

MU-9000X

BY: Mike MacFarland

AEROPERFECT'S USB INTERFACED MEASURING SYSTEM

Working for years as a carpenter, I've made a living using every kind of leveling and measuring device from bubble vials to laser levels to build stuff straight and true. The days as a carpenter have long been replaced by a contracting desk and computer. Since then I've come to appreciate the accuracy of personal computing in design and data storage. My search for the perfect marriage between the computer and an aircraft leveling and measuring device was complete when I stumbled across a magazine ad for the AeroPerfect MU-9000x USB measuring system.

Who needs one?

This cutting edge device is the

perfect tool for a guy who owns a laptop computer that runs Windows XP or Vista operating systems, and who is looking to get the best

performance from his airplanes.

For an airplane to fly according to how it was designed, it is important for a builder to make

With the measuring unit attached to the aileron, the surface is neutralized and the zero button is pressed to establish the reference angle of 0 degrees deflection.

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 sure its control surface setups (the distance the elevator, rudder, ailerons and flaps travel when moved) match the manufacturer's documentation. Kit and ARF manufacturers want to ensure their products perform well for you by doing exhaustive prototype testing and documenting the final results within their manuals. In regards to control throw settings, I once crashed an airplane by not following the instructions that came with the kit and instead set them to what looked "close enough". That was a big mistake. After that incident, I paid more attention to setting deflections with a ruler but still questioned the accuracy of such measurements. With this new unit in my box of tricks, it's now fun and easy to setup my airplanes perfectly, which results in me having more confidence in my airplanes on maiden flights.

What is it?

The 9000x is a digital measuring device that connects via USB cable



to a computer to measure, set and verify angles of surface throws, wing and stabilizer incidences and decalage (angle formed of wing incidence versus stabilizer incidence) of your airplane. The unit consists of a small measuring head that measures only 2 x 3 x 0.75 in. Tall, which connects to your laptop computer with an included 6-ft USB cable. The unit does not require any batteries and draws the necessary power from

the computer connection. At only 2-1/2 ounces, it's light enough to use on airplanes as small as park flyers and as large as giant scale and even full scale. The accuracy is incredible with a digital readout of two simultaneous axes of information within 0.01 degrees. The angle sending unit uses an absolute inclinometer to measure angles from 0 to 360 degrees using MEMS (micro electro-mechanical systems) technology.



Closeup of the two axis measuring head unit.



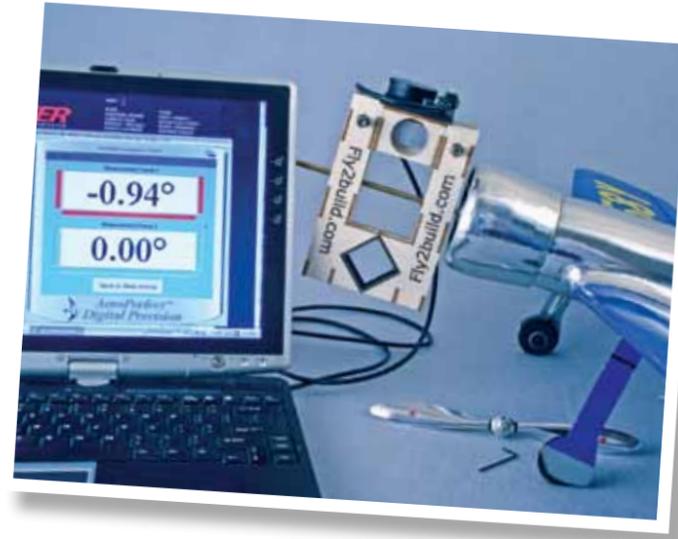
What is supplied in the measuring system purchase (plus instructions pages not shown).



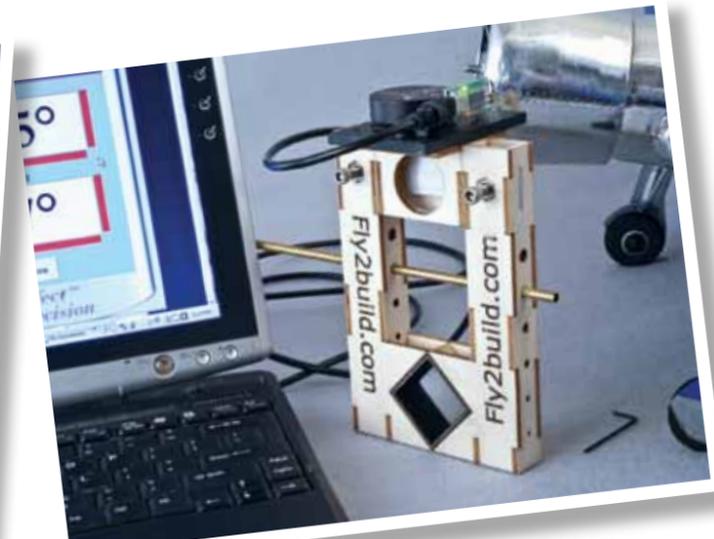
After establishing a neutral reference point, the measuring head is placed upon the flat plate stabilizer of this 32-in. wingspan Hughes racer and the incidence shown on the screen is 1.46 degrees



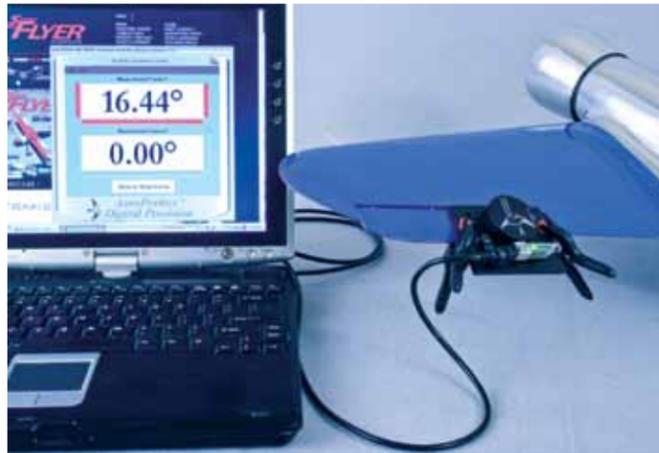
The wing incidence is measured next and the resulting angle is 2.81 degrees of positive incidence relative to the neutral reference point.



The motor down thrust is measured by using a piece of snug fitting brass tubing slipped over the motor shaft and attached through the jigs and is indicated as .94 degrees.



The laser cut jigs add to the versatility of the measuring unit.



- ▶ The aileron is shown deflected down at 16.44 degrees from neutral while the second axis of measurement is not being used.
- ▶ The large digit view option displays three red bars around the angle box, which will turn green at the lower, level, and upper user-set desired angles of deflection.

What You Get

The manufacturer sells this instrument for \$199.00 and it comes with the measuring head and attached USB cable, two holding clamps, a padded clamping support piece, software CD, and a few pages of instructions.

Getting Started

The software installation is simple and automated, requiring mostly repeated clicking of the "next" key to install the program on your laptop. Following the instructions, wait until after the software is installed to plug in the USB cable into an available USB port and the computer will then automatically install the device drivers from the previously installed software.

Here's where windows XP users should deviate slightly from the included instructions: After your system tray prompts you that "your new hardware is ready to use", unplug the USB cable. Then, start the program, and once it is

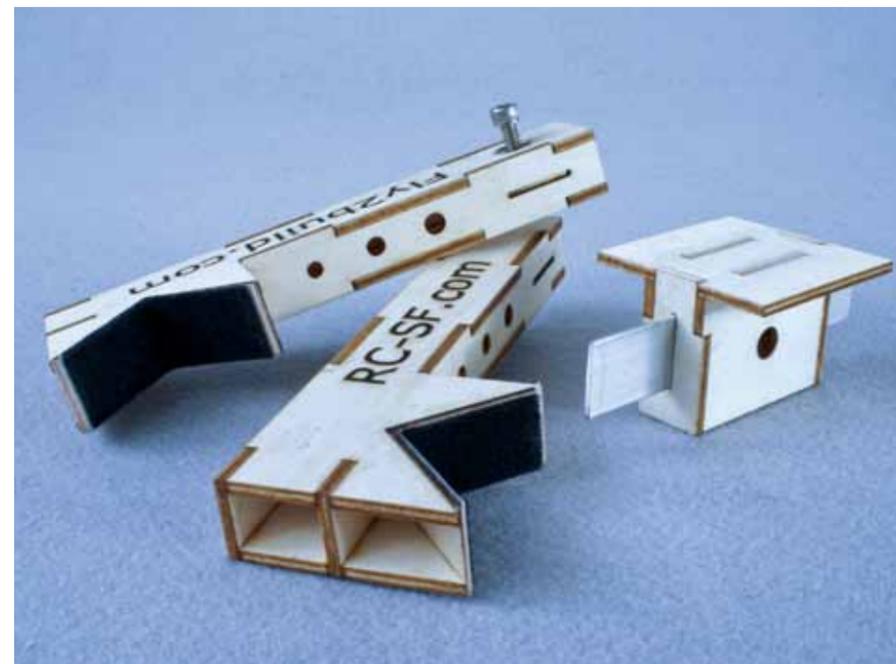
- ▶ Using the plan part templates, these jigs can be made from 1/8 in. light plywood and use a length of 1/16 x 0.75-in. aluminum bar stock for adding versatility to the measuring system.

fully loaded, plug in the USB cable and you will be up and running. Each time I start the program, I've found that I get the best success by waiting until the program is loaded before connecting the USB cable.

What You Need

Once I read and understood how I could use this device best in my airplane building and setting up, I realized I was going to want some additional accessories to go with

the 9000x. If you are upgrading from a previous incidence measuring unit, you may already have a chord-bar-clamping setup that will work. I didn't, so I sat down and designed an incidence measuring platform made from laser cut 1/8-in. plywood pieces and using a spare piece of 1/16 x 0.75-in. aluminum bar stock I had in the workshop (and easily found at any hardware store). I wanted not only a wing incidence



meter but also an accurate motor shaft attachment method and the resulting design accomplishes this. RC Sport Flyer is including the full-size plan templates for your use. Copy them and spray-glue (3M® 77 glue) to scrap light plywood. Then you can cut and drill the parts for easy assembly. Alternately, you can order the parts already laser cut and shipped to your door using the source guide at the end.

What's Special

One of the things you'll immediately appreciate as you begin to use this unit is that you do not have to spend any time leveling your airplane prior to measuring. This is a one of the advantages it

has over mechanical or bubble level meters. The program has a button that, when pressed, resets the reference angle to zero for either or both axes of measure.

This is a very nice feature that allows you to either stand the airplane on its own legs or simply secure it in an airplane stand. To check aileron or elevator control throws, the user simply clamps the non-skid measuring head onto the surface using the supplied Neoprene foam backing plate, neutralizes the surface and presses the 'zero' button. The user then enters the desired surface degrees of deflection into the "plus" and "minus" boxes and the desired margin of deviation above

and below the target value. As the surface is moved (using the RC system) and approaches the target values by the preset deviation margin, the red light will change to green showing that it has reached the correct value. This is pretty neat, and since most transmitters are computerized today, setting the travel limits is as easy as pressing the up or down button on them. If you like easy to read large screen digits, you can easily switch to viewing just the large axis numbers with the red and green target value bars alongside by simply clicking a button.

Why Buy

Sometimes airplane manuals

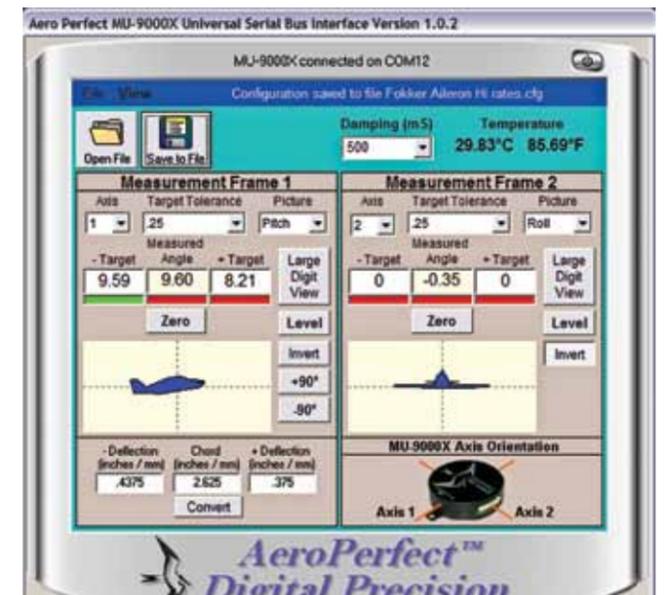


- ▶ The measuring system is secured to the Aileron with the supplied clamping system. The chord length of the surface was measured from the hinge line to the tip and entered into the included software for conversion to degrees.

- ▶ The screen-shot of the pitch axis shows the desired inches of deflection and the measured chord length in the "convert boxes" and the converted degree equivalents automatically input in the plus and minus target boxes above. The second reference frame is not being used in this example.



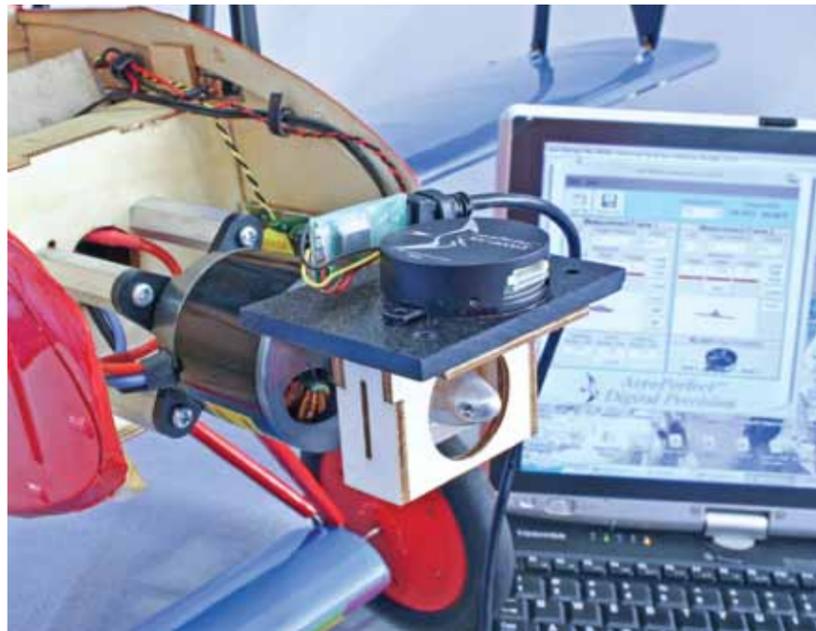
- ▶ After a neutral reference angle was stored as a zero reference in the program, the surface was deflected using the transmitter to the desired preset degrees as shown on the on screen display.





A neutral reference point is being measured on this Fokker D.VII.

The holes on the measuring head unit holder allow secure attachment to propeller adapters for motor thrust angles.



After subtracting 90 degrees from the previously measured neutral angle, the measuring head is rotated 90 degrees positive to determine the firewall thrust angle.

How to Use

If you're into building airplanes from plans or kits, this thing is going to come in handy. Consult your airplane's plans to establish a neutral reference datum, which can frequently be a fuselage crutch, longeron, or servo tray. With the airplane's wing attached to a secured fuselage, place the measuring unit flat on the reference datum with the pitch axis in the fore and aft direction and zero the data. Next, keeping the direction of the unit constant, attach it to the wing incidence jig and record the reading as the wing incidence angle. Repeat the process for the stabilizer and record the reading and note whether it is positive or negative. A nice plus to the laser-cut incidence jigs is that you can close them together and use the outside edge of the vertical leg, placed against the firewall, to measure the amount of up or down thrust. If the airplane's motor is installed, a piece of tubing can be slid through the jig in the holes using tubing that is sized to fit tightly to the shaft diameter.

Yet another neat feature of the

unit is its ability to be rotated 90 degrees and placed flat against the firewall. Rather than having to do the math required to get the degrees of deflection from the vertical plane, the user can click an on-screen button to add or subtract 90 degrees to the reading prior to performing the rotation. After rotating flat onto the firewall, if the number is negative, it indicates the degrees of firewall down thrust and a zero reading indicates a neutral thrust angle. To check motor side thrust and rudder deflection angles, the airplane must be rotated and secured on its side. Using the same methods as outlined herein, the angles are measured and set easily.

Conclusion

Can you live without the AeroPerfect 9000x in your workshop? Maybe! As for me, I would rather food lost its taste

or cake its frosting (and I love frosting). If you're looking for absolute accuracy and ease in setting up your airplanes properly to get optimum performance, then I would encourage you to order your 9000x today. With the ability to run within Windows XP and Vista operating systems, the software is versatile and ready for all measuring tasks. With the measuring unit's diminutive size and weight, it's ready for use with setting up park flyers to pylon racers, gliders or even giant-scale airplanes.

The question is: Are you ready to begin building straight and true?

- All wood is 1/8-in. light plywood except the angled pieces attached to the wing cradles which are from 1/16-in. plywood.
- Glue felt or soft fabric to wing cradles to protect wing surfaces.
- Epoxy a hex nut into the cut hex slot for thumbscrew tightening.

MU-9000x *Sources*

MU-9000X Universal Serial Bus Angle Measuring System

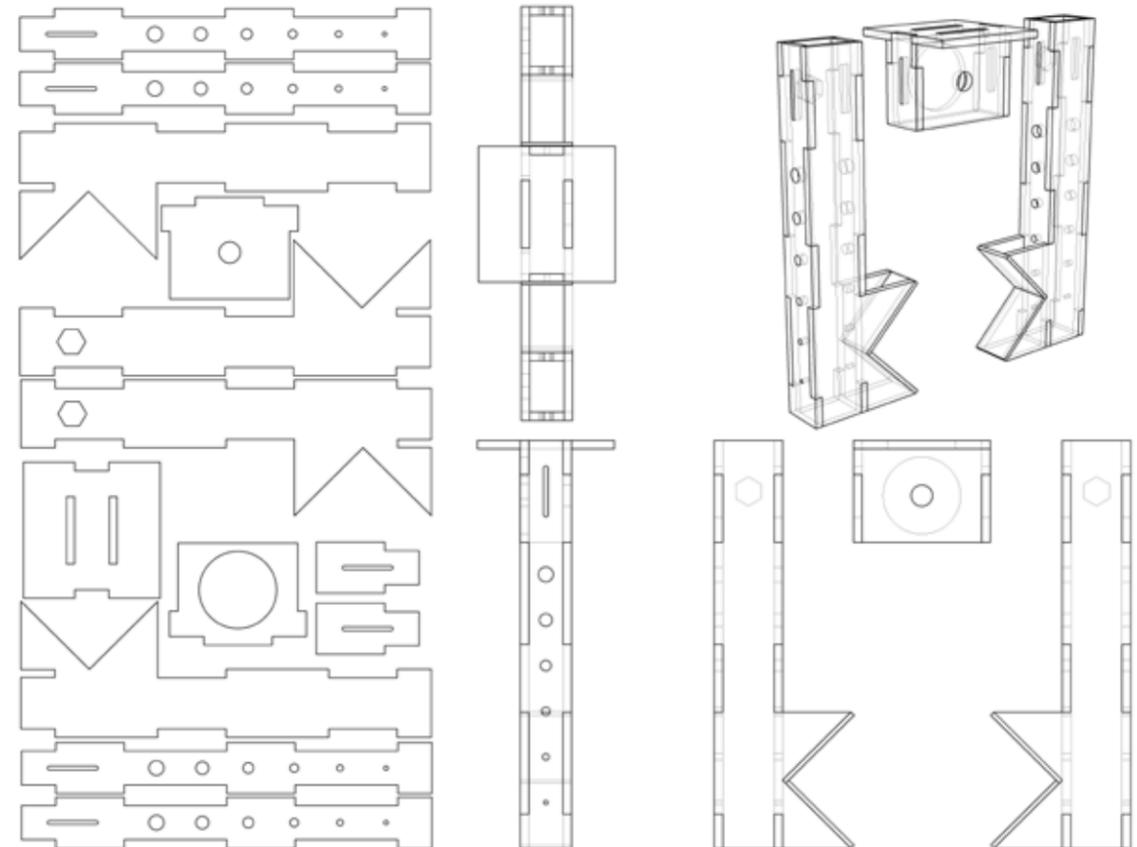
Bell Electronic Technologies
4330 Old Pine Court
Etna, CA 96027-9518
Phone: 530-467-3777
Web Site: aeroperfect.com
Price: \$ 199.00

Laser cut wing incidence measuring jigs:
TFC Aeroplanes
9461 Deschutes Rd Ste 10
Palo Cedro, CA 96073
Web Site: fly2build.com

Hughes H-1B racer (shown) short kit:
Website: tnjmodels.rchomepage.com/tnjh1.php

Horizon Hobby
4105 Fieldstone Road
Champaign, IL 61822
Phone: (217) 352-1913
Web Site: horizonhobby.com

- Full size parts templates are shown on left side of the page. A top, front and side view along with an isometric view is shown at the right.
- Jigs designed and drawn by Mike MacFarland
- Laser cut parts shown are available at: Fly2build.com



call out the control throws in degrees and other times in inches or millimeters. This can be frustrating. A really cool part of this program is that when the deflection is given in non-degree format, it has a handy conversion calculator built right into the program. On my Hangar 9® Fokker D.VII ARF, the manual spelled out high rate aileron deflections of 7/16 in. up and 3/8 in. down. Using the data boxes included in "Measurement Frame 1", I converted the fractions to decimal values (use a calculator to divide the top fraction number by the one on the bottom) and input the decimal numbers into their respective boxes. For the "chord" box, the distance from the hinge

line to the trailing edge of the aileron was measured using a small inch ruler. It is important to note where the manual recommends measuring the deflections from and take all chord measurements there. By then clicking the "convert" button, the program automatically calculated and entered the degree equivalent for the surface into the appropriate target value boxes. That was very cool. Also, it's worth noting that as long as you keep the values entered for conversion in the same units, it doesn't matter if it's inches, millimeters, feet, or light years. The program can also save and recall the data you entered if you give it a name and save it to a folder on your computer.