

Argent Data Systems OpenTracker USB User's Manual

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OpenTracker USB User's Manual

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1. Introduction

The OpenTracker USB was designed as a low-cost entry-level APRS tracker, but it includes features previously found only on significantly more expensive models.

The OpenTracker USB includes almost all of the features of the higher-end Tracker2, with the exception of the digipeater and Garmin protocol functions.

Firmware updates and enhancements are published frequently, so check our website at <http://www.argentdata.com/support> to make sure you have the latest firmware and documentation. The Wiki site at <http://wiki.argentdata.com> also has in-depth technical information and user-contributed tips and tricks.

2. Major Features

APRS Tracker - The OpenTracker USB is first and foremost a full-featured APRS tracker. It works with GPS receivers using the industry-standard NMEA format (\$GPRMC, \$GPGGA, and \$GPGLL sentences). In addition to transmitting its own position, it can also decode incoming positions and plot them as waypoints on the screen of a GPS receiver, selecting appropriate symbols and setting comment text and other waypoint details if supported by the receiver.

KISS Mode - The KISS protocol defines an interface between a TNC and its host, typically a PC. This mode allows the tracker to be used with PC-based APRS programs like Xastir, WinAPRS, and UI-View32. It can also be used with non-APRS applications, subject to the limitations of the tracker's transmit and receive buffers.

Weather Station – The OpenTracker USB can be connected to several models of weather station, including the Peet Bros. Ultimeter 2000 series, Dallas/AAG 1-Wire Weather Station, Davis VantagePro 2, and LaCrosse WS-2310 wireless weather station, to provide remote weather telemetry.

Command Console – While the OpenTracker USB comes with a Windows-based configuration program, it can also be configured, tuned, and upgraded through a traditional console interface with command syntax similar to that of the classic TNC2 and its clones. Keyboard-to-keyboard QSOs are supported through a 'converse' mode as well as APRS messaging commands.

Telemetry – The OpenTracker USB has on-board temperature and voltage sensors, plus four analog 0-20v inputs and two digital input/output pins. Temperature and voltage readings can be reported in status packets, and the other readings can be reported in an APRS telemetry message.

Scripting – To automate a variety of tasks and increase the device's feature set, the OpenTracker USB includes a simple user-programmable script system.

3. Hardware Description

3.1. SERIAL Connector Pin Assignments

2:	Data in (port A)
3:	Data out (port A)
4:	Power output for GPS
5:	Ground
7:	Data out (port B)
8:	Data in (port B)

Note: The serial interface is configured as DTE (data terminal equipment) to allow direct connection to a GPS receiver. Connection to a PC requires a null-modem cable.

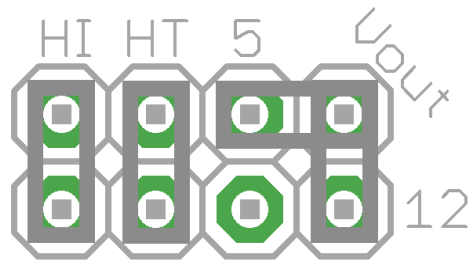
3.2. RADIO Connector Pin Assignments

1:	Audio out
2:	COR / Squelch input
3:	PTT out
5:	Audio in
6:	Ground
7:	Power in (7 to 24 volts)
8:	PTT in
9:	AUX IO / GPIO1 / Power relay output

3.3. Internal Header CN4

1:	+5 Volt power
2:	1-Wire data bus
3:	Analog input 1
4:	Analog input 2
5:	Analog input 3
6:	Analog input 4
7:	Digital input/output
8:	Ground

4. Jumper Settings



Three settings are controlled by the jumper block on the circuit board.

'HI' – This jumper sets the audio output level to the high range. This is needed mostly for mobile radios, especially some commercial models.

'HT' – Selects if push-to-talk signaling through the audio output line is enabled. Use this jumper with most HTs by Icom, Yaesu, and Alinco handhelds, but not Kenwood, Puxing, and Baofeng.

'Vout' – Selects GPS output voltage on pin 4 of the serial connector. This is set to 5v by default. Valid positions are horizontal for 5v and vertical to pass the OTUSB's unregulated supply voltage (typically 12v) straight through to pin 4. Use the 5v setting for all GPS receivers supplied by Argent Data Systems.

If you don't expect to use a 12-volt GPS receiver, clipping the pin marked '12' is highly recommended to eliminate the possibility of accidentally setting the jumper to the wrong position and destroying the GPS receiver.

5. Setup and Configuration

You can use a PC to connect to the OpenTracker USB using either the Windows configuration program (otwincfg.exe) or a terminal emulation program of your choice, such as HyperTerminal, PuTTY, or Minicom. Either the serial port or the USB port may be used for configuration.

To use the command console, connect at the proper baud rate (4800 baud is the default) and press enter several times until you see a command prompt. To use the Windows configuration program, simply start the program, select the COM port, and power up the device.

The only setting absolutely required for normal APRS tracker operation is the callsign. The defaults for all other settings should be reasonable, but you should check on locally recommended settings, particularly for the digipeater path.

5.1. USB Operation

The USB port can be used for configuring the tracker with the otwincfg.exe utility, accessing the command prompt, and connecting to a PC in KISS interface mode.

When the USB connection is in use, the tracker draws its power from the host system - no other connections are required for configuration of the unit. Note that the OpenTracker USB does NOT act as a host device - the USB port is only used for connecting to a PC, and cannot be used to connect a USB GPS receiver.

Windows systems require the provided .INF for the OpenTracker USB to be recognized properly. Once installed, you can find the COM port number assigned in Device Manager. Alternatively, you can plug in the USB port after running otwincfg.exe and the new port should be detected automatically.

Modern **Linux** distributions should automatically assign a device name like /dev/ttyACM0 to the OpenTracker USB. If the unit is not automatically recognized, you can select the driver with the following command:

```
sudo modprobe usbserial vendor=0x134a product=0x9000
```

Mac OS X should assign a device name starting with `/dev/cu.usbmodem`.

Other modern operating systems should be able to use the OpenTracker USB as a generic CDC ACM serial device. Its VID is 0x134A and PID is 0x9000.

6. Position Modes

Before getting started, it's important to understand that the tracker ordinarily will *not* make automatic transmissions (including position, status, weather, and telemetry packets) unless it knows where it is.

The device knows where it is when it receives a valid fix from a GPS receiver, or when it's programmed by the user with a fixed position. It can be configured to transmit without a valid fix; if no fix has been received since power-up, only status and telemetry packets will be sent. If the last valid GPS fix is more than 30 seconds old, a 'NO FIX' warning is added to each position packet.

If the AUTOSAVE option is enabled, as soon as the last valid fix is 30 seconds old, that position is saved and the device enters fixed position mode. As soon as another valid fix is received, it switches back to GPS mode. This is useful for portable weather stations that will have a GPS receiver connected only briefly during deployment.

7. Port Modes

The OpenTracker USB has two serial ports that share the same physical connector. A 'Y' adapter is available to separate the ports if needed. Both ports can operate in multiple modes:

AUTO – In this mode, the device will automatically detect NMEA GPS data, Peet Bros weather data, or (for port A only) command console input. Note that while both ports can be configured in AUTO mode, only one should be used for a given function at any time. For example, port A can accept NMEA data while port B accepts weather data, but providing NMEA data to both ports simultaneously will cause unpredictable operation.

If the USB port is not in KISS mode, the command console will only be present on the USB port while it's connected. When the USB port is disconnected, the console will default back to port A.

KISS – In KISS mode, a PC or other host device sends and receives raw AX.25 packets. Keep in mind that even with one or both ports in KISS mode, the tracker will continue to perform its other functions, including messaging and remote command access. The host should use a different callsign/SSID combination to avoid interference.

WS2300 – Supports LaCrosse WS-2300 series weather stations at 2400 baud, again ignoring manual baud rate settings.

DAVIS – Supports Davis Vantage Pro series weather stations.

TEXT – Functions like 'converse' mode. Each line of text is sent as a plain text packet when a carriage return is received. Pressing control-C twice will exit TEXT mode.

FLOW – Valid only for port B, this setting causes the port B pins to function as CTS/RTS flow control signals for port A.

The USB port has two modes, controlled by the 'USB KISS' option in otwincfg.exe or the USBKISS ON/OFF option from the command console.

When USBKISS is ON, the USB port will operate in KISS mode. If the tracker receives a KISS exit command from the host, USBKISS will be switched OFF.

With USBKISS OFF, the USB port functions as the command console. In both modes, the baud rate setting has no effect on the serial link's speed. Some applications may make assumptions about timing based on the selected speed, however, so it's recommended that the baud rate be set to 115,200 bps or higher.

8. Remote Access

Commands can be issued to the tracker remotely via APRS messages. The originating station's callsign must appear in the device's security authorization list (see AUTHLIST command.) Commands are prefixed with 'CMD', and the results of the command, if any, will be send back as an APRS message to the sending station.

For example, 'CMD VERSION', sent from an APRS client, will cause the target device to reply with its firmware version.

In response to a RESET command, the device will attempt to send one acknowledgement before resetting. This is intended to prevent message retries from causing multiple resets, but especially if the channel is busy there is a possibility that the acknowledgement will not be sent before the reset is executed. A RESET command should be cancelled after a few retries with no response received to check if the device has indeed been reset.

9. Safe Mode

Starting with firmware build 56294, the OpenTracker USB includes a 'safe mode' option to place the device temporarily into its default configuration. The safe mode entry condition is checked only when the tracker first powers on or resets.

It should always be possible to recover from an invalid configuration using a cold boot procedure over the serial interface. This procedure, however, can be problematic with certain hardware setups. Safe mode offers an alternative to a serial cold boot.

Safe mode is entered by connecting the digital I/O and 1-Wire bus pins (CN4 pins 7 and 2) together. Connect the pins with a short piece of wire or other conductive item such as a pair of metal tweezers while the tracker powers up. The tracker will blink its red LED five times to indicate safe mode entry and will display *SAFE MODE* in the banner.

While in safe mode, the tracker will operate from a saved copy of the default configuration, with ports A and B set to AUTO at 4800 baud. Changes to the configuration will affect the normal configuration and not the saved defaults. To

exit safe mode, use the RESET command or power off the tracker after removing the jumper used to enter safe mode.

The use of the default configuration is temporary. Normal operation will be resumed when safe mode is exited. To overwrite the active configuration with the saved defaults, use the RESET DEFAULT command. The tracker need not be in safe mode to restore defaults.

10. Authentication

In addition to the security authorization list, remote access to the tracker can be controlled through a more secure one-time password mechanism. This mechanism is enabled by setting PWAUTH ON.

To set up one-time password authentication, use the command SECRET followed by a pass phrase of at least 16 characters. The device will use this pass phrase to generate a 128-bit key that is stored in nonvolatile memory. The password sequence counter is set to 0 when the key is created.

The PASSLIST command can then be used to generate a list of 4-character one-time passwords, each listed with a unique sequence number. These passwords must be used in the specified order. You can print out this list and cross off each password as it's used.

```
cmd:secret The quick brown fox jumps over the lazy dog.
Set.
cmd:passlist 24
 0:C0EP   1:U60T   2:8JES   3:BVPN   4:Z2ZC   5:TEAR   6:VA5S   7:EV1F
 8:JCBX   9:NE8G  10:NAAM  11:P1Y8  12:ZJ59  13:H654  14:KSBB  15:PDM8
16:VM89  17:GTNW  18:CW52  19:B7ZX  20:X4DF  21:Z5HF  22:CNUU  23:A8FS
```

To use a password, append it to the CMD prefix at the start of the command message. For example, if the next valid password is 'SBCY', the message "CMD SBCY VERSION" will execute the VERSION command.

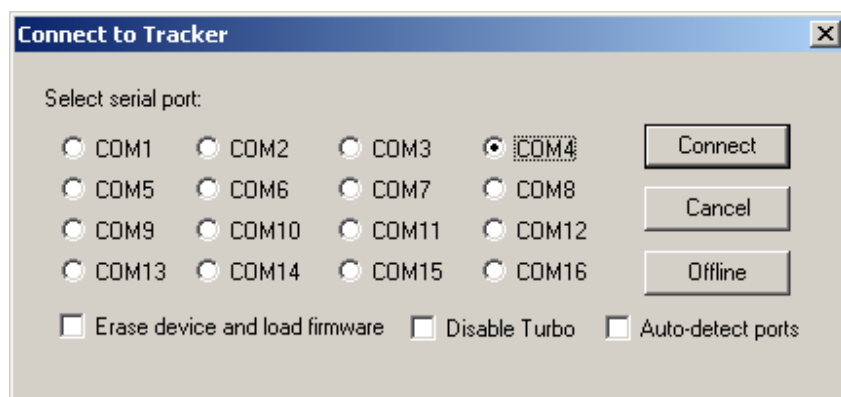
While it should be virtually impossible for someone to determine the next password without knowing your pass phrase, the system is not foolproof. Be sure not to use the same pass phrase on two different devices, because an eavesdropper who hears a password used on one device (or who retrieves an old message from an online database) could potentially use the same password on the other unit.

Also, should a valid password be sent without being received by the target device, an eavesdropper would know the next valid password. If you are unsure of being able to reach the target device, send an unauthenticated message or query first and make sure you get a reply.

11. OTWINCFG Configuration Program

The OpenTracker USB can be configured using the otwincfg.exe program under Windows. The program is available for download at <http://www.argentdata.com/support>.

Connect the tracker and start the configuration program. The first window displayed allows you to select the COM port that the tracker is connected to.



11.1. Overwriting an Invalid Configuration

The 'Erase device and load new firmware' option will load a new firmware image, using the default configuration settings, without attempting to read the existing configuration first. This is particularly useful if the tracker has an invalid or missing configuration.

11.2. Turbo Mode

By default, the configuration program will attempt to connect at 115,200 baud. If you have trouble connecting, use the 'Disable Turbo' option to force the program to connect at 19,200 baud.

11.3. Auto-detect ports

Selecting this option will cause the program to constantly scan all of the ports and display which are available. Connecting the tracker via USB while this option is checked will cause the program to automatically connect. On some systems this option may cause trouble connecting; disable it if you experience problems.

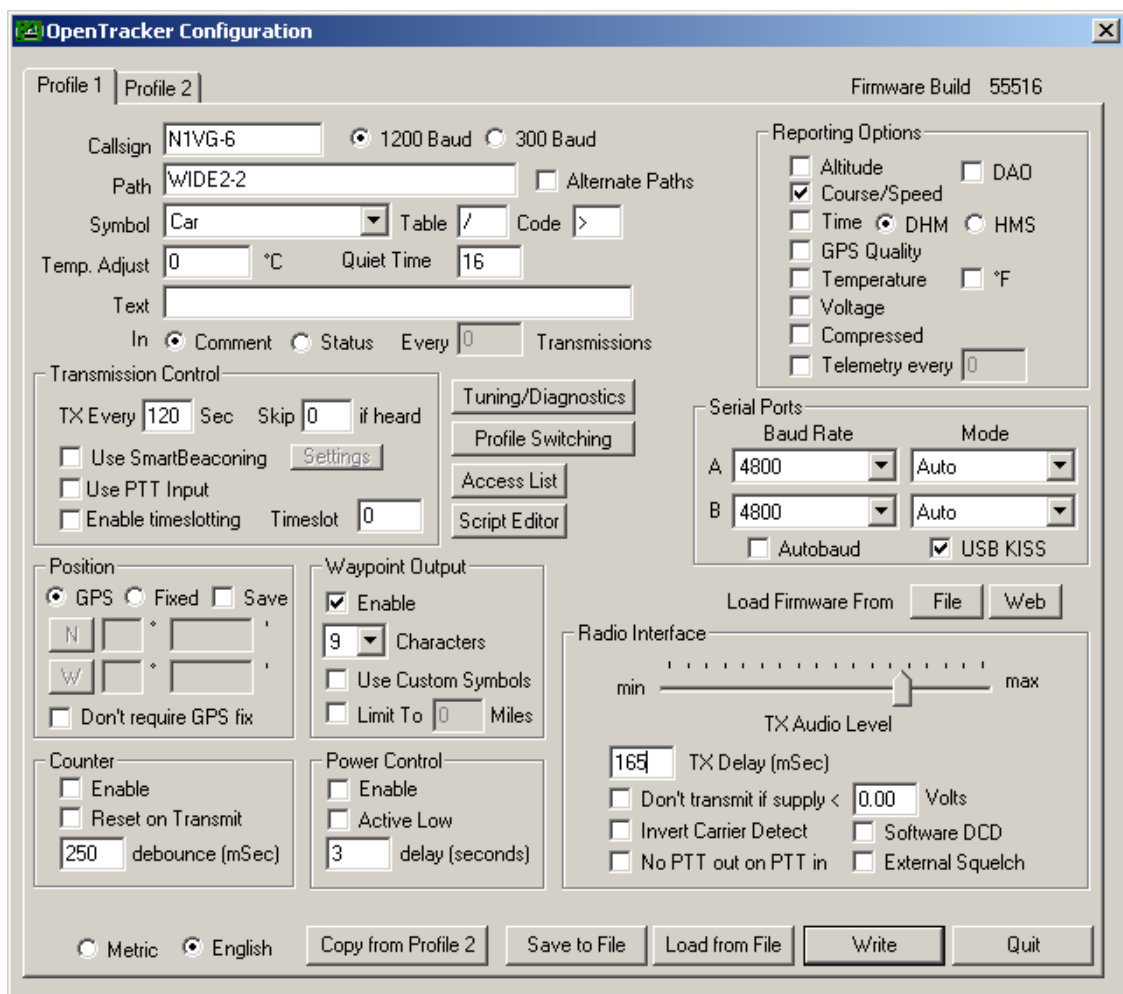
11.4. Warm Boot vs. Cold Boot

If the unit is already powered on and operating when you click the 'Connect' button, the program attempts a 'warm boot' operation to put the device into configuration mode. If the firmware has been corrupted, i.e. by a failed upgrade, it may fail to enter configuration mode. You can correct this by performing a 'cold boot' - power the unit off and power it on again after clicking 'Connect'.

11.5. Working Offline

If you need to edit a configuration without connecting the tracker, click the 'Offline' button. You will need to have a saved configuration file to work from.

11.6. Main Configuration Window



11.7. Configuration Profiles

The OpenTracker USB can store two separate configuration profiles. The profile currently being shown is selected using the tabs at the top of the window labeled 'Profile 1' and 'Profile 2'.

When it is first powered on, the tracker will always start out using Profile 1. After startup, profile selection depends on the settings in the profile switching screen. To access these settings, click 'Profile Switching'. See the section below on profile switch for more information.

11.8. Loading and Saving Settings

After changing any configuration options, you must click the 'Write' button to write the changes to the tracker's firmware. You may also use the 'Save to File' button to save the configuration options to a file, which can be loaded later using the 'Load from File' button.

11.9. Basic Configuration Options

Callsign – The radio callsign to use when transmitting. Tactical callsigns may be used, but FCC and ITU rules require periodic identification. If the actual callsign is not used here, be sure to include it in the comment field.

Baud Rate – For normal VHF operation this should be 1200. 300 baud is commonly used for HF. The mark and space frequencies are 1600 and 1800 hz respectively in 300 baud mode.

Path – This specifies the digipeater path to use. Specific callsigns may be entered (e.g., 'K6SYV-10, K6TZ-10') but for APRS operation a set of common aliases are usually used. A suggested default path is 'WIDE1-1, WIDE2-1'. It is rarely necessary to use a path greater than WIDE3-3 (requesting three 'wide' digipeater hops), and excessive paths generate large amounts of traffic that degrade the performance of the network. If you're not sure what path should be used for your local area, check with a local digipeater operator. This field may be left blank.

Alternate Paths - When enabled, this option causes the tracker to alternate between the paths specified in either profile with each transmission.

Symbol Table and Symbol Code – These settings control the symbol used to indicate the station's position when drawn on a map. See Appendix B for a listing of available symbols.

Temp. Adjust – Calibration offset for onboard temperature sensor. The sensor used on the OpenTracker is fairly linear across its operating range and requires a single-point calibration. The easiest way to accomplish this is to set a thermometer next to the tracker. Subtract the temperature reported by the tracker from the temperature shown by the thermometer, and enter that value in this field. For example, if the thermometer shows the temperature as 26°C and the tracker reports 29°C, enter -3 for the adjustment value.

Quiet Time – This setting determines how long the channel must be clear before the tracker will transmit. Each unit is approximately 1/56 second. Setting the quiet time to zero causes the tracker to ignore detected traffic.

Text – This is a freeform text field. Anything entered here will be displayed in the comment portion of the transmission or in a separate status packet, as selected. Keep comments as brief as possible to avoid wasting channel capacity, or use the 'Every __ Transmissions' option to reduce how often the text is sent.

Altitude, Course/Speed, Time – When checked, report these values as indicated by the GPS receiver. The timestamp may be in Days/Hours/Minutes or Hours/Minutes/Seconds.

DAO – Enables the proposed !DAO! APRS extension to provide the map datum used and an extra digit of latitude and longitude resolution. May not be supported by all APRS clients. The datum is always reported as WGS84, which is the standard for normal APRS operation.

GPS Quality – Report number of satellites in use and horizontal dilution of precision information as reported by the GPS receiver.

Temperature – Report temperature as indicated by the onboard temperature sensor in the comment field, in degrees C. Not affected by the Metric / English setting.

Voltage – Report input voltage in the comment field. The maximum value is 18.5 volts, and the minimum is the dropout voltage of the regulator – typically 6.7 volts.

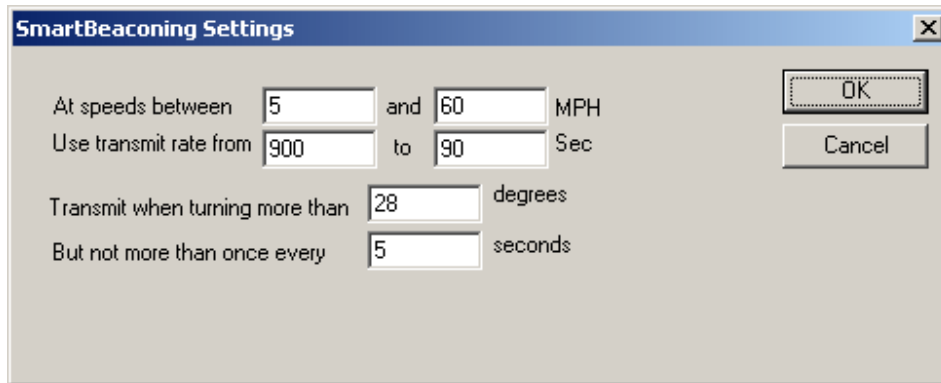
Compressed – Enables Base91 compressed position reporting. This mode is widely, but not universally, supported. Packets in Base91 format are shorter than their uncompressed equivalents and provide greater position resolution.

Telemetry every n – Sends a telemetry packet every n transmissions. See the telemetry section for more details.

TX Interval – How often the tracker should transmit. Allowable values are 0 to 65,535 seconds. This setting will depend on your intended use. One transmission every two minutes is acceptable for most mobile stations. A fixed station (e.g., a solar powered site reporting battery voltage and temperature) might choose an interval in the range of 5 to 30 minutes. If you require transmissions more often than every two minutes or so, consider using the SmartBeaconing™ options detailed below. Special events with many trackers and short transmission intervals should be operated on a separate frequency, not on the shared APRS channel. An interval of zero will disable timed transmissions.

SmartBeaconing – Originally developed for the HamHUD by Tony Arnerich, KD7TA, and Steve Bragg, KA9MVA, the SmartBeaconing™ algorithm allows the tracker to operate more efficiently by changing how often it transmits depending on its speed and direction of travel.

When stopped or moving at a speed below the low speed setting, the tracker will transmit at a fixed rate determined by the lower rate setting. Above the specified high-speed threshold, the higher rate setting is used. Between these two extremes, the interval varies between the low and high rates depending on the speed. A turn angle can also be specified to cause the tracker to transmit when turning. The final setting ensures that the tracker will never transmit more often than the specified interval, regardless of speed and turn rate. This can be useful to avoid transmitting more than once in a long, shallow turn.



Use PTT Input – When this checkbox is enabled, the tracker can be connected inline with a microphone to operate in burst-after-voice (mic encoder) mode. A packet will be transmitted whenever the microphone PTT is released.

Timeslot – The timeslot option is typically used to coordinate multiple trackers, especially for special events where many transmitters will be sharing the same channel with a high beacon rate. The number entered selects the timeslot's offset, in seconds, from the start of the hour. The tracker will transmit at this time, and every transmit interval after that. The timeslot value should be smaller than the transmit interval.

As an example, two trackers could be configured with an interval of 10 seconds, with one tracker set to slot 0 and the other to slot 5. The first tracker would transmit at 12:00:00, 12:00:10, 12:00:20, and so on, while the second would transmit at 12:00:05, 12:00:15, and 12:00:20.

Position – The tracker can operate in GPS or fixed position mode. When entering a fixed position, enter degrees in the first box and decimal minutes in the next box. Click on the buttons next to the coordinates to select North/South and East/West.

Don't require GPS fix – Normally, while in GPS mode, the tracker will not transmit without a valid fix. When this option is selected, the tracker will continue to transmit its last known position if GPS lock is lost for more than 30 seconds. This condition is indicated by the text 'NOFIX' in the status message. If the tracker has received no valid fix since startup, no position will be reported. Status text and telemetry packets will be unaffected. This option is particularly useful for applications like high altitude balloons that may lose GPS lock after landing, but still need to transmit to be found.

Save – When enabled, the tracker will save its last-known GPS position as a permanent fixed position if the GPS fix is lost. This may be used in the case of a temporary weather station where a GPS receiver is installed only during setup and is removed to conserve power. The system must remain powered on for 30 seconds after GPS fix loss before the position is saved.

Waypoint Output – Enabling the waypoint output option causes the tracker to parse received APRS positions and output them over the serial port at 4800 baud. Waypoints are provided in both NMEA 0183 format (\$GPWPL sentence) and Magellan format (\$PMGNWPL sentence).

Length Limit – Some GPS receivers are not capable of display the full 9 characters required for APRS call signs and object names. Setting this option to a smaller number causes the tracker to intelligently truncate the name of the waypoint. Spaces and dashes are eliminated first, and if further truncation is required, characters are dropped from the left first. This prevents stations with different SSIDs from conflicting – for example, with a limit of 6 characters, KB6YUO-12 and KB6YUO-6 would be truncated as 6YUO12 and B6YUO6 respectively.

Use Custom Symbols - Enables the use of custom symbols if they have been uploaded to a compatible Garmin GPS receiver (using the Garmin xImage utility).

Range Limit - When enabled, waypoints will only be created for stations and objects within the specified range.

Enable Counter – This checkbox enables the digital counter function. When this function is enabled, the tracker will no longer transmit immediately when X1 pin 4 is shorted to ground. Instead, it will increment a counter and include the current count in the status text, e.g., 'CNT00001'. The maximum count is 65535, after which the counter rolls over to zero. This option can not be used concurrently with profile switching with the 'jumper' option.

Reset on Transmit – Setting this checkbox causes the counter to reset with every transmission. Hence, the count reported is the number of events since the last transmission.

Debounce – This is a delay applied to the counter input. After a counter event is registered, all subsequent events are ignored until the specified time has elapsed. Without a suitable debounce setting, a typical pushbutton could register several events for one press.

Power Control – When selected, the tracker will activate its power control line (AUX IO) before each transmission. The tracker will pause for the specified number of seconds to give the transmitter time to power up. The power control feature is especially useful for solar-powered weather or telemetry stations.

TX Audio Level – This slider sets the audio output level. This level can be set interactively from the Tuning/Diagnostics screen. If you find that the required level is less than one quarter of the full scale, make sure you have the 'HI' jumper removed. Running with the audio level set in software to a very low level can increase DAC quantization noise.

TX Delay – All radios require a certain amount of time to stabilize on their transmitting frequency, and receivers also require time to lock on. This value specifies the number of milliseconds the tracker should wait after the start of the transmission before it begins sending data. Allowable values are 0 to 1023 milliseconds. Setting this value too high will keep the channel busy longer than necessary. Setting it too low will prevent packets from being transmitted properly. Finding the optimum value for your radio may require some experimentation.

Don't transmit if supply < n – To avoid over-discharging batteries, enable this option and enter the minimum voltage at which the tracker should operate the transmitter.

Invert Carrier Detect – Usually used with mobile radios, this checkbox indicates that the channel is busy when the carrier detect input is low.

Software DCD – This option selects the data carrier detect (DCD) mode used. When unchecked, the tracker considers the channel to be busy in the presence of any noise, including voice or static. When checked, the channel is considered busy only when a valid 1200 baud signal is present.

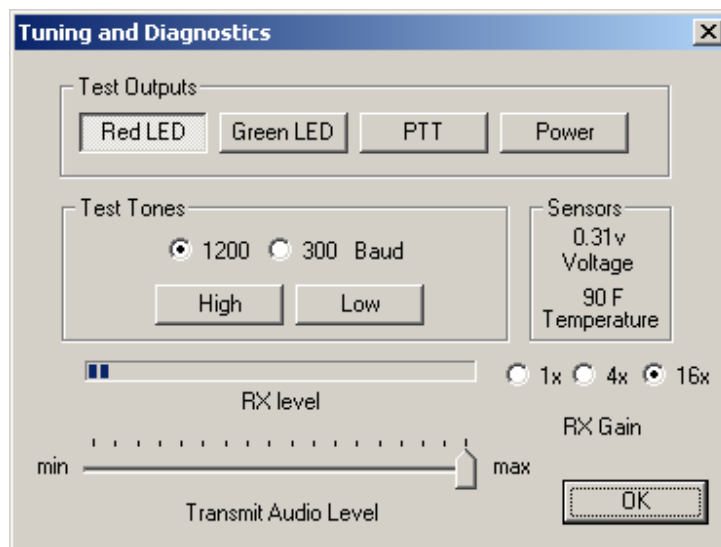
No Suppress PTT Out on PTT In – This option allows the tracker to be used in burst-after-voice mode without breaking any lines between the microphone and radio. PTT is not asserted by the tracker until the microphone PTT is released.

External Squelch – Enables the use of an external squelch or COR input.

Copy from Profile *n* – This button copies the contents of one profile to the other.

11.10. Tuning and Diagnostics

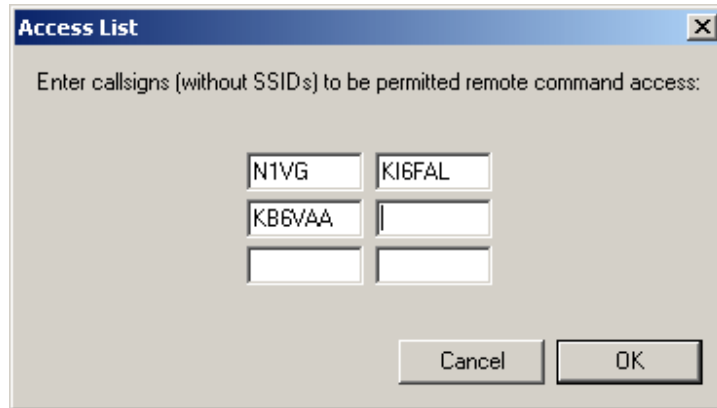
Access the tuning and diagnostics screen with the 'Tuning/Diagnostics' button.



From this screen, you can exercise the tracker hardware and set the audio level. The top row of buttons controls the red and green elements of the ACT LED, the PTT output, and the power relay, and the second row allows AFSK tones to be sent, either with or without PTT on. When both tone buttons are on, the tracker sends alternating mark/space tones at the specified baud rate. The 'Sensors' pane shows the raw readings from the on-board sensors. The temperature reading is shown without the calibration constant applied.

Use the RX Gain setting and your radio's volume adjustment to keep the received audio level (indicated by the blue bar) between 50% and 100% of full scale when the radio is receiving a packet.

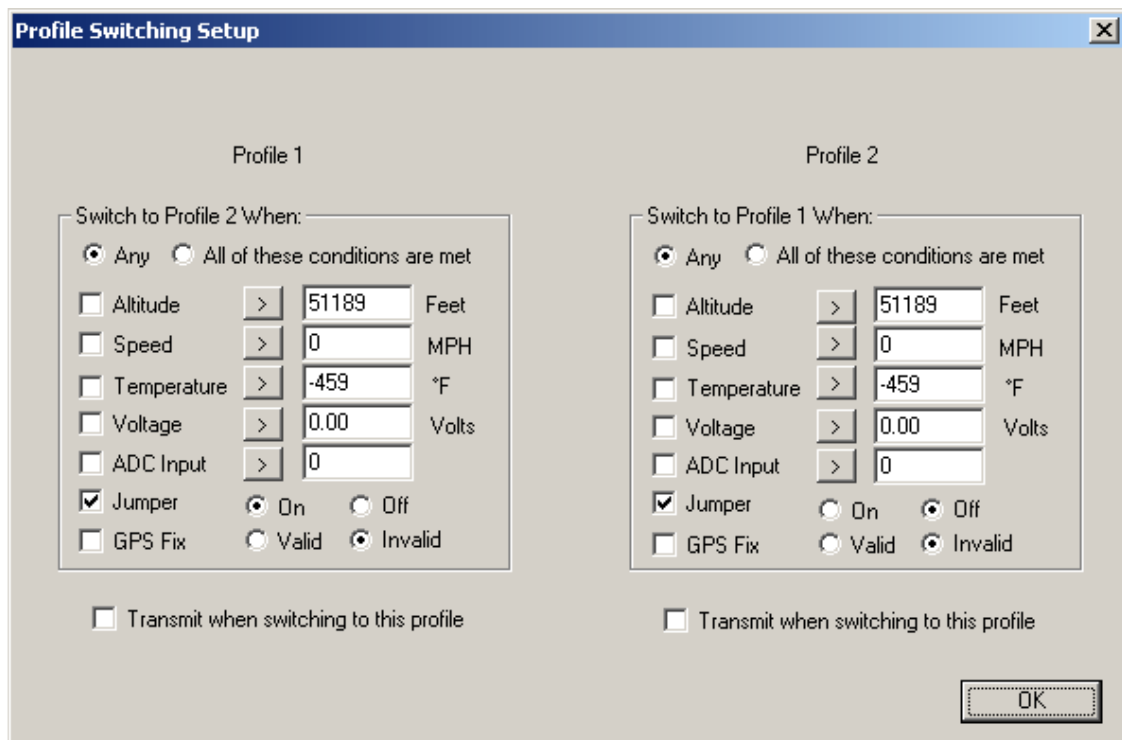
11.11. Access List



This screen allows editing of the tracker's remote access control list.

11.12. Profile Switching

To access the profile switching setup, click on the 'Profile Switching' button from the main configuration screen.



The conditions to test are selected using the checkboxes to the left of each condition. The comparison can be either '>' (greater than) or '<=' (less than or

equal to). Clicking on the button showing the comparison operator toggles it between these two settings.

The *Altitude* and *Speed* values are compared with those indicated by the GPS. Onboard sensors provide readings for comparison with the *Temperature* and *Voltage* fields. *ADC Input* refers to the extra unused analog-to-digital converter input on X1 pin 9. The possible values are 0 to 255, corresponding to a range of 0 to 20 volts. The 'jumper' setting refers to the state of the CFG input on the accessory port (CN4 pin 7). The input is 'Off' when the CFG pin is pulled to ground, as through a toggle or pushbutton switch. The *GPS Fix* is considered invalid if it has been more than 20 seconds since the last valid position was received from the GPS unit.

The selected tests are run once every second. If the conditions are met, the new profile is loaded. If *Transmit when switching to this profile* is checked in the new profile, a packet is transmitted immediately.

If the conditions in both profile panes are met, the tracker will switch between the two profiles each second and may cause undesired operation.

12. Command Reference

Most commands can be issued through the serial console, APRS message, or fleet management message. Some commands make sense only when used from the local console and are not available for remote access.

The OpenTracker USB will accept command abbreviations. A minimum of three characters must be entered. For example, CALIBRATE can be entered as CAL. AUTOBAUD can be entered as AUTOB, the additional characters being required to distinguish it from AUTOSAVE.

Many commands return values in the script engine's 'Result' variable. On/Off commands return 1 for 'On' and 0 for 'Off'. Numeric settings return the value of the setting. Other return values are documented below in italics.

1WIREWX

Enables 1-Wire Weather Station mode. The TAI8515 weather station should be connected to the 1-wire pin on header CN4.

ABAUD 1200 | 2400 | 4800 | 9600 | 19200 | 38400 | 57600 | 115200

Sets baud rate for the primary serial port. Default is 4800 baud.

Return value: 99 = invalid setting, 0-7 = 300 to 115200 baud

ALTITUDE on|off

Report altitude in position packet.

ALTPATH on|off

Causes the tracker to alternate between the digipeater path entries in either profile with each transmission.

AMODE AUTO | KISS | WS2300 | DAVIS

Sets mode for primary serial port. See 'Port Modes' above for more information.

ANALOG <n>

Returns the current reading for the specified analog input pin. See the telemetry section of this manual for details on pin assignments. This command is used primarily for scripting.

Return value: Current analog reading for specified pin

AUThLIST +/-<callsign>

Displays or changes the list of callsigns authorized for remote access. +callsign adds a callsign to the list, -callsign removes a callsign from the list, and 'none' erases the entire list. Up to six callsigns can be stored.

AUTOBAUD on|off

Enables automatic baud rate detection. When a baud rate mismatch is detected, the unit will attempt to automatically select the proper baud rate.

AUTOSAVE on|off

When enabled, the tracker will save its last-known GPS position as a permanent fixed position if the GPS fix is lost. This may be used in the case of a temporary weather station where a GPS receiver is installed only during setup and is removed to conserve power. The system must remain powered on for 30 seconds after GPS fix loss before the position is saved.

BBAUD 1200 | 2400 | 4800 | 9600 | 19200 | 38400 | 57600 | 115200

Sets baud rate for the secondary serial port. Default is 4800 baud.
Return value: 99 = invalid setting, 0-7 = 300 to 115200 baud

BEACON [text] (local only)

If no beacon text is specified, a position beacon (and weather beacon, if applicable) will be queued for immediate transmission. If a text string is entered, that text will be transmitted as an AX.25 text packet.

The command 'BEACON W' will transmit only a weather packet, and 'BEACON P' will transmit a position packet.

BMODE AUTO | KISS | WS2300 | FLOW | DAVIS

Sets mode for secondary serial port. See 'Port Modes' above.

CALIBRATE LOW | HIGH | ALT | PACKET (local only)

Calibration functions to set demodulator tuning and transmitter deviation. 'Low' transmits a 1200 hz tone, 'high' transmits a 2200 hz tone, 'alt' transmits alternating 1200 and 2200 hz tones, and 'packet' sends a test packet repeatedly. Use the '[' and ']' keys for coarse adjustment of the transmit audio level, and '-' and '+' for fine adjustment. Press any other key to exit calibration mode.

CDINVERT on|off

Inverts carrier detect input polarity.

CNTRESET on|off

Causes counter to reset with each transmission. See accessory port information.

COMMENT <string>

Sets beacon text / comment string, up to 64 characters.

COMPRESS on|off

Enables Base91 compressed format for position transmissions.

CONFIG 1|2

(local only)

Selects configuration profile to modify.

CONVERSE

(local only)

In converse mode, text entered at the console is transmitted when the ENTER key is pressed. Hit CTRL-C to exit. The command 'K' may also be used to enter CONVERSE mode.

COUNTER on|off

Transmits counter value in status text.

CUSTSYM on|off

Enables the use of custom symbols if they have been uploaded to a compatible Garmin GPS receiver (using the Garmin xImage utility).

CWBEACON <text>

(local only)

Sends <text> as a Morse code beacon.

DAO on|off

Enables transmission of the !DAO! extended-precision construct. This provides an extra digit of precision over the standard APRS position format, but results in a longer packet and may not be supported by all APRS clients.

DEVLIST

(local only)

Lists addresses of all connected 1-wire devices.

Return value: Number of devices detected

DISPLAY (local only)

Lists all configuration parameters.

DOUBLE <n> on | off

When enabled, two identical copies of the position packet are sent with each transmission. This should only be used with short packets when extra redundancy is required.

DUMP (local only)

Displays the tracker's memory contents for troubleshooting purposes. By default only RAM contents are displayed. **DUMP CONFIG** displays configuration memory contents, and **DUMP ALL** displays everything.

EXTSQL on | off

Enables external squelch input.

EXTTEMP on | off

Enables temperature reporting from an external DS18S20 temperature sensor connected to the 1-wire data bus..

FAHRENHT on | off

Reports temperatures in Fahrenheit when temperature output in the status text is enabled.

FILTER on | off

When **FILTER** is ON, the **MONITOR** command will only output printable characters.

GPSDATA on | off

Reports GPS quality data in status text, including horizontal dilution of precision (HDOP) and number of satellites used (SATS).

GPIO <n> on | off | toggle | in

Reads or sets state of a general-purpose digital I/O pin. 'On' sets the pin to the high state, 'Off' sets it to low state, 'Toggle' reverses the state of the pin, and 'In' switches the pin to input mode and returns 1 or 0 depending on the input signal. This command is used primarily for scripting. Pin output state settings are not retained when power is lost. See the telemetry section of this manual for details on pin assignments.

Example: GPIO 1 ON

Return value: 0 or 1 depending on input signal

HALFSLOT on | off

When timeslotting is enabled, HALFSLOT adds ½ second to the slot time.

HBAUD 1200 | 300

Selects transmission baud rate. Note that the reception baud rate is fixed at 1200 baud.

HEADERLN on | off

Breaks MONITOR packets into two lines, with header and payload separated.

INFO

Displays general system and diagnostic data, including number of packets heard, buffer overruns, and frame check sequence errors detected.

INTERVAL <0-65535> (seconds)

Sets the interval between automatic transmissions.

LVINHIBIT <0-255> (* 0.0784 volts)

Sets the low-voltage inhibit threshold. When the supply voltage drops below this level, the unit will cease transmitting. Each unit is 0.0784 volts, so a setting of 100 equals 7.84 volts.

MAXRANGE <0-255> (miles)

When set to a non-zero value, waypoints will only be created for stations and objects within the specified range.

MONITOR on | off

Displays incoming packets on the console as they are received.

MYCALL <xxxxxx-nn>

Sets the unit's callsign and optional SSID.

NICE <n>

When the tracker hears one of its own packets digipeated, it will skip the following <n> transmissions. This allows a faster beacon rate to be used in areas with poor coverage, without increasing the load on the network in areas with better coverage.

OUTPUT1 on|off

Not currently implemented.

PASSALL on|off

Normally the tracker ignores all received packets that fail a frame check sequence test. **PASSALL** disables the FCS test. This option should only be used for troubleshooting as it will result in output of corrupted packets.

PASSLIST [n]

(local only)

Generates a list of the next *n* one-time passwords to be used, based on the pass phrase entered with the **SECRET** command. Default is 144.

PATCH <hex string>

The patch command allows direct modification of the contents of the tracker's flash memory. This command should only be used as directed by the manufacturer. Improper use of this command may render the tracker inoperable.

PATH <call1,call2,...>

Comma-separated digipeater path list, containing up to three digipeater addresses.

POSITION <hhmm.mmx hhhmm.mmx> | GPS

Sets fixed position or enable GPS. Position must be entered in degrees and decimal minutes, including leading zeros. Setting position to 'GPS' reverts to GPS tracking mode.

Example: **POSITION** 4851.49N 00217.66E

Return value: 0 = Using GPS, 1 = Fixed Position, 2 = Position Unknown

POWER on|off|<0-255> (seconds)

ON or OFF will manually set the state of the power relay control pin (AUX IO). Specifying a value in seconds will enable automatic power control mode, where the power output is turned on for the specified number of seconds prior to transmission, and turned off immediately after transmission.

Return value: 0 = Off, 1 = On, 2 = Timed

PROFILE 1 | 2

Selects the configuration profile to use.

PROPWPT on|off

Enables proprietary waypoint strings. With PROPWPT OFF, output formats are \$GPWPL and \$PGRMW. With PROPWPT ON, \$PKWDWPL, \$GPWPT, and \$PMGNWPL are output.

PTTINPUT on|off

Enables PTT input for mic encoder operation. A position packet will be transmitted when the mic PTT is released.

PULSE <0-255> (seconds)

Activates power output for specified duration.

PWAUTH on|off

Enables one-time password authentication.

QUIET <0-255>

Time channel must be free before transmission can occur, in 1/64 second units.

REARM <0-255> (milliseconds)

Specifies minimum time between counter inputs. May be used for switch de-bouncing.

REPLY <message>

(local only)

Sends a text message to the last person who sent a message addressed to this unit's callsign

RETRIES <0-255>

Number of times to retransmit an outgoing message.

RETRYTIME <0-255> (seconds)

Time between message retry attempts - interval increases by this value with each transmission.

REQALL on|off

Require all configuration switch parameters to be met before switching profiles.

RESET

Perform software reset. Saved settings are unaffected.

RING on|off

Sends a bell character whenever an incoming message arrives.

SCRIPT on|off

Enables the script engine.

SECRET <pass phrase>

Sets the pass phrase for the one-time password authentication system.

SEND <callsign> <message> (local only)

Sends a text message to the designated recipient.

SHAREDPTT on|off

Controls PTT line behavior for mic encoder mode. If enabled, PTT output is not asserted until the PTT input is released.

SLOT <0-65535>

Time slot for transmission (if TIMESLOT is on). Slot position is counted in seconds from the start of the hour.

SMARTBCON <low speed> <high speed> <low rate> <angle> <time>

Configures SmartBeaconing. The SmartBeaconing algorithm allows the tracker to operate more efficiently by changing how often it transmits depending on its speed and turn rate.

When stopped or moving at a speed below the low speed setting, the tracker will transmit at a fixed rate determined by the lower rate setting. Above the specified high-speed threshold, the higher rate setting is used.

Between these two extremes, the interval varies between the low rate and high rate (specified separately with the INTERVAL command) depending on the speed.

The <low speed> and <high speed> settings define these two limits. For storage efficiency, the speeds are represented in units of 32 centimeters/second. To convert from miles per hour, multiply by 1.397. To convert from kilometers per hour, divide by 1.152.

Setting	MPH	Km/h
5	3.6	5.7
10	7.2	11.5
15	10.7	17
25	17.9	29
40	28.6	46
60	43	69
80	57	92
100	71	115

<low rate> and <high rate> are specified in seconds. <angle> indicates the change of direction, in degrees, that will cause an immediate transmission. <time> specifies, in seconds, the minimum time required between transmissions, regardless of speed or turns.

SNOOP [hex] (local only)

The SNOOP command outputs on port A each character received on port B until another key is pressed. Use this command to troubleshoot GPS and weather station connections on port B. Make sure port A's baud rate is equal to or greater than port B's baud rate.

SQUAWK <0-255> (seconds)

Transmits alternating tones for specified number of seconds. May be used for testing or direction finding.

SWDCD on|off

ON selects software data carrier detect mode, providing a channel busy indication only when data is present. OFF selects energy detect mode, which will provide a busy indication for any signal, including static or voice.

STATUS <0-255>

Status packets are sent every n transmissions, or if set to 0, status text is sent as part of the position packet.

SYMBOL <1-2 characters>

APRS symbol character, optionally preceded by symbol table or overlay identifier.

TELEMETRY on|off

Enables transmission of telemetry packets.

TEMP on|off

Enables transmission of temperature readings from the on-board temperature sensor.

TEMPADJ <-128 to 127> (degrees C)

Offset for temperature sensor in degrees C.

TIMEHMS on|off

Sets timestamp mode to hour/minute/second when enabled. Default is day/hour/minute.

TIMESLOT on|off

Force position packets to be transmitted only in designated time slots, expressed as the number of seconds from the start of the hour to the first transmission.

TIMESTAMP on|off

Report time information in the position packet.

TRACE on|off

(local only)

When trace is on, each received raw packet is output in hexadecimal on the active console port.

TXDELAY <0-255>

Delay between start of transmission and start of data. This setting should be set to the minimum value that allows reliable reception of transmitted packets. An excessively high TXDELAY setting wastes channel capacity. Each unit is one character time – 1/150 second at 1200 baud.

TXLEVEL <1-255>

Sets transmission audio level. This value should be selected to provide an appropriate FM deviation level, typically about 3.5 kHz.

TXNOFIX on|off

Allows transmission of last position if GPS fix is lost for more than 30 seconds. Default behavior is to cease transmitting the position in the absence of a valid GPS signal.

TXONCHG on|off

Causes an immediate transmission when switching configuration profiles.

VELOCITY on|off

Enables transmission of velocity (course and speed) information in the position packet.

VERSION

Displays firmware version number.

VOLTAGE on|off

Enables reporting of supply voltage in status text.

WAYPOINTS on|off

Enables output of waypoints from received positions.

WPTLEN <6-9>

Sets maximum waypoint name length.

WXINFO

Displays weather information from attached station.

13. Telemetry

The OpenTracker USB has the ability to send telemetry information from its onboard temperature and voltage sensors, and header CN4 provides four 0 to 20 volt analog inputs and one general-purpose digital input/output pin.

When telemetry reporting is enabled, the tracker transmits standard APRS telemetry reports in the following format:

```
T#sss , aaa , bbb , ccc , ddd , eee , 76543210
```

The 'sss' field is a sequence number that increments with each report. Fields 'aaa' through 'eee' encode five channels of analog readings from 0 to 255, and fields 7 through 0 are binary bits, either 0 or 1, representing digital inputs.

The 'aaa' field represents the tracker's supply voltage, and fields 'bbb' through 'eee' correspond to inputs A1 through A4 respectively. All voltages are reported in 1/10 volt units.

Digital bit 1 reflects the state of the tracker's GPIO pin (CN4 pin 7), and bit 0 indicates the configuration profile currently in use.

14. Script System

The OpenTracker USB's script engine allows simple programs to be run on the tracker to customize the tracker's operation and automate tasks. Use the 'script' button in the otwincfg utility to access the script editors.

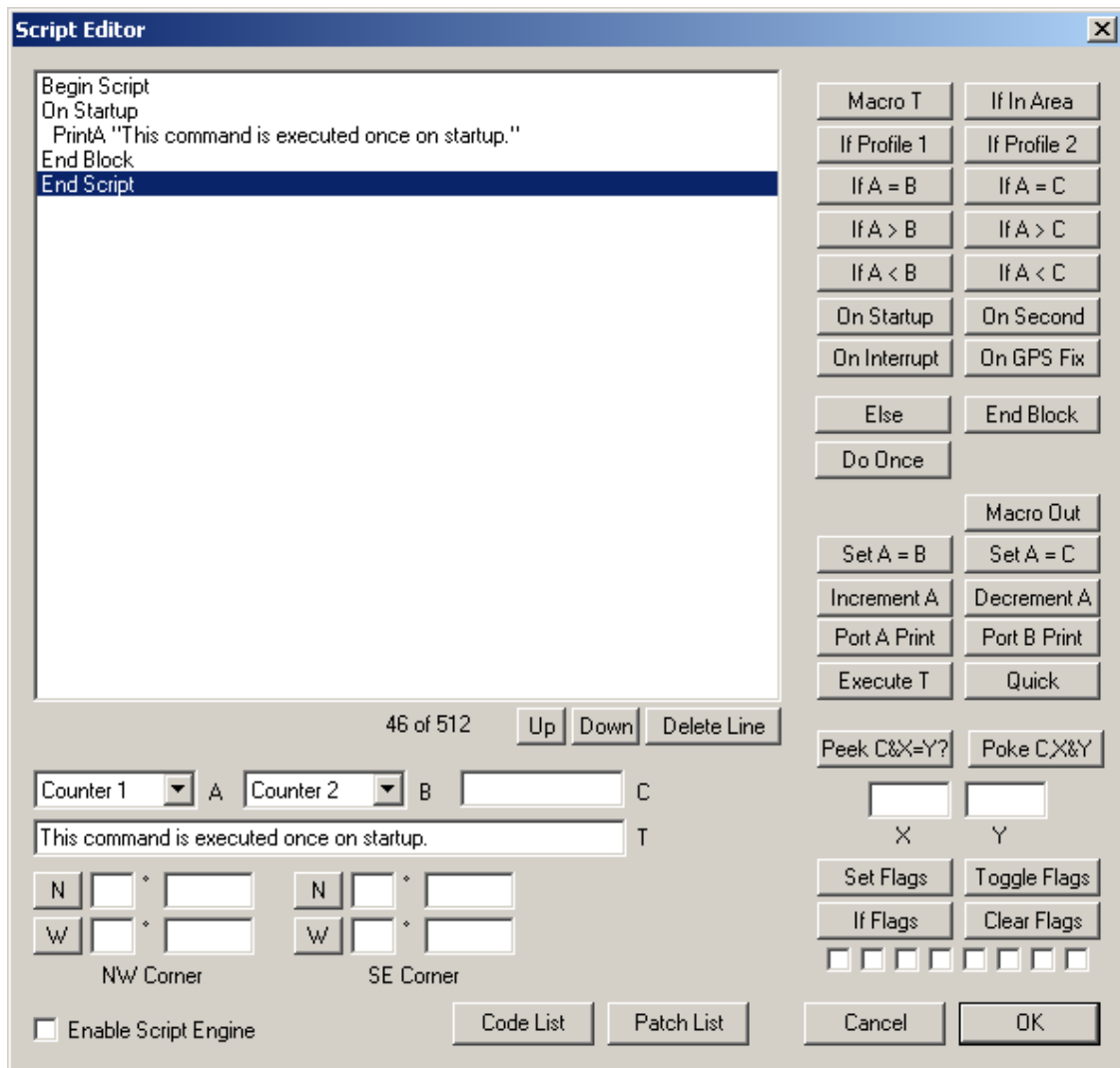
Common script tasks include handling multiple beacon texts, responding to events such as door alarms or high temperatures, transmitting APRS objects or telemetry parameters, and changing regional settings automatically. Detailed information on all script commands and additional example scripts can be found at wiki.argentdata.com.

14.1. Script Editor

Scripts are created in otwincfg and uploaded to flash memory in the tracker. When the SCRIPT option is enabled, the script is executed 8 times per second. If the 'Quick' command is used in the script, the script will execute again in one timer tick – 1/1200 second on the Tracker3.

Scripts cannot be remotely edited directly, but the script editor can generate a list of PATCH commands that will allow a prepared script to be uploaded to a remote tracker. Make sure the SCRIPT option is turned off while the script is being uploaded. Turn the script option on, when you are ready to run scripts.

The editor screen is divided into three main parts. The top left portion is the script listing, the bottom left portion allows data entry, and the right side provides buttons for all script commands.



The highlighted line in the script listing shows where the next command will be inserted. The 'Delete Line' button deletes the currently selected line, and the 'Up' and 'Down' buttons move the line in the listing. Conditional commands cause automatic indentation in the listing. The numbers directly under the listing show the amount of script memory used.

Commands that accept one or more parameters use the values in the A, B, C, T, X, Y, area corners, and flags fields. A and B allow selection of three general-purpose 16-bit counters that are used only within the scripting engine, as well as a number of other system variables. C allows entry of numeric constants, T is for text entry, the area corners allow a geographic area to be defined in terms of northwest and southeast corner coordinates, and the flag checkboxes represent "set", "clear", and "don't care" states.

To compare the current altitude to a fixed value, for example, you can select "Altitude" in box A and enter "10000" in box C, and click the "If A > C" button to create the line "If Altitude > 10000". The next command entered will be indented, indicating that it will only be executed if that condition is true. The "End Block" command ends the conditional statement. "Else" reverses the sense of the last conditional statement and should be used before the closing "End Block".

14.2. Script Commands

Do Once

This command is used in conjunction with a conditional statement to execute a block of code once once for each time that the condition becomes true. This makes it very useful for ensuring that a command is not executed repeatedly.

The "Do Once" command can be used at most 16 times in one script.

Macro T / Macro Out

The following block is executed when the command named in T is entered at the command line, through the FMI interface, or by APRS message. The Macro Out command responds to the macro through the same channel

If In Area

Executes the following block if the tracker's current location is within the defined geographic area. Coordinates are entered in degrees and decimal minutes, but are displayed in decimal degrees.

If Profile 1 / If Profile 2

Executes code based on the currently active profile.

If A = B / If A < B / If A > B

Compares two 16-bit counters.

If A = C / If A < C / If A > C

Compares a counter to a constant value.

On Startup

Executes a block of code only once, immediately after the tracker is powered on.

On Second

Executes a block of code once per second.

On Interrupt

Executes a block of code whenever a low-going edge is detected on the CT (counter/trigger) pin.

On GPS Fix

Executes the following block whenever a valid GPS position fix is obtained.

Set A = B

Sets a counter to the value in another counter.

Set A = C

Sets a counter to the value specified in box C.

Increment A / Decrement A

Increments or decrements the specified counter by one.

Port A Print / Port B Print

Sends a string to the specified serial port.

Execute T

Executes the text in T as if it was entered at the command line. The command's return value will be stored in the 'Result' variable.

Use this command carefully - the tracker's flash memory has a write endurance of about 100,000 cycles, and any command that changes a value in the tracker's configuration will require a flash write. At 8 script executions per second, an errant script could wear out the flash memory in a few hours. Flash writes also cause the received packet buffer to be discarded. Use flags or 'Do Once' to avoid executing the same command repeatedly.

Quick

Causes the script engine to start again in 1/1200 second instead of 1/8 second. This can be useful when higher timing resolution is required.

Peek C&X=Y?

Reads the contents of memory location C, performs a logical AND with X, and compares the result to Y. Use of this command requires knowledge of the tracker's memory map.

Poke C,X&Y

Sets the contents of memory location C with the value in X, using Y as a bit mask.

Set Flags / Toggle Flags / Clear Flags

Sets, toggles, or clears the selected flags.

If Flags

Executes the following code block if the flags match the specified pattern. A grayed-out checkbox indicates a "don't care" condition. This is shown in the code listing with an 'x'.

14.3. Counters

Three general-purpose counter variables are reserved for scripting use, and other system values are also accessible. All counters are unsigned 16-bit integers, and will wrap from 65535 back to 0.

Counter 1 - Counter 3

These general-purpose counters have no predefined meaning, and they have no effect on the rest of the system.

Ticks

This counter increments every 1/1200 second, and counts from 0 to 1199.

TX Counter

Seconds elapsed since the last automatic transmission.

Second

This counter indicates the second of the current hour (synchronized to GPS time) from 0 to 3599.

Pulse Count

This counter is used by the event counter function described elsewhere in this manual.

Last Digi

Seconds elapsed since the tracker last heard one of its own packets repeated by a digipeater.

Last Fix

Seconds elapsed since the last valid GPS position fix was received.

Altitude

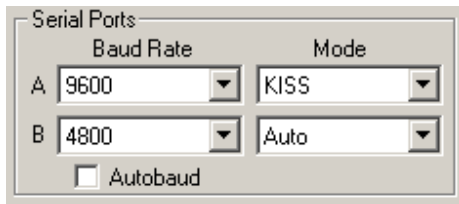
Current altitude reported by the GPS receiver. Units are 2.56 meters, and 0 indicates an altitude of -10,000 meters. Thus, a value of 5097 is approximately 10,000 feet or 3,048 meters ($(3,048 \text{ meters} + 10,000) / 2.56 = 5096.875$).

Result

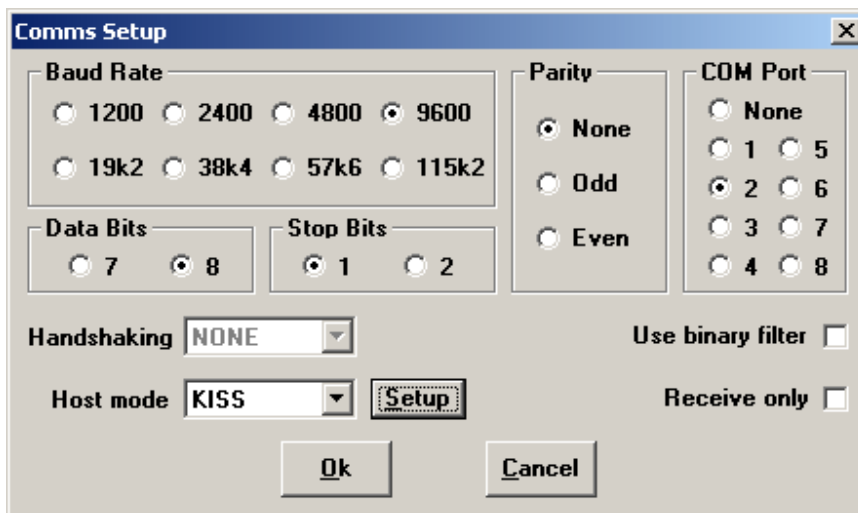
Return value of the last command line command executed.

15. UI-View32 Setup

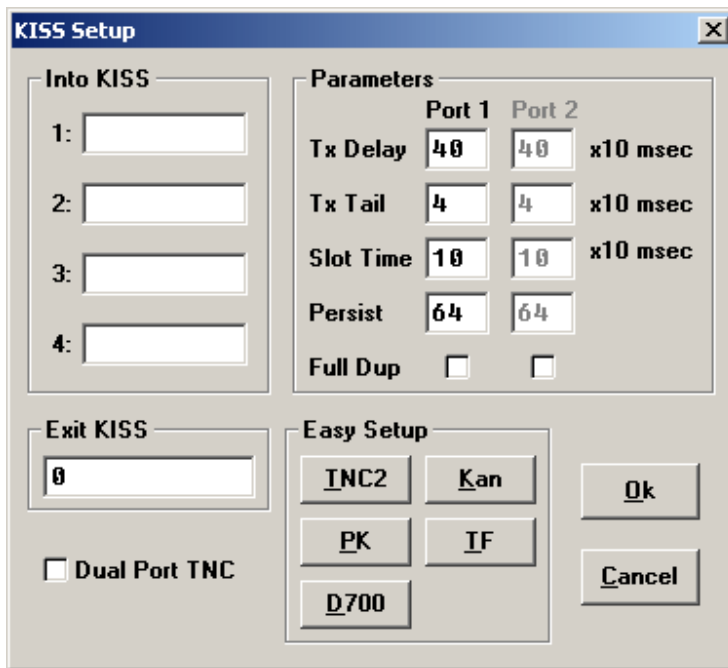
For use with the UI-View32 APRS client, either port of the tracker can be set manually to KISS mode. No configuration commands are needed in UI-View32 once this has been accomplished.



In this example, port A has been set to KISS mode at 9600 baud using the tracker configuration utility. The console commands `AMODE KISS` and `ABAUD 9600` produce the same result.

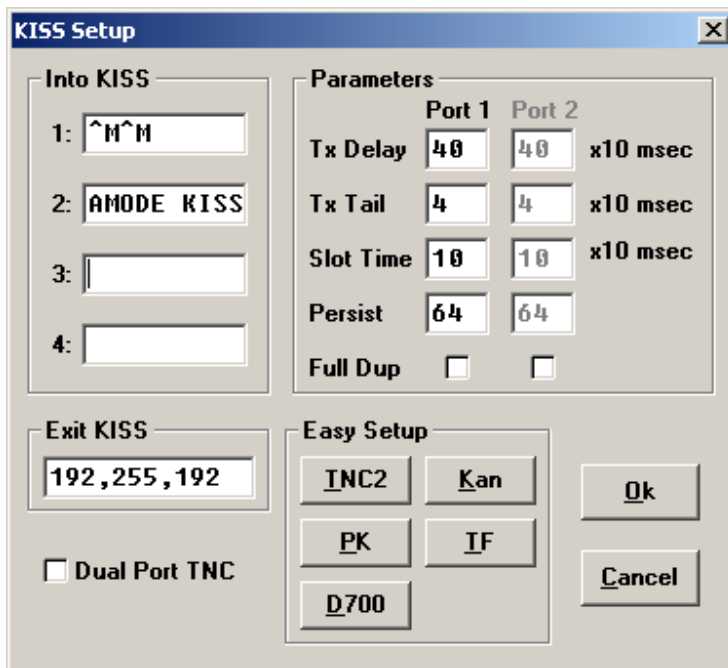


The baud rate selected in the UI-View32 'Comms Setup' screen must match the rate selected for the port in use. Select host mode 'KISS', and be sure to choose the correct COM port for your PC. Click on 'Setup' to continue configuration.



No 'Into KISS' or 'Exit KISS' commands are needed, and any settings in these fields should be deleted. Placing a '0' in the 'Exit KISS' field avoids a bug in UI-View32 that prevents it from exiting properly when the option is left blank.

If you would prefer to have UI-View32 automatically reconfigure the tracker for KISS mode each time the program is started, use the following settings:



This configuration will *only* work with port A, as the command console is not available on port B.