Understanding how it all works!

Pitch and Bank

The AHRS board inside the iLevil and the BOM, has two MEMs gyros and a 3-axis accelerometer that measures your airplane's attitude. When the AHRS is turned on, it is recommended that the aircraft stays in a steady position (or taxing) until the AHRS stabilizes.

During flight, the instrument will calculate the aircraft's attitude based on accelerations and rotation rates and you can expect the horizon to have an accuracy of +- 3 degrees. Fast airplanes such as Jets and airlines with high acceleration rates at take-off and landings, may experience a pitch up error right after take-off until the airplane stabilizes. In this situation, it is recommended to perform a +15 deg bank turn to the left for 10 seconds, then a +15 deg bank turn to the right at the beginning of the flight. Power off/on during flight will not damage the instrument even at an unusual attitude.

There are no flight limitations to the AHRS-G micro. The instrument will operate in a full 360 degrees of turn and may be used in light aerobatic type maneuvers. The gyros are rated for 300 degrees/sec max turn rate. When the maximum turn rate is exceeded, the AHRS is temporarily disabled. This is indicated by a flashing behavior (pitch goes from 0->90 degrees, and roll from 0->180degrees). The instrument automatically resets itself within 4 seconds if kept steady during that time, otherwise the instrument will recover within 15-40 seconds depending on the amount of error induced during recovery. This will not cause any harm to the instrument.

Note: Moving the instrument with your hand will most likely trigger the excess rotation alarm unless simulating smooth aircraft behavior.

Magnetic Heading

There is a 3-axis magnetometer embedded to the AHRS board. Unlike a compass, the 3-axis magnetometer allows pilots to have a magnetic heading even if the airplane is up-side down. When you install your instrument, it is recommended to locate it far away from ferrous metals that may affect the magnetic field around the AHRS. In the case of magnetic deviations, the AHRS will try to adjust to its surroundings by a process of learning where those deviations may be coming from. Thus, the magnetic heading may be off during the first two minutes after initialization, and slowly corrects itself as the airplane starts moving around. Usually a 360 turn to the right and then to the left is

sufficient for the AHRS to isolate the magnetic field of the earth (most aircraft achieve this maneuver just by taxing to the runway). However, if there is too much deviation, it will probably take a little longer to correct. If unable to obtain a good heading, try installing your instrument on a different location. Restart the AHRS when changing locations to erase any data stored about magnetic deviations from the other location.

Indicated Airspeed and Altitude

For those home-built aircraft that have access to the pitot-static system we offer the AW model. The AW have pressure transducers installed, one for static pressure and another one for the dynamic pressure. Having access to pitot-static information the AHRS is able to transmit indicated airspeed and Pressure altitude at 29.92 in-Hg. In order to adjust the altitude due to barometric pressure changes, your navigation software of choice will allow you to input the altimeter setting at your current location. For models without pitot-static connectivity, you will have to rely on air data derived from the GPS.

Wireless Transmission

Some mobile devices that do not have a USB or serial port, require wireless communication to the AHRS (i.e iPad/iPhones). The iLevil and AHRS-G mini series have an embedded wireless transmitter that works as the router at home and creates a Wi-Fi access point to which your tablet will link to. Once connected, navigation programs can then telnet to the transmitter using either TCP or UDP transmission:

TCP/IP connection is very robust and requires the remote device to confirm receipt of data every time the AHRS sends a package. Although TCP connection guarantees no data is lost on the way, it may cause some latency on the transmission if either the sender or the receiver is not properly responding in a timely manner. For example, iPad devices have shown latency when you move the device around because it is trying to figure out the screen rotation. You can also expect some latency if you are inside a building with multiple Wi-Fi access points or if you are accidentally blocking the iPad transmitter with your hand. The best way to test the AHRS transmission is to fly with it. TCP can only be used by one application at a time.

UDP transmission is not as robust as TCP, but allows multiple devices to access the same data simultaneously. If you'd like to use two iPads, for example, you might want to use the device in UDP mode. UDP is the default mode and is recommended for in-flight use.

ADS-B receiver and GPS

Thanks to the FAA efforts to enhance flight safety, monitoring the weather and other airplanes around you is now possible without any subscription. All iLevil devices have a built-in GPS and 978 MHz ADS-B receiver, the iLevil 2 and 3 incorporated the 1090 MHz receiver, that will capture the following data:

1. **Flight Information Services–Broadcast** (FIS-B): Is the ground-to-air broadcast of meteorological and aeronautical information. FIS-B allows the pilot to passively collect and display real-time weather and other operational data such as METAR, TAF, NOTAMs etc.

2. **Traffic Information Services-Broadcast** (TIS-B): Is the broadcast of traffic information to ADS-B-equipped aircraft from ADS-B ground based transceivers. For an aircraft to receive TIS-B services, the following conditions must exist:

- Your aircraft (or an aircraft within range) must be equipped with an ADS-B OUT and be able to receive the UAT data on (978 MHz).

- The aircraft must fly within the coverage volume of a compatible ground station that is configured for TIS-B up-links.

- The target aircraft must be within the coverage of, and detected by, at least one of the ATC radars serving the ground station in use.

3. **Air-To-Air Traffic:** Is the traffic broadcasted by other ADS-B Out equipped aircraft on 978 MHz, and 1090 MHz on the iLevil 2 and 3. You can find more information about ADS-B technology here...

Does ADS-B feature work outside the US?

No. ADS-B weather broadcast is limited to certain regions within the US and is only broadcasted using the 978/1090 MHz channel. This channel is also used to broadcast traffic with Mode-C, Mode-S (1090 MHz) and ADS-B Out (978 MHz) transponders and is only being used inside the US for this purpose.

The iLevil SW and iLevil AW both are equipped with a 978MHz ADS-B receiver. The iLevil 2 and 3 incorporate the 1090MHz ADS-B receiver when a GPS Fix is acquired. The antenna must have a line-of-site to ground towers that are transmitting the weather and traffic information. The SW's antenna is small and is not as efficient as the standard AW's antenna or a remote antenna installed on the belly of the aircraft. However, if needed, a remote antenna can be installed on the SW. ADS-B reception is almost non-existing on the ground, because the antennas are pointing upward. Therefore, you must be flying at least 2000 ft high in order to get steady information.

GPS Navigation

There is a GPS receiver located inside each iLevil (not the AHRS-G mini). The GPS antenna on the iLevil Sport and SW is located inside, thus requires the iLevil unit to have a clear view to the sky in order to get as many satellites as possible. The iLevil AW allows for remote GPS antenna connection, thus providing installation flexibility.

AHRS Power/Battery

There is a standard Li-ion rechargeable battery inside the iLevil and AHRS-G mini. The ON-OFF switch enables/disables the battery as a power source. Charging the battery usually takes up to 4 hours if fully discharged. The mini USB port will recharge the battery as long as it is connected to a standard USB wall charger or a cigarette lighter receptacle (5V out). On the AHRS-G mini, power on the USB plug will turn ON the AHRS even if the switch is OFF. The same applies to the iLevil Sport and SW when 5V are applied on the 3.5mm audio jack. The iLevil AW uses a DB9/DB15 connector for wiring 12V or 28V system. The LED indicators next to the battery switch can be used to determine the charging status of the instrument.

For home-built airplanes that would like to attach the AHRS to the electrical system of the aircraft (8-32V) you can use the DB9/DB15 connector located on the front of the instrument.

<u>iLevil AW</u>

1. Connect PIN5 to GND.
2. Connect power source accordingly to either PIN1 or PIN6 of the RS-232.

PIN1 5V only!	AHRS ON, recharges the battery
PIN6 8-32V	AHRS ON, recharges the battery

3. When using external power for automatic ON/OFF operations, make sure the battery switch is OFF. Leaving the switch ON will cause the battery to be continuously drained after flight and then recharged on the next flight, reducing battery life. A remote switch can be installed on the iLevil AW in case of an emergency (see remote battery switch below).

<u>iLevil 2/3 AW</u>

1. Connect PIN8 to GND.
2. Connect power source accordingly to either PIN1 or PIN15 of the RS-232.

PIN1 5V only!	AHRS ON, recharges the battery
PIN15 8-32V	AHRS ON, recharges the battery

4. When using external power for automatic ON/OFF operations, make sure the battery switch is OFF. Leaving the switch ON will cause the battery to be continuously drained

after flight and then recharged on the next flight, reducing battery life. A remote switch can be installed on the iLevil AW in case of an emergency (see remote battery switch below).

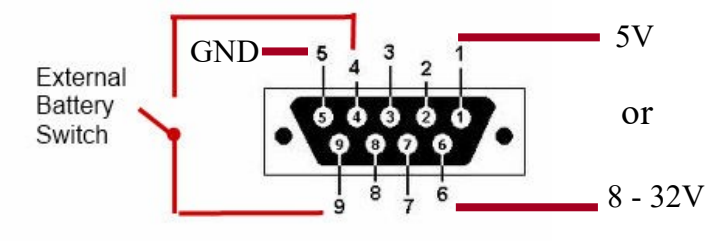
Remote Battery Switch

If the battery (ON-OFF) switch on the AHRS is not easily accessible, it is recommended to install a remote switch that the pilot can use to control the battery. Use a normally open switch to connect:

iLevil AW: PIN4 (Battery) with PIN9 of the DB9 connector.
iLevil 2/3 AW: PIN9 of the DB15 connector.

See diagrams below.

iLevil AW



iLevil 2/3 AW