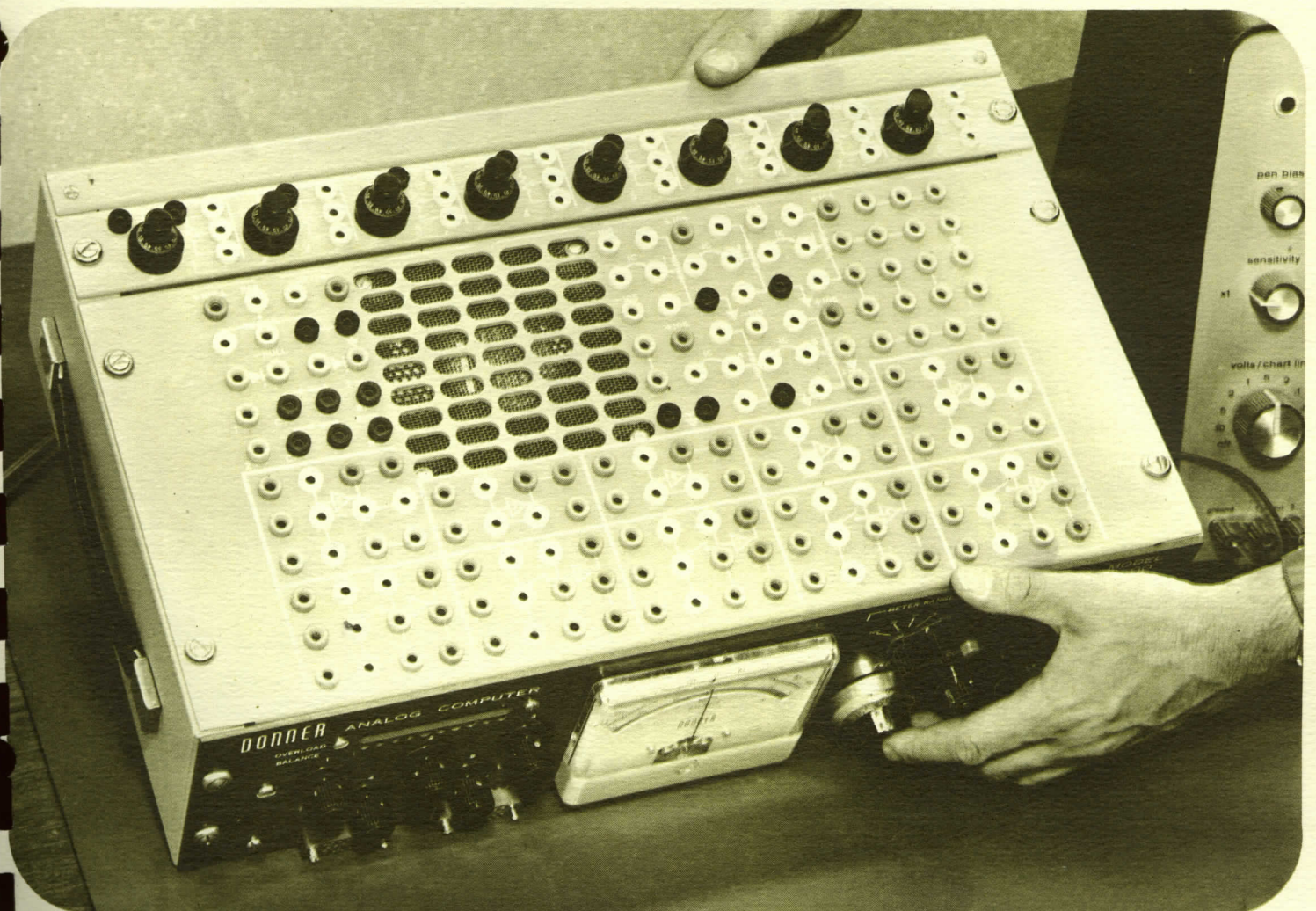


SYSTRON  DONNER
CORPORATION

MODEL

35000

ANALOG COMPUTER



***Accuracy,
Convenience,
Low Cost***

Donner's Model 3500 is a full-fledged analog computer weighing just 28 pounds. Designed for engineers, educators and scientists, it can be used to study almost any physical system that can be described by differential equations. It can be operated on desk tops and benches by anyone who can run a slide rule. The standard 3500 contains 10 amplifiers, stabilized or unstabilized as the user chooses. The computer performs accurately with 1% or 0.1% computing components, and is furnished ready-to-work for \$1850, depending upon specific equipment desired.

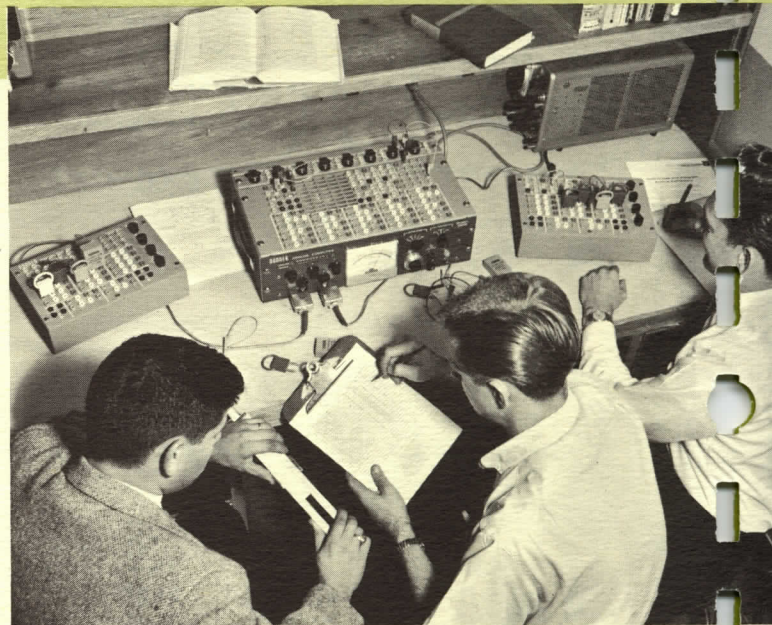
**This is how you use it
FOR INSTRUCTION**

The Donner 3500 uses problem boards designed especially to solve problems peculiar to classroom instruction. Two such problem boards may be associated with the basic computer through interconnecting cables supplied with the problem boards. When so connected, 5 amplifiers terminate at each problem board, and two student groups can simultaneously program and control their half of the basic computer without mutual interference.

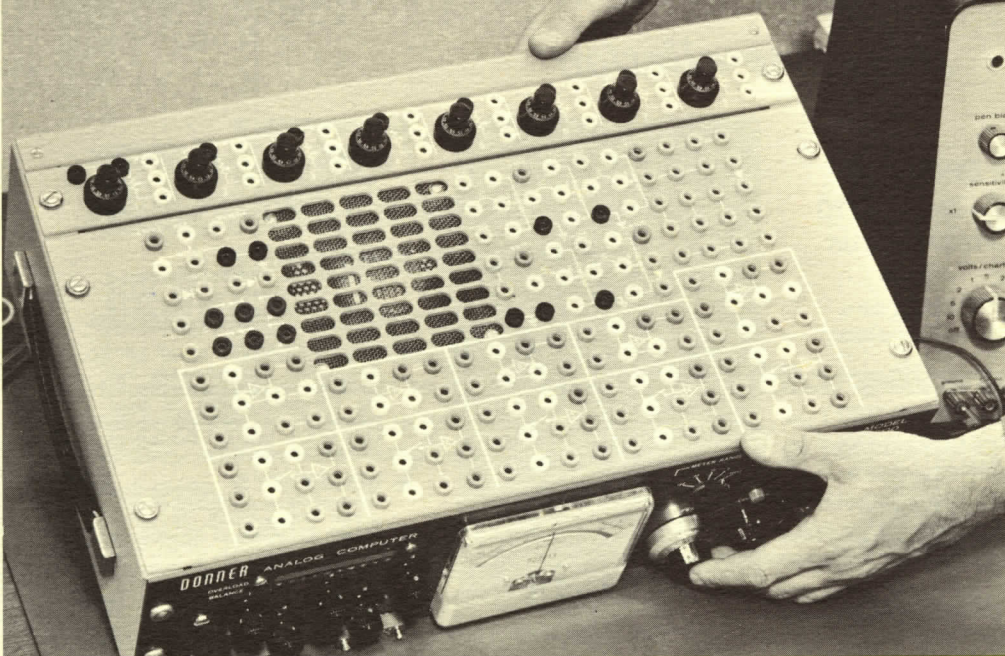
Further, possession of more than two 3530 Problem Boards permits additional student groups to set up the boards away from the computer and to store their programmed boards between classes for subsequent use.

Each 3530 Problem Board terminates 5 of the computer's 10 amplifiers. Three of these amplifiers may be used as summers or integrators and the remaining two amplifiers may be used as summers. Integrators can be controlled in the Reset, Compute, and Hold modes of operation from each board without interfering with the adjacent group of students.

To program a problem, students merely plug molded resistors, capacitors, and patch cords into the jacks on the board. The amplifier designation screened on the problem board surface corresponds directly to the symbolism the students use in drawing the computer wiring diagrams. Thus, students capture a "feel" for



computer programming by directly duplicating the programming instructions.



Model 3500 Analog Computer complete with Model 3571 Potentiometer Strip which provides 8 additional free helical potentiometers.

What the 3500 contains

AMPLIFIERS

5 dual amplifiers (10 channels) are mounted on plug-in printed circuit cards. The Model 3103 Dual Amplifier provides drift-free chopper-stabilized operation. The first 5 amplifiers may be used as integrators or summers; the remaining 5 channels as summers.

POWER SUPPLIES

Internally regulated supplies provide all power required by 10 amplifiers. Sources of +105 and -105 volts at 20 ma maximum load current terminate at the problem board for additive constants and initial condition supplies. A reference voltage of 100 volts, positive and negative, is used with the comparison Null Voltmeter for precision voltage measurements.

PROBLEM DIODES

Four silicon diodes are contained within the 3500 and terminate at the problem board. Additional diodes may be obtained to plug into the problem board for more demanding applications.

POTENTIOMETERS

Five single turn, ungrounded potentiometers are included and may be used to establish problem coefficients or initial conditions. Additional potentiometers may be obtained in groups of 8 by associating Potentiometer Strips with the 3500. The Model 3570 Potentiometer Strip provides 8 ungrounded single turn pots, and the Model 3751 contains 8 ungrounded, ten turn helical potentiometers with digital indicating dials. One Potentiometer Strip may be mounted on the 3500 as shown. Additional strips are supplied with protective enclosures.

COMPUTING COMPONENTS

Precision resistors, capacitors, and patch cords must be associated with the computer to yield a complete facility. A large variety of plug-in resistors, capacitors, cords, diodes, potentiometers, relays, and shunt plugs are available, either individually or in recommended assortments.

METERING SYSTEM

The voltmeter located on the 3500 front panel can be switched to function as a conventional zero-centered meter with sensitivities of 100, 30, 10, and 3 volts full scale or as a comparison Null Voltmeter in conjunction with the ten-turn reference pot to yield measurements within 0.25% of full scale. The meter movement is protected against burnout in all modes of operation, and the metering system may be used to measure differential voltages as well as voltages referred to ground.

OVERLOAD INDICATION

The output voltage range of each amplifier is continuously monitored, and voltages exceeding ± 100 volts are indicated through a bank of neon indicators. Thus, amplifier gain fall off caused by voltage saturation is instantly indicated at the 3500 front panel.

VENTILATION SYSTEM

All vacuum tubes in the 3500 are mounted on vertically oriented printed circuit cards, and an integral muffin blower provides ample ventilation to insure long component life, even in elevated ambient temperatures.

CONTROL CONNECTORS

Two panel mounted connectors terminate all amplifier input and output leads. Thus, amplifiers may be programmed and controlled remotely.

PROBLEM CAPACITY The complexity of a problem which can be handled by a given computer is determined by the number of amplifiers, initial condition circuits, coefficient potentiometers, and non-linear accessories available. The basic Model 3500 includes 10 amplifiers and 5 initial condition circuits. Five potentiometers are included which may be used for coefficient setting or establishment of initial conditions. Additional potentiometers may be added to the basic 3500 in groups of eight mounted on two types of potentiometer strips.

Thus, a basic Model 3500 computer has sufficient problem capacity to permit solution of a 5th order differential equation with initial conditions, or a seventh order equation where at least two of the initial conditions are zero. Higher order transfer functions may be simulated. Laplace equations of the ninth degree are readily programmed on the problem board.

SPECIFICATIONS

STABILIZED AMPLIFIERS (Model 3103)

(Measurements made at problem board)

DC gain greater than 10 million.

Offset of a unity inverter less than 0.2 mv per day.

Drift of a unity integrator less than 0.5 mv per second.

Phase shift of a unity inverter less than 0.5° at 1 KC.

Output range of ± 100 volts @ 4 ma load current.

(Note: Unstabilized amplifiers (Model 3104) exhibit a DC gain in excess of 20,000 and an inverter offset of 20 mv per day; other specifications are as above.)

REFERENCE VOLTAGE

Positive and negative source available at problem board for additive constants.

METER

Direct ranges of $\pm 100V$, $\pm 30V$, $\pm 10V$, and ± 3 volt, full scale. Null comparison using internal reference voltage and precision reference potentiometer measures any voltage within ± 100 volt range to 0.25% and permits setting or measuring coefficient potentiometers to 0.25%.

INITIAL CONDITIONS

5 integrators are associated with initial condition supplies. Two other amplifiers may be used as integrators with zero initial conditions.

OPERATIONAL MODES

Reset, Compute, and Hold.

POWER REQUIREMENTS

115 or 230 volts ($\pm 10\%$), 50 to 60 cps, single phase.

SIZE

Basic computer 5 $\frac{1}{4}$ inches high x 19 inches wide x 12 inches deep.

WEIGHT

Net weight, approximately 28 pounds. Shipping weight, approximately 40 pounds.

PRICE RANGE

\$1850 f.o.b. Concord, California.

SYSTRON-DONNER ENGINEERING REPRESENTATIVES

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This is how you use it

FOR DATA REDUCTION AND CONTROL—

By simply removing a few screws from the top surface of the basic 3500, the problem board and potentiometer strips can be mounted in an instrumentation cabinet as illustrated. The complete computer with 10 stabilized amplifiers then uses only 17½ inches of panel space.

Using drift stabilized amplifiers, precision computing components, and ten turn coefficient potentiometers, the 3500 meets all requirements for analog data handling systems with precision and versatility. All integrators may be controlled to function in the Compute, Reset, and Hold modes of operation either at the panel or through remotely located contact closures. Thus, the 3500 may be left unattended and automatically controlled by external timing devices.

Equally compact and versatile non-linear accessories extend the data handling capabilities to include multiplication and function generation.

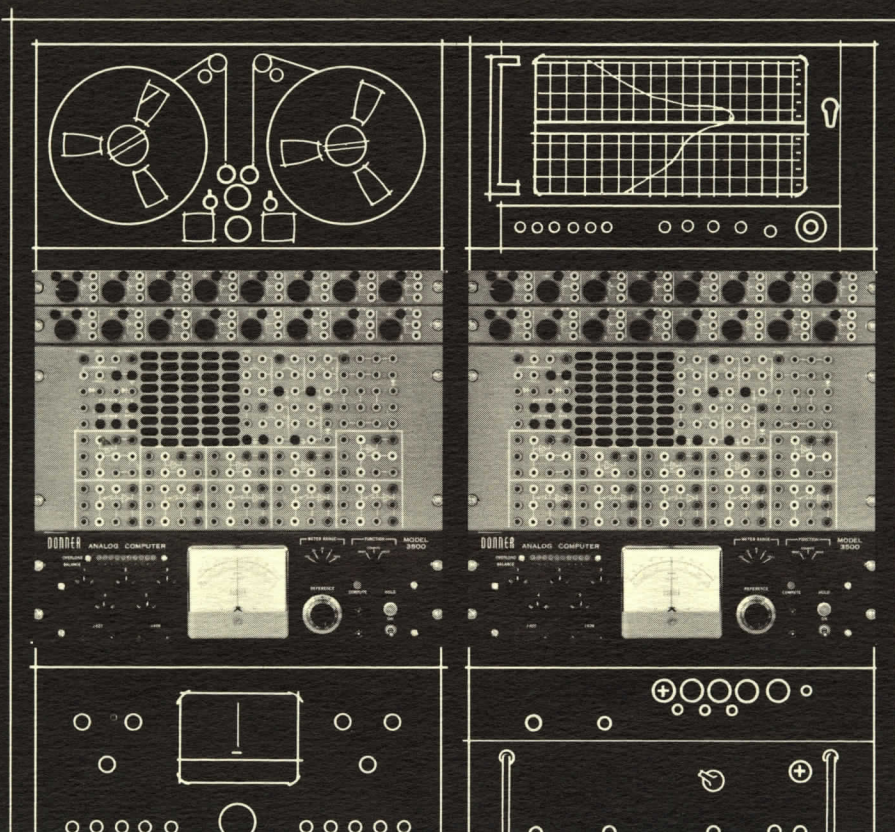
For the first time, analog signal conditioning or data processing can be accomplished with precision by including an off-the-shelf analog computer right into the instrumentation cabinetry. The versatile problem board permits the computer to be programmed on the spot to suit the particular requirements on hand.

Other areas of application include:

SIGNAL GENERATION. The 3500's operational amplifiers are easily programmed to generate sinusoidal, cosinusoidal, triangular, ramp, and square waveforms with shape and frequency precisely controlled through the ten turn potentiometers.

PREAMPLIFICATION. The low noise, low drift, and wide bandwidth characteristics of the 3500 computer amplifiers permit preamplification of low level signals directly at the source. By interconnecting two amplifiers at the problem board to function as an unloading circuit, signal amplification with input impedances in excess of 1000 megohms is obtained.

PROCESS CONTROL. The Donner 3500 is simply programmed to function as a conventional 3 mode controller with independent adjustment of proportional, reset, and rate control. More complex requirements for non-linear or sampled data controllers, and transport delay compensation, may be included with appropriate accessories. Process engineers are afforded the opportunity of studying and synthesizing optimum controller characteristics by inserting the computer into the control loop.



Two rack-mounted Model 3500 computers provide precision data reduction or computer-control with versatile at-the-site programming.

Basic Installation

1— Model 3500
Analog Computer
with 5
Model 3103
Dual Amplifiers
(10 chopper stabilized
amplifiers); all power
supplies, metering,
control circuitry

CHOICE OF
1— Model 3570
Potentiometer
Strip
(8 single turn
potentiometers)

OR

1— Model 3571
Potentiometer
Strip
(8 ten turn
potentiometers)

AND

1— Plug-in
Component
Selection
(plug-in resistors,
capacitors, and patch
cords); choice of
Component Selection
A, B, C, or D

SELECTION A

Permits solution of problems of average complexity with economy, based on 1% resistors. 36 patch cords, 25 resistors (1%), and 6 integrating capacitors (0.1% polystyrene).

SELECTION B

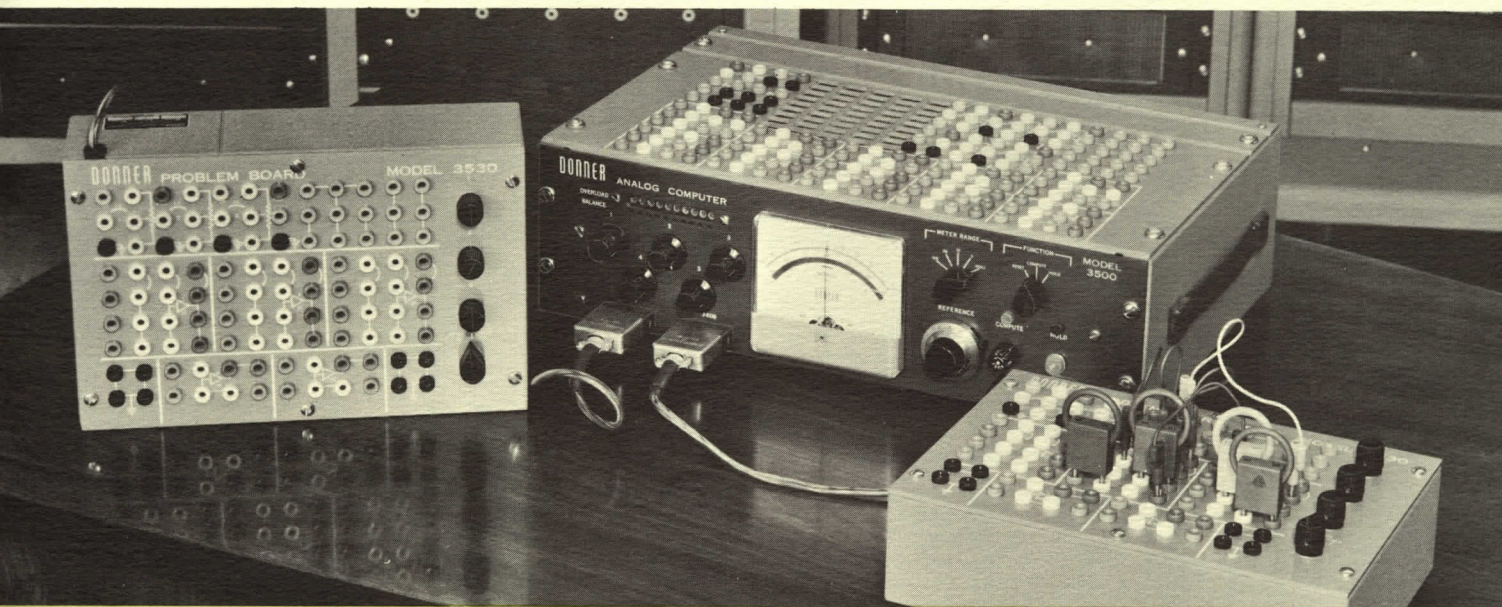
A versatile assortment based on 1% resistors. 60 patch cords, 40 resistors (1%), and 8 capacitors (0.1% polystyrene).

SELECTION C

Precision components for problems of average complexity. 60 patch cords, 25 resistors (0.1%), 6 high-ohm resistors (1%), and 13 capacitors (0.1% polystyrene).

SELECTION D

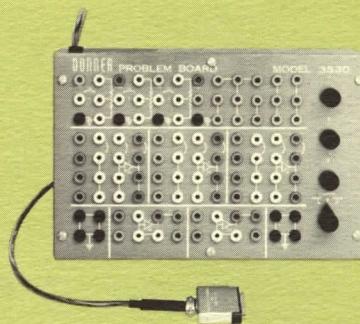
A versatile assortment of precision components. 75 patch cords, 35 resistors (0.1%), 15 high-ohm resistors (1%), and 13 capacitors (0.1% polystyrene).



ACCESSORIES

Model 3530 Problem Board

Two Model 3530 Problem Boards may be associated with a single 3500 simultaneously by simply plugging associated interconnecting cables into the mating connectors on the 3500 front panel. When so connected, half of the 3500's ten amplifiers are controlled and programmed from each problem board without interference. This permits two independent student groups to share the 3500 without mutual interference. A supply of more than two Model 3530 problem boards permits students to set up and store the programming away from the basic computer between classes.



DONNER