



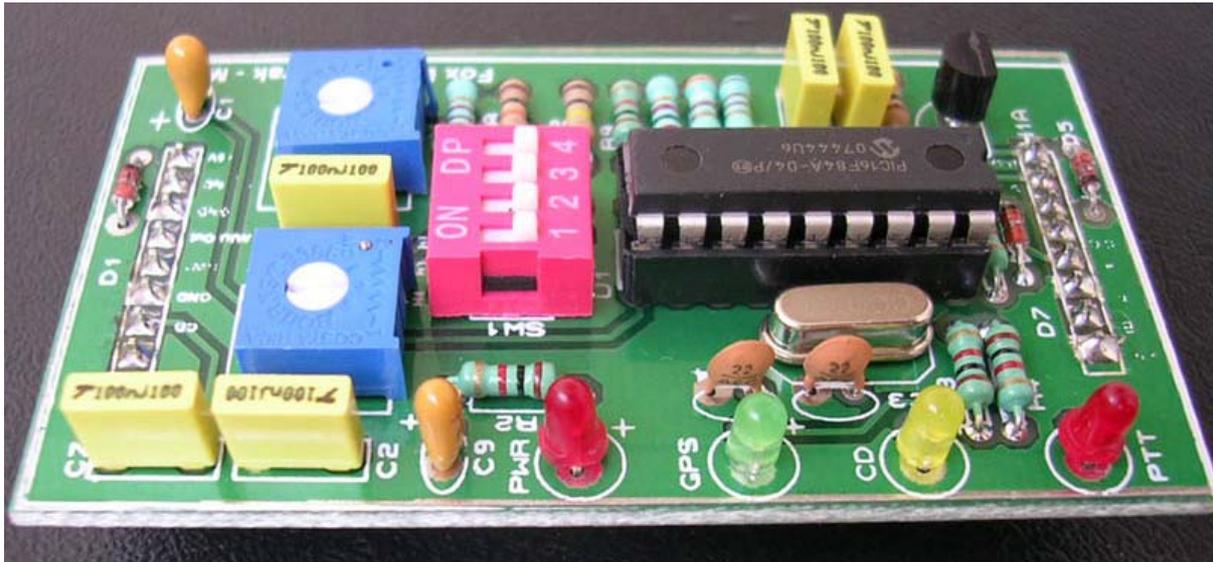
Fox Delta

Amateur Radio Projects & Kits

FD – FoxTrak - M

Technical information: Compact PIC 16F84A/628A APRS Tracker Module

Picture of the Completed FoxTrak-M:



FoxTrak - M is designed on a Double Sided PTH Board Measuring 7 x 4cm.

FoxTrak- M is basically same as FoxTrak APRS Tracker except that instead of two D9M/F Connectors, it uses 0.1inch headers. It may be used for:

1. To obtain a tracker function in a project as a plug-in module
2. To use it as a tracker in newly developed FoxView-2, APRS Terminal.
3. In your own project where you have some space to include a tracker.

The Schematic & Technical Information presented here generates an APRS signal with very little effort. It's a TinyTrak type of tracker hardware with small changes, where all functions are controlled by PIC16F84A.

The position data in NMEA format (\$GPRMC) delivered from a GPS is decoded and a 1200 bps packet radio signal is generated from it. This can be fed directly into a Radio Transmitter without the need of an expensive TNC. Because of not having enough program memory left on PIC & to make hardware simple, circuit does not decode received APRS signals.

This APRS interface has a serial interface for connecting to the GPS and for programming user parameters into PIC's memory.

The main new features compared to TinyTrak (Byonics) besides some hardware variations is, speed dependable beacon rates and beacon transmissions at major course changes.

Firmware is developed by DK7IN who has also made a nice configuration utility to write user parameters in PIC. However, TinyTrak windows & DOS configuration utilities may also be used for the same purpose.

FoxTrak-M may be configured for various firmware, you may update FoxTrak with better & smarter Firmware simply by changing the Firmware & if necessary, changing the PIC, to 16F628A. The Basic hardware remains the same.

FoxTrak-M is designed on a Double Sided PTH PCB & measures only 7cm x 4cm. I am using standard 0.1 Inch Headers as edge connectors.

PIC FIRMWARE:

Present firmware for PIC16F84A is written by DK7IN and may be downloaded from his website.

Besides the fixed beacon rates this extended firmware supports a smart beacon control. With that the beacon rate changes depending on your speed, according to two selectable tables.

Maximum speed	< 4 km/h	> 4 km/h	> 11 km/h	> 24 km/h	> 50 km/h	> 100 km/h	> 150 km/h
SW1-1 on: beacon every	25 min	4 min	120 sec	60 sec	30 sec	20 sec	10 sec
SW1-1 off: beacon every	30 min	5 min	160 sec	80 sec	40 sec	30 sec	20 sec

Relevant is the maximum value of the speed since the last beacon transmitted. For a better track accuracy at street edges, a beacon will be transmitted if there is a major change in the driving direction, while the speed is more than 15 km/h.

That is, if the current course differs more than 40 degrees (60 ° if H4 is off) from the course at the time the last beacon was transmitted. The beacon will be delayed, if the last beacon was less than 10 sec ago.

For checking the modulation or the frequency shift the circuit can produce some constant frequencies. This can be controlled with DK7IN Configuration program or by entering special commands with a terminal program (4800 baud, 8N1). Using the last another arbitrary character ends the tone and reinitializes the circuit.

ESC T 0 generates a 1200 Hz tone

ESC T 1 generates a 2200 Hz tone

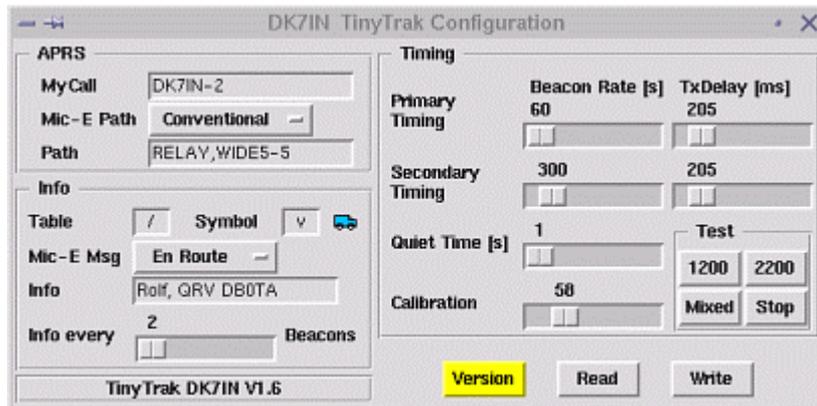
ESC T M generates a mixed 1200/2200 Hz tone

Configuration of PIC parameters:

A DOS based utility is supplied with FoxTrak to configure your call sign & other parameters for APRS operation.

A Tinytrak config program for windows may also be used for the same purpose.

Linux version is also provided, which looks like this:



Running any of the 3 config program works well, “Version” should display the version string of the connected FoxTrak as “DK7IN V.1.6”.

The fixed beacon rate could be set in 10 sec steps, the TX Delay with a resolution of 6.6 ms.

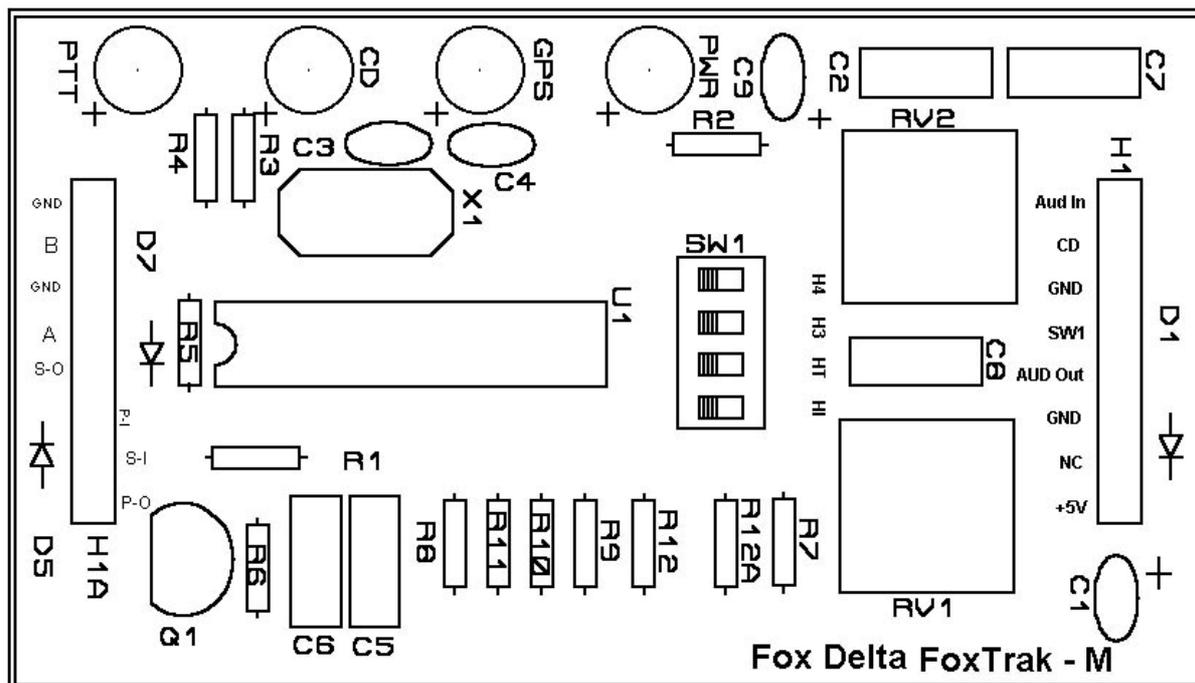
Calibration:

The mark and space frequencies can be adjusted slightly with the Calibration parameter. For Bell 202 they should be 1200 and 2200 Hz, but because of system limitations their distance is a bit too high.

Calibration	36	40	50	58	60	63	70	80	90
Frequency 1 [Hz]	1199	1197	1191	1187	1186	1184	1180	1175	1169
Frequency 2 [Hz]	2249	2244	2234	2225	2223	2220	2212	2202	2192

Here the influence of the calibration factor on the measured frequencies is shown. For the smallest symmetrical percentage error a value of 58 may be used. (TT Config. has default value of 63)

Silk Snap of FoxTrak-M: Headers, LEDs & Switches:



Two switches select the operation mode: SW1-1 & SW1-2. With Switch SW1-2 open, a fixed beacon rate will be used, if closed smart beaconing is enabled, where the beacon rate is controlled by your speed and direction changes.

With fixed beacon rate, H4 (SW1-1) decides whether to use the primary (H4 on) or the secondary timing (H4 off). With smart beaconing and H4 closed, beacons will be transmitted more often and direction changes of more than 40 degrees trigger a beacon. Otherwise transmissions occur less often and a direction change has to be more than 60 degrees. H4 always determines the TX Delay according to the primary or secondary timing.

The carrier detect LED at Marked "CD" (pin 17) is illuminated if another station is transmitting.

The GPS LED Marked "GPS" (pin 18) is on with valid data from the GPS receiver and blinks while receiving GPS data without a valid position. The PTT LED is on while the transmitter is keyed.

During initialization at power up the yellow and green LEDs are blinking three times followed by a beacon. **Automatic beacons will only be transmitted if valid NMEA data from the GPS receiver is received.**

Audio Adjustments:

The audio level has to be adjusted for correct modulation of the connected transceiver. FoxTrak-M may be configured for portable units by switching SW1-3, which will connect a 2.2k resistor to PTT line (MIC input).

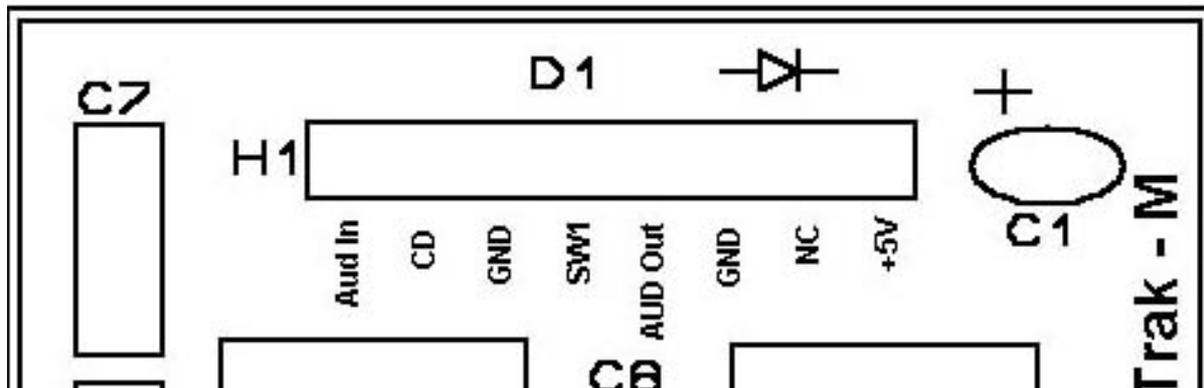
RV1 & RV2 are presets to adjust audio to & from transceiver. Both need to be adjusted for proper operation.

SW1-4 is used to increase TX audio output level. It switches a parallel resistor to existing R12 for this purpose.

Power:

FoxTrak-M is designed to receive power (+5V) from the 0.1inch header pins. It doesn't have either a 5V regulator or a possibility to supply power to GPS.

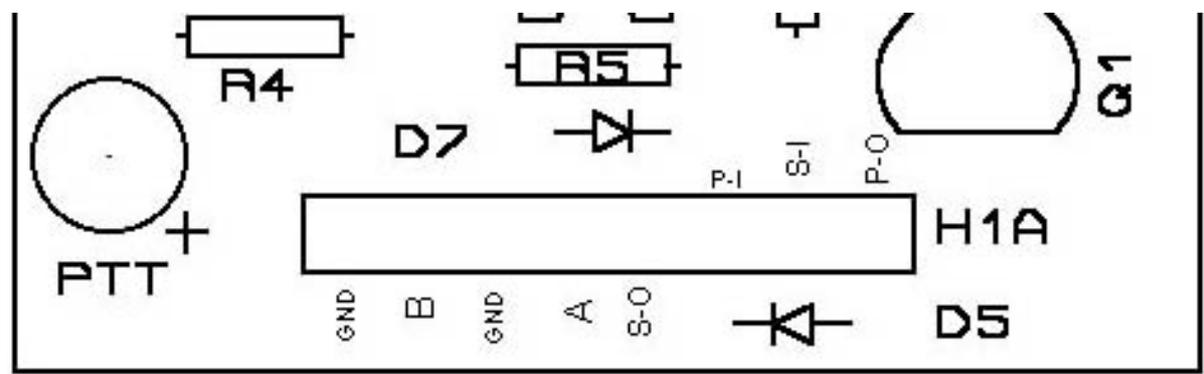
Transceiver Connections:



Header H1 has following output/input connections:

- Audio in: Transceiver audio to this tracker
- CD: CD from Transceiver, if available
- GND: Tracker Supply & Signal Ground
- SW1: Instant Transmit button may be connected here.
- Audio Out: Tracker audio out to transceiver microphone
- GND: Ground
- NC: No Connection
- +5V: Input 5V DC to Tracker.

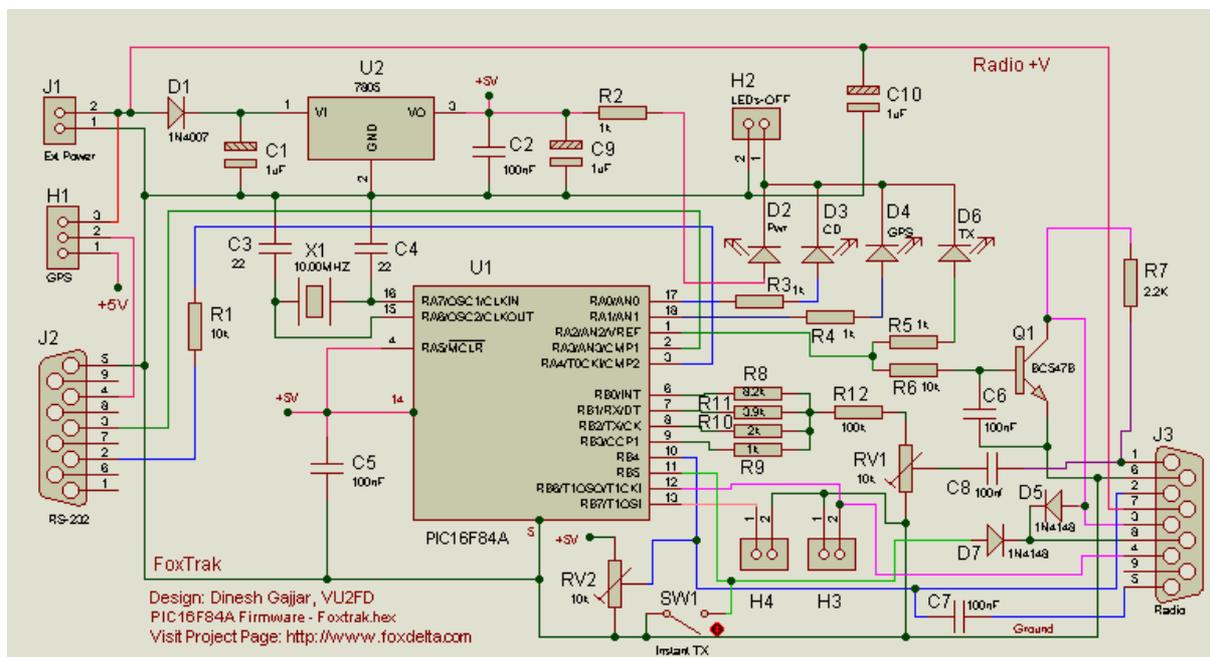
GPS/PC Connection:



H1A at the bottom of Module uses same 8pin 0.1inch header for GPS/PC connection:

- GND: Tracker Ground
- B: Not Used for Foxtrak-M
- GND: Ground
- A: Not used for FxTrak-M
- S0: Serial Data OUT From PC or GPS
- PI: PTT-In from transceiver
- SI: Serial Data IN from PC/GPS
- PO: PTT out to transceiver

Schematic of the FoxTrak:



Another View of FoxTrak-M:



I hope this tracker kit will be useful to many radio amateurs wish to join APRS and also wish to try their own firmware to make development of better APRS network.

Dinesh Gajjar
Date: 08th June 08

Visit Project Page at: <http://www.products.foxdelta.com>