

Anywhere AI

Installation and Operations

Revised 2-12-2003



- Introduction
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- Connection
- Battery Operation
- Startup
- Normal Operations
- Shut Down
- Checklist



Anywhere AI Installation And Operations Manual

USE LIMITATIONS

Anywhere AI is not an STC'd or otherwise approved or endorsed aircraft instrument. Its use is restricted solely to that of an aid for visualizing aircraft attitude with reliance only upon approved primary instruments. Pilots are cautioned to observe this restriction. In no case should Anywhere AI be relied upon as a primary instrument, nor should its use, or that of any attitude instrument, exclude normal pilot vigilance including scanning and cross-checking of primary and secondary aircraft instruments.

Congratulations on purchasing Anywhere AI. The **AI** unit emulates a traditional gyrosopic attitude indicator module in an aircraft using solid-state motion sensors coupled with advanced digital signal processing technology. The attitude information is intuitively displayed on an inexpensive Pocket PC, delivering a very sophisticated secondary source of attitude reference information. Sensor data is processed in real time by a powerful built-in microprocessor and interpreted into traditional pitch, roll, and yaw information. The sensors, power-supplies, and signal processing electronics are contained in a compact portable housing, referred to as the **I**ntegrated **A**ttitude **R**eference **M**odule (**IARM**).

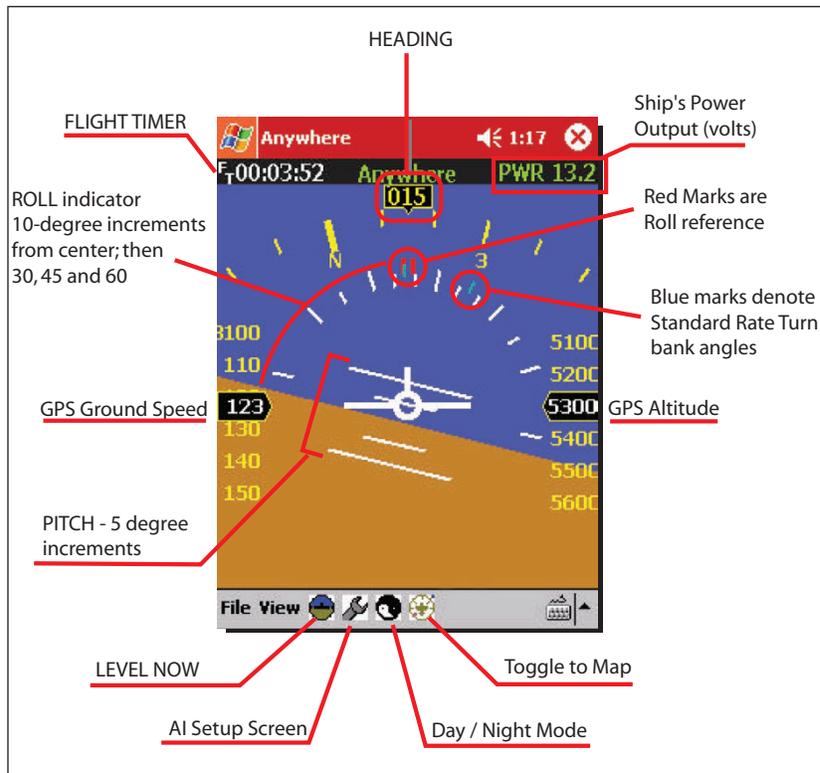
The IARM also includes inputs for GPS data; heading output is slaved to the GPS. The Anywhere AI system is calibrated at the factory, however it continuously fine-tunes the calibration of the sensors based on redundant information being gathered by multiple sensors in the IARM.

Power - The AI system can run on either vehicle power (14 or 28 Volt), or on a built in Nickel-metal-hydride rechargeable battery pack. This pack provides several hours of run time for a slaved GPS and the IARM.

IMPORTANT!



Prior to being used for flight, the IARM unit **must be allowed to perform an auto-reference operation**. During this phase, the unit must be kept immobilized, while the electronics warm up and perform a quick calibration check. This process takes about 30 seconds, and should be done **prior to engine start** for best results. Once the unit has auto-referenced, it is ready for use. The auto-referencing procedure should be conducted at a fairly stable temperature. Subjecting the IARM package to rapid and significant temperature change may necessitate repeating the auto-reference operation.



1. PLACEMENT

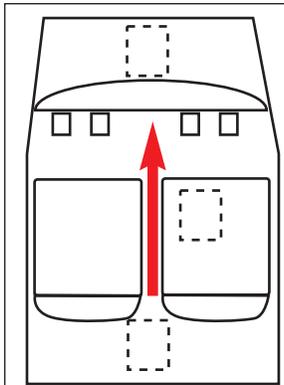
Stable location in aircraft – secure installation - alignment with aircraft center-line – vibration kept to a minimum – temperature range of operation

• Stability

This system is technically known as a “*Strapdown Inertial Navigation System.*” It is critical that the unit be firmly mounted in the aircraft and not slide or move with vibration during operation. ANY motion of the IARM module within the aircraft while the unit is operating will result in greatly exaggerated attitude errors being displayed.

• Placement & Alignment

In addition to being immobilized, **it is important that the arrow on the IARM box be closely aligned with the aircraft's direction of travel.** Alignment is particularly critical about the YAW axis. While the box can be several degrees misaligned in the Pitch and Roll axes, the FORWARD arrow on the IARM module must be aligned parallel to the centerline within one degree for optimum performance.



The IARM can be located in any convenient place as long as it is aligned longitudinally with the aircraft's direction of travel.

• **Vibration:**

Try to find a mounting location where vibration is at a minimum. While the IARM attempts to compensate for vibration, certain modes and frequencies can cause the unit to drift excessively. Velcro works quite well in most installations.

• **Temperature Stability**

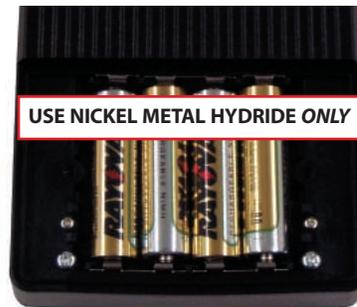
Avoid mounting the unit where it will be directly in the sun, or near heating or ventilation ducts. The system works best when the temperature of the module is stabilized or only allowed to change slowly.

2. CONNECTION - Refer to diagram at end of this chapter.

3. BATTERY OPERATION



The IARM unit has a standby-power battery pack that will support operation of both the IARM and the GPS. The unit ships with, and is intended **ONLY** for use with **Nickel Metal Hydride** cells. NEVER use alkaline or NiCad (Nickel Cadmium) cells. Use of these cells can cause fire and/or permanent damage to the IARM.



Incoming voltage is displayed in the upper right corner of the Pocket Computer screen display. If there is incoming power, the upper right corner of the screen will say **PWR: 13.8** (if drawing power from a 14V system). If the unit is not receiving external power, the upper right corner will display **BAT: 5.5V**, or whatever the voltage of the battery pack is. Loss of external power results in an immediate switch to battery backup mode. Two red LEDs on the back of the IARM indicate use of battery power. When fully charged, the battery pack should supply about 5.6 volts, when fully discharged, it should read about 1.5 volts.



External Power Indicators

- **Green** - Charge indicator: stays ON during normal operation.
- **Red** - Lights during normal charging operation; OFF when charged.



On Power-up (battery or external) both lights are ON for 5 seconds.

- TOP light blinks indicating incoming GPS data.
- bottom light stays ON when receiving power.

4. STARTUP

Constant Operation – Connecting & Starting – Auto-Referencing – Normal Operation – Level NOW – Fine Tuning – Background Operation – Attitude Alerts – Maneuvering Limitations – Battery/Power – Shutting Down

• Constant operation requirement



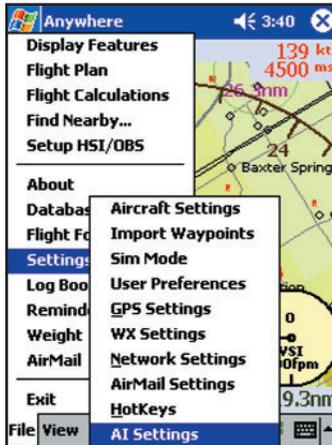
Anywhere AI is intended for **constant operation** while in the aircraft. Do not attempt to start and calibrate the IARM during flight. It is very difficult to auto-reference the system in turbulent air without the initial ground reference.

Connecting and starting the unit - follow steps A through F

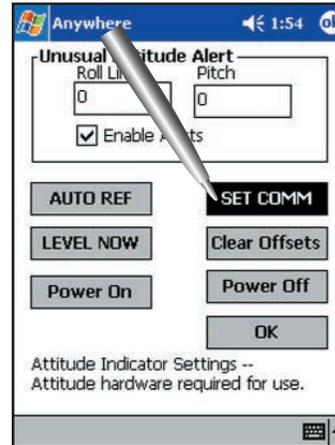
- Connect the power cable to a suitable 14 to 28 volt power supply.**
- Connect the iPAQ pocket PC and the GPS unit to the IARM module.**
- Start the IARM power using the power switch located on the top face of the IARM module.**

The green “charge power” and the red “charging” indicator lights should illuminate. Depending upon the state of charge of the batteries, the charging indicator will shut off within a few minutes to a few hours of operation. The batteries are fully charged when this light goes off, and the unit should have a few hours of operating power available.

D. Set Comm Port



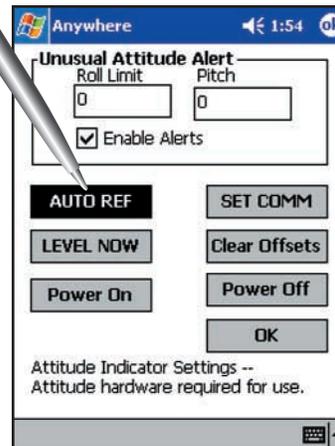
Set the Comm Port *before* the Auto-Reference procedure. It is not necessary to repeat this unless you switch systems or use another GPS.



Go to **File > Settings > AI Settings** and tap **SET COMM**. The system automatically initializes the correct port. **Note:** It is not necessary to repeat this step unless you use the PDA with another system or another GPS. If you do, you will be required to reset the port whenever you switch between GPS configurations.

E. Auto-Reference

After power up, and prior to use, the unit must perform an **auto-reference** operation while the aircraft and the IARM module are perfectly still. This will ensure that the unit operates smoothly. **Auto Reference** may be selected at any time by pressing the **Auto REF** button in the AI settings screen on the pocket computer (**File > Settings > AI Settings**). After the unit has been auto-referenced, leave the unit on and running. Turning the unit off will require another auto-reference operation and this is very difficult to execute successfully in flight.



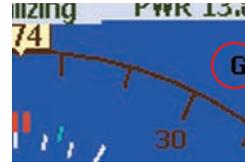
F. Start the aircraft

If you have followed these procedures, the aircraft is ready to fly with Anywhere AI.

5. NORMAL OPERATION

Normally the unit operates in *gimbal* mode, where the IARM processor updates the perceived position of the aircraft based entirely on the outputs of the internal gyro-

scopic sensors. Gimbal mode is indicated by the presence of a letter “G” near the upper right corner of the screen. The AI module functions automatically. When the IARM unit senses a period of relatively little motion, it briefly switches to *pendulous* mode, in which a gravity sensor eliminates any errors that may have accumulated while in gimbal mode.



Note: *The unit requires only a few seconds of **straight and level** operation every several minutes to maintain almost perfect position reference. As the unit operates, each time it switches into *pendulous* mode, it corrects any measurable attitude errors and remembers these corrections using them to refine the ongoing position solution. The result is an almost continuous refinement of the module’s operation.*

6. TUNING; SETTING ALERT LIMITS

• LEVEL NOW command:

If the unit has developed an attitude error due to turbulence, aggressive maneuvering, or some other cause, the pilot can instantly “*erect*” the gyro by pressing the **Level Now** button on the toolbar of the Pocket PC. The unit will instantly return to a level attitude, as determined by the internal inclinometer system.

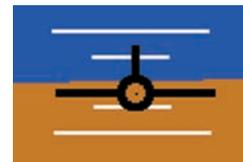


The LEVEL NOW button **erects** the gyro in level flight.

Note: *if the aircraft is in a coordinated turn at the time of a **Level Now** command, the roll angle will be reset to zero, and the attitude will begin to diverge. You should issue **Level Now** commands **only** when the aircraft is in a steady state. It is not critical that the vehicle be immobilized during this process, but it should be traveling in straight unaccelerated flight.*

• Fine Tuning the Level Attitude Indication:

The horizon reference can be *tuned* to read **level** when the IARM module is slightly out of level. The Pocket PC’s *Hat-Switch* adjusts the horizon. This is analogous to the adjustment knob on traditional attitude indicator instruments. In the illustration to the right, the horizon is slightly *above* the aircraft. Pressing the *bottom* of the Hat-Switch *lowers the horizon*. Similarly, the wings can be leveled using the *left-right* Hat Switch positions. If the IARM module is not mounted in an exactly true level attitude when the aircraft is straight and level, minor errors can be nulled out with this adjustment. To clear these adjustments, press the

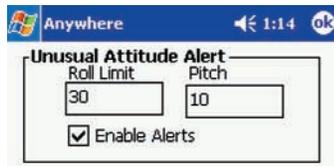


Fine-tune the position of the virtual airplane with the PDA’s Hat Switch: Top & Bottom for pitch reference, Left & Right for Roll.

Clear Offsets button in the AI settings screen (**File > Settings > AI Settings > Clear Offsets**) on the Pocket PC. This will cause the symbolic airplane to show it’s true attitude on the screen.

• Background operation / Unusual Attitude Alerts

Because the IARM contains its own powerful computer, the device continues to track attitude, even if another application is running on the pocket computer. *Anywhere Map* software can be set to alert the pilot if the vehicle encounters any unusual attitudes. (**File > Settings > AI Settings**) Pitch and roll limits are set in



this screen. Enter a value for Pitch and Roll: recommended values are 30 degrees in **Roll Limit**, and 10 degrees in **Pitch**. Check the **Enable Alerts** box. If the vehicle exceeds these values while displaying the moving map, the screen will instantly revert to the

attitude indicator screen. Note that if the current map details selected are extremely complex, there may be a several second delay until the screen switches to the attitude indicator. In the AI screen, the map continues to update at five to ten times per second.

• Maneuvering limitations:

The solid state sensors in the IARM module are rugged and not easily damaged, however exceeding a roll rate of sixty degrees per second will result in a temporary loss of positional integrity. **Note:** If this ever happens, the symbolic airplane symbol on the screen will turn RED, signifying a loss of attitude accuracy. To clear this condition, execute the **Level Now** command. *The IARM is not intended to be used in inverted and or extreme attitudes.* Should this happen, simply issue a **Level Now** command as soon as the aircraft is straight and level. This procedure instantly re-orientes the electronics package for further use.

6. Shutting down the system:

After shutting down the aircraft, disconnect the Pocket PC from the IARM module and/or turn off the Pocket PC. If you don't plan to use the IARM for several days, simply turn off the power switch located on top of the module. Prior to using the unit again for attitude reference, it will be necessary to allow it to perform an **Auto Reference** operation.

If you do not shut off the IARM's power, within several minutes, it will automatically select a battery-saving *sleep* mode (if the iPAQ is disconnected and there is no 14/28-Volt external power being supplied to the unit). **Note:** in this mode, the system is not tracking attitude information, but *still draws a tiny amount of current from the internal batteries.* The module will run for about a week in sleep mode before discharging the internal rechargeable batteries.

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We strongly recommend that you practice partial-panel flying with a flight instructor and familiarize yourself with these procedures. Budget some time to become comfortable with Anywhere AI. The time to learn this product is during severe VFR with a safety pilot, not during an actual emergency. Check with the Air Safety Foundation (www.asf.org) for recommendations on emergency procedure training and partial panel exercises.

QUICK-START CHECKLIST

1. Placement

IARM is aligned with aircraft centerline; securely situated--no movement.

2. Connection

All cables secure; test power source by turning on Master switch - check power adapter LED, IARM LEDs, iPAQ power light .

3. Battery Operation

NiMH batteries installed; batteries charged.

4. Startup AI:

File > Settings > AI Settings

- **SET COMM**
- **AUTO REF**
- **Start aircraft**

5. Normal Operations

- **Level Now** (toolbar)

Resets gyro when in Straight & Level flight.

- **Tune horizon**

Fine-tune position of horizon (Hat-Switch)

- **Alerts (File > Settings > AI Settings)**

Set roll & pitch limits

- **Switch from AI to Map**

Tap MAP icon on menu bar

6. Shut Down

Shut down aircraft; disconnect PDA; Switch IARM power unit OFF (or allow to Sleep for 3-5 days)

For technical support, use our web site at

www.controlvision.com

or contact Tech Support by phone

620 231-9748