

Overview

The Byonics Micro-Trak All-In-One B (MT-AIO-B) V1 is a small, lightweight, self-contained, APRS transmitter/GPS receiver designed for portable & airborne use. It produces 5-6 watts with a run time of approximately 30 hours. The design and function is nearly identical to the larger MT-AIO (yellow Pelican case version), but has been refined for use in high altitude balloon operations, including differences such as a high efficiency DC/DC power converter, a lower voltage, high efficiency amplifier circuit, fewer batteries, and a much lighter case (3.2 ounces versus 16 ounces). Like the standard AIO, the AIO-B is not intended to be operated as the sole balloon payload, but rather should be encased within a larger payload to provide physical and thermal protection from the environment.



The MT-AIO-B is computer programmable and frequency agile over the entire 2 meter ham band in 5 KHZ channel steps. The device is rugged and intended for operation using alkaline AA batteries for ground operations or Energizer “Ultimate Lithium” AA batteries for high altitude and/or cold temperature operations. The MT-AIO-B sends voltage and temperature telemetry in the MIC-E format and may be viewed graphically on websites like aprs.fi.

The MT-AIO-B uses a special version of the TinyTrack3 chip which includes 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. GPS power switching is not recommended for high altitude operations.

The MT-AIO-B is a transmitter only, and may send packets coincidentally with other transmitters. We recommend using the default MIC-E format, since shorter packets tend to have a higher throughput, save power, and minimize potentially high RF exposure levels. The MT-AIO-B is not intended for operation using external power, and is intended primarily for high altitude applications above 60,000 feet.

Power Switch

The power switch is located on the lower left hand corner. Sliding the switch to the right will turn on the MT-AIO-B. It will send an identification transmission immediately, so be careful to have an antenna or a dummy load connected.

Channel Selector Switch

The channel switch is located on the lower right hand side of the MT-AIO-B’s PC board and can select one of two user programmed configurations. Each configuration can have a different frequency, icon, transmission rate, call signs, beacons, and all other programmable features.

Deviation Control

The small blue trimmer potentiometers marked “DEV” is the deviation control. This is factory set to 3.5 KHz FM deviation and should not require any adjustment. Deviation adjustments should be made with an FM deviation meter; adjusting deviation by ear tends to produce over modulation and “splatter” onto adjacent channels.

Power Control

The power control is the other blue trimmer potentiometer, located near the upper right hand corner of the board. 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 (other than setting fully clockwise for maximum power or full counter-clockwise for disabling the final amplifier) are best set using a wattmeter and dummy load.

Antennas

The Micro-Trak AIO-B may be used with a “rubber duck” antenna for ground operations, although these are not optimal. The Byonics V6, center-fed, ½ wave dipole is ideal for high altitude operations, as it provides its own counterpoise, and has nearly 6 dB of gain over a rubber duck. Do not place the RF connector on the MT-AIO-B under excessive strain.

Status LEDs

Three LEDs indicate the MT-AIO-B status. Immediately upon start up, the red and green LED’s will flash back and forth briefly indicating that the unit is starting up and internally resetting. The final red LED flash indicates a transmission is taking place. If this pattern continues without stopping, this is an indication that something is wrong, typically a low battery state or excessive SWR (bad antenna connection, etc.) 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 acquires a valid position, the flashing green LED will light solid, and the transmitter will send a complete packet out over the air. If the AIO-B has been programmed to use the GPS power saving switch mode, The GPS will switch off after a valid transmission, and the green LED will turn off.

There is a blue LED status light on the GPS receiver module, which is mounted on the upper left corner of the PC board. This LED flashing acts “backwards” in respect to the green LED on the main board. The blue LED will light solidly when “seeking” or attempting to acquire a valid position, and flash when it has acquired a valid position. For fastest acquisition, the flat patch GPS antenna should be pointed up, which is to say that the top of the board enclosure should be facing the sky. Extremely long periods of non-use may require the unit to be left outside under the open sky after power up until the GPS can gather enough information about where is in the world to develop a valid position report. For HAB operations, the balloon should not be launched until the GPS has successfully acquired a valid position before launch.

Programming

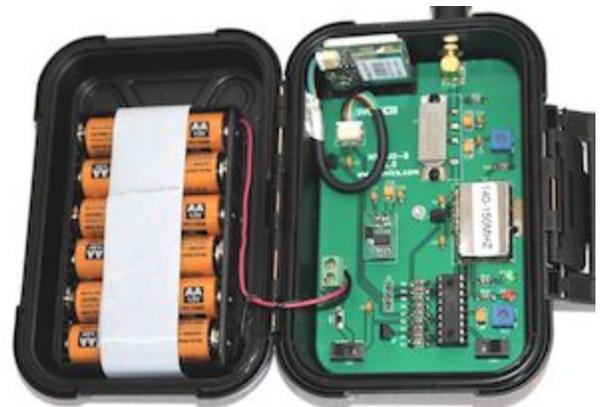
Ordinarily, the MT-AIO-B is shipped configured with the user's information. But the MT-AIO-B can be re-configured by the user at any time. Unlike the standard MT-AIO, the AIO-B has a row of 4 through hole pads on the PCB. Connecting the AIO-B to your PC will require a Byonics TT-USB programming cable and the included DB-9 to 1x4 SIP pin adapter. The Byonics cable plugs into the adapter and the adapter is inserted into the programming header holes marked "J2" and located about an inch to the right of the power terminal block. The lowest hole (square) is ground, and this is indicated on the programming adapter as minus (-). You will not cause any damage by inserting the programming adapter backwards. Note that for programming, power must be applied to the MT-AIO-B, and a dummy load or antenna should be connected. Alternatively, turning the power control deviation pot fully and gently counter clockwise will also prevent RF power related programming problems.

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 MT-AIO-B uses the latest TinyTrak3Config software, freely available from the Byonics website. Additional information on programming parameters may be found in the regular TT3 manual. Not all functions in the standard TT3 configuration are available for use on the MT-AIO-B.

Battery Operation

The MT-AIO-B utilizes a standard 6 AA battery holder mounted in the lid of the case. A 1 inch strip of Velcro tape is in place in the unlikely event your transmitter receives a shock strong enough to knock the batteries loose. This battery cartridge is mounted to the case by means of a screw and double-sided foam shock tape. If the battery cartridge becomes damaged or corroded, the cartridge should be replaced, and this is an operation that may be carried out by a competent Ham, or by sending the unit back to the manufacturer for replacement. The battery cartridge is wired to the main PCB by means of a screw type wire connector terminal, which can optionally accept external DC power of no more than 9 Volts.



NEVER leave batteries of any type in the MT-AIO-B when it is in storage. Nearly every type of battery will "gas off" and many batteries will leak corrosives into the case. With a multiple layer transmitter like the MT-AIO-B, these corrosives can permeate the layers and render the unit beyond repair.

Rechargeable Batteries

Standard AA rechargeable batteries operate at 1.2 Volts, provide inadequate power output, and tend to fail at cold temperatures, and in some cases can self-destruct with pressure and temperature changes. These are not encouraged. High quality, 3.7 Volt LiPo rechargeable batteries can be used

on the MT-AIO-B, although only three should be utilized with three dummy spacers, as running the AIO-B with 6 3.7 volt batteries in series, or 22.2 volts, will destroy the power amplifier. Although these batteries will actually provide significantly higher power output from the AIO-B, they are not recommended for flight operations due to their cold intolerance and proclivity for exploding.

Operation

The internal GPS antenna is horizontally polarized “looking upwards”. In general use, this is optimal for operation in an upright orientation. In flight operation while airborne, nearly any direction the GPS antenna points other than straight down will work fine at altitude. Careful thought should be given as to the payloads likely orientation after landing to try to keep the VHF antenna vertically polarized and the GPS antenna “looking up”. This can be frustratingly difficult to predict.

Schematic

