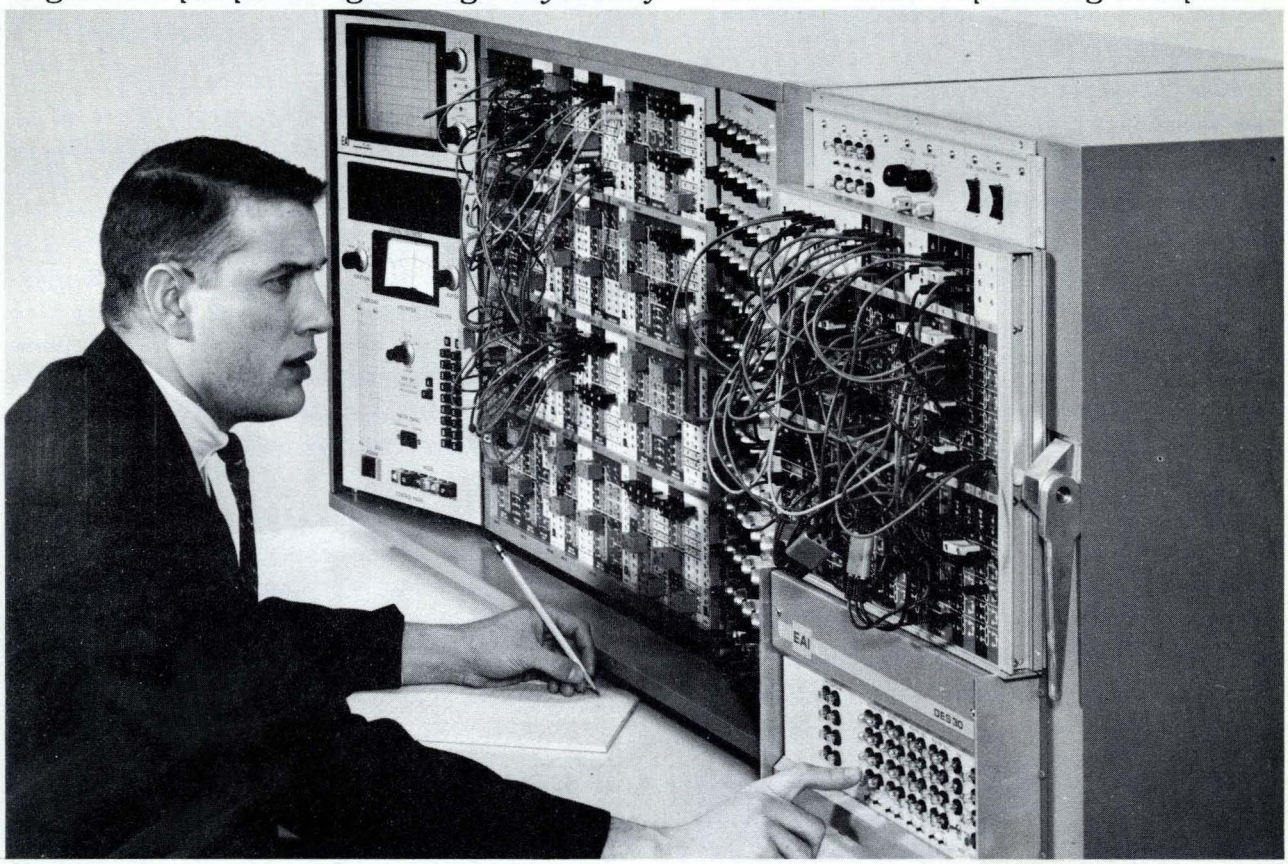
PIR

PRODUCT INFORMATION RELEASE

DIGITAL EXPANSION SYSTEM, DES-30

. . . a general purpose digital logic system for use with desk-top analog computers



The DES-30 (Digital Expansion System) is a general-purpose, low-cost digital logic system. Though capable of operating autonomously, it was primarily designed as an expansion to the PACE® TR-48 Analog Computer – providing basic hybrid capabilities to the small computer facility. It is also readily combined with other general-purpose analog or digital computers to provide extended control functions.

SYSTEM HIGHLIGHTS

- Synchronous logic
- Internal clock, or triggered by external signal
- Desk-top or standard 19-inch rack-mount
- 540 hole removable patch panel
- May be linked to any general-purpose analog or digital computer
- Used alone as an aid to digital instruction or design
- All components are modular plug-in units
- Expansion achieved by simply plugging in more modules
- Only one type of flip-flop module – which may be enabled as a shift register, counter, or as four individual flip-flops
- All flip-flops may be manually set and cleared
- Programs may be run manually or at one step per second . . . for program checkout
- Completely self-contained

EAI reserves the right to revise its product specifications in accordance with its continuing program of product development.

EAI®
ELECTRONIC ASSOCIATES, INC. *West Long Branch, New Jersey*

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In combination with the TR-48, the DES-30 enables the solution of problems far more complex than previously possible with computers of this class. It provides for economical, advanced work in such fields as:

Simulation of continuous and discrete systems
Statistical calculations
System optimization through the use of iterative techniques
Analysis of discontinuous systems
Incremental computations
Iterative solution, storage and playback
Iterative search for eigen values
Fourier analysis
Transport delay simulation
— — and many others

Digital operations are performed by modular building blocks designed to relieve the programmer from the details of timing, loading, fan "in" or "out", and other circuit considerations usually associated with digital-logic module systems. The use of level logic throughout the system including the flip-flops and proper buffering of all outputs provides maximum noise immunity and fan out. Inputs and outputs to the components, as well as control signals, are terminated at a plug-in patch-bay — enabling the inter-connecting of digital circuits with patch cords and plugs much like that of an analog computer. Pre-programmed patch panels are readily accepted for faster "on-computer" time or program repeat.

The DES-30 was developed by the same group of engineers who produced the HYDAC® 2000 and 2400 Hybrid Computing Systems, the EAI 8400 Digital Computer, and other related EAI scientific computing systems. All EAI products are backed by the greatest depth of scientific computing experience in industry, and the largest service department of its kind in the world. In almost every area of scientific endeavor, EAI products and services have become known for their utility, quality and dependability.

EAI has a basic philosophy . . . *complete customer support.* In choosing, operating, or maintaining equipment, in training personnel, in developing new techniques or new computers, every assistance is provided the user for maximum utilization of his equipment.

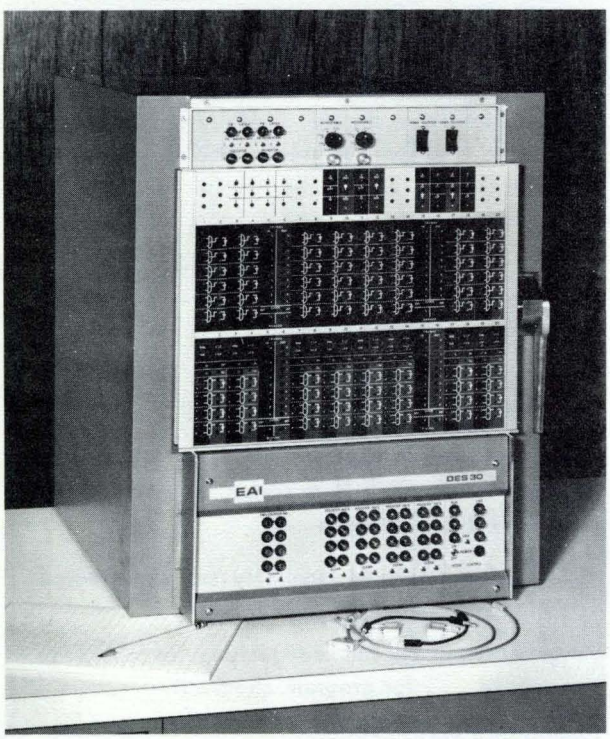

Figure 1. DES-30 is Physically and Aesthetically Compatible to EAI Desk-Top Computers

DESCRIPTION

The DES-30 is the same height as the EAI TR-48 Analog Computer, so that when placed next to it on a desk or laboratory bench it gives the appearance of physically being one unit. Its width without skins is such that it also mounts conveniently in a standard 19-inch relay rack if desired. This mounting requires 24-1/2 inches of rack panel space.

It is aesthetically compatible to EAI computers. If used with other computers, colors can be provided to match any color sample on special order.

The system is functionally divided into four areas, or fields, designed with special consideration to convenient and logical inter-connection of modules within these areas. All modules are plug-in type — inserted from the front of the chassis. The patchable logic modules are plugged into fields 0 through 2 (see Figure 3). A removable, 540-hole patching panel provides the versatility required for any patching combination. The clock and manual control and indicator modules are plugged into the lower control area.

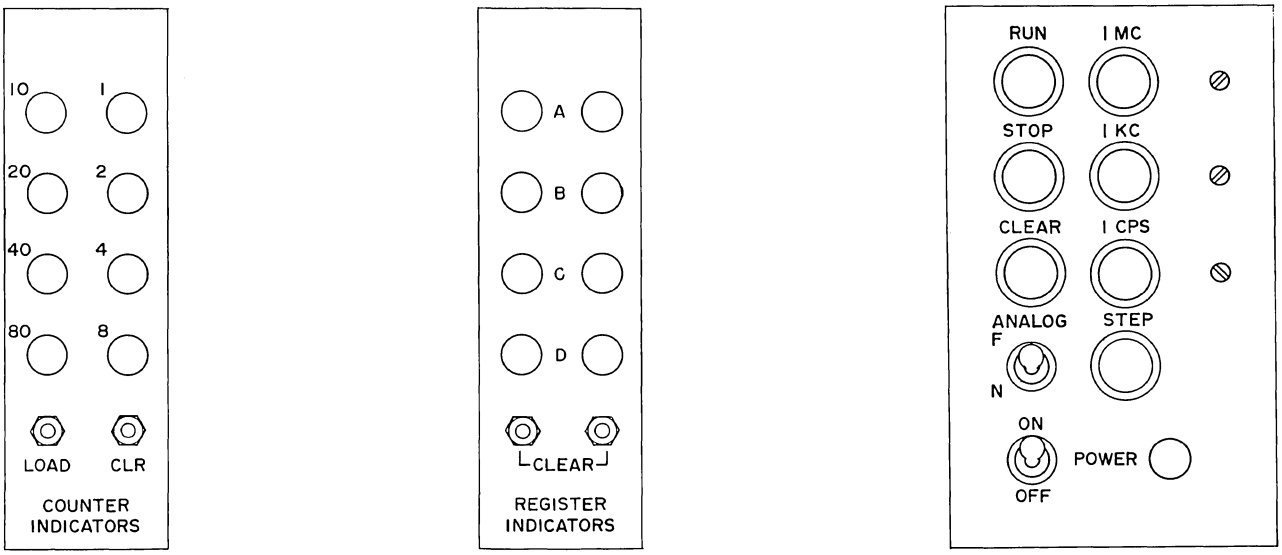

Figure 2. DES-30 Control Area (Field 3) provides control of timing, all clock frequencies, modes of operation and power. General purpose register and down counter indicators are also housed in this area.

CONTROL AND TIMING

The operation of the DES-30 is controlled from the front panel by pushbuttons (see Figure 2). Each control pushbutton (RUN, CLEAR, STOP) has its own indicator light to show the present state of the system.

In the RUN mode, clock pulses are applied to all flip-flops and the logic sequence proceeds as programmed. In the STOP mode, the clock is removed from all logic elements to halt the program – without clearing the registers or extinguishing the register indicators; it also enables the manual STEP pushbutton. In the CLEAR mode, the logic sequence halts and all flip-flops are reset to the zero state.

Power is controlled by the toggle switch on the control panel.

Three free-running oscillators, 1 mc, 1 kc and 1 cps are provided within the control unit. In the RUN mode, any one of these three frequencies can be selected to operate as the clock of the system. In the STOP mode, clock pulses can be accepted from an external source, via a patch hole on the SLAVE tray, or may be generated by pushing the STEP button on the control panel. Each clock pulse is reshaped into a clock pulse of 1 μs width regardless of frequency.

External timing frequencies can be "patched" into the system for operation at *any* frequency desired within 1 cps to 1 mc.

PRE-PATCH PANEL

The DES-30 Pre-Patch Panel multiplies the usefulness of the DES. Programs can be patched and checked off the computer, and may be stored for future use, making most efficient use of equipment time. The removable pre-patch panel permits the patching of pre-determined problems at any convenient location. Panels may be assigned to individual departments and used on a centrally located DES-30 . . . permitting solution of a wider range of problems.

The pre-patch panel features: *flexibility* – its modular design permits many component configurations to be set up on the DES . . . accomplished in minutes; *ease of patching* – with "stackable" patch cords, in vividly color-coded patching areas with large, clear lettering, component locations are numbered for convenience; *reliability* assured through the use of sturdy aluminum fittings, a precise locking device, positive wiper contact between pre-patch panel bushings and contact springs (gold-plated phosphor-bronze for positive electrical continuity).

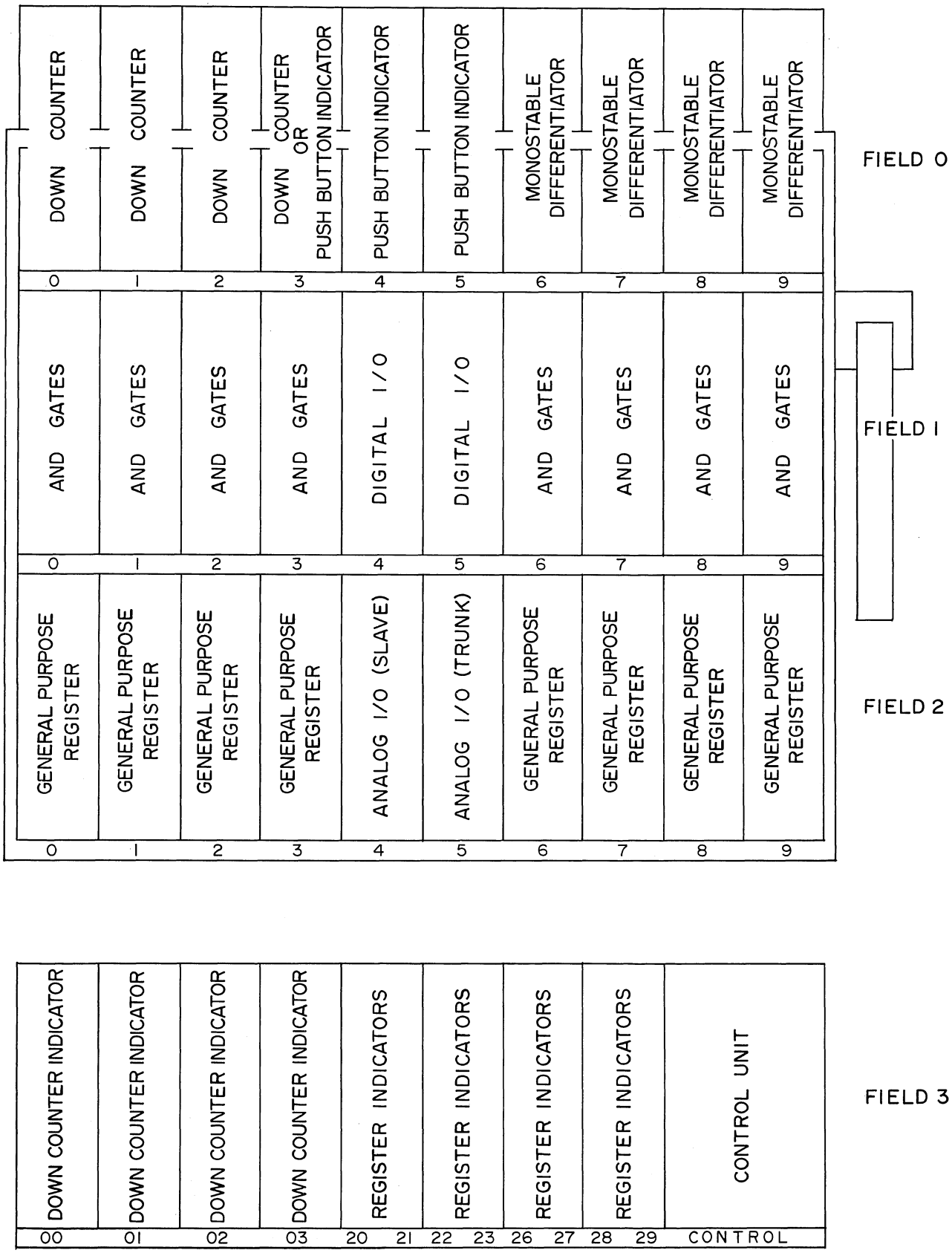

Figure 3. Overall Layout of DES-30 Functional Fields

FUNCTIONAL FIELDS

Control Area

As described under Control and Timing, all clock frequencies, modes of operation and power are controlled from one central area – situated below the removable patch panel. Besides the control panel, this area contains up to four indicator panels for the eight General Purpose Registers. Each indicator panel has eight indicators (see Figure 2), representing two General Purpose Register Trays – one vertical row of indicators for each General Purpose Register. When a neon indicator-pushbutton is depressed the associated flip-flop is set and the neon lights up. The Clear pushbutton resets the four associated flip-flops and the indicators go out. The indicators also light when the flip-flops are set electronically on the patch panel.

Space is also provided for four more indicator panels to be used with four BCD Down Counters. For those DES systems not fully expanded, blank panels are provided.

Field 0

The uppermost field is used for logic trays which simultaneously present six patch holes and manual controls and/or indicators to the operator. Three standard types are presently available for this field (Figure 4):

a) Down Counter
b) Monostable-Differentiator
c) Pushbutton-Indicators

These three types of logic trays may be used in the ten locations of Field 0 in any combination.

a. Down Counter Tray. The BCD thumbwheel switch may be preset to any value between 00 and 99, then loaded into the counter on raising the Load Paralled Line L for subsequent down counting. When the reading passes zero a Carry-Out pulse is generated on C_o.

The Enable Carry In EC_i is normally high; the counter may be disabled by lowering EC_i. The registers of the counter can be reset to 00 by applying a One signal to the Clear (CLR) patch hole, or by pushing the CLR pushbutton on the associated Indicator Tray.

Optional down counter indicator trays may be provided in the control area at the bottom. The eight indicator lights monitor the status of the two BCD registers of the associated counter. LOAD and CLR pushbuttons underneath permit manual setting and resetting of the counter registers.

b. Monostable-Differentiator Tray. This tray contains a variable monostable timer. On time is determined by two controls: a coarse switch provides six different ranges – from 10 μs to 10 seconds, a "FINE" potentiometer gives a 10 to 1 variation in each of the six ranges.

A One on "IN" makes the output a One for the time set by the timer. The turn-on and turn-off of this output is synchronized with the clock. Its complement is also available on the patch panel. A One on the Differentiator Trigger input "DIF" makes its output a One immediately until the next clock pulse.

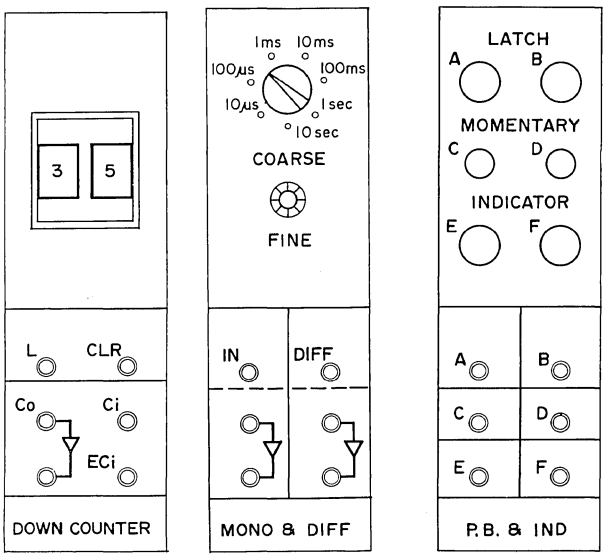

Figure 4. Field 0 Module Panel Layouts

c. Pushbutton-Indicator. Two latching pushbuttons, two momentary pushbuttons, two Indicators and associated input and output patch holes are included in this tray. When a PB LATCH pushbutton is depressed it will light and remain illuminated; its associated output in the patch area will go to One. When depressed a second time the light goes off, and the associated output goes to Zero. The outputs are clocked.

When a PB MOMENTARY pushbutton is depressed its output will go to One for exactly one clock period. A One on an indicator input will light the indicator as long as the input is high.

Field 1

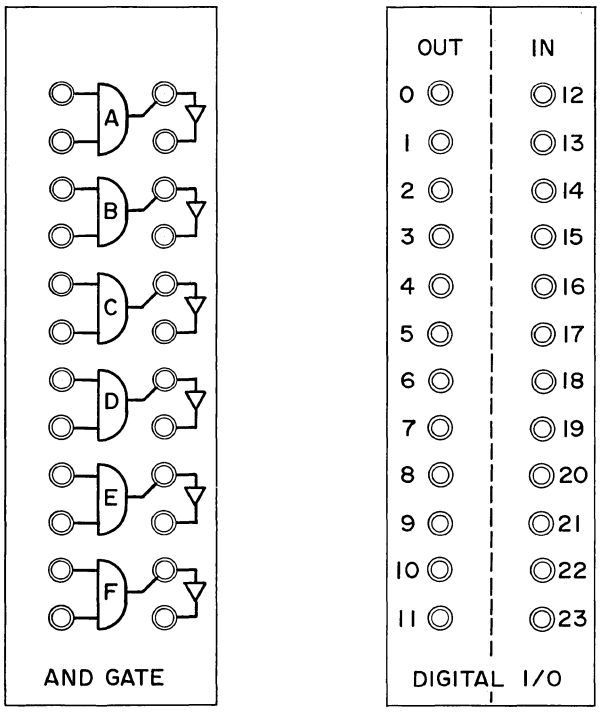

Figure 5. Field 1 Module Panel Layouts

Normally, this field contains two types of trays (Figure 5).

a) General Purpose AND Gate Tray
b) Digital I/O Trays

Two positions are provided for the Digital I/O Trays, and the remaining eight positions for Gate Trays. Gate Trays may also be plugged into any one of the two I/O Tray positions to increase the complement of gates.

a. General Purpose AND Gate Tray. The six 2-input AND gates included in this tray may be combined into multi-input AND gates by simply shorting the NOT outputs. All inputs to the AND gates are normally in the One state, which enables a gate to be used as an AND function even when not all of the inputs are being used. An OR function may be obtained from the AND function by patching an inverted signal to the AND gate inputs and using the inverted output. An INVERTER function is obtained from the NOT output of the AND gates.

b. Digital I/O Trays. Two trays may be provided in Field 1 for the communication with external digital equipment. These trays may accommodate Function Lines, Status Lines, Interrupt and Control lines. These trays are tailored to suit specific digital equipment.

DES-30 Systems	Basic DES-30	Standard DES-30	Expanded DES-30
Frame and Power Supply	1	1	1
Mode Control Panel (Clock)	1	1	1
General Purpose Register Tray	3	5	8
"AND" Gate Tray	3	5	8
Monostable and Differentiator Tray	2	2	4
Down Counter	0	1	2
Pushbutton and Indicator Tray	1	2	2
Register Indicator Panel	2	3	4
Down Counter Indicator Panel	0	1	2

Field 2

This field contains two types of trays (Figure 6).

a) General Purpose Flip-Flop Register Tray
b) Analog I/O Tray

I/O Trunk Trays are plugged into two positions, and General Register Trays are plugged into the remaining eight positions. Rear connectors in the General Register Tray positions are wired for the monitor and control signals to/from the register Indicator Panels in the Control Area; the basic system can easily be expanded by merely plugging additional registers into any one of these eight positions.

Any one of the eight register locations in this field is capable of accepting a General Purpose AND Gate Tray to greatly increase the versatility of the DES-30 Unit.

a. General Purpose Flip-Flop Register Tray. The General Purpose Register Tray contains four basic J-K flip-flop circuits. These flip-flops may be used individually, or patched to give a four-bit shift register or a four-bit binary counter. Four patch holes are assigned to the four flip-flops, the remaining eight patch holes for register function control and input/output.

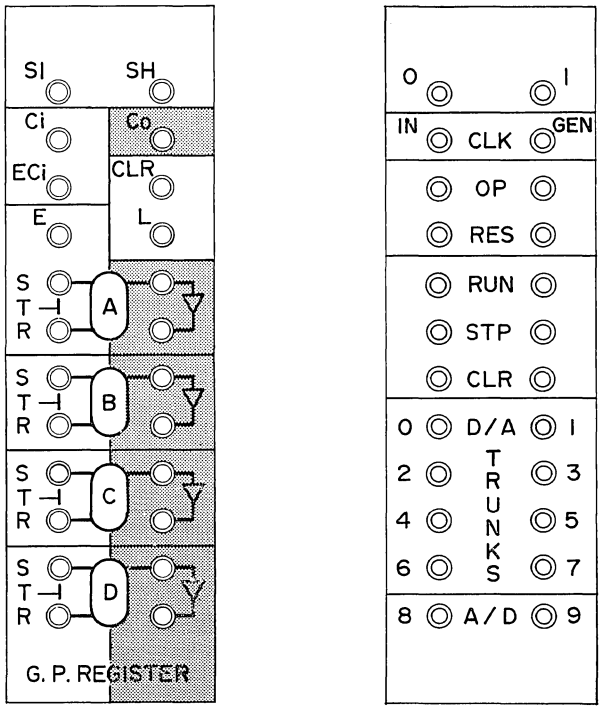

Figure 6. Field 2 Module Panel Layouts

The system is enabled as a binary counter by applying a One to the Carry In Control C_i, and as a shift register by applying a One to the Shift Control SH. Register Trays may be cascaded to give larger counters or shift registers. The four flip-flops may also be enabled as independent J-K flip-flops by applying a One to E (flip-flop A) and/or L (flip-flops B, C, and D).

The status of the flip-flops is monitored by four indicator lights on the indicator panel in the control field. Each flip-flop can be individually set, and the complete register be reset, by pushing the proper pushbuttons.

Register Trays may be cascaded to give larger counters or shift registers. Each flip-flop has manual SET/CLEAR/INDICATE functions on the control panel below the patch panel.

b. Analog I/O Trays. The two trays "Slave" and "Trunk" are mechanically and electrically identical and interchangeable. Moreover, due to different wiring in the rear, they will perform different functions in the system as indicated on the two patch blocks provided in the pre-patch panel.

The "Slave Tray" establishes the intercommunication between analog computer and DES-30 by transmitting AND/OR receiving control signals controlling the different modes of operation of the analog computer. In addition, it also carries eight D-A trunks and two A-D trunks. Of the eight D-A trunks, four may be made available as –20 volt relay drivers, for the tie-in with a relay controlled TR-48.

The "Trunk Tray" adds 10 additional D-A trunks (two may be relay drivers) and five additional A-D trunks to the complement of interconnecting trunks between the analog computer and the DES-30.