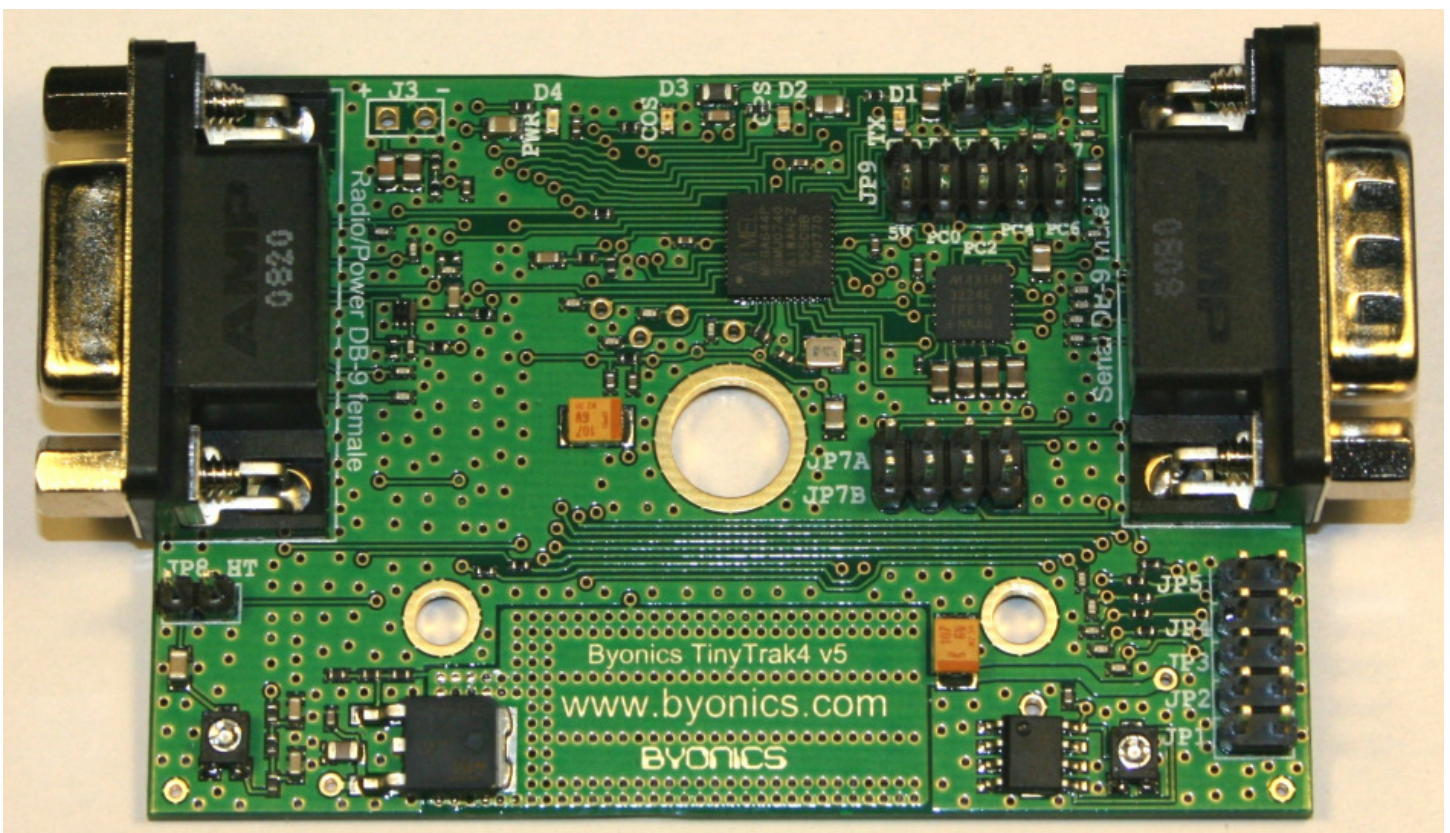


BYONICS

TinyTrak4 Built and Tested Hardware Manual

Version 0.62

<http://www.byonics.com/tinytrak4>



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Overview

TinyTrak4 is a radio controller similar to a packet TNC, which can transmit and receive signals over a two-way radio. It can receive and broadcast position reports from a GPS receiver, decode incoming packet tones, is field programmable, and more. The TinyTrak4 is interfaced to a radio transceiver so it can cause the radio to transmit audio tones, and also listen to the received audio from the radio and decode and react to that information. The TinyTrak4 can be re-programmed at any time with a computer's serial port as new functionality is created or problems are fixed. A common use of the TinyTrak4 will be an APRS Tracker, which will take position information from a connected serial GPS and transmit that over the APRS network. With TinyTrak4's ability to also decode packets, the tracker can also display other nearby stations on the display of the GPS (when supported), or be commanded from other packet stations. The TinyTrak4 APRS Tracker firmware will support the TinyTrak3 features, such as text, MIC-E, and NMEA output formats, altitude, speed, and heading reporting, timestamps, burst after voice, time-slotting, and SmartBeaconing. Other TinyTrak4 firmware programs will provide different functionality. The TinyTrak4 microcontroller is not backward compatible to older TinyTrak circuit boards. All TinyTrak devices have been created by Byon Garrabrant, N6BG. More information can be found at the Byonics web site at <http://www.byonics.com>.

This manual is for the built and tested, surface mount version of the TinyTrak4. For information on the through hole kit version, please see the TinyTrak4 Kit Hardware Manual. The TinyTrak4 Built version is based on the kit version, but due to the different component sizes, has a different printed circuit board layout. Since the built version requires no board assembly, there is no construction section in this manual. See the Kit manual for part and schematic information.

Acknowledgments

Thank you to all the testers and users of the TinyTrak4, TinyTrak3, TinyTrakII, and TinyTrak. Without your suggestions and support, TinyTrak4 could not have been created. Special thanks to Sean Sheedy, AI4ID, Matt Krick, KC7GSA, and Scott Evans, VK7HSE who each gave excellent help and suggestions during TinyTrak4 beta development. Finally, Extra Big Thanks to the Wonderful Lara Garrabrant, KD6AYO, who kits and ships all the TinyTrak products.

Interfacing

The following are the interface connections for the TinyTrak4, some of which are required before operation.

J1 – DB-9 female jack for radio and power interfacing

J2 – DB-9 male jack for serial interfacing (computer and GPS)

J3 – 2 holes for alternate power interfacing

JP1 – JP5 – 5 1x2 header posts for digital and analog input or output. Currently used for telemetry

JP6 – Serial power jumper to send 5V or Vin to GPS on J2

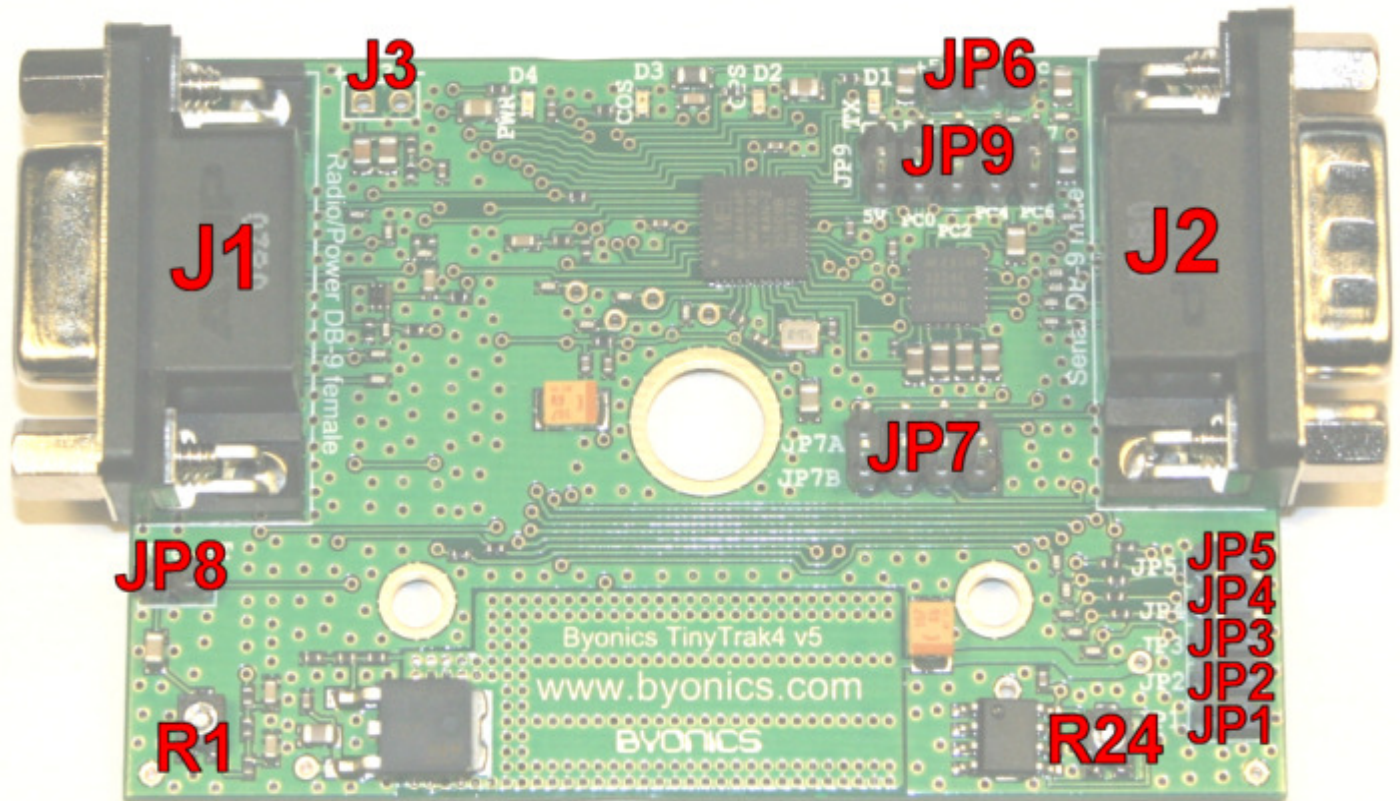
JP7 – 2x4 header posts for secondary serial voltage levels (TTL vs RS-232)

JP8 – 1x2 header posts for configuring J1 for hand held radios that do not use a PTT keying line

JP9 – 2x5 header posts for digital PORT C interfacing. Currently used for display and keyboard interface

R1 – Potentiometer for setting transmit audio level

R24 – Potentiometer for adjusting temperature sensor



Radio – J1

Pin	Function	Description
1	Audio out	Generated packet or other audio tones to be transmitted via the radio microphone jack.
2	Carrier Detect	Digital carrier detect state from radio. Can either be active high or active low.
3	PTT Out	This line is grounded when the radio should transmit. Connect to radio PTT input.
4	JP1	Optional J1 interface to the JP1 line. Can be an analog or digital input, or output, depending on firmware.
5	Audio in	Audio received from the radio via the earphone or speaker jack.
6	Ground	Ground return for power, audio, PTT and all other signals.
7	Power In	Power input to the TinyTrak4. Can be 6V to 18V.
8	PTT In	State of optional external microphone PTT switch. Grounded during transmit.
9	No connection	May be end-user wired for custom features.

Female DB-9 connector J1 is used to interface TinyTrak4 to a radio transceiver. It is compatible with the radio connector on the TinyTrak3 and Kantronics TNCs, such as the KPC-3. Connect Audio Out (J1 pin 1) to the radio's microphone input. If the transmitter transmits when the microphone input is grounded (most handheld (HT) radios do, except the Kenwood brand), jumper JP8 must be installed, but PTT Out (J1 pin 3) will not need to be connected to the transmitter. For all other transmitters, PTT Out (J1 pin 3) will be needed, and should be connected to the transmitter's PTT input. If JP8 is closed,

you should not wire PTT Out to the radio. PTT Out is grounded when the transmitter is to be keyed. To prevent transmissions over other stations, connect the receiver's audio out (earphone or speaker) jack to the Audio In (J1 pin 5). Also connect Ground (J1 pin 6) to the radio's ground. Refer to the transceiver's manual for more information, and look for a section on installing a terminal-node controller (TNC) for packet operation, as TinyTrak4 is interfaced in a similar manner.

J1 is usually used to supply TinyTrak4's power, via pin 6 and pin 7. Current draw is approximately 50ma, and it can be feed with a voltage between 6 volts and 18 volts.

J1 also provides an optional PTT Input (J1 pin 8) to allow TinyTrak4 to transmit a data burst after the microphone is unkeyed after voice traffic. This input should be grounded when PTT is pressed, and floating when PTT is released. This input is not needed for normal operation. J1 also can optionally interface to a radio's carrier detect output via the Carrier Detect input (J1 pin 2). To use this option, Carrier Detect should be grounded when the channel is busy. Some example radio interface diagrams are available at <http://www.byonics.com/>.

JP1 is available on the J1 connector at J1 pin 4 to add an optional interface point for that signal. Various firmware can use this as an option switch, an analog input, or a digital output.

Serial – J2

PIN	Function
1	No Connection
2	Primary Serial data in from a GPS or computer
3	Primary Serial data out to a GPS or computer
4	Power out for GPS (Vin or 5V), or alternate power input
5	Ground
6	No Connection
7	Secondary Serial data out to a computer
8	Secondary Serial data in from a computer
9	No Connection

The male DB-9 J2 serial connector is used to connect to a computer, or a serial GPS, or both. The primary serial port is on pins 2 and 3. J2 pin 3 is used to transfer serial data from the TinyTrak4 to a GPS or a computer. J2 pin 2 is used to transfer serial data from the GPS or computer to the TinyTrak4. J2 pin 5 is serial ground. Both a gender-changer (female-to-female) AND a null-modem adapter will be needed to interface a computer to TinyTrak4. A null-modem adapter swaps pins 2 and 3, and connects pin 5. Use a DB-9 serial extension cable if it is difficult to connect the gender-changer, null-modem adapter, and TinyTrak4 directly to the computer 9-pin serial port.

The secondary serial port is available on pins 7 and 8. A "Y-adatper cable" can be built to separate the primary and secondary serial ports to separate connectors.

If using a GPS that normally plugs directly into a computer serial port, that GPS can be plugged directly into TinyTrak4's J2 serial connector. If the GPS does not connect directly into a computer's serial port, an interface will need to be built. The GPS should have a female DB-9 with GPS serial data out wired to pin 2, and ground to pin 5. If GPS serial input will be used, it should be wired to pin 3. J2 can also be used to supply or receive TinyTrak4's power. If this is desired, JP6 can jumpered to Vin (the right 2 pins) to send in incoming voltage (usually 12V) to the GPS via J2 pin 4. Set a jumper shunt on the left 2 pins of JP6 to make 5V available on J2 pin 4. When selecting 5V, do not use a GPS that draws more that about 120ma. The TinyTrak4 may get warm when providing 5V to most GPSs. If JP6 is jumpered to Vin (the right two pins), power can be supplied to the TinyTrak4 via J2 pin 4.

The secondary serial port (J2 pins 7 and 8) can be set for either RS-232 levels, or TTL levels via jumper JP7A and JP7B.

Power – J3 (also J1 and J2)

TinyTrak4 must be powered with an external source of 6-18 volts DC, such as a 9-volt battery, or a 12-volt cigarette lighter plug. TinyTrak4 is NOT powered via a computer's serial port. Power can be applied via J1, J2, or J3. J1 is the most common way to power the TinyTrak4. To use J1, connect pin 7 to positive voltage and pin 6 to ground. To use J2, connect pin 4 to positive voltage and pin 5 to ground. JP6 must be set for Vin to apply power via J2 and 5V out will not be available on J2. To use J3, apply positive voltage to the plus (+) hole, nearest J1, and ground to the minus (-) hole. Only one of the three jacks J1, J2, and J3 should be used to supply power to the TinyTrak4. If power is applied via J2 or J3, the same power will be available on J1 to power a radio. If power is supplied via J1 or J3, power can be retrieved via J2 to power a GPS, if JP6 is set properly. Be sure not to draw more current than your supply can handle.

J1 – DB-9 female jack for radio and power interfacing

Jumper JP1 – JP5

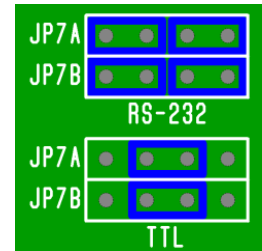
These jumpers are available for input or output, depending on the firmware loaded. They can be used for analog telemetry, selection of options, or driving external loads. JP1 is connected to J1 pin 4. JP5 is connected to pull-up resistor R7.

Serial Power - Jumper JP6

This jumper controls what power is connected to the GPS via J2 pin 4. When the left two pins are connected, 5V is available on J2 pin 4. When the right two are connected, Vin is available there. When none of the pins are connected (no jumper) J2 pin 4 is not connected.

Serial Level Jumpers - Jumper JP7A & JP7B

This jumper sets the level for the secondary serial port (J2 pins 7 & 8) to either TTL levels or RS-232 levels. When jumpers connect the two left and two right pairs of pins on JP7A and JP7B, the level is set to RS-232. When 2 jumpers are placed between the 2 middle pins of JP7A and JP7B, the level is set to TTL. Jumpers should NOT be placed connecting any pins from JP7A to JP7B.



PTT Control - Jumper JP8

This jumper adds the resistor R15 (2.2K) to the radio mic line to allow PTT via the mic audio connector. It should be closed (shorted) for use with handhelds other than Kenwood. For mobile radios and Kenwood radios, J8 should be open.

PORT C Interface - Jumper JP9

This 2x5 header post allows for connection to the 8 Port C pins, plus power and ground. It is currently used to interface to a 20x4 LCD display and PC keyboard in some firmware. Note this interface doesn't exist on the kit version of TinyTrak4.

TinyTrak4 Adjustment

Transmit Audio Level – R1

The transmit audio level should be adjusted at R1 for proper deviation. If using the TinyTrak tracker firmware, use the transmit tones buttons (1200 Hz/2200 Hz/Send Both) in the configuration software to cause the TinyTrak4 to transmit while adjusting. You can listen on a separate receiver, and start the potentiometer at maximum drive. Lower the drive level until there is a noticeable change in the receiver. Overdriving the transmitter is a common cause of failure to decode.

Temperature adjustment – R24

R24 can be used to tweak the voltage level out of the temperature sensor. Use the diagnostic firmware, or other firmware that reports the temperature, and adjust to match the correct temperature. Note this interface doesn't exist on the kit version of TinyTrak4.

Firmware Updates

The TinyTrak4 firmware can be updated at any time to new and improved functionality with just a computer serial port. This is done with the .TT4 files, which are new programs which can be burned into the main TinyTrak4 chip. See the TinyTrak4 Firmware Manual for more information.

Troubleshooting

Frequently Asked Questions

Hints, Tricks, & Notes

- JP6 is a jumper to GPS power output. It is not a power input.
- TinyTrak4 DB-9 connectors are pin compatible with TinyTrak3, so GPS and Radio/Power cables for one will work with the other.
- A Null modem adapter and gender changer, or a similar LapLink cable is needed whenever TinyTrak4 is connected to a computer serial port.