

BYONICS

TinyTrak4 Tracker Manual

Version 4.07

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Overview

This manual explains the functionality and use of the Tracker firmware for the Byonics TinyTrak4. The latest version can be found at the TinyTrak4 website at <http://www.byonics.com/tinytrak4>. The TinyTrak4 Tracker should be connected to a GPS receiver sending NMEA serial data at 4800 baud in the \$GPRMC and \$GPGGA sentence formats. The tracker should also be connected to a radio transmitter, usually set to the APRS frequency of 144.39MHz in North America, or 144.80MHz in Europe. The tracker will proceed to transmit the location received from the GPS over the radio network. These transmissions are usually picked up by the amateur radio APRS network, and sent to the internet, where they can be viewed in real time at web sites like <http://aprs.fi>, <http://findu.com/>, and <http://aprsworld.net/>.

Updating the firmware

Before the TinyTrak4 can be used as a tracker, the TinyTrak4 Tracker firmware must be loaded into the TinyTrak4 code memory. The TinyTrak4 Firmware Manual contains details on how to update the TinyTrak4 firmware, and can be found at <http://www.byonics.com/tinytrak4>. The firmware will be retained even when power is removed from the TinyTrak4. Once the firmware is loaded, and when power is cycled, the 4 LEDs will light in sequence from left to right to left to right to left, and the tracker code will begin running.

Setting the configuration

After programming the Tracker firmware into the TinyTrak4, the next step is to update the configuration with the desired tracker settings. These settings include callsign, transmit rates, and many other options. These configuration options are set with the TT4TrackerConfig.EXE program. This program can be found in the ZIP file along with the tracker firmware and this document. It is currently only available for Windows operating systems.

The TinyTrak4 must be powered to use the TT4TrackerConfig program, and must be connected to a computer serial port via a female-to-female null modem adapter. The same adapter used to program the firmware can be used to configure the TT4 Tracker. If the connected computer does not have a serial port, a USB to serial adapter can be used.

After starting the TT4TrackerConfig program, and setting the desired options, select the COM port that the TinyTrak4 is connected to, and click the "Write Config" button to save the configuration settings to the TinyTrak4 non-volatile memory.

After setting the configuration options, the TinyTrak4 can be disconnected from the computer, connected to a radio and a GPS, and can then be used as a tracker.

Configuration options

The screenshot shows the TT4TrackerConfig dialog box with the Primary tab selected. The interface is organized into several sections:

- Primary/Secondary Tabs:** At the top, with 'Primary' selected.
- Call Sign and Path:** Callsign: NOCALL, Digi Path: WIDE1-1,WIDE2-1.
- Symbol and Table/Overlay:** Symbol: >, Table/Overlay: /.
- Timing:** Auto TX Delay: 300 ms, Auto Transmit Rate: 120 sec, Manual TX Delay: 125 ms, Manual Transmit Rate: 30 sec, Quiet Time: 500 ms.
- Status:** Text: TinyTrak4, Send Every: 3, Send Separate: unchecked, Don't Send '>': unchecked.
- Waypoint Output:** Enable: checked, Num Chars: 9.
- Telemetry:** Send After Position: unchecked, Rate: 0 sec, High Res: unchecked, Send Voltage: unchecked, Send Temp: unchecked.
- Send Options:** Send Altitude: checked, Timestamp DHM: unchecked, Timestamp HMS: unchecked, Send NMEA: unchecked, Skip Start Packet: unchecked, Only Send Valid: unchecked, No TX on PTT In: unchecked, 9600 Baud GPS: unchecked, Alternate Digi Paths: unchecked, 300 Baud packet: unchecked, Disable LEDs: unchecked.
- MIC-E Settings:** Enable: checked, Message: Off Duty, Force Printable: unchecked, Path: Conventional.
- Time Slotting:** Enable: unchecked, Transmit Offset: 15 sec.
- SmartBeaconing:** Enable: unchecked, Slow Speed: 5 knots, Min Turn Angle: 27 deg, Slow Rate: 1800 sec, Turn Slope: 255, Fast Speed: 65 knots, Min Turn Time: 5 deg, Fast Rate: 90 sec.
- Power Switch:** Enable: unchecked, Time: 3 sec.
- Carrier Detect:** Audio Tones, RX Level: 100, TX Level: 128, TX Twist: 50.
- Configure:** COM1, Read Config, Read Version, Write Config.
- Tone Test:** Send 1200 Hz, Send Both, Send 2200 Hz, Stop Sending.
- Buttons:** Save, About, Load, Exit.

This section will give information to explain each of the TT4TrackerConfig program options.

Primary & Secondary Configuration

The tracker allows for two completely independent sets of configuration options, called primary and secondary. The two tabs at the top of the dialog window allow access to each of the two groups of settings. When the tracker is running the desired group of options can be selected at jumper JP1. When open, or floating, the primary settings are used. When shorted, the secondary settings are used. The JP1 pin is also available at J1 pin 4. Leaving this pin unconnected will select the primary settings, and grounding this pin will select the secondary settings.

Callsign

This sets the amateur radio callsign used to identify the tracker transmissions. This identifier can be up to 6 upper-case letters and numbers. An optional hyphen and SSID number from 1 to 15 can be added after the callsign to identify the tracker further. A tactical callsign can be used in place of the amateur radio callsign. When using a tactical callsign, be sure to transmit an actual amateur radio

callsign in the Status Text at least every 10 minutes to follow FCC identification requirements. Example callsign settings are N6BG, KD6BCH-9, LEADER, and FOLLOW-1.

Digi Path

This sets the optional digipeater path used to propagate the tracker transmission through a radio network. The default and recommended digi path is **WIDE1-1,WIDE2-1**. The number of callsigns in the digi path will limit the space available for the status text.

Symbol & Table/Overlay

These sets the graphical symbol used to display the tracker when it is set to transmit MIC-E protocol. The table/overlay will modify the symbol by selecting either the original or alternate table, or an overlay character. Use / for the main symbol table, \ for the alternate symbol table, or a letter or number for an overlay for symbols that allow it. The default symbol > and table / will select a car to be displayed. A full table of symbols can be found at <http://www.jarviscomputer.com/jim/aprs-symbols>.

Auto TX Delay

This sets the transmit delay time in milliseconds between when the radio begins transmitting, and when the data is sent. It is used to give receiving stations time to synchronize to the transmitted data. It is normal for this value to be changed slightly after writing the configuration to the TinyTrak4, due to rounding. Maximum delay is about 1700 seconds

Auto Transmit Rate

This sets how often in seconds that a position report is transmitted. Rates between 2 seconds and 65535 seconds (18.2 hours) are possible.

Manual TX Delay

This sets the transmit delay time in milliseconds between when the user releases the push-to-talk button from a voice transmission, and when the data is sent. The feature is used to send a position report on a radio normally used for voice transmissions. The microphone PTT button should be wired to ground J1 pin 8 when the user is speaking. Upon PTT release of the PTT button, a transmission will be sent. This setting is normally set less than the auto TX delay above, since the receiving stations should already be synchronized to the transmitter when the data is sent.

Manual Transmit Rate

This sets how often in seconds that a position report is transmitted as a result of the release of the PTT In line (J1 pin 8). It is normally set less than the auto transmit rate above. When the PTT In line is released, if the time since the last position transmission is greater than the manual transmit rate, a report will be sent.

Quiet Time

This sets how long a carrier must be absent in milliseconds before a transmission will be sent. It is used to keep the tracker from transmitting over other stations. When a carrier is detected (see carrier detect, below), the yellow CD LED will be on solid. After the carrier is gone, the LED will flash quickly for the quiet time, then turn off, and transmissions will be allowed.

Status Text

This sets a generic beacon text or comment that can be sent by the tracker. It can be used to further identify the tracker, to send a static position report, and more. The space available for the status text is lessened when a longer digi path is used. Setting the primary and secondary digi paths or status text to the same value will allow for longer texts.

Status Send Every

This sets how often the status text is sent, in position report units. For example, a setting of 2 will send the status text with every other position report. If a position report is not sent, due to the Only Send Valid setting, the status text will still be sent at its configured rate. A setting of 0 will disable status transmissions.

Status Send Separate

This sets if the status text should be appended to the transmitted position report, or sent as a separate packet, right after the position report.

Status Don't Send '>'

Normally, separate status text beacons are sent with a leading > character, to mark the transmission as a status beacon. When sending a fixed position report, this > character will cause some parsers not to accept the position, so it is best left off. An example fixed position status text would be:
"!3612.34N/11512.34W-"

Waypoint Output enable

This sets if position reports received and decoded by the TinyTrak4 should be sent to the GPS as a NMEA \$GPWYL sentence. For supported GPS receivers, this will display the received position and transmitting callsign as a waypoint on the GPS screen. Received position formats and examples that are acceptable for this feature are:

NMEA: \$GPRMC,013641.06,A,3348.1607,N,11807.4631,W,34.0,090.5,
 \$GPGGA,040332,3405.438,N,11801.836,W,1,06,1.1,114.2,M,-
APRS: =3340.25N/11754.88WKP HG2100/WinAPRS 2.7.5
 !3436.62NN11717.30W#PHG5760/A=004530/W-R-
 @230139z3352.18N/11749.77W_240/00...
 /230141z3343.89N/11801.89Wk315/000/A=000013/TT3
 ;IRLP-1234*230156z3419.32NI11826.52W0440220s110IDLE
MIC-E: K7ABC-7>P0PPP0:'vXl

Waypoint Output Num Chars

This sets the length of the label used with the waypoint output feature. Some GPS receivers can only handle a limited number of label characters, and this setting will trim the label to the set length.

Telemetry Rate

This sets the how often in seconds that a telemetry report is sent. A setting of 0 will disable the feature, unless Send after position is checked. Telemetry reports will send 5 analog settings, taken from JP1 – JP5, the supply voltage, and the temperature sensor. It will also send 8 digital readings take from the PORTC pins.

Telemetry Send After Position

This sets that a telemetry report should be sent after each sent position report. This setting is independent from the telemetry rate setting above.

Telemetry High Res

This sets that a telemetry report should be sent as high resolution. Normally the analog section of the telemetry report is sent with a linear range from 0 to 255, where 0 represents a sampled 0 volts, and 255 represents a sampled 5 volts. Then the high res option, 10 bits rather than eight bits are sent. So the range now becomes 0 to 999, where 0 represents 0 volts and 1023 represents 5 volts, and anything sampled over a value of 999 is clamped to 999. High res values are about 4 times the non high res values.

Telemetry Send Voltage

This sets that a telemetry report should include the supply voltage. When send voltage and send temp are not included, the analog values sent are JP5, JP4, JP3, JP2, and then JP1. If send voltage is selected, it will be sent first. Then, if send temp is selected it will be sent. Then, the readings for JP5 to JP1 are sent, and limited to only 5 samples. Any remaining samples (JP1 and JP2 possibly) are not sent. The voltage at pin 39 is 18% of the J3 supply voltage. The transmitted voltage is $(255 * .18 * J3 \text{ supply voltage}) / 5 \text{ volts}$. (when not sending high res). So a J3 voltage of 12 volts would send a telemetry value of 110 (or 440 for high res).

Telemetry Send Temp

This sets that a telemetry report should include the temperature. If send voltage is checked, temperature will be the second sent sample. If not, it will be the first. The temperature sent is $(^{\circ}\text{C} + 273) * 0.51$. So $80^{\circ}\text{F} = 26.6^{\circ}\text{C}$ would be a telemetry value of about 153 or 611 in high res.

Digipeater Alias

This sets an alias that will cause a packet to be digipeated when heard by the Tracker. Set to an empty string to disable digipeating. The alias can contain an SSID. When a packet is received, with a request to be digipeated by a alias matching the given alias, and if it has not already been repeated by that alias, the packet will be sent, with the alias marked as digipeated. There is no delay or carrier detect test after receiving the packet, and sending the repeated packet. An example alias would be WIDE1-1.

Send Altitude

This sets that position report should include altitude. Do use this, be sure the GPS is sending NMEA \$GPGGA sentences.

Timestamp DHM

This sets that a position report should be sent with a timestamp including the day, hour, and minutes. The time used is the last received from the GPS. This is not used when sending the MIC-E format.

Timestamp HMS

This sets that a position report should be sent with a timestamp including the hour, minutes, and seconds. The time used is the last received from the GPS. This is not used when sending the MIC-E format.

Send NMEA

This sets that a position report should be sent as a NMEA \$GPRMC format, rather than the APRS text or MIC-E formats. The last 2 fields will be left empty. One advantage of this format is that 2 additional digits of latitude and longitude are sent, thus giving a higher resolution report. Also, this format may be useful in feeding received data into software expecting a GPS receiver format. Altitude and symbol settings are not used with this format, although SSIDs can be used to select symbols for some receivers.

Skip Start Packet

This sets that an initial packet transmission identifying the TinyTrak should not be sent when the unit is first powered up. It is recommended to not check this, as the initial transmission is useful for confirming the unit is working.

Only Send Valid

This sets that position reports should not be sent when satellite synced GPS data is not available. GPS data is considered invalid when the GPS receiver is first powered up, or when it loses a clear view

of the sky, or when the GPS is disconnected from the TinyTrak4. Status beacons and telemetry can still be sent when position reports are not allowed due to this setting.

No TX on PTT In

This sets that PTT Out should not be asserted when PTT In is detected and a manual transmission will follow the PTT In release.

9600 Baud GPS

This sets that the GPS baud rate is 9600 baud instead of the normal 4800 baud. Serial settings for both are N81.

Alternate Digi Paths

This sets that the TinyTrak4 alternates between the primary and secondary callsign and digipath with each transmission. It can be used to use 2 digi paths when the best path for an area is not known.

300 Baud Packet

This sets that the transmitted audio tones should be 1600Hz and 1800Hz at 300 baud, rather than the normal 1200Hz and 2200Hz at 1200 baud. 300 baud is used for HF position reports. The Test Tone buttons below will send the 300 baud tones when this is selected. The 30 meter HF/FSK APRS frequency pair in the United States is 10.1492 / 10.1494 MHz. To transmit the correct frequency pair, set the transceiver to 10.150 LSB or 10.1476 USB.

Disable LEDs

This sets that the 4 LEDs should not be used after the initial power up sweep. This is used to reduce power consumption by about 3ma per LED.

MIC-E Enable

This sets that the position report should be sent in the MIC-E format. This is the most compact and common 4 format. It contains position, heading, speed, and altitude. Timestamps are not supported in this mode. The format is not human readable, but rather compressed binary. Because it is shorter than other formats, it is more likely to be received successfully. If this format is not selected, the longer, but human readable APRS text format will be used.

MIC-E Force Printable

This sets that the MIC-E position report should only be sent with printable characters, which will result in some rounding. In the past, unprintable characters were found to corrupt MIC-E packets, though this has generally been resolved now. It is included here just for legacy support.

MIC-E Message

This sets one of 8 pre-assigned MIC-E messages to be sent in the position report. Caution should be used when selecting the Emergency! setting, as this will alert most APRS receivers that an emergency is occurring.

MIC-E Path

This sets one of 16 pre-assigned MIC-E paths. It is generally not supported in the current APRS network, and should be set to Conventional.

Time Slotting Enable

This sets that the tracker transmissions should be synchronize to the GPS clock at a particular offset from the start of the hour. It is useful to coordinate many trackers to share the network with minimum overlap. SmartBeaconing is not available when time slotting is used.

Time Slotting Transmit Offset

This sets time after the start of the hour that a transmission should occur. After that, transmissions will continue at the auto transmit rate. It may take some time after the initial power up for the tracker to synchronize with the GPS time, up to an hour, depending on the auto transmit rate. If the auto transmit rate evenly divides into 600 seconds, the tracker will re-sync every ten minutes. If the auto transmit rate evenly divides into 60 seconds, the tracker will re-sync every minute.

Smart Beaconsing

This sets that the tracker transmissions should follow the SmartBeaconsing algorithm. This allows transmissions to occur more often when the tracker is moving faster, and also to use Corner Pegging to tend to send a transmission when turning corners. All the default SmartBeaconsing settings are reasonable to use as is. To modify these settings, read about the SmartBeaconsing algorithm at <http://www.hamhud.net/hh2/smartbeacon.html>. This site explains all the values, and the creation of the algorithm.

Power Switch

This is not supported at this time.

Carrier Detect

This sets the carrier detection method used to prevent transmitting over other stations. The choices are:

Audio Tones: Use a “software” carrier detect to listen for the proper packet tones. This will allow running a radio with an open squelch.

Audio Level: Use with a squelched radio. When any audio is present at the J1 pin 5, it will assume this is a carrier. This can be useful to prevent transmitting over voice traffic.

J1 pin 2: This allows the use of an external digital carrier detect. Grounding J1 pin 2 means a carrier is present.

J1 pin 2 inverted: This allows the use of an external digital carrier detect. Grounding J1 pin 2 means a carrier is absent.

RX Level

This sets the internal receiving amp. It can help to compensate for low incoming audio. This may be removed in future revisions, and is not currently supported.

TX Level

This sets the software audio transmit level. Pot R1 can also be used to adjust the audio transmit level. Transmitting with too much audio deviation is a common cause of packet not being decoded.

TX Twist

This sets the twist between the relative level of the high and low packet tones. Since the TinyTrak4 transmit audio filter, and the audio path on some transmitters can cause the relative levels of the two audio tones to be different, this setting can be used to equalize them. A setting of 0 would send a full level low tone and a no level high tone. A setting of 50 would send both tones at full level. A setting of 100 would send a full level high tone, and a no level low tone.

Configure Com Port

This sets which serial port should be used to communicate with the tracker.

Configure Read Version

This will get the version of the connected tracker. This is useful to test serial communications to the tracker.

Configure Read Config

This will read all the settings from the connected tracker into the dialog fields. This is useful to change a single setting in a tracker.

Configure Write Config

This will download all settings from the dialog to the connected tracker.

Tone Test Send 1200 Hz

This will cause the tracker to send a 1200 Hz tone. This is useful for setting audio levels.

Tone Test Send 2200 Hz

This will cause the tracker to send a 2200 Hz tone.

Tone Test Send Both

This will cause the tracker to send both 1200 and 2200 Hz tones alternating every 833us.

Tone Test Stop Sending

This will cause the tracker to stop sending the tones above.

Save

This will allow saving of all dialog settings to a file.

Load

This will allow loading settings from a previously saved file.

About

This will show the version of the TT4TrackerConfig program.

Exit

This will quit the TT4TrackerConfig program.

Revision History

Version 4.06 – 3/26/08

- Fixed Disabled Waypoints
- Fixed Time Slotting
- Added Skip start packet
- Added Don't Send >
- Added 9600 baud GPS
- Removed serial out high setting
- Fixed rounding telemetry over 255
- Fixed write failures with config program
- Added more beacon text space,
- Added support to COM16
- Made config program only work with current firmware version
- Added disable LEDs
- Added carrier detect options
- Fixed config units display
- Set default auto TX rate higher