REV 0.4

Technical Description

uPatch02-L

GPS Receiver Module

This document describes the features, specification and interfacing of the uPatch02-L GPS receiver module.

April 15, 2004

Fastrax Ltd.

Fastrax

CHANGE LOG

Rev.	Notes	Date
0.1	Initial revision	2004-01-15
0.2	Corrections on I/O signal names	2004-02-18
0.3	Clarification on connector configuration. Added configuration for CMOS signal levels	2004-04-07
0.4	Added description on HW configurations and description on all I/O pins, corrections on Port configurations	2004-04-15

CONTENTS

COMPLEMENTARY READING

The following reference documents are complementary reading for this document:

Ref. #	File name	Document name
1	Itrax02.pdf	iTRAX02 Brochure
2	Itrax02_id.pdf	iTRAX02 Interface Description
3	Nmea.pdf	NMEA Protocol Specification

1. OVERVIEW

The uPatch02-L is a GPS receiver board, which consists of the integrated iTRAX02 (*ref #1,2*) receiver electronics with an internal GPS patch antenna together with regulators and a power-up-reset circuit.

The module provides complete signal processing from antenna to serial data output in either NMEA messages or in proprietary iTALK binary protocol (configurable). A second serial port is also optionally available for custom purposes. The nominal power supply is +3.0…+5.5V and serial data signal levels are RS232 compatible (option for CMOS +2.8V levels).

The module supports also a control input with 3V CMOS signal levels to wakeup the module from sleep state. Alternatively this input can be used for ON/OFF control of the module with a custom firmware.

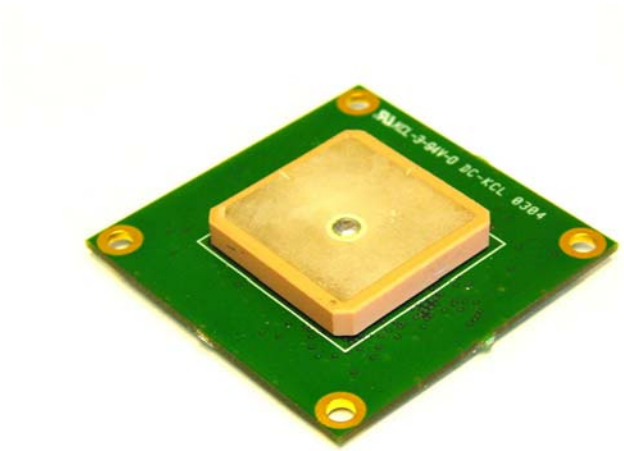

Figure 1 uPatch02-L module

2. FEATURES

2.1 Technical specification

Receiver	iTRAX02, L1 C/A-code, SPS
Channels	12
Update rate	1 Hz (default), user configurable
Supply voltage range, PWR	+3.0 V…+5.5 V
Nominal supply voltage, PWR	+5.0 V
Current drain	50 mA typical
Antenna directivity	+2 dBi typical
Operating and storage temperature	-40ºC…+85ºC
Serial ports (default)	Port 0: iTALK (configurable to NMEA) Port 1: NMEA (configurable to iTALK)
Serial data format	8 bits, no parity, 1 stop bit
Serial data speed	NMEA: 4800 baud (configurable)
Serial data signal levels	RS232 compatible (default), CMOS +2.8V (optional)
NMEA output messages	GGA, RMC, GSV, GSA (default)
Control inputs	TTL +5V compatible
I/O protection against ESD	IEC61000-4-2 : +/-8kV contact and air gap discharge; +/-15kV human body model

2.2 Absolute maximum ratings

Table 1 Absolute maximum ratings

Item	Min	Max	unit
Operating and storage temperature	-40	+85	ºC
Power dissipation		500	mW
Supply voltage, PWR	-0.3	+5.5	V
Current on any CMOS I/O	-30	+30	mA
Input voltage on control inputs	-0.3	+5.5	V
Output voltage on serial ports RS232	-13.2	+13.2	V
Input voltage on serial ports RS232	-25	+ 25	V

3. OPERATING MODES

3.1 Normal mode

The module enters normal navigating mode after power up. It will start the navigation in cold start mode, unless a proprietary aiding command is given from host, see the NMEA Protocol Specification (*ref #3*). The module runs as long as the power supply is available.

3.2 Special modes

The GPS receiver operating modes can be controlled by the host via special NMEA messages (*ref #3*). A few commands that affect the operation modes are described below.

STOP command will stop the navigation, which reduces the current drain to about 6 mA; START will start the navigation with the specified mode (Auto, Quick, Hot, Warm and Cold start).

Sleep mode is entered with the PWRDOWN command. In this mode only the Real Time Clock (RTC) is running and the current drain is reduced to minimum, 400 uA typical. The PWRDOWN command requires a parameter to set the length of the sleep period after which the module wakes up automatically and performs the fastest possible navigation start. If this parameter is omitted, the module sleeps until the next power up occurs or an interrupt is generated via the WAKEUP input.

3.3 Upgrading the firmware

The module supports the possibility to upgrade the firmware. In order to enter the Serial Boot mode, the Test point TP2 or pin J2-6 should be connected to GND during power up or reset (TP2/J2-6 is internally connected to GPIO15 at iTRAX02, see also *ref #2*). The module remains in this mode until the next power up or reset occurs.

A free programming tool as an executable is available from Fastrax. The module uses Port 0 for down loading the firmware.

4. EXTERNAL INTERFACES

4.1 System connectors

The uPatch02-L supports versatile I/O with 3 different connectors. These interface connectors provide ESD protection against static discharge according to IEC61000-4-2 : +/-8kV contact and air gap discharge and also +/-15kV human body model.

4.1.1 J1 connector

The main system connector J1 is a 1x5 SMT soldering pads for direct cable soldering with 2.54 mm pitch. The following table describes the pin identification.

Table 2 Pin Identification

	Name	Description	I/O	Note
1	PWR	Power supply	I	
2	RXD_RS	Serial Port 0, receive	I	
3	GND	Power and signal ground	I/O	
4	TXD_RS	Serial Port 0, transmit	O	
5	N.C.	No connection, reserved for future usage	I	

4.1.2 J2 connector

The module supports optionally a board-to-cable connector from JAE-connector FI-series with 1x6 pins. The following table describes the pin identification. The J2 cannot be used at the same time as with the J1 connector.

Table 3 Pin Identification

Pin	Name	Description	I/O	Note
1	PWR	Power supply	I	
2	RX0_RS	Serial Port 0, receive	I	
3	GND	Power and signal ground	I/O	
4	TX0_RS	Serial Port 0, transmit	O	
5	WAKEUP	Control input, internal pull down resistor 100kohm	I	TTL +5V levels
6	BOOT_MODE	Control input for firmware upgrading, internal pull up resistor 8.2kohm to +2.8V	I	Open collector interface

The WAKEUP control input is used to wake up the module from sleep state, see details in *ref #3* how utilize the sleep state via PWRDOWN command. The WAKEUP interrupt is generated by a state transition from 0->1 or by 1->0. The WAKEUP in internally connected to iTRAX02 GPIO11 via an inverter, see *ref #2* for further details. Alternatively the WAKEUP can be used for ON/OFF control of the module with a custom firmware: ON - <high state>, OFF - <low state>. The input has an internal 100k pull down resistor, so for normal operation this input should be connected to high state, e.g. to PWR.

The BOOT_MODE input is connected internally to the test point TP2, which provides control to the internal boot selection control signal (internally connected to the iTRAX02 GPIO15). By forcing the BOOTMODE or TP2 to GND with a open collector driver, the module boots after power up from the external host via the serial port 0. In normal operation the BOOT_MODE should be left floating unconnected.

4.1.3 J3 connector

The module supports optionally a board-to-cable connector from JAE-connector FI-series with 1x6 pins. The following table describes the pin identification.

Table 4 Pin Identification

Pin	Name	Description	I/O	Note
1	PWR	Power supply	I	
2	RX1_RS	Serial Port 1, receive	I	
3	GND	Power and signal ground	I/O	
4	TX1_RS	Serial Port 1, transmit	O	
5	On/Off	On/Off (active/inactive) indicator output	O	Open collector interface
6	PPS	Pulse per second output, CMOS +2.8V signal level	O	Only available with HW option uPatch02-L3C. Default mode is OFF.

The On/Off output allows the indication on the GPS receiver status: when the receiver is active, the output is in high impedance state (floating). During inactive state (navigation stopped or sleep state) the output is in low impedance state (low state).

The PPS output provides the Pulse per second output only in CMOS +2.8V level. The PPS output is only available in HW configuration option uPatch02-L3C, which also *excludes* the ESD protection of the I/O. Default PPS mode is OFF; supported modes are ROVING, STATIC and SURVEY; see ref #3 for details.

4.2 Power supply

The main power supply PWR feeds the digital parts of the iTRAX02 directly. The input has a 4.7µF capacitive load utilized with a low loss ceramic capacitor.

The internal regulator provides +2.8V supply voltage for the internal analog and digital parts.

4.3 Serial interface

All serial ports operate by default at the RS232 compatible signal levels. There is also an option for CMOS +2.8V signal levels. The Port 0 is configured for NMEA messages, which supports the NMEA 0183, version 3.0 output messages. Port 1 supports binary iTALK protocol. Protocols can also be configured to the ports the other way round.

Table 5 Serial data protocols (default configuration)

Port 0	NMEA 0183, version 3.0
Port 1	ITalk

Table 6 Serial data interface

Speed	configurable, see Serial data speed
Data format	No parity, 8 data bits, 1 stop bit
NMEA messages	configurable, see NMEA message mask

Proprietary NMEA input commands (*ref #3*) are also available for serial data configuration, i.e. data speed, selecting NMEA messages, switching to iTALK binary protocol etc.

4.4 Test point TP1

The test point TP1 provides control to the internal Reset signal. By forcing the TP1 to GND with a open collector driver (sink current > 1 mA), the module resets. Minimum reset pulse length is 1 ms. In normal operation the TP1 should be left floating in high impedance state.

4.5 Test point TP2

The test point TP2 provides control to the internal BOOT_MODE control signal (internally connected to the iTRAX02 GPIO15). By forcing the TP2 to GND with a open collector driver, the module boots after reset from the external host via the serial port 1. In normal operation the TP1 should be left floating in high impedance state or connected to ‘1’ state (0.7 x 2.8V).

5. MECHANICAL DIMENSIONS

5.1 Dimensions

Board size is 45 mm x 45 mm +/- 0.3mm, general tolerance +/-0.5mm.

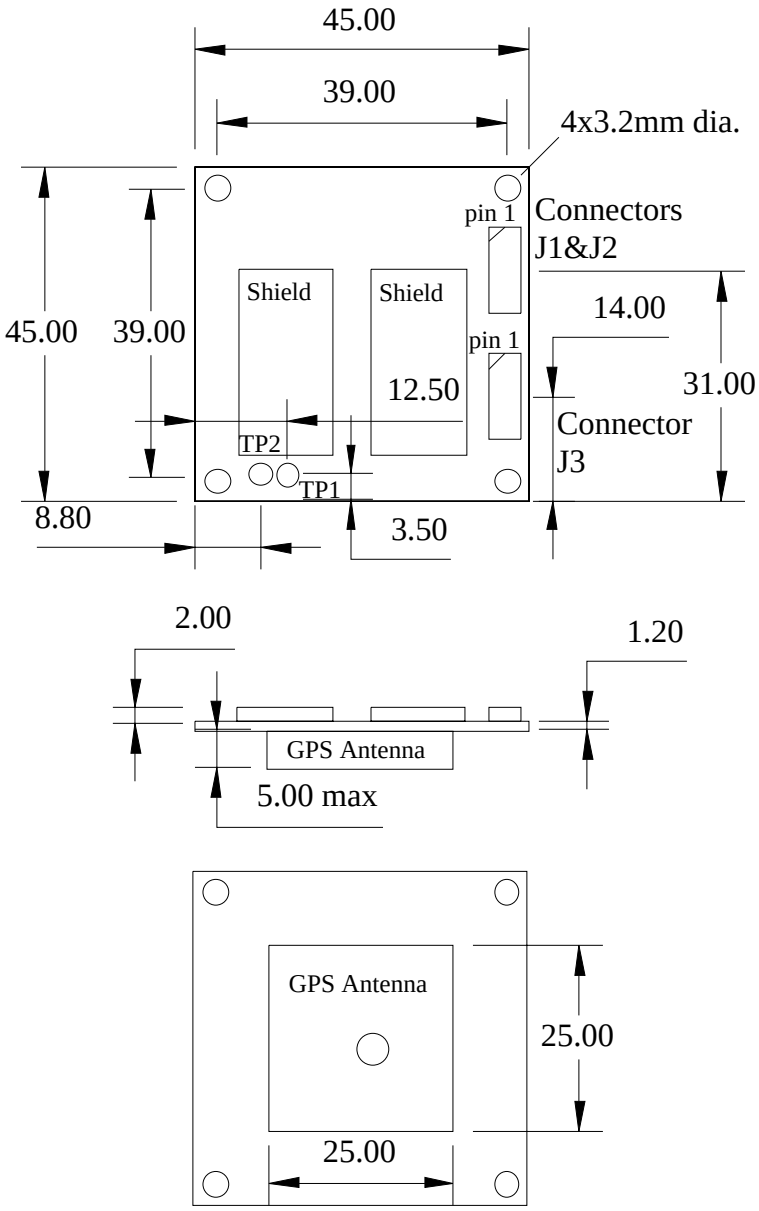

Figure 2 uPatch02-L module, dimensions

6. PRODUCT LINEUP

6.1 HW configuration options

The uPatch02-L module is type numbered according to the HW configuration option:

uPatch02-L[*n*][*s*]

where *n* indicates the connectivity option 1[2,3] and *s* indicates the serial data signal level option R[,C]. E.g. type number for the default HW configuration is uPatch02-L1R.

6.1.1 Connectivity

The following combinations of the system connector type(s) are supported. For other configurations and requests for custom I/O Fastrax sales.

Table 7 System connector options

Option *n*	Configuration
1 (default)	J1, No connector, soldering pads only, Port 0
2	J2 connector only, Serial Port 0
3	J2 & J3 connectors, Serial Port 0 & 1

6.1.2 Serial data signal levels

The default serial data signal levels are RS232 compatible. There is also an option for a special HW configuration to support CMOS+2.8V levels. Note that this option *excludes* the ESD protection of all I/O.

Table 8 Serial data levels

Option *s*	Configuration
R (default)	RS232 levels
C	CMOS +2.8V levels, *excludes* the ESD protection at I/O

The CMOS data level option requires a special HW configuration (SMT assembly) at the factory. For requests with CMOS signal level option contact Fastrax sales.

6.1.3 Standard product HW configurations

The standard products supported are

1. uPatch02-L1R (connector option 1 [J1 connector] and RS232 levels)

2. uPatch02-L3R (connector option 3 [J2&J3 connectors] and RS232 levels)

Other HW configurations require a factory order, please contact Fastrax sales.

6.2 Firmware configuration options

Firmware configurations can be specified with any HW options.

6.2.1 Serial Port configuration

The uPatch02-L is configured for the default Port protocols at the factory.

Table 9 Port protocol

Option	Configuration
DEFAULT	PORT 0: NMEA, PORT 1: ITALK
INVERTED	PORT 0: ITALK, PORT 1: NMEA

If the Inverted Port protocol is requested to be configured at the factory, please contact Fastrax sales. For requests with custom protocols contact Fastrax sales.

6.2.2 NMEA Message mask

The default NMEA message mask used is the same as with the standard iTRAX02 firmware, which outputs the GGA, RMC, GSA and GSV messages.

Table 10 NMEA message mask (default)

Item	Configuration
NMEA message mask	GGA, RMC, GSA, GSV active (mask A003)

If required, any custom NMEA message mask can configured by the special NMEA command. The NMEA mask can be set with any terminal program as described in the NMEA documentation and stored permanently by the STORE command (*ref #3*).

If a custom NMEA mask is requested to be configured at the factory, please contact Fastrax sales.

6.2.3 Serial data speed

The default NMEA serial data speed used is 4800 baud, which is the same as with the standard iTRAX02 firmware.

Table 11 Serial data speed (default)

Item	Configuration
ITALK serial speed	115200 baud
NMEA serial speed	4800 baud

If required, any supported serial data speed can configured by the special NMEA command. The speed can be set with any terminal program and stored permanently by the STORE command as described in the NMEA documentation (*ref #3*). Supported speeds are 1200, 2400, 4800, 9600,19200, 57600 or 115200 baud.

If a custom serial data speed is requested to be configured at the factory, please contact Fastrax sales.