

Car-top Array

Cornell University Bioacoustics Program

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1. Overview

The array is made up of 2 linear arrays of 4 elements each, one on each side of the car. Each of the 4 elements in each array are separated by 80 cm, while the 2 arrays are separated by 1 meter. This provides a resolution of 413Hz and 331Hz respectively. The array (and its elements) are weather resistant, and are designed to work in all weather conditions.

Each element within the array is powered by its own 9-volt battery. This battery is accessed by removing the lid from the top of the element (it pulls off). The power to an element is turned on when the protective cap is removed (and turned off when replaced). The element is omnidirectional, with a sensitivity of -42dB re 1V/Pa. Each element drives a 20' RG-174 coaxial cable that can be connected directly into a recorder, or into a gain block such as that provided.

The Amplifier unit is a low noise, variable gain circuit, single-voltage, single-ended input designed for use with this array. It runs off of the vehicle's 12 VDC battery, as supplied through the cigarette lighter. The gain can be set to x1, x10, x100, or ~x200 by opening the cover and changing the switch settings internally. The amplifier unit has an internal automotive filter to isolate typical electrical noise found in an automobile.

2. Fabrication

Fabricate the circuits per the schematics, preparing the applicable enclosure for the array amplifier (including jacks, etc.).

Fabricate the array base per the drawings attached. When gluing the pieces, ensure a solid glue joint, using plenty of cement to provide a little more time to position the pieces being glued.

Fabricate the elements per the diagram. When complete, mount the microphones, circuits, and batteries. Test each unit, then mount it onto the array after threading the wire through the array base.

Before going off into the field, measure the array spacing to use later in acoustic locations.

3. Usage

The array is designed to fit on top of a car or van, or on the bed of a pickup. The base of the array is intended to be used to tie down the array. Cables for each of the array groups are routed out of the respective sides -- these should be routed into the vehicle at the closest entry point (e.g. a window).

Inside the vehicle, the amplifier unit and recorder should be setup and powered (by the vehicle's power). Each element cable is then connected to an amplifier input position, with the amplifier output being connected to the recorder. The recorder should employ an automotive filter to prevent its noise from affecting the amplifier unit.

In your documentation, note which element is located where, the amplifier unit's gain setting, the recorder's specifics, and the weather conditions (e.g. windy/calm, etc.).

When you are ready to start recording, pull off the protective caps from each element. (this turns on the microphone). When you are finished (before you drive away), please remember to place the protective caps back on. This will also prolong the battery life.

If you are wishing to do locations and source level measurements of the acoustics recorded, you may want to contact us for a copy of Canary.

4. Maintenance & Repair

4.1. Replacing elements

Spare elements should be provided should one need to be replaced. The following steps will guide you through the element replacement process. These steps assume you have already identified the faulty element.

1. Tie a string (~10' long) to the BNC connector of the element. Secure the other end of the string to the array frame.
2. Locating the element, grasp it by the base and unscrew it (never grasp it by the grey supports or upper section!), pulling the string through with the cable.
3. Untie the string from the faulty element and then tie it to the new element's BNC.
4. Taking the end of the string tied to the array frame, begin pulling it (and the element's cable) until you have pulled all of the cable's slack through.

5. Screw on the new element. If available, a non-petroleum lubricant such as plumber's grease can be used.

5. Precautions and Notes

1. The array is not meant to be used (for recording) while driving, due to the vibrational noise, etc.
2. When in transit between research areas, the element caps should be in place to protect the elements and to turn off the battery.
3. When parked the engine, radio, fan, etc. can all be picked up by the array so they should be shut off.
4. Should an element begin to sound distorted, it is most likely because the battery is weak. Replace the battery with a fresh one.
- ** 5. Under windy conditions, you may want to try using nylon stockings (Lady's panty hose), slipping sections over the center area of each element.
6. If constant noise is found in your recordings, you may have to isolate the amplifier and recorder further by employing separate batteries for each.
7. If an element is not functioning, first check to ensure that the microswitch on the side of the element is not jammed (e.g. by the rubber shroud over it). One way to test this is to manually depress and release the switch several times.

Appendix A. Specifications

A.1. Array Specifications

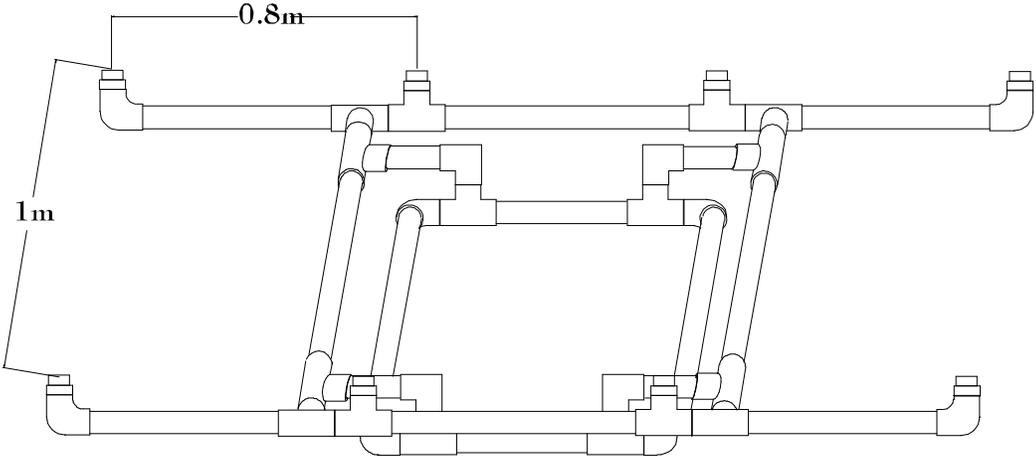
Array element spacing	0.8 meters
Array group spacing	1.0 meters
Array resolution (0.8m, 1m spacing)	~415Hz, ~330Hz
Element sensitivity	-42dB re 1V/Pa
Element response (3dB)	20Hz-16KHz
Element s/n ratio	>60dB
Element power	9VDC @ <1mA

A.2. Amplifier Specifications

Note: Only one gain switch can be ON at a time

Response is flat from 30Hz to 75KHz
(3dB from <10Hz to >200Hz)
110dB supply rejection (w/o filter)
60dB channel separation
8mV noise maximum w/input grounded
Unit draws <40mA (w/o LED & automotive power filter)

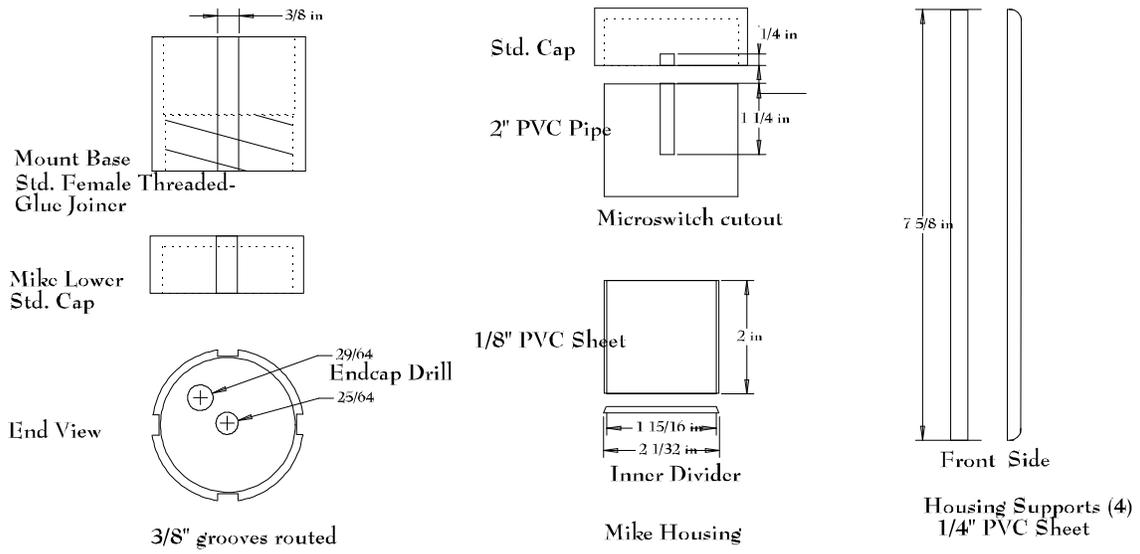
Appendix B. Mechanical Drawings



Material = 2" PVC pipe & fittings

Car-Top Array
Foundation Details
Cornell Bioacoustics
Scale = 1" : 1'

Figure 1. Array Foundation



Car-Top Array
Array Element Components
Cornell Bioacoustics
 Scale = 1" : 2"

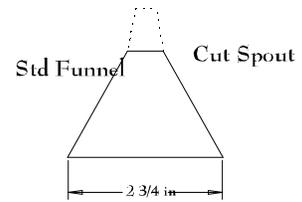


Figure 2. Array Element Components

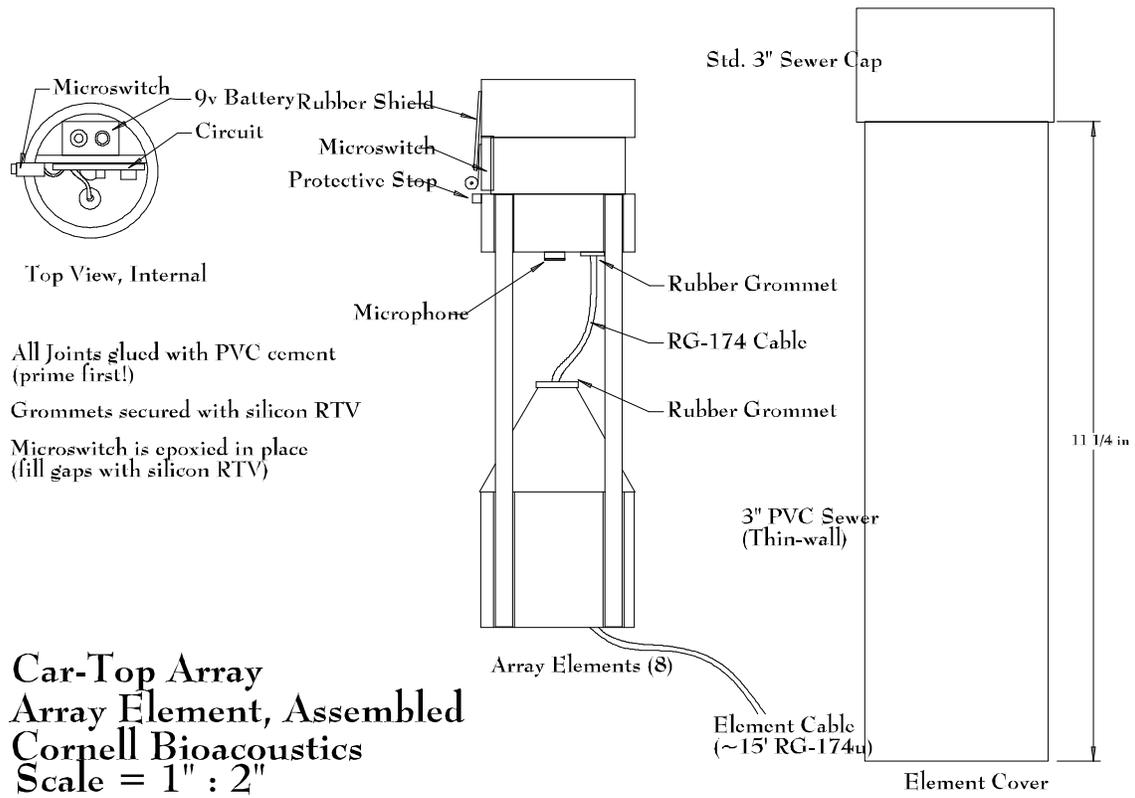


Figure 3. Assembled Array Element

Appendix C. Electrical Schematics

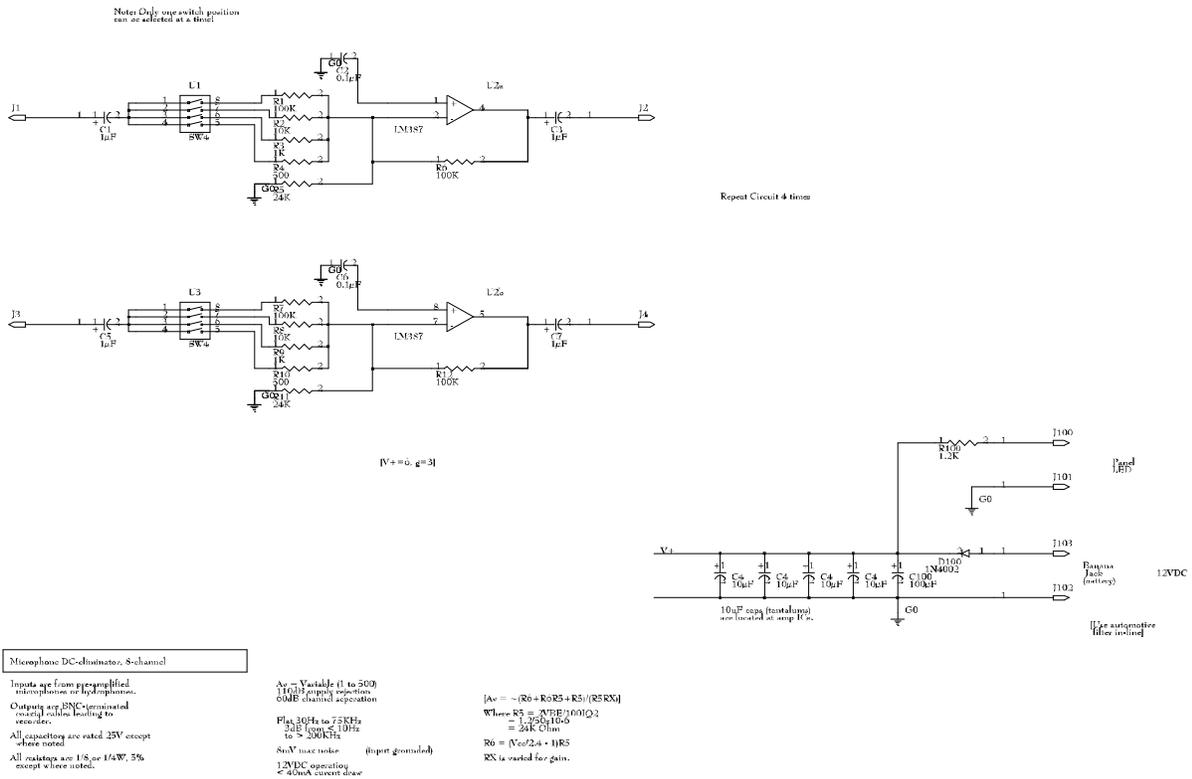
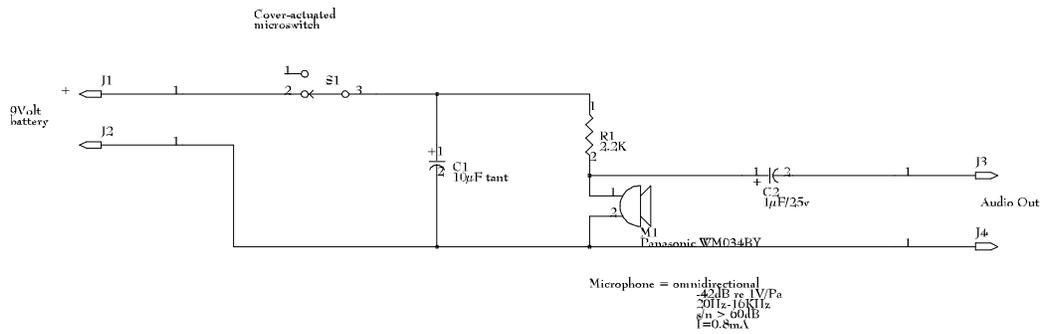


Figure 4. DC Eliminator Schematic



Array Element Circuit

Frog Array Element Electronics, employing a Panasonic electroret microphone. Operation is from a single 9-volt transistor battery using a cover-actuated microswitch to activate. Estimated life with Duracell Procell batteries is approximately 23 days continuous.

Figure 5. Array Element Schematic