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ALPHAPHONE® headset  
ALPHAPHONE® basic e.e.p.  
ALPHAPHONE® brainwave analyzer  
AQUARIAN<sup>T.M.</sup> photon coupler  
AQUARIAN<sup>T.M.</sup> FM transmitter  
AQUARIAN<sup>T.M.</sup> percent/time chart recorder

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# BIOFEEDBACK

## A New Science

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Biofeedback, a new scientific field, is the process of feeding information back to you about biological processes—processes of which you are normally unaware. Its purpose is to teach voluntary, conscious control of autonomic, unconscious functions.

A specific design of biofeedback instrument is required for each bodily process to be controlled. The first brainwave monitor to be packaged in the headset was invented and produced by Aquarius Electronics in 1969. Aquarius Electronics is a small electronics company located near Mendocino, on the north coast of California. The instrument and the corporation received international acclaim as a result of an article in LIFE magazine in the August 21, 1970 issue. This instrument, the ALPHAPHONE® headset, is an example of a biofeedback instrument used for learning conscious control of brainwave production.

Since the early experiments with the first ALPHAPHONE® headset, Aquarius has been steadily growing, refining designs and inventing newer and more elaborate instruments. The first "analog" brainwave monitor (producing a warbling tone) has been joined by "digital" brainwave analyzers (producing an on/off tone and providing on/off switching, with or without variable threshold) and a wide range of accessories.

Aquarius has also branched out into other areas of biofeedback. An EMG (electromyograph—an instrument for measuring muscle

tension) has been added to our product line. In a more experimental vein, we are now offering a feedback system for enhancing ESP. This last instrument is an improvement upon a training device that was invented by renowned parapsychist Russell Targ and his associate, David B. Hurt.

We have avoided the discussion of the many applications of biofeedback because the subject is too broad to cover accurately in this brief catalog. Instead, we offer a number of popular books on the subject and our own instructional booklets as sources of information.

From the many books available on the subject of biofeedback, we have chosen the few listed below as source material for information on neurophysiology, biofeedback and its applications. Although we try to keep all of these books in stock, there may be a delay in delivery should a particular title be in heavy demand.

We would like to make it clear that while biofeedback is spreading from the confines of the laboratory into the field of social application, the work is still highly experimental. We make no medical claims for our instruments and recommend that anyone with any form of physical or psychological ailment consult his physician before experimenting with biofeedback. We do not know of any danger associated with our using instruments as instructed, *but* we cannot assume responsibility for any risks.

# BOOKS



**ALPHA BRAIN WAVES** by Jodi Lawrence. We think this is the best general discussion of brainwave bio-feedback yet published. But then we may be prejudiced because Jodi visited us in collecting material for her book. She also discusses EMG feedback.

Paperback A1 \$1.25

**BIOFEEDBACK** by Marvin Karlins and Lewis M. Andrews. A good general discussion of biofeedback which suffers only slightly from the authors' failure to visit our factory. Includes a good section on EMG feedback and a short discussion of Dave Hurt and Russell Targ's ESP teaching machine.

Paperback A2 \$1.25

**ALTERED STATES OF CONSCIOUSNESS** edited by Charles Tart, Ph.D. An excellent collection of papers covering the field of altered states of consciousness (ASC). Includes hypnotic, hypnagogic and sleep states, drug induced states and biofeedback.

Paperback A3 \$4.95

**THE PHYSIOLOGY OF CONSCIOUSNESS** by Robert E. Ornstein. An excellent comparison of left hemisphere and right hemisphere thinking patterns, including a discussion of biofeedback.

Paperback A4 \$3.50

**SPEECH AND BRAIN MECHANISMS** by Wilder Penfield and Lamar Roberts. A somewhat technical but engaging discussion of the geography of the brain that provides a basic understanding of current scientific knowledge of the functions of the different lobes of the human brain. Many drawings and photographs.

Paperback A5 \$2.45

**EEG TECHNOLOGY** by Cooper, Osselson and Shaw. A handbook for EEG technicians which covers the hardware aspect of brainwave measurement rather well.

Hardbound A6 \$10.75

**BRAINS OF ANIMALS AND MEN** by Freedman and Moriss. A well illustrated, general introduction to the brain, written on a readable, popular level.

Hardbound A7 \$4.95

**ATTENTION IN NEUROPHYSIOLOGY** edited by Evans and Mulholland. A collection of papers given at an international conference on neurophysiological definition of attention. Quite technical but extremely interesting. Excellent bibliography. A must for the serious researcher in brainwaves and related fields.

Hardbound A8 \$24.50

**MIND OF MAN** by Nigel Calder. A very readable and not too technical review of recent research on the mind. Well illustrated.

Paperback A9 \$4.95

**ALTERED STATES OF AWARENESS**, readings from the "Scientific American" with an introduction by Timothy J. Teyler. 140 pages with many illustrations. Excellent collection of papers.

Paperback A10 \$2.95

**PSYCHOLOGY: WHAT'S IN IT FOR US?** by Marvin Karlins and Lewis M. Andrews. An ancillary text for first year psychology courses which opens with a chapter on biofeedback.

Paperback A11 \$2.95

## MANUALS

We are offering the instruction manuals for various Aquarius Electronics instruments for those who would like to read them without purchasing an instrument. The instruction manuals for the brainwave instruments are printed in three parts: 1) an investigation of the nature and physiology of brainwaves, the history and basics of biofeedback, and a brief discussion of how brainwave feedback might be used for selectively stilling thought as a meditational practice; 2) the operating instructions for the particular instrument; and 3) a 35 page bibliography listing various popular and research articles and books.

The manual for the ESP teaching machine includes a section on recent research in ESP and proposed research in that field. It is also supplied with an extensive bibliography.

These manuals are offered both as introductions to the field of research in which their respective instruments are employed, and as an aid to choosing the right instrument for your application. You will find them listed in the ordering information section at the back of the catalog.

# 201

## Basic EEP

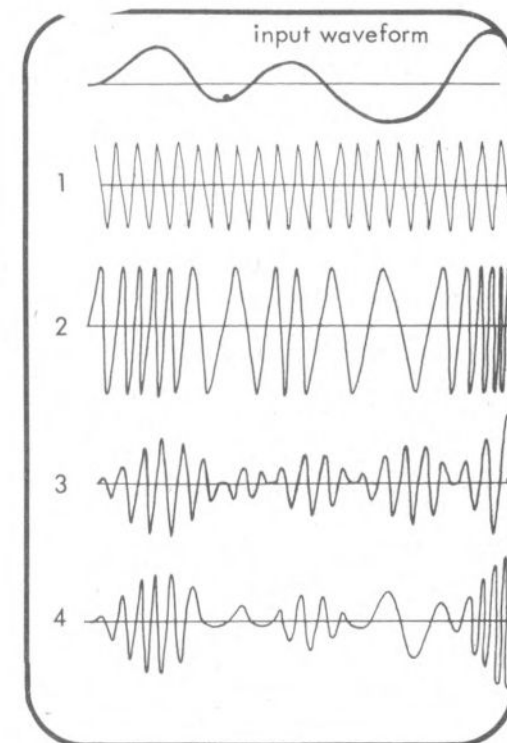
**AM-FM.** One of the main features that sets the basic e.e.p. and headset apart from other instruments in their price range is the low noise, AM-FM preamplifier that the instruments share. Most (if not all) of the currently available low cost EEPs modulate either the frequency or the amplitude of the internally generated tone, not both.

**Deciding factor.** The difference between AM-only, FM-only and AM-FM modulation can make the difference between whether or not the instrument is understandable and useful. In the classical paper on EEPs, Peter Stewart, William Belcher and John Morris report on their findings with these three approaches (EEG and Clin. Neurophysiol., 11:161-164, 1959). They conclude that:

*"The sound of the output from the EEP [encephalophone] when brainwaves are fed into it is difficult to describe verbally. In general, amplitude modulation is not very satisfactory. The chief difficulty is that it is not polarity sensitive, so that the apparent frequency of repetitive signals such as the alpha wave is twice the actual frequency. Frequency modulation permits the ear to follow the EEG tracing very easily and to pick out characteristic patterns as they occur. The only objection to FM alone is the constant background level, regardless of signal intensity, which becomes distinctly unpleasant after a brief period of listening. Combining amplitude and frequency modulation eliminates both of the difficulties, and provides a very sensitive method of analysis of brainwave patterns. With very little practice, characteristic patterns can be readily detected by ear and recognized when they occur."*

**Diagram.** It is somewhat clearer to represent the three approaches to brainwave modulation of a tone with diagrams. Figure 1 is the unmodulated tone, a single constant sound generated within the circuitry. Figure 2 illustrates FM-only modulation. The spaces between zero crossings, measured horizontally, are sensed by the ear as a changing rhythm of constant loudness. Figure 3 illustrates AM-only modulation. The distances

between the wave peaks, measured vertically, are sensed by the ear as a tone of constant pitch, (or as "white noise" in some instruments), with only the loudness changing. This doubles the apparent frequency of the brainwave signal. Figure 4 illustrates the combination of AM and FM modulation, such as used in the ALPHAPHONE® headset, ALPHAPHONE® basic e.e.p. and ALPHA-



PHONE® brainwave analyzer (in the ANALOG mode). The internally generated tone is varied both in frequency and amplitude, (both horizontally and vertically in graphic terms and both in pitch and loudness in common terms).

*Harmonic analyzer.* The human ear is a very sophisticated harmonic analyzer. It can distinguish subtleties in speech that are far more complex than the sounds produced by an EEP. Provided the EEP is of good quality and of AM-FM design, an average person with only a little practice can hear fine variations in his brainwave patterns. For some purposes, some researchers consider auditory analysis of EEP sounds to be superior to visual scrutiny of EEG ink tracings. This is especially the case when using brainwaves for feedback purposes with naive Subjects.

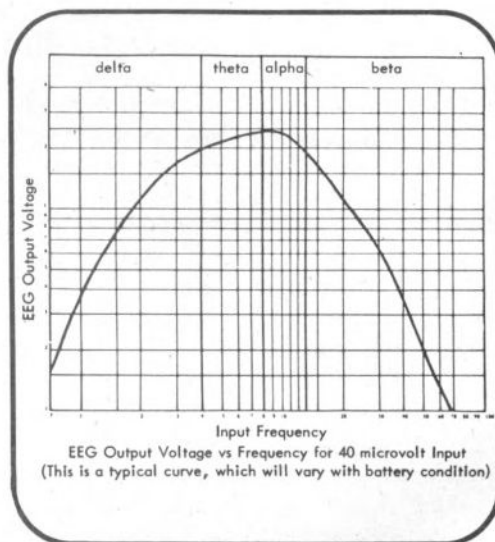
*Hyperkinetic.* An example of this is the experimental work of Rev. George von Hilscheimer, Superintendent of the Green Valley Residential Treatment Center in Orange City, Florida. Working with hyperkinetic adolescents, who are naive (regarding the study of brainwaves) and have much weaker powers of attention than the average individual, he reported that "successful training of naive and unaware subjects to produce alpha rhythms on signal can readily be demonstrated." (von Hilscheimer, Some simple techniques in biological and behavioral feedback, delivered at annual meeting of A.A.B.T., Washington, D.C., 1971).

*Flexible.* Rev. von Hilscheimer further reported in this 1971 paper that: "After experimenting with a number of inexpensive alpha filters which signal alpha production with light or sound, we have concluded that the most flexible and reliable is the ALPHAPHONE® [headset], made by Aquarius Electronics. . ." We attribute this comment and others like it to our use of quality materials throughout, careful testing before shipment of each and every instrument, and the employment of our patented AM-FM preamplifier design.

*Original.* The ALPHAPHONE® headset was the first EEP (electroencephalophone) to use a headset design. In turn, the ALPHAPHONE® basic e.e.p. was the first economy EEP to use an AM-FM, low noise circuit with high input impedance and common mode rejection.

*Careful design.* Beginning with the same patented circuitry that was developed for the ALPHAPHONE® headset, the careful design of the basic e.e.p. has eliminated many of the problems that other inexpensive instruments share, such as hum, noise, sensitivity to electrode contact resistance and poor accuracy of distinction between brainwave types. This care in design is backed up with equal attention to detail and quality in manufacturing. The basic e.e.p., as our other instruments, carries a five year warranty.

*Broad spectrum.* The ALPHAPHONE® basic e.e.p. responds to a broad spectrum of brainwave frequencies, 2 to 25 Hz, making it capable of accurate feedback of beta and theta patterns. The absence of noise and hum from the clear warbling sounds of combined AM and FM modulation makes it easy to recognize subtle differences in brainwave patterns with the basic e.e.p.



*Black box.* To arrive at the basic e.e.p., we removed from the headset its costly earphone shells, its extreme miniaturization, its EXT A, FM and EEG output jacks and the related circuitry. We simplified production assembly through the use of a large printed circuit board. We chose a rugged (and somewhat plain) plastic box as a case. But, most important, the fundamental accuracy and reliability of the ALPHAPHONE® headset's proven circuitry have been strictly maintained.

*What's included.* The basic e.e.p. is shipped complete with solid silver electrodes, cream, headband, an 86 page instruction manual and

an instructional 33 $\frac{1}{3}$  RPM record. The price of \$80 includes all this, plus a five year parts and labor warranty. Each instrument is individually tested to meet specifications before leaving the factory and is built in such a way that it will continue to work accurately, years after the warranty has expired.

*Choice.* Not included in the basic e.e.p. package are earphones or any other audio transducer. This allows you a choice of many ways of processing the sound. You can use your own earphones, with a suitable adapter to a mini-phone plug if needed. Or you may choose one of the several audio transducers that Aquarius offers. These include inexpensive earphones, the NOVA-FONE earpiece, a battery powered loudspeaker/amplifier and a short range FM transmitter which can broadcast your brainwaves to any nearby FM radio receiver. By using the Model 501A photon coupler (which is *important*), you can amplify or record the output of the basic e.e.p. with powerline operated equipment. When unpowered or battery powered amplification is used, of course, *no such optical isolation is needed.* (See Accessories, page 8)

**Input Impedance:** 1 megohm.

**Common Mode Rejection:** at least 60 db, measured at 10 Hz; at least 90 db of combined 60 Hz filtering and common mode rejection.

**Common Mode Rejection Sensitivity to Input Impedance Unbalance:** less than 20 db drop in CMMR for 10 k ohm unbalance in input impedance.

**Equivalent Input Noise** (broadband): less than 1 microvolt RMS (less than 5 microvolts peak to peak). 10 Hz reference signal.

**Frequency Response:**  $\pm 3$  db from 2 to 25 Hz.

**Sensitivity:** 3 microvolt RMS 10 Hz signal for a 10 db signal to noise ratio.

**Overload Recovery:** less than 200 milliseconds for a 100,000 microvolt single 10 Hz cycle.

**Audio Output Impedance:** 8 ohms; output jack is a mini-phone jack.

**Audio Output Power:** 25 milliwatts (sufficient to drive most headphones or earpieces).

**Batteries Required:** 2 NEDA type 1604 (9 volt transistor radio batteries).

**Size:** 4" x 3" x 1 $\frac{1}{2}$ ".

**Shipping Weight:** 2 $\frac{1}{2}$  lbs.

**Accessories Available:** CN1, CN2, CN3, CN5, 301 and 501A. (The accessories that correspond with these numbers may be found both in the body of the catalog and in the ordering information, listed in numerical order).

**Price:** \$80 FOB Mendocino, California.

**Delivery:** usually from stock.

## ALPHAPHONE® Headset

*Self-contained.* The ALPHAPHONE® headset is more than a basic encephalophone. It is a completely self-contained, miniaturized brainwave monitor and feedback instrument—part of a growing system of complementary instruments. Today's ALPHAPHONE® headset is a rugged yet refined descendent of the original headset encephalophone—the Model 101 ALPHAPHONE® headset. It is a precision instrument that contains the solid state circuitry and batteries within its high quality earphone shells. This serves to keep the center of gravity low, making the ALPHAPHONE® headset more comfortable to wear than the box-on-top designs—and it will not fall off the Subject's head.

*Versatile.* The experimental designs possible with the ALPHAPHONE® headset are not limited to simple audio feedback of the



ALPHAPHONE® Headset, 501 Photon Coupler, Calibration Oscillator, FM Demodulator, and Pulse Forming Network.

brainwave signal. The headset's four output jacks—EXT A, EXT B, FM and EEG—provide a means of connecting it to an extensive list of instruments that greatly expand its potentialities while many accessories are possible, none are needed.

**EXT A:** This jack is used for "switched audio" feedback—inserting a plug in it switches off the sound in the headset and carries it to an external monitor, such as a speaker/amplifier, FM transmitter, battery powered or isolated tape recorder, another ALPHAPHONE® headset, etc. It allows monitoring changes in brainwaves that are unaffected by feedback. Putting an unwired plug in the EXT A jack will cut off the feedback.

**EXT B:** This jack is like the EXT A jack except that the feedback sound in the headset is maintained. It is useful for recording or monitoring brainwave changes that are affected by feedback. It is also valuable for tandem brainwave control—for synchronizing with another's brainwaves by connecting two ALPHAPHONE® headsets together.

**EEG.** This jack, meant for use with the Model 501A or Model 502 photon couplers, allows for relay of the amplified EEG signal (without the AM-FM sound) to powerline operated equipment. The isolated EEG signal can be displayed on an oscilloscope, chart recorder, brainwave analyzer or other accessory. The Model 502 photon coupler is designed to serve as a link between the headset and brainwave analyzer; the Model 501A is sufficient for other applications.

**FM.** This jack provides an FM encoded version of the EEG signal, designed for tape recording. Although brainwaves are too low in frequency to record directly on ordinary tape recorders, this special FM output records very well—even on the least expensive cassette recorders. By use of the 600 series demodulation equipment, the FM signal can be decoded to recover the EEG signal for analysis. By recording both the external audio and FM outputs, one can listen for interesting sections in the experiment, demodulate the FM track, thereby making a considerable savings in chart paper costs.

**Two versions.** The ALPHAPHONE® headset is available with or without tone control. On the Model 102A, the tone is fixed. On the Model 102T, it is adjustable by means of a knob under one of the earphones. The tone

control, besides allowing adjustment to suit taste, is specifically useful for distinguishing between individual sounds when two headsets are used in tandem. It is also useful when recording the FM brainwave signal. Statistically, most people buy the 102T; but we supply the other model where the \$10 savings (\$140 as opposed to \$150) is significant.

**Tandem use.** Two ALPHAPHONE® headsets may be used in tandem. This works simply by fitting two Subjects with headsets and connecting the respective external audio outputs with a connecting cable. If the EXT A jacks are used, each Subject will hear *only* the other's brainwaves. If the EXT B jacks are used, each Subject will hear *both* his and his partner's brainwave patterns. This potential for brainwave synchronization may be further extended by channeling the audio output to a tape recorder via a "Y" connector. Naturally, the FM and EEG outputs may be employed at the same time as the external audio output.

**Construction.** The ALPHAPHONE® headset is built into a headset made of Cyclocac—the same tough plastic that telephones are made of. Although rugged, it is light and comfortable to wear. The headset is adjustable to fit all sizes of head, and its thick ear cushions dampen external noise interference. Because all of the solid state circuitry is built into one earcup, the electrode wires are short and move with the head, helping to eliminate electrical and magnetic interference.

**Everything.** The ALPHAPHONE® headset is shipped with everything necessary for use: electrodes, electrode cream, headband, 86 page instruction manual and 33 $\frac{1}{3}$  RPM instruction record. Our claims of ruggedness and reliability are backed up by a five year parts and labor warranty.

### SPECIFICATIONS

**Input Impedance:** 1 megohm.

**Common Mode Rejection:** at least 60 db measured at 10 Hz; at least 90 db of combined 60 Hz filtering and common mode rejection.

**Common Mode Rejection Sensitivity to Input Impedance Unbalance:** less than 20 db drop in CMMR for 10k ohm unbalance in input impedance.

**Equivalent Input Noise (broadband):** less than 1 microvolt RMS (less than 5 microvolts peak to peak). 10 Hz reference.

**Frequency Response:**  $\pm 3$  db from 4 to 20 Hz.

**Sensitivity:** 3 microvolt RMS 10 Hz signal for a 10 db signal noise ratio.

**Overload Recovery:** less than 200 milliseconds for a 100,000 microvolt single 10 Hz cycle.

**Audio signal:** combined amplitude and frequency modulation (suppressed carrier).

**Audio Outputs:** EXT A (switched output), 8 ohms, 25 milliwatts; EXT B (unswitched output), 8 ohms, 25 milliwatts.

**FM Outputs:** a current output from an emitter source impedance; intended to drive the Model 610 pulse forming network.

**EEG Output:**s a current output from an emitter follower with open return leg; designed to drive the Model 501A or Model 502 photon couplers.

**Output Jacks:** all four output jacks are mini-phone jacks.

**Batteries Required:** 2 NEDA 1604 (9 volt transistor radio batteries).

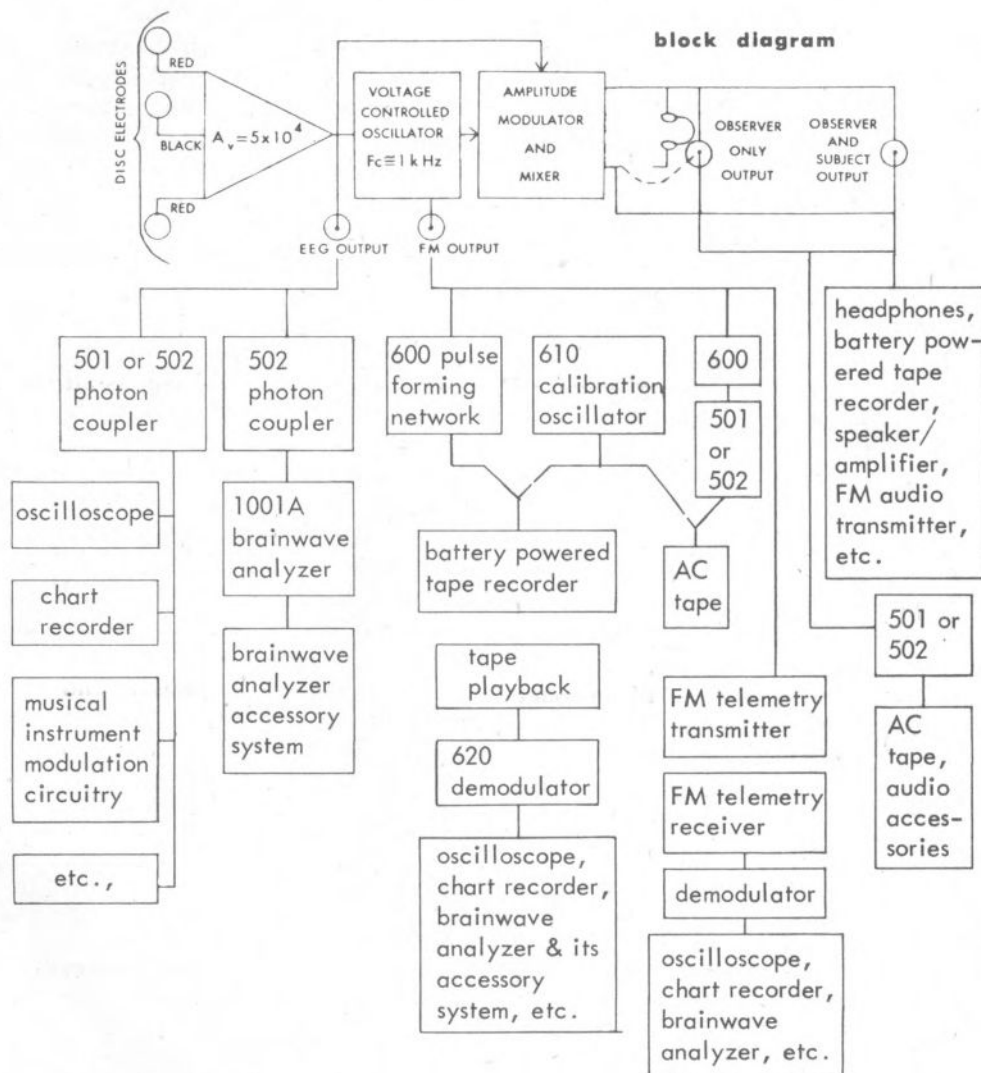
**Size:** 8" x 9" x 4" adjustable headset.

**Weight:** 18 oz.—shipping weight 2½ lbs.

**Accessories Available:** CN1, CN2, CN3, CN5, CN6, 301, 501A, 502, 600, 610, 620, 700.

**Price:** \$140 for Model 102A (without tone control); \$150 for Model 102T (with tone control) FOB Mendocino, California.

**Delivery:** usually from stock.



## Alphaphone Systems Diagram

## ALPHAPHONE® Headset & Basic EEP Accessories

The ALPHAPHONE® headset is a complete brainwave monitoring and feedback system—you need add nothing to it but your brainwaves. If you do want to add accessories to your headset, however, the necessary jacks are designed and built into it. The block diagram on the preceding page shows how the headset works. The systems diagram beneath it illustrates some of the many possible uses of the accessory system.

### CN1

The REALISTIC™ speaker/amplifier is a battery powered transducer that allows several people to hear the brainwave sound—especially useful when instructing in brainwave control and demonstrating brainwave sounds. Includes battery, patch cord and instructions.

CN1                      \$15.

### CN2

The NOVA-FONE earphone is a light, pocketable earpiece that hangs on one ear, leaving the observer's hands free. Included is a patch cord with appropriate mini-phone plug for connection to either headset or basic e.e.p.

CN2                      \$6.

### CN6

We offer these headphones as an output accessory for the basic e.e.p. They can also be used as monitor earphones for the ALPHAPHONE® headset or brainwave analyzer. Equipped with a standard stereo phone plug, they can also be used with a hi-fi set. Shipped with CN5, the adaptor plug which converts the stereo phone plug to a mini-phone plug, these headphones are usable with our instruments and cassette recorders. Impedance is 8 ohms.

CN6                      \$10.

## 600 SERIES

*Recording.* The 5-volt pulses that form the signal produced at the FM output of the ALPHAPHONE® headset are of such a nature that recordings of reasonable technical accuracy may be made on low cost, battery powered cassette recorders. This allows the operator to make recordings in the field, leaving the bulky analysis equipment in the laboratory. The 600 series instruments—the pulse forming network, calibration oscillator and demodulator—serve (with a tape recorder) to store the FM signal and re-convert it back into an EEG signal, ready for chart recording, analysis, etc.

*Limits.* While the Model 620 demodulator provides an inexpensive and reasonably high fidelity replica of the brainwave signal, there are limits to its accuracy which should be understood.

The frequency response of the combined FM output/tape recorder/demodulator system is somewhat limited at the high end of its range. For example, the response of the demodulated recordings to 30 Hz signals will be about 6 db down from the original EEG signal. Since most inexpensive cassette recorders do have some wow and flutter, the noise level of the demodulated recording will be somewhat higher than the original EEG recording.

*Result.* The result of these two inaccuracies is that a recorded and demodulated FM signal will not exactly match a directly monitored EEG signal. The error will be greatest for low amplitude, high frequency signals—appearing as a decrease in the percent-time spent in beta. These results will be kept to a minimum if proper equipment is used.

*Pulse.* The pulse forming network improves the waveform of the FM output for best recordings.

Model 600                      \$15.

## 610 CALIBRATION OSCILLATOR

*Calibration.* At the push of a button, the Model 610 calibration oscillator produces an accurate synthetic brainwave signal, 40 microvolts in amplitude and 10 Hz in frequency ( $\pm 5\%$ ).

Model 610                      \$30.

*Process.* At the beginning of each recording session, the Model 610's three clip leads are attached to the EEP's electrodes. Care is taken to see that the EEP's controls remain in fixed position during the recording. The Model 610's signal is recorded for a few moments to provide a reference tone so that later, when the recording is played back and demodulated, accurate frequency and amplitude measurements can be made. The recording of the FM output is made via the Model 600 pulse forming network (and, if necessary, the Model 501A or 502 photon coupler), and it is ready for demodulation.

## 620 DEMODULATOR

*Demodulation.* The demodulator decodes the FM signal and returns it to an EEG signal. The Model 620's output can drive the ALPHAPHONE® brainwave analyzer's EXT EEG INPUT directly. It will drive a 4.7 k ohm load bypassed by 0.2 microfarad, allowing it to easily supply signals to almost any chart recorder or oscilloscope.

Model 620 \$50.

## 301 FM TRANSMITTER

The AQUARIAN<sup>TM</sup> FM transmitter bolts directly to the headset and will broadcast the brainwave sound to any nearby FM radio. It will also work with the basic e.e.p. and brainwave analyzer (AUDIO OUTPUT). Its unique advantage is that it allows a way of amplifying the sound while providing isolation and maintaining subject mobility.

Model 301 \$30.

## 501A & 502 PHOTON COUPLERS

*Isolation.* When technical accuracy demands better quality than a cassette recorder allows, you will need either a battery powered reel-to-reel recorder of good quality, or an AC powered recorder. If the AC powered machine is used, safety and the elimination of powerline noise (60 Hz hum) require the use of the Model 501A photon coupler. The increased fidelity, relative lack of noise and absence of "wow" and "flutter" make this a good choice when maximum accuracy is demanded.

The AQUARIAN<sup>TM</sup> photon coupler meets the

demand for a safe way to record, amplify, display and analyze the headset's output with AC powered equipment—a demand rarely encountered in normal use. The photon coupler provides the necessary isolation to insure against electrical shock, and 60 Hz filtration to eliminate powerline noise. (We provide specially equipped photon couplers to those areas of the world where powerline noise is 50 Hz.)

While the AQUARIAN<sup>TM</sup> photon coupler is primarily intended for use with the EEG output, it can also be used with the FM, EXT A or EXT B outputs. This is especially valuable where recording of different kinds of data at the same time—such as AM-FM audio and FM encoded information—requires the use of multi-channel line operated equipment. Simultaneously isolating two outputs would, of course, require two photon couplers.

The Model 502 photon coupler is the same as the Model 501A, except that it contains a booster amplifier. This model may be used in all the above applications, but its primary purpose is to serve as a link between the headset's EEG output and the brainwave analyzer's EEG input. It links the headset with the brainwave analyzer's accessory system.

### Model 501A specs

**Isolation:** 500 volts.

**Input Impedance:** EEG function—250 ohms; FM/EMG function—250 ohms; EXT A/B function—16 ohms.

**Input Bias:** in EEG and FM/EMG functions, the 501A requires about 8 milliamps bias which is supplied by the source instrument; for inputs from instruments not built by Aquarius Electronics, an accessory bias input is required.

**Output Impedance:** 4,000 ohms.

**Batteries:** 1—9 volt 2U6 or equivalent, and 1—"AA" penlite cell.

**Battery Life:** over 50 hours of continuous use; longer for intermittent use.

**Sensitivity:** the Model 501A has a transmission gain of about 0.25; for example, to get a 2 volt p-p EEG output, an 8 volt p-p EEG input is required.

**Frequency Response:** depends on function switch position—see graph.

**Input Connector:** mini-phone jack.

**Output Connector:** RCA or phono jack.

**Size:** 6" x 3" x 2 3/4".

**Shipping Weight:** 2 lbs.

**Price:** \$48 FOB Mendocino, California.

**Delivery:** from stock.

# model 502 specs

**Isolation:** 500 volts.

**Notch Filter:** at least 40 db down at 60 Hz.

**Input Impedance:** EEG—250 ohms; FM/EMG—250 ohms; EXT A/B—16 ohms.

**Input Bias:** in EEG and EMG modes, the 502 requires about 8 milliamps bias current which is supplied by the ALPHAPHONE headset or the Model 300 EMG for inputs from instruments not built by Aquarius Electronics, and accessory bias input is required.

**Output Impedance:** 4,000 ohms.

**Output Zero Level:** less than 10 mV.

**Size:** 6" x 3" x 2 3/4".

**Shipping Weight:** 1 lb.

**Batteries:** 2 Burgess 2U6 or equivalent and 1 size "AA" penlite cell.

**Battery Life:** over 50 hours.

**Sensitivity:** unity transmission gain.

**Frequency Response:** depends on the FUNCTION switch position—see graphs.

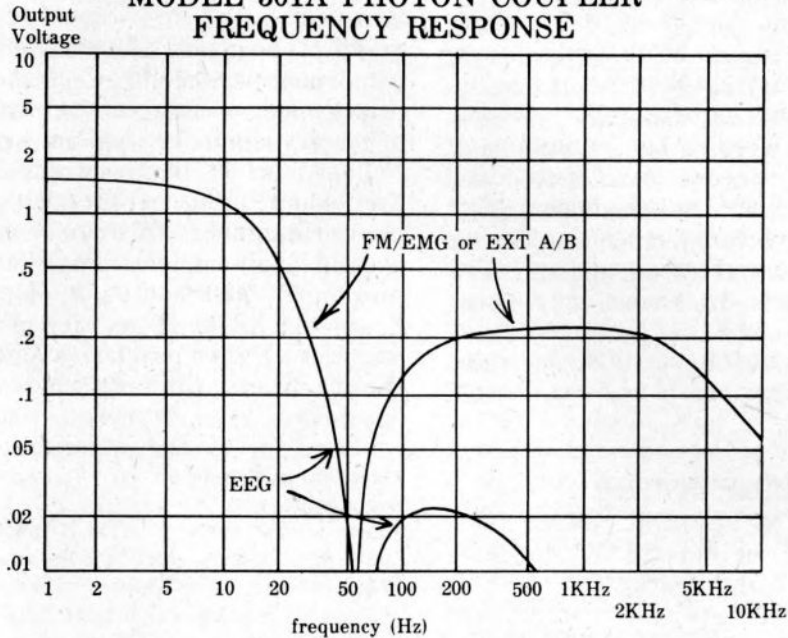
**Input Connector:** mini-phone jack.

**Output Connector:** RCA or phono jack.

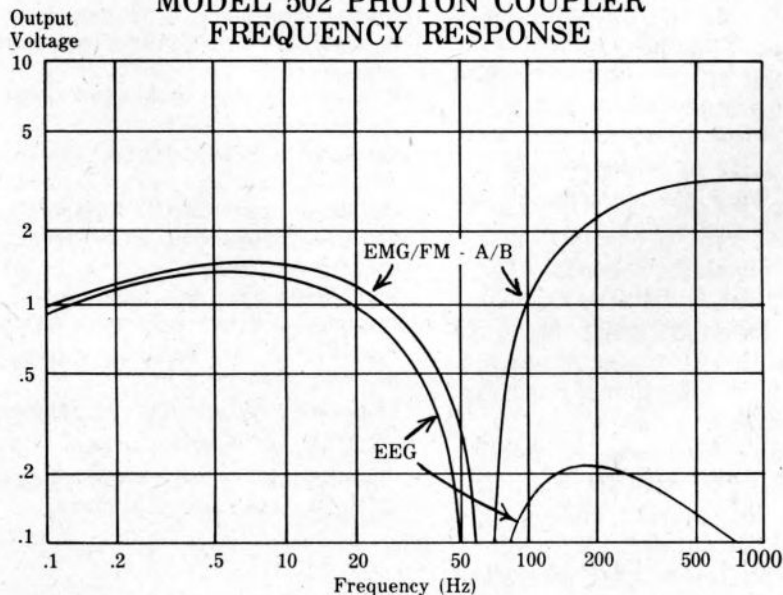
**Price:** \$63 FOB Mendocino, California.

**Delivery:** from stock.

## MODEL 501A PHOTON COUPLER FREQUENCY RESPONSE



## MODEL 502 PHOTON COUPLER FREQUENCY RESPONSE



# Brainwave Analysis

The problem of brainwave analysis is not a simple one. It requires considerable training to visually interpret the EEG tracings made by a chart recorder. While auditory analysis of the EEG signals from an EEP (such as the ALPHAPHONE® headset) is easier to learn, it still requires attention and practice. It should come as no surprise then that a computer would have some difficulty doing something that is a task for a human brain.

Computers are by nature stupid and can only follow orders blindly. The definitions of the brainwave types that are programmed into a computer limit the meaningfulness of its output. However sophisticated the equipment, any computer analysis of brainwaves will have inherent limitations. As well as its many strong points, the ALPHAPHONE® brainwave analyzer has such limitations and if you are considering its purchase you should understand them.

An ideal filter for frequency data would respond equally well to all signals within a given frequency range while rejecting everything outside that band. The device should also allow the possibility of filtering for any of the four basic frequencies, not just alpha. To approach this goal, we are using a zero crossing(Z/C) detector followed by a period measuring filter in the ALPHAPHONE® brainwave analyzer. The filter accepts all signals within chosen range while rejecting signals outside that range. The error is less than 5%, e.g., the edge limits for the alpha range are  $8 \text{ Hz} \pm .4 \text{ Hz}$  to  $13 \text{ Hz} \pm 0.65 \text{ Hz}$ .

This method yields information on the dominant brainwave frequency quite accurately and quickly, and provides that information in such a way that it is instantly useable to operate a wide variety of accessory counting and feedback systems.

The principal limitation on this technique is that it provides dominant frequency information only. Amplitude information is not taken into account. For this reason, we have supplemented the period measuring circuit with a peak amplitude measuring circuit as mentioned earlier. This is used primarily to discard artefacts and noise. The brainwave

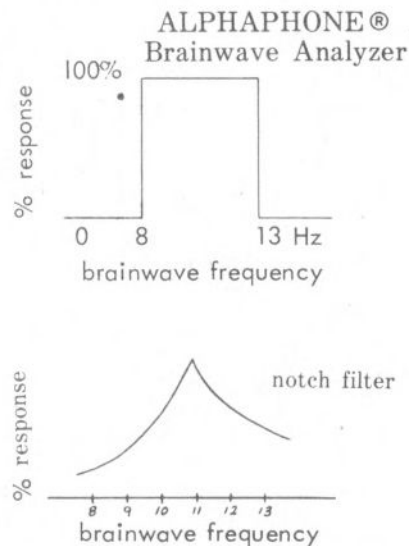
analyzer has adjustable upper and lower amplitude limits. If a signal is too strong or too weak, it is thrown out, regardless of whether it happens to be in the selected frequency range.

The result is an instrument that uses an imposed definition of brainwave type, i.e., a signal between certain frequency and amplitude limits, to perform averaging and switching tasks.

A much less expensive way to approach the problem of analyzing brainwave patterns is "notch" filtering. This technique, like averaging amplitudes, compounds the inherent limitations of simplification with undue distortion.

This type of notch filter strongly emphasizes one narrow band of frequencies while suppressing others in the same range. The arbitrary labels for frequency ranges, such as "alpha", refers to broad ranges, not single frequencies. Thus, a filter which responds to an 11 Hz signal much more sensitively than an 8 or 12 Hz signal, for example, would introduce too much distortion to be of practical use.

As well as the inaccuracy of notch filtering, there is another problem with this technique. Notch filters tend to ring—they tend to produce a false brainwave-like signal when shocked by a fast rising, high amplitude waveform, such as an eye-blink or a muscle twitch.



Above is an artist's rendering of the type of ringing a sharp "notch" type filter may produce. Every eyeblink can turn into a burst of false brainwave signals.

This tendency, when coupled with their fundamentally inaccurate filtering, led us to decide that building a notch filtering brainwave analysis circuit would be too high a degree of simplification in the interest of economy.

We are of the opinion that frequency and amplitude computing should be done well or not at all. Given the alternatives, we feel that period measuring is the best technique.

## 1001A BRAINWAVE ANALYZER

The Model 1001A ALPHAPHONE® brainwave analyzer's SWITCHED ANALOG feature overcomes one of the major limitations of digital brainwave analysis: the loss of amplitude information and subtle nuances from the feedback signal. In this mode, the analyzer's computer decides if the incoming signal is within the chosen frequency and amplitude limits. If it is, the computer turns on the AM-FM analog representation of the brainwave signal. In this way, both the frequency accuracy of the digital mode and the waveform information of the analog mode are preserved.

*Frequency.* The ALPHAPHONE® brainwave analyzer individually measures the frequency of each cycle of a brainwave pattern. The frequency is measured instantaneously with a zero-crossing (Z/C) detector and a four channel period measuring filter. This process eliminates the many errors and inaccuracies of averaging circuits, bandpass filters or notch filters.

*Amplitude.* The peak to peak amplitude of each cycle is compared to adjustable upper and lower amplitude limits. This eliminates signals too weak to measure accurately (noise) and signals which do not originate in the brain (artefacts).

*Sorting.* The ALPHAPHONE® brainwave analyzer sorts signals into six different categories: artefact, noise, beta, alpha, theta and delta. It indicates the percent/time spent in selected brainwave category. It indicates which brainwave state is dominant when not in selected state. Unlike single filter instruments, the brainwave analyzer does not leave you guessing.

*Seven sounds.* The ALPHAPHONE® brainwave analyzer offers a choice of seven,

short latency, built-in feedback sounds; 1) ANALOG is the same AM-FM sound heard in the headset and basic e.e.p.; 2) DIGITAL+ turns on a steady tone when the selected brainwave frequency type is dominant; 3) DIGITAL+ with EXT AUDIO IN turns on any externally provided sound (tape recording, white noise, etc.) when the selected brainwave type is dominant; 4) DIGITAL—turns off the steady tone when the selected brainwave type dominates—a mode of operation ideal for meditative use; 5) DIGITAL— with EXT AUDIO IN turns off any externally provided sound when selected type dominates; 6) SWITCHED ANALOG+ turns on the ANALOG sound when the selected type dominates; 7) SWITCHED ANALOG— turns off the ANALOG sound when the selected type dominates.

*Lights.* Panel mounted lights provide instant visual indication of the brainwave state. Additional light displays, such as Jean Mayo's biofeedback light sculpture, are available as accessories.

*Filters.* The period measuring filter system in the ALPHAPHONE® brainwave analyzer gives a response curve which closely approximates the ideal filter response. It completely rejects any signal outside its frequency limits, regardless of amplitude. It accepts any signal within its chosen frequency limits, providing it is also within the adjustable amplitude limits (designed to exclude artefacts and noise).

Most of the commercially available brainwave analyzers do not use period measuring filters, and hence lack the short latency and high accuracy of the ALPHAPHONE® brainwave analyzer. Of the few available analyzers which do employ period measuring filters, those we've seen include only one, or at most, two, in one instrument.

The ALPHAPHONE® brainwave analyzer's three internal period measuring filters, (set normally at 4, 8 and 13 Hz), are used to define *four* filter channels. Thus, while one of the four channels is used to control the feedback sound, the other three accurately analyze any brainwave signal which falls outside the selected range. When combined with accessories such as the Model 1502 four channel percent/time chart recorder, all four channels will accurately record the degree of brainwave activity within their limits.

*Electrodes.* A 60 Hz filter and differential preamplifier design allow a choice of two or three electrode connections, (mono-polar and bi-polar). See analyzer accessories.



ALPHAPHONE® Brainwave Analyzers; top, 1001 CT; Bottom right, 1001 DT; Bottom left, 1001A.

**Outputs.** Banana jack category outputs provide low level TTL logic signals indicating the brainwave state, instantaneously. These can drive a broad range of accessories, including power switching circuits, chart recorders, printing timers, cycle counters, visual display systems, and so on. EEG, audio and FM outputs provide the same chart, audio and FM recording potentials as the headset.

**Input Sensitivity:** 1 microvolt RMS at 10 Hz for 6 db signal to noise ratio.

**Preamp Gain:** 40 microvolt peak to peak input at 10 Hz yields a 1.4 volt peak to peak output; voltage gain 35,000.

**Equivalent Input Noise:** less than 0.5 microvolt RMS, less than 2.5 microvolts peak to peak with inputs grounded.

**Frequency Response:**  $\pm 3$  db for signals from 6 to 20 Hz; 6 db for signals from 4 to 30 Hz.

**60 Hz Filter:** response at least 60 db down at 60 Hz.

**60 Hz Rejection** (including CMMR): 120 db for signals less than 0.5 volt peak to peak.

**Common Mode Rejection Sensitivity to Input Unbalance:** CMMR at least 40 db for 10k unbalance. **Input Impedance:** 1 megohm.

**Overload Recovery:** recovers from 0.5 volt (500,000 microvolt) overload within one cycle.

**Batteries Required:** 4 Burgess F4BP or equivalent (available at most hardware stores).

**Battery Life:** over 200 hours of continuous use with no degradation of accuracy.

**Semiconductor Complement:** 1-unijunction transistor, 4-field effect transistors, 12 integrated circuits, 25-bipolar transistors 28 diodes.

**Size:**  $13\frac{1}{2}$ " x 9" x  $5\frac{1}{4}$ ".

**EEG OUTPUT:** a current output designed to drive the Model 501A or Model 502 photon couplers.

**EEG INPUT:** 4.7k input impedance bypassed by 0.47 microfarad; input signals should be about 1.4 volts for 40 microvolt EEG; input should be accurately referenced to ground.

**NOISE THRESHOLD:** panel mounted control, sets minimum amplitude limit; adjustable from 0 to 100%—100% corresponding to 2.0 volts p-p applied to EXT EEG INPUT or 107 microvolts p-p 10 Hz applied to INPUT; LOW setting is 2.5 volts p-p applied to EXT EEG INPUT or 67 microvolts p-p 10 Hz applied to INPUT.

**PERIOD MEASURING FILTER:** compares each cycle to three internal standards corresponding to 4.0, 8.0 and 13.0 Hz; absolute frequency accuracy  $\pm 5\%$ ; stability better than  $\pm 2.5\%$ .

**NOTE:** On special order, analyzers can be supplied with frequency limits other than 4, 8 and 13 Hz. Any three frequencies between 3 and 30 Hz may be specified. There is no additional charge for special frequency limit settings. There is, however, a special charge of \$50 if you wish to have the panel artwork changed to reflect the new limits (ie. change alpha to read 7.5 to 11.5 Hz, etc.).

**EXT AUDIO INPUT:** allows any externally supplied audio signal to be gated by the analyzer's circuitry; input impedance: 1 megohm; maximum signal level 10 volts peak to peak.

**EXT PHONES OUTPUT:** allows the use of earphones in place of the analyzer's built-in speaker; 8 ohm output; 50 milliwatts.

**CATEGORY OUTPUT JACKS:** banana jacks located at the extreme right edge of the analyzer's front panel; supply TTL level signals with negative logic—for example, the ALPHA jack will be "low" if the analyzer's input signal falls into the alpha category, otherwise it will be "high"; low = less than 0.8 volts; high = more than 2.0 volts. These outputs are intended to drive the 1500 series of accessories made by Aquarius.

**CLOCK OUTPUT:** "CLOCK" output jack provides a

narrow (200 microsecond) pulse at each negative-going zero-crossing of the brainwave signal; pulse is 10 volts high; output impedance 10k ohms.

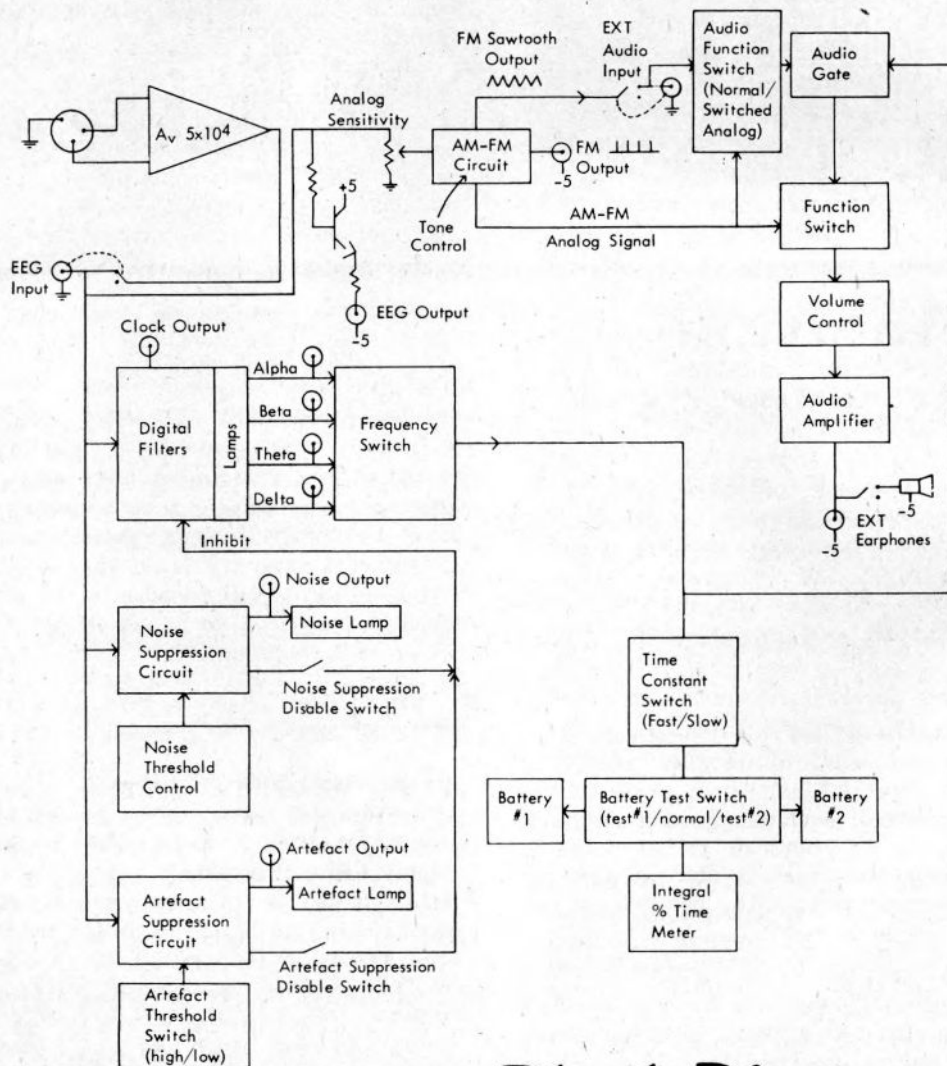
**NOTE:** The use of any input or output jack with power line operated accessory equipment requires some form of electrical shock protection for the Subject. The Model 501A and 502 photon couplers supply this protection for analog signals. The 1500 series of accessories contain built-in isolation for similar protection of the digital outputs.

**Assessories Available:** CN1, CN2, CN3, CN5, CN6, CN7, CN8, CN9, 301, 501A, 502, 600, 610, 620, 1501, 1502A, 1503A, 1504, 1505, 1505A, 1506, 1507, 1508 and 1509.

**Shipping Weight:** 10 lbs. (batteries not included).

**Price:** \$540 FOB Mendocino, California.

**Delivery:** usually from stock.



**Block Diagram**

# 1001CT & DT

## TUNABLE MODELS

**Variable.** When experimental design requires that a specific frequency or range of frequencies be monitored, the most desirable instrument is the tunable ALPHAPHONE® brainwave analyzer. This instrument is available in two models, identical except for the method of frequency selection.

**Increments.** The Model 1001DT is the easier of the two to operate. Its frequency limits are varied in increments of 1 Hz, selected by turning a rotary switch to values that are clearly marked on the front panel. The standard limits are: 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, and 20 Hz. By the use of the three selector switches, any four frequency bands can be selected in a matter of moments.

**Continuous.** The Model 1001CT is continuously tunable. The values are selected by means of three helipots, each equipped with ten-turn, turns-counting duo-dials which resolve the selector's rotation into 1000 different

settings. Each frequency selector is smoothly adjustable over the 3 to 20 Hz range (30 Hz on request). The three helipots can be set anywhere within the range (at 3.5 Hz, 7.5 Hz, and 14.7 Hz, for example).

The added resolution of the Model 1001CT does have its cost, however: the frequency limits are a bit more complex to adjust. To set a given limit to a particular frequency range, the operator looks up the corresponding dial setting on a calibration table that is supplied with the instrument. Thus, for instance, 3.35 Hz might correspond to a dial setting of 0.75. Each instrument is individually calibrated.

**General:** both 1001CT and 1001DT are identical in all respects to the standard Model 1001A brainwave analyzer, with the specific exception of its adjustable frequency limits.

**Frequency Accuracy:** absolute accuracy  $\pm 5\%$ , repeatability  $\pm 2\frac{1}{2}\%$ .

**Size:** 16" x 9" x 5 $\frac{1}{2}$ ".

**Weight:** 15 lbs. (with batteries); 10 lbs. (without batteries). Due to high shipping cost, analyzers are shipped without batteries.

**Price:** \$660 FOB Mendocino, California.

**Delivery:** 2 to 4 weeks ARO.

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## Analyzer Accessories

**Adaptable.** The ALPHAPHONE® brainwave analyzer was designed to be adaptable to many professional situations through its inherent versatility and through the addition of many useful accessories. Each of the category lights relates to an output jack. Thus, with the same short latency, a wide variety of counting, recording and feedback instruments can further assimilate the brainwave signal.

**Prices** are all FOB Mendocino. Delivery times quoted are ARO (after receipt of order). All prices are subject to change without notice.

**Hazard.** In attaching the ALPHAPHONE® brainwave analyzer to powerline operated equipment, please be aware that it is WELL connected to the head. Some form of isolation MUST be provided between the subject and any AC powered instruments. Besides avoiding the danger of electrical shock, isolation must be provided to keep 60 Hz hum from drowning out the weak brainwave signal.

**Isolation.** To eliminate such problems as

these, we use optical isolation, i.e., a light emitting diode/photo transistor coupled pair. For simple isolation of an analog signal, we market the AQUARIAN<sup>TM</sup> photon coupler — Model 501A or 502 — a one channel optical isolator. For digital instrumentation, using the category outputs, we build the isolation into the switching circuitry.

## CN7

As mentioned, the ALPHAPHONE® brainwave analyzer has 60 Hz filtration in combination with a differential preamplifier design, allowing different electrode arrangements. CN7 is a mono-polar electrode assembly (using only two electrodes, one active and one ground). Its plug is wired to ground one of the preamplifier's two differential inputs, converting it to a "single-ended" preamplifier. This electrode can be used either with the brainwave analyzer or the EMG.

Due to increased sensitivity to 60 Hz hum caused by the lack of common mode rejection (a situation minimized by the 60 Hz notch rejection filter), it is preferable that this electrode set be used in electrically quiet areas—such as a shielded room or outdoors, away from powerlines.

This electrode set uses the same solid silver disc electrodes that are supplied with all our instruments. The cable is 4 feet long and is terminated in an A3F connector which matches the analyzer or EMG's input connector.

CN7 \$10.

## CN8

CN8 is a bi-polar electrode assembly with a silver earclip ground electrode and two silver disc electrodes. Otherwise, it is identical to the standard electrode assembly supplied with the brainwave analyzer or EMG.

CN8 \$10.

## CN9

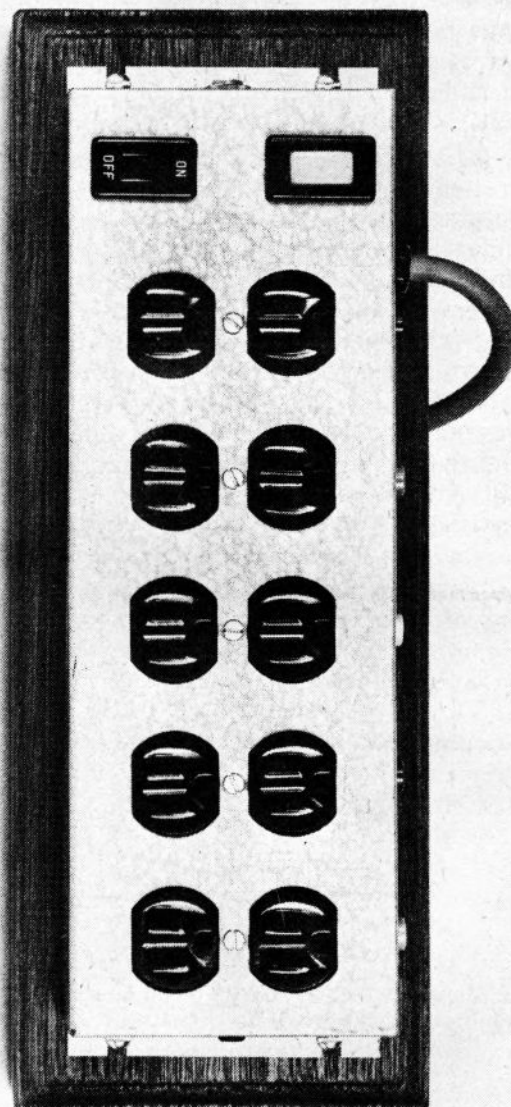
CN9 is an extension cable which allows the subject to be located up to 25 feet away from the brainwave analyzer or EMG to which he is connected. The extension cable is shielded and is terminated at one end with an A3M connector, and at the other end, with an A3F connector. Any brainwave analyzer or EMG electrode cable can be extended with CN9.

CN9 \$15.

## CN10

CN10 refers to adhesive discs which are sold by Beckman Instruments. They are used to hold electrodes in place where a headband will not work. The adhesive disc has a hole in the center which is usually filled by the user with electrode cream. Package of 500, 3/8" ID x 1 1/4" OD.

CN10 \$30.



## 1501 POWER SWITCHING CIRCUIT

*Isolator/switch.* The Model 1501 is a four channel power switching circuit through which the ALPHAPHONE® brainwave analyzer's category outputs control powerline operated (AC) instruments and feedback displays. Each of the four channels has its own optical isolating circuit, providing both safety from shock and exclusion of distracting powerline noise (60 Hz hum).

*Dominant frequencies.* Isolated signals from the analyzer are simple on/off signals, indicating which brainwave type is dominant. These signals control power switching circuits

which supply 110 volt, 60 Hz power to ordinary power outlets. Any powerline operated accessory can be plugged into the outlets and thus be controlled by the Subject's brainwaves. In typical use, the 1501 controls incandescent light displays (such as the Model 1504), timers for measuring accumulated time

*Instant.* Because the 1501's power outlets are controlled by the analyzer's category outputs, only one output is activated at any time. The outputs instantly switch on when the associated analyzer category is activated and switch off when it is not. Each of the 1501's four channels has two outlet receptacles, allowing two accessories to be controlled by each channel. The power is relayed through receptacles of the three-wire, grounding type. Mounted on a fine hardwood case, the Model 1501 arrives complete with connecting cables, instructions and a five year warranty.

spent in each brainwave category, event recorders, vibrators for tactile feedback, etc. The 1501 contains no moving parts and is silent in use.

**Isolation:** all inputs protected by 500 volts isolation.  
**Input Sensitivity:** designed to be driven by the brainwave analyzer Model 1001A, CT or DT; accepts TTL inputs, negative logic.

**Power Switching Capability:** can handle a total load among all four channels of 10 amps (1,000 watts); load may be divided among the channels in any way provided no single channel's load exceeds 5 amps (500 watts); smallest load reliably switched is 10 watts.

**Circuit Breaker:** protected by its own circuit breaker

**Power Consumption:** 110 volt 60 Hz power; with no loads attached consumes about 10 watts; with loads, up to 1,010 watts.

**Size:** 18" x 6" x 4".

**Shipping Weight:** 10 lbs.

**Price:** \$270 FOB Mendocino, California.

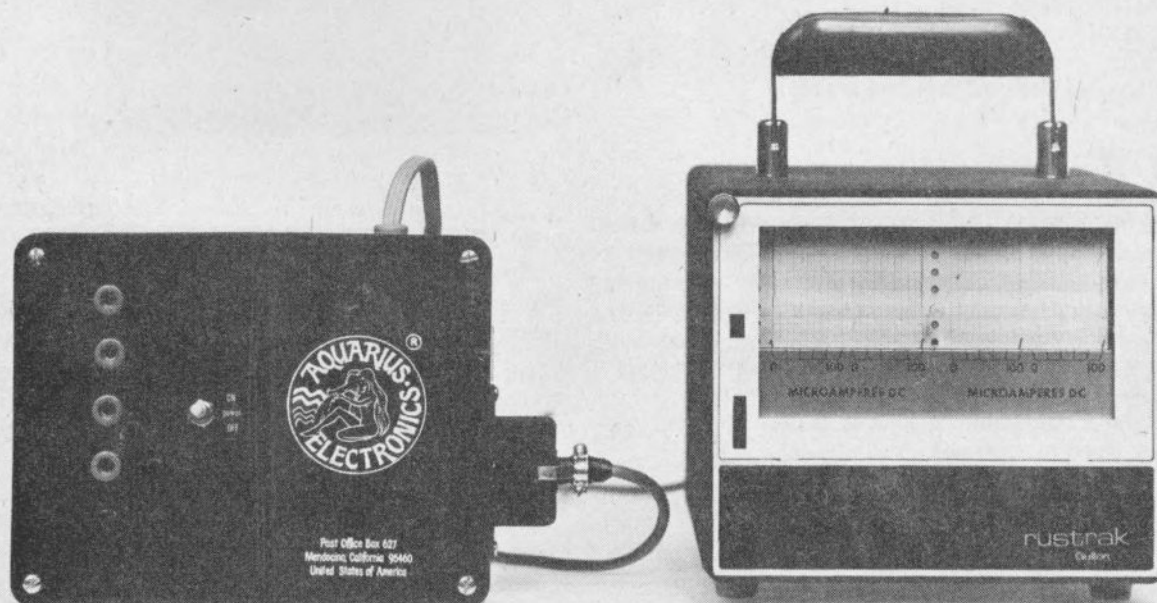
**Delivery:** 2 weeks ARO.

## 1502A CHART RECORDER

*Percent/time.* The Model 1502A is an inexpensive system for recording the average percentage of time a Subject spends in each of four brainwave categories. The isolated signals from the analyzer are simple on/off

signals indicating instantaneous changes in dominant brainwave state. The 1502A averages these signals over a time period of 5 seconds, and uses the information to drive the four independent meter movements of a Rustrak chart recorder.

*Low operating cost.* One 63 foot roll of chart paper will record over 12 hours of



brainwave data. This is a much more compact recording method than directly recording the EEG signals with a high speed chart recorder and it is appropriately less expensive. The Rustrak chart recorder is an unusually inexpensive type of analog chart recorder, producing traces on pressure sensitive paper by clamping the pointers of four meter movements to the surface of the chart paper at regular intervals. The resulting record is highly linear and accurate, although the chart recorder costs only a fraction of what conventional pen/ink or thermal recorders do.

*Easily read.* The dots are produced by the clamping action at a rate of 3/second on 1 inch/minute chart paper. The resulting, closely spaced dots form four lines that graphically indicate the relative ebb and flow of the four primary brainwave categories. The patterns are easy to understand and are a definite aid in teaching brainwave control and measuring the progress of students or Subjects at a glance.

*Remote.* The Model 1502A has a two package design, mounting the isolating and integrating circuitry in a plastic case, separate from the Rustrak recorder. In this way, two purposes are served: the rhythmic clamping of the chart recorder is inaudible by virtue of distance from the Subject (a 25' cable is supplied with the instrument), the experimenter can observe the changes in percent/time from a different room. The distance between the analyzer and the isolator/switch circuitry must be kept short to cut down on electrical interference, but there is no limit (within reason) on the length of the isolator/switch to Rustrak cable.

**Isolation:** all inputs protected by 500 volts isolation.

**Input Sensitivity:** designed to be driven by the brainwave analyzer Model 1001A, CT or DT; accepts TTL inputs, negative logic.

**Integration:** 5 second time constant; longer time constants are possible.

**Chart Speed:** 1" per minute is standard; slower speeds are possible.

**Interconnecting Cable:** a 25 foot cable is provided.

**Power Requirements:** 110 volts 60 Hz 10 watts.

**Size** (plastic box): 5½" x 7" x 2½".

**Size** (Rustrak recorder): 6½" x 6½" x 5½".

**Weight** (plastic box): 2 lbs.

**Weight** (Rustrak recorder): 6 lbs.

**Total Shipping Weight** (including cable): 12 lbs.

**Price:** \$850 FOB Mendocino, California. NOTE: \$450 deposit required with order to pay for Rustrak recorder.

**Delivery:** 6 to 8 weeks ARO (due to long delivery for Rustrak recorder).

## 1503A

*Versatile.* The 1503A is the most versatile of all the 1500 series brainwave analyzer accessories. It includes a four channel percent/time chart recorder with all the capabilities of the Model 1502A. It contains also a four channel power switching circuit of unusual capability.

*Integrated switching.* As many experimental designs require minimum latency for feedback, the analyzer's output follows very fast shifts in the brainwave pattern. The 1503A contains a switching circuit similar to the 1501. But, also, many other designs require a less labile signal, where constant on/off switching would be a distraction to the subject or where feedback is desired only for high percent/time states. The 1503A averages the output signal from the category output jacks and relays this information both to a percent/time chart recorder and to variable threshold power switching circuits. Each channel on the 1503A has a control that is calibrated from 0 to 100%, which is the threshold adjustment. This could be set, as an example, so that more than 50% alpha turns on one light, more than 25% theta another light, and so on.

*Modes.* The Model 1503A has four modes of switch operation. *Instant+* is the mode identical to the Model 1501 and 1505A, that is, the power outlet is activated when the category output is activated. *Instant-* switches the power on when the category output is *not* activated. *Averaged+* switches the power on only when each given brainwave type exceeds the specified percent/time threshold. *Averaged-* switches the power on only when the percent/time of each given brainwave type is *below* the specified threshold.

*Silent.* The Model 1503A is a two package instrument, with the chart recorder remotely placed to eliminate any possibility of distraction to the Subject. The switching circuits are, of course, silent.

**Isolation:** provides 500 volts of isolation between its inputs and its power line operated circuitry.

**Integration:** averages over a 5 second time constant; longer time constants are available on request.

**Threshold:** the threshold control's setting will correspond to the chart recorder's indications 5%.

**Power Switching Capability:** can handle a total load among all four channels of 10 amps (1,000 watts); load may be divided among the channels in any way provided no single channel's load exceeds 5 amps (500 watts); smallest load reliably controlled is 10 watts.

**Circuit Breaker:** protected by its own circuit breaker.

**Chart Speed:** 1" per minute.

**Interconnecting Cable:** 25 feet.

**Power Consumption:** 115 volts 60 Hz 20 watts aside from the power controlled by the switching circuits; 1120 watts maximum total.

**Size** (electronics package): 12" x 14½" x 4½"; electronics package is built into a fine hardwood case.

**Size** (Rustrak recorder): 6½" x 6½" x 5½".

**Weight** (electronics package): 7 lbs.

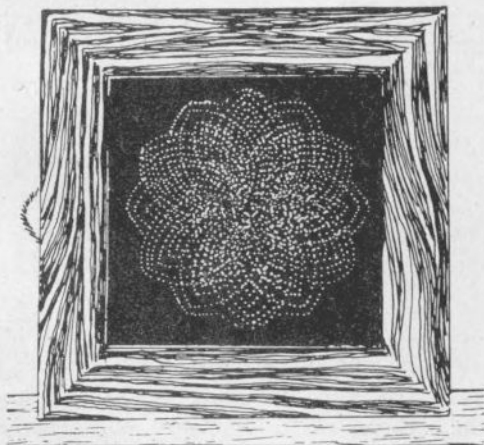
**Weight** (Rustrak recorder): 6 lbs.

**Total Shipping Weight:** 20 lbs.

**Price:** \$1200 FOB Mendocino, California. NOTE: a \$450 deposit is required with order to pay for the Rustrak chart recorder.

**Delivery:** 6 to 8 weeks (due to long delivery for the Rustrak recorder).

## 1504



### VISUAL FEEDBACK DISPLAYS

**Visuals.** The Model 1504 is a unique visual display designed by artist Jean Mayo. Collaborating with Dr. Stanley Krippner of the Menninger Dream Laboratory, Maimonides Medical Center, Brooklyn, New York, Jean Mayo has developed an unusually effective and pleasing display that visually indicates the brainwave state as presented by the ALPHAPHONE® brainwave analyzer.

**Construction.** The Model 1504, which Dr. Krippner is using to further his now famous studies of ESP and brainwaves, is constructed of hardwood and plexiglass with incandescent

lighting. The edge-lit plexiglass sheets are engraved with mandala-like patterns. The Subject sits in front of the 1504, watching the concentric display of changing patterns and colors. It is very effective for group display and for learning eyes-open alpha, theta and beta control.

**Switching.** The Model 1504 does not include the ALPHAPHONE® brainwave analyzer or power switching circuit, which should be ordered separately. There are five independent lighting circuits, all of which are designed to be powered by 110 volt power. One of the five circuits is normally ON continuously, the other four are plugged into a suitable power switching circuit (such as the Model 1501, 1503A, 1505A or 1506), which is in turn attached to a brainwave analyzer.

**Lamps:** the brainwave category inputs each have two 15 watt lamps; the fifth, or fixation lamp is a single 15 watt lamp; all lamps are miniature screw base type.

**Plexiglass:** plexiglass sheets are ¼" x 20" x 20" and are easily removed; special engraved designs are available on special order; standard designs are mandala patterns.

**Input cable:** all five lamp inputs are contained in a single input cable 25 feet long which separates into five cables with individual plugs at its end.

**Size:** 30" x 30" x 14".

**Shipping Weight:** 80 lbs. NOTE: The Model 1504 is too large and heavy to ship via US Mail. It is shipped via Express (truck).

**Price:** \$250 FOB Mendocino, California.

**Delivery:** 4 weeks ARO.

## 1504S

**Stereo.** The Model 1504S is a stereo version of the Model 1504 visual feedback display. The 1504S was shown at the Museum of Modern Art in New York City by Jean Mayo. It is similar in design to the Model 1504, but contains eight sheets of engraved plexiglass instead of four. The 1504S is used with two brainwave analyzers and two isolated switching boxes (1501, 1503A, 1505A or 1506) to display two different brainwave signals at once. These signals may be from two different parts of one person's brain, or they may be from two different persons (for experiments in synchronization and left/right hemisphere balance).

**Construction.** The 1504S is built into a fine hardwood case.

**Lamps:** brainwave category inputs each have two 15 watts lamps; all lamps are miniature screw base type.  
**Plexiglass:** plexiglass sheets are 1/4" x 20" x 30" and are easily removed; special engraved designs are available on special order; standard designs are mandala patterns.

**Input Cables:** the eight lamp inputs are separated into two cables of four inputs each, both of which in turn

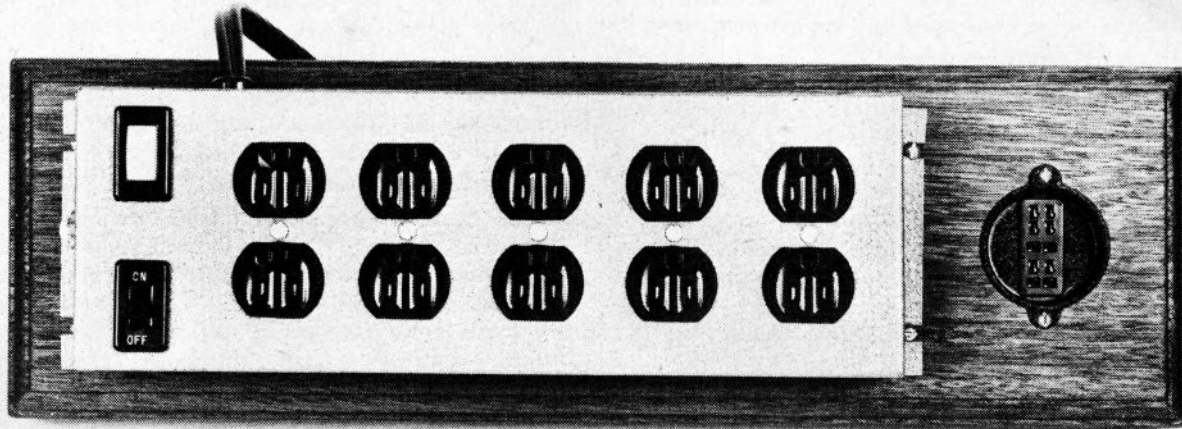
split into four separate cables with individual plugs at their ends; the cables are 25 feet long.

**Size:** 30" x 40" x 18".

**Shipping Weight:** 120 lbs. NOTE: The Model 1504S is too large and heavy to ship via US Mail. It is shipped via Express (truck).

**Price:** \$400 FOB Mendocino, California.

**Delivery:** 4 weeks ARO.



## 1505A

**Combination.** The Model 1505A combines the features of the Model 1501 and the Model 1502. The result is less expensive than the two instruments separately, as they share the same isolating circuitry and power supply. As with the other instruments that include a Rustrak chart recorder, the switching circuit is placed near the brainwave analyzer and the chart recorder as much as 25 feet away (with standard cable).

**Isolation:** 500 volts.

**Integration:** 5 seconds.

**Chart Speed:** 1" per minute.

**Input Sensitivity:** TTL levels, negative logic.

**Power Switching:** the 1505A can switch a total of 1,000 watts or 10 amps; this may be divided among the four channels in any way providing no one channel has a load over 500 watts or 5 amps; smallest load reliably switched is 10 watts.

**Power Requirements:** the 1505A consumes about 10 watts at 110 volts 60 Hz, not including the power switched by the switching circuitry which may vary from 0 to 1,000 watts.

Model 1505A Four Channel Percent Time Chart Recorder with Four Channel Isolated Switching Circuit (Chart Recorder not shown)

**Circuit Breaker:** the 1505 is protected by its own circuit breaker.

**Size** (electronics package): 18" x 6" x 4".

**Size** (chart recorder): 6 1/2" x 6 1/2" x 5 1/2".

**Weight** (electronics package): 7 lbs.

**Weight** (chart recorder): 6 lbs.

**Price:** \$990 FOB Mendocino, California. NOTE: a \$450 deposit is required with order to pay for the Rustrak chart recorder.

**Total Shipping Weight:** 20 lbs.

**Delivery:** 6 to 8 weeks (due to slow delivery of Rustrak recorder).

## 1506

**Variable threshold.** The Model 1506 percent /time switching circuit is identical to the Model 1503A. The Model 1506 does not include the Rustrak chart recorder, but it is in other respects identical to the 1503A.

**General:** does not include chart recorder; otherwise identical to Model 1503.

**Price:** \$600 FOB Mendocino, California.

**Delivery:** 2-4 weeks ARO.

## 1507

**Gate.** The Model 1507 stereo audio gate is a battery operated brainwave analyzer accessory. It can be plugged into any of the five main brainwave analyzer categories: artefact, beta, alpha, theta or delta. The selected brainwave category will then control the audio gate. A stereo audio signal from a tape recorder (battery powered) or other source is plugged into the gate's input. This audio signal will appear at the gate's output whenever the gate is turned on by the dominance of the selected brainwave category. This functioning is very similar to the analyzer's EXTERNAL AUDIO INPUT feature.

**Modes.** The 1507 can operate in two modes. In the *instant* mode, the audio input will be switched on whenever the selected brainwave category is activated. In the *averaged* mode, the audio input will be switched on whenever the selected brainwave category is activated more than the selected percent/time level. A knob allows this threshold to be adjusted from 0 to 100%.

**Construction.** The 1507 is built into a rugged, plastic case. It is battery powered, with over 200 hours of battery life. It is built of carefully assembled solid state circuitry and is covered by Aquarius's usual five year parts and labor warranty.

**Input Impedance:** 100k.

**Input Sensitivity:** signals must be less than 5 volts peak to peak.

**Output Impedance:** 8 ohms.

**Output Power:** 50 milliwatts per channel.

**Averaging Circuit Time Constant:** 5 seconds.

**Batteries:** 2 Burgess F4BP or equivalent.

**Battery Life:** over 200 hours.

**Size:** 7 1/2" x 8 1/2" x 3 1/4".

**Shipping Weight:** 7 lbs. with batteries.

**Price:** \$140 FOB Mendocino, California.

## 1508

**Pentatone.** The Model 1508 pentatone adapter is an accessory which converts the ALPHAPHONE® brainwave analyzer into a pentatone feedback system. The 1508 accepts inputs from the analyzer's artefact, beta, alpha, theta and delta category outputs. It represents them with tones of descending

pitch, similar to the form of audio feedback used by Dr. Elmer Green in his well known experiments. The different brainwave frequency ranges are easily recognized by their representative tones. The 1508 is battery powered and contains its own built in amplifier and loudspeaker. It is equipped with all necessary interconnecting cables and has the usual five year warranty.

**Input Sensitivity:** designed to accept the analyzer's category outputs; low level TTL negative logic.

**Built In Loudspeaker:** 2 3/4" diameter.

**Audio Output Power:** 50 milliwatts.

**Tones:** the five different tones are internally adjustable by means of screwdriver adjustments; they are factory set to pleasing pitch intervals.

**Batteries:** 2 Burgess F4BP or equivalent.

**Battery Life:** over 200 hours of continuous use.

**Size:** 7 1/2" x 8 1/2" x 3 1/4".

**Shipping Weight:** 7 lbs. with batteries.

**Price:** \$150 FOB Mendocino, California.

## 1509

**Accumulation.** The 1509 is a battery operated timer which measures the accumulated amount of time any one of the brainwave analyzer's five main category outputs (artefact, beta, alpha, theta or delta) is activated in 1/100 of a second and which displays the accumulated time in 1/10 of a second, up to a total time of 999.9.

**Construction.** The 1509 has two controls: an ON/OFF switch and a START/STOP switch. The mechanical counter which displays the accumulated time has a separate RESET button. The 1509 is mounted in a rugged plastic case. Its battery life is over 100 hours with continuous use. It is shipped with interconnecting cables (to plug into the brainwave analyzer), instructions and a five year warranty.

**Input Sensitivity:** the 1509 is designed to be driven from the analyzer's category outputs; these are low level TTL outputs with negative logic.

**Timing Accuracy:** displays time in 1/10 sec increments but measures it in 1/100 second increments; accuracy 1% 0.1 second.

**Batteries:** 2 Burgess F 4BP or equivalent.

**Size:** 7 1/2" x 8 1/2" x 3 1/4".

**Weight:** about 7 lbs. with batteries.

**Price:** \$150 FOB Mendocino, California.

## 700 CHART RECORDER

**Rapid.** The Model 700 is a single channel EEG chart recorder. It differs from the Rustrak percent/time chart recorder in that it is more expensive (per channel), and has the ability to respond to rapidly changing brainwave signals. The Model 700 can record the EEG signal directly, while the Model 1502 can record only percent/time spent in given brainwave category. Each has its function, purpose and value.

**Construction.** The Model 700 is equipped with a built-in photon coupler to provide isolation for EEG signals coming from an ALPHAPHONE® headset or ALPHAPHONE® brainwave analyzer. There is a panel selection between two different chart speeds—25 mm/sec and 50 mm/sec. A sensitivity control allows expansion or contraction of the width of the image. A heated

stylus traces the EEG signal on inexpensive NCR paper. A 150 foot roll of chart paper costs only \$1.75 and lasts for about 1/2 hour of continuous recording at 25 mm/sec. The Model 700 is built into a fine hardwood case and is covered by a five year parts and labor warranty.

**Input Impedance** (bypassing photon coupler): 1 megohm.

**Input Impedance** (through photon coupler): to match EEG outputs of headset and brainwave analyzer.

**Input Sensitivity** (through photon coupler): sufficient to display 1 microvolt/mm with signals from headset or analyzer.

**Position Control:** full scale.

**Linearity:** within 2%.

**Chart Speed Starting Time:** 2 second maximum.

**Chart Speed Accuracy:** 2% maximum.

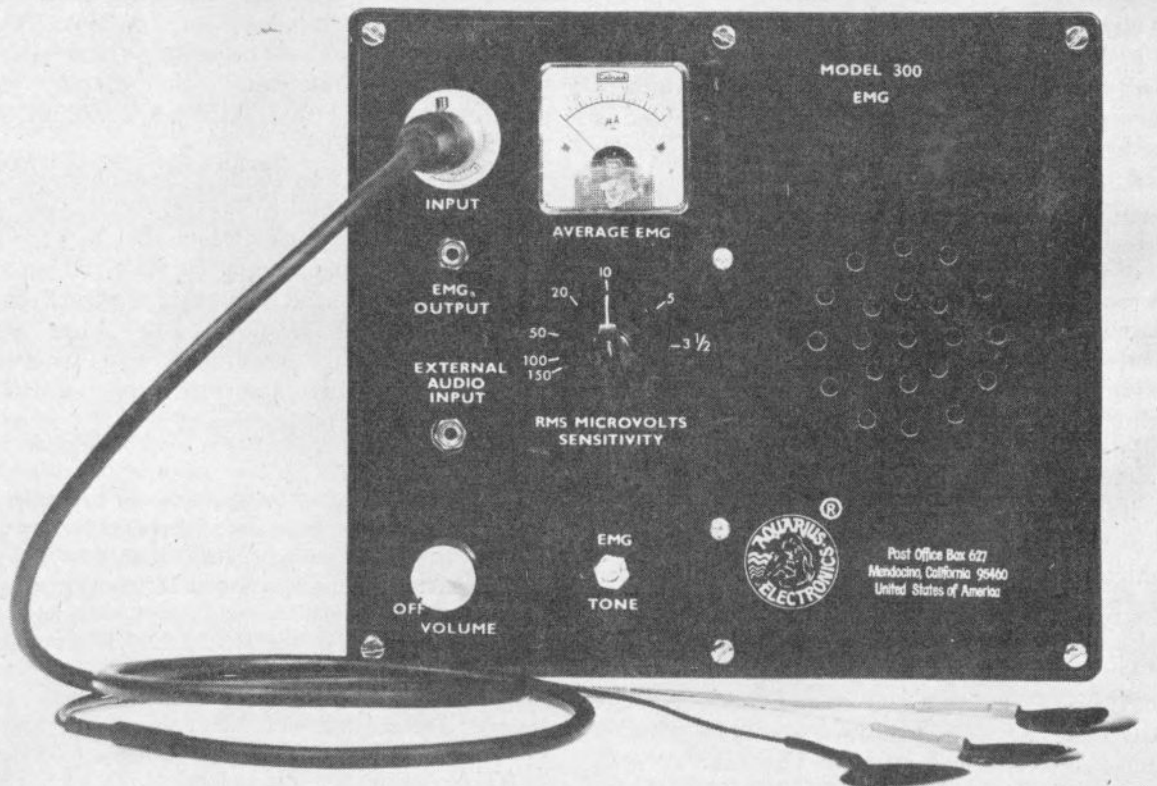
**Frequency Response** (at 1 cm amplitude): 0.5 db 1 Hz to 50 Hz, -3 db 100 Hz.

**Size:** 13 1/2" x 9" x 5 1/4".

**Shipping Weight:** 15 lbs.

**Price:** \$500 FOB Mendocino, California.

**Delivery:** 2 to 4 weeks ARO.



Model 300 EMG

# 300 EMG

**EMG.** The Model 300 is a battery powered, portable and completely self-contained system for electromyography. An electromyograph, or EMG, is an instrument which picks up, by means of electrodes, the weak electrical signals your body uses to control muscle contractions. These signals are amplified and then displayed in one or more ways.

**Display.** The Model 300 is designed to display three kinds of feedback—two audio and one visual. The visual feedback consists of a meter which reads out the average value of the EMG signal. In one of the audio modes, you hear the amplified muscle signals themselves, which sound a bit like bacon frying. In the other audio mode, you hear a tone whose pitch is proportional to the panel meter's reading, i.e., which rises and falls with the increases and decreases in muscle tension.

**Gate.** In addition to the variation of the pitch of the tone, there is an audio gate circuit which cuts off the tone completely if the meter reading falls below 20%. Thus, as a muscle is progressively relaxed, the feedback tone drops from a high pitch to a low pitch and finally to silence. An accessory input jack, labeled EXTERNAL AUDIO INPUT, allows the user to turn on and off any sound in preference to the internally generated tone. For example, a tape recording of autogenic feedback suggestions may be played through this jack.

**Output.** An accessory output jack allows a Model 501A or 502 photon coupler to be attached to the Model 300. With the safety from shock and hum, the EMG signal may be examined on an oscilloscope, chart recorder, or other accessory instrument.

**Panel.** The Model 300 has two control knobs; one is an ON/OFF switch, the other is a sensitivity control. The sensitivity control allows the user to adjust the muscle tension level which corresponds to 100% meter reading. During normal use, the sensitivity is at first set low. As muscle tension drops, the sensitivity is raised until EMG levels of only 1 microvolt keep the feedback tone on. When that tone is gated off, the muscles are completely relaxed. There is a toggle switch on the front panel of the Model 300 which selects the type of audio feedback heard. In normal use, the tone feedback is used until the

Subject is relaxed enough to allow use of maximum sensitivity. Then he can listen to the directly amplified EMG, which sound like "clicks" as individual muscle fibres are triggered.

**Construction.** The Model 300 is powered by two 6 volt lantern batteries (the same type used in the analyzer). A set will last for 250 hours of continuous use, or nearly 500 hours of intermittent operation. It is built into a strong, plastic case, is shipped with instruction manual, electrode set (see analyzer accessories for other electrode combinations), electrode cream, headband and five year warranty.

**"Squelch":** The Model 300 has an audio squelch circuit which suppresses any signals under 2 microvolts peak to peak. Because of this, silence is heard when there are no muscle signals; there is no annoying background noise. The meter rectifier and averager circuit also acts as something of a squelch circuit. With no input to the Model 300, the meter reading is zero even at maximum sensitivity. At maximum sensitivity a 3.5 microvolt RMS 220 Hz sine wave input to the Model 300 will produce a 100% meter reading. This indicates that the Model 300 can be used to measure weak muscle signals without interference from internally generated noise.

**Batteries Required:** 2 Burgess F4BP or equivalent.

**Battery Drain:** less than 20 milliamps.

**Battery Life:** over 250 hours.

**Internal Loudspeaker:** 2 3/4" diameter.

**Panel meter:** 1 3/4" diameter.

**Panel Meter:** 1 3/4" square; indicates EMG averaged over 1 second period.

**Sensitivity Control:** adjusts full scale meter sensitivity from 3.5 to 150 microvolts RMS.

**External Audio Input Impedance:** 100k (miniature phone jack).

**External Audio Sensitivity:** 1 volt.

**EMG Output Jack:** signal intended to drive Model 501A or 502 photon coupler (miniature phone jack).

**Input Jack:** standard three conductor microphone connector; microphone cable may be used to extend electrode cable.

**Electrodes:** solid silver discs 1 3/4" diameter are with a 4 foot shielded cable; many other electrode arrangements are possible; an elastic headband is supplied for holding electrodes in place for feedback of tension of frontalis muscles; Beckman adhesive discs are supplied to hold electrodes in place elsewhere on the body.

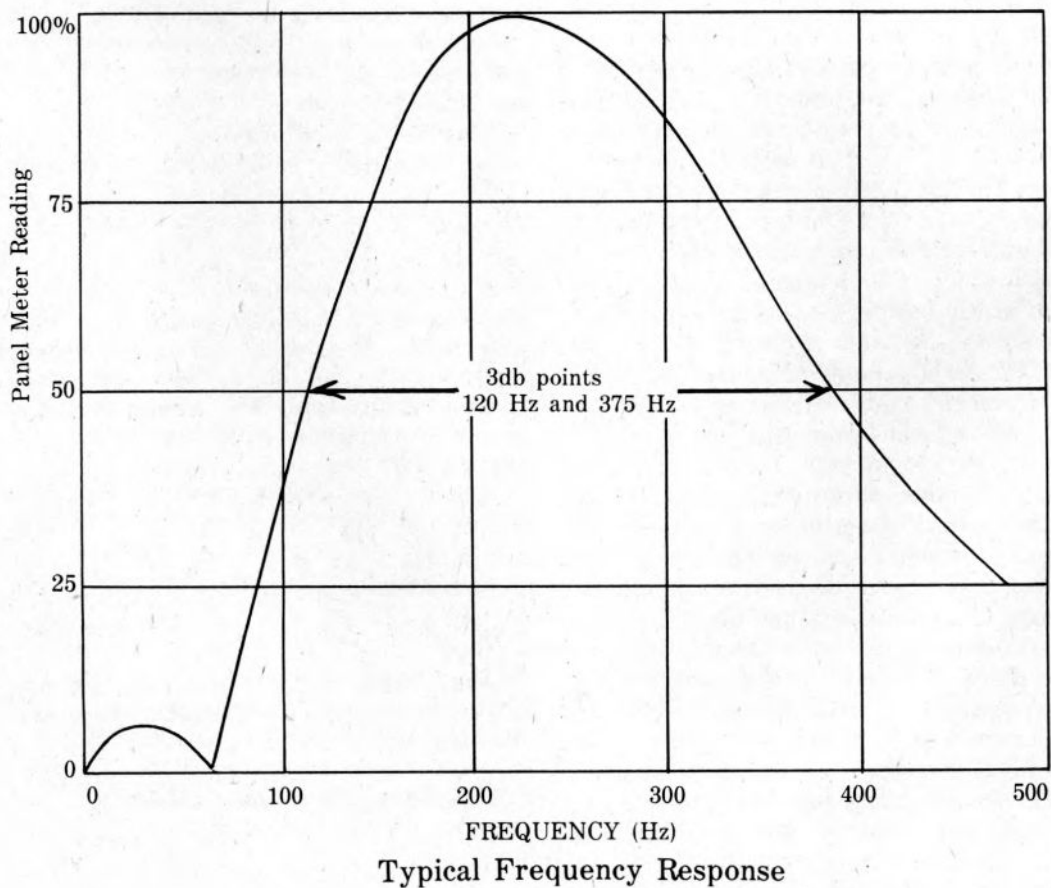
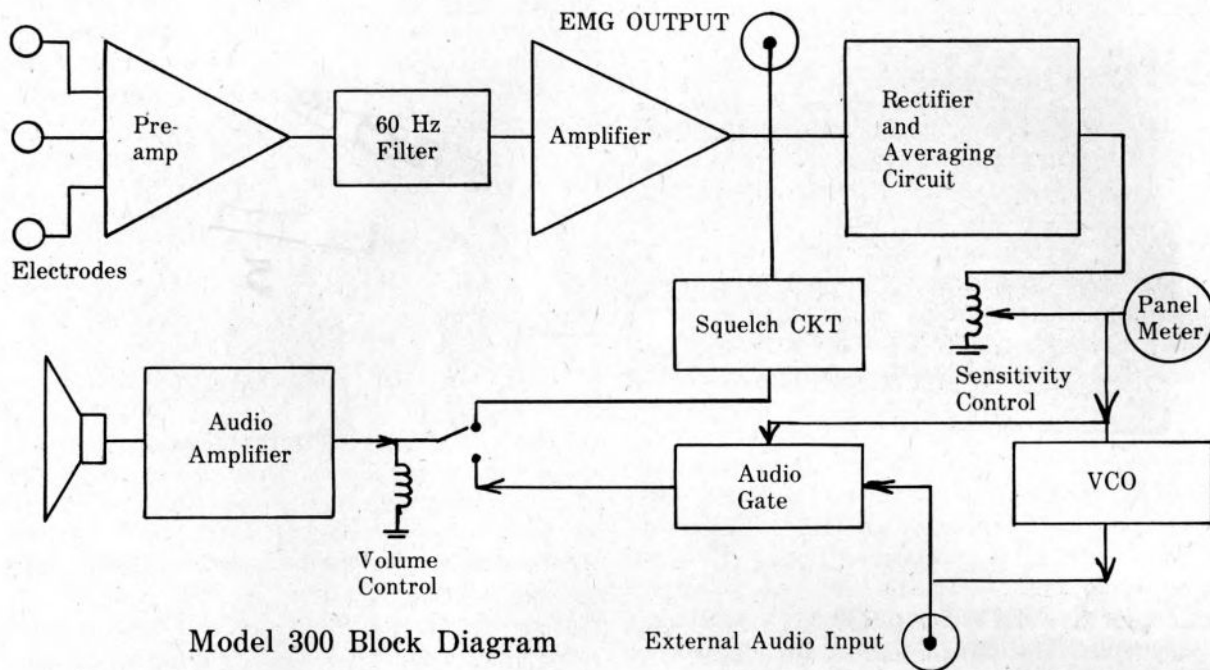
**Electrode Cream:** GROOM & CLEAN hairdressing is supplied for use as electrode contact cream.

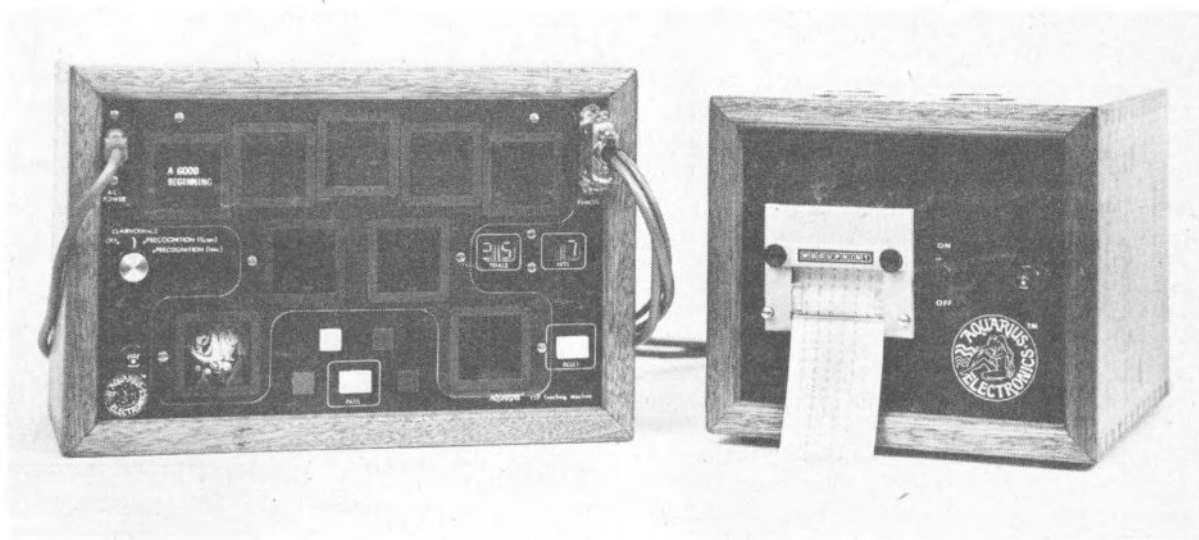
**Size:** 7 1/2" x 8 1/2" x 3 1/4".

**Shipping Weight:** 7 lbs.

**Price:** \$250 FOB Mendocino, California.

**Delivery:** Usually from stock.





## 100A ESP MACHINE

*Improved.* The Model 100A AQUARIAN<sup>T.M.</sup> ESP teaching machine can be used either as a test instrument to measure ESP ability or as a feedback system for enhancing ESP ability. It is an improved version of the machine described in Dave Hurt and Russell Targ's paper "Use of an Automatic Stimulus Generator to Teach Extrasensory Perception" (an invited paper presented to the IEE International Symposium on Information Theory).

*Random.* The Model 100A contains a random target selector which has no moving parts and which gives the subject no sensory clues to the target selected. The machine generates targets at a rate determined by the subject so that choices are not "forced". In the CLAIRVOYANCE mode the Model 100A selects a target and stores its selection internally. Then the subject tries to sense clairvoyantly the target chosen. In the precognition modes, the Model 100A doesn't select a target until  $\frac{1}{4}$  second or 1 second after the subject has made his choice. This gives the user an opportunity to determine if there is any change in his perceptual ability as he attempts to look further into the future. The temporal distance is zero in the clairvoyance mode, increasing to  $\frac{1}{4}$  second and 1 second in the two precognition modes.

*Modes.* In all modes of operation, the subject has a choice of five pushbuttons to indicate his choice of target. Four of the pushbuttons correspond to the four targets (which are color transparencies). The fifth pushbutton is a

PASS switch. The PASS switch is used when the subject does not have an ESP "feeling" of the correct target. Pushing the PASS button causes the machine to choose another target without changing the TRIALS score displayed on the front panel. Pushing any of the five buttons causes the target chosen by the machine to light up. If the subject's choice is a correct one, a bell rings and one (1) is added to the HITS score. In any case, if one of the four target buttons is pressed, one (1) is added to his TRIALS score.

*Encouragement.* In addition to the four target transparencies there are five encouragement legends which are also transparencies. The encouragement legends light up for 6, 8, 10, 12 and 14 hits. The first encouragement legend, the one which lights up for 6 hits, will remain lit for 7 hits and then goes out for 8-15 hits. The other four encouragement legends are "latching", that is, they will remain lit once they are turned on regardless of the total number of hits accumulated, until the RESET button is pressed.

*Reset.* The Model 100A is designed for "runs" of 25 trials. Once 25 trials are accumulated on the trials counter, the last target selected will remain lit even after the target pushbutton is released. The RESET pushbutton will light up to indicate that no further trials are possible until the RESET button is pushed. Until the machine is RESET, pushing any of the five selector buttons will have no effect on the machine.

*Telepathy.* The Model 100A can also be used in telepathy experiments. For this mode

of operation, the telepathy adapter accessory is plugged into the Model 100A's output jack. The accessory box displays the target chosen by the Model 100A in the clairvoyance mode to the sender while the receiver uses the Model 100A's pushbuttons in the usual way to indicate his choice of target.

**Targets:** type 127 or "Super Slides"; targets are easily changed (any slide in 2" x 2" mount may be used, including 35mm).

**Encouragement Legends:** type 127 or "Super Slides"; these are also easily changed.

**Randomness:** each Model 100A is carefully individually tested for randomness.

**Power Consumption:** uses 110 volt 60 Hz power, 40 watts.

**Speed:** targets may be selected at any rate; the Model 1600 printer accessory can only print three target choices per second, so if it is attached to the Model 100A that rate cannot be exceeded.

**Lamps:** targets and encouragement legends illuminated with Sylvania type #12-RB-352221-0 bulbs; 10,000 hour lifetime; easily changed, should one burn out; pushbuttons illuminated by #336 bulbs, also easily changed.

**Output Jack:** accessory output jack provides TTL logic signals with the following information: number of hits, number of trials, machine target choice, subject target choice, hit strobe, hit count, trial count and reset; mating connector is Amphenol 57-30240.

**Cabinet:** built into a fine hardwood case.

**Circuitry:** contains 31 integrated circuits, 18 discrete transistors and 8 discrete diodes; circuitry is mounted on three fiberglass-epoxy printed circuit boards which are silver plated.

**Size:** 13½" L x 9" W x 6¾" H.

**Weight:** 12 lbs. (actual) 17 lbs. (shipping).

**Accessories Available:** 1600, 1602, 1702 and 1703.

**Price:** \$990 FOB Mendocino, California.

on the panel; the third and fourth digits are the number of hits displayed; the fifth identifies the target selected by the Model 100's random target generator (using numbers 0 through 3); the sixth digit indicates the target selected (again using 0 through 3, and representing "pass" with the number 7). Serious researchers will find that the Model 1600's permanent records are essential to experimental design, relieving the researcher of the drudgery of making hand notations and removing the likelihood of error.

**Fast.** The Model 1600 can print up to two lines per second. The Subject can make up to two pushbutton choices per second without running ahead of the printer. The Model 1600 can print accurate data for precognition experiments as well as clairvoyance experiments. The data from the paper tape can be used to verify machine randomness, and check patterns of Subject choice (such as always guessing the target which the machine has just chosen).

**Capacity:** prints six digits on 2¼" wide fan-fold paper; the paper pack has a capacity of 4500 lines.

**Speed:** prints up to 2 lines per second in the CLAIRVOYANCE mode; in the precognition modes, the Model 100A's precognition delay time will limit the trial rate.

**Input:** contains all the necessary logic and driving circuitry to process the data from the Model 100A.

**Interconnect:** supplied with a 6 foot interconnecting cable to plug into the Model 100A.

**Power:** operates from 110 volt 50/60 Hz power; it consumes about 100 watts of power.

**Size:** 8" x 9¼" x 11".

**Weight:** 15 lbs. (actual) 20 lbs. (shipping).

**Price:** \$650 FOB Mendocino, California.

**Delivery:** 4 to 6 weeks.

## 1600 PRINTER

**Permanent.** Designed as an accessory to the Model 100A ESP teaching machine, the Model 1600 printer provides a permanent record on 2¼" wide, fan-fold paper of the number of trials and hits displayed on the Model 100A's front panel. The Model 1600 prints a six digit number every time a target selection or "pass" pushbutton is pressed. The six digit number contains the following information: the first two digits are the number of trials displayed

## 1602

**Converters.** The Model 1602 is identical to the Model 1600, with the addition of a parallel to serial converter which formats the printed data for driving a Model ASR-33 teletype. The teletype printer will print gibberish, but the teletype's paper tape punch will record data for each trial in an eight bit code which is easily read by a computer. The punched paper tape contains the following information: whether a trial was a hit, the machine choice, the Subject choice (if any), a special punch to indicate a "pass", and one parity bit.

**General:** identical to the Model 1600 except for the following features:

**Teletype Output:** Amphenol Hex connector type #126-197.

**Output Level:** + 15.0 volts with 1k ohm series resistor.

**Clock Rate:** 110 bps.

**Shipping Weight:** 20 lbs.

**Price:** \$750 FOB Mendocino, California.

**Delivery:** 4 to 6 weeks.

## 1702 TELEPATHY ADAPTER

**Telepathy.** The Model 1702 is an accessory to the Model 100A ESP teaching machine. The combination of the two is intended for use in telepathy experiments. The teaching machine is set to its clairvoyance mode. The 1702 displays the targets generated by the machine to the telepathic sender, who, with the 1702, is located up to 25 feet away. Thus, the telepathic sender sees the target before the receiver makes his choice, allowing for a test of thought transfer.

**Construction.** The 1702 has the same four transparencies mounted to its front panel that the 100A does, and four indicator lights keyed to the machine choices. The sender is notified of the receiver's choices by light and a bell that is the same as the bell in the Model 100A. As the 1702 derives its operating power from the

Model 100A, no additional power is necessary. The interconnecting cable is 25 feet long. The 1702 has an output jack which provides suitable signals for driving a eight channel Rustrak event recorder as an additional accessory. The Rustrak recorder then serves to record the machine and Subject choices for each trial. A two position switch on the 1702 allows it to be used to drive the event recorder for precognition experiments as well as telepathy and clairvoyance.

**Input:** plugs into the Model 100A ESP teaching machine; it derives all of its operating power from the 100A.

**Input Connector:** has a Cinch-Jones P-310RP 10 pin Connector into which the interconnecting cable plugs.

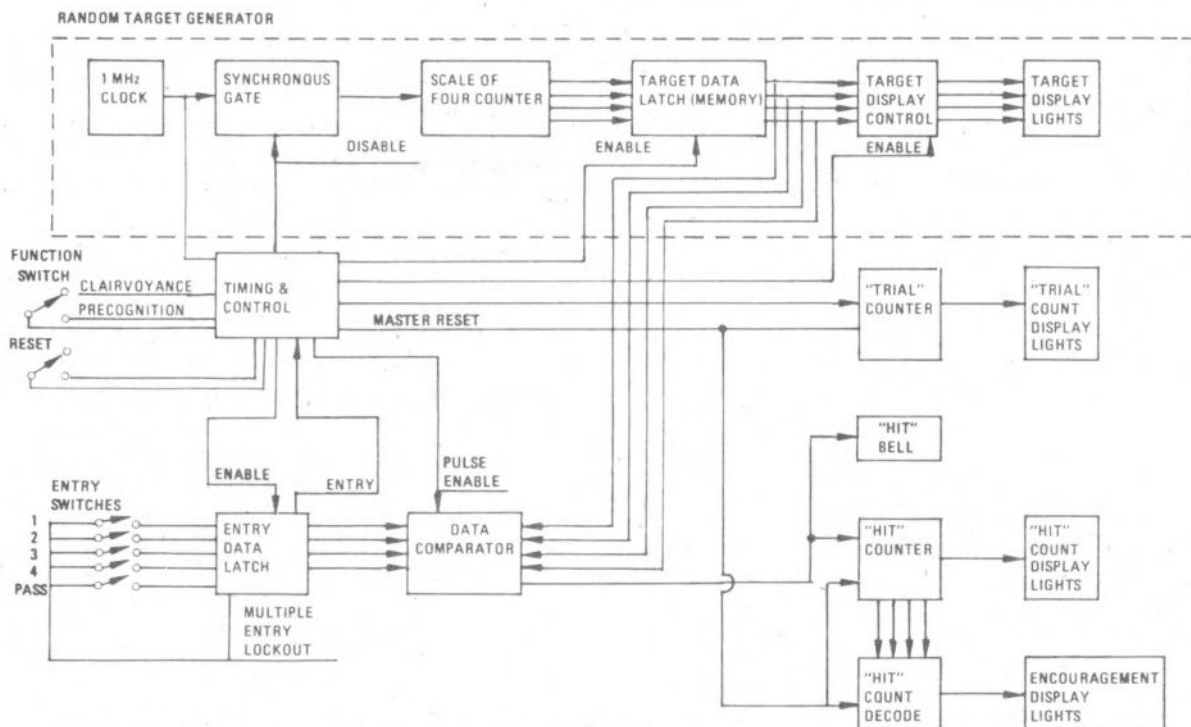
**Interconnect:** a 25 foot 10 connector cable is provided with an Amphenol 57-30240 plug on one end (to match the 100A's remote output) and a Cinch-Jones S-310CCT at the other end to match the 1702's socket.

**Output Jack:** a Cinch-Jones S-310RP is provided as an output jack to connect a Rustrak event recorder to the 1702.

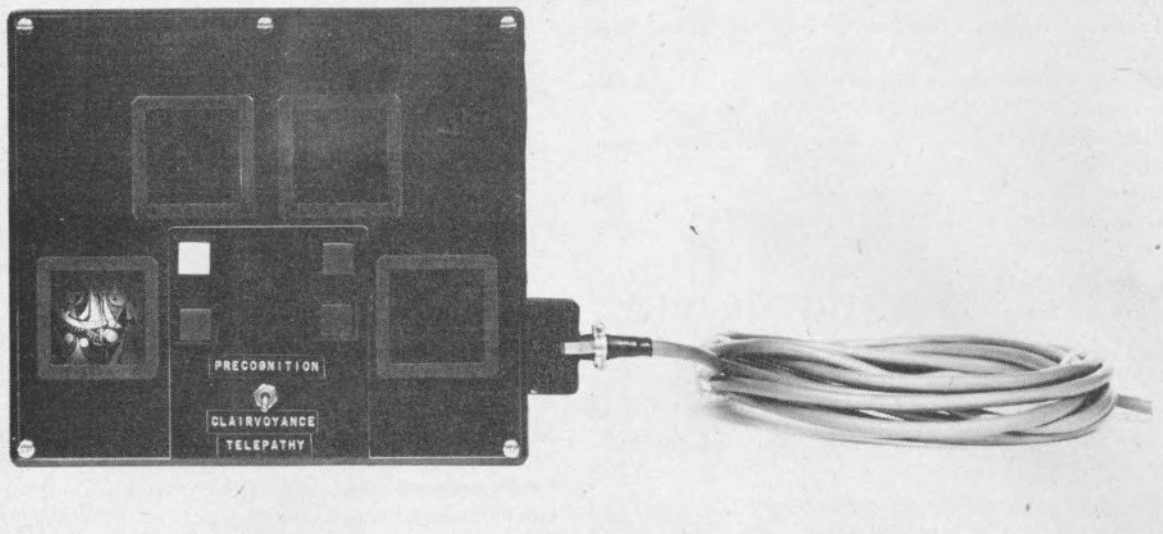
**Targets:** four color transparencies, type 127, often called "Super Slides"; these are easily changed.

**Lamps:** the targets are illuminated by Sylvania 12-RB-35221-0 bulbs; the receiver choice indicator lamps are illuminated by #336 bulbs; both the target and receiver choice bulbs are easily changed.

**Controls:** only control is a two position switch; in one position the 1702 acts as a display for telepathy



Block Diagram of ESP Teaching Machine



### 1702 Telepathy Adapter

transmission and it will properly drive an event recorder for both CLAIRVOYANCE and TELEPATHY modes; in the other switch position the 1702 will properly drive an event recorder for precognition experiments.

**Size:** 7½" x 8½" x 3".

**Weight:** 5 lbs. (actual) 7 lbs. (shipping).

**Cabinet:** the 1702 is built into a plastic box.

**Circuitry:** the 1702 contains 4 integrated circuits, 18 discrete transistors, and 28 discrete diodes; its circuitry is contained on a fiberglass-epoxy printed circuitry board.

**Warranty:** covered by Aquarius' standard five year warranty.

**Shipping Weight:** 20 lbs.

**Price:** \$300 FOB Mendocino, California.

**Delivery:** 2 to 4 weeks ARO.

## 1703

*Low cost.* Aquarius can supply an eight channel Rustrak event recorder with suitable chart drive (600 inches per hour) and interconnecting cable to permanently record the Subject and machine choices in ESP experiments. Although not as easy to read as the record from the 1602 printer accessory, the event recorder provides an inexpensive alternative to the 1602.

**Recorder:** Rustrak Model 292-8 event recorder with 24 volt pen actuators.

**Motor:** 100RPM with #12 gear train to supply 600 inch/hour chart speed.

**Power Supply:** Rustrak Model 921-8 24 volt supply is included.

**Interconnect:** a six foot cable is wired to the Rustrak at one end and provided with a Cinch-Jones P-310CCT plug to match the 1702's output jack.

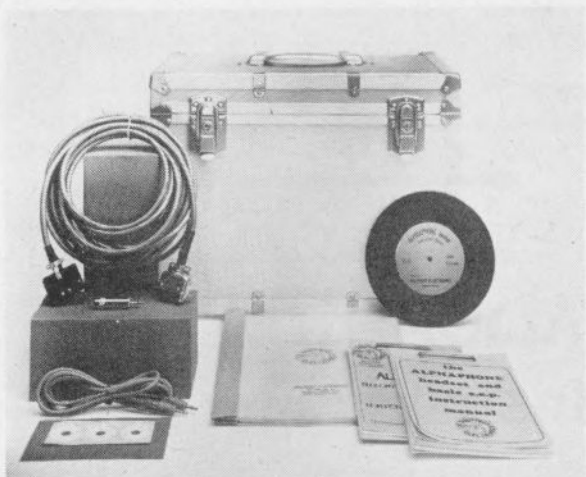
**Power Requirements:** 110 volts 60 Hz 20 watts.

**Chart Paper:** one roll of Rustrak type EE chart paper lasts for one full hour of experimenting.

**Shipping Weight:** 12 lbs.

**Price:** \$300 FOB Mendocino, California.

**Delivery:** 4 to 6 weeks ARO.



Carrying Case CC-2, Left top to bottom, Interconnect Cable for 1702, CN5, CN3, CN10, Adhesive Discs, Right, Instruction Record and Instruction Manuals.

## Product List

The books listed below are offered for your convenience. Add 50c to any book order for shipping and handling. As with any order California sales tax applies to book orders, just as to all other orders, for California residents. Book orders are shipped via surface mail, book rate, unless otherwise specified.

- A1**  
**ALPHA BRAIN WAVES** by Jodi Lawrence \$1.25
- A2**  
**BIOFEEDBACK** by Marvin Karlins and Lew Andrews \$1.25
- A3**  
**ALTERED STATES OF CONSCIOUSNESS** by Charles Tart \$4.95
- A4**  
**THE PHYSIOLOGY OF CONSCIOUSNESS** by Robert Ornstein \$3.50
- A5**  
**SPEECH AND BRAIN MECHANISMS** Wilder Penfield and Lamar Roberts \$2.45
- A6**  
**EEG TECHNOLOGY** by Cooper, Osselson and Shaw \$10.75
- A7**  
**BRAINS OF ANIMALS AND MEN** by Freedman and Morriss \$4.95
- A8**  
**ATTENTION IN NEUROPHYSIOLOGY** ed by Evans and Mulholland \$24.50

**A9**  
**MIND OF MAN** by Nigel Calder. \$4.95

**A10**  
**ALTERED STATES OF AWARENESS** Readings from Sci. Am. \$2.95

**A11**  
**PSYCHOLOGY: WHAT'S IN IT FOR US?** by Marvin Karlins and Lewis M. Andrews. \$2.95

## Manuals

**B1**  
**ALPHAPHONE® headset and basic e.e.p. instruction manual.** Includes: correlation, practice (emphasis on meditation), research bibliography, instrument operation, technical information, questions and answers on brainwave feedback. 102 pages. \$2.50

**B2**  
**ALPHAPHONE® brainwave analyzer instruction manual.** Includes: same as above, but has operating instructions and technical information for brainwave analyzer. 100 pages. \$2.50

**B3**  
**ALPHAPHONE® headset instruction record.** Describes analog (AM-FM) brainwave sounds. \$.50

**B4**  
**Model 100A ESP teaching machine instruction manual.** \$2.50

**B5**  
**FM demodulation instruction manual.** Includes instructions for use of 600 series instruments: the Model 600 pulse forming network, Model 610 calibration oscillator and Model 620 demodulator. \$.25

**B6**  
**Photon Coupler instruction manual.** Includes instructions for Model 501A and 502 Photon Couplers. \$.25

All orders for instruments naturally include instructions. If you would like to buy your manual in advance, we will credit you with \$2.50 for that instrument's purchase. [if you mark your instrument order to indicate you have already received your manual]. Booklets, with or without a record, will be shipped airmail for 50c additional. Californians please add sales tax. Orders from out of state to be shipped to addresses in California should include sales tax.

# Carrying Cases

## CC-1

**Carrying Case** for all ALPHAPHONE® brainwave analyzers. A hard type fiber case with polyurethane foam padding and moveable foam dividers. Dividers also form compartments for accessories. Size 18"x14"x8". Shipping weight: 10 lbs. **\$47**

## CC-2

**Carrying Case** for ESP teaching machine-aluminum clad reinforced chest type with poly foam lining. Shipping weight: 7 lbs. **\$57**

## CC-3

**Carrying Case** for ALPHAPHONE® headset & basic e.e.p. Same type case as CC-1 in smaller size. Shipping weight: 7 lbs. **\$37**

# Accessories

## CN1

**REALISTIC battery powered audio speaker/amplifier.** Includes: speaker/amplifier, battery, patch cord and instructions. Shipping weight: 10 oz. **\$15**

## CN2

**NOVA-FONE earphone.** Includes: earphone, patch cord. Shipping weight: 6 oz. **\$6**

## CN3

**Patch cord** with male mini-phone plugs on either end. 3 feet long. Shipping weight: 6 oz. **\$1.25**

## CN4

**Patch cord** with male RCA (phono) plug on one end, mini-phone plug on the other. 3 feet long. Shipping weight: 6 oz. **\$1.25**

## CN5

**Adapter** which allows standard stereo earphone to plug into a mini-phone jack such as on the basic e.e.p. or headset. **\$1.50**

## CN6

**Headphone.** For use with the basic e.e.p. and other instruments. Includes: 8 ohm stereo headphone with CN5 adapter plug. Shipping weight: 1 lb. **\$10**

## CN7

**Monopolar electrode assembly** with 4 foot cable. Shipping weight: 1 lb. **\$10**

## CN8

**Bipolar electrode assembly** with earlobe ground clip. Shipping weight: 1 lb. **\$10**

## CN9

**Extension for electrode cables.** 25 foot shielded cable with connectors to match normal electrode cables. Shipping weight: 2 lb. **\$15**

## CN10

**Adhesive discs** for holding electrodes in place. Package of 500. Shipping weight: 8 oz. **\$30**

**ALL PRICES SUBJECT TO  
CHANGE WITHOUT NOTICE**

# AQUARIUS

## Instruments

### 100A

See Page 25

**ESP teaching machine.** Includes: teaching machine, instructions and 5 year warranty. Shipping weight: about 20 lbs. **\$990**

### 102A

See Page 5

**ALPHAPHONE® headset** (without tone control). Includes: headset (with silver, integral electrodes), batteries, headband, electrode cream, instruction book and record, 5 year warranty. Shipping weight: 2½lbs. **\$140**

### 102T

See Page 5

**ALPHAPHONE® headset** (with tone control). Includes: same as Model 102A. Shipping weight: 2½lbs. **\$150**

### 201

See Page 3

**ALPHAPHONE® basic e.e.p.** Includes: instrument, batteries, headband, electrodes, electrode cream, instruction book and record, 5 year warranty. Shipping weight: 2½lbs. **\$80**

### 300

See Page 23

**EMG (electromyograph).** Includes: EMG, batteries, instructions, bipolar electrode assembly, headband, electrode cream, 100 adhesive electrode collars and 5 year warranty. Shipping weight: 7lbs. **\$250**

### 301

See Page 9

**AQUARIAN T.M. FM transmitter.** Includes: transmitter (with bolts for attaching to headset), batteries, instructions. Built-in cord. Shipping weight: ½lb. **\$30**

### 501A

See Page 9

**AQUARIAN T.M. photon coupler.** Includes: photon coupler, batteries, instructions and 5 year warranty (no patch cords). Shipping weight: 2 lbs. **\$48**

502 See Page 9  
**AQUARIAN<sup>T.M.</sup> photon coupler**, same as above; with booster amplifier.  
 Shipping weight: 2 lbs. **\$63**

600 See Page 8  
**Pulse forming network**. Includes: instrument, instructions..  
 Shipping weight: about 1/2 lb. **\$15**

610 See Page 8  
**Calibration oscillator**.  
 Includes: instrument, instructions.  
 Shipping weight: about 1lb. **\$30**

620 See Page 9  
**Demodulator**. Includes: instrument, instructions. Shipping weight: 1/2lb. **\$50**

700 See Page 22  
**EEG chart recorder**. Includes: chart recorder, instructions, chart paper. Allow 2 to 4 weeks for delivery. Shipping weight: 15 lbs. **\$500**

1001A See Page 12  
**ALPHAPHONE® brainwave analyzer**. Includes: brainwave analyzer, electrode assembly (bipolar), headband and electrode cream, 5 year warranty. Batteries are not included due to their high shipping cost. Shipping weight: 10 lbs. **\$540**

1001A-B See Page 12  
**Battery set** for brainwave analyzer, installed. We recommend you save shipping cost and buy locally. Shipping weight: 6lbs. **\$8**

1001CT See Page 15  
**ALPHAPHONE® tunable brainwave analyzer** with continuously adjustable frequency limits, from 3 to 30 Hz. Otherwise identical to Model 1001A. Includes: brainwave analyzer, electrode assembly (bipolar), headband and electrode cream, instruction manual and record, 5 year warranty. Batteries are not included due to their high shipping cost. Shipping weight: about 15lbs. **\$660**

1001DT See Page 15  
**ALPHAPHONE® tunable brainwave analyzer** with switch-selectable frequency limits of: 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17, and 20 Hz. Otherwise identical to Model 1001 A. Includes: brainwave analyzer, electrode assembly (bipolar), headband and electrode cream, instruction manual and record, 5 year warranty. Batteries are not included due to their high shipping cost. Shipping weight: about 15 lbs. **\$660**

1501 See Page 16  
**Four channel switching/isolating circuit**. Includes: switching box, cables for connecting to analyzer. Allow 4 to 6 weeks delivery. Shipping weight: about 10 lbs. **\$270**

1502A See Page 17  
**Four channel percent/time chart recorder**. Includes: chart recorder, cables for connecting to analyzer, 5 year warranty and chart paper and instructions. Allow 4 to 6 weeks delivery. Shipping weight: about 12 lbs. **\$850**

1503A See Page 18  
**Four channel variable threshold isolator/switch** with percent/time chart recorder. Includes: chart recorder and switching circuit, cables for connecting to analyzer, 5 year warranty and chart paper and instruments. Allow 4 to 6 weeks for delivery. Shipping weight: about 20 lbs. **\$1200**

1504 See Page 19  
**Jean Mayo's visual feedback display**. Includes: handmade hardwood/plexiglass instrument with cables for connecting to isolator/switching box (direct or variable threshold). Does not include switching box. Delivery 4 weeks. **\$250**

1504S See Page 19  
**Stereo version of Jean Mayo's visual display**. Includes: handmade hardwood/plexiglass instrument with cables for connection to isolator switching boxes. Does not include switching boxes. Delivery 4 to 6 weeks. Shipping weight: 120 lbs. **\$400**

1505A See Page 20  
**Four channel percent/time chart recorder** with four channel isolated switching circuit. Includes: switching box, chart recorder, 5 year warranty, chart paper and instructions, and cables for connecting to analyzer. Shipping weight: about 30 lbs. **\$990**

1506 See Page 20  
**Four channel percent/time switching circuit**. Includes: switching circuit, interconnecting cables to analyzer, instructions and 5 year warranty. Shipping weight: 15 lbs. **\$600**

1507 See Page 21  
**Stereo audio gate**. Includes: instrument, patch cords to connect to brainwave analyzer, batteries, instructions, and 5 year warranty. Shipping weight: 7 lbs. **\$140**

1508 See Page 21  
**Pentatone adapter**. Includes: instrument, patch cords to connect to brainwave analyzer, instructions, 5 year warranty. Shipping weight: 7 lbs. **\$150**

1509 See Page 21  
**Timer**. Includes: instrument, patch cords for connection to brainwave analyzer, instructions and 5 year warranty. Shipping weight: 2 1/2 lbs. **\$150**

**1600** See Page 26  
**Printer.** Includes: printer, interconnecting cable to plug into ESP teaching machine, and 5 year warranty. Shipping weight: about 20 lbs. **\$650**

**1602** See Page 27  
**Printer with teletype output provision.** Includes: printer, interconnecting cable to plug into ESP teaching machine and 5 year warranty. Shipping weight about: 20 lbs. **\$750**

**1702** See Page 27  
**Telepathy adaptor** for ESP teaching machine. Includes adaptor, interconnecting cable to plug into ESP teaching machine, instructions and 5 year warranty. Shipping weight: about 5 lbs. **\$300**

**1703** See Page 28  
**Eight channel Rustrak event recorder** (intended as accessory for the Model 1702). Includes: Event recorder with interconnecting cable to plug into Model 1702, special high speed motor and gear train. Shipping weight: about 5 lbs. **\$300**

## Ordering Information

**ORDERING** Please read carefully.

*We have two ordering plans:*

1) check or money order with order (in which case it is a good idea to use registered mail).

2) C.O.D.—the post office is paid the full amount plus shipping charges when the products arrive. C.O.D. orders may be placed by telephone.

**NOTE:** The United States Post Office does not allow C.O.D. orders to be shipped outside the U.S. Orders from outside the U.S. should be sent with full remittance in U.S. funds, by registered mail. The post office will not handle C.O.D. shipments for more than \$200. For any instrument costing more than \$200, we require a deposit of the purchase price less \$200.

### POSTAGE

We will ship orders with shipping charges collect unless you prepay them. The shipping weight of each item is listed on the order form. If you add the weights of the items you wish to order, and add the dollar value of these items for computing insurance, your local post office will be able to give you the exact shipping charges. As all major items are shipped

separately, only those whose individual dollar value is greater than \$200 (such as the brainwave analyzer) will be insured for less than their full value.

If you would prefer not to calculate shipping charges, you may either have your instrument shipped collect, or overpay enough to cover charges (and receive a refund of the difference). For example, the cost of shipping an ALPHAPHONE® Headset anywhere in the United States is less than \$5 (less than \$20 to anywhere in the world, not including customs duty); a brainwave analyzer, less than \$15.

### SHIPPING PREPAID ORDERS

California orders shipped parcel post, special handling, insured with return receipt. All orders outside of California shipped air parcel, insured with return receipt.

Orders are insured for full cash value up to \$200 which is the postal maximum. For orders over \$200, we ship registered mail with return receipt. If there is United Parcel service in your area, we will ship all orders over \$200 via this service.

### FOREIGN ORDERS

As C.O.D. orders are not accepted outside the U.S., payment must accompany order in the form of a bank draft drawn on an American bank and must be in U.S. funds. Such a draft has the U.S. bank's identification number printed in its upper right hand corner. Almost any bank can provide a draft in U.S. funds upon request.

Customs charges and regulations change frequently, making it impossible for us to keep ourselves accurately informed of changes. It is the buyer's responsibility to investigate regulations and pay customs charges. If you would like us to identify or label the package in any special (legal) way to aid customs clearance, let us know when you place your order. To aid in describing these instruments to your customs officials, explain that they are bio-electronic monitors and inject no current into the body.

### INVOICES

Invoices not enclosed or sent under separate cover unless otherwise requested. We cannot extend credit, except to universities and other large institutions who cannot make purchases any other way, for which we apologize.

### TELEPHONE ORDERS

As stated, telephone C.O.D. orders are accepted, however, they cannot be sent to foreign, APO or FPO addresses. A confirming written purchase order, with signed release (see order form) must be sent.

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Maryville, Tenn. 37801

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Amsterdam, Holland

Midland College  
Fremont, Nebraska

Mind Science Research Foundation  
Haddon Heights, N.J. 08035

Minnesota Mining & Manufacturing  
(3M Company)  
Saint Paul, Minnesota

Modesto Junior College  
Modesto, CA

Montecito Health Center  
Santa Barbara, CA

NASA-Langley Research Center  
Hampton, VA 23365

Ohio State University  
Athens, Ohio 45701

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Monmouth, Oregon

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