# RIVER COURSE STREAMFLOW METERS – CALIBRATION AND CONSTRUCTION

## Calibration

The meter uses a bicycle speedometer to directly read the instant and average velocities of the flow. It must be calibrated using a known velocity determined with another meter or float.

The speedometer is calibrated by adjusting the “wheel size” constant in the setup menu. The constant in an Avocet speedometer is accessed by pressing and holding both buttons for 10 sec. When km are selected as the distance units, the default constant is 2086.

For example, if the measured velocity is 1.40 m/sec and the speedometer reading is 2.65 m/sec, the constant should be changed to:

(1.40 / 2.65) 2086 = 1102

This is approximately the value for a propeller with a magnet attached to only one blade. The adjustment is linear throughout the velocity range.

The velocity in m/sec can be read directly but **the correct decimal place is one place to the left of that shown on the LCD screen**. The correct position should be marked on the surface of the screen with a waterproof pen to avoid confusion as shown. The average velocity shown is 0.82 m/sec.


In all stream metering regardless of the meter used the velocity readings should be confirmed by measuring the time a surface float (tree branch, orange, ball of paper etc.) takes to travel over a known length passing through the metering section.

**Construction**

Components:

- bicycle speedometer (Avocet 35 or more)
- ½" x 1¼" x 1¼" PVC tee
- ½" x ½" x ½" PVC tee
- length of ½" PVC pipe (24" to 48")
- ½" length of 1" copper pipe
- 2½" of 1/8" brass rod
- 1/8" acorn nut or cap screw
- 1/8" brass washer
- 1¼" to 1½" model boat propeller -1/8" shaft
- 1/8" d x 1/16" earth magnet

Trim the 1¼" ends of the tee flush with the outside diameter of the ½" fitting and round all edges with a file or router. Reduce the outside diameter of the ½" fitting until the 1" copper pipe slides snugly over it and rests on the top of the 1¼" fitting. .


Insert 1½" of the brass rod in a wooden block and bend it to 90°. Thread the short end so that the acorn nut can be fully threaded on the shaft. Solder the 1/8" washer on the shaft 5/8" from the threaded end. Solder the long end of the rod to the outside of the copper pipe aligning the ends of the pipe and rod.

File or bore out the centre hole of the propeller to 5/32". Trim the hub to 3/8" long. Epoxy the earth magnet to the front of one blade. Slide the pipe and shaft assembly onto the trimmed PVC tee and mount the propeller with the magnet facing inwards. Adjust the axle so the propeller runs freely in the centre of the tee.

Trim the PVC pipe to the maximum measurement depth plus 12" and attach the ½" tee. Mount the speedometer on one arm of the tee using the handlebar clip and run the sensor wire up the pipe to the clip. Epoxy the sensor in the end of the pipe and insert it into the 11/4" tee until the clearance between the sensor and propeller is less than 3/16". Test the meter and then glue or setscrew the tees to the pipe. Mark the proper decimal place on the speedometer face and calibrate the meter.

## BUILDING A 3D TOPOGRAPHIC MODEL FROM A CONTOUR MAP

1. Obtain contour maps sheets for the area of interest. National Topographic Survey maps are available at 1:50,000, 1:250,000, and 1:500,000 scales for areas. Smaller scale maps are often available from local agencies, forestry managers, community water suppliers, etc. Join sheets as needed to cover the area using 2-sided tape or a thin mixture of white glue. Trim any excess underlying the joined sheets.

2. Draw in the area of the model (including the drainage basin boundaries if required) with a soft pencil that can be erased easily from the map surface. If this is the only copy of the map, obtain any particular data that are required while the map will sit flat on a table. For example, the area of a drainage basin, stream channel orders, or the long profile of a river and tributaries. The long profile may be obtained by marking the contour crossings on the edge of a scrap of paper and transferring the distances to a graph sheet.

3. Mark in the topographic model boundaries. Include all points of interest and the drainage basin boundaries. It is often useful to extend the model enough to include local landmarks (towns, mountain peaks, shorelines, etc.).

4. Cut out the model area. Set aside the map scale bars, title blocks, and legends for use later.

5. Prepare foam core (also called foam poster board) or cardboard platforms the same size as the model area for at least 3/4 of the contour levels that will be cut out.

6. Select the contour that will best reflect the topography, viz. working from the ocean level upwards, or a lake level, or from the mountain peaks. For an undistorted model (distorted vertical models are also useful) measure the thickness of the platform using the map scale bar units or calculate it from the map scale. This is the contour interval for an undistorted model. For example, for an undistorted model using 1/8" foam core (3.2 mm), the model contour interval should be 2600 ft (800 m approx) at the 1:250,000 scale NTS map, 520 ft (160 m approx) at the 1:50,000 scale map, and 210 ft (app. 64 m) at the 1:20,000 scale map. Mark in the contours to be cut with a soft pencil that is easily erased from the surface,

7. Spray glue the map to a platform covering both sides and allowing them to dry with contact cement. When they are both dry to the touch, carefully roll the map sheet onto the platform, smoothing it out and away from the centre of the sheet. A roller may be used to smooth out wrinkles and firmly press down the map.

8. Connect a blank platform to the bottom of the map platform with easily removed masking or post-it tape using small tabs of tape along the edges of the boards. Be sure to have at least one tape connecting each contour section.

9. Cut the lowest contour out following the penciled line with a narrow knife, a hand fret saw or a power fret saw. Spiral saw blades will make the job easier as they will cut in all directions without turning the map.

10. Separate the contour areas and clean the saw debris from the cut edges with a soft brush. Remove the pencil guidelines that were not cut out by the saw kerf with a soft eraser.

11. Separate the two platforms and place the map platform with the next lowest contour to be cut on a new blank platform. Discard the platform underlying the contour just cut.

12. Place the map contour portion just cut on a base platform and fit it snugly to the underlying blank portion of the next lowest contour. This will form the base for the model.

13. Tape the remaining sections to a new platform and cut out the next lowest contour level.

14. Repeat steps 11 to 16 until there are no remaining contours. Discarded scraps may be used for underlying platform at higher contour levels as the areas decrease.

15. Assemble all layers on the base platform. Clean each contour layer and either glue all layers to the base platform, or, attach each layer with tape on the underside to allow the model to be disassembled at each layer.

16. After the glue has dried, trim the model sides with a sharp utility blade or a sanding block to align the layer edges. Check the contour layers for remaining guidelines, bits of tape or glue remnants..

17. Mount the scale bar and titles from the original topographic maps on the back of the model and note the model contour intervals. A cover may be made using a spare platform and scrap bits to protect the surface.