

## Instructions for Construction of Soil MFC Prototypes:

1. First put the TEROS 12 sensor into the PVC pipe and feed its cable through the lower hole of the pipe. Ensure that the spikes of TEROS 12 are pointing up and that the sensor is relatively centered in the middle of the pipe. The smaller hole on the PVC pipe should be toward the bottom of the cell (see Figure 1)



Figure 1: Orientation of PVC pipe with test cap on the side closer to small hole

2. Prepare a bucket of your soil sample by fully saturating it with water (ideally dechlorinated) until it has the consistency of mud (very wet but not "soupy"). See Figure 2 for an example of what the soil texture should be.



Figure 2: Soil slurry

3. Close the bottom of the pipe with the test cap and pack it with enough soil so that the distance between the soil line and the top of the cell is 7.5 cm. Make sure to press down on the soil to push out air bubbles and pack it down. Drain any excess water.
4. Glue the carbon felt ring to the top rim of the PVC pipe with your adhesive of choice so that the diameter of its opening is now reduced.
5. Cut an appropriately long piece of wire from the reel (exact length depends on how much wire you need to connect the cell to a load, but the wire should be at least 20 cm long to be long enough to extend beyond the top of the PVC pipe).
6. Connecting the anode
  - a. To construct the carbon-carbon cells (a total of 4 cells). Strip one end of the copper wire for about 12.5 cm and insert it horizontally into the side of one of the circular carbon felt disks (this serves as the anode). The wire should be parallel with the face of the disk, not perpendicular. It's okay if the wire pokes out of the carbon felt, but enough of the wire should be in direct contact with the felt to ensure good conductivity. Lay the carbon felt disk with the wire inserted flat onto the soil and bend the wire 90 degrees so that the wire extending beyond the disk is now perpendicular with the soil line (see Figure 3).



Figure 3: Carbon disk lying flat on the soil layer

- b. To construct the copper-carbon cells (a total of 4 cells). Strip one end of the copper wire for about 5 cm and solder it onto one of the copper disks (this serves as the anode). Lay the stripped wire across the face of the wire instead of just touch the end to the side to ensure good conductivity. Lay the copper disk flat onto the soil and bend the wire 90 degrees so that the wire extending beyond the disk is now perpendicular with the soil line (see Figure 4).



Figure 4: Copper disk lying flat on soil layer

7. Feed the other end of the wire through one of the two small holes on the circular portion of the wire mesh (not through the rectangular flaps) (see Figure 5).

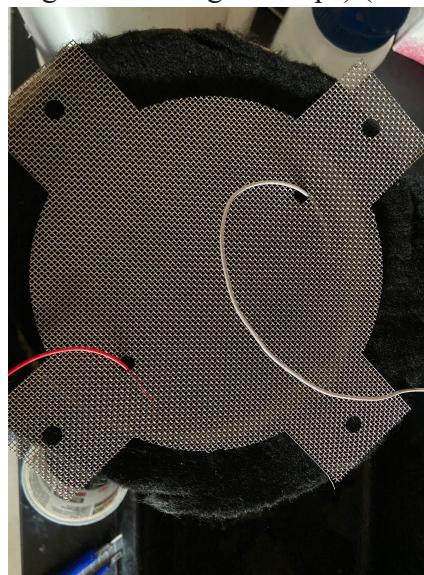


Figure 5: Wires from electrodes extending through wire mesh

8. Pack more soil into the pipe just like Step 3 until the soil line is only 2 cm below the top rim of the pipe.
9. To install the cathode (carbon felt), repeat step 5 and 6a, but this time feed the wire through the other small hole on the circular portion of the wire mesh.
10. Put the circular wire mesh (this should now have two wires going through it) flat over the carbon felt ring on the top of the pipe and align the 4 rectangular flaps with the 4 holes

near the top rim of the PVC pipe. Secure the mesh with screws through each of the 4 holes.

11. Plug the port (large hole) near the middle of the pipe to prevent water/soil from leaking out, and seal the port the TEROS 12 sensor cable is going through with a sealant of your choice (silicone, hot glue, etc.).
12. Monitor and maintain desired soil moisture over time.