

# Measuring Pools for Certification and Conformance:

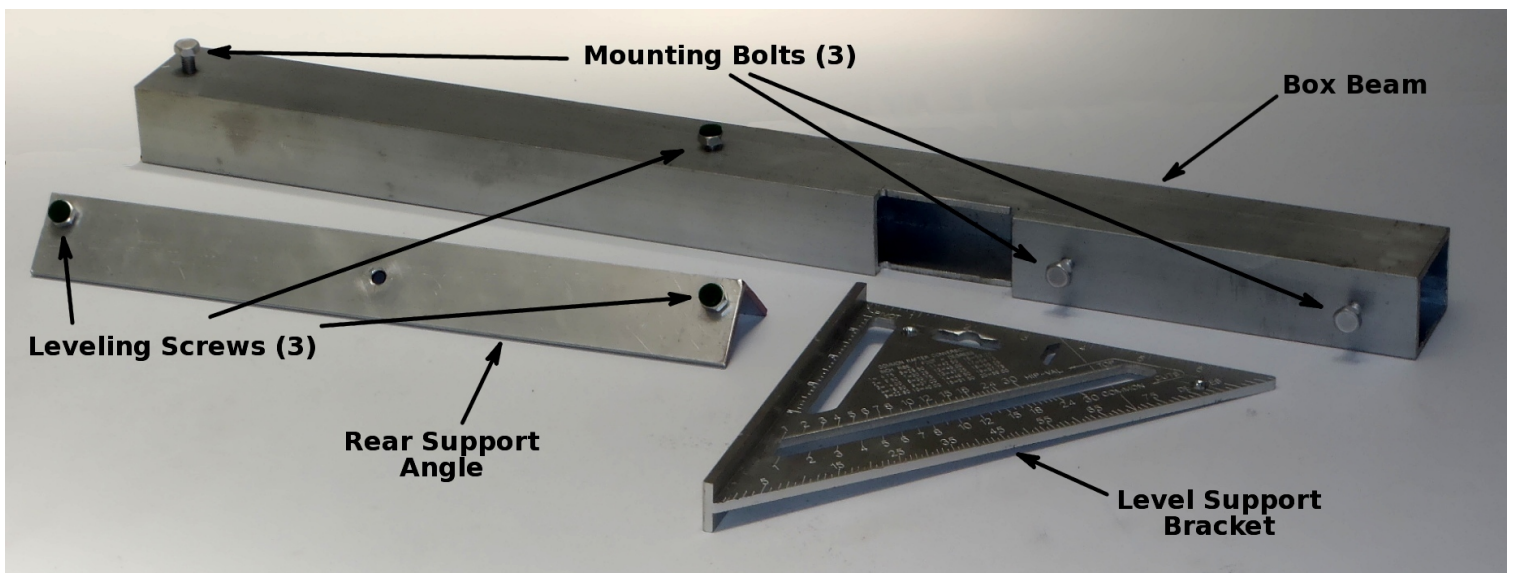
USMS rules require that for the results of a meet to be considered for a record or for top-ten placing, the pool must measure at least as long as 25 yards, 25 meters or 50 meters. Measurements must include (or allow for) any timing touch pads in place during the competition.

The rules allow measurements to be made with a simple steel tape, but the procedure (to correct for tape tension, stretch, sag, temperature, etc.) is quite complex and error prone. Alternatively, the measurements may be made with a sufficiently-accurate laser rangefinder. Although still quite tedious, such measurements are much simpler. No complicated corrections are required; the measurements are read directly from the display of the instrument.

The Florida LMSC has commissioned such an apparatus, and it is available for any sponsoring club to make the measurements required to certify or verify a pool for competition. Contact the Chair to make arrangements.

The measuring apparatus consists of several components:

- Two high-precision aluminum levels, used as reference points for the measurement.
- A matte target to be affixed to one of the reference levels.
- A high-precision laser rangefinder, placed against the other reference level to measure the distance to the target.
- Two fixtures to help hold the reference levels plumb while you make your measurements.
- A set of three clamps to hold the reference levels in the fixtures and the target against its level.
- Two thin-bladed screwdrivers to adjust the fixtures so the levels are plumb.

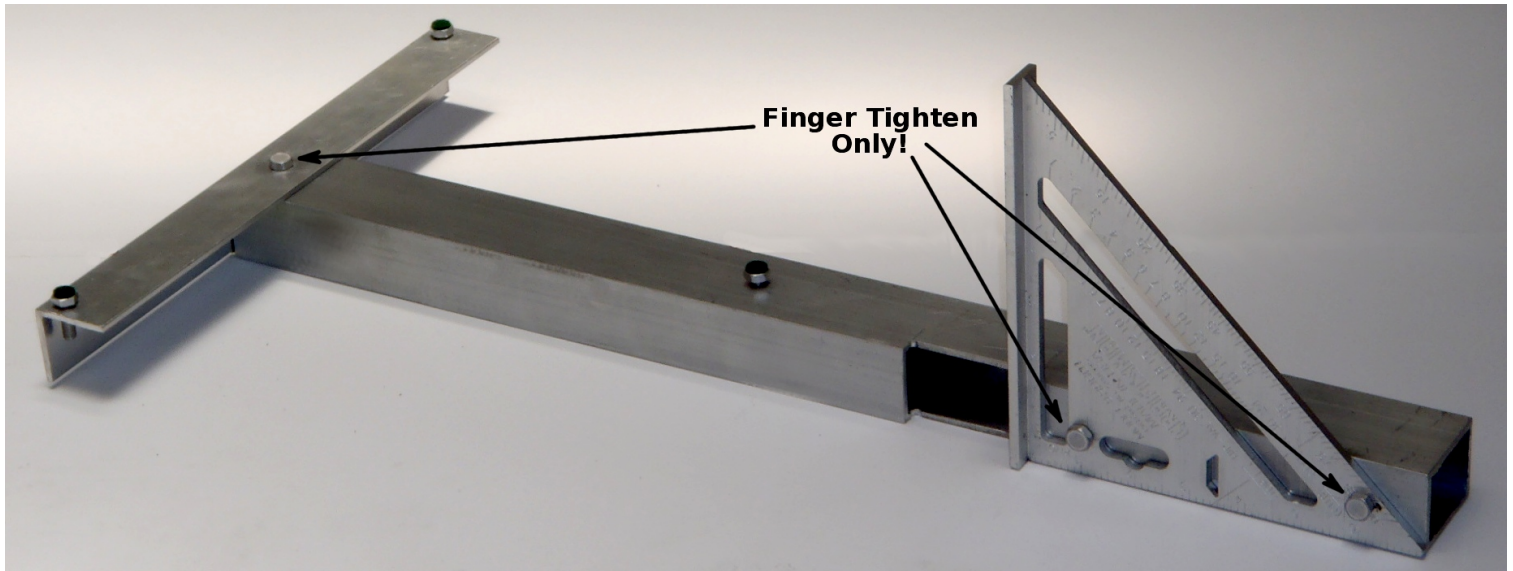


*Illustration 1: Disassembled fixture.*

**Step 1: Unpack the fixture hardware. Make sure no mounting or leveling bolts are missing. Remove the mounting bolts, and use them to mount the rear supports and angle brackets to the box beams as shown**

below.

**CAUTION:** *Don't use tools to tighten the bolts.*



*Illustration 2: Assembled fixture, shown here upside down.*

**NOTE:** For corrosion resistance, the fixtures are fabricated from aluminum, and the hardware won't withstand much abuse. A little slop is acceptable. The accuracy of the measurement depends only on the precision of the levels and the laser. The fixtures' integrity is of no practical importance.

**Step 2 (optional):** Place the fixtures in position at the ends of the first lane to be measured. Make sure the level support brackets overhang the pool edge. Place the levels atop the fixtures and adjust the leveling screws so the beams are approximately level.

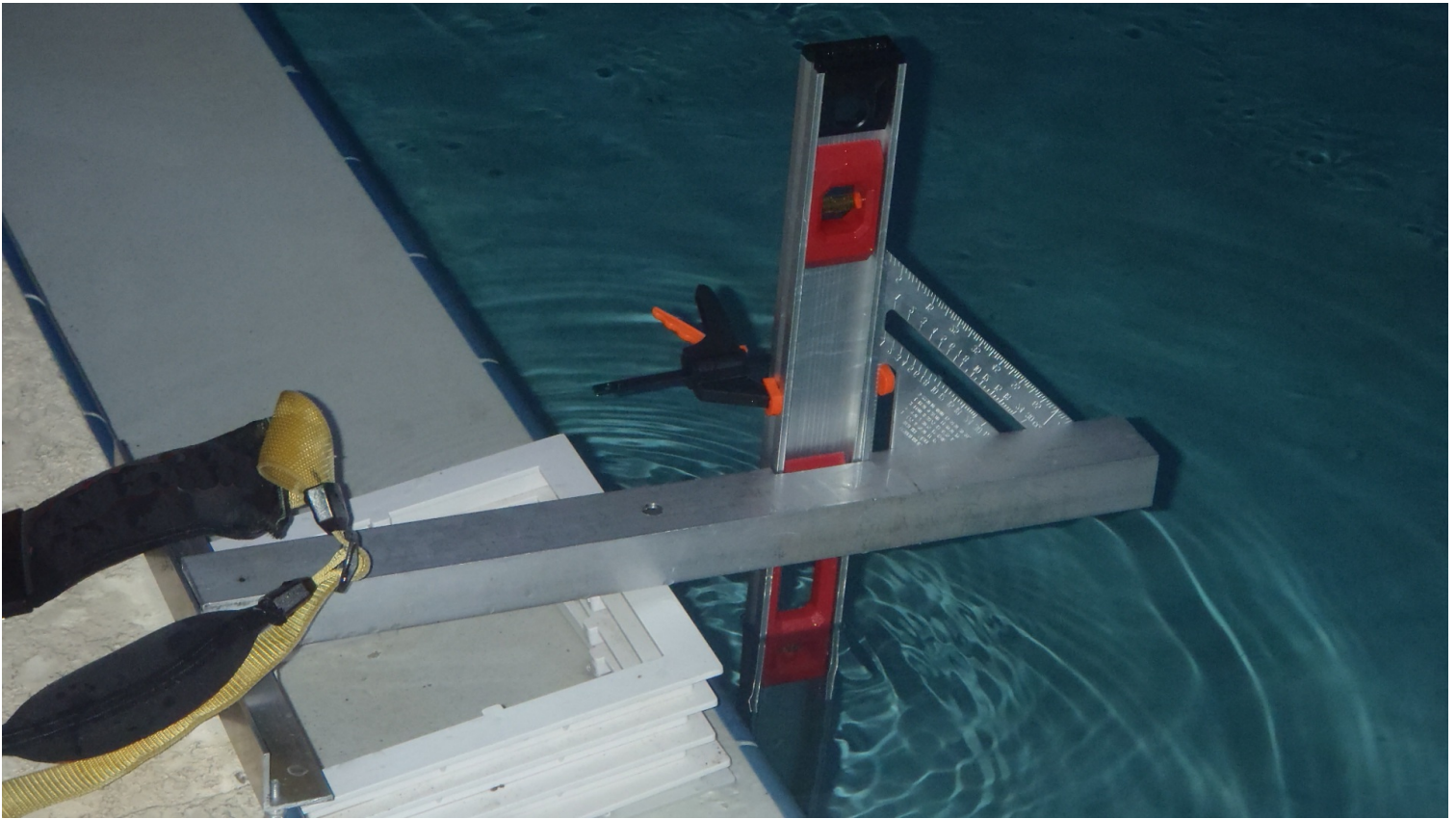
Don't work too hard at it. You'll still need to make fine readjustments to plumb the levels before each measurement is made.



*Illustration 3: Waterline is between level vial and handling slot.*

USMS/USS/FINA rules require the precision levels be suspended so that 800 millimeters of their length is beneath the surface of the water. For the Craftsman™ units chosen for this apparatus, one plumb vial and both level vials will be submerged.

**Step 3:** Clamp the levels vertically into the fixtures. Position them so the first 80 centimeters is submerged and the water comes to the level shown in Illustration 3, above.

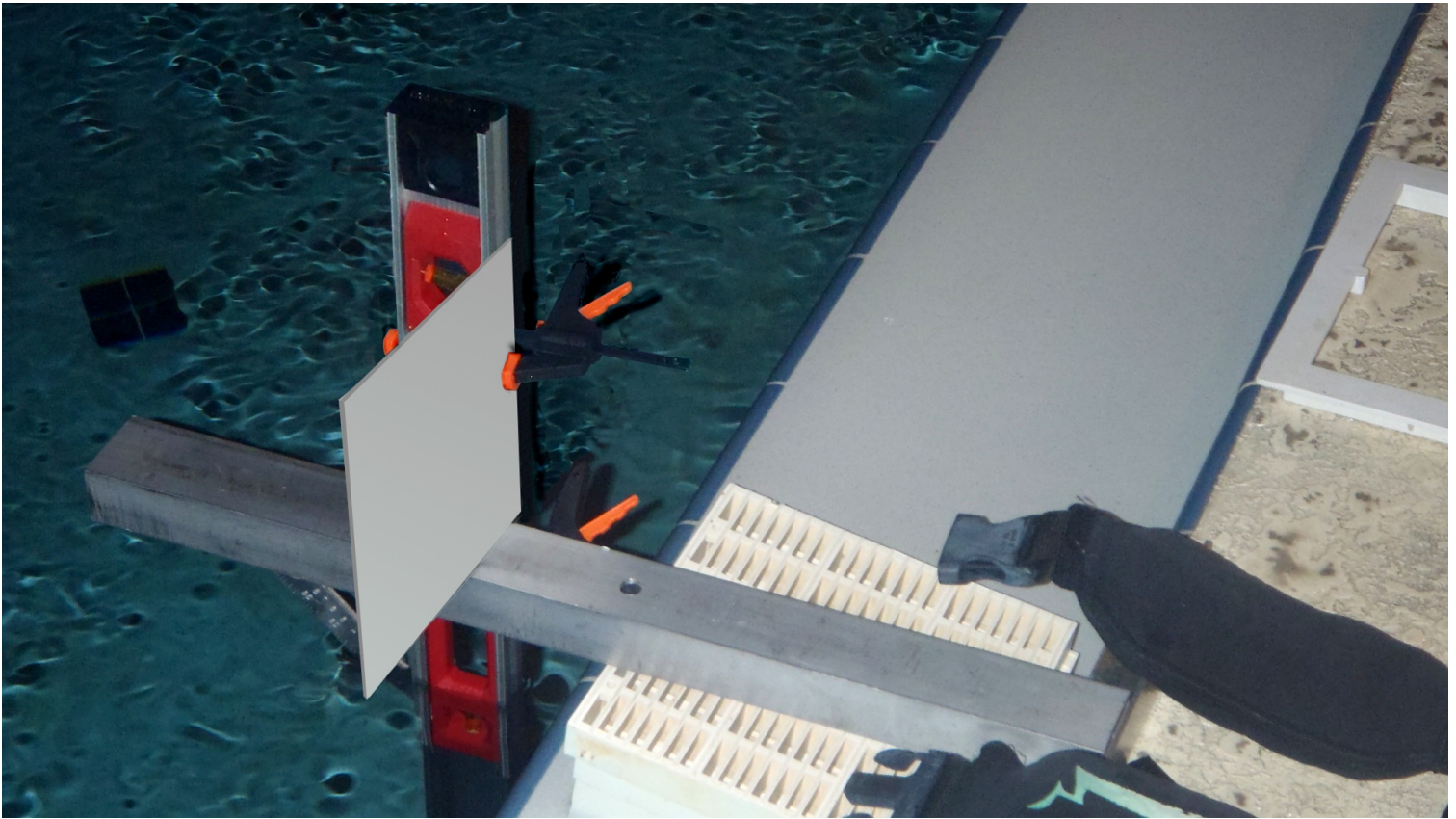


*Illustration 4: Level clamped at proper depth and ready for final plumb adjustment.*

The fixture is designed to handle FINA-recommended gutters. For older pools with nonstandard gutters, some ingenuity and jury rigging will almost certainly be necessary.

Illustration 4 shows old pool grating components pressed into service to plumb the reference level. The assembly is nose heavy, and the diver's weights were needed to prevent the whole assembly from toppling into the water. Because the gutter is so low, the level-support bracket has been flipped to keep the steel clamp well clear of the water.

**Step 4: Clamp the target to the furthest face of one of the levels so that it extends upward from the top surface of the box beam.**



*Illustration 5: Target clamped into position at far end of lane.*

**Step 5: Carefully position the fixtures and adjust the leveling screws so that the levels are in contact with the pool wall and the bubbles in the plumb vials are exactly centered between the lines.**



*Illustration 6: A pool wall that is far from plumb. At the surface, there's a one-inch gap between the reference level and the lip of the pool! After adjusting to plumb, the level only touches the wall at its deepest extreme.*

### *How many measurements must I make?*

When the pool is initially certified, two measurements should be made for each lane. Suggested measurement locations are either:

1. the two outer edges of the turn T on each side of the lane center line (as shown in Illustration 6) **-or-**
2. the center of each lane, next to each lane line, and next to the walls in the outermost lanes.

Obviously, the first alternative requires one less measurement than the second.

### *What about pools with movable bulkheads?*

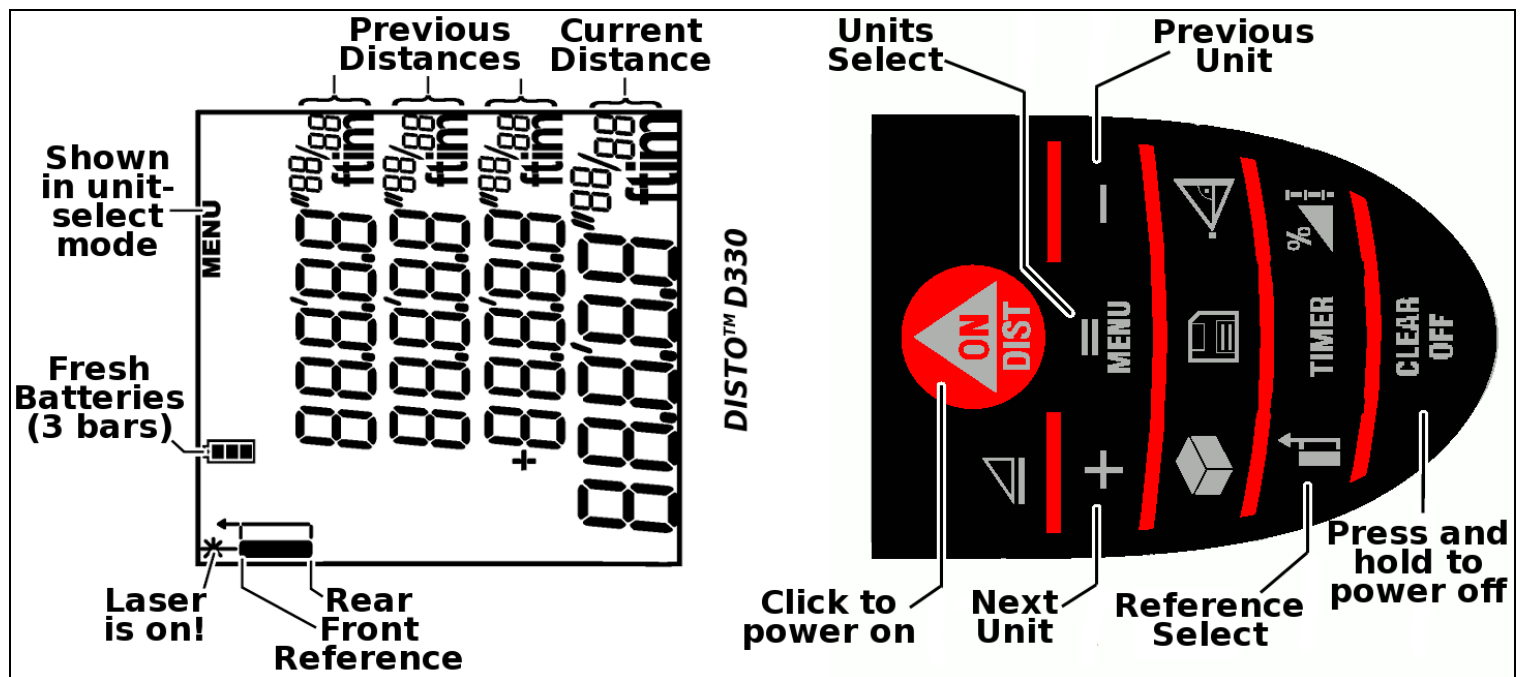
Current USMS rules require the length of certified, movable-bulkhead pools be “verified before and after each session. 'Pool Length Certification Forms' from each session must be included with any

*USMS record application and with results sent to the LMSC Top Ten Recorder.”*

Fortunately, only three measurements are required: the two outside lanes and (one of) the middle lane(s). Presumably, these measurements are compared against those made when the pool was certified, and any major discrepancy might cause the results to be rejected for consideration.

Repeated measurements are best done with at least two people. The assistant moves the target to its next position and adjusts the fixture if necessary. The supervisor handles the same task at the laser end, but also makes and records each measurement.

**Caution:** *If you're not careful, the Laser Rangefinder will blind you, your assistants and/or innocent bystanders! Be careful around airports. It's a Federal offense to dazzle pilots with the beam.*

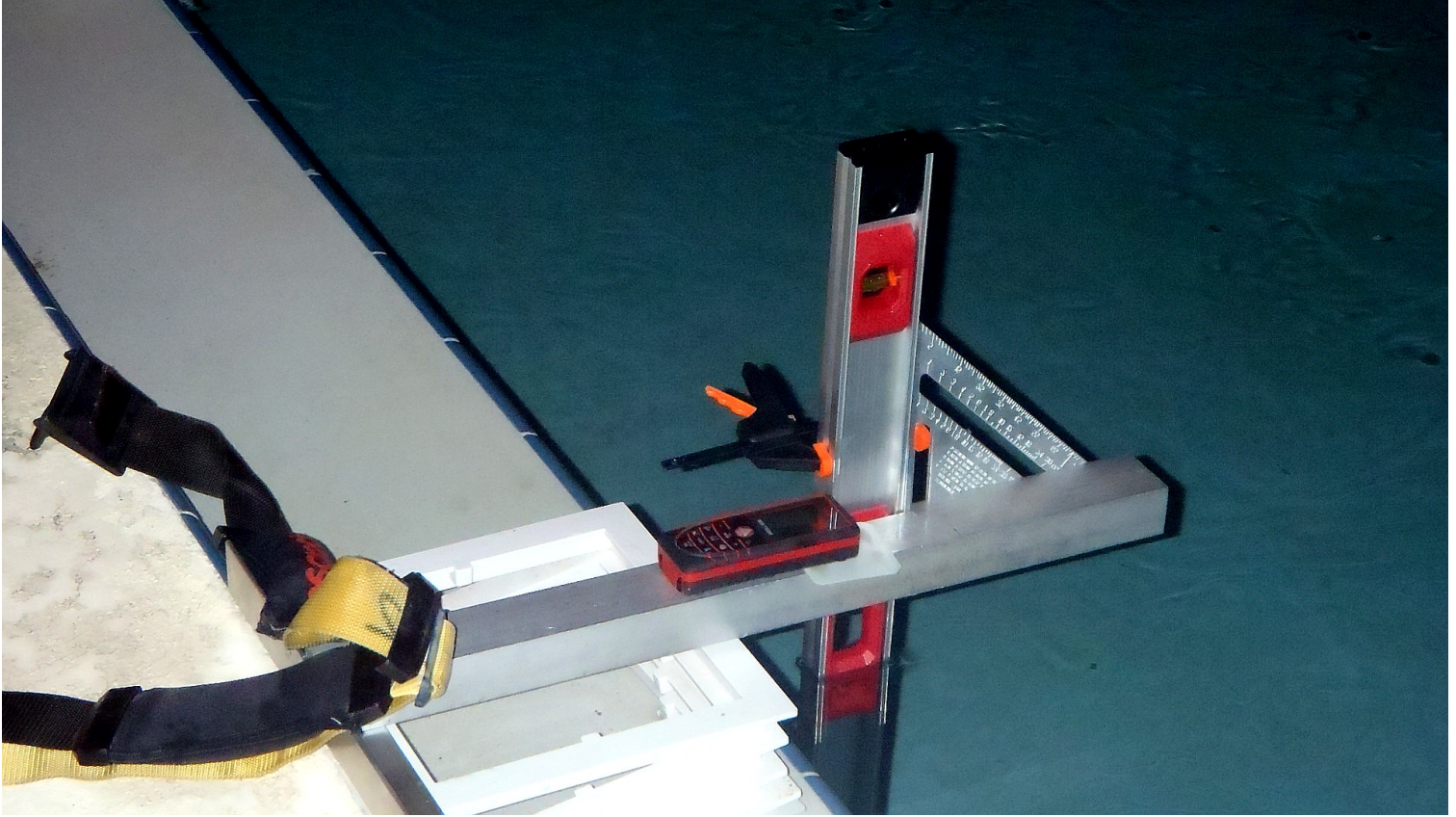


*Illustration 7: The Leica D330 Laser Rangefinder – Display and Keypad.*

**Step 6: Prepare the rangefinder to make your measurements. See Illustration 7, above:**

- Remove the rangefinder from its case and secure the lanyard around your wrist. ***This unit is not water-tight!*** If you drop the unit into the pool, be prepared to follow it and remain at least until rigor mortis sets in.
- Point the business end in a safe direction and click the **ON/DIST** button to power up the unit. ***The laser will be on; watch your eyes!***
- While the laser is lit, check the batteries are fresh, and replace them if they aren't. See appendix.
- Click the **CLEAR/OFF** button to turn off the laser.
- Press and hold*** the **=/MENU** button until **unit** and **MENU** appear on the display. Click **+** and **-** to select the units you want to use. Feet-inches-1/32in, 0.01inch, or meters-millimeters-1/10mm are all reasonable choices. Press and hold the **=/MENU** button again until **MENU** disappears from the display. The laser should still be off.

- f. **IMPORTANT: Press and hold** the **Reference Select** button until the front reference is selected. Failure to do this will cause your measurements to be in error by 5 inches (the length of the rangefinder case). **Don't just click the button!** Clicking also sets the reference, but the setting will not persist past your first measurement. The unit is now ready to make the first measurement.
- g. Optional: If you foul up, Press and hold the **CLEAR/OFF** button to turn the unit off, and then start fresh.



*Illustration 8: Laser in place (but where is the lanyard and operator's wrist?!). Shim visible beneath laser.*

### **Step 7: Measure the lane:**

- a. Position the rangefinder atop the beam with its front edge in contact with the level face as shown in illustration 8.
- b. Alert your assistants to shield their eyes, and click ON/DIST to activate the laser. Aim the beam at the interior of the target.
- c. Click **ON/DIST** to freeze the measurement and extinguish the laser. Record the measurement on the prescribed form.

### **NOTES:**

- 1. 50-meter pools are best measured at dusk when the laser spot is easier to see.
- 2. Credit cards make great shims to correct for fabrication tolerance.

**Step 8: Repeat steps 5 and 7 to perform the rest of the required measurements.**

**Step 9: The hard part is over! Disassemble, dry and pack up apparatus in consideration of the next user.**

- a. **Press and hold the **CLEAR/OFF**** button on the laser to turn it off, and return the unit to its soft case.
- b. Towel-dry the levels, box beams, support angles and brackets.
- c. Stow the aluminum assembly bolts in the main box beam. See Illustration 1 to make sure you haven't lost one.

## Appendix: Replacing the Batteries

