labK

DIGITAL EQUIPMENT CORPORATION

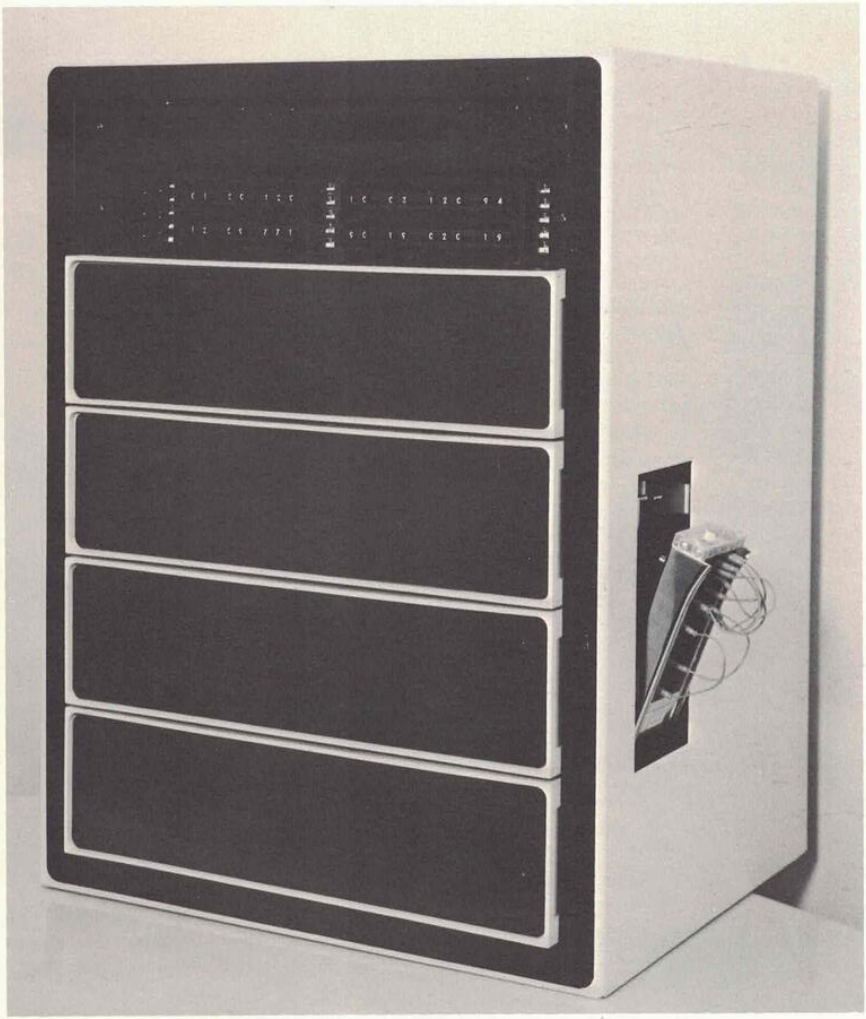
labK

Psychological researchers have for several years used logic modules and relays to control experiments. Test results have varied, however, due to the lack of uniformity in laboratory equipment. A researcher using relays to control an experiment might, for example, produce different results from those received in an identical experiment by a researcher using solid state modules. Relay experiments have often proved mechanically difficult, and the presence of noise or unwanted interference in solid state-controlled experiments has made completely consistent results almost impossible. LAB-K solves these problems.

LAB-K is a logic controller kit made by Digital Equipment Corporation and designed for use in life science research to control time and events in experiments. The basic module kit is expandable, using K Series modules to solve Boolean-type logic equations.

FEATURES

- K Series solid state modules
  - A hybrid module of discrete and integrated circuits
  - A maximum speed of 100 KHz
    - Slow down feature to 5 KHz (maximum Noise Immunity)
  - Signal levels: 0 volts = Logic "0" and + 5 volts = Logic "1"
  - Fan out: 15 ma available from all outputs; typical inputs 1-3 ma
  - High noise immunity
  - Manual controls
- Logic independent of a computer which offers convenience and low cost
- Programmable patchboard kit—easily changes experiments and eliminates back wiring by customer
- Complete logic documentation and installation instructions
- Automatic wirewrap service
- Prewired for maximum logic configuration allowing ease for expanding



LOW COST

Because a researcher buys only the logic capability he needs, LAB-K is extremely low cost. The basic kit contains the materials necessary for most fundamental experiments. It costs less than three thousand dollars. Expanding the kit up to its maximum configuration still keeps the total price below five thousand dollars.

Low cost is possible because K Series modules are manufactured in volume, at a reduced cost per unit. Digital now builds nearly two million modules per year. And all modules are tested before they leave the factory. Finished modules as well as all incoming integrated circuits are thoroughly tested under computer control.

INTEGRATED CIRCUITS

The K Series modules used in LAB-K are composed of integrated circuits and discrete components. Integrated circuits are small, complete circuits and require only a fraction of the space needed for a similar function built from only individual components. Integrated circuits let K Series modules provide an amount of logic power often equal to a larger module. Using economical integrated circuits, Digital gives the psychological researcher more logic power for less money with LAB-K.

Size and weight of the LAB-K are also reduced through use of the integrated circuits, which make the logic controller a compact package, easily stored in the corner of a laboratory. In addition, integrated circuits give increased flexibility to the hardware programmed kit because more functions can be packaged on each module.

EXPANDABLE

LAB-K is an expandable kit. Its modular configuration makes changes and expansions simple. Researchers assemble the kit to suit their experiments. In this way, the researcher purchases only the logic functions he needs. When experiments change, he can rewire the plugboard or, if changes are extensive, he can buy the additional modules as needed.

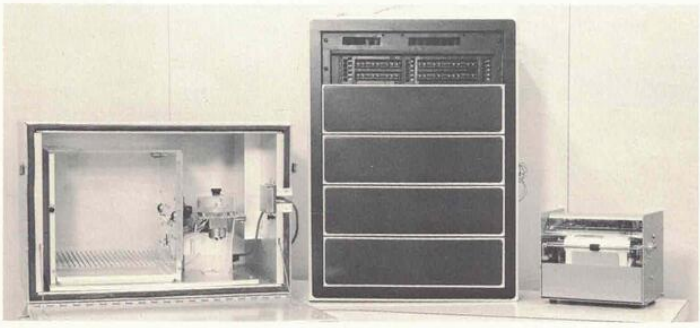
ELIMINATES NOISE

LAB-K is made with Digital's K Series logic modules, the most efficient and noise-free line of logic modules ever designed. K Series eliminates electrical noise. The signals wanted by researchers are generally low frequency and steady. K Series keeps out high frequency erratic noise, allowing only the low frequency signal to be recognized by the modules. Noise which does enter the module is isolated in order to minimize its effect on the signal.

Because of its high noise immunity, K Series has been used successfully in industry, where operation of heavy machinery creates noise problems far greater than those of the research laboratory.

MANUAL CONTROLS

Digital offers a group of K Series control and indicator light modules for manual control of experiments. These modules are located behind a modular panel equipped with magnetic strips. Convenient location of the panel makes possible parameter adjustment during experiments. Changes can be made within the panel to allow for the addition or removal of individual control modules. With Digital's new control panel, the researcher customizes his controls to suit his experiments.



Typical rat test chamber housing and cumulative recorder.

PROGRAMMING LAB-K

A major convenience of LAB-K is fast and simple manual program changing through a plugboard. The plugboard unit has two hundred positions that allow a vast number of program variations. A researcher develops his own program for control of individual experiments. All changes to experiments are made through the plugboard.

LAB-K is designed so that the two hundred position plugboard provides all the functional control capabilities the psychological researcher will ever need without the inconveniences and confusion usually associated with larger and less efficient boards.

There is no need to handwire the back panel of the plugboard, for this has already been done by Digital, using printed circuit boards. Wires from the back panel of the plugboard are brought out in eight cables, each of which ends in a plug-in card. These cards are attached to the mounting panel that holds the modules in the LAB-K kit.

An additional feature of the LAB-K is Nixie tubes which give the experimenter a readout in decimal rather than in the often confusing binary numbers. A decimal readout is less prone to interpretation error than is a binary one. Decimal readouts are made possible by a K Series decoder module which automatically converts the binary output of LAB-K to a decimal input for the Nixie tubes.

LAB-K AND THE COMPUTER

LAB-K is an experiment controller. But it can be more than that. It can also be a means to provide direct access to a computer for arithmetic computations. There are several ways in which LAB-K can be used in connection with a computer:

LAB-K can operate alone, recording results on existing electromechanical devices;

LAB-K can also hardware program an experiment with the results being processed later by a computer; or

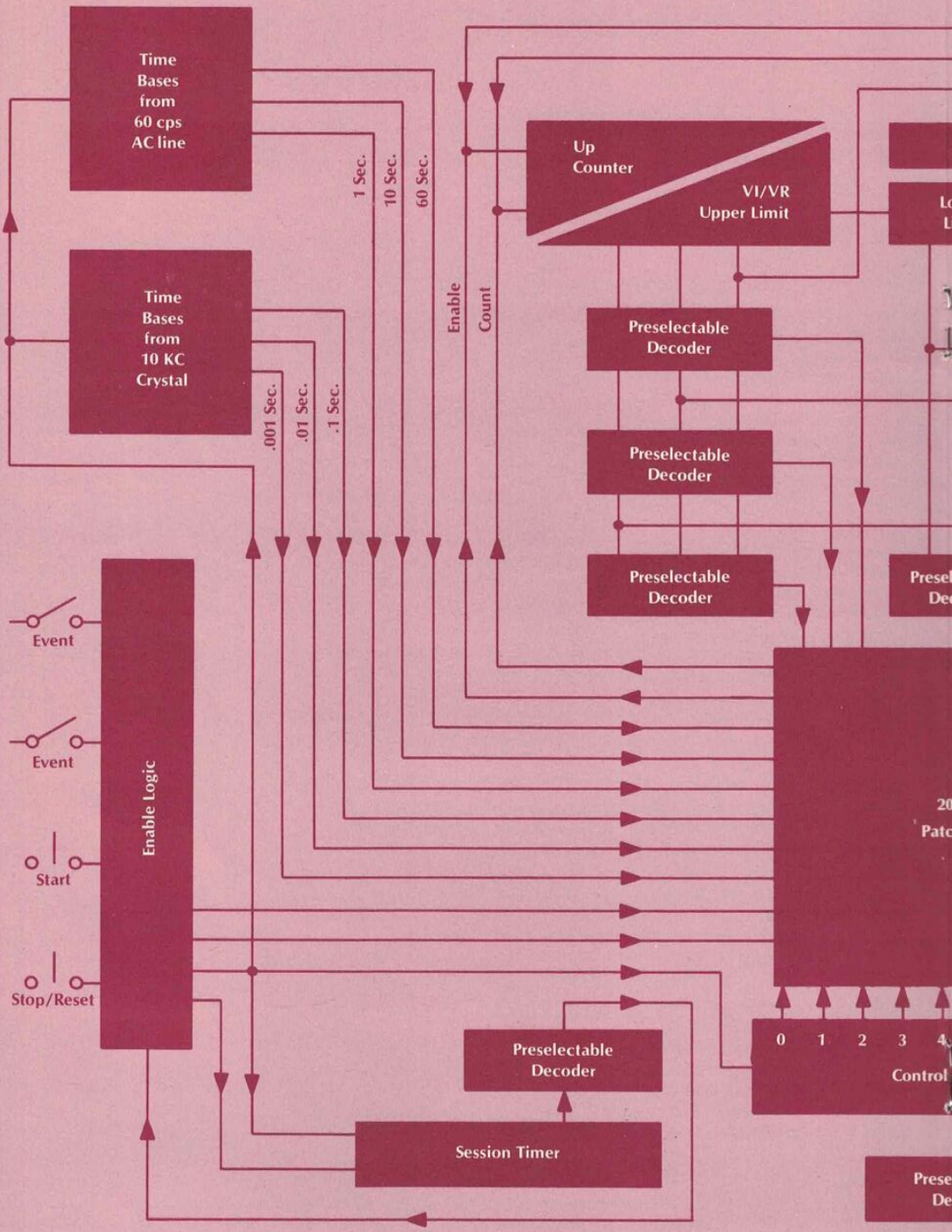
LAB-K, interfaced to a computer, can control an experiment on-line, allowing the computer to process and store the resulting data;

Experiments normally controlled by LAB-K can also be governed by the computer's software.

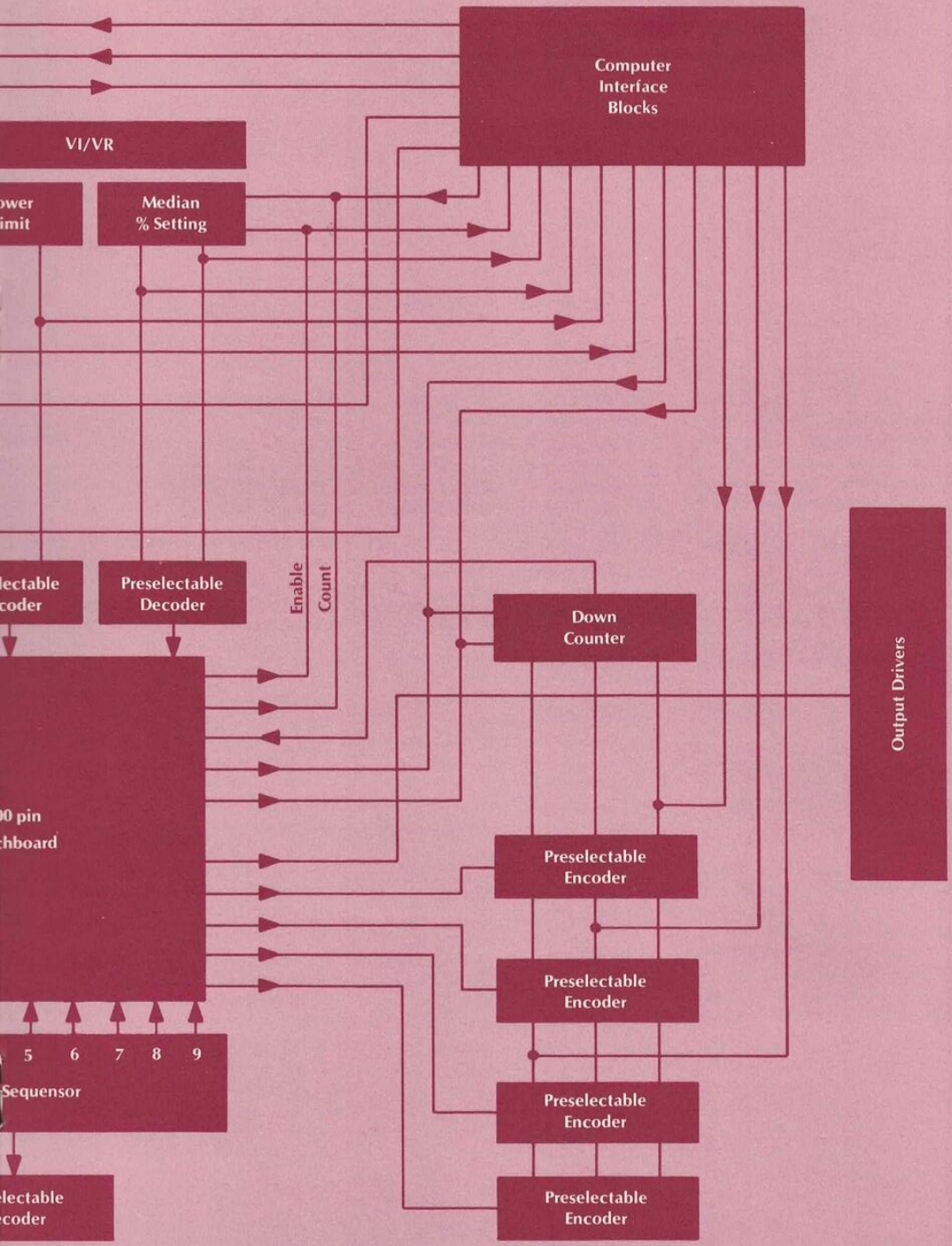
In using LAB-K with a computer for long-term experiments, LAB-K can act as a backup in case the computer goes down. One problem connected with computer control of psychological research experiments is the development of software, a process which often takes considerable time. With LAB-K the researcher can manually control early experiments and later turn control of those experiments over to a computer when software has been completed. Work done with the hardware-programmable LAB-K can make development of the researcher's own software a relatively easy task.

DESIGNED BY COMPUTER PEOPLE

LAB-K has been designed with the future in mind. Built by specialists in the computer field, it can be interfaced with a computer. But this step may not be necessary now. You may just need the LAB-K to control current experiments. Later, options may be added and peripherals attached until the time when you're ready to buy a computer for total control of laboratory experiments.



Lab K Logic Flow Block Diagram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LAB-K LOGIC FUNCTION SYNOPSIS

A. INPUT LOGIC

The LAB-K input logic provides for handling of eight switch closures and three spring-loaded toggle or pushbutton switches. These switches may be used to start and stop experiments, or to enable the researcher to terminate positive or negative reinforcement.

B. 0-9 SEQUENCER

The 0-9 sequencer is a ten-position stepper or controller and may be used to sequence time and/or events. Each output of the sequencer is terminated on the plugboard so it may be wired to control events in the ongoing experiment. The unit can also be used as a random selector of time intervals.

C. THREE-DIGIT BCD DOWN COUNTER

The 0-9 sequencer may be used to enable up to three thumb-wheel registers containing decimal numbers to be set into the BCD down counter. Either time or events may be used to step the counter down to zero. This added feature allows a number to be set into the counter and time or events may count up or down, allowing threshold and titration experiments to be run. Visual readout of the counter may be seen through a Nixie digital display, an option on the LAB-K. This option is available at a reasonable price. The number of times or events counted by this unit is limited only by the number of thumbwheel switches acquired. Controls for this unit are brought out to the plugboard.

D. TIME GENERATORS FOR 1-10-60 SECONDS

The time generators are asynchronous. They may be started or stopped through plugboard control.

E. UP COUNTER

The up counter will count time to a maximum count of 999. The time base is determined by the time generator which is enabled by the 0-9 sequencer. The time bases available are found in Section D above, as well as in Section I of the add-on logic functions.

F. OUTPUT LOGIC

All outputs are controlled by dc drivers that are protected from the external environment. There are no moving parts in these units, and the drivers will last longer than relay-controlled drivers normally used in logic control. Four of the drivers are heavy duty and can drive 2-1/2 amp at up to 28 volts dc. Eight drivers can be used to control inductive loads up to 250 ma or incandescent lamps. These drivers are provided with timing controls. An optional replacement for the heavy duty dc drivers is four ac switches.

The logic functions listed above, along with the hardware previously described, provide a meaningful logic function controller which may be used without any additional logic.

ADD-ON LOGIC FUNCTIONS AS NEEDED

I. TIME GENERATORS OF .001, .01, .1 SECONDS

The time generators provide asynchronous time pulses controlled through the plugboard. The accuracy of these generators is .01%.

II. VARIABLE INTERVAL OR VARIABLE RATIO PROGRAMMER

A. Used where pseudorandom interval or ratio generator is needed.

B. Three BCD up counters are decoded by the thumbwheel switch modules and establish the following:
   1. Lower Limit (LL) of interval or ratio;
   2. percentile setting to establish median (M) interval or ratio formula LL/M x 100 = % setting;
   3. Upper Limit (UL) of interval or ratio.

C. A sequencer step output through the plugboard enables one of the following signals to enter the (LL) counter, (.1, 1, 10-second pulses or one of two responses). The two-digit BCD up counter is decoded by two thumb-wheel modules. The decoded output fires a fifty-nanosecond M Series one shot.

D. A 6 KHz frequency pulse from a timer continuously counts up on another two-digit BCD counter. Two BCD thumb-wheels decode a number and when reached, fire another fifty-nanosecond M Series one shot. The two fifty-nanosecond intervals must coincide to set the memory logic which allows reinforcement through the patchboard.

E. The upper limit is set by three BCD decoding thumb-wheels and is connected to the up counter described above. The upper limit counter receives a count every time the lower limit decoded number has been reached. If there is no coincidence in the fifty-nanosecond window mentioned above, the upper limit decoded output will set the memory logic which allows reinforcement.

III. SESSION TIMER

A session timer is available to count in minutes up to nine hours and fifty-nine minutes. There is an option to expand the timer to ninety-nine hours and fifty-nine minutes. Nixie tube readouts are also optional.

IV. SECOND VARIABLE INTERVAL OR VARIABLE RATIO PROGRAMMER

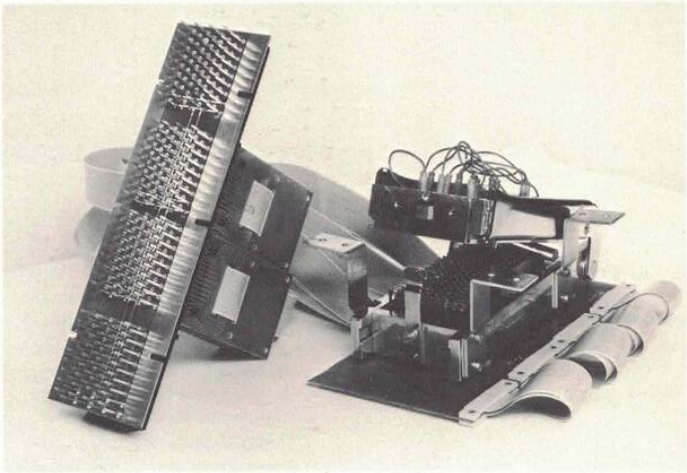
The logic is the same as the first VI/VR programmer with two exceptions:

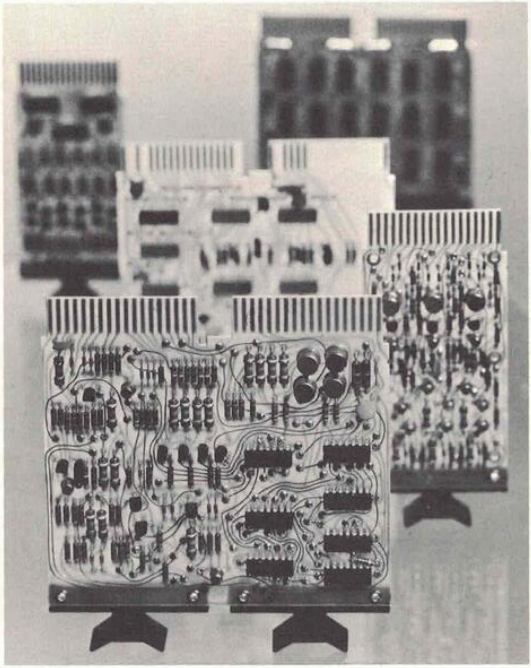
A. only one input, time, or response per experiment;

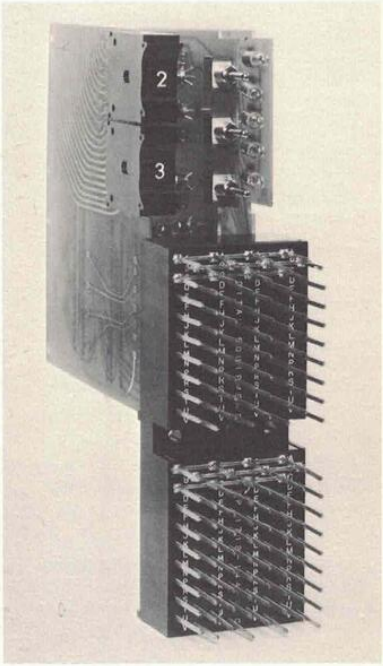
B. the upper limit three-digit decoding logic is not shared with the up counter. A three-digit up counter has been added.

V. IRT DISTRIBUTOR

The logic configuration divides events into ten classes or bins. Classes are terminated in dc drivers which can operate existing electromechanical digital counters. Redistributing of time or events is possible through the programming plugboard to acquire a finer distribution.



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HARDWARE

A feature of LAB-K is an inexpensive table top cabinet which has 33-1/4 inches of vertical space in a standard width of nineteen inches. This space is available both in the front and the rear of the cabinet. Table top cabinets can be stacked one on top of another and interconnections made through three-inch knockout plates located in the top and bottom of each cabinet.

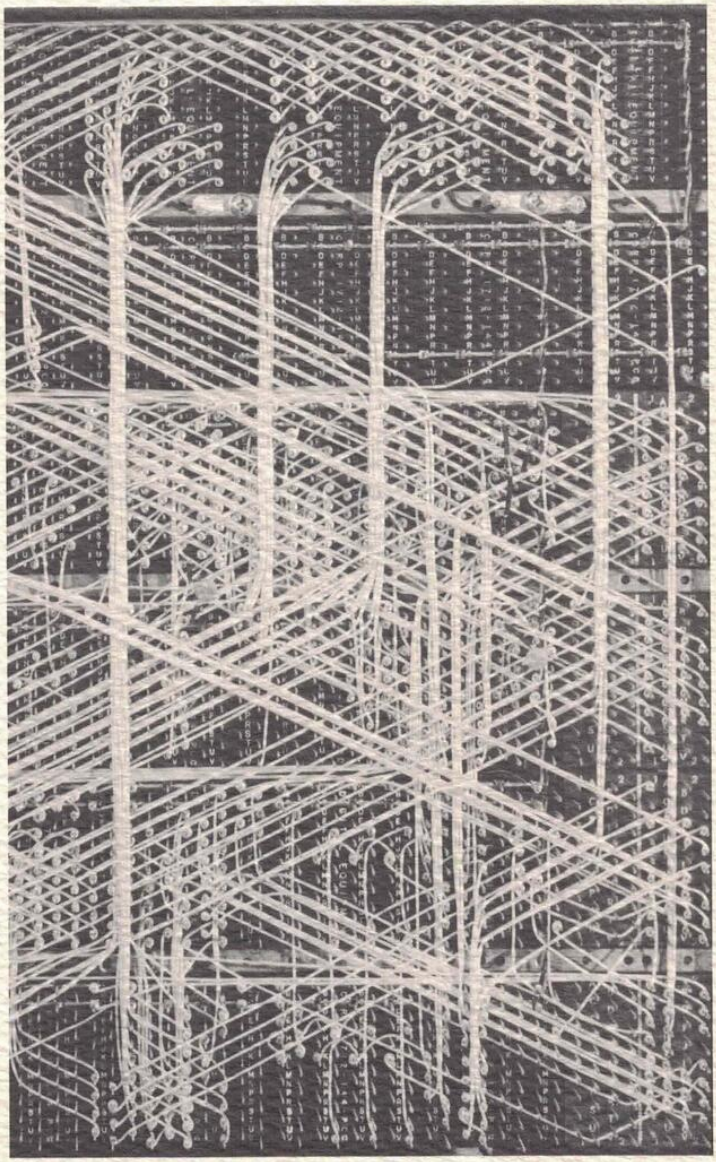
An appropriate cutout is made in the side of the cabinet to accept the patchboard programming unit. All the manual controls are located in a modular panel with magnetic strips so that the researcher may customize these controls to suit his experiments.

All wiring is exposed to the front of the cabinet for easy access. This area may be covered by snap-on panels for protection and esthetics.

Each LAB-K has a seven-amp power supply which can supply power to a fully expanded unit.

Connection panel modular hardware allows the researcher to use stripped wire to the spade lug terminals. This hardware is conveniently located at the rear of the cabinet.

The modules are mounted in three mounting panels. Each mounting panel holds up to sixty-four modules for very high density and requires only 5-1/2 inches of front panel space.



For more detailed information on LAB-K, mail the attached reply card requesting the LAB-K Handbook .

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