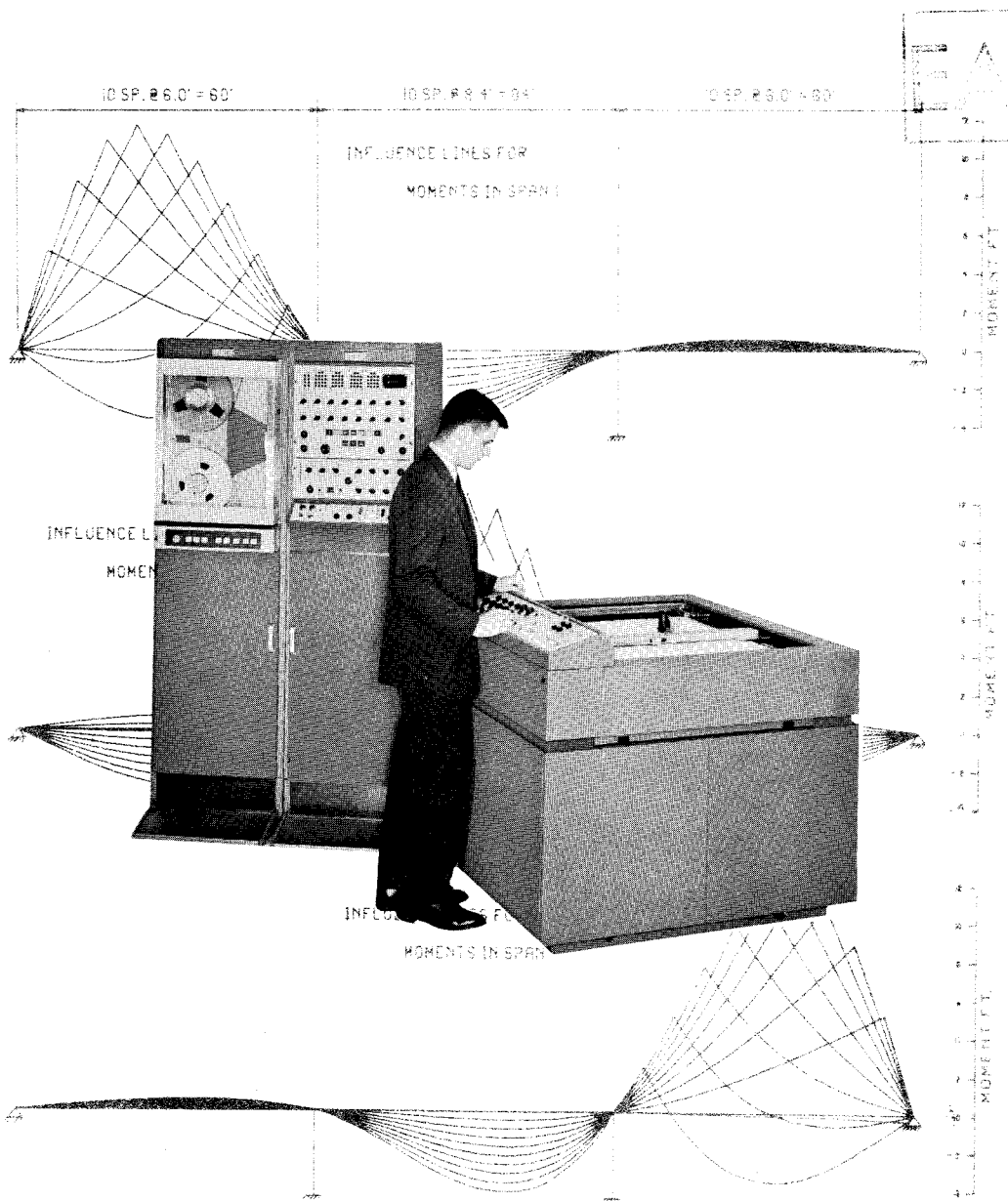*series* **3440**

DATAPLOTTER®

for fast, accurate, automatic plotting of digital information

POINT PLOTTING

LINE PLOTTING
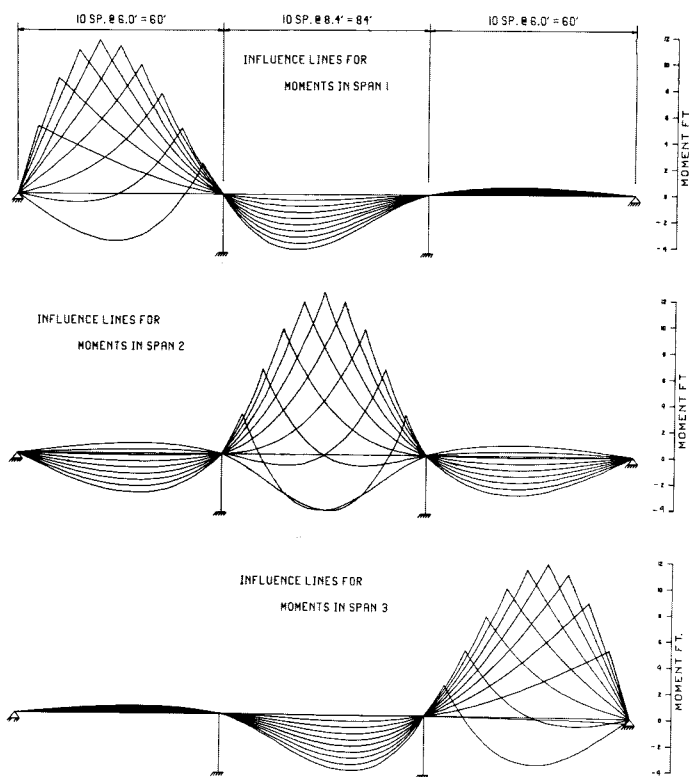
SYMBOL PLOTTIN(

from

  magnetic tape

  punched tape

  punched cards

  manual keyboard

  analog signals

EAI ——————————————

ELECTRONIC ASSOCIATES, INC. *Long Branch, New Jersey*

Typical of the versatility of the 3440 is this plot of bridge span INFLUENCE LINES.

X·Y PLOTTER

In a truly fast, economical digital plotting system an analog type X-Y plotter is required to produce the graphic plot of the digital data being read by the digital to analog circuitry. In the 3440 DATAPLOTTER an EAI Series 205 VARIPLOTTER®, standard equipment on every missile range in the Free World, is used. This completely transistorized instrument plots one d-c voltage as a function of a second d-c voltage. It combines all the facilities required for rapid, accurate, graphic recording of data read by the 3440 DATAPLOTTER. The VARIPLOTTER is also capable of independent operation directly from analog voltages. Origin location and scale factor controls are provided for use when the VARIPLOTTER is used for direct analog plotting.

masses of data to graphic form

punched tape, punched cards, manual keyboard,

for faster, easier interpretation and study.

almost every area of science and industry can benefit

Research and Engineering. Research investigations and design calculations performed by a digital computer may be accurately and economically plotted in graphic form for the rapid evaluation and comparison of results.

Business. Almost every area of commerce and industry draws graphs of business activities, both internal and external. With the DATAPLOTTER, management obtains up-to-the-minute graphic plots of information for faster, sounder decision making.

Production. Production fluctuations, inventories of stock and parts, etc., can be automatically charted for modern production control. The DATAPLOTTER can also be used to provide a quick, convenient way to eliminate errors in the automatic programming of machine tools—before machining operations begin.

Statistics. Statisticians graph a high percentage of the solutions they obtain because graphs can provide an integrated picture of the analysis and allow better decisions to be made from the results.

Data Processing. Data Processing Groups may rapidly obtain a graphic display of the data produced by digital computers—economically and accurately.

Weather Charts. Isobars, isotherms, and weather symbols may be plotted automatically from computer outputs or from transmitted digital data.

Mapping. Contour lines and geographical characteristics may be plotted automatically. Geophysical information for oil exploration may be graphically presented as it is processed by the digital computer. Well-logs, gravity and magnetic data are readily mapped.

Military. Missile trajectories and orbits as determined through digital computations and/or telemetered data can be accurately converted to graphic form.

Insurance. Actuarial graphs or other statistical data can be economically plotted.

System Testing. Today's defense and space development programs require elaborate system evaluations where telemetered data are produced in large quantities. Digital test data from wind tunnels, missile ranges, etc., may be rapidly and accurately reduced to graphic form.

**Other Uses** of automatic plotting are constantly being discovered.

features

... *Accurate graphs up to 30 x 30 inch*

... *Solid state reliability*

... *Plots up to 4500 line segments per minute*

... *Directly compatible with most computers*

... *Magnetic tape, punched cards*, punched tape*, manual keyboard or analog inputs*

... *Fully automatic control*

... *No temperature controlled environment necessary— temperature sensitive elements housed in oven*

... *Dial controlled data selection*

... *Versatile automatic data selection* and location**

... *Self-contained parity check system*

... *Built-in ease of maintenance*

... *Vacuum paper hold-down*

... *Disposable ink cartridge*

... *Incremental advance plotting**

... *Numerical* or Symbol* point identification*
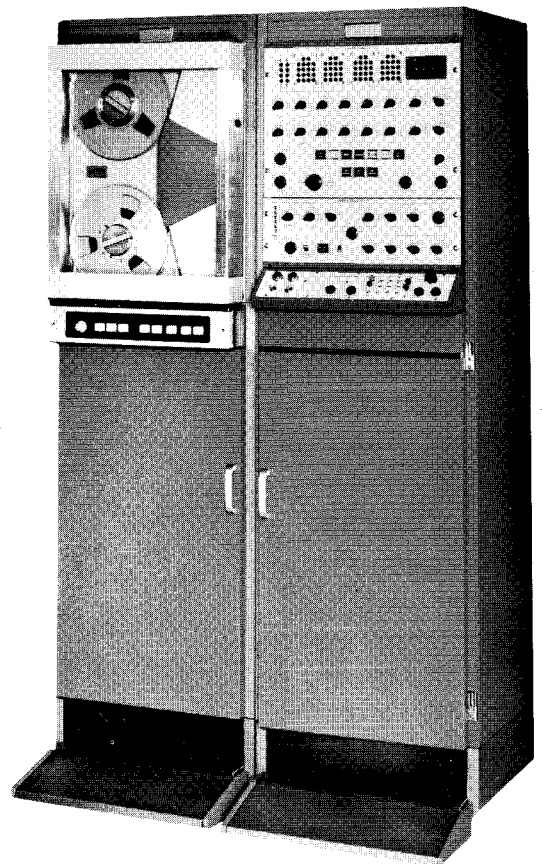
DATAPLOTTER, Series 3440 offers complete facilities for the independent (off-line) plotting of digital information as inked plots on 30" x 30" or smaller graph sheets. Digital data may be read directly from magnetic tape, eliminating the time consuming step of preparing punched cards or paper tape. In addition to saving valuable computer or tape unit time, this feature also permits locating the DATAPLOTTER remotely from the computer. Thus, one DATAPLOTTER may be used to plot runs from several widely separated computers or several DATAPLOTTERS may be used simultaneously with the same computer.
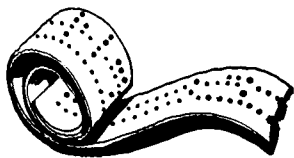
may be accomplished from the following system inputs . . .
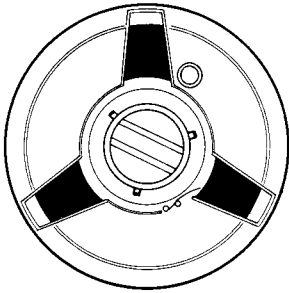
MAGNETIC TAPE
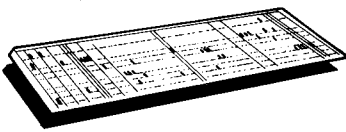
PUNCHED CARDS

PUNCHED TAPE

MAGNETIC TAPE. The DATAPLOTTER tape transport will accept ½ inch magnetic tape written at a density of two-hundred characters per inch. The tape is comprised of seven channels of which six are used for BCD-coded characters. The seventh channel is used for parity check.

PUNCHED CARDS*. The DATAPLOTTER accepts decimal data read from Card Readers in a parallel or serial manner. With parallel read data the columns to be read are selected on the Card Reader patch panel. Data that can be accepted from the Reader includes: sign, command, thousands, hundreds, tens, and units for both X and Y, and the "select-reject" control characters. Operation for serially read data is similar to magnetic tape. Uniquely defined control characters are used for "end of file", and "select-reject".

PUNCHED TAPE*. A high speed photo-electric paper tape reader capable of reading any punched paper tape up to eight channels width is provided. The system recognizes the numbers 0 through 9. In addition, it recognizes three unique characters from punched tape which signify: "minus sign"; "end of block"; and "end of file". Optional provisions may include pen/printer selection and data block selection.

*Optional features

The accuracy of the analog plotter is 0.015 inches; conversion of the digital data is within 4 counts, giving an overall plotting precision very close to the width of the line drawn. High stability, wirewound resistors and silicon diodes are located in a thermostatically controlled oven to give extra protection against changes in environmental temperature. Analog operational amplifiers are chopper stabilized and, except for the tape transport unit, all circuitry is transistorized for greater reliability.

20,000 COUNT INPUT DATA RANGE

The DATAPLOTTER plots up to 4-digit decimal numbers of either sign, making its range effectively 20,000 counts or +9999 to −9999. Front panel controls are provided to permit plotting 1, 2, 3, or 4 digit numbers as desired. Scale and origin controls allow the plot to be compressed or expanded from 1/3 of full scale to more than 10 times full scale and to move the data origin to a point either on or off the plotting surface up to 4 board widths, depending on the scale used.

THREE PLOTTING MODES

Two types of plots may be made with the standard DATAPLOTTER: (a) Point Plots in which each set of X-Y coordinates are recorded as a point, and (b) Line Plots in which successive X-Y points are connected by straight lines. As an optional feature the system may be supplied with equipment to provide Symbol Plots, either as one of 12 automatically selected symbols or with numeric identification of points. The VARIPLOTTER may also be equipped with a second plotting arm for additional plotting versatility. When the second arm is equipped with a symbol printer both pen or symbol plots can be obtained by the selection of the proper arm.

3440 DATAPLOTTER *speed with a h*

Lateral parity check is maintained on selected words to minimize the chances of error when data is being plotted from magnetic tape. By placing the *Parity Action* switch on the Control Panel in the "Reject" position, the DATAPLOTTER automatically rejects questionable data and continues plotting. With this switch in the "Stop" position, faulty data causes the DATA-PLOTTER to cease all operations so that the operator can examine the nature of the error and take appropriate action. The operator may decide to manually reject the data or to correct it by entering correct information with the Manual Data Entry Keyboard. After either of these actions are taken, the plotter will continue to plot subsequent data.

EASE OF MAINTENANCE

Trouble-shooting and maintenance are easily accomplished on the Series 3440 DATAPLOTTER.

All triggers and counters in the system are monitored by visual indicators. The keyboard may be used to simulate the tape. In this mode all data detection, control and counting circuitry are utilized. All digital logic and control printed circuit cards are mounted on rolling drawers for easy accessibility. Each of these cards has color-coded phone jacks on its edge which

allow safe monitoring of the output of all active elements on the card. In addition, a Test Panel is provided which contains a selector switch for monitoring any of the system power supplies with a self-contained voltmeter, and balance potentiometers for balancing the operational amplifiers.

OPTIONAL EQUIPMENT

Optional equipment is available for increasing the plotting versatility of the Series 3440 DATAPLOTTER. This includes printing facilities for symbol or numeric identification of plotted data, automatic incremental advance, paper roll mechanism and others.

SPECIAL MODELS

Variations of the Series 3440 DATAPLOTTER can be provided on special order to accept magnetic tapes from other digital computers. A VARIPLOTTER with a 45" x 58" plotting surface is also available on special order.

Magnetic Tape Format Definitions
    Character—consists of a group of bits placed in each of the seven channels on the tape.
    Record—a sequence of characters along the tape.
    File—a sequence of records along the tape.

DIGITAL TAPE TRANSPORT

The tape transport used with the 3440 DATAPLOTTER is the Ampex FR400, which is designed for reading tape prepared by IBM 650, 704, 705, 709, 7070, 7090, 1401, 1620, and CDC 160 and 1604 Computers. It is equipped with hubs for mounting standard IBM or NARTB tape reels using ½ inch wide tape. The tape is read at a speed of 75 inches per second with a seven-channel reading head to fit the dimensions of

...gree of accuracy plus simplified operation

the recorded data. Manual controls are provided for controlling the tape reader in addition to the automatic controls that are required to carry out the automatic plotting operations. Brakes are provided to automatically stop the tape in event of tape breakage or failure of AC power. Optionally available are stop devices which sense the IBM end of the tape foil markers.

Word and Character Selection. A record is first divided into words of arbitrary size (from 2 to 12 characters) and the words into characters. The size of the word is set on the *Word Size* dial. The location of the words to be plotted within the record are set on the X and Y *Word Selector* dials. Any word from 000 to 159 can be selected. When plotting from magnetic tape, punched tape or serially fed punched cards it is possible to select the following characters from anywhere within the desired word: sign character, command character, thousands digit, hundreds digit, tens digit, and units digit. These selections are accomplished by the use of six dials for X and six for Y. The action taken on each record will depend upon the command characters which appear in the location as set on the *Command Character* dials. Note that it is possible to set the *Command Character* selector to "0" in which case every X and Y word selected will be plotted.

3440
DATAPLOTTER

data selection

The Series 3440 DATAPLOTTER offers unprecedented input format flexibility. No patching is necessary except in the Card Reader—all data selection is performed by dials.

RECORD SELECT * Frequently, information to be plotted appears only in certain records and, accordingly, it is useful to have a means for selecting these particular records. Similarly, for other cases, it may be desirable to reject certain records. Any character position within any word of the record may be selected as the record control character by the *Control Character Select* dials. The control character itself can be defined by the *Character Code* selector switches. When in the "reject" mode all records with this character are rejected; and when in the "select" mode all records with this character are selected and processed. This feature applies to operation from magnetic tape, punched tape, and punched cards.

RECORD THINNING * Sometimes, large amounts of well resolved data are written on magnetic tape, punched tape or punched cards. By plotting only a percentage of the data, time can be saved during the plotting operation. Accordingly, for magnetic tape, punched tape, and punched cards, one can predetermine that every second, every third, every fourth, etc., up to every 1599th record will be plotted. This is known as Record Thinning and is accomplished by setting the *Mode* switch to *Record Thin* and selecting the proportion of records to be thinned out on the *Thin Counter* dials.

data location

One of the outstanding features of the Series 3440 DATAPLOTTER is its ability to locate the data to be plotted. By using any of the following means it is easy to find the data to be plotted.

The operator preselects that number of files or records which he wishes to advance or regress on the *Scan Counter* dials and then pushes the *Tape Forward* or *Reverse* key. The magnetic tape will be positioned at the beginning of the pre-selected file or record. Up to 1599 files or records may be traversed in this manner. Data may be located in a similar manner on punched paper tape except that it cannot be scanned backwards.

The *Record Address* dials are preset to the value at which the operator wishes to start plotting. The word in which this value appears is selected with the X *Data Selector* dials. The magnetic tape will be positioned at the point at which this value appears. Similarly, a terminal value may be preset through the *Record Address* dials and the machine will stop plotting at the desired point. Data location by Record Address is also possible with punched cards and punched tape.

A file counter is provided which gives a continuous display of the file that is under the reading head when operating from magnetic tape. The tape is caused to move forward or backwards by depressing the *Tape Forward* or *Reverse* key. It is stopped at any time by pushing the *Stop* key. Under manual control and depending upon the position of the *Scan* switch, the tape advances or regresses one record or file or moves continuously in one direction until halted by the *Stop* key. The position of the *Mode* switch determines whether records or files are to be scanned. A unique character which simulates the file mark may be written on punched tape and is handled in the same manner except that punched tape cannot be moved backwards.

*Optional features

series 3440 DATAPLOTTER
system control panel
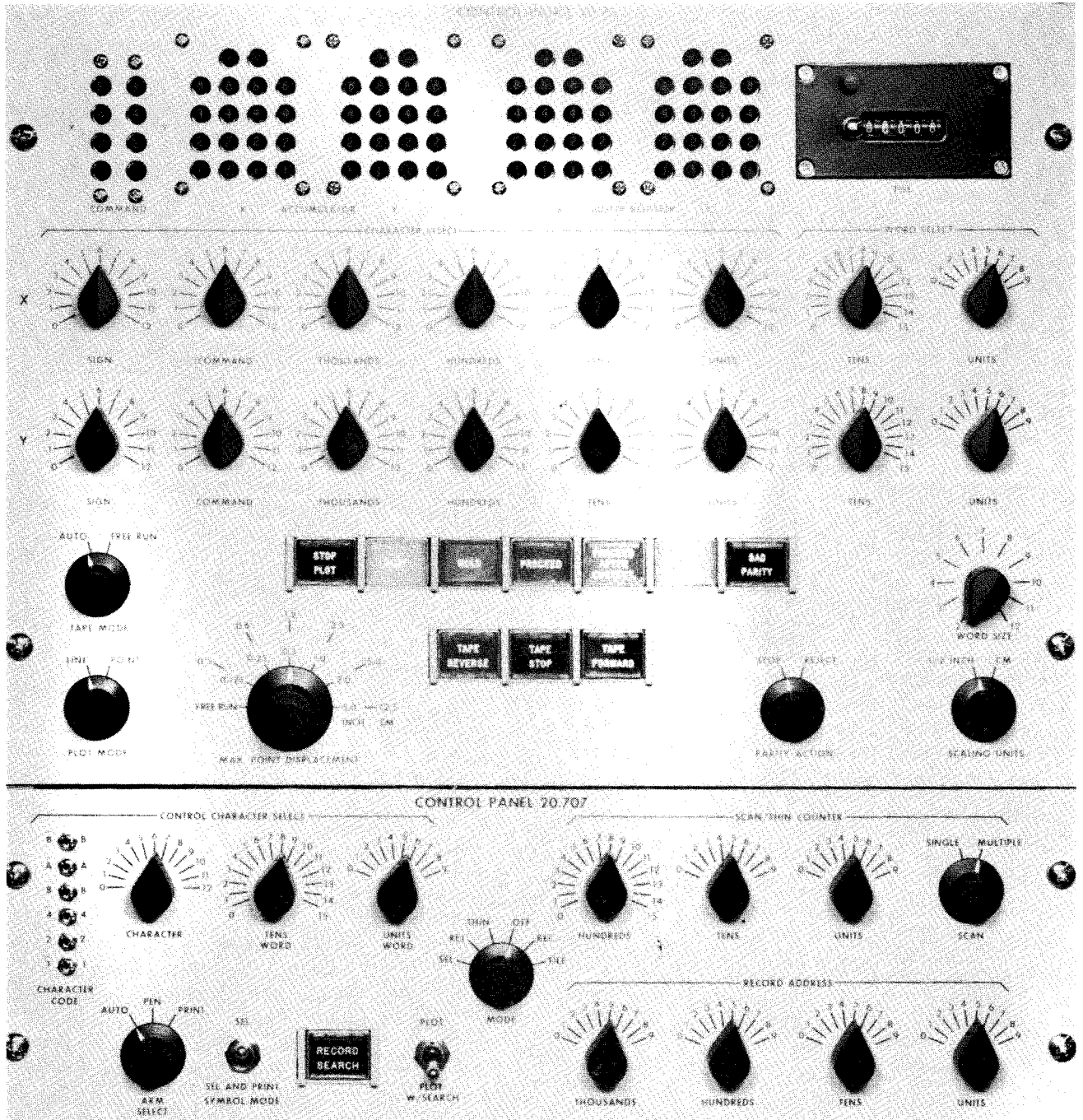
automatic plotting and set-up is facilitated by use of commands

The DATAPLOTTER is capable of performing several different functions from commands written on magnetic tape, punched tape or punched cards. Two command characters, one taken from the X word and another from the Y word, grouped together as a pair, are known as a command. For each parcel of quantitative data that is read from the record there is a command which instructs the machine what to do with the data. These commands are listed at the right.

An alternate to fully automatic plotting is available through manual selection. In this mode of operation, even though commands do not exist in the stored data, the machine automatically gives itself a plot command and thereby plots the data points from all those records except those rejected for any of the various reasons that the machine normally rejects data. In addition, all commands can be introduced with the Manual Data Entry Keyboard.

The Control Panel of the Series 3440 DATAPLOTTER provides for the complete control of the plotting operation. Controls are arranged in a logical grouping and are clearly marked to indicate their function. In addition, for high speed operation, the Control Panel displays in X and Y, both a four-digit input and output register with sign plus their associated command characters that are in storage. The contents of both the input and output register are displayed at all times.

**As an alternate the DATAPLOTTER can be supplied with 0 0 and 1 1 codes transposed.

CONTROL COMMAND CODE

Commands		Action	Data Meaning
0	0	Skip this data	Has no significance
1	1	Plot this data	Coordinates for X and Y
2	2	Set scale factor for X and Y coordinates	Counts per half inch or centimeter
2	0	Set scale factor for X coordinate	
0	2	Set scale factor for Y coordinate	
3	3	Set data value at Data Reference Point for X and Y coordinates	Coordinate value at Data Reference Point
3	0	Set data value at Data Reference Point for X coordinate	
0	3	Set data value at Data Reference Point for Y coordinate	
4	4	Set Data Reference Point for X and Y coordinates	Number of half inches or centimeters that the Data Reference Point is to be displaced from the Board Reference Point
4	0	Set Data Reference Point for X coordinate	
0	4	Set Data Reference Point for X coordinate	
0	5	Select symbol	Denotes a particular symbol on the printer
0	6	Pen down	Has no significance
0	7	Pen up	Has no significance
0	8	Start new curve	Has no significance
0	9	Paper advance*	Has no significance
0	11	Select pen*	Has no significance
0	12	Select printer*	Has no significance

Optional features

The Series 3440 DATAPLOTTER includes provisions to allow scale factor and origin to be set automatically. Inclusion of the appropriate command code and setting instructions causes the DATAPLOTTER to move the data origin to any point either on or off the plotting surface and to adjust the scale factor of either co-ordinate to any desired value. These adjustments are accomplished automatically where the appropriate commands are included in the data. When data is written without commands, scale factor and origin commands and setting can be manually introduced with the Manual Data Entry Keyboard.

Scale factor adjustment varies continuously within the range of 000.1 to 999.9 counts per half-inch or centimeter. It is possible to select all scale factors within this range from input command without any manual adjustment being made. Scale factors are set digitally.

POINT. This is the location of the analog plotter pen on the plotting surface corresponding to zero voltage into the plotter. It is established by adjustment of the Parallax controls on the analog plotter.

POINT. This is a reference point on the curve which establishes a correspondance between the data to be plotted and a point on the plotting surface. This point is set (Code 4 4) with respect to the Board Reference Point in terms of numbers of one-half inches or centimeters; the range is from —79 to +79 half-inches or centimeters. The value of the data at the Data Reference Point is set by command code 3 3 and has a continuous range from —9999 to +9999. This point is also set digitally.

The **DATA INPUT PANEL** provides controls and indicators for monitoring the electrical power, controls for the manual reset of the digital circuits and input register, the Manual Data Entry Keyboard, and a six-position *Input* switch for selecting the input to the DATAPLOTTER.

specifications

DATA INPUT

Magnetic Tape: Accepts ½ inch wide, 7 track, BCD tape, written at a density of 200 characters per inch.**

Punched Cards: Read with parallel or serial fed Card Readers.

Punched Tape: High speed photo-electric reader capable of reading tape with up to 8 levels.

Keyboard: Manually operated—adding machine type.

DATA OUTPUT*

Point Plot: Any size paper up to 30 inch x 30 inch (available in plain or ruled sheets or rolls)

Continuous Line: Any size reproducible ink drawing on any size paper up to 30 inch x 30 inch.

Coded Plots: Symbols—up to 12 distinct symbols (average selection time 0.33 seconds); Numeric point identification.

PLOTTING ACCURACY (quoted as maximum errors)

Analog Plotter: 0.015 inches
Data Conversion: within 4 counts
Line Segment Conformity: 0.015 inches

PHYSICAL DESCRIPTION

	Tape Reader and Console	X-Y Plotter
Width (overall)	42"	46"
Depth (overall)	32"	46½"
Height	75¼"	41¾"
Weight (uncrated)	1212 lbs.	660 lbs.

Power—Requires 30 amp, 115V, 60 cycle (single phase) service. (50 cycle model available on special order)

*Wide line (up to 1/16 inch) pens are available
**Other formats available on special order

PLOTTING SPEEDS

Point Plots: Magnetic Tape (at ⅛ inch spacing) at least 350 ppm
Punched Cards:
   Serial-fed—nominally 75 ppm
   Parallel-fed—nominally 100 ppm
   Punched Tape—nominally 300 ppm

Line Plot: Magnetic Tape: (depends upon setting of *Max. Point Displacement* switch)
   ⅛ inch—540 lines/min
   ¼ inch—306 lines/min
   ½ inch—144 lines/min
   1 inch—114 lines/min
   2 inch— 90 lines/min
   5 inch— 42 lines/min

Punched Cards
   Serial-fed—maximum 75 lines/min
   Parallel-fed—maximum 100 lines/min

Punched Tape
   maximum 300 lines/min

Coded Plots (⅛ inch spacing):
Magnetic Tape—at least 180 ppm
Punched Cards
   Serial-fed—75 ppm
   Parallel-fed—100 ppm
Punched Tape—180 ppm

Free Running Mode—up to 4500 ppm
   (Data points are read at 75 inches per second tape speed without stopping in the record gaps)

(All equipment specifications contained herein are subject to change)