

BYONICS

Byonics TinyTrak4 Alpha Firmware Manual Manual version 0.65 for Firmware version 0.65

Overview

The Alpha firmware is code for the Byonics TinyTrak4 (TT4) and Micro-Trak TinyTrak4 (MT-TT4) to operate as an APRS Tracker, APRS receiver, KISS TNC, Text UI TNC, packet digipeater, and more. It can display received data to a connected LCD display, send and receive APRS Text messages with a connected display and PS/2 keyboard, send weather reports, and send analog or digital telemetry. Firmware updates, and new code functionality can be downloaded and stored into the TinyTrak4 with a simple terminal program, or a custom Windows firmware loading application. Firmware and Documentation for the TinyTrak4 can be found at <http://www.byonics.com/tinytrak4> . See this site for the TinyTrak4 Firmware Manual for instructions to load the Alpha firmware into a TinyTrak4, or to download the firmware loader program.

There are 2 different microprocessors used by TinyTrak4 boards, and each requires a different version of the firmware. TinyTrak4s sold before July 2010 use a MEGA644P chip and those sold after use a MEGA1284P. The chip type is printed on the top of the chip on the circuit board. The bootloader version can also be used to identify the chip. The MEGA644P uses bootloader version 1.2b, and the MEGA1284P uses version 1.2c. The TinyTrak4 Alpha firmware .ZIP file includes versions for both chips, one marked 644 and the other marked 1284. Only the firmware version that matches the chip on the TinyTrak4 should be loaded.

Acknowledgments

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Hardware

The TinyTrak4 hardware is based around an Atmel AVR MEGA644P microcontroller. It also includes components to interface to computer and GPS serial ports, radio microphone and speaker jacks, analog telemetry, and an optional display and keyboard. The TinyTrak4 hardware is currently available in 3 forms: the original kit with through-hole components, the built and tested surface mount board, and the Micro-Trak TinyTrak4, which combines the TinyTrak4 with a radio transceiver.

The TinyTrak4 Alpha draws about 40mA, and about 80mA when connected to a Byonics GPS2 receiver.

LEDs

The TinyTrak4 has 4 LEDs along the top edge to show operation status.

- Blue - Power
- Yellow - Carrier Detect – On when carrier or tone is detected, off when clear to transmit. It does not necessarily imply valid is being decoded.
- Green - GPS Status – On when receiving GPS data in sync with satellites, Flashing when GPS is not synced with satellites.
- Red - Push To Talk (PTT) – On when the radio transmitter is being activated.

Radio Interface

The TinyTrak4 J1 DB-9 port is used to interface to a radio and power. TinyTrak4 is powered with 5.5V - 26V DC. The radio interface supports hand held radios which key via current on the microphone line, as well as mobile radios with a separate Push-To-Talk (PTT) line. Received audio can be squelched or unsquelched.

Serial Interface

The TinyTrak4 J2 DB-9 port is used to access the two serial ports on the TinyTrak4. The primary port (pins 2 & 3) uses RS-232 levels and voltages, and the secondary port (pins 7 & 8), can use both RS-232 and TTL levels and voltages. Pin 4 can provide 5V, or the supply voltage, to power an external GPS. The two ports can support computers, GPS receivers, weather stations (in the future), and other serial sources. When connecting to a computer serial port, a female to female null modem adapter is needed. The primary port is used to update TinyTrak4 firmware, and to configure the settings of the Alpha firmware. A splitter cable is available from Byonics with can split the J2 port into two separate DB-9 connections, and includes a female to female null modem adapter for the computer connection. When this cable is used, it is recommended to use the secondary port for the GPS (BMODE GPS & BBAUD 4800), and the primary for the computer, or weather station. When the splitter cable is not used, BMODE setting is irrelevant.

Telemetry Interface

The TinyTrak4 can interface to external analog voltage sources which can be samples and reported. Voltage levels can be between 0 and 5V DC. The TinyTrak4 can also sample and report the supply voltage, and ambient temperature. The MT-TT4 does not and a temperature sensor.

Display and Keyboard Interface

The TinyTrak4 can be interfaced to a 44780 compatible display. It can also be connected to a PS/2 style computer keyboard (See APRS Message Terminal below.)

Jumpers

The following TinyTrak4 hardware jumpers should be set as required.

- **JP6** – JP6 near the upper right of the board is used to select the power sent to the GPS. If a jumper is placed on the left two pins, 5 volts will be sent to JP2 pin 4. This is the setting used with the Byonics GPS2 receiver. If a jumper is placed on the right 2 pins, the supply voltage, usually 12V is sent the J2 pin 4. Warning: This setting will damage most 5V GPS receivers, such as the Byonics GPS2. No jumper on JP6 will send no power to J2 pin 4.
- **JP7A & JP7B** – JP7A & JP7B will select if the secondary serial port uses TTL or RS-232 voltage levels. To select TTL, place a jumper across the center 2 pins of each 1x4 pin block. To select RS-232, place a jumper across the left 2 pins and the right 2 pins of each 1x4 pin block.
- **JP8** – JP8 near the left side of the board is used to select radio keying via the mic audio line. This jumper should be on when using non-Kenwood HTs, and off for all others. When this jumper is off, the PTT output line (J1 pin 3) must be connected to the radio.

Functionality

The TinyTrak4 Alpha can provide several simultaneous functions, which are described below.

APRS™ Tracker

The TinyTrak4 Alpha firmware can transmit APRS position reports. Position data can be preset for static locations, or updated live from a NMEA GPS. Two NMEA 0183 GPS sentences formats are recognized: \$GPRMC and \$GPGGA.

Position reports can be sent in the standard MIC-E binary format, or in the easier to read APRS text format, or in the highly compressed and accurate compressed format. Nearly all APRS receivers can decode all three formats. They can be sent at regular intervals, and synchronized to the GPS clock, or with the dynamic SmartBeaconing algorithm, which adjusts report rate based on speed and turns. Position reports can include timestamps, and user status information.

APRS™ Receiver

When connected to a compatible GPS receiver, the TinyTrak4 Alpha firmware can display received positions on a GPS displays as waypoints. APRS reports in MIC-E, APRS Text, and NMEA formats will be decoded. GPS receivers known to support the \$GPWPL sentence include Garmin GPSMAP 276C, GPSMAP 60CSx, GPSMAP 76CS, Garmin GPS 12Map, GPS 12XL, Garmin eTrex Legend and eTrex Vista, and the AvMap G5.

KISS TNC

The TinyTrak4 Alpha firmware can act as a KISS TNC. A KISS TNC provides an interface between a radio and computer software. Most all the packet radio logic and formatting is done by the computer. Only software written to support a KISS TNC can be used, such as APRSISCE, WinAPRS, UI-View, and Xastir. With programs such as WinTNC, the TinyTrak4 can be used for classic connected mode packet.

UI TNC

The TinyTrak4 Alpha firmware can also act as a UI TNC. This is similar to the KISS TNC, but with a protocol similar to a classic TNC. This can be useful to send and receive simple serial messages, and interfacing to BASIC Stamp projects. After setting callsigns and other data to the TinyTrak4, one simply sends serial text in, terminated with carriage returns, and the packets will be sent. As packets are received, a single serial line is displayed with the packet contents. Connected mode packets are not supported with this mode.

Telemetry Transmitter

Telemetry data can be sent with the TinyTrak4 Alpha firmware. The supply voltage, ambient temperature, up to 5 external voltage source, and up to 8 digital inputs can be sampled and transmitted. The MT-TT4 does not have a temperature sensor. Analog data should be in the 0V – 5V range, and can be sent as either 8 or 10-bit data.

Weather Transmitter

When connected to a Peet Bros weather station, TinyTrak4 Alpha firmware can transmit weather information in the APRS protocol. This can be done simultaneously with the APRS tracker features to enable a mobile weather station, suitable for storm chasing.

The TinyTrak4 Alpha can also be connected to a Davis Vantage Pro weather station if it has the WeatherLink for APRS adapter. See <http://tinyurl.com/lu6zs6> and <http://tinyurl.com/m8a4yx> for more details.

Smart Digipeater

The TinyTrak4 Alpha firmware can act as a smart packet digipeater, storing and forwarding packets from other stations. The digipeater functionality supports multiple aliases, callsign substitution, dupe checking, and preemptive digipeating,

Packet Display

When connected to a compatible 20 x 4 display, the TinyTrak4 Alpha can display received position and weather reports from other stations, as well as raw packet data.

APRS™ Message terminal

When connected to a display and PS/2 computer keyboard, the TinyTrak4 Alpha can be used to send and receive APRS text messages. Entered messages will be retied with a exponential decay algorithm. The accepted keys are:

F1 – Help mode (currently placeholder. Not yet implemented)

- F2 – Enter raw display mode (default)
- F3 – List all stored messages. Use the up/down arrow keys to navigate, enter to view. When viewing, type ESC to return to the list, or r to send a reply.
- F4 – Enter new message. First enter the target callsign and press enter. Then enter the message and press enter. Type ESC to cancel.
- F5 – Configure mode. Type commands to view or edit settings.
- F6 – UI Terminal mode. (currently placeholder. Not yet implemented)

The TinyTrak4 Alpha firmware can also react to incoming messages directed toward it, regardless if the display and keyboard are used. These messages include the ability to request a position report, and to remotely control digital outputs.

Stand Alone Configuration

When using a connected display and keyboard, all the configuration parameters can be adjusted without a computer. Pressing F5 on the keyboard will enter this mode.

APRS Radio Protocols

The TinyTrak4 Alpha will send position reports in the MIC-E, APRS Text, and APRS Compressed protocols. All radio packets conform to the AX.25 UI formatting.

Computer Protocols

The TinyTrak4 Alpha can communicate with a connected computer in either KISS, TEXT, or DEAFTEXT modes. In each of these modes, data sent from the computer to the TinyTrak4 will be sent over the air, and packet audio received and decoded will be sent back to the computer. The KISS mode sends and receives serial data in the KISS protocol, and is for use with software written to support a KISS TNC. In the TEXT mode, received packets are presented as a standard TNC would display monitored UI packets, and sends UI packets from the computer received from the computer, terminated with a new line. Empty packets are not sent. DEAFTEXT is like TEXT, but received packets are not sent to the computer. It is used for weather stations, such as the Davis Vantage Pro with the APRS WeatherLink adapter.

GPS Protocols

The TinyTrak4 can decode two NMEA 0183 GPS sentences: \$GPRMC and \$GPGLL.

```
$GPRMC,201050,V,3610.9912,N,11516.4034,W,0.0,005.2,240799,013.7,E*67
$GPGLL,201050,3610.9912,N,11516.4034,W,1,05,2.4,777.8,M,-25.2,M,,*74
```

It can also send received station position reports back to the GPS to be displayed as waypoints using the \$GPWPL & \$PGRMW sentences. GPS receivers that support this format include Garmin GPSMAP 276C & GPSMAP 60CSx, Garmin GPS 12Map, Garmin eTrex Legend and eTrex Vista, and the AvMap G5.

Weather Protocols

The TinyTrak4 can read the Peet Brothers Data Logging format, and convert it to APRS weather report format. To do this, set the serial mode to PEET.

```
!!005A0011019104C9281D0296-----0047035E0000008B
```

The TinyTrak4 can also be connected to a Davis Vantage Pro with the WeatherLink APRS adapter. To do this, set the serial mode to DEAFTEXT, and configure the station to transmit the weather

reports at the desired frequency, and set the TinyTrak4 with the callsign and path. The weather station will output the APRS weather protocol.

Telemetry Protocols

The TinyTrak4 Alpha will send telemetry reports in the MIC-E telemetry protocol. This includes 5 analog voltage readings (usually from 0 to 5 volts) and 8 digital readings (when the optional display is not used.) The analog telemetry data can optionally be set into high-res mode for 1000 possible values instead of the normal 256.

Display Interface and Formats

The TinyTrak4 can display received position and weather reports from other stations to a compatible 44870 display. The follow screen formats are used.

Position

CALLxx-ss	xxxM xxx*	- Call & SSID, Speed, Course
N DD*MM.mmmmm	xxxxx'	- Latitude & Altitude
WDDD*MM.mmmmm	MIC-E	- Longitude & report format
xxxxxxxxxxxxxxxxxxxxxx		- Status text

Weather

CALLxx-ss	0000.0mb	- Call & SSID, Barometer
NDD*MM.mm/WDDD.MM.mm		- Latitude & longitude
000* 000M/g000 h100%		- Wind Bearing, Speed & Gust, Humidity
t000* r000p000P000		- Temperature & Rain counters

Configuration

TinyTrak4 Alpha settings are adjusted by connecting J2 primary port (pins 2 & 3) to a computer serial port with a female to female null modem adapter cable, and running a computer terminal program at 19200 baud. Flow control should be off. Upon powerup, press the ESC key in the terminal program 3 times as prompted, and the TinyTrak4 will begin the configuration menu. The 3 ESCs must be sent quickly, and no other key may be pressed. The use the Alpha commands to check and adjust the various settings. Each setting is saved as it is entered. Use the QUIT command to exit the menu and begin operations.

Settings can also be adjusted using the TinyTrak4AlphaConfig software for Windows. This will provide a graphical, tabbed list of all settings, rather than using terminal command line adjustments.

When using the Byonics TinyTrak4 Serial Splitter cable to connect more than one serial device to the TinyTrak4, is it recommended to connect the computer to the primary port (AMODE TEXT or KISS) and the GPS to the secondary port (BMODE GPS, BBAUD 4800). If only connecting one device, set the mode via AMODE, and BMODE will be ignored.

There are 2 complete banks of settings, allowing for run time switching of all user settings. See the BANK and BNKMODE commands for more details.

Parameter Commands

ABAUD [baudrate]

Sets the baud rate for the primary (A) serial port on J2 pins 2, 3, and 5.

ALIAS1 [call]

ALIAS2 [call]

ALIAS3 [call]

Sets up to 3 aliases to repeated by the digipeater. The parameter call can be a callsign or id up to 6 characters long, and should not include an SSID. For example: TEMP, RELAY, or WIDE2. Set call to % to clear.

ALTNET [call]

Sets the ALTNET callsign, sent as the destination callsign in all outgoing packets, except MIC-E position packets. An SSID should not be used. The default of APTT4 is restored when cleared.

AMODE [TEXT | KISS | GPS | DEAFTEXT | PEET]

Sets the protocol mode of the primary (A) serial port on J2 pins 2, 3, and 5.
TEXT will send and receive UI packet which are new line terminated
KISS will send and receive in the KISS protocol.
GPS is receive NMEA position data to send, and transmit waypoints
DEAFTEXT is like TEXT, but with no output
PEET will decode Peet Bros Data Logging format

BANK [0 | 1]

Sets whether the entered menu commands apply to BANK 0 or BANK 1. There are two complete banks for settings, which can be selected at runtime via the BNKMODE command.

BBAUD [baudrate]

Sets the baud rate for the secondary (B) serial port on J2 pins 7, 8, and 5.

BMODE [TEXT | KISS | GPS | DEAFTEXT | PEET]

Sets the protocol mode of the secondary (B) serial port on J2 pins 7, 8, and 5. See AMODE.

BNKMODE [0 | 1]

Sets how the desired bank is selected at runtime. 0 means no bank switching, and only use BANK 0. 1 means to consider JP1, where open means use BANK 0 and closed or grounded means to use BANK 1. More modes may be added in the future.

BPERIOD [seconds]

Sets the time in seconds between transmissions of BTEXT as a separate packet. A setting of 0 will disable BTEXT transmissions.

BTEXT [text]

Sets the text to be sent periodically as a separate beacon packet, up to 50 characters. Set period with BPERIOD. The first character should be > for status reports. Telemetry variables can be sent by adding the following escape codes to the string:

- ^T sends the temperature in Fahrenheit
- ^t sends the temperature in Celsius
- ^V sends the incoming supply voltage
- ^1 sends the voltage at JP1
- ^2 sends the voltage at JP2
- ^3 sends the voltage at JP3

- `^4` sends the voltage at JP4
- `^5` sends the voltage at JP5
- `^6` sends the voltage at PA1 (divided supply voltage)
- `^7` sends the voltage at PA2 (raw temperature voltage)
- `^^` sends the ^ character

Note, the MT-TT4 does not have a temperature sensor.

CDLEVEL [level]

Sets the level to be used to determine the presence of another station transmitting. If the CDMODE is LEVEL, this sets the audio level to detect carrier. If the CDMODE is TONES, level sets the time duration of valid audio data to indicate carrier.

CDMODE [LEVEL | TONES | PIN2 | INVERTED_PIN2]

Sets the method used to detect presence of another station transmitting. LEVEL uses audio levels, and requires squelched audio. TONES looks at the incoming audio for data. PIN2 uses J1 pin 2 as high as the indications. INVERTED_PIN2 uses J1 pin 2 as low as the indication, for use with radios with an external squelch output.

DDIST [true | false]

Sets the LCD output to show the distance and bearing towards received stations in addition to the station's position. If a GPS is not connected, the LOCATION setting is used for the TT4 location.

DEC96 [true | false]

Sets the packet decoding algorithm to decode 9600 baud packet audio rather than 1200 baud packet audio. 9600 baud encoding is not yet implemented so this is mainly for decode testing.

DIGIID [true | false]

Sets whether the digipeater should insert MYCALL into the path of packets it repeats. Enabling this helps trace the path of repeated packets.

DMETRIC [true | false]

Set to display show distances, speeds, and temperatures in metric.

DMSDISP [true | false]

Set to display received positions as degrees, minutes, and seconds (DD°MM'SS") rather than the default of degrees and decimal minutes (DD°MM.mmmm).

DUPETIME [seconds]

Sets the amount of time a previously digipeated packet will be compared to incoming packets to detect and ignore duplicate transmission.

ENTS [true | false]

Enables the use of time slotting for GPS time controlled transmissions. Use with TSOFFSET to set the times to transmit position report.

FRAWDISP [true | false]

Forces received packets to be displayed as raw text, rather than parsed for position or weather.

FILTERCALL [call]

Sets a callsign to filter displayed packets and those sent as GPS waypoints. This is similar to the BUDLIST command of older TNCs, matching the source callsign. Use an * at the end of call to match the remainder of the source callsign, such as BIKE* to match packets from BIKE, BIKE1, and BIKE2. FILTERCALL does not affect digipeating. Set call to % to clear and display all.

GALT [altitude]

Sets the initial default altitude in meters. This value will be used in position reports until overridden by incoming GPS data. Use with LOCATION.

GRELAYBITS [bitfield]

Sets which GPS sentences should be relayed to the computer TEXT port. A setting of 0 will report no sentences. 1 will report \$GPRMC sentences, 2 will report \$GPGLL sentences, and 3 will report both \$GPRMC and \$GPGLL. Use with the GRELAYRATE command.

GRELAYRATE [rate]

Sets how often GPS sentences should be relayed to the computer TEXT port. A setting of 0 will disable GPS relays to the computer, a setting of 1 will pass every requested sentence, 2 will report every other requested sentence. Use with the GRELAYBITS command.

GWAYLEN [length]

Sets the maximum name length of the waypoint sent to the GPS from decoded incoming packets. Set to 0 to disable waypoint output.

GWAYMODE [NMEA | KENWOOD | MAGELLAN]

Sets waypoint output mode to NMEA (\$GPWPL & \$PGRMW), Kenwood (\$PKWDWPL) or Magellan (\$PMGNWPL) format.

HEADERLN [true | false]

Sets if a new line should be sent between the header and payload sections on packets sent to the serial port in TEXT mode.

HRAWDISP [true | false]

Disables the displaying of packets which cannot be parsed for positions or weather. If FALSE, these packets will be displayed as raw text.

LEDS [true | false]

Enables the 4 LEDs. The initial sweep on powerup is always shown, regardless of this setting.

LOCATION [DDMM.mmmmmH DDDMM.mmmmmH]

Sets the initial default latitude and longitude in degrees and minutes. This value will be used in position reports until overridden by incoming GPS data. TOSV must be set to false to report this setting. Format must match exactly,

including number of digits after the decimal point. For example: to set to 34° 45.29' North, 76° 13.7482' East, use "LOCATION 3445.2900N 07613.7482E".

MMSG [value]

Sets MIC-E message number, sent with MIC-E position packets. Common settings are 0 for Off Duty, 1 for En Route, 2 for In Service. Message 7 is Emergency! and should only be used for emergencies.

MICETMV [true | false]

Set to use the newer MIC-E format, including the type, manufacturer, and version in MIC-E packets. This will send a ' after the MIC-E inf bytes, and a |4 at the end of the packet to signify a Byonics TinyTrak4.

MSGCAP [true | false]

Set to show this TinyTrak4 as Message Capable in the APRS Text position reports. This should be done when using the optional display and keyboard.

MSGCMD [true | false]

Set to allow processing of commands in messages. Currently the only commands supported are ?APRSP to request a position report, and !OUT \$xx to adjust the PORTC pins. Messages must be directed to the MYCALL to be processed.

MYCALL [call]

Sets the callsign or identification the station. This is used to identify all transmissions. It can optionally be followed by an SSID from 1 to 15 to distinguish from other stations under the call. For example: KD6BCH-4, or SAG1.

NODISP [true | false]

Set to disable display output. This is needed to use the display I/O lines for digital telemetry.

P300 [true | false]

Sets if transmitted packets should be sent at 300 baud, rather than the default 1200 baud. Only 1200 baud packets will be decoded, regardless of this setting.

PATH1 [call]

PATH2 [call]

PATH3 [call]

Sets up to 3 path names to repeat transmissions. For example: PATH1 WIDE1-1 and PATH2 WIDE2-1. Set call to % to clear. There were called DIGI1, DIGI2, DIGI3 in previous versions.

PAVPEN [true | false]

Sets PAVP mode, which can be used to transmit and receive APRS messages via a GPS receiver. This feature is coming soon.

PERSIST [value]

Sets the value used to determine when to transmit after a carrier is no longer detected, to prevent several stations from transmitting at the same time.

Range is 0 – 255, and higher values will result in longer delays. Use with SLOTTIME.

PKTICOM [true | false]

Sets if received packets should be sent to the computer TEXT, DEAFTEXT, and KISS ports.

PKTOCOM [true | false]

Sets if generated packets should be sent to the computer TEXT, DEAFTEXT, and KISS ports.

PPATHING [true | false]

Set to enable proportional pathing on sent packets. For each packet type (position, beacon, telemetry, weather), every other transmission will be sent direct, with no digipeater path requested. Every other remaining is sent with PATH1 only. Every fourth is sent via PATH1, PATH2, and every eighth is sent via PATH1, PATH2+1. PATH2 is assumed to be an n-N callsign, and PATH2+1 means the n and N are both incremented. So a PATH2 of SS2-2 would be sent as SS3-3 every eighth transmission. Note PPATHING does not apply to packet sent from received serial.

PPERIOD [seconds]

Sets the time in seconds between transmissions of a position report. A setting of 0 will disable position reports.

PREEMPT [true | false]

Sets whether the digipeater should perform preemptive digipeating. Normally, a digipeater only looks at the callsign of the next digi requested, but with PREEMPT enabled, it will search the full digi path for a callsign it matches.

QUIET [time]

Sets the time in 100ms units that a carrier must be absent before a transmission can occur.

RPATHDISP [true | false]

Set to enable displaying the full packet path to the display when raw packets are shown.

RXAMP [value]

Sets an amplification gain to amplify incoming audio to a level the software decode can read. Use with the MONITOR command, and set so incoming packet tones are at a level of about 80.

SBEN [true | false]

Enables SmartBeaconing for position report timing. This allows for sending reports more often when moving faster, and Corner Pegging to better indicate turns. Use SBFDELAY, SBF SPEED, SBSDELAY, SBSSPEED, SBTANGLE, SBT SLOPE, SBT TIME for specific settings.

SBFPERIOD [seconds]

SBF SPEED [knots]

SBSPERIOD [seconds]

SBSSPEED [knots]

SBTANGLE [deg]

SBTSLOPE [value]

SBTTIME [seconds]

Sets the SmartBeaconing settings. Use with SBEN to enable. The default values are recommended for most users. See <http://www.hamhud.net/hh2/smartbeacon.html> for details on the settings.

SOFTTRST [true | false]

Enables resetting the TinyTrak4 by sending the following 4 bytes to a TEXT serial port: ESC ESC ESC Enter (0x1B 0x1B 0x1B 0x0D)

SSIDROUTE [route]

Sets the SSID routing option to select path for some networks. When non 0, normal Digipeater paths (DIGI1, DIGI2, DIGI3, PPATH1ST, PPATH2ND) are ignore and left out, and the SSIDROUTE is used as the SSID on the destination callsign of outgoing packets.

STATUSRATE [rate]

Sets how often (in position reports) the TSTAT should be appended to a position report. Set to 0 to disable. For example, STATUSRATE 3 will append TSTAT to every third position report.

TALT [true | false]

Enables sending of altitude in position reports.

TDAO [digits]

Sets the number of added precision digits in the position report. This added data will appear in the comment section of the report packet, and look similar to: !wBK! Valid settings are 0 – 2. Not used with COMPRESSED protocol.

TELHIRES [true | false]

Enables sending of high resolution telemetry data. If false, telemetry reports range from 0 for 0V to 255 for 5V. If true, telemetry reports range from 0 for 0V to 999 for 5V.

TELREAD [true | false]

Set the telemetry reports to send the voltage and temperature, if enabled, in human readable form, regardless of the TELHIRIS setting. Voltage will be sent in units of 100mV, so 128 equals 12.8V. Temperature will be sent in °C or °F, depending on the DMETRIC setting.

TELTEMP [true | false]

Enables sending of ambient temperature in telemetry reports. This will be sent after voltage telemetry, before external telemetry, and replace the last external reading. When TELREAD is true, the temperature is sent in °C or °F, depending on DMETRIC. When TELREAD is false, the temperature sent is $(^{\circ}\text{C} + 273) * 0.51$. So 80°F = 26.6°C would be a telemetry value of about 153 or 611 in high resolution. Not available on MT-TT4.

TELVOLT [true | false]

Enables sending of supply voltage in telemetry reports. This will be sent after before all other telemetry, and replace the last external reading. The voltage read is 18% of the supply voltage. When TELREAD is true, or TELHIRES is false, the transmitted voltage is $10 * \text{supply voltage}$, so a supply voltage of 12.8 volts would send a telemetry value of 128 (or 500 for high resolution).

TIMEHMS [true | false]

Enables sending of hours, minute, and seconds rather than day, hours, minutes in position timestamp. Must be enabled with TIMESTAMP.

TIMESTAMP [true | false]

Enables sending of a timestamp in position reports. Use TIMEHMS to select format.

TOSV [true | false]

Instructs the tracker to only send valid position data received from a locked GPS. If valid data is not present, position reports will not be sent.

TPERIOD [seconds]

Sets the time in seconds between transmissions of a telemetry report. A setting of 0 will disable telemetry reports. The analog voltages sent in order are JP5, JP4, JP3, JP2, JP1. If TELVOL and/or TELTEMP is true, those will be sent first, followed by JP5, and the rest, up to a total of 5.

TPROTOCOL [MIC-E | APRS | COMPRESSED]

Sets the tracker position report format. Valid settings are MIC-E for the standard binary encoded short reports, APRS for the human readable text format, or COMPRESSED for the highly compressed and high resolution format.

TPSWITCH [seconds]

Sets the time in seconds before a position transmission in which the power switch output will be enabled. This can be used to switch power to a GPS via an external relay so it will not need to be constantly powered, but instead only enabled a few seconds before a transmission is needed. The power switch output is pin 8 on the kit version, and the bottom left of the 4 holes in a square between the chip and the regulator on the built version. The default setting of 0 seconds disables the output.

TSPEED [true | false]

Enables the sending of speed and heading in position reports. In MIC-E protocol, the sent speed and heading are forced to 0. In APRS Text and compressed, the values are omitted. TSPEED should be set to false in order to send PHG packets with the TSTAT setting.

TSOFFSET [seconds]

Sets the time in seconds after the top of the hour to use for time slotting. Use ENTS to enable.

TRNKMODE [mode]

Sets Trunking mode, which uses the CD input line to begin packet transmissions after PTT is set. Mode 0 is disabled, modes 1 and 2 wait for

CD input after activating PTT before transmitting, modes 3 and 4 allow add CD input debouncing of 200ms.

TSOFFSET [seconds]

Sets the time after the top of the hour that a position packet should be sent. Transmission will repeat every PPERIOD seconds. This is used to pre-synchronize several trackers to GPS times. Use ENTS to enable.

TSTAT [text]

Sets the text to be periodically appended to position packets, up to 50 characters. Set rate with STATUSRATE. Telemetry variables can be sent by adding escape codes to the string. See BTEXT for escape codes.

TSWPT [true | false]

Sets the sending of a GPS waypoint named MYCALL each time a position packet is sent.

TSYMCODE [symbol]

Sets the character used for the symbol icon for position packets. Symbols can be found here: http://wa8lmf.net/aprs/APRS_symbols.htm

TSYMTABLE [table]

Sets the table or overlay used with TSYMCODE for the symbol icon for position packets.

TTEMPTWK [value]

Allows the temperature sensor reading to be adjusted. Default is 128 and each adjustment unit up or down will tweak the reading by about 0.5°C and 0.87°F. On built TT4 PCBs, a potentiometer will also adjust this reading.

TVOLTTWK [value]

Allows the supply voltage sensor reading to be adjusted. Default is 128 and each adjustment unit up or down will tweak the reading by 27mV.

TXD [duration]

Sets the length of time between the radio PTT being activated, and the packet audio being generated. Duration is in bytes, where each byte is about 7ms.

TXLEVEL [level]

Sets the software packet transmit level from 0 to 128. Transmit level can also be set via R1 on the TinyTrak4 PCB.

TXTDISP [true | false]

Set to send packets generated from incoming serial to the display.

TXTWIST [twist]

Sets the transmitted packet audio twist, or relative level between the high and low tones. It can be used to correct for audio twist in a transmitter. A setting of 0 means full low tone, no high tone, 50 means equal high and low tone levels, and 100 means full high tone, no low tone.

WPERIOD [seconds]

Sets the time in seconds between transmissions of a weather report. A setting of 0 will disable weather reports. At least one of the serial ports must be set to PEET.

WXPOS [true | false]

Set to enable weather position reports that include position data.

WYPTXT [true | false]

Set to send waypoints from decoded packets to the computer TEXT port in addition to the GPS port. Waypoints are sent in the format selected by GWAYMODE.

Immediate Commands

CALIBRATE

Use this command to adjust and test the transmit audio levels. While calibrating, PTT is activated and audio tones are sent to the radio. Use the L to transmit the low tone, H to transmit the high tone, B to transmit both tones, alternating every 833us, and S to transmit both tones, alternating every 6ms (helpful to adjust twist with a scope). Use 1 & 2 to change overall tone levels, 3 & 4 to adjust twist (high tone vs. low tone), and Q to quit calibration.

COPY

This command copies all settings from the current bank to the other bank.

DISPLAY

This command displays the current value of all parameters in the current bank.

HELP

Display a short description of each command.

MONITOR

Use this command to adjust receive audio amplification. It displays the live amplified audio level. Press any key near the end of the reception of a packet, and check the level. Adjust RXAMP for a audio level around 60 when packets are being received.

EXPORT

This command will output all the current settings, similar to the DISPLAY command, but in a format that can be uploaded to the command prompt to restore all the settings. It can be useful for copying settings between TT4 Alpha units, or to copy settings between firmware updates. Both banks will be exported.

QUIT

Quit the configuration menu and continue with operation.

RESTORE

Restore each parameter to the factory default setting.