26
7.1	Sleep mode.....	26
7.2	Power-down.....	26
7.3	Memory full.....	26

COMPLEMENTARY READING

The following reference documents are complementary reading for this document:

Ref. #	Date	Document
01		iTalk Protocol Specification
02		NMEA protocol specification

1. OVERVIEW

The iTrax02 data logging capability enables the receiver to store location and time information to module's build-in flash memory while the module is navigating.

When logging, the receiver every now and then stores new "log points" consisting of the current navigation information to the log. There may be several different logs in the module's memory at the same time, so that e.g. different routes can be stored into different logs. The user may download the logged data from the iTrax module to a PC or other host device for observation or post processing.

User may choose how much information is stored along each point, affecting how many log points can fit into available memory. Each log point may contain the following navigation information or a chosen subset of these:

- Position in latitude+longitude coordinates with precision of 0.0000001 degrees (i.e. about 1 cm on earth surface).
- Altitude with precision of 1 meter.
- Time with precision of 1 second.
- Horizontal and vertical velocity with precision of 0.01 m/s, direction of movement with precision of 0.01 degrees.
- Fix quality information like number of satellites used in fix, 2D/3D fix indication, HDOP value with precision of 0.1 units.

User may also set various conditions for how often new data points are added to the log:

- Minimum and maximum limits for how much time may elapse between logging points.
- Minimum and maximum limits for how much the receiver may move between logging points.

Depending on the logging settings, between 14000 to 39000 log points can fit into memory of a standard iTrax02/8 module with 8Mbits of flash memory. The logging capability is not available in iTrax02/4 modules with 4Mbit flash memory.

2. QUICK START

This chapter describes the quick steps for starting using the logging system.

During these steps, user may use either NMEA protocol or the LogTool utility supplied with GPS WorkBench to communicate with the iTrax02 module. For more information of how to setup the iTrax02 module to communicate with PC or other host device, please see respectively NMEA protocol specification [2] or chapter 6 (LogTool).

Step 1: Logging settings

Logging filter settings define how often new points are added to the log and how much information is saved along each log point.

The default settings are that a new point is added to log if the receiver has moved at least 15 meters AND at least 5 seconds have elapsed since the previous point was added to the log. According to the default settings, iTrax stores time and latitude & longitude coordinates at each point.

If these default settings are ok, no operation is needed in this step. If user wishes to change the filter settings, see chapter 3.1 for more information.

Step 2: Logging start mode

By default, logging is disabled.

To activate logging, set the logging start mode e.g. to "3". In this mode a new log is created and logging started each time when navigation is started, while keeping also the old logs in the memory. If some other logging mode is desired, please see chapter 3.2 for more information about logging start modes.

Using NMEA protocol

The logging start mode is set to "3" with the following command:

```
$PFST, LOGMODE, 3<CR><LF>
```

Using the LogTool utility

iTrax is configured to use logging start mode “3” along other default parameters with the following command:

```
LOGTOOL SET 3 2 5 15
```

Please see chapter 6.2.8 for more information of using LogTool to configure logging settings.

NOTES:

- When using NMEA, navigation has to be stopped before setting the logging start mode. LogTool automatically stops navigation.
- In the logging start mode “3” logging is started each time when navigation is started after setting this mode. To disable logging, the start mode has to be set again to zero (see step 6 below)
- The logging settings are stored to flash memory and can thus persist resetting the module and switching off the power.

Step 3: Start navigation

When the logging settings have been configured as described in the previous sections, logging starts automatically as navigation is started.

Navigation is started as usually, i.e.

- Giving the NMEA command \$PFST,START<CR><LF>
- Using the GPS WorkBench.
- Resetting the iTrax02 module (assuming that the auto-start after power-up is enabled [on by default]).

Step 4: Download logged data

After data has been logged by navigating with the iTrax02 module, the logged data can be downloaded to PC as follows:



Using NMEA protocol

1. Stop navigation to finish the logging session.
2. Read how many logs there are in iTrax's memory, as new logs are created each time when logging is started with the given settings. The number of logs can be displayed with the \$PFST,LOGNUM command, e.g.

```
$PFST, LOGNUM<CR><LF>
```

The system responds with a message having the number of logs, e.g.

```
$PFST, LOGNUM, 1*32
```

This would mean there are one log currently in the memory.

3. The logged data can be outputted using the command "\$PFST,LOGGET,<N>", where <N> is the number of the log of interest. This command outputs the logged data formatted as standard NMEA messages according to the current NMEA settings.

For example, the following command will display all data in log 1:

```
$PFST, LOGGET, 1<CR><LF>
```

NOTE: If there are plenty of data in the log, it may take some time to output all the data as NMEA messages. To speed-up the operation, it may be advisable to increase the NMEA port speed or disable some of the NMEA messages (see \$PFST,NMEA command documentation in NMEA protocol specification [2] for more information).

Using the LogTool utility:

1. LogTool automatically commands iTrax to stop navigation upon starting.
2. Read number of logs in iTrax's memory with the following command:

```
LOGTOOL NUM
```

3. The logged data is downloaded to PC with the following command. <FILENAME> field defines name for the target file and <NUM> defines the number of the log:

```
LOGTOOL GET <FILENAME> <NUM>
```

For example, the following command downloads data in log number 1 to file "logdata.txt":

```
LOGTOOL GET logdata.txt 1
```

Please see chapter 6.2.3 for more information of downloading log data using the LogTool utility.

Step 5: Erasing logs

iTrax logging system doesn't automatically delete old log data but always creates new logs or appends data to the previous log. While it's often advantageous to have several logging sessions in memory at the same time, eventually the memory will fill up if old log data isn't erased.

Using NMEA protocol

The log data is deleted with the following command:

```
$PFST, LOGCLEAR<CR><LF>
```

Using the LogTool utility:

The log data is deleted with the following command:

```
LOGTOOL CLEAR 1
```

Please see chapter 6.2.1 for more information of using the LogTool CLEAR command.

Step 6: Disable logging

When logging system is configured as described in above steps, a new log is created each time when navigation is started. To stop using the logging capability, the logging can be disabled by setting the start mode to zero.

Using NMEA protocol

The logging start mode is set to zero with the following command:

```
$PFST, LOGMODE, 0<CR><LF>
```

Using the LogTool utility

Logging is disabled with the following command:

```
LOGTOOL DI SABLE
```

2.1 Summary

This chapter described the quick steps for starting using the iTrax02 logging system. The steps were in short:

1. [No action needed at first step if the default logging settings are ok.]

2. Set logging start mode to "3", e.g.

```
NMEA      : $PFST, LOGMODE, 3<CR><LF>  
LOGTOOL: LOGTOOL SET 3 2 5 15
```

3. Start navigation, e.g.

```
$PFST, START<CR><LF>
```

4. Download logged data, e.g.

```
NMEA      : $PFST, LOGGET, 1<CR><LF>  
LOGTOOL: LOGTOOL GET logdata.txt 1
```

5. Erase log data, e.g.

```
NMEA      : $PFST, LOGCLEAR<CR><LF>  
LOGTOOL: LOGTOOL CLEAR 1
```

6. Disable logging, e.g.

```
NMEA      : $PFST, LOGMODE, 0<CR><LF>  
LOGTOOL: LOGTOOL DI SABLE
```

3. LOGGING SETTINGS

This chapter describes the settings affecting the logging system. The settings can be configured either by using NMEA protocol, iTalk protocol or the supplied LogTool utility.

The log settings are stored into flash memory and thus persist power-offs and stay valid until the user again reconfigures them.

3.1 Logging filters

Logging filters are settings controlling how often and how much time is stored into log. Using these settings the user may affect how much data and over how large span of time or distance can fit into available memory.

3.1.1 Position and interval limits

User may define minimum and maximum time intervals as well as minimum and maximum movement limits between storing points to the log:

- Minimum interval time (seconds): A new point won't be added to a log if less than this time has elapsed since the previous log point. An exception is that if the maximum movement limit is exceeded, then a new point is logged.
- Maximum interval time (seconds): If this time or longer has elapsed since the previous log point, a new point is logged. If set to zero, the maximum limit isn't used.
- Minimum movement (meters): A new point won't be added to a log if distance to the previous log point is less than this limit. An exception is that if the maximum interval time from the previous log point is exceeded, then a new point is logged.
- Maximum movement (meters): If distance from the previous log point is this distance or more, a new point is logged. If set to zero, the maximum limit isn't used.

In pseudo-code, the limit rules are evaluated as follows:

```
if ((time >= min_interval) and (distance >= min_move)) then
    log;
else if ((time >= max_interval) or (distance >= max_move))
then
    log;
else
    dont_log;
```

Default settings for the filter limit are as follows:

```
min_interval    = 5
max_interval    = 0 (max. limit not used)
min_move        = 15
max_move        = 0 (max. limit not used)
```

According to these default settings, a new point is logged when at least 5 seconds has elapsed from the previous point **and** distance to the previous point is at least 15 meters.

Example:

Assume that the limit settings are defined as follows:

```
min_interval    = 5
max_interval    = 60
min_move        = 15
max_move        = 100
```

In this case a new point is logged when at least 5 seconds has elapsed from the previous point **and** distance to the previous point is at least 15 meters. However, a new point is logged also when at least 60 seconds has elapsed since the previous point **or** distance to the previous point is 100 meters or more.

3.1.2 Logging data level

Logging data level controls how much information is stored along each log point. The data level directly affects how much space each log point requires, and consequently how many log points can fit into memory.

Data-Level	Size per point (16-bit words)	Information stored per point
1	4	Latitude & Longitude coordinates
2	6	Lat&Lon + GPS Time
3	7	Lat&Lon + Time + Altitude
4	8	Lat&Lon + Time + Alt + Fix information (i.e. number of satellites used for fix, 2D/3D fix indicator, HDOP value)
5	10	Lat&Lon + Time + Alt + FixInfo + Horizontal Velocity + Direction of movement
6	11	Lat&Lon + Time + Alt + FixInfo + HVel + Dir + Vertical velocity

3.1.3 Configuring the filter settings

Using NMEA: Filter settings are configured with the command \$PFST, LOGSETTING.

Using LogTool: Filter settings are configured with the command "LOGTOOL SET" (see section 6.2.8).

3.2 Start modes

Logging start mode controls if and how iTrax should start logging when GPS navigation is started. Depending on the start mode, the system may create a new log each time when logging is started or continue using the old log so that new log points are appended after the old points.

The start mode also controls if logging is started only once at the next time when navigation starts, or continuously so that logging is started always when navigation is started (until again disabled by user).

Available start modes are described in the following table:

Start Mode	Description
0	Logging disabled (default).
1	Logging is started so that a new log is created once when navigation is started for the next time. On the consecutive navigation starts after that logging won't be used.
2	The previous log is continued once when navigation is

	started for the next time. On the consecutive navigation starts after that logging won't be used.
3	Logging is started so that a new log is created each time when navigation is started. Logging is active until user changes the start mode again.
4	The previous log is continued each time when navigation is started. Logging is active until user changes the start mode again.

Using **NMEA**, logging start mode is configured with the command \$PFST, LOGMODE.

Using **LogTool**, logging start mode is configured with the command "LOGTOOL SET" (see section 6.2.8).

3.3 Log name

Along each log the system stores a log name which is formed by combining a user-given log name text string and the index number of the log. The default log name is "Log".

Using **NMEA**, log name can be configured with the command \$PFST, LOGNAME.

Using **LogTool**, log name can be configured with the command "LOGTOOL SET" (see section 6.2.8).

4. DOWNLOADING LOGGED DATA TO HOST

The logged data can be downloaded to the host device using one of these alternative approaches:

- Using NMEA protocol. In this approach iTrax outputs the logged data to the NMEA serial port as standard NMEA messages.
- Using the LogTool utility delivered with GPS WorkBench. With the LogTool utility the logged data can be downloaded quickly and easily to PC in ASCII text file format.
- Using iTalk protocol. The binary iTalk protocol offers an efficient way for downloading the logged data to own applications.

4.1 Download log data using NMEA

ITrax02 can output the logged data to the NMEA serial port formatted as standard NMEA messages. User may then capture and parse the outputted messages from the serial port by his/her own means.

Depending on the data level settings that were used when logging the data, it may be possible that not all data required for generating complete NMEA messages are available; in such case, the missing data fields are replaced with zeros.

The log data outputting is activated with the NMEA command \$PFST, LOGGET; please see the NMEA protocol specification [2] document for detailed usage instructions of the command.

4.2 Download log data using LogTool

The LogTool utility can be used to download the logged data to PC in ASCII text file format. Please see section 6.2.3 for detailed instructions.

4.3 Download log data using iTalk

The iTalk message LOG_CMD_MSG can be used for controlling the logging system and downloading the logged data as documented in iTalk Protocol Specification [1].

The LogTool utility uses this iTalk message, and if planning own applications using the logging system, it's advisable to notice that the LogTool source codes are available on iSuite HDK for selected customers. Please see chapter 6.3 for a note about LogTool source codes.

5. NMEA PROTOCOL SUPPORT

iTrax02 has a set of NMEA commands that can be used to control the logging system. On the table below is a summary of the available NMEA logging commands.

Please see the NMEA Protocol Specification [02] document chapter “Logging Commands” for more detailed usage information of these commands.

Command	Description
LOGCLEAR	Erase log data from iTrax02's memory
LOGFREE	Calculate how much space is left for log data
LOGGET	Output logged data as standard NMEA messages
LOGINFO	Show log information
LOGMODE	Set logging start mode
LOGNAME	Set log name
LOGNUM	Show how many logs are currently stored in the memory
LOGSETTING	Sets the logging settings
LOGSTOP	Stop logging without stopping navigation

6. LOGTOOL

The LogTool utility is a simple but effective tool for controlling the iTrax02 logging system. Using LogTool, user can quickly and easily configure the logging settings, download logged data to PC and erase logged data. The LogTool is delivered with the Fastrax GPS WorkBench installation kit as well as iSuite HDK and iSuite SDK kits.

6.1 Setup

LogTool uses iTalk protocol to communicate with the iTrax02 module. Connect iTrax02's iTalk port (iTrax UART port0) to PC COM port with a cross-connected serial cable (provided with the iTrax02 Evaluation kit).

6.1.1 Serial port configuration

LogTool uses the PC serial port COM1 by default. Other serial port can be chosen by using the "-PORT" command line switch when running the LogTool program:

```
LogTool -PORT N
```

For example, port COM3 can be chosen with the following command:

```
LogTool -PORT 3
```

6.1.2 Running the program

The LogTool utility has two alternative operation modes:

- Interactive mode: In this mode user is presented a menu of commands and the program asks user for parameter values as needed.
- Command-line mode: In this mode all the commands and parameters are entered as command-line arguments for the LogTool program. Command-line mode enables quick execution of commands and creating batch scripts for automating routinely used log system operations.

LogTool is started to interactive mode by executing the program as is, without any command-line arguments (except for the possible serial



port choosing switch, see previous section). In interactive mode the program shows user the alternative command choices and asks for required parameters. Otherwise the commands are similar as in the command-line mode.

LogTool is started to command-line mode by entering the logging command arguments after the “logtool” command name entry to the command prompt, for example:

```
C:\>logtool COMMAND PARAM1 PARAM2
```

In command-line mode LogTool rapidly executes the given command and exits. Please see the section 6.2 for more examples of using the LogTool in command-line mode.

NOTE: If iTrax is navigating, LogTool automatically stops navigation when the program is started.

6.2 Commands

The following sections describe the LogTool commands.

6.2.1 Clear Logs

This command erases the log data from iTrax’s flash memory.

Command-line syntax:

```
logtool CLEAR <MODE>
```

where <MODE> is the clear operation:

<MODE>	Description
0	Reclaim the flash file system only. Doesn't delete any logged data, only frees up data clusters that have been deleted but not freed yet.
1	Erase log data. Erases logged data but keeps the current logging settings.
2	Erase log data and logging settings.
3	Formats the flash file system used by the logging system. Not recommended for normal use, useable only for recovering from an extreme system disaster.

6.2.2 Disable Logging

Disables logging by setting the log start mode to zero (see 6.2.8). At consequent navigation starts, logging won't be started.

Command-line syntax:

```
logtool DI SABLE
```

6.2.3 Get log data

Downloads the logged data from iTrax02 into an ASCII text file on the PC.

Command-line syntax:

```
logtool GET <FILENAME> <LOGNUM> [FIRST] [NUM]
```

Parameter	Description
<FILENAME>	Name for the file where the downloaded data is saved.
<LOGNUM>	Number of the log whose data is downloaded.
[FIRST]	(optional) The starting point, from which log item on to start downloading the log data. If omitted, data is downloaded starting from the first log item.
[NUM]	(optional) How many log items are downloaded. If omitted, all items until end of the log are downloaded.

Examples:

```
logtool GET logdata.txt 1
```

This command would read all logged data in log number 1, storing the result to a file named "logdata.txt".

```
logtool GET logdata2.txt 2 50 100
```

This command would read the logged data in log number 2, at most 100 log items starting from the 50th item, storing the result to a file named "logdata2.txt".

Log data is downloaded in ASCII text format so that each row of the file correspond to one log item and each row consist of columns that are separated by "tab" characters. The following table has description of the data file columns:

Column Name	Description
Lat	Latitude coordinate in degrees.

Lon	Longitude coordinate in degrees.
Alt	Altitude from reference ellipsoid (WGS-84 by default).
Week	GPS Week number.
TowSec	Time-of-week seconds from the beginning of the GPS week.
H.Vel	Horizontal velocity, m/s.
Dir	Direction of movement to geological north, degrees.
V.Vel	Vertical velocity, m/s.
NumSVs	Number of satellites used for the fix.
FixInfo	Fix information. If 0, the fix is a 2D fix, if 1, the fix is a 3D fix.
HDOP	HDOP (horizontal dilution of precision) value of the fix.

NOTE: Depending on the data level setting that has been used when logging the data, data related with some of the columns may be unavailable and corresponding columns are consequently filled with zeros.

6.2.4 Help

View help on LogTool or discrete command usage.

Command-line syntax:

```
logtool HELP <COMMAND>
```

Where <COMMAND> is an optional field identifying the command for which to view help.

Examples:

```
logtool HELP
```

This command views LogTool general usage help

```
logtool HELP GET
```

This command views help on the "GET" command usage.

6.2.5 Show log information

Shows detailed information of a single log.



Command-line syntax:

```
logtool INFO <LOGNUM>
```

Where <LOGNUM> is the number of the log whose information is shown.

Description of the outputted log information fields:

Field	Description
Log ID	Number of the log.
Items	How many log items are stored into this log.
Offset	System-specific information: Starting offset from the beginning of the log file.
Log item size	How many words of flash memory does a single log item occupy.
Datum ID	Datum ID. Value 65535 corresponds to WGS-84 (default datum).
Name	Name of the log.
Logging data level	Logging data level, defining how much data is stored along each log item. See "logging data level" (section 3.1.2) for more information.
Min. log interval	Minimum time interval between adding new item to log. See section 3.1.1.
Min. move threshold	Minimum movement required to add a new item to log. See section 3.1.1.
Max. log interval	Maximum time interval between adding new item to log. See section 3.1.1.
Max. move threshold	Maximum movement required to add a new item to log. See section 3.1.1.

6.2.6 List logs

Shows a lists of all logs in iTrax's memory.

Command-line syntax:

```
logtool LIST
```

6.2.7 Number of logs

Shows how many logs are currently stored into iTrax's memory.

Command-line syntax:



logtool NUM

6.2.8 Set logging settings

Configure logging settings. These settings take effect on the next time when navigation is started.

Command-line syntax:

```
logtool SET<MODE> <DATALEVEL> <MIN.INT> <MIN.MOVE>
[<MAX.INT>] [<MAX.MOVE>] [<NAME>]
```

Parameter	Description
<MODE>	Logging start mode. See section 3.2.
<DATALEVEL>	Logging data level. See section 3.1.2.
<MIN.INT>	Minimum time interval between adding new item to log. See section 3.1.1.
<MIN.MOVE>	Minimum movement required to add a new item to log. See section 3.1.1.
[<MAX.INT>]	(optional) Maximum time interval between adding new item to log. See section 3.1.1. If omitted, doesn't use maximum time interval,
[<MAX.MOVE>]	(optional) Maximum movement required to add a new item to log. See section 3.1.1. If omitted, doesn't use maximum move limit.
[<NAME>]	(optional) New name that's used for logs from this on, see section 3.3. If omitted, uses the old name.

NOTE: The logging settings are stored into flash memory and thus can persist reset and power-off.

6.2.9 System status

Displays the logging system status.

Command-line syntax (notice that this command is letter T):

```
logtool T
```

Description of the outputted system status information fields:

Field	Description
Log system version ID	Logging system version number. This is used for checking the iTrax log system and LogTool version compatibility.

Start mode flags	Current logging start mode flags in system-specific format. See below.
Corrsp. tool start mode	Current logging start mode as described in section 3.2.
Current logging status	Is iTrax currently logging data to a log (0 = no, 1 = yes). Should usually be zero as LogTool stops navigation upon starting.
Latest error code	Latest logging system error code. Currently not used.
Free space, words	How much free space is there available in iTrax for log data (16bit words).
Free space, items	For how many log items there are free space in iTrax with the current logging settings.
Log name	Current log name body. Log names are formed by concatenating this name and the log number.
Logging data level	Logging data level, defining how much data is stored along each log item. See "logging data level" (section 3.1.2) for more information.
Min. log interval	Minimum time interval between adding new item to log. See section 3.1.1.
Min. move threshold	Minimum movement required to add a new item to log. See section 3.1.1.
Max. log interval	Maximum time interval between adding new item to log. See section 3.1.1.
Max. move threshold	Maximum movement required to add a new item to log. See section 3.1.1.

6.3 LogTool source codes.

LogTool uses binary iTalk protocol (see iTalk Protocol Specification [1]) to control the iTrax02 logging system.

Full source codes for the LogTool are delivered with the iSuite HDK. If planning own applications that'll control the logging system, the LogTool source codes will provide a quick starting point for own modifications and operate as a reference implementation for how to command the logging system from a host device. Please contact Fastrax customer support for more information on how to acquire the iSuite HDK.

7. USAGE CONSIDERATIONS

7.1 Sleep mode

Sleep mode (power-down mode) doesn't affect the logging system. If logging is active when going to sleep mode, logging is resumed as the module wakes up and first valid fixes are received.

The comments in the next chapter concern also losing power during the sleep mode.

7.2 Power-down

The iTrax02 logging system can sustain sudden power losses without major affects, however, it's suggested to stop navigation properly prior to switching off the power or otherwise some of the most recently logged data may be lost and the next power-up time may be longer as iTrax logging system performs automatic recovery checks due to the power loss.

It's also possible that iTrax02 logging system may occasionally not be able to continue the previous log (logging start modes 2 and 4) after sudden power-losses. In such cases, the logging system creates a new log and continues using that one as usually.

7.3 Memory full

iTrax02 logging system automatically ceases from logging shortly before the flash memory gets totally full. It's thus quite normal that logging may stop although there'd seem to be flash space for several dozen more log items still available.

This early logging stopping is implemented to prevent problems with saving logging settings and book-keeping information due to lack of available memory.