Lawrence Livermore National Laboratory (LLNL) Flux Chamber Modifications

Stan Martins, LLNL

Three flux chambers were constructed at LLNL using the basic EPA design as described by Kinbush (1985). These chambers were modified to provide more reliable data with lower detection limits and quicker sample rates.

- In the EPA design, air within the chamber is stirred by the sweep air, which is emitted from a ring of perforated tubing affixed to the side of the chamber just under the dome. This method requires sweep air rates of about 5 L/min to achieve gas equilibrium in about 60 minutes.

  The LLNL chambers are fitted with a variable speed fan suspended from the dome to circulate air inside the chamber (Figures 1 and 2). Because this fan mixes the chamber air far better than the sweep air by itself, sweep-air flow rates can be reduced to 3 L/min and samples can be taken at about 35 minutes after the sweep air is started. This cuts sample times by about 25 minutes.

  Because sweep air rates in LLNL chambers are lower than with the EPA design, soil emission concentrations in the LLNL chambers will always be greater than in EPA style chambers. A higher vapor concentration results in lower detection limits.

- In the EPA design, a hand held thermocouple is used to measure chamber temperature. Because there is no solar shading for this instrument, chamber temperature measurements are almost always higher than the actual air temperature in the chamber.

  Temperatures in LLNL chambers are measured with thermistors that are permanently mounted in the chamber inside an aspirated solar shield. Because air is pulled past the sensor by the internal fan, air temperature measurements are more representative of the internal chamber temperature.

- In the EPA design, sweep air is forced into the chamber at 5 L/min. Because there is no prevision made to equalize the internal chamber pressure to ambient air pressure, the chamber can become pressurized. This can cause a reduction in apparent surface flux rate.

  Air is removed from the LLNL chambers at the same rate at which it is added. This results in a pressure drop of zero between the inside of the chamber and the outside air. Because the pressure drop is zero, more representative flux rates are achieved.

Flux Chamber Physical Characteristics

	Volume	Height	Diameter	Area
Chamber	L	m	m	m^2
1	26.4	0.178	0.394	0.1219
2	27.3	0.178	0.394	0.1219
3	26.9	0.178	0.394	0.1219

Flux Chamber Temperature Calibration

Unit	Internal Thermistor	Omega Thermocouple	Mercury Thermometer
1	22.0	22.0	22.0
	33.7	33.5	33.6
	35.6	35.6	35.6
2	22.8	22.9	22.9
	30.5	30.4	30.5
	33.4	33.4	33.4
3	21.0	21.2	21.1
	32.3	32.2	32.2
	35.7	35.6	35.2

REFERENCES

Kinbush, M. (1985), *Measurement of Gaseous Emissions Rates from Land Surfaces Using an Emission Isolation Flux Chamber: User's Guide*, EPA User's Guide, Contract No. 68-02-03389-WA18.

This work was performed under the auspices of the U.S. Department of Energy by University of California Lawrence Livermore National Laboratory under contract No. W-7405-Eng-48. (UCRL-JC-137682)

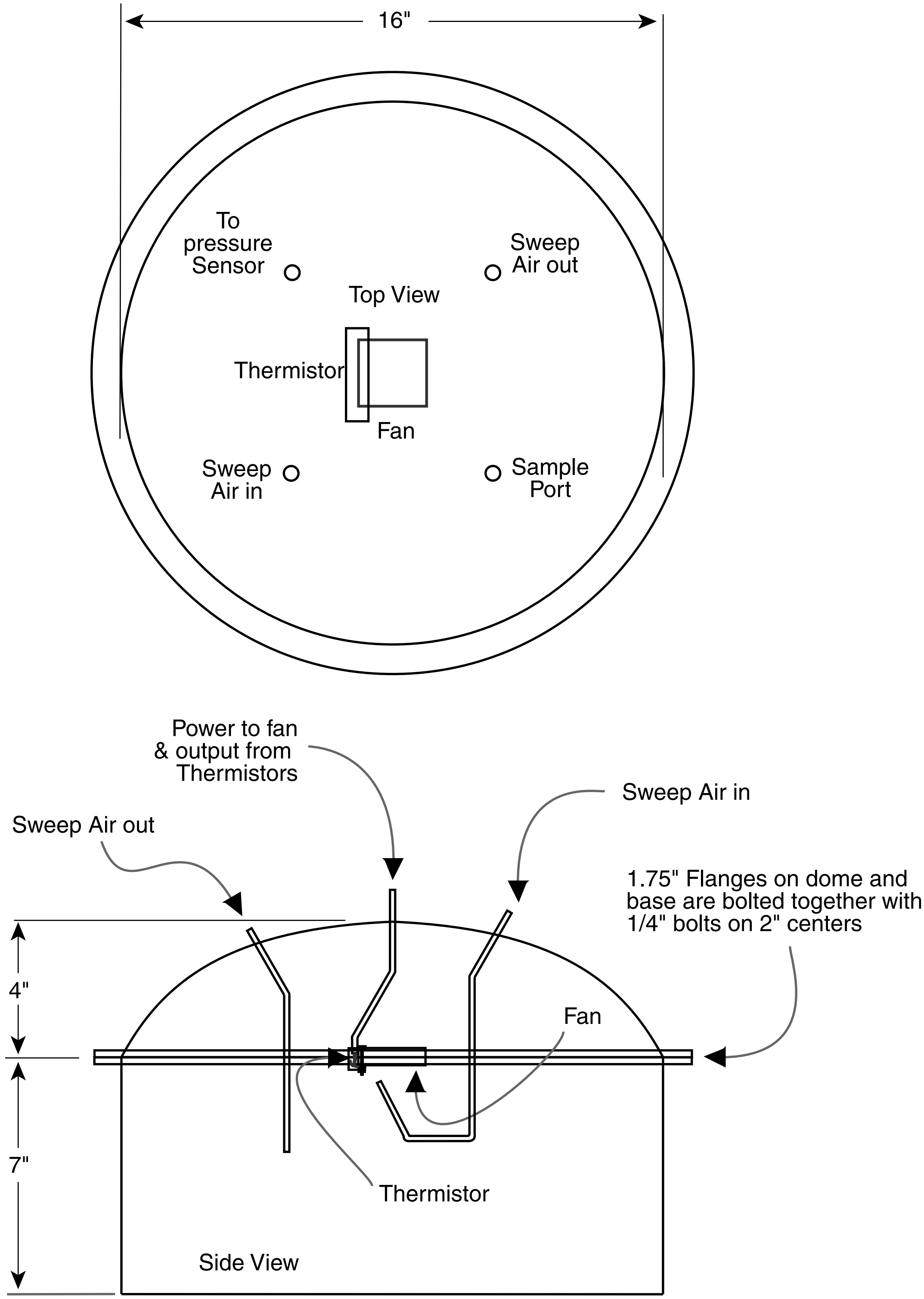

Figure 1: Soil surface flux chamber schematic.

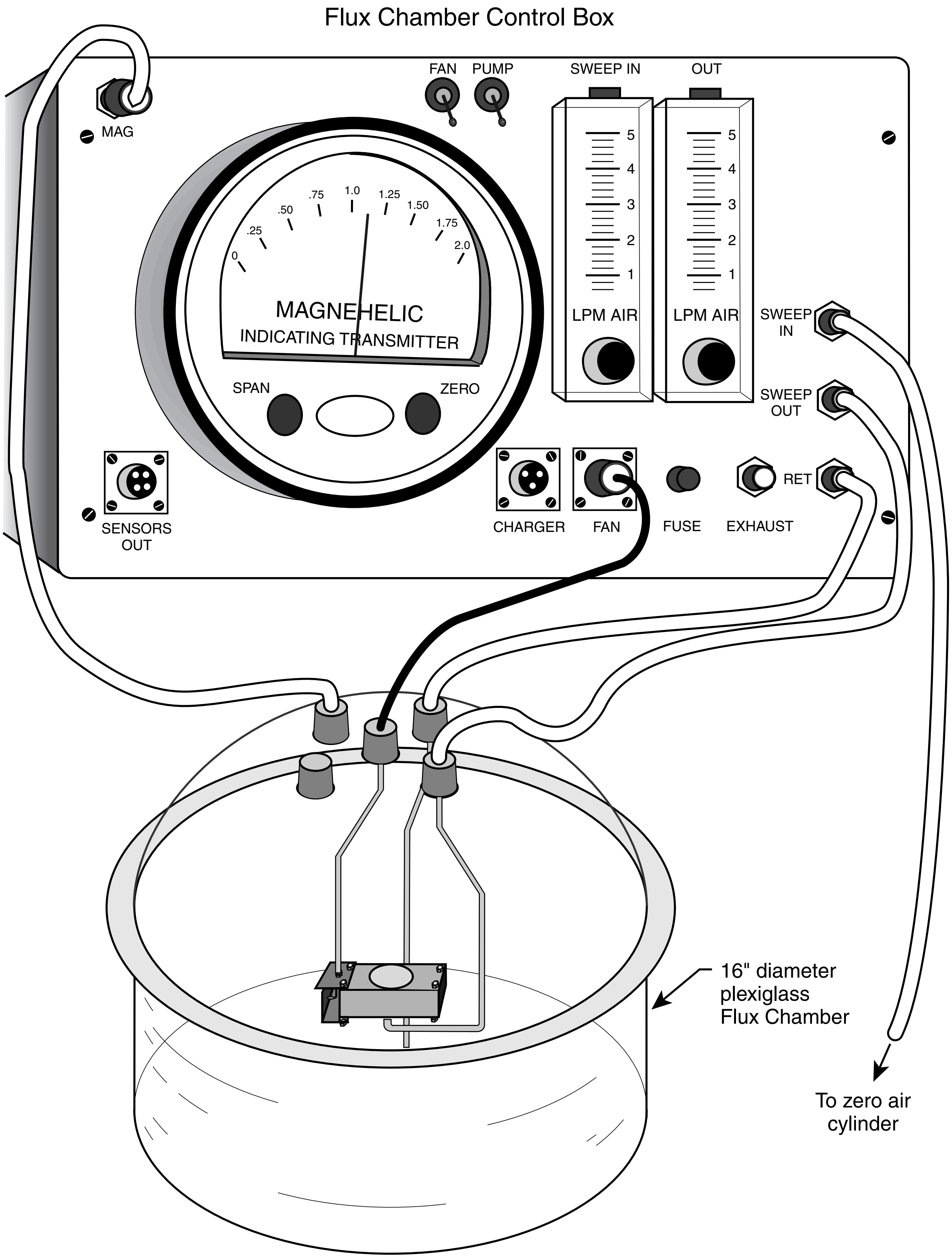

Figure 2: Soil surface flux chamber connections.