

# Micro-Trak All-In-One APRS Transmitter

## Version 2.0



The MT-AIO is a self-contained, water resistant APRS transmitter designed for portable use. The MT-AIO is computer-programmable, and frequency agile over the entire 2 Meter ham band. Government Agencies exempt from FCC requirements may contact us about out of band operations, which the AIO will generally support from 136 to 160 MHz. The device is rugged, and intended for operation using conventional AA batteries or other battery packages available locally that do not exceed 13.2

volts. The MT-AIO has optional inputs for unregulated voltages for automotive or other applications with 20 volt or less power supplies. The MT-AIO is not designed to be submerged.

The MT-AIO is a transmitter only, and may send packets coincidentally with other transmitters. We recommend using the MIC-E format (default) with this transmitter, since shorter packets tend to have a higher throughput, save power, and minimize potentially high RF exposure levels. The device is ordinarily shipped with our recommended default values unless otherwise requested.

The MT-AIO is controlled by a special version of the TinyTrack 3 chip, and retains most, but not all, of the special functionality of the TT3. Features intended primarily for HF operation have been omitted, for instance. Special features of the MT-AIO include a power saving mode that switches the GPS on and waits for a locked GPS position before sending a transmission. Since the MT-AIO draws only a few milliamperes in the standby mode, battery life can be extended to days or weeks, depending upon the transmission rate selected and other parameters, including the type of data packet sent.

Power output of the Micro-Trak AIO is adjustable, and may be dialed down to a few hundred milliwatts of power or up to as much as 10 Watts. It is shipped set to maximum power. Adjustment of the power control requires an RF Wattmeter.

## **Power On/Off**

The ON/OFF switch, located near the center of the PC board, is a two position switch, clearly marked with ON/OFF. Please note that the MT-AIO does not have an LED that stays lit continuously during operation! The single red/green LED will blink during initialization (power on) and to indicate operations, and will ordinarily be off between operations, except in the case of operating under “Smart Beacons” mode. Even when left off, the batteries should be removed for extended storage to prevent leakage and damage to the device.

## **Channel Configuration Switch**

The other slide switch is used to select one of the two configurations stored in the AIO’s memory. The two pages of configuration selection allow you to enter different frequencies, icons, transmission rates, FCC call signs, tactical call signs, beacons, and all other programmable features.

With the power on, moving the Channel selector switch to the channel 1 or channel 2 positions will send a transmission. This data will not include valid GPS data, since the GPS will not have had time to synchronize. Subsequent transmissions will wait for the GPS to acquire lock, and this may cause transmissions to be sent at intervals different than those programmed into the device. For instance, if you select 2 minute transmission intervals (the default option) and enter a cave, the GPS will not synch up, preventing a transmission. Immediately upon the transmission timing cycle requesting a transmission, the device will verify that the GPS data is valid and hold off transmitting until verified. This allows a tremendous power savings. A transmission can be forced by recycling the channel selector switch. Note that the device takes a few seconds to complete a transmission on reset. When the unit is powered off and on, the TT3 PIC re-flashes the stored frequency parameters into the transmitter. This memory is non-volatile, and data will be retained even if the unit loses power for long periods.

## Deviation Control

Two small blue trimmer potentiometers are located on the printed circuit board. One is marked “DEV”. This is the deviation control. The deviation control is fixed so that at maximum rotation, deviation does not exceed 4 KHZ, which is well within the range of most digipeaters. Commercial receivers may require a narrower signal, and this control can be used to allow better decoding in these receivers. This control will not ordinarily require user adjustment.

## Power Control

The power control is the other blue trimmer potentiometer. It is set fully clockwise from the factory for maximum power. This trimmer sets the gate voltage on the amplifier module to allow power control over a wide range, but it is important to remember that this controls range is all within a few degrees of fully clockwise. Power adjustments are best set using a wattmeter and dummy load. The power adjustment is used when programming your MT-AIO with your computer. Turning the power all the way down will minimize problems in programming caused by RF energy “swamping” your computer or USB to serial adaptor. This control will not ordinarily require user adjustment.

## Antennas

The Micro-Trak AIO is shipped with a high quality 2 Meter whip antenna. For portable use, this is a great option. Take care not to bend the base of the antenna, as this can result in a cracked enclosure or broken PC board. External antennas may be utilized, but care should be taken to ensure that the SWR is within best practices, and that the antenna is not in too close a proximity to other transmitters or static fields, as this can damage the final amplifier. Operating without an antenna will destroy the final amplifier. For this reason, **final amplifiers are not covered under warranty, and repairs will be subject to parts and bench tech costs.**

## **Status LED**

A single bi-color LED is used to show the status of the unit. Immediately upon start up, the LED will flash a pattern of red and green, indicating that the unit is starting up and internally resetting. If this pattern continues without stopping, this is an indication that something is wrong, such as a low battery state or excessive SWR. The single pulse of a red signal indicates that the unit is sending a transmission. A blinking green indicates that the unit has switched on the GPS and is waiting for it to lock onto the GPS satellites. When the GPS locks on solidly, the TT3 brain will allow the transmitter to send its data out over the air, causing the GPS green indicator to switch off. In some cases, the GPS LED will remain lit until the next timing cycle. This is normal, and is an attempt by the TT3 to verify good GPS data. A continuously flashing “reset” condition indicates a problem, possibly including low batteries, high SWR, or RF power “swamping” the unit, which is possible with external incorrectly routed GPS or power cabling.

## **Programming**

Ordinarily, the MT-AIO is shipped pre-programmed with the user's information. The user may need to reprogram the MT-AIO; this can be accomplished fairly easily. A Kenwood compatible cable is available through Byonics for this device, and will mate with the 2.5mm connector on the MT-AIO PC board.

The Micro-Trak AIO software may be downloaded from the Byonics website. Additional information on programming parameters may be found in the regular TT3 manual. Note that not all functions are available in the standard TT3 configuration are available for use on the MT-AIO.

Alternatively, the PIC may be removed and plugged into a regular TT3 for programming, using a null modem cable and a gender changer. Note that there is a difference in the chips, and the TT3 should not be connected to a radio while programming! Use only the programming software designed for the MT-AIO Version 1.4.2 and above.

## **Battery operation**

The MT-AIO includes a standard 8 pack AA holder. This connects to the PCB using a standard 9 volt style battery clip. This clip notwithstanding, the device will not satisfactorily run on a 9 volt transistor radio battery! Battery connections are notoriously common points of failure for battery powered devices. The MT-AIO was designed to allow end-users to replace the battery clip using nothing more than a small screwdriver. The Nine volt battery clip should be used to connect to the standard battery pack only. The battery input bypasses the voltage regulator stages, allowing full power output without the voltage drop induced by a voltage regulator, which would result in reduced power and battery operational time. External power may be used while the battery pack is in place, but will not charge the battery pack.

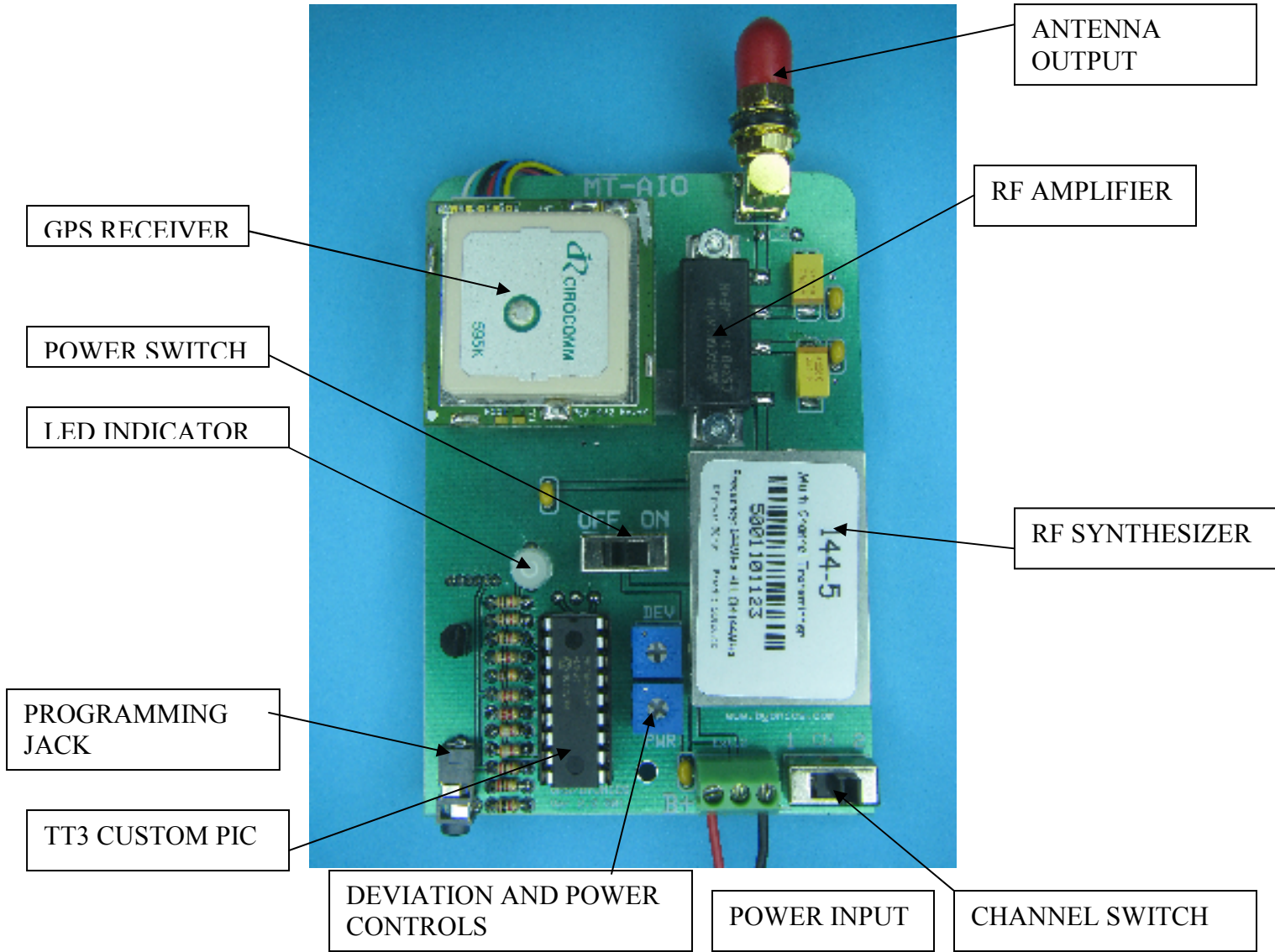
## **External Power Operation**

The MT-AIO will run well from clean 9 to 20 volts DC using external power. This power may be supplied through the center conductor of the three –screw terminal block near the bottom of the PC board. Note that while the ground input is shared, the center screw is used exclusively for external power. The transmitter will ordinarily draw no more than 1.7 amperes in operation, and a 2 Ampere fuse should be used on the external power line.

## **Operation**

The internal GPS antenna is horizontally oriented. In general use, this does not present a problem. It is recommended that after an extended period without being powered, or after having relocated the unit to a distant location from the last general area of operation, the unit should be powered laying on its back with the GPS facing open sky. Allowing the unit to face upright during this time will allow the GPS to more easily view multiple satellites and update its internal memories more quickly.

# MT-AIO PCB LAYOUT AND CONTROLS



## A word about using the Smart Beaconsing Feature

The MT-AIO was initially designed for portable, hand-held uses. Many Byonics/VHS customers requested that the Smart Beaconsing capabilities available in other Byonics products be made available in the MT-AIO. The Smart Beaconsing parameters require the GPS to provide a constant source of data to the processor. This means that when Smart Beaconsing is selected, the GPS will automatically be switched on. Depending upon the battery type and transmission interval, this will shorten battery life to about 2 days at best.

### Default Programming Options

The screenshot shows the 'Micro-Trak AIO Config' window. It has a 'Primary' tab selected. The interface is divided into several sections:

- Primary / Secondary:** Call sign: KG6HXO-9, Digi Path: WIDE1-1;WIDE2-1, Symbol: [ ] Table / Overlay: [ / ], Frequency: 144.390.
- Timing:** Auto TX Delay: 500 milliseconds, Auto Transmit Rate: 120 seconds, Manual TX Delay: 125 milliseconds, Manual Transmit Rate: 30 seconds, Quiet Time: 500 milliseconds, Calibration: 128.
- Status:** Text: MT AIO, Send every: 3, Send Separate: [ ], Don't Send '>': [ ].
- Configure:** COM3, Read Configuration, Read Version, Write Configuration.
- Send Altitude:** [checked], Allow TTL Serial: [ ], No TX on PTT In: [checked], Serial Out High: [ ], 9600 baud GPS: [ ].
- Alternate Digi Paths:** [ ], Invert CD IN: [ ], Send NMEA: [ ], Skip Start Packet: [ ].
- Only Send Valid:** [checked], Timestamp DHM: [ ], Timestamp HMS: [ ], 300 baud packet: [ ].
- MIC-E Settings:** Enable: [checked], Force Printable: [ ], Message: Off Duty, Path: Conventional.
- Time Slotting:** Enable: [ ], Transmit offset: 15 seconds.
- Smart Beaconsing:** Enable: [ ], Min Turn Angle: 27 degrees, Turn Slope: 255, Min Turn Time: 5 seconds, Slow Speed: 5 MPH, Slow Rate: 1800 seconds, Fast Speed: 65 MPH, Fast Rate: 90 seconds.
- Power Switch:** Enable: [checked], Power Switch Time: 5 seconds.
- Tone Test:** Send 1200 Hz, Send Both, Send 2200 Hz, Stop Sending, Save, Load, About, Exit.

These are the default options typically used in programming the MT-AIO as shipped from Byonics. Your call sign and optional SSID are ordinarily the only info we require for programming. The default Digi Path setting is considered optimal for mobile trackers, and the

APRS Icon is typically a pedestrian symbol. We suggest a polite beacon rate of 120 seconds.

You can download a free copy of the Byonics MT-AIO config program from Byonics, and the AIO may be configured with a Kenwood style programming cable, also available from Byonics.

The MT-AIO config program is designed for IBM PC compatible computers with true RS-232 serial ports (as opposed to USB-only devices). USB to Serial adaptors run over a wide range of quality and compatibility ranges, and we cannot guarantee any single USB "dongle" as being fully compatible.

## PCB LAYOUT

