Understanding how it all works!

Pitch and Bank

The AHRS G mini has three MEMs gyros and a 3-axis accelerometer that measures your airplane's attitude. When the AHRS is turned on, it requires a two minute interval to calibrate itself. You might see the horizon shifting +- 5 degrees during this self-calibration process and a flashing behavior of the horizon. To achieve better performance, it is recommended that the aircraft stays in a steady position (or taxing) during this two minute period.

During flight, the instrument utilizes the indicated airspeed from the pitot-static system for roll and pitch calculations. However, SS and SW models that are not connected to the pitot-static system will not have access to speed and might display a small error during take-off, often seen as a pitch-up error on Jets and fast airplanes.

If you have an SS or SW model, the AHRS will estimate the speed of the aircraft. In order to better estimate the speed, a +15 deg bank turn to the left for 10 seconds, then a +15 deg bank turn to the right is recommended at the beginning of each 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 Series. The instrument will operate in a full 360 degrees of turn and may be used in light aerobatic type maneuvers. Extreme turns may cause the instrument to temporarily disable itself (200 degrees/sec max turn rate). 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 aircrafts 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 homebuilt-aircrafts that have access to the pitot-static system we offer the AW and AS model. These models 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 inHg. 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 an external GPS.

Wireless Transmission

Some mobile devices that do not have a USB or serial port require wireless communication to the AHRS. On models AW and SW there is an embedded wireless transmitter that works as the router at home and creates a WiFi 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 not enabled when you receive your AHRS. However, users can configure their devices to enable UDP Broadcasting by using the AHRS Utility App available at the AppStore. All AHRS shipped after Marchl 1st, 2012 will be UDP enabled from the factory.

How to enable UDP broadcasting for the first time?

- First make sure you are connected to the WiFly-GSX network on your device.
- Open AHRS Utility and click Disconnect (if connected)
- Click Enable UDP Broadcast under Configuration manager, and wait for the "Configuration done" message. You only need to do this once unless you restored defaults at any given time.
- Select the UDP tab and then click Connect to try the new configuration.

Things you should know about UDP:

- Although your instrument may be UDP enabled, some applications are not yet compatible with this type of protocol. You should check with your Navigation app to see if they are UDP compatible. (AHRS Utility and the latest version of Digital Sectional are the only applications to offer UDP connectivity with the AHRS G mini so far). With time and the help of our costumers, we hope to persuade all our partners to integrate this new feature in the coming months!
- UDP broadcasting will be paused if connected via the standard TCP on any other device/application. As soon as the TCP connection is released, UDP broadcasting will resume.
- Although rare, UDP broadcasts may come in random order (recognized by a trembling attitude). If this is the case, you may reset the connection or reset the AHRS.

USB – Serial Transmission

If you'd like to compare the difference between AHRS transmission in real-time versus transmission over the air, you can download the EFIS-1831 application to your Windows computer and connect the AHRS directly to the USB port. USB communication is usually more reliable than wireless. In case of transmission problems on your mobile device, this can also help troubleshoot the root of the problem. You'll need to download the USB driver, available for downlaod under "Support" on the AHRS-G mini website.

AHRS Power/Battery

There is a standard Polymer Li-ion rechargeable battery inside the AHRS box. The ON-OFF switch on the side of the unit enables/disables the battery as a power source. Charging the battery usually takes up to 3 hours if fully discharged. The mini USB port will always turn ON the AHRS and recharge the battery as long as it is connected to a standard computer USB2.0 port or a cigarette lighter receptacle (5V out) even if the battery switch is OFF. Alternatively, 5V on the DB9 connector PIN1 or 8-32V on PIN6 performs the same function as the USB connection. The LED indicators next to the battery switch can be used to determine the status of the instrument.

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

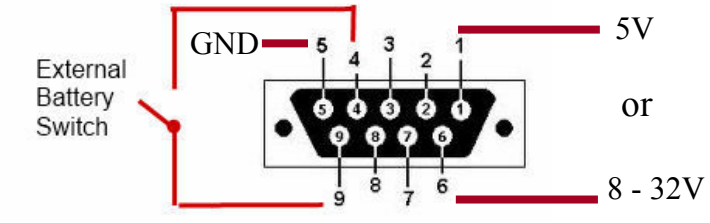
1. Connect PIN5 to GND.
2. Connect power source accordingly to either PIN1 or PIN6 of the RS-232.

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

3. Make sure the battery switch on the side of the instrument 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 in case of an emergency (see remote battery switch below). If desired, the Master Switch of the aircraft can be used for automatic ON-OFF operation of the internal battery.

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 PIN4 (Battery) with PIN9 of the DB9 connector.



SkyRadar Connection

Having access to both ADS-B weather and AHRS data using WingX Pro7 has been the demand of our costumers from the beginning but it was not possible due to the devices' restriction to one wireless connection at a time. The newest hardware of SkyRadar is now capable of channeling data from the AHRS G mini through the same wireless. All you have to do is connect your AHRS-G mini using a wiring harness to the back of the SkyRadar box. On your mobile device, you'll have to connect to the Skyradar's wireless network. You can purchase the wiring harness online from Levil Technology.

Note: Even though SkyRadar provides power to the AHRS, it is not sufficient for proper operation. The battery switch must be ON for the instrument to work properly (unless connected to the electrical system of the aircraft via USB or RS-232). Power from the SkyRadar box is just enough to extend the battery life (as much as four times), but users must re-charge accordingly.