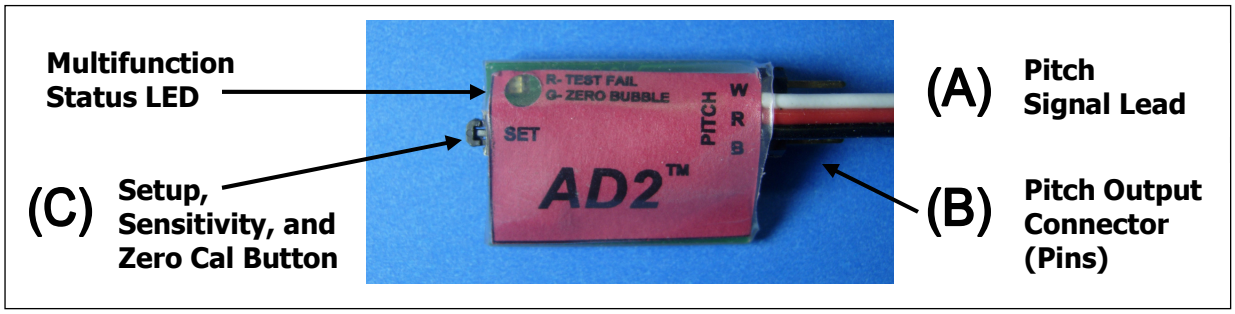
AD2™

Angle Driver (Gen 2, w/o failsafe)

General layout



Quick Setup Guide

1. Install and setup your pitch and ballast servo *including servo reverse and end-point adjustments in your transmitter*.
2. Plug the **Pitch Signal Lead (A)** into the pitch channel of your receiver
3. Plug the stern planes servo into the **Pitch Output Connector (B)** connector on the AD2 taking note of the correct polarity
4. Use the **Setup Button (C)** to set the pitch neutral, pitch full rise, and active pitch axis.
5. Place your equipment tray on a level surface and calibrate the zero-bubble angle.

Features

- Any orientation works! The AD2 uses a 3-axis sensor and a simple user configuration interface to allow it to be installed in any convenient orientation. No more needing to choose between "wires facing back or wires facing forward…"
- Pitch command priority algorithm always lets you override the angle signal, no matter what angle you're at.
- Pitch command limits are user defined so you can't accidentally overdrive your servos or bind linkages.
- Setup/Sensitivity/Zero Calibrate Button: All setup functions as well as sensitivity adjustment and zero bubble calibration are accessed through the multifunction setup button.

Multifunction Status LED

When power is initially switched on red and green lights indicate the pass/fail state of the power on self test. (Red+Green = pass, Red flashing = fail.) Signals coming from the receiver are then evaluated and the LEDs will present a double-green flash to confirm that a signal has been detected. After initialization the green LED illuminates when you're at "zero bubble".

The Multifunction Status LED is also used to indicate the current step when in the setup routine. Step 1 is indicated with a double-green blink, Step 2 with a triple green blink, and Step 3 with a quadruple green blink.

AD2 Installation

The AD2 is sensitive to pitch changes in any of 3 axes (along the long edge of the circuit board, across the short edge of the circuit board, or "through" the board) so choose the most convenient orientation for the available space and wire routing that still offers adequate access to the setup button.

1. Attach the AD2 using double-sided foam tape.
2. Install and setup your pitch servo including servo reverse and end-point adjustments in your transmitter.
3. Connect the **Pitch Signal Lead** to your receiver.
4. Connect the pitch servo to the **Pitch Output Connector** taking care to orient the servo connectors so that the servo wire colours line up with to the **W** (white/signal), **R** (red/positive) and **B** (black/negative) notations on the AD2's label. (Note that the servo connector orientation is also the same as the wires coming out of the AD2.)

Setup Mode

Setup mode allows the AD2 to learn which way to drive your pitch servo, what the appropriate travel limit is, and which way it's been installed on your equipment tray. The Pitch Control setup mode can only be accessed when the pitch receiving a signal from your receiver. Note that during Pitch setup the AD2 will not drive your servos according to your transmitter commands – the servo will be commanded to neutral for the duration of the Setup procedure. To enter setup mode turn on your transmitter, press and hold the setup button on the AD2, then turn on your receiver. The status LED will flash to indicate the self test and input signal test results, and will then show a solid green to indicate that you've entered Setup mode. (You may now release the Setup button.) Now complete the following steps:

1. At the beginning of this step the status LED will be flashing with a 2 green blink pattern. With your transmitter commanding neutral on the pitch planes press and hold the setup button until the LED flash pattern changes to a solid

green – this will save the pitch neutral command setting. When you release the setup button the LEDs will begin flashing a 3 green blink pattern.

2. Orient your equipment tray so that the AD2 is sitting (more or less) what it will see when your sub is sitting level in the water. (A zero-bubble condition.) Command **and hold** full rise on the stern planes channel of your transmitter, and while holding full rise push and hold the setup button again until the flash pattern changes to a solid green – this will save the normal ship attitude of the AD2 and the full-rise command setting. When you release the setup button the flashing will change to a 4 green blink pattern.
3. Now orient your equipment tray so that the bow of the boat would be pointed directly toward the ceiling (or orient the AD2 so that it would be pointed at the ceiling for your chosen orientation) and push and hold the setup button again until the flash pattern changes to a solid green – this will identify and save the active pitch axis in the AD2. **After completing this step you must also perform a zero bubble calibration (after exiting the setup routine).**

The AD2 will now exit setup mode and return to normal operation.

Zero Bubble Calibration

Carefully place your equipment tray on a known level surface. (Because of the increased sensitivity of the AD2, a bubble level is recommended to help with this.) During normal operation mode press and hold the set button for a half second, then release. The Green LED will turn on and the Red LED will flash quickly for 2 seconds while the current angle is recorded in to the AD2 as your zero bubble reference angle. If your equipment tray does not sit exactly level when installed in the WTC in your submarine a two step calibration process is recommended:

1. Orient your equipment tray as close to your sub's "zero bubble attitude" as possible and calibrate. Next install the WTC in your sub and precisely level the hull it to the desired "zero bubble" angle. With your system powered up, take note of the exact angle of the pitch servo arm with respect to the pitch servo body. (Alternatively, a precise measurement of the length of the pushrod extending from the aft bulkhead will also work.)
2. Remove your equipment tray, apply power and shim it up so the servo arm is exactly in the same position as it was when your installed WTC was level. Press and release the set button to lock in this attitude as your zero bubble angle.

Sensitivity Adjustment

During normal operation mode, press and hold the set button for at least 2 seconds, then release. When the button is released the sensitivity setting will change to the next setting and the red LED will flash the new sensitivity setting value. There are three sensitivity settings which range from 1 to 3, 3 being the most sensitive and 1 being the least sensitive. The default sensitivity setting is 3.

General Notes

- For proper detection of input signals your transmitter must always be turned on **before** you turn on your receiver.
- You must setup the travel direction (servo reverse) and end point adjustments in your transmitter **before** connecting the AD2. During the setup routine the AD2 uses your travel direction and end point settings to figure out what orientation it's in and how to command rise on the planes so you'll never have to install it twice. From your maximum rise command the AD2 also learns how much control throw it may use and will never exceed your control limit regardless of command or pitch angle. If after setting up your AD2 you need to change the end point settings in your Tx it is highly recommended that you go through the pitch setup routine again with your AD2.
- Always perform a zero bubble calibration after using the Pitch Setup routine.
- If you can't quite get the zero bubble indicator to stay illuminated when your submarine is fully assembled and level *that's okay!* As long as you're close the AD2 will still function properly. You can use the trim tab on your transmitter to fine tune the stern plane angle required to hold constant depth (to compensate for minor ballast changes) while underway. (Note that the pitch trim lever on your transmitter will not affect the calibrated zero bubble angle of the AD2.)
- The AD2 always generates a signal for the pitch servo even if the **Pitch Signal Lead** is not connected to your receiver. (The pitch function can be powered directly from a 4.8V battery pack.) Because of this the AD2 can be used to stabilize the rear planes on a model while the pitch channel is used to drive the bow planes on low-channel count radios. If you wish to use the pitch control function in this "stand alone" mode it is recommended that you set it up using the pitch channel on your transmitter (to enable programming of servo travel limits and direction) then simply disconnect the Pitch Input Lead.
- For best depth-keeping performance leave the Sensitivity Selection at level 3. If your submarine oscillates up and down at high speed, reduce the AD2's sensitivity to level 2 or level 1. Sensitivity level 2 on the AD2 is approximately the same as the HIGH sensitivity setting on the ADF, sensitivity level 1 is approximately the same as LOW on the ADF.

Questions?

- If you have questions or concerns about your AD2 please contact Kevin McLeod by email at KevinMc.Electronics@gmail.com