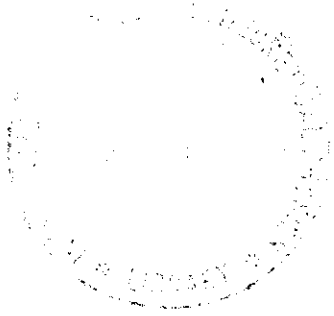


INTERNATIONAL ATOMIC ENERGY AGENCY
UNITED NATIONS EDUCATIONAL, SCIENTIFIC AND CULTURAL ORGANIZATION

INTERNATIONAL CENTRE FOR THEORETICAL PHYSICS
34100 TRIESTE (ITALY) - P.O.B. 586 - MIRAMARE - STRADA COSTIERA 11 - TELEPHONES: 224281/2/3/4/5/6
CABLE: CENTRATOM - TELEX 460392-1

SMR/90 - 41

COLLEGE ON MICROPROCESSORS:

TECHNOLOGY AND APPLICATIONS IN PHYSICS

7 September - 2 October 1981

MAN-MACHINE INTERACTION -
COMPUTER TERMINALS AND COMPUTER GRAPHICS

C.E. Vandoni
DD Division
CERN
1211 Geneva 23
Switzerland

COMPUTER TERMINALS

- PRINTING TERMINALS
- ALPHANUMERIC TERMINALS
- GRAPHIC TERMINALS

This set of transparencies is unfortunately incomplete due to difficulties in reproducing some of the slides presented during the lecture.

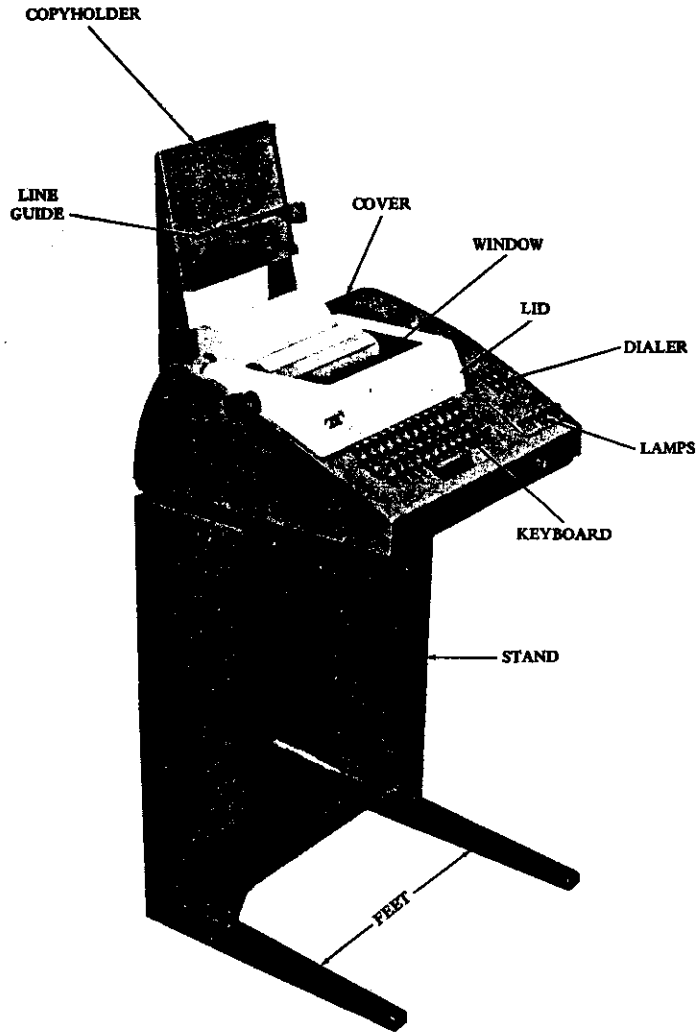


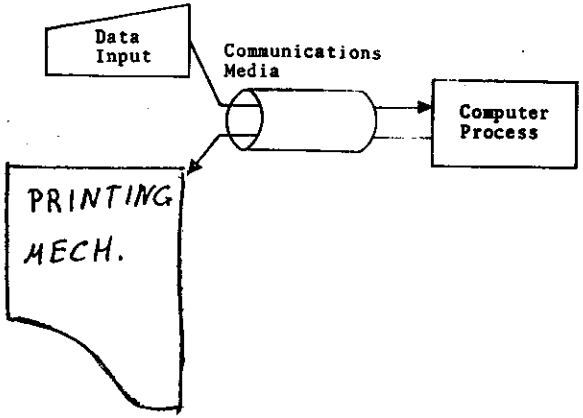
Figure 2 - Model 33 Keyboard Send-Receive (KSR) Teletypewriter Set

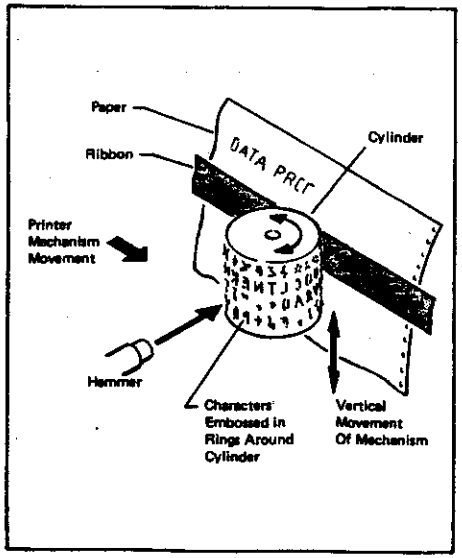
One of the first computer terminals.

PRINTING TERMINALS

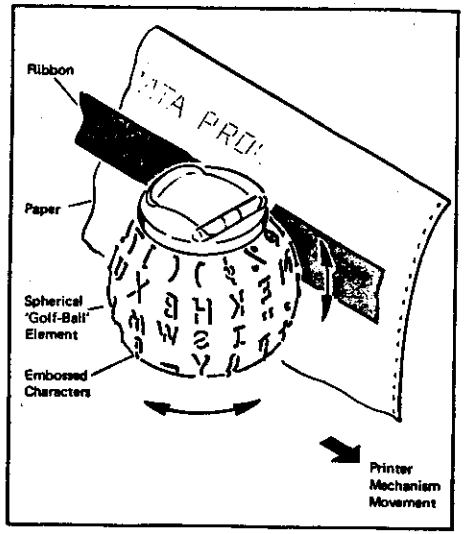
BASIC COMPONENTS:

- THE PRINTING MECHANISM
- THE CONTROL LOGIC
- THE CHARACTER GENERATOR, IF NE
- THE KEYBOARD
- THE COMMUNICATION INTERFACE

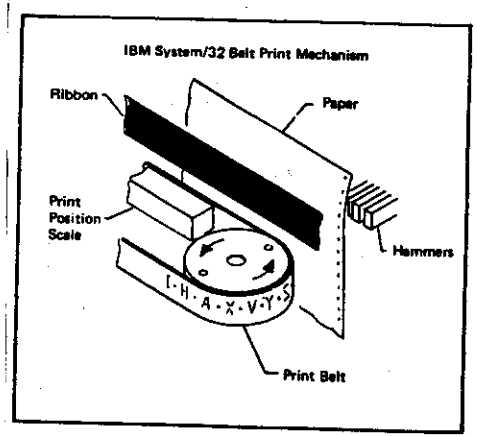




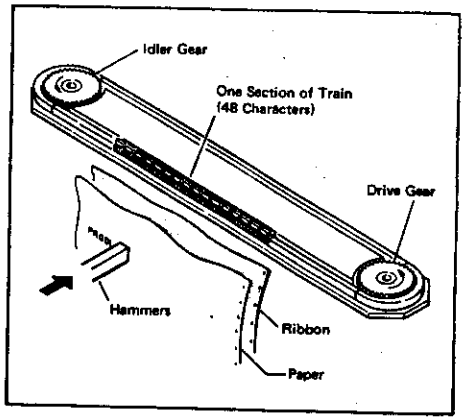
Part of a cylinder printing mechanism consists of a complete character set embossed in a series of rings around the small cylinder. To print, the mechanism moves the cylinder into position along the paper, rotates it and shifts it vertically, then strikes it with a hammer.



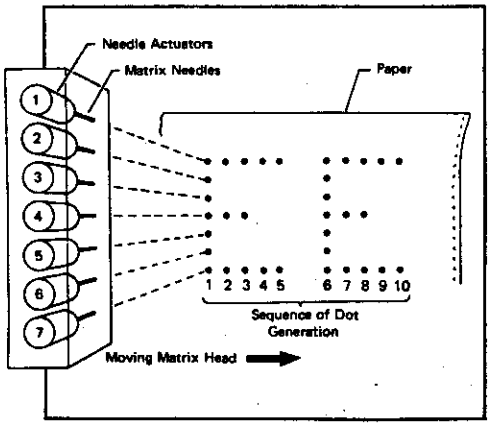
Golf ball printing mechanism performs its printing functions much as the cylinder mechanism, except that the sphere itself strikes the paper without the aid of a hammer.



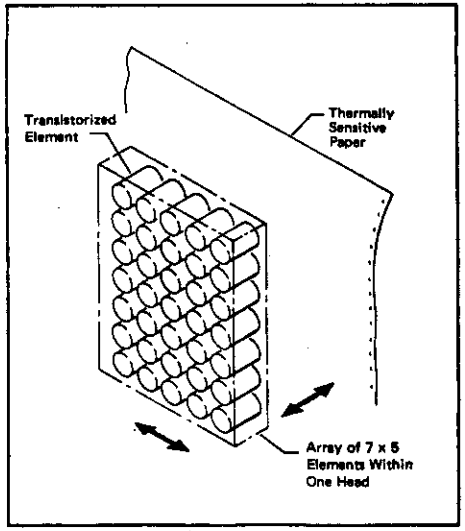
This printing character belt moves at constant speed. Precisely timed hammers make the impressions. The hammer may strike the belt or the paper.



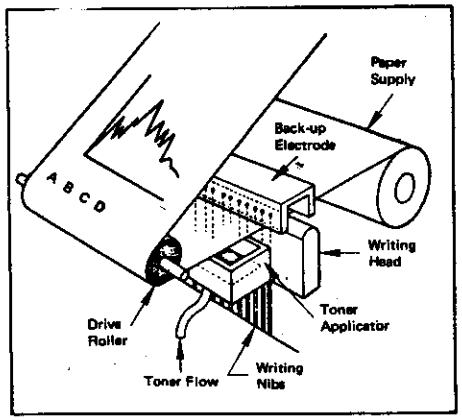
Similar to a belt machine, the train printer consists of a series of linked character "slugs" moving at constant speed. Precisely timed hammers make the impression striking from behind the paper.



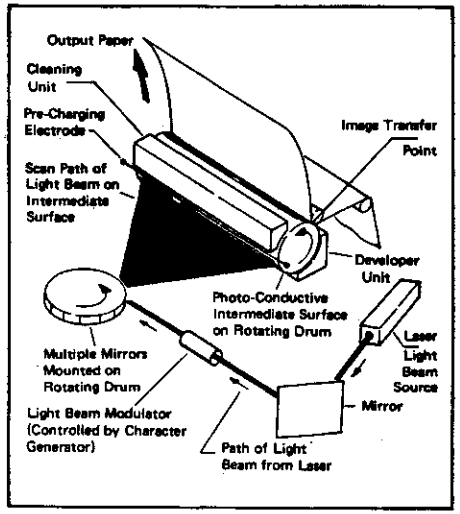
Serial matrix printers employ a single head that moves across the page. Electromagnetically driven pins in the head form the characters from dot patterns. Each scan of the print head across the page produces one line of print. The number of pins varies, but 7 is most common.



A single thermal matrix head moves across the paper and stops momentarily at each character position. The matrix head elements are transistors that when switched on produce heat. The hot spots force a heat sensitive dye in the paper to change color and create a series of dots.



Direct electrostatic printers use a specially-coated paper passing over an array of styli or nibs. Each stylus is charged to produce the required output. The paper then passes through a toner bath from which the charged areas attract ink particles.



Indirect electrostatic (laser) printers need no special paper. A modulated laser light beam, aimed at an intermediate surface (drum), forms dot matrix characters photoelectrically. The drum is then toned with ink powder and transfers the ink to the paper. Heat fuses the ink to the paper.

ALPHANUMERIC TERMINALS

OR

CRT TERMINALS

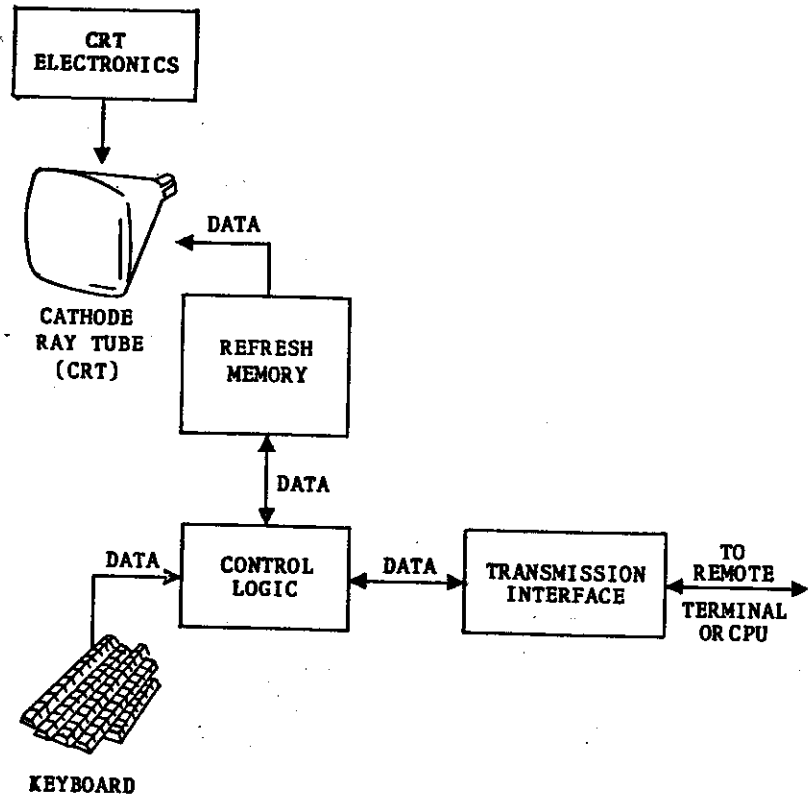
OR

VDU (VIDEO DISPLAY UNITS)

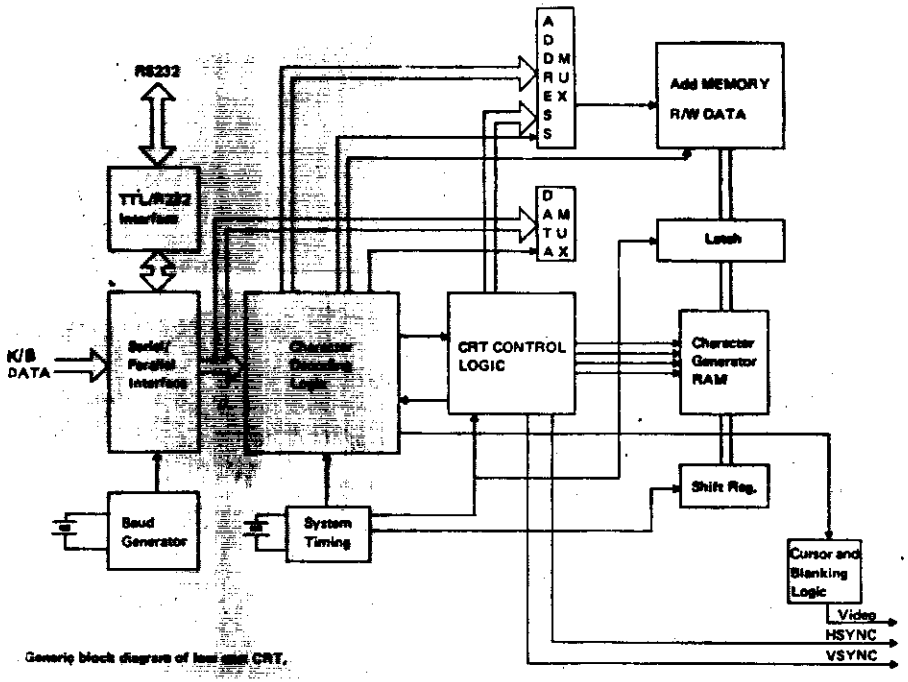
CRT TERMINALS

BASIC COMPONENTS:

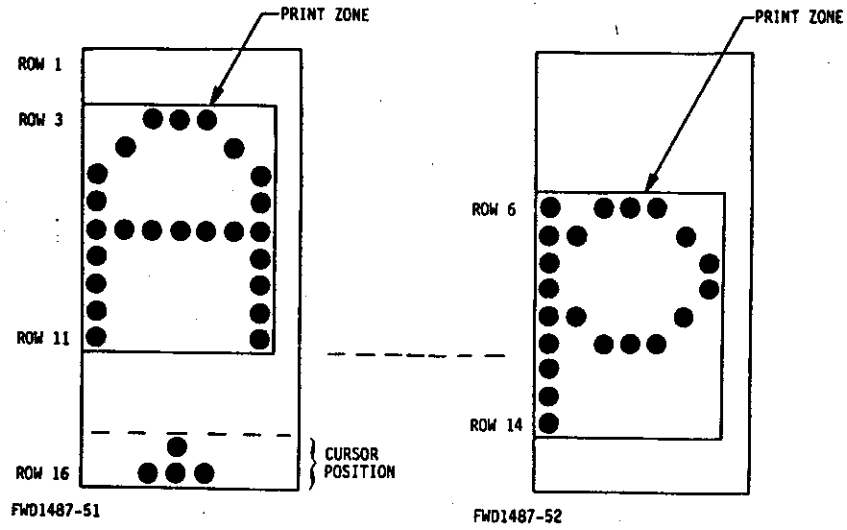
- THE MONITOR, OR DISPLAY SCREEN
- THE DATA STORE
- THE CHARACTER GENERATOR
- THE KEYBORD, INTERFACE WITH THE USER
- THE COMMUNICATION INTERFACE, WITH THE COMPUTER



Typical CRT Display Terminal Functional Block Diagram

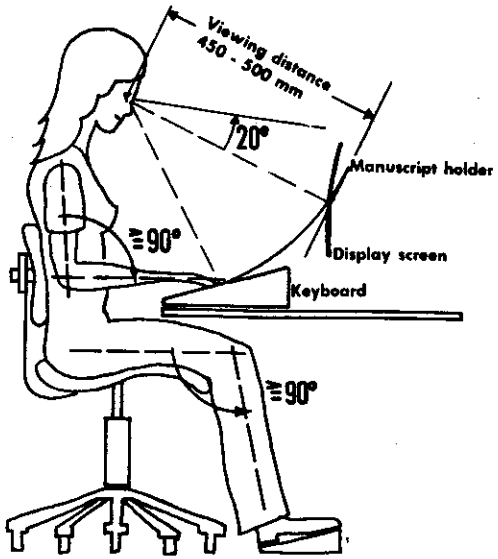


Generic block diagram of [illegible] CRT.

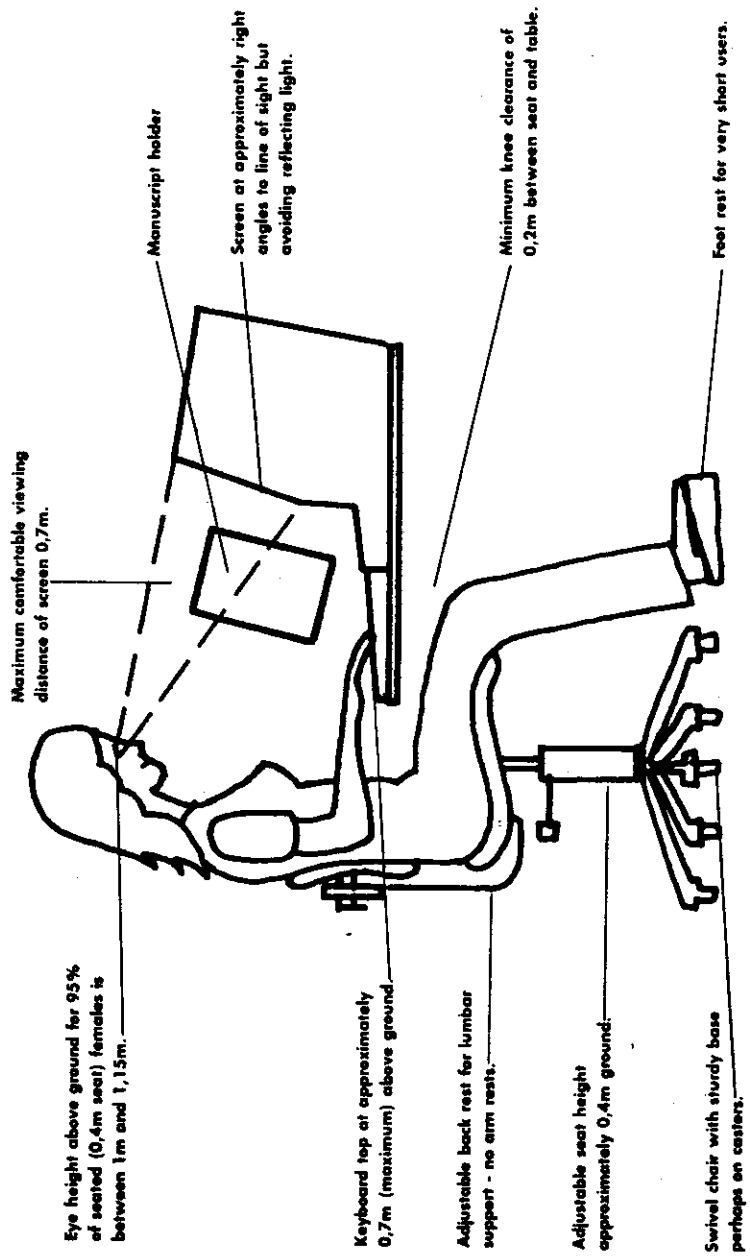


Standard Uppercase Letter

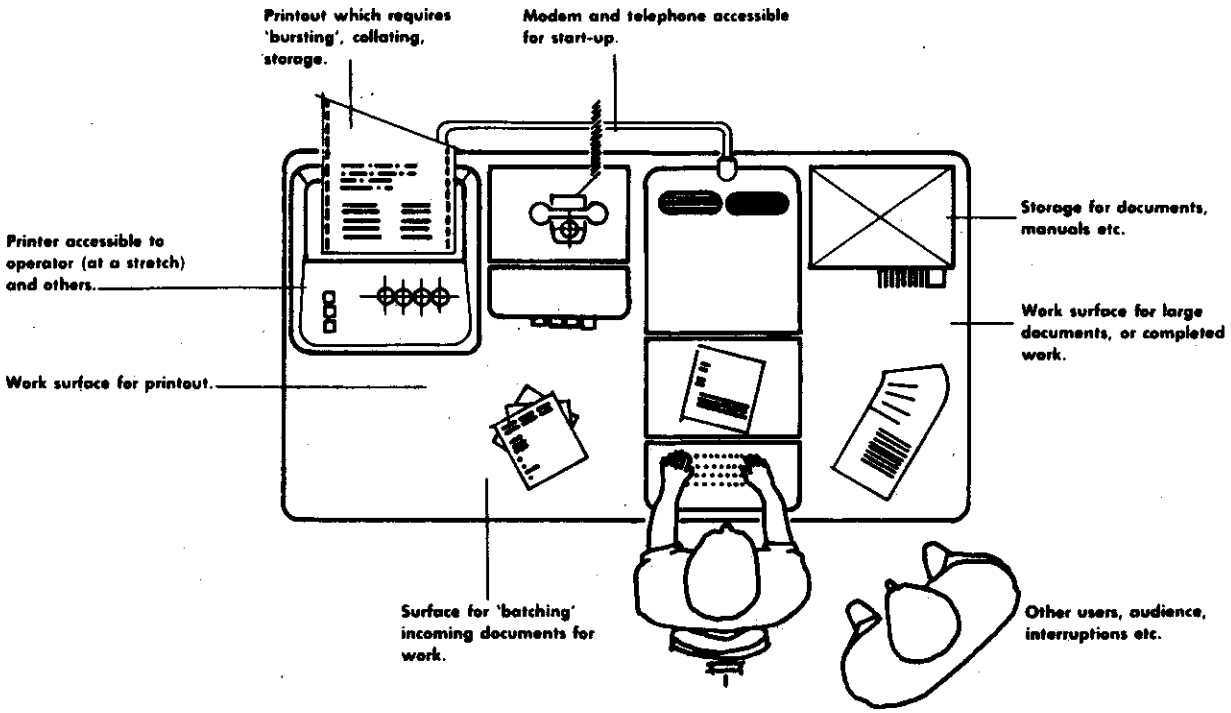
Standard Lowercase Below-the-Line Letter



Recommended viewing distance.



Typical dimensions for a VDT workstation.



VDT-printer workstation with work surfaces and storage facilities.

Components of a PROGRAMMABLE TERMINAL

Keyboard

Display

Character generator

Microprocessor (controller)

Internal storage

External storage

Communication Line

Peripherals, e.g. printer

CRT TERMINALS

First generation (till 1974):

TTL LOGIC, 150 ICs

Second generation (1975):

TTL LOGIC, MICROPROCESSOR, 100 ICs

Third Generation (1978)

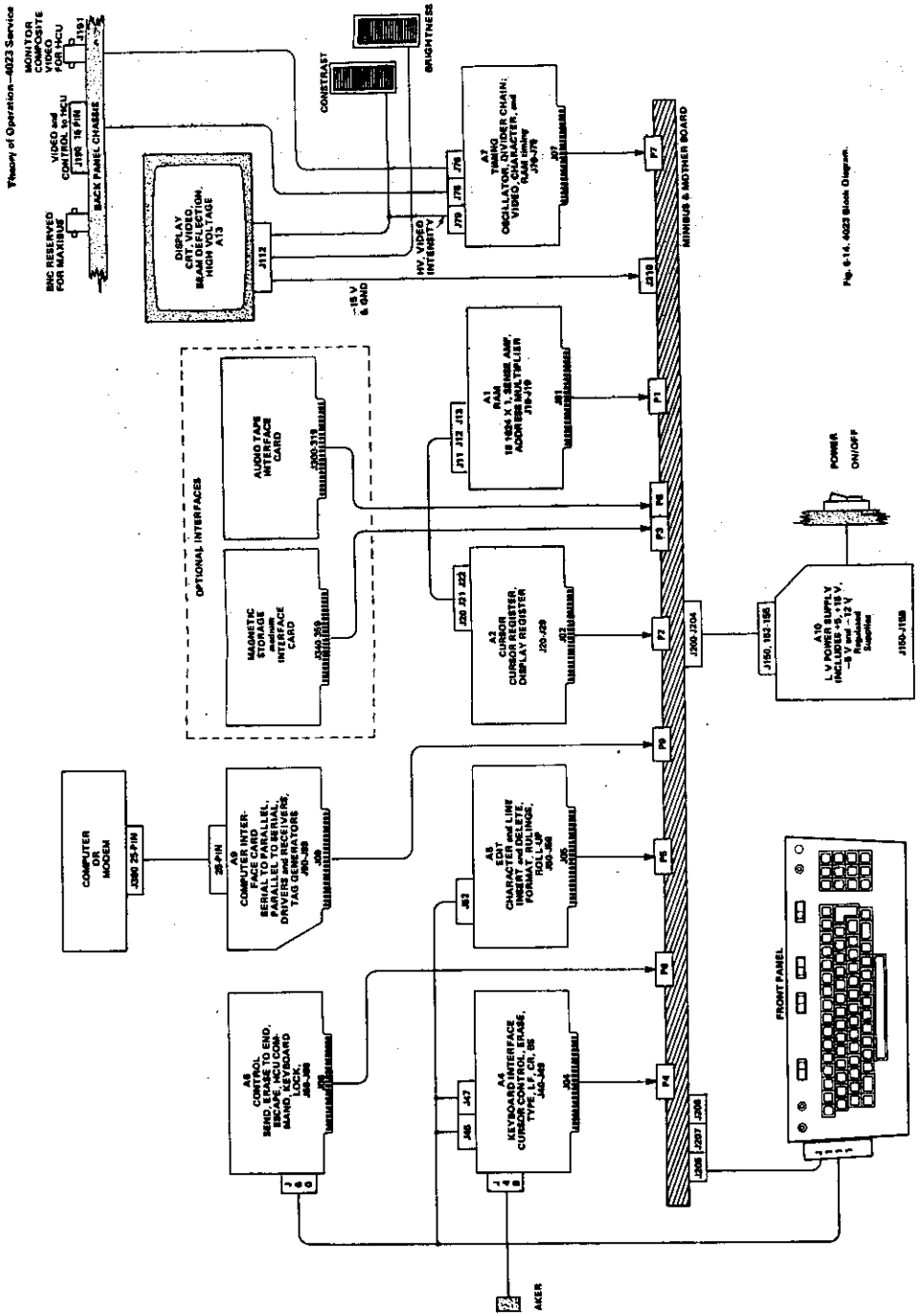
TTL LOGIC, Microprocessor, CRT Controller

60 ICs

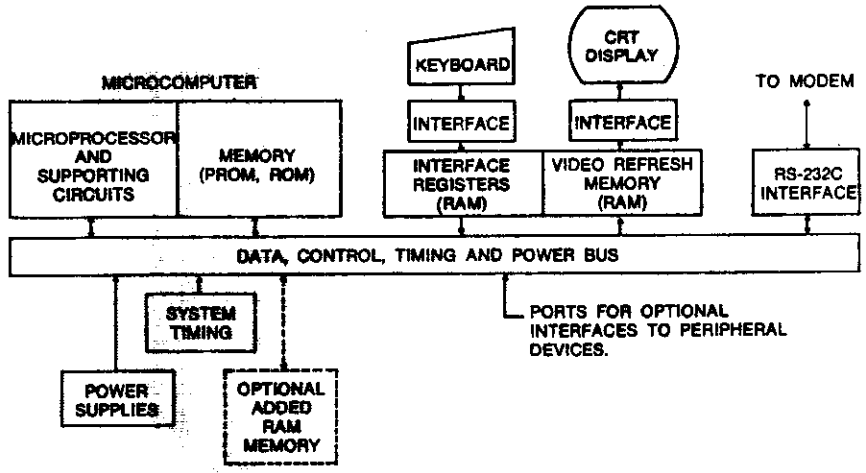
Today:

Microprocessor, custom LSI, TTL Logic

19 ICs ..or less



Block diagram of an early alpha-numeric terminal

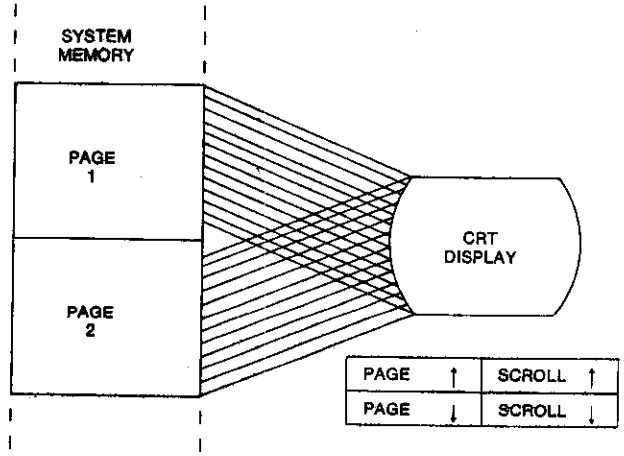


BLOCK DIAGRAM OF A MODERN ALPHANUMERIC TERMINAL

ALPHANUMERIC DISPLAY TERMINALS

ADVANCED FEATURES:

- EXTENSIVE DISPLAY
- VIDEO ATTRIBUTES (INVERTED VIDEO, UNDERLINE, FLASHING)
- PROGRAMMABLE KEYS
- ALTERNATE CHARACTER SET
- PRINTER PORT
- DETACHABLE KEYBOARD
- LARGE SCREEN

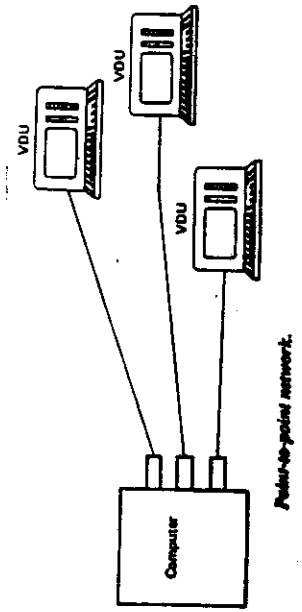


MULTI-PAGES TERMINAL

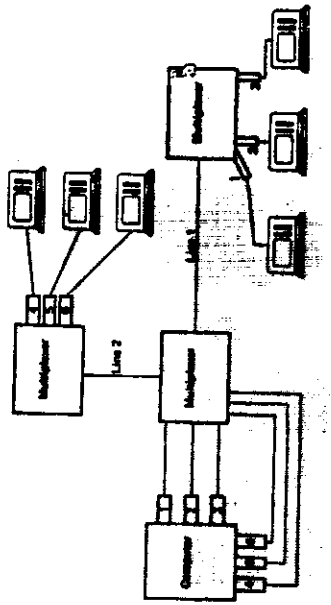
Table 2. ASCII Code Chart

b7 b6 b5 / b4 b3 b2 b1	0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
0 0 0 0	0	NUL	DLE	SP	0	@	P	`	p
0 0 0 1	1	SOH	DC1	!	1	A	Q	a	q
0 0 1 0	2	STX	DC2	"	2	B	R	b	r
0 0 1 1	3	ETX	DC3	#	3	C	S	c	s
0 1 0 0	4	EOT	DC4	$	4	D	T	d	t
0 1 0 1	5	ENQ	NAK	%	5	E	U	e	u
0 1 1 0	6	ACK	SYN	&	6	F	V	f	v
0 1 1 1	7	BEL	ETB	'	7	G	W	g	w
1 0 0 0	8	BS	CAN	(	8	H	X	h	x
1 0 0 1	9	HT	EM	)	9	I	Y	i	y
1 0 1 0	10	LF	SUB	*	:	J	Z	j	z
1 0 1 1	11	VT	ESC	+	;	K	[	k	{
1 1 0 0	12	FF	FS	,	<	L	\	l	|
1 1 0 1	13	CR	GS	-	=	M	]	m	}
1 1 1 0	14	SO	RS	.	>	N	^	n	~
1 1 1 1	15	SI	US	/	?	O	_	o	DEL

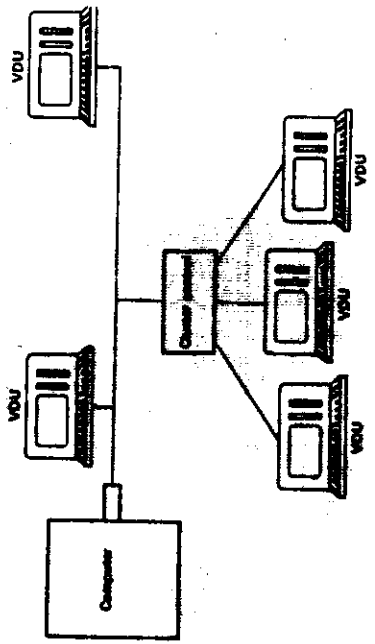
1487-41



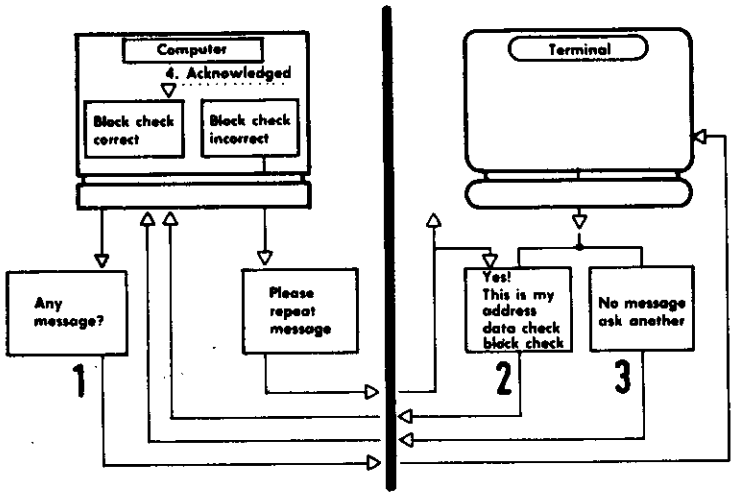
Point-to-point network.



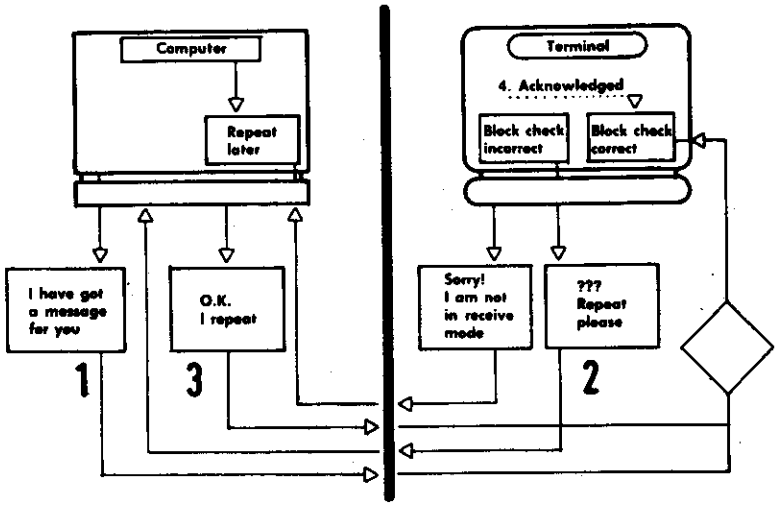
A multiplexed network.



A polled network.



POLL FROM COMPUTER



MESSAGE FROM COMPUTER

Polling. With several terminals sharing a common line to the central processor, one way of ensuring that they all receive adequate service is for the central processor to scan or poll each terminal in turn, (a) transmitting data or (b) receiving data from the terminal.

REFERENCES

VISUAL DISPLAY UNITS

DERRICK GROVER, EDITOR

IPC SCIENCE AND TECHNOLOGY PRESS, 1976

VISUAL DISPLAY TERMINALS

A. CAKIR ET AL.

JOHN WILEY & SONS, 1980

- Computer Graphics

  - Non-Interactive (Passive, Batch)

    Hard-Copy Devices (Plotters)

    - Plotters

      - Pen Plotters

        . Drum

        . Flatbed

      - Photo-Plotters

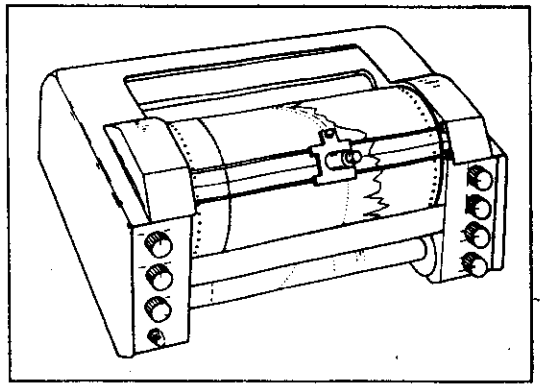
      - Microfilm

      - Electrostatic Plotters

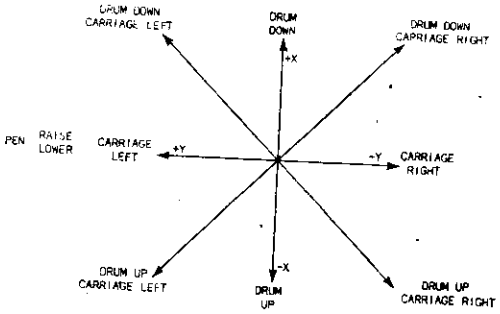
      - Ink-Jet Plotters

  - Interactive

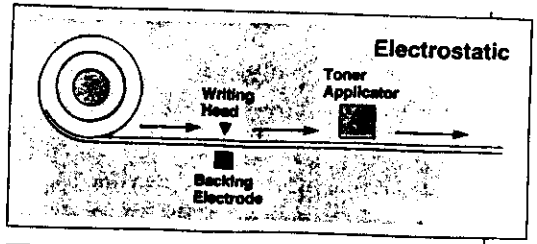
    Graphic Displays

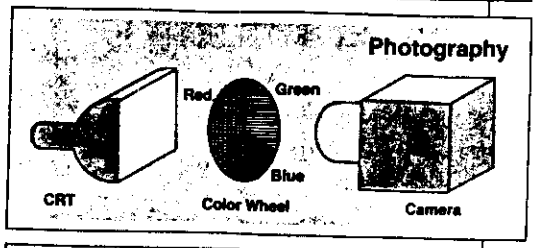


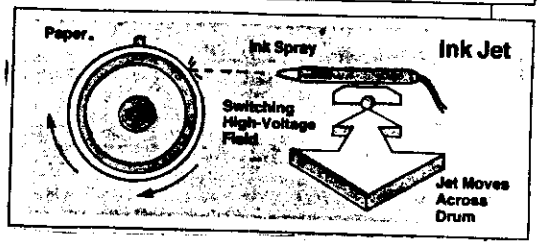
Drum-type plotter

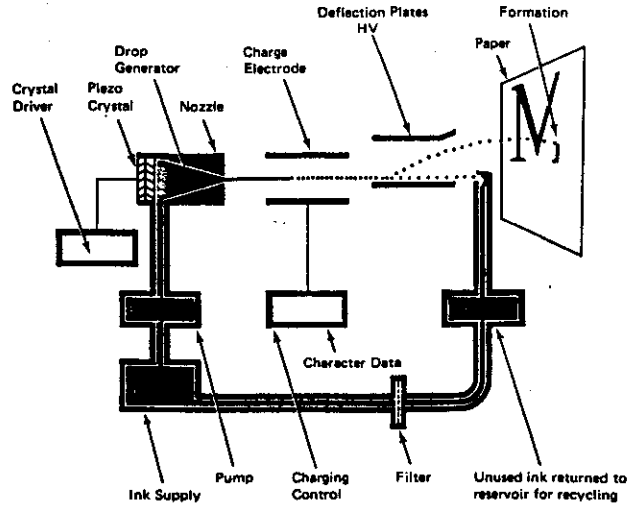


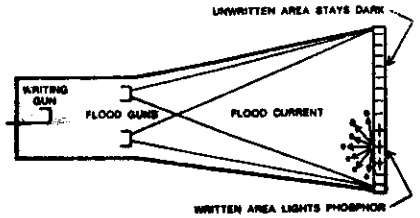
Direction of movement related to control code as viewed from front of plotter. Graphs are plotted with axes oriented as shown.











Principle of a storage tube display

ıic Displays

ɔrage Tube Displays

freshed, Line Drawing,
Stroke, Calligraphic

aster Scan

Storage Tube Displays

Advantages .

-Low Cost

-Good Resolution

-No Flicker

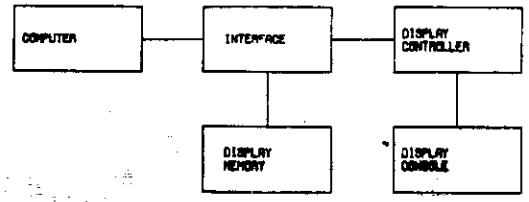
-High Density Graphs Possible

Disadvantages .

-No Partial Erase

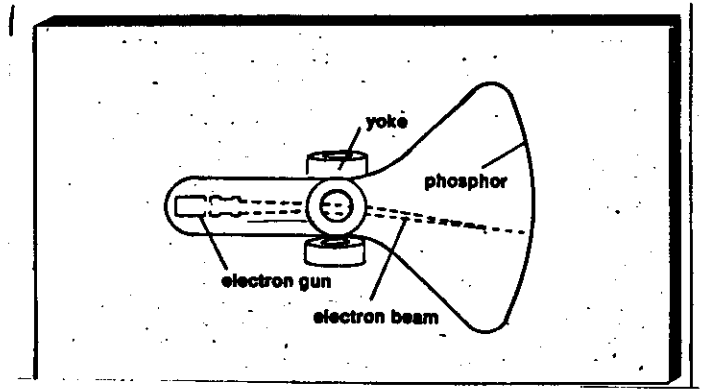
-No Dynamic Display

-Low Speed



REFRESHED DISPLAY

Principle of a refreshed display



Refreshed Displays

Advantages .

–High Level Interaction

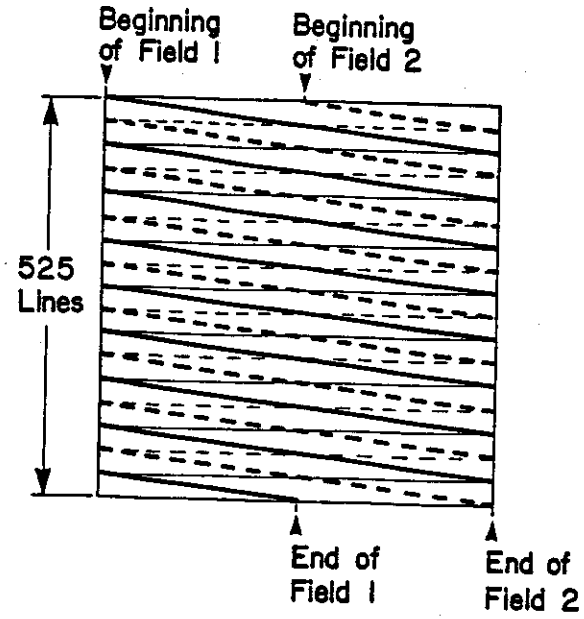
–Dynamics

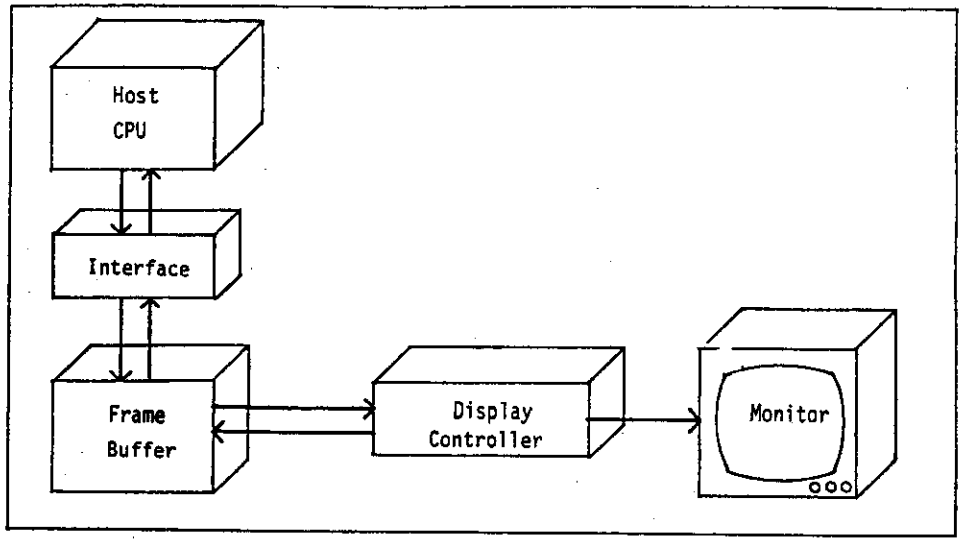
Disadvantages .

–High Cost

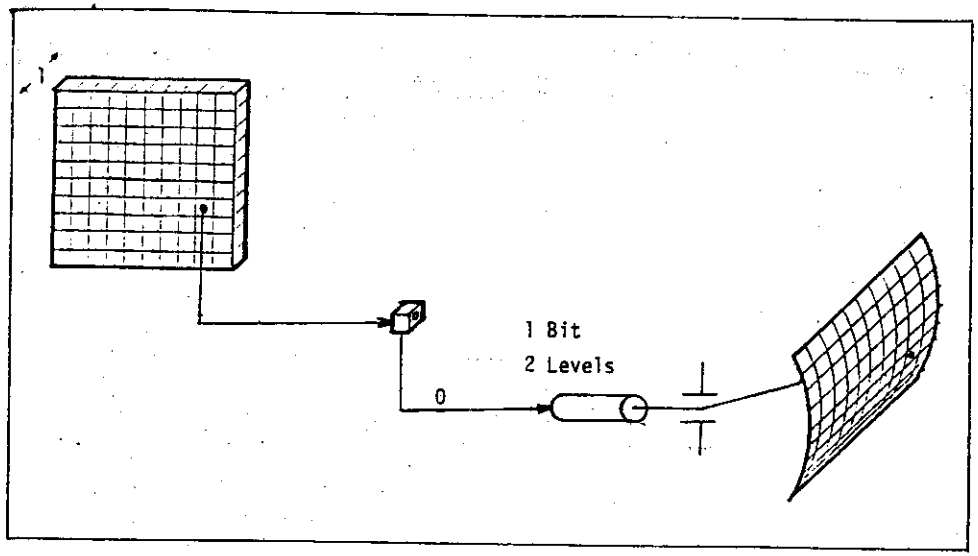
–Possible Flicker with
High Density Graphs

–Expensive Interface

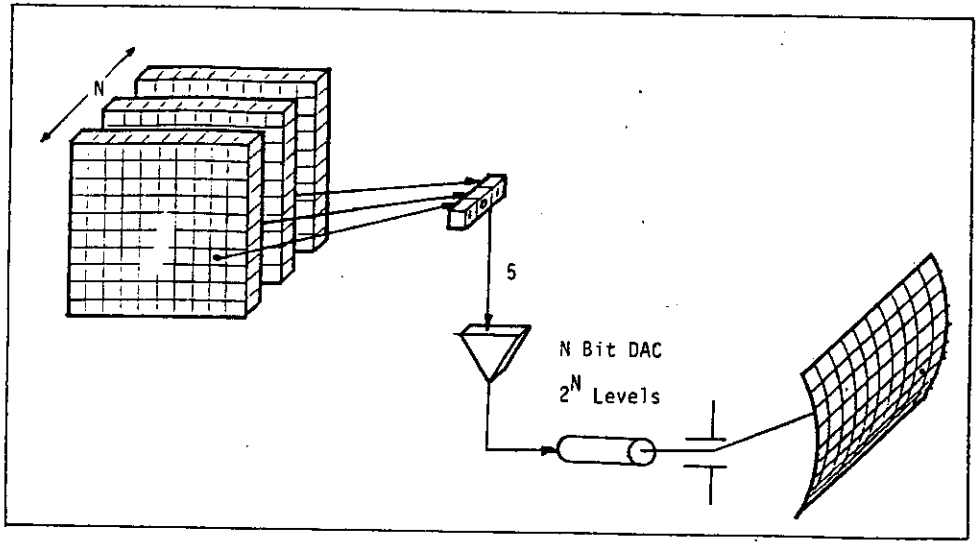




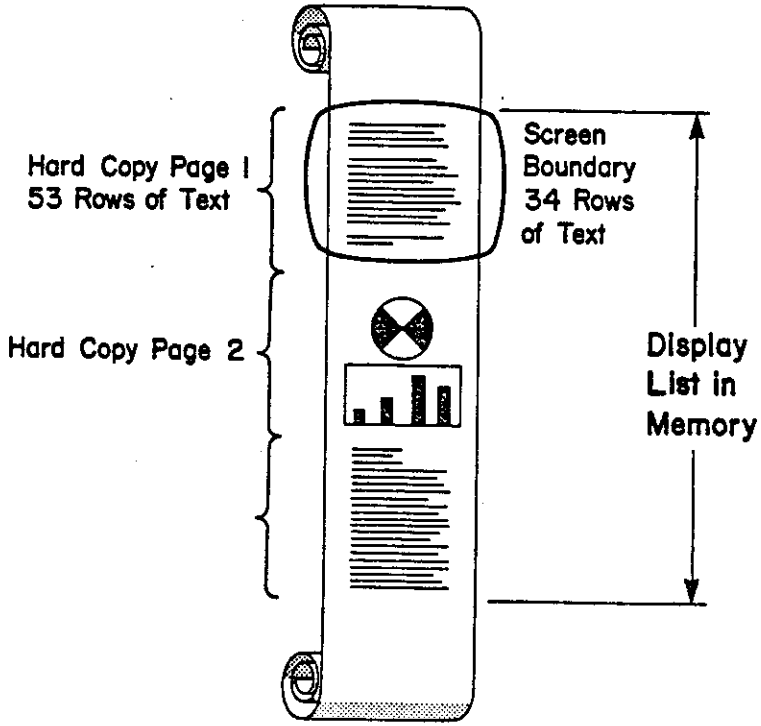
General frame buffer system.



Black and white frame buffer system with 1 bit plane

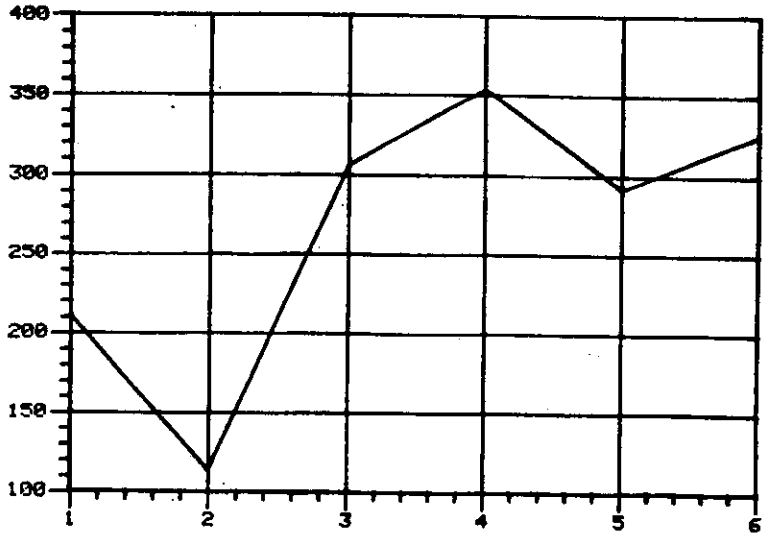


Black and white frame buffer system with N bit planes driving a DAC.

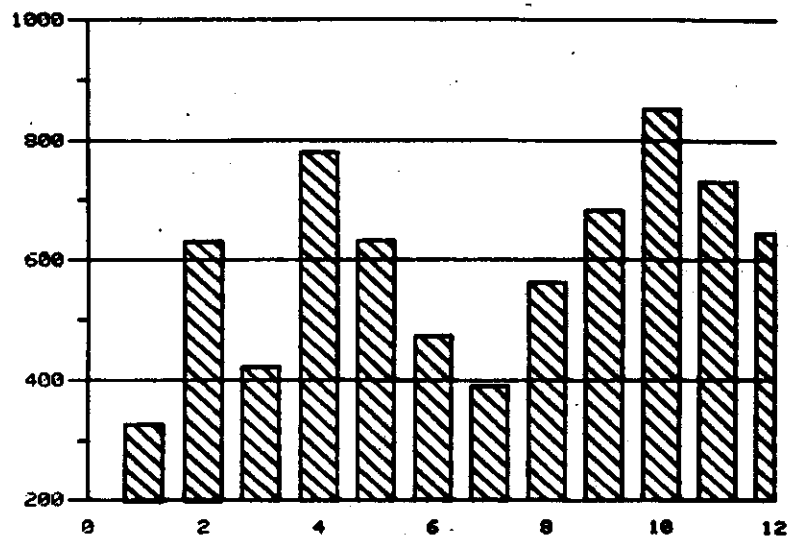


SCROLLING TEXT AND GRAPHICS

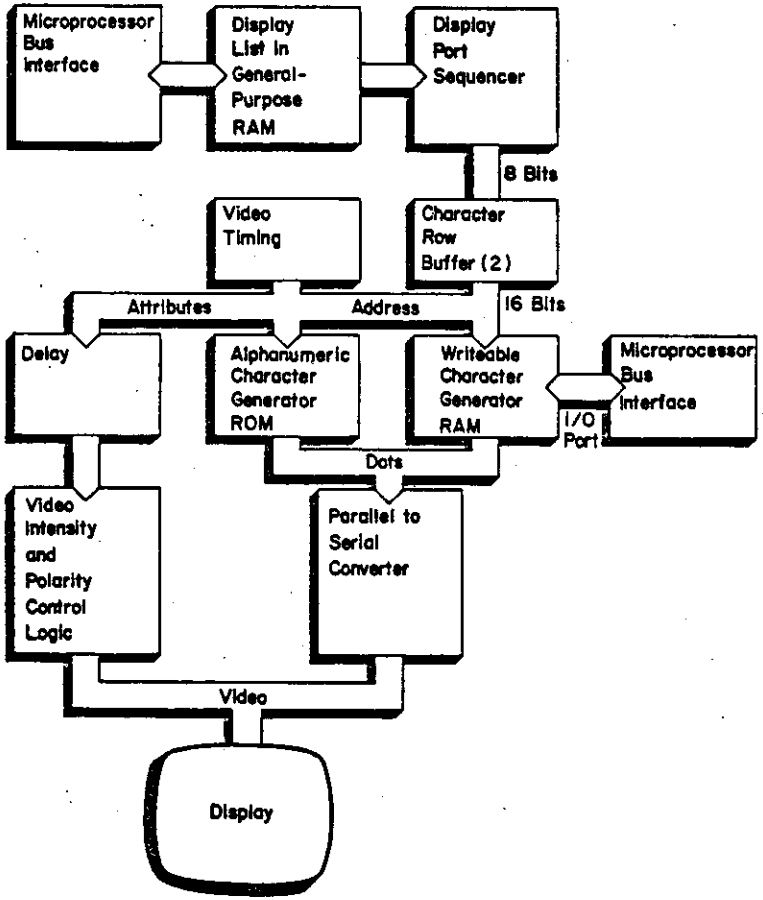
```
DIMENSION XDATA(7),YDATA(7)
DATA XDATA/0.,1.,2.,3.,4.,5.,6./
DATA YDATA/0.,211.,114.,306.,354.,291.,325./
CALL INITT(120)
CALL BINITT
CALL CHECK(XDATA,YDATA)
CALL DSPLAY(XDATA,YDATA)
CALL FINITT(0,700)
STOP
END
```




```
DIMENSION XDATA(4),YDATA(13)
DATA XDATA/-1.,12.,1.,1./
DATA YDATA/12.,328.,632.,421.,780.,632.,472.,390.,562.,
& 680.,852.,729.,645./
CALL INITT(30)
CALL BINITT
CALL UBARST(0,0,0)
CALL XFRMK(1)
CALL CHECK(XDATA,YDATA)
CALL DSPLAY(XDATA,YDATA)
CALL TINPUT(I)
CALL FINITT(0,700)
STOP
END
```



Bar Chart



ACM/SIGGRAPH STATUS REPORT OF THE
GRAPHIC STANDARDS PLANNING COMMITTEE
OF ACM/SIGGRAPH
COMPUTER GRAPHICS, SIGGRAPH/ACM,VOL.11,
NO.3, FALL 1977

DRAFT INTERNATIONAL STANDARD ISO/DIS
INFORMATION PROCESSING, GRAPHICAL
KERNEL SYSTEM (GKS), VERSION 6.6
FUNCTIONAL DESCRIPTION,
ISO TC97/SC5/WG2, 1981

REFERENCE TEXT

PRINCIPLES OF INTERACTIVE COMPUTER GRAPHICS

BY W.M. NEWMAN AND R.F. SPROULL

MCGRAW-HILL 1973

A P P L I C A T I O N S

- CAD/CAM
- ARCHITECTURE
- SCIENTIFIC APPLICATIONS
- PROCESS CONTROL
- CARTOGRAPHY
- BUSINESS GRAPHICS
- EMERGING FIELDS