PARTS LIST

All resistors ¼-watt 10% unless noted
R1, R2, R14, R16, R20, R28, R32, R45, R46, R64—10,000 ohms
R3, R4, R41, R42, R47, R68, R72, R73—10,000 ohms, 5%
R5, R31—2700 ohms
R6—27,000 ohms
R7, R8, R48—30,000 ohms, 5%
R9, R10, R12, R13—3 megohms, 5%
R11—3900 ohms
R15, R53, R63, R65, R74, R75, R77, R78, R79, R80, R88—4700 ohms
R17—820,000 ohms
R18—22 ohms
R19, R36, R52—56,000 ohms
R21, R39, R44, R59, R76, R91—15,000 ohms
R22, R34, R51—100,000 ohms
R23, R25, R26, R33, R81, R82, R83, R84, R86—22,000 ohms
R24—47,000 ohms
R27—3300 ohms
R29—10 megohms
R30—1.5 megohms
R35—750,000 ohms
R37—20,000 ohms, 5%
R38—4700 ohms, 5%
R40, R89—1000 ohms
R43—15,000 ohms, 5%
R49—120,000 ohms
R50—39,000 ohms
R54, R57, R58, R60, R61—5600 ohms
R55, R62—33,000 ohms
R56—220,000 ohms, 5%
R66, R71—13,000 ohms, 5%
R67—220,000 ohms
R69—12,000 ohms, 5%
R70—7500 ohms, 5%
R85—12,000 ohms
R87—240 ohms
R90—200 ohms
R92—10,000 ohms, linear potentiometer

All capacitors 25V or more unless noted
C1, C2—0.47 μF, 100 V, 10%
C3, C4, C5, C6—.0033 μF, disc, 10%
C7, C8, C20—5 μF, electrolytic
C9, C15, C29, C30—10 μF, 25V, electrolytic
C10, C12, C14, C19—1 μF, 100V, 20%
C11, C23—0.1 μF, 100V, 10%
C13, C26, C27—0.01 μF, disc
C16—(see text)
C17, C18—2000 μF, 50V, electrolytic
C21—.0082 μF, disc, 10%
C22—.033 μF, 100V, 10%
C24—.0015 μF, disc, 10%
C25—.0068 μF, disc, 10%
C28—150 pF, disc
C29, C30—10 μF, 25V, electrolytic
*C31, C32—10 μF, 25V, electrolytic
*If required (see text)

Transistors*
Q1, Q2, Q3, Q4, Q5, Q7, Q8, Q9, Q10, Q11, Q12, Q13—2N4401
Q6—2N4403
Q14—2N5524
Q15—SE4021

Diodes*
D1 through D19—1N3064
D20—1N5240, 10V, 10% Zener

Integrated Circuits*
IC1—CD4046AE (CMOS)
IC2, IC3—CD4001AE (CMOS)
IC4—CD4011AE (CMOS)
IC5, IC6, IC7, IC8, IC9, IC10, IC11, IC12—LM311N (voltage comparator)
IC13—LM318N (op amp)
IC14, IC15, IC16, IC17, IC18, IC19, IC25, IC26—LM307N (op amp)
IC20, IC22—NE555 (programable timer)
IC21—CD4040AE (CMOS)
IC23—MC7815 (+15V regulator)
IC24—MC7915 (−15V regulator)
IC27—MCT-2 photocoupler

Miscellaneous
Printed circuit board (2 sided, plated through holes)
Plastic case
Miniature speaker, 8-ohms
Headband assembly
Battery clips
Battery connectors
BATT1, BATT2—9-volt alkaline batteries
Transformer
S1—3-pole, double throw slide
S2—N.O. single pole pushbutton (or slide)
S3—dpst slide
S4—spst slide
IC sockets
Misc hardware

***Do not substitute**

The following items are available from National Mentor Corp., Box 53, Wykagyl Station, New Rochelle, NY 10804

Circuit board. 2-sided, plated through holes. Order part number NM-P108: $34.50

Transformer. Order part number NM-T6: $17.50

Headband. Order part number NM-HA39: $9.50

Case, punched and drilled. Order part number NM-C56: $14.75

Set of all semiconductors including 27 IC's and 35 transistors and diodes. Order part number NM—Semis 1: $99.50

Complete set of all parts needed to build Brainwave: Alpha: $265.00.

All prices include postage and insurance in the continental United States.

pinging noise voltages, etc.) produce a signal that shows the predominant make-up of the brain waves across the greatest mass of the brain, traversing the frontal, temporal, parietal, and occipital lobes. In effect, such a signal describes the principal state of the brain's major, distinguishable lobes, thus providing a useful index of brain-wide mental state.

How it works

A simplified functional block diagram of *Mindpower: Alpha* is shown in Figure 1. There are five principal sections, enclosed by dashed lines. These are: the horizontal and vertical sweep generators, the display logic and video driver, the isolated EEG amplifier, the display beep control section, and the power supply.

Because *Mindpower: Alpha* creates a video display that is then acted upon by control signals developed from an alpha wave input, the most logical starting point is the horizontal and vertical sweep generators section.

To establish a field for producing a display on a TV screen, it is necessary to sweep the CRT electron beam both horizontally and vertically on the screen face. The horizontal sweep must produce 256 left-to-right lines (one-half frame), moving vertically from top to bottom of the screen within 1/60th of a second. Each line must be written within 65 microseconds. The flyback time between lines must thus be less than nine microseconds. To develop this basic field, the horizontal and vertical sweep generators receive a 60-Hz AC input signal from the AC power supply. This signal is squared by transistor Q9. This stage provides 60-Hz pulse outputs to the two sweep generators. Horizontal sweep is obtained with a X 256 phase-locked loop (IC1, IC21), that multiplies the input to an output of 15.36 KHz. This output is differentiated by Q3, and is applied to the horizontal ramp generator, IC13. This stage produces a ramp voltage rising from 0 to 10 volts in 65 microseconds. Its output is applied to the horizontal comparators and gates of the display logic and video driver section.

Since the vertical sweep rate is synonymous with the line frequency, the pulse output of Q9 is simply differentiated to produce pulses which control the vertical ramp generator, IC16. The output of this stage is a ramp voltage rising from 0 to 10 volts in 1/60th of a second (16.7 milliseconds), and is applied to the vertical comparators and gates of the display logic and video driver section. Sync pulses to determine field timing are provided by sync driver Q1, Q2 to video driver Q12.

The two ramp voltages provided from these earlier stages are used to produce a rectangular display by comparing their instantaneous voltage levels against reference voltage levels in horizontal comparators IC5 through IC8 and vertical comparators IC9 through IC12. These develop beam control signals which determine the point on each line where the CRT electron beam will be turned-on and shut-off. However, since it is desired to produce a rectangle display rather than a cross-hatch, we must use logic to eliminate those line segments which lie *outside* the rectangle's confines. This function is performed by gates IC2, 3, and 4. The result is a white rectangle on a dark field, sized (in Mode 1) to fill about 75% of the screen's usable area. This video signal is applied to the television set by video driver Q12.

Having established the basic display, all we now need is a way to vary the *size* of the display. This is done by the display/beep control section. Vertical control amplifier IC17

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