



POWERFIN Propellers
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Propeller & Light Sport Aviation Manufacturing

Setting Propeller Pitch with a Digital Protractor

A Propeller DIGITAL Protractor is currently the most accurate and – with its large digital screen – the easiest way to pitch your propeller blades within a fraction of a degree.

However, there are some principles that absolutely must be followed to consistently achieve a professional level of results. Please use these next few guidelines as you complete the directions below this section ...

- Always use the same side of the DIGITAL Protractor. (*But ANY side can be used – just continue to use the same side.*) In other words, whatever side of the Digital Protractor you use to ‘zero-out’ the angle of the mounting hub, use that same side for placing & reading the angle on each blade’s flat side, at the tip’s edge.
- In order to maintain a consistent pitch setting throughout your propeller configuration, always have each blade being adjusted in the same position – relative to the frame - relative to your stand and – relative to the ground before setting pitch; and...
- Always have the protractor in the same position on each blade’s flat side, at the tip’s edge before setting its pitch – noting that the DIGITAL Protractor should never be secured to the blade with the leading edge tape under it (i.e., always move the Digital protractor further up or further down the blade’s tip so that the DIGITAL Protractor is not on the leading edge tape).
- When you have the protractor set on the blade, use a Ratchet-Bar clamp to secure it in place.

Read through all of the instructions first, before starting. And then please follow these instructions carefully. If you have any questions, please do not hesitate to contact the factory for a clarification of these procedures.

1) Set your position – relative to the craft

Position your craft to allow for easy access to the propeller area – especially for easy access to the flat side of the tips of the propeller. Noting that there is no need to adjust your craft’s position (once it is secured) – relative to level ground - to set the pitch of your blades.

Set the relative “ZERO point” of your digital protractor – your “Starting point” – as follows...

- Once your craft is positioned so that you can easily access the flat side of your prop blade tips, SECURE the application (aircraft, boat, hovercraft, etc)
- Turn the Protractor “ON”
- Place the side of the DIGITAL Protractor – the same side that you will be placing against the blade’s flat surface - against your prop’s mounting hub to ‘zero-out’ the angle of the mounting hub, and hence compensate for any ‘offset’ in the sitting position of your craft.
- Press the “ZERO” button – the digital readout will then change to “0.00”. (*This compensates for any angled-position of your secured application.*)



2) Prepare your Hub and Blades

Loosen the hub bolts - just enough (*but not so much that your blades are “sloppy” in the hub*) to allow the blades to be twisted with your hands, but yet, keep the Powerfin hub flat/flush against the mounting plate of

your engine/gear box.

3) Setting degrees of pitch

ALWAYS set your degrees of pitch on the flat of the blades, at the tip with the back of the Digital Protractor flush to the outside edge of your blade's tip!

4) Adding Pitch to your Blades

Once you have determined the amount of pitch that you want at the tips of your blades...then...

Secure the Digital Protractor – using a Ratchet-Bar clamp – keeping the protractor even with the tip of the blade while against the FLAT side, BELOW the leading edge tape, to insure a flat surface on the blade's tip, then using just enough pressure to hold the protractor in place on the blade's flat.



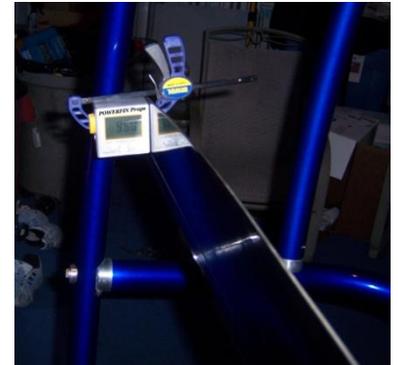
Pull outward on the blade (from the blade's root toward the blade's tip) BEFORE setting the pitch to ensure that the blade's shoulder is firmly seated against the inside collar of the Powerfin hub.

Now, with the Digital Protractor SECURE, and aligned flush at the tip of the blade, rotate the blade until you get the desired angle**.

Hint: While rotating the blade with one hand close to the hub, gently rock the blade back and forth at the middle of the blade with the other hand. This method will allow for a smoother and finer pitch adjustment. OR, as in the image, use a slotted 2x4 as gentle leverage to smoothly rotate the blade in its hub.

****Note: Please make sure that you are reading the positive pitch angle (AOA of the blade); and not the negative angle. In other words, pitch the blade, as if it was a wing flying with a positive AOA!**

Once the proper pitch is achieved on the blade's tip, tighten the blade's root bolts (*two bolts per blade*) just enough to snug this blade in the hub - tighten just enough to keep the adjusted blade from moving as you complete this routine for the other blades; but not so tight, that the other blades cannot be adjusted.



*Example of a Ratchet Clamp
About \$4 at a HW store*

While you remain in the same position relative to the aircraft, rotate your propeller so that the next tip to be pitched is in the same position as the last blade that was just pitched – relative to the position of the blade to the aircraft (i.e., always adjusting a blade while it is at 0300 or 0900 on the clock). In other words, bring the blade to be adjusted to your standing position. You should NOT move to the blade; instead, have the blades rotated to you!

Noting that keeping each blade in the same position as you set the pitch is extremely important in maintaining a constant pitch throughout all of your blades!

5) Verify the Pitch of each Blade

After all of your blades (their tips) have been pitched, and the blades are secured just enough with the bolts in the hub to keep them from twisting in the hub – rotate each blade back to its original adjustment position and re-check the pitch of each blade. If all of the blades are consistent (within 0.2 of a degree) to your desired pitch then continue to the next Step to secure your blades; IF NOT, repeat these five Steps.

6) Secure your blades in the hub

Using the recommended torque PATTERN for your engine/gear box mounting plate, torque your hub bolts to **175**-inch pounds on the Powerfin hub center bolts (the 6-center mounting bolts) and torque the blade bolts - the two bolts around each blade's root to the specification for your Propeller configuration.

- For “**B**”, “**C**”, and “**F**” model propellers, the torque setting to be used to secure the two 40-mm x 8-mm socket head bolts around each blade's root is **175**-in/lb.
- For “**E**” model propellers, the torque setting to be used to secure the two 30-mm x 6-mm socket head bolts around each blade's root is **125**-in/lb.)



Another example of a **RATCHET CLAMP**

Used to hold the Digital Protractor to the flat side of the blade's tip.



Operating Instructions for the Digital POWERFIN Propeller Protractor



Please read through this brief Owner's Manual carefully before using your new Digital Protractor.



Overview

The DIGITAL Protractor is a precision instrument used for measuring angles in which any of its four surfaces may be utilized as the initial base surface.

- Zero can also be set at any application angle-so that the relative angle (your blade's angle of pitch in degrees) between your hub mounting surface and the blade's flat surface can be measured.
- The DIGITAL Protractor can also measure absolute level, you can utilize it as a portable Packet level
- When the Protractor is inverted, the digital read-out automatically switches to an 'upright, readable' position.

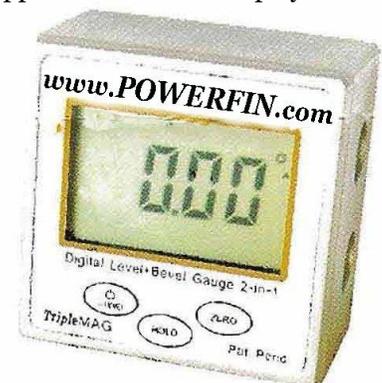
Operation

1. To Power "ON" and read absolute level, push the left/'LEVEL' button;"Level" will then appear on the upper-left corner of the display.
2. To begin pitching your propeller blades, measure relative level (i.e., the level of the propeller hub on your application) by picking either the Left or Right side (relative to the display) of your Digital Protractor to serve as the base side (this side will be the side that is consistently placed against the hub and the flat of your blades); then place the cleaned, selected 'base side' firmly up-against your hub, then while it is firmly placed on the flat of the engine/gear box plate, then push the "ZERO" button – the display will read "0.00".
3. Once your relative 'Zero angle' of the mounting hub is established, move the DIGITAL Protractor – using the same selected 'Base side' that you zeroed-out on the mounting hub – now move it on to the flat side of the tip end of your blade; keeping the Digital Protractor flush with the end of your blade's tip; and secure it there with a ratchet-bar clamp.

[NOTE: Make sure that the protractor is not setting on top of any leading edge tape when securing the protractor to the blade's tip – as this will affect your pitching angle.]

Once secure and its back flush to your tip's end, your Digital Protractor will accurately measure and display the pitching angle of your blade's tip.

4. To hold the pitch reading, push the "HOLD" button. "H" will now display at upper-center of the display. To disable the HOLD function, push the "HOLD" button again.
5. If a 'battery image' appears on the LCD display, or the gauge will not power-ON, it is time to change the battery. Remove the back plate with the provided screwdriver, and insert a new standard 9V-battery
6. To Power OFF, press the left/'LEVEL' button. Otherwise, the units will self power-off within 5-minutes of non-use.
7. To switch back to the absolute level measuring, push and hold the left/'LEVEL' button for 3 seconds.



Specifications:

Resolution: 0.05° <> Repeatability: 0.1° <> Accuracy: ±0.2° <> Battery: Standard 9-volt <> Retail \$44.95

Incorporating handcrafted integrity with carbon-fiber composite blade technologies! www.Powerfin.com

Angle Cube RE-CALIBRATION

Under normal conditions, AngleGauge does not need re-calibration. If necessary, under the condition of the reading become inaccurate, or under the condition of severe impact, the AngleGauge may be re-calibrated professionally. Re-calibration require a calibrated level surface within $\leq 0.02^\circ$ accuracy, and may require several attempts to accomplish accurate calibration. It is important to hold the AngleGauge steady while pressing the buttons to re-calibrate. **Warning: un-leveled surface may result inaccurate calibration.



1) Place the gauge upright on a level surface.
**The accuracy of the Granite level surface must be $\leq 0.02^\circ$ in order to make the re-calibration effective.



2) Press and hold \odot and ZERO buttons for 5 seconds until the screen displays CA1.



3) Release the buttons and make sure the box has no movement until the "1" flash.

The Angle gauge should be setting right side up.



4) Turn the box 90 degrees clockwise; press the ZERO button-the screen will read CA2, make sure the box has no movement until the "2" flash.

The Angle gauge should be setting on it's right side.



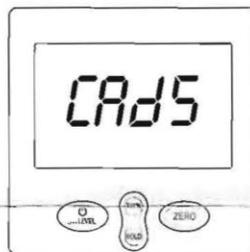
5) Turn the box for another 90 degrees clockwise; press the ZERO button-the screen will read CA3, make sure the box has no movement until the "3" flash.

The Angle gauge should be setting on it's top.



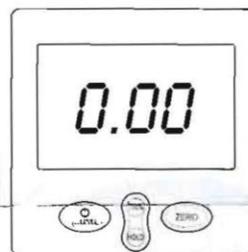
6) Turn the box another 90 degrees clockwise; press the ZERO button-the screen will read CA4, make sure the box has no movement until the "4" flash.

The Angle gauge should be setting on it's left side.

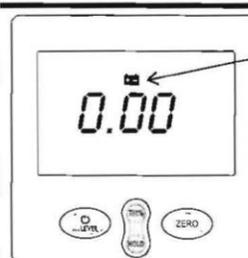


7) Turn the box another 90 degrees clockwise; press the ZERO button-the screen will read CA5. After 3 seconds the display will read 0.00-this completes the calibration.

The Angle gauge should be setting right side up.



8) Your Angle gauge is now ready to use.



Low Battery Warning