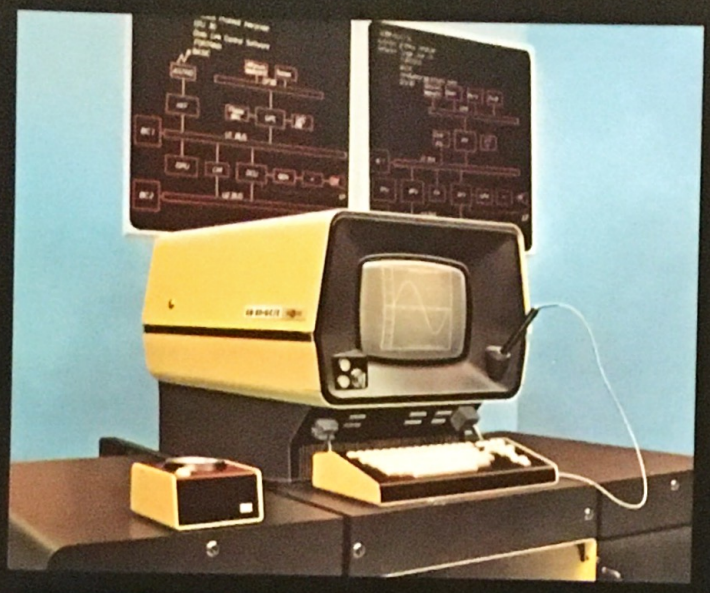
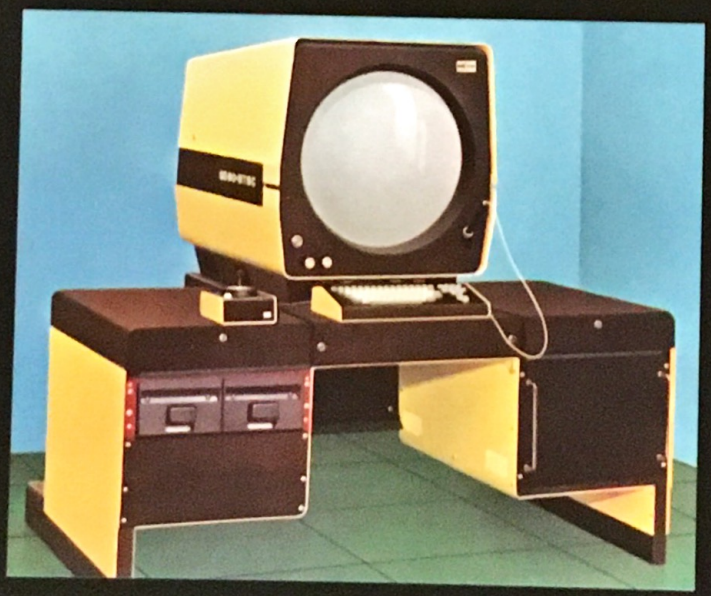

GOBO
A CASE FOR ADVANCED
GRAPHIC FAMILY PLANNING





GD 80

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Graphic displays are the most powerful extant vehicles for dialogue between man and machine. They are being put to a rapidly growing number of uses in

- Computer-Aided Design
- Process Supervision
- Traffic Control
- Simulation
- Analysis

and a host of other applications.

Many computer users feel the need for graphics. But they are afraid of

- high costs
- long commissioning delays
- in-house development commitments

that will cause more difficulties than benefits. Many – not you, of course – fight shy of all novelty. Yet they are under pressure from their own computer-buffs, to install a high-performance, flexible, graphic display system.

The solution to this dilemma is the GD80 Family. A graphic display (and much more)

- at a reasonable price (because you only have to pay for the facilities that your application really needs)
- quickly and easily linked to your extant systems
- with a copious set of high-level user-oriented application features.

For the novice, the student, or the simpler industrial applications, there is the Benjamin of the Family.
The GD80-GC/E is a

- table-top computer
- with a fully interactive graphic and alphanumeric console.

It is a Graphic Computer for your personal use.

For more complex applications, you will need more processing power, more storage, higher display resolution, better picture quality, advanced picture handling, possibly colour. The Senior members of the Family offer you all these.

Start with a small configuration and expand later; grow with the needs of your growing application. Many parts are common for all configurations, other are simply replaced.

Communication is part of the Family way of life. You may start right away with a GD80 graphic network terminal or, alternatively, any GD80 configuration may be enhanced later with communication facilities compatible with your main-frame computer.

A glance at the design of the GD80 Family architecture will show the expert that it embodies the results of long experience in the design of graphic hardware and software and the development of many practical applications.

Many people think that graphic displays should only be bought from famous companies, like TEKTRONIX[1] or HP[2].

Just sit in front of the console of GD80! You'll experience all the goodies the more famous companies offer. And you may well imagine: we have to provide much more to compete with the big names. See the technical details for confirmation.

[1] TEKTRONIX is the trade mark of Tektronix Inc., Beaverton, Oregon, USA
[2] HP is the trade mark of Hewlett Packard, Palo Alto, California, USA

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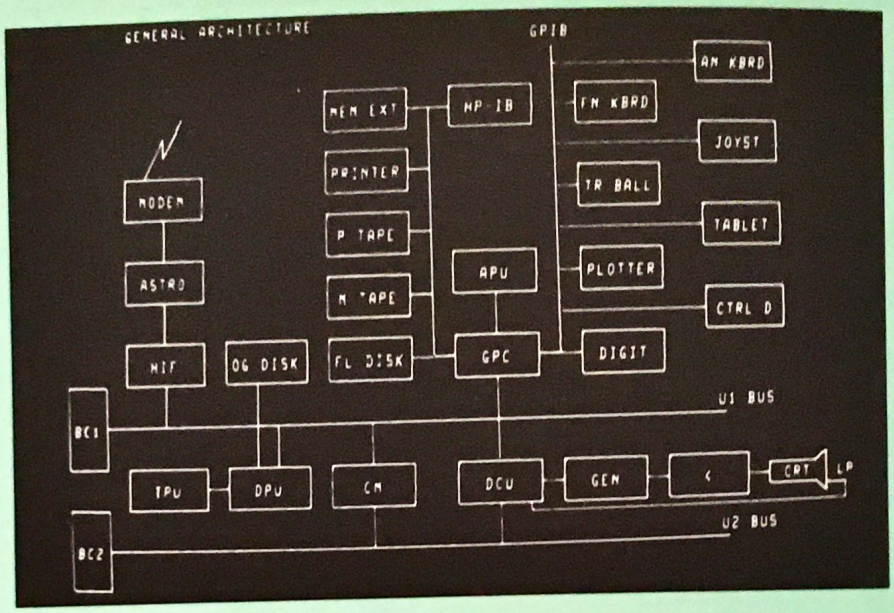


The GD80 Family is based on a multi-microprocessor architecture. It is a modular architecture; the members of the family are interactive line-drawing graphic configurations with widely differing power, but based on the same set of building blocks and a common internal structure. Any configuration may simply be enhanced by adding new blocks (or replacing some) and thus becomes a more powerful configuration. The suite of building blocks, can be used to form general purpose standard configurations or, alternatively, special purpose configurations for turnkey systems.

The GD80 comes with two alternative tube sizes (with a different number of addressable points), and they may be monochrome or colour. The different functions of the configuration are performed by several different types of microprocessors.

The GD80 may be used as a terminal to a computer or on its own as a stand-alone system. A range of interaction devices is available.

The general architecture is shown in the figure with all the details of a larger configuration.

The picture is generated on the screen (CRT) by the Display Control Unit (DCU) via the Generators and Amplifiers. Picture generation is based on the "picture program" stored in the Common Memory (CM). The DCU accesses the CM through the U2 bus. The Light Pen is also connected to the DCU. All other input devices are handled by the Graphic Peripheral Controller (GPC) through the Graphic Peripheral Interface Bus (GPIB). Computer Peripherals are connected either to the GPIB or to the general purpose U1 bus. The GPC may use a Memory Extension (GPC-ME) if necessary and handle conventional peripherals as well (paper tape I/O, line printer etc.). The capabilities of the GPC can be extended using the APU floating point processor.

The Display Processing Unit (DPU) performs all calculations necessary to produce the picture program. The DPU may also perform as a general purpose processor.

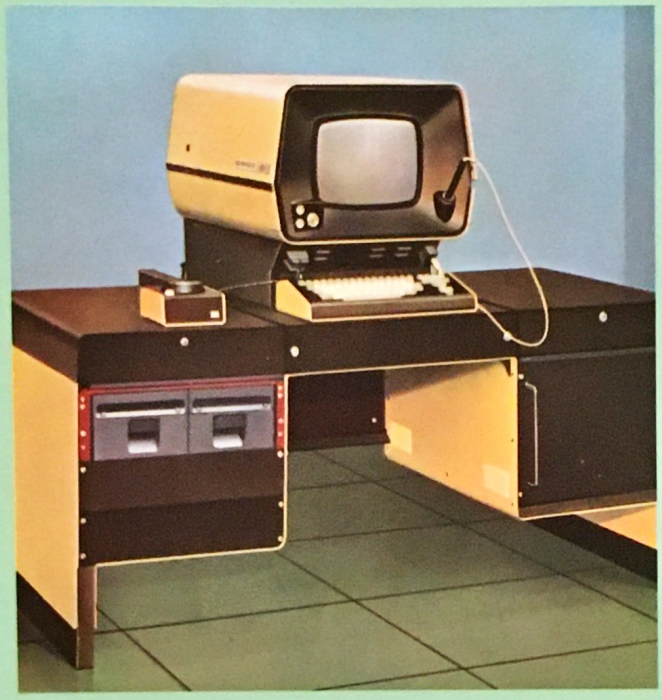
The Transformation Processing Unit (TPU) is basically a general purpose arithmetic processor which was designed to enable very fast geometric transformations.

The Host Interface (HIF) is in charge of communications with other configurations and includes the necessary protocol. Standard synchronous or asynchronous interfaces may be used.

Background stores are connected either directly to the U1 bus (cartridge disc) or to the GPC (floppy disc, magnetic tape etc.).

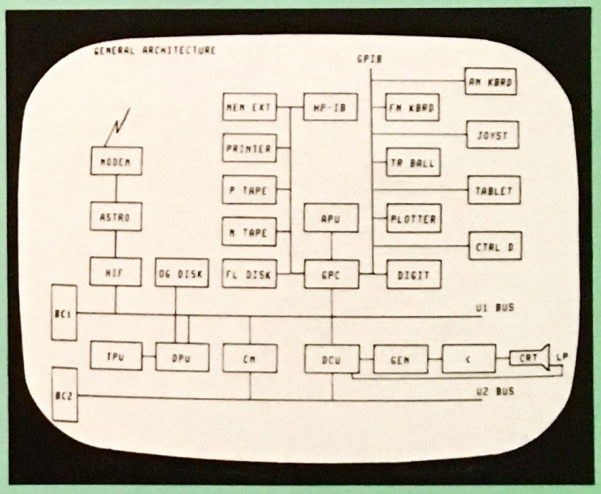
The BC1 and BC2 are the controllers for bus U1 and U2 respectively. The U1 bus is used by all processors, the U2 bus is dedicated for refresh only.

Some Technical Data



In the graphic consol there are two different performance versions available for all modules.

TUBES	Small	Large
– Viewing area	190 × 254 mm	507 mm dia.
– Colour	1 or 4	1 or 4
– Phosphor	P31 or P49	P31, P39, P49
– Deflection	el. magnetic	el. magnetic
– Focus	el. static	el. static
– Switching time (colour tubes only!)	25 microsec.	25 microsec.



Small and large screen versions of the GD80

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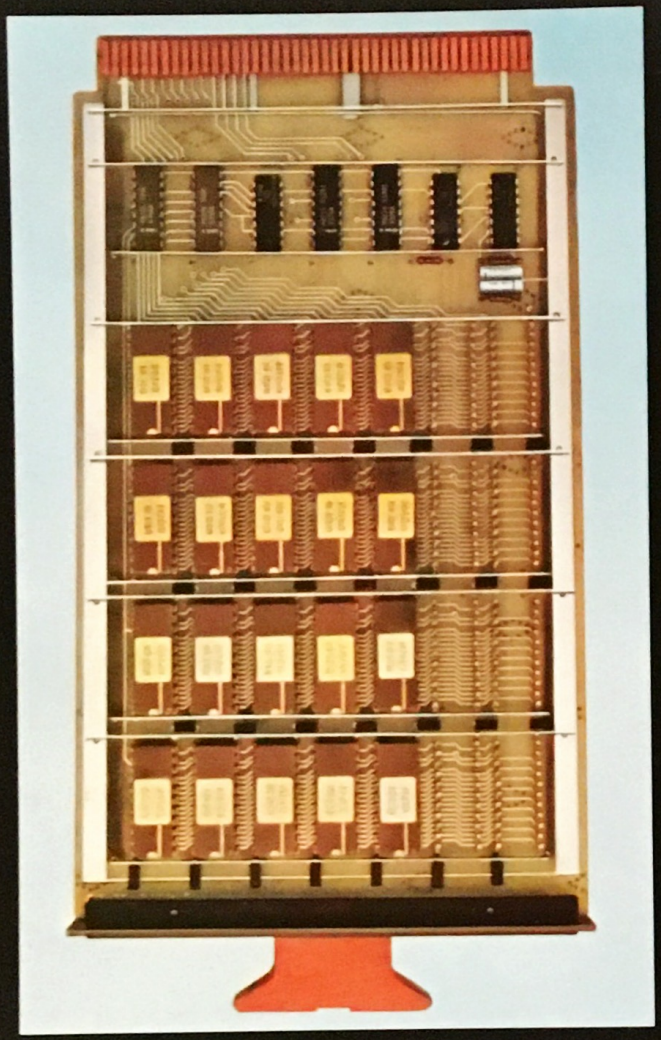

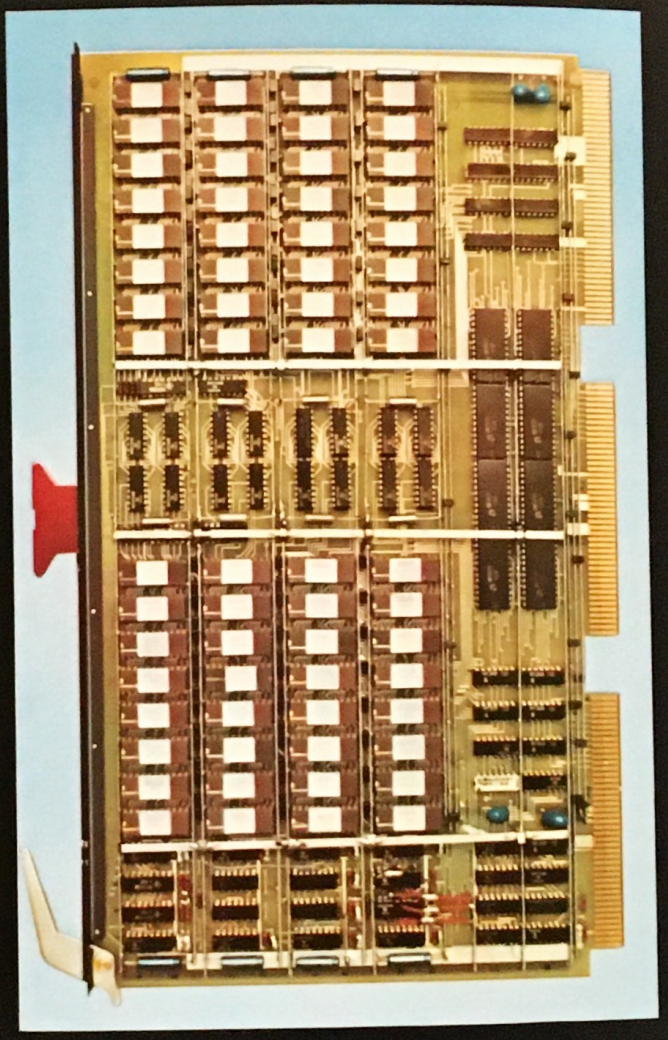

Two RAM storage boards of the GD80

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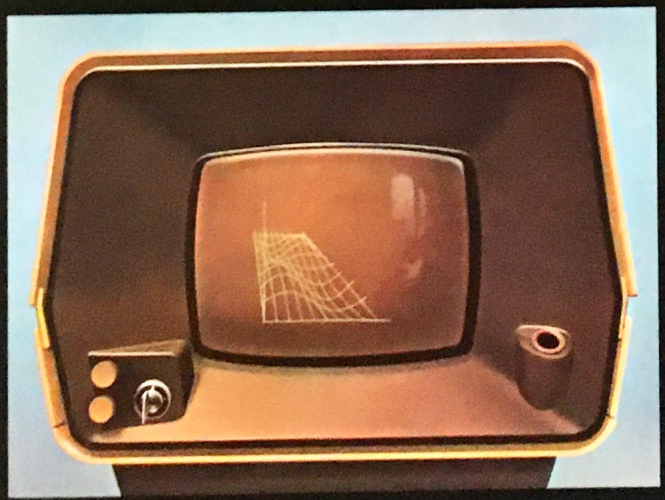
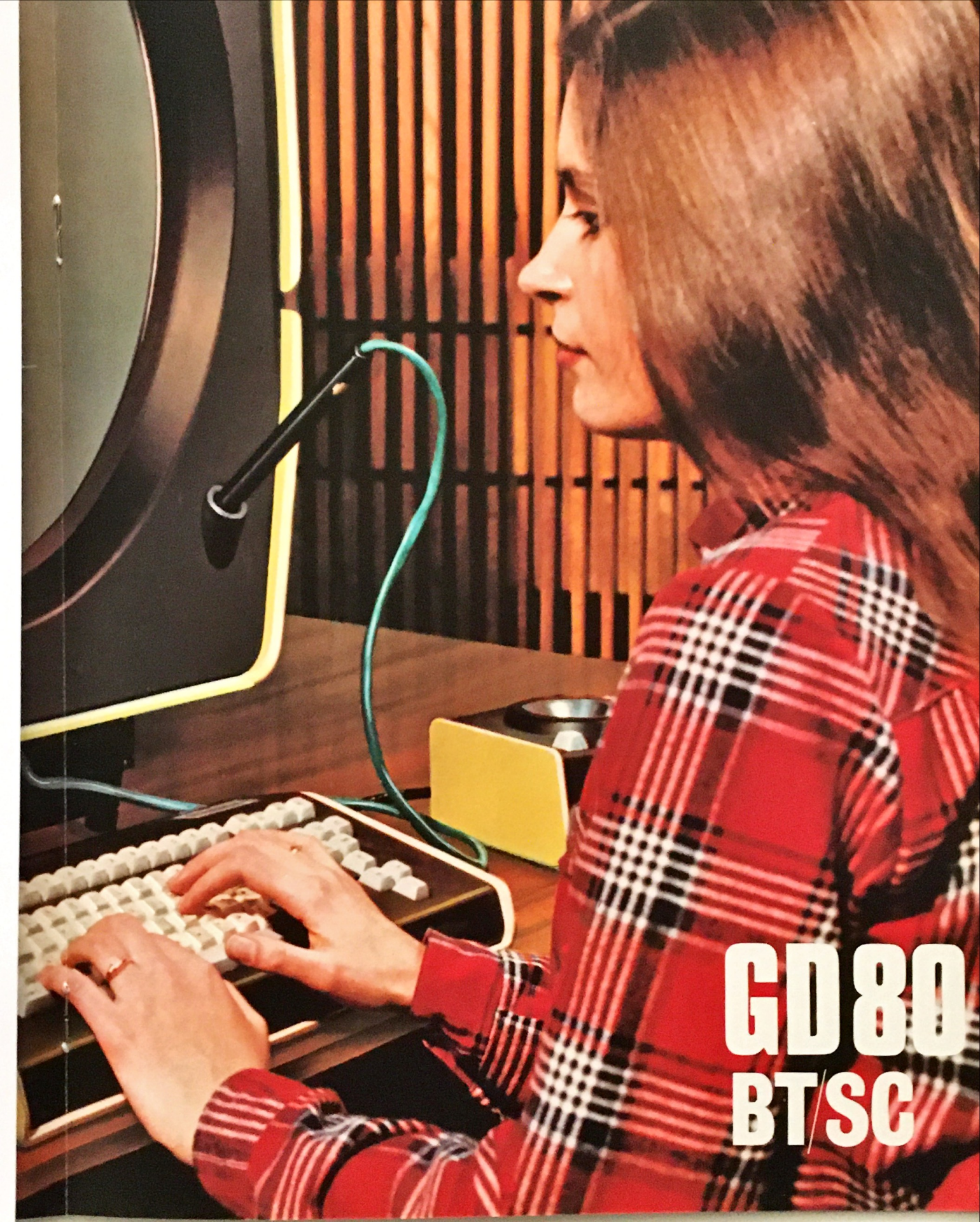
GENERATORS	Low-cost	High-performance
Vector generator	Digital Type	Analog Type
– addressable matrix	64k × 64k	64k × 64k
– viewable matrix	1024 × 1024	4096 × 4096
– absolute vectors	yes	yes
– relative vectors	yes	yes
– long vectors	0–1023	0–4095
– short vectors	0–63	0–63
– generation time (maximum length vectors)	60 microsec.	30 microsec.
– line types	4	4
– intensity levels	4	16
– conics	DCU firmware	DCU firmware

Character generator	Low-cost	High-performance
	7 × 9 dot matrix type	Stroke type
– generation time	17 microsec.	4 microsec.
– character set	128 extended ASCII (upper-lower case) 128 user programable (optional)	128 extended ASCII (upper-lower case) 128 user programable (optional)
– sizes	2	4
– italics	yes	yes
– rotation	yes	yes
– scaling	no	yes (16 levels)
– number of characters in a line	80	128
– text orientation	3	3
– character spacing	0, 0.25, 0.5, 0.75 characterwidths	0, 0.25, 0.5, 0.75 characterwidths



GD80 graphic computer with small screen (GC/E)


0-BT/SC


GD80
BT/SC

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Processing background

U1, U2 Bus

- 18 bit address
- 16 bit data
- interprocessor interrupt facility

Display Control Unit (DCU)

- microprogramable 16 bit processor
- control store 512 × 48 bit (standard) PROM
- control store 4096 × 48 bit (maximum) PROM and/or RAM
- microcycletime 200 nsec
- internal (scartchpad) memory 256 × 16 bit

Display Processing Unit (DPU)

- same as DCU

Transformation Processing Unit (TPU)

- microprogramable 48 bit processor
- control store 512 × 64 bit (standard) ROM
- control store 4096 × 64 bit (maximum) PROM and/or RAM
- microcycletime 200 nsec
- internal (scratchpad) memory 256 × 48 bit

Graphic Peripheral Controller (GPC)

- standard 8 bit microprocessor
- 32 kbyte memory (16 k ROM, 16 k RAM) max.
- DMA
- Real Time Clock
- IT Controller
- Graphic Peripheral Interface Bus (GPIB)
- Window to the U1 bus

Host Interface (HIF)

- same as GPC

Common Memory

- dual port
- 16 kbyte (minimum)
- 256 kbyte (maximum)
- 300 nsec access time
- 400 nsec cycletime

Peripherals

Dual floppy disk

- EC 5074
- IBM 3740 soft sector format
- 256 kbyte/drive
- DMA controller to GPC

Cartridge disk

- IZOT 1370/CM 5400 type drive
- 12 or 24 sector
- DMA controller to U1 bus

Magnetic tape

- EC 5017
- 9 track
- DMA controller to GPC

Printer

- DZM 180 (LOGABAX license)
- 7 × 9 dot matrix

Alphanumeric keyboard

- Standard ASCII, cursor control keys, 16 funtional keys, 4 switches, 16 character LED readout

Tracking ball

- 2 × 12 bit coordinates

Light pen

- solid state

Joystick

- 2 × 12 bit coordinates

Tablet

- 2 × 12 bit coordinates, A3 size

Functional keyboard

- 32 keys

Control dials

- 16 potentiometers (16 × 8 bit data)

Plotter

- A3 size
- built in interpolator for vectors only

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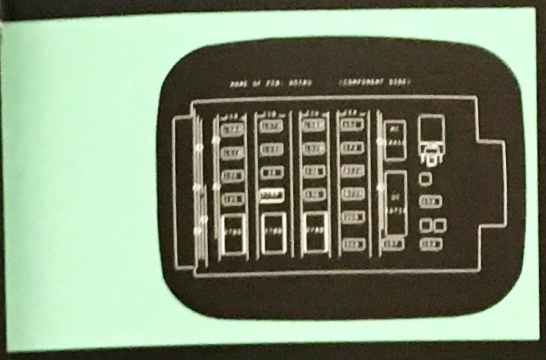

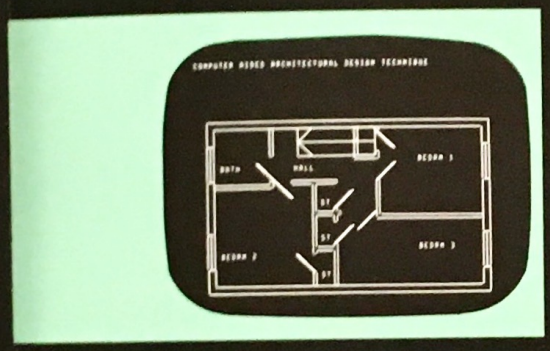

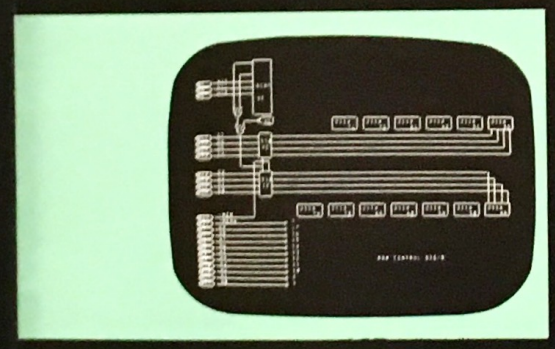

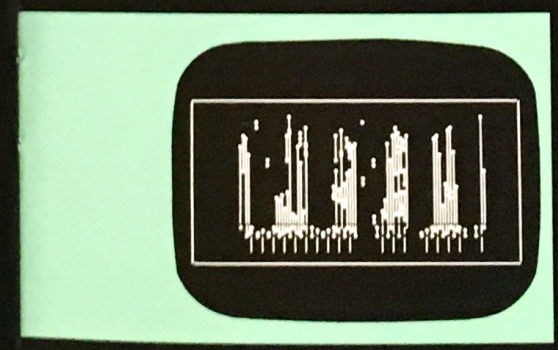

Communication

The basic tool the GD80 provides for communication with other systems is the Host Interface and the ASTRO asynchronous/synchronous communication interface. High speed modems (up to 50 kbaud) can be connected to this interface or much higher speeds can be achieved without modem on short distances. Direct memory access parallel interfaces are provided for CM3, CM4[1] type minicomputers ("window") and EC[2] series host machines (multiplex or selector channel adapter).

Software

For the GD80 Family a modular software system has been developed, to enable the flexible use of all configurations. The core of the graphic software is the GSS80 line drawing system which incorporates experiences gained with line drawing packages and the main features of developing standards.

GSS80 is used to define pictures as a set of pieces with appropriate naming. GSS80 handles input actions, reads input data and enables the referencing and manipulation of picture parts. GSS80 accepts both 2D and 3D data, in user coordinates ("world coordinates") and performs the necessary viewing transformations.
If connected to other host computers, the host version of GSS80 may be used to prepare data for the "Graphic Protocol" which is further processed at the GD80 configuration after transmission.

Autonomous configurations may be programmed in high-level languages (FORTRAN, BASIC, etc.) extended with GSS80 services. Programs run under a single-user disk operating system. (On smaller configurations a floppy disk is used.) The operating system provides flexible file handling, editing, program and data segmentation.

The basic software moduls are listed below:

Supervisor
Assembler
FORTRAN, BASIC
Systems programming language
GESAL
File handling
Editor, debug, etc.
GSS80 or MINI-GSS80
Graphic Protocol Interpreter
Data Link Control Software (BSC, SDLC, etc.)
Remote Batch Terminal Emulator (IBM 2780, CDC 734, etc.)
Host GSS80 package

[1] CM3 is a PDP 11/10, CM4 a PDP 11/40 plug compatible standard minicomputer of the socialist countries.
[2] EC machines are IBM 360/370 compatible standard big computers of the socialist countries.

Standard Configurations

Some building blocks are used in all configurations, whereas others are optional. Using these blocks one can install configurations with differing processing power. The processing power is highly dependent on the presence of the optional processors (DPU, TPU, HIF).
If a processor is absent, the appropriate function may be missing too or, alternatively, another processor takes over the function. In the latter case this function may operate partially or with limited speed.
If, for instance, there is no TPU, all its functions are performed in the DPU itself. If the DPU is missing, the picture program is prepared in the GPC which may do some other DPU functions as well.
In the absence of a HIF, the GPC is able to perform simpler communication tasks.
The table below indicates the general configurations which may be built. These configurations fall into the following main categories – the standard configurations:

GD80 – BT: Basic Terminal

GD80 – GC: Personal "Graphic Computer"

GD80 – AGS: Autonomous Graphic System

GD80 – SGS: Satellite Graphic System

GD80 – IT: Intelligent Terminal

GD80 Configurations

Tube	mono-chrome small	colour small	mono-chrome large	colour large
Processors	E	EC	S	SC
B	GC			
B + DPU				
B + DPU + TPU				AGS
B + HIF	BT			
B + DPU + HIF			IT	
B + DPU + TPU + HIF				SGS

B: The basic set consists of the following modules: BC1, BC2, GPC and its peripherals, CM, DCU, Graphic Generators, amplifiers, CRT, LP.

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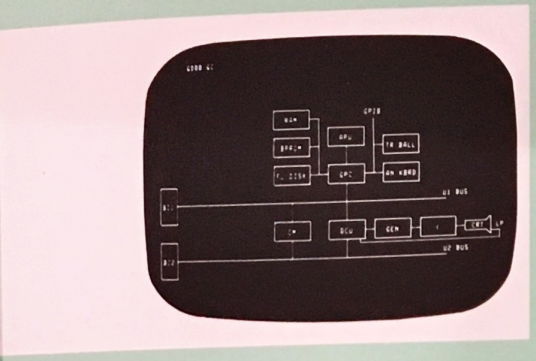
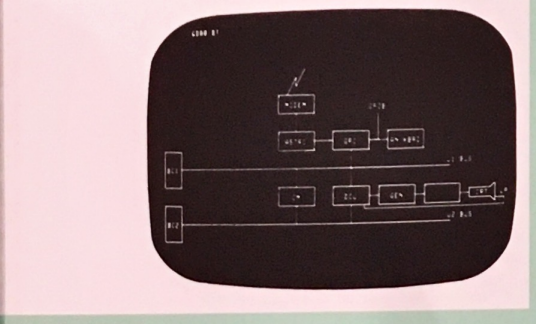


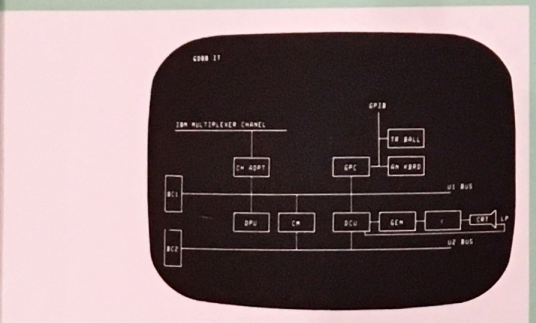
GD80 GC

The PERSONAL GRAPHIC COMPUTER is an intelligent desk top computer extended with graphic capabilities. The only processing power in the system is the GPC in charge of peripheral handling, high level programming and graphics. For floating point and trigonometric operations the GPC uses its arithmetic extension (APU). The memory size is extended using RAM and ROM. The background storage of the system is a dual floppy disk: the GPC runs a small single user operating system on it, which includes file handling, editor, assembler, debug, etc. The main programming tool of the system is the BASIC interpreter extended with graphics using the MGSS80 line drawing package. (The latter is the minimal version of the GSS80.)
The GD80 GC is suitable for the same tasks as the middle members of the TEKTRONIX[1] storage tube display family and HP[2] graphic terminals, but with extended capabilities in resolution and interactivity.



GD80 BT

The BASIC TERMINAL is the simplest member of the GD80 Family. It is a graphic terminal of a host. The GPC handles the peripherals, interprets the graphic protocol and also communicates with the host using the ASTRO. (In more sophisticated environment the communication requires a dedicated processor, the HIF; for simple asynchronous communication the GPC can perform well enough.) Application programming is done on the host, using the host GSS80, which produces the graphic protocol for the terminal.



GD80 IT

The INTELLIGENT TERMINAL is a more powerful graphic terminal. It can execute complex commands, which are sent from the host. Some interactive manipulations can be done without host interference.
The communication between host and terminal is realized generally using serial links and modems, but it can be connected directly to the IBM multiplexer channel. (The latter is shown on the picture below.)

GD80 AGS

The AUTONOMOUS GRAPHIC SYSTEM is a sophisticated stand-alone graphic configuration. The main processing power of the system are the DPU, TPU twins: they emulate a powerful minicomputer instruction set and its floating point extension. The twins can perform as a list processor-transformation processor pair when converting high level geometrical description into structured display file. The configuration can be equipped with large internal memory and background store (disk, magnetic tape). Besides the operator's interactive input devices the GPC can handle a variety of conventional I/O devices (paper tape, printer, etc.).
All the software modules run under a single user disk operating system.

[1] TEKTRONIX is the trade mark of Tektronix Inc., Beaverton, Oregon, USA
[2] HP is the trade mark of Hewlett Packard, Palo Alto, California, USA

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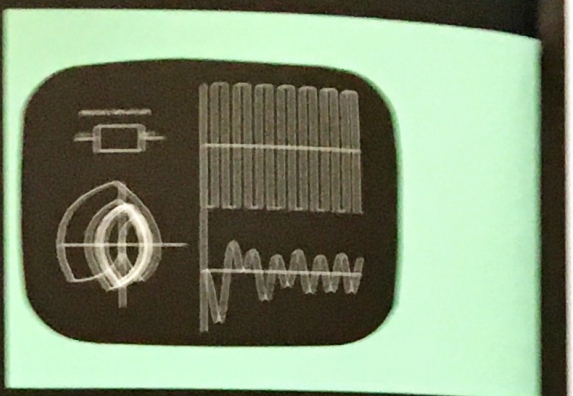
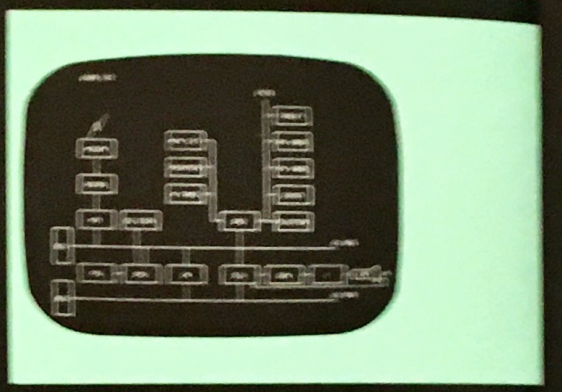
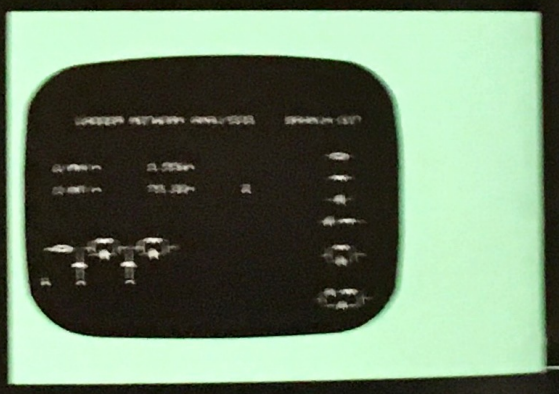
The AGS can be programmed on different levels: starting with microprogramming of the DPU and TPU, through assembly programming of all processors in the system up to high level languages including BASIC, FORTRAN and a systems programming language GESAL.
The GD80 AGS is very suitable to build CAD turn-key systems.

GD80 SGS

The SATELLITE GRAPHIC SYSTEM is the most powerful member of the GD80 Family. It has the same architecture and local capabilities as GD80 AGS, but it is extended with communication facilities. The work can be shared between the satellite and the host. The picture shows a satellite system; omitting the HIF the configuration is converted to AGS.







Developed by:
COMPUTER AND AUTOMATION INSTITUTE
HUNGARIAN ACADEMY OF SCIENCES
H-1502 Budapest, XI. Kende u. 13–17.
Phone: 665-644
Telex: 22-5066 akibp h

Manufactured by:
HÍRADÁSTECHNIKA COOPERATIVE
H-1519 Budapest, XI. Temesvár u. 20.
Phone: 852-811
Telex: 22-6151 htsz h

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METRIMPEX Foreign Trading Co.
H-1051 Budapest, V. Münnich F. u. 21.
Phone: 321-330
Telex: 22-5451

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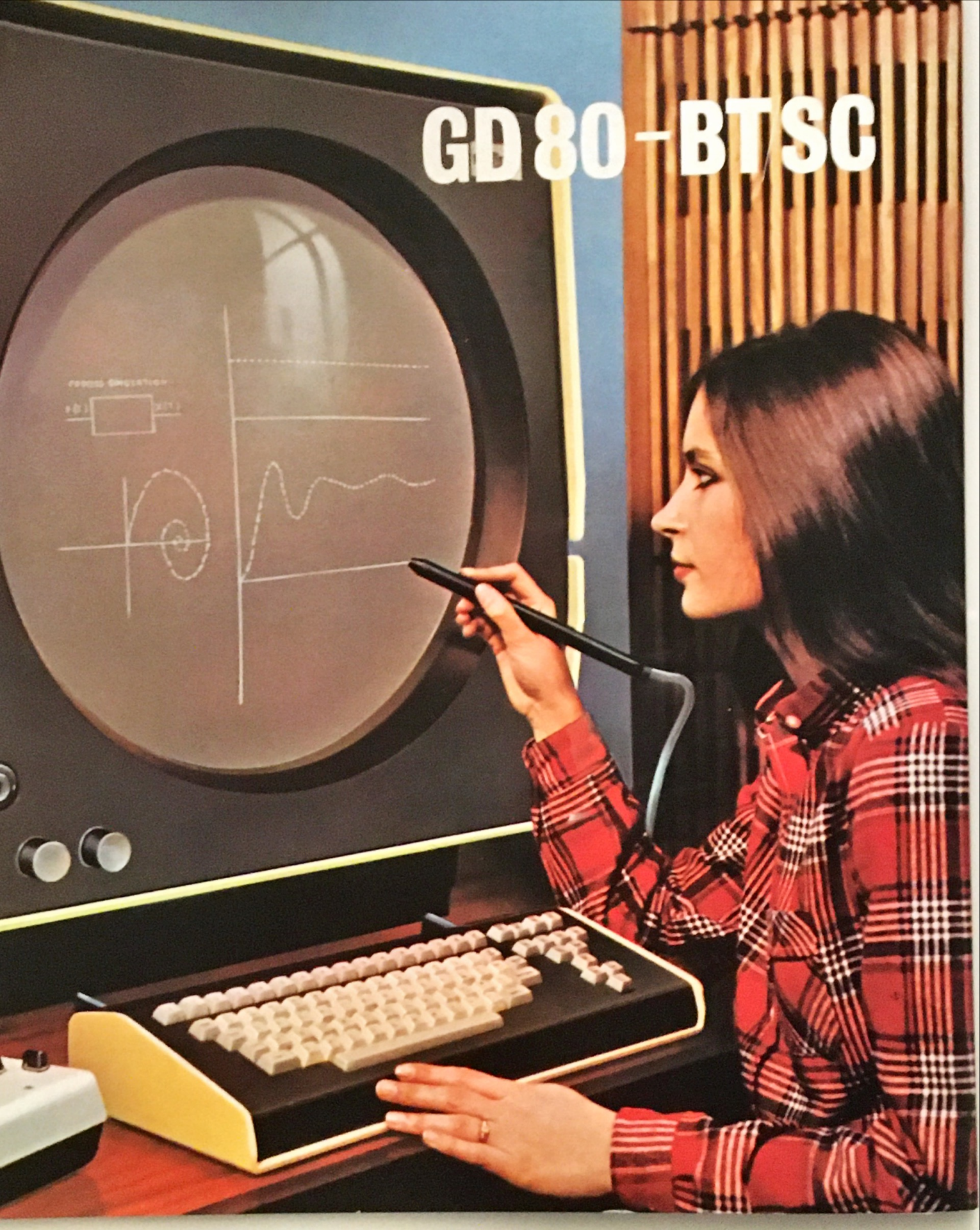
GD 80-BTSC