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## FEATURES

- 4 independent electrodes
- 2-axis tilt sensor
- Direct interface to computer for real time control through RS-232 serial link or r/f wireless link
- Support for non-real time control through running and storing of scripts on non-volatile EEPROM memory
- 40 Hz internal script clock

## APPLICATIONS

- Visual/vestibular interaction, simulator sickness
- Terrestrial training facilities
- Visual/vestibular influences on operation of remotely piloted vehicles
- Medical research

## GENERAL DESCRIPTION

The Vestibulator is a device which transmits low-level current signals to induce sensations of tilting in human subjects. It consists of a small box designed to be fastened to a person's body with 4 leads protruding outward to output the currents. The Vestibulator can be controlled locally using scripts and the attached push button, or remotely and in real time via serial link (RS-232 hard wired, or R/F wireless) to a nearby computer.

The output of the electrodes can be between -2.56 mA and +2.54 mA. All four electrodes can be individually controlled directly through the serial link to a host program, or with great accuracy using a script.

Scripts are saved on an onboard 2KB EEPROM store and are run using a 25ms internal clock with one instruction executed per clock cycle. The script instruction set has only 9 instructions.

Host software is available for Windows and Java platforms. These programs allow users to upload/run/stop scripts on the Vestibulator, read/calibrate the tilt sensors, or directly control the electrode currents. In addition, the software can automatically generate scripts from a matrix of data containing the electrode currents (for easy Matlab interfacing).

The Vestibulator is equipped with an onboard tilt sensor for measuring a subject's reaction to a stimulus. The tilt sensor has a resolution of 0.655 degrees. A bandwidth of 10 Hz is used which is more than adequate for typical human motion.

## SPECIFICATIONS

Weight	600 grams
Power Consumption	40-55 mA @ 9.5 V
Source	8 AA batteries
Electrodes	
Number of Sources	4
Nominal Current	-2.56 to +2.54 mA
Measured Current	-2.57 to +2.59 mA
Serial Comm.	
Data Rate	9600 baud
Scripts	
EEPROM Memory	2 Kilobytes
Clock speed	40 Hz
Tilt Sensor	
Gravity Range	-2g to +2g
Analog Noise	0.456 degrees pp <sup>1</sup>
Quantization Noise	0.471 degrees pp
Resolution	0.655 degrees <sup>2</sup>
Analog BW	10 Hz
Acquisition time	2-4 ms (both axes) <sup>3</sup>

- 1) Is within this range with a probability of 95.4%
- 2) Root-sum-square of analog and quantization noise
- 3) Not including data transfer over serial link



An additional module with weight 340 grams and dimensions 10 cm x 16.5 cm x 2 cm is required for r/f wireless communication.