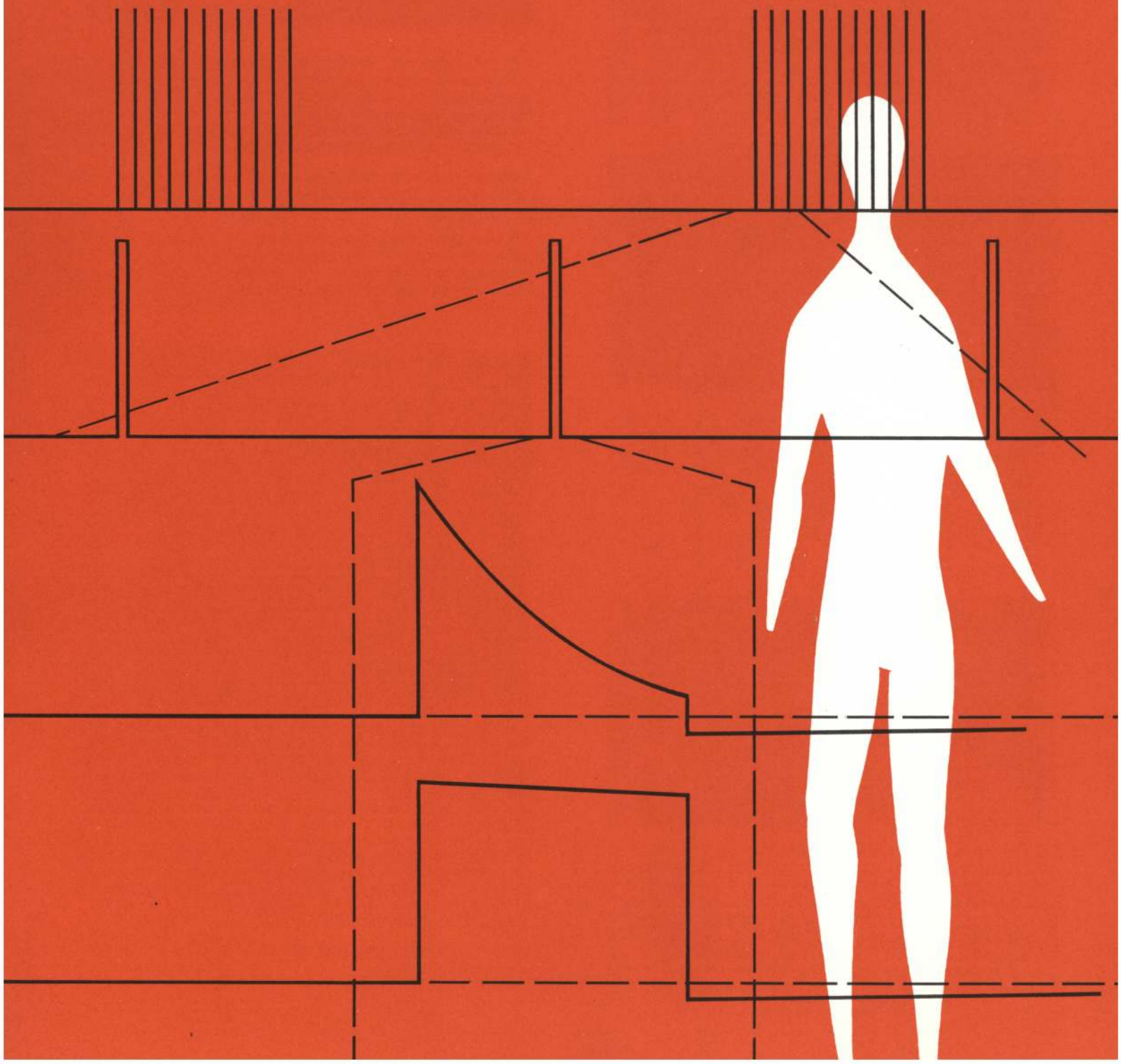
GENERAL ELECTRIC

REPETITIVE-PULSE STIMULATORS
CARDIAC PACEMAKERS

for Research Applications



REPETITIVE-PULSE STIMULATORS

These new, solid-state, investigatory stimulator devices are designed for general-research applications wherever artificial triggering of muscular reactions is indicated.

All models utilize solid-state circuitry for low power drain and trouble-free operation. Some units utilize external triggering accomplished by means of magnetic induction or electro-magnetic coupling. The stimulator mechanism is encapsulated in biologically-inert silicon rubber; internal lead wires have surgical needles already attached.

Should your needs dictate a more-specialized stimulator design than those you see here... we will be happy to work with you in the design of custom units. For details, write to General Electric, 4855 West Electric Avenue, Milwaukee, Wisconsin 53201, U.S.A.

OUTPUT STIMULATION WAVEFORM

(applies to all stimulator models)

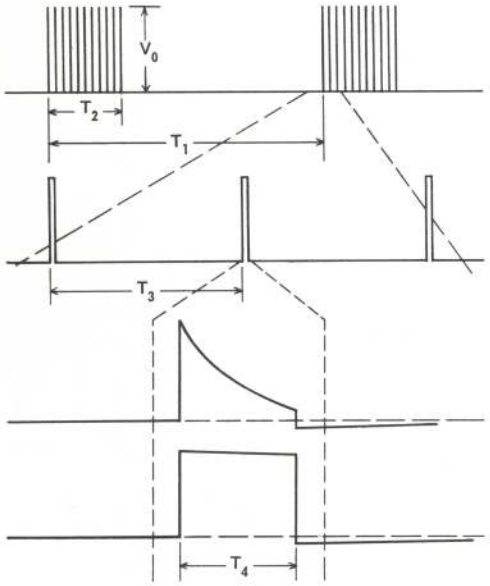


Fig. 1A

Fig. 1B

Fig. 1C

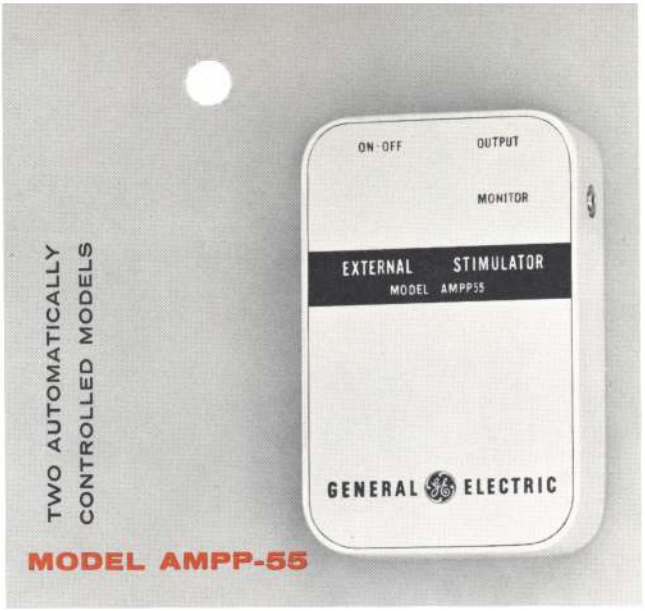
or

Fig. 1D

Definition of terms:

T_1 — Stimulation Period
T_2 — Stimulation Pulse Train
T_3 — Pulse Period
T_4 — Pulse Width
V_0 — Pulse Peak Voltage

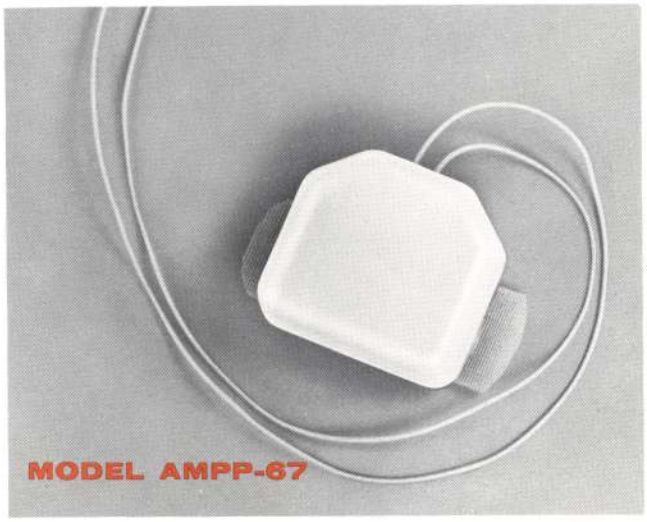
Load impedance: All stimulators are designed to operate into a minimum resistive load of $R_L = 330$ ohms.



Our automatic pulse sequencing external stimulator is completely transistorized, with long-life mercury batteries, compact hand-carried case with belt clip. The output pulse is variable in width, period and peak voltage. The output is a rectangular, biphasic pulse (See Fig. ID). Control adjustments of variables are made from back of case.

Variables and value ranges: T_1 — 10-30 seconds, T_2 — 0.1-1 second, T_3 — 10-50 milliseconds, T_4 — 0.1-1 millisecond, V_0 — 0-15 volts.

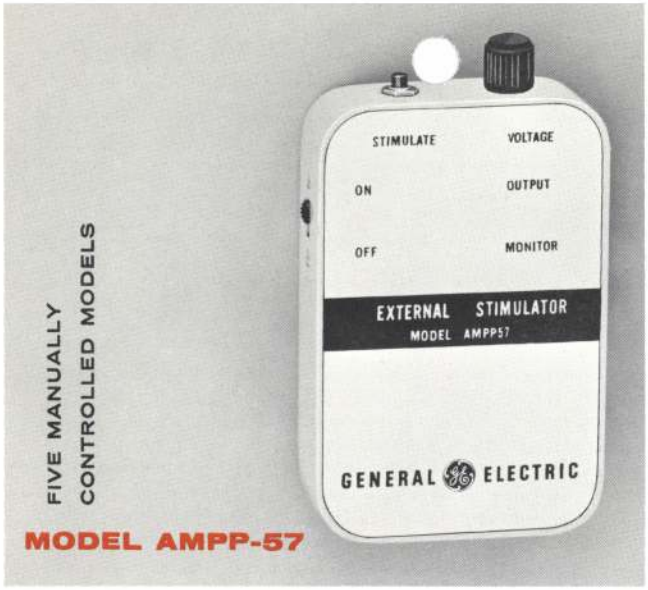
Four stainless steel electrodes are supplied, each consisting of a dual stainless steel stranded wire covered with silicon rubber. Special electrodes can be provided, at additional cost, to meet individual needs.
L — 4½″ W — 3″ D — 1″



The AMPP-67 implantable stimulator utilizes solid-state circuitry (as do all our stimulator models) with long-life mercury batteries. The electrode connector is easily removable. The unit's electronics and batteries are encapsulated in epoxy and then sealed with a biologically-inert, protective coating of silicon rubber.

Stimulator output is a differentiated, biphasic pulse with all parameters fixed in value (See Fig. 1C). Parameters and values are as follows: T_1 — 15 seconds, T_2 — 0.5 second, T_3 — 50 milliseconds, T_4 — 0.5 millisecond, V_0 — 15 volts ± 3 volts.

The unit includes one dual stainless steel electrode with connector attached.
L — 2¼″ W — 2½″ D — 1″



Our manually-controlled external stimulator, a versatile experimental device, is similar in design and construction to AMPP-55, with the exception of the manual control feature. The unit's output is a rectangular, biphasic pulse, variable in width, period and peak voltage (See Fig. ID). Control adjustments of T_3 and T_4 are made from back of case.

Variables and their value ranges: T_1 — manual, T_2 — manual, T_3 — 10-50 milliseconds, T_4 — 0.1-1 millisecond, V_0 — 0-15 volts.

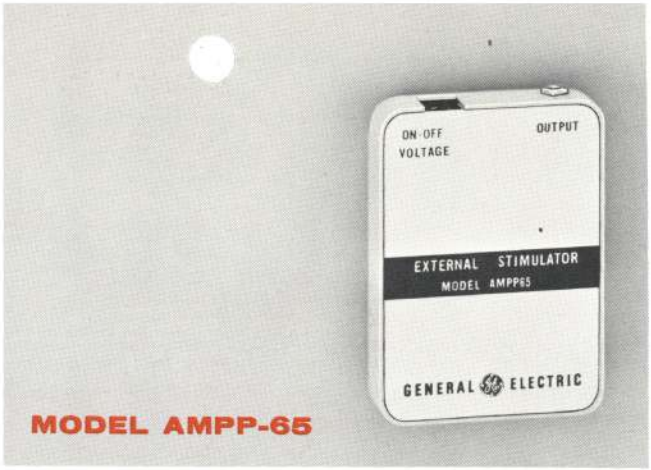
Four stainless steel electrodes are supplied, each constructed of a dual stainless steel stranded wire covered with silicon rubber. Special electrodes can be designed to meet the individual needs of the researcher, but at additional cost.
L — 4½″ W — 3″ D — 1″

This device — an R.F. controlled, implantable stimulator — contains an R.F. switching circuit controlled by an external R.F. transmitter. The implantable portion of the unit is epoxy-encapsulated, then sealed in a protective coating of biologically-inert silicon rubber.

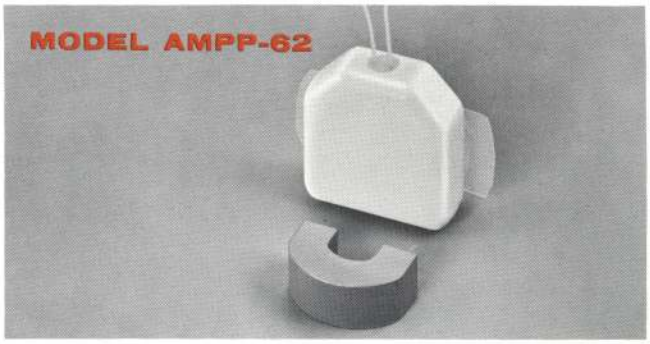
The stimulator output pulse, shown in Figure 1C, is a differentiated biphasic pulse, with parameters and values as follows: T_1 — manual, T_2 — "on" period of the R.F. transmitter (manual), T_3 — fixed at 50 milliseconds, T_4 — fixed at 0.5 millisecond, V_0 — fixed at 15 volts ±3 volts.

One implantable dual stainless steel electrode is supplied with connector attached.

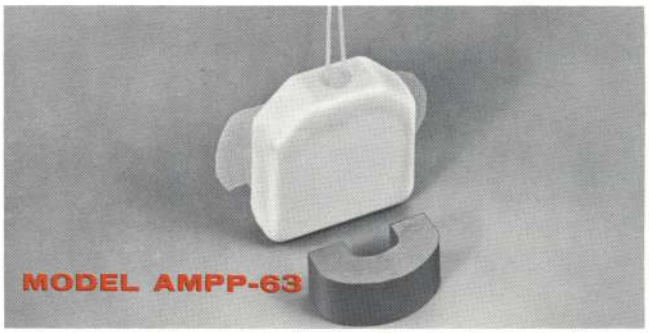
A L — 3½″ W — 2½″ D — ¾″
B Dia — 4¼″ C L — 2¼″ W — 2½″ D — 1″



From this manually-controlled, external stimulator—a variable-output, differentiated biphasic pulse (See Fig. 1C) is produced. The unit is compact, transistorized, powered by mercury batteries. A monitor jack is provided for observation and recording of the output stimulus waveform. Parameters and values: T_1 — manual, T_2 — manual, T_3 — variable from 10-50 milliseconds, T_4 — fixed at 0.5 millisecond, V_0 — variable from 0 to 18 volts. Four electrodes are supplied.
L — 3½″ W — 2½″ D — ¾″



AMPP-62 is a completely implantable, magnetically controlled stimulator having a differentiated biphasic pulse (See Fig. 1C). The electronics and batteries are encapsulated in epoxy and then sealed with a protective coating of silicon rubber. Parameters and fixed values: T_1 — manual, T_2 — manual, with application of external magnet, T_3 — 50 milliseconds, T_4 — 0.5 millisecond, V_0 — 15 volts ±3 volts. One stainless steel electrode is supplied with connector attached.
L — 2¼″ W — 2½″ D — 1″



This magnetically-controlled, implantable stimulator has an easily-removed electrode connector, and a magnetic reed switch controlled by an external permanent magnet. The output is a rectangular biphasic pulse (Figure 1D) with the following parameters and values: T_1 — manual, T_2 — manual, with application of an external magnet, T_3 — 50 milliseconds, T_4 — 0.5 millisecond, V_0 — 15 volts ±3 volts. The unit is epoxy-encapsulated, with a coating of silicon rubber.
L — 2¼″ W — 2½″ D — 1″

CARDIAC PACEMAKER

General-Electric investigatory cardiac pacemakers are similar in design (i.e.: solid-stage circuitry, long-life mercury batteries, encapsulation) to the stimulators discussed on the preceding pages.

Often indicated for treatment of complete heart block where Stokes-Adams seizures are present — the pacemakers, too, offer the exclusive advantage of an external trigger, overriding the internal set rate.

Again — if your needs seem to dictate a specialized pacemaker design, we will be happy to work with you in the development of "custom" pacemakers. For information write to General Electric, 4855 West Electric Avenue, Milwaukee, Wisconsin 53201, U.S.A.

This instrument has been designed with a special circuit which was chosen for its high reliability and low power drain. Small, long-life mercury batteries produce 65 microjoules of energy at 3.5 volts peak, for a duration of 5 milliseconds, at a repetition rate of 70 pulses per minute. Electronic research and space age technology have kept size and power drain down to a minimum consistent with the need for complete reliability. Weight: 5 ounces. Special unit can be supplied at any rate desired.
L — 2¼″ W — 2½″ D — 1″

Two internal wires lead from the implanted pacemaker to the heart itself. They are stainless steel, stranded for flexibility. Chemically inert silicon rubber encases the wires as well as the entire pacemaker . . . a plastic material noted for its physiological compatibility. Surgical needles are welded to each lead allowing the active part of the lead to be sutured into the myocardium of the left ventricle after which the needles are removed,

The optional external control — which increases the pacemaker rate by means of magnetic induction — eliminates troublesome leads through the skin . . . serves a succession of patients in their post-operative recovery.
L — 3½″ W — 2½″ D — ¾″

The G-E cardiac pacemaker was developed in conjunction with Adrian Kantrowitz, M.D., Maimonides Hospital, Brooklyn, N.Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC

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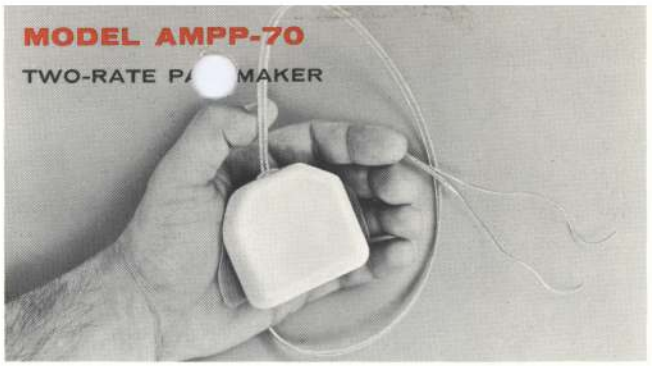
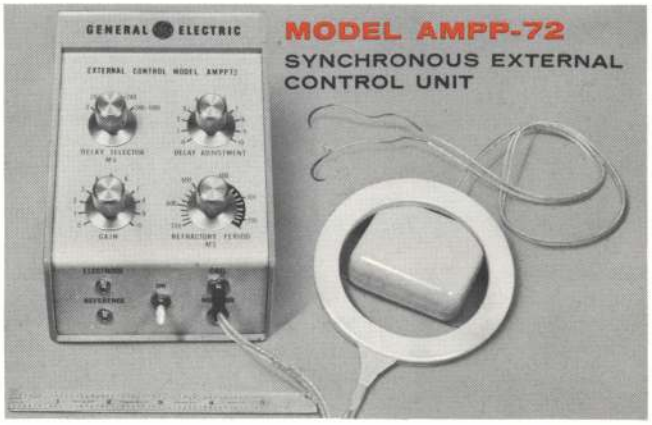


This unit has two repeatable set rates, NORMAL and ACTIVITY pacing modes, with external magnet control. The modes are selected by changing the magnetic switching logic within the internal pacemaker . . . accomplished by placing an external permanent magnet over the implantable unit. The pacemaker has a built-in memory which will retain the selected rate upon removal of the external switching magnet. The stimulus waveform is identical to that of our standard internal pacemaker. The fixed rate values must be specified when ordering this unit.

This unit provides four repeatable set rates with external magnet control. The four-rate unit is ideally suited for conducting experiments where the variable is studied as a function of rate. The switching function is performed simply by placing an external permanent magnet over the implantable unit. The pacemaker has a built-in memory which will retain the selected rate upon removal of the external switching magnet. The stimulus waveform is identical to that of our standard internal pacemaker. The fixed rate values must be specified when ordering this unit.



This device is designed for use in pacemaker experimentation. Three variable controls are included in the design: 1. Signal Delay (time interval between the detection of the electrical P-wave signal found on the body exterior and the firing of the internal pacemaker). 2. Refractory Period Control (to assure that the pacemaker rate does not exceed upper limits and to assure that the stimulus pulse will be kept well outside the danger zones found within the QRS-T complex). 3. Gain (control of input signal gain of the amplifier from minimum signal level value to full signal level). Complete specifications available on request.
L — 6″ W — 4½″ D — 2½″