

Micro-Trak All-In-One APRS Transmitter

Hardware version 3.2



The MT-AIO is a self-contained, water resistant APRS transmitter/GPS receiver designed for portable use. The MT-AIO is computer programmable, and frequency agile over the entire 2 Meter ham band. Operation beyond 2 Meter bandwidth limits are not supported, since the device is not FCC approved for use outside the ham bands. Agencies exempt from FCC requirements may contact us about out of band operations. The device is rugged, and intended for operation using 8 conventional AA batteries or other battery packages available locally that do not exceed 13.6 volts. Although the MT-AIO is water resistant, and uses door gaskets, and O-rings to maintain water resistance, it is not designed to be submerged.

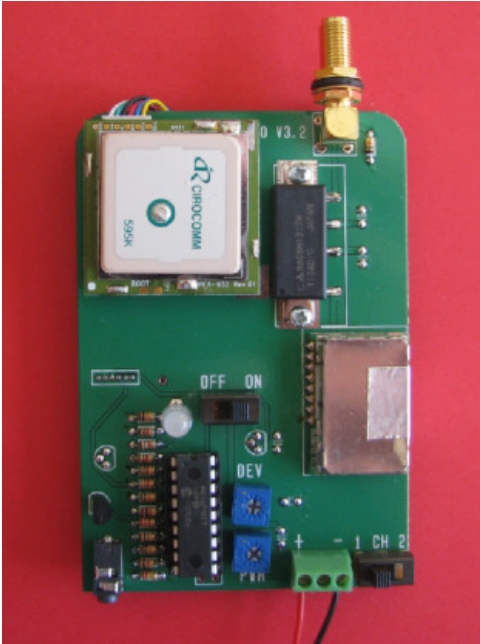
The MT-AIO is a transmitter only, and may send packets coincidentally with other transmitters. We recommend using the MIC-E format (default) with this transmitter, since shorter packets tend to have a higher throughput, save power, and minimize potentially high RF exposure levels.

The 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.

USER CONTROLS

Switches



The selector switch, located near the center of the PC board, is a two position switch. Even when left off, the batteries should be removed for extended storage to prevent leakage and damage to the device.

The other switch, shown in the lower right hand corner of the Printed Circuit Board, is for selecting one of the two configurations stored in the TT3 chip'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.

The MT-AIO will ordinarily be shipped programmed with the customers requested parameters, allowing instant on-the-air operations; just add batteries.

On moving the switch to the channel 1 or channel 2 positions, the device will send a transmission. This data may not immediately 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 “waking up” from its sleep cycle, the GPS will be activated, and a transmission will occur as soon as the GPS determines a valid position fix.

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.

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 made using a wattmeter and dummy load. The power adjustment may also be 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.

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 processor 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.

Programming

Ordinarily, the MT-AIO is shipped pre-programmed with the user's information. In the event that a user needs to reprogram the MT-AIO, this can be accomplished in several ways. A MT-AIO Programming cable is available through Byonics for this device. The programming jack is a 2.5mm, 3 conductor jack located on the lower left hand corner of the P.C. Board.

The Micro-Trak AIO is configured with the latest TinyTrak3 Configuration software, which may be downloaded from the Byonics website. Additional information on programming parameters may be found in the TinyTrak3 Configuration manual. Note that not all functions available in the standard TT3 configuration are available for use on the MT-AIO. **PLEASE NOTE:** MT-AIO users should typically check the Power Switch Enable box in the TinyTrak3 Config program to allow the GPS to power down between transmissions. 3 seconds is a reasonable switch time to use. Failure to check this will result in much shorter battery life.

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!

The configuration allows for sending continuous test tone transmissions. These should not be sent for more than a few seconds at a time, as the MT-AIO power amplifier is not heat synced for long transmissions.

New Features

Please note that this is the newest generation of Micro-Trak Products, and older configuration software will not be compatible. Also, this generation of Micro-Trak products uses a far more powerful processor, and among its many features, it will allow you to load new or special versions of the Micro-Trak firmware as improvements become available. This version of the Micro-Trak AIO has built in telemetry sensors to measure and report the battery voltage on the Micro-Trak, as well as the temperature. An optional set of inputs is available just below the IC socket, and can be used to report the status of any 0-5 Volt sensor.

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 MT-AIO will run well from 9 to 13.6 volts DC. This allows a wide variety of options for power if needed, including lithium, NICAD, NIMH, or alkaline batteries. It is possible that batteries going into the last segment of their lives will exhibit erratic behavior, and cause the MT-AIO to continuously recycle. Naturally, these batteries should be removed and disposed of. (Or recharged) **Please note that connecting the battery connector backwards may damage the MT-AIO.** A polarity protection steering diode has been installed in this transmitter, as opposed to the last version of the MT-AIO, which had a “crowbar” protection circuit. To operate the MT-AIO from external power, use a fused line. Please be careful not to install the battery cartridge in a way that allows its snap connectors to short across the PC Board. This can cause the battery case to melt and the batteries to explode or leak.

Operation

The internal GPS antenna is horizontally oriented. In general use, this does not present a problem using the unit in upright operation. It is recommended that the unit be powered on initially after a long period without being powered, or after having relocated the unit to a distant location from the last general area of operation. Allowing the unit to face upright during this time will allow the GPS to more easily view multiple satellites and locate itself in the universe quickly.

Specifications

Dimensions	6.37 X 2.62 X 2.06 inches (case dimensions)
Weight	14 ounces, batteries not included
Power supply	8 AA alkaline batteries of equivalent
Antenna	15" 2 Meter whip antenna
Output connector	SMA Male
Frequency range	144 to 148 MHz 2 Meter ham band
Output power	Maximum 10 Watts at 13.2 volts DC, adjustable
Deviation	3.5 KHz, factory set, adjustable
Estimated operation	8 Days, @ 2min Check-ins using MIC-E Data
Frequency Stability	+/- 1.5 KHz
Operating temperature	-20 to +70 Centigrade
Spurious radiations	ETSI EN 300 220-3 and ETSI-301 489-3
Adjacent Channel spurs	<-40 dBm

GPS Data

GPS Specifications

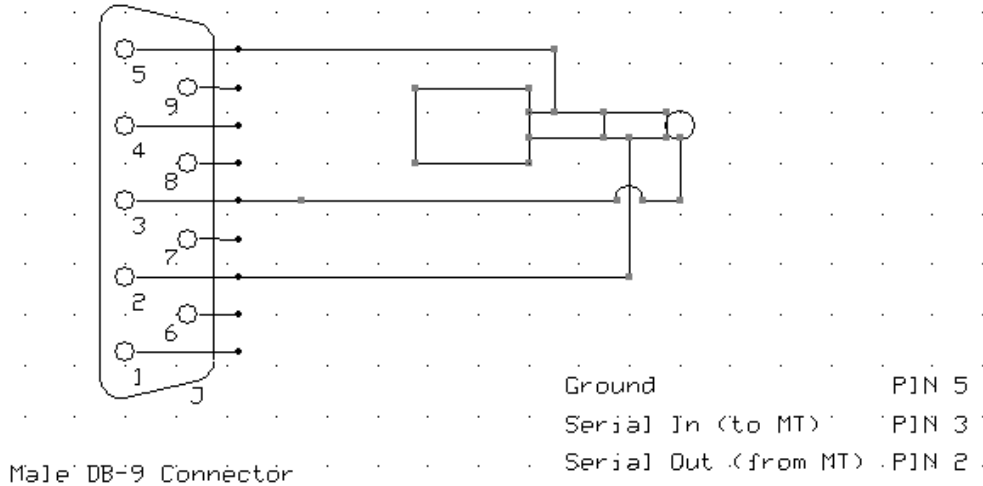
General	Tracking up to 20 satellites L1, 1575.42 MHz, C/A code
Accuracy	Position: 2DRMS approximately 5m, WAAS support Velocity: 0.1 m/s without SA imposed Time: $\pm 1\mu\text{s}$
Acquisition Time	Cold Start: 42s (Average) Warm Start: 38s (Average) Hot Start: 1s (Minimum)
Sensitivity	Acquisition: -148dBm Tracking: -159dBm
Dynamics	Max Altitude: 18000m Max Velocity: 500m/s Max Acceleration: $\pm 4g$
Navigation Update Rate	Once per second
Serial Port	TTL, RS-232
Baud Rate	4800 bps (Optional 9600,19300,38400 bps)
Output Message	NMEA0283 V2.2 GGA, GSV, GSA, RMC (optional VTG, GLL)
Datum	WGS 84
Power Supply	DC 3.3~5V
Power Consumption	Typical 80mA @5V
LED Indicator	Power On/Off Navigation
Operating Temperature	-40°C ~ +85°C
Storage Temperature	-40°C ~ +100°C
Humidity	5%~95%
Antenna Type	Built-in patch antenna

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.

Programming Cable Version 1.2



External Power

The Micro-Trak AIO was designed primarily for battery powered operation using the internal battery pack. The Micro-Trak can be operated off any clean external source of DC that does not exceed 13.6 Volts

External Antennae

Like all radio frequency devices, the Micro-Trak can potentially be damaged by using an external antenna located too close to another antenna radiating high levels of power. Avoiding crossing DC power lines and antenna cables, as this can allow high level interference to cause erratic function.

Schematic

