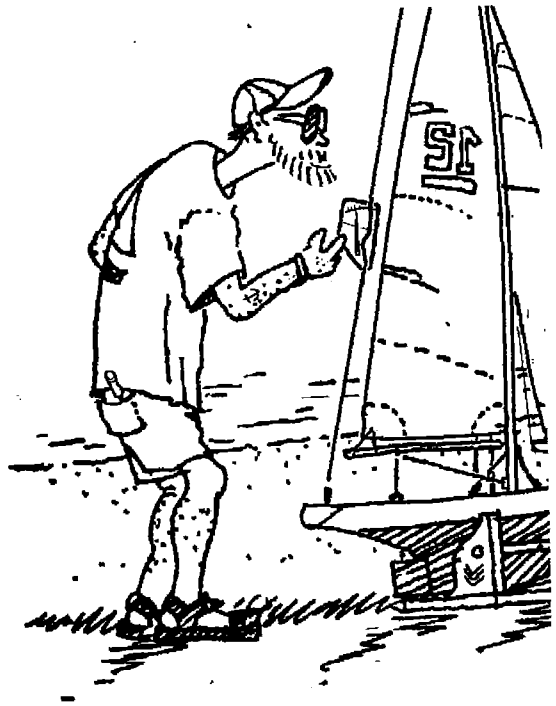
Making A Tensionometer

Measuring the tension of shrouds and stays is a basic part of big boat tuning. Many fleets have evolved to the point where exact values for various settings are recommended by the fleet to help newcomers get up to speed quickly. There are several devices on the market that make these measurements. The most common is the Loos Tension Gauge. It measures in arbitrary units, thus you will see references to setting a shroud to a certain value on the Loos Gauge. Until Larry made the first (we think) tension gauge for model yachts about three or four years ago, this important aspect of tuning had been neglected by the model yachting community. With his new device, Larry developed tuning methods that were otherwise not possible. At first there was little interest and the tension gauge (tensionometer) was regarded as an interesting oddity. However, as Bob Wells and Jerry Brower began to have success with 'tuning by the numbers' more of the local group began asking Larry to make one for them. The result was a small production run of 30, made to the drawing in **Figure 1**. These have long since been sold and since doing this sort of work is not very high on Larry's fun to do list, there are no current plans to make more. If the situation changes, it will be announced.



Using The Tensionometer

You may see a few of these tensionometers at the race site under the (tongue in cheek) name of Tune–O–Matic II by Larco. (No --- Larry is not associated in any way with Ronco or the Veg–A–Matic.) The current edition shown in **Figures 1, 2, and 3** is lighter and a little smaller than the one shown in the *EC–12 Manual*. Reducing weight is desirable because the device will hang more easily from the shrouds or stays and its own weight will not distort readings as much. A number of smaller improvements have been made too. You might be tempted to make the device out of aluminum with fancy Teflon bearings, etc. When Larry tried it, the tensionometer ended up heavier and with more stickiness in its action. We recommend that you stay with the simple but effective bearings as drawn.

Materials List

- 1/8 inch thick five ply model aircraft plywood
- 4 each - #2 brass roundhead wood screws
- 2 each - #2 nylon washers (from hardware store or hobby shop)
- 1 each - Dubro Rigging coupler and #2-56 nut
- 1 each - 3/32 long x 1/8 inch OD. section of brass tube
- 1 each - ball point pen spring
- 1 each - small cup hook
- 0.031 & 0.046 inch diameter brass rod
- 0.015 inch thick sheet styrene
- A scale that can measure one to eight pounds with an accuracy of one to two ounces.

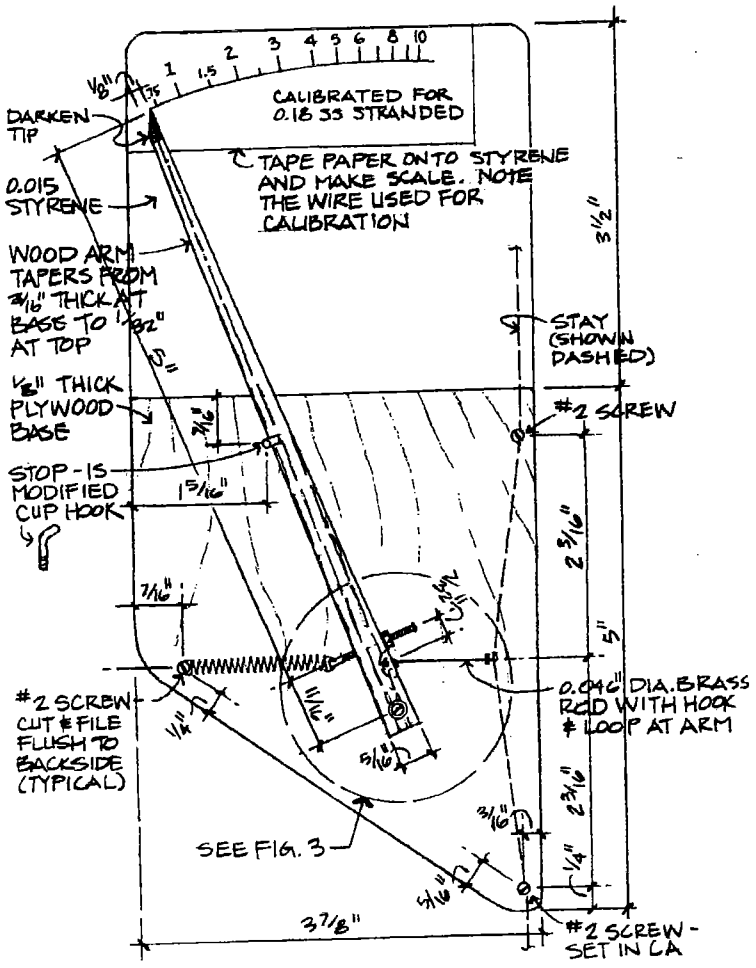
Construction

1. Begin by cutting out and sanding the base board. You may want to put a ¼ by 0.020 inch rabbet on the top of the backside to help align the plastic scale.

2. Drill the required holes as squarely a possible to the board. A drill press is recommended. We used a #56 drill bit for the #2 screws and a 0.31 inch drill for the small bale. Just use a section of the brass rod cut off with diagonal cutters for the drill if you don't have the proper size. Also drill the hole for the stop, which is made from the cup hook, cut off and bent.

Figure 1.

Model Yacht Tensionometer (Plan View)



3. Apply some sort of sealer on the board. We used several coats of Watco Natural Oil Finish.

4. Make the arm to the dimensions shown in the drawing. Use a hardwood such as oak or maple. Drill the hole at the base with a #49 drill bit. This hole must be perpendicular to the bottom side of the arm so that the arm can move freely. Use of a drill press is advised. Also drill the hole for the rigging coupler with a #46 bit.

5. Rout out the small semicircular depression in the side of the arm for the hook. We used a suitable Dremel bit for this. With very small round nose pliers, bend a loop in the end of a two or three inch length of 0.046 inch diameter brass rod. Don't bend the hook on the other end yet. Install the rod with a 0.031 inch diameter brass pin as shown in the drawing. Also install the rigging coupler with a nut threaded on.

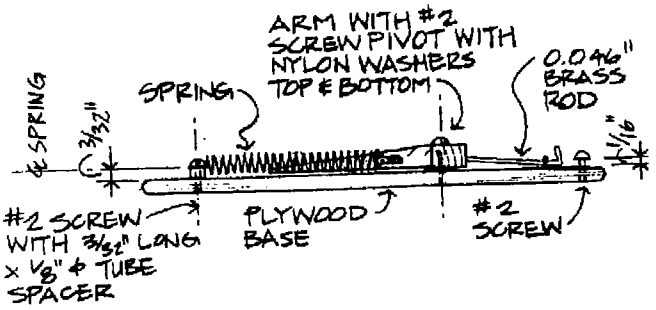
6. Bend the last turn on each end of the spring out to 90 degrees and hook the spring through the rigging coupler. (Note: you may have to adjust the length of your spring later, or try another one in order to have your instrument measure the desired range of loads. You can also move the position of the spring support which holds the end of the spring if you have to.)

7. Polish the shank of a #2 roundhead screw by thrumming. That is, coat a length of cord with abrasive such as tripoli (or even toothpaste) and pull the cord back and forth around the shank. This will make a nice bearing surface. Install the arm with this screw, using a #2 nylon washer under the screw head and between the arm and the board. You may want to substitute a shop made Teflon washer here as we did.

8. Bend the small 'U' shaped bale from 0.031 inch diameter brass rod and install over the wire in the position shown. We drill the holes a little oversize (0.035 inch) to help the CA glue penetrate. Make the bale overly long at this point, install, but glue only after bending the hook and then adjusting the height of the bale as described below. Later you can cut off the excess on the back side and file off any sharp protrusions.

Figure 2.

Model Yacht Tensionometer (End View)



9. Install the stop (made from the bent cup hook) and file off any excess on the backside of the board.

10. Install the spring support with its 3/32 x 1/8 inch OD. brass tube spacer. Hook the spring over the screw head so that the spacer holds the spring off the board.

11. Bend up the end of the 0.046 inch diameter brass rod to from a hook about 1/32 inch outside of the bale. The bend should be sharp, and the rod should be bent through about 100 degrees (10 degrees more than a right angle). See the drawing to note the relationship between the pull on the hook, the position of the arm and the location of the spring. You should have all these forces in the same plane so as not to torque the arm and cause excessive friction.

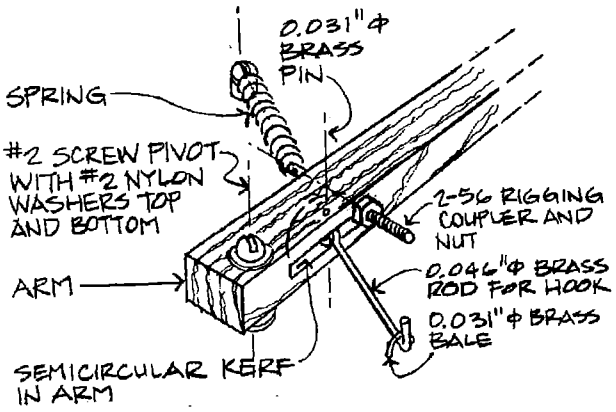
12. Cut out and install the sheet styrene scale card. We stick it on the backside with double-stick tape.

13. Carefully check to see that the arm and hook move freely without binding.

14. Begin to calibrate your scale by preparing a two or three foot section of your standard rigging wire with a loop at each end. Tie one end to the ceiling and make some sort of hook for the lower end.

Figure 3.

Model Yacht Tensionometer (Detail)



15. Using the most accurate scale available to you, fill a bucket with water or whatever until it weighs about ¾ lb. Hang the bucket from the wire and hook the tensionometer onto the wire. As shown on the drawing, the wire should pass to the right of the two screws at the right hand side of the instrument and should pass behind the hook so that the arm is pulled to the right as tension is applied. With practice you will find that you can do this with one hand.

16. Adjust the nut on the rigging coupler so that the arm just comes off the stop with the ¾ lb. load on the wire. Place a drop of glue on the nut so that the adjustment does not change. Mark the position of one side of the pointer on the sheet styrene. We like to bevel the top of the pointer so that there is no confusion about which side to read.

17. Add weight to the bucket until it weighs 1.0 lb. Hang on the wire and mark the position of the arm.

18. Add weight one pound at a time to about eight pounds, marking the scale each time.

19. Cover your scale with clear tape so that it does not get rubbed off.

20. Check the friction in your instrument by gently pulling up on the bucket, then slowly releasing the load. Check the reading. Now push the bucket down a little and slowly release. Check the reading again. The reading on our tensionometers varies by no more than 0.1 to 0.2 lbs.

We strongly recommend making some sort of box to protect this instrument in transit. Now that you have gone to the trouble of making and calibrating your own tensionometer, you don't want to break it by tossing it in the bottom of your tool box.

End

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